ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

For the Blaauwbosch Diamond Mine

In the Boshof district of the Free State Province

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Free State Province

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EXECUTIVE SUMMARY

The mining venture

Kophia Diamonds (Pty) Ltd has the right to mine the farm Catherine's Fancy 831, which forms part of the Blaauwbosch Mine property in the Boshof district of the Free State Province. The claims area consists of a blast hole, which will be re-commissioned, remnants of previous mine buildings which are in severe disrepair and old tailings dumps, which were never rehabilitated. While it is not anticipated that any additional areas will be altered by the new mining activities, the alterations that have already occurred are permanent in nature.

The mining venture has been divided into two phases: Phase One involves the reprocessing of the old tailings, while Phase Two entails the mining of the kimberlite pipe beneath the blast hole using inclined chambering.

It is expected that the mine will be in operation for a period of 15-25 years from the date of commencement.

The construction phase for Kophia is seen as an integral part of the operations phase. The plant and associated infrastructure will be assembled first. The slimes dam and process water storage dam will be established and the office, manager's house, workshop storerooms and the explosives magazines will be renovated / rebuilt. The necessary services such as water and electricity will also be installed and redundant ruins and remnants of buildings will be removed. The only other construction required is that of a wash bay and vehicle service yard near the office, neither of which is really integral to the workings of the mine initially.

The blast hole will be dewatered, this water initially pumped into the process water storage dam over a one to two week period. As per the requirements of the DME, the blast hole will also be 'made safe' through the construction of a safety berm around the perimeter.

The hoist and headgear will be erected before the commencement of Phase Two.

Topography - The topography has already been impacted by previous mining activity. The changes to the topography are those associated with the visual impact of the disposal sites and with drainage.

Soils - The primary impact mining activities will have on the soils is in the form of pollution. Contaminated soils will show a reduction in fertility, depending on the type and severity of contamination, affecting both agricultural potential and natural vegetation. Soil compaction is considered a secondary impact. Permanent structures such as the slimes dams, tailings dumps, the storage dam and waste rock dump sterilise valuable topsoil if not this is not removed beforehand. The reduction of vegetation cover on the *Valsrivier* soils, and the failure to treat / rehabilitate slopes which are already eroding (i.e. specifically those of the blast hole) leads to severe erosion, which is difficult to curb.

Land capability - The entire claims area has historically been converted from any previous land capability (which is believed to have been wilderness and grazing) to mining. While it is not anticipated that any further areas on the site will be altered by mining activities, the claims area has been permanently altered, and potential land capability is therefore limited.

Vegetation - Naturally occurring plant habitats are limited on the site, and those that remain could be further impacted on by mine residual, litter and waste disposal, limiting the capability of the site to support habitat. The invasion of problem species could occur on the site, especially in disturbed areas. These may spread to adjacent areas if not controlled.

Animal life - Previous mining related activities and infrastructure have led to the destruction of natural animal habitats within the claims area. The disturbance created by mining activity will result in the migration of wildlife away from the site and a potential impact of mining activity on the wildlife and animal life at the site would be in the form of poaching and extermination during the operational phase.

Surface water - As no natural surface water occurs on the site no impact is anticipated in this regard.

Ground water - The extraction of groundwater has an effect on the groundwater table. Limited impact on the groundwater quality is expected, as none of the mining methods involve the generation of acidic fluids that can lead to leaching of the surrounding rocks.

Other potential sources of groundwater pollution include the plant, the washing bay, the vehicle maintenance yard, storage areas, and hazardous and industrial waste collection sites.

Air quality - It is not anticipated that the Blaauwbosch mine will cause significant amounts of atmospheric pollution during operation as the whole diamond extraction process is a wet process. Potential problem areas do, however, include gravelled roads, the point where kimberlite is dumped on the conveyor belt; and the crusher plant.

Dust pollution from slimes dams and tailings dumps is anticipated to be virtually non-existent during operation and will only become an issue on closure when these processes no longer occur and when the slimes dams start to dry out.

Noise - The mine is expected to generate very little noise due to its size, so noise emanating from the site is of limited significance in terms of being a nuisance to others. The primary impact in this case is the effect of noise on the personnel at the Blaauwbosch mine, specifically inside the mine and plant.

Archaeology - No sites of archaeological, social, cultural or historical significance occur on the site.

Sensitive landscapes - Erosion of the somewhat sensitive soils is of concern, especially where slopes have already begun to erode. Areas of heavy traffic and high activity are also susceptible. As many denuded areas will not be rehabilitated and re-vegetated until the decommissioning phase, this impact is of moderate to high significance throughout the operational phase.

Visual aspects - Structures on the site, including residue dumps and mining infrastructure are noticeable over the medium distance as horizon elements. The former are permanent structures and the latter temporary.

It is not the intention to apply for partial closure of the mine on completion of mining operations. Infrastructure such as the hoist, headgear and all components of the plant will be dismantled and removed and the shafts will be closed and sealed. Other structures built and / or renovated specifically for mining purposes, such as the office, workshop, explosives magazines, wash bays, vehicle maintenance yards, salvage yards and waste disposal sites will be demolished and cleared away, and final backfilling and shaping of the trenches, the storage dam, tailings dumps and slimes dams will be done. All the above areas will then be rehabilitated and re-vegetated.

Overall benefits

The claims area under consideration is largely disturbed as a result of previous mining activity and no further disturbances to virgin land with arable, grazing or wilderness potential will occur. This is deemed beneficial as disturbances can be contained within historically altered areas. This limits the overall impact of the mining activity.

Direct benefits include the creation of 40 permanent jobs, of which 8 will be skilled and 32 unskilled. Housing will be provided for employees at the neighbouring New Eland property. To bring the project into production, an expenditure of approximately R1,5 million has been estimated. Annual operational costs are estimated at R2,4 million.

Overall benefits can therefore be determined to be capital inflow into the regional economy and the provision of employment, albeit on a small scale. In addition to these capital benefits, there are also, to a certain degree, environmental benefits. The site is currently in a degraded state as no rehabilitation of the site has been undertaken since closure 35 years ago. Mining activities will involve the reprocessing of old tailings dumps and the rehabilitation of the mine in compliance with the Minerals Act 1991.

Findings

Impacts associated with construction activities are considered limited and will be addressed in the operational phase as it is anticipated that they will occur concurrently.

Geology - The impacts of mining on the geology are essentially associated with the change to the geological structure at the mining area and are therefore limited.

Management

Kophia Diamonds is committed to the rehabilitation of all areas affected by the mine and associated activities on an ongoing basis. This aims not only to minimise final rehabilitation costs during the decommissioning phase, but also to reduce the cumulative effect of impacts by addressing them sooner rather than later. To accomplish this, management guidelines have been detailed for each of the objectives set out below:

Topography - All slimes dams, tailings dumps and blast holes will be made stable and safe and the visual impact of the altered topography will be limited by a process of ongoing reclamation and rehabilitation.

Reclamation and rehabilitation techniques include re-grading, re-contouring and re-vegetation of degraded land surfaces, long term water management measures and mine residue treatment measures.

Soils –Measures will be employed to conserve soil and to curb the continued erosion of soil on denuded slopes. The compaction of soil will be prevented, as will the pollution and sterilisation of soil, the contamination thereof and the possibility of contaminated soil adversely affecting water courses. Mining areas will also be covered with sufficient soil in order to maintain vegetation.

Land capability and use –The impact of land transformation and the alteration of land capability will be minimised by the location of residue dumps on previously disturbed areas, as well and the employment of reclamation and rehabilitation techniques.

Vegetation – Attempts to achieve self sustaining vegetation on residue disposal sites and all rehabilitated areas will be made and invader / exotic species will be controlled.

Animal life – The reinstatement of vegetation implies the reinstatement of wildlife habitat. Poaching and the extermination of animals perceived to be vermin will be eliminated.

Surface water – Measures will be employed to conserve water, facilitate drainage and eliminate the contamination of water by keeping clean and dirty water separated and

preventing clean water runoff from becoming contaminated. This will obviate the need to treat excessive quantities of polluted water. Any water pollution that does occur will be contained on mine property so that natural water courses / bodies are not affected. In addition the efficient operation of storm and process water systems will be maintained.

Ground water – The quantity of groundwater will be monitored to ensure that dewatering does not impact too adversely on the regional or local water users and the contamination of groundwater will be minimised through the implementation of surface water management as discussed above.

Air quality – The incidence of unnecessary dust on the site will be controlled and the associated nuisance and health problems thereby eliminated.

Noise - The incidence of unnecessary noise on the site will be controlled and the associated nuisance and health problems thereby eliminated.

Interested and affected parties – Measures will be implemented to concerning the maintenance and condition of public access roads, litter, and security in the area.

Closure

Mining operations have had an impact on the environment in the past and will continue to have an impact in the future. The management plan is therefore very important for the operational and decommissioning phases as well as after closure. If the management plan is adhered to, then the outstanding impacts that Kophia will have to address at closure will be minimal. These residual impacts include:

- The blast hole constitutes a physical danger to humans and livestock.
- The slopes of the blast hole will continue to erode.
- Slimes dams, which occupy land, alter topography and potentially degrade the surrounding soil and water quality.
- Tailings dumps, which occupy land, alter the topography and potentially degrade surrounding soil and water quality.
- Potential lack of stability of rehabilitated ground and residue deposits – the possibility of erosion would have to be monitored and handled.

- The potential for the appearance of invasive plants and weeds, especially in rehabilitating areas.
- Failure of the rehabilitated area, or parts of it, to vegetate.

The soil, land capability and land use together with the vegetation will be somewhat better than present conditions, as these areas have been exposed to historical deterioration without rehabilitation. The areas likely to cause dust pollution, erosion and safety risk will be rehabilitated and secured to ensure the obviation or minimisation of impacts post closure.

Assuming that environmental management is practised throughout the operational phase of the mine, and that the closure objectives are met, the general overall impact on the environment should be minimal.

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1.1 Mining company, mine owner and mine manager

1.1.1 Name and address of mine

Blaauwbosch Diamond Mine
C/o Kophia Diamonds (Pty) Ltd
PO Box 378
Barkly West
8375
Tel / fax: (053) 5301267

1.1.2 Name and address of mine owner

Kophia Diamonds (Pty) Ltd
PO Box 378
Barkly West
8375
Tel / fax: (053) 5301267

1.1.3 Name of mine manager / responsible person

Mr J.P. Snyman (Snr)
P.O. Box 418
Barkly West
8375
Tel: 083 260 5535

1.2 Mineral rights holder

Coronation Freehold Estates, Town and Mines Limited[1]
PO Box 378
Barkly West
8375
Tel / fax: (053) 5301267

[1] According to the Deed of Title, Coronation Freehold Estates, Town and Lines Limited owns an undivided six tenths share and the state holds a four tenths share.

1.3 Applicant for mining authority

Kophia Diamonds (Pty) Ltd
P.O. Box 378
Barkly West
8375
Tel / fax: (053) 5301267

1.4 Land owner and title deed description

Kophia Diamonds (Pty) Ltd
PO Box 378
Barkly West
8375
Tel / fax: (053) 5301267

The mine property includes the farm Catherine's Fancy 831 and Portion 4 of the farm Blaauwboschfontein 229 in the Boshof District of the Free State Province, hereafter referred to as **the site**. Only the farm Catherine's Fancy is earmarked for any mining or associated activity and will hereafter be referred to as **the claims area**.

1.5 Regional setting

See Map 1.

1.5.1 Magisterial District

The magisterial district is that of Boshof and the Regional Service Council authority is the Lejwelephytswy District Council.

1.5.2 Direction of and distance to neighbouring towns

Distances given are approximate distances by road:

- Hertzogville 50 north
- Boshof – 30 km west
- Dealesville – 35km south-east

1.5.3 Surface infrastructure

Roads: The site is accessed by means of a gravel road off the R64, the tarred main road between Boshof and Dealesville which bypasses the site approximately 2,5km to the south.

Railways: The Kimberley-Sishen and Kimberley-Johannesburg railway lines are the nearest rail connection to the site, with the nearest siding approximately 100km to the south west, in Kimberley.

Power: No power currently services the site, but Eskom lines do bypass the site approximately 3km to the north west as well as approximately 1km to the south. These lines run from the town of Boshof nearby.

Water: No municipal water services the site, nor does any municipal service infrastructure exist. Ground water is used for domestic, agricultural and mining purposes in the area.

Airstrip: While there are private airstrips in the region, the closest airport is in Kimberley.

Other: A telephone line crosses the site in an east west direction. This is not operational at present.

1.5.4 Presence of servitudes

According to the Deed of Title, there are no proclaimed servitudes over the site. It is not anticipated that the telephone lines will be reinstated, bearing no implications.

1.5.5 Land tenure and use of immediately adjacent land

See Map 1.

The farm Blouboswes 1508 lies to the north west and south west of the site and the remainder of the farm Blaauwboschfontein 229 lies to the north east and south east. Diamond mining operations exist at Zoet and Zuur, approximately 2km to the northeast, as well as at Rovic, some 3km beyond that. The remaining surrounding areas are used for maize and livestock farming.

1.5.6 River catchment

Far to the south east, the area is drained by the Modder River, which flows westwards, and to the north west is the Vaal River. There are no permanent or seasonal rivers of any significance in the vicinity of the site, but many pans and calcrete outcrops occur, which are possibly remnants of a relic drainage system in the area[2].

1.6 Brief description of the mining venture

For practical purposes and as dictated by the financial feasibility of the diamond recovery process, the mining venture has been divided into two phases. Phase One refers to the re-mining of the old tailings dumps already existing on the site. Phase Two refers to the mining of the kimberlite pipe, which will be mined using inclined chambering.

Coronation Freehold (Pty) Ltd was operational on the site until 1967, but most of the infrastructure is currently in disrepair, with little remaining in a useable state.

During the 'construction phase' the blast hole will be dewatered and the site 'tidied'. The office, manager's house, workshop storerooms and explosives magazines will be renovated / rebuilt, the plant and associated infrastructure will be assembled and the process water storage dam and the slimes will be constructed. The necessary services such as water and electricity will also be installed and redundant ruins and remnants of buildings will be removed.

The hoist and headgear will be erected before the commencement of Phase Two.

1.6.1 Mineral deposit

Diamonds were formed millions of years ago when carbon deposits subjected to tremendous heat and pressure, reacted with other mineral components and crystallized to form diamonds.

When molten magma forced channels, or pipes, upward through the earth's crust and burst though the surface in volcanic eruptions, it carried diamonds with it. The magma eventually cooled in the pipes and the diamonds became trapped in this relatively soft rock known as kimberlite.

The main ore-body at Blaauwbosch is a near-vertical kimberlite pipe intersected by a vertical fissure zone containing up to four kimberlite-filled fissures.

1.6.2 *Mine product*

Diamonds are being exploited.

1.6.3 *Estimated reserves*

Blaauwbosch mine is reported to have processed some 1531000 tons of kimberlite up to the discontinuation of mining activities in 1967. The pipe has been mined to a level of 140m below surface.

During the period 1982 to 1983, nine core holes were drilled to determine the extent of the kimberlite pipe and intersecting fissures. From the results of the drilling programme as well as data from old underground plans, the following remaining ore reserves were determined to a depth of 450m below the surface:

Structure	Proved (tons)	Probable (tons)	Possible (tons)	Total (tons)
Pipe	600000	78000	10000	688000
Fissures	374000	224000	129000	727000
Totals	974000	302000	139000	1415000

1.6.4 *Mining method*

The method of mining will be inclined chambering. This is essentially a combination of shrinkage, stoping and caving, in which advantage is taken of the enormous pressure exerted by the loose rock, which,

[2] DEPARTMENT OF MINERALS AND ENERGY AFFAIRS. *The Geology of the Region Kimberley.* 1993.

through the collapse of the kimberlite pipe walls, accumulates in the open excavations.

Due to the flat nature of the terrain and the mining method to be used for ore extraction, entry will be made through a shaft.

A shaft requires hoisting equipment to raise the ore and rock to the surface, pumping equipment to dispose of any ground water within the mine, and structural support for the rock and the mechanical equipment operating in the shaft.

1.6.5 Planned production rate

Initially, the monthly production rate will be approximately 3000 tons. It is anticipated that this will increase to a maximum of 6000 tons per month at full production.

1.6.6 Planned life of mine

It is expected that the mine will be in operation for a period of 15-25 years from the date of commencement.

PART 2: THE EXISTING MINING ENVIRONMENT

2.1 Geology

See Map 2.

2.1.1 Geological setting

According to the 1:250000 Geological Series (Sheet 2824 Kimberley – Geological Survey Institute), the geology of the site forms part of the Tierberg Formation of the Karoo Sequence and consists of shale, siltstone and sandstone. The shale weathers fast, and outcrops are limited to dolerite capped hills within a landscape of low relief and rolling or flat plains.

Diamondiferous kimberlites occur as near-vertical pipe-like intrusions as well as fissure fillings. Up to four different kimberlite types are present within a single intrusive body[3].

2.1.2 Dykes, sills and faults beyond the property boundary

The 1:250000 Geological Series of the area indicates the presence of two kimberlite fissures, one to the north west of the site and one to the north east, partly on the Blaauwbosch property.

2.2 Climate

2.2.1 Regional Climate

This climatic zone is characterised by hot summers and cold dry winters.

Rainfall in the area is unpredictable. The majority of rain (88.2%) falls between October and April in the form of thunderstorms. During this period rain can be expected every 5 days.

[3] Faxed correspondence: Trans Hex Group Limited. 9 December 1997.

The winters are very dry and rainfall is rare. Any precipitation that does take place tends to be brought about by cyclones penetrating the interior of the country.

The prevailing winds in this area are from a north to north-westerly direction. The strongest winds tend to blow from a west-south-westerly direction to a north-north-westerly direction and occur from August to December. October and November are the windiest months.

The various climatic parameters such as rainfall data, temperature data, evaporation rates, wind speed and direction have been obtained from the weather station at Kimberley.

2.2.2 *Mean monthly and annual rainfall*

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Rainfall (mm)	7.0	7.0	12.0	30.0	42.0	46.0	57.0	76.0	65.0	49.0	16.0	7.0	384,9
Days of Rain	0.9	1.0	1.5	3.6	5.0	6.0	6.6	7.0	7.7	5.2	2.6	1.3	

2.2.3 *Maximum rainfall intensities*

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
24 HRS	22.0	26.0	44.0	35.0	60.1	60.5	45.0	88.0	54.0	51.0	55.0	18.0
24 HRS / 50 YRS	26.6	23.4	24.1	53.8	41.2	70.7	65.1	58.9	72.1	65.9	36.8	26
24 HRS / 100 YRS	31	27.3	28	61.8	46.7	80.9	73.8	66.5	81.4	75.2	42.4	30.4

2.2.4 *Mean temperatures*

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Maximum	19	22.2	24.7	29.2	30.4	32.7	32.9	31.2	29.2	25.8	22.4	19.2
Minimum	0.4	3.3	7.0	12.1	14	16.2	16.9	16.2	14.0	9.7	5.0	1.3

2.2.5 *Mean monthly wind direction and speed*

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Speed (m/s)	4.0	4.3	4.6	4.8	4.9	4.7	4.4	4.0	3.8	3.7	3.6	3.8

	N	NE	E	SE	S	SW	W	NW
Wind Direction (m/s)	159	98	39	35	55	78	110	155

2.2.6 *Mean monthly evaporation*

The gross annual evaporation rate is on average 2365mm. Thus, with an annual average rainfall of 380,8mm, the nett evaporation may be calculated to be 1984mm.

This denotes extremely dry conditions.

2.2.7 *Incidence of extreme weather conditions*

Frost: This can occur from April to October and temperatures during this period can be extremely low. The lowest recorded temperature in this area is –7,8 °C.

Hail: This is a very rare occurrence in the region. Hail does, however, occur at an average of 1,2 days per year in the area.

Drought: Temperatures during the summer months frequently exceed 30°C and can reach 40 °C at times. These high temperatures coupled with low rainfall make the region susceptible to very dry conditions.

High winds: High winds occur infrequently in the region.

2.3 Topography

See Map 2.

The site is situated on the Highveld of the inland plateau at an altitude of 1200m – 1400m above sea level. The landscape slopes generally to the south west and gradients are very shallow.

There is much local disturbance in and on the claims area where the topography has been significantly altered due to previous mining activities. The blast hole currently measures about 250m in diameter and is estimated to be approximately 50m deep with steep sides (i.e. up to 1:1 gradients). Significant erosion has occurred around the perimeter of this blast hole, causing it to have become larger than when the mine was still operational.

Figure 1: Blast hole

The old slimes dam is evident and the tailings dumps are prominent, currently covering an area of about 5ha. A small pan has formed as a result of contained runoff within the tailings dumps.

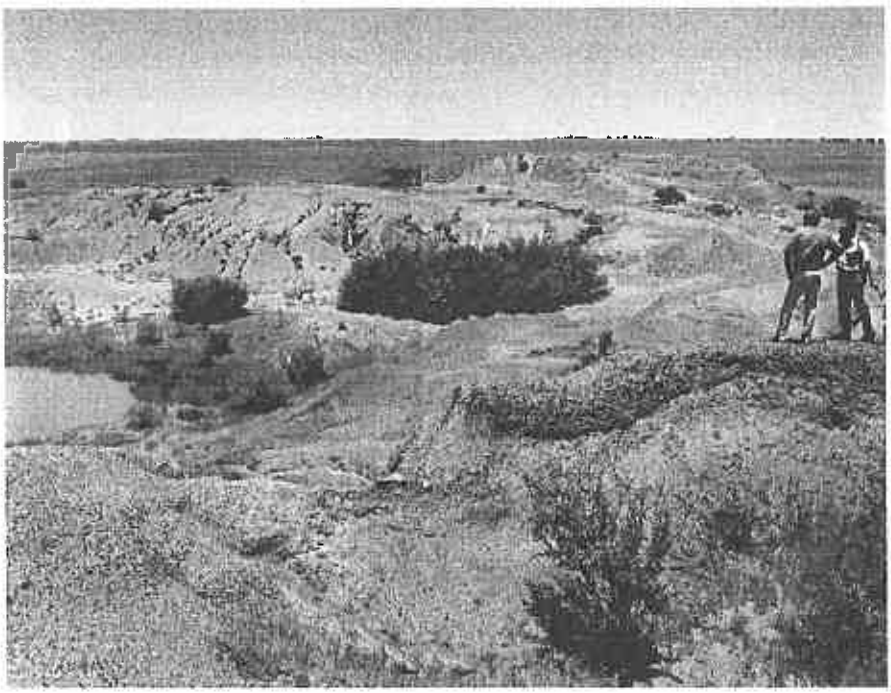

Figure 2: Existing tailings dumps to the south

Figure 3: Existing slimes dam

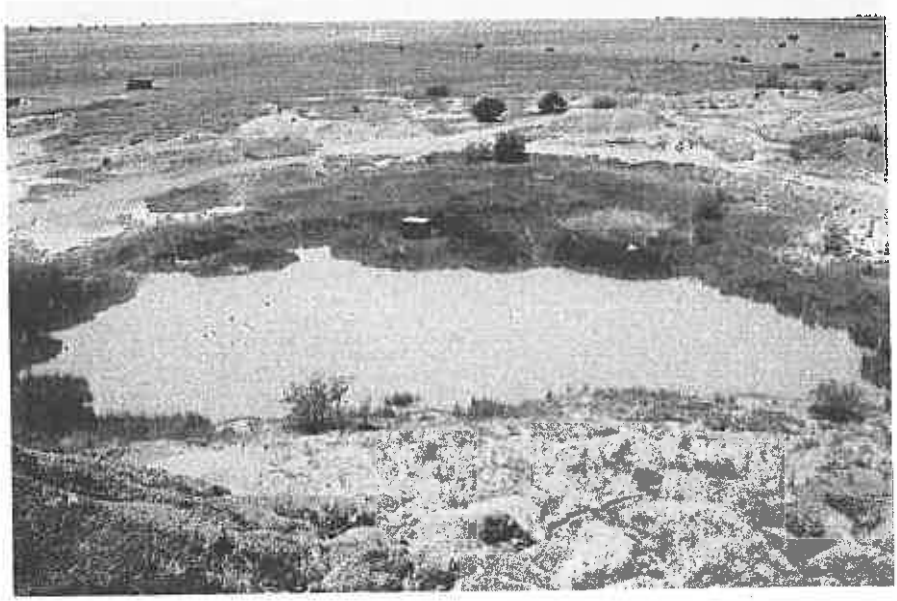

Figure 4: Localised pan due to runoff from tailings

2.4 Soil

See Map 3.

Soil classification is done according to the Taxonomic System for South Africa (Macvicar *et* al, 1991). The site falls under land type Db3a, according to Land Type Map 2824 Kimberley (Department of Agriculture – Technical Services). These soils are characterised by a dominant prismacutanic and / or pedocutanic horizon and a non-red B-horizon.

The soils of the claims area are very erodible and classified into the *Valsrivier* form. The topsoil is a bleached sandy clay *Orthic A* horizon that overlies a sandy clay pedocutanic *sub*-horizon.' Unconsolidated material without signs of wetness' underlies the pedocutanic sub-horizon. The depth of the topsoil is 250mm and that of the pedocutanic horizon 550mm.

Figure 5: Soil profile (*Valsrivier* form) as seen at periphery of blast hole

2.5 Pre-mining land capability

See Map 4.

Mining activity on Blaauwbosch was discontinued in 1967, so it is difficult to determine with certainty the pre-mining land capability of the mine. It can, however be stated, given consideration of the surrounding un-mined areas that the land would have been suitable for grazing.

The claims area (measuring 85,6ha) is mostly disturbed as a result of the aforementioned mining activities. As all activities associated with the re-commissioning of the mine will be concentrated in this claims area, no further disturbance of virgin land with arable, grazing or wilderness potential will occur.

2.6 Land use

2.6.1 Pre-mining land use

See point 2.5 above. The claims area was previously mined, before which the site was most likely used for grazing.

2.6.2 Historical agricultural production

Much of the adjacent land is presently used for grazing and the production of crops. The nature of the grazing is sweet due to the clay substrates, but production of sweet grass is limited nowadays due to the condition of the pastures. This, mainly as a result of overgrazing, has resulted in sub-optimal grazing.

2.6.3 Evidence of misuse

In addition to the disturbances caused by past mining activities, which were left un-rehabilitated, the general condition of the site and surrounds is degraded. Overgrazing on the sensitive *Valsrivier* soils is reflected in the dominance of sub-climax grasses. Outside the property next to the road reserve where the area is protected against grazers, red grass (*Themeda triandra*) dominates.

2.6.4 *Existing structures*

Remnant structures from past mining operations still exist on the site, most of which will be used in the new mining operation. Those that will not be used will be demolished during the initial site cleanup.

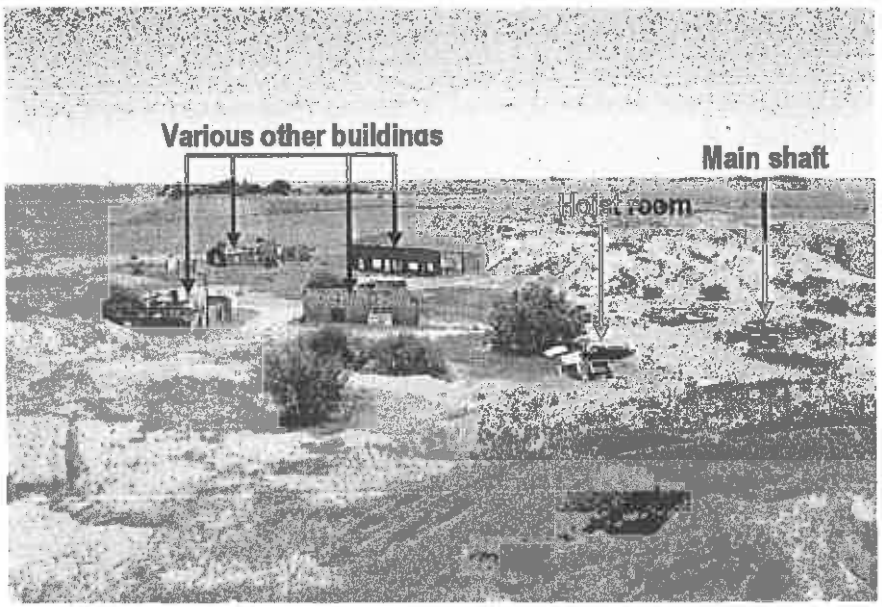

Figure 6: Remnants of previous mining activities – claims area

2.7 Natural vegetation / plant life

See Map 3.

2.7.1 *Dominant species*

The vegetation of the area may be described as Pan Turf Veld (*Veld Types of Southern Africa*. Acocks 1975). This is veld occurring on the turf soils of the flats around the pans and constitutes a very dense *Themeda* veld. Not much of this veld is left in its original condition, however, and overgrazing has led to other species replacing *Themeda* as well as some invasion by Karoo species.

Little natural vegetation remains within the claims area as most has been degraded by previous mining activities and the construction of associated infrastructure.

The following species were noted on the site:

- *Aristida congesta* subsp.*barbicollis;*
- *Cynodon dactylon;*
- *Digitaria eriantha;*
- *Enneapogon cenchroides;*
- *Eragrostis lehmanniana;*
- *Eragrostis obtusa;*
- *Eragrostis superba;*
- *Fingerhuthia africana;*
- *Panicum sp;*
- *Sporobolus sp* and
- *Themeda triandra.*

The woody layer is not well represented, but the following species were noted:

- *Acacia tortilis* and
- *Rhus lancea.*

2.7.2 *Endangered or rare species*

No endangered or rare species were noted on the site.

2.7.3 *Invader or exotic species*

Exotic invaders species that were noted on the site include the following:

- Syringa (*Melia azedarach*) and
- Mesquite (*Prosopis glandilosa*).

2.8 Animal life

2.8.1 *Common species*

A small herd of introduced blesbok were the only large mammals encountered during the site visit by the Landscape Architect on 8 January 2002. Due to the nature of the environment, small antelope

such as duikers could be expected to occur as well as dassies and jackals. Birds such as guinea fowl may also be found.

2.8.2 Endangered or rare species

No endangered animals, as listed in Schedule 1 of the Nature and Environmental Conservation Ordinance of 1974, are known to occur in the area.

2.9 Surface water

See Map 2.

2.9.1 Details of surface water quantity

Numerous pans in the vicinity constitute the only perennial or seasonal surface water near the site. The blast hole contains permanent water as a result of some seepage and surface runoff. A small pan which is enclosed by tailings dumps holds surface runoff water, but it is unlikely that this is a natural feature.

Floodpeaks and volumes are not applicable as the claims area is situated well away from any perennial watercourse. No river diversions will be required.

2.9.2 Surface water quality

A water quality sample dated 28 January 2002 was taken from the blast hole on the Blaauwbosch site (referred to as Bloubospyp – see Appendix 1). Tests on this sample reported it to be 'not in good condition', with Calcium, Chloride, Magnesium, Sodium and Sulphate exceeding recommended standards. This water is believed to be mostly surface runoff water.

2.9.3 Drainage density

No drainage areas outside of the disturbed claims area will be affected as the required infrastructure will be rebuilt on previously disturbed land.

2.9.4 *Surface water use*

Some of the pans in the area are used for agricultural purposes, and a few small dams have been built on nearby farms for irrigation and stock watering. The mine does not, however, affect any of these pans or dams, and consequently no surface water users in the area will be affected.

2.9.5 *Water authority*

The provincial department of Water Affairs and Forestry has authority over all underground and surface water resources. Boshof and Dealesville fall within the Lower Vaal Management Area.

2.9.6 *Wetlands*

No natural wetlands or pans are present in the claims area or on the site. The small pan is not believed to be a natural feature, but rather formed as a result of altered runoff because of the old tailings dumps.

2.10 Ground water

2.10.1 *Depth of water table*

No assessment was undertaken to establish the ground water table, but it may be assumed that permanent water would occur at 40m, which is the level of water in the boreholes on the Blaauwbosch site.

2.10.2 *Water boreholes and springs*

No natural springs occur on the site. Two boreholes dating from previous mining activities are to be found at the site gate and near the old manager's house. Only the borehole at the manager's house will be used for mining and / or domestic use on the Blaauwbosch site, and it is estimated to have a maximum yield of 8000 litres/hr.

2.10.3 *Ground water quality*

A water quality sample dated 28 January 2002 was taken from the borehole on the Blaauwbosch site (referred to as Bloubos – see

Appendix 1). Tests undertaken on this sample reported that it was 'in good condition', with no element exceeding recommended limits.

2.10.4 Ground water use

The farms to the west and east of the mine both utilise ground water for domestic and agricultural purposes. Regionally, most farms make use of ground water supplemented by surface water from local pans and farm dams. Mining operations in the area also make use of ground water.

The Blaauwbosch mining operation use approximately 15000 litres of water per day, obtained mostly from the borehole and from ground water pumped from the mine. Excess water from the slimes dam, surface runoff from the claims area and some seepage water from the blast hole will supplement the supply. All this water will be captured and stored in a process water storage dam for use in the plant.

2.10.5 Ground water zone

No assessment was undertaken to establish the extent of the ground water zone, but Mr George van der Merwe of DWAF is of the opinion that there is minimal ground water in the area. A programme of monitoring the level of the water in the borehole on Blaauwbosch will be used to assess whether mining operations are impacting on the ground water zone.

2.10.6 River diversions

Not applicable.

2.11 Air quality

The areas surrounding the Blaauwbosch mine are characterised mostly by farming and some mining activity.

Due to the arid conditions of the region and historical overgrazing practices, the vegetative cover has been depleted. Soil particles are easily airborne and thus contribute to the cumulative impact of dust as an air pollutant.

Ploughing and harvesting of croplands are a seasonal source of dust, especially during dry years.

Additional sources of air pollution are the Zoet and Zuur Diamond Mine approximately 3km to the north east and the New Elands Diamond Mine (which may be re-commissioned in the near future) beyond that. Furthermore, the roads in the area are predominantly gravelled and generate considerable dust through daily use.

2.12 Noise

Currently no noise pollution is noticeable on the site, and the potential impact of noise is not expected to be significant, even with the undertaking of activities such as blasting and crushing. The two neighbouring farms, of which the homesteads are less than 2km away, may experience some disturbance.

2.13 Sites of archaeological and cultural interest

The mine and associated infrastructure will be located on the previously disturbed claims area. No evidence was found of any artefacts, graves, or historical buildings that may be of archaeological or cultural interest during a site visit by the Landscape Architect on 8 January 2002.

It is therefore not deemed necessary to undertake an archaeological survey unless excavations reveal significant finds during the course of mining operations.

2.14 Sensitive landscapes

No landscapes under statutory protection occur on the property, but the highly erodible nature of the *Valsrivier* soils is of concern.

2.15 Visual aspects

The mine is located well away from tourist routes, scenic areas and residential areas. The secluded nature of the site as well as the limited infrastructure means that the visual impact will be small despite the flat topography. When approaching

the mine, the tailings dumps and mining infrastructure will be visible from both neighbouring farms and from the gravel access road (leading off the R64). The mine will also be visible from the R64, although not significantly apparent as it is situated approximately 3km from this road.

No dust or any other atmospheric pollution is in evidence as the mine is not yet operational, but dust generated from mining activity may be evident from the two neighbouring farms and the gravel road.

2.16 Regional socio-economic structure

The following socio economic information was acquired from Statistics SA and reflects the findings of the 1995 census:

2.16.1 Population density, growth and location

The Free State Province constitutes about 7% of the population of South Africa. The black population group makes up 84% of this, followed by the white population (13%) and the Coloured and Indian populations (3%). The relatively low population density is estimated at 21 people per square kilometre of which the majority is to be found in urban areas (59,2%).

The following socio economic information was acquired from Statistics SA and reflects the findings of the 1995 census:

2.16.2 Economic activities and sources of employment

The employed sector of the population in the Free State work in three main sectors:

- Community, social and personal services (38%, including general government);
- Agriculture (26%, including hunting, forestry and fishing) and
- Wholesale and retail trade (13%, including catering and hotel services).

Those working in the informal sector constitute about 16% of the economically active population of the Free State.

The main contribution to gross geographic product (GGP) is mining and quarrying, followed by community, social and personal services.

Black households in the Free State are the poorest, with 38% earning less than R6868 per year, while more than 50% of white households earn in excess of R52800 per year.

2.16.3 Unemployment estimate

The economically active population is defined as all people aged 15 years or older who are working or available for work in the next week. According to this definition, about 38% of the population of the Free State is economically active and about 74% of this economically active population is employed – slightly higher than the proportion for the entire country (71%). This implies an unemployment rate of 26%.

2.16.4 Housing

Approximately 69% of households in the Free State live in formal brick structures. The remainder of households live in traditional dwellings (12%), shacks (10%) and hostels (9%). Workers on the gold mines in the northern part of the Free State account for the high proportion of hostel dwellers. Also, the fact that shacks are more common in urban areas compared with non-urban areas reflects the migration of people into towns and cities.

2.16.5 Social infrastructure

There is no social infrastructure in the form of schools, hospitals, sports and recreation facilities, shops, police or civil administration in the area outside of the urban centres of Boshof and Dealesville. Kimberley is the closest large urban centre.

2.16.6 Water supply

Tap water is the main source of water for drinking in the Free State, and over 80% of households in the province use this source. Rainwater, streams, dams, wells and springs are also used as sources for water.

No municipal service infrastructure exists in the area. Ground water is used for domestic, agricultural and mining purposes.

2.16.7 Power

The 1995 household survey findings for the Free State Province indicate that proportions of households using electricity for cooking, heating and lighting are 56%, 54% and 71% respectively. After electricity, wood and paraffin are used for domestic purposes.

Eskom lines bypass the site approximately 3km to the north west and approximately 1km to the south. These lines run from the town of Boshof nearby.

2.17 Interested and affected parties

The two adjacent landowners were visited by representatives of Kophia Diamonds on 13 February 2002 for their comment on the Draft EMPR. Neither one had any objection to the proposed mining operations. Their declarations in this regard have been included as Appendix 5.

PART 3: MOTIVATION FOR THE PROPOSED PROJECT

3.1 Benefits of the project

3.1.1 Where is it intended that the product be sold

No buyers have been predetermined and no agreements have been reached as to the sale of the diamonds. The diamonds will most likely be sold to various buyers and on tender, depending on price.

3.1.2 An estimate of the expenditure required to bring the project into production

To bring the project into production an expenditure of approximately R1,5 million has been estimated.

3.1.3 An estimate of the total annual expenditure at full production

Monthly expenditure / operational costs are estimated at R200000 at full production:

- Wages and salaries: R90000
- Diesel and oil: R18000
- Explosives and accessories: R20000
- Eskom power: R12000
- Surveying fees: R 3000
- Consumables: R17000
- Drillsteel etc: R15000
- Petty cash: R 5000
- Miscellaneous: R20000

This amounts to an annual expenditure of approximately R2,4 million.

3.1.4 An estimate of the labour force at full production

Direct benefits of the project include the creation of 40 permanent jobs, of which 8 will be skilled and 32 unskilled.

3.1.5 *An estimate of the multiplier effect*

The 40 permanent jobs created by the project will secure a constant income for 40 families. With an average family size of 3 persons, this implies that an estimated 120 persons will benefit financially from employment created by the project.

A translation of the estimated expenditure and operational costs addressed in 3.1.3 above indicates that the mine will spend approximately R110000 per month locally and approximately R90000 per month regionally.

3.2 Consideration of project alternatives

3.2.1 *Mining method*

No alternatives to the chosen inclined chambering method have been explored as this is deemed to be the best method to use on the blast hole.

3.2.2 *Mineral processing method*

Kimberlite ore is crushed followed by a gravity separation process. The infrastructure remaining on site from previous methods used for this process makes the investigation of alternatives redundant.

3.2.3 *Transport, power and water supply routes*

Regionally, the gravel road leading from the R64 and the R64 itself, are the only viable transport routes. No alternative routes are possible.

An access route to the mine currently exists, and this route will be upgraded. Power and water supply routes are indicated as the most direct links and are therefore the most economical. No alternatives have been considered.

3.2.4 *Sources of water*

It is anticipated that the borehole, supplemented by ground water from the mine will yield sufficient quantities of water for Phase One and Phase Two of the mining operation. Runoff water and water from the residue dumps will also be collected and recycled for re-use in the mine processing plant. No other alternatives are considered viable.

3.2.5 *Mine infrastructure sites*

All required mine infrastructure will be established within the claims area, and to a large extent determined by existing infrastructure. The main shaft is located to the south west of the deposit, and this will be re-opened for use.

The plant will be erected close to the shaft, which will be mined during Phase Two. Other associated infrastructure such as the compressor will be located close to the plant. Wash bays and vehicle service yards will be constructed near to the office. No alternatives were investigated as these locations are most efficient and economical and the area is already disturbed.

3.2.6 *Mine residue disposal sites*

Tailings will be reworked and used for some initial rehabilitation work on the site. Due to the large amount of erosion that has taken place around the blast hole, reworked tailings will initially be dumped into the eroded gullies of the blast hole (but not into the blast hole itself) and then used to construct a berm around the perimeter of the blast hole to render it safe. Thereafter, the tailings will be dumped in the area currently under tailings.

Slimes dams will be constructed on the site of the old slimes dam. As this site is already disturbed and adequate space exists for expansion, no alternatives have been considered.

3.2.7 *Domestic and industrial waste disposal sites*

Domestic waste will be transported to the nearest registered domestic waste disposal site.

Industrial waste will be sorted and stored in a salvage yard for reuse, sale or disposal at the nearest registered industrial waste disposal site.

Due to the relatively remote location of the mine, it was not deemed necessary to explore alternatives.

3.2.8 *Housing sites*

Only a manager will be housed on the Blaauwbosch Mine property.

Kophia is currently in the process of applying for the re-commissioning of the New Elands Diamond Mine (approximately 5km to the north of Blaauwbosch), and a staff housing compound adequate for the needs of both mines exists on this site. Staff from Blaauwbosch will therefore be housed on the New Elands site. The construction of staff housing on the Blaauwbosch site is not economically viable so this was not considered as an alternative.

Figure 7: Housing compound at the New Elands site

3.2.9 *Land use options after rehabilitation*

Land use options after rehabilitation are constrained by the nature of the claims area. Extensive alteration to the natural vegetation and topography has occured and there is also evidence of historical overgrazing having taken place. The claims area will be rehabilitated in accordance with the requirements of the Minerals Act 1991, however, the land is unlikely to be agriculturally productive or suitable for extensive livestock grazing purposes.

3.2.10 *Alternatives to river diversions*

Not applicable.

3.2.11 *The "No project" option*

The claims area has already been mined and environmental damage has already occured. The site is currently in a degraded state as no rehabilitation of the site has been undertaken since closure 35 years ago. The option to mine this site has been determined to have greater benefits than the 'no project' option as mining activities will involve the reprocessing of old tailings dumps and the rehabilitation of the mine in compliance with the Minerals Act 1991. In addition, the mine will have a positive socio-economic impact on the region through expenditure and job creation.

PART 4: DETAILED DESCRIPTION OF THE PROJECT

4.1 Surface infrastructure

Map 5 indicates the surface infrastructure that will be required to support the mining operation.

4.1.1 Roads, Railways and Powerlines

The gravel road leading off the R64 to the site will be graded and maintained as a gravel access road. Internal roads will also be gravel roads.

Power will be supplied by means of a 22000kVa overhead connection to the Eskom lines that bypass the site to the south.

No rail link is required to the site.

4.1.2 Solid waste management facilities

4.1.2.1 Industrial and domestic waste disposal sites

Domestic waste, generated from the office will be collected in refuse receptacles strategically located around the claims area. Refuse will be collected from these receptacles on a regular basis and disposed of at a registered refuse disposal site. This system of waste disposal will also be used at the housing compound on the New Elands site.

All industrial waste within the mining area will be sorted and consolidated within a defined salvage yard measuring approximately 50m x 50m which will be fenced off. Redundant and scrap steel may be stored separately for re-use or sale.

All hazardous waste such as oil, grease, batteries, neon globes etc. will be stored in suitable receptacles within the allocated fenced storage area.

No waste and / or scrap will be buried or haphazardly dumped on the site.

4.1.2.2 Mine residue disposal sites

The mine generates and disposes of three types of residue:

- Waste rock;
- Tailings from the treatment plant and
- Slimes from the treatment plant and underground.

Waste rock will be used as a support for the slimes dam and tailings dumps. The foot of these dumps will be compacted, and overlain with waste rock material at a gradient of 18° as it is generated. Rehabilitation and stabilisation of the tailings and slimes dams will occur throughout the normal course of activities thereby minimising the need for extensive rehabilitation of these structures on closure.

The tailings dumps consist of kimberlite ore, which is treated through a number of crushing / grinding processes and screened out. Phase One of the new mining operation will involve the re-working of the existing tailings (currently covering an area of approximately 5ha) and its subsequent re-deposition firstly into erosion gullies, then to create a safety berm around the blast hole, and finally onto dumps within the area currently under tailings.

The source of all slimes generated by the mine is from kimberlite ore being crushed to various sizes, followed by a gravity separation process. The old slimes dam is empty, but the footprint measures approximately 100m x 75m, currently allowing for the storage of 7500m² of material to a maximum height of 5m. Slimes for the Blaauwbosch operation will be disposed of on the site of the old slimes dam. Space exists on disturbed land to the south, east and north for expansion, should this be necessary.

4.1.3 Water pollution management facilities

4.1.3.1 Sewage plant

An ablution facility consisting of a toilet, a wash hand basin and a shower will be located alongside the office building in the claims area. Sewage will be directed into a septic tank, to be cleaned as required, while all effluent water from the shower and basin as well as from any washing facility in the claims area will be disposed of in a properly constructed French drain, and allowed to infiltrate.

The French drain will have an overall capacity of approximately 30m³. Only domestic type wash water will be allowed to enter the drain and any effluents containing oil, grease or other industrial substances will be collected in a suitable receptacle and removed from the site to a registered disposal site.

The 5 toilets, 5 wash hand basins and 10 showers at the housing compound at New Elands will be upgraded to accommodate the needs of the mine workers. The sewage and effluent will be directed to the septic tanks and French drains on site respectively.

4.1.3.2 Pollution control systems.

The tailings dumps and mine processing plant area will be protected by a system of toe trenches that will collect surface water runoff from these areas. The trenches will deliver the 'dirty' water to the process water storage dam via gravity feed.

Despite the arid and dry nature of the area and the high evaporation rate, the slimes dam has been identified as an area of potential seepage. A runoff containment trench will therefore be constructed to minimise seepage into the surrounding natural areas. The slimes dam will additionally be equipped with a penstock sump drainage system and any water emanating from this source will be channelled to the process water storage dam. No excess water will be stored in the slimes dam.

4.1.3.3 Polluted water treatment facilities

As the processing of kimberlite does not utilise any chemicals, the amount of polluted water likely to be generated is not deemed to be significant. No treatment beyond the management of polluted water discussed in 4.1.3.2 will take place.

4.1.4 Potable water plant

No potable water plant is required for this operation. Potable water for the mine and the manager's house will be obtained from the borehole and stored in 2000 litre tanks - two at the mine and one at the house. The housing compound on the New Eland site will obtain potable water from a borehole on the site. This water will be stored at the compound in two 2000 litre tanks.

4.1.5 Process water supply system

Water for the mine and plant processes will be pumped from the process water storage dam as required. This dam will be an unlined earth-wall construction (using tailings material) measuring roughly 50m x 50m x 3m, with a capacity of 8000m^3.

It is estimated that approximately 5000 litres per day will be required for the mining operations. Two 14 foot wash pans will be used, each requiring 250 litres/hr. This implies that approximately 5000 litres of water will be required per day (assuming a 10 hour work day).

The dam will be filled mainly by borehole water and ground water from the mine, which will be pumped dry on an ongoing basis. This water will be supplemented by a combination of ongoing dewatering of the blast hole (not anticipated to be much), excess water from the slimes dam and runoff from within the claims area.

4.1.6 *Mineral processing plant*

Once the kimberlite is mined it, is sent to be processed in recovery plants, where it is first crushed to manageable proportions. The recovery process begins as the material passes through the first series of rotary washing pans. Here it is mixed with puddle, which has a specific gravity of 1,25 in comparison with a diamond's 3,5 and is kept in suspension by revolving arms with triangular teeth. The heavy concentrate settles to the bottom with most of the bigger diamonds and moves to the outer rim of the pan where it is drawn off. In all it amounts to about one percent of the total.

The lighter mass revolving in the pan eventually escapes over a weir in the middle, and runs over screens which separate particles bigger than 10mm in diameter from smaller ones. Undersize passes to secondary pans while the oversize goes to a re-crush section and run through the process again. A further one per cent of concentrate emerges from these secondary pans, and goes on to the recovery plant by conveyor belt.

The residue in the secondary pans is passed over even finer screens sifting concentrate down to 3 mm across and the oversize is disposed of as waste or 'tailings'. The material less than 3mm across is pumped to hydrocyclones, where the solids are pulled out and passed to tertiary pans where even more true concentrate is recovered. At the recovery plant the concentrates, which have emerged from the rotary pans, are thoroughly washed on a 3 mm vibrating screen and the undersize are pumped back to the re-concentrating pans of the washing plant.

The oversize go on to a heavy media separation cone containing a charge of ferro-silicone and water, which has a specific gravity of 2,95. Revolving scrapers keep the mixture in suspension. When the concentrate reaches the cone, the material with a specific gravity of less than 2,95 rises to the surface, overflows and is discarded. The heavier material sinks, and is removed and is then raised to a secondary heavy

media separation cone where the charge has a specific gravity of 3,15. The overflow is again discarded and the heavier fraction, comprising about 50 per cent of the feed, is removed, sized and washed ready for final recovery of the diamonds.

The feed then passes to the grease-belts, covered with a thick layer of highly refined grease and sloped across the direction of movement. These belts will catch diamonds bigger than 3mm across. Water runs over the surface in a wide stream and concentrate from the heavy media separator section is dropped on to the belt in an even flow. Other minerals in the concentrate are washed over the surface of the grease to waste. The concentrate less than 3 mm across goes over electro-magnetic vibrating screens which remove all the water, then gravitate down towards the grease tables. These have sloping, three-stepped decks, which are vibrated as the concentrate steadily passes over them. The water washes away the gravel while the diamonds stick to the grease and are scraped off. The diamonds are given a final cleaning before they are graded.

4.1.7 Workshops, Administration and other buildings

Most of these structures are located in positions as decided by previous mining activities (refer to Map 5). They will be grouped in a defined work area. Only the explosives magazines will be located to the south of the tailings dumps, for safety purposes.

A wash bay and vehicle service yard will be constructed adjacent to the proposed office and a salvage yard will be located near the workshop storeroom.

4.1.8 Housing, recreation and other employee facilities.

A housing compound exists about 5km away at the nearby decommissioned New Elands Diamond Mine. Kophia Diamonds is currently applying for this mine to be re-commissioned at the same time

as Blaauwbosch. The capacity of this compound is 80 beds, and the staff from the Blaauwbosch Mine will be housed there.

Should the accommodation requirement increase beyond the capacity of this compound, it will be enlarged to ensure that there is no overcrowding and that the accommodation provided is both hygienic and safe.

Social and recreational facilities in the form of an informal soccer field, a television and a pool table will be provided at the compound.

4.1.9 Transport

Heavy-duty trucks and front loaders will be used within the claims area. These trucks will keep to the defined paths and graded routes.

As workers will be housed at the compound approximately 5km from the mine, they will be brought in to work and transported back every day.

4.1.10 Water Balance Diagram

The figure overleaf illustrates the expected source, storage and consumption of water at the Blaauwbosch Mine. Figures are approximations based on similar mines operating in similar environments.

4.1.11 Disturbances of watercourses

Not applicable.

4.1.12 Stormwater

Refer to 4.1.3.2

Stormwater from undisturbed areas will be directed away from the processing area, residue deposits and the open pit, by means of a trench and berm system. The trenches will collect 'clean' water and dispose of it in the veld. All such trenches will be equipped with energy dissipation measures at the discharge points.

Stormwater and process water will be kept separate and directed to appropriate destinations by trenches.

Stormwater diversion walls will be constructed to prevent contamination of clean run-off water.

4.2 Construction phase

See Map 5.

Most construction required will be in the form of rebuilding infrastructure. This would include the construction / restoration of an office with ablutions, a workshop storeroom, two explosives magazines, the manager's house, the process water storage dam, the slimes dam and the establishment of roads and services.

The blast hole will be dewatered, this water initially pumped into the process water storage dam over a one to two week period. It is estimated that approximately 10000m³ will have to be pumped from the blast hole before mining can commence. A pump will remain in the blast hole, which will be pumped dry as required throughout the operational phase (and specifically during the rainy season).

As per the requirements of the DME, the blast hole will be 'made safe' through the construction of a safety berm around the perimeter. Considering the very sensitive nature of the *Valsrivier* soils on the site, this berm will be constructed using tailings.

4.3 Operational phase

4.3.1 Soil utilisation guide

See Map 5.

It is anticipated that very little topsoil will be disturbed due to the fact that all development which is required will be located on disturbed land. Should any topsoil be salvaged from the developments (i.e. ahead of the safety berm, tailings and storage dam sites), this will be stockpiled and then used together with waste rock to stabilize the walls of the slimes dam as required.

4.3.2 Mine surface layout

See Map 5.

All facilities will be restricted to previously disturbed land within the claims area.

4.3.2.1 Access to the workings

In order to afford the men working in the chambers a ready means of ingress and egress, and to provide ventilation, so-called 'poleways' will be constructed. A second outlet shaft lies to the north of the blast hole. This shaft, which is connected by means of a corridor to the main shaft will not be operational but will be equipped with a ladder and maintained as a safety exit.

Entrance and exit points will be constructed and developed in accordance with the determined safety requirements, as will be made

apparent during safety inspections. Compliance with prescribed safety requirements will be adhered to.

4.3.2.2 Structures affected by blasting operations

It is not anticipated that any structures will be affected by blasting operations.

4.3.2.3 Surface subsidence

Areas prone to subsidence and erosion will be 'made safe' and rendered inaccessible by means of a fence or berm around the perimeter (refer to 4.2 above).

4.3.2.4 Structures and drainage paths that may be affected by surface subsidence

It is not anticipated that any structures or drainage paths will be affected by subsidence.

4.3.2.5 Mining Plan

Refer to Maps 5 and 6.

4.3.3 Mineral processing

Hoisted ore from underground is fed into the plant. The ground is crushed until it is smaller than 6mm. This fine material is then put through a pan plant and the concentrate is retained. The light material is conveyed out onto the tailings dumps.

The plant is potentially the area most likely to contribute to air, water and noise pollution. Air pollution could rise from the inefficient operation of dust extraction and scrubbing plants. Crushers, feeders, cyclones and screens can possibly cause noise pollution. This noise is localised and depending on climatic conditions could be regarded as an irritant only by residents / workers on the mine.

It is anticipated that noise and dust will be generated during drilling and blasting, and withdrawal and loading of blue-ground.

4.3.4 *Plant residue disposal*

The processing of material will begin at approximately 3000 tons and peak at 6000 tons per month. For calculation purposes, an average of 4000 tons per month over a period of 10 years is used. Approximately 60% of this material will be tailings and 40% slimes residue.

Therefore, 2400 tons tailings per month and 1600 tons of slimes residue will be produced at maximum production.

Tailings:

2400 x 120 months = 288000 tons of tailings over 10 years = approximately 288000m^3 of dump volume required.

The area allocated for tailings effectively allows for the storage of the required material calculated at a construction gradient of 45°. No additional area will be required.

Slimes:

1600 x 120 months = 192000 tons of slimes over 10 years = approximately 192000m^3 of dump volume required.

This will require that the existing slimes dam be enlarged to accommodate the additional material load. Map 6 illustrates the expansion of the existing slimes dam to 20000m^2 (allowing for 100000m^3 of material at a depth of 5m) as well as the possible position of a second slimes dam should this be necessary.

The requirements for the design construction and operation of mine residue deposits including tailings and slimes dumps are described in the document "Guidelines for the Compilation of a Mandatory Code of Practice for Mines residue Deposits" (Department of Minerals and

Energy, 1998). Any improvements and extensions to existing will be done in accordance with the specific requirements of this document.

4.3.5 Transport

Owing to the size of the mine and the expected yields, no transport routes or methods have been devised for exporting the diamonds. It is envisaged that the diamonds will be sold to local buyers.

In terms of transport to and from the crusher and plant, the necessary machinery in the form of tipper trucks and front-end loaders will be used. Tailings will be dumped onto tailings dumps by conveyor belt.

4.3.6 River diversion

Not applicable.

PART 5: ENVIRONMENTAL IMPACT ASSESSMENT

The significance of impacts has been determined through a synthesis of the duration, magnitude and probability of anticipated environmental impacts occurring.

Duration Here it is considered whether the lifetime of the impact will be:

- Short term (e.g. 0-5 yrs)
- Medium term (e.g. 6-20 yrs)
- Long term more than 20 yrs.

Magnitude Here it is established whether the impact is destructive or benign and should be indicated as:

- Low (site) – within the mine boundaries
- Medium (local) – within the relevant district
- High (regional) – within the relevant province or region.

Probability Here the likelihood that the impact will actually occur is indicated as:

- *Definite* - More than 90% certainty. Substantial supportive data exists to verify the assessment
- *Probable* – Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
- *Possible* – Only 40% sure of a particular fact or of the likelihood of an impact occurring
- *Unsure* – Less than 40% sure of a particular fact or the likelihood of an impact occurring.

Based on the above, the significance rating scale has been determined as follows:

Very high Of the highest order possible within the bounds of impacts which could occur. In the case of negative impacts, there would be no possible mitigation and / or remedial activity to offset the impact at the spatial or

time scale for which it was predicted. In the case of positive impacts, there is no real alternative to achieving the benefit.

High Impacts of a substantial order. In the case of negative impacts, mitigation and / or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these. In the case of positive impacts, other means of achieving this benefit would be feasible, but these would be more difficult, expensive, time-consuming or some combination of these.

Moderate Impact would be real but not substantial within the bounds of those, which could occur. In the case of negative impacts, mitigation and / or remedial activity would be both feasible and fairly easily possible. In the case of positive impacts, other means of achieving these benefits would be about equal in time, cost and effort.

Low Impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and / or remedial activity would be either easily achieved or little would be required, or both. In case of positive impacts alternative means for achieving this benefit would likely be easier, cheaper, more effective, less time-consuming, or some combination of these.

Very low Impact would be negligible. In the case of negative impacts, almost no mitigation and or remedial activity would be needed, and any minor steps, which might be needed, would be easy, cheap and simple. In the case of positive impacts, alternative means would almost all likely be better, in one or a number of ways, than this means of achieving the benefit

No effect There would be a no impact at all – not even a very low impact on the system or any of its parts.

5.1 Construction phase

The construction phase for Kophia Diamonds is seen as an integral part of the operations phase.

The plant and associated infrastructure will be assembled first, and the necessary services such as water and electricity will be installed. The slimes dam and process water storage dam will also be established.

There are remains of previous mine infrastructure on the site, and some of these will be rebuilt as an office, a workshop, explosives magazines, a storeroom and a manager's house. The only other construction required is that of a wash bay and vehicle service yard near the office, none of which are really integral to the workings of the mine initially. The hoist and headgear will be erected later for Phase Two.

For this reason impacts associated with construction activities are considered limited and will be addressed in the operational phase as it is anticipated that they will occur concurrently.

5.2 Operational phase

As the mine is not currently in operation, the impacts dealt with below are simply anticipated impacts, and have been considered as worst case scenarios. The management plan that follows, again addresses the worst-case scenario, but it is anticipated that if it is adhered to during all phases of operation, the mine will have pre-empted and contained any potential impacts. The size of the mine, the localised extent of the operations activities and the disturbed nature of the adjacent farms also need to be borne in mind when listing anticipated impacts and when determining their degree of significance.

5.2.1 Geology

The impacts of mining on the geology are essentially associated with the change to the geological structure. This impact occurs only at the actual mining area and is therefore relatively limited. The anticipated structural changes, already effected through historical mining on the site, are not expected to influence the geological stability significantly, although some collapse of dykes could occur.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Structural changes	Subsidence	Moderate	Possible	Long term	Site

5.2.2 *Topography*

The topography has already been impacted by previous mining activity. The changes to the topography are those associated with the visual impact of the disposal sites and with drainage.

The flat low relief of the area has been altered by the physical presence of tailings dumps and the blast hole. These are permanent in nature and there is no mitigation available, other than profiling / landscaping and establishing vegetation on the slopes of slimes dams to soften the impact.

Those changes due to drainage structures are temporary in nature, and include the construction of drainage canals, stockpiles and the process water storage dam.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Permanent structures: slimes dams, tailings dumps, blast hole	Visual	Moderate	Definite	Long term	Local
		Alteration to drainage	Moderate	Probable	Long term	Site
	Temporary structures: drainage canals, storage dam, spoil dumps, stockpiles					

5.2.3 *Soils*

The primary impact mining activities will have on the soils is in the form of pollution. The issue of soil pollution is inextricably linked to that of water pollution, both surface and groundwater. Soils contaminated will show a reduction in fertility, depending on the type and severity of contamination, affecting both agricultural potential and natural vegetation. Soil can be contaminated through process water, the

cleaning of machinery and human use and may occur at and adjacent to the plant, office, workshop, salvage yards, wash bays and vehicle service areas.

Soil compaction is considered a secondary impact. It is expected that soil will be compacted during the erection of infrastructure and the renovation of structures. The processing area and the compound will be compacted throughout the operational phase. Existing roads are also continuously compacted by trucks and vehicles.

Permanent structures such as the slimes dams, tailings dumps, the storage dam and waste rock dump sterilise valuable topsoil if not this is not removed beforehand. Although most of these structures will be located on disturbed soils, it is crucial that existing topsoil be removed as far as possible prior to undertaking any such activity.

The reduction of vegetation cover on the *Valsrivier* soils, and the failure to treat / rehabilitate slopes which are already eroding (i.e. specifically those of the blast hole) leads to severe erosion, which is difficult to curb.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Infrastructure	Pollution	Moderate	Probable	Med. term	Site
	Vehicles	Compaction	Moderate	Definite	Med. term	Site
	Spoil dumps	Sterilisation	Mod. - low	Possible	Med. term	Site
		Erosion	Mod. - High	Definite	Long term	Site

5.2.4 Land (Capability and Use)

The entire claims area has historically been converted from any previous land capability (which is believed to have been wilderness and grazing) to mining. While it is not anticipated that any further areas on the site will be altered by mining activities, the claims area has been permanently altered, and potential land capability is therefore limited.

It is not possible to reinstate arable land to its historic capacity, but mine land, slimes dams, tailings dumps and other disturbed areas within the claims area may be stabilised and vegetated.

A concern is the effect on land capability in agricultural areas on the remainder of the site as well as adjacent to the site, which are subject to pollution by mine waste-water runoff. As far as possible, the management programme must ensure that all mining impacts are confined to the claims area.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Plant & shaft	Land transformation	Moderate	Definite	Med - long term	Local
	Slimes dams	Land capability	Moderate	Definite / Probable	Med. term	Local
	Tailings dumps					

5.2.6 *Vegetation / Plant life*

Naturally occurring plant habitats are limited on the site, and those that remain could be further impacted on by mine residual, litter and waste disposal, limiting the capability of the site to support habitat. However, none of the presently occurring species are considered rare or endangered thus the significance of this impact is limited.

Areas adjacent to the site are categorised by farming activities (mainly grazing), so it is not anticipated that any rare or endangered species will be found there.

The invasion of problem species could occur on the site, especially in disturbed areas. These may spread to adjacent areas if not controlled.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Plant & shaft	Habitat loss	Low	Definite	Med. - Long term	Site
	Slimes dams	Land capability	Moderate	Probable	Med. - Long term	Local
	Tailings dumps	Invasive species	Moderate - low	Probable	Long term	Site
	Compound					

5.2.7 *Animal life*

Previous mining related activities and infrastructure have led to the destruction of natural animal habitats within the claims area. In addition, the disturbance created by mining activity will result in the migration of wildlife away from the site.

Due to the size and type of animals likely to be found, i.e. small mammals, birds and reptiles, a potential impact of mining activity on the wildlife and animal life at the site would be in the form of poaching and extermination during the operational phase.

Another issue to be considered is the effect on the grazing / habitat potential of adjacent areas subject to mine wastewater runoff. Again, grazing land in the proximity of the mine that could be affected by runoff is limited and thus the impact of low significance although any disruption is to be contained and avoided as is practical.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Plant & shaft	Habitat loss	Low	Definite	Med. - Long term	Site
	Slimes dams	Land capability	Moderate	Probable	Med. term	Local
	Tailings dumps	Poaching	Moderate	Probable	Med. - Long term	Local
	Compound					

5.2.8 *Surface water*

As no natural surface water occurs on the site no impact is anticipated in this regard.

5.2.9 *Ground water*

The extraction of groundwater has an effect on the groundwater table. This is a temporary impact. Due to the limited ground water zone in the area, minimal seepage is anticipated, and therefore a minimal impact in this regard is anticipated.

During the crushing and sorting process of the plant, water is used to facilitate the process. The water is contaminated with silt, clay minerals and other suspended solids. This will impact mainly on the turbidity of the water. The process water will be pumped to the slimes dams where most, if not all the suspended solids will settle out.

While pollution of groundwater through infiltration of wastewater could occur, it should be noted that the mining process does not include any chemical processes. Limited impact on the groundwater quality is expected, as none of the mining methods would involve the generation of acidic fluids that can lead to leaching of the surrounding rocks.

Other potential sources of groundwater pollution include:

- The plant,
- The washing bay,
- The vehicle maintenance yard,
- Storage areas,
- Hazardous and Industrial waste collection sites

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Plant & shaft	Water quantity	Low	Definite	Med. term	Local
	Infrastructure	Water quality	Moderate	Possible	Med. - Long term	Local
	Slimes dams					
	Tailings dumps					

5.2.10 Air quality

It is not anticipated that the Blaauwbosch mine will cause significant amounts of atmospheric pollution during operation. The whole diamond extraction process is a wet process and during operation the slimes dams and tailings dumps will be moist and dust suppression processes will be in operation. Potential problem areas do, however, include:

- Gravelled roads, which will be used by heavy duty machinery transporting the kimberlite to the processing area;
- The point where kimberlite is dumped on the conveyor belt; and

- The crusher plant.

Dust pollution from slimes dams and tailings dumps is anticipated to be virtually non-existent during operation.

Dust will only become an issue on closure when these processes no longer occur and when the slimes dams start to dry out. The fine, loose particles on un-rehabilitated slimes dams are easily lifted and transported by the wind, causing local dust storms in gusty conditions. Dust will potentially be liberated from the slimes dams until vegetation on the dams has been established.

Prevailing winds are north to north-westerly with October and November being the windiest months. As the ground is extremely dry during this time, there is a likelihood that dust will become a more significant problem during this time of the year.

High winds could also induce fugitive dust from the tailings dumps, stockpiles, crusher plants, conveyor belts, roads, and other areas denuded of vegetation. This fugitive dust could affect crops and livestock in the area.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Plant	Dust	Low	Definite	Med. - Long term	Local
	Roads					
	Slimes dams					
	Tailings dumps					

5.2.11 Noise

The region is sparsely populated, with the closest residences located approximately 2km away. The mine is expected to generate very little noise due to its size, so noise emanating from the site is thus of limited significance in terms of being a nuisance to others.

The primary impact in this case is the effect of noise on the personnel at the Blaauwbosch mine, specifically inside the mine and plant. Providing that those working on the mine are issued with adequate safety equipment e.g. SABS approved hearing protection as required, the noise impact could be adequately ameliorated.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Plant	Noise	Low	Definite	Med. - Long term	Site

5.2.12 Resources (Archaeological and Cultural)

No sites of archaeological, social, cultural or historical significance occur on the site. The claims area is already disturbed by previous mining activities and no additional excavation will occur in undisturbed areas on the remainder of the site. Most new infrastructure required will be constructed on the existing disturbed areas. The impact on archaeological and cultural sites is not therefore deemed to be significant.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Blasting	Loss of artefacts	Low	Unsure	Long term	Site
	Shafts					

5.2.13 Sensitive Landscapes

Erosion of the somewhat sensitive soils is of concern, especially where slopes have already begun to erode. Areas of heavy traffic and high activity are also susceptible. As many denuded areas will not be rehabilitated and re-vegetated until the decommissioning phase, this impact is of moderate to high significance throughout the operational phase.

Activity	Aspect	Impact	Significance	Certainty	Duration	Magnitude
Mining	Infrastructure	Erosion	Mod. - high	Probable	Med. – Long term	Site
	Staff and labour					