mineral resources
Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Private Bag X6076, Port Elizabeth, 6000
Tel: (041) 396 3934
Fax: 0865768004
Cnr.Diaz and Mount Roads
Mount Croix
Port Elizabeth, 6001

Enquiries: D. A. Watkins
E-mail: deidre.watkins@dme.gov.za

Reference: EC 30/5/1/3/3/2/1/0415 EM
Date:

South African Heritage Resources Agency
P.O. Box 758
GRAHAMSTOWN
5200

Case ID: 2177

ATTENTION: MR. T. LUNGILE

Sir

CONSULTATION IN TERMS OF SECTION 40 OF THE MPRDA OF 2002: ENVIRONMENTAL MANAGEMENT PLAN, MINING PERMIT FOR STONE AGGREGATE GRAVEL MINING ON UNREGISTERED STATE LAND FARM 54 NYANDENI LOCAL MUNICIPALITY, DISTRICT OF LIBODE IN EASTERN CAPE.

1. Attached herewith, please find a copy of the contact details, a locality map and Mine development plan received for your comments.

2. Please forward any written comments or requirements your department may have in this regard, to this office not later than **20 AUGUST 2010.** Failure to do so, will lead to the assumption that your department has no objection(s) or comments with regard to the said document.

3. Consultation in this regard has also been initiated with other relevant State Departments.

4. Please use the reference number **(EC) 30/5/1/3/3/2/1(0433)** EM in all future correspondence.

5. Your co-operation is appreciated.

Yours faithfully

Motseo

REGIONAL MANAGER
EASTERN CAPE
DATE 23/06/2010

mineral resources
Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Private Bag X6076, Port Elizabeth, 6000
Tel: (041) 396 3934
Fax: 0865768004
Cnr.Diaz and Mount Roads
Mount Croix
Port Elizabeth, 6001

Enquiries: D. A. Watkins
E-mail: deidre.watkins@dme.gov.za

Reference: EC 30/5/1/3/3/2/1/0415 EM
Date:

South African Heritage Resources Agency
P.O. Box 758
GRAHAMSTOWN
5200

ATTENTION: MR. T. LUNGILE

Sir

CONSULTATION IN TERMS OF SECTION 40 OF THE MPRDA OF 2002: ENVIRONMENTAL MANAGEMENT PLAN, MINING PERMIT FOR STONE AGGREGATE; GRAVEL MINING ON UNREGISTERED STATE LAND FARM 54 NYANDENI LOCAL MUNICIPALITY, DISTRICT OF LIBODE IN EASTERN CAPE.

1. Attached herewith, please find a copy of the contact details, a locality map and Mine development plan received for your comments.

2. Please forward any written comments or requirements your department may have in this regard, to this office not later than **20 AUGUST 2010.** Failure to do so, will lead to the assumption that your department has no objection(s) or comments with regard to the said document.

3. Consultation in this regard has also been initiated with other relevant State Departments.

4. Please use the reference number **(EC) 30/5/1/3/3/2/1(0433)** EM in all future correspondence.

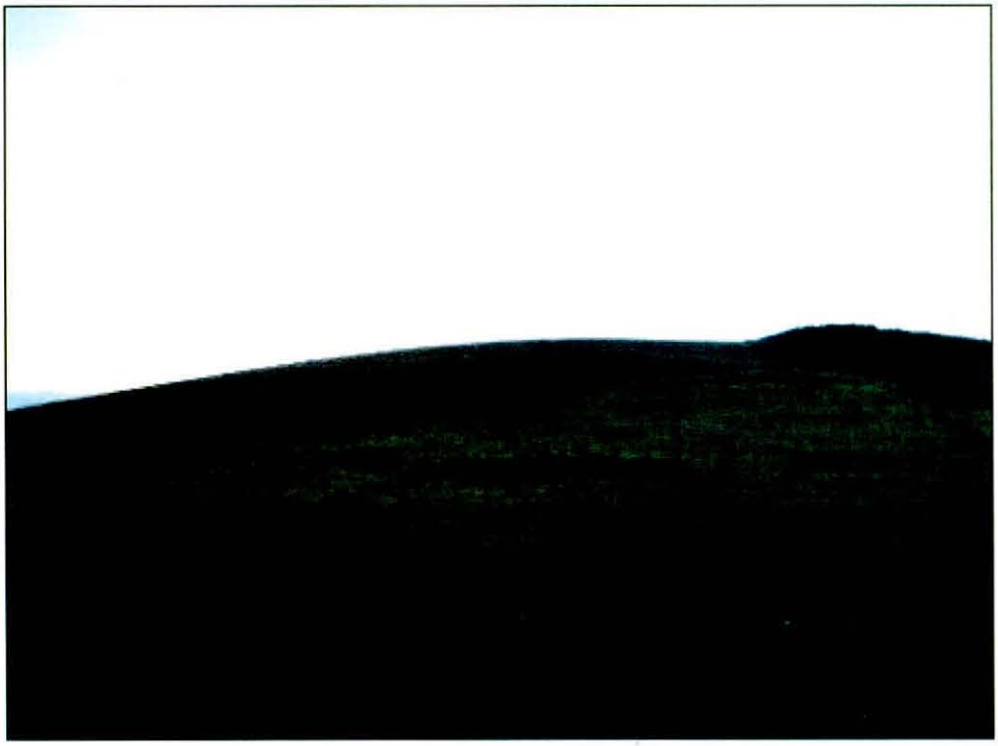
5. Your co-operation is appreciated.

Yours faithfully

Dots-co
REGIONAL MANAGER
EASTERN CAPE
DATE 23/06/2010

STELLENRYCK ENVIRONMENTAL SOLUTIONS

ENVIRONMENTAL MANAGEMENT PLAN FOR NGQELENI HARD ROCK QUARRY



PREPARED FOR:

Ikewezi Quarries
P. O. Box 808
Mthatha
5099

JUNE 2010

Tel. & Fax: 041 3672049 · Cell 0824140464/0824140472 · 4 Josephine Avenue LORRAINE 6070
Member: J. A. van As: B.Sc (Botany & Zoology), B.Sc (Hons) (Eco-Physiology), M.Sc (Plant Physiology)

ENVIRONMENTAL MANAGEMENT PROGRAMME FOR IKWEZI HARD ROCK QUARRY: NGQELENI

INTRODUCTION & BACKGROUND

The larger Ngqeleni area hosts a large number of large residential areas all located along the tar road that stretches down to the Mthatha and Mdumbi River mouths and has been identified as a future growth point on the outskirts of Mthatha in terms of residential development, smaller construction activities and road building and therefore represents a definite market for construction minerals, inclusive of cement bricks. The high costs of hauling causes aggregate from Mthatha to be very expensive and cannot be afforded by rural communities. There are also positive signs that the economy has started to recover from the 2009 slump and increasing business confidence is experienced by Ikwezi Quarries, who also operates another concern on the road to Port St. Johns and it wishes to seize the opportunities that the Ngqeleni area holds.

Considering that the Ngqeleni does not dispose of a commercial quarry and brick manufacturing concern, the applicant has decided to establish a hard rock quarry here with the possibility of brickyard at a later stage once the aggregate market has been adequately analyzed. This approach will ensure that the mobile crusher used at Ikwesi Quarries' other concern will be optimally used, resulting in better profitability over the short and long term. All the rural people as well as small brick making concerns and companies in the area will benefit from the venture since these products will be freely available at a reduced cost.

Development of a mining concern always poses a substantial financial risk irrespective of market predictions therefore the applicant has to determine the viability of the market prior to the application for a long term mining operation, the reason for applying for a mining permit first. Should Ikwezi Quarries manage to successfully establish an aggregate market, the proposed quarry will be made permanent and be extended by means of an application for a mining right. Certainty on the long-term viability of the proposed quarry will be known within the next two years. If Ikwezi Quarries cannot achieve the mentioned long-term goal, the quarry will be closed down in 2013.

The establishment of a small office and workshop will be the only infrastructure anticipated for the initial stages of the hard rock quarry. All topsoil on the mine area and process areas will be conserved to facilitate future rehabilitation thereof and the site would be reintroduced as a limited grazing unit. To reach this objective the excavation will not be used as a dumpsite, the production faces will be profiled and re-vegetated and will be protected by the required storm water control structures to facilitate stability of rehabilitated areas.

The proposed mining site will be an extension to the non-rehabilitated DRT Quarry that was used for the upgraded of the R61 that was concluded prior to 1995 and therefore constitute a partially degraded area. From a sensitivity point of view the site is not located in or adjacent to a protected area or hosts any important vegetation type. The site is also located away from any surface water and the development of it will thus not pose any major environmental impact. The concern is located distant from residences hence blasting and dust generation will not impact significantly on inhabitants of the area. Being located close to the R61 visual impact is rated moderate and appropriate profiling and vegetation of the quarry must take place.

TERMS OF REFERENCE

The applicant has appointed John Victor Surveys (JVS) & Stellenryck Environmental Solutions (SES) to legalize the application and include the following activities and submissions:

- Compilation of a baseline EIA & EMP for the proposed clay quarry.
- The EMP would cover all biotic and abiotic components.
- SES was not appointed to conduct the public participation process. The applicant has conducted the public participation process prescribed in terms of section 27(5) of the MPRDA and the outcome was submitted to the DME.
- The site visits revealed a disturbed section of land and no large or small mammals were observed in the area hence no formal survey was conducted.
- A basic floral survey was conducted by SES (Adrian Odgers) and no species of importance was identified.
- A Basic Heritage Assessment will be done by Dr. Johan Binneman. A layman's assessment revealed no sites or objects of significance.
- Additional studies required by the regulating authorities will be submitted on receipt of such request and will be funded by the applicant.

The findings of the EMP are based on:

- Quarry applications and EMPs submitted by *SES* & John Victor Surveys in the past to the DMR.
- Musina & Rutherford, EMPAT, SANBI & AGIS environmental information, Council for Geoscience.
- Sites visits conducted in 2000 & 2010.

PROJECT DESCRIPTION

Applicant

Ikwezi Quarries
P.O. Box 808
Mthatha
5099

Reg No.

Tel No: 0475530594

Fax No. 0475530594

Responsible person

M. Siwahla.
P.O. Box 808
Mthatha
5099

Tel No: 0475530594

Fax No. 0475530594

Cell: 0836552596

Surface owner

State; Tribal Land

Title deed description

Unsurveyed Tribal land: Dumasi A/A

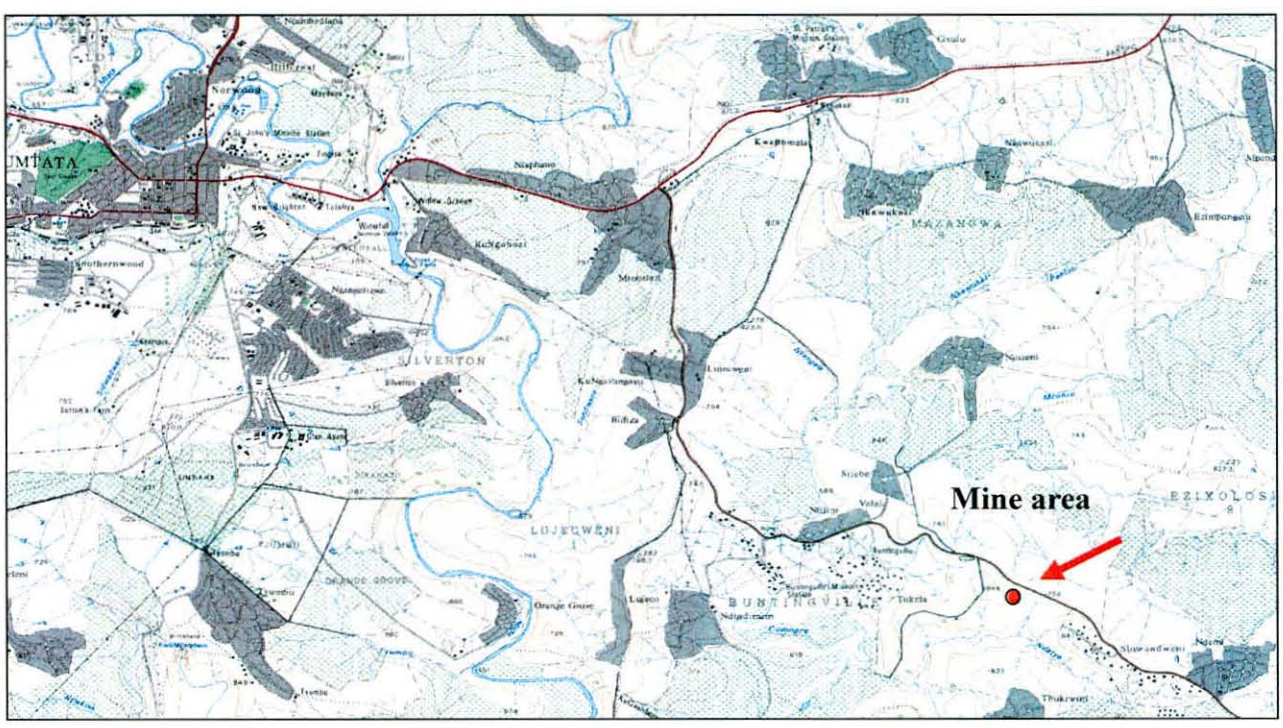
Mineral

Dolerite, gravel & aggregate

LAND DESCRIPTION / INFORMATION

Regional setting

The proposed sand quarry is situated within the boundaries of the Nyandeni Local Municipality and magisterial district of Mthatha. Access to the quarry is via the Mthatha-Port St. Johns (R61) Road and turn off at 6,5km onto the Ngqeleni Road. The site is located approximately 9,5km from the turnoff on the right-hand side.



Surface infrastructure

Surrounding areas

The road to Ngqeleni is located 200m to the north-east of the quarry site and will be used to cart material to surrounding markets. Telephone/power lines are located on the eastern side of the road. A small stock water dam is located 500m to the north-east. An existing gravel road constructed by the Department of Roads & Transport during the previous mining phase connects the southern side of the mine with the tar road. The previous crushing site is located to the immediate north-north-east in a hollow located between the road embankment and the quarry, causing the site to be invisible from all road vantage points.

Further afield a number of residential areas are located to the north-west, south and south-east, with the nearest residential area 700m from the site and thus outside the generally required 500m impact area.

Mine

There is no infrastructure within the proposed mine area.

The applicant will liaise with the community regarding the loss of the water supply in the current quarry area and provide an alternative source. Water would either be trucked in from the nearby Mthatha River or from Mthatha. No labour accommodation or campsite will be established on site. If need be, only a security guard will be on site during the night. The crusher will be temporarily located either in the quarry or within the old crushing site to the immediate north-north-east whilst the office container, workshop container and toilet facilities will be positioned at the old crushing site. The crusher has an onboard generator and therefore Eskom power supply is not required. The decision on establishing a cement brick manufacturing plant and the locality thereof will be taken at a later stage.

Average quantities of aggregate and crusher dust will be generated onsite and stored at the old crushing site. This material will be removed in accordance with local aggregate demand. Therefore a loader and possibly two trucks will permanently parked overnight at the stockpile area during the non-quarrying periods, whilst an excavator, drilling machine and additional dumper trucks will be added during the quarrying periods.

Presence of servitudes

There are no servitudes registered in the proposed quarry area.

Land tenure and use of immediately adjacent land

There are no residences in close proximity to the mine. The predominant land use is grazing.

The surrounding residences are situated:

- 700m to the south-east - Mdoni
- 1,2 km to the north-north-west & north - Sixhotyeni & Ntilini
- 1,8km to the south - Sinwandweni.
- 3,5km to south-west - Sitebe

Zoning

Current zoning is still agriculture, but since mining is seen to be a temporary change of land use, no application for change of land use in terms of LUPO is required. In this regard, the repealed Minerals Act 50 of 1991 and the current MPRDA 28 of 2002 have replaced the provisions of the repealed Physical Planning Act. The application also does not trigger any listed activities in terms of NEMA and the applicant do not need to apply for change in land use. Mining *per se* is not yet a listed activity and is currently not governed by NEMA, although the broad principles and objectives need to be taken into consideration.

PROJECT DESCRIPTION

The proposed Ngqeleni Quarry will be a private concern licensed by the Department of Mineral Resources and constitutes an extension to an abandoned DRT quarry used for the upgrade of the R61 many years ago. Material will be extracted by means of drilling, blasting and excavation to a depth of approximately 10-15m. The northern production faces which will be split by establishing a bench at face height of 7,5m. The objective of mining would be to prevent the northern face becoming too high by also extending the eastern face for

approximately 30m towards the stockpile area. Trucks will enter and exit the site from the south. Shot rock will be crushed either inside the existing quarry or at the old crushing site

Mineral Deposit & Mine Product

The site reflects a solid dolerite deposit. Various crushed rock products will be produced onsite of which crusher dust could be used in future to manufacture cement bricks/blocks.

Estimated reserves

The total mine area comprises about 1,5ha of which 1ha will be used for mining to a depth of ±10-15m and ± 100 000 cubic meters (tight) of aggregate could be supplied from this area.

Life of Mine

Maximum of two years as per MPRDA permit provisions provided that no further slump in the aggregate market is experienced. If a lesser demand is experienced an application for renewal of the permit will be submitted to the DMR. If demand justifies, the applicant anticipates applying for a mining right at the end of the two year period.

Markets

Considering that the surrounding rural areas do not dispose of commercial quarry and brick manufacturing concerns, these areas constitute a small but sustainable market of approximately 3500 cubic meters per month. All building and construction companies in area currently import material from Mthatha and the Ngqeleni Quarry would be able to supply these concerns. Considering hauling cost to be the largest contributor to cost structures, the development of these concerns will result in major savings for construction companies and local inhabitants and will secure the future market for the quarry.

Alternatives

The applicant has not investigated alternative mining sites as there were no other existing quarry sites in close proximity to this area. To limit the impact footprint, greenfield sites were not considered.

Due to the flat areas available to the south-east and east, the crushing plant and stockpile areas could be hosted here but would be very visible from the road and would be subject to wind erosion, which will increase the dust footprint. Therefore, the mobile plant will either be hosted in the quarry or at the old crushing area, which is mostly invisible from the road and less exposed to prevailing winds.

Prospecting

The quarry was previously used for the construction of the tar road from Mthatha to Mthatha River Mouth. The site hosts almost solid dolerite stone with excellent quality in terms of hardness, durability and flakiness. The aggregate produced from the quarry should therefore be of adequate quality for construction purposes, road building and block/brick making. Mineral reserves are clearly visible as portrait by the pictorial record. Previous mining has resulted in the removal of reserves on the southern end of the deposit and vast amount of stone is available to the west and north and would be able to sustain a long term quarry operation. It therefore negates the need for prospecting to motivate the sustainability of the proposed mining venture.

The existing excavation shows mineral depth in excess of 10m and the proposed 1ha mining area site will produced approximately 140 000 cubic meters (loose) of aggregate.

Mining methodology

An existing gravel road constructed by the Department of Roads & Transport during the previous mining phase is located to the south of the quarry area and will be used to gain access to the tar road. The road will require minor upgrading and since it is positioned on a slope, it requires run-off control measures. Access to the tar road already exists and the gravel Bell-mouth needs to be upgraded on a continuous basis to prevent damage to the road edge or alternatively a tarred Bell-mouth must be provided. The applicant will liaise with the District Roads Engineer (DRE) in this regard.

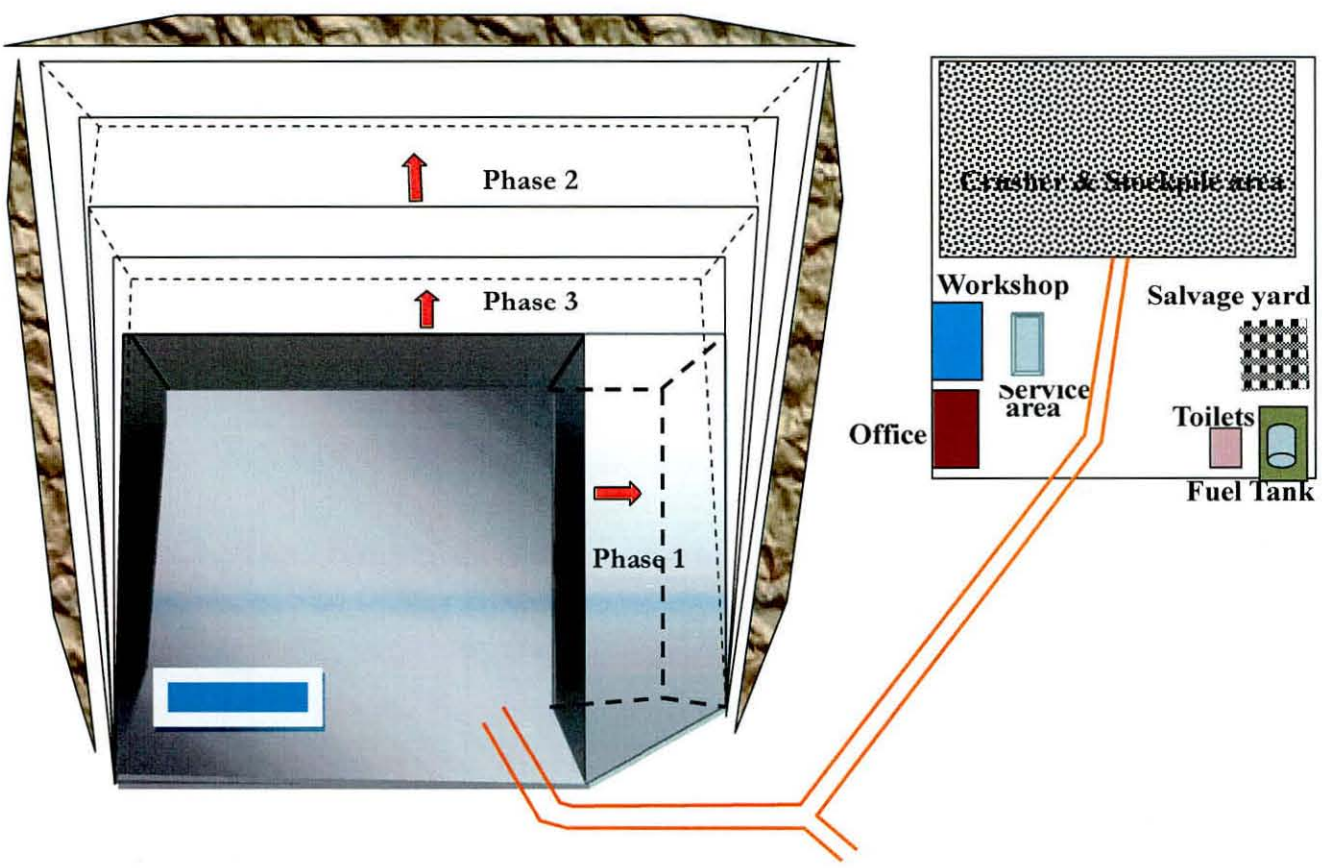
The mine area slopes moderately towards the south and constitutes a dolerite dome with north-south disposition. Located to the south-west is a steeply incised drainage line falling outside the mine boundaries. The tar road is positioned approximately 200m to the north-east and should not be protected from blasting impacts. The following mitigation measures will be implemented:

- A burden/spacing assessment as well as risk assessment will be done to ensure that safety standards are upheld.
- Smaller blasts rather than large blasts will be conducted.
- Blasting design will be evaluated to facilitate precise rock positioning and reduce diameter of blast.

- The road will be closed off 10 minutes before blasting until 10minutes after blasting in conjunction with the District Roads Engineer and local Traffic Department.
- The road will be inspected prior and after each blast to determine any impact prior to opening the road. All fly rock, if any will be removed from the road.

The total mine area comprises about 1,5ha of which 1ha will be used for mining and the remaining 0,5ha as stockpile and crusher area. Average depth of the excavation will on average be approximately 10-15 meter with production faces 5-7m high. Open cast mining would then commence by cutting in a bench on the eastern side and progressing towards the northern and western face in order to reduce the height of the current production faces. The eastern and northern faces will then be extended as indicated on plan. The existing reserves will be mined in three phases with the first phase being represented by eastward extensions, the second phase be extending the first bench northwards towards 20m from the quarry perimeter followed by the third phase namely the extension of the second bench northwards. In order to access each bench a cambered access ramp will be constructed through precision blasting.

Schematic mine development and plant layout plans

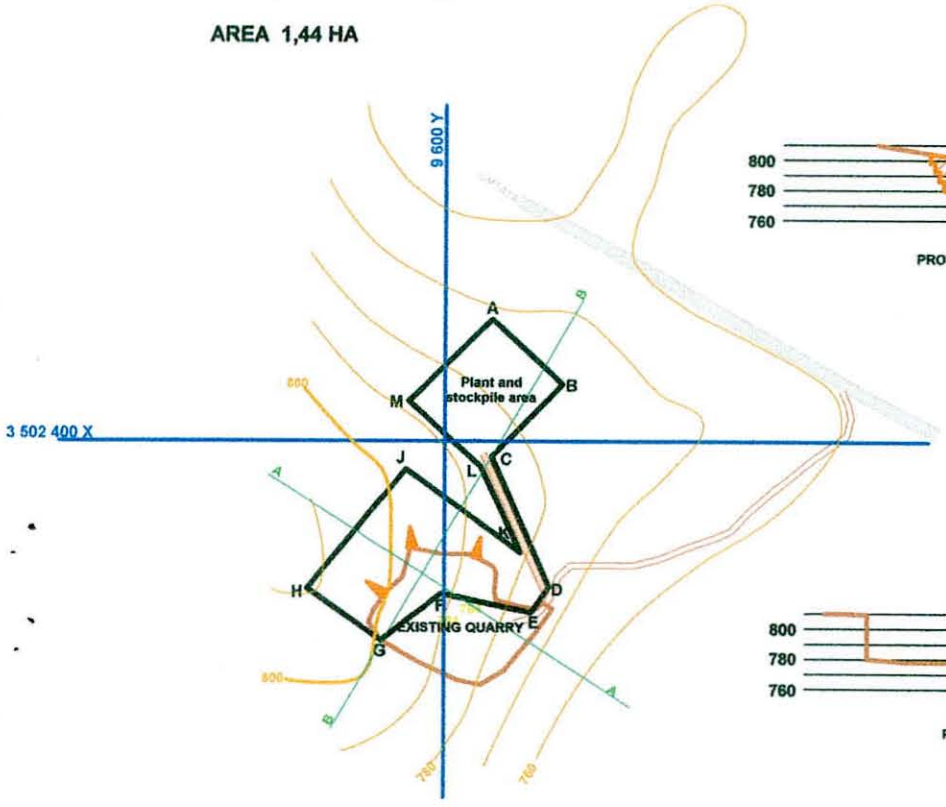


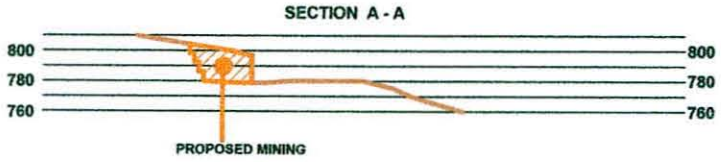
The quarry floor will for all practical reasons be flat with a 1% gradient towards the south to facilitate dry working conditions at the production face. Water that accumulates in this section of the old quarry will be used for dust suppression and possibly stock watering.. Production blasts will be performed by a contractor, which holds an opencast blasting qualification. Since the necessary blasting precautionary measures must be implemented due to the close proximity (200m) of the road, it would be advisable to use a multi-row, chevron blasting design at the northern face. Overburden and spacing will typically be 2,5m x 2,5m with drill holes of 76mm. P101 slurry will be used as explosives and primed with pentolite boosters. Since more than one shot hole will be fired at a time shock tube assemblies of the Nonel and handidet systems will be used to ensure controlled blasting conditions and limits flyrock and PPV readings. Average stemming of 1-1,5m will be used to reduce flyrock.

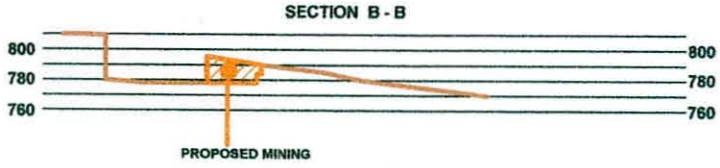
CO-ORDINATE SYSTEM WGS 84
EAST 29°

A	Y 9 569,0	X 3 502 319,4
B	Y 9 522,7	X 3 502 362,3
C	Y 9 569,3	X 3 502 410,2
D	Y 9 531,6	X 3 502 496,7
E	Y 9 543,1	X 3 502 513,3
F	Y 9 601,9	X 3 502 500,8
G	Y 9 641,4	X 3 502 531,8
H	Y 9 689,8	X 3 502 497,6
J	Y 9 625,2	X 3 502 418,6
K	Y 9 550,4	X 3 502 473,7
L	Y 9 576,4	X 3 502 416,8
M	Y 9 623,5	X 3 502 373,5

AREA 1,44 HA







SCALE 1:5 000

0 100 200 400

SURVEYOR _____
J. E. VICTOR

DATE 21. 06. 2010

APPLICANT _____

DATE _____

JOHN VICTOR SURVEYS
PORT ELIZABETH
TEL/FAX (041) 5813044

OFFICE USE

_____
REGIONAL MANAGER
EASTERN CAPE

_____
DATE

The above figure lettered A,B,C,D, E, F,G,H J,K,L,M, represents an area of land, in extent 1,44 Ha, situated on State Land, district of Umtata, Eastern Cape Region, in respect of which a mining permit has been issued to

_____

ID No _____

Direction of blasts will mostly be away from the road, except when profile blasting is done at the western face but the close proximity of the quarry to the road will require that the road must be secured during blasting, by having traffic stopped in both directions during blasting. The necessary liaison with the local Traffic Department and District Roads Engineer will take place in this regard. Also, the two closest residential areas should be informed of blasting schedules.

Blasting will most probably take place only once a quarter to support only local developments and brick manufacturing If any large project is secured, blasting will take place once a month for at least 10 months. An average production rate of 3500 cubic meters per month will be applicable during normal extraction rates whilst 10000 cubic meters will be extracted if any large project is secured.

Shot rock will be loaded on dumper trucks with an excavator and transported to the diesel powered mobile crusher and screening plant located either in the quarry or in the hollow to the north-east of the mining area. Once crushed, the material will be stockpiled and then as per demand loaded onto 5-12m^3 tipper trucks and hauled to the road construction site or to local markets/brick manufacturing plants. In the event that no large project is secured, the crushing plant will only remain onsite for a total period of three-four months per annum. A weigh bridge would not be installed as aggregate will be sold per volume.

All shot rock would be utilized except for oversize, which will be returned to the excavation for profiling of the sides. Alternatively, these blocks can be reduced in size by fitting a hydraulic hammer to the excavator or performing secondary blasting, but it might to costly for the applicant.

Topsoil will be removed ahead of the production faces and stored as indicated on plan. The nature of this igneous rock will result in mining to remain above any primary or perched aquifer. Working hours will be from 7.00am to 5pm five days a week with cessation of activities on 1pm on Saturdays, if construction schedules require work on a Saturday.

The proposed development will result in profiled benches reflecting increased runoff, due to underlying impenetrable bedrock. This will cause rehabilitation to be difficult and has to be taken into consideration during the rehabilitation phase. In order to make the mentioned faces safe, they will be profiled through a cut & fill operation to a slope of 1:3 (western & eastern faces) and 1:2 (northern face) respectively in order to integrate the quarry too some extent with the topography of the surrounding landscape

The development of phase 2 will coincide with the rehabilitation of the sides of phase1. Development of phase 3 will coincide with the rehabilitation of the sides of phase 2. The sides and floor area of phase 3 will be progressively rehabilitated in conjunction with the profiling of the western face. On completion of rehabilitation activities at the quarry, the roads and plant/office area will be rehabilitated.

Construction phase

Road

The existing gravel access to the quarry will be upgraded through grading and placement of a weathered dolerite wearing course. The road will be provided with the required drainage system to prevent scouring of the wearing surface.

Water reticulation

A water reticulation system will be established at the crushing site consisting of an elevated water tank, taps and sprinkler system. Water will be gravity fed to the crusher to facilitate dust suppression. The tank will be filled with water from the excavation by means of a water tanker or water will be trucked in from the nearby Mthatha River or from Mthatha Municiple sources. Available water sources should be adequate to provide dust suppression during high extraction rates.

Sewage system

Due to the thin overburden in the study area the sewage system will consist of chemical toilets which will be maintained/serviced according to prescribed guidelines. A washroom will be established and waste water will be drained into a French drain and disperse with a soak away. These facilities will be provided in the office are as indicated on plan.

Waste facilities

Considering that at most five persons would work on site, no permanent waste disposal site will be established. Containers with proper lids would be placed within the mine area for the storage of any household waste. These receptacles will be emptied on a regular basis at the nearest waste facility in Ngqeleni or Mthatha. Used hydrocarbon fluids will be stored within selected receptacles and stored within a bunded area for disposal to recycling facilities located in Mthatha.

Offices and workshops

No permanent offices will be constructed at this stage. A temporary, mobile office in the form of a steel container will be positioned in the process area. A second container will serve as shed for the storage of oils, lubricants and spare parts. Considering the soil in this are to be sufficiently flattened during the previous mining phase, hence no major earthworks are required. A small maintenance area for machinery/vehicles will be established in the form of a concrete slab fitted with a central sump for capturing any spilled hydrocarbons. However, the applicant will perform major maintenance work off-site.

Housing

No housing would be provided as the workforce would not reside on the mine, but will commute to work every day. A small structure would be provided for the night guard.

Quarry infrastructure.

The plant area will be cleared of topsoil, which will be positioned in a berm on its perimeter. Since the process area was previously established it is reasonably flat and no major earthworks are required.

After the first blast, a ramp will be constructed to facilitate the dumping of shot rock into the holding bin of the primary crusher. The mobile crusher will typically consist of a primary jaw crusher, cone crushers and a triple deck screen with conveyor system feeding the various stockpiles. Explosives will not be housed onsite but will be purchased and transported to site under the auspices of the SAPS explosive unit.

Mine development

Topsoil will be removed from the mining area and stockpiled ahead of the faces to divert runoff away from the quarry area. Water will be safely spilled to the west and east

Power supply

No power will be required since the mobile crusher dispose of an onboard generator. However, should it be necessary at a later stage a link to the Eskom reticulation network will be established and a transformer will be hosted onsite.

Mineral processing & residue disposal

Mineral processing will entail the crushing of shot rock to amongst other to crusher dust (grid), 9mm, 13mm and 19mm crushed stone with first mentioned to be used for brick manufacturing. These products will be piled on the quarry floor or in the designated plant area depicted on plan. Larger, weathered boulders or oversize will be disposed of in the excavation and used in profiling the sides of the quarry to acceptable slopes or be reduced with an hydraulic hammer or secondary blasting to crushable chunks.

Decommissioning

Plant area

- All buildings/containers and equipment will be demolished/removed.
- All foundations will be ripped up and concrete disposed of in the quarry void.
- Remove the ramp and dispose material in quarry.
- Empty and remove fuel tank or request service provider to remove the fuel tank.
- All scrap metal/dysfunctional parts and waste will be removed to an approved facility.
- All hydrocarbon waste and contaminated soil will be safely transferred to appropriate receptacles, and removed to a hazardous waste site or recycling company.
- All material stockpiles will be sold off, or returned to the quarry void.
- All crushed stone on the plant floor and stockpile areas shall be removed.
- The perimeter fence will be retained until the end of the aftercare period.
- Reintroduce topsoil, fertilize, rip the entire area, seed, scarify and irrigate if water is available.
- Once vegetation has been successfully established, the irrigation system will be removed.

Quarry area

- Any access material or overburden will be used to profile the production faces.
- Perimeter of the excavation will be trimmed and profiled to an acceptable 1:2-1:3 slope through precision blasting to achieve safety requirements and to blend the quarry with surrounding landscape.
- Should three 5-7m high faces be developed the middle bench will be profiled to a 1:2 slope and the lower bench to a 1:1,5 slope.
- If stability of material on the benches is a challenge, it could be considered to position anchored gabions (1m wide and 0,75m high) on the edge of each profiled bench to retain material.
- Ensure that a drainage system is implemented to ensure that the northern face remain stable.
- Spread at least 45cm of overburden over compacted material on quarry faces to allow for crevasse infill and prevent topsoil to disappear amongst shot rock.
- Spread topsoil to a depth of at least 20cm over overburden and scarify lightly (if possible) to key it in with the sub-layer. The development of production faces will require additional topsoil and it should be imported from any approved development sites in Mthatha or surrounding residential areas whenever it becomes available.
- Apply fertilizer and mulch, and seed entire area.
- All equipment, waste or scrap metal will be removed from site.
- The quarry area will remain fenced.

HEALTH AND SAFETY MATTERS

The applicant will comply with the conditions of the Mine Health & Safety Act, Act 29 of 1996, Minerals Act and Regulations, Act 50 of 1991 and Mines and Works Act, Act 27 of 1956 and as a minimum will ensure the following:

General/Permissions

- The Principle Inspector of Mines will be informed on the date on which mining commences.
- Since mining will take place on surveyed Private and State land, the retention of the required 9m-boundary pillars will be applicable and these pillars will be maintained – MA Reg 7.12.
- Work will be performed within 500m from a rail line and Provincial Road that needs to be protected hence authorization in this regard is required from the Principle Inspector of Mines – MHSA Reg 17
- At this stage Sunday labour will not be applicable hence no permission is required – MW Sect 9.
- Appointment of Competent Person to responsible at more than one mine – Mrs. Siwahla
- Appointment of Sub-ordinate Manager to be responsible at more than one mine– If applicable
- More than one shot hole will be blasted at a time and the necessary authorization will be obtained from the Principle Inspector of Mines.
- Mining will be done within 500m from structures and Provincial Road and the necessary risks assessments will be done in this regard.
- A competent mine surveyor will be appointed for submission of plans and annual updates thereof to the DMR.

Appointment of following responsible persons will be done.

- A competent mine manager will be appointed (Section 3).
- Employer may entrust functions to another person, e.g. CEO. (Section 4).
- A risk & safety officer will be appointed.
- Employer will staff the mine with due regard to health and safety. (Section 7).
- Engineer/ Competent Person - MA Reg. 2.13.1/ 2.13.2
- Sub-ordinate Manager - MA Req 2.6.1
- Safety Officer MA - Req 2.17.1
- Surveyor - MHSA Reg 17.(2)
- Operators of Mobile Machines - MA Reg 18.1.1

List of Codes of Practices to be submitted:

- CoP to combat rock fall and slope instability related accidents in surface mines;
- CoP on Trackless Mobile Machines
- CoP on minimum standards of fitness to perform work at a mine
- CoP on personal exposure to airborne pollutants
- CoP on thermal stress – not applicable to this mine
- CoP on occupational health programme for noise
- CoP on occupational health programme (occupational hygiene and medical surveillance) on thermal stress
- CoP on mine residue deposits – not applicable to this mine
- Lock-out Procedures.

Duties of appointed persons

- If the mine is not being worked and in respect of which a closure certificate in terms of the Minerals Act or MPRDA has not been issued, Ikwezi Quarries will take reasonable steps to continuously prevent injuries, ill-health, loss of life or damage of any kind from occurring at or because of the mine in terms of Section 2.
- Ikwezi Quarries will provide and maintain a working environment that is safe and without risk to the health of employees. The owner will identify the relevant hazards and assess the related risks to which persons who are not employees may be exposed; and ensure that persons who are not employees, but who may be

directly affected by the activities at the mine, are not exposed to any hazards to their health and safety as per Section 5.

- Ikwezi Quarries will prepare a Health and Safety Policy document as per Section 8.
- Ikwezi Quarries will prepare and implement a code of practice on any matter affecting the health or safety of employees and other persons who may be directly affected by activities at the mine if the Chief Inspector of Mines requires it as per Section 9.
- Ikwezi Quarries will provide employees with any information, instruction, training or supervision that is necessary to enable them to perform their work safely and without risk to health; and as far as reasonably practicable, the owner will ensure that every employee is properly trained as per Section 10.
- Ikwezi Quarries will identify the hazards to health or safety to which employees may be exposed while they are at work; assess the risks to health or safety to which employees may be exposed while they are at work; record the significant hazards identified and risks assessed; and make those records available for inspection by employees. The owner will conduct an investigation into every accident that must be reported in terms of this Act; serious illness; and health-threatening occurrence as per Section 11.

Dust

- Since there are no residences within 700m from the quarry, dust impact would not be applicable.
- Loads will be covered with tarpaulin.
- Screens, conveyors and crusher will be fitted with water atomizers at transfer points to curb dust generation.
- If applicable a sprinkler will be installed at the crusher dust stockpile and yard to reduce airborne pollutant levels.
- $PM_{2,5}$ dust counts will be done and will be repeated annually and the outcome conveyed to the DMR if required by the Principle Inspector. Considering it a dolerite mine the $PM_{2,5}$ value should not exceed 0,5 within the quarry environment.
- Drilling rigs will be fitted with dust bags.
- Blasting will not be done during periods of high winds to reduce dust counts at any receiving environ of importance.
- Applicant will comply with the provisions of the Mine Health and Safety Act 29 of 1996 and NEMA with regards to dust generation.

Noise

- Crushing equipment will be regularly serviced/lubricated
- Noise generation by vehicles will be controlled through regular servicing and fitting of standard exhaust systems.
- Noise levels at source will be maintained below 85dB
- Noise levels at any nearby residents will be maintained below 50 dB
- No operations will be conducted before 7h00 or after 18h00
- Blasting will be done midday when clear skies prevail to reduce noise levels and the impact of air overpressure.
- Baseline noise counts will be done and will be repeated annually if required by the DMR and the outcome conveyed to the DMR.
- Since blasting will be sporadic the impact will be low

Roads

- Since public roads will be used for carting material it might have an impact on traffic flow and accident rates. Risks associated with the transport of material will be identified and mitigated.
- Vehicle speed on gravel roads will be maintained to 60km/h to lower safety risks.
- Internal haul roads will be dampened to curb fugitive dust levels
- Heavy vehicle signage will be posted on both sides of the access with affected roads and the intersection.
- Vehicles and mining equipment will be properly maintained and will not be overloaded.
- All vehicles will come to a complete stop before accessing any road. Operators will be trained to observe carefully whether any traffic is nearing the access and operators will make use of indicator lights when turning into any road.

- Vehicles will turn their lights on whilst hauling takes place.
- If required, a flagman will be used to improve safety standards at access points.
- Good visibility at the intersection with roads will be ensured by removing all vegetation, other obstacles or natural topographical screens (if possible) within the road verge.
- Since the amount of trips anticipated would be low (10-15 trips per day) the potential risk of accidents occurring will be similarly low but the necessary risk assessment will still be done and remedial measures implemented. It is important that trucks do not follow directly behind each other but that trips area spaced to ensure good traffic flow. The provisions of the National Transport Act would be observed.

Stability and safety of production faces

- The geology of the site will be regularly assessed to identify any fault lines and weathered layers that could affect stability of the face and result in abnormal blasting patterns.
- Production faces will be kept to a high of 5-7m and the production face will be split with a to increase in-pit safety and increase rehabilitation potential
- Benches/faces will be kept clean and free of loose/hanging rock.
- Workers will be granted the right to refuse working in unsafe areas.
- Pit development will comply with standard procedures prescribed by the Mine Health & Safety Act and regular consultations with personnel of the Mine Health & Safety Directorate will be held in this regard.

Access to mine area

- Access to the mining area will be controlled by maintaining the perimeter fence as well as fence around the quarry to a proper standard to reduce the safety impact of the concern.
- A security guard will be appointed to control access to the site.
- No loitering of residents within the mine area will be allowed.
- No access to the excavation will be allowed except for people operating in this area.
- An access register will be held.
- Required hazard/safety signage will be posted on the fence and entrance to mine.

Safety/Accidents

- Any accidents will be reported immediately to the Principle Inspector of Mines telephonically and in writing in the applicable format.
- Mine development and applicable safety regulations will be discussed with the landowner and abutting landowners. If applicable a community liaison forum will be established and will meet on a quarterly basis for the first year and then every trimester to disseminate information and outlining mining and rehabilitation procedures.
- Vehicle movement in the pit will be restricted to the excavator and one haul truck and safe turning circles will be established.
- Workers will be provided with the necessary mining and safety training.
- Equipment will be well maintained to reduce the risks of accidents occurring.
- Blasting will be done by an appropriately qualified person and if necessary electronic detonation will be used if there is a risk of affecting traffic on the tar road.
- The correct powder factor will be used during blasting.
- The correct amount of stemming will be used to limit flyrock production.
- The blaster will ensure that all people are removed to a safe distance from the blasting area before setting off the blast.
- The blaster and mine manager will ensure that the tar road is secured and no traffic will pass through ten minutes before and after blasting. This requirement will be arranged with the District Roads Engineer and local Traffic Department.
- After blasting, the blaster will inspect the blasting area to ensure that there were no misfires and that all live detonators are removed from site before any people/machines enter the mine area. Holes where misfires occurred will be dealt with by the blaster according to standard protocol.
- The nearest residential areas will be informed of the time of blasting and a siren will three minutes before blasting inform any close by resident of each blast.
- All civilian people within a 500m radius will be vacated before each blast.

- The generator to be used it will be operated by a trained person and all cabling will dispose of the required isolation cover and/or be buried underground.
- Quarry development will include the establishment of a bench splitting the high walls to facilitate effective and safe rock production.
- Benches will be wide enough to facilitate easy and safe movement of mining equipment.
- Ramp to primary crusher hopper will be made stable and safe by means of concrete retaining wall with steel support anchors or any other acceptable method.
- Monitor ground vibration within 300m from the quarry for the first four representative blasts and maintain PPV counts to below 12mm/s.
- Reverse warning hooters shall be fitted to all mining vehicles.
- All structures within a 500m radius, if any will be assessed for structural flaws and a photographic record will be compiled before the first blast.
- Protection of workings will be implemented as per MHSA Chapter 14

Health & Safety equipment to be provided

- Ikwezi Quarries will ensure adequate supply of all the necessary health and safety equipment and health and safety facilities, e.g. (safety boots, hard hats, ear plugs, eye protection, dust masks, gloves, safety belts, etc.) (Section 6) at the office and in the cabins of the mining equipment/vehicles.
- Workers will be medically tested on an annual basis as prescribed by the Health & Safety Act.
- Workers will be professionally trained to deal with medical emergencies
- Fire extinguishers for fuel tanks, vehicles, compressors and generators will be provided.
- First Aid Equipment as per MA Req 24.1 will be provided.

Hygiene

- Clean drinking water will be provided in a small tanker/JOJO tank.
- Chemical toilets will be provided and serviced as prescribed or a French drain system will be established with soak-away.
- A safe and clean area will be provided where workers can rest and have lunch/tea times.
- Waste will be stored in suitable receptacles and disposed of regularly.
- The surrounding environment will not be used for ablutions.
- A policy on the above matters will be developed and the necessary penalties imposed where and when appropriate.
- Since it is dolerite mine no deleterious minerals will be released to the environment that could facilitate acid mine drainage and that could affect water quality and subsequently the health of local inhabitants.
- Ikwezi Quarries will conduct occupational hygiene measurements as per Section 12.
- The applicant will establish a system of medical surveillance as per Section 13 and appoint Health and Safety Representatives as per Section 25.

Decommissioning/closure

- Benches and side walls will be fracture blasted through precision blasting to facilitate a slope of approximately 23degrees.
- All loose and dangerous rock will be removed or compacted. Established slopes will be compacted.
- Shot rock will be covered with at least 0,3- 0,5m of soft overburden to filter into crevices and prevent post closure subsidence.
- Overburden on the slopes will be compacted.
- Slopes will be covered with topsoil and vegetated to facilitate a stable soil surface.
- This quarry will not be free draining and will be turned into a wetland area with acceptable profiled slopes.
- Storm water control structures will remain in place to ensure post closure stability of the slopes and soil.
- The quarry will remain fenced until closure but with access on the southern end for stock to acess the wetland area.
- The necessary signage will be posted around the quarry to sensitize local residents on the latent dangers of the quarry.
- All equipment, structures and cabling will be removed from the plant area.
- All hazardous substances will be removed from the quarry.

- All stockpiles will be removed and the area vegetated and protected against erosion.
- Roads will be ripped, vegetated and protected against erosion.
- Two years of aftercare will be provided and the necessary performance reports will be submitted to the DMR.
- Closure application will be lodged with the DMR
- Final meeting with community liaison committee will take place.

Reports that will be submitted

- Monthly return of work - MAReg14.1.1
- Annual medical report - MHSA Sect 16
- Accident reports - MHSA Chapter 23

COMPETENCY TO CONDUCT MINING

Financial competency

Ikwezi Quarries will provide the finances to develop the proposed mining site. The company is financially sound and is been in existence for a number of years showing a good net profit. Accumulated funds within the business will be able to pay for developing the quarry.

Ikwezi Quarries has been financially independent for many years and the recovery of the construction market will ensure that in future the mining concern remains financially independent. As all equipment has already been acquired, no additional finances will be required for purchasing equipment.

Technical competency

Technical competency will be provided in-house by Ikwezi Quarries. Equipment to be used onsite will include a drill rig, excavator, loaders, dumpers, and haul trucks. A mobile crusher was obtained a few years ago and consists of Jaw Crusher, Cone crusher and Triple Deck Screener. Ikwezi Quarries therefore disposes of adequate plant and equipment to develop the Ngqeleni Quarry in a professional and sustainable manner and to transport quarry products to the relevant markets.

Mrs. Siwahla and her quarry manager currently manages another hard rock quarry, located on the way to Port St. Johns, for a few years and therefore dispose of the necessary technical skills to manage the proposed hard rock quarry. Ikwezi Quarries also dispose of good quality administrative workers and machine and plant operators which should be able to extract and dispose of aggregate to the various market destinations in a technical correct and environmentally sustainable manner with limited safety considerations.

With regards to blasting and mine development, Ikwezi Quarries dispose of an experienced blaster to assist the company. In order to address environmental matters and demarcating the mine area the applicant appointed JVS as surveyor and SES as environmental consultants. Through the EMP and continued assistance to the applicant the site should be developed in a sustainable manner.

Developing a hard rock quarry in an appropriate manner does require above average mining skills but considering the experience of Mrs Siwahla and her quarry manager; the applicant will be able to develop the quarry in a manner that would be acceptable from a mine health & safety as well as from an environmental perspective.

Environmental competency

It is important that an applicant for a mining authorization dispose of adequate environmental knowledge to ensure that an environmentally sustainable concern is established, that activities comply with current legislation and poses limited post closure impacts.

Development of the quarry will require quarry development activities such as blasting, extraction of shot rock with an excavator, loading of material onto a haul truck, transport of shot rock to the crusher, two-stage crushing and transport of graded crushed rock to the immediate surrounding market and Mthatha. Minor servicing/maintenance of vehicles will be done onsite. Considering the activities involved with the mining venture, the proposed concern will require good management and housekeeping and a dedicated rehabilitation approach, which will be within reach of the applicant's abilities considering the knowledge of Mrs. Siwahla and her quarry manager of hard rock quarries. A site manager will be appointed and will on almost daily basis be on site and would therefore be able to identify and mitigate any environmental impacts that might surface during the operational phase and in the process prevent any extended environmental and social impact.

Since the site is located on a moderate slope, storm water diversion/control measures are required and construction of diversion berms will suffice, an exercise that the applicant has gained adequate experience in whilst managing Ikwezi Quarries. Dust suppression might be required and water from an elevated tank will be used for this purpose. A sprinkler system will be installed on the mine area and be connected to the crusher's dust suppression system. A similar systems is used at the applicant's other quarry and will therefore not pose a significant challenge to the applicant.

Re-vegetation of disturbed areas will be easily achieved by seeding the area, a practice, which is known to the applicant. The applicant will be assisted by a consultant during such a process. Visual impacts will be addressed through the rehabilitation of the site. Considering noise generated along the tar road and the distance to noise receptors, it will be easily controlled.

In conclusion, the environmental impacts associated with the proposed mining concern is restricted to moderate silt transport and soil instability, limited erosion on slopes, limited visual impact, loss of vegetation cover, loss of soil fertility, and limited social impact in terms of hauling material on public roads. Remedial measures to manage these impacts fall within the scope of the applicant's capabilities.

Considering that Mrs. Siwahla has worked previously with consultants such as Mrs. Sandy Muller of CEM and Mr. Frank Merryweather, she should have gained reasonable environmental knowledge with regards to managing impacts related to quarry development.

The concern should have a reasonable product turnover that will mostly guarantee financial stability and should put the applicant in a position to manage the quarry properly and to effect the proposed mitigation measures and amendment of the guarantee as required by the MPRDA, which in turn should reduce the environmental risk.

Through the implementation of the conditions of the EMP, the applicant will ensure that the important environmental considerations applicable to this particular mining site are executed. The applicant will also submit annually a performance assessment report reflecting on its ability to manage the environment.

"NO GO" OPTION

This option will result in the following impacts:

1. The no go option would prevent the applicant from supplying the rural communities in the Ngqeleni areas with more affordable construction materials and thereby limiting development in these areas.
2. The applicant will be prevented from expanding its business.
3. Mining will result only in the removal of degraded grassland which as far as could be stabled host no species of special concern and occurs frequently in abutting vegetation types. This option will therefore not contribute to maintaining specie diversity.
4. Tranquility of residential areas will be insignificantly better for a quarter of every year considering the ad hoc mining and crushing on the property
5. Soil and vegetation cover of new development areas will remain intact and no potential erosion will be applicable to these areas.
6. The existing visual impact will not be remedied through the proposed profiling of the sides of the quarry.
6. The abutting landowners will be able to continue with stock farming/development practices irrespective of whether the development is taking place or not.
7. The community will lose the opportunity to gain either permanent or temporary employment.

Considering the low environmental impacts related to quarry development and the site to be fully rehabilitated, the financial befits favour the mining option.

EXISTING MINING AUTHORIZATIONS HELD BY THE APPLICANT

The applicant holds one new order mining license for a hard rock quarry.

JOB CREATION

The proposed mining concern will create approximately 4-7 permanent job opportunities and at least 5 temporary job opportunities during the various rehabilitation phases, without taking into consideration downstream employment. If the mentioned brickyard is established another 5 job opportunities will be created. The current unemployment rate for the larger area ranges from 45%-60%, therefore the proposed quarry and potential brick manufacturing plant will be of value to the local economy and residents.

REGIONAL CLIMATE

Climatic conditions such as temperature, rainfall and wind velocity influence for example plant growth, erosion level of disturbed areas, dust generation and air pollution levels as well as social impact in terms of quality of life. Climatic conditions can therefore influence the significance of impacts caused by developments such as mines. It is important to understand the role thereof when determining the impacts of a specific development and the remedial measures that need to be implemented.

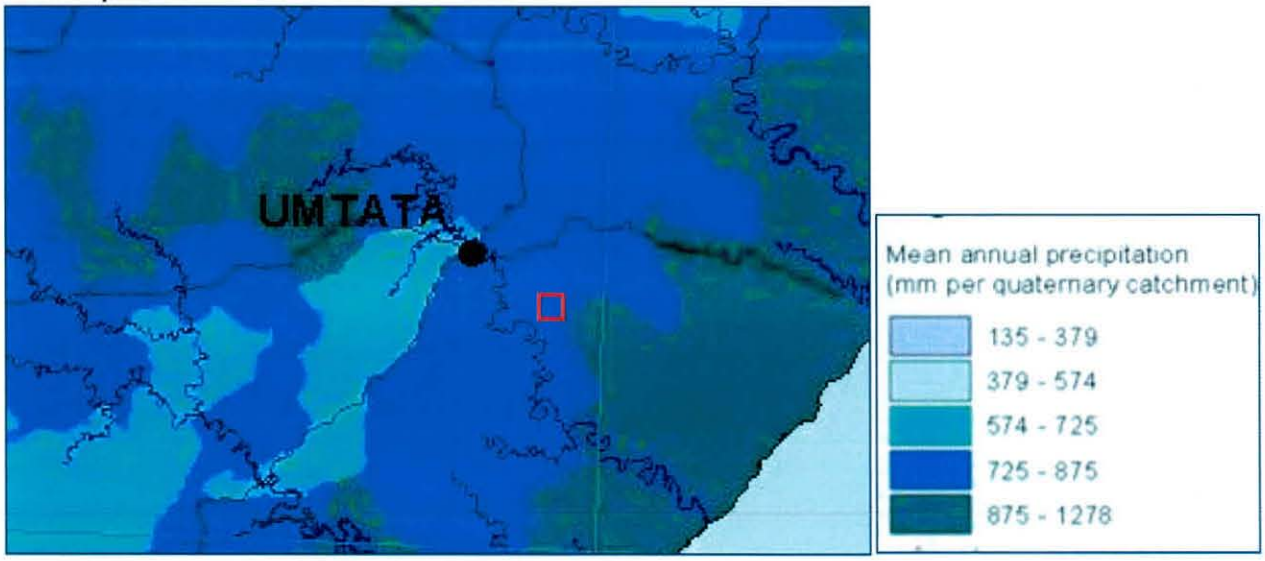
The study site falls within the Semi Arid Plateau Climatic Region of South Africa, which is typified by a short, cold dry winter with summer rain generally in the form of thunderstorms.

Rainfall

The Eastern Cape Province experiences a bimodal rainfall pattern with pronounced wet seasons coinciding with spring and autumn. These rain periods are frequently associated with northeasterly winds. Spring rains may also be associated with the passage of cold fronts drifting in from the west. Thunderstorm activity is common in the area during summer. This is illustrated by the fact that the maximum rainfall recorded in a 24h period for any month is almost double the monthly average. Dry periods are coinciding with midwinter. The average annual rainfall for the Eastern Cape Province is approximately 873mm.

Rainfall in the area, 725-875mm, is significantly higher than the average rainfall for the Province and would expedite vegetation processes and mostly prevent drought conditions, but will in turn, increase soil erosion on disturbed and uncovered mine areas and storm water control measures must be implemented once profiling of quarry faces has been completed. Seeding should therefore take place from late September to early March to ensure a successful re-vegetation phase. Hail and snow is not common phenomena in this area and should not affect the re-vegetation process.

Rainfall patterns of wider area



Climatic data obtained from the South African Weather Bureau (WeatherSA) was used to describe the prevailing climate in the Mthatha region. A climate summary for Mthatha (Period = 1961-1990) in terms of the Köppen classification scheme can be regarded as Subtropical with a summer maximum rainfall season.

The Eastern Cape Province straddles the transition between three major climatic regions, namely a maritime influence of winter rainfall from the west, summer rainfall in the east from anticyclonic low-pressure movement and a combination of both climatic patterns in the interior.

The Mthatha area (interior) experiences a summer maximum rainfall, with annual rainfall varying between 600 and 700 mm per annum. Average surface run-off values are estimated to be between 50 to 100 mm per annum (Midgley *et al.*, 1981) and average evaporation values between 1200 and 1300 mm per annum (Middleton and Lorentz, 1988).

Temperature

Summer (January) temperatures vary from an average maximum of about 27°C to an average minimum of about 16°C, whilst winter (July) maximums and minimums are about 21°C and 4°C, respectively. The highest temperature in the area was 44° recorded on 30 September 1983, whilst the lowest temperature at –3° was recorded on 4 July 1980. The climatic database suggests that about 113 days of the year experience rainfall in excess of 1 mm per day.

Seeding will benefit from the higher temperatures that are maintained in summer, whilst no seeding will be possible between April and early September.

Period: 1976-1990

This climatological information is the normal values and, according to World Meteorological Organization (WMO) prescripts, based on monthly averages for the 30-year period 1961 – 1990

Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	42	27	16	9	87	15	47
February	40	27	16	9	89	14	57
March	40	26	15	7	83	13	55
April	36	25	12	1	58	8	82
May	34	23	8	-1	18	5	31
June	30	21	4	-3	11	3	22
July	30	21	4	-3	18	3	43
August	33	22	7	-1	15	5	35
September	44	23	9	1	35	8	57
October	38	23	11	2	73	13	48
November	41	25	13	4	75	13	43
December	41	27	15	7	88	14	86
Year	**44**	**24**	**11**	**-3**	**650**	**113**	**86**

Wind Regimes

The prevailing wind direction is from the west and south-west with an equally dominant easterly and north-easterly component during the summer months. Winds and alternating cold and warm fronts also make for a variable climate. Considering the wind rose, it will not contribute to dust pollution at the nearest residential areas mentioned.

Weinert's climatic N number in this region varies between about 1 and 2, which implies that chemical weathering dominates over mechanical weathering. The Thornwaite Index for this area is about 0, which separates the dry and wet climates. A negative Thornwaite Index represents a water deficit, whilst a positive Thornwaite Index a moisture surplus. The Thornwaite Index generally becomes positive towards the coast and negative inland of Mthatha.

ENVIRONMENTAL IMPACT ASSESSMENT CRITERIA

The impacts of the Ngqeleni Quarry on environmental parameters are assessed in this section in accordance with the criteria of the Minerals and Petroleum Resource Development Act 28 of 2002 and applicable sections of Sections 21, 22 and 26 of the Environmental Conservation Act. The process will highlight the impacts and emphasized the importance of remedial measures over the short term, as well as during the post mining phase. Impacts were assessed according to the criteria listed below:

Extent

Whether the impact will occur on a scale limited to the immediate site of the proposed activity, local area and immediate communities and settlements, sub-regional (municipal), regional (provincial) or national scale.

Duration

Whether the time span of the impact will be short term (0-5 years), medium term (6-10 years), long term (11-25 years) or permanent where natural processes or mitigation processes cannot eliminate the impacts.

Intensity (Magnitude)

Whether the size of the impact is negligible, very low, low, low- medium, medium, medium-high, high & very high.

Probability

The probability of the impact actually occurring as either unlikely, probable, likely or definite.

These criteria are evaluated in terms of

1) Significance (Insignificant-very low, low, low-moderate, moderate-high, high & very high).
2) Status (positive-negative-neutral).
3) Confidence (based on academic information, specialist knowledge, site evaluations, applicants approach).

The significance of the impact on the parameters of the affected environment is rated as:

Low Significance

The project will not cause any major adverse or beneficial changes to the biophysical, social or economic environment. Impacts experienced will abate almost immediately after cessation of activities and the biophysical, social or economic system should recover and return more or less to the natural state. No expensive mitigating measures will be needed to address any of these impacts. Ecological functions will continue undisturbed and no complaints from Interested and Affected Parties (I&APs) are anticipated. No rare and endangered species or sensitive areas exist in the area.

Moderate Significance

The project will induce moderate short to medium term changes to the biophysical, social or economic environment. The impact would be induced outside the development area and also possibly on a sub-regional level. Over the medium term the impacts could fade away, but the implementation of mitigation measures are normally required to eliminate these impacts. The impacts would be experienced for some time after cessation of activities, but would not affect the biophysical, social or economic environment severely. With mitigation the

bio-physical, social or economic system should recover, but the return to the natural state would be very slow and in some instances may not be achieved. I&APs might express some concerns and complaints may be received on an ad hoc basis. Rare and endangered species or sensitive areas may exist in the area and could be marginally affected.

High Significance

The project will induce extensive long-term changes to the biophysical, social or economic environment. The impact would be induced outside the development area and also possibly on a regional to national level. The possibility of secondary impacts arising from the project is high. Over the long term the impacts could fade away, but the implementation of expensive mitigation measures are normally required to eliminate or mitigate these impacts. These impacts would be experienced after cessation of activities and could affect the biophysical, social or economic environment severely. With mitigation the biophysical, social or economic system could possibly recover, but the return to the natural state would be or normally not be achieved. Ecological functions will be permanently disturbed and major complaints from Interested and Affected Parties (I&APs) could be expected. Rare and endangered species or sensitive areas exist in the area might be critically affected.

Should the impact assessment as a minimum reflect 2-3 impacts of high significance and 2-3 impacts of moderate significance, the project shall be viewed as a potentially flawed and continuation of the project should be seriously reconsidered or special engineering or biophysical/social intervention must be implemented.

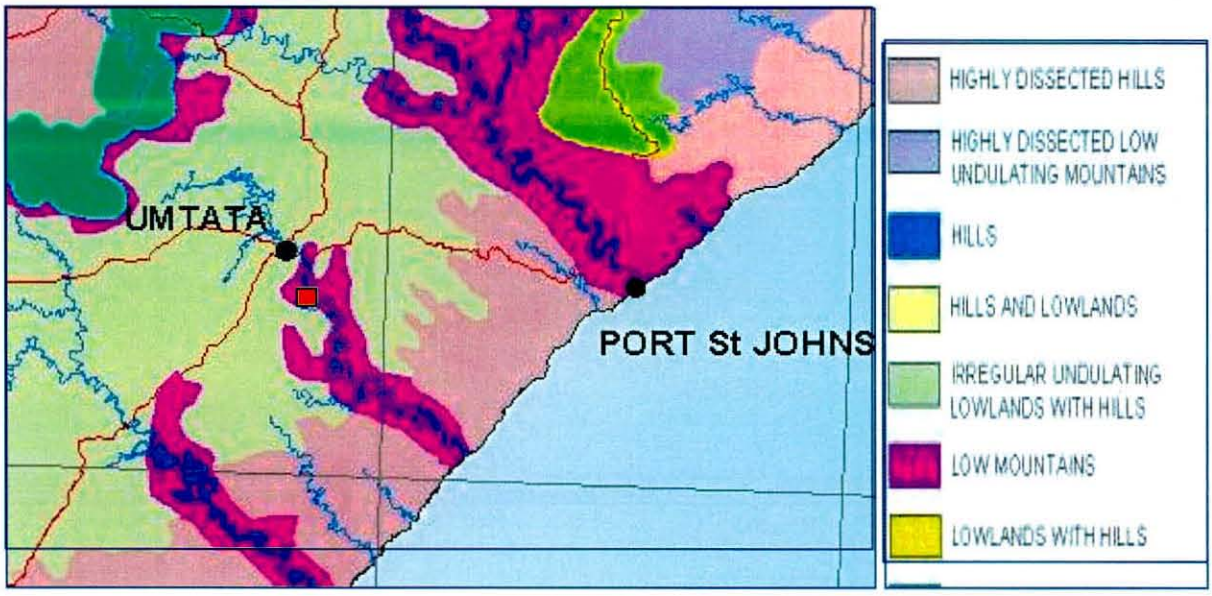
Descriptive terms

Spatial extent:	None/Insignificant (0), Site (1), Local (2), Sub-Regional (3), Regional (4),
Duration:	None (0), Short Term (1), Medium Term (2), Long Term (3), Permanent (4)
Intensity:	None (0), Very Low (1), Low (2), Low-Medium (3), Medium (4), Medium-High (5) High (6), Very High (7)
Probability:	None (0), Unlikely (1), Probable (2), Likely (3), Definite (4)
Significance:	0-6 = Insignificant; 7-15 = Very Low; 15-22 = Low; 23-31 = Low-Moderate; 32-40 = Moderate; 41-47 = Moderate-High; 48-55= High; above 55 = Very High

TOPOGRAPHY

Topography can be described as the form and structure of the landscape. This structure of the landscape is influenced by the specific geology of a specific area whilst the form is dictated by factors such as erosion and drainage channels shaping the landscape to plains, hills, mountainous areas and valleys.

The greater area falls within the Eastern Plateau Slope and can morphologically be described as a mixture of "Low Mountains' and 'Irregular undulating Lowlands with Hills'.

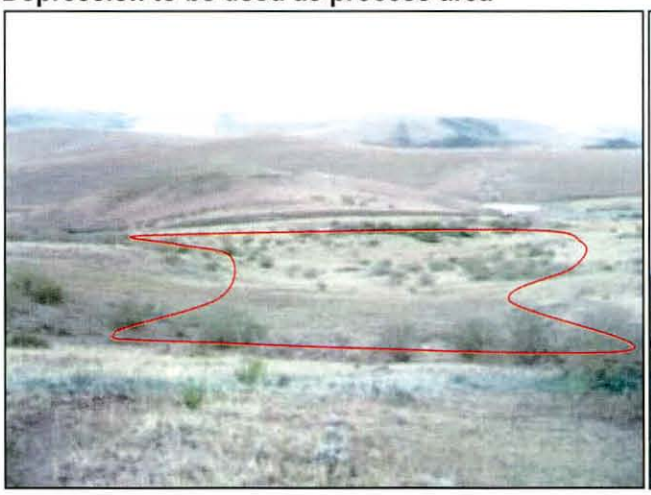


The immediate surrounds of the quarry display very large hills with mostly north-west to south-east disposition reflecting steep sides and deeply incised water courses that drains these hills.

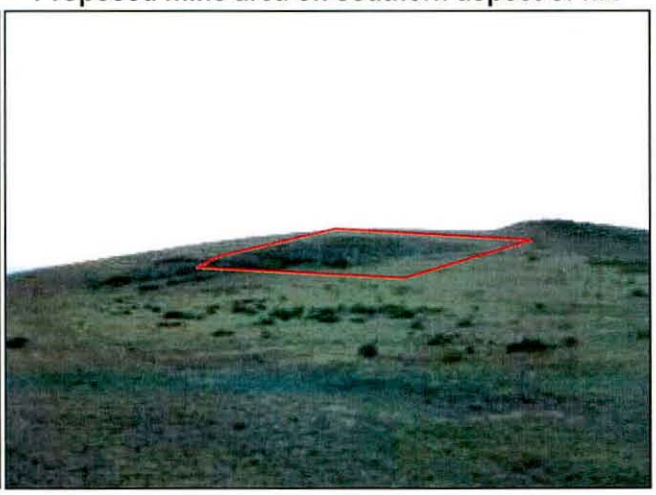
The structural topography of the immediate surrounds has only been affected in a minor way through the construction of small dams, roads and residential structures and is therefore rated as mostly intact. In the study area the topography has been disturbed by the one hectare large dolerite quarry.

The quarry area constitutes the upper section of the southern-eastern aspect of a very large dolerite hill with gentler slopes towards the north and east but steeper slopes in the other directions. The process area is located in a hollow located to the north-east which dispose of an almost flat floor created through previous mining operations. To the south, south-west and west much steeper gradients are encountered which could result in slope erosion if any activity takes place below the current quarry area. The area to the north-west reveals a moderate gradient and will result in increased face heights; the reason why the quarry is also extended eastwards to limit the mentioned impact. The land to the south-east constitute a saddle area in-between the target area and the next hill and falls away steeply to form a drainage channel which further away confluence with the Mthatha River. The drainage will not be affected by quarry operations.

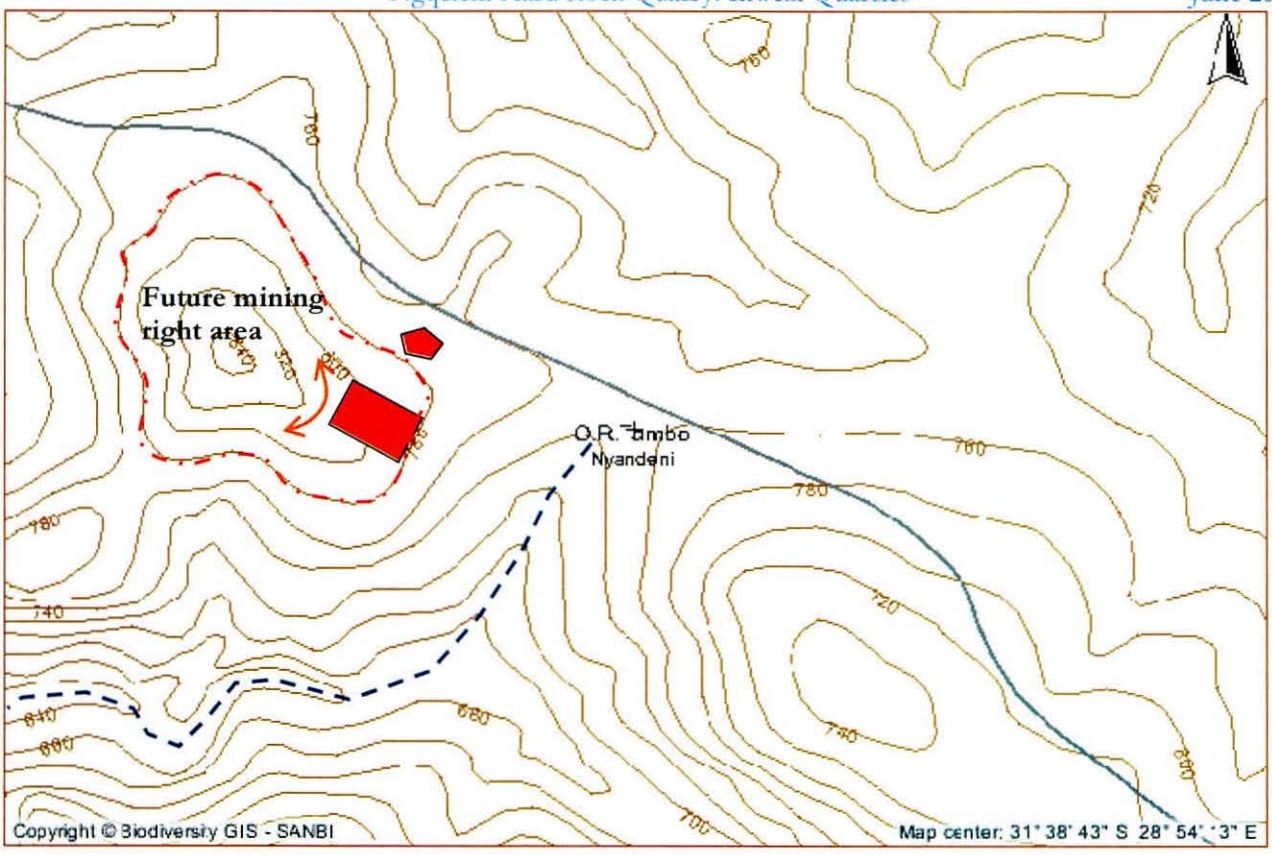
Depression to be used as process area



Proposed mine area on southern aspect of hill



The surrounding areas lie at altitudes of between 640 m above sea level in the valleys and 840m at the crest of the hill on which the proposed study is located. The mine area is situated between contour levels at 780m and 810m above sea level whilst the process area lies at altitude 770m. The hills in the area are definite focal points and disturbances would be noticeable and should thus be properly mitigated.



In the study area the slope of the ground is approximately 1:3 and this moderate slope will contribute to increased surface flow during heavy precipitation if denuded, potentially resulting only in limited erosion since the soil is relatively thin and located on hard rock. However, since the soils of the site display relative good structure, development of large erosion gullies are not anticipated, as being reflected by the area below the quarry area, but it has to be mentioned that no water egress is taking place due to the limited catchment involved. However, the soil structure change down slope of the quarry and is erodible as is reflected by the erosion scars on the northern slope of the hill to the south. Since the process area is almost flat, no erosion is anticipated here. The characteristics of the site as well as climatic factors lean towards effective rehabilitation if additional soil can be obtained. Despite the small catchment area above the quarry, the northern slope should be protected by a cut off berm ahead of the north-western slope.

The existing DRT excavation reveals a definite scar in the landscape and production needs to be profiled and vegetated reasonably well to mitigate this impact to some extent and causing it to be less visible from further afield. The surrounding landscape displays a homogenous, smooth texture resultant of the Savanna vegetation type found in the area. Mining would thus impact significantly on the texture of the area but if appropriately vegetated, the rugged, undulating topography will mask this impact significantly. There are no prominent environmental features within the mine area and it is barely visible from surrounding residences, roads and public vantage points, except from the south-east.

Access to the site already exists since it was established during the DRT mining phase but the rehabilitated road surface will require upgrading but due to the flattish landscape will not result in any change in the landform. Since the establishment of the office, stockpile and crushing area will take place within the rehabilitated DRT process area, it will only require the removal of topsoil and limited groundwork, resulting in an insignificant impact on the landform. No additional roads need to be graded that could impact on the landform. Topsoil of these areas will be positioned around the site in berms as indicated on the schematic development plan and will in a limited but temporary manner influence the landform. This action will however have other the environmental benefit of improved storm water control. At closure this specific impact will be rectified.

Establishing the hard rock quarry will during the operational phase significantly increase the impact on the topography, since it will result in a box-cut depression of between 5 (south-east) and 20m (north-west) deep with steep, hard, unnatural faces with no vegetation to soften the impact. To curb this impact, mining should be phased and the sides progressively rehabilitated to slopes between 1:2 (east) and 1:3 (south) in order to blend it with surrounding landscape. Complete integration with the landscape is not possible, but could be adequately mitigated with the placement of overburden, additional topsoil and proper re-vegetation with climax species found onsite. At closure, the quarry area will not be free draining and the current status quo will be maintained and will result in ponding during the rainy season to sustain a secondary wetland system and much welcomed stock watering facility. Once rehabilitated, it will represent an acceptable feature in the landscape. On cessation of the mining process, the floor area will be relatively smooth, but could display minor humps and depressions due to irregular blasting patterns, but these will me masked by the proposed wetland. This semi-wetland feature could result in a positive attribute to the post mining area with regards to increasing biodiversity in the area.

Changing the micro topography will change run-off patterns that may increase erosion potential which could manifest in the development of minor erosion gullies in the quarry area, but more pronounced gullies on the quarry slopes if affected areas are not protected. To reduce the potential of scouring during extreme high precipitation rates, relevant slopes should be protected by appropriated storm water control measures above the quarry. Without mitigation this impact will be of low-moderate significance due to the limited soil depth but can be mitigated to low by the construction of cut-off berms. Drainage density will therefore be slightly altered as water is channeled to the south-west of the quarry where it will be captured in a sump created for this purpose. Since the process area is located in a hollow, erosion is not possible.

Upon complete rehabilitation of the area, the quarry will to some extent blend in with the surrounding area but will always tend to represent an unnatural slot in the landscape. The fact that the quarry is developed against the contour will increase the topographical interference and the reason why north-westward development was limited to the minimum. This dolerite hill site is ideally suited for future development along the 780m contour without impacting significantly on environmental parameters.

The mining area is a limited focal point in the landscape and will therefore enhance the impact caused by mining, but as previously indicated this impact would be properly mitigated by means of profiling the sides of the excavation through precision blasting. It is important that quarry be developed as much as possible to the east to limit the increase in north-western face height. The current high faces should be benched as a matter of urgency to reduce the safety risk of the quarry. Previous quarry developments on the hill have already changed the texture/appearance of this hill slightly and the proposed development will cause the cumulative topographical impact to be of moderate significance.

As no permanent infrastructure within the mining or process areas is anticipated, no long-term impact on the topography will be applicable. The positioning of ablution facilities, office and workshop containers, crusher and associated infrastructure within the hollow will result in a low, short term topographical interference but will be eliminated at closure. The mentioned interference will be similar to the impacts that residences pose in the landscape

Considering the nature of the mining process envisaged, the moderate changes to the micro landscape would only be acceptable, should the necessary precautionary measures contained in this document be implemented. The impact on the topography is rated as permanent, site specific and of moderate significance if no remedial measures are implemented, but of low-moderate significance at closure. With time this topographical interference would become less prominent due to natural re-vegetation processes, provided that proper soil horizons are established. Any spoil material generated at development sites in Ngqeleni, immediate surrounds or should be secured and imported to profile the sides of the excavation to a better standard and the necessary funds should be allocated for this purpose. This objective can be easily achieved should empty trucks returning to the quarry be utilized for this purpose.

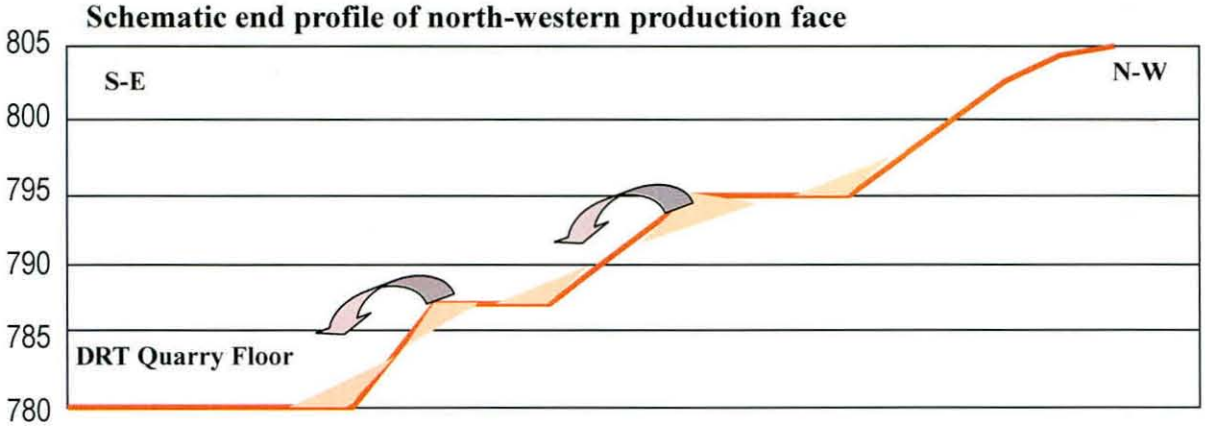
Impact on topography.

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
Extent	Site Specific	1	Site Specific	1	Site Specific	1
Duration	Permanent	4	Permanent	4	Permanent	4
Intensity	Medium	4	Low-Moderate	3	Low	2
Probability	Definite	4	Definite	4	Definite	4
Status	Negative		Negative		Negative	
Confidence	High		High		High	
Significance	**Moderate**	**36**	**Moderate**	32	**Low-Moderate**	**28**

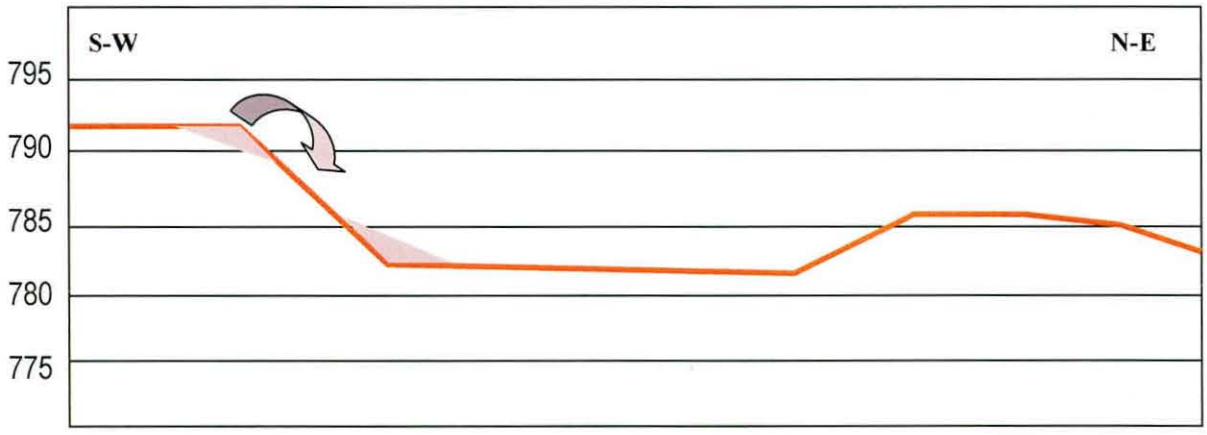
Remedial measures to be implemented are:

- Mining shall not progress beyond the approved mine area.
- The upper, north-western production face to be profiled to a minimum slope of 1:2 and second and third benches to 1:2 &1:1 slopes respectively. .

Schematic end profile of north-western production face



Schematic end profile of south-western and northern-eastern production faces



- Profiling will be done aiming to prevent sharp angles and rather form flowing curves instead, which blend with the surrounding landscape.

- Any oversize rock that the quarry may generate must be stockpiled and once a particular phase has been completed, it will be stashed against the high wall and covered with overburden to improve slope profiles, top dressed with topsoil and vegetated.
- The mining area will be divided in three phases to fast track rehabilitation. Each phase shall be fully rehabilitated within 24 months on completion thereof.
- The area will be mined according to the mine plan, but in order to reduce the man made appearance thereof, the shape will at closure be modified by shaping the corners to rounded profiles instead of a rectangular shape.
- Vegetation around the approved mine area will not be disturbed to curb erosion processes on site and reduce visual impact.
- The access and haul roads, where applicable, will be maintained with a proper wearing course and protected by properly designed cross drains and, where applicable, side drains.
- The north-western production face will be protected by means of a vegetated diversion berm constructed along the contour with topsoil that has been removed ahead of the production face.
- Erosion rills in the mine area, if any, will immediately be filled in, compacted and vegetated to prevent erosion gullies to develop with specific emphasis on the eastern and southern production faces of the quarry.
- The storm water control measures described under the headings 'Soil & Surface water" will be strictly implemented.
- A photographic record must be kept and complemented annually and must accompany the annual performance assessment report.
- The mining and process areas will be reclaimed as close as possible to its original vegetation status, by first establishing an acceptable grass cover followed by indigenous shrubs and trees along the bottom of production faces.
- The post rehabilitation topography will result in gentle overland flow with no evident erosion processes that could permanently scar the land and cause irreversible changes to the topography.
- At closure the following remedial measures will be applicable.
  1. The haul road to the quarry and process area will be obliterated and vegetated.
  2. All stockpiles shall be removed.
  3. All infrastructure and waste will be removed.
  4. The north-western face will be protected by a diversion berm that shall be removed after the two year aftercare period has expired.
- The rehabilitation plan will be implemented in accordance with the time frames set.

GEOLOGY

Residual dolerite of the Drakensberg Group will be mined at the Ngqeleni Quarry, where the dolerite has cooled to form massive, sub-horizontal sheets. About 180 million years ago, during the break-up of Gondwanaland, lava spewed on the surface through fissures and cracks that extended deep into the Earth's surface (mantle). Not all of the magma reached the surface and some injected under pressure into the surrounding sedimentary rock layers. The magma that spewed out on surface cooled to form the basalt that caps the Drakensberg Mountains.

The injected magma cooled to form dolerite, which in the case of the material exposed at the Ngqeleni Quarry, is erosion resistant and the target of future mining operations.

The lithostratigraphic units discussed in this section are indicated on the published geological map as follows

- Katberg Formation, Tarkastad Subgroup, Beaufort Group (green and red) "TRk" symbol
- Adelaide Subgroup, Beaufort Group, Karoo Supergroup (light green) "Pa" symbol
- Drakensberg Group Dolerite (red) "Jd" symbol

In the Mthatha area the dolerite intrusion generally comprises a massive (little internal structure) shallow-dipping sheet (sill) that extends in an elongated dyke structure. A dyke is a near-vertical intrusion and is considered as the "feeders" of lava from the mantle to the surface when dolerite intrusions first occurred. The width of the dyke structure varies from 100's of metres to a few kilometres in places. The dolerite has intruded into sedimentary rock of the Adelaide Subgroup in the study area, which is the basal lithostratigraphic unit of the Beaufort Group of the Karoo Supergroup in the area.

The Adelaide Subgroup lithologies have not been differentiated on the published geological map (see Appendix 2 of the Scoping report) and generally comprise alternating mudstone and sandstone lithologies. Petrographically, the dolerites in thinner sheets and in the dykes the texture is usually porphyritic, whilst in the ticker bodies it is best described as opthitic. The rock type varies from olivine dolerite through tholeiite to granophyres, and in the tick sills gravity separation has taken place. Dolerite intrusions caused metamorphism of adjacent Karoo strata and mudstone were turned into a black, flinty rock called 'lydianite'.

Dolerite deposits occur in abundance in the larger area and are thus not a strategic mineral. The site is also not a geo-site and is therefore of less importance. The impact on the geology is site specific and permanent. The area is small and the occurrence of similar geological features in the surrounding areas, render the impact of low-moderate significance.

Solid outcrop on eastern side of excavation

Solid outcrop ahead of northern production face

Considering the small amount of stone that will be removed from the dyke and from the regional deposits in general, the impact is rated of low-moderate significance

Impact on geology

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
Extent	Local	2	Site Specific	1	Site Specific	1
Duration	Permanent	4	Permanent	4	Permanent	4
Intensity	Low	2	Very Low	1	Very Low	1
Probability	Definite	4	Definite	4	Definite	4
Status	Negative		Negative		Negative	
Confidence	High		High		High	
Significance	**Moderate**	**32**	**Low-Moderate**	**24**	**Low-Moderate**	**24**

Remedial Measures

- The minimum working area for an efficient and effective operation should be utilized and demarcated prior to the start of mining activities and the personnel at the mine must be informed in this regard.
- No mining will be undertaken in areas where reserves have not been proved, in order to avoid unnecessary/wasteful mining
- No activities will be permitted outside the approved mine area and demarcated phase, especially on the steeper south-western to western slopes.
- All oversize material and overburden will be used in profiling the production faces of the quarry. This material will be covered with overburden or imported shale/gravel, compacted; top dressed with topsoil and vegetated.
- Due to the nature of the development, storm water will be retained in the excavation and will therefore not affect the geology on the slopes below the excavation.
- All spill areas of storm water control structures shall be protected against erosion.
- Storm water control structures shall be constructed as per the details provided under the chapter on handling of soils.
- Embankments must be profiled as stipulated in the chapter on topography, seeded and fertilized to prevent erosion gullies to develop, especially on the quarry slopes.
- Individual phases will be rehabilitated within 24 months after completion of a particular phase, but will be subject to normal rain patterns being experienced.
- All erosion gullies, especially on the newly profiled production faces, must immediately be filled, compacted and vegetated. An erosion-monitoring programme must be implemented as a cradle to grave process.

SOILS

Soil properties

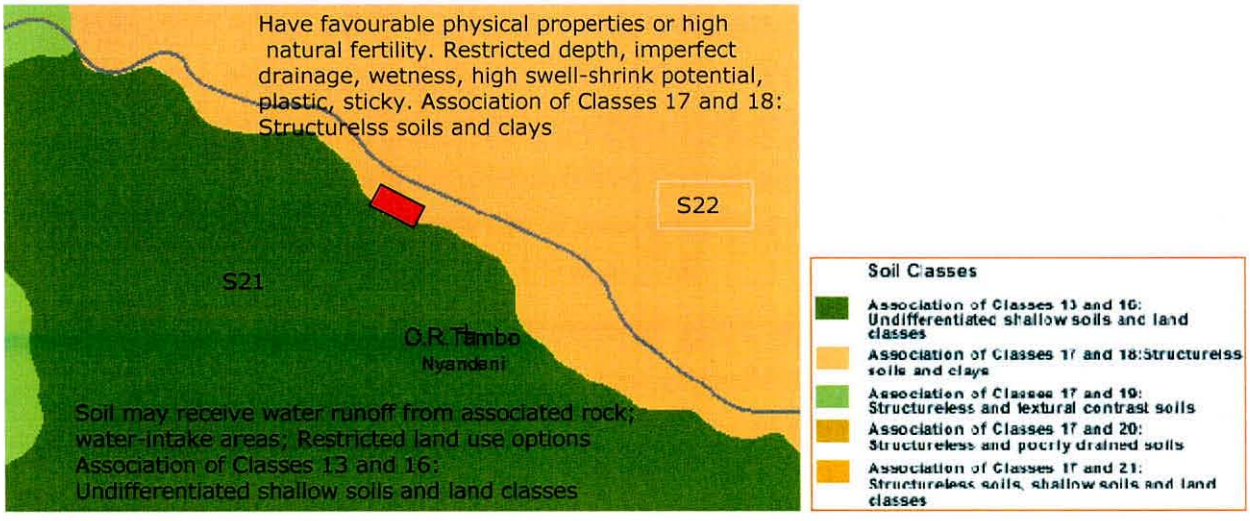
Topsoil is a very precious, non-renewable resource with high conservation importance and is necessary for the effective rehabilitation of disturbances caused by mining developments. The potential of soils to rehabilitate disturbed areas is defined by its depth, structure, texture, and sequence of soil horizons. It is therefore essential that where it occurs, it be preserved and protected and if necessary, obtained from outside sources to effect proper rehabilitation of disturbed areas.

Soil is a complex mixture of eroded rock, mineral nutrients, decaying organic matter, water, air and micro organisms. Soil forms when organic matter decay, solid rock weathers and crumbles, and when sediments are deposited by erosion. Mature soils are arranged in a series of zones called soil horizons, each with a distinct texture and composition that vary in different types of soils and it is important to reinstate soil horizons in the same sequence as when they were removed. Soil colour generally indicates fertility of soils for example; dark brown or black topsoil is nitrogen rich and high in organic matter. Grey, bright yellow or red topsoils are low in organic matter and will need enrichment to support a proper vegetation cover.

The average size of the spaces or pores in a soil determines soil permeability, i.e. the rate at which water and air move from upper to lower soil layers. Soil permeability is also influenced by soil structure: how soil particles are organized and clumped together. Soils vary in their contents of clay (very fine particles), silt (fine particles), sand (medium size particles), and gravel (course to very course particles). The proportion of the different sizes and types of mineral particles determines the soil texture. Loam soils which are comprised of roughly equal mixtures of clay, sand silt and humus, are the best soils for growing most crops. Calcarious soils are those that contain free calcium carbonate and can also be regarded as alkaline soils. The term "dystrophic" refers to an imbalance in nutrients. Dystrophic soils are therefore soils that are rich in humus, giving them a brown colour. They have variable amounts of nutrients and are sometimes depleted of oxygen owing to the high concentration of humus. The term "leaching" refers to a process whereby various soil components are dissolved by water moving through the upper layers, carrying the dissolved material to lower layers. Highly leached soils are those where most of the nutrients, etc. have been leached from the upper layers.

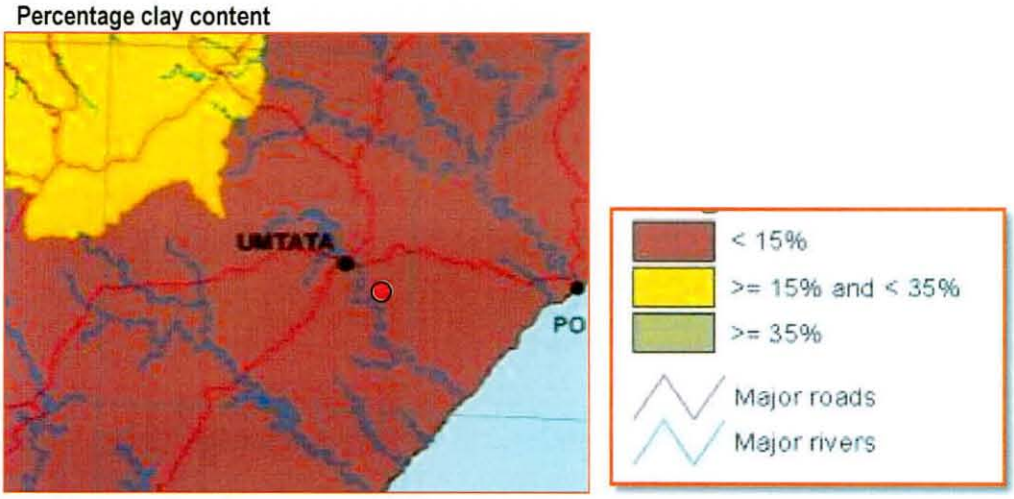
Soils within the greater study area derived from the Karoo sediments, are geologically complex and dystrophic. The most important land types include Fa & Fb on the mudstones and dolerites of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup). Soil properties have been influenced by both mudstone and dolerite parent material. Soil colour varies from light-brown to dark brown and is classed as fertile sandy loams and represents a typical lithosol with a relative permeable topsoil abruptly overlying solid rock with low permeability.

General soil classification

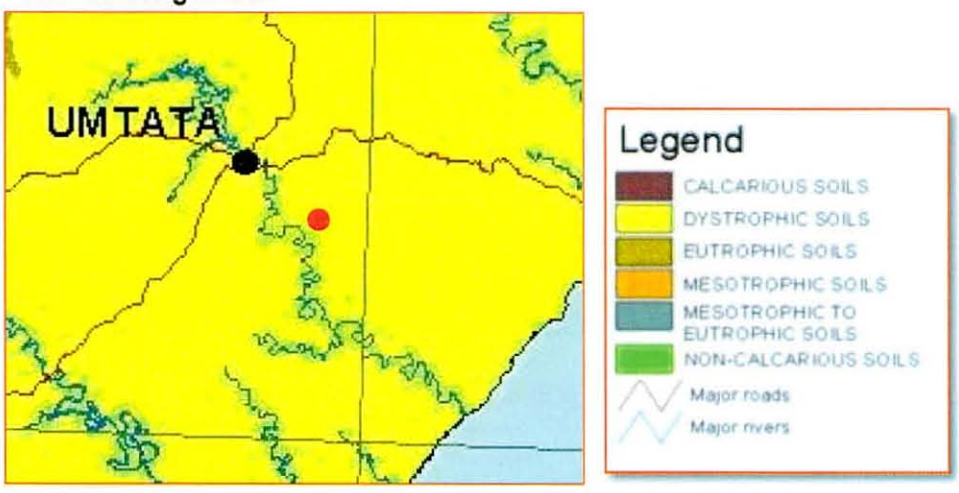


The clay content of surrounding soils are generally low and thus thus dispose of good permeability, without causing excessive leaching of minerals.

Percentage clay content



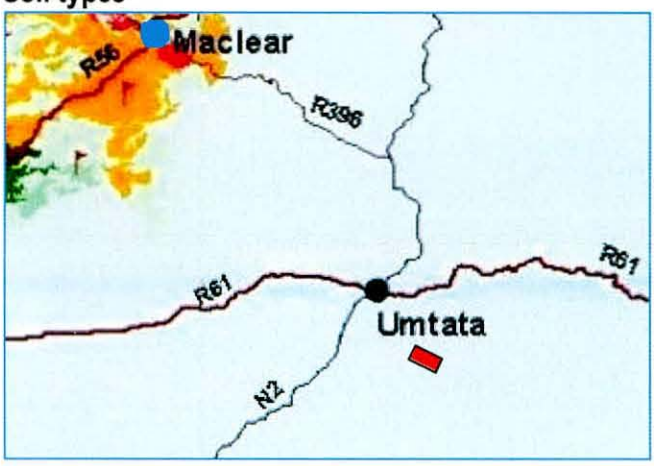
Soil leaching status



Soils in the study differ significantly from those of surrounding soils derived from the Adelaide Subgroup and are are dark brown to blackish in colour and can be described as a Fa type with limited lime availability and positioned on solid rock.

Doleritic topsoil with dark colour positioned on solid rock

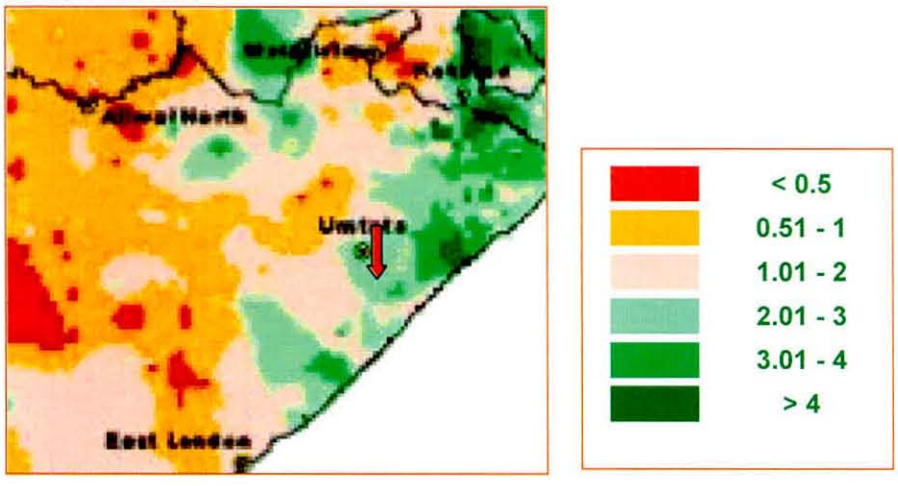
Soil types



	Fa	MISPAH FORMS (of the Myhill Series but other soils may occur); lime rare or absent in the entire landscape. Generally shallow soils consisting of an A-horizon that is not bleached but directly underlain by hard rock, sometimes with surface rock and steep slopes. Found in moister areas or areas with acidic parent materials, where little lime exists.

The soil disposes generally of low-moderate clay component, well structured, moderately rich in humus (between 2 & 3 %) content and is suitable for agriculture but these activities are restricted by its limited depth. Since the soils are well structured and dispose of reasonable clay content its water potential values remains good during dryer periods and are still able to support plant growth during such periods. During heavy precipitation increased runoff rates can be expected, especially on slopes due to lower penetration capability of the underlying dolerite. However due to its moderate penetrability and good structure the soil is generally not susceptible to erosion in its undisturbed state. No soil erosion was observed within the proposed mining area. This soil is generally very fertile and thus able to sustain a good Savanna cover and with implementing the necessary agricultural practices, disturbed soils can be upgraded to its original status.

Carbon content



Incorrect stockpiling of soil can cause its physical nature to deteriorate and become sterile due to compaction, loss of nutrients, texture and structure, chemical properties and decline in biological activity. Soil heaps may therefore not exceed 2m and must be vegetated or be returned to disturbed areas as quickly as possible. Due to the nature of the soils in the study area this alteration of the physical, biological and chemical properties will be limited over the short term (12 months) and a low-moderate reduction in soil productivity is anticipated during the storage period. Topsoil onsite will, according to the rehab schedule, be stored at least for 12-18 months and must therefore be seeded after removal from the mining area to main the fertility.

Due to the dystrophic nature of the mineral rich doleritic soils, supplementation with organic matter is not a requirement unless different soil types are imported to assist with the rehabilitation of the sides of the quarry. The AEC & CEC of these soils are normally good and it is anticipated that both important macro as well as micro elements will be well represented. However, calcium: magnesium ratios would be inadequate. The pH-values will be lower due to the influence of the dolerite and lime should be applied to ensure an effective

nutrient cycle and mineral absorption, which in turn will stimulate plant growth. The pH of soils will not be affected by mining activities.

Medium internal drainage capacity and adsorption capacity (available water capacity) due to average clay content will cause during the summer periods that these soils display good field capacity values, which will have a positive effect on biomass accumulation. This soil characteristic would generally preclude irrigation of reinstated soils on continuous bases during drier periods. No excessive water requirements are therefore anticipated. Soils of the study area have low leaching capabilities hence the soils will remain fertile after prolonged heavy precipitation, also when disturbed. If seeded, after removal from the mine area, and be reintroduced within a 12 month period no major upgrading would be necessary. Considering the soil characteristics the impact on soils removed during the mining process is rated moderate if no mitigation measures are applied but low if it is appropriately upgraded when reinstated. The thin topsoil horizon could result in this impact to be slightly higher if soil loss is not controlled.

The potential of soils to rehabilitate is defined by its depth, structure and texture and sequence of soil horizons. In the study area the soil depth is less than 45cm and is directly underlain by a solid rock layer but has still suitable textural and structural features and it would be amenable to physical rehabilitation. The topsoil is therefore suited to support a proper surface cover. Soil will mostly be reintroduced on the slopes and not the quarry floor as it might be partially flooded. This will result in increased soil depth on the slopes that in turn will provide for improved establishment of vegetation.

The C-horizon (rock) has due to its solid nature no properties that will assist with the rehabilitation of the area.

Soils of the process area will be disturbed to a lesser degree as the sub-layer will remain intact. The only factor that may influence the quality and ability of the soil to maintain vegetation cover after mining has ceased, is if aggregate and cement layers are not completely removed before topsoil is reinstated. If this is not done, topsoil will infiltrate into the aggregate layer and since the soil's particle affinity and stability will be severely affected by the large stone chips, it will tend to wash away and vegetation might slowly die off to to changing surface temperature and radiance. This negative scenario will increase in severity over time and will result in loss of humus content, increase in soil temperatures due to aggregate presence, which in turn will reduce productivity of the soil completely and may leave a bare and sterile area behind.

Topsoil removed from the mining area will be temporarily stored ahead of the production faces and soil from the process area will be positioned on the perimeter of the area.

As pointed out previously, the limited topsoil available and the increased surface area created through the mining process might result in a topsoil shortage and available soils should be supplemented to effect proper re-vegetation of the quarry area.

Impact on soil properties

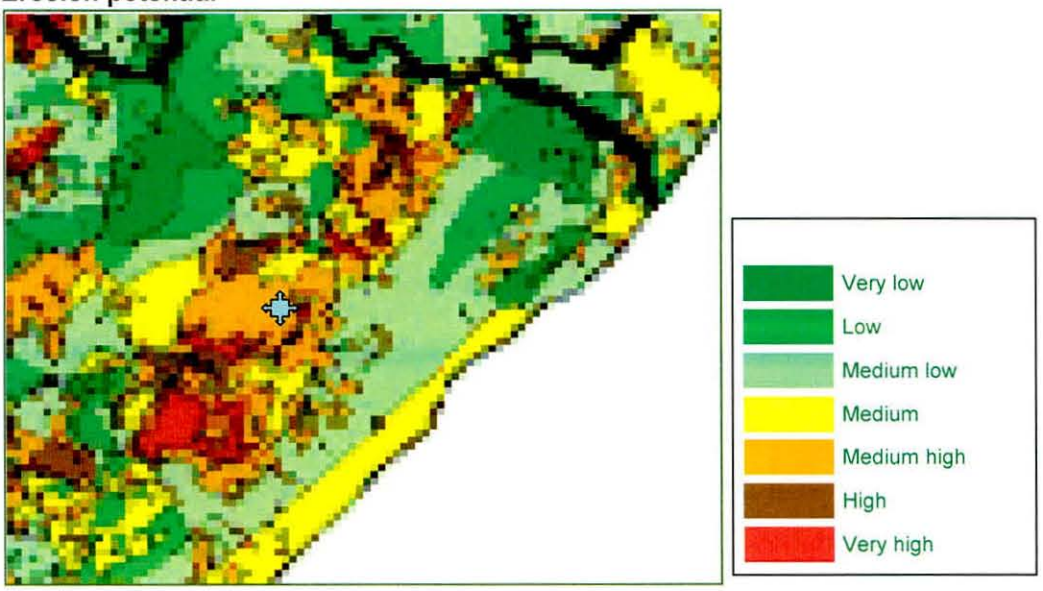
	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
Extent	Local	2	Site Specific	1	Site Specific	1
Duration	Long Term	3	Medium Term	2	Short Term	1
Intensity	Medium	4	Low-Medium	3	Low	2
Probability	Definite	4	Likely	3	Probable	2
Status	Negative		Negative		Negative	
Confidence	Medium		Medium		High	
Significance	**Moderate**	**36**	Low	18	Very Low	8

Soil Erosion

Soil properties determine the erodibility of soils and their ability to support vegetation and must be taken into consideration when assessing the potential for erosion and the suitability for rehabilitation. Soils susceptible to water erosion are normally silty/sandy, are weakly structured, have low organic contents, have poor internal drainage and are located on a slope.

Soils derived from dolerite parent material are generally not subject to degradation irrespective of the extensive grazing that is taking place and is related to its well established grass cover and soil characteristics. However, soils derived from the surrounding Adelaide mother material are more susceptible to erosion, especially when heavily grazed or disturbed. Surrounding soils display a medium to high erosion index due to poor structure and sand and silt content, especially on the slopes and represent a sensitive soil system.

Erosion potential



Extensive erosion of mudstone derived soils in the saddle area between two dolerite hills

However, soils in the study area are well structured, have low-medium clay content, high humus content and have average internal drainage capacity and thus dispose of a much lower erodibility factor. This is clearly observed onsite where very little erosion has taken place on the perimeter of the current excavation. When fully vegetated, these soils are very stable even on slope areas. Therefore, if adequately upgraded and seeded, its pre-mining stability can be achieved during the rehabilitation and post closure maintenance period.

These observations generally support the assessment made regarding the impact of the proposed quarry on soil stability. The process area is located on relatively flat land hence no soil erosion is anticipated. It should be mentioned that water is naturally retained within the quarry, a scenario that will be upheld during the mining phase hence no erosion is anticipated on the steeper slopes immediately south of the quarry. The berm of rocks that was established at the entrance of the quarry should be maintained, but alien plants should be removed.

Soils in the study area are generally not susceptible to wind erosion and no mitigation measures are required in this regard. If such impact is experienced contrary to the assessment of the EMP, the application of manure/grass cuttings on seeded areas will vastly reduce this impact and such material can be obtained from the surrounding stockowners and veld respectively.

Once mining is completed, the placement of topsoil on almost bare or blasted rock (slopes and benches) will result in the displacement of topsoil through sheet flow during heavy rain events if these areas are not suitably protected. This particular impact would be much more pronounced on the slopes. Such a scenario will eventually preclude the establishment of vegetation. The worst-case scenario would, however be erosion gullies of approximately 40cm deep and material eroded will be fanned out on the southern side of the quarry floor. It will not be lost and could be retrieved if necessary. If left unattended, these erosion gullies will be increasing in lateral extent and eventually bare rock will be exposed and total loss of vegetation will be prevalent. It is therefore imperative to obtain additional subsoil for crevasse infill and use all available organic matter as mulch on the slope areas, to reduce the battering impact of rain and to improve water absorption capacity and re-vegetation rate. Considering the above, it is pertinent that soil stability be achieved as soon as possible after mining has been terminated in a particular phase. Since there will be very little overburden available, it would be essential to import some of this material from other development sites and must be done according to determined schedule and volume targets.. Areas outside the mine will not readily be affected, as head cut erosion is not anticipated due to the solid underlying parent rock.

To reduce any potential surface flow within the mining area, it is important that the vegetation ahead of the proposed quarry areas is retained for as long as possible. A cut-off berm must be constructed ahead of the final production face to protect soil reintroduced to profiled production faces.

The floor of the excavation will receive minimal topsoil since it will be mostly inundated. In order to stimulate some vegetation growth around the edges, topsoil should be introduced to slopes right down to floor level. If the bedrock is too permeable and water is not retained, the floor will be provided with topsoil and vegetated. Due to the flat quarry floor that will eventually be created, no erosion is anticipated.

The access road the road to the quarry could be subject to erosion due to the moderate slope of the land concerned and would require runoff protection. Once the road is upgraded it is anticipated that the impact will be more pronounce than at the current scenario.

The impact of erosion on soils and the environment in general, is rated low with mitigation, but moderate without remedial measures in place.

Impact on soil stability

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
Extent	Local	2	Site Specific	1	Site Specific	1
Duration	Long Term	3	Medium Term	2	Short Term	1
Intensity	Medium	4	Low-Medium	3	Low	2
Probability	Likely	3	Likely	3	Probable	2
Status	Negative		Negative		Negative	
Confidence	High		Medium		High	
Significance	**Low-Moderate**	27	Low	18	Very Low	8

Soil Pollution

Soil pollution will mostly be restricted to the plant area. Soil pollution can only occur should hydrocarbon spills occur, or when 1) used oils and lubricants are purposefully drained into the soil, 2) storage facilities are destabilized, or 3) if ablution facilities contaminate soils. At the process area, these impacts, although low, are anticipated since trucks and earthmoving equipment will be serviced, fuel storage will take place and a sewage system will be installed. Storage of hydraulic fluids will take place, but no other chemicals or hazardous substances will be used at the site.

Hydrocarbons

The crushing plant and mining equipment will require large quantities of diesel fuel, oils and hydraulic fluids and in return it produces substantial amounts of used oils and lubricants. It is essential that these substances are handled correctly and that workers are properly trained in this regard; otherwise they could inadvertently cause unwanted environmental impacts, such as draining used oils into the soil. It is further imperative that certain areas are designated for maintenance of vehicles and that such areas be provided with a concrete floor with a sump to collect spilled hydrocarbons. All removed hydrocarbons will be drained into drip pans positioned in the sump areas and later on siphoned into appropriate containers and stored within the workshop container for disposal at the earliest convenience.

With normal extraction rates, due to the limited amount of vehicles that will be used, the worst case scenario would lead to very small hydrocarbon spills that will penetrate the soil and be retained within the upper layer as concentrated pollution that can be easily scooped up and be dispose of. Natural bio-degradation of such small hydrocarbons spills would take readily place onsite.. Nevertheless the use of fertilizers or oil surfactants could assist in breaking down limited spills in a short period of time. The impact is rated low under worst-case scenario and insignificant under normal circumstances, due to the limited spills anticipated in the process area.

If a major spill from one of the vehicles occurs, it will lead to a large spill due to the solid rock sub-layer and could result in medium adverse impacts on vegetation especially during dryer periods. It will severely affect soil fertility through impaired nutrient imbalances, pH values as well as reduced water retention capacity and will affect soils and vegetation over longer periods than smaller spills and needs to be bio-remedied. For this purpose, a specialist, approved by DWAF will be called in to remedy the impact. In addition, polluted soil should be scooped up into a truck and immediately disposed of at the closest waste facility. Fortunately the site is not located close to any surface water and due to the absence of groundwater the impact on water resources would be minimal.

Destabilizing the diesel tank and spilling the entire contents will result in a much higher impact than what can be expected from spills from vehicles. However, since the process area is located in a hollow, spreading of such spill would be limited and due to the reasons already mentioned, groundwater as well as surface water would not be affected. Once established; the diesel tank must be protected with a bund wall and positioned in an area with low vehicular traffic. Used oils and lubricants must be stored safely in appropriate receptacles in a bunded area and be provided with a roof or alternatively it must be stored inside the workshop container.

The impact of small spills is rated of very low significance but with if any large contract is secured, the anticipated impact will increase due to the increase in extraction and crushing rates and improved control will be required.

Sewage

The proposed chemical toilet(s) could result in limited soil pollution as the system is a closed system and negligible rise in coliform count in the soil is anticipated. The system must be maintained according to Municipal Regulations. The risk involved is reduced since the soils in the study area will not be used for housing or agricultural purposes in future. The anticipated impact will be much lower than the impact caused by the sewage systems at the surrounding residential areas. The anticipated soil pollution risk is rated negligible.

Waste

Due to the low number of people that will work onsite, a limited amount of domestic waste will be produced in the process area and the waste stream (tins, paper, wood, plastic bags, food, f) should generally not exceed 2 cubic meters per month. Waste need to be stored in proper receptacles to protect it from wind dispersal and it must be removed to the nearest approved waste facility in Ngqeleni or Mthatha on a regular basis. Even in limited amounts, uncontrolled storage of waste could lead to littering of the surrounds, which could affect livestock and impact on the visuals of the site. Storage of cement bags (if the brickyard is developed) in particular must be properly controlled during the construction phase. Cement contaminated water and residue cement could affect soil and subsoil negatively and the correct operational procedures need to be implemented. Waste production will be low in the quarry area and the impacts on soils in this area are rated insignificant. Handling of waste should be included in an environmental awareness programme to be developed for workers.

Vegetation removed from the quarry area, will later on be reintroduced to disturbed areas as mulch.

Impact of pollution on soils

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
Extent	Local	2	Site Specific	1	Site Specific	1
Duration	Short Term	1	Short Term	1	Short Term	1
Intensity	Low-Medium	3	Low	2	Very Low	1
Probability	Likely	3	Probable	2	Unlikely	1
Status	Negative		Negative		Slightly negative	
Confidence	High		Medium		High	
Significance	**Low**	18	Very Low	8	Insignificant	3

Remedial measures to be implemented are:

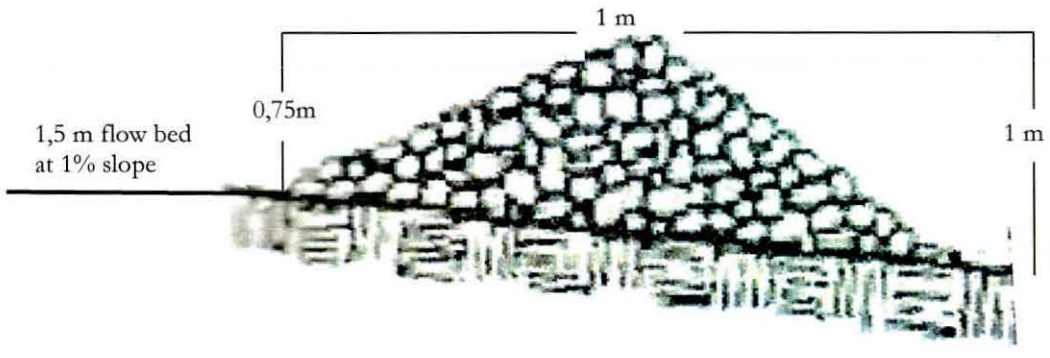
Conservation of *in situ* and removed soils

- All *in situ* soils will be removed from the quarry and process areas and conserved on the perimeter of these areas and will not be sold. If needed, soils shall be removed by hand to increase retrievable volumes.
- Soil will be stored as depicted on plan and will be piled to a maximum height of 1,5m not to negatively affect microbial action and the mineral cycle through compaction.
- Once removed topsoil, will be seeded with the specified seed mixture, upgraded with inorganic fertilizer and irrigated if possible.
- Mining will be restricted to the approved mine area. The amount of soil removed ahead of the production face will be reduced to the minimum required for optimal development.
- Mining will take place progressively from east to north and removal of topsoil will be done in similar manner.

- Only the one haul road to the quarry and plant area will be used and vehicles would not deviate from it and crossing virgin land.
- Any spoil material will be placed inside the quarry in mined out areas and not on surrounding vegetated areas.
- Disturbance of the soil and vegetation zones around the quarry will be prohibited.
- Removed topsoil will not be integrated with sub-soils, if before storage thereof.
- The quarry area might experience a shortage of soil for the rehabilitation process. Topsoil sourcing from development areas will be investigated without causing any environmental degradation in such area. Developments in Ngqeleni and Mthatha and surrounds will be targeted for this purpose. Empty trucks returning from town could easily haul additional topsoil to the mine. Imported topsoil should be used as B-horizon and will improve the soil profile and structure, which in turn will increase rehabilitation potential. Such soil must come from areas with zero alien plant infestation.
- Once profiled, the production faces will be rough and course and topsoil could easily be lost in the crevices between rocks. To counteract this impact, adequate overburden must be obtained to cover the shot rock and to establish a proper root horizon.

Protection of unstable soils

- No mining or associated activities shall take place to the south and southwest of the quarry entrance as it would stimulate severe erosion.
- The haul road should be protected with a proper wearing course of at least 30cm. If necessary it shall be protected from erosion and rutting with cross and appropriate mitre drains.
- Mining will commence from the east with minimum removal of soil ahead of the production face to keep it intact for as long as possible.
- The mining areas will be developed and rehabilitated in 3 phases as proposed in the development plan to reduce the extent of the disturbed area and limit erosion of non-vegetated areas.
- Each phase will be profiled and full vegetated within 24 months after rock extraction has been completed.
- Each production area will be profiled and vegetated as soon as possible to stimulate re-growth and to facilitate proper natural compaction of soils before the aftercare period commences.
- During dry periods, soils should be irrigated if water is available since it will stimulate plant growth and prevent applied fertilizers 'burning' established vegetation.
- Vehicles will not drive over rehabilitated areas to prevent compaction and dieback of established vegetation.
- In order to protect the north-western production face a diversion berm constructed along the contour with minimum dimensions of 1m at base and 0,75m high must be constructed 5m ahead of the final perimeter of the profiled quarry. The slope of the berm may not exceed 1% and it must spill on a correctly constructed and anchored gabion mattress (2m x 5m). Silt dams are not a possibility in this area due to the shallow soil depth in the study area. Inside the drain small rock heaps acting as energy dissipaters should be positioned every 20m-25m. Water egress from the gabion mattress must be checked after each rain event to ensure that it does not concentrate water or result in erosion down slope.



- All aggregate must be removed from the process area before reinstating the topsoil failing which surface cover will be affected and in turn soil stability will be affected.
- Storm water control structures will be retained and maintained until closure. If needed a soil conservation officer or expert will be employed to assist in constructing storm water control structures.
- The quarry will be developed in such a manner that slopes are smooth to prevent concentration of surface water on them that could stimulate erosion.
- Production faces will be benched to reduce slope angle, limit soil slumping and reduce erosion potential of runoff. Adequate subsoil must be positioned on benches to facilitate a proper root development zone.
- Should erosion on the slopes, although not anticipated, become problematic the following mitigation measures will be applied:
  1. Any erosion rills or gullies that develop will be filled in with subsoil, compacted but upper layer to be scarified to bind with topsoil, top dressed with soil, fertilized and seeded.
  2. Such areas will be provided with a mulch/manure layer of at least 5cm thick.
  3. In worst case scenario geofabric (biodegradable netting) or Soil Saver (natural organic sheet material with seeds) will be pegged onto the slopes after spreading of topsoil and seeding was effected. A soil conservation officer or expert will be appointed to oversee the process.
  4. Vetiver can be planted in rows across the affected area, 3m apart. These grasses must be wetted every 3 day during drier periods and must be lightly fertilized every month during the growing season.
  5. The contour ahead of the north-western face shall be retained until stability has been achieved.

Upgrading of soils

- In the process area topsoil will be keyed-in slightly with lower horizons by ripping it and upgraded as stipulated below.
- Profiled sides of the quarry will be adequately compacted, covered with subsoil to extent of the root zone, lightly compacted, covered with topsoil which must be upgraded as follow:
  1. Apply 5cm of manure and 5 ton/ha agricultural lime to seedbed (alternatively the 4:1:1 can be replaced by 300kg/ha LAN) and scarify to improve soil fertility and micro-climate of the soil, which in turn would facilitate improved germination and percentage soil cover. Let soil rest for 1 month (important to perform this task before September)
  2. Apply fertilizers at a rate of 150kg 2:3:2 and 100kg 4:1:1 per hectare before seeding.
  3. Once the grass seedlings have reached a 15cm height, applications of super phosphate at a rate of 100kg per hectare twice per annum (March & September) will be effected. Seeding will coincide with the rain season or when soil moisture regimes are good. Due to high fertility of doleritic derived soils, phosphate and trace element concentrations would be adequate, especially in the case of lime applications being affected.
  4. All grass/vegetation removed from the mine area will be stockpiled, protected against wind erosion and re-introduced as mulch to seeded areas.
- Upgrading of soils and re-vegetation of disturbed areas will be done concurrently with mining.
- If needed, soils will be analyzed by a competent laboratory and the nutrient requirements determined.

Contamination of soils

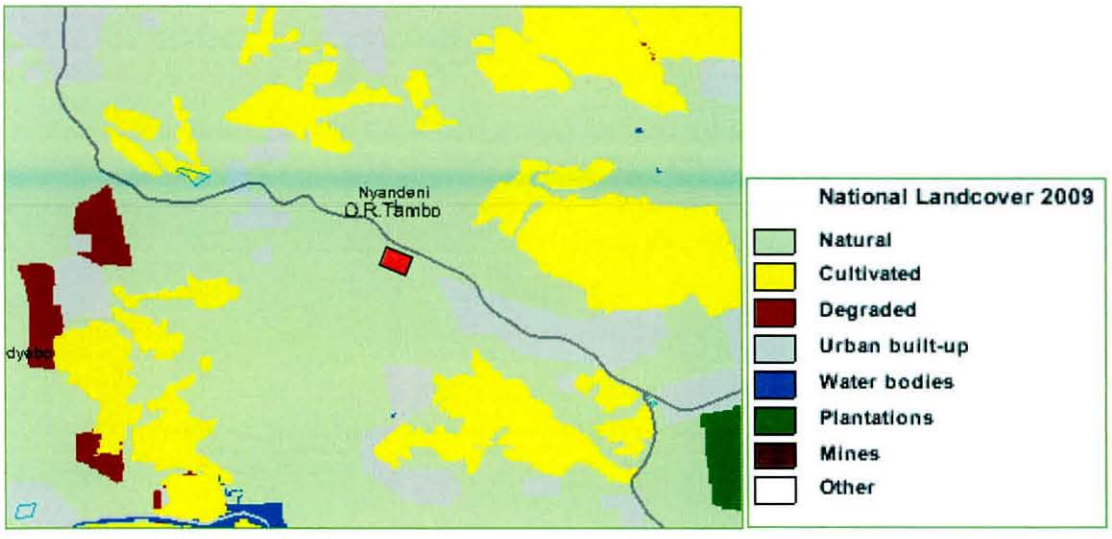
- Oil and lubricants will be stored inside the workshop container.
- Used oils and lubricants will be stored in receptacles with a proper lid within a bunded area. It will be disposed of at a registered recycling facility on a regular basis.
- All filters or oil/lubricant contaminated material will be stored in a separate receptacle within the bund wall and dispose of at a registered recycling facility on a regular basis.
- The fuel tank shall be established as described under the construction phase. The fuel pump shall be provided with an apron to capture all spilled fuels. The fuel tank will be positioned where the least vehicle movement is taking place. The bund wall around the fuel tank shall dispose of a capacity of 115% of the volume of the fuel tank. The bund wall shall dispose of a release valve to let water out after rain events.
- All vehicle maintenance and servicing will be done on the concrete pad provided for this purpose. If required, a wash bay will be constructed alongside it with an oil trap designed to specification.
- The diesel tank and all vehicles will be leak-free.

- Hydrocarbons shall not be drained into the soils, nor shall used filters and hydrocarbon-contaminated parts be buried in the soil, but will be removed to an approved waste site or recycling facility.
- Making use of bio-remediation facilitated by a specialist company will negate larger spills, whilst smaller spills could be treated with fertilizer to break it down or be scooped up by front-end loader to a hazardous waste site.
- Peatsorb or sawdust will be used to contain larger spills and some of this material must be on site as a contingency measure.
- Spills will be prevented by properly maintaining vehicles and restrict major servicing of vehicles to offsite facilities.
- No other hazardous chemicals will be used on site without authorization granted by the DMR and other regulating authorities.
- Waste will be removed from the mine area on a continuous basis to the closest waste facility with specific emphasis on household waste, plastics, and unusable scrap metal and tire casings.
- All quarry/plant debris must be removed before topsoil is re-introduced to disturbed areas.
- The toilet facilities will be mai9ntained according to Municipal Regulations.
- Cement mixing for establishing for example the concrete service area will not take place on bare soil but on a steel plate or plastic liner.
- The handling of hydrocarbons will be included in an environmental awareness programme.

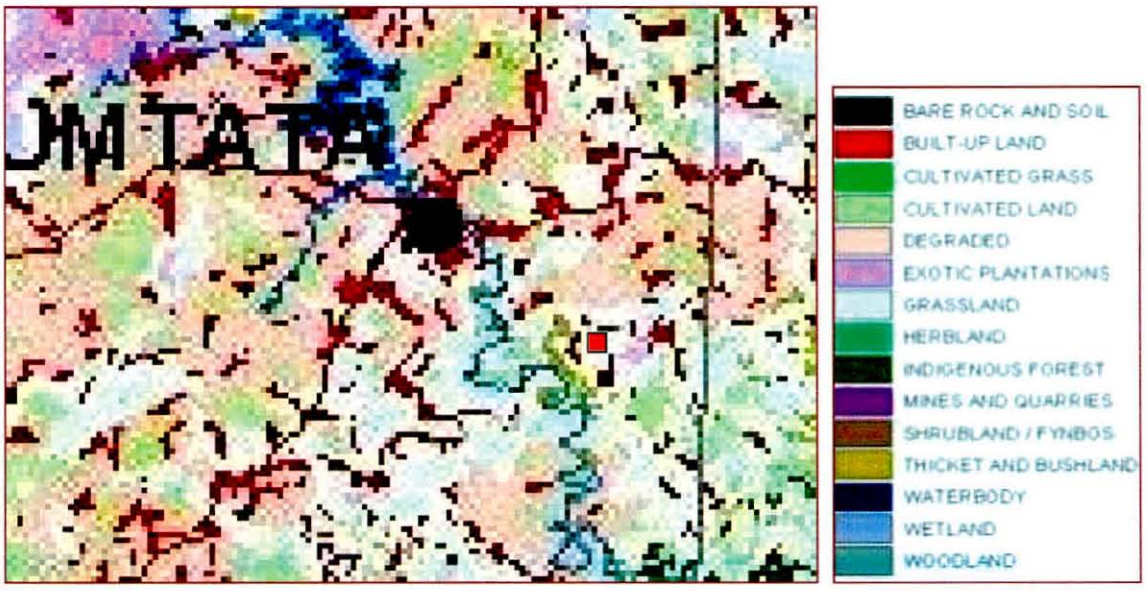
LAND USE AND LAND CAPABILITY

The study area is zoned agricultural. The land capability of the surrounding area is mostly grazing, maintaining wilderness land and associated fauna in some of the drainage lines. Wilderness land will not be affected by the proposed development as there are no acknowledged forest areas or drainage lines in close proximity to the study area. Since there are no human settlements in close proximity to the site, no future encroachment will take place that could affect land use. The area reflects no development nodes and does not fall into an area earmarked for future urban development parcels.

Land capability is directly related to the favourable climatic conditions and soil structure. Although soil depth is limited, soil structure is good and the above average annual precipitation that is received will ensure that the site is able to maintain a good surface cover resulting in the area to be a prime beef area if a proper camp system is implemented. However, since grazing takes placed uncontrolled, most of the sweet grasses with high carrying capacity has been removed and the land disposes of low grazing capacity. Since the soils in the immediate study area are relative shallow it is not recognized or used as a food producing area and the quarry activity will pose no impact on food security of the surrounding area.



In terms the EMPAT classification system the land concerned is categorized as unspecified/vacant grassland However this is not the case in the immediate study area as it hosts mostly a Savanna type cover, most probably because of historic bush clearing and pastoralism.



Environmental Capability

The study area hosts approximately 60% grazing induced semi-degraded grassland, 10% rock outcrop, 15% mining induced degraded area and 25% secondary grassland established during the DRT rehabilitation phase. The vegetation cover of the study area therefore represents a moderately transformed environmental system with low ecological value. From that perspective the environmental capability is rated of low significance, especially considering the absence of the faunal component. On completion of mining the existing mining scar would have been rehabilitated and the area turned into a grassland area with infill planting and a wetland and would result in improved environmental capability. During operations the impact on environmental capability would be of low significance, due to the small area that is involved but once rehabilitated the impact is rated of very low positive significance.

The quarry will not impose any impact on the environmental capability of the surrounding areas.

Agricultural Capability

From a grazing perspective, the study area reflects a low agricultural capability due to the extent of already disturbed area, shallow soils and overgrazing that is taking place. The area is not recognized as an agricultural important node hence no commercial crop production is taking place in or close to the mine area. Abutting areas reflect similar low agricultural potential.

From a carrying capacity perspective, the study area reflects also a low agricultural capability due to overgrazing that has transformed the sweet grassland to mostly sour grassland. In addition the relative small area to be affected in relation to available grazing land, will not result in mining causing any major impact on grazing potential of the Tribal Land. Potential loss of income due to loss of grazing land will be outweighed by the income generated by the mining operation as well as the social benefits that will flow from the operation. Taking into account the small area to be denuded and the aggressive rehabilitation strategy that will be

followed, the mentioned negative impact pact can be rated overall as very low and medium term. Once the area is fully rehabilitated, the agricultural potential will be restored to more or less its original status. The properties surrounding the site are extensively used for grazing, but will not be affected.

The potential end use of an area disturbed by development is mostly determined by the capability of the land before development, which in turn is defined by the soil types, climate and topography in that particular area. In the study area the increase in slope gradient and limited soil depth will affect the end use of the quarry area. It is therefore important to bench production faces and profile high walls to at least a 1:2 slope to ensure stable seedbeds during the rehabilitation phase. Most of the time the climate would be conducive to the establishment of adequate soil covers and there is no reason for the mine not to be rehabilitated to a decent standard. However, mining will reduce this potential over the short term due to marginally lower soil fertility (impaired nutrient cycles) and reduced organic content, therefore all topsoil must be conserved and reinstated as soon as possible. This potential impact can be restored through upgrading with inorganic fertilizers and is rated of low significance.

Mining the area in question would only cause a temporary affect on carrying capacity by stripping off the topsoil. However, the mining area will be re-vegetated as per the mine rehabilitation plan and will over time in most areas regain its grazing capacity. Introduced topsoil will act as a seed bank due to the limited time that it will be stored and it is anticipated that a portion of the natural vegetation will grow back, however, no complete Restoration is anticipated over the short term. Some species could be temporarily lost in the development process but over time will migrate back to the disturbed areas. Since this is not a conservation area or area reflecting high biodiversity, the need to maintain complete biodiversity is therefore not a prerequisite. Removing vegetation and topsoil will result in increased sediment transport and subsequent loss of topsoil, but would be curbed with the proposed mitigation measures. The area falls outside any fluvial footprint and will therefore not be affected by floodwaters.

Currently the high non-profiled production faces of the quarry pose a definite safety threat to humans and animals therefore the proposed development and rehabilitation strategy will eliminate this risk over time. It remains important that faces be profiled progressively as mining progresses and the site must be fenced off and the entrance gate locked after hours. These impacts are of low significance if mitigated.

The rock and topsoil berm at the entrance to the quarry hosts a number of alien plant species and this seed bank pose a threat to future rehabilitated areas and must be removed as soon as possible. No alien species were observed in the immediate surrounds within intact grassland hence it is not foreseen that alien species will affect natural veld status if these plants are effectively controlled within the disturbed environment. This impact is rated of low significance. Workers making fires on site may pose a fire hazard to communal farmers especially during winter when the grass is dry and may result in extensive losses to these farmers. Strict control in this regard is required. With a careless approach this impact is rated of high significance but with the necessary mitigation measures in place it can be reduced to very low.

Workers onsite could potentially result in stock theft and this potential impact needs to be controlled through penalty system and required disciplinary action since it could result in major conflict between the applicant and communal farmers. The same applies to the loss of the natural stock watering facility in the mine when development commences and it is proposed that a 5000l YoYo tank be installed for human consumption and if necessary, stock watering. The tank must be filled regularly to fulfill the needs of the community. In order to circumvent some of these challenges local people should get preference when recruiting the workforce.

Considering the low conservation status of the mining area (refer to other chapters) mining would not detrimentally affect the ecological value thereof. It is the authors' view that this particular development can be integrated with the surrounding land uses, which currently are grazing and residential without endangering sensitive natural and cultural resources or abutting land uses.

The temporary nature of the mining proposal would also not compromise the needs and the well being of future generations as it will be fully rehabilitated. In fact it will impact significantly (positive) on future

generations by providing material for less expensive infrastructure development Since this habitat is already disturbed by previous mining it is, from an economical and ecological point of view, the correct strategy to develop this site and not a green-field site.

Anticipated increases in dust levels (see chapter on dust) will not affect vegetation on abutting land due to decreasing photosynthetic rates. Since there are only grazing pastures and no crop production in the immediate vicinity of the quarry, no real threat to the livelihood of landowners is anticipated. The proposed site is located a reasonable distance from abutting residences and will therefore not affect the ambiance that residents of this farming community enjoy. Mining infrastructure that will be required will be mobile and no permanent impact on land capability and land-use is anticipated. The impact on land use and land capability could be rated of low-moderate significance during mining, but of low positive significance at closure.

Impact on land capability and land use

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
Extent	Local	2	Site Specific	1	Site Specific	1
Duration	Long Term	3	Medium Term	2	Short Term	1
Intensity	Low-Moderate	3	Low	2	Very Low	1
Probability	Likely	3	Likely	3	Likely	3
Status	Negative		Negative		**Positive**	
Confidence	Medium		High		High	
Significance	**Low-Moderate**	24	Low	15	Very Low	9

Remedial measures to be implemented are:

- Mining will be restricted to the approved mine area.
- All *in situ* topsoil removed shall be conserved and additional subsoil and topsoil will be obtained to increase topsoil depth and stability.
- Topsoil would be re-introduced to disturbed areas and upgraded by the application of fertilizers and lime and organic material where necessary as discussed previously.
- The quarry will be seeded with the prescribed seed mixture and planted with grass, indigenous shrubs and trees to ensure a surface cover that will stimulate the return of other plant species.
- Alien plant infestation will be prevented through a monthly alien eradication programme.
- Rehabilitation will be done concurrently with mining and in phases as proposed by the mine plan. Progress will be monitored and audited against proposed rehabilitation schedule to improve land use options and land capability.
- The impact on the topography of worked out areas will be remedied by means of profiling and stabilizing production faces.
- The necessary storm water structures as prescribed in the chapter on handling soils would be constructed to reduce water erosion, if any, and be maintained for as long as needed to ensure soil stability.
- The slopes shall be profiled to such an extent that the area could be used for grazing purposes. Rehabilitated areas would be fenced and not grazed by domestic animals within two years after extraction and rehabilitation were completed.
- Vehicles would only make use of designated haul roads to ensure that neither rehabilitated areas nor natural environments are adversely affected.
- Cooking fires will only be allowed in designated areas within safe and appropriate appliances. Soil around these designated areas will be cleared to safeguard the land use of the surrounding communal land.
- The applicant will ensure that adequate firebreaks and a liability policy will be put in place.
- A fire fighting protocol will be designed and workers will be trained accordingly.

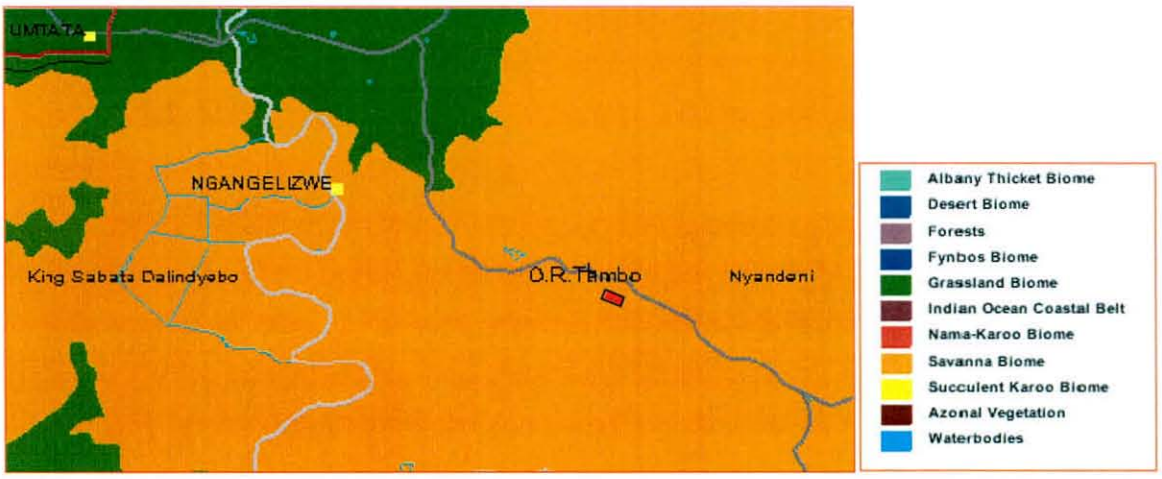
- All stock theft that can be attributed to the presence of quarry personnel will be the responsibility of the applicant and the necessary compensation will be paid to affected parties. In addition, any person that engages in such activities shall be dismissed.
- Vegetation outside the mine boundary shall not be affected by mining activities.
- Visual impact shall be reduced through proper re-vegetation strategies as outlined in the chapter on vegetation and normal working hours will be maintained.
- Production areas/faces will be made stable/safe as stipulated in the chapter on handling of soils.
- Waste will be continuously removed from site.
- Dust generation will be minimized through the mitigation measures stipulated under dust management.
- At closure all infrastructure will be removed from site.

FLORA

Vegetation plays an important role in maintaining ecosystems, stabilizing soils, maintaining the aesthetics of an area, serving as forage for animals and in providing income for landowners. When development is anticipated, the vegetation structure of the area to be disturbed needs to be analyzed, rare or endangered plant species be identified and economic value of plant cover be determined. Vegetation structure is mostly determined by the geology and climatic factors and the Eastern Cape coastline and bordering inland represents a climatic transition between the temperate rainfall region to the south-west and west and subtropical rainfall region to the south and south-east and a variable geology. This results in a diverse mosaic of plant communities, characteristic of Cape Flora and subtropical flora.

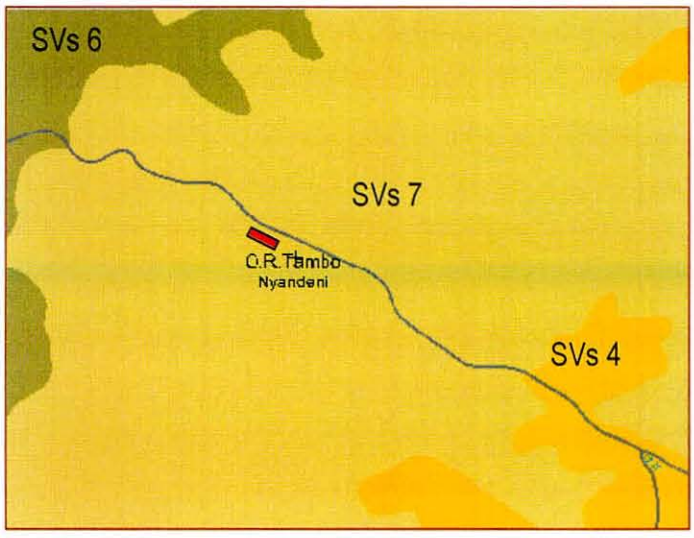
Vegetation analysis

The study area falls within the Savanna Biome but no trees were found within the proposed quarry area or immediate surrounds and the vegetation rather represents pure grassland.



In terms of the latest vegetation classification of Musina & Rutherford, the site hosts Bisho Thornveld (SVs7), which is apparently poorly protected but dispose of a 'Least Threatened" status since approximately 80% of this veld type is still relatively intact. To the distant north-east Eastern Valley Bushveld (SVs 6) is found and dispose of the same ecological status. To the distant south-west Ngongoni Veld (SVs 4) carrying a 'Vulnerable' status is found. For obvious reasons the latter two veld types will not be affected.

Mucina & Rutherford



Distribution

Eastern Cape Province: From near Mthatha in a band parallel to but inland of the coast to north of East London, turning to run along the southern side of the Amathole Mountains as far as Fort Beaufort. Also on dissected hills and low mountains around Grahamstown, especially to the southwest, and in a few fragments in valleys northeast of the Amathole Mountains. Altitude mostly 200–700 m.

Conservation

Least threatened. Target 25%. Only 0.2% statutorily conserved in the Doubledrift and Thomas Baines Nature Reserves. About 2% conserved in private reserves such as Shamwari Game Reserve, Rockdale Game Ranch and Fourie Safaris Game Farm. Some 20% already transformed for cultivation, urban development or plantations. Erosion is very low to moderate.

Important Taxa:

Small Tree: *Acacia natalitia* (d).

Tall Shrub: *Tephrosia capensis.*

Low Shrubs: *Anthospermum rigidum* subsp. *pumilum, Chrysocoma ciliata, Felicia muricata.*

Graminoids: *Eragrostis plana* (d), *Heteropogon contortus* (d), *Hyparrhenia hirta* (d), *Sporobolus africanus* (d), *Themeda triandra* (d), *Aristida junciformis* subsp. *junciformis, Bulbostylis humilis, Cynodon dactylon, Digitaria diagonalis, D. eriantha* subsp. *eriantha, Elionurus muticus, Eragrostis capensis, E. chloromelas, E. curvula, Kyllinga alata, Microchloa caffra, Paspalum dilatatum, Schoenoxiphium sparteum.*

Herbs: *Centella asiatica, Commlina africana , Gazania linearis, Gerbera ambigua, Helichrysum miconiifolium, H. nudifolium* var. *pilosellum, H. rugulosum, Senecio retrorsus, Spermacoce natalensis, Wahlenbergia stellarioides, Zornia capensis.*

Geophytic Herbs: *Hypoxis argentea, Moraea polystachya, Pellaea calomeanos.*