



**mineral resources**

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Reference:  
Date:

EC 30/5/1/3/3/2/1/0417 EM  
22 April 2010

Regional Manager  
Department of Economic Affairs, Environment and Tourism  
P/Bag X9060  
**EAST LONDON**  
5200

case ID: 2339

Sir / Madam

**CONSULTATION IN TERMS OF SECTION 40 OF THE MPRDA OF 2002:  
ENVIRONMENTAL MANAGEMENT PLAN IN SUPPORT OF AN APPLICATION FOR  
GRAVEL MINING ON THE FARM OF 359, DIVISION OF KING WILLIAMS TOWN IN  
EASTERN CAPE.**

1. Mr Sikolobo has applied for a mining permit on the above-mentioned area.
2. Attached is the EMP for your comment.
3. Please forward any written comments or requirements your department may have on this application, to this office no later than **18 June 2010**. Failure to do so will lead to the assumption that your Department has no objection(s) or comments with regards to the application.
4. Consultation on this application has been initiated with other relevant State Departments.
5. Kindly quote the relevant file reference number in all correspondence.

Sincerely,

  
REGIONAL MANAGER  
EASTERN CAPE



47mp

**ENVIRONMENTAL MANAGEMENT PLAN FOR  
WEATHERED DOLERITE MINING ON KING  
WILLIAM'S TOWN COMMONAGE**



**PREPARED FOR:**

**F. SIKOLOBO  
2 ROSS CRESCENT  
KING WILLIAM'S TOWN  
5257**

**APRIL 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 (Mine area Physiology)



**ENVIRONMENTAL MANAGEMENT PROGRAMME FOR WEATHERED DOLERITE QUARRY ON THE FARM MARTINDALE: EAST LONDON.****INTRODUCTION & BACKGROUND**

Lolo & Lolo CC has been established a few years ago with the aim to establish mining concerns within the Greater East London area and supply construction materials to Municipalities and Department of Roads & Transport. The applicant has already establish three mining concerns within Kei Mouth and another in Bathurst therefore the applicant has acquired adequate skills in successfully handling extraction of minerals as well as the environmental requirements related to these mining operations.

King William's Town was identified as a potential growth centre with regards to gravel distribution and the applicant decided to establish a weathered dolerite quarry near town. The applicant was fortunate to identify an existing borrow pit on the Municipal commonage, which forms the subject of this application. Since the town and surrounding areas have a shortage of weathered dolerite, the need for a source providing this mineral will be welcomed by the construction industry. The material has a wide range of applications and is used in substantial quantities as a replacement for sand as bedding material and is also used extensively as sub-layer in road construction. Currently there are no legalized sources and all the material is being obtained from illegal operators in the area, which causes extensive environmental damage by not being regulated by the Department of Mineral Resources. Currently the very same site is extensive used for unauthorized weathered dolerite production. Although residential development has declined substantially due to the current economic downswing, construction activities are maintained by the establishment of new businesses, industries and low cost housing. Therefore, the market for weathered dolerite will be maintained.

The proposed site disposes over adequate reserves to facilitate long term extraction and an application for a mining right might be considered in future. Although the geological features of the greater area made identification of alternative sites possible, the site selection process had the environment at heart and was therefore restricted to an already disturbed site located in an area which was previously disturbed through mining by the Department of Roads & Transport & the Municipality. The portion of land involved has been severely transformed by illegal mining and overgrazing activities and is not environmentally sensitive and mostly thorn trees are present on site. The chosen site will therefore facilitate mining without causing major environmental damage or disruption of community life.

In terms of the STEP programme the proposed mine area neither constitutes a very sensitive environment nor hosts endangered mine area or animal communities and can therefore withstand limited loss of land through development. The portion of land involved has no other current land use than livestock grazing. In terms of the development guidelines provided in this EMP the proposed mine development should be able to take place without causing environmental degradation. In terms of the development proposal a 1,4ha portion of the lower, western aspect of a large dolerite hill will be developed. There are no infrastructure related to the study area and residences are more than 500m from the proposed quarry.

**TERMS OF REFERENCE**

The applicant has appointed Stellenryck Environmental Solutions to compile the EMP for the mining concern but is restricted to the following:

- Compilation of a baseline EIA & EMP for the proposed weathered dolerite quarry.
- The EMP would cover all biotic and abiotic components on basic impact assessment level.
- The site visits revealed a disturbed section of land and no large mammals were observed in the area hence no formal survey was conducted. Reference in this regard is made to the Amatola Environmental Plan.



- A basic floral survey was conducted by SES but the area mainly hosts a grass and alien vegetation stand and no species of value was identified.
- Additional studies required by the regulating authorities will be submitted on receipt of such request depending on the extent of such studies and will be funded by the applicant.

SES was not tasked to perform the public participation process prescribed in terms of section 27(5) of the MPRDA and was not mandated to appoint a Heritage Impact Practitioner to conduct the HIA.

**The findings of the EMP are based on information/requirements gathered from:**

- EMP's submitted to the DMR for quarry operations in the greater East London area.
- Amatola Environmental Report, STEP report, Musina & Rutherford vegetation analysis report, EMPAT, SANBI
- Quarry sites visited in the past that occurred in similar environment.
- Site visits to the study area site in December 2008 and February 2010.

**PROJECT DESCRIPTION**

**Applicant, responsible person & mine manager**

F. Sikolobo

2 Ross Crescent  
King William's Town  
E.L.  
5257

Tel 08325079349

**Surface owner/s**

Buffalow City Municipality

**Holder of mineral rights**

State

**Title deed description**

Commonage

**Mineral**

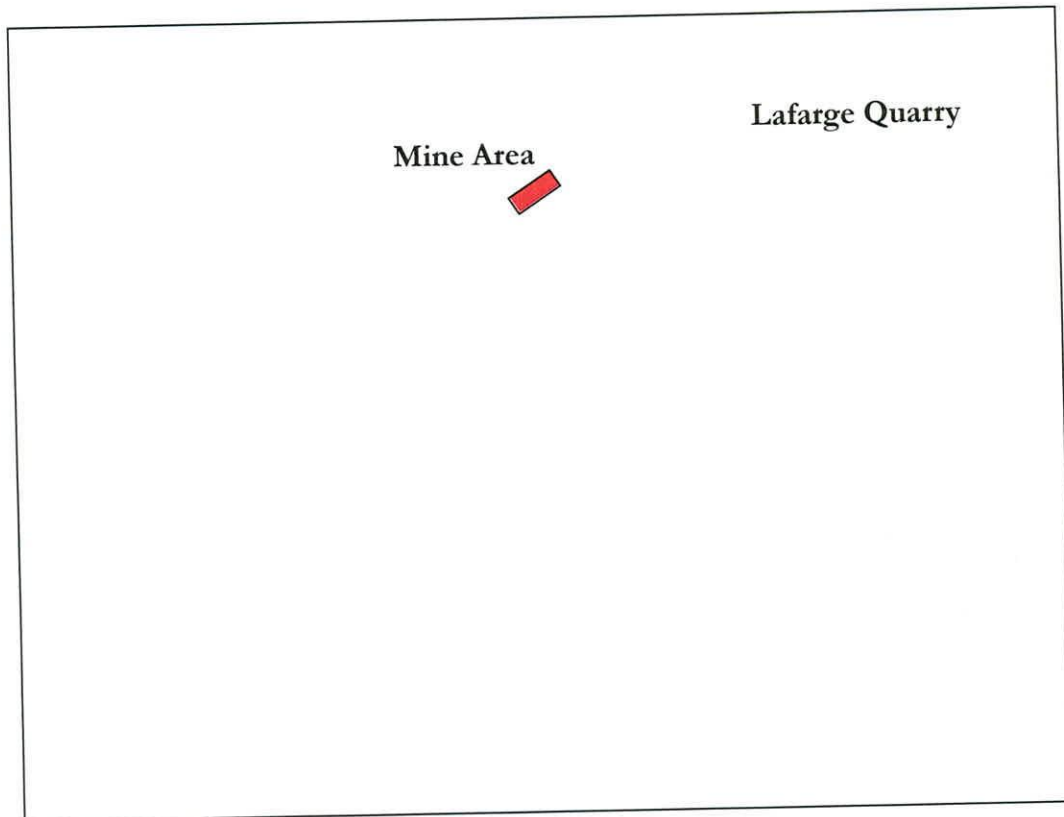
Weathered Dolerite

**LAND DESCRIPTION / INFORMATION**

**Regional setting**

**LOCALITY**

The site is located approximately 1km north-east of town on the gravel road to Lafarge Quarry and King William's Town.





## **Surface infrastructure**

### **Surrounding areas**

There are no power or telephone lines within the proposed quarry area. The gravel road to King William's Town is located approximately 300m to the east.

There are a few houses occupied by smallholding workers and labourers of Mr. Weyer are located on the opposite side of the gravel road to the south-east of the site. Lafarge Quarry is located to the north-east whilst Reservoir Hill residential area is located 700m to the south-east.

The immediate surrounds are therefore sparsely populated.

### **Presence of servitudes**

There are no servitudes registered in the proposed quarry area.

### **Land use of immediately adjacent land**

- North – Grazing on Municipal property.
- West – Informal grazing on Municipal land.
- East – Formal grazing on smallholding on land leased by Mr Weyer from King William's Town Municipality.
- South – Informal grazing and Municipal land and in the distance the town.

### **Existing land uses that impact on the environment in/outside the proposed mining area.**

- Previous clearing of small holdings/Municipal land causing almost total loss of floral biodiversity.
- Lafarge mining to the north-east causing a substantial increase in traffic and safety risks on the road.
- Illegal mining on the site concerned causing total degradation of a large area.
- Unrehabilitated sandstone quarry located to the south-west
- General pastoralism causing limited impact on terrestrial ecology of the area.
- Informal hunting causing an almost 100% impact on faunal biodiversity.
- Gravel road causing substantial increase in noise and dust levels within 100m from the road.

### **Name of the river catchment in which the quarry is situated**

The immediate area is drained by a tertiary watercourse located approximately 300m to the south-south-west, which eventually confluence with the Buffalo River approximately 1,2km to the south-west.

### **Mine**

Water required for rehabilitation or dust suppression, if required, will be obtained from the Municipality and trucked in. The mine area will not be fenced since the area disturbed by unauthorized mine is simply too large. No labour accommodation or campsite will be established on site. A toilet facility will be positioned south-west of the quarry.

No power source or workshop facilities would be required. Trucks will return to the contractor's facilities in town at the end of the working day, whilst the excavator might remain onsite and looked after by night watchman. There is no infrastructure within the proposed mine area.

Because of the above impacts on the environment, the proposed quarry area and surrounds cannot be categorized as pristine and in terms of biodiversity and conservation potential the mine area disposes of



limited ecological value. Temporary loss of secondary vegetation cover through development can therefore still be accommodated. However, through the proposed mining and rehabilitation process, the applicant will ensure that the affected land is satisfactorily rehabilitated to grassland and randomly spaced indigenous trees with no alien vegetation.



## Zoning

Current zoning is still grazing and 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 needs no application for change in land use. It needs to be emphasized that 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 Martindale Weathered Dolerite Quarry will be a private concern licensed by the Department of Minerals and Energy. Material will be extracted from the western aspect of a large dolerite hill by means of an excavator to a depth of 3-5m. The objective of mining would be to extend the existing, unauthorized mining area along the contour to the west along the base of the hill. Trucks will enter and exit the site from the east from the gravel road.



## Mineral Deposit & Mine Product

Weathered dolerite, a coarse material that develops through chemical and mechanical weathering of solid dolerite deposits.

## Estimate reserves

Approximately 60 000 cubic meters of weathered dolerite are available on site. The site would provide material for approximately 2 years.

## Markets

King William's Town dispose of no legal weathered dolerite quarries hence a substantial untapped market is available. Although residential development has declined due to the current economic downswing, construction activities are maintained by the establishment of new businesses and industries and low cost housing developments. Therefore, the substantial market for weathered dolerite will be maintained.

## Prospecting

Department of Roads and Transport as well as the King William's Town Municipality previously mined weathered dolerite on the property and the production faces are clearly visible. The mineral is fine to coarse and ideal for construction purposes as portrait by the pictorial record. The material is not uniform in texture and large dolerite boulders were observed within the old quarry footprint. However, it seems if the quality of material is improving towards the west with less dolerite boulders and represents an area of increased weathering, which will provide for a less cumbersome rehabilitation process. The study area hosts the same quality material which was mined at the site previously by the DRT and since the applicant is conversant with specification of dolerite material, the quality of material could be established through visual survey. Additional reserves are available to the north and north-west, should the applicant be interested in applying for a mining right.

## Illegal mining by Municipality





**Current & historical mining area****Mining methodology**

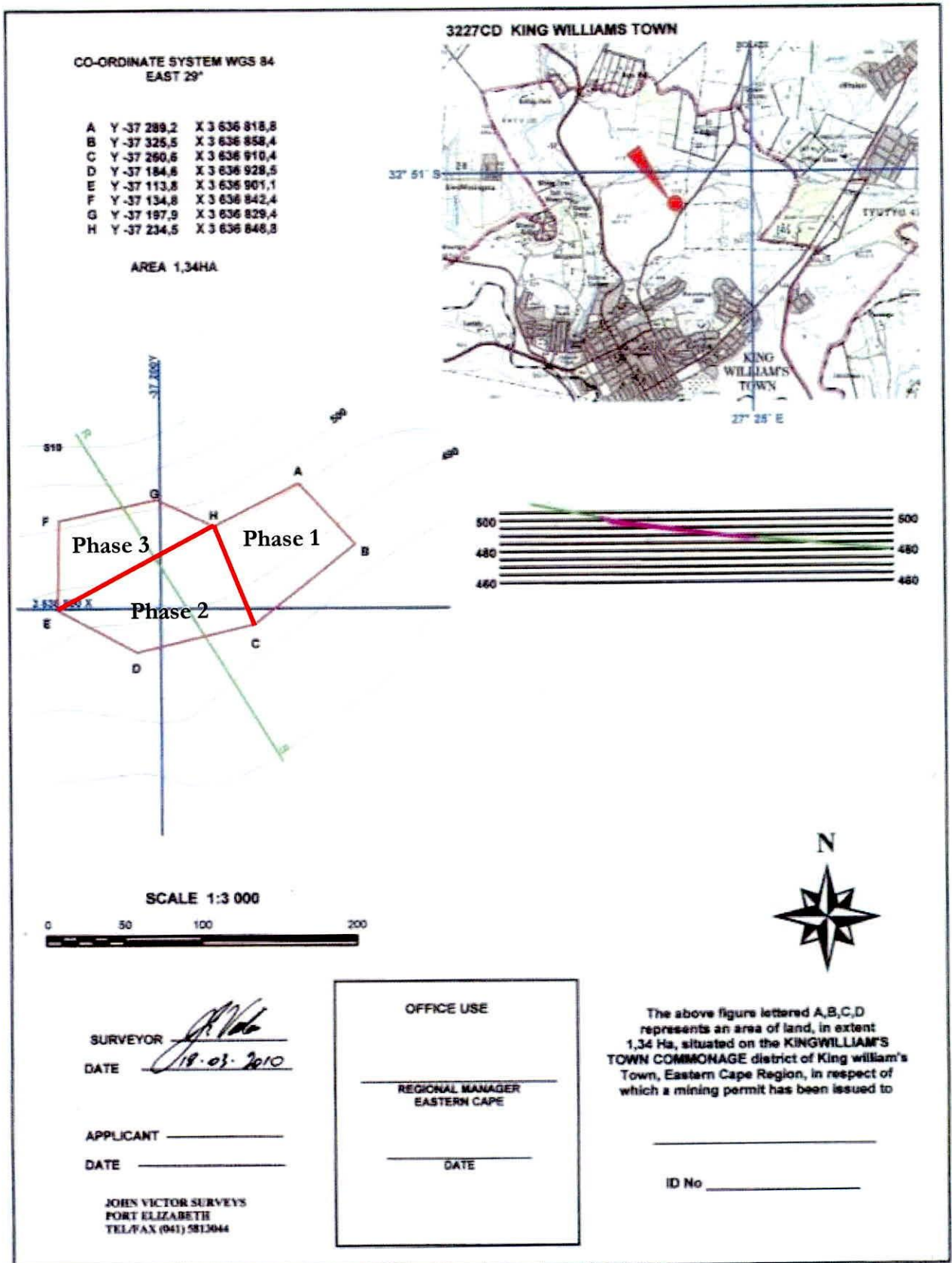
The total mine area comprises about 1,4 ha and the depth will be restricted to 3-5m below current land level. Approximately 60000 cubic meters would be extracted once authorization for the project has been obtained. The study area displays a well-developed and structured topsoil layer that will be stored on the sides of the excavation, except for on the southern side for rehabilitation purposes. A limited stockpile equal to one day's sales will be established. Once extracted, material will be loaded onto 5-10 cubic meter trucks and carted to the relevant markets. In the event that dolerite boulders are exposed, these will remain onsite and be neatly stacked against the base of the production faces to reduce slope heights and slope gradients. A stage one crushing mine area will be housed on site to crush the large chunks to finer material.

The nature of this igneous rock will result in mining to remain above any primary or perched aquifer. The material is granular and coarse in nature and dust generation will be limited and no wetting of the mining area is anticipated. If required dust sampling will be done.

Open cast mining will commence on the north-eastern side of the mine area and the existing access road will be used. Mining will then progress along the contour in a south-western direction in three phases to encourage concurrent rehabilitation. Face height will be restricted to between 3-5 meters. If needed, production faces will be benched to reduce safety risks and facilitate an easier rehabilitation process. The bench will dispose of a minimum width of 5m. Once the final quarry perimeter is reached, the benches will be profiled through the cut and fill method to slopes of 1:2-1:3. The top edge will also be trimmed to facilitate integration with the surrounding landscape. Once the weathered dolerite is extracted, the quarry area will resemble a rectangular depression in the landscape but will still be useable for grazing provided upgrading of the soil and seeding program are implemented.

Access to the gravel road has already been established and disposes of a gravel Bell-mouth. Working hours will be between 7.30am to 5pm five days a week, when required with cessation of activities on 1pm on Saturdays, if construction schedules require operations on Saturdays.





## **Construction phase**

### Roads

The internal gravel access/haul road from the N6 to the quarry already exists as it has been constructed during the previous mining ventures of the DRT. This road might need occasional upgrading and material from the quarry would be used for this purpose. No new access roads are therefore needed.

### Offices and workshops

No permanent office will be constructed. If the need arises, a mobile office in the form of a steel container will be positioned in the south-western corner below the mine area and could also serve as shed for the storage of oils, lubricants and spare parts. For this purpose the soil will be levelled with a bulldozer/front-end loader. If needed for emergency servicing. No maintenance area will be established due to the close proximity to town. The applicant and contractor will endeavour to maintain vehicles off-site at the workshop of the contractor.

### Water reticulation

Due to the size of the operation no water reticulation system will be established and if necessary the system will merely consist of a raised water tank and water cart to facilitate dust suppression. Water will be brought in by water tanker. Potable water will be brought on site daily in a 50L PVC receptacle.

### Sewage system

No permanent sewage system will be installed due to the limited size of the operation. A pit toilet will be provided for workers on the south-western side of the mining area between trees and will be serviced according to prescribed guidelines. No other facilities such as showers will be provided.

### Waste facilities

Considering that only  $\pm$  three persons would work on site, no permanent waste disposal site will be established. A container with proper lid would be placed within the mine area for the storage of any household waste. This receptacle will be emptied on a regular basis at King William's Town. Appropriate receptacles will be provided when needed for disposal of used hydrocarbons.

### Housing

No housing would be provided as the workforce would not reside on the mine, but will commute to work every day.

### Quarry infrastructure

No quarry infrastructure would be required other than possibly a water tank, container office and single stage crusher will be established on the quarry floor.

### Mine development

Topsoil will be partially removed from the mining area and stockpiled on the western, northern and eastern perimeters of the quarry. A portion of the topsoil will be stockpiled in the quarry to rehabilitate the quarry floor.



No additional mineral processing will be carried out in the mining area, since extracted material will be hauled directly to the identified markets.

### **Decommissioning**

- All containers and equipment will be removed.
- 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.
- Reintroduce topsoil, fertilize, rip the entire area, seed, scarify and irrigate.
- 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 1:3 slope to achieve safety requirements and to blend in the quarry with surrounding landscape.
- Ensure that an effective drainage system is in place.
- Retain at least 30-40cm of weathered dolerite in the quarry floor to facilitate some retention capacity to curb erosion.
- Spread topsoil to a depth of at least 20cm over overburden and scarify lightly (if possible) to key it in with the B-horizon.
- Ensure that soils are stable and that adequate surface cover has been established.
- Two years of aftercare will be provided and the necessary performance reports will be submitted to the DMR.

## **HEALTH AND SAFETY MATTERS**

The applicant will endeavour to 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 of the date on which mining commences.
- Since mining will take place on surveyed land, the retention of 9m-boundary pillars will be applicable – MA Reg 7.12.
- No work will be performed within 100m from any registered road or infrastructure that needs to be protected hence no authorization in this regard is required from the Principle Inspector of Mines – MHSA Reg 17
- No Sunday labour will be required hence no permission is required – MW Sect 9.

### Appointment of following responsible persons will be done

- 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 Reg 2.6.1
- Safety Officer - MA - Req 2.17.1
- Surveyor - MHSA Reg 17.(2)
- Health & Safety Committee - MHSA Sect 34
- Operators of Mobile Machines - MA Reg 18.1.1

- CoP to combat slope instability related accidents in surface mines
- CoP on 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

- The mine manager will ensure safety.
- The applicant will provide and maintain a working environment that is safe and without risk to the health of employees. The applicant 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.
- The applicant will prepare a Health and Safety Policy document as per Section 8.
- The applicant 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.
- The applicant 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 applicant will ensure that every employee is properly trained as per Section 10.
- The applicant and mine manager 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 applicant 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 and infrastructure within 500m from the quarry dust impact would not be applicable.
- Loads will be covered with tarpaulin.
- If applicable a water cart and water tank will be used at the quarry area to reduce airborne pollutant levels.
- Baseline PM<sub>10-25</sub> (nuisance & inhalable dust) and PM<sub>2,5</sub> (respirable dust) fallout counts will be done on request and will be repeated annually and the outcome conveyed to the DMR. The PM<sub>10-25</sub> will not be increased with more than 50µg/m<sup>2</sup>/d.
- Applicant will comply with the provisions of the Mine Health and Safety Act 29 of 1996 and NEMA with regards to dust generation.

#### Noise

- Mining equipment will be regularly serviced/lubricated.
- Noise generation by vehicles will be controlled through regular servicing and fitting of standard exhaust systems.



King William's Town Weathered Dolerite Quarry: Lolo & Lolo

- Noise levels at source will be maintained below 75dB.
- No operations will be conducted before 7h00 or after 18h00.
- Mining will not be done during periods of high winds to prevent hearing abilities of workers being affected which could result in increased safety risks.
- Baseline noise counts will be done if requested and will be repeated annually and the outcome conveyed to the DMR.

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 reduced to 40km/h to lower safety risks.
- If needed, internal haul road will be dampened to curb fugitive dust levels.
- Heavy vehicle signage will be posted at all road junctions.
- Vehicles and mining equipment will be properly maintained and will not be overloaded.
- All vehicles will come to a dead 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 onto 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 all 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 (approximately 8-12 per day) the potential risk of accidents occurring will be low provided that provisions of the National Transport Act are 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 production face failure.
- 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 could be controlled by fencing the area, but considering the low population density of the area, it might not be necessary.
- If required, a security guard will be appointed to control access to the site.
- No loitering of people 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.
- Danger signage will be posted on the fence and entrance to mine.

Safety/Accidents

- Any accidents will immediately be reported 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 surrounding residents, if required. A community liaison forum will be established if required and could meet quarterly to disseminate information and outline 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.



King William's Town Weathered Dolerite Quarry: Lolo & Lolo

- Mining will be done by an appropriate qualified/trained person to prevent production faces being established that pose danger to workers and that could detrimentally affect the lives of people.
- The mine manager will daily ensure that all people, if any, are removed from the production area before mining commences to limit safety risks.
- At the end of each day the mine manager will inspect the production faces and ensure that there are no unsafe areas and should any be found, it will be made safe according to the code of practice drawn up.
- Reverse warning hooters shall be fitted to all mining vehicles.
- Protection of workings will be implemented as per MSHA Chapter 14.

Health & Safety equipment to be provided

- The applicant 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 vehicles 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.
- Pit toilet will be provided and serviced as prescribed.
- 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 a dolerite mine no deleterious minerals will be released to the environment that could facilitate acid mine drainage that could affect water quality and subsequently the health of local inhabitants.
- The applicant 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

- No water will accumulate within the quarry and it will be free draining.
- Storm water control structures will remain in place to ensure post closure stability of the slopes and soil.
- The necessary signage will be posted around the quarry to sensitize people on the latent dangers of the quarry.
- All equipment, structures and cabling will be removed from the mine area area.
- All hazardous substances will be removed from the quarry.
- All stockpiles will be removed and the area vegetated and protected against erosion.
- 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 - MSHA Sect 16
- Accident reports - MSHA Chapter 23



**COMPETENCY TO CONDUCT MINING****Financial competency**

Lolo & Lolo CC will provide the finances to develop the proposed mining site. The Close Corporation is financially sound and has been in existence for a number of years and the financial statements cited, show good annual net profit. Accumulated funds reflected by the financial statements are substantial hence the company will be able to execute the rehabilitation plan as stipulated in this report.

Considering that Lolo & Lolo has been financially independent for many years and the positive trend in the construction/building market, a sustainable mining concern is guaranteed. As all equipment has already been acquired, no additional finances will be required for purchasing equipment.

**Technical competency**

Lolo & Lolo already developed three other mining sites and should therefore be in a position to develop the site. Technical competency was proved to the DMR and its application was subsequently accepted. Equipment will be provided by a contractor.

In order to address environmental matters and demarcate the mine area, the applicant appointed John Victor Surveys as surveyor and SES as environmental consultant. Through the EMP and continued assistance to the applicant, the site will be developed in a sustainable manner.

**Environmental competency**

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

Development of the quarry will encompass activities such as extraction of weathered dolerite with an excavator, loading of material onto a haul truck, transport of mineral to the identified markets in King Williams Town. Only minor emergency 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 its involvement with other quarry concerns and understanding of environmental principles as stipulated within its approved EMPs.

Since the site is located on a steeper slope, storm water diversion/control intervention will be required and the diversion berm to be constructed will be easily implemented, since the contractor has gained adequate experience in this procedure.

Re-vegetation of disturbed areas will be easily achieved by seeding the area, a practice which is known to the applicant. This aspect is of particular practise since the site is visible from the certain areas in town but not readily from the gravel road. Considering the distances to neighbouring properties, noise generation will also be limited and easily controlled.

In conclusion, the environmental impacts associated with the proposed mining concern are restricted to limited silt transport and erosion on slopes, limited loss of vegetation cover, limited 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.

Since the concern will have a good product turnover and guaranteed financial stability, the rehabilitation fund can be managed properly and the applicant will be able to affect the amenDRnt of the guarantee as required by the MPRDA, which in turn will 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 an annual performance assessment report reflecting on its ability to manage the environment.

### **"NO GO" OPTION**

This option will result in the following:

1. The site will provide work and therefore a living for at least three people and their families (excluding downstream employment) over a period of two years and this employment opportunity will be lost.
2. The building sector would be hampered since there are no legal sources and it could hamper the projected upswing predicted for 2010.
3. The potential reduction in illegal sites will not materialize.
4. Economic and ecological value of the land will remain low due to previous disturbances and will be affected by unauthorised mining.
5. The "no go" option would prevent the applicant from supplying the rural areas located to the north with more affordable construction materials.
6. The applicant will be prevented from expanding its business and range of products and granting the residents of King William's Town an alternative when opting to purchase construction materials.
7. Tranquillity of the area will be insignificantly better.
8. Noise levels will be insignificantly lower.
9. Secondary grass cover of the mine area will remain intact and the area will not be upgraded to a proper grazing unit.
10. There will be an equivalent of 10-15 vehicles less per day on the gravel road, which will result in a significant lower safety risk to road users. However, it should be acknowledged that this is a major service road constructed for all purpose transport between the rural areas and Lafarge Quarry and King William's Town.
11. Visual impact will be insignificantly lower.
12. The abutting landowners will be able to continue with current farming/development practices irrespective of whether the development is taking place or not.

Considering the low environmental impacts and the site to be fully rehabilitated, the financial benefits favour the mining option.

### **EXISTING MINING AUTHORIZATIONS HELD BY THE APPLICANT**

The applicant holds three new order mining permits for weathered dolerite, gravel & rock.

### **JOB CREATION**

The proposed mining concern will create at least three additional job opportunities, without taking into consideration downstream employment. The current unemployment rate for the larger area is approximately 35%, therefore every employment opportunity created, is important.



## REGIONAL CLIMATE

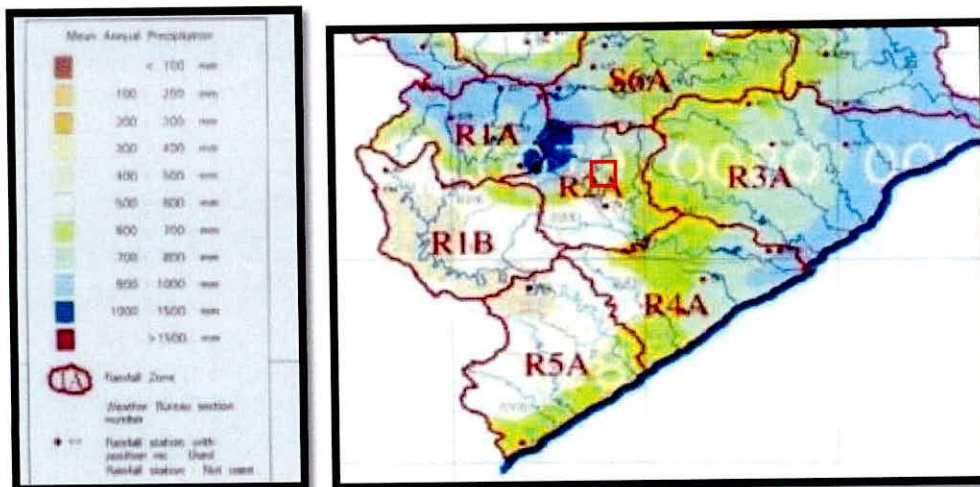
Climatic conditions such as temperature, rainfall and wind velocity influence for example mine area growth, erosion levels of disturbed areas, dust generation and air pollution levels, as well as social impact in terms of quality of life. Climatic conditions can therefore influence the significance of 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 into the Southern Temperate Climatic Zone and the climate can therefore be considered mild with strong winds and occasional periods of high humidity during the high summer months.

### 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 north-easterly winds. Spring rains may also be associated with the passage of cold fronts drifting in from the west. Thunderstorm activity is common along the coast in late summer and autumn and results in intense cycles of rain and wind. 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 coincide with mid winter. The average annual rainfall for the Eastern Cape Province is approximately 873mm.

The area falls within rainfall area R2A and receives between 500 and 600mm per annum, which will stimulate mine area growth and reduce dust generation to some extent. However, it will increase erosion on disturbed and uncovered mine areas and the necessary storm water control measures need to be implemented. Seeding must therefore coincide with early spring and early autumn to ensure a successful re-vegetation phase. Hail, frost or snow is not common phenomena in this area and will not affect the re-vegetation process.



**Rainfall: East London: Nahoon Dam – Average data 1966-1980**

Month	Average	Minimum	Maximum
January	40	15	109
February	83	11	180
March	67	4	183
April	51	7	155
May	36	3	160
June	26	2	65
July	33	0	165
August	106	6	671
September	54	3	174
October	71	4	210
November	85	12	184
December	67	19	155
<b>YEAR</b>	<b>719</b>	<b>355</b>	<b>1177</b>

**Temperature**

The area experiences warm to hot summers with maximum temperatures in February and minimum temperatures in July. Hot north-westerly berg winds may occur in winter and may last for a few days, usually preceding cold fronts. From the statistics, it is essential that seeding be restricted to the warmer periods to achieved optimum germination and growth, but seeding of disturbed areas with commercial grasses such as barley is possible during the winter time. The annual evaporation of the area totals approximately 1400mm with the highest evaporation rates associated with the summer months. The negative water balance will therefore ensure that groundwater pollution does not readily occur.

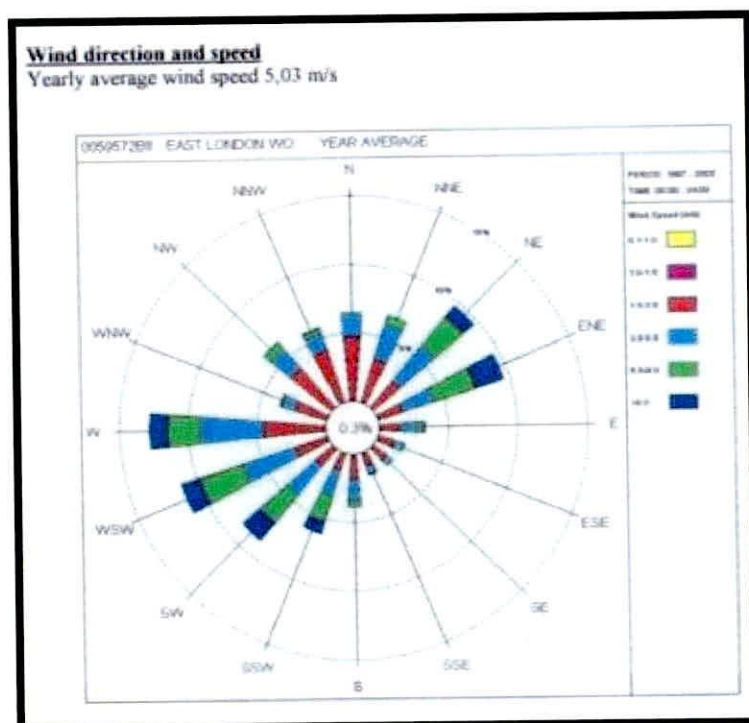
**East London**

Month	Average	Ave. Max.	Ave. Min.	'S' pan evap.
January	22.0	25.5	18.2	168
February	21.1	25.7	18.4	144
March	21,3	25	17.6	122
April	19,5	23.6	15.1	96
May	17,7	22.7	12.8	81
June	15,9	21	10.4	73
July	15,6	21	10.1	76
August	15,9	21.1	11	91
September	16,7	21.2	12.3	102
October	17,7	21.5	13.9	127
November	19,1	22.8	15.5	146
December	20,7	24.3	16.8	174
<b>YEAR</b>	<b>18,7</b>	<b>22,9</b>	<b>14,4</b>	<b>1400</b>



## Wind Regimes

The prevailing wind directions are predominantly west and east-north-east but with significant easterly, north-easterly, south-westerly and northerly components. Winds are mostly aligned with the coast during the summer months. The north-easterly winds decrease from April when the south-westerly winds become more pronounced. Wintertime is dominated by south-westerly winds and north-westerly winds. Strong winds above 5m/s occur more than 12% of the year with calms approximately 5-10% of the year. The calms are mostly restricted to the summer months and then well into night time. The average wind speeds are moderate with 50% of the winds reaching speeds between 1.5-5.5m/s. The calms can for example result in the concentration of dust near ground level at night. Wind erosion is also an environmental perimeter that needs to be controlled where sandy soils are predominant, whilst it would have a lesser effect when well-developed soils such as weathered dolerite soils are predominant.



**ENVIRONMENTAL IMPACT ASSESSMENT CRITERIA**

The impacts of the Lolo & Lolo weathered dolerite quarry on environmental perimeters are assessed in this section in accordance with the criteria of the Minerals and Petroleum Resource Development Act 28 of 2002 and section 21, 22 and 26 of the Environmental Conservation Act. It should be noted that all the impacts have already been experienced in the past, since mining was prevalent on the property for more than ten years. The process will highlight the impacts and emphasized the importance of remedial measures over the short term as well as post extraction. 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 (5-15 years), long term (in excess of 15 years) or permanent where natural processes or mitigation processes cannot eliminate the impacts.

Intensity

(Magnitude) Whether the size of the impact is low, medium, high or negligible.

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

These criteria are evaluated in terms of

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

The significance of the impact on the perimeters of the affected environment are 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 biophysical, 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 permanent 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 potentially flawed and continuation of the project should be seriously reconsidered or special engineering or biophysical/social intervention must be implemented.

### Descriptive terms

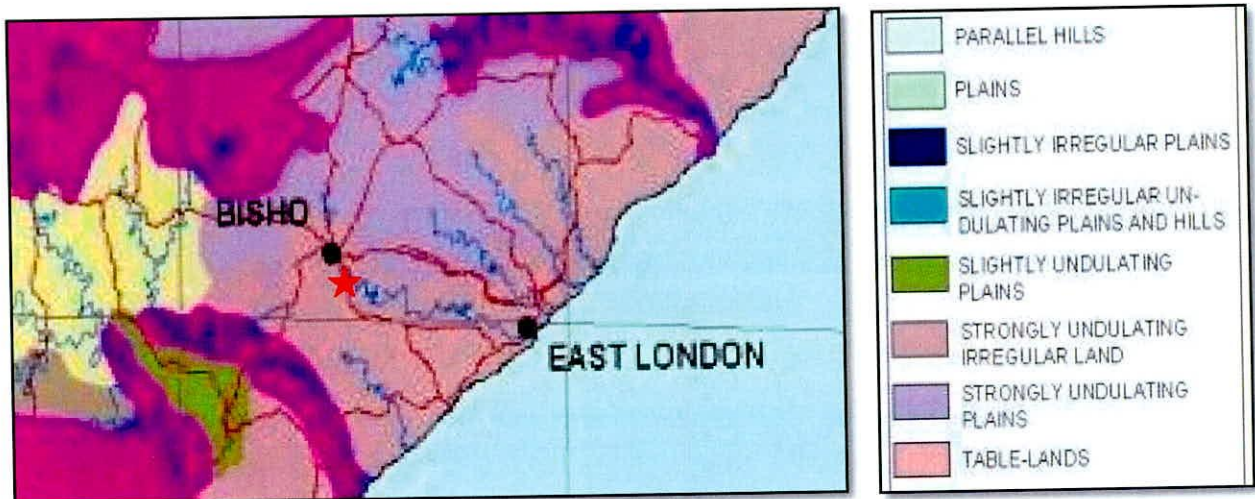
Spatial extent: None/Insignificant (0), Site (1), Local (2), Sub-Regional (3), Regional (4),  
 Duration: None/Insignificant (0), Short Term (1), Medium Term (2), Long Term (3), Permanent (4)  
 Intensity: None/Insignificant (0), Very Low (1), Low (2), Low-Medium (3), Medium (4),  
 Medium-High (5), 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

Due to the extensive illegal mining that is taking place onsite, the assessment will reveal cumulative impacts and will not necessarily reflect only the impact of the proposed development.

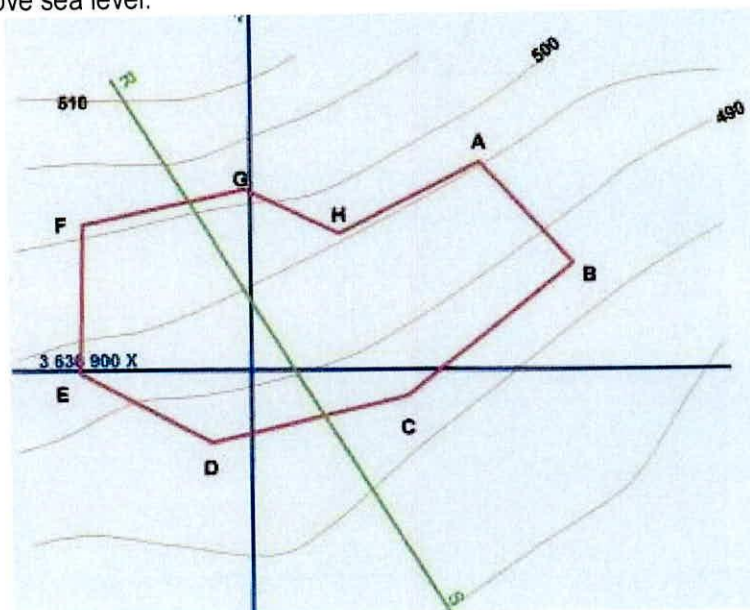
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## TOPOGRAPHY

The greater area falls within the Eastern Plateau Slope and can be described as undulating, irregular land. The immediate surrounds display a mixed relief of large hills with gentle slopes towards the south and shallowly intersected by a number of drainage lines at the intersections of these hills. The site is located on the south-western aspect of such a hill. The site slopes gently towards the road to the east and to the west towards a dry drainage line 300m to the south-west. To the north the site display a steep incline to the top of the hill whilst to the north-west the area has mostly been mined to a flat platform area. The hill involved is impressive in the landscape and represents a definite focal point. The applicant has specifically selected the south-western aspect of the hill since it has a much flatter topography than the north-eastern side which will cause rehabilitation to be less cumbersome and more effective.



The surrounding areas lie at altitudes of between 444m-518m above sea level with the mine area between 485m and at 500m above sea level.





The hill towards the north reveals a slope of 1:4 and will facilitate increase surface flow and velocity and could result in erosion of the north-western production face if not protected properly. The land towards the south-west reveals a slope of approximately 1:20 and will not affect the mine area or stability of profiled slopes. To the north-east the land is mostly mined to a flat platform and will generally not influence stability of the proposed mine. The quarry floor will be flat and will blend with the flatter slopes found to the south-east. The soils of the site display good structure and will facilitate successful re-vegetation strategy which will curb erosion processes onsite that could impact on the topography of the suite. The good drainage of the soil will preclude accumulation of water in the pit as it would drain along the gentle slope towards the south-east. Limited erosion is anticipated in this area.

Previous mining conducted by the DRT & Municipality into the hill has already changed the texture/appearance of this hill significantly, especially since it was left unrehabilitated. The proposed development will result in a cumulative topographical impact during the development stage but will be reduced by proper rehabilitation. It is imperative that the DMR address the illegal mining to the north-east and ensure that outstanding rehabilitation is performed; failing which there will be no initiative for the applicant to rehabilitate the proposed mining site.

Disturbed areas would be noticeable onsite in the beginning due to the height of the production face, but with mitigation through benching, profiling and re-establishment of the grass cover, these changes will become less noticeable over time. As no infrastructure will be established within the mining area other than the toilet facility and single stage crusher, no additional impact will be imposed. Since the existing access road will be upgraded, it would not result in additional changes to the landform and visuals.

Developing the quarry will during the operational phase impose a moderate impact on the topography, since it will result in a box-cut depression of between 3 and 5m 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 and 1:3 in order to blend in with surrounding landscape. Complete integration with the landscape is not possible, but could adequately be mitigated with a proper re-vegetation strategy. This quarry would be free draining during the operational stage but due to the gentle south-western slope no erosion down slope is anticipated. On cessation of the mining process, the floor area would be relatively smooth, but could display minor humps and depressions caused by dolerite outcrops and areas of increased weathering. Due to mining of the weathered dolerite, sponge capacity of the soil would decrease substantially. To prevent potential scouring of the floor, water will be diverted away from the quarry. Upon rehabilitation of the area, all the production faces would blend in well with the surrounding land, provided that it is re-vegetated to a proper grass cover.

Changing the micro topography will change run-off patterns, especially on the north-western slope which will increase erosion potential which could manifest in the development of extensive erosion gullies cutting back into the slope. 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 high. Drainage density will therefore be slightly altered as water is channelled to the south-west the quarry. Inside the quarry increased erosion due to the presence of solid rock floor might be experienced. 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 along the contour at the foot of the hill.

Currently the land concerned displays a heterogeneous and rough texture resultant of the grass and dominant *Acacia karoo* tree cover. Mining would change the texture of the area permanently as the area will be turned into homogenous grassland. There are no prominent environmental features within the mine and immediate surrounds and it is not visible at all from the gravel road but indeed from higher altitudes, especially from residential areas located to the south-east. There are no structures within the mine area that have affected the topographical appearance of the immediate area, but previous mining has resulted in extensive unrehabilitated areas with poor onsite visuals. No major erosion was observed.



Considering the nature of the proposed mining process, the changes to the landscape would be acceptable, should the necessary precautionary measures contained in this document, be implemented. If not it will result in a moderate to high cumulative topographical impact. The topographical changes brought about would be of low-moderate significance once profiling and re-vegetation of the excavation have been completed.

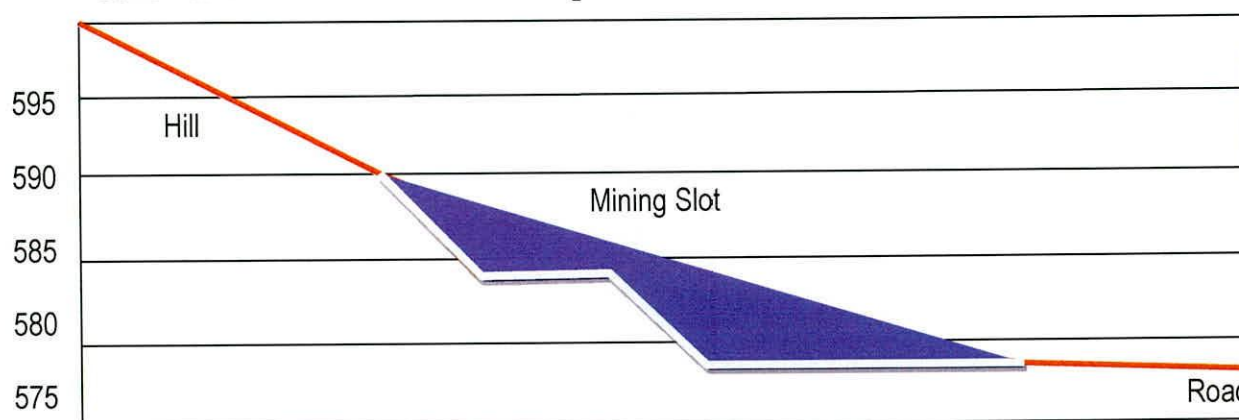
### Impact on topography

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
<b>Extent</b>	Local	2	Site Specific	1	Site Specific	1
<b>Duration</b>	Permanent	4	Permanent	4	Permanent	4
<b>Intensity</b>	Medium-High	5	Medium	4	Low-Medium	3
<b>Probability</b>	Definite	4	Definite	4	Definite	4
<b>Status</b>	Negative		Negative		Negative	
<b>Confidence</b>	High		High		High	
<b>Significance</b>	<b>Moderate-High</b>	<b>44</b>	<b>Low-Moderate</b>	<b>36</b>	<b>Moderate</b>	<b>32</b>

### Remedial measures to be implemented are:

- The mining area will be divided in three phases to fast track rehabilitation and encourage concurrent rehabilitation.
- The production faces to be profiled to a minimum slope of 1:2 in such a way that sharp angles are prevented but that flowing curves are formed instead which will blend in with the surrounding landscape.
- Each phase shall be fully profiled within 30 days after mining in a particular phase ceased and will be fully vegetated within 24 months.
- The rehabilitated excavation will be free draining to the south-west but will not result in erosion due to flat landscapes
- The north-westerly face will be protected by means of properly designed erosion control structures.
- No areas outside the authorized mine area will be disturbed.
- Driving and mining in non-mining areas will not be permitted.
- Any erosion in the mine area will immediately be filled in and compacted.
- Runoff control measures described under the heading 'Surface Water' will be followed.
- The depth of the excavation will be restricted to 50cm above bedrock to ensure adequate sponge capacity during periods of heavy precipitation.
- The storm water control measures described under the headings 'Soil & Surface water' will be strictly implemented and no impact on the valley slope will be allowed.
- No stockpiles shall remain at closure.
- All machinery and waste, if any, will be removed at closure.
- Any boulders generated in the quarry must be stockpiled and once a particular phase has been completed, it must be stacked at the bottom of production faces to improve slope profiles, be top dressed with topsoil and vegetated.
- The mining area will be reclaimed to a grass cover.
- The post rehabilitation area will result in a quarry floor with gentle gradient to act as energy breaker for runoff from the northern slope. No erosion on the slopes, which could scar the land and cause permanent changes to the topography, will be present.
- The rehabilitation plan will be implemented in accordance with the time frames set.
- A photographic record must be kept and complemented annually and must accompany the annual performance assessment report.



**Schematic south-west – north-east profile****Schematic north-west – south-east profile****GEOLOGY**

The area reflects three rock types. Firstly, the sedimentary rocks of the Karoo Sequence (Geological Survey: Sheet 3228) and in this case the Beaufort Group represented by the Adelaide Subgroup, depicted Pum on map. The Subgroup consists of alternating units from a few meters to tens of meters thick of grey, fine-grained ultra-lithofeldspatic sandstone (subordinate) and greyish-red mudstone, generally constituting distinct upward-fining cycles. The sandstone displays flat-bedding, trough cross-bedding and micro-cross lamination. The mudstone is poorly stratified or massive and is relatively abundant immediately below the top of the Adelaide Subgroup. The upper boundary of the Subgroup is defined as a horizon above, with a distinct increase in the sandstone to mudstone ratio.

Secondly, brownish-red and grey mudstone (subordinate) and sandstone of the Katberg Formation (Pub on map), in turn represent the Tarkastad Subgroup. The Katberg Formation consists of a repetition of mutually truncating, trough cross-bedded channel-fill sand lenses, individually up to 1 m thick. Depositional history indicates a fluvial environment of deposition of the Beaufort Group and to a braided stream environment the case of the Katberg Formation, whilst the rest of the group has been laid down by meandering streams. Palaeocurrent trends are usually north-west to north.

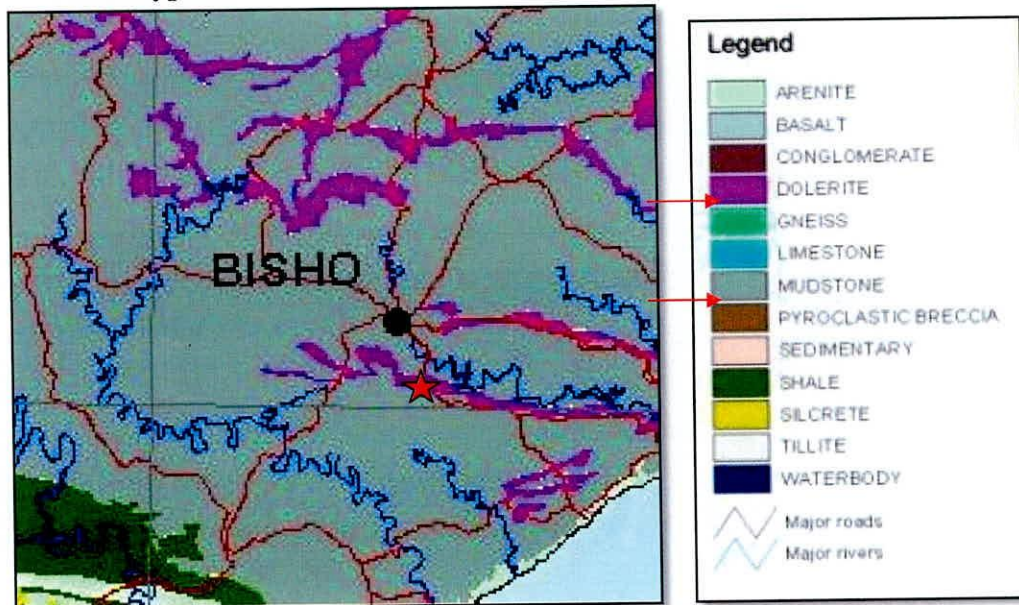
Thirdly, the sedimentary rocks of the area were intruded by dykes, sills and inclined sheets of dolerite. Fourthly, dolerite intrusions (Jd), which are abundant in the area, intruded the sediments of the Karoo Sequence during the Jurassic period. Dykes are generally 3-10m wide and several kilometres long, mostly with a west-north-west-east-south-east orientation. Sills, as represented in study area, are generally discordant and often undulating. Thickness varies from 1m to over 100m. In the thinner sheets and in the



dykes, the texture is usually porphyritic, whilst in the thicker bodies, such as displayed in the mining area, it is ophitic and rock type varies from olivine dolerite through tholeiite to granophyre. Through chemical weathering this rock, in some cases, produced thin to thick layers of weathered dolerite, the target mineral in this case.

The reserves applied for, dip away on the south-eastern and south-western ends and has been mined out on the north-eastern side. To the north-west the steep slope and height of the hill precludes mining.

**Broad rock types**



The site is not a geo-site and the mineral not strategic; hence the impact on the geology of the study area is rated of low-moderate significance, but in a district perspective insignificant due to the abundance of small outcrops and since chemical weathering will again results in the generation of weathered dolerite over time.

**Impact on geology**

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
<b>Extent</b>	Site Specific	1	Site Specific	1	Site Specific	1
<b>Duration</b>	Long Term	3	Long Term	3	Long Term	3
<b>Intensity</b>	Low	2	Very Low	1	Very Low	1
<b>Probability</b>	Definite	4	Definite	4	Definite	4
<b>Status</b>	Negative		Negative		Negative	
<b>Confidence</b>	High		High		High	
<b>Significance</b>	<b>Low-Moderate</b>	24	Low	20	Low	20

**Remedial Measures**

- The minimum working area for an efficient and effective operation should be utilized and the excavator operator must be informed in this regard.
- No mining will be undertaken in areas where reserves have not adequately been proved in order to avoid unnecessary/wasteful mining.
- No activities will be permitted outside the approved mine area.
- All oversize stones/boulders will be returned to the excavation or used in profiling the production faces. In such cases this material will be neatly stacked against the sides of the excavation, compacted, covered with topsoil and vegetated.
- Quarry development will take place with final rehabilitation objectives in mind.



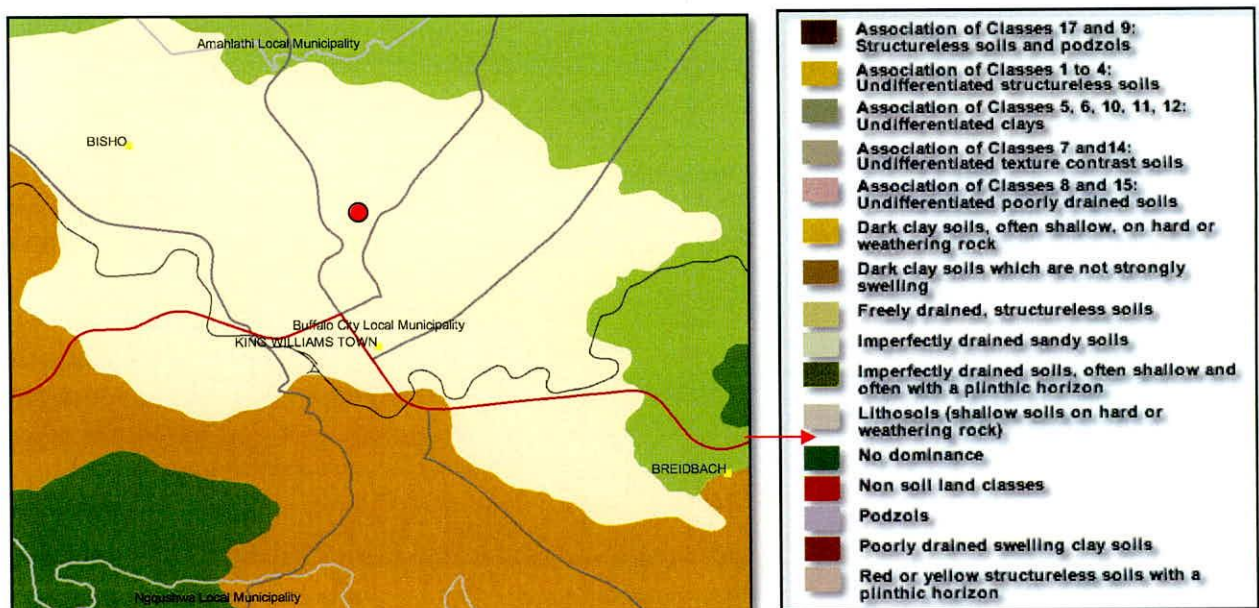
- Production faces must be profiled to a minimum slope of 1:2 to prevent head cuts into the established north-western and south-western slopes affecting the stability thereof.
- All erosion gullies on the faces will immediately be filled in and compacted and an erosion-monitoring programme will be implemented as a cradle to grave process.
- Storm water, if any, shall be diverted around the quarry to reduce erosion potential of rehabilitated faces.
- Storm water control structures shall be constructed when mining commences.
- Topsoil must be removed ahead of the production face and must be reinstated as soon as possible after extraction has been completed to limit erosion potential.

## SOILS

### Soil properties

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

Soils within the greater study area derived from the Karoo sediments are geologically complex and derived from the Beaufort Group mudstones and sandstones and the most important land types include Db, Fa & Ae. Soil properties have been influenced by both mudstone and sandstone parent material. Soil colour varies from light-brown to dark brown and soils are classed as rich, sandy, clayey loams and represent a typical lithosol with a relative permeable topsoil abruptly overlying solid rock with moderate permeability. This soil is suitable for agriculture due to its medium to high fertility provided adequate water is available for irrigation. The soils are reasonably well structured but reveal low to average humus content. Erosion potential is low in its undisturbed state. During heavy precipitation periods increased runoff rates can be expected due to lower penetration capability of the clayey B-horizon. The percentage of carbon content will be less than 2% and is restricted to the topsoil layer but since the soils are well structured, it will sustain a good grass/thicket cover.





Within the study area, however, the soil type is very different from the surrounding soils and is related to the dolerite intrusion that characterises the area. Due to the change in parent material (dolerite), the soils of the study area differ significantly from soils deriving from sedimentary deposits. The soils in the study site have three distinct horizons namely a dark brown, structured, humus rich A-horizon of 40cm-60cm thick which constitutes the topsoil to be preserved. The next layer is a structure-less, reddish brown decomposed dolerite layer of 3-5m deep and constitutes the B-horizon as well as the mineral to be exploited. This is followed by the C-horizon of many meters thick which constitute the solid parent dolerite.

#### Pictorial record of topsoil available onsite



Soil analysis reveals the follow soil types and characteristics:

	Glenrosa and/or mispah forms (other soils may occur)
	Fc Lime generally present in the entire landscape

	Fc GLENROSA AND/OR MISPAH FORMS (other soils may occur); lime generally present in the entire landscape. Generally shallow soils consisting of a topsoil directly underlain by weathered rock (Glenrosa form) sometimes with surface rock and steep slopes. Found in drier areas than Broad Soil Pattern Fa or Fb or areas on base-rich parent materials, so that lime occurs throughout the landscape.
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The percentage of carbon content will be more than 3%, but is restricted to the topsoil layer. Since the soils are well structured, it will stimulate and support mine area growth when reintroduced to disturbed areas.

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 should therefore in general not exceed 2m and must be vegetated or returned to disturbed areas as quickly as possible. Due to the nature of the doleritic soils in the study area, this alteration of the physical, biological and chemical properties will not be extensive over the short term (3-9 months) and a low reduction in soil productivity is anticipated during the storage period. Topsoil onsite will, according to the rehabilitation schedule, be stored for less than 8 months and the impact is rated of low-moderate significance, but topsoil should still be seeded after stockpiling took place to maintain its fertility.

With regards to the humus contents of the soil, it might have been negatively affected by the low cover in the grassland area, as well as the alien infestation of the rest of the area. Supplementation with organic matter should be considered when re-instating topsoil in mined out areas. 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 and in addition good and calcium: magnesium ratios should be present. The pH-values will be slightly more alkaline, but it would not be harmful if lime is applied mildly to ensure an effective nutrient cycle and mineral absorption, which in turn will stimulate mine area growth. pH should not be affected over the short term by mining activities.



Soils in the study area reveal average clay content and will therefore mostly be stable in its undisturbed state. Soils will also be able to retain moisture, which will assist the re-vegetation process. The subsoil has very little structure and no humus content and fertility is extremely low. It has low clay content and will therefore not be stable in its undisturbed state and will have a high erodibility factor. It is therefore imperative that production faces be properly profiled and vegetated as soon as possible. If the quarry is extended further uphill, severe gully erosion could develop and extension to the north-west should not be entertained.



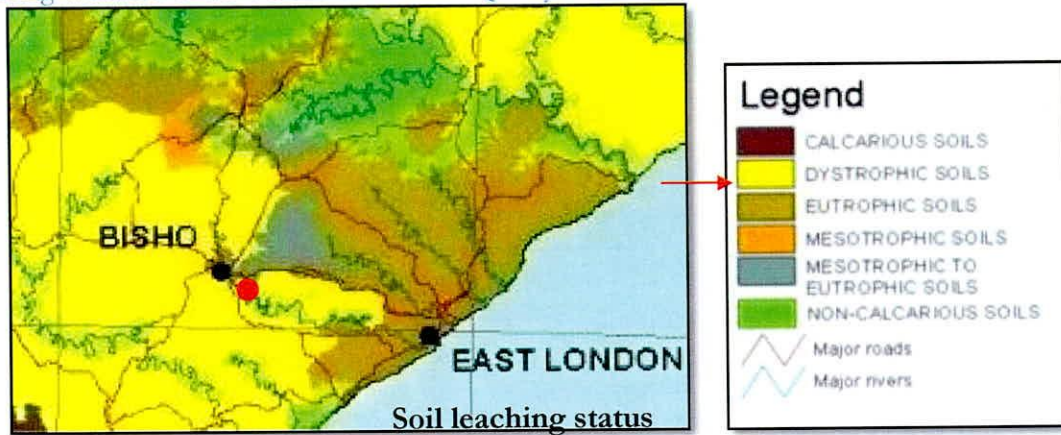
The subsoil (B-horizon-Sabunga) is less structured and not suitably textured, since it is still in the process of weathering and would also have much lower nutrient levels and would not readily sustain mine area life. If upgraded with fertilizers and if the area is exposed to normal weathering for long periods, it can be used as weak topsoil. In this instance the B-horizon will mostly be removed and the impact on the soil horizon therefore is high.

Lower internal drainage capacity and high adsorption capacity due to increased clay content and organic matter will during the summer periods cause these soils to display moderate field capacity values, which will have a positive effect on biomass accumulation. This soil characteristic would preclude prolonged irrigation of reinstated soils and only initial irrigation during very dry periods would be applicable. These soils have good pH-values, will still support vegetation covers well and facilitate the use of inorganic fertilizers without the risk of lowering the pH beyond the required levels for mineral absorption. Topsoil removed from mining areas will temporarily be stored on the western, northern and eastern perimeter of each phase.

Soils of the study area thus have low leaching capabilities hence the soils will remain fertile after prolonged heavy precipitation. If seeded after removal from the mine area and reintroduced within a 12 month period, no major upgrading would be necessary although application of manure would be recommended to increase organic content. 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 seeded after removal and improved with application of manure when reinstated.

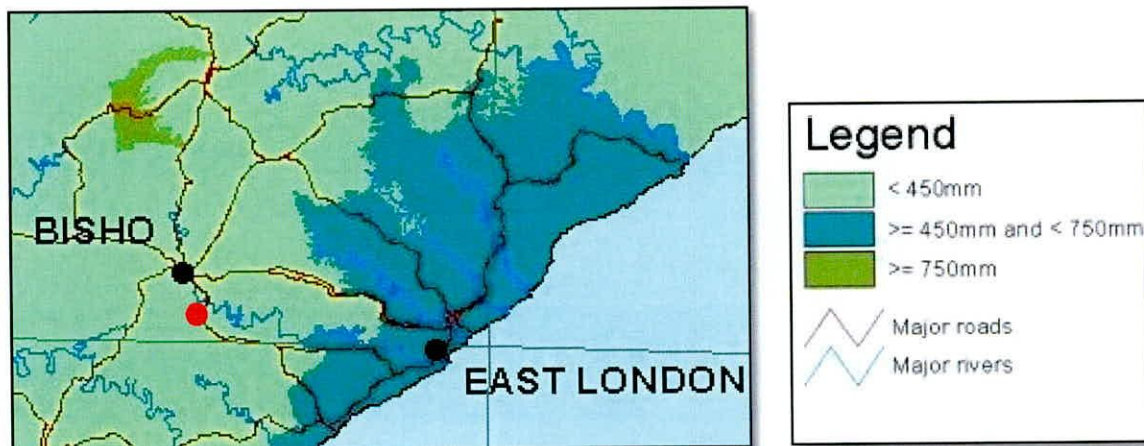
Organic matter in the soil is fine and derived from the grass cover and will be quickly mineralized hence it will be necessary to establish a proper grass cover and supplement it with organic material during the rehabilitation phase. The AEC & CEC of these soils are normally good and it is anticipated that both important macro as well as micro elements will be well represented in these soils as well as calcium: magnesium ratios. The pH-values are good and will ensure an effective nutrient cycle and mineral absorption, which in turn will stimulate mine area growth.





The potential of soils to rehabilitate is defined by its depth, structure and texture and sequence of soil horizons. In the study area soil depth ranges from 30-45cm and it would be amenable to physical rehabilitation. The topsoil therefore is well suited to support mine area life and is vastly better than the sandy/leached soils derived from sandstone and mudstone parent material. Since most of the soil will be introduced to flat areas, soil stability will mostly be good.

The C-horizon (rock) has, due to its solid nature, no properties that will assist with the rehabilitation of the area hence it is important that a certain amount of weathered dolerite be left behind to provide for proper soil horizons that will be able to support a good vegetation cover.



**Impact on soil properties**

	<b>OPERATIONAL (no mitigation)</b>	<b>WEIGHT</b>	<b>OPERATIONAL (with mitigation)</b>	<b>WEIGHT</b>	<b>CLOSURE</b>	<b>WEIGHT</b>
<b>Extent</b>	Local	2	Local	2	Local	2
<b>Duration</b>	Long Term	3	Medium Term	2	Medium Term	2
<b>Intensity</b>	High	6	Medium	4	Low-Medium	3
<b>Probability</b>	Definite	4	Definite	4	Definite	4
<b>Status</b>	Negative		Negative		Negative	
<b>Confidence</b>	Medium		Medium		High	
<b>Significance</b>	<b>Moderate-High</b>	<b>44</b>	<b>Moderate</b>	<b>32</b>	<b>Low-Moderate</b>	<b>28</b>



## Soil Erosion

Soil properties determine the erodibility of soils and their ability to support vegetation which 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.

Topsoil in the study area has been degraded because of previous mining and what is left needs to be protected as it represents a sensitive system. Topsoil in the study area is well structured, has a medium clay and humus content and has medium internal drainage; therefore it disposes of a low erodibility factor of 11. When fully vegetated, these soils are stable, but due to its soil properties, it also largely maintains its stability in the disturbed state as reflected by the old DRT Y Municipal mining areas. No large-scale erosion was observed in the mining area.

The underlying solid rock layer which will act as a cut-off layer, however, will stimulate increased overland flow within the quarry area and will result in erosion rills on the quarry floor if not protected by a vegetation cover. It is also important that excessive runoff is diverted to stable soils on the south-western side by means of a cut-off berm and that spill areas be protected. Due to the soil's low silt and sand content it is not susceptible to wind erosion and no mitigation measures are required. 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 farmers and veld.

Soils susceptible to water erosion normally are silty, weakly structured, have low organic contents and have poor internal drainage. Soils on site have an adequate clay composition and are not silty, are moderately structured, but have good organic content and internal drainage is moderate. This results in the soil to not be susceptible to erosion and is supported by the low K values. The subsoil, however, is quite unstable and very susceptible to erosion when exposed and deep gully erosion can be anticipated and it poses a definite environmental risk with regards to the north-western and south-western production faces. It is very important that the quarry is not extended up slope as it may result in severe head cut erosion. Since there is quite a difference in the erodibility of the top- and subsoil, it needs to be integrated with each other during the rehabilitation phases to ensure a stable soil complex. Soils and sub-soils are, due to their low silt and sand content, not susceptible to wind erosion.

Once mining is completed, the placement of topsoil on rock outcrop will result in the displacement of topsoil through sheet flow during heavy rain events if the quarry floor is not suitably protected. Spreading the topsoil on the steeper slopes of the excavation will also cause it to become more susceptible to erosion. Such a scenario will eventually preclude the establishment of vegetation. The worst-case scenario would be erosion gullies of approximately 50cm-3m deep and material eroded will be fanned out on the benches and the areas below the quarry. In the process some of it could be lost and should be prevented. If left unattended, the mentioned gullies will increase in extent and eventually bare rock will be exposed and total loss of vegetation will be prevalent. Areas outside the mine will not readily be affected but the north-western face might experience head cut erosion. Prior to mining a cut-off berm must be constructed ahead of the final production face to protect soil reintroduced to the north-western face. It is also imperative to 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.

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.

The access road to the quarry will not readily be subject to erosion since the land is quite flat, but it might rut in rainy periods. This road must be provided with mitre drains to protect it.



The impact of erosion on soils and the environment in general, is rated very 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	Definite	4	Likely	3	Probable	2
Status	Negative		Negative		Negative	
Confidence	High		Medium		High	
Significance	Moderate	36	Low	18	Very Low	8

### Soil Pollution

Soil pollution can only occur should hydrocarbon spills occur, or when 1) used oils and lubricants are purposefully drained into the alluvium; 2) storage facilities are destabilized; or 3) if ablution facilities contaminate soils. At the quarry, none of these impacts are anticipated since trucks and earthmoving equipment will be well maintained. Servicing of vehicles and fuel storage will not take place at the proposed quarry area and the toilet facility will be a pit toilet, which will only cause minor soil pollution. No other chemicals or hazardous substances will be used or stored at the site. The moderate drainage and absorption capabilities of soils will cause any pollution plumes to be restricted to near surface and will therefore not easily reach groundwater, especially since dolerite is not a water-bearing rock. The subsoil, however, has much higher drainage capacity and will cause pollution plumes to spread more rapidly, but which will only be applicable to very large spills which are not anticipated bearing in mind the nature of the operation.

### Hydrocarbons

Storage of all fuels, oils and lubricants, as well as servicing of vehicles, will be restricted to the offsite workshop of the contractor located in King William's Town which both dispose of the required facilities. Emergency repairs will be done on over drip pans on a flat surface to ensure that any spills are not transported to drainage channels hence no impact on soils or groundwater is anticipated.

Due to the limited amount of vehicles which will be used on the site, the worst case scenario will constitute very small hydrocarbon leaks which will penetrate, but be retained in the topsoil (more compacted and less air space which may result in decreased bio-degradation of hydrocarbons) as an area of concentrated pollution which can easily be scooped up and be disposed of. Limited use of fertilizers could assist in breaking down small spills in a short space of time. The limited vertical extent of the plume and the nature of the substrate will preclude it from reaching groundwater. Due to the extent of land between the excavation and drainage channels, surface water pollution is not anticipated. If a major spill in some or other way occurs, it will lead to a concentrated but average size spill, which will result in medium adverse impacts on vegetation down slope, 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 in comparison to smaller spills and need to be bio-remedied. For this purpose, a specialist, approved by DWAF, will be called in to remedy the impact. As alternative, polluted weathered dolerite or soil will immediately be scooped up and be disposed of at the Berlin waste facility.

The impact is rated low under worst-case scenario conditions and insignificant under normal, controlled circumstances.



## Sewage

A pit toilet will be constructed south-west of the proposed excavation. Due to the small number of people (2-3) that will be onsite it is anticipated that the sewage stream will be very limited, resulting in limited soil pollution and a similar impact on the coliforms count in the soil and even to a lesser extent, in any perched aquifer.

The system must be maintained according to Municipal regulations. Due to the absence of other ablution facilities, no effluent will be generated which could affect soils and groundwater sources inside or outside the study area. Since the study area is outside the footprint of any fluvial environment, the risk involved with the use of the pit toilet will be very low and the depth and nature of topsoil and subsoil in this area will preclude any significant groundwater impact. The anticipated soil pollution risk is rated low under worst-case scenario conditions and insignificant under controlled conditions.

## Waste

Domestic waste will be produced at the quarry, but the waste stream (tins, paper, food) will be rather limited (0,5m<sup>3</sup> per month) and will be removed to the nearest approved waste facility at King William's Town or Berlin. The nature of the waste will preclude any impact on soils.

The vegetation that will be removed from the quarry area will at a later stage be reintroduced to disturbed areas as mulch.

Waste production will be limited at the quarry sites and the impact on soils is rated insignificant

### Impact of pollution on soils

	OPERATIONAL (no mitigation)	WEIGHT	OPERATIONAL (with mitigation)	WEIGHT	CLOSURE	WEIGHT
<b>Extent</b>	Local	2	Site Specific	1	Site Specific	1
<b>Duration</b>	Short Term	1	Short Term	1	Short Term	1
<b>Intensity</b>	Low	2	Very Low	1	Very Low	1
<b>Probability</b>	Likely	3	Likely	3	Unlikely	1
<b>Status</b>	Negative		Negative		Negative	
<b>Confidence</b>	High		Medium		High	
<b>Significance</b>	Low	15	Very Low	9	Insignificant	3

### Remedial measures to be implemented are:

#### Protection of unstable soils

- Haul road must be protected with a proper wearing course of at least 30cm. Mitre drains to be constructed every 30m and spill in well-vegetated areas.
- Mining will commence from the north-east with minimum removal of soil ahead of the production face to keep it intact for as long as possible.
- The mining area will be developed and rehabilitated as proposed by the development plan to reduce the extent of the disturbed area and limit erosion of non-vegetated areas.
- The 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.
- On completion of each phase the area will be profiled, seeded, fertilized and irrigated within 300 days of cessation of mining in that particular area during the summer and within 90 days during the winter.
- During dry periods seeded soils should be irrigated as it will stimulate mine area growth which in turn will prevent soil erosion, as well as prevent fertilizers from 'burning' established vegetation.



- Vehicles will not drive over rehabilitated areas to prevent compaction and dieback of established vegetation.
- Vegetation around the quarry perimeter must not be disturbed in order to limit the impact which runoff might have on production faces.
- Storm water control structures (diversion berm east of quarry area) 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 spill area of the diversion berm should be protected by a dissipation bed, rock mattress or gabion structure.
- If the quarry floor experiences extensive erosion, low berms will be constructed from north-east to south-west, 10m apart, starting on the eastern side with each ensuing berm 2m shorter than the previous berm to ensure that they do not spill on each other.
- The quarry will be developed in such a way that slopes are smooth to prevent concentration of surface water on it which could stimulate erosion.
- Should erosion on the slopes become problematic:
  1. Any erosion rills or gullies that develop will be filled in with subsoil and compacted, but the upper layer will 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 geo-fabric (biodegradable netting) or Soil Saver (natural organic sheet material with seeds) will be pegged onto the slopes after spreading of topsoil and seeding were affected. A soil conservation officer or expert will be appointed to oversee the process.

### Upgrading of soils

- Profiled sides of the quarry, as well as the quarry floor, will be adequately covered by subsoil to establish a proper B-horizon and thus to increase the root zone.
- Topsoil introduced to profiled areas will be upgraded as follows:
  1. Apply 5cm of manure to seedbed and scarify to improve soil fertility and micro-climate of the soil, which in turn would facilitate improved germination and percentage soil cover.
  2. Apply fertilizers at a rate of 100kg 2:3:2 (22) Zn 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) must be applied. Seeding must as far as possible coincide with the rain season or when soil moisture regimes are good.
  4. Application of lime at a rate of 1-2 tons per hectare should be considered.
  5. All non-alien 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

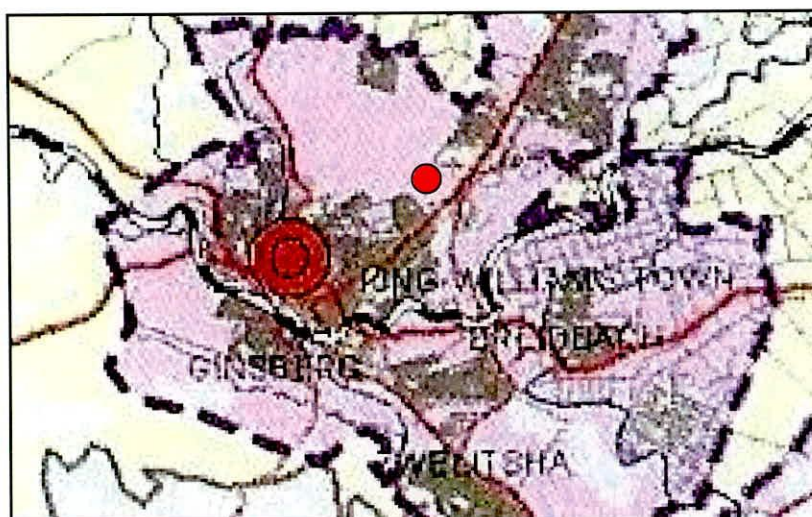
- Oil and lubricants will be stored offsite or inside the workshop container, if such container is to be positioned at the mine area.
- All used oils and lubricants which were drained during emergency maintenance will be stored in approved, spill proof receptacles and will be removed off site the same day to a registered recycling facility, or relocated to the contractor's workshop where appropriate storage facilities have been constructed.
- All filters or oil/lubricant contaminated material removed during emergency maintenance will be handled in the same way as described above.
- For the interim period no fuel tank shall be established in the mine area.
- All emergency vehicle maintenance and servicing will be done over a drip pan.
- Vehicles used on the property will be free of major leaks.



- 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 and disposed of at 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 servicing of vehicles to the offsite workshop.
- 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 nearest waste facility with specific emphasis on household waste, plastics, and unusable scrap metal and tire casings.
- All quarry/mine area debris must be removed before topsoil is re-introduced to disturbed areas.
- The toilet facilities will be constructed according to Municipal specifications and be relocated every six months to prevent soil saturation.
- The handling of hydrocarbons will be included in an environmental awareness programme.

## LAND USE AND LAND CAPABILITY

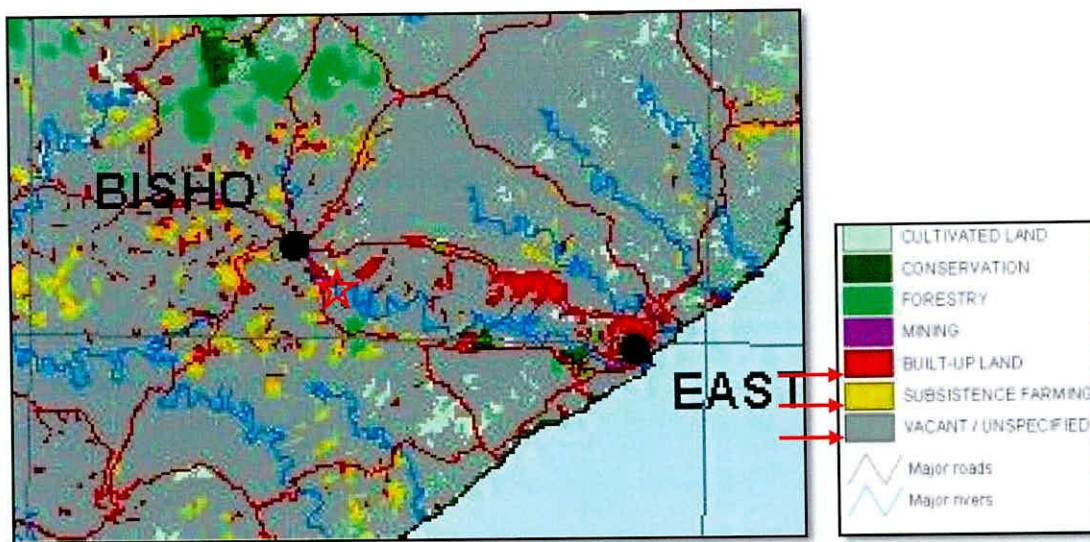
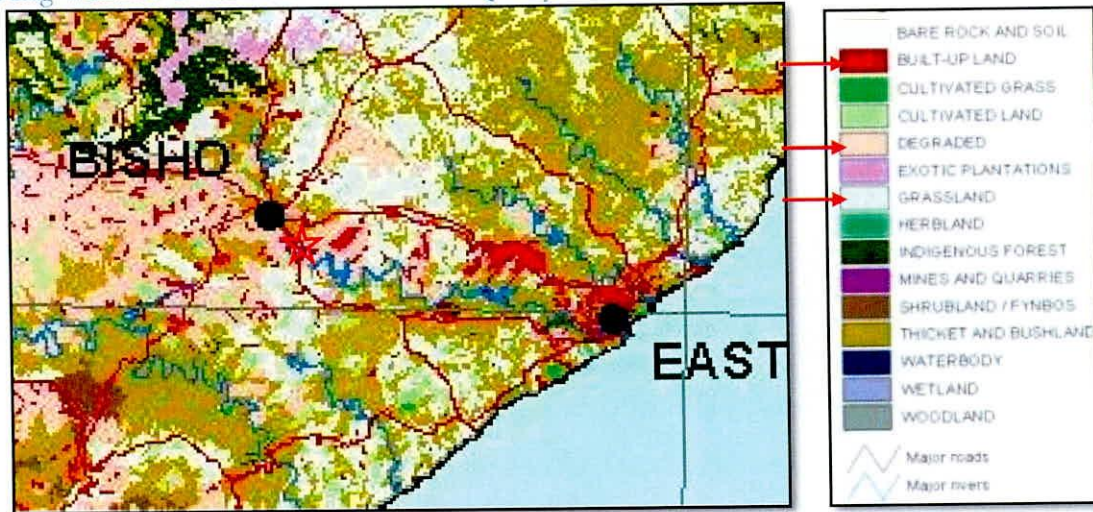
The land concerned falls within the urban edge. The land capability of the study area is mostly supporting secondary grassland and providing future extension possibilities to residential areas. The site is located 0,8km north of town centre and 700 west of the Reservoir Hill residential area. The area is also in terms of the IDP incorporated in the KWT urban area and belongs to KWT Municipality.



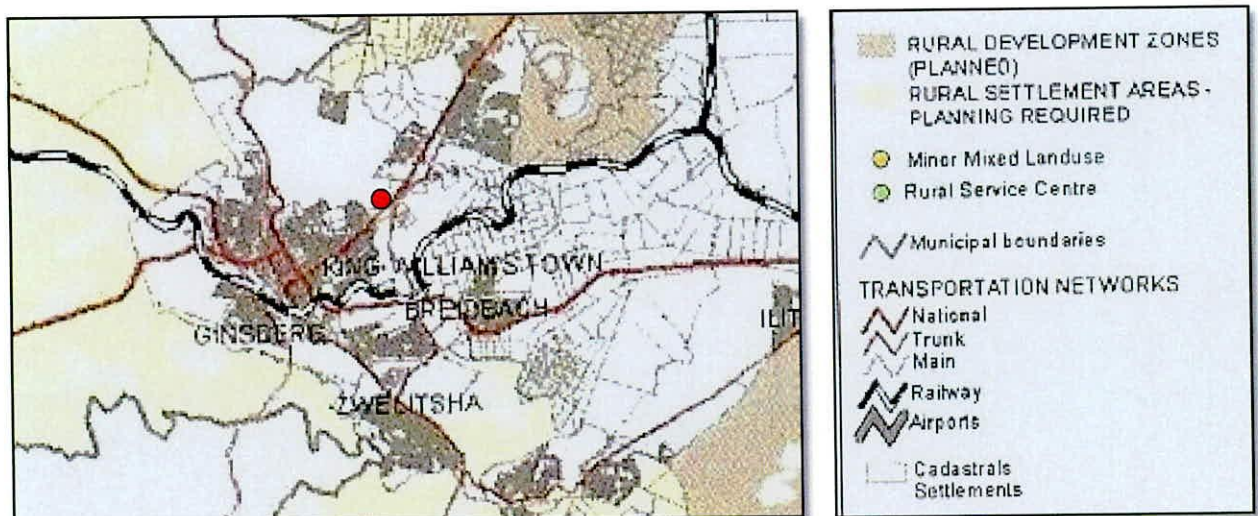
Provided that adequate water is available the soils provide for limited agricultural activities but little more than occasional grazing is taking place on the property concerned. The close proximity to town does not allow for intensive farming practices. With regards to land use only unauthorized mining is taking place within the larger study area with some minor light industrial activities to the immediate south-west, opposite the gravel road.

In terms EMPAT the land cover is given as mostly degraded grassland within a semi-buildup area. The current land capability is therefore limited. In terms of land use it is rated as a mixture of build up areas, subsistence farming and vacant land.

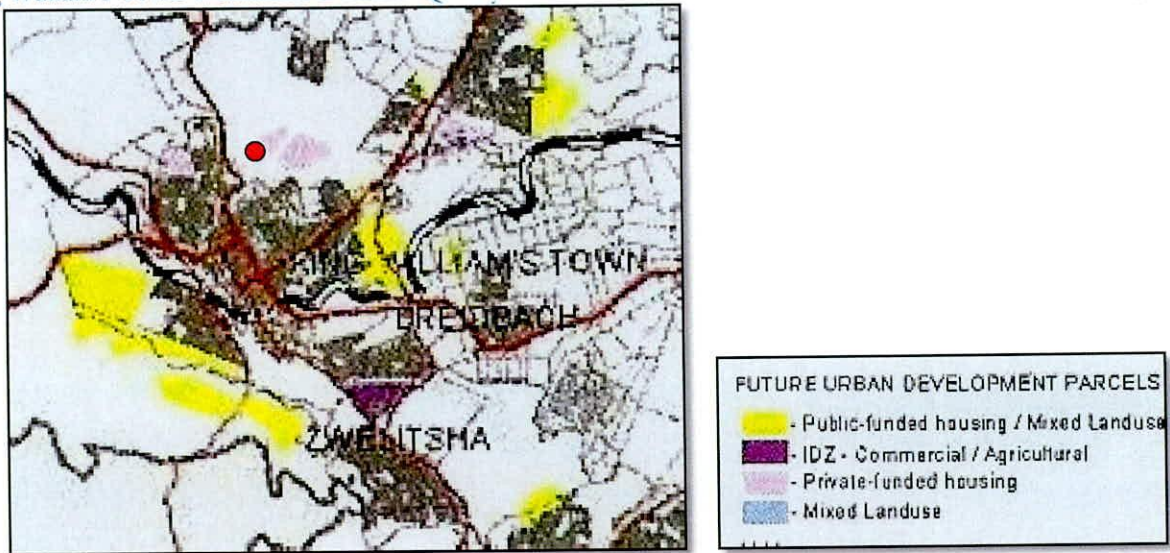




In terms of the Buffalo City IDP for the KWT area the area does not fall within any rural development zones, rural settlement areas or within future planned residential areas hence no impact is anticipated in terms of expansion of KWT or increased social impact.







### Environmental Capability

The study area reflects a totally degraded mine area but is connected to Buffels Thicket to the west and Berlin Thorn Veld to the north. This vegetation cover therefore reflect from an environmental perspective limited potential to maintain original terrestrial/ecological processes especially due to its close proximity to town, hence land capability is limited. On cessation of the mining activities the area will be turned to grassland with same environmental capability as prior to development. The final impact would be neutral.

The properties/areas to the immediate north-east, south & east reflect similar degradation status due to bush clearing, pastoralism and human activities, with only the area to the north-west that display a less degraded Buffels Thicket surface cover and represents an area with medium to high environmental capability but no impact on this veld type would be applicable.

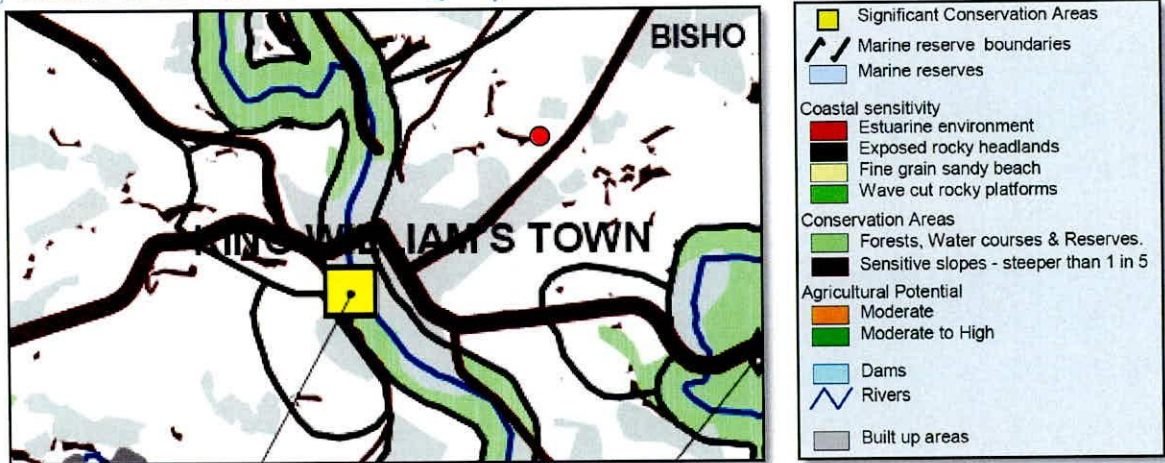
### Agricultural Capability

From a cash crop production perspective the property reflects a very low land capability due to the thin topsoil, underlying rock layer and lack of water. No crop production is taking place in or close to the mine area.

From a grazing perspective the property reflects a low-moderate land capability but in the study area it is very low due to transformation of the land. No formal grazing is taking place on the property and the impact is rated insignificant.

The potential end use of an area disturbed 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. As the agricultural potential of the soil in the study area is moderate due to the fertility of the doleritic soils, the post mining land capability will in the first year be lower due to marginally lower soil fertility (impaired nutrient cycles) and reduced organic content. This potential impact will be restored over a two year period through upgrading with organic and inorganic fertilizers and is rated of very low significance.





### Land use

The current land use of the area is limited occasional communal grazing. To the north-west the area can be rated as semi-wilderness land, whilst to the east the land is locked up in small holding and residential development. To the south there is no specific land use. To the north-east one finds the light industrial concerns and further north Lafarge KWT quarry.

The extensive degradation of the area involved and the inclusion thereof into the urban development zone, cause the proposed mining area to fit in comfortably with this specific setting. If no mitigation measures are implemented at the mine the impact on abutting land uses would be low (mostly be visual and possibly soil erosion) but with the necessary mitigation measures in place the impact is rated very low.

Removing vegetation and topsoil will result in increased runoff volumes, 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. These impacts are of insignificant status.

Operating the mine area will result in limited loss of grazing area to the community but with no financial loss to the Municipality since the property is not officially rented to the local community. In any event, the bottom section of the proposed mine area is already exploited by the Municipality. Once the area has been rehabilitated at closure, the limited agricultural potential will be restored to its original status.

Workers making cooking fires on site may pose a fire hazard to grazing areas especially during winter when the grass is dry and may result in shortage of grazing [www.mba.co.za](http://www.mba.co.za) for the community. However, if the area to the



**Impact on land capability and land use**

	<b>OPERATIONAL (no mitigation)</b>	<b>WEIGHT</b>	<b>OPERATIONAL (with mitigation)</b>	<b>WEIGHT</b>	<b>CLOSURE</b>	<b>WEIGHT</b>
<b>Extent</b>	Local	2	Site Specific	1	Site Specific	1
<b>Duration</b>	Long Term	3	Medium Term	2	Short Term	1
<b>Intensity</b>	Low	2	Low	2	Very Low	1
<b>Probability</b>	Definite	4	Likely	3	Likely	3
<b>Status</b>	Negative		Negative		Negative	
<b>Confidence</b>	Medium		High		High	
<b>Significance</b>	<b>Low-Moderate</b>	<b>28</b>	Low	15	Very Low	9

**Remedial measures to be implemented are:**

- No activities near any drainage channel will take place.
- The mining area will not be extended up slope.
- Mining will be restricted to the approved mine area.
- All *in situ* topsoil removed shall be conserved.
- Topsoil would be re-introduced to disturbed areas and upgraded by the application of fertilizers and organic material as discussed previously.
- The quarry will be seeded with the prescribed seed mixture complemented with limited infill planting of indigenous trees.
- Alien 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 and be maintained 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 one year after rehabilitation has been 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 property as well as those of abutting properties.
- All stock theft that can be attributed to the presence of the quarry will be the responsibility of the applicant and the necessary remuneration 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.
- Production areas/faces will be stabilized/made 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.

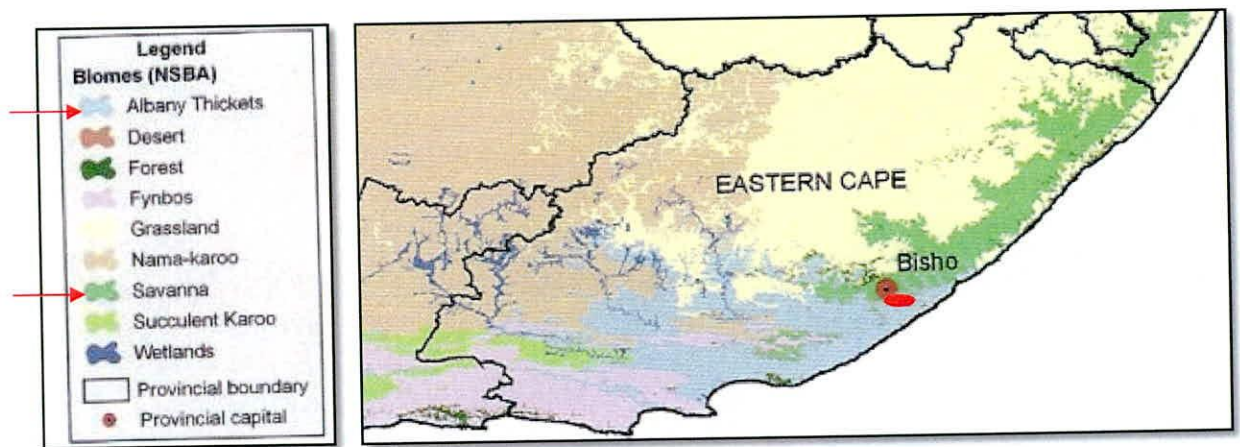


**FLORA**

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

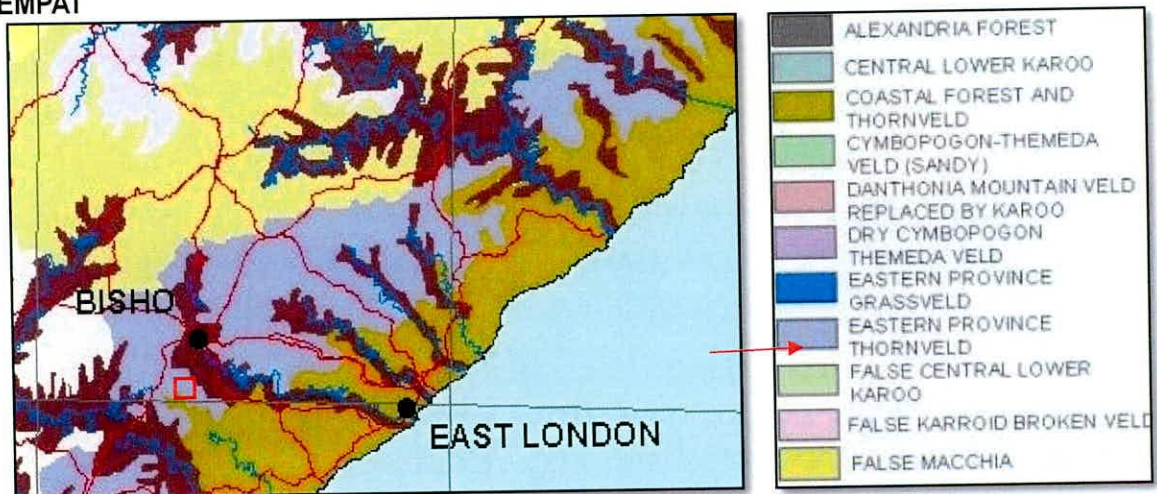
**Vegetation analysis**

In terms of the National Biodiversity Strategy the study area falls within the ecotone between the Savanna Biome and the Albany Thicket Biome.



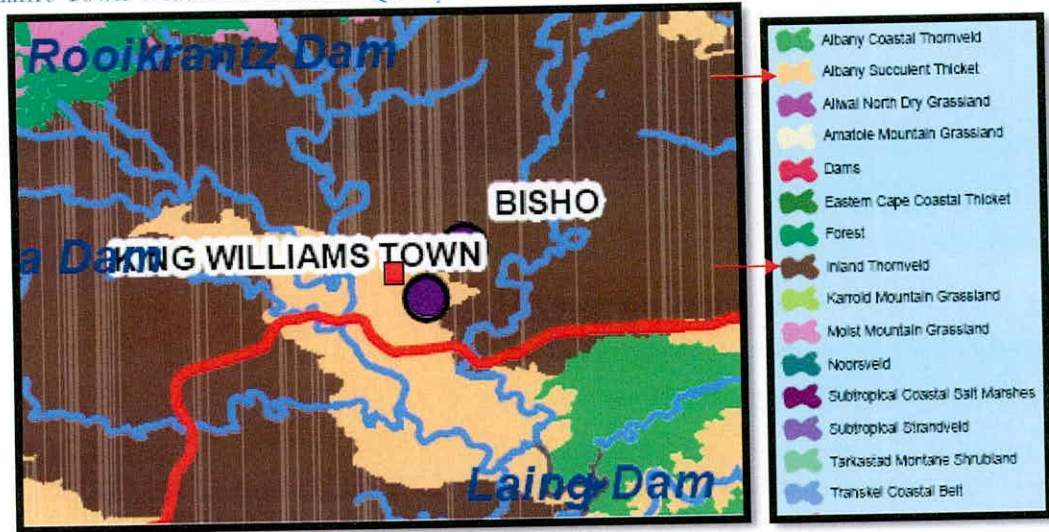
In terms of the EMPAT system the vegetation of the area is described as Eastern Province Thorn Veld with some influence of Buffels Ticket located to the west and south-west of the property.

**EMPAT**



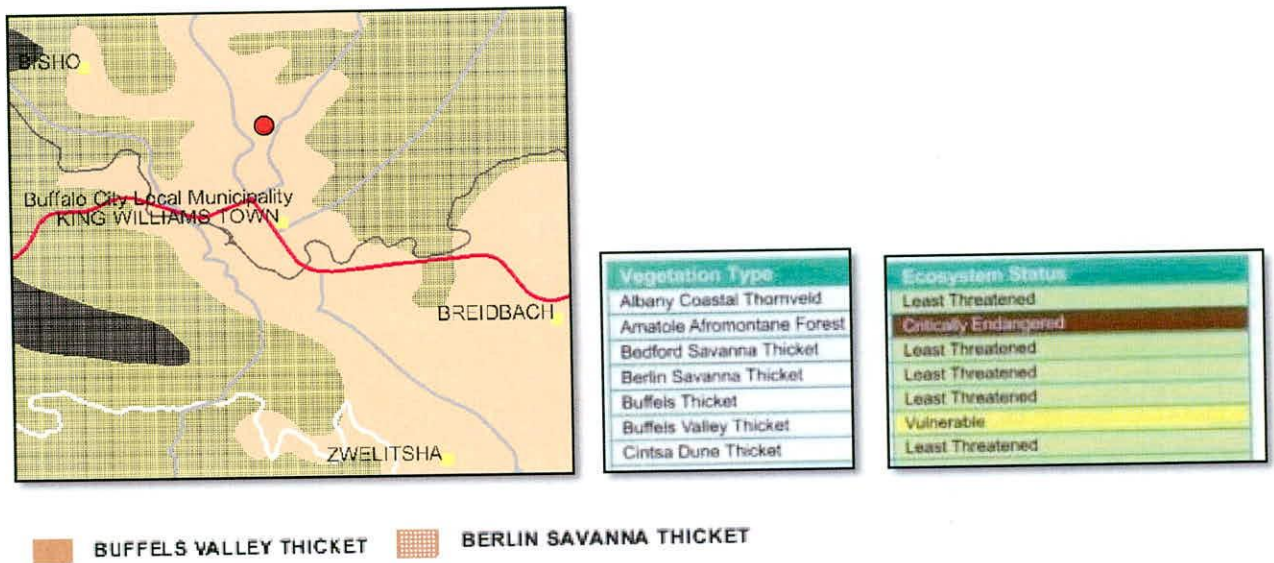
The vegetation of the study area and immediate surrounds was further defined in the Amatola Environmental Report as Albany Succulent Thicket and Inland Thorn veld. Statistics of these vegetation types indicate that they are reasonably well represented within the ADM but that very little thereof is conserved.





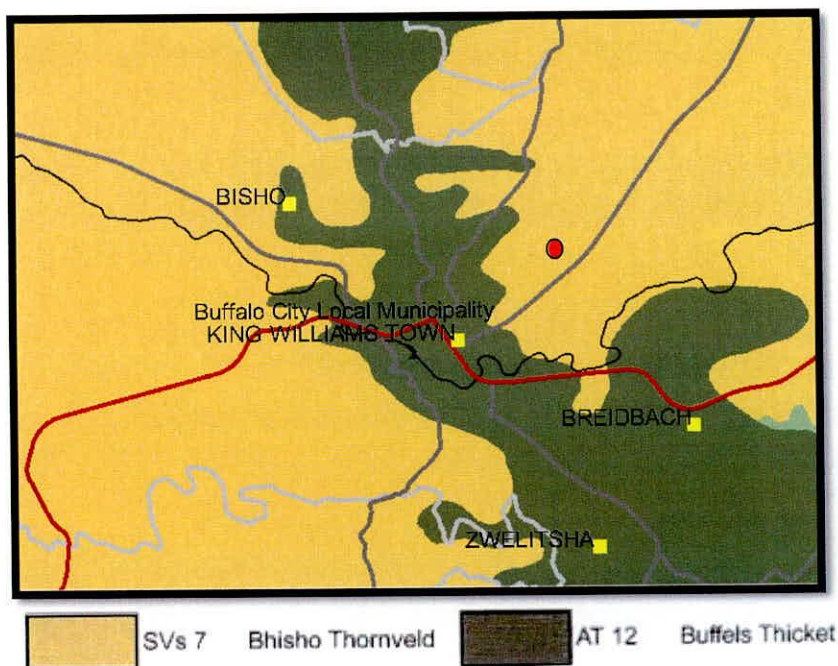
Vegetation type	% arial extent in ADM (endemism)	% of ADM	% conserved in ADM	% conserved globally	% transformed in ADM
Inland Thornveld	82.6	24.7	0		31.5
Albany Succulent Thicket	45.2	22.2	10		21.8

In terms of the STEP programme the vegetation type involved is Berlin Savanna Thicket and carries a conservation status of least threatened and is thus not ecologically sensitive. Possibly species composition of the area can be influenced by the abutting Buffels Valley Thicket but mining will not affect the latter per se.



In terms of the latest vegetation classification of Musina & Rutherford the site hosts Bisho Thornveld. Onsite analysis confirmed this vegetation type but to the north-west and south-west the species composition has been influenced by the Buffels Ticket vegetation cover. A description of this vegetation type is provided as well as the species associated with this vegetation type is provided. This vegetation type is poorly protected, but has a conservation status of 'Least Threatened' and development in this area should not pose a high negative impact.





### SVs 7 Bhisho Thorn veld

Name of vegetation type:	Bhisho Thorn veld
Code as used in the Book - contains space :	SVs7
Conservation Target (percent of area) from NSBA:	25%
Protected (percent of area) from NSBA:	0.2% (+2%)
Remaining (percent of area) from NSBA:	80.3%
Description of conservation status from NSBA:	Least threatened
Description of the Protection Status from NSBA:	Hardly protected
+Area (sqkm) of the full extent of the Vegetation Type:	8005.97
Name of the Biome:	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos):	Sub-Escarpment Savanna Bioregion
Name of Bioregion (only differs from Group in Fynbos):	Sub-Escarpment Savanna Bioregion

### 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