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Reference: EC30/5/1/3/3/2/1(0442)EM
Date: 18 May 2010

South African Heritage Resources Agency
P.O. Box 758
GRAHAMSTOWN
6140

CaseID: 2461

ATTENTION: MR. T. LUNGILE

Sir

CONSULTATION IN TERMS OF SECTION 40 OF THE MPRDA OF 2002: ENVIRONMENTAL MANAGEMENT PLAN (EMP); BORROW PIT - BHOLANI ACCESS ROAD, DIVISION OF PORT ST. JOHNS

1. Attached herewith, a copy of an EMP received from Port St. Johns Local Municipality for your comments.

2. Any written comments or requirements your department may have in this regard can be forwarded to this office no later than **17 July 2010.** Failure to do so, will lead to the assumption that your department has no objection(s) or comments with regard to the said documents. Comments may be submitted at your earliest convenience e.g. 30 days from the date hereof in order to reduce the turn around time for the application process.

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

4. Please use the reference number (EC) 30/5/1/3/3/2/1(0442) EM in all future correspondence.

5. Your co-operation is appreciated.

Sincerely,

REGIONAL MANAGER

EASTERN CAPE

FINAL

BORROW PIT

ENVIRONMENTAL MANAGEMENT PLAN

AND REHABILITATION PLAN

BHOLANI ACCESS ROAD

Prepared by:

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On behalf of

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April 2010

Introduction

Flux Development Scientists has been appointed by Milowo Consulting Engineers on behalf of Port St Johns Local Municipality to conduct environmental impact studies (Basic Assessment) for the construction of an access road between Bholani, Noqhekwane and Dedeni Villages in Port St Johns. The environmental impact assessment has commenced and the Basic Assessment Report has been submitted to Department Economic Development and Environmental Affairs (DEDEA, Mthatha offices). Part of the terms of reference of the appointment included an application for a mining permit for two borrow pits for extraction of road material including an area identified for extraction of sabhunga.

Description of the environment

i. Site Location

The road site is located east of Port St John's, Eastern Cape (Map 1) and the GPS positions of the borrow pits are as follows:

Burrow Pit 1: 31° 34′ 09.0″ S; 29° 32′ 41.1″E

Borrow Pit 2: 31° 33′ 44.8″S; 29° 32′ 09.9″E

A **third site** situated at 31°35'39.63"S; 29°34'52.89"E will be used to extract sabhunga. This site is situated in an open area near Noqhekwane village and was not included in the geotechnical survey conducted for the two borrow pits. However, environmental impacts have been assessed for all three sites.

The two borrow pits are shown in Figure 1.

ii. Topography

In general the site is hilly, becoming steep in places.

Figure 1. Borrow Pit Locality Map

iii. Vegetation

The Port St John's area is predominantly comprised of Grassland covered hills (Transkei coastal belt), of varying species composition, and Coastal Scarp Forest in the valleys and in small pockets on the slopes. The Scarp forest tends to be restricted to valleys and lower hill slopes with isolated pockets occurring in parts along the sea-facing slopes.

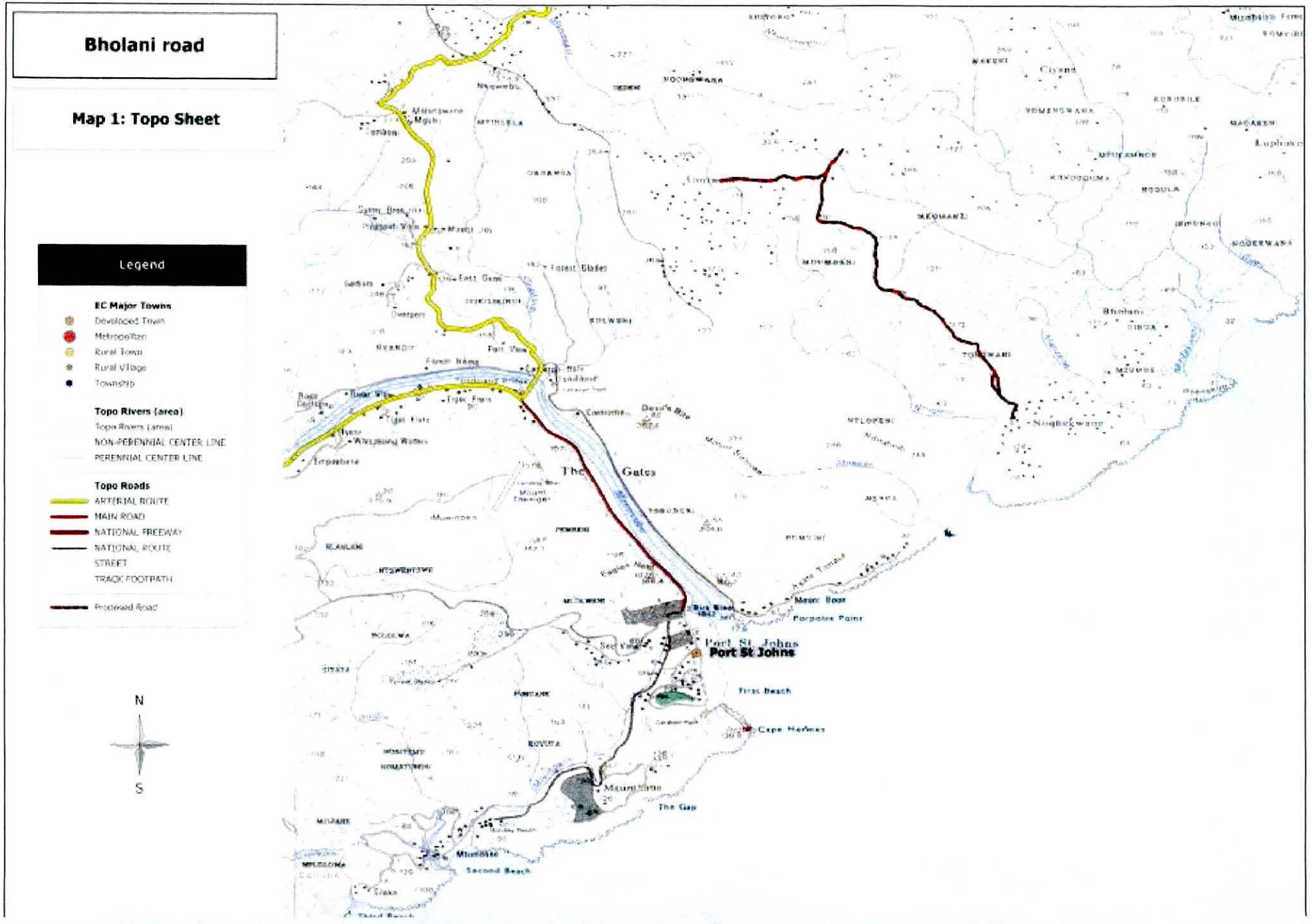
The steep sea facing slopes are predominantly Grassland dominated by the grass *Stenotaphrum secundatum* whilst the remainder of the grassland areas, further inland along the ridges of the hills, are dominated by patches of the grasses *Aristida junciformis* and/or *Cymbopogon validus*, both having a low grazing value. Other grasses present include *Sporobolus africanus*, *Themeda triandra*, *Paspalum dilatatum*, *Heteropogon* sp. and *Cynodon dactylon*, which have a greater grazing value, but occur in small patches or as a low percentage cover component. Numerous herbaceous species are present within the grasslands and percentage cover and total height varied between sites and vegetation units. The grassland areas are predominantly secondary in nature as a result of forest clearing for grazing.

Coastal scarp forest pockets are dominated by a number of tree species, including *Brachylaena discolor, Dracaena aletriformis, Strelitzia nicolai, Phoenix reclinata, Mimeos caffra, Protorhus longifolia, Millettia grandis, Rapanea revoluta, Vepris lanceolata and Zanthoxylum capensis*. Numerous other species are present within the forest and the height and percentage cover varied between sites and strata.

Other smaller vegetation units include foredune vegetation and stream thickets. Foredunes are dominated by *Ipomoea crassipes, Passerina rigida* and *Arctotheca populifolia*, whilst stream thickets are characterized by the species *Phoenix reclinata, Cyperus textilis* and *Ficus thonningii*.

Bholani road

Map 1: Topo Sheet



Assessment of potential impacts

An evaluation and prediction of the likely impacts of the proposed development on the receiving environment has been performed. This report focuses on environmental impacts that may result from development activities that will affect the flora and fauna within the sites and surrounds.

1.1 Introduction

The proposed road and associated borrow pits will result in removal of vegetation within the boundaries of the development footprint, dependant on the specific type.

1.2 Existing Impacts

Existing anthropogenic impacts within the study area:

- Degradation of Scarp Forest as a result of historical land use, including agricultural activities – goat, sheep and cattle grazing;
- vegetation clearing for infrastructure and buildings and roads;
- removal of vegetation (trees) for firewood, timber and traditional ceremonies.

1.3 Proposed Project Actions

The project will consist of the following infrastructure, requiring direct removal of vegetation:

- Clearing of vegetation from site to facilitate road construction and extraction of materials from the borrow pits, predominantly along existing pathway/old access road;
- Minor landscaping of topography and revegetation and rehabilitation after construction;
- Construction of culverts and ditches to manage water runoff.

1.4 General Impact Rating Scale for Specialists/ Baseline data

1.4.1 Methodology for rating significance of impacts:

The following section outlines the assessment methodology and legal context for specialist studies. (Section 3: Assessment of Impacts, in DEAT Guideline 5, June 2006). The identification of potential impacts should include impacts that may occur during the construction and operational phases of the activity. The assessment of impacts is to include direct, indirect as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed activity is well understood so that the impacts associated with the activity can be understood. The process of identification and assessment of impacts will include:

- Determine the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured.
- Determine future changes to the environment that will occur if the activity does not proceed.
- An understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken

As per Guideline Document 5: Assessment of Alternatives and Impacts the following methodology is to be applied to the predication and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative.

- **"Direct** impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect** impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Cumulative** impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts." DEAT (2006).
- **Spatial extent** – The size of the area that will be affected by the impact
    - Site specific
    - Local (<2 km from site)
    - Regional (within 30 km of site)
    - National
- **Intensity** –The anticipated severity of the impact

- High (severe alteration of natural systems, patterns or processes)
- Medium (notable alteration of natural systems, patterns or processes)
- Low (negligible alteration of natural systems, patterns or processes)

- **Duration** –The timeframe during which the impact will be experienced
  - Temporary (less than 1 year)
  - Short term (1 to 6 years)
  - Medium term (6 to 15 years)
  - Long term (the impact will cease after the operational life of the activity)
  - Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient)

Using the criteria above, the impacts will further be assessed in terms of the following:

- **Probability** –The probability of the impact occurring
  - Improbable (little or no chance of occurring)
  - Probable (<50% chance of occurring)
  - Highly probable (50 – 90% chance of occurring)
  - Definite (>90% chance of occurring)

- **Significance** – Will the impact cause a notable alteration of the environment?
  - Low to very low (the impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making)
  - Medium (the impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated).
  - High (the impacts will result in major alteration to the environment even with the implementation of the appropriate mitigation measures and will have an influence on decision-making)

- **Status** - Whether the impact on the overall environment will be positive, negative or neutral
  - "+" (positive - environment overall will benefit from the impact).
  - "-"(negative - environment overall will be adversely affected by the impact).

- "o" (neutral - environment overall will not be affected).

- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge
  - Low
  - Medium
  - High

- **Management Actions and Monitoring of the Impacts (EMP)**
  - Where negative impacts are identified, mitigatory measures will be identified to avoid or reduce negative impacts. Where no mitigatory measures are possible this will be stated.
  - Where positive impacts are identified, mitigatory measures will be identified to potentially enhance positive impacts.
  - Quantifiable standards for measuring and monitoring mitigatory measures and enhancements will be set. This will include a programme for monitoring and reviewing the recommendations to ensure their ongoing effectiveness.

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts will be described both before and after the proposed mitigation and management measures have been implemented.
- Impacts will be evaluated for the construction, operation and termination phases of the development
- The impact evaluation will, where possible, take into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area.
- The impact assessment will attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.

1.5 Identified Impacts

Eleven (11) direct biophysical environmental impacts have been identified, as follows:

A. Direct Impacts

1. Direct loss of Scarp Forest;
2. Direct loss of Transkei Coastal Belt
3. Loss or reduction in ecological processes within Scarp Forest;
4. Loss or reduction in ecological processes within Transkei Coastal Belt ;
5. Loss of habitat for species of special concern in Scarp Forest;
6. Loss of habitat for species of special concern in Transkei Coastal Belt ;
7. Loss of Scarp Forest Species of Special Concern habitat;
8. Loss of Transkei Coastal Belt Species of Special Concern habitat;
9. Increased risk of alien invasion;
10. Cumulative loss of Scarp Forest ;
11. Cumulative loss of Transkei Coastal Belt.

B. Indirect Impacts

12. Increased incidence soil erosion

Impact Assessment

1. Direct loss of Scarp Forest

Nature of the Impact	The proposed development will result in the permanent removal of Scarp Forest from within the site.
Extent	Site specific - the removal of vegetation will be restricted to the road footprint.
Duration	Permanent
Intensity	Low, confined to road and borrow pit footprint and
Probability	Definite (>90% chance of occurring)
Status of Impact	-ve negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	No mitigation possible for actual road footprints, but can be minimizing by keeping road widths to the absolute minimum (single lane) and only clearing what is required. Wherever possible, large trees should be avoided.
Significance (with mitigation)	Low

2. Direct loss of Transkei Coastal Belt

Nature of the Impact	The proposed development will result in the permanent removal of Transkei Coastal Belt from within the site.
Extent	Site specific - the removal of Transkei Coastal Belt will be restricted to the road footprint
Duration	Permanent
Intensity	Low, confined to road and borrow pit footprint
Probability	Definite (>90% chance of occurring
Status of Impact	-ve negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	No mitigation possible for actual road footprints, but can be minimizing by keeping road widths to the absolute minimum (single lane) and only clearing what is required. Wherever possible, large trees should be avoided.
Significance (with mitigation)	Low

3. Loss or reduction in ecological processes within Scarp Forest;

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-ve negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

4. Loss or reduction in ecological processes within Transkei Coastal Belt

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-ve negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

5. Loss of habitat for species of special concern in Scarp Forest

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-ve negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained

Significance (with mitigation)	Low

6. Loss of habitat for species of special concern in Transkei Coastal Belt

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-ve negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

7. Loss of Scarp Forest Species of Special Concern habitat

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-ve negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

8. Loss of Transkei Coastal Belt Species of Special Concern habitat

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-vet negative
Degree of Confidence	High
Significance (no mitigation)	Low

Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

9. Increased risk of alien invasion

Nature of the Impact	Construction of the borrow pits may open up areas for colonisation of alien invasive species
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-vet negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

10. Cumulative loss of Scarp Forest

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Permanent
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-vet negative
Degree of Confidence	High
Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

11. Cumulative loss of Transkei Coastal Belt

Nature of the Impact	Some removal and trimming of vegetation is likely to occur and may result in some impact to ecological processes.
Extent	Site specific
Duration	Temporal (with mitigation)
Intensity	Low, roads will be narrow and clearing minimal
Probability	Definite (>90% chance of occurring)
Status of Impact	-ve negative
Degree of Confidence	High

Significance (no mitigation)	Low
Mitigation	Wherever possible, trees should be avoided and understorey trimming minimised so that overhead canopy is retained
Significance (with mitigation)	Low

12. Increased incidence of erosion

Nature of the Impact	Removal of multi layers of soil
Extent	Site specific
Duration	Temporal (with mitigation)
Intensity	Moderate, some initial clearing may occur of key species
Probability	Possible
Status of Impact	-ve negative
Degree of Confidence	Moderate
Significance (no mitigation)	Low
Mitigation	All exposed areas must be rehabilitated immediately after use
Significance (with mitigation)	Low

Summary of the significance of potential impacts and proposed mitigation

Table1: Recommended Impact Mitigation procedures.

Impact Description	Proposed Mitigation actions
Vegetation and Flora	
1. Direct loss of Scarp Forest	• Vegetation clearing must be limited to the required borrow pits' footprint • Borrow pits to be constructed along existing old road, so clearing will be limited to re-growth
2. Direct loss of Transkei Coastal Belt	• Borrow pits to be constructed predominantly along existing old road, so clearing will be limited to re-growth
3. Loss or reduction in ecological processes within Scarp Forest	• Removal of trees and pruning of understorey vegetation to be kept to a minimum • Canopy connectedness should be retained as far as possible
4. Loss or reduction in ecological processes within Transkei Coastal Belt	• Road widths to be kept to a the minimum required and already degraded areas utilised as far as possible
5. Loss of habitat for species of special concern in Scarp Forest	• Species of special concern should be avoided where reasonably possible permits should be obtained where unavoidable and already degraded areas utilized as far as possible.
6. Loss of habitat for species of special concern in Transkei Coastal Belt	• Species of special concern should be avoided where reasonably possible, permits should be obtained where unavoidable
7. Loss of Scarp Forest Species of Special Concern habitat	• Road to be constructed along existing old road, so clearing will be limited to re-growth
8. Loss of Transkei Coastal Belt Species of Special Concern habitat	• Road to be constructed along existing old road, so clearing will be limited to re-growth
9. Increased risk of alien invasion	• River crossing and clearing of thicket should be avoided
10. Increased incidence of erosion	• Exposed areas must be rehabilitated immediately after use.

Impact Description	Proposed Mitigation actions
11. Cumulative loss of Scarp Forest	• Cumulative loss will most likely be insignificant • Clearing to be kept to minimum, no unnecessary vegetation removal
12. Cumulative loss of Transkei Coastal Belt	• Cumulative loss will most likely be insignificant • Clearing to be kept to minimum, no unnecessary vegetation removal

Standard Management Programme

Environmental Specifications

a) Fauna and Flora

- The Port St John's area is predominantly comprised of Grassland covered hills (Transkei coastal belt), of varying species composition, and Coastal Scarp Forest in the valleys and in small pockets on the slopes. The Scarp forest tends to be restricted to valleys and lower hill slopes with isolated pockets occurring in parts along the sea-facing slopes. A list of flora of the area and surrounding areas is tabled in Appendix 1.
- Indigenous reptiles and birds may be present, if found, they may not be damaged or harmed. Vegetation removals as part of the development requirements are excluded and are dealt with in a site specific method statement.
- All sensitive areas will be marked out properly. Demarcation procedures are explained below.
- All incidents of harm to any animal or natural vegetation (apart from the agreed areas) must be reported to the ECO who will keep a register of these incidents.

b) Services

- Care and due cognisance must be taken of existing services and service construction methods and restrictions.
- A base plan indicating the existing services and all no–go areas must be supplied by the client through the engineers and discussed by the engineer to all contractors before any work activities may commence.

c) Appropriate use of machinery

- The contractor shall at all times carefully consider what machinery is appropriate to the task while minimising the extent of environmental damage.

d) Demarcating and fencing

- Sensitive areas - In the event that sensitive features are threatened by construction activities, the temporary fencing off of these areas (for individual areas such as trees or rocks) or the construction
- area (when working in a mainly natural environment) is recommended. A two-strand barbed wire fence of approximately 1m high is considered adequate.
- All fencing and fence placement / positioning must be approved by the ECO on site.
- Where the construction area is fenced, all activities including stockpiling must occur within this fenced area. The contractor shall be fined and must pay for reinstatement or rehabilitation of damaged areas and features.
- Deep excavations and trenching taking place must conform to the following:
- Proper demarcation must be in place prior to construction commencing and all excavations must be screened off for the duration of construction.
- Proper signage must warn people of the risk involved.
- All necessary precautions must be taken during excavations of bedrock in order to prevent contamination of the ground water.
- Contractors must take cognisance of all demarcated areas on site: Work areas (including stockpiling, lay-down and waste areas) and access routes will be clearly demarcated to minimise environmental impact. Demarcation can take the form of colour coded pegs at least 1 m high. Danger tape may also be used for this purpose. All pegs and tape must be maintained.

e) Anti-erosion measures

- The Contractor shall take appropriate and active measures to prevent erosion resulting from his own works, operations and activities as well as stormwater control measures to the satisfaction of the ECO / Engineer. Restoration costs are for the contractor's account, should these measures not be reasonably implemented. Aspects normally covered in construction contracts in terms of "protection of works" are standard and are not to be billed or confused with any details covered under environmental requirements.
- During construction the Contractor shall protect areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible. Other measures as may be necessary will be taken to prevent the surface water from being

concentrated within the channel and from scouring slopes, banks or other areas. All such measures will be discussed with and approved by the ECO / Engineer

- Measures can include cut off trenches, straw stabilising, brush packing etc.

f) Fuel and Service areas

- Fuels and flammable materials are to be stored in suitably equipped storage areas. These areas shall comply with general fire safety requirements. Impervious materials are to be used in these storage areas to prevent contamination of the ground in the event of spillages or leaks. Quantities of fuels and hazardous materials stored on site should be appropriate to the requirement for these substances on site.

- All vehicles, equipment, fuel and petroleum services and tanks must be maintained in a good condition that prevents leakage and possible contamination of soil or water supplies. The following recommendations should be implemented:
    - Refuelling areas should be bunded and lined to prevent spilled fuels and oils from contaminating the area. It is suggested that as a minimum, sandbags surround the bulk fuel supply tank, the floor of the area is to be lined with plastic and a layer of sand of approximately 50mm is placed on top of the plastic.
    - The park and service area should be treated with a suitable hydrocarbon absorption or remediation product. Properly maintained absorbent spill mop-up kits need to be on hand - Drizzit and products from Enretech should be investigated for these purposes.
- All servicing areas must have a drip tray present to prevent accidental spillage of oils and fuels.
- A suitable leak proof container for the storage of oiled equipment (filters, drip tray contents and oil changes etc.) must be established. Fuels and oils must be safely located out of harm's way from the elements and safety and fire prevention must be strictly adhered to. No fuel may be stored within the 1:50 year flood line level. No fuel/oil containers may be left unattended within drainage areas.
- All spills and remedial action are to be recorded in the ECO diary.
- The condition of the bundwalls and drip trays should be checked periodically for compliance

g) Concrete works

- Wherever concrete works are necessary, even of a limited scale, preventative measures needs to be taken to prevent pollution. Cement powder has a high alkalinity pH rating, which can contaminate and affect both soil and water pH dramatically. A shift in pH can have serious consequences on the functioning of soil and water organisms and plants. The following recommendations must be implemented to minimise impact:

    - Cement contaminated water may not enter a natural or man-made water system (e.g. trench or storm water system).
    - Preventative measures include:
        - If possible/appropriate ready mix concrete should be used.
        - Mixing areas to be carefully placed in consultation with the Engineer / ECO.
        - Cement bags are to be stored securely out of harm's way from the elements (wind and rain). Used bags must be removed to a licensed waste management facility and ***may not be burned*** on site.
        - Excess or spilled concrete should be confined within the works area and then removed to a waste site.

- In case of high volumes, establishing sumps from where contaminated water can be either treated in situ or removed to an appropriate waste site may be requested by the ECO.

h) Fires

- No open fires (for cooking, warming etc.) may be allowed within the construction area. Adequate firefighting equipment according to the fire hazard during the construction period must be available on site in good working order (at least one type ABC (all purpose) 12.5 kg extinguisher).
- Welding, gas cutting or cutting of metal will only be permitted inside the working areas and then only within a designated area due to the intensity and/or frequency if deemed necessary by the ECO.
- The Contractor shall pay the costs incurred to organisations called to put out any fires started by him. The Contractor shall also pay any costs incurred to reinstate burnt areas, fences, properties etc. as deemed necessary by the Engineer.

i) Refuse

- The Contractor shall be responsible for the establishment of a refuse control system that is acceptable to the ECO.
- The Contractor shall ensure that all waste, including surplus food, food packaging and organic waste are not deposited by his employees anywhere on the site or in the surrounding area except in refuse bins provided for removal on a regular basis by the Contractor.
- For the purposes of this document refuse also includes discarded construction materials such as steel reinforcing, wooden shuttering and timbers, cement bags, piping etc.
- Refuse bins shall be weather and animal-proof and the amount of bins provided needs to be sufficient for daily volumes of waste produced. The Contractor must transport refuse collected from the working areas from site at least once a week. Refuse must be disposed of at a licensed site approved by the ECO/Engineer.

j) Toilets

- The Contractor shall provide suitable sanitary arrangements near his offices and construction sites for his staff. A minimum of one toilet shall be provided per 15 persons at each working area or as stipulated by local authority or other relevant legislation.
- Toilets shall be of a neat construction and shall be provided with doors and locks and shall be secured to prevent them blowing over.
- Sanitation provision and servicing shall be to the satisfaction of the Engineer. The Contractor shall ensure that toilets are emptied before any builders' holidays. The toilets will be for use of the construction personnel on-site only and the toilets should therefore, be lockable and should be kept locked outside of working hours to prevent public use of the facilities.

k) Dust Control

- The Contractor is to take appropriate measures to minimise the generation of dust as a result of construction works, to the satisfaction of the ECO. On sandy or very dusty sites, mulched indigenous vegetation which is to be removed from the site and is suitable can be used as a method of stabilisation and dust control on any cleared or exposed sections of the site. Alternatively, straw stabilisation or watering can be used. Seed bearing invasive vegetation should not be used for this purpose.

- No water should be extracted from rivers or dams for dust suppression as such activity will require authorisation from Department of Water Affairs and Environmental Affairs.

l) Top material Removal and Stockpiling

- Prior to construction or earthworks commencing on site, top material should be stripped from work sites and separat4ely stockpiled for later use in rehabilitating damaged areas or for landscaping purposes.
- Topsoil stockpiles not to exceed 1.5m in height.
- Compaction of topsoil stockpiles is not permitted.

m) Site Clean Up and Rehabilitation

- The Contractor must ensure that all structures, equipment, materials and facilities used or created on site for or during construction activities are removed once the project has been completed. The construction site shall be cleared, and cleaned to the satisfaction of the ECO.

Rehabilitation Plan

Rehabilitation Objective

The overall objective of the rehabilitation plan is to minimize adverse environmental impacts associated with the activities. Additional broad rehabilitation strategies / objectives include the following:

- Rehabilitating the worked-out areas to take place concurrently within prescribed framework established in the Standard Management Programme.
- All infrastructures, equipment, plant and other items used during the construction/mining period will be removed from the site.
- Waste material of any description, including scrap, rubble and tyres, will be removed entirely from the mining area and disposed of at a recognised landfill facility. It will not be permitted to be buried or burned on site.
- Final rehabilitation shall be completed within a period specified by the Engineer/ECO.

Topsoil and Subsoil Replacement

Topsoil and subsoil will be stripped separately and will be stockpiled separately and only used in rehabilitation work towards the end of the operations. Stripped overburden will be backfilled into the worked out areas. Stripped topsoil will be spread over the re-profiled areas to an adequate depth to encourage plant re-growth. The vegetative cover will be stripped with the thin topsoil layer to provide organic matter to the relayed material and to ensure that the seed store contained in the topsoil is not diminished. Reseeding may be required should the stockpiles stand for too long and be considered barren from a seed bank point of view. Stockpiles should ideally be stored for no longer than a year.

The topsoil and overburden will be keyed into the re-profiled surfaces to ensure that they are not eroded or washed away. The topsoiled surface will be left fairly rough to enhance seedling establishment, reduce water run-off and increase filtration.

Revegetation

All prepared surfaces will be seeded with suitable grass species to provide an initial ground cover and stabilize the soil surface. Whilst *Chloris gayana* and *Themeda triandra* are the preferred species to use for revegetation, other species that can work in this regard include the following and can either be collected on site (using a mower or by hand) or purchased from a relevant local seed supplier:

Botanical name	Common name
Cynodon dactylon	Couch grass
Stenotaphrum secundatum	Buffalo turf grass
Themeda triandra	Rooigras
Digitaria eriantha	Finger grass
Paspalum dilatatum	Dallis grass
Setaria sphacelata	
Sporobolus africanus	
Sporobolus virginicus	

The overall revegetation plan will, therefore, be as follows:

- Ameliorate the aesthetic impact of the site
- Stabilise disturbed soil and rock faces
- Minimize surface erosion and consequent siltation of natural water course located on site
- Control wind-blown dust problems
- Enhance the physical properties of the soil
- Re-establish nutrient cycling
- Re-establish a stable ecological system

Every effort must be made to avoid unnecessary disturbance of the natural vegetation during quarrying operations.

Drainage and Erosion Control

To control the drainage and erosion at site the following procedures will be adopted:

- Areas where construction/mining is completed should be rehabilitated immediately.
- Borrow pit slopes will be profiled to ensure that they are not subjected to excessive erosion but capable of drainage run-off with minimum risk of scour (maximum 1:3 gradient).
- All existing mined areas will be revegetated to control erosion and sedimentation
- Existing vegetation will be retained as far as possible to minimize erosion problems.

Visual Impacts Amelioration

The overall visual impact of the proposed borrow pit will be minimised by the following mitigating measures:

- Confining the mining footprint to an area as small as possible
- Integrating the borrow pit into the existing land slope
- Re-topsoiling and vegetating all disturbed areas
- Use indigenous trees around the perimeter of the mine to mask borrow pitscars.

Monitoring and performance assessment

Monitoring and Reporting

Adequate management, maintenance and monitoring will be carried out by the applicant to ensure successful rehabilitation of the property until a closure certificate is obtained.

To minimise adverse environmental impacts associated with quarrying operations it is intended to adopt a progressive rehabilitation programme, which will entail carrying out the proposed rehabilitation procedures concurrently with quarrying activities.

Inspecting and Monitoring

- Monitoring of all the environmental management measures and components shall be carried out by the holder of the mining permit to ensure that the provisions of this programme are adhered to.
- Ongoing and regular reporting of the progress of implementation of this programme will be done. An environmental audit should be carried out by an independent consultant on before closure basis. The findings of this audit shall be reported back to the Regional Director.
- Any change to the mining process needs to be documented during the audit process and the necessary changes recorded to facilitate future mining operations and audit investigations.
- Adherence to the impacts associated with the borrow pit quarrying operations must be addressed in the annual audit.
- Inspections and monitoring shall be carried out on both the implementation of the programme and the impact on plant and animal life.
- Adherence to concerns raised by IAP's during the public participation process should receive special attention during the environmental audit and correspondence to the various IAP's should be made on an annual basis in this regard.

Compliance Reporting / Submission of Information

- Any emergency or unforeseen impact must be reported to the Regional Manager within 14 days of such event being noticed.
- An assessment of environmental impacts that were not properly addressed or were unknown when the EMP was compiled shall be carried out and added as a corrective action.

Closure and environmental objectives

Closure

When the holder of a mining right intends closing the mining operation, an environmental risk report shall accompany the application for closure. The requirements of such a risk report are contained in Regulation 60 of the MPRDA.

Closure Objectives

The decommissioning phase and closure of the borrow pits will involve removal of all debris and rehabilitation of areas not rehabilitated during the operational phases of the project. This will comprise the scarification of compacted areas, reshaping of areas, topsoiling and regenerating all prepared surfaces. The crusher and screening plants will be dissembled and all other infrastructural development such as haulage roads and stock pile areas will be rehabilitated.

Borrow pit closure upon completion of the operation needs to be conducted in accordance to the objectives outlined in this report. The recommendations outlined in this report regarding precision blasting of besides, topsoil replacement and re-vegetation all need to be complied with before closure can be considered.

Appendix 1: Flora

The following provides a list of both recorded flora and plant species known to occur in the general vicinity and vegetation communities:

Botanical Name	Family	Status*	Seeps / Riparian	Scarp Forest	Grassland	Thicket	Disturbed
Acacia karoo	Fabaceae						1
Acanthospermum glabratum	Asteraceae	Common weed					
Achyranthes aspera	Amaranthaceae	Common weed					
Acokanthera oblongifolia	Apocynaceae						
Adiantum capillus-veneris	Adiantaceae						
Alectra capensis	Scrophulariaceae						
Allophylus natalensis	Sapindaceae						
Andropogon eucomus	Poaceae						
Anthospermum herbaceum	Rubiaceae						
Argyrolobium incanum	Fabaceae						
Aristida junciformis	Poaceae						
Asclepias flexuosa	Asclepiadaceae						
Asparagus densiflorus	Asparagaceae						
Asparagus falcatus	Asparagaceae						
Asplenium cordatum	Aspleniaceae						
Behnia reticulata	Behniaceae						
Berkheya decurrens	Asteraceae						1
Bidens pilosa	Asteraceae	Common weed					
Brachylaena discolor	Asteraceae						
Brunsvigia grandiflora	Amaryllidaceae						
Calpurnia sericea	Fabaceae						1
Canthium inerme	Rubiaceae						
Carex aethiopica	Cyperaceae						
Centella asiatica	Apiaceae						1
Cestrum laevigatum	Solanaceae	CARA 1					1
Chamaecrista mimosoides	Fabaceae						
Cheilanthes viridis	Adiantaceae						
Chromolaena odorata	Asteraceae	CARA 1					1
Clerodendrum glabrum	Verbenaceae						
Clivia nobilis	Amaryllidaceae						
Commelina africana	Commelinaceae						
Commelina benghalensis	Commelinaceae						
Commelina erecta	Commelinaceae						
Conyza scabrida	Asteraceae						1
Crassula arvensis	Crassulaceae						
Crassula multicava	Crassulaceae						
Crassula sarmentosa	Crassulaceae						
Cymbopogon validus	Poaceae						
Cynodon dactylon	Poaceae						

Botanical Name	Family	Status*	Seeps / Riparian	Scarp Forest	Grassland	Thicket	Disturbed
Cyperus textilis	Cyperaceae						
Dalbergia obovata	Fabaceae						
Desmodium incanum	Fabaceae						
Digitaria eriantha	Poaceae						
Digitaria sanguinalis	Poaceae	Common weed					
Dioscorea sylvatica	Dioscoreaceae						
Diospyros lycioides	Ebenaceae						
Dovyalis rhamnoides	Flacourtiaceae						
Dracaena aletriformis	Dracaenaceae	NFA					
Drimiopsis maculata	Hyacinthaceae						
Eriosema squarrosum	Fabaceae						
Eucalyptus sp.	CARA						
Euphorbia epicyparissias	Euphorbiaceae						
Euryops pectinatus	Asteraceae						
Felicia	Asteraceae						
Ficus natalensis	Moraceae						
Ficus sur	Moraceae						
Ficus thonningii	Moraceae						
Fimbristylis dichotoma	Cyperaceae						
Gazania krebsiana	Asteraceae						1
Gazania rigens	Asteraceae						1
Geranium incana	Geraniaceae						
Gerbera sp	Asteraceae						1
Gladiolus oppositiflorus	Iridaceae	IUCN (NE)					
Gladiolus sericeo-villosus	Iridaceae						
Gloriosa superba	Colchicaceae						
Grewia occidentalis	Tiliaceae						
Helichrysum cymosum	Asteraceae						1
Helichrysum nudifolium	Asteraceae						1
Helichrysum odoratissimum	Asteraceae						1
Heteropogon sp.	Poaceae						
Hibiscus tiliaceus	Malvaceae						1
Hypoestes aristata	Acanthaceae						
Hypoestes forskaolii	Acanthaceae						
Hypoxis hemerocallidea	Hypoxidaceae						
Indigophora velutina	Fabaceae						
Inula graveolens	Asteraceae						
Ischaemum fasciculatum	Poaceae						
Isoglossa woodii	Acanthaceae						
Isolepis sororia	Cyperaceae						
Juncus kraussii	Juncaceae						
Justicia betonica	Acanthaceae						
Kniphofia rooperi	Asphodelaceae	1					

Botanical Name	Family	Status*	Seeps / Riparian	Scarp Forest	Grassland	Thicket	Disturbed
Lantana camara	Verbenaceae						
Laportea peduncularis	Urticaceae						
Launaea sarmentosa	Asteraceae						
Lauridia tetragona	Celastraceae						
Leonotis leonurus	Lamiaceae						1
Maerua cafra	Capparaceae						
Maesa lanceolata	Myrsinaceae						
Mariscus dregeanus	Cyperaceae						
Mariscus grantii	Cyperaceae						
Millettia grandis	Fabaceae	IUCN (C)					
Mimusops caffra	Sapotaceae	NFA					
Mitriostigma axillare	Rubiaceae						
Monopsis unidentata	Lobeliaceae						
Nemesia caerulea	Solanaceae						
Oplismenus hirtellus	Poaceae						
Oxalis semiloba	Oxalidaceae						
Oxalis sp	Oxalidaceae						
Oxyanthus speciosus	Rubiaceae						
Paspalum dilatatum	Poaceae	Common weed					
Pavetta lanceolata	Rubiaceae						
Pavonia columella	Malvaceae						
Phoenix reclinata	Arecaceae						
Plectranthus fruticosus	Lamiaceae						1
Plectranthus strigosus	Lamiaceae						1
Pleurostylia capensis	Celastraceae						
Polygala myrtifolia	Polygalaceae						
Protorhus longifolia	Anacardiaceae						
Psidium guajava	Myrtaceae	CARA 2					1
Ptaeroxylon obliquum	Ptaeroxylaceae	NFA					
Pycnostachys reticulata	Lamiaceae						
Pycreus polystachys	Cyperaceae						
Rapanea melanophloeos	Myrsinaceae						
Rhoicissus digitata	Vitaceae						
Rhoicissus rhomboidea	Vitaceae						
Rhoicissus tomentosa	Vitaceae						
Rhus dentata	Anacardiaceae						
Rhus fraseri	Anacardiaceae						
Rhus pyroides	Anacardiaceae						
Rhus sp.	Anacardiaceae						
Rubia petiolaris	Rubiaceae						1
Samolus valerandi	Primulaceae						
Scabiosa columbaria	Asteraceae						1
Scadoxus multiflorus	Amaryllidaceae						

Botanical Name	Family	Status*	Seeps/ Riparian	Scarp Forest	Grassland	Thicket	Disturbed
Schistostephium rotundifolia	Asteraceae						
Scirpus sp.	Cyperaceae						
Scolopia zeyheri	Flacourtiaceae						
Scutia myrtina	Rhamnaceae						
Senecio chrysocoma	Asteraceae						1
Senecio inaequidens	Asteraceae						1
Senecio pterophorus	Asteraceae						1
Senecio rhyncholaenus	Asteraceae						1
Senecio speciosus	Asteraceae						1
Senna didymobotrya	Fabaceae	CARA 3					1
Setaria megaphylla	Poaceae						1
Setaria sphacelata	Poaceae						1
Sida cordifolia	Malvaceae						
Sida dregei	Malvaceae						
Sideroxylon inerme	Sapotaceae	NFA					
Solanum mauritianum	Solanaceae	CARA 1					1
Sporobolus africanus	Poaceae						1
Sporobolus virginicus	Poaceae						1
Stachys sp.	Lamiaceae						
Stangeria eriopus	Stangeriaceae						
Stenotaphrum secundatum	Poaceae						1
Strelitzia nicolai	Strelitziaceae	IUCN (LC)					
Syzygium cordatum	Myrtaceae						
Tagetes minuta	Asteraceae	Common weed					
Tecoma capensis	Bignoniaceae						
Tephrosia sp.	Fabaceae						1
Themeda triandra	Poaceae						1
Trimeria grandiflora	Flacourtiaceae						
Vangueria madagascariensis	Rubiaceae						
Vepris lanceolata	Rutaceae						
Vernonia oligocephala	Asteraceae						
Vigna sp.	Fabaceae						
Watsonia sp.	Iridaceae						
Zantedeschia aethiopica	Araceae						
Zanthoxylum capense	Rutaceae						
Zornia capensis	Fabaceae						

APPENDIX 2: Geotechnical Report

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sanas Testing Laboratory
T0308
ISO/IEC 17025:2005 Accredited Laboratory

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Reference: 01022010Let - Brief report - UT8047.doc

1 February 2010

Flux Development Scientists
2nd Floor Super Spar Centre
85 Main Road
GONUBIE
5257

ATTENTION: MISS N NTUNZI

Dear Madam

BHOLANI VILLAGE BORROW PIT INVESTIGATION: BRIEF REPORT

ControLab was requested to do a borrow pit investigation at two (2) existing borrow pits close to the village of Bholani. The aim of the investigation was to determine of the material in these borrow pits would be suitable for use in gravel roads.

The co-ordinates for the two borrow pits were as follow:

- Borrow pit one S31°34'09.0" E29°32'41.1"
- Borrow pit two S31°33'44.8" E29°32'09.9"

Port St Johns normally receives about 990mm of rain per year, with most rainfall occurring mainly during summer. It receives the lowest rainfall (17mm) in June and the highest (136mm) in March. The monthly distribution of average daily maximum temperatures indicates that the average midday temperatures for Port St Johns range from 21°C in July to 25.8°C in February. The region is the coldest during July when the mercury drops to 10°C on average during the night.

Wienerts climatic N number for the area is in the order of 1, which should indicate that the rocks would decompose implying that chemical weathering would dominate over mechanical weathering.

According to the geological map number 2128 Umtata published in 1979 by the Chief Director of Surveys and Mapping, the site under investigation falls within the Karoo sequence, embracing the Ecca group. The material would generally consist of mudstones, sandstones, shale and tillite.

Three (3) samples were taken of typical materials encountered at each of the borrow pits for Road Indicators, California Bearing Ratio (CBR) and Atterberg Limits tests. All the test results are attached to this document.

BRIEF INTERPRETATION OF THE TEST RESULTS

- **Road Indicators**

  Three disturbed samples from each borrow pit were tested for CBR, grading and Atterberg limits. The grading was used to classify the material sampled according the TRH 20: 1990 (The structural design, construction and maintenance of unpaved roads).

  The CBR and grading was also used to classify the material according to the TRH 14 (Guidelines for road construction materials) and classifications are indicated below:

BORROW PIT	MATERIAL DESCRIPTION	TRH 20 CLASSIFICATION	TRH 14 CLASSIFICATION
BP1 – A	Dark red clay	D	Less than G10
BP1 – B	Dark yellow mudstone	E	Less than G10
BP1 – C	Dark red cay	D	G10
BP2 – A	Dark olive yellowish mudstone	D	Less than G10
BP2 – B	Dark olive yellowish mudstone	D	Less than G10
BP2 – C	Dark grey shale with clay	D	G7

  Please note that some of the TRH14 materials classification indicating less than G10 quality was due to the high swell percentages measured and low CBR values. The TRH20 requires a CBR value of 15 at 95% of modified AASHTO density. The material sampled from BR2 – sample C would be suited for use as a gravel wearing course.

  The TRH 20 classification can be explained by the following:

  - A classification – material in this area generally performs satisfactory but is fine graded and particularly erodible material. Roads constructed from these materials perform satisfactorily but may require periodic labour intensive maintenance and have high gravel loss due to erosion

- B classifications – these materials generally lack cohesion and are highly susceptible to the formation of loose materials (ravelling) and corrugations
- C classification – materials generally conforms to gab-graded gravel and lacks adequate cohesion resulting in loose materials that are prone to ravelling
- D classification – Materials with a shrinkage product in excess of 365 tends to be slippery when wet
- E classification – material in this zone generally performs well provided that the oversize materials are limited to the recommended limits.

The material varied between a less than a G10 and G5 TRH 14 material classification.

Most of the material tested in the borrow pits will not be suitable for use as a gravel wearing course. The borrow pit must be properly managed to ensure that the mudstones are NOT used in the road construction.

While every effort has been made during the fieldwork phase of this investigation to identify the various soil horizons, their problems and distribution, it is impossible to guarantee that isolated zones of poorer material have not been missed. The investigation was, however, thorough and conditions are not expected to vary from those described in this report. Disparities in the material type should be referred to an expert.

The report does not provide a pavement design but merely recommendation on the use of the available materials.

Regards,

DEON LOUW
Pr. Tech. Eng, MSc (Civil)

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CIVIL ENGINEERING MATERIALS AND GEOTECHNICAL LABORATORY

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ATT: Mr N Ntuzi

PROJECT: BHOLANI VILLAGE
DATE RECEIVED: 2009.12.18
DATE TESTED: 2010.01.26
DATE REPORTED: 2010.01.28
TEST REPORT NO.: UT 8047 **O/N:**

GRAVEL ROADS BORROW PIT DATA REPORT

BORROWPIT NUMBER	BP 1			ROAD NUMBER	
SAMPLE NO.	6971	6972	6973	CHAINAGE	
POSITION	Sample A	Sample B	Sample C	DEGREES SOUTH	31°34'09.0"
	FACE			DEGREES EAST	29°32'41.1"
DESCRIPTION	dk R	dk Y	dk R	EST. VOL. INSITU m³	
	cl	Ms	cl	EST. VOL. STOCKPILE m³	

SAMPLE ANALYSIS

% PASSING 37.5 mm	100	100	100	BORROWPIT SKETCH
26.5 mm	100	100	100	
4.75 mm	99	74	100	
2.00 mm	96	61	99	REMARKS: Not to scale
0.425 mm	82	48	81	
0.075 mm	65.8	28.9	64.6	
LIQUID LIMIT	46	35	44	
PLASTICITY INDEX	15	11	13	**AS ATTACHED**
LINEAR SHRINKAGE	7.5	6	7	
M.D.D.	1596	1840	1566	
O.M.C.	21.8	15.8	26.4	
C.B.R. @ 100%	2	16	7	
C.B.R. @ 98%	1	13	6	
C.B.R. @ 95%	1	10	6	
C.B.R. @ 93%	1	8	6	
C.B.R. @ 90%	1	6	6	
SWELL (MAX)	2.45	2.82	1.34	
L.A. ABRASION				
VENTER TEST				
TEXAS BALL MILL				

GRAVEL CHARACTERISTTICS

OVER SIZE INDEX 53mm	0	5	0	A ----- ERRODIBLE MATERIAL
OVER SIZE INDEX 37.5mm	0	5	0	B ----- RAVELS & CORRUGATES
GRADING COEFFICIENT	4	29	1	C ----- RAVELS
SHRINKAGE PRODUCT	615	291	567	D ----- SLIPPERY WHEN WET
CLASS (TRH 20)	D	E	D	E ----- IDEAL

Testing in Accordance With T R H 20

Technical Signatory
J Atterbury

Sample Delivered by Customer
Sampled by Controlab: YES

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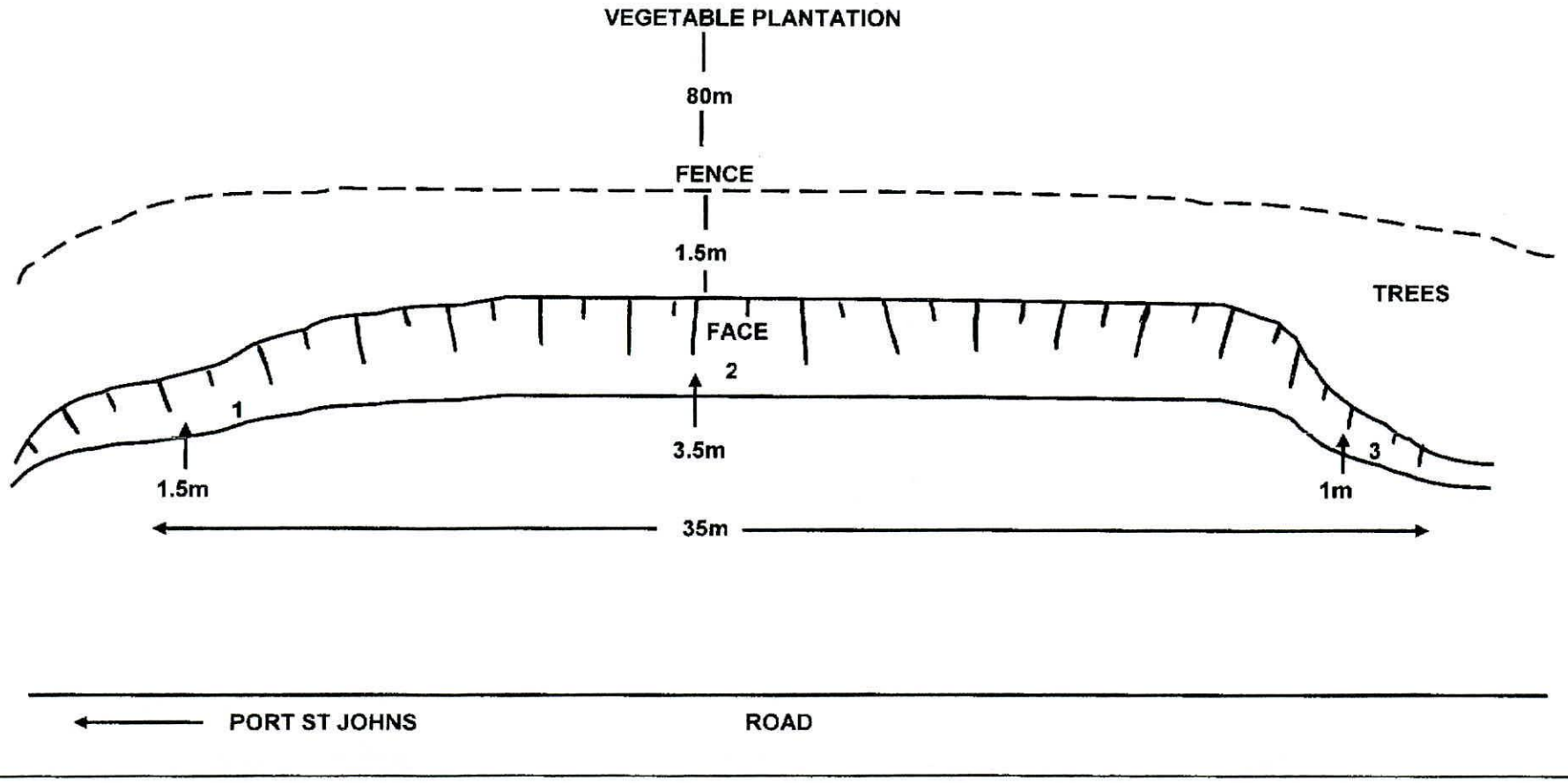
Port Elizabeth
Mthatha

CLIENT: Flux Development Scientists **PROJECT:** BHOLANI VILLAGE

DATE: 2010-01-28 **REF:** UT8047

SKETCH PLAN

REMARKS: Not to scale **BORROW PIT 1** **S 31°34'09.0" E 29°32'41.1"**



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85 Main Road
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ATT: Mr N Ntuzi

PROJECT: BHOLANI VILLAGE
DATE RECEIVED: 2009.12.18
DATE TESTED: 2010.01.26
DATE REPORTED: 2010.01.28
TEST REPORT NO.: UT 8047 **O/N:**

GRAVEL ROADS BORROW PIT DATA REPORT

BORROWPIT NUMBER	BP 2			ROAD NUMBER	
SAMPLE NO.	6974	6975	6976	CHAINAGE	
POSITION	Sample A	Sample B	Sample C	DEGREES SOUTH	31°33'44.8"
	FACE			DEGREES EAST	29°32'09.9"
DESCRIPTION	dk OI + Y	dk OI + Y	dk G + Br	EST. VOL. INSITU m³	
	Ms	Ms	Sh + cl	EST. VOL. STOCKPILE m³	

SAMPLE ANALYSIS

% PASSING 37.5 mm	100	100	100	BORROWPIT SKETCH
26.5 mm	100	100	98	
4.75 mm	78	85	72	
2.00 mm	66	75	66	REMARKS: Not to scale
0.425 mm	53	61	58	
0.075 mm	15.9	42.5	46.2	
LIQUID LIMIT	35	40	34	
PLASTICITY INDEX	14	18	15	
LINEAR SHRINKAGE	7.0	9.0	7.5	
M.D.D.	1726	1665	1978	**AS ATTACHED**
O.M.C.	13.4	17.0	11.2	
C.B.R. @ 100%	2	1	19	
C.B.R. @ 98%	2	1	19	
C.B.R. @ 95%	2	1	19	
C.B.R. @ 93%	2	1	19	
C.B.R. @ 90%	2	1	19	
SWELL (MAX)	2.46	2.96	0.36	
L.A. ABRASION				
VENTER TEST				
TEXAS BALL MILL				

GRAVEL CHARACTERISTTICS

OVER SIZE INDEX 53mm	0	0	1	A ---- ERRODIBLE MATERIAL
OVER SIZE INDEX 37.5mm	0	0	2	B ---- RAVELS & CORRUGATES
GRADING COEFFICIENT	27	21	23	C ---- RAVELS
SHRINKAGE PRODUCT	371	549	436	D ---- SLIPPERY WHEN WET
CLASS (TRH 20)	D	D	D	E ---- IDEAL

Testing in Accordance With T R H 20

Technical Signatory: J Atterbury

Sample Delivered by Customer
Sampled by Controlab. YES

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Cape Town
Kokstad
Port Elizabeth
Mthatha

CLIENT: Flux Development Scientists **PROJECT:** BHOLANI VILLAGE

DATE: 2010-01-28 **REF:** UT8047

SKETCH PLAN

REMARKS: Not to scale **BORROW PIT 2** **S 31°33'44.8" E 29°32'09.9"**