SITE SELECTION STUDY FOR
THE PROPOSED NEW TRANSMISSION SUBSTATION
NEAR MAKOPANE IN THE NORTHERN REGION

GEOTECHNICAL REPORT

PRELIMINARY GEOTECHNICAL INVESTIGATION FOR THE SELECTION OF A SITE FOR THE PROPOSED NEW BURUTHO 400/132kV SUBSTATION

May 2010

GEOTECHNICAL INVESTIGATIONS
TRANSMISSION TECHNOLOGY

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APPENDICES

TITLE : GEOTECHNICAL REPORT

PRELIMINARY GEOTECHNICAL INVESTIGATION
FOR THE SELECTION OF A SITE FOR THE
PROPOSED NEW BURUTHO 400/132kV SUBSTATION

PREPARED BY : *Specialist Consultant Geotechnical Investigations*
Transmission Technology

CLIENT : *Land and Rights*
Transmission

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REPORT NO : *GR03-08*

DATE : *May 2010*

Approved :

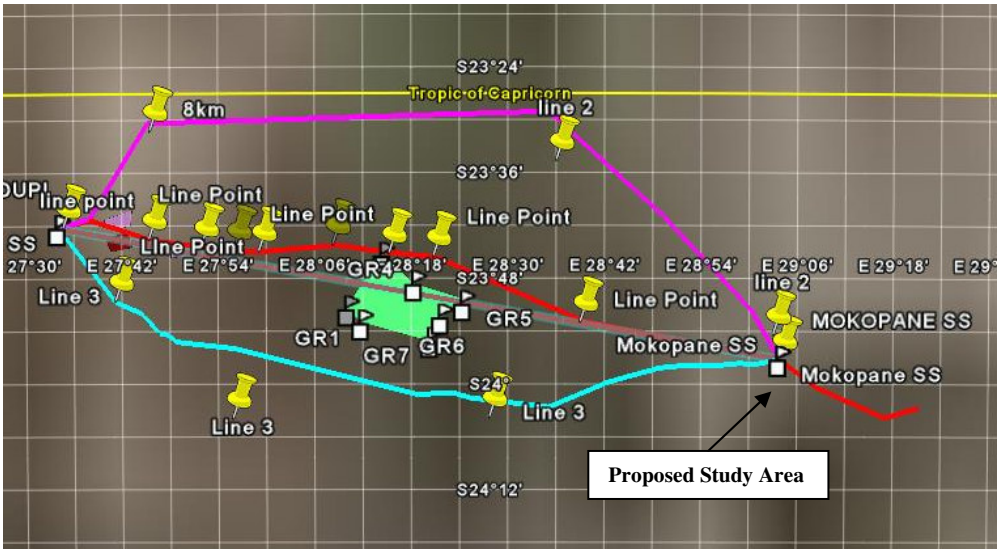
F A Grové

Senior Specialist Consultant
Geotechnical Investigations

1.0 INTRODUCTION

Eskom plans to construct a new 400/132 kV Substation near Makopane in the Northern Region.

It was requested by Transmission System Planning to carry out a site selection study for the proposed new Burutho, 400/132kV Substation, near Makopane in the Northern Region.



PROPOSED STUDY AREA FOR THE NEW BURUTHO 400/132kV SUBSTATION
(Previously referred to Makopane Substation)

Figure-I

A Site for the planned development is required in the area near Makopane. The **first phase** of this investigation included extensive desk studies, where a total number of three most suitable study areas were identified for the substation. For the selection of these study areas during the desk studies, factors such as the geology, topography, farming activities, mining activities, Eskom installations and power line servitude routes were considered.

Information collected during this investigation is **suitable for site selection purposes,** and once the final design is required, a **Detailed Geotechnical Investigation** will be required to provide design parameters and confirm findings of this investigation..

2.0 THE NATURE OF THE PROJECT

The project comprises the construction of a new Substation in the Mashashane area, approximately 35km to the north of Mokopane town in the Limpopo Province.

The development would include the installation of typical equipment such as:

- Electrical transformers
- Circuit breakers or line termination structures
- High-voltage switchgear
- Low voltage switchgear
- Surge & lightning protection equipment
- Control and metering equipment
- Access roads and buildings

3.0 OBJECTIVES OF THE INVESTIGATION

The objectives of this investigation were defined as follows:

- Conduct intensive desk studies of the area to identify a total number of three most suitable sites for the proposed new substation
- Obtain geotechnical information during a Preliminary Geotechnical Investigation of selected sites to confirm findings of the desk study for suitability evaluation of sites

4.0 DESK STUDY

41 Maps Consulted

An attempt was made to collect as much information as possible of the study area demarcated by Transmission System Planning, for the proposed new substation during the desk study. For this purpose the following maps were consulted:

i)`Topographical Maps – 2328DD LIMBURG; 2329CC MASHASANE
ii) Ortho Photos – Covering the area
iii) Geological Map – Geological Map 2328 Pietersburg
iv) Mining - Mineral Map of the Bushveld Complex – South Africa
With Special reference to Platinum and Chrome Simplified Geology, Selected Mines and Mineral Deposits – South Africa, Lesotho and Swaziland

4.2 Aerial Photographic Interpretation

In principle the following features are being studied, information being obtained and interpreted when studying aerial photographs for geotechnical purposes:

- Reflection of the action of nature in creating the existing conditions
- Grouping of materials according to certain patterns
- Definition of various boundaries and linear features of significance
- Field checking by visual inspection

Stereo-interpretation has a great advantage over interpretation of a single photograph, because it is better able to identify topographical and erosion features, grey tones, and textures have greater requisite clarity contrasts. Basically, two aspects of the air photo image are revealed in the stereo-model of a given area, and these are surface form and grey tone, which could be subdivided as:

a) Elements of Surface Form
- Topographic form
- Drainage form
- Erosion form

b) Elements of Grey tone and Texture of :
- vegetation
- due to land use
- soil and rock material

Geotechnical information obtained in this way was correlated with Geological Map data.

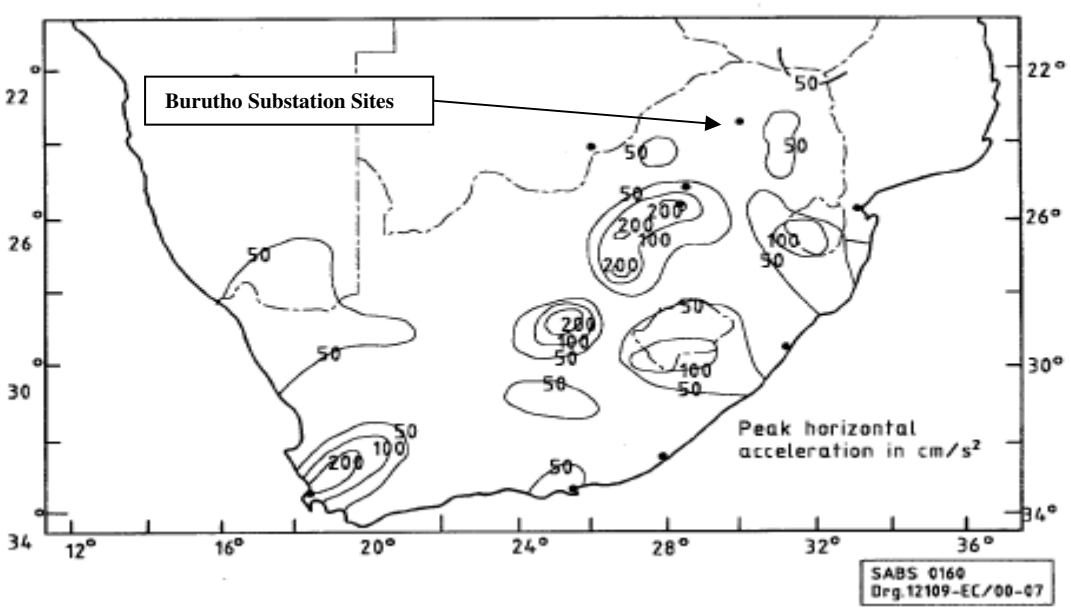
4.3 Review of Desk Study and Selection of Sites

The size of the substation platform is 338m x 354,2m. For the purpose of flexibility site areas selected are of the order of 700mx700m. The region is known for its platinum and chrome mining activities. It has been confirmed by the EIA studies that

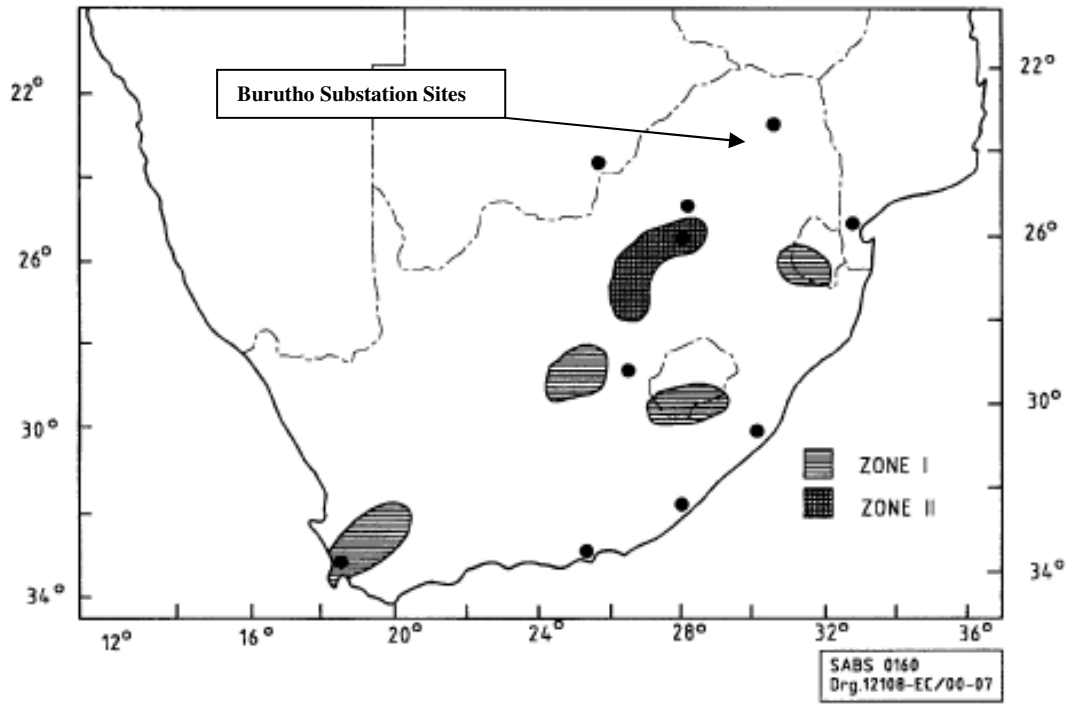
the sites selected for this study are not located in future mining fields. It should be noticed that the load centre area is limited in site options due to extreme topographical constraints.

4.4 Seismic Zoning

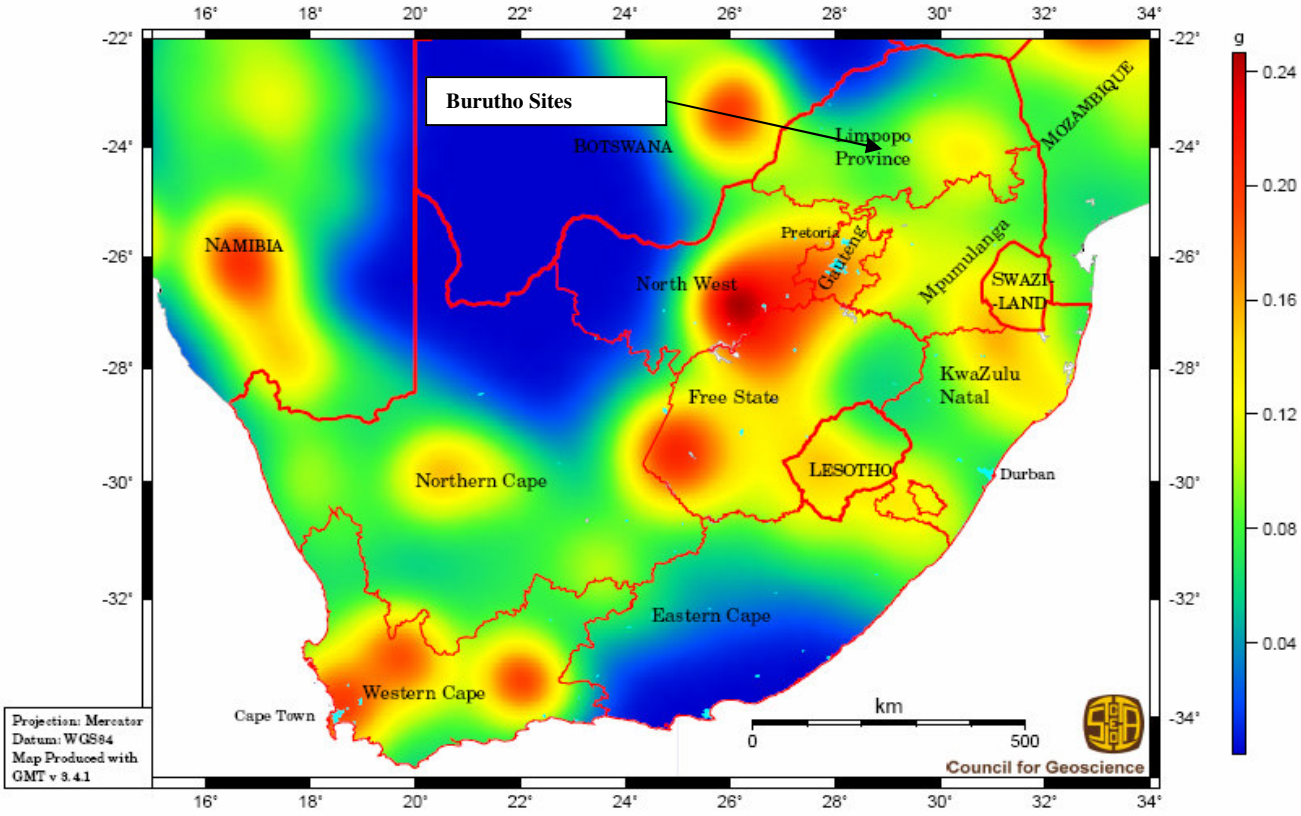
The South African loading code, SANS 10160 – 1969 (Figure-IIa and IIb) , shows that the proposed sites for this study are situated in an area where the peak ground acceleration with a 10% probability of being exceeded in a 50 year period is between 50cm/sec² and 100cm/sec². Figure-IIb also show the zones where detailed seismic design (Zone-I) and compliance with minimum requirements (Zone-II) are specified by the code. The proposed Burutho sites fall outside of these Zones.



SEISMIC HAZARD MAP OF SA ***Figure-IIa***



SEISMIC HAZARD ZONES OF SA ***Figure-IIb***



4.1 MAP 1: SEISMIC HAZARD MAP OF SOUTH AFRICA
(INCLUDING THE KINGDOMS OF LESOTHO AND SWAZILAND)
Peak ground acceleration (g) with a 10 % probability of being exceeded in a 50 year period

Figure-III

More recent data produced by the Council of Geoscience place the sites within the zone where the minimum seismic event, with a 10% probability of being exceeded in a 50 year period, falls in the range of 0,07g to o,10g (Figure-III). This data however, still needs to be verified.

5.0 LOCALITY OF SITES INITIALLY SELECTED

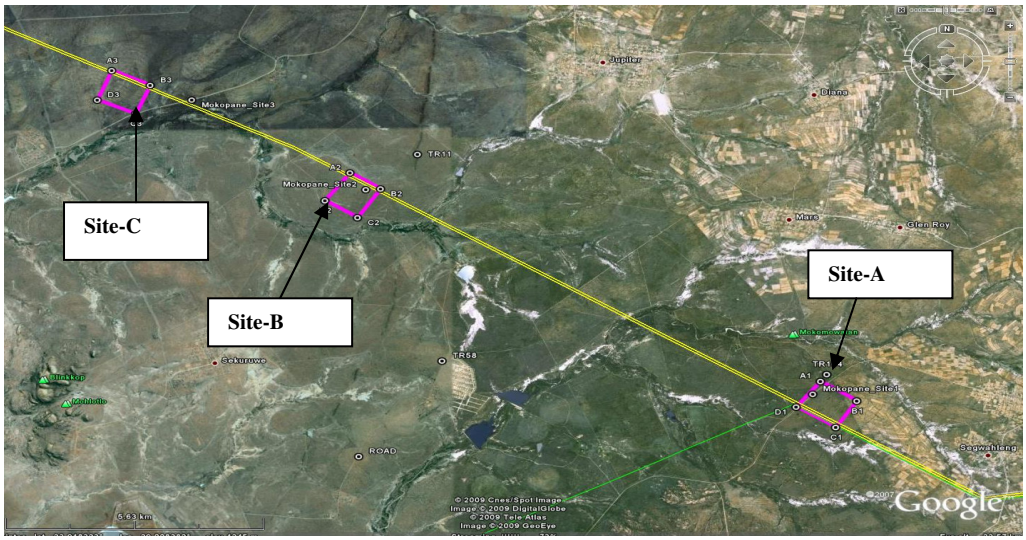


Figure-IV

It should be noted that options for suitable sites are limited in the Study Area due to extreme topographical constraints, which entails hillocks, water ways, perennial and non-perennial water streams and no road infrastructure.

For this reason, considering costs to develop **Site-A, Site-A** was rejected at an early stage due to extreme access and topographical difficulties and related costs. It was obvious to have geotechnical studies carried out for only Site-B and Site-C.

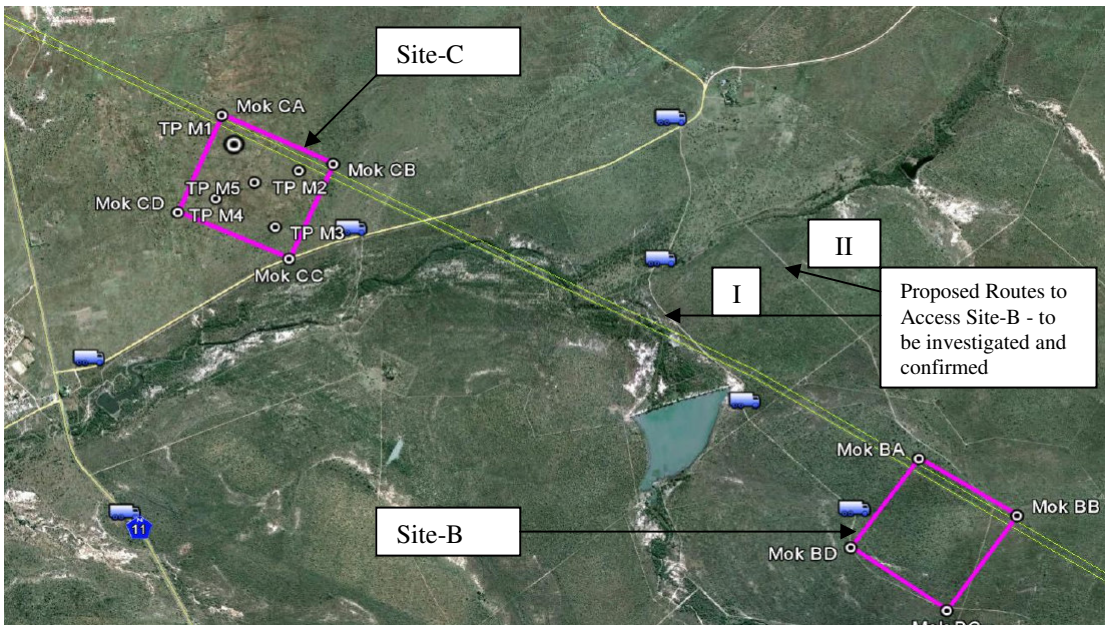


Figure-V

POSITIONING OF SITE-B AND SITE-C
SHOWING ACCESS TO SITES FROM THE N11

Site-C can easily be accessed from the N11 as indicated in ***Figure-V***. To access **Site-B** will require a further investigation to obtain approval for road servitude options as indicated (**Option-I and Option-II).** Both these route options should be topographically surveyed and be evaluated in terms of flood lines and construction costs.

The identification and evaluation of the preferred access route does not form part of this preliminary Geotechnical Investigation.

Site-B and Site-C are located on the farms Noord Braband 774 LR and Zuid Holland 773 LR respectively. Site coordinates are:

Site-B S 23˚ 53' 42" E 28˚ 58` 30.4 "
Site-C S 23˚ 52' 21.8" E 28˚ 55` 34 "

6.0 REGIONAL ENVIRONMENT

6.1 Geography

6.1.1 Topography and Drainage

Waving topography with the presence of hillocks, hills and water ways forms features of the region. The two sites selected for final evaluation purposes are located within a 6 km radius. **Site-B** is located on a high, well drained and has no risk of flooding. **Site-C** is partly located within the 1:50 year flood line, and subject to a risk of being flooded. Access to Site-B is problematic since a road servitude needs to be located without a risk of flooding. This access road will cross a non-perennial water way which will require careful design.

The **slope** traversing **Site-B in a north to south direction away from the hillock is ±2,5%** and **Site-C** is located on a gentle, south western slope, of ±2,0%.

6.1.2 Flood –line

Flood line studies carried out indicate Site-C to have a risk of being flooded with a 1:50 year flood. Site-B has no risk of flooding.**(See Appendix-A)**

6.1.3 Climate

N-Value

*The "Weinert N-Value", that describes the climatic environment, is approximately 4 for the area. Where **"N" is more than "5",** disintegration is the prominent form of weathering, and where **"N" is less than "5",** decomposition affects those rocks whose minerals are liable to change chemically under atmospheric conditions.*

Rainfall

The average annual rainfall of the study areas is 505.3mm

. *Vegetation*

Both sites are covered with typical indigenous bush of the area, re grass, bush and trees.

6.2 Geology

The regional geology comprises Gneiss, Migmatite and Leucogranite. The solid geology of the sites investigated is masked by transported silty sands at shallow depths. The solid geology is considered decomposed to highly weathered at shallow depths, Gneiss. (Geological Map 2328 Pietersburg)

6.3 Water Table

No evidence of a shallow water table was observed on any of the sites.

7.0 THE INVESTIGATION

7.1 Topographical Survey

Topographical surveys of sites were carried out to enable preliminary geometric designs. This forms an important part of the geotechnical evaluation of sites, since ground elevations will be altered, due to the cut to fill operations during construction of the platform.

7.2 Geometric Design

Preliminary geometric designs were carried out for all three sites, at positions considering the optimisation of the topography and existing and future power line routes. These designs expose valuable information in terms of construction costs.

7.3 Exploratory Work

Test pits were excavated randomly to maximum reach or refusal, to confirm findings of the desk study, in terms of geotechnical properties.

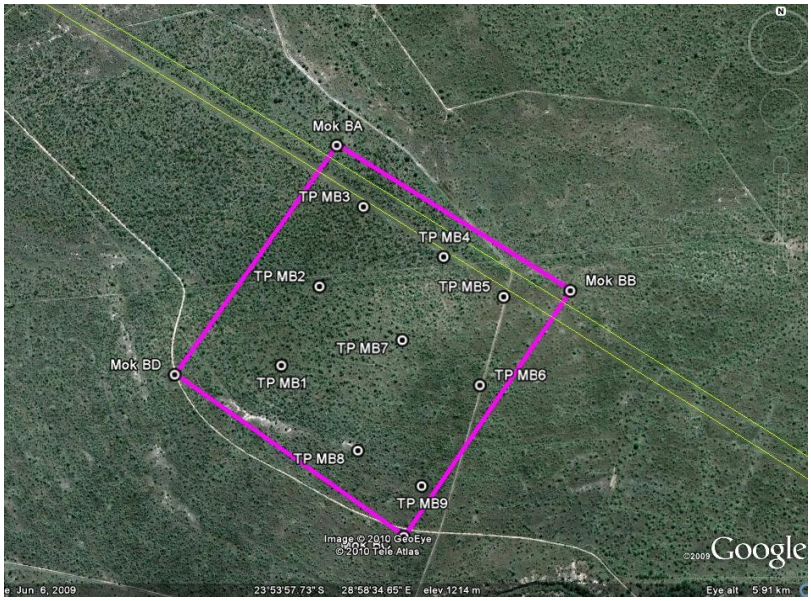


Figure-VI

SITE-B TEST PIT POSITIONING

The average soil profile was found uniformly present over the sites, with discrepancies regarding the material occurrences and physical properties with depth.

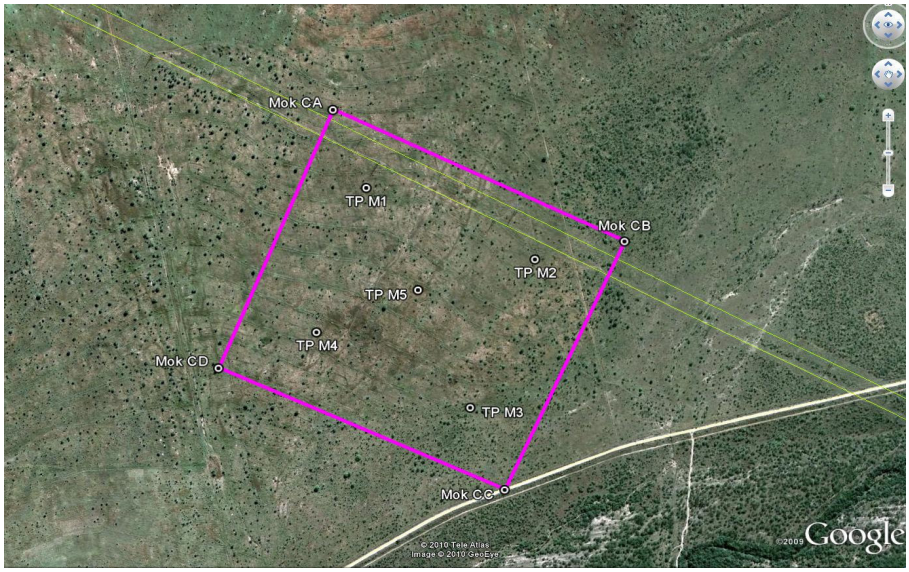


Figure-VII

SITE-C TEST PIT POSITIONING

The exception was that the profile of Site-B was found less weathered with depth than Site-C, with rock outcropping in places.

7.4 Laboratory Testing

Laboratory tests on soil samples were primarily conducted to determine Geotechnical properties of the soil, confirming findings during profiling.

The following tests were carried out:

- Grading (Mechanical and Hydrometer)
- Atterberg Limits

- Moisture Content
- Electrical Conductivity

8.0 GEOTECHNICAL EVALUATION

8.1 Soil Profile

The soil profiles of both sites investigated **(Site-B & Site-C)** are similar, with shallowly weathered rock near surface. However the difference in topography will have a remarkable influence on the cost of the construction of the substation platform on each site.

TABLE - I GEOTECHNICAL PROPERTIES

PROJECT: BURUTHO SUBSTATION - SITE SELECTION

Page No_____,
_____Pages

TP/ BH NO	DEPTH (m)	ATTERBERG LIMITS			GM	PI OF WS	-2 µm %	PE	INSITU PROPERTIES								SOIL CHEMISTRY			COMPACTION						SOIL CLASIFCT	
		LL	PI	LS					Soil Prof Hor izon	% -425	% MC	Gra- vel	Sand	Silt	Clay	Per meab lity cm/s	pH	Con- ducti- vity S/m	Lange lier Index	Insitu BDD kg/m3	MDD kg/m3	CBR % Mod AASHTO 90	93	95	100	Pra	U
TP-M2	0-0,2	20	6	3	0.96	<4	8	L	A		-	11	53	29	5			0.0456								A4(3)	C
TP-M2	0.8-1.3	20	6	3	1.8	<4	1	L	C			26	59	14	1			0.0275								A1-b(0)	S
TP-M3	),1-0.40	19	8	4	1.96	<5	4	L	A			57	23	17	4			0.0322								A2-4(0)	C
TP-M3	0,4-1.40	SP	SP	0.5	2.08	NP	4	L	B			55	31	14	0			0.668								A1-b(0)	S
TP-MB4	0 -0.3	NP	NP	0	1.1	NP	0	L	A			12	57	7	1			0.0208								A4(3)	S
TP-MB4	0.3-0.8	SP	SP	0.5	1.1	SP	0	L	B			77	20	3	0			0.019								A1-a(0)	C
TP-MB4	0.8-1.1	NP	NP	0	2.19	NP	0	L	B			56	37	7	0			0.0187								A1-a(0)	S

LEGEND

TP	- Test Pit	e	- Void Ratio	T - TRANSPORTED MATERIAL	
BH	- Borehole	LS	- Linear Shinkrage	P-1	ALLUVIUM (First Horizon)
LL	- Liquid Limit	GM	- Grading Modul	P-2	ALLUVIUM (Second Horizon)
PI	- Plastic Index	µm	- Clay Fraction		
PI/WS	- PI of Whole Sample	PE -	- Potential Expansiveness		
		MDD	- Maximum Dry Density kg/m3		
		W	- Weston (Heave Prediction)		

Laboratory testing confirmed geotechnical properties and findings during profiling of test pits.

8.2 Geology Influences on Construction

It is believed that the combination of ground conditions and topography of **Site-B and C** will have **a great affect** on conventional construction methods. Both sites are shallowly underlain by **SOFT ROCK.** However, the steeper sloping of the **topography of Site-B** will have a vast influence on the difference in construction costs of the platform. In addition the construction of an access road of at least 5km is required to access Site-B.

8.2 Water Table

No evidence of a shallow **perched water table was found during the field investigation.**

8.3 Topography - Preliminary Substation Positioning and Geometry (Earthworks Volumes)

An attempt was made to optimise the positioning of the substation platform on both sites, considering topography and power line locality ***(See Appendix-D)***

Topographical features and present soil information of each site were taken into account during this exercise. The following volumes for earthworks were obtained during this exercise for each site:

Site	Strip m³	Cut m³	Fill m³	Special Measures
Site-A	15 570	168 370	151 135	Construction of Access Road ± 10km
Site-B	13 655	42635	33 305	Borrow material required to Construct the Substation Platform + 5km Access Road
Site-C	13 165	14 555	11 455	None – Access Road 600m

From the preliminary quantities it is clear that **Site-C will be the most cost effective** site to develop, ignoring the risk of flooding and the costs to develop **Site-A** is abnormally high. Considering all costs to develop sites and risks involved **Site-B** would be the most suitable site to develop.

Attached to this report are preliminary geometric designs, indicating optimised platform positioning for each site **(Appendix-D).** Combining the geometry of the topography with the ground conditions of each site **(only Site-B & Site-C)** it is clear that a vast quantity of rock will be excavated from **Site-B**, during a cut to fill operation. This will result in the need to import borrow material to replace unsuitable rock from cut. It is estimated with information at hand that a minimum of 15 000m³ of rock from cut will be unsuitable for the construction of the fill.

8.4 Flood Line Studies

Flood line studies have revealed that Site-A and Site-B have no risk of flooding but Site-C has an apparent risk of being flooded during a 1:50 year flood.

9.0 CONCLUSIONS AND RECOMMENDATIONS

Considering the results of all the studies carried out during this investigation it is clear that Site-C is the most cost effective site to develop, not considering the risk of flooding. Though Site-B will be more costly site to develop it has no risk of being flooded.

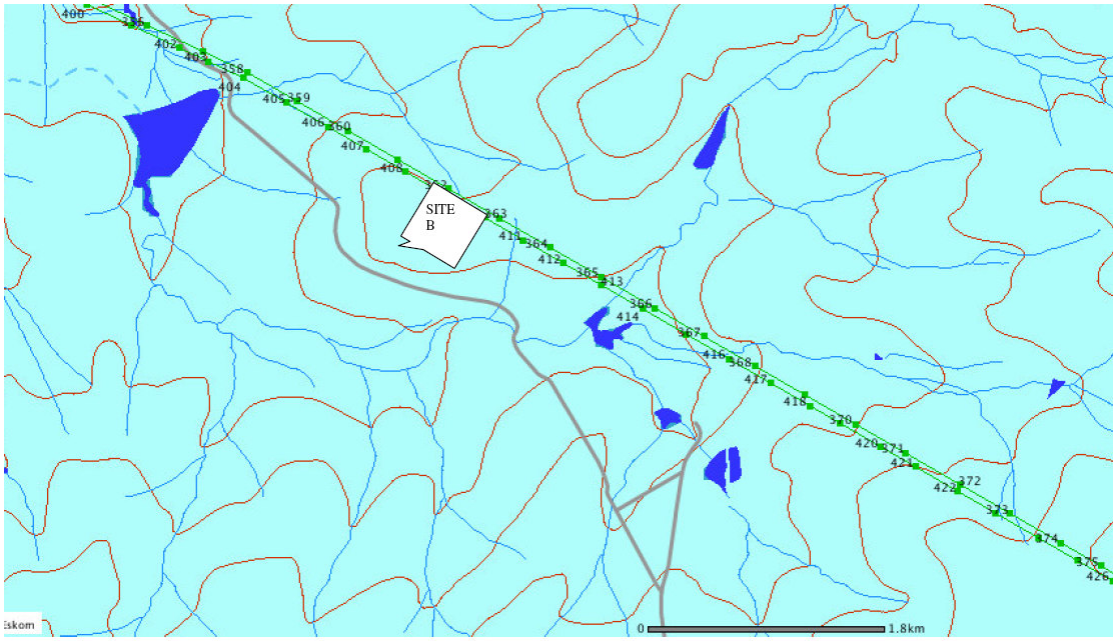
9.0 REFERENCES

9.1 Jennings Brink & Williams (1973). Revised Guide to Soil Profiling for Civil Engineering purposes in South Africa. The civil Engineer in S.A. Jan. 1973.

APPENDIX-A

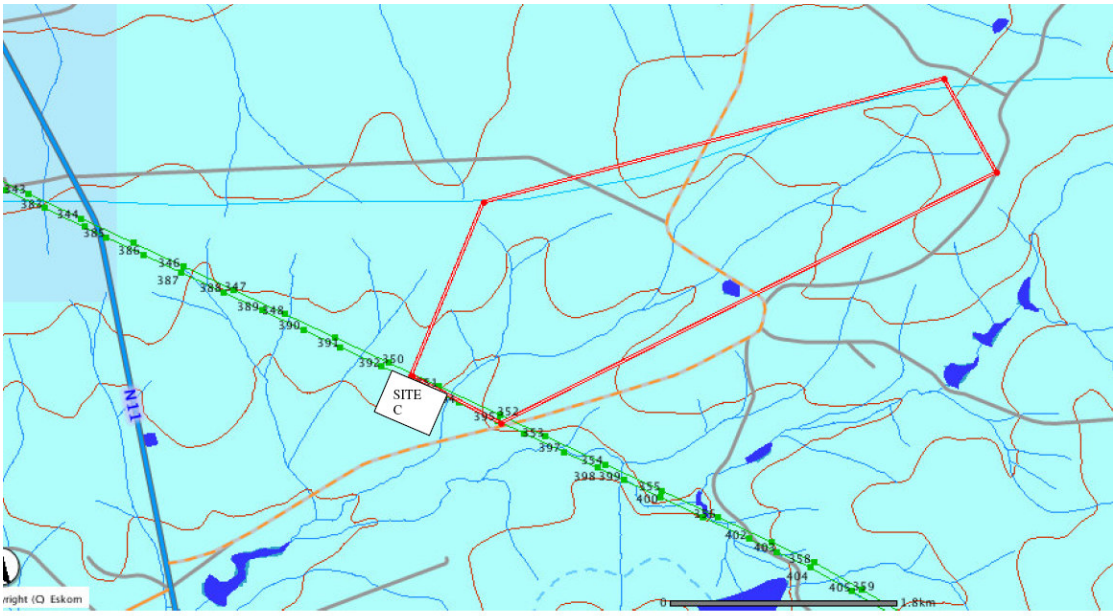
Flood line Studies

Burotho Sites



MOKOPANE SITE-B

SITE B IS SITUATED CLOSE TO A RIDGE AND THEREFORE HAS A VERY SMALL CATCHMENT WHICH DELIVERS A MAXIMUM FLOW OF 7.10 CUBIC METERS PER SECOND IN A 1:50 FLOOD. THE NEAREST WATER COURSE IS 120 METERS AWAY FROM THE SITE AND THE EXPECTED WIDTH A FLOW IS ONLY 27.5 METERS WHICH MEANS THAT THIS SITE HAS NO DANGER OF FLOODING UNDER A 1:50 YEAR FLOOD.



MOKOPANE SITE-C

SITE C IS SITUATED CLOSE TO A TRIBITURY WHICH HAS A CATCHMENT OF 4.73 SQUARE KILOMETERS WHICH DELIVERS A MAXIMUM FLOW OF 42.3 CUBIC METERS PER SECOND IN A 1:50 FLOOD. THE NEAREST WATER COURSE IS 20.4 METERS AWAY FROM THE SITE AND THE EXPECTED WIDTH A FLOW IS 51.5 METERS WHICH MEANS THAT THIS SITE HAS AN APPARENT POSSIBILITY OF FLOODING UNDER A 1:50 YEAR FLOOD.

APPENDIX - B
SOIL PROFILES

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-C
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

LEGEND
Sheet 1 of 1

JOB NUMBER: GR03-08

	BOULDERS	{SA01}
	GRAVEL	{SA02}
	SAND	{SA04}
	SANDY	{SA05}
	SILT	{SA06}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	GRANITE	{SA17}{SA44}
Name	DISTURBED SAMPLE	{SA38}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION :
DIAM :
DATE :
DATE :

DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION :
X-COORD :
Y-COORD :

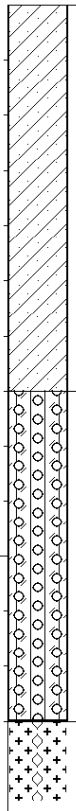
LEGEND
SUMMARY OF SYMBOLS

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-C
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-M1
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00 Dry,light grey, shattered, sandy CLAY with roots and organic material.
Transported

0.70 Dry,light yellowish olive, very dense, intact, micaceous, fine gravel in a clayey SILT
Residual Gneiss

1.30 Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
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DATE : 21/02/10
DATE : 08/06/10 13:05
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ELEVATION : NGL
X-COORD : 7520
Y-COORD : 2641194

HOLE No: TP-M1

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-C
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-M2
Sheet 1 of 1

JOB NUMBER: GR03-08

0.00

Dry, brown, medium dense, intact, clayey SAND with roots and organic material.
Topsoil

0.20

Dry, light greyish, very dense, intact, quartz GRAVEL in a clayey sand.
Residual Gneiss

0.80

Dry, dark yelowish, fractured very soft ROCK GRANITE GNEISS

1.30

Refusal on MEDIUM HARD ROCK GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

2) Disturbed Sample take at 0--0,2m

3) Disturbed Sample take at 0,8--1,3m

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ

TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 21/02/10

DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

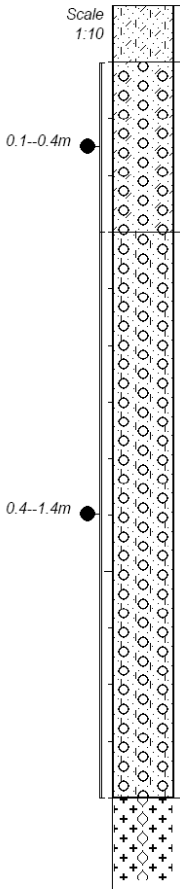
ELEVATION : NGL
X-COORD : 7047
Y-COORD : 2641405

HOLE No: TP-M2

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-C
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-M3
Sheet 1 of 1

JOB NUMBER: GR03-08



Dry, yellowish brown, medium dense, intact, slightly clayey silty SAND with roots and organic material.
Topsoil

Dry, drtak brown, dense, intact, ferruginised quartz GRAVEL in a clayey sand.
Pebble Marker

Dry, dark olive, very dense, intact, ferruginised in places, GRAVEL in a silty sand.
Residual Gneiss

Refusal on MEDIUM HARD ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees

2) Disturbed Sample take at 0,1--0,4m

3) Disturbed Sample take at 0,4--1,4m

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

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DIAM : Trench Pit
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DATE : 21/02/10
DATE : 08/06/10 13:05
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ELEVATION : NGL
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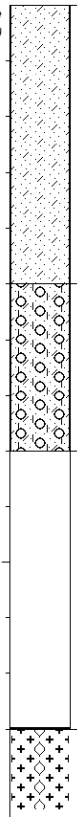
Y-COORD : 2641850

HOLE No: TP-M3

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-C
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-M4
Sheet 1 of 1

JOB NUMBER: GR03-08



0.00 Slightly moist, light yellowish, medium dense, intact, clayey fine SAND with roots and organic material in top 300mm.
Topsoil

0.50 Dry, dark yelowish stained light grey, intact, well developed fe gravel in a slightly clayey silty sand.
Transported

0.80 Dry, dark yelowish, fractured very sOFT ROCK Gneiss

1.30 Refusal on MEDIUM HARD ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

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DIAM : Trench Pit
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ELEVATION : NGL
X-COORD : 7664
Y-COORD : 2641624

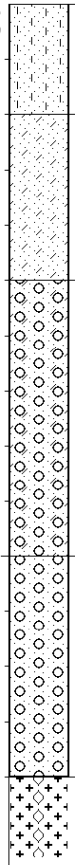
HOLE No: TP-M4

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-C
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-M5
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00	Dry, light brown, medium dense, intact, silty SAND wit roots and prganic materiial. Top Soil
0.20	Dry, light brown, medium dense, intact, slightly clayey SAND with roots and organic material in top. Transported
0.50	Slightly moist to moist, dark red black mottled, very dense, intact,ferruginised quartz GRAVEL in a clayey sand. Pebble Marker
1.00	Dry, light brown stained black and dark yellow, very dense, intact, well cemented, GRAVEL in a sity sand. Residual Gneiss
1.40	Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 21/02/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 7376
Y-COORD : 2641497

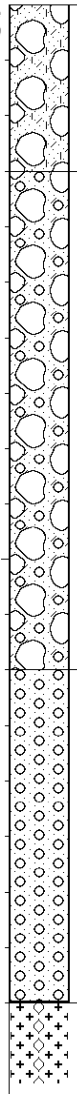
HOLE No: TP-M5

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB1
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00 Dry, light brown, medium dense, intact, slightly clayey silty SAND with roots and organic material in top 200mm, with BOULDERS.
Transported

0.30 Dry,speckIled white,yellowish orange and light brown, dense,intact,quartz GRAVEL and BOULDERS in a slightly clayey sand.
Residual Gneiss

1.20 Dry,light greyish, dense,intact,fine to medium GRAVEL in sity sand.
Residual Granite

1.80 Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2700
Y-COORD : 2641929

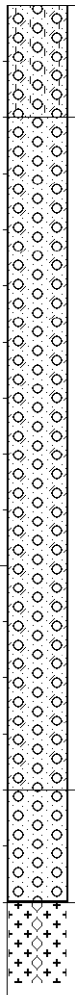
HOLE No: TP-MB1

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB2
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00 Dry, light brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material in top 200mm.
Transported

0.20 Dry, speckIled white red yellowish orange and light brown, very dense, intact,medium to coarse GRAVEL in a slightly clayey sand.
Residual Granite

1.40 Dry, light greyish, very dense, intact, fine to medium GRAVEL in sity sand.
Residual Gneiss

1.60 Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2586
Y-COORD : 2644106

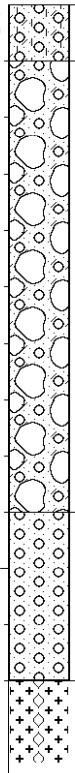
HOLE No: TP-MB2

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB3
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00	Dry, light brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material in top 200mm. Transported
0.10	Dry, speckIled white,red, yellowish orange and light brown, very dense, intact, medium to coarse GRAVEL and BOULDERS in a slightly clayey sand. Pebble Marker
0.90	Dry,light greyish, very dense,intact,fine to medium GRAVEL in sity sand. Residual Gneiss
1.20	Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2456
Y-COORD : 2643866

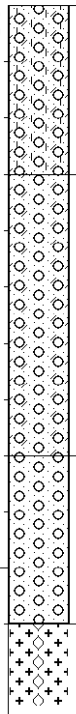
HOLE No: TP-MB3

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB4
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00

Dry, light greyish brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material.
Transported

0.30

Dry, light brown, very dense, intact,medium to coarse GRAVEL in a slightly clayey sand.
Pebble Marker

0.80

Dry, light greyish, very dense, intact, fine to medium GRAVEL in sity sand.
Residual Gneiss

1.10

Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2216
Y-COORD : 2644016

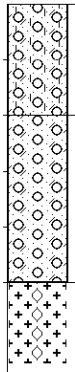
HOLE No: TP-MB4

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB5
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00 Dry, light greyish brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material.
Transported

0.20 Dry, light brown, very dense, intact,micaceous, medium to coarse GRAVEL in a slightly clayey sand.
Residual Granite

0.50 Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2036
Y-COORD : 2644135

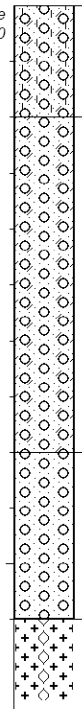
HOLE No: TP-MB5

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB6
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00

Dry, light greyish brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material.
Transported

0.20

Dry, light brown, very dense, intact,medium to coarse GRAVEL in a slightly clayey sand.
Pebble Marker

0.80

Dry, light greyish, very dense, intact, fine to medium GRAVEL in sity sand.
Residual Granite

1.10

Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2107
Y-COORD : 2644401

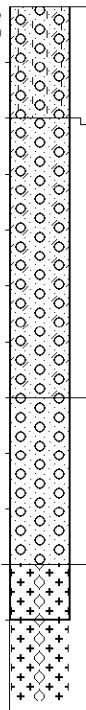
HOLE No: TP-MB6

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB7
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00 Dry, light greyish brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material.
Transported

0.20 Dry, light brown, very dense, intact,medium to coarse GRAVEL in a slightly clayey sand.
Pebble Marker

0.70 Dry, light greyish, very dense, intact, fine to medium GRAVEL in sity sand.
Residual Granite

1.00 Refusal on SOFT ROCK GRANITE GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2340
Y-COORD : 2644264

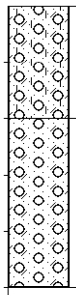
HOLE No: TP-MB7

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB8
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00

Dry, light greyish brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material.
Transported

0.20

Dry, light brown, very dense, intact,medium to coarse GRAVEL in a slightly clayey sand.
Residual Granite

0.50

Refusal on HARD ROCK GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

2) Trees100mm to 300mm

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2340
Y-COORD : 2644264

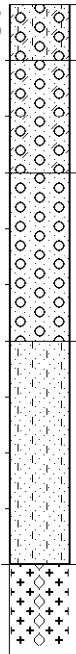
HOLE No: TP-MB8

PROJECT: BURUTHO SUBSTATION SITE SELECTION-SITE-B
Done by: Specialist Consultant
Geotechnical Investigations
TRANSMISSION TECHNOLOGY

HOLE No: TP-MB9
Sheet 1 of 1

JOB NUMBER: GR03-08

Scale 1:10



0.00	Dry, light greyish brown, medium dense, intact, quartz GRAVEL in a slightly clayey silty SAND with roots and organic material. Transported
0.10	Dry, light brown, very dense, intact,medium to coarse quartz GRAVEL in a slightly clayey sand. Pebble Marker
0.30	Dry, light yellowish speckled brown and white, very dense, intact, fine to medium GRAVEL in sity sand. Residual Gneiss
0.60	Dry, light grey, very dense, intact, fine GRAVEL in a silty sand Residual Gneiss
1.00	Refusal on SOFT ROCK GRanite GNEISS

NOTES

1) Area covered with dense indigineos grass bush and trees.

CONTRACTOR : Tyris Plant Hire
MACHINE : CAT 428C
DRILLED BY :
PROFILED BY : FA GrovÈ
TYPE SET BY :
SETUP FILE : PROF-1.SET

INCLINATION : VERTICAL
DIAM : Trench Pit
DATE :
DATE : 15/03/10
DATE : 08/06/10 13:05
TEXT : ..C:\GEOFRED\MAKPTPPF.TXT

ELEVATION : NGL
X-COORD : 2281
Y-COORD : 2644707

HOLE No: TP-MB9

APPENDIX - C

Laboratory Test Results

CLIENT : ESKOM TRANSMISSION

PROJECT : BUROTHO (MAKOPANE) SUBSTATION

PROJECT NO. : S10-0401

DATE : 2010-04-01

CONDUCTIVITY

Soillab No	Sample Position	Sample Depth (m)	Electrical Conductivity S/m
S10-0401-01	TP-M2	0-0.2	0.0456
S10-0401-02	TP-M2	0.8-1.3	0.0257
S10-0401-03	TP-M3	0.1-0.4	0.0311
S10-0401-04	TP-M3	0.4-1.4	0.0668
S10-0401-05	TP-MB4	0-0.3	0.0208
S10-0401-06	TP-MB4	0.3-0.8	0.0190
S10-0401-07	TP-MB4	0.8-1.1	0.0187

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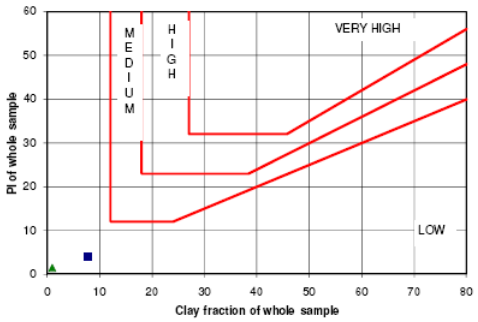
230 Albertus Street
La Montagne 0184
Tel (012) 481-3999
P O Box 72928
Lynnwood Ridge 0040
Fax (012) 481-3812

PARTICLE SIZE ANALYSIS

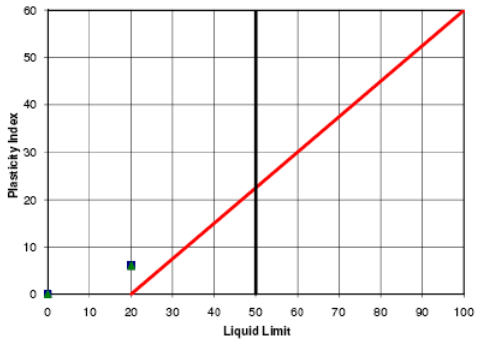
Sample No.	44362	44363
Soillab sample no.	S10-0401-01	S10-0401-02
Depth (m)	0-0.2	0.8-1.3
Position	TP-M2	TP-M2
Material Description	DARK BROWN QUARTZ SILTY SAND	DARK OLIVE DOLERITE GRAVELLY SAND
Moisture (%)	4.2	3.4
SG		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	100	100
4.75 mm	95	93
2.00 mm	89	74
0.425 mm	65	24
0.075 mm	50	22
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	18	5
0.027 mm	16	4
0.013 mm	13	2
0.005 mm	12	2
0.002 mm	8	1
% Clay	8	1
% Silt	29	14
% Sand	53	59
% Gravel	11	26
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit	20	20
Plasticity Index	6	6
Linear Shrinkage (%)	3.0	3.0
Grading Modulus	0.96	1.80
Classification	A-4 (3)	A-1-b (0)
Unified Classification	CL-ML	SC & SM
Chart Reference		

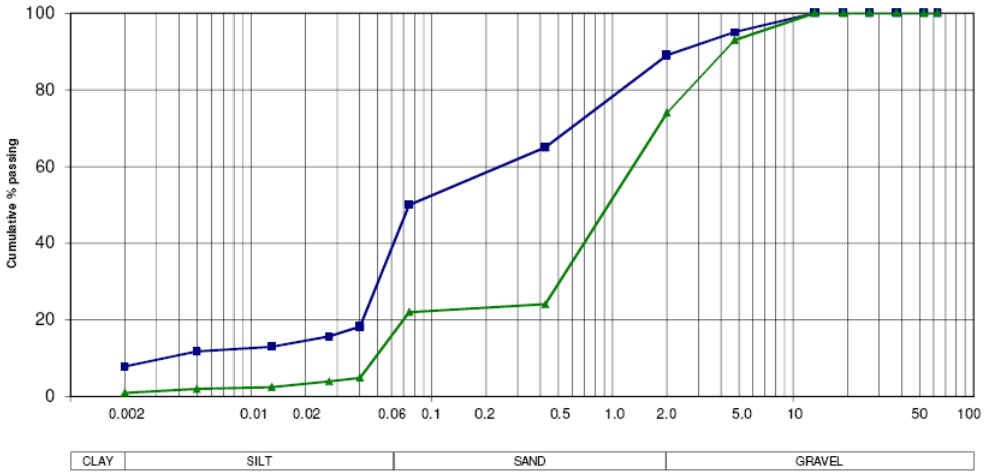
PROJECT : BUROTHO (MAKOPANE) SUBSTATION
JOB No. : S10-0401
DATE : 2010-04-22

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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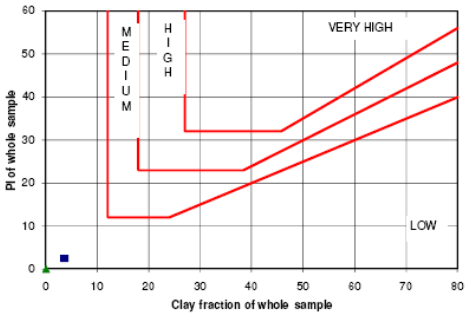
Lynnwood Ridge 0040
Fax (012) 481-3812

PARTICLE SIZE ANALYSIS

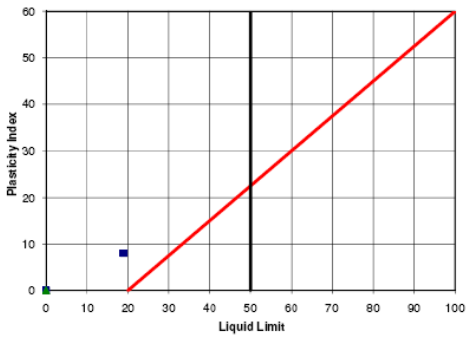
Sample No.	44364	44365
Soillab sample no.	S10-0401-03	S10-0401-04
Depth (m)	0.1-0.4	0.4-1.4
Position	TP-M3	TP-M3
Material Description	DARK BROWN QUARTZ SANDY GRAVEL	DARK BROWN RHYOLITE SANDY GRAVEL
Moisture (%)	3.0	6.6
SG		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	100
26.5 mm	100	100
19.0 mm	100	100
13.2 mm	94	92
4.75 mm	57	63
2.00 mm	43	45
0.425 mm	31	25
0.075 mm	28	22
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	10	5
0.027 mm	8	3
0.013 mm	7	2
0.005 mm	6	1
0.002 mm	4	0
% Clay	4	0
% Silt	17	14
% Sand	23	31
% Gravel	57	55
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit	19	
Plasticity Index	8	SP
Linear Shrinkage (%)	4.0	0.5
Grading Modulus	1.98	2.08
Classification	A-2-4 (0)	A-1-b (0)
Unified Classification	GC	SM
Chart Reference		

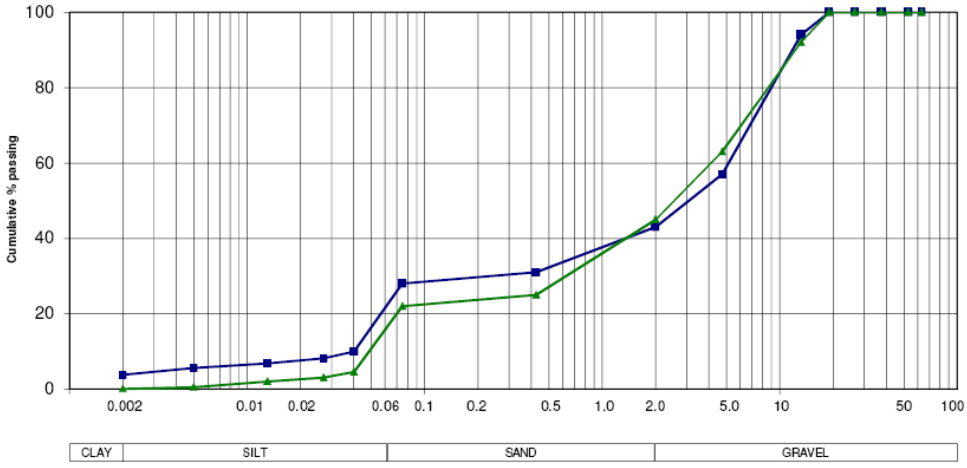
PROJECT : BUROTHO (MAKOPANE) SUBSTATION
JOB No. : S10-0401
DATE : 2010-04-22

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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Lynnwood Ridge 0040
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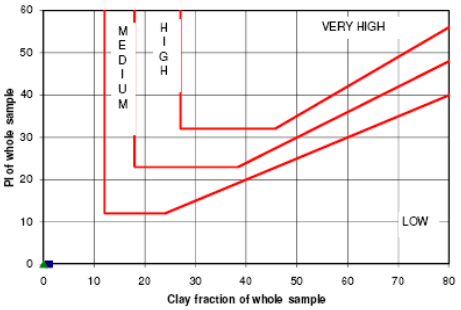
PARTICLE SIZE ANALYSIS

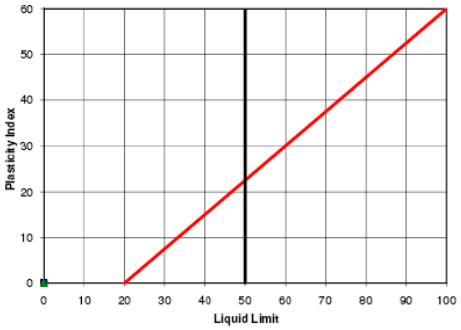
Sample No.	44366	44367
Soillab sample no.	S10-0401-05	S10-0401-06
Depth (m)	0-0.3	0.3-0.8
Position	TP-MB4	TP-MB4
Material Description	DARK BROWN QUARTZ SILTY SAND	DARK BROWN QUARTZ SANDY GRAVEL
Moisture (%)	1.1	1.0
SG		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	100
53.0 mm	100	100
37.5 mm	100	89
26.5 mm	100	75
19.0 mm	100	66
13.2 mm	100	53
4.75 mm	96	32
2.00 mm	88	23
0.425 mm	53	14
0.075 mm	49	4
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	6	2
0.027 mm	5	1
0.013 mm	4	1
0.005 mm	3	0
0.002 mm	1	0
% Clay	1	0
% Silt	30	3
% Sand	57	20
% Gravel	12	77
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	SP
Linear Shrinkage (%)	0.0	0.5
Grading Modulus	1.10	2.59
Classification	A-4 (3)	A-1-a (0)
Unified Classification	SM	GP
Chart Reference		

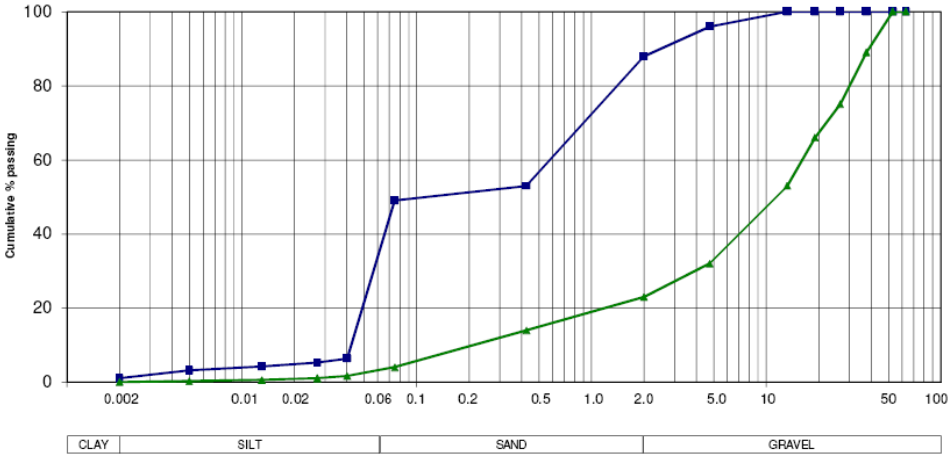
PROJECT : BUROTHO (MAKOPANE) SUBSTATION
JOB No. : S10-0401
DATE : 2010-04-22

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





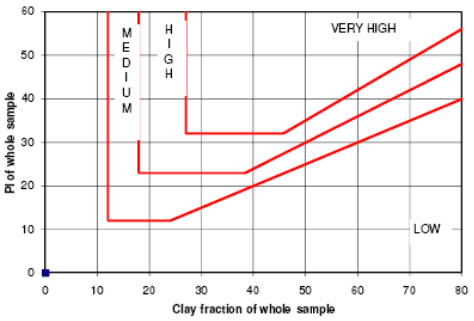
SOILLAB (PTY) LTD
Reg No 1971/000112/07
230 Albertus Street
La Montagne 0184
Tel (012) 481-3999
P O Box 72928
Lynnwood Ridge 0040
Fax (012) 481-3812

PARTICLE SIZE ANALYSIS

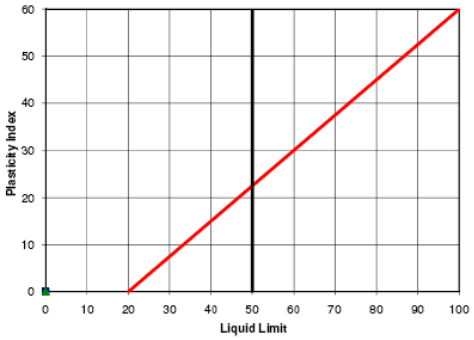
Sample No.	44368	
Soillab sample no.	S10-0401-07	
Depth (m)	0.8-1.1	
Position	TP-MB4	
Material Description	DARK BROWN QUARTZ SANDY GRAVEL	
Moisture (%)	1.0	
SG		
SCREEN ANALYSIS (% PASSING) **(TMH 1 A1(a) & A5)**		
63.0 mm	100	
53.0 mm	100	
37.5 mm	95	
26.5 mm	92	
19.0 mm	84	
13.2 mm	76	
4.75 mm	60	
2.00 mm	44	
0.425 mm	28	
0.075 mm	9	
HYDROMETER ANALYSIS (% PASSING) **(TMH 1 A6)**		
0.040 mm	4	
0.027 mm	3	
0.013 mm	2	
0.005 mm	1	
0.002 mm	0	
% Clay	0	
% Silt	7	
% Sand	37	
% Gravel	56	
ATTERBERG LIMITS **(TMH 1 A2 - A4)**		
Liquid Limit		
Plasticity Index	NP	
Linear Shrinkage (%)	0.0	
Grading Modulus	2.19	
Classification	A-1-a (0)	
Unified Classification	SW & SC	
Chart Reference		

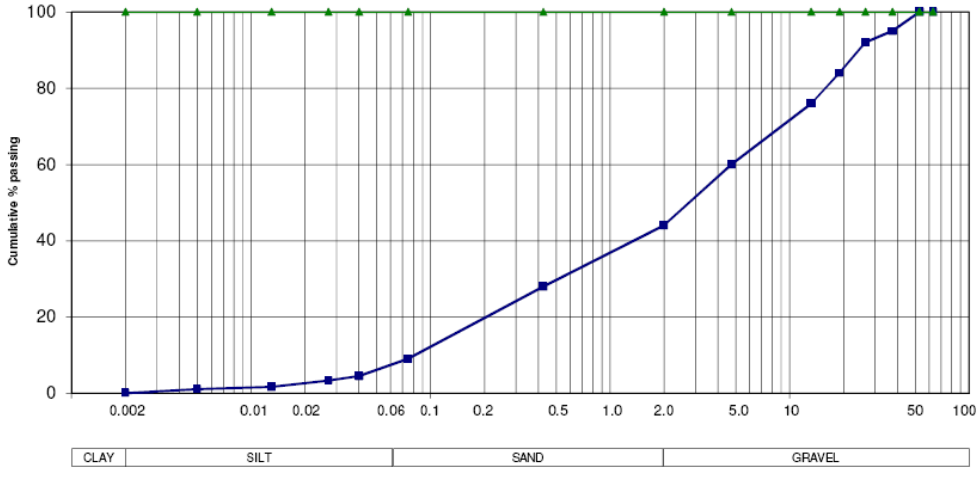
PROJECT : BUROTHO (MAKOPANE) SUBSTATION
JOB No. : S10-0401
DATE : 2010-04-22

POTENTIAL EXPANSIVENESS



PLASTICITY CHART





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Tel (012) 481-3999
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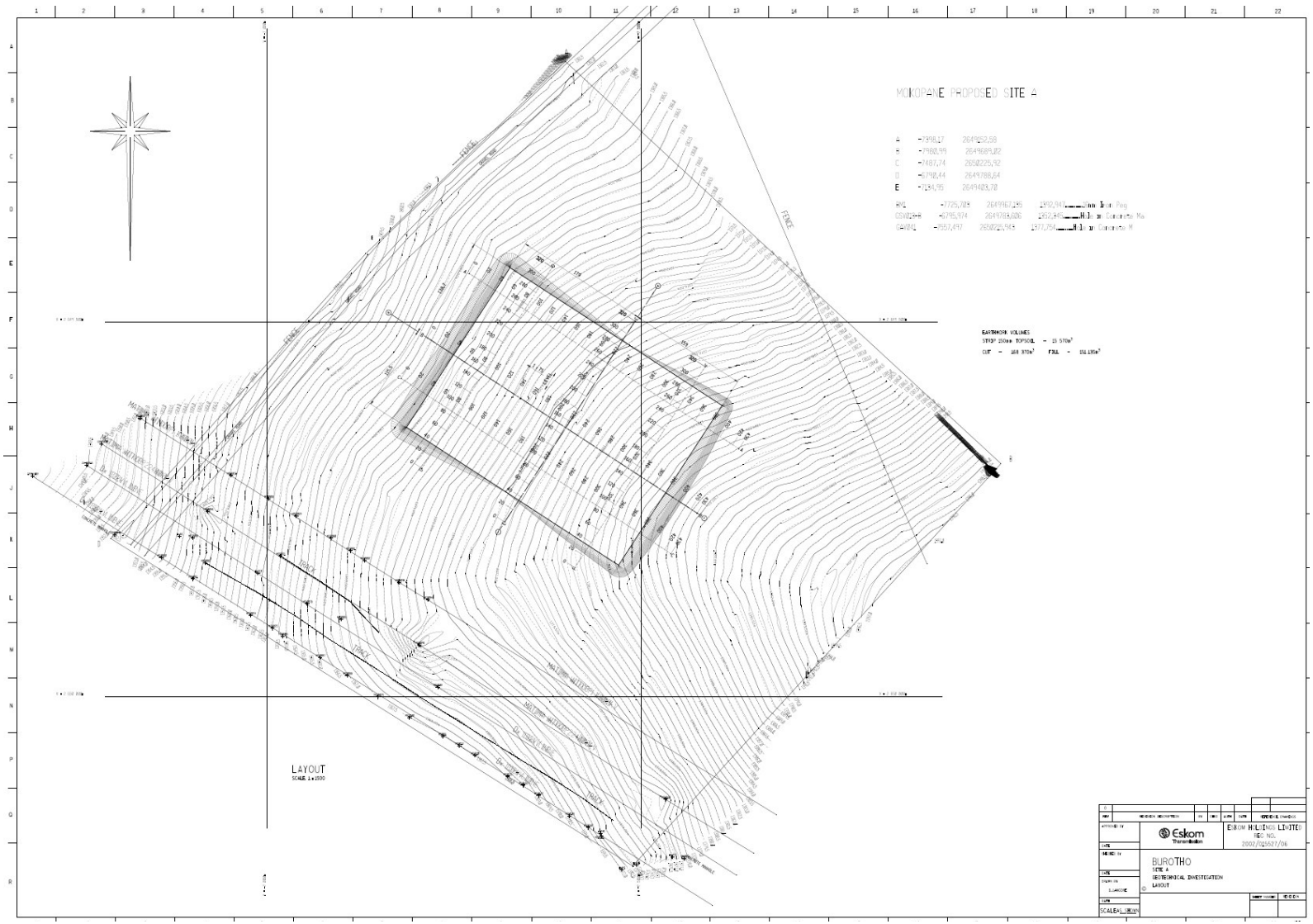
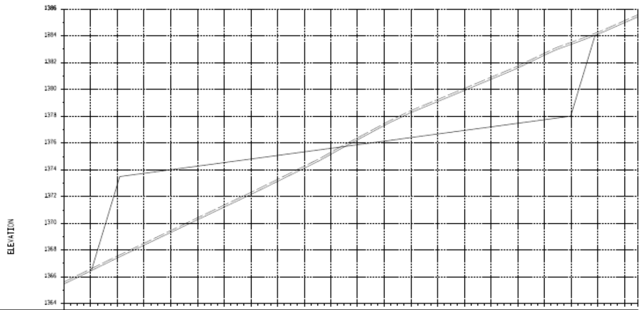
Lynnwood Ridge 0040
Fax (012) 481-3812

APPENDIX - D

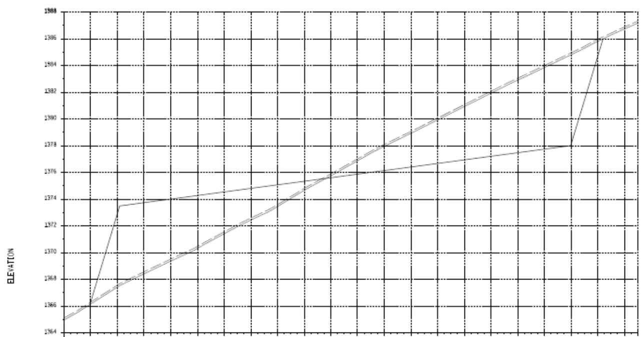
Contour Plans, Preliminary Geometric Designs and Sections


MOKOPANE PROPOSED SITE A
A -7498,17 2649252,58
B -7980,99 2649689,82
C -7487,74 2650225,92
D -6798,44 2649788,64
E -7154,95 2649483,78
EARTHWORK VOLUMES
STRIP 150mm TOPSOIL = 13 570m³
CUT = 168 870m³ FILL = 154 195m³
LAYOUT
SCALE 1:1000
Eskom
Transmission
ESKOM HOLDINGS LIMITED
REG NO:
2002/015527/06
BUROTHO
SITE A
GEOTECHNICAL INVESTIGATION
LAYOUT



EXISTING GROUND LEVEL	1365.62	1366.59	1367.56	1368.51	1369.46	1370.41	1371.36	1372.30	1373.28	1374.26	1375.30	1376.39	1377.45	1378.42	1379.24	1380.07	1380.90	1381.74	1382.70	1383.52	1384.27	1385.13	1385.56
PREPARED GROUND LEVEL	1365.47	1366.44	1367.41	1368.36	1369.31	1370.26	1371.21	1372.15	1373.13	1374.11	1375.15	1376.24	1377.30	1378.27	1379.09	1379.92	1380.75	1381.59	1382.55	1383.37	1384.12	1384.98	1385.41
TERRACE LEVEL			1372.91	1373.73	1374.00	1374.27	1374.53	1374.80	1375.07	1375.33	1375.60	1375.87	1376.14	1376.40	1376.67	1376.94	1377.20	1377.47	1377.74	1378.08			
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	430

SECTION A – A
SCALE HORIZ 1:1000
VERT 1:100



EXISTING GROUND LEVEL	1365.11	1366.30	1367.56	1368.56	1369.51	1370.46	1371.56	1372.58	1373.60	1374.80	1375.89	1377.02	1378.09	1379.07	1380.07	1381.07	1382.07	1383.05	1383.99	1384.95	1385.95	1386.88	1387.31
PREPARED GROUND LEVEL	1364.96	1366.15	1367.41	1368.41	1369.36	1370.31	1371.41	1372.43	1373.45	1374.65	1375.74	1376.87	1377.94	1378.92	1379.92	1380.92	1381.92	1382.90	1383.84	1384.80	1385.80	1386.73	1387.16
TERRACE LEVEL		1366.31	1372.91	1373.73	1374.00	1374.27	1374.53	1374.80	1375.07	1375.33	1375.60	1375.87	1376.14	1376.40	1376.67	1376.94	1377.20	1377.47	1377.74	1378.08	1384.68		
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	430

SECTION B – B
SCALE HORIZ 1:1000
VERT 1:100

0						
REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REFERENCE DRAWINGS

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BURTHO
SITE A
GEOTECHNICAL INVESTIGATION
LONGITUDINAL SECTIONS A–A AND B–B

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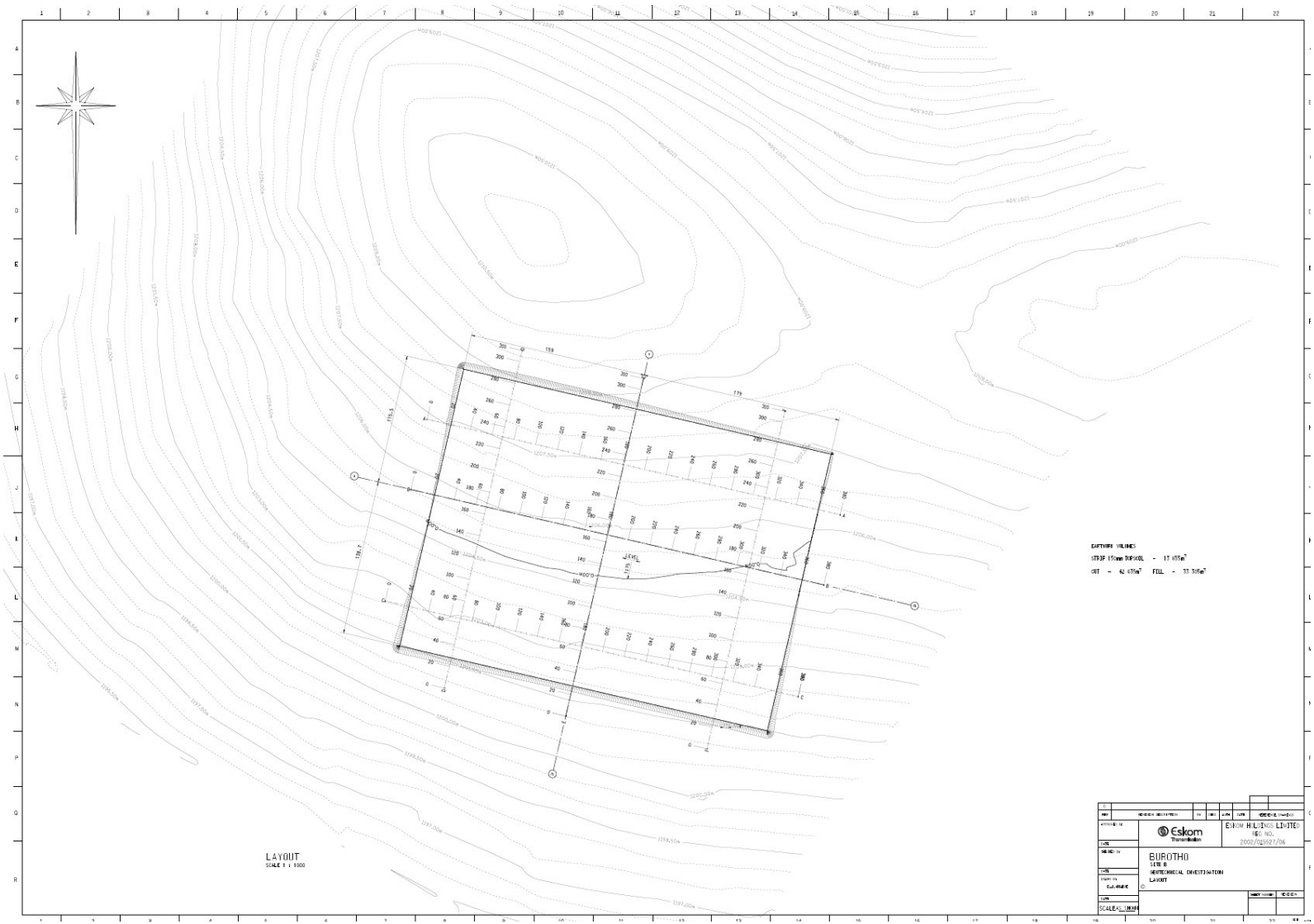
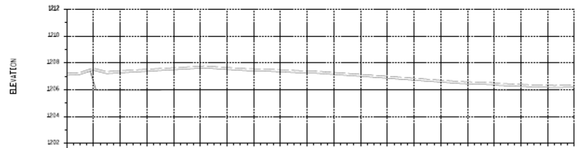
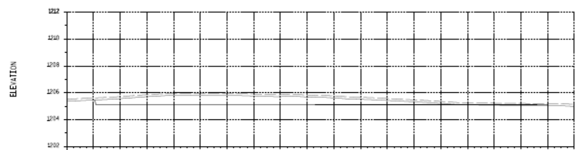
SHEET NUMBER
REVISION


EARTHWORK VOLUMES
STRIP 150mm TOPSOIL - 17 655m³
CUT - 42 670m³ FILL - 37 305m³
LAYOUT
SCALE 1 : 1000
Eskom Transmission
ESKOM HOLDINGS LIMITED
REG NO. 2002/015527/06
BUROTHO
SITE B
GEOTECHNICAL INVESTIGATION
LAYOUT



	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380
EXISTING GROUND LEVEL	1207.23	1207.60	1207.41	1207.52	1207.64	1207.75	1207.66	1207.56	1207.48	1207.39	1207.29	1207.14	1207.00	1206.86	1206.71	1206.59	1206.51	1206.40	1206.33	1206.35
PREPARED GROUND LEVEL	1207.08	1207.45	1207.26	1207.37	1207.49	1207.60	1207.51	1207.41	1207.33	1207.24	1207.14	1206.99	1206.85	1206.71	1206.56	1206.44	1206.36	1206.25	1206.18	1206.20
TERRACE LEVEL		1206.60	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1205.97	1206.00	
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380

SECTION A – A
SCALE HORIZ 1:1000
VERT 1:100



	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380
EXISTING GROUND LEVEL	1205.53	1205.61	1205.71	1205.86	1205.97	1205.96	1205.94	1205.91	1205.86	1205.83	1205.77	1205.66	1205.58	1205.48	1205.36	1205.25	1205.23	1205.21	1205.20	1205.13
PREPARED GROUND LEVEL	1205.38	1205.46	1205.56	1205.71	1205.82	1205.81	1205.79	1205.76	1205.71	1205.68	1205.62	1205.51	1205.43	1205.33	1205.21	1205.10	1205.08	1205.06	1205.05	1204.98
TERRACE LEVEL			1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.11	1205.07	
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380

SECTION B – B
SCALE HORIZ 1:1000
VERT 1:100

ESKOM HOLDINGS LIMITED
REG NO. 2002/015527/06

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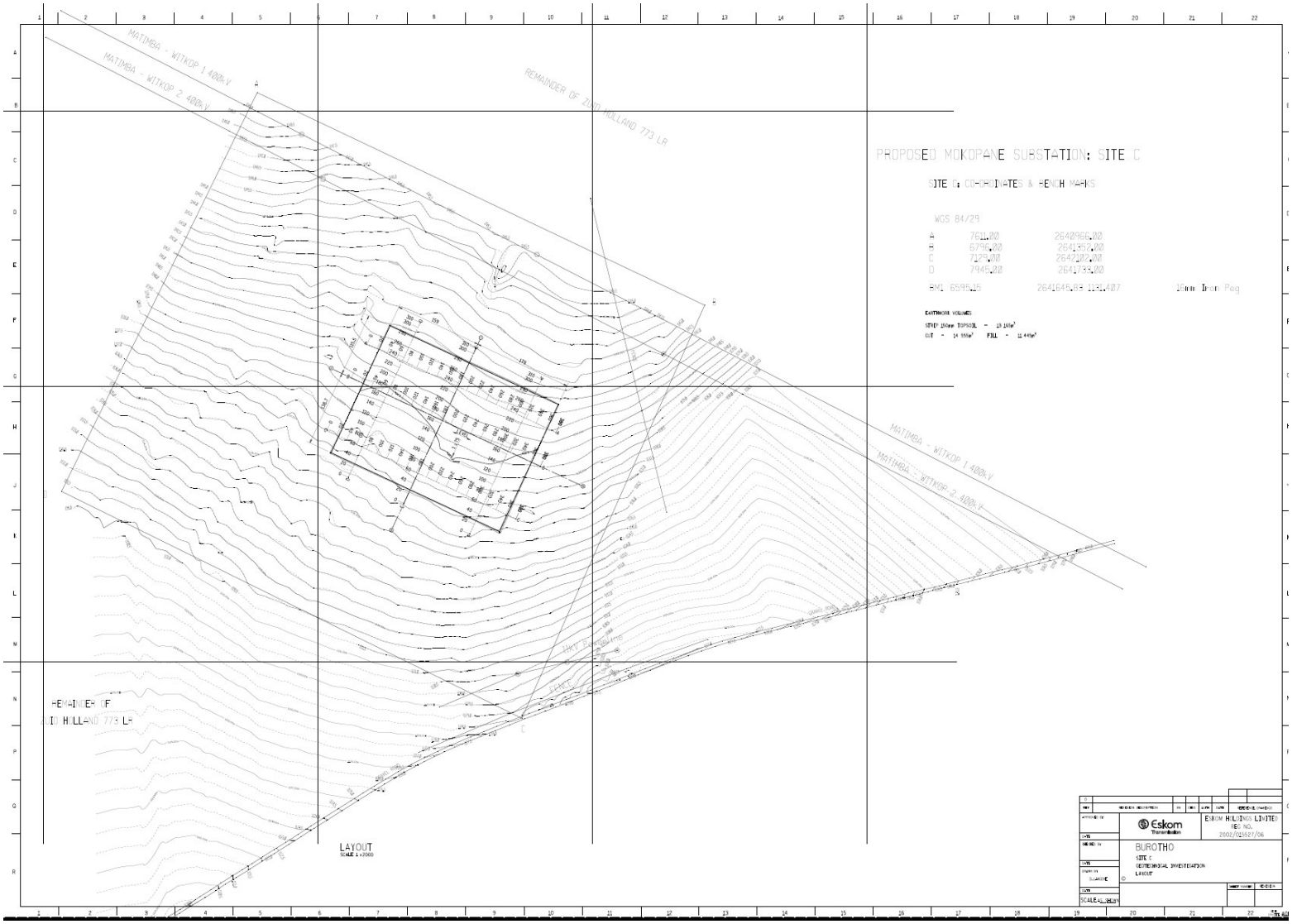
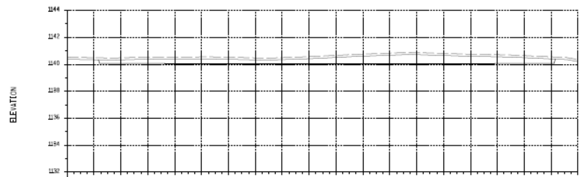
BUROTHO
SITE B
GEOTECHNICAL INVESTIGATION
LONGITUDINAL SECTIONS A–A AND B–B

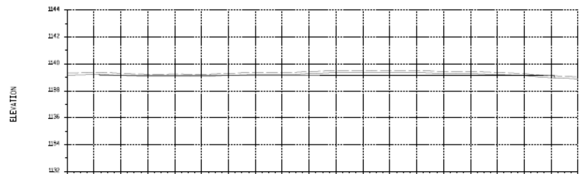
SCALE AS SHOWN


MATIMBA - WITKOP 1 400kV
MATIMBA - WITKOP 2 400kV
REMAINDER OF FARM HOLLAND 773 LR
PROPOSED MOKOPANE SUBSTATION: SITE C
SITE C: COORDINATES & BENCH MARKS
WGS 84/29
A 7611.00 2640966.00
B 6795.00 2641359.00
C 7195.00 2642206.00
D 7948.00 2641759.00
BM1 6595.16 2641645.83 1191.407 20mm Iron Peg
EARTHWORK VOLUMES
STRIP 150mm TOPSOIL = 13 165m³
CUT = 14 155m³ FILL = 11 445m³
REMAINDER OF
FARM HOLLAND 773 LR
LAYOUT
SCALE 1:1000
ESKOM HOLDINGS LIMITED
REG NO.
2002/015527/06
BUROTHO
SITE C
GEOTECHNICAL INVESTIGATION
LAYOUT
SCALE AS SHOWN



EXISTING GROUND LEVEL	1140.52	1140.49	1140.49	1140.59	1140.55	1140.55	1140.52	1140.48	1140.50	1140.56	1140.66	1140.75	1140.82	1140.87	1140.81	1140.75	1140.71	1140.65	1140.56	1140.36
PREPARED GROUND LEVEL	1140.37	1140.34	1140.34	1140.38	1140.40	1140.40	1140.37	1140.39	1140.35	1140.41	1140.51	1140.60	1140.67	1140.72	1140.66	1140.60	1140.56	1140.50	1140.41	1140.21
TERRACE LEVEL			1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	1140.06	
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380

SECTION A – A
SCALE HORIZ 1:1000
VERT 1:100



EXISTING GROUND LEVEL	1139.32	1139.37	1139.30	1139.25	1139.25	1139.24	1139.30	1139.36	1139.37	1139.43	1139.51	1139.51	1139.51	1139.51	1139.44	1139.42	1139.37	1139.29	1139.19	1139.03
PREPARED GROUND LEVEL	1139.17	1139.22	1139.15	1139.10	1139.10	1139.09	1139.15	1139.21	1139.22	1139.28	1139.36	1139.36	1139.36	1139.36	1139.29	1139.27	1139.22	1139.14	1138.98	1138.88
TERRACE LEVEL			1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	1139.56	
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380

SECTION B – B
SCALE HORIZ 1:1000
VERT 1:100

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REFERENCE DRAWINGS
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BUROTHO
SITE C
GEOTECHNICAL INVESTIGATION
LONGITUDINAL SECTIONS A-A AND B-B
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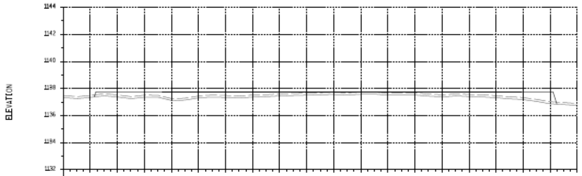
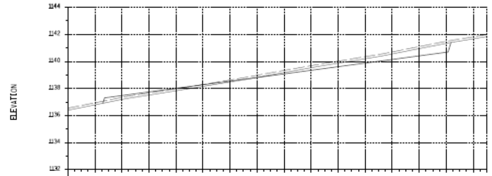


EXISTING GROUND LEVEL	1137.46	1137.49	1137.53	1137.51	1137.26	1137.45	1137.49	1137.52	1137.60	1137.66	1137.71	1137.73	1137.66	1137.67	1137.54	1137.56	1137.47	1137.32	1137.03	1136.90
PREPARED GROUND LEVEL	1137.31	1137.34	1137.38	1137.36	1137.11	1137.30	1137.34	1137.37	1137.45	1137.51	1137.56	1137.58	1137.51	1137.52	1137.39	1137.41	1137.32	1137.17	1136.88	1136.75
TERRACE LEVEL			1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	1137.75	
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380

SECTION C – C

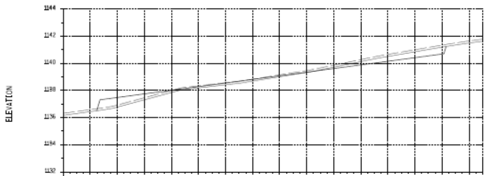
SCALE HORIZ 1:1000
VERT 1:100



EXISTING GROUND LEVEL	1136.55	1136.94	1137.34	1137.67	1137.98	1138.30	1138.63	1138.98	1139.34	1139.69	1140.02	1140.36	1140.70	1141.10	1141.49	1141.82	1141.98
PREPARED GROUND LEVEL	1136.40	1136.79	1137.19	1137.52	1137.83	1138.15	1138.48	1138.83	1139.19	1139.54	1139.87	1140.20	1140.55	1140.95	1141.34	1141.67	1141.83
TERRACE LEVEL			1137.48	1137.75	1138.01	1138.28	1138.55	1138.81	1139.08	1139.35	1139.61	1139.88	1140.15	1140.42	1140.68		
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	310

SECTION E – E

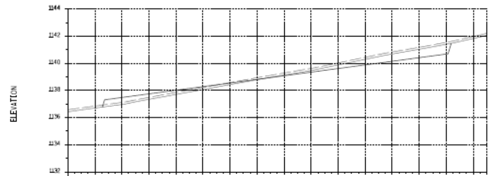
SCALE HORIZ 1:1000
VERT 1:100



EXISTING GROUND LEVEL	1136.31	1136.59	1136.92	1137.46	1138.00	1138.34	1138.56	1138.83	1139.15	1139.47	1139.87	1140.27	1140.66	1141.00	1141.34	1141.64	1141.77
PREPARED GROUND LEVEL	1136.16	1136.44	1136.77	1137.31	1137.85	1138.19	1138.41	1138.68	1139.00	1139.32	1139.72	1140.12	1140.51	1140.85	1141.19	1141.49	1141.62
TERRACE LEVEL			1137.48	1137.75	1138.01	1138.28	1138.55	1138.81	1139.08	1139.35	1139.61	1139.88	1140.15	1140.42	1140.68		
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	310

SECTION D – D

SCALE HORIZ 1:1000
VERT 1:100



EXISTING GROUND LEVEL	1136.57	1136.85	1137.12	1137.49	1137.85	1138.22	1138.58	1138.94	1139.28	1139.63	1140.03	1140.44	1140.83	1141.18	1141.55	1141.98	1142.21
PREPARED GROUND LEVEL	1136.42	1136.70	1136.97	1137.34	1137.70	1138.07	1138.43	1138.79	1139.13	1139.48	1139.88	1140.29	1140.68	1141.03	1141.40	1141.83	1142.06
TERRACE LEVEL			1137.48	1137.75	1138.01	1138.28	1138.55	1138.81	1139.08	1139.35	1139.61	1139.88	1140.15	1140.42	1140.68		
DISTANCE	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	310

SECTION F – F

SCALE HORIZ 1:1000
VERT 1:100

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REFERENCE DRAWINGS
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DATE
DRAWN BY
D.JANDOVE
DATE
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ESKOM HOLDINGS LIMITED
REG NO.
2002/015527/06

BUROTHO
SITE C
GEOTECHNICAL INVESTIGATION
LONGITUDINAL SECTIONS C–C, D–D, E–E AND F–F

SHEET NUMBER
REVISION