

**REPORT TO THE INZUZO YE-SIZWE DEVELOPMENT CONSULTANTS CC  
ON THE RESULTS OF A GEOTECHNICAL DESKTOP INVESTIGATION FOR  
PROPOSED CEMETERY SITES IN GREATER KOKSTAD MUNICIPALITY,  
KWAZULU-NATAL**

**REPORT REFERENCE: SGE-165-2019.REP01**

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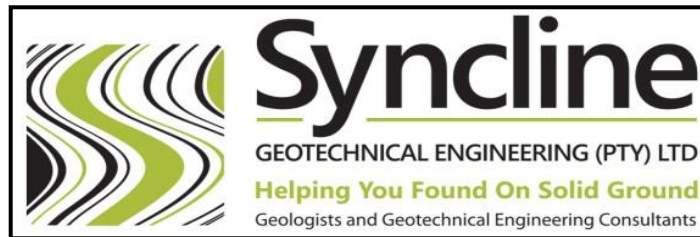
**Reviewed: S. Pather (Pr.Sci.Nat.) 400020/08 (South African Council for Natural Scientific Professions)**

**Date: 19 June 2019**

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Figure 1: Locality Plan  
Figure 2: Site Plan

# REPORT TO THE INZUZO YE-SIZWE DEVELOPMENT CONSULTANTS CC ON THE RESULTS OF A GEOTECHNICAL DESKTOP INVESTIGATION FOR PROPOSED CEMETERY SITES IN GREATER KOKSTAD MUNICIPALITY, KWAZULU-NATAL

## 1. TERMS OF REFERENCE

Syncline Geotechnical Engineering (Pty) Ltd (hereafter referred to as SGE) was requested by Mr Mxolisi T. Ndlovu of Inzuzo Ye-Sizwe Development Consultants cc to submit a quotation to conduct a geotechnical desktop investigation for the “*Proposed Cemetery Sites in Greater Kokstad Municipality, KwaZulu-Natal*”.

SGE provided this proposal and cost estimate in an electronic message referenced “*Proposal 117-2019*” and dated 26 April 2019, and was subsequently appointed by Mr Ndlovu on 06 June 2019 to carry out the investigation.

## 2. SCOPE OF REPORT

This report details the results of a Desktop Geotechnical Investigation for the “*Proposed Cemetery Sites in Greater Kokstad Municipality, KwaZulu-Natal*”.

The Desktop Geotechnical Investigation involved visual assessment of the proposed sites in accordance to specific criteria as listed below:

- Topography – slope and drainage;
- Soil characteristics;
- Excavatability – by mechanical and manual means;
- Workability – ease with which excavated soil can be reworked;
- Overall stability of site;
- Ground and surface water occurrence; and
- Permeability of soils.

***Note: The above is based on a desktop assessment (visual observation and limited fieldwork) and is subject to Detailed Phase 2 Geotechnical Investigation which will further divide the areas into several geotechnical zones and the feasibility of using the land as a future cemetery.***

## 3. INFORMATION SUPPLIED

For the purposes of assisting with this investigation, Inzuzo provided SGE with a cadastral map demarcating the study areas, as well as an environmental feasibility study report compiled by Bizycon (Pty) Ltd and titled, “*Greater Kokstad Local Municipality: Investigation of Suitable Land for Cemetery within Kokstad Town, Franklin Town and Makhoba Farm*”. SGE also made reference to the 1:250000 Geological Map titled “*3028 Kokstad*” as published by the Geological Survey.

## 4. LIMITATIONS

The nature of Geotechnical Engineering is such that variations in soil conditions may occur even where sites seem to be consistent. Variations in what is reported here may become evident during construction and it is thus imperative that a Competent Person inspects all excavations to ensure that conditions at variance with those predicted do not occur and to undertake an interpretation of the facts supplied in this report.

## 5. FIELDWORK

The fieldwork for the investigation was carried out on 14 June 2019 and comprised the following:

- Terrain Appraisal and Geological Mapping;
- Inspection Pits; and
- CBR Dynamic Cone Penetrometer (DCP) tests.

### 5.1 Inspection Pits

Six (6No.) inspection pits, designated IP1 through IP6, were conducted by hand at the approximate positions indicated in Figure 2. The inspection pits were extended to refusal depths in the range 0.6 to 1.5 metres below existing ground level (EGL) and profiled using the “Guidelines for Soil and Rock Logging in South Africa”, (2001)<sup>1</sup>.

Copies of the detailed log profiles are given in Appendix A.

### 5.2 CBR Dynamic Cone Penetrometer (DCP) Tests

Ten (10No.) CBR Dynamic Cone Penetrometer (DCP) tests, designated DCP1 through DCP10 were carried out at the approximate positions given in Figure 2. The DCP tests were advanced to refusal depths in the range 0.6 to 2.6 metres below EGL.

The results of the DCP tests comprising plots of blow counts versus depth are given in Appendix B.

## 6. ERF 1

### 6.1 Site Description

The study area (11.1ha in extent) is situated approximately 1km north of Kokstad CBD, and accessed off the R617 Main Road. The site is characterised by an existing undeveloped open plot of land, and comprises gently to moderately sloping landform for the most part.

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<sup>1</sup> AEG, SAICE and SAIEG. "Guidelines for Soil and Rock Logging in South Africa". Editors, A. B. A. Brink and R. M. H. Bruin; Proceedings, Geoterminology Workshop, Johannesburg 2001.

The locality of the site is shown in Figure 1.

Plates 1 and 2 below show general views of the study area.



Plate 1



Plate 2

Plates 1 and 2: General views of the study area

## 6.2 Geology and Subsoils

The area underlain by Beaufort Group – Adelaide Formation mudstone bedrock, is characterised by moderate brown, clayey SAND to sandy silty CLAY (colluvium) and orange brown to reddish brown, moderately clayey sandy SILT (residual). Weathered bedrock was not visually observed but inferred (from DCP test results) to occur at depths typically in the range 1.5 to 2.0 metres below EGL.

Plates 3 and 4 below provide an indication of the typical subsoils encountered in the study area.



Plate 3: IP4



Plate 4: Spoil from IP4

Plates 3 and 4: Typical subsoils encountered in the study area



### 6.3 Groundwater Occurrence

The permanent water table was not observed in the inspection pit excavated on the site, and is anticipated to occur at a depth in excess of 5.0 metres below EGL.

However, in spite of the limited occurrence of groundwater, a perched groundwater table can be expected at depths typically less than 2.0 metres below EGL (during and after periods of heavy rainfall, particularly at the interface of the residual soils-bedrock boundary).

## 7. ERF 258

### 7.1 Site Description

The study area (73.5ha in extent) is situated approximately 2km east of Kokstad CBD, and accessed through Bhongweni Township. The site is characterised by an existing undeveloped open plot of land bounded by the Mzintlava River, and comprises gently to moderately sloping landform for the most part.

The locality of the site is shown in Figure 1.

Plates 5 and 6 below show general views of the study area.



Plate 5

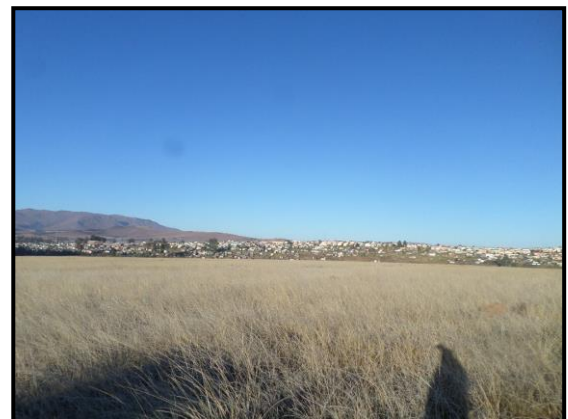


Plate 6

Plates 5 and 6: General views of the study area

### 7.2 Geology and Subsoils

The area underlain by Beaufort Group – Adelaide Formation mudstone bedrock, is characterised by moderate brown, clayey SAND to sandy silty CLAY (colluvium) and orange brown to reddish brown, moderately clayey sandy SILT (residual). Karoo-age dolerite intrudes the mudstone bedrock in the form of sills, predominantly along the eastern portion of the study area. Bedrock occurs at depths typically less than 1.0 metre below EGL across the study area.

Plates 7 and 8 below provide an indication of the typical subsoils and bedrock encountered in the study area.





Plate 7: IP1



Plate 8: Dolerite exposed in cutting

Plates 7 and 8: Typical subsols and bedrock encountered in the study area

### 7.3 Groundwater Occurrence

The permanent water table was not observed in any of the inspection pits excavated on the site, and is anticipated to occur at a depth in excess of 5.0 metres below EGL.

However, in spite of the limited occurrence of groundwater, a perched groundwater table can be expected at depths typically less than 1.0 metre below EGL (during and after periods of heavy rainfall, particularly at the interface of the residual soils-bedrock boundary).

## 8. ERF 286

### 8.1 Site Description

The study area (205.7ha in extent) is situated approximately 2km southwest of Kokstad CBD, and accessed via a gravel road. The site is characterised by an existing open plot of land bounded by the Mzintlava River in the north and a gravel road in the south, and comprises gently to moderately sloping landform for the most part.

The locality of the site is shown in Figure 1.

Plates 9 and 10 below show general views of the study area.



**Plate 9**



**Plate 10**

**Plates 9 and 10: General views of the study area**

## **8.2 Geology and Subsoils**

The area underlain by Beaufort Group – Adelaide Formation mudstone bedrock, is characterised by moderate brown, clayey SAND to sandy silty CLAY (colluvium) and orange brown to reddish brown, moderately clayey sandy SILT (residual).

Thick, dark grey alluvial clay (which extends to depths in excess of 1.5 metres below EGL) was encountered in the northern portion of the site, closer to the Mzintlava River.

Plates 11 and 12 below provide an indication of the typical subsoils encountered in the study area.



**Plate 11: IP5**



**Plate 12: IP6**

**Plates 11 and 12: Typical subsoils encountered in the study area**

## **8.3 Groundwater Occurrence**

The permanent water table was not observed in any of the inspection pits excavated on the site, and is anticipated to occur at a depth in excess of 5.0 metres below EGL.

However, in spite of the limited occurrence of groundwater, a perched groundwater table can be expected at depths typically less than 1.0 metre below EGL (during and after periods of heavy rainfall, particularly at the interface of the residual soils-bedrock boundary).

## 9. DISCUSSION

### 9.1 General

The nature and locations of cemeteries is generally dictated by the following factors below:

- Topography;
- Soil and Geotechnical Conditions;
- Religious Beliefs;
- Social Attitudes;
- Aesthetics Considerations; and
- Sanitary Considerations.

*From visual observation and limited fieldwork carried out on the sites, the proposed cemetery sites are considered to be stable with no evidence of landslides, sinkholes or the potential to be flooded. In addition, the sites are topographically favourably located, on gently to moderately undulating ground for the most part.*

Aspects relating to religious belief, social and aesthetic considerations, and sanitation whilst vitally important, are outside the scope of this report.

Sections 10.2 through 10.8 of this report, are briefly discussed using rating descriptions, as per *Hall and Hanbury, 1990*<sup>2</sup>.

### 9.2 Excavatability

**Erf 1** - In terms of hand excavations, difficulties with regard to excavatability are expected with the weathered bedrock on the site (where present). Nonetheless, hand excavation to depths of 1.5 to 2.5 metres below EGL is considered mostly achievable. Excavations to depths in excess of approximately 2.5 metres below EGL are considered slightly achievable by tractor loader backhoe (TLB), over majority portion of the study area (+/- 70%).

**Erf 258** - In terms of hand excavations, difficulties with regard to excavatability are expected with the weathered bedrock on the site. Nonetheless, hand excavation to depths of 1.5 to 2.5 metres below EGL is considered mostly achievable. Excavations to depths in excess of approximately 2.5 metres below EGL are considered slightly achievable by tractor loader backhoe (TLB), over majority portion of the study area (+/- 70%).

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<sup>2</sup> Hall, B. and Hanbury, R. Some Geotechnical Considerations in the Selection of Cemetery Sites. IMIESA, March 1990.

**Erf 286** - In terms of hand excavations, difficulties with regard to excavatability are expected with the weathered bedrock and stiff alluvium on the site. Nonetheless, hand excavation to a depth of 1.5 metres below EGL is considered mostly achievable. Excavations to depths in excess of approximately 1.5 metres below EGL are considered slightly achievable by tractor loader backhoe (TLB), over localised portions of the study area (+/- 50%).

### **9.3 Stability**

Excavation of inspection pits within the subsoils and weathered bedrock is considered for the most part stable with little overbreak occurring across Erven 1, 258 and 286.

### **9.4 Workability**

The workability refers to the ease with which the excavated soil can be worked and replaced in the grave, as well as the likely settlement of the backfill that could occur. The workability of the subsoils and weathered bedrock (where encountered) for Erf 1, 258 and 286 is considered to be fair to good.

### **9.5 Water Table Depth**

The water table at the proposed cemetery sites should be at least 2.0 metres below proposed burial depth (approximately 4.0 metres below EGL). During the field investigation, groundwater seepage activity was not encountered in any of the inspection pits at any of the proposed sites.

The regional water table at the proposed cemetery sites is considered to be at depth, generally greater than 5.0 metres below EGL.

### **9.6 Subsoil Permeability**

The subsoils and weathered bedrock across the study areas will likely classify as slightly permeable to relatively impermeable (where shallow bedrock is encountered at or near surface level), and generally practical for cemetery development.

### **9.7 Backfill Permeability**

Backfill permeability refers to the ability to reduce subsoil percolation through compaction of the backfilled soil, and is anticipated to be relatively suitable.

### **9.8 Suitability Rating**

An assessment of the suitability of the sites for cemetery using specific criteria is briefly classified in Tables 1 to 3 below (a detailed rating with related scores will be provided in the Detailed Phase 2 Geotechnical Investigation):

Table 1: Erf 1 - Suitability rating descriptions

<u>Criteria</u>	<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Excellent</u>
<b>Excavatibility</b>			X	
<b>Stability</b>			X	
<b>Workability</b>		X		
<b>Watertable Depth</b>			X	
<b>Subsoil Permeability</b>			X	
<b>Backfill Permeability</b>		X		

**Erf 1** - Considering the above and initial desktop assessment of the site, **it is anticipated that the study area will generally be FEASIBLE for development of a cemetery (as approximately 70% of the site can be utilised).**

Table 2: Erf 258 - Suitability rating descriptions

<u>Criteria</u>	<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Excellent</u>
<b>Excavatibility</b>			X	
<b>Stability</b>				X
<b>Workability</b>		X		
<b>Watertable Depth</b>			X	
<b>Subsoil Permeability</b>			X	
<b>Backfill Permeability</b>			X	

**Erf 258** - Considering the above and initial desktop assessment of the site, **it is anticipated that the study area will generally be VERY FEASIBLE for development of a cemetery (as approximately 80% of the site can be utilised).**

Table 3: Erf 286 - Suitability rating descriptions

<u>Criteria</u>	<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Excellent</u>
<b>Excavatibility</b>	X			
<b>Stability</b>			X	
<b>Workability</b>		X		
<b>Watertable Depth</b>		X		
<b>Subsoil Permeability</b>		X		
<b>Backfill Permeability</b>		X		

**Erf 286** - Considering the above and initial desktop assessment of the site, **it is anticipated that the study area will generally be MARGINALLY FEASIBLE to UNFEASIBLE for development of a cemetery, as this site is variable with regards to subsoils, geology and groundwater conditions (as approximately only 40 – 50% of the site can be utilised).**

## 10. RECOMMENDED ADDITIONAL WORK

It must be appreciated that the above recommendations have been based solely on a desktop study and limited field testing of the study area. In order to provide more accurate recommendations, the following additional geotechnical work is required for this site:

- Machine excavated inspection pits (using a TLB or similar) for the logging and sampling of soil and bedrock horizons. This will provide a visual assessment of the soil and bedrock strata, variation in depths to bedrock and an assessment of the excavation requirements, which is essential for budgeting and other related costs;
- CBR Dynamic Cone Penetrometer (DCP) tests to gauge the in-situ relative densities of the subsoils with depth;
- Percolation tests; and
- Laboratory tests on soil and bedrock samples to allow for materials classification.

## 11. CONCLUSIONS

This report details the results of a Desktop Geotechnical Investigation for the *“Proposed Cemetery Sites in Greater Kokstad Municipality, KwaZulu-Natal”*.

The study areas are underlain mainly by Beaufort Group – Adelaide Formation mudstone bedrock and associated colluvial/alluvial and residual clayey/silty soils. Karoo-age dolerite intrudes the mudstone bedrock in the form of sills, predominantly in Erf 258.

**It is our opinion that Erven 1 and 258 are suitable for development as a cemetery site from a geotechnical perspective (with Erf 258 being the most suitable from both), whilst Erf 286 is considered the least suitable.**

The ground conditions given in this report refer specifically to the limited field tests carried out on site. It is therefore quite possible that conditions at variance with those given in this report can be encountered elsewhere on site, and there may be zones/subareas where cemetery development will not be possible (due to shallow bedrock conditions, perched water table, steeply sloping landform etc.).

**As such, it is imperative that a Detailed Phase 2 Geotechnical Investigation be carried out prior to development, in order to determine site restrictions and demarcate zones in terms of geotechnical feasibility.**



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**Author: Y. Hansa (Pr.Sci.Nat.)**

19 June 2019

**Date**



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**Checked: S. Pather (Pr.Sci.Nat.)**

19 June 2019

**Date**



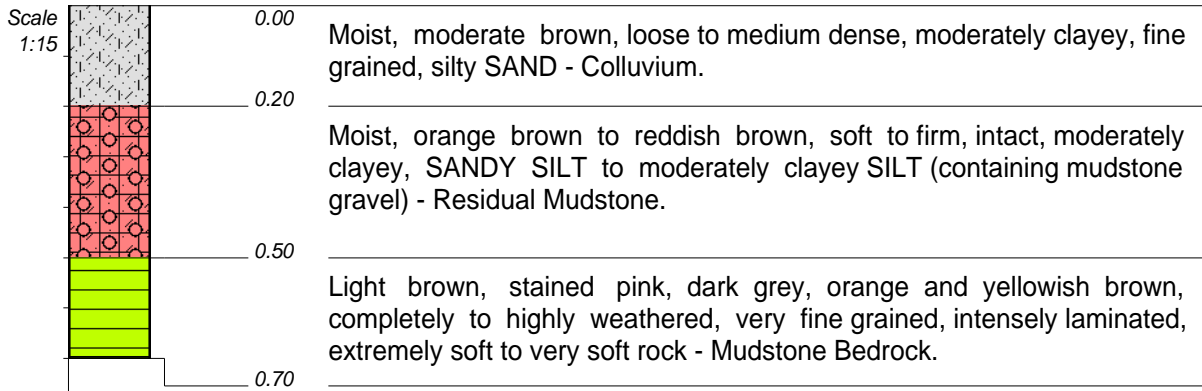


# APPENDIX A

June 19, 2019

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## INSPECTION PIT LOG PROFILES



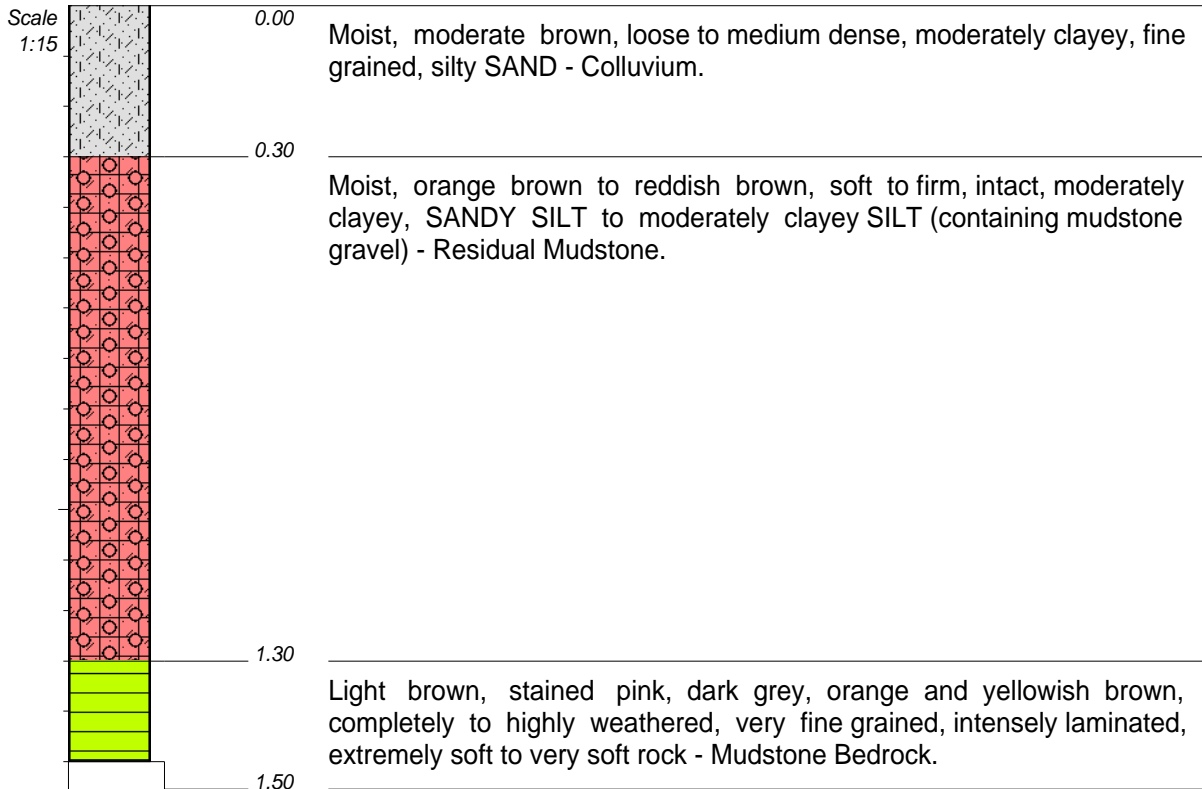
**NOTES**

- 1) Depth of water table: Not encountered.
- 2) Refusal depth at 0.70m.

CONTRACTOR :  
 MACHINE : by hand  
 DRILLED BY :  
 PROFILED BY : Y. Hansa  
 TYPE SET BY : K. Govender  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 14 June 2019  
 DATE : 14 June 2019  
 DATE : 19/06/2019 15:30  
 TEXT : C:\PERFLOGS\PITS1.TXT

ELEVATION :  
 X-COORD : 30° 32' 29.5" S  
 Y-COORD : 29° 26' 47.2" E



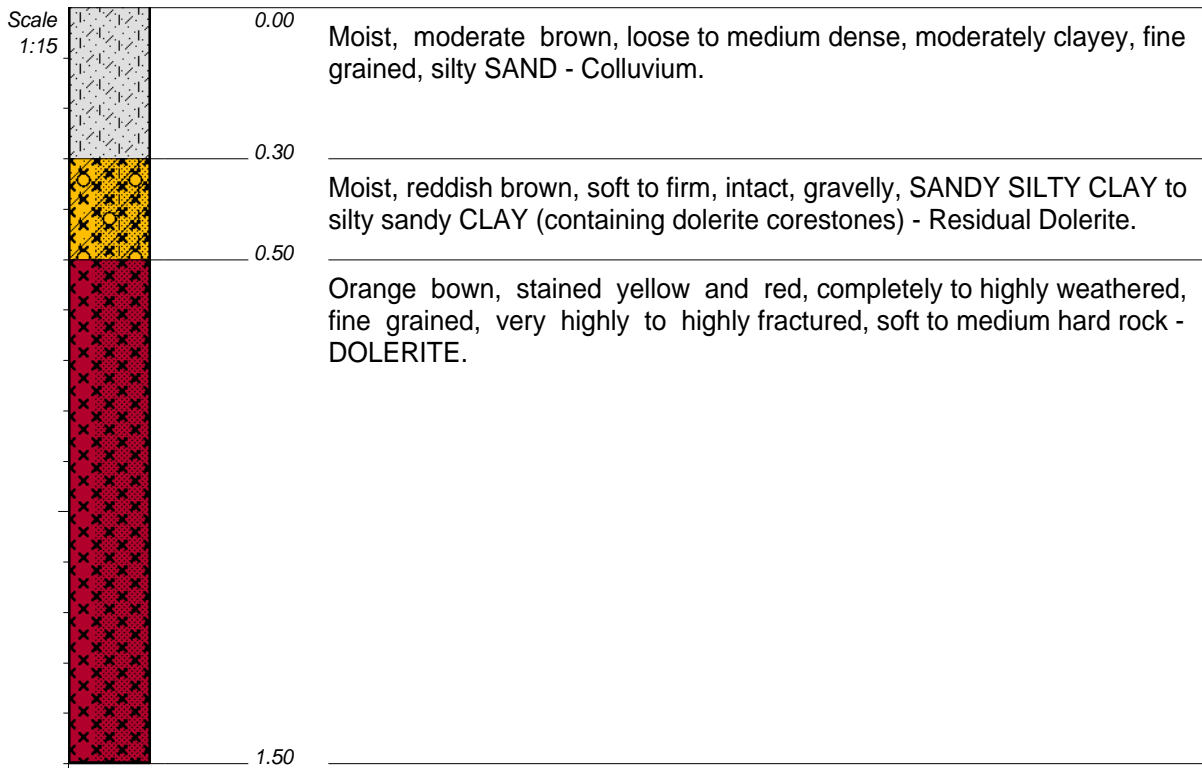
**NOTES**

- 1) Depth of water table: Not encountered.
- 2) Refusal depth at 1.50m.

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 PROFILED BY : Y. Hansa  
 TYPE SET BY : K. Govender  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 14 June 2019  
 DATE : 14 June 2019  
 DATE : 19/06/2019 15:30  
 TEXT : C:\PERFLOGS\PITS1.TXT

ELEVATION :  
 X-COORD : 30° 32' 13.0" S  
 Y-COORD : 29° 26' 36.4" E



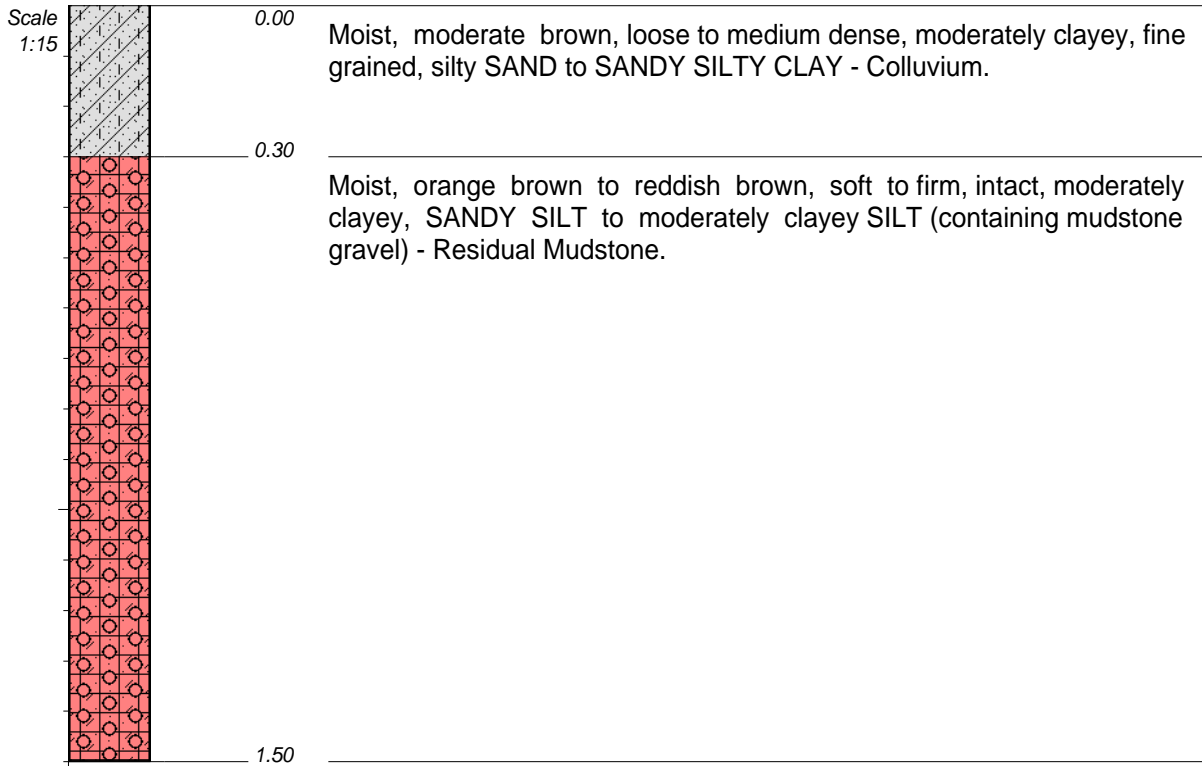
**NOTES**

- 1) Depth of water table: Not encountered.
- 2) Refusal depth at 1.50m.

CONTRACTOR :  
 MACHINE : by hand  
 DRILLED BY :  
 PROFILED BY : Y. Hansa

INCLINATION :  
 DIAM :  
 DATE : 14 June 2019  
 DATE : 14 June 2019  
 DATE : 19/06/2019 15:30  
 TEXT : C:\PERFLOGS\PITS1.TXT

ELEVATION :  
 X-COORD : 30° 32' 10.0" S  
 Y-COORD : 29° 25' 55.3" E



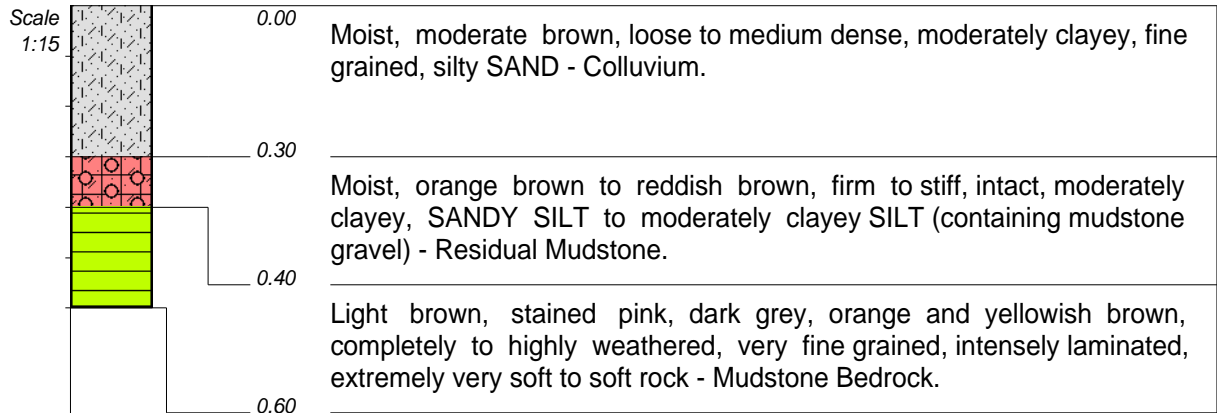
**NOTES**

- 1) Depth of water table: Not encountered.
- 2) Final depth at 0.70m.

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 PROFILED BY : Y. Hansa  
 TYPE SET BY : K. Govender  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 14 June 2019  
 DATE : 14 June 2019  
 DATE : 19/06/2019 15:30  
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ELEVATION :  
 X-COORD : 30° 31' 48.4" S  
 Y-COORD : 29° 25' 22.0" E



**NOTES**

- 1) Depth of water table: Not encountered.
- 2) Refusal depth at 0.60m.

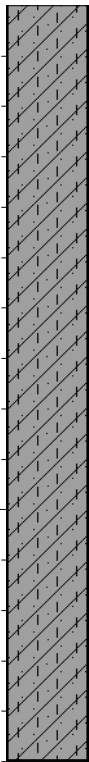
CONTRACTOR :  
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 PROFILED BY : Y. Hansa  
 TYPE SET BY : K. Govender  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 14 June 2019  
 DATE : 14 June 2019  
 DATE : 19/06/2019 15:30  
 TEXT : C:\PERFLOGS\IPITS1.TXT

ELEVATION :  
 X-COORD : 30° 34' 19.0" S  
 Y-COORD : 29° 24' 42.5" E



Scale  
 1:15



0.00

Moist, dark grey, loose to medium dense, moderately clayey, fine grained, SANDY SILTY CLAY - Alluvium.

1.50

**NOTES**

- 1) Depth of water table: Not encountered.
- 2) Refusal depth at 1.50m.

CONTRACTOR :  
 MACHINE : by hand  
 DRILLED BY :  
 PROFILED BY : Y. Hansa  
 TYPE SET BY : K. Govender  
 SETUP FILE : STANDARD.SET

INCLINATION :  
 DIAM :  
 DATE : 14 June 2019  
 DATE : 14 June 2019  
 DATE : 19/06/2019 15:30  
 TEXT : C:\PERFLOGS\PITS1.TXT

ELEVATION :  
 X-COORD : 30° 33' 44.5" S  
 Y-COORD : 29° 24' 48.7" E

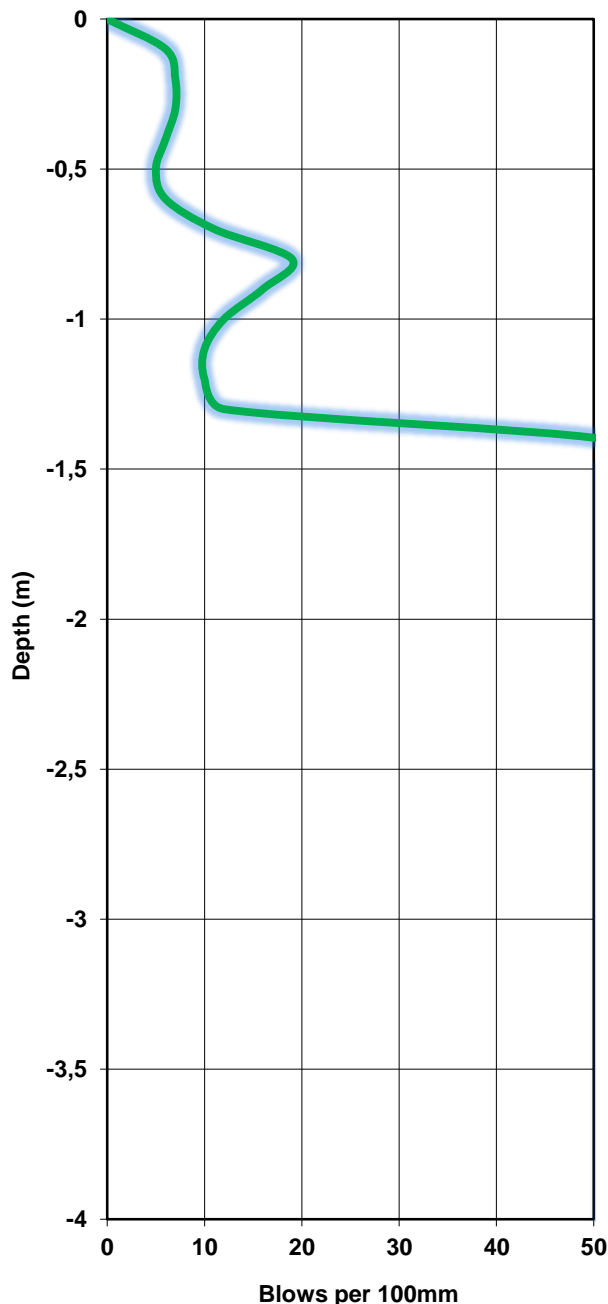
## RESULTS OF CBR DYNAMIC CONE PENETROMETER (DCP) TESTS

<b>Client:</b>	Inzuzo Ye-Sizwe Development Consultant cc	<b>Ref.No.</b>	SGE-165-2019
<b>Project:</b>	Desktop Study - GKM Cemetery Sites - Erf 258	<b>Date:</b>	14 June 2019
<b>Latitude:</b>	S30° 32' 29,5"	<b>Operator:</b>	Y. Hansa
<b>Longitude:</b>	E29° 26' 47,2"		

***Dynamic Cone Penetrometer (DCP)***      **TEST NO:**      **DCP1**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	6	Firm	50 kPa	10
0,2	7	Firm	60 kPa	12
0,3	7	Firm	60 kPa	12
0,4	6	Firm	50 kPa	10
0,5	5	Firm	40 kPa	8
0,6	6	Firm	50 kPa	10
0,7	11	Stiff	90 kPa	19
0,8	19	Very Stiff	>150 kPa	35
0,9	16	Stiff	130 kPa	29
1	12	Stiff	100 kPa	21
1,1	10	Stiff	85 kPa	17
1,2	10	Stiff	85 kPa	17
1,3	12	Stiff	100 kPa	21
	Refusal			

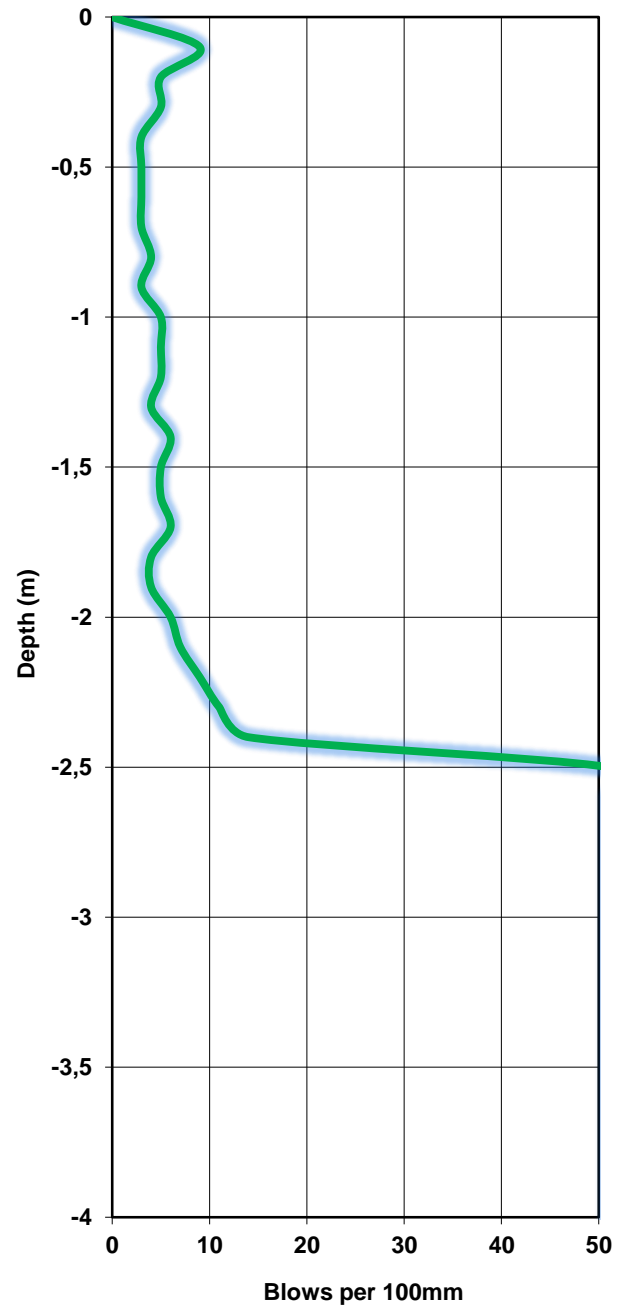


<b>Client:</b>	Inzuzo Ye-Sizwe Development Consultant cc	<b>Ref.No.</b>	SGE-165-2019
<b>Project:</b>	Desktop Study - GKM Cemetery Sites - Erf 258	<b>Date:</b>	14 June 2019
<b>Latitude:</b>	S30° 32' 13,0"	<b>Operator:</b>	Y. Hansa
<b>Longitude:</b>	E29° 26' 36,4"		

**Dynamic Cone Penetrometer (DCP) TEST NO: DCP2**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	9	Stiff	75 kPa	15
0,2	5	Firm	40 kPa	8
0,3	5	Firm	40 kPa	8
0,4	3	Soft	25 kPa	5
0,5	3	Soft	25 kPa	5
0,6	3	Soft	25 kPa	5
0,7	3	Soft	25 kPa	5
0,8	4	Soft	35 kPa	7
0,9	3	Soft	25 kPa	5
1	5	Firm	40 kPa	8
1,1	5	Firm	40 kPa	8
1,2	5	Firm	40 kPa	8
1,3	4	Soft	35 kPa	7
1,4	6	Firm	50 kPa	10
1,5	5	Firm	40 kPa	8
1,6	5	Firm	40 kPa	8
1,7	6	Firm	50 kPa	10
1,8	4	Soft	35 kPa	7
1,9	4	Soft	35 kPa	7
2	6	Firm	50 kPa	10
2,1	7	Firm	60 kPa	12
2,2	9	Stiff	75 kPa	15
2,3	11	Stiff	90 kPa	19
2,4	14	Stiff	115 kPa	25
	Refusal			



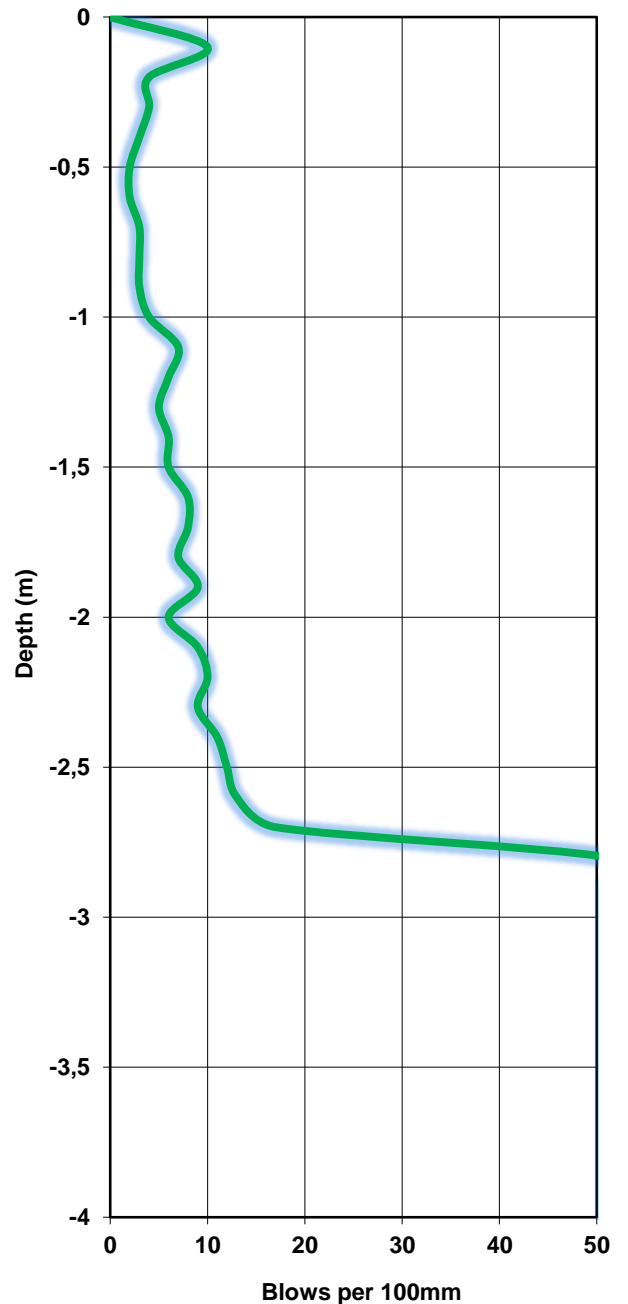
Client: Inzuzo Ye-Sizwe Development Consultant cc  
 Project: Desktop Study - GKM Cemetery Sites - Erf 258  
 Latitude: S30° 32' 18,3"  
 Longitude: E29° 26' 47,9"

Ref.No. SGE-165-2019  
 Date: 14 June 2019  
 Operator: Y. Hansa

**Dynamic Cone Penetrometer (DCP) TEST NO: DCP3**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	10	Stiff	85 kPa	17
0,2	4	Soft	35 kPa	7
0,3	4	Soft	35 kPa	7
0,4	3	Soft	25 kPa	5
0,5	2	Soft	20 kPa	3
0,6	2	Soft	20 kPa	3
0,7	3	Soft	25 kPa	5
0,8	3	Soft	25 kPa	5
0,9	3	Soft	25 kPa	5
1	4	Soft	35 kPa	7
1,1	7	Firm	60 kPa	12
1,2	6	Firm	50 kPa	10
1,3	5	Firm	40 kPa	8
1,4	6	Firm	50 kPa	10
1,5	6	Firm	50 kPa	10
1,6	8	Firm	65 kPa	14
1,7	8	Firm	65 kPa	14
1,8	7	Firm	60 kPa	12
1,9	9	Stiff	75 kPa	15
2	6	Firm	50 kPa	10
2,1	9	Stiff	75 kPa	15
2,2	10	Stiff	85 kPa	17
2,3	9	Stiff	75 kPa	15
2,4	11	Stiff	90 kPa	19
2,5	12	Stiff	100 kPa	21
2,6	13	Stiff	110 kPa	23
2,7	17	Stiff	140 kPa	31
	Refusal			



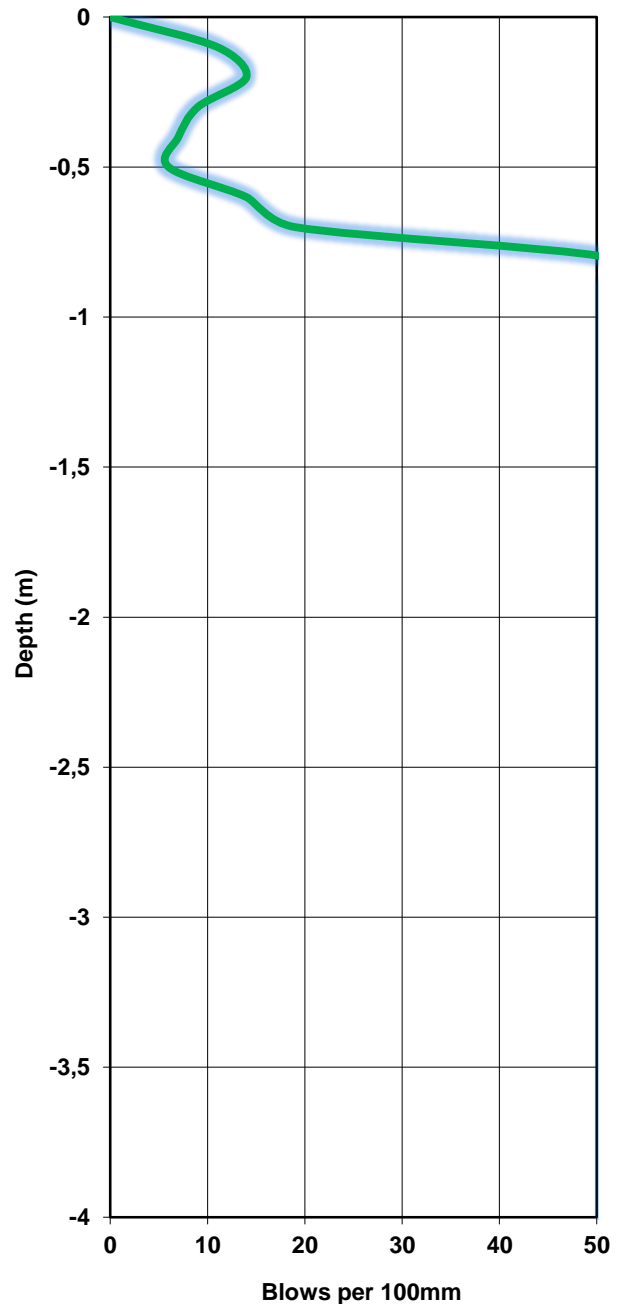
Tel: (031) 207 1383      Fax: (031) 207 1349      Email: admin@syncline.co.za

Client:	Inzuzo Ye-Sizwe Development Consultant cc	Ref.No.	SGE-165-2019
Project:	Desktop Study - GKM Cemetery Sites - Erf 258	Date:	14 June 2019
Latitude:	S30° 32' 10,0"	Operator:	Y. Hansa
Longitude:	E29° 26' 55,3"		

***Dynamic Cone Penetrometer (DCP)***      TEST NO:      ***DCP4***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	11	Stiff	90 kPa	19
0,2	14	Stiff	115 kPa	25
0,3	9	Stiff	75 kPa	15
0,4	7	Firm	60 kPa	12
0,5	6	Firm	50 kPa	10
0,6	14	Stiff	115 kPa	25
0,7	19	Very Stiff	>150 kPa	35
	Refusal			



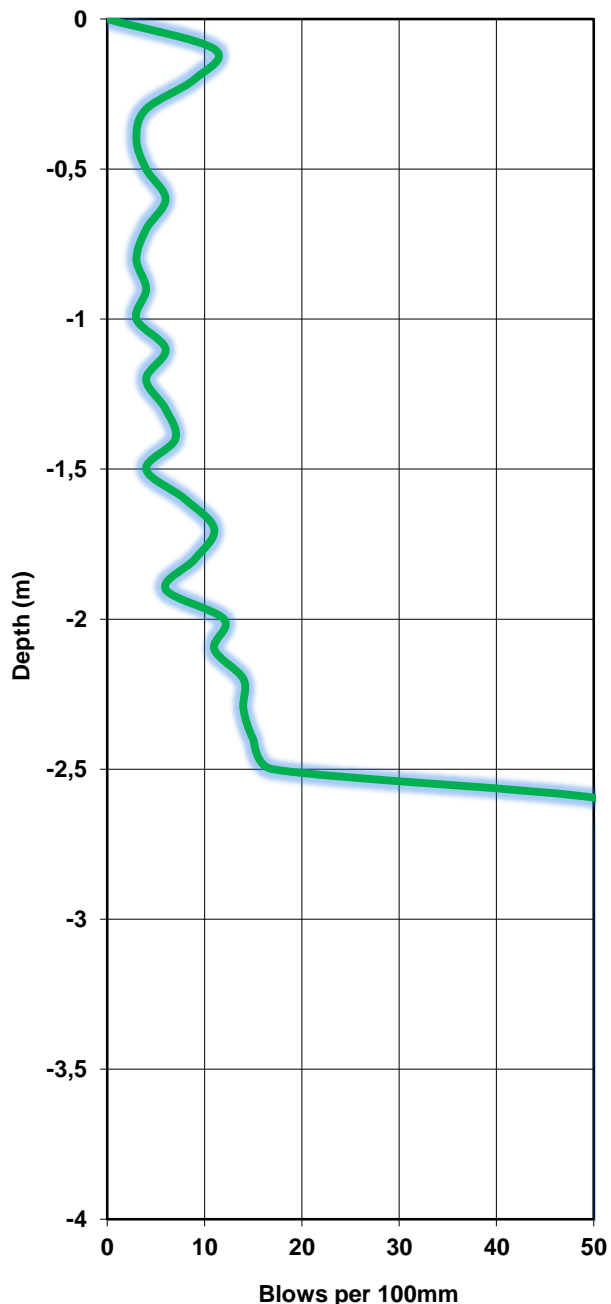
<b>Client:</b>	Inzuzo Ye-Sizwe Development Consultant cc	<b>Ref.No.</b>	SGE-165-2019
<b>Project:</b>	Desktop Study - GKM Cemetery Sites - Erf 1	<b>Date:</b>	14 June 2019
<b>Latitude:</b>	S30° 31' 48,4"	<b>Operator:</b>	Y. Hansa
<b>Longitude:</b>	E29° 25' 22,0"		

**Dynamic Cone Penetrometer (DCP) TEST NO: DCP5**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	11	Stiff	90 kPa	19
0,2	9	Stiff	75 kPa	15
0,3	4	Soft	35 kPa	7
0,4	3	Soft	25 kPa	5
0,5	4	Soft	35 kPa	7
0,6	6	Firm	50 kPa	10
0,7	4	Soft	35 kPa	7
0,8	3	Soft	25 kPa	5
0,9	4	Soft	35 kPa	7
1	3	Soft	25 kPa	5
1,1	6	Firm	50 kPa	10
1,2	4	Soft	35 kPa	7
1,3	6	Firm	50 kPa	10
1,4	7	Firm	60 kPa	12
1,5	4	Soft	35 kPa	7
1,6	8	Firm	65 kPa	14
1,7	11	Stiff	90 kPa	19
1,8	9	Stiff	75 kPa	15
1,9	6	Firm	50 kPa	10
2	12	Stiff	100 kPa	21
2,1	11	Stiff	90 kPa	19
2,2	14	Stiff	115 kPa	25
2,3	14	Stiff	115 kPa	25
2,4	15	Stiff	125 kPa	27
2,5	17	Stiff	140 kPa	31

Refusal





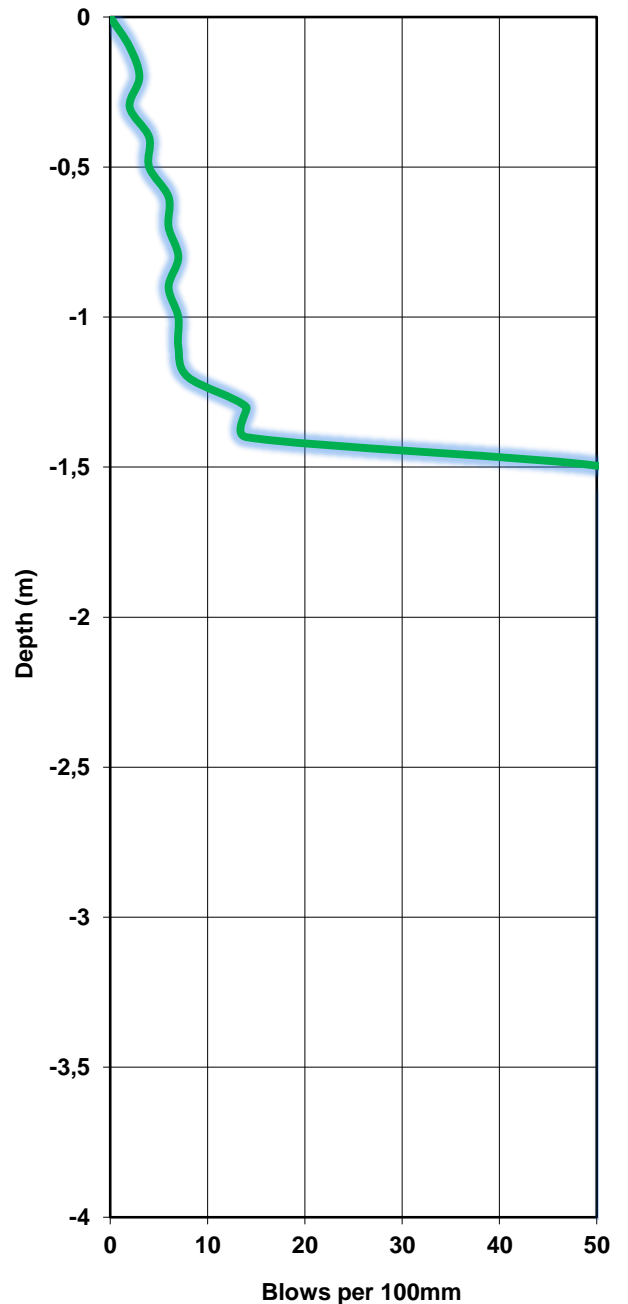
Client: Inzuzo Ye-Sizwe Development Consultant cc  
 Project: Desktop Study - GKM Cemetery Sites - Erf 1  
 Latitude: S30° 31' 54,0"  
 Longitude: E29° 25' 18,3"

Ref.No. SGE-165-2019  
 Date: 14 June 2019  
 Operator: Y. Hansa

**Dynamic Cone Penetrometer (DCP) TEST NO: DCP6**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	2	Soft	20 kPa	3
0,2	3	Soft	25 kPa	5
0,3	2	Soft	20 kPa	3
0,4	4	Soft	35 kPa	7
0,5	4	Soft	35 kPa	7
0,6	6	Firm	50 kPa	10
0,7	6	Firm	50 kPa	10
0,8	7	Firm	60 kPa	12
0,9	6	Firm	50 kPa	10
1	7	Firm	60 kPa	12
1,1	7	Firm	60 kPa	12
1,2	8	Firm	65 kPa	14
1,3	14	Stiff	115 kPa	25
1,4	14	Stiff	115 kPa	25
	Refusal			

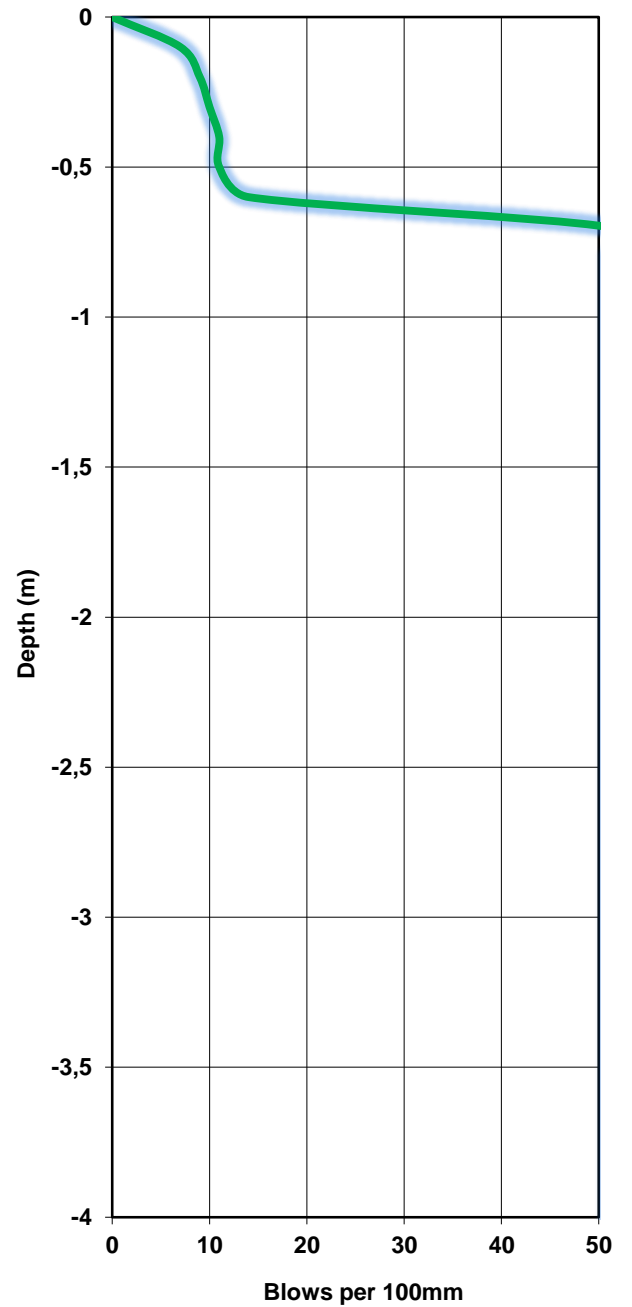


Client:	Inzuzo Ye-Sizwe Development Consultant cc	Ref.No.	SGE-165-2019
Project:	Desktop Study - GKM Cemetery Sites - Erf 286	Date:	14 June 2019
Latitude:	S30° 34' 19,0"	Operator:	Y. Hansa
Longitude:	E29° 24' 42,5"		

***Dynamic Cone Penetrometer (DCP)      TEST NO:      DCP7***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	7	Firm	60 kPa	12
0,2	9	Stiff	75 kPa	15
0,3	10	Stiff	85 kPa	17
0,4	11	Stiff	90 kPa	19
0,5	11	Stiff	90 kPa	19
0,6	14	Stiff	115 kPa	25
	Refusal			



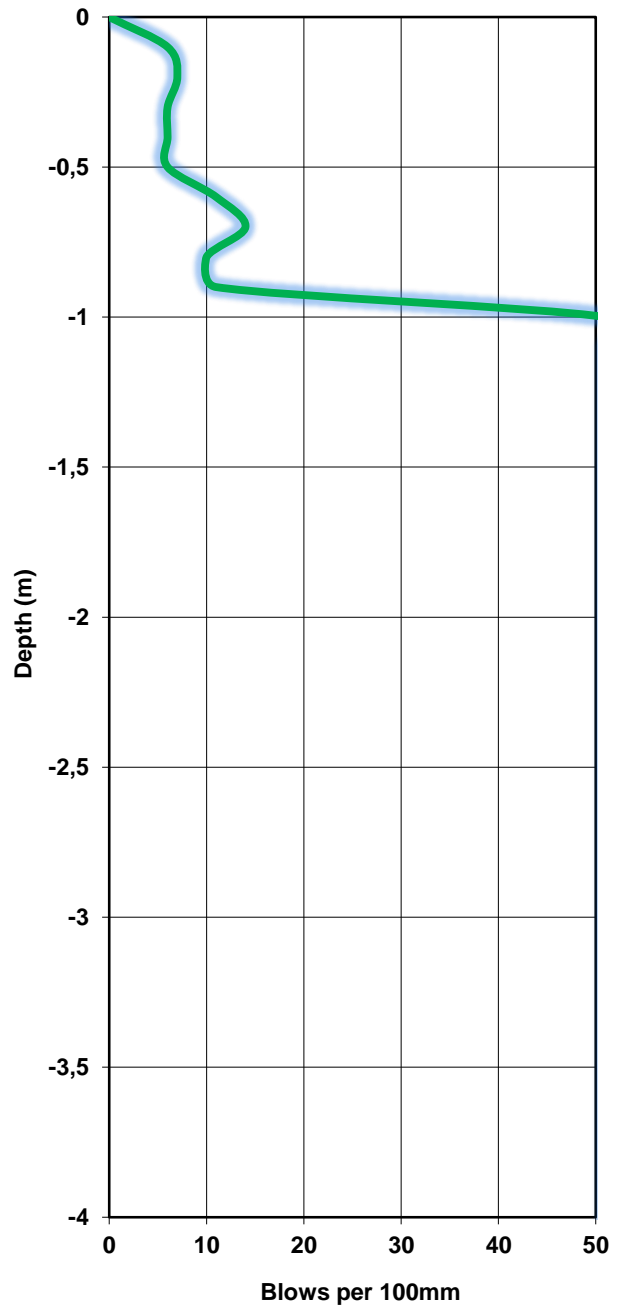
Client:	Inzuzo Ye-Sizwe Development Consultant cc	Ref.No.	SGE-165-2019
Project:	Desktop Study - GKM Cemetery Sites - Erf 286	Date:	14 June 2019
Latitude:	S30° 33' 59,8"	Operator:	Y. Hansa
Longitude:	E29° 24' 36,6"		

***Dynamic Cone Penetrometer (DCP)      TEST NO:      DCP8***

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	6	Firm	50 kPa	10
0,2	7	Firm	60 kPa	12
0,3	6	Firm	50 kPa	10
0,4	6	Firm	50 kPa	10
0,5	6	Firm	50 kPa	10
0,6	11	Stiff	90 kPa	19
0,7	14	Stiff	115 kPa	25
0,8	10	Stiff	85 kPa	17
0,9	11	Stiff	90 kPa	19

Refusal

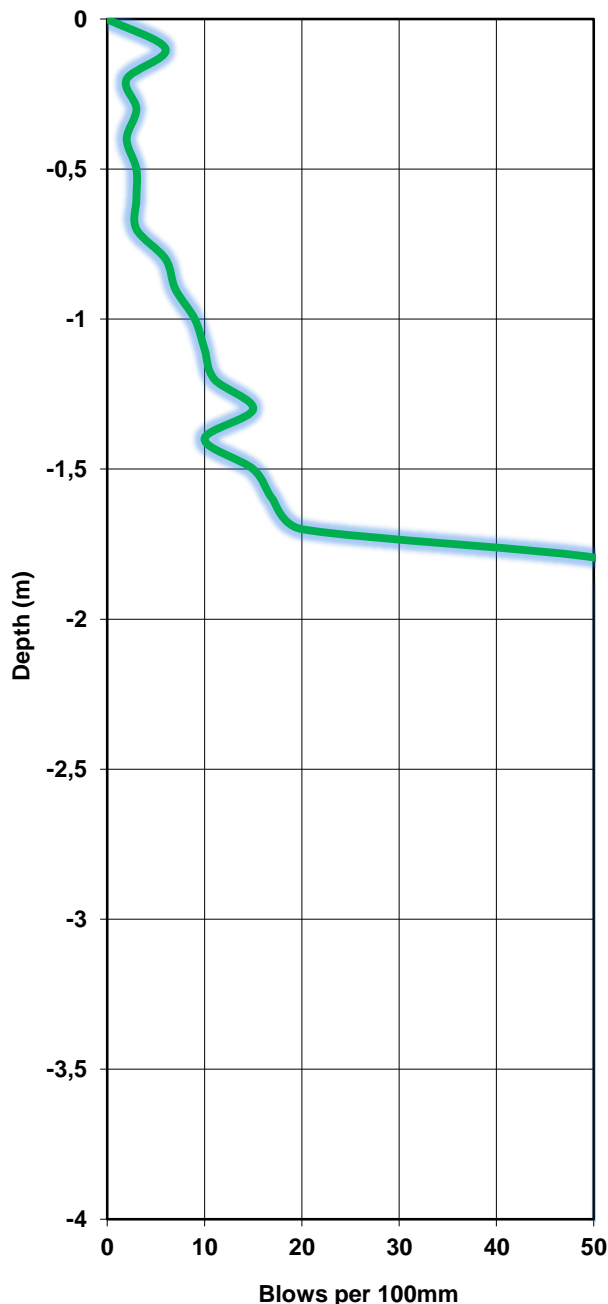


<b>Client:</b>	Inzuzo Ye-Sizwe Development Consultant cc	<b>Ref.No.</b>	SGE-165-2019
<b>Project:</b>	Desktop Study - GKM Cemetery Sites - Erf 286	<b>Date:</b>	14 June 2019
<b>Latitude:</b>	S30° 33' 44,5"	<b>Operator:</b>	Y. Hansa
<b>Longitude:</b>	E29° 24' 48,7"		

**Dynamic Cone Penetrometer (DCP) TEST NO: DCP9**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	6	Firm	50 kPa	10
0,2	2	Soft	20 kPa	3
0,3	3	Soft	25 kPa	5
0,4	2	Soft	20 kPa	3
0,5	3	Soft	25 kPa	5
0,6	3	Soft	25 kPa	5
0,7	3	Soft	25 kPa	5
0,8	6	Firm	50 kPa	10
0,9	7	Firm	60 kPa	12
1	9	Stiff	75 kPa	15
1,1	10	Stiff	85 kPa	17
1,2	11	Stiff	90 kPa	19
1,3	15	Stiff	125 kPa	27
1,4	10	Stiff	85 kPa	17
1,5	15	Stiff	125 kPa	27
1,6	17	Stiff	140 kPa	31
1,7	20	Very Stiff	>150 kPa	37
	Refusal			

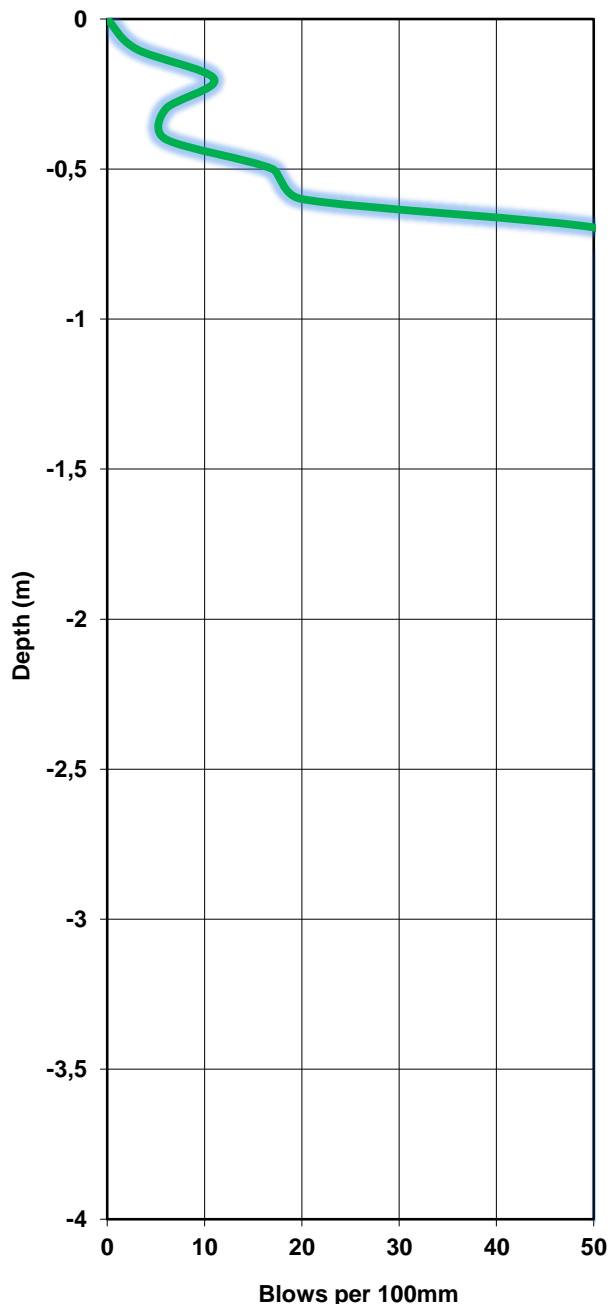


<b>Client:</b>	Inzuzo Ye-Sizwe Development Consultant cc	<b>Ref.No.</b>	SGE-165-2019
<b>Project:</b>	Desktop Study - GKM Cemetery Sites - Erf 286	<b>Date:</b>	14 June 2019
<b>Latitude:</b>	S30° 34' 01,3"	<b>Operator:</b>	Y. Hansa
<b>Longitude:</b>	E29° 25' 00,1"		

***Dynamic Cone Penetrometer (DCP)***      **TEST NO:**      **DCP10**

THE STRENGTH AND CBR VALUES ARE EMPIRICAL AND DEPEND ON FACTORS SUCH AS MOISTURE CONTENT WHICH HAVE NOT BEEN DETERMINED. THEY ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Depth metres	Blows per 100mm	Inferred Consistency	Shear Strength	CBR %
0				
0,1	3	Soft	25 kPa	5
0,2	11	Stiff	90 kPa	19
0,3	6	Firm	50 kPa	10
0,4	6	Firm	50 kPa	10
0,5	17	Stiff	140 kPa	31
0,6	20	Very Stiff	>150 kPa	37
	Refusal			



# FIGURE 1

June 19, 2019

## LOCALITY PLAN







# FIGURE 2

June 19, 2019

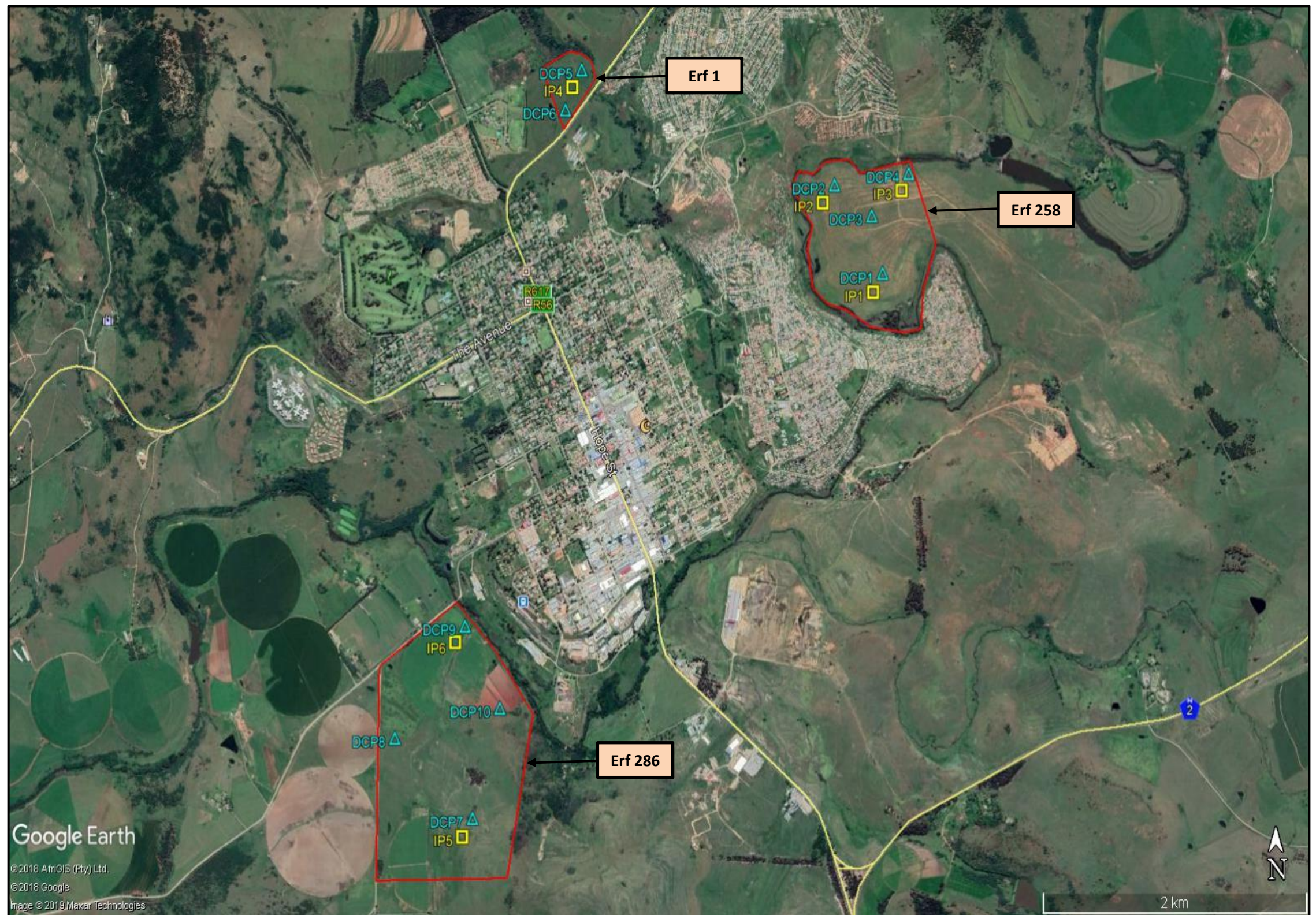
## SITE PLAN



**NORTH**



Test Position	Latitude (S)	Longitude (E)
IP1	S30° 32' 29.5"	E29° 26' 47.2"
IP2	S30° 32' 13.0"	E29° 26' 36.4"
IP3	S30° 32' 10.0"	E29° 26' 55.3"
IP4	S30° 31' 48.4"	E29° 25' 22.0"
IP5	S30° 34' 19.0"	E29° 24' 42.5"
IP6	S30° 33' 44.5"	E29° 24' 48.7"
DCP1	S30° 32' 29.5"	E29° 26' 47.2"
DCP2	S30° 32' 13.0"	E29° 26' 36.4"
DCP3	S30° 32' 18.3"	E29° 26' 47.9"
DCP4	S30° 32' 10.0"	E29° 26' 55.3"
DCP5	S30° 31' 48.4"	E29° 25' 22.0"
DCP6	S30° 31' 54.0"	E29° 25' 18.3"
DCP7	S30° 34' 19.0"	E29° 24' 42.5"
DCP8	S30° 33' 59.8"	E29° 24' 36.6"
DCP9	S30° 33' 44.5"	E29° 24' 48.7"
DCP10	S30° 34' 01.3"	E29° 25' 00.1"



**IP1** – Approximate position of Inspection Pit

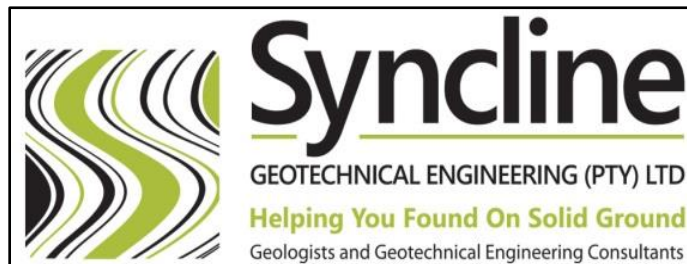
**DCP1** – Approximate position of CBR Dynamic Cone Penetrometer (DCP) Test

Image sourced from Google Earth 2019

Latitude: S30° 32' 29.5"

Longitude: E29° 26' 47.2"

Scale: As shown on image



**PROJECT:** Desktop Study - GKM Cemetery Sites - Erf 1, Erf 258 and Erf 286

**CLIENT:** Inzuzo Ye-Sizwe Development Consultant cc

**DATE:** 19 June 2019

**PROJECT REFERENCE NUMBER:** SGE-165-2019

**DRAWN BY:** K. Govender

**FIGURE NUMBER:** 1

**CHECKED BY:** S. Pather

**REVISION:** 0