PHASE I

GEOTECHNICAL SITE INVESTIGATION

LOUWVILLE HOUSING
ERF 7752 AND PORTION OF ERF 1003
VREDENBURG

FOR

iX ENGINEERS

CORE GEOTECHNICAL CONSULTANTS
Engineering Geology and Geohydrology

CONTACT DETAILS
Tel: +27 21 671 4274/80 **Fax:** +27 21 671 4277 **email:** admin@coregeotech.co.za
Postal address: Postnet Suite 177, Private Bag X3, Pumstead, 7801, Cape Town
Physical address: Unit b02, Clareview Business Park, 236 Imam Haron Road, Claremont, 7708, Cape Town, South Africa

LOUWVILLE HOUSING
ERF 7752 AND PORTION OF ERF 1003 VREDENBURG

February 2019 Project no: 016-19

Contents

LOUWVILLE HOUSING
ERF 7752 AND PORTION OF ERF 1003 VREDENBURG
FOR
iX ENGINEERS

February 2019 Project no: 016-19

Executive Summary

The investigated site is roughly a triangular-shaped piece of land approximately 5.1 ha in area, located in the Vredenburg suburb of Louwville. It is bordered by Klooitjieskloof Street to the north, Maclons Street to the west and Louwville High School to the south. The site is currently undeveloped. Vegetation consists of mostly small shrubs, grasses and weeds.

In terms of topography, the site is fairly flat lying with a slight slope down from the west towards the south-east. A stormwater channel lies to the south of the site and forms the boundary between Louwville High School and the investigated site.

The general geology of the area consists primarily of Tertiary Aged consolidated and unconsolidated limestone and lime rich sands (calcretes) overlain by sand and sandy soils. There are scattered outcrops of course grained porphyritic Vredenburg Granite (550-500 Ma) within the surrounding area, but these are not found within the site boundaries.

Fill encountered across the entire site comprises gravelly clayey sand and variable amounts of builders and domestic waste. The waste is however mostly scattered and is generally less than 10 % of the fill profile. The fill ranges from 0.30 m deep (in test pit TP1) to approximately 0.8 m (in TP4) deep.

Gravelly and clayey sands of transported origin underlie the fill and extend to a depth in excess of 2.90 m below ground level (bgl). The transported soils are relatively granular and coarse grained near surface increasing in clay content and becoming more clayey with depth.

Residual soils and rock were not encountered on site. With depth, weathered residual granite soils and granite rock can be expected.

Groundwater was encountered in TP2 at a depth of 2.8 m bgl. TP2 was located in the south-western corner of the site and is near the stormwater channel indicated earlier. The water in TP2 is potentially seepage from the nearby channel. Groundwater was not encountered in any of the other test pits.

Highly compressible sandy fill soils are expected to have an impact on subsidy housing development and subsidy variations. A schedule of generic subsidy variations applicable to the site is outlined in Table 6.2. The Residential Site Class Designation (after Watermeyer & Tromp and the Joint Structural Division) is set out in Table 7.1.

The entire site is classified as **P(fill)/S/H**, that is, compressible sandy fill material which in turn overlie moderately compressible sandy and clayey transported soils.

This Phase 1 geotechnical site investigation indicates that the site is broadly suitable for project linked subsidy housing development, provided that aspects of concern relating to the geotechnical character of the site are addressed.

1. Introduction

At the request of Mr. Jean de Klerk from iX Engineers, we have prepared a Phase 1 geotechnical site investigation report for the proposed development on erf 7752 and portion of erf 1003 in Louwville, Vredenburg.

The objectives of this investigation were as follows:-

a) Identify any potential hazards

b) Define the ground conditions and provide site classifications including detailed soil profiles and groundwater occurrences within the zone of influence of foundations

c) Provide the geotechnical basis for safe and appropriate land use planning, infrastructure design, housing unit design and the formulation of precautionary measures and risk management procedures

d) Broadly classify the land that is to be developed for subsidy housing in terms of the Housing Code's Residential Site Class Designations

e) Gather factual data that has a bearing on the determination of housing subsidy variations and the installation of services.

This report has been prepared in accordance with the standard specifications of the National Housing Code for Project Linked Greenfield Subsidy Housing Projects (Standard Specification GFSH-2).

2. Information used in the study

The following information sources were used in the investigation: -

a) Remote imagery from various years.

b) The 1:250 000 geological map – 3218 Clanwilliam (Council for Geoscience)

c) The geotechnical report compiled by Core Geotechnical Consultants for the Louwville High School (184-13) was also used to confirm nearby founding conditions and potential geotechnical constraints.

3. Site description

The investigated site is roughly a triangular-shaped piece of land approximately 5.1 ha in area, located in the Vredenburg suburb of Louwville. It is bordered by Klooitjieskloof Street to the north, Maclons Street to the west and Louwville High School to the south. The site is currently undeveloped. Vegetation consists of mostly small shrubs, grasses and weeds.

In terms of topography, the site is fairly flat lying with a slight slope down from the west towards the south-east. A stormwater channel lies to the south of the site and forms the boundary between Louwville High School and the investigated site. There is a moderate drop in elevation on the western part of the site with a moderate steep slope separating the two levels.

The site locality is indicated in Figure 3.1, while the site features are illustrated in the remote image in Figure 3.2.

There is no evidence of past mining activity and the area is not undermined.

Figure 3.1: Locality of the site

N

Figure 3.2: Physiological features of the site

4. Nature of investigation

4.1 Test pits and dynamic probe light (DPL) tests

The following field work was carried out: -

a) Seven test pits (TP1-TP7), located across the site, were excavated using a BELL315 digger-loader to expose the soil profile. All test pits were visually profiled, with representative soil samples taken from selected horizons for laboratory testing purposes.

b) Six Dynamic Probe Light (DPL) tests were carried out across the site, to assess soil compressibility and strength with depth.

Test pit soil profiles and DPL test positions are shown in the site plan (see Appendix A). Copies of the recorded soil profiles and DPL test results are included in Appendices B and C respectively.

4.2 Laboratory testing

The following laboratory tests were carried out on selected soil samples: -

a) Indicator tests in the form of moisture content, grading and Atterberg Limits analyses to determine basic soils engineering properties.

b) Compaction testing in the form of CBR and Mod AASHTO tests to determine material compaction characteristics.

c) Geochemical testing (pH and conductivity) to indicate possible deleterious effects of soils on concrete and buried services.

Copies of the full laboratory test results are included in Appendix D.

5. Site geology and groundwater conditions

5.1 General

The general geology of the area consists primarily of Tertiary Aged consolidated and unconsolidated limestone and lime rich sands (calcretes) overlain by sand and sandy soils.

There are scattered outcrops of course grained porphyritic Vredenburg Granite (550-500 Ma) within the surrounding area, but these are not found within the site boundaries.

5.2 Soil profile

Fill encountered across the entire site comprises gravelly clayey sand and variable amounts of builders and domestic waste. The waste is however mostly scattered and is generally less than 10 % of the fill profile. The fill ranges from 0.30 m deep (in test pit TP1) to approximately 0.8 m (in TP4) deep.

Gravelly and clayey sands of transported origin underlie the fill and extend to a depth in excess of 2.90 m below ground level (bgl). The transported soils are relatively granular and coarse grained near surface increasing in clay content and becoming more clayey with depth.

Residual soils and rock were not encountered on site. With depth, weathered residual granite soils and granite rock can be expected.

Detailed descriptions of the ground profile in specific areas may be found in the recorded soil profiles included in Appendix B.

5.3 Water table

Groundwater was encountered in TP2 at a depth of 2.8 m bgl. TP2 was located in the south-western corner of the site and is near the stormwater channel indicated earlier. The water in TP2 is potentially seepage from the nearby channel. Groundwater was not encountered in any of the other test pits.

The water table relies mainly on recharge from direct infiltration of rainfall, as well as from up-slope recharge of the groundwater. As such, the water table will be at its highest level at the end of winter, with water table elevations dropping over the dry summer season.

6. Geotechnical evaluation

6.1 Engineering and materials characteristics

Relevant soils engineering properties of the soils within 2.8 m of present ground level are summarized in Table 6.1.

On the basis of the field investigation and soils engineering data, the following points relating to geotechnical engineering conditions on the site may be made: -

a) The fill material is variable in composition and consistency and is generally moderately to highly compressible. These materials are thus unsuitable for use as a founding horizon unless unsuitable fill can be isolated and proper compaction can be achieved.

b) DPL test results indicate that the transported sandy soils as well as the clayey sands within approximately 1.0 m of present ground surface are generally dense to very dense with isolated areas of medium dense soils present throughout the site. The transported soils are moderately compressible and will form a competent load-bearing founding horizon if precautions are taken to accommodate potential softer spots.

c) Residual soils and rock, of the Vredenburg Granite, were not encountered in any of the test pits. Residual soils and possibly residual rock could be encountered within 5.00 m bgl but not within 2.80 m bgl.

d) In terms of material properties, the near-surface sands are granular and non-plastic. They will thus form a fairly good construction material of at least selected layer quality (see Table 6.1). With depth, approximately 1.0 m and deeper, the transported soils are clayey and slightly plastic. These deeper lying and more clayey soils should still be able to achieve moderate compaction levels if required.

e) Uniform excavation conditions can be expected, with relatively easy excavation in sandy and clayey soils. However, some trench side-wall collapse can be expected in places mainly due to the cohesion-less nature of the upper near surface sandy soils.

f) Significant groundwater problems are not expected to develop over the major portion of the site. A shallow and perched water table could however develop during times of heavy rain and wet winters with moderate to severe inflow, especially along the stormwater channel. Any inflow of groundwater could easily be managed by sump pumps.

g) As regards to sub-grade conditions for roads, unsuitable fill (with uncontrollable amounts of waste) will probably have to be taken to spoil and the sandy sub-grade soils recompacted to provide a stable sub-grade of moderate strength. In areas of shallow seepage, although not expected, soil compaction will be difficult and drainage may well be required due to the risk of shallow perched groundwater developing in winter. Shallow seepage might be confined to isolated areas, if encountered.

h) Wit regards to chemical testing, soils are slightly to moderately alkaline in terms of pH and moderate in conductivity. Chemical results are summarised in Table 6.1 and should be taken in to account when assessing possible deleterious effects on buried services, particularly those located above the perched water table.

As has been indicated, site conditions are relatively uniform with no evidence that any significant variability occurs. The investigation and testing carried out are thus considered to be sufficient to characterize the site and provide the necessary geotechnical input for both civil and structural design.

Table 6.1 Summary of Soils Engineering Properties

Test Pit	2	3	5	6
Depth (m)	1.5	0.5	1.0	1.0
Description	Clayey sand - Transported	Sand - Transported	Sand - Transported	Clayey sand - Transported
LL	23	-	-	18
PI	12	NP	NP	8
LS	6.0	-	-	4.0
MC	12.9	-	3.6	12.7
GM	0.85	1.15	1.17	0.96
pH	8.76	-	-	8.54
Conductivity mS/m	320	-	-	200
CBR@ 95% Mod.	-	13	-	-
Potential usage and drainage	General fill, poor to moderate drainage	General fill, selected layer, good drainage	General fill, selected layer, good drainage	General fill, moderate drainage
TRH 14 classification	-	G8 - G9	-	

Key: LL – Liquid limit. LS - Linear shrinkage PI – plasticity index. MC – in-situ moisture content. GM – grading modulus. CBR – California Bearing Ratio. NP – Non Plastic.

6.2 Slope stability and erosion

The site is essentially fairly flat-lying, with gentle gradients. The risk of soil creep and slope instability is thus considered to be low. There is a moderate drop in elevation on the western part of the site with a moderate steep slope separating the two levels. Due to the flat area of the existing sports field and the embankments created by the sports field, mass earthworks will be required.

Slopes cut in the recompacted cohesion-less near-surface sandy soils will be potentially unstable at gradients greater than 30° to 35° to the horizontal. Design precautions will thus be required for both temporary and permanent cut slopes.

The cohesion-less nature of the near-surface sandy soils over most of the site indicates that they will be susceptible to erosion by wind and water. Appropriate design precautions will therefore be necessary, particularly as regards storm water management.

6.3 Excavation classification with respect to services

Excavation in both the fill and clayey sands classifies as “soft excavation” in terms of the SANS 1200 D Earthworks Specification.

In practice, these materials can probably be excavated and worked using conventional earthmoving equipment in a doze-and-load type operation or using scrapers.

6.4 Impact of the geotechnical character of the site on subsidy housing developments

The geotechnical character of the site has a significant impact on subsidy housing development and subsidy variations. Theses impacts comprise the presence of uncontrolled fill and moderately compressible sandy and clayey soils at surface over much of the site. The relatively flat nature of the

site as well as the moderate steep slope towards the west needs to be allowed for during earthworks.

A schedule of principal generic subsidy variations applicable to the site is outlined in Table 6.2.

Table 6.2 Factors to Consider in Subsidy Variations

Category of subsidy Variation	Verification Criteria	Factors Affecting Amount of Subsidy Variation
Founding conditions: compressible sandy fill, Class P(fill),	Site class designations classified in accordance with 2.5 of Part 1 Section2 of the NHBRC Home Building Manual	Unsuitable fill will not be suitable for load-bearing foundations. Masonry houses will require foundation design, building procedures and precautionary measures to be in accordance with Tables 5, 6 and 7 of Part 1 Section 2 of the NHBRC Home Building Manual
Founding conditions: transported soils Class S/H.		Masonry houses will require foundation design, building procedures and precautionary measures to be in accordance with Tables 5, 6 and 7 of Part 1 Section 2 of the NHBRC Home Building Manual
Mass earthworks required for uneven areas. Type 1	Average slope measured across the the erf in any direction is generally flatter than 1:100 with isolated areas outside this range.	Terracing, earth works and leveling required for development, drainage and storm water design.
Mass earthworks required for uneven areas. Type 5	Average slope measured in the isolated area on the western part of the site exceeds 1:5 with isolated areas outside this range.	Terracing, earth works and leveling required for development, drainage and storm water design.

7. Site classification

The Residential Site Class Designation (after Watermeyer & Tromp and the Joint Structural Division) is set out in Table 7.1. The areal extent of classified areas is shown in the site plan in Appendix A.

The entire site is classified as P(fill)/S/H, that is, compressible sandy fill material which in turn overlie moderately compressible sandy and clayey transported soils.

Table 7.1 Residential Site Class Designations

Site Classification	Character of founding materials	Expected range of total soil movement (unimproved soils) (mm)	Differential movement (% of total)	Maximum allowable bearing pressure (kPa)
P(fill)/S/H	Uncontrolled compressible fill overlying moderately compressible sands and clayey sands	5 - 10	50	120 kPa for shallow foundations (<1.5m bgl) and 150 kPa for deeper foundations (>1.5m bgl) (after replacement of uncontrolled fill and re-compaction)

8. Foundation recommendations and solutions

The following founding options may be considered for single and possibly double storey structures with a bearing pressure not exceeding 120 kPa:-

a) Found using strip foundations at approximately 0.50 - 1.0 m bgl in medium dense to dense soils. Settlement should not exceed 10 mm with a maximum allowable bearing pressure of 120 kPa. Surface beds may be founded conventionally on compacted sub-grade at terrace level after the removal of any unsuitable fill.

b) Structures could be founded using stiffened concrete raft foundations, founded at nominal depth on recompacted clayey sands (transported) and suitable recompacted fill soils. Rafts can be expected to reduce differential movement, depending on raft stiffness. Settlement of raft structures are raft type, stiffness and bearing pressure depended. The maximum allowable bearing pressure for raft foundations is 80 kPa.

9. Drainage

Close attention to drainage and the effective collection and disposal of storm water run-off is required throughout the site, as part of surface erosion management. Roads should also be constructed with adequate drainage to minimize the possible deleterious effects of seasonal shallow perched ground water and surface water run-off and to prevent deterioration of the upper layer works (base course and sub base layers). This may include subsurface drainage in low-lying areas, or where shallow groundwater is anticipated unless levels can be raised sufficiently to ensure that shallow groundwater is kept well below road layer works.

Further measures that need to be considered include grading of slopes to promote run-off and discourage ponding of water around buildings and effective collection and disposal of storm water and water from down pipes.

10. Special precautionary measures

Apart from the measures outlined above, and relating to fill treatment, roadbed sub-grade, drainage and foundation design, no special precautions with regard to infrastructure design are considered to be required.

11. Conclusions

The Phase 1 geotechnical site investigation indicates that the site is suitable for project linked subsidy housing development, although some design precautions will need to be considered in view of the nature of the site, including the presence of uncontrolled fill and compressible sandy soils.

JOHN YATES

JURGENS SCHOEMAN

APPENDIX A

SITE PLAN AND CLASSIFICATION

LEGEND

Test Pit and DPL position

SITE CLASSIFICATION DESIGNATION

P(fill)/S/H

Uncontrolled compressible fill overlying compressible sandy soils – for the entire site

N

CORE GEOTECHNICAL CONSULTANTS
Engineering Geology and Geohydrology

Tel: +27 21 671 4274/4280
Email: admin@coregeotech.co.za
Postal address: Postnet Suite 177, Private Bag X3, 7801, Plumstead
Physical address: Unitb1, Clareview Business Park, 236 Imam Haron Road, Claremont, 7708

Client:	IX Engineers								
Project:	Vredenburg Louwville Housing								
Title:	Phase-1 Geotechnical Investigation								
Date:	Mar 19	**Traced by:**	JS	**Scale:**	NTS	**Fig no.:**	1	**Job no.:**	016-19

APPENDIX B – SOIL PROFILES

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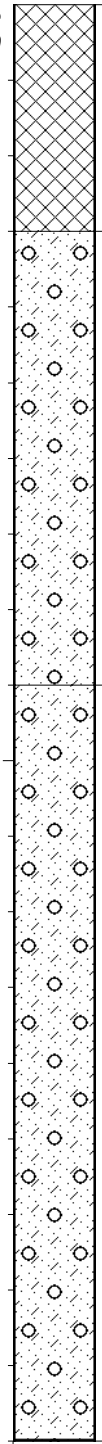
VREDENBURG
LOUWVILLE HOUSING

TEST PIT SOIL PROFILES

HOLE No: TP01
Sheet 1 of 1

JOB NUMBER: 016-19

Scale 1:10



0.00 Dry light grey and brown dense intact gravelly sand. Fill (contains minor amounts of plastic <5%).

0.30 Slightly moist dark orange brown very dense intact gravelly clayey sand. Transported (Colluvium).

0.90 Slightly moist to moist light brown speckled red and orange dense intact gravelly clayey sand with some ferricrete nodules. Transported (Colluvium).

1.90

NOTES

1) No seepage.
2) No sidewall collapse.
3) Near refusal.

CONTRACTOR :
MACHINE : TLB BELL315
DRILLED BY :
PROFILED BY : JURGENS SCHOEMAN
TYPE SET BY : JURGENS SCHOEMAN
SETUP FILE : STANDARD.SET

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DATE : FEBRUARY 2019
DATE : 25/02/2019 15:26
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COLLAR LEVEL : GL
X COORD :
Y COORD :

HOLE No: TP01

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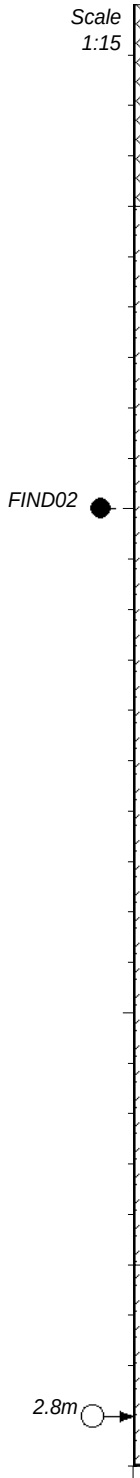
LOUWVILLE HOUSING

TEST PIT SOIL PROFILES

HOLE No: TP02
Sheet 1 of 1

JOB NUMBER: 016-19



0.00

Dry light grey and orange brown very dense intact gravelly clayey sand. Fill.

0.40

Slightly moist to moist light orange and brown dense intact gravelly clayey sand. Transported (Colluvium)(cemented).

2.50

Wet light greenish grey firm to stiff intact gravelly clayey sand. Transported (Colluvium). /*Layer more clayey as above lying layer.

2.90

NOTES

1) Water seepage at 2.8m moderate flow.
2) No sidewall collapse.
3) No refusal.
4) FIND02 sample at 1.0m.

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PROFILED BY : JURGENS SCHOEMAN
TYPE SET BY : JURGENS SCHOEMAN
SETUP FILE : STANDARD.SET

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Y COORD :

HOLE No: TP02

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TEST PIT SOIL PROFILES

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Sheet 1 of 1

JOB NUMBER: 016-19

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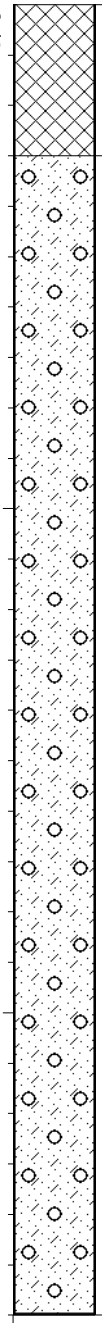

0.00 Dry light grey and orange brown very dense intact gravelly clayey sand. Fill.

0.30 Slightly moist to moist light orange and brown dense with random medium dense zones intact gravelly clayey sand. Transported (Colluvium)(cemented).

2.60

NOTES

1) No seepage.
2) No sidewall collapse.
3) No refusal.
4) BULK03 sample at 0.5m.

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PROFILED BY : JURGENS SCHOEMAN

LOCATION:
DIAM :
DATE :
DATE : FEBRUARY 2019

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Y COORD :

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LOUWVILLE HOUSING

TEST PIT SOIL PROFILES

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Sheet 1 of 1

JOB NUMBER: 016-19

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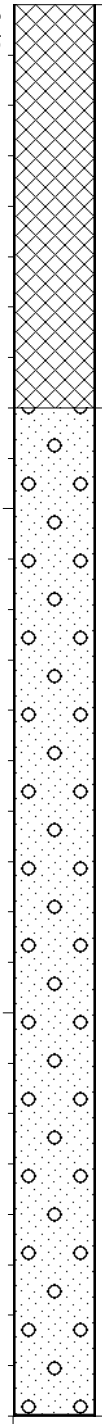

0.00 Dry light grey and orange brown medium dense intact gravelly sand. Fill with domestic and builders waste <40%.

0.80 Slightly moist light orange red and brown dense intact gravelly sand. Transported (Colluvium)(slightly cemented).

2.80

NOTES

1) No seepage.
2) No sidewall collapse.
3) No refusal.

CONTRACTOR :
MACHINE : TLB BELL315
DRILLED BY :
PROFILED BY : JURGENS SCHOEMAN

LOCATION:
DIAM :
DATE :
DATE : FEBRUARY 2019

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Y COORD :

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SETUP FILE : STANDARD.SET

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TEST PIT SOIL PROFILES

HOLE No: TP05
Sheet 1 of 1

JOB NUMBER: 016-19

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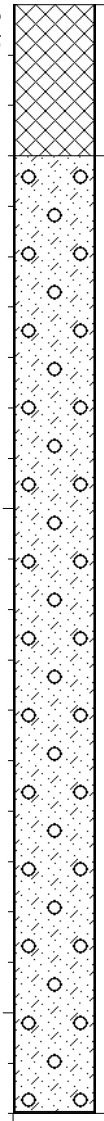

0.00 — Slightly moist light grey and orange brown <u>medium dense</u> to <u>dense</u> intact gravelly clayey sand. <u>Fill</u> with domestic waste <10%.

0.30 — Slightly moist to moist light orange and brown <u>dense</u> with random <u>medium dense</u> zones intact <u>gravelly clayey sand.</u> Transported (Colluvium)(cemented).

FIND05 ●

2.20

NOTES

1) No seepage.
2) No sidewall collapse.
3) No refusal.
4) FIND05 sample at 1.0m.

CONTRACTOR :
MACHINE : TLB BELL315
DRILLED BY :
PROFILED BY : JURGENS SCHOEMAN

LOCATION:
DIAM :
DATE :
DATE : FEBRUARY 2019

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: TP05

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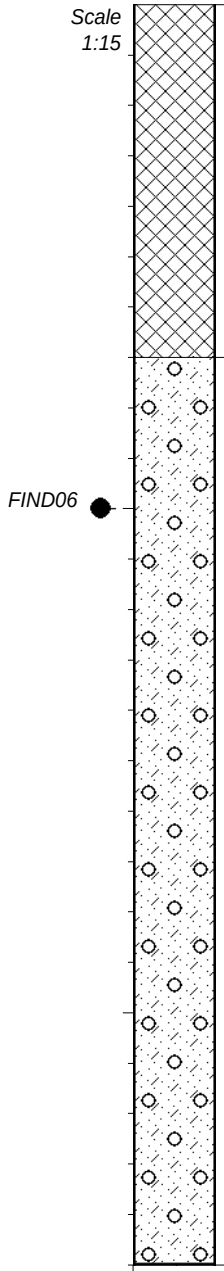
TEST PIT SOIL PROFILES

HOLE No: TP06
Sheet 1 of 1

JOB NUMBER: 016-19



Dry to slightly moist light grey and orange brown medium dense to dense intact gravelly sand. Fill with domestic waste <10%.

Slightly moist to moist light orange and brown dense with random medium dense zones intact gravelly clayey sand. Transported (Colluvium)(cemented).

NOTES

1) No seepage.
2) No sidewall collapse.
3) No refusal.
4) FIND06 sample at 1.0m.

CONTRACTOR :
MACHINE : TLB BELL315
DRILLED BY :
PROFILED BY : JURGENS SCHOEMAN

LOCATION:
DIAM :
DATE :
DATE : FEBRUARY 2019

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: TP06

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TEST PIT SOIL PROFILES

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Sheet 1 of 1

JOB NUMBER: 016-19

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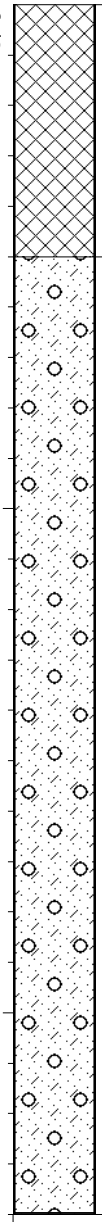

0.00

Dry to slightly moist light grey and orange brown medium dense to dense intact gravelly sand. Fill with domestic waste <10%.

0.50

Slightly moist to moist light orange and brown dense with random medium dense zones intact gravelly clayey sand. Transported (Colluvium)(cemented).

2.40

NOTES

1) No seepage.
2) No sidewall collapse.
3) No refusal.

CONTRACTOR :
MACHINE : TLB BELL315
DRILLED BY :
PROFILED BY : JURGENS SCHOEMAN

LOCATION:
DIAM :
DATE :
DATE : FEBRUARY 2019

COLLAR LEVEL :
X COORD :
Y COORD :

HOLE No: TP07

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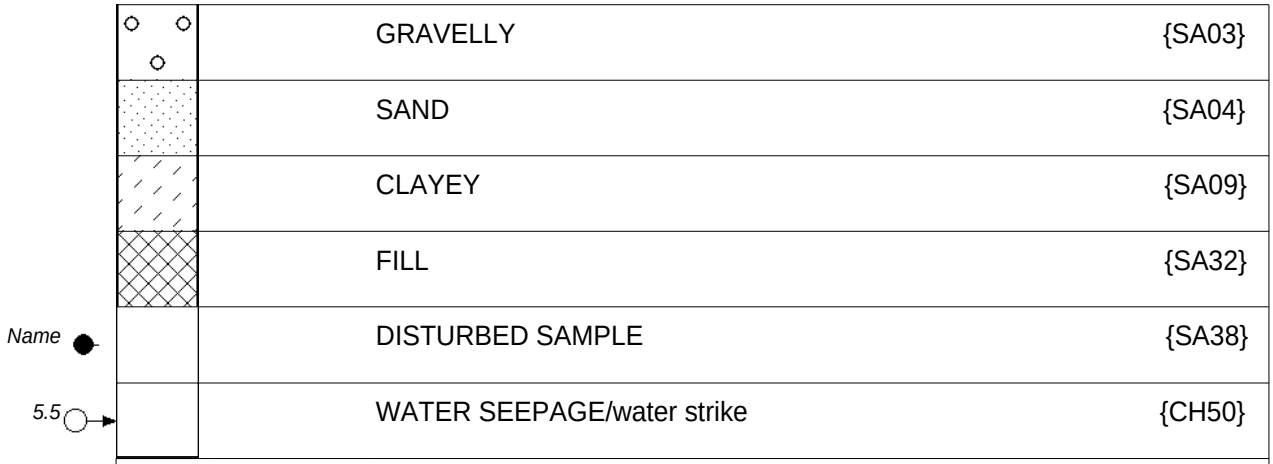
VREDENBURG
LOUWVILLE HOUSING

TEST PIT SOIL PROFILES

LEGEND
Sheet 1 of 1

JOB NUMBER: 016-19



CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

LOCATION:
DIAM :
DATE :
DATE :

COLLAR LEVEL :
X COORD :
Y COORD :

TYPE SET BY : JURGENS SCHOEMAN
SETUP FILE : STANDARD.SET

DATE : 25/02/2019 15:26
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LEGEND
SUMMARY OF SYMBOLS

APPENDIX C – DYNAMIC PROBE LIGHT (DPL) TESTS

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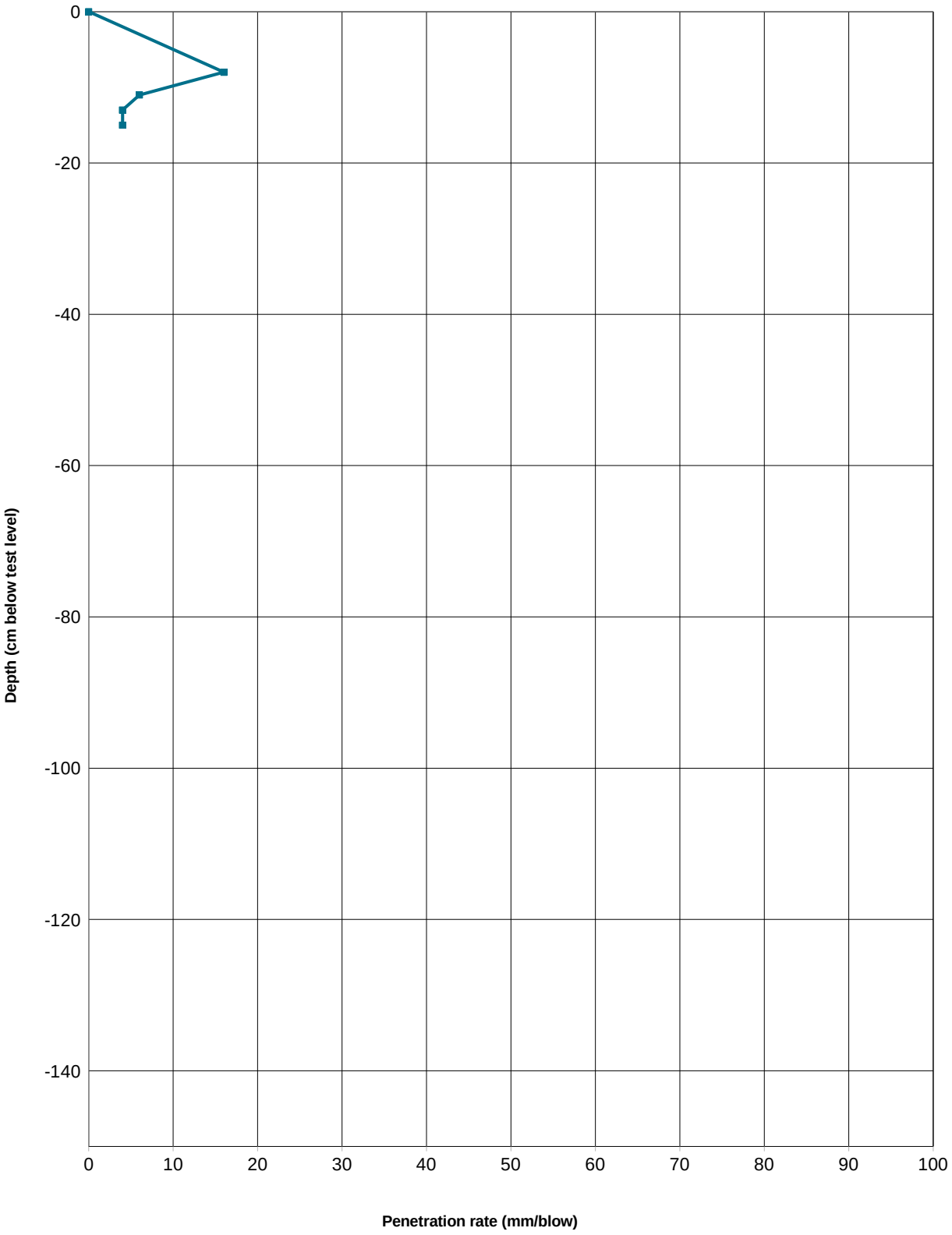
JOB NO.: 016-19

DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: 1
LEVEL: GL



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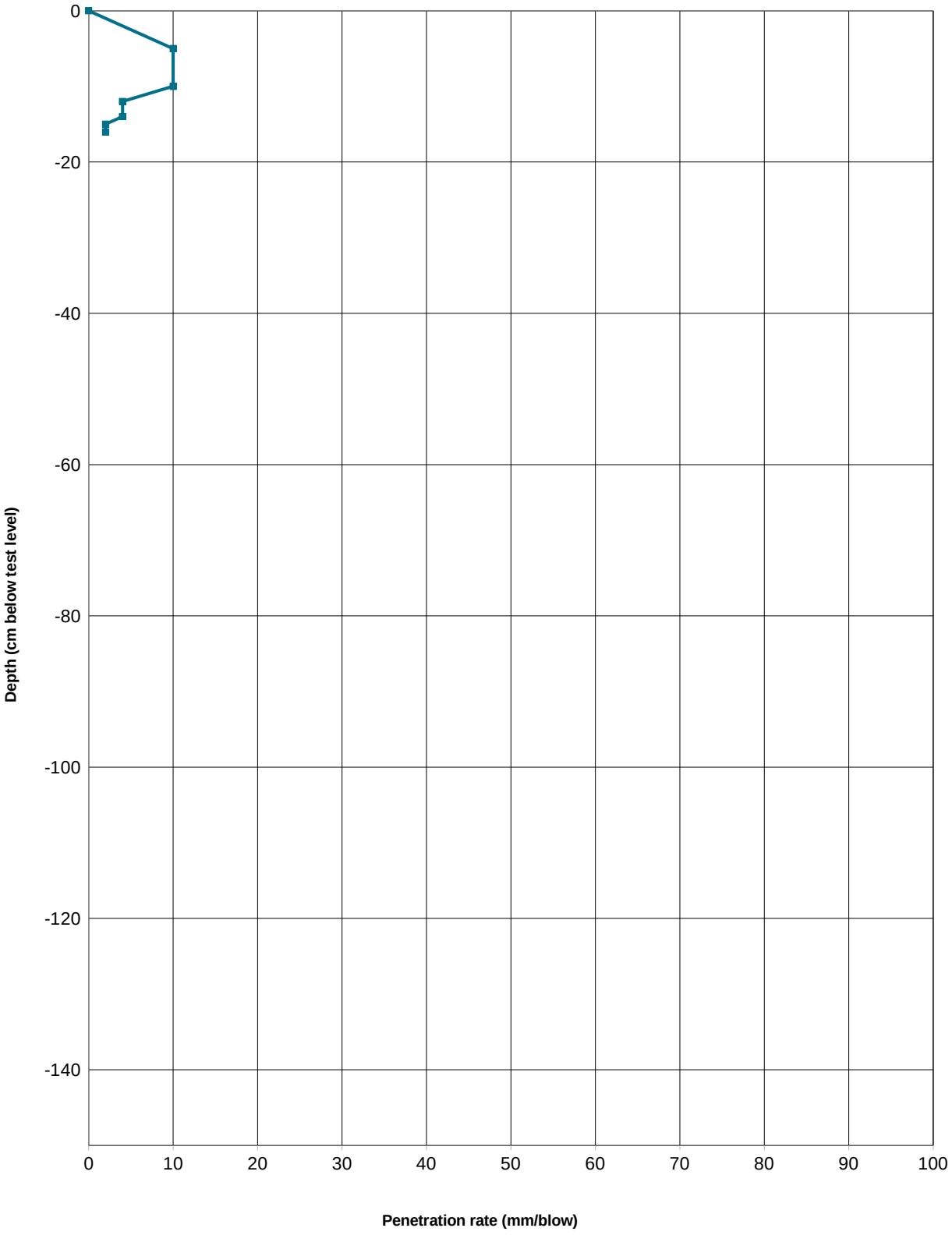
DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: 2
LEVEL: GL



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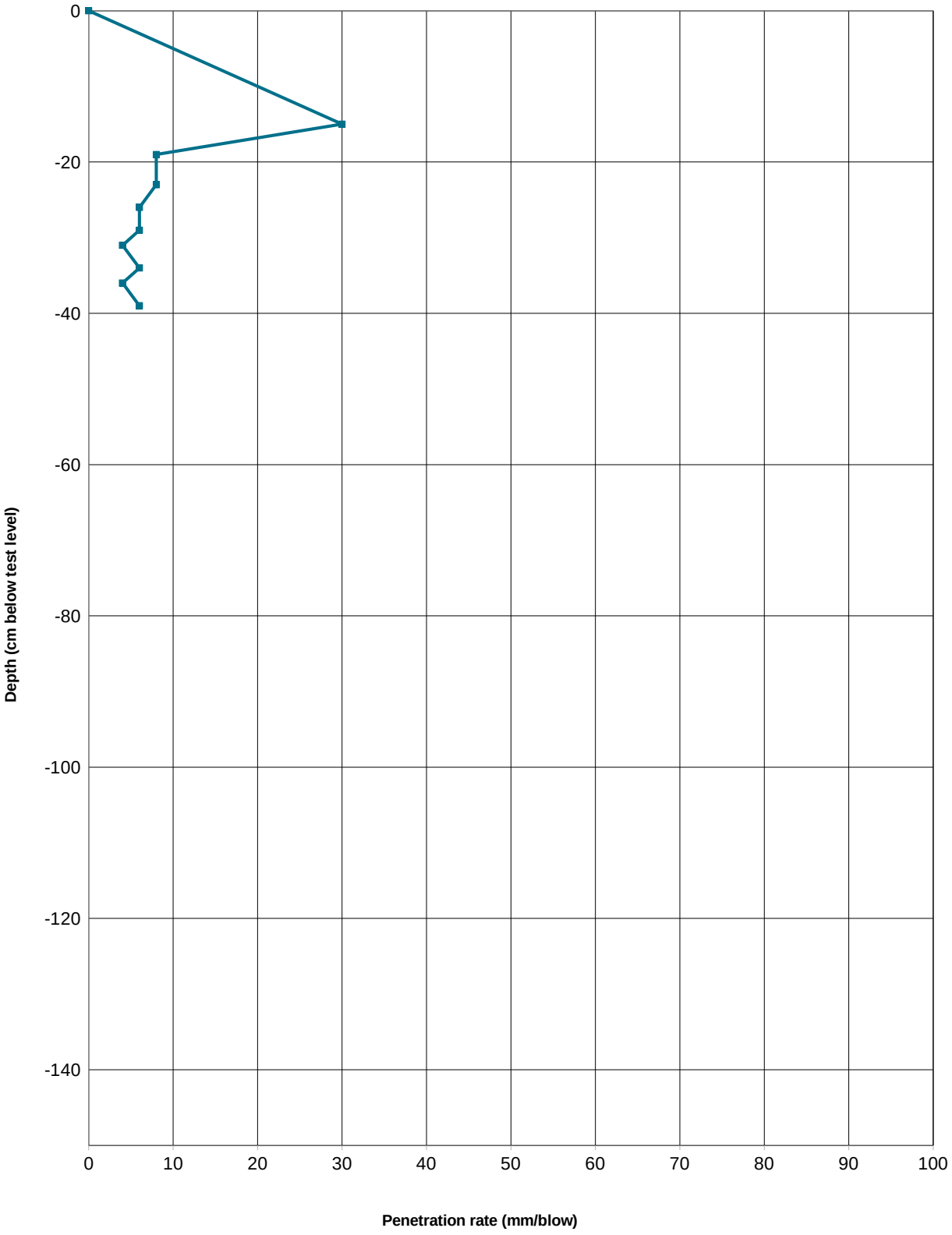
DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: 3
LEVEL: GL



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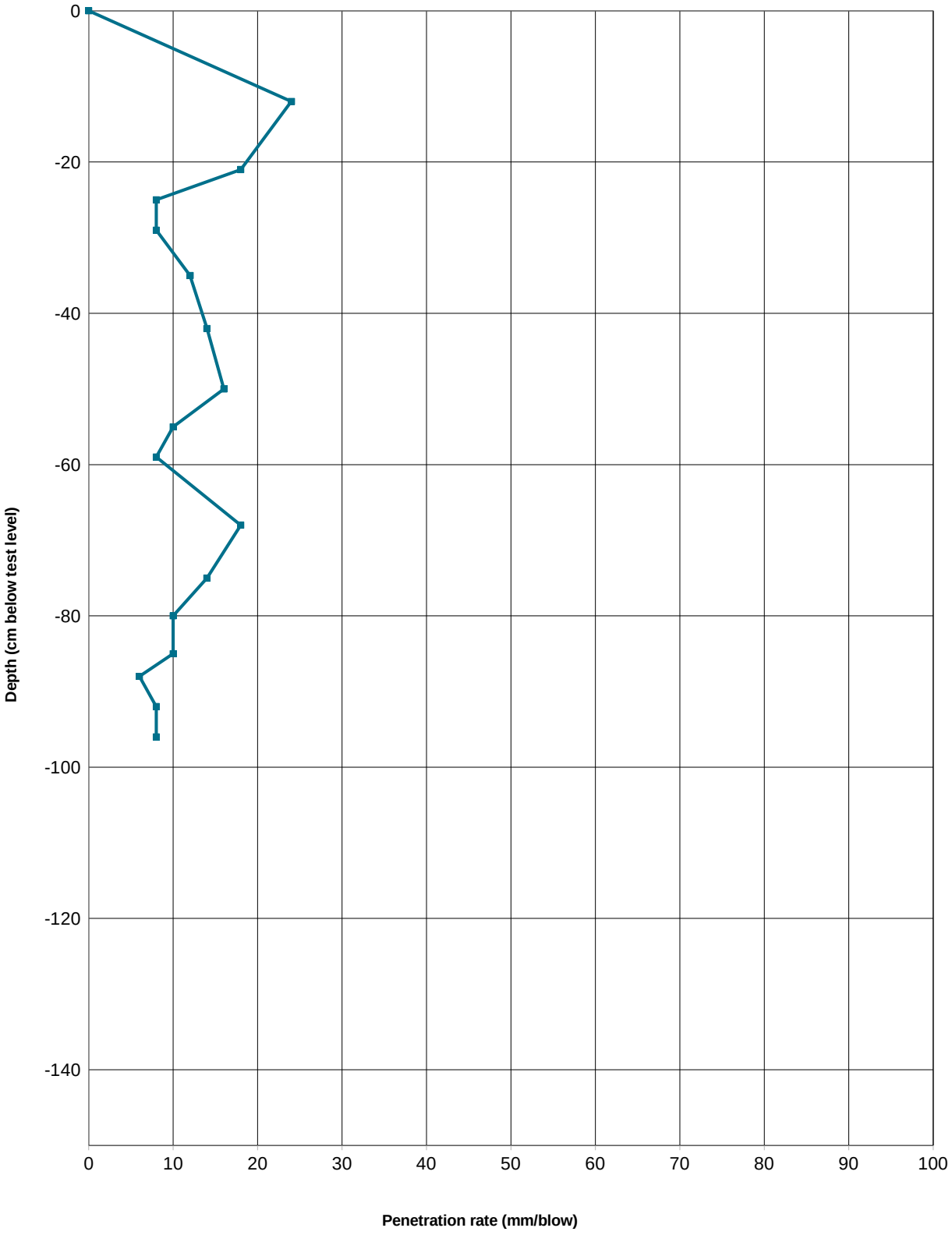
DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: 4
LEVEL: GL



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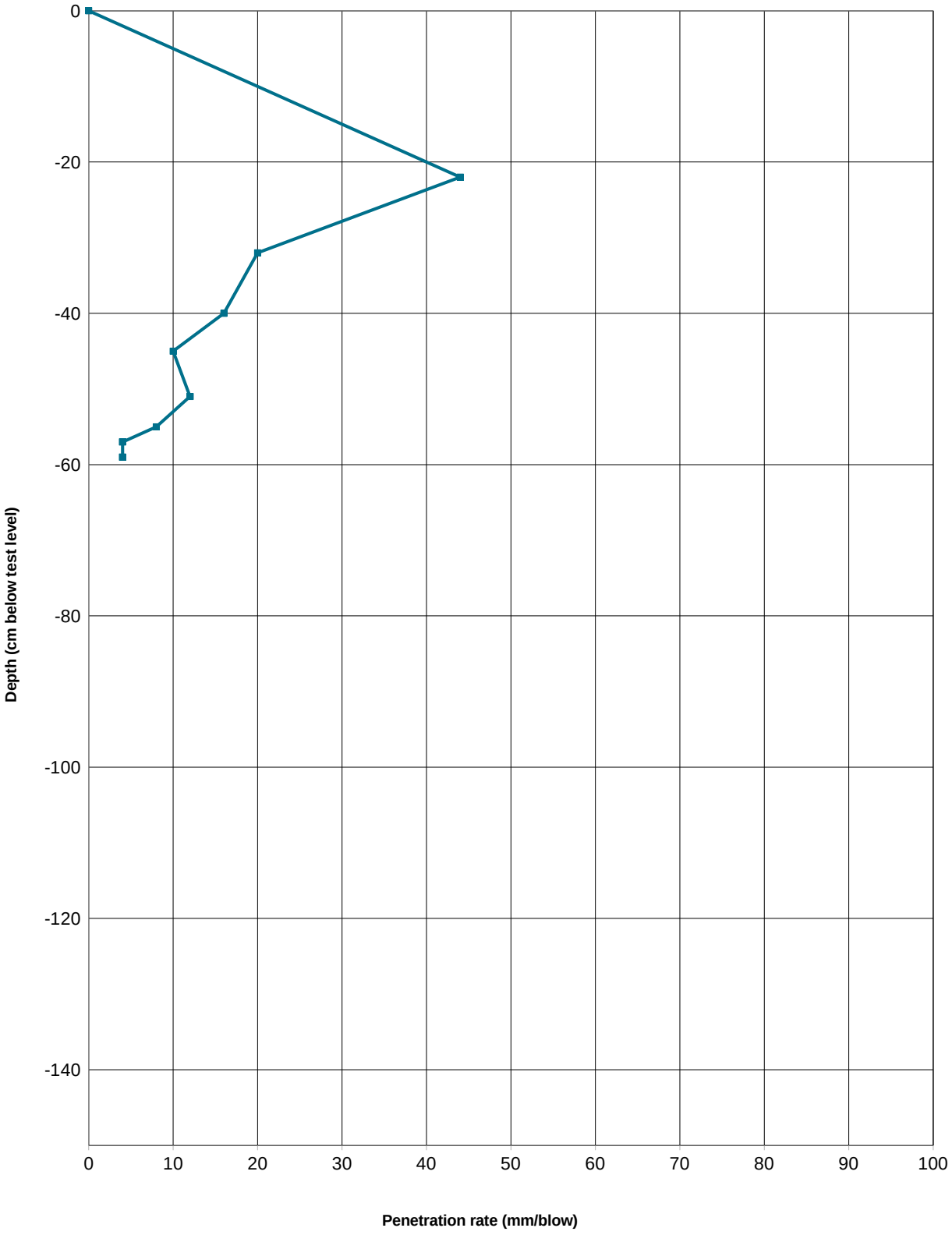
JOB NO.: 016-19

DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: 5
LEVEL: GL



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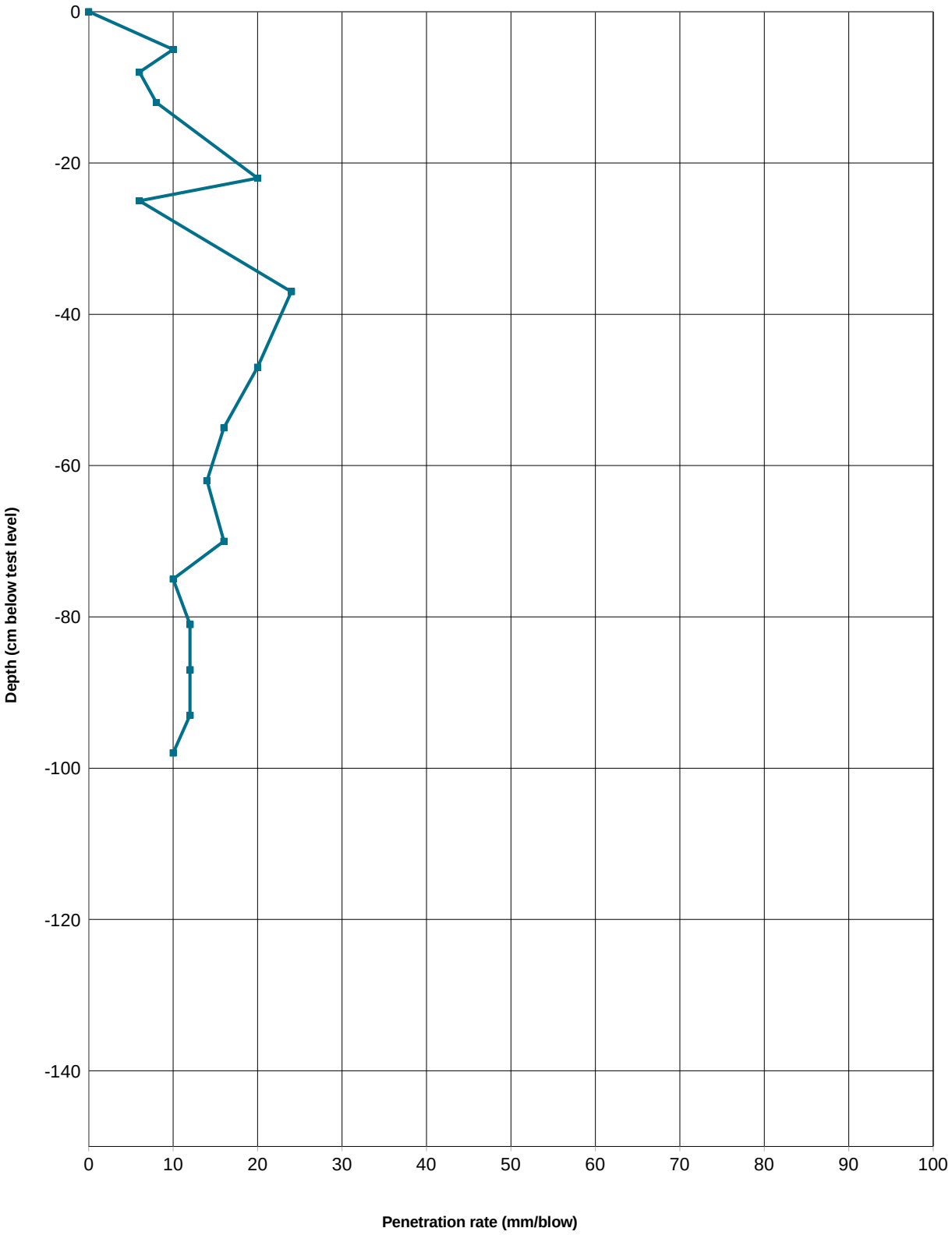
JOB NO.: 016-19

DYNAMIC PROBE LIGHT (DPL) TEST

DPL NO: 6
LEVEL: GL



APPENDIX D
Laboratory test results

GEOSCIENCE LABORATORIES (PTY) LTD

CLIENT:	Core Geotechnical Postnet Suite 177 Private Bag X3 Plumstead 7801	**PROJECT:**	Vredenburg Louwville Housing Erf 7752
		DATE:	05-03-2019
ATT:	John Yates	**REF:**	L190224

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	brown & red sand	**SAMPLE NO. :**	31241
POSITION :	TP 3 @ 0.5m	**CLIENT SAMPLE NO. :**	

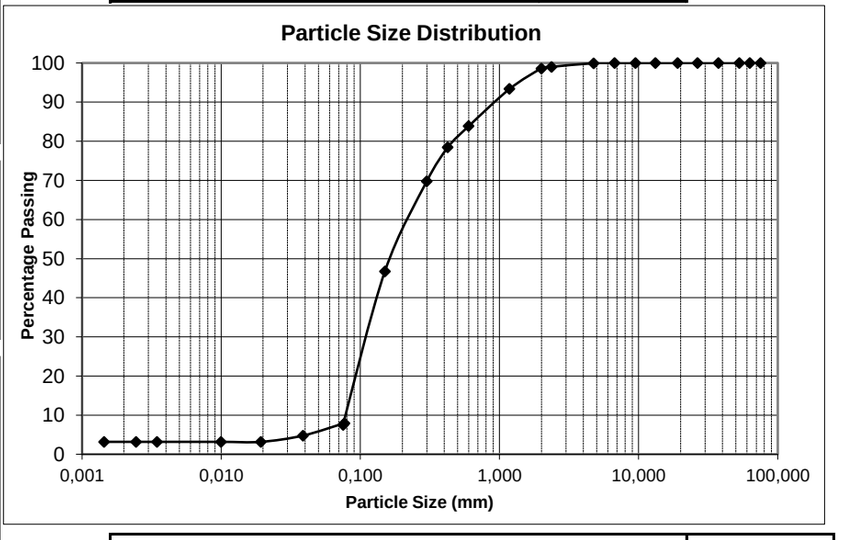
Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	
	4,75	100
	2,36	99
	2,00	99
	1,18	93
	0,600	84
	0,425	78
	0,300	70
	0,150	47
	0,0750	8

Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0767	8
0,0386	5
0,0193	3
0,0100	3
0,0035	3
0,0024	3
0,0014	3

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	
pH:	
Conductivity mS/m:	

Atterberg Limits :	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	



MOD AASHTO ; C.B.R. :	
MOD AASHTO (Kg/m³)	1804
O.M.C. (%)	10,2
C.B.R. @ 100% Comp.	30
C.B.R. @ 98 % Comp.	20
C.B.R. @ 95 % Comp.	13
C.B.R. @ 93 % Comp.	9
C.B.R. @ 90 % Comp.	4
Swell (max) %	0,00

Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	0
Sand : Percentage - 4.75mm and + 0.075mm	92
Silt : Percentage - 0.075mm and + 0.002mm	5
Clay : Percentage - 0.002mm	3

For Geoscience:

Remarks:

ConSR22

GEOSCIENCE LABORATORIES (PTY) LTD

CLIENT:	Core Geotechnical Postnet Suite 177 Private Bag X3 Plumstead 7801	**PROJECT:**	Vredenburg Louwville Housing Erf 7752
		DATE:	05-03-2019
ATT:	John Yates	**REF:**	L190224

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	yellow brown clayey sand	**SAMPLE NO. :**	31240
POSITION :	TP 2 @ 1.5m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	100
	6,70	99
	4,75	99
	2,36	98
	2,00	97
	1,18	93
	0,600	86
	0,425	82
	0,300	75
	0,150	58
	0,0750	36

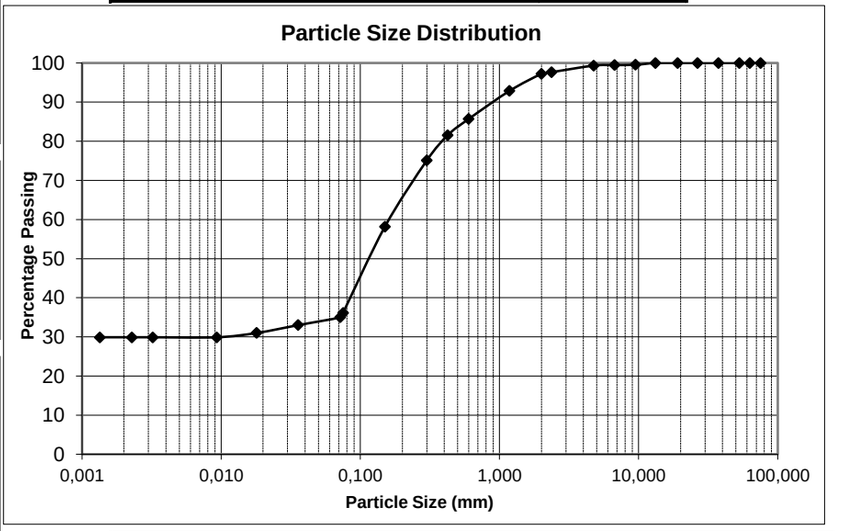
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0715	35
0,0357	33
0,0180	31
0,0093	30
0,0032	30
0,0023	30
0,0013	30

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	12,9
pH:	8,76
Conductivity mS/m:	320

Atterberg Limits :	
Liquid Limit	23
Plastic Index	12
Linear Shrinkage	6,0

MOD AASHTO ; C.B.R. :	
MOD AASHTO (Kg/m³)	
O.M.C. (%)	
C.B.R. @ 100% Comp.	
C.B.R. @ 98 % Comp.	
C.B.R. @ 95 % Comp.	
C.B.R. @ 93 % Comp.	
C.B.R. @ 90 % Comp.	
Swell (max) %	



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	1
Sand : Percentage - 4.75mm and + 0.075mm	63
Silt : Percentage - 0.075mm and + 0.002mm	6
Clay : Percentage - 0.002mm	30

For Geoscience:

Remarks:

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GEOSCIENCE LABORATORIES (PTY) LTD

CLIENT:	Core Geotechnical Postnet Suite 177 Private Bag X3 Plumstead 7801	**PROJECT:**	Vredenburg Louwville Housing Erf 7752
		DATE:	05-03-2019
ATT:	John Yates	**REF:**	L190224

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	brown clayey sand	**SAMPLE NO. :**	31243
POSITION :	TP 6 @ 1.0m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	
	4,75	100
	2,36	98
	2,00	98
	1,18	92
	0,600	83
	0,425	79
	0,300	72
	0,150	53
	0,0750	27

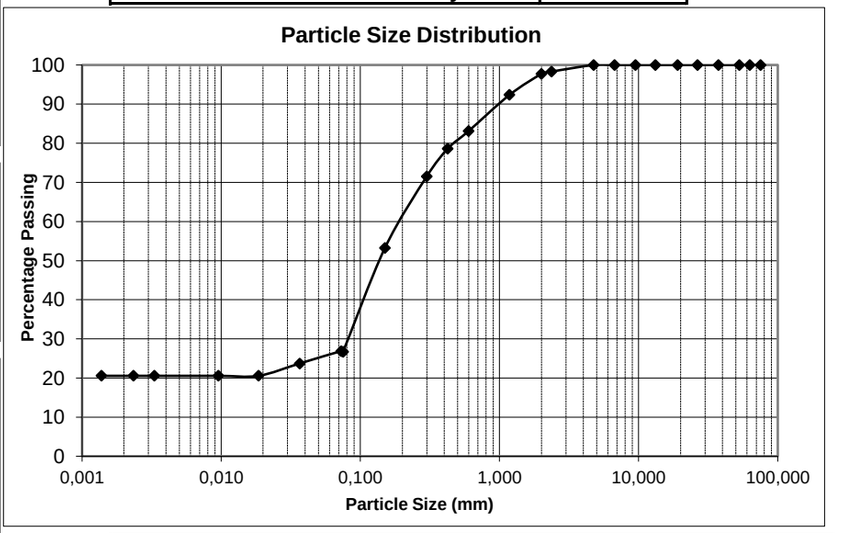
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0727	27
0,0366	24
0,0185	21
0,0096	21
0,0033	21
0,0023	21
0,0014	21

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	12,7
pH:	8,54
Conductivity mS/m:	200

Atterberg Limits :	
Liquid Limit	18
Plastic Index	8
Linear Shrinkage	4,0

MOD AASHTO ; C.B.R. :	
MOD AASHTO (Kg/m³)	
O.M.C. (%)	
C.B.R. @ 100% Comp.	
C.B.R. @ 98 % Comp.	
C.B.R. @ 95 % Comp.	
C.B.R. @ 93 % Comp.	
C.B.R. @ 90 % Comp.	
Swell (max) %	



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	0
Sand : Percentage - 4.75mm and + 0.075mm	73
Silt : Percentage - 0.075mm and + 0.002mm	7
Clay : Percentage - 0.002mm	20

The above test results are pertinent to the samples received and tested only.
While the tests are carried out according to recognized standards Geoscience shall not be liable for erroneous testing or reporting thereof. This report may not be reproduced except in full without prior consent of Geoscience.

For Geoscience:

Remarks:

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GEOSCIENCE LABORATORIES (PTY) LTD

CLIENT:	Core Geotechnical Postnet Suite 177 Private Bag X3 Plumstead 7801	**PROJECT:**	Vredenburg Louwville Housing Erf 7752
		DATE:	05-03-2019
ATT:	John Yates	**REF:**	L190224

ASTM D422 SIEVE ANALYSIS

DESCRIPTION :	brown sand	**SAMPLE NO. :**	31242
POSITION :	TP 5 @ 1.0m	**CLIENT SAMPLE NO. :**	

Sieve Analysis		Percent Passing
SIEVE SIZE (mm)	75,00	
	63,00	
	53,00	
	37,50	
	26,50	
	19,00	
	13,20	
	9,50	
	6,70	
	4,75	100
	2,36	98
	2,00	97
	1,18	90
	0,600	80
	0,425	75
	0,300	66
	0,150	42
	0,0750	11

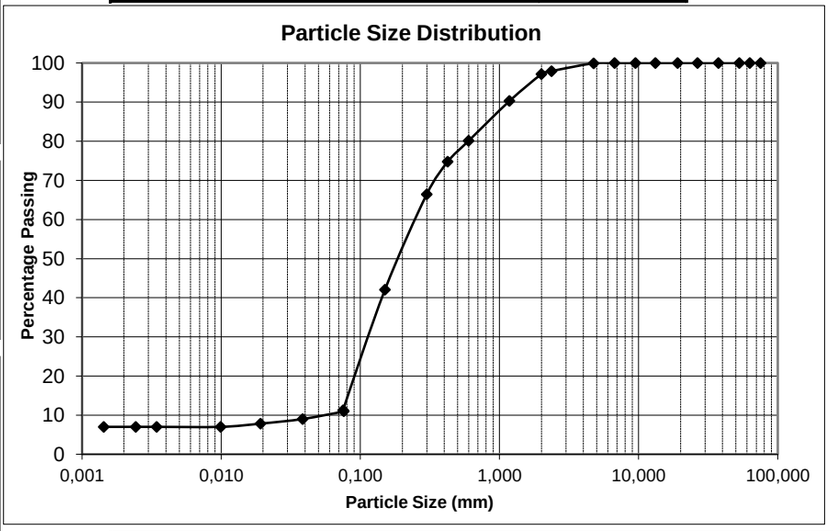
Hydrometer Analysis	
Diameter of particle (mm)	Percentage of soil suspension (%)
0,0760	11
0,0384	9
0,0192	8
0,0099	7
0,0034	7
0,0024	7
0,0014	7

SCS Dispersion Test	
Diameter of particle (mm)	Percentage of soil suspension (%)

% SCS Dispersion:	
Initial Moisture Content (%) :	3,6
pH:	
Conductivity mS/m:	

Atterberg Limits :	
Liquid Limit	
Plastic Index	N-P
Linear Shrinkage	

MOD AASHTO ; C.B.R. :	
MOD AASHTO (Kg/m³)	
O.M.C. (%)	
C.B.R. @ 100% Comp.	
C.B.R. @ 98 % Comp.	
C.B.R. @ 95 % Comp.	
C.B.R. @ 93 % Comp.	
C.B.R. @ 90 % Comp.	
Swell (max) %	



Tabulated Summary	Percentage
Gravel : Percentage - 4.75 mm	0
Sand : Percentage - 4.75mm and + 0.075mm	89
Silt : Percentage - 0.075mm and + 0.002mm	3
Clay : Percentage - 0.002mm	8

For Geoscience:

Remarks:

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