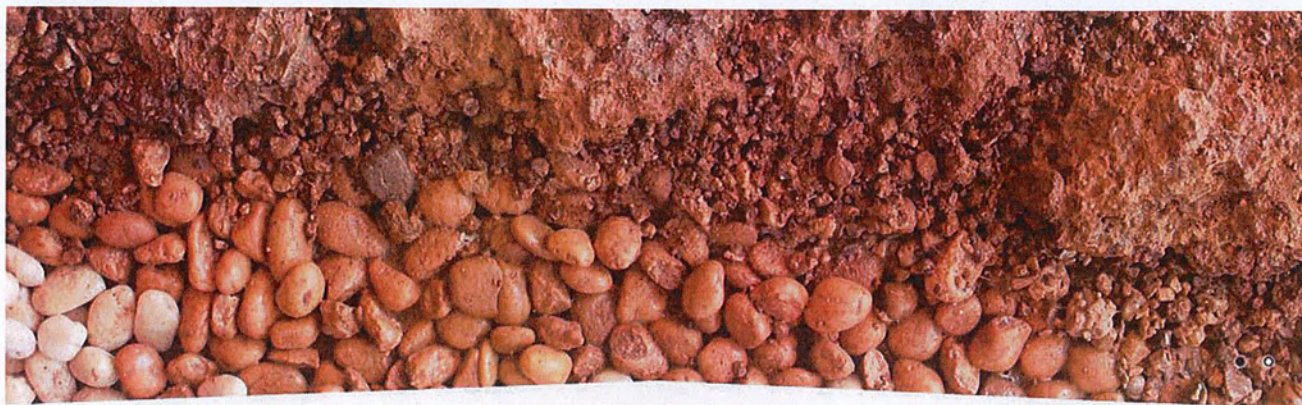




**SAICE 2010 Site Investigation Code of Practice Guided
Tender Design or Basic Engineering Geotechnical Site
Investigation Report for R/3, The Willows 340-JR, Region 6,
Ward 86, Tshwane Metropolitan Municipality, Gauteng
Province, South Africa**

SAICE 2010 Code of Practice Guided Feasibility Geotechnical Site Investigation

ROCKSOIL CONSULT PTY LTD
REG NO 2013/139402/07
DIRECTOR: DIRK HERMAN WESSELS
✉ **INFO@ROCKSOILCONSULT.CO.ZA**
SAGNASP: 400076/08

Client: Bvi Consulting Engineers (Pty) Ltd. Gauteng

Project number: RS18056

Report version: V1.0

30 September 2019

ORIGINAL



**SAICE 2010 Site Investigation Code of Practice Guided
Tender Design or Basic Engineering Geotechnical Site
Investigation Report for R/3, The Willows 340-JR, Region 6,
Ward 86, Tshwane Metropolitan Municipality, Gauteng
Province, South Africa**

Document History

Rev.	Date Revised	Editor Details	Note of Changes Conducted
V1.0	30 September 2019	DH Wessels	Final Report

Document Approval and Quality Control

Action	Responsible Person	Profession and Registration
Fieldwork	JD Swart	Qualified Engineering Geologist
Data capturing	JD Swart	Engineering Geologists
Report writing	JD Swart and DH Wessels	Engineering Geologists - Pr.Sci.Nat
Reviewed	Jl Roux	Engineering Geologist - Pr.Sci.Nat
Approved by	DH Wessels	Engineering Geologist - Pr.Sci.Nat

© RockSoil Consult (Pty) Ltd.

No part of this document or any of the information or data within may be disclosed, copied, distributed or used for any purposes without the written permission of RockSoil Consult (Pty) Ltd. RockSoil Consult (Pty) Ltd. take no responsibility for any loss of any kind resulting from miss-interpretation of data that may result from selective data distribution. If anything is unclear, feel free to ask.

Table of Contents

Page no.

1	Introduction and Terms of Reference	1
2	Objectives of the Assessment.....	1
3	Nature of the Development.....	2
4	Information Used During the Study.....	2
5	Investigation Methodology.....	3
6	Site Description.....	4
6.1	Location.....	4
6.2	Current Land Use and Known Services	5
6.3	Topography and Drainage.....	5
6.4	Vegetation	5
6.5	Accessibility	6
7	Regional Climate	6
8	Geology	7
8.1	Regional Geology.....	7
8.2	Site Specific Geology	8
9	Geohydrology.....	9
9.1	Groundwater Levels and Quality.....	9
9.2	Seasonal Seepage Water or Perched Water Tables.....	9
10	Basic Geotechnical Evaluation	10
10.1	Material Grading and Atterberg Limits	10
10.2	Material Classification	10
10.2.1	Unified Soil Classification System	10
10.2.2	AASHTO Classification System	11
10.2.3	TRH or COLTO Classification System.....	11
10.3	Typical Material Properties and Performance Correlations	12
10.4	Geotechnical Constraints	12
10.4.1	Collapse and Compressibility	12
10.4.2	Seepage.....	13

10.4.3	Soil Heave or Activity	13
10.4.4	Susceptibility to Erosion.....	15
10.4.5	Excavatability	15
10.4.6	Undermined Ground	16
10.4.7	Stability (Dolomitic Land).....	16
10.4.8	Steep Slopes and Areas of Unstable Natural Slopes.....	16
10.4.9	Areas Subject to Seismic Activity	16
10.4.10	Areas Subject to Flooding	17
10.4.11	Contaminated Land	17
10.4.12	Soil Corrosiveness.....	18
11	Site Class Designations (NHBRC & SANS634)	18
12	Foundation Options and Recommendations.....	20
12.1	Bearing Capacity Principles	20
12.2	Generic Foundation Options for Small Low-Bearing Structures.....	22
12.3	Generic Foundation Options for Larger Structures.....	24
12.4	Soil or Material Parameters to Consider in Evaluation	24
12.5	Allowable Bearing Capacity.....	25
12.5.1	Cohesive Soils (Undrained Clay)	25
12.5.2	Non-Cohesive Soils.....	26
13	Drainage.....	28
14	Construction Materials	29
14.1	Soil Mattress Construction	29
14.2	Road Construction.....	30
14.3	Pipe Bedding and Backfill	31
14.4	Fine aggregate for Mortar and Plaster.....	31
14.5	Coarse Aggregate for Concrete	31
15	Special Measures or Considerations.....	32
16	Identified Shortcomings.....	32
17	Conclusions	32
18	Way Forward.....	33

19 Report Provisions.....35

20 References1

List of Appendices

Appendix no.

Appendix A: Figures	A
Appendix B: Soil Profile Descriptions	B
Appendix C: Soil Profile Photographs	C
Appendix D: Laboratory Test Results	D
Appendix E: Summary and Evaluation Sheets	E
Appendix F: Reference Tables.....	F

List of Figures

Page / Appendix no.

Figure R1: Regional Geological Sheet 1:50 000-scale 2528 CB Silverton.....	8
Figure R2: Seismic Hazard Zones of South Africa.....	17
Figure A3: Site Locality.....	A
Figure A4: Ground Contours - Regional Topography.....	A
Figure A5: SANBI BGIS LUDS Tool - National Wetlands and Biodiversity Areas	A
Figure A6: Evaluation Test Pit Positions.....	A
Figure A7: Seepage Water Encountered.....	A
Figure A8: Seepage Water Encountered – Aerial Image Overlay (2009-09-13 as YMD)	A
Figure A9: Seepage Water Encountered – Aerial Image Overlay (2016-05-28 as YMD)	A
Figure A10: Seepage Water Encountered – Aerial Image Overlay (2019-05-13 as YMD)	A
Figure A11: Test Pit Termination Depths (mbgl).....	A
Figure A12: Test Pit Termination Depths (mbgl) - Contoured	A
Figure A13: Preliminary Broad Zonation Map	A
Figure A14: Preliminary Broad Zonation Map – Aerial Image Overlay (2019-05-13 as YMD)	A

List of Charts

Page no.

Chart R1: Regional Average, Minimum and Maximum Temperatures (source: climate-data.org).....	6
Chart R2: Regional Average Monthly Rainfall (source: climate-data.org).....	7
Chart R3: CBR Values at Different Mod. AASHTO Compaction Efforts.....	12
Chart R4: Potential Swell Predication Chart – Weighted PI vs Clay Fraction of Whole Sample	13
Chart R5: Design Resistance of Spread Footings on Undrained Clay for Vertical, Concentric Loading (SANS10160-5, 2011, p. 31)	26
Chart R6: Design Resistance of Shallow Spread Footings on a Non-Cohesive Soil (Deep Water Table) (SANS10160-5, 2011, p. 32)	27
Chart R7: Design Resistance of Shallow Spread Footings on a Non-Cohesive Soil (Water Table at Founding Level) (SANS10160-5, 2011, p. 32).....	27
Chart R8: Design Resistance of Shallow Spread Footings on a Non-Cohesive Soil (Water Table at Surface) (SANS10160-5, 2011, p. 33)	28
Chart R9: Site Investigation Good Practice Flow Chart (SAICE, 2010)	34

List of Tables

Page / Appendix no.

Table R1: General Investigation Procedures and Information	3
Table R2: Laboratory Tests and Tests Quantities.....	4
Table R3: Swell Pressure Test Results Basic Summary	14
Table R4: Total Heave Estimations – Generic Layer Thicknesses – Van Der Merwe’s Method.....	15
Table R5: Residential Site Class Designation (SANS634, 2012).....	20
Table R6: Typical Material Parameters for Preliminary or Conceptual Analysis	24
Table R7: Relaxed Pipe Bedding Specifications (DWA).....	31
Table E8: Simplified Soil Horizons and General Conditions Encountered	E
Table E9: Foundation Indicator Test Results and Soil Classification Summary.....	E
Table E10: Soil pH, Conductivity and Corrosiveness Rating.....	E
Table E11: Typical Compressibility Rating Correlations Based on USCS.....	E
Table E12: Compaction and Typical Fill Rating Correlations Based on USCS.....	E
Table E13: Typical Material Rating for Use as Road Construction Material	E
Table E14: Typical Material Rating for Use as General and Foundation Fill.....	E
Table F15: Residential Site Class Designations (SAICE, 1995).....	F
Table F16: Foundation design, building procedures and precautionary measures for single-storey residential buildings founded on horizons subject to consolidation settlement (SAICE, 1995).....	F
Table F17: Foundation design, building procedures and precautionary measures for single-storey residential buildings founded on horizons subject to both consolidation and collapse settlement (SAICE, 1995).....	F
Table F18: Foundation design, building procedures and precautionary measures for single-storey residential buildings founded on expansive soil horizons (SAICE, 1995).....	F
Table F19: Geotechnical Constraints in Urban Development (SANS634, 2012).....	F
Table F20: Shear Strength Parameters for Slow Draining Cohesive Materials (SAICE, 2010)	F
Table F21: Shear Strength Parameters for Quick Draining Non-Cohesive Materials (SAICE, 2010).....	F
Table F22: Elastic Parameters of Various Soils (Das & Sivakugan, 2015, p. 623)	F
Table F23: Typical Properties of Compacted Soils (NAVFAC, 1986)	F
Table F24: Summary Evaluation of Fill Materials for Compaction (Das & Sobhan, 2014, p. 183).....	F
Table F25: Typical Properties of Compacted Soils (Franki, 2008, pp. 51-52)	F
Table F26: Classification of Plasticity (Das & Sobhan, 2014, p. 102)	F
Table F27: Approximate Range of Capillary Rise in Soils (Das & Sobhan, 2014, p. 296)	F
Table 28: Shear Strength-Clays (TRH10, 1994, p. 62)	F
Table 29: Compressibility (All Material) (TRH10, 1994, p. 63)	F
Table 30: Elastic Modulus for Sands (TRH10, 1994, p. 63)	F
Table 31: Coefficient of Compressibility for Clays (TRH10, 1994, p. 64)	F
Table 32: Coefficient of Consolidation (TRH10, 1994, p. 64).....	F
Table 33: Presumed Safe Bearing Capacity on Supporting Ground for Central Vertical Static Loads* on the Foundation (SABS0161-1980-(Amdt.1986))	F
Table 34: Consistency of Cohesive Soils (SABS0161-1980-(Amdt.1986))	F
Table 35: Hardness of Rocks (SABS0161-1980-(Amdt.1986)).....	F

List of Formulas

Page no.

Equation 10.1	14
Equation 10.2	14
Equation 10.3	14
Equation 12.1	21
Equation 12.2	21
Equation 12.3	25

List of Selective Symbols

R_d : design value of resistance to an action

R_k : characteristic value of resistance to an action

ϕ' : angle of shearing resistance in terms of effective stress

ϕ'_{d} : design value of ϕ'

ϕ'_{k} : characteristic value of ϕ'

c : Cohesion intercept

c' : Cohesion intercept in terms of effective stress

L : Larger of the plan dimensions of a rectangular footing

B : Smaller of the plan dimensions of a rectangular footing

g :

c_u : Undrained shear strength

$c_{u,d}$: Design value of undrained shear strength

$c_{u,k}$: Characteristic value of undrained shear strength

γ' : *Submerged weight density of ground*

Z : *Depth of foundation below ground level (bottom of foundation)*

N_c : *Bearing capacity factor*

$g * Z = p_0$: *Total stress at the level of the base of the foundation*

List of Selective Abbreviations

Abbreviation	Description
AASHTO	American Association of State Highway and Transportation Officials
CBR	California Bearing Ratio
COLTO	Committee of Land Transport Officials
Eff.	Effort
FID	Foundation Indicator Test
GM	Grading Modulus
Ha	Hectares
ISRM	International Society for Rock Mechanics
LL	Liquid Limit
LS	Linear Shrinkage
m	Meter
mamsl	Meters Above Mean Sea Level
mbngl	Meters Below Natural Ground Level
MDD	Maximum Dry Density for specific compaction energy
mm	Millimetre
Mod.	Modified
PI	Plasticity Index
PL	Plastic Limit
SANS	South African National Standard
SAPEM	South African Pavement Engineering Manual
TP	Test Pit
USCS	Unified Soil Classification System

List of Selective Definitions

Characteristic value: value of an action or material property having a prescribed probability of not being attained.

NOTE This value generally corresponds to a specified fractile of the assumed statistical distribution of the particular property of the material or product. A nominal value is used as the characteristic value in some circumstances.

Design value: value obtained by multiplying or dividing the representative value of an action or material property by a partial factor.

Limit State STR & STR-P: Internal failure or excessive deformation of the structure or structural members in which the strength of the structural material is significant in providing resistance. STR-P represents the case of dominant permanent action.

Limit State GEO: Failure, or excessive deformation of the ground in which the strength of the ground is significant in providing resistance.

Limit State EQU: Loss of static equilibrium of the structure or any part of it or the ground considered as a rigid body or involving uplift due to water pressure (buoyancy) or other vertical actions, where the strengths of construction materials or ground are generally not governing.

Limit State ACC: Limit states involving accidental and seismic actions.

SAICE 2010 Site Investigation Code of Practice Guided Tender Design or Basic Engineering Geotechnical Site Investigation Report for R/3, The Willows 340-JR, Region 6, Ward 86, Tshwane Metropolitan Municipality, Gauteng Province, South Africa

1 Introduction and Terms of Reference

RockSoil Consult (Pty) Ltd. (to be referred to as the consultant) was appointed by Bvi Consulting Engineers (Pty) Ltd. (to be referred to as the client) to conduct a SAICE 2010 guided Tender Design geotechnical site investigation for an indicated portion of land forming part of the Tshwane Automotive Supplier Park. The portion of land is in Silverton, Pretoria, South Africa.

The consultant was appointed at the end of December 2018, appointment reference: CCG_03_003. Site access were granted in April 2019. The fieldwork phase was conducted during April and May 2019.

The report presents the factual data and interpretative results and recommendations. The report serves as a combined SANS634:2012 Preliminary and SAICE2010 Tender Design Geotechnical Site Investigation report.

2 Objectives of the Assessment

The main objectives of Tender Design or Basic Geotechnical investigation are to:

- Gather readily available geotechnical information;
- Identify and categorize terrain types;
- Identify the geotechnical constraints;
- Identify potential geotechnical fatal flaws;
- Establish if a parcel of land is suitable for the proposed development;
- Comment on potential sources of construction materials;
- Comment on potential foundation options and considerations;
- Provide the geotechnical background or information for contractors to be able to define a scope of work, draw up a bill of quantities and price the project for tender purposes.

The level of investigation is for planning and conceptualization purposes. This tender design geotechnical investigation report should not be confused with the detailed design investigation or the geotechnical design report defined by the code of practice (SAICE, 2010). Infill geotechnical investigation work will be required as well as a geotechnical design report for final design-level input.

3 Nature of the Development

The nature of development is not known at the time of writing this report. The client indicated that an Automotive Industry Supplier Park is earmarked for this site.

It is thus expected that the development will comprise a variety of light industrial and commercial buildings/structures. Induced foundation loads, nature of loads, foundation sizes and earthwork preparation are expected to vary significantly.

Loading specifications, structure sizes and deformational limits are not known at the time of writing this report.

4 Information Used During the Study

The following readily available information were considered during this investigation:

- 1) Locality map (Google Earth image) with provided approximate site boundaries and size;
- 2) 1:250 000-scale regional geological sheet;
- 3) 1:50 000-scale regional geological sheet;
- 1) Tshwane online GIS information;
- 2) Google Earth images;
- 3) Council for Geoscience Geohazard database;
- 4) SANBI BGIS online database;
- 5) Climate-date.org database;

The available information was supplemented with local knowledge of the area and the information obtained during the fieldwork phase of this assessment, as discussed in the relevant report sections.

The following general standards and codes of conduct were considered during this investigation:

- 1) SAICE 1990: Guidelines for Soil and Rock Logging in SA;
- 2) SANS633:2012: Soil Profiling and Rotary Percussion Borehole Logging on Dolomite Land in Southern Africa for Engineering Purposes;
- 3) SAICE 2010: Site Investigation Code of Practice;
- 4) SANS634:2012: Geotechnical Investigations for Township Development;
- 5) NHBRC 2015: National Home Builders Registration Council: Home Builders Manual;
- 6) SANS10400-H: The Application of the National Building Regulations: Foundations;
- 7) SANS10160-5:2012 Edition 1.1: Basis of Structural Design and Actions for Buildings and Industrial Structures, Part 5: Basis for Geotechnical Design and Actions;
- 8) SABS0161-1980 (Amdt 1, Nov. 1984): Code of Practice for The Design of Foundations for Buildings.

Other sources considered are referenced in the report.

5 Investigation Methodology

The fieldwork phase of the investigation was conducted between 15 April and 2 May 2019.

The investigation comprises:

- Desk study of readily available information;
- Site visit and drive over/walk over survey;
- Test pit excavation (Limited to practical excavation depth of <3.2 mbgl or unpractical excavation conditions such as restricted refusal or very slow excavation progress. Refer to the individual soil profile descriptions for details.);
- In-situ soil profile logging by a suitably qualified engineering geologist;
- Soil profile and material photography;
- Selective representative material sampling;
- Soil testing at an accredited commercial laboratory;
- Evaluation and reporting by a suitably qualified and professionally registered engineering geologist.

The number of test pits, equipment and general investigation procedures/methods are provided in **Table R1**. The soil classification testing, relevant test methods and quantities are provided in **Table R2**. Additional information on the test procedures can be provided upon request.

Table R1: General Investigation Procedures and Information

Description	Information
Number of trial pits excavated	68
Placing Methodology	Land facet targeting and overall site coverage
Machine used for excavation	CAT 428F TLB
Profiling standards used for descriptions	SAICE 2009 and SANS633:2012 guided (ISRM 1981b where indicated)
Profile logged by	Qualified engineering geologist/s
Test pit positioning	Hand-Held Garmin E-Trex GPS
Soil profile capturing and illustration	dotPLOT Version 3.22.0
Coordinate system	Decimal Degrees and WGS84 SA Grid

Table R2: Laboratory Tests and Tests Quantities

Laboratory Test	Laboratory	Test Standard	Number of Tests
Screen Analysis	ST Laboratory (Pty) Ltd.	SANS 3001:GR1	32
Hydrometer Analysis	ST Laboratory (Pty) Ltd.	SANS 3001:GR3 & TMH1	32
Atterberg Limits	ST Laboratory (Pty) Ltd.	SANS 3001:GR10	32
Relative Density	ST Laboratory (Pty) Ltd.	SANS 5844	10
Modified AASHTO	ST Laboratory (Pty) Ltd.	SANS 3001-GR30	10
CBR	ST Laboratory (Pty) Ltd.	SANS 3001-GR4	10
pH	ST Laboratory (Pty) Ltd.	Refer to lab report	10
Electrical Conductivity	ST Laboratory (Pty) Ltd.	Refer to lab report	10
Swell Pressure	ST Laboratory (Pty) Ltd.	Refer to lab report	5

ST → Specialised Testing Laboratory

Refer to the laboratory test reports for investigation procedures/standards followed. More details on the investigation methodology and test standards can be provided upon request.

6 Site Description

6.1 Location

The property of interest is referred to as R/3, The Willows 340-JR, Tshwane Metropolitan Municipality and is situated in Region 6 Ward 86.

The area of interest borders to the north of Bronkhorstspuit Road, between Propshaft Road and Swartkoppies Avenue, The Willows, Silverton, Pretoria, South Africa.

The approximate centre site coordinates are (Decimal Degrees):

- Latitude: -25.737467°
- Longitude: 28.339259°

The locality is depicted in **Figure A3**, Appendix A.

The area of interest is rectangular in shape and comprise a surface area of approximately 81.066 Ha (TMM online database).

6.2 Current Land Use and Known Services

The site is currently mainly undeveloped. Limited paved roads are present in the south-western site portion with an unpaved road in the eastern portion of the site.

An existing municipal bulk sewer line is crossing the site in an SSW to NNE direction towards the eastern third of the site. The sewer line is situated towards the west of a drainage feature.

An underground Transnet pipeline runs parallel to the east of Propshaft Road, north of Vonkprop Road and North of Bronkhorstspuit Road, within the site boundaries.

Numerous shallow cut-off trenches are present on site, seemingly draining excessive seasonal seepage water and stormwater towards the spruit.

Excessive uncontrolled surficial fill is present in regions across the site. Localised portions of more extensive fill are present on site.

The information provided are for planning purposes. The planners/designers should refer to the site-specific services report.

6.3 Topography and Drainage

An existing earth dam are present in the centre to eastern portion of the site, storing water from the SSW to NNE draining drainage feature (Non-perennial stream referred to as Willow Spruit) bisecting the eastern third of the site. The spruit drains into the Pienaars River situated approximately 2.4 km to the NE of the site that drain into the Roodeplaat dam.

The site is situated between approximately 1 320 and 1 300 mamsl (online TMM database) with a regional slope direction towards the N to NE. The site-specific slope is generally towards the E to NE (as for the western site portion) and towards the W to NW (as for the eastern site portion), in the direction of the Willow Spruit draining towards the NNE. The site has a fall of approximately 20 m over a surface distance of ~1 140 m with an average slope angle of approximately 1.1°, thus a gradient of generally around 2 %.

The regional topography and drainage are depicted in **Figure A4, Appendix A**.

6.4 Vegetation

The site is mainly covered with grass, scrubs and small-size to medium-size trees mainly concentrated adjacent to the access roads and towards the centre southern portion of the site. Broadleaved grass species are present across the site and mainly towards the mid-slope seepage areas and lower-lying region around the spruit. Hydrophytes / wetland species are present in mid-slope seepage regions and towards the drainage feature.

The biodiversity status and national wetlands as per the SANBI BGIS Land Use Decision Support Tool is depicted in **Figure A5, Appendix A**. The information provided are for planning purposes. The planners/designers should refer to the relevant environmental report/s.

6.5 Accessibility

The site is situated within a developed region and adjacent to existing formal roads. The site is accessible via these roads. On-site trafficability will be of concern during the wet season due to the presence of clay.

7 Regional Climate

The site falls within a semi-arid region. The climate is an important parameter in determining the climatic N-value, which is a function of the rainfall and evaporation rate. According to the contour map of climatic N-values for Southern Africa (Weinert, 1980), the expected N-values for the area of study range between N=2 and N=3 which are aligned with the readily available climatic data. The predominant form of weathering in the area is expected to be chemical in nature. The weathering is however also influence by the topography and nature of drainage. Chemical weathering is also expected to be the predominant form of weathering in and around the drainage/seepage features.

As per climate-data.org, the climate in Silverton is considered "Cwa" according to the Koppen-Geiger climate classification. The average annual temperature is ~17.5 °C with an average annual rainfall of ~694 mm.

The temperatures are highest on average in January, at around 22.1 °C. The lowest average temperatures in the year occur in June at around 10.8 °C.

The regional average, minimum and maximum temperatures are depicted in **Chart R1** The regional average monthly rainfall is depicted in **Chart R2**.

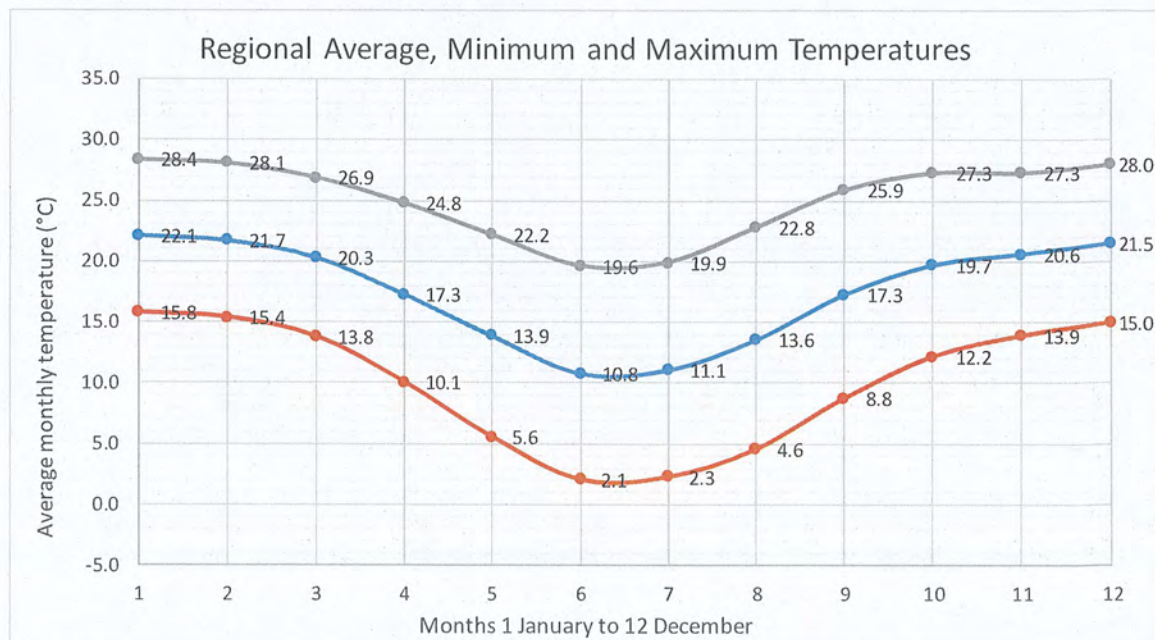


Chart R1: Regional Average, Minimum and Maximum Temperatures (source: climate-data.org)

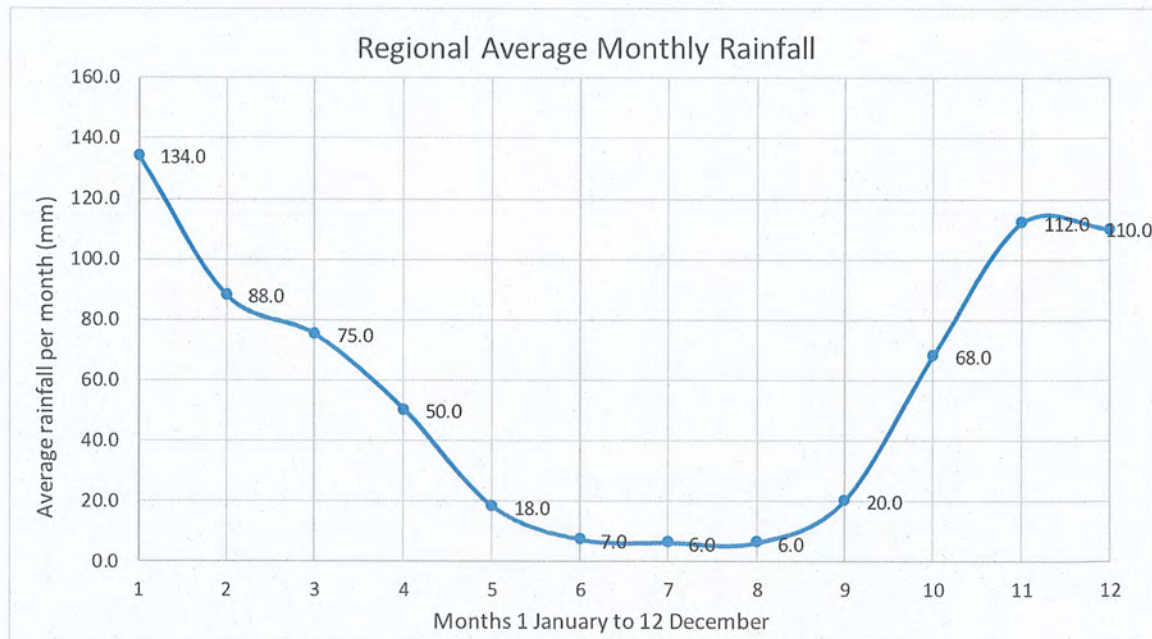


Chart R2: Regional Average Monthly Rainfall (source: climate-data.org)

The provided data may be refined by site-specific measurements that may be available from the client which are expected to have weathered stations on the mining site. It is however expected that the information provided are suitable for planning and design-level purposes.

8 Geology

8.1 Regional Geology

According to the 1:250 000-scale 2528 Pretoria geological sheet (and 1:250 000-scale 2528 CB Silverton geological sheet), the site is underlain by sedimentary rock (shale) of the Silverton Formation (denoted by Vsi as per the 1:250 000-scale or T3mS as per the 1:50 000-scale geological sheets), Pretoria Group, Transvaal Supergroup. The Silverton formation has been intruded by diabase dykes (denoted by di) from the Vaalian to post-Mogolian age.

Simplified definitions of the two formations encountered are:

- **Diabase** is a dark, medium-grained igneous rock, typically with ophitic texture, containing plagioclase, pyroxene, and olivine.
- **Shale** is a soft finely stratified sedimentary rock that formed from consolidated “mud” or clay (or clay-size particles) and can be split easily into fragile plates.

Silver (Ag) and copper (Cu) economically valuable mineral sources are indicated in the vicinity of the site. No sources are indicated within the area of interest.

Numerous structural features such as faults and linear features are indicated on the geological sheet. A main SW to NE-NNE striking fault seemingly bisects the centre portion of the site. Diabase intrusions are indicated on site. A cropped section of the 1:50 000-scale 2528 CB Silverton geological sheet is depicted in **Figure R1**.

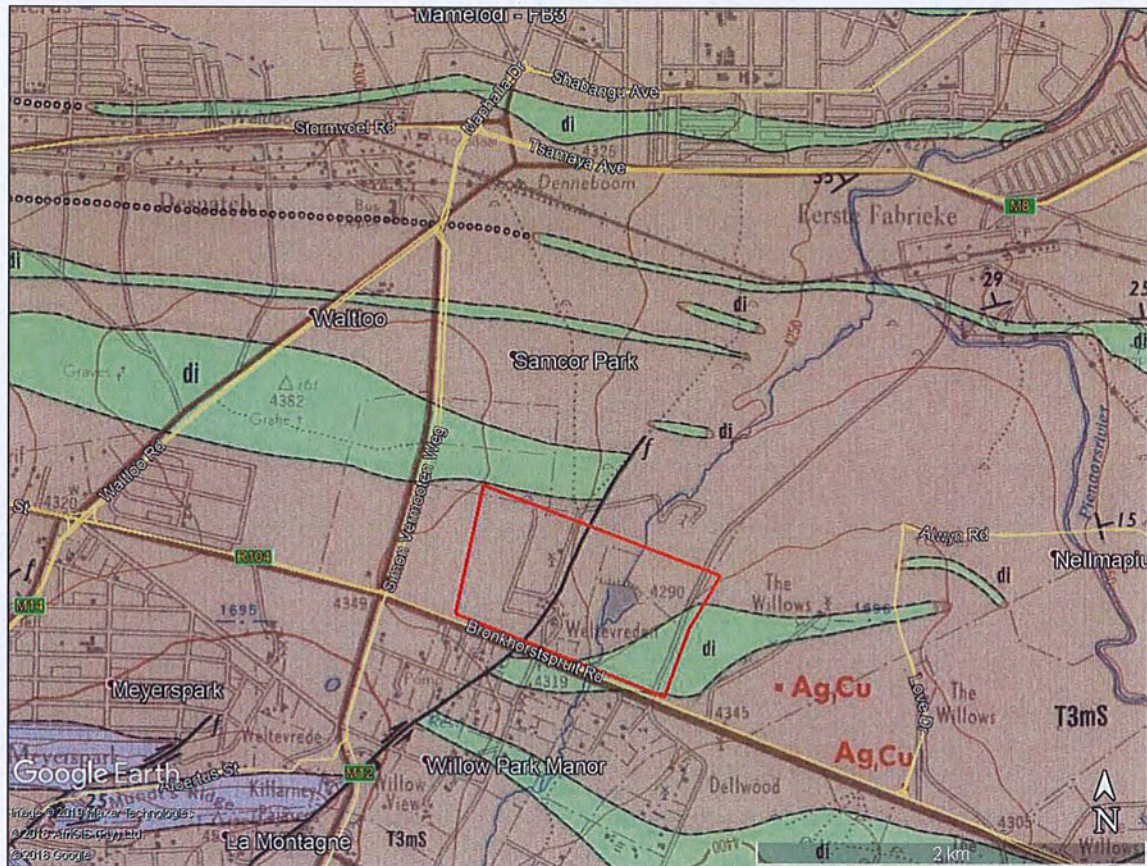


Figure R1: Regional Geological Sheet 1:50 000-scale 2528 CB Silverton

8.2 Site Specific Geology

The geology present on site was assessed via 68 trial pits excavated in accessible areas on site. Majority of the trial pits were terminated at maximum depth of TLB reach in shale and diabase material, whereas 23 trial pits experienced confined refusal, between 0.60 and 2.80 meters below ground level (mbgl), predominantly within shale and occasionally in fill and pedogenic material. The positions of the test pits are depicted in **Figure A6, Appendix A**.

The soil and rock horizons, thicknesses of the horizons and general conditions encountered during this assessment are summarized in **Table E8, Appendix E**.

The site is mainly covered with a **topsoil** horizon, underlain by a sandy colluvium to occasionally clayey to sandy alluvium, transgressing into reworked residual shale to slightly to completely weathered shale. Minor areas in the south-western and north-western portions of site is underlain by residual diabase. A thin **pebble marker** is encountered in the far eastern and western portions of site.

Large areas are covered with thin to relatively thick superficial uncontrolled fill mostly comprising of domestic waste and building rubble.

The **uncontrolled fill** material was generally encountered from surface to 1.05 mbgl, to an average depth of 0.35 mbgl. The uncontrolled fill material generally exhibits medium dense to loose consistency with an open structured fabric exhibited by a sandy matrix with abundant organic and anthropogenic material.

The **colluvium to alluvium** generally has a medium dense to firm in-situ consistency with an open soil structure and is ferruginised in places. The transported horizons were encountered between 0.10 and 1.90 mbgl, from an average depth of 0.29 mbgl.

The **reworked residual shale** horizon was encountered from between 0.20 to 3.10 mbgl and generally consisted of a silty clayey sand matrix with a medium dense to firm in-situ consistency and exhibited an open soil structure with micro-shattered and occasionally slightly jointed fabric.

The lower **residual shale**, located in a north-east to south-west band in the eastern to middle portion of site, was recorded as being yellow brown mottled grey and black exhibiting a soft to firm in-situ consistency with a fissured structure and comprising of a sandy clay matrix. This horizon usually occurred between 1.50 mbgl to 3.40 mbgl.

The **residual diabase** was encountered from 0.55 to 3.30 mbgl in the south-western and north-western portions of site, from an average depth of 1.03 mbgl. The material exhibited a firm to medium dense in-situ consistency with jointed structure, with occasionally open soil structure, and comprises of a sandy to silty matrix.

Pedogenic formations were usually encountered in the upper soil profile throughout most of the site. Moderately cemented honeycomb ferricrete was encountered in TP35 a depth of 1.50 mbgl to 2.00 mbgl and comprised of open structured, weakly to moderately cemented Fe and Mn concretions with a lesser amount of medium dense, open soil structure, silty clayey sand matrix. The overall in-situ consistency was described as dense becoming very dense with depth.

9 Geohydrology

9.1 Groundwater Levels and Quality

Input on the quality and depth to the permanent groundwater table falls outside the scope of this assessment. The planners/designers should refer to the specialist geohydrological report, if available.

9.2 Seasonal Seepage Water or Perched Water Tables

Shallow seepage water was encountered in 7 of the 68 test pits excavated between 15 April 2019 and 2 May 2019, which falls towards the end of wet season for this region. Seepage water were encountered in test pits TP11 (2.90 mbgl), TP21 (2.80 mbgl), TP25 (3.40 mbgl), TP32 (2.80 mbgl), TP45 (1.90 mbgl), TP50 (2.70 mbgl) and TP62 (2.00 mbgl).

The positions and depth of seepage encountered are depicted in **Figure A7** and **Figure A8, Appendix A**. Three zones of expected severe seepage water conditions are also indicated on these figures.

Varying degrees of shallow pedocrete formations were encountered in the majority of the test pits encountered on site (see **Table E8, Appendix E**). The pedocrete formation is an indication of seasonal fluctuating groundwater levels. Seepage water are thus expected at shallower depth to near surface and localised surface seepage during the wet season, especially during and shortly after heavy and/or continuous downpours.

10 Basic Geotechnical Evaluation

The geotechnical evaluation is based on the existing information as well as the site-specific information obtained for the purposes of this assessment. The original laboratory test results for the tests conducted on the representative selectively retrieved soil/material samples are attached as **Appendix D**. Provided properties and parameters are as per the appointed investigation level. Refinement will be required for the design-level investigation and geotechnical design evaluation and reporting.

10.1 Material Grading and Atterberg Limits

The material grading and Atterberg Limits are summarized in **Table E9, Appendix E**.

The materials in general have a combined fine (clay and silt size particles) percentage of between 23 and 83 % with an average of ~52 % and a standard deviation of 16 %.

The Liquid Limit of the soils varies between 28 % and 92 % with an average of 54 % and a standard deviation of 13.77 %.

The Plasticity Index of the soils varies between 13 % and 47 % with an average of 28 % and a standard deviation of 7.93 %.

10.2 Material Classification

10.2.1 Unified Soil Classification System

The materials tested classifies as the following soil classes (Unified Soil Classification System):

- GC → Course-grained soils (more than 50 % retained on the 0.075 mm sieve), gravels (50 % or more of course fraction retained on the 4.75 mm sieve), gravel with fines, clayey gravels, gravel-sand-clay mixtures.
- SC → Course-grained soils (more than 50 % retained on the 0.075 mm sieve), sands (50% or more of course fraction passes the 4.75 mm sieve), sands with fines, clayey sands, sand-clay mixtures.

- CL → Fine-grained soils (more than 50 % passes the 0.075 mm sieve), silts and clays with Liquid Limit of 50 % or less, inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays.
- MH → Fine-grained soils (more than 50 % passes the 0.075 mm sieve), silts and clays with Liquid Limit greater than 50 %, inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
- CH → Fine-grained soils (more than 50 % passes the 0.075 mm sieve), silts and clays with Liquid Limit greater than 50 %, inorganic clays or high plasticity, fat clays.

10.2.2 AASHTO Classification System

The materials tested classifies as the following soil classes (AASHTO Classification System):

- A-2 → Granular materials (35 % or less passing the 0.075 mm sieve), different LL and PI for A-2 variances (refer to A-2-4, A-2-5 A-2-6 and A-2-7 sub-groups) with significant constituent: silty or clayey gravel sand.
- A-6 → Silt-clay materials (>35 % passing the 0.075 mm sieve), minimum of 36 % passing the 0.075 mm sieve, LL max of 40, PI min of 11, with significant constituent: clayey soils.
- A-7 → Silt-clay materials (>35 % passing the 0.075 mm sieve), minimum of 36 % passing the 0.075 mm sieve, LL min of 41, PI min of 11, with significant constituent: clayey soils. Note: Plasticity Index of A-7-5 subgroup is equal to or less than the Liquid Limit – 30. Plasticity Index of A-7-6 subgroup is greater than LL – 30.

10.2.3 TRH or COLTO Classification System

The materials tested classifies as the following classes (TRH or COLTO Classification Systems):

- G7 → Gravel-soil with a CBR > 15 % at 93 % Mod. AASHTO density with swell < 1.5 % at 100 % percent Mod. AASHTO density.
- G9 → Gravel-soil with a CBR > 7 % at in-situ density with swell < 1.5 % at 100 % percent Mod. AASHTO density.
- G10 → Gravel-soil with a CBR > 3 % at in-situ density with swell < 1.5 % at 100 % percent Mod. AASHTO density.

Refer to more detailed TRH14 and/or COLTO classification specifications.

The fine material (colluvium, transported and residual shale) generally have a CBR of between 3 and 9 % at 90 % Mod. AASHTO compaction effort. The CBR range generally increase to between 5 and 22 % at 98 % compaction effort. The % swell at 100 % Mod.AASHTO compaction effort varies between 0.1 and 5.0 % with an average of 0.9 % and standard deviation of 1.5 %.

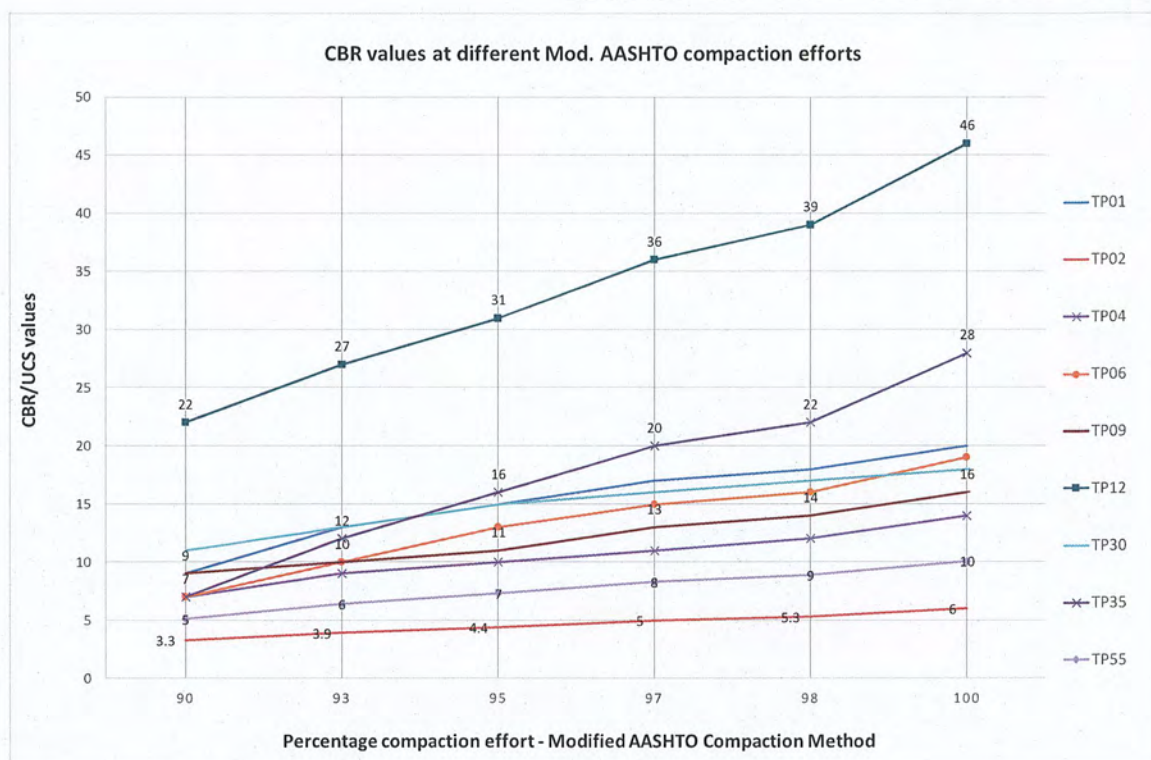


Chart R3: CBR Values at Different Mod. AASHTO Compaction Efforts

10.3 Typical Material Properties and Performance Correlations

The typical material properties and expected performances based on the soil classifications are provided in the relevant tables attached in **Appendix E** and **Appendix F**. Shear strength parameters are discussed under the foundation options and recommendations section, **report section 12**.

10.4 Geotechnical Constraints

The geotechnical constraints generally associated with urban development are summarized in **Table F19, Appendix F (SANS634, 2012)**. The identified constraints are discussed in the following report sections.

10.4.1 Collapse and Compressibility

The on-site soils generally contain a high percentage of fines (clay-size and silt-size grains) and the typical collapsible structure is not present. The upper transported and reworked horizons however have a slightly pinholed structure with open root channels. Considering the relatively high percentage of fines and indications of shrink/swell movement in soil, the collapse potential is considered low.

Compressibility due to dissipation of soil water pressure under an induced load to a state of equilibrium can however be expected, as typical from these fine-grained soils. Moderate soil compressibility is assigned to the upper transported and residual horizons.

The soils mainly classify as A-7 (silt-clay materials) and CH, CL, ML (clays and silts) with an expected medium to high to even very high compressibility and expansion characteristics in the compacted (Das & Sobhan, 2014).

10.4.2 Seepage

Permanent or seasonal perched water table or less than 1.5 mbgl is expected throughout large portions of the site, as evident from the seepage water and pedocrete formation encountered during the fieldwork exercise. The areas of intermediate to severe seepage conditions are depicted in **Figure A7** and **Figure A8, Appendix A**.

10.4.3 Soil Heave or Activity

The site is blanketed with soils with a high fines content (clay-size and silt-size particles), mainly originating from weathering of shale and diabase rock. A shattered and slickensided soil structure were generally recorded in the soil profiles (transported horizon, reworked residuum and lower residuum), which is an indication of shrink-swell movement.

Based on the weighted PI and clay fraction of the whole sample, the materials generally have a medium to high heave potential (van der Merwe, 1964). Occasional samples indicated a very high heave potential. The potential expansiveness plot is depicted in **Chart R4**.

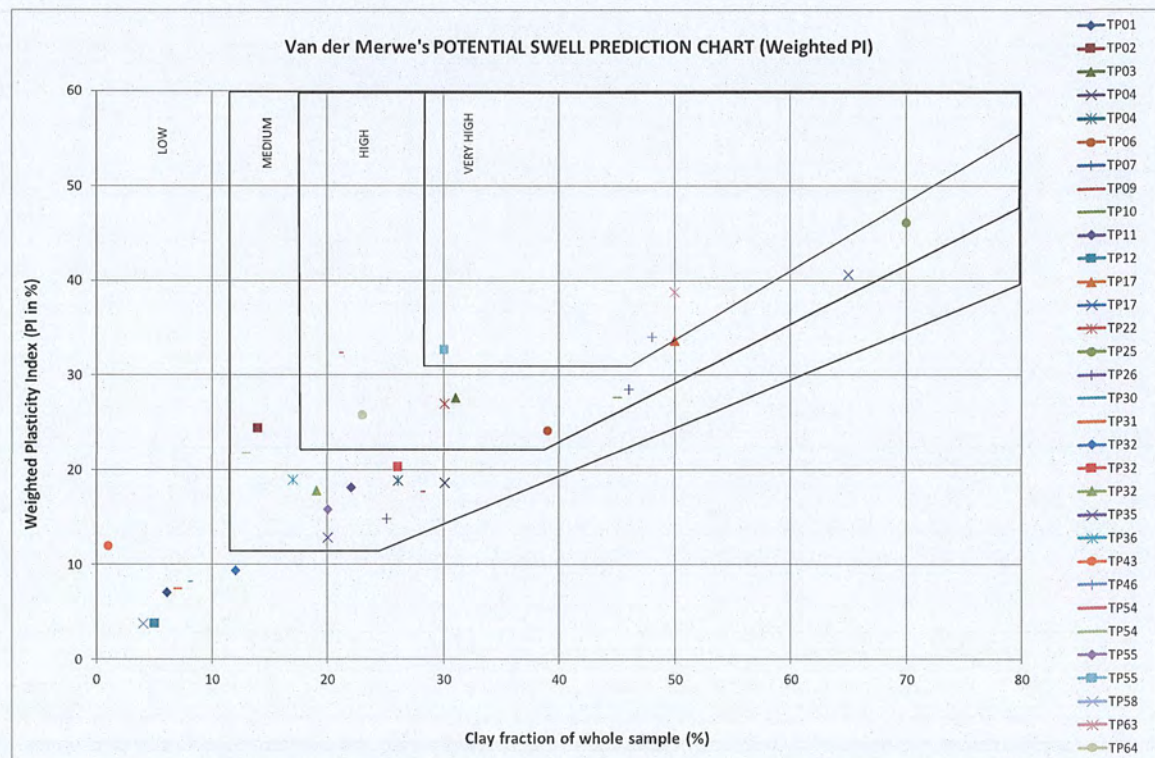


Chart R4: Potential Swell Predication Chart – Weighted PI vs Clay Fraction of Whole Sample

The “free” swell (swell measured on compacted sample soaked with an ~2.5 kPa induced pressure, 4.536 kg load on 150 mm diameter circle barrel sample) measurements from the compaction results generally indicate swell measurements of between 0.1 to generally 1.1 %.

“Free” swell of 5 % was measured on the residual and completely weathered shale mix retrieved from test pit TP02 (1.20 to 1.80 mbgl). The swell is measured on samples compacted to 100 % Mod. AASHTO compaction effort, then soaked for 4 days in a water bath.

Swell pressure tests were performed on 5 undisturbed samples. A basic summary is provided as **Table R3**.

Table R3: Swell Pressure Test Results Basic Summary

Test Pit Number	Sample Depth (mbgl)	Basic Material Description	Initial Moisture Content (%)	Final Moisture Content (%)	Dry Density (kg/m ³)	Void Ratio	Swell Pressure Measured (kPa)
TP07	1.10 – 1.80	Residual shale	27.8	31.0	1 471	0.881	24.2
TP17	1.80	Residual shale	21.3	29.5	1 514	0.904	12.3
TP25	1.80 – 2.00	Residual shale	39.7	46.2	1 156	1.239	21.2
TP37	2.00	Very weak to weak rock shale	10.3	14.8	1 880	0.459	10.9
TP63	2.80	Residual shale	28.0	32.7	1 405	0.948	29.7

Notes:

- Testing conducted on undisturbed samples.
- Refer to laboratory test report for detailed results.

A simplified mathematical expression for calculating total heave can be provided as (van der Merwe, 1964).

$$\text{Total Heave} = \sum_{D=1}^{D=n} FD \cdot (P.E.)D \quad \text{Equation 10.1}$$

Where:

F is a depth factor (reduction in heave with depth due to overburden pressures and moisture)

$$D = 20 \log_{10} F$$

D is the negative depth in feet

P.E is the potential expansiveness

Solving F :

$$F = 10^{\frac{D}{20}} \quad \text{Equation 10.2}$$

or F :

$$F = \text{Exp}^{\frac{-d+0.4}{8.75}} \quad \text{Equation 10.3}$$

Quantification of the heave should be provided in the geotechnical design report, as the heave will be affected by the depth of placement of the foundations, the induced loads and earthworks that will be conducted.

Guidance on heave is provided in **Table R4**. For the purposes of this level of reporting/guidance, a number of assumptions were made. Some of these assumptions are:

- The active clay horizon is immediately below the foundation;
- The active zone (moisture variation) extend down to 3.0 m below the foundation;
- The active horizon is uniform;
- Total heave is predicted, with differential have considered 50 % of total heave;
- Moisture changes from dry to wet are considered.

Table R4: Total Heave Estimations – Generic Layer Thicknesses – Van Der Merwe’s Method

Active Zone Thickness (m)	High Expansiveness Rating (13 mm per 300 mm)		Medium Expansiveness Rating (6 mm per 300 mm)	
	Total Heave Calculated (mm)	Differential Heave Calculated as 50 % Total Heave (mm)	Total Heave Calculated (mm)	Differential Heave Calculated as 50 % Total Heave (mm)
1.0	~12	~6	~6	~3
2.0	~24	~12	~12	~6
3.0	~36	~18	~16	~8

Notes:

- Low expansiveness 0 mm per 300 mm active horizon (0 inch per foot).
- Medium potential expansiveness 6 mm per 300 mm active horizon (0.25 inch per foot).
- High potential expansiveness 13 mm per 300 mm active horizon (0.50 inch per foot).
- Very high expansiveness 25 mm per 300 mm active horizon (1 inch per foot).

Soil heave is a constraint, as indicated in **Table R4**. Foundation modifications will be required. Individual foundations should be assessed in the design-level assessments and/or geotechnical design report.

Heave calculations/estimates should be refined once structural and conceptual earthwork specifications are available. The planners/designers should liaise with the engineering geologist upon availability of additional information.

10.4.4 Susceptibility to Erosion

Based on the general site slope, material properties and regional observations, the materials are expected to have a low to intermediate susceptibility towards erosion.

10.4.5 Excavatability

Sixty-eight (68) test pits were excavated across the area of interest. The test pits were terminated between 0.95 and 3.40 mbgl, at an average termination depth of 2.76 mbgl with a standard deviation of 0.61 m.

Soft excavation conditions were generally encountered through the upper soils (transported, reworked residuum and residuum to completely weathered rock). Confined excavation refusal conditions were experienced in test pits TP01, TP12, TP13, TP14, TP15, TP22, TP23, TP24, TP26, TP27, TP28, TP29, TP33, TP35, TP40, TP47, TP49, TP52, TP56, TP57, TP61, TP62 and TP67. Confined termination was encountered in material with correlated soft to intermediate to intermediate excavatability classification.

No “hard rock” excavation conditions were encountered in any of the test pits excavated. The test pits are however point data and the presence of localised “hard rock” excavation cannot be outruled.

Undulating bedrock conditions can be expected, as well as large-size diabase boulders, that may result in localised hard rock excavation conditions.

The use of pneumatic excavation equipment and blasting may be required during the installation of deep services. Blasting, if necessary, are expected to be limited for excavations less than ~2.0 to ~2.5 mbgl.

Termination depths encountered across the site are visually depicted in **Figure A11, Appendix A**. The planners/designers can refer to the interpolated TLB termination depths experienced during this TLB assessment. A number of track-based excavator (30 Ton) trial pits may be considered in the regions where relatively shallow TLB refusal conditions were experienced for refinement of the excavation conditions across the site.

10.4.6 Undermined Ground

The area is not undermined and surface instability due to undermining is not of any concern for this site.

10.4.7 Stability (Dolomitic Land)

The area is not underlain by potentially soluble dolomite or limestone formations.

10.4.8 Steep Slopes and Areas of Unstable Natural Slopes

No natural steep slopes or areas of unstable natural slopes are present on site. Localised excavations, cut-off trenches and disturbed areas with localised minor steep slopes can be expected.

10.4.9 Areas Subject to Seismic Activity

Seismic hazard zones applicable to South Africa are depicted in **Figure R2**. The zones are determined from the seismic hazard map which presents the peak ground acceleration with a 10 % probability of being exceeded in a 50-year period. It included both natural and mining-induced seismicity (SANS1060-4, 2017).

The following zones are considered:

- Zone I: Natural seismic activity.
- Zone II: Regions of mining-induced and natural seismic activity.

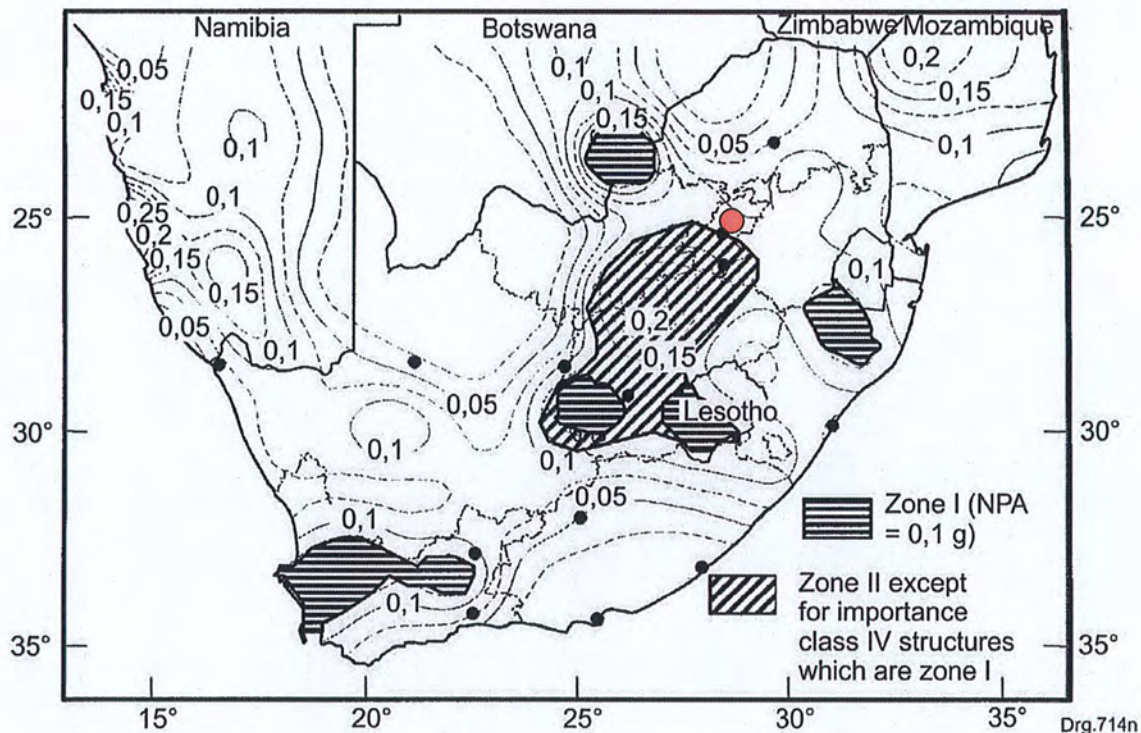


Figure R2: Seismic Hazard Zones of South Africa

Seismic activity is not considered to be of concern. The structural engineer should refer to the relevant national standards (SANS1060-4, 2017) and indicate if additional seismic input is required for the structures of concern.

10.4.10 Areas Subject to Flooding

The Willow Spruit drains through the eastern third of the site, with an existing earth dam in the centre portion of the spruit. The spruit and area adjacent to the spruit will be subject to seasonal flooding.

A number of cut-off trenches are present across the area of interest, seemingly collecting/controlling seasonal seepage water. Proper stormwater control, general drainage and flood certification will be required for this site.

10.4.11 Contaminated Land

Uncontrolled construction and domestic waste are scattered across the investigated area, especially around the existing internal access roads.

Stormwater outlets from developments towards the west and east of the site are evident from the satellite images.

No water and/or soil chemistry tests were conducted during this assessment to confirm if soil contamination can be considered a fatal flaw.

No hazardous waste such as mine tailings, chemical waste or raw sewer were identified during the walkover survey. It is thus unlikely that soil contamination can be considered a fatal flaw.

The environmentalists may conduct a baseline assessment to confirm possible water and/or soil contamination if deemed necessary.

10.4.12 Soil Corrosiveness

Electrical conductivity and pH measurements of the soil or soil-water pastes were taken on 10 soil samples retrieved from test pits TP02, TP07, TP10, TP11, TP22, TP25, TP32, TP54, TP55. The results and corrosiveness rating based on the electrical conductivity are provided in **Table E10, Appendix E**.

The corrosiveness rating towards ferrous metals/services generally varies between “Mildly corrosive” towards “Extremely corrosive”. Corrosion protection should be considered.

11 Site Class Designations (NHBRC & SANS634)

As from a town-planning and application perspective, site class designation is provided (SANS634:2012 and NHBRC HBM 2015). The planners should note that the designation is for single-storey masonry structures as per the SAICE 1995 and NHBRC 2015 home builder’s manual, of which the foundation options are not relevant to the planned industrial/commercial development.

The site is assigned with four (4) broad preliminary residential site class designations (NHBRC, 2015).

The broad residential site class designations are summarized as (NHBRC, 2015):

- **Zone I:** H1-H2-S // 2BCDE 1F
- **Zone II:** H2-S1 // 2BCDE 1F
- **Zone III:** H3-S1-S2 // 3C 2BDE
- **Zone IV:** P (**Flooding**) H2-H3-S2 // 2-3BCDL 2E 1F

The assigned designation/s before the “//” represent/s the following (NHBRC, 2015):

- R → Rock (Stable founding material).
- H → Expansive soils.
- C → Compressible and potentially collapsible soils.
- S → Compressible soils.
- P → Variable constraint/s (refer to description in brackets).

The assigned designation/s after the “//” represent/s the following (SANS634, 2012):

- A → Collapsible soil.
- B → Seepage.
- C → Active soil.
- D → Highly compressible soil.
- E → Erodability of soil.

- F → Difficulty of excavation to 1.5 m depth below ground level.
- G → Undermined ground.
- H → Stability (dolomitic land).
- I → Steep slopes.
- J → Areas of unstable natural slopes.
- K → Areas subject to seismic activity.
- L → Areas subject to flooding (To be confirmed by flood line assessment).

The severity of the assigned residential designation (symbols before the “//”) are summarized in **Table R5**. The severity of the assigned constraints (symbols after the “//”) is provided in **Table F19**.

In the assigned classifications, the settlement “S” is considered secondary to the heave “H”. The planners/designers should refer to **Figure A7**, **Figure A8**, **Figure A9** and **Figure A10**, **Appendix A** for more refined regions/areas of expected shallow seepage to surface seepage conditions.

Table R5: Residential Site Class Designation (SANS634, 2012)

Typical founding material / site descriptor	Nature of founding material	Expected range of total soil movements (mm)	Assumed differential movement (% of total)	Site class designation
Rock (excluding mud rocks which may exhibit swelling to some depth).	Stable	Negligible	-	R
Fine grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays).	Expansive soils	<7.5	50%	H
		7.5 to 15	50%	H1
		15 to 30	50%	H2
		>30	50%	H3
Silty sands, sands, sandy and gravelly soils.	Compressible and potentially collapsible soils	<5	75%	C
		5 to 10	75%	C1
		>10	75%	C2
Fine grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils.	Compressible soils	<10	50%	S
		10 to 20	50%	S1
		>20	50%	S2
Contaminated soils, controlled fill, dolomitic areas, mine waste fill, mining subsidence reclaimed areas, uncontrolled fill and very soft silts /silty clays.	Variable	Variable	-	P
The site class designations are derived from an estimation of the expected range of total soil movements experienced by single-storey and double-storey homes having masonry walls that are not supported by steel, concrete or reinforced masonry columns under the following assumptions: - The foundation has a width that does not exceed 0.6 to 0.8 m in respect of single-storey and double-storey buildings respectively; - The design soil bearing pressure does not exceed 50 kPa; and - The total soil movements are such that the resultant differential movement implied in the table is equal to that which is to be expected in the field.				

12 Foundation Options and Recommendations

12.1 Bearing Capacity Principles

For a foundation to perform satisfactorily, it must comply with two limits (as from a geotechnical perspective) namely:

- Ultimate bearing capacity;
- Maximum overall settlement limit and/or allowable differential movement.

The induced load under the specific condition or set of conditions should thus not result in overall shear failure in the soil/rock that supports the foundation and it shall not exceed a specific settlement limit for the specific structure under consideration. The settlement limit may be total settlement or a combination of total and differential settlement.

The general bearing capacity formula is presented in Equation 12.1.

$$q_u = (c' N_c F_{cs} F_{cd} F_{ci}) + (q N_q F_{qs} F_{qd} F_{qi}) + \frac{1}{2} (\gamma B N_\gamma F_{\gamma s} F_{\gamma d} F_{\gamma i}) \quad \text{Equation 12.1}$$

Where:

c' = cohesion

q = effective stress at the level of the bottom of the foundation

γ = unit weight of soil

B = width of foundation (or diameter for a circular foundation)

$F_{cs}, F_{qs}, F_{\gamma s}$ = shape factors

$F_{cd}, F_{qd}, F_{\gamma d}$ = depth factors

$F_{ci}, F_{qi}, F_{\gamma i}$ = load inclination factors

N_c, N_q, N_γ = shape factors

It is clear that the ultimate bearing capacity of the soil is affected by, but not limited to, the cohesion of the material, effective stress at the bottom of the foundation, unit weight of the soil, shape of the foundation, depth of placement of the foundation as well as the inclination of the load. In other words, the bearing capacity of the soil is not a constant and is dependent on the foundation under consideration, depth of placement and so forth.

A basic formula for settlement based on the theory of elastic settlement, below a foundation that is perfectly flexible, can be expressed by Equation 12.2.

$$S_e = q_0 (\alpha \beta') \frac{1 - \mu_s^2}{E_s} I_s I_f \quad \text{Equation 12.2}$$

Where:

S_e = elastic settlement

q_0 = net applied pressure on the foundation

μ_s = Poisson's ratio of soil

E_s = average modulus of elasticity of the soil under the foundation, measured from $z=0$ to about $z=5B$

$B' = B/2$ for center of foundation

$B' = B$ for corner of foundation

I_s = shape factor

I_f = depth factor

α = a factor that depends on the location on the foundation where settlement is calculated

It is clear that settlement is affected by, but not limited to, the net applied pressure on the foundation, the foundation shape, foundation size, depth of placement and the indicated soil parameters. In other words, the settlement below a foundation is not a constant and is dependent on the foundation under consideration, induced loads, depth of placement and so forth.

In order to provide sensible allowable bearing capacity estimates, conceptual foundation, load and allowable tolerances (with reference to settlement limits) are required.

12.2 Generic Foundation Options for Small Low-Bearing Structures

Foundation options for small low bearing structures (single to potentially double storey masonry brick structures) with structure dimensions of approximately <15m to <15m, the foundation options aligned with the NHBRC 2015 HBM and SANS634:2012 designations provided in report section 11 may be considered.

The foundation options may be aligned with class H1, H2 and H3, depending on the zone under consideration and depth of founding or earthwork preparations.

Foundation Options for Soil Class: "H1":

Modified normal:

- Lightly reinforced strip footings.
- Articulation joints at all internal and external doors and openings.
- Light reinforcement in masonry.
- Site drainage and service and plumbing precautions.

Soil raft:

- Remove all or necessary parts of expansive horizon to 1.0 m beyond the perimeter of the building and replace with inert backfill compacted to at least 93 % MOD AASHTO density at -1 % to +2 % of optimum moisture content.
- Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are < 7.5 mm, or construction type as appropriate to residual movements.
- Site drainage and service and plumbing precautions.

Foundation Options for Soil Class: "H2":

Stiffened or cellular raft:

- Stiffened or cellular raft of articulated lightly reinforced masonry.
- Site drainage and service and plumbing precautions.

Piled construction:

- Piled foundations with suspended floor slabs with or without ground beams.
- Site drainage and service and plumbing precautions.

Split construction:

- Combination of reinforced masonry and full movement joints.
- Suspended floors or fabric reinforced ground slabs acting independently from the building.
- Site drainage and service and plumbing precautions.

Soil raft:

- Remove all or necessary parts of expansive horizon to 1.0 m beyond the perimeter of the building and replace with inert backfill compacted to at least 93 % MOD AASHTO density at -1 % to +2 % of optimum moisture content.
- Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are < 7.5 mm, or construction type as appropriate to residual movements.
- Site drainage and service and plumbing precautions.

Foundation Options for Soil Class: "H3":

Stiffened or cellular raft:

- Stiffened or cellular raft of articulated lightly reinforced masonry.
- Site drainage and service and plumbing precautions.

Piled construction:

- Piled foundations with suspended floor slabs with or without ground beams.
- Site drainage and service and plumbing precautions.

Soil raft:

- Remove all or necessary parts of expansive horizon to 1.0 m beyond the perimeter of the building and replace with inert backfill compacted to at least 93 % MOD AASHTO density at -1 % to +2 % of optimum moisture content.
- Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are < 7.5 mm, or construction type as appropriate to residual movements.
- Site drainage and service and plumbing precautions.

12.3 Generic Foundation Options for Larger Structures

Larger structures should be design by a competent engineer. Input can be provided upon request if load schedules and allowable structural tolerances are available.

Foundation options will probably include one or a combination of the following:

Stiffened strip footings, stiffened or cellular raft

Soil raft.

Piled or pier foundations.

A combination of soil raft and stiffened strip footings, stiffened or cellular raft construction will probably be recommended, depending on the structural details, load schedules and sensitivity of the structures. The design engineer should ideally liaise with the engineering geologist to optimize foundation designs.

Final foundation options and designs should be provided in the design-level (foundation specific assessments) and geotechnical design report.

12.4 Soil or Material Parameters to Consider in Evaluation

Strength, deformation, stiffness and general material parameters assigned in this report section is based on typical material properties correlated form the Unified Soil Classification System. Guidance are provided in Table R6. Parameters specific to the soil class and density (stiffness) are provided in Appendix F.

Table R6: Typical Material Parameters for Preliminary or Conceptual Analysis

Material Type	Unit Weights (kN/m ³)	Effective Angle of Internal Friction (°)	Effective Cohesion (kPa)	Modulus of elasticity, E _s (MN/m ²)	Poisson's Ratio, μ_s
Upper colluvium	16.5 – 18.9	20 – 28	2 – 5	20 – 40	0.20 – 0.50 *
Soft to firm alluvial soils	13.0 – 15.0	18 – 22	2 – 5	20 – 40	0.20 – 0.50 *
Reworked residuum	16.5 – 18.9	20 – 28	2 – 5	20 – 40	0.20 – 0.50 *
Very soft rock shale	18.6 – 19.5	**	**	70 – 150	0.30 – 0.40

Notes:

- Unit weights are considered compacted state.
- * For saturated silts/clays (cohesive soils) insignificant volume change will occur and Poisson's Ration of 0.5 should be considered.
- ** Refer to geotechnical design report to be complied upon foundation-specific assessments.

Depending on the application and sensitivity of the structures, the evaluators/planners/designers should determine/consider the need for material parameter refinement by means of additional geotechnical laboratory or in-situ testing. Guidance of typical parameter values or ranges are provided in this report section and appendices. The final parameter selection will depend on the design philosophy and analysis method under consideration, such as working stress design, limit state design or probabilistic design.

The final parameters to consider should be selected by the competent person conducting the actual evaluations in the geotechnical design report.

12.5 Allowable Bearing Capacity

A brief discussion on the basic principles of bearing capacity are provided in **report section 12.1**. The bearing capacity of a soil is not constant. Provision of bearing capacity without conceptual earthwork/platform preparation, load schedules and structural tolerances (allowable total and differential settlements) will be premature. Some guidance is however provided in the following sections.

The design engineer or structural engineer should liaise with the engineering geologist once conceptual foundation or structure information are available for input regarding the allowable bearing capacity. Typical soil parameters are provided for each Unified Soil Class in **Appendix F**.

12.5.1 Cohesive Soils (Undrained Clay)

The design resistance of the foundation system should be determined in accordance with the relevant material-specific design codes. For conceptualisation purposes, the design resistance of spread footings on undrained clay for vertical, concentric loaded can be estimated by means of the formulation presented in **Chart R5** (SANS10160-5, 2011).

$$\frac{R_d}{(L \cdot B)} = (N_c \cdot c_{u,d}) + p_0$$

Equation 12.3

Where:

R_d : design value of resistance to an action

L : Larger of the plan dimensions of a rectangular footing

B : Smaller of the plan dimensions of a rectangular footing

N_c : Bearing capacity factor

$c_{u,d}$: Design value of undrained shear strength

$p_0 = g \cdot Z$: Total stress at the level of the base of the foundation

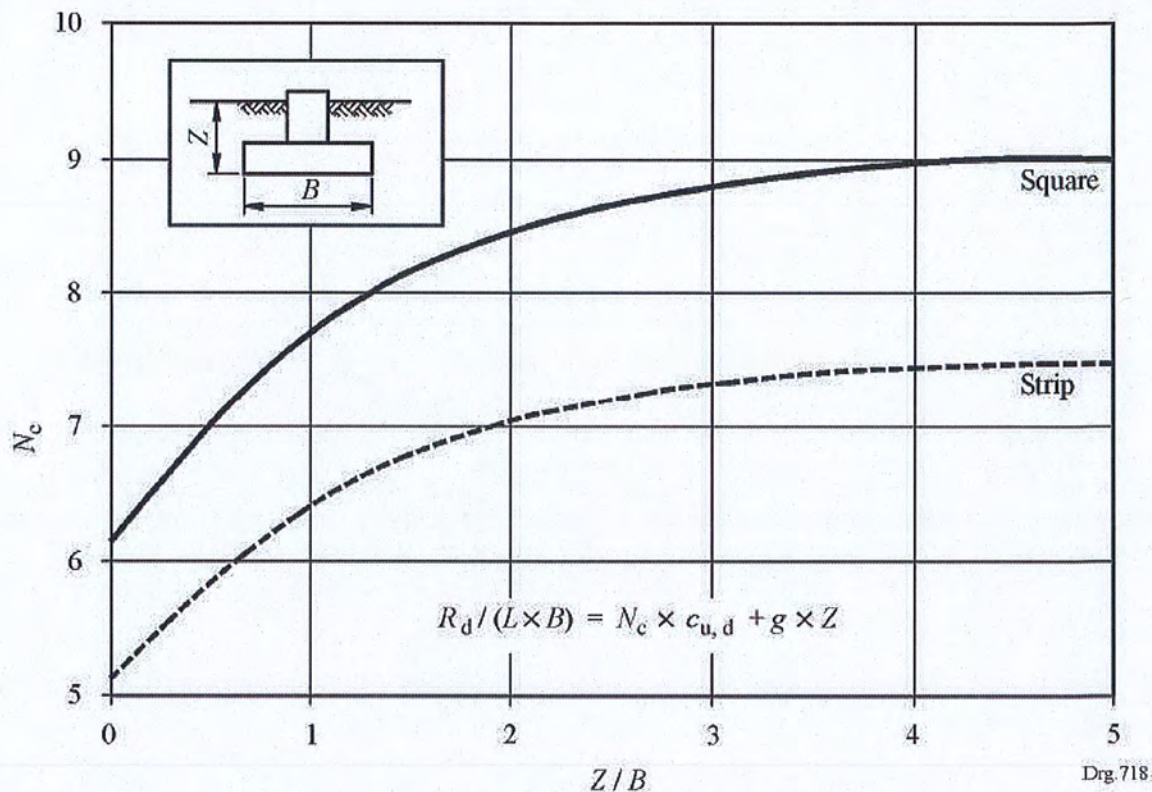


Chart R5: Design Resistance of Spread Footings on Undrained Clay for Vertical, Concentric Loading (SANS10160-5, 2011, p. 31)

Where:

- For STR and STR-P limit states $c_{u,d} = c_{u,k}$
- For GEO and EQU limit states $c_{u,d} = c_{u,d} / 1.4$

The $c_{u,d}$ selected will be the characteristic value, as for the STR and STR-P limit states. The $c_{u,d}$ will be the $c_u / 1.4$, as for the GEO and EQU limit states.

The undrained shear strength (c_u) of the soils can be considered half of the UCS. Typical UCS values for the different consistencies encountered on site are provided in **Appendix F**. Ranges of c_u values, as suggested by TRH10 are also provided in **Appendix F**.

Typical c_u for soft consistency soils are between ~ 10 and ~ 20 kN/m², for firm soils between ~ 20 and ~ 40 kN/m² and for stiff soils between ~ 40 and ~ 75 kN/m².

12.5.2 Non-Cohesive Soils

The design resistance of the foundation system should be determined in accordance with the relevant material-specific design codes. For conceptualisation purposes, the design resistance of spread footings on non-cohesive soils (concentric loaded) can be estimated by means of the generic design charts provided as **Chart R6**, **Chart R7** and **Chart R8**. This conceptual bearing assessment can be conducted where the cohesive soils are removed and replaced with inert material (non-cohesive soil).

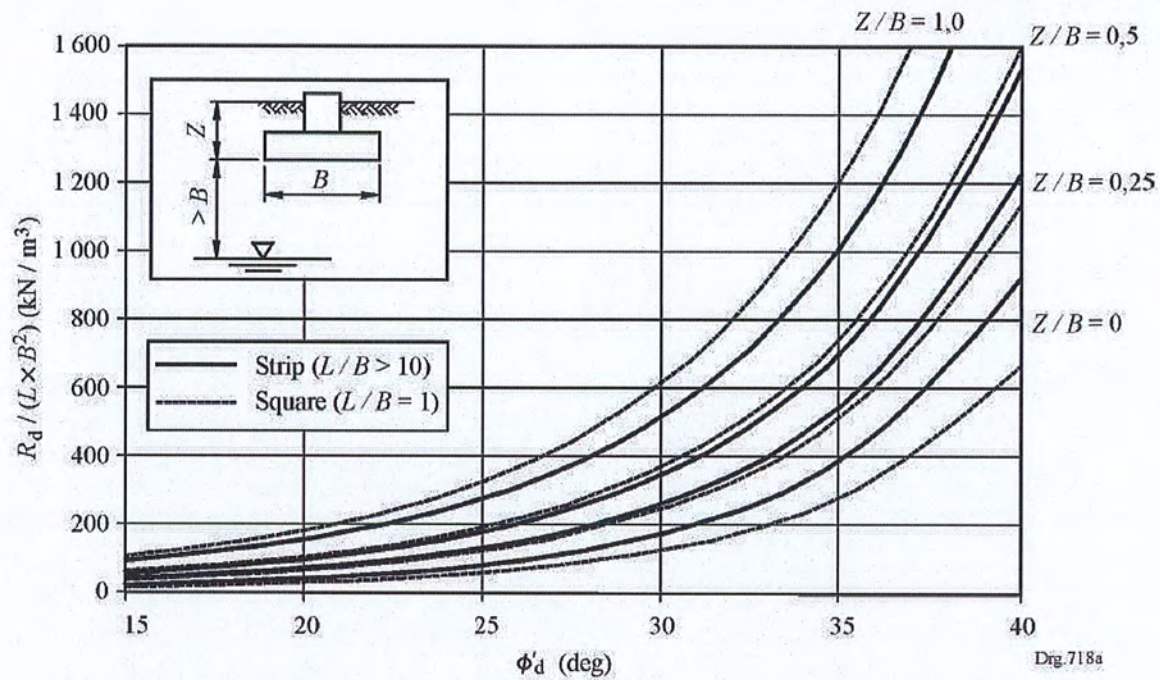


Chart R6: Design Resistance of Shallow Spread Footings on a Non-Cohesive Soil (Deep Water Table) (SANS10160-5, 2011, p. 32)

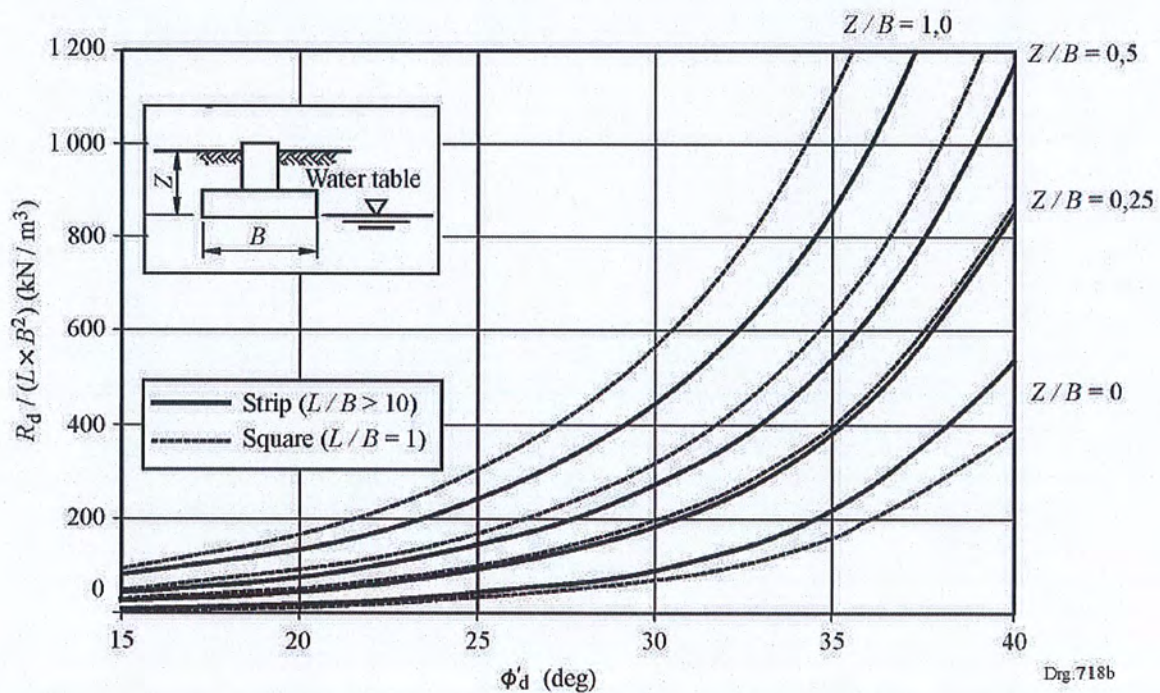


Chart R7: Design Resistance of Shallow Spread Footings on a Non-Cohesive Soil (Water Table at Founding Level) (SANS10160-5, 2011, p. 32)

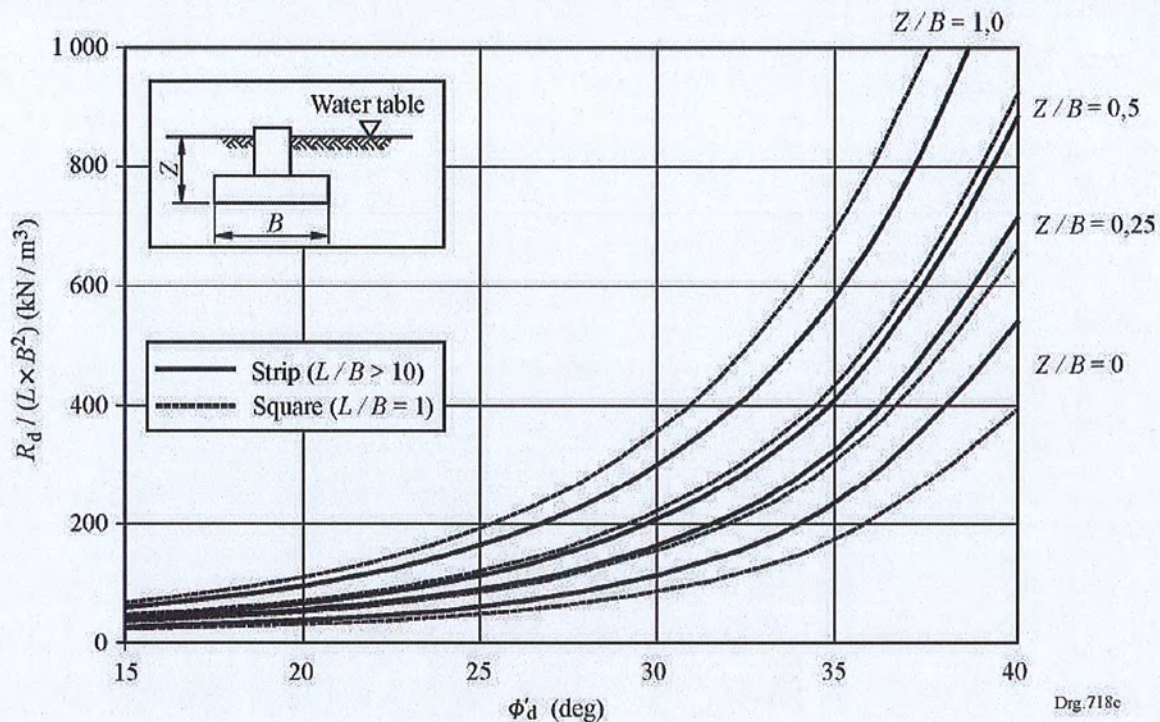


Chart R8: Design Resistance of Shallow Spread Footings on a Non-Cohesive Soil (Water Table at Surface) (SANS10160-5, 2011, p. 33)

Where:

- For STR and STR-P limit states $\phi'_d = \phi'_k$
- For GEO and EQU limit states $\phi'_d = \phi'_k \cdot \tan(\tan \phi'_k / 1.25)$
- Based on $\gamma = 18 \text{ kN/m}^3$, $\gamma' = 10 \text{ kN/m}^3$

The ϕ'_d selected will be the characteristic value, as for the STR and STR-P limit states. The ϕ'_d will be the $\phi'_{d/1.25}$, as for the GEO and EQU limit states.

Typical effective friction angles for the soils under consideration can be obtained from the tables provided in **Appendix F**. Typical ranges were also provided in **report section 12.4**.

13 Drainage

A prominent drainage feature bisects the eastern third of the site. Shallow seepage to surface seepage water conditions will be a reality in and around the drainage feature. To additional areas of expected severe seasonal seepage water conditions were identified. The positions of the areas of concern are indicated on **Figure A7** and **Figure A8**, **Appendix A**.

The regional runoff is affected by the surrounding development. Stormwater drainage from the surroundings are discharged at numerous positions on the site boundaries.

Proper drainage precautionary measures will be essential for this site. Depending on the site preparation and earthworks to be conducted, subsurface drainage will be required in areas. Surface and subsurface drainage precautionary measures will especially be required upslope from any cut-and-fill or cut-to-level site preparations or excavations. The depths of pedogenic formation encountered in the soil profiles (refer to **Table E8, Appendix E**) can be considered as guidance of the expected depth of seasonal seepage water.

Surface drainage precautionary measures will be required as from an erosion control perspective and may comprise of a combination of the following basic precautionary measures:

- Construction phasing to limit vast exposed areas;
- Proper surface water management to prevent high run-off rates and concentrated water flow;
- Temporary surface protection during construction;
- Permanent surface protection after construction for example grass establishment and/or paving;
- Physical improvement of the upper soils such as compaction in order to increase resistance to erosion;
- Subsurface drainage where pedogenic or expected seasonal perched water contacts are exposed by possible cuts/excavations.

14 Construction Materials

A detailed construction materials assessment falls outside the scope of this assessment. The suitability of the on-site materials for some general construction purposes are discussed in the following report sections.

14.1 Soil Mattress Construction

The following is typical basic requirements for soil mattress material:

- Material needs to be workable;
- The material must have good to fair compaction characteristics;
- The material must exhibit low heave, or heave within the allowable tolerances of the structure under consideration;
- The material must exhibit low amounts of settlement, or settlement within the allowable tolerances of the structure under consideration once properly compacted;
- The constructed mattress should have a suitable bearing capacity once properly compacted, thus considering the settlement limit and ultimate bearing capacity;
- The mattress material should be resistant to excessive erosion or piping;

- The mattress should have insignificant amounts of organic material to prevent long term deterioration and settlement;
- The mattress should pose no health threats. The use of contaminated soil/material is thus not permitted.

The on-site soils generally classify as silty and clayey material as per the USCS. The compaction characteristics of these soils are generally fair to poor to very poor. These fine-grained soils are also prone to settlement, even if properly compacted. The material generally exhibits medium to high heave potential. The on-site soils are not ideal for mattress construction. The structural engineer should liaise with the geotechnical engineer or engineering geologist to evaluate the suitability of the soils for specific structures under consideration. The soils may potentially be used for lower mattress construction, if the above listed requirements are satisfied. As per the bearing capacity input, the suitability of the on-site soils for mattress construction will depend on the loading conditions, drainage precautionary measures and structural tolerances.

The material will be considered, in general, not to be ideal for mattress construction.

14.2 Road Construction

The structural behaviour of a road pavement during its expected structural life is dependent on the interaction between the strength of the various pavement layers (pavement balance) and the repeated traffic stresses imposed on the pavement structure.

Procedures for estimating the cumulative traffic over the structural design period, the selection of the thickness and material type for the various layers in order to obtain a balanced design, planned rehabilitation and economic analysis of alternative designs are covered in the TRH14 and South African Pavement Engineering Manual.

The material generally classifies as clay and silt as per the Unified Soil Classification System are >G9 to G10 as per the COLTO (or TRH14) classification system. Guidance on the elastic moduli of the soils are provided in **report section 12.4**. The pavement engineer should refer to the compaction test results attached to this report.

The pavement engineer should however note that the indicated ranges of Elastic Moduli, as suggested by the specific evaluation methodology, should be chosen for structural performance. Ranges of parameters are provided in Chapter 10 of the South African Pavement Engineering Manual on Pavement Design (SAPEM Chapter 10, 2014).

In general, the material will not be recommended for surfacing, base, subbase or even selected layer construction.

Suitable material will have to be imported. Alternatively, physical and/or chemical stabilisation techniques can be considered. It is expected, based on the proximity of local commercial sources, that the importation of suitable road construction material will be the more feasible option.

14.3 Pipe Bedding and Backfill

The bedding and blanketing material can be evaluated by SANS or the more relaxed DWA specifications. Department Water Affairs developed a relaxed bedding specification especially for areas where materials with specifications as per SANS cannot be obtained. The specifications are summarized in Table R7.

Table R7: Relaxed Pipe Bedding Specifications (DWA)

Material Description	Percentage by Mass Passing Sieve Size (mm)				Atterberg Limits Shall Not Exceed (%)		
	9,5	4,75	0,425	0,002	LL*	PI*	LS*
Finely Graded A	100	100	80 - 100	0 - 45	30	15	5
Medium Graded B	100	80 - 100	60 - 80	0 - 40	35	18	7,5
Granular C	100	70 - 100	30 - 60	0 - 35	40	20	10

Notes: * LL, PI and LS on material passing the 0,425mm sieve.

The average PI (Plasticity Index) for the soils tested on-site is approximately 28 % with a standard deviation of around 7,9. Only the highly to moderately weathered shale as retrieved from test pits TP12 and TP58 and the ferruginised colluvium and pebble-marker material as retrieved from test pits TP32 and TP35 have Plasticity Indices of less than 20. The average LL (Liquid Limit) of the materials tested varied between 28 and 92 %, with an average of ~54 % with a standard deviation of ~14. The LS (Linear Shrinkage) varies from 6.5 to 30 %, with an average of ~16.5 % and a standard deviation of ~7.

The on-site material in general is not complying with the relaxed DWA pipe bedding specifications. The design engineer should consider the recommended specifications for the pipeline/s under consideration for this site. The importation of lower PI and suitably graded material should be considered for any rigid or semi-rigid pipelines.

14.4 Fine aggregate for Mortar and Plaster

No suitable source for use as fine aggregate for mortar and plaster were identified on site. These materials will have to be imported from a commercial source.

14.5 Coarse Aggregate for Concrete

No suitable source for use as coarse aggregate for concrete was identified on site. Suitable material will have to be imported from a commercial source.

15 Special Measures or Considerations

The site was trafficable at the time of inspection. Accessibility may be problematic during the wet season, especially during and after downpours, due to the presence of upper fines/clay. Temporarily roadworks should be considered for access roads, especially if considered for use of heavy construction equipment/vehicles during the wet season.

Corrosion protection will be recommended due to the potential corrosiveness of the soils and/or soil-water paste.

The structural engineer should confirm if additional seismic input is required. This will depend on the planned structures.

Site surface drainage and erosion control measures will be recommended.

Damp proofing will be recommended below all structures.

Additional precautionary measures may be required in areas affected by historic workings, root systems or large trees, termite workings or underground services. The aforementioned should be confirmed in the more detailed assessment.

Very localised historic works and road layer works are present on the site that will require rehabilitation.

Pesticide control should be considered below/around all footings/structures.

16 Identified Shortcomings

This report serves as a near surface SAICE1995 Feasibility-Level (or tender-design) geotechnical assessment with input and guidance based on material classification and expected performances. The more detailed material characterisation investigations should follow, together with a geotechnical design report once more information is available such as conceptual layouts and expected foundation loads and allowable structural tolerances. The design level investigation should then be followed with construction inspections that is generally conducted at the time of excavation of the services and foundation trenches and excavations.

17 Conclusions

The majority of the site is deemed developable as from a geotechnical perspective. An existing drainage feature bisects the eastern third of the site with resulting expected seasonal flooding and potential flood areas adjacent to the drainage feature. The flood lines should be determined by a competent person and the layout planning of the proposed development should be aligned with the findings.

The geotechnical constraints identified in this assessment are discussed in the report. Remedial measures will be necessary, especially for consideration of shallow seepage water and/or saturated soil profiles, expected expansiveness of the soils and consolidation of the soft soils.

Trafficability of the site during and after downpours may be problematic due to the upper fines across the majority of the site. The planners should incorporate this in the construction planning.

The material properties and typical performances are provided in the report and Appendices. Generic foundation options and initial guidance on allowable bearing capacities, limited to conceptualisation purposes were provided. The design engineer/s should liaise with the engineering geologist once conceptual earthwork, foundation details, allowable structural tolerances and conceptual load schedules are available.

The suitability of the on-site materials for use as different construction materials are provided/discussed in the relevant report sections.

Foundation specific assessments should follow.

18 Way Forward

The objectives of this tender design (Feasibility-level) geotechnical investigation are provided in **report section 2**. The levels of investigation covered is depicted in **Chart R9**.

The detailed geotechnical investigation (footprint investigation for detailed design), geotechnical design report (if required by the design engineer) and construction monitoring (inspection of open trenches/excavations) should follow, as per the relevant code of practice (SAICE, 2010).

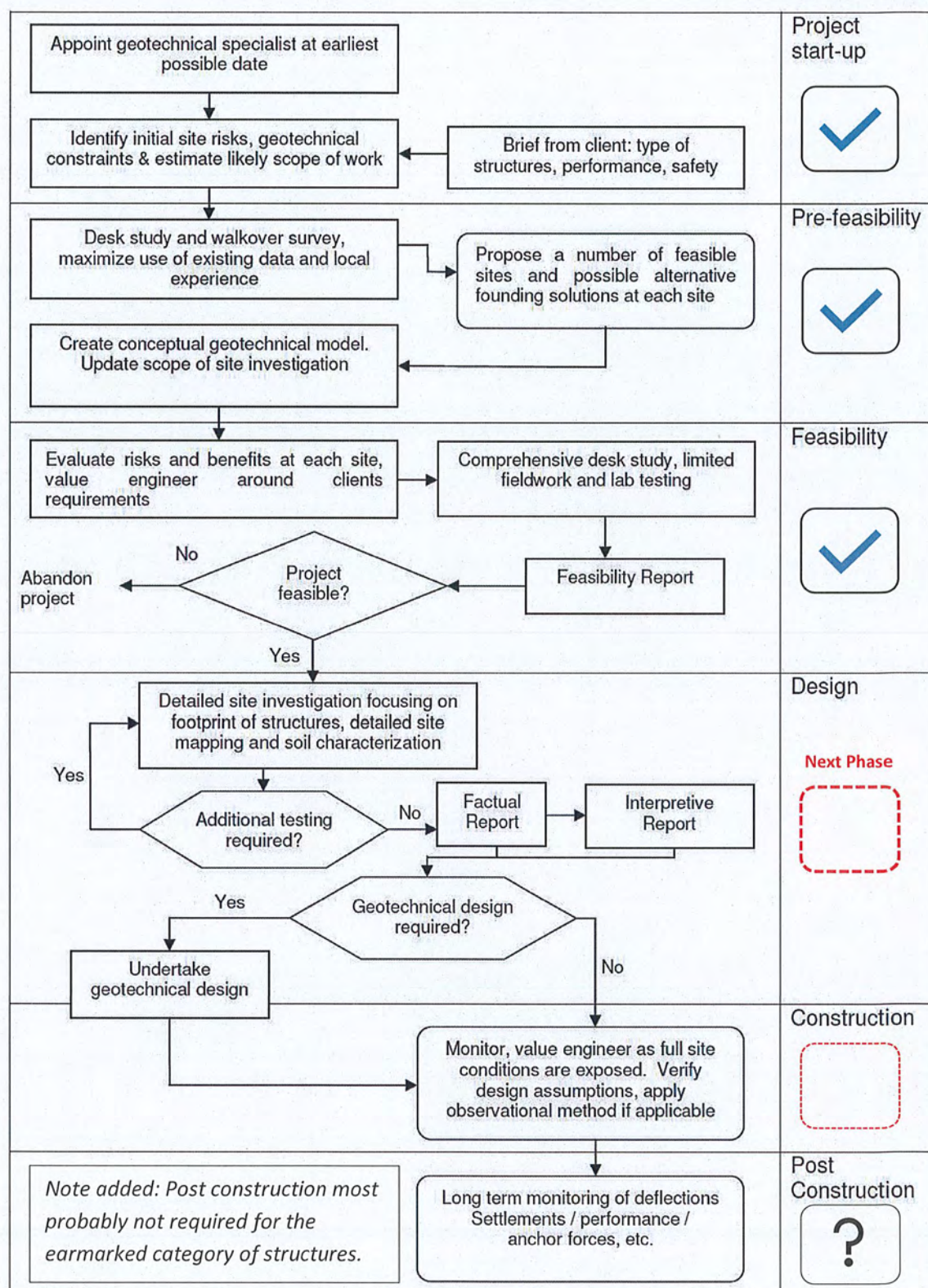


Chart R9: Site Investigation Good Practice Flow Chart (SAICE, 2010)

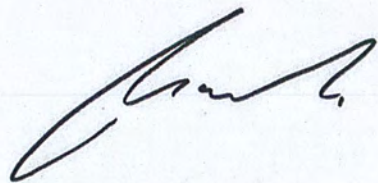
19 Report Provisions

While every effort was made during this basic shallow soil materials assessment investigation to identify the different geological materials, areas subject to a perched water tables, hydrogeological conditions, areas of poor drainage and to estimate their distribution, it is impossible to guarantee that isolated zones of significantly different conditions have not been missed.

For this reason, this investigation has sought to highlight the significant issues regarding the influence of the proposed development on the geological environment to provide prior warning to the developer.

The investigation is no substitute for detailed foundation assessments, as proposed by the relevant code of practice, where variances are usually brought to light.

The report may only be distributed in its full context. RockSoil Consult (Pty) Ltd. and/or any of its employees or sub-contractors will not be held liable for any damages caused due to misinterpretation of the findings and/or recommendations due to selective data presentation or distribution.

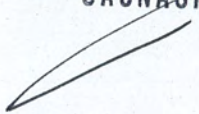


DH WESSELS Pr.Sci.Nat.

Engineering Geologist

SACNASP registration number: 400076/8

ROCKSOIL CONSULT PTY LTD
REG NO 2013/139402/07
DIRECTOR: DIRK HERMAN WESSELS
 **INFO@ROCKSOILCONSULT.CO.ZA**
SACNASP: 400076/08



20 References

- Das, B. M., & Sobhan, K. (2014). *Principles of Geotechnical Engineering* (Eight, SI ed.). Stamford, United States: CENGAGE Learning.
- Das, M. B., & Sivakugan, N. (2015). *Fundamentals of Geotechnical Engineering* (Fifth Edition, International ed.). California, United States: Cengage Learning.
- Franki. (2008). *A Guide to Practical Geotechnical Engineering in Southern Africa* (Fourth ed.). FRANKI.
- NAVFAC. (1986). *Design Manual - Naval Facilities Engineering Command - Foundations & Earth Structures* (7.02 ed.). Washington D.C.: Superintendent of Documents, U.S. Government Printing.
- NHBRC. (2015). *Home Builders Manual*. National Home Builders Registration Council of South Africa.
- SABS0161-1980-(Amdt.1986). (n.d.). *Code of Practice for The Design of Foundations for Buildings*. Pretoria: The Council of the South African Bureau of Standards.
- SAICE. (2010). *Site Investigation Code of Practice*. The South African Institution of Civil Engineering - The Geotechnical Division of SAICE.
- SANS10160-1. (2010). *Basis of structural design and actions for buildings and industrial structures* (1.1 ed., Vols. SANS10160-1). South Africa: South African National Standard. Retrieved 2010
- SANS10160-5. (2011). *Basis of structural design and actions for buildings and industrial structures. 5(1978-0-626-26612-7), 1.1*. South Africa: South African National Standard. Retrieved 2011
- SANS10400-H. (2012). *The Application of the National Building Regulations - Part H: Foundations*. South African National Standard.
- SANS10400-H. (2012). *The application of the national building regulations: Part H: Foundations*. South African National Standard.
- SANS1060-4. (2017). *Basis of structural design and actions for buildings and industrial structures Part 4: Seismic actions and general requirements for buildings* (2 ed.). South African National Standard.
- SANS634. (2012). *Geotechnical Investigations for Township Development*. South African National Standard.

SAPeM Chapter 10. (2014). *South African Pavement Engineering Manual - Pavement Design* (2 ed., Vol. 10). Republic of South Africa: The South African National Roads Agency Ltd.

TRH10. (1994). *Technical Recommendations for Highways - The Design of Road Embankments*. Pretoria, Republic of South Africa: Department of Transport.

TRH14. (1985). *Technical Recommendations for Highways - Guidelines for Road Construction Materials*. Pretoria, Republic of South Africa: Department of Transport.

van der Merwe, D. (1964, June). The prediction of heave from the plasticity index and percentage clay fraction of soils. *The Civil Engineer in South Africa*, 103-229.

Appendix A: Figures

Figure A3: Site Locality

Figure A4: Ground Contours - Regional Topography

Figure A5: SANBI BGIS LUDS Tool - National Wetlands and Biodiversity Areas

Figure A6: Evaluation Test Pit Positions

Figure A7: Seepage Water Encountered

Figure A8: Seepage Water Encountered – Aerial Image Overlay (2009-09-13 as YMD)

Figure A9: Seepage Water Encountered – Aerial Image Overlay (2016-05-28 as YMD)

Figure A10: Seepage Water Encountered – Aerial Image Overlay (2019-05-13 as YMD)

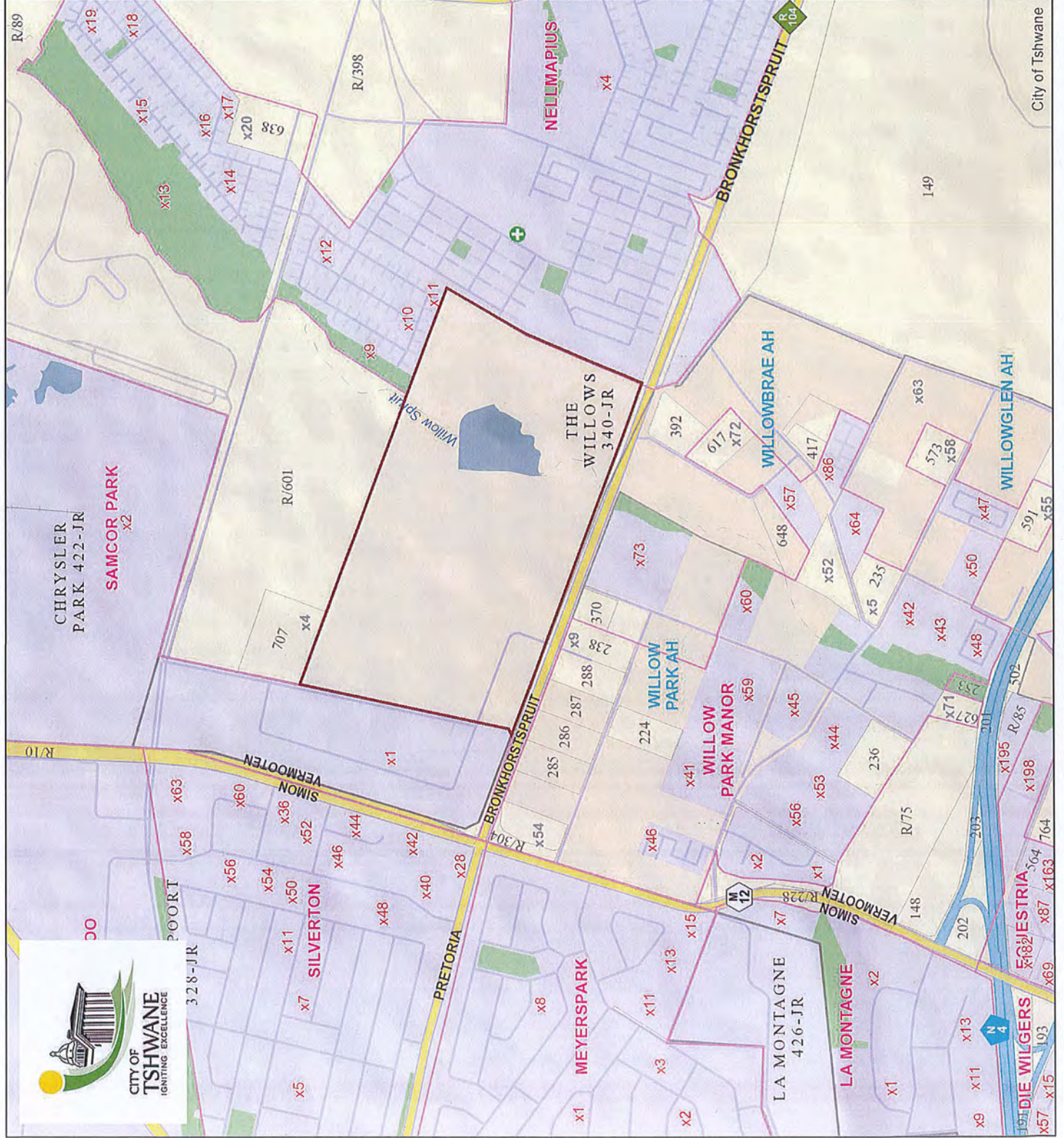
Figure A11: Test Pit Termination Depths (mbgl)

Figure A12: Test Pit Termination Depths (mbgl) - Contoured

Figure A13: Preliminary Broad Zonation Map

Figure A14: Preliminary Broad Zonation Map – Aerial Image Overlay (2019-05-13 as YMD)

Figure A3: Site Locality

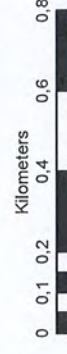


Legend

- Points of Interest**
- Shopping Centre
 - Social Service
 - Hotel & Lodges
 - Police Station
 - Emergency Services
 - Clinic
 - Hospital
 - Primary School
 - Secondary School
 - Tertiary Education
 - Post Office
 - Library
 - Animal Welfare
 - Places of Interest
 - Court
 - Tourism Information
 - Municipal
 - Government Department
 - Foreign Representation
 - Societies, Institutes
 - Theatre
 - Cinema
 - Casino
 - Museum
 - Art Gallery
 - Park
 - Nature Conservation
 - Resort
 - Caravan Park
 - Swimming Pool
 - Ice Rink
 - Cemetery
 - Place of Worship
 - Refuse Site
 - Sport
 - Stadium
 - Toll Gate
 - E-Toll
 - Airport

Base map

- Tshwane Regions
- Wards
- Municipal Boundary
- Suburb Boundary
- Farm Boundary
- Open Space
- Dam
- River
- Freeway
- Main Road
- Street
- Main Railway
- Gautrain



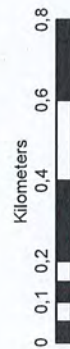
Date: 2019/09/02

Compiled & issued by: Corporate GIS (gis@tshwane.gov.za)
 Whilst every care has been taken in compiling the information on this document, the CITY OF TSHWANE cannot accept responsibility for any inaccuracies. The information in this document assumes no legal status, and is not intended to replace legally recorded data and documentation.

Figure A4: Ground Contours
(Regional Topography)

Legend

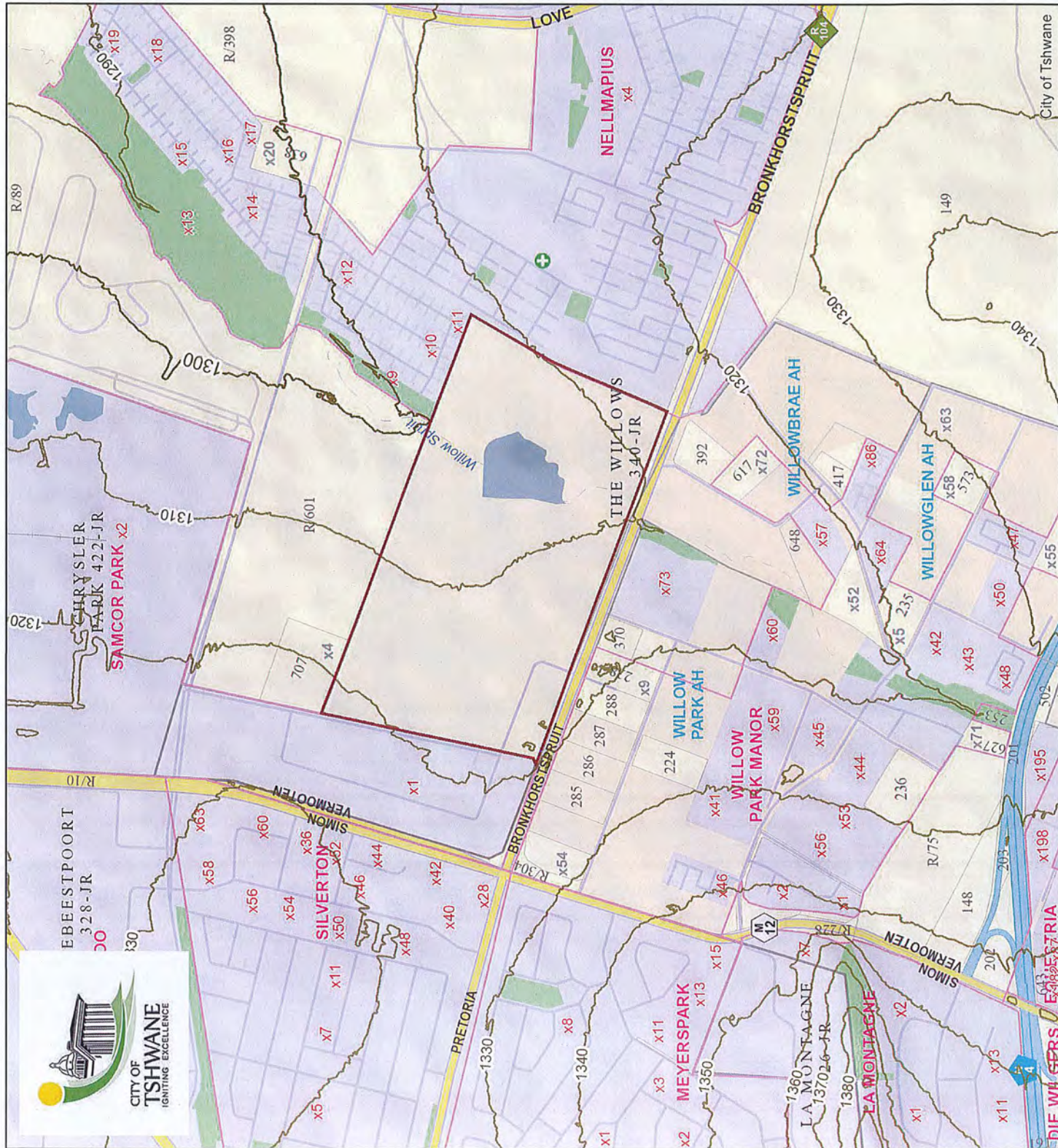
- Points of Interest**
- Shopping Centre
 - Social Service
 - Hotel & Lodges
 - Police Station
 - Emergency Services
 - Clinic
 - Hospital
 - Primary School
 - Secondary School
 - Tertiary Education
 - Post Office
 - Library
 - Animal Welfare
 - Places of Interest
 - Court
 - Tourism Information
 - Municipal
 - Government Department
 - Foreign Representation
 - Societies, Institutes
 - Theatre
 - Cinema
 - Casino
 - Museum
 - Art Gallery
 - Park
 - Nature Conservation
 - Resort
 - Caravan Park
 - Swimming Pool
 - Ice Rink
 - Cemetery
 - Place of Worship
 - Refuse Site
 - Sport
 - Stadium
 - Toll Gate
 - E-Toll
 - Airport
- Base map**
- Tshwane Regions
 - Wards
 - Municipal Boundary
 - Suburb Boundary
 - Farm Boundary
 - Open Space
 - Dam
 - River
 - Freeway
 - Main Road
 - Street
 - Main Railway
 - Gautrain

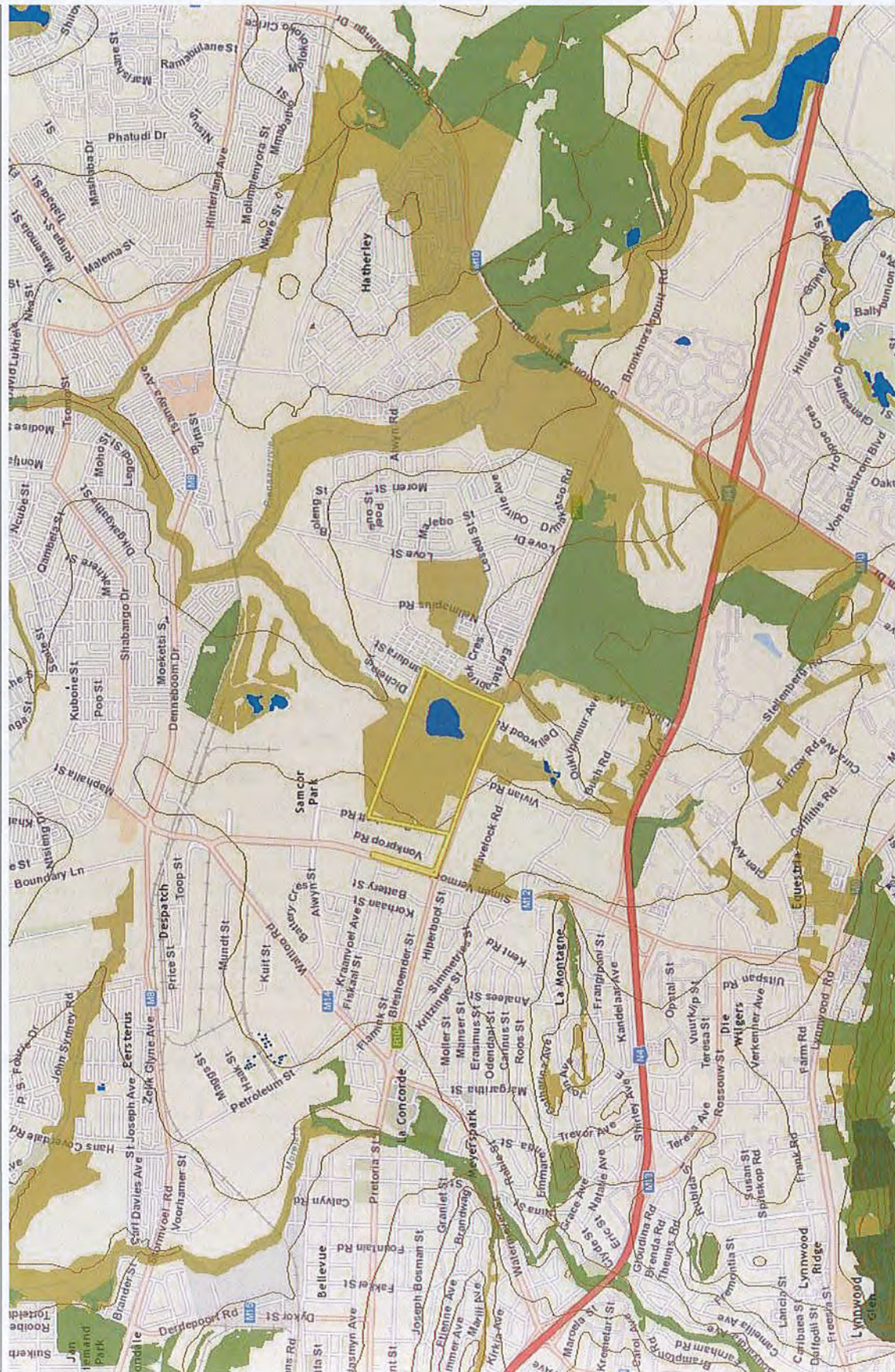


Date: 2019/09/02

Compiled & Issued by: Corporate GIS (gis@tshwane.gov.za)
Whilst every care has been taken in compiling the information on this document, the CITY OF TSHWANE cannot accept responsibility for any inaccuracies. The information in this document assumes no legal status, and is not intended to be used as a legal document.

Copyright © City of Tshwane 2018



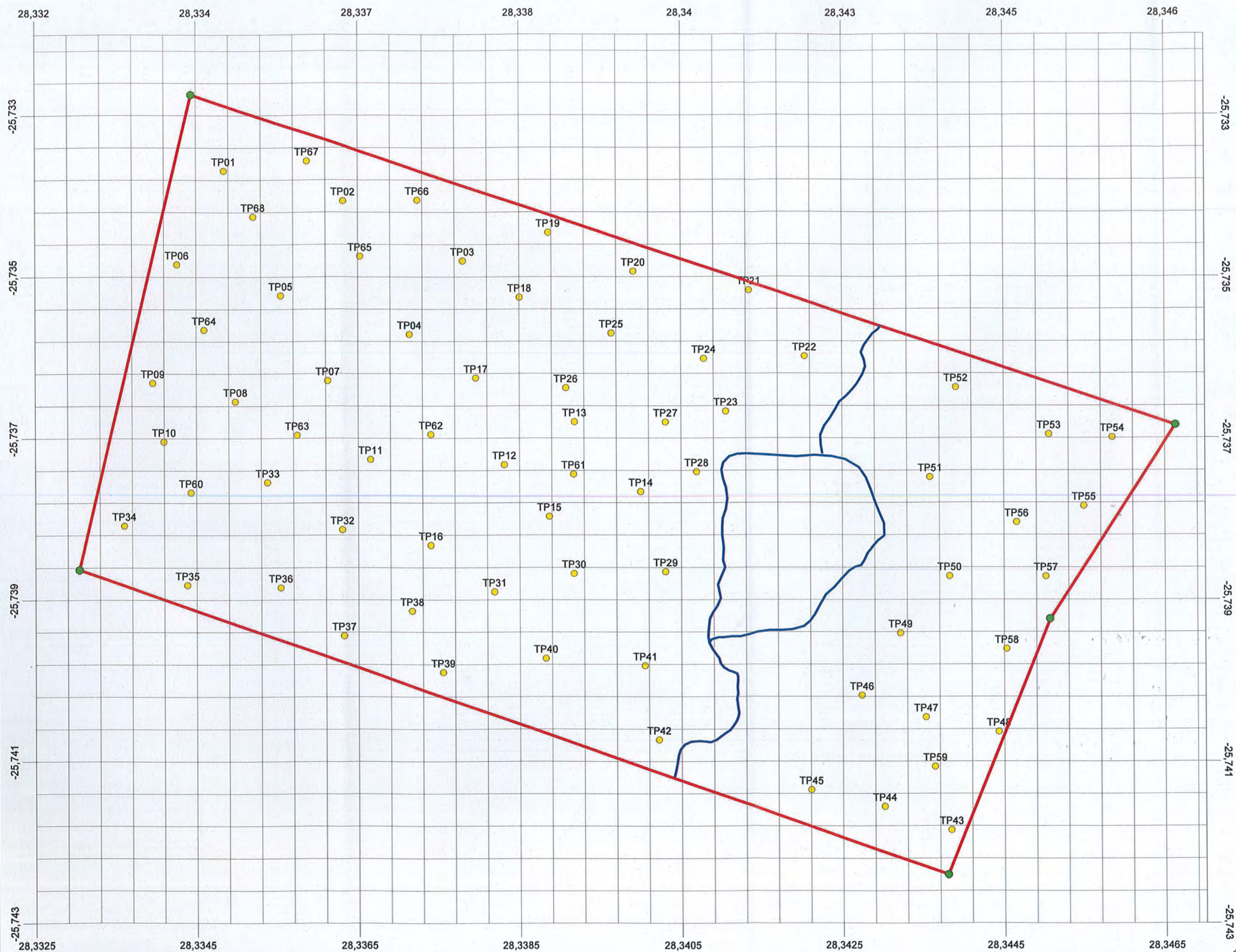


This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

1.8 0 0.92 1.8 Kilometers

WGS_1984_Web_Mercator_Auxiliary_Sphere
© Latitude Geographics Group Ltd



Easting	Southing	Name	Easting	Southing	Name
28.334844	-25.733685	TP01	28.334383	-25.738816	TP35
28.336318	-25.734060	TP02	28.335538	-25.738848	TP36
28.337801	-25.734802	TP03	28.336320	-25.739443	TP37
28.337139	-25.735713	TP04	28.337164	-25.739138	TP38
28.335545	-25.735232	TP05	28.337547	-25.739897	TP39
28.334262	-25.734845	TP06	28.338821	-25.739724	TP40
28.336124	-25.736286	TP07	28.340047	-25.739816	TP41
28.334982	-25.736544	TP08	28.340218	-25.740733	TP42
28.333960	-25.736313	TP09	28.343839	-25.741850	TP43
28.334096	-25.737040	TP10	28.343014	-25.741560	TP44
28.336652	-25.737263	TP11	28.342103	-25.741352	TP45
28.338312	-25.737329	TP12	28.342735	-25.740184	TP46
28.339182	-25.736799	TP13	28.343527	-25.740452	TP47
28.339999	-25.737663	TP14	28.344426	-25.740633	TP48
28.338868	-25.737970	TP15	28.343215	-25.739413	TP49
28.337399	-25.738325	TP16	28.343825	-25.738708	TP50
28.337961	-25.736255	TP17	28.343586	-25.737484	TP51
28.338505	-25.735254	TP18	28.343909	-25.736372	TP52
28.338862	-25.734453	TP19	28.345059	-25.736955	TP53
28.339913	-25.734933	TP20	28.345845	-25.736992	TP54
28.341342	-25.735166	TP21	28.345491	-25.737841	TP55
28.342036	-25.735987	TP22	28.346555	-25.738045	TP56
28.341052	-25.736668	TP23	28.345016	-25.738712	TP57
28.340782	-25.736015	TP24	28.344527	-25.739609	TP58
28.339640	-25.735698	TP25	28.343638	-25.741065	TP59
28.339077	-25.736377	TP26	28.334430	-25.737673	TP60
28.340308	-25.736802	TP27	28.339170	-25.737446	TP61
28.340689	-25.737418	TP28	28.337403	-25.736954	TP62
28.340304	-25.738651	TP29	28.335745	-25.736962	TP63
28.339172	-25.738674	TP30	28.334596	-25.735655	TP64
28.338185	-25.738900	TP31	28.336526	-25.734744	TP65
28.336300	-25.738134	TP32	28.337240	-25.734050	TP66
28.335377	-25.737548	TP33	28.335873	-25.733566	TP67
28.333600	-25.738083	TP34	28.335205	-25.734254	TP68

ROCKSOIL CONSULT PTY LTD
 REG NO 2013/139402/07
 DIRECTOR: DIRK HERMAN WESSELS
 INFO@ROCKSOILCONSULT.CO.ZA
 SACNASP: 400076/08

Company Stamp

Drawing Approved (Signature) Date Approved

Drawing Revision Date: 2019-09-10
 Drawing Revised By: DH Wessels

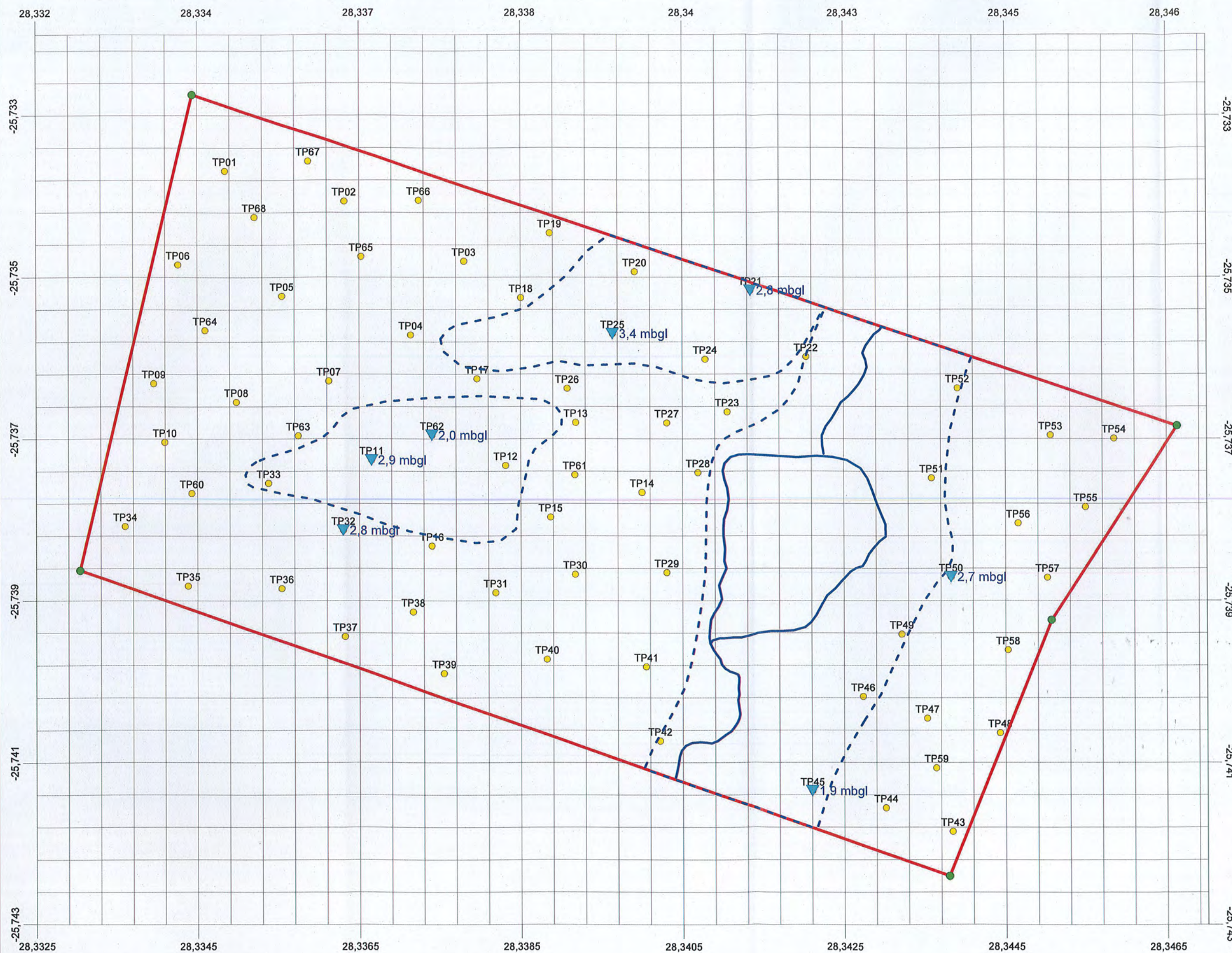
Coordinate System: Decimal Degrees (Lat/Lon)
 Reference: RS18056/P1/SS/V1.0
 Drawing Version: V1.0

Figure A6: Evaluation Test Pit Positions

Copyright:
 This drawing enjoys copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.

ROCKSOIL
 CONSULT





Easting	Southing	Name	Easting	Southing	Name
28.334844	-25.733685	TP01	28.334383	-25.738816	TP35
28.336318	-25.734060	TP02	28.335538	-25.738848	TP36
28.337801	-25.734802	TP03	28.336320	-25.739443	TP37
28.337139	-25.735713	TP04	28.337164	-25.739138	TP38
28.335545	-25.735232	TP05	28.337547	-25.739897	TP39
28.334262	-25.734845	TP06	28.338821	-25.739724	TP40
28.336124	-25.736286	TP07	28.340047	-25.739816	TP41
28.334982	-25.736544	TP08	28.340218	-25.740733	TP42
28.333960	-25.736313	TP09	28.343839	-25.741850	TP43
28.334096	-25.737040	TP10	28.343014	-25.741560	TP44
28.336652	-25.737263	TP11	28.342103	-25.741352	TP45
28.338312	-25.737329	TP12	28.342735	-25.740184	TP46
28.339182	-25.736799	TP13	28.343527	-25.740452	TP47
28.339999	-25.737663	TP14	28.344426	-25.740633	TP48
28.338868	-25.737970	TP15	28.343215	-25.739413	TP49
28.337399	-25.738325	TP16	28.343825	-25.738708	TP50
28.337961	-25.736255	TP17	28.343586	-25.737484	TP51
28.338505	-25.735254	TP18	28.343909	-25.736372	TP52
28.338862	-25.734453	TP19	28.345059	-25.736955	TP53
28.339913	-25.734933	TP20	28.345845	-25.736992	TP54
28.341342	-25.735166	TP21	28.345491	-25.737841	TP55
28.342036	-25.735987	TP22	28.344655	-25.738045	TP56
28.341052	-25.736668	TP23	28.345016	-25.738712	TP57
28.340782	-25.736015	TP24	28.344527	-25.739609	TP58
28.339640	-25.735698	TP25	28.343638	-25.741065	TP59
28.339077	-25.736377	TP26	28.334430	-25.737673	TP60
28.340308	-25.736802	TP27	28.339170	-25.737446	TP61
28.340689	-25.737418	TP28	28.337403	-25.736954	TP62
28.340304	-25.738651	TP29	28.335745	-25.736962	TP63
28.339172	-25.738674	TP30	28.334596	-25.735655	TP64
28.338185	-25.738900	TP31	28.336526	-25.734744	TP65
28.336300	-25.738134	TP32	28.337240	-25.734050	TP66
28.335377	-25.737548	TP33	28.335873	-25.733566	TP67
28.333600	-25.738083	TP34	28.335205	-25.734254	TP68

ROCKSOIL CONSULT PTY LTD
 REG NO 2013/139402/07
 DIRECTOR: DIRK HERMAN WESSELS
 INFO@ROCKSOILCONSULT.CO.ZA
 SACNASP: 400076/08

Company Stamp

[Signature] 2019/09/30
 Drawing Approved (Signature) Date Approved

Figure A7: Seepage Water Encountered

Copyright:
 This drawing enjoy copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.

ROCKSOIL
 CONSULT

Drawing Revision Date: 2019-09-10
 Drawing Revised By: DH Wessels
 Coordinate System: Decimal Degrees (Lat/Lon)
 Reference: RS18056/P1/SS/V1.0
 Drawing Version: V1.0



Easting	Southing	Name	Easting	Southing	Name
28.334844	-25.733685	TP01	28.334383	-25.738816	TP35
28.336318	-25.734060	TP02	28.335538	-25.738848	TP36
28.337801	-25.734802	TP03	28.336320	-25.739443	TP37
28.337139	-25.735713	TP04	28.337164	-25.739138	TP38
28.335545	-25.735232	TP05	28.337547	-25.739897	TP39
28.334262	-25.734845	TP06	28.338821	-25.739724	TP40
28.336124	-25.736286	TP07	28.340047	-25.739816	TP41
28.334982	-25.736544	TP08	28.340218	-25.740733	TP42
28.333960	-25.736313	TP09	28.343839	-25.741850	TP43
28.334096	-25.737040	TP10	28.343014	-25.741560	TP44
28.336652	-25.737263	TP11	28.342103	-25.741352	TP45
28.338312	-25.737329	TP12	28.342735	-25.740184	TP46
28.339182	-25.736799	TP13	28.343527	-25.740452	TP47
28.339999	-25.737663	TP14	28.344426	-25.740633	TP48
28.338868	-25.737970	TP15	28.343215	-25.739413	TP49
28.337399	-25.738325	TP16	28.343825	-25.738708	TP50
28.337961	-25.736255	TP17	28.343586	-25.737484	TP51
28.338505	-25.735254	TP18	28.343909	-25.736372	TP52
28.338862	-25.734453	TP19	28.345059	-25.736955	TP53
28.339913	-25.734933	TP20	28.345845	-25.736992	TP54
28.341342	-25.735166	TP21	28.345491	-25.737841	TP55
28.342036	-25.735987	TP22	28.344655	-25.738045	TP56
28.341052	-25.736668	TP23	28.345016	-25.738712	TP57
28.340782	-25.736015	TP24	28.344527	-25.739609	TP58
28.339640	-25.735698	TP25	28.343638	-25.741065	TP59
28.339077	-25.736377	TP26	28.334430	-25.737673	TP60
28.340308	-25.736802	TP27	28.339170	-25.737446	TP61
28.340689	-25.737418	TP28	28.337403	-25.736954	TP62
28.340304	-25.738651	TP29	28.335745	-25.736962	TP63
28.339172	-25.738674	TP30	28.334596	-25.735655	TP64
28.338185	-25.738900	TP31	28.336526	-25.734744	TP65
28.336300	-25.738134	TP32	28.337240	-25.734050	TP66
28.335377	-25.737548	TP33	28.335873	-25.733566	TP67
28.333600	-25.738083	TP34	28.335205	-25.734254	TP68

ROCKSOIL CONSULT PTY LTD
 REG NO 2013/139402/07
 DIRECTOR: DIRK HERMAN WESSELS
 INFO@ROCKSOILCONSULT.CO.ZA
 SACNASP: 400076/08

Company Stamp

Drawing Approved (Signature) *[Signature]* Date Approved 2019/09/30

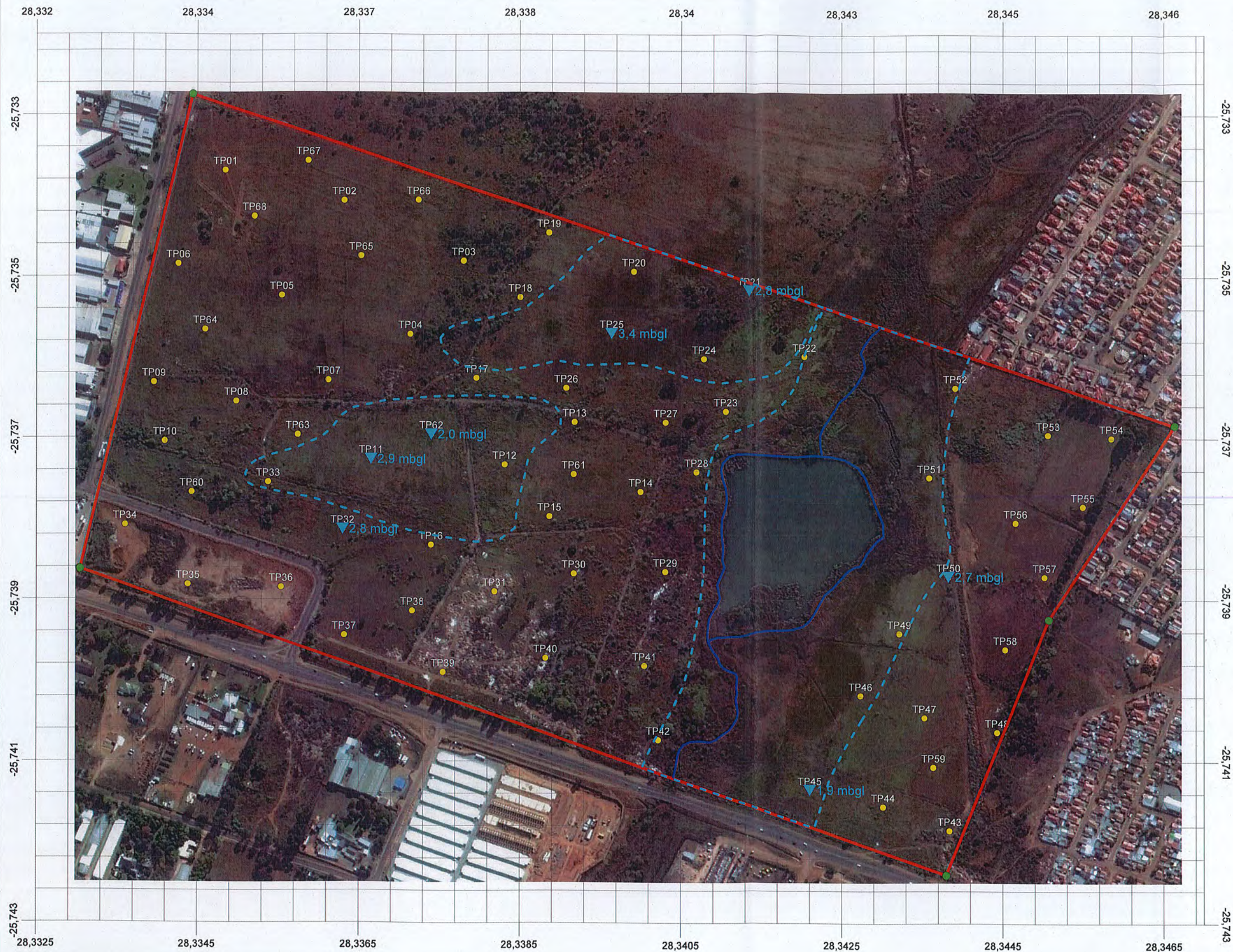
Figure A8: Seepage Water Encountered - Aerial Image Overlay (2009-09-13 as YMD)

Copyright:
 This drawing enjoy copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.

ROCKSOIL
 CONSULT



Drawing Revision Date: 2019-09-10
 Drawing Revised By: DH Wessels
 Coordinate System: Decimal Degrees (Lat/Lon)
 Reference: RS18056/P1/SS/V1.0
 Drawing Version: V1.0



Easting	Southing	Name	Easting	Southing	Name
28.334844	-25.733685	TP01	28.334383	-25.738816	TP35
28.336318	-25.734060	TP02	28.335538	-25.738848	TP36
28.337801	-25.734802	TP03	28.336320	-25.739443	TP37
28.337139	-25.735713	TP04	28.337164	-25.739138	TP38
28.335545	-25.735232	TP05	28.337547	-25.739897	TP39
28.334262	-25.734845	TP06	28.338821	-25.739724	TP40
28.336124	-25.736286	TP07	28.340047	-25.739816	TP41
28.334982	-25.736544	TP08	28.340218	-25.740733	TP42
28.333960	-25.736313	TP09	28.343839	-25.741850	TP43
28.334096	-25.737040	TP10	28.343014	-25.741560	TP44
28.336652	-25.737263	TP11	28.342103	-25.741352	TP45
28.338312	-25.737329	TP12	28.342735	-25.740184	TP46
28.339182	-25.736799	TP13	28.343527	-25.740452	TP47
28.339999	-25.737663	TP14	28.344426	-25.740633	TP48
28.338868	-25.737970	TP15	28.343215	-25.739413	TP49
28.337399	-25.738325	TP16	28.343825	-25.738708	TP50
28.337961	-25.736255	TP17	28.343586	-25.737484	TP51
28.338505	-25.735254	TP18	28.343909	-25.736372	TP52
28.338862	-25.734453	TP19	28.345059	-25.736955	TP53
28.339913	-25.734933	TP20	28.345845	-25.736992	TP54
28.341342	-25.735166	TP21	28.345491	-25.737841	TP55
28.342036	-25.735987	TP22	28.344655	-25.738045	TP56
28.341052	-25.736668	TP23	28.345016	-25.738712	TP57
28.340782	-25.736015	TP24	28.344527	-25.739609	TP58
28.339640	-25.735698	TP25	28.343638	-25.741065	TP59
28.339077	-25.736377	TP26	28.334430	-25.737673	TP60
28.340308	-25.736802	TP27	28.339170	-25.737446	TP61
28.340689	-25.737418	TP28	28.337403	-25.736954	TP62
28.340304	-25.738651	TP29	28.335745	-25.736962	TP63
28.339172	-25.738674	TP30	28.334596	-25.735655	TP64
28.338185	-25.738900	TP31	28.336526	-25.734744	TP65
28.336300	-25.738134	TP32	28.337240	-25.734050	TP66
28.335377	-25.737548	TP33	28.335873	-25.733566	TP67
28.333600	-25.738083	TP34	28.335205	-25.734254	TP68

ROCKSOIL CONSULT PTY LTD
 REG NO 2013/139402/07
 DIRECTOR: DIRK HERMAN WESSELS
 INFO@ROCKSOILCONSULT.CO.ZA
 SACNASP: 400076/08

Company Stamp

Drawing Approved (Signature) *[Signature]* Date Approved 2019/09/30

Drawing Revision Date: 2019-09-10
 Drawing Revised By: DH Wessels

Coordinate System: Decimal Degrees (Lat/Lon)
 Reference: RS18056/P1/SS/V1.0
 Drawing Version: V1.0

Figure A9: Seepage Water Encountered - Aerial Image Overlay (2016-05-28 as YMD)

Copyright:
 This drawing enjoy copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.

ROCKSOIL
 CONSULT



Easting	Southing	Name	Easting	Southing	Name
28.334844	-25.733685	TP01	28.334383	-25.738816	TP35
28.336318	-25.734060	TP02	28.335538	-25.738848	TP36
28.337801	-25.734802	TP03	28.336320	-25.739443	TP37
28.337139	-25.735713	TP04	28.337164	-25.739138	TP38
28.335545	-25.735232	TP05	28.337547	-25.739897	TP39
28.334262	-25.734845	TP06	28.338821	-25.739724	TP40
28.336124	-25.736286	TP07	28.340047	-25.739816	TP41
28.334982	-25.736544	TP08	28.340218	-25.740733	TP42
28.333960	-25.736313	TP09	28.343839	-25.741850	TP43
28.334096	-25.737040	TP10	28.343014	-25.741560	TP44
28.336652	-25.737263	TP11	28.342103	-25.741352	TP45
28.338312	-25.737329	TP12	28.342735	-25.740184	TP46
28.339182	-25.736799	TP13	28.343527	-25.740452	TP47
28.339999	-25.737663	TP14	28.344426	-25.740633	TP48
28.338868	-25.737970	TP15	28.343215	-25.739413	TP49
28.337399	-25.738325	TP16	28.343825	-25.738708	TP50
28.337961	-25.736255	TP17	28.343586	-25.737484	TP51
28.338505	-25.735254	TP18	28.343909	-25.736372	TP52
28.338862	-25.734453	TP19	28.345059	-25.736955	TP53
28.339913	-25.734933	TP20	28.345845	-25.736992	TP54
28.341342	-25.735166	TP21	28.345491	-25.737841	TP55
28.342036	-25.735987	TP22	28.344655	-25.738045	TP56
28.341052	-25.736668	TP23	28.345016	-25.738712	TP57
28.340782	-25.736015	TP24	28.344527	-25.739609	TP58
28.339640	-25.735698	TP25	28.343638	-25.741065	TP59
28.339077	-25.736377	TP26	28.334430	-25.737673	TP60
28.340308	-25.736802	TP27	28.339170	-25.737446	TP61
28.340689	-25.737418	TP28	28.337403	-25.736954	TP62
28.340304	-25.738651	TP29	28.335745	-25.736962	TP63
28.339172	-25.738674	TP30	28.334596	-25.735655	TP64
28.338185	-25.738900	TP31	28.336526	-25.734744	TP65
28.336300	-25.738134	TP32	28.337240	-25.734050	TP66
28.335377	-25.737548	TP33	28.335873	-25.733566	TP67
28.333600	-25.738083	TP34	28.335205	-25.734254	TP68

Figure A10: Seepage Water Encountered - Aerial Image Overlay (2019-05-13 as YMD)

Copyright:
This drawing enjoy copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.

ROCKSOIL
CONSULT



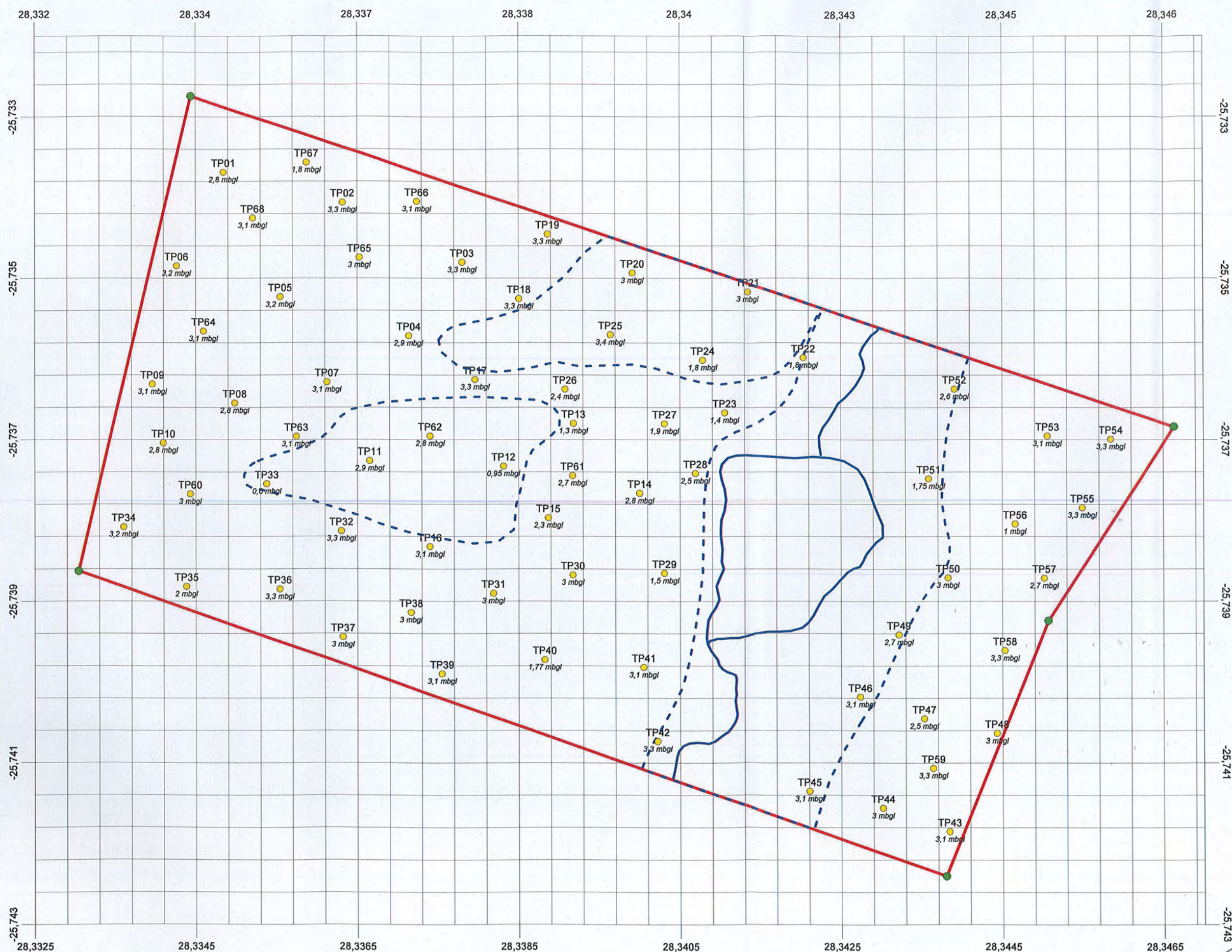
ROCKSOIL CONSULT PTY LTD
REG NO 2013/139402/07
DIRECTOR: DIRK HERMAN WESSELS
INFO@ROCKSOILCONSULT.CO.ZA
SAGNASI: 400076/88

Company Stamp

Drawing Approved (Signature) 2019/09/30 Date Approved

Drawing Revision Date: 2019-09-10
Drawing Revised By: DH Wessels

Coordinate System: Decimal Degrees (Lat/Lon)
Reference: RS18056/P1/SS/V1.0
Drawing Version: V1.0



Easting	Southing	Name	Easting	Southing	Name
28.334844	-25.733685	TP01	28.334383	-25.738816	TP35
28.336318	-25.734060	TP02	28.335538	-25.738848	TP36
28.337801	-25.734802	TP03	28.336320	-25.739443	TP37
28.337139	-25.735713	TP04	28.337164	-25.739138	TP38
28.335545	-25.735232	TP05	28.337547	-25.739897	TP39
28.334262	-25.734845	TP06	28.338821	-25.739724	TP40
28.336124	-25.736286	TP07	28.340047	-25.739816	TP41
28.334982	-25.736544	TP08	28.340218	-25.740733	TP42
28.333960	-25.736313	TP09	28.343839	-25.741850	TP43
28.334096	-25.737040	TP10	28.343014	-25.741560	TP44
28.336652	-25.737263	TP11	28.342103	-25.741352	TP45
28.338312	-25.737329	TP12	28.342735	-25.740184	TP46
28.339182	-25.736799	TP13	28.343527	-25.740452	TP47
28.339999	-25.737663	TP14	28.344426	-25.740633	TP48
28.338868	-25.737970	TP15	28.343215	-25.739413	TP49
28.337399	-25.738325	TP16	28.343825	-25.738708	TP50
28.337961	-25.736255	TP17	28.343586	-25.737484	TP51
28.338505	-25.735254	TP18	28.343909	-25.736372	TP52
28.338862	-25.734453	TP19	28.345059	-25.736955	TP53
28.339913	-25.734933	TP20	28.345845	-25.736992	TP54
28.341342	-25.735166	TP21	28.345491	-25.737841	TP55
28.342036	-25.735987	TP22	28.344655	-25.738045	TP56
28.341052	-25.736668	TP23	28.345016	-25.738712	TP57
28.340782	-25.736015	TP24	28.344527	-25.739609	TP58
28.339640	-25.735698	TP25	28.343638	-25.741065	TP59
28.339077	-25.736377	TP26	28.334430	-25.737673	TP60
28.340308	-25.736802	TP27	28.339170	-25.737446	TP61
28.340689	-25.737418	TP28	28.337403	-25.736954	TP62
28.340304	-25.738651	TP29	28.335745	-25.736962	TP63
28.339172	-25.738674	TP30	28.334596	-25.735655	TP64
28.338185	-25.738900	TP31	28.336526	-25.734744	TP65
28.336300	-25.738134	TP32	28.337240	-25.734050	TP66
28.335377	-25.737548	TP33	28.335873	-25.733566	TP67
28.333600	-25.738083	TP34	28.335205	-25.734254	TP68

Figure A11: Test Pit Termination Depths (mbgl)

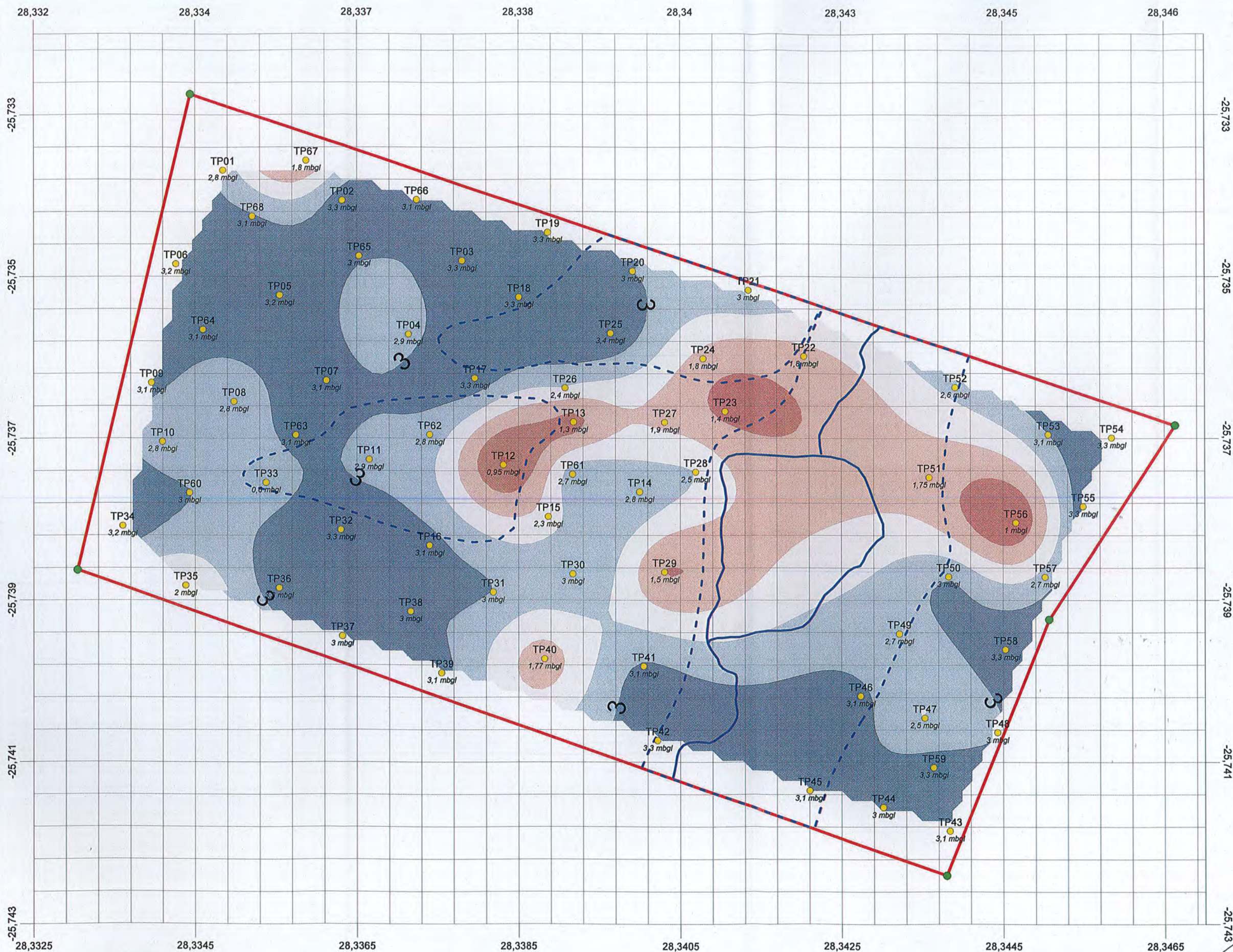
Copyright:
This drawing enjoy copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.



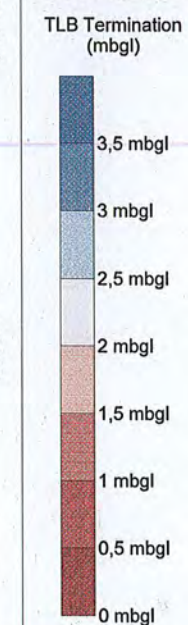
ROCKSOIL CONSULT PTY LTD
REG NO 2013/139402/07
DIRECTOR: DIRK HERMAN WESSELS
INFO@ROCKSOILCONSULT.CO.ZA
SACNASP: 400076/08
Company Stamp

2019/09/30
Drawing Approved (Signature) Date Approved

Drawing Revision Date: 2019-09-10
Drawing Revised By: DH Wessels
Coordinate System: Decimal Degrees (Lat/Lon)
Reference: RS18056/P1/SS/V1.0
Drawing Version: V1.0



Easting	Southing	Name	Easting	Southing	Name
28.334844	-25.733685	TP01	28.334383	-25.738816	TP35
28.336318	-25.734060	TP02	28.335538	-25.738848	TP36
28.337801	-25.734802	TP03	28.336320	-25.739443	TP37
28.337139	-25.735713	TP04	28.337164	-25.739138	TP38
28.335545	-25.735232	TP05	28.337547	-25.739897	TP39
28.334262	-25.734845	TP06	28.338821	-25.739724	TP40
28.336124	-25.736286	TP07	28.340047	-25.739816	TP41
28.334982	-25.736544	TP08	28.340218	-25.740733	TP42
28.333960	-25.736313	TP09	28.343839	-25.741850	TP43
28.334096	-25.737040	TP10	28.343014	-25.741560	TP44
28.336652	-25.737263	TP11	28.342103	-25.741352	TP45
28.338312	-25.737329	TP12	28.342735	-25.740184	TP46
28.339182	-25.736799	TP13	28.343527	-25.740452	TP47
28.339999	-25.737663	TP14	28.344426	-25.740633	TP48
28.338868	-25.737970	TP15	28.343215	-25.739413	TP49
28.337399	-25.738325	TP16	28.343825	-25.738708	TP50
28.337961	-25.736255	TP17	28.343586	-25.737484	TP51
28.338505	-25.735254	TP18	28.343909	-25.736372	TP52
28.338862	-25.734453	TP19	28.345059	-25.736955	TP53
28.339913	-25.734933	TP20	28.345845	-25.736992	TP54
28.341342	-25.735166	TP21	28.345491	-25.737841	TP55
28.342036	-25.735987	TP22	28.344655	-25.738045	TP56
28.341052	-25.736668	TP23	28.345016	-25.738712	TP57
28.340782	-25.736015	TP24	28.344527	-25.739609	TP58
28.339640	-25.735698	TP25	28.343638	-25.741065	TP59
28.339077	-25.736377	TP26	28.334430	-25.737673	TP60
28.340308	-25.736802	TP27	28.339170	-25.737446	TP61
28.340689	-25.737418	TP28	28.337403	-25.736954	TP62
28.340304	-25.738651	TP29	28.335745	-25.736962	TP63
28.339172	-25.738674	TP30	28.334596	-25.735655	TP64
28.338185	-25.738900	TP31	28.336526	-25.734744	TP65
28.336300	-25.738134	TP32	28.337240	-25.734050	TP66
28.335377	-25.737548	TP33	28.335873	-25.733566	TP67
28.333600	-25.738083	TP34	28.335205	-25.734254	TP68



ROCKSOIL CONSULT PTY LTD
 REG NO 2013/139402/07
 DIRECTOR: DIRK HERMAN WESSELS
 INFO@ROCKSOILCONSULT.CO.ZA
 SACNASP: 400076/08

Company Stamp

Drawing Approved (Signature) *[Signature]* Date Approved 2019/09/30

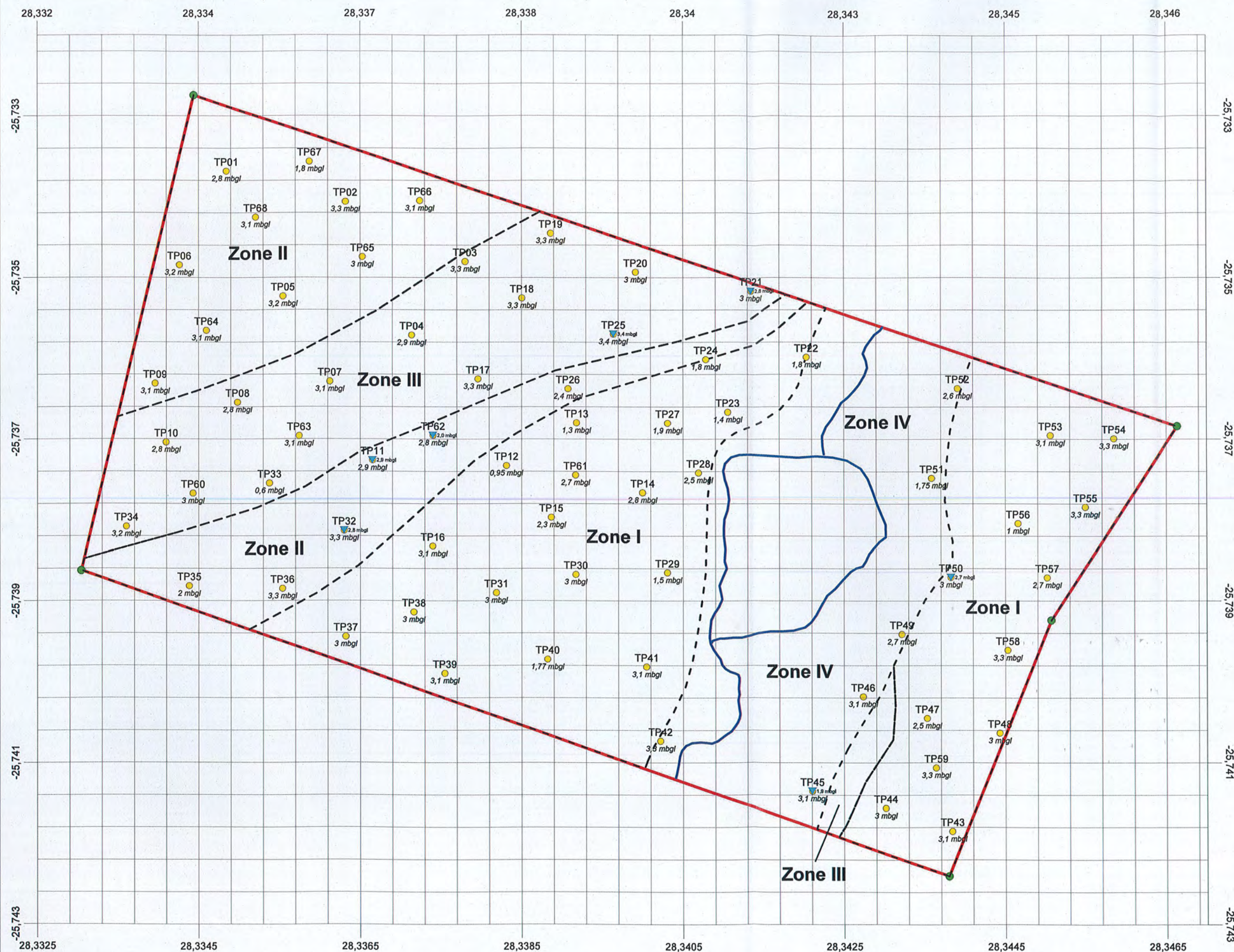
Drawing Revision Date: 2019-09-10
 Drawing Revised By: DH Wessels

Coordinate System: Decimal Degrees (Lat/Lon)
 Reference: RS18056/P1/SS/V1.0
 Drawing Version: V1.0

Figure A12: Test Pit Termination Depths (mbgl) - Contoured

Copyright:
 This drawing enjoy copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.

ROCKSOIL
 CONSULT



Assigned Broad Shallow Soil Designation

Zone I: H1-H2-S// 2BCDE 1F
 Zone II: H2-S1 // 2BCDE 1F
 Zone III: H3-S1-S2 // 3C 2BDE
 Zone IV: P (Flooded) H2-H3-S2 // 2-3BCD, 2E 1F

The assigned designation/s before the "/" represent/s the following (NHBRC, 2015):

R - Rock (Stable founding material).
 H - Expansive soils.
 C - Compressible and potentially collapsible soils.
 S - Compressible soils.
 P - Variable constraint/s
 (refer to description in brackets).

The assigned designation/s after the "/" represent/s the following (SANS634, 2012):

A - Collapsible soil.
 B - Seepage.
 C - Active soil.
 D - Highly compressible soil.
 E - Erodability of soil.
 F - Difficulty of excavation to 1.5 m depth below ground level.
 G - Undermined ground.
 H - Stability (dolomitic land).
 I - Steep slopes.
 J - Areas of unstable natural slopes.
 K - Areas subject to seismic activity.
 L - Areas subject to flooding.

The severity of the assigned residential designation (symbols before the "/") are summarized in Table R5 (see report).

The severity of the assigned constraints (symbols after the "/") is provided in Table F19.

Important Notes:

This zonation is for township establishment purposes only. This is a shallow soil designation and constraints with SAICE1995 or NHBRC2015 typical foundation options for small size structures falling within the limitations of the intended use.

The planners/designers should refer to the individual soil profile descriptions, layer thicknesses, loading and structural details and tolerances of the structures to be erected for design-level input. The foundation options/recommendations should be individually investigated/assessed by a competent person to ensure that the earthwork and foundation options are tailored to the structure/conditions.

Refer to the report, individual soil profile descriptions, laboratory test results and original laboratory reports.

Foundation specific input can only be provided once the structure/loading/tolerance details are available.

ROCKSOIL CONSULT PTY LTD
 REG NO 2013/139402/07
 DIRECTOR: DIRK HERMAN WESSELS
 INFO@ROCKSOILCONSULT.CO.ZA
 SACNASP: 400076/08

Company Stamp

Drawing Approved (Signature) Date Approved 2019/09/30

Figure A13: Preliminary Broad Zonation Map (This is provide for Township Application purposes only)

Copyright:
 This drawing enjoy copyright protection which vests in RockSoil Consult (Pty) Ltd. The drawing may not be distributed in any format without the written consent of RockSoil Consult (Pty) Ltd.

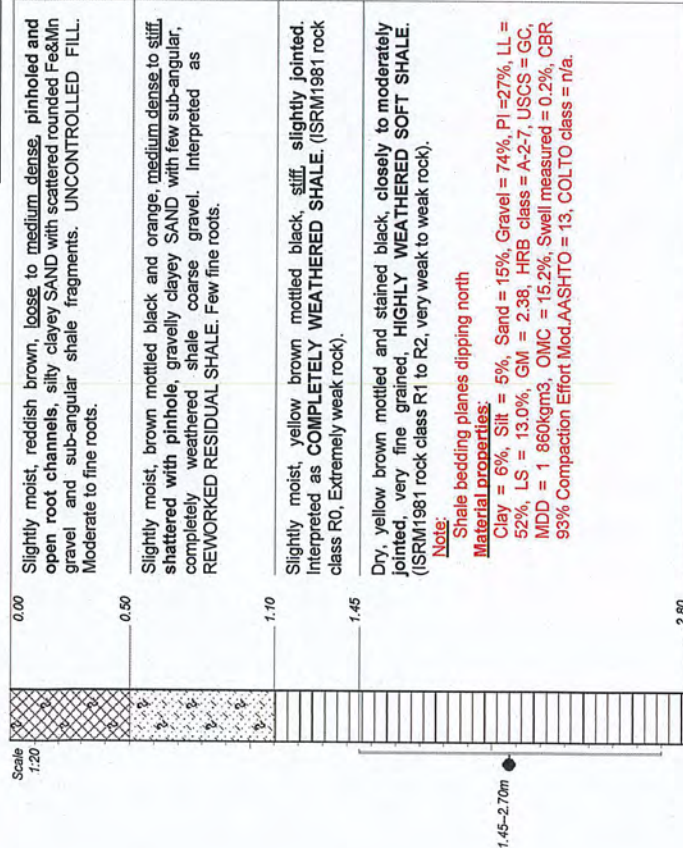
ROCKSOIL
 CONSULT



Drawing Revision Date: 2019-09-10
 Drawing Revised By: DH Wessels

Coordinate System: Decimal Degrees (Lat/Lon)
 Reference: RS18056/P1/SS/V1.0
 Drawing Version: V1.0

Appendix B: Soil Profile Descriptions



As above becoming moderately jointed.

NOTES

- 1) TLB confined refusal.
- 2) Soft to intermediated excavation conditions at TLB confined refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample retrieved at 1.45–2.70m.

CONTRACTOR : V & S CAT Hire
MACHINE : CAT 428F TLB
DRILLED BY: Rock Soil Consult (Pty) Ltd.
PROFIED BY: D Swart
TYPE SET BY : D Swart
SETUP FILE : RSC Set

INCINATION : Vertical
DIAM : 600mm wide trench
DATE : 2019-04-15
DATE : 2019-05-02

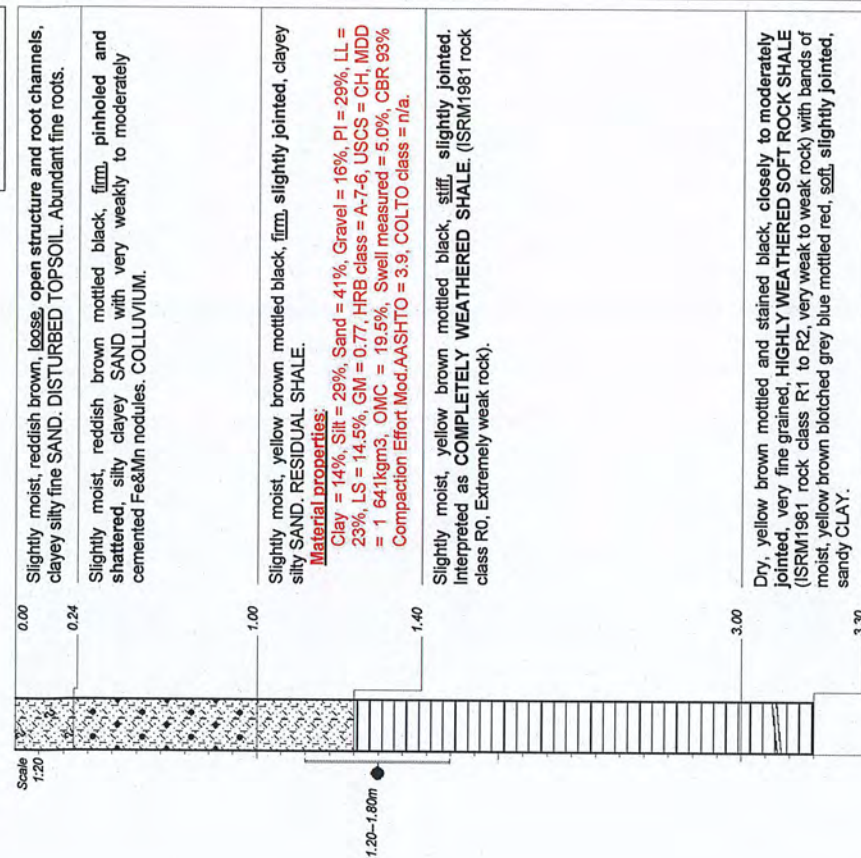
DATE : 31/07/2019 10:16
TEXT : ..\Logs\IRS180656SPV1 3.txt

ELEVATION : 1326m
X-COORD : -25.733685
Y-COORD : -28.33484

HOLE No: TP01

D03E WSM Leshika Consulting (Pty) Ltd

doi:PLOT 7020 PBpH67



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 1.20–1.80m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFIED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

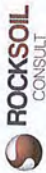
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: PL0811RS18056SPV1 3 M

ELEVATION: 1324m
X-COORD: -25.734060
Y-COORD: 26.336318

HOLE No: TP02

D03E WSM Leshika Consulting (Pty) Ltd

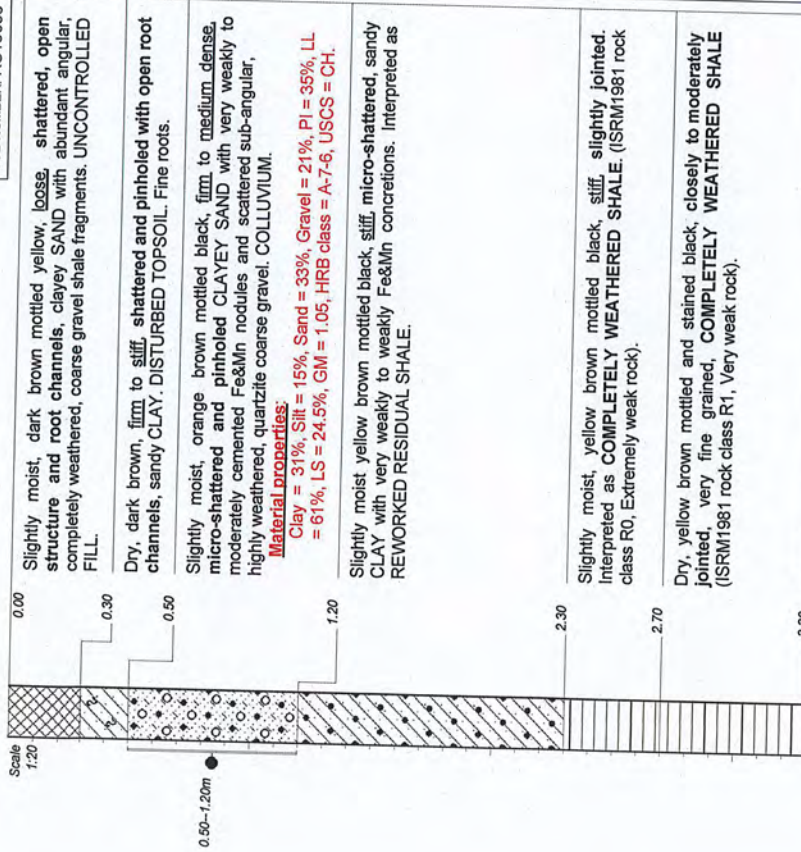
[illegible]



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP03
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 0.50–1.20m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLogg\RS18056SPV1.3.txt

ELEVATION: 1320m
X-COORD: -25.734801
Y-COORD: 28.33780

HOLE No: TP03

DOSE WSM Leshika Consulting (Pty) Ltd

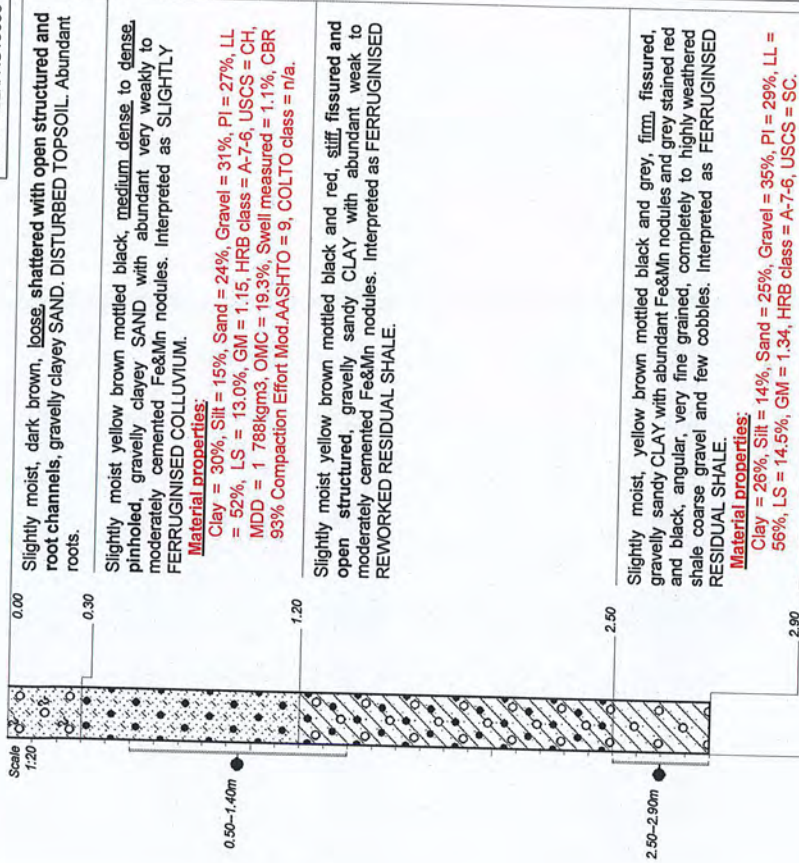
ddPLOT 7020 PBp467



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP04
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 0.50–1.40m.
- 5) Disturbed sample retrieved at 2.50–2.90m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLogg\RS18056SPV1.3.txt

ELEVATION: 1318m
X-COORD: -25.735713
Y-COORD: 28.33713

HOLE No: TP04

DOSE WSM Leshika Consulting (Pty) Ltd

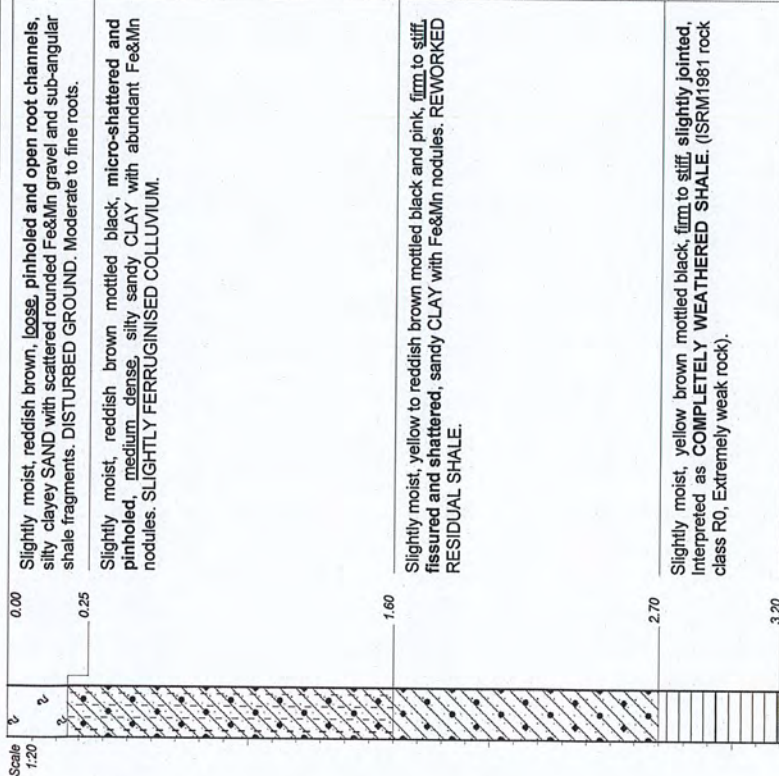
ddPLOT 7020 PBp467



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP05
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
TEXT: .PLogs\RS18056SPV1.3.txt

ELEVATION: 1323m
X-COORD: -25.7352319
Y-COORD: 28.335545
HOLE No: TP05

DO3E WSM Leshika Consulting (Pty) Ltd

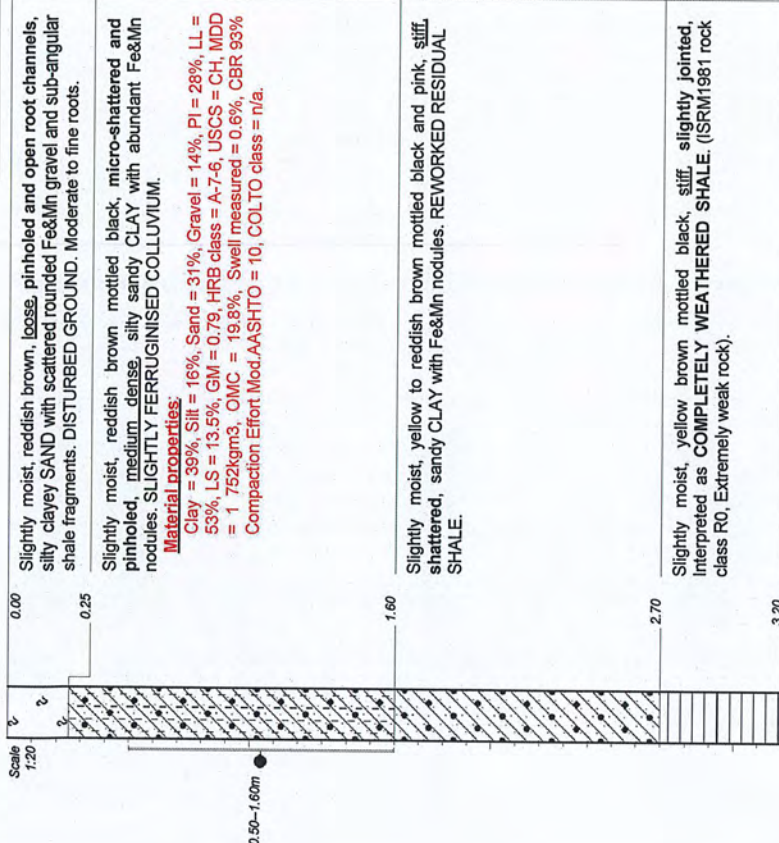
delPLOT 7020 P8pH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP06
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) Undulating bedrock.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample retrieved at 0.50-1.60m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
TEXT: .PLogs\RS18056SPV1.3.txt

ELEVATION: 1326m
X-COORD: -25.7348449
Y-COORD: 28.334262
HOLE No: TP06

DO3E WSM Leshika Consulting (Pty) Ltd

delPLOT 7020 P8pH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP07
Sheet 1 of 1

JOB NUMBER: RS18056

0.00
0.30
Slightly moist, medium brown, loose, shattered with open root channels, silty clayey SAND. TOPSOIL. Abundant roots.

0.30
Slightly moist, yellow brown mottled black, firm to medium dense, micro-shattered and pinholed, silty clayey SAND with weakly to moderately cemented Fe&Mn nodules and very few scattered angular, completely weathered shale coarse gravel and cobble. Interpreted as SLIGHTLY FERRUGINISED COLLUVIUM.

1.10
1.80
Slightly moist, yellow brown mottled black, grey and orange firm to stiff, micro-shattered and pinholed, silty sandy CLAY with very weakly to moderately cemented Fe&Mn nodules. REWORKED RESIDUAL SHALE.

Material Properties:
Clay = 46%, Silt = 20%, Sand = 23%, Gravel = 11%, PI = 32%, LL = 60%, LS = 23.5%, GM = 0.53, HRB class = A-7-6, USCS = CH.

2.00m
Moist, yellow brown mottled grey and black, firm, fissured, slightly sandy CLAY. RESIDUAL SHALE.

NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 1.10–1.80m.
- 5) Undisturbed sample at 2.00m

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLG\RS18056SPV1.3.txt
ELEVATION: 1321m
X-COORD: -25.7362860
Y-COORD: 28.336123
HOLE No: TP07

D03E WSM Leshika Consulting (Pty) Ltd

delPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP08
Sheet 1 of 1

JOB NUMBER: RS18056

0.00
0.30
Slightly moist, medium brown, loose, shattered with open root channels, silty clayey SAND. TOPSOIL. Abundant roots.

0.30
Slightly moist, yellow brown mottled black, firm to medium dense, micro-shattered and pinholed, silty clayey SAND with weakly to moderately cemented Fe&Mn nodules and very few scattered angular, completely weathered shale coarse gravel and cobble. Interpreted as SLIGHTLY FERRUGINISED COLLUVIUM.

1.30
2.80
Slightly moist, yellow brown mottled black, grey and orange firm to stiff, micro-shattered and pinholed, silty sandy CLAY with very weakly to moderately cemented Fe&Mn nodules. REWORKED RESIDUAL SHALE.

As above.

NOTES

- 1) TLB terminated due to very slow progress.
- 2) Soft to intermediate excavation conditions at TLB termination depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLG\RS18056SPV1.3.txt
ELEVATION: 1323m
X-COORD: -25.736544
Y-COORD: 28.334982
HOLE No: TP08

D03E WSM Leshika Consulting (Pty) Ltd

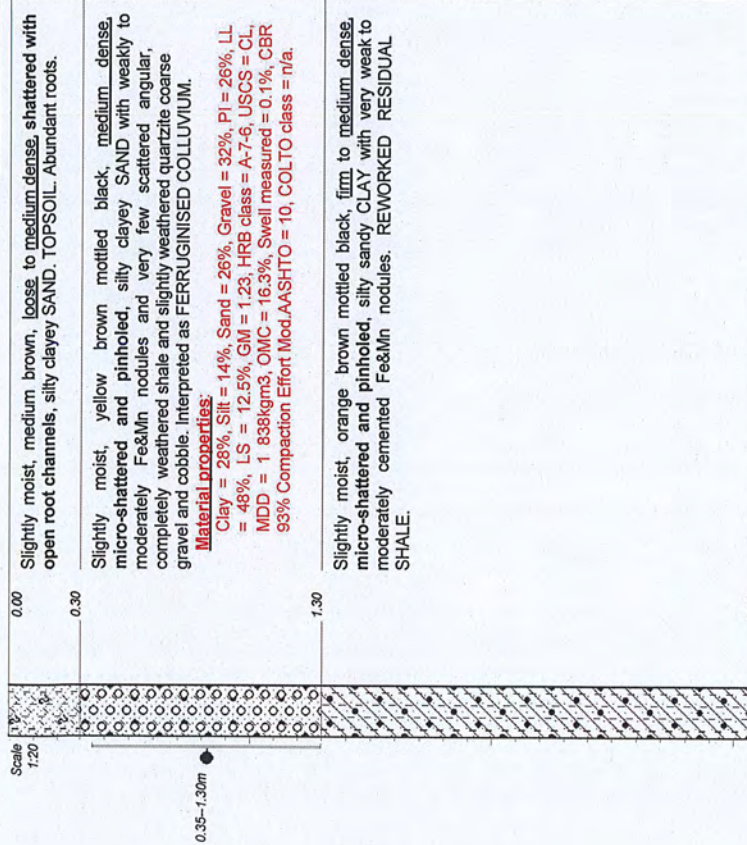
delPLOT 7020 PBpH67



BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP09
Sheet 1 of 1

JOB NUMBER: RS18056

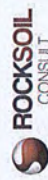


NOTES

- 1) TLB maximum reach.
- 2) Soft excavation conditions at TLB termination depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample retrieved at 0.35-1.30m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1325m
X-COORD: -25.7363129
Y-COORD: 28.333960
HOLE No: TP09
TEXT: ..Plots\RS18056SPV1.3.nt

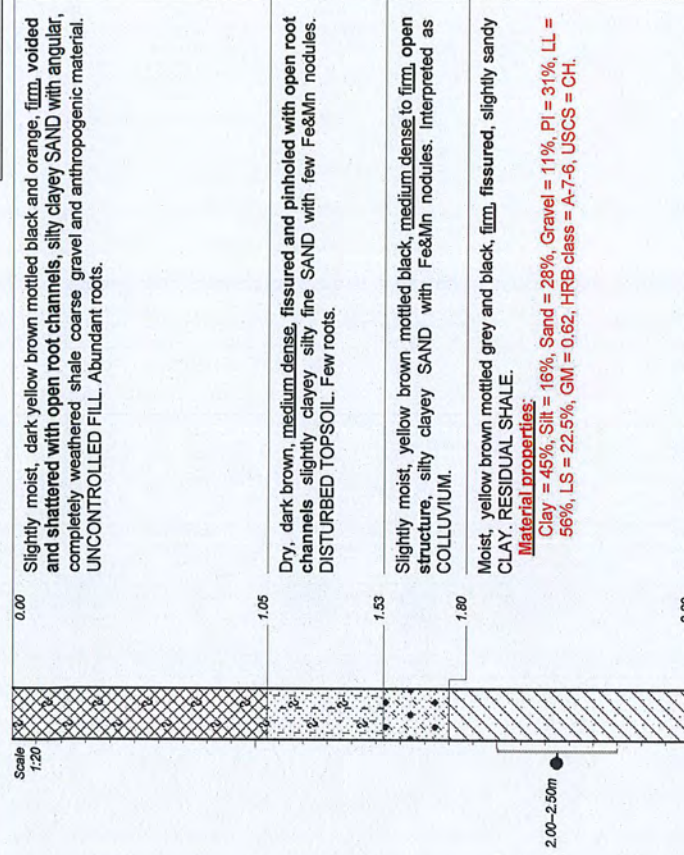
D03E WSM Leshika Consulting (Pty) Ltd
d03E\LOT 7020 PBPH67



BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP10
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) Soft to intermediate excavation conditions at TLB termination depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample retrieved at 2.00-2.50m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1325m
X-COORD: -25.737039
Y-COORD: 28.334095
HOLE No: TP10
TEXT: ..Plots\RS18056SPV1.3.nt

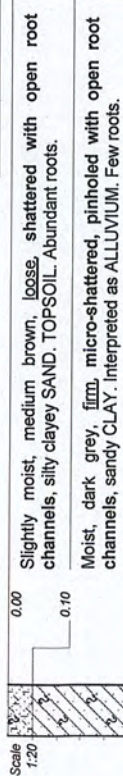
D03E WSM Leshika Consulting (Pty) Ltd
d03E\LOT 7020 PBPH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP11
Sheet 1 of 1

JOB NUMBER: RS18056



Moist, yellow brown mottled black and grey, medium dense to firm, open structure, gravelly sandy CLAY with abundant Fe&Mn nodules and angular, completely weathered, shale fragments. FERRUGINISED REWORKED RESIDUAL SHALE.

Moist, yellow brown mottled black and grey stained red and black, stiff, slightly jointed with infill as moist, yellow brown blotched grey blue, soft, laminated, sandy CLAY. Interpreted as COMPLETELY WEATHERED SHALE. (ISRM1981 rock class R0, Extremely Weak Rock).

WATER

NOTES

- 1) TLB maximum reach.
- 2) Soft excavation conditions at TLB termination depth.
- 3) WATER SEEPAGE at 2.90m.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample retrieved at 0.90-1.20m.

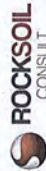
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
TEXT: ..PLog\RS18056SPV1.3.txt

ELEVATION: 1319m
X-COORD: -25.737263
Y-COORD: 28.336652

HOLE No: TP11

D03E WSM Leshika Consulting (Pty) Ltd

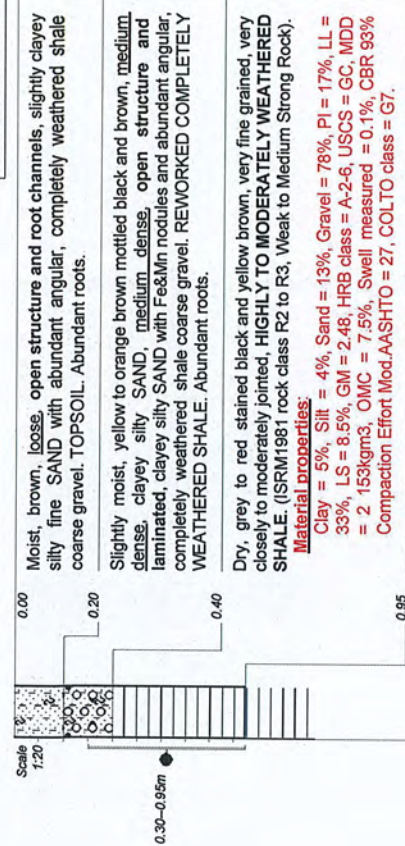
datPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP12
Sheet 1 of 1

JOB NUMBER: RS18056



As above becoming moderately jointed.

NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample at 0.30-0.95m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
TEXT: ..PLog\RS18056SPV1.3.txt

ELEVATION: 1320m
X-COORD: -25.737328
Y-COORD: 28.33831

HOLE No: TP12

D03E WSM Leshika Consulting (Pty) Ltd

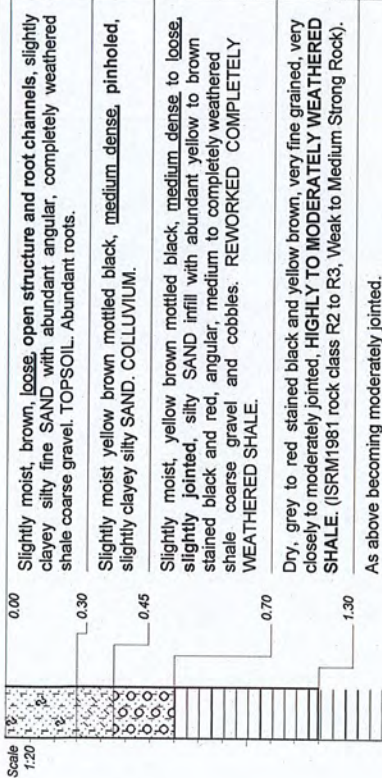
datPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP13
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

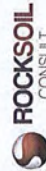
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1316m
X-COORD: -25.736798
Y-COORD: 28.339182

HOLE No: TP13

D03E WSM Leeshika Consulting (Pty) Ltd

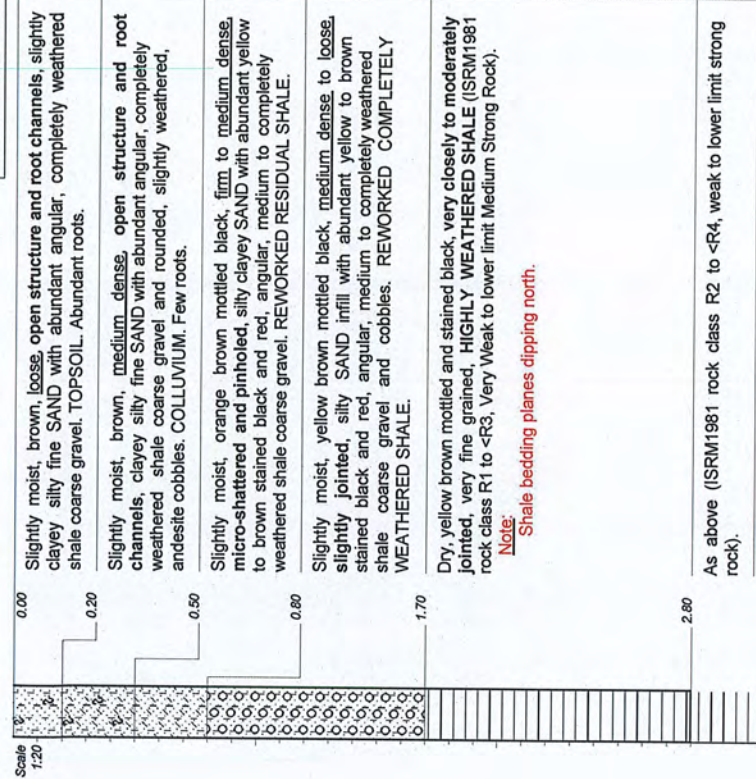
ddPLOT 7020 P8p467



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP14
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

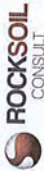
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1313m
X-COORD: -25.737662
Y-COORD: 28.33999

HOLE No: TP14

D03E WSM Leeshika Consulting (Pty) Ltd

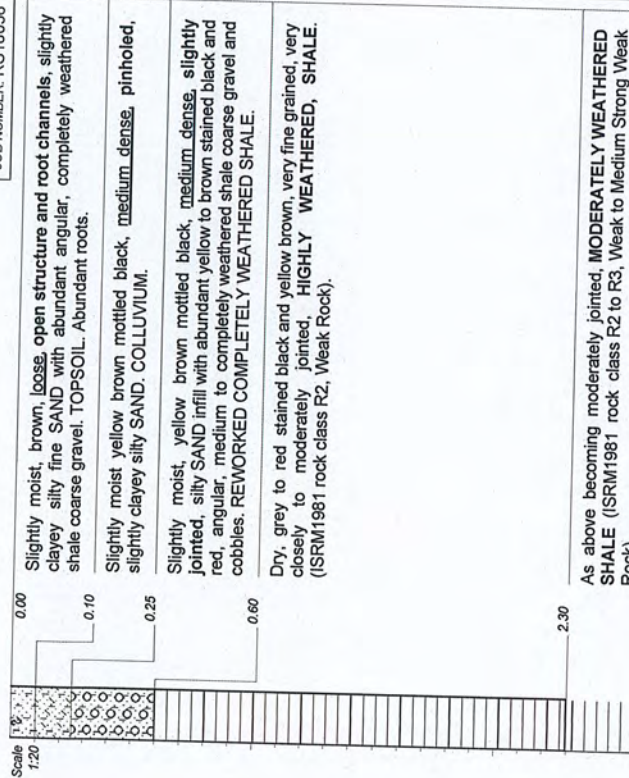
ddPLOT 7020 P8p467



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP15
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

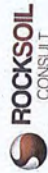
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLoggs\RS18056SPV1.3.txt

ELEVATION: 1317m
X-COORD: -25.737970
Y-COORD: 28.338868

HOLE No: TP15

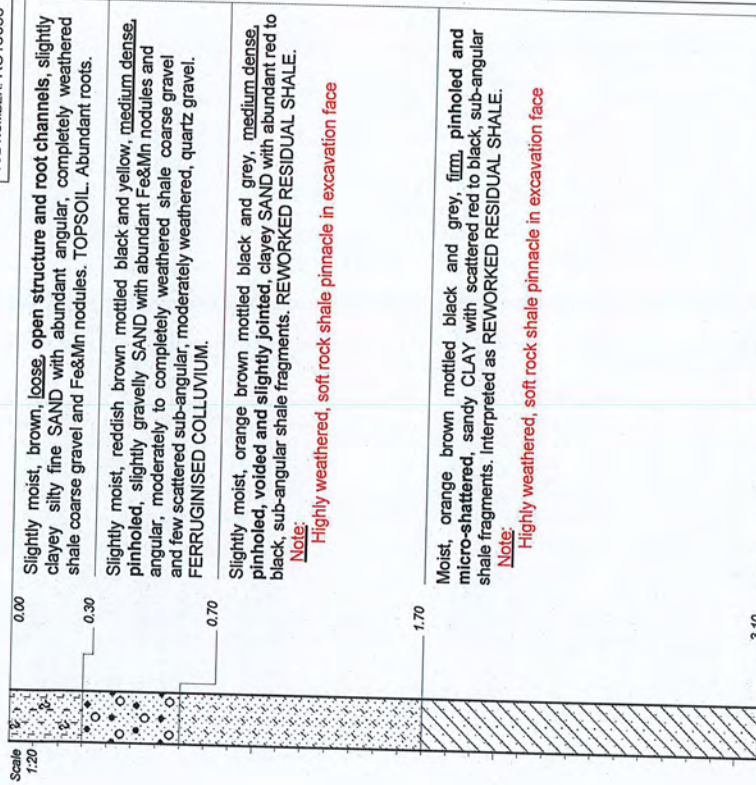
doPLOT 7020 PBp467



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP16
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) Pinnacle in excavation face.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.
- 6) Termite mound near excavation.

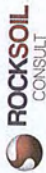
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLoggs\RS18056SPV1.3.txt

ELEVATION: 1320m
X-COORD: -25.738324
Y-COORD: 28.337399

HOLE No: TP16

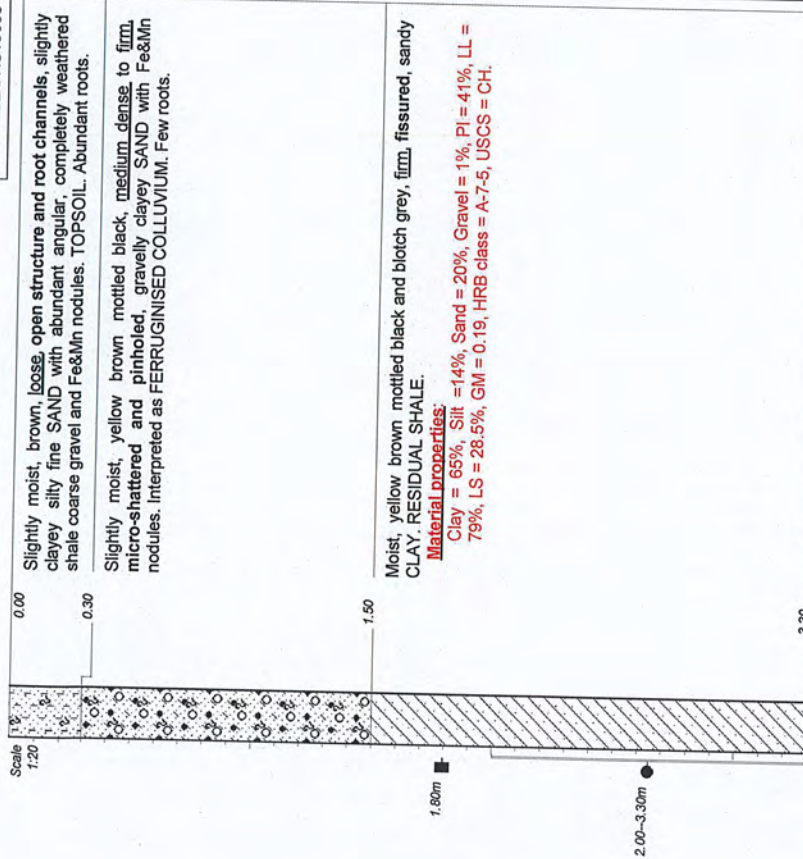
doPLOT 7020 PBp467



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP17
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 2.00-3.30m.
- 5) Undisturbed sample retrieved at 1.80m.

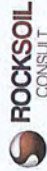
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1317m
X-COORD: -25.736254
Y-COORD: 28.337961

HOLE No: TP17

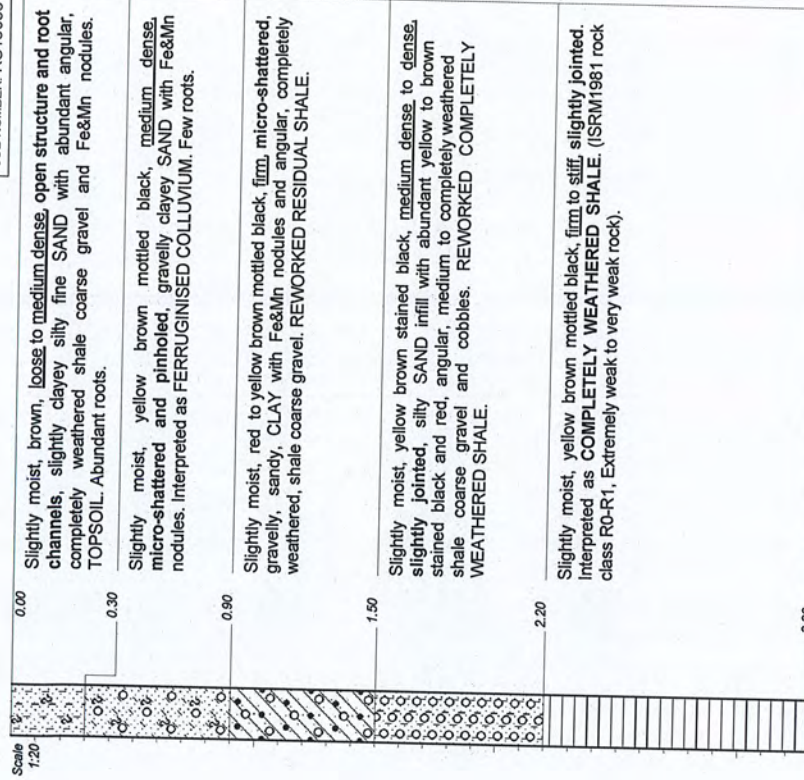
datPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP18
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1323m
X-COORD: -25.735254
Y-COORD: 28.33850

HOLE No: TP18

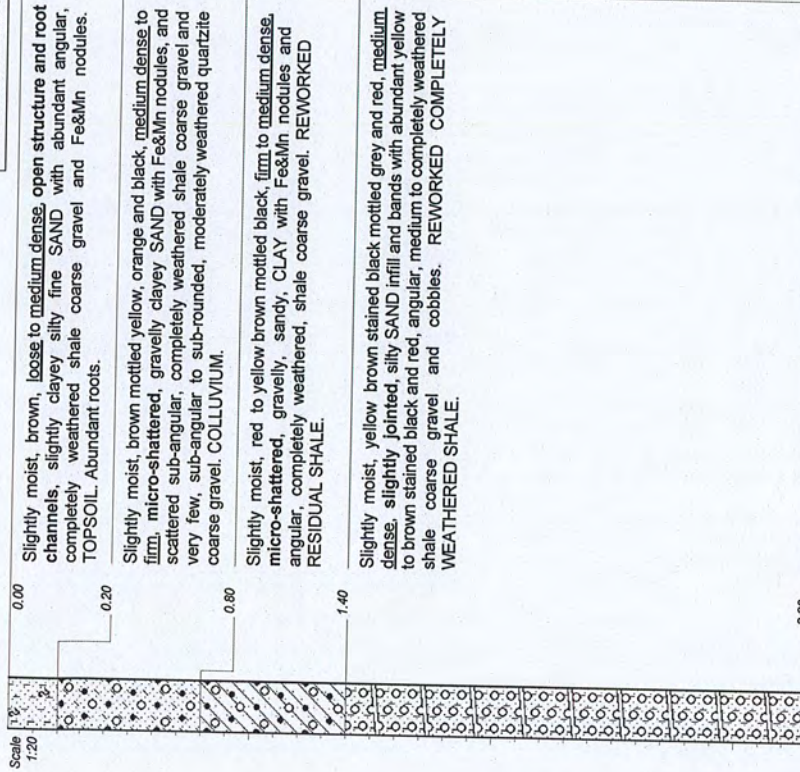
datPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP19
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

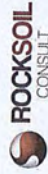
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1317m
X-COORD: -25.73445
Y-COORD: 28.33861

HOLE No: TP19

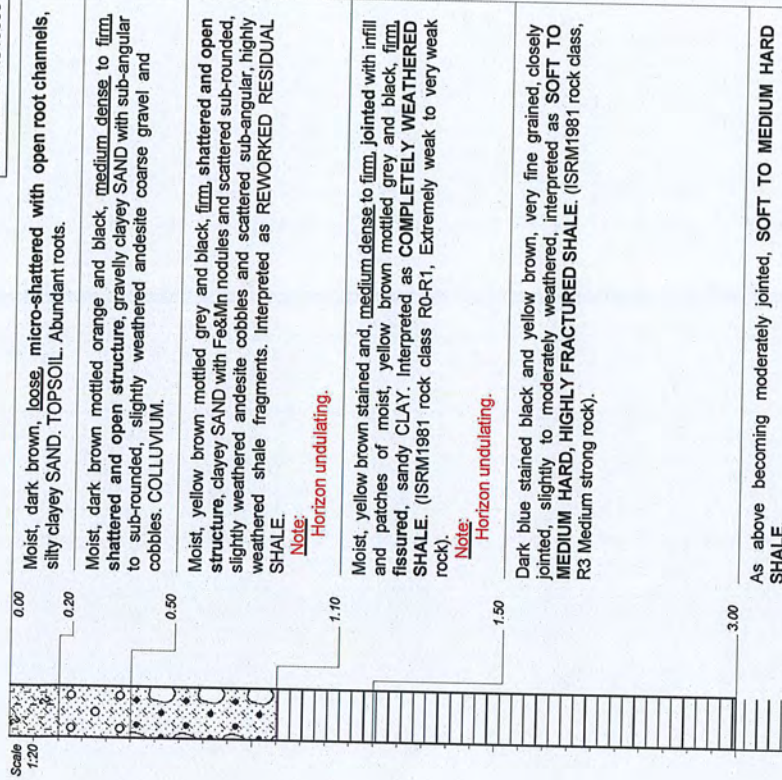
doPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP20
Sheet 1 of 1

JOB NUMBER: RS18056



As above becoming moderately jointed, SOFT TO MEDIUM HARD SHALE.

NOTES

- 1) TLB maximum reach.
- 2) Intermediate to soft excavation conditions at TLB termination depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.
- 6) All horizons in excavation face undulating.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1314m
X-COORD: -25.734933
Y-COORD: 28.339913

HOLE No: TP20

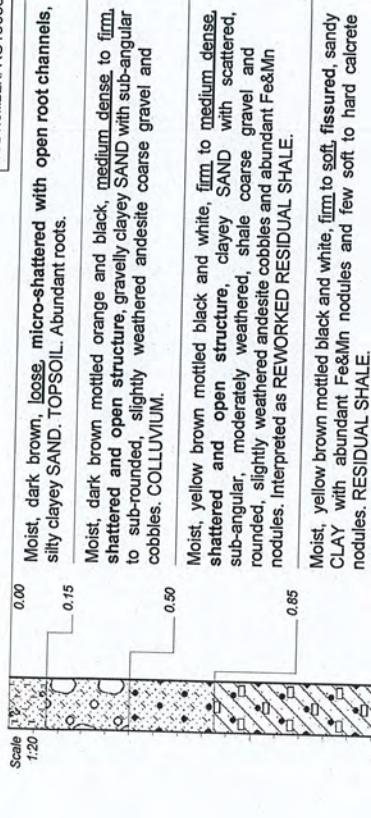
doPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP21
Sheet 1 of 1

JOB NUMBER: RS18056



Wet, light blue, soft, intact, CLAY infill and bands with dry, yellow brown mottled and stained black, very closely to moderately jointed, very fine grained, HIGHLY WEATHERED SHALE (ISRM1981 rock class R1 to R2, Very weak to weak rock).

Note:
Shale bedding planes dipping north. Instability in excavation face along joints due to seepage.

NOTES

- 1) TLB Maximum reach.
- 2) Water seepage encountered at 2.80m during the time of inspection.
- 3) Sidewall instability encountered at 2.80m during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
TEXT: ..\Logs\RS18056SPV1.3.txt

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..\Logs\RS18056SPV1.3.txt

ELEVATION: 13119m
X-COORD: -25.735165
Y-COORD: 28.341341

HOLE No: TP21

D03E WSM Leshika Consulting (Pty) Ltd

ddPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP22
Sheet 1 of 1

JOB NUMBER: RS18056

Moist, dark brown, loose, micro-shattered with open root channels, silty clayey SAND. TOPSOIL. Abundant roots.

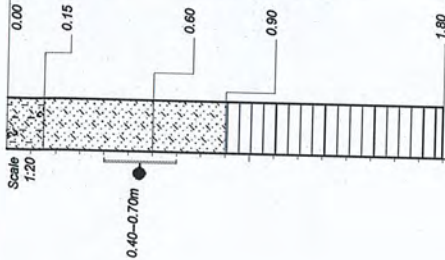
Moist, dark brown mottled orange and black, firm, shattered and open structure, clayey SAND. COLLUVIUM.

Material properties:

Clay = 30%, Silt = 27%, Sand = 43%, Gravel = 0%, Pl = 27%, LL = 50%, LS = 13.5%, GM = 0.41, HRB class = A-7-6, USCS = CH.

Slightly moist, dark brown to yellow brown, firm, shattered and open structure, clayey SAND with angular, highly weathered shale coarse gravel. Interpreted as REWORKED RESIDUAL SHALE.

Dry, grey blue stained yellow brown and black, very fine grained, closely jointed, SLIGHTLY TO HIGHLY WEATHERED SHALE. (ISRM1981 rock class, R2 to R3 Weak to Medium Strong Rock).



As above becoming moderately jointed.

NOTES

- 1) TLB confined refusal.
- 2) Soft to intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample at 0.40-0.70m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
TEXT: ..\Logs\RS18056SPV1.3.txt

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..\Logs\RS18056SPV1.3.txt

ELEVATION: 1309m
X-COORD: -25.735987
Y-COORD: 28.342035

HOLE No: TP22

D03E WSM Leshika Consulting (Pty) Ltd

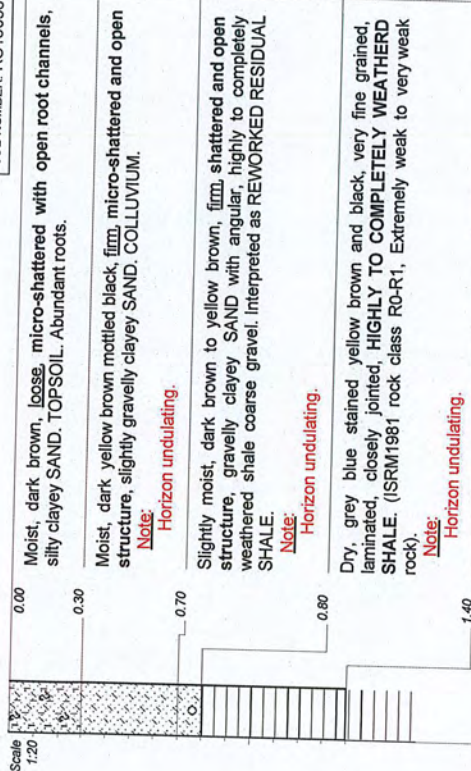
ddPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP23
Sheet 1 of 1

JOB NUMBER: RS18056



As above becoming moderately jointed, SLIGHTLY WEATHERED SHALE. (ISRM1981 rock class, R3 Medium strong rock).

NOTES

- 1) TLB confined refusal.
- 2) Soft to intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

CONTRACTOR: V & S CAT Hire

MACHINE: CAT 428F TLB

DRILLED BY: RockSoil Consult (Pty) Ltd.

PROFILED BY: D Swart

TYPE SET BY: D Swart

SETUP FILE: RSC.SET

D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:

DIAM: 600mm wide trench

DATE: 2019-04-15

DATE: 2019-05-02

DATE: 31/07/2019 10:16

TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1312m

X-COORD: -25.736667

Y-COORD: 28.341052

HOLE No: TP23

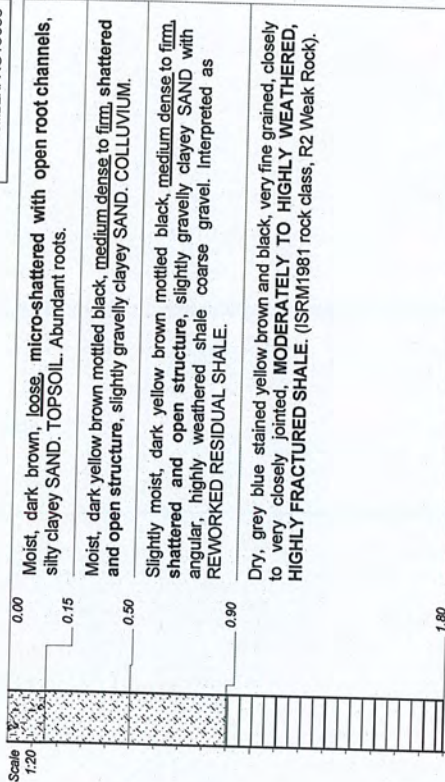
datPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP24
Sheet 1 of 1

JOB NUMBER: RS18056



As above becoming moderately jointed, moderately weathered MEDIUM HARD ROCK SHALE. (ISRM1981 rock class, R3 Medium Strong Rock).

NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

CONTRACTOR: V & S CAT Hire

MACHINE: CAT 428F TLB

DRILLED BY: RockSoil Consult (Pty) Ltd.

PROFILED BY: D Swart

TYPE SET BY: D Swart

SETUP FILE: RSC.SET

D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:

DIAM: 600mm wide trench

DATE: 2019-04-15

DATE: 2019-05-02

DATE: 31/07/2019 10:16

TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1312m

X-COORD: -25.736015

Y-COORD: 28.340782

HOLE No: TP24

datPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP25
Sheet 1 of 1

JOB NUMBER: RS18056

Scale 1:20
0.00
0.15
0.60
1.40
3.40m

Slightly moist, dark brown, loose, micro-shattered with open structure and root channels, silty clayey fine SAND. TOPSOIL. Abundant roots.

Slightly moist, dark brown, firm, micro-shattered with open structure, gravelly clayey SAND with Fe&Mn nodules. COLLUVIUM.

Slightly moist, yellow brown mottled orange, black and grey, firm to medium dense, open structure, clayey SAND with Fe&Mn nodules. REMORKED RESIDUAL SHALE.

Moist, yellow brown mottled grey, black and orange speckled white, firm to soft, fissured, sandy CLAY with Fe&Mn nodules and few soft to hard calcare concretions. RESIDUAL SHALE.

Material properties:
Clay = 70%, Silt = 13%, Sand = 15%, Gravel = 2%, Pl = 47%, LL = 92%, LS = 30.0%, GM = 0.14, HRB class = A-7-5, USCS = MH.

NOTES
1) TLB maximum reach.
2) Water seepage encountered at 3.40m during the time of inspection.
3) No sidewall instability encountered during the time of inspection.
4) Disturbed sample retrieved at 1.80–2.00m.
5) Undisturbed sample retrieved at 1.80–2.00m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLots\RS18056SPV1.3.txt

ELEVATION: 1314m
X-COORD: -25.735698
Y-COORD: 28.339640

HOLE No: TP25

datPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP26
Sheet 1 of 1

JOB NUMBER: RS18056

Scale 1:20
0.00
0.10
0.40
1.20
1.70
2.40

Slightly moist, dark brown, loose, micro-shattered with open structure and root channels, silty clayey fine SAND. TOPSOIL. Abundant roots.

Slightly moist, dark brown, firm to medium dense, micro-shattered with open structure, clayey SAND. COLLUVIUM. Few roots.

Slightly moist, dark yellow brown mottled black and orange, dense, slightly shattered with open structure, gravelly clayey SAND with very weakly to moderately cemented Fe&Mn nodules and few sub-angular, moderately weathered, quartzite and shale coarse gravel. SLIGHTLY FERRUGINISED COLLUVIUM.

Material properties:
Clay = 25%, Silt = 12%, Sand = 20%, Gravel = 43%, Pl = 26%, LL = 53%, LS = 12.0%, GM = 1.50, HRB class = A-7-6, USCS = SC.

Slightly moist, yellow brown mottled black, orange and grey, firm to stiff, shattered and slightly jointed, gravelly clayey SAND with angular, highly weathered, shale coarse gravel. RESIDUAL SHALE.

Dry, light grey stained black and yellow brown, very fine grained, laminated, closely to moderately jointed, HIGHLY TO MODERATELY WEATHERED SHALE. (ISRM1981 rock class R2 to R3, Weak to medium strong rock).

NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Disturbed sample retrieved at 0.60–1.50m.

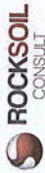
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: .PLots\RS18056SPV1.3.txt

ELEVATION: 1316m
X-COORD: -25.736377
Y-COORD: 28.339076

HOLE No: TP26

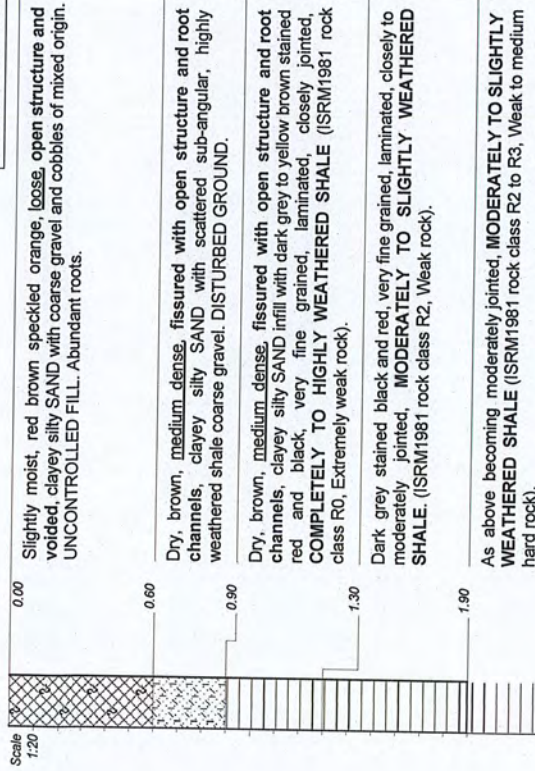
datPLOT 7020 PBpH67



BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP27
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.
- 6) Vicinity covered in surficial fill.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...Logs\RS18056SPV1.3.txt

ELEVATION: 1313m
X-COORD: -25.736801
Y-COORD: 28.340307

HOLE No: TP27

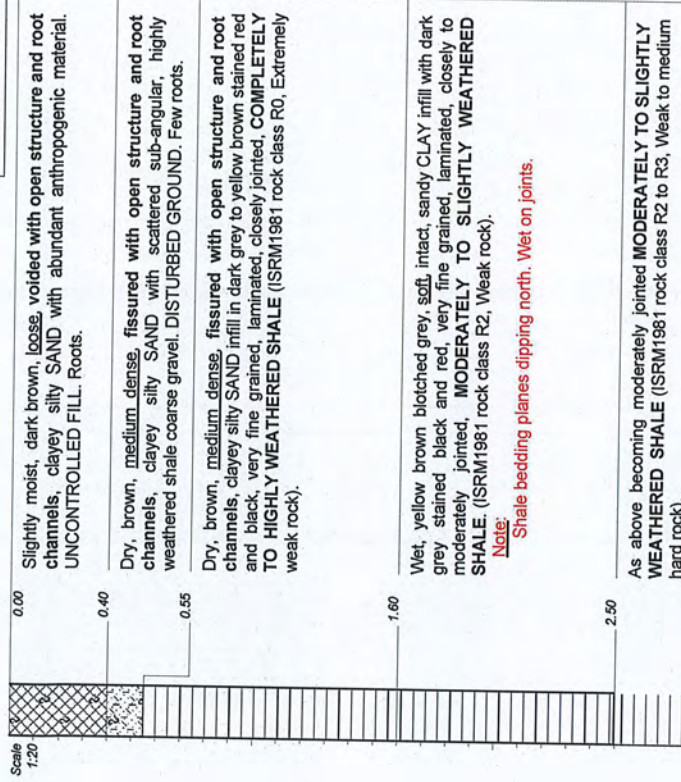
dotPLOT 7020 PBpH67



BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP28
Sheet 1 of 1

JOB NUMBER: RS18056



Note:
Shale bedding planes dipping north. Wet on joints.

As above becoming moderately jointed MODERATELY TO SLIGHTLY WEATHERED SHALE (ISRM1981 rock class R2 to R3, Weak to medium hard rock).

NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.
- 6) Vicinity covered in surficial fill.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...Logs\RS18056SPV1.3.txt

ELEVATION: 1313m
X-COORD: -25.737417
Y-COORD: 28.340688

HOLE No: TP28

dotPLOT 7020 PBpH67

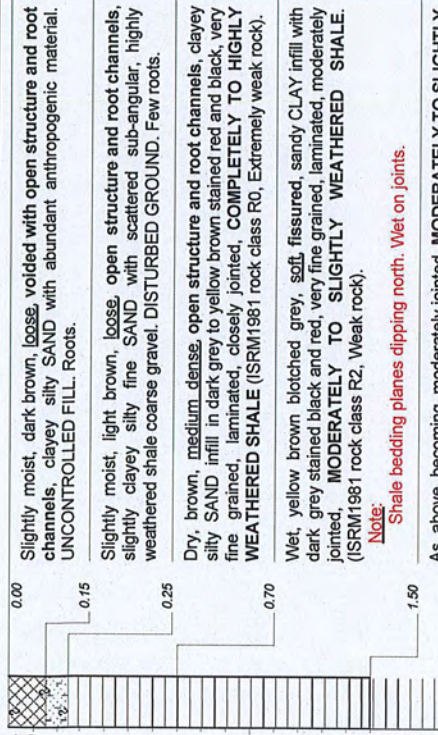


BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP29
Sheet 1 of 1

JOB NUMBER: RS18056

Scale
1:20



Slightly moist, dark brown, loose, voided with open structure and root channels, clayey silty SAND with abundant anthropogenic material. UNCONTROLLED FILL. Roots.

Slightly moist, light brown, loose, open structure and root channels, slightly clayey silty fine SAND with scattered sub-angular, highly weathered shale coarse gravel. DISTURBED GROUND. Few roots.

Dry, brown, medium dense, open structure and root channels, clayey silty SAND infill in dark grey to yellow brown stained red and black, very fine grained, laminated, closely jointed, COMPLETELY TO HIGHLY WEATHERED SHALE (ISRM1981 rock class R0. Extremely weak rock).

Wet, yellow brown blotched grey, soft, fissured, sandy CLAY infill with dark grey stained black and red, very fine grained, laminated, moderately jointed, MODERATELY TO SLIGHTLY WEATHERED SHALE (ISRM1981 rock class R2, Weak rock).

Note:
Shale bedding planes dipping north. Wet on joints.

As above becoming moderately jointed, MODERATELY TO SLIGHTLY WEATHERED SHALE (ISRM1981 rock class R2 to R3. Weak to medium hard rock).

NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.
- 6) Vicinity covered in surficial fill.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02

ELEVATION: 1313m
X-COORD: -25.738650
Y-COORD: 28.340304

HOLE No: TP29

D03E WSM Leshika Consulting (Pty) Ltd

ddPLOT 7020 PBp467

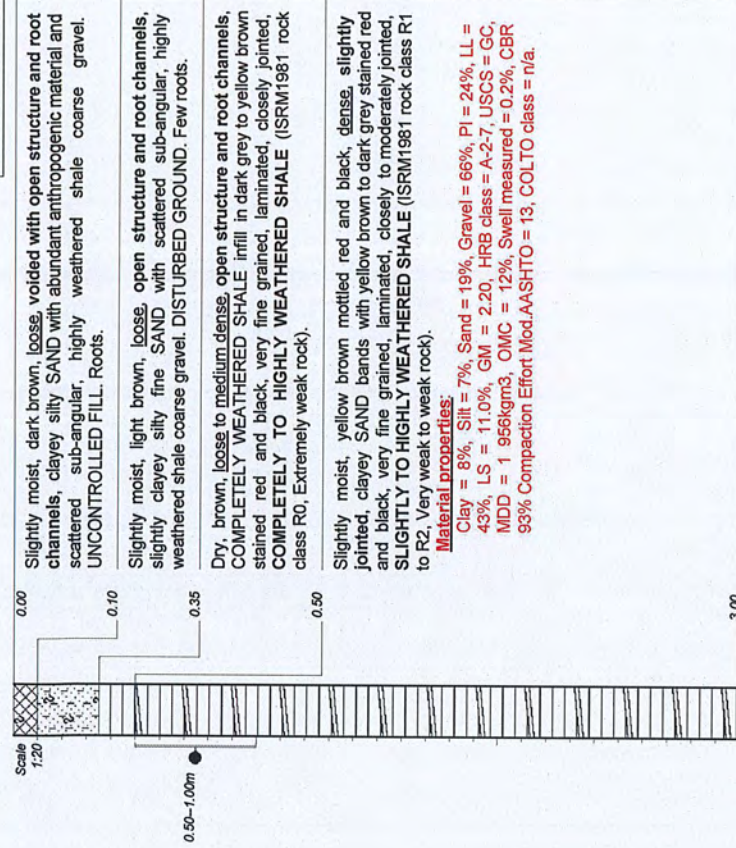


BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP30
Sheet 1 of 1

JOB NUMBER: RS18056

Scale
1:20



Slightly moist, dark brown, loose, voided with open structure and root channels, clayey silty SAND with abundant anthropogenic material and scattered sub-angular, highly weathered shale coarse gravel. UNCONTROLLED FILL. Roots.

Slightly moist, light brown, loose, open structure and root channels, slightly clayey silty fine SAND with scattered sub-angular, highly weathered shale coarse gravel. DISTURBED GROUND. Few roots.

Dry, brown, loose to medium dense, open structure and root channels, COMPLETELY WEATHERED SHALE infill in dark grey to yellow brown stained red and black, very fine grained, laminated, closely jointed, COMPLETELY TO HIGHLY WEATHERED SHALE (ISRM1981 rock class R0. Extremely weak rock).

Slightly moist, yellow brown mottled red and black, dense, slightly jointed, clayey SAND bands with yellow brown to dark grey stained red and black, very fine grained, laminated, closely to moderately jointed, SLIGHTLY TO HIGHLY WEATHERED SHALE (ISRM1981 rock class R1 to R2. Very weak to weak rock).

Material properties:

Clay = 8%, Silt = 7%, Sand = 19%, Gravel = 66%, PI = 24%, LL = 43%, LS = 11.0%, GM = 2.20, HRB class = A-2-7, USCS = GC, MDD = 1.958kg/m3, OMC = 12%, Swell measured = 0.2%, CBR = 93% Compaction Effort Mod.AASHTO = 13, COLTO class = n/a.

NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 0.50-1.00m.
- 5) Vicinity covered in surficial fill.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

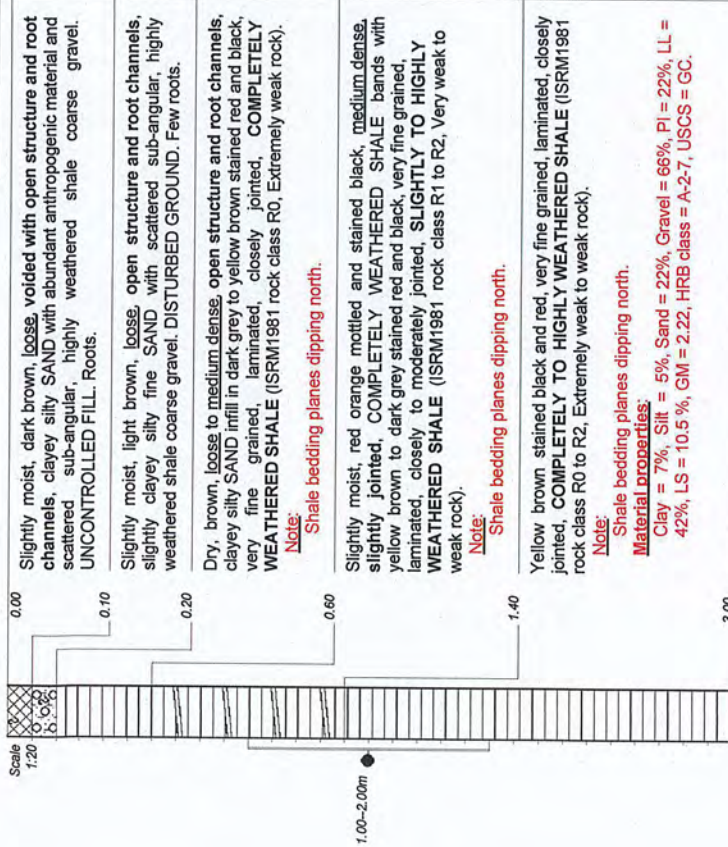
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02

ELEVATION: 1316m
X-COORD: -25.738674
Y-COORD: 28.339171

HOLE No: TP30

D03E WSM Leshika Consulting (Pty) Ltd

ddPLOT 7020 PBp467



NOTES

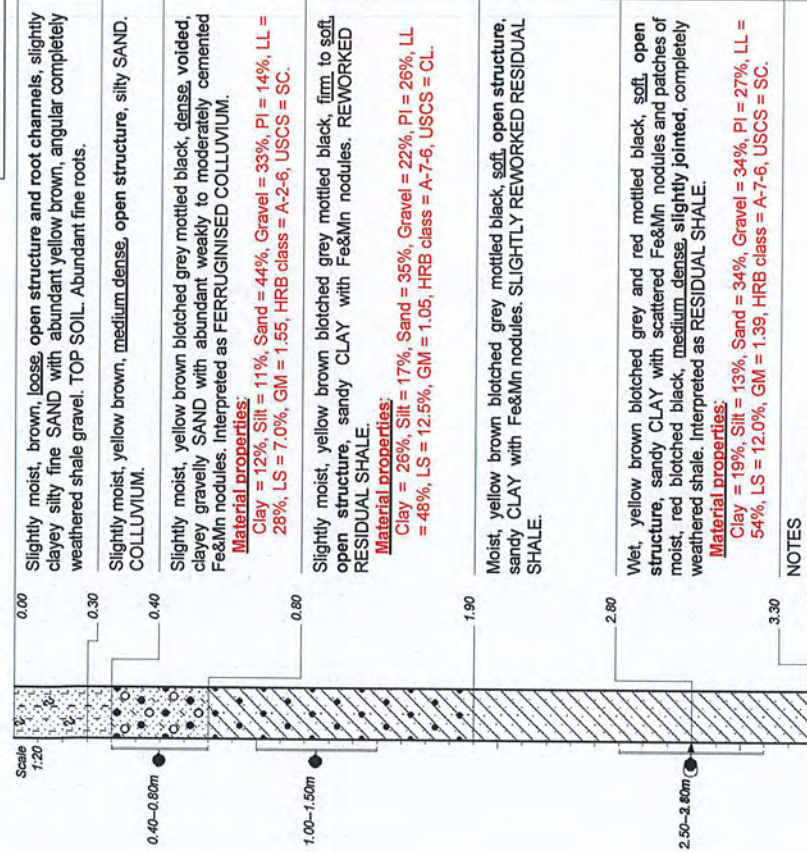
- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 1.00-2.00m.
- 5) Vicinity covered in surficial fill.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFIED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...Logs\RS18056SPV1.3.txt

ELEVATION: 1319m
X-COORD: -25.738899
Y-COORD: 28.338184

HOLE No: TP31



NOTES

- 1) TLB maximum reach.
- 2) Water seepage encountered at 2.80m during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 0.40-0.80m.
- 5) Disturbed sample retrieved at 1.00-1.50m.
- 6) Disturbed sample retrieved at 2.50-3.10m.
- 7) Small termite mounds in near vicinity.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFIED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...Logs\RS18056SPV1.3.txt

ELEVATION: 1322m
X-COORD: -25.7381339
Y-COORD: 28.3362999

HOLE No: TP32

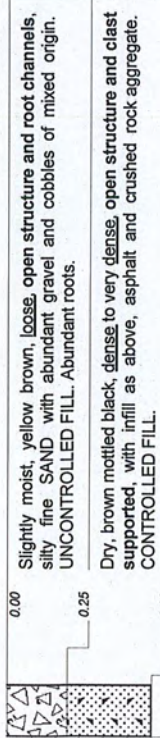


BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP33
Sheet 1 of 1

JOB NUMBER: RS18056

Scale
1:20



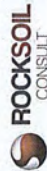
NOTES

- 1) TLB confined refusal.
- 2) Intermediate to hard excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.
- 6) Trial pit excavated in uncontrolled fill covered paved road.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1322m
X-COORD: -25.737547
Y-COORD: 28.335376
HOLE No: TP33

D03E WSM Leshika Consulting (Pty) Ltd

doiPLOT 7020 PBpH67

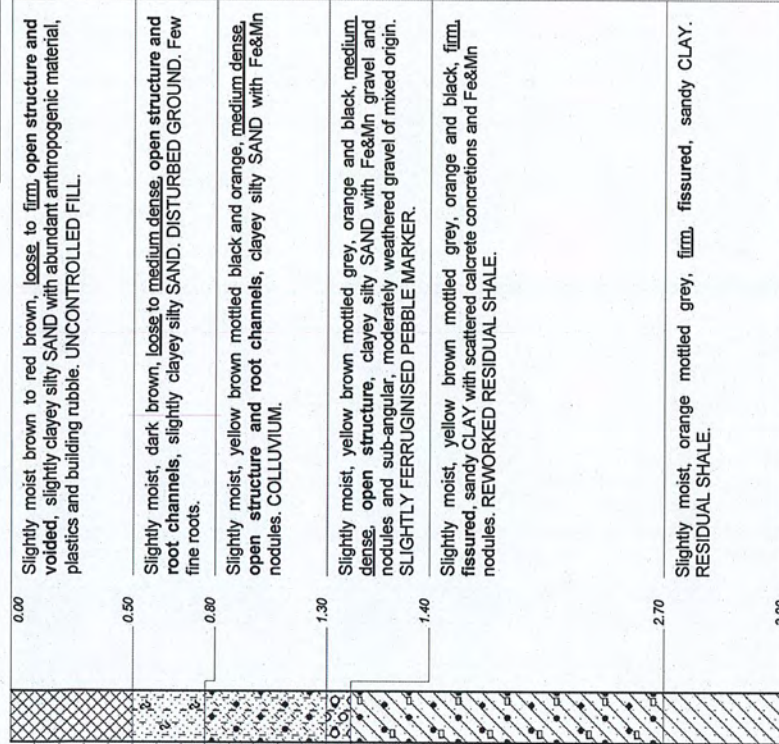


BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP34
Sheet 1 of 1

JOB NUMBER: RS18056

Scale
1:20



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1326m
X-COORD: -25.738083
Y-COORD: 28.33360
HOLE No: TP34

D03E WSM Leshika Consulting (Pty) Ltd

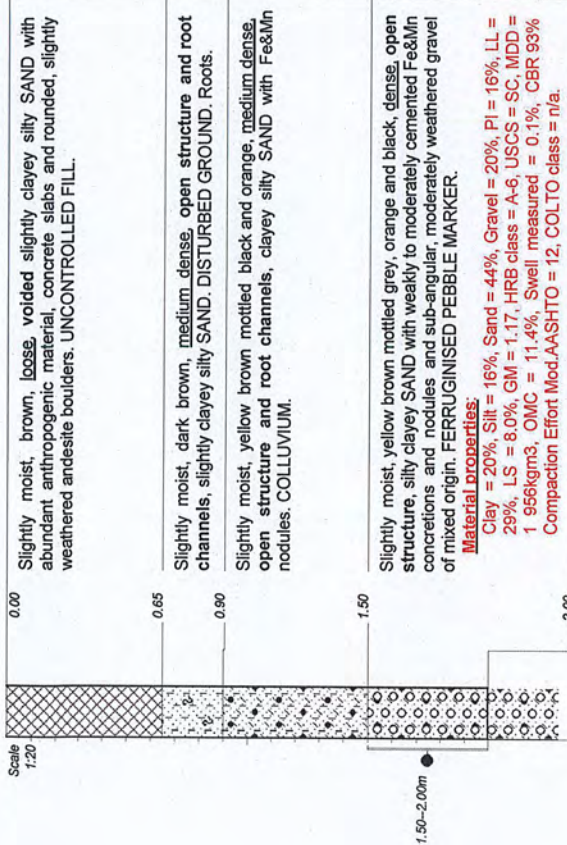
doiPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP35
Sheet 1 of 1

JOB NUMBER: RS18056



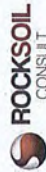
NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) Sidewall instability encountered at 0.00–0.65m during the time of inspection.
- 5) Disturbed sample retrieved at 1.50–2.00m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1326m
X-COORD: -25.738816
Y-COORD: 28.334382
HOLE No: TP35

D03E WSM Leshika Consulting (Pty) Ltd

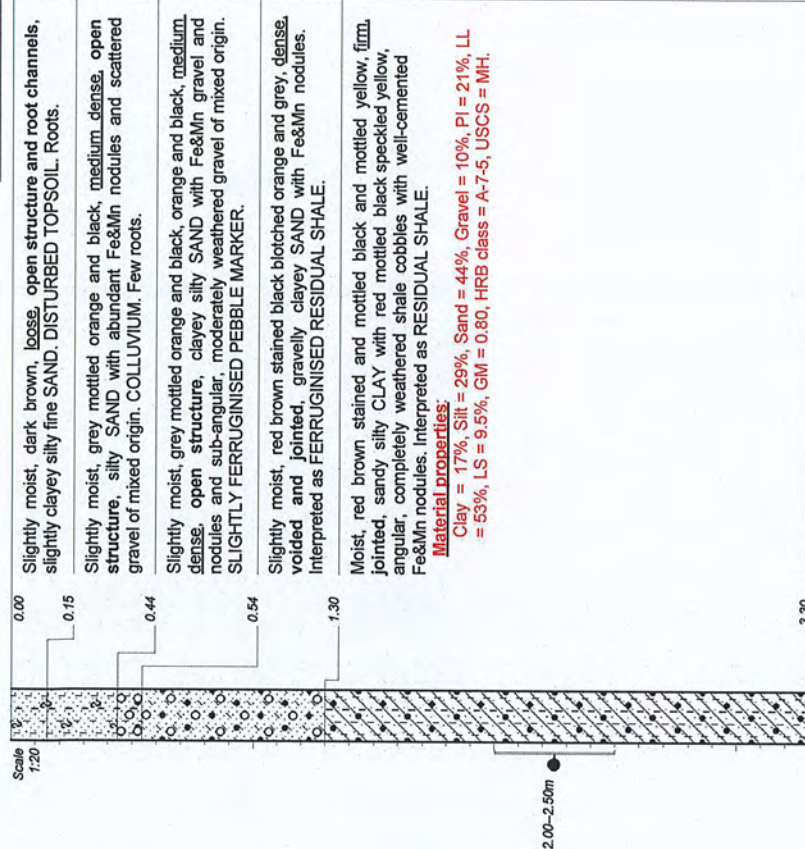
ddPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP36
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 2.00–2.50m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1323m
X-COORD: -25.738848
Y-COORD: 28.335537
HOLE No: TP36

D03E WSM Leshika Consulting (Pty) Ltd

ddPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP37
Sheet 1 of 1

JOB NUMBER: RS18056

Scale 1:20
0.00
0.10
0.60
3.00

Slightly moist, light brown, loose, open structure and root channels, slightly clayey silty fine SAND with scattered yellow brown, sub-angular, highly weathered shale coarse gravel. DISTURBED GROUND. Few roots.

Dry, brown, loose to medium dense, open structure and root channels, clayey silty SAND infill in yellow brown stained red and black mottled orange and grey, very fine grained, laminated, very closely jointed, COMPLETELY WEATHERED SHALE (ISRM1981 rock class <R1, lower limit very weak rock).

Note: Shale bedding planes dipping north.

Yellow brown stained black, very fine-grained, laminated, closely to moderately jointed, COMPLETELY TO HIGHLY WEATHERED SHALE. (ISRM1981 rock class >R1 to R2, upper limit Very Weak Rock to Weak Rock).

Note: Shale bedding planes dipping north.

2.00m

NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) Partial sidewall instability encountered on northern face during the time of inspection.
- 4) Undisturbed sample retrieved at 2.00m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
TEXT: ..PLogs\RS18056SPV1.3.txt

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1323m
X-COORD: -25.739442
Y-COORD: 28.336320

HOLE No: TP37

D03E WSM Leshika Consulting (Pty) Ltd

doiPLOT7020 PBqH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP38
Sheet 1 of 1

JOB NUMBER: RS18056

Scale 1:20
0.00
0.10
0.70
1.90
3.00

Slightly moist, light brown, loose, open structure and root channels, slightly clayey silty fine SAND with scattered yellow brown, sub-angular, highly weathered shale coarse gravel. DISTURBED GROUND. Few roots.

Slightly moist, grey brown, medium dense, open structure and root channels, slightly clayey silty fine SAND with scattered yellow brown, sub-angular, highly weathered shale coarse gravel. COLLUVIUM. Few roots.

Dry, brown, medium dense, open structure and root channels, clayey silty SAND infill in yellow brown stained red and black mottled orange and grey, very fine grained, laminated, very closely jointed, COMPLETELY WEATHERED SHALE (ISRM1981 rock class <R1, lower limit Very Weak Rock).

Note: Shale bedding planes dipping north.

1.90

Slightly moist, red orange mottled and stained black, firm, slightly jointed, COMPLETELY WEATHERED SHALE bands with yellow brown stained black, very fine-grained, laminated, closely to moderately jointed, COMPLETELY TO HIGHLY WEATHERED SHALE (ISRM1981 rock class >R1 to R2, upper limit Very Weak Rock to Weak Rock).

Note: Shale bedding planes dipping north.

NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
TEXT: ..PLogs\RS18056SPV1.3.txt

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1322m
X-COORD: -25.739138
Y-COORD: 28.337163

HOLE No: TP38

D03E WSM Leshika Consulting (Pty) Ltd

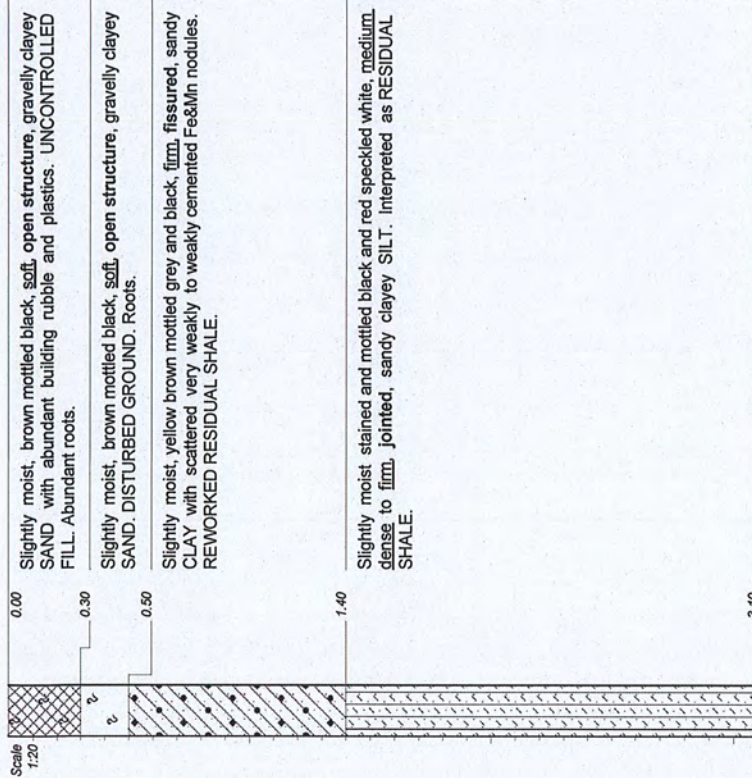
doiPLOT7020 PBqH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP39
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..Plots\RS18056SPV1.3.txd

ELEVATION: 1322m
X-COORD: -25.739897
Y-COORD: 28.337546

HOLE No: TP39

D03E WSM Leshika Consulting (Pty) Ltd

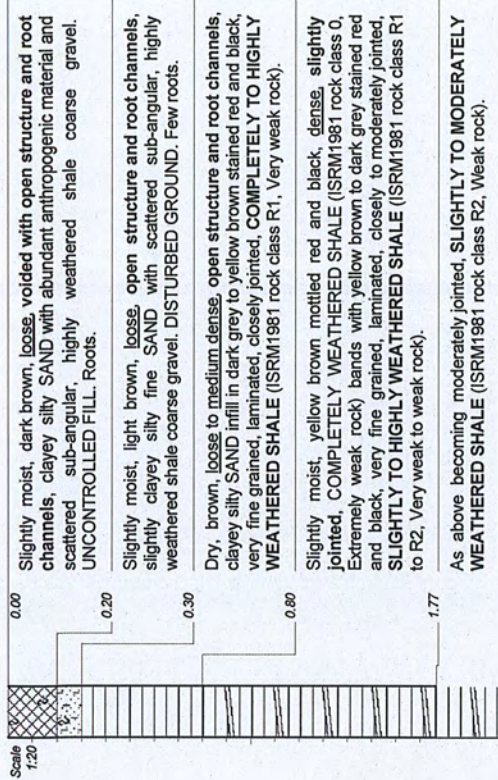
ddPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP40
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

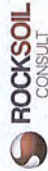
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..Plots\RS18056SPV1.3.txd

ELEVATION: 1316m
X-COORD: -25.739724
Y-COORD: 28.338821

HOLE No: TP40

D03E WSM Leshika Consulting (Pty) Ltd

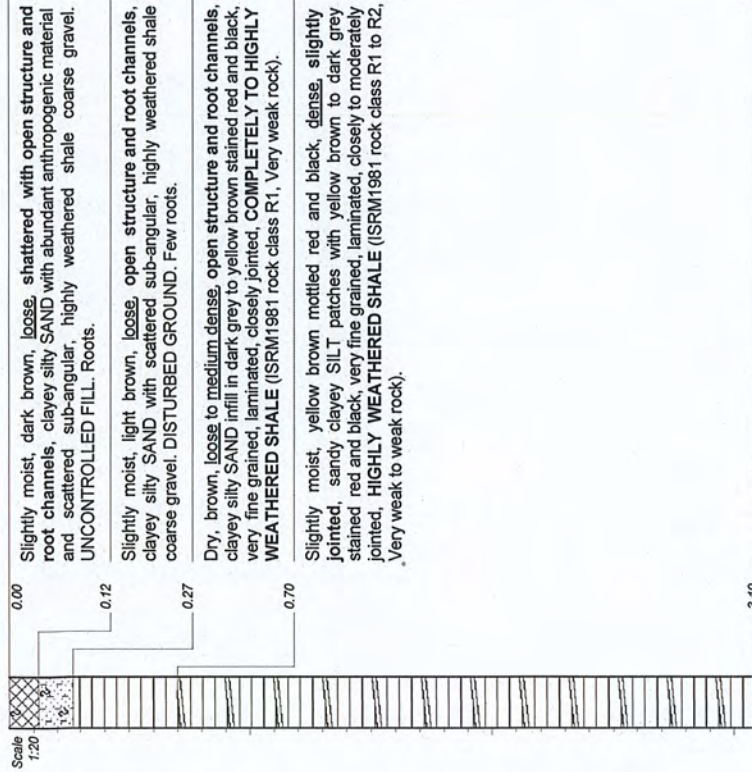
ddPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP41
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) Particle sidewall instability encountered in southern and western faces during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..\Logs\RS18056SPV1.3.txt

ELEVATION: 1313m
X-COORD: -25.739815
Y-COORD: 28.340047

HOLE No: TP41

D03E WSM Leshika Consulting (Pty) Ltd

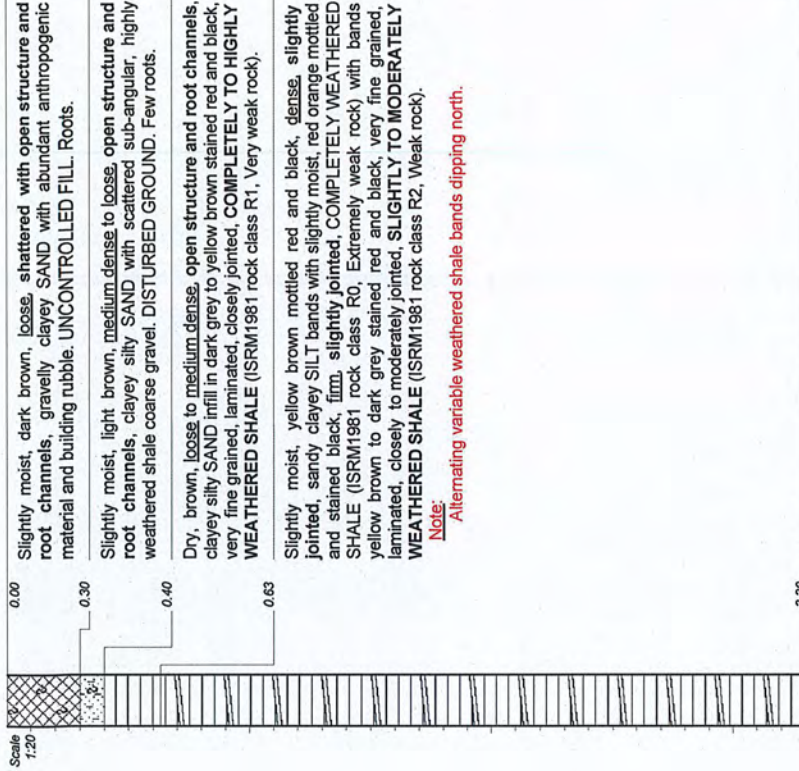
ddrPLOT 7020 P8pH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP42
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET

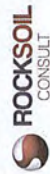
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..\Logs\RS18056SPV1.3.txt

ELEVATION: 1314m
X-COORD: -25.740733
Y-COORD: 28.340218

HOLE No: TP42

D03E WSM Leshika Consulting (Pty) Ltd

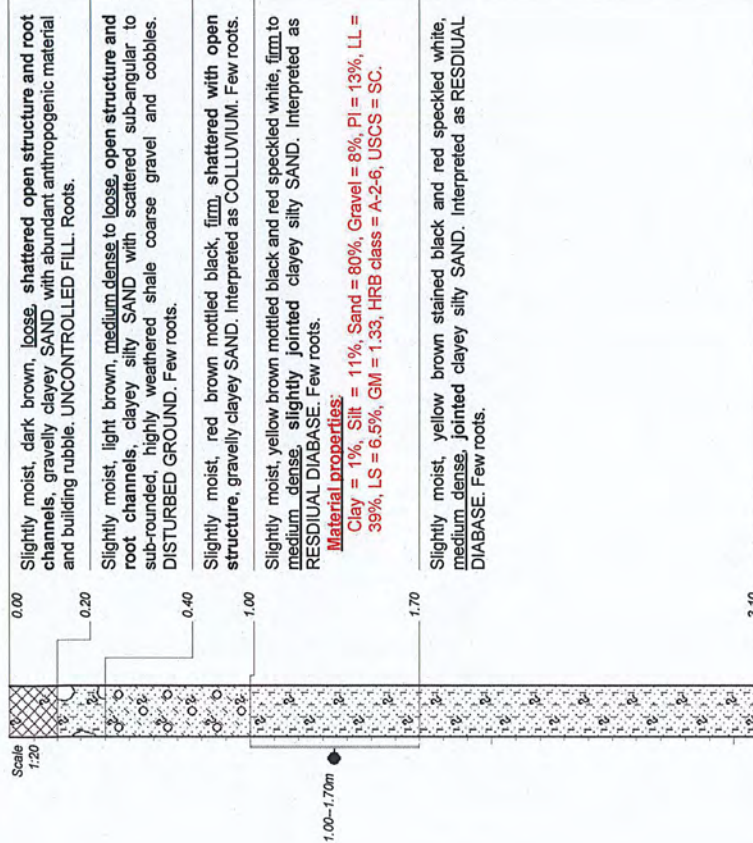
ddrPLOT 7020 P8pH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP43
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) Disturbed sample retrieved at 1.00-1.70m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1320m
X-COORD: -25.741849
Y-COORD: 28.343839
HOLE No: TP43

D03E WSM Leshika Consulting (Pty) Ltd

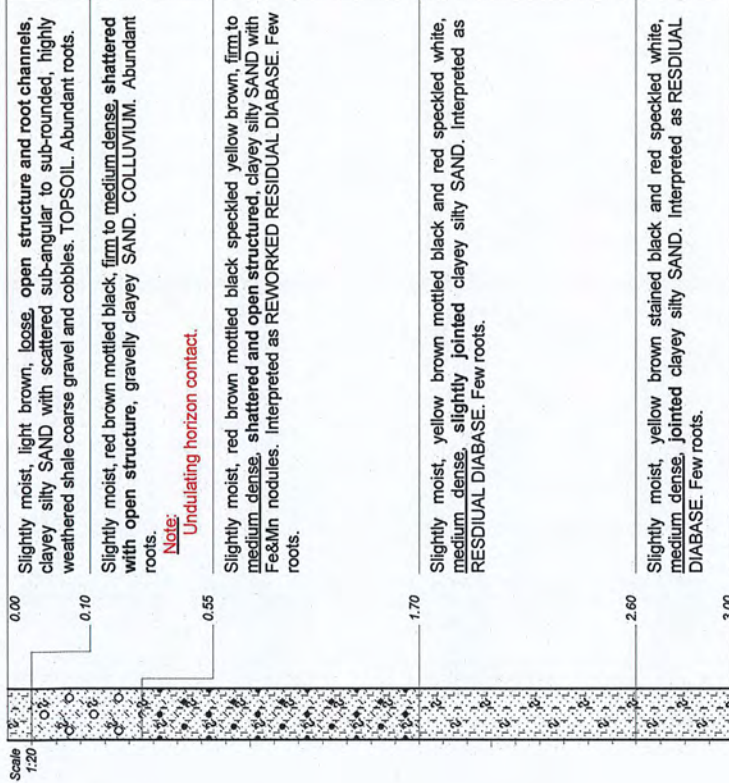
00PLOT 7020 P8pH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP44
Sheet 1 of 1

JOB NUMBER: RS18056



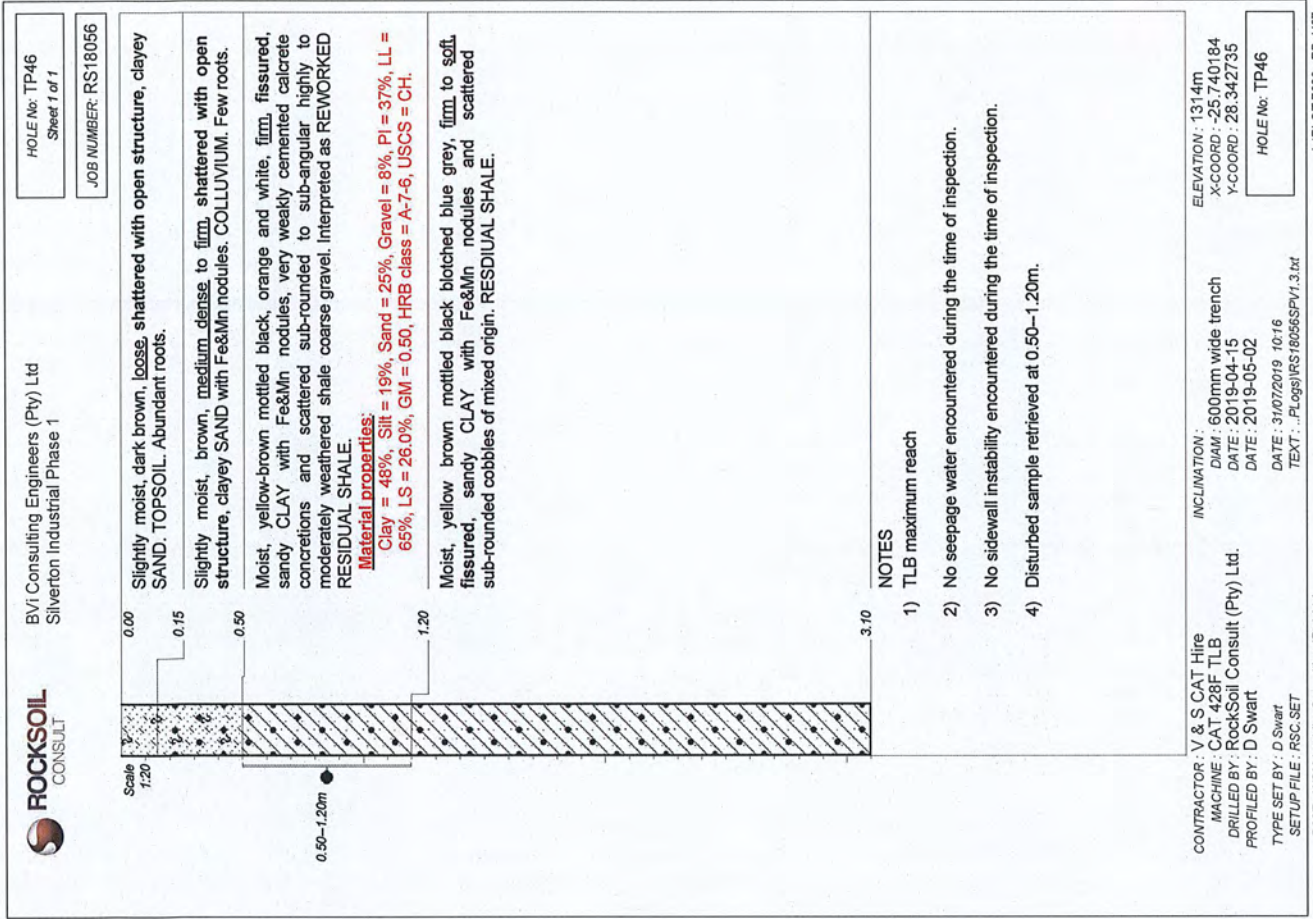
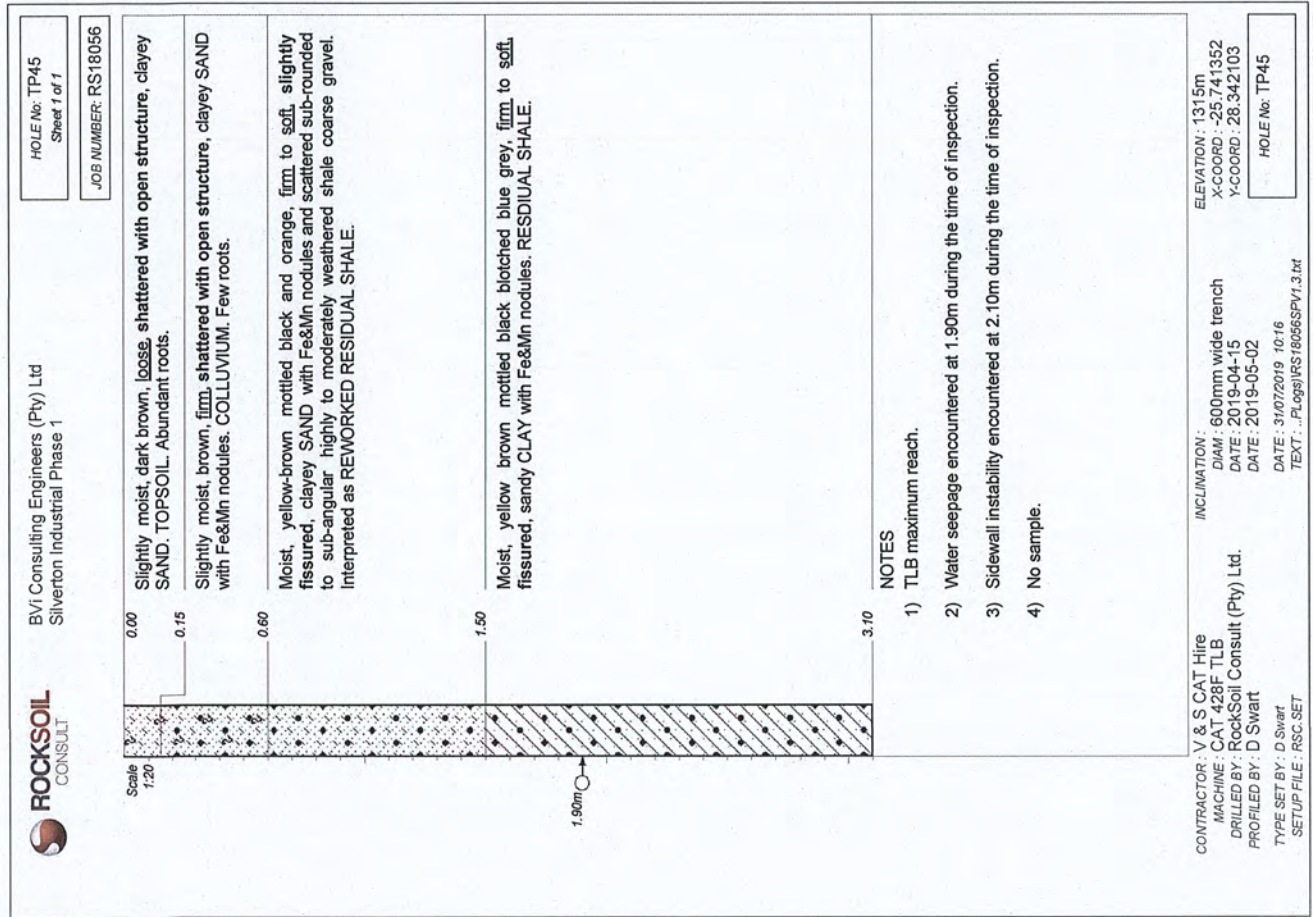
NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1317
X-COORD: -25.741559
Y-COORD: 28.343013
HOLE No: TP44

D03E WSM Leshika Consulting (Pty) Ltd

00PLOT 7020 P8pH67

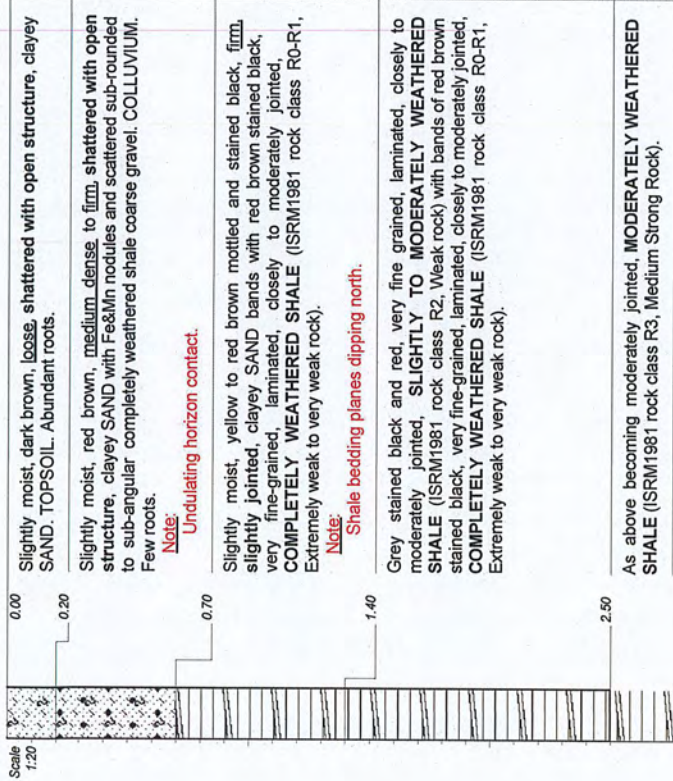




BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP47
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB confine refusal.
- 2) Intermediate to hard excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET

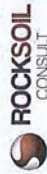
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...Plots\RS18056SPV1.3.txt

ELEVATION: 1314m
X-COORD: -25.740451
Y-COORD: 28.343527

HOLE No: TP47

D03E WSM Leshika Consulting (Pty) Ltd

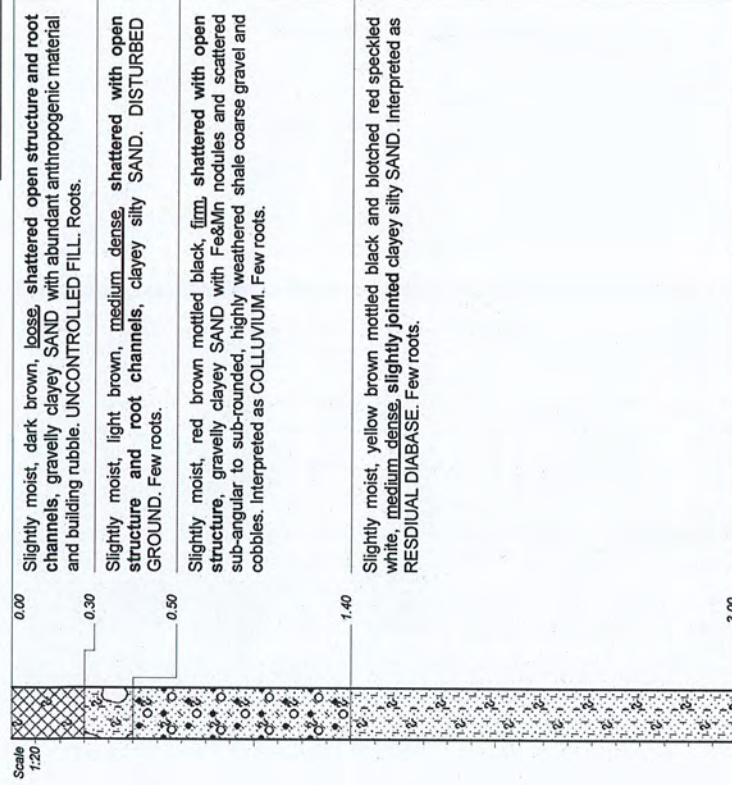
addPLOT7020 PBqH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP48
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILLED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET

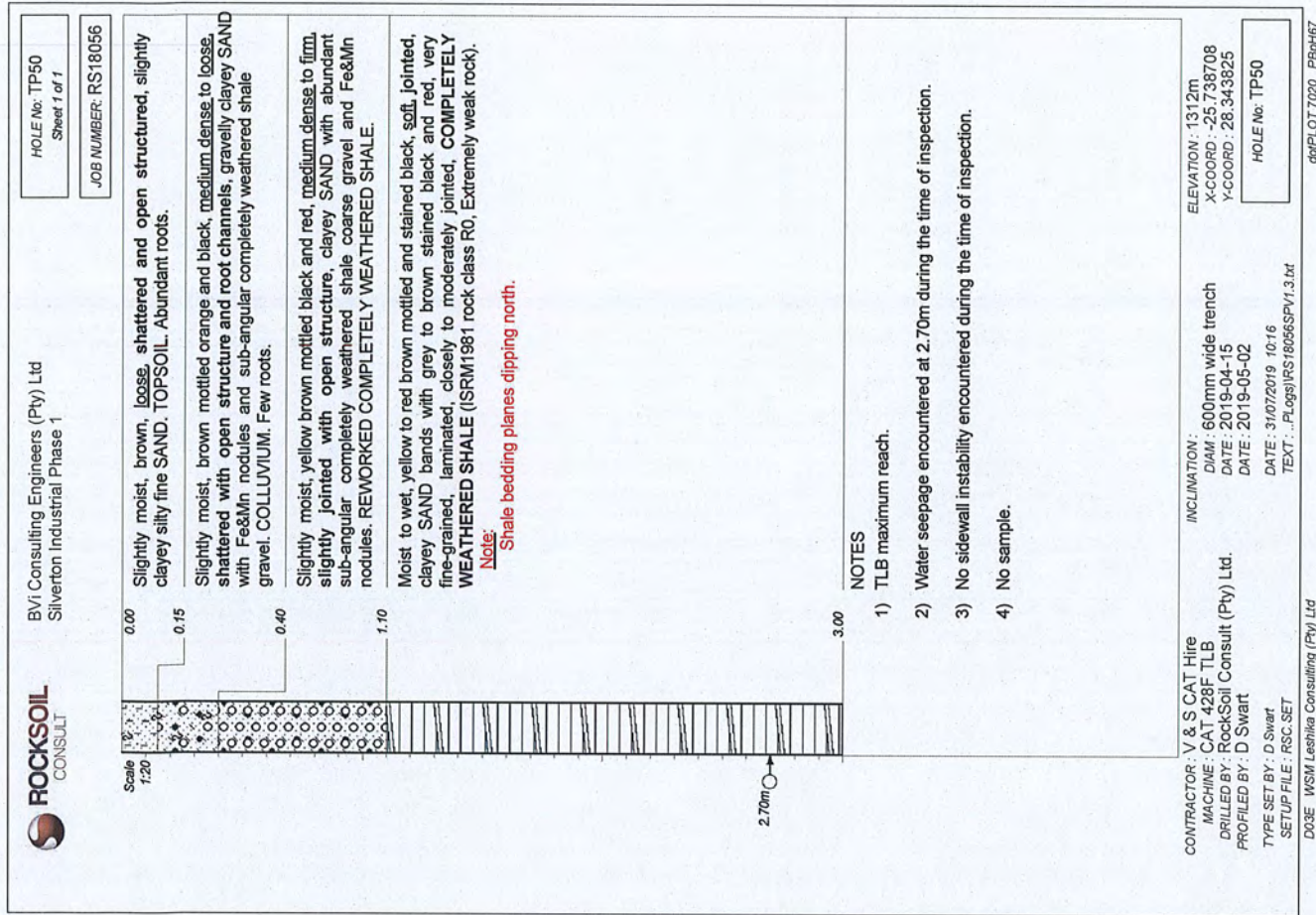
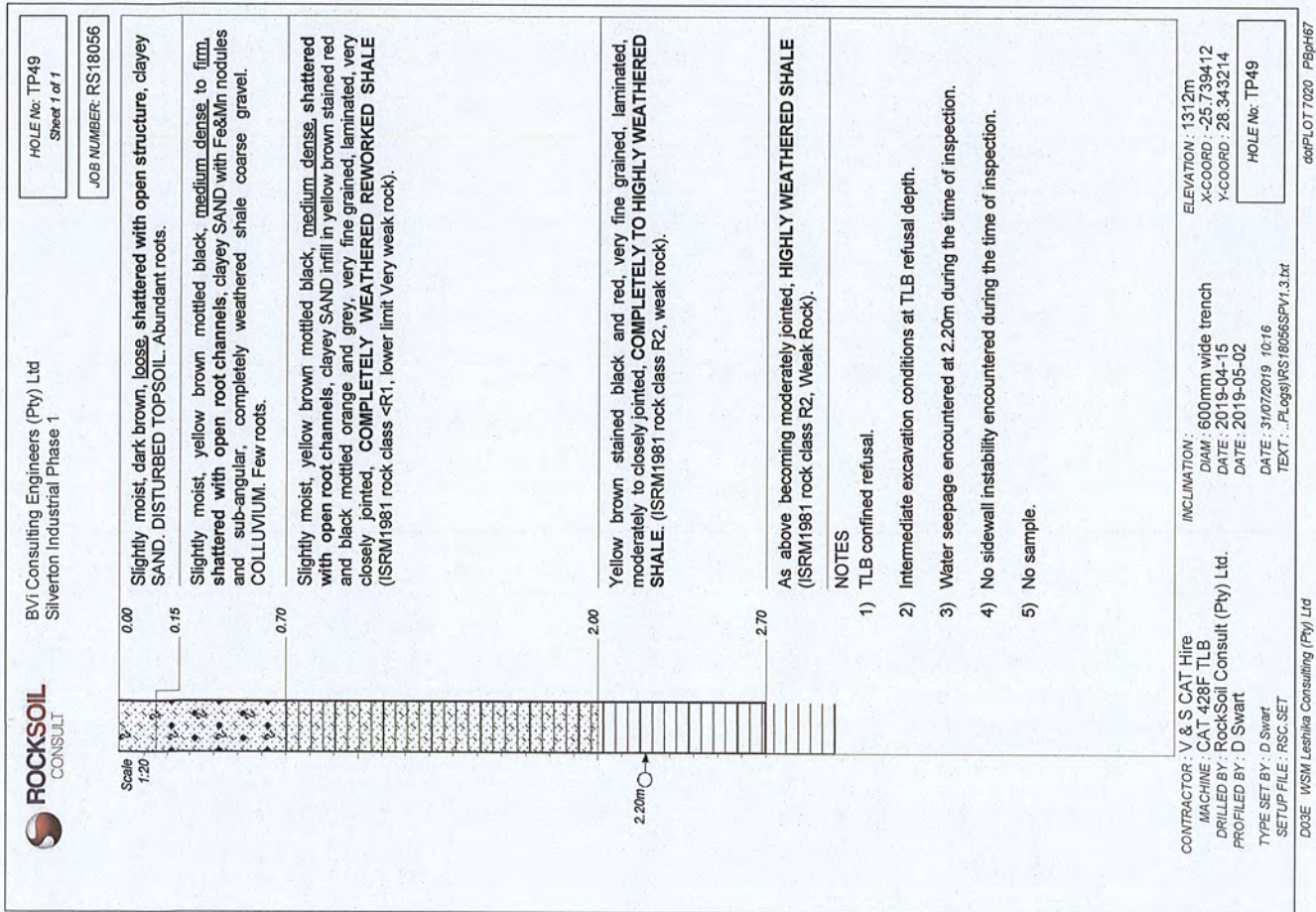
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...Plots\RS18056SPV1.3.txt

ELEVATION: 1318m
X-COORD: -25.740633
Y-COORD: 28.344425

HOLE No: TP48

D03E WSM Leshika Consulting (Pty) Ltd

addPLOT7020 PBqH67

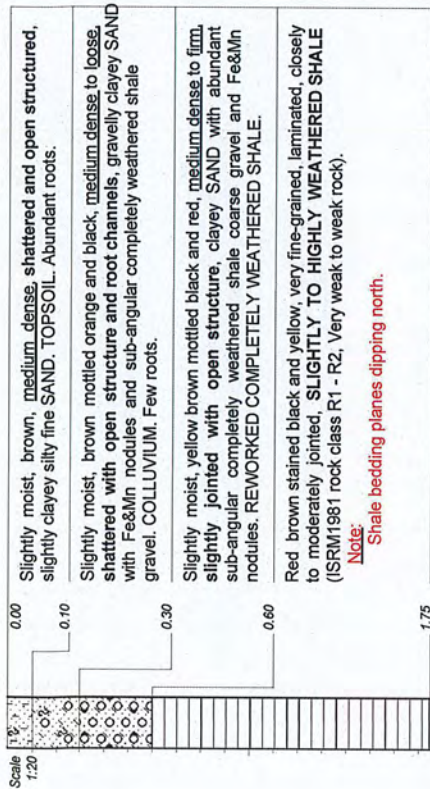




BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP51
Sheet 1 of 1

JOB NUMBER: RS18056

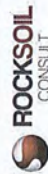


As above becoming moderately jointed SLIGHTLY TO HIGHLY WEATHERED SHALE. (ISRM1981 rock class R2, Weak rock).

NOTES

- 1) TLB confined refusal.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

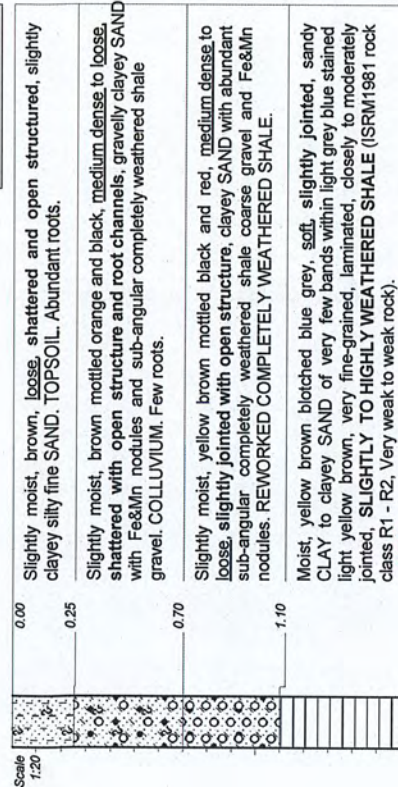
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1312m
X-COORD: -25.737484
Y-COORD: 28.343586
HOLE No: TP51



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP52
Sheet 1 of 1

JOB NUMBER: RS18056



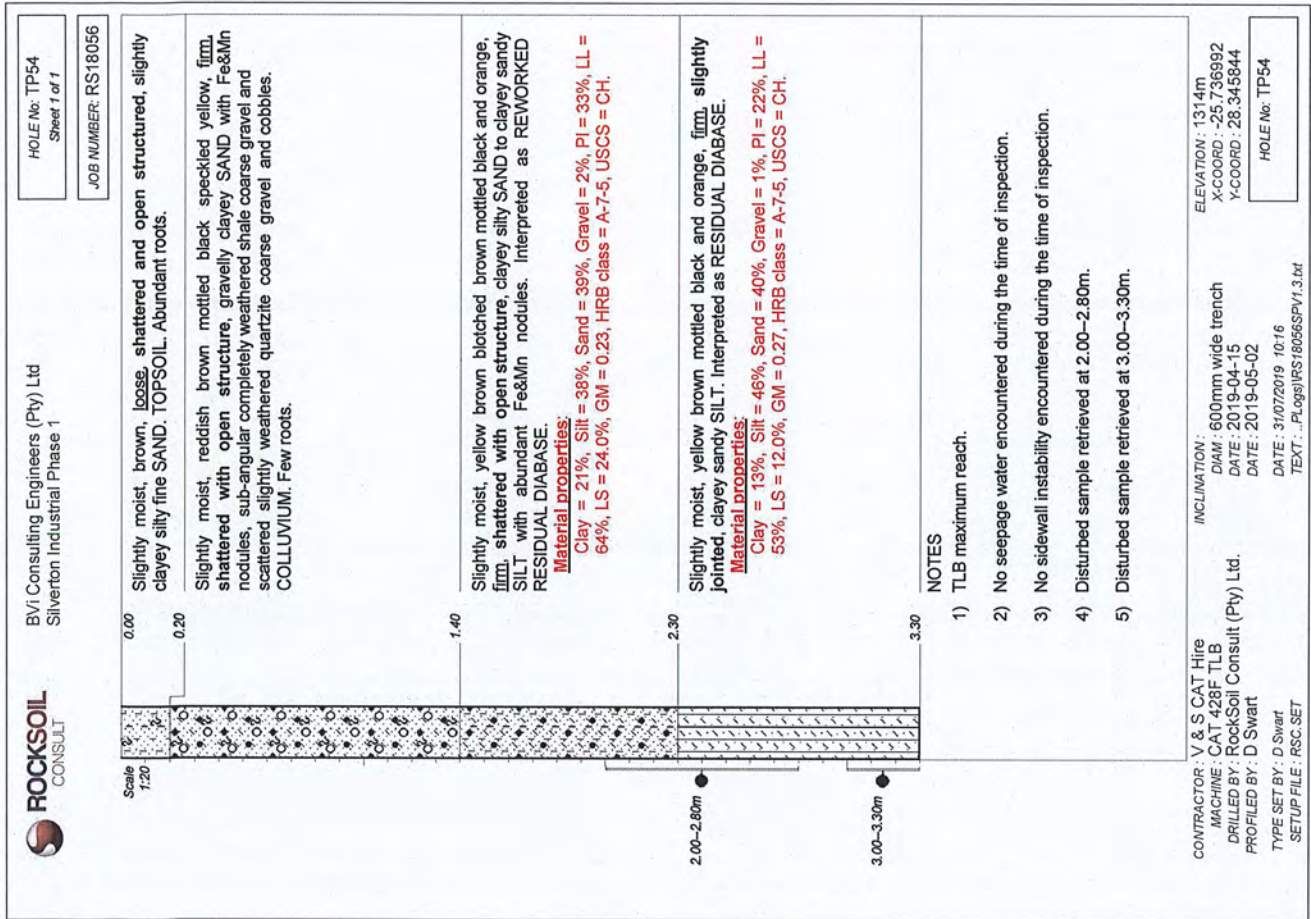
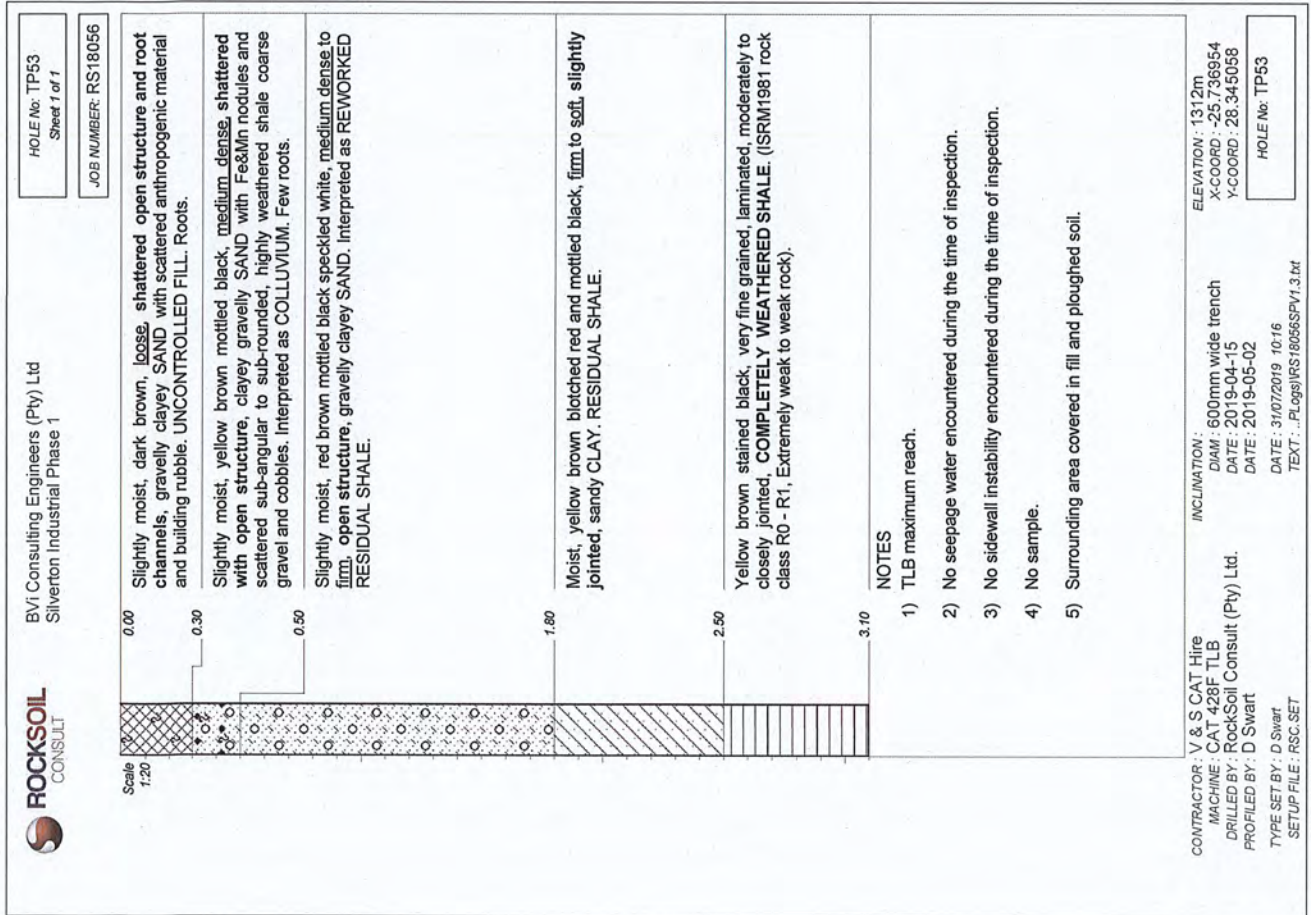
Note: Shale bedding planes dipping north.

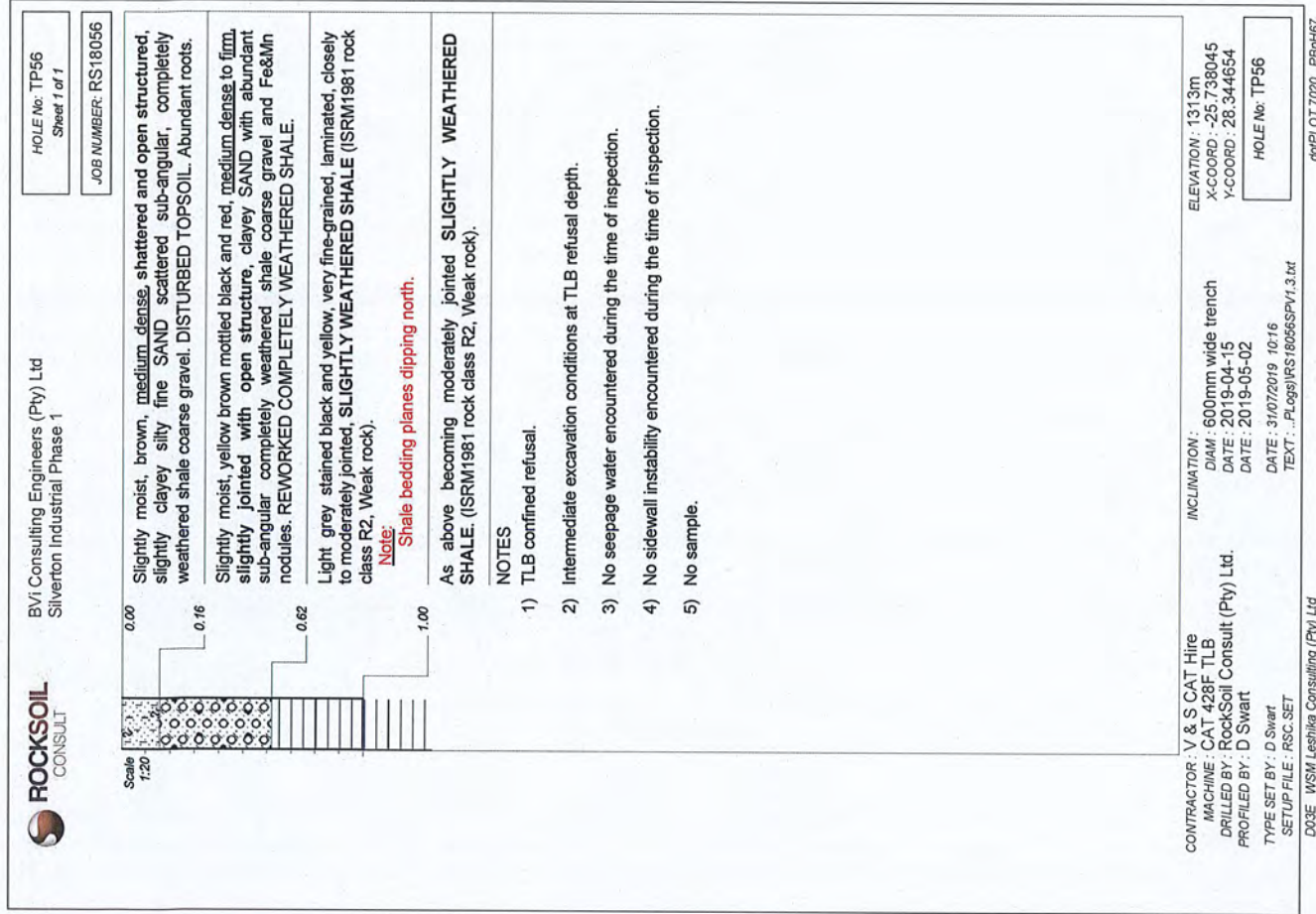
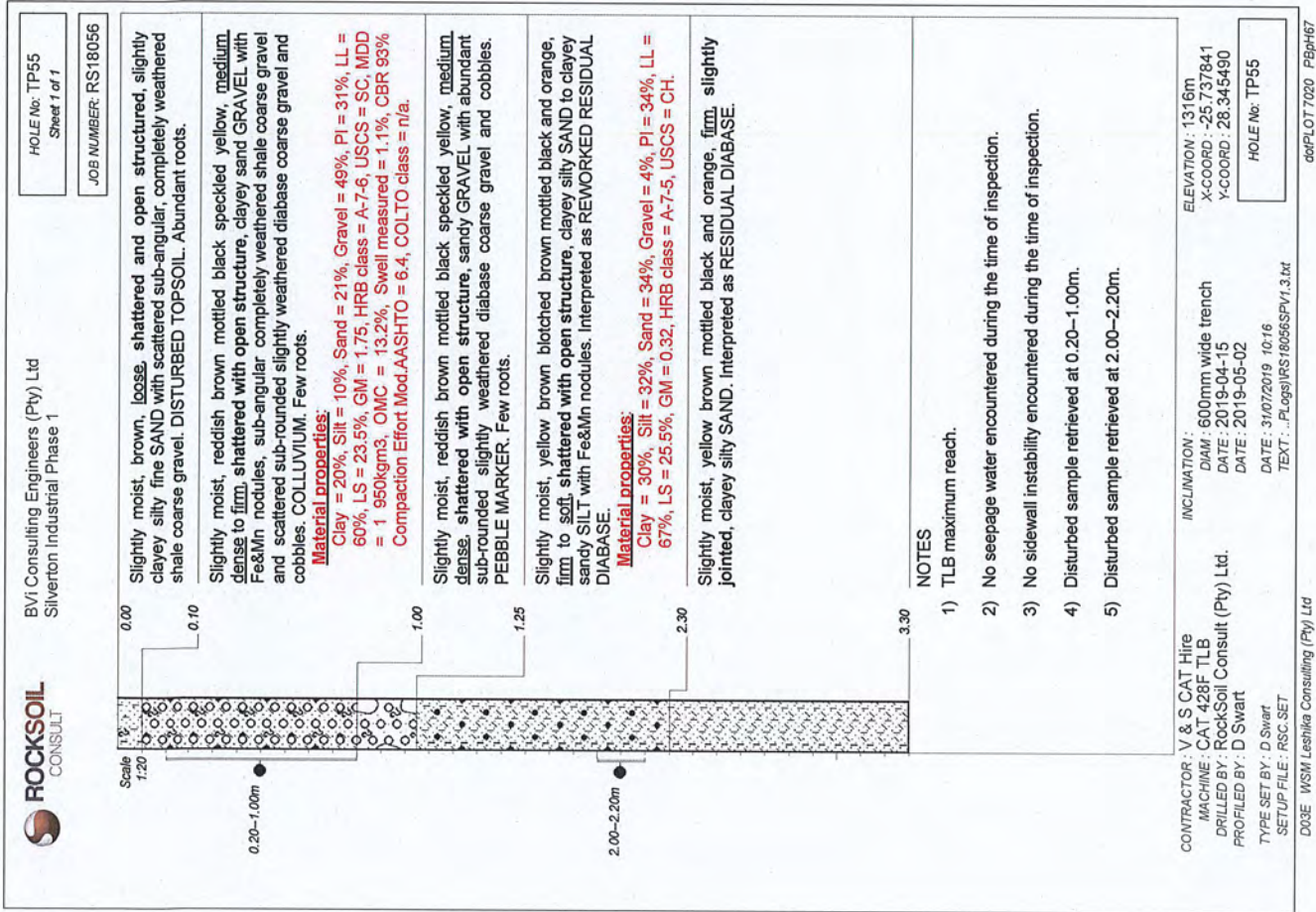
As above becoming moderately jointed SLIGHTLY TO HIGHLY WEATHERED SHALE. (ISRM1981 rock class R2, Weak rock).

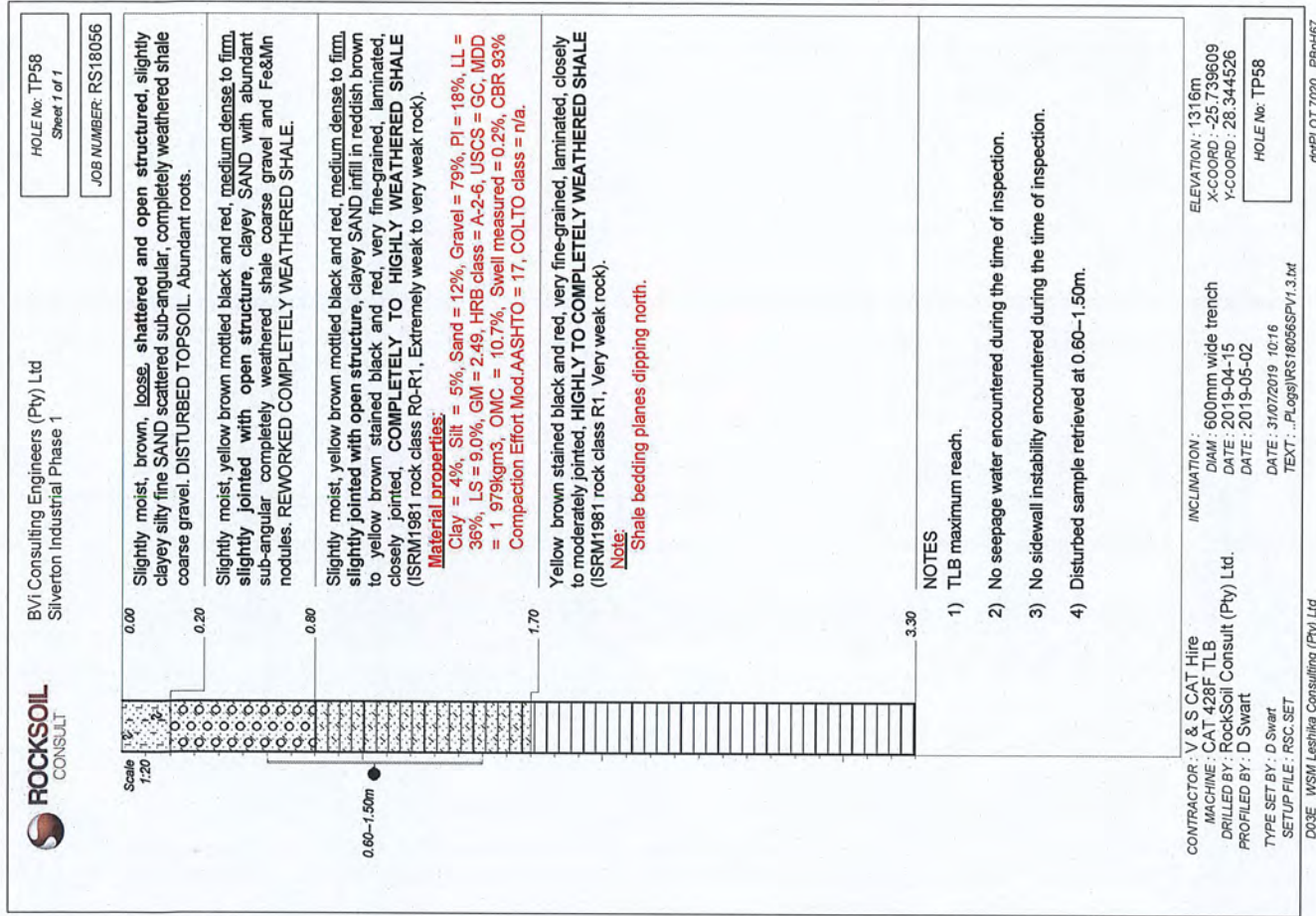
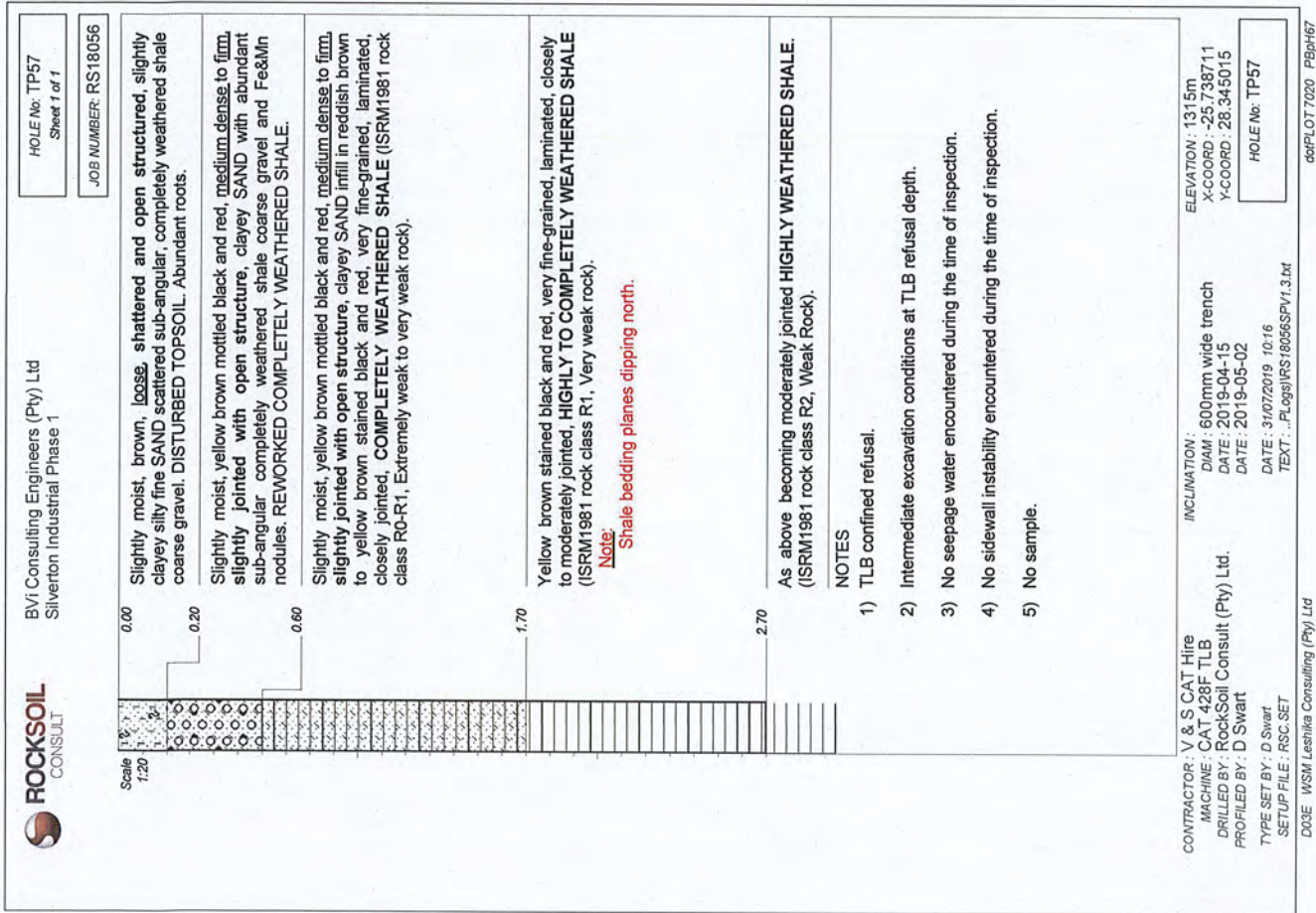
NOTES

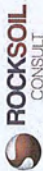
- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) Undulating horizon contacts.
- 6) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
ELEVATION: 1310m
X-COORD: -25.736372
Y-COORD: 28.343908
HOLE No: TP52





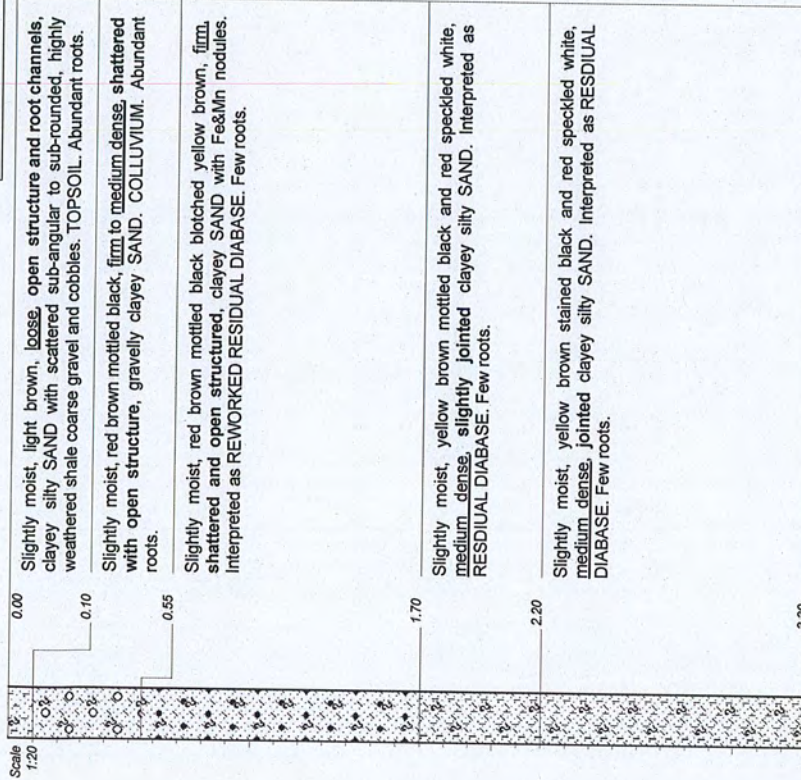




BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP59
Sheet 1 of 1

JOB NUMBER: RS18056



0.00
0.10
0.55
1.70
2.20
3.30

Slightly moist, light brown, loose, open structure and root channels, clayey, silty SAND with scattered sub-angular to sub-rounded, highly weathered shale coarse gravel and cobbles. TOPSOIL. Abundant roots.

Slightly moist, red brown mottled black, firm to medium dense, shattered with open structure, gravelly clayey SAND. COLLUVIUM. Abundant roots.

Slightly moist, red brown mottled black blotched yellow brown, firm, shattered and open structured, clayey SAND with Fe&Mn nodules. Interpreted as REWORKED RESIDUAL DIABASE. Few roots.

Slightly moist, yellow brown mottled black and red speckled white, medium dense, slightly jointed clayey silty SAND. Interpreted as RESIDUAL DIABASE. Few roots.

Slightly moist, yellow brown stained black and red speckled white, medium dense, jointed clayey silty SAND. Interpreted as RESIDUAL DIABASE. Few roots.

NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

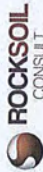
CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION: DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..Flgs\RS18056SPV1.3.txt

ELEVATION: 1317m
X-COORD: -25.741065
Y-COORD: 28.343638

HOLE No: TP59

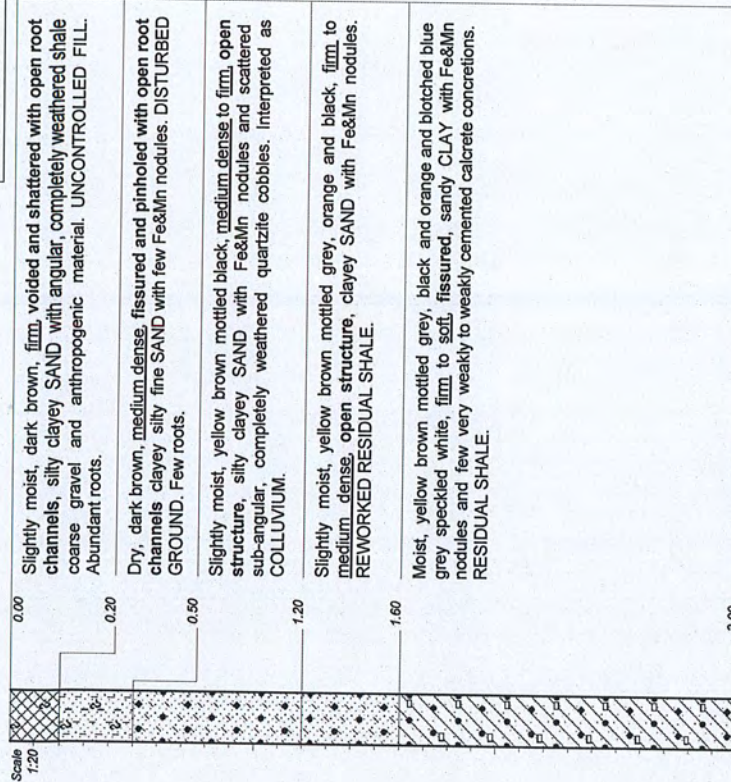
ddrPLOT7 7020 P8pH67



BVi Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP60
Sheet 1 of 1

JOB NUMBER: RS18056



0.00
0.20
0.50
1.20
1.60
3.00

Slightly moist, dark brown, firm, voided and shattered with open root channels, silty clayey SAND with angular, completely weathered shale coarse gravel and anthropogenic material. UNCONTROLLED FILL. Abundant roots.

Dry, dark brown, medium dense, fissured and pinholed with open root channels clayey silty fine SAND with few Fe&Mn nodules. DISTURBED GROUND. Few roots.

Slightly moist, yellow brown mottled black, medium dense to firm, open structure, silty clayey SAND with Fe&Mn nodules and scattered sub-angular, completely weathered quartzite cobbles. Interpreted as COLLUVIUM.

Slightly moist, yellow brown mottled grey, orange and black, firm to medium dense, open structure, clayey SAND with Fe&Mn nodules. REWORKED RESIDUAL SHALE.

Moist, yellow brown mottled grey, black and orange and blotched blue grey speckled white, firm to soft, fissured, sandy CLAY with Fe&Mn nodules and few very weakly to weakly cemented calcareous concretions. RESIDUAL SHALE.

NOTES

- 1) TLB maximum reach.
- 2) No seepage water encountered during the time of inspection.
- 3) No sidewall instability encountered during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC SET
D03E WSM Leshika Consulting (Pty) Ltd

INCLINATION: DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..Flgs\RS18056SPV1.3.txt

ELEVATION: 1324m
X-COORD: -25.737672
Y-COORD: 28.334429

HOLE No: TP60

ddrPLOT7 7020 P8pH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP61
Sheet 1 of 1

JOB NUMBER: RS18056

Scale
1:20

0.00
0.25
0.40
0.60

Slightly moist, brown, loose, open structure and root channels, slightly clayey silty fine SAND with abundant angular, completely weathered shale coarse gravel. TOPSOIL. Abundant roots.

Slightly moist yellow brown mottled black, medium dense to loose, pinholed, slightly clayey silty SAND. COLLUVIUM.

Slightly moist, yellow brown mottled black, medium dense to loose, slightly jointed, silty SAND infill with abundant yellow to brown stained black and red, angular, medium to completely weathered shale coarse gravel and cobbles. REWORKED COMPLETELY WEATHERED SHALE.

Dry, grey to yellow brown stained black and red, very fine grained, very closely to moderately jointed, **MODERATELY TO HIGHLY WEATHERED SHALE**. (ISRM1981 rock class R2, Weak rock).

2.70

As above becoming moderately jointed, **MODERATELY WEATHERED SHALE** (ISRM1981 rock class R2 to R3, Weak to medium strong weak rock)

NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No seepage water encountered during the time of inspection.
- 4) No sidewall instability encountered during the time of inspection.
- 5) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET

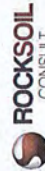
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...PLogS\RS18056SPV1.3.txt

ELEVATION: 1316m
X-COORD: -25.737445
Y-COORD: 28.339170

HOLE No: TP61

D03E WSM Leshika Consulting (Pty) Ltd

ddPLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP62
Sheet 1 of 1

JOB NUMBER: RS18056

Scale
1:20

0.00
0.15

Moist, dark brown, soft, open root channels, sandy SILT. TOP SOIL. Abundant roots.

Moist, grey brown speckled white mottled black, soft, intact, sandy CLAY with Fe&Mn nodules and scattered very weakly calcareous concretions. Interpreted as ALLUVIUM. Few roots.

1.10

Moist, yellow brown blotched grey mottled black, soft to medium dense, open structure, sandy gravelly CLAY with abundant Fe&Mn nodules and very weakly cemented calcareous concretions and gravel of mixed origin. PEBBLE MARKER.

1.30

Moist, yellow brown blotched red mottled black and grey, firm to medium dense, slightly jointed, sandy CLAY to clayey SAND with red stained black, sub-angular, completely weathered shale coarse gravel and cobbles. REWORKED RESIDUAL SHALE.

1.90

Wet, red stained black and grey, very fine grained, very closely to moderately jointed, **COMPLETELY WEATHERED SHALE**. (ISRM1981 rock class R0-R1, Extremely to very weak rock).

2.80

As above becoming moderately jointed, **MODERATELY WEATHERED SHALE** (ISRM1981 rock class R2, Weak rock)

NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) Water seepage encountered at 2.00m during the time of inspection.
- 4) Sidewall instability encountered on north facing wall during the time of inspection.
- 5) Disturbed sample retrieved at 0.50-1.10m.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFILED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET

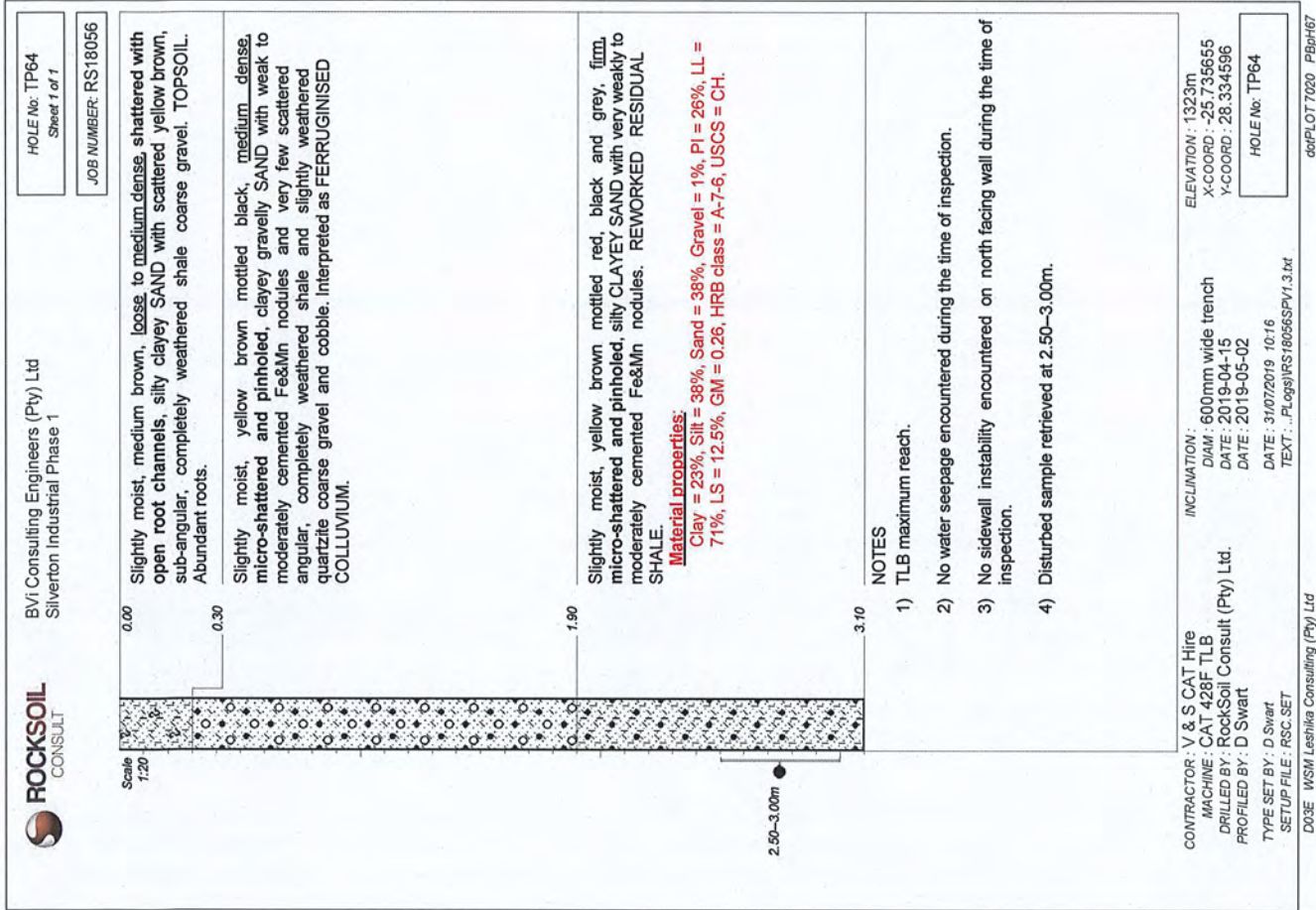
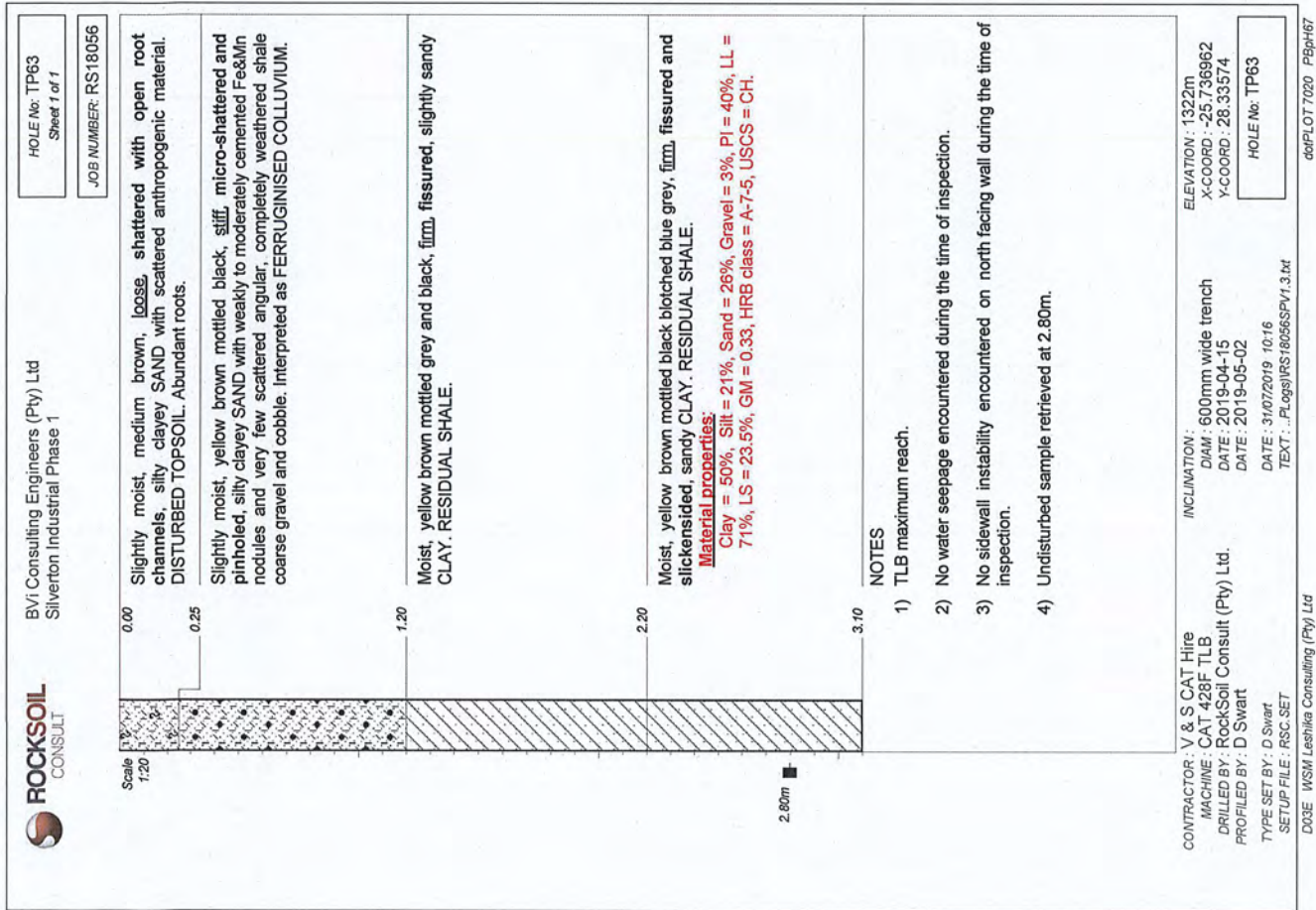
INCLINATION:
DIAM: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ...PLogS\RS18056SPV1.3.txt

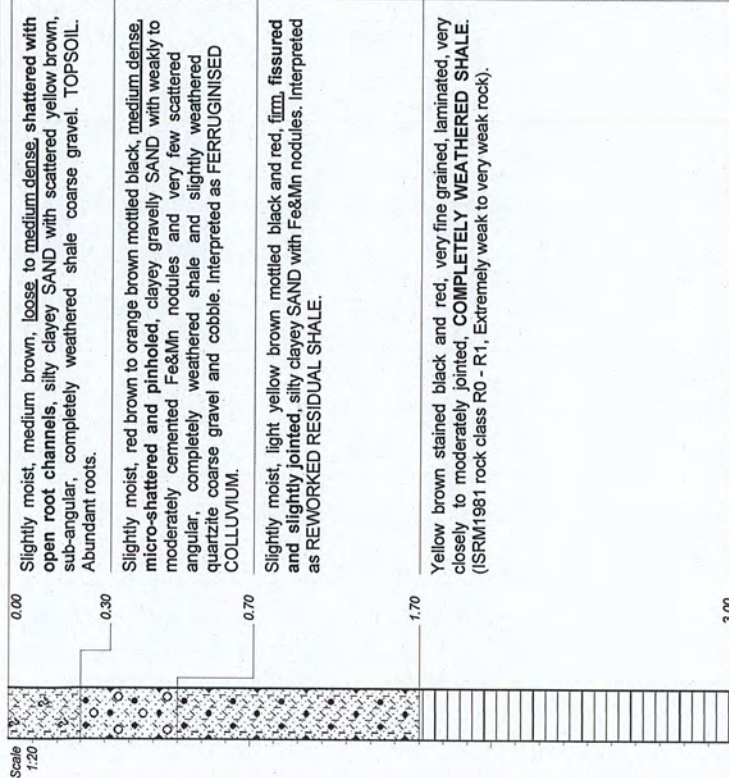
ELEVATION: 1318m
X-COORD: -25.736953
Y-COORD: 28.337402

HOLE No: TP62

D03E WSM Leshika Consulting (Pty) Ltd

ddPLOT 7020 PBpH67





NOTES

- 1) TLB maximum reach.
- 2) No water seepage encountered during the time of inspection.
- 3) No sidewall instability encountered on north facing wall during the time of inspection.
- 4) No sample.

CONTRACTOR : V & S CAT Hire
MACHINE : CAT 429F TLB
DRILLED BY : RockSoll Consult (Pty) Ltd.
PROFILED BY : D Swart

INCINATION :
DIAM : 600mm wide trench
DATE : 2019-04-15
DATE : 2019-05-02

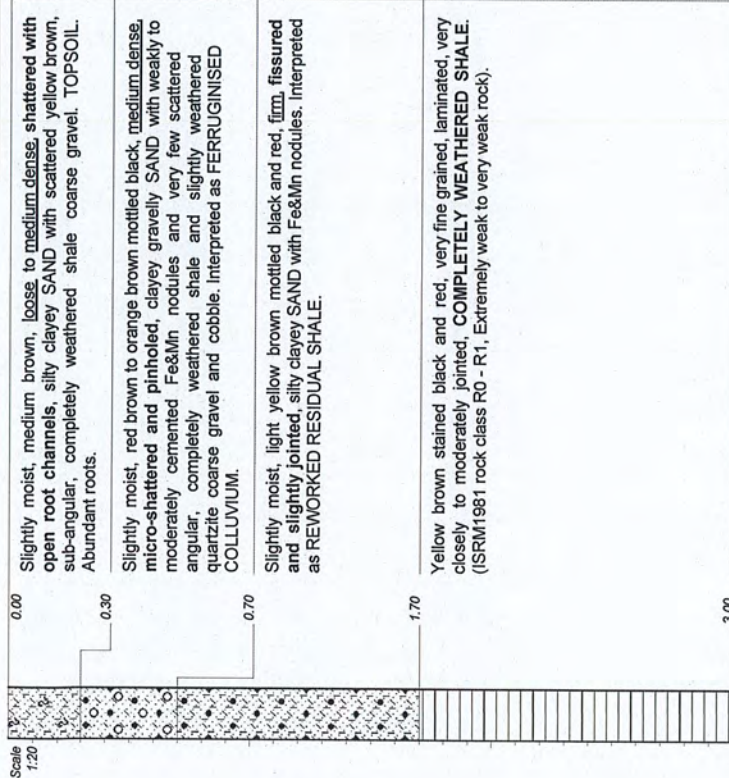
ELEVATION : 1321m
X-COORD : -25.734743
Y-COORD : 28.33652

DATE : 31/07/2019 10:16
TEXT : ...Fluores/RS180656Pv1.3.bdt

TYPE SET BY : D Swart
SETUP FILE : RSC set

HOLE No: TP65

doi:PLOT 7020 PBpH67



NOTES

- 1) TLB maximum reach.
- 2) No water seepage encountered during the time of inspection.
- 3) No sidewall instability encountered on north facing wall during the time of inspection.
- 4) No sample.

CONTRACTOR : V & S CAT Hire
MACHINE : CAT 429F TLB
DRILLED BY : RockSoll Consult (Pty) Ltd.
PROFILED BY : D Swart

INCINATION :
DIAM : 600mm wide trench
DATE : 2019-04-15
DATE : 2019-05-02

ELEVATION : 1321m
X-COORD : -25.734743
Y-COORD : 28.33652

DATE : 31/07/2019 10:16
TEXT : ...Fluores/RS180656Pv1.3.bdt

TYPE SET BY : D Swart
SETUP FILE : RSC set

HOLE No: TP65

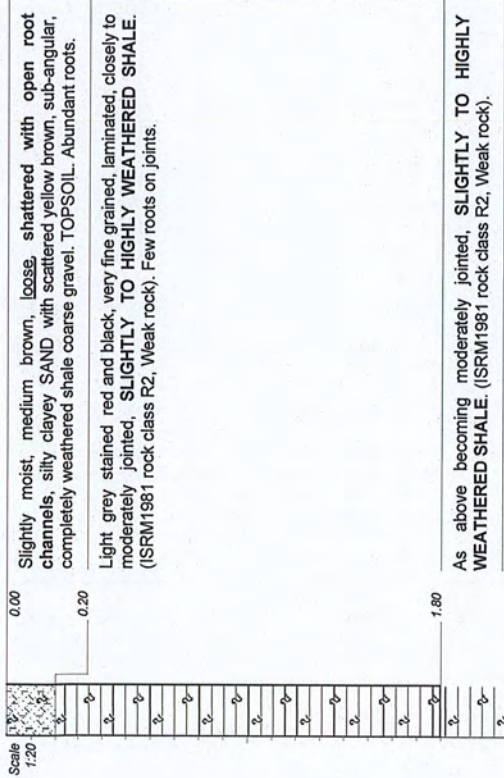
doi:PLOT 7020 PBpH67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP67
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB confined refusal.
- 2) Intermediate excavation conditions at TLB refusal depth.
- 3) No water seepage encountered during the time of inspection.
- 4) No sidewall instability encountered on north facing wall during the time of inspection.
- 5) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFIED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET

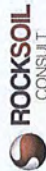
INCLINATION:
DIA: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1325m
X-COORD: -25.733565
Y-COORD: 28.335873

HOLE No: TP67

D03E WSM Leshika Consulting (Pty) Ltd

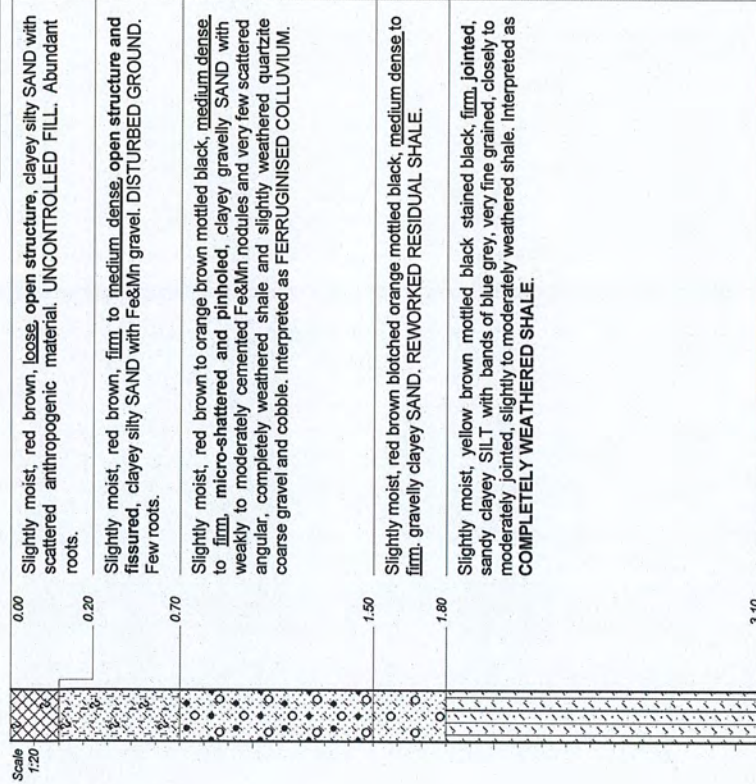
ddPLOT7020 PBgh67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

HOLE No: TP68
Sheet 1 of 1

JOB NUMBER: RS18056



NOTES

- 1) TLB maximum reach.
- 2) No water seepage encountered during the time of inspection.
- 3) No sidewall instability encountered on north facing wall during the time of inspection.
- 4) No sample.

CONTRACTOR: V & S CAT Hire
MACHINE: CAT 428F TLB
DRILLED BY: RockSoil Consult (Pty) Ltd.
PROFIED BY: D Swart
TYPE SET BY: D Swart
SETUP FILE: RSC.SET

INCLINATION:
DIA: 600mm wide trench
DATE: 2019-04-15
DATE: 2019-05-02
DATE: 31/07/2019 10:16
TEXT: ..PLogs\RS18056SPV1.3.txt

ELEVATION: 1325m
X-COORD: -25.734253
Y-COORD: 28.335204

HOLE No: TP68

D03E WSM Leshika Consulting (Pty) Ltd

ddPLOT7020 PBgh67



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

LEGEND
Sheet 1 of 2

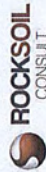
JOB NUMBER: RS18056

	SCATTERED BOULDERS/occasional boulders	{SA48}
	GRAVEL	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SANDY	{SA05}
	SILT	{SA06}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	SHALE	{SA12}
	NODULAR FERRICRETE/ferricrete nodules/honeycomb ferric....	{SA24}
	SPARSE FERRICRETE NODULES/occasional ferricrete nodu....	{SA25}
	NODULAR CALCRETE/calcrete nodules/honeycomb calcrete	{SA27}
	SPARSE CALCRETE NODULES/occasional calcrete nodules....	{SA28}
	RUBBLE	{SA31}
	FILL	{SA32}
	CRUSHED ROCK	{SA33}
	UNDISTURBED SAMPLE	{SA37}
	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}
	WATER SEEPAGE/water strike	{CH50}
	BAND	{SA53}

Name ■

Name ●

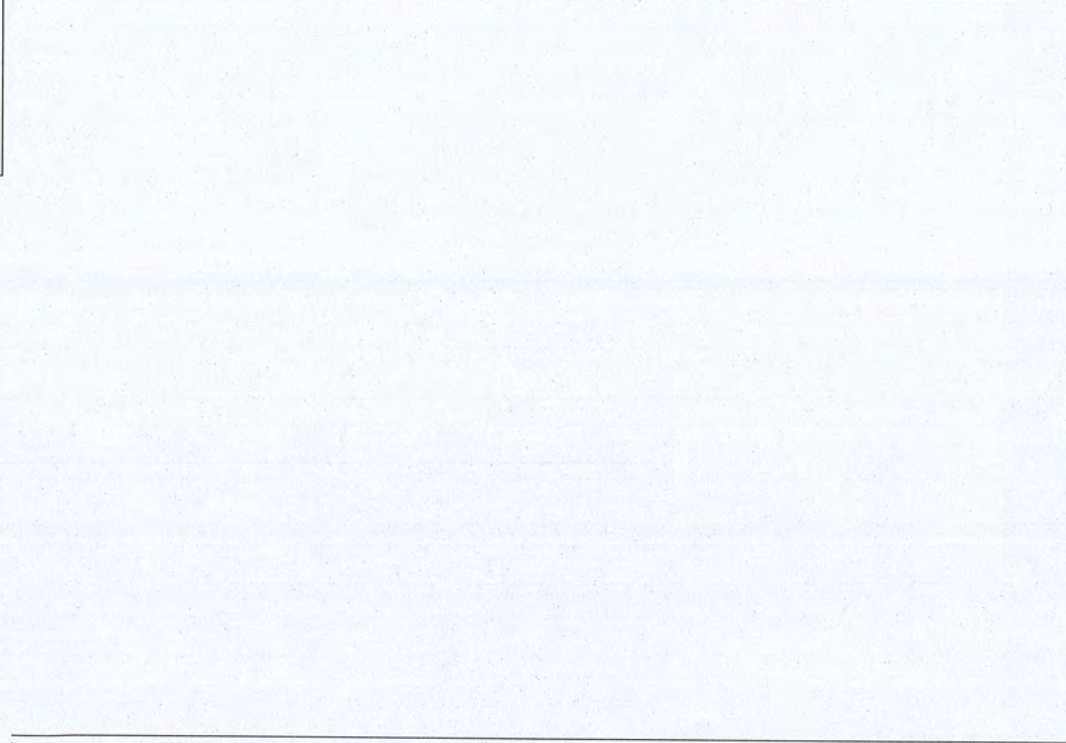
20.5 ○



BVI Consulting Engineers (Pty) Ltd
Silverton Industrial Phase 1

LEGEND
Sheet 2 of 2

JOB NUMBER: RS18056



CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :
TYPE SET BY : D Swart
SETUP FILE : RSC.SET

INCLINATION :
DIAM :
DATE :
DATE :
DATE :
TEXT : ..Plots\RS18056SPV1.3.txt

ELEVATION :
X-COORD :
Y-COORD :
LEGEND
SUMMARY OF SYMBOLS

DATE : 31/07/2019 10:16
TEXT : ..Plots\RS18056SPV1.3.txt

D03E WSM Leshika Consulting (Pty) Ltd

00PLOT 7020 PBPH67

Appendix C: Soil Profile Photographs

Test Pit no: TP01  Note: Soil profile down to 2.80mbgl.	Test Pit no: TP01  Note: Completely weathered shale.
Test Pit no: TP01  Note: Excavated tested material.	Test Pit no: TP01  Note: Excavated tested material.

Test Pit no: TP02  Note: Soil profile down to 3.30mbgl.	Test Pit no: TP02  Note: Upper colluvium.
Test Pit no: TP02  Note: Lower residual shale.	Test Pit no: TP02  Note: Clay bands in highly weathered shale.

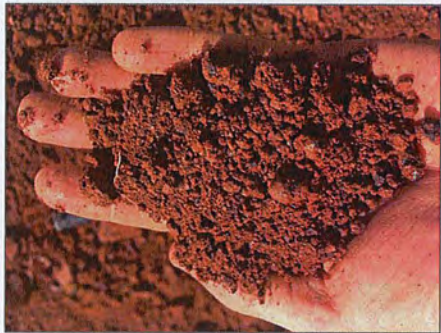
Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP03  Note: Soil profile down to 3.30mbgl.	Test Pit no: TP03  Note: Tested upper colluvium.
Test Pit no: TP03  Note: Tested upper colluvium exhibiting plasticity.	Test Pit no: TP03  Note: Lower completely weathered shale

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP04  Note: Soil profile down to 2.90mbgl.	Test Pit no: TP04  Note: Upper colluvium.
Test Pit no: TP04  Note: Excavated tested upper colluvium	Test Pit no: TP04  Note: Lower slightly ferruginised residual shale.

Test Pit no: TP05  Note: Soil profile down to 3.20mbgl.	Test Pit no: TP05  Note: Upper colluvium.
Test Pit no: TP05  Note: Lower residual shale.	Test Pit no: TP05  Note: Lower completely weathered shale

Test Pit no: TP06  Note: Soil profile down to 3.20mbgl.	Test Pit no: TP06  Note: Upper colluvium
Test Pit no: TP06  Note: Excavated tested colluvium.	Test Pit no: TP06  Note: Lower completely weathered shale.

Test Pit no: TP07  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP07  Note: Upper ferruginised colluvium.
Test Pit no: TP07  Note: Fissured structure indicates potential heave in lower residual shale.	Test Pit no: TP07  Note: Plasticity exhibited by lower residual shale.

Test Pit no: TP08  Note: Soil profile down to 2.80mbgl.	Test Pit no: TP08  Note: Upper colluvium.
Test Pit no: TP08  Note: Excavated lower reworked residual shale.	Test Pit no: TP08  Note: Lower reworked residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1



Test Pit no: TP09  Note: Upper colluvium exhibiting open structure.	Test Pit no: TP09  Note: Excavated and tested upper colluvium.
Test Pit no: TP09  Note: Lower reworked residual shale exhibiting open structure.	Test Pit no: TP09  Note: Excavated lower reworked residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1



Test Pit no: TP10  Note: Upper uncontrolled fill exhibiting open structure.	Test Pit no: TP10  Note: Colluvium exhibiting open structure.
Test Pit no: TP10  Note: Fissured surfaces present in lower residual shale.	Test Pit no: TP10  Note: Excavated and tested lower residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP11  Note: Soil profile down to 2.90mbgl.	Test Pit no: TP11  Note: Upper alluvium.
Test Pit no: TP11  Note: Lower alluvium.	Test Pit no: TP11  Note: Lower highly weathered shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP12  Note: Soil profile down to 0.95mbgl.	Test Pit no: TP12  Note: Upper reworked completely weathered shale.
Test Pit no: TP12  Note: Lower moderately weathered shale.	Test Pit no: TP12  Note: Excavated and test shale rock.

Test Pit no: TP13



Note: Soil profile down to 1.30mbgl.

Test Pit no: TP13



Note: Upper colluvium.

Test Pit no: TP13



Note: Lower reworked completely weathered shale.

Test Pit no: TP13



Note: Lower moderately weathered shale.

Test Pit no: TP14



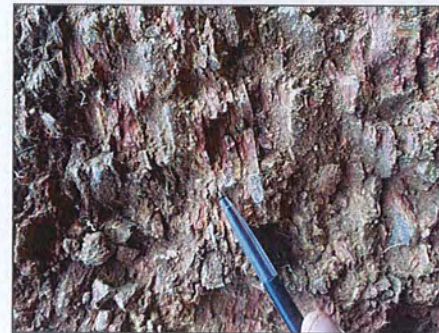
Note: Soil profile down to 2.80mbgl.

Test Pit no: TP14



Note: Upper colluvium.

Test Pit no: TP14



Note: Reworked residual shale.

Test Pit no: TP14



Note: Shales dipping in a northerly direction.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP15  Note: Soil profile down to 2.30mbgl.	Test Pit no: TP15  Note: Excavated lower shale.
Test Pit no: TP15  Note: Lower highly weathered shale.	Test Pit no: TP15  Note: Shales dipping in a northerly direction.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP16  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP16  Note: Lower reworked residual shale exhibiting open structure.
Test Pit no: TP16  Note: Pinnacle in trial pit face	Test Pit no: TP16  Note: Lower reworked residual shale.

Test Pit no: TP17  Note: Soil profile down to 3.30mbgl.	Test Pit no: TP17  Note: Upper slightly ferruginised colluvium.
Test Pit no: TP17  Note: Upper slightly ferruginised colluvium.	Test Pit no: TP17  Note: Fissured surfaces exhibited by lower residual shale.

Test Pit no: TP18  Note: Soil profile down to 3.30mbgl.	Test Pit no: TP18  Note: Upper colluvium.
Test Pit no: TP18  Note: Lower completely weathered shale.	Test Pit no: TP18  Note: Excavated shale material.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

Test Pit no: TP19  Note: Soil profile down to 3.30mbgl.	Test Pit no: TP19  Note: Upper colluvium.
Test Pit no: TP19  Note: Lower moderately to completely weathered shale.	Test Pit no: TP19  Note: Excavated shale material.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

Test Pit no: TP20  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP20  Note: Upper colluvium.
Test Pit no: TP20  Note: Reworked completely weathered shale.	Test Pit no: TP20  Note: Excavated lower shale material with wet joint faces.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

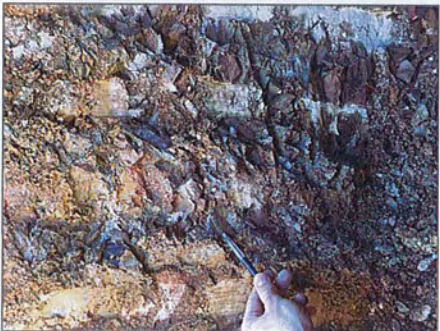
Test Pit no: TP21  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP21  Note: Residual shale with ferricrete nodules and calcrete concretions.
Test Pit no: TP21  Note: Residual shale exhibiting fissured surfaces.	Test Pit no: TP21  Note: Lower shale dipping in a northerly direction with water seepage present.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

Test Pit no: TP22  Note: Soil profile down to 1.80mbgl.	Test Pit no: TP22  Note: Upper colluvium.
Test Pit no: TP22  Note: Lower shale dipping in a northerly direction.	Test Pit no: TP22  Note: Excavated lower shale material.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



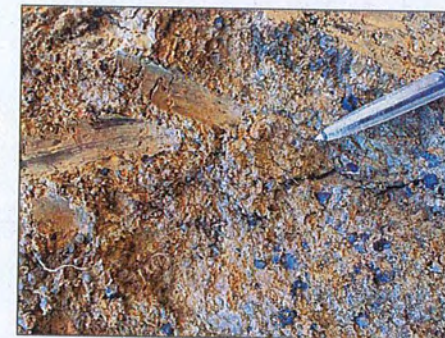
Test Pit no: TP23  Note: Reworked residual shale.	Test Pit no: TP23  Note: Excavated reworked residual shale.
Test Pit no: TP23  Note: Lower slightly weathered shale.	Test Pit no: TP23  Note: Excavated slightly weathered shale.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



Test Pit no: TP24  Note: Soil profile down to 1.80mbgl.	Test Pit no: TP24  Note: Upper colluvium.
Test Pit no: TP24  Note: Reworked residual shale.	Test Pit no: TP24  Note: Lower moderately weathered shale.

Test Pit no: TP25  Note: Soil profile down to 3.40mbgl.	Test Pit no: TP25  Note: Upper colluvium exhibiting open structure.
Test Pit no: TP25  Note: Lower residual shale exhibiting fissured structure.	Test Pit no: TP25  Note: Lower residual shale possesses plasticity.

Test Pit no: TP26  Note: Soil profile down to 2.40mbgl.	Test Pit no: TP26  Note: Upper slightly ferruginised colluvium.
Test Pit no: TP26  Note: Lower reworked residual shale.	Test Pit no: TP26  Note: Lower moderately to highly weathered shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1



Test Pit no: TP27



Note: Excavated upper uncontrolled fill.

Test Pit no: TP27



Note: Upper uncontrolled fill exhibiting open structure.

Test Pit no: TP27



Note:

Test Pit no: TP27

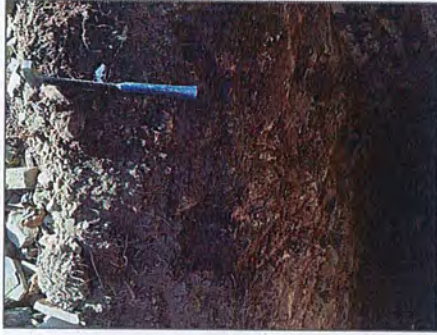


Note: Excavated lower moderately to slightly weathered shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1



Test Pit no: TP28



Note: Soil profile down to 2.50mbgl.

Test Pit no: TP28



Note: Upper uncontrolled fill.

Test Pit no: TP28



Note: Upper disturbed ground.

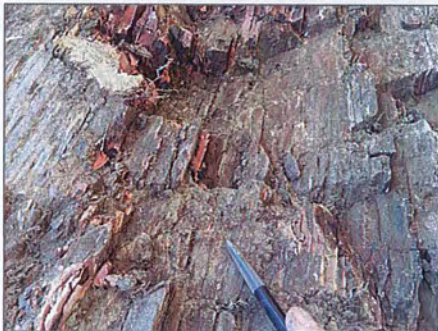
Test Pit no: TP28



Note: Lower slightly weathered shale.

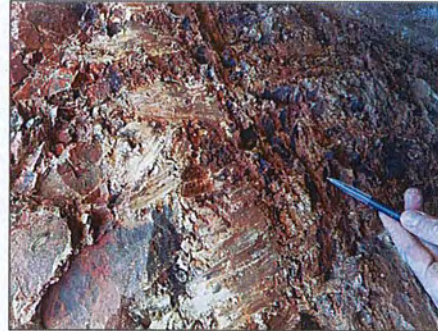
Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

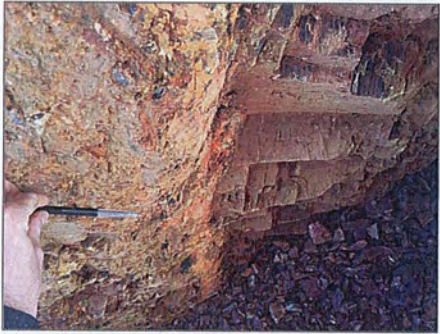


Test Pit no: TP29 	Test Pit no: TP29 
Note: Soil profile down to 1.50mbgl.	Note: Upper disturbed ground.
Test Pit no: TP29 	Test Pit no: TP29 
Note: Lower moderately to slightly weathered shale.	Note: Excavated lower slightly weathered shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1



Test Pit no: TP30 	Test Pit no: TP30 
Note: Soil profile down to 3.00mbgl.	Note: Upper reworked completely weathered shale.
Test Pit no: TP30 	Test Pit no: TP30 
Note: Bands of clayey sand in lower slightly to highly weathered shale.	Note: Different degrees of weathering in shale layers.

Test Pit no: TP31  Note: Soil profiles down to 3.00mbgl.	Test Pit no: TP31  Note: Different degrees of weathering in shale layers.
Test Pit no: TP31  Note: Excavated completely weathered shale material.	Test Pit no: TP31  Note: Excavated highly to completely weathered shale.

Test Pit no: TP32  Note: Excavated and tested upper ferruginised material.	Test Pit no: TP32  Note: Typical weakly to moderately weathered ferricrete concretions.
Test Pit no: TP32  Note: Excavated and tested reworked residual shale.	Test Pit no: TP32  Note: Plasticity exhibited by reworked residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP33  Note: Soil profile down to 0.60mbgl.	Test Pit no: TP33  Note: Upper uncontrolled fill.
Test Pit no: TP33  Note: Lower asphalt layer.	Test Pit no: TP33  Note: Lower cemented coarse aggregate.

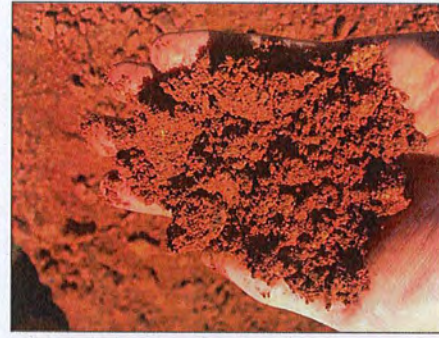
Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP34  Note: Soil profile down to 3.20mbgl.	Test Pit no: TP34  Note: Upper uncontrolled fill.
Test Pit no: TP34  Note: Disturbed ground exhibiting open structure.	Test Pit no: TP34  Note: Lower residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP35  Note: Soil profile down to 2.00mbgl.	Test Pit no: TP35  Note: Upper uncontrolled fill.
Test Pit no: TP35  Note: Colluvium exhibiting open structure.	Test Pit no: TP35  Note: Lower ferruginised pebble marker.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP36  Note: Upper ferruginised residual shale..	Test Pit no: TP36  Note: Lower residual shale.
Test Pit no: TP36  Note: Excavated ferruginised residual shale material.	Test Pit no: TP36  Note: Excavated and tested lower residual shale.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

Test Pit no: TP37  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP37  Note: Upper reworked shale material.
Test Pit no: TP37  Note: Highly to completely weathered shale.	Test Pit no: TP37  Note: Excavated and tested lower shale material.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

Test Pit no: TP38  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP38  Note: Upper reworked shale material.
Test Pit no: TP38  Note: Different degrees of weathering of shale layers.	Test Pit no: TP38  Note: Different degrees of weathering of shale layers.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP39  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP39  Note: Jointed structure exhibited residual shale.
Test Pit no: TP39  Note: Excavated lower residual shale.	Test Pit no: TP39  Note: Excavated residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP40  Note: Soil profile down to 1.77mbgl.	Test Pit no: TP40  Note: Upper uncontrolled fill exhibiting open structure.
Test Pit no: TP40  Note: Lower slightly to highly weathered shale.	Test Pit no: TP40  Note: Excavated lower slightly to highly weathered shale material.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



Test Pit no: TP41



Note: Soil profile to 3.10mbgl.

Test Pit no: TP41



Note: Completely to highly weathered shale.

Test Pit no: TP41



Note: Upper uncontrolled fill.

Test Pit no: TP41



Note: Lower highly weathered shale.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



Test Pit no: TP42



Note: Soil profile down to 3.30mbgl.

Test Pit no: TP42



Note: Different degrees of weathering in shale layers.

Test Pit no: TP42



Note: Different degrees of weathering in shale layers.

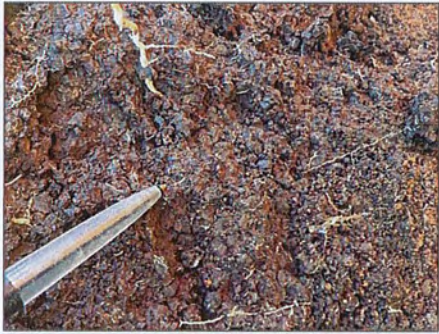
Test Pit no: TP42



Note: Excavated lower shale material.

Test Pit no: TP43  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP43  Note: Open structure exhibited by upper disturbed ground.
Test Pit no: TP43  Note: Lower residual diabase.	Test Pit no: TP43  Note: Excavated residual diabase.

Test Pit no: TP44  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP44  Note: Upper colluvium.
Test Pit no: TP44  Note: Excavated and tested colluvium.	Test Pit no: TP44  Note: Lower residual diabase.

Test Pit no: TP45  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP45  Note: Upper colluvium.
Test Pit no: TP45  Note: Lower residual shale material.	Test Pit no: TP45  Note: Plasticity exhibited by lower clay material.

Test Pit no: TP46  Note: Excavated lower residual shale material.	Test Pit no: TP46  Note: Fissured structure exhibited by lower residual shale.
Test Pit no: TP46  Note: Upper reworked residual shale.	Test Pit no: TP46  Note: Ferricrete nodules present in residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP47  Note: Soil profile down to 2.50mbgl.	Test Pit no: TP47  Note: Upper colluvium.
Test Pit no: TP47  Note: Different degrees of weathering in shale layers.	Test Pit no: TP47  Note: Lower highly weathered shale

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP48  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP48  Note: Upper colluvium.
Test Pit no: TP48  Note: Excavated and tested colluvium.	Test Pit no: TP48  Note: Lower residual diabase.

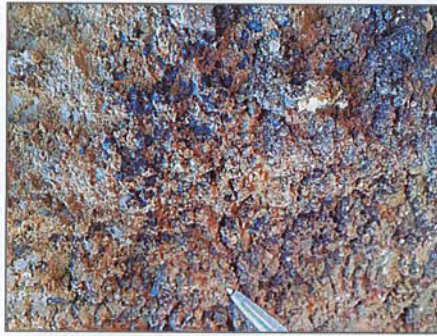
Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP49



Note: Soil profile down to 2.70mbgl.

Test Pit no: TP49



Note: Upper colluvium.

Test Pit no: TP49



Note: Reworked residual shale.

Test Pit no: TP49



Note: Lower residual shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP50



Note: Soil profile down to 3.00mbgl.

Test Pit no: TP50



Note: Upper reworked residual shale.

Test Pit no: TP50



Note: Lower slightly to highly weathered shale.

Test Pit no: TP50



Note: Lower slightly to highly weathered shale.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP51



Note: Soil profile down to 1.75mbgl

Test Pit no: TP51



Note: Upper reworked shale material.

Test Pit no: TP51



Note: Lower shale material.

Test Pit no: TP51



Note: Excavated shale material.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP52



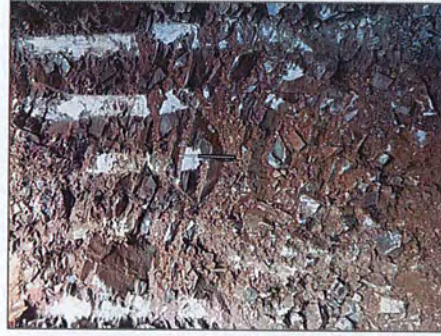
Note: Soil profile down to 2.60mbgl.

Test Pit no: TP52



Note: Upper colluvium.

Test Pit no: TP52



Note: Lower highly weathered shale.

Test Pit no: TP52



Note: Lower highly weathered shale.

Test Pit no: TP53



Note: Soil profile down to 3.10m bgl.

Test Pit no: TP53



Note: Excavated reworked residual shale material.

Test Pit no: TP53



Note: Lower completely weathered shale.

Test Pit no: TP53



Note: Lower completely weathered shale.

Test Pit no: TP54



Note: Soil profile down to 3.30m bgl.

Test Pit no: TP54



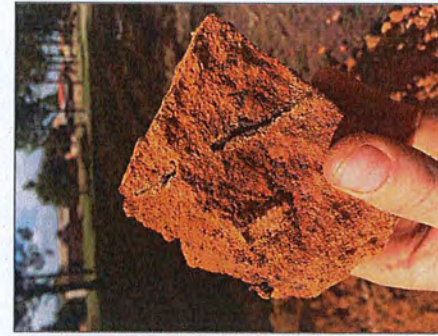
Note: Excavated diabase material.

Test Pit no: TP54



Note: Excavated and tested residual diabase.

Test Pit no: TP54

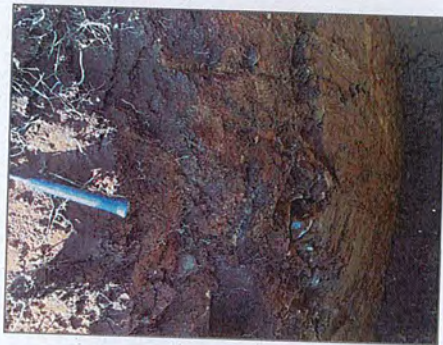


Note: Lower excavated diabase material.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



Test Pit no: TP55



Note: Soil profile down to 3.30mgbl.

Test Pit no: TP55



Note: Upper colluvium.

Test Pit no: TP55



Note: Excavated and tested colluvium.

Test Pit no: TP55



Note: Lower residual diabase.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



Test Pit no: TP56



Note: Soil profile down to 1.00mbgl.

Test Pit no: TP56



Note: Lower shale material.

Test Pit no: TP56



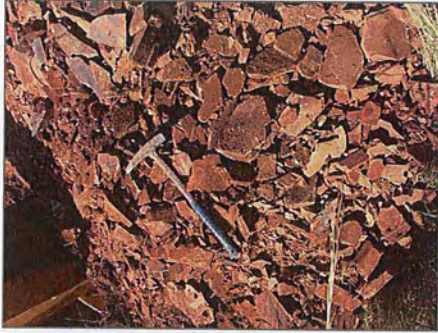
Note: Upper reworked shale material.

Test Pit no: TP56

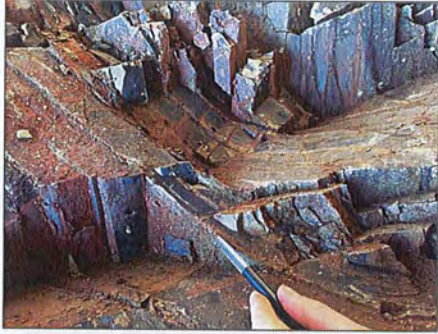


Note: Lower shale material.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP57  Note: Soil profile down to 2.70mbgl.	Test Pit no: TP57  Note: Upper reworked residual shale.
Test Pit no: TP57  Note: Lower shale material.	Test Pit no: TP57  Note: Excavated lower shale material.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP58  Note: Soil profile down to 3.30mbgl.	Test Pit no: TP58  Note: Upper reworked residual shale..
Test Pit no: TP58  Note: Lower shale material.	Test Pit no: TP58  Note: Lower shale material.

Test Pit no: TP59  Note: Soil profile down to 3.30mbgl.	Test Pit no: TP59  Note: Upper colluvium.
Test Pit no: TP59  Note: Reworked residual shale.	Test Pit no: TP59  Note: Lower residual diabase.

Test Pit no: TP60  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP60  Note: Upper colluvium.
Test Pit no: TP60  Note: Lower residual shale.	Test Pit no: TP60  Note: Lower residual shale exhibiting fissured structure.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP61



Note: Soil profile down to 2.70mbgl.

Test Pit no: TP61



Note: Upper reworked shale.

Test Pit no: TP61



Note: Lower shale with expected sidewall instabilities on north facing face.

Test Pit no: TP61



Note: Lower shale material.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP62



Note: Soil profile down to 2.80mbgl.

Test Pit no: TP62



Note: Excavated and tested alluvium.

Test Pit no: TP62

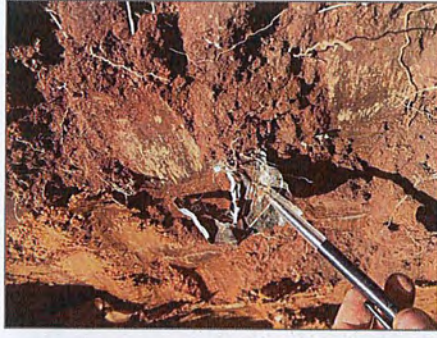


Note: Residual shale.

Test Pit no: TP62



Note: Lower shale material.

Test Pit no: TP63  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP63  Note: Upper disturbed ground.
Test Pit no: TP63  Note: Lower residual clay exhibiting fissured structure.	Test Pit no: TP63  Note: Lower residual shale.

Test Pit no: TP64  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP64  Note: Upper colluvium
Test Pit no: TP64  Note: Upper colluvium.	Test Pit no: TP64  Note: Upper colluvium exhibiting plasticity.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP65  Note: Soil profile down to 3.00mbgl.	Test Pit no: TP65  Note: Upper colluvium.
Test Pit no: TP65  Note: Lower shale material.	Test Pit no: TP65  Note: Lower shale material.

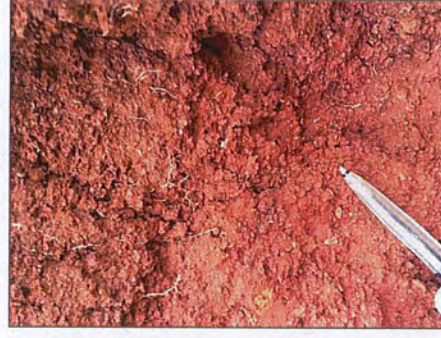
Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP66  Note: Lower shale material.	Test Pit no: TP66  Note: Lower shale material.
Test Pit no: TP66  Note: Upper colluvium.	Test Pit no: TP66  Note: Upper roots present.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP67  Note: Soil profile down to 1.80mbgl.	Test Pit no: TP67  Note: Upper profile.
Test Pit no: TP67  Note: Lower shale material.	Test Pit no: TP67  Note: Excavated lower shale material.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

Test Pit no: TP68  Note: Soil profile down to 3.10mbgl.	Test Pit no: TP68  Note: Upper uncontrolled fill.
Test Pit no: TP68  Note: Upper colluvium.	Test Pit no: TP68  Note: Lower shale material.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1



Tractor Loader Backhoe



Note: CAT 428F TLB used during the site investigation.

Tractor Loader Backhoe



Note: CAT 428F TLB used during the site investigation.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1



TP02



Note: Typical site conditions. Photograph was taken in a south-westerly direction.

TP03



Note: Typical site conditions. Photograph was taken in a westerly direction, west of TP03

TP04



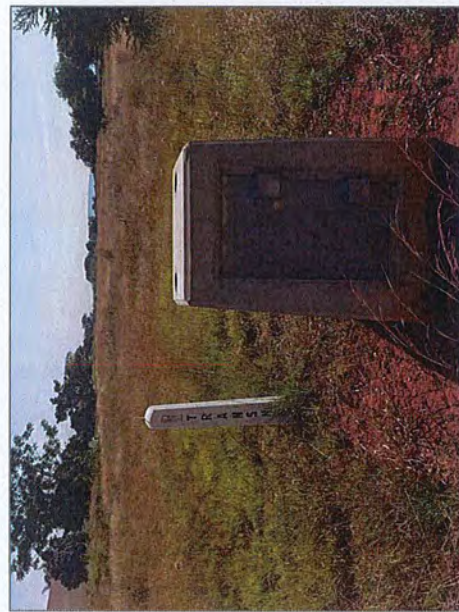
Note: Typical fill material found on site. Photograph taken south of TP04.

TP07



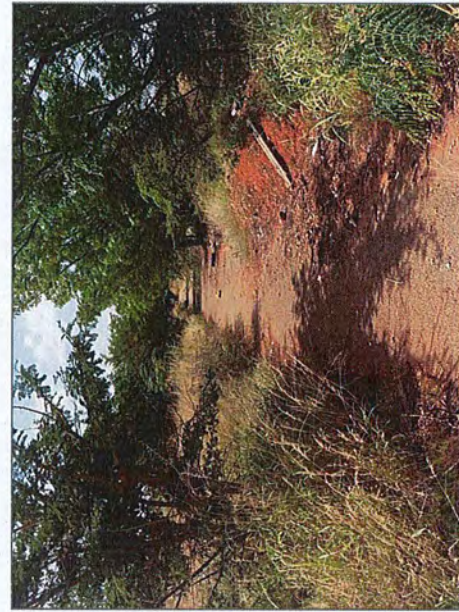
Note: Typical fill material found on site.

TP06



Note: Transnet pipeline markers present on site.

TP07



Note: Paved surfaces covered by uncontrolled fill material associated with illegal dumping.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



TP10



Note: Typical site conditions. Photograph taken of drainage ditch south of TP10.

TP12



Note: Typical site conditions. Photograph taken in a south-westerly direction northwest of TP12.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1



TP13



Note: Typical on site conditions around paved surface areas. Photograph taken north of TP13. Uncontrolled fill material associated with illegal dumping.

TP13



Note: Typical fill material found on site.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

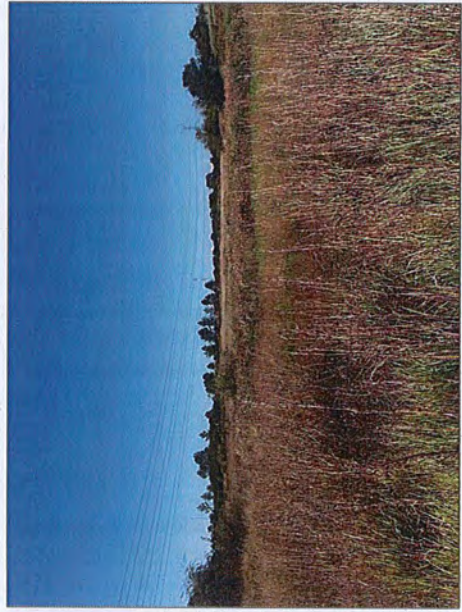


TP20



Note: Typical on site conditions. Photograph taken in a westerly direction, east of TP20.

TP22

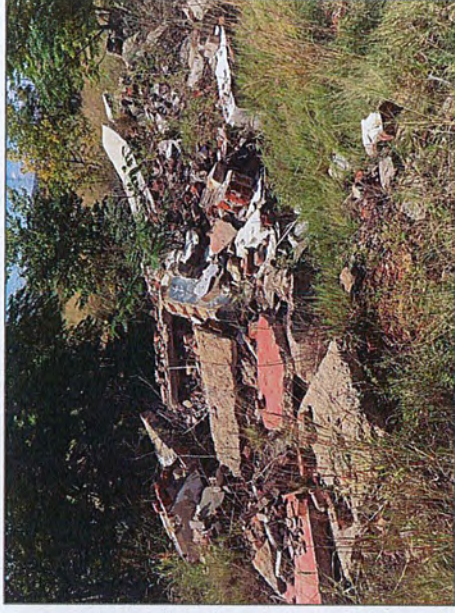


Note: Typical on site conditions. Photograph taken in an easterly direction, west of TP22.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

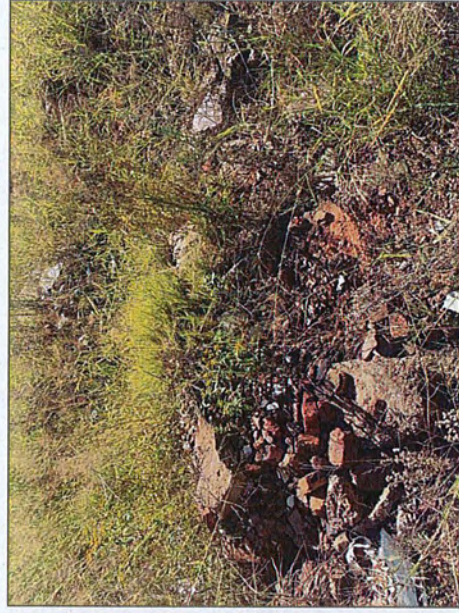


TP29



Note: Typical fill material found on site. Area around TP29 is intensely covered by uncontrolled fill.

TP30



Note: Typical fill material found on site. Majority of fill on site has been overgrown by vegetation.

Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

TP33



Note: Typical fill material found on site.

TP34



Note: Typical site conditions. Photograph taken in a south easterly direction, north of TP34.

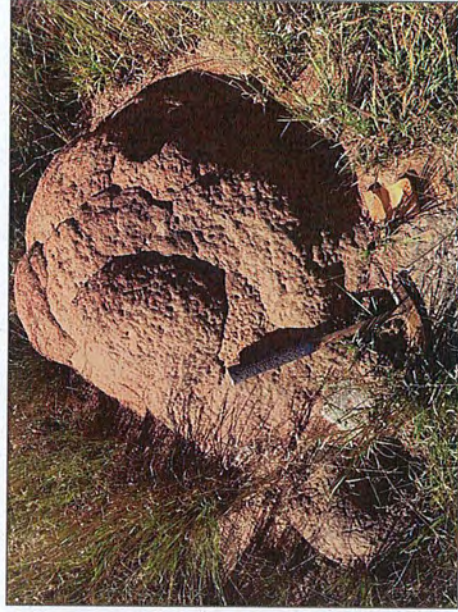
Project reference number: RS18056
Project name: Silvertown Industrial Phase 1

TP37



Note: Typical site conditions. Photograph was taken in a westerly direction, south of TP37.

TP37



Note: Typical size of termite mounds found scattered across site.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

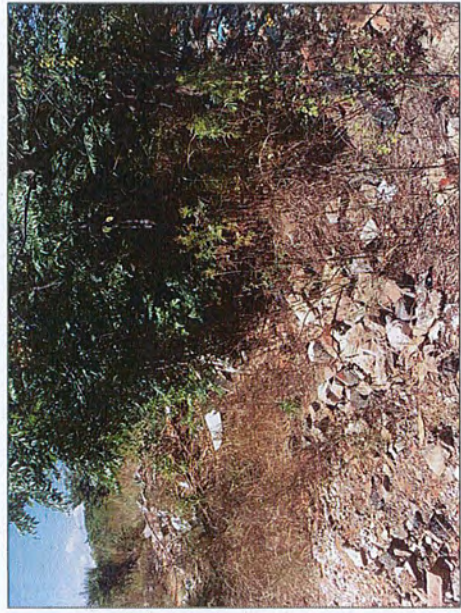


TP41



Note: Typical site conditions. Paved areas adjacently covered with thick superficial uncontrolled fill.

TP41



Note: Typical site conditions. Area around TP41 intensely covered by thick superficial uncontrolled fill.

Project reference number: RS18056
Project name: Silverton Industrial Phase 1

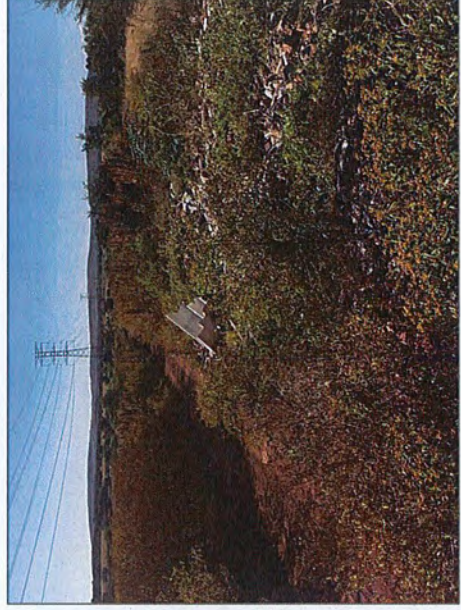


TP44



Note: Typical site conditions. Photograph taken in a north-easterly direction, north of TP44.

TP48



Note: Typical site conditions. Area around TP48 intensely covered by thick superficial uncontrolled fill.

TP54



Note: Typical site conditions. Photograph taken in a south-westerly direction, west of TP54.

TP56



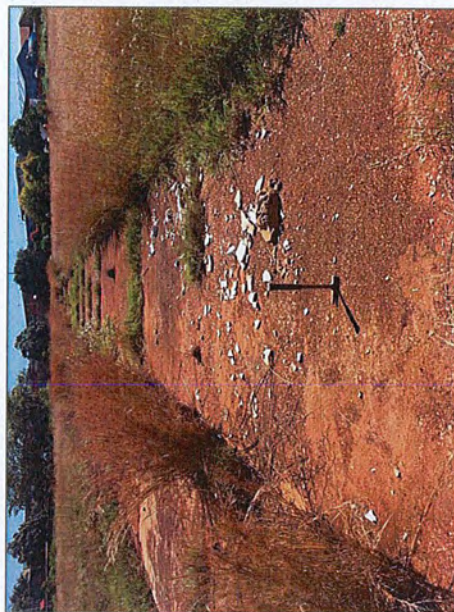
Note: Typical site conditions. Photograph taken in a south-westerly direction, west of TP56

TP60



Note: Typical site conditions. Photograph taken in a northerly direction, north east of TP60.

TP66



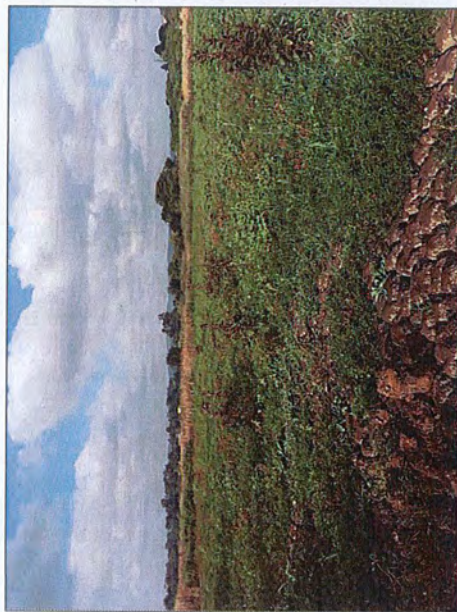
Note: Typical site conditions. Isolated paved surfaces exist in the north west portion of site.

Dam



Note: Seepage water exist on site surrounding the central dam area. Photograph taken east of the dam in a southerly direction.

Dam



Note: Typical site conditions within dam area. Photograph taken in a south-westerly direction.

Dam



Note: Typical fill material within dam area.

Dam



Note: Surface morphology typical of heaving. Photograph taken within the dam area.

Appendix D: Laboratory Test Results



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkle Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP01	TP02	TP03	Sample	TP01	TP02	TP03
Depth (m)	1.45 - 2.70	1.20 - 1.80	0.50 - 1.20	Depth (m)	1.45 - 2.70	1.20 - 1.80	0.50 - 1.20
Lab No	RSC-05-24	RSC-05-25	RSC-05-26	Lab No	RSC-05-24	RSC-05-25	RSC-05-26
53.0	100	100	100	Liquid Limit (%)	52	52	61
37.5	100	100	100	Plastic Limit (%)	25	23	26
26.5	86	98	100	Plasticity Index (%)	27	29	35
19.0	64	88	100	Linear Shrinkage (%)	13.0	14.5	24.5
13.2	58	88	100	PI of whole sample	5	22	22
9.5	51	88	100				
6.7	41	88	99	% Gravel	74	16	21
4.75	36	87	97	% Sand	15	41	33
2.00	26	84	79	% Silt	5	29	15
1.00	22	79	66	% Clay	6	14	31
0.425	20	76	62	Activity	4.5	2.1	1.1
0.250	19	73	58				
0.150	19	70	56	% Soil Mortar	26	84	79
0.075	16	63	54				
0.060	11	43	46	Grading Modulus	2.38	0.77	1.05
0.050	10	39	45	Moisture Content (%)	N / T	N / T	N / T
0.035	9	33	43	Relative Density (SG)*	2.857	2.79	2.75
0.020	9	28	41				
0.006	7	20	36	Unified (ASTM D2487)	GC	CH	CH
0.002	6	14	31	AASHTO (M145-91)	A - 2 - 7	A - 7 - 6	A - 7 - 6

Remarks: *: 2.857 & 2.79 Determined, 2.75 Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

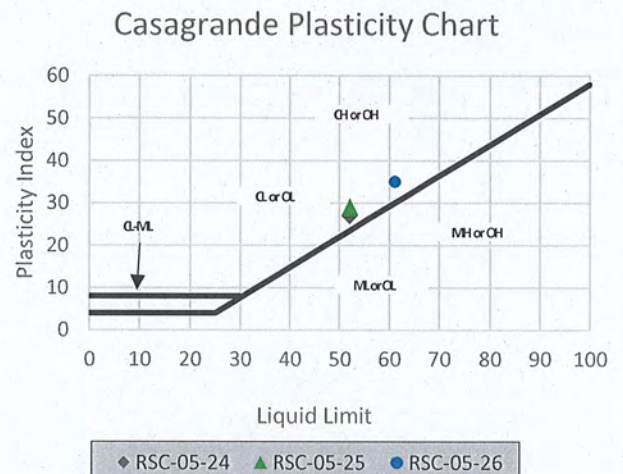
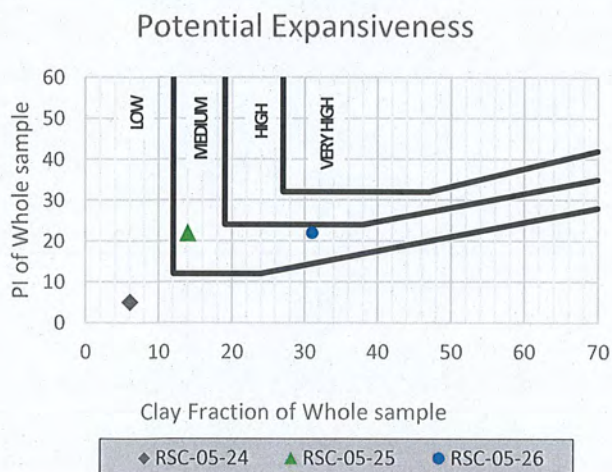
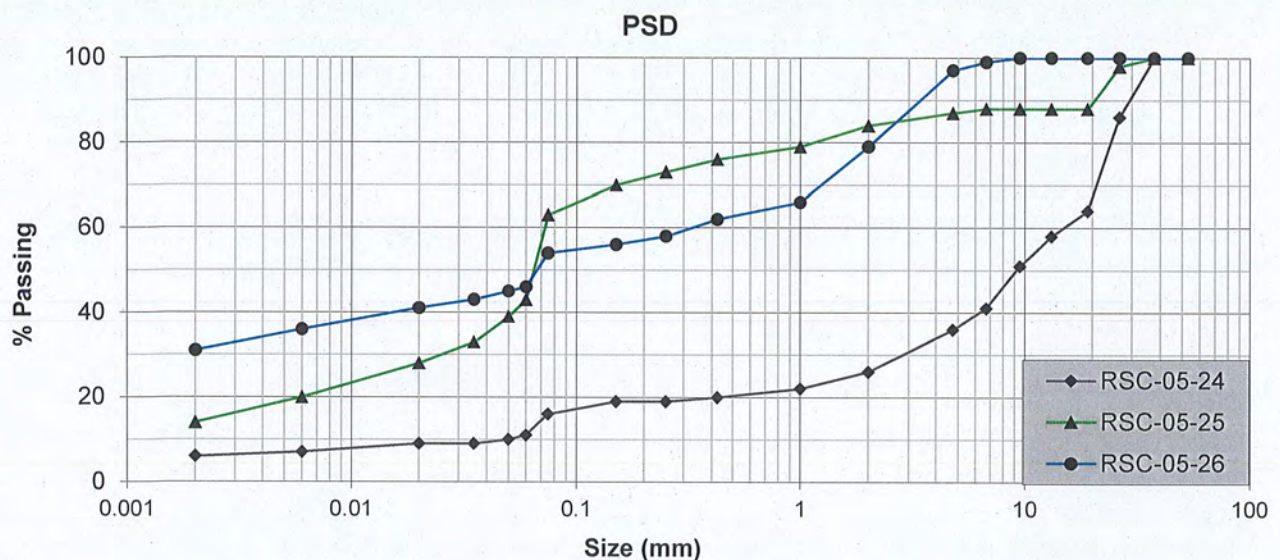
Gertie | 082 309 4448 | gertie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silvertown Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkle Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP04	TP04	TP06	Sample	TP04	TP04	TP06
Depth (m)	0.50 - 1.40	2.50 - 2.90	0.50 - 1.60	Depth (m)	0.50 - 1.40	2.50 - 2.90	0.50 - 1.60
Lab No	RSC-05-27	RSC-05-28	RSC-05-29	Lab No	RSC-05-27	RSC-05-28	RSC-05-29
53.0	100	100	100	Liquid Limit (%)	52	56	53
37.5	100	100	100	Plastic Limit (%)	25	27	25
26.5	100	100	100	Plasticity Index (%)	27	29	28
19.0	100	100	100	Linear Shrinkage (%)	13.0	14.5	13.5
13.2	100	100	100	PI of whole sample	16	15	20
9.5	99	100	100				
6.7	94	94	100	% Gravel	31	35	14
4.75	88	89	98	% Sand	24	25	31
2.00	69	65	86	% Silt	15	14	16
1.00	63	55	75	% Clay	30	26	39
0.425	61	53	71	Activity	0.9	1.1	0.7
0.250	60	51	69				
0.150	58	49	67	% Soil Mortar	69	65	86
0.075	55	48	64				
0.060	45	40	55	Grading Modulus	1.15	1.34	0.79
0.050	43	39	54	Moisture Content (%)	N / T	N / T	N / T
0.035	41	37	52	Relative Density (SG)*	2.875	2.75	2.886
0.020	38	35	48				
0.006	33	31	42	Unified (ASTM D2487)	CH	SC	CH
0.002	30	26	39	AASHTO (M145-91)	A - 7 - 6	A - 7 - 6	A - 7 - 6

Remarks: *: 2.875 & 2.886 Determined, 2.75 Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

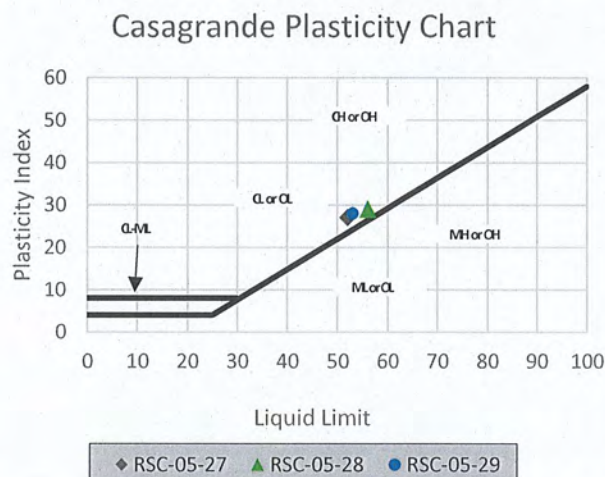
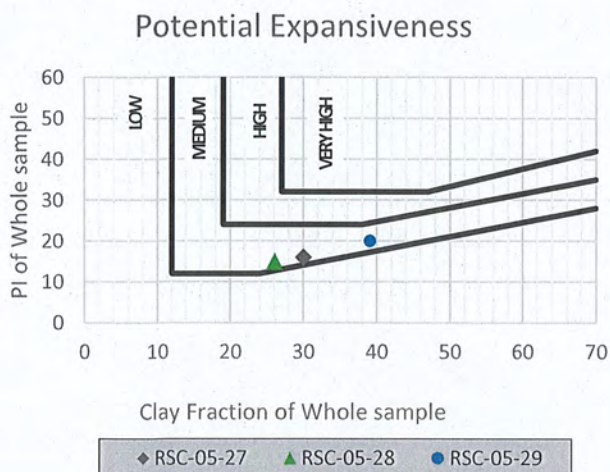
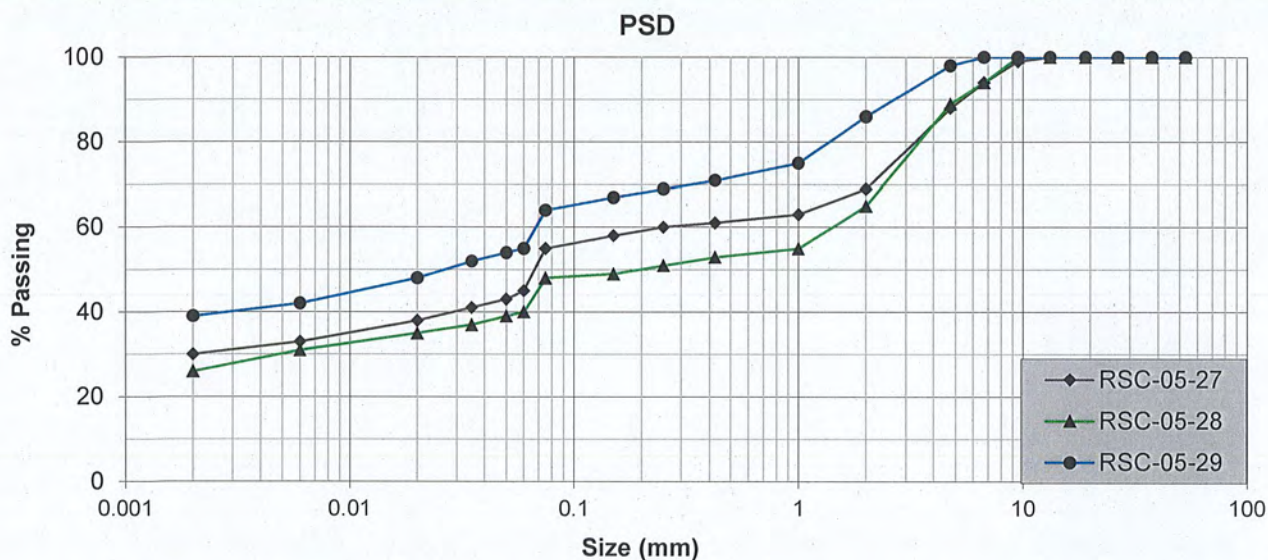
Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP07	TP09	TP10	Sample	TP07	TP09	TP10
Depth (m)	1.10 - 1.80	0.35 - 1.30	2.00 - 2.50	Depth (m)	1.10 - 1.80	0.35 - 1.30	2.00 - 2.50
Lab No	RSC-05-30	RSC-05-32	RSC-05-33	Lab No	RSC-05-30	RSC-05-32	RSC-05-33
53.0	100	100	100	Liquid Limit (%)	60	48	56
37.5	100	100	100	Plastic Limit (%)	28	22	25
26.5	100	100	100	Plasticity Index (%)	32	26	31
19.0	100	100	100	Linear Shrinkage (%)	23.5	12.5	22.5
13.2	100	100	100	PI of whole sample	26	15	25
9.5	99	96	100				
6.7	98	91	99	% Gravel	11	32	11
4.75	96	85	98	% Sand	23	26	28
2.00	89	68	89	% Silt	20	14	16
1.00	85	63	84	% Clay	46	28	45
0.425	82	58	80	Activity	0.7	0.9	0.7
0.250	80	55	74				
0.150	78	53	72	% Soil Mortar	89	68	89
0.075	76	51	69				
0.060	66	42	61	Grading Modulus	0.53	1.23	0.62
0.050	65	41	60	Moisture Content (%)	N / T	N / T	N / T
0.035	61	38	58	Relative Density (SG)*	2.75	2.682	2.75
0.020	58	36	55				
0.006	50	31	50	Unified (ASTM D2487)	CH	CL	CH
0.002	46	28	45	AASHTO (M145-91)	A - 7 - 6	A - 7 - 6	A - 7 - 6

Remarks: *: 2.682 Determined, 2.75 Assumed
N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

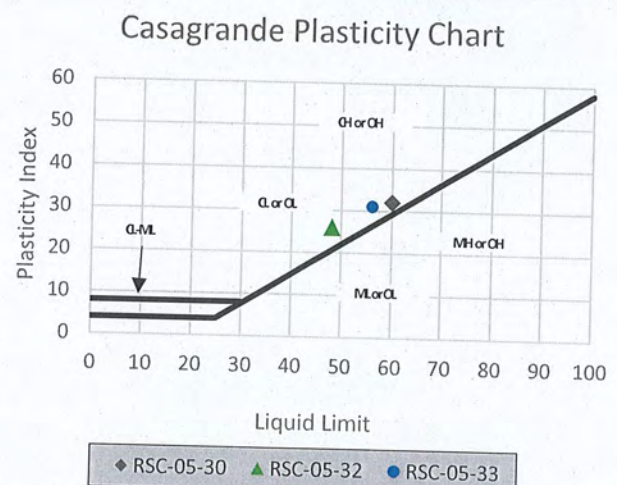
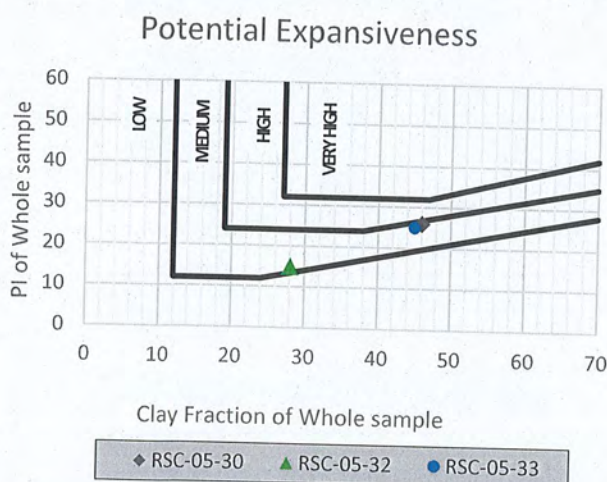
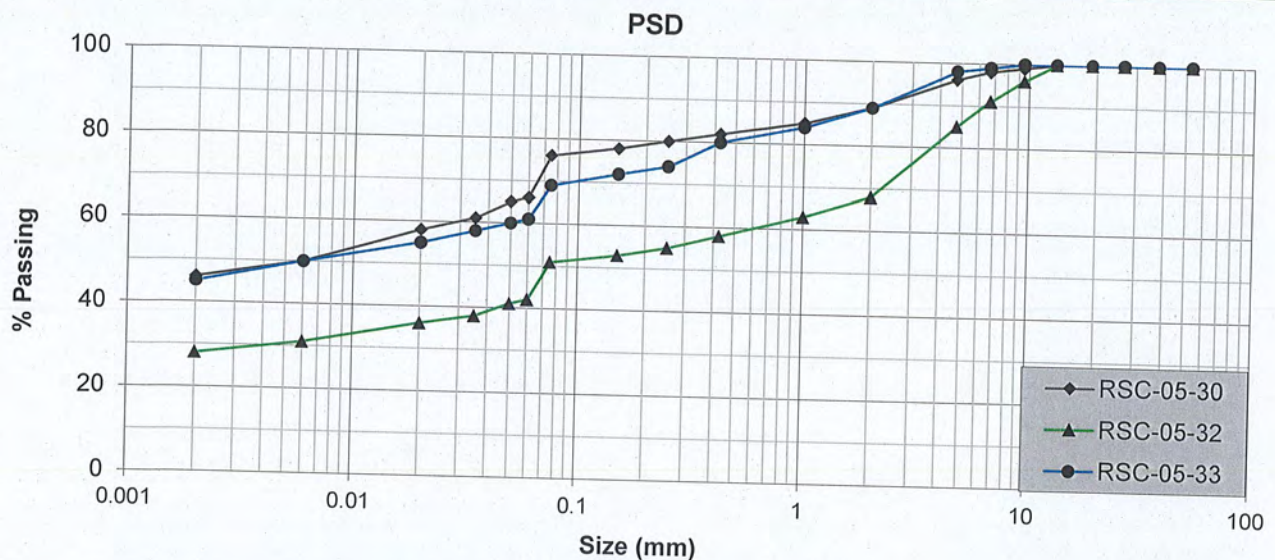
Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrit | 082 309 4448 | gerrit@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP11	TP12	TP17	Sample	TP11	TP12	TP17
Depth (m)	0.90 - 1.20	0.30 - 0.95	1.80	Depth (m)	0.90 - 1.20	0.30 - 0.95	1.80
Lab No	RSC-05-34	RSC-05-35	RSC-05-36	Lab No	RSC-05-34	RSC-05-35	RSC-05-36
53.0	100	83	100	Liquid Limit (%)	56	33	72
37.5	100	70	100	Plastic Limit (%)	23	16	35
26.5	100	59	100	Plasticity Index (%)	33	17	37
19.0	100	50	100	Linear Shrinkage (%)	23.5	8.5	25.0
13.2	100	47	100	PI of whole sample	13	3	30
9.5	99	41	100				
6.7	97	34	99	% Gravel	45	78	9
4.75	92	31	99	% Sand	26	13	24
2.00	55	22	91	% Silt	7	4	17
1.00	45	20	85	% Clay	22	5	50
0.425	40	17	82	Activity	1.5	3.4	0.7
0.250	37	15	80				
0.150	36	14	78	% Soil Mortar	55	22	91
0.075	34	13	76				
0.060	29	9	67	Grading Modulus	1.71	2.48	0.51
0.050	28	9	66	Moisture Content (%)	N / T	N / T	N / T
0.035	26	8	64	Relative Density (SG)*	2.75	2.741	2.883
0.020	25	7	60				
0.006	23	6	55	Unified (ASTM D2487)	SC	GC	CH
0.002	22	5	50	AASHTO (M145-91)	A - 2 - 7	A - 2 - 6	A - 7 - 5

Remarks: *: 2.741 & 2.883 Determined, 2.75 Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkle Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

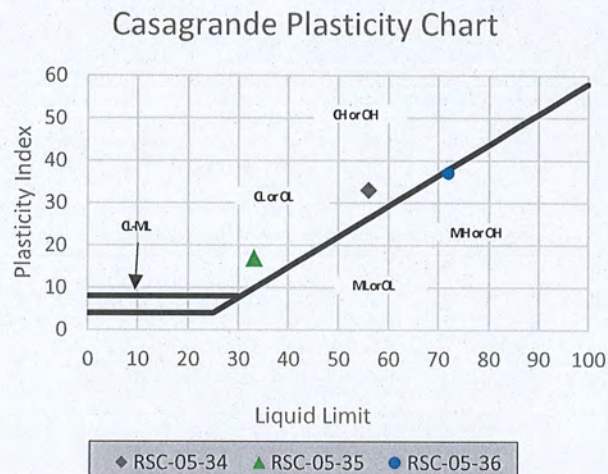
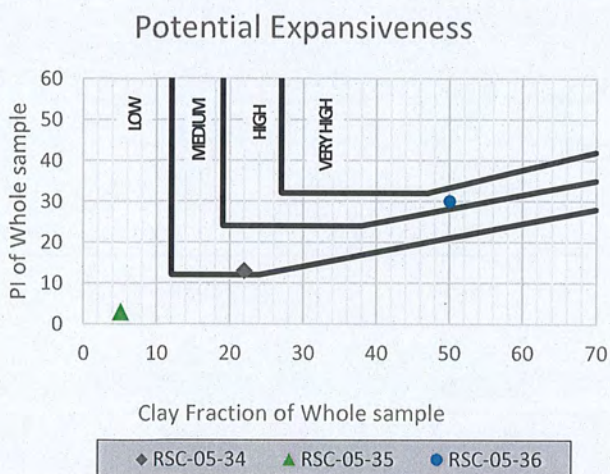
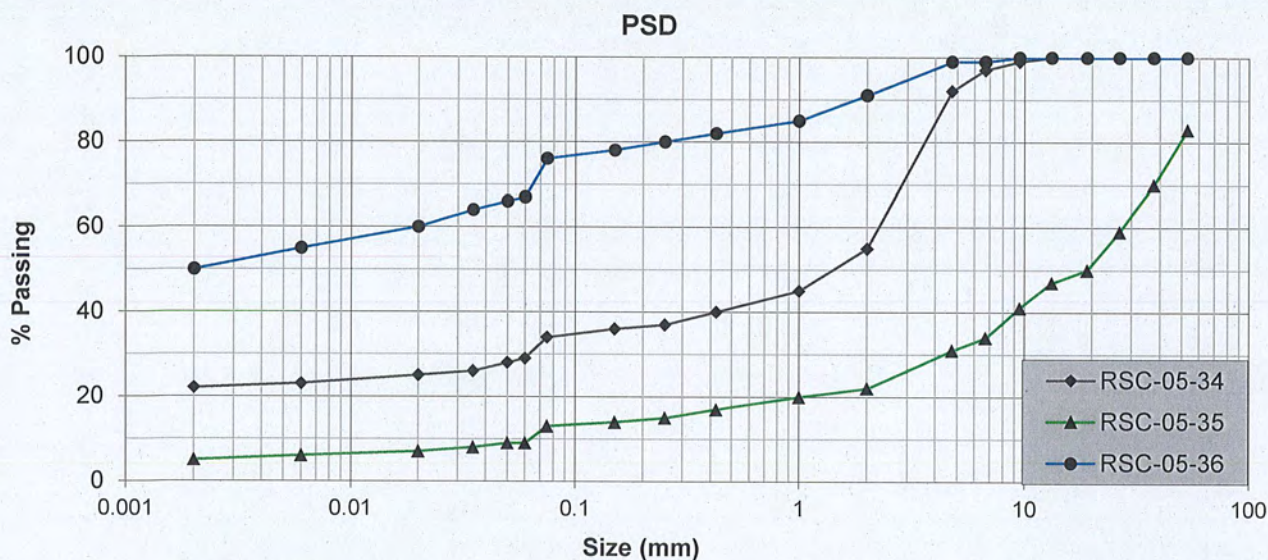
Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silvertown Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP17	TP22	TP25	Sample	TP17	TP22	TP25
Depth (m)	2.00 - 3.30	0.40 - 0.70	1.80 - 2.00	Depth (m)	2.00 - 3.30	0.40 - 0.70	1.80 - 2.00
Lab No	RSC-05-37	RSC-05-38	RSC-05-40	Lab No	RSC-05-37	RSC-05-38	RSC-05-40
53.0	100	100	100	Liquid Limit (%)	79	50	92
37.5	100	100	100	Plastic Limit (%)	38	23	45
26.5	100	100	100	Plasticity Index (%)	41	27	47
19.0	100	100	100	Linear Shrinkage (%)	28.5	13.5	30.0
13.2	100	100	100	PI of whole sample	39	25	45
9.5	100	100	100				
6.7	100	100	99	% Gravel	1	0	2
4.75	100	100	98	% Sand	20	43	15
2.00	99	100	98	% Silt	14	27	13
1.00	97	99	97	% Clay	65	30	70
0.425	94	91	96	Activity	0.6	0.9	0.7
0.250	91	85	95				
0.150	89	79	94	% Soil Mortar	99	100	98
0.075	88	68	92				
0.060	79	57	83	Grading Modulus	0.19	0.41	0.14
0.050	78	55	82	Moisture Content (%)	N / T	N / T	N / T
0.035	77	51	81	Relative Density (SG)*	2.75	2.75	2.75
0.020	74	45	78				
0.006	70	37	74	Unified (ASTM D2487)	CH	CH	MH
0.002	65	30	70	AASHTO (M145-91)	A - 7 - 5	A - 7 - 6	A - 7 - 5

Remarks: *: Assumed
N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkle Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

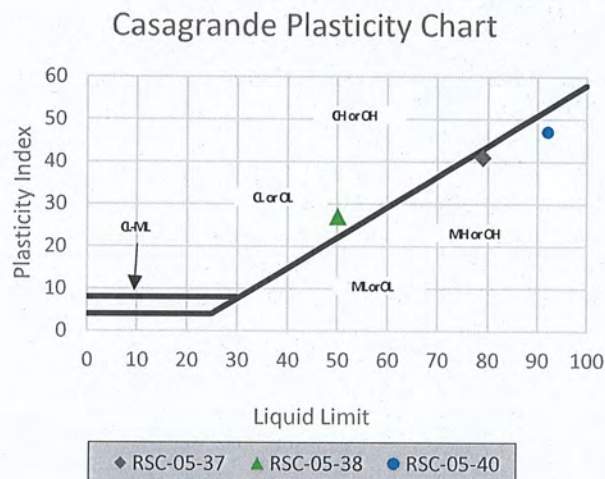
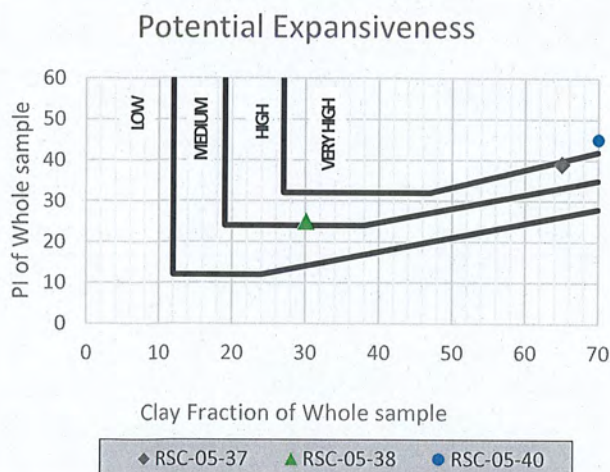
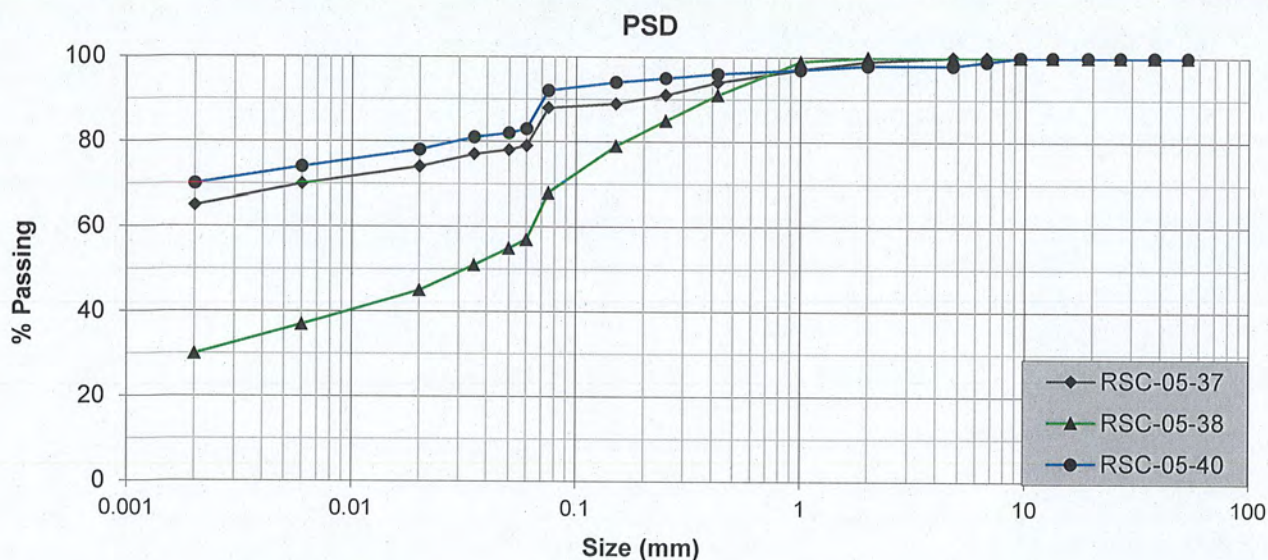
Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP26	TP30	TP31	Sample	TP26	TP30	TP31
Depth (m)	0.60 - 1.50	0.50 - 1.00	1.00 - 2.00	Depth (m)	0.60 - 1.50	0.50 - 1.00	1.00 - 2.00
Lab No	RSC-05-41	RSC-05-42	RSC-05-43	Lab No	RSC-05-41	RSC-05-42	RSC-05-43
53.0	100	92	100	Liquid Limit (%)	53	43	42
37.5	100	79	100	Plastic Limit (%)	27	19	20
26.5	100	69	100	Plasticity Index (%)	26	24	22
19.0	100	61	100	Linear Shrinkage (%)	12.0	11.0	10.5
13.2	100	55	100	PI of whole sample	13	6	6
9.5	91	54	65				
6.7	83	49	51	% Gravel	43	66	66
4.75	76	45	44	% Sand	20	19	22
2.00	57	34	34	% Silt	12	7	5
1.00	51	29	28	% Clay	25	8	7
0.425	49	26	25	Activity	1.0	3.0	3.1
0.250	46	23	22				
0.150	45	22	20	% Soil Mortar	57	34	34
0.075	44	20	19				
0.060	37	15	12	Grading Modulus	1.50	2.20	2.22
0.050	36	14	12	Moisture Content (%)	N / T	N / T	N / T
0.035	35	13	11	Relative Density (SG)*	2.75	2.758	2.75
0.020	32	12	10				
0.006	28	10	9	Unified (ASTM D2487)	SC	GC	GC
0.002	25	8	7	AASHTO (M145-91)	A - 7 - 6	A - 2 - 7	A - 2 - 7

Remarks: *: 2.758 Determined, 2.75 Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

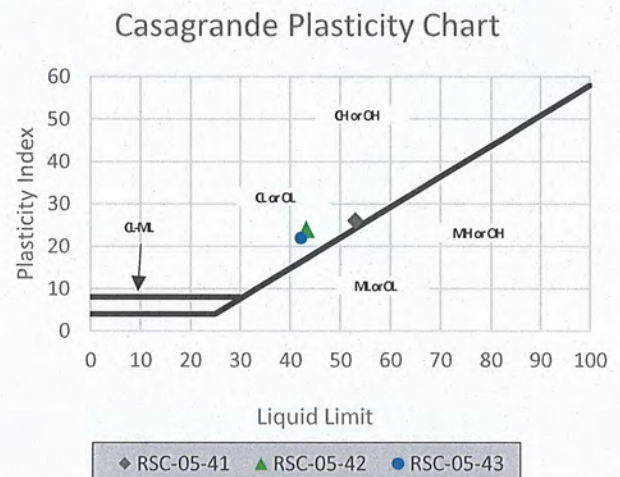
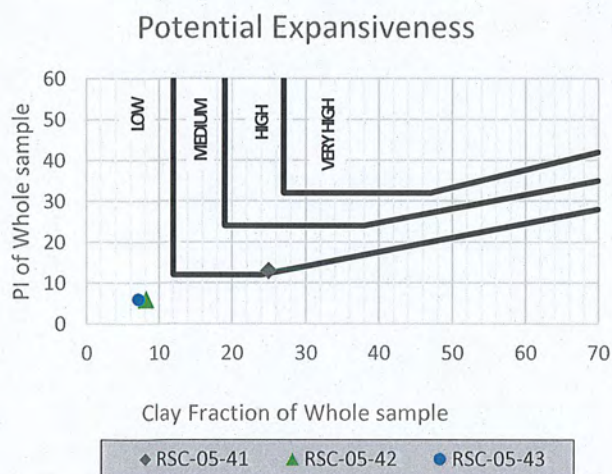
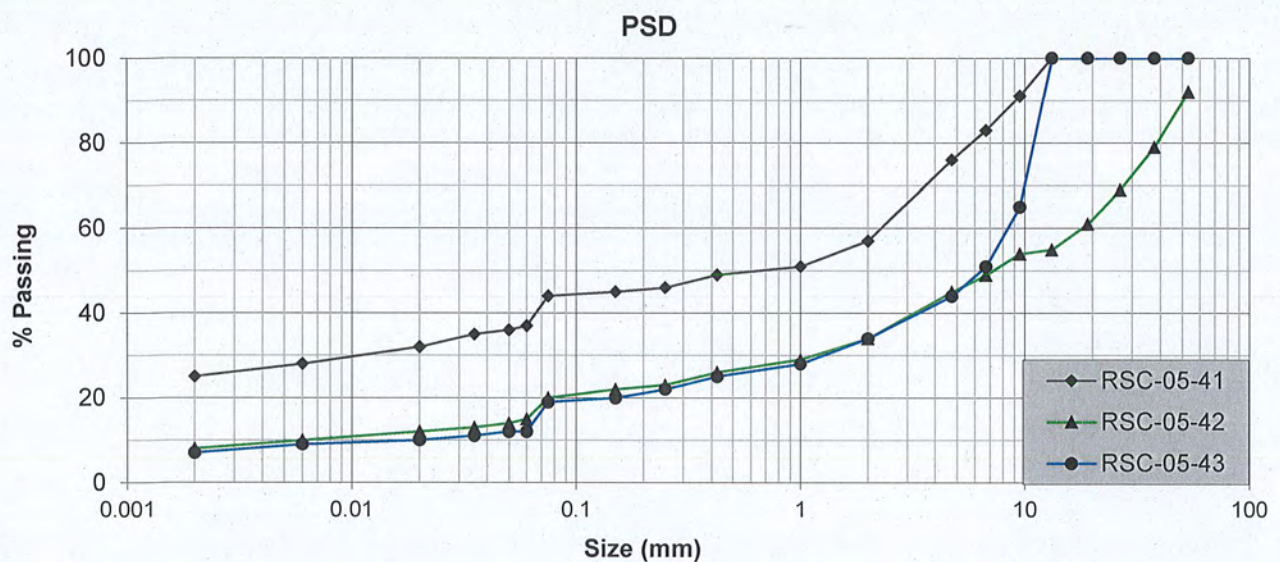
Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP32	TP32	TP32	Sample	TP32	TP32	TP32
Depth (m)	0.40 - 0.80	1.00 - 1.50	2.50 - 3.10	Depth (m)	0.40 - 0.80	1.00 - 1.50	2.50 - 3.10
Lab No	RSC-05-44	RSC-05-45	RSC-05-46	Lab No	RSC-05-44	RSC-05-45	RSC-05-46
53.0	100	100	100	Liquid Limit (%)	28	48	54
37.5	100	100	100	Plastic Limit (%)	14	22	27
26.5	100	100	100	Plasticity Index (%)	14	26	27
19.0	100	100	100	Linear Shrinkage (%)	7.0	12.5	12.0
13.2	100	100	100	PI of whole sample	7	17	14
9.5	99	100	89				
6.7	93	96	83	% Gravel	33	22	34
4.75	86	91	78	% Sand	44	35	34
2.00	67	78	66	% Silt	11	17	13
1.00	59	72	59	% Clay	12	26	19
0.425	49	67	53	Activity	1.2	1.0	1.4
0.250	39	60	49				
0.150	34	57	46	% Soil Mortar	67	78	66
0.075	29	53	42				
0.060	23	43	32	Grading Modulus	1.55	1.02	1.39
0.050	22	42	31	Moisture Content (%)	N / T	N / T	N / T
0.035	20	40	29	Relative Density (SG)*	2.75	2.75	2.75
0.020	17	37	25				
0.006	14	30	21	Unified (ASTM D2487)	SC	CL	SC
0.002	12	26	19	AASHTO (M145-91)	A - 2 - 6	A - 7 - 6	A - 7 - 6

Remarks: *: Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

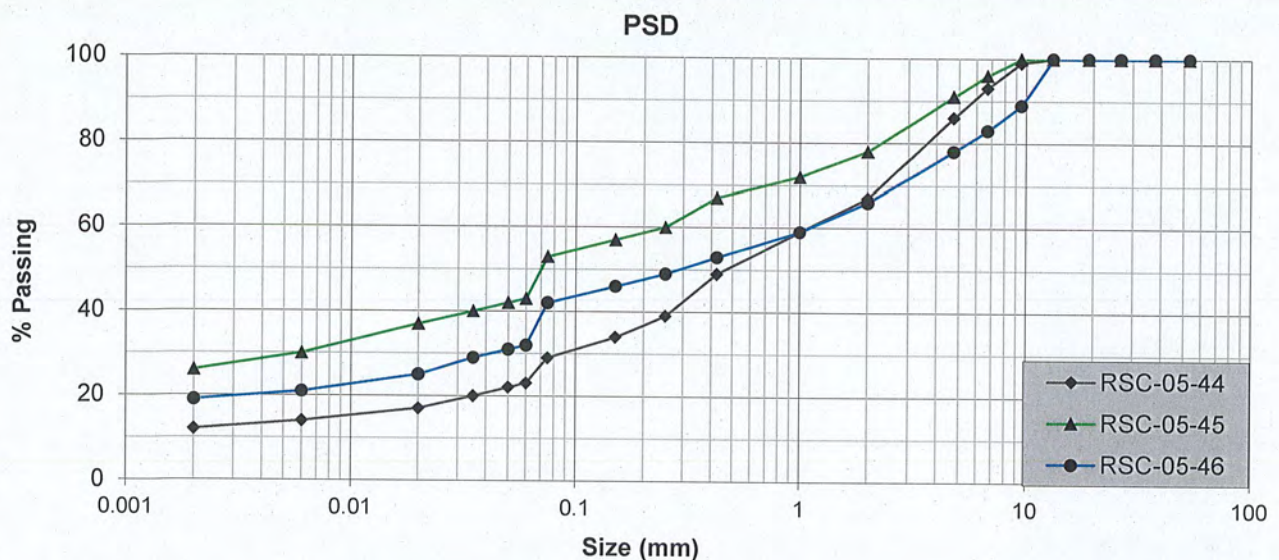
Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

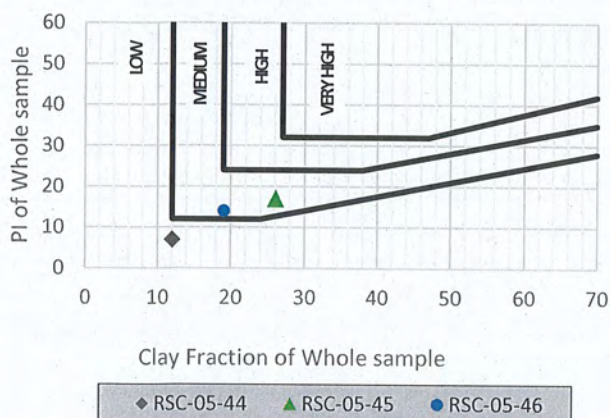
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

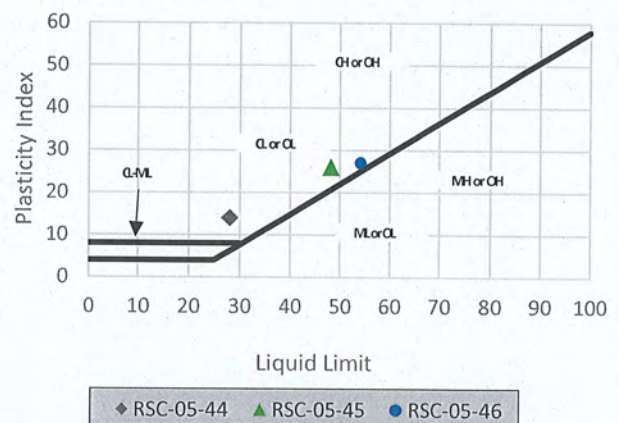
FOUNDATION INDICATOR



Potential Expansiveness



Casagrande Plasticity Chart



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP35	TP36	TP43	Sample	TP35	TP36	TP43
Depth (m)	1.50 - 2.00	2.00 - 2.50	1.00 - 1.70	Depth (m)	1.50 - 2.00	2.00 - 2.50	1.00 - 1.70
Lab No	RSC-05-47	RSC-05-48	RSC-05-50	Lab No	RSC-05-47	RSC-05-48	RSC-05-50
53.0	100	100	100	Liquid Limit (%)	29	53	39
37.5	100	100	100	Plastic Limit (%)	13	32	26
26.5	100	100	100	Plasticity Index (%)	16	21	13
19.0	100	100	100	Linear Shrinkage (%)	8.0	9.5	6.5
13.2	100	100	100	PI of whole sample	10	16	6
9.5	100	100	100				
6.7	96	100	100	% Gravel	20	10	8
4.75	90	98	100	% Sand	44	44	80
2.00	80	90	92	% Silt	16	29	11
1.00	76	81	68	% Clay	20	17	1
0.425	65	74	47	Activity	0.8	1.2	13.0
0.250	53	69	39				
0.150	46	64	34	% Soil Mortar	80	90	92
0.075	38	56	28				
0.060	36	46	12	Grading Modulus	1.17	0.80	1.33
0.050	34	42	10	Moisture Content (%)	N / T	N / T	N / T
0.035	31	36	7	Relative Density (SG)*	2.743	2.75	2.75
0.020	29	30	5				
0.006	24	22	2	Unified (ASTM D2487)	SC	MH	SC
0.002	20	17	1	AASHTO (M145-91)	A - 6	A - 7 - 5	A - 2 - 6

Remarks: *: 2.743 Determined, 2.75 Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

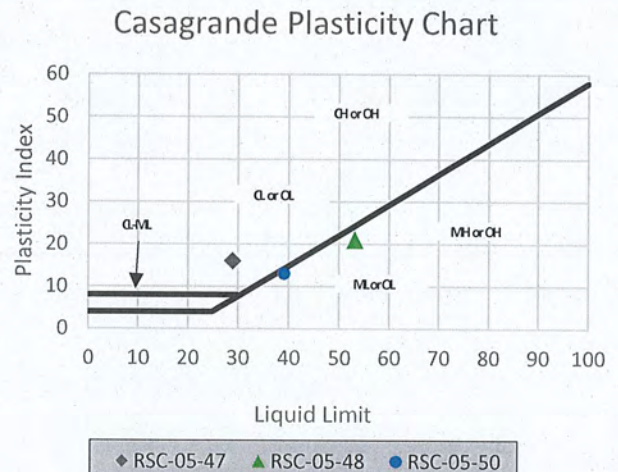
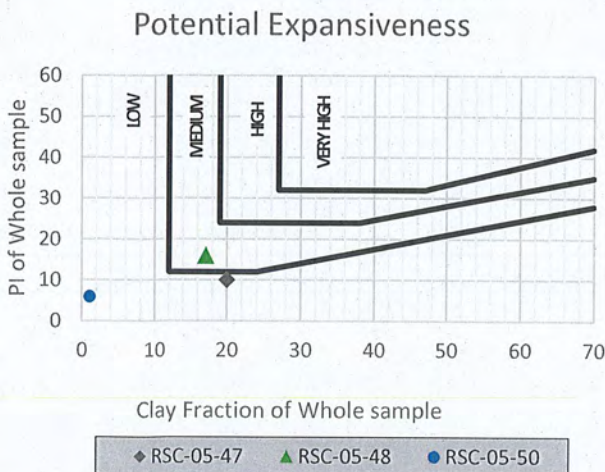
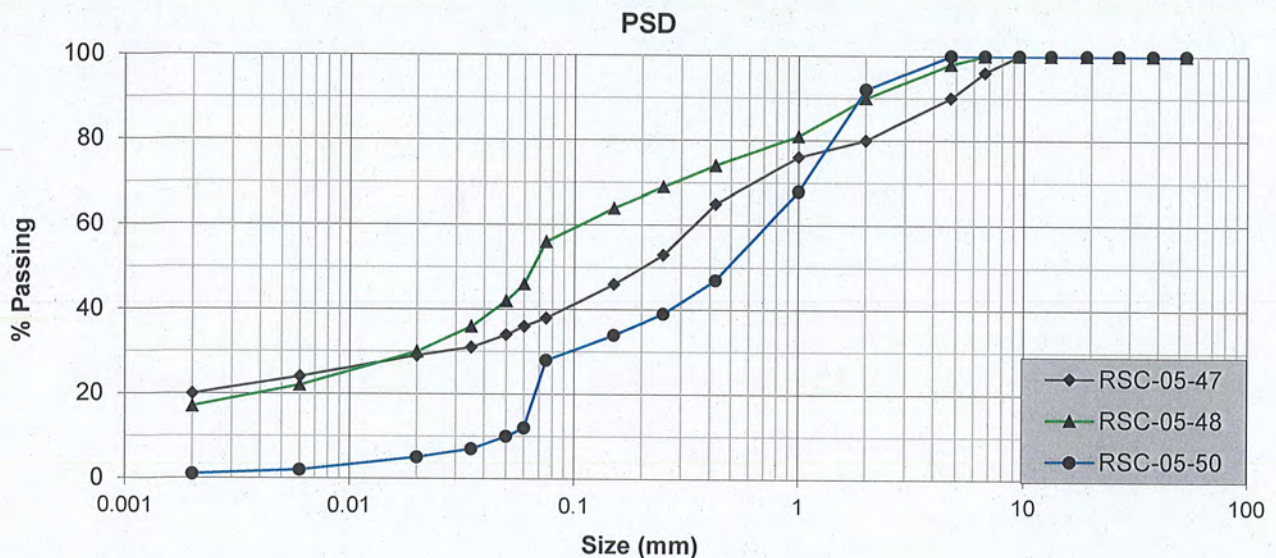
Gertie | 082 309 4448 | gertie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silvertown Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrit | 082 309 4448 | gerrit@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silvertown Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP46	TP54	TP54	Sample	TP46	TP54	TP54
Depth (m)	0.50 - 1.20	2.00 - 2.80	3.00 - 3.30	Depth (m)	0.50 - 1.20	2.00 - 2.80	3.00 - 3.30
Lab No	RSC-05-51	RSC-05-52	RSC-05-53	Lab No	RSC-05-51	RSC-05-52	RSC-05-53
53.0	100	100	100	Liquid Limit (%)	65	64	53
37.5	100	100	100	Plastic Limit (%)	28	31	31
26.5	100	100	100	Plasticity Index (%)	37	33	22
19.0	100	100	100	Linear Shrinkage (%)	26.0	24.0	12.0
13.2	100	100	100	PI of whole sample	31	31	21
9.5	98	100	100				
6.7	97	100	100	% Gravel	8	2	1
4.75	96	100	100	% Sand	25	39	40
2.00	92	98	99	% Silt	19	38	46
1.00	87	96	99	% Clay	48	21	13
0.425	84	93	94	Activity	0.8	1.6	1.7
0.250	81	92	91				
0.150	79	90	86	% Soil Mortar	92	98	99
0.075	74	86	80				
0.060	67	59	59	Grading Modulus	0.50	0.23	0.27
0.050	66	56	55	Moisture Content (%)	N / T	N / T	N / T
0.035	64	50	48	Relative Density (SG)*	2.75	2.75	2.75
0.020	61	45	37				
0.006	54	31	23	Unified (ASTM D2487)	CH	CH	CH
0.002	48	21	13	AASHTO (M145-91)	A - 7 - 6	A - 7 - 5	A - 7 - 5

Remarks: *: Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

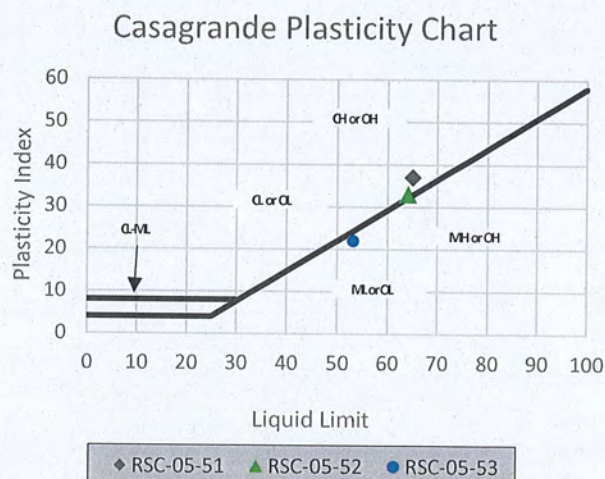
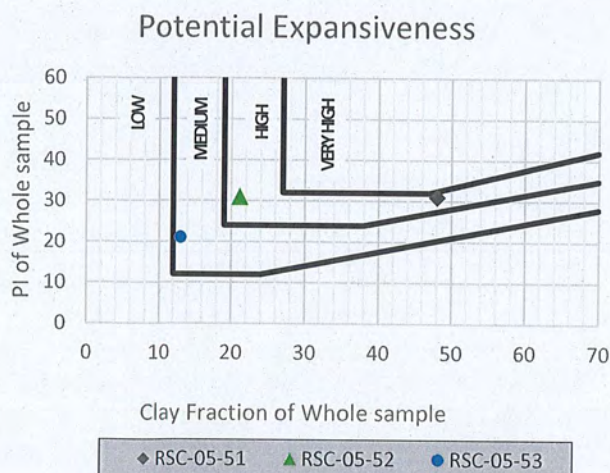
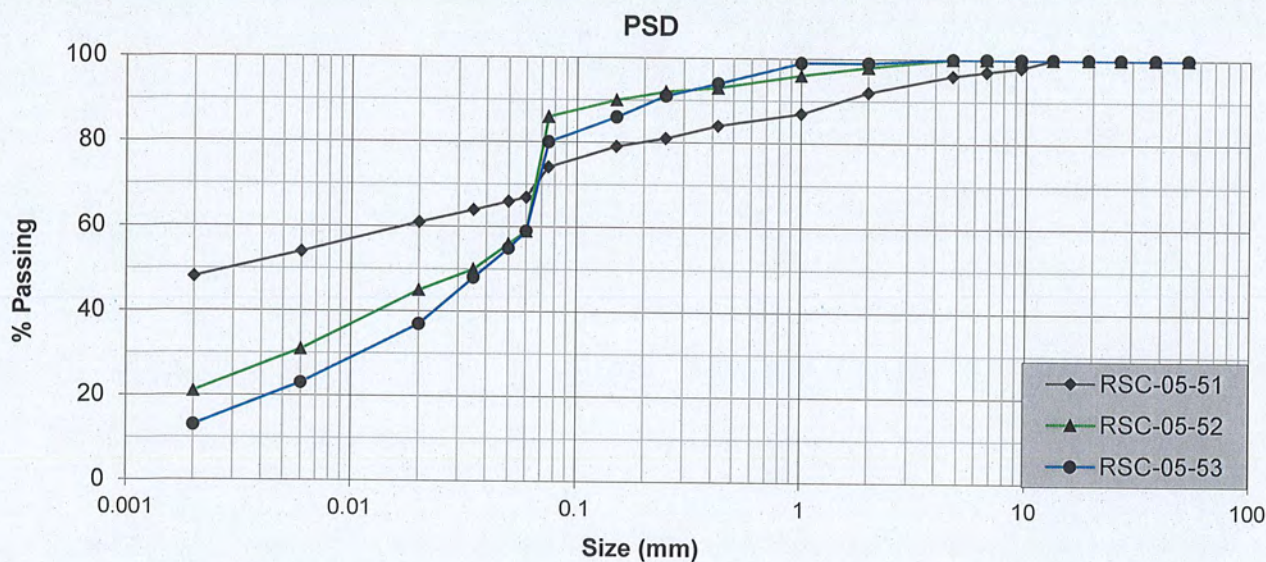
Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP55	TP55	TP58	Sample	TP55	TP55	TP58
Depth (m)	2.00 - 2.20	2.00 - 2.20	0.60 - 1.50	Depth (m)	2.00 - 2.20	2.00 - 2.20	0.60 - 1.50
Lab No	RSC-05-54	RSC-05-55	RSC-05-56	Lab No	RSC-05-54	RSC-05-55	RSC-05-56
53.0	100	100	100	Liquid Limit (%)	60	67	36
37.5	100	100	100	Plastic Limit (%)	29	33	18
26.5	100	100	94	Plasticity Index (%)	31	34	18
19.0	100	100	74	Linear Shrinkage (%)	23.5	25.5	9.0
13.2	100	100	52	PI of whole sample	12	31	3
9.5	100	100	40				
6.7	98	100	34	% Gravel	49	4	79
4.75	93	100	30	% Sand	21	34	12
2.00	51	96	21	% Silt	10	32	5
1.00	42	93	18	% Clay	20	30	4
0.425	39	90	17	Activity	1.6	1.1	4.5
0.250	38	88	16				
0.150	37	85	14	% Soil Mortar	51	96	21
0.075	35	82	13				
0.060	30	62	9	Grading Modulus	1.75	0.32	2.49
0.050	29	58	8	Moisture Content (%)	N / T	N / T	N / T
0.035	28	51	7	Relative Density (SG)*	2.807	2.75	2.813
0.020	26	44	6				
0.006	23	36	5	Unified (ASTM D2487)	SC	CH	GC
0.002	20	30	4	AASHTO (M145-91)	A - 7 - 6	A - 7 - 5	A - 2 - 6

Remarks: *: 2.807 & 2.813 Determined, 2.75 Assumed

N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



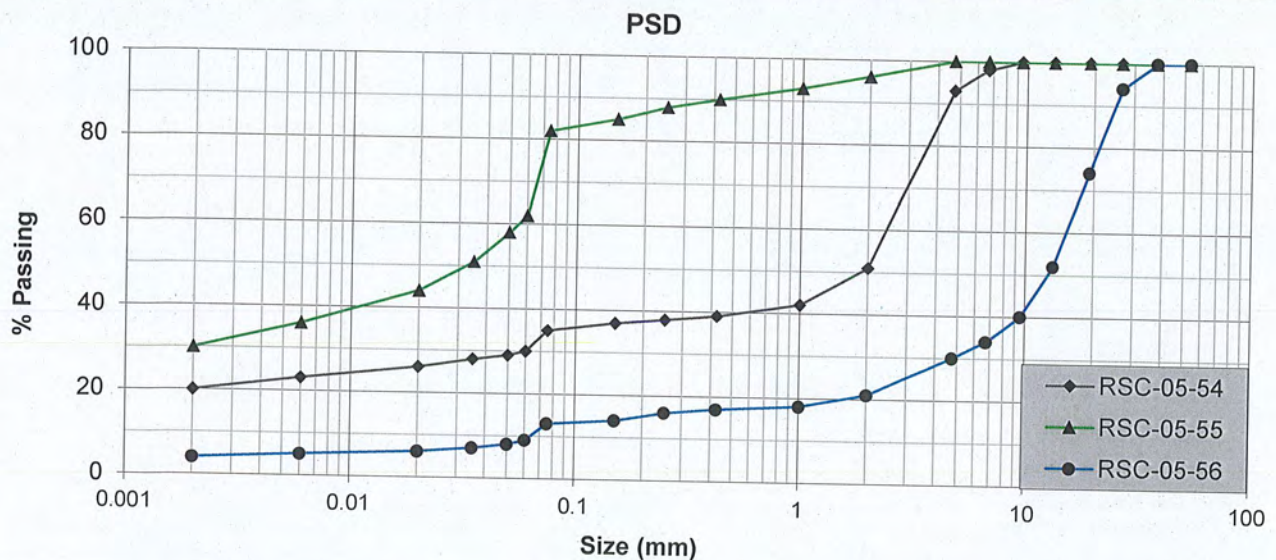
**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186
Roelof | 072 674 6343 | roelof@stlab.co.za
Gerrie | 082 309 4448 | gerrie@stlab.co.za
www.stlab.co.za

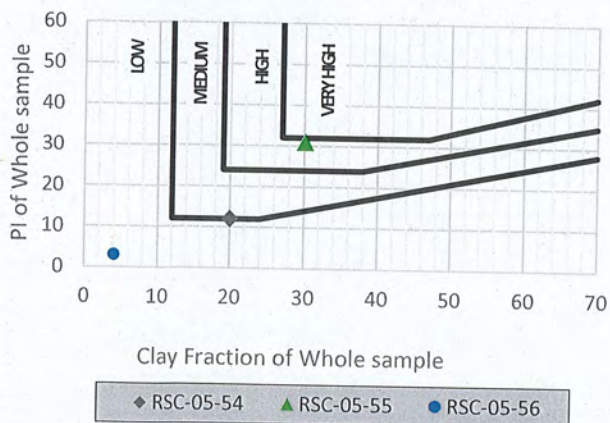
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

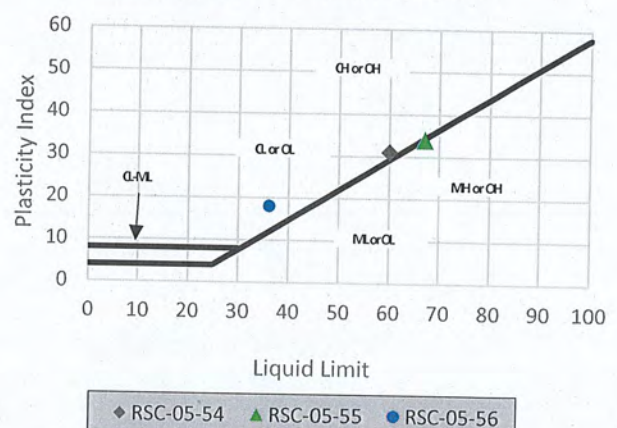
FOUNDATION INDICATOR



Potential Expansiveness



Casagrande Plasticity Chart



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186
Roelof | 072 674 6343 | roelof@stlab.co.za
Gerrie | 082 309 4448 | gerrie@stlab.co.za
www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP63	TP64		Sample	TP63	TP64	
Depth (m)	2.80	2.50 - 3.00		Depth (m)	2.80	2.50 - 3.00	
Lab No	RSC-05-57	RSC-05-58		Lab No	RSC-05-57	RSC-05-58	
53.0	100	100		Liquid Limit (%)	71	50	
37.5	100	100		Plastic Limit (%)	31	24	
26.5	100	100		Plasticity Index (%)	40	26	
19.0	100	100		Linear Shrinkage (%)	23.5	12.5	
13.2	100	100		PI of whole sample	36	24	
9.5	100	100					
6.7	100	100		% Gravel	3	1	
4.75	100	100		% Sand	26	38	
2.00	97	99		% Silt	21	38	
1.00	94	97		% Clay	50	23	
0.425	91	94		Activity	0.8	1.1	
0.250	88	92					
0.150	84	88		% Soil Mortar	97	99	
0.075	79	81					
0.060	71	61		Grading Modulus	0.33	0.26	
0.050	69	56		Moisture Content (%)	N / T	N / T	
0.035	65	48		Relative Density (SG)*	2.736	2.75	
0.020	60	39					
0.006	55	28		Unified (ASTM D2487)	CH	CH	
0.002	50	23		AASHTO (M145-91)	A - 7 - 5	A - 7 - 6	

Remarks: *: 2.736 Determined, 2.65 Assumed
N / T: Not Tested

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

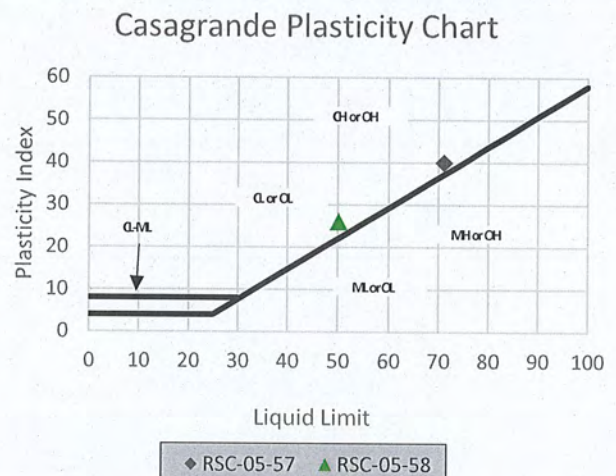
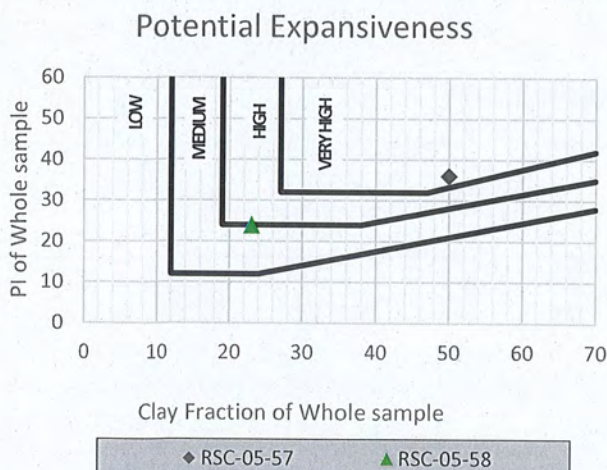
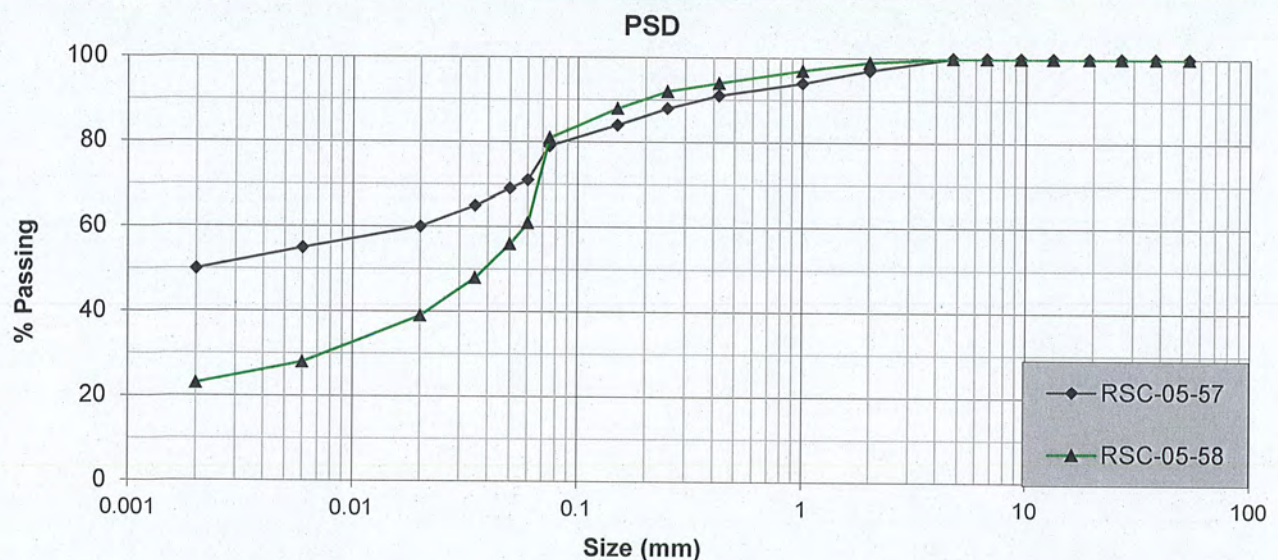
Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Job Number: RSC-05
Date: 2019-06-13
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@slab.co.za

Gerrie | 082 309 4448 | gerrie@slab.co.za

www.slalab.co.za

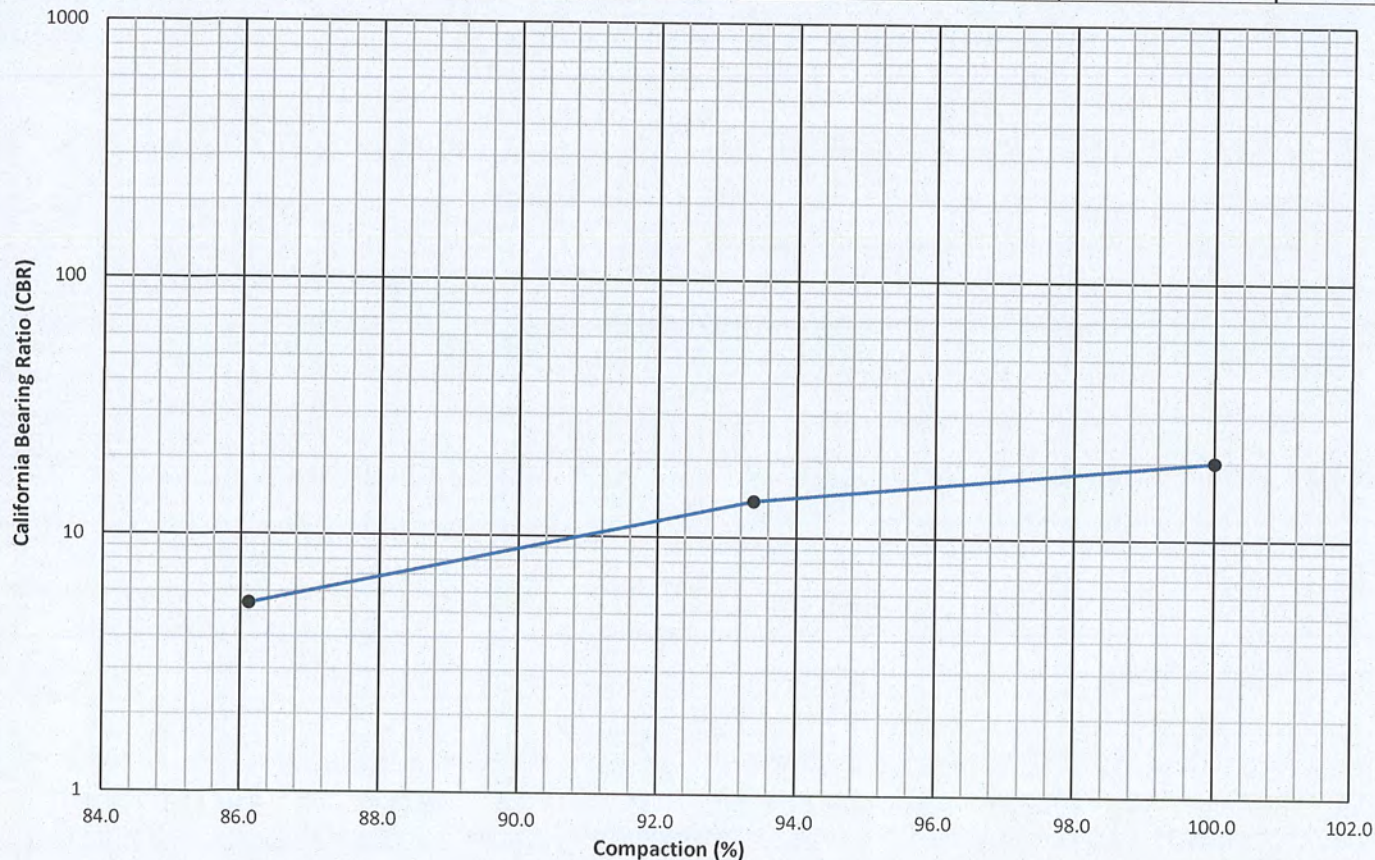
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP01
Depth: (m) 1.45 - 2.70

Job Number: RSC-05
Lab Number: RSC-05-24
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1860	15.2	1844	16.3	100.0	0.2	20	21	20	100	20
									98	18
1860	15.2	1722	16.3	93.4	0.3	14	14	13	97	17
									95	15
1860	15.2	1588	16.3	86.1	0.5	5	5	6	93	13
									90	9



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP01
Depth: (m) 1.45 - 2.70

Job Number: RSC-05
Lab Number: RSC-05-24
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1860** kg/m³

Optimum Moisture Content: **15.2** %

Moisture Content (%):	13.2	14.2	15.2	16.2	17.2			
Dry Density (kg/m ³)	1792	1838	1860	1840	1789			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186
Roelof | 072 674 6343 | roelof@stlab.co.za
Gerrie | 082 309 4448 | gerrie@stlab.co.za
www.stlab.co.za

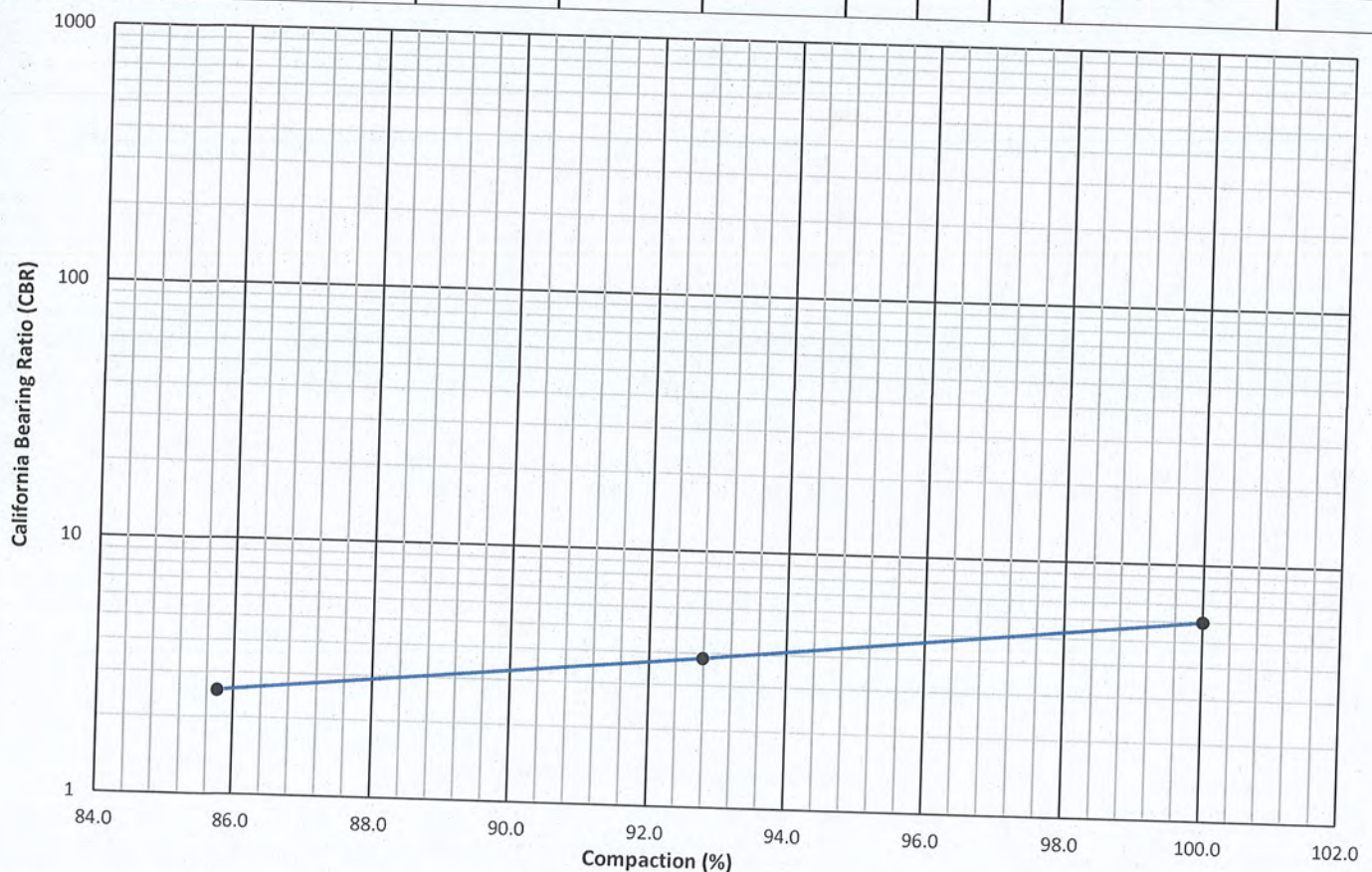
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP02
Depth: (m) 1.20 - 1.80

Job Number: RSC-05
Lab Number: RSC-05-25
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD (kg/m ³)	OMC (%)	Dry Dens. (kg/m ³)	MC (%)	Comp. (%)		2.5	5.0	7.5	Compaction (%)	CBR
1641	19.5	1636	20.0	100.0	5.0	6	4	4	100	6.0
1641	19.5	1518	20.0	92.8	4.1	4	4	4	98	5.3
1641	19.5	1403	20.0	85.8	3.1	3	2	2	97	5.0
									95	4.4
									93	3.9
									90	3.3



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkle Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP 02
Depth: (m) 1.45 - 1.80

Job Number: RSC-05
Lab Number: RSC-05-25
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1641** kg/m³

Optimum Moisture Content: **19.5** %

Moisture Content (%):	17.9	18.9	19.9	20.9	21.9			
Dry Density (kg/m ³)	1614	1634	1636	1624	1604			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

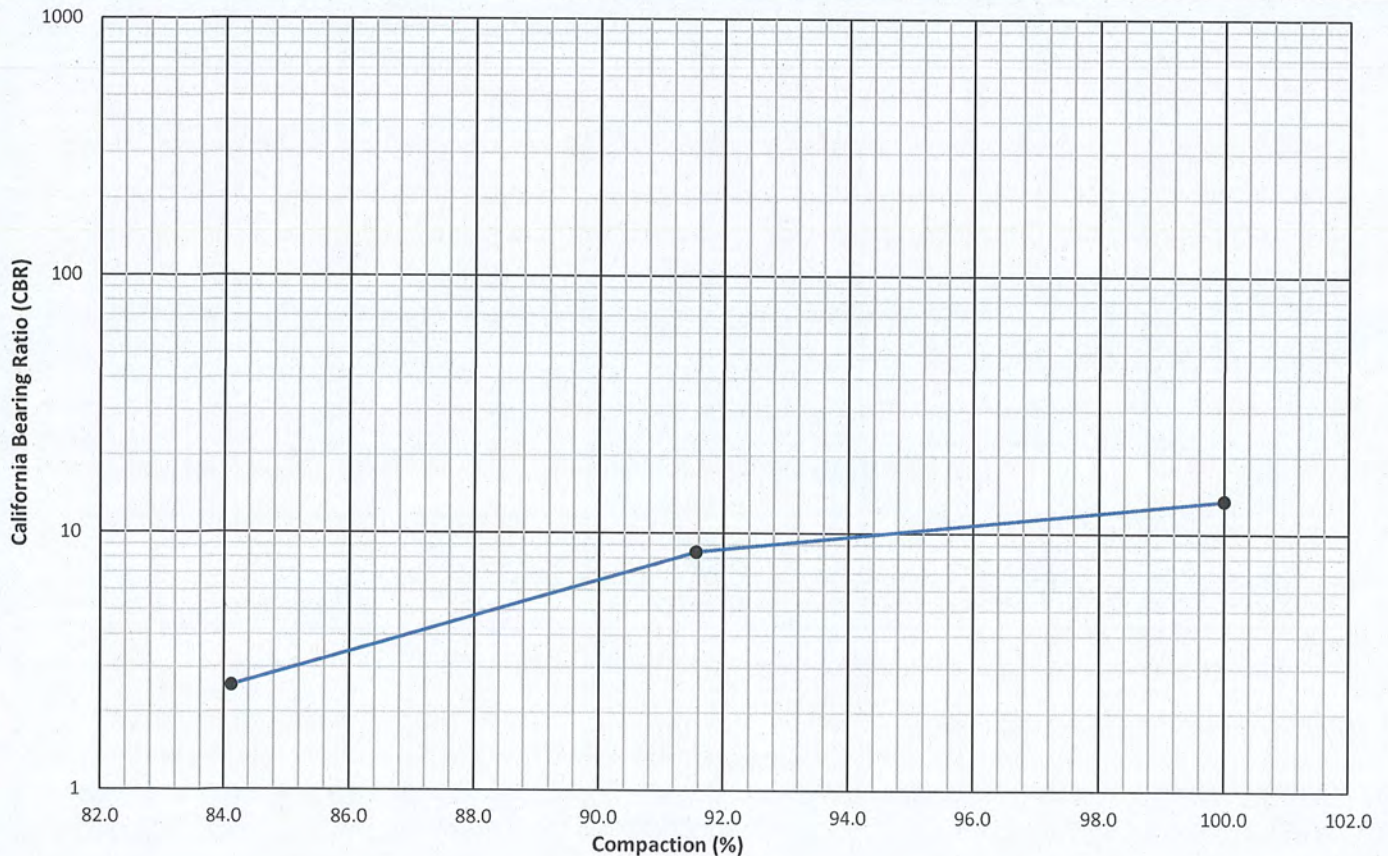
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP04
Depth: (m) 0.50 - 1.40

Job Number: RSC-05
Lab Number: RSC-05-27
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1788	19.3	1789	18.9	100.0	1.1	13	11	10	100	14
									98	12
									97	11
1788	19.3	1638	18.9	91.6	0.9	8	7	6	95	10
									93	9
1788	19.3	1505	18.9	84.1	0.9	3	2	2	90	7



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrit | 082 309 4448 | gerrit@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP04
Depth: (m) 0.50 - 1.40

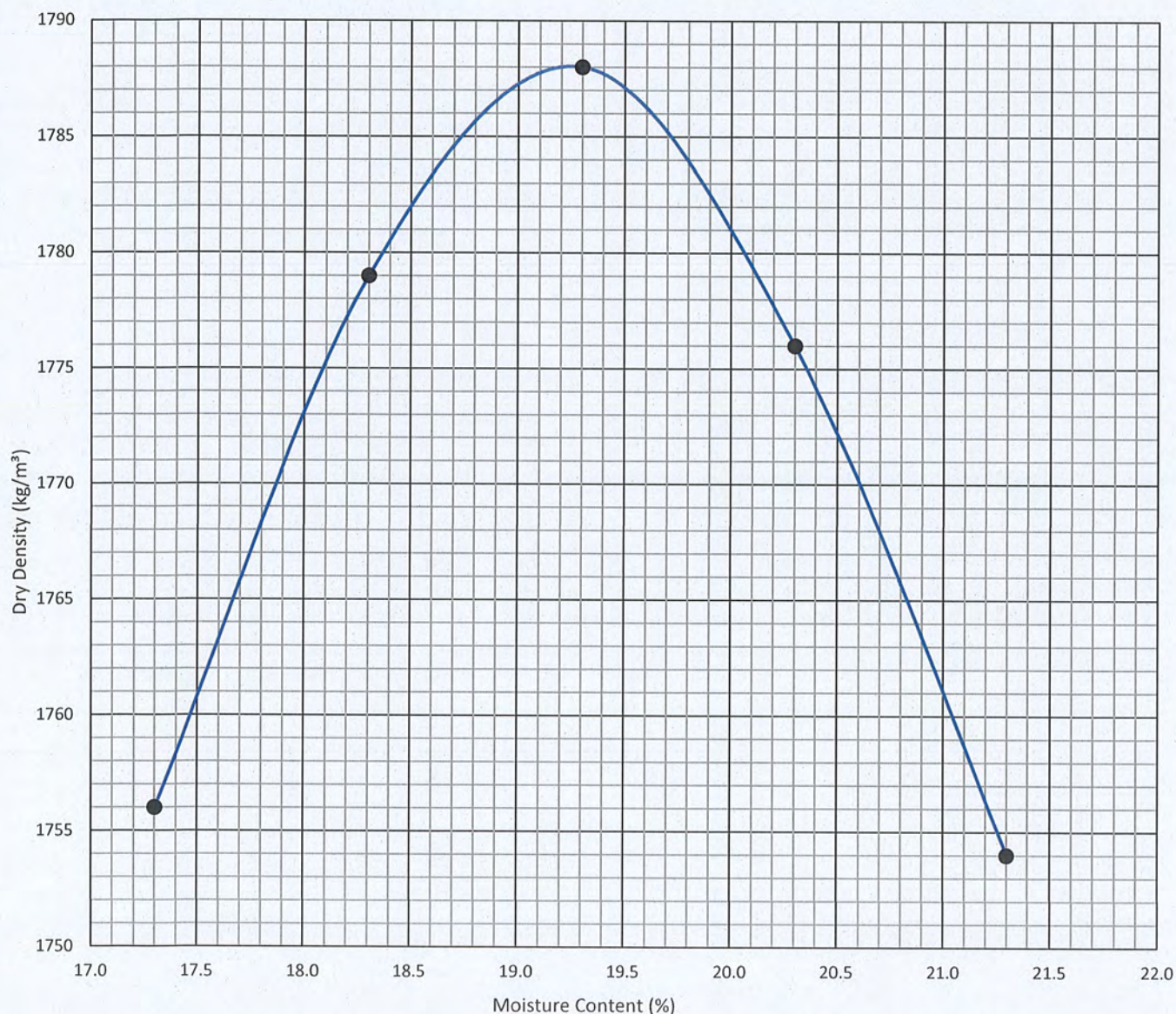
Job Number: RSC-05
Lab Number: RSC-05-27
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1788** kg/m³

Optimum Moisture Content: **19.3** %

Moisture Content (%):	17.3	18.3	19.3	20.3	21.3			
Dry Density (kg/m ³)	1756	1779	1788	1776	1754			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

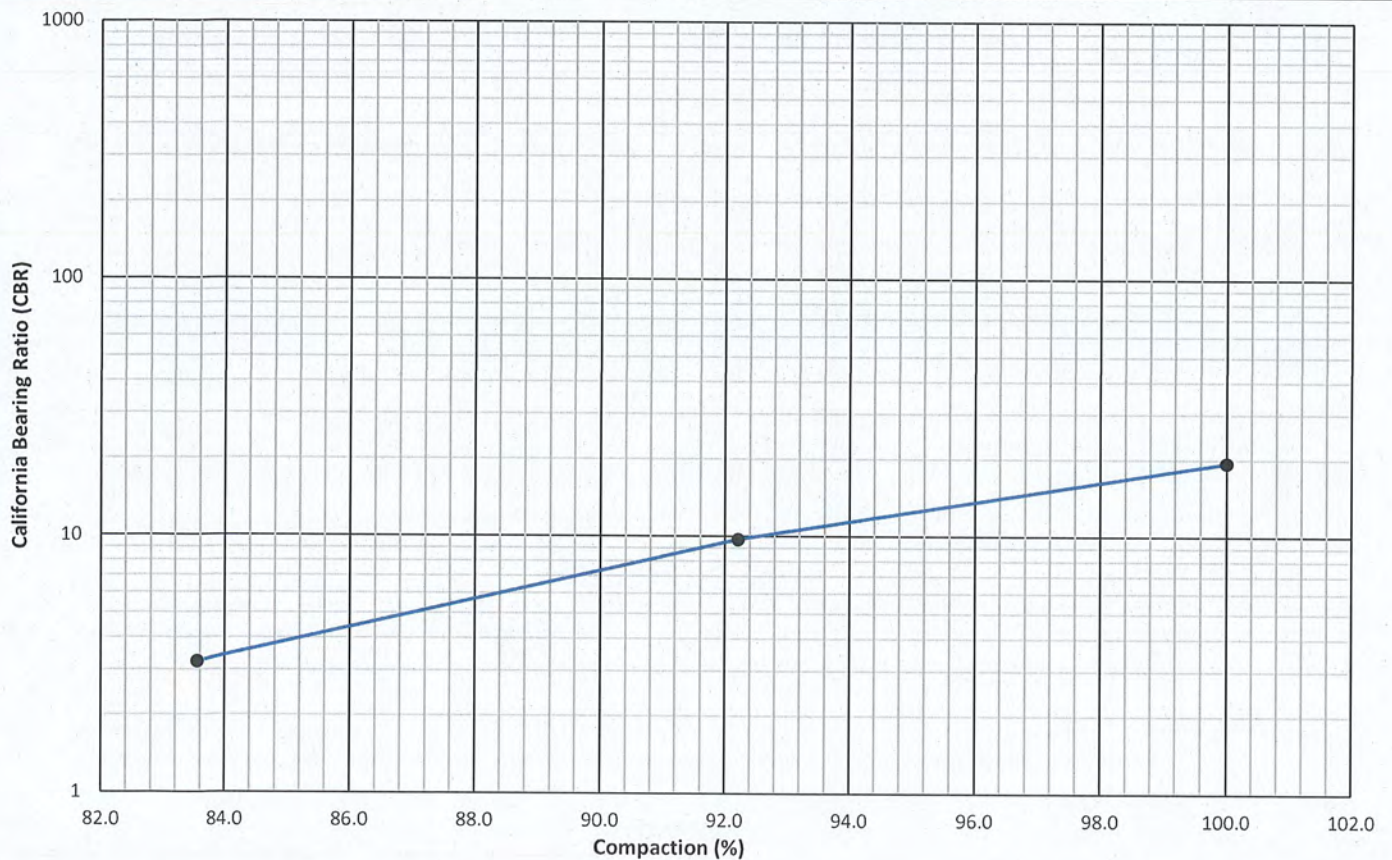
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP06
Depth: (m) 0.50 - 1.60

Job Number: RSC-05
Lab Number: RSC-05-29
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1752	19.8	1733	20.8	100.0	0.6	19	16	14	100	19
									98	16
									97	15
1752	19.8	1598	20.8	92.2	0.7	10	10	9	95	13
									93	10
1752	19.8	1448	20.8	83.6	0.8	3	3	3	90	7



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP06
Depth: (m) 0.50 - 1.60

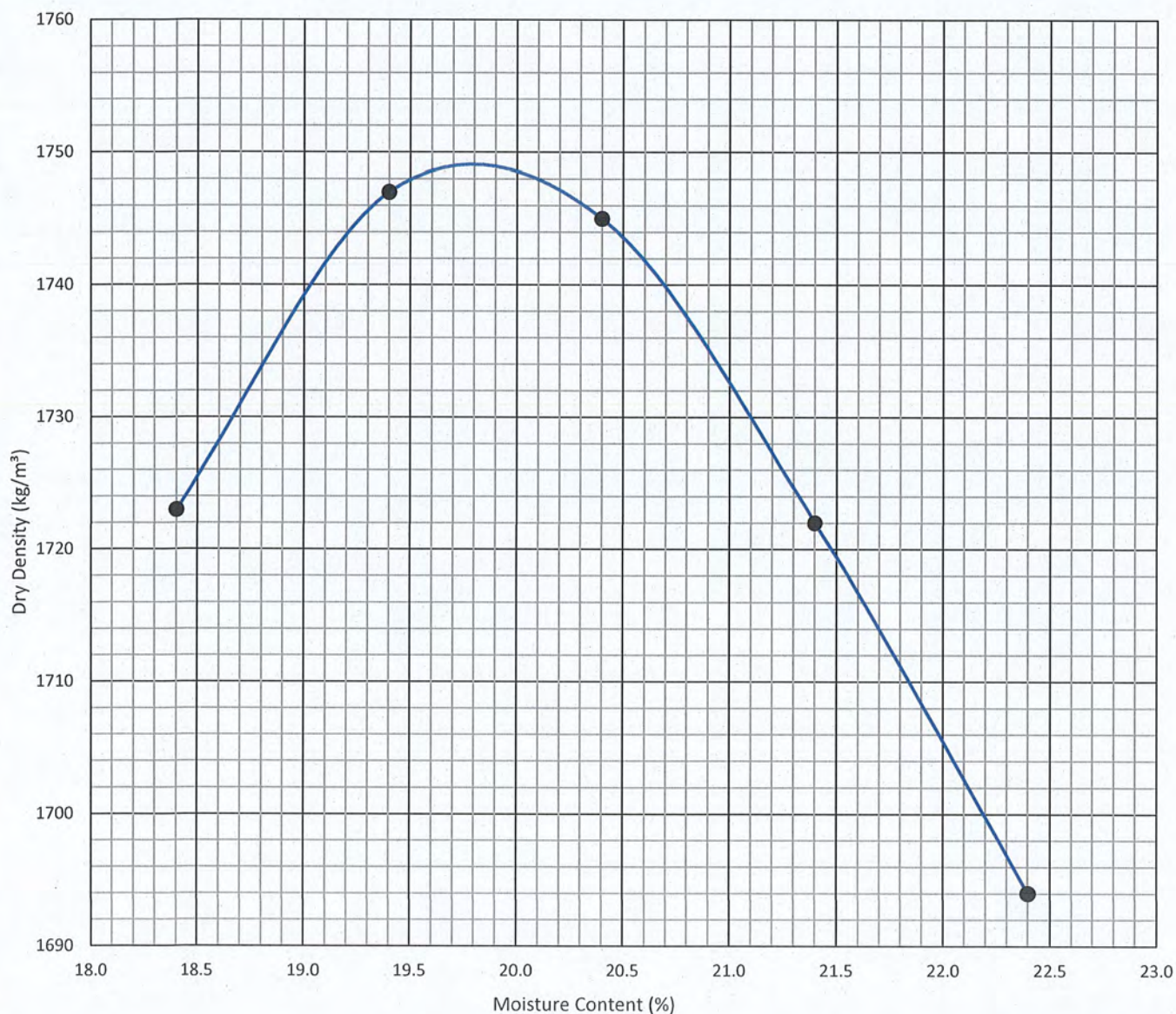
Job Number: RSC-05
Lab Number: RSC-05-29
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1752** kg/m³

Optimum Moisture Content: **19.8** %

Moisture Content (%):	18.4	19.4	20.4	21.4	22.4			
Dry Density (kg/m ³)	1723	1747	1745	1722	1694			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerle | 082 309 4448 | gerle@stlab.co.za

www.stlab.co.za

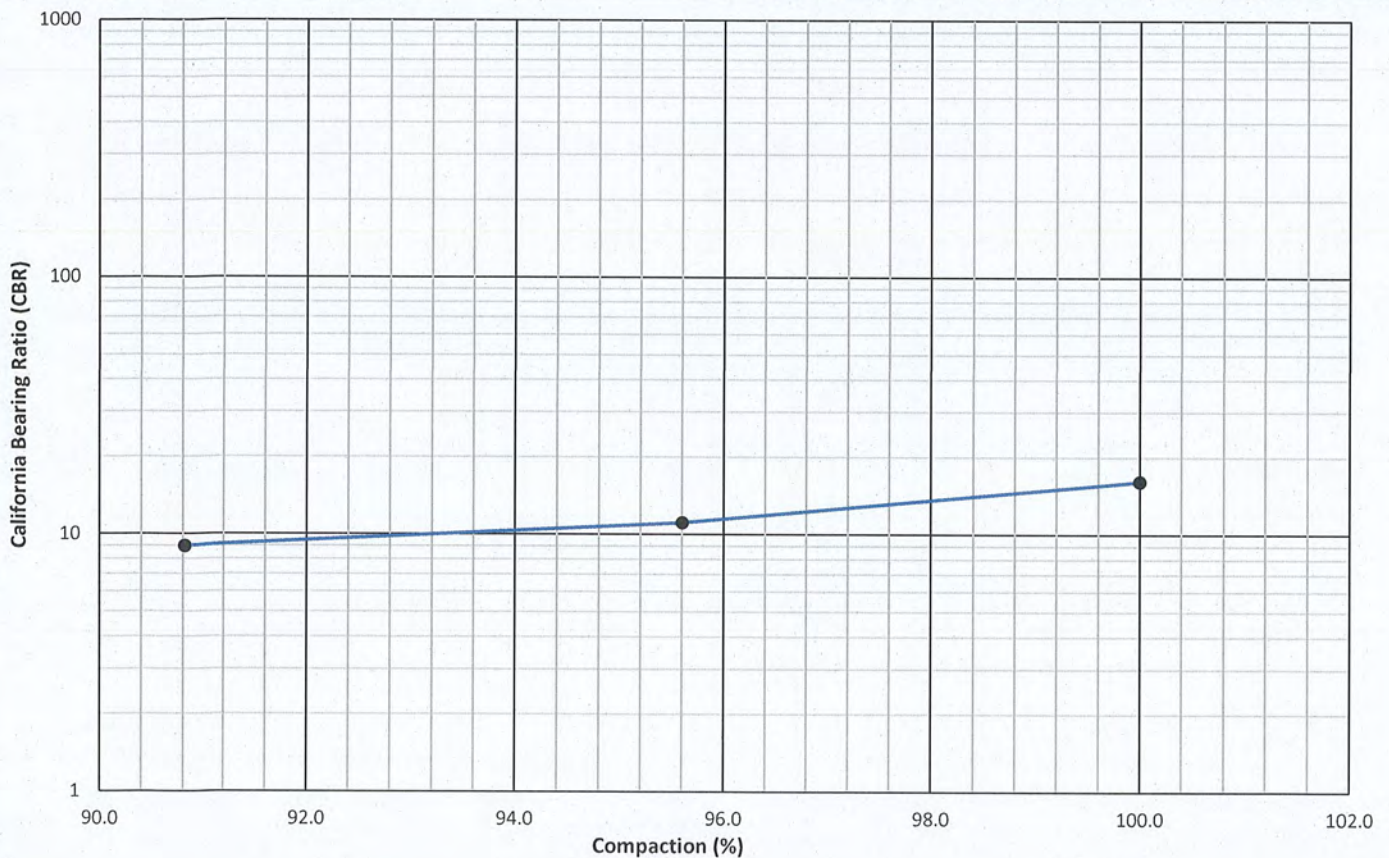
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP09
Depth: (m) 0.35 - 1.30

Job Number: RSC-05
Lab Number: RSC-05-32
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1838	16.3	1819	17.0	100.0	0.1	16	13	12	100	16
									98	14
									97	13
1838	16.3	1739	17.0	95.6	0.1	11	12	12	95	11
									93	10
1838	16.3	1652	17.0	90.8	0.2	9	7	6	90	9



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP09
Depth: (m) 0.35 - 1.30

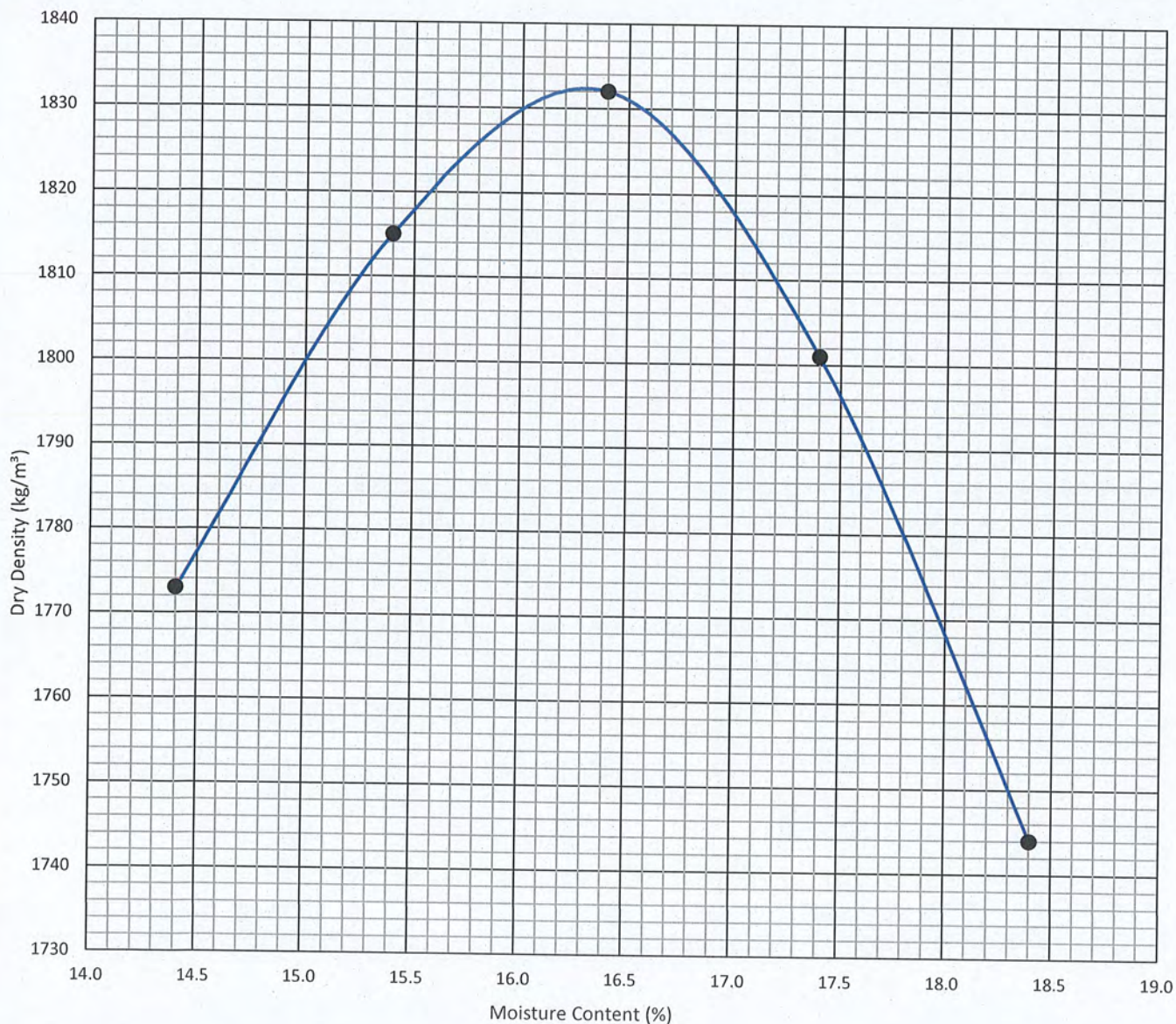
Job Number: RSC-05
Lab Number: RSC-05-32
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1838** kg/m³

Optimum Moisture Content: **16.3** %

Moisture Content (%):	14.4	15.4	16.4	17.4	18.4			
Dry Density (kg/m ³)	1773	1815	1832	1801	1744			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@slab.co.za

Gerle | 082 309 4448 | gerle@slab.co.za

www.slabs.co.za

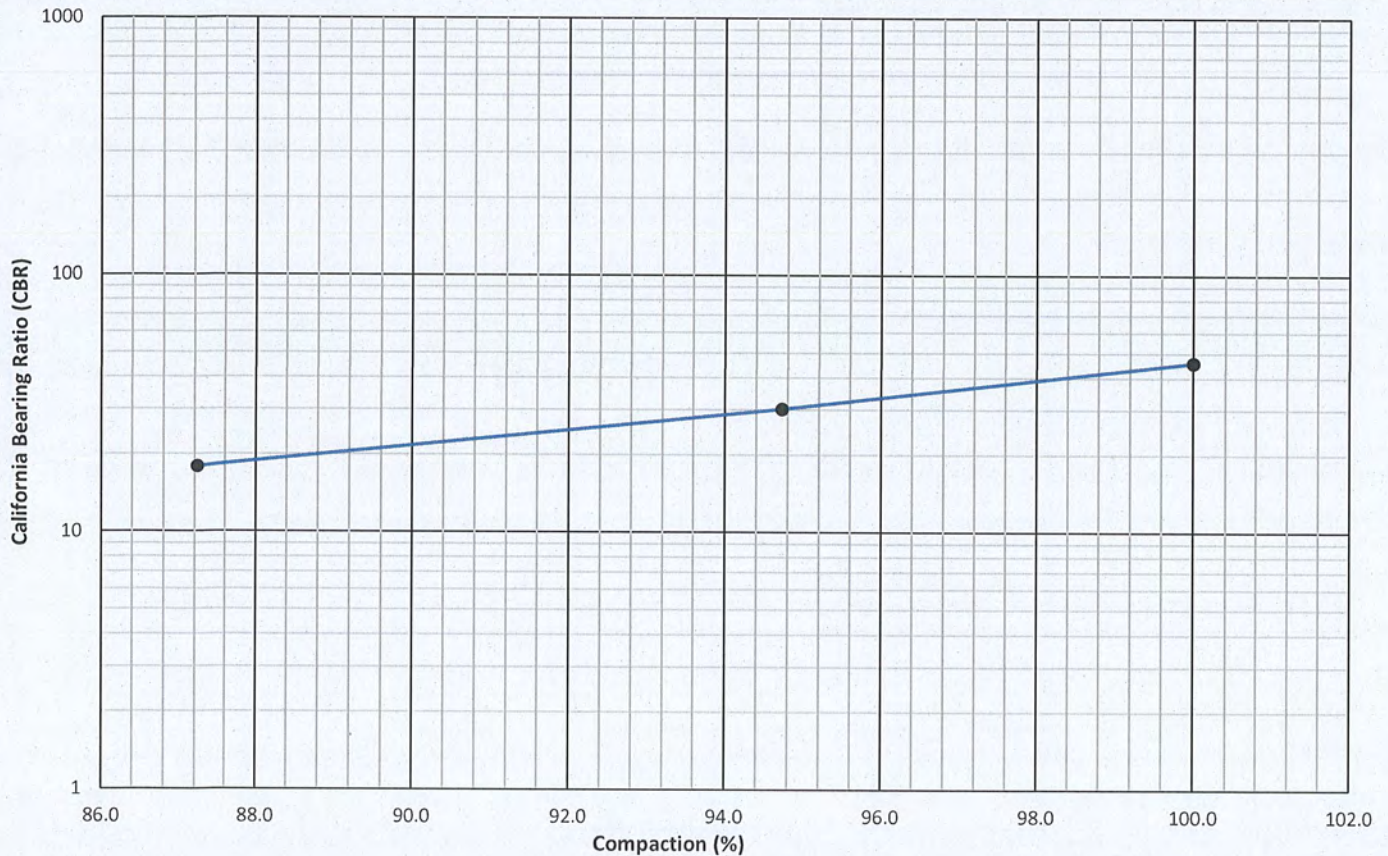
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP12
Depth: (m) 0.30 - 0.95

Job Number: RSC-05
Lab Number: RSC-05-35
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
2153	7.5	2162	7.0	100.0	0.1	46	57	59	100	46
									98	39
2153	7.5	2048	7.0	94.7	0.1	30	34	34	97	36
									95	31
2153	7.5	1886	7.0	87.2	0.1	18	18	18	93	27
									90	22



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP12
Depth: (m) 0.30 - 0.95

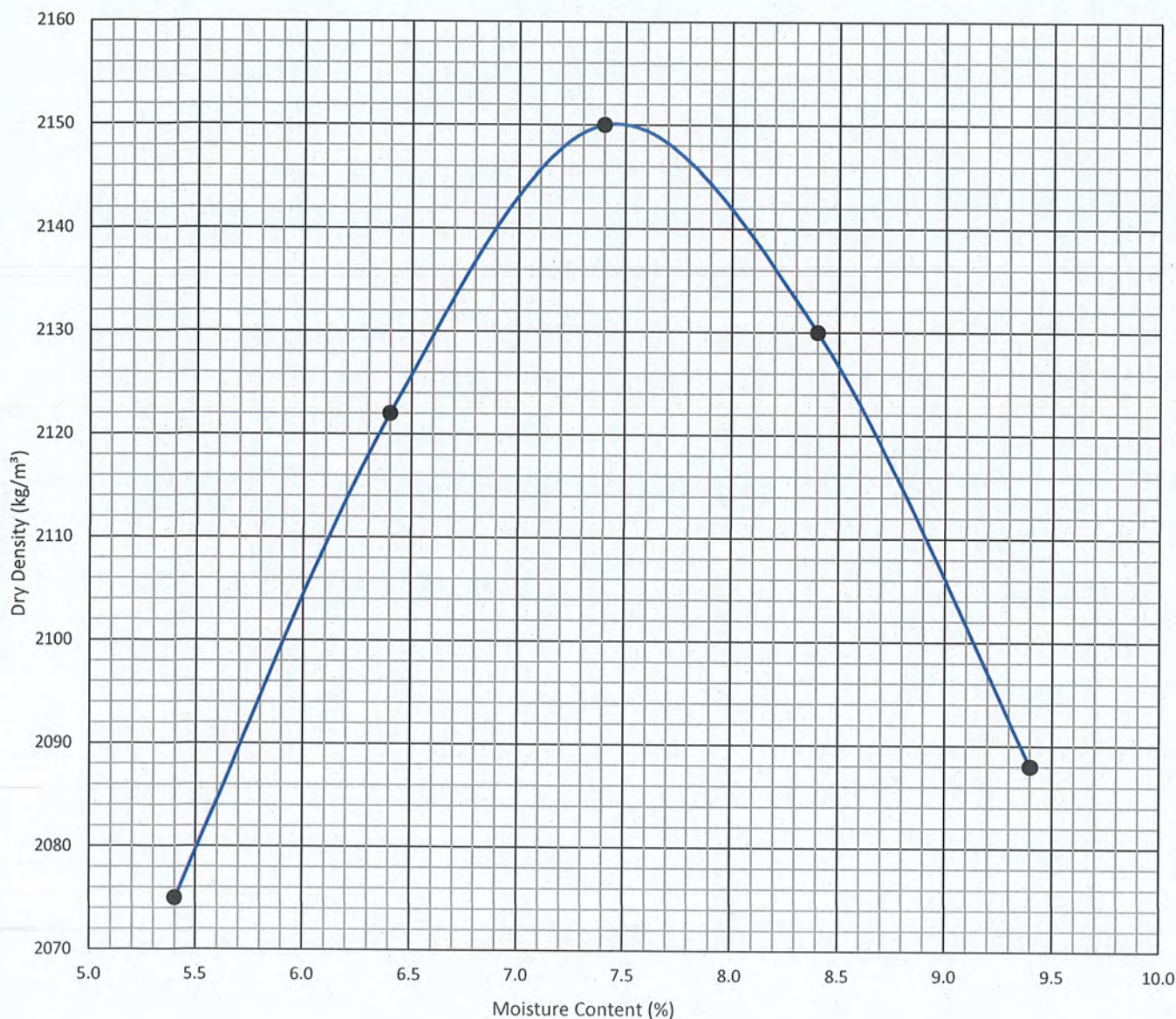
Job Number: RSC-05
Lab Number: RSC-05-35
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **2153** kg/m³

Optimum Moisture Content: **7.5** %

Moisture Content (%):	5.4	6.4	7.4	8.4	9.4			
Dry Density (kg/m ³)	2075	2122	2150	2130	2088			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gertie | 082 309 4448 | gertie@stlab.co.za

www.stlab.co.za

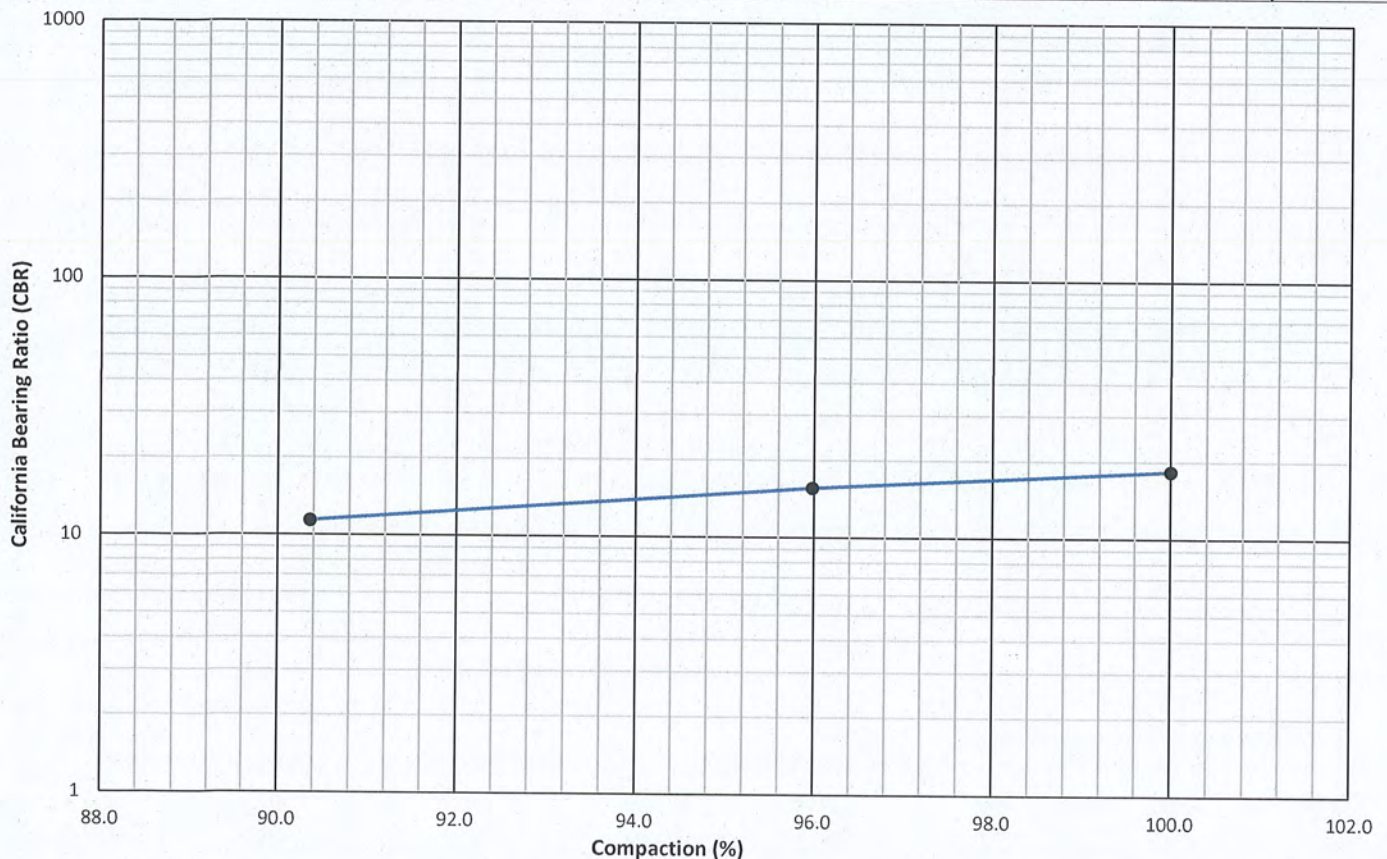
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP30
Depth: (m) 0.50 - 1.00

Job Number: RSC-05
Lab Number: RSC-05-42
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1956	12.0	1940	12.6	100.0	0.2	18	17	17	100	18
									98	17
1956	12.0	1862	12.6	96.0	0.2	16	17	16	97	16
									95	15
1956	12.0	1753	12.6	90.4	0.4	11	10	10	93	13
									90	11



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP30
Depth: (m) 0.50 - 1.00

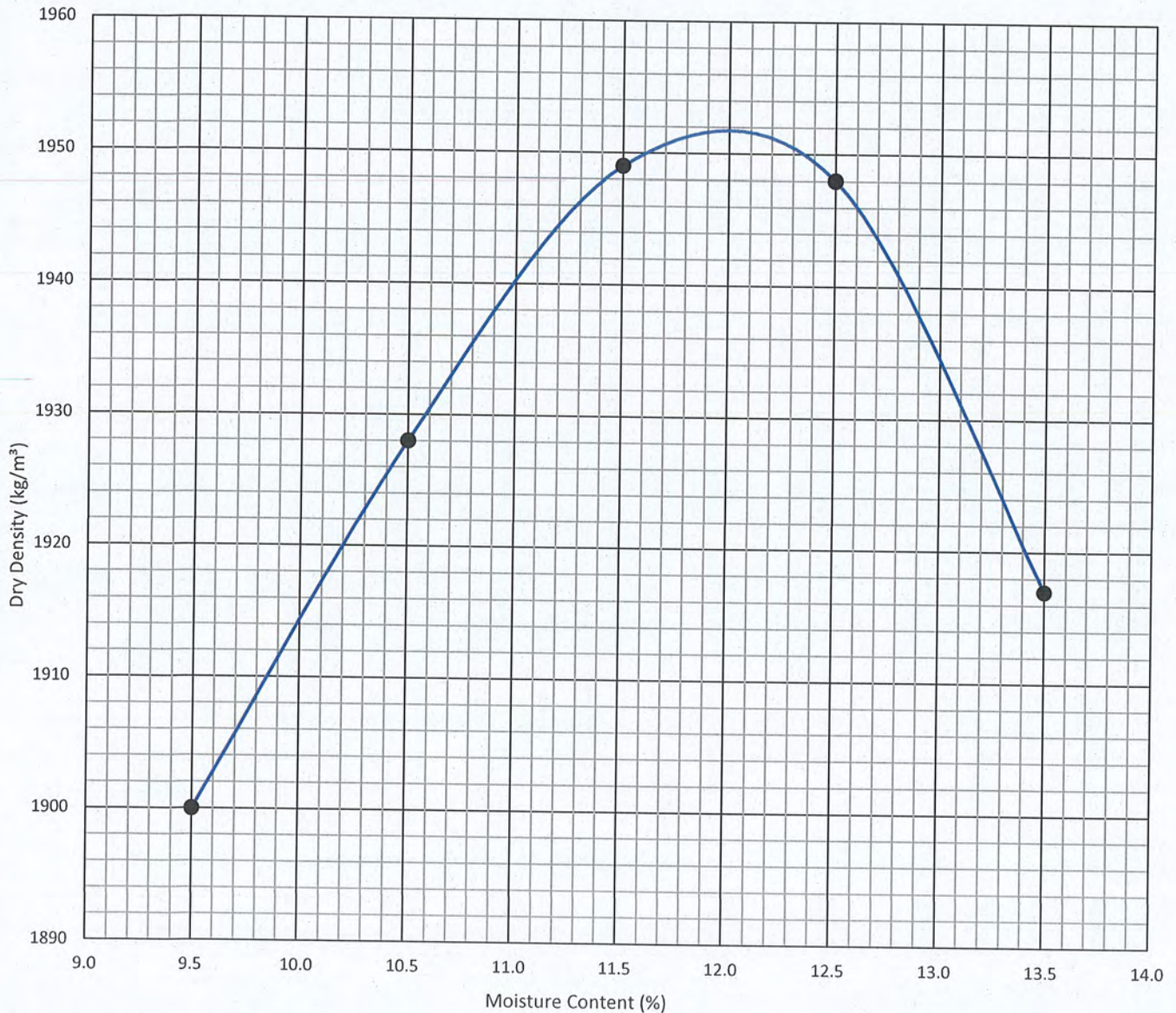
Job Number: RSC-05
Lab Number: RSC-05-42
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1956** kg/m³

Optimum Moisture Content: **12.0** %

Moisture Content (%):	9.5	10.5	11.5	12.5	13.5			
Dry Density (kg/m ³)	1900	1928	1949	1948	1917			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

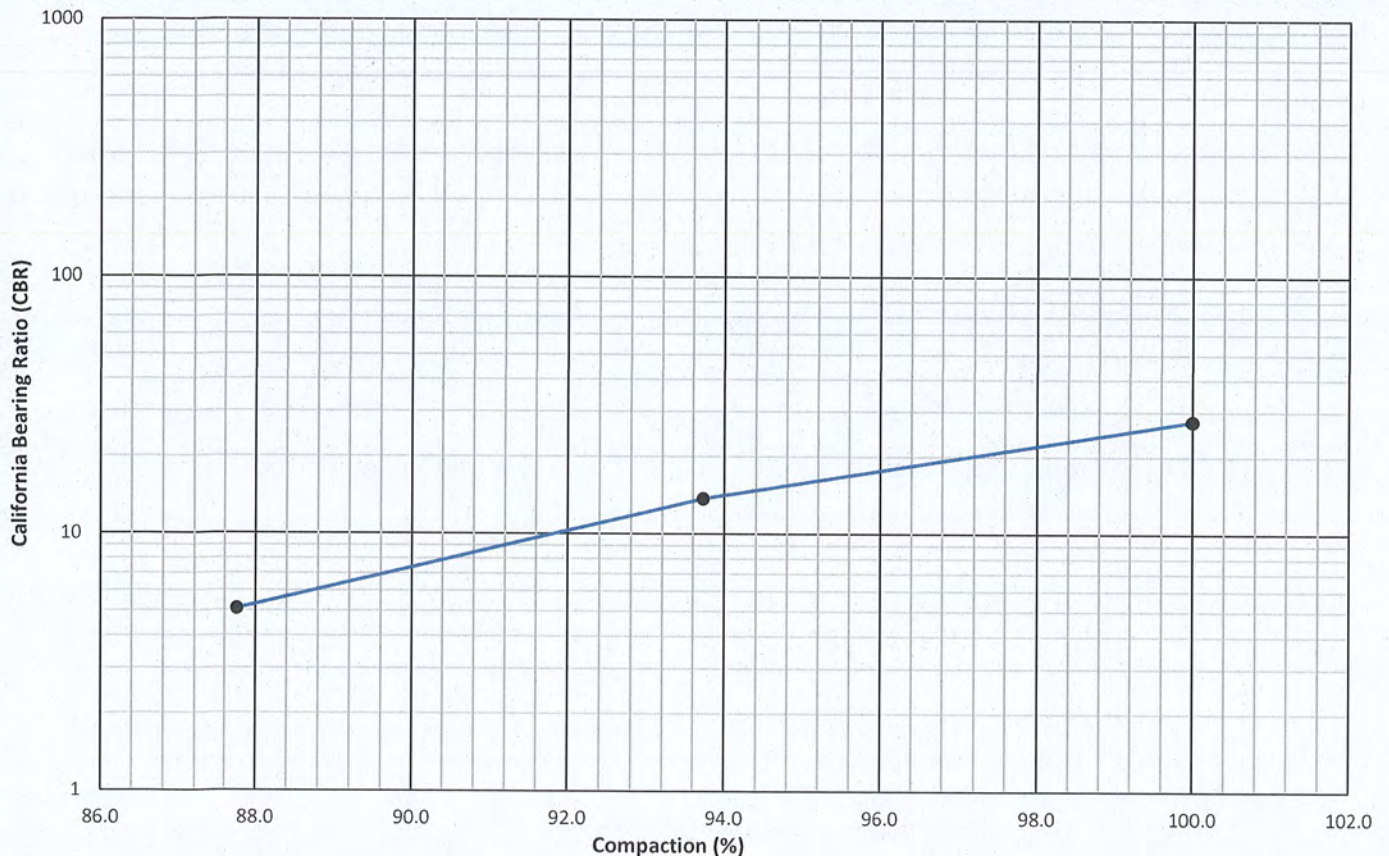
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP35
Depth: (m) 1.50 - 2.00

Job Number: RSC-05
Lab Number: RSC-05-47
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1956	11.4	1961	9.9	100.0	0.1	28	27	26	100	28
									98	22
									97	20
1956	11.4	1838	9.9	93.7	0.2	14	12	11	95	16
									93	12
1956	11.4	1721	9.9	87.8	0.2	5	4	3	90	7



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP35
Depth: (m) 1.50 - 2.00

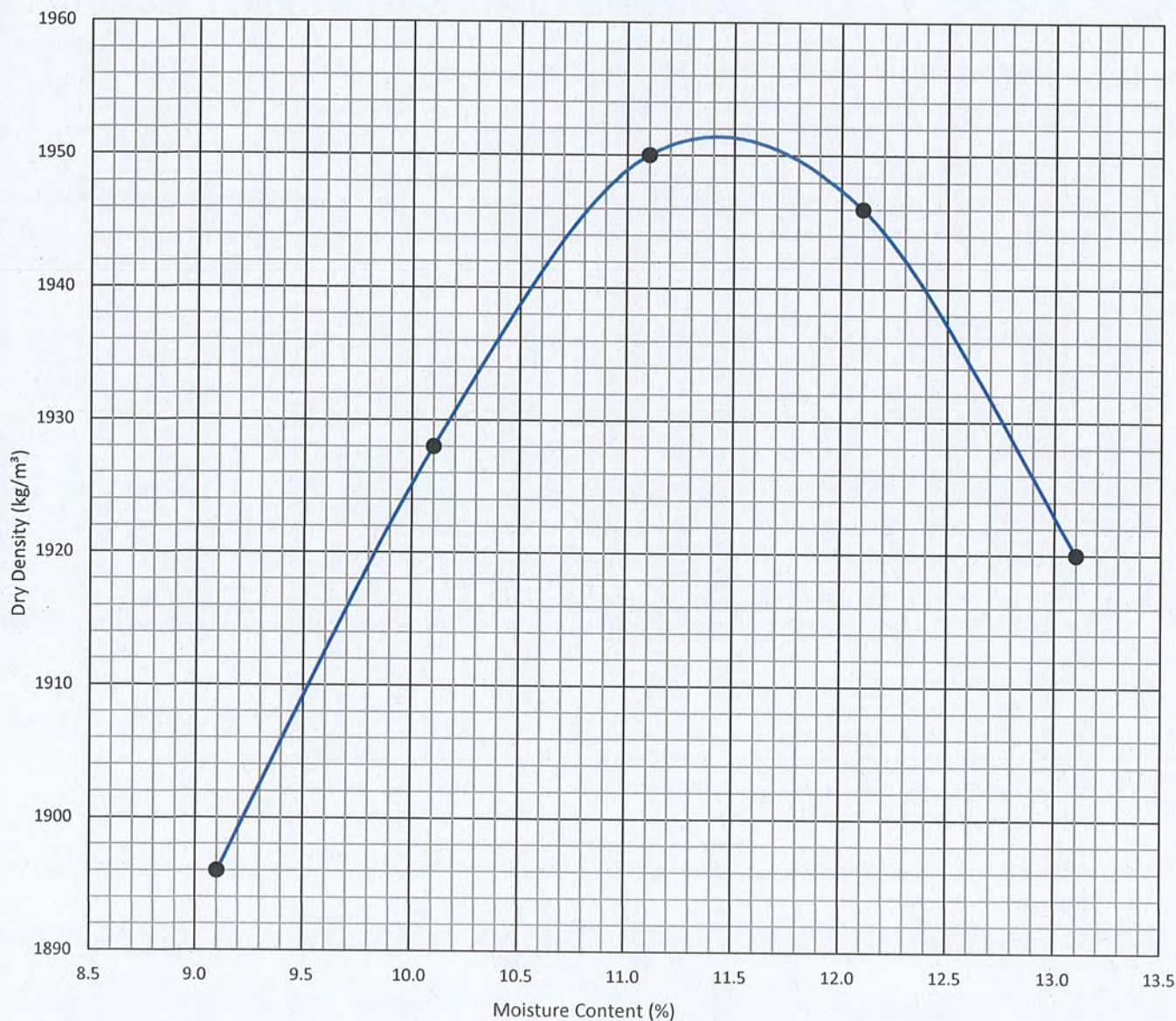
Job Number: RSC-05
Lab Number: RSC-05-47
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1956** kg/m³

Optimum Moisture Content: **11.4** %

Moisture Content (%):	9.1	10.1	11.1	12.1	13.1			
Dry Density (kg/m ³)	1896	1928	1950	1946	1920			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gertie | 082 309 4448 | gertie@stlab.co.za

www.stlab.co.za

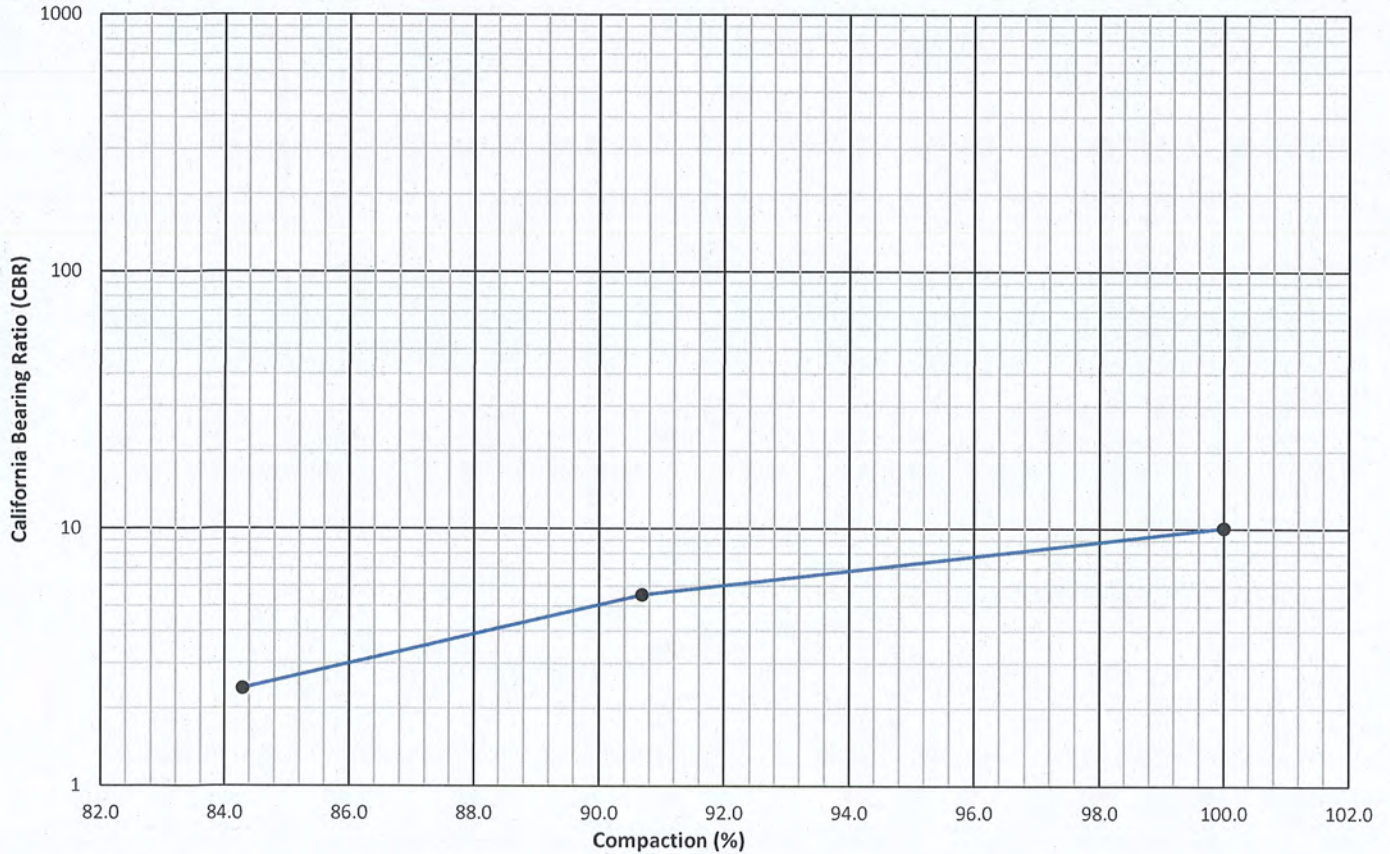
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP55
Depth: (m) 0.2 - 1.00

Job Number: RSC-05
Lab Number: RSC-05-54
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1950	13.2	1910	13.3	100.0	1.1	10	10	10	100	10.1
									98	8.9
									97	8.3
1950	13.2	1732	13.3	90.7	1.2	6	6	5	95	7.3
									93	6.4
1950	13.2	1610	13.3	84.3	1.3	2	2	2	90	5.1



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gertie | 082 309 4448 | gertie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP55
Depth: (m) 0.2 - 1.00

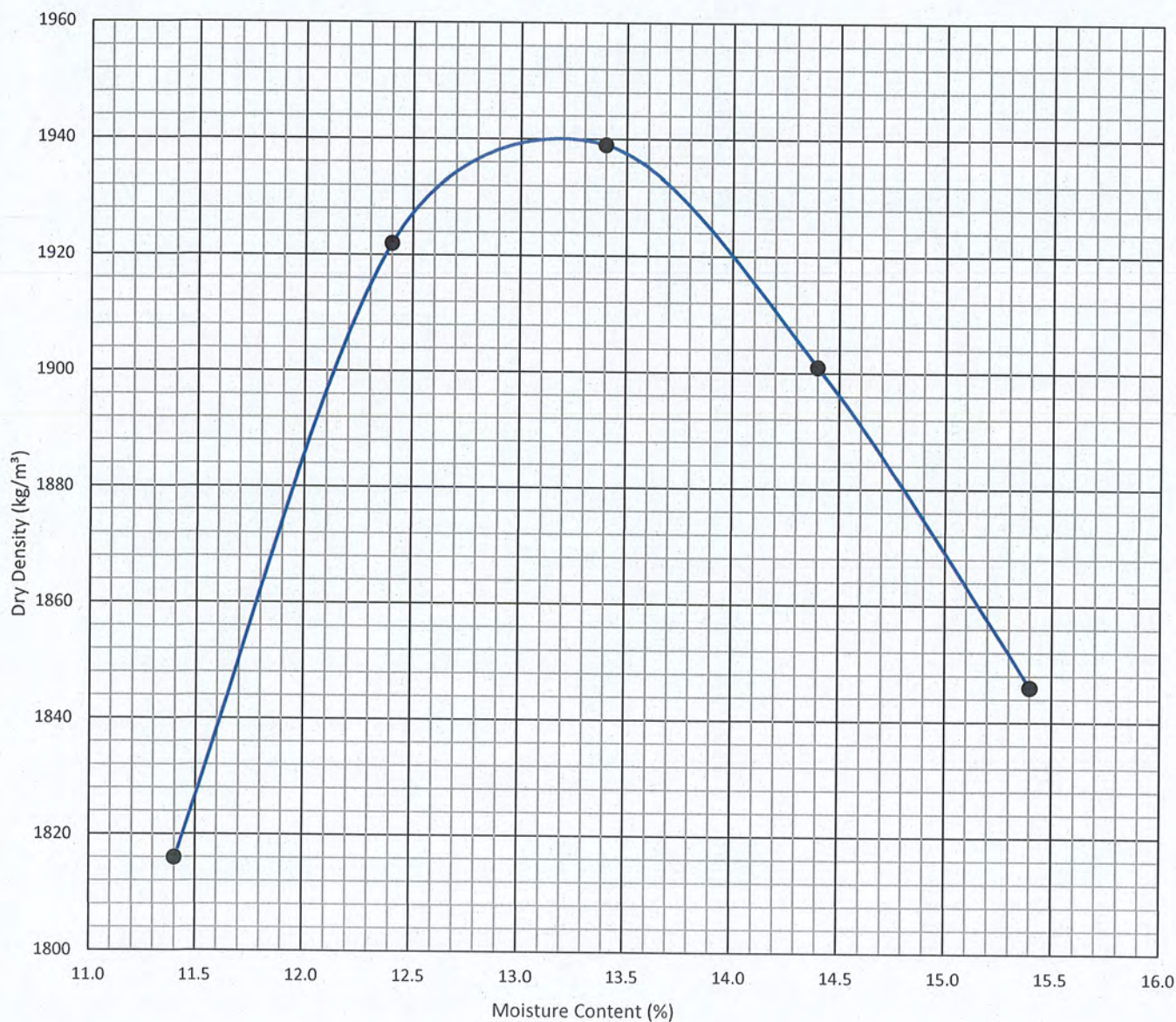
Job Number: RSC-05
Lab Number: RSC-05-54
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1950** kg/m³

Optimum Moisture Content: **13.2** %

Moisture Content (%):	11.4	12.4	13.4	14.4	15.4			
Dry Density (kg/m ³)	1816	1922	1939	1901	1846			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

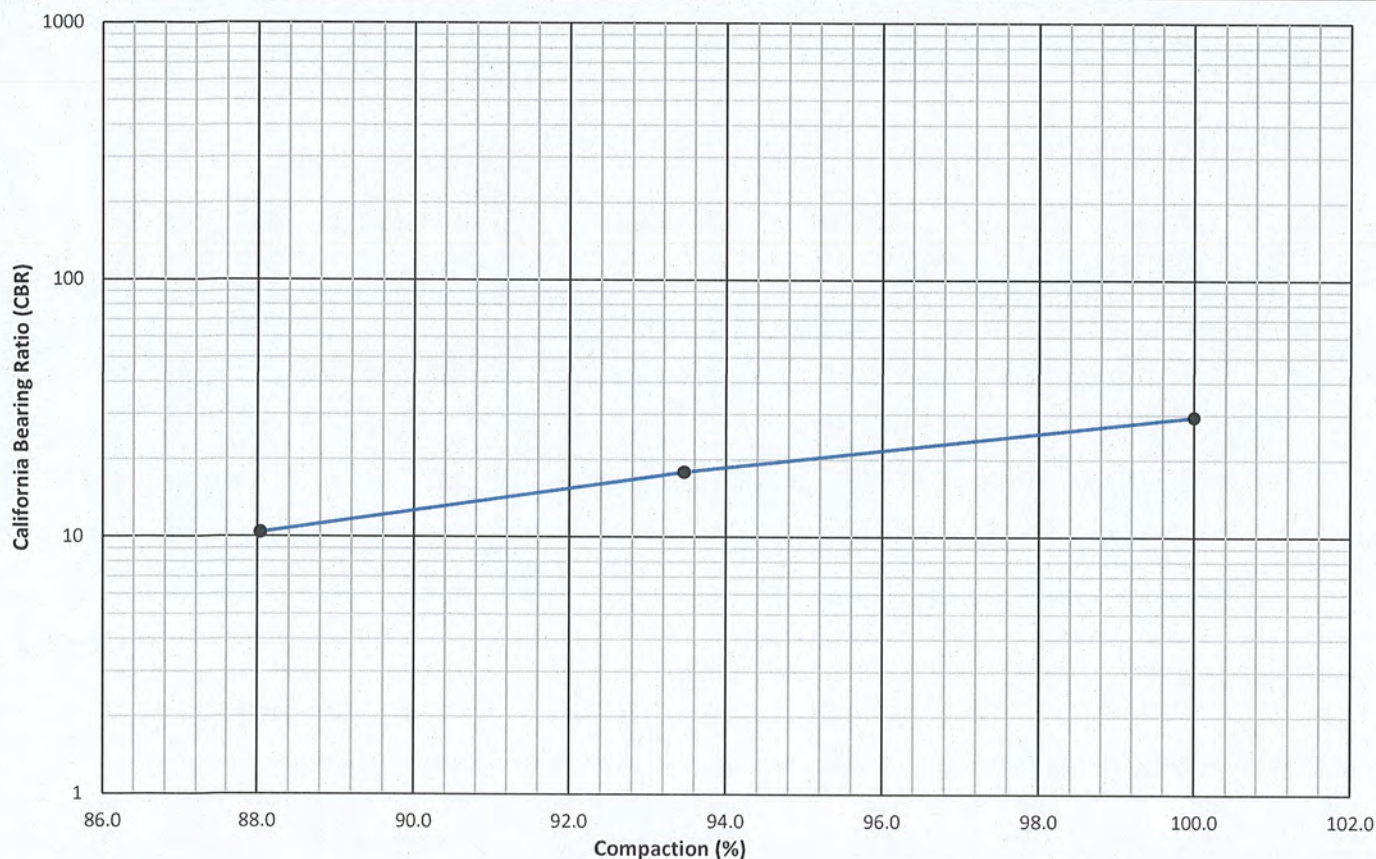
Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP58
Depth: (m) 0.60 - 1.50

Job Number: RSC-05
Lab Number: RSC-05-56
Method: SANS 3001 GR40
Date: 13-Jun-19

CALIFORNIA BEARING RATIO

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.		2.5	5.0	7.5	Compaction (%)	CBR
(kg/m ³)	(%)	(kg/m ³)	(%)	(%)	(%)					
1979	10.7	1989	10.5	100.0	0.2	29	32	32	100	29
									98	25
1979	10.7	1859	10.5	93.5	0.4	18	19	18	97	23
									95	20
1979	10.7	1751	10.5	88.0	0.5	10	9	9	93	17
									90	13



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** [Pty] Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP58
Depth: (m) 0.60 - 1.50

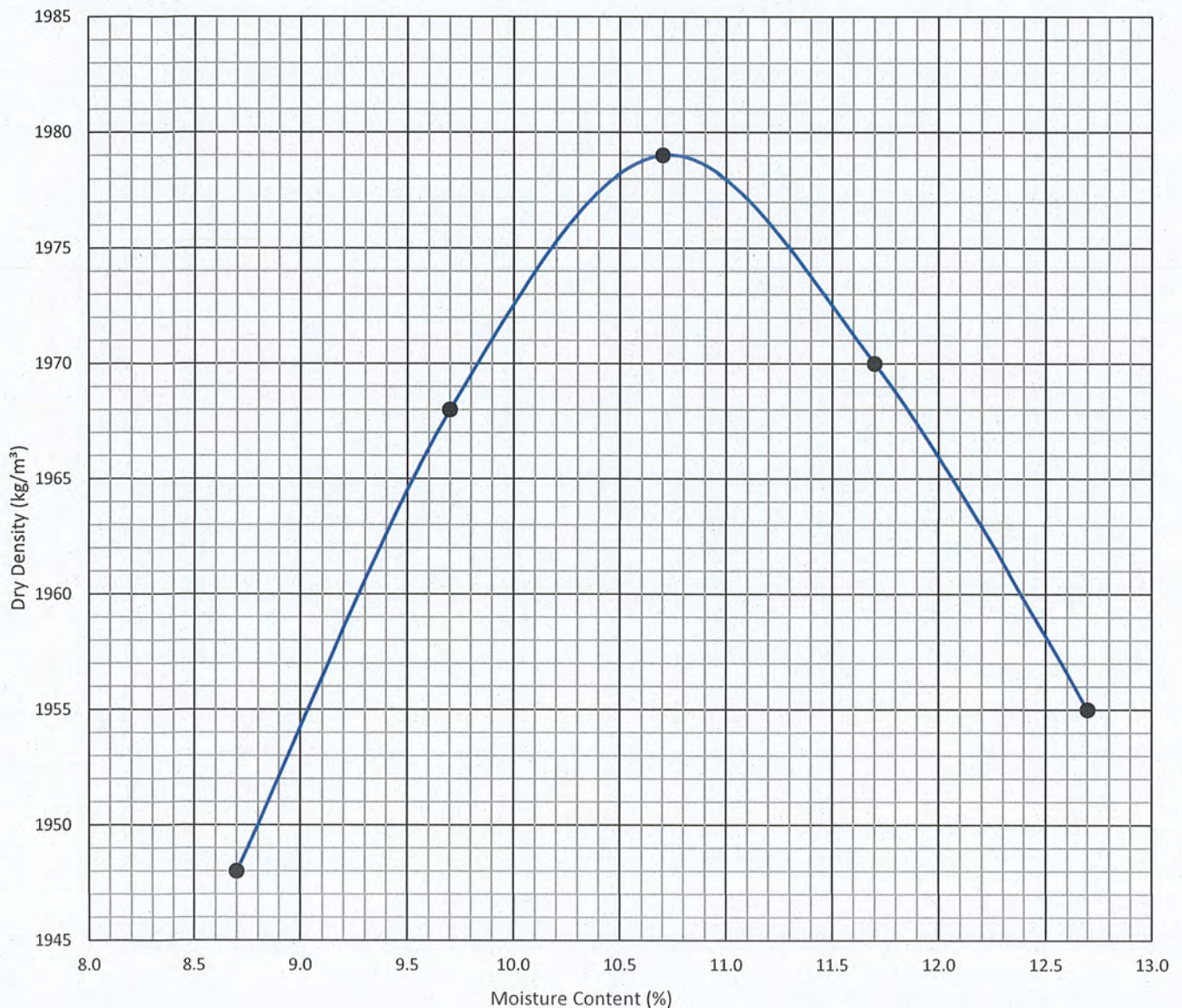
Job Number: RSC-05
Lab Number: RSC-05-56
Method: SANS 3001 GR30
Date: 13-Jun-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1979** kg/m³

Optimum Moisture Content: **10.7** %

Moisture Content (%):	8.7	9.7	10.7	11.7	12.7			
Dry Density (kg/m ³)	1948	1968	1979	1970	1955			



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP07
Depth: (m) 1.1 - 1.8

Job Number: RSC-05
Lab Number: RSC-05-31
Method: BS 1377 Part 5
Date: 13-Jun-19

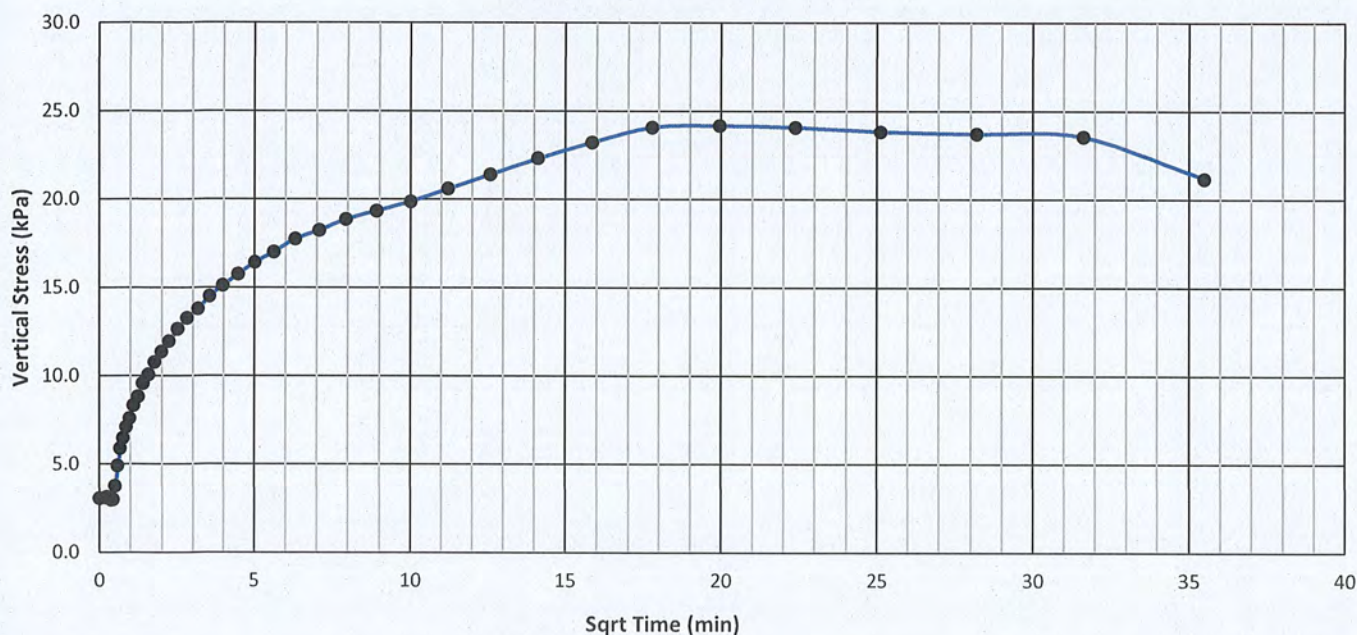
SWELL PRESSURE TEST

Sample Info		Unit	Initial	Test Remarks:
Test Specimen Height		mm	25.4	
Moisture Content	Initial	%	27.8	
	Final	%	31.0	
Dry Density		kg/m ³	1471	
Void Ratio		-	0.881	
Degree of Saturation		%	87.3	
Relative Density (SG)		-	2.767	Determined

Swell Pressure	kPa	24.2	
----------------	-----	------	--

Vertical Stress	kPa	3.05	3.10	3.13	3.09	2.98	2.98	3.76	4.91	5.88	6.47	7.11	7.60	8.33
		8.83	9.57	10.06	10.77	11.36	11.95	12.64	13.25	13.79	14.51	15.11	15.75	16.43
		17.01	17.75	18.23	18.86	19.33	19.86	20.59	21.40	22.32	23.21	24.08	24.16	24.07
		23.83	23.71	23.55	21.18									
Time	Sqrt min	0.00	0.18	0.22	0.29	0.37	0.43	0.50	0.58	0.66	0.75	0.86	0.97	1.10
		1.24	1.39	1.57	1.77	1.98	2.23	2.50	2.81	3.15	3.54	3.97	4.46	5.01
		5.62	6.31	7.08	7.94	8.91	10.00	11.22	12.59	14.12	15.85	17.78	19.95	22.39
		25.12	28.18	31.62	35.48									

Vertical Stress vs Sqrt Time



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silvertown Industrial
Sample: TP17
Depth: (m) 1.8

Job Number: RSC-05
Lab Number: RSC-05-36
Method: BS 1377 Part 5
Date: 13-Jun-19

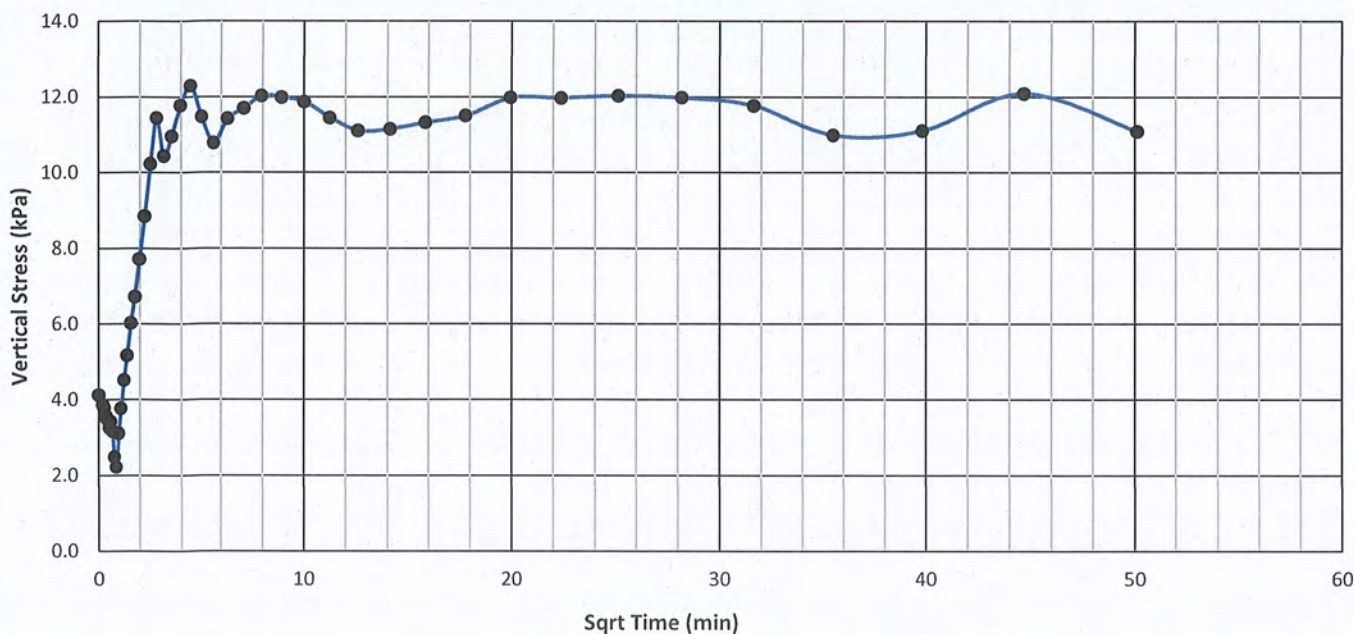
SWELL PRESSURE TEST

Sample Info		Unit	Initial	Test Remarks:
Test Specimen Height		mm	25.4	
Moisture Content	Initial	%	21.3	
	Final	%	29.5	
Dry Density		kg/m ³	1514	
Void Ratio		-	0.904	
Degree of Saturation		%	68.1	
Relative Density (SG)		-	2.883	Determined

Swell Pressure	kPa	12.3	
----------------	-----	------	--

Vertical Stress	kPa	4.12	3.86	3.79	3.54	3.56	3.46	3.26	3.42	3.18	2.49	2.22	3.12	3.78
		4.52	5.17	6.03	6.72	7.72	8.85	10.23	11.44	10.44	10.96	11.77	12.29	11.47
		10.78	11.42	11.70	12.02	11.99	11.86	11.45	11.10	11.15	11.33	11.50	11.98	11.97
		12.03	11.98	11.77	10.99	11.10	12.09	11.09						
Time	Sqrt min	0.00	0.18	0.26	0.32	0.37	0.43	0.50	0.58	0.66	0.75	0.86	0.97	1.10
		1.24	1.39	1.57	1.77	1.98	2.23	2.50	2.81	3.15	3.54	3.97	4.46	5.01
		5.62	6.31	7.08	7.94	8.91	10.00	11.22	12.59	14.12	15.85	17.78	19.95	22.39
		25.12	28.18	31.62	35.48	39.81	44.67	50.12						

Vertical Stress vs Sqrt Time



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrle | 082 309 4448 | gerrle@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP25
Depth: (m) 1.8 - 2.0

Job Number: RSC-05
Lab Number: RSC-05-39
Method: BS 1377 Part 5
Date: 13-Jun-19

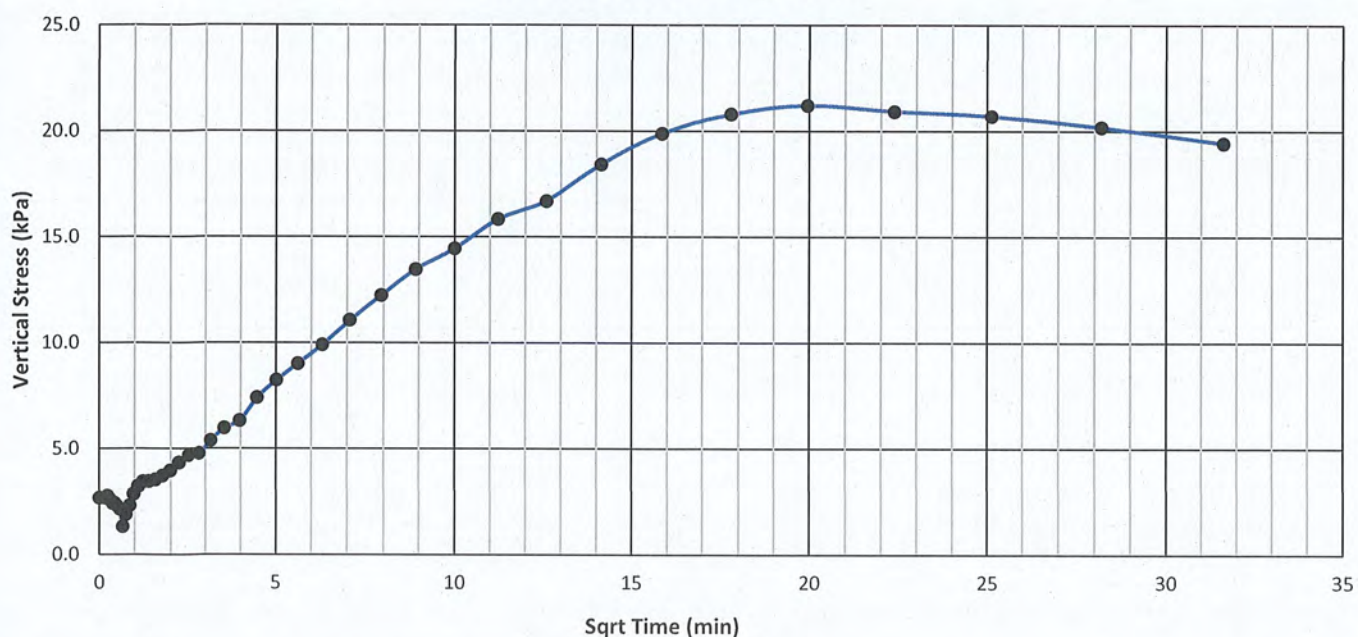
SWELL PRESSURE TEST

Sample Info		Unit	Initial	Test Remarks:
Test Specimen Height		mm	25.4	
Moisture Content	Initial	%	39.7	
	Final	%	46.2	
Dry Density		kg/m ³	1156	
Void Ratio		-	1.293	
Degree of Saturation		%	81.4	
Relative Density (SG)		-	2.651	Determined

Swell Pressure	kPa	21.2	
----------------	-----	------	--

Vertical Stress	kPa	2.66	2.65	2.76	2.60	2.41	2.42	2.29	2.14	1.31	1.89	2.31	2.85	3.23
		3.44	3.46	3.53	3.71	3.95	4.33	4.69	4.76	5.39	5.97	6.31	7.40	8.23
		9.02	9.90	11.06	12.24	13.47	14.45	15.83	16.69	18.42	19.88	20.79	21.21	20.92
		20.70	20.19	19.42										
Time	Sqrt min	0.00	0.18	0.22	0.29	0.37	0.43	0.50	0.58	0.66	0.75	0.86	0.97	1.10
		1.24	1.39	1.57	1.77	1.98	2.23	2.50	2.81	3.15	3.54	3.97	4.46	5.01
		5.62	6.31	7.08	7.94	8.91	10.00	11.22	12.59	14.12	15.85	17.78	19.95	22.39
		25.12	28.18	31.62										

Vertical Stress vs Sqrt Time



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP37
Depth: (m) 2.0

Job Number: RSC-05
Lab Number: RSC-05-49
Method: BS 1377 Part 5
Date: 13-Jun-19

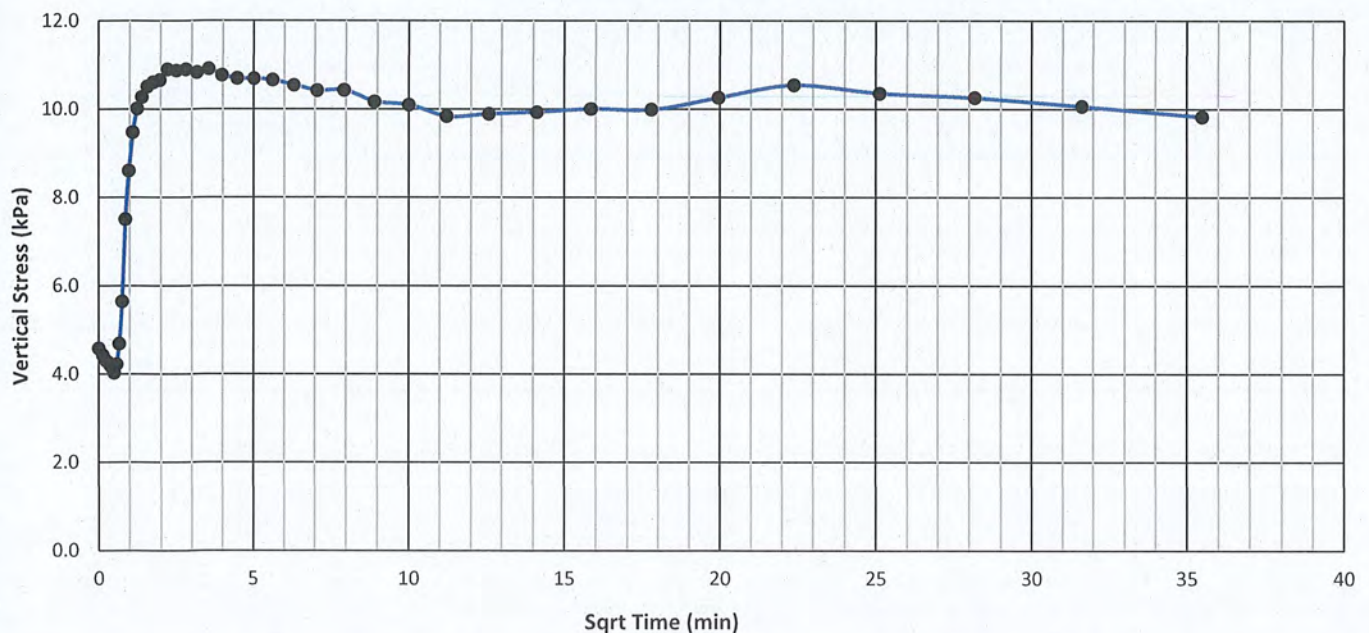
SWELL PRESSURE TEST

Sample Info		Unit	Initial	Test Remarks:
Test Specimen Height		mm	25.4	
Moisture Content	Initial	%	10.3	
	Final	%	14.8	
Dry Density		kg/m ³	1880	
Void Ratio		-	0.459	
Degree of Saturation		%	61.3	
Relative Density (SG)		-	2.742	Determined

Swell Pressure	kPa	10.9	
----------------	-----	------	--

Vertical Stress	kPa	4.58	4.42	4.30	4.27	4.20	4.13	4.02	4.22	4.69	5.64	7.50	8.61	9.48
		10.01	10.28	10.51	10.61	10.66	10.90	10.87	10.90	10.83	10.91	10.77	10.70	10.69
		10.65	10.54	10.42	10.43	10.17	10.10	9.84	9.89	9.93	10.00	9.99	10.26	10.54
		10.36	10.25	10.06	9.83									
Time	Sqrt min	0.00	0.13	0.22	0.29	0.37	0.43	0.50	0.58	0.66	0.75	0.86	0.97	1.10
		1.23	1.39	1.57	1.76	1.98	2.22	2.50	2.81	3.15	3.54	3.97	4.46	5.01
		5.62	6.31	7.08	7.94	8.91	10.00	11.22	12.59	14.12	15.85	17.78	19.95	22.39
		25.12	28.18	31.62	35.48									

Vertical Stress vs Sqrt Time



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrit | 082 309 4448 | gerrit@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd
Project Name: RS18056: Silverton Industrial
Sample: TP63
Depth: (m) 2.8

Job Number: RSC-05
Lab Number: RSC-05-57
Method: BS 1377 Part 5
Date: 13-Jun-19

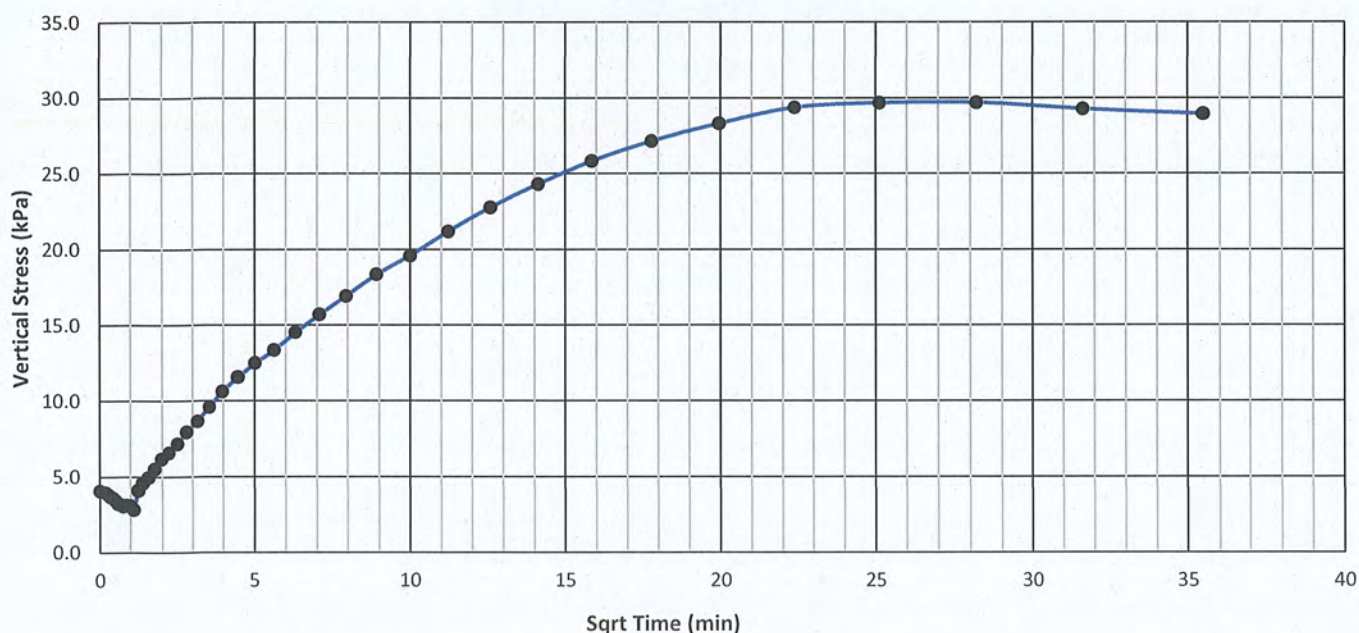
SWELL PRESSURE TEST

Sample Info		Unit	Initial	Test Remarks:
Test Specimen Height		mm	25.4	
Moisture Content	Initial	%	28.0	
	Final	%	32.7	
Dry Density		kg/m ³	1405	
Void Ratio		-	0.948	
Degree of Saturation		%	80.7	
Relative Density (SG)		-	2.736	Determined

Swell Pressure	kPa	29.7	
----------------	-----	------	--

Vertical Stress	kPa	4.06	3.94	3.83	3.69	3.66	3.56	3.45	3.24	3.15	3.07	3.12	3.10	2.84
		4.10	4.62	4.95	5.51	6.17	6.57	7.18	7.96	8.67	9.61	10.64	11.57	12.50
		13.36	14.52	15.71	16.92	18.35	19.58	21.18	22.77	24.31	25.83	27.15	28.32	29.37
		29.67	29.69	29.27	28.94									
Time	Sqrt min	0.00	0.18	0.26	0.32	0.37	0.43	0.50	0.58	0.67	0.75	0.86	0.97	1.10
		1.24	1.40	1.57	1.77	1.98	2.23	2.50	2.81	3.15	3.54	3.97	4.46	5.01
		5.62	6.31	7.08	7.94	8.91	10.00	11.22	12.59	14.12	15.85	17.78	19.95	22.39
		25.12	28.18	31.62	35.48									

Vertical Stress vs Sqrt Time



Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd

Project Name: RS18056: Silverton Industrial

Job Number: RSC-05

Date: 13-Jun-19

Method: SANS 3001 GR1, GR3, GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	TP01	TP02	TP03	TP04	TP04	TP06	TP07	TP09
Depth (m)	1.45 - 2.70	1.20 - 1.80	0.50 - 1.20	0.50 - 1.40	2.50 - 2.90	0.50 - 1.60	1.10 - 1.80	0.35 - 1.30
Lab No	RSC-05-24	RSC-05-25	RSC-05-26	RSC-05-27	RSC-05-28	RSC-05-29	RSC-05-30	RSC-05-32
53.0	100	100	100	100	100	100	100	100
37.5	100	100	100	100	100	100	100	100
26.5	86	98	100	100	100	100	100	100
19.0	64	88	100	100	100	100	100	100
13.2	58	88	100	100	100	100	100	100
9.5	51	88	100	99	100	100	99	96
6.7	41	88	99	94	94	100	98	91
4.75	36	87	97	88	89	98	96	85
2.00	26	84	79	69	65	86	89	68
1.00	22	79	66	63	55	75	85	63
0.425	20	76	62	61	53	71	82	58
0.250	19	73	58	60	51	69	80	55
0.150	19	70	56	58	49	67	78	53
0.075	16	63	54	55	48	64	76	51
0.060	11	43	46	45	40	55	66	42
0.050	10	39	45	43	39	54	65	41
0.035	9	33	43	41	37	52	61	38
0.020	9	28	41	38	35	48	58	36
0.006	7	20	36	33	31	42	50	31
0.002	6	14	31	30	26	39	46	28
GM	2.38	0.77	1.05	1.15	1.34	0.79	0.53	1.23

Atterberg Limits

LL (%)	52	52	61	52	56	53	60	48
PI (%)	27	29	35	27	29	28	32	26
LS (%)	13.0	14.5	24.5	13.0	14.5	13.5	23.5	12.5

pH & Conductivity

pH		6.4					6.1	
EC (S/m)		0.074					0.042	

MDD / OMC

MDD (kg/m ³)	1860	1641		1788		1752		1838
OMC (%)	15.2	19.5		19.3		19.8		16.3

CBR

100%	20	6.0		14		19		16
98%	18	5.3		12		16		14
97%	17	5.0		11		15		13
95%	15	4.4		10		13		11
93%	13	3.9		9		10		10
90%	9	3.3		7		7		9
Swell (%)	0.2	5.0		1.1		0.6		0.1

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

	*	*		*		*		*
--	---	---	--	---	--	---	--	---

Remarks: * = Not Classifiable

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokke Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd

Project Name: RS18056: Silverton Industrial

Job Number: RSC-05

Date: 13-Jun-19

Method: SANS 3001 GR1, GR3, GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	TP10	TP11	TP12	TP17	TP17	TP22	TP25	TP26
Depth (m)	2.00 - 2.50	0.90 - 1.20	0.30 - 0.95	1.80	2.00 - 3.30	0.40 - 0.70	1.80 - 2.00	0.60 - 1.50
Lab No	RSC-05-33	RSC-05-34	RSC-05-35	RSC-05-36	RSC-05-37	RSC-05-38	RSC-05-40	RSC-05-41
53.0	100	100	83	100	100	100	100	100
37.5	100	100	70	100	100	100	100	100
26.5	100	100	59	100	100	100	100	100
19.0	100	100	50	100	100	100	100	100
13.2	100	100	47	100	100	100	100	100
9.5	100	99	41	100	100	100	100	91
6.7	99	97	34	99	100	100	99	83
4.75	98	92	31	99	100	100	98	76
2.00	89	55	22	91	99	100	98	57
1.00	84	45	20	85	97	99	97	51
0.425	80	40	17	82	94	91	96	49
0.250	74	37	15	80	91	85	95	46
0.150	72	36	14	78	89	79	94	45
0.075	69	34	13	76	88	68	92	44
0.060	61	29	9	67	79	57	83	37
0.050	60	28	9	66	78	55	82	36
0.035	58	26	8	64	77	51	81	35
0.020	55	25	7	60	74	45	78	32
0.006	50	23	6	55	70	37	74	28
0.002	45	22	5	50	65	30	70	25
GM	0.62	1.71	2.48	0.51	0.19	0.41	0.14	1.50

Atterberg Limits

LL (%)	56	56	33	72	79	50	92	53
PI (%)	31	33	17	37	41	27	47	26
LS (%)	22.5	23.5	8.5	25.0	28.5	13.5	30.0	12.0

pH & Conductivity

pH	6.5	6.7				6.3	7.0	
EC (S/m)	0.075	0.043				0.065	0.091	

MDD / OMC

MDD (kg/m ³)			2153					
OMC (%)			7.5					

CBR

100%			46					
98%			39					
97%			36					
95%			31					
93%			27					
90%			22					
Swell (%)			0.1					

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

			G7					
--	--	--	----	--	--	--	--	--

Remarks:

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd

Project Name: RS18056: Silverton Industrial

Job Number: RSC-05

Date: 13-Jun-19

Method: SANS 3001 GR1, GR3, GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	TP30	TP31	TP32	TP32	TP32	TP35	TP36	TP43
Depth (m)	0.50 - 1.00	1.00 - 2.00	0.40 - 0.80	1.00 - 1.50	2.50 - 3.10	1.50 - 2.00	2.00 - 2.50	1.00 - 1.70
Lab No	RSC-05-42	RSC-05-43	RSC-05-44	RSC-05-45	RSC-05-46	RSC-05-47	RSC-05-48	RSC-05-50
53.0	92	100	100	100	100	100	100	100
37.5	79	100	100	100	100	100	100	100
26.5	69	100	100	100	100	100	100	100
19.0	61	100	100	100	100	100	100	100
13.2	55	100	100	100	100	100	100	100
9.5	54	65	99	100	89	100	100	100
6.7	49	51	93	96	83	96	100	100
4.75	45	44	86	91	78	90	98	100
2.00	34	34	67	78	66	80	90	92
1.00	29	28	59	72	59	76	81	68
0.425	26	25	49	67	53	65	74	47
0.250	23	22	39	60	49	53	69	39
0.150	22	20	34	57	46	46	64	34
0.075	20	19	29	53	42	38	56	28
0.060	15	12	23	43	32	36	46	12
0.050	14	12	22	42	31	34	42	10
0.035	13	11	20	40	29	31	36	7
0.020	12	10	17	37	25	29	30	5
0.006	10	9	14	30	21	24	22	2
0.002	8	7	12	26	19	20	17	1
GM	2.20	2.22	1.55	1.02	1.39	1.17	0.80	1.33

Atterberg Limits

LL (%)	43	42	28	48	54	29	53	39
PI (%)	24	22	14	26	27	16	21	13
LS (%)	11.0	10.5	7.0	12.5	12.0	8.0	9.5	6.5

pH & Conductivity

pH					5.9			
EC (S/m)					0.055			

MDD / OMC

MDD (kg/m ³)	1956					1956		
OMC (%)	12.0					11.4		

CBR

100%	18					28		
98%	17					22		
97%	16					20		
95%	15					16		
93%	13					12		
90%	11					7		
Swell (%)	0.2					0.1		

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

	*					*		
--	---	--	--	--	--	---	--	--

Remarks: * = Not Classifiable

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.



**Specialised
Testing
Laboratory** (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical

Unit 1, 13 Blouboekle Street, Koedoespoort 0186

Roelof | 072 674 6343 | roelof@stlab.co.za

Gerrie | 082 309 4448 | gerrie@stlab.co.za

www.stlab.co.za

Quality | Excellence | On Time

Client Name: RockSoil Consult (Pty) Ltd

Project Name: RS18056: Silvertown Industrial

Job Number: RSC-05

Date: 13-Jun-19

Method: SANS 3001 GR1, GR3, GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	TP46	TP54	TP54	TP55	TP55	TP58	TP63	TP64
Depth (m)	0.50 - 1.20	2.00 - 2.80	3.00 - 3.30	2.00 - 2.20	2.00 - 2.20	0.60 - 1.50	2.80	2.50 - 3.00
Lab No	RSC-05-51	RSC-05-52	RSC-05-53	RSC-05-54	RSC-05-55	RSC-05-56	RSC-05-57	RSC-05-58
53.0	100	100	100	100	100	100	100	100
37.5	100	100	100	100	100	100	100	100
26.5	100	100	100	100	100	94	100	100
19.0	100	100	100	100	100	74	100	100
13.2	100	100	100	100	100	52	100	100
9.5	98	100	100	100	100	40	100	100
6.7	97	100	100	98	100	34	100	100
4.75	96	100	100	93	100	30	100	100
2.00	92	98	99	51	96	21	97	99
1.00	87	96	99	42	93	18	94	97
0.425	84	93	94	39	90	17	91	94
0.250	81	92	91	38	88	16	88	92
0.150	79	90	86	37	85	14	84	88
0.075	74	86	80	35	82	13	79	81
0.060	67	59	59	30	62	9	71	61
0.050	66	56	55	29	58	8	69	56
0.035	64	50	48	28	51	7	65	48
0.020	61	45	37	26	44	6	60	39
0.006	54	31	23	23	36	5	55	28
0.002	48	21	13	20	30	4	50	23
GM	0.50	0.23	0.27	1.75	0.32	2.49	0.33	0.26

Atterberg Limits

LL (%)	65	64	53	60	67	36	71	50
PI (%)	37	33	22	31	34	18	40	26
LS (%)	26.0	24.0	12.0	23.5	25.5	9.0	23.5	12.5

pH & Conductivity

pH		6.1	6.3	6.4				
EC (S/m)		0.089	0.153	0.0230				

MDD / OMC

MDD (kg/m ³)				1950		1979		
OMC (%)				13.2		10.7		

CBR

100%				10.1		29		
98%				8.9		25		
97%				8.3		23		
95%				7.3		20		
93%				6.4		17		
90%				5.1		13		
Swell (%)				1.1		0.2		

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

				*		*		
--	--	--	--	---	--	---	--	--

Remarks: * = Not Classifiable

Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.

Appendix E: Summary and Evaluation Sheets

Table E8: Simplified Soil Horizons and General Conditions Encountered

Table E9: Foundation Indicator Test Results and Soil Classification Summary

Table E10: Soil pH, Conductivity and Corrosiveness Rating

Table E11: Typical Compressibility Rating Correlations Based on USCS

Table E12: Compaction and Typical Fill Rating Correlations Based on USCS

Table E13: Typical Material Rating for Use as Road Construction Material

Table E14: Typical Material Rating for Use as General and Foundation Fill

Table E8: Simplified Soil Horizons and General Condition

Test Pit No.	Latitude	Longitude	Uncontrolled Fill		(Distu Top
			From	To	From
TP01	-25.733685	28.334844	0.00	0.50	-
TP02	-25.734060	28.336318			0.00
TP03	-25.734802	28.337801	0.00	0.30	0.30
TP04	-25.735713	28.337139			0.00
TP05	-25.735232	28.335545			0.00
TP06	-25.734845	28.334262			0.00
TP07	-25.736286	28.336124			0.00
TP08	-25.736544	28.334982			0.00
TP09	-25.736313	28.333960			0.00
TP10	-25.737040	28.334096	0.00	1.05	1.05
TP11	-25.737263	28.336652			0.00
TP12	-25.737329	28.338312			0.00
TP13	-25.736799	28.339182			0.00
TP14	-25.737663	28.339999			0.00
TP15	-25.737970	28.338868			0.00
TP16	-25.738325	28.337399			0.00
TP17	-25.736255	28.337961			0.00
TP18	-25.735254	28.338505			0.00
TP19	-25.734453	28.338862			0.00
TP20	-25.734933	28.339913			0.00
TP21	-25.735166	28.341342			0.00
TP22	-25.735987	28.342036			0.00
TP23	-25.736668	28.341052			0.00
TP24	-25.736015	28.340782			0.00
TP25	-25.735698	28.339640			0.00
TP26	-25.736377	28.339077			0.00
TP27	-25.736802	28.340308	0.00	0.60	0.60
TP28	-25.737418	28.340689	0.00	0.40	0.40
TP29	-25.738651	28.340304	0.00	0.15	0.15
TP30	-25.738674	28.339172	0.00	0.10	0.10
TP31	-25.738900	28.338185	0.00	0.10	0.10
TP32	-25.738134	28.336300			0.00
TP33	-25.737548	28.335377	0.00	0.60	-
TP34	-25.738083	28.333600	0.00	0.50	0.50
TP35	-25.738816	28.334383	0.00	0.65	0.65
TP36	-25.738848	28.335538			0.00
TP37	-25.739443	28.336320			0.00
TP38	-25.739138	28.337164			0.00
TP39	-25.739897	28.337547	0.00	0.30	0.30
TP40	-25.739724	28.338821	0.00	0.20	0.20
TP41	-25.739816	28.340047	0.00	0.12	0.12
TP42	-25.740733	28.340218	0.00	0.30	0.30

Table E9: Grading, Atterberg Limits and Soil Classifications

Test Pit No.	Sample depth (mbgl)	Material description	Soil composition				Atterberg Limits		LS (%)	GM	Class (AASHTO)	Class (USCS) 1	Class (USCS) 2	Class (TRH14)
			Clay (%)	Silt (%)	Sand (%)	Gravel (%)	LL (%)	PI (%)						
TP01	1.45 - 2.70	Shale	6	5	15	74	52	27	13.0	2.38	A-2-7	GC	-	-
TP02	1.20 - 1.80	Residual and completely weathered shale	14	29	41	16	52	29	14.5	0.77	A-7-6	CH	-	-
TP03	0.50 - 1.20	Colluvium	31	15	33	21	61	35	24.5	1.05	A-7-6	CH	-	-
TP04	0.50 - 1.40	Ferruginised colluvium	30	15	24	31	52	27	13.0	1.15	A-7-6	CH	-	-
TP04	2.50 - 2.90	Ferruginised residual shale	26	14	25	35	56	29	14.5	1.34	A-7-6	SC	-	-
TP06	0.50 - 1.60	Slightly ferruginised colluvium	39	16	31	14	53	28	13.5	0.79	A-7-6	CH	-	-
TP07	1.10 - 1.80	Reworked residual shale	46	20	23	11	60	32	23.5	0.53	A-7-6	CH	-	-
TP09	0.35 - 1.30	Ferruginised colluvium	28	14	26	32	48	26	12.5	1.23	A-7-6	CL	-	-
TP10	2.00 - 2.50	Residual shale	46	20	23	11	56	31	22.5	0.62	A-7-6	CH	-	-
TP11	0.90 - 1.20	Ferruginised alluvium	22	7	26	45	56	33	23.5	1.71	A-2-7	SC	-	-
TP12	0.30 - 0.95	Shale	5	4	13	78	33	17	8.5	2.48	A-2-6	GC	-	G7
TP17	1.80	Residual shale	50	17	24	9	72	37	25.0	0.51	A-7-5	CH	-	-
TP17	2.00 - 3.30	Residual shale	65	14	20	1	79	41	28.5	0.19	A-7-5	CH	-	-
TP22	0.40 - 0.70	Colluvium	30	27	43	0	50	27	13.5	0.41	A-7-6	CH	-	-
TP25	1.80 - 2.00	Residual shale	70	13	15	2	92	47	30.0	0.14	A-7-5	MH	-	-
TP26	0.60 - 1.50	Slightly ferruginised colluvium	25	12	20	43	53	26	12.0	1.50	A-7-6	SC	-	-
TP30	0.50 - 1.00	Shale	8	7	19	66	43	24	11.0	2.20	A-2-7	GC	-	-
TP31	1.00 - 2.00	Shale	7	5	22	66	42	22	10.5	2.22	A-2-7	GC	-	-
TP32	0.40 - 0.80	Ferruginised colluvium	12	11	44	33	28	14	7.0	1.55	A-2-6	SC	-	-
TP32	1.00 - 1.50	Reworked residual shale	26	17	35	22	48	26	12.5	1.02	A-7-6	CL	-	-
TP32	2.50 - 3.10	Residual shale	19	13	34	34	54	27	12.0	1.39	A-7-6	SC	-	-
TP35	1.50 - 2.00	Ferruginised pebble marker	20	16	44	20	29	16	8.0	1.17	A-6	SC	-	-
TP36	2.00 - 2.50	Residual shale	17	29	44	10	53	21	9.5	0.80	A-7-5	MH	-	-
TP43	1.00 - 1.70	Residual diabase	1	11	80	8	39	13	6.5	1.33	A-2-6	SC	-	-
TP46	0.50 - 1.20	Reworked residual shale	48	19	25	8	65	37	26.0	0.50	A-7-6	CH	-	-
TP54	2.00 - 2.80	Reworked residual diabase	21	38	39	2	64	33	24.0	0.23	A-7-5	CH	-	-
TP54	3.00 - 3.30	Residual diabase	13	46	40	1	53	22	12.0	0.27	A-7-5	CH	-	-
TP55	0.20-1.00	Colluvium	20	10	21	49	60	31	23.5	1.75	A-7-6	SC	-	-
TP55	2.00 - 2.20	Reworked residual diabase	30	32	34	4	67	34	25.5	0.32	A-7-5	CH	-	-
TP58	0.60 - 1.50	Shale	4	5	12	79	36	18	9.0	2.49	A-2-6	GC	-	-
TP63	2.80	Residual shale	50	21	26	3	71	40	23.5	0.33	A-7-5	CH	-	-
TP64	2.50 - 3.00	Reworked residual shale	23	38	38	1	50	26	12.5	0.26	A-7-6	CH	-	-

Min:	1.00	4.00	12.00	0.00	28.00	13.00	6.50	0.14
Max:	70.00	46.00	80.00	79.00	92.00	47.00	30.00	2.49
Average:	26.63	17.50	29.97	25.91	53.97	28.00	16.42	1.08
Standard deviation:	17.53	10.44	13.30	24.84	13.77	7.93	7.14	0.73

Notes:

1) This is only a basic summary for quick reference purposes.

2) Refer to the laboratory test results and individual soil profile logs for more detailed properties and descriptions.

Table E10: Soil pH, Conductivity and Corrosiveness Rating

Test Pit No.	Sample depth (mbgl)	Material description	pH	Electrical conductivity of the soil paste (S/m)	Electrical conductivity of the soil paste (mS/cm)	Corrosiveness rating based on the electrical conductivity correlation
TP02	1.20 - 1.80	Residual and completely weathered shale	6.4	0.0740	0.740	Extremely corrosive
TP07	1.10 - 1.80	Reworked residual shale	6.1	0.0420	0.420	Very corrosive
TP10	2.00 - 2.50	Residual shale	6.5	0.0750	0.750	Extremely corrosive
TP11	0.90 - 1.20	Ferruginised alluvium	6.7	0.0430	0.430	Very corrosive
TP22	0.40 - 0.70	Colluvium	6.3	0.0650	0.6500	Extremely corrosive
TP25	1.80 - 2.00	Residual shale	7.0	0.0910	0.9100	Extremely corrosive
TP32	2.50 - 3.10	Residual shale	5.9	0.0550	0.5500	Not generally corrosive
TP54	2.00 - 2.80	Reworked residual diabase	6.1	0.0890	0.8900	Not generally corrosive
TP54	3.00 - 3.30	Residual diabase	6.3	0.1530	1.5300	Mildly corrosive
TP55	0.20-1.00	Colluvium	6.4	0.0230	0.2300	Not generally corrosive

Notes:

- 1) This is only a basic summary for quick reference purposes.
- 2) Refer to the laboratory test results.

Table E11: Typical Compressibility Rating Correlations Based on Unified Soil Classification System (Well-Compacted State)

Test Pit No.	Sample depth (mbgl)	Material description	Unified Soil Classification System	Expected compressibility when properly compacted (USCS)
TP01	1.45 - 2.70	Shale	GC	Low
TP02	1.20 - 1.80	Residual and completely weathered shale	CH	Medium to high
TP03	0.50 - 1.20	Colluvium	CH	Medium to high
TP04	0.50 - 1.40	Ferruginised colluvium	CH	Medium to high
TP04	2.50 - 2.90	Ferruginised residual shale	SC	Low
TP06	0.50 - 1.60	Slightly ferruginised colluvium	CH	Medium to high
TP07	1.10 - 1.80	Reworked residual shale	CH	Medium to high
TP09	0.35 - 1.30	Ferruginised colluvium	CL	Medium
TP10	2.00 - 2.50	Residual shale	CH	Medium to high
TP11	0.90 - 1.20	Ferruginised alluvium	SC	Low
TP12	0.30 - 0.95	Shale	GC	Low
TP17	1.80	Residual shale	CH	Medium to high
TP17	2.00 - 3.30	Residual shale	CH	Medium to high
TP22	0.40 - 0.70	Colluvium	CH	Medium to high
TP25	1.80 - 2.00	Residual shale	MH	Medium to high
TP26	0.60 - 1.50	Slightly ferruginised colluvium	SC	Low
TP30	0.50 - 1.00	Shale	GC	Low
TP31	1.00 - 2.00	Shale	GC	Low
TP32	0.40 - 0.80	Ferruginised colluvium	SC	Low
TP32	1.00 - 1.50	Reworked residual shale	CL	Medium
TP32	2.50 - 3.10	Residual shale	SC	Low
TP35	1.50 - 2.00	Ferruginised pebble marker	SC	Low
TP36	2.00 - 2.50	Residual shale	MH	Medium to high
TP43	1.00 - 1.70	Residual diabase	SC	Low
TP46	0.50 - 1.20	Reworked residual shale	CH	Medium to high
TP54	2.00 - 2.80	Reworked residual diabase	CH	Medium to high
TP54	3.00 - 3.30	Residual diabase	CH	Medium to high
TP55	0.20-1.00	Colluvium	SC	Low
TP55	2.00 - 2.20	Reworked residual diabase	CH	Medium to high
TP58	0.60 - 1.50	Shale	GC	Low
TP63	2.80	Residual shale	CH	Medium to high
TP64	2.50 - 3.00	Reworked residual shale	CH	Medium to high

Notes:

1) The rating does not consider voided soil structure.

Table E12: Compaction and Typical Fill Rating Correlations Based on Unified Soil Classification System

Test Pit No.	Sample depth (mbgl)	Material description	Unified Soil Class	General compaction characteristics or rating based on USCS	Typical fill material rating based USCS
TP01	1.45 - 2.70	Shale	GC	Good to fair	Good
TP02	1.20 - 1.80	Residual and completely weathered shale	CH	Fair to poor	Unsuitable
TP03	0.50 - 1.20	Colluvium	CH	Fair to poor	Unsuitable
TP04	0.50 - 1.40	Ferruginised colluvium	CH	Fair to poor	Unsuitable
TP04	2.50 - 2.90	Ferruginised residual shale	SC	Good to fair	Average
TP06	0.50 - 1.60	Slightly ferruginised colluvium	CH	Fair to poor	Unsuitable
TP07	1.10 - 1.80	Reworked residual shale	CH	Fair to poor	Unsuitable
TP09	0.35 - 1.30	Ferruginised colluvium	CL	Fair	Average
TP10	2.00 - 2.50	Residual shale	CH	Fair to poor	Unsuitable
TP11	0.90 - 1.20	Ferruginised alluvium	SC	Good to fair	Average
TP12	0.30 - 0.95	Shale	GC	Good to fair	Good
TP17	1.80	Residual shale	CH	Fair to poor	Unsuitable
TP17	2.00 - 3.30	Residual shale	CH	Fair to poor	Unsuitable
TP22	0.40 - 0.70	Colluvium	CH	Fair to poor	Unsuitable
TP25	1.80 - 2.00	Residual shale	MH	Fair to poor	Poor
TP26	0.60 - 1.50	Slightly ferruginised colluvium	SC	Good to fair	Average
TP30	0.50 - 1.00	Shale	GC	Good to fair	Good
TP31	1.00 - 2.00	Shale	GC	Good to fair	Good
TP32	0.40 - 0.80	Ferruginised colluvium	SC	Good to fair	Average
TP32	1.00 - 1.50	Reworked residual shale	CL	Fair	Average
TP32	2.50 - 3.10	Residual shale	SC	Good to fair	Average
TP35	1.50 - 2.00	Ferruginised pebble marker	SC	Good to fair	Average
TP36	2.00 - 2.50	Residual shale	MH	Fair to poor	Poor
TP43	1.00 - 1.70	Residual diabase	SC	Good to fair	Average
TP46	0.50 - 1.20	Reworked residual shale	CH	Fair to poor	Unsuitable
TP54	2.00 - 2.80	Reworked residual diabase	CH	Fair to poor	Unsuitable
TP54	3.00 - 3.30	Residual diabase	CH	Fair to poor	Unsuitable
TP55	0.20-1.00	Colluvium	SC	Good to fair	Average
TP55	2.00 - 2.20	Reworked residual diabase	CH	Fair to poor	Unsuitable
TP58	0.60 - 1.50	Shale	GC	Good to fair	Good
TP63	2.80	Residual shale	CH	Fair to poor	Unsuitable
TP64	2.50 - 3.00	Reworked residual shale	CH	Fair to poor	Unsuitable

Notes:

1) For guideline purposes only, refer to compaction test results if available.

Table E13: Typical Material Rating for Use as Road Construction Material

Test Pit No.	Sample depth (mbgl)	Material description	Soil Class (USCS)	Material typical road construction rating based on Unified Soil Classification System			Soil Class (AASHTO)	Material typical road construction rating based on AASHTO Soil Classification System	
				Subgrade	Subbase	Base		Subgrade	Significant Constituent Materials
TP01	1.45 - 2.70	Shale	GC	Good	Fair	Poor to not suitable	A-2-7	Excellent to Good	Silty or clayey gravel sand
TP02	1.20 - 1.80	Residual and completely weathered shale	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP03	0.50 - 1.20	Colluvium	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP04	0.50 - 1.40	Ferruginised colluvium	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP04	2.50 - 2.90	Ferruginised residual shale	SC	Fair	Poor	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP06	0.50 - 1.60	Slightly ferruginised colluvium	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP07	1.10 - 1.80	Reworked residual shale	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP09	0.35 - 1.30	Ferruginised colluvium	CL	Fair to poor	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP10	2.00 - 2.50	Residual shale	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP11	0.90 - 1.20	Ferruginised alluvium	SC	Fair	Poor	Not suitable	A-2-7	Excellent to Good	Silty or clayey gravel sand
TP12	0.30 - 0.95	Shale	GC	Good	Fair	Poor to not suitable	A-2-6	Excellent to Good	Silty or clayey gravel sand
TP17	1.80	Residual shale	CH	Poor to fair	Not suitable	Not suitable	A-7-5	Fair to Poor	Clayey soils
TP17	2.00 - 3.30	Residual shale	CH	Poor to fair	Not suitable	Not suitable	A-7-5	Fair to Poor	Clayey soils
TP22	0.40 - 0.70	Colluvium	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP25	1.80 - 2.00	Residual shale	MH	Poor	Not suitable	Not suitable	A-7-5	Fair to Poor	Clayey soils
TP26	0.60 - 1.50	Slightly ferruginised colluvium	SC	Fair	Poor	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP30	0.50 - 1.00	Shale	GC	Good	Fair	Poor to not suitable	A-2-7	Excellent to Good	Silty or clayey gravel sand
TP31	1.00 - 2.00	Shale	GC	Good	Fair	Poor to not suitable	A-2-7	Excellent to Good	Silty or clayey gravel sand
TP32	0.40 - 0.80	Ferruginised colluvium	SC	Fair	Poor	Not suitable	A-2-6	Excellent to Good	Silty or clayey gravel sand
TP32	1.00 - 1.50	Reworked residual shale	CL	Fair to poor	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP32	2.50 - 3.10	Residual shale	SC	Fair	Poor	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP35	1.50 - 2.00	Ferruginised pebble marker	SC	Fair	Poor	Not suitable	A-6	Fair to Poor	Clayey soils
TP36	2.00 - 2.50	Residual shale	MH	Poor	Not suitable	Not suitable	A-7-5	Fair to Poor	Clayey soils
TP43	1.00 - 1.70	Residual diabase	SC	Fair	Poor	Not suitable	A-2-6	Excellent to Good	Silty or clayey gravel sand
TP46	0.50 - 1.20	Reworked residual shale	CH	Poor to fair	Not suitable	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP54	2.00 - 2.80	Reworked residual diabase	CH	Poor to fair	Not suitable	Not suitable	A-7-5	Fair to Poor	Clayey soils
TP54	3.00 - 3.30	Residual diabase	CH	Poor to fair	Not suitable	Not suitable	A-7-5	Fair to Poor	Clayey soils
TP55	0.20-1.00	Colluvium	SC	Fair	Poor	Not suitable	A-7-6	Fair to Poor	Clayey soils
TP55	2.00 - 2.20	Reworked residual diabase	CH	Poor to fair	Not suitable	Not suitable	A-7-5	Fair to Poor	Clayey soils

Test Pit No.	Sample depth (mbgl)	Material description	Soil Class (USCS)	Material typical road construction rating based on Unified Soil Classification System			Soil Class (AASHTO)		Material typical road construction rating based on AASHTO Soil Classification System	
				Subgrade	Subbase	Base			Subgrade	Significant Constituent Materials
TP58	0.60 - 1.50	Shale	GC	Poor to fair	Not suitable	Not suitable	A-7-5		Fair to Poor	Clayey soils
TP63	2.80	Residual shale	CH	Poor to fair	Not suitable	Not suitable	A-7-5		Fair to Poor	Clayey soils
TP64	2.50 - 3.00	Reworked residual shale	CH	Poor to fair	Not suitable	Not suitable	A-7-5		Fair to Poor	Clayey soils

Notes:

- 1) Based on Unified Soil Classification System.
- 2) Refer to compaction test results and specific testing for detailed evaluation and selection purposes if available.
- 3) USCS - Unified Soil Classification System.

Table E14: Typical Material Rating for Use as General and Foundation Fill

Test Pit No.	Sample depth (mbgl)	Material description	Unified Soil Class	Typical rating for use as general fill material	Typical rating for use as fill for foundation purposes	Expected Dry Density (kg/m ³) (PROCTOR)
TP01	1.45 - 2.70	Shale	GC	Good	Excellent	> 1 840
TP02	1.20 - 1.80	Residual and completely weathered shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP03	0.50 - 1.20	Colluvium	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP04	0.50 - 1.40	Ferruginised colluvium	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP04	2.50 - 2.90	Ferruginised residual shale	SC	Average	Good (density important)	1 840 +/- 20
TP06	0.50 - 1.60	Slightly ferruginised colluvium	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP07	1.10 - 1.80	Reworked residual shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP09	0.35 - 1.30	Ferruginised colluvium	CL	Average	Average (Swell?)	1 730 +/- 20
TP10	2.00 - 2.50	Residual shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP11	0.90 - 1.20	Ferruginised alluvium	SC	Average	Good (density important)	1 840 +/- 20
TP12	0.30 - 0.95	Shale	GC	Good	Excellent	> 1 840
TP17	1.80	Residual shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP17	2.00 - 3.30	Residual shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP22	0.40 - 0.70	Colluvium	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP25	1.80 - 2.00	Residual shale	MH	Poor	Unsuitable (Swell?)	1 310 +/- 60
TP26	0.60 - 1.50	Slightly ferruginised colluvium	SC	Average	Good (density important)	1 840 +/- 20
TP30	0.50 - 1.00	Shale	GC	Good	Excellent	> 1 840
TP31	1.00 - 2.00	Shale	GC	Good	Excellent	> 1 840
TP32	0.40 - 0.80	Ferruginised colluvium	SC	Average	Good (density important)	1 840 +/- 20
TP32	1.00 - 1.50	Reworked residual shale	CL	Average	Average (Swell?)	1 730 +/- 20
TP32	2.50 - 3.10	Residual shale	SC	Average	Good (density important)	1 840 +/- 20
TP35	1.50 - 2.00	Ferruginised pebble marker	SC	Average	Good (density important)	1 840 +/- 20
TP36	2.00 - 2.50	Residual shale	MH	Poor	Unsuitable (Swell?)	1 310 +/- 60
TP43	1.00 - 1.70	Residual diabase	SC	Average	Good (density important)	1 840 +/- 20
TP46	0.50 - 1.20	Reworked residual shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP54	2.00 - 2.80	Reworked residual diabase	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP54	3.00 - 3.30	Residual diabase	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP55	0.20-1.00	Colluvium	SC	Average	Good (density important)	1 840 +/- 20
TP55	2.00 - 2.20	Reworked residual diabase	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP58	0.60 - 1.50	Shale	GC	Good	Excellent	> 1 840
TP63	2.80	Residual shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30
TP64	2.50 - 3.00	Reworked residual shale	CH	Unsuitable	Poor (Swell?)	1 510 +/- 30

Notes:

1) Based on Unified Soil Classification System.

2) The evaluator should refer to the compaction, consolidation and swell test results for detailed evaluation and selection purposes.

Appendix F: Reference Tables

Table F15: Residential Site Class Designations (SAICE, 1995)

Typical Founding Material	Character of Founding Material	Expected Range of Total Soil Movements (mm)	Assumed Differential Movement (% of total)	Site Class
Rock (excluding mud rocks which exhibit swelling to some depth)	Stable	NEGLIGIBLE	-	R
Fine-grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	Expansive Soils	< 7,5 7,5 – 15 15 – 30 > 30	50% 50% 50% 50%	H H1 H2 H3
Silty sands, sands, sandy and gravelly soils	Compressible and Potentially Collapsible Soils	< 5,0 5,0 – 10 > 10	75% 75% 75%	C C1 C2
Fine-grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	Compressible Soils	< 10 10 – 20 > 20	50% 50% 50%	S S1 S2
Contaminated soils Controlled fill Dolomitic areas Land fill Marshy areas Mine waste fill Mining subsidence Reclaimed areas Very soft silt/silty clays Uncontrolled fill	Variable	Variable		P

Notes:

1. The classifications C, H, R and S are not intended for dolomitic area sites unless specific investigations are carried out to assess the stability (risk of sinkholes and doline formation) of the dolomites. Where this risk is found to be acceptable, the site shall be designated as Class P (dolomitic areas).
2. Site classes are based on the assumption that differential movements, experienced by single-storey residential buildings, expressed as a percentage of the total movements are equal to about 50% for soils that exhibit expansive or compressive characteristics and 75% for soils that exhibit both compressible and collapse characteristics. Where this assumption is incorrect or inappropriate, the total soil movements must be adjusted so that the resultant different movements implied by the table are equal to that which is expected in the field.
3. In some instances, it may be more appropriate to use a composite description to describe a site more fully e.g. C1/H2 or S1 and/or H2. Composite Site Classes may lead to higher differential movements and result in design solutions appropriate to a higher range of differential movement e.g. a Class R/C1 site. Alternatively, a further site investigation may be necessary since the final design solution may depend on the location of the building on a particular site.
4. Where it is not possible to provide a single site designation and a composite description is inappropriate, sites may be given multiple descriptions to indicate the range of possible conditions e.g. H-H1-H2 or C1-C2.
5. Soft silts and clays usually exhibit high consolidation and low bearing characteristics. Structures founded on these horizons may experience high settlements and such sites should be designated as being Class S1 or S2 as relevant and appropriate.
6. Sites containing contaminated soils include those associated with reclaimed mine land, land down-slope of mine tailings and old land fills.
7. Where a site is designated as Class P, full particulars relating to the founding conditions on the site must be provided.
8. Where sites are designated as being Class P, the reason for such classification shall be placed in brackets immediately after the suffix – i.e. P(contaminated soils). Under certain circumstances, composite description may be more appropriate – e.g. P(dolomite areas)-C1.
9. Certain fills may contain contaminants which present a health risk. The nature of such fill should be evaluated and should be clearly demarcated as such.

Table F16: Foundation design, building procedures and precautionary measures for single-storey residential buildings founded on horizons subject to consolidation settlement (SAICE, 1995).

Site Class	Estimated Total Settlement	Construction Type	Foundation Design and Building Procedures
S	<10 mm	Normal	- Normal construction (strip footing or slab-on-the-ground foundations) - Good site drainage
S1	10-20 mm	Modified normal	- Reinforced strip footings - Articulation joints at some internal and all external doors - Light reinforcement in masonry - Site drainage and service/plumbing precautions - Foundation pressure not to exceed 50 kPa
		Compaction of in situ soils below individual footings	- Remove in situ material below foundations to a depth and width of 1,5 times the foundation width or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. - Normal construction with lightly reinforced strip foundations and light reinforcement in masonry.
		Deep strip foundations	- Normal construction with drainage requirements. - Founding on a competent horizon below the problem horizon
		Soil raft	- Remove in situ material to 1,0m beyond perimeter of building to a depth and width of 1,5 times the widest foundation or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. - Normal construction with lightly reinforced strip footings and light reinforcement in masonry.
S2	>20 mm	Stiffened strip footings, stiffened or cellular raft	- Stiffened strip footing or stiffened or cellular raft with articulation joints or solid lightly reinforced masonry. - Bearing pressure not to exceed 50kPa. - Fabric reinforcement in floor slabs. - Site drainage and service/plumbing precautions.
		Deep strip foundations	- As for S1 but with fabric reinforcement in floor slabs
		Compaction of in-situ soils below individual footings	- As for S1.
		Piled or pier foundations	- Reinforced concrete ground beams or solid slabs on piled or pier foundations. - Ground slabs with fabric reinforcement. - Good site drainage.
		Soil raft	- As for S1.

Notes:

1. Differential settlement assumed to equal 50% of total settlement.
2. The relaxation of some of these requirements, e.g. the reduction or omission of steel or articulation joints, may result in a Category 2 level of expected damage.
3. Account must be taken on sloping site since differential fill heights may lead to greater differential settlements.
4. Settlements induced by loads imposed by deep filling beneath surface beds may necessitate the adoption of a construction type appropriate to a more severe site class.

Table F17: Foundation design, building procedures and precautionary measures for single-storey residential buildings founded on horizons subject to both consolidation and collapse settlement (SAICE, 1995)

Site Class	Estimated Total Settlement	Construction Type	Foundation Design and Building Procedures
C	<5 mm	Normal	- Normal construction (strip footing or slab-on-the-ground foundations) - Good site drainage
C1	5 – 10 mm	Modified normal Compaction of in situ soils below individual footings Deep strip foundations Soil raft	- Reinforced strip footings - Articulation joints at some internal and all external doors - Light reinforcement in masonry - Site drainage and service/plumbing precautions - Foundation pressure not to exceed 50 kPa - Remove in situ material below foundations to a depth and width of 1,5 times the foundation width or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. - Normal construction with lightly reinforced strip foundations and light reinforcement in masonry. - Normal construction with drainage requirements. - Founding on a competent horizon below the problem horizon - Remove in situ material to 1,0m beyond perimeter of building to a depth and width of 1,5 times the widest foundation or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. - Normal construction with lightly reinforced strip footings and light reinforcement in masonry.
C2	>10 mm	Stiffened strip footings, stiffened or cellular raft Deep strip foundations Compaction of in situ soils below individual footings Piled or pier foundations Soil raft	- Stiffened strip footing or stiffened or cellular raft with articulation joints or solid lightly reinforced masonry. - Bearing pressure not to exceed 50kPa. - Fabric reinforcement in floor slabs. - Site drainage and service/plumbing precautions. - As for C1 but with fabric reinforcement in floor slabs - As for C1. - Reinforced concrete ground beams or solid slabs on piled or pier foundations. - Ground slabs with fabric reinforcement. - Good site drainage. - As for C1.

Notes:

1. Differential settlement assumed to equal 75% of total settlement
2. The relaxation of some of these requirements, e.g. the reduction or omission of steel or articulation joints, may result in a Category 2 level of expected damage.

Table F18: Foundation design, building procedures and precautionary measures for single-storey residential buildings founded on expansive soil horizons (SAICE, 1995)

Site Class	Estimated Total Heave	Construction Type	Foundation Design and Building Procedures
H	<7,5 mm	Normal	- Normal construction (strip footing or slab-on-the-ground foundations) - Good site drainage and service/plumbing precautions recommended.
H1	7,5 – 15 mm	Modified normal	- Lightly reinforced strip footings - Articulation joints at all internal/external doors - Light reinforcement in masonry - Site drainage and service/plumbing precautions
		Soil raft	- Remove in situ material to 1,0m beyond perimeter of the structure and replace with inert backfill, compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. - Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are <7,5mm, or construction type appropriate to residual movements. - Site drainage and plumbing/service precautions.
H2	15-30 mm	Stiffened or cellular raft	- Stiffened or cellular raft with articulation joints or lightly reinforced masonry. - Site drainage and plumbing/service precautions.
		Piled construction	- Piled foundations with suspended floor slabs with or without ground beams. - Site drainage and plumbing/service precautions.
		Split construction	- Combination of reinforced brickwork/block work and full movement joints. - Suspended floors of fabric-reinforced ground slabs acting independently from the structure. - Site drainage and plumbing/service precautions.
		Soil raft	- As for H1.
H3	>30 mm	Stiffened or cellular raft	- As for H2.
		Piled construction	- As for H2.
		Soil raft	- As for H1.

Notes:

1. Differential movement assumed to equal 50% of total heave.
2. The relaxation of some of these requirements, e.g. the reduction or omission of steel or articulation joints, may result in a Category 2 level of expected damage.

Table F19: Geotechnical Constraints in Urban Development (SANS634, 2012)

Constraint		Descriptor		
Letter	Description	1 (most favourable)	2 (intermediate)	3 (least favourable)
A	Collapsible soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness ^a	Any collapsible horizon or consecutive horizons with a depth of more than 750 mm in thickness	A least favourable situation for this constraint does not occur
B	Seepage	Permanent or perched water table more than 1,5 m below ground below	Permanent or perched water table less than 1,5 m ground surface	Swamps and marshes
C	Active soil	Low soil-heave potential anticipated ^a	Moderate soil-heave potential anticipated	High soil-heave potential anticipated
D	Highly compressible soil	Low soil compressibility anticipated ^a	Moderate soil compressibility anticipated	High soil compressibility anticipated
E	Erodability of soil	Low	Intermediate	High
F	Difficulty of excavation to 1,5 m depth	Scattered or occasional boulders less than 10 % of the total volume ^a	Rock or hardpan pedocretes between 10 % and 40 % of the total volume	Rock or hardpan pedocretes more than 40 % of the total volume
G	Undermined ground	Undermining at a depth greater than 200 m below surface (except where total extraction mining has not occurred)	Old undermined areas to a depth of 200 m below surface where slope closure has ceased	Mining within less than 200 m of surface or where total extraction mining has taken place
H	Stability (dolomite land)	Possibly stable. Areas of dolomite overlain by Karoo rocks or intruded by sills. Areas of Black Reef rocks. Anticipated inherent hazard class 1 (see SANS 1936-2)	Potentially characterized by instability. Anticipated inherent classes 2 to 5 (see SANS 1936-2)	Known sinkholes and dolines. Anticipated inherent hazard classes 6 to 8 (see SANS 1936-2)
I	Steep slopes	Between 2° and 6° (all regions)	Slopes between 6° and 18° and less than 2° (Natal and Western Cape) Slopes between 6° and 12° and less than 2° (all other regions)	More than 18° (Natal and Western Cape) More than 12° (all other regions)
J	Areas of unstable natural slopes	Low risk	Intermediate risk	High risk (especially in areas subject to seismic activity)
K	Areas subject to seismic activity	10 % probability of an event less than 100 cm/s ² within 50 years	Mining-induced seismic activity more than 100 cm/s ²	Natural seismic activity more than 100 cm/s ²
L	Areas subject to flooding	A "most favourable" situation for this constraint does not occur	Areas adjacent to a known drainage channel or floodplain with slope less than 1 %	Areas within a known drainage channel or floodplain

^a These areas are designated as 1A, 1C, 1D, or 1F where localized occurrences of the constraint might arise.

Notes:

1. Areas should be designated by the numeral associated with the most appropriate descriptor in columns 3 to 5 followed by the letter associated with the constraint. For example, an area designated as Zone 2BF would be an intermediate class with anticipated seepage and excavation problems while an area designated as Zone 3B would be least favourable and not recommended for development due to surface water inundation.
2. More detailed information on undermined land can be obtained from Stacey, T.R. and Bakker, D. The erection or construction of buildings and other structures on undermined ground. NOTE 3 Undermining assessments should be carried out by persons with expert knowledge of such conditions.

Table F20: Shear Strength Parameters for Slow Draining Cohesive Materials (SAICE, 2010)

Consistency	Rule of thumb Field identification	Unconfined Compressive Strength (kN/m ²)	UCS (kPa) (COP4)	UCS (kPa) (Terz & Peck)	Approximate SPT (N)
Very soft	Easily moulded by fingers. Full pick penetration.	< 40	< 35	<25	<2
Soft	Easily penetrated by with thumb. Moulded with strong pressure. 30 to 40mm penetration.	40 to 80	35 to 75	25 to 50	2 to 4
Firm	Indent by thumb with effort. Very difficult to mould with fingers. 10mm penetration.	80 to 160	75 to 150	50 to 100	4 to 8
Stiff	Penetration by thumb nail. Cannot be moulded with fingers. Geologist pick (sharp end) makes slight indentation when pushed.	160 to 320	150 to 300	100 to 200	8 to 15
Very stiff	Indentation by thumb nail difficult. Slight indentation with blow of geologist pick. Power tools required for excavation.	320 to 1000	> 300	200 to 400	15 to 50

Notes:

1. For guideline purposes only.

Table F21: Shear Strength Parameters for Quick Draining Non-Cohesive Materials (SAICE, 2010)

Consistency	Rule of thumb Field identification	Approximate CPT (MPa)	Approximate SPT (N)	Approximate ϕ'	Typical Dry Density (kg/m ³)
Very loose	Crumbles very easily when scraped with geological pick.	0 to 2	0 to 5	26 to 28	< 1450
Loose	Small resistance to penetration by sharp end of geological pick.	2 to 4	5 to 10	28 to 30	1 450 to 1 600
Medium dense	Considerable resistance to penetration by sharp end of geological pick.	4 to 9	10 to 30	30 to 35	1 600 to 1 750
Dense	Very high resistance to penetration of sharp end of geological pick. Requires many blows of pick for excavation.	9 to 12.5	30 to 50	35 to 40	1 750 to 1 950
Very dense	High resistance to repeated blows of geological pick. Requires power tools for excavation.	< 12.5	> 50	40 to 50	> 1 950

Notes:

1. For guideline purposes only.

Table F22: Elastic Parameters of Various Soils (Das & Sivakugan, 2015, p. 623)

Type of Soil	Modulus of elasticity, E_s (MN/m ²)	Poisson's Ratio, μ_s
Loose sand	10 – 25	0.20 – 0.40
Medium dense sand	15 – 30	0.25 – 0.40
Dense sand	35 – 55	0.30 – 0.45
Silty sand	10 – 20	0.20 – 0.40
Sand and gravel	70 – 170	0.15 – 0.35
Soft clay	4 – 20	0.20 – 0.50
Medium clay	20 – 40	0.20 – 0.50
Stiff clay	40 – 100	0.20 – 0.50

Notes:

1. Typical parameter ranges are for drained soils.
2. Saturated clay will not undergo volume change when loaded under drained conditions where $\mu_s = 0.5$.

Table F23: Typical Properties of Compacted Soils (NAVFAC, 1986)

Group Symbol	Soil Type	Range of Maximum Dry Density (kg/m ³)	Range of Optimum Moisture Content (%)	Typical Cohesion (Compacted State)	Typical Cohesion (Saturated)	Typical Effective Stress Envelope (°)	Range of CBR Value (%)
GC	Clayey gravels, poorly graded gravel-sand-clay.	1842 – 2082	9 – 14			>31	20 – 40
SC	Clayey sands, poorly graded sand-clay mix.	1682 – 2002	11 – 19	74	11	31	5 – 20
CL	Inorganic clays of low to medium plasticity.	1522 – 1922	12 – 24	86	13	28	≤ 15
MH	Inorganic clayey silts, elastic silts.	1121 – 1522	24 – 40	72	20	25	≤ 10
CH	Inorganic clays of high plasticity.	1201 – 1682	19 – 36	103	11	19	≤ 15

Notes:

1. All properties are for condition of "Standard Proctor" maximum density, except values of k and CBR which are for "modified Proctor" maximum density.
2. Typical strength characteristics are for effective strength envelopes and are obtained from USBR data.
3. Compression values are for vertical loading with complete lateral confinement.
4. (>) indicates that typical property is greater than the value shown.
5. "...." Indicates insufficient data available for an estimate.

Table F24: Summary Evaluation of Fill Materials for Compaction (Das & Sobhan, 2014, p. 183)

Group Symbol	Soil Type	Typical Compressibility and Expansion Characteristics	Maximum Dry Unit Weight (Standard Proctor Compaction) (kN/m ³)	General Compaction Characteristics	Rollers(s) for Best Results
GC	Clayey gravels, poorly graded gravel-sand-clay.	Slight	18.1 – 19.7	Good to fair	Rubber-tired, sheepfoot
SC	Clayey sands, poorly graded sand-clay mix.	Slight	16.5 – 18.9	Good to fair	Rubber-tired, sheepfoot
CL	Inorganic clays of low to medium plasticity.	Medium	14.1 – 18.1	Fair to poor	Rubber-tired, sheepfoot
MH	Inorganic clayey silts, elastic silts.	Very high *	13.4 – 15.7	Fair to poor	Rubber-tired, sheepfoot
CH	Inorganic clays of high plasticity.	Very high	13.4 – 16.5	Fair to poor	Sheepfoot

Notes:

1. Based on Sowers (1979) and Highway Research Board (1962).
2. * Very high – Not provide in source. Assigned compressibility, expansiveness for high organic content low.

Table F25: Typical Properties of Compacted Soils (Franki, 2008, pp. 51-52)

Group Symbol	Soil Type	Max γ_d (kN/m ³)	Optimum Moisture (%)	Typical Strength Characteristics			
				c_u (kPa)	c' (kPa)	ϕ' (°)	$\tan\phi'$
GC	Clayey gravels, poorly graded gravel-sand-clay.	18.1 – 20.5	9 – 14	0	0	> 31	> 0.60
SC	Clayey sands, poorly graded sand-clays.	16.5 – 19.7	11 – 19	75	10	31	0.60
CL	Inorganic clays of low to medium plasticity.	15.0 – 18.9	12 – 24	85	12	28	0.54
ML	Inorganic silts and clayey silts.	15.0 – 18.9	12 – 24	65	10	32	0.62
CH	Inorganic clays of high plasticity.	11.8 – 16.5	19 – 36	100	12	19	0.35

Notes:

1. Values summarized after NAVFAC DM7, 1971.
2. The values should be taken as the upper bound values for natural soils.
3. It is necessary to point out that for most soils caution must be exercised if an effective cohesion value greater than zero is to be used for design purposes.

Table F26: Classification of Plasticity (Das & Sobhan, 2014, p. 102)

Plasticity Index	Description
0	Nonplastic
1 – 5	Slightly plastic
5 – 10	Low plasticity
10 – 20	Medium plasticity
20 – 40	High plasticity
> 40	Very high plasticity

Notes:

1. Categories of plasticity after Burmister, 1949.

Table F27: Approximate Range of Capillary Rise in Soils (Das & Sobhan, 2014, p. 296)

Soil Type	Range of Capillary Rise (m)
Coarse sand	0.10 – 0.20
Fine sand	0.30 – 1.20
Silt	0.75 – 7.50
Clay	7.50 – 23.00

Notes:

1. Categories of plasticity after Burmister, 1949.

Table 28: Shear Strength-Clays (TRH10, 1994, p. 62)

Consistency Description	SPT (N)	CPT q_c (MPa)	Undrained Shear Strength c_u (kPa)
Very soft	<2	<0.3	<20
Soft	2 – 4	0.3 – 0.6	20 – 40
Firm	4 – 8	0.6 – 1.4	40 – 80
Stiff	8 – 15	1.4 – 3.0	80 – 150

Notes:

- Consistency description is moisture/seasonal dependant.
- For guideline purposes. To be refined for final design-level input.

Table 29: Compressibility (All Material) (TRH10, 1994, p. 63)

Soil	Stiffness Modulus, E (MPa)			
	Loose	Medium	Dense	-
Granular				
Sandy gravel	30 – 80	80 – 100	100 – 200	-
Sand	10 – 30	50 – 80	50 – 80	-
Non-plastic silt	8 – 12	12 – 20	20 – 30	-
Cohesive	Soft	Plastic	Hard	Very Hard
Silty sand	5 – 8	10 – 15	15 – 20	20 – 40
Silt	3 – 6	6 – 10	10 – 15	15 – 30
Lean clay	2 – 5	5 – 8	8 – 12	12 – 20
Fat clay	1 – 4	4 – 7	7 – 12	12 – 30

Notes:

- Consistency description is moisture/seasonal dependant.
- For guideline purposes. To be refined for final design-level input.

Table 30: Elastic Modulus for Sands (TRH10, 1994, p. 63)

Description	SPT (N)	CPT q_c (MPa)	Stiffness Modulus, E (MPa)
Very loose	< 4	2	< 4
Loose	4 – 10	2 – 5	4 – 10
Medium dense	10 – 30	5 – 15	10 – 30
Dense	30 – 50	15 – 20	30 – 40
Very dense	> 50	> 20	> 40

Notes:

- Consistency description is moisture/seasonal dependant.
- For guideline purposes. To be refined for final design-level input.

Table 31: Coefficient of Compressibility for Clays (TRH10, 1994, p. 64)

Description	SPT (N)	CPT q_c (MPa)	Coefficient of Compressibility, m_v m^2/MN
Very soft	< 2	0.3	1.5
Soft	2 – 4	0.3 – 0.6	1.5 – 0.3
Firm	4 – 8	0.6 – 1.4	0.3 – 0.1
Stiff	8 – 15	1.4 – 3.0	0.1 – 0.05

Notes:

- Consistency description is moisture/seasonal dependant.
- For guideline purposes. To be refined for final design-level input.

Table 32: Coefficient of Consolidation (TRH10, 1994, p. 64)

Subsoil Description	Permeability	Coefficient of Consolidation, c_v $m^2/year$
Intact clays	Very low	0.1 – 1.0
Fissured clay, alluvial silty clay	Low	1.0 – 10.0
Clayey sand, sandy	Medium	10 – 100
Silty sands	High	100 – 1 000
Sands	Very high	> 1 000

Notes:

- Consistency description is moisture/seasonal dependant.

Table 33: Presumed Safe Bearing Capacity on Supporting Ground for Central Vertical Static Loads* on the Foundation (SABS0161-1980-(Amdt.1986))

Supporting Ground		Description of Rocks, Soils and Fills	Presumed Safe Bearing Capacity+ (kN/m ²)	
Type	Class		Dry ‡	Submerged‡
Rocks	1	Fresh rock, massively bedded, intact (igneous, metamorphic, or sedimentary) and requiring blasting for excavation.	5 000	5 000
	2	Fresh rock, fractured or jointed, which can be excavated with difficulty by pneumatic picks, but which normally requires light blasting.	1 000	1 000
	§//3	Shale, of hard rock consistency.	200 – 400	200 – 400
	4	Decomposed rock, to be assessed as a soil as below.	--	--
Non-Cohesive Soils	5	Compact, well graded gravels, very dense silty sand, sands, gravel-sand mixtures.	400 – 600	200 – 300
	6	Compact but poorly graded gravels, gravel-sand, dense sands, silty sands, sandy silt, silt mixtures.	200 – 400	100 – 200
	**7	Medium dense sands, silty sands, sandy silts, and silts, clayey sands, clayey silts.	100 – 150	50 – 75
	**8	Loose and very loose sand, silty sands, sandy silts, clayey sands, clayey silts.	By test only	By test only
Cemented Soils	++9	Cemented gravel, hard "oukclip" (ferricrete), hard calcrete, and hard silcrete.	400 – 600	400 – 600
	**10	Weakly cemented soils of medium and low (loose) density.	100 – 150	By test only
Cohesive Soils	//11	Very stiff sandy or silty clays.	400 – 500	300 – 400
	//12	Stiff clays, sandy clays, silty clays.	200 – 400	150 – 200
	//13	Firm clays, sandy clays, silty clays.	100 – 200	75 – 150
	)14	Soft clays, sandy clays, silty clays.	50 – 100	50 – 100
	)15	Very soft sandy or silty clays.	0 – 50	0 – 50
Compacted Selected Fill	16	Compacted fill or selected material.	By test only	By test only
Random Fill	17	Made-up ground, waste dumps, and other uncompacted fills.	By test only	--

Notes:

* Most foundation loads in buildings are applied vertically to the centre of the foundation. However, where the load is applied eccentrically or inclined from the vertical or both, the safe bearing capacity will require modification.

** The presumed safe bearing capacities should be taken at a depth of not less than 600 mm below the top of natural supporting ground.

‡

- The bearing capacity of non-cohesive soils in particular, is greatly influenced by the effective density of the soil. Thus, when a soil occurs above the water-table, the full density will act, but when the soil occurs below the water-table, only the submerged density will be effective.
- The soil zone that provides the bearing capacity extends to a depth of twice the least dimension (breadth) of the foundation below the base of the footing and, therefore, if the water-table is at a level at least twice the least dimension of the footing below the base of the footing, the value of safe bearing capacity given under the heading "Dry" in Column 4 may be used.
- The fully submerged case occurs when the water-table is at the base of the footing or above, in which case the value of safe bearing capacity given under the heading "Submerged" in Column 5 may be used.
- When the water-table is between the base of the footing and twice the least dimension of the footing below the base of the footing, the foundation is partially submerged and an intermediate value of the safe bearing capacity between those appearing under the headings "Dry" and "Submerged" in Columns 4 and 5 may be used.

§ Bedding planes can affect the stability of excavations in shales of this class.

// Heaving may be a problem with shales or clays of this class.

** Beware of collapse settlement on inundation of soils of this class.

) Appreciable settlement may be expected on soils of this class.

++ If not underlain by any softer layer.

Table 34: Consistency of Cohesive Soils (SABS0161-1980-(Amdt.1986))

Designation	Silts and Clays, and Combinations of Silts and Clays with Sand, Generally Slow Draining		Typical Ranges of Unconfined Compressive Strength* (kPa)	
S1	Very Soft	Pick head can easily be pushed in as far as the shaft of the handle; easily moulded by fingers.	< 35	< 25
S2	Soft	Easily penetrated by thumb; sharp end of pick can be pushed in 30 – 40 mm; moulded by fingers with some pressure.	35 – 75	25 – 50
S3	Firm	Indented by thumb with effort; sharp end of pick can be pushed in up to 10 mm; very difficult to mould with fingers; can just be penetrated with an ordinary hand spade.	75 – 150	50 – 100
S4	Stiff	Indented by thumb-nail; slight indentation produced by pushing pick point into soil; cannot be moulded by fingers; requires hand pick for excavation.	150 – 300	100 – 200
S5	Very Stiff	Indented by thumb-nail with difficulty; slight indentation produced by blow of pick point; requires power tools for excavation.	> 300	200 – 400

Notes:

- * As given by two separate authorities.
- Consistency description is moisture/seasonal dependant.

Table 35: Hardness of Rocks (SABS0161-1980-(Amdt.1986))

Designation	Degree of Hardness	Silts and Clays, and Combinations of Silts and Clays with Sand, Generally Slow Draining	Typical Ranges of Unconfined Compressive Strength (MPa)
R1	Very Soft	Material crumbles under firm (moderate) blows with sharp end of geological pick and can be peeled off with a knife; it is too hard for a triaxial sample to be cut by hand.	0.7 – 3
R2	Soft Rock	Can just be scraped and peeled with a knife; indentations of 1-3 mm show in the specimen with firm (moderate) blows of the pick point.	3 – 10
R3	Hard Rock	Cannot be scraped or peeled with a knife; handheld specimen can be broken with a hammer end of a geological pick with a single firm (moderate) blow.	10 – 20
R4	Very Hard Rock	Hand-held specimen breaks with hammer end of pick under more than one blow.	20 – 70
R5	Extremely Hard Rock	Specimen requires many blows with geological pick to break through intact material.	> 70

Notes:

- Guideline purposes only.