

New Super Fines Storage Facility, Gloria Mine

Interpretive Geotechnical Investigation Report

Report Prepared for

Assmang (Pty) Ltd



Report Number 547073/2



Report Prepared by

 **srk** consulting

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New Super Fines Storage Facility, Gloria Mine: Interpretive Geotechnical Investigation Report

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Executive Summary

SRK Consulting (South Africa) (Pty) Ltd (SRK) was appointed by Assmang (Pty) Ltd to conduct a geotechnical investigation for a proposed New Super Fine Storage Facility (SFSF) at the Gloria Mine located near Santoy in the Northern Cape. SRK undertook a site visit from 24 June to 4 July 2019, during which intrusive field investigations were conducted and samples retrieved for testing. This interpretive report presents the results of the field investigations and laboratory testing with recommendations and conclusions.

The site is situated outside the access control area of Gloria Mine, approximately 70 km northwest of Kuruman in the Northern Cape. The Hotazel area receives an average annual rainfall of 223 mm, the bulk of which occurs during the summer months. Slight topographic variations occur from the south to the central portion of the site (1 042 mamsl to 1 036 mamsl) rising to 1 039 mamsl in the north of the site. Similar topographic variations are noted across the site from the west to the east. At the time of the investigation, the site was densely vegetated with trees of various sizes, bushes and thorn trees. The SFSF site is located in a low seismic hazard area with a peak ground acceleration (PGA) of approximately 0.03 g.

Regionally, the general area has a cover of predominantly Quaternary Surficial deposits of red to light orange coloured Aeolian (windblown) sands of the Kalahari Group that extends to depths of 20.0 m and deeper in places. The geology underlying the site comprises approximately 100 m of unconsolidated Kalahari Formation consisting of fine Aeolian sand, gravels, calcrete and clays. From the thirty-five test pits excavated, the site is generally underlain by poorly developed Topsoil / Aeolian soils from surface to an average depth of 0.3 m underlain by orange brown to yellow brown silty fine sand to an average depth of 3.3 m. Pedogenic soils in the form of powder calcrete, nodular calcrete or strongly cemented fractured hardpan calcrete are found underlying the Aeolian soils. The test pits were advanced to an average depth of 4.9 m (with a minimum excavation depth of 3.5 m and a maximum depth of 5.3m). No groundwater was noted in any of the test pits excavated.

Four zones were identified to be present based on the ground profiles underlying the site and these include the following:

- Areas underlain by Aeolian sands only – Zone 1
- Areas underlain by Aeolian sands and Hardpan Calcrete – Zone 2
- Areas underlain by Aeolian sands and Nodular Calcrete Gravelly Sand – Zone 3
- Areas underlain by Aeolian sands and Powder Calcrete Sand– Zone 4

The Aeolian sands present in Zone 1, Zone 3 and Zone 4 generally classify as SM (silty sand) with poorly graded sand with silty soils also present. Aeolian soils classifying as clayey sands (SC) was also noted at depth in GL-TP3. The nodular calcrete gravelly sands mostly classified as SM soils however, poorly graded gravel (GP) and clayey and or silty sandy soils (SC-SM) were encountered locally. The hardpan calcrete soils classified as a silty sand (SM) based on the USCS classification. The nodular calcrete in Zone 3 generally has an average 25% gravel fraction. The Aeolian poorly developed Topsoil material has a loose consistency to an average depth of 0.3 m, which overlies medium dense becoming dense silty sandy soils to a depth of approximately 4.1 m. The Pedogenic material present in Zone 3 and Zone 4 have a medium dense to dense consistency extending to a depth of 4.8 m below ground surface whilst the strongly cemented hardpan calcrete was described as having a hard rock hardness.

The Aeolian soils classify as non-plastic or slightly plastic with a low potential expansiveness however, the possibility of the Pedogenic soil exhibiting dispersive behaviour is probable. A geotechnical

constraint that must be considered is the possibility of the calcareous Pedogenic soils going into solution on exposure to groundwater.

Based on empirical information, the following design parameters for assessing the stability of the embankments can be assumed:

Zone	USCS Classification	Drained Cohesion c' (kPa)	Drained Friction Angle ϕ' (Degrees)	Hydraulic Conductivity (m/s)
Zone 1	SM / SP-SM	0	33	10^{-6}
Zone 2	Hardpan (Fractured - no USCS Classification)	0	33	10^{-5}
Zone 3	SM / SC-SM	0	32	10^{-7}
Zone4	SM	0	33	10^{-6}

Excavation conditions classify as Soft in the Zone 1, 3 and 4 soils to a depth of approximately 4.6 m based on the classification provided in SANS 1200D. Intermediate to hard excavation conditions can be expected in Zone 2 below an average depth of 3.8 m where the strongly cemented hardpan calcrete was noted.

The Aeolian sand at the site are suitable for use in sand drains. They may also be stabilised with cement for use in starter embankment construction or blended with waste rock and used as engineered fill. The Aeolian soils are expected to be highly erodible and aggressive towards concrete and fibre cement pipes. The Pedogenic soils should be used with caution as a construction material due to the likelihood of these soils going into solution when wet as well as exhibiting dispersive behaviour.

The site is generally not associated with a high degree of topographic variation and existing natural slope stability is not of major concern. However, the loose soils consistency of the Aeolian soils is of concern and it is recommended that all temporary excavated slopes in excess of 2.0 m must be fully supported or battered back at least 1v:1.5h in soil. For excavations over 2.0 m in depth, the ground conditions should be assessed by a geotechnical engineer or engineering geologist prior to and during excavation, and the safe slope angles be determined by analysis.

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by Assmang (Pty) Ltd (the Client). The opinions in this Report are provided in response to a specific request from the Client to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

CBR	California Bearing Ratio
DCP	Dynamic Cone Penetrometer
GM	Grading Modulus
GPS	Global Positioning System
GSHAP	Global Seismic Hazard Assessment Program
ha	hectares
km	kilometres
LL	Liquid Limit
MDD	Maximum Dry Density
OMC	Optimum Moisture Content
PE	Potential Expansiveness
PGA	peak ground acceleration
PI	Plasticity Index
PL	Plastic Limit
m	metres
mamsl	metres above mean sea level
MC	Moisture Content
SFSF	Super Fines Storage Facility
SG	Specific Gravity
SRK	SRK Consulting (South Africa) (Pty) Ltd
USCS	Unified Soils Classification System

1 Introduction and Scope of Report

SRK Consulting (South Africa) (Pty) Ltd (SRK) was appointed by Assmang (Pty) Ltd (the Client) in terms of order number AMM/KBB/19/015 dated 20 May 2019 to conduct a geotechnical investigation for a proposed New Super Fines Storage Facility (SFSF) at Gloria Mine located near Santoy in the Northern Cape. SRK undertook a site visit from 24 June to 4 July 2019, during which intrusive field investigations were conducted and samples retrieved for testing.

This interpretive report presents the findings of the field and laboratory investigations and provides geotechnical recommendations and conclusions.

2 Available Information

The following information was received from the Client and referred to during the compilation of this report:

- An email detailing the Scope of Work for the project received from the Client on 15 March 2019.
- A Google Earth image showing the layout of the area of interest including pipelines, tailings dams, the return water dam as well as the position of two boreholes received via email from the Client on 15 March 2019.

3 Scope of Work

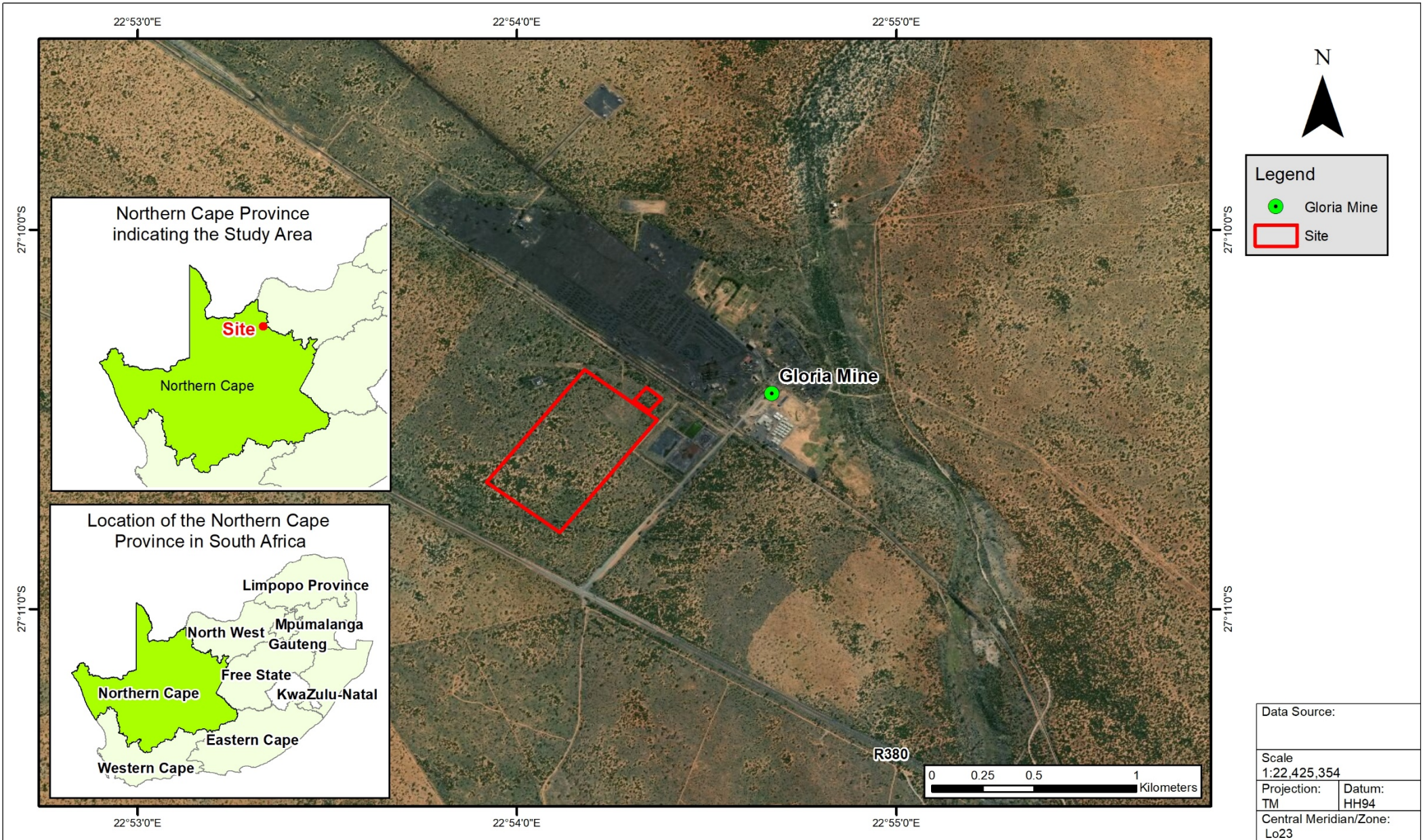
SRK undertook a site visit from 24 June to 4 July 2019 during which the following work was conducted:

- Thirty-five test pits were excavated to a maximum depth of 5.3 m using a 20-tonne excavator provided by mine from 24 to 27 June 2019.
- The ground profiles were recorded in accordance with the Jennings, *et al.* procedure and the SAICE “*Guidelines for Soil and Rock Logging in SA (2nd Impression 2002)*”.
- No groundwater was intercepted in the excavated test pits.
- Test pits were backfilled immediately after ground profiling and sampling.
- Drop Cone Penetrometer (DCP) tests were conducted adjacent to all test pits except GL-TP10, GL-TP15 and GL-TP16 to an average depth of approximately 3.4 m from 1 to 4 July 2019.
- The test pit positions were located using a hand-held Global Positioning System (GPS).
- Representative disturbed samples were retrieved from the test pits and submitted to Specialised Testing Laboratory (Pty) Ltd in Pretoria.

4 Site Description

4.1 Site Location

Gloria Mine is located approximately 70 kilometres (km) northwest of Kuruman and 7 km northwest of Hotazel in the Northern Cape, as shown on Figure 4-1. The site itself is situated outside the access control area of Gloria Mine.



Legend

- Gloria Mine
- Site



Data Source:	
Scale 1:22,425,354	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo23	
Date: 01/08/2019	Compiled by: REEL
Project No. 547073	Fig No. 4-1



GLORIA MINE SFSF GEOTECHNICAL INVESTIGATION LOCALITY PLAN

4.2 Climate and Topography

The Hotazel area receives an average annual rainfall of 223 mm, the bulk of which occurs during the summer months. The average midday temperatures range from 19°C in June to 33°C in January (SA Explorer, 2000-2011).

The topography slopes very gently from the south to the central portion of the site (1 042 mamsl to 1 036 mamsl) rising to 1 039 mamsl in the north of the site. Similar topographic variations are noted across the site from the west to the east. Due to the expected high permeability of the soils at the site, very little surface run-off and / or ponding of water on surface is expected.

4.3 Site Description

The site is bounded by the R380 road to the south-west, the Gloria Mine operations to the north, vacant densely vegetated land to the west and northwest and in the east the existing slimes dam managed by Fraser Alexander.

At the time of the investigation, the site was densely vegetated with trees of various sizes, bushes and thorn trees. The area is also known to be inhabited by numerous snakes, buck and bird species.

4.4 Seismicity

The South African seismic hazard map was compiled during a study conducted by the Council for Geoscience to produce probabilistic peak ground acceleration and spectral seismic hazard maps for South Africa. The parametric-historic procedure was used in the estimation of the seismic hazard and the map shows the contoured median values of acceleration with a 10% probability of exceedance in 50 years. The SFSF Site is located in a low seismic hazard area with a peak ground acceleration (PGA) of approximately 0.03 g, as shown on Figure 4-2.

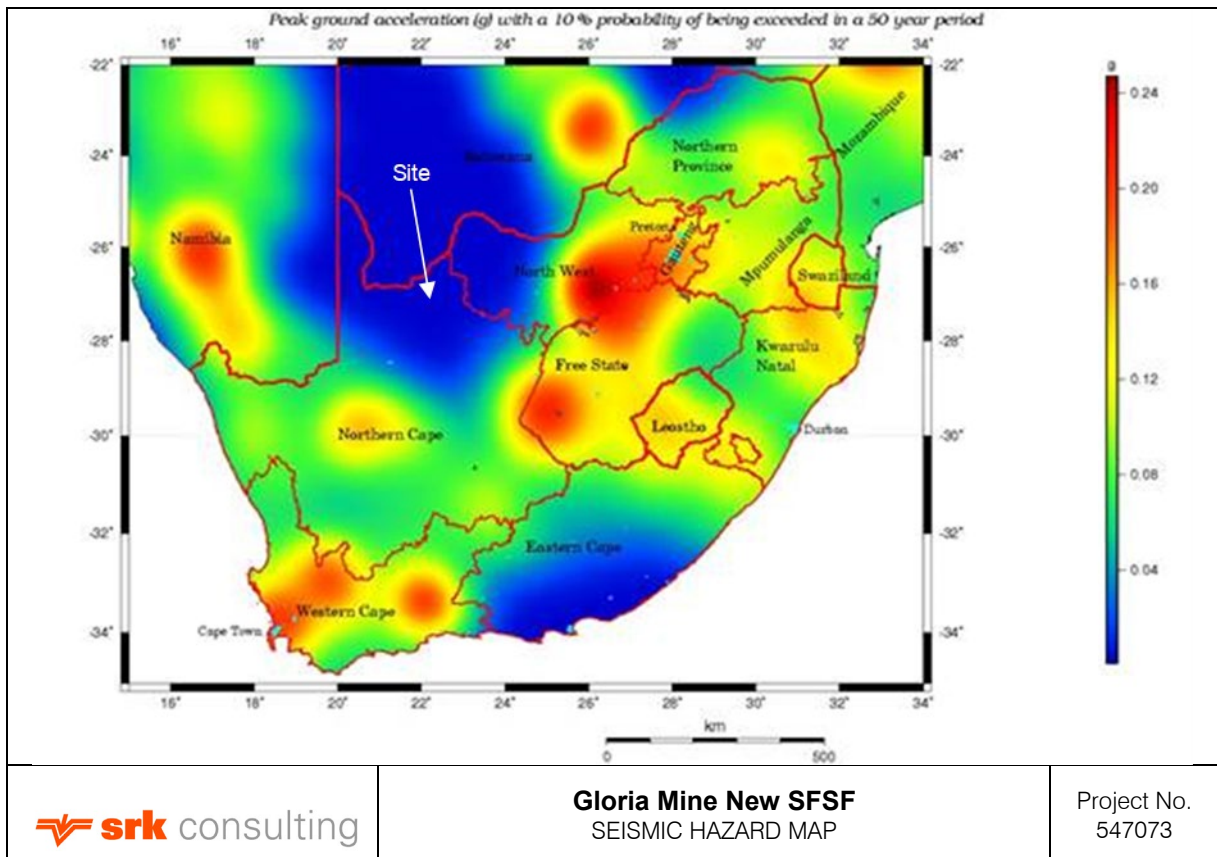


Figure 4-2: Seismic Hazard Map of Southern Africa

5 Geology

5.1 Regional and Local Geology

Based on the 1:250 000 scale 2722 Kuruman geological map, the general area has a cover of predominantly Quaternary Surficial deposits of red to light orange coloured Aeolian (windblown) sands of the Kalahari Group that extends to depths of 20.0 m and deeper in places.

The geology underlying the site comprises approximately 100 m of unconsolidated Kalahari Formation consisting of fine Aeolian sand, gravels, calcrete and clays. Refer to Figure 5-1 and Chief Geologist report attached in Appendix A.

From the excavated test pits, it was found that the site in general is directly underlain by poorly developed Topsoil soils from surface to an average depth of 0.3 m underlain by Aeolian orange brown to yellow brown silty fine sand to an average depth of 3.3 m. Pedogenic soils in the form of powder calcrete, nodular and strongly cemented hardpan calcrete was also recorded underlying the Aeolian soils.

The detailed ground profiles are included in Appendix B.

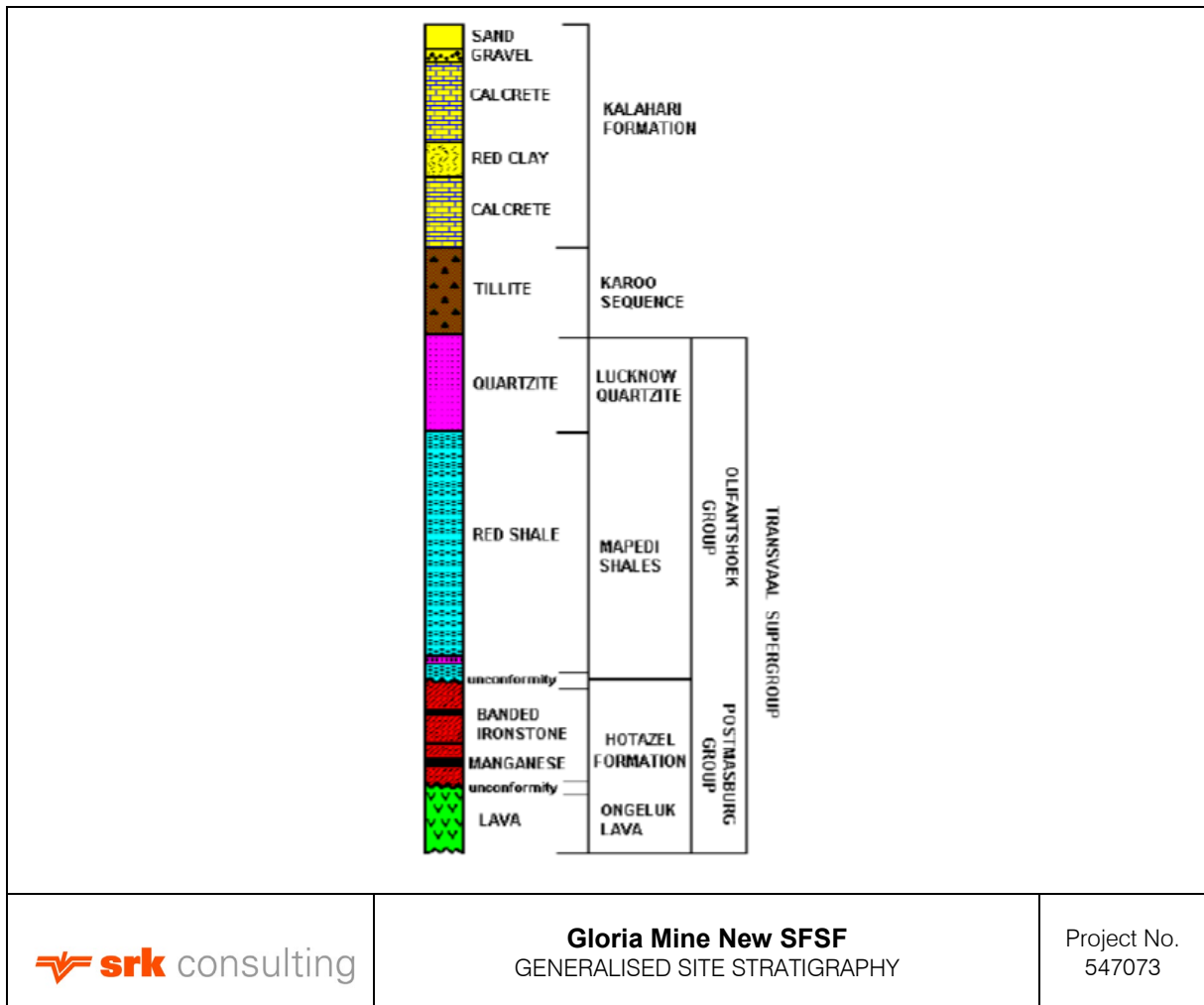


Figure 5-1: Generalised Site Stratigraphy

6 Fieldwork Results

6.1 Test Pit Coordinates

The test pit locations are shown in Figure 6-1 and their coordinates are provided in Table 6-1.

Table 6-1: Test Pit Coordinates

TP ref.	WGS84/SA Grid (Lo23)		TP ref.	WGS84/SA Grid (Lo23)	
	X-coord.	Y-coord.		X-coord.	Y-coord.
GL-TP1	10 019	3 007 340	GL-TP19	9 448	3 007 176
GL-TP2	9 729	3 007 560	GL-TP20	9 506	3 006 888
GL-TP3	9 609	3 006 809	GL-TP21	9 928	3 007 338
GL-TP4	9 332	3 007 031	GL-TP22	9 802	3 007 505
GL-TP5	9 311	3 006 930	GL-TP23	9 790	3 007 204
GL-TP6	9 361	3 006 927	GL-TP24	9 679	3 007 345
GL-TP7	9 896	3 007 431	GL-TP25	9 726	3 007 116
GL-TP8	9 931	3 007 239	GL-TP26	9 606	3 007 259
GL-TP9	9 810	3 007 354	GL-TP27	9 667	3 007 039
GL-TP10	9 673	3 007 486	GL-TP28	9 524	3 007 138
GL-TP11	9 855	3 007 140	GL-TP29	9 597	3 006 965
GL-TP12	9 733	3 007 260	GL-TP30	9 454	3 007 014
GL-TP13	9 606	3 007 388	GL-TP31	9 527	3 006 988
GL-TP14	9 774	3 007 029	GL-TP32	9 856	3 007 264
GL-TP15	9 666	3 007 158	GL-TP33	9 409	3 006 963
GL-TP16	9 530	3 007 299	GL-TP34	9 409	3 007 076
GL-TP17	9 684	3 006 900	GL-TP35	9 748	3 007 415
GL-TP18	9 577	3 007 079	-	-	-

6.2 Test Pits – Ground Profile

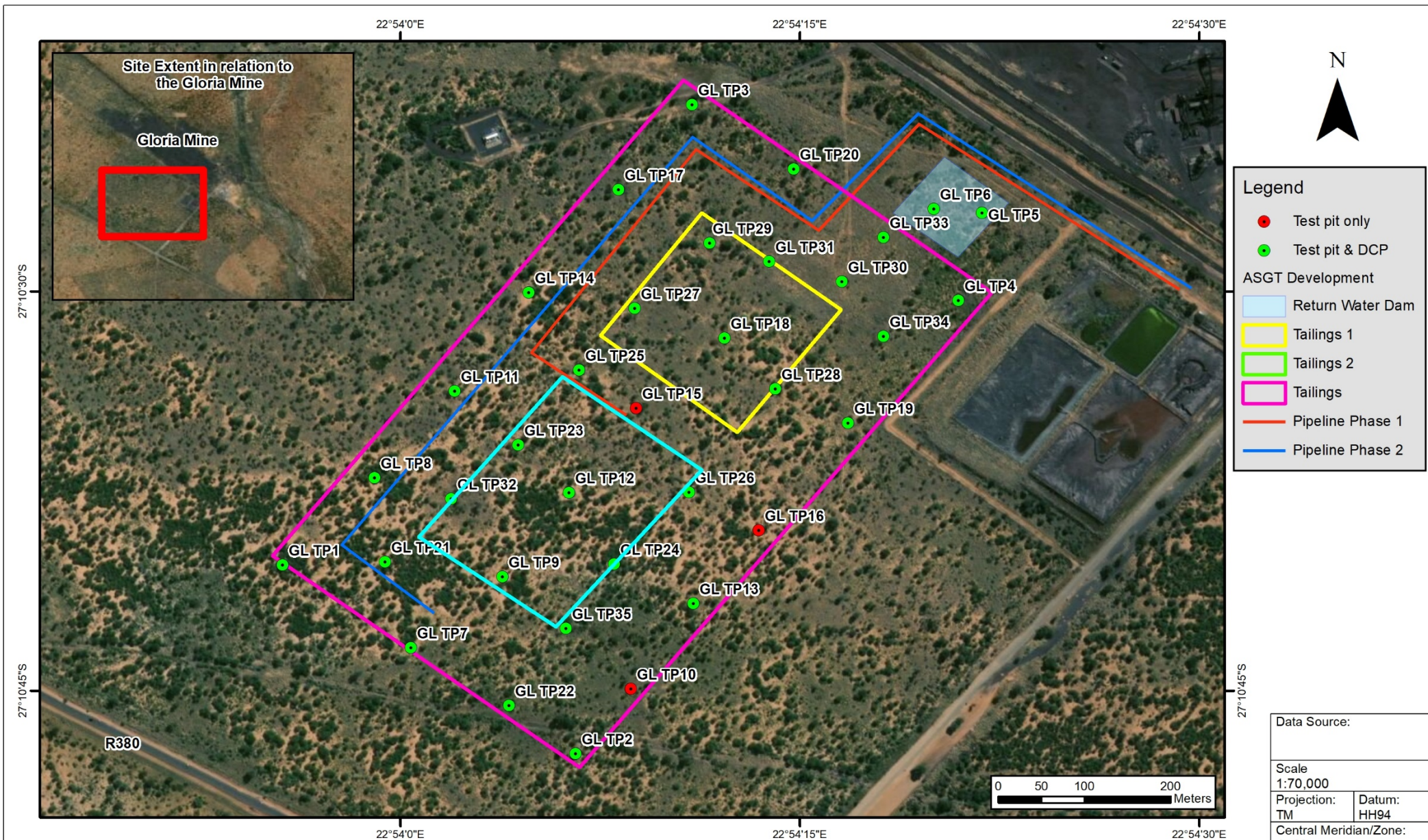
The ground profiles recorded in the test pits excavated across the site are summarised in Table 6-2 and attached as Appendix B. The site in general is underlain by poorly developed Topsoil from surface to an average depth of 0.3 m underlain by Aeolian orange brown to yellow brown silty fine sand to an average depth of 3.3 m. Pedogenic soils in the form of powder calcrete, nodular calcrete or weakly cemented hardpan calcrete are found underlying the Aeolian soils. The test pits were advanced to an average depth of 4.9 m (with a minimum excavation depth of 3.5 m and a maximum depth of 5.3m).

The subsequent subsections describe the soil horizons profiled across the site.

6.2.1 Aeolian Soils

Poorly Developed Topsoil

Present in all test pits excavated (except GL-TP5) from surface to a maximum depth of 0.4 m (average thickness 0.3 m), the poorly developed Topsoil was profiled as slightly moist, light orange brown, loose to medium dense, intact, silty fine sand with roots. Locally a small proportion (5 to 10%) of sub-angular to sub-rounded, medium to coarse, manganese gravel was also present in the Topsoil layer.



Aeolian Silty Sand

The silty fine to medium Aeolian sand was described in all test pits from 0.1 m to a maximum depth of 1.6 m (average depth of 0.3 m and layer thickness of 3.3 m) except in GL-TP5 where this layer was present from surface to 4.9 m. This horizon was profiled as slightly moist, orange to yellow brown and occasionally khaki, loose to medium dense becoming dense with depth, intact, silty fine to medium sand.

Fine manganese nodules were present in GL-TP2, GL-TP7, GL-TP10, GL-TP13, GL-TP16, GL-TP19, GL-TP22 and GL-TP34 whilst manganese staining was noted at approximately 3.7 m in GL-TP5.

<5% fine quartz gravel was also noted to be present within this horizon in GL-TP3 and GL-TP6.

6.2.2 Pedogenic Soils

Powder Calcrete

Powder calcrete described as a slightly moist, off-white, medium dense to dense, silty fine sand with 5 to 10% hard, sub-angular to sub-rounded, intact nodules was present in the test pits excavated in the central portion of the site from a depth of 1.8 m to a maximum depth of 4.6 m (average depth of 3.5 m) with an average layer thickness of 1.5 m. Sands with a very dense soil consistency were noted in GL-TP28 and GL-TP31.

Nodular Calcrete Gravelly Sand

The nodular calcrete noted in GL-TP4, GL-TP6, GL-TP9 to GL-TP11, GL-TP13, GL-TP14, GL-TP17, GL-TP20, GL-TP25, GL-TP27, GL-TP33 and GL-TP34 was present from a minimum depth of 2.3 m to a maximum depth of 4.8 m (average depth of 3.6 m) and with a thickness ranging from 0.3 m to 2.7 m (average 1.3 m) was described as slightly moist, yellow orange brown and occasionally off-white, medium dense to dense, intact silty fine to medium sand with 10 to 30% fine to coarse gravel consisting of hard, sub-rounded to sub-angular, gravelly sandy nodular calcrete. Dense to very dense soil consistencies were noted to in GL-TP13 and GL-TP20 (from 4.8 to 5.2 m).

Locally, the soils were present as a slightly moist to dry, off-white to white, dense, slightly clayey silty fine sandy fine to coarse gravel, consisting of hard, sub-angular to sub-rounded, nodular calcrete (GL-TP33).

Hardpan Calcrete

Profiled as a dry, off-white, fractured, strongly cemented hardpan calcrete was present in the test pits excavated in the south western corner of the site from a minimum depth of 2.6 m to a maximum depth of 4.8 m (average depth of 4.0 m and an average layer thickness of 0.4 m).

6.3 Ground Profile Derived Geotechnical Zones

The site was classified into four geotechnical zones based on the ground profiles, the typical ground profile for each zone is described below. The spatial distribution of these zones is shown on Figure 6-2.

Areas underlain by Aeolian sands only - Zone 1

Poorly developed Topsoil consisting loose silty fine sand with roots present to 0.2 m, underlain by loose to medium dense, loose to medium dense silty fine Aeolian sands present to 4.6 m.

Areas underlain by Aeolian sands and Hardpan Calcrete – Zone 2

Poorly developed Topsoil consisting loose silty fine sand with roots present to 0.3 m, underlain by medium dense to dense, silty fine Aeolian sands present to 3.8 m underlain by hard, moderately fractured weakly cemented hardpan calcrete to a depth in excess of 4.3 m.

Areas underlain by Aeolian sands and Nodular Calcrete Gravelly Sand – Zone 3

Poorly developed Topsoil consisting loose, silty fine sand with roots present to 0.4 m, underlain by medium dense to dense silty fine Aeolian sand to a depth of 3.6 m which in turn is underlain by dense, silty fine to medium sand with coarse, hard, sub-rounded and sub-angular nodular calcrete to a depth of 4.9 m.

Areas underlain by Aeolian sands and Powder Calcrete – Zone 4

Poorly developed Topsoil comprised of loose, silty fine sand with roots to a depth of 0.3 m underlain by medium dense to dense, silty fine Aeolian sand present to a depth of 3.3 m underlain by medium dense to dense silty fine to medium sand powder calcrete present to a depth of 5.0 m.

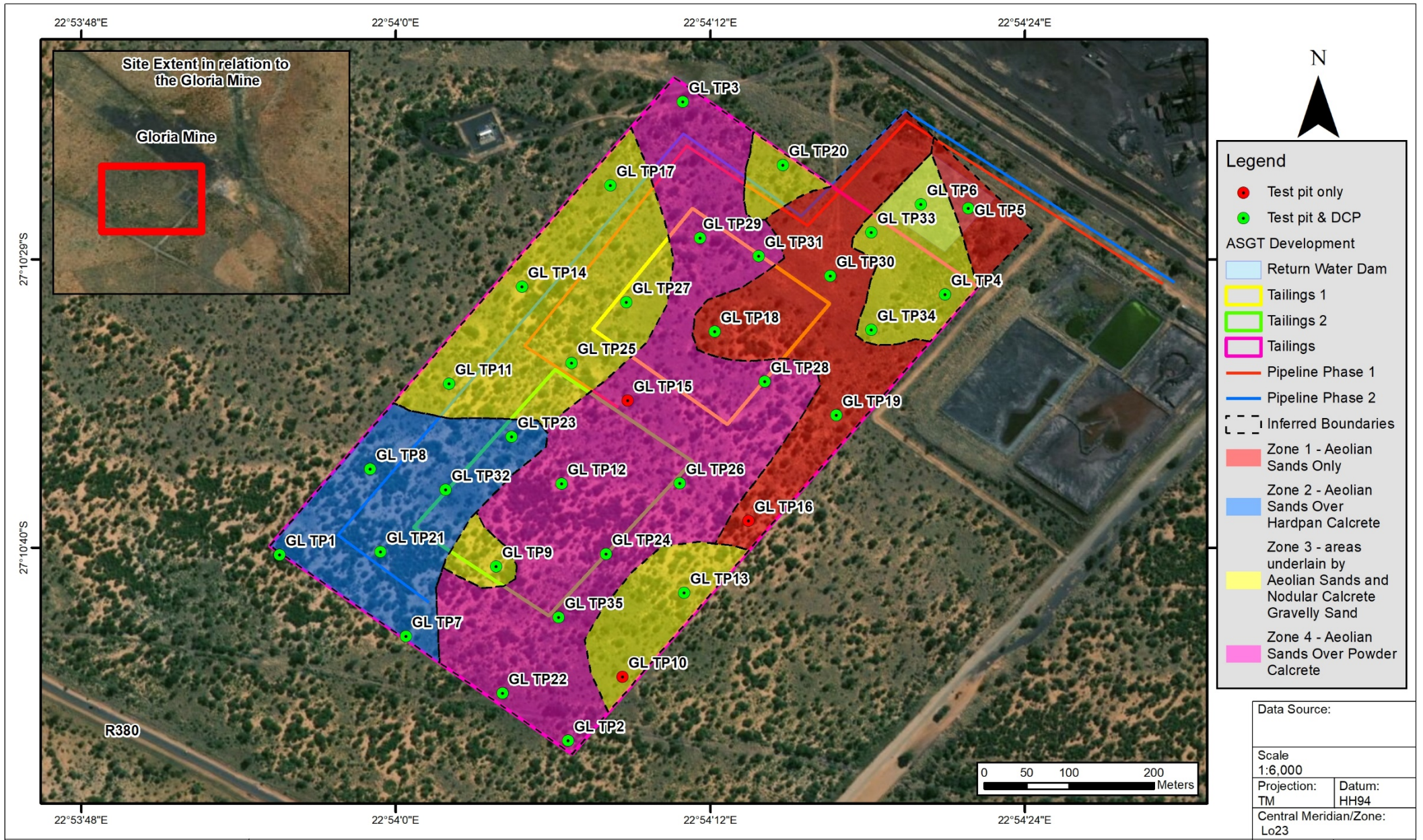


Table 6-2: Summary of Test Pit Ground Profiles

Zone Ref.	Test Pit Ref	Depth to top of strata in metres (thickness in brackets)								Final Depth (m)	Excavatability	Notes			
		Aeolian				Pedogenic									
		Poorly Developed Topsoil – Silty SAND		Silty Fine SAND		Powder Calcrete SAND		Nodular Calcrete Gravelly SAND					Strongly cemented Fractured Hardpan Calcrete		
Zone 1	GL-TP5	-	-	0.0	(4.9)	-	-	-	-	-	-	4.9	Soft	No refusal - maximum reach of excavator	
	GL-TP16	0.0	(0.2)	0.2	(4.6)	-	-	-	-	-	-	4.8	Soft	No refusal - maximum reach of excavator	
	GL-TP18	0.0	(0.3)	0.3	(4.7)	-	-	-	-	-	-	5.0	Soft	No refusal - maximum reach of excavator	
	GL-TP19	0.0	(0.1)	0.1	(4.5)	-	-	-	-	-	-	4.6	Soft	No refusal - maximum reach of excavator	
	GL-TP30	0.0	(0.3)	0.3	(4.7)	-	-	-	-	-	-	5.0	Soft	No refusal - maximum reach of excavator	
		Min.	0.0	(0.1)	0.0	(4.5)	-	-	-	-	-	-	4.6		
	Max.	0.0	(0.3)	0.3	(4.9)	-	-	-	-	-	-	5.0			
	Ave.	0.0	(0.2)	0.2	(4.7)	-	-	-	-	-	-	4.9			
Zone 2	GL-TP1	0.0	(0.2)	0.2	(2.4)	-	-	-	-	2.6	(1.1)	3.5	Soft becoming hard to intermediate below 3.5 m	Very slow excavator advance below 3.5 m	
	GL-TP7	0.0	(0.3)	0.3	(2.9)	-	-	-	-	3.2	(0.8)	4.0	Soft becoming intermediate to hard at 4.0 m	Refusal on hardpan at 4.0 m.	
	GL-TP8	0.0	(0.3)	0.3	(1.1)	-	-	-	-	4.4	(0.4)	4.8	Soft becoming intermediate below 4.8 m	Difficult advance in calcrete and maximum reach of excavator	
	GL-TP21	0.0	(0.4)	0.4	(3.8)	-	-	-	-	4.2	(0.3)	4.5	Soft becoming intermediate to hard below 4.5 m	Very slow excavator advance below 4.5 m	
	GL-TP23	0.0	(0.3)	0.3	(3.3)	-	-	-	-	3.6	(0.4)	4.0	Soft becoming intermediate to hard below 4.0 m	Refusal on hardpan at 4.0 m.	
	GL-TP32	0.0	(0.3)	0.3	(4.5)	-	-	-	-	4.8	(0.2)	5.0	Soft	No refusal - maximum reach of excavator	
	Min	0.0	(0.2)	0.2	(1.1)	-	-	-	-	2.6	(0.2)	3.5			
	Max	0.0	(0.4)	0.4	(4.5)	-	-	-	-	4.8	(1.1)	5.0			
	Ave	0.0	(0.3)	0.3	(3.0)	-	-	-	-	3.8	(0.5)	4.3			
Zone 3	GL-TP4	0.0	(0.2)	0.2	(2.2)	-	-	2.4	(2.4)	-	-	4.8	Soft	No refusal - maximum reach of excavator	
	GL-TP6	0.0	(0.2)	0.2	(2.1)	-	-	2.3	(2.7)	-	-	5.0	Soft	No refusal - maximum reach of excavator	
	GL-TP9	0.0	(0.3)	0.3	(2.1)	-	-	2.4	(2.5)	-	-	4.9	Soft	No refusal - maximum reach of excavator	
	GL-TP10	0.0	(0.3)	0.3	(3.4)	-	-	3.7	(1.3)	-	-	5.0	Soft	No refusal - maximum reach of excavator	
	GL-TP11	0.0	(0.3)	0.3	(3.1)	-	-	3.4	(1.1)	-	-	4.5	Soft becoming intermediate at 4.5m	Slow excavator advance at 4.5 m	
	GL-TP13	0.0	(0.3)	0.3	(2.1)	-	-	4.4	(0.9)	-	-	5.3	Soft	No refusal - maximum reach of excavator	
	GL-TP14	0.0	(0.3)	0.3	(3.9)	-	-	4.2	(0.3)	-	-	4.5	Soft becoming intermediate at 4.5 m	Slow excavator advance at 4.5 m	
	GL-TP17	0.0	(0.2)	0.2	(2.4)	-	-	2.6	(2.5)	-	-	5.1	Soft	No refusal - maximum reach of excavator	
	GL-TP20	0.0	(0.4)	1.6	(3.2)	-	-	4.8	(0.4)	-	-	5.2	Soft	No refusal - maximum reach of excavator	
	GL-TP25	0.0	(0.3)	0.3	(3.8)	-	-	4.1	(0.7)	-	-	4.8	Soft becoming intermediate below 4.8 m	Difficult excavation below 4.8 m	
	GL-TP27	0.0	(0.2)	0.2	(4.0)	-	-	4.2	(0.9)	-	-	5.1	Soft	No refusal - maximum reach of excavator	
	GL-TP33	0.0	(0.2)	0.2	(4.6)	-	-	4.8	(0.5)	-	-	5.3	Soft	No refusal - maximum reach of excavator	
	GL-TP34	0.0	(0.3)	0.3	(3.3)	-	-	3.6	(0.9)	-	-	4.5	Soft becoming intermediate below 4.5 m	Very slow excavator advance at 4.5 m	
		Min.	0.0	(0.2)	0.2	(2.1)	-	-	2.3	(0.3)	-	-	4.5		
	Max.	0.0	(0.4)	1.6	(4.6)	-	-	4.8	(2.7)	-	-	5.3			
	Ave.	0.0	(0.3)	0.4	(3.1)	-	-	3.6	(1.3)	-	-	4.9			
Zone 4	GL-TP2	0.0	(0.1)	0.1	(1.8)	1.9	(3.0)	-	-	-	-	4.9	Soft	No refusal - maximum reach of excavator	
	GL-TP3	0.0	(0.4)	0.4	(2.8)	3.2	(2.0)	-	-	-	-	5.2	Soft	No refusal - maximum reach of excavator	
	GL-TP12	0.0	(0.3)	0.3	(3.8)	4.1	(0.8)	-	-	-	-	4.9	Soft	No refusal - maximum reach of excavator	
	GL-TP15	0.0	(0.4)	0.4	(3.1)	3.5	(1.5)	-	-	-	-	5.0	Soft	No refusal - maximum reach of excavator	
	GL-TP22	0.0	(0.3)	0.3	(1.5)	1.8	(3.1)	-	-	-	-	4.9	Soft	No refusal - maximum reach of excavator	
	GL-TP24	0.0	(0.3)	0.3	(3.1)	3.4	(1.6)	-	-	-	-	5.0	Soft	No refusal - maximum reach of excavator	
	GL-TP26	0.0	(0.3)	0.3	(4.3)	4.6	(0.4)	-	-	-	-	5.0	Soft	No refusal - maximum reach of excavator	
	GL-TP28	0.0	(0.4)	0.4	(3.2)	3.6	(1.2)	-	-	-	-	4.8	Soft	No refusal - maximum reach of excavator	
	GL-TP29	0.0	(0.3)	0.3	(3.3)	3.6	(1.3)	-	-	-	-	4.9	Soft	No refusal - maximum reach of excavator	
	GL-TP31	0.0	(0.3)	0.3	(4.2)	4.5	(0.5)	-	-	-	-	5.0	Soft becoming intermediate at 5.0 m	Difficult excavation at 5.0 m	
	GL-TP35	0.0	(0.3)	0.3	(1.9)	2.2	(2.7)	-	-	-	-	4.9	Soft	No refusal - maximum reach of excavator	
		Min.	0.0	(0.1)	0.1	(1.5)	1.8	(0.4)	-	-	-	-	4.8		
		Max.	0.0	(0.4)	0.4	(4.3)	4.6	(3.1)	-	-	-	-	5.2		
		Ave.	0.0	(0.3)	0.3	(3.0)	3.3	(1.6)	-	-	-	-	5.0		
	Overall Min.	0.0	(0.1)	0.0	(1.1)	1.8	(0.4)	2.3	(0.3)	2.6	(0.2)	3.5			
	Overall Max.	0.0	(0.4)	1.6	(4.9)	4.6	(3.1)	4.8	(2.7)	4.8	(1.1)	5.3			
	Overall Ave.	0.0	(0.3)	0.3	(3.3)	3.3	(1.6)	3.6	(1.3)	3.8	(0.5)	4.8			

6.4 Dolomite Rock

SRK consulted with the Chief Geologist at Black Rock Mine Operations, Mr Benjamin Ruzive, to understand the underlying geology at the Gloria Mine and specifically the proposed new SFSF area, to confirm that this site is not underlain by Dolomite rock that may have the potential for sinkhole development. Mr Ruzive tasked Resource Geologist, L Ngalela with the compilation of a geological appraisal of the Gloria Mine SFSF site. Based on the results of exploration boreholes drilled within the SFSF footprint, it was confirmed that the site is not underlain by dolomite and therefore there is no risk of sinkhole development. This geological appraisal is included in Appendix A.

6.5 Drop Cone Penetrometer (DCP) Testing

DCP tests were conducted adjacent to all test pits excavated except GL-TP10, GL-TP15 and GL-TP16 as shown on Figure 6-1. The DCP results are summarised in Table 6-3 and the equivalent SPT N_{field} results are summarised in Table 6-4. The detailed field results sheets are included in Appendix C.

The DCP results indicate that the Topsoil material has a loose consistency to a depth of 0.4 m with medium dense becoming dense silty sandy soils to a depth of approximately 4.1 m. Where noted, the nodular calcrete as well as the powder calcrete have a medium dense to dense consistency extending to a depth of 4.8 m below ground surface. The strongly cemented fractured hardpan as identified in GL-TP1, GL-TP7, GL-TP8, GL-TP21, GL-TP23 and GL-TP32 was noted to have a hard rock consistency in the field.

6.6 Groundwater Conditions

No groundwater seepage was recorded on any of the test pits excavated across the SFSF site.

Table 6-3: Summary Soils Consistency from DCP Results

Zone Ref.	Test pit ref.	Depth to top of consistency variation in metres (thickness of consistency in brackets)								DCP Final Depth
		Loose		Medium Dense		Dense		Strongly cemented fractured Hardpan		
Zone 1	GL-TP5	-	-	0.0	(3.9)	3.9	(1.0)	-	-	4.9
	GL-TP16	0.0	(0.2)	0.2	(4.6)	-	-	-	-	4.8
	GL-TP18	0.0	(0.3)			0.3	(3.3)	-	-	3.6
	GL-TP19	0.0	(0.1)	0.1	(3.1)	3.2	(1.4)	-	-	4.6
	GL-TP30	-	-	0.0	(0.3)	0.3	(4.7)	-	-	5.0
	Min.	0.0	(0.1)	0.0	(0.3)	0.3	(1.0)	-	-	3.6
	Max.	0.0	(0.3)	0.2	(4.6)	3.9	(4.7)	-	-	5.0
Ave.	0.0	(0.2)	0.1	(3.0)	1.9	(2.6)	-	-	4.6	
Zone 2	GL-TP1	0.0	(0.2)	0.2	(1.2)	1.4	(1.2)	2.6	(0.9)	3.5
	GL-TP7	0.0	(0.3)	0.3	(1.1)	1.4	(1.8)	3.2	(0.8)	4.0
	GL-TP8	0.0	(0.3)	0.3	(3.1)	-	-	4.4	(0.4)	4.8
	GL-TP21	0.0	(0.4)	0.4	(1.5)	1.9	(2.3)	4.2	(0.3)	4.5
	GL-TP23	0.0	(0.3)	0.3	(3.3)	-	-	3.6	(0.4)	4.0
	GL-TP32	0.0	(0.3)	0.3	(1.6)	1.9	(2.9)	4.8	(5.0)	5.0
	Min.	0.0	(0.2)	0.2	(1.1)	1.4	(1.2)	2.6	(0.3)	3.5
	Max.	0.0	(0.4)	0.4	(3.3)	1.9	(2.9)	4.8	(5.0)	5.0
Ave.	0.0	(0.3)	0.3	(2.0)	1.7	(2.1)	3.8	(1.3)	4.3	
Zone 3	GL-TP4	0.0	(0.2)	0.2	(2.2)	2.4	(2.4)	-	-	4.8
	GL-TP6	0.0	(0.2)	0.2	(2.1)	2.3	(2.7)	-	-	5.0
	GL-TP9	-	-	0.0	(1.1)	1.1	(1.3)	-	-	4.9
				2.4	(2.5)	-	-			
	GL-TP10	-	-	0.0	(1.4)	1.4	(2.3)	-	-	5.0
				3.7	(1.3)	-	-			
	GL-TP11	0.0	(0.3)	0.3	(2.0)	2.3	(2.2)	-	-	4.5
	GL-TP13	0.0	(0.3)	0.3	(1.1)	1.4	(3.1)	-	-	4.5
	GL-TP14	-	-	0.0	(4.2)	4.2	(0.3)	-	-	4.5
	GL-TP17	0.0	(0.2)	0.2	(2.4)	2.6	(2.5)	-	-	5.1
	GL-TP20	0.0	(0.4)	0.4	(4.4)	4.8	(0.4)	-	-	5.2
	GL-TP25	0.0	(0.3)	0.3	(0.8)	2.1	(2.7)	-	-	4.8
	GL-TP27	0.0	(0.2)	0.2	(4.0)	4.2	(0.9)	-	-	5.1
	GL-TP33	0.0	(0.2)	0.2	(4.6)	4.8	(0.5)	-	-	5.3
	GL-TP34	0.0	(0.3)	0.3	(1.1)	1.4	(3.1)	-	-	4.5
Min.	0.0	(0.2)	0.0	(0.8)	1.1	(0.3)	-	-	4.5	
Max.	0.0	(0.4)	3.7	(4.6)	4.8	(3.1)	-	-	5.3	
Ave.	0.0	(0.3)	0.6	(2.3)	2.7	(1.9)	-	-	4.9	
Zone 4	GL-TP2	0.0	(0.1)	0.1	(1.8)	1.9	(3.0)	-	-	4.9
	GL-TP3	0.0	(0.4)	0.4	(2.8)	3.2	(2.0)	-	-	5.2
	GL-TP12	0.0	(0.3)	0.3	(1.5)	1.8	(2.3)	-	-	4.9
		-	-	4.1	(0.8)	-	-			
	GL-TP15	0.0	(0.4)	0.4	(1.4)	1.8	(2.3)	-	-	4.9
		-	-	-	-	4.1	(0.8)			
	GL-TP22	0.0	(0.3)	0.3	(1.6)	1.9	(3.0)	-	-	4.9
	GL-TP24	0.0	(0.3)	0.3	(1.2)	1.5	(3.5)	-	-	5.0
	GL-TP26	0.0	(0.3)	0.3	(4.7)	-	-	-	-	5.0
	GL-TP28	0.0	(0.4)	0.4	(3.2)	3.6	(1.2)	-	-	4.8
	GL-TP29	-	-	0.0	(2.4)	2.4	(2.5)	-	-	4.9
	GL-TP31	0.0	(0.3)	0.3	(4.2)	4.5	(0.5)	-	-	5.0
	GL-TP35	0.0	(0.3)	0.3	(1.9)	2.2	(2.7)	-	-	4.9
	Min.	0.0	(0.1)	0.0	(0.8)	1.5	(0.5)	-	-	4.8
	Max.	0.0	(0.4)	4.1	(4.7)	4.5	(3.5)	-	-	5.2
Ave.	0.0	(0.3)	0.6	(2.3)	2.6	(2.2)	-	-	4.9	
Overall Min.	0.0	(0.1)	0.0	(0.3)	0.3	(0.3)	2.6	(0.3)	3.5	
Overall Max.	0.0	(0.4)	4.1	(4.7)	4.8	(4.7)	4.8	(5.0)	5.3	
Overall Ave.	0.0	(0.3)	0.5	(2.3)	2.4	(2.1)	3.8	(1.3)	4.8	

Table 6-4: Equivalent SPT N_{field} Results

Depth below Surface	GL-DCP1		GL-DCP2		GL-DCP3		GL-DCP4		GL-DCP5		GL-DCP6		GL-DCP7		GL-DCP8		GL-DCP9		GL-DCP11	
	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency
300	8	loose/soft	9	loose/soft	10	loose/soft	8	loose/soft	8	loose/soft	6	loose/soft	11	loose/soft	7	loose/soft	11	firm/medium dense	9	loose/soft
600	15	firm/medium dense	14	firm/medium dense	12	firm/medium dense	11	firm/medium dense	19	firm/medium dense	10	loose/soft	19	firm/medium dense	18	firm/medium dense	20	firm/medium dense	18	firm/medium dense
900	26	firm/medium dense	27	firm/medium dense	25	firm/medium dense	19	firm/medium dense	22	firm/medium dense	27	firm/medium dense	28	firm/medium dense	22	firm/medium dense	33	stiff/dense	26	firm/medium dense
1200	28	firm/medium dense	31	stiff/dense	30	stiff/dense	31	stiff/dense	30	firm/medium dense	46	stiff/dense	30	stiff/dense	28	firm/medium dense	39	stiff/dense	32	stiff/dense
1500	34	stiff/dense	32	stiff/dense	40	stiff/dense	45	stiff/dense	32	stiff/dense	34	stiff/dense	32	stiff/dense	27	firm/medium dense	40	stiff/dense	36	stiff/dense
1800	36	stiff/dense	25	firm/medium dense	37	stiff/dense	47	stiff/dense	32	stiff/dense	31	stiff/dense	31	stiff/dense	25	firm/medium dense	37	stiff/dense	31	stiff/dense
2100	33	stiff/dense	28	firm/medium dense	33	stiff/dense	51	very stiff/very dense	33	stiff/dense	34	stiff/dense	33	stiff/dense	24	firm/medium dense	36	stiff/dense	35	stiff/dense
2400	29	firm/medium dense	28	firm/medium dense	41	stiff/dense	48	stiff/dense	35	stiff/dense	33	stiff/dense	32	stiff/dense	30	stiff/dense	30	firm/medium dense	39	stiff/dense
2700	32	stiff/dense	30	firm/medium dense	36	stiff/dense	42	stiff/dense	33	stiff/dense	36	stiff/dense	33	stiff/dense	30	firm/medium dense	28	firm/medium dense	39	stiff/dense
3000					35	stiff/dense	38	stiff/dense	29	firm/medium dense	35	stiff/dense	33	stiff/dense						
3300					34	stiff/dense	36	stiff/dense	25	firm/medium dense	33	stiff/dense								
3600					34	stiff/dense	36	stiff/dense	26	firm/medium dense	32	stiff/dense								
3900					33	stiff/dense	37	stiff/dense	25	firm/medium dense	31	stiff/dense								
4200					28	firm/medium dense	34	stiff/dense	33	stiff/dense	34	stiff/dense								
4500					28	firm/medium dense	39	stiff/dense	34	stiff/dense	37	stiff/dense								
4800					26	firm/medium dense	39	stiff/dense	31	stiff/dense	39	stiff/dense								
Depth below Surface	GL-DCP12		GL-DCP13		GL-DCP14		GL-DCP17		GL-DCP18		GL-DCP19		GL-DCP20		GL-DCP21		GL-DCP22		GL-DCP23	
	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency
300	8	loose/soft	11	loose/soft	12	firm/medium dense	8	loose/soft	3	loose/soft	10	loose/soft	8	loose/soft	10	loose/soft	7	loose/soft	8	loose/soft
600	15	firm/medium dense	23	firm/medium dense	13	firm/medium dense	19	firm/medium dense	10	loose/soft	16	firm/medium dense	14	firm/medium dense	16	firm/medium dense	14	firm/medium dense	11	firm/medium dense
900	21	firm/medium dense	45	stiff/dense	28	firm/medium dense	36	stiff/dense	30	stiff/dense	31	stiff/dense	29	firm/medium dense	27	firm/medium dense	22	firm/medium dense	21	firm/medium dense
1200	26	firm/medium dense			36	stiff/dense	50	very stiff/very dense	48	stiff/dense	42	stiff/dense	41	stiff/dense	34	stiff/dense	29	firm/medium dense	32	stiff/dense
1500	29	firm/medium dense			35	stiff/dense	44	stiff/dense		51	very stiff/very dense	43	stiff/dense	34	stiff/dense	33	stiff/dense	31	stiff/dense	
1800	33	stiff/dense			27	firm/medium dense	32	stiff/dense		48	stiff/dense	42	stiff/dense	31	stiff/dense	30	stiff/dense	29	firm/medium dense	
2100	35	stiff/dense			34	stiff/dense	32	stiff/dense		46	stiff/dense	42	stiff/dense	29	firm/medium dense	26	firm/medium dense	30	firm/medium dense	
2400	39	stiff/dense			34	stiff/dense	28	firm/medium dense		43	stiff/dense	42	stiff/dense	30	stiff/dense	23	firm/medium dense	30	firm/medium dense	
2700	39	stiff/dense			34	stiff/dense	30	firm/medium dense		40	stiff/dense	40	stiff/dense	33	stiff/dense	25	firm/medium dense	28	firm/medium dense	
3000							24	firm/medium dense		40	stiff/dense	33	stiff/dense							
3300							26	firm/medium dense		50	stiff/dense	33	stiff/dense							
3600							28	firm/medium dense		39	stiff/dense	30	firm/medium dense							
3900							26	firm/medium dense		44	stiff/dense	38	stiff/dense							
4200							23	firm/medium dense		44	stiff/dense	36	stiff/dense							
4500							22	firm/medium dense		45	stiff/dense	35	stiff/dense							
4800										44	stiff/dense	33	stiff/dense							

Depth below Surface	GL-DCP24		GL-DCP25		GL-DCP26		GL-DCP27		GL-DCP28		GL-DCP29		GL-DCP30		GL-DCP31		GL-DCP32		GL-DCP33	
	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency	SPT N Value	Consistency
300	7	loose/soft	16	firm/medium dense	7	loose/soft	6	loose/soft	6	loose/soft	14	firm/medium dense	12	firm/medium dense	9	loose/soft	6	loose/soft	4	loose/soft
600	8	loose/soft	26	firm/medium dense	14	firm/medium dense	16	firm/medium dense	23	firm/medium dense	18	firm/medium dense	39	stiff/dense	11	firm/medium dense	16	firm/medium dense	9	loose/soft
900	3	loose/soft	21	firm/medium dense	25	firm/medium dense	28	firm/medium dense	36	stiff/dense	22	firm/medium dense	44	stiff/dense	27	firm/medium dense	28	firm/medium dense	16	firm/medium dense
1200	7	loose/soft	25	firm/medium dense	35	stiff/dense			45	stiff/dense	28	firm/medium dense	41	stiff/dense	35	stiff/dense	35	stiff/dense	30	firm/medium dense
1500	23	firm/medium dense	30	stiff/dense	47	stiff/dense			54	very stiff/very dense	33	stiff/dense	35	stiff/dense	39	stiff/dense	37	stiff/dense	31	stiff/dense
1800	30	firm/medium dense	33	stiff/dense	42	stiff/dense			39	stiff/dense	34	stiff/dense	36	stiff/dense	39	stiff/dense	31	stiff/dense	33	stiff/dense
2100	36	stiff/dense	35	stiff/dense	55	very stiff/very dense			39	stiff/dense	40	stiff/dense	38	stiff/dense	32	stiff/dense	31	stiff/dense	29	firm/medium dense
2400	39	stiff/dense	37	stiff/dense					53	very stiff/very dense	38	stiff/dense	36	stiff/dense	30	stiff/dense	34	stiff/dense	34	stiff/dense
2700	39	stiff/dense	35	stiff/dense					59	very stiff/very dense	35	stiff/dense	36	stiff/dense	30	firm/medium dense	33	stiff/dense	33	stiff/dense
3000											31	stiff/dense	33	stiff/dense	29	firm/medium dense			32	stiff/dense
3300											32	stiff/dense	31	stiff/dense	33	stiff/dense			31	stiff/dense
3600											30	firm/medium dense	33	stiff/dense	38	stiff/dense			35	stiff/dense
3900											32	stiff/dense	34	stiff/dense	39	stiff/dense			34	stiff/dense
4200											36	stiff/dense	36	stiff/dense	43	stiff/dense			31	stiff/dense
4500											41	stiff/dense	44	stiff/dense	66	very stiff/very dense			34	stiff/dense
4800													44	stiff/dense					37	stiff/dense
Depth below Surface	GL-DCP34		GL-DCP35																	
	SPT N Value	Consistency	SPT N Value	Consistency																
300	7	loose/soft	7	loose/soft																
600	21	firm/medium dense	19	firm/medium dense																
900	33	stiff/dense	22	firm/medium dense																
1200	42	stiff/dense	33	stiff/dense																
1500	51	very stiff/very dense	40	stiff/dense																
1800	43	stiff/dense	30	stiff/dense																
2100	43	stiff/dense	28	firm/medium dense																
2400	42	stiff/dense	47	stiff/dense																
2700	33	stiff/dense	33	stiff/dense																
3000	36	stiff/dense																		
3300	36	stiff/dense																		
3600	28	firm/medium dense																		
3900	47	stiff/dense																		
4200	30	stiff/dense																		
4500	36	stiff/dense																		
4800	36	stiff/dense																		

7 Laboratory Testing

Representative disturbed soil samples were retrieved from the test pits and submitted to Specialised Testing Laboratory (Pty) Ltd where the following tests were conducted:

- Sieve analysis.
- Atterberg limits.
- Moisture content.
- Specific gravity.
- Modified AASHTO compaction with CBR determinations
- Remoulded shear box tests.
- Remoulded triaxial tests (consolidated undrained).
- Flexible wall permeability testing.
- Soils aggressivity.

7.1 Soils Classification

The classification testing results are provided in Table 7-1 and the detailed laboratory results sheets are included in Appendix D. The laboratory testing was carried out in accordance with the TMH1 A1, A5 and MT1 test methods. As a result, there are some differences between the field descriptions in Section 6 and the USCS classification descriptions in this section (classified in accordance to ASTM D2487), due to the particle sizes for sands defined differently by the two classifications methods.

7.1.1 Aeolian Soils

The Aeolian soils consist of a sand content ranging from 89% to 93% (average 91%), a silt content ranging from 5% to 8% (average of 7%) and a clay content ranging from 1% to 3% (average of 2%). The grading modulus (GM), moisture content (MC) and specific gravity (SG) ranges from 0.89 to 0.98 (average of 0.94), 1.0% to 6.1% (average 2.53%) and 2.65 to 2.71 (average of 2.66) respectively.

Eight of the ten aeolian soil samples tested are non-plastic whilst the sample retrieved from GL-TP3 (at 3.2 m) had a plasticity index (PI) of 8, a plastic limit (PL) of 24%, liquid limit (LL) of 32% and linear shrinkage (LS) of 3.5%. The sample retrieved from GL-TP19 (3.2 – 4.6 m) reported a slight plasticity and a LS of 0.5%. All samples have a low potential expansiveness (PE) with Unified Soils Classification System (USCS) classes generally of SM (silty sand) but locally with SP-SM (poorly graded sand with silt in GL-TP3 at 0.4 – 3.2 m and GL-TP27 at 0.2 – 2.3 m) and SC (clayey sand in GL-TP3 at 3.2 m) soils.

Table 7-1: Soils Classification Test Results

TP Ref	Depth (m)	Short field description	GM	NMC (%)	SG	1TMH1 A1, A5 and MT1				LL (%)	PL (%)	LS (%)	PI	PE	USCS Class	USCS Class Description
						>2.0 mm	0.06 - 2.0 mm	0.002 - 0.06 mm	< 0.002 mm							
GL-TP1	1.4 - 2.6	Silty sand, Aeolian.	0.93	2.6	2.65	0	91	8	1	-	-	0.0	NP	Low	SM	Silty sand
GL-TP1	0.2 - 1.4	Silty sand, Aeolian.	0.95	2.3	2.69	0	91	8	1	-	-	0.0	NP	Low	SM	Silty sand
GL-TP3	0.4 - 3.2	Silty sand with quartz gravel, Aeolian.	0.98	1.0	2.65	0	92	5	3	-	-	0.0	NP	Low	SP-SM	Poorly graded sand with silt
GL-TP3	3.2	Silty sand with quartz gravel, Aeolian.	0.90	6.1	2.65	0	89	8	3	32	24	3.5	8	Low	SC	Clayey sand
GL-TP6	0.2 - 2.3	Silty sand, Aeolian.	0.96	2.2	2.65	0	93	6	1	-	-	0.0	NP	Low	SM	Silty sand
GL-TP19	3.2 - 4.6	Silty sand with manganese nodules, Aeolian.	0.89	3.1	2.65	0	92	7	1	-	-	0.5	SP	Low	SM	Silty sand
GL-TP21	0.4 - 1.9	Silty sand, Aeolian.	0.94	2.2	2.65	0	92	7	1	-	-	0.0	NP	Low	SM	Silty sand
GL-TP27	0.2 - 2.3	Silty sand, Aeolian.	0.97	1.9	2.71	0	92	7	1	-	-	0.0	NP	Low	SP-SM	Poorly graded sand with silt
GL-TP30	3.0 - 5.0	Silty sand, Aeolian.	0.97	2.2	2.65	0	90	7	3	-	-	0.0	NP	Low	SM	Silty sand
GL-TP32	1.9 - 4.8	Silty sand, Aeolian.	0.9	1.7	2.65	0	92	7	1	-	-	0.0	NP	Low	SM	Silty sand
		Minimum	0.89	1.0	2.65	0	89	5	1	32	24	0.0	8			
		Maximum	0.98	6.1	2.71	0	93	8	3	32	24	3.5	8			
		Average	0.94	2.5	2.66	0	91	7	2	32	24	0.0	8			
GL-TP1	2.6 - 3.5	Hardpan calcrete, Pedogenic.	1.19	6.4	2.65	12	79	8	1	-	-	0.5	NP	Low	SM	Silty sand
GL-TP10	3.7 - 5.0	Nodular calcrete gravelly sand, Pedogenic.	1.12	5.3	2.678	10	81	8	1	20	17	1.5	3	Low	SM	Silty sand
GL-TP17	2.6 - 4.6	Nodular calcrete gravelly sand, Pedogenic.	0.94	3.6	2.666	0	93	6	1	-	-	0.5	SP	Low	SM	Silty sand
GL-TP28	3.6 - 4.8	Silty sand, powder calcrete with nodules, Pedogenic.	1.00	5.0	2.681	2	88	9	1	-	-	0.5	SP	Low	SM	Silty sand
GL-TP29	3.6 - 4.9	Silty sand, powder calcrete with nodules; Pedogenic.	1.55	7.9	2.682	30	64	5	1	-	-	1	SP	Low	SM	Silty sand
GL-TP33	4.8 - 5.3	Nodular calcrete gravelly sand, Pedogenic.	2.72	2.2	2.65	86	13	0	1	-	-	1	SP	Low	GP	Poorly graded gravel
GL-TP35	2.2 - 4.9	Silty sand, powder calcrete with nodules, Pedogenic.	1.00	3.9	2.66	4	89	6	1	28	20	3.5	8	Low	SC-SM	Silty, clayey sand
		Minimum	0.94	2.2	2.65	0	13	0	1	20	17	1	3			
		Maximum	2.72	7.9	2.68	86	93	9	1	28	20	4	8			
		Average	1.36	4.9	2.67	21	72	6	1	24	19	1	6			
		Overall Minimum	0.89	1.0	2.65	0	13	0	1	20	17	0	3			
		Overall Maximum	2.72	7.9	2.71	86	93	9	3	32	24	4	8			
		Overall Average	1.11	3.5	2.66	8.5	83.6	6.6	1.4	27	20	0.7	6.3			

GM - Grading Modulus NMC - Moisture Content SG - Specific Gravity LL - Liquid Limit PL - Plastic Limit LS - Linear Shrinkage PI - Plasticity Index
 PE - Potential Expansiveness USCS - Unified Soils Classification System

Table 7-2: Compaction Test Results

TP Ref	Depth (m)	USCS Description	USCS	OMC (%)	Mod AASHTO MDD (kg/m³)	CBR (%)							TRH14 Classification
						% Swell	100%	98%	97%	95%	93%	90%	
TP1	0.2 - 1.4	Silty sand	SM	7.3	1826	0.0	30	17	13	7	4	1	G10
GL-TP21	0.4 - 1.9	Silty sand	SM	8.5	1850	0.0	46	32	26	18	15	12	G7
GL-TP28	3.6 - 4.8	Silty sand	SM	9.1	1938	0.1	44	30	25	17	13	8	G8
GL-TP29	3.6 - 4.9	Silty sand	SM	13.9	1781	0.1	27	22	20	17	13	9	G8

OMC - Optimum Moisture Content MDD - Maximum Dry Density CBR - California Bearing Ratio

7.1.2 Pedogenic Soils

The Pedogenic soils were described as either powder, nodular or hardpan calcrete.

The *powder calcrete* had a gravel content ranging from 2% to 30% (average 12%), a sand content ranging from 64% to 89% (average 80%), silt content ranging from 5% to 9% (average 7%) and 1% clay. The GM of these soils ranged from 1.00 to 1.55 (average 1.18), NMC from 3.9% to 7.9% (average of 5.6%) and the SG ranged from 2.66 to 2.68 (average of 2.67). Two of the three samples were slightly plastic in nature with linear shrinkage values of 0.5% (GL-TP28 3.6-4.8 m) and 1 % (GL-TP29 3.6 – 4.9 m) recorded. These samples also classified as SM (silty sand) soils according to the USCS. The sample retrieved from GL-TP35 (2.2 -4.9 m) reported a PL of 20%, LL of 28, LS of 3.5 and a PI of 8. This sample classified as a SC-SM (silty or clayey sand) according to the USCS. All samples were classified as having a low PE.

The *nodular calcrete gravelly sand* samples retrieved from GL-TP10 (3.7-5.0 m), GL-TP17 (2.6 – 4.6 m) and GL-TP33 (4.8 – 5.3 m) had a gravel content ranging from 0% to 86% (average 32%), sand content ranging from 13% to 93% (average 62%), silt content ranging from 0% to 8% (average 5%) and 1% clay. GM, NMC and SG values ranging from 0.94 to 2.72 (average 1.59), 2.2% to 5.3% (average 3.7%) and 2.65 to 2.678 (average 2.66) respectively were reported. The samples from test pits GL-TP10 had a measured LL of 20%, a PL of 17% and a LS of 3% with a PI of 3. This sample classified as SM (silty sand) according to the USCS and has a low PE. The nodular calcrete samples tested from GL-TP17 and GL-TP33 classified as a SM (silty sand) and GP (poorly graded gravel) respectively. Both these samples were slightly plastic in nature with LS values ranging from 0.5% to 1% and with a low PE.

A single *hardpan calcrete* sample was retrieved from GL-TP1 (2.6 – 3.5 m) and the gradings reported 12% gravel, 79% sand, 8% silt and 1% clay. This sample had a GM of 1.19, NMC of 6.4% and was non-plastic however reported a LS of 0.5%. The soil has a low PE and classifies as SM (silty sand) according to the USCS).

7.2 Compaction and CBR Testing Results

Modified AASHTO compaction testing with CBR determinations was conducted on the Aeolian and Pedogenic powder calcrete sands. The results are provided in Table 7-2 and the detailed results sheets are included in Appendix D. The soils in general tested with very low CBR values. The Aeolian soils classify as G7 and G10 in terms of the TRH14 guidelines whilst the nodular calcrete soils classify as a G8 quality materials.

7.3 Shear Box Testing

Shear box testing was conducted on the Aeolian soils retrieved from GL-TP1 (0.2 – 1.4 m and GL-TP21 (0.4 – 1.9 m) and the Pedogenic nodular calcrete sands from GL-TP28 remoulded to a dry density of approximately 1 500 kg/m³. The results are provided in Table 7-3 and the detailed results sheets are included in Appendix D.

The results from the samples tested are indicative of medium dense silty sands (SM) with friction angles (ϕ) ranging from 31° to 33°. Although cohesion values ranging from 3.5 kPa to 5.3 kPa were interpreted on the laboratory test sheets, a cohesion of 0 kPa is expected for the SM soils.

Table 7-3: Shear Box Test Results

TP Ref	Depth (m)	Origin	USCS Description	USCS	Angle of Internal Friction, ϕ (°)	Cohesion, c (kPa)
GL-TP1	0.2 - 1.4	Aeolian	Silty sand	SM	32.9	3.5
GL-TP21	0.4 - 1.9	Aeolian	Silty sand	SM	30.8	5.3
GL-TP28	3.6 - 4.8	Pedogenic	Silty sand	SM	33.3	4.8

7.4 Triaxial Testing

Consolidated undrained triaxial tests were conducted on selected remoulded samples. The results are summarised in Table 7-4 and the detailed results sheets are included in Appendix D.

Table 7-4: Consolidated Undrained Triaxial Test Results

TP Ref	Depth (m)	Origin	USCS Description	USCS	Effective Angle of Internal Friction, ϕ (°)	Effective Cohesion, c (kPa)
GL-TP1	0.2 - 1.4	Aeolian	Silty sand	SM	27	0
GL-TP28	3.6 - 4.8	Pedogenic	Silty sand	SM	31	0
GL-TP29	3.6 - 4.9	Pedogenic	Silty sand	SM	33	0

7.5 Permeability Testing

The permeability of the Aeolian and powder calcrete sands was determined using the flexible wall permeability testing apparatus within the triaxial cells, on remoulded soils samples. The permeability was measured at effective pressures of 100 kPa, 200 kPa and 300 kPa. Table 7-5 provides a summary of the permeability test results. These permeability test results conform to empirical permeability value ranges for SM type soils. The detailed laboratory test sheets are included in Appendix D.

Table 7-5: Summary of Permeability Testing

TP Ref	Depth (m)	USCS	Specific Gravity (SG)	Dry Density (g/cm ³)	Initial Moisture Content (%)	Coefficient of Permeability (m/s)		
						100 kPa	200 kPa	300 kPa
GL-TP1	0.2 - 1.4	SM	2.693	1.469	10.0	6.02×10^{-6}	4.38×10^{-6}	3.68×10^{-6}
GL-TP28	3.6 - 4.8	SM	2.681	1.496	7.5	6.83×10^{-6}	4.03×10^{-6}	2.79×10^{-6}

7.6 Soils Aggressivity

Chemical testing was conducted on two Aeolian sand samples from TP1 (1.4 – 2.6 m) and GL-TP3 (3.2 m) and one Pedogenic nodular calcrete sand sample from GL-TP10 (3.7 – 5.0 m). The results are summarised in Table 7-6 and the detailed results are included in Appendix D. The Aeolian sand sample from TP1 was found to be corrosive whilst the aeolian samples tested from GL-TP3 and the nodular calcrete sample from GL-TP10 was found to be non-corrosive towards metals. All samples tested were found to be aggressive towards concrete and fibre cement pipes.

Table 7-6: Soils Aggressivity Test Results

TP Ref.	Depth (m)	USCS	pH (at 25°C)	SO ₄ mg/l	Mg mg/l	Cl mg/l	NH ₄ mg/l	Corrosivity Index	Basson Index
TP1	1.4 - 2.6	SM	6.0	89	<1	16	<0.3	Corrosive	Aggressive
GL-TP3	3.2	SC	7.0	<2	<1	<2	<0.3	Non-Corrosive	Aggressive
GL-TP10	3.7 - 5.0	SM	7.3	<2	<1	<2	<0.3	Non-Corrosive	Aggressive

8 Geotechnical Evaluation

The geotechnical evaluation is based on the results gathered from the intrusive geotechnical investigation, field observations and laboratory investigations.

8.1 General Ground Profile

The new SFSF area is underlain by poorly developed Topsoil from surface to an average depth of 0.3 m underlain by Aeolian orange brown to yellow brown silty fine sand to an average depth of 3.3 m. Pedogenic soils in the form of powder calcrete sand, nodular calcrete sand or strongly cemented fractured hardpan calcrete are found underlying the Aeolian soils. The test pits were advanced to a maximum depth of 5.3 m.

Four zones were identified to be present based on the ground profiles underlying the site and these include the following:

- Areas underlain by Aeolian sands only – Zone 1
- Areas underlain by Aeolian sands and Hardpan Calcrete – Zone 2
- Areas underlain by Aeolian sands and Nodular Calcrete gravelly sands – Zone 3
- Areas underlain by Aeolian sands and Powder Calcrete sands – Zone 4

The Aeolian sands present in Zone 1, Zone 3 and Zone 4 generally classify as SM (silty sand) with poorly graded sand with silt soils present in the vicinity of GL-TP3 and GL-TP27. Aeolian soils classifying as clayey sands (SC) was also noted at depth in GL-TP3. The nodular calcrete soils mostly classified as SM soils however, poorly graded gravel (GP) and clayey and or silty sandy soils (SC-SM) were present locally. The hardpan calcrete classified as a silty sand (SM) based on the USCS classification. The nodular calcrete sands in Zone 3 generally have an average 25% gravel fraction.

The poorly developed Topsoil material has a loose consistency to an average depth of 0.3 m, which overlies medium dense becoming dense silty sandy soils to a depth of approximately 4.1 m. The Pedogenic material present in Zone 3 and Zone 4 have a medium dense to dense consistency extending to a depth of 4.8 m below ground surface whilst the strongly cemented hardpan calcrete was described as being highly to moderately fractured.

Although, no indicators for collapse potential was identified in the field and therefore not tested for in the laboratory suite of tests conducted, according to literature, Aeolian soils are known to exhibit a collapse settlement phenomenon. This needs to be borne in mind and taken into consideration during the design of the proposed SFSF foundations.

8.2 Geotechnical Characteristics

The Technical Recommendations for Highways, TRH10 (1994) document was used to relate the equivalent SPT N_{field} to E modulus values as shown in Table 8-1.

Table 8-1: Consistency descriptions for granular soils as a function of SPT N and E Modulus values (TRH10)

Description	SPT N	Modulus E (MPa)
Very loose	4	4
Loose	4-10	4-10
Medium dense	10-30	10-30
Dense	30-50	30-40
Very dense	>50	>40

The loose Topsoil present to an average depth of 0.3 m are expected to have an E modulus value of 4 MPa with the medium dense becoming dense soils present to a depth of 4.1 m expected to have an E modulus value ranging from 10 to 40 MPa with depth. The Pedogenic soils present in Zone 3 and 4 which also have a medium dense to dense consistency are expected to exhibit an E modulus of 10 to 30 MPa whilst the strongly cemented hardpan calcrete will have an E modulus in excess of 100 to 200 MPa.

Potentially high consolidation and collapse settlements of in-situ foundation soils may be expected across the site.

The Aeolian soils classify as non-plastic or slightly plastic therefore geotechnical problems associated with active soils such as heaving is not anticipated. Both the Aeolian and Pedogenic soils present across the site exhibited a low potential expansiveness. Although, not confirmed with laboratory testing, based on literature, the Pedogenic soils are expected to be dispersive in nature.

A geotechnical constraint that may influence the settlement of foundations is the potential of a component of the calcareous Pedogenic soils going into solution on exposure to groundwater. This is an important consideration for design purposes and during the construction of the SFSF.

8.3 Design Stability Assessment Parameters

Based on laboratory testing and empirical information, it is recommended that the parameters presented in Table 8-2 be assumed for the design of the SFSF.

Table 8-2: Design Parameters for Stability Analysis

Zone	USCS Classification	Drained Cohesion c' (kPa)	Drained Friction Angle ϕ' (Degrees)	Hydraulic Conductivity (m/s)
Zone 1	SM / SP-SM	0	33	10^{-6}
Zone 2	Hardpan (Fractured - no USCS Classification)	0	33	10^{-5}
Zone 3	SM / SC-SM	0	32	10^{-7}
Zone4	SM	0	33	10^{-6}

8.4 Founding Conditions

8.4.1 Bearing Capacity

The following bearing capacities (limiting total consolidation settlement to 25 mm, (with differential settlement 50% of total settlement) are recommended for the soils:

Loose soils - maximum allowable bearing pressure of 50 kPa.

Medium dense soils - maximum allowable bearing pressure of 100 kPa.

Dense soils - maximum allowable bearing pressure of 150 kPa.

Strongly cemented Fractured Hardpan calcrete – maximum allowable bearing pressure estimated at 250 kPa, however the thickness of this hardpan layer and the soils underlying this layer will need to be confirmed.

Note: Although the bearing capacities are provided for the various soil consistencies, provision must be made in design and construction for the potential of these soils to exhibit collapse settlement.

8.4.2 Light Structures

Strip footings and small spread footings (1 m x 1 m) < 100 kPa should be placed on a 1.0 m thick engineered fill raft. The in-situ soils should be compacted to a depth of 0.5 m below this. The base should be dynamically compacted to remove collapse settlement potential. Average settlements of < 10 mm can be expected.

8.4.3 Raft Foundations

Concrete raft foundations may be placed on 1.0 m thick engineered fill. The in-situ soils should be excavated to 1.0 m. The base should be saturated and dynamically compacted to remove collapse settlement potential. Engineered fill should be constructed over this with TRH 14 G6 (or better) gravel. The size and loading of the rafts must be considered when determining the engineered fill thickness.

8.4.4 Starter Embankments

The starter embankments should be box cut to the medium dense soils which occur below depths ranging from the surface to 4.1 m, and with an average depth of 0.5 m. The excavation base should be saturated and dynamically compacted to remove collapse settlement potential. The Aeolian soils should be reintroduced and engineered to the starter embankment founding elevation. The starter embankment should then be constructed over this with TRH 14 G6 (or better) gravel. The Pedogenic material as construction materials should be used with caution due to the possibility of this material being dispersive and the potential of a component of the soils that can go into solution.

8.4.5 Return Water Dam

The recommendations for a Liner placed over engineered fill as described for the concrete raft foundations should be adhered to. The thickness of the engineered fill is to be determined from the expected loading.

The Aeolian sands may be used as a protection layer between an HDPE liner and the engineered fill. It is recommended that the Pedogenic material not be considered as a construction material for the return water dam.

8.5 Dolomite Rock

According to the geological appraisal of the site provided by Assmang, the site is not underlain by dolomite and therefore there is no risk of sinkhole development across the footprint of the proposed SFSF as a result of dolomite.

8.6 Undermining

Where the underground mining operation extends to below the proposed SFSF area, there is a potential risk of surface subsidence. Further confirmation of the extent of undermining will be required to assess the risk of subsidence.

8.7 Excavation Conditions

Excavation conditions classify as Soft in the Zone 1, 3 and 4 soils to a depth of approximately 4.6 m based on the classification provided in SANS 1200D. Intermediate to hard excavation conditions may be expected in Zone 2 below an average depth of 3.8 m where the strongly cemented fractured hardpan calcrete was noted, however this will depend on the amount of fracturing.

8.8 Construction Materials

The Aeolian sands across the proposed SFSF site may be used as construction materials in the following applications:

- Sand drains.
- A protective layer beneath and above an HDPE liner.
- Cement stabilised sands (Starter embankment). Cement may be added at 2%, 3% and 4% dependant on the strength requirement of the sands. This will need to be confirmed from laboratory testing.
- Engineered fill when blended with waste rock (TRH14 G5 gravel). This may be used for the construction of starter embankments and in engineered fill platforms.

The Aeolian sands are highly erodible, and this must be considered in the design.

The Pedogenic soils will need to be used with caution or should be protected due to the dispersive nature of these soils as well as the possibility of the calcareous component going into solution during periods of wetting.

8.9 Ground Aggressivity

In general, the Aeolian and Pedogenic soils are expected to be non-corrosive towards metals however, are aggressive towards concrete and fibre cement pipes. Due to the localised occurrence of corrosive soils at the site (in the vicinity of GL-TP1), sufficient cover of concrete over foundation reinforcing must be allowed for.

8.10 Seismic Conditions

It is believed that no additional 'special' design considerations will be required in terms of the seismic risk, as the area falls within a low risk area with a peak ground acceleration of approximately 0.03 g. This PGA will need to be included in the stability analyses as a pseudo static load.

It is assumed that relevant engineering standards will be applied to the design of the infrastructure and foundations as required by the relevant authorities or an acceptable international equivalent.

8.11 Slope Stability

The site is generally not associated with a high degree of topographic variation and existing natural slope stability is not of major concern. However, the loose soils consistency of the Aeolian soils is of concern and it is recommended that all temporary excavated slopes in excess of 1.5 m must be fully supported or battered back at least 1v:1.5h in soil.

For excavations over 2.0 m in depth, the ground conditions should be assessed by a geotechnical engineer or engineering geologist prior to and during excavation, and the safe slope angles be determined by analysis.

9 Conclusions

This report presents the results of the invasive geotechnical investigation conducted for the proposed Gloria Mine SFSF. It also outlines the geotechnical flaws associated with the Area and provides conclusions on geotechnical parameters and foundation design considerations for the site. The main conclusions derived from these results are summarised below:

- The typical ground profile recorded was loose to medium dense Poorly Developed Topsoil and Aeolian silty fine to medium sand overlying medium dense and dense with depth medium Aeolian silty sand. Powder, nodular and strongly cemented hardpan calcrete were also noted to be present underlying the site.
- The DCP results indicate that the Aeolian poorly developed Topsoil material has a loose consistency to a depth of 0.3 m with medium dense becoming dense silty sandy soils to a depth of approximately 4.1 m. Where noted, the nodular calcrete as well as the powder calcrete have

a medium dense to dense consistency extending to a depth of 4.8 m below ground surface. The strongly cemented hardpan was noted to have a hard rock consistency.

- The soils classify as non-plastic or slightly plastic with a low potential expansiveness.
- The Aeolian soils, powder and nodular calcrete gravelly sands are expected to have a potentially high collapse potential.
- The site is not underlain by dolomite and therefore there is no risk of sinkhole development at the site.
- Excavation conditions in the Aeolian soils, nodular and powder calcrete are expected to classify as soft in accordance with SANS 1200D. The strongly cemented hardpan may classify as intermediate to hard excavation.
- The area falls within a low risk seismic area with a peak ground acceleration of approximately 0.03 g.
- The Aeolian sand at the site are suitable for use in sand drains. They may also be stabilised with cement for use in starter embankment construction or blended with waste rock and used as engineered fill.
- The Aeolian soils are generally not corrosive towards metals however are aggressive towards concrete and fibre cement pipes.
- The Pedogenic soils should be used with caution as a construction material due to the likelihood of these soils going into solution when wet as well as exhibiting dispersive behaviour.

10 Recommendations

The following recommendations are made from the results of this investigation:

- The potential for collapse settlement of the Aeolian sands must be considered in foundation design.
- The potential instability of the soils in excavations must be considered during construction.
- The calcareous Pedogenic soils will need to be protected where used as construction materials due to the dispersive nature hence erosive potential of these soils as well as the possibility of these soils going into solution on exposure to groundwater.

The following bearing capacities (limiting total consolidation settlement to 25 mm, with differential settlement 50% of total settlement) are recommended for the soils:

- Loose soils - maximum allowable bearing pressure of 50 kPa.
- Medium dense soils - maximum allowable bearing pressure of 100 kPa.
- Dense soils - maximum allowable bearing pressure of 150 kPa.
- Strongly cemented Hardpan calcrete is expected to have a maximum allowable bearing pressure estimated at 250 kPa, this may be revised after the thickness of this layer and the ground underlying this material has been classified.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

11 References

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Appendices

Appendix A: Assmang Geological Appraisal – Gloria Mine

PROPOSED NEW GLORIA TAILINGS FACILITY

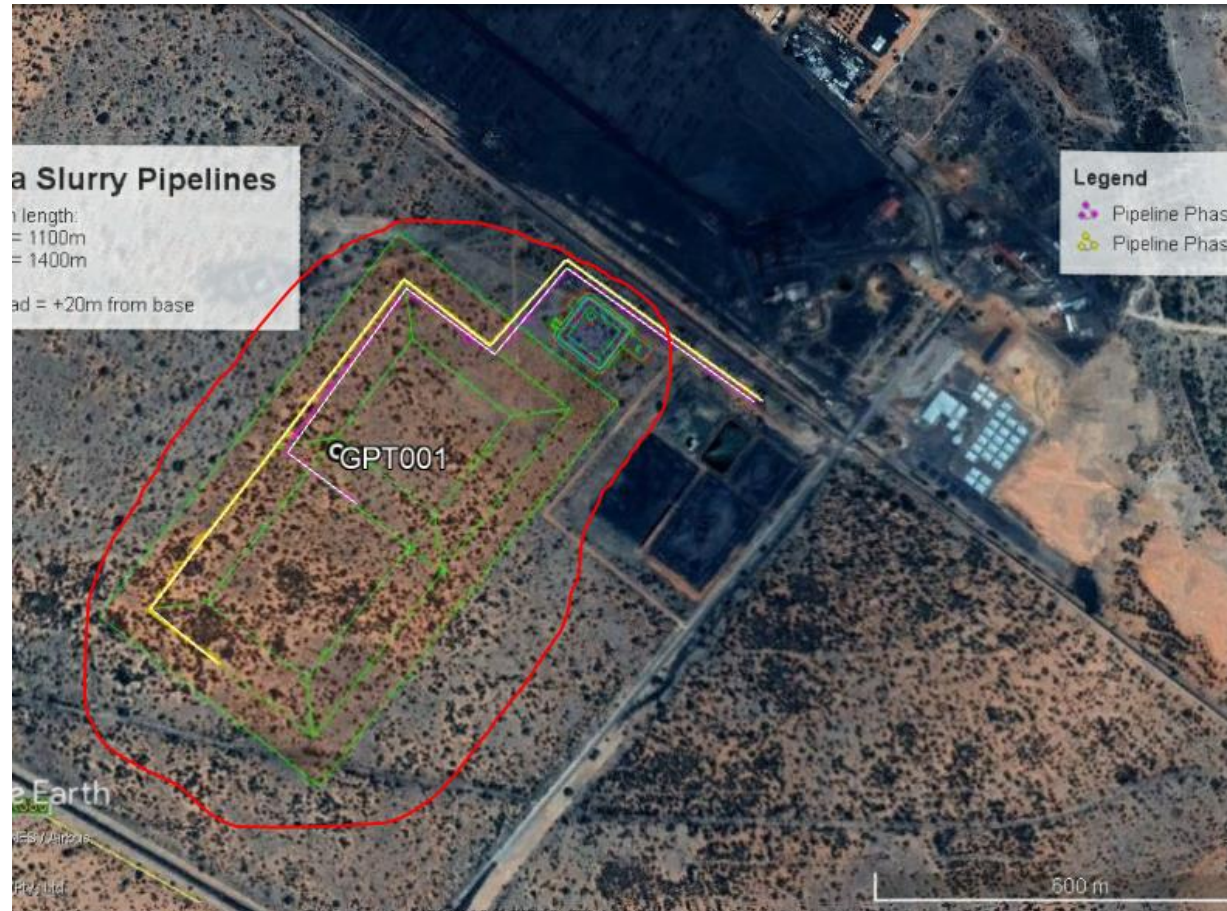
GEOLOGICAL APRAISAL

L. Ngalela

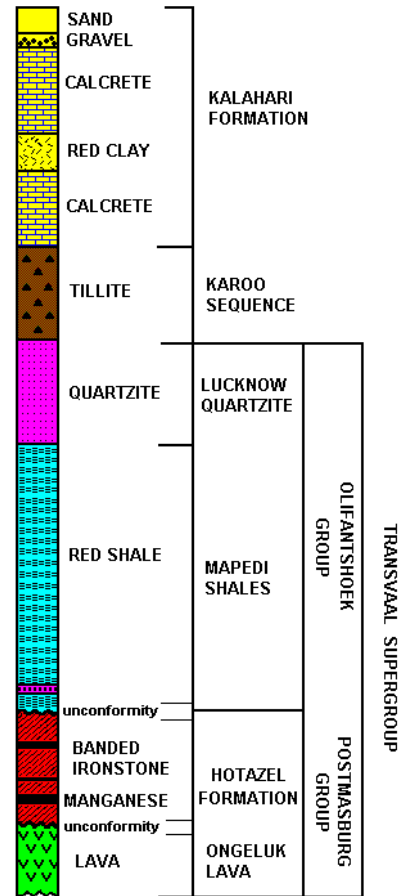
Resource Geologist

18 June 2019

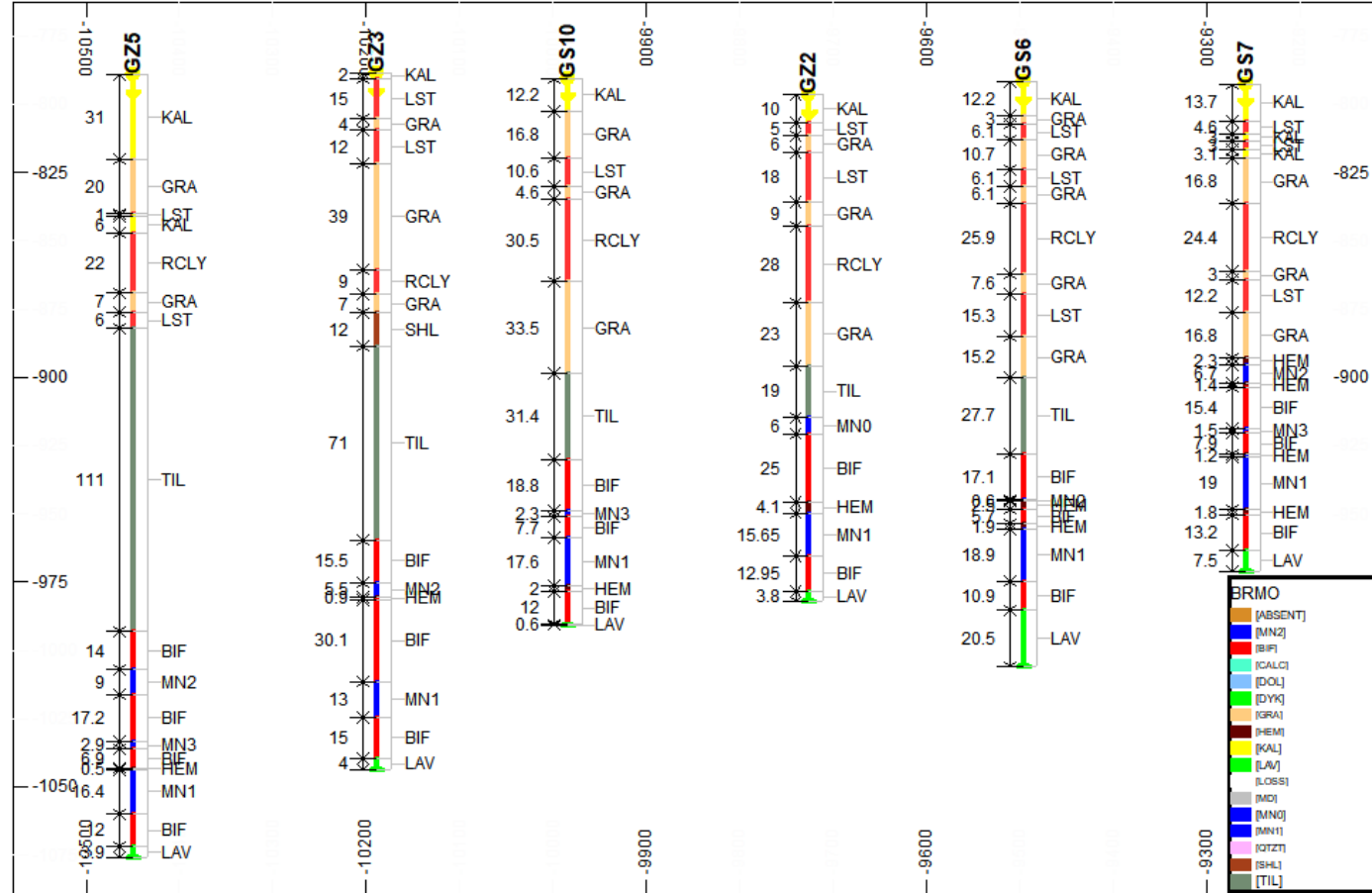
PROPOSED NEW GLORIA TAILINGS



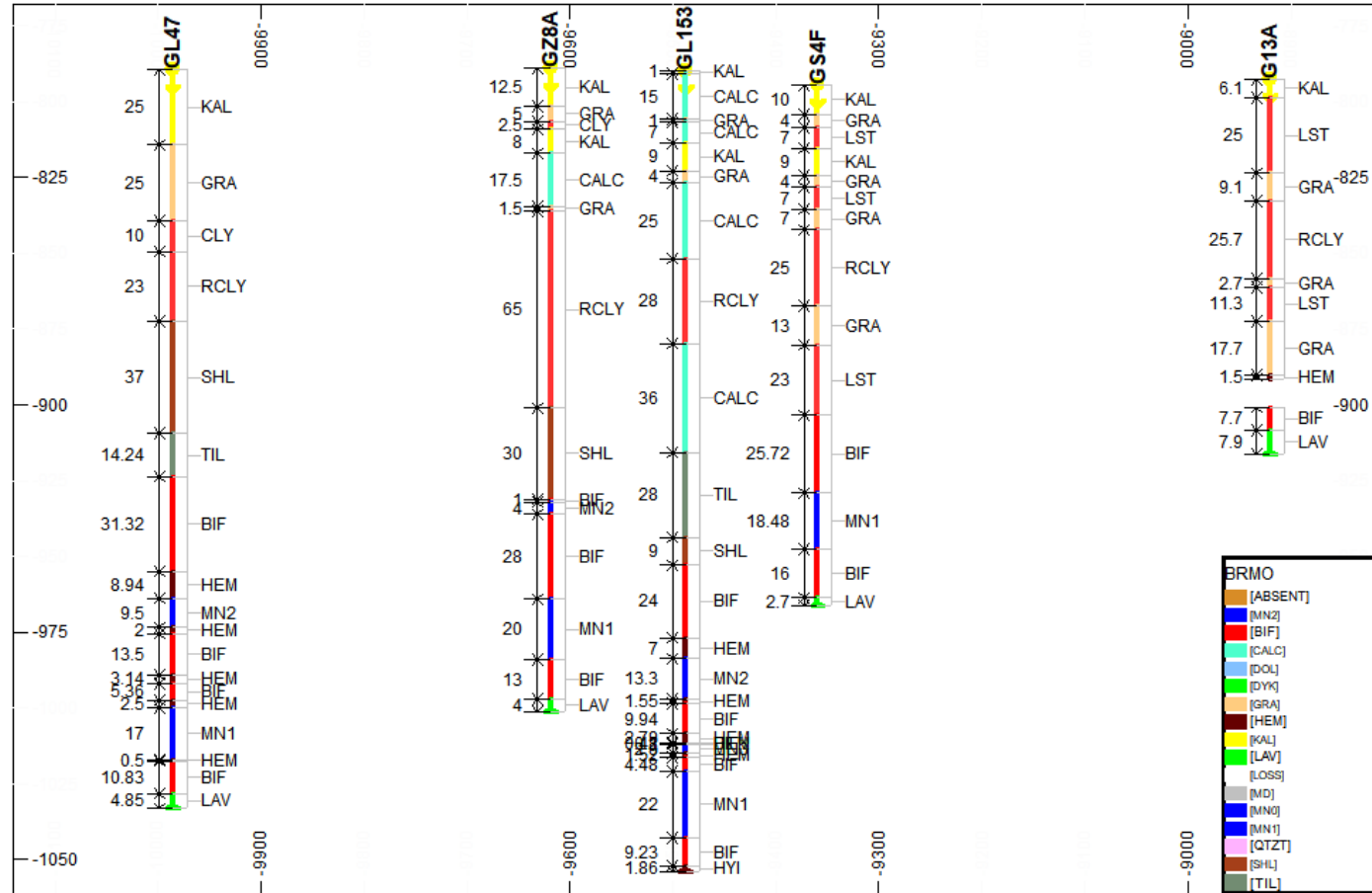
GENERALIZED STRATIGRAPHY



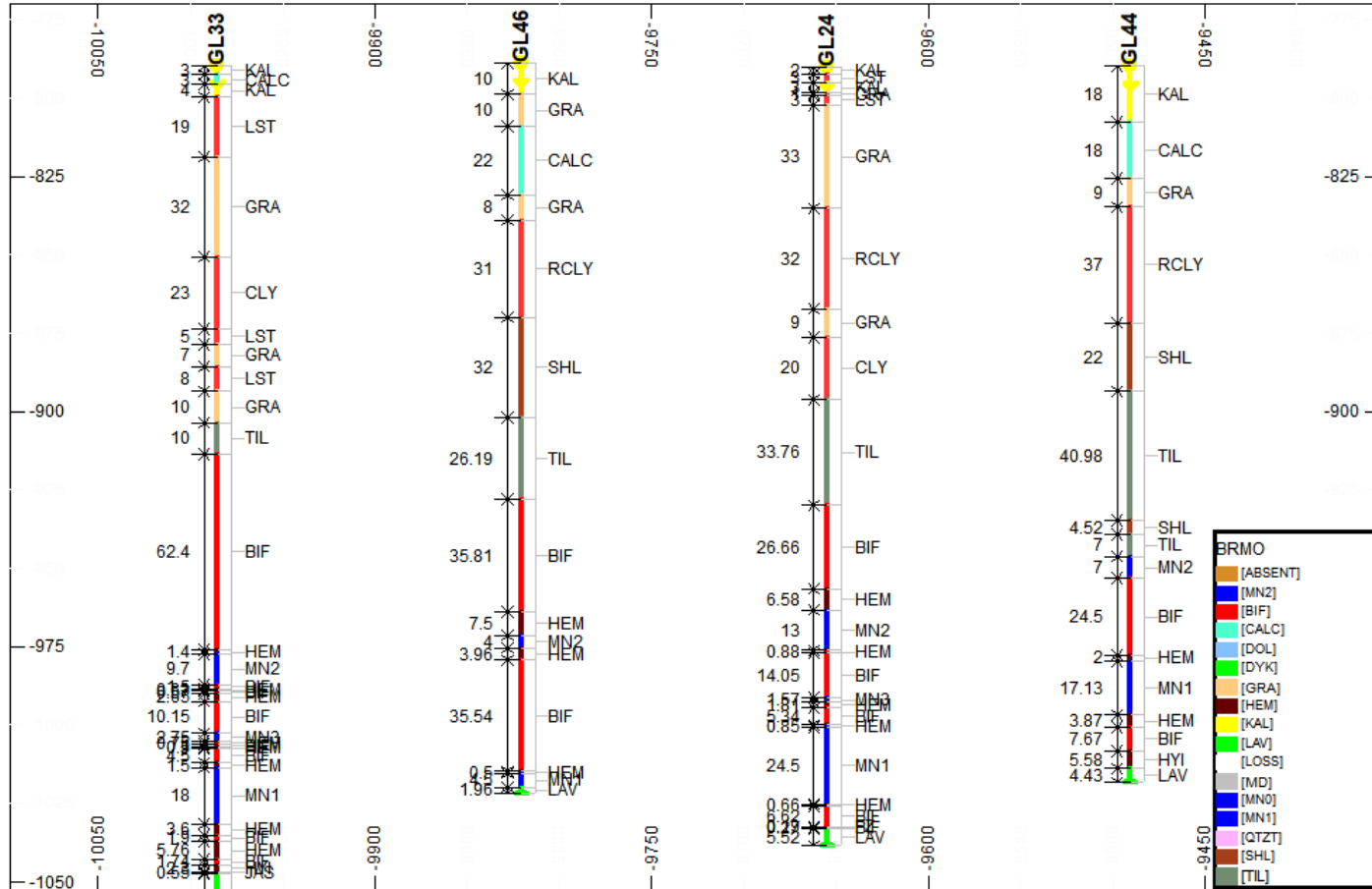
Section A – A'



Section B – B'



Section C – C'

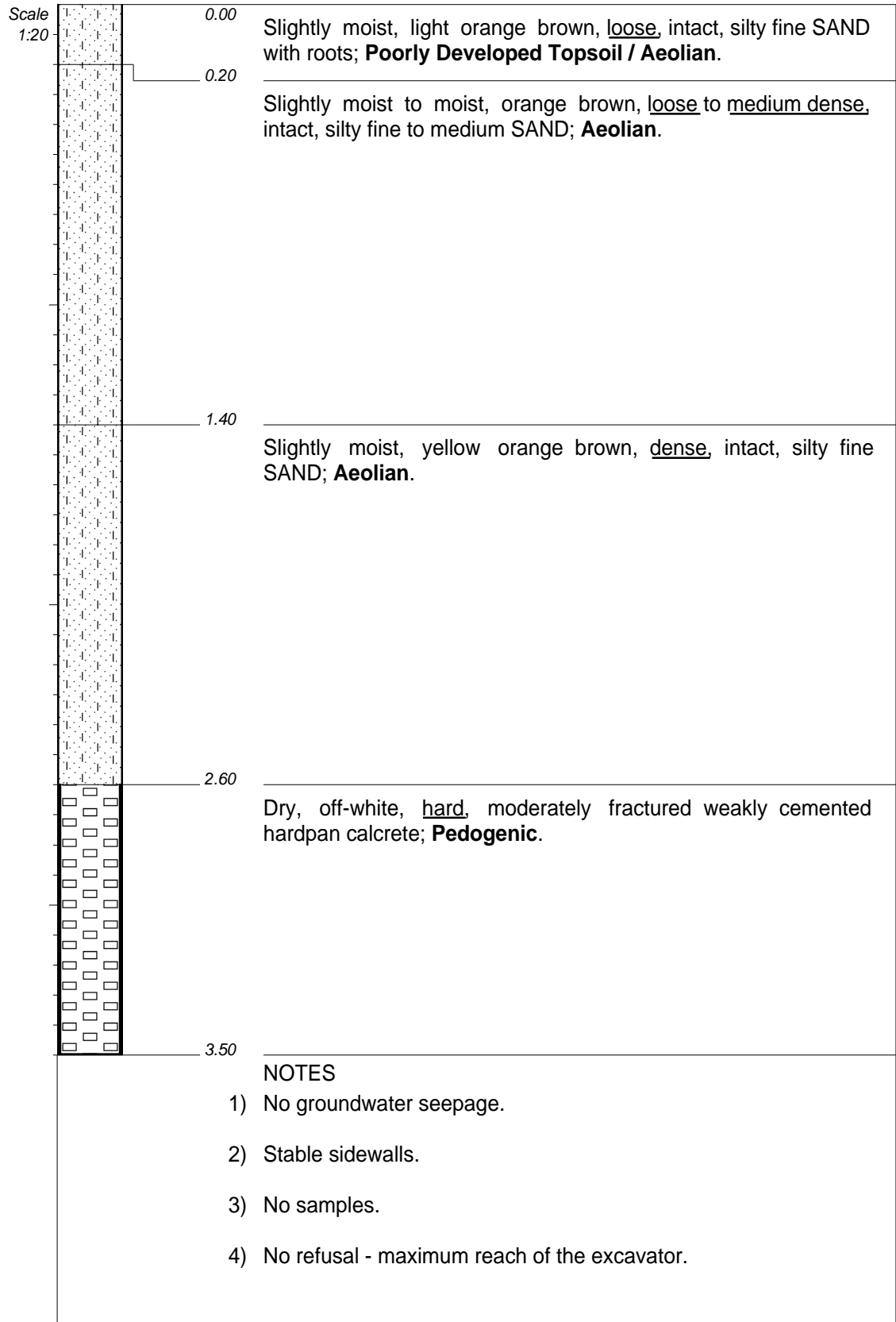


GEOLOGICAL DESCRIPTION

The proposed Gloria Tailings Facility is underlain by approximately 100 metres of unconsolidated Kalahari Formation (KF) consisting of fine Aeolian sand, gravels, calcrete and clays. The Kalahari Formation overlies older rock sequences – see stratigraphic sequence, and specific sections of boreholes, A-A'; B-B' and C-C'.

Based on the best available information, there are no underlying dolomites in the proposed area that could compromise or pose subsidence risk to the proposed tailings facility.

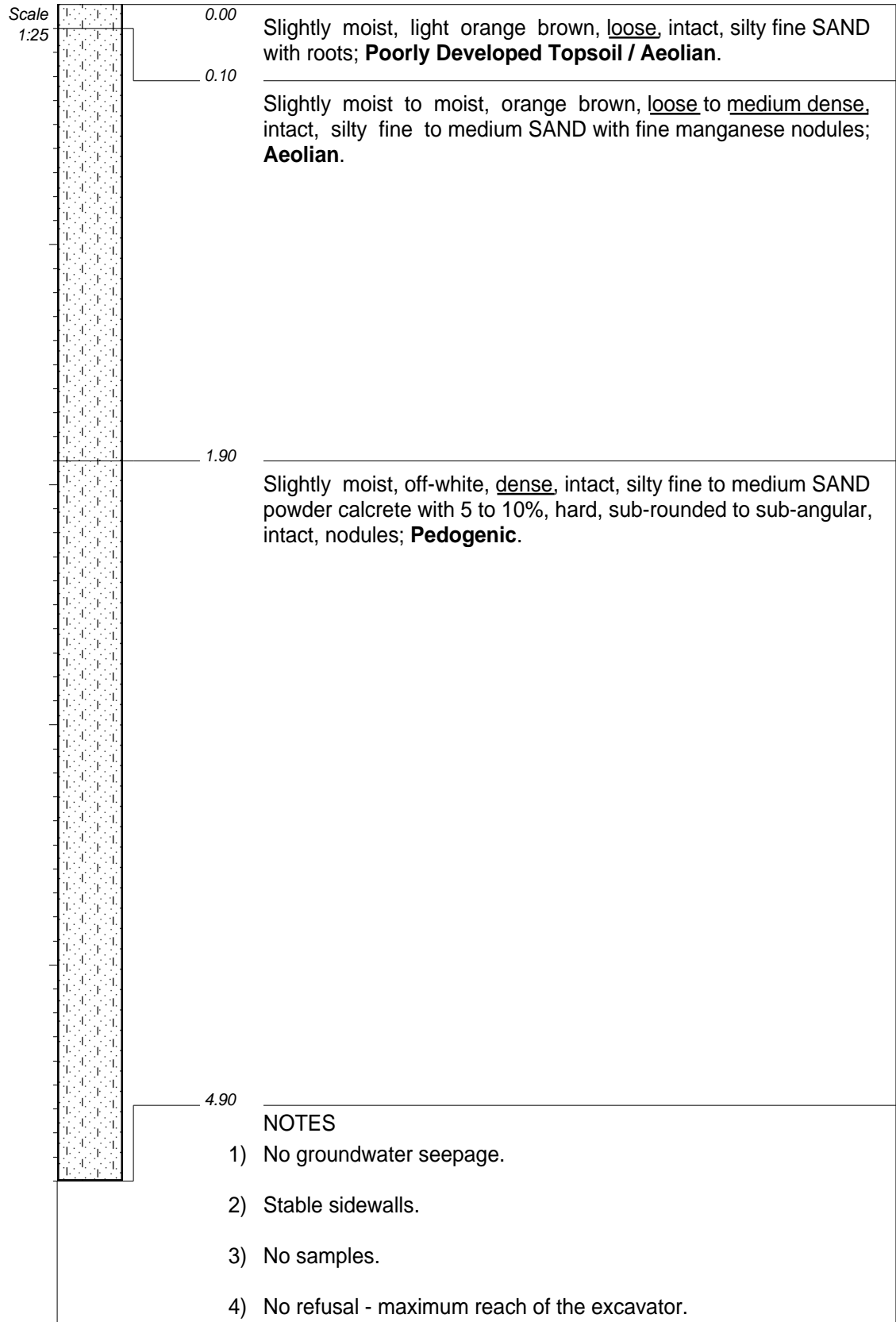
Appendix B: Test Pit Logs



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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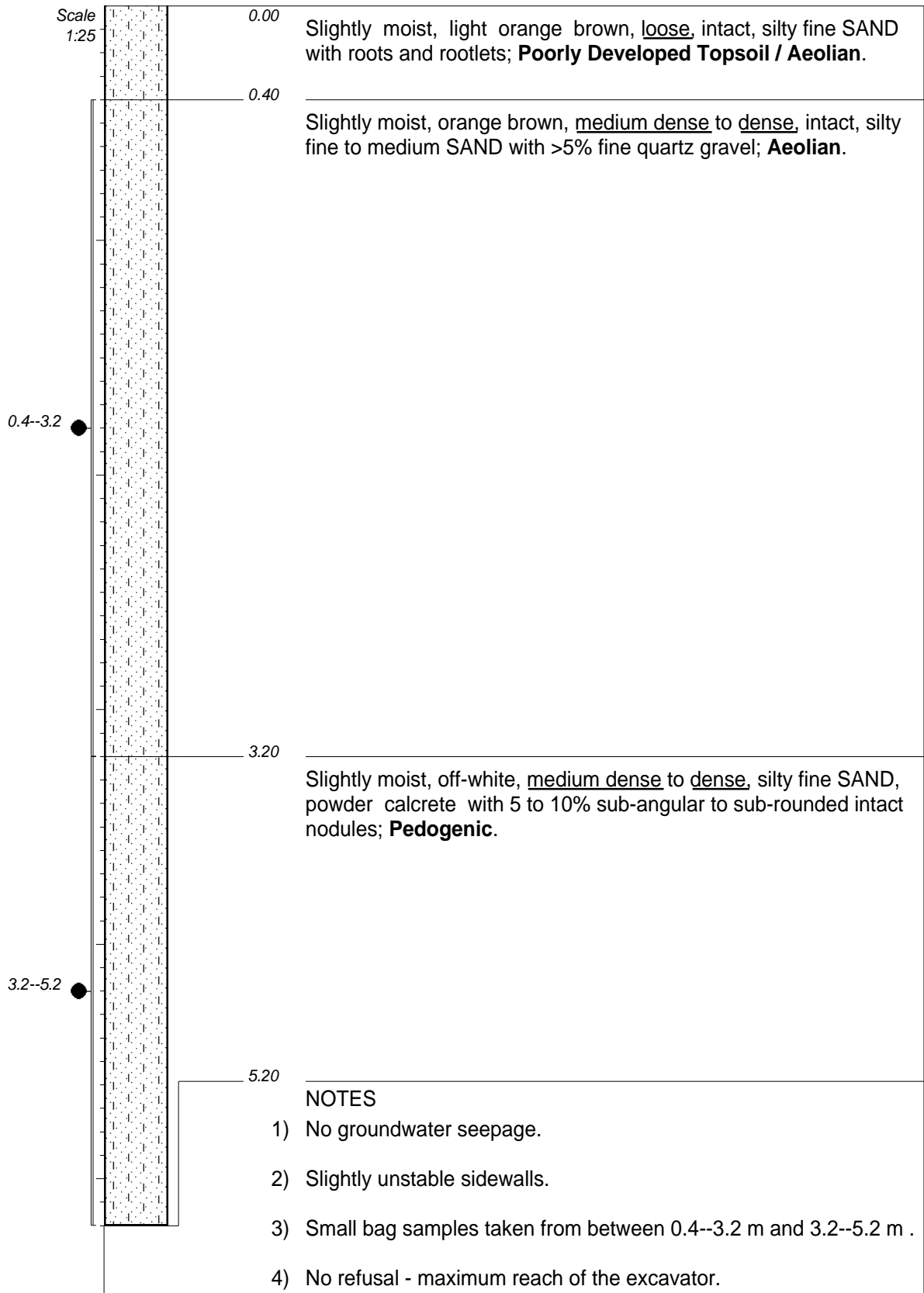
ELEVATION :
X-COORD : 10 019
Y-COORD : 3 007 340



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DIAM :
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DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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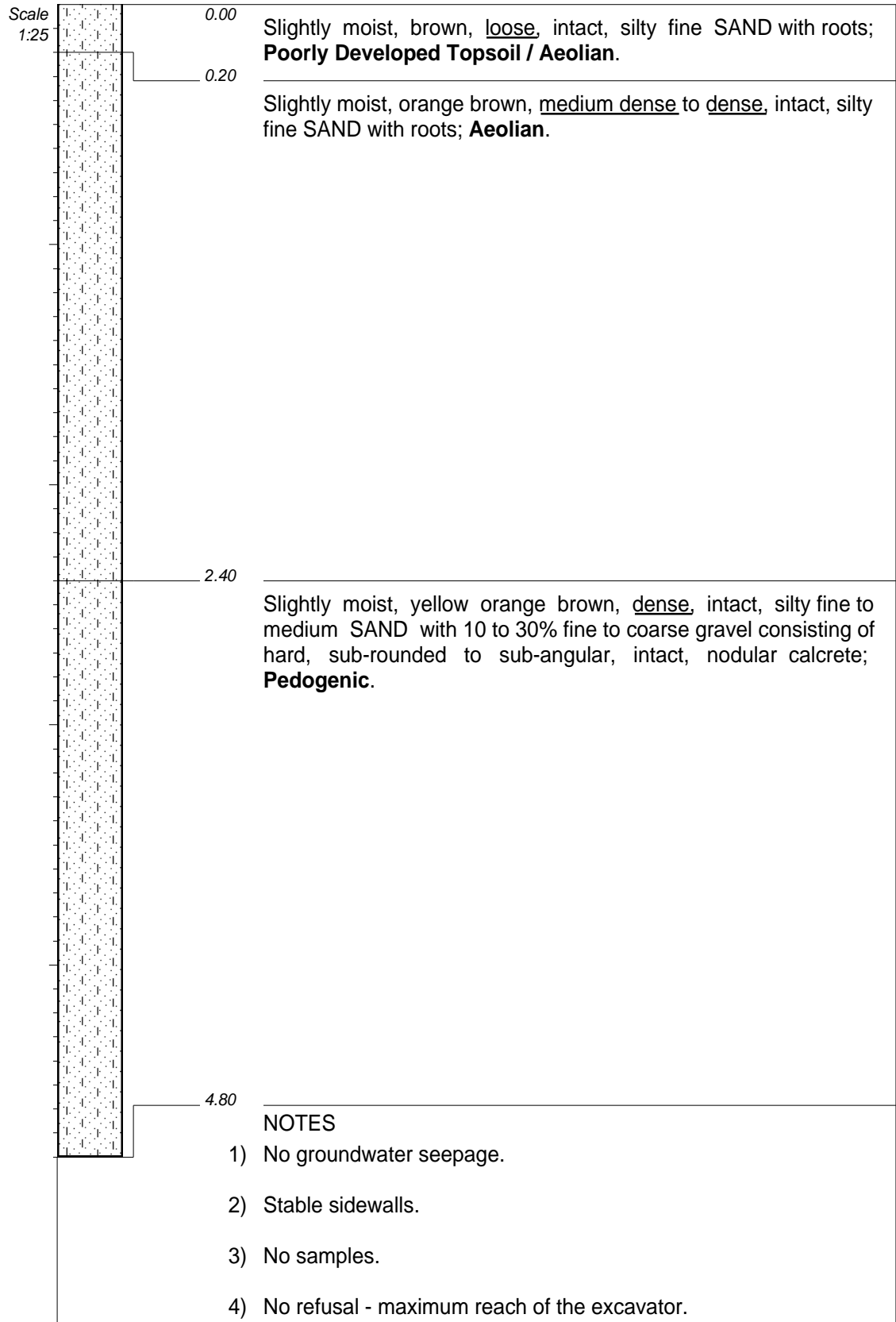
ELEVATION :
X-COORD : 9 729
Y-COORD : 3 007 560



CONTRACTOR :
 MACHINE : CAT 320CL
 DRILLED BY :
 PROFILED BY : SINR
 TYPE SET BY : SINR
 SETUP FILE : STANDA~1.SET

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 DATE : 24 to 27 June 2019
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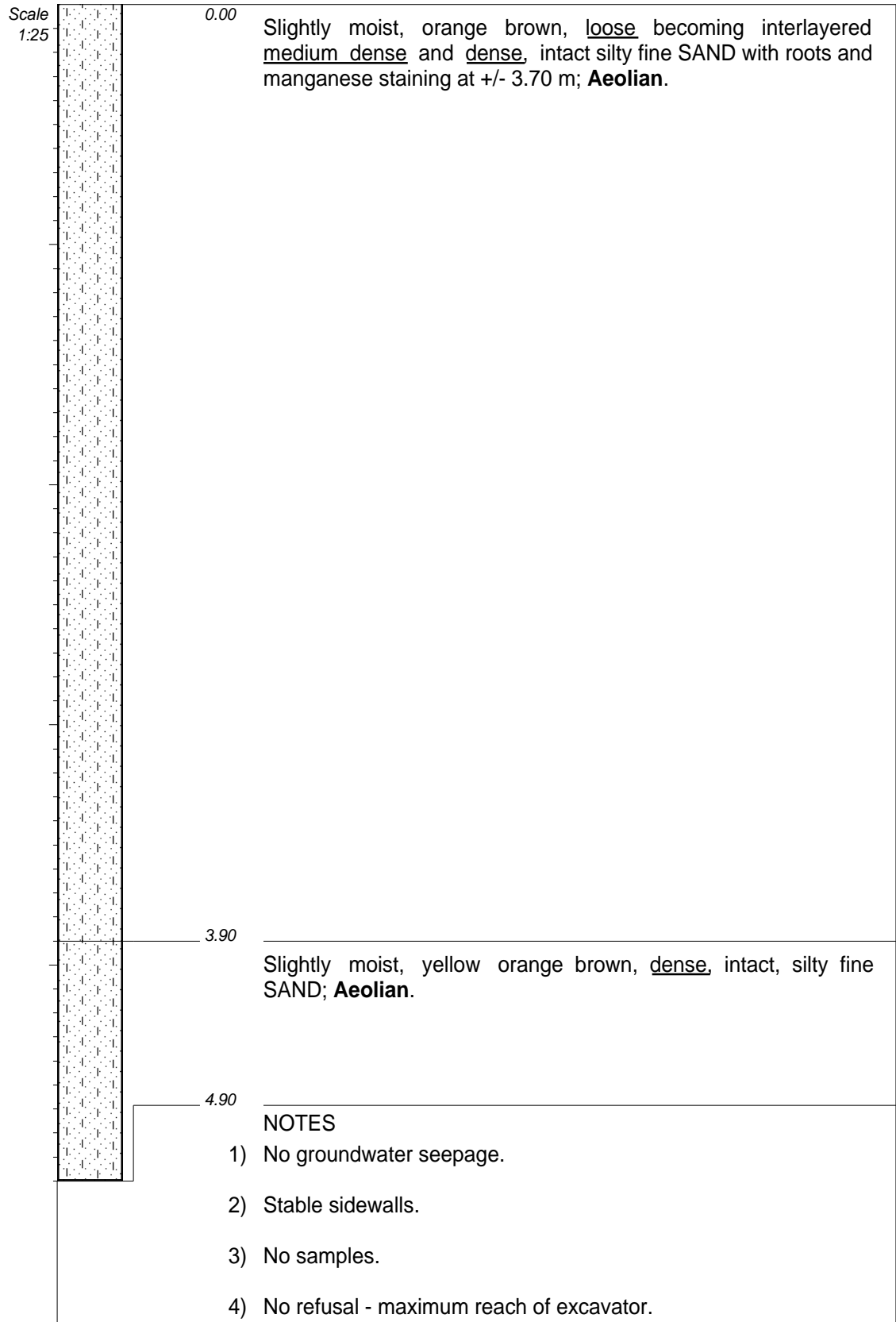
ELEVATION :
 X-COORD : 9 609
 Y-COORD : 3 006 809
HOLE No: GL-TP3



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DATE : 24 to 27 June 2019
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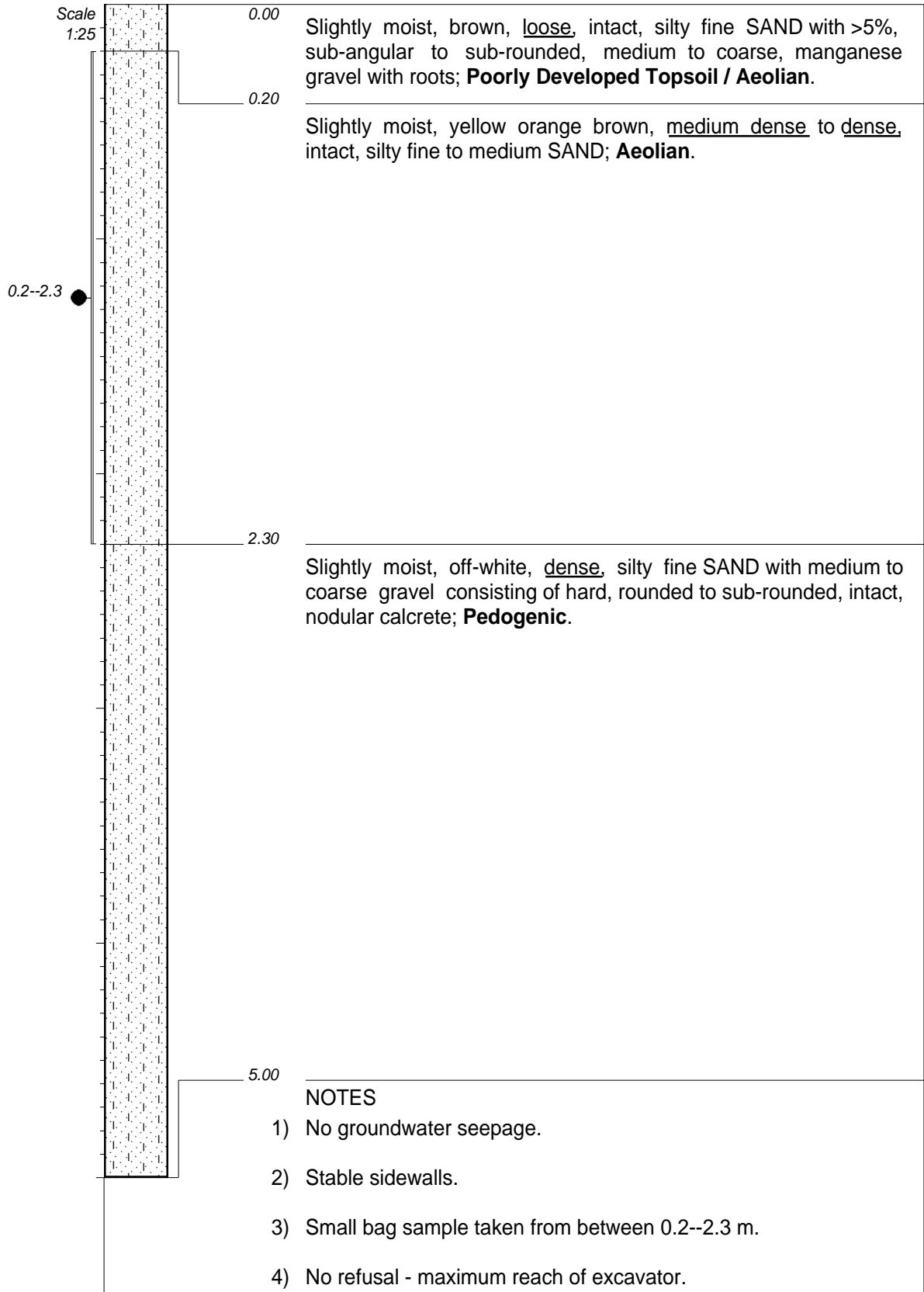
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X-COORD : 9 332
Y-COORD : 3 007 031



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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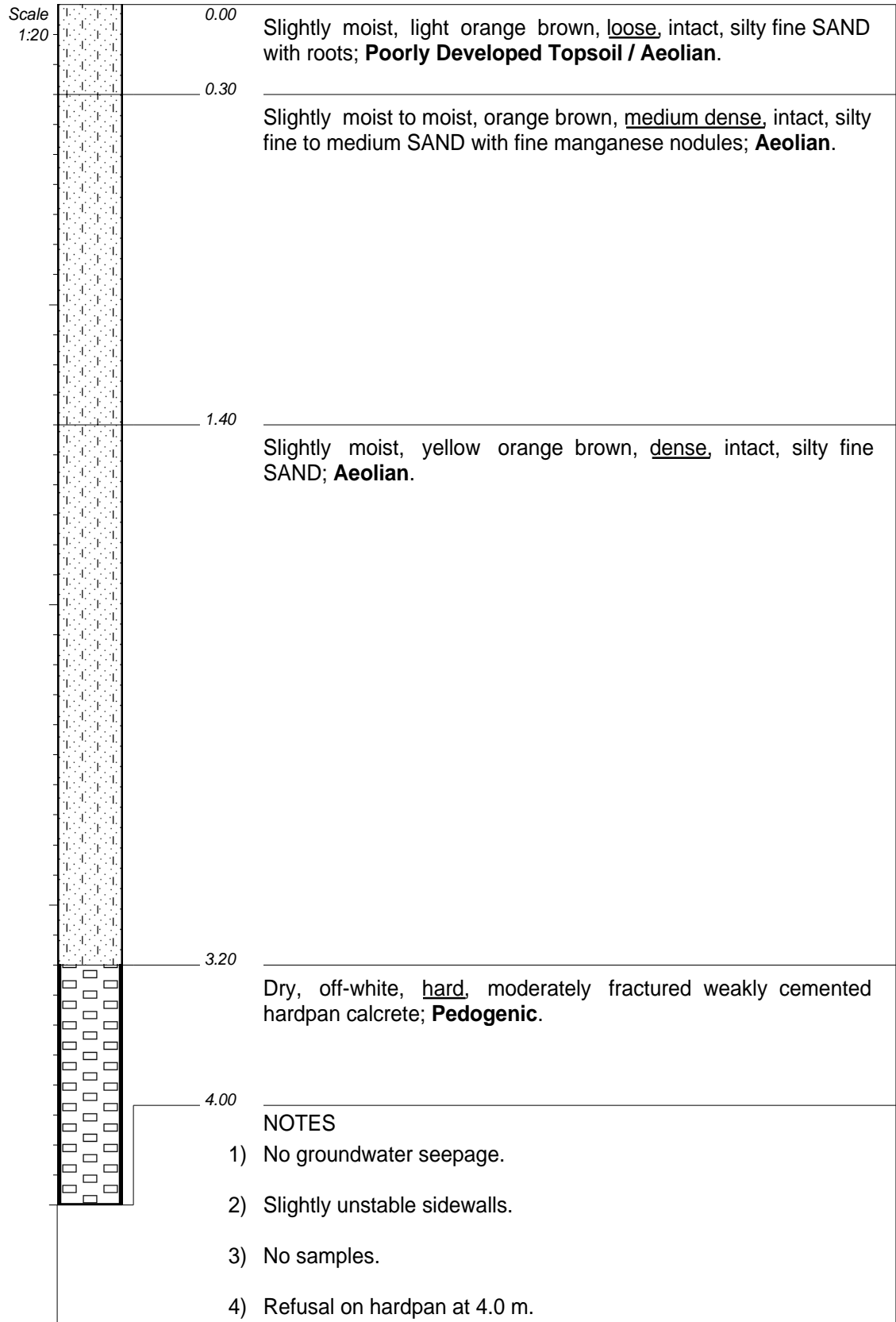
ELEVATION :
X-COORD : 9 311
Y-COORD : 3 006 930



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DIAM :
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DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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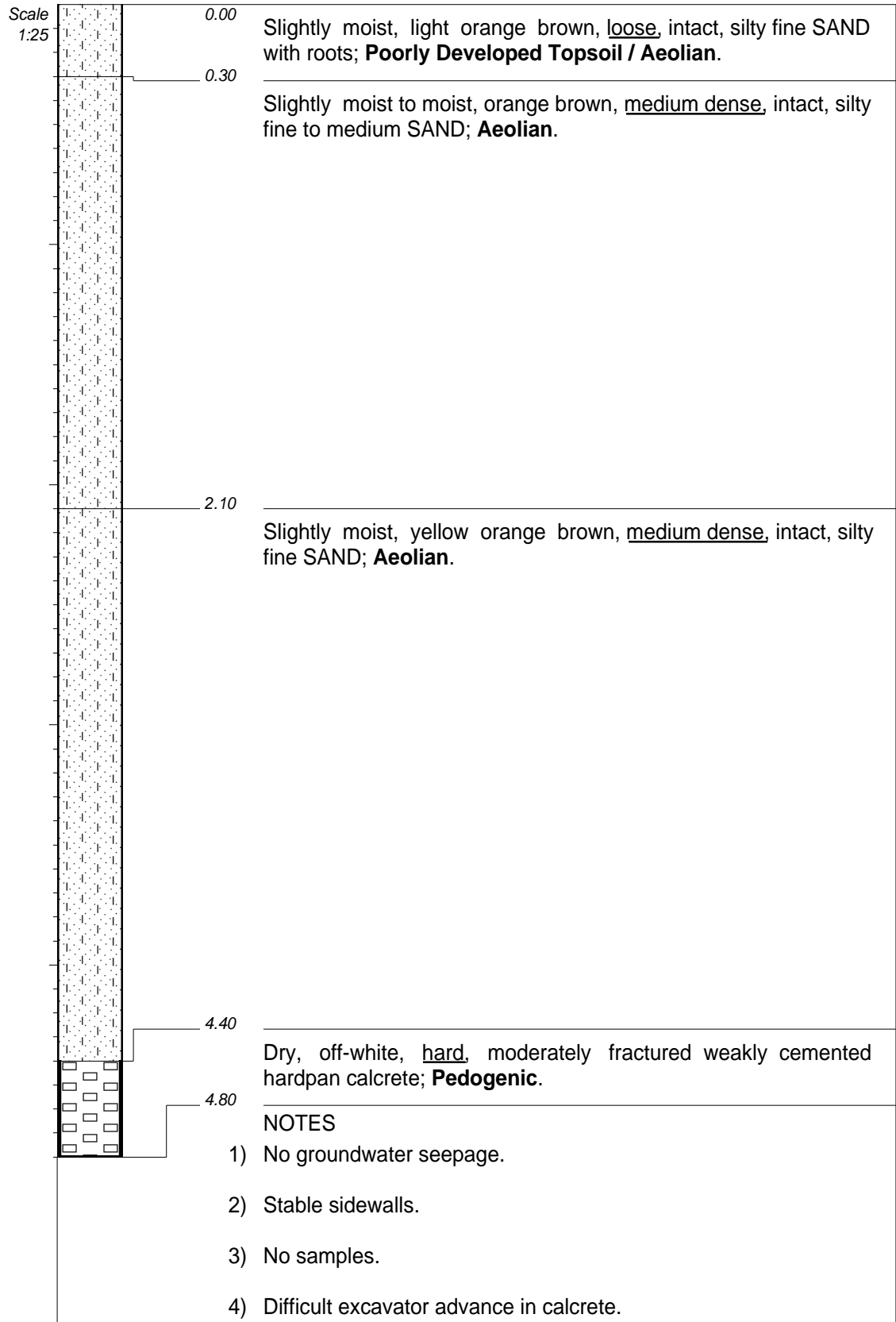
ELEVATION :
X-COORD : 9 361
Y-COORD : 3 006 927



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DIAM :
DATE :
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DATE : 13/08/2019 12:05
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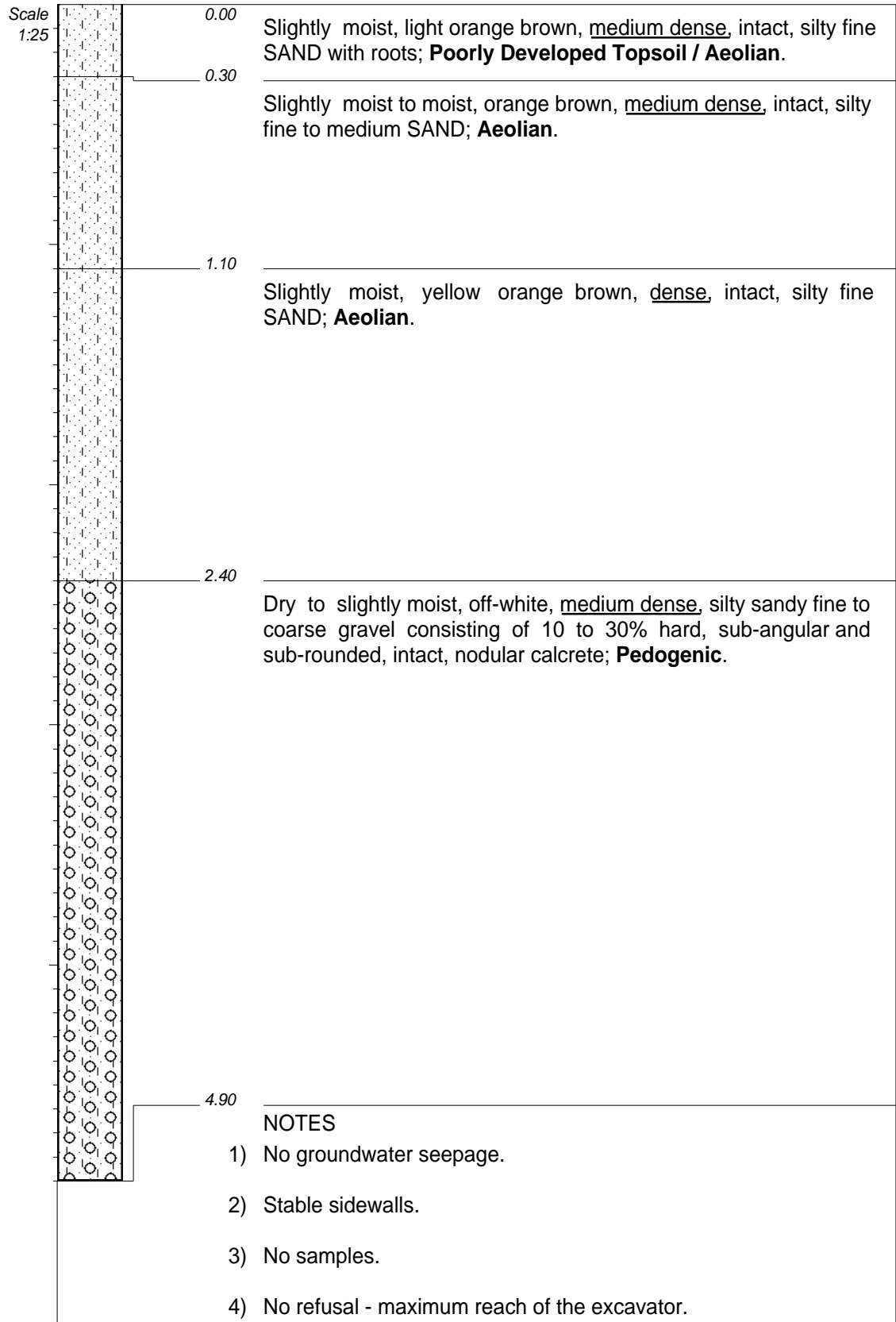
ELEVATION :
X-COORD : 9 896
Y-COORD : 3 007 431



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

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DIAM :
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DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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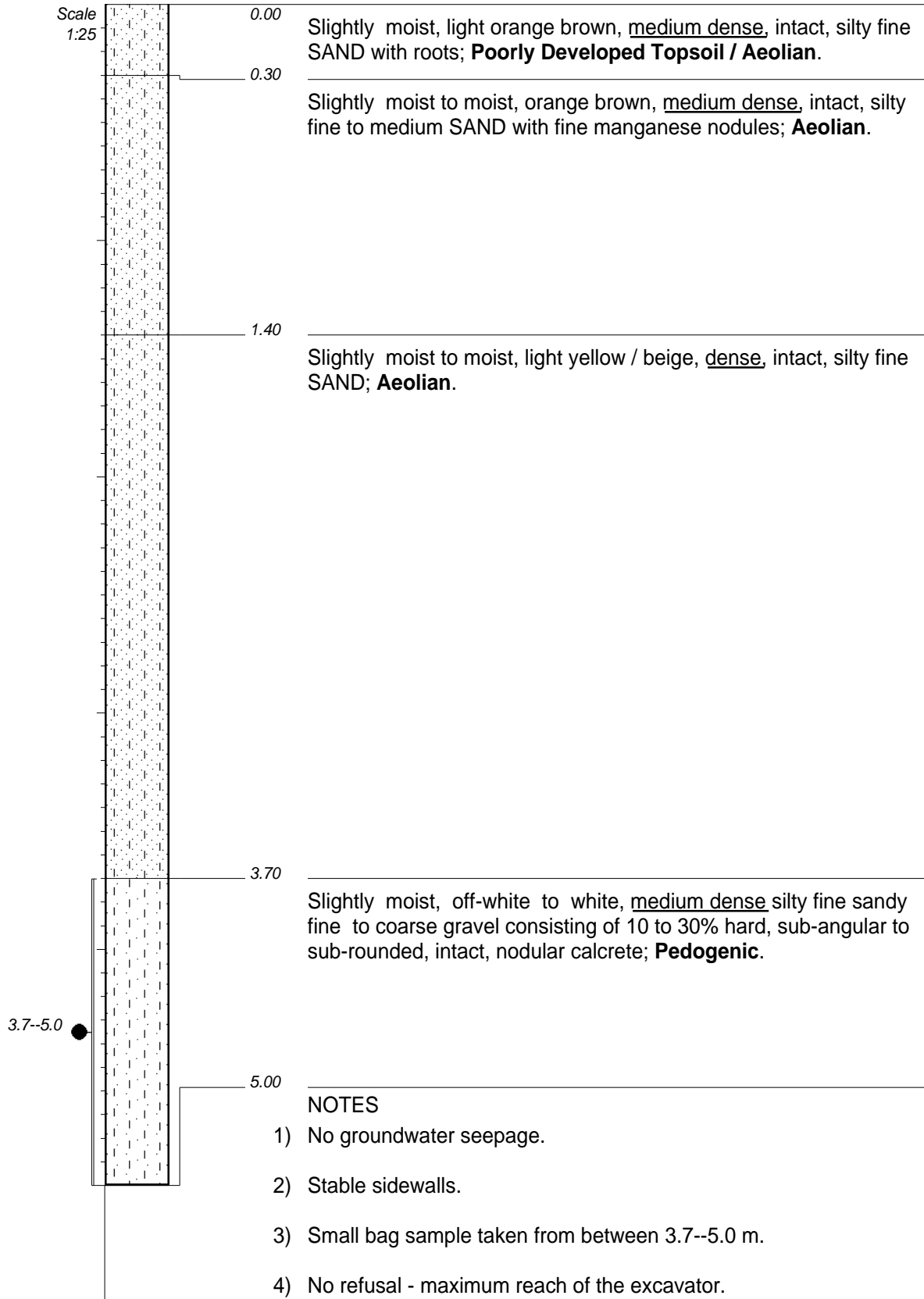
ELEVATION :
X-COORD : 9 931
Y-COORD : 3 007 239



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DIAM :
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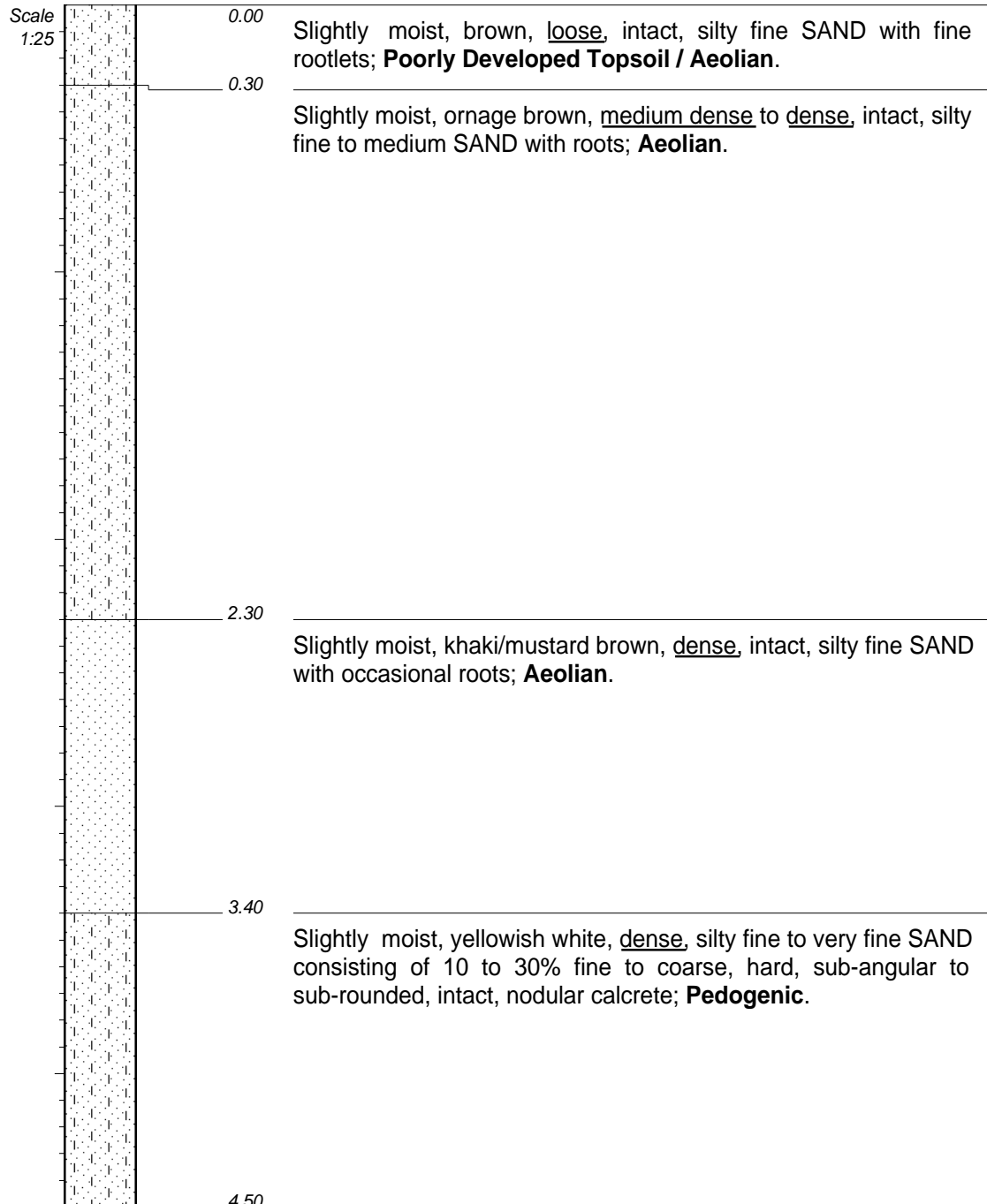
ELEVATION :
X-COORD : 9 810
Y-COORD : 3 007 354



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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ELEVATION :
X-COORD : 9 673
Y-COORD : 3 007 486



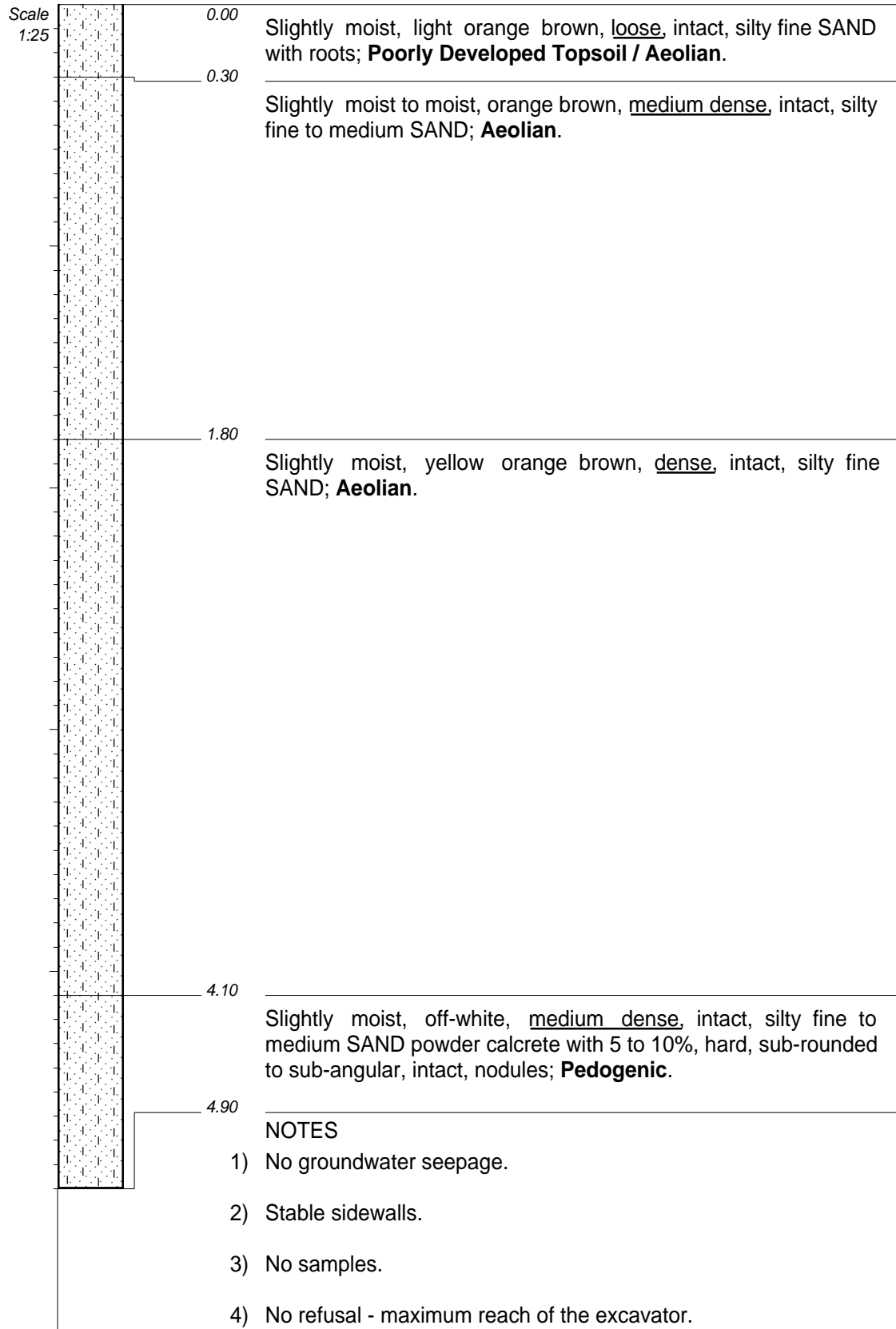
NOTES

- 1) No groundwater seepage.
- 2) Stable sidewalls.
- 3) No samples.
- 4) Slow excavator advance below 4.5 m on calcrete.

CONTRACTOR :
 MACHINE : CAT 320CL
 DRILLED BY :
 PROFILED BY : SINR
 TYPE SET BY : SINR
 SETUP FILE : STANDA-1.SET

INCLINATION :
 DIAM :
 DATE :
 DATE : 24 to 27 June 2019
 DATE : 13/08/2019 12:05
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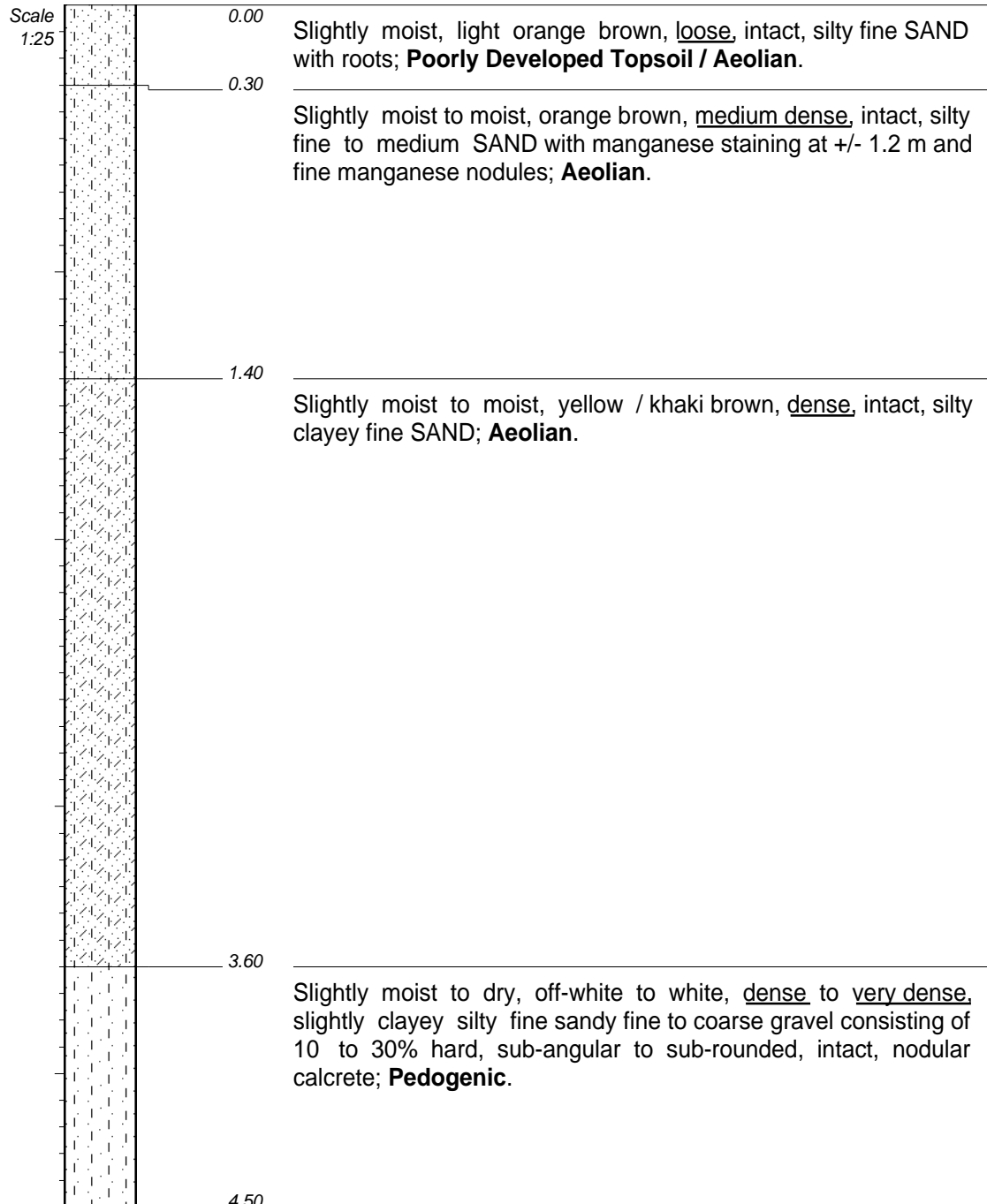
ELEVATION :
 X-COORD : 9 855
 Y-COORD : 3 007 140



CONTRACTOR :
 MACHINE : CAT 320CL
 DRILLED BY :
 PROFILED BY : SINR
 TYPE SET BY : SINR
 SETUP FILE : STANDA~1.SET

INCLINATION :
 DIAM :
 DATE :
 DATE : 24 to 27 June 2019
 DATE : 13/08/2019 12:05
 TEXT : ..neTLogsSINR20190813.txt

ELEVATION :
 X-COORD : 9 733
 Y-COORD : 3 007 260



NOTES

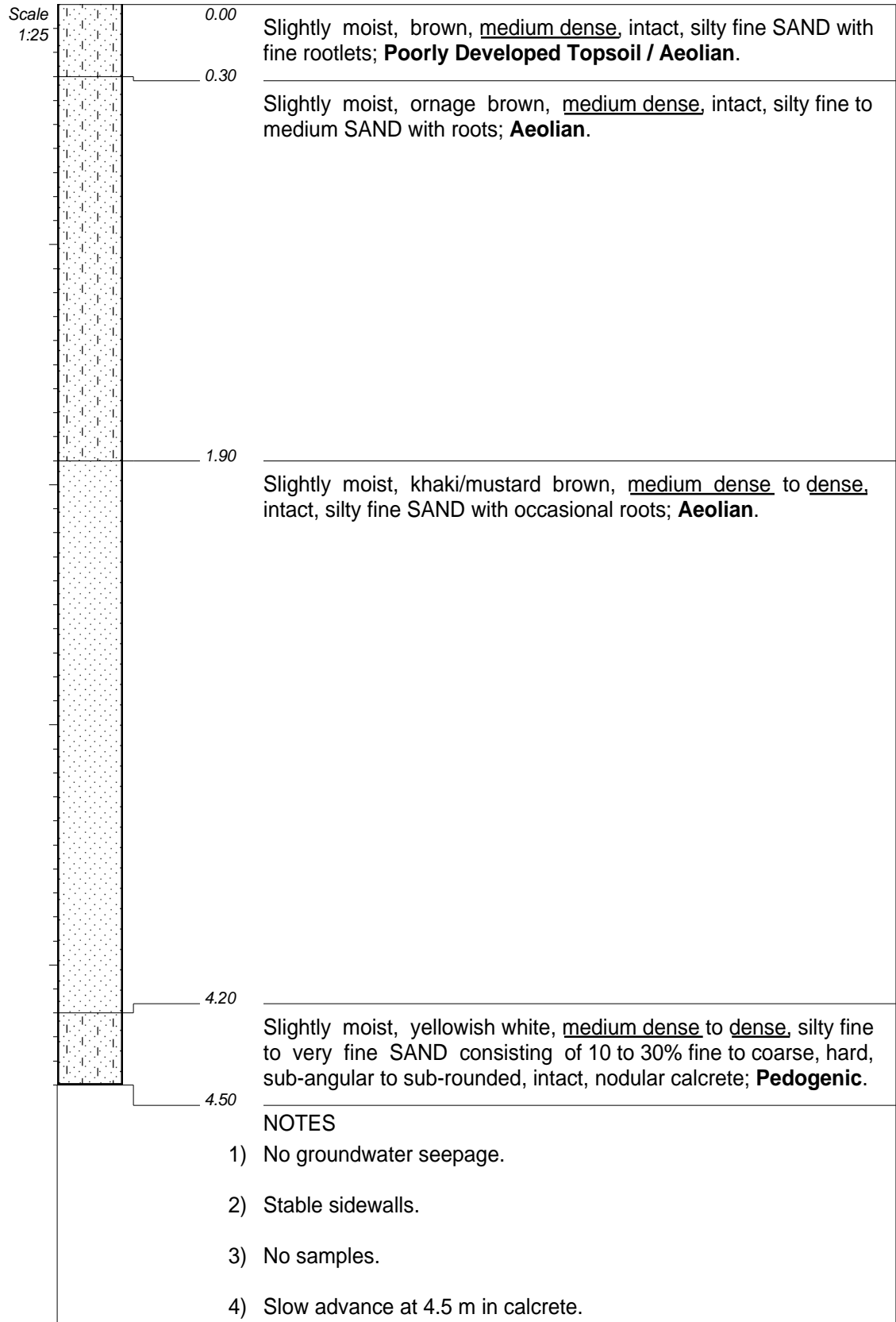
- 1) No groundwater seepage.
- 2) Slightly unstable sidewalls.
- 3) No samples.
- 4) No refusal - maximum reach of the excavator.

CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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ELEVATION :
X-COORD : 9 606
Y-COORD : 3 007 388

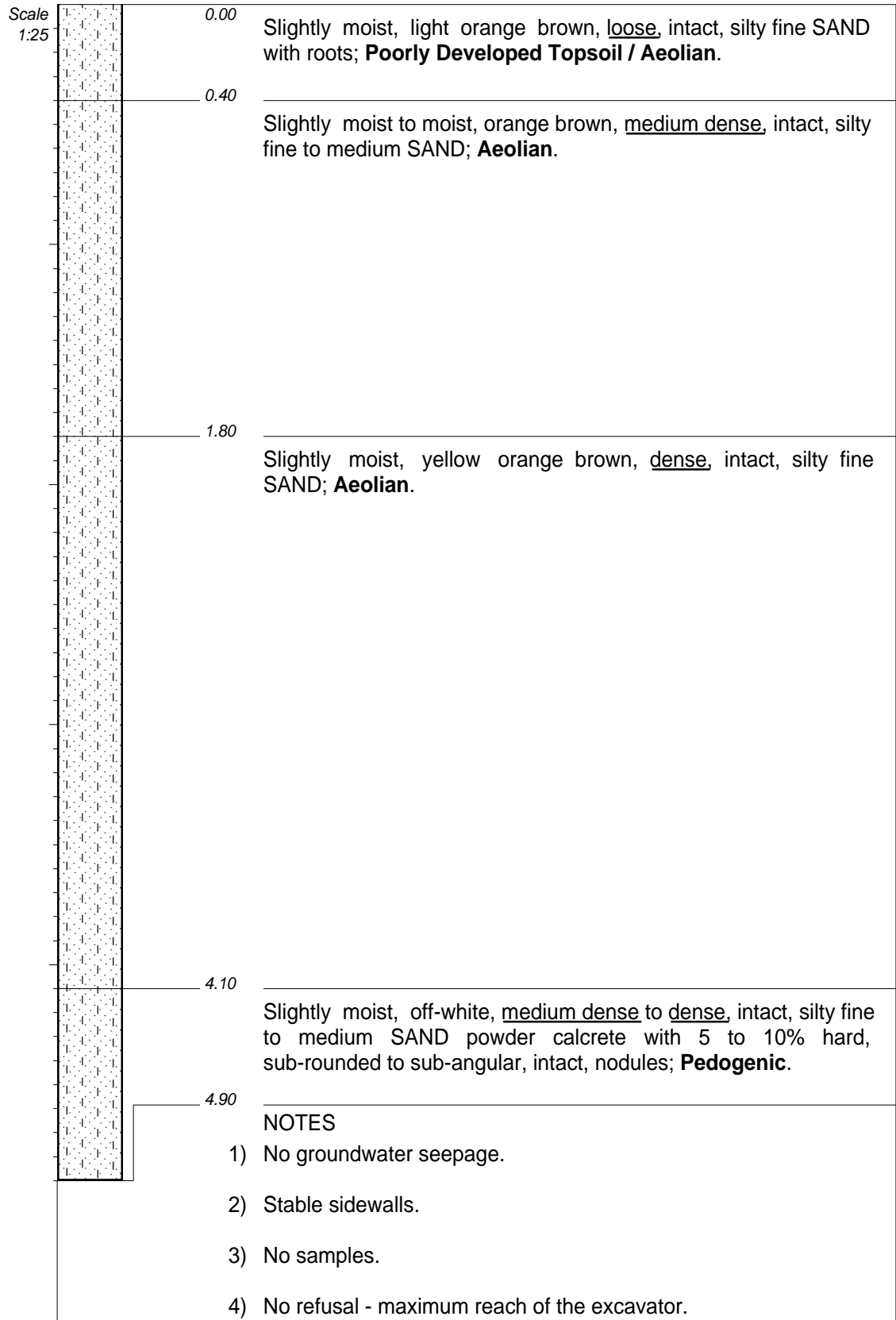
HOLE No: GL-TP13



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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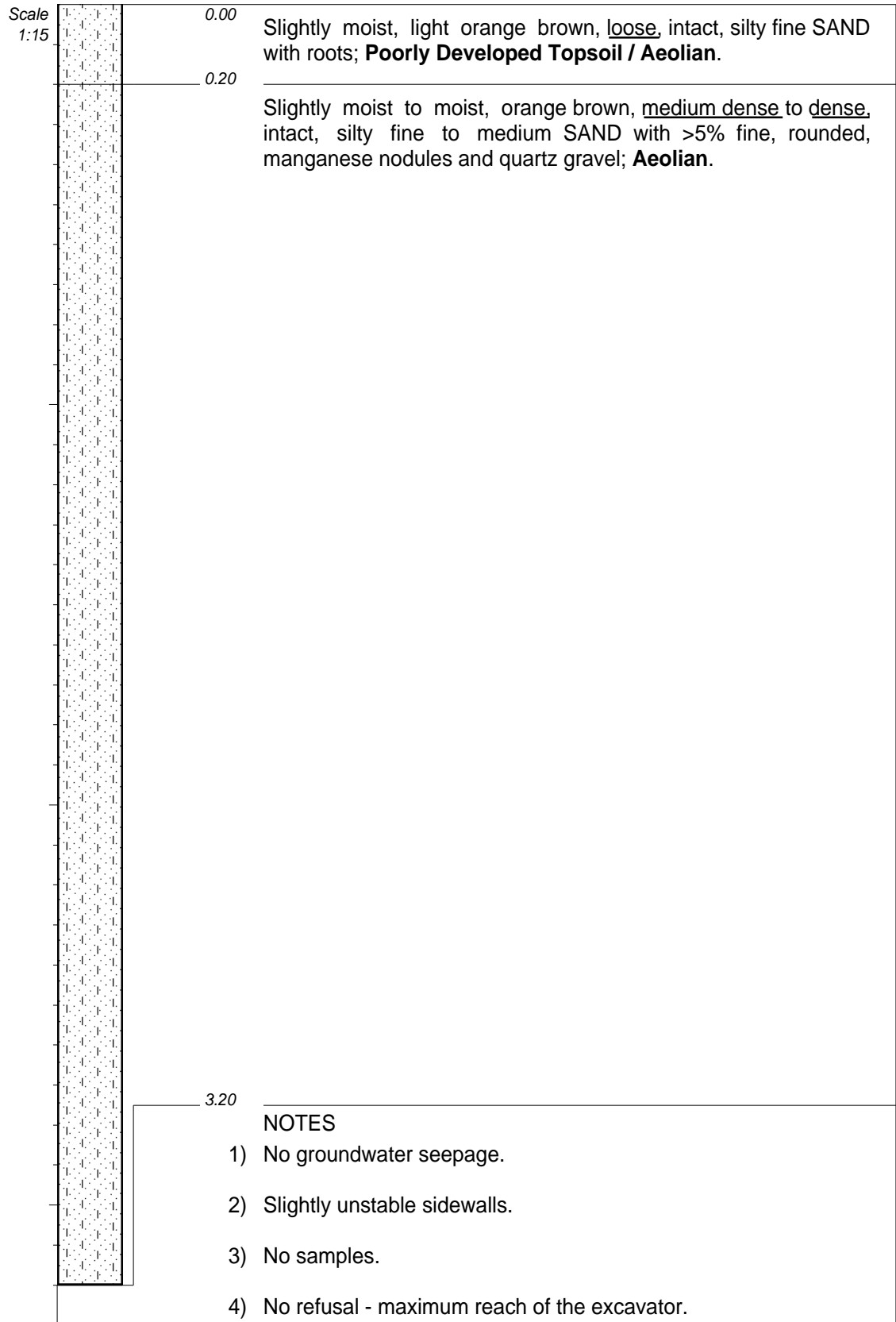
ELEVATION :
X-COORD : 9 774
Y-COORD : 3 007 029'



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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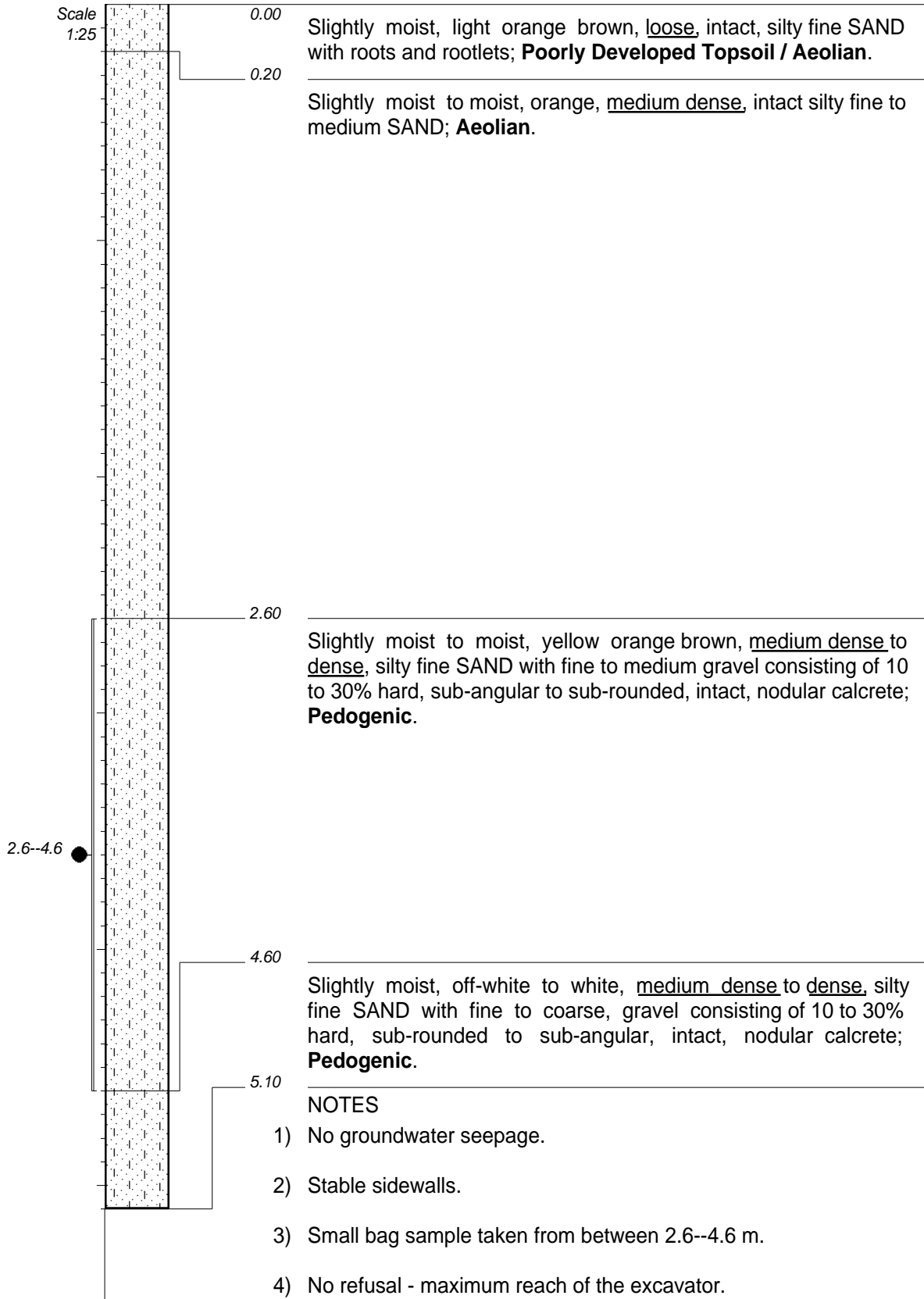
ELEVATION :
X-COORD : 9 666
Y-COORD : 3 007 158



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
TEXT : ..neTLogsSINR20190813.txt

ELEVATION :
X-COORD : 9 530
Y-COORD : 3 007 299

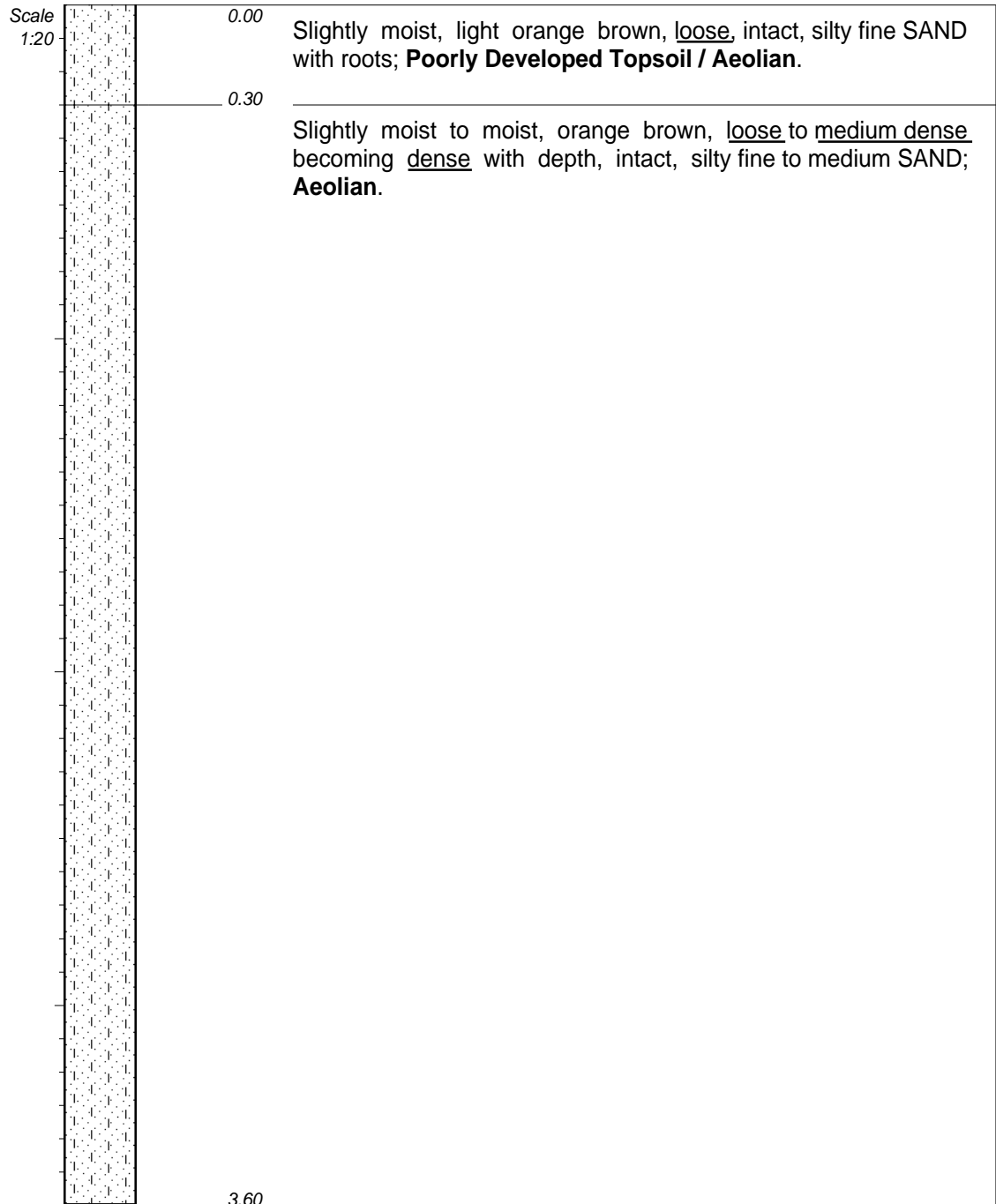


CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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ELEVATION :
X-COORD : 9 684
Y-COORD : 3 006 900

HOLE No: GL-TP17



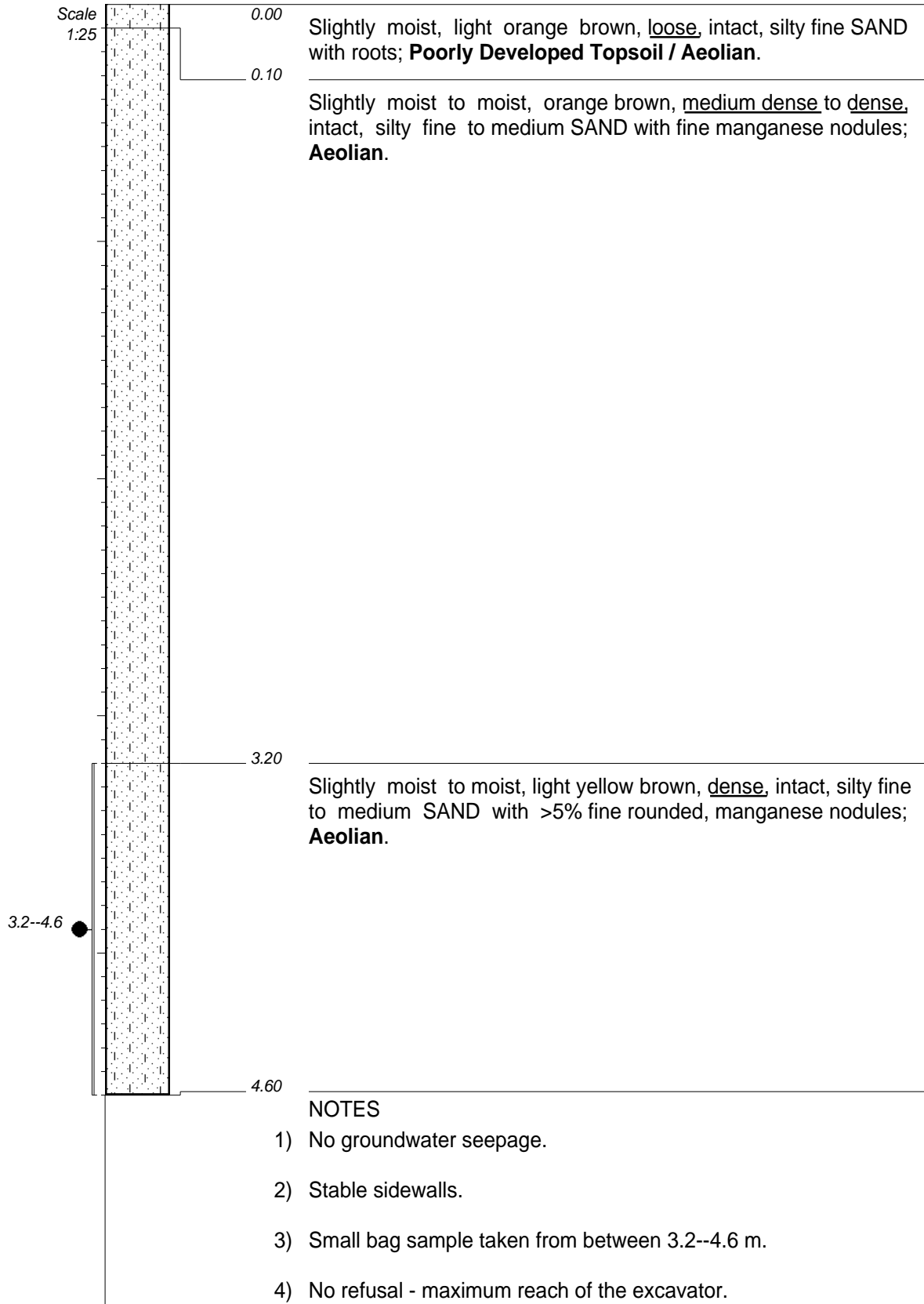
NOTES

- 1) No groundwater seepage.
- 2) Stable sidewalls.
- 3) No samples.
- 4) No refusal - maximum reach of the excavator.

CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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ELEVATION :
X-COORD : 9 577
Y-COORD : 3 007 079

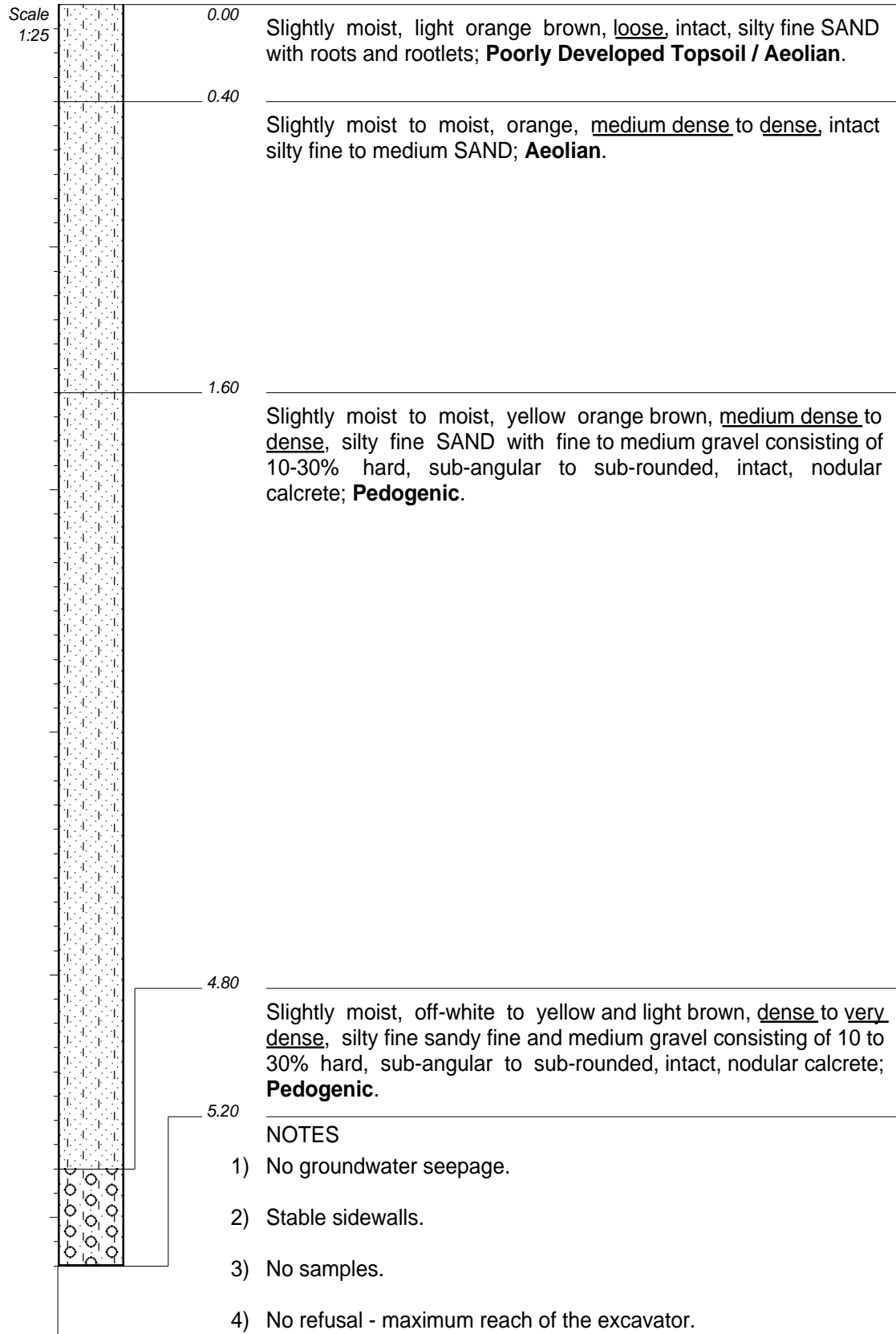


CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
TEXT : ..neTPlOgsSINR20190813.txt

ELEVATION :
X-COORD : 9 448
Y-COORD : 3 007 176

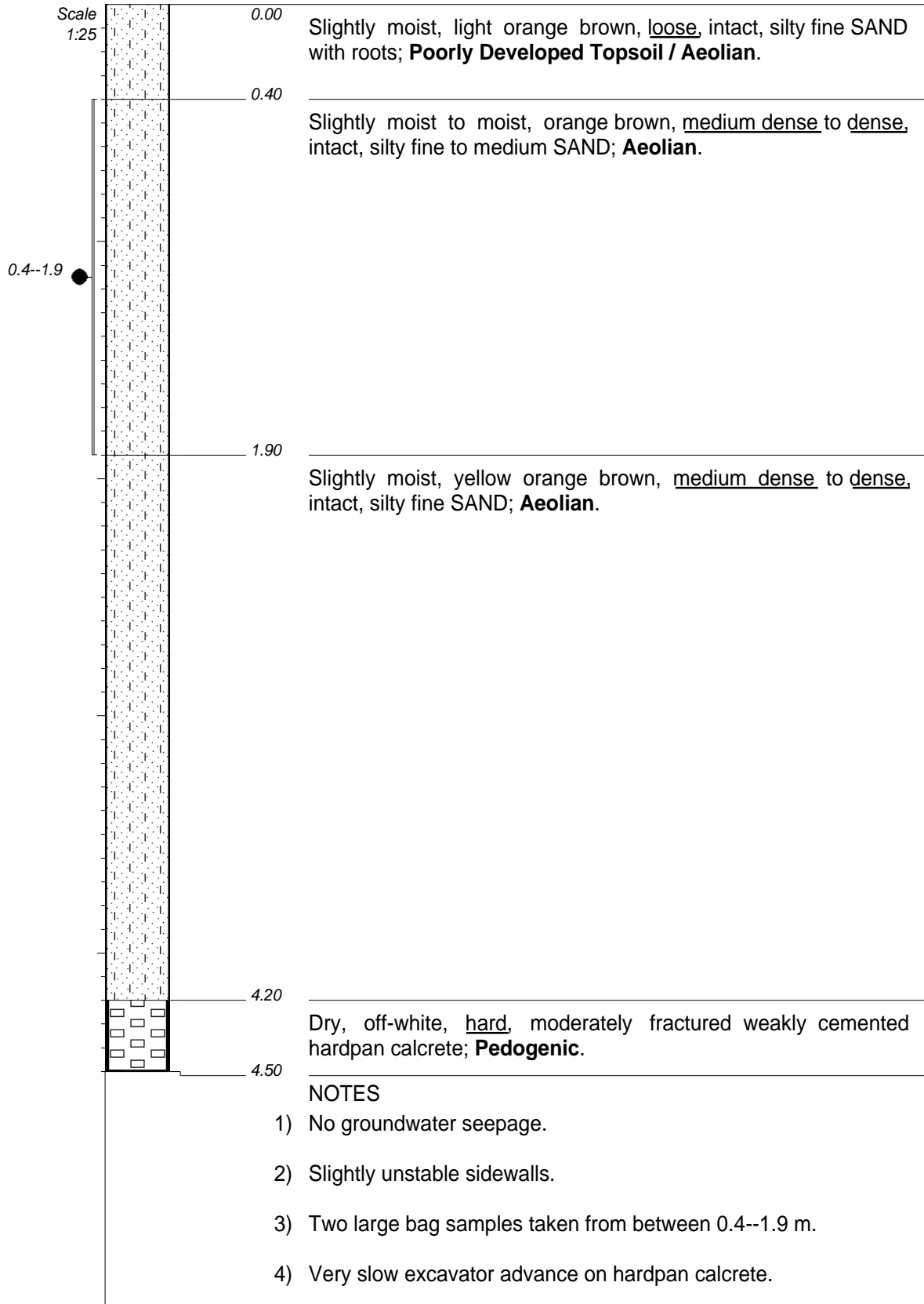
HOLE No: GL-TP19



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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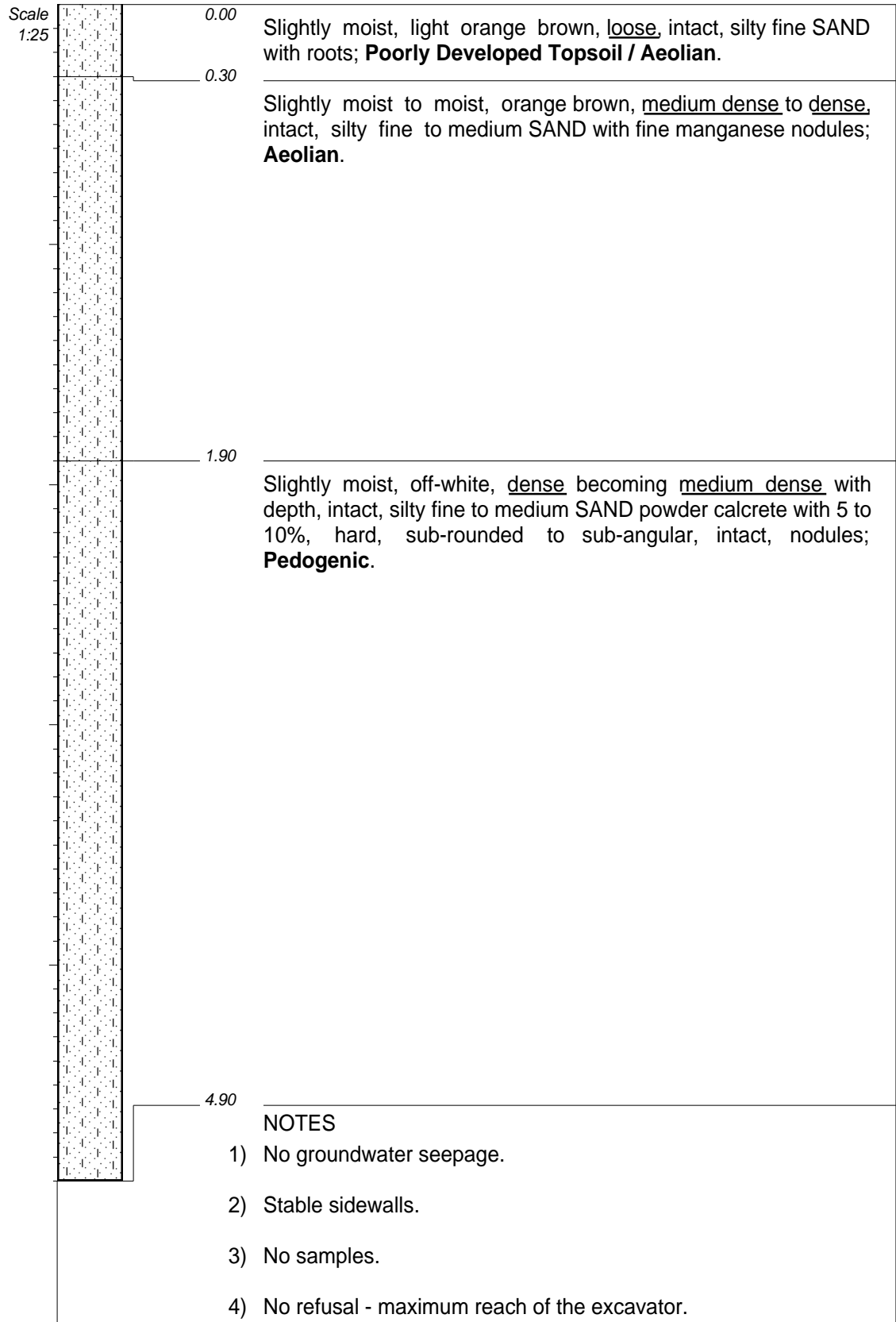
ELEVATION :
X-COORD : 9 506
Y-COORD : 3 006 888



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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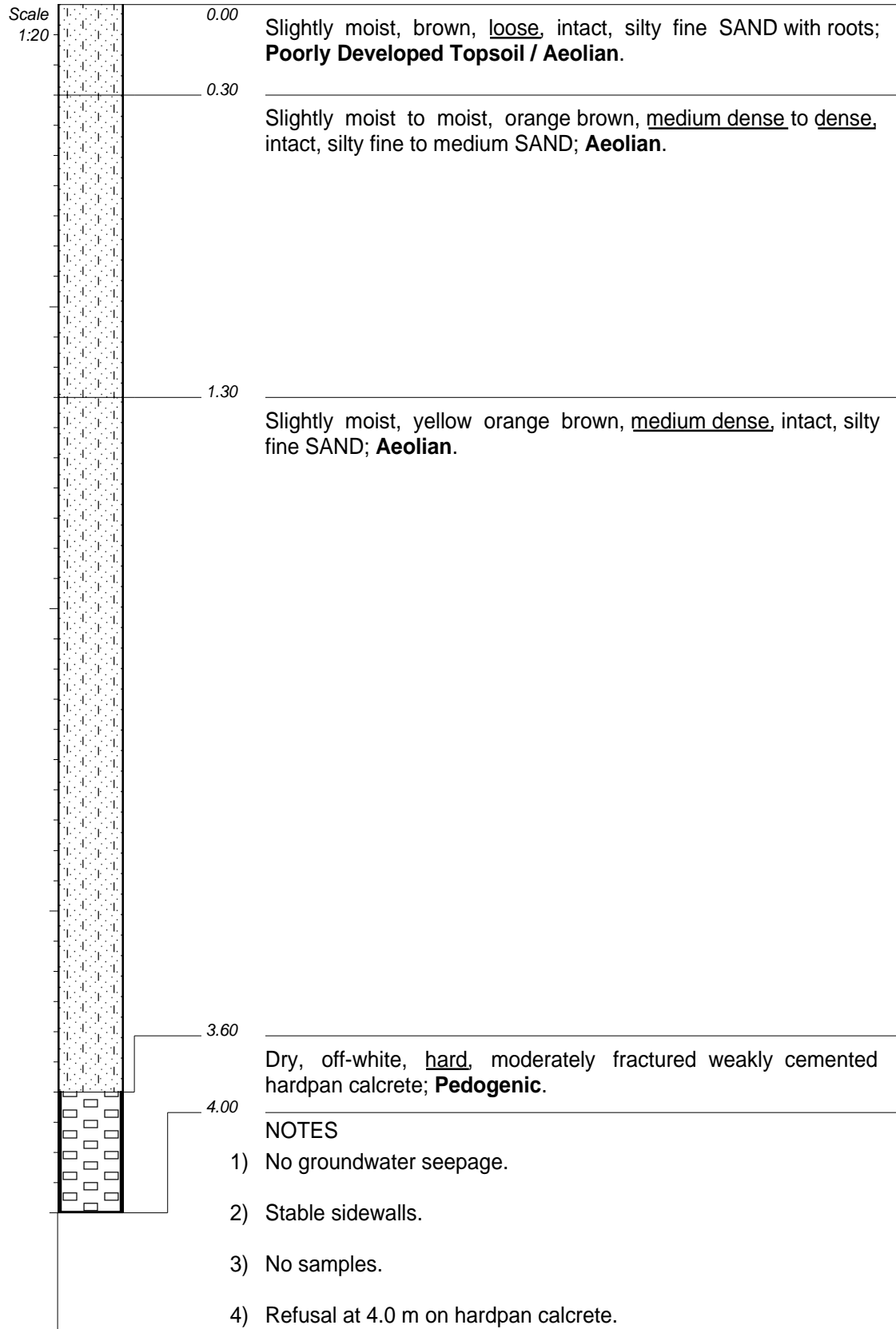
ELEVATION :
X-COORD : 9 928
Y-COORD : 3 007 338



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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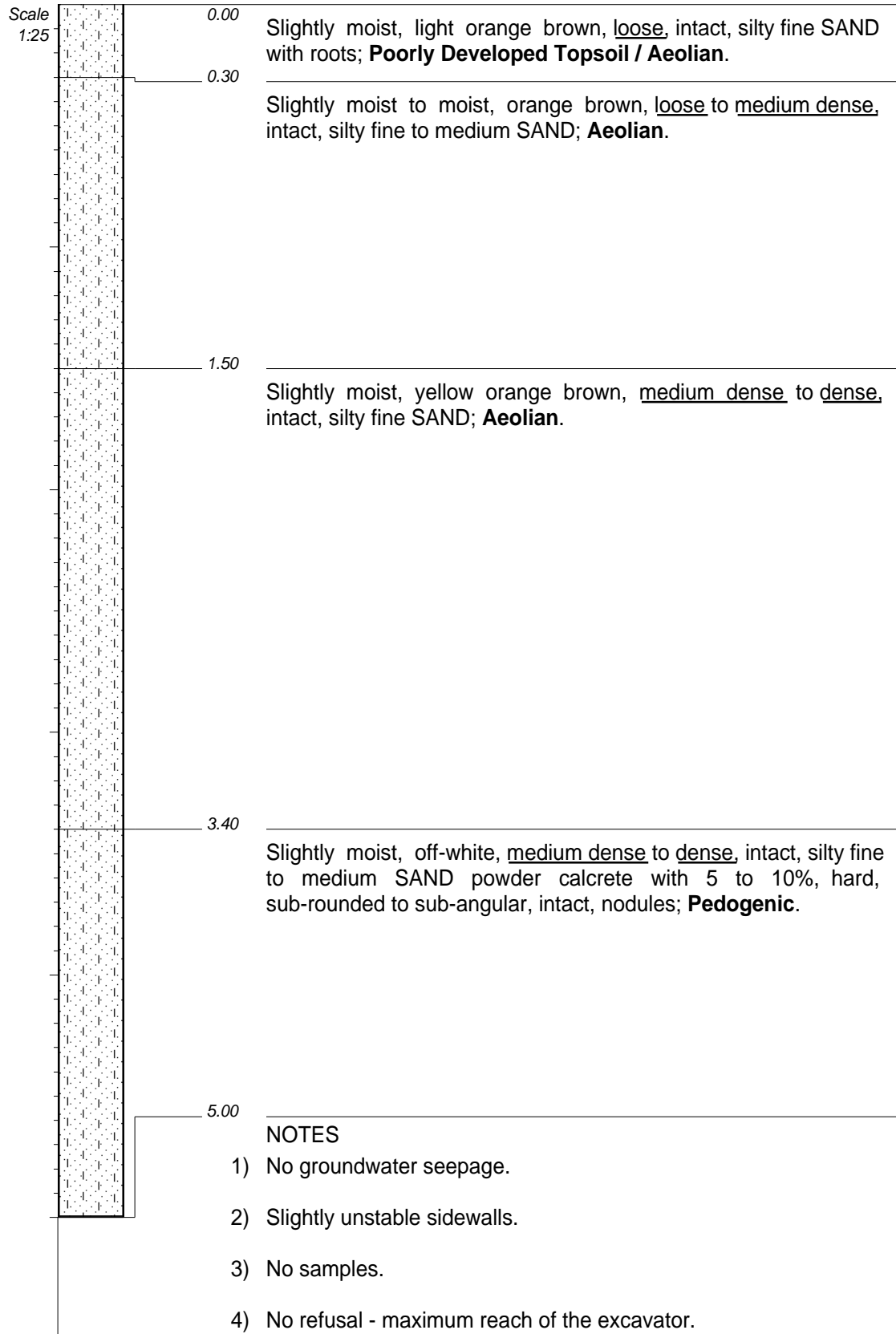
ELEVATION :
X-COORD : 9 802
Y-COORD : 3 007 505



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DATE : 24 to 27 June 2019
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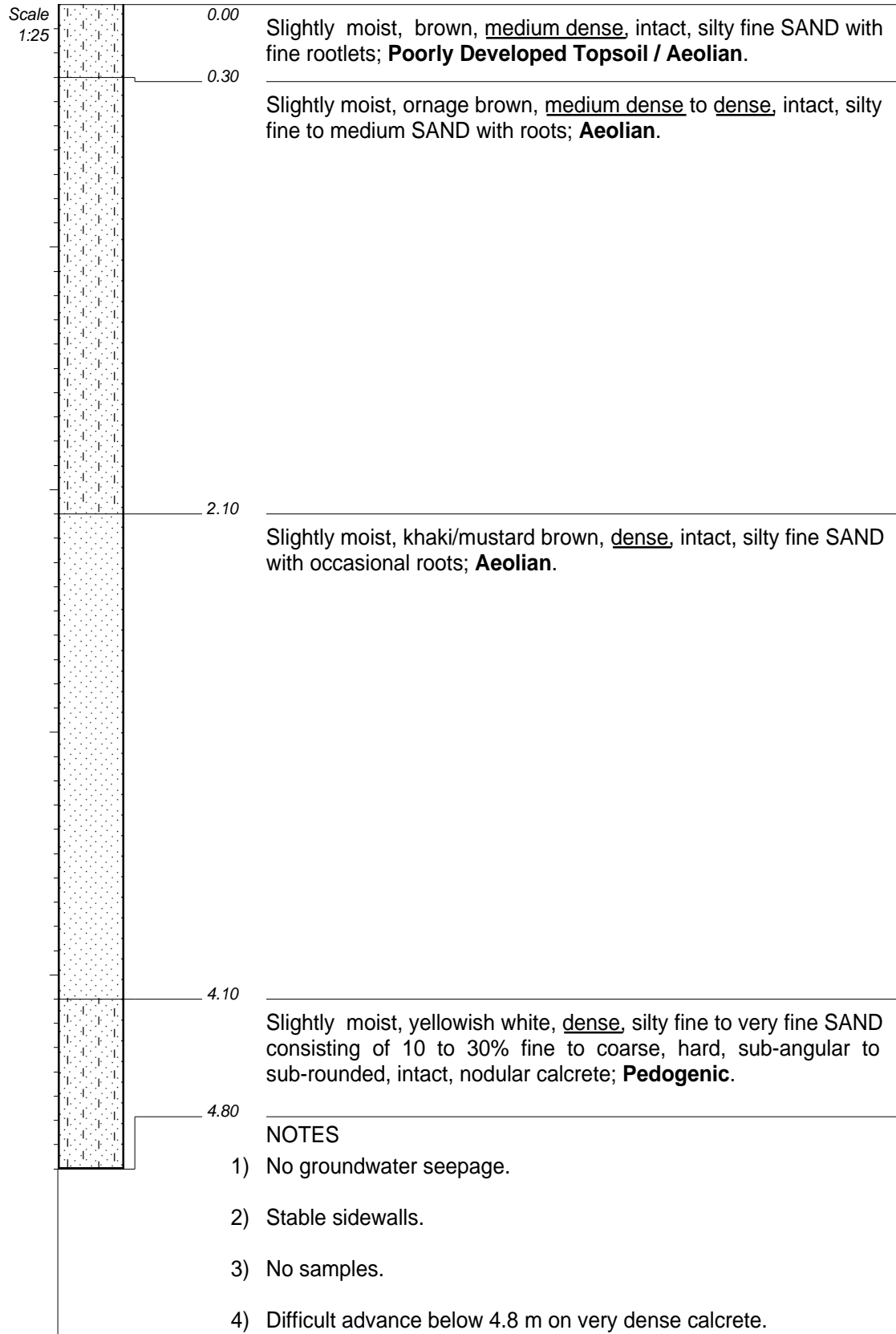
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Y-COORD : 3 007 204



CONTRACTOR :
 MACHINE : CAT 320CL
 DRILLED BY :
 PROFILED BY : SINR
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 SETUP FILE : STANDA~1.SET

INCLINATION :
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ELEVATION :
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 Y-COORD : 3 007 345

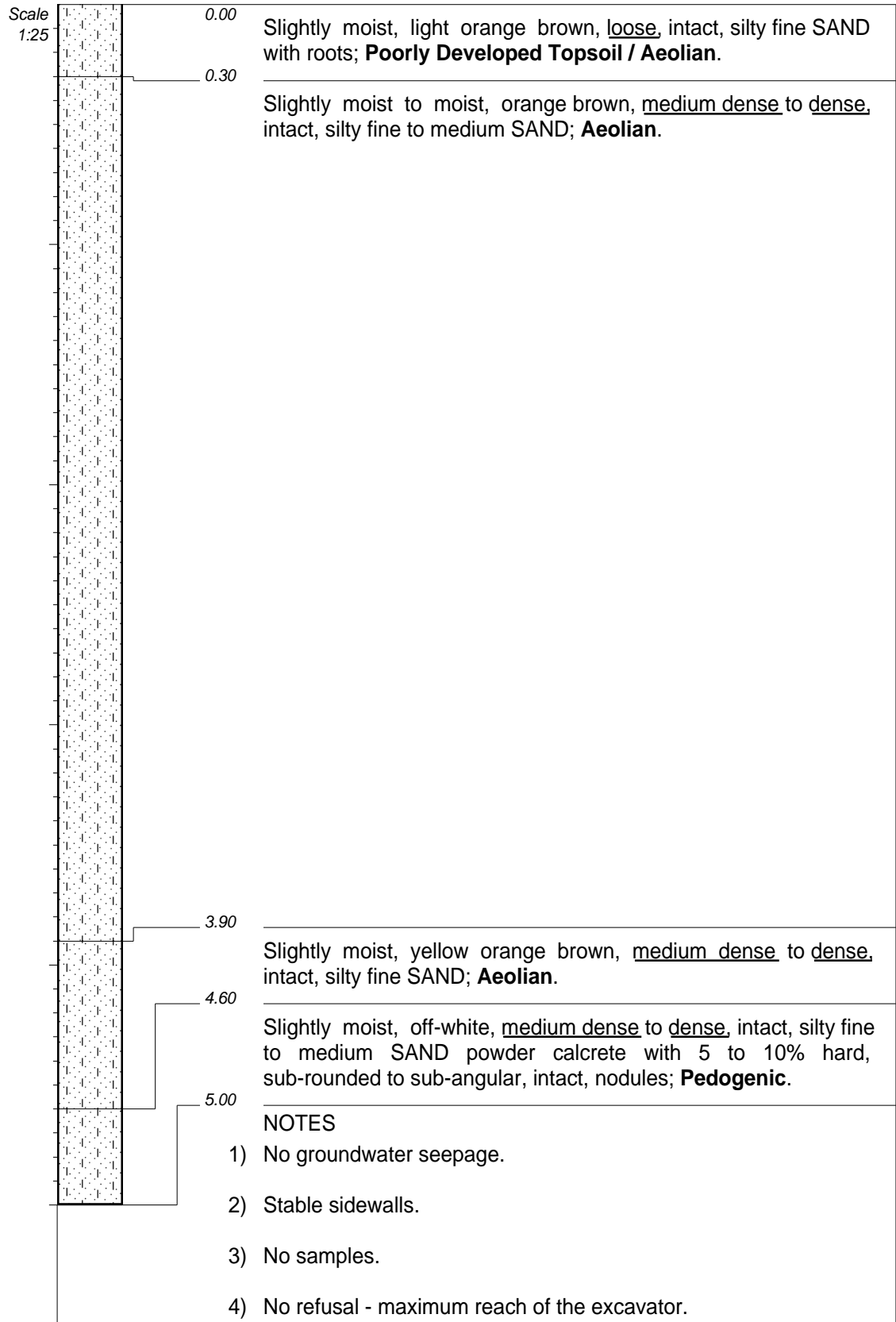


CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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ELEVATION :
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Y-COORD : 3 007 116

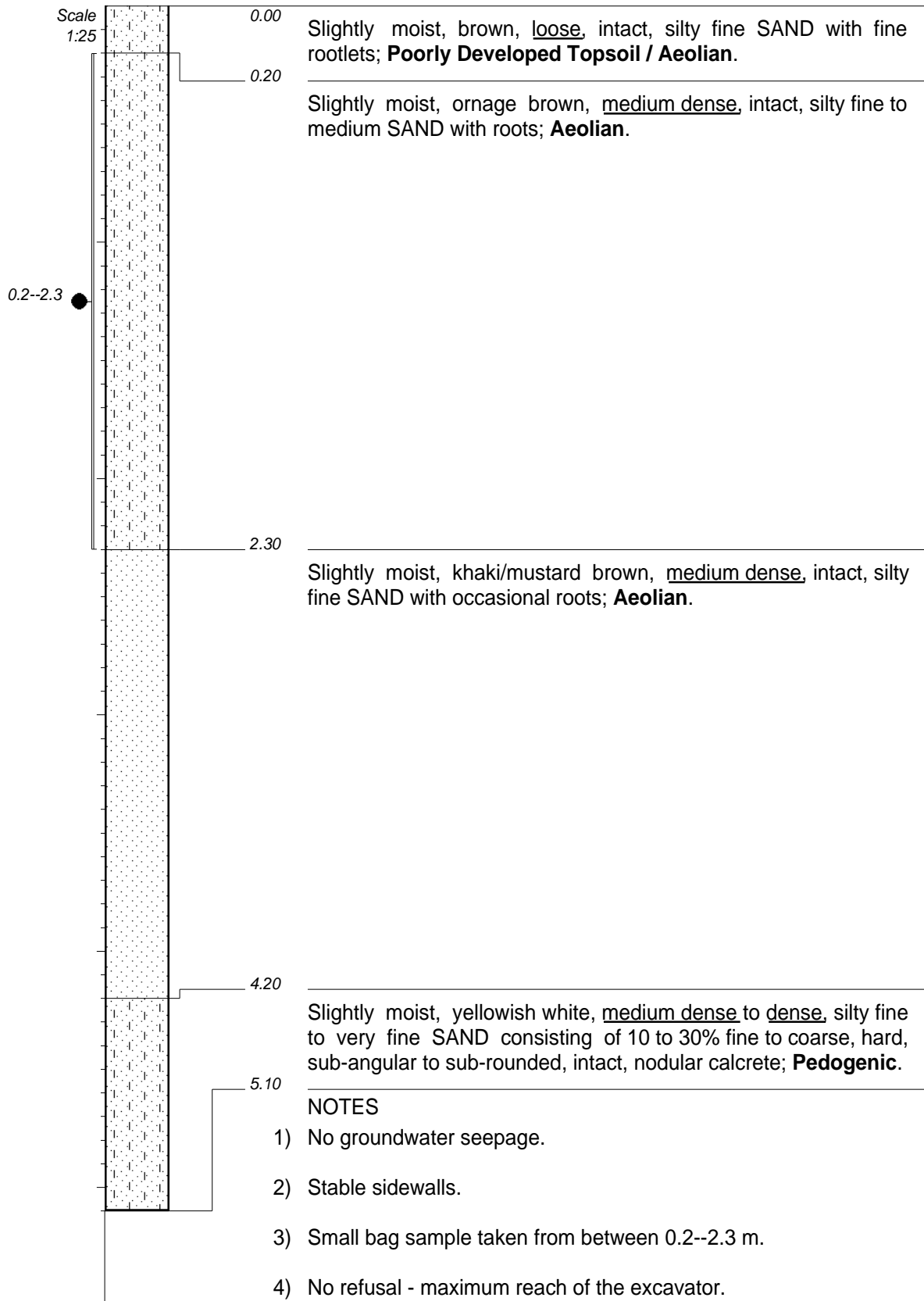
HOLE No: GL-TP25



CONTRACTOR :
MACHINE : CAT 320CL
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PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

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DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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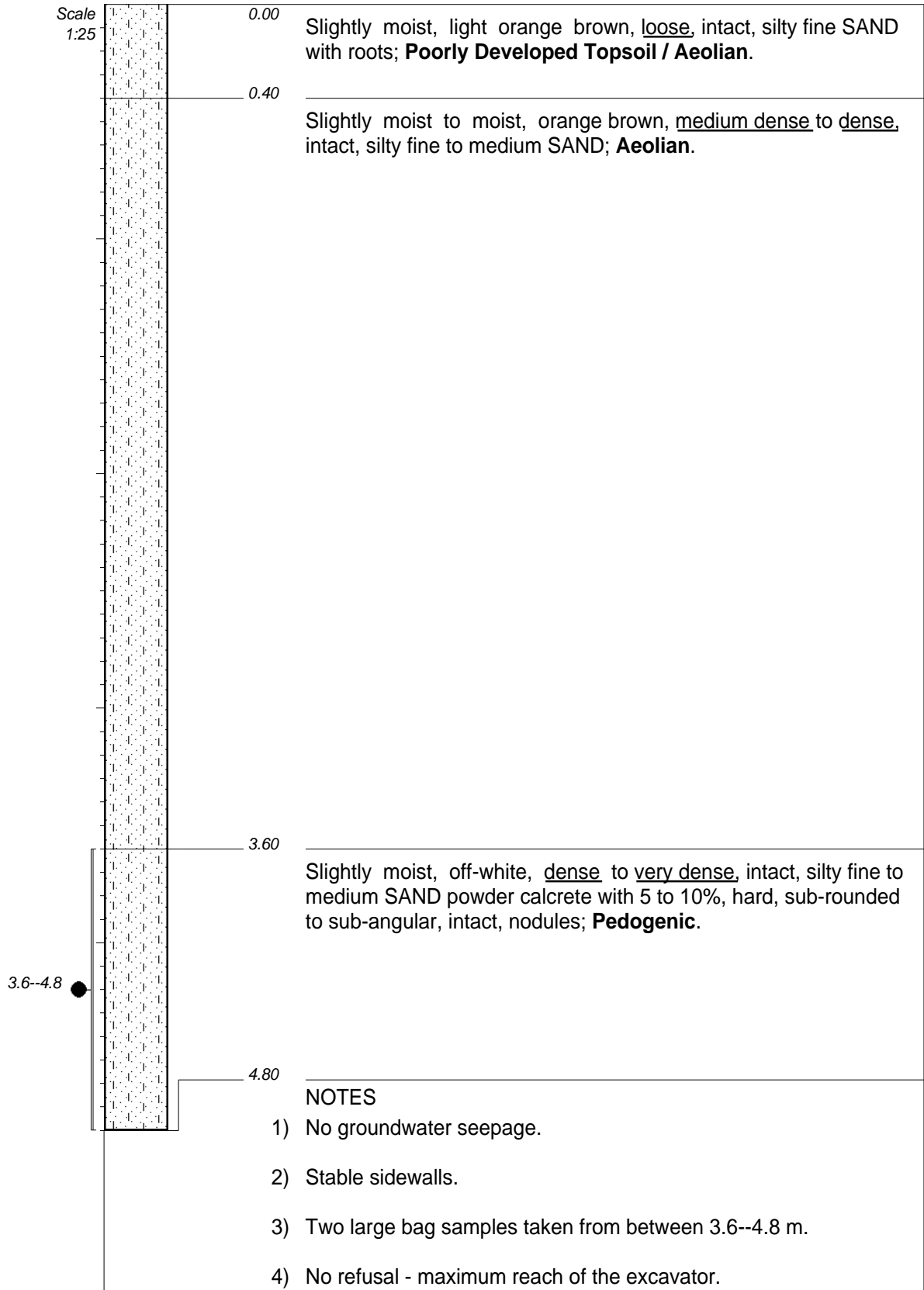
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CONTRACTOR :
MACHINE : CAT 320CL
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PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

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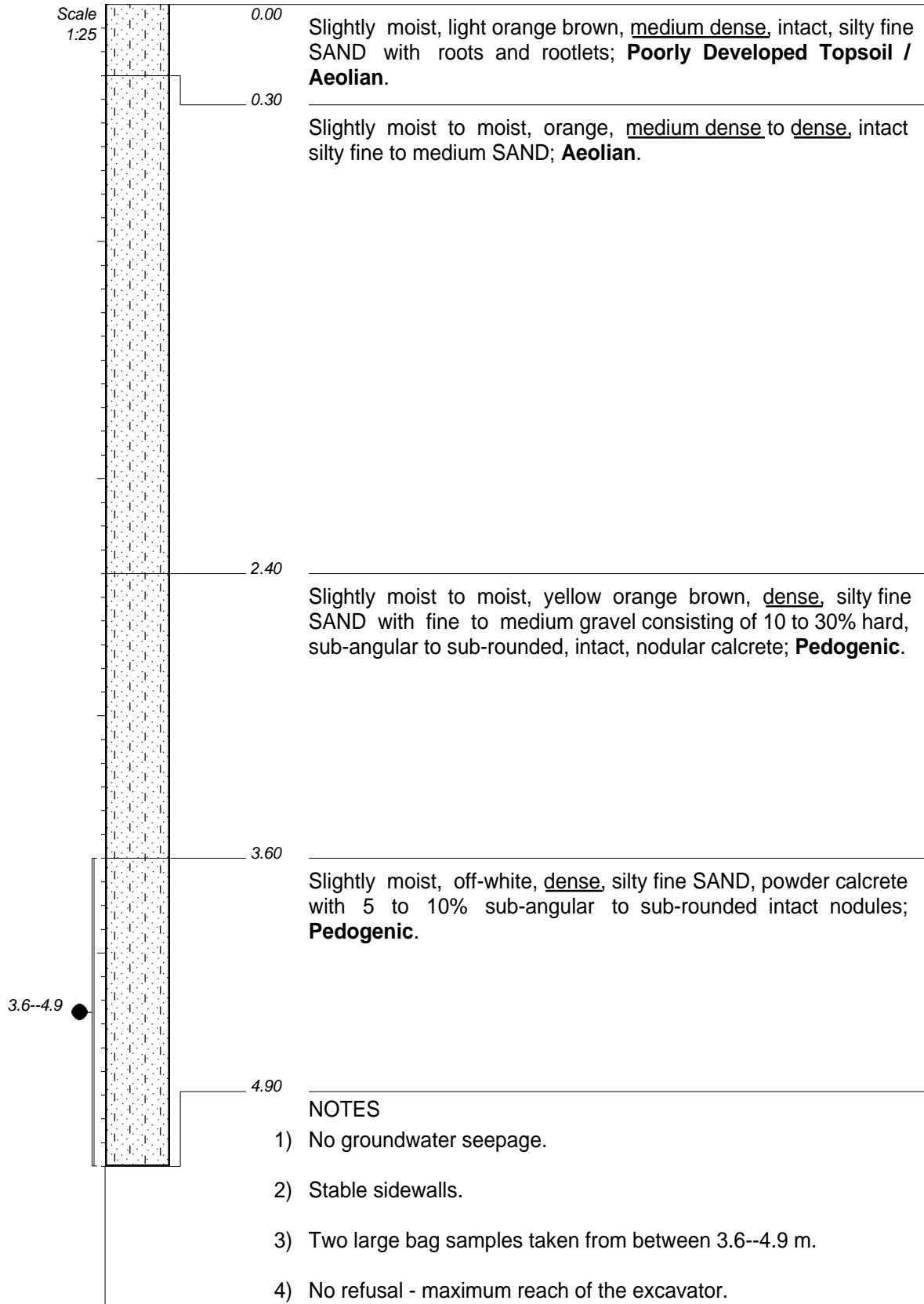
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X-COORD : 9 667
Y-COORD : 3 007 039



CONTRACTOR :
 MACHINE : CAT 320CL
 DRILLED BY :
 PROFILED BY : SINR
 TYPE SET BY : SINR
 SETUP FILE : STANDA~1.SET

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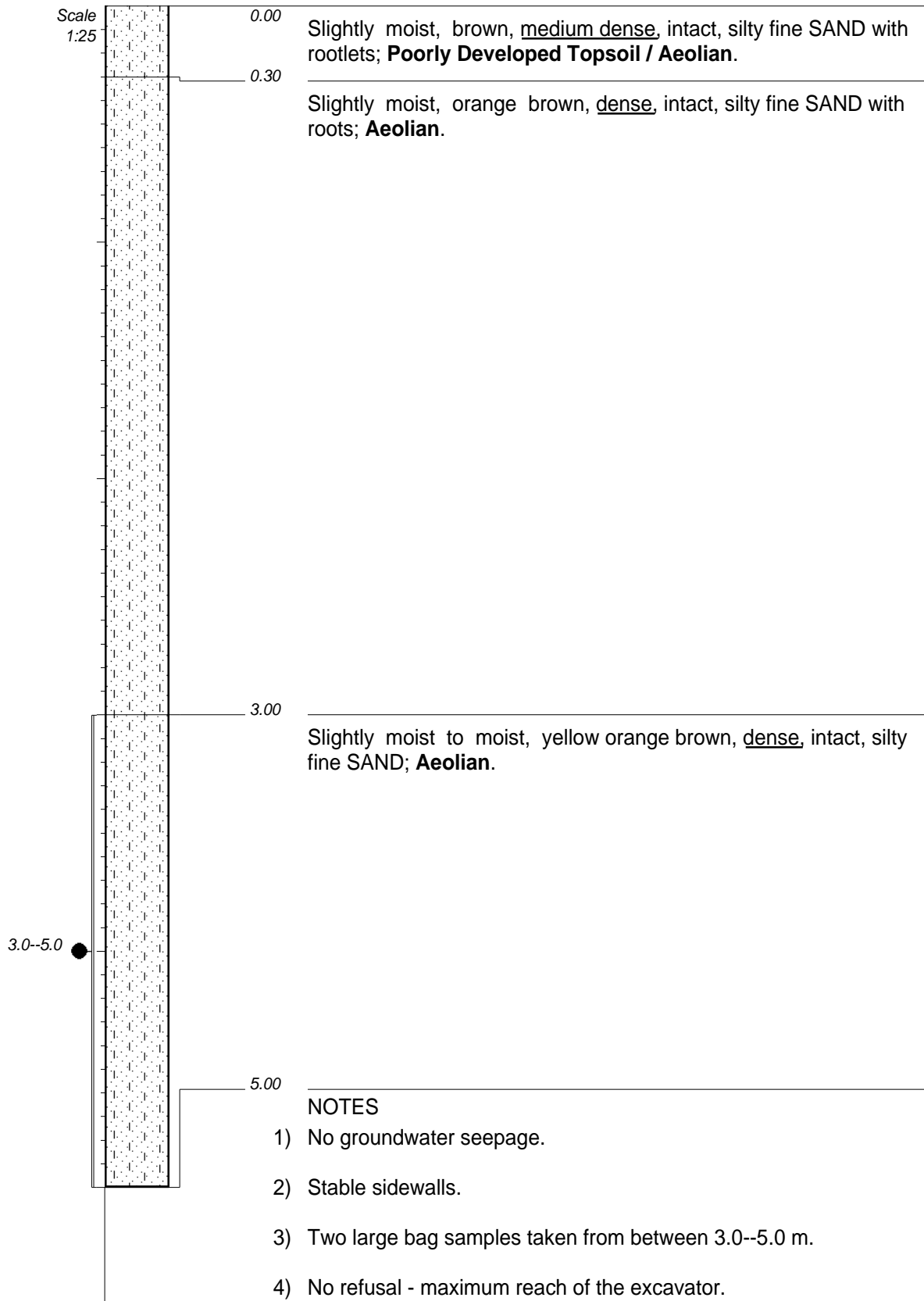
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 X-COORD : 9 524
 Y-COORD : 3 007 138



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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ELEVATION :
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Y-COORD : 3 006 965

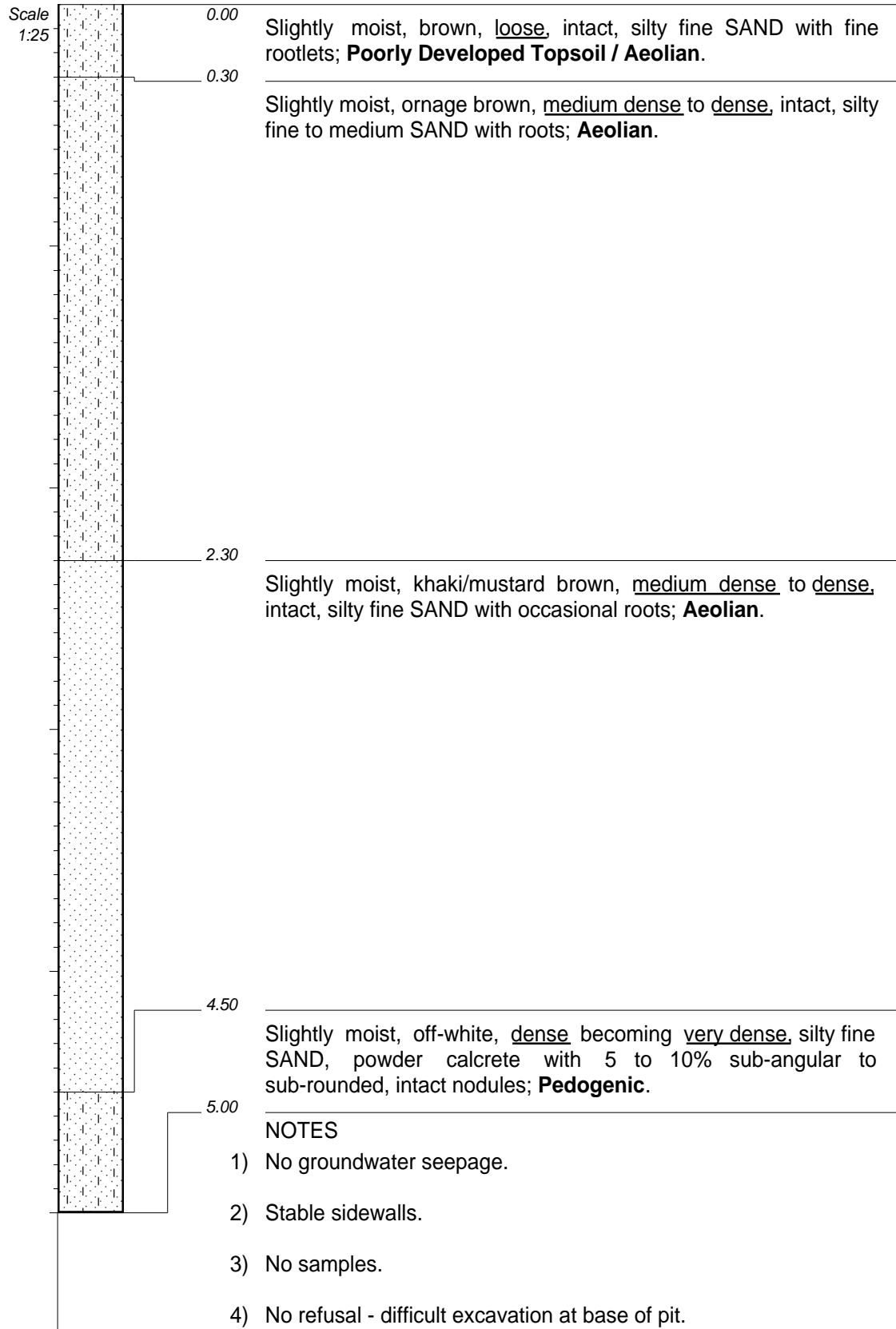


CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
TEXT : ..neTLogsSINR20190813.txt

ELEVATION :
X-COORD : 9 454
Y-COORD : 3 007 014

HOLE No: GL-TP30

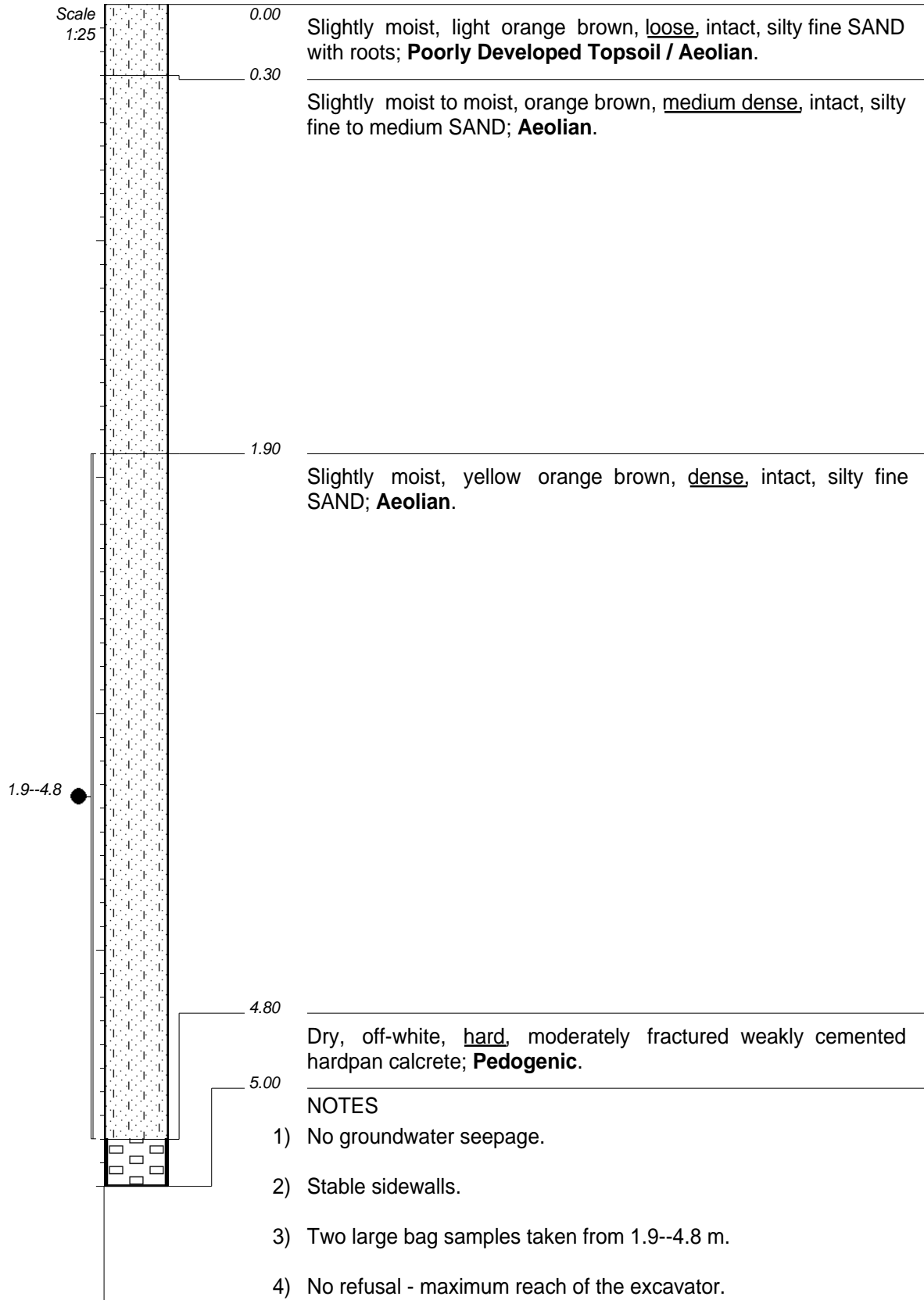


CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
TEXT : ..neTPLogsSINR20190813.txt

ELEVATION :
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Y-COORD : 3 006 988

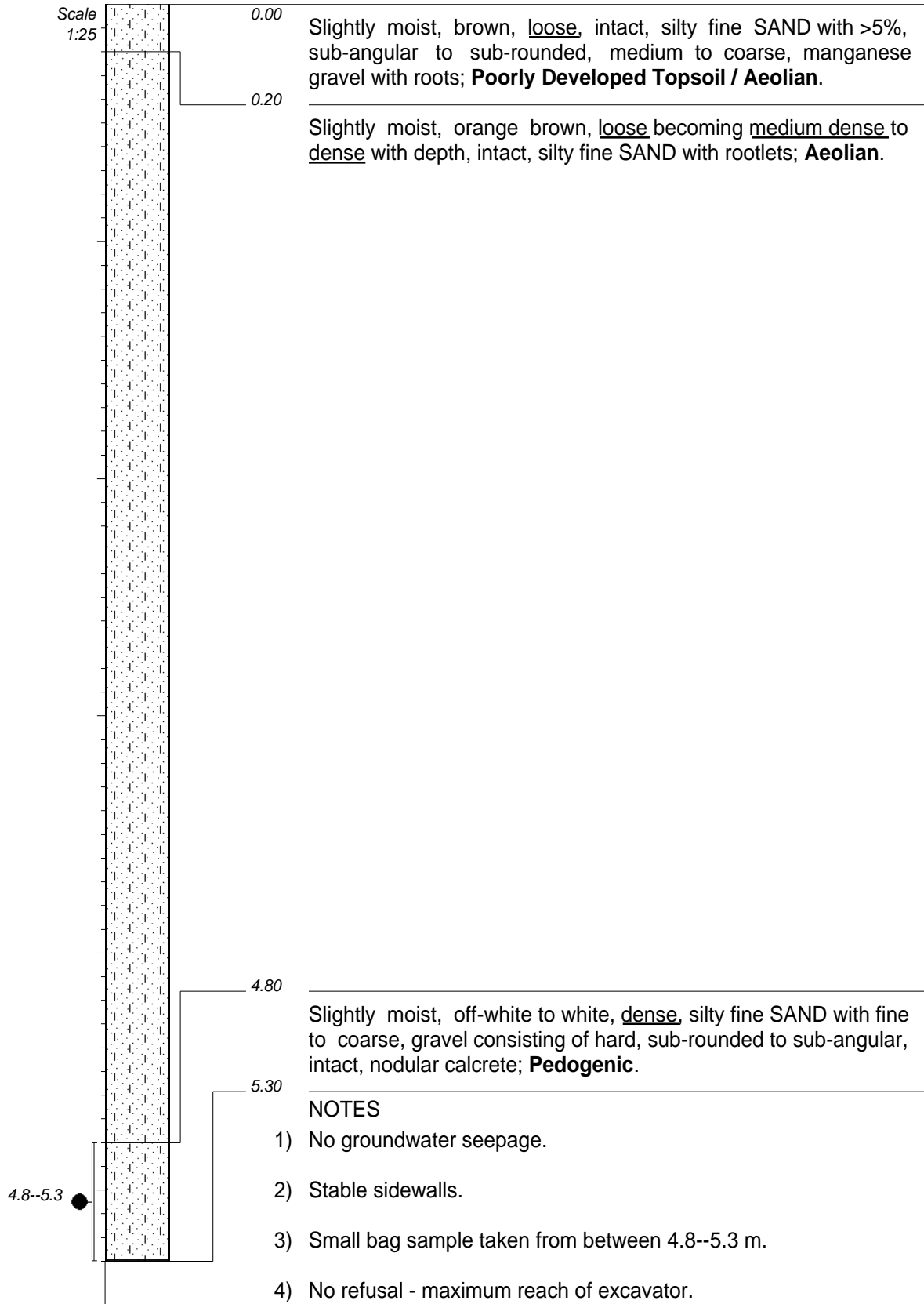
HOLE No: GL-TP31



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

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DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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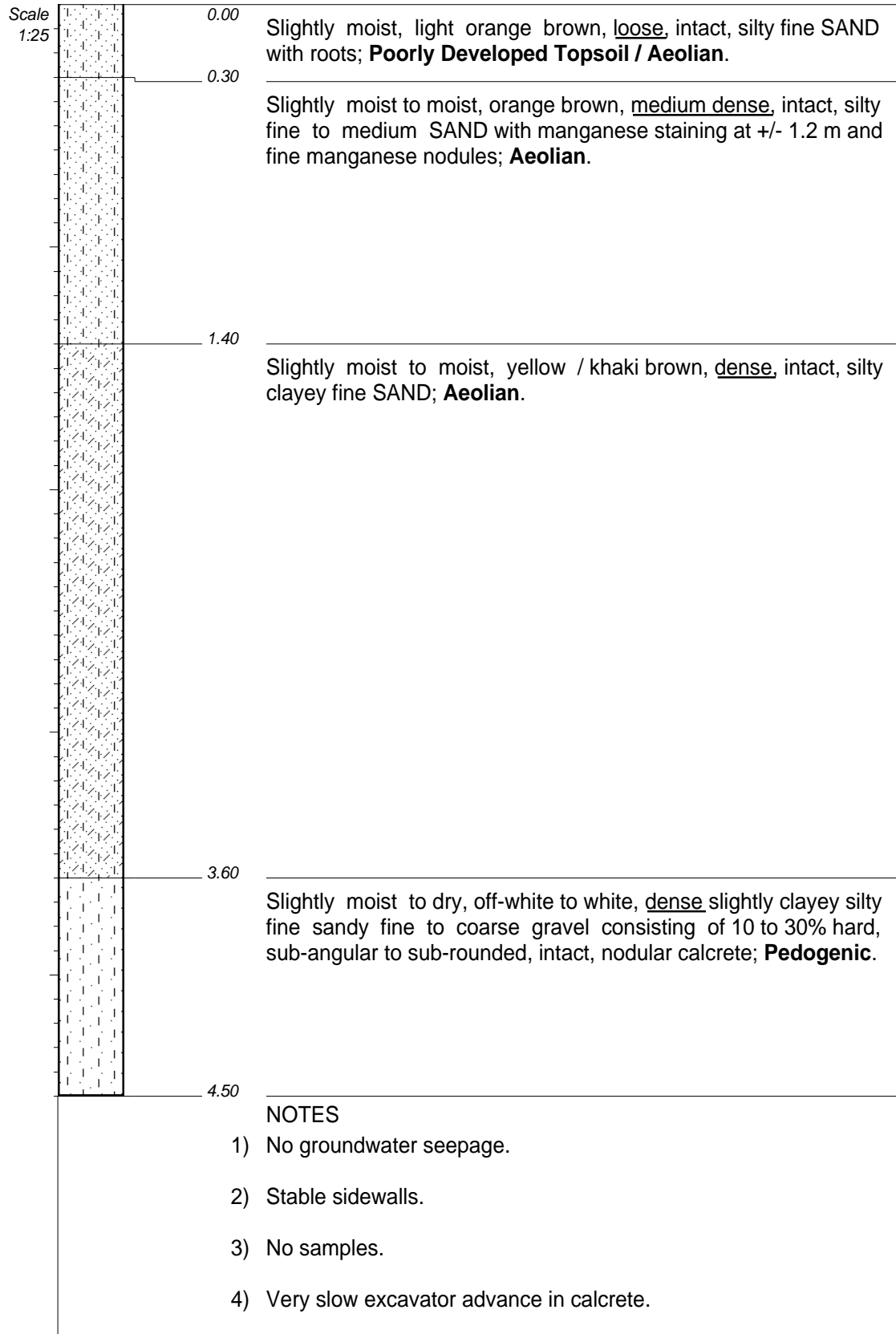
ELEVATION :
X-COORD : 9 856
Y-COORD : 3 007 264



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA~1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
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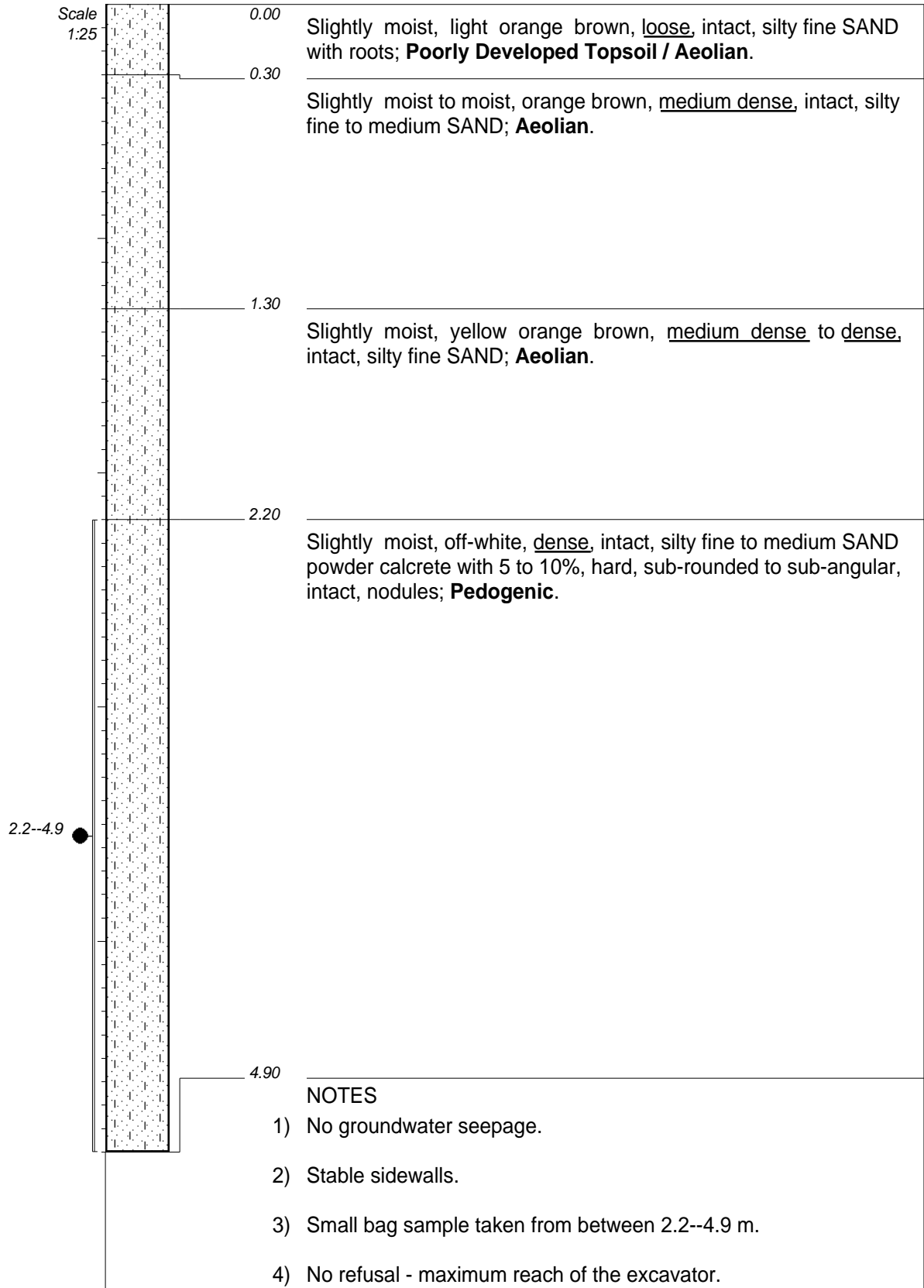
ELEVATION :
X-COORD : 9 409
Y-COORD : 3 006 963



CONTRACTOR :
MACHINE : CAT 320CL
DRILLED BY :
PROFILED BY : SINR
TYPE SET BY : SINR
SETUP FILE : STANDA-1.SET

INCLINATION :
DIAM :
DATE :
DATE : 24 to 27 June 2019
DATE : 13/08/2019 12:05
TEXT : ..neTPLogsSINR20190813.txt

ELEVATION :
X-COORD : 9 409
Y-COORD : 3 007 076



CONTRACTOR :
 MACHINE : CAT 320CL
 DRILLED BY :
 PROFILED BY : SINR
 TYPE SET BY : SINR
 SETUP FILE : STANDA~1.SET

INCLINATION :
 DIAM :
 DATE :
 DATE : 24 to 27 June 2019
 DATE : 13/08/2019 12:05
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ELEVATION :
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 Y-COORD : 3 007 415

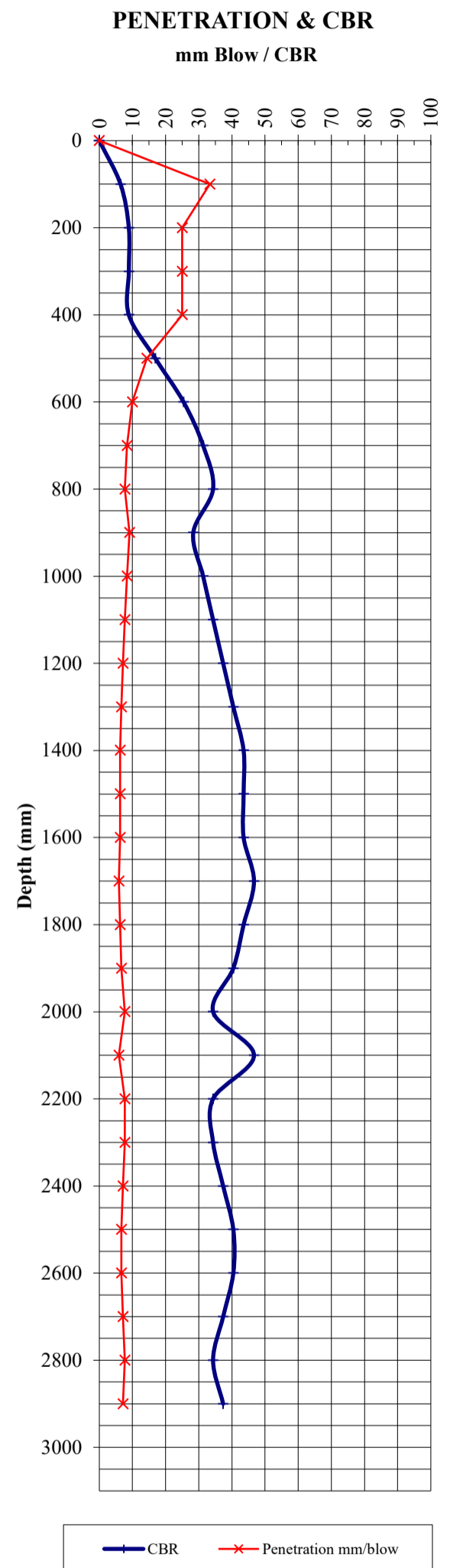
HOLE No: GL-TP35

Appendix C: Drop Cone Penetration Test Results

Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP1**
 Date : **July 2019**



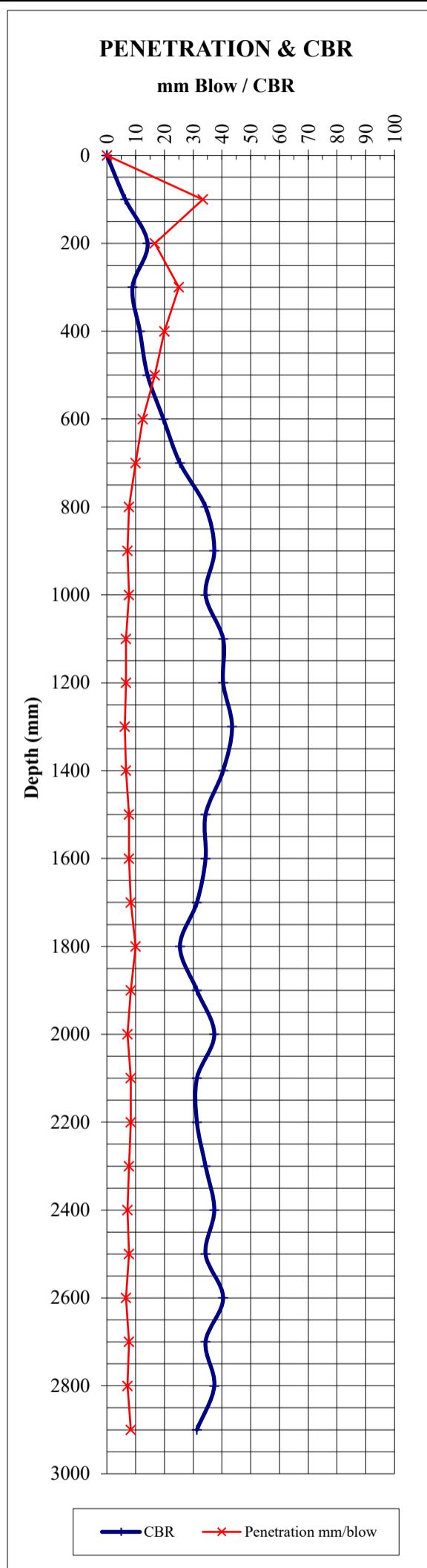
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	4	7	200	25.0	8.9
4	300	4	11	300	25.0	8.9
5	400	4	15	400	25.0	8.9
6	500	7	22	500	14.3	16.9
7	600	10	32	600	10.0	25.4
8	700	12	44	700	8.3	31.3
9	800	13	57	800	7.7	34.3
10	900	11	68	900	9.1	28.3
11	1000	12	80	1000	8.3	31.3
12	1100	13	93	1100	7.7	34.3
13	1200	14	107	1200	7.1	37.4
14	1300	15	122	1300	6.7	40.4
15	1400	16	138	1400	6.3	43.5
16	1500	16	154	1500	6.3	43.5
17	1600	16	170	1600	6.3	43.5
18	1700	17	187	1700	5.9	46.7
19	1800	16	203	1800	6.3	43.5
20	1900	15	218	1900	6.7	40.4
21	2000	13	231	2000	7.7	34.3
22	2100	17	248	2100	5.9	46.7
23	2200	13	261	2200	7.7	34.3
24	2300	13	274	2300	7.7	34.3
25	2400	14	288	2400	7.1	37.4
26	2500	15	303	2500	6.7	40.4
27	2600	15	318	2600	6.7	40.4
28	2700	14	332	2700	7.1	37.4
29	2800	13	345	2800	7.7	34.3
30	2900	14	359	2900	7.1	37.4
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP2**
 Date : **July 2019**



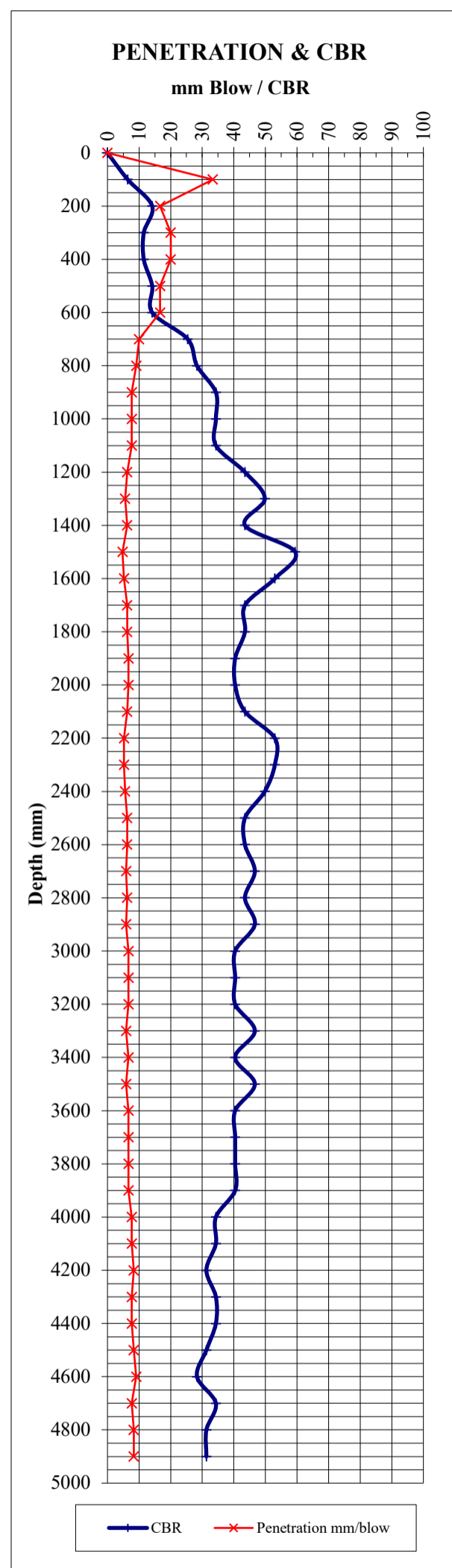
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	6	9	200	16.7	14.2
4	300	4	13	300	25.0	8.9
5	400	5	18	400	20.0	11.5
6	500	6	24	500	16.7	14.2
7	600	8	32	600	12.5	19.7
8	700	10	42	700	10.0	25.4
9	800	13	55	800	7.7	34.3
10	900	14	69	900	7.1	37.4
11	1000	13	82	1000	7.7	34.3
12	1100	15	97	1100	6.7	40.4
13	1200	15	112	1200	6.7	40.4
14	1300	16	128	1300	6.3	43.5
15	1400	15	143	1400	6.7	40.4
16	1500	13	156	1500	7.7	34.3
17	1600	13	169	1600	7.7	34.3
18	1700	12	181	1700	8.3	31.3
19	1800	10	191	1800	10.0	25.4
20	1900	12	203	1900	8.3	31.3
21	2000	14	217	2000	7.1	37.4
22	2100	12	229	2100	8.3	31.3
23	2200	12	241	2200	8.3	31.3
24	2300	13	254	2300	7.7	34.3
25	2400	14	268	2400	7.1	37.4
26	2500	13	281	2500	7.7	34.3
27	2600	15	296	2600	6.7	40.4
28	2700	13	309	2700	7.7	34.3
29	2800	14	323	2800	7.1	37.4
30	2900	12	335	2900	8.3	31.3
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP3**
 Date : **July 2019**



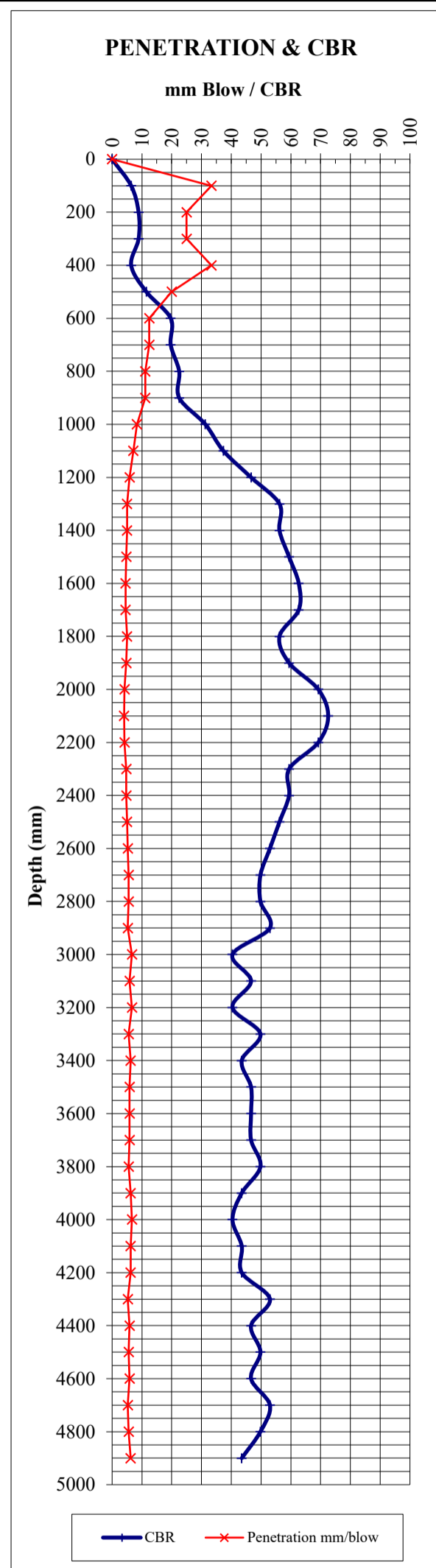
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	6	9	200	16.7	14.2
4	300	5	14	300	20.0	11.5
5	400	5	19	400	20.0	11.5
6	500	6	25	500	16.7	14.2
7	600	6	31	600	16.7	14.2
8	700	10	41	700	10.0	25.4
9	800	11	52	800	9.1	28.3
10	900	13	65	900	7.7	34.3
11	1000	13	78	1000	7.7	34.3
12	1100	13	91	1100	7.7	34.3
13	1200	16	107	1200	6.3	43.5
14	1300	18	125	1300	5.6	49.8
15	1400	16	141	1400	6.3	43.5
16	1500	21	162	1500	4.8	59.4
17	1600	19	181	1600	5.3	53.0
18	1700	16	197	1700	6.3	43.5
19	1800	16	213	1800	6.3	43.5
20	1900	15	228	1900	6.7	40.4
21	2000	15	243	2000	6.7	40.4
22	2100	16	259	2100	6.3	43.5
23	2200	19	278	2200	5.3	53.0
24	2300	19	297	2300	5.3	53.0
25	2400	18	315	2400	5.6	49.8
26	2500	16	331	2500	6.3	43.5
27	2600	16	347	2600	6.3	43.5
28	2700	17	364	2700	5.9	46.7
29	2800	16	380	2800	6.3	43.5
30	2900	17	397	2900	5.9	46.7
31	3000	15	412	3000	6.7	40.4
32	3100	15	427	3100	6.7	40.4
33	3200	15	442	3200	6.7	40.4
34	3300	17	459	3300	5.9	46.7
35	3400	15	474	3400	6.7	40.4
36	3500	17	491	3500	5.9	46.7
37	3600	15	506	3600	6.7	40.4
38	3700	15	521	3700	6.7	40.4
39	3800	15	536	3800	6.7	40.4
40	3900	15	551	3900	6.7	40.4
41	4000	13	564	4000	7.7	34.3
42	4100	13	577	4100	7.7	34.3
43	4200	12	589	4200	8.3	31.3
44	4300	13	602	4300	7.7	34.3
45	4400	13	615	4400	7.7	34.3
46	4500	12	627	4500	8.3	31.3
47	4600	11	638	4600	9.1	28.3
48	4700	13	651	4700	7.7	34.3
49	4800	12	663	4800	8.3	31.3
50	4900	12	675	4900	8.3	31.3
51	5000					
52	5100					
53	5200					
54	5300					
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56	5500					
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58	5700					
59	5800					
60	5900					
61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP4**
 Date : **July 2019**



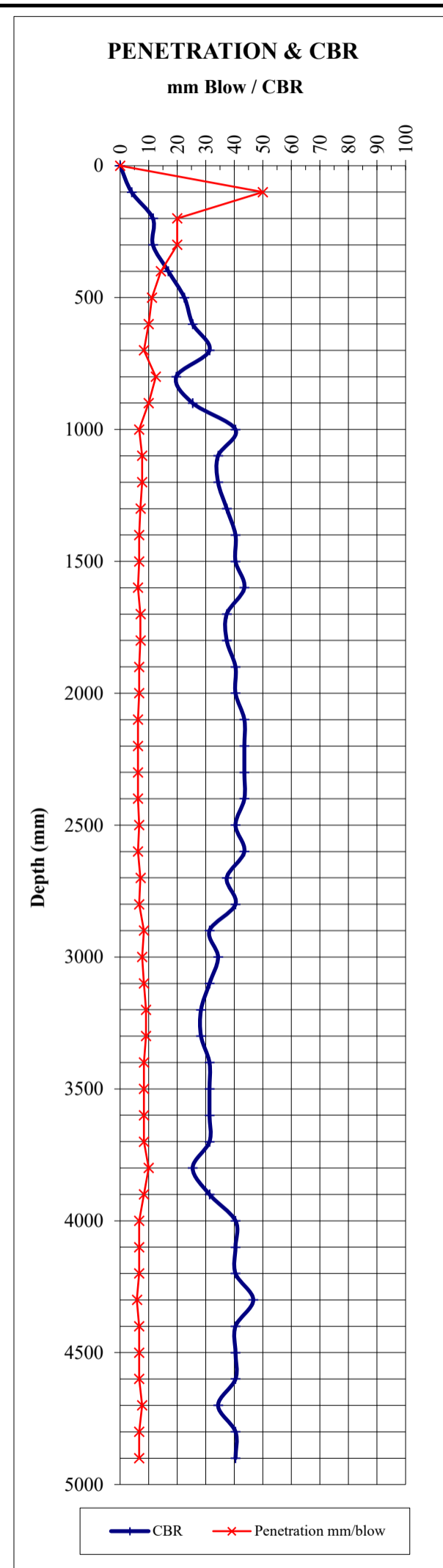
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	4	7	200	25.0	8.9
4	300	4	11	300	25.0	8.9
5	400	3	14	400	33.3	6.4
6	500	5	19	500	20.0	11.5
7	600	8	27	600	12.5	19.7
8	700	8	35	700	12.5	19.7
9	800	9	44	800	11.1	22.5
10	900	9	53	900	11.1	22.5
11	1000	12	65	1000	8.3	31.3
12	1100	14	79	1100	7.1	37.4
13	1200	17	96	1200	5.9	46.7
14	1300	20	116	1300	5.0	56.2
15	1400	20	136	1400	5.0	56.2
16	1500	21	157	1500	4.8	59.4
17	1600	22	179	1600	4.5	62.7
18	1700	22	201	1700	4.5	62.7
19	1800	20	221	1800	5.0	56.2
20	1900	21	242	1900	4.8	59.4
21	2000	24	266	2000	4.2	69.2
22	2100	25	291	2100	4.0	72.6
23	2200	24	315	2200	4.2	69.2
24	2300	21	336	2300	4.8	59.4
25	2400	21	357	2400	4.8	59.4
26	2500	20	377	2500	5.0	56.2
27	2600	19	396	2600	5.3	53.0
28	2700	18	414	2700	5.6	49.8
29	2800	18	432	2800	5.6	49.8
30	2900	19	451	2900	5.3	53.0
31	3000	15	466	3000	6.7	40.4
32	3100	17	483	3100	5.9	46.7
33	3200	15	498	3200	6.7	40.4
34	3300	18	516	3300	5.6	49.8
35	3400	16	532	3400	6.3	43.5
36	3500	17	549	3500	5.9	46.7
37	3600	17	566	3600	5.9	46.7
38	3700	17	583	3700	5.9	46.7
39	3800	18	601	3800	5.6	49.8
40	3900	16	617	3900	6.3	43.5
41	4000	15	632	4000	6.7	40.4
42	4100	16	648	4100	6.3	43.5
43	4200	16	664	4200	6.3	43.5
44	4300	19	683	4300	5.3	53.0
45	4400	17	700	4400	5.9	46.7
46	4500	18	718	4500	5.6	49.8
47	4600	17	735	4600	5.9	46.7
48	4700	19	754	4700	5.3	53.0
49	4800	18	772	4800	5.6	49.8
50	4900	16	788	4900	6.3	43.5
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
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59	5800					
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61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP5**
 Date : **July 2019**



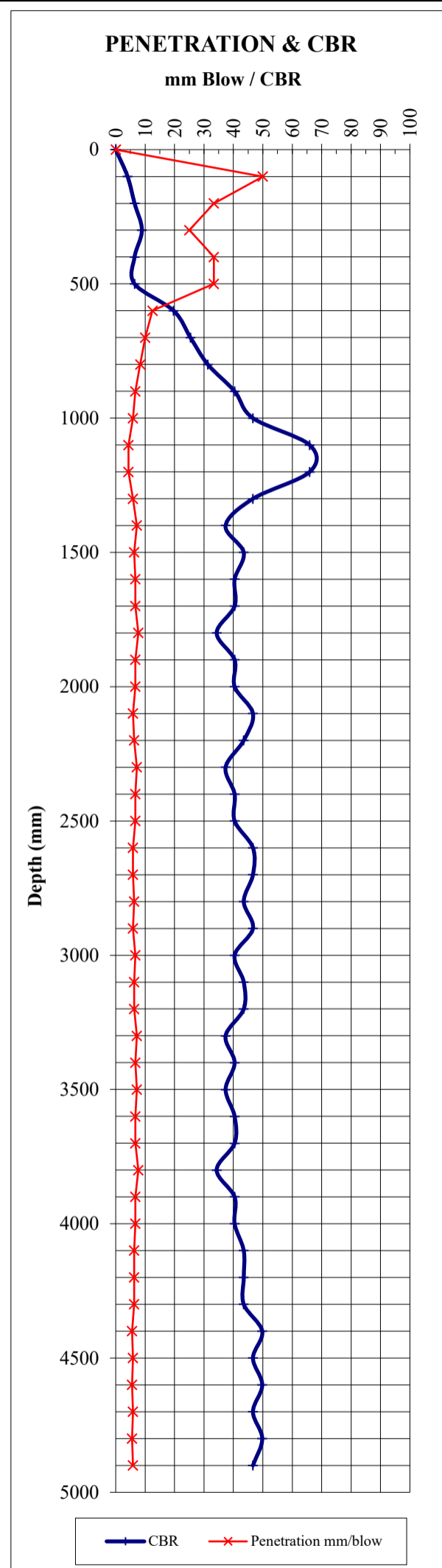
Reading No	c	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	5	7	200	20.0	11.5
4	300	5	12	300	20.0	11.5
5	400	7	19	400	14.3	16.9
6	500	9	28	500	11.1	22.5
7	600	10	38	600	10.0	25.4
8	700	12	50	700	8.3	31.3
9	800	8	58	800	12.5	19.7
10	900	10	68	900	10.0	25.4
11	1000	15	83	1000	6.7	40.4
12	1100	13	96	1100	7.7	34.3
13	1200	13	109	1200	7.7	34.3
14	1300	14	123	1300	7.1	37.4
15	1400	15	138	1400	6.7	40.4
16	1500	15	153	1500	6.7	40.4
17	1600	16	169	1600	6.3	43.5
18	1700	14	183	1700	7.1	37.4
19	1800	14	197	1800	7.1	37.4
20	1900	15	212	1900	6.7	40.4
21	2000	15	227	2000	6.7	40.4
22	2100	16	243	2100	6.3	43.5
23	2200	16	259	2200	6.3	43.5
24	2300	16	275	2300	6.3	43.5
25	2400	16	291	2400	6.3	43.5
26	2500	15	306	2500	6.7	40.4
27	2600	16	322	2600	6.3	43.5
28	2700	14	336	2700	7.1	37.4
29	2800	15	351	2800	6.7	40.4
30	2900	12	363	2900	8.3	31.3
31	3000	13	376	3000	7.7	34.3
32	3100	12	388	3100	8.3	31.3
33	3200	11	399	3200	9.1	28.3
34	3300	11	410	3300	9.1	28.3
35	3400	12	422	3400	8.3	31.3
36	3500	12	434	3500	8.3	31.3
37	3600	12	446	3600	8.3	31.3
38	3700	12	458	3700	8.3	31.3
39	3800	10	468	3800	10.0	25.4
40	3900	12	480	3900	8.3	31.3
41	4000	15	495	4000	6.7	40.4
42	4100	15	510	4100	6.7	40.4
43	4200	15	525	4200	6.7	40.4
44	4300	17	542	4300	5.9	46.7
45	4400	15	557	4400	6.7	40.4
46	4500	15	572	4500	6.7	40.4
47	4600	15	587	4600	6.7	40.4
48	4700	13	600	4700	7.7	34.3
49	4800	15	615	4800	6.7	40.4
50	4900	15	630	4900	6.7	40.4
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
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61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP6**
 Date : **July 2019**



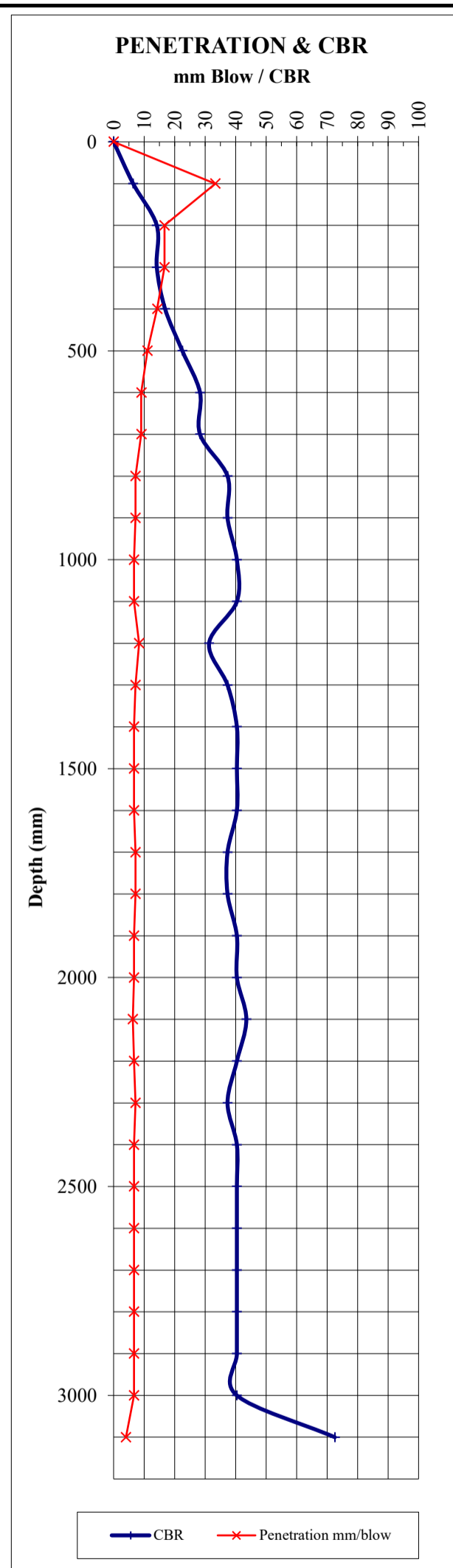
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	3	5	200	33.3	6.4
4	300	4	9	300	25.0	8.9
5	400	3	12	400	33.3	6.4
6	500	3	15	500	33.3	6.4
7	600	8	23	600	12.5	19.7
8	700	10	33	700	10.0	25.4
9	800	12	45	800	8.3	31.3
10	900	15	60	900	6.7	40.4
11	1000	17	77	1000	5.9	46.7
12	1100	23	100	1100	4.3	65.9
13	1200	23	123	1200	4.3	65.9
14	1300	17	140	1300	5.9	46.7
15	1400	14	154	1400	7.1	37.4
16	1500	16	170	1500	6.3	43.5
17	1600	15	185	1600	6.7	40.4
18	1700	15	200	1700	6.7	40.4
19	1800	13	213	1800	7.7	34.3
20	1900	15	228	1900	6.7	40.4
21	2000	15	243	2000	6.7	40.4
22	2100	17	260	2100	5.9	46.7
23	2200	16	276	2200	6.3	43.5
24	2300	14	290	2300	7.1	37.4
25	2400	15	305	2400	6.7	40.4
26	2500	15	320	2500	6.7	40.4
27	2600	17	337	2600	5.9	46.7
28	2700	17	354	2700	5.9	46.7
29	2800	16	370	2800	6.3	43.5
30	2900	17	387	2900	5.9	46.7
31	3000	15	402	3000	6.7	40.4
32	3100	16	418	3100	6.3	43.5
33	3200	16	434	3200	6.3	43.5
34	3300	14	448	3300	7.1	37.4
35	3400	15	463	3400	6.7	40.4
36	3500	14	477	3500	7.1	37.4
37	3600	15	492	3600	6.7	40.4
38	3700	15	507	3700	6.7	40.4
39	3800	13	520	3800	7.7	34.3
40	3900	15	535	3900	6.7	40.4
41	4000	15	550	4000	6.7	40.4
42	4100	16	566	4100	6.3	43.5
43	4200	16	582	4200	6.3	43.5
44	4300	16	598	4300	6.3	43.5
45	4400	18	616	4400	5.6	49.8
46	4500	17	633	4500	5.9	46.7
47	4600	18	651	4600	5.6	49.8
48	4700	17	668	4700	5.9	46.7
49	4800	18	686	4800	5.6	49.8
50	4900	17	703	4900	5.9	46.7
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP7**
 Date : **July 2019**



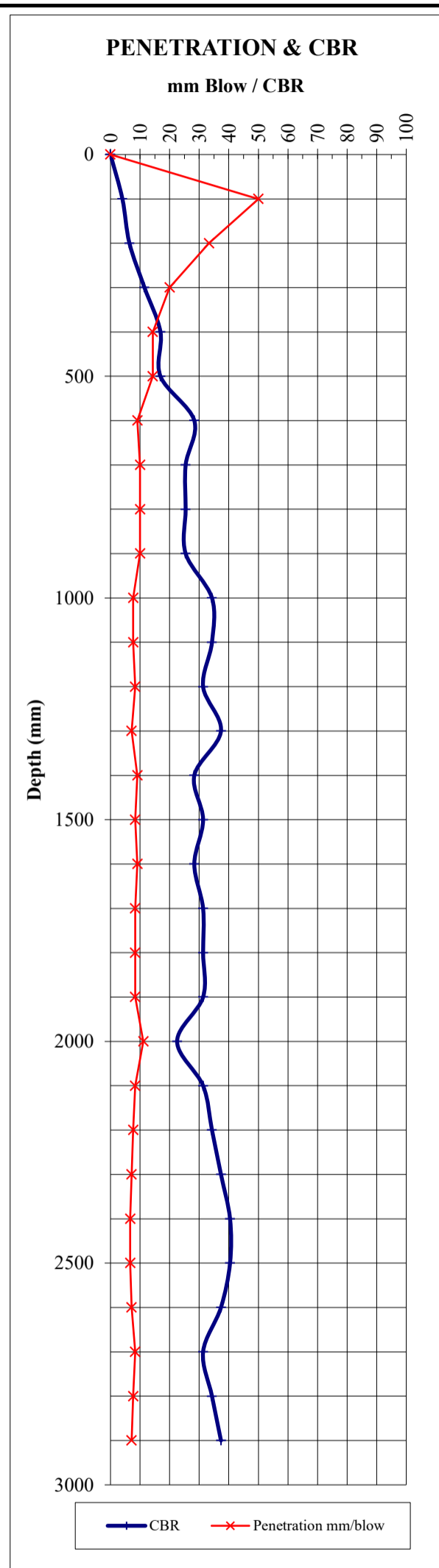
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	6	9	200	16.7	14.2
4	300	6	15	300	16.7	14.2
5	400	7	22	400	14.3	16.9
6	500	9	31	500	11.1	22.5
7	600	11	42	600	9.1	28.3
8	700	11	53	700	9.1	28.3
9	800	14	67	800	7.1	37.4
10	900	14	81	900	7.1	37.4
11	1000	15	96	1000	6.7	40.4
12	1100	15	111	1100	6.7	40.4
13	1200	12	123	1200	8.3	31.3
14	1300	14	137	1300	7.1	37.4
15	1400	15	152	1400	6.7	40.4
16	1500	15	167	1500	6.7	40.4
17	1600	15	182	1600	6.7	40.4
18	1700	14	196	1700	7.1	37.4
19	1800	14	210	1800	7.1	37.4
20	1900	15	225	1900	6.7	40.4
21	2000	15	240	2000	6.7	40.4
22	2100	16	256	2100	6.3	43.5
23	2200	15	271	2200	6.7	40.4
24	2300	14	285	2300	7.1	37.4
25	2400	15	300	2400	6.7	40.4
26	2500	15	315	2500	6.7	40.4
27	2600	15	330	2600	6.7	40.4
28	2700	15	345	2700	6.7	40.4
29	2800	15	360	2800	6.7	40.4
30	2900	15	375	2900	6.7	40.4
31	3000	15	390	3000	6.7	40.4
32	3100	25	415	3100	4.0	72.6
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
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41	4000					
42	4100					
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51	5000					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP8**
 Date : **July 2019**



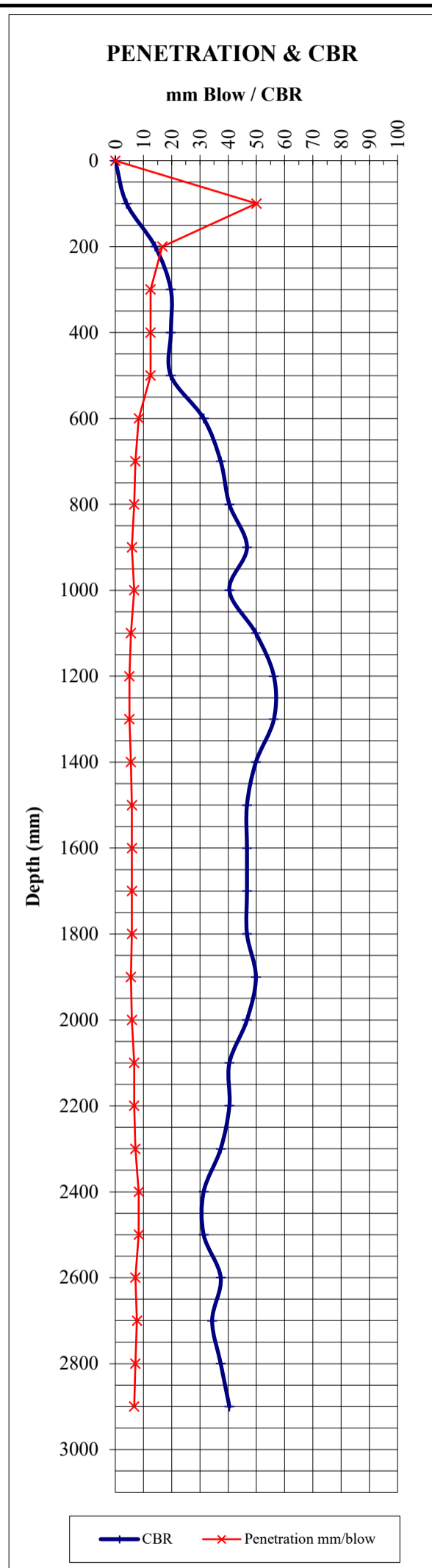
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	3	5	200	33.3	6.4
4	300	5	10	300	20.0	11.5
5	400	7	17	400	14.3	16.9
6	500	7	24	500	14.3	16.9
7	600	11	35	600	9.1	28.3
8	700	10	45	700	10.0	25.4
9	800	10	55	800	10.0	25.4
10	900	10	65	900	10.0	25.4
11	1000	13	78	1000	7.7	34.3
12	1100	13	91	1100	7.7	34.3
13	1200	12	103	1200	8.3	31.3
14	1300	14	117	1300	7.1	37.4
15	1400	11	128	1400	9.1	28.3
16	1500	12	140	1500	8.3	31.3
17	1600	11	151	1600	9.1	28.3
18	1700	12	163	1700	8.3	31.3
19	1800	12	175	1800	8.3	31.3
20	1900	12	187	1900	8.3	31.3
21	2000	9	196	2000	11.1	22.5
22	2100	12	208	2100	8.3	31.3
23	2200	13	221	2200	7.7	34.3
24	2300	14	235	2300	7.1	37.4
25	2400	15	250	2400	6.7	40.4
26	2500	15	265	2500	6.7	40.4
27	2600	14	279	2600	7.1	37.4
28	2700	12	291	2700	8.3	31.3
29	2800	13	304	2800	7.7	34.3
30	2900	14	318	2900	7.1	37.4
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP9**
 Date : **July 2019**



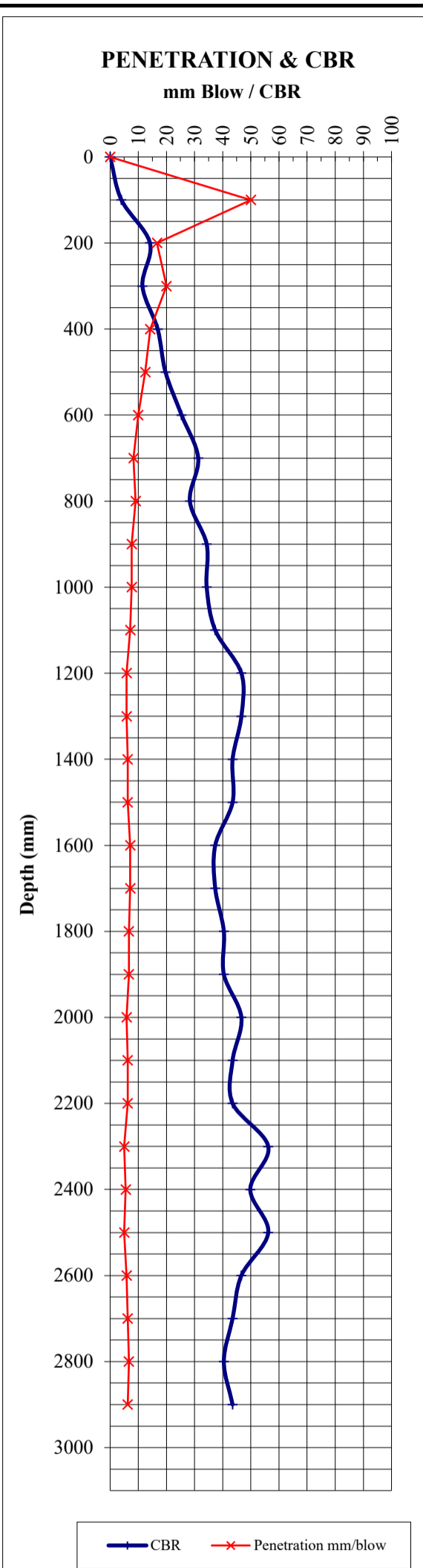
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	6	8	200	16.7	14.2
4	300	8	16	300	12.5	19.7
5	400	8	24	400	12.5	19.7
6	500	8	32	500	12.5	19.7
7	600	12	44	600	8.3	31.3
8	700	14	58	700	7.1	37.4
9	800	15	73	800	6.7	40.4
10	900	17	90	900	5.9	46.7
11	1000	15	105	1000	6.7	40.4
12	1100	18	123	1100	5.6	49.8
13	1200	20	143	1200	5.0	56.2
14	1300	20	163	1300	5.0	56.2
15	1400	18	181	1400	5.6	49.8
16	1500	17	198	1500	5.9	46.7
17	1600	17	215	1600	5.9	46.7
18	1700	17	232	1700	5.9	46.7
19	1800	17	249	1800	5.9	46.7
20	1900	18	267	1900	5.6	49.8
21	2000	17	284	2000	5.9	46.7
22	2100	15	299	2100	6.7	40.4
23	2200	15	314	2200	6.7	40.4
24	2300	14	328	2300	7.1	37.4
25	2400	12	340	2400	8.3	31.3
26	2500	12	352	2500	8.3	31.3
27	2600	14	366	2600	7.1	37.4
28	2700	13	379	2700	7.7	34.3
29	2800	14	393	2800	7.1	37.4
30	2900	15	408	2900	6.7	40.4
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
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40	3900					
41	4000					
42	4100					
43	4200					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP11**
 Date : **July 201**



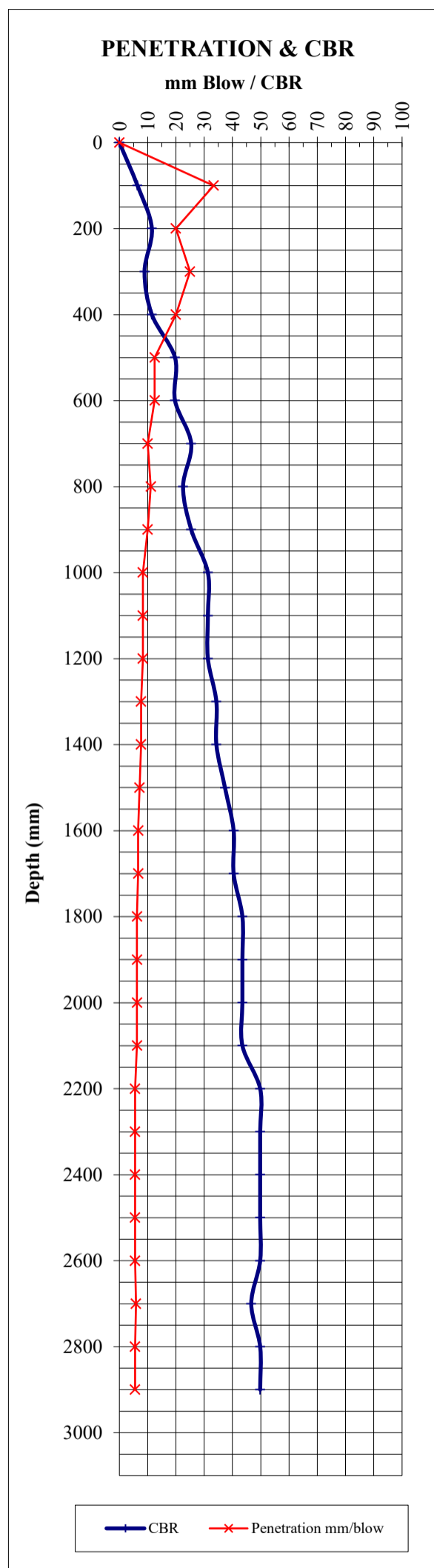
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	6	8	200	16.7	14.2
4	300	5	13	300	20.0	11.5
5	400	7	20	400	14.3	16.9
6	500	8	28	500	12.5	19.7
7	600	10	38	600	10.0	25.4
8	700	12	50	700	8.3	31.3
9	800	11	61	800	9.1	28.3
10	900	13	74	900	7.7	34.3
11	1000	13	87	1000	7.7	34.3
12	1100	14	101	1100	7.1	37.4
13	1200	17	118	1200	5.9	46.7
14	1300	17	135	1300	5.9	46.7
15	1400	16	151	1400	6.3	43.5
16	1500	16	167	1500	6.3	43.5
17	1600	14	181	1600	7.1	37.4
18	1700	14	195	1700	7.1	37.4
19	1800	15	210	1800	6.7	40.4
20	1900	15	225	1900	6.7	40.4
21	2000	17	242	2000	5.9	46.7
22	2100	16	258	2100	6.3	43.5
23	2200	16	274	2200	6.3	43.5
24	2300	20	294	2300	5.0	56.2
25	2400	18	312	2400	5.6	49.8
26	2500	20	332	2500	5.0	56.2
27	2600	17	349	2600	5.9	46.7
28	2700	16	365	2700	6.3	43.5
29	2800	15	380	2800	6.7	40.4
30	2900	16	396	2900	6.3	43.5
31	3000					
32	3100					
33	3200					
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35	3400					
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43	4200					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP12**
 Date : **July 2019**



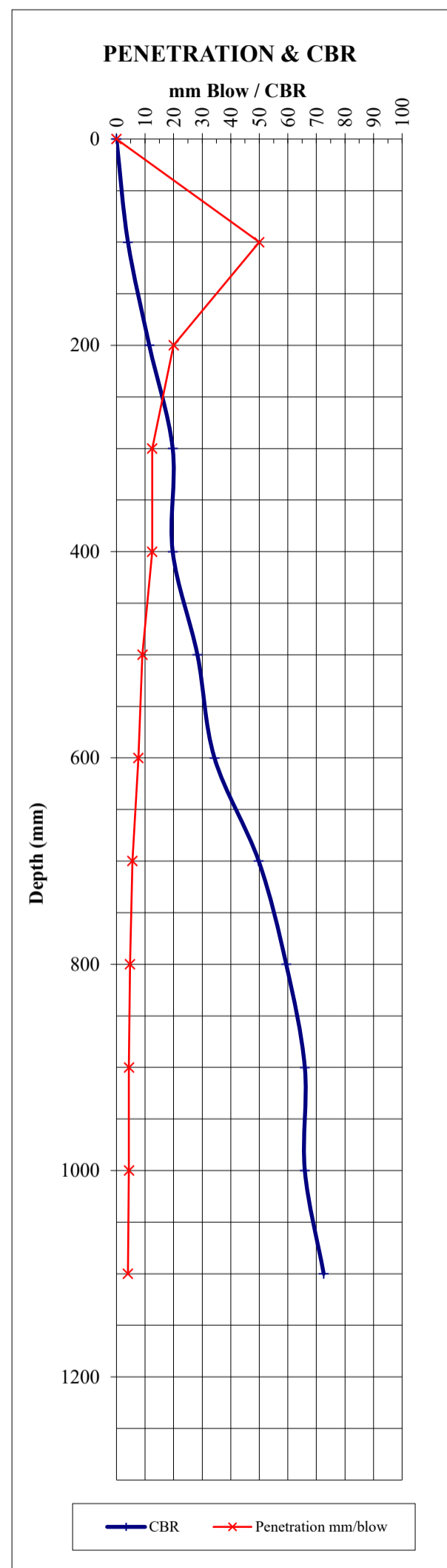
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	5	8	200	20.0	11.5
4	300	4	12	300	25.0	8.9
5	400	5	17	400	20.0	11.5
6	500	8	25	500	12.5	19.7
7	600	8	33	600	12.5	19.7
8	700	10	43	700	10.0	25.4
9	800	9	52	800	11.1	22.5
10	900	10	62	900	10.0	25.4
11	1000	12	74	1000	8.3	31.3
12	1100	12	86	1100	8.3	31.3
13	1200	12	98	1200	8.3	31.3
14	1300	13	111	1300	7.7	34.3
15	1400	13	124	1400	7.7	34.3
16	1500	14	138	1500	7.1	37.4
17	1600	15	153	1600	6.7	40.4
18	1700	15	168	1700	6.7	40.4
19	1800	16	184	1800	6.3	43.5
20	1900	16	200	1900	6.3	43.5
21	2000	16	216	2000	6.3	43.5
22	2100	16	232	2100	6.3	43.5
23	2200	18	250	2200	5.6	49.8
24	2300	18	268	2300	5.6	49.8
25	2400	18	286	2400	5.6	49.8
26	2500	18	304	2500	5.6	49.8
27	2600	18	322	2600	5.6	49.8
28	2700	17	339	2700	5.9	46.7
29	2800	18	357	2800	5.6	49.8
30	2900	18	375	2900	5.6	49.8
31	3000					
32	3100					
33	3200					
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35	3400					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP13**
 Date : **July 2019**



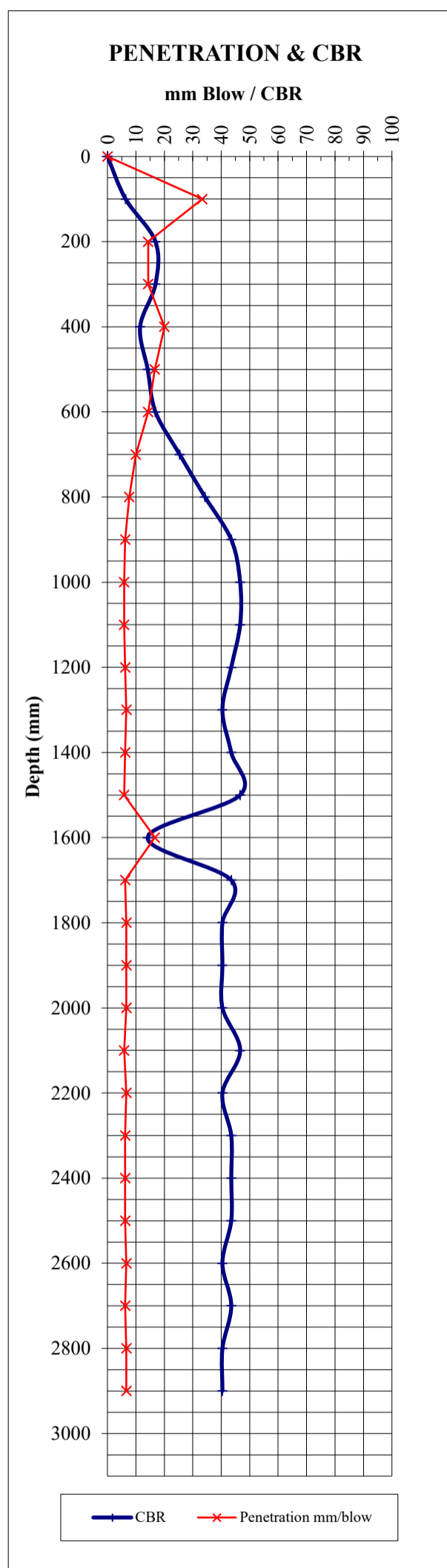
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	5	7	200	20.0	11.5
4	300	8	15	300	12.5	19.7
5	400	8	23	400	12.5	19.7
6	500	11	34	500	9.1	28.3
7	600	13	47	600	7.7	34.3
8	700	18	65	700	5.6	49.8
9	800	21	86	800	4.8	59.4
10	900	23	109	900	4.3	65.9
11	1000	23	132	1000	4.3	65.9
12	1100	25	157	1100	4.0	72.6
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
23	2200					
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26	2500					
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28	2700					
29	2800					
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39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
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51	5000					
52	5100					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP14**
 Date : **July 2019**



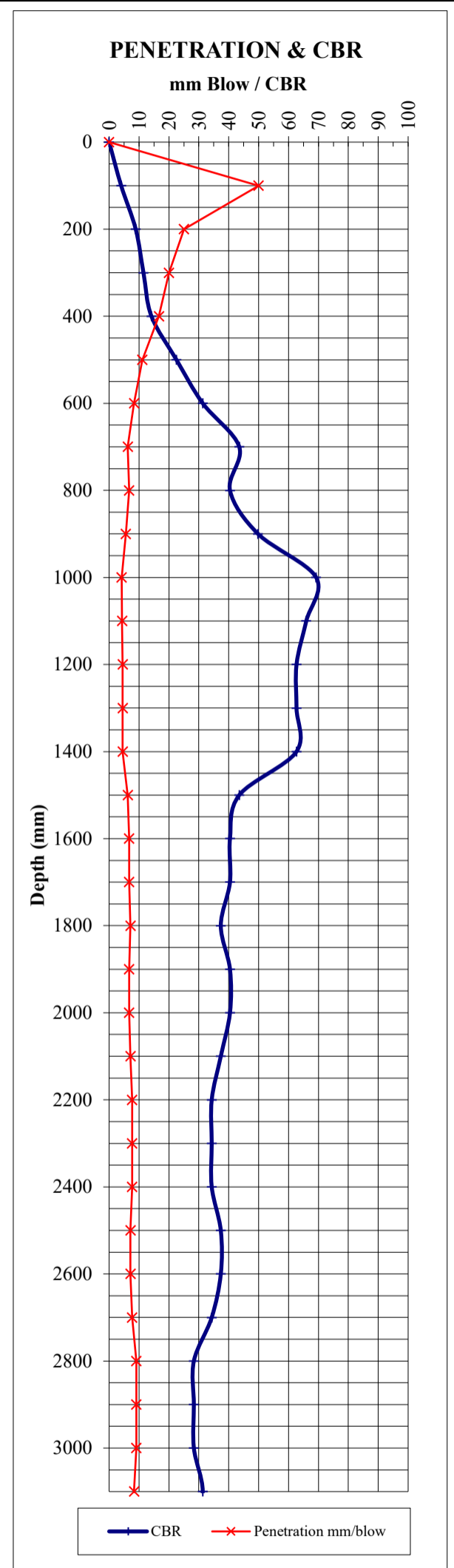
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	7	10	200	14.3	16.9
4	300	7	17	300	14.3	16.9
5	400	5	22	400	20.0	11.5
6	500	6	28	500	16.7	14.2
7	600	7	35	600	14.3	16.9
8	700	10	45	700	10.0	25.4
9	800	13	58	800	7.7	34.3
10	900	16	74	900	6.3	43.5
11	1000	17	91	1000	5.9	46.7
12	1100	17	108	1100	5.9	46.7
13	1200	16	124	1200	6.3	43.5
14	1300	15	139	1300	6.7	40.4
15	1400	16	155	1400	6.3	43.5
16	1500	17	172	1500	5.9	46.7
17	1600	6	178	1600	16.7	14.2
18	1700	16	194	1700	6.3	43.5
19	1800	15	209	1800	6.7	40.4
20	1900	15	224	1900	6.7	40.4
21	2000	15	239	2000	6.7	40.4
22	2100	17	256	2100	5.9	46.7
23	2200	15	271	2200	6.7	40.4
24	2300	16	287	2300	6.3	43.5
25	2400	16	303	2400	6.3	43.5
26	2500	16	319	2500	6.3	43.5
27	2600	15	334	2600	6.7	40.4
28	2700	16	350	2700	6.3	43.5
29	2800	15	365	2800	6.7	40.4
30	2900	15	380	2900	6.7	40.4
31	3000					
32	3100					
33	3200					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP17**
 Date : **July 2019**



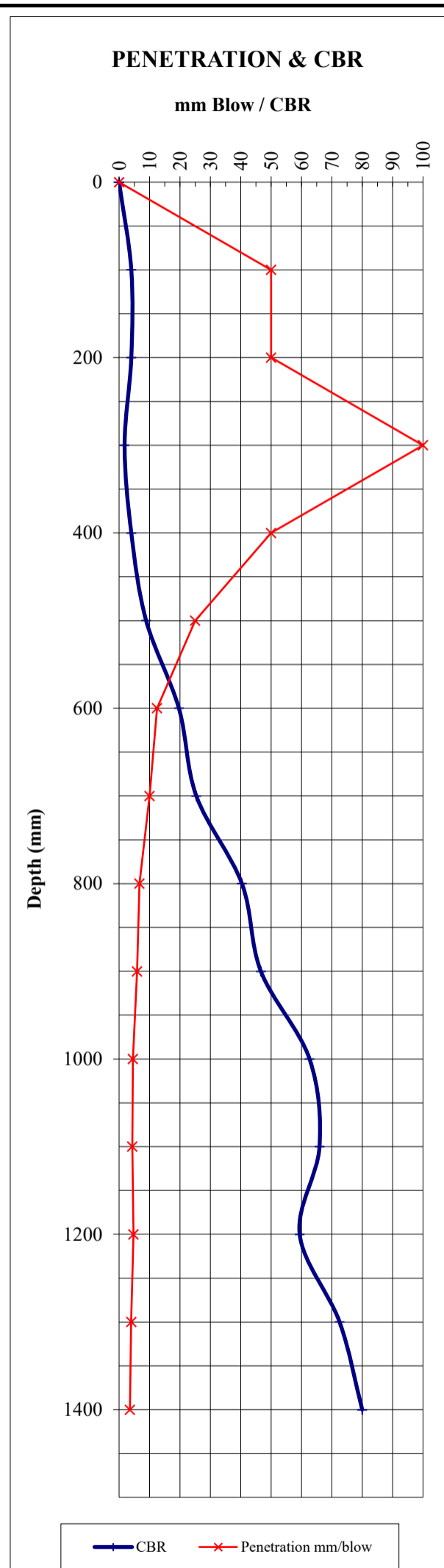
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	4	6	200	25.0	8.9
4	300	5	11	300	20.0	11.5
5	400	6	17	400	16.7	14.2
6	500	9	26	500	11.1	22.5
7	600	12	38	600	8.3	31.3
8	700	16	54	700	6.3	43.5
9	800	15	69	800	6.7	40.4
10	900	18	87	900	5.6	49.8
11	1000	24	111	1000	4.2	69.2
12	1100	23	134	1100	4.3	65.9
13	1200	22	156	1200	4.5	62.7
14	1300	22	178	1300	4.5	62.7
15	1400	22	200	1400	4.5	62.7
16	1500	16	216	1500	6.3	43.5
17	1600	15	231	1600	6.7	40.4
18	1700	15	246	1700	6.7	40.4
19	1800	14	260	1800	7.1	37.4
20	1900	15	275	1900	6.7	40.4
21	2000	15	290	2000	6.7	40.4
22	2100	14	304	2100	7.1	37.4
23	2200	13	317	2200	7.7	34.3
24	2300	13	330	2300	7.7	34.3
25	2400	13	343	2400	7.7	34.3
26	2500	14	357	2500	7.1	37.4
27	2600	14	371	2600	7.1	37.4
28	2700	13	384	2700	7.7	34.3
29	2800	11	395	2800	9.1	28.3
30	2900	11	406	2900	9.1	28.3
31	3000	11	417	3000	9.1	28.3
32	3100	12	429	3100	8.3	31.3
33	3200	11	440	3200	9.1	28.3
34	3300	13	453	3300	7.7	34.3
35	3400	14	467	3400	7.1	37.4
36	3500	12	479	3500	8.3	31.3
37	3600	12	491	3600	8.3	31.3
38	3700	12	503	3700	8.3	31.3
39	3800	12	515	3800	8.3	31.3
40	3900	12	527	3900	8.3	31.3
41	4000	11	538	4000	9.1	28.3
42	4100	11	549	4100	9.1	28.3
43	4200	10	559	4200	10.0	25.4
44	4300	9	568	4300	11.1	22.5
45	4400	10	578	4400	10.0	25.4
46	4500	12	590	4500	8.3	31.3
47	4600	25	615	4600	4.0	72.6
48	4700					
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51	5000					
52	5100					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP18**
 Date : **July 2019**



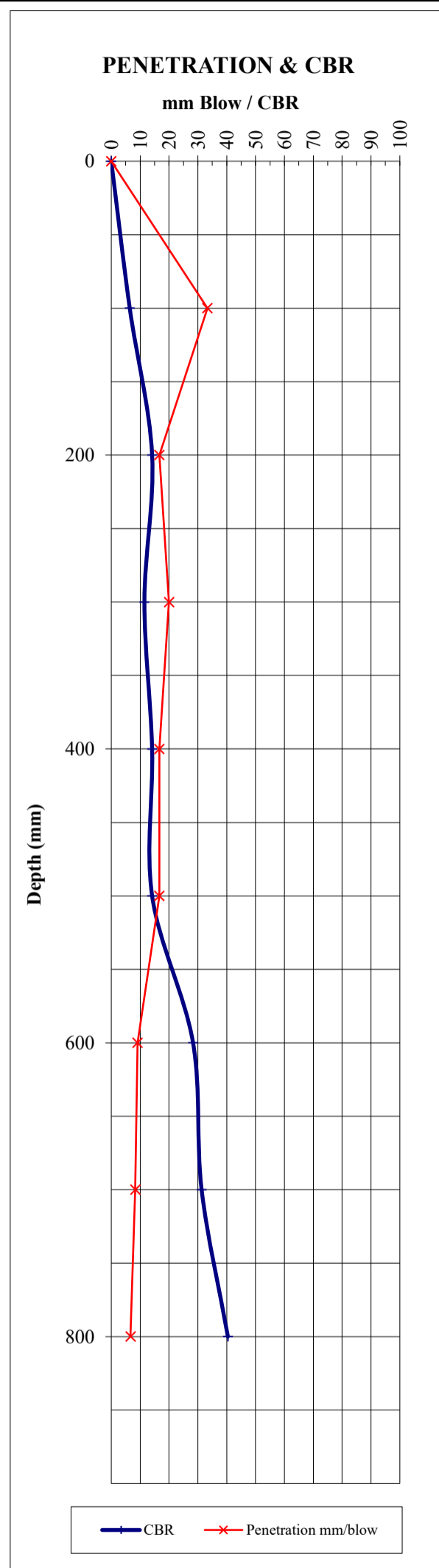
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	2	4	200	50.0	4.0
4	300	1	5	300	100.0	1.8
5	400	2	7	400	50.0	4.0
6	500	4	11	500	25.0	8.9
7	600	8	19	600	12.5	19.7
8	700	10	29	700	10.0	25.4
9	800	15	44	800	6.7	40.4
10	900	17	61	900	5.9	46.7
11	1000	22	83	1000	4.5	62.7
12	1100	23	106	1100	4.3	65.9
13	1200	21	127	1200	4.8	59.4
14	1300	25	152	1300	4.0	72.6
15	1400	28	180	1400	3.6	80.0
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP19**
 Date : **September 2018**



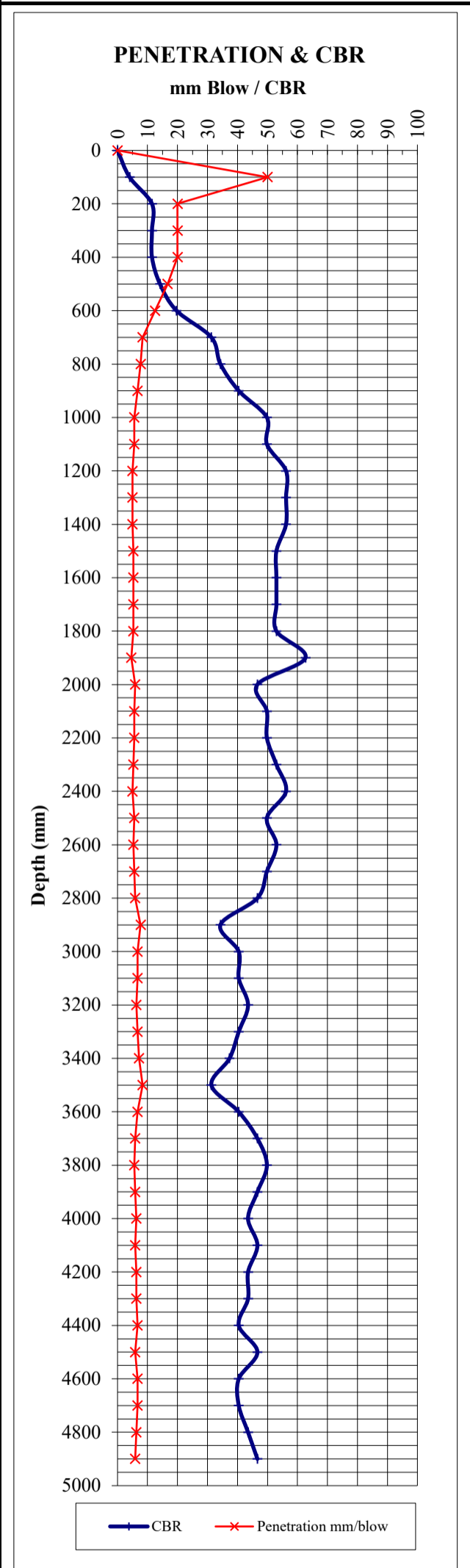
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	6	9	200	16.7	14.2
4	300	5	14	300	20.0	11.5
5	400	6	20	400	16.7	14.2
6	500	6	26	500	16.7	14.2
7	600	11	37	600	9.1	28.3
8	700	12	49	700	8.3	31.3
9	800	15	64	800	6.7	40.4
10	900	16	80	900	6.3	43.5
11	1000	19	99	1000	5.3	53.0
12	1100	19	118	1100	5.3	53.0
13	1200	20	138	1200	5.0	56.2
14	1300	20	158	1300	5.0	56.2
15	1400	24	182	1400	4.2	69.2
16	1500	26	208	1500	3.8	75.9
17	1600	23	231	1600	4.3	65.9
18	1700	21	252	1700	4.8	59.4
19	1800	22	274	1800	4.5	62.7
20	1900	21	295	1900	4.8	59.4
21	2000	21	316	2000	4.8	59.4
22	2100	21	337	2100	4.8	59.4
23	2200	21	358	2200	4.8	59.4
24	2300	20	378	2300	5.0	56.2
25	2400	18	396	2400	5.6	49.8
26	2500	18	414	2500	5.6	49.8
27	2600	19	433	2600	5.3	53.0
28	2700	18	451	2700	5.6	49.8
29	2800	17	468	2800	5.9	46.7
30	2900	18	486	2900	5.6	49.8
31	3000	20	506	3000	5.0	56.2
32	3100	21	527	3100	4.8	59.4
33	3200	21	548	3200	4.8	59.4
34	3300	26	574	3300	3.8	75.9
35	3400	19	593	3400	5.3	53.0
36	3500	18	611	3500	5.6	49.8
37	3600	17	628	3600	5.9	46.7
38	3700	20	648	3700	5.0	56.2
39	3800	20	668	3800	5.0	56.2
40	3900	20	688	3900	5.0	56.2
41	4000	18	706	4000	5.6	49.8
42	4100	20	726	4100	5.0	56.2
43	4200	22	748	4200	4.5	62.7
44	4300	22	770	4300	4.5	62.7
45	4400	21	791	4400	4.8	59.4
46	4500	19	810	4500	5.3	53.0
47	4600	21	831	4600	4.8	59.4
48	4700	19	850	4700	5.3	53.0
49	4800	20	870	4800	5.0	56.2
50	4900	21	891	4900	4.8	59.4
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP20**
 Date : **July 2019**



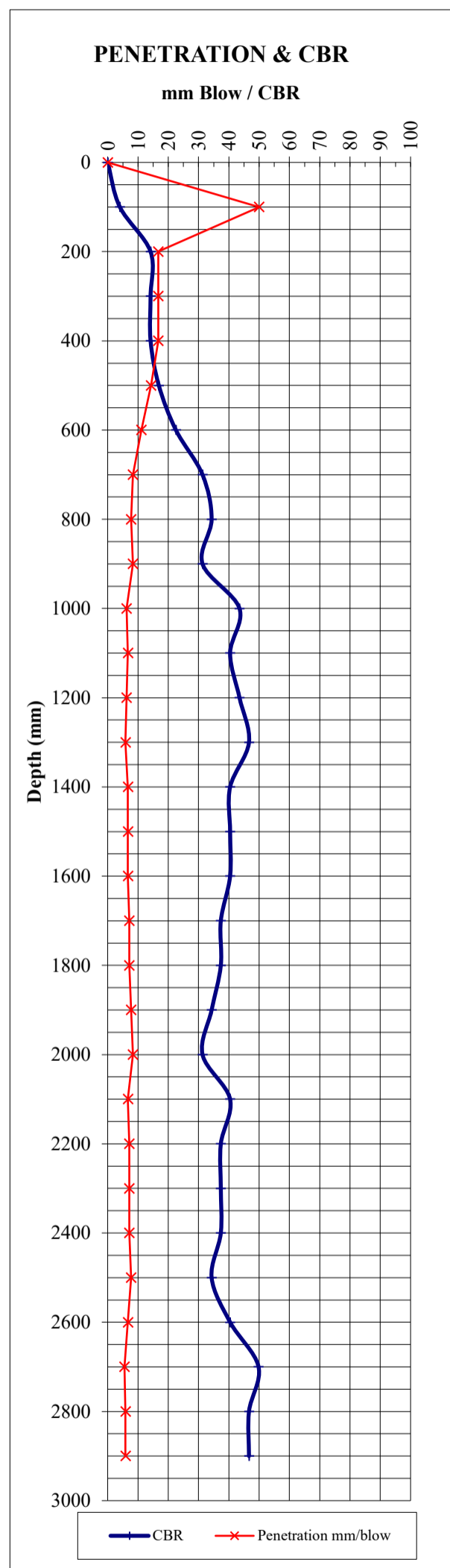
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	5	7	200	20.0	11.5
4	300	5	12	300	20.0	11.5
5	400	5	17	400	20.0	11.5
6	500	6	23	500	16.7	14.2
7	600	8	31	600	12.5	19.7
8	700	12	43	700	8.3	31.3
9	800	13	56	800	7.7	34.3
10	900	15	71	900	6.7	40.4
11	1000	18	89	1000	5.6	49.8
12	1100	18	107	1100	5.6	49.8
13	1200	20	127	1200	5.0	56.2
14	1300	20	147	1300	5.0	56.2
15	1400	20	167	1400	5.0	56.2
16	1500	19	186	1500	5.3	53.0
17	1600	19	205	1600	5.3	53.0
18	1700	19	224	1700	5.3	53.0
19	1800	19	243	1800	5.3	53.0
20	1900	22	265	1900	4.5	62.7
21	2000	17	282	2000	5.9	46.7
22	2100	18	300	2100	5.6	49.8
23	2200	18	318	2200	5.6	49.8
24	2300	19	337	2300	5.3	53.0
25	2400	20	357	2400	5.0	56.2
26	2500	18	375	2500	5.6	49.8
27	2600	19	394	2600	5.3	53.0
28	2700	18	412	2700	5.6	49.8
29	2800	17	429	2800	5.9	46.7
30	2900	13	442	2900	7.7	34.3
31	3000	15	457	3000	6.7	40.4
32	3100	15	472	3100	6.7	40.4
33	3200	16	488	3200	6.3	43.5
34	3300	15	503	3300	6.7	40.4
35	3400	14	517	3400	7.1	37.4
36	3500	12	529	3500	8.3	31.3
37	3600	15	544	3600	6.7	40.4
38	3700	17	561	3700	5.9	46.7
39	3800	18	579	3800	5.6	49.8
40	3900	17	596	3900	5.9	46.7
41	4000	16	612	4000	6.3	43.5
42	4100	17	629	4100	5.9	46.7
43	4200	16	645	4200	6.3	43.5
44	4300	16	661	4300	6.3	43.5
45	4400	15	676	4400	6.7	40.4
46	4500	17	693	4500	5.9	46.7
47	4600	15	708	4600	6.7	40.4
48	4700	15	723	4700	6.7	40.4
49	4800	16	739	4800	6.3	43.5
50	4900	17	756	4900	5.9	46.7
51	5000					
52	5100					
53	5200					
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61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP21**
 Date : **July 2019**



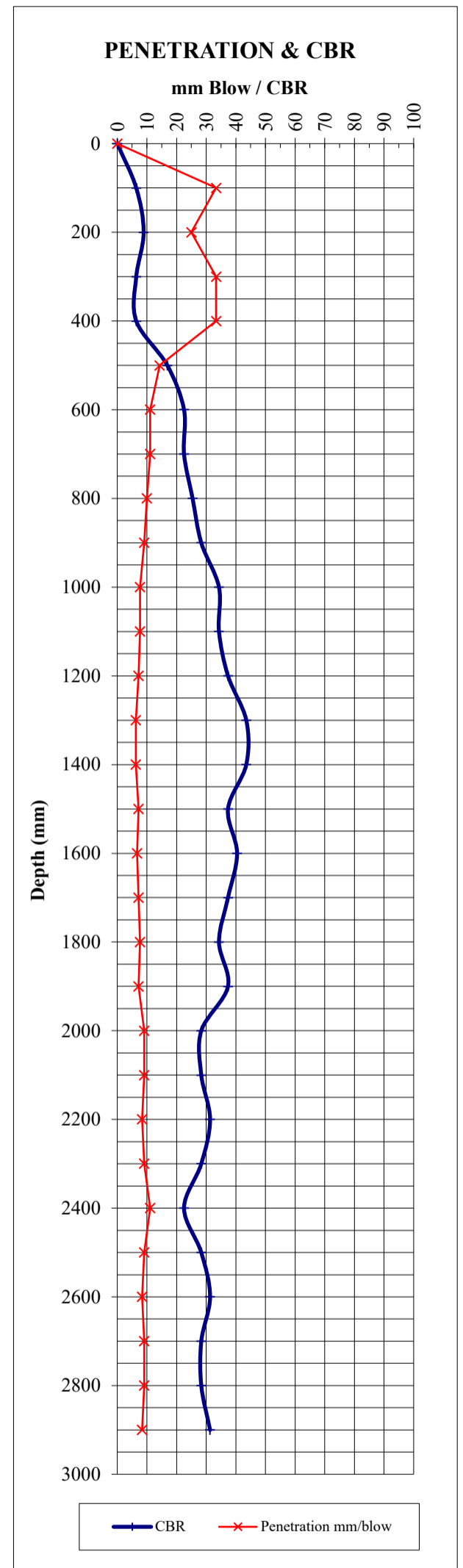
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	6	8	200	16.7	14.2
4	300	6	14	300	16.7	14.2
5	400	6	20	400	16.7	14.2
6	500	7	27	500	14.3	16.9
7	600	9	36	600	11.1	22.5
8	700	12	48	700	8.3	31.3
9	800	13	61	800	7.7	34.3
10	900	12	73	900	8.3	31.3
11	1000	16	89	1000	6.3	43.5
12	1100	15	104	1100	6.7	40.4
13	1200	16	120	1200	6.3	43.5
14	1300	17	137	1300	5.9	46.7
15	1400	15	152	1400	6.7	40.4
16	1500	15	167	1500	6.7	40.4
17	1600	15	182	1600	6.7	40.4
18	1700	14	196	1700	7.1	37.4
19	1800	14	210	1800	7.1	37.4
20	1900	13	223	1900	7.7	34.3
21	2000	12	235	2000	8.3	31.3
22	2100	15	250	2100	6.7	40.4
23	2200	14	264	2200	7.1	37.4
24	2300	14	278	2300	7.1	37.4
25	2400	14	292	2400	7.1	37.4
26	2500	13	305	2500	7.7	34.3
27	2600	15	320	2600	6.7	40.4
28	2700	18	338	2700	5.6	49.8
29	2800	17	355	2800	5.9	46.7
30	2900	17	372	2900	5.9	46.7
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
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52	5100					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP22**
 Date : **July 2019**



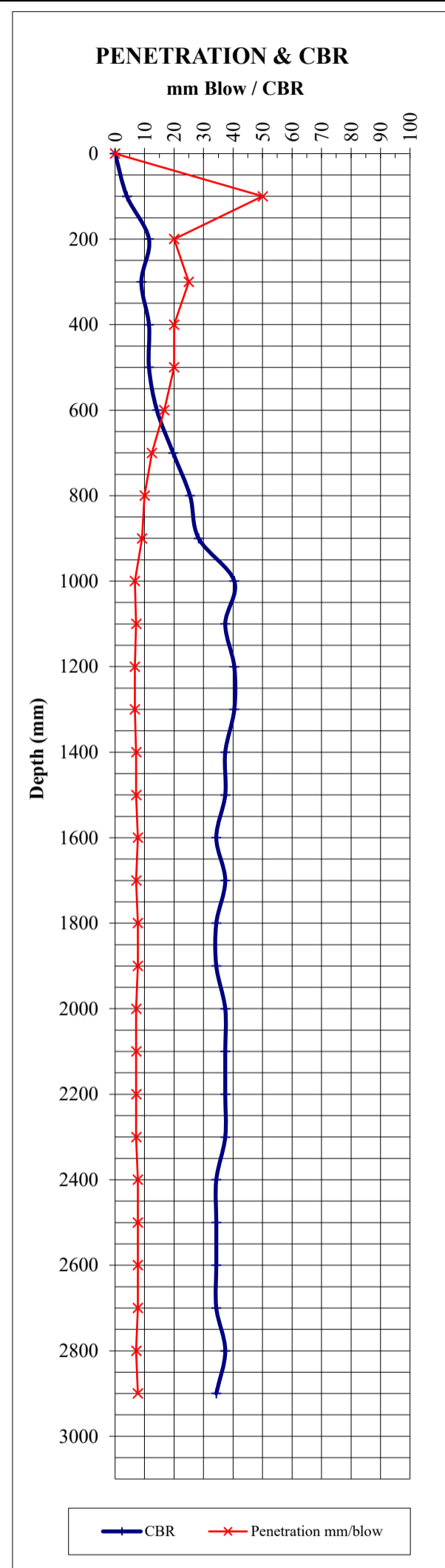
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	4	7	200	25.0	8.9
4	300	3	10	300	33.3	6.4
5	400	3	13	400	33.3	6.4
6	500	7	20	500	14.3	16.9
7	600	9	29	600	11.1	22.5
8	700	9	38	700	11.1	22.5
9	800	10	48	800	10.0	25.4
10	900	11	59	900	9.1	28.3
11	1000	13	72	1000	7.7	34.3
12	1100	13	85	1100	7.7	34.3
13	1200	14	99	1200	7.1	37.4
14	1300	16	115	1300	6.3	43.5
15	1400	16	131	1400	6.3	43.5
16	1500	14	145	1500	7.1	37.4
17	1600	15	160	1600	6.7	40.4
18	1700	14	174	1700	7.1	37.4
19	1800	13	187	1800	7.7	34.3
20	1900	14	201	1900	7.1	37.4
21	2000	11	212	2000	9.1	28.3
22	2100	11	223	2100	9.1	28.3
23	2200	12	235	2200	8.3	31.3
24	2300	11	246	2300	9.1	28.3
25	2400	9	255	2400	11.1	22.5
26	2500	11	266	2500	9.1	28.3
27	2600	12	278	2600	8.3	31.3
28	2700	11	289	2700	9.1	28.3
29	2800	11	300	2800	9.1	28.3
30	2900	12	312	2900	8.3	31.3
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
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51	5000					
52	5100					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP23**
 Date : **July 2019**



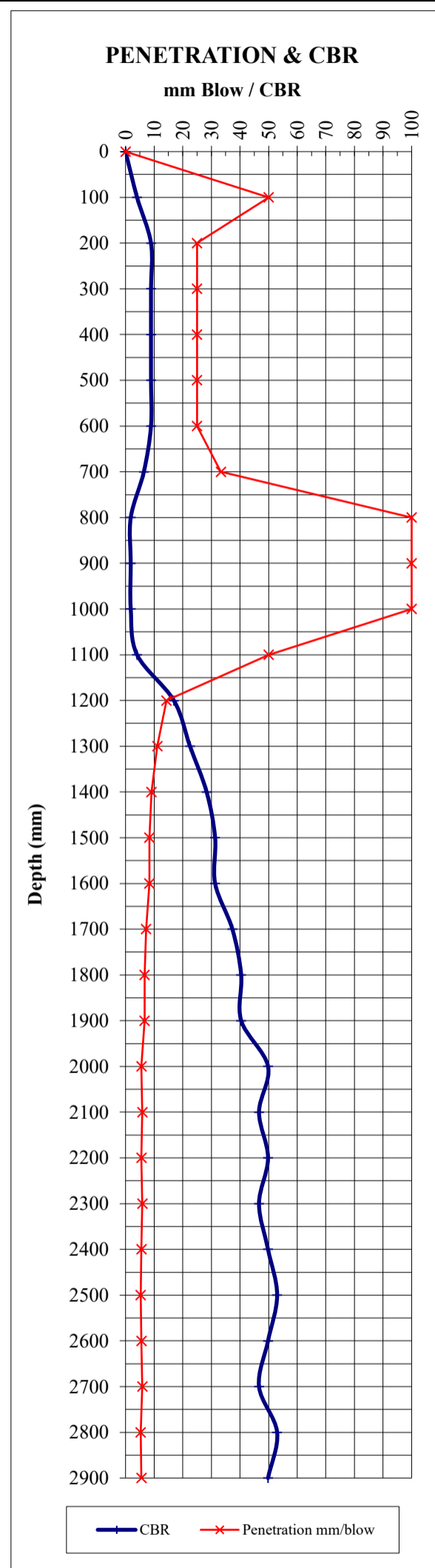
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	5	7	200	20.0	11.5
4	300	4	11	300	25.0	8.9
5	400	5	16	400	20.0	11.5
6	500	5	21	500	20.0	11.5
7	600	6	27	600	16.7	14.2
8	700	8	35	700	12.5	19.7
9	800	10	45	800	10.0	25.4
10	900	11	56	900	9.1	28.3
11	1000	15	71	1000	6.7	40.4
12	1100	14	85	1100	7.1	37.4
13	1200	15	100	1200	6.7	40.4
14	1300	15	115	1300	6.7	40.4
15	1400	14	129	1400	7.1	37.4
16	1500	14	143	1500	7.1	37.4
17	1600	13	156	1600	7.7	34.3
18	1700	14	170	1700	7.1	37.4
19	1800	13	183	1800	7.7	34.3
20	1900	13	196	1900	7.7	34.3
21	2000	14	210	2000	7.1	37.4
22	2100	14	224	2100	7.1	37.4
23	2200	14	238	2200	7.1	37.4
24	2300	14	252	2300	7.1	37.4
25	2400	13	265	2400	7.7	34.3
26	2500	13	278	2500	7.7	34.3
27	2600	13	291	2600	7.7	34.3
28	2700	13	304	2700	7.7	34.3
29	2800	14	318	2800	7.1	37.4
30	2900	13	331	2900	7.7	34.3
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
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50	4900					
51	5000					
52	5100					
53	5200					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP24**
 Date : **July 2019**



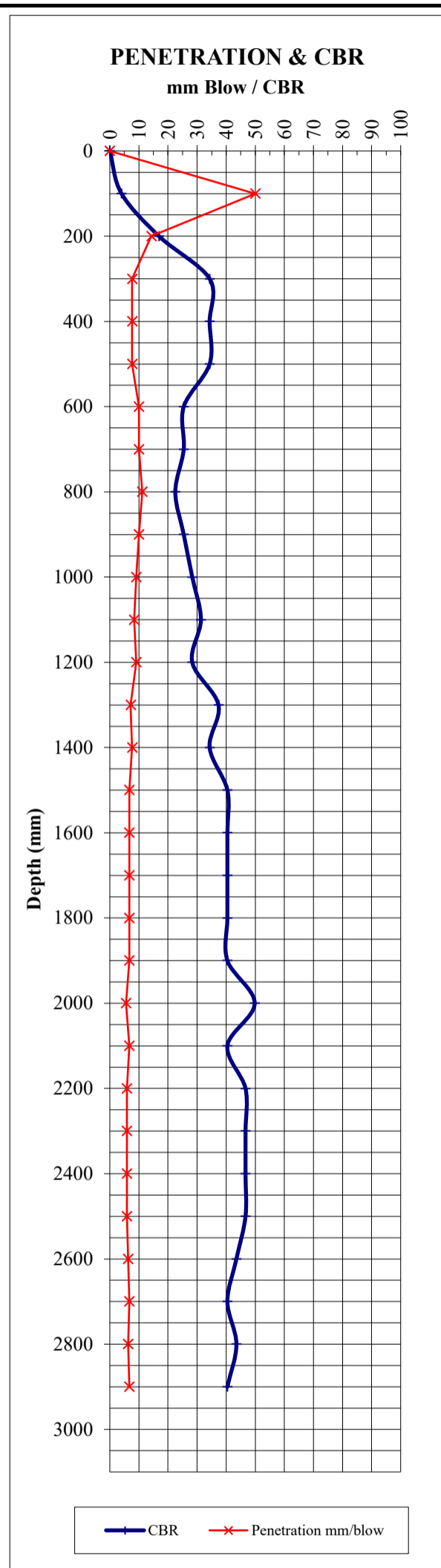
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	4	6	200	25.0	8.9
4	300	4	10	300	25.0	8.9
5	400	4	14	400	25.0	8.9
6	500	4	18	500	25.0	8.9
7	600	4	22	600	25.0	8.9
8	700	3	25	700	33.3	6.4
9	800	1	26	800	100.0	1.8
10	900	1	27	900	100.0	1.8
11	1000	1	28	1000	100.0	1.8
12	1100	2	30	1100	50.0	4.0
13	1200	7	37	1200	14.3	16.9
14	1300	9	46	1300	11.1	22.5
15	1400	11	57	1400	9.1	28.3
16	1500	12	69	1500	8.3	31.3
17	1600	12	81	1600	8.3	31.3
18	1700	14	95	1700	7.1	37.4
19	1800	15	110	1800	6.7	40.4
20	1900	15	125	1900	6.7	40.4
21	2000	18	143	2000	5.6	49.8
22	2100	17	160	2100	5.9	46.7
23	2200	18	178	2200	5.6	49.8
24	2300	17	195	2300	5.9	46.7
25	2400	18	213	2400	5.6	49.8
26	2500	19	232	2500	5.3	53.0
27	2600	18	250	2600	5.6	49.8
28	2700	17	267	2700	5.9	46.7
29	2800	19	286	2800	5.3	53.0
30	2900	18	304	2900	5.6	49.8
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
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41	4000					
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Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP25**
 Date : **July 2019**



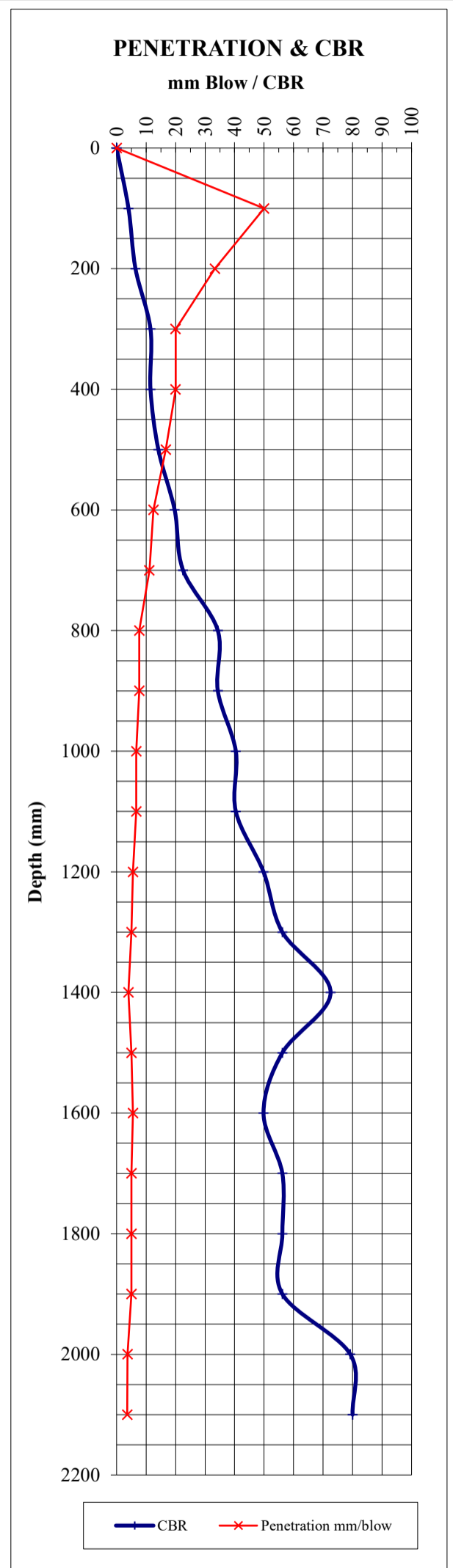
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	7	9	200	14.3	16.9
4	300	13	22	300	7.7	34.3
5	400	13	35	400	7.7	34.3
6	500	13	48	500	7.7	34.3
7	600	10	58	600	10.0	25.4
8	700	10	68	700	10.0	25.4
9	800	9	77	800	11.1	22.5
10	900	10	87	900	10.0	25.4
11	1000	11	98	1000	9.1	28.3
12	1100	12	110	1100	8.3	31.3
13	1200	11	121	1200	9.1	28.3
14	1300	14	135	1300	7.1	37.4
15	1400	13	148	1400	7.7	34.3
16	1500	15	163	1500	6.7	40.4
17	1600	15	178	1600	6.7	40.4
18	1700	15	193	1700	6.7	40.4
19	1800	15	208	1800	6.7	40.4
20	1900	15	223	1900	6.7	40.4
21	2000	18	241	2000	5.6	49.8
22	2100	15	256	2100	6.7	40.4
23	2200	17	273	2200	5.9	46.7
24	2300	17	290	2300	5.9	46.7
25	2400	17	307	2400	5.9	46.7
26	2500	17	324	2500	5.9	46.7
27	2600	16	340	2600	6.3	43.5
28	2700	15	355	2700	6.7	40.4
29	2800	16	371	2800	6.3	43.5
30	2900	15	386	2900	6.7	40.4
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
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41	4000					
42	4100					
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61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP26**
 Date : **July 2019**



Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	3	5	200	33.3	6.4
4	300	5	10	300	20.0	11.5
5	400	5	15	400	20.0	11.5
6	500	6	21	500	16.7	14.2
7	600	8	29	600	12.5	19.7
8	700	9	38	700	11.1	22.5
9	800	13	51	800	7.7	34.3
10	900	13	64	900	7.7	34.3
11	1000	15	79	1000	6.7	40.4
12	1100	15	94	1100	6.7	40.4
13	1200	18	112	1200	5.6	49.8
14	1300	20	132	1300	5.0	56.2
15	1400	25	157	1400	4.0	72.6
16	1500	20	177	1500	5.0	56.2
17	1600	18	195	1600	5.6	49.8
18	1700	20	215	1700	5.0	56.2
19	1800	20	235	1800	5.0	56.2
20	1900	20	255	1900	5.0	56.2
21	2000	27	282	2000	3.7	79.2
22	2100	28	310	2100	3.6	80.0
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
30	2900					
31	3000					
32	3100					
33	3200					
34	3300					
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41	4000					
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51	5000					
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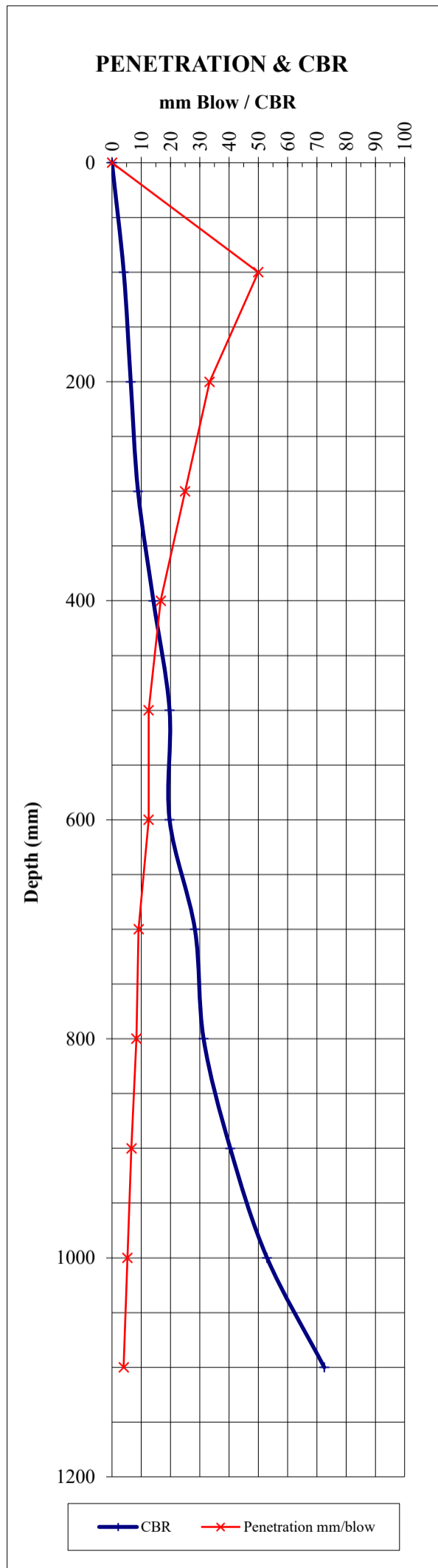


Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**

Test No: **GL-DCP27**
 Date : **July 2019**



Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	3	5	200	33.3	6.4
4	300	4	9	300	25.0	8.9
5	400	6	15	400	16.7	14.2
6	500	8	23	500	12.5	19.7
7	600	8	31	600	12.5	19.7
8	700	11	42	700	9.1	28.3
9	800	12	54	800	8.3	31.3
10	900	15	69	900	6.7	40.4
11	1000	19	88	1000	5.3	53.0
12	1100	25	113	1100	4.0	72.6
13	1200					
14	1300					
15	1400					
16	1500					
17	1600					
18	1700					
19	1800					
20	1900					
21	2000					
22	2100					
23	2200					
24	2300					
25	2400					
26	2500					
27	2600					
28	2700					
29	2800					
30	2900					
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
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51	5000					
52	5100					
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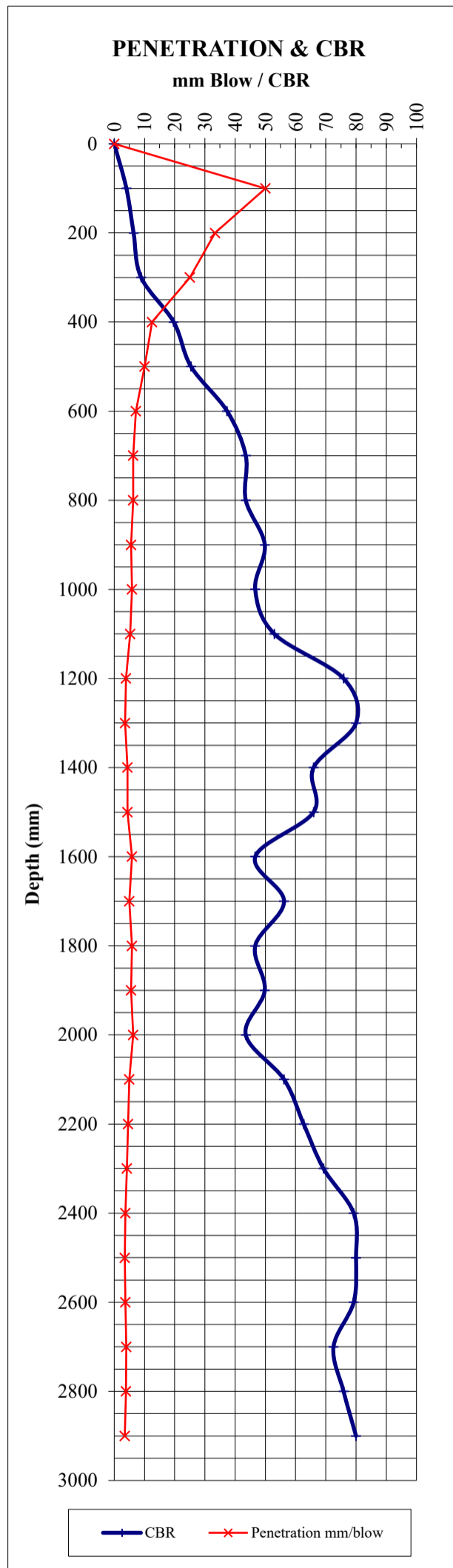


Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**



Test No: **GL-DCP28**
 Date : **July 2019**

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	3	5	200	33.3	6.4
4	300	4	9	300	25.0	8.9
5	400	8	17	400	12.5	19.7
6	500	10	27	500	10.0	25.4
7	600	14	41	600	7.1	37.4
8	700	16	57	700	6.3	43.5
9	800	16	73	800	6.3	43.5
10	900	18	91	900	5.6	49.8
11	1000	17	108	1000	5.9	46.7
12	1100	19	127	1100	5.3	53.0
13	1200	26	153	1200	3.8	75.9
14	1300	28	181	1300	3.6	80.0
15	1400	23	204	1400	4.3	65.9
16	1500	23	227	1500	4.3	65.9
17	1600	17	244	1600	5.9	46.7
18	1700	20	264	1700	5.0	56.2
19	1800	17	281	1800	5.9	46.7
20	1900	18	299	1900	5.6	49.8
21	2000	16	315	2000	6.3	43.5
22	2100	20	335	2100	5.0	56.2
23	2200	22	357	2200	4.5	62.7
24	2300	24	381	2300	4.2	69.2
25	2400	27	408	2400	3.7	79.2
26	2500	29	437	2500	3.4	80.0
27	2600	27	464	2600	3.7	79.2
28	2700	25	489	2700	4.0	72.6
29	2800	26	515	2800	3.8	75.9
30	2900	29	544	2900	3.4	80.0
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
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55	5400					
56	5500					
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58	5700					
59	5800					
60	5900					
61	6000					

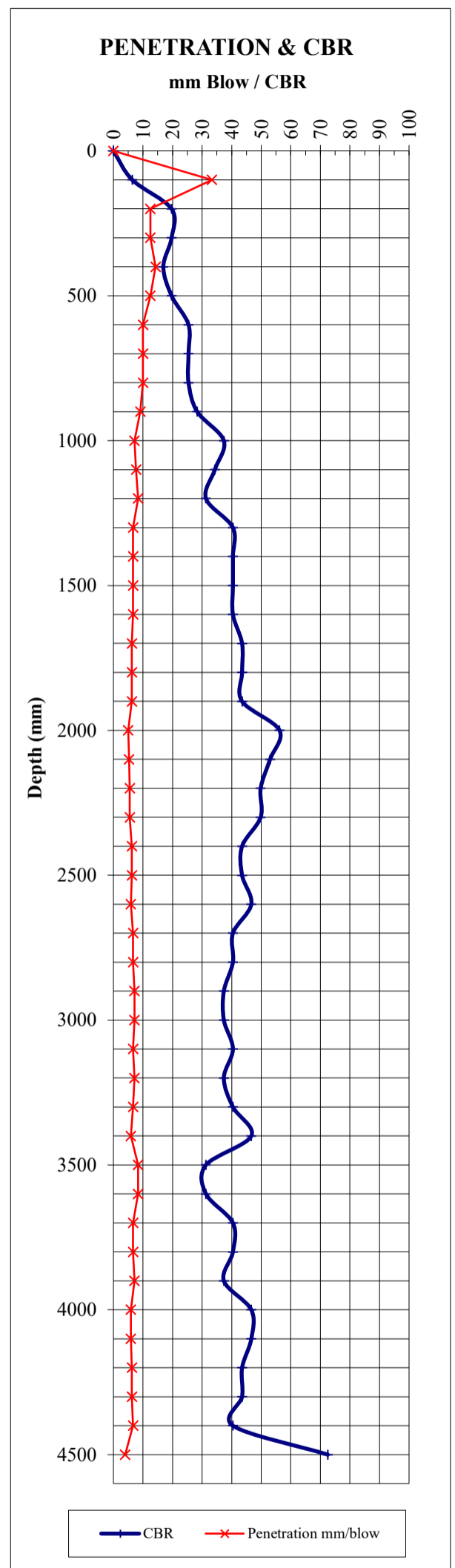


Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**



Test No: **GL-DCP29**
 Date : **July 2019**

Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	3	3	100	33.3	6.4
3	200	8	11	200	12.5	19.7
4	300	8	19	300	12.5	19.7
5	400	7	26	400	14.3	16.9
6	500	8	34	500	12.5	19.7
7	600	10	44	600	10.0	25.4
8	700	10	54	700	10.0	25.4
9	800	10	64	800	10.0	25.4
10	900	11	75	900	9.1	28.3
11	1000	14	89	1000	7.1	37.4
12	1100	13	102	1100	7.7	34.3
13	1200	12	114	1200	8.3	31.3
14	1300	15	129	1300	6.7	40.4
15	1400	15	144	1400	6.7	40.4
16	1500	15	159	1500	6.7	40.4
17	1600	15	174	1600	6.7	40.4
18	1700	16	190	1700	6.3	43.5
19	1800	16	206	1800	6.3	43.5
20	1900	16	222	1900	6.3	43.5
21	2000	20	242	2000	5.0	56.2
22	2100	19	261	2100	5.3	53.0
23	2200	18	279	2200	5.6	49.8
24	2300	18	297	2300	5.6	49.8
25	2400	16	313	2400	6.3	43.5
26	2500	16	329	2500	6.3	43.5
27	2600	17	346	2600	5.9	46.7
28	2700	15	361	2700	6.7	40.4
29	2800	15	376	2800	6.7	40.4
30	2900	14	390	2900	7.1	37.4
31	3000	14	404	3000	7.1	37.4
32	3100	15	419	3100	6.7	40.4
33	3200	14	433	3200	7.1	37.4
34	3300	15	448	3300	6.7	40.4
35	3400	17	465	3400	5.9	46.7
36	3500	12	477	3500	8.3	31.3
37	3600	12	489	3600	8.3	31.3
38	3700	15	504	3700	6.7	40.4
39	3800	15	519	3800	6.7	40.4
40	3900	14	533	3900	7.1	37.4
41	4000	17	550	4000	5.9	46.7
42	4100	17	567	4100	5.9	46.7
43	4200	16	583	4200	6.3	43.5
44	4300	16	599	4300	6.3	43.5
45	4400	15	614	4400	6.7	40.4
46	4500	25	639	4500	4.0	72.6
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
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59	5800					
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61	6000					

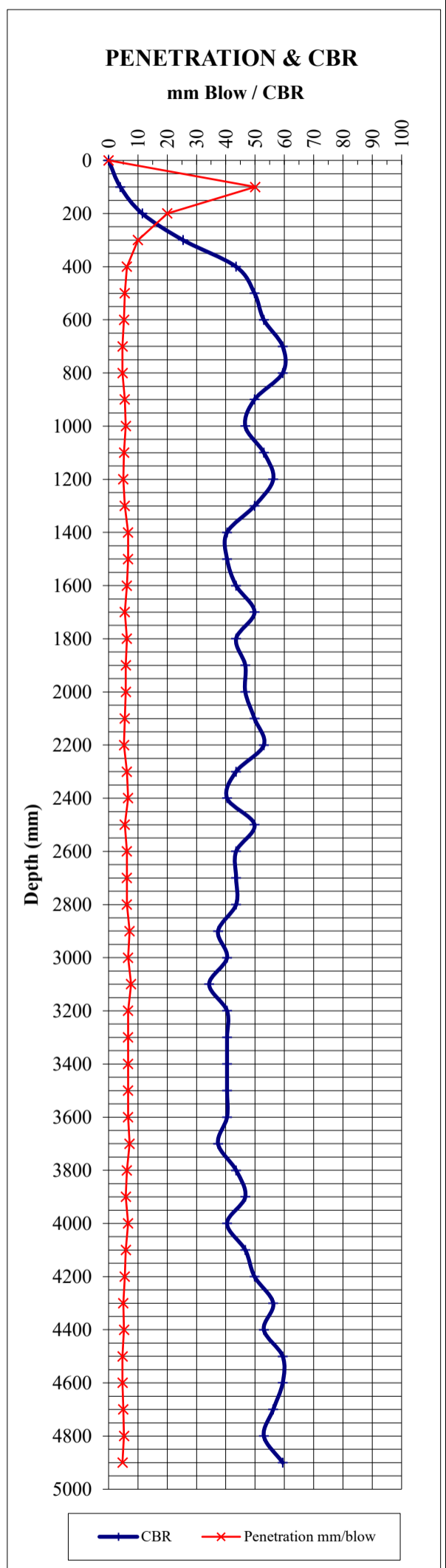


Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**



Test No: **GL-DCP30**
 Date : **July 2019**

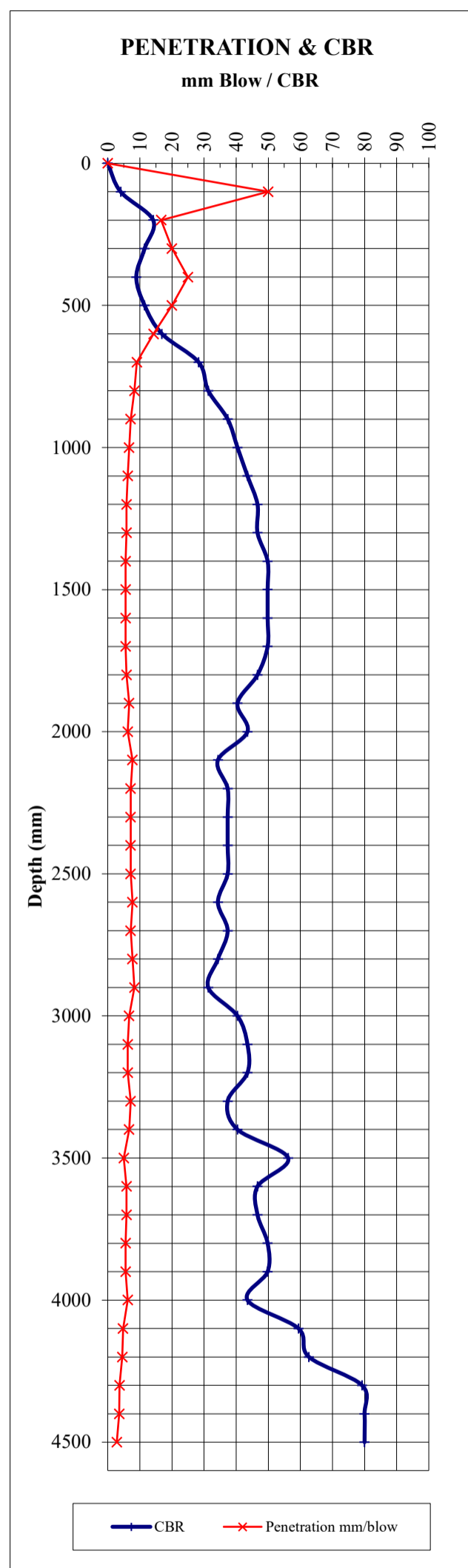
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	5	7	200	20.0	11.5
4	300	10	17	300	10.0	25.4
5	400	16	33	400	6.3	43.5
6	500	18	51	500	5.6	49.8
7	600	19	70	600	5.3	53.0
8	700	21	91	700	4.8	59.4
9	800	21	112	800	4.8	59.4
10	900	18	130	900	5.6	49.8
11	1000	17	147	1000	5.9	46.7
12	1100	19	166	1100	5.3	53.0
13	1200	20	186	1200	5.0	56.2
14	1300	18	204	1300	5.6	49.8
15	1400	15	219	1400	6.7	40.4
16	1500	15	234	1500	6.7	40.4
17	1600	16	250	1600	6.3	43.5
18	1700	18	268	1700	5.6	49.8
19	1800	16	284	1800	6.3	43.5
20	1900	17	301	1900	5.9	46.7
21	2000	17	318	2000	5.9	46.7
22	2100	18	336	2100	5.6	49.8
23	2200	19	355	2200	5.3	53.0
24	2300	16	371	2300	6.3	43.5
25	2400	15	386	2400	6.7	40.4
26	2500	18	404	2500	5.6	49.8
27	2600	16	420	2600	6.3	43.5
28	2700	16	436	2700	6.3	43.5
29	2800	16	452	2800	6.3	43.5
30	2900	14	466	2900	7.1	37.4
31	3000	15	481	3000	6.7	40.4
32	3100	13	494	3100	7.7	34.3
33	3200	15	509	3200	6.7	40.4
34	3300	15	524	3300	6.7	40.4
35	3400	15	539	3400	6.7	40.4
36	3500	15	554	3500	6.7	40.4
37	3600	15	569	3600	6.7	40.4
38	3700	14	583	3700	7.1	37.4
39	3800	16	599	3800	6.3	43.5
40	3900	17	616	3900	5.9	46.7
41	4000	15	631	4000	6.7	40.4
42	4100	17	648	4100	5.9	46.7
43	4200	18	666	4200	5.6	49.8
44	4300	20	686	4300	5.0	56.2
45	4400	19	705	4400	5.3	53.0
46	4500	21	726	4500	4.8	59.4
47	4600	21	747	4600	4.8	59.4
48	4700	20	767	4700	5.0	56.2
49	4800	19	786	4800	5.3	53.0
50	4900	21	807	4900	4.8	59.4
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP31**
 Date : **July 2019**



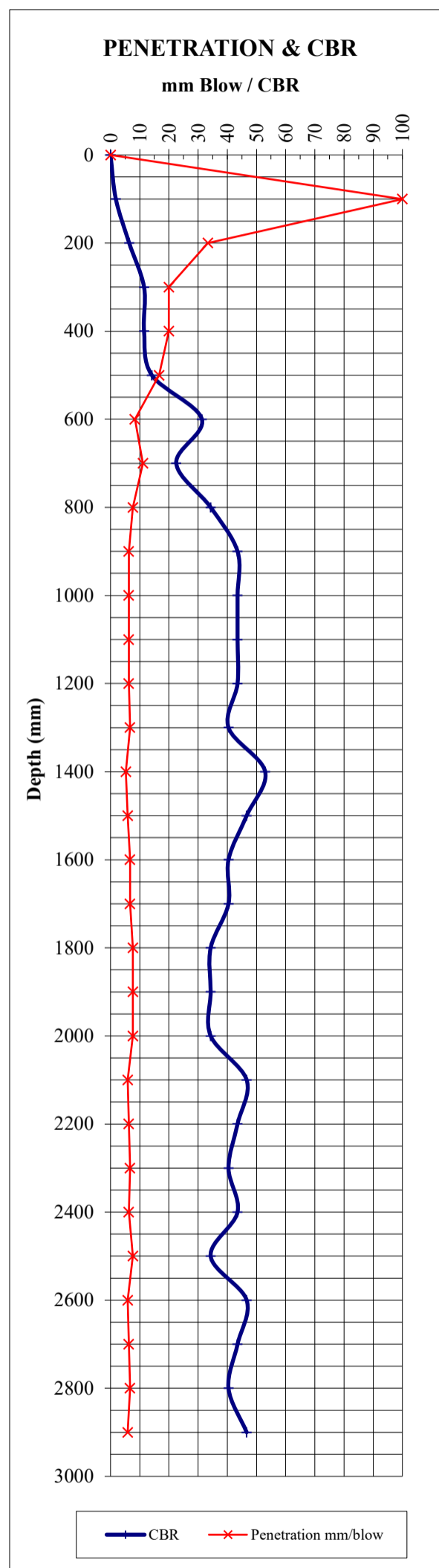
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	6	8	200	16.7	14.2
4	300	5	13	300	20.0	11.5
5	400	4	17	400	25.0	8.9
6	500	5	22	500	20.0	11.5
7	600	7	29	600	14.3	16.9
8	700	11	40	700	9.1	28.3
9	800	12	52	800	8.3	31.3
10	900	14	66	900	7.1	37.4
11	1000	15	81	1000	6.7	40.4
12	1100	16	97	1100	6.3	43.5
13	1200	17	114	1200	5.9	46.7
14	1300	17	131	1300	5.9	46.7
15	1400	18	149	1400	5.6	49.8
16	1500	18	167	1500	5.6	49.8
17	1600	18	185	1600	5.6	49.8
18	1700	18	203	1700	5.6	49.8
19	1800	17	220	1800	5.9	46.7
20	1900	15	235	1900	6.7	40.4
21	2000	16	251	2000	6.3	43.5
22	2100	13	264	2100	7.7	34.3
23	2200	14	278	2200	7.1	37.4
24	2300	14	292	2300	7.1	37.4
25	2400	14	306	2400	7.1	37.4
26	2500	14	320	2500	7.1	37.4
27	2600	13	333	2600	7.7	34.3
28	2700	14	347	2700	7.1	37.4
29	2800	13	360	2800	7.7	34.3
30	2900	12	372	2900	8.3	31.3
31	3000	15	387	3000	6.7	40.4
32	3100	16	403	3100	6.3	43.5
33	3200	16	419	3200	6.3	43.5
34	3300	14	433	3300	7.1	37.4
35	3400	15	448	3400	6.7	40.4
36	3500	20	468	3500	5.0	56.2
37	3600	17	485	3600	5.9	46.7
38	3700	17	502	3700	5.9	46.7
39	3800	18	520	3800	5.6	49.8
40	3900	18	538	3900	5.6	49.8
41	4000	16	554	4000	6.3	43.5
42	4100	21	575	4100	4.8	59.4
43	4200	22	597	4200	4.5	62.7
44	4300	27	624	4300	3.7	79.2
45	4400	28	652	4400	3.6	80.0
46	4500	35	687	4500	2.9	80.0
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
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59	5800					
60	5900					
61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP32**
 Date : **July 2019**



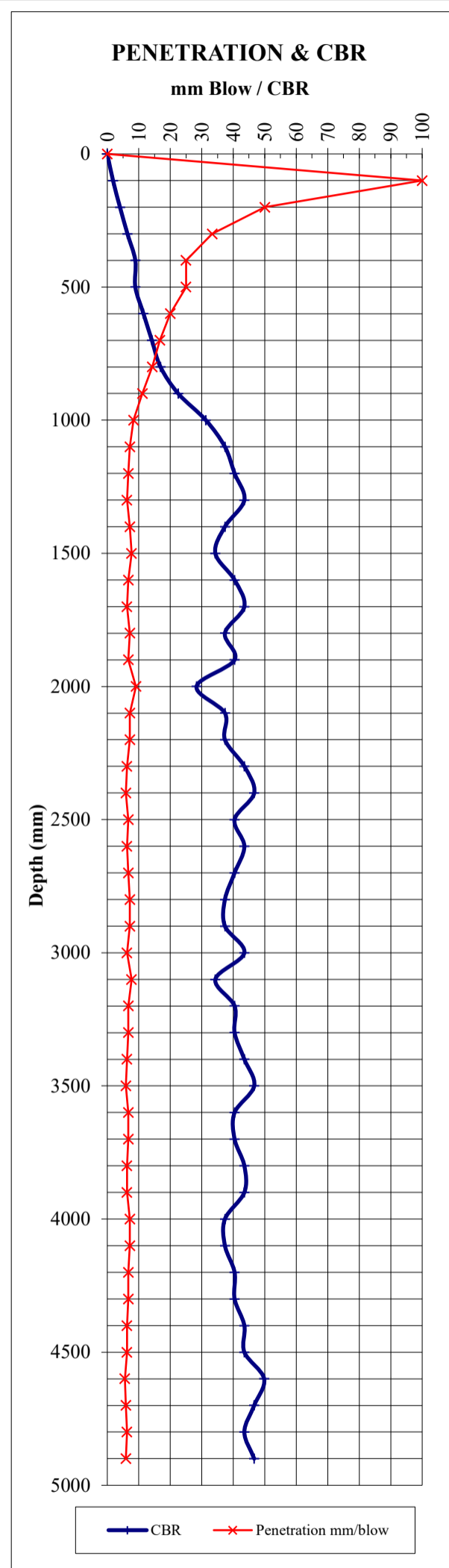
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	1	1	100	100.0	1.8
3	200	3	4	200	33.3	6.4
4	300	5	9	300	20.0	11.5
5	400	5	14	400	20.0	11.5
6	500	6	20	500	16.7	14.2
7	600	12	32	600	8.3	31.3
8	700	9	41	700	11.1	22.5
9	800	13	54	800	7.7	34.3
10	900	16	70	900	6.3	43.5
11	1000	16	86	1000	6.3	43.5
12	1100	16	102	1100	6.3	43.5
13	1200	16	118	1200	6.3	43.5
14	1300	15	133	1300	6.7	40.4
15	1400	19	152	1400	5.3	53.0
16	1500	17	169	1500	5.9	46.7
17	1600	15	184	1600	6.7	40.4
18	1700	15	199	1700	6.7	40.4
19	1800	13	212	1800	7.7	34.3
20	1900	13	225	1900	7.7	34.3
21	2000	13	238	2000	7.7	34.3
22	2100	17	255	2100	5.9	46.7
23	2200	16	271	2200	6.3	43.5
24	2300	15	286	2300	6.7	40.4
25	2400	16	302	2400	6.3	43.5
26	2500	13	315	2500	7.7	34.3
27	2600	17	332	2600	5.9	46.7
28	2700	16	348	2700	6.3	43.5
29	2800	15	363	2800	6.7	40.4
30	2900	17	380	2900	5.9	46.7
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
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61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP33**
 Date : **July 2019**



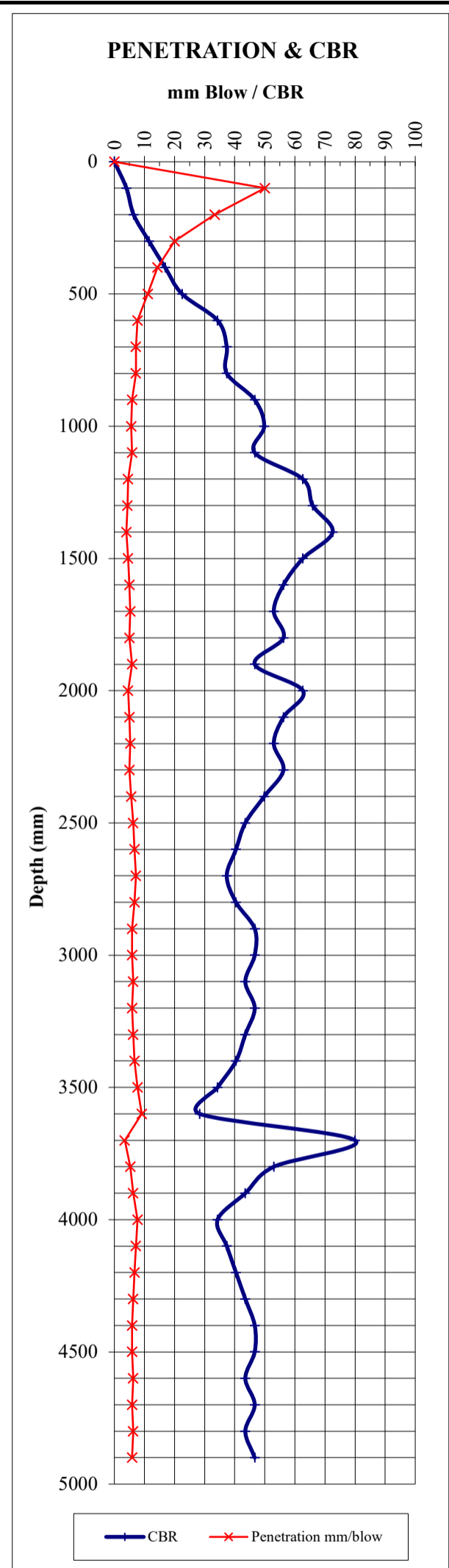
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	1	1	100	100.0	1.8
3	200	2	3	200	50.0	4.0
4	300	3	6	300	33.3	6.4
5	400	4	10	400	25.0	8.9
6	500	4	14	500	25.0	8.9
7	600	5	19	600	20.0	11.5
8	700	6	25	700	16.7	14.2
9	800	7	32	800	14.3	16.9
10	900	9	41	900	11.1	22.5
11	1000	12	53	1000	8.3	31.3
12	1100	14	67	1100	7.1	37.4
13	1200	15	82	1200	6.7	40.4
14	1300	16	98	1300	6.3	43.5
15	1400	14	112	1400	7.1	37.4
16	1500	13	125	1500	7.7	34.3
17	1600	15	140	1600	6.7	40.4
18	1700	16	156	1700	6.3	43.5
19	1800	14	170	1800	7.1	37.4
20	1900	15	185	1900	6.7	40.4
21	2000	11	196	2000	9.1	28.3
22	2100	14	210	2100	7.1	37.4
23	2200	14	224	2200	7.1	37.4
24	2300	16	240	2300	6.3	43.5
25	2400	17	257	2400	5.9	46.7
26	2500	15	272	2500	6.7	40.4
27	2600	16	288	2600	6.3	43.5
28	2700	15	303	2700	6.7	40.4
29	2800	14	317	2800	7.1	37.4
30	2900	14	331	2900	7.1	37.4
31	3000	16	347	3000	6.3	43.5
32	3100	13	360	3100	7.7	34.3
33	3200	15	375	3200	6.7	40.4
34	3300	15	390	3300	6.7	40.4
35	3400	16	406	3400	6.3	43.5
36	3500	17	423	3500	5.9	46.7
37	3600	15	438	3600	6.7	40.4
38	3700	15	453	3700	6.7	40.4
39	3800	16	469	3800	6.3	43.5
40	3900	16	485	3900	6.3	43.5
41	4000	14	499	4000	7.1	37.4
42	4100	14	513	4100	7.1	37.4
43	4200	15	528	4200	6.7	40.4
44	4300	15	543	4300	6.7	40.4
45	4400	16	559	4400	6.3	43.5
46	4500	16	575	4500	6.3	43.5
47	4600	18	593	4600	5.6	49.8
48	4700	17	610	4700	5.9	46.7
49	4800	16	626	4800	6.3	43.5
50	4900	17	643	4900	5.9	46.7
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP34**
 Date : **July 2019**



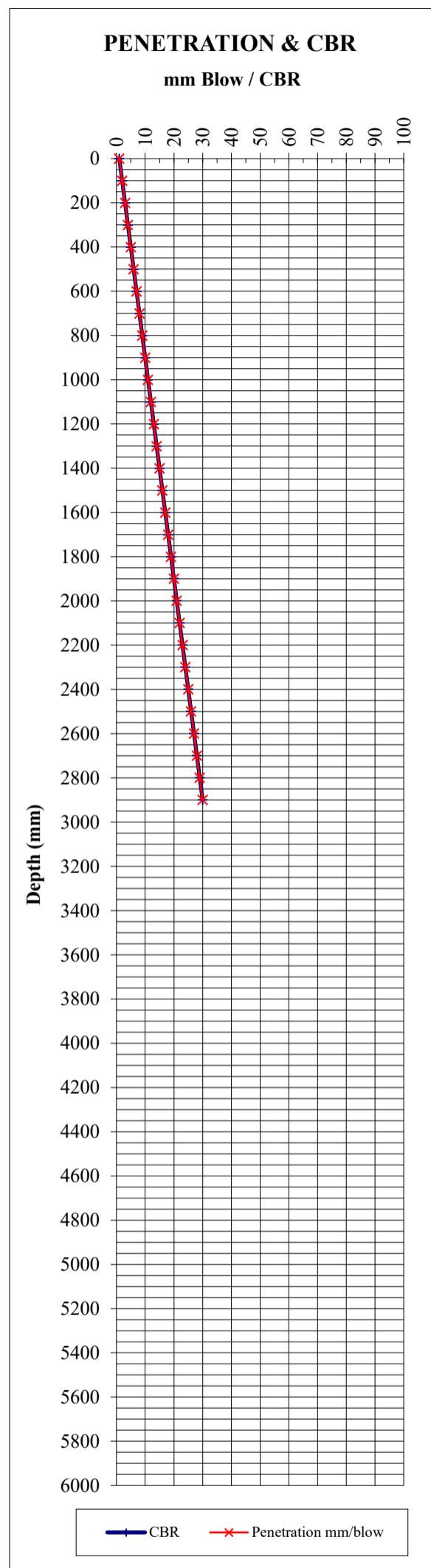
Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	2	2	100	50.0	4.0
3	200	3	5	200	33.3	6.4
4	300	5	10	300	20.0	11.5
5	400	7	17	400	14.3	16.9
6	500	9	26	500	11.1	22.5
7	600	13	39	600	7.7	34.3
8	700	14	53	700	7.1	37.4
9	800	14	67	800	7.1	37.4
10	900	17	84	900	5.9	46.7
11	1000	18	102	1000	5.6	49.8
12	1100	17	119	1100	5.9	46.7
13	1200	22	141	1200	4.5	62.7
14	1300	23	164	1300	4.3	65.9
15	1400	25	189	1400	4.0	72.6
16	1500	22	211	1500	4.5	62.7
17	1600	20	231	1600	5.0	56.2
18	1700	19	250	1700	5.3	53.0
19	1800	20	270	1800	5.0	56.2
20	1900	17	287	1900	5.9	46.7
21	2000	22	309	2000	4.5	62.7
22	2100	20	329	2100	5.0	56.2
23	2200	19	348	2200	5.3	53.0
24	2300	20	368	2300	5.0	56.2
25	2400	18	386	2400	5.6	49.8
26	2500	16	402	2500	6.3	43.5
27	2600	15	417	2600	6.7	40.4
28	2700	14	431	2700	7.1	37.4
29	2800	15	446	2800	6.7	40.4
30	2900	17	463	2900	5.9	46.7
31	3000	17	480	3000	5.9	46.7
32	3100	16	496	3100	6.3	43.5
33	3200	17	513	3200	5.9	46.7
34	3300	16	529	3300	6.3	43.5
35	3400	15	544	3400	6.7	40.4
36	3500	13	557	3500	7.7	34.3
37	3600	11	568	3600	9.1	28.3
38	3700	29	597	3700	3.4	80.0
39	3800	19	616	3800	5.3	53.0
40	3900	16	632	3900	6.3	43.5
41	4000	13	645	4000	7.7	34.3
42	4100	14	659	4100	7.1	37.4
43	4200	15	674	4200	6.7	40.4
44	4300	16	690	4300	6.3	43.5
45	4400	17	707	4400	5.9	46.7
46	4500	17	724	4500	5.9	46.7
47	4600	16	740	4600	6.3	43.5
48	4700	17	757	4700	5.9	46.7
49	4800	16	773	4800	6.3	43.5
50	4900	17	790	4900	5.9	46.7
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Job No. **547073**
 Job Name : **Gloria Mine Slimes Dam Geotechnical Investigation**
 Test No: **GL-DCP35**
 Date : **01/07/2019**



Reading No	Staff Reading	No Blows/100mm	No CumBlows	Depth (mm)	Penetration mm/blow	CBR
1	0	0	0	0	0.0	0
2	100	4	0	100	0.0	0
3	200	4	4	200	25.0	8.9
4	300	6	10	300	16.7	14.2
5	400	8	18	400	12.5	19.7
6	500	8	26	500	12.5	19.7
7	600	10	36	600	10.0	25.4
8	700	9	45	700	11.1	22.5
9	800	9	54	800	11.1	22.5
10	900	12	66	900	8.3	31.3
11	1000	14	80	1000	7.1	37.4
12	1100	15	95	1100	6.7	40.4
13	1200	17	112	1200	5.9	46.7
14	1300	17	129	1300	5.9	46.7
15	1400	20	149	1400	5.0	56.2
16	1500	18	167	1500	5.6	49.8
17	1600	14	181	1600	7.1	37.4
18	1700	14	195	1700	7.1	37.4
19	1800	14	209	1800	7.1	37.4
20	1900	12	221	1900	8.3	31.3
21	2000	14	235	2000	7.1	37.4
22	2100	13	248	2100	7.7	34.3
23	2200	16	264	2200	6.3	43.5
24	2300	23	287	2300	4.3	65.9
25	2400	25	312	2400	4.0	72.6
26	2500	18	330	2500	5.6	49.8
27	2600	16	346	2600	6.3	43.5
28	2700	12	358	2700	8.3	31.3
29	2800	12	370	2800	8.3	31.3
30	2900	13	383	2900	7.7	34.3
31	3000					
32	3100					
33	3200					
34	3300					
35	3400					
36	3500					
37	3600					
38	3700					
39	3800					
40	3900					
41	4000					
42	4100					
43	4200					
44	4300					
45	4400					
46	4500					
47	4600					
48	4700					
49	4800					
50	4900					
51	5000					
52	5100					
53	5200					
54	5300					
55	5400					
56	5500					
57	5600					
58	5700					
59	5800					
60	5900					
61	6000					



Appendix D: Laboratory Test Results

Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 13-Aug-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	TP1	TP1	TP1	GL-TP3	GL-TP3	GL-TP6	GL-TP10	GL-TP17
Depth (m)	1.4 - 2.6	2.6 - 3.5	0.2 - 1.4	0.4 - 3.2	3.2	0.2 - 2.3	3.7 - 5.0	2.6 - 4.6
Lab No	SRK-58-888	SRK-58-889	SRK-58-890	SRK-58-891	SRK-58-892	SRK-58-893	SRK-58-894	SRK-58-895
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	100	100	100
19.0	100	98	100	100	100	100	97	100
13.2	100	96	100	100	100	100	94	100
9.5	100	95	100	100	100	100	92	100
6.7	100	93	100	100	100	100	92	100
4.75	100	92	100	100	100	100	91	100
2.00	100	88	100	100	100	100	90	100
1.00	99	85	100	99	99	99	88	99
0.425	92	78	92	91	91	89	79	90
0.250	77	65	77	71	72	71	65	75
0.150	45	40	42	40	45	42	43	44
0.075	15	15	13	11	19	15	19	16
0.060	9	9	9	8	11	7	9	7
0.050	7	8	7	8	9	5	8	6
0.035	2	5	4	6	6	2	5	4
0.020	2	4	4	6	6	2	3	2
0.006	2	2	2	6	6	2	2	2
0.002	1	1	1	3	3	1	1	1
GM	0.93	1.19	0.95	0.98	0.90	0.96	1.12	0.94

Atterberg Limits

LL (%)	-	-	-	-	32	-	20	-
PI (%)	NP	SP	NP	NP	8	NP	3	SP
LS (%)	0.0	0.5	0.0	0.0	3.5	0.0	1.5	0.5

pH & Conductivity

pH								
EC (S/m)								

MDD / OMC

MDD (kg/m ³)			1826					
OMC (%)			7.3					

CBR

100%			30					
98%			17					
97%			13					
95%			7					
93%			4					
90%			1					
Swell (%)			0.0					

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

			*					
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Remarks: * = Not Classifiable

Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 13-Aug-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	GL-TP19	GL-TP21	GL-TP27	GL-TP28	GL-TP29	GL-TP30	GL-TP32	GL-TP33
Depth (m)	3.2 - 4.6	0.4 - 1.9	0.2 - 2.3	3.6 - 4.8	3.6 - 4.9	3.0 - 5.0	1.9 - 4.8	4.8 - 5.3
Lab No	SRK-58-896	SRK-58-897	SRK-58-898	SRK-58-899	SRK-58-900	SRK-58-901	SRK-58-902	SRK-58-903
53.0	100	100	100	100	79	100	100	58
37.5	100	100	100	100	78	100	100	40
26.5	100	100	100	100	75	100	100	26
19.0	100	100	100	100	74	100	100	21
13.2	100	100	100	100	73	100	100	18
9.5	100	100	100	99	72	100	100	17
6.7	100	100	100	99	72	100	100	16
4.75	100	100	100	99	72	100	100	15
2.00	100	100	100	98	70	100	100	14
1.00	99	99	99	97	69	99	100	14
0.425	93	92	91	88	62	89	92	12
0.250	77	74	68	71	48	73	78	9
0.150	49	44	38	42	28	44	47	6
0.075	18	14	12	14	13	14	18	2
0.060	8	8	8	10	6	10	8	1
0.050	7	6	6	8	5	9	7	1
0.035	6	4	4	6	4	6	4	1
0.020	4	3	2	4	4	5	4	1
0.006	2	2	2	2	3	5	4	1
0.002	1	1	1	1	1	3	1	1
GM	0.89	0.94	0.97	1.00	1.55	0.97	0.90	2.72

Atterberg Limits

LL (%)	-	-	-	-	-	-	-	-
PI (%)	SP	NP	NP	SP	SP	NP	NP	SP
LS (%)	0.5	0.0	0.0	0.5	1.0	0.0	0.0	1.0

pH & Conductivity

pH								
EC (S/m)								

MDD / OMC

MDD (kg/m ³)		1850		1938	1781			
OMC (%)		8.5		9.1	13.9			

CBR

100%		46		44	27			
98%		32		30	22			
97%		26		25	20			
95%		18		17	17			
93%		15		13	13			
90%		12		8	9			
Swell (%)		0.0		0.1	0.1			

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

		G7		G8	G8			
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Remarks:



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 13-Aug-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	GL-TP35						
Depth (m)	2.2 - 4.9						
Lab No	SRK-58-904						
53.0	100						
37.5	100						
26.5	100						
19.0	100						
13.2	100						
9.5	100						
6.7	98						
4.75	97						
2.00	96						
1.00	94						
0.425	86						
0.250	71						
0.150	46						
0.075	18						
0.060	7						
0.050	6						
0.035	5						
0.020	4						
0.006	2						
0.002	1						
GM	1.00						

Atterberg Limits

LL (%)	28						
PI (%)	8						
LS (%)	3.5						

pH & Conductivity

pH							
EC (S/m)							

MDD / OMC

MDD (kg/m ³)							
OMC (%)							

CBR

100%							
98%							
97%							
95%							
93%							
90%							
Swell (%)							

UCS (MPa)

100%							
97%							
90%							

COLTO Classification

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Remarks: _____

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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	TP1	TP1	TP1	Sample	TP1	TP1	TP1
Depth (m)	1.4 - 2.6	2.6 - 3.5	0.2 - 1.4	Depth (m)	1.4 - 2.6	2.6 - 3.5	0.2 - 1.4
Lab No	SRK-58-888	SRK-58-889	SRK-58-890	Lab No	SRK-58-888	SRK-58-889	SRK-58-890
53.0	100	100	100	Liquid Limit (%)	-	-	-
37.5	100	100	100	Plastic Limit (%)	-	-	-
26.5	100	100	100	Plasticity Index (%)	NP	SP	NP
19.0	100	98	100	Linear Shrinkage (%)	0.0	0.5	0.0
13.2	100	96	100	PI of whole sample	-	-	-
9.5	100	95	100				
6.7	100	93	100	% Gravel	0	12	0
4.75	100	92	100	% Sand	91	79	91
2.00	100	88	100	% Silt	8	8	8
1.00	99	85	100	% Clay	1	1	1
0.425	92	78	92	Activity	0.0	0.0	0.0
0.250	77	65	77				
0.150	45	40	42	% Soil Mortar	100	88	100
0.075	15	15	13				
0.060	9	9	9	Grading Modulus	0.93	1.19	0.95
0.050	7	8	7	Moisture Content (%)	2.6	6.4	2.3
0.035	2	5	4	Relative Density (SG)*	2.65	2.65	2.693
0.020	2	4	4				
0.006	2	2	2	Unified (ASTM D2487)	SM	SM	SM
0.002	1	1	1	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4

Remarks: *: 2.693 Determined, 2.65 Assumed
 N / T: Not Tested



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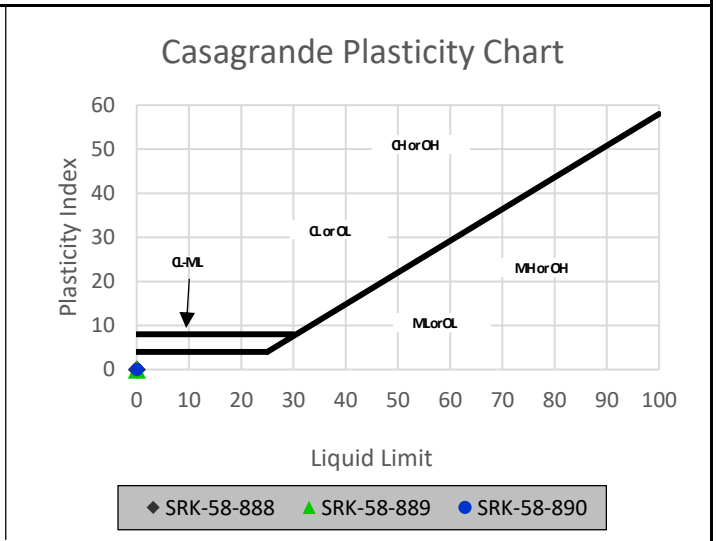
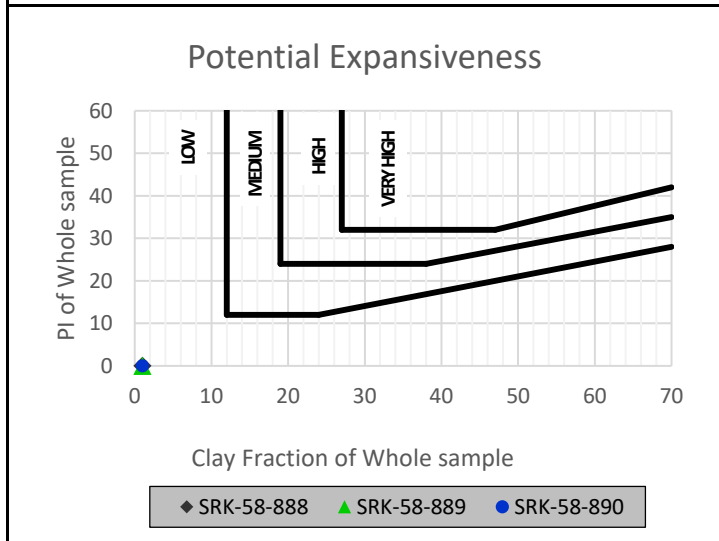
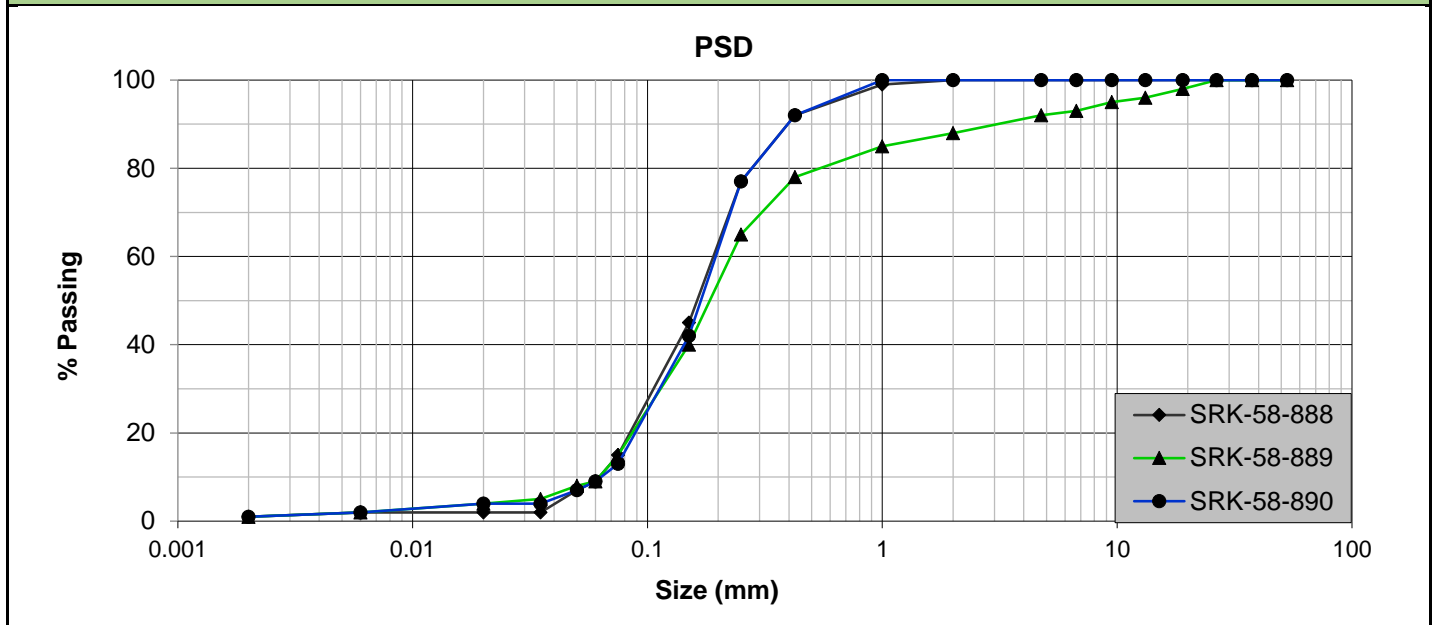
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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	GL-TP3	GL-TP3	GL-TP6	Sample	GL-TP3	GL-TP3	GL-TP6
Depth (m)	0.4 - 3.2	3.2	0.2 - 2.3	Depth (m)	0.4 - 3.2	3.2	0.2 - 2.3
Lab No	SRK-58-891	SRK-58-892	SRK-58-893	Lab No	SRK-58-891	SRK-58-892	SRK-58-893
53.0	100	100	100	Liquid Limit (%)	-	32	-
37.5	100	100	100	Plastic Limit (%)	-	24	-
26.5	100	100	100	Plasticity Index (%)	NP	8	NP
19.0	100	100	100	Linear Shrinkage (%)	0.0	3.5	0.0
13.2	100	100	100	PI of whole sample	-	7	-
9.5	100	100	100				
6.7	100	100	100	% Gravel	0	0	0
4.75	100	100	100	% Sand	92	89	93
2.00	100	100	100	% Silt	5	8	6
1.00	99	99	99	% Clay	3	3	1
0.425	91	91	89	Activity	0.0	2.7	0.0
0.250	71	72	71				
0.150	40	45	42	% Soil Mortar	100	100	100
0.075	11	19	15				
0.060	8	11	7	Grading Modulus	0.98	0.90	0.96
0.050	8	9	5	Moisture Content (%)	1.0	6.1	2.2
0.035	6	6	2	Relative Density (SG)*	2.65	2.65	2.65
0.020	6	6	2				
0.006	6	6	2	Unified (ASTM D2487)	SP-SM	SC	SM
0.002	3	3	1	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4

Remarks: *: Assumed
 N / T: Not Tested

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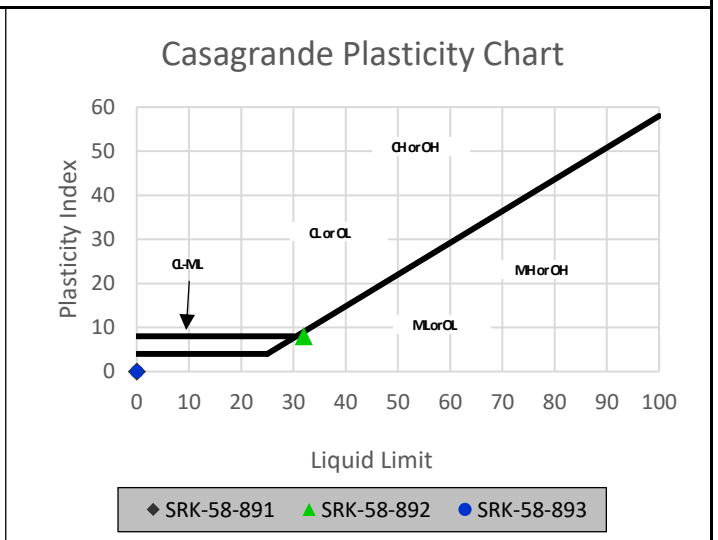
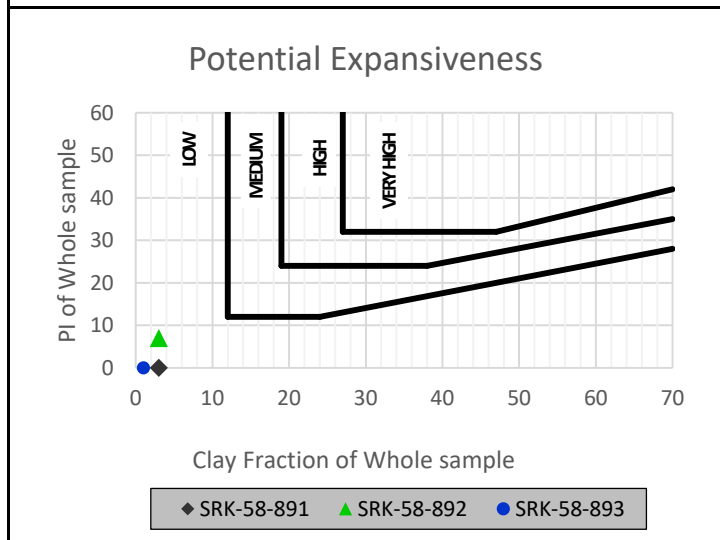
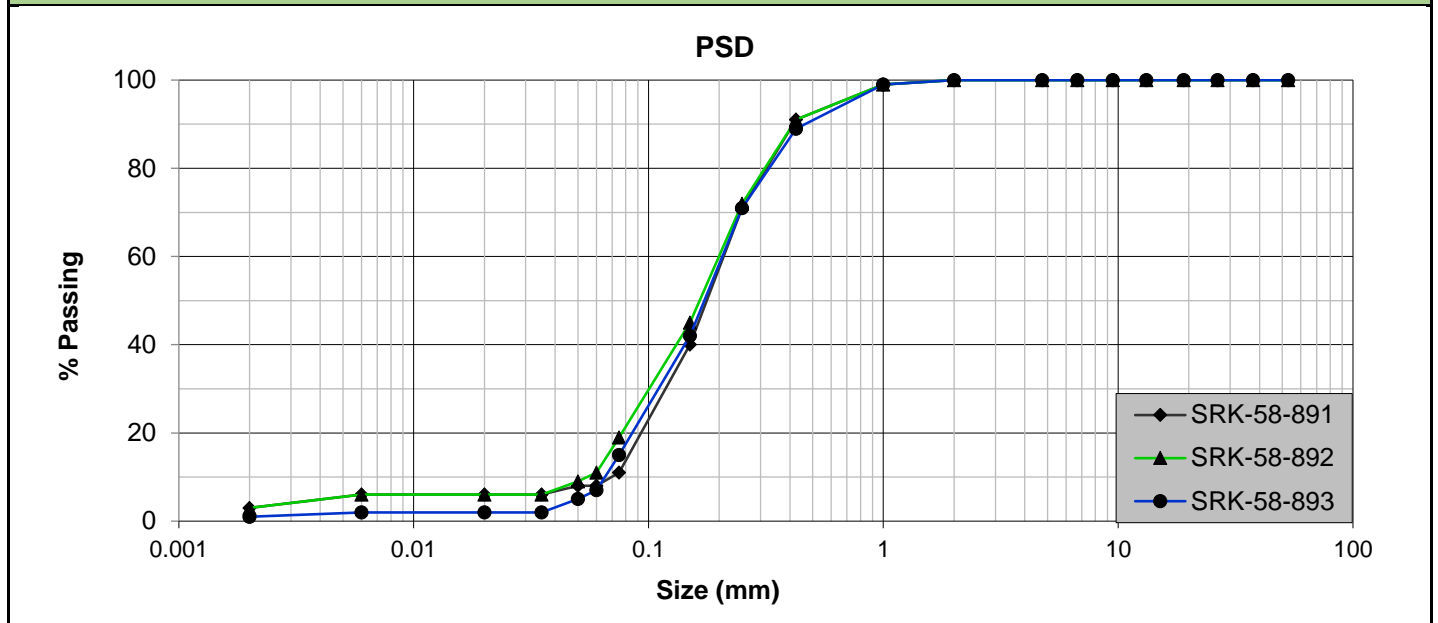
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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	GL-TP10	GL-TP17	GL-TP19	Sample	GL-TP10	GL-TP17	GL-TP19
Depth (m)	3.7 - 5.0	2.6 - 4.6	3.2 - 4.6	Depth (m)	3.7 - 5.0	2.6 - 4.6	3.2 - 4.6
Lab No	SRK-58-894	SRK-58-895	SRK-58-896	Lab No	SRK-58-894	SRK-58-895	SRK-58-896
53.0	100	100	100	Liquid Limit (%)	20	-	-
37.5	100	100	100	Plastic Limit (%)	17	-	-
26.5	100	100	100	Plasticity Index (%)	3	SP	SP
19.0	97	100	100	Linear Shrinkage (%)	1.5	0.5	0.5
13.2	94	100	100	PI of whole sample	2	-	-
9.5	92	100	100				
6.7	92	100	100	% Gravel	10	0	0
4.75	91	100	100	% Sand	81	93	92
2.00	90	100	100	% Silt	8	6	7
1.00	88	99	99	% Clay	1	1	1
0.425	79	90	93	Activity	3.0	0.0	0.0
0.250	65	75	77				
0.150	43	44	49	% Soil Mortar	90	100	100
0.075	19	16	18				
0.060	9	7	8	Grading Modulus	1.12	0.94	0.89
0.050	8	6	7	Moisture Content (%)	5.3	3.6	3.1
0.035	5	4	6	Relative Density (SG)*	2.678	2.666	2.65
0.020	3	2	4				
0.006	2	2	2	Unified (ASTM D2487)	SM	SM	SM
0.002	1	1	1	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4

Remarks: *: 2.678 & 2.666 Determined, 2.65 Assumed
 N / T: Not Tested



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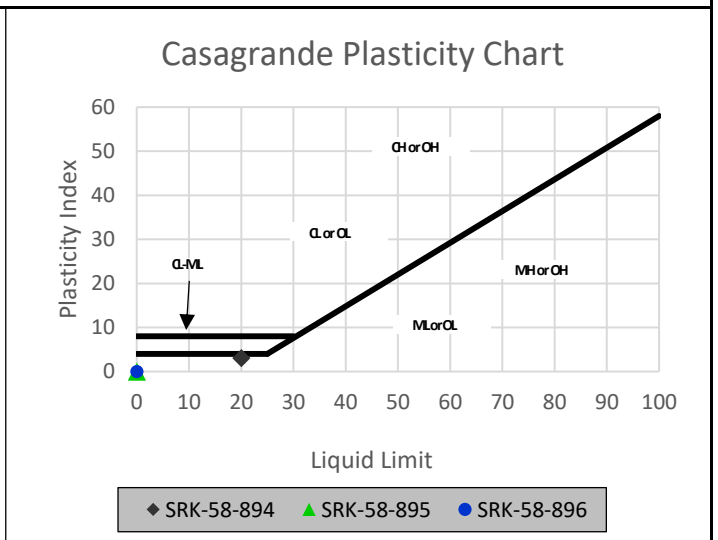
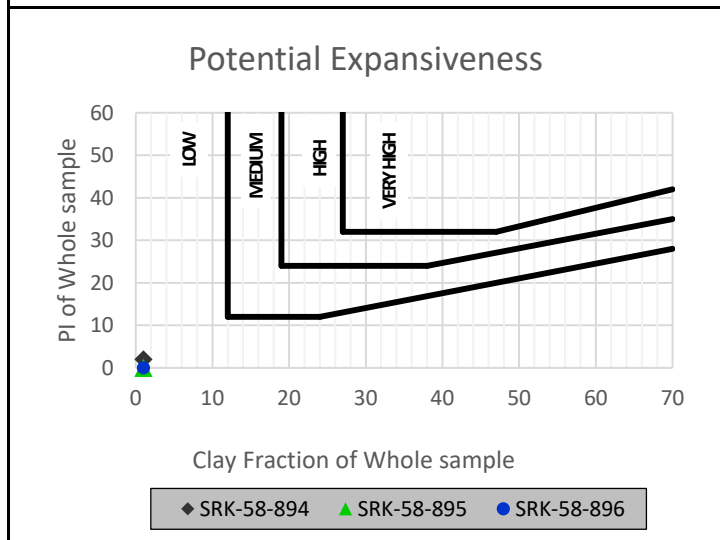
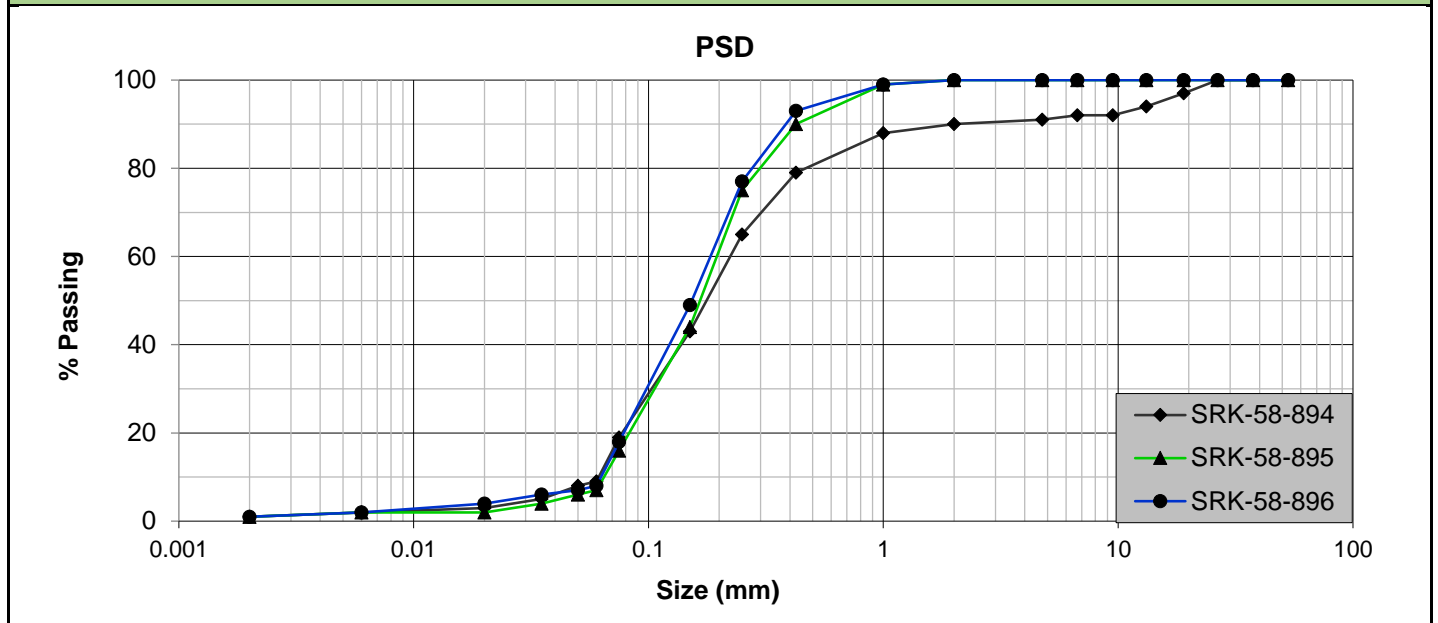
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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	GL-TP21	GL-TP27	GL-TP28	Sample	GL-TP21	GL-TP27	GL-TP28
Depth (m)	0.4 - 1.9	0.2 - 2.3	3.6 - 4.8	Depth (m)	0.4 - 1.9	0.2 - 2.3	3.6 - 4.8
Lab No	SRK-58-897	SRK-58-898	SRK-58-899	Lab No	SRK-58-897	SRK-58-898	SRK-58-899
53.0	100	100	100	Liquid Limit (%)	-	-	-
37.5	100	100	100	Plastic Limit (%)	-	-	-
26.5	100	100	100	Plasticity Index (%)	NP	NP	SP
19.0	100	100	100	Linear Shrinkage (%)	0.0	0.0	0.5
13.2	100	100	100	PI of whole sample	-	-	-
9.5	100	100	99				
6.7	100	100	99	% Gravel	0	0	2
4.75	100	100	99	% Sand	92	92	88
2.00	100	100	98	% Silt	7	7	9
1.00	99	99	97	% Clay	1	1	1
0.425	92	91	88	Activity	0.0	0.0	0.0
0.250	74	68	71				
0.150	44	38	42	% Soil Mortar	100	100	98
0.075	14	12	14				
0.060	8	8	10	Grading Modulus	0.94	0.97	1.00
0.050	6	6	8	Moisture Content (%)	2.2	1.9	5.0
0.035	4	4	6	Relative Density (SG)*	2.65	2.706	2.681
0.020	3	2	4				
0.006	2	2	2	Unified (ASTM D2487)	SM	SP-SM	SM
0.002	1	1	1	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4

Remarks: *: 2.706 & 2.681 Determined, 2.65 Assumed
 N / T: Not Tested

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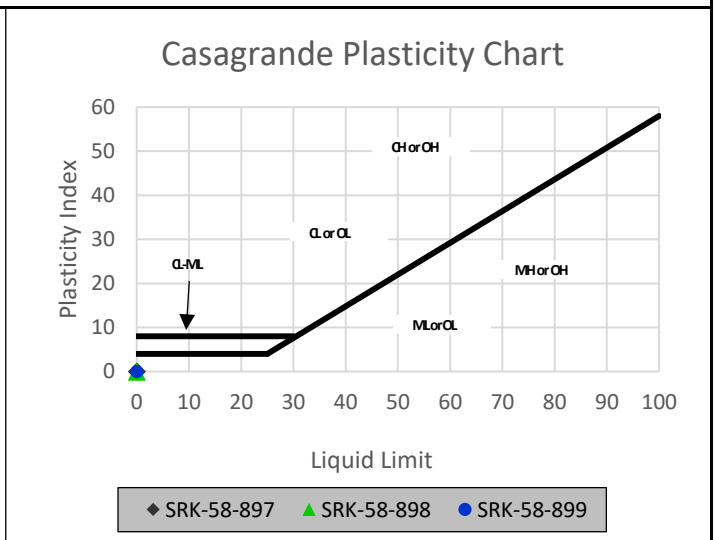
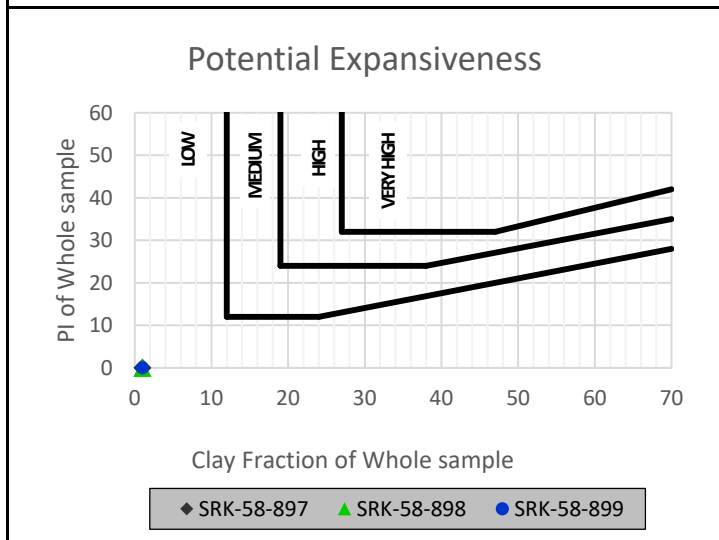
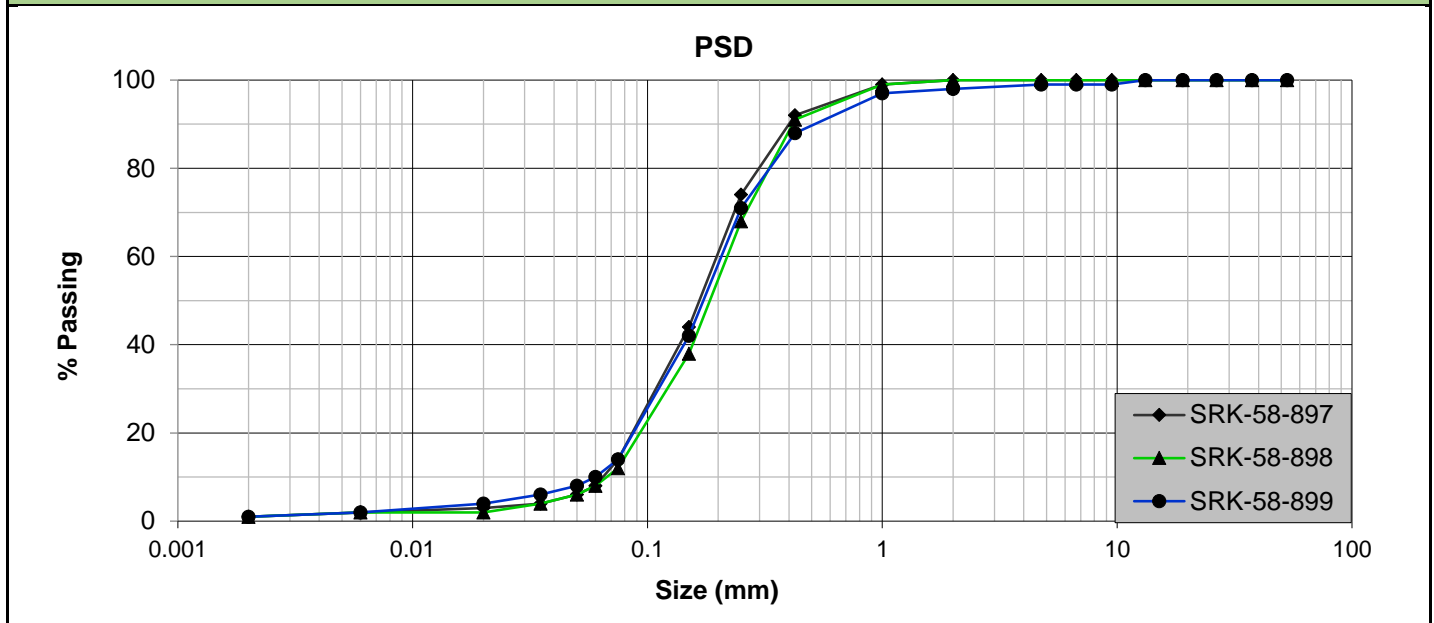
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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



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Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	GL-TP29	GL-TP30	GL-TP32	Sample	GL-TP29	GL-TP30	GL-TP32
Depth (m)	3.6 - 4.9	3.0 - 5.0	1.9 - 4.8	Depth (m)	3.6 - 4.9	3.0 - 5.0	1.9 - 4.8
Lab No	SRK-58-900	SRK-58-901	SRK-58-902	Lab No	SRK-58-900	SRK-58-901	SRK-58-902
53.0	79	100	100	Liquid Limit (%)	-	-	-
37.5	78	100	100	Plastic Limit (%)	-	-	-
26.5	75	100	100	Plasticity Index (%)	SP	NP	NP
19.0	74	100	100	Linear Shrinkage (%)	1.0	0.0	0.0
13.2	73	100	100	PI of whole sample	-	-	-
9.5	72	100	100				
6.7	72	100	100	% Gravel	30	0	0
4.75	72	100	100	% Sand	64	90	92
2.00	70	100	100	% Silt	5	7	7
1.00	69	99	100	% Clay	1	3	1
0.425	62	89	92	Activity	0.0	0.0	0.0
0.250	48	73	78				
0.150	28	44	47	% Soil Mortar	70	100	100
0.075	13	14	18				
0.060	6	10	8	Grading Modulus	1.55	0.97	0.90
0.050	5	9	7	Moisture Content (%)	7.9	2.2	1.7
0.035	4	6	4	Relative Density (SG)*	2.682	2.65	2.65
0.020	4	5	4				
0.006	3	5	4	Unified (ASTM D2487)	SM	SM	SM
0.002	1	3	1	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 2 - 4

Remarks: *: 2.682 Determined, 2.65 Assumed
 N / T: Not Tested



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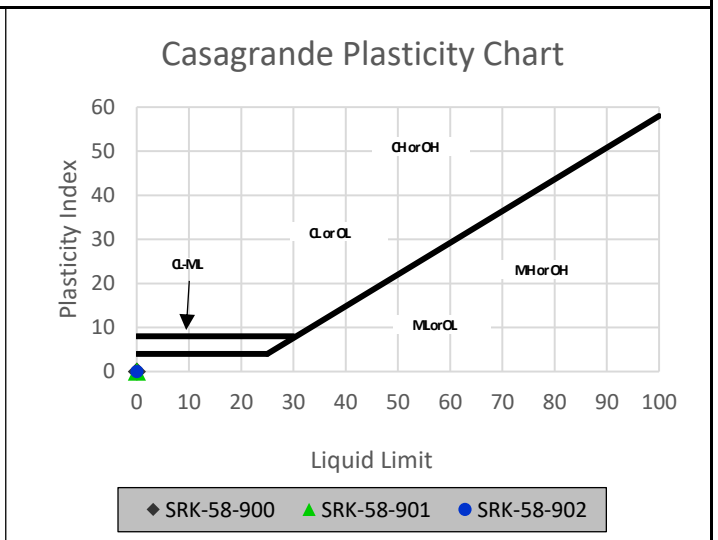
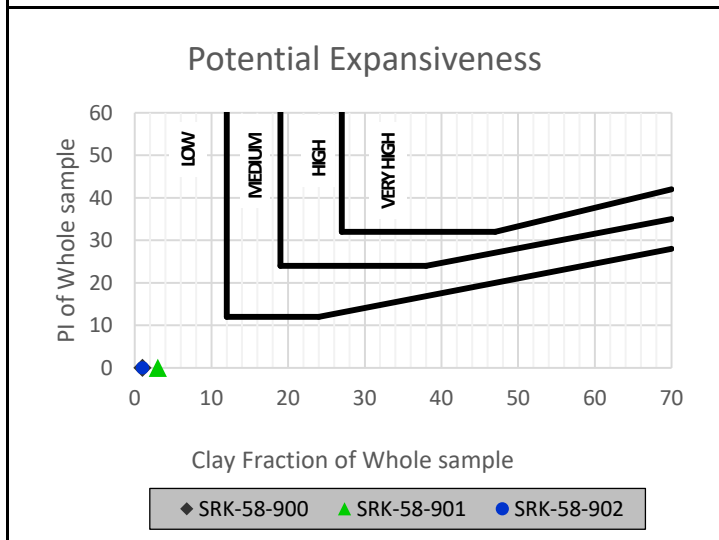
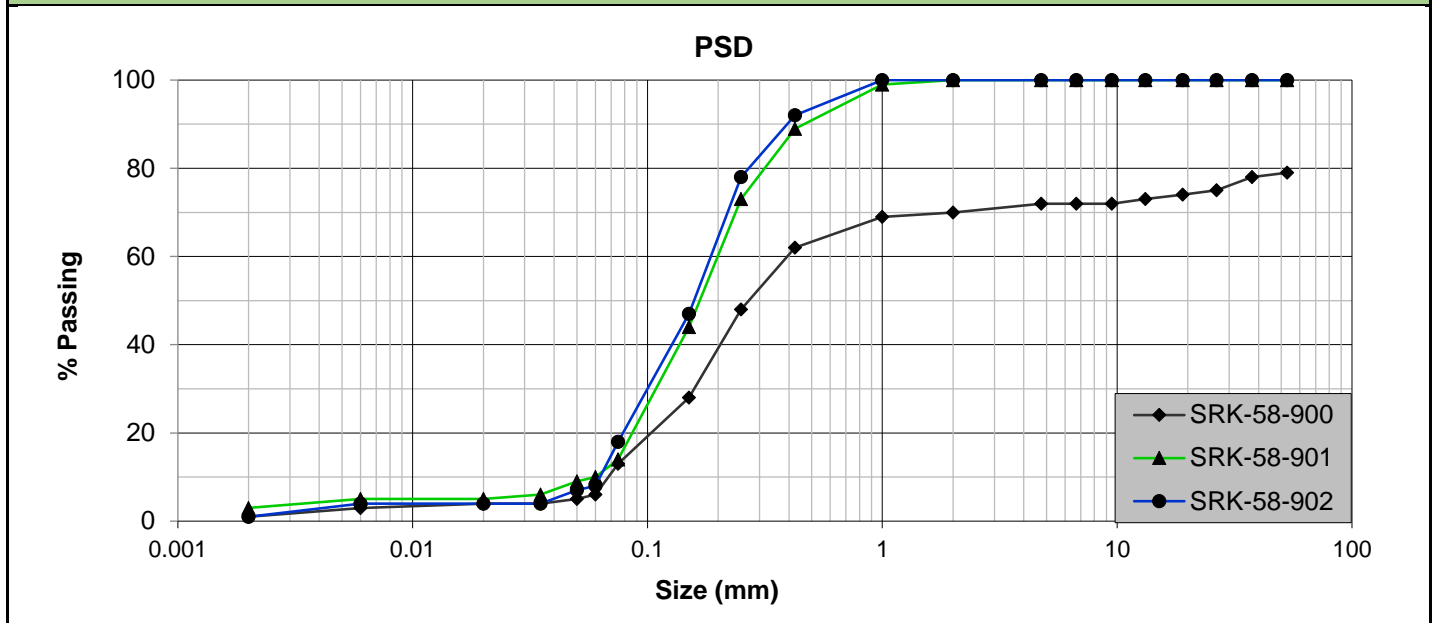
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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	GL-TP33	GL-TP35		Sample	GL-TP33	GL-TP35	
Depth (m)	4.8 - 5.3	2.2 - 4.9		Depth (m)	4.8 - 5.3	2.2 - 4.9	
Lab No	SRK-58-903	SRK-58-904		Lab No	SRK-58-903	SRK-58-904	
53.0	58	100		Liquid Limit (%)	-	28	
37.5	40	100		Plastic Limit (%)	-	20	
26.5	26	100		Plasticity Index (%)	SP	8	
19.0	21	100		Linear Shrinkage (%)	1.0	3.5	
13.2	18	100		PI of whole sample	-	7	
9.5	17	100					
6.7	16	98		% Gravel	86	4	
4.75	15	97		% Sand	13	89	
2.00	14	96		% Silt	0	6	
1.00	14	94		% Clay	1	1	
0.425	12	86		Activity	0.0	8.0	
0.250	9	71					
0.150	6	46		% Soil Mortar	14	96	
0.075	2	18					
0.060	1	7		Grading Modulus	2.72	1.00	
0.050	1	6		Moisture Content (%)	2.2	3.9	
0.035	1	5		Relative Density (SG)*	2.65	2.66	
0.020	1	4					
0.006	1	2		Unified (ASTM D2487)	SP	SC-SM	
0.002	1	1		AASHTO (M145-91)	A - 1 - a	A - 2 - 4	

Remarks: *: 2.66 Determined, 2.65 Assumed
 N / T: Not Tested

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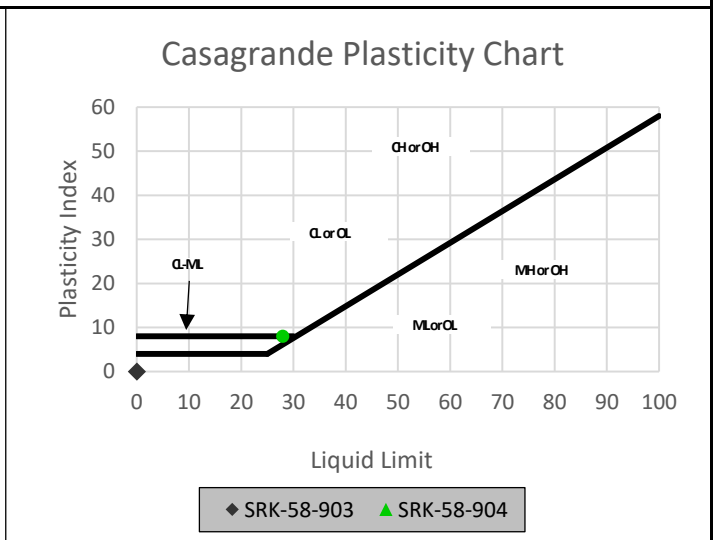
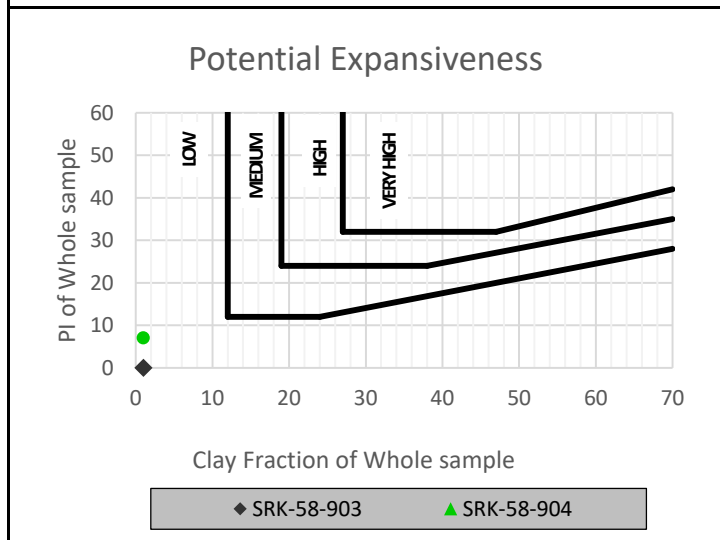
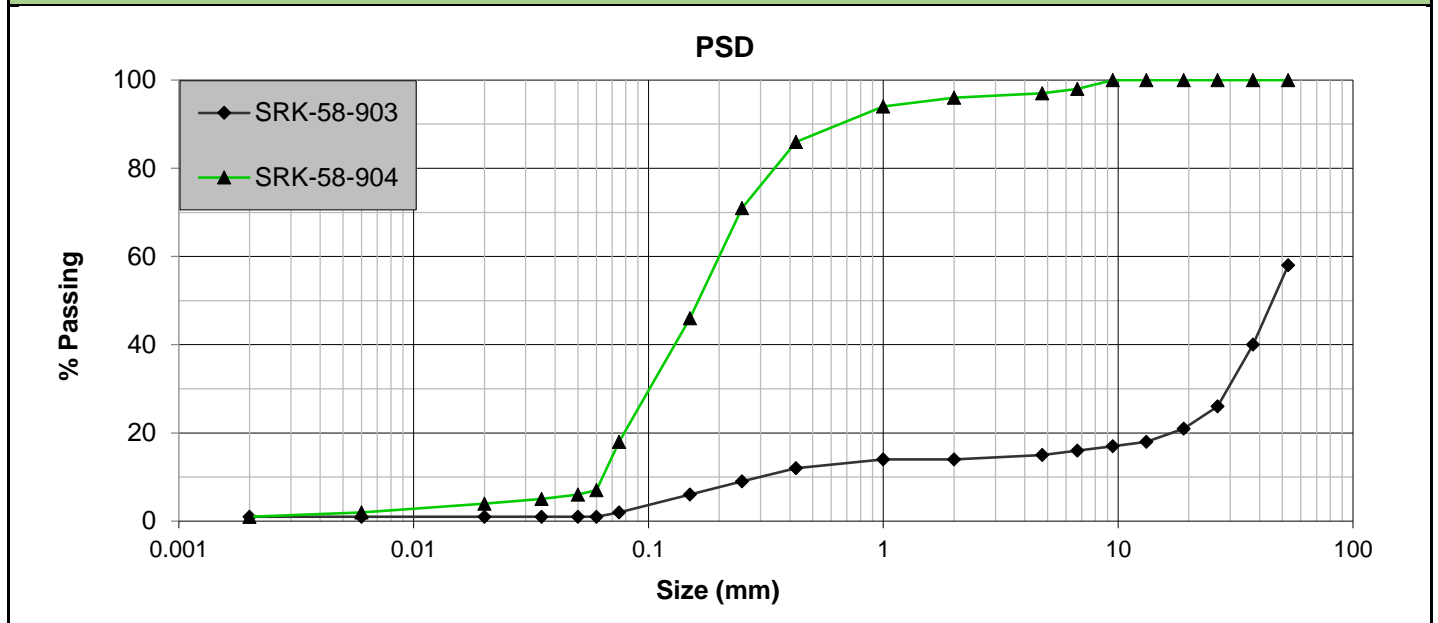
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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Job Number: SRK-58
Date: 2019-08-12
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

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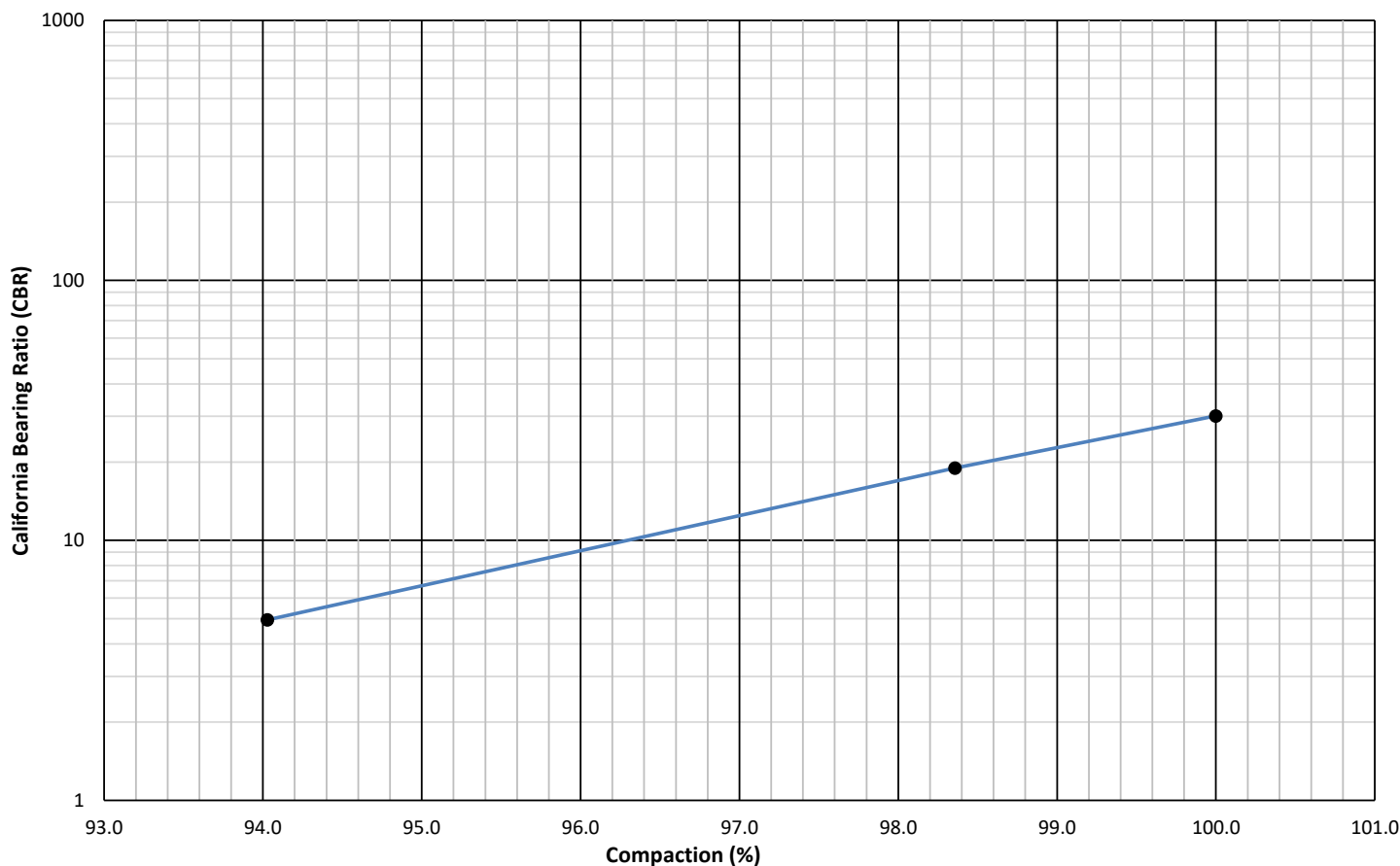
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: TP1
Depth: (m) 0.2 - 1.4

Job Number: SRK-58
Lab Number: SRK-58-890
Method: SANS 3001 GR40
Date: 13-Aug-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
1826	7.3	1825	7.2	100.0	0.0	30	38	23	100	30
1826	7.3	1795	7.2	98.4	0.0	19	23	18	98	17
1826	7.3	1716	7.2	94.0	0.0	5	6	7	97	13
									95	7
									93	4
									90	1



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: TP 1
Depth: (m) 0.2 - 1.4

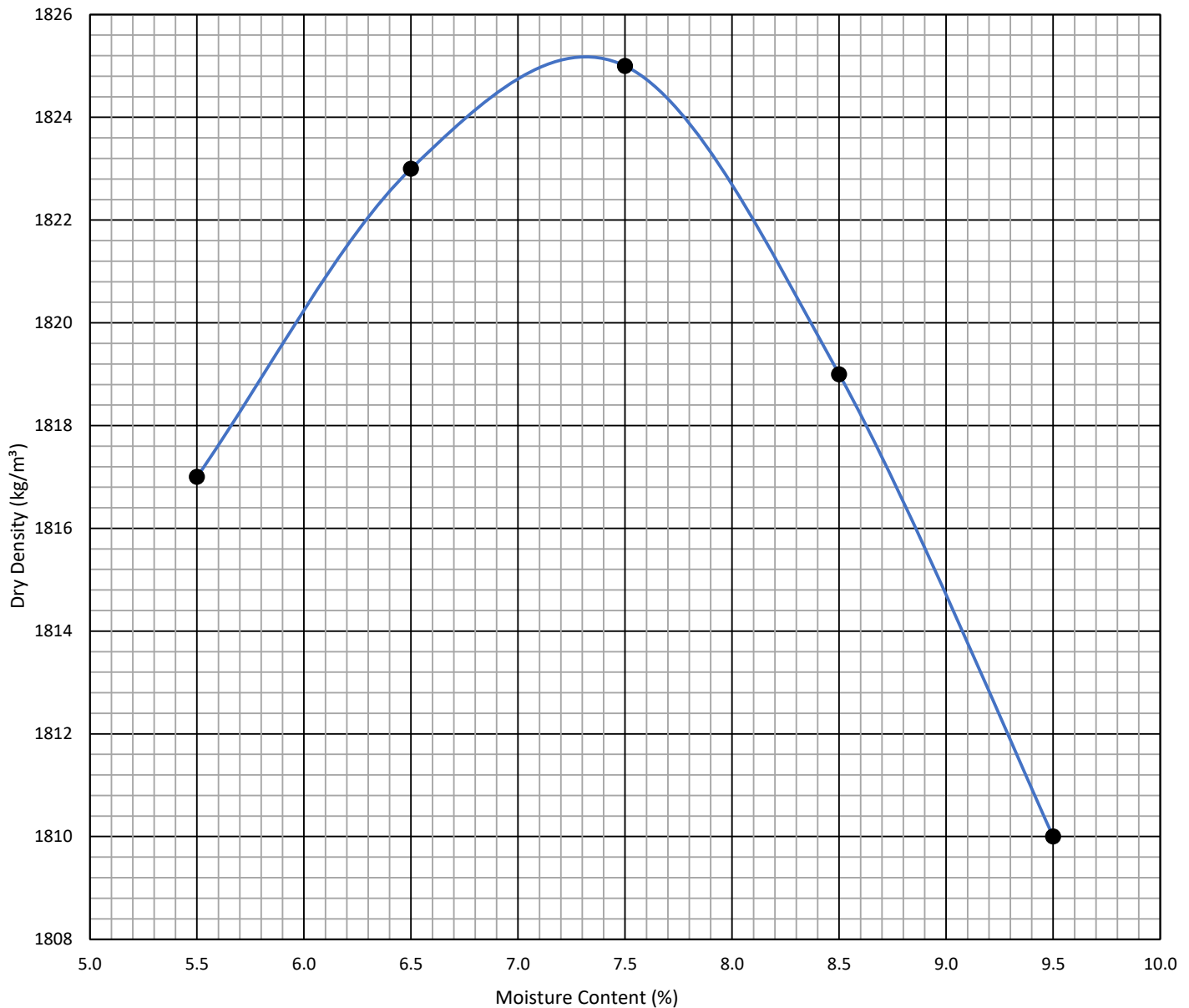
Job Number: SRK-58
Lab Number: SRK-58-890
Method: SANS 3001 GR30
Date: 13-Aug-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1826** kg/m³

Optimum Moisture Content: **7.3** %

Moisture Content (%):	5.5	6.5	7.5	8.5	9.5		
Dry Density (kg/m ³)	1817	1823	1825	1819	1810		





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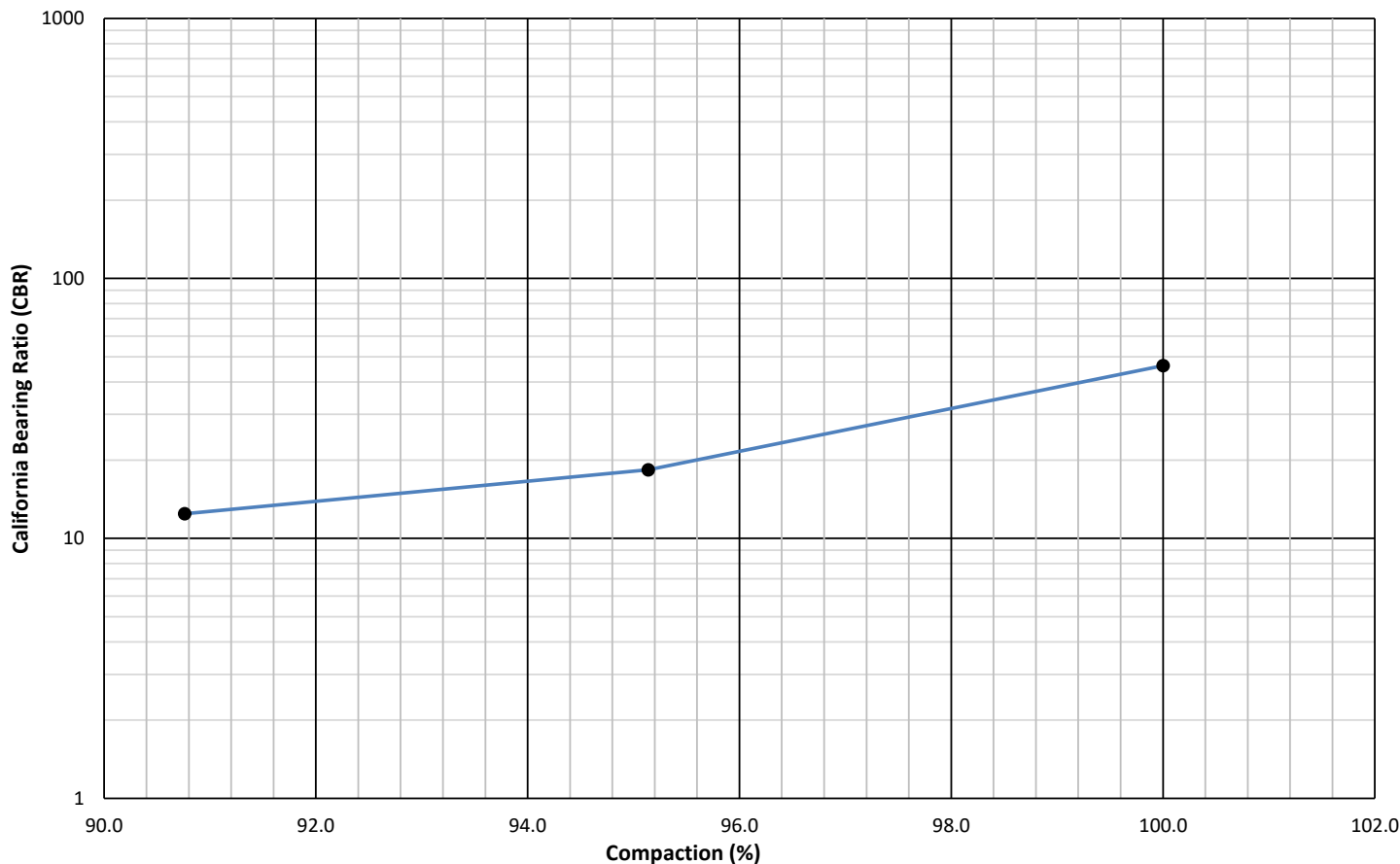
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP21
Depth: (m) 0.4 - 1.9

Job Number: SRK-58
Lab Number: SRK-58-897
Method: SANS 3001 GR40
Date: 13-Aug-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)	(%)	(%)	(%)					
1850	8.5	1851	7.9	100.0	0.0	46	45	23	100	46
1850	8.5	1761	7.9	95.1	0.0	18	21	19	98	32
1850	8.5	1680	7.9	90.8	0.0	12	15	13	97	26
									95	18
									93	15
									90	12



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP21
Depth: (m) 0.4 - 1.9

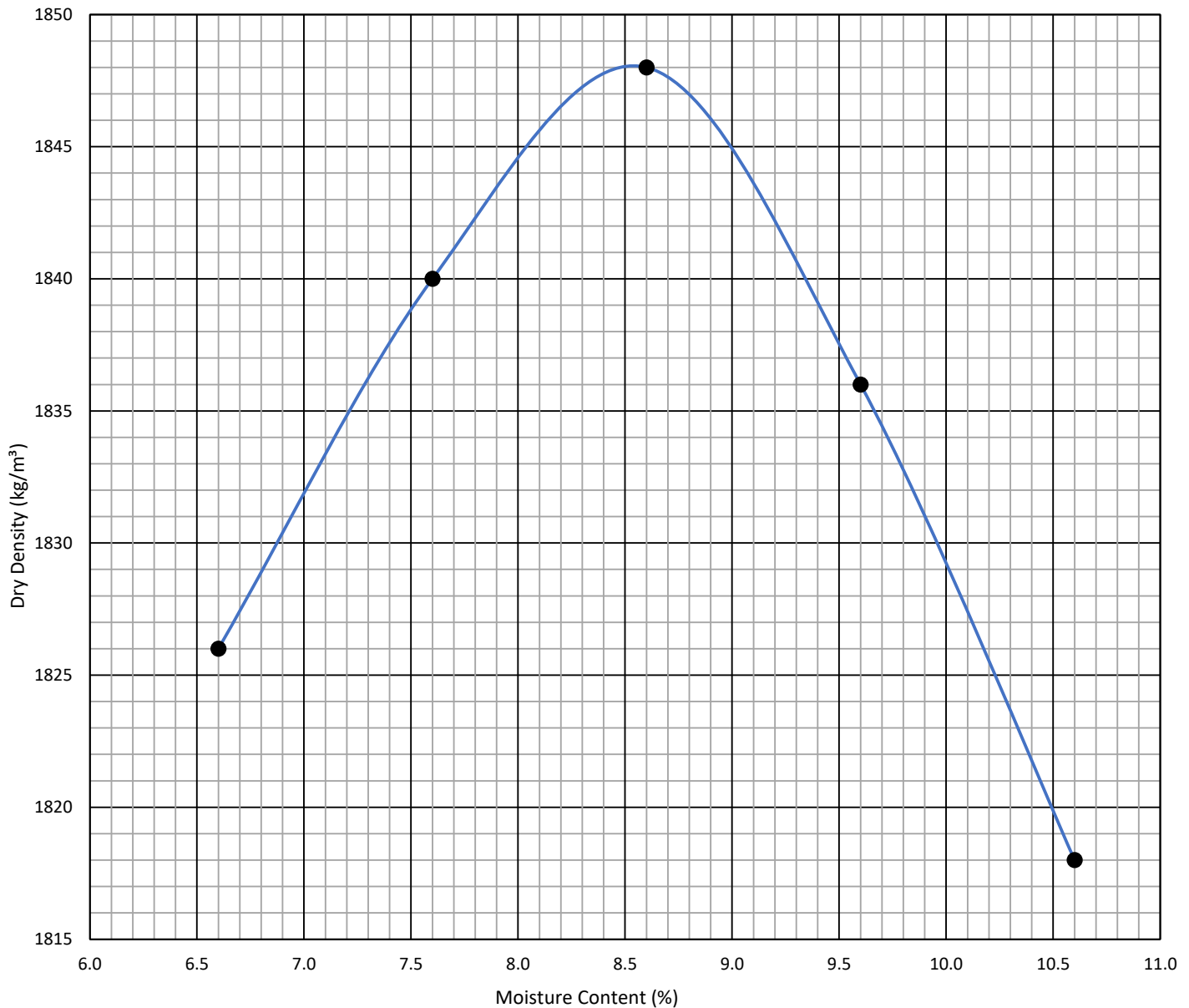
Job Number: SRK-58
Lab Number: SRK-58-897
Method: SANS 3001 GR30
Date: 13-Aug-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1850** kg/m³

Optimum Moisture Content: **8.5** %

Moisture Content (%):	6.6	7.6	8.6	9.6	10.6		
Dry Density (kg/m ³)	1826	1840	1848	1836	1818		





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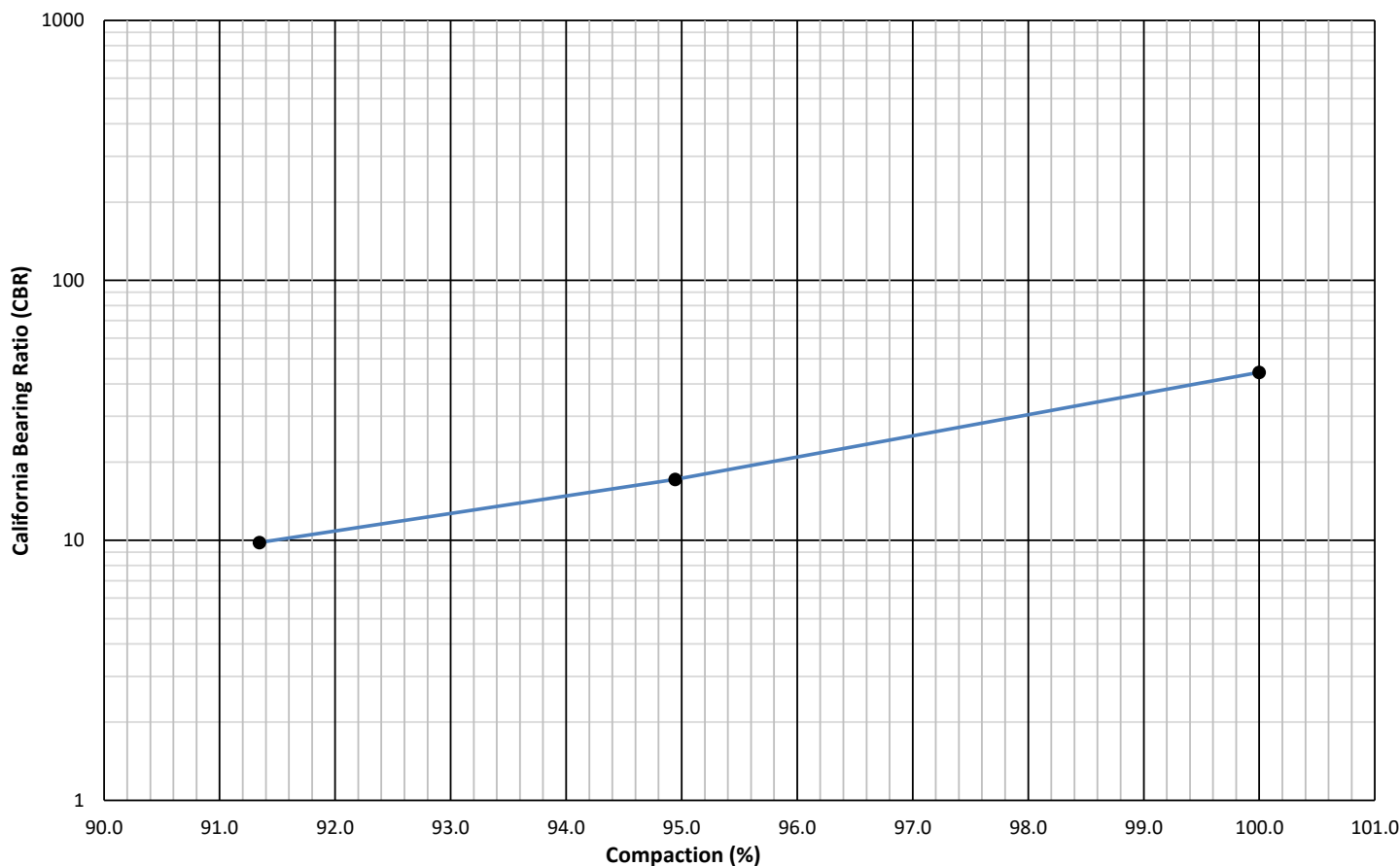
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP28
Depth: (m) 3.6 - 4.8

Job Number: SRK-58
Lab Number: SRK-58-899
Method: SANS 3001 GR40
Date: 13-Aug-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)	(%)	(%)	(%)					
1938	9.1	1918	9.3	100.0	0.1	44	61	52	100	44
1938	9.1	1821	9.3	94.9	0.2	17	18	21	98	30
1938	9.1	1752	9.3	91.3	0.3	10	9	9	97	25
									95	17
									93	13
									90	8



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Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP28
Depth: (m) 3.6 - 4.8

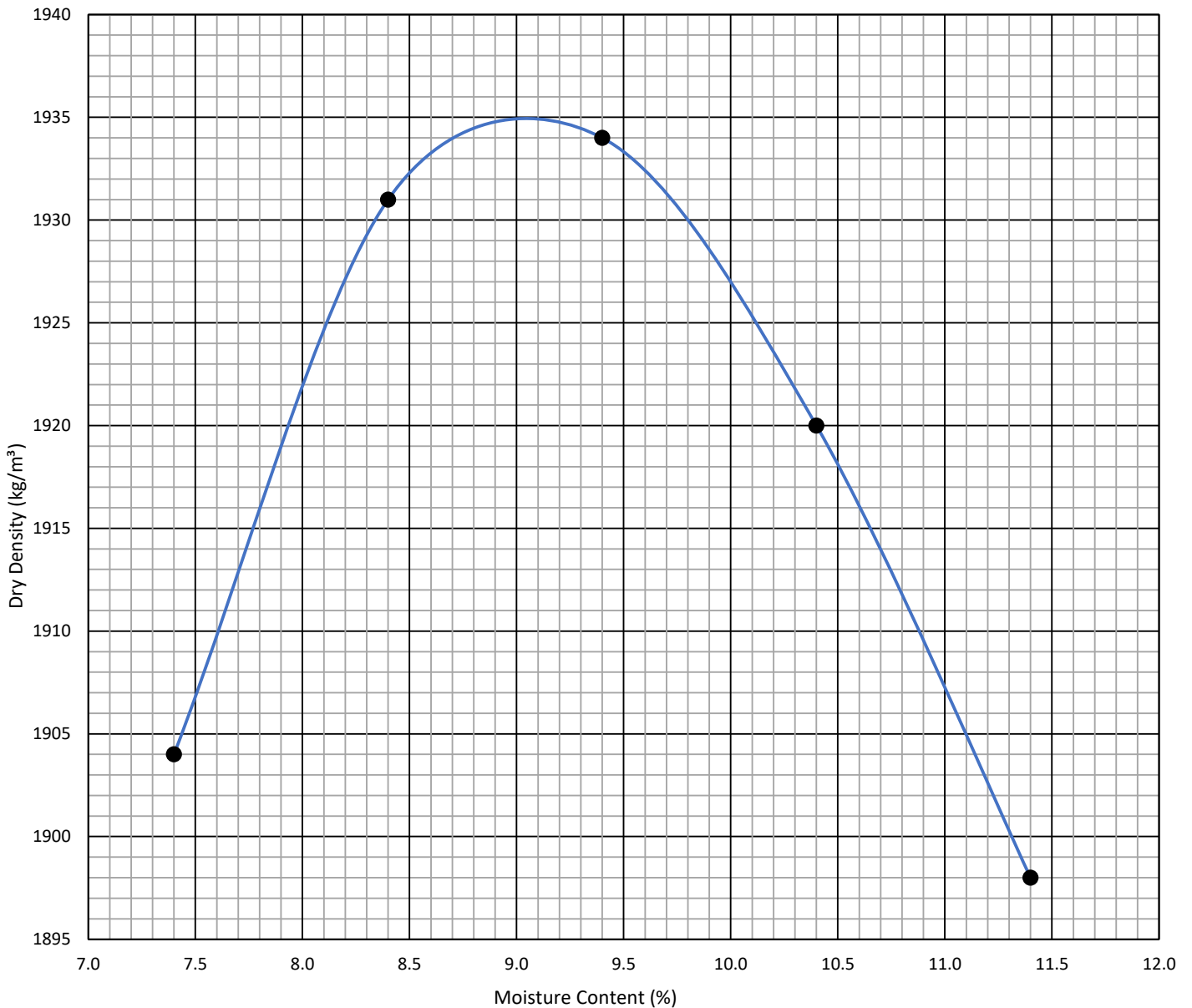
Job Number: SRK-58
Lab Number: SRK-58-899
Method: SANS 3001 GR30
Date: 13-Aug-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1938** kg/m³

Optimum Moisture Content: **9.1** %

Moisture Content (%):	7.4	8.4	9.4	10.4	11.4		
Dry Density (kg/m ³)	1904	1931	1934	1920	1898		



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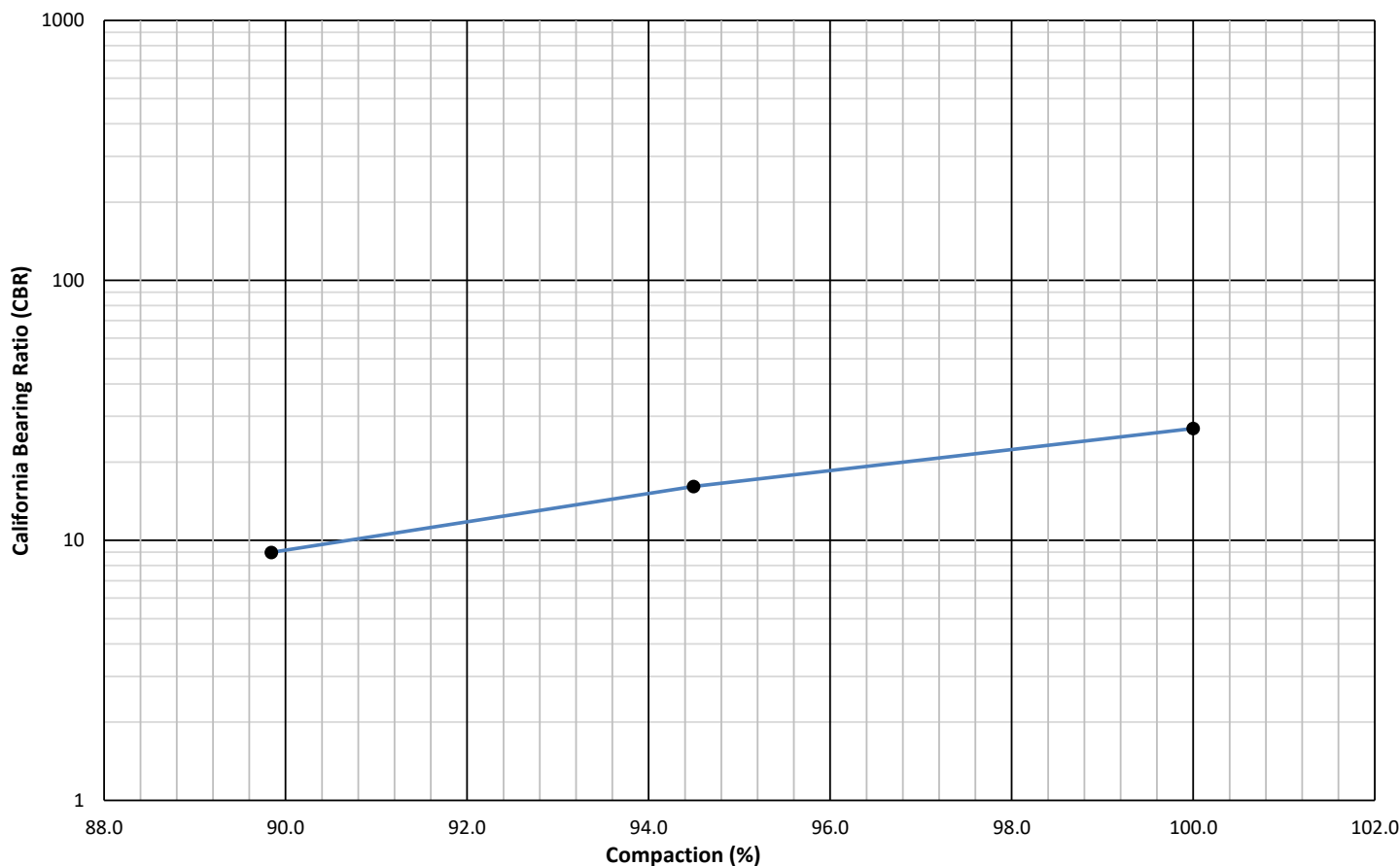
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP29
Depth: (m) 3.6 -4.9

Job Number: SRK-58
Lab Number: SRK-58-900
Method: SANS 3001 GR40
Date: 13-Aug-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)	(%)	(%)	(%)					
1781	13.9	1762	14.5	100.0	0.1	27	36	41	100	27
1781	13.9	1665	14.5	94.5	0.1	16	19	21	98	22
1781	13.9	1583	14.5	89.8	0.2	9	9	8	97	20
									95	17
									93	13
									90	9



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Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP29
Depth: (m) 3.6 - 4.9

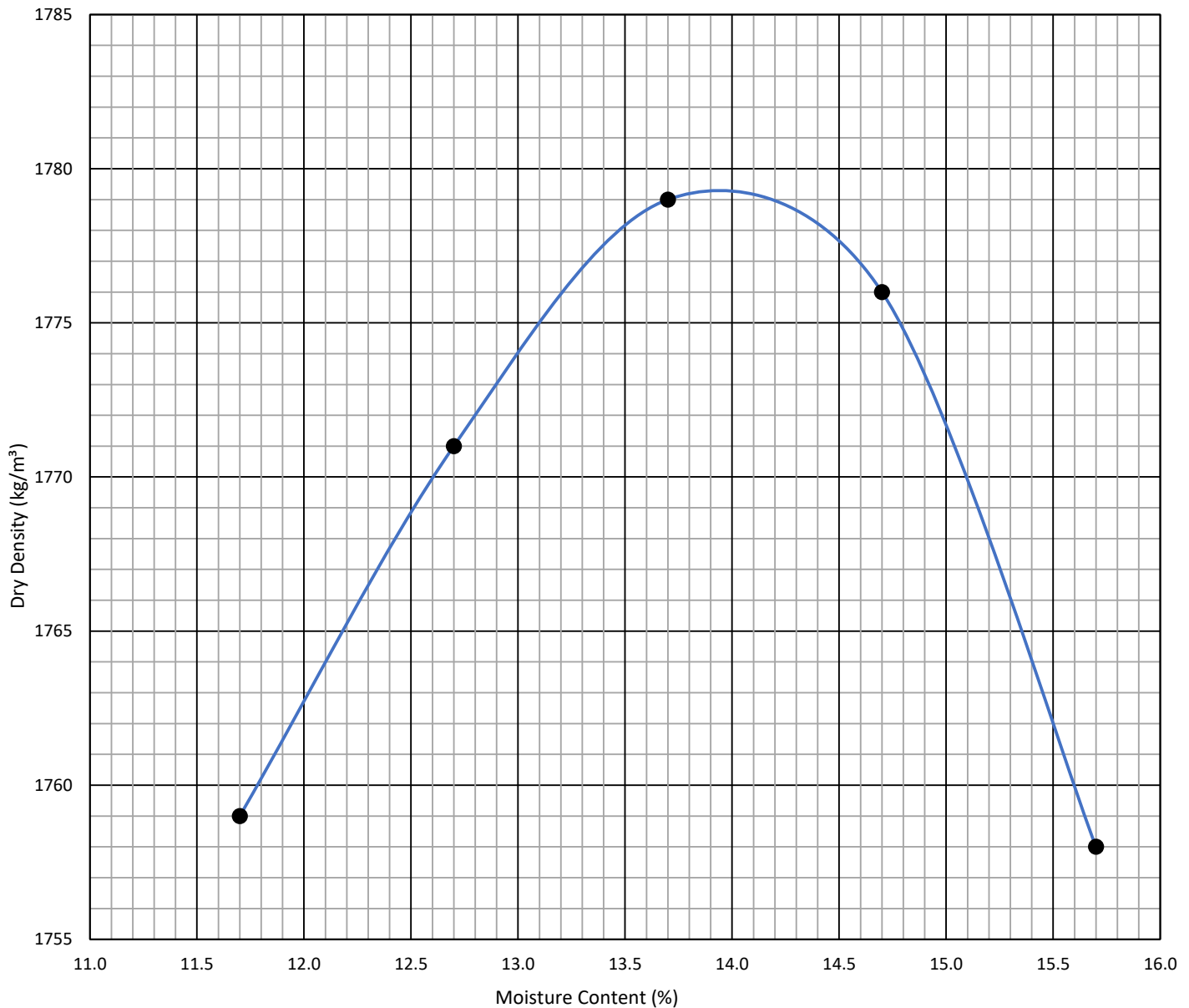
Job Number: SRK-58
Lab Number: SRK-58-900
Method: SANS 3001 GR30
Date: 13-Aug-19

MDD & OMC DETERMINATION (Mod. AASHTO)

Maximum Dry Density: **1781** kg/m³

Optimum Moisture Content: **13.9** %

Moisture Content (%):	11.7	12.7	13.7	14.7	15.7			
Dry Density (kg/m ³)	1759	1771	1779	1776	1758			



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BM du Plessis
Civil Engineering

Req. No: cc 200004833323

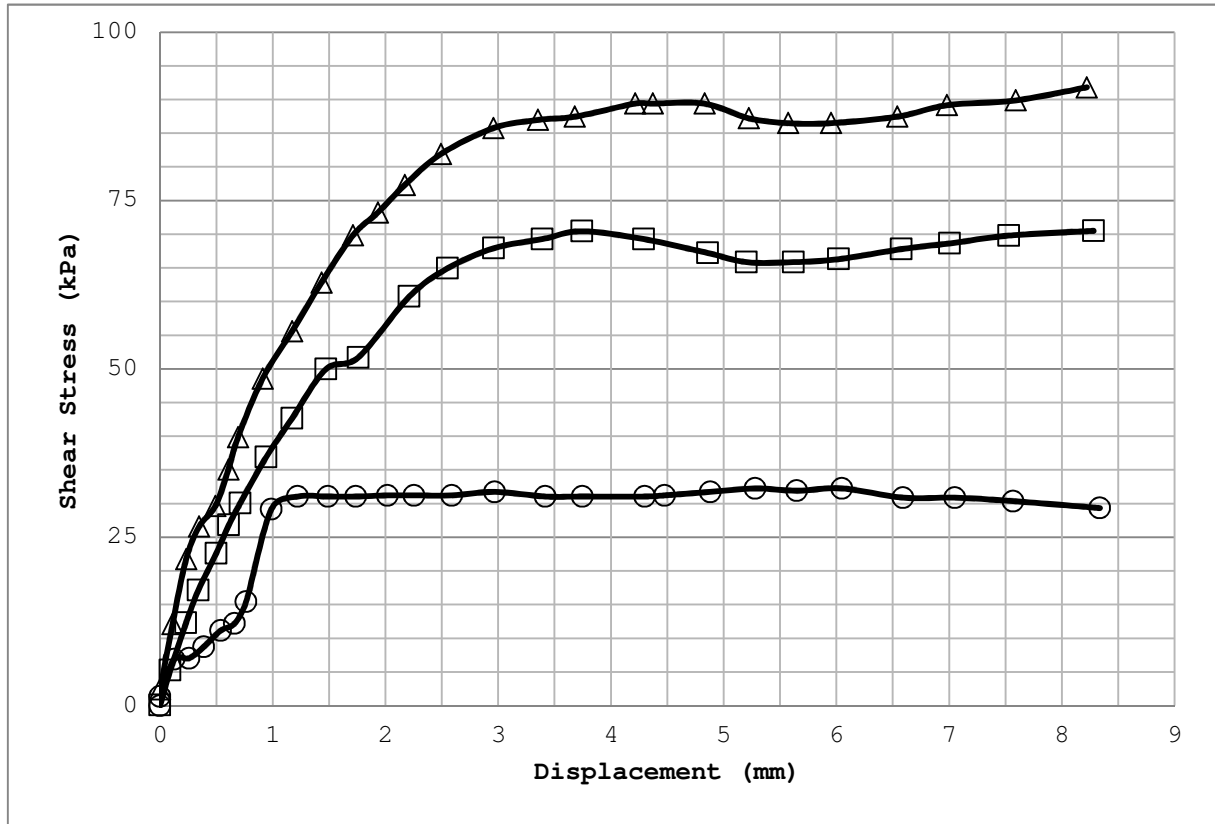
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Monument Park
0181

PO Box 26272
Monument Park
0105

P1/2

Tel/Fax 012 346 7586
Cell: 082 375 3003
bennie@geotesting.co.za

Project:	Gloria Mine
Sample Number:	GL-TP21
Sample Position:	0.4-1.9 m
Test:	DIRECT SHEAR TEST
Preparation:	Remoulded
Lab Number:	19/281
Test Date:	30-Jul-19



Normal Stress (kPa)	50.0	100.0	150.0
Shear Stress (kPa)	32.3	70.5	91.8
Displacement (mm)	1.2	4.9	3.2



BM du Plessis
Civil Engineering

Req. No: cc 200004833323

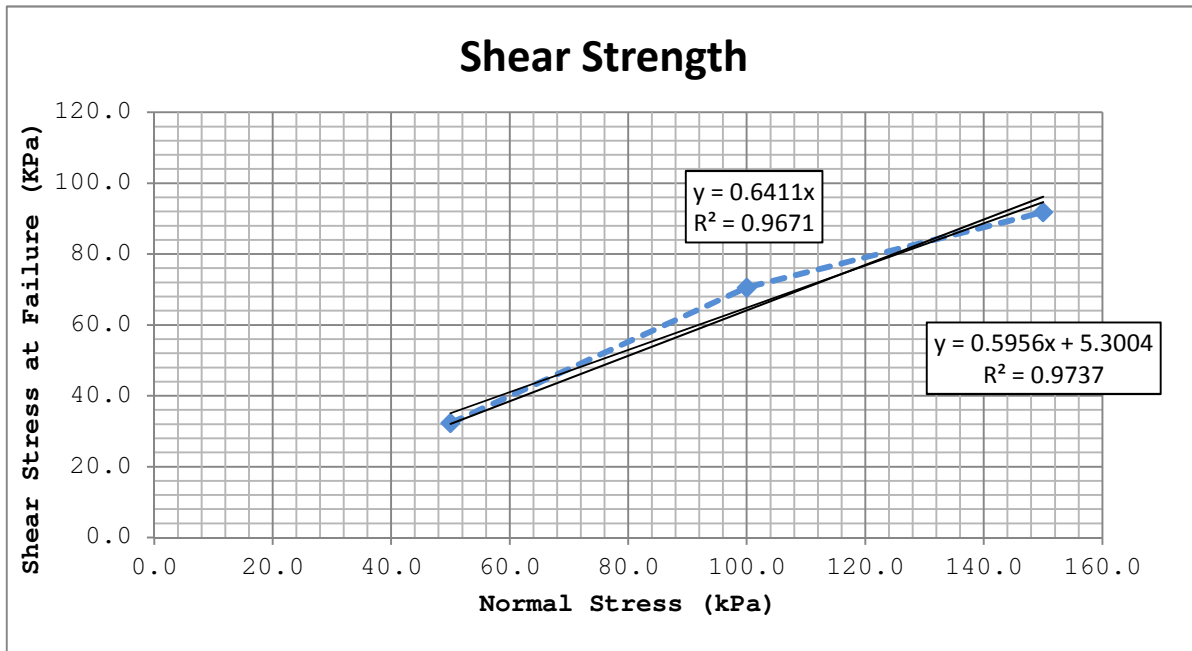
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PO Box 26272
Monument Park
0105

P2/2

Tel/Fax 012 346 7586
Cell: 082 375 3003
bennie@geotesting.co.za

Project:	Gloria Mine
Sample Number:	GL-TP21
Sample Position:	0.4-1.9 m
Test:	DIRECT SHEAR TEST
Preparation:	Remoulded
Lab Number:	19/281
Test Date:	30-Jul-19



Linear trendline fit intersecting zero:

Apparent Cohesion Intersect : 0.0
Angle of Shear Resistance ϕ : 32.7 °

Linear trendline fit intersecting 3 data points:

Apparent Cohesion Intersect : 5.3
Angle of Shear Resistance ϕ : 30.8 °

Sample:	1	2	3
Initial Moisture:	8.0%	8.4%	8.4%
Initial Bulk Density (kg/m ³):	1960.5	1965.0	1960.9
Initial Dry Density (kg/m ³):	1814.6	1811.9	1808.1



BM du Plessis
Civil Engineering

Req. No: cc 200004833323

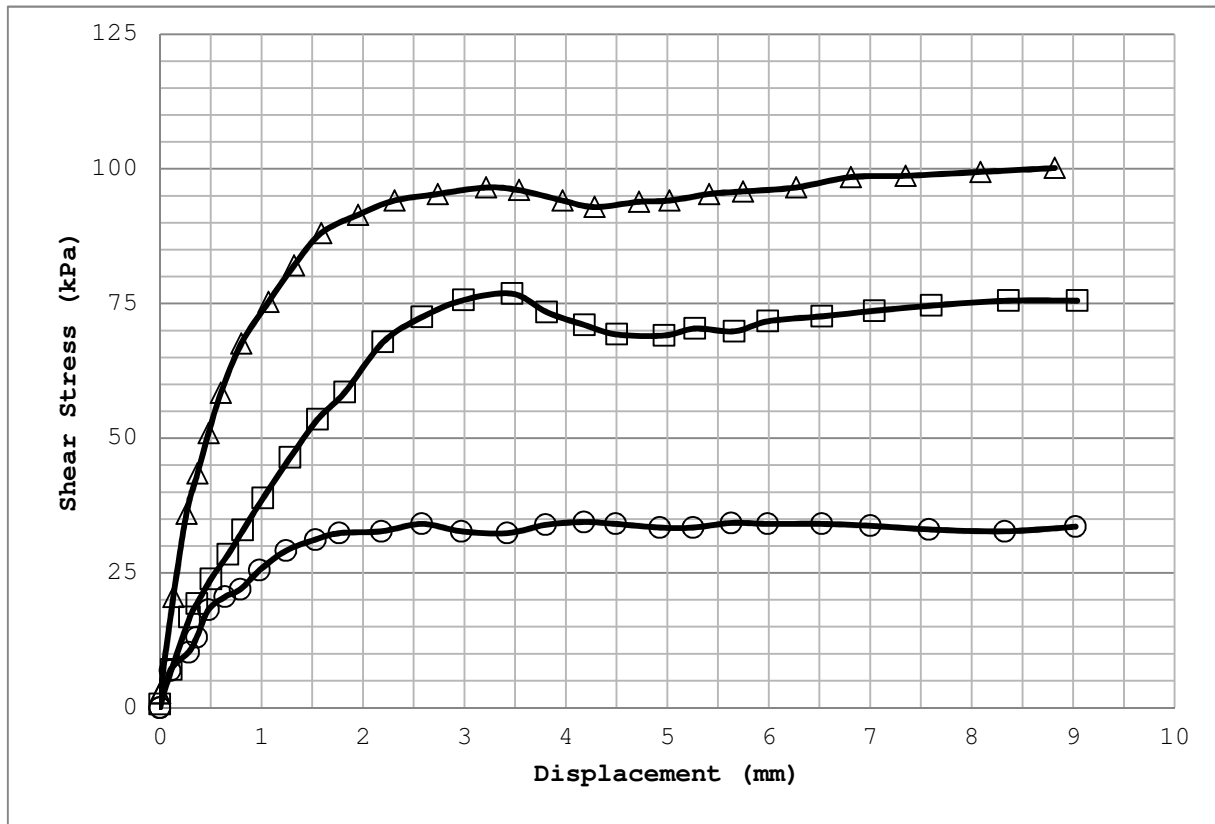
250 ORION Ave
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Monument Park
0105

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Tel/Fax 012 346 7586
Cell: 082 375 3003
bennie@geotesting.co.za

Project:	Gloria Mine
Sample Number:	GL-TP28
Sample Position:	3.5-4.8m
Test:	DIRECT SHEAR TEST
Preparation:	Remoulded
Lab Number:	19/282
Test Date:	01-Aug-19



Normal Stress (kPa)	50.0	100.0	150.0
Shear Stress (kPa)	34.5	76.8	100.2
Displacement (mm)	4.2	3.5	8.8



BM du Plessis
Civil Engineering

Req. No: cc 200004833323

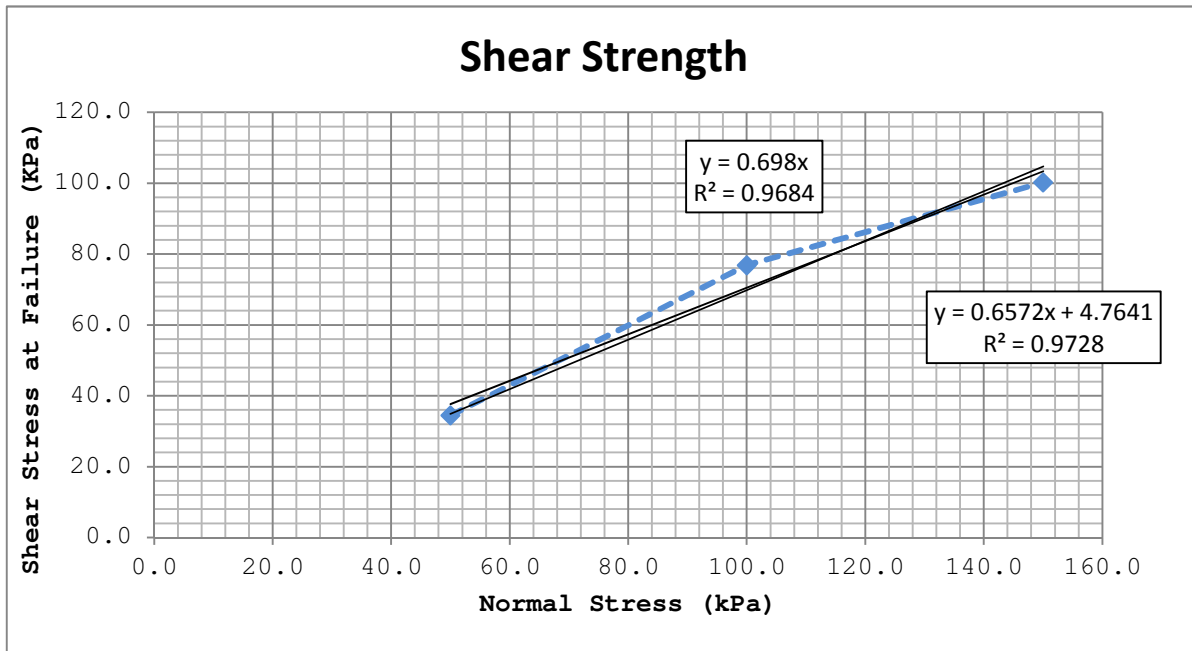
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Tel/Fax 012 346 7586
Cell: 082 375 3003
bennie@geotesting.co.za

Project:	Gloria Mine
Sample Number:	GL-TP28
Sample Position:	3.5-4.8m
Test:	DIRECT SHEAR TEST
Preparation:	Remoulded
Lab Number:	19/282
Test Date:	01-Aug-19



Linear trendline fit intersecting zero:

Apparent Cohesion Intersect : 0.0
Angle of Shear Resistance ϕ : 34.9 °

Linear trendline fit intersecting 3 data points:

Apparent Cohesion Intersect : 4.8
Angle of Shear Resistance ϕ : 33.3 °

Sample:	1	2	3
Initial Moisture:	8.8%	8.8%	9.4%
Initial Bulk Density (kg/m ³):	2045.3	2066.0	2077.0
Initial Dry Density (kg/m ³):	1880.0	1898.5	1897.8



BM du Plessis
Civil Engineering

Req. No: cc 20000483323

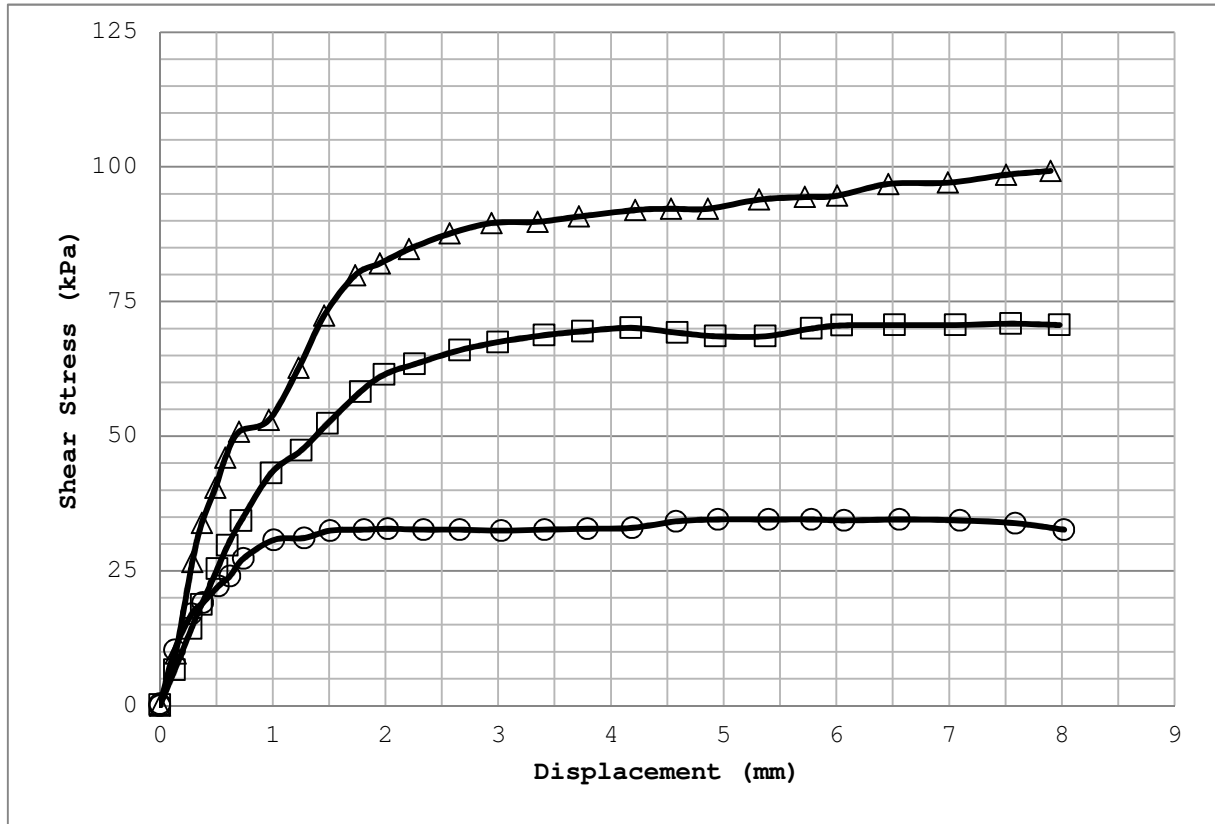
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Cell: 082 375 3003
bennie@geotesting.co.za

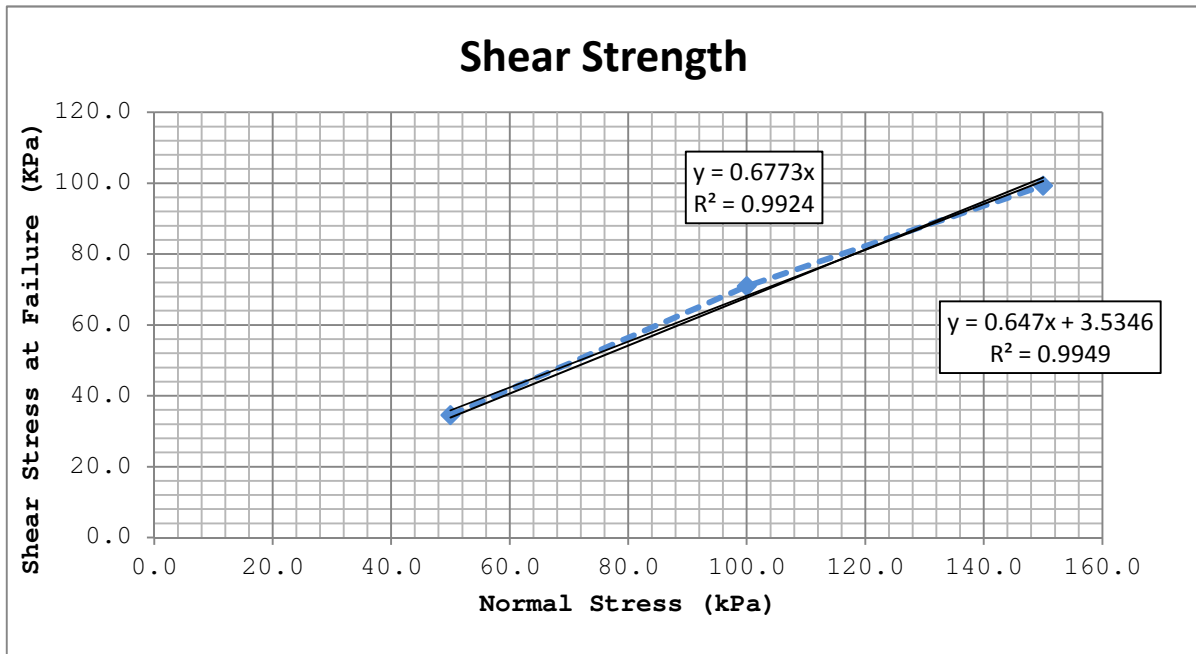
Project:	Gloria Mine
Sample Number:	TP1
Sample Position:	0.2-1.4m
Test:	DIRECT SHEAR TEST
Preparation:	Remoulded
Lab Number:	19/280
Test Date:	29-Jul-19



Normal Stress (kPa)	50.0	100.0	150.0
Shear Stress (kPa)	34.6	70.9	99.3
Displacement (mm)	5.0	7.6	7.9



Project:	Gloria Mine
Sample Number:	TP1
Sample Position:	0.2-1.4m
Test:	DIRECT SHEAR TEST
Preparation:	Remoulded
Lab Number:	19/280
Test Date:	29-Jul-19



Linear trendline fit intersecting zero:

Apparent Cohesion Intersect : 0.0
 Angle of Shear Resistance ϕ : 34.1 °

Linear trendline fit intersecting 3 data points:

Apparent Cohesion Intersect : 3.5
 Angle of Shear Resistance ϕ : 32.9 °

Sample:	1	2	3
Initial Moisture:	7.0%	7.4%	7.1%
Initial Bulk Density (kg/m ³):	1916.0	1950.3	1919.7
Initial Dry Density (kg/m ³):	1790.3	1816.2	1792.8



Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: TP1
Depth: (m) 0.2 - 1.4

Job Number: SRK-58
Lab Number: SRK-58-890
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

General Test Data

Type of Test:	Saturated, Consolidated Undrained with Pore Water Pressure Measurements
Type of Sample:	Remoulded to dry density of 1500kg/m ³
Side Drains:	No
Drainage:	To One End
Comments:	-

Initial Specimen Details

		Specimen 1	Specimen 2	Specimen 3
Diameter	mm	50.0	50.0	50.0
Length	mm	100.7	100.6	100.8
Volume	cm ³	197.7	197.4	198.0
Moisture Content	%	8.8	9.9	9.3
Dry Density	g/cm ³	1.478	1.466	1.470
Void Ratio	-	0.821	0.837	0.832
Degree of Saturation	%	28.8	31.8	30.1
Particle Density (SG)	-		2.693	

End of Saturation Phase

Method:		Increments of Cell- and Backpressure		
		Specimen 1	Specimen 2	Specimen 3
Cell Pressure	kPa	200	200	200
Back Pressure	kPa	190	190	190
B Value	-	0.96	0.98	0.96

Consolidation Phase

		Specimen 1	Specimen 2	Specimen 3
Cell Pressure	kPa	290	390	490
Back Pressure	kPa	190	190	190
Pore Pressure (Initial)	kPa	277.1	377.7	477.8
Pore Pressure (Final)	kPa	186.7	189.0	188.7
Volumetric Strain	%	1.7	2.6	3.2
Effective Stress *	kPa	99.1	197.7	298.3

*: At commencement of Shear

End of Shear Phase

Failure Criterion:		Maximum Deviator Stress			
Rate of Strain		1%/hour			
		Specimen 1	Specimen 2	Specimen 3	
Corrected Deviator Stress	kPa	31.0	77.9	122.0	
at Axial Strain	%	0.3	0.7	0.4	
Principal Stresses	σ_1'	kPa	88	175	287
	σ_3'	kPa	57	98	165

Final Specimen Details

Moisture Content	%	24.8	23.7	23.3
Dry Density	g/cm ³	1.503	1.505	1.519
Void Ratio	-	0.791	0.789	0.773



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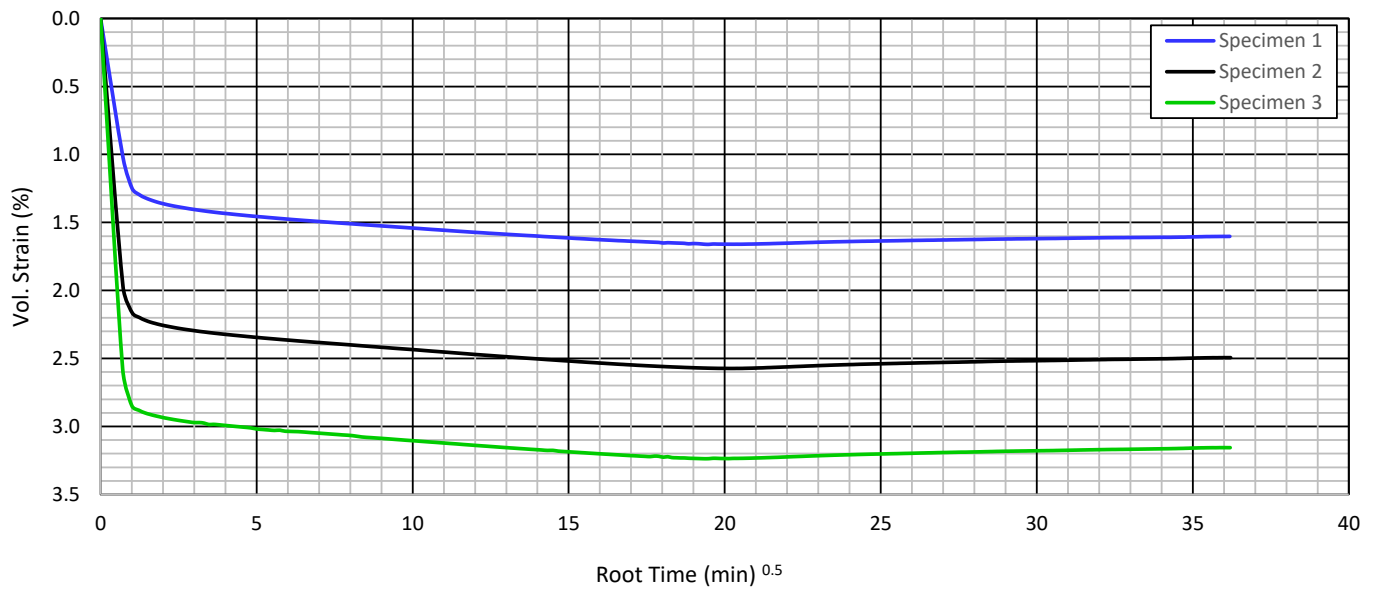
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: TP1
Depth: (m) 0.2 - 1.4

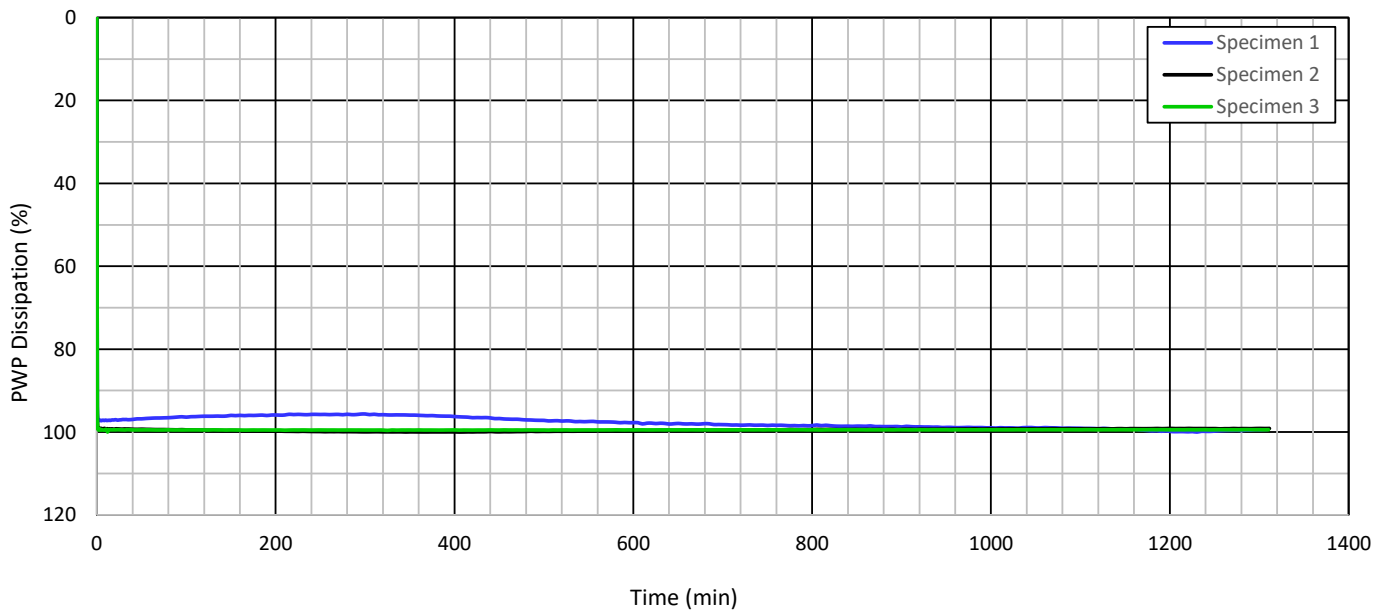
Job Number: SRK-58
Lab Number: SRK-58-890
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

Consolidation



Pore Water Pressure Dissipation





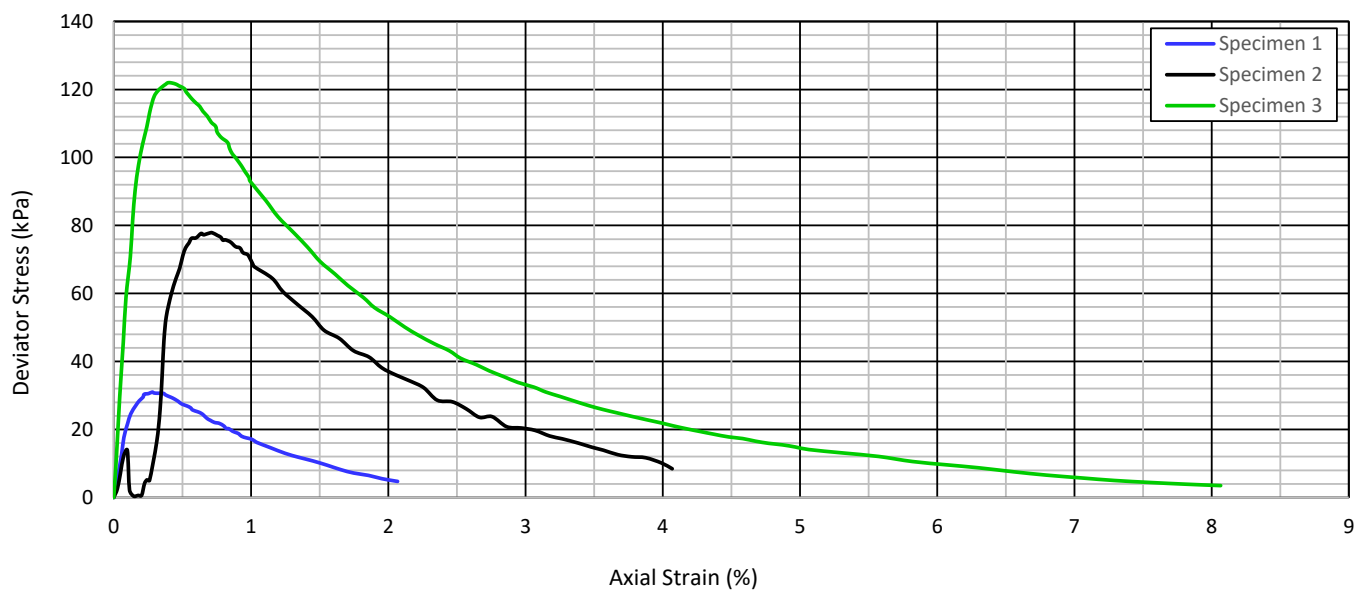
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: TP1
Depth: (m) 0.2 - 1.4

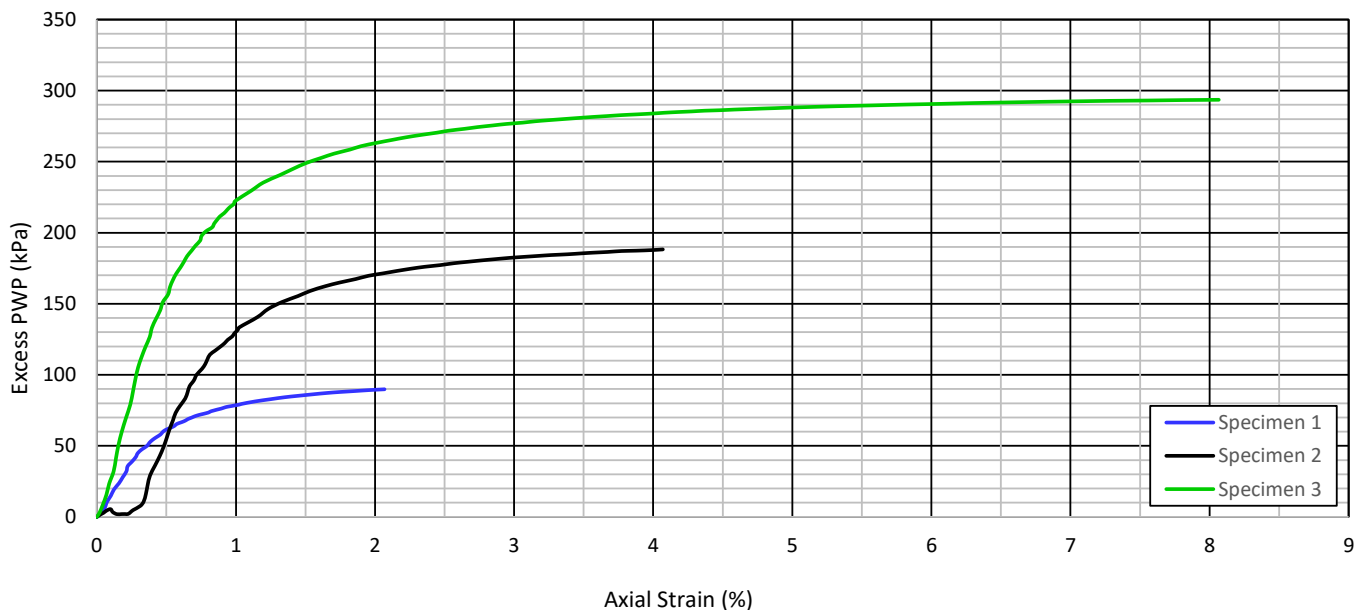
Job Number: SRK-58
Lab Number: SRK-58-890
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

Deviator Stress vs Axial Strain



Excess Pore Water Pressure vs Axial Strain





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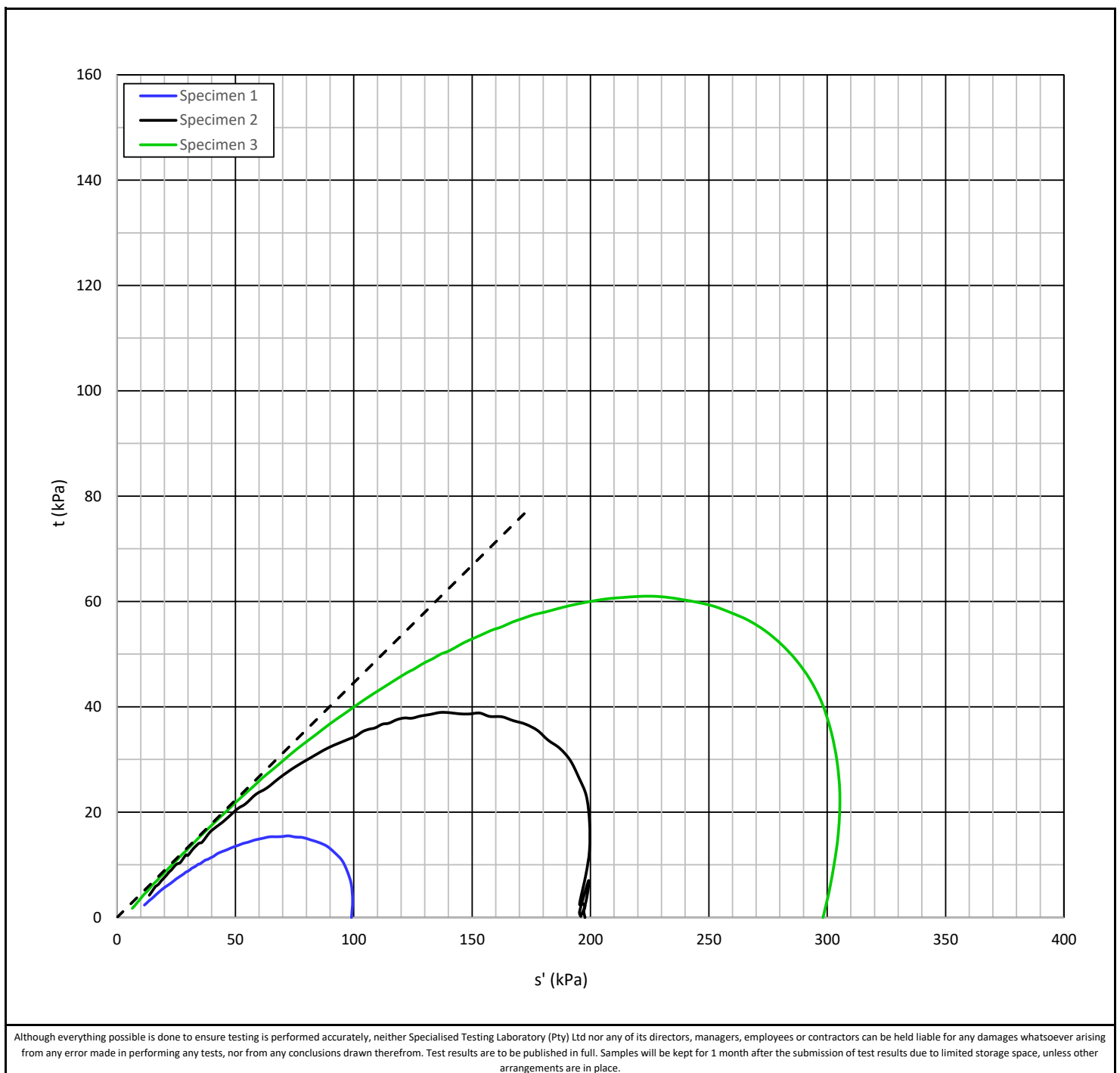
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: TP1
Depth: (m) 0.2 - 1.4

Job Number: SRK-58
Lab Number: SRK-58-890
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

ϕ'	Deg.	27
c'	kPa	0



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP28
Depth: (m) 3.6 - 4.8

Job Number: SRK-58
Lab Number: SRK-58-899
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

General Test Data

Type of Test:	Saturated, Consolidated Undrained with Pore Water Pressure Measurements
Type of Sample:	Remoulded to dry density of 1500kg/m ³
Side Drains:	No
Drainage:	To One End
Comments:	-

Initial Specimen Details

		Specimen 1	Specimen 2	Specimen 3
Diameter	mm	50.0	50.0	50.0
Length	mm	100.6	100.9	100.9
Volume	cm ³	197.4	198.2	198.0
Moisture Content	%	8.8	7.9	7.9
Dry Density	g/cm ³	1.480	1.488	1.488
Void Ratio	-	0.811	0.802	0.801
Degree of Saturation	%	29.0	26.4	26.6
Particle Density (SG)	-		2.681	

End of Saturation Phase

Method:		Increments of Cell- and Backpressure		
		Specimen 1	Specimen 2	Specimen 3
Cell Pressure	kPa	200	200	200
Back Pressure	kPa	190	190	190
B Value	-	0.96	0.96	0.96

Consolidation Phase

		Specimen 1	Specimen 2	Specimen 3
Cell Pressure	kPa	290	390	490
Back Pressure	kPa	190	190	190
Pore Pressure (Initial)	kPa	280.4	378.1	476.2
Pore Pressure (Final)	kPa	191.0	190.3	187.9
Volumetric Strain	%	5.3	8.1	9.1
Effective Stress *	kPa	96.1	197.3	298.4

*: At commencement of Shear

End of Shear Phase

Failure Criterion:		Maximum Deviator Stress		
Rate of Strain		1 %/hour		
		Specimen 1	Specimen 2	Specimen 3
Corrected Deviator Stress	kPa	36.0	81.9	114.0
at Axial Strain	%	0.9	0.5	0.5
Principal Stresses	σ_1'	77	177	255
	σ_3'	41	95	141

Final Specimen Details

Moisture Content	%	24.4	22.3	21.6
Dry Density	g/cm ³	1.564	1.619	1.637
Void Ratio	-	0.714	0.656	0.638



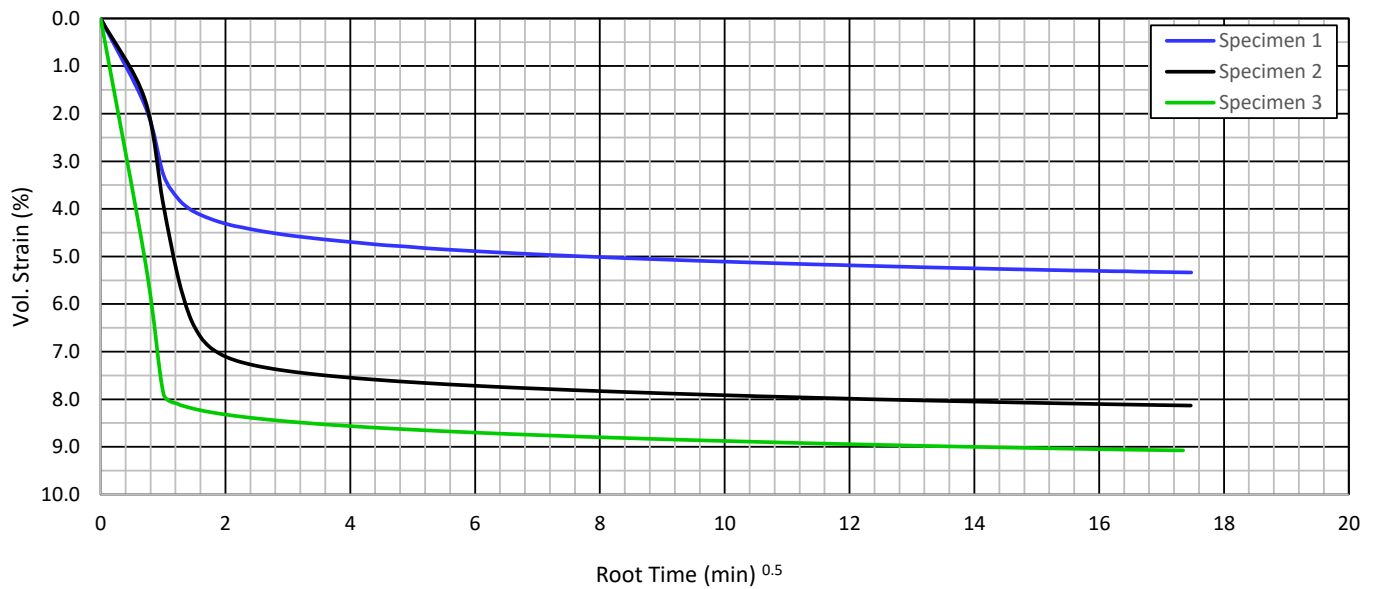
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP28
Depth: (m) 3.6 - 4.8

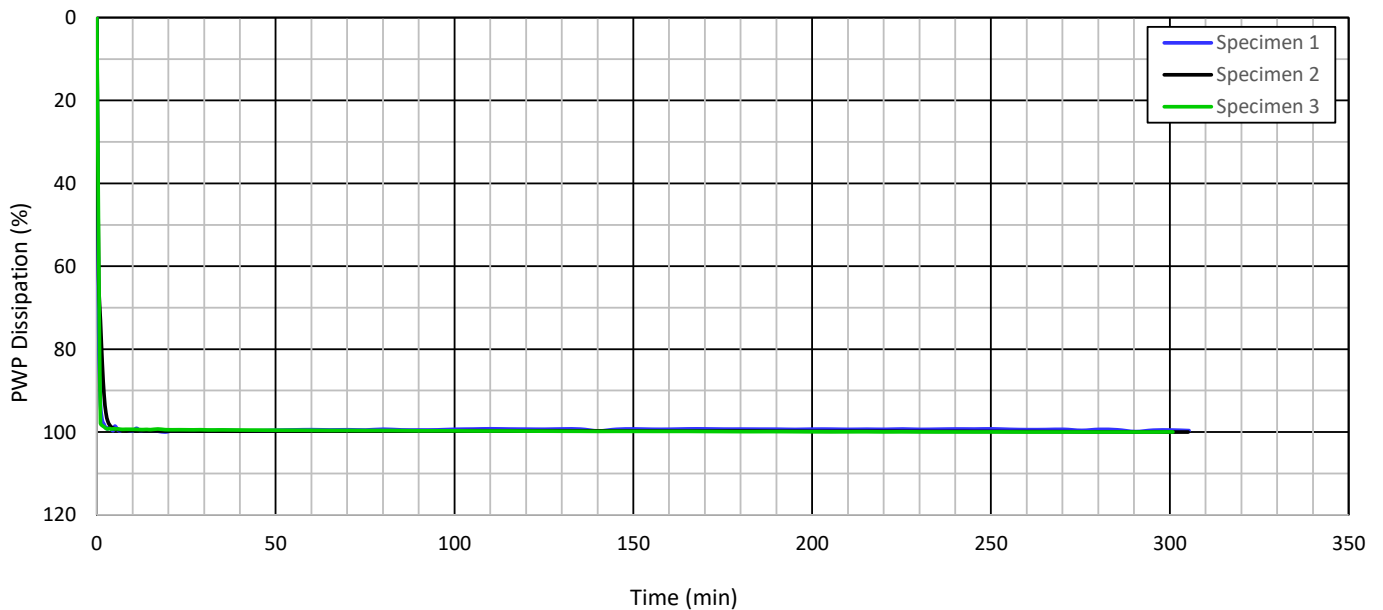
Job Number: SRK-58
Lab Number: SRK-58-899
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

Consolidation



Pore Water Pressure Dissipation





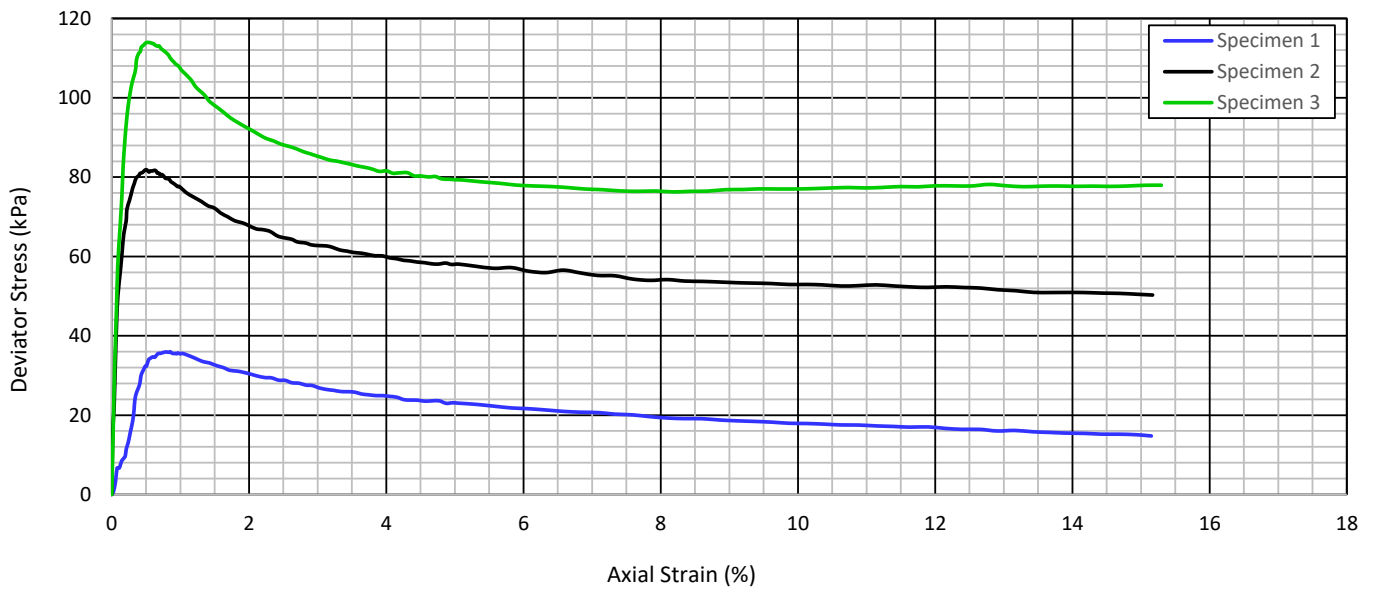
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP28
Depth: (m) 3.6 - 4.8

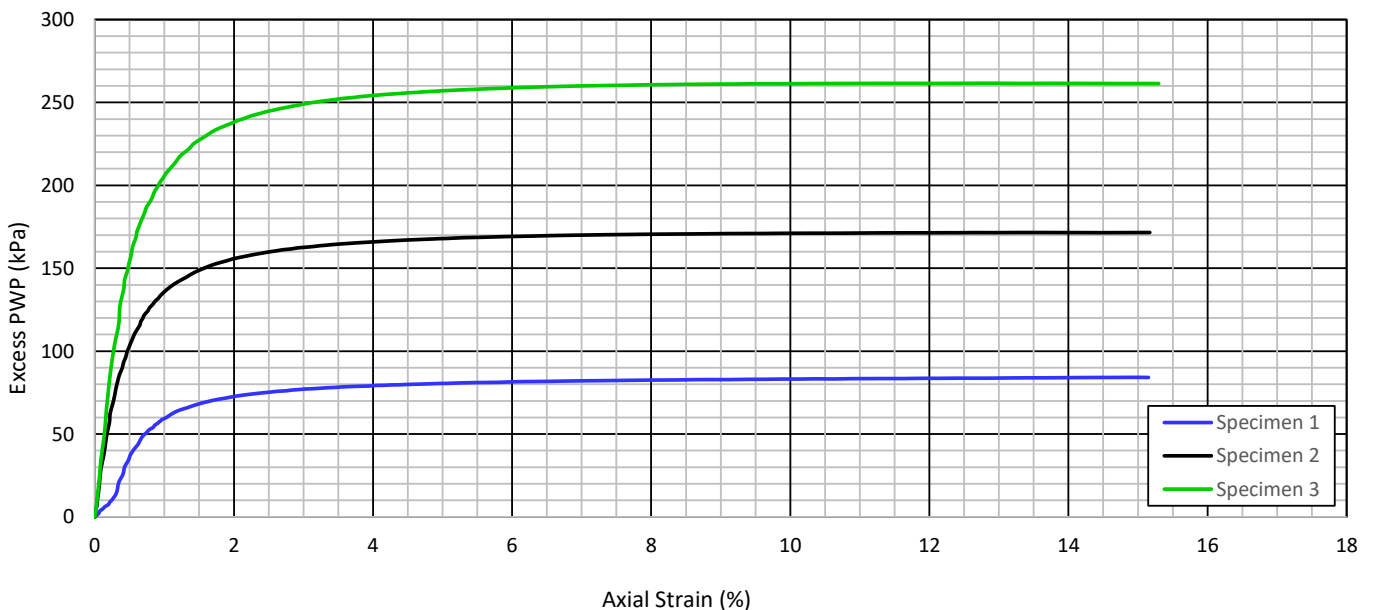
Job Number: SRK-58
Lab Number: SRK-58-899
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

Deviator Stress vs Axial Strain



Excess Pore Water Pressure vs Axial Strain





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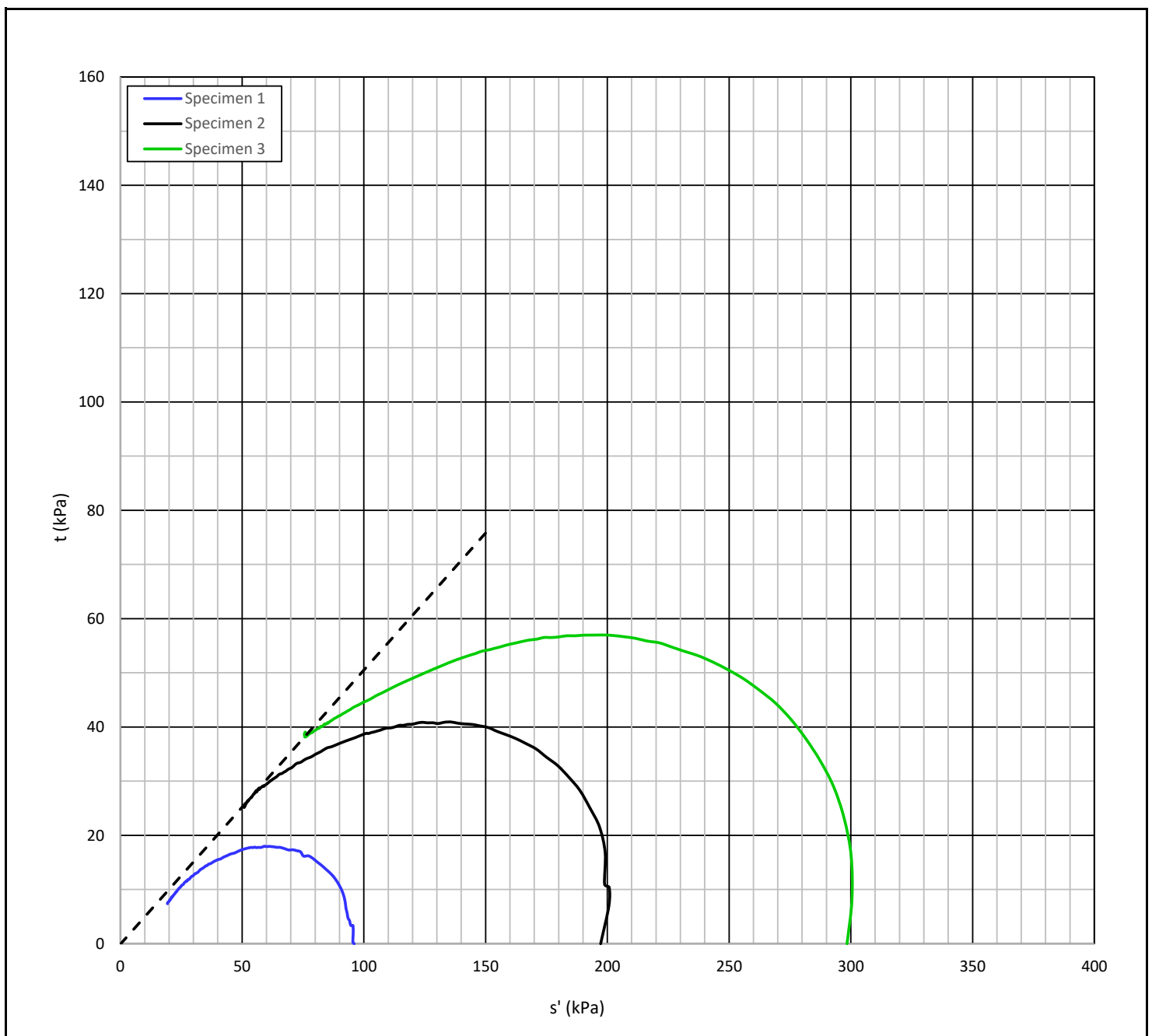
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP28
Depth: (m) 3.6 - 4.8

Job Number: SRK-58
Lab Number: SRK-58-899
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

ϕ'	Deg.	31
c'	kPa	0



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP29
Depth: (m) 3.6 - 4.9

Job Number: SRK-58
Lab Number: SRK-58-900
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

General Test Data

Type of Test:	Saturated, Consolidated Undrained with Pore Water Pressure Measurements
Type of Sample:	Remoulded to dry density of 1500kg/m ³
Side Drains:	No
Drainage:	To One End
Comments:	-

Initial Specimen Details

		Specimen 1	Specimen 2	Specimen 3
Diameter	mm	50.0	50.0	50.0
Length	mm	100.4	100.7	100.8
Volume	cm ³	197.1	197.6	198.0
Moisture Content	%	7.7	7.6	7.2
Dry Density	g/cm ³	1.491	1.489	1.492
Void Ratio	-	0.799	0.801	0.798
Degree of Saturation	%	25.9	25.4	24.1
Particle Density (SG)	-		2.682	

End of Saturation Phase

Method:	Increments of Cell- and Backpressure			
		Specimen 1	Specimen 2	Specimen 3
Cell Pressure	kPa	200	200	200
Back Pressure	kPa	190	190	190
B Value	-	0.99	0.96	0.99

Consolidation Phase

		Specimen 1	Specimen 2	Specimen 3
Cell Pressure	kPa	290	390	490
Back Pressure	kPa	190	190	190
Pore Pressure (Initial)	kPa	277.3	379.1	477.8
Pore Pressure (Final)	kPa	189.6	188.0	189.7
Volumetric Strain	%	3.5	5.4	6.8
Effective Stress *	kPa	97.8	198.6	297.2

*: At commencement of Shear

End of Shear Phase

Failure Criterion:	Maximum Deviator Stress			
Rate of Strain	1%/hour			
		Specimen 1	Specimen 2	Specimen 3
Corrected Deviator Stress	kPa	81.0	121.1	189.8
at Axial Strain	%	5.8	1.5	2.0
Principal Stresses	σ_1'	kPa	117	198
	σ_3'	kPa	36	77

Final Specimen Details

Moisture Content	%	27.9	26.9	25.9
Dry Density	g/cm ³	1.545	1.574	1.601
Void Ratio	-	0.736	0.704	0.675



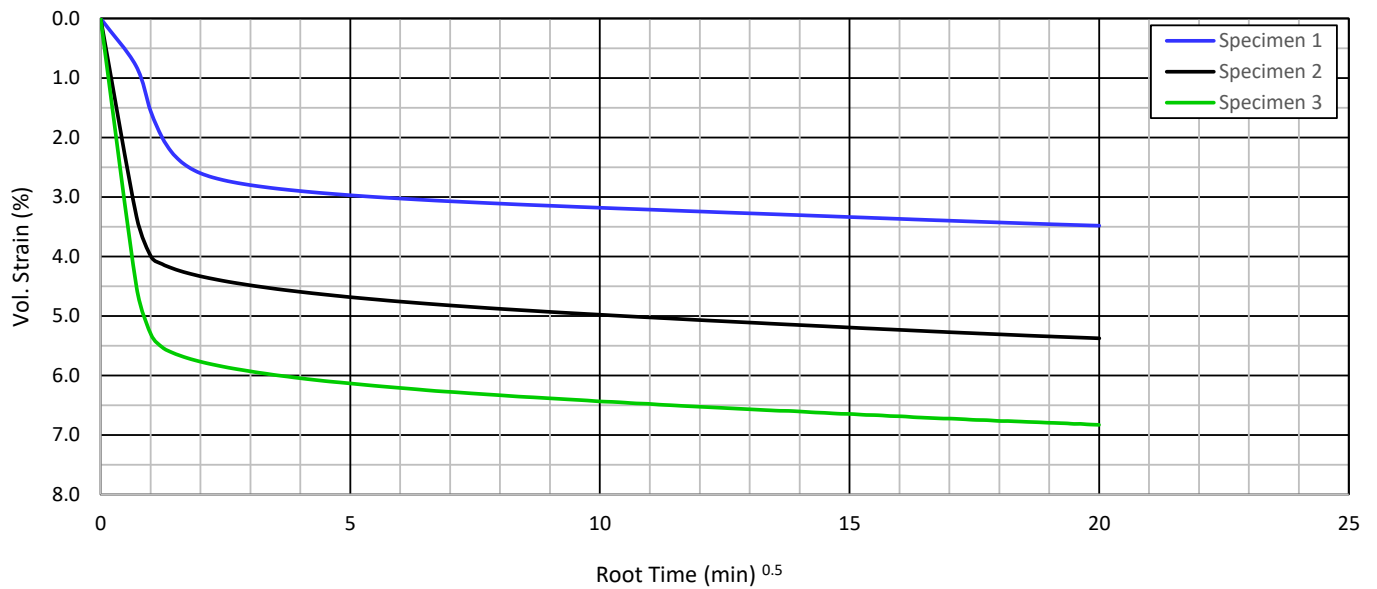
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP29
Depth: (m) 3.6 - 4.9

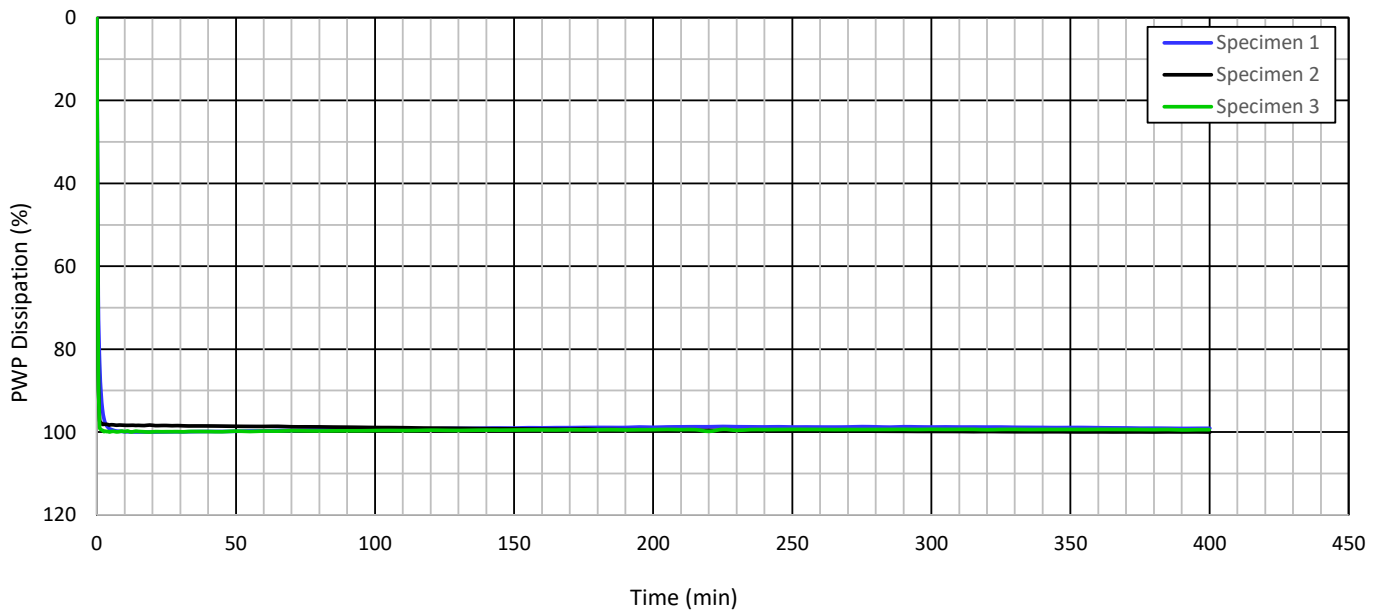
Job Number: SRK-58
Lab Number: SRK-58-900
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

Consolidation



Pore Water Pressure Dissipation





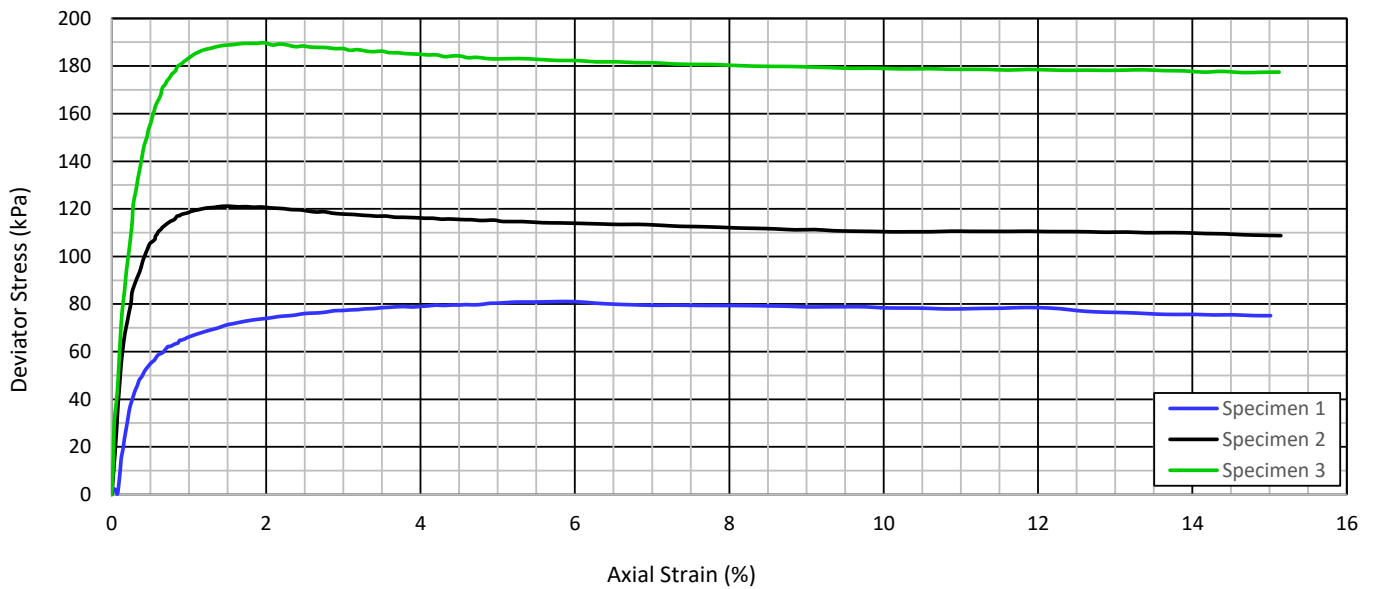
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP29
Depth: (m) 3.6 - 4.9

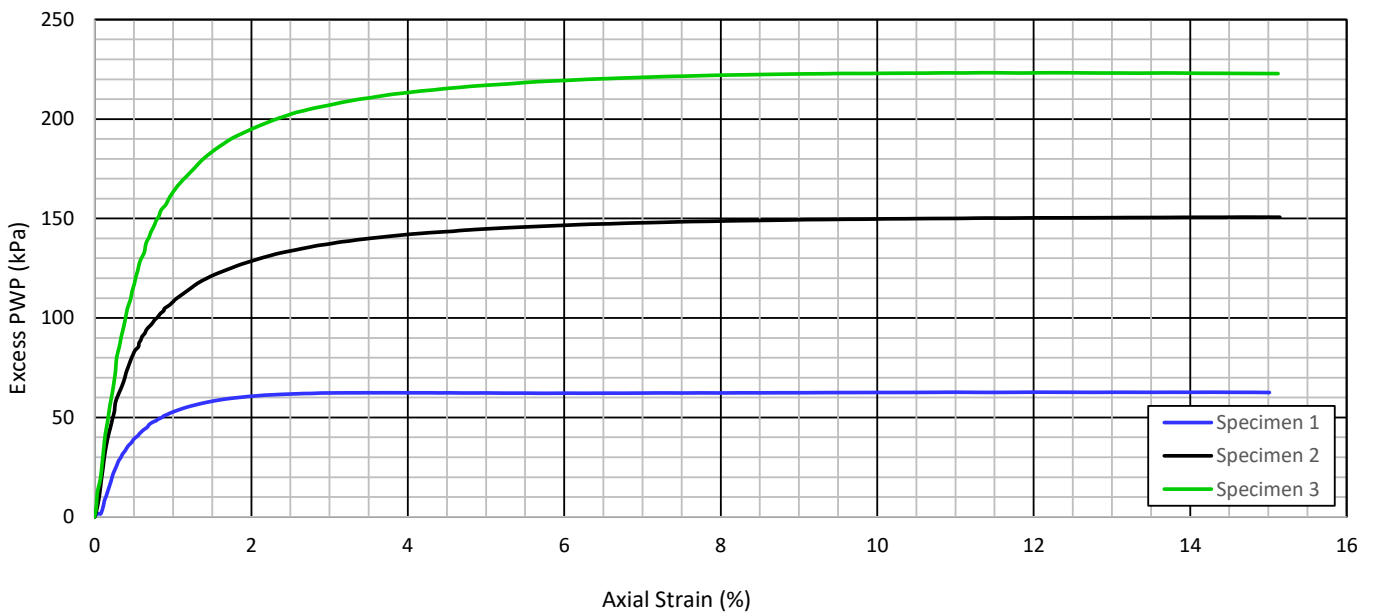
Job Number: SRK-58
Lab Number: SRK-58-900
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

Deviator Stress vs Axial Strain



Excess Pore Water Pressure vs Axial Strain





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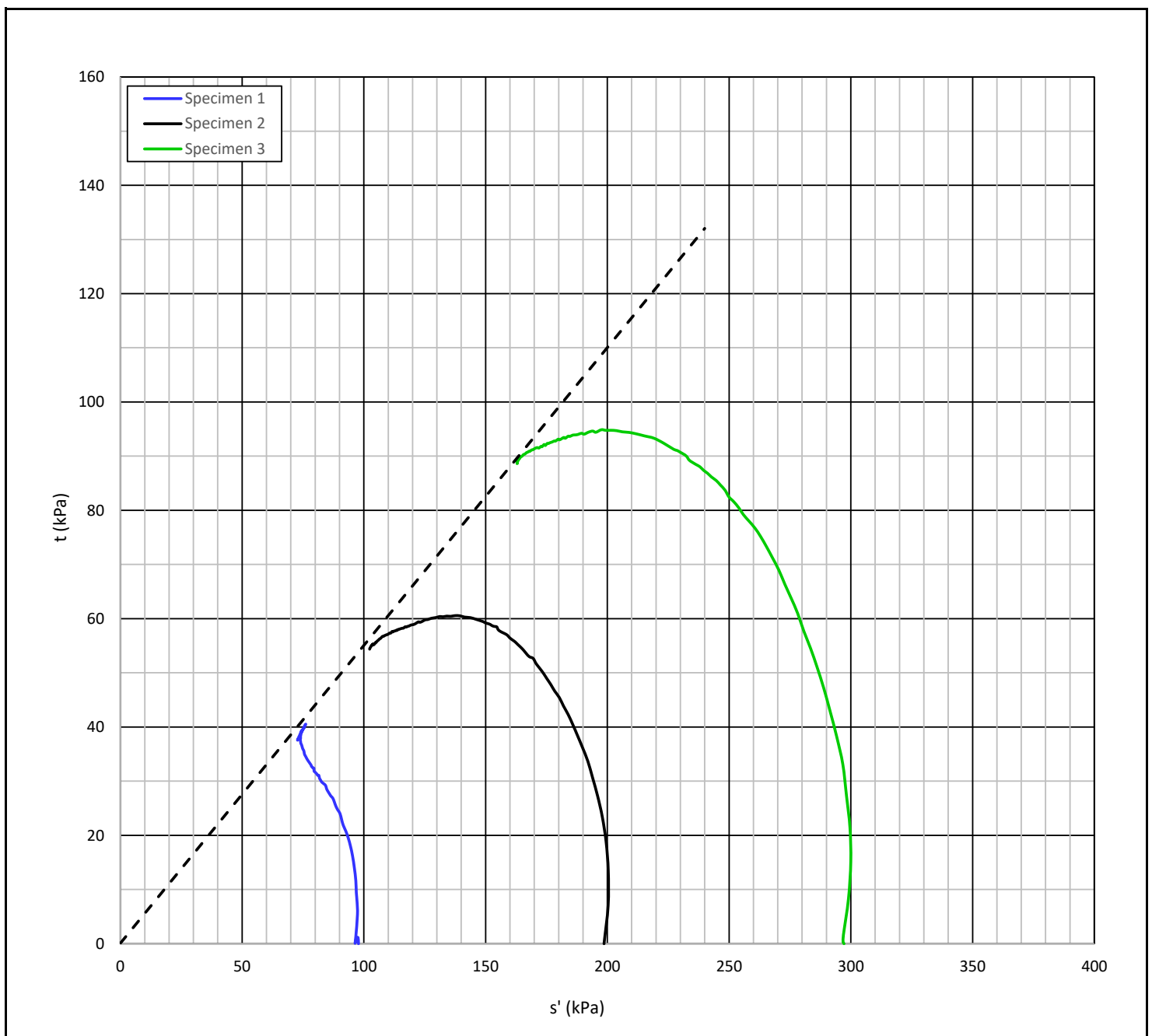
Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP29
Depth: (m) 3.6 - 4.9

Job Number: SRK-58
Lab Number: SRK-58-900
Date: 13/08/2019
Method: BS 1377 Part 8

CONSOLIDATED UNDRAINED TRIAXIAL TEST

ϕ'	Deg.	33
c'	kPa	0



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Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: TP1
Depth: (m) 0.2 - 1.4

Job Number: SRK-58
Lab Number: SRK-58-890
Date: 29-Aug-19

FLEXIBLE WALL PERMEABILITY TEST

General Test Data

Type of Sample:	-	Remoulded to dry density of 1500kg/m ³
MDD (Proctor Effort):	g/cm ³	-
OMC:	%	-
Effective Pressure	kPa	100, 200, 300
Hydraulic Gradient:	kPa	10

Initial Specimen Details

Diameter	mm	50.0
Length	mm	100.3
Volume	cm ³	196.9
Moisture Content	%	10.0
Dry Density	g/cm ³	1.469
Void Ratio	-	0.833
Degree of Saturation	%	32.2
Particle Density (SG)	-	2.693 - Determined

End of Saturation Phase

Method:	Increments of Cell- and Backpressure	
Cell Pressure	kPa	250
Back Pressure	kPa	240
B Value	-	0.98

Consolidation Phase

		Stage 1	Stage 2	Stage 3
Cell Pressure	kPa	340	440	540
Back Pressure	kPa	240	240	240

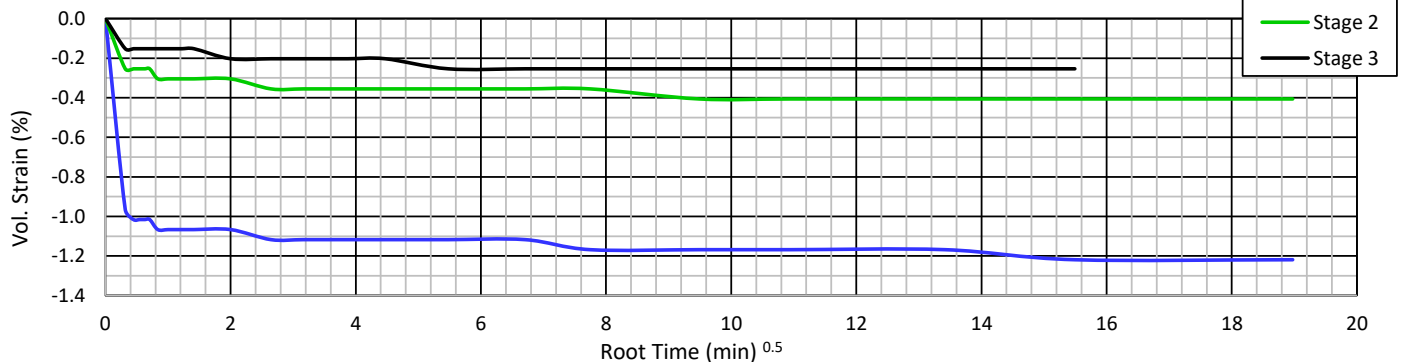
Permeability Details

Coefficient of Permeability	Min.	m/s	4.35E-06	3.29E-06	2.45E-06
	Max.	m/s	8.51E-06	6.37E-06	5.66E-06
	Ave.	m/s	6.02E-06	4.38E-06	3.68E-06

Final Specimen Details

Moisture Content	%	22.6
Dry Density	g/cm ³	1.487
Void Ratio	-	0.811

Consolidation



Quality | Excellence | On Time

Client Name: SRK Consulting
Project Name: 547037: Gloria Mine
Sample: GL-TP28
Depth: (m) 3.6 - 4.8

Job Number: SRK-58
Lab Number: SRK-58-899
Date: 29-Aug-19

FLEXIBLE WALL PERMEABILITY TEST

General Test Data

Type of Sample:	-	Remoulded to dry density of 1500kg/m ³
MDD (Proctor Effort):	g/cm ³	-
OMC:	%	-
Effective Pressure	kPa	100, 200, 300
Hydraulic Gradient:	kPa	10

Initial Specimen Details

Diameter	mm	50.0
Length	mm	100.7
Volume	cm ³	197.8
Moisture Content	%	7.5
Dry Density	g/cm ³	1.496
Void Ratio	-	0.792
Degree of Saturation	%	25.3
Particle Density (SG)	-	2.681 - Determined

End of Saturation Phase

Method:	Increments of Cell- and Backpressure	
Cell Pressure	kPa	200
Back Pressure	kPa	190
B Value	-	0.99

Consolidation Phase

		Stage 1	Stage 2	Stage 3
Cell Pressure	kPa	290	390	490
Back Pressure	kPa	190	190	190

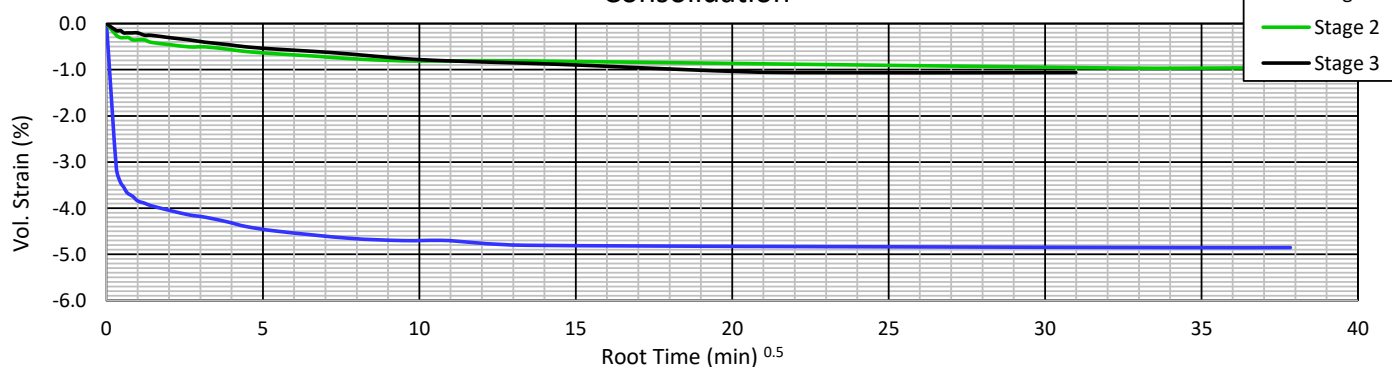
Permeability Details

Coefficient of Permeability	Min.	m/s	6.11E-06	3.54E-06	2.44E-06
	Max.	m/s	7.42E-06	4.56E-06	3.26E-06
	Ave.	m/s	6.83E-06	4.03E-06	2.79E-06

Final Specimen Details

Moisture Content	%	21.5
Dry Density	g/cm ³	1.572
Void Ratio	-	0.705

Consolidation





WATERLAB

WATERLAB (PTY) LTD

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CERTIFICATE OF ANALYSES BASSON INDEX

Date received: 2019-08-14
Project number: 1000

Report number: 85431

Date completed: 2019-08-30
Order number: G231

Client name: Specialised Testing Laboratory
Address: Unit 1, 13 Bloubokkie Street, Koedoespoort, 0186
Telephone: ---

Contact person: Gerrie Janse v. Rensburg
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Analyses in mg/ℓ (Unless specified otherwise)	Sample Identification:		
	GL-TP1 (1.4-2.6) SRK-58-888	GL-TP3 (3.2) SRK-58-892	GL-TP10 (3.7-5.0) SRK-58-894
Sample Number	71710	71711	71712
pH Value at 25°C	6.0	7.0	7.3
pHs Value at 20°C (calc)	10.6	10.0	9.9
Electrical Conductivity in mS/m at 25°C	6.3	10.3	12.4
Total Dissolved Solids* (calc)	42	69	83
Total Alkalinity as CaCO ₃	8	36	48
Total Hardness as CaCO ₃ (calc)	7	7	7
Calcium Hardness as CaCO ₃ (calc)	2	2	2
Calcium as Ca	<1	<1	<1
Magnesium as Mg	<1	<1	<1
Free & Saline Ammonia	0.1	<0.1	<0.1
Ammonium as NH ₄ (calc)	<0.3	<0.3	<0.3
Sulphate as SO ₄	89	<2	<2
Chloride as Cl	16	<2	<2
Langelier Index at 20°C (calc)	-4.6	-3.0	-2.6
Ryznar Index at 20°C (calc)	15.3	13.0	12.5
Corrosivity Ratio (calc)	14.4	0.1	0.1
Leaching Index [LCSI] (calc)	3696	2542	2244
Spalling Index [SCSI] (calc)	10	1	1
Aggressiveness Index [N _c] (calc)	3706	2543	2245

*TDS Calculated EC X 6.7

2:1 Distilled Water : Soil Extract

Important notes (see table for corrections on p.3):

1. The above aggressiveness index is only applicable for conditions of laminar flow at a mean annual temperature of 20°C.
2. For stagnant/turbulent conditions the aggressiveness index must be corrected.
3. For wet/dry cycling conditions (for example in tidal zones) the aggressiveness index must be corrected.
4. For mean annual temperatures lower/higher than 20°C the aggressiveness index must be corrected.

S. Laubscher
Assistant Geochemistry Project Manager

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Guidelines for assessing overall aggressiveness (N_c):

N _c	Aggressiveness
Not greater than 300	None to mild
400-700	Mild to moderate
800-1000	High
= or > 1 100	Very high

Aggressiveness Towards Concrete and Fibre Cement Pipes			
Index	Aggressive	Neutral	Non- Aggressive
a) Stability pH (pHs)	> pH	= pH	<pH
b) Langelier Index	Neg. Value	Zero	Pos. Value
c) Ryznar Index	>7.5	6-7	<6

Corrosiveness Towards metals	
Corrosivity	>0.2

Sample Name	Sample Number	Corrosivity Indices	Basson Index
GL-TP1 (1.4-2.6) SRK-58-888	71710	Corrosive	Aggressive
GL-TP3 (3.2) SRK-58-892	71711	Non-Corrosive	Aggressive
GL-TP10 (3.7-5.0) SRK-58-894	71712	Non-Corrosive	Aggressive

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To correct for:	Multiply	By: (see Notes 2 to 5 below)
Turbulence	LCSI	1.75
Stagnance	LCSI	0.5
Temperature	LCSI, SCSi, N7 Where N7=0.2 x CI in mg/l	(1+ [0.05 x (T-20)])
Wet-dry cycles	SCSi	0.23 x 10 ⁻⁶ x TDS x DTF x CPA Where: DTF = Dry Time Fraction CPA = wet-dry cycles per annum

Note 1: Only if the concrete contains embedded steel.

Note 2: To preserve the correct logical relationships when dealing with the negative sub-indices (i.e. LCSI or SCSi having minus values) they should be multiplied by the reciprocal of the relevant factor indicated in this column

Note 3: If more than one correction is required, multiply by the product of the individual correction factors

Note 4: Use subscript c to indicate that the index has been corrected, e.g. for turbulent conditions LCSI_c = LCSI x 1.75

Note 5: Round off corrected indices to the nearest 100.

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