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GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT: MIDRAND AND WATERFALL CITY, GAUTENG – FINAL

1. INTRODUCTIONS AND TERMS OF REFERENCE

At the request of Ms. T. Sibambato of Zutari Consulting Engineers, acting on behalf of Johannesburg Water (SOC) Ltd, we have carried out a geotechnical investigation for the proposed bulk water supply pipeline from Midrand to Waterfall City. Confirmation of our appointment to proceed with the investigation was received via an E-mail from Ms. T. Sibambato on 30 October 2020. A comprehensive Phase 1 preliminary report was submitted to Zutari on 16 December 2020. This Phase 2 report includes additional test pit profile information, as well as Dynamic Probe Super-Heavy test data. A comprehensive preliminary report excluding laboratory test results was submitted to the Client on 1 February 2021.

The following documents have been received from Zutari to assist with the investigation:

- Halfway House Water Upgrade Project: Geotechnical Investigation Scope of Work Document.
- Google Earth KMZ. file indicating the route of the proposed pipeline.
- Drawings indicating dimensions of the pipeline along the proposed route. inclusive of pipe-jacked sections below Allandale Road and the N1 Highway.
- Several Wayleaves for affected areas.

The proposed pipeline is of the order of 7,8 km in length and will aid in water supply to Midrand and Waterfall City. The invert levels for the pipeline are variable, ranging between 2,0m to 3,0m below existing ground surface for the most part, extending to depths of between 4,0m and 20,0m, below present ground surface, in areas of pipe-jacking below road surfaces.

The terms of reference for the investigation are as follows:

i) to establish the nature and relevant engineering properties of the upper soil and rock strata underlying the site.

ii) to comment on suitable excavation procedures for the installation of the pipeline.

iii) to present comments on the use of the on-site soils for use as bedding sand, selected granular material and selected fill material in terms of SANS 1200LB.

iv) to comment on any other geotechnical aspects that may affect the development.

2. SITE DESCRIPTION

The area of investigation is situated in Midrand and Waterfall City, Johannesburg. The pipeline is proposed to run from an existing pump station on the north-eastern corner of Dale and Old Pretoria Main Road, traversing in a general southerly direction towards the Jukskei Quarry, at which point the route turns towards the west, around The Villas development (Century Properties), then northwards to the corner of Allandale Road and Harry Galaun Drive. Due to the length of the proposed pipeline, vegetation ranges considerably from short to long veld grass with large trees, paved and tarred sections. A site locality plan is presented in **Figure 1** below.

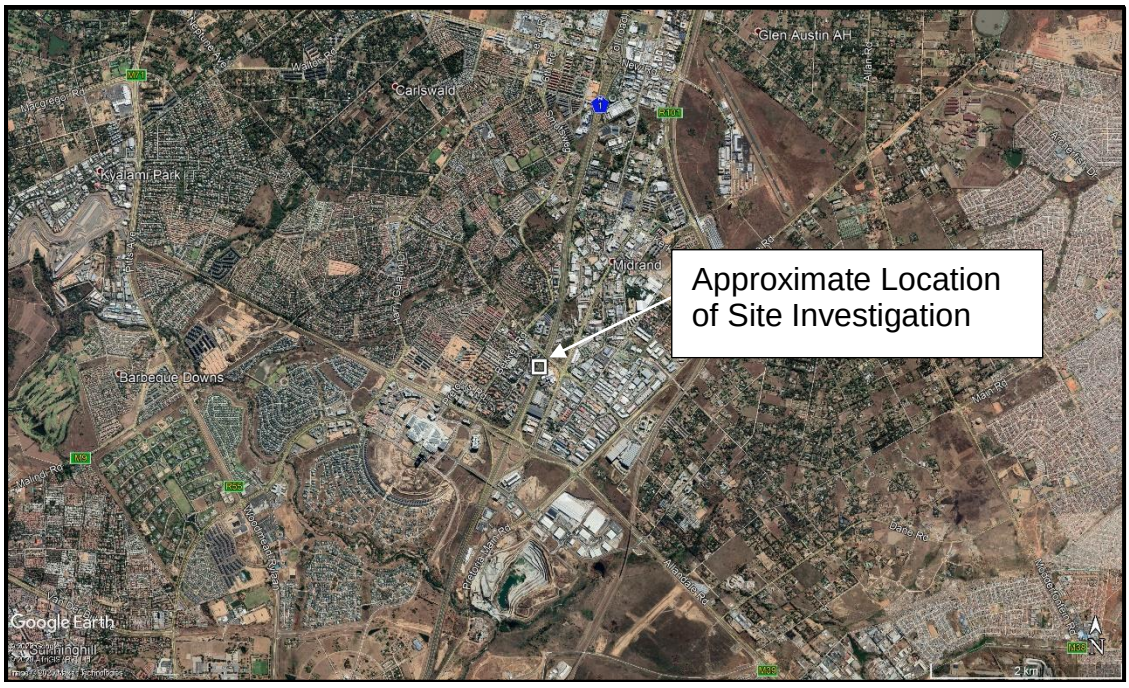

Figure 1: Site Locality Plan, Halfway House Water Upgrade Project: Midrand and Waterfall City, Gauteng.

3. NATURE OF INVESTIGATION

3.1 Fieldwork

Sixty-three test pits (TP1 to TP28, TP31 to TP40, TP43 to TP67) have been excavated along the proposed pipeline route from 26 November 2020 to 15

January 2020. The majority of the test pits were hand-excavated, however test pits TP31 to TP36 were excavated using a CAT 426F2 4x4 tractor-loader-backhoe (backacter). The test pits were excavated to final depths ranging between of 0,5m and 3,0m below ground surface. All test pits were profiled in-situ by an engineering geologist and where necessary, disturbed soil samples were obtained for laboratory testing. The positions of the test pits are shown on the site plan enclosed in **Appendix A**. Copies of the recorded test pit soil profiles are presented in **Appendix B**. A number of Dynamic Cone Penetrometer tests were conducted at test pit positions where it was deemed prudent to make an assessment of the consistency of the soils below the hand-excavation level of 2,0m below existing ground surface for excavation purposes.

In addition to the test pitting, twelve Dynamic Prober Super-Heavy tests (DPSH1 to DPSH12) were executed at selected positions on the route. The testing was carried out in order to determine material excavatibility at depths below the termination depths of the test pits. The positions of the penetrometer tests were dictated by the locations where shallow pipe-jacking would be required below minor arterial roads. The positions of the DPSH tests are shown on the site plan enclosed in **Appendix A**. Copies of the recorded DPSH test results are presented in **Appendix D**.

Further to the above, four rotary cored boreholes (BH1 to BH4) were drilled, two at each proposed pipe-jacked positions below Allandale Road and the N1 Freeway. The rotary cored boreholes were carried out by Roelf Fourie Geotechnical Services between 24 November 2020 and 9 December 2020. The boreholes were logged by engineering geologists and a geotechnical engineer using recognised practice. The positions of the boreholes are shown on the site plan enclosed in **Appendix A**. Copies of the recorded boreholes logs are presented in **Appendix C**.

3.2 Laboratory Testing

The following laboratory tests have been carried out on the soil samples recovered from the test pits during the field investigation.

i) Atterberg limits, particle size distribution and hydrometer analyses to determine basic engineering properties and to effect classification.

ii) Moisture / density and California Bearing Ratio (CBR) tests to evaluate compaction and related strength characteristics.

iii) Basson Index Tests to determine soil corrosivity towards concrete
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iv) DIN 50929-3 Tests to determine corrosivity of soil towards metal.

The laboratory test results are presented in **Appendix E**.

4. SITE GEOLOGY / SOIL PROFILE

Figure 2. Regional Geology, Halfway House Water Upgrade Project: Midrand And Waterfall City, Gauteng.

Available geological maps (see **Figure 2,** above) indicate that the area of investigation is underlain by **granite** of the Johannesburg Granite Dome. This was confirmed during the present investigation. The granite has been locally intruded by a **diabase** dyke, encountered on the western-side of the N1 highway. Residual soils have developed from the weathering of the granite and diabase bedrock. The upper soil layer across the site comprises fill, transported hillwash and pebble marker horizons, inclusive of nodular and hardpan ferricrete.

Due to the length of the pipeline and materials encountered, the route has been sub-divided into six zones for ease of readability. The six sections are as follows:

- **Zone 1**: Intersection of Harry Galaun Drive and Allandale road, to the Waterfall Country Estate GATE 2 entrance on Jukskei View Drive
- **Zone 2:** Waterfall Country Estate GATE 2 entrance on Jukskei View Drive to the eastern edge of the N1 Highway.
- **Zone 3:** Intersection of Bridal Veil Road and Old Pretoria Main Road to the Intersection of Old Pretoria Main Road and Allandale Road (including boreholes on Allandale Road).
- **Zone 4:** Intersection of Dale Road and Old Pretoria Main Road to intersection of Allandale Road and Morkels Close.
- **Zone 5:** Pipe Jacking section under Allandale Road.
- **Zone 6:** Pipe Jacking section under N1 Highway.

The zones and associated test pit and boreholes locations are enclosed in **Appendix A**. Summaries of the various soil and rock thicknesses from the test pit profiles / borehole logs, are presented in **Table 1 to 6** below.

Zone 1:

Table 1: Summary of the test pit soil horizon thickness Zone 1 (m)

	Horizon thicknesses and Description													
TP nr.	**Fill (m)**	**Hillwash (m)**	**Pebble Marker (m)**	**Nodular Ferricrete (m)**	**Hardpan Ferricrete (m)**	**Reworked Residual Granite (m)**	**Residual Granite (m)**	**Reworked Residual Diabase (m)**	**Residual Diabase (m)**	**Very Soft Rock Diabase (m)**	**Soft Rock Diabase (m)**	**Very Soft Rock granite (m)**	**Soft Rock Granite or Better (m)**	**Termination Depth (m)**
	Silty sand with variable amounts of gravel	**Silty sand with scattered gravels**	**Gravelly silty sand**	**Gravelly silty sand**	**Very dense to very soft rock strongly cemented silty sand**	**Slightly clayey silty sand with scattered fine to medium gravel**	**Silty sand with scattered fine to medium gravel**	**Slightly clayey sandy silt**	**Slightly clayey sandy silt**					
1	0,0-2,0	-	-	-	-	-	-	-	-	-	-	-	-	2,0
2	0,0-0,5	-	0,5-0,7	-	-	0,7-1,3	-	-	-	-	-	1,3	-	1,3
3	-	0,0-0,4	0,4-0,5	-	-	0,5-0,8	0,8-1,3	-	-	-	-	1,3	-	1,3
4	0,0-0,9	-	-	-	1,1-1,3	-	0,9-1,1	-	-	-	-	-	-	1,3
5	-	0,0-0,4	0,4-0,7	-	0,7-0,9	-	-	-	-	-	-	-	-	0,9
6	-	0,0-0,6	-	-	1,2-1,4	-	0,6-1,2	-	-	-	-	-	-	1,4
7	-	0,0-0,95	0,95-1,05	-	1,05-1,3	-	-	-	-	-	-	-	-	1,3
8	-	0,0-0,8	0,8-1,05	-	-	-	1,05-1,4	-	-	-	-	-	-	1,4
9	0,0-0,6	-	0,6-0,8	-	1,4	0,8-1,4	-	-	-	-	-	-	-	1,4
10	0,0-0,5	0,5-0,9	0,9-1,1	-	-	-	1,1-1,4	-	-	-	-	-	-	1,4
11	0,0-0,25	0,25-0,5	-	0,5-0,9	0,9	-	-	-	-	-	-	-	-	0,9

No perched water table or zones of groundwater seepage was noted in any of the test pits excavated across this zone at the time of the investigation.

Zone 2:

Table 2: Summary of the test pit soil horizon thickness Zone 2 (m)

	Horizon thicknesses and Description										
TP nr.	**Fill (m)**	**Hillwash (m)**	**Pebble Marker (m)**	**Nodular Ferricrete (m)**	**Hardpan Ferricrete (m)**	**Reworked Residual Granite (m)**	**Residual Granite (m)**	**Reworked Residual Diabase (m)**	**Very Soft Rock granite (m)**	**Soft Rock Granite or Better (m)**	**Termination Depth (m)**
	Silty sand with variable amounts of gravel	**Silty sand with scattered gravels**	**Gravelly silty sand**	**Gravelly silty sand**	**Very dense to very soft rock strongly cemented silty sand**	**Slightly clayey silty sand with scattered fine to medium gravel**	**Silty sand with scattered fine to medium gravel**	**Slightly clayey sandy silt**			
12	-	0,0-0,3	0,3-0,5	-	-	0,5-0,8	0,8-2,0		2,0		2,0
13	-	-	0,0-0,2	-	-	0,2-1,3	-	-	-	-	1,3
14	-	0,0-0,5	0,5-0,8	-	-	0,8-1,6	1,6-2,0	-	-	-	2,0
15	-	0,0-0,3	0,3-0,5	-	-	0,5-0,7	0,7-2,2	-	2,2	-	2,2
16	-	0,0-0,3	0,3-0,4	-	-	0,4-0,8	0,8-2,1	-	2,1	-	2,1
17	-	0,0-0,2	0,2-0,6	-	-	0,6-1,6	1,6-2,1	-	-	-	2,1
18	-	0,0-0,2	0,2-0,4	-	-	-	0,4-0,6	-	-	0,6	0,6
19	-	0,0-0,4	-	-	-	-	0,4-1,6	-	1,6	-	1,6
20	0,0-0,4	-	-	-	-	-	0,4-1,0	-	1,0	-	1,0
21	0,0-0,4	-	-	-	-	-	0,4-1,0	-	1,0	-	1,0
22	0,0-0,4	-	-	-	-	-	0,4-1,0	-	1,0	-	1,0
23	0,0-1,4	-	-	-	-	-	1,4-1,6	-	1,6	-	1,6
24	0,0-1,4	-	-	-	-	-	1,4-1,6	-	1,6	-	1,6
25	0,0-2,0	-	-	-	-	-	-	-	-	-	2,0
26	0,0-2,0	-	-	-	-	-	-	-	-	-	2,0
27	0,0-2,0	-	-	-	-	-	-	-	-	-	2,0
28	0,0-0,3	0,3-1,5	-	-	-	-	-	1,5-2,0	-	-	2,0

Slight seepage was encountered at the base of test pits TP14 and TP19 at the time of the investigation.

Zone 3:

Table 3: Summary of the test pit soil horizon thickness Zone 3 (m)

	Horizon thickness and Description									
TP nr.	**Fill (m)**	**Hillwash (m)**	**Pebble Marker (m)**	**Nodular Ferricrete (m)**	**Hardpan Ferricrete (m)**	**Reworked Residual Granite (m)**	**Residual Granite (m)**	**Very Soft Rock granite (m)**	**Soft Rock Granite or Better (m)**	**Termination Depth (m)**
	Silty sand with variable amounts of gravel	**Silty sand with scattered gravels**	**Gravelly silty sand**	**Gravelly silty sand**	**Very dense to very soft rock strongly cemented silty sand**	**Slightly clayey silty sand with scattered fine to medium gravel**	**Silty sand with scattered fine to medium gravel**			
31	-	0,0-0,35	0,35-0,5	0,5-1,7	-	-	1,0-3,0	-	-	3,0
32	-	0,0-0,3	0,3-0,5	0,5-1,5	-	-	1,5-3,0	-	-	3,0
33	-	0,0-0,4	0,4-0,6	0,6-1,3	-	-	1,3-3,0	-	-	3,0
34	-	0,0-0,3	-	0,3-1,5	-	-	1,5-3,0	-	-	3,0
35	-	-	-	-	-	-	-	-	0,0	0,0
36	-	-	0,0-0,3	0,3-0,5	0,5-2,0	-	2,0-3,0	-	-	3,0

Slight seepage was encountered at the base of test pit TP36 at the time of the investigation. It should be noted that hard rock granite was present at test pit TP35 at surface.

Zone 4:

Table 4: Summary of the test pit soil horizon thickness Zone 4 (m)

	Horizon thicknesses and Description									
TP nr.	**Fill (m)**	**Hillwash (m)**	**Pebble Marker (m)**	**Nodular Ferricrete (m)**	**Hardpan Ferricrete (m)**	**Reworked Residual Granite (m)**	**Residual Granite (m)**	**Very Soft Rock granite (m)**	**Soft Rock Granite or Better (m)**	**Termination Depth (m)**
	Silty sand with variable amounts of gravel	**Silty sand with scattered gravels**	**Gravelly silty sand**	**Gravelly silty sand**	**Very dense to very soft rock strongly cemented silty sand**	**Slightly clayey silty sand with scattered fine to medium gravel**	**Silty sand with scattered fine to medium gravel**			
46	0,0-2,0	-	-	-	-	-	-	-	-	2,0
47	0,0-2,0	-	-	-	-	-	-	-	-	2,0
48	0,0-0,8	-	-	-	-	-	-	-	0,8	0,8
49	0,0-1,5	-	-	-	1,5-1,6	-	-	-	-	1,6
50	0,0-1,0	-	-	1,0-1,1	-	-	-	-	-	1,1
51	0,0-0,12	-	-	1,2-1,5	-	-	-	-	-	1,5
52	-	-	-	0,0-0,9	0,9-1,5	-	-	-	-	1,5
53	0,0-0,2	-	-	0,2-0,7	0,7-1,4	-	-	-	-	1,4
54	-	0,0-0,5	0,5-0,8	0,8-0,9	-	-	-	-	-	0,9
55	-	0,0-0,5	-	-	-	-	0,5-1,4	1,4	-	1,4
56	0,0-0,5	0,5-0,9	-	0,9-1,2	1,2-1,4	-	-	-	-	1,4
57	0,0-1,3	-	-	1,3-1,4	1,4-1,5	-	-	-	-	1,5
58	0,0-0,9	0,9-1,3	-	1,3-1,5	1,5-1,6	-	-	-	-	1,6
59	-	0,0-1,3	-	1,3-1,4	1,4	-	-	-	-	1,4
60	0,0-0,2	0,2-1,0	-	1,0-1,2	1,2	-	-	-	-	1,2
61	0,0-0,7	0,7-1,4	-	1,4-1,6	1,6-1,7	-	-	-	-	1,7
62	0,0-0,7	0,7-1,5	-	-	-	-	-	-	-	1,5
63	0,0-0,5	-	-	-	-	-	-	-	-	0,5
64	0,0-0,15	0,15-0,7	-	0,7-0,85	0,85-0,9	-	-	-	-	0,9
65	0,0-0,8	0,8-1,3	-	1,3-1,5	1,5-1,6	-	-	-	-	1,6
66	0,0-0,7	0,7-0,85	-	0,85-1,1	1,1-1,2	-	-	-	-	1,2
67	0,0-1,6	-	-	-	-	-	-	-	-	1,6

Slight groundwater seepage was encountered at the base of test pit TP58 and TP62 at the time of the investigation.

Zone 5:

Table 5: Summary of the borehole soil and rock horizon thickness Zone 5 (m)

	Horizon thicknesses and Description													
	Fill (m)	Hillwash (m)	Pebble Marker (m)	Nodular Ferricrete (m)	Hardpan Ferricrete (m)	Reworked Residual Granite (m)	Residual Granite (m)	Reworked Residual Diabase (m)	Residual Diabase (m)	Very Soft Rock Diabase (m)	Soft Rock Diabase (m)	Very Soft Rock granite (m)	Soft Rock Granite or Better (m)	Termination Depth (m)
	Silty sand with variable amounts of gravel	Silty sand with scattered gravels	Gravelly silty sand	Gravelly silty sand	Very dense to very soft rock strongly cemented silty sand	Slightly clayey silty sand with scattered fine to medium gravel	Silty sand with scattered fine to medium gravel	Slightly clayey sandy silt	Slightly clayey sandy silt					
BH1	0,0-0,5	-	-	0,5-0,85	0,85-1,65	1,65-2,85	2,85-6,4	-	-	-	-	-	6,4-10,0	10,0
BH2	0,0-1,6	1,6-1,8	-	1,8-2,0	2,0-2,3	2,3-6,2 ; 6,4-7,5	-	-	-	-	-	-	6,2-6,4 ; 7,5-10,0	10,0

Rest water levels of 5,0m and 3,0m were measure in boreholes BH1 and BH2, respectively.

Zone 6:

Table 6: Summary of the borehole soil and rock horizon thickness Zone 6 (m)

	Horizon thicknesses and Description													
	Fill (m)	Hillwash (m)	Pebble Marker (m)	Nodular Ferricrete (m)	Hardpan Ferricrete (m)	Reworked Residual Granite (m)	Residual Granite (m)	Reworked Residual Diabase (m)	Residual Diabase (m)	Very Soft Rock Diabase (m)	Soft Rock Diabase (m)	Very Soft Rock granite (m)	Soft Rock Granite or Better (m)	Termination Depth (m)
	Silty sand with variable amounts of gravel	Silty sand with scattered gravels	Gravelly silty sand	Gravelly silty sand	Very dense to very soft rock strongly cemented silty sand	Slightly clayey silty sand with scattered fine to medium gravel	Silty sand with scattered fine to medium gravel	Slightly clayey sandy silt	Slightly clayey sandy silt					
BH3	-	0,0-1,0	1,0-1,5	-	-	-	-		1,5-3,7	3,7-9,7	9,7-10,0	-	-	10,0
BH4	-	0,0-1,0	-	-	-	1,0-1,4	1,4-4,5	-	-	-	-	4,5-9,0	9,0-20,0	20,0

Rest water levels of 4,0m and 11,0m were measured in boreholes BH3 and BH4, respectively.

5. BULK EARTHWORKS

5.1 Excavation Procedures

Excavation procedures for the pipeline trench excavation has been evaluated according to the South African National Standards standardized classification for excavations (SANS 1200D, DA & DB). This evaluation and classification (as indicated in **Table 7 to 12** below) was determined by all information obtained from the test pitting, dynamic probe testing and borehole operations. the test pit profiles and DPSH tests results, excavatibility along the route of the pipeline is classified as presented in Tables 7 to 12 below.

Zone 1:

Table 7: A summary of the excavatibility of materials in Zone 1

	Horizon and Description																
TP nr.	Fill (m)	Hillwash (m)	Pebble Marker (m)	Nodular Ferricrete (m)	Hardpan Ferricrete (m)	Reworked Residual Granite (m)	Residual Granite (m)	Reworked Residual Diabase (m)	Residual Diabase (m)	Very Soft Rock Diabase (m)	Soft Rock Diabase (m)	Very Soft Rock granite (m)	Soft Rock Granite or Better (m)	Termination Depth (m)	Soft Material (m)	Intermediate Material (m)	Hard Rock Material (m)
	Silty sand with variable amounts of gravel	Silty sand with scattered gravels	Gravelly silty sand	Gravelly silty sand	Very dense to very soft rock strongly cemented silty sand	Slightly clayey silty sand with scattered fine to medium gravel	Silty sand with scattered fine to medium gravel	Slightly clayey sandy silt	Slightly clayey sandy silt								
1	0,0-2,0	-	-	-	-	-	-	-	-	-	-	-	-	2,0	0,0-3,0	-	-
2	0,0-0,5	-	0,5-0,7	-	-	0,7-1,3	-	-	-	-	-	1,3	>1,3	1,3	0,0-1,3	-	>1,3
3	-	0,0-0,4	0,4-0,5	-	-	0,5-0,8	0,8-1,3	-	-	-	-	1,3	>1,3	1,3	0,0-1,3	-	>1,3
4	0,0-0,87	-	-	-	1,1-1,3	-	0,8-1,1	-	-	-	-	-	-	1,3	0,0-1,3	1,3	-
5	-	0,0-0,4	0,4-0,7	-	0,7-0,9	-	-	-	-	-	-	-	-	0,9	0,0-0,7	0,7-0,9	-
6	-	0,0-0,6	-	-	1,2-1,35	-	0,6-1,2	-	-	-	-	-	-	1,4	0,0-1,2	1,2-1,35	-
7	-	0,0-0,95	0,95-1,05	-	1,05-1,25	-	-	-	-	-	-	-	-	1,3	0,0-1,05	1,05-1,25	-
8	-	0,0-0,8	0,8-1,05	-	-	-	1,05-1,4	-	-	-	-	-	-	1,4	0,0-1,4	-	>1,4
9	0,0-0,6	-	0,6-0,8	-	1,4	0,8-1,4	-	-	-	-	-	-	-	1,4	0,0-1,4	1,4	-
10	0,0-0,5	0,5-0,9	0,9-1,1	-	-	-	1,1-1,4	-	-	-	-	-	-	1,4	0,0-1,4	-	>1,4
11	0,0-0,25	0,25-0,5	-	0,5-0,85	0,9	-	-	-	-	-	-	-	-	0,9	0,0-0,9	0,9	-

Zone 2:

Table 8: A summary of the excavatibility of materials in Zone 2

	Horizon and Description												
TP nr.	Fill (m)	Hillwash (m)	Pebble Marker (m)	Nodular Ferricrete (m)	Hardpan Ferricrete (m)	Reworked Residual Granite (m)	Residual Granite (m)	Reworked Residual Diabase (m)	Very Soft Rock granite (m)	Soft Rock Granite or Better (m)	Termination Depth (m)	Soft Material (m)	Intermediate Material (m)	Hard Rock Material (m)
	Silty sand with variable amounts of gravel	Silty sand with scattered gravels	Gravelly silty sand	Gravelly silty sand	Very dense to very soft rock strongly cemented silty sand	Slightly clayey silty sand with scattered fine to medium gravel	Silty sand with scattered fine to medium gravel	Slightly clayey sandy silt						
12	-	0,0-0,3	0,3-0,5	-	-	0,5-0,8	0,8-2,0		2,0	>2,0	2,0	0,0-2,0	-	>2,0
13	-	-	0,0-0,2	-	-	0,2-1,3	-	-	-	-	1,3	0,0-1,3	-	-
14	-	0,0-0,5	0,5-0,8	-	-	0,8-1,6	1,6-2,0	-	-	-	2,0	0,0-2,6	2,6-3,1	3,1
15	-	0,0-0,3	0,3-0,5	-	-	0,5-0,7	0,7-2,2	-	2,2	>2,2	2,2	0,0-2,2	-	>2,2
16	-	0,0-0,3	0,3-0,4	-	-	0,4-0,8	0,8-2,1	-	2,1	>2,1	2,1	0,0-2,1	-	>2,1
17	-	0,0-0,2	0,2-0,6	-	-	0,6-1,6	1,6-2,1	-	-	-	2,1	0,0-3,0	-	-
18	-	0,0-0,2	0,2-0,4	-	-	-	0,4-0,6	-	-	0,6	0,6	0,0-0,6	-	0,6
19	-	0,0-0,4	-	-	-	-	0,4-1,6	-	1,6	>1,6	1,6	0,0-1,6	-	>1,6
20	0,0-0,4	-	-	-	-	-	0,4-1,0	-	1,0	>1,0	1,0	0,0-1,0	-	>1,0
21	0,0-0,4	-	-	-	-	-	0,4-1,0	-	1,0	>1,0	1,0	0,0-1,0	1,0-1,5	>1,0
22	0,0-0,4	-	-	-	-	-	0,4-1,0	-	1,0	>1,0	1,0	0,0-1,0	1,0-1,5	>1,0
23	0,0-1,4	-	-	-	-	-	1,4-1,6	-	1,6	>1,6	1,6	0,0-1,6	1,6-2,1	>1,6
24	0,0-1,4	-	-	-	-	-	1,4-1,6	-	1,6	>1,6	1,6	0,0-1,6	1,6-2,1	>1,6
25	0,0-2,0	-	-	-	-	-	-	-	-	-	2,0	0,0-2,5	-	>2,5
26	0,0-2,0	-	-	-	-	-	-	-	-	-	2,0	0,0-2,5	-	>2,5
27	0,0-2,0	-	-	-	-	-	-	-	-	-	2,0	0,0-2,5	-	>2,5
28	0,0-0,3	0,3-1,5	-	-	-	-	-	1,5-2,0	-	-	2,0	0,0-3,0	-	-

Zone 3:

Table 9: A summary of the excavatibility of materials in Zone 3

	Horizon and Description												
TP nr.	**Fill (m)**	**Hillwash (m)**	**Pebble Marker (m)**	**Nodular Ferricrete (m)**	**Hardpan Ferricrete (m)**	**Reworked Residual Granite (m)**	**Residual Granite (m)**	**Very Soft Rock granite (m)**	**Soft Rock Granite or Better (m)**	**Termination Depth (m)**	**Soft Material (m)**	**Intermediate Material (m)**	**Hard Rock Material (m)**
	Silty sand with variable amounts of gravel	**Silty sand with scattered gravels**	**Gravelly silty sand**	**Gravelly silty sand**	**Very dense to very soft rock strongly cemented silty sand**	**Slightly clayey silty sand with scattered fine to medium gravel**	**Silty sand with scattered fine to medium gravel**						
31	-	0,0-0,35	0,35-0,5	0,5-1,7	-	-	1,0-3,0	-	-	3,0	0,0-3,0	-	-
32	-	0,0-0,3	0,3-0,5	0,5-1,5	-	-	1,5-3,0	-	-	3,0	0,0-3,0	-	-
33	-	0,0-0,4	0,4-0,6	0,6-1,3	-	-	1,3-3,0	-	-	3,0	0,0-3,0	-	-
34	-	0,0-0,3	-	0,3-1,5	-	-	1,5-3,0	-	-	3,0	0,0-3,0	-	-
35	-	-	-	-	-	-	-	-	0,0	0,0	-	-	0,0
36	-	-	0,0-0,3	0,3-0,5	0,5-2,0	-	2,0-3,0	-	-	3,0	0,0-3,0	-	-

Zone 4:

Table 10: A summary of the excavatibility of materials in Zone 4

	Horizon and Description												
TP nr.	**Fill (m)**	**Hillwash (m)**	**Pebble Marker (m)**	**Nodular Ferricrete (m)**	**Hardpan Ferricrete (m)**	**Reworked Residual Granite (m)**	**Residual Granite (m)**	**Very Soft Rock granite (m)**	**Soft Rock Granite or Better (m)**	**Termination Depth (m)**	**Soft Material (m)**	**Intermediate Material (m)**	**Hard Rock Material (m)**
	Silty sand with variable amounts of gravel	**Silty sand with scattered gravels**	**Gravelly silty sand**	**Gravelly silty sand**	**Very dense to very soft rock strongly cemented silty sand**	**Slightly clayey silty sand with scattered fine to medium gravel**	**Silty sand with scattered fine to medium gravel**						
44	0,0-0,4	0,4-1,0	1,0-1,15	-	-	1,15-1,5	-	-	-	1,5	0,0-3,3	3,3-3,8	3,8
45	0,0-0,2	-	-	-	-	0,2-0,6	0,6-1,5	-	-	1,5	0,0-4,8	4,8-5,3	5,3
46	0,0-2,0	-	-	-	-	-	-	-	-	2,0	2,0-3,0	-	-
47	0,0-2,0	-	-	-	-	-	-	-	-	2,0	2,0-3,0	-	-
48	0,0-0,8	-	-	-	-	-	-	-	0,8	0,8	0,0-0,8	-	0,8
49	0,0-1,5	-	-	-	1,5-1,6	-	-	-	-	1,6	0,0-1,6	-	>1,6
50	0,0-1,0	-	-	1,0-1,1	-	-	-	-	-	1,1	0,0-1,1	-	>1,1
51	0,0-0,12	-	-	1,2-1,5	-	-	-	-	-	1,5	0,0-1,5	1,5	-
52	-	-	-	0,0-0,9	0,9-1,5	-	-	-	-	1,5	0,0-1,5	1,5	-
53	0,0-0,2	-	-	0,2-0,7	0,7-1,4	-	-	-	-	1,4	0,0-1,4	1,4	-
54	-	0,0-0,5	0,5-0,8	0,8-0,9	-	-	-	-	-	0,9	0,0-0,9	0,9	-
55	-	0,0-0,5	-	-	-	-	0,5-1,4	1,4	-	1,4	0,0-1,4	-	>1,4
56	0,0-0,5	0,5-0,9	-	0,9-1,2	1,2-1,4	-	-	-	-	1,4	0,0-1,4	1,4	-
57	0,0-1,3	-	-	1,3-1,4	1,4-1,5	-	-	-	-	1,5	0,0-1,45	1,5	-
58	0,0-0,9	0,9-1,3	-	1,3-1,5	1,5-1,6	-	-	-	-	1,6	0,0-1,6	1,6	-
59	-	0,0-1,3	-	1,3-1,4	1,4	-	-	-	-	1,4	0,0-1,4	1,4	-
60	0,0-0,2	0,2-1,0	-	1,0-1,2	1,2	-	-	-	-	1,2	0,0-1,2	1,2	-
61	0,0-0,7	0,7-1,4	-	1,4-1,6	1,6-1,7	-	-	-	-	1,7	0,0-1,65	-	-
62	0,0-0,7	0,7-1,5	-	-	-	-	-	-	-	1,5	0,0-1,5	1,5	-
63	0,0-0,5	-	-	-	-	-	-	-	-	0,5	0,0-0,5	-	-
64	0,0-0,15	0,15-0,7	-	0,7-0,85	0,85-0,9	-	-	-	-	0,9	0,0-0,9	0,9	-
65	0,0-0,8	0,8-1,3	-	1,3-1,5	1,5-1,6	-	-	-	-	1,6	0,0-1,55	1,6	-
66	0,0-0,7	0,7-0,85	-	0,85-1,1	1,1-1,2	-	-	-	-	1,2	0,0-1,2	1,2	-
67	0,0-1,6	-	-	-	-	-	-	-	-	1,6	0,0-1,6	-	>6,0

Zone 5:

Table 11: A summary of the excavatibility of materials in Zone 5

	Horizon and Description																
	Fill (m)	**Hillwash (m)**	**Pebble Marker (m)**	**Nodular Ferricrete (m)**	**Hardpan Ferricrete (m)**	**Reworked Residual Granite (m)**	**Residual Granite (m)**	**Reworked Residual Diabase (m)**	**Residual Diabase (m)**	**Very Soft Rock Diabase (m)**	**Soft Rock Diabase (m)**	**Very Soft Rock granite (m)**	**Soft Rock Granite or Better (m)**	**Termination Depth (m)**	**Soft Material (m)**	**Intermediate Material (m)**	**Hard Rock Material (m)**
	Silty sand with variable amounts of gravel	**Silty sand with scattered gravels**	**Gravelly silty sand**	**Gravelly silty sand**	**Very dense to very soft rock strongly cemented silty sand**	**Slightly clayey silty sand with scattered fine to medium gravel**	**Silty sand with scattered fine to medium gravel**	**Slightly clayey sandy silt**	**Slightly clayey sandy silt**								
BH1	0,0-0,5	-	-	0,5-0,85	0,85-1,65	1,65-2,85	2,85-6,4	-	-	-	-	-	6,4-10,0	10,0	0,0-0,85 ; 1,65-6,4	0,85-1,65	6,4-10,0
BH2	0,0-1,6	1,6-1,8	-	1,8-2,0	2,0-2,3	2,3-6,2 ; 6,4-7,5	-	-	-	-	-	-	6,2-6,4 ; 7,5-10,0	10,0	0,0-2,0 ; 2,3-6,2 ; 6,4-7,5	2,0-2,3	6,2-6,4 ; 7,5-10,0

Zone 6:

Table 12: A summary of the excavatibility of materials in Zone 6

	Horizon and Description																
	Fill (m)	Hillwash (m)	Pebble Marker (m)	Nodular Ferricrete (m)	Hardpan Ferricrete (m)	Reworked Residual Granite (m)	Residual Granite (m)	Reworked Residual Diabase (m)	Residual Diabase (m)	Very Soft Rock Diabase (m)	Soft Rock Diabase (m)	Very Soft Rock granite (m)	Soft Rock Granite or Better (m)	Termination Depth (m)	Soft Material (m)	Intermediate Material (m)	Hard Rock Material (m)
	Silty sand with variable amounts of gravel	Silty sand with scattered gravels	Gravelly silty sand	Gravelly silty sand	Very dense to very soft rock strongly cemented silty sand	Slightly clayey silty sand with scattered fine to medium gravel	Silty sand with scattered fine to medium gravel	Slightly clayey sandy silt	Slightly clayey sandy silt								
BH3	-	0,0-1,0	1,0-1,5	-	-	-	-	-	1,5-3,7	3,7-9,7	9,7-10,0	-	-	10,0	0,0-3,7	3,7-9,7	9,7-10,0
BH4	-	0,0-1,0	-	-	-	1,0-1,4	1,4-4,5	-	-	-	-	4,5-9,0	9,0-20,0	20,0	0,0-4,5	4,5-9,0	9,0-20,0

The following points should be noted with regards to the excavatibility of material:

- Soft to intermediate excavation material could be removed using **medium to heavy earthmoving equipment and / or powertools.**
- Hard rock excavation material would essentially require **blasting** for removal.
- Based on our experience of the granitic profile within the Midrand and Waterfall City areas, very soft rock granite material is typically of the order of 0,5m to 1,0m thick, at which point a transition to soft rock granite is encountered (blast quality material).
- As noted in the tables above, the depths to blast quality material is highly variable throughout the length of the pipeline. The undulatory topography of the granitic bedrock is a common feature within South Africa.

6. STABILITY OF OPEN TRENCH EXCAVATIONS

In general, all of the test pits excavated across the site exhibited stable sidewalls. It is envisaged that stability for open trench excavations for longer-term conditions could be provided by battering the excavation walls back to suitable slope angles. In this regard for planning and budget purposes, the recommended batter slope across the alignment should not exceed 1V:1H.

7. MATERIAL USAGE & COMMERCIAL SOURCING

Laboratory testing has been carried out on the upper soil horizons to determine their suitability for use as construction material for pipe bedding, selected granular material and selected fill material, according to SANS 1200LB. Based on the laboratory test results, as well as the fieldwork information, material usage may be summarized in as per the table below.

SOIL TYPE	POTENTIAL USES				COMMENTS
	SELECTED FILL	SELECTED GRANULAR	GENERAL FILL	SPOIL	
Fill	x		x		Upper 150mm contains abundant organic matter and should be removed to spoil. Deeper material suitable for use as indicated
Hillwash	x		x		Upper 150mm contains abundant organic matter and should be removed to spoil. Deeper material suitable for use as indicated
Pebble Marker	x		x		Where present at surface, the upper 150mm contains abundant organic material and should be removed to spoil. Deeper mater suitable for use as indicated
Nodular Ferricrete	x		x		Suitable for use as indicated
Hardpan Ferricrete	x		x		Hardpan ferricrete should be crushed to a suitable size prior to use a bedding material. Alternatively the hardpan material should be removed to spoil where encountered
Reworked Residual Granite	x		x		Suitable for use as indicated
Residual Granite	x		x		Suitable for use as indicated
Very Soft Rock Granite	x		x		Very Soft Rock Granite should be crushed to a suitable size prior to use a bedding material. Alternatively the very soft rock granite material should be removed to spoil where encountered
Soft Rock Granite or Better	x		x		Soft rock granite should be crushed to a suitable size prior to use a bedding material. Alternatively the soft rock granite should be removed to spoil where encountered
Reworked Residual Diabase				x	Moderately to highly plastic and thus unsuitable for use as construction material. Should be removed to spoil where intersected
Residual Diabase				x	Moderately to highly plastic and thus unsuitable for use as construction material. Should be removed to spoil where intersected
Very Soft Rock Diabase				x	Particle size exceeds that of 30mm. Once crushed, it is our considered opinion that this material would exhibit a moderately to high plastic nature
Soft Rock Diabase or Better	x		x		Soft rock diabase should be crushed to a suitable size prior to use a bedding material. Alternatively the soft rock diabase should be removed to spoil where encountered

It is noted from the table that none of the material encountered along the pipeline route would prove suitable for use as **bedding sand and / or selected granular material**. These would therefore need to be sourced and imported to the site for such purposes.

M CROSSMAN Pr Eng
CROSSMAN, PAPE & ASSOCIATES

W KRETZINGER Pr Sci. Nat

APPENDIX A:
SITE PLAN WITH TEST PIT AND BOREHOLE LOCATIONS

REPORT 20/91/DK:
GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT PHASE 2

SITE PLAN INDICATING APPROXIMATE POSITIONS OF TEST PITS, BOREHOLES AND DPSH TESTS

Crossman, Pape & Associates
Geotechnical Engineers and Engineering Geologists
Tel. (+27)11 465 1699
Cell. (+27)82 556 7302

SCALE:
NOT TO SCALE

DATE:
JANUARY 2021

REPORT 20/91/DK:
GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT PHASE 2

SITE PLAN INDICATING APPROXIMATE POSITIONS OF TEST PITS AND DPSH TESTS ZONE 1

Crossman, Pape & Associates
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Tel. (+27)11 465 1699
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SCALE:
NOT TO SCALE

DATE:
JANUARY 2021

REPORT 20/91/DK:
GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT PHASE 2

SITE PLAN INDICATING APPROXIMATE POSITIONS OF TEST PITS AND BOREHOLES ZONE 2

Crossman, Pape & Associates
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SCALE:
NOT TO SCALE

DATE:
JANUARY 2021

REPORT 20/91/DK: **GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT** **PHASE 2**	**SITE PLAN INDICATING APPROXIMATE POSITIONS OF TEST PITS AND BOREHOLES** **ZONE 3**	Crossman, Pape & Associates Geotechnical Engineers and Engineering Geologists Tel. (+27)11 465 1699 Cell. (+27)82 556 7302	**SCALE:** **NOT TO SCALE** **DATE:** **JANUARY 2021**

REPORT 20/91/DK: **GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT** **PHASE 2**	**SITE PLAN INDICATING APPROXIMATE POSITIONS OF TEST PITS AND DPSH TESTS** **ZONE 4**	Crossman, Pape & Associates Geotechnical Engineers and Engineering Geologists Tel. (+27)11 465 1699 Cell. (+27)82 556 7302	**SCALE:** **NOT TO SCALE** **DATE:** **JANUARY 2021**

REPORT 20/91/DK:
GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT
PHASE 1

SITE PLAN INDICATING APPROXIMATE POSITIONS OF BOREHOLES ZONE 5

Crossman, Pape & Associates
Geotechnical Engineers and Engineering Geologists
Tel. (+27)11 465 1699
Cell. (+27)82 556 7302

SCALE:
NOT TO SCALE

DATE:
DECEMBER 2020

REPORT 20/91/DK: **GEOTECHNICAL INVESTIGATION FOR HALFWAY HOUSE WATER UPGRADE PROJECT** **PHASE 1**	**SITE PLAN INDICATING APPROXIMATE POSITIONS OF BOREHOLES ZONE 6**	Crossman, Pape & Associates Geotechnical Engineers and Engineering Geologists Tel. (+27)11 465 1699 Cell. (+27)82 556 7302	**SCALE:** **NOT TO SCALE** **DATE:** **DECEMBER 2020**

APPENDIX B:
TEST PIT SOIL PROFILES

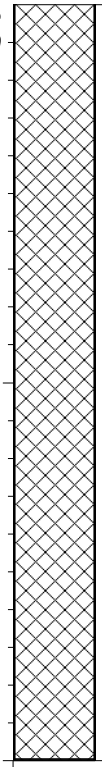
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP01
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00

Slightly moist to moist light grey beige speckled orange and white medium dense moderately compacted slightly clayey silty gravelly sand with scattered cobbles. Fill.

2.00

NOTES

1) No refusal. No DCP refusal at 3,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP01

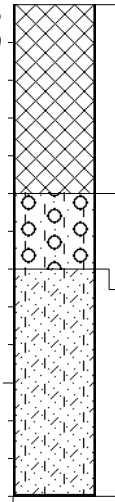
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP02
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist to moist lightly grey beige speckled orange and white medium dense to dense compacted silty sandy gravel. Fill.
0.50	Slightly moist grey beige medium dense to dense intact silty sandy gravel. Pebble marker.
0.70	Slightly moist grey beige speckled orange red and white dense to very dense cemented and ferruginised slightly clayey silty sand. Reworked residual granite.
1.30	

NOTES

1) Refusal at 1,3m on very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP02

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

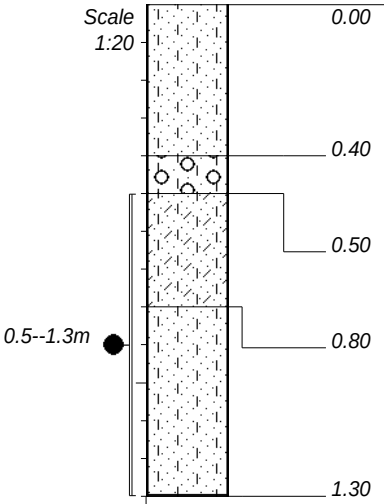
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP03
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00	Slightly moist to moist light grey speckled off white loose open voided silty sand. Hillwash.
0.40	Slightly moist grey beige medium dense to dense intact silty sandy gravel. Pebble marker.
0.50	Slightly moist grey beige speckled orange red and white medium dense intact slightly clayey silty sand. Reworked residual granite.
0.80	Slightly moist red brown dense becoming dense to very dense at depth jointed silty sand. Residual granite.
1.30	

NOTES

1) Refusal at 1,3m on very dense to very soft rock granite.
2) No evidence of water.
3) Disturbed sample taken at 0,5--1,3m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP03

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

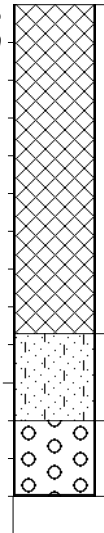
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP04
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist to moist light grey beige speckled orange and white medium dense moderately compacted slightly clayey silty gravelly sand with scattered cobbles. Fill.

0.87 Slightly moist red brown dense becoming dense to very dense at depth cemented, ferruginised and jointed silty sand. Residual granite.

1.10 Slightly moist red brown blotched black very dense to very soft rock strongly cemented and ferruginised gravel. Hardpan ferricrete.

1.30

NOTES

1) Refusal at 1,3m on soft rock hardpan ferricrete.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP04

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

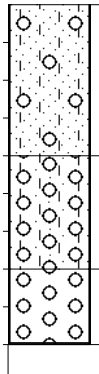
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP05
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist to moist lightly grey speckled off white medium dense open voided gravelly silty sand. Hillwash.

0.40 Slightly moist grey beige dense to very dense intact silty sandy gravel. Pebble marker.

0.70 Slightly moist red brown blotched black very dense to very soft rock strongly cemented and ferruginised gravel. Hardpan ferricrete.

0.90

NOTES

1) Refusal at 0,9m on soft rock hardpan ferricrete.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP05

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

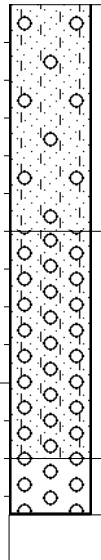
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP06
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry to slightly moist grey brown dense open voided gravelly silty sand. Hillwash.

0.60 Slightly moist beige brown blotched orange medium dense becoming very dense at depth cemented, ferruginised and jointed silty sand with scattered gravels. Residual granite.

1.20 Slightly moist red brown blotched black very dense to very soft rock strongly cemented and ferruginised gravel. Hardpan ferricrete.

1.35

NOTES

1) Refusal at 1,35m on soft rock hardpan ferricrete.
2) No evidence of water.
3) Disturbed sample taken at 0,6--1,35m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP06

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

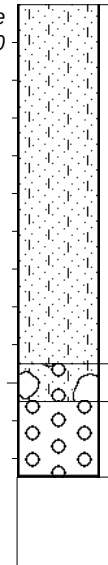
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP07
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry beige brown loose pinholed silty sand. Hillwash.

0.95 Slightly moist beige brown speckled off white medium dense intact silty sand with abundant coarse gravels and cobbles. Pebble marker.

1.05 Slightly moist red brown blotched black very dense to very soft rock strongly cemented and ferruginised gravel. Hardpan ferricrete.

1.25

NOTES

1) Refusal at 1,25m in soft rock hardpan ferricrete.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP07

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

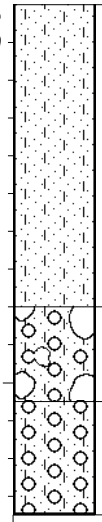
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP08
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry beige brown dense pinholed silty sand. Hillwash.

0.80 Slightly moist beige brown speckled off white dense intact silty sand with abundant coarse gravels and cobbles. Pebble marker.

1.05 Slightly moist beige brown blotched orange dense becoming very dense at depth cemented ferruginised and jointed silty sand with scattered gravels. Residual granite.

1.35

NOTES

1) Refusal at 1,35m on very dense residual granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP08

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

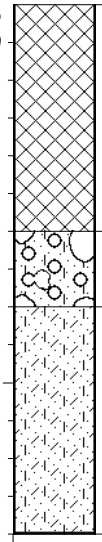
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP09
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist to moist light grey beige speckled orange and white medium dense to dense moderately compacted slightly clayey silty gravelly sand with scattered pebbles. Fill.

0.60 Slightly moist beige brown speckled off white dense intact silty sand with abundant coarse gravels and cobbles. Pebble marker.

0.80 Slightly moist grey beige speckled orange red and white medium dense to dense cemented and ferruginised slightly clayey silty sand. Reworked residual granite becoming hardpan ferricrete at depth.

1.40

NOTES

1) Refusal at 1,4m on hardpan ferricrete.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP09

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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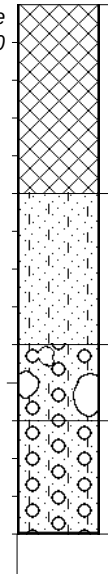
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP10
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist to moist grey brown dense compacted silty sand with scattered gravels. Fill.
0.50	Slightly moist dark grey brown medium dense pinholed silty sand. Hillwash.
0.90	Slightly moist beige brown speckled off white dense intact silty sand with abundant coarse gravels and cobbles. Pebble marker.
1.10	Slightly moist beige brown blotched orange dense becoming very dense at depth cemented, ferruginised and jointed silty sand with scattered gravels. Residual granite.
1.40	

NOTES

1) Refusal at 1,4m on very dense residual granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP10

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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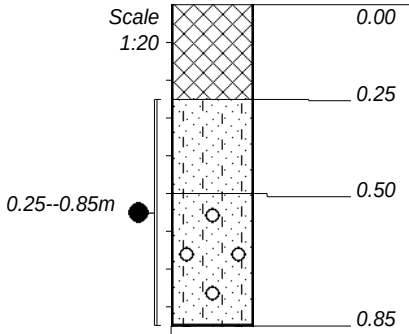
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP11
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00 – 0.25: Slightly moist grey brown speckled white and red medium dense to dense layered slightly clayey silty sand with scattered gravel. Fill.

0.25 – 0.50: Slightly moist dark grey brown medium dense pinholed silty sand. Hillwash.

0.50 – 0.85: Slightly moist grey beige speckled orange and black dense ferruginised gravelly silty sand. Nodular ferricrete becoming hardpan ferricrete at base.

NOTES

1) Refusal at 0,85m on very soft rock hardpan ferricrete.
2) No evidence of water.
3) Disturbed sample taken at 0,25--0,85m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP11

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

Crossman, Pape and Associates
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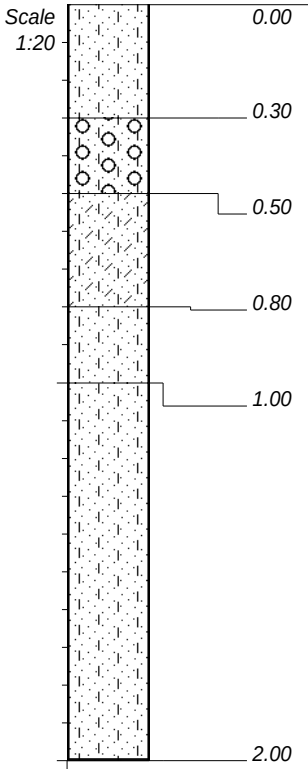
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP12
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00 – 0.30: Moist dark brown loose intact silty sand. Hillwash.

0.30 – 0.50: Slightly moist to moist dark brown loose intact silty sand with abundant fine to coarse gravels. Pebble marker.

0.50 – 0.80: Moist orange brown mottled and blotched grey loose weakly cemented and ferruginised slightly clayey silty sand. Reworked residual granite.

0.80 – 1.00: Moist orange brown speckled off white medium dense jointed silty sand. Residual granite with zones of reworked residual granite.

1.00 – 2.00: Moist orange beige grey brown speckled off white medium dense to dense becoming very dense with depth jointed silty sand. Residual granite.

NOTES

1) Refusal at 2,0m on very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP12

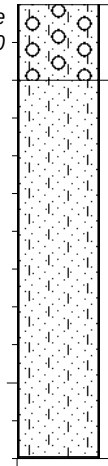
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP13
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist to moist grey mottled and blotched orange brown loose intact silty sand with abundant gravels. Pebble marker.

0.20 Moist orange brown mottled and blotched black and grey dense strongly cemented and ferruginised silty sand. Reworked residual granite.

1.20

NOTES

1) Refusal at 1,2m on very dense reworked residual granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP13

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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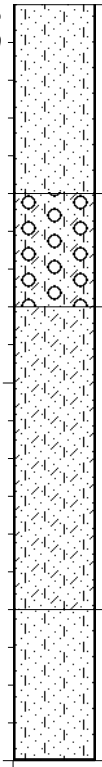
Halfway House Water Upgrade

HOLE No: TP14
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Moist dark brown loose to medium dense intact silty sand. Hillwash.
0.50	Moist grey mottled blotched orange brown loose to medium dense intact clayey silty sand with abundant gravels. Pebble marker.
0.80	Very moist orange brown mottled and blotched black and grey loose weakly cemented and ferruginised clayey silty sand. Reworked residual granite.
1.60	Very moist orange brown speckled off white and blotched grey loose to medium dense and medium dense in places jointed silty sand. Residual granite.
2.00	

NOTES

1) No refusal at 2,0m however DCP indicated refusal at 2,6m.
2) Slight seepage at 1,6m.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

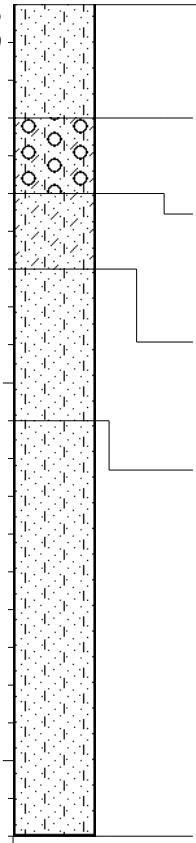
HOLE No: TP14

Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP15
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00 – 0.30: Moist dark brown loose to medium dense intact silty sand. Hillwash.

0.30 – 0.50: Moist grey mottled blotched orange brown loose to medium dense intact clayey silty sand with abundant gravels. Pebble marker.

0.50 – 0.70: Moist orange brown mottled and blotched black and grey loose to medium dense weakly cemented and ferruginised clayey silty sand. Reworked residual granite.

0.70 – 1.10: Moist orange brown speckled off white and blotched grey loose to medium dense and medium dense in places jointed silty sand. Residual granite.

1.10 – 2.20: Moist orange brown speckled off white and blotched grey medium dense becoming very dense with depth jointed silty sand. Residual granite.

NOTES

1) Refusal at 2,2m on very dense to very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP15

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

Crossman, Pape and Associates
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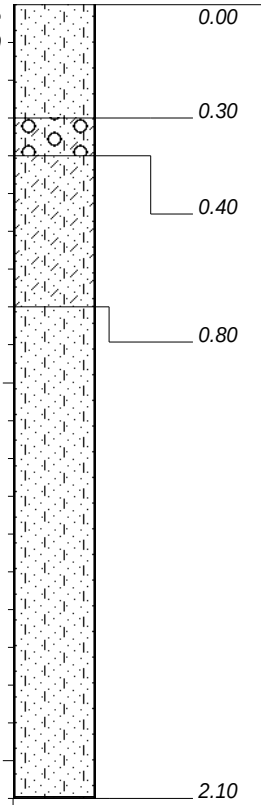
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP16
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00 – 0.30: Moist dark brown loose to medium dense intact silty sand. Hillwash.

0.30 – 0.40: Moist grey mottled and blotched orange brown loose to medium dense intact clayey silty sand with abundant gravels. Pebble marker.

0.40 – 0.80: Moist to very moist orange brown mottled and blotched black and grey loose to medium dense weakly cemented and ferruginised slightly clayey silty sand. Reworked residual granite.

0.80 – 2.10: Moist orange brown speckled off white and blotched grey medium dense becoming very dense with depth jointed silty sand. Residual granite.

NOTES

1) Refusal at 2,1m on very dense to very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP16

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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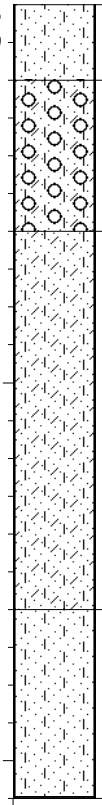
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP17
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Moist dark brown loose to medium dense intact silty sand. Hillwash.
0.20	Moist grey mottled and blotched orange brown loose to medium dense intact clayey silty sand with abundant gravels. Pebble marker.
0.60	Moist orange brown mottled and blotched black and grey medium dense weakly cemented and ferruginised slightly clayey silty sand. Reworked residual granite.
1.60	Moist to very moist orange brown speckled off white and blotched grey medium dense and loose to medium dense in places jointed silty sand. Residual granite.
2.10	

NOTES

1) No refusal at 2,1m. No refusal of DCP at 3,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP17

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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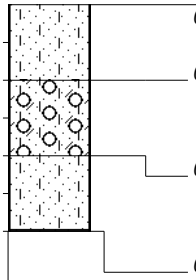
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP18
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Moist dark brown loose to meidium dense intact silty sand. Hillwash.
0.20	Moist grey mottled and blotched orange brown loose to medium dense intact clayey silty sand with abundant gravels. Pebble marker.
0.40	Moist to very moist orange brown speckled off white and blotched grey dense cemented and ferruginised silty sand. Residual granite.
0.60	

NOTES

1) Refusal at 0,6m on soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP18

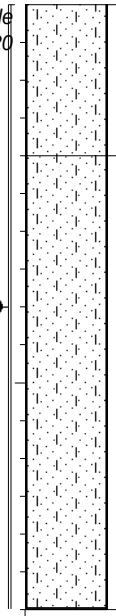
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP19
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist dark brown loose to medium dense intact silty sand. Hillwash.

0.40 Moist to very moist orange brown speckled off white and blotched grey dense to very dense cemented and ferruginised silty sand. Residual granite.

1.60

NOTES

1) Refusal at 1,6m on very soft rock granite.
2) Moderate seepage at 1,6m.
3) Disturbed sample taken at 0,0--1,6m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP19

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

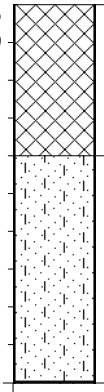
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP20
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist grey brown speckled off white loose to medium dense uncontrolled slightly clayey silty sand with scattered gravels. Fill.

0.40 Moist to very moist orange brown speckled off white and blotched grey dense to very dense cemented and ferruginised silty sand. Residual granite.

1.00

NOTES

1) Refusal at 1,0m on very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP20

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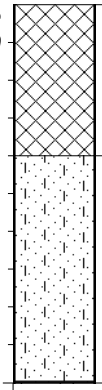
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP21
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist grey brown speckled off white loose to medium dense uncontrolled slightly clayey silty sand with scattered gravels. Fill.

0.40 Moist to very moist orange brown speckled off white and blotched grey dense to very dense cemented and ferruginised silty sand. Residual granite.

1.00

NOTES

1) Refusal at 10m on very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP21

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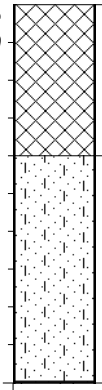
Halfway House Water Upgrade

HOLE No: TP22
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist grey brown speckled off white loose to medium dense uncontrolled slightly clayey silty sand with scattered gravels. Fill.

0.40 Moist to very moist orange brown speckled off white and blotched grey dense to very dense cemented and ferruginised silty sand. Residual granite.

1.00

NOTES

1) Refusal at 1,0m on very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP22

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

Crossman, Pape and Associates
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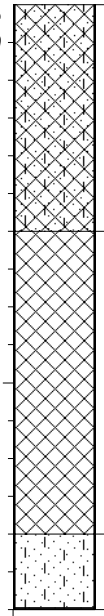
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP23
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist grey beige very dense compacted silty sand with abundant pebbles. Fill.

0.60 Moist grey brown speckled red and black medium dense layered slightly clayey silty sand. Fill.

1.40 Slightly moist to moist beige grey brown speckled off white and red very dense intact silty sand. Residual granite.

1.60

NOTES

1) Refusal at 1,6m on very dense to very soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP23

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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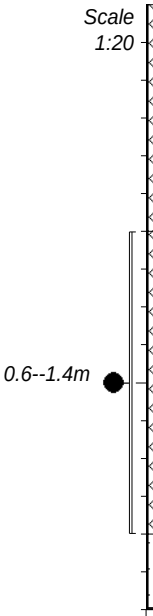
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP24
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00 Moist grey beige very dense compacted silty sand with abundant pebbles. Fill.

0.60 Moist grey brown speckled red and black medium dense layered slightly clayey silty sand. Fill.

1.40 Slightly moist to moist beige grey brown speckled off white and red very dense intact silty sand. Residual granite.

1.60

NOTES

1) Refusal at 1,6m on very dense to very soft rock granite.
2) No evidence of water.
3) Disturbed sample taken at 0,6--1,4m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP24

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

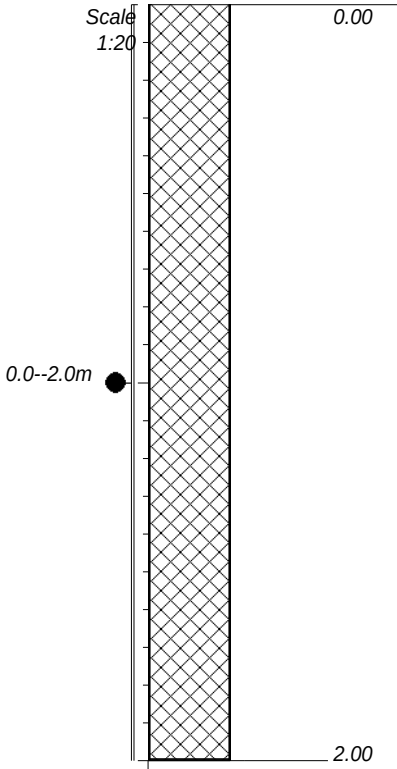
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP25
Sheet 1 of 1

JOB NUMBER: 20/91/TP



Slightly moist to moist beige brown medium dense layered silty sand with gravels and cobbles. Fill.

NOTES

1) No refusal at 2,0m. DCP refusal at 2,5m.
2) No evidence of water.
3) Disturbed sample taken at 0,0--2,0m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP25

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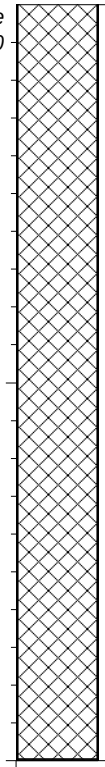
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP26
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist to moist beige brown medium dense layered silty sand with gravels and cobbles. Fill.

2.00

NOTES

1) No refusal at 2,0m. DCP refusal at 2,5m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP26

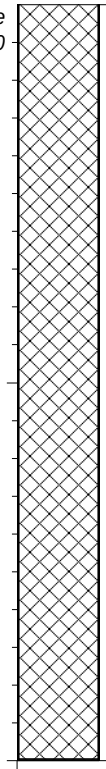
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP27
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist to moist beige brown medium dense layered silty sand with gravels and cobbles. Fill.

2.00

NOTES

1) No refusal at 2,0m. DCP refusal at 2,5m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

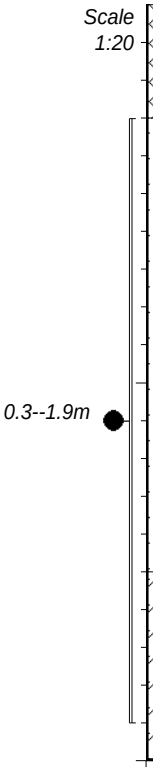
HOLE No: TP27

Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP28
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00 Slightly moist beige brown medium dense layered silty sand with gravels and cobbles. Fill.

0.30 Slightly moist to moist beige brown medium dense pinholed silty sand with gravels. Hillwash.

1.50 Moist dark olive grey streaked black and grey stiff silty sandy clay. Reworked residual diabase.

2.00

NOTES

1) No refusal at 2,0m. No DCP refusal at 3,0m.
2) No evidence of water.
3) Disturbed sample taken at 0,3--1,9m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP28

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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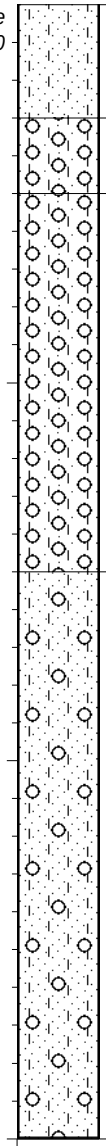
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP32
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist grey brown loose to medium dense open voided silty fine sand with abundant fine gravels. Hillwash.
0.30	Slightly moist grey brown medium dense open voided silty fine sandy gravel. Pebble marker.
0.50	Slightly moist grey brown blotched orange and black medium dense ferruginised silty fine sandy gravel. Nodular ferricrete.
1.50	Slightly moist red brown dense ferruginised silty gravelly sand. Residual granite.
3.00	

NOTES

1) No refusal at 3,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP32

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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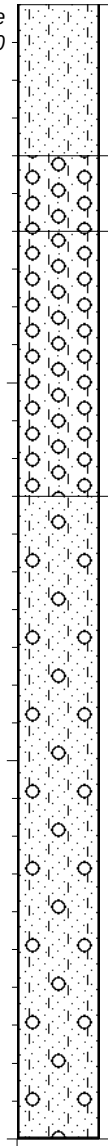
Halfway House Water Upgrade

HOLE No: TP33
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist grey brown loose to medium dense open voided silty fine sand with abundant fine gravels. Hillwash.
0.40	Slightly moist grey brown medium dense open voided silty fine sandy gravel. Pebble marker.
0.60	Slightly moist grey brown blotched orange and black medium dense ferruginised silty fine sandy gravel. Nodular ferricrete.
1.30	Slightly moist red brown dense ferruginised silty gravelly sand. Residual granite.
3.00	

NOTES

1) No refusal at 3,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP33

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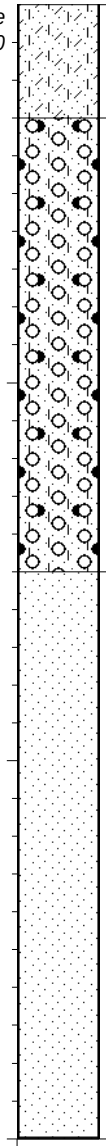
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP34
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist grey beige loose pinholed slightly clayey silty sand. Hillwash.

0.30 Slightly moist grey beige yellow blotched orange and black medium dense intact silty sand with abundant ferricrete gravels. Nodular ferricrete.

1.50 Slightly moist to moist red brown dense intact sity sand. Residual granite.

3.00

NOTES

1) No refusal at 3,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP34

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP35
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20

0.00
0.01

Hard rock granite.

NOTES

1) Test pit not excavated due to granite bedrock at surface.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

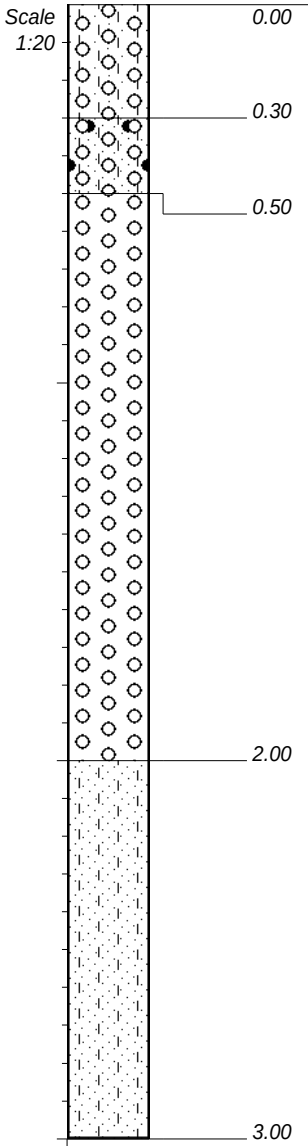
HOLE No: TP35

Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP36
Sheet 1 of 1

JOB NUMBER: 20/91/TP



0.00 – 0.30: Slightly moist grey brown medium dense open voided silty fine sandy gravel. Pebble marker.

0.30 – 0.50: Slightly moist grey beige yellow blotched orange and black medium dense intact silty sand with abundant ferricrete gravels. Nodular ferricrete.

0.50 – 2.00: Slightly moist grey beige yellow blotched orange and black medium dense strongly cemented and ferruginised gravel. Hardpan ferricrete.

2.00 – 3.00: Slightly moist to moist red brown medium dense to dense intact silty sand. Residual granite.

NOTES

1) No refusal at 3,0m.
2) Slight seepage at 2,0m.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP36

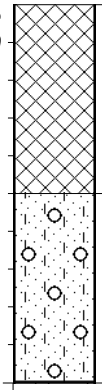
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP37
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry grey mottled black dense to very dense layered silty gravelly sand. Fill with builders rubble.

0.50 Dry to slightly moist orange brown mottled grey dense becoming very dense nodular to strongly cemented silty gravelly sand. Nodular ferricrete becoming hardpan ferricrete.

1.00

NOTES

1) Refusal at 1,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP37

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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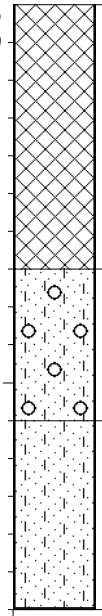
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP38
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry to slightly moist grey brown mottled black medium dense to dense layered silty gravelly sand. Fill with builders rubble.

0.70 Slightly moist orange brown mottled black medium dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.

1.10 Slightly moist orange brown intact silty sand. Reworked residual granite.

1.60

NOTES

1) No refusal.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP38

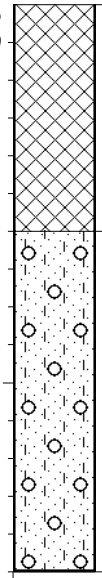
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP39
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry to slightly moist grey brown mottled black medium dense to dense silty gravelly sand with builders rubble. Fill.

0.60 Dry to slightly moist grey brown mottled black cemented and ferruginised silty gravelly sand. Nodular ferricrete becoming hardpan ferricrete.

1.50

NOTES

1) Refusal at 1,5m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP39

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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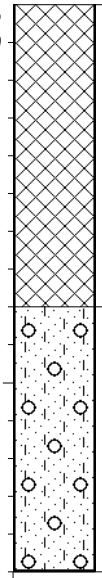
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP40
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist red to orange brown medium dense becoming loose layered silty gravelly sand. Fill.

0.80 Slightly moist yellow to orange brown mottled black medium dense becoming dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.

1.50

NOTES

1) No Refusal.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP40

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

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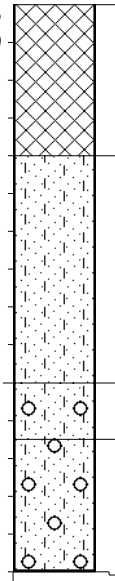
Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP44
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist grey brown speckled white medium dense to dense silty gravelly sand. Fill.

0.40 Dry to slightly moist orange brown to grey medium dense pinholed silty sand with scattered pebbles. Hillwash.

1.00 Dry to slightly moist orange brown to grey medium dense intact silty gravelly sand. Pebble marker.

1.15 Slightly moist orange brown medium dense to dense jointed and cemented silty gravelly sand. Reworked residual granite.

1.50

NOTES

1) No Refusal.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP44

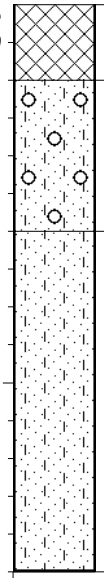
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP45
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist grey brown mottled orange and red medium dense silty gravelly sand. Fill.
0.20	Slightly moist orange to red brown speckled black loose to medium dense weakly cemented and ferruginised silty gravelly sand. Reworked residual granite.
0.60	Slightly moist dark orange to red brown medium dense jointed silty sand. Residual granite.
1.50	

NOTES

1) Refusal at 1,5m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP45

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

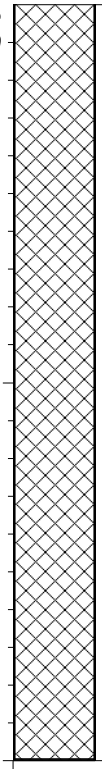
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP46
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist red brown speckled white and black medium dense slightly clayey silty sand with scattered gravels and cobbles. Fill.

2.00

NOTES

1) No refusal at 2,0m. No DCP refusal at 3,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP46

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

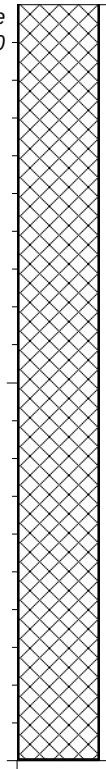
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP47
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist red brown speckled white and black medium dense slightly clayey silty sand with scattered gravels and cobbles. Fill.

2.00

NOTES

1) No refusal at 2,0m. No DCP refusal at 3,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP47

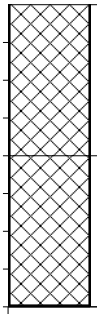
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP48
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist red brown speckled white and black medium dense slightly clayey silty sand with scattered gravels and cobbles. Fill.

0.40 Moist dark grey brown loose to medium dense silty sand. Fill.

0.80 Soft rock granite.

0.80

NOTES

1) Refusal at 0,8m on soft rock granite.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP48

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

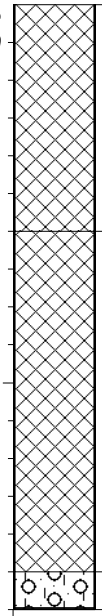
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP49
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist red brown speckled white and black dense slightly clayey silty sand with scattered gravels and cobbles. Fill.

0.60 Moist dark grey brown loose to medium dense silty sand. Fill.

1.50 Moist orange to red brown mottled black dense to very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.

1.60

NOTES

1) Refusal at 1,6m on very soft rock hardpan ferricrete.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP49

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

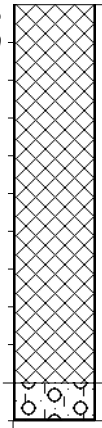
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP50
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist red brown speckled white and black dense slightly clayey silty sand with scattered gravels and cobbles. Fill.

1.00 Moist orange to red brown mottled black dense to very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.

1.10

NOTES

1) Refusal at 1,1m on very soft rock hardpan ferricrete.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP50

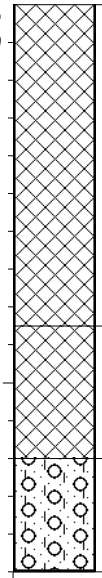
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP51
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Moist red brown speckled white and black dense slightly clayey silty sand with scattered gravels. Fill.

0.85 Moist dark grye brown loose to medium dense silty sand. Fill.

1.20 Moist dark grey beige mottled red orange and black loose to medium dense nodular gravel within a silty sand matrix. Nodular ferricrete.

1.50

NOTES

1) No refusal at 1,5m. DCP refusal at 2,0m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP51

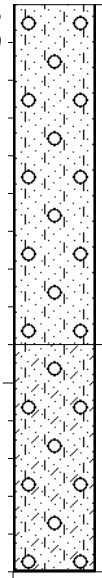
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP52
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist grey brown loose becoming medium dense slightly cemented silty gravelly sand. Nodular ferricrete.

0.90 Slightly moist grey brown mottled red and black dense becoming very dense cemented and ferruginised slightly clayey silty gravelly sand. Reworked residual granite.

1.50

NOTES

1) Refusal at 1,5m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP52

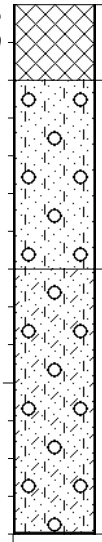
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP53
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist orange brown loose silty sand. Fill.
0.20	Slightly moist grey brown loose becoming medium dense slightly cemented silty gravelly sand. Nodular ferricrete.
0.70	Slightly moist grey brown mottled red and black dense becoming very dense cemented and ferruginised slightly clayey silty gravelly sand. Reworked residual granite.
1.40	

NOTES

1) Refusal at 1,4m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP53

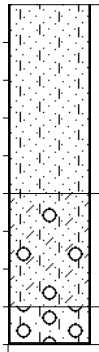
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP54
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist yellow brown loose pinholed silty sand. Hillwash.

0.50 Dry yellow to orange brown loose to medium dense weakly cemented and ferruginsed slightly clayey silty gravelly sand. Nodular ferricrete.

0.80 Slightly moist orange to red brown mottled black dense to very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.

0.90

NOTES

1) Refusal at 0,9m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP54

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

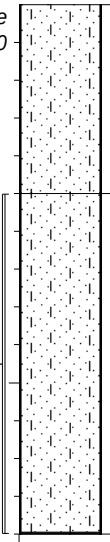
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP55
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist yellow brown loose pinholed silty sand. Hillwash.

0.50 Slightly moist dark red brown mottled cream and orange medium dense to dense becoming very dense jointed silty sand. Residual granite.

1.40

NOTES

1) Refusal at 1,4m.
2) No evidence of water.
3) Disturbed sample taken at 0,5--1,4m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP55

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

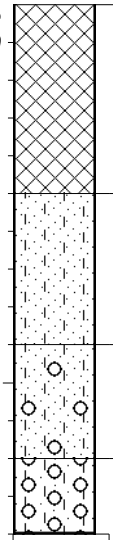
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP56
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist red brown speckled black and white medium dense layered silty sand with scattered gravels. Fill.
0.50	Slightly moist yellow brown loose pinholed silty sand. Hillwash.
0.90	Dry yellow to orange brown loose to medium dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.
1.20	Slightly moist orange to red brown mottled black dense to very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.
1.40	

NOTES

1) Refusal at 1,4m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP56

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

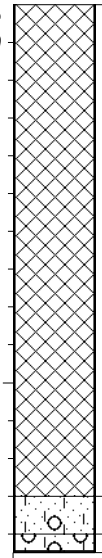
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP57
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist orange to red brown and grey medium dense to dense silty gravelly sand. Fill with builders rubble and waste.

1.30 Dry to yellow to orange brown dense to very dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.

1.40 Slightly moist orange to red brown mottled black very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.

1.45

NOTES

1) Refusal at 1,45m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP57

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

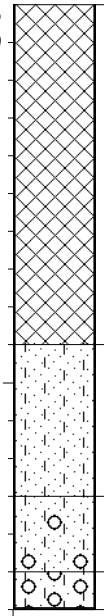
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP58
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Slightly moist to moist orange brown mottled grey medium dense becoming loose uncontrolled silty gravelly sand with cobbles and boulders. Fill.
0.90	Slightly moist yellow brown medium dense becoming loose pinholed silty sand. Hillwash.
1.30	Dry yellow to orange brown dense to very dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.
1.50	Slightly moist orange to red brown mottled black very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.
1.60	

NOTES

1) Refusal at 1,6m.
2) Seepage at 1,5m.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP58

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

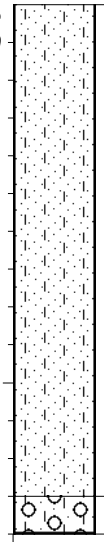
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP59
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist red loose pinholed silty sand. Hillwash.

1.30 Slightly moist red brown mottled black dense becoming very dense cemented and ferruginised silty sandy gravel. Nodular to hardpan ferricrete.

1.40

NOTES

1) Refusal at 1,4m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP59

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

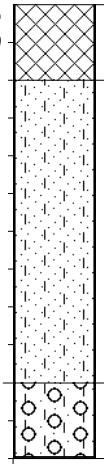
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP60
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist to moist grey to red brown loose to medium dense silty gravelly sand. Fill.

0.20 Slightly moist grey brown loose pinholed silty sand. Hillwash.

1.00 Slightly moist red brown mottled black dense becoming very dense cemented and ferruginised silty sandy gravel. Nodular to hardpan ferricrete.

1.20

NOTES

1) Refusal at 1,2m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP60

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

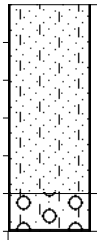
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP61
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist red loose pinholed silty sand. Hillwash.

0.50 Slightly moist red brown mottled black dense becoming very dense cemented and ferruginised silty sandy gravel. Nodular to hardpan ferricrete.

0.60

NOTES

1) Refusal at 0,6m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP61

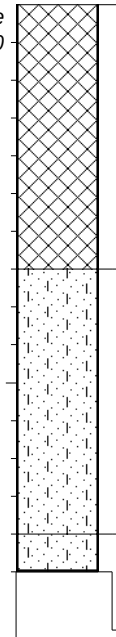
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP62
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist red brown speckled and mottled black and grey dense to very dense layered silty gravelly sand. Fill.

0.70 Moist yellow to grey brown loose pinholed silty sand. Hillwash.

1.40 Moist yellow to grey brown very loose to loose pinholed silty sand. Hillwash.

1.50

NOTES

1) No refusal at 1,5m.
2) Seepage at 1,4m.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :	*INCLINATION :*	*ELEVATION :*
MACHINE : Hand Excavated	*DIAM :*	*X-COORD :*
DRILLED BY :	*DATE :*	*Y-COORD :*
PROFILED BY : Riaan / Warren	*DATE :* 10/12/2020	
TYPE SET BY : Renee	*DATE :* 25/01/2021 12:08	
SETUP FILE : STANDARD.SET	*TEXT :* ..wayHouseWaterUpgrade.txt	

HOLE No: TP62

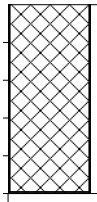
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP63
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry to slightly moist grey brown dense to very dense silty gravelly sand with cobbles. Fill.

0.50

NOTES

1) Refusal at 0,5m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020
DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP63

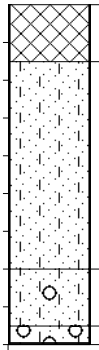
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP64
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Dry to slightly moist grey brown to light yellow brown loose to medium dense silty sand. Fill.
0.15	Slightly moist orange to red brown loose pinholed silty sand. Hillwash.
0.70	Slightly moist orange to red brown mottled black medium dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.
0.85	Slightly moist orange to red brown mottled black dense to very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.
0.90	

NOTES

1) Refusal at 0,9m.
2) No evidence of water.
3) Disturbed sample taken at 07--0,85m.
4) Stable sidewalls.

07--0.85m

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP64

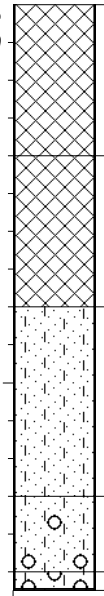
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP65
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Slightly moist orange to red brown mottled grey loose voided silty sand. Fill with builders rubble and waste.

0.40 Dry orange to grey brown and cream white dense to very dense layerd silty gravelly sand with cobbles and boulders. Fill.

0.80 Slightly moist red brown loose pinholed silty sand. Hillwash.

1.30 Slightly moist orange to red brown mottled black loose to medium dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.

1.50 Slightly moist orange to red brown mottled black dense to very dense strongly cemeted and ferruginised silty sandy gravel. Hardpan ferricrete.

1.55

NOTES

1) Refusal at 1,55m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP65

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

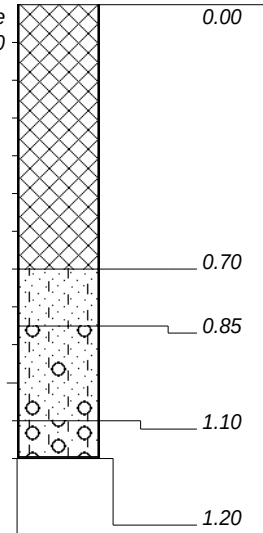
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP66
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00	Dry to grey brown and cream white dense to very dense layered silty gravelly sand with cobbles and boulders. Fill.
0.70	Slightly moist yellow to orange brown loose pinholed silty sand. Hillwash.
0.85	Slightly moist orange to red brown mottled black medium dense weakly cemented and ferruginised silty gravelly sand. Nodular ferricrete.
1.10	Slightly moist orange to red brown mottled black dense to very dense strongly cemented and ferruginised silty sandy gravel. Hardpan ferricrete.
1.20	

NOTES

1) No refusal at 1,2m.
2) No evidence of water.
3) No sample.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP66

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

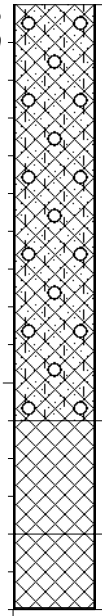
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: TP67
Sheet 1 of 1

JOB NUMBER: 20/91/TP

Scale 1:20



0.00 Dry orange to grey brown and cream white dense to very dense layered silty gravelly sand with cobbles and boulders. Fill.

1.10 Dry orange to grey brown and cream white loose to medium dense layered silty gravelly sand with cobbles and boulders. Fill.

1.40 Slightly moist grey brown orange and black medium dense to dense intact silty sand. Fill.

1.60

NOTES

1) No refusal at 1,6m.
2) No evidence of water.
3) Disturbed sample taken at 0--1,1m.
4) Stable sidewalls.

CONTRACTOR :
MACHINE : Hand Excavated
DRILLED BY :
PROFILED BY : Riaan / Warren

INCLINATION :
DIAM :
DATE :
DATE : 10/12/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP67

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

LEGEND
Sheet 1 of 1

JOB NUMBER: 20/91/TP

	GRAVEL/gravels	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SANDY	{SA05}
	SILTY	{SA07}
	CLAY	{SA08}
	CLAYEY	{SA09}
	GRANITE	{SA17}{SA44}
	FERRICRETE	{SA24}
	FILL	{SA32}
Name ●	DISTURBED SAMPLE	{SA38}
	COBBLES	{SA58}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 25/01/2021 12:08
TEXT : ..wayHouseWaterUpgrade.txt

LEGEND
SUMMARY OF SYMBOLS

APPENDIX C:
BOREHOLE LOGS

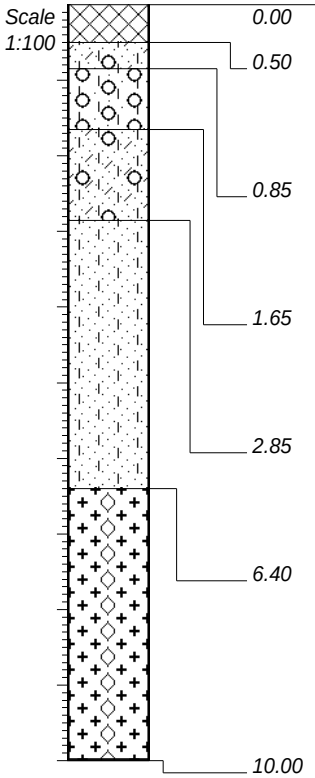
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: BH01
Sheet 1 of 1

JOB NUMBER: 20/91/BH

% Core Rec	% RQD	Fract No./ Metre	SPT 'N60'
-	-	-	
-	-	-	
-	-	-	
-	-	-	Ref
-	-	-	
-	-	-	Ref
-	-	-	
70	18	>20	
70	16	>20	
100	73	10	
100	84	6	



Grey brown silty sand. Fill.

Dark red brown mottled black slightly clayey silty gravelly sand. Nodular ferricrete.

Dark red to orange brown mottled grey and black very dense silty sandy gravel. Hardpan ferricrete.

Dark red brown to orange mottled grey slightly clayey silty gravelly sand. Reworked residual granite.

Yellow to grey brown mottled cream and grey very dense silty sand with zones of pegmatite gravel. Residual granite.

Light green to grey speckled cream white and black highly weathered closely to medium jointed medium grained soft rock granite with a brecciated pegnmatite zone at 6,4--7,0m.

NOTES

1) Borehole stopped at 10,0m.

2) Rest water level at 5,0m.

CONTRACTOR : RFGS
MACHINE :
DRILLED BY :
PROFILED BY : Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 11/12/2020

DATE : 11/12/2020 09:53
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: BH01

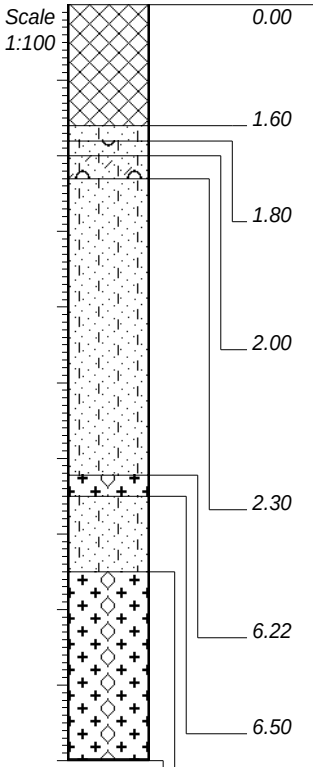
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: BH02
Sheet 1 of 1

JOB NUMBER: 20/91/BH

% Core Rec	% RQD	Fract No./ Metre	SPT 'N60'
			13
			Ref
			Ref



0.00 – 1.60	Grey brown mottled orange silty gravelly sand. Fill with boulders.
1.60 – 1.80	Orange to grey brown silty sand. Hillwash.
1.80 – 2.00	Orange to grey and red brown weakly cemented silty gravelly sand. Nodular ferricrete.
2.00 – 2.30	Orange to red brown mottled grey speckled black strongly cemented slightly clayey silty gravelly sand. Hardpan ferricrete.
2.30 – 6.22	Dark red brown speckled cream silty sand. Residual granite with zones of reworked residual granite.
6.22 – 6.50	Orange brown hightly weathered soft rock granite.
6.50 – 7.50	Dark red brown speckled cream silty sand. Residual granite with zones of reworked residual granite.
7.50 – 10.00	Orange to grey brown highly weathered closely jointed soft rock granite.

NOTES

1) Borehole stopped at 10,0m.

2) Rest water level at 3,6m.

CONTRACTOR : RFGS
MACHINE :
DRILLED BY :
PROFILED BY : Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 11/12/2020

DATE : 11/12/2020 09:53
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: BH02

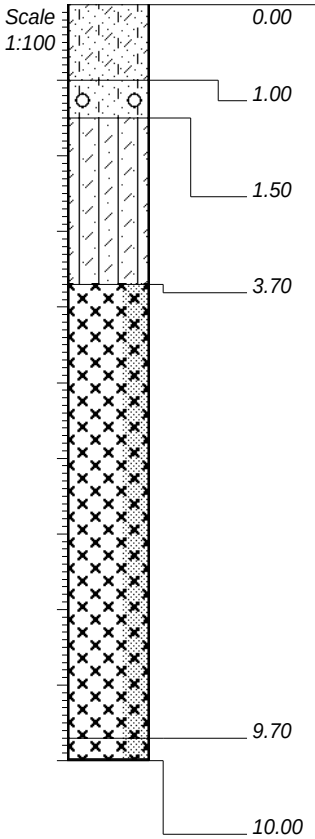
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: BH03
Sheet 1 of 1

JOB NUMBER: 20/91/BH

% Core Rec	% RQD	Fract No./ Metre	SPT 'N60'
-	-	-	
-	-	-	
-	-	-	
-	-	-	
			14
93	56	13	
60	0	>20	
100	75	>20	
90	46	>20	
93	50	>20	



Grey brown slightly clayey silty sand. Hillwash.

Grey brown silty gravelly sand. Pebble marker.

Orange brown stiff mottled grey slightly clayey sandy silt. Residual diabase.

Beige brown mottled red and black completely weathered closely to medium jointed fine grained very soft rock diabase. Joints orientated between 0-50 degrees.

As above except highly weathered soft rock diabase.

NOTES

1) Borehole stopped at 10,0m.

2) Rest water level at 4,0m.

CONTRACTOR : RFGS
MACHINE :
DRILLED BY :
PROFILED BY : Warren

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 11/12/2020

DATE : 11/12/2020 09:53
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: BH03

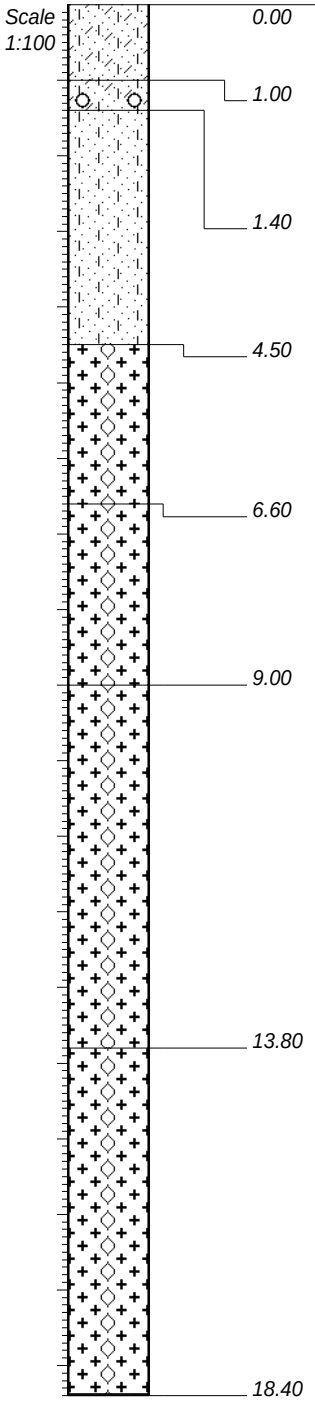
Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

HOLE No: BH04
Sheet 1 of 1

JOB NUMBER: 20/91/BH

% Core Rec	% RQD	Fract No./ Metre	SPT 'N60'
-	-	-	
-	-	-	
-	-	-	
-	-	-	
-	-	-	
-	-	-	
98	40	12	
13	24	>20	
100	70	11	
80	35	11	
100	26	>20	
100	23	15	
100	33	16	
100	100	9	
67	100	5	



Grey brown slightly clayey silty sand. Hillwash.

Orange to yellow brown speckled black medium dense slightly clayey silty gravelly sand. Reworked residual granite.

Orange to grey brown speckled black and cream dense to very dense silty sand. Residual granite.

Grey brown to light green speckled black and white completely weathered closely jointed coarse grained very soft rock granite.

Light to olive green grey speckled black highly weathered coarse grained closely jointed very soft rock granite.

As above but moderately weathered moderately jointed coarse grained soft rock granite.

Speckled black and white slightly weathered slightly jointed medium hard rock granite.

NOTES

1) Borehole stopped at 18,4m.

2) Rest water level at 11,0m.

CONTRACTOR : RFGS
MACHINE :
DRILLED BY :
PROFILED BY : Warren
TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 11/12/2020
DATE : 11/12/2020 09:53
TEXT : ..wayHouseWaterUpgrade.txt

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: BH04

Crossman, Pape and Associates
Consulting Geotechnical Engineers and Engineering Geologists

Zutari Consulting Engineers
Halfway House Water Upgrade

LEGEND
Sheet 1 of 1

JOB NUMBER: 20/91/BH

	GRAVEL	{SA02}
	GRAVELLY	{SA03}
	SAND	{SA04}
	SANDY	{SA05}
	SILT	{SA06}
	SILTY	{SA07}
	CLAYEY	{SA09}
	PLUTONIC/norite/syenite	{SA17}
	HYPABYSSAL/anorthosite/syenite aplite	{SA18}
	DIORITE FAMILY	{SA41}
	FREE QUARTZ/visible quartz	{SA44}
	GRANITE	{SA17}{SA44}
	DIABASE	{SA18}{SA41}
	FILL	{SA32}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

LEGEND
SUMMARY OF SYMBOLS

TYPE SET BY : Renee
SETUP FILE : STANDARD.SET

DATE : 11/12/2020 09:53
TEXT : ..wayHouseWaterUpgrade.txt

APPENDIX D:
DYNAMIC PROBE SUPER HEAVY TEST RESULTS

RFGS Geotechnical Services (Pty) LTD -REG Nr: 2015/134679/07
22 Mustang Avenue- Pretoria – Gauteng – South Africa
Rian Fourie +27 82 825 1050
www.drillingsa.co.za

RFGS ROELF FOURIE *Geotechnical Services*

Job Type:	Penetrometer Testing	Remarks:
Quote Ref:	RFQ1175	
Site Location:	Grand Central	
Date:	21-01-2021	
Done By:	Delito	

DEPTH:	DPSH1	DPSH2	DPSH3	DPSH4	DPSH5	DPSH6	DPSH7		
0.3	1	1	13	1	1	1	1		
0.6	1	1	1	1	1	1	1		
0.9	2	2	1	1	6	1	1		
1.2	3	32	40	4	7	2	4		
1.5	4	100REF	41	7	15	2	4		
1.8	15		100REF	7	17	6	6		
2.1	10			20	19	16	14		
2.4	14			31	19	19	14		
2.7	14			100REF	12	16	19		
3.0	8				13	29	25		
3.3	11				24	32	35		
3.6	9				25	25	100REF		
3.9	14				33	29			
4.2	11				100REF	30			
4.5	19					33			
4.8	22					45			
5.1	17					100REF			
5.4	20								
5.7	20								
6.0	21 STOP								
6.3									
6.6									
6.9									
7.2									
7.5									
7.8									
8.1									
8.4									
8.7									
9.0									
9.3									
9.6									
9.9									
10.2									
10.5									
10.8									
11.1									
11.4									
11.7									
12.0									
12.3									
12.6									
12.9									
13.2									
13.5									
13.8									
14.1									
14.4									
14.7									
15.0									
Re-drive									
0.3									
0.6									

RFGS Geotechnical Services (Pty) LTD -REG Nr: 2015/134679/07
22 Mustang Avenue- Pretoria – Gauteng – South Africa
Rian Fourie +27 82 825 1050
www.drillingsa.co.za

RFGS ROELF FOURIE *Geotechnical Services*

Job Type:	Penetrometer Testing				Remarks:				
Quote Ref:	RFQ1174								
Site Location:	Grand Central								
Date:	21-01-2021								
Done By:	Delito								
DEPTH:	DPSH9	DPSH8	DPSH10	DPSH11	DPSH12				
0.3	1	1	1	1	1				
0.6	1	1	1	1	1				
0.9	1	1	1	1	1				
1.2	2	3	4	12	2				
1.5	22	6	4	33	4				
1.8	100REF	25	24	40	10				
2.1		39	15	100REF	11				
2.4		100REF	15		14				
2.7			17		14				
3.0			26		17				
3.3			38		35				
3.6			39						
3.9			100REF						
4.2									
4.5									
4.8									
5.1									
5.4									
5.7									
6.0									
6.3									
6.6									
6.9									
7.2									
7.5									
7.8									
8.1									
8.4									
8.7									
9.0									
9.3									
9.6									
9.9									
10.2									
10.5									
10.8									
11.1									
11.4									
11.7									
12.0									
12.3									
12.6									
12.9									
13.2									
13.5									
13.8									
14.1									
14.4									
14.7									
15.0									
Re-drive									
0.3									
0.6									

APPENDIX E:
LABORATORY TEST RESULTS

Specialised Testing Laboratory (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical
Quality | Excellence | On Time

Unit 1, 13 Bloubokkie Street, Koedoespoort 0186
Roelof | 072 674 6343 | roelof@stlab.co.za
Gerrie | 082 309 4448 | gerrie@stlab.co.za
www.stlab.co.za

Client Name: Crossman Pape & Associates
Project Name: 2091: Halfway House Water Upgrade
Job Number: CPA-38
Date: 2021-02-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Sheet Reference: R-STL-011 Rev02

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				**Atterberg Limits & Classification**			
Sample	TP 3	TP 6	TP 11	Sample	TP 3	TP 6	TP 11
Depth (m)	0.5 - 1.3	0.6 - 1.35	0.25 - 0.85	Depth (m)	0.5 - 1.3	0.6 - 1.35	0.25 - 0.85
Lab No	CPA-38-148	CPA-38-149	CPA-38-150	Lab No	CPA-38-148	CPA-38-149	CPA-38-150
53.0	**100**	**100**	**100**	Liquid Limit (%)	**35**	**26**	**20**
37.5	**100**	**100**	**100**	Plastic Limit (%)	**26**	**12**	**13**
26.5	**100**	**100**	**96**	Plasticity Index (%)	**9**	**14**	**7**
19.0	**100**	**100**	**95**	Linear Shrinkage (%)	**4.5**	**6.5**	**3.0**
13.2	**99**	**100**	**89**	PI of whole sample	**3**	**8**	**3**
9.5	**98**	**99**	**83**				
6.7	**97**	**98**	**77**	% Gravel	**28**	**7**	**37**
4.75	**94**	**97**	**72**	% Sand	**54**	**64**	**47**
2.00	**72**	**93**	**63**	% Silt	**13**	**13**	**9**
1.00	**48**	**79**	**54**	% Clay	**5**	**16**	**7**
0.425	**35**	**60**	**40**	Activity	**1.8**	**0.9**	**1.0**
0.250	**30**	**50**	**31**				
0.150	**26**	**41**	**24**	% Soil Mortar	**72**	**93**	**63**
0.075	**20**	**32**	**18**				
0.060	**18**	**29**	**16**	Grading Modulus	**1.73**	**1.15**	**1.79**
0.050	**16**	**27**	**15**	Moisture Content (%)	**N / T**	**N / T**	**N / T**
0.035	**14**	**23**	**12**	Relative Density (SG)*	**2.65**	**2.65**	**2.65**
0.020	**11**	**21**	**10**				
0.006	**8**	**18**	**8**	Unified (ASTM D2487)	**SC**	**SC**	**SC-SM**
0.002	**5**	**16**	**7**	AASHTO (M145-91)	**A - 2 - 4**	**A - 2 - 6**	**A - 2 - 4**

Remarks: *: Assumed
N / T: Not Tested

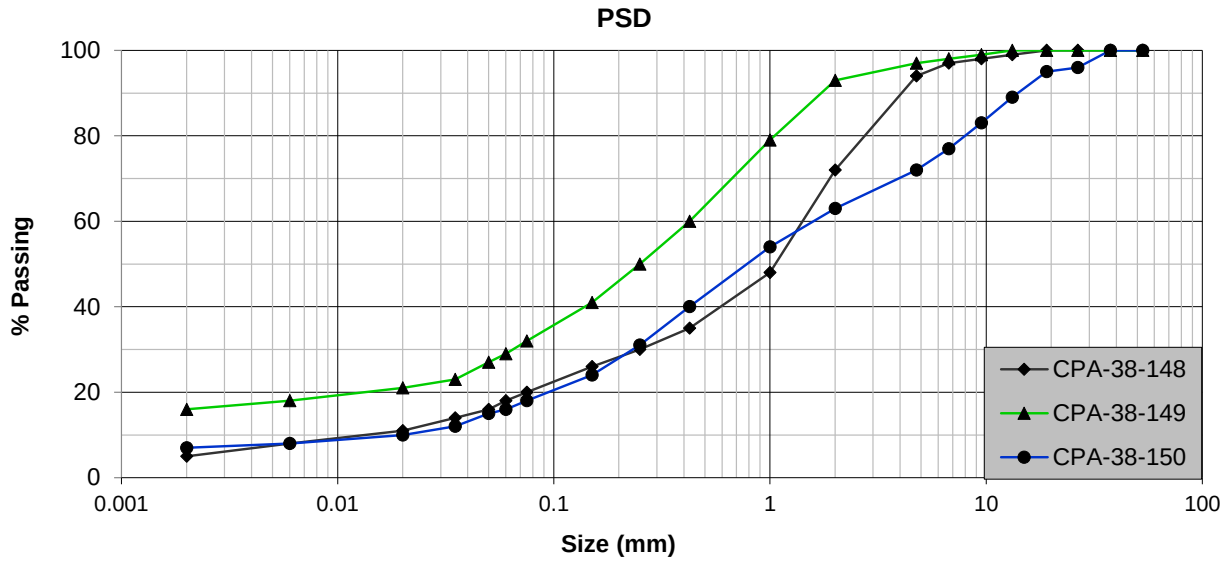
Specialised Testing Laboratory (Pty) Ltd
Asphalt | Aggregate | Bitumen | Geotechnical
Quality | Excellence | On Time

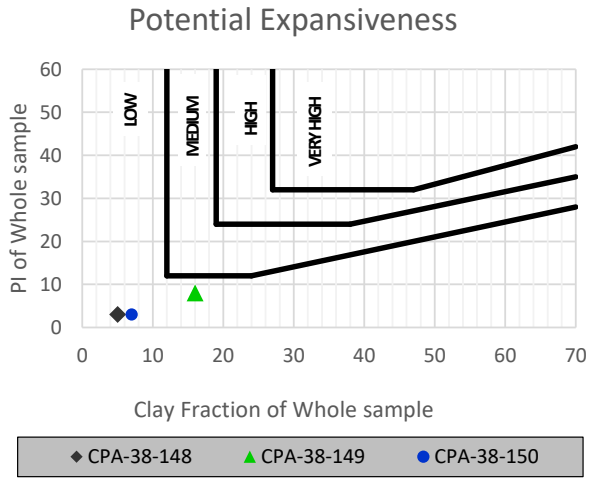
Unit 1, 13 Bloubokkie Street, Koedoespoort 0186
Roelof | 072 674 6343 | roelof@stlab.co.za
Gerrie | 082 309 4448 | gerrie@stlab.co.za
www.stlab.co.za

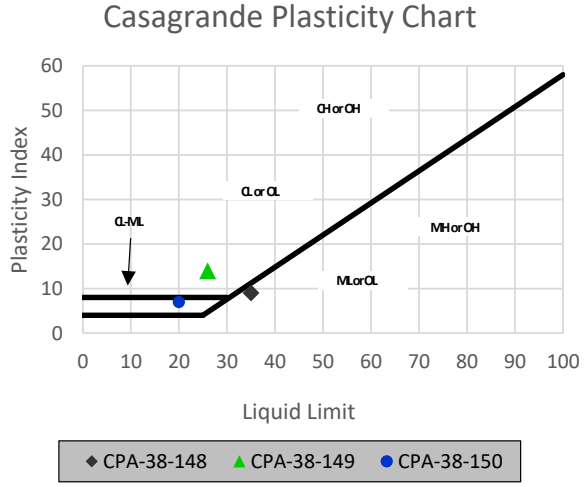
Client Name: Crossman Pape & Associates
Project Name: 2091: Halfway House Water Upgrade
Job Number: CPA-38
Date: 2021-02-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Sheet Reference: R-STL-011 Rev02







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Client Name: Crossman Pape & Associates
Project Name: 2091: Halfway House Water Upgrade
Job Number: CPA-38
Date: 2021-02-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

Sheet Reference: R-STL-011 Rev02

Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				**Atterberg Limits & Classification**			
Sample	TP 19	TP 67	TP 53	Sample	TP 19	TP 67	TP 53
Depth (m)	0 - 1.6	0 - 0.1	0.7 - 1.4	Depth (m)	0 - 1.6	0 - 0.1	0.7 - 1.4
Lab No	CPA-38-151	CPA-38-152	CPA-38-153	Lab No	CPA-38-151	CPA-38-152	CPA-38-153
53.0	**100**	**100**	**100**	Liquid Limit (%)	**30**	**28**	**-**
37.5	**100**	**98**	**100**	Plastic Limit (%)	**20**	**16**	**-**
26.5	**100**	**95**	**100**	Plasticity Index (%)	**10**	**12**	**SP**
19.0	**100**	**90**	**100**	Linear Shrinkage (%)	**5.0**	**6.0**	**0.5**
13.2	**98**	**85**	**83**	PI of whole sample	**4**	**5**	**-**
9.5	**97**	**83**	**80**				
6.7	**95**	**81**	**75**	% Gravel	**20**	**29**	**35**
4.75	**92**	**79**	**73**	% Sand	**60**	**46**	**47**
2.00	**80**	**71**	**65**	% Silt	**12**	**15**	**14**
1.00	**57**	**58**	**55**	% Clay	**8**	**10**	**4**
0.425	**41**	**44**	**41**	Activity	**1.3**	**1.2**	**0.0**
0.250	**34**	**38**	**33**				
0.150	**29**	**33**	**27**	% Soil Mortar	**80**	**71**	**65**
0.075	**22**	**28**	**20**				
0.060	**20**	**25**	**18**	Grading Modulus	**1.57**	**1.57**	**1.74**
0.050	**18**	**23**	**16**	Moisture Content (%)	**N / T**	**N / T**	**N / T**
0.035	**16**	**20**	**13**	Relative Density (SG)*	**2.65**	**2.65**	**2.65**
0.020	**12**	**17**	**9**				
0.006	**9**	**12**	**6**	Unified (ASTM D2487)	**SC**	**SC**	**SM**
0.002	**8**	**10**	**4**	AASHTO (M145-91)	**A - 2 - 4**	**A - 2 - 6**	**A - 1 - b**

Remarks: *: Assumed
N / T: Not Tested

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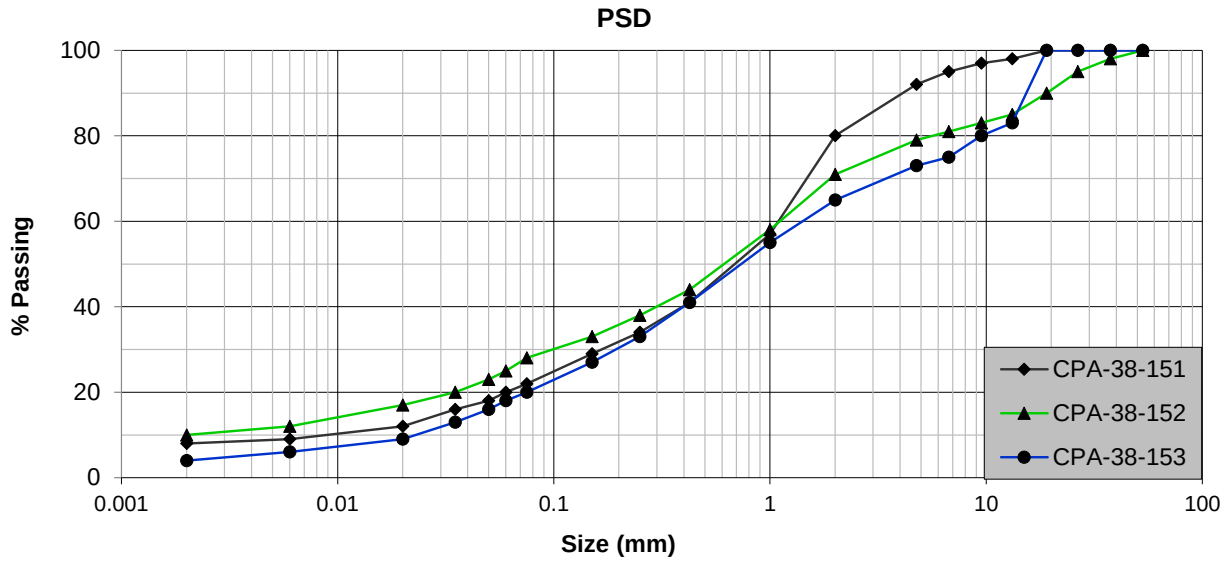
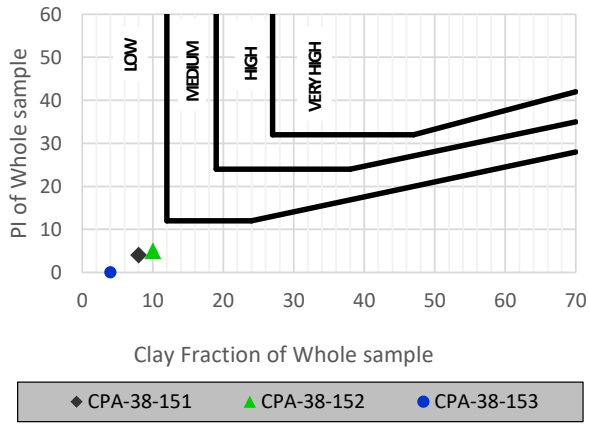
Client Name: Crossman Pape & Associates
Project Name: 2091: Halfway House Water Upgrade
Job Number: CPA-38
Date: 2021-02-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR

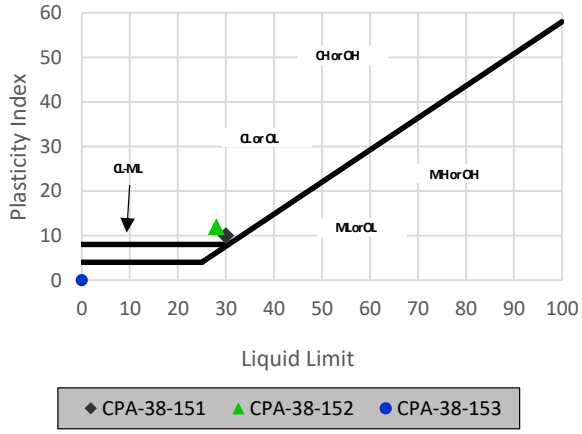
Sheet Reference: R-STL-011 Rev02



Potential Expansiveness



Casagrande Plasticity Chart



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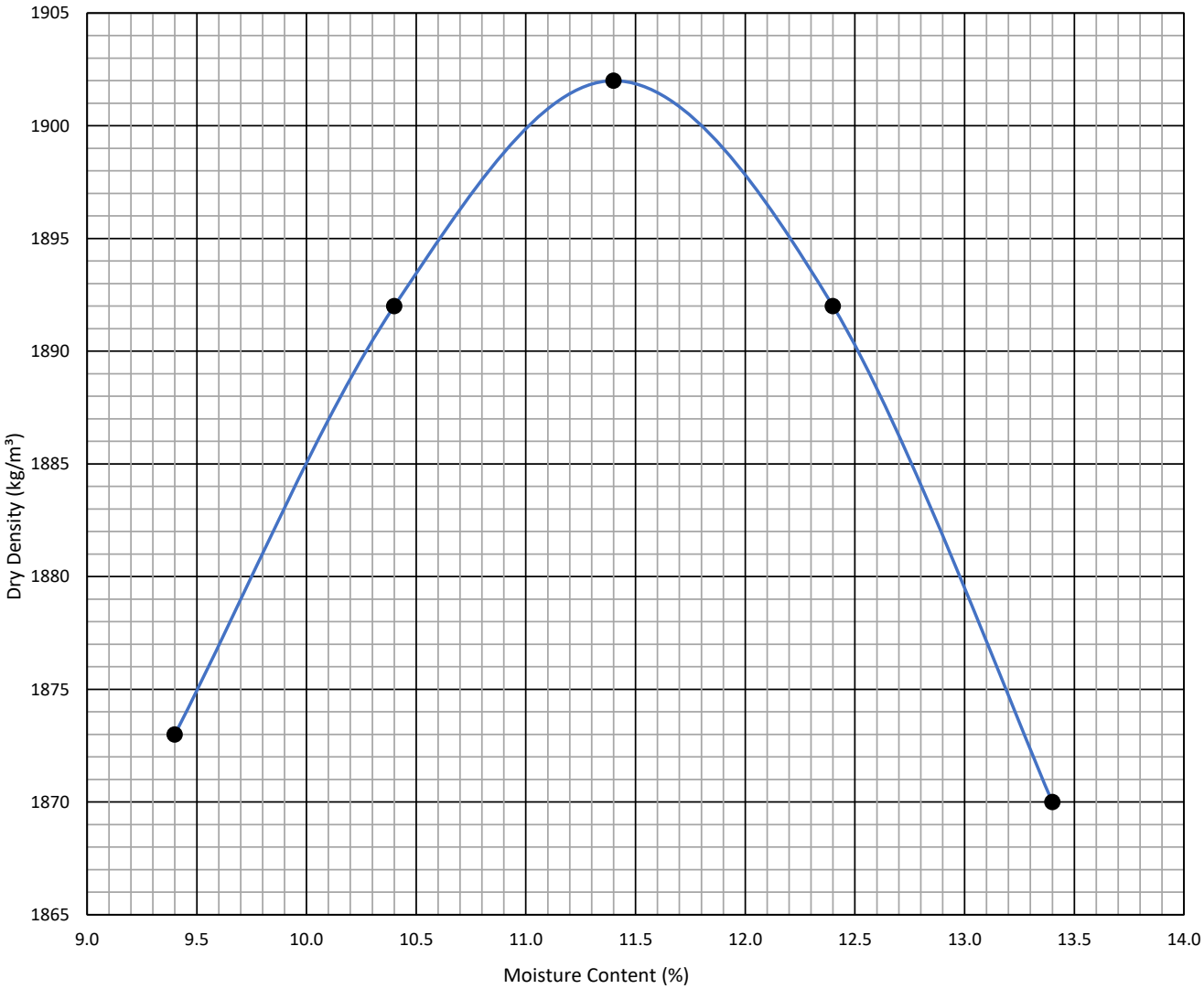
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-148
Sample:	TP 3	**Method:**	SANS 3001 GR30
Depth: (m)	0.5 - 1.3	**Date:**	10-Feb-21

MDD & OMC DETERMINATION (Mod. AASHTO)

Sheet Reference: R-STL-013 Rev01

Maximum Dry Density: **1902** kg/m³ Optimum Moisture Content: **11.4** %

Moisture Content (%)	9.4	10.4	11.4	12.4	13.4			
Dry Density (kg/m³)	1873	1892	1902	1892	1870			



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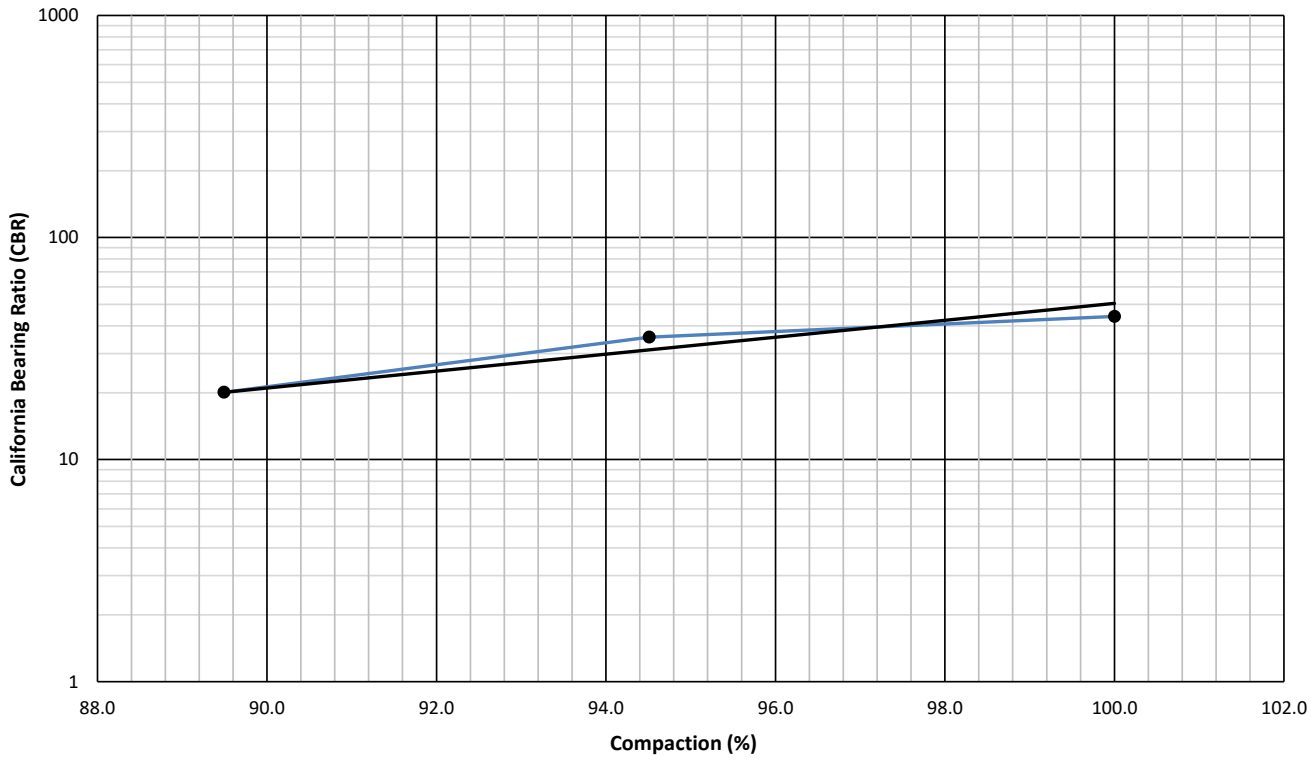
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-148
Sample:	TP 3	**Method:**	SANS 3001 GR40
Depth: (m)	0.5 - 1.3	**Date:**	10-Feb-21

CALIFORNIA BEARING RATIO

Sheet Reference: R-STL-014 Rev01

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.						
(kg/m³)	(%)	(kg/m³)	(%)	(%)	(%)	2.5	5.0	7.5	Compaction (%)	CBR
1902	11.4	1913	10.8	100.0	0.0	44	52	55	100	**44**
									98	**41**
1902	11.4	1808	10.8	94.5	0.0	36	35	34	97	**39**
									95	**36**
1902	11.4	1712	10.8	89.5	0.0	20	18	17	93	**30**
									90	**21**



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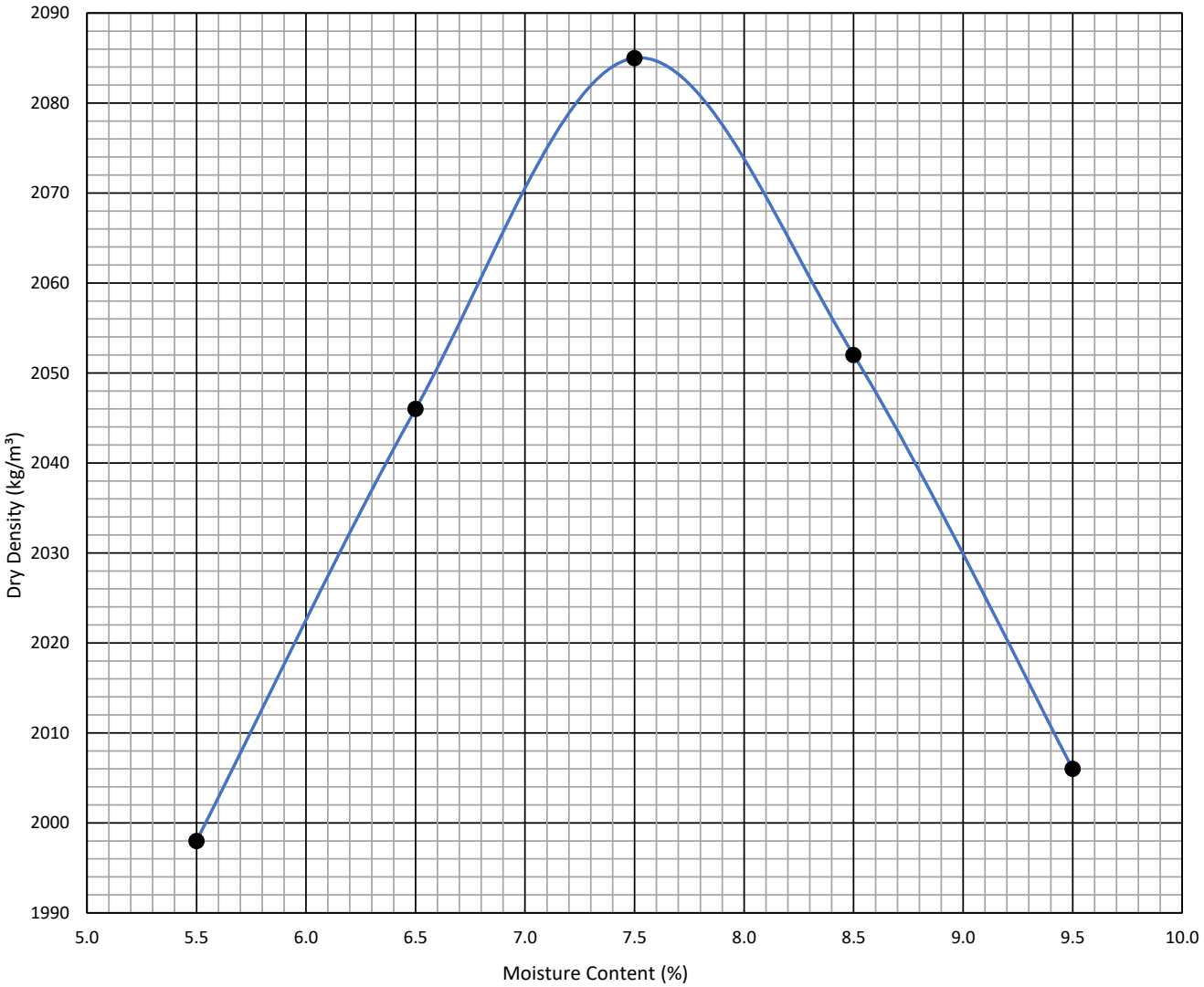
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-149
Sample:	TP 6	**Method:**	SANS 3001 GR30
Depth: (m)	0.6 - 1.35	**Date:**	10-Feb-21

MDD & OMC DETERMINATION (Mod. AASHTO)

Sheet Reference: R-STL-013 Rev01

Maximum Dry Density: **2085** kg/m³ Optimum Moisture Content: **7.5** %

Moisture Content (%)	5.5	6.5	7.5	8.5	9.5			
Dry Density (kg/m³)	1998	2046	2085	2052	2006			



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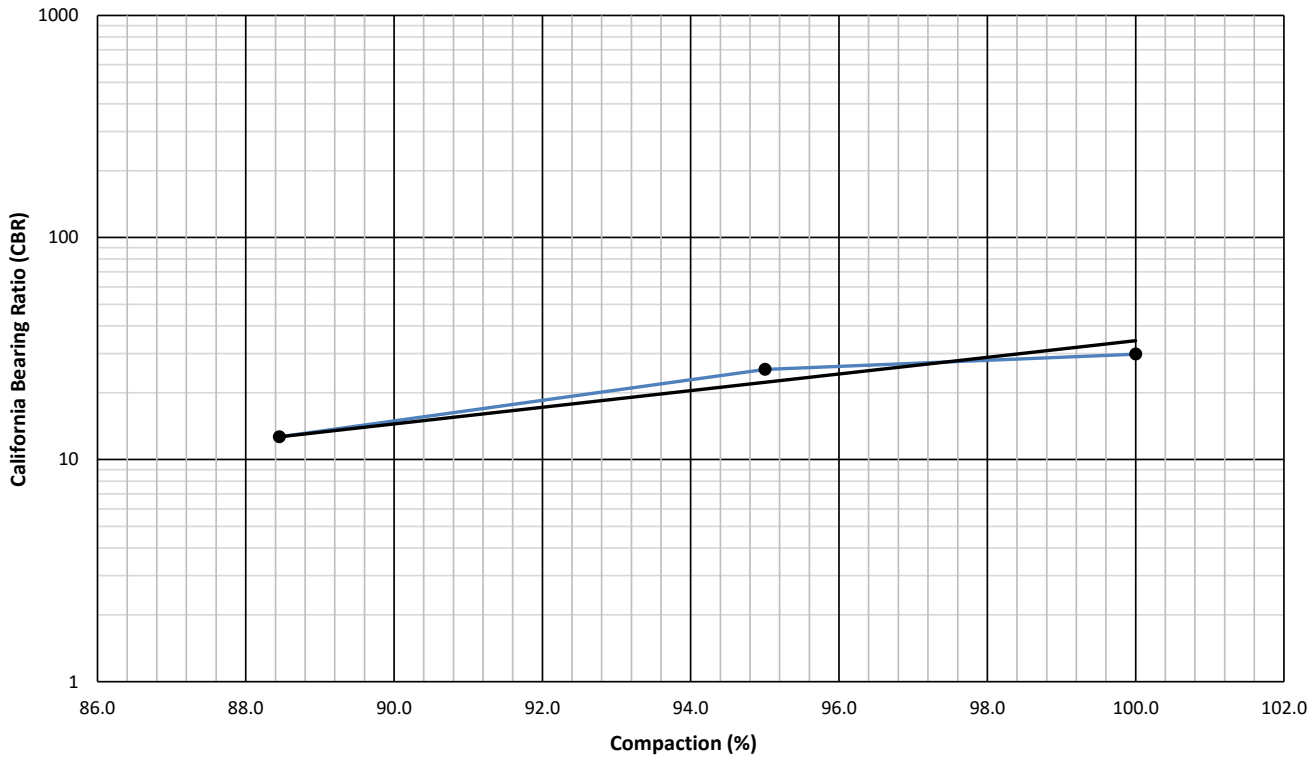
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-149
Sample:	TP 6	**Method:**	SANS 3001 GR40
Depth: (m)	0.6 - 1.35	**Date:**	10-Feb-21

CALIFORNIA BEARING RATIO

Sheet Reference: R-STL-014 Rev01

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	**OMC**	**Dry Dens.**	**MC**	**Comp.**						
(kg/m³)	(%)	(kg/m³)	(%)	(%)	(%)	2.5	5.0	7.5	Compaction (%)	CBR
2085	7.5	2061	8.2	100.0	0.0	30	32	33	100	**30**
									98	**28**
2085	7.5	1958	8.2	95.0	0.0	25	27	25	97	**27**
									95	**25**
2085	7.5	1823	8.2	88.5	0.0	13	10	8	93	**21**
									90	**15**



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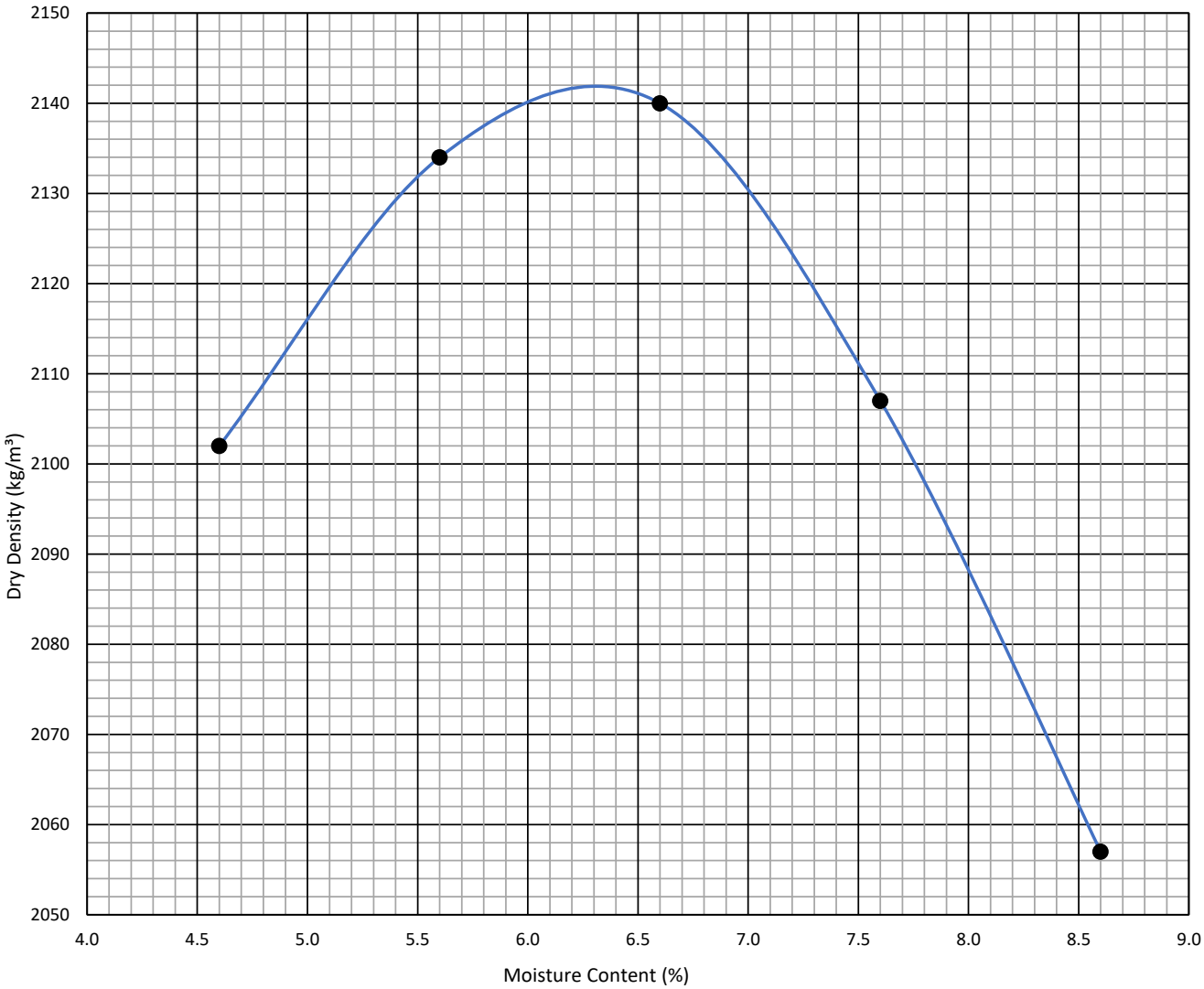
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-150
Sample:	TP 11	**Method:**	SANS 3001 GR30
Depth: (m)	0.25 - 0.85	**Date:**	10-Feb-21

MDD & OMC DETERMINATION (Mod. AASHTO)

Sheet Reference: R-STL-013 Rev01

Maximum Dry Density: **2146** kg/m³ Optimum Moisture Content: **6.3** %

Moisture Content (%)	4.6	5.6	6.6	7.6	8.6			
Dry Density (kg/m³)	2102	2134	2140	2107	2057			



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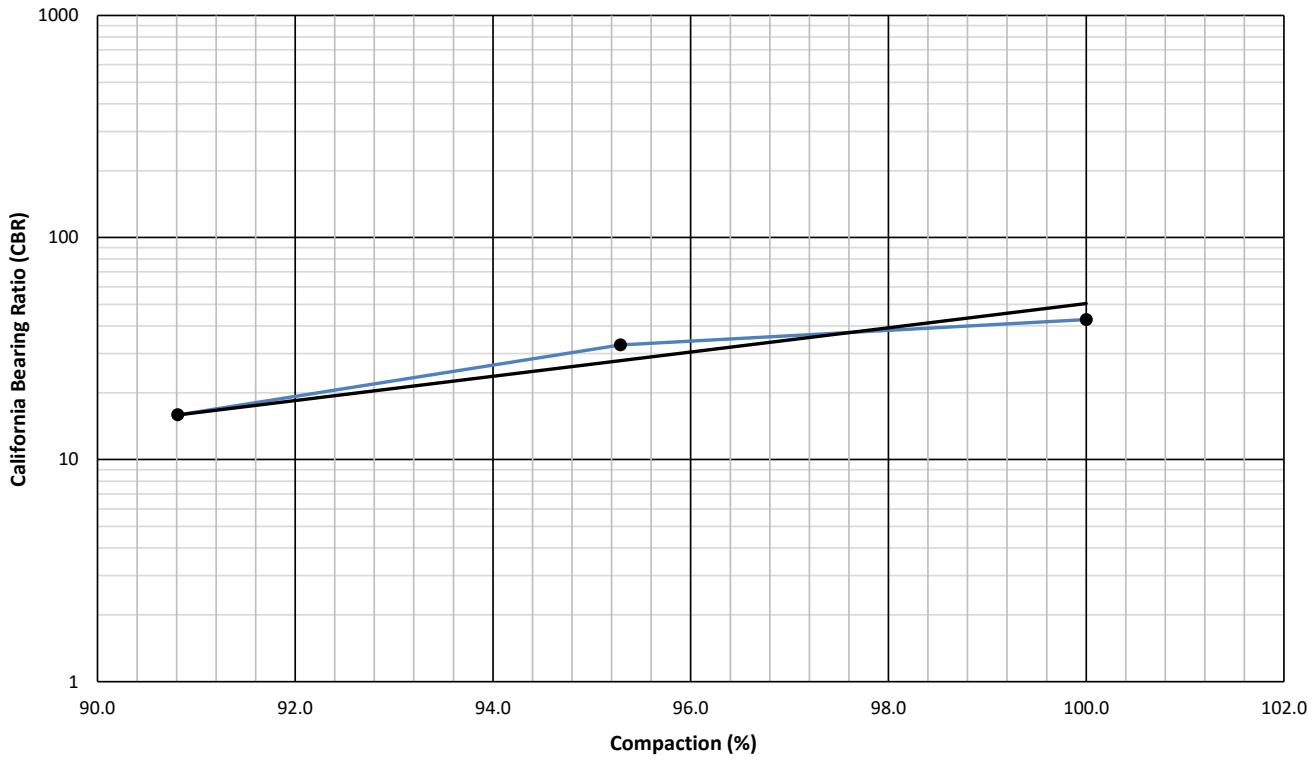
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-150
Sample:	TP 11	**Method:**	SANS 3001 GR40
Depth: (m)	0.25 - 0.85	**Date:**	10-Feb-21

CALIFORNIA BEARING RATIO

Sheet Reference: R-STL-014 Rev01

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	**OMC**	**Dry Dens.**	**MC**	**Comp.**						
(kg/m³)	(%)	(kg/m³)	(%)	(%)	(%)	2.5	5.0	7.5	Compaction (%)	CBR
									100	**43**
2146	6.3	2144	6.3	100.0	0.0	43	52	59	98	**38**
									97	**36**
2146	6.3	2043	6.3	95.3	0.0	33	38	38	95	**31**
									93	**23**
2146	6.3	1947	6.3	90.8	0.0	16	15	14	90	**14**



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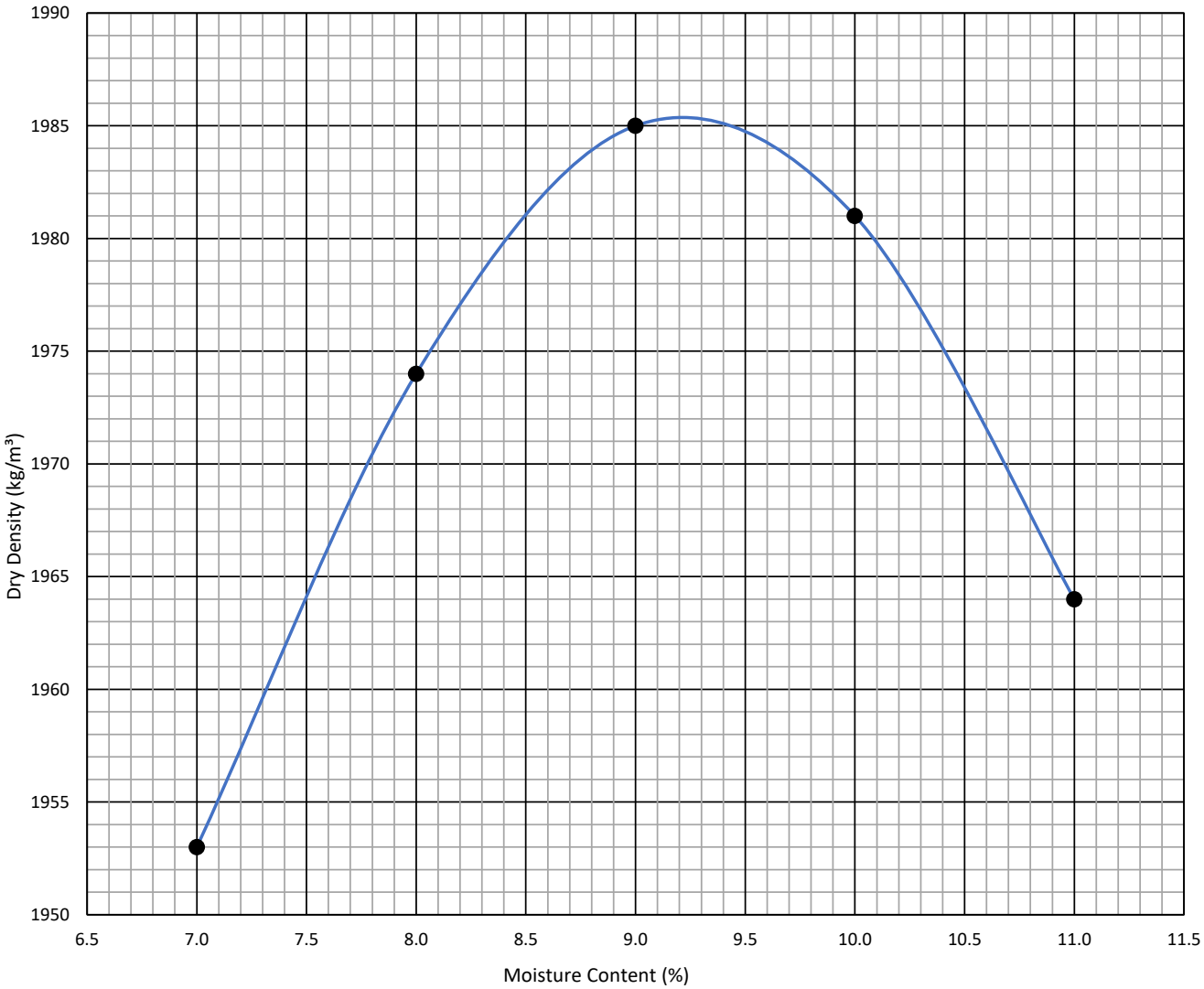
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-151
Sample:	TP 19	**Method:**	SANS 3001 GR30
Depth: (m)	0 - 1.6	**Date:**	10-Feb-21

MDD & OMC DETERMINATION (Mod. AASHTO)

Sheet Reference: R-STL-013 Rev01

Maximum Dry Density: **1988** kg/m³ Optimum Moisture Content: **9.2** %

Moisture Content (%)	7.0	8.0	9.0	10.0	11.0			
Dry Density (kg/m³)	1953	1974	1985	1981	1964			



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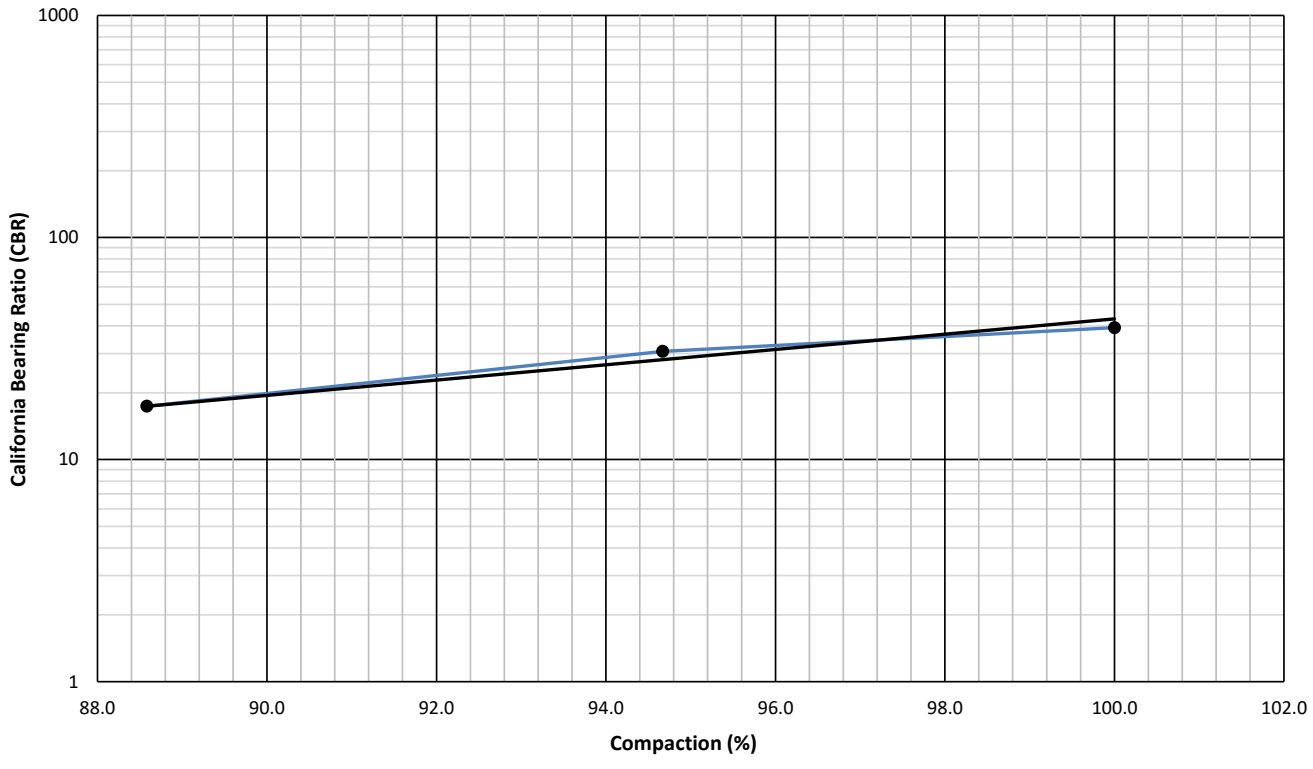
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-151
Sample:	TP 19	**Method:**	SANS 3001 GR40
Depth: (m)	0 - 1.6	**Date:**	10-Feb-21

CALIFORNIA BEARING RATIO

Sheet Reference: R-STL-014 Rev01

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.						
(kg/m³)	(%)	(kg/m³)	(%)	(%)	(%)	2.5	5.0	7.5	Compaction (%)	CBR
1988	9.2	1988	9.3	100.0	0.1	39	52	57	100	**39**
									98	**36**
1988	9.2	1882	9.3	94.7	0.1	31	35	34	97	**34**
									95	**31**
1988	9.2	1761	9.3	88.6	0.1	17	16	14	93	**26**
									90	**20**



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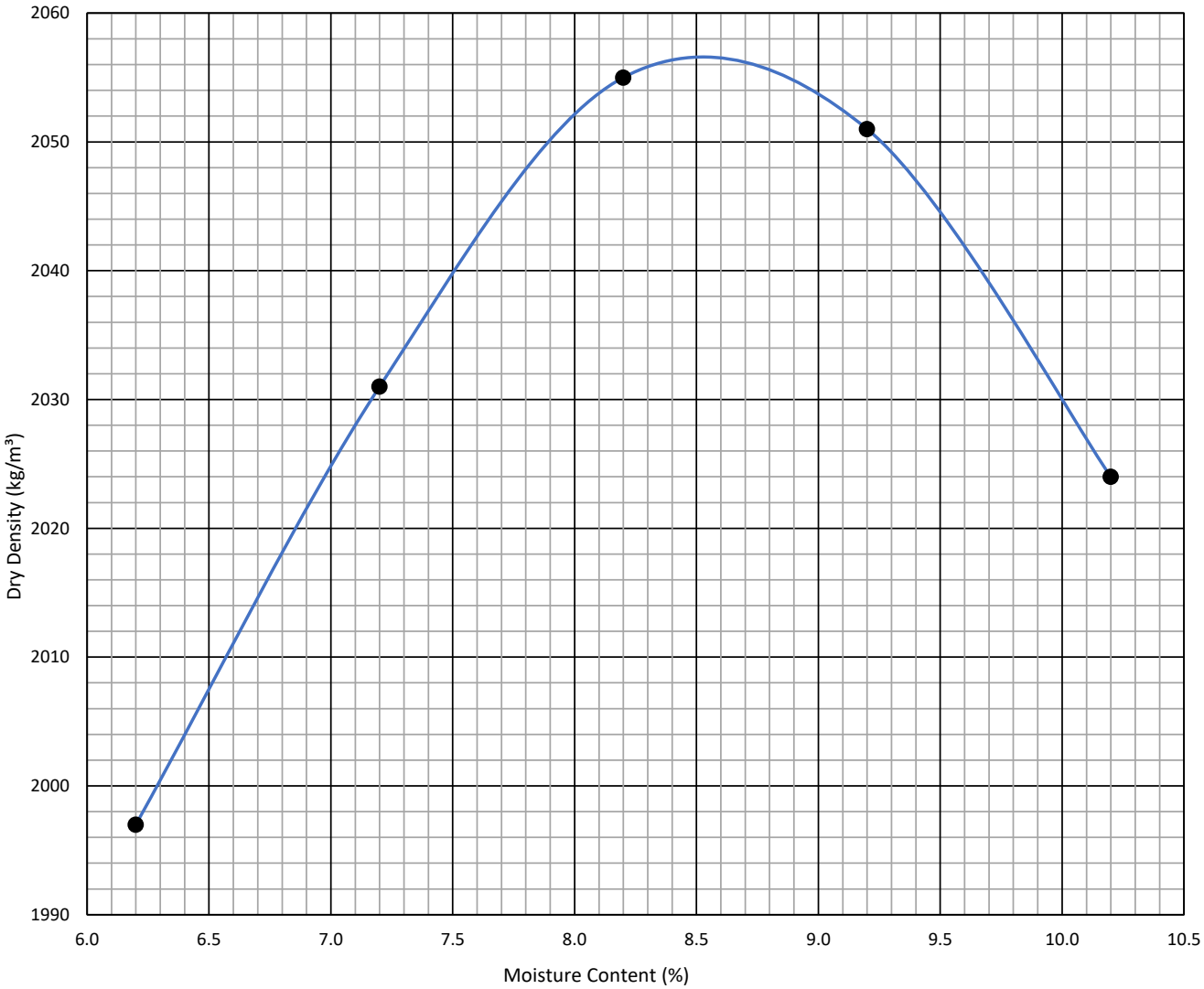
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-152
Sample:	TP 67	**Method:**	SANS 3001 GR30
Depth: (m)	0 - 0.1	**Date:**	10-Feb-21

MDD & OMC DETERMINATION (Mod. AASHTO)

Sheet Reference: R-STL-013 Rev01

Maximum Dry Density: **2059** kg/m³ Optimum Moisture Content: **8.5** %

Moisture Content (%)	6.2	7.2	8.2	9.2	10.2			
Dry Density (kg/m³)	1997	2031	2055	2051	2024			



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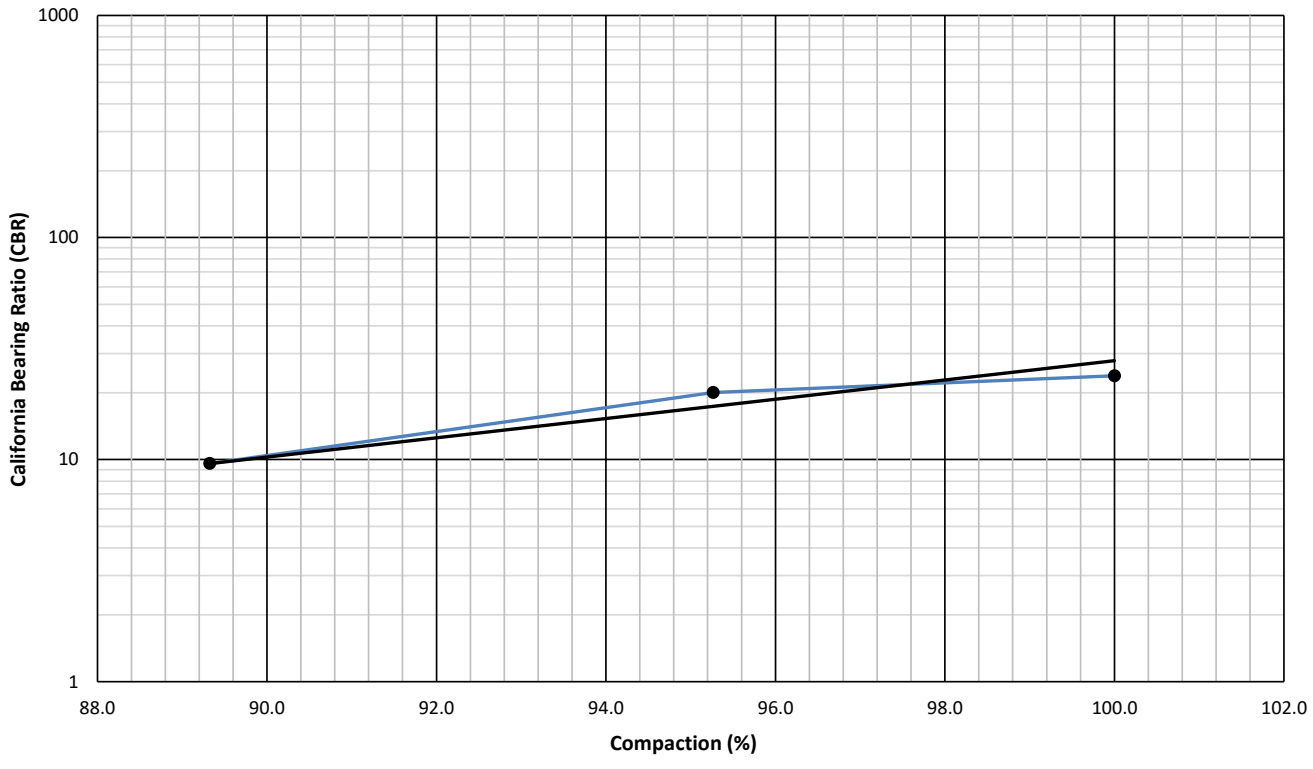
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-152
Sample:	TP 67	**Method:**	SANS 3001 GR40
Depth: (m)	0 - 0.1	**Date:**	10-Feb-21

CALIFORNIA BEARING RATIO

Sheet Reference: R-STL-014 Rev01

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.						
(kg/m³)	(%)	(kg/m³)	(%)	(%)	(%)	2.5	5.0	7.5	Compaction (%)	CBR
2059	8.5	2070	8.6	100.0	0.1	24	28	31	100	**24**
									98	**22**
2059	8.5	1972	8.6	95.3	0.2	20	22	23	97	**21**
									95	**19**
2059	8.5	1849	8.6	89.3	0.3	10	9	8	93	**15**
									90	**10**



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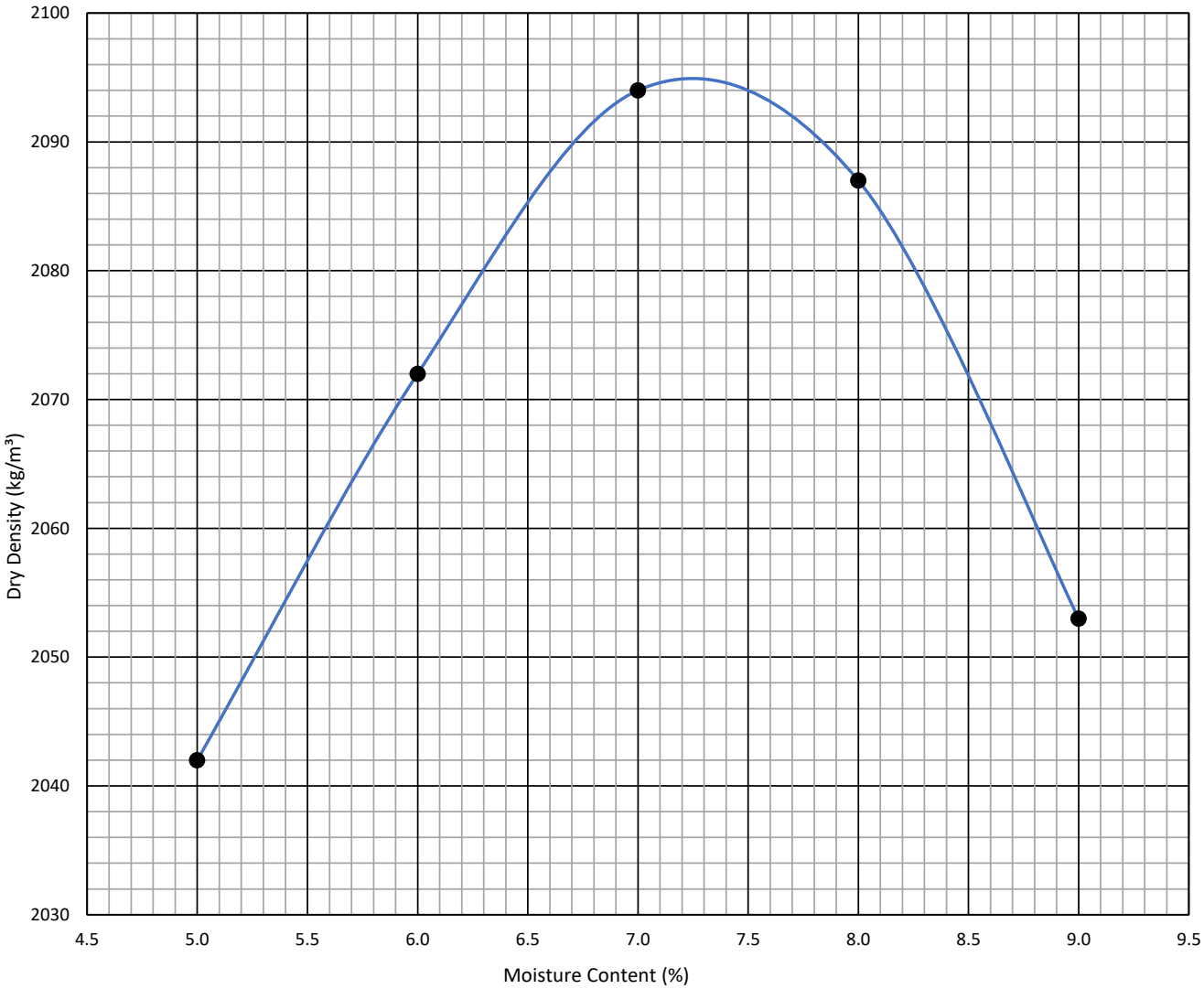
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-153
Sample:	TP 53	**Method:**	SANS 3001 GR30
Depth: (m)	0.7 - 1.4	**Date:**	10-Feb-21

MDD & OMC DETERMINATION (Mod. AASHTO)

Sheet Reference: R-STL-013 Rev01

Maximum Dry Density: **2099** kg/m³ Optimum Moisture Content: **7.3** %

Moisture Content (%)	5.0	6.0	7.0	8.0	9.0			
Dry Density (kg/m³)	2042	2072	2094	2087	2053			



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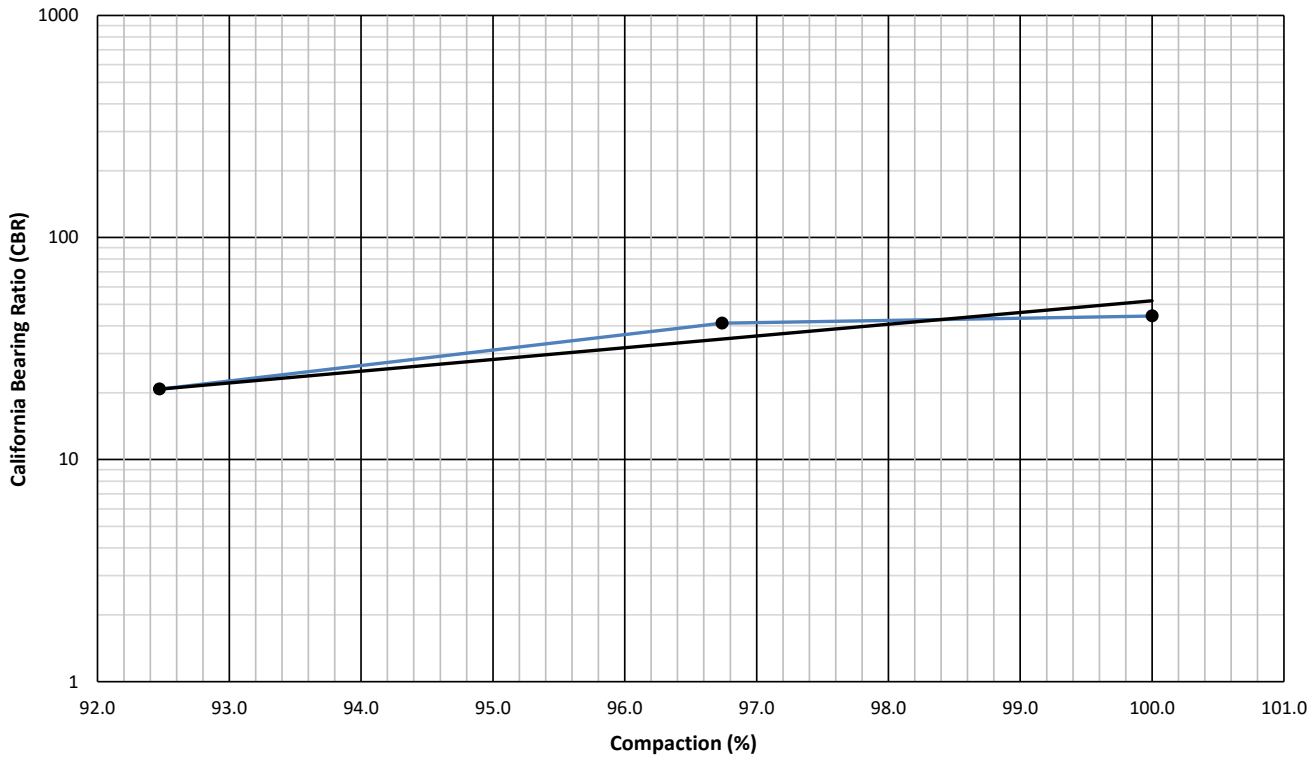
Client Name:	Crossman Pape & Associates	**Job Number:**	CPA-38
Project Name:	2091: Halfway House Water Upgrade	**Lab Number:**	CPA-38-153
Sample:	TP 53	**Method:**	SANS 3001 GR40
Depth: (m)	0.7 - 1.4	**Date:**	10-Feb-21

CALIFORNIA BEARING RATIO

Sheet Reference: R-STL-014 Rev01

Mod. AASHTO Values		Compaction Data: CBR			Swell	CBR at (mm)			CBR Values	
MDD	OMC	Dry Dens.	MC	Comp.						
(kg/m³)	(%)	(kg/m³)	(%)	(%)	(%)	2.5	5.0	7.5	Compaction (%)	CBR
2099	7.3	2085	7.3	100.0	0.0	44	53	57	100	**44**
									98	**42**
2099	7.3	2017	7.3	96.7	0.0	41	48	49	97	**41**
									95	**31**
2099	7.3	1928	7.3	92.5	0.0	21	20	18	93	**23**
									90	**14**



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Client	:	CROSSMAN PAPE ASSOCIATES cc			
Address	:	P O BOX 3557	**Client Reference**	:	
	:	KRAMERVIEW	**Order No.**	:	Mark
	:	2060			
Attention	:		**Date Received**	:	01/02/2021
Facsimile	:	011 465 4586	**Date Tested**	:	01/02/2021 - 16/02/2021
E-mail	:	lynne@crossmanpape.co.za	**Date Reported**	:	16/02/2021
Project	:	Halfway House Water Upgrade			
Project No.	:	2021-B-86	**Report Status**	:	Final
			Page	:	1 of 16

Herewith please find the test report(s) pertaining to the above project. All tests were conducted in accordance with prescribed test method(s). Information herein consists of the following:

Test(s) conducted / Item(s) measured	Qty.	Test Method(s)	Authorized By**	Page(s)
Moisture Density Relationship	7.000	SANS 3001 GR30	B Mvubu	6-12
Atterberg Limits <0.425mm	7.000	SANS 3001 GR10	B Mvubu	2-5; 13-16
Sieve Analysis 0.075mm	7.000	SANS 3001 GR1	B Mvubu	2-5; 13-16
California Bearing Ratio (CBR)	7.000	SANS 3001 GR40	B Mvubu	13-16
Hydrometer Analysis	7.000	SANS 3001 GR3	B Mvubu	2-5

Any test results contained in this report and marked with * in the table above are "not SANAS accredited" and are not included in the schedule of accreditation for this laboratory.

Any information contained in this test report pertain only to the areas and/or samples tested. Documents may only be reproduced or published in their full context.

While every care is taken to ensure that all tests are carried out in accordance with recognised standards, neither Civilab (Proprietary) Limited nor its employess shall be liable in any way whatsoever for any error made in the execution or reporting of tests or any erroneous conclusions drawn therefrom or for any consequences thereof.

All interpretations, Interpolations, Opinions and/or Classifications contained in this report falls outside our scope of accreditation.

The following parameters, where applicable, were excluded from the classification procedure: Chemical modifications, Additional fines, Fractured Faces, Soluble Salts, pH, Conductivity, Coarse Sand Ratio, Durability (COLTO: G4-G9).

The following parameters, where applicable, were assumed: Rock types were assumed to be of an Arenaceous nature with Siliceous cementing material.

Unless otherwise requested or stated, all samples will be discarded after a period of 3 months.

This report is completely confidential between the parties (Civilab and Civilab`s client) and shall not be disclosed to anybody else, unless agreed upon in writing or made publicly available by the client or required to make available by law.

Deviations in Test Methods:

Technical Signatory:	
Signature:	

**All results are authorized electronically by approved managers and/or technical signatories.

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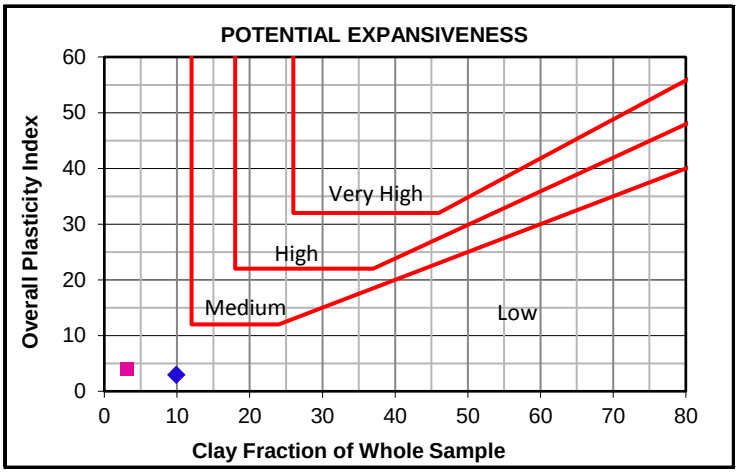
Client	:	CROSSMAN PAPE AND ASSOCIATES CC	Date Received:	01/02/2021
Project	:	Halfway House	Date Reported:	16/02/2021
Project No	:	2021-B-86	Page No. :	2 of 16

FOUNDATION INDICATOR

Laboratory Number		S23 ◆	S24 ■
Field Number		TP5	TP24
Client Reference			
Depth (m)		0.6-1.35	0.6-1.4
Position			
Coordinates	X		
	Y		
Description			
Aditional Information			
Calcrete / Crushed Stabilizing Agent			

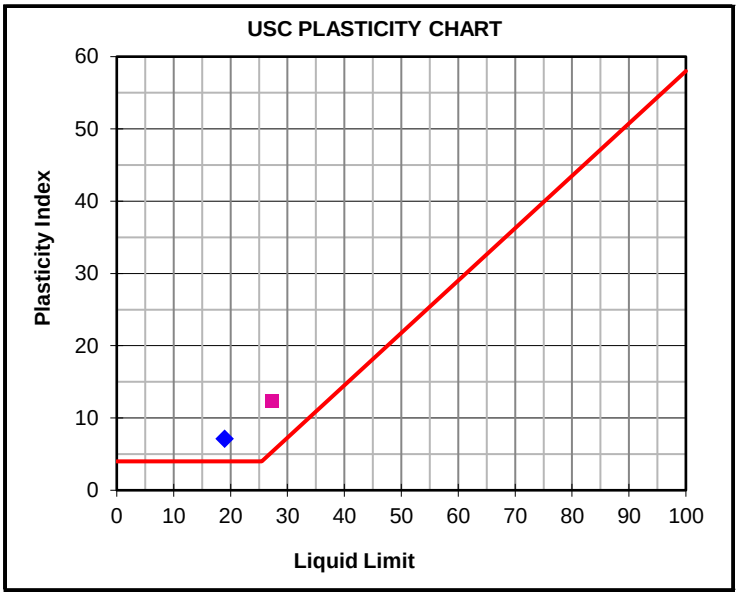


Moisture Content & Relative Density

Moisture Content (%)		
Relative Density (S.G.)		

Sieve Analysis (Wet Prep)

Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	100	100
	50 mm	100	100
	37.5 mm	100	100
	28 mm	100	100
	20 mm	100	100
	14 mm	90	92
	5 mm	67	83
	2 mm	60	71
	1 mm	51	52
	0.425 mm	36	35
	0.250 mm	28	29
	0.150 mm	21	25
	0.075 mm	16	21
Grading Modulus		1.87	1.74



Hydrometer Analysis

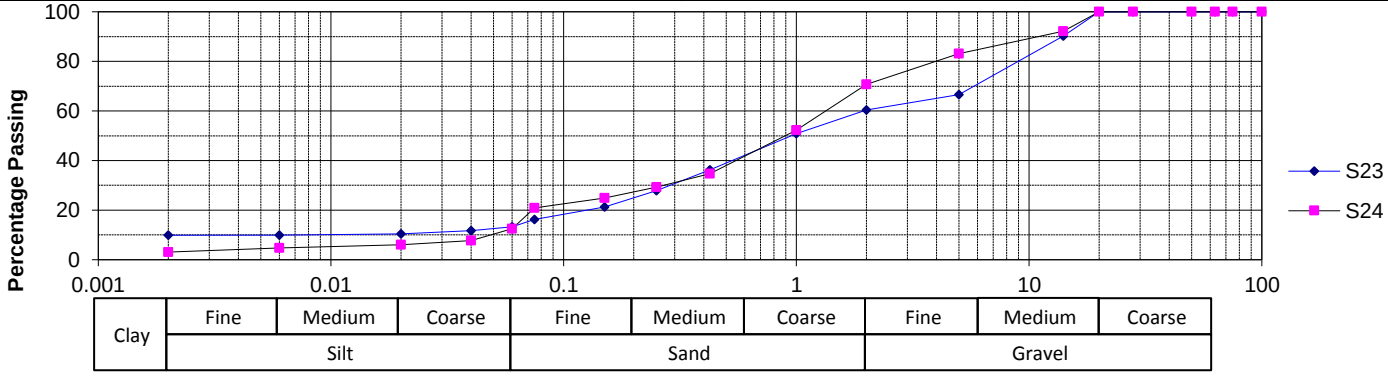
Percentage Passing	0.060 mm	13	13
	0.040 mm	12	8
	0.020 mm	10	6
	0.006 mm	10	5
	0.002 mm	10	3
Gravel	%	40	29
Sand	%	47	58
Silt	%	3	9
Clay	%	10	3

Note: An assumed S.G. may be used in Hydrometer Analysis calculations

Laboratory Number		S23 ◆	S24 ■
Atterberg Limits -425µ			
Liquid Limit	%	19	27
Plasticity Index	%	7	12
Linear Shrinkage	%	2.5	5.5
Overall PI	%	3	4

Classifications

HRB (AASHTO)	A-2-4(0)	A-2-6(0)
Unified (ASTM D2487)	SC	SC
Weston Swell @ 1 kPa		



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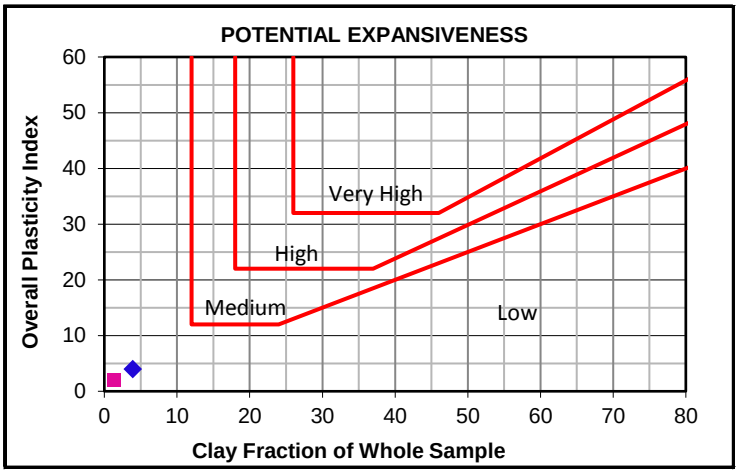
Project	:	Halfway House	Date Reported:	16/02/2021
Project No	:	2021-B-86	Page No. :	3 of 16

FOUNDATION INDICATOR

Laboratory Number		S25 ◆	S26 ■
Field Number		TP25	TP63
Client Reference			
Depth (m)		0.0-2.0	0.0-0.5
Position			
Coordinates	X		
	Y		
Description			
Aditional Information			
Calcrete / Crushed Stabilizing Agent			

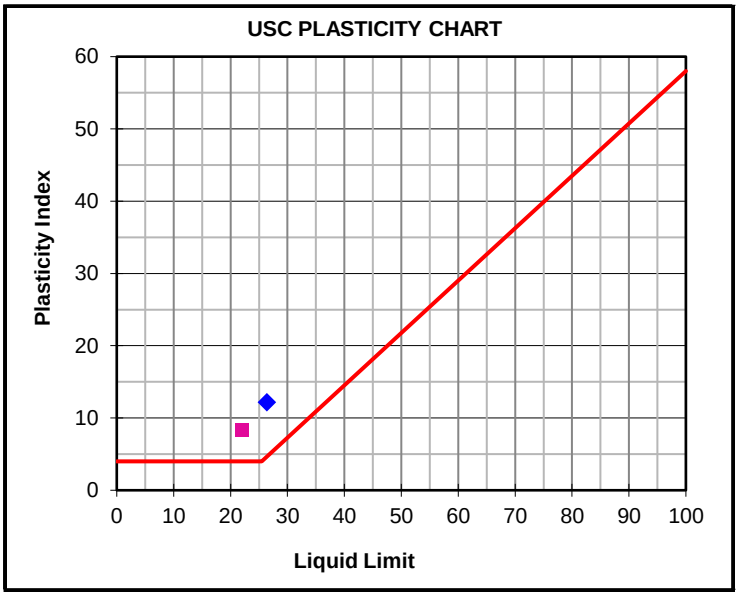


Moisture Content & Relative Density

Moisture Content (%)		
Relative Density (S.G.)		

Sieve Analysis (Wet Prep)

Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	100	100
	50 mm	100	87
	37.5 mm	100	65
	28 mm	100	60
	20 mm	100	57
	14 mm	93	50
	5 mm	83	42
	2 mm	70	36
	1 mm	53	30
	0.425 mm	36	22
	0.250 mm	31	19
	0.150 mm	25	17
	0.075 mm	20	15
Grading Modulus		1.74	2.27



Hydrometer Analysis

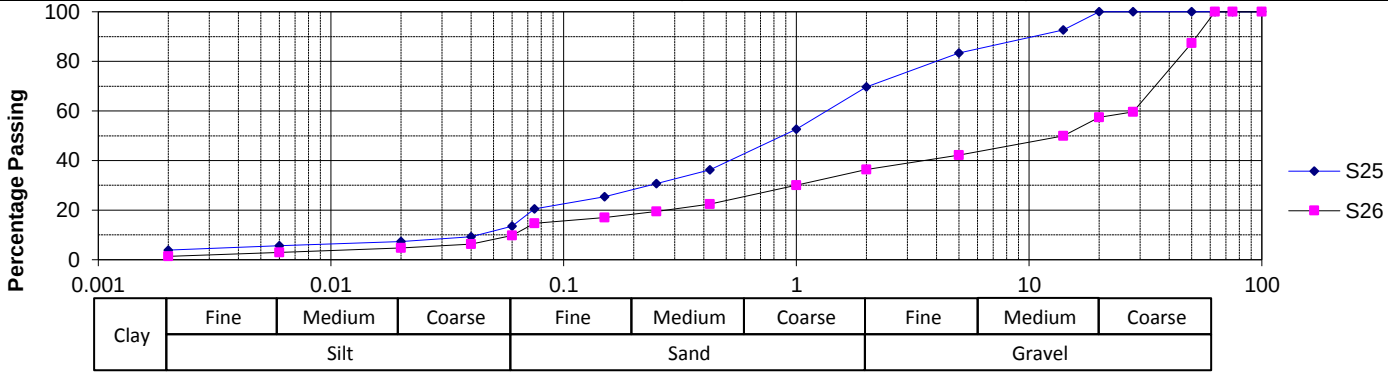
Percentage Passing	0.060 mm	14	10
	0.040 mm	9	6
	0.020 mm	7	5
	0.006 mm	6	3
	0.002 mm	4	1
Gravel	%	30	64
Sand	%	56	27
Silt	%	10	8
Clay	%	4	1

Note: An assumed S.G. may be used in Hydrometer Analysis calculations

Laboratory Number		S25 ◆	S26 ■
Atterberg Limits -425µ			
Liquid Limit	%	26	22
Plasticity Index	%	12	8
Linear Shrinkage	%	4.5	3.0
Overall PI	%	4	2

Classifications

HRB (AASHTO)	A-2-6(0)	A-2-4(0)
Unified (ASTM D2487)	SC	GC
Weston Swell @ 1 kPa		



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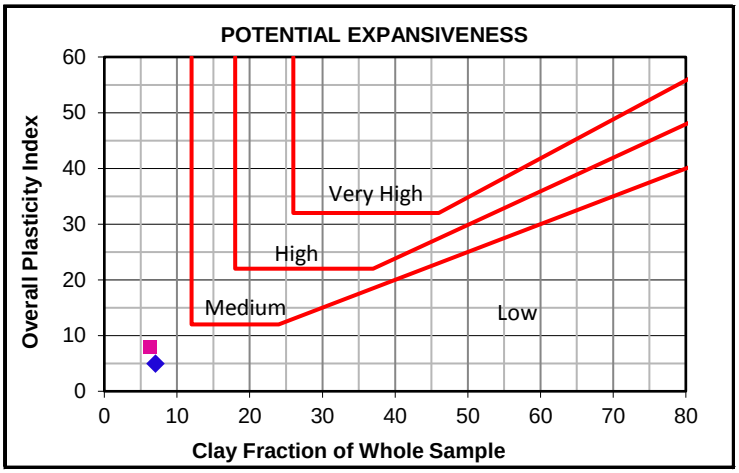
Project	:	Halfway House	Date Reported:	16/02/2021
Project No	:	2021-B-86	Page No. :	4 of 16

FOUNDATION INDICATOR

Laboratory Number		S27 ◆	S28 ■
Field Number		TP64	TP45
Client Reference			
Depth (m)		0.70-0.85	0.60-1.50
Position			
Coordinates	X		
	Y		
Description			
Aditional Information			
Calcrete / Crushed Stabilizing Agent			

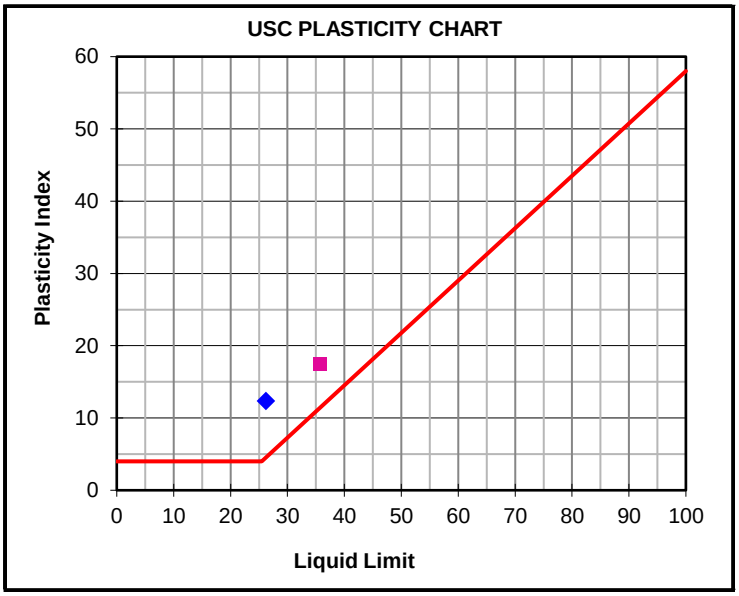


Moisture Content & Relative Density

Moisture Content (%)		
Relative Density (S.G.)		

Sieve Analysis (Wet Prep)

Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	100	100
	50 mm	100	100
	37.5 mm	100	100
	28 mm	100	100
	20 mm	100	100
	14 mm	92	99
	5 mm	75	90
	2 mm	65	85
	1 mm	56	69
	0.425 mm	43	45
	0.250 mm	36	37
	0.150 mm	31	31
	0.075 mm	25	26
Grading Modulus		1.67	1.45



Hydrometer Analysis

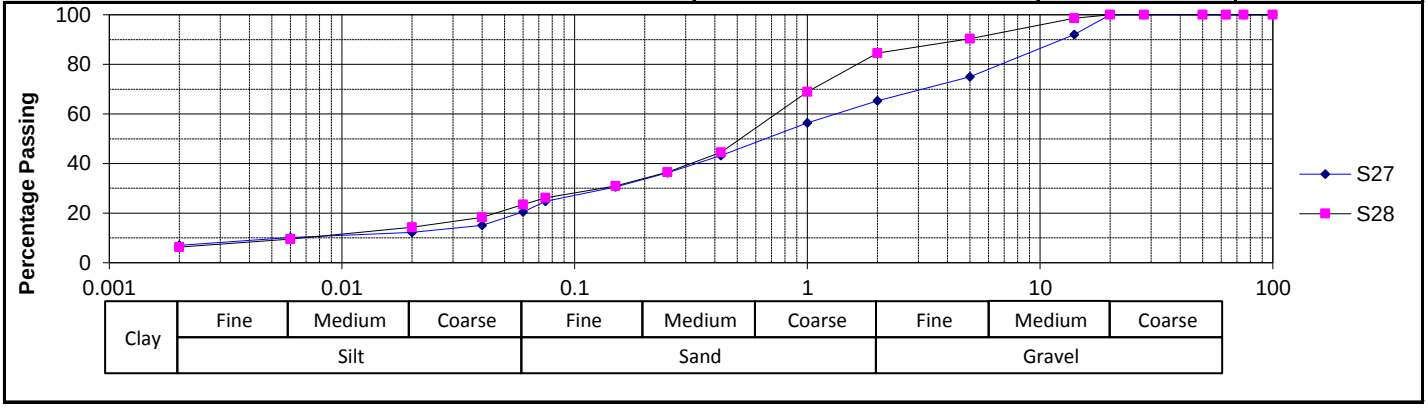
Percentage Passing	0.060 mm	20	23
	0.040 mm	15	18
	0.020 mm	12	14
	0.006 mm	10	10
	0.002 mm	7	6
Gravel	%	35	15
Sand	%	45	61
Silt	%	13	17
Clay	%	7	6

Note: An assumed S.G. may be used in Hydrometer Analysis calculations

Laboratory Number		S27 ◆	S28 ■
Atterberg Limits -425µ			
Liquid Limit	%	26	36
Plasticity Index	%	12	17
Linear Shrinkage	%	5.5	8.5
Overall PI	%	5	8

Classifications

HRB (AASHTO)	A-2-6(0)	A-2-6(1)
Unified (ASTM D2487)	SC	SC
Weston Swell @ 1 kPa		



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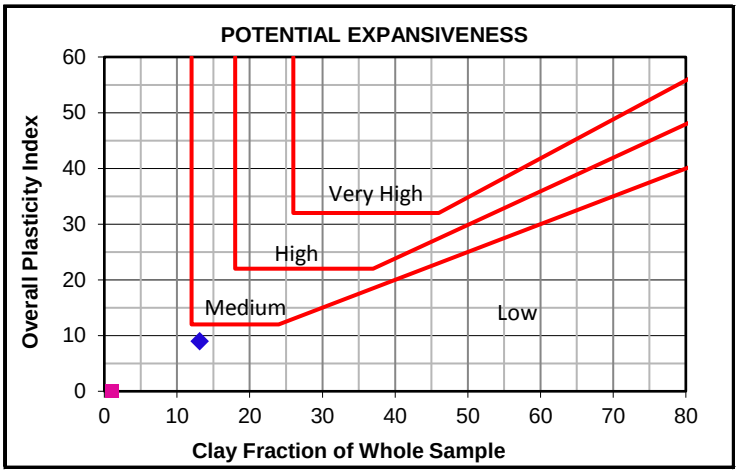
Client	:	Date Received:	01/02/2021
Project	:	Date Reported:	16/02/2021
Project No	:	Page No. :	5 of 16

FOUNDATION INDICATOR

Laboratory Number		S29 ◆	■
Field Number		TP28	
Client Reference			
Depth (m)		0.3-1.9	
Position			
Coordinates	X		
	Y		
Description			
Aditional Information			
Calcrete / Crushed Stabilizing Agent			

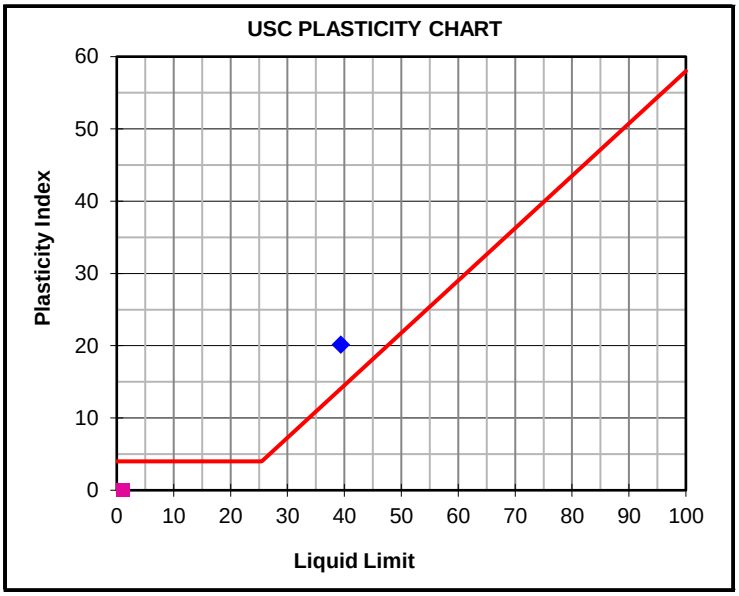


Moisture Content & Relative Density

Moisture Content (%)		
Relative Density (S.G.)		

Sieve Analysis (Wet Prep)

Percentage Passing	100 mm	100	
	75 mm	100	
	63 mm	100	
	50 mm	100	
	37.5 mm	100	
	28 mm	100	
	20 mm	100	
	14 mm	98	
	5 mm	91	
	2 mm	74	
	1 mm	61	
	0.425 mm	45	
	0.250 mm	40	
	0.150 mm	35	
	0.075 mm	30	
Grading Modulus		1.51	



Hydrometer Analysis

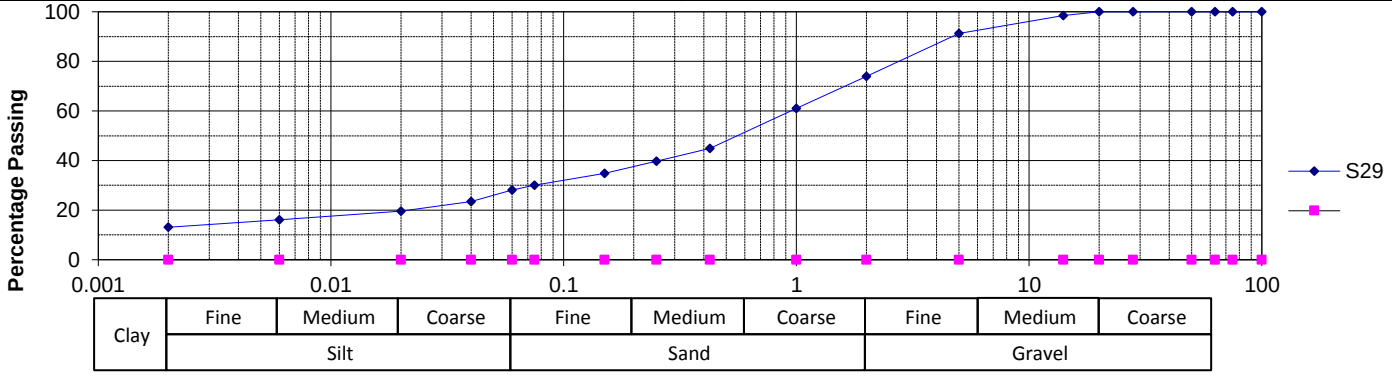
Percentage Passing	0.060 mm	28	
	0.040 mm	23	
	0.020 mm	20	
	0.006 mm	16	
	0.002 mm	13	
Gravel	%	26	
Sand	%	46	
Silt	%	15	
Clay	%	13	

Note: An assumed S.G. may be used in Hydrometer Analysis calculations

Laboratory Number		S29 ◆	■
Atterberg Limits -425µ			
Liquid Limit	%	39	
Plasticity Index	%	20	
Linear Shrinkage	%	9.5	
Overall PI	%	9	

Classifications

HRB (AASHTO)	A-2-6(2)	
Unified (ASTM D2487)	SC	
Weston Swell @ 1 kPa		



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Client	:	CROSSMAN PAPE ASSOCIATES cc	Date Received: 01/02/2021
Project	:	Halfway House Water Upgrade	Date Reported: 16/02/2021
Project No:		2021-B-86	Page No. : 6 of 16

MOISTURE DENSITY RELATIONSHIP

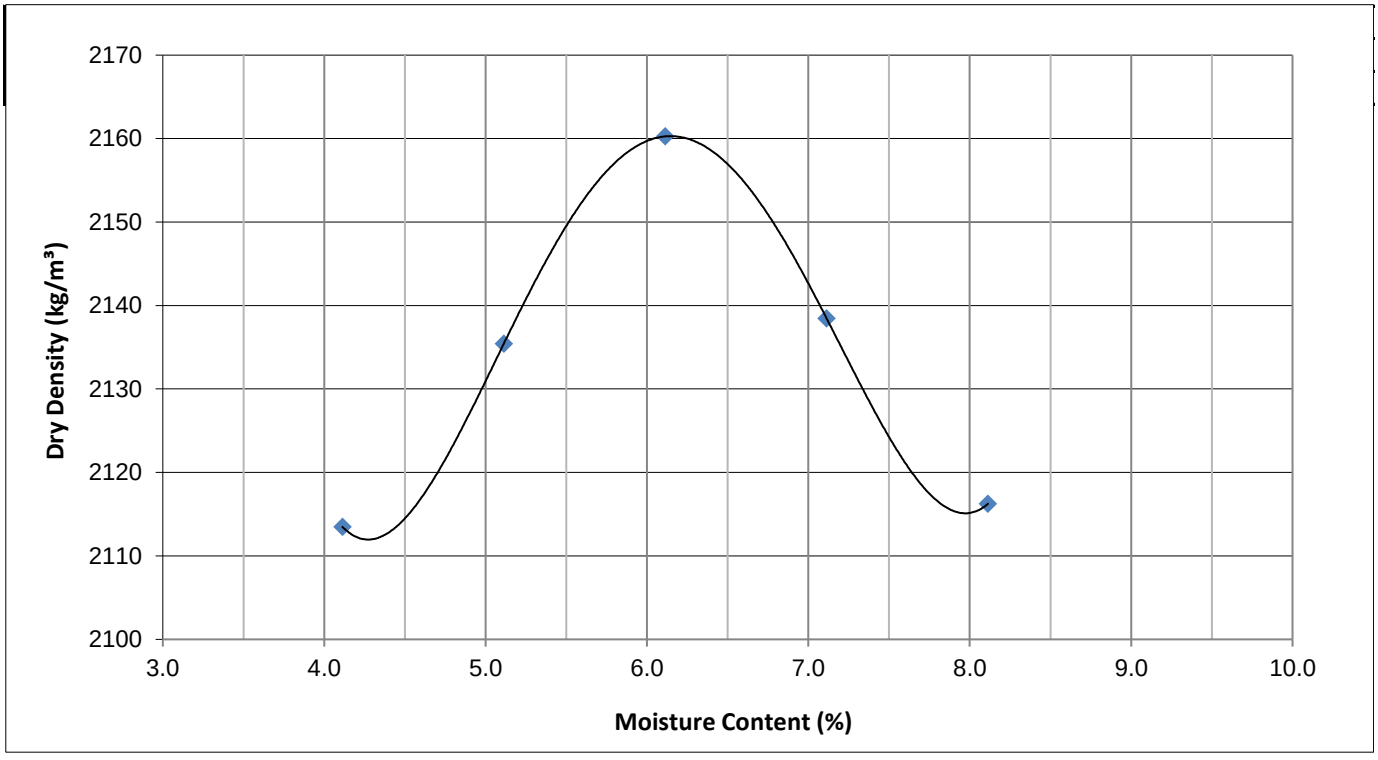
Laboratory Number		S-23
Field Number		TP5
Client Reference		
Depth (m)		0.6-1.35
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
% of Sample Scalped		1.2% scalped on 37.5mm
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO

Dry Density	kg/m³	2138	2160	2135	2113	2116	
Moisture Content	%	7.1	6.1	5.1	4.1	8.1	

Max. Dry Density	kg/m³	2160
Optimum Moisture	%	6.2



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Project	:	Halfway House Water Upgrade	Date Reported: 16/02/2021
Project No:		2021-B-86	Page No. : 7 of 16

MOISTURE DENSITY RELATIONSHIP

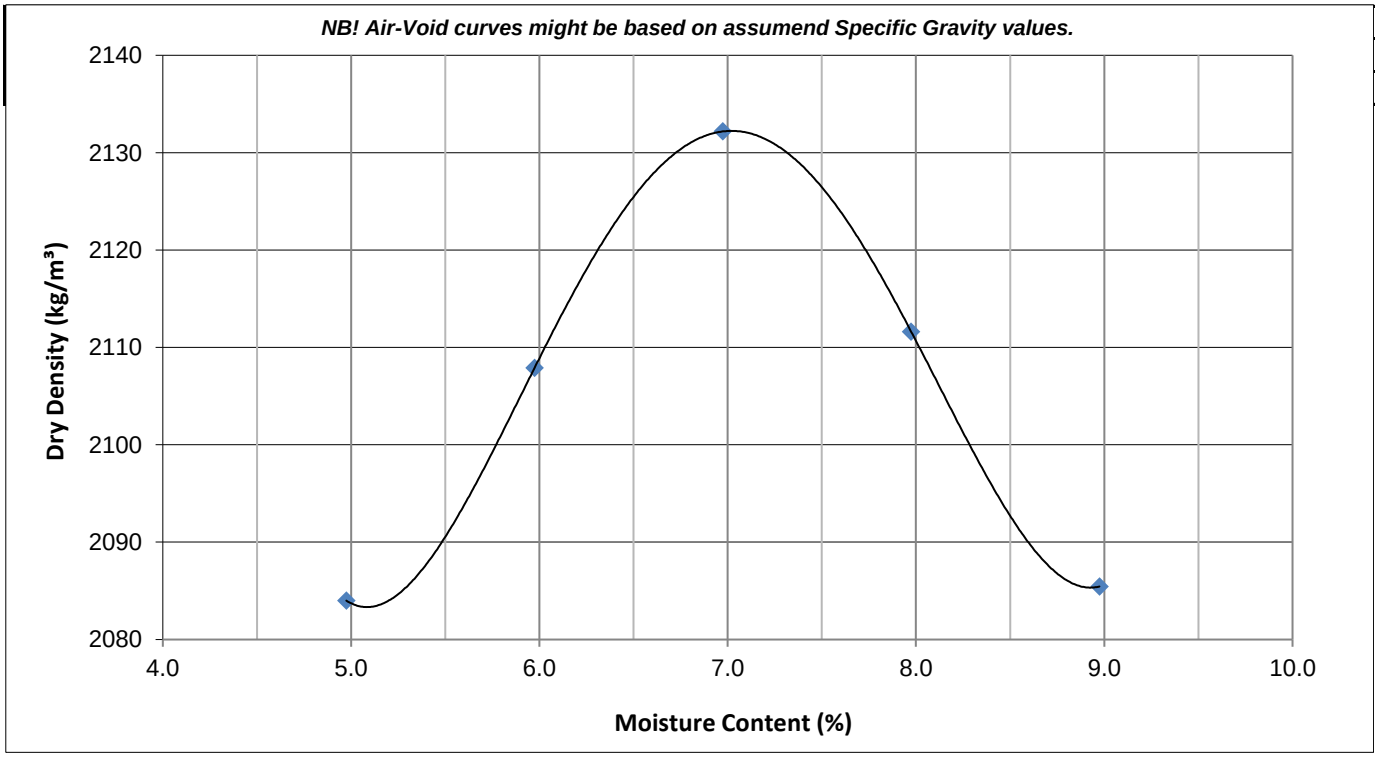
Laboratory Number		S-24
Field Number		TP24
Client Reference		
Depth (m)		0.6-1.4
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
% of Sample Scalped		2.5% scalped on 37.5mm
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO

Dry Density	kg/m³	2132	2112	2108	2085	2084	
Moisture Content	%	7.0	8.0	6.0	9.0	5.0	

Max. Dry Density	kg/m³	2132
Optimum Moisture	%	7.1



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Project	: Halfway House Water Upgrade	Date Reported:	16/02/2021
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MOISTURE DENSITY RELATIONSHIP

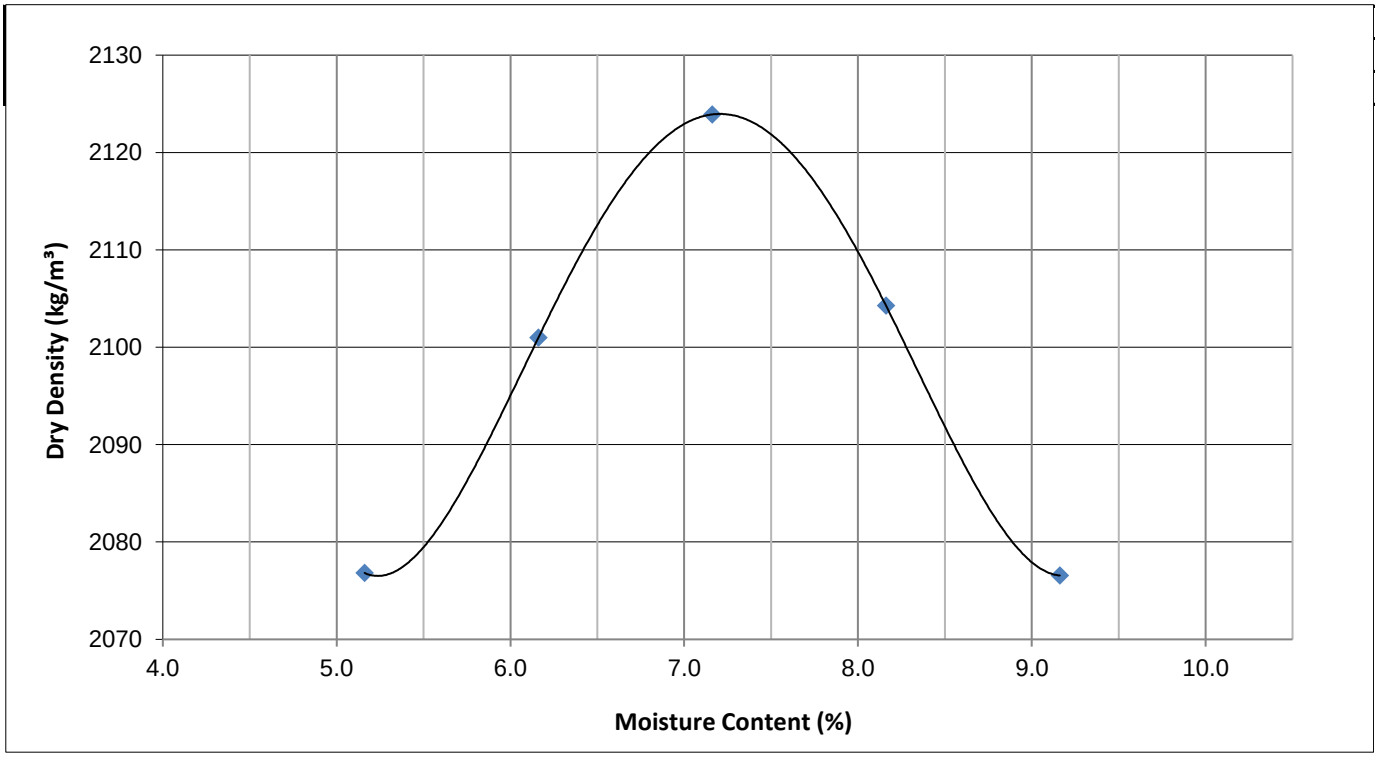
Laboratory Number		S-25
Field Number		TP25
Client Reference		
Depth (m)		0.0-2.0
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
% of Sample Scalped		1.2% scalped on 37.5mm
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO

Dry Density	kg/m³	2101	2124	2104	2077	2077	
Moisture Content	%	6.2	7.2	8.2	9.2	5.2	

Max. Dry Density	kg/m³	2124
Optimum Moisture	%	7.2



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Project	:	Halfway House Water Upgrade	Date Reported: 16/02/2021
Project No:		2021-B-86	Page No. : 9 of 16

MOISTURE DENSITY RELATIONSHIP

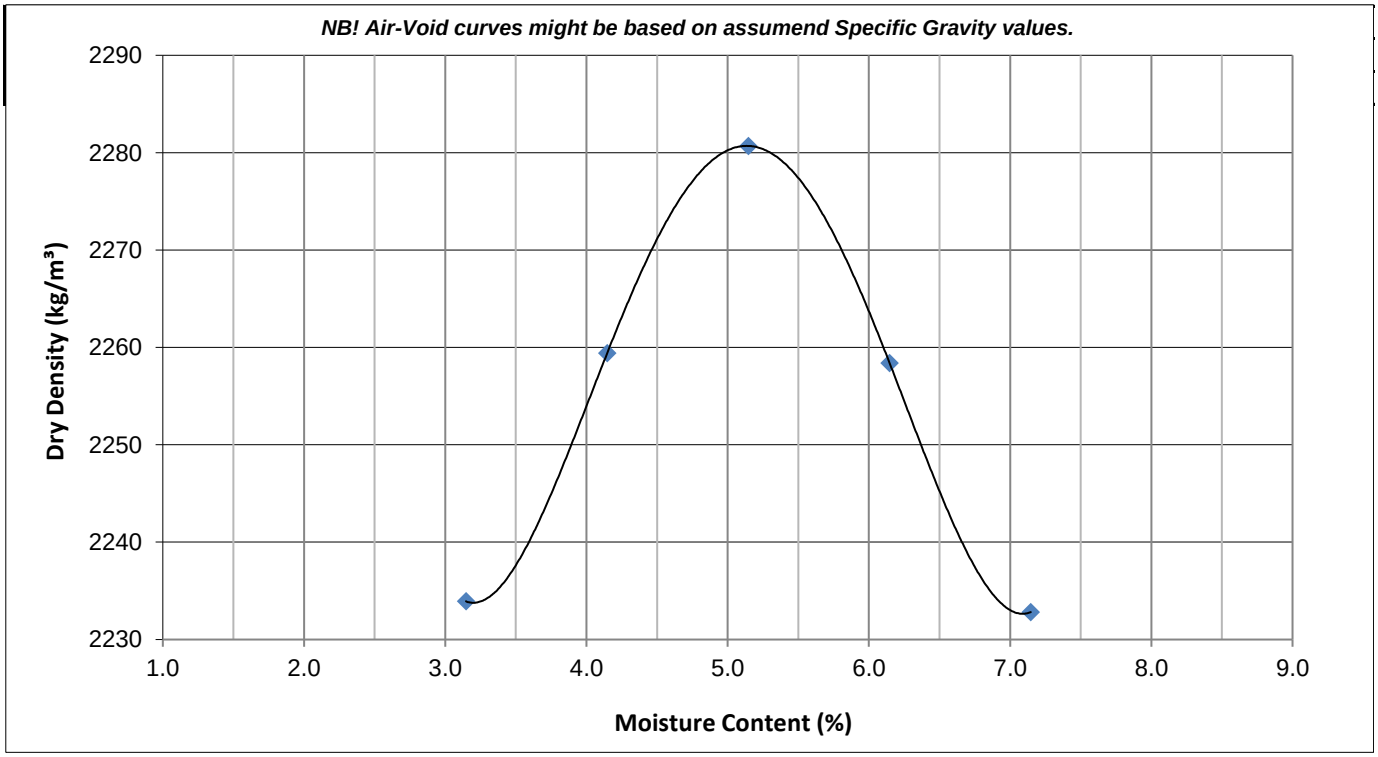
Laboratory Number		S-26
Field Number		TP63
Client Reference		
Depth (m)		0.0-0.5
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
% of Sample Scalped		15.7% scalped on 37.5mm
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO

Dry Density	kg/m³	2258	2233	2281	2259	2234	
Moisture Content	%	6.1	7.1	5.1	4.1	3.1	

Max. Dry Density	kg/m³	2281
Optimum Moisture	%	5.2



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Project	:	Halfway House Water Upgrade	Date Reported: 16/02/2021
Project No:		2021-B-86	Page No. : 10 of 16

MOISTURE DENSITY RELATIONSHIP

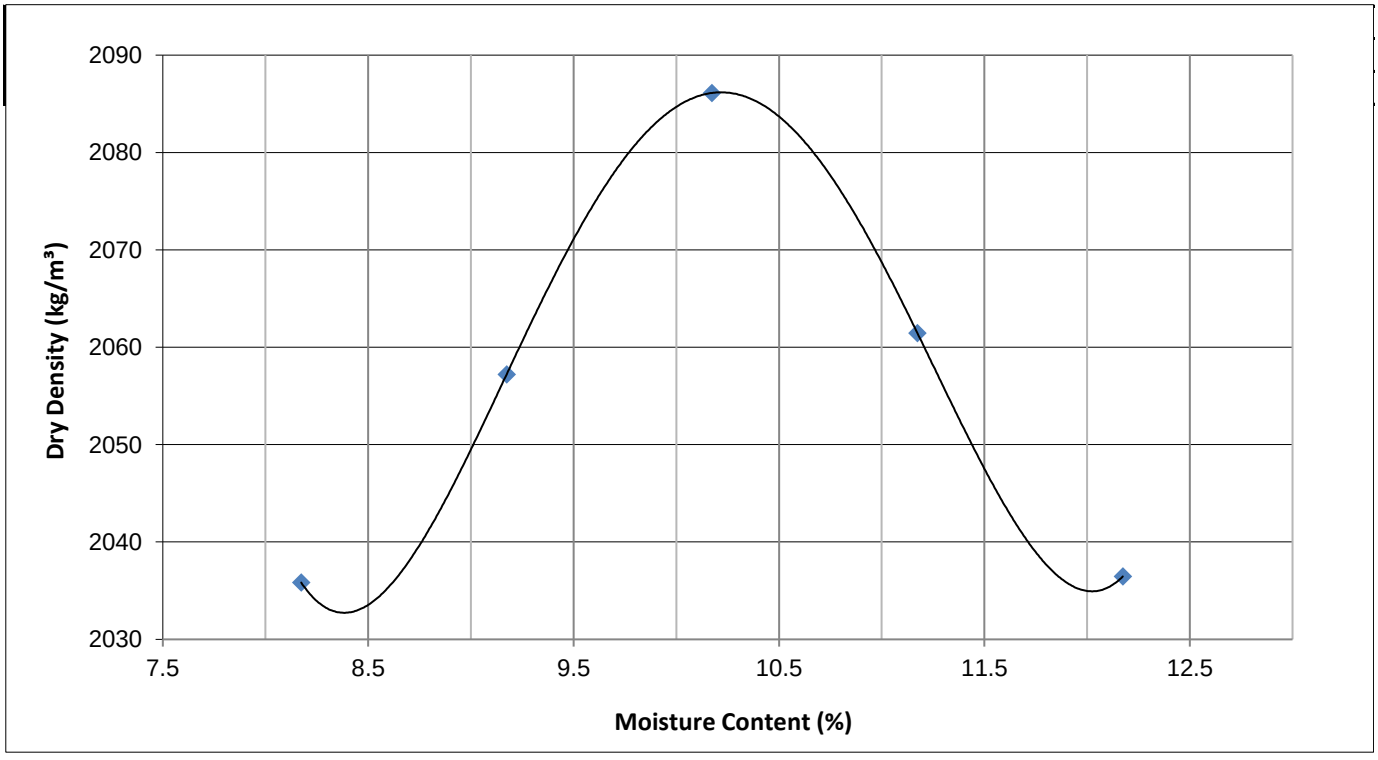
Laboratory Number		S-27
Field Number		TP64
Client Reference		
Depth (m)		0.7-0.85
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
% of Sample Scalped		0% scalped on 37.5mm
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO

Dry Density	kg/m³	2036	2057	2086	2061	2036	
Moisture Content	%	8.2	9.2	10.2	11.2	12.2	

Max. Dry Density	kg/m³	2086
Optimum Moisture	%	10.3



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sanas Testing Laboratory T0062

Civilab
Civil Engineering Testing Laboratories

Client	: CROSSMAN PAPE ASSOCIATES cc	Date Received:	01/02/2021
Project	: Halfway House Water Upgrade	Date Reported:	16/02/2021
Project No:	2021-B-86	Page No. :	11 of 16

MOISTURE DENSITY RELATIONSHIP

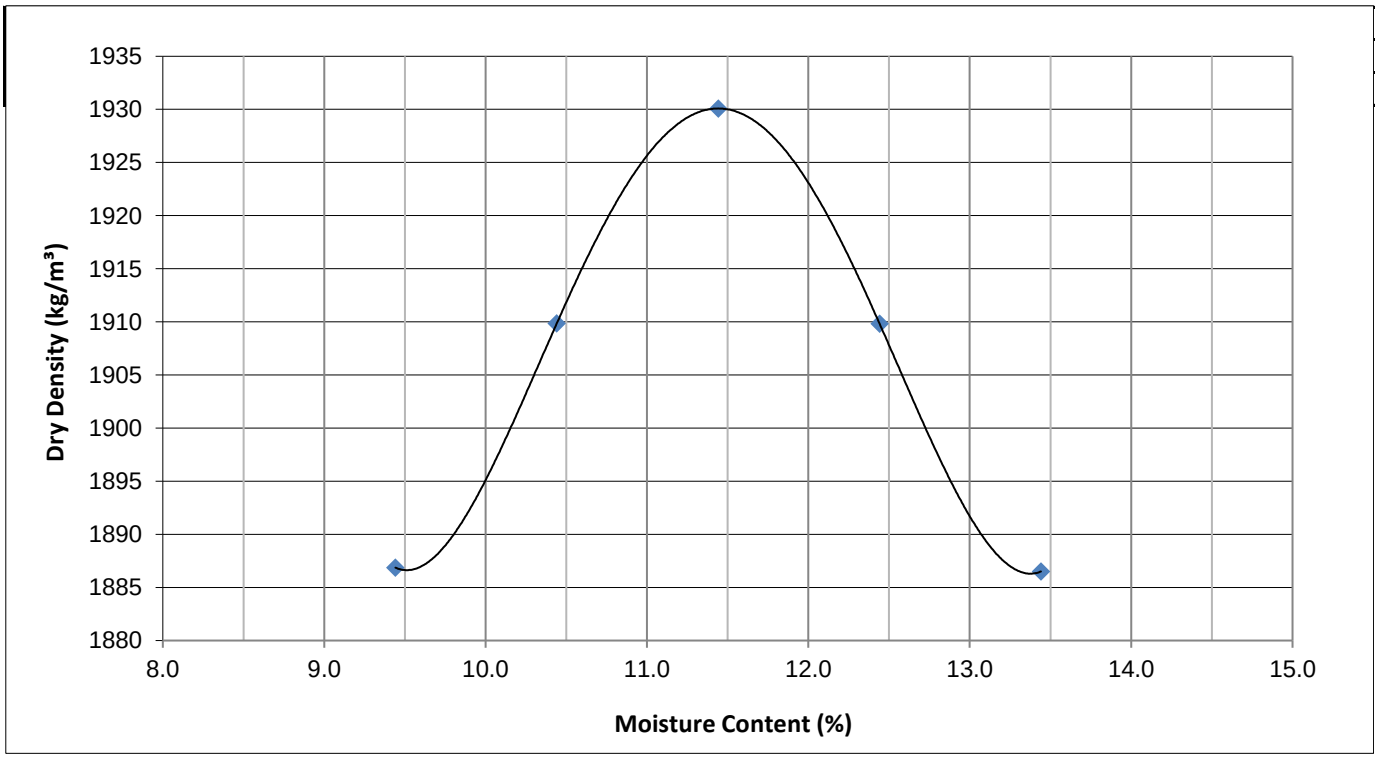
Laboratory Number		S-28
Field Number		TP45
Client Reference		
Depth (m)		0.6-1.5
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
% of Sample Scalped		0% scalped on 37.5mm
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO

Dry Density	kg/m³	1910	1930	1910	1887	1886	
Moisture Content	%	12.4	11.4	10.4	9.4	13.4	

Max. Dry Density	kg/m³	1930
Optimum Moisture	%	11.4



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Client	:	CROSSMAN PAPE ASSOCIATES cc	Date Received: 01/02/2021
Project	:	Halfway House Water Upgrade	Date Reported: 16/02/2021
Project No:		2021-B-86	Page No. : 12 of 16

MOISTURE DENSITY RELATIONSHIP

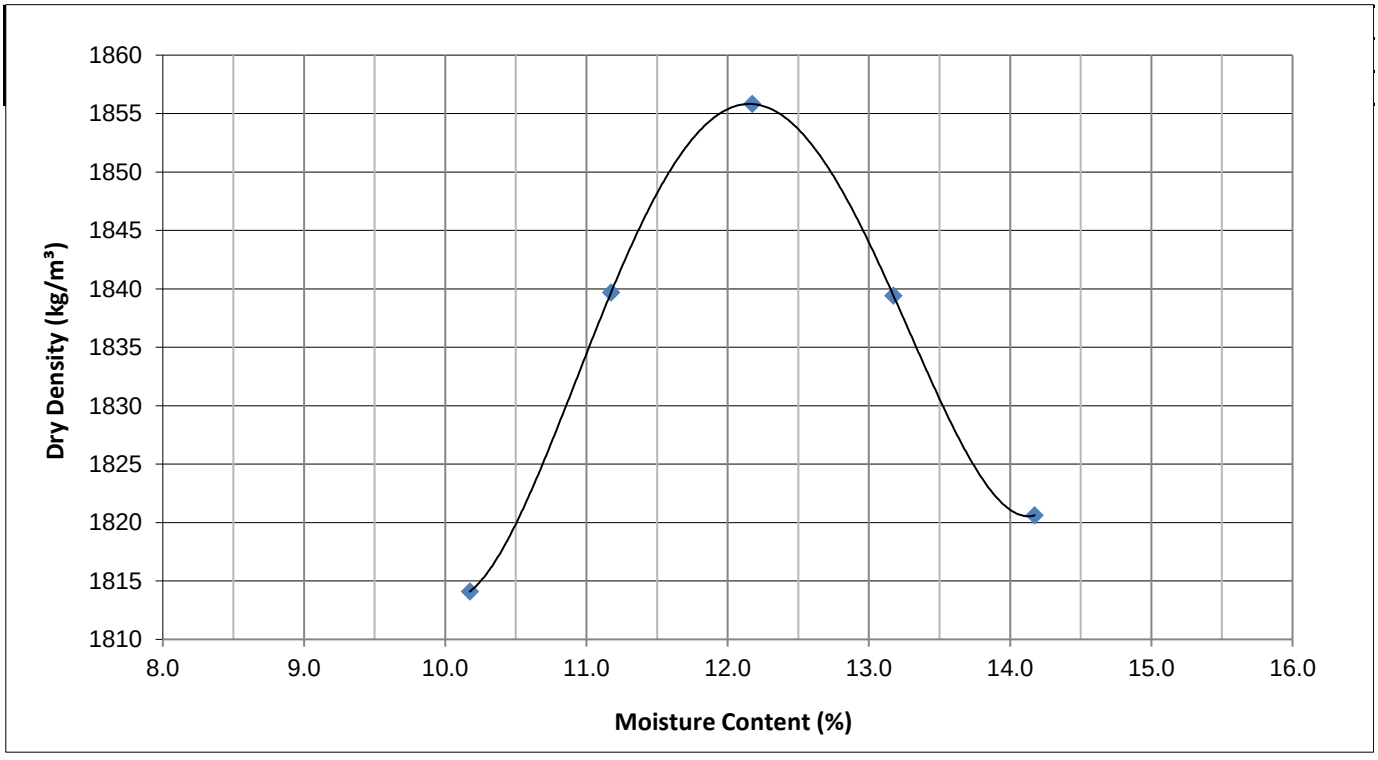
Laboratory Number		S-29
Field Number		TP28
Client Reference		
Depth (m)		0.3-1.9
Position		
Coordinates	X	
	Y	
Description		
Additional Information		
% of Sample Scalped		0% scalped on 37.5mm
Stabilizing Agent		

Maximum Dry Density & Optimum Moisture Content - SANS 3001 GR30

Compactive Effort:	Modified AASHTO

Dry Density	kg/m³	1821	1839	1856	1840	1814	
Moisture Content	%	14.2	13.2	12.2	11.2	10.2	

Max. Dry Density	kg/m³	1856
Optimum Moisture	%	12.2



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Civil Engineering Testing Laboratories

Client	:	CROSSMAN PAPE ASSOCIATES cc	Date Received	:	01/02/2021
Project	:	Halfway House Water Upgrade	Date Reported	:	16/02/2021
Project No.	:	2021-B-86	Page No.	:	13 of 16

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.		S-23 ◆	S-24 ■
Field Number		TP5	TP24
Client Reference			
Depth (m)		0.6-1.35	0.6-1.4
Position			
Coordinates	X		
	Y		
Description			
Additional information			
Calcrete/Crushed			
Stabilizing Agent			

Sieve Analysis (Wet preparation)

Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	100	100
	53 mm	100	100
	37.5 mm	100	100
	28 mm	100	100
	20 mm	100	100
	14 mm	90	92
	5 mm	67	83
	2 mm	60	71
	1 mm	51	52
	0.425 mm	36	35
	0.250 mm	28	29
	0.150 mm	21	25
	0.075 mm	16	21
Grading Modulus		1.87	1.74

Soil Mortar Analysis

Coarse Sand	39	
Coarse Fine Sand	11	
Medium Fine Sand	8	
Fine Fine Sand	7	
Silt and Clay	36	

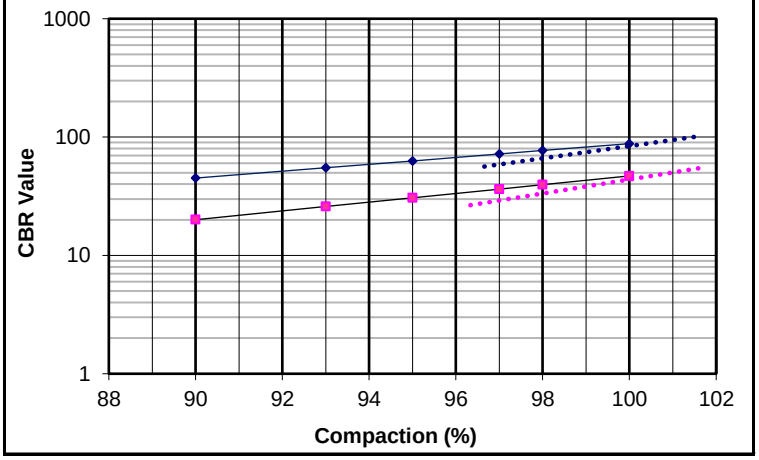
Atterberg Limits

Liquid Limit (%)	19	27
Plasticity Index (%)	7	12
Linear Shrinkage (%)	25.0	5.5

Laboratory No.		S-23 ◆	S-24 ■
Maximum Dry Density & Optimum Moisture Content			
MDD	kg/m^3	2160	2132
OMC	%	6.2	7.1

California Bearing Ratio

Compaction Data							
Moisture	%	6.16436621			7.020429822		
Dry Density	kg/m^3	2192	2085	1976	2166	2054	1948
Compaction	%	101.5	96.5	91.5	101.6	96.3	91.4
Penetration Data							
CBR at	2.54 mm	100	55	45	54	26	20
	5.08 mm	151	109	59	84	33	19
	7.62 mm	175	122	63	98	33	18
Swell	%	0.1	0.1	0.1	0.2	0.3	0.3
Final Moisture (%)		8.3	12.26	16.65	8.928	12.08	14.35

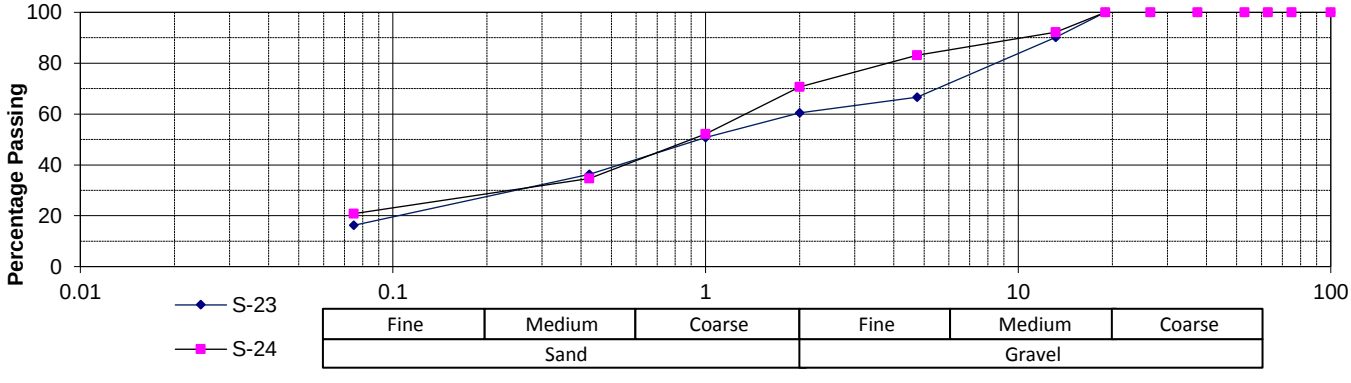


Interpolated CBR Data

CBR	@ 100%	Mod. AASHTO	88	47
	@ 98%		77	40
	@ 97%		72	36
	@ 95%		63	31
	@ 93%		55	26
	@ 90%		45	20
	@ SANS3001 Midpoint		74	38

Classifications

HRB (AASHTO)	A-2-4(0)	A-2-6(0)
COLTO	G7	G7
TRH14	G6	G6



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Client	:	CROSSMAN PAPE ASSOCIATES cc	Date Received	:	01/02/2021
Project	:	Halfway House Water Upgrade	Date Reported	:	16/02/2021
Project No.	:	2021-B-86	Page No.	:	14 of 16

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.		S-25 ◆	S26 ■
Field Number		TP25	TP63
Client Reference			
Depth (m)		0.0-2.0	0.0-0.5
Position			
Coordinates	X		
	Y		
Description			
Additional information			
Calcrete/Crushed			
Stabilizing Agent			

Sieve Analysis (Wet preparation)

Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	100	100
	53 mm	100	87
	37.5 mm	100	65
	28 mm	100	60
	20 mm	100	57
	14 mm	93	50
	5 mm	83	42
	2 mm	70	36
	1 mm	53	30
	0.425 mm	36	22
	0.250 mm	31	19
	0.150 mm	25	17
	0.075 mm	20	15
Grading Modulus		1.74	2.27

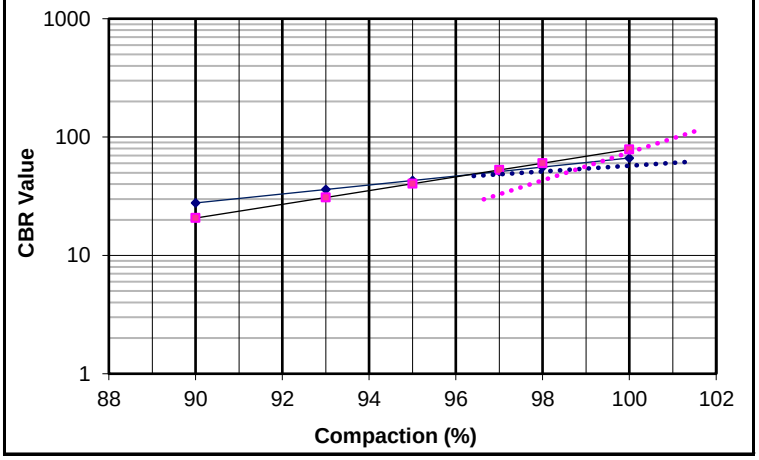
Soil Mortar Analysis

Coarse Sand	40	51
Coarse Fine Sand	14	8
Medium Fine Sand	11	6
Fine Fine Sand	8	6
Silt and Clay	27	30

Atterberg Limits

Liquid Limit (%)	26	22
Plasticity Index (%)	12	8
Linear Shrinkage (%)	4.5	3.0

Laboratory No.		S-25 ◆			S-26 ■		
Maximum Dry Density & Optimum Moisture Content							
MDD	kg/m³	2124			2281		
OMC	%	7.2			5.2		
California Bearing Ratio							
Compaction Data							
Moisture	%	7.208612314			5.119835867		
Dry Density	kg/m³	2151	2045	1937	2315	2200	2087
Compaction	%	101.3	96.3	91.2	101.5	96.5	91.5
Penetration Data							
CBR at	2.54 mm	61	47	28	111	28	21
	5.08 mm	63	52	31	139	35	27
	7.62 mm	60	52	31	141	35	34
Swell	%	0.1	0.0	0.1	0.0	0.1	0.1
Final Moisture (%)		8.8	11.21	15.81	6.702	9.169	13.76

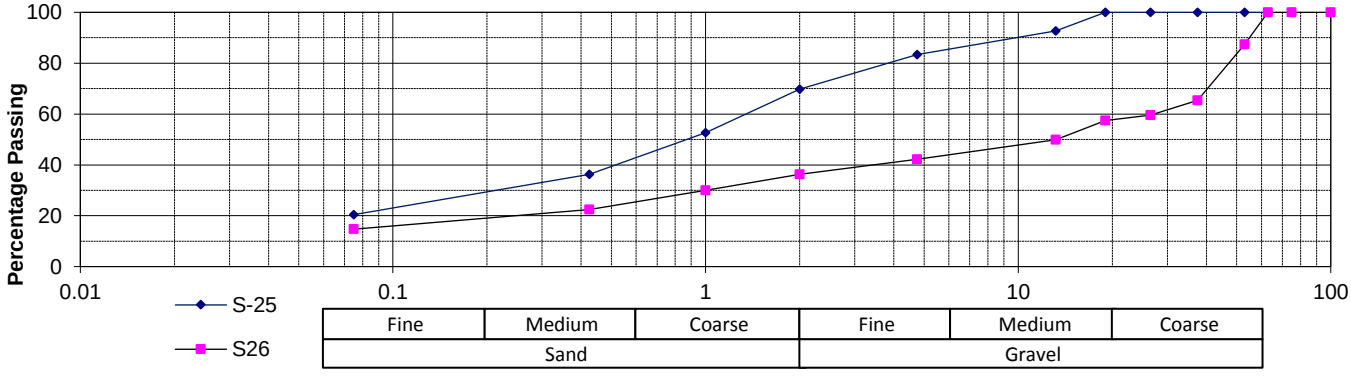


Interpolated CBR Data

CBR	@ 100%	Mod. AASHTO	67	79
	@ 98%		56	60
	@ 97%		51	53
	@ 95%		43	40
	@ 93%		36	31
	@ 90%		28	21
	@ SANS3001 Midpoint		54	56

Classifications

HRB (AASHTO)	A-2-6(0)	A-2-4(0)
COLTO	G6	G6
TRH14	G6	G6



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Civil Engineering Testing Laboratories

Client	:	CROSSMAN PAPE ASSOCIATES cc	Date Received	:	01/02/2021
Project	:	Halfway House Water Upgrade	Date Reported	:	16/02/2021
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CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.		S-27 ◆	S-28 ■
Field Number		TP64	TP45
Client Reference			
Depth (m)		0.7-0.85	0.6-1.5
Position			
Coordinates	X		
	Y		
Description			
Additional information			
Calcrete/Crushed			
Stabilizing Agent			

Sieve Analysis (Wet preparation)

Percentage Passing	100 mm	100	100
	75 mm	100	100
	63 mm	100	100
	53 mm	100	100
	37.5 mm	100	100
	28 mm	100	100
	20 mm	100	100
	14 mm	92	99
	5 mm	75	90
	2 mm	65	85
	1 mm	56	69
	0.425 mm	43	45
	0.250 mm	36	37
	0.150 mm	31	31
	0.075 mm	25	26
Grading Modulus		1.67	1.45

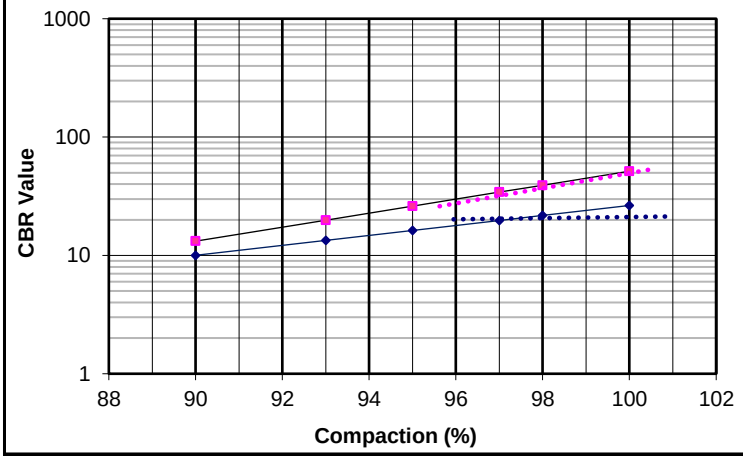
Soil Mortar Analysis

Coarse Sand	49	39
Coarse Fine Sand	8	8
Medium Fine Sand	8	7
Fine Fine Sand	7	6
Silt and Clay	29	40

Atterberg Limits

Liquid Limit (%)	26	37
Plasticity Index (%)	12	17
Linear Shrinkage (%)	4.5	8.5

Laboratory No.		S-27 ◆			S28 ■		
Maximum Dry Density & Optimum Moisture Content							
MDD	kg/m^3	2086			1930		
OMC	%	10.3			11.4		
California Bearing Ratio							
Compaction Data							
Moisture	%	10.24470388			11.15854382		
Dry Density	kg/m^3	2103	2002	1898	1938	1842	1761
Compaction	%	100.8	95.9	91.0	100.4	95.5	91.2
Penetration Data							
CBR at	2.54 mm	21	20	10	53	25	13
	5.08 mm	28	22	11	48	25	13
	7.62 mm	31	23	12	41	22	14
Swell	%	0.2	0.2	0.3	0.3	0.3	0.3
Final Moisture (%)		11.9	13.92	17.94	13.09	15.36	19.41

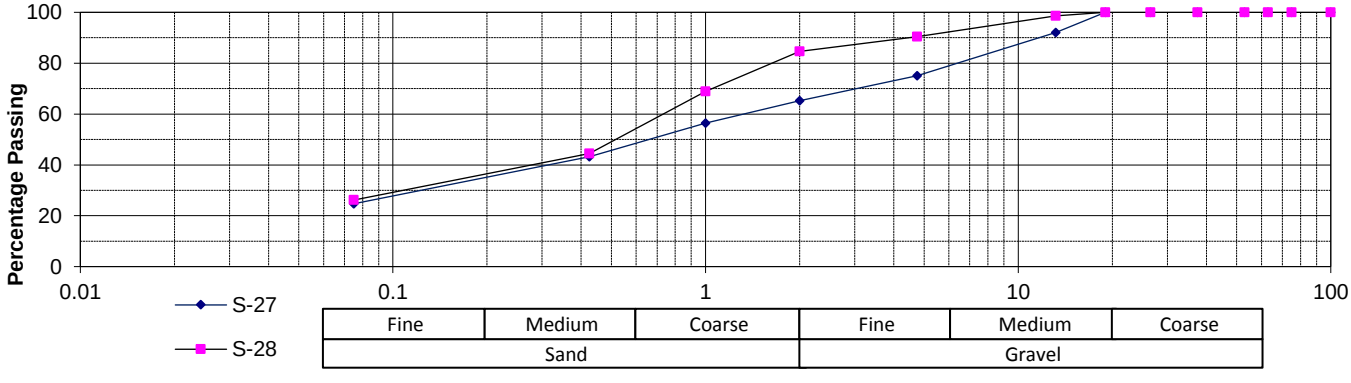


Interpolated CBR Data

CBR	@ 100%	Mod. AASHTO	26	51
	@ 98%		22	39
	@ 97%		20	34
	@ 95%		16	26
	@ 93%		13	20
	@ 90%		10	13
	@ SANS3001 Midpoint		21	37

Classifications

HRB (AASHTO)	A-2-6(0)	A-2-6(1)
COLTO	G8	
TRH14	G8	G8



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Project No.	:	2021-B-86	Page No.	:	16 of 16

CALIFORNIA BEARING RATIO (CBR) & ROAD INDICATOR REPORT

Laboratory No.		S-29 ◆	■
Field Number		TP28	
Client Reference			
Depth (m)		0.3-1.9	
Position			
Coordinates	X		
	Y		
Description			
Additional information			
Calcrete/Crushed			
Stabilizing Agent			

Sieve Analysis (Wet preparation)

Percentage Passing	100 mm	100	
	75 mm	100	
	63 mm	100	
	53 mm	100	
	37.5 mm	100	
	28 mm	100	
	20 mm	100	
	14 mm	98	
	5 mm	91	
	2 mm	74	
	1 mm	61	
	0.425 mm	45	
	0.250 mm	40	
	0.150 mm	35	
	0.075 mm	30	
Grading Modulus		1.51	

Soil Mortar Analysis

Coarse Sand	39	
Coarse Fine Sand	11	
Medium Fine Sand	8	
Fine Fine Sand	7	
Silt and Clay	36	

Atterberg Limits

Liquid Limit (%)	39	
Plasticity Index (%)	20	
Linear Shrinkage (%)	9.5	

Laboratory No.		S-29 ◆	■

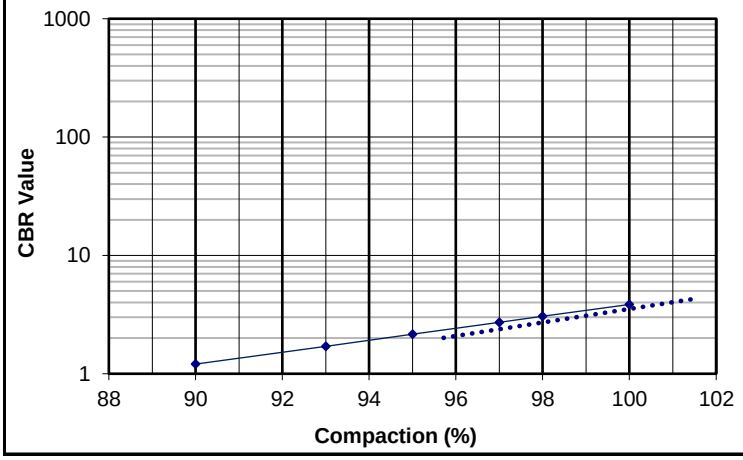
Maximum Dry Density & Optimum Moisture Content

MDD	kg/m^3	1856	
OMC	%	12.2	

California Bearing Ratio

Compaction Data							
Moisture	%	12.26891312					
Dry Density	kg/m^3	1882	1772	1692			
Compaction	%	101.4	95.5	91.2			

Penetration Data							
CBR at	2.54 mm	4	2	1			
	5.08 mm	4	2	2			
	7.62 mm	4	2	2			
Swell	%	2.3	2.9	3.7			
Final Moisture (%)		16.1	18.86	24.53			

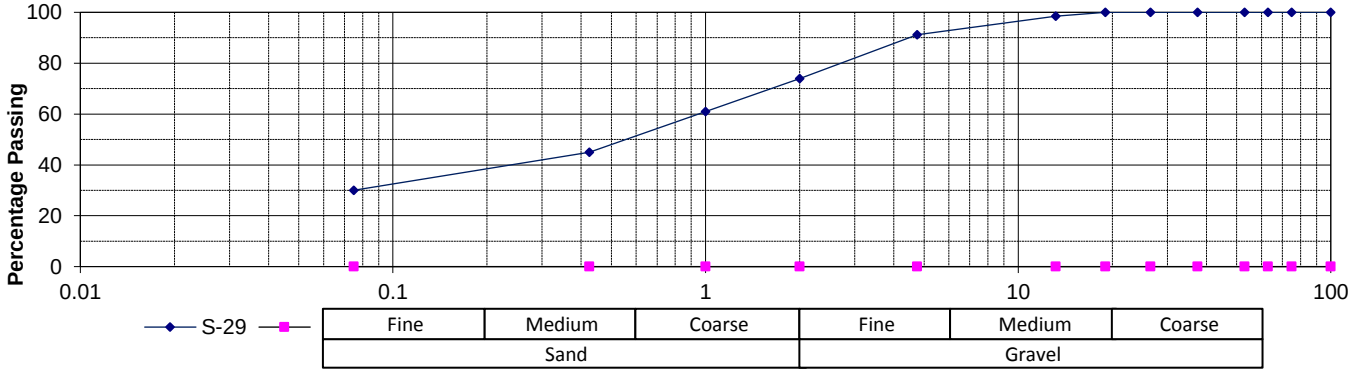


Interpolated CBR Data

CBR	@ 100%	Mod. AASHTO	4	
	@ 98%		3	
	@ 97%		3	
	@ 95%		2	
	@ 93%		2	
	@ 90%		1	
	@ SANS3001 Midpoint		3	

Classifications

HRB (AASHTO)	A-2-6(2)	
COLTO		
TRH14		G8



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Email: accounts@waterlab.co.za

CERTIFICATE OF ANALYSES
BASSON INDEX

Date received: 2021-01-26 **Date completed: 2021-02-10**
Project number: 1000 **Report number: 97570** **Order number:**

Client name: Crossman Pape & Associates **Contact person: Warren Kretzinger**
Address: 7 Manor Close, Norscot Manor, Douglasdale, Jhb **Email: warren@crossmanpape.co.za**
Telephone: 011 465 1699 **Cell: 083 324 4371**

Analyses in mg/ℓ (Unless specified otherwise)	Sample Identification:	
	TP3 (0.5-1.3)	TP6 (0.6-1.35)
Sample Number	**117189**	**117190**
pH Value at 25°C	4.0	4.4
pHs Value at 20°C (calc)	10.0	9.7
Electrical Conductivity in mS/m at 25°C	13.5	13.4
Total Dissolved Solids* (calc)	90	90
Total Alkalinity as $CaCO_3$	8	8
Total Hardness as $CaCO_3$ (calc)	25	39
Calcium Hardness as $CaCO_3$ (calc)	12	22
Calcium as Ca	5	9
Magnesium as Mg	3	4
Free & Saline Ammonia	<0.1	<0.1
Ammonium as NH_4 (calc)	<0.3	<0.3
Sulphate as SO_4	29	39
Chloride as Cl	7	5
Langelier Index at 20°C (calc)	-6.0	-5.3
Ryznar Index at 20°C (calc)	16.0	15.1
Corrosivity Ratio (calc)	5.0	6.0
Leaching Index [LCSI] (calc)	**4712**	**4241**
Spalling Index [SCSI] (calc)	**4**	**5**
Aggressiveness Index [N_c] (calc)	**4716**	**4246**

***TDS Calculated EC X 6.7**
2:1 Distilled Water : Soil Extract

S. Laubscher
Assistant Geochemistry Project Manager

WATERLAB (Pty) Ltd

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CERTIFICATE OF ANALYSES
BASSON INDEX

Date received: 2021-01-26 **Date completed: 2021-02-10**
Project number: 1000 **Report number: 97570** **Order number:**

Client name: Crossman Pape & Associates **Contact person: Warren Kretzinger**
Address: 7 Manor Close, Norscot Manor, Douglasdale, Jhb **Email: warren@crossmanpape.co.za**
Telephone: 011 465 1699 **Cell: 083 324 4371**

Analyses in mg/ℓ (Unless specified otherwise)	Sample Identification:	
	TP24 (0.6-1.4)	TP63 (0.0-0.5)
Sample Number	**117191**	**117192**
pH Value at 25°C	7.9	8.0
pHs Value at 20°C (calc)	8.5	8.2
Electrical Conductivity in mS/m at 25°C	15.8	25.1
Total Dissolved Solids* (calc)	106	168
Total Alkalinity as $CaCO_3$	56	76
Total Hardness as $CaCO_3$ (calc)	62	117
Calcium Hardness as $CaCO_3$ (calc)	50	80
Calcium as Ca	20	32
Magnesium as Mg	3	9
Free & Saline Ammonia	<0.1	<0.1
Ammonium as NH_4 (calc)	<0.3	<0.3
Sulphate as SO_4	12	30
Chloride as Cl	2	2
Langelier Index at 20°C (calc)	-0.6	-0.2
Ryznar Index at 20°C (calc)	9.2	8.4
Corrosivity Ratio (calc)	0.3	0.4
Leaching Index [LCSI] (calc)	**864**	**558**
Spalling Index [SCSI] (calc)	**2**	**5**
Aggressiveness Index [N_c] (calc)	**866**	**563**

***TDS Calculated EC X 6.7**
2:1 Distilled Water : Soil Extract

S. Laubscher
Assistant Geochemistry Project Manager

WATERLAB (Pty) Ltd

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CERTIFICATE OF ANALYSES
BASSON INDEX

Date received: 2021-01-26 **Date completed: 2021-02-10**
Project number: 1000 **Report number: 97570** **Order number:**

Client name: Crossman Pape & Associates **Contact person: Warren Kretzinger**
Address: 7 Manor Close, Norscot Manor, Douglasdale, Jhb **Email: warren@crossmanpape.co.za**
Telephone: 011 465 1699 **Cell: 083 324 4371**

Analyses in mg/ℓ (Unless specified otherwise)	Sample Identification:	
	TP64 (0.7-0.85)	TP5 (0.0-0.7)
Sample Number	**117193**	**117194**
pH Value at 25°C	5.0	5.3
pHs Value at 20°C (calc)	10.0	9.6
Electrical Conductivity in mS/m at 25°C	6.2	16.1
Total Dissolved Solids* (calc)	42	108
Total Alkalinity as $CaCO_3$	8	8
Total Hardness as $CaCO_3$ (calc)	18	44
Calcium Hardness as $CaCO_3$ (calc)	10	27
Calcium as Ca	4	11
Magnesium as Mg	2	4
Free & Saline Ammonia	<0.1	<0.1
Ammonium as NH_4 (calc)	<0.3	<0.3
Sulphate as SO_4	19	21
Chloride as Cl	<2	5
Langelier Index at 20°C (calc)	-5.0	-4.3
Ryznar Index at 20°C (calc)	15.1	14.0
Corrosivity Ratio (calc)	2.8	3.6
Leaching Index [LCSI] (calc)	**4022**	**3524**
Spalling Index [SCSI] (calc)	**3**	**3**
Aggressiveness Index [N_c] (calc)	**4025**	**3528**

***TDS Calculated EC X 6.7**
2:1 Distilled Water : Soil Extract

S. Laubscher
Assistant Geochemistry Project Manager

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CERTIFICATE OF ANALYSES
BASSON INDEX

Date received: 2021-01-26 **Date completed: 2021-02-10**
Project number: 1000 **Report number: 97570** **Order number:**

Client name: Crossman Pape & Associates **Contact person: Warren Kretzinger**
Address: 7 Manor Close, Norscot Manor, Douglasdale, Jhb **Email: warren@crossmanpape.co.za**
Telephone: 011 465 1699 **Cell: 083 324 4371**

Analyses in mg/ℓ (Unless specified otherwise)	Sample Identification:
	TP28 (0.3-1.9)
Sample Number	**117195**
pH Value at 25°C	5.9
pHs Value at 20°C (calc)	9.1
Electrical Conductivity in mS/m at 25°C	21.3
Total Dissolved Solids* (calc)	143
Total Alkalinity as $CaCO_3$	28
Total Hardness as $CaCO_3$ (calc)	52
Calcium Hardness as $CaCO_3$ (calc)	27
Calcium as Ca	11
Magnesium as Mg	6
Free & Saline Ammonia	<0.1
Ammonium as NH_4 (calc)	<0.3
Sulphate as SO_4	42
Chloride as Cl	<2
Langelier Index at 20°C (calc)	-3.2
Ryznar Index at 20°C (calc)	12.3
Corrosivity Ratio (calc)	1.7
Leaching Index [LCSI] (calc)	**2730**
Spalling Index [SCSI] (calc)	**6**
Aggressiveness Index [N_c] (calc)	**2736**

***TDS Calculated EC X 6.7**
2:1 Distilled Water : Soil Extract

Important notes (see table for corrections on p. 6):

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

WATERLAB (Pty) Ltd

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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
TP3 (0.5-1.3)	117189	Corrosive	Aggressive
TP6 (0.6-1.35)	117190	Corrosive	Aggressive
TP24 (0.6-1.4)	117191	Corrosive	Aggressive
TP63 (0.0-0.5)	117192	Corrosive	Aggressive
TP64 (0.7-0.85)	117193	Corrosive	Aggressive
TP5 (0.0-0.7)	117194	Corrosive	Aggressive
TP28 (0.3-1.9)	117195	Corrosive	Aggressive

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BASSON INDEX

Date received: 2021-01-26 **Date completed: 2021-02-10**
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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 Cl in mg/l	(1+ [0.05 x (T-20)])
Wet-dry cycles	SCSI	0.23×10^{-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 (ie 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, eg for turbulent conditions $LCSI_c$ = LCSI x 1.75
Note 5: Round off corrected indices to the nearest 100.

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CERTIFICATE OF ANALYSES
DIN 50 929

Date received: 2021-01-26 **Date completed: 2021-02-15**
Project number: 1000 **Report number: 97570** **Order number:**

Client name: Crossman Pape & Associates **Contact person: Warren Kretzinger**
Address: 7 Manor Close, Norscot Manor, Douglasdale, Jhb **Email: warren@crossmanpape.co.za**
Telephone: 011 465 1699 **Cell: 083 324 4371**

Analyses in mg/ℓ	Sample Identification			
	TP3 (0.5-1.3)	TP6 (0.6-1.35)	TP24 (0.6-1.4)	TP63 (0.0-0.5)
Sample Number	**117189**	**117190**	**117191**	**117192**
pH Value at 25°C	4.0	4.4	7.9	8.0
Electrical Conductivity	13.5	13.4	15.8	25.1
Alkalinity as $CaCO_3$	8	8	56	76
Acidity as $CaCO_3$	<5	<5	<5	<5
Resistivity (ohm.cm) (calc)	7407	7463	6329	3984
Water content (%)	10.2	7.1	7.3	9.2
Sulphide as S^{2-}	2.9	4.0	6.8	1.3
Chloride as Cl	7	5	2	2
Water Soluble Sulphate as SO_4	29	39	12	30
Acid Soluble Sulphate as SO_4*	<5	12	30	122

[*] Colour interference

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CERTIFICATE OF ANALYSES
DIN 50 929

Date received: 2021-01-26 **Date completed: 2021-02-15**
Project number: 1000 **Report number: 97570** **Order number:**

Client name: Crossman Pape & Associates **Contact person: Warren Kretzinger**
Address: 7 Manor Close, Norscot Manor, Douglasdale, Jhb **Email: warren@crossmanpape.co.za**
Telephone: 011 465 1699 **Cell: 083 324 4371**

Analyses in mg/ℓ	Sample Identification		
	TP64 (0.7-0.85)	TP5 (0.0-0.7)	TP28 (0.3-1.9)
Sample Number	**117193**	**117194**	**117195**
pH Value at 25°C	5.0	5.3	5.9
Electrical Conductivity	6.2	16.1	21.3
Alkalinity as $CaCO_3$	8	8	28
Acidity as $CaCO_3$	<5	<5	<5
Resistivity (ohm.cm) (calc)	16129	6211	4695
Water content (%)	13.7	6.8	17.2
Sulphide as S^{2-}	0.4	9.8	0.7
Chloride as Cl	<2	5	<2
Water Soluble Sulphate as SO_4	19	21	42
Acid Soluble Sulphate as SO_4 *	<5	<5	102

[*] Colour interference

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WATERLAB (PTY) LTD

CONVERSION OF RESULTS

Date received:	**26-01-21**	**Date Completed:**	**15-02-21**
Project number:	**1000**	**Report number:**	**97570**
Client name:	**Crossman Pape & Associates**	**Contact person:**	**Warren Kretzinger**
Adress:	**7 Manor Close, Norscot Manor, Douglasdale, Jhb**	**Email:**	**warren@crossmanpape.co.za**
Telephone:	**011 465 1699**	**Cell:**	**083 324 4371**

Sample number	Chloride as Cl in mg/l	Chloride as Cl mg/kg	Chloride as Cl mmol/kg
Det. Limit	**<2**	**<4**	**<0.113**
117189	7	14	0.395
117190	5	10	0.282
117191	2	4	0.113
117192	2	4	0.113
117193	<2	<4	<0.113
117194	5	10	0.282
117195	<2	<4	<0.113

Sample number	Water Soluble Sulphate As SO_4 in mg/l	Water Soluble Sulphate As SO_4 mg/kg	Water Soluble Sulphate As SO_4 mmol/kg
Det. Limit	**<2**	**<4**	**<0.042**
117189	29	58	0.604
117190	39	78	0.812
117191	12	24	0.250
117192	30	60	0.625
117193	19	38	0.396
117194	21	42	0.437
117195	42	84	0.874

Sample number	Acid Soluble Sulphate As SO_4 in mg/l	Acid Soluble Sulphate As SO_4 mg/kg	Acid Soluble Sulphate As SO_4 mmol/kg
Det. Limit	**<5**	**<20**	**<0.104**
117189	<5	<20	<0.104
117190	12	24	0.250
117191	30	60	0.625
117192	122	244	2.54
117193	<5	<20	<0.104
117194	<5	<20	<0.104
117195	102	204	2.12

Sample number	Total Alkalinity (mg/l)	Total Alkalinity (mg/kg)	Total Alkalinity (mmol/kg)
Det. Limit	**<5**	**<10**	**<0.100**
117189	8	16	0.160
117190	8	16	0.160
117191	56	112	1.119
117192	76	152	1.519
117193	8	16	0.160
117194	8	16	0.160
117195	28	56	0.559

Sample number	Total Acidity (mg/l)	Total Acidity (mg/kg)	Total Acidity (mmol/kg)
Det. Limit	**<5**	**<10**	**<0.100**
117189	<5	<10	<0.100
117190	<5	<10	<0.100
117191	<5	<10	<0.100
117192	<5	<10	<0.100
117193	<5	<10	<0.100
117194	<5	<10	<0.100
117195	<5	<10	<0.100

Sample number	Water Soluble Sulphide As S^{2-} in mg/l	Water Soluble Sulphide As S^{2-} mg/kg	Water Soluble Sulphide As S^{2-} mmol/kg
	<5	**<10**	**<0.312**
117189	2.9	5.80	0.181
117190	4.0	8.00	0.249
117191	6.8	14	0.424
117192	1.3	2.60	0.081
117193	0.4	0.800	0.025
117194	9.8	20	0.611
117195	0.7	1.40	0.044