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PROJECT No: M20/3838

7 June 2020

MERONOX (Pty) LTD
Postnet Suite 290
Private Bag X7260
WITBANK
1035

Attention: Mr. Eben Kotze

Dear Sir,

REPORT ON A FOUNDATION INVESTIGATION CARRIED OUT FOR THE PROPOSED: NEW FILLING STATION DEVELOPMENT ON: PORTION 234 OF THE FARM ZEEKOEWATER 311-JS, WITBANK, MPUMALANGA PROVINCE

1. INTRODUCTION

This report presents results and observations on a foundation investigation that was carried out during March 2020 at the above property in Witbank for a proposed new filling station development. The site is located in President Park Extension 6 in the eastern part of Witbank on the corner of Mandela Drive & Nita Avenue. The investigation was carried out at the request of Mr. Eben Kotze of EDL Engineers (Pty) Ltd, who is acting on behalf of his client, Messrs. Meronox (Pty) Ltd from Witbank.

2. TERMS OF REFERENCE

The objectives of the investigation were to: -

- Determine the engineering properties of the site soils and bedrock including potentially expansive material, low bearing capacity soils, areas difficult to excavate and to determine the quality of the in situ material for road and pavement construction.
- Present appropriate recommendations for commercial development and appropriate precautionary measures.

Written permission to carry out the investigation was obtained from Mr. Eben Kotze in his electronic mail dated 10 March 2020.

3. INFORMATION CONSULTED

The following information was available and was consulted: -

- The 1: 50 000 scale Topographical Map Sheet Number 2529CD Middelburg.
- The 1: 125 000 scale Geological Map 2529C Witbank.

- A copy of a concept access layout plan to a scale of 1: 750 in Google Earth format prepared by EDL Engineers (Pty) Ltd, showing the boundaries of the site and the proposed development of the filling station including the location of underground tanks, the forecourt with canopy and shop.
- A copy of a site aerial view plan showing existing services prepared by WSP Engineers, drawing number 331278/SL/01 prepared to a scale of 1: 1 250, showing the boundaries of the site and existing services.
- A copy of a site contour plan prepared by a professional land surveyor to a scale of 1: 2000 with contours at 0,5m intervals was supplied.
- A copy of a report prepared by Lomalab during 2010 entitled “Geotechnical investigation of the foundation conditions on Portion 234 of the farm Zeekoewater311 JS, Witbank”
- A copy of an aerial photo of the site was obtained from Google Earth via the Internet.

4. SITE DESCRIPTION

The site for the proposed development is located in the eastern part of Witbank in President Park Extension 6 and is roughly triangular in shape covering a surface area of some 0,21 hectares. The property is bounded to the north by Mandela Avenue, to the east by open veld, to the south by the old Portuguese Club and to the west by Nita Avenue. The property consists of a vacant stand that is partly covered by imported fill some 1,0m thick. Surface cover consists of veld grass, weeds and isolated Black Wattle trees towards the north-eastern part whilst no rock outcrops were observed on site. The general slope of the property is towards the north-east grading from an elevation 1 571m to 1568m above masl at an average gradient of roughly 3% to 4%.

5. SITE INVESTIGATION

The site investigation consisted of the excavation of six test pits by Hyundai H940S backactor supplied by Vanall’s Plant Hire from Witbank. The test pits were entered by the undersigned, a registered professional engineering geologist who described the soil and bedrock formations in terms of the methods advocated by Jennings *et al* (1973) namely, moisture condition, colour, soil consistency, soil structure, soil type and origin (MCCSSO).

During the test pit profiling, disturbed and undisturbed soil samples were recovered from the test pits and submitted to Soillab’s commercial soils laboratory in Pretoria for testing and identification. Detailed descriptions of the test pit profiles are provided on the Soil Profile Sheets in Appendix 1 of the report whilst the laboratory test results appear in Appendix 2. The location of the test pits and geotechnical zones are shown on the “Geotechnical Map”, Drawing Number M20/3838 at the back of the report.

6. SITE SOILS AND GEOLOGY

The site is blanketed by a thin to moderate veneer of transported soils and imported fill overlying a prominent horizon of residual soils over felsite bedrock (termed rhyolite in later publications) belonging to the Rooiberg Group, Transvaal Supergroup.

The site has been apportioned into two prominent Geotechnical Zones, **Soil Zones “A”** and **“B”** as shown on the attached Geotechnical Map at the back of the report.

Soil Zone “A” covers the *northern portion* of the property and a very generalized description of the typical soil profile which may be encountered here, is as follows (represented by test pits PP/1 to PP/3 & PP/6): -

- 0,0 – 0,2: *Moist, dark greyish brown, dense, voided, silty SAND containing roots; colluvium.*
- 0,2 – 0,4: *Abundant coarse medium and fine, sub-rounded QUARTZ GRAVELS and NODULAR FERRICRETE in a matrix as above and containing roots; pebble marker. Overall consistency is medium dense.*
- 0,4 – 1,2: *Moist, pinkish brown to reddish brown blotched grey and yellow, dense, voided, silty SAND containing numerous angular FELSITE GRAVELS and runnels of grey SAND with fine roots; reworked residual felsite.*
- 1,2 – 1,8: *Abundant coarse medium and fine, sub-rounded and sub-angular FELSITE GRAVELS and COBBLES clast supported in a matrix as above; residual felsite. Overall consistency is dense.*
- 1,8 – 4,0: *Moist, pinkish brown to greenish brown blotched yellow and red, dense, intact, silty SAND containing numerous FELSITE GRAVELS; residual felsite.*

Note: Firm silty reworked residual felsite was only encountered in test pit PP/2 at a depth of between 0,6m and 1,2m below surface.

Soil Zone “B” covers the *southern portion* of the property and is characterized by a moderate horizon (1,0m to 1,1m thick) of imported fill overlying transported and residual soils over felsite bedrock with depth. A generalized description of the typical soil profile which may be encountered here, is as follows (represented by test pits PP/4 and PP/5): -

- 0,0 – 0,6: *FILL; Slightly moist, dark brown blotched pink, medium dense, silty SAND containing minor GRAVELS and COBBLES with roots and foreign material.*
- 0,6 – 1,1: *FILL; Slightly moist, dark brown, loose, silty SAND containing minor COBBLES, roots and foreign material.*
- 1,1 – 2,1: *Moist becoming very moist, brown blotched pink, yellow and purple, medium dense containing loose pockets, slightly voided, silty SAND containing numerous fine FELSITE GRAVELS; residual felsite.*
- 2,1 – 2,9: *Moist to very moist, purplish brown blotched yellow, medium dense, intact, silty SAND containing numerous fine and medium FELSITE GRAVELS; residual felsite.*
- 2,9+ *Purple stained black and white, highly weathered, very closely jointed, very soft rock FELSITE.*

Gradual refusal of the backactor was experienced in one pit only at a depth of 2,9m below surface in very soft rock felsite in test pit PP/4. Point water seepage was encountered in two test pits: PP/2 from below 1,2m and in PP/4 from below 2,1m below surface. The fill material occupying Soil Zone “B” acts as a sponge for collecting water due to its loose and permeable nature. Water percolating through the fill eventually perches on top of the underlying less permeable residual felsite thereby creating a seasonal perched water table. A seasonal wetland is indicated to the east of this site by the environmental consultant, however, no signs of a wetland was observed on this site, a wetland is usually indicated by mottling of the soil, saturated soil conditions, water plants and reeds and none of these conditions are present on this site.

7. GEOTECHNICAL CONSIDERATIONS

7.1 Expansive Soils

The site soils are generally sandy, gravelly and silty and are potentially “low” in the degree of expansiveness based on the results of the laboratory tests and according to the Van der Merwe (1964) method. A total surface heave value of less than 7,5mm is predicted across the site depending on location and should the moisture condition of soils range from desiccated to saturated.

7.2 Excavation Characteristics

No problems are foreseen to remove the site soils and weathered felsite bedrock down to a depth of at least 3,0m and 4,0m below surface using conventional earth-moving equipment. Very hard machine excavation and possibly the use of jackhammers will be required to remove the felsite bedrock from below 2,9m across the south-western portion of the study area. It is not improbable that isolated hard rock felsite spheroids (boulders) may be encountered within the residual soils and where present, may require jackhammer work and very hard excavation for removal. The sidewalls of deep excavations should remain stable during construction in the dry season whereas isolated instabilities may occur during the wet season.

7.3 Collapsible and Compressible Soils

An undisturbed soil sample, representative of the silty residual felsite soil, was tested to determine the collapse potential of the material according to the method advocated by Jennings (1974). A summary of the results of the laboratory tests appears below in Table 7.1.

TABLE 7.1: COLLAPSE POTENTIAL TEST RESULTS

| HOLE NUMBER | DEPTH (m) | DRY DENSITY (kg/m ³) | COLLAPSE POTENTIAL (%) | COMPRESSIBILITY (%) | TROUBLE RATING |
|-------------|-----------|----------------------------------|------------------------|---------------------|------------------|
| PP/2 | 1,0 | 1 403 | 1,90 | 1,80 | Moderate Trouble |

The analysis from the collapse potential tests indicated that the residual felsite soils are potentially slightly to moderately collapsible and compressible with a compressibility ratio of 1,8%. The medium dense sandy and gravelly transported soils blanketing Soil Zone “A” to depths ranging from 0,4m to 0,6m below surface are considered to be potentially collapsible and compressible. The loose to medium dense sandy imported fill is predicted to be potentially moderately to highly collapsible and compressible, based on visual observations of the in-situ soils profiles.

7.4 Foundations

Soil Zone “A”

This portion of the site classifies as a Class “C1/S” according to the guidelines of the NHBRC Standards and Guidelines of October 2014 and in view of the thin to moderate horizon of potentially collapsible and compressible foundation soils which underlie this portion of the site, one of the following foundation solutions may be considered for the construction of proposed rigid, single-storey, masonry residential structures: -

Deep Strip Foundations

- Normal construction with drainage precautions and with mesh reinforced floor slabs.
- Founding on the dense residual felsite horizon from below 0,4m to 1,2m below the natural ground surface and adopting a safe allowable bearing pressure of at least 100 kPa.

Compaction of in situ soils below individual footings

- Remove in situ material below foundations to a depth and width of 1,5 times the foundation width or to a competent horizon and replace with material compacted to 93% Mod AASHTO density at -1% to +2% of optimum moisture content.
- Normal construction with lightly reinforced strip footings.
- Light reinforcement in masonry.
- Site drainage and plumbing/service precautions to be taken.

Soil Raft

- Remove in situ material to 1m beyond perimeter of building to a depth of 1,5 times the widest foundation or to a competent horizon and replace with material compacted to 93% Mod AASHTO density at -1% to +2% of optimum moisture content.
- Normal construction with lightly reinforced strip footings.
- Light reinforcement in masonry.
- Site drainage and plumbing/service precautions to be taken.

Modified Normal Construction

- Reinforced strip footings
- Articulation joints at some internal and all external doors
- Light reinforcement in masonry
- Site drainage and plumbing precautions to be taken
- Foundation pressure not to exceed 50 kPa.

Soil Zone “B”

This portion of the site classifies as a Site Class “S2/P” (disturbed ground) according to the guidelines of the NHBRC Standards and Guidelines of 2014. It is recommended that the potentially collapsible and compressible sandy fill blanketing this soil zone be removed in order to expose the natural in situ soils after which time, similar foundation methods as for Soil Zone “A” may be adopted.

Disturbed ground conditions caused by previous activities (old borrow pits, test pits etc.) should be identified and carefully reinstated prior to the construction of rigid structures or paved areas, neglect to do this, may result in structural distress to buildings.

7.5 Earthworks

The upper site soils were tested to determine their compaction characteristics. A summary of the test results appears below in Table 7.2: -

TABLE 7.2: SUMMARY OF COMPACTION TESTS

| HOLE NO | DEPTH (m) | SOIL TYPE | PI | GM | CBR | TRH14 | SWELL (%) |
|---------|-----------|---------------|----|------|-----|-------|-----------|
| PP/1 | 0,2 – 2,3 | Sandy GRAVELS | 7 | 1,27 | 64 | G6 | 0,10 |
| PP/3 | 0,0 – 1,4 | Gravelly SAND | 8 | 1,48 | 36 | G6 | 0,10 |

Note : PI = Plasticity Index
GM = Grading Modulus
CBR = California Bearing Ration at 95% Mod AASHTO compaction

Based on the results of the compaction tests, it is evident that the sandy and gravelly soils blanketing Soil Zone "A" should be suitable for use as fill underneath surface beds and for use possibly as selected and lower subbase layers in road construction (G6 Quality), after carefully removing all organic material. The sandy fill occupying Soil Zone "B" should be suitable for use as backfill underneath surface beds and lower selected layers (G8 quality) after removal of the coarser than 60mm fraction and all foreign matter.

7.6 Ground Water and Soil Chemistry

Point water seepages were encountered in two test pits from 1,2m to 2,1m below the present ground surface, the necessary damp proofing precautions should therefore be taken underneath structures. This phenomenon should also be taken into account in the design of subsurface structures, buried tanks will have to be anchored to prevent uplift when empty.

The site soils are expected to be potentially chemically aggressive with regards to underground ferrous metal pipes (pH values ranging from 5,61 to 7,19 and electrical conductivity values ranging from 0,0045 to 0,0313 S/m) and the use of non-ferrous metal pipes or plastic pipes are recommended for wet services, the foundation soils should be treated with an environmentally friendly insecticide to combat termites. The chemical tests conducted on the ground water have shown the water to be potentially very highly aggressive towards buried steel and concrete structures.

8. GENERAL

The above observations and recommendations are based on the assumption that geological conditions will not vary drastically from those encountered during the investigation. Although every effort has been made to ensure the accuracy of the information contained in this report, the results of the investigation are based upon field work and laboratory testing only. We cannot be held responsible if localized soil conditions at variance to those described in the report are encountered.

It is recommended that a competent person inspect foundation excavations during construction in order to verify that the materials thus exposed are not at variance with those described in the report. The placement of the fill must be controlled with suitable field tests to confirm that the required densities are achieved during compaction and that the quality of fill material is within specification.

We trust that the above information will meet with your immediate requirements, please do not hesitate to call for any further information.

Yours faithfully,



JOHANN VAN DER MERWE (Drs. Sci. Nat.)

Engineering Geologist

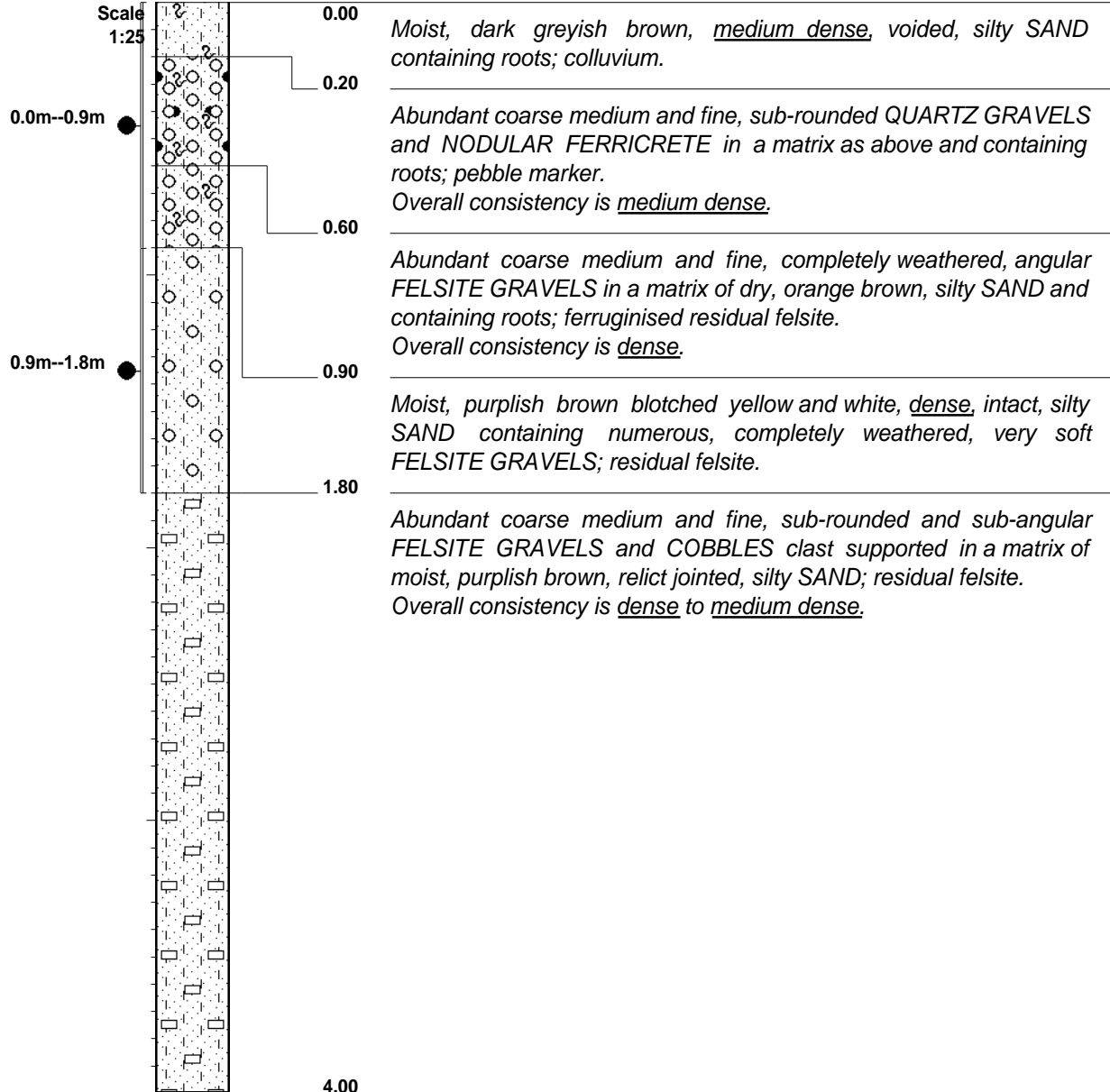
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9. APPENDICES

Appendix 1: Test Pit Profiles

Appendix 2: Laboratory Test Results

Geotechnical Map



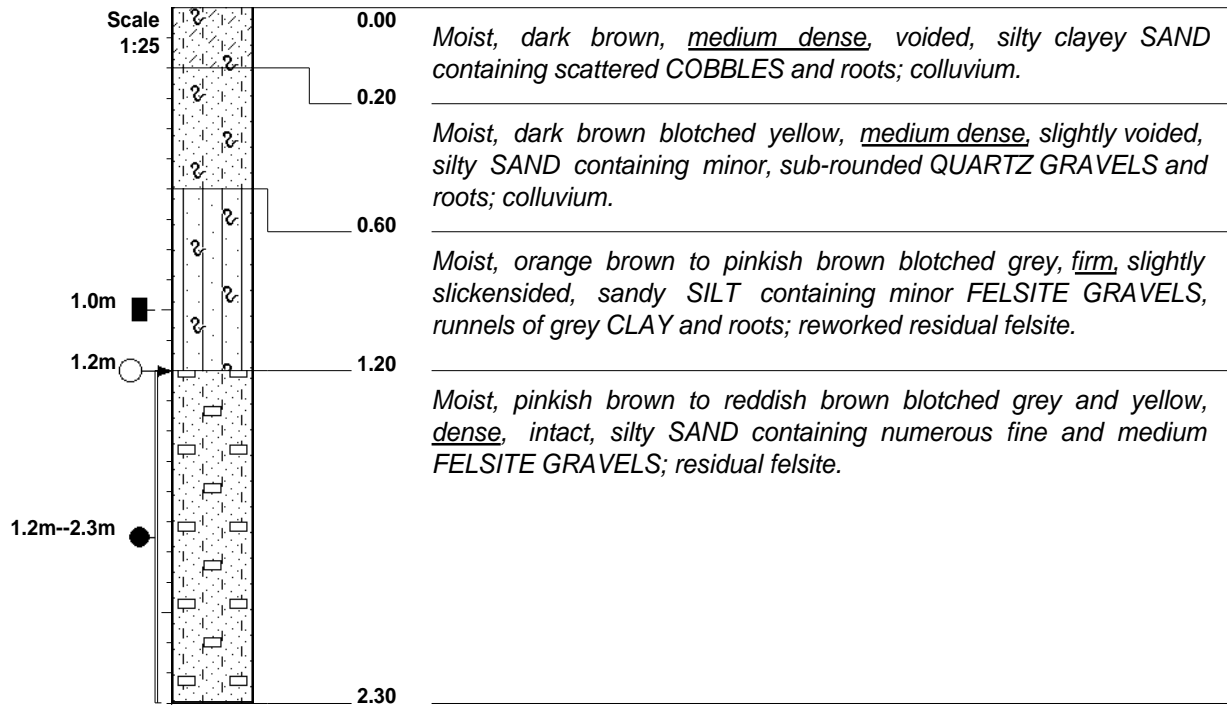
NOTES

- 1) No refusal of backactor at 4,0m.
- 2) No water seepage encountered.
- 3) Disturbed bulk sample taken from 0,0m--0,9m.
- 4) Disturbed foundation indicator sample taken from 0,9m--1,8m.

CONTRACTOR : Vanall's Plant Hire
MACHINE : Hyundai H940S Backactor
DRILLED BY :
PROFILED BY : avdm
TYPE SET BY : BC
SETUP FILE : STANDARD.SET

INCLINATION : Vertical
DIAM : Trench
DATE :
DATE : 23/03/2020
DATE : 08/07/2020 09:28
TEXT : ..ktop\ARCHIVEM203838.txt

ELEVATION :
X-COORD : S25 52 56.7
Y-COORD : E29 15 26.9



NOTES

- 1) No refusal of backactor at 2,3m.
- 2) Point water seepage encountered at 1,2m.
- 3) Disturbed foundation indicator sample taken from 1,2m--2,3m.
- 4) Undisturbed sample taken at 1,0m.

CONTRACTOR : Vanall's Plant Hire
 MACHINE : Hyundai H940S Backactor
 DRILLED BY :
 PROFILED BY : avdm
 TYPE SET BY : BC
 SETUP FILE : STANDARD.SET

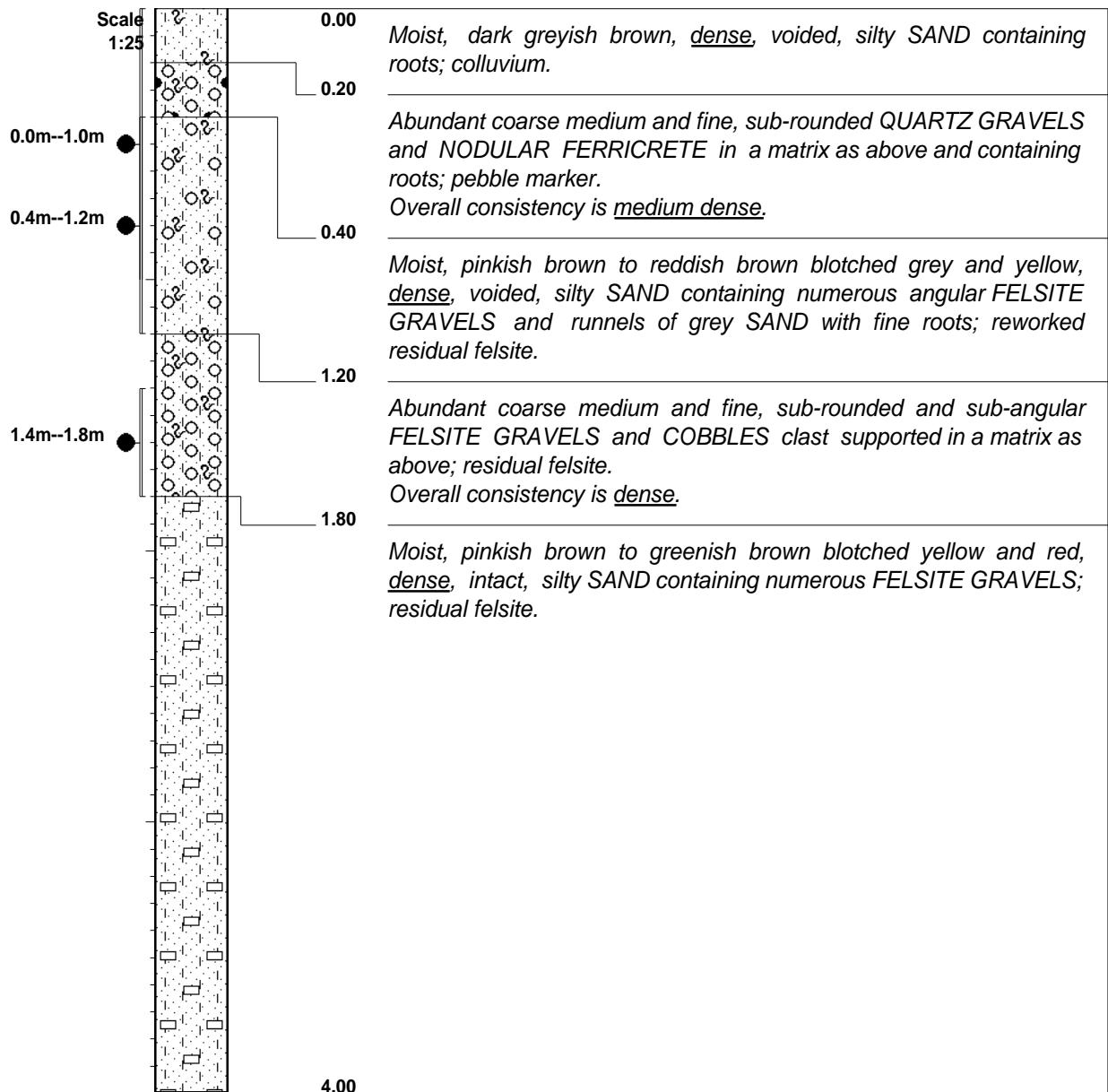
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 DATE : 08/07/2020 09:28
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ELEVATION :
 X-COORD : S25 52 56.6
 Y-COORD : E29 15 25.8

MERONOX (PTY) LTD
 Portion 234 of Zeekoewater 311-JS, Witbank, Mpumalanga Province
 GEOTECHNICAL INVESTIGATION CARRIED OUT FOR:
PROPOSED NEW FILLING STATION DEVELOPMENT

HOLE No: PP/3
Sheet 1 of 1

JOB NUMBER: M20/3838



NOTES

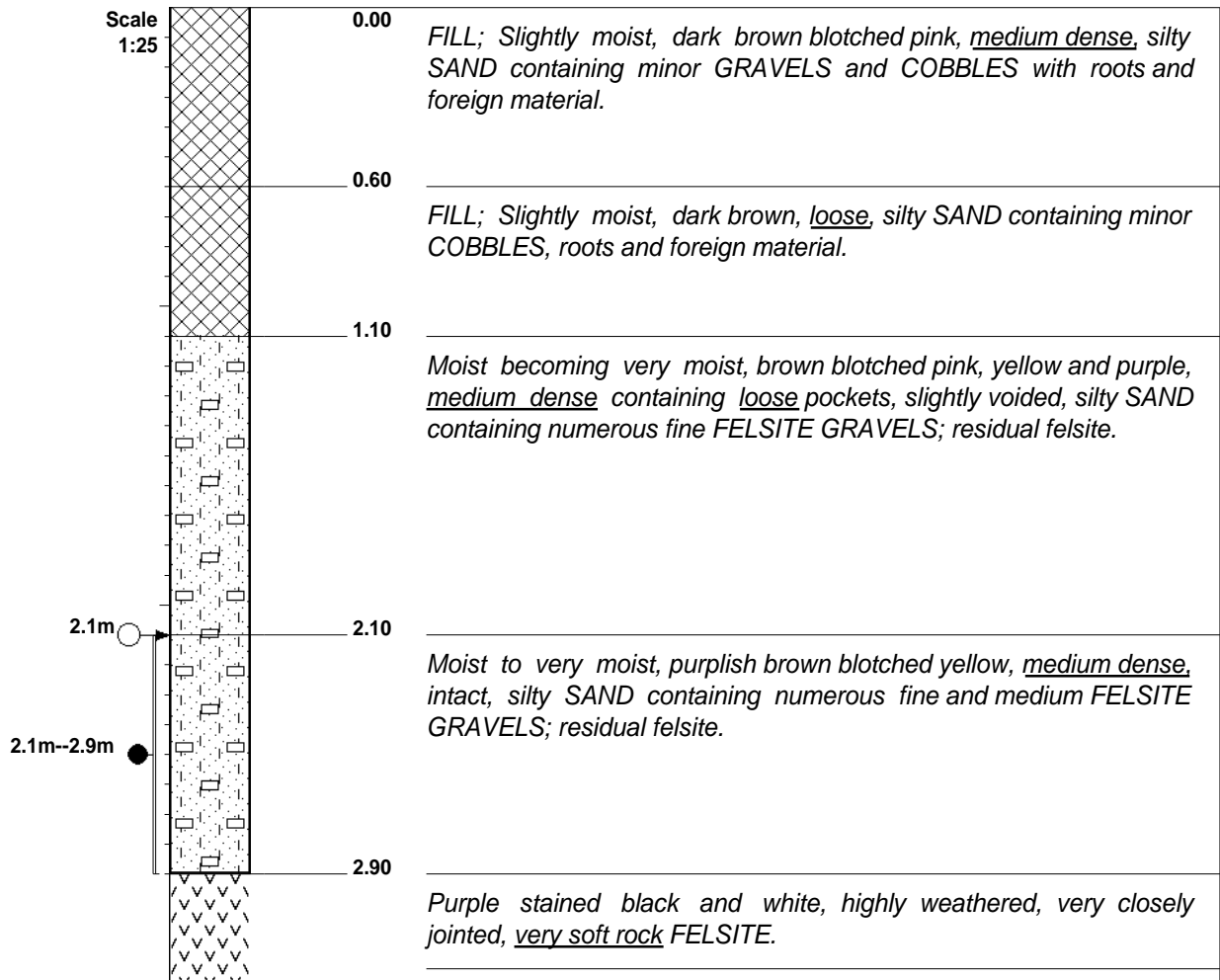
- 1) No refusal of backactor at 4,0m.
- 2) No water seepage encountered.
- 3) Disturbed bulk sample taken from 0,0m--1,0m.
- 4) Disturbed foundation indicator samples taken from 0,4m--1,2m and 1,4m--1,8m.

CONTRACTOR : Vanall's Plant Hire
 MACHINE : Hyundai H940S Backactor
 DRILLED BY :
 PROFILED BY : avdm
 TYPE SET BY : BC
 SETUP FILE : STANDARD.SET

INCLINATION :
 DIAM : Trench
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 DATE : 23/03/2020
 DATE : 08/07/2020 09:28
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ELEVATION :
 X-COORD : S25 52 56.3
 Y-COORD : E29 15 24.9

HOLE No: PP/3



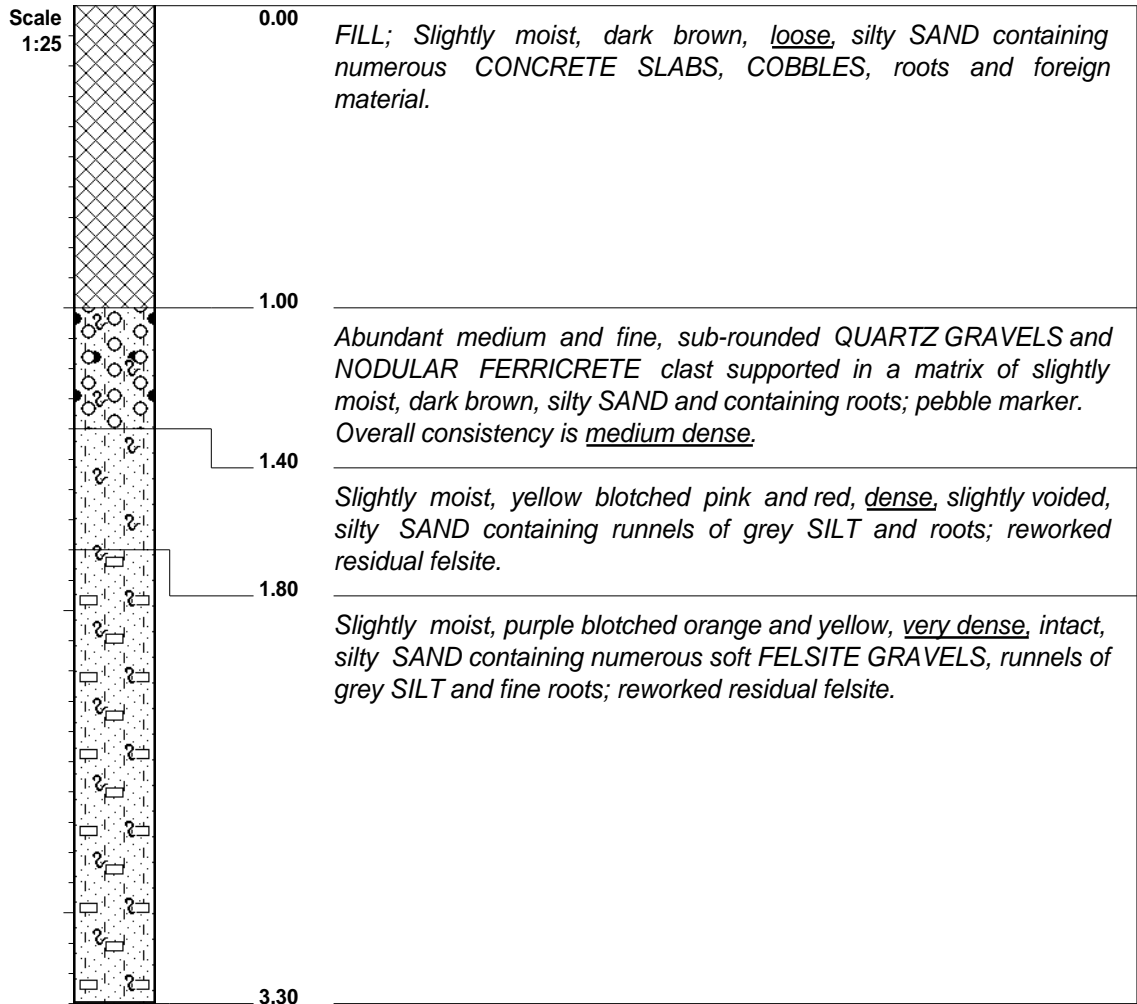
NOTES

- 1) Gradual refusal of backactor at 2,9m in very softrock felsite bedrock.
- 2) Slight water seepage encountered from below 2,1m.
- 3) Water sample taken from 2,1m--2,9m.

CONTRACTOR : Vanall's Plant Hire
 MACHINE : Hyundai H940S Backactor
 DRILLED BY :
 PROFILED BY : avdm
 TYPE SET BY : BC
 SETUP FILE : STANDARD.SET

INCLINATION :
 DIAM : Trench
 DATE :
 DATE : 23/03/2020
 DATE : 08/07/2020 09:28
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ELEVATION :
 X-COORD : S25 52 57.4
 Y-COORD : E29 15 24.3



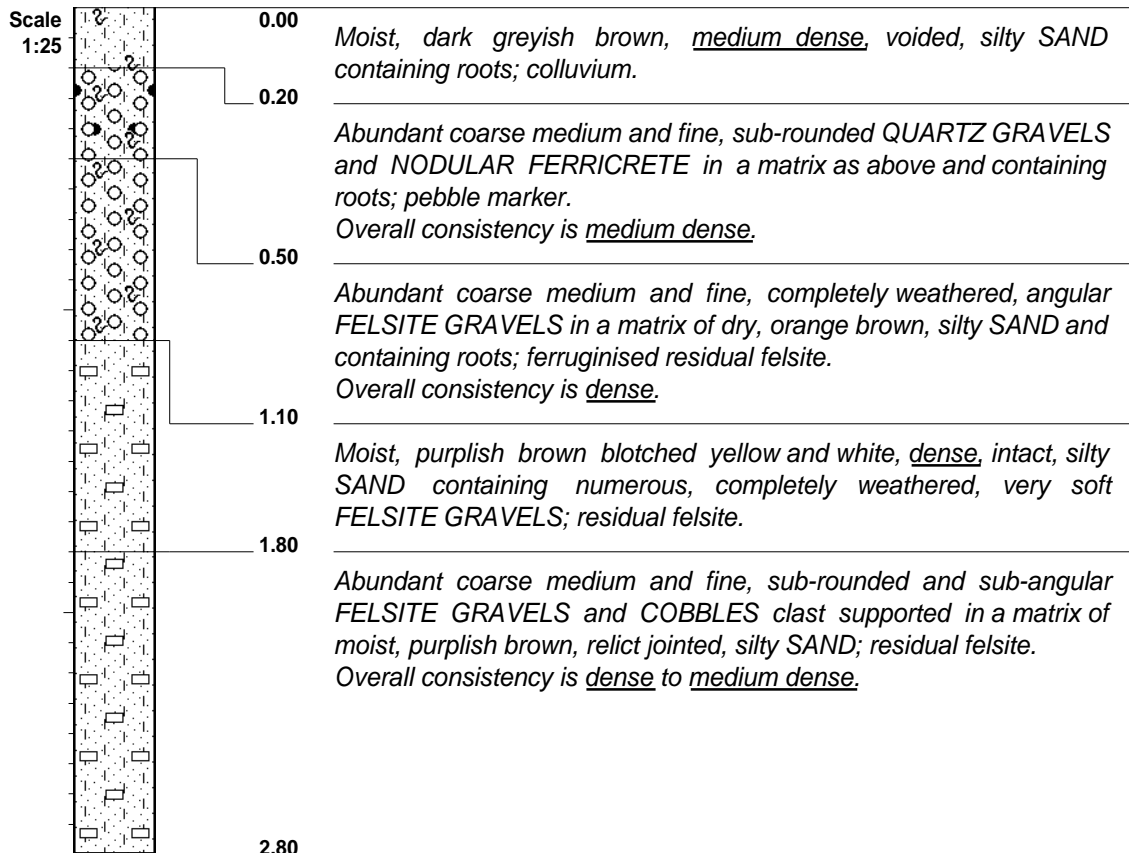
NOTES

- 1) No refusal of backactor at 3,3m.
- 2) No water seepage encountered.

CONTRACTOR : Vanall's Plant Hire
 MACHINE : Hyundai H940S Backactor
 DRILLED BY :
 PROFILED BY : avdm
 TYPE SET BY : BC
 SETUP FILE : STANDARD.SET

INCLINATION :
 DIAM : Trench
 DATE :
 DATE : 23/03/2020
 DATE : 08/07/2020 09:28
 TEXT : ..ktop\ARCHIVEM203838.txt

ELEVATION :
 X-COORD : S25 52 57.5
 Y-COORD : E29 15 25.9



NOTES

- 1) No refusal of backactor at 2,8m.
- 2) No water seepage encountered.

CONTRACTOR : Vanall's Plant Hire
 MACHINE : Hyundai H940S Backactor
 DRILLED BY :
 PROFILED BY : avdm
 TYPE SET BY : BC
 SETUP FILE : STANDARD.SET

INCLINATION :
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 DATE : 23/03/2020
 DATE : 08/07/2020 09:28
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ELEVATION :
 X-COORD : S25 52 57.1
 Y-COORD : E29 15 27.8

Project Description

| | | | |
|------------------|--|-------------------|----------|
| Client: | JOHANN VAN DER MERWE (PTY) LTD | Soillab Job No.: | S20-0579 |
| Job Description: | PORTION 234 ZEEKOE WATER 311-JS-M20-3838 | Contract Number: | |
| Date: | 2020-06-24 | Reference Number: | |

Sample Description

| | | | | |
|-----------------------|-------------|--------------------------|--|--|
| Soillab Sample No.: | S20-0579-01 | S20-0579-04 | | |
| Sample Description: | PP1 | PP3 | | |
| Sample Depth: | 0,0 - 0,9 | 0,0 - 1,0 | | |
| Material Description: | PALE RED | DARK YELLOWISH ORANGE | | |

Screen Analysis (% Passing) - SANS 3001-GR1

| | | | | |
|----------|-----|-----|--|--|
| 75,00 mm | 100 | 100 | | |
| 63,00 mm | 100 | 99 | | |
| 50,00 mm | 100 | 98 | | |
| 37,50 mm | 100 | 98 | | |
| 28,00 mm | 100 | 97 | | |
| 20,00 mm | 100 | 94 | | |
| 14,00 mm | 99 | 94 | | |
| 5,00 mm | 90 | 82 | | |
| 2,000 mm | 76 | 68 | | |
| 0,425 mm | 66 | 57 | | |
| 0,075 mm | 31 | 28 | | |

Soil-mortar percentages - SANS 3001-PR5

| | | | | | |
|------------------|---------------|----|----|--|--|
| Coarse Sand | 2.000-0.425mm | 14 | 17 | | |
| Coarse Fine Sand | 0.425-0.250mm | 12 | 12 | | |
| Medium Fine Sand | 0.250-0.150mm | 15 | 14 | | |
| Fine Fine Sand | 0.150-0.075mm | 18 | 16 | | |
| Silt and clay | <0.075mm | 41 | 41 | | |

Constants

| | | | | | |
|------------------|----------------|------|------|--|--|
| Grading Modulus | SANS 3001-PR5 | 1.27 | 1.48 | | |
| Liquid Limit | | 26 | 29 | | |
| Plasticity Index | SANS 3001-GR10 | 7 | 8 | | |
| Linear Shrinkage | | 2.5 | 4.0 | | |

MOD AASHTO - SANS 3001-GR30

| | | | | |
|--------------------------------------|------|------|--|--|
| Max Dry Density (kg/m ³) | 1946 | 1921 | | |
| Optimum Moisture Content (%) | 12.1 | 12.5 | | |

CBR - SANS 3001-GR40

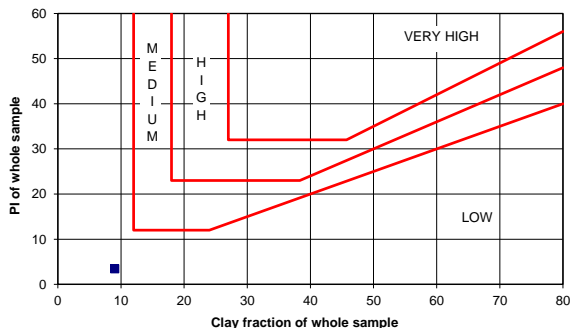
| | | | | |
|----------------------------------|-----------|-----------|--|--|
| MOD AASHTO | | | | |
| Moulding Moisture Content (%) | 12.2 | 12.5 | | |
| Dry Density (kg/m ³) | 1961 | 1914 | | |
| % of Max Dry Density | 100.8 | 99.6 | | |
| 100% MOD CBR (%) | 166 | 75 | | |
| % Swell | 0.1 | 0.1 | | |
| NRB | | | | |
| Dry Density (kg/m ³) | 1850 | 1823 | | |
| % of Max Dry Density | 95.1 | 94.9 | | |
| 100% NRB CBR (%) | 64 | 36 | | |
| % Swell | 0.1 | 0.1 | | |
| PROCTOR | | | | |
| Dry Density (kg/m ³) | 1735 | 1731 | | |
| % of Max Dry Density | 89.1 | 90.1 | | |
| 100% PROCTOR CBR (%) | 24 | 17 | | |
| % Swell | 0.2 | 0.2 | | |
| CBR (%) | | | | |
| 100% Mod AASHTO | 146 | 79 | | |
| 98% Mod AASHTO | 105 | 58 | | |
| 97% Mod AASHTO | 89 | 50 | | |
| 95% Mod AASHTO | 64 | 36 | | |
| 93% Mod AASHTO | 46 | 27 | | |
| 90% Mod AASHTO | 28 | 17 | | |
| COLTO Classification: | G6 | G6 | | |

PARTICLE SIZE ANALYSIS

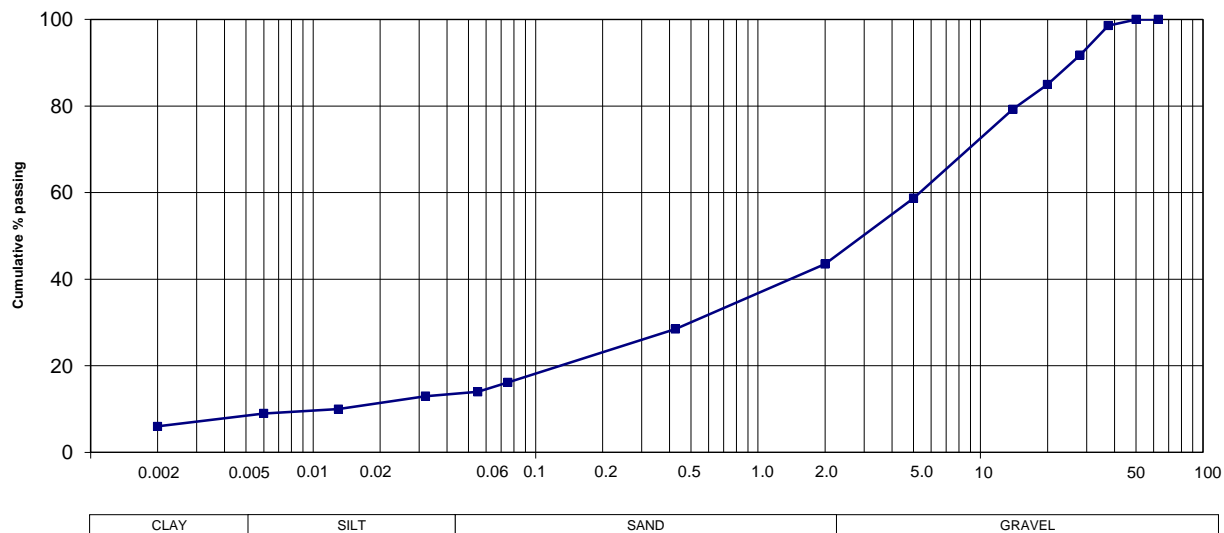
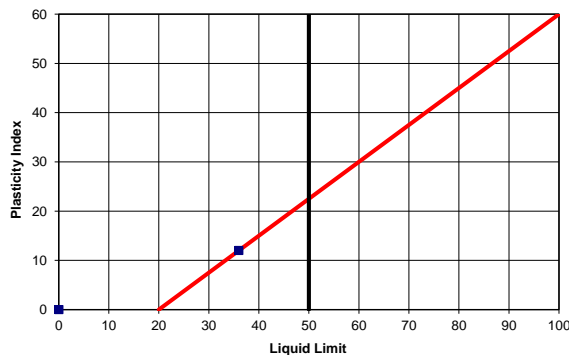
| | | | | | | | | | |
|---|--|--------|---|--------|---|--------|----|----------|----|
| Sample No. | 2 | | | | | | | | |
| Soillab Sample No. | S20-0579-02 | | | | | | | | |
| Depth (m) | 0,9 - 1,8 | | | | | | | | |
| Position | PP1 | | | | | | | | |
| Material Description | DARK YELLOWISH ORANGE SANDY GRAVEL | | | | | | | | |
| Relative density on < 2 mm (SANS 5844) | 2.65 | | | | | | | | |
| Organic Material | | | | | | | | | |
| Moisture (%) / Dispersion (%) | | | | | | | | | |
| SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1) | | | | | | | | | |
| 63.0 mm | 100 | | | | | | | | |
| 50.0 mm | 100 | | | | | | | | |
| 37.5 mm | 99 | | | | | | | | |
| 28.0 mm | 92 | | | | | | | | |
| 20.0 mm | 85 | | | | | | | | |
| 14.0 mm | 79 | | | | | | | | |
| 5.0 mm | 59 | | | | | | | | |
| 2.00 mm | 43 | | | | | | | | |
| 0.425 mm | 29 | | | | | | | | |
| 0.075 mm | 16 | | | | | | | | |
| HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3) | | | | | | | | | |
| 55 µm | 14 | | | | | | | | |
| 32 µm | 13 | | | | | | | | |
| 13 µm | 10 | | | | | | | | |
| 6 µm | 9 | | | | | | | | |
| 2 µm | 6 | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>% Clay</td> <td>9</td> </tr> <tr> <td>% Silt</td> <td>5</td> </tr> <tr> <td>% Sand</td> <td>29</td> </tr> <tr> <td>% Gravel</td> <td>57</td> </tr> </table> | | % Clay | 9 | % Silt | 5 | % Sand | 29 | % Gravel | 57 |
| % Clay | 9 | | | | | | | | |
| % Silt | 5 | | | | | | | | |
| % Sand | 29 | | | | | | | | |
| % Gravel | 57 | | | | | | | | |
| ATTERBERG LIMITS (SANS 3001:GR10) | | | | | | | | | |
| Liquid Limit | 36 | | | | | | | | |
| Plasticity Index | 12 | | | | | | | | |
| Linear Shrinkage (%) | 4.5 | | | | | | | | |
| Grading Modulus | 2.12 | | | | | | | | |
| Classification | A-2-6 (0) | | | | | | | | |
| Unified Classification | SC | | | | | | | | |
| Chart Reference | | | | | | | | | |

PROJECT : PORTION 234 OF ZEEKOEWATER 311-JS-M20-3838
 JOB No. : S20-0579
 DATE : 2020-06-24

POTENTIAL EXPANSIVENESS



PLASTICITY CHART




Note: Standard Relative Density of 2.650 was used.



HIDROMETER/S20-0579-02 F1
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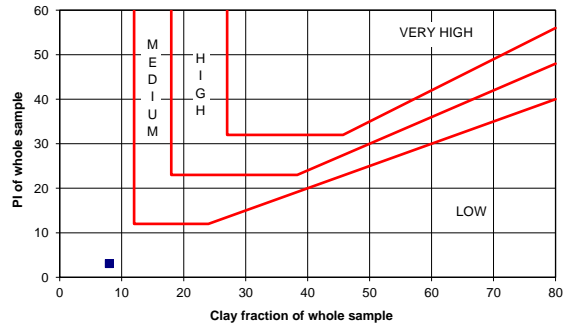
Soillab is a SANAS accredited Testing Laboratory.

PARTICLE SIZE ANALYSIS

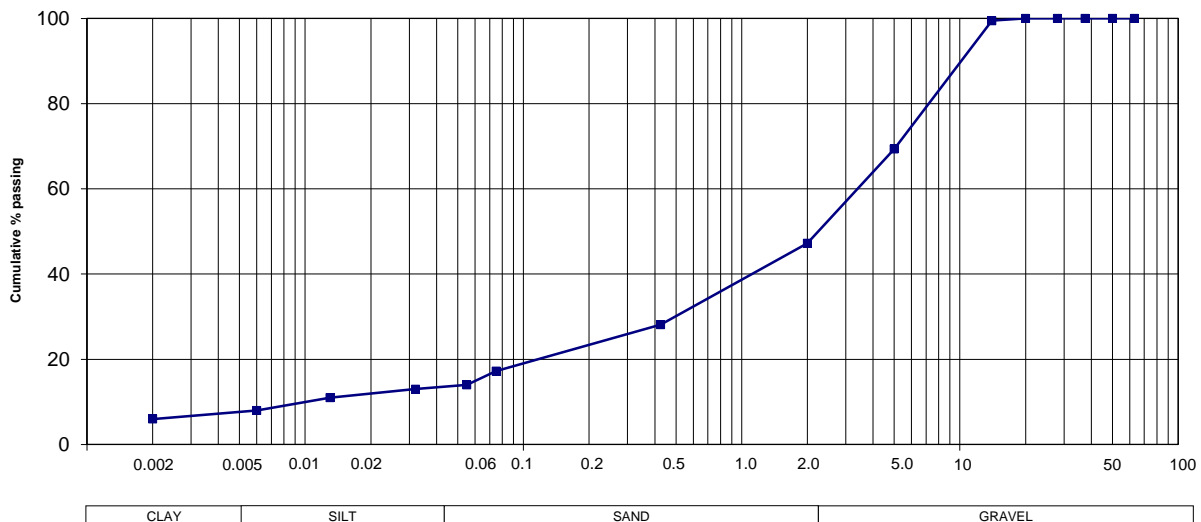
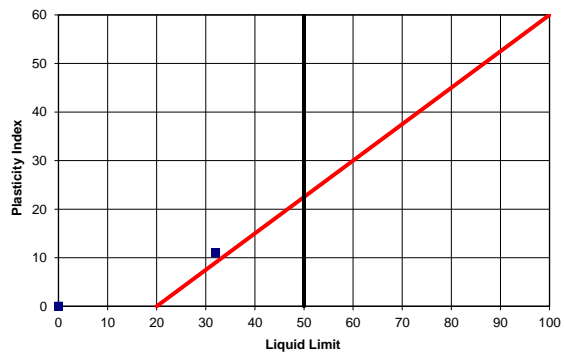
| | |
|--|---|
| Sample No. | 3 |
| Soillab Sample No. | S20-0579-03 |
| Depth (m) | 1,2 - 2,3 |
| Position | PP2 |
| Material Description | LIGHT REDDISH ORANGE SANDY GRAVEL |
| Relative density on < 2 mm (SANS 5844) | 2.65 |
| Organic Material | |
| Moisture (%) / Dispersion (%) | |
| SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1) | |
| 63.0 mm | 100 |
| 50.0 mm | 100 |
| 37.5 mm | 100 |
| 28.0 mm | 100 |
| 20.0 mm | 100 |
| 14.0 mm | 99 |
| 5.0 mm | 69 |
| 2.00 mm | 47 |
| 0.425 mm | 28 |
| 0.075 mm | 17 |
| HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3) | |
| 55 µm | 14 |
| 32 µm | 13 |
| 13 µm | 11 |
| 6 µm | 8 |
| 2 µm | 6 |
| ATTERBERG LIMITS (SANS 3001:GR10) | |
| Liquid Limit | 32 |
| Plasticity Index | 11 |
| Linear Shrinkage (%) | 4.0 |
| Grading Modulus | 2.07 |
| Classification | A-2-6 (0) |
| Unified Classification | SC |
| Chart Reference |  |

PROJECT : PORTION 234 OF ZEEKOEWATER 311-JS-M20/3838
 JOB No. : S20-0579
 DATE : 2020-06-24

POTENTIAL EXPANSIVENESS




PLASTICITY CHART



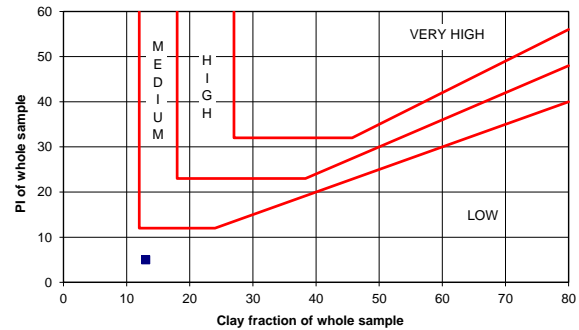
Note: Standard Relative Density of 2.650 was used.

PARTICLE SIZE ANALYSIS

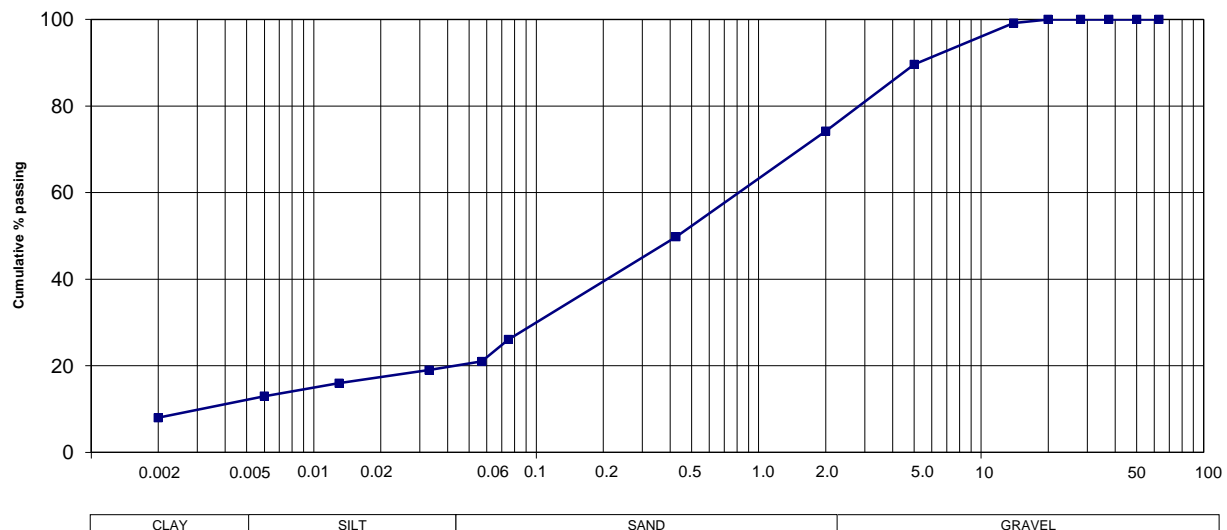
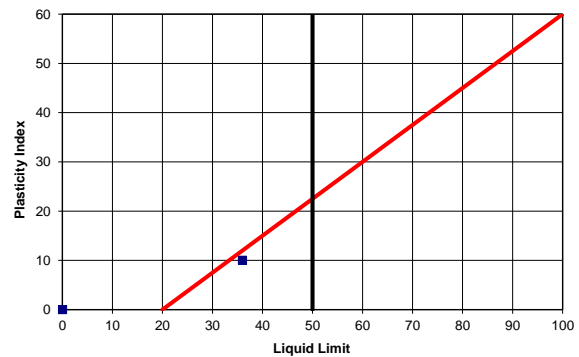
| | |
|--|---|
| Sample No. | 5 |
| Soillab Sample No. | S20-0579-05 |
| Depth (m) | 1,8 - 4,0 |
| Position | PP3 |
| Material Description | DARK YELLOW GRAVELLY SAND |
| Relative density on < 2 mm (SANS 5844) | 2.65 |
| Organic Material | |
| Moisture (%) / Dispersion (%) | |
| SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1) | |
| 63.0 mm | 100 |
| 50.0 mm | 100 |
| 37.5 mm | 100 |
| 28.0 mm | 100 |
| 20.0 mm | 100 |
| 14.0 mm | 99 |
| 5.0 mm | 90 |
| 2.00 mm | 74 |
| 0.425 mm | 50 |
| 0.075 mm | 26 |
| HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3) | |
| 57 µm | 21 |
| 33 µm | 19 |
| 13 µm | 16 |
| 6 µm | 13 |
| 2 µm | 8 |
| % Clay | 13 |
| % Silt | 8 |
| % Sand | 53 |
| % Gravel | 26 |
| ATTERBERG LIMITS (SANS 3001:GR10) | |
| Liquid Limit | 36 |
| Plasticity Index | 10 |
| Linear Shrinkage (%) | 4.0 |
| Grading Modulus | 1.50 |
| Classification | A-2-4 (0) |
| Unified Classification | SM |
| Chart Reference |  |

PROJECT : PORTION 234 OF ZEEKOEWATER 311-JS-M20/3838
 JOB No. : S20-0579
 DATE : 2020-06-24

POTENTIAL EXPANSIVENESS




PLASTICITY CHART



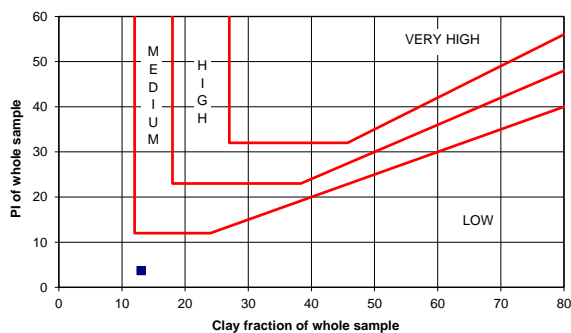
Note: Standard Relative Density of 2.650 was used.

PARTICLE SIZE ANALYSIS

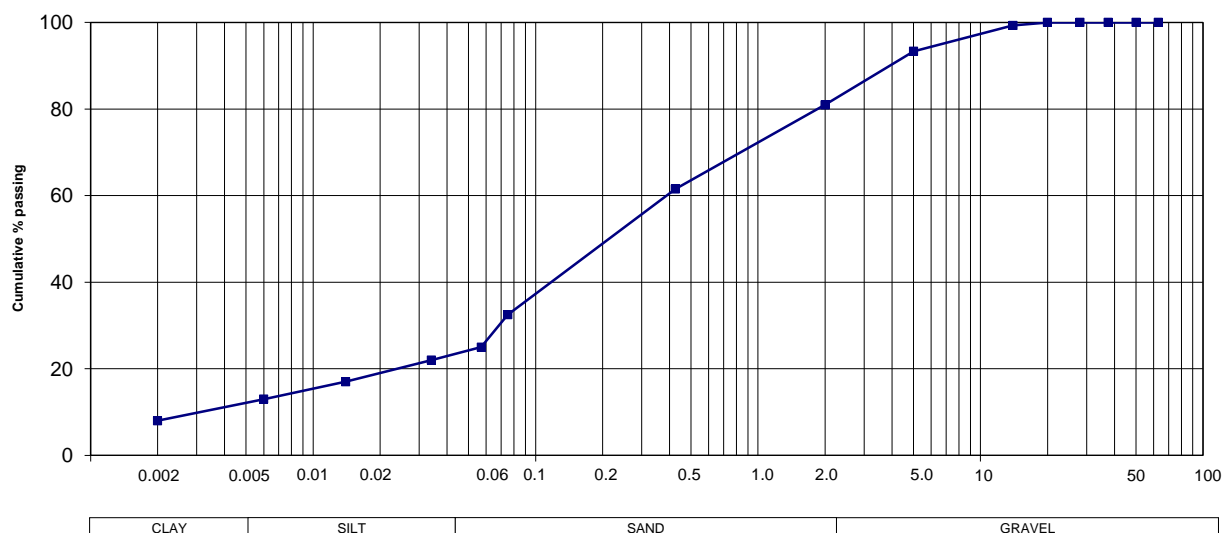
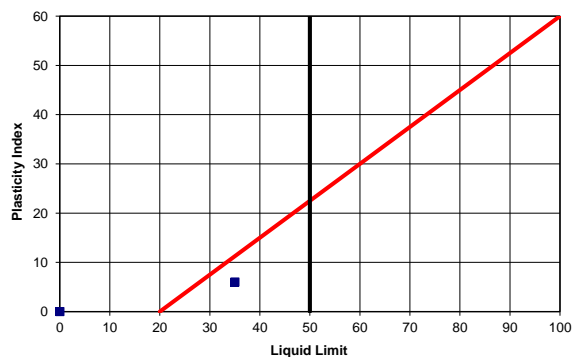
| | |
|--|---|
| Sample No. | 6 |
| Soillab Sample No. | S20-0579-06 |
| Depth (m) | 0,4 - 12, |
| Position | PP3 |
| Material Description | LIGHT REDDISH GRAVELLY SAND |
| Relative density on < 2 mm (SANS 5844) | 2.65 |
| Organic Material | |
| Moisture (%) / Dispersion (%) | |
| SCREEN ANALYSIS (% PASSING) (SANS 3001:GR1) | |
| 63.0 mm | 100 |
| 50.0 mm | 100 |
| 37.5 mm | 100 |
| 28.0 mm | 100 |
| 20.0 mm | 100 |
| 14.0 mm | 99 |
| 5.0 mm | 93 |
| 2.00 mm | 81 |
| 0.425 mm | 62 |
| 0.075 mm | 33 |
| HYDROMETER ANALYSIS (% PASSING) (SANS 3001:GR3) | |
| 57 µm | 25 |
| 34 µm | 22 |
| 14 µm | 17 |
| 6 µm | 13 |
| 2 µm | 8 |
| % Clay | 13 |
| % Silt | 12 |
| % Sand | 56 |
| % Gravel | 19 |
| ATTERBERG LIMITS (SANS 3001:GR10) | |
| Liquid Limit | 35 |
| Plasticity Index | 6 |
| Linear Shrinkage (%) | 3.0 |
| Grading Modulus | 1.25 |
| Classification | A-2-4 (0) |
| Unified Classification | SM |
| Chart Reference |  |

PROJECT : PORTION 234 OF ZEEKOEWATER 311-JS-M20/3838
 JOB No. : S20-0579
 DATE : 2020-06-24

POTENTIAL EXPANSIVENESS



PLASTICITY CHART



Note: Standard Relative Density of 2.650 was used.

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South Africa, 0040

Client: JOHANN VAN DER MERWE (PTY) LTD

Project: PORTION 234 OF ZEEKOEWATER 311-JS - M20/3838

Project No.: S20-0579

Date: 2020-06-04

pH & CONDUCTIVITY - TMH 1 A20 & A21T

| Sample No | Sample Position | Depth (m) | pH | Electrical Conductivity S/m |
|-------------|-----------------|-----------|------|-----------------------------|
| S20-0579-02 | PP1 | 0.9-1.8 | 6.23 | 0.0045 |
| S20-0579-03 | PP2 | 1.2-2.3 | 7.12 | 0.0143 |
| S20-0579-05 | PP3 | 1.8-4.0 | 5.86 | 0.0081 |
| S20-0579-06 | PP3 | 0.4-1.2 | 5.61 | 0.0068 |
| S20-0579-07 | PP2 | 1.0 | 7.19 | 0.0313 |
| | | | | |

Comments:

Note: Items marked with a star (*) is Not Accredited
Soillab is a SANAS accredited Testing Laboratory according to the Accreditation Scope



WATERLAB (Pty) Ltd

Reg. No.: 1983/009165/07 V.A.T. No.: 4130107891

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e-mail: admin@waterlab.co.za



T0391

CERTIFICATE OF ANALYSES GENERAL WATER QUALITY PARAMETERS

Date received: 2020 - 05 - 26

Date completed: 2020 - 06 – 03

Project number: 150

Report number: 91849

Order number: PTA07095

Client name: Soillab (Pty) Ltd

Contact person: Ms. C. Edwards

Address: P.O. Box 72928 Lynnwood Ridge 0040

e-mail: edwards@soillab.co.za

e-mail: Kluytse@soillab.co.za

e-mail: Mahlangut@soillab.co.za

Telephone: 012 481 3801

Facsimile: 012 481 3812

Mobile: -

| Analyses in mg/l (Unless specified otherwise) | Method Identification | Sample Identification: |
|--|--------------------------|------------------------|
| | | PP4 Zeekoewater |
| Sample Number | | 95393 |
| pH Value at 25°C | WLAB001 | 6.6 |
| Electrical Conductivity in mS/m at 25°C | WLAB002 | 37.5 |
| Total Dissolved Solids at 180°C | WLAB003 | 238 |
| Total Alkalinity as CaCO ₃ | WLAB007 | 84 |
| Calcium Hardness as CaCO ₃ | WLAB051 | 86 |
| pH Saturation (pHs) at 20°C | WLAB053 | 8.1 |
| Chloride as Cl | WLAB046 | 22 |
| Sulphate as SO ₄ | WLAB046 | 62 |
| Free & Saline Ammonia as N | WLAB046 | <0.1 |
| Ammonium as NH ₄ * | --- | <0.1 |
| Calcium as Ca | WLAB015 | 35 |
| Magnesium as Mg | WLAB015 | 6 |
| Leaching Index [LCSI] * | --- | 1 497 |
| Spalling Index [SCSI] * | --- | 7 |
| Aggressiveness Index [N] * | --- | 1 504 |

* = Not SANAS Accredited

Tests marked "Not SANAS Accredited" in this report are not included in the SANAS Schedule of Accreditation for this Laboratory.

Important notes:

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.

E. Nkabinde

Technical Signatory

The information contained in this report is relevant only to the sample/samples supplied to WATERLAB (Pty) Ltd. Any further use of the above information is not the responsibility of WATERLAB (Pty) Ltd. Except for the full report, part of this report may not be reproduced without written approval of WATERLAB (Pty) Ltd. Details of sample conducted by Waterlab (PTY) Ltd according to WLAB/Sampling Plan and Procedures/SOP are available on request.

Collapse Potential

| | |
|-----------------------|--|
| Project: | Portion 234 of Zeekoewater 311-JS - M20-3838 |
| Client: | Johann van der Merwe |
| Geolab Job Nr: | S20-0579 |
| Test Method: | TMH 6 ST10 |

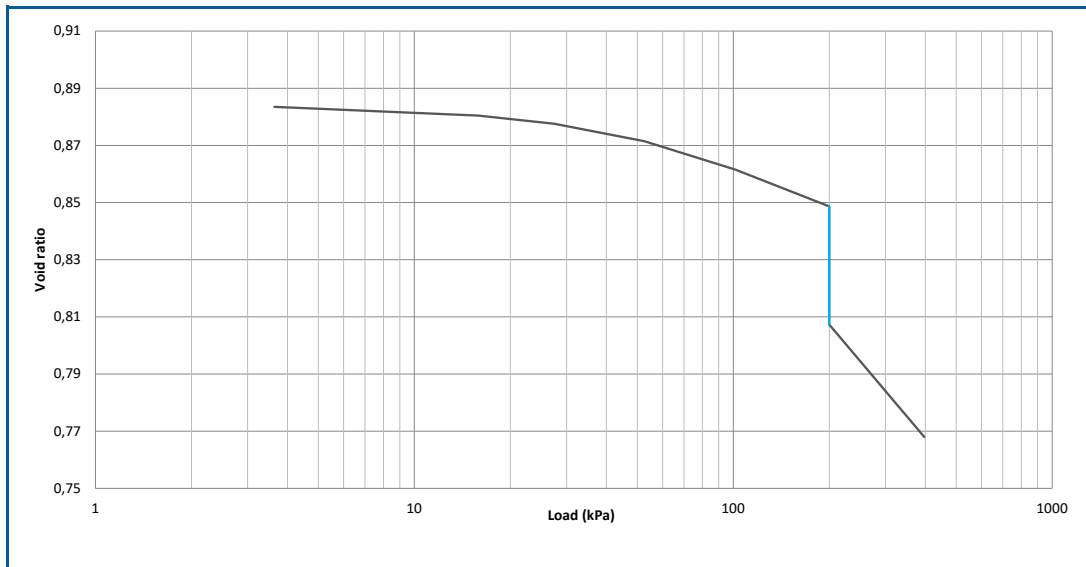
| | |
|----------------------|------------|
| Sample Nr: | PP2 |
| Sample Depth: | 1.0m |
| Date: | 2020-06-22 |

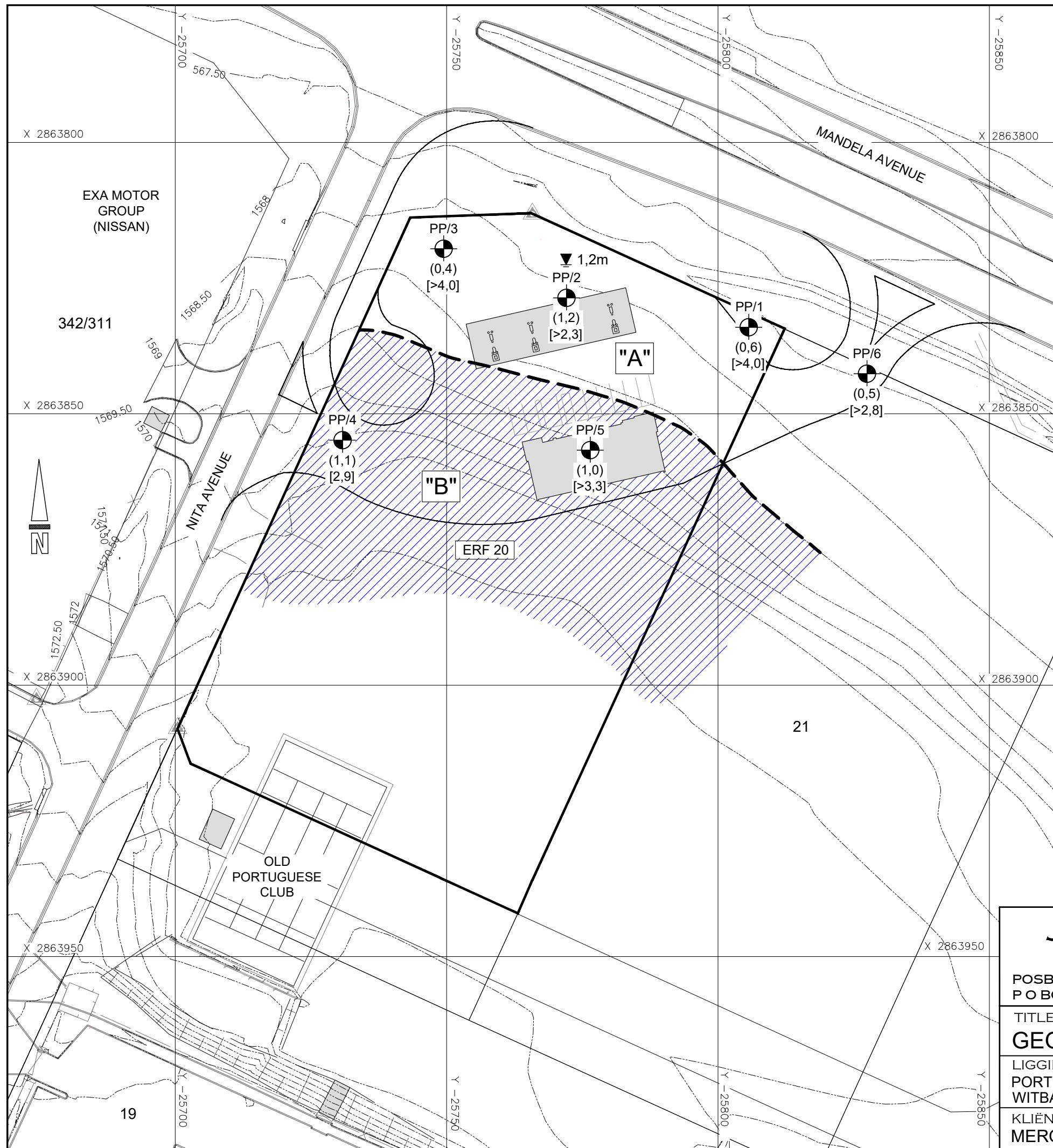
| Results | |
|----------------------------|-------|
| Collapse Potential: | 1,9 % |

| | |
|--------------------------|-------------|
| Sampling Method: | Block |
| Disturbed/Undist: | Undisturbed |
| Remoulded To: | NA |

| Load kPa | Height mm | Void Ratio |
|----------|-----------|------------|
| 3,6 | 19,7 | 0,883 |
| 15,9 | 19,668 | 0,880 |
| 27,5 | 19,638 | 0,878 |
| 52,6 | 19,574 | 0,871 |
| 101,6 | 19,47 | 0,861 |
| 199,9 | 19,336 | 0,849 |
| 199,9 | 18,904 | 0,807 |
| 397,1 | 18,492 | 0,768 |

| | Initial | Final | |
|--------------------------|---------|-------|-------------------|
| Sample Height: | 19,70 | 18,49 | mm |
| Sample Mass: | 84,8 | 108,3 | g |
| Dry Density: | 1403 | 1494 | kg/m ³ |
| Density: | 1424 | 1938 | kg/m ³ |
| Moisture Content: | 1,5 | 29,7 | % |
| Void Ratio: | 0,883 | 0,768 | |
| Specific Gravity: | 2,642 | | Mg/m ³ |





LEGEND:

- PP/1 TEST PIT BY BACKACTOR, POSITION AND NUMBER SHOWING
- THICKNESS OF POTENTIALLY COLLAPSIBLE AND COMPRESSIBLE SOIL HORIZON IN METRES
- (0,6) COMPRESSIBLE SOIL HORIZON IN METRES
- [>4,0] REFUSAL DEPTH OF BACKACTOR IN M.B.G.L.
- 1,2m DEPTH OF WATER SEEPAGE IN M.B.G.L.
- MATERIAL BOUNDARY*

| SOIL ZONE | BRIEF MATERIAL DESCRIPTION |
|------------|---|
| "A" | <p>Thin to moderate horizon (0,2m to 0,6m thick) of generally <i>medium dense to dense</i> SANDY colluvium overlying a thin to moderate horizon (0,2m to 0,4m thick) of <i>medium dense</i> GRAVELLY pebble marker over a moderate to prominent horizons (0,9m to >3,6m thick) of either generally <i>dense</i> GRAVELLY or SANDY residual felsite or a moderate horizon (0,6m thick) of <i>stiff</i> SILTY residual felsite.</p> <ul style="list-style-type: none"> ⇒ The sandy and gravelly transported soils are potentially collapsible and compressible. ⇒ All site soils in this zone are potentially "low" in potential expansiveness with a total surface heave value of <7,5mm. ⇒ Soft excavation by a backactor are foreseen to depths ranging between >2,3m and >4,0m below surface. ⇒ Stable sidewalls during investigation. ⇒ Point water seepage encountered in test pit PP/2 at a depth of 1,2m below surface. Ferricrete-rich soils indicate a possible seasonal perched water table in the wet season from surficial depths of between 0,2m and 0,6m below surface. |
| "B" | <p>Moderate horizon (1,0m to 1,1m thick) of generally <i>loose to medium dense</i> SANDY imported fill overlying a thin to moderate horizon (0,4m thick) of <i>medium dense</i> GRAVELLY pebble marker over a prominent horizon (1,8m to >1,9m thick) of generally <i>medium dense to very dense</i> SANDY residual felsite or <i>very soft rock</i> FESITE with depth.</p> <ul style="list-style-type: none"> ⇒ The sandy imported fill is potentially collapsible and compressible. ⇒ All site soils in this zone are potentially "low" in potential expansiveness with a total surface heave value of <7,5mm. ⇒ Soft excavation by a backactor are foreseen to depths ranging between 2,9m and >3,3m below surface. Very hard excavation and light blasting foreseen in the very soft rock felsite. ⇒ Stable sidewalls during investigation. ⇒ Slight ground water seepage encountered at 2,1m depth in test pit PP/4. Ferricrete-rich soils indicate a possible seasonal perched water table in the wet season from a surficial depth of 1,0m below surface. |

NOTE:

* = Soil boundaries are approximate and should be considered as a gradual change from one soil zone to the next.

Adapted from Drawing: Concept Access Layout, President Park x 6, Revision 0, issued 12/03/2020. The Copyright of EDL Consulting Engineers is recognised

JOHANN VAN DER MERWE (PTY) LTD
INGENIEURSGEOLOG / ENGINEERING GEOLOGIST

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| | |
|--|---------------------------------|
| TITLE / TITLE GEOTECHNICAL MAP | TEK / DRG NO M20/3838 |
| LIGGING / LOCALITY PORTION 234 OF THE FARM ZEEKOEWATER 311-JS, WITBANK, MPUMALANGA PROVINCE | DATUM / DATE JULY 2020 |
| KLIËNT / CLIENT MERONOX (PTY) LTD | SKAAL / SCALE ~1 : 750 ON A3 |