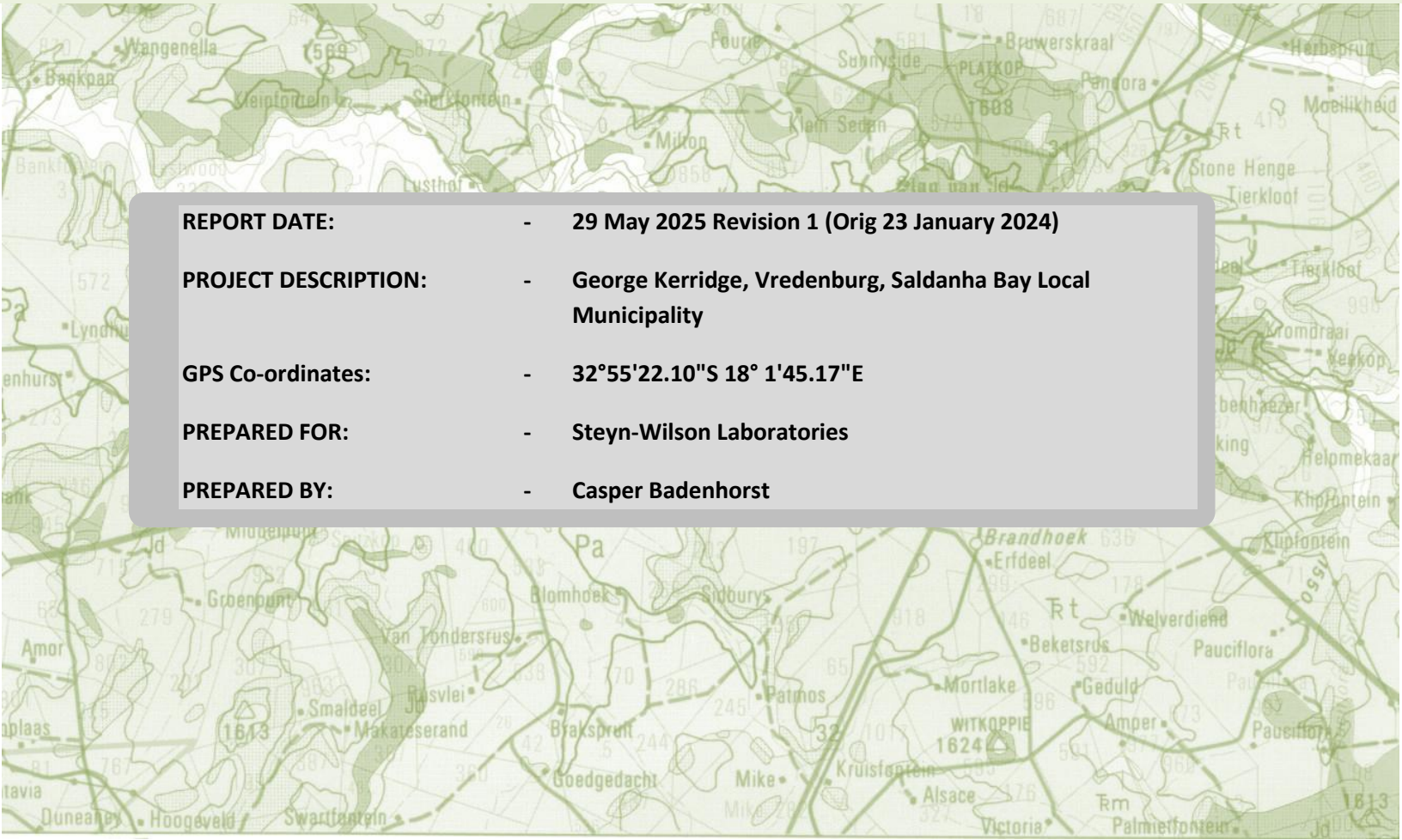
REPORT

On Geotechnical Investigation undertaken for George Kerridge, Vredenburg in the Western Cape Province

Revision 1



REPORT DATE:	-	**29 May 2025 Revision 1 (Orig 23 January 2024)**
PROJECT DESCRIPTION:	-	**George Kerridge, Vredenburg, Saldanha Bay Local Municipality**
GPS Co-ordinates:	-	**32°55'22.10"S 18° 1'45.17"E**
PREPARED FOR:	-	**Steyn-Wilson Laboratories**
PREPARED BY:	-	**Casper Badenhorst**

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EXECUTIVE SUMMARY

Casper Badenhorst was appointed by Steyn-Wilson Laboratories to compile a geotechnical engineering report based on the conditions on site and the information provided by the client. The Investigation was carried out in November 2023.

The following activities were carried out to finalise this report

- Desktop Study
- Site Visit
- Field mapping
- Soil profiling
- Laboratory testing

The coordinates of the site are 32°55'22.10"S 18° 1'45.17"E.

The area of the site is 6.98 hectares. Sixteen (16) test pits were excavated by TLB to adequately cover the study area and the soil profiles were described according to the method proposed by Jennings, Brink and Williams (1973).

Two (2) undisturbed samples were taken on site to reflect the typical materials encountered on site. Based on the consolidation test results, the materials are considered to be moderate to highly compressible. (Void Ratios of [0.519 - 0.492] and [0.448 - 0.423] between 25kPa and 100kPa).

Disturbed samples of the most prominent soil horizons were taken and submitted for indicator and CBR tests. Sixteen (16) test pits were excavated across the study area with one refusal encountered at a depth less than 1.5meters. The average depth of the test pits were 2.8 meters. Excavatability constraints may be expected for excavations exceeding 1.5meters in depth.

The geological map from the Council for Geosciences indicates that the site is underlain by sand and sandy loam of the hillocky veld (Q2) and consolidated to unconsolidated limestone and lime-rich sand with shells in places (QC) of the sediments of the Quaternary Era. The soil horizons consisted of sandy materials as recorded in the attached soil profiles included within Annexure A.

The study area is located east of Vredenburg, east of Ongegund. The study area drains well by sheetwash to the north east. The soils appear very permeable. Vredenburg is located in a moderate climatic zone of South Africa with a Weinert N-value between 2 and 5. The Western Cape Province is typically a winter rainfall region with a Mediterranean climate.

No ground water was encountered during the site investigation.

The potential expansiveness of the material encountered on the site was calculated according to the method proposed by Van der Merwe (1964). The following material characteristics are considered when applying this method:

- Clay content
- Plasticity index
- Liquid limit
- Linear shrinkage

The finding can be differentiated as follows:

Generally the materials encountered on site were sandy. The foundation indicators indicate ''low'' heave potential across the study area.

Six (6) CBR tests were done and the results varied between 11 and 33% @ 95% Mod AASHTO, reflecting medium to high bearing capacities of approximately 100 to 200 KPa. The typical materials sampled on site classified as G6 to >G9 according to the COLTO classification system.

Two pH and electrical conductivity tests were conducted which indicated pH values ranging between 6.4 and 7.6 and conductivities between 62 and 65mS/m. The materials are expected to mildly corrosive.

The following geotechnical considerations that could influence structure were identified:

Engineering properties of soils:

- The NHBRC engineering geological zoning of this site is as follows: S. The Site Classes are S2 (100%). All the site classes are indicated on the soil profiles.
- Site Class S2 – Reinforced strip foot foundations are recommended as will be decided upon by the Structural Engineer. All trenches have to be inspected by the appointed Structural Engineer before steel is placed (if required) and concrete is poured. Load bearing capacities are on the low side.
- Although none of the refusals encountered were shallow, excavation constraints may be expected in excavations exceeding 1500mm.

1. INTRODUCTION AND TERMS OF REFERENCE

Casper Badenhorst was appointed by Steyn-Wilson Laboratories to compile a materials report on George Kerridge, Vredenburg located in Saldanha Bay Local Municipality of the Western Cape Province. The site field investigation was undertaken according to the expected requirements for this project.

The following aspects were addressed in this report:

1.1 Geology and soil profiles
1.2 Geohydrology
1.3 Engineering properties of soil samples taken

The schedule of services includes trial pits (16 for this project), with material classifications (classified according to COLTO), grading analysis, Atterberg limits and potential expansiveness of the *in-situ* material. For the purpose of this study, 10 foundation indicators were sampled with 6 maximum dry density, optimum moisture content and California Bearing Ratio samples.

Table 1: Reference Summary

Description	Quantity	Relevant method or specification
Test Pits Excavated	16 test pits	As per quotation, by TLB
Field work and Sampling	10 samples	Sampled according to TMH 5 with relevance to SAICE Geotechnical Investigations Manual. No deviations were recorded.
Analysis of samples	10 samples	Subjected to analysis according to SANS 3001
Material Classifications	6 classifications	According to COLTO 1998
pH and Electrical Conductivity	2 tests	SANS 5854 and SANS 6240
Consolidation Test	2 tests	According to BS 1377 Part 5

Phase 1: Field work, which includes the excavation of 16 test pits, profiled to at least minimum 2meters deep or to shallower refusal for soil profiling and sampling purposes as part of the contract.

Phase 2: Laboratory testing to establish the characteristics of the in-situ materials on site done by **Steyn-Wilson Laboratories (Pty) Ltd.** The testing includes:

- Sieve Analysis and Grading
- Atterberg Limits
- Moisture Density Relationship and Californian Bearing Ratio
- pH and Electrical Conductivity
- Consolidation Test

Phase 3: Assessment Reporting done by **Casper Badenhorst**, which includes the following:

- Assessment of the site conditions and recommendations thereon
- Engineering properties of soils and expected geotechnical constraints

This report outlines the method of the investigation and describes the geological conditions encountered. The results of the investigation are evaluated and conclusions drawn with regard to the above objectives.

2. DESCRIPTION OF THE SITE AND ACCESS

The site is located on George Kerridge, Vredenburg located in Saldanha Bay Local Municipality in the Western Cape Province.

The site coordinates are 32°55'22.10"S 18° 1'45.17"E.

The area of the site is 6.98 hectares. Sixteen (16) test pits were excavated by TLB to adequately cover the study area and the soil profiles were described according to the method proposed by Jennings, Brink and Williams (1973).

The site location is indicated below: (Figure 1)

Figure 1: Site Location

3. INVESTIGATION PROCEDURE

3.1 Desk Study

A desk study involving the perusal of the 1:250 000 geological maps as well as a detailed geological description of the area by Brink (1979) was undertaken to establish broad geological boundaries. Geological information obtained from the Council of Geoscience is depicted in Figure 2 within section 4.1.

3.2 Field Work

The field work included the excavation of 16 test pits in order to determine the soil formations of the underlying soil and to obtain samples for possible laboratory testing.

The test pits were excavated by TLB to a depth of minimum 2meters or refusal. The test pit positions are indicated on Figure 1. The soil profiling of the 16 test pits were carried out according to the guidelines proposed by Jennings et al (1973). The profile logs of the test pits are given in **Appendix A**. Soil samples were taken from strategic horizons along the sides of the test pits for laboratory testing (**Appendix B**).

3.3 Laboratory Testing

Soil samples taken during the field work stage were submitted to the laboratory at Steyn-Wilson Laboratories (Pty) Ltd for the following testing: (as stipulated in the sub-consultant agreement)

a) Foundation Indicator Test: SANS 3001 GR1, GR10 and ASTM D422
b) Optimum Moisture Content and Maximum Dry Density Test: SANS 3001: GR20 and GR30
c) Californian Bearing Ratio of a Soil Sample: SANS 3001 GR40
d) pH and Electrical Conductivity Test: SANS 5854 and SANS 6240
e) Consolidation Test: BS 1377 Part 5

The test results are included in Appendix B at the back of the report.

4. SITE GEOLOGY AND CLIMATE

4.1 General Geology

The geological map from the Council for Geosciences indicates that the site is underlain by sand and sandy loam of the hillocky veld (Q2) and consolidated to unconsolidated limestone and lime-rich sand with shells in places (QC) of the sediments of the Quaternary Era. The soil horizons consisted of sandy materials as recorded in the attached soil profiles included within Annexure A.

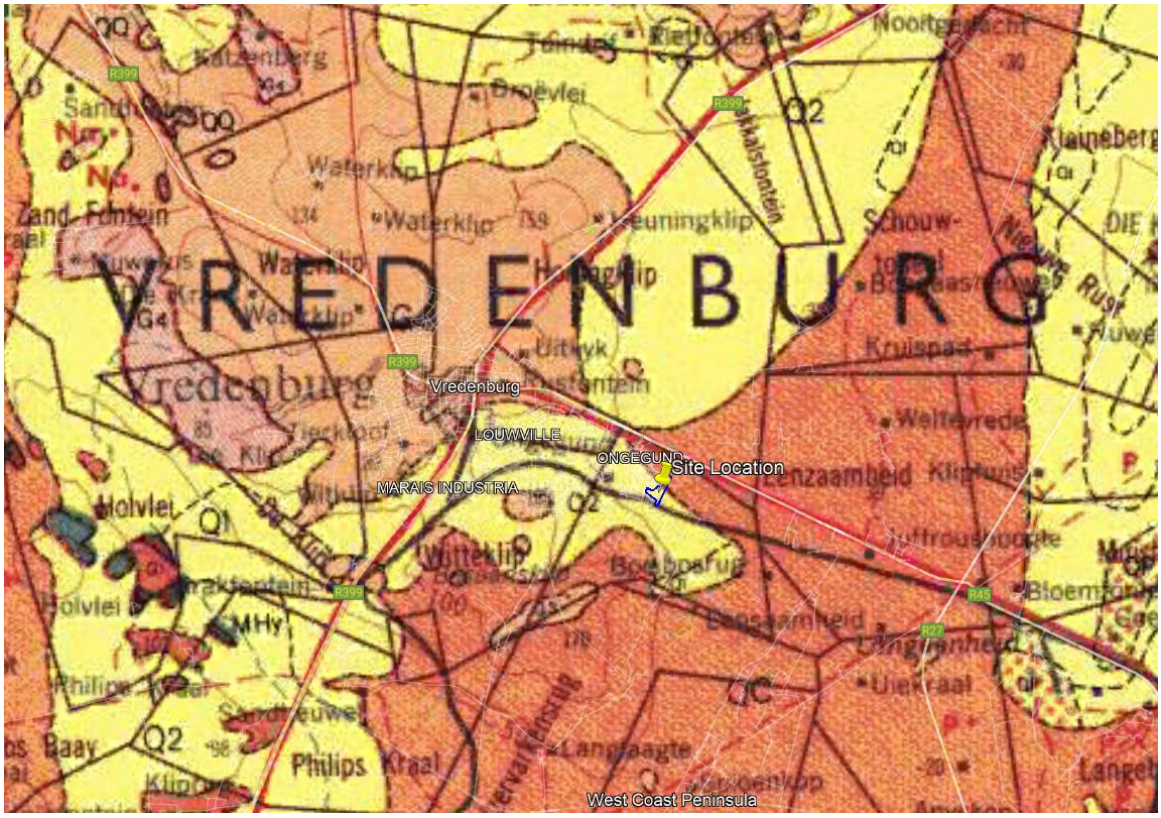

Figure 2: Geological Map of the Study Area

4.2 Topography, Drainage and Site Climate

The study area is located east of Vredenburg, east of Ongegund. The study area drains well by sheetwash to the north east. The soils appear very permeable. Vredenburg is located in a moderate climatic zone of South Africa with a Weinert N-value between 2 and 5. The Western Cape Province is typically a winter rainfall region with a Mediterranean climate.

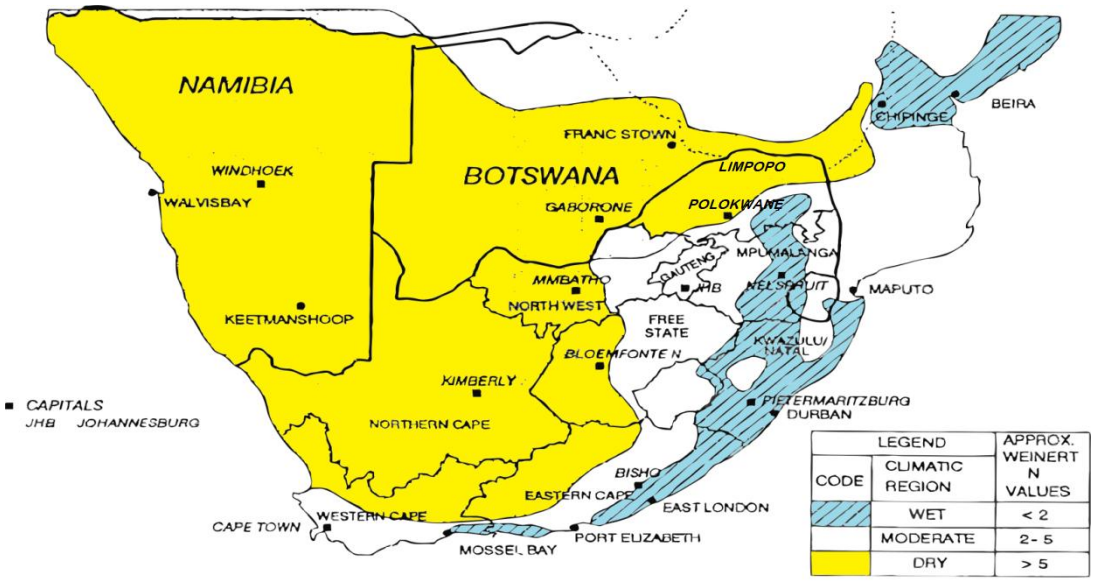

Figure 3: Macro-Climatic Regions of Southern Africa (Adapted from Weinert, 1980)

4.3 Geohydrology

Ground water was encountered deeper than 2m during the site investigation in 3 test pits.

5. SUMMARY OF LABORATORY RESULTS

Table 2: Summary of Laboratory Results

TP Nr	Clay %	Silt %	Sand %	Gravel %	PI %	CBR % @ 95%
TP1: 500-1000	3.0	3.0	95.0	0.0	NP	13.0
TP2: 500-1000	2.0	3.0	95.0	0.0	NP	
TP4: 500-1000	1.0	4.0	95.0	0.0	NP	14.0
TP5: 500-1000	1.0	5.0	94.0	0.0	NP	
TP7: 500-1000	1.0	3.0	96.0	0.0	NP	
TP8: 700-1000	1.0	10.0	70.0	19.0	NP	33.0
TP10: 500-1000	1.0	5.0	94.0	0.0	NP	
TP12: 500-1000	1.0	4.0	95.0	0.0	NP	11.0
TP14: 500-1000	4.0	6.0	90.0	0.0	NP	18.0
TP16: 500-1000	4.0	8.0	88.0	0.0	NP	16.0

The relevant engineering characteristics of the materials encountered have been evaluated by visual assessment during profiling and from the results of the field and laboratory testing; these may be summarized as follows:

5.1 Potential Expansiveness

The potential expansiveness of the materials encountered on the site was calculated according to the method proposed by Van der Merwe (1964). The following material characteristics are considered when applying this method:

- Clay content
- Plasticity index
- Liquid limit
- Linear shrinkage

The method of Van der Merwe (1964) was used to determine the potential heave of soil samples. In addition to Van der Merwe's method, the plasticity index and linear shrinkage of soil samples were used to indicate the soils potential expansiveness. From the laboratory test results the potential expansiveness of all soils on the site is as follows:

Generally the materials encountered on site were sandy. The foundation indicators indicate ''low'' heave potential across the study area.

5.2 Excavation Classification

Excavatability is defined as the ease with which the ground can be dug to a depth of 1,5m. This is of importance for urban development as increased costs are associated with installing services or foundations in areas where difficulty is experienced during the investigation stage.

Sixteen (16) test pits were excavated across the study area with one refusal encountered at a depth less than 1.5meters. The average depth of the test pits were 2.8 meters. Excavatability constraints may be expected for excavations exceeding 1.5meters in depth.

In terms of the SABS 1200 the excavations can be classified as soft to intermediate to 2meter in depth. Excavations between 2.0 and 2.5 meters are considered as intermediate. Excavations in excess of 2.5meters are considered to be intermediate to hard.

5.3 Erodibility

There were no signs of piping (erosion) visible on site.

5.4 Ground Slope Stability

No unstable geological materials that can move either gradually (creep) or suddenly as a slump or a slide are visually present.

5.5 California Bearing Ratio Tests

Six (6) CBR tests were done and the results varied between 11 and 33% @ 95% Mod AASHTO, reflecting medium to high bearing capacities of approximately 100 to 200 KPa. The typical materials sampled on site classified as G6 to >G9 according to the COLTO classification system.

5.6 pH and Conductivity Tests

Two pH and electrical conductivity tests were conducted which indicated pH values ranging between 6.4 and 7.6 and conductivities between 62 and 65mS/m. The materials are expected to mildly corrosive.

6. ENGINEERING PROPERTIES OF SOILS

The NHBRC engineering geological zoning of this site is as follows: S. The Site Classes are S2 (100%). All the site classes are indicated on the soil profiles.

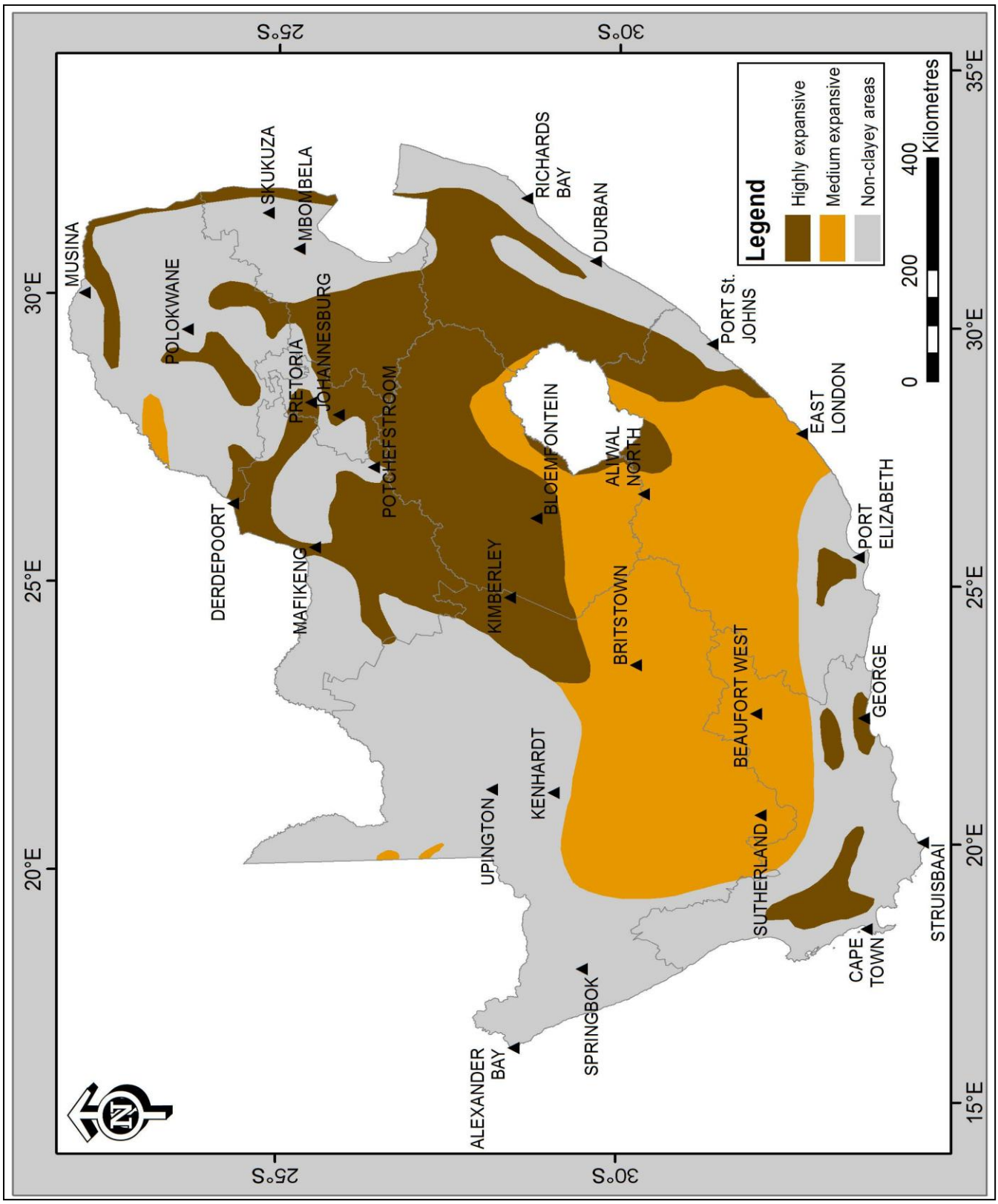

Figure 4: Regional Distribution of Expansive Clays

7. GEOTECHNICAL CONSIDERATIONS

7.1 Classification of Soils

The typical materials encountered on site were sandy. Silty alluvial materials near the surface with the material becoming more gravelly with depth. The classification of the sandy sampled (sand and sandy loam of the hillocky veld (Q2) and consolidated to unconsolidated limestone and lime-rich sand with shells in places (QC)) classified as G6 to >G9 according to the COLTO classification system.

7.2 Excavatibility

Although none of the refusals encountered were shallow, excavation constraints may be expected in excavations exceeding 800mm

7.3 Soil Classification

The materials typically encountered on site were profiled as sandy.

7.4 Ground Water

Ground water was encountered during the site investigation in only 3 test pits, all deeper than 2.0m.

7.5 Stability of Slopes and Excavations

Most sidewalls collapsed, while some remained stable. Excavations on site needs to be battered or protected to avoid injuries during construction.

8. CONCLUSION AND RECOMMENDATIONS

It is important to note that the recommendations are based primarily on the profiling of test pits and the interpolation of information between test pits. It is therefore possible that variations from the expected conditions can occur.

8.1 Classification of soils – Six (6) CBR tests were done and the results varied between 11 and 33% @ 95% Mod AASHTO, reflecting medium to high bearing capacities of approximately 100 to 200 KPa. The typical materials sampled on site classified as G6 to >G9 according to the COLTO classification system.

8.2 Excavatability - No significant problems were noted, with no refusals encountered at depths shallower than 1500mm. Excavation constraints may be expected at depths exceeding 1,5meter.

8.3 Geohydrology - Excavations are to be adequately drained should rain water fill trenches during construction or if the water tables rise.

8.4 Construction Material - The low expansive materials found on this site are suitable for floor fill purposes. Where encountered, clayey materials should be cut to spoil.

8.5 Stability of Excavations - Most sidewalls collapsed, while some remained stable. Excavations on site (especially those exceeding 1.5m in depth) needs to be battered or protected to avoid injuries during construction.

8.6 The NHBRC engineering geological zoning of this site is as follows: S. The Site Classes are S2 (100%). All the site classes are indicated on the soil profiles.

8.7 Site Class S2 – Reinforced strip foot foundations are recommended as will be decided upon by the Structural Engineer. All trenches have to be inspected by the appointed Structural Engineer before steel is placed (if required) and concrete is poured. Load bearing capacities are on the low side.

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GeorgeKerridgeRev1Report (WB)

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APPENDIX B: ***Laboratory Test Results***

APPENDIX A:

Soil Profile Sheets

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Laboratory Test Results