

**TIGANE EXTENSIONS 7 AND 8, HARTBEESFONTEIN,
KLERKSDORP MATLOSANA**

**ENGINEERING GEOLOGICAL INVESTIGATION
to DETERMINE the POTENTIAL for TOWNSHIP DEVELOPMENT
for TIGANE EXTENSIONS 7 and 8, HARTBEESFONTEIN,
on PORTIONS of the FARMS URAAN 295IP & VOGELSTRUISFONTEIN 273IP,
KLERKSDORP MATLOSANA, NORTHWEST PROVINCE.**

Georeference: 2626DC Klerksdorp

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CK 1999/65610/23

Engineering geologist:

A handwritten signature in black ink, appearing to read 'D. S. Van der Merwe', written over a horizontal line.

DAVID S. VAN DER MERWE

B.Sc. (Hons)(Enggeol.)(Pret.)

Pr. Sci. Nat. Nr. 400057/96; MSAIEG Nr. 93/154; NHBRC REG Nr. 600444.

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CK Nr. 1999/65610/23 VAT Nr. 4590237881

P O Box / Posbus 60995
KARENPARK 0118
TEL: 012 5251004
WEBFAX: 086 658 3190
e-mail: davidsvdm@webmail.co.za
CEL: 082 925 4075

CONSULTING ENVIRONMENTAL AND ENGINEERING GEOLOGISTS
RAADGEWENDE OMGEWINGS- EN INGENIEURSGEOLOË

ENGINEERING GEOLOGIST / INGENIEURSGEOLOOG:
David S. van der Merwe: Pr Sci Nat, MSAIEG.

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION CONDUCTED FOR TIGANE EXTENSIONS 7 AND 8, HARTBEEFONTEIN, KLERKSDORP MATLOSANA, NORTHWEST PROVINCE.

Executive Summary

An engineering geological investigation with reference to GFSH-2 specification was conducted for Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana, Northwest Province, with the aim to assess aspects such as geology, relief and subsoil conditions which may influence the planned development in the area. The site is underlain by quartzite, conglomerate & greywacke, of the Bothaville Formation, Platberg Group of the Ventersdorp Supergroup. Surficial deposits include quaternary hillwash covering the lithology. The mechanical properties of the soil layers were determined by means of laboratory tests performed on representative disturbed samples taken during the profiling of trial pits. The obtained site information is evaluated with regard to the development of masonry structures by the application of standard evaluation techniques. Development zonation for township development according to the NHBRC and SAIEG guidelines were done, characterizing the geotechnical conditions of the site. The site is underlain by quartzite with highly collapsible properties, with an estimated total collapse of up to 15mm measured at surface, and the majority of the site mainly classified as site class C2. Foundations will therefore require special foundation techniques such as proper compaction techniques and lightly reinforced strip footings with articulation joints at all internal and external doors and openings with light reinforcement (brickforce) in masonry, or soil replacement by an engineered fill soil raft, stiffened or cellular rafts and even piled foundations. Excavatibility may hamper the placement of some services in some areas. Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures. A concrete apron of at least 1,0m around structures are prescribed, and we recommend no gardening around structures to keep the moisture content as stable as possible. These proposed mitigation measures will be sufficient to successfully address the anticipated geotechnical problems and to ensure the sustainable development as planned.

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Extract from: THE SOUTH AFRICAN INSTITUTE OF ENGINEERING GEOLOGISTS (SAIEG), 1997.
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Site Specific Data Input Sheets

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P O Box / Posbus 60995
KARENPAK 0118
WEBFAX: 086 658 3190
e-mail: davidsvdm@webmail.co.za
CEL: 082 925 4075

CONSULTING ENVIRONMENTAL AND ENGINEERING GEOLOGISTS
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ENGINEERING GEOLOGIST / INGENIEURSGEoloog:
David S. van der Merwe: Pr Sci Nat, MSAIEG.

REPORT ON THE ENGINEERING GEOLOGICAL INVESTIGATION CONDUCTED FOR TIGANE EXTENSIONS 7 AND 8, HARTBEEFONTEIN, NORTHWEST PROVINCE.

1. INTRODUCTION AND TERMS OF REFERENCE

On request of Mr Koot Raubenheimer of Maxim Planning Solutions in Klerksdorp, an engineering geological investigation was conducted for Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana, Northwest Province, and communication between us and the abovementioned parties lead to the field work, commencing on 3 September 2019.

The aim of this investigation was to identify and evaluate any possible engineering geological problems before township proclamation.

This report is based on the in-situ evaluation of all the representative soil horizons within the ground profile, visual results of the site visit and other relative exposed geotechnical properties on site and derived from interpretation of laboratory results.

The proposed development site of 174 ha is for Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana, on a portion of the remaining portion of the farm Uraan 295IP and a portion of the remaining portion of the farm Vogelstruisfontein 273IP, located north of Tigane & Hartbeesfontein. Figures 1-6 in Appendix A delineates the site.

2. INFORMATION USED IN THE STUDY

The following was consulted during the investigation:

- 2.1 The geological map 2626 West Rand. Scale 1:250 000. The Geological Survey of South Africa.
- 2.2 The topography map 2626C Klerksdorp Chief Directorate: Surveys and Land Information, Mowbray.

3. SITE DESCRIPTION

3.1 PHYSIOGRAPHY

3.1.1 Topography

The site is located on a shallow to moderate northwestern slope towards the drainage feature on site.

3.1.2 Climate

The region is characterized by summer rainfall with thunderstorms, with annual low rainfall figures of 625 mm (Potchefstroom - Agriculture), recorded at the closest weather station to the site. Winters are dry with frost common. The warmest months are normally December and January and the coldest months are June and July.

An analysis of the data confirms a Weinert's N-Value in the order of 2,4 for Klerksdorp. The chemical decomposition of rocks will therefore be dominant over mechanical disintegration, and deep soil horizons will be expected in areas of poor drainage, underlain by igneous rocks. Storm water drainage and road pavement design must incorporate the climatic extremes above.

3.1.3 Vegetation

The area is typically characterized by sourish mixed bushveld *veld type* (Acocks, 1988).

The site itself is covered by sparse grasslands of which some was used as agriculture

land, and few indigenous thorn trees are present on site within the stands.

4. NATURE OF INVESTIGATION

4.1 SITE INVESTIGATION

All available information was studied before and during the site visit.

The investigation commenced with a desk study, where all relevant information is collected and compiled on a base map. The site was divided into land forms, after which the accuracy of the information was checked by means of a field visit.

Test pits were dug and representative disturbed samples were collected and tested. The position of the test pits are represented in FIGURE 5 (Appendix A). The soil profiles were described according to the methods described by Jennings *et al* (Jennings 1973). This method describes each horizon in terms of moisture content, colour, consistency, structure, type of soil and origin of the soil.

Disturbed samples of the soil materials were taken for laboratory analysis. The gradings of the soils were determined by sieve and hydrometer analysis, resulting in cumulative grading curves.

The mechanical properties of the soil material are described in terms of the liquid limit and plasticity index (determined by means of the Atterberg Limit tests) and the linear shrinkage. These values can be used to calculate the potential expansiveness of the soils, and to evaluate the materials for use as construction material. The consistency of a soil is described by means of its Atterberg limits, where the effect of a change in the moisture content on the consistency of a cohesive soil is measured. According to Cernica (1982) these tests are useful "mostly for soil identification and classification". It can also be used to determine the mechanical properties of cohesive soil material. Note that cohesionless soils (i.e. sandy material) cannot be tested for plasticity or collapse potential as this material does not contain enough fines to exhibit consistency. The taking of undisturbed samples was not possible due to disintegration.

The linear shrinkage test to determine the percentage shrinkage that can be expected, is performed by wetting a soil to approximately its liquid limit and drying the resultant paste in a linear shrinkage mould.

The potential expansiveness of a soil depends upon its clay content, the type of clay mineral, its chemical composition and mechanical character. A material is potentially expansive if it exhibits the following properties (Kantey and Brink, 1952):

- clay content greater than 12 percent,
- plasticity index of more than 12,
- liquid limit of more than 30 percent, and
- linear shrinkage of more than 8 percent.

The potential expansiveness (low, medium, high, very high) is calculated by means of Van der Merwe's method (Van der Merwe, 1964), where the equivalent plasticity index versus the clay content of the material is plotted on a graph divided into heave categories. If any sample in the study area classifies as potentially expansive, the amount of heave or mobilization in mm measured on the surface will be calculated.

4.2 LABORATORY TESTS

Sampling was reduced according to the limited variability of the geotechnical character and simplicity of the entire sites as well as accessibility to the almost totally built up area comprising double and single story upmarket houses with associated infrastructure.

No consolidometer or potential collapse tests were done as it was impossible to secure any undisturbed soil sample required for these tests.

No soil chemistry samples were tested as all new developments use synthetic pipes not reactive to soil aggressiveness.

The disturbed samples taken during the investigation were tested by the accredited laboratory of Specialised Testing Laboratory in Pretoria to determine their physical properties.

Indicator tests include a grading analyses, the determination of Atterberg limits and linear shrinkage.

The results are represented in Appendix C.

5. SITE GEOLOGY AND GROUNDWATER CONDITIONS

5.1 Geology

The area is underlain by quartzite, conglomerate & greywacke, of the Bothaville Formation, Platberg Group of the Ventersdorp Supergroup. Surficial deposits on site include quaternary ferricrete and hillwash, covering the lithology.

No dolomite occurs in the area and no stability investigation is required.

5.2 Groundwater Conditions

Plate flow is the dominant drainage pattern on site, and the site is drained in a northern direction towards the Buisfontein Spruit, and the east wards towards the Schoon Spruit east of the site.

The permanent or perched water table on site is deeper than 1,5m below ground surface. Slow percolation of water within the clay is expected.

6. GEOTECHNICAL EVALUATION

6.1 ENGINEERING AND MATERIAL CHARACTERISTICS

6.1.1 SOIL PROFILES

All terrain land forms or mapping units were extensively sampled and more than adequate representative characterization of each unit took place.

The soil profiles with accompanied plates are represented in Appendix B.

Typical profile

Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand. Hillwash.

End of hole in medium, well rounded, quartzite pebbles and sometimes ferricrete nodules. Pedogenetic / Pebble marker.

Dry, white, dense, intact, sand with quartzite gravel. Slightly weathered quartzite.

Refusal of TLB on sandy gravel of slightly weathered quartzite pebbles or core stones or slightly weathered quartzite.

Although some problems regarding excavatability can be expected on the site, the competent TLB refused in a few test pits with an average depth of 2,03m reached, generally ranging from 1,5 to 2,7m in refusal depth. Shallow rock and rock outcrop were noted and quartzite core stones are expected that can cause differential settlement, and it will also increase development cost as pneumatic tools and even blasting may be required to reach installation depths for services in some places.

To ensure the stability of excavations, it will need standard sidewall protection in all excavations exceeding 1,5m.

6.1.2 LABORATORY RESULTS

Sampling took place according to the limited variability of the geotechnical character according to the land forms and simplicity of the entire site. All terrain land forms or mapping units were extensively sampled with more than adequate representative characterization of each identified zone or unit.

No consolidometer or potential collapse tests were done as it was impossible to secure any undisturbed soil sample required for these tests.

The low clay percentages tested between 3 to 18% with plasticity indexes ranging from slightly plastic up to 11, with liquid limits from not determined up to 24% and linear shrinkage percentages between 0 and 5%.

The PRA classification was mainly A-4 (8 samples) as low compressible silt to A-2-4 (9 samples) as sand and gravel with low plasticity silt fines. According to the Unified System it was classified as mainly SC-SM (14 samples): clayey silty sand or poorly graded sand silt clay mixtures.

The material tested low in expansive potential (all 19 samples) according to the method of heave estimation of Van der Merwe with no expected heave measured at surface in all the test pits.

Special foundation techniques and construction methods will be required for development on the site.

Due to the level of development within the area, the likelihood for the development of borrow pits on the site is low. All road building and construction materials will be sourced from established commercial activities in and around Klerksdorp.

6.2 SLOPE STABILITY AND EROSION

The potential for lateral soil movement or erosion is medium to high, and the sandy hillwash may be washed away during thunderstorms, although the relative flat topography prevents this from reaching problematic status.

Except for local slope instability within opened trenches and the collapse of pit side walls, no other slope instability is expected within these areas.

6.3 EXCAVATION CLASSIFICATION WITH RESPECT TO SERVICES

The excavation characteristics of the different soil horizons encountered have been evaluated according to the South African Bureau of Standards standardized excavation classification for earthworks (SABS – 1200D) and earthworks (small works – SABS 1200DA). In terms of this classification and the in-situ soil/rock consistencies as profiled, the relationships given below are generally applicable:

1. “soft excavation” - very loose/very soft through to dense or stiff.
2. “intermediate excavation” - very dense/very stiff through to very soft rock.
3. “hard excavation” - soft rock or better

Problems regarding excavatability can be expected on small portions of the site, with some sub outcrop or shallow quartzite rock and quartzite rock outcrop areas that classified as hard rock excavation.

The upper hillwash comprising of sand is relatively easily excavated by hand, and it was classified as soft in restricted and non-restricted excavation (SANS 1200 D).

To ensure the stability of excavations, it will need standard sidewall protection in all excavations exceeding 1,5m.

6.4 IMPACT OF THE GEOTECHNICAL CHARACTER OF THE SITE ON HOUSING DEVELOPMENTS

During the engineering geological investigation it is essential to determine and quantify the extent of potential problems associated with the area (addressed in **bold** below), before proper township proclamation. The ideal conditions for urban development may be listed as follows:

- * A smooth surface gradient with slopes less than 12°. Accessibility should not be restricted by topography (plateau areas).
- * No potential for slope instability features - landslides, mud flows.
- * **Easy excavation** for foundations and installation of services (normal depth of 1,5 m required).
- * Foundations above the ground water level or perched water table, with not too low permeability.
- * Development above the 1:50 year flood line.
- * Adequate surface and subsurface drainage conditions, with minimal erosion potential.
- * No presence of problematic soils, for example heaving clays, compressible clays, sand with a **collapse potential**, or dispersive soils, that will require expensive remedial measures.
- * No potential for surface subsidence due to the presence of dolomite (sinkholes) or undermining.
- * No damaging differential subsidence or movement (less than 5mm total movement at the surface allowed).
- * The site should be placed away from potential pollutants such as waste disposal sites.

6.4.1 EVALUATION FOR URBAN DEVELOPMENT

The presence of ferricrete indicates that perennial fluctuations of ground water will be encountered on site, proving that a seasonal perched water table may exist.

Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures. A concrete apron of at least 1,0m around structures are prescribed, and we recommend no gardening around structures to keep the moisture content as stable as possible.

The sites contain moderately to highly collapsible soil, and foundations may need special treatment to withstand movement associated with the variation in moisture content of the soil.

Some problems regarding excavatability can be expected on the site reflected in the R classification of the zone due to the presence of quartzite.

Retaining walls as well as slope stabilization measures are recommended on all constructed embankments exceeding 1,5m.

Mining activities in the areas and a history of mining and possibly contaminated land were not identified on the site. The site itself is located a distance from any active mining operations and in an inactive area regarding seismic activity.

Storm water diversion measures such as ponding pools are recommended to control peak flows during thunderstorms. Drainage systems along the existing roads from town should be well maintained.

All embankments must be adequately compacted and planted with grass to stop excessive erosion and scouring of the landscape.

7. SITE CLASSIFICATION

By grouping together all the land facets with the same geotechnical characteristics, the site can be divided into development zones, this being the main objective or result of a phase 1 engineering geological investigation. Each zone can therefore be defined as a grouping of areas with specific geotechnical properties placing similar constraints upon development. With the above-mentioned criteria in mind, the study area can be divided into typical development zones for residential development (SAICE, SAIEG & NHBRC, 1995):

Land suitable for development: Standard foundation techniques and normal construction with normal site drainage and standard building practice will be adequate for development.

Land suitable for development with precaution or risk: A few precautionary

measures for problematic soils in this zone are necessary before urban development can be initiated, with a higher than normal cost implication to overcome geotechnical constraints. The risk of restricted excavatability for the placing of services induces a higher cost for development.

Land not suitable for development typically comprises of the drainage features that are susceptible to annual flooding below the 1:50 year flood line, and is also associated with perched water tables. Land in close proximity of unstable ground such as a potential slope failure or mud flow induced by rainfall is also not suitable for development.

On account of the field observations, laboratory results, previous experience and engineering properties of the soil, it is zoned as follows (SAIEG,1997- See tabular explanation of classification in Appendix D):

7.1 ENGINEERING GEOLOGICAL ZONATION

Modified Normal to Special Development:

Site Class C2/2A:

Hillwash comprising orange to dark reddish brown silty clayey sand sometimes with fine gravel represents a medium to highly collapsible soil, with thickness in excess of 0,75m, and an expected range of up to 15mm of total soil movement measured at surface, form this zone on site. Foundations will therefore require modified normal foundation techniques such as lightly reinforced strip footings or reinforced boxed steel in slightly widened strip foundations, the use of split construction techniques or articulation joints at all internal and external doors and openings with light reinforcement (brickforce) in masonry, or soil replacement by an engineered fill soil raft with a COLTO classification of G5 or better, by removing all or part of the expansive horizon to 1,0m beyond the perimeter of the structure and replacing with inert backfill, compacted to 93%MOD ASSHTO density at or near optimum moisture content, where after normal strip footing foundations can be used. Site drainage, a concrete apron of 1,0m around all structures and plumbing and service precautions are advised. It is classified as C2 in terms of the NHBRC guidelines (1995) or the SAICE Code of practice (1995) and 2A after the classification for urban development (Partridge, Wood & Brink).

Suitable for development with precaution

Site Class PR:

Quartzite rock outcrop and sub-outcrop will restrict excavatability required during service installation as well as foundation excavations. Blasting or difficult excavation operations will dramatically increase the development cost in this zone.

Site Class PQ:

Areas where small quarries or filling or dumping of spoil were identified must be rehabilitated before any construction can be allowed, and backfilling with an engineer's material with a COLTO classification of G5 or better may improve the developability of these zones, but these operations will dramatically

increase the development cost in this zone.

Undevelopable:

Site Class PD/PDM:

Perennial drainage features where the 1:100 year flood line will determine or specify the allowable distance of development from rivers, usually at least 32m from the center of the river (PD), with adjacent areas subject to perennial wetness where seasonal marshy conditions may be encountered (PDM).

8. FOUNDATION RECOMMENDATIONS AND SOLUTIONS

8.1 Consolidation or collapse settlement

Site Class C (Estimated total Settlement of less than 5mm):

Normal Construction:

Minor collapse settlement requires normal construction (strip footing and slab on the ground) with compaction in foundation trenches and good site drainage.

Site Class C1 (Estimated total Settlement of between 5 and 10mm):

Modified normal construction:

Reinforced strip footing and slab on the ground.
 Articulation joints at some internal and all external doors and openings.
 Light reinforcement in masonry.
 Site drainage and service/plumbing precautions recommended.
 Foundation pressure not to exceed 50 kPa (single storey buildings).

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 light reinforcement in strip foundation and masonry.

Deep strip foundations

Normal construction with drainage precaution.
 Founding on a competent horizon below problem horizon.

Soil Raft

Remove in situ material to 1,0m beyond perimeter of building to a depth and width of 1,5 times the widest foundation or to a competent horizon and replace with material compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content.
 Normal construction with lightly reinforced strip footings and masonry.

Site Class C2 (Estimated total Settlement of more than 10mm):

Stiffened strip footings, stiffened or cellular raft

Stiffened strip footings or stiffened or cellular raft with articulation joints or solid lightly reinforced masonry
 Bearing pressure not to exceed 50 kPa.
 Fabric pressure not to exceed 50 kPa.
 Site drainage and service/plumbing precautions.

Deep strip foundations

See C1

Compaction of in situ soils below individual footings

See C1

Piled or pier foundations

Reinforced concrete ground beams or solid slabs on piled or pier foundations.

Ground slabs with fabric reinforcement.

Good site drainage.

Soil Raft

See C1

9. DRAINAGE

The site is located on a shallow to moderate slope in a northern direction towards the Buisfontein Spruit, and the eastwards towards the Schoon Spruit east of the site.

Plate flow is the dominant drainage pattern on the site, and a prominent drainage feature or channel intersects the site towards the northwestern portion.

The drainage systems from culverts for the roads should be incorporated within the roads.

Seepage and the presence of perennial fluctuations of ground water were encountered on site, proving that a seasonal perched water table may exist. A ferruginised profile or ferricrete indicates that some perennial water level fluctuations may occur.

Ground water in the form of seepage was not intersected in any test pit during the investigation, but normal water tightening techniques such as damp course on foundation levels are required.

The expected high permeability of the sand will increase the possibility that leachate from sanitation systems to reach the ground water along the quartzite bedrock, and a closed water borne sewage system is recommended as the high percolation rate through this material may result in leachate reaching and polluting water systems. There is also a good possibility that unstable side walls of pits may cave in.

The depth of excavation also restricts the use of open pit latrines on the site in certain areas.

Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures. A concrete apron of at least 1,0m around structures are prescribed, and we recommend no gardening around structures to keep the moisture content as stable as possible.

Storm water diversion measures such as ponding pools are recommended to control peak flows during thunderstorms.

All embankments must be adequately compacted and planted with grass to stop any excessive erosion and scouring of the landscape.

10. CONCLUSIONS

1. The proposed development of Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana, about 174 ha in size was investigated to determine the engineering geological properties that will influence the planned township development.
2. The area is underlain by quartzite, conglomerate & greywacke, of the Bothaville Formation, Platberg Group of the Ventersdorp Supergroup. Surficial deposits include quaternary calcrete and colluvium, covering the lithology on site.
3. Some problems are foreseen regarding the excavatability to 1,5m depth on portions of the site.
4. Special care must be taken to ensure adequate surface drainage to prevent the accumulation of water next to structures. A concrete apron of at least 1,0m around structures are prescribed, and we recommend no gardening around structures to keep the moisture content as stable as possible.
5. Zoning of the site revealed zones with constraints regarding the **compressibility, as well as the expansive properties** of the soil, and **shallow rock and core stones** may hamper the placement of services.

6. The following Zones were identified:

Modified Normal to Special Development:

Site Class C2/2A: Hillwash comprising orange to dark reddish brown silty clayey sand sometimes with fine gravel represents a medium to highly collapsible soil, with thickness in excess of 0,75m, and an expected range of up to 15mm of total soil movement measured at surface, form this zone on site. Foundations will therefore require modified normal foundation techniques such as lightly reinforced strip footings or reinforced boxed steel in slightly widened strip foundations, the use of split construction techniques or articulation joints at all internal and external doors and openings with light reinforcement (brickforce) in masonry, or soil replacement by an engineered fill soil raft with a COLTO classification of G5 or better, by removing all or part of the expansive horizon to 1,0m beyond the perimeter of the structure and replacing with inert backfill, compacted to 93%MOD ASSHTO density at or near optimum moisture content, where after normal strip footing foundations can be used. Site drainage, a concrete apron of 1,0m around all structures and plumbing and service precautions are advised. It is classified as C2 in terms of the NHBRC guidelines (1995) or the SAICE Code of practice (1995) and 2A after the classification for urban development (Partridge, Wood & Brink).

Suitable for development with precaution

Site Class PR: Quartzite rock outcrop and sub-outcrop will restrict excavatability required during service installation as well as foundation excavations. Blasting or difficult excavation operations will dramatically increase the development cost in this zone.

Site Class PQ: Areas where small quarries or filling or dumping of spoil were identified must be rehabilitated before any construction can be allowed, and backfilling with an engineer's material with a COLTO classification of G5 or better may improve the developability of these zones, but these operations will dramatically increase the development cost in this zone.

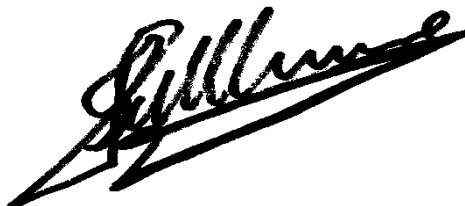
Undevelopable:

Site Class PD/PDM: Perennial drainage features where the 1:100 year flood line (PD) will determine or specify the allowable distance of development from rivers, usually at least 32m from the center of the river with areas subject to perennial wetness where seasonal marshy conditions may be encountered (PDM).

7. **Special construction** techniques must be used to enable proper development including the use of **compaction techniques with steel reinforcement** or **soil rafts** and even **piled foundations** or **stiffened or cellular rafts** as described.

8. **This investigation was done to reveal the geotechnical properties on site with the techniques as described to form our opinion. Although every possible factor during the investigation was dealt with, it is possible to encounter variable local conditions. This will require the inspection of foundations by a competent person to verify expected problems.**

Engineering geologist:

A handwritten signature in black ink, appearing to read 'D. Van der Merwe', written over a horizontal line.

DAVID S. VAN DER MERWE

B.Sc. (Hons)(Enggeol.)(Pret.)

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APPENDICES

APPENDIX A: FIGURES

- Figure 1: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Regional Locality Map.
- Figure 2: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Topography Map.
- Figure 3: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Drainage and Infrastructure Map.
- Figure 4: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Geology Map.
- Figure 5: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Engineering Geological Zone Map with Test Positions on Google Image.

APPENDIX B: SOIL PROFILES

- Soil Profiles Tabled Summary
- Soil Profile Descriptions
- Soil Profile Photographs

APPENDIX C: LABORATORY RESULTS

- Table A: Summary of Laboratory Results
- STL Summary of Results
- STL Laboratory Results

APPENDIX D: TABULAR EXPLANATION OF ZONING

Extract from: THE SOUTH AFRICAN INSTITUTE OF ENGINEERING GEOLOGISTS (SAIEG), 1997.
Guidelines for Urban Engineering Geological Investigations.

Table 1. Categories of Urban Engineering Geological Investigation

Table 2. Geotechnical Classification for Urban Development:
Partridge, Wood & Brink (1993)

Table 3. Residential Site Class Designations:
SAICE, SAIEG & NHBRC (1995)

APPENDIX E: DATA INPUT SHEETS

Site Specific Data Input Sheets

APPENDIX A: FIGURES

- Figure 1: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Regional Locality Map.
- Figure 2: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Topography Map.
- Figure 3: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Drainage and Infrastructure Map.
- Figure 4: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Geology Map.
- Figure 5: Tigane Extensions 7 and 8, Hartbeesfontein, Klerksdorp Matlosana: Engineering Geological Zone Map with Test Positions on Google Image.

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 CONSULTING ENGINEERING AND ENVIRONMENTAL GEOLOGISTS
 PO BOX 19101 BOX 19101
 WATSONIA 1510
 TEL: 011 709 1234 FAX: 011 709 1234
 EMAIL: info@geoset.co.za
 www.geoset.co.za

Engineering Geological
 David S. van der Merwe
 (Doc. No. ENG. Geol.), 17 de Aie, 1054421, 102550

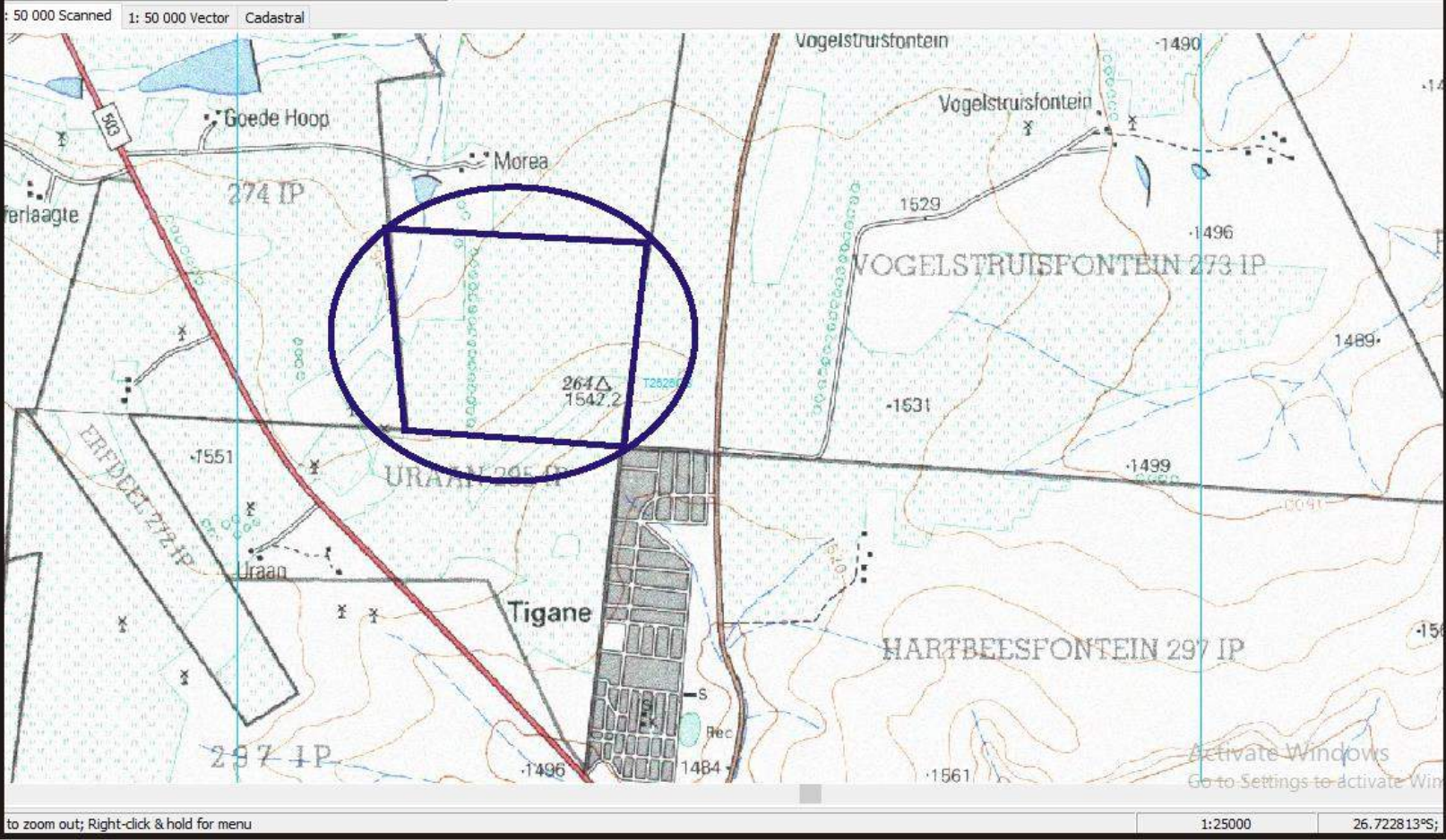
ENGINEERING GEOLOGICAL SURVEY:
 Author on plan and drafted in report
 Engineering Geological investigation to determine the suitability for
 Township Development in Tigane/Ekwaleni 7 & 8, Northwest Province.

Georeferensie: 2628DC Merkadorp
 REPOORTNUMMER: G2019007 DATED: August 2019
 Scale: App. 1:25 000
 Design & Drawn: CS

Legend:



Figure 2: Topography Map
 Tigane X7 & 8, Hartbeesfontein, Northwest Province.



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 PO BOX 6000 6000 HAREROWEN 0181
 WESFAK 086 658 1190
 TEL/FAX 071 274 0125 086 4076
 e-mail: info@geoset.co.za
 info@geoset.co.za

Engineering Geologist
David S. van der Merwe
 (Lic. No. 2007/0001, 7/00/1/01, 10/00/1/01, 10/00/1/02, 10/00/1/03)

ENGINEERING GEOLOGICAL SURVEY:
 Author on plan and detailed in report
 Engineering Geological investigation to determine the criteria for
 Township Development in Tigris/Eksteras 7 & 8, Northwest Province.

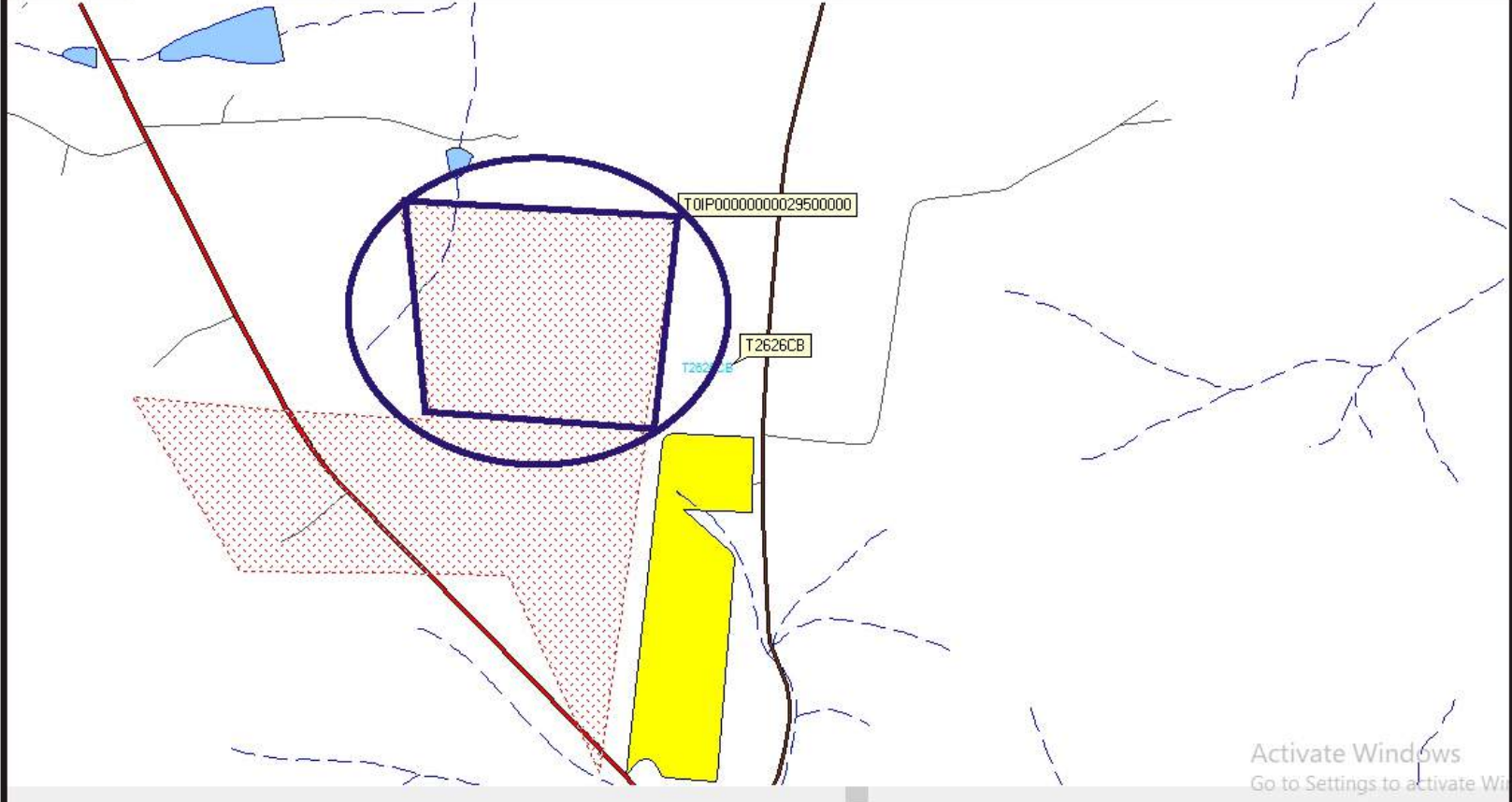
Georeferensie: 2626DC Klarksdorp
 REPORT NUMBER: G2019087 DATE: August 2019
 Scale App: 1:25 000
 Design & Drawn: CS

Legend:



Figure 3: Infrastructure & Drainage Map
 Tigris X7 & 8, Hartbeestfontein, Northwest Province.

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 RANGEWIND ENGINEERS-EN-INGENIEUR-GEOLIE
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 PO BOX 60985 HARLOWERS DRIF
 WESTFAK 018 650 3190
 TELFAK 011 274 012 558 1859
 E-MAIL: info@geoset.co.za
 www.geoset.co.za
 Ingeenieurspanning
 Engineering Geologist: **David S. van der Merwe**
 (Doc. No. 1000 1000 1000 1000)

ENGINEERING GEOLOGICAL SURVEY:
 Author on plan and described in report
 Engineering Geological investigation to determine the suitability for
 Township Development in Tigris/Ekwaleni 7 & 8, Northwest Province.
 Georeferenced: 2628DC Mankardorp
 REPORT NUMBER: G2019007 DATE: August 2019
 Scale: App. 1:25 000
 Design & Drawn: CS

Geological Legend
 The site is underlain by quartzite, conglomerate & greywacke,
 of the Bothaville Formation, Platberg Group of the
 Ventersdorp Supergroup.


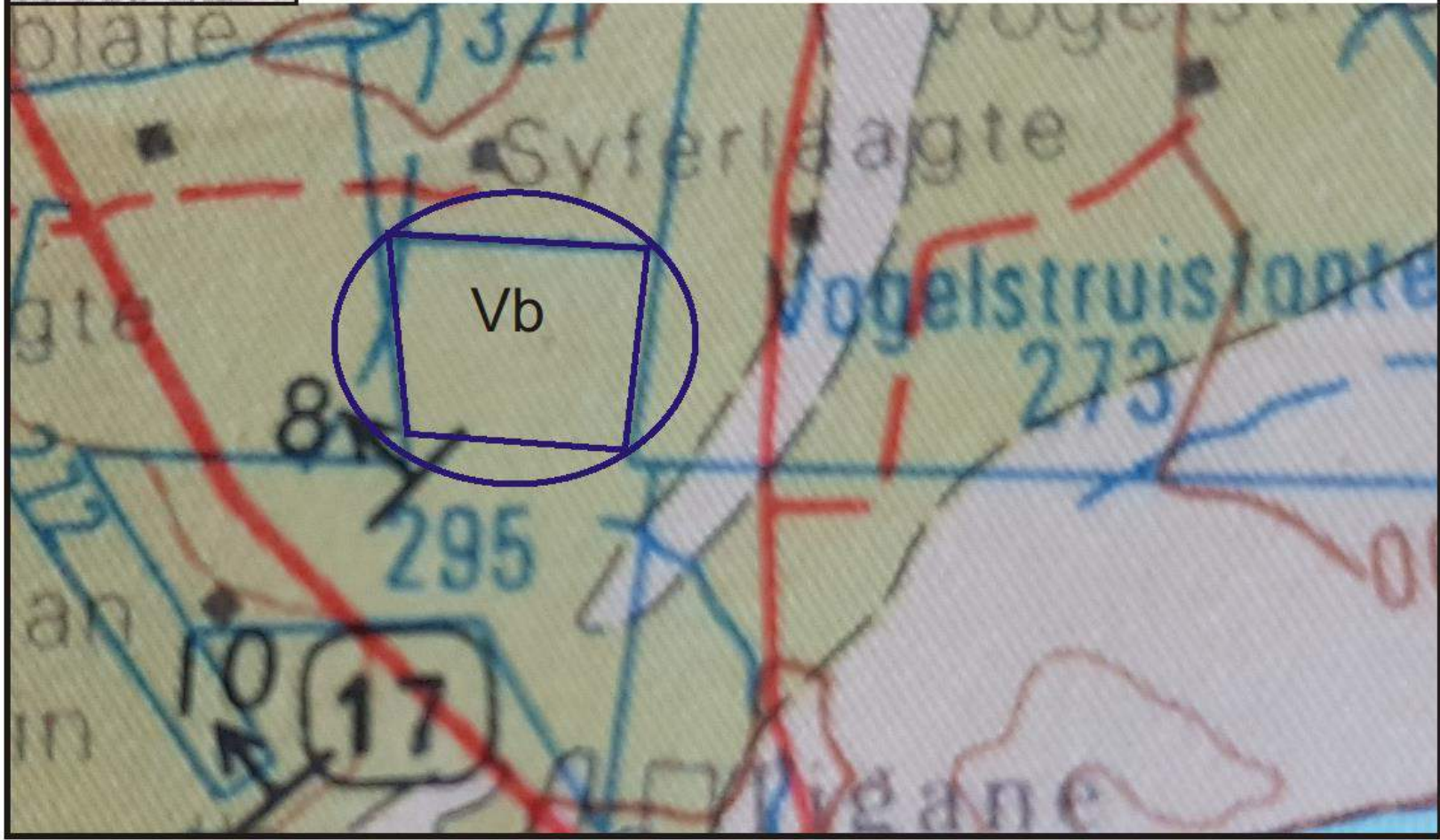
Legend:
 Border of study area

Figure 3: Geology Map
 Tigris X7 & 8, Hartbeesfontein, Northwest Province.



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 PO BOX 10118 SANDTON 2013
 TEL: (021) 201 0252
 FAX: (021) 201 0252
 www.geoset.co.za

David S. van der Merwe
 Engineering Geologist

ENGINEERING GEOLOGICAL SURVEY
 Retrospect on plan and described in report
 Engineering Geological Investigation to determine the potential for Township Development in Iganga Extensions 7 & 8, Northwest Province.
 Georeference: 262EDC Klerksdorp
 REPORT NUMBER: G6019081 DATE: August 2019
 Scale: App: 1: 25 000
 Design & Drawn: DS

Engineering Geologic at Location
Modified Normal to Special Development
Site Class C2: Fill with compaction range to dark reddish brown silty clay and sometimes with fine gravel represents a medium to highly collapsible soil, with thickness in excess of 3,0m, and an average range of up to 15mm of total soil movement measured at surface. Foundation will therefore require modified normal foundation techniques such as lightly reinforced strip footings or reinforced board steel (slightly well and strip foundations, the use of split construction techniques or articulation joints at all internal and external corners and openings with light reinforcement (brickforce) in masonry, or a replacement by an engineered fill soil with a CGLTO classification of G5 or better, by removing all or part of the uppermost horizon to 1,0m beyond the perimeter of the structure and replacing with inert backfill, compacted to 95% MOD AASH TO density at or near optimum moisture content, where after normal strip footing foundations can be used. Shallow edge, a concrete apron of 1,0m around all structures and plumbing and service procedures are advised. It is classified as C2 in terms of the NHBSC guidelines (1998) or the SAICE Code of practice (1995) and 2A after the classification for urban development (Patricky, Ward & Bekk).

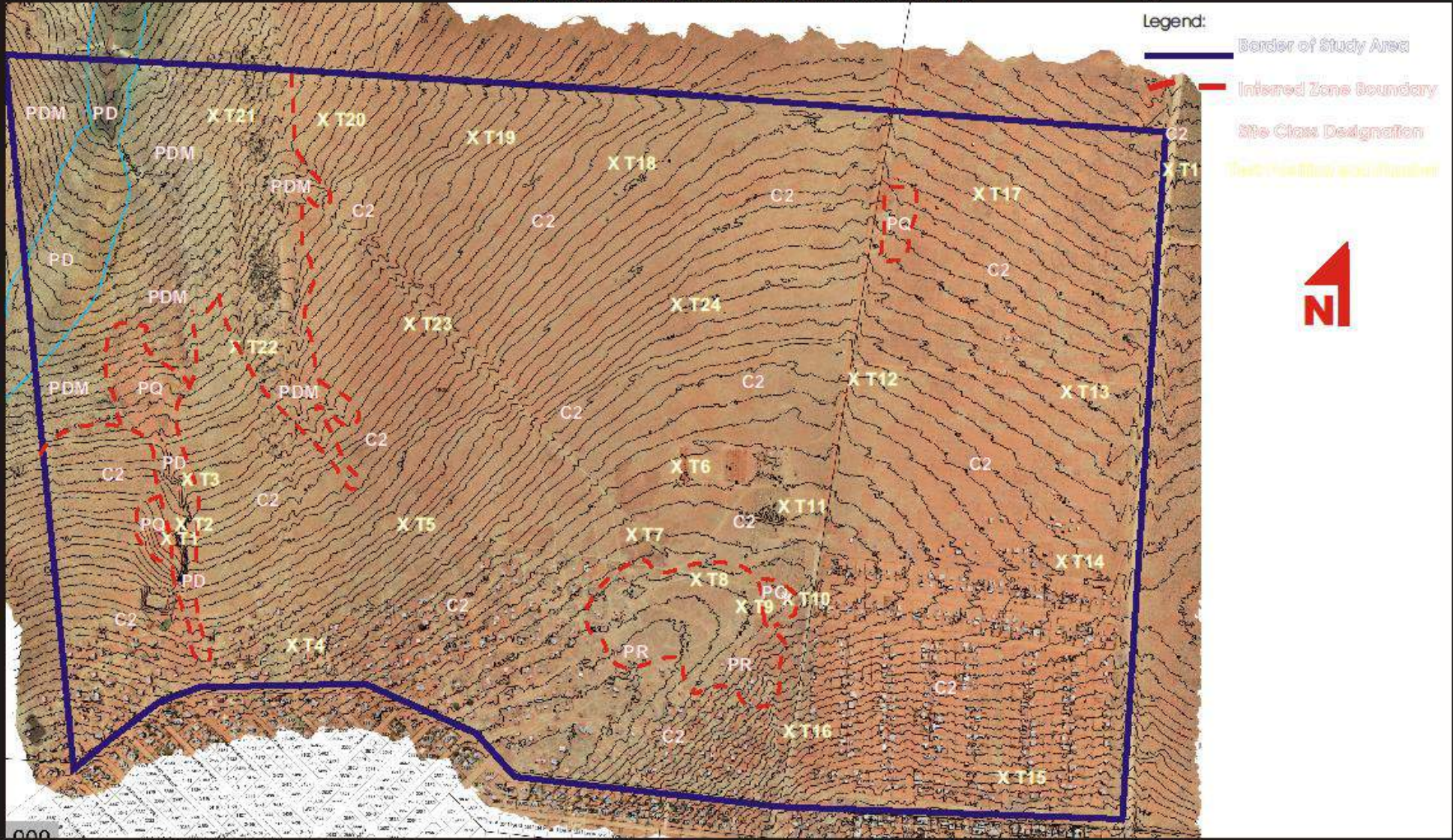
Site Class PD: Quartzite rock outcrop will restrict accessibility required during service installation as well as foundation excavations. Steeper or difficult excavation operations will result in a higher development cost in this zone.

Site Class PQ: Areas where small quantities of filling or dumping of soil were identified must be rehabilitated before any construction can be allowed, and be drilled with an engineer's input with a CGLTO classification of G5 or better may improve the soil capability of these zones, but the operations will increase the development cost in this zone.

Site Class PR: Perennial drainage features where the 1:50 year flood line (PFD) will determine or specify the allowable distance of development from rivers, usually a 5.0m from the center of the river, with the joint area subject to permeable walls so where necessary marshy conditions may be encountered (POM).

Figure 5: Engineering Geological Zone Map
 Iganga X7 & 8, Hartbeesfontein, Northwest Province.

Geological Legend
 The site is underlain by quartzite, conglomerate & greywacke, of the Bothaville Formation, Platberg Group of the Ventersdorp Supergroup.




APPENDIX B: SOIL PROFILES

Soil Profiles Tabled Summary

Soil Profile Descriptions

Soil Profile Photographs

Soil Profile Nr: T1		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 3 September 2019			
JOB NR: GS201909T			
PROJECT NAME: Tigane X 7&8			
TOWN: Hartbeesfontein			
CLIENT: Maxim: King & Associates			
TLB Contractor: Toni			
TLB Machine: CAT 424D 4X4			
TLB Operator: Abram			
P.O. Box / Posbus 60995			
KARENPAK 0118		Webfax: 086 658 3190	
e-mail: davidsvdm@w e b m a i l . c o . z a		Cell: 082 925 4075	
Engineering Geologist:		David S. van der Merwe.	
Ingenieursgeoloog:		Pr. Sci. Nat., MSAIEG.	


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :	T1-0,8	
0.8	: : : : : : :	●	
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		Dry, orange to reddish brown, very loose, open textured, clayey sand. Hillw ash.
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		

Notes:

1. Quarry.
2. No groundwater was intersected.
3. ● Disturbed sample T1-0,8m.

Lat/long	X Coord:	26° 43'41,88" S
WGS84 datum	Y Coord:	26° 24'36,53" E

Soil Profile Nr: T1


Soil Profile Nr: T2			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@w e b m a i l . c o . z a	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.

Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : : : :		
0.2	: : : : : : : : :		
0.3	: : :~:~:~:~:~:~:~:~:~		
0.4	: : :~:~:~:~:~:~:~:~:~		
0.5	: : :~:~:~:~:~:~:~:~:~		
0.6	: : :~:~:~:~:~:~:~:~:~		
0.7	: : :~:~:~:~:~:~:~:~:~		
0.8	: : :~:~:~:~:~:~:~:~:~		
0.9	: : :~:~:~:~:~:~:~:~:~		
1.0	: : :~:~:~:~:~:~:~:~:~		
1.1	: : :~:~:~:~:~:~:~:~:~		
1.2	: : :~:~:~:~:~:~:~:~:~		Dry, orange to reddish brown, very loose, open textured, clayey sand. Hillwash.
1.3	: : :~:~:~:~:~:~:~:~:~		
1.4	: : :~:~:~:~:~:~:~:~:~		
1.5	: : :~:~:~:~:~:~:~:~:~		
1.6	: : :~:~:~:~:~:~:~:~:~		
1.7	: : :~:~:~:~:~:~:~:~:~		
1.8	: : :~:~:~:~:~:~:~:~:~		
1.9	: : :~:~:~:~:~:~:~:~:~		
2.0	: : :~:~:~:~:~:~:~:~:~		
2.1	: : :~:~:~:~:~:~:~:~:~		
2.2	: : :~:~:~:~:~:~:~:~:~		
2.3	: : :~:~:~:~:~:~:~:~:~		
2.4	: : :~:~:~:~:~:~:~:~:~		
2.5	: : :~:~:~:~:~:~:~:~:~		

- Notes:
1. Deep erosion channel.
 2. No groundwater was intersected.
 3. No sample.

Lat/long	X Coord:	26° 43'42,24" S
WGS84 datum	Y Coord:	26° 24'37,29" E

Soil Profile Nr: T2

Soil Profile Nr: T3			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :	●	
0.7	: : : : : : :	T3-0,6	
0.8	: : : : : : :		
0.9	: : : : : : :		Dry, orange to reddish brown, very loose, open textured, clayey sand. Hillwash.
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		

Notes:

1. Deep erosion channel.
2. No groundwater was intersected.
3. ● Disturbed sample T3-0,6m.

Lat/long	X Coord:	26° 43'39,37" S
WGS84 datum	Y Coord:	26° 24'36,77" E

Soil Profile Nr: T3


Soil Profile Nr: T4			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.

Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :	T4-0,6	
0.6	: : : : : : :	●	
0.7	: : : : : : :		Dry, orange brown, very loose, open textured, clayey sand. Hillwash.
0.8	: : : : : : :		
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		

- Notes:
1. End of hole.
 2. No groundwater was intersected.
 3. ● Disturbed sample T4-0,6m.

Lat/long	X Coord:	26° 43'47,48" S
WGS84 datum	Y Coord:	26° 24'43,14" E

Soil Profile Nr: T4

Soil Profile Nr: T5			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KARENPAK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :	T5-0,8	
0.8	: : : : : : :	●	
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
1.2	: : : : : : :		Hillw ash.
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T5-0,8m.

Lat/long	X Coord:	26°43'41,96" S
WGS84 datum	Y Coord:	26°24'49,21" E

Soil Profile Nr: T5

Soil Profile Nr: T6		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KAREN PARK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
DATE: 3 September 2019			
JOB NR: GS201909T			
PROJECT NAME: Tigane X 7&8			
TOWN: Hartbeesfontein			
CLIENT: Maxim: King & Associates			
TLB Contractor: Toni			
TLB Machine: CAT 424D 4X4			
TLB Operator: Abram			


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :		
0.8	: : : : : : :		
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
1.2	: : : : : : :		Hillw ash.
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. No sample.
4. Cemetery.

Lat/long	X Coord:	26°43'39,33" S
WGS84 datum	Y Coord:	26°25'05,23" E

Soil Profile Nr: T6

Soil Profile Nr: T7			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@w e bmail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1			
0.2			
0.3		T7-0,4	Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
0.4		●	Hillw ash.
0.5			
0.6			
0.7			
0.8			
0.9			
1.0			
1.1			
1.2			
1.3			End of hole in medium, well rounded, quartz pebbles. Pebble marker.
1.4			
1.5			
1.6			
1.7			
1.8			
1.9			
2.0			


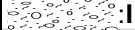
Notes:

1. Near refusal of TLB in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T7-0,4m.

Lat/long	X Coord:	26°43'42,91" S
WGS84 datum	Y Coord:	26°25'03,45" E

Soil Profile Nr: T7

Soil Profile Nr: T8			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1		I	
0.2		I	Outcrop


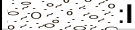
Notes:

1. Outcrop.
2. No groundwater was intersected.
3. No sample.

Lat/long	X Coord:	26° 43'44,50" S
WGS84 datum	Y Coord:	26° 25'05,66" E

Soil Profile Nr: T8

Soil Profile Nr: T9			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1		I	
0.2		I	Outcrop


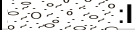
Notes:

1. Outcrop.
2. No groundwater was intersected.
3. No sample.

Lat/long	X Coord:	26° 43'46,33" S
WGS84 datum	Y Coord:	26° 25'08,40" E

Soil Profile Nr: T9

Soil Profile Nr: T10			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1		I	
0.2		I	Filling of quarry?

Notes:

1. Quarry
2. No groundwater was intersected.
3. No sample.

Lat/long	X Coord:	26° 43'45,96" S
WGS84 datum	Y Coord:	26° 25'11,18" E

Soil Profile Nr: T10

Soil Profile Nr: T11		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë P.O. Box / Posbus 60995 Tel: 012 525 1004 KAREN PARK 0118 Webfax: 086 658 3190 e-mail: davidsvdm@webmail.co.za Cell: 082 925 4075 Engineering Geologist: David S. van der Merwe. Ingenieursgeoloog: Pr. Sci. Nat., MSAIEG.	
DATE: 3 September 2019			
JOB NR: GS201909T			
PROJECT NAME: Tigane X 7&8			
TOWN: Hartbeesfontein			
CLIENT: Maxim: King & Associates			
TLB Contractor: Toni			
TLB Machine: CAT 424D 4X4			
TLB Operator: Abram			


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :		
0.8	: : : : : : :		
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
1.2	: : : : : : :		Hillw ash.
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End fo hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. Cemetery.
2. No groundwater was intersected.
3. No sample.

Lat/long	X Coord:	26°43'40,59" S
WGS84 datum	Y Coord:	26°25'10,90" E

Soil Profile Nr: T11

Soil Profile Nr: T12		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 3 September 2019			
JOB NR: GS201909T			
PROJECT NAME: Tigane X 7&8			
TOWN: Hartbeesfontein			
CLIENT: Maxim: King & Associates			
TLB Contractor: Toni			
TLB Machine: CAT 424D 4X4			
TLB Operator: Abram			
P.O. Box / Posbus 60995			
KARENPARK 0118		Webfax: 086 658 3190	
e-mail: davidsvdm@webmail.co.za		Cell: 082 925 4075	
Engineering Geologist:		David S. van der Merwe.	
Ingenieursgeoloog:		Pr. Sci. Nat., MSAIEG.	


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :	T12-0,4	Dry, orange brown, very loose, open textured, clayey sand. Hillw ash.
0.4	: : : : : : :	●	
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :		
0.8	: : : : : : :		End of hole in medium, well rounded, quartzite pebbles. Pebble marker.
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		Refusal on quartzite

Notes:

1. Refusal of TLB.
2. No groundwater was intersected.
3. ● Disturbed sample T12-0,4m.

Lat/long	X Coord:	26°43'34,41" S
WGS84 datum	Y Coord:	26°25'15,25" E

Soil Profile Nr: T12

Soil Profile Nr: T13			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :	T13-0,7	
0.7	: : : : : : :	●	
0.8	: : : : : : :		
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
1.2	: : : : : : :		Hillw ash.
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T13-0,7m.
4. Very large 0,8m in diameter boulder.
5. Loose pit walls caving in.

Lat/long	X Coord:	26°43'35,16" S
WGS84 datum	Y Coord:	26°25'27,84" E

Soil Profile Nr: T13

Soil Profile Nr: T14		 GEOSET CC Consulting Engineering & Environmental Geologists Raadgewende Ingenieurs- en Omgewingsgeoloë	
DATE: 3 September 2019			
JOB NR: GS201909T			
PROJECT NAME: Tigane X 7&8			
TOWN: Hartbeesfontein			
CLIENT: Maxim: King & Associates			
TLB Contractor: Toni			
TLB Machine: CAT 424D 4X4			
TLB Operator: Abram			
P.O. Box / Posbus 60995			
KAREN PARK 0118		Webfax: 086 658 3190	
e-mail: davidsvdm@webmail.co.za		Cell: 082 925 4075	
Engineering Geologist:		David S. van der Merwe.	
Ingenieursgeoloog:		Pr. Sci. Nat., MSAIEG.	


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
0.7	: : : : : : :	T14-0,8	Hillwash.
0.8	: : : : : : :	●	
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		Dry to slightly moist, orange to reddish brown speckled black, very loose, open textured clayey sand with ferricrete nodules. Pedogenetic.
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T14-0,8m.
4. Very loose pit walls caving in.

Lat/long	X Coord:	26°43'43,73" S
WGS84 datum	Y Coord:	26°25'27,05" E

Soil Profile Nr: T14

Soil Profile Nr: T15			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
0.7	: : : : : : :	T15-0,8	Hillwash.
0.8	: : : : : : :	●	
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		Dry to slightly moist, orange to reddish brown speckled black, very loose, open textured clayey sand with ferricrete pebbles. Pedogenetic.
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T15-0,8m.
4. Very loose pit walls caving in.

Lat/long	X Coord:	26°43'55,15" S
WGS84 datum	Y Coord:	26°25'23,82" E

Soil Profile Nr: T15

Soil Profile Nr: T16			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KARENPAK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		Dry to slightly moist, orange to reddish brown, very loose, open textured, clayey sand.
0.7	: : : : : : :	T16-0,8	Hillwash.
0.8	: : : : : : :	●	
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		Dry to slightly moist, orange to reddish brown speckled black, very loose, open textured clayey sand with ferricrete pebbles. Pedogenetic.
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T16-0,8m.
4. Very loose pit walls caving in.

Lat/long	X Coord:	26°43'52,32" S
WGS84 datum	Y Coord:	26°25'11,50" E

Soil Profile Nr: T16

Soil Profile Nr: T17			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KARENPAK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		Dry to slightly moist, orange to reddish row n, very loose, open textured, clayey sand.
0.7	: : : : : : :	T17-0,8	Hillw ash.
0.8	: : : : : : :	●	
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		Dry to slightly moist, orange to reddish row n speckled black, very loose, open texturec clayey sand w ith ferricrete pebbles. Pedogenetic.
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, w ell rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T17-0,8m.
4. Very loose pit walls caving in.

Lat/long	X Coord:	26°43'24,72" S
WGS84 datum	Y Coord:	26°25'22,90" E

Soil Profile Nr: T17

Soil Profile Nr: T18			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@w e b m a i l . c o . z a	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :	T18-0,8	Slightly moist, reddish row n, very loose, open textured, clayey sand.
0.8	: : : : : : :	●	Hillw ash.
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		Dry to slightly moist, orange to reddish row n speckled black, very loose, open textured
2.1	: : : : : : :		clayey sand w ith ferricrete pebbles. Pedogenetic.
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, w ell rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T18-0,8m.
4. Very loose pit walls caving in.

Lat/long	X Coord:	26° 43' 23,42" S
WGS84 datum	Y Coord:	26° 25' 00,85" E

Soil Profile Nr: T18

Soil Profile Nr: T19			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :	T19-0,8	Slightly moist, reddish brown, very loose, open textured, clayey sand.
0.8	: : : : : : :	●	Hillw ash.
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		
1.9	: : : : : : :		
2.0	: : : : : : :		Dry to slightly moist, orange to reddish brown speckled black, very loose, open textured clayey sand with ferricrete pebbles. Pedogenetic.
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		
2.5	: : : : : : :		
2.6	: : : : : : :		
2.7	: : : : : : :		End of hole in medium, well rounded, quartz pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T19-0,8m.
4. Very loose pit walls caving in.

Lat/long	X Coord:	26°43'21,91" S
WGS84 datum	Y Coord:	26°24'53,31" E

Soil Profile Nr: T19

Soil Profile Nr: T20			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KARENPAK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@webmail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		
0.7	: : : : : : :	T20-0,8	Slightly moist, reddish row n, very loose, open textured, clayey sand.
0.8	: : : : : : :	●	Hillw ash.
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		Dry to slightly moist, orange to reddish row n speckled black, very loose, open texturec
1.9	: : : : : : :		clayey sand w ith ferricrete pebbles. Pedogenetic.
2.0	: : : : : : :		
2.1	: : : : : : :		
2.2	: : : : : : :		
2.3	: : : : : : :		
2.4	: : : : : : :		End of hole in medium, w ell rounded, quartzite pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T20-0,8m.
4. Very loose pit walls caving in.

Lat/long	X Coord:	26°43'20,72" S
WGS84 datum	Y Coord:	26°24'44,81" E

Soil Profile Nr: T20

Soil Profile Nr: T21			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@w e b m a i l . c o . z a	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : : :		
0.2	: : : : : : : :		
0.3	: : : : : : : :	●	Slightly moist, reddish brown, very loose, open textured, clayey sand.
0.4	: : : : : : : :	T21-0,3	Hillw ash.
0.5	: : : : : : : :		
0.6	: : : : : : : :		
0.7	: : : : : : : :		Dry to slightly moist, dark brown speckled black, dense, intact
0.8	: : : : : : : :		sandy clay with quartzite pebbles and ferricrete nodules. Pedogenetic.
0.9	: : : : : : : :		
1.0	: : : : : : : :		
1.1	: : : : : : : :		

Notes:

1. Near refusal in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T21-0,3m.

Lat/long	X Coord:	26°43'20,73" S
WGS84 datum	Y Coord:	26°24'38,30" E

Soil Profile Nr: T21

Soil Profile Nr: T22			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KAREN PARK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.


Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : :		
0.2	: : : : : : :		
0.3	: : : : : : :		
0.4	: : : : : : :		
0.5	: : : : : : :		
0.6	: : : : : : :		Slightly moist, yellow to orange brown, very loose, open textured, clayey sand.
0.7	: : : : : : :	T22-0,8	Hillw ash.
0.8	: : : : : : :	●	
0.9	: : : : : : :		
1.0	: : : : : : :		
1.1	: : : : : : :		
1.2	: : : : : : :		
1.3	: : : : : : :		
1.4	: : : : : : :		
1.5	: : : : : : :		
1.6	: : : : : : :		
1.7	: : : : : : :		
1.8	: : : : : : :		Dry to slightly moist, light brown speckled black, dense, intact
1.9	: : : : : : :		sandy clay with quartzite pebbles. Pedogenetic.
2.0	: : : : : : :		
2.1	: : : : : : :		

Notes:

1. Near refusal in pebble marker.
2. No groundwater was intersected. ,,
3. ● Disturbed sample T22-0,8m.

Lat/long	X Coord:	26°43'32,42" S
WGS84 datum	Y Coord:	26°24'39,54" E

Soil Profile Nr: T22

Soil Profile Nr: T23			
DATE: 3 September 2019			
JOB NR: GS201909T		Consulting Engineering & Environmental Geologists	
PROJECT NAME: Tigane X 7&8		Raadgewende Ingenieurs- en Omgewingsgeoloë	
TOWN: Hartbeesfontein		P.O. Box / Posbus 60995	Tel: 012 525 1004
CLIENT: Maxim: King & Associates		KARENPAK 0118	Webfax: 086 658 3190
TLB Contractor: Toni		e-mail: davidsvdm@wemail.co.za	Cell: 082 925 4075
TLB Machine: CAT 424D 4X4		Engineering Geologist:	David S. van der Merwe.
TLB Operator: Abram		Ingenieursgeoloog:	Pr. Sci. Nat., MSAIEG.

Depth bngl (m)	Soil Profile Symbol	Sample Nr Symbols	Description of soil and properties
0.1	: : : : : : : : :		
0.2	: : : : : : : : :		
0.3	: : : : : : : : :		
0.4	: : : : : : : : :		
0.5	: : : : : : : : :		
0.6	: : : : : : : : :		
0.7	: : : : : : : : :	T23-0,8	Slightly moist, reddish row n, very loose, open textured, clayey sand.
0.8	: : : : : : : : :	●	Hillw ash.
0.9	: : : : : : : : :		
1.0	: : : : : : : : :		
1.1	: : : : : : : : :		
1.2	: : : : : : : : :		
1.3	: : : : : : : : :		
1.4	: : : : : : : : :		
1.5	: : : : : : : : :		
1.6	: : : : : : : : :		
1.7	: : : : : : : : :		
1.8	: : : : : : : : :		
1.9	: : : : : : : : :		
2.0	: : : : : : : : :		Dry to slightly moist, orange to reddish row n speckled black, very loose, open textured
2.1	: : : : : : : : :		clayey sand w ith ferricrete pebbles. Pedogenetic.
2.2	: : : : : : : : :		
2.3	: : : : : : : : :		
2.4	: : : : : : : : :		
2.5	: : : : : : : : :		
2.6	: : : : : : : : :		
2.7	: : : : : : : : :		End fo hole in medium, w ell rounded, quartzite pebbles. Pebble marker.

Notes:

1. End of hole in pebble marker.
2. No groundwater was intersected.
3. ● Disturbed sample T23-0,8m.

Lat/long	X Coord:	26°43'31,15" S
WGS84 datum	Y Coord:	26°24'49,83" E

Soil Profile Nr: T23











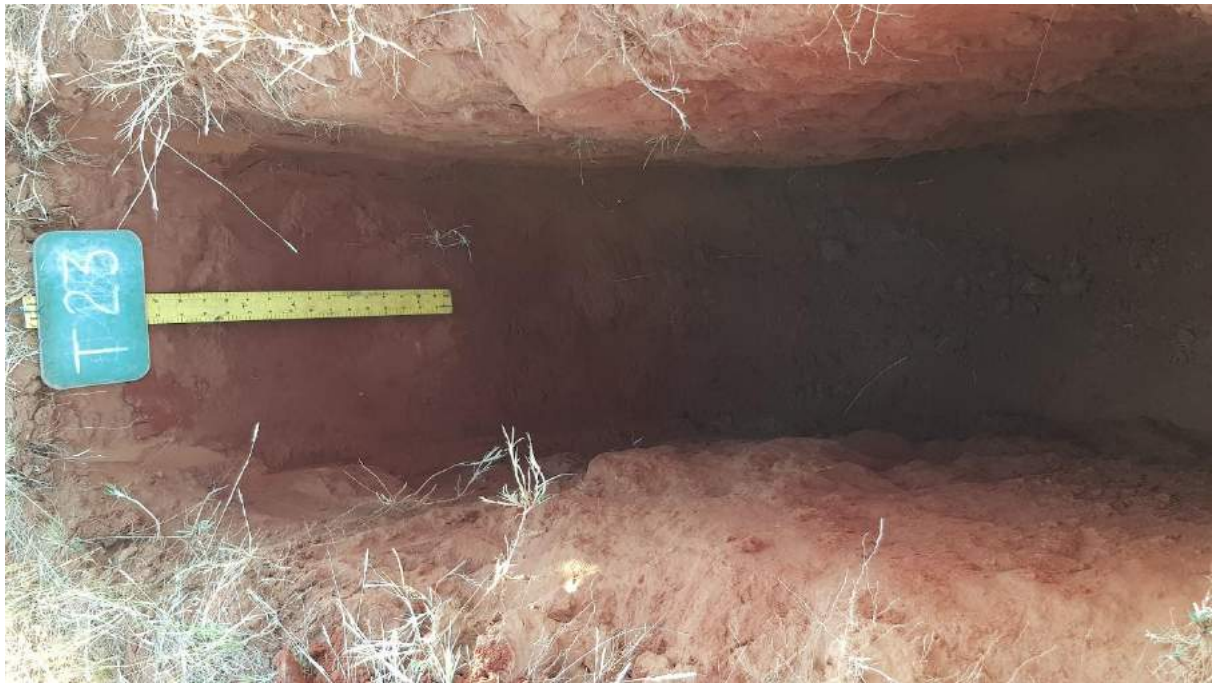














APPENDIX C: LABORATORY RESULTS

Table A: Summary of Laboratory Results
STL Summary of Results
STL Laboratory Results

Table A Summary of Laboratory Results										
Stats 19	Nr	Depth m	Material Description and Origin	Clay %	Classification		% Linear Shrinkage	Plasticity Index	Liquid Limit	Expan- siveness
					Unified	PRA				
1	T1	0,8	Silty clayey sand	13	SM	A-4	1	SP	ND	L
2	T2	0,2	Silty clayey sand	16	SC	A-6	5	11	24	L
3	T3	0,6	Clayey silty sand	6	SM	A-2-4	0	SP	ND	L
4	T4	0,6	Silty clayey sand	11	SC-SM	A-4	2,5	6	21	L
5	T5	0,8	Clayey silty sand	11	SC-SM	A-4	1,5	4	20	L
6	T7	0,4	Clayey silty sand	8	SM	A-2-4	1	SP	ND	L
7	T12	0,4	Clayey silty sand & gravel	3	SM	A-1-b	1	SP	ND	L
8	T13	0,7	Clayey silty sand	10	SC-SM	A-2-4	1,5	4	17	L
9	T14	0,8	Clayey silty sand	10	SC-SM	A-4	1,5	4	18	L
10	T15	0,8	Silty clayey sand	12	SC-SM	A-4	2,5	5	18	L
11	T16	0,8	Silty clayey sand	11	SC-SM	A-2-4	1,5	3	17	L
12	T17	0,8	Clayey silty sand	9	SC-SM	A-2-4	1,5	3	17	L
13	T18	0,8	Silty clayey sand	10	SC-SM	A-4	2,5	5	20	L
14	T19	0,8	Silty clayey sand	11	SC-SM	A-2-4	1	3	19	L
15	T20	0,2	Clayey silty sand	9	SC-SM	A-2-4	3	7	20	L
16	T20	0,8	Silty clayey sand	12	SC-SM	A-2-4	1,5	4	19	L
17	T21	0,3	Clayey silty sand	8	SC-SM	A-2-4	2	4	18	L
18	T22	0,8	Silty clayey sand	11	SC-SM	A-4	2	4	19	L
19	T23	0,8	Silty clayey sand	12	SC-SM	A-4	1,5	4	19	L
Material possibly expansive if value:				>12%			>8%	>12	>30	Exp?
Table A Legend										
Unified										
19	According to the revised ASTM-Standard on the "Unified Soil Classification System" (Weinert).									
4	SM: silty sand, poorly graded sand silt mixtures.									
14	SC-SM: silty clayey sand, poorly graded sand silt clay mixtures.									
1	SC: clayey sand, poorly graded sand clay mixtures.									
PRA / AASHTO										
19	"Public Roads Classification" (Brink, Partridge & Williams).									
1	A-1-b: gravelly sand or graded sand may include fines.									
9	A-2-4: Sand & gravel with low plasticity silt fines.									
8	A-4: Low compressibility silt.									
1	A-6: Low to medium compressibility clay.									
19	Expansiveness according to Van der Merwe's method (Brink, Partridge & Williams).									
19	L: Low									
0	L/M: Low to medium									
0	M: Medium									
0	H: High									
0	VH: Very High									
A clayey material is potentially expansive if it exhibits the following properties (Kantey and Brink, 1952):										
2	a clay content greater than 12 percent,									
0	a linear shrinkage of more than 8 percent,									
0	a plasticity index of more than 12, and									
0	a liquid limit of more than 30 percent									
0	NP: Not plastic: sandy material with no cohesion									
4	SP: Slightly plastic: material with little cohesion									
4	ND: not determined									



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Unit 1, 13 Raubobbe Street, Kewdale, Western Australia
 Perth | 072 671 6363 | sales@stlab.co.au
 Geelong | 082 309 4440 | ge@stlab.co.au
 www.stlab.co.au

Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 10-Oct-19
Method: SANS 3001 GR1, GR3 GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	T1	T2	T3	T4	T5	T7	T12	T13
Depth (m)	0.8	0.2	0.6	0.6	0.8	0.4	0.4	0.7
Lab No	DVM-96-968	DVM-96-969	DVM-96-970	DVM-96-971	DVM-96-972	DVM-96-973	DVM-96-974	DVM-96-975
53.0	100	100	100	100	100	100	100	100
37.5	100	100	100	100	100	100	100	100
26.5	100	100	100	100	100	100	93	100
19.0	100	100	100	100	100	100	91	100
13.2	100	99	100	100	100	100	88	100
9.5	100	98	100	100	100	100	85	100
6.7	100	96	100	100	100	100	82	100
4.75	100	94	100	100	100	100	78	100
2.00	99	87	99	99	100	99	64	99
1.00	95	83	97	96	96	96	53	94
0.425	78	75	76	75	76	77	38	74
0.250	67	67	62	66	69	65	30	66
0.150	59	57	52	59	62	58	27	59
0.075	36	41	29	37	38	34	17	34
0.060	29	36	22	31	30	27	11	27
0.050	26	33	19	27	26	23	9	23
0.035	20	27	13	20	19	16	6	16
0.020	16	25	10	17	16	14	5	15
0.006	15	21	8	14	13	12	4	13
0.002	13	16	6	11	11	8	3	10
GM	0.87	0.97	0.96	0.89	0.86	0.90	1.81	0.93

Atterberg Limits

LL (%)	-	24	-	21	20	-	-	17
PI (%)	SP	11	NP	6	4	SP	SP	4
LS (%)	1.0	5.0	0.0	2.5	1.5	1.0	1.0	1.5

pH & Conductivity

pH								
EC (S/m)								

MDD / OMC

MDD (kg/m ³)								
OMC (%)								

CBR

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

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

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Remarks:

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



Specialised Testing Laboratory Pty Ltd
 9/11 St Austins | Auckland | New Zealand

Unit 1, 13 Raebobble Street, Newmarket C11 0A
 Auckland | 072 671 6363 | info@stlab.co.nz
 Geisel | 082 309 4440 | geisel@stlab.co.nz
www.stlab.co.nz

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Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 10-Oct-19
Method: SANS 3001 GR1, GR3 GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	T14	T15	T16	T17	T18	T19	T20	T20
Depth (m)	0.8	0.8	0.8	0.8	0.8	0.8	0.2	0.8
Lab No	DVM-96-976	DVM-96-977	DVM-96-978	DVM-96-979	DVM-96-980	DVM-96-981	DVM-96-982	DVM-96-983
53.0	100	100	100	100	100	100	100	100
37.5	100	100	100	100	100	100	100	100
26.5	100	100	100	100	100	100	100	100
19.0	100	100	100	100	100	100	100	100
13.2	100	100	100	100	100	100	97	100
9.5	100	100	100	100	100	100	96	100
6.7	100	100	100	100	100	100	93	100
4.75	100	100	100	100	100	100	90	100
2.00	99	99	99	99	100	100	81	100
1.00	92	90	93	94	96	96	75	96
0.425	74	75	76	74	78	75	69	77
0.250	67	66	67	66	70	67	63	68
0.150	61	60	59	60	64	59	55	59
0.075	36	37	34	34	37	34	34	33
0.060	25	30	31	25	23	25	26	27
0.050	22	26	25	21	21	21	23	24
0.035	15	21	17	14	17	16	19	18
0.020	13	17	14	11	15	14	17	16
0.006	12	14	13	10	13	13	12	15
0.002	10	12	11	9	10	11	9	12
GM	0.91	0.89	0.91	0.93	0.85	0.91	1.16	0.90

Atterberg Limits

LL (%)	18	18	17	17	20	19	20	19
PI (%)	4	5	3	3	5	3	7	4
LS (%)	1.5	2.5	1.5	1.5	2.5	1.0	3.0	1.5

pH & Conductivity

pH								
EC (S/m)								

MDD / OMC

MDD (kg/m ³)								
OMC (%)								

CBR

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

UCS (MPa)

100%								
97%								
90%								

COLTO Classification

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Remarks:

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



**Specialised
Testing
Laboratory** Pty Ltd
 1/14 | Adelaide | Perth | Darwin

Unit 1, 13 Raubold Street, Rowleydown SA 5116
 Perth | 072 671 6363 | perth@stlab.co.za
 Gele | 082 309 4440 | gele@stlab.co.za
 www.stlab.co.za

Quality | Excellence | On Time

Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 10-Oct-19
Method: SANS 3001 GR1, GR3 GR10, GR12 GR20, GR30, GR31, GR40, GR50, GR53, GR54 & BS 1377 (where applicable)

SUMMARY OF TEST DATA

Grading & Hydrometer Analysis (% Passing)

Sample	T21	T22	T23				
Depth (m)	0.3	0.8	0.8				
Lab No	DVM-96-984	DVM-96-985	DVM-96-986				
53.0	100	100	100				
37.5	100	100	100				
26.5	100	100	100				
19.0	100	100	100				
13.2	100	100	100				
9.5	100	100	100				
6.7	100	100	100				
4.75	100	100	100				
2.00	99	100	100				
1.00	97	97	96				
0.425	75	78	75				
0.250	62	69	66				
0.150	54	61	57				
0.075	31	37	36				
0.060	27	29	22				
0.050	23	25	21				
0.035	16	18	18				
0.020	15	15	15				
0.006	11	13	14				
0.002	8	11	12				
GM	0.95	0.85	0.89				

Atterberg Limits

LL (%)	18	19	19				
PI (%)	4	4	4				
LS (%)	2.0	2.0	1.5				

pH & Conductivity

pH							
EC (S/m)							

MDD / OMC

MDD (kg/m ³)							
OMC (%)							

CBR

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

UCS (MPa)

100%							
97%							
90%							

COLTO Classification

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Remarks:

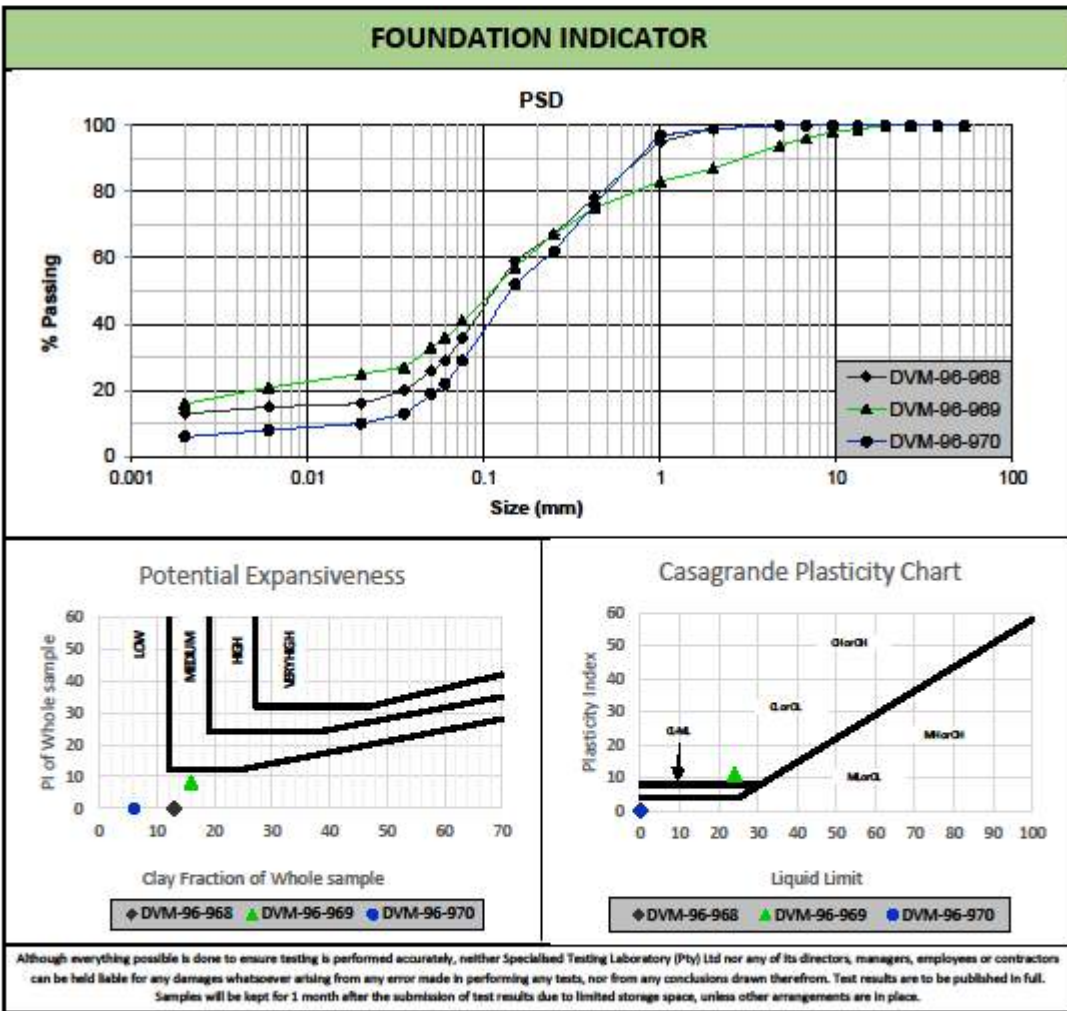
Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any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



Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR							
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	T1	T2	T3	Sample	T1	T2	T3
Depth (m)	0.8	0.2	0.6	Depth (m)	0.8	0.2	0.6
Lab No	DVM-96-968	DVM-96-969	DVM-96-970	Lab No	DVM-96-968	DVM-96-969	DVM-96-970
53.0	100	100	100	Liquid Limit (%)	-	24	-
37.5	100	100	100	Plastic Limit (%)	-	13	-
26.5	100	100	100	Plasticity Index (%)	SP	11	NP
19.0	100	100	100	Linear Shrinkage (%)	1.0	5.0	0.0
13.2	100	99	100	PI of whole sample	-	8	-
9.5	100	98	100				
6.7	100	96	100	% Gravel	1	13	1
4.75	100	94	100	% Sand	70	51	77
2.00	99	87	99	% Silt	16	20	16
1.00	95	83	97	% Clay	13	16	6
0.425	78	75	76	Activity	0.0	0.7	0.0
0.250	67	67	62				
0.150	59	57	52	% Soil Mortar	99	87	99
0.075	36	41	29				
0.060	29	36	22	Grading Modulus	0.87	0.97	0.96
0.050	26	33	19	Moisture Content (%)	N / T	N / T	N / T
0.035	20	27	13	Relative Density (SG)*	2.65	2.65	2.65
0.020	16	25	10				
0.006	15	21	8	Unified (ASTM D2487)	SM	SC	SM
0.002	13	16	6	AASHTO (M145-91)	A - 4	A - 6	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
<small>Although everything possible is done to ensure testing is performed accurately, neither Specialised Testing Laboratory (Pty) Ltd nor any of its directors, managers, employees or contractors can be held liable for any damages whatsoever arising from any error made in performing any tests, nor from any conclusions drawn therefrom. Test results are to be published in full. Samples will be kept for 1 month after the submission of test results due to limited storage space, unless other arrangements are in place.</small>							

Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

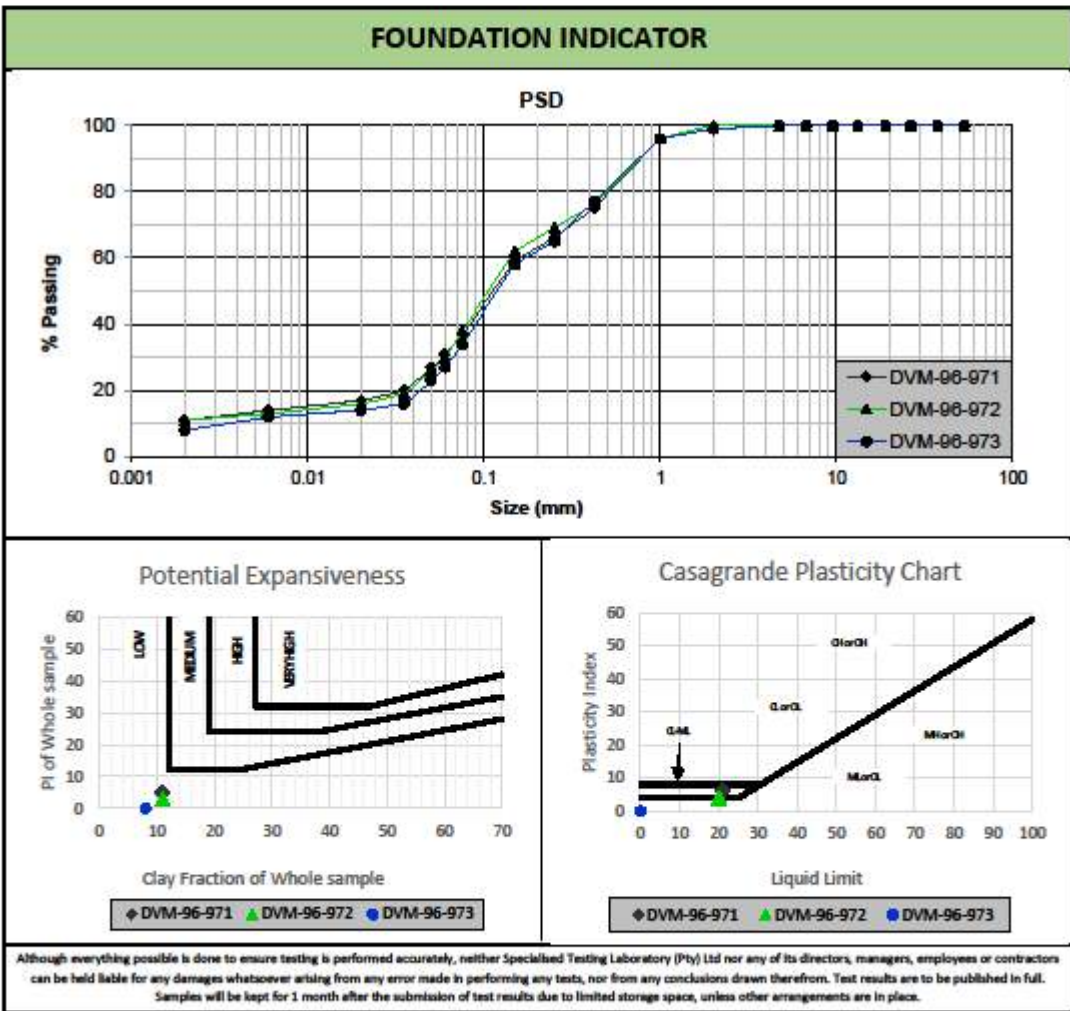




Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR							
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	T4	T5	T7	Sample	T4	T5	T7
Depth (m)	0.6	0.8	0.4	Depth (m)	0.6	0.8	0.4
Lab No	DVM-96-971	DVM-96-972	DVM-96-973	Lab No	DVM-96-971	DVM-96-972	DVM-96-973
53.0	100	100	100	Liquid Limit (%)	21	20	-
37.5	100	100	100	Plastic Limit (%)	15	16	-
26.5	100	100	100	Plasticity Index (%)	6	4	SP
19.0	100	100	100	Linear Shrinkage (%)	2.5	1.5	1.0
13.2	100	100	100	PI of whole sample	5	3	-
9.5	100	100	100				
6.7	100	100	100	% Gravel	1	0	1
4.75	100	100	100	% Sand	68	70	72
2.00	99	100	99	% Silt	20	19	19
1.00	96	96	96	% Clay	11	11	8
0.425	75	76	77	Activity	0.6	0.4	0.0
0.250	66	69	65				
0.150	59	62	58	% Soil Mortar	99	100	99
0.075	37	38	34				
0.060	31	30	27	Grading Modulus	0.89	0.86	0.90
0.050	27	26	23	Moisture Content (%)	N / T	N / T	N / T
0.035	20	19	16	Relative Density (SG)*	2.65	2.65	2.65
0.020	17	16	14				
0.006	14	13	12	Unified (ASTM D2487)	SC-SM	SC-SM	SM
0.002	11	11	8	AASHTO (M145-91)	A - 4	A - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
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Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

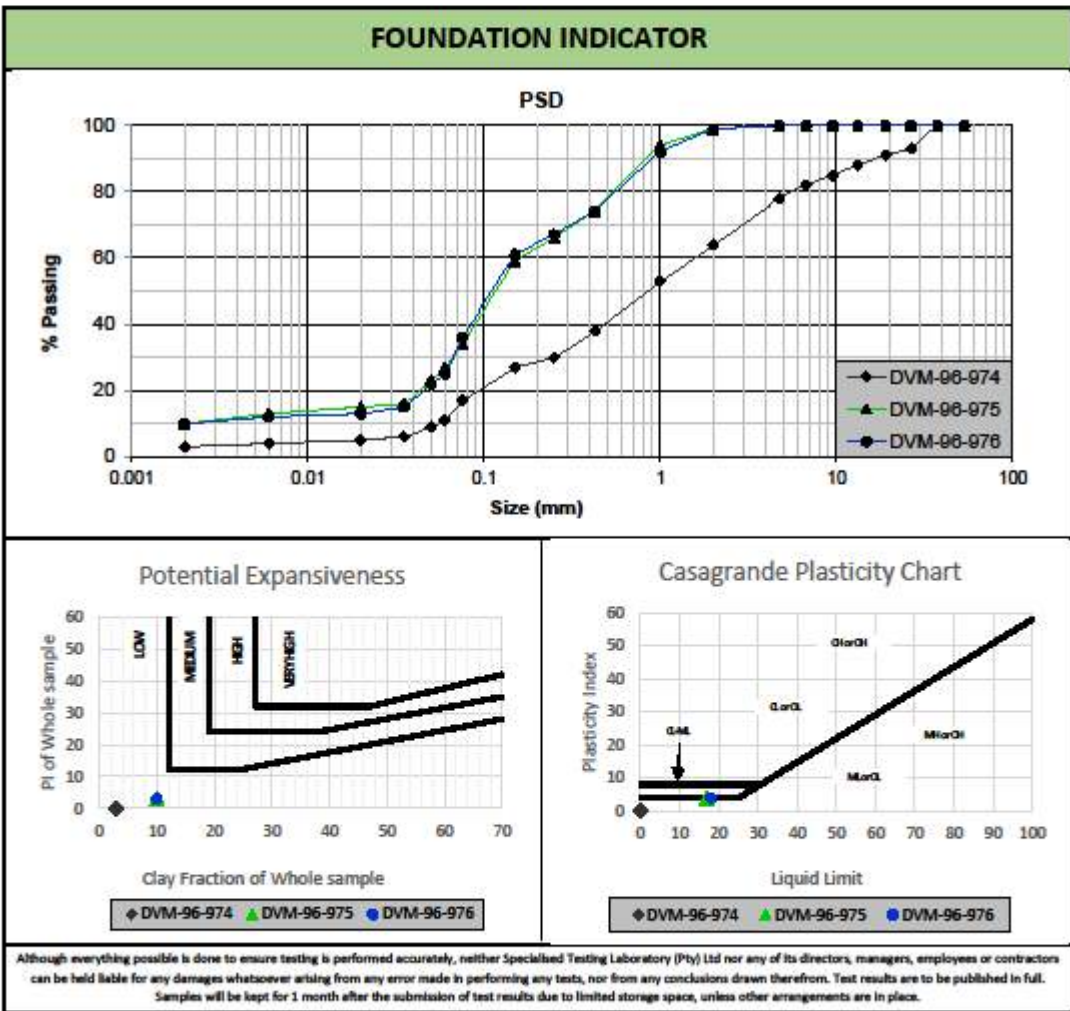




Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR							
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	T12	T13	T14	Sample	T12	T13	T14
Depth (m)	0.4	0.7	0.8	Depth (m)	0.4	0.7	0.8
Lab No	DVM-96-974	DVM-96-975	DVM-96-976	Lab No	DVM-96-974	DVM-96-975	DVM-96-976
53.0	100	100	100	Liquid Limit (%)	-	17	18
37.5	100	100	100	Plastic Limit (%)	-	13	14
26.5	93	100	100	Plasticity Index (%)	SP	4	4
19.0	91	100	100	Linear Shrinkage (%)	1.0	1.5	1.5
13.2	88	100	100	PI of whole sample	-	3	3
9.5	85	100	100				
6.7	82	100	100	% Gravel	36	1	1
4.75	78	100	100	% Sand	53	72	74
2.00	64	99	99	% Silt	8	17	15
1.00	53	94	92	% Clay	3	10	10
0.425	38	74	74	Activity	0.0	0.4	0.4
0.250	30	66	67				
0.150	27	59	61	% Soil Mortar	64	99	99
0.075	17	34	36				
0.060	11	27	25	Grading Modulus	1.81	0.93	0.91
0.050	9	23	22	Moisture Content (%)	N / T	N / T	N / T
0.035	6	16	15	Relative Density (SG)*	2.65	2.65	2.65
0.020	5	15	13				
0.006	4	13	12	Unified (ASTM D2487)	SM	SC-SM	SC-SM
0.002	3	10	10	AASHTO (M145-91)	A - 1 - b	A - 2 - 4	A - 4
Remarks: *: Assumed N / T: Not Tested							
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Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

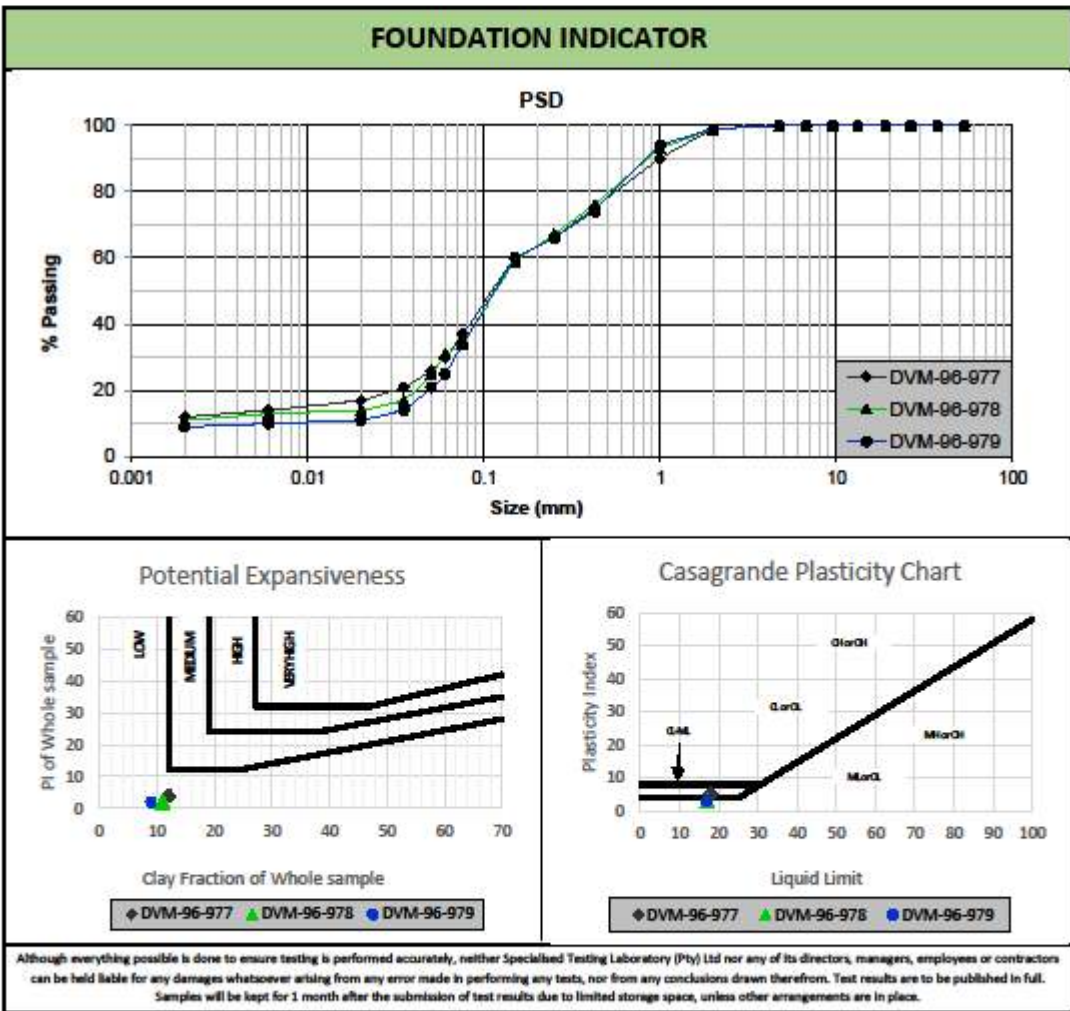




Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR							
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	T15	T16	T17	Sample	T15	T16	T17
Depth (m)	0.8	0.8	0.8	Depth (m)	0.8	0.8	0.8
Lab No	DVM-96-977	DVM-96-978	DVM-96-979	Lab No	DVM-96-977	DVM-96-978	DVM-96-979
53.0	100	100	100	Liquid Limit (%)	18	17	17
37.5	100	100	100	Plastic Limit (%)	13	14	14
26.5	100	100	100	Plasticity Index (%)	5	3	3
19.0	100	100	100	Linear Shrinkage (%)	2.5	1.5	1.5
13.2	100	100	100	PI of whole sample	4	2	2
9.5	100	100	100				
6.7	100	100	100	% Gravel	1	1	1
4.75	100	100	100	% Sand	69	68	74
2.00	99	99	99	% Silt	18	20	16
1.00	90	93	94	% Clay	12	11	9
0.425	75	76	74	Activity	0.4	0.3	0.3
0.250	66	67	66				
0.150	60	59	60	% Soil Mortar	99	99	99
0.075	37	34	34				
0.060	30	31	25	Grading Modulus	0.89	0.91	0.93
0.050	26	25	21	Moisture Content (%)	N / T	N / T	N / T
0.035	21	17	14	Relative Density (SG)*	2.65	2.65	2.65
0.020	17	14	11				
0.006	14	13	10	Unified (ASTM D2487)	SC-SM	SC-SM	SC-SM
0.002	12	11	9	AASHTO (M145-91)	A - 4	A - 2 - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
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Project Name: Tigane
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Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

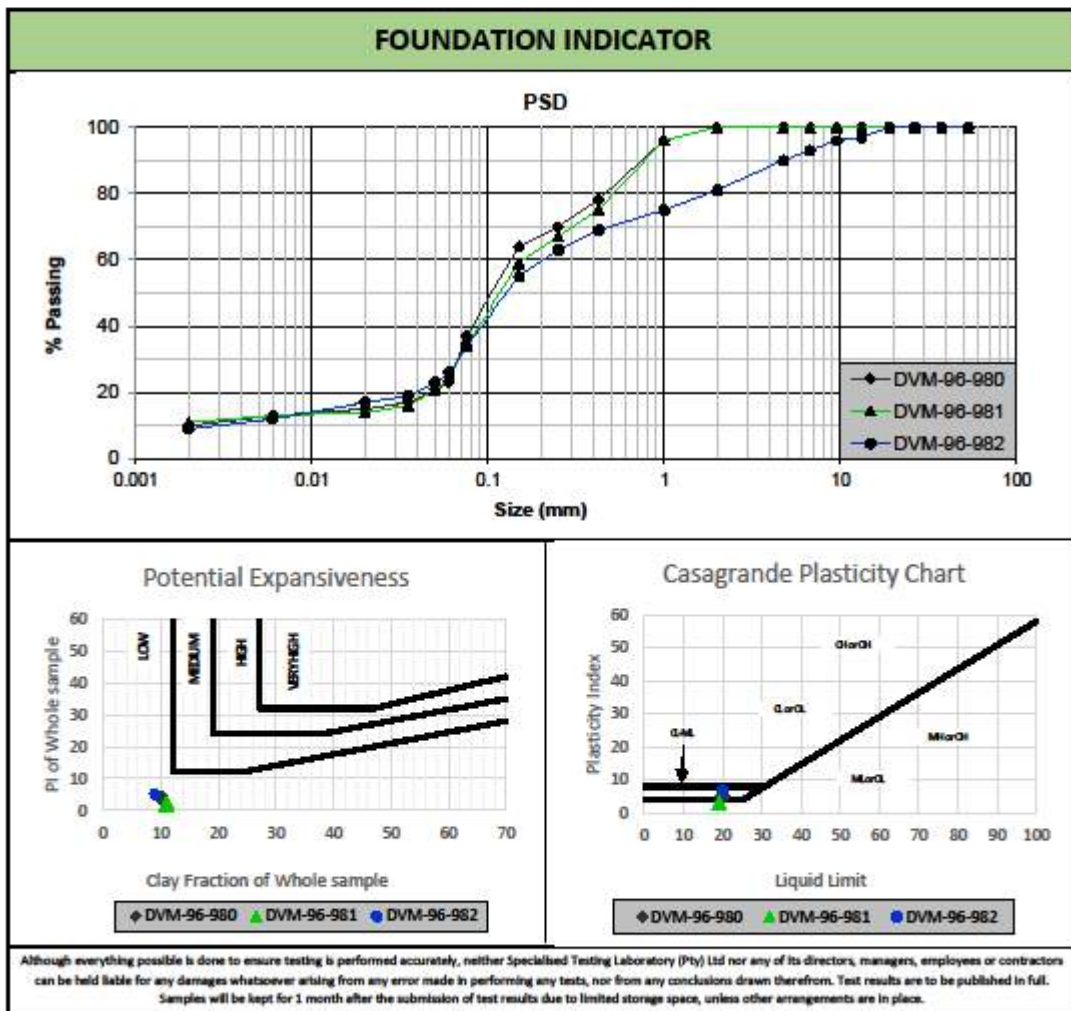




Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR							
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	T18	T19	T20	Sample	T18	T19	T20
Depth (m)	0.8	0.8	0.2	Depth (m)	0.8	0.8	0.2
Lab No	DVM-96-980	DVM-96-981	DVM-96-982	Lab No	DVM-96-980	DVM-96-981	DVM-96-982
53.0	100	100	100	Liquid Limit (%)	20	19	20
37.5	100	100	100	Plastic Limit (%)	15	16	13
26.5	100	100	100	Plasticity Index (%)	5	3	7
19.0	100	100	100	Linear Shrinkage (%)	2.5	1.0	3.0
13.2	100	100	97	PI of whole sample	4	2	5
9.5	100	100	96				
6.7	100	100	93	% Gravel	0	0	19
4.75	100	100	90	% Sand	77	75	55
2.00	100	100	81	% Silt	13	14	17
1.00	96	96	75	% Clay	10	11	9
0.425	78	75	69	Activity	0.5	0.3	0.8
0.250	70	67	63				
0.150	64	59	55	% Soil Mortar	100	100	81
0.075	37	34	34				
0.060	23	25	26	Grading Modulus	0.85	0.91	1.16
0.050	21	21	23	Moisture Content (%)	N / T	N / T	N / T
0.035	17	16	19	Relative Density (SG)*	2.65	2.65	2.65
0.020	15	14	17				
0.006	13	13	12	Unified (ASTM D2487)	SC-SM	SC-SM	SC-SM
0.002	10	11	9	AASHTO (M145-91)	A - 4	A - 2 - 4	A - 2 - 4
Remarks: *: Assumed N / T: Not Tested							
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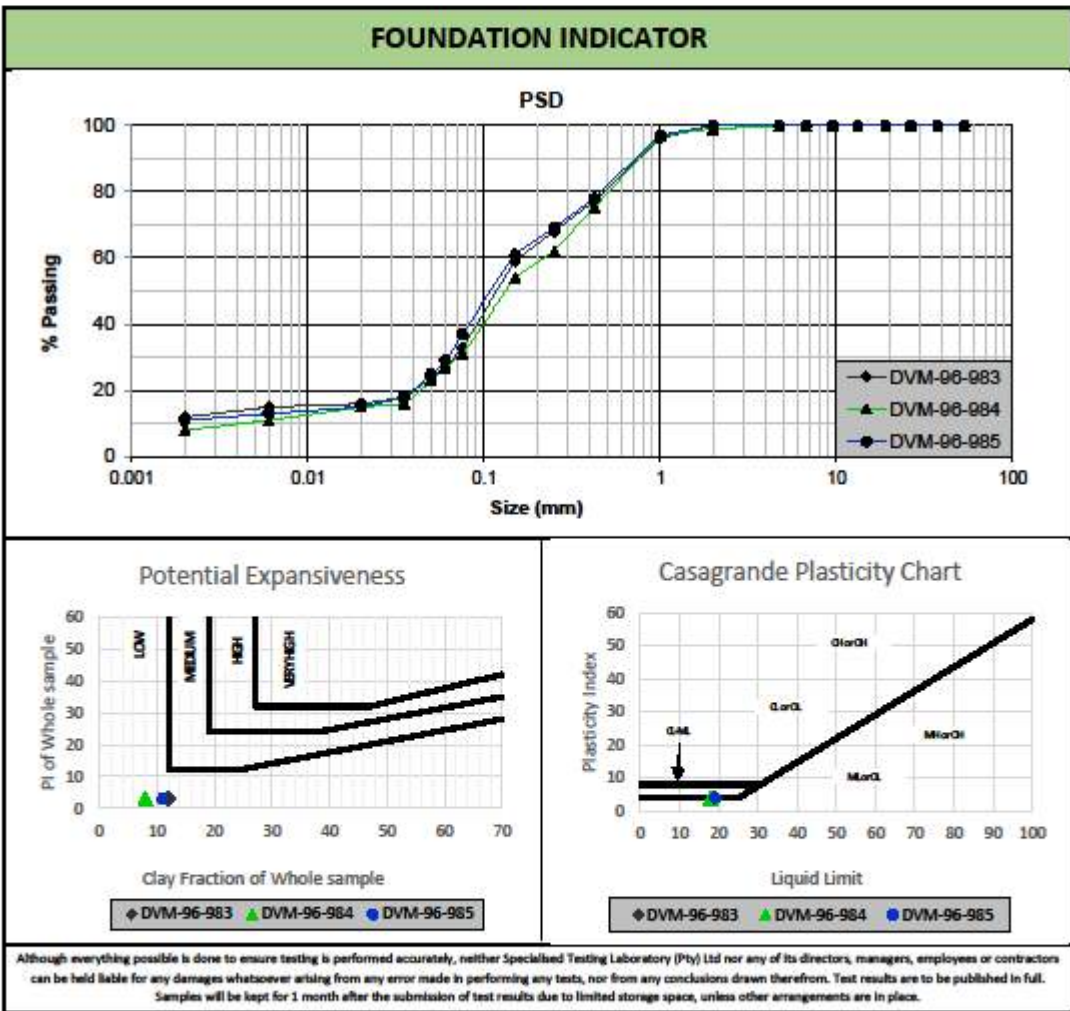




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Project Name: Tigane
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Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR							
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	T20	T21	T22	Sample	T20	T21	T22
Depth (m)	0.8	0.3	0.8	Depth (m)	0.8	0.3	0.8
Lab No	DVM-96-983	DVM-96-984	DVM-96-985	Lab No	DVM-96-983	DVM-96-984	DVM-96-985
53.0	100	100	100	Liquid Limit (%)	19	18	19
37.5	100	100	100	Plastic Limit (%)	15	14	15
26.5	100	100	100	Plasticity Index (%)	4	4	4
19.0	100	100	100	Linear Shrinkage (%)	1.5	2.0	2.0
13.2	100	100	100	PI of whole sample	3	3	3
9.5	100	100	100				
6.7	100	100	100	% Gravel	0	1	0
4.75	100	100	100	% Sand	73	72	71
2.00	100	99	100	% Silt	15	19	18
1.00	96	97	97	% Clay	12	8	11
0.425	77	75	78	Activity	0.3	0.5	0.4
0.250	68	62	69				
0.150	59	54	61	% Soil Mortar	100	99	100
0.075	33	31	37				
0.060	27	27	29	Grading Modulus	0.90	0.95	0.85
0.050	24	23	25	Moisture Content (%)	N / T	N / T	N / T
0.035	18	16	18	Relative Density (SG)*	2.65	2.65	2.65
0.020	16	15	15				
0.006	15	11	13	Unified (ASTM D2487)	SC-SM	SC-SM	SC-SM
0.002	12	8	11	AASHTO (M145-91)	A - 2 - 4	A - 2 - 4	A - 4
Remarks: *: Assumed N / T: Not Tested							
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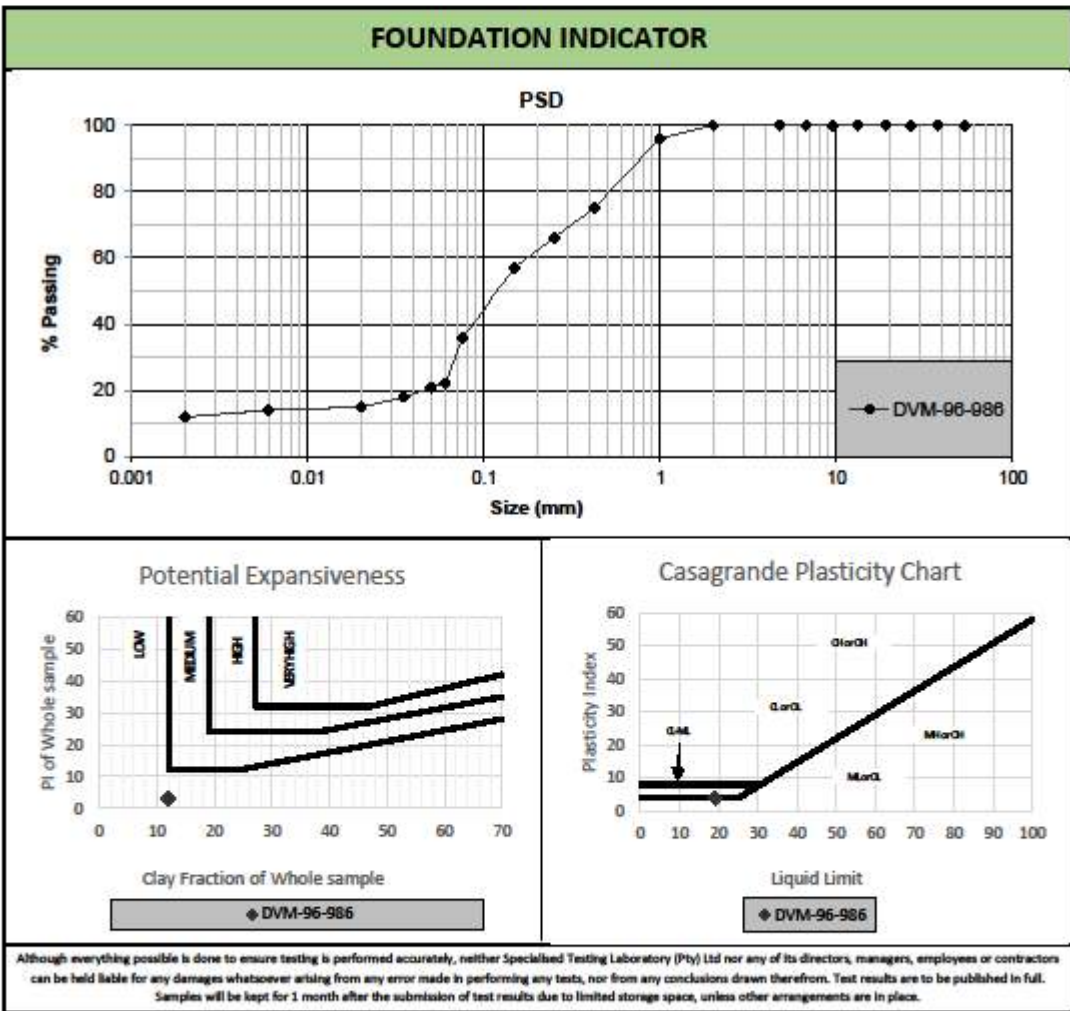




Client Name: Geoset
Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)

FOUNDATION INDICATOR							
Grading & Hydrometer Analysis (Particle Size (mm) & % Passing)				Atterberg Limits & Classification			
Sample	T23			Sample	T23		
Depth (m)	0.8			Depth (m)	0.8		
Lab No	DVM-96-986			Lab No	DVM-96-986		
53.0	100			Liquid Limit (%)	19		
37.5	100			Plastic Limit (%)	15		
26.5	100			Plasticity Index (%)	4		
19.0	100			Linear Shrinkage (%)	1.5		
13.2	100			PI of whole sample	3		
9.5	100						
6.7	100			% Gravel	0		
4.75	100			% Sand	78		
2.00	100			% Silt	10		
1.00	96			% Clay	12		
0.425	75			Activity	0.3		
0.250	66						
0.150	57			% Soil Mortar	100		
0.075	36						
0.060	22			Grading Modulus	0.89		
0.050	21			Moisture Content (%)	N / T		
0.035	18			Relative Density (SG)*	2.65		
0.020	15						
0.006	14			Unified (ASTM D2487)	SC-SM		
0.002	12			AASHTO (M145-91)	A - 4		
Remarks: *: Assumed N / T: Not Tested							
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Project Name: Tigane
Job Number: DVM-96
Date: 2019-10-10
Method: SANS 3001 GR1, GR3, GR10 GR12 & BS 1377 (where applicable)



APPENDIX D: TABULAR EXPLANATION OF ZONING

Table 1. Categories of Urban Engineering Geological Investigation

Table 2. Geotechnical CLASSIFICATION FOR Urban Development:
Partridge, Wood & Brink (1993)

Table 3. Residential Site Class Designations: SAICE, SAIEG & NHBRC (1995)

Table 1. CATEGORIES OF URBAN ENGINEERING GEOLOGICAL INVESTIGATION

Type	Planning Investigations		Urban Development Investigations		Specialised Investigations
	Regional Engineering Geological Mapping (REGM)	Mapping for Urban Planning	Urban Development Investigation	Urban Development Investigation	
Description					Specialised Geotechnical Investigation
Size of study area and field work	More than 1000 ha. Walk-over survey and limited test pits and soil sampling.	Less than 1000 ha. Walk-over survey.	Less than 10 ha. Test pits, trial holes and soil sampling.	More than 10 ha. Walk-over survey with trial pits and test holes and soil sampling.	Not relevant. Specific to type of specialised investigation.
Suggested number of test pits	A minimum of 3 test pits per land facet type.	None suggested. However, a limited number of test pits may be required at the discretion of the consultant.	Between 6 and 10 test pits.*	Between 1 and 6 test pits per 10 ha. depending on the size and variability of the area to as much as 1 test pit per hectare for highly variable sites.*	Dependent on the type of specialised investigation performed.
Mapping unit	Land systems and land facets.	Terrain types: 1 - most favourable 2 - intermediate 3 - least favourable	Soil classes: C, H, S and P and other (e.g. excavation, drainage features)	Soil classes: C, H, S and P and other (e.g. excavation, drainage features)	Not applicable.
Reference	Brink, Partridge and Williams (1982)	Partridge, Wood and Brink (1993)	SAICE Code of Practice (1995)	SAICE Code of Practice (1995)	Not relevant.
Consultants	Engineering geologists.	Engineering geologists and to a lesser extent geotechnical engineers.	Both engineering geologists and geotechnical engineers.	Both engineering geologists and geotechnical engineers.	Geotechnical engineers and to a lesser extent engineering geologists.

* Note that these figures are not intended to be absolute and should serve only as a guideline.

Table 2. GEOTECHNICAL CLASSIFICATION FOR URBAN DEVELOPMENT (after Partridge, Wood and Brink 1993)

CONSTRAINT	Most favourable (1)	Intermediate (2)	Least favourable (3)
A Collapsible Soil	Any collapsible horizon or consecutive horizons totalling a depth of less than 750 mm in thickness.*	Any collapsible horizon or consecutive horizons with a depth of more than 750 mm in thickness.	A least favourable situation for this constraint does not occur.
B Seepage	Permanent or perched water table more than 1,5 m below ground surface.	Permanent or perched water table less than 1,5 m below ground surface.	Swamps and marshes.
C Active soil	Low soil-heave potential predicted.*	Moderate soil heave potential predicted.	High soil-heave potential predicted.
D Highly compressible soil	Low soil compressibility expected.*	Moderate soil compressibility expected.	High soil compressibility expected.
E Erodability of soil	Low.	Intermediate.	High.
F Difficulty of excavation to 1,5 m depth	Scattered or occasional boulders less than 10% of the total volume.	Rock or hardpan pedocretes between 10 and 40 % of the total volume.	Rock or hardpan pedocretes more than 40 % of the total volume.
G Undermined ground	Undermining at a depth greater than 100 m below surface (except where total extraction mining has not occurred.)	Old undermined areas to a depth of 100 m below surface where slope closure has ceased.	Mining within less than 100 m of surface or where total extraction mining has taken place.
H Instability in areas of soluble rock	Possibly unstable.	Probably unstable.	Known sinkholes and dolines.
I Steep slopes	Between 2 and 6 degrees (all regions).	Slopes between 6 and 18 degrees and less than 2 degrees (Natal and Western Cape). Slopes between 6 and 12 degrees and less than 2 degrees (all other regions).	More than 18 degrees (Natal and Western Cape). More than 12 degrees (all other regions).
J Areas of unstable natural slopes	Low risk.	Intermediate risk.	High risk (especially in areas subject to seismic activity).
K Areas subject to seismic activity	10% probability of an event less than 100 cm/s ² within 50 years.	Mining-induced seismic activity more 100 cm/s ² .	Natural seismic activity more than 100 cm/s ² .
L Areas subject to flooding	A "most favourable" situation for this constraint does not occur.	Areas adjacent to a known drainage channel or floodplain with slope less than 1%.	Areas within a known drainage channel or floodplain.

* These areas are designated as 1A, 1C, 1D, or 1F where localised occurrences of the constraint may arise.

Table 3. RESIDENTIAL SITE CLASS DESIGNATIONS (SAICE, 1995)

TYPICAL FOUNDATION MATERIAL	CHARACTER OF FOUNDING MATERIAL	EXPECTED RANGE OF TOTAL SOIL MOVEMENTS (mm)	ASSUMED DIFFERENTIAL MOVEMENT (% OF TOTAL)	SITE CLASS
Rock (excluding mud rocks which exhibit swelling to some depth)	STABLE	NEGLIGIBLE	-	R
Fine-grained soils with moderate to very high plasticity (clays, silty clays, clayey silts and sandy clays)	EXPANSIVE SOILS	< 7,5	50%	H
		7,5 - 15	50%	H1
		15 - 30	50%	H2
		> 30	50%	H3
Silty sands, sands, sandy and gravelly soils	COMPRESSIBLE AND POTENTIALLY COLLAPSIBLE SOILS	< 5,0	75%	C
		5,0 - 10	75%	C1
		> 10	75%	C2
Fine-grained soils (clayey silts and clayey sands of low plasticity), sands, sandy and gravelly soils	COMPRESSIBLE SOIL	< 10	50%	S
		10 - 20	50%	S1
		> 20	50%	S2
Contaminated soils Controlled fill Dolomitic areas Land fill Marshy areas Mine waste fill Mining subsidence Reclaimed areas Very soft silt/silty clays Uncontrolled fill	VARIABLE	VARIABLE		P

NOTES:

1. The classifications C,H,R and S are not intended for dolomitic area sites unless specific investigations are carried out to assess the stability (risk of sinkholes and doline formation) of the dolomites. Where this risk is found to be acceptable, the site shall be designated as Class P (dolomitic areas).
2. Site classes are based on the assumption that differential movements, experienced by single-storey residential buildings, expressed as a percentage of the total soil movements are equal to about 50% for soils that exhibit expansive or compressive characteristics and 75% for soils that exhibit both compressible and collapse characteristics. Where this assumption is incorrect or inappropriate, the total soil movements must be adjusted so that the resultant different movement implied by the table is equal to that which is expected in the field.
3. In some instances, it may be more appropriate to use a composite description to describe a site more fully e.g. C1/H2 or S1 and/or H2. Composite Site Classes may lead to higher differential movements and result in design solutions appropriate to a higher range of differential movement e.g. a Class R/S1 site. Alternatively, a further site investigation may be necessary since the final design solution may depend on the location of the building on a particular site.
4. Where it is not possible to provide a single site designation and a composite description is inappropriate, sites may be given multiple descriptions to indicate the range of possible conditions e.g. H-H1-H2 or C1-C2.
5. Soft silts and clays usually exhibit high consolidation and low bearing characteristics. Structures founded on these horizons may experience high settlements and such sites should be designated as Class S1 or S2 as relevant and appropriate.
6. Sites containing contaminated soils include those associated with reclaimed mine land, land down-slope of mine tailings and old land fills.
7. Where a site is designated as Class P, full particulars relating to the founding conditions on the site must be provided.
8. Where sites are designated as being Class P, the reason for such classification shall be placed in brackets immediately after the suffix - i.e. P(contaminated soils). Under certain circumstances, composite description may be more appropriate - e.g. P(dolomitic areas)-C1.
9. Certain fills may contain contaminants which present a health risk. The nature of such fill should be evaluated and should be clearly demarcated as such.

APPENDIX E: DATA INPUT SHEETS

Site Specific Data Input Sheets



**NORTH WEST PROVINCE
HOUSING DEPARTMENT**

PROJECT-LINKED /RURAL PROJECT (PLEASE INDICATE P or R IN BOX)

SUBSIDY VARIATION CALCULATOR

DATA INPUT SHEET

Version 1.10

Name of Project		Tigane Extensios 7 & 8	
Distance from nearest major centre in km (see list adjacent)	10 km	Name of Centre (Only Potchefstroom, Klerksdorp, Rustenburg, Mafikeng, Brits or Tshwane)	Klerksdorp
Total Number of houses in Project			
How many houses with this classification?			
Subsidy amount for this development ?			
1 VARIATION IN SITE CLASS			
Site Classification			
House Size Class (30-40m ²)			
Basic Site Class Designation (H1,C2,S1 etc or combination Please) (Dominant Mode)		C2	
Note that for a combination classification (i.e C1/S2) the designer must select the dominant mode that will be used for design purposes (Contributory Mode)		C2	
If the Site Classification is H3, what is the predicted differential movement?			
Is the Site Underlain By Dolomites?			No
If so, what is the Dolomitic Area Designation?			N/A
2 VARIATION IN SITE CONDITIONS			
2.1 Seepage/Ground Water		No	
2.1.1	Does the Site have a water table less than 1m from the surface?	No	
2.1.2	Does the Site have a water table less than 1,5m but more than 1m from the surface?	No	
2.2 Soil Slope			
2.3.2	What is the average slope of the erf in %?	<6 %	
2.3 Soil dispersion		No	
2.3.3	Is the uppermost soil horizon classified as SP,SM, CL or CH in terms of the Unified Soil Classification System?	SM 20%	
2.4 Difficulty of excavation			
	What percentage of the uppermost soil horizon is classified as hard in terms SABS 1200 D?	20%	

I certify that the above information is based on my assessment of the proposed housing site and that it is in my opinion representative of the General Site Conditions.

Name:	David S vd Merwe	Signature	
Professional registration No	Pr. Sci. Nat.: 400057/96 MSAIEG: 93/154 NHBRC: Reg. Nr. 600444	Date: 18 October 2019	