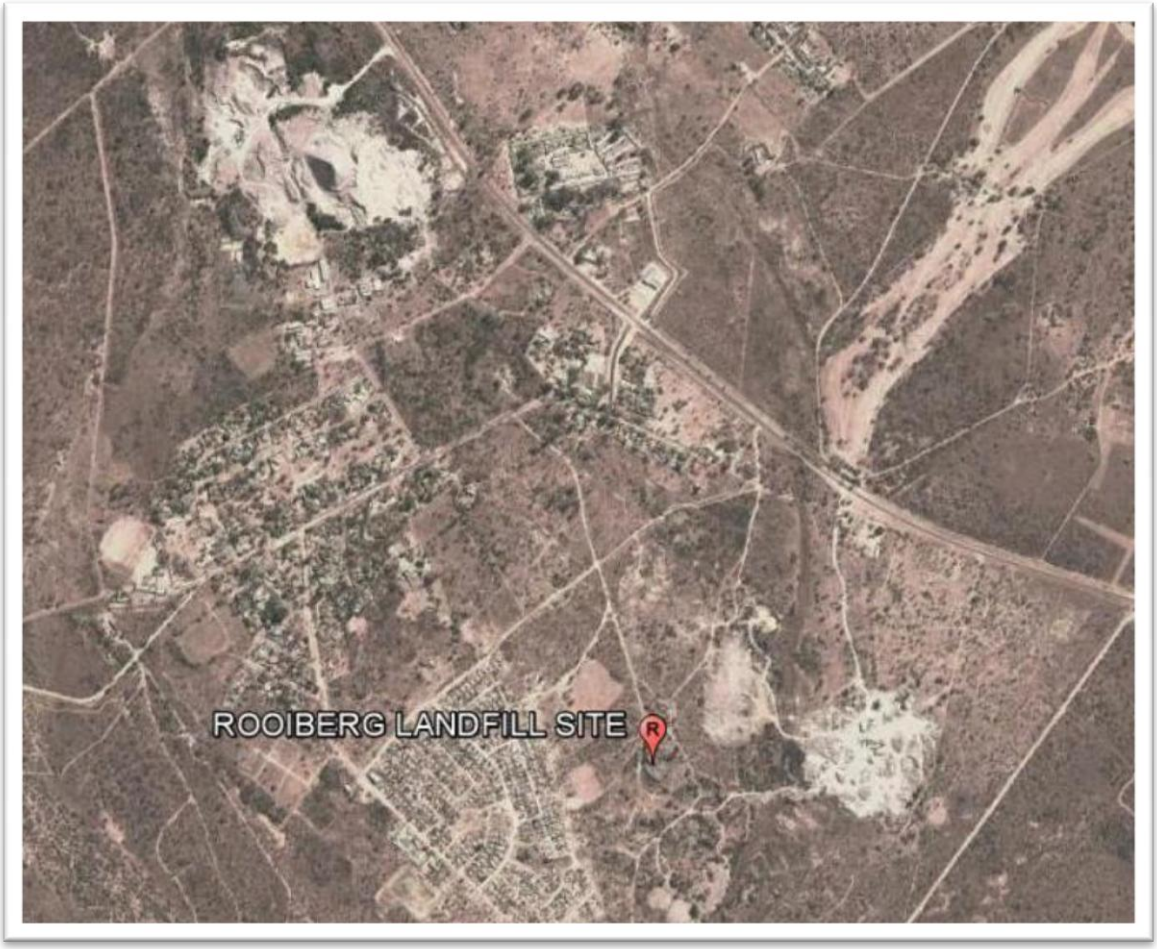
REPORT ON THE GEOTECHNICAL INVESTIGATION OF THE ROOIBERG LANDFILL SITE, LIMPOPO



Jaco Bloem Consulting

Title:	***REPORT ON THE GEOTECHNICAL INVESTIGATION OF THE ROOIBERG LANDFILL SITE, LIMPOPO***
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1. INTRODUCTION

The author was requested by AURECON, on behalf of their client, to determine the sub soil conditions of the proposed ROOIBERG Landfill Site. The brief was simply to excavate test holes on the site and determine the geological layers and excavatebility of the material on site. This will also provide information to determine the viability of the establishment of the landfill.

2. PURPOSE OF THE INVESTIGATION

The purpose of the investigation was the following:

- Determine the geological and geotechnical characteristics of the different soils underlying the site;
- Determine excavatebility of the in-situ material on site;
- Identify geotechnical constraints for the establishment of a Class B Landfill facility;
- Comment on possible liner quality material on site; and
- Give recommendations as to any other special precaution to be taken, including shallow ground water seepage.

3. SITE LOCATION AND DESCRIPTION

This site is located south east of Thabazimbi in the town of Rooiberg. The location of the site is indicated on the following map, **Figure 1**.

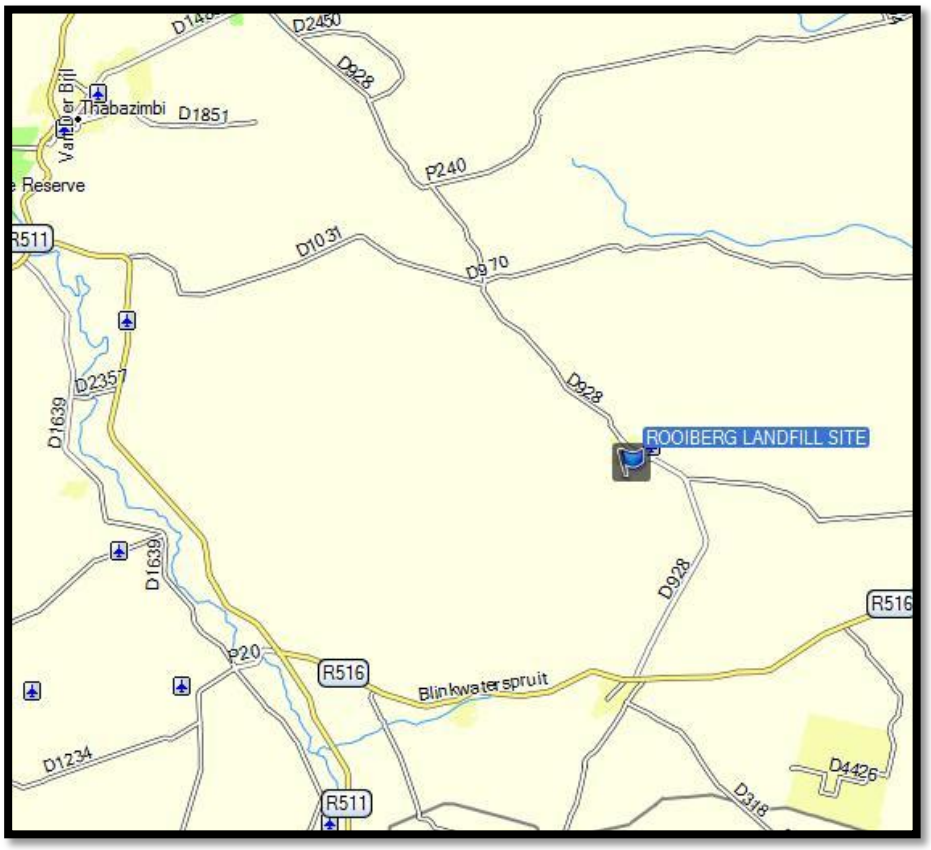

Figure 1: Site Locality

The area investigated is in and around an existing quarry excavation. There are quite a few illegal sand excavations that resulted in some of the access road being undercut and making some of the surrounding slopes unstable.

Most of this area has been stripped or cleared of the top soil. Illegal duping is prevalent all over the site.

There are discard material disposed on the eastern and southern side of the existing quarry. There are no services present on the site.

The natural gradient of the site is to the east with a 2% gradient, and surface run-off will drain to the north.

4. GEOLOGY

The site is located on quartzites, andesites and arkose of the Bushveld Complex. According to the geological map, the site is also underlain by black porphyritic ryolite, amygdaloidal rhyolite and pyroclastic rocks. (**Figure 2**).

Vsm – Quartzite, andesite

Vle – Quartzite, arkose

Figure 2: Site Geology

5. METHOD OF INVESTIGATION

A VOLVO TLB was used to open 8 test pits to determine the subsurface conditions. All the test pits were dug to their refusal or the maximum reach of the excavator. The test pits were placed in such a manner as to get maximum coverage of the proposed future development of the site.

The test pits and boreholes were profiled by a qualified engineering geologist according to the method described by Jennings et al (1973).

The profiles are included in **Appendix A** with photos of each test hole included in **Appendix B.** Coordinates of all the test pits were taken and are included on the soil profiles and are indicated on **Figure 3**.

Selected soil horizons were sampled to confirm the soil description and these results are included in **Appendix C**

Figure 3: Test Pit Positions

6. RESULTS

6.1 SOIL PROFILES

The test pits were spaced in such a manner to determine the availability of liner material, if any, and to determine if there is a perched water level on site

In general most of the test pits went to maximum reach (2.6m+) of the machine with partial refusal in RB TP 3 and 7 on weathered Quartzite. Although none of the test pit refused on the Ferricrete layer, Hardpan Ferricrete boulders are present in some of the test pits. However the Hardpan Ferricrete was brittle enough for the TLB to break through the layer.

The rest of the test pits however had deeply weathered soils. In these deeper weathered areas the ferricrete is poorly developed, being at most a ferruginised horizon. In some of the test pits well rounded boulders of up to 300 mm are present in the ferricrete that indicates that this is transported/reworked material.

No groundwater seepage was encountered in any of test pits during the investigation. However, perched water during the rainy season could occur above the Ferricrete layer.

The elevation of the site suggests it is situated below the African erosion surface. The African erosion surface represents a base level of erosion during which there was a prolonged exposure to weathering processes. The remnants of these areas are thus deeply weathered to the order of tens of meters.

The findings of this investigation are consistent with the notion that the site is below this African surface. The significance of this is that bedrock is shallower and ferricrete is well developed (McKnight, 1997).

6.2 LABORATORY TESTS

None of the soil samples taken were submitted to the Laboratory for testing due to the fact that this is predominantly sands and silty sand with no clay present on the site.

7. DISCUSSION OF RESULTS

During the Test Pit investigation the generalized soil profiles can be summarised as follows:

Typical profile:

0 – 0.1m	Light brown, dense, reworked silty sand. Topsoil.
0.1 – 1.6m	Orange brown, medium dense to dense, silty sand - reworked quartzite. Alluvial material.
1.6- 2.3m	Dark red/orange mottled black, very dense silty sand. Ferricrete Layer.
2.3- 2.8m	Dark red/orange mottled black, very dense silty sand. Residual Granite.

7.1 PERCHED WATER LEVEL

Quartzite rock is usually associated with a perched water level due to the presence of Ferricrete in the soil profile. During the test pit excavation a Ferricrete layer was evident in all the holes with some of the test pits displaying Hardpan Ferricrete in places. No seepage was present in any of the test pits but the presence of the ferricrete indicates that a perched water level could be present during the wet season.

7.2 EXCAVATEBILITY

The machine that was used on site was the Volvo TLB. In most of the test pits the excavator could excavate to its maximum reach except where the residual quartzite was on a shallow depth.

Rocky outcrops were also present on surface especially on the southern section of the site between RB TP 5 and 8.

The excavatebility of the material on site was in the ***Medium*** to ***Intermediate*** range and ***Hard*** where the soft rock quartzite was close to surface. The shallow bedrock can also be due to the excavation during the lifetime of the quarry.

7.3 LINER MATERIAL

No liner quality material was encountered on site. The sandy nature of the soils makes it a high permeable layer even if compacted.

7.4 FOUNDATION CONDITIONS

Due to the collapsible grain structure associated with alluvial sands, it is recommended that certain precautions should be taken to prevent structural damage to newly constructed buildings. According to the NHBRC this site will classify as a C1 and all the prescribed conditions as specified should be adhered to.

8. CONCLUSIONS

- The site is underlain by quartzite that consists mainly of silty sands.
- During the fieldwork 8 test pits were excavated using a Volvo TLB.
- This test pits varied in depth between 1.6 and 3.0m.
- No Perched water levels were present during the investigation.
- A perched water level could be present on the drainage area during the rainy season
- Excavation of the material on site will pose no problem as the material classify as *medium to intermediate.*
- No clay material suitable for the use as liners material was encountered on site.
- Due to the nature of the soil on site the only major concern will be perched water that could occur during the rainy season, however this can be overcome by proper design of a storm water and groundwater control system.
- The site can be re-shaped and cover present on the northern section of the site can be used in the operation of the landfill site

9. RECOMMENDATIONS

- The site will be suited to develop a landfill site.
- Liner material for the construction of the landfill liners must be imported or a GCL could be used.
- Excavatebility on site is *medium* to *intermediate*.
- Proper sub-soil drainage systems should be constructed due to the presence of a perch water level on site.
- Building foundations must be reinforced or earth mattresses should be used due to the collapse potential of the soils on site. Allowable bearing pressure will be approximately 150 kPa.
- The foundation should also be protected from moisture ingress by constructing a concrete or paved apron around the buildings.
- Site roads could be built with the material on site.
- Proper surface drainage needs to be designed and constructed to prevent excessive erosion.

10. REFERENCES

Jennings, J.E., A.A.B. Brink and A.B.A. Williams. *Revised guide to soil profiling for civil engineering purposes in southern Africa.* The Civil Engineer in South Africa, 1973.

"Minimum Requirements for Waste Disposal by Landfill", DWAF, Second Edition 1998.

Appendix A

Test Pit profiles

Appendix B

Test Pit Photo's

RB TP 1

RB TP 2

RB TP 3

RB TP 4

RB TP 5

RB TP 6

RB TP 7

RB TP 8