GEOTECHNICAL SITE SENSTIVITY VERIFICATION & COMPLIANCE STATEMENT

FOR

THE PROPOSED VEGETATED LANDING STRIP ON PORTION 1 OF FARM 172, NEAR HERBERTSDALE.

Prepared by:

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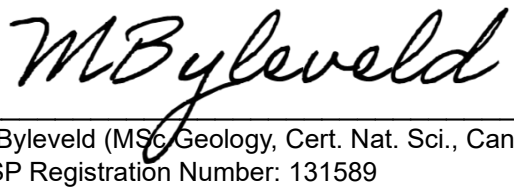
Specialist Declaration

I, Mariska Byleveld, as the appointed specialist hereby declare/affirm the correctness of the information in this document. I consider myself bound to the rules and ethics of the South Africa Council for Natural Scientific Professions (SACNASP).



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Qualifications: MSc Geology.

Expertise: > 1 year experience with compiling soil profiles across the Garden Route.

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1. Introduction

The Applicant, Morning Tide Investments (Pty) Ltd, proposes to develop the following on Portion 1 of Farm 172, Herbertsdale:

- vegetated landing strip,
- one (1) hangar with apron,
- taxiway, and a
- small water reservoir.

The vegetated runway will be created by regularly mowing the existing vegetation and compaction until the surface complies with the required standards.

1.1. Screening Tool Result & Terms of Reference

According to the DFFE (Department of Environment, Forestry and Fisheries) Screening Tool, a Geotechnical Assessment is needed for the proposed activity.

According to the protocols specified in GN 320 (Protocol for the Site Sensitivity Verification Requirements where a Specialist Assessment is required but no specific assessment protocol has been prescribed), prior to commencement with a specialist assessment, the environmental sensitivity of the site under consideration of the screening tool must be confirmed by undertaking a Site Sensitivity Verification.

The Site Sensitivity Verification is submitted with the relevant prepared Compliance Statement in accordance with the requirements of Appendix 6 in the EIA Regulations.

Mariska Byleveld was appointed as a geological / earth science specialist to conduct a geotechnical Site Sensitivity Verification and required level of geotechnical assessment. In this case, based on the verified **low** sensitivity of the site (Section 2), the required level of geotechnical assessment is a **Compliance Statement**.

1.2. Scope of Work

The following scope of work and methodology was carried out:

(a) Desktop Analysis (CapeFarmMapper & 1:50 000 Geological Map).

(b) Preliminary on-site inspection (19 March 2023).

(c) Other relevant information (type of landing strip)

(d) Confirm / Dispute the environmental sensitivity & motivate with photographs.

(e) Submit a Compliance Statement in accordance with Appendix 6 of the EIA Regulations.

2. Desktop Analysis / Baseline Geotechnical Environment

The 1:50 000 Geological Map of Herbertsdale shows that Portion 1 of Farm 172 is entirely within the Grahamstown Formation. The Grahamstown Formation represents South Africa's pedogenic duricrusts (Figure 1) (Johnson *et al*., 2006). A duricrust is characterised as a very hard, erosion resistant rock that occur either as hard nodules, crusts, or simply as hard layers. There are different types of duricrusts (Hugget, 2011):

- Ferricrete (iron-rich),
- Calcrete (rich in calcium carbonate),
- Silcrete (silica-rich),
- Alcrete (rich in aluminium),
- Gypcrete (rich in gypsum),
- Magnecrete (rich in magnesite), and
- Manganocrete (rich in manganese).

Duricrusts typically form where evaporation exceeds precipitation, except for ferricrete and alcrete which form where precipitation exceeds evaporation (Stow, 2005). Only ferricrete (iron-rich) nodules were found on site.

According to CapeFarmMapper (2023), the site consists of high-level terrace gravel, silcrete and ferricrete (Figure 2). The soils have a sandy texture, is leached and has a subsurface accumulation of organic matter, iron and aluminium oxides (CapeFarmMapper, 2023). The site investigation (as described under Section 4) confirmed that the site does contain gravel & ferricrete but no silcrete was found. The topsoil has a sandy texture but also contains small amounts of silt (silty sandy topsoil) and organic matter. The topsoil is underlain by a silty sandy layer with quarzitic pebbles, cobbles and boulders. This layer was underlain by ferricrete nodules within a clayey sand.

The on-site findings confirm that the 1:50 000 geological map and CapeFarmMapper (2023) are accurate.

According to CapeFarmMapper (2023) and the 1:50 000 geological map, no geological faults are on or near the landing strip.

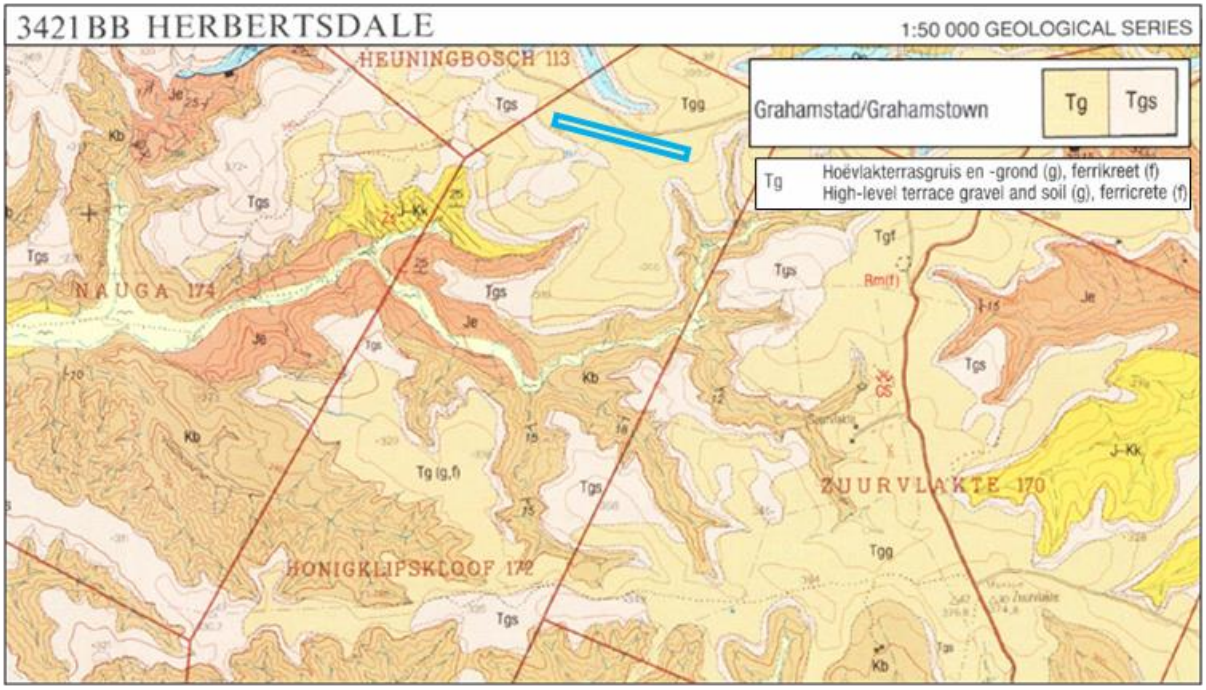


Figure 1: Geological Map of Portion 1 of Farm 172 (1:50 000 geological map of Herbertsdale).

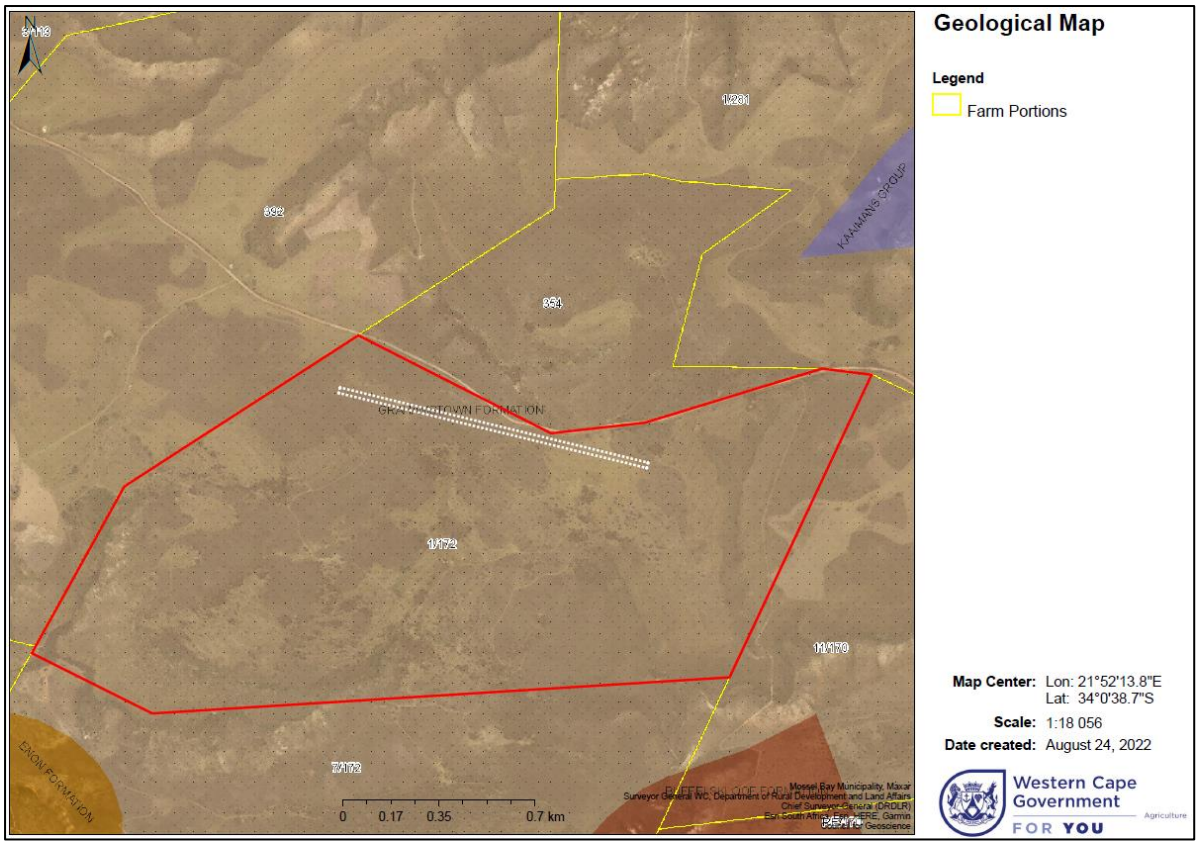


Figure 2: Geological Map of Portion 1 of Farm 172, near Herbertsdale (CapeFarmMapper, 2023).

3. Site Sensitivity Verification

The site was visited on 19 March 2023 by Mariska and Francois Byleveld. Two test pits (TP1 & 2) were excavated by hand in order to get a sense of the geology (Figure 3). Since the two soil profiles shared the same soil and geology (refer to Section 3 for a detailed explanation of the geology on-site) and the entire landing strip is contained inside the same geological formation, additional test pits were deemed unnecessary (Figure 1).

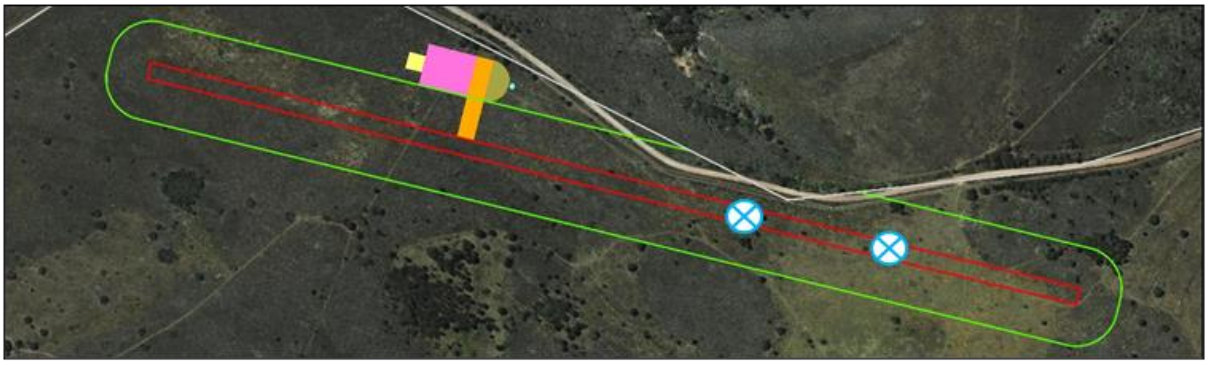


Figure 3: Approximate localities of the two test pits (TP1 & TP2).

TP 1 & 2 have three different soil layers (refer Section 3):

1	Silty Sandy Topsoil	Topsoil with a sandy texture with silt and organic matter.
2	Silty Sandy Gravel	Silty Sandy soil with quarzitic pebbles, cobbles & boulders.
3	Clayey Sandy Ferricrete	Clayey Sandy soil with Ferricrete nodules.

The topsoil has a sandy texture and also contains small amounts of silt (silty sandy topsoil) and organic matter. The topsoil is underlain by a silty sandy layer with quarzitic pebbles, cobbles and boulders. This layer was underlain by ferricrete nodules within a clayey sand. No silcrete were found on site. The gravel varied from quarzitic pebbles to boulders and the ferricrete was nodular with variable sizes (Figure 4a-c).

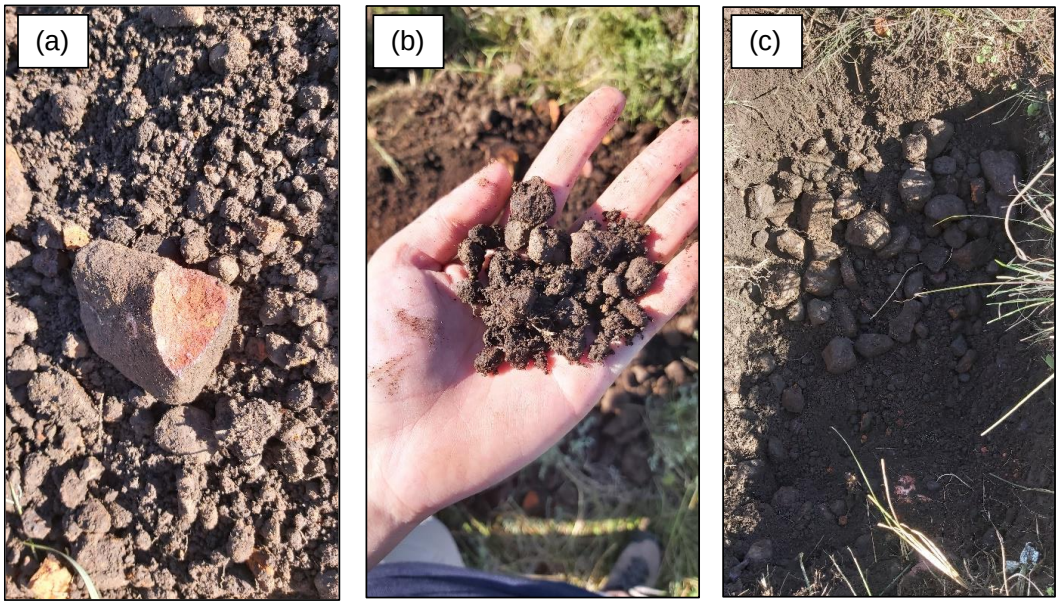


Figure 4: (a) Quarzitic boulder & ferricrete nodules found on-site. (b) Ferricrete nodules found on-site. (c) Quarzitic pebbles, cobbles and boulders found on-site.

The National Web based Environmental Screening Tool has indicated that a Geotechnical Assessment is needed for the proposed development but does not specify the reason. It is assumed that the Screening Tool might have identified a Geotechnical Assessment due to CapeFarmMapper (2023) allocating a high erodibility factor of 0.57 (K factor). Considering that the Screening Tool does not take into account the type of landing strip i.e., International Airport with tarmac and high volumes of air traffic vs. small vegetated landing strip with limited traffic and only small planes, the assumption is that a Geotechnical Assessment would be flagged irrespective.

The K factor represents both susceptibility of soil to erosion and the rate of runoff. The mean annual precipitation for the site is moderate (446mm) and is mapped at a moderate to high intensity. As mentioned earlier, ferricrete can form when precipitation exceeds evaporation. Extensive leaching over time could've resulted in the formation of the hard nodular layers of iron. Although CapeFarmMapper (2023) and the Screening Tool indicate that the erodibility factor of the area is high, **site-specific verification indicates no evidence of erosion in the area**. The site is densely vegetated with roots going beyond the topsoil layer (Figure 5). The ferricrete nodules itself are very hard erosion resistant sedimentary rocks. The current state of the site is considered stable for the proposed vegetated landing strip, subject to whether the landing strip will be properly compacted with the required standards.

Figure 5: Proposed development site which is densely vegetated.

3.1. Outcome of the Site Sensitivity Verification

Considering the lack of evident erosion in the area, the fact that there will be continues ground cover (albeit intermittently depending on frequency of flights), as well as the presence of ferricrete that has low erodibility characteristics, the sensitivity classification of HIGH is **disputed**. A level of **LOW** is more appropriate to this site and in particular the proposal activity conditions.

A Geotechnical Compliance Statement is therefore deemed appropriate.

4. Compliance Statement

Based on the outcome of the Site Sensitivity Verification (refer to Section 3.1.), a Compliance Statement is deemed appropriate for the proposed landing strip. The Site Sensitivity classification of HIGH is disputed, and a level of LOW is more appropriate.

4.1. Methodology

The following equipment were used during the site investigation:

- Geological Hammer
- Hand Lens
- Pick
- Shovel

The following aspects were considered to examine and compile the soil profiles:

- Moisture condition
- Colour
- Consistency
- Structure
- Soil Texture
- Origin
- Additional comments

4.2. Soil Profiles

As previously mentioned, the site was visited on 19 May 2023 by Mariska (SACNASP # 131589) and Francois Byleveld. Two test pits were excavated by hand.

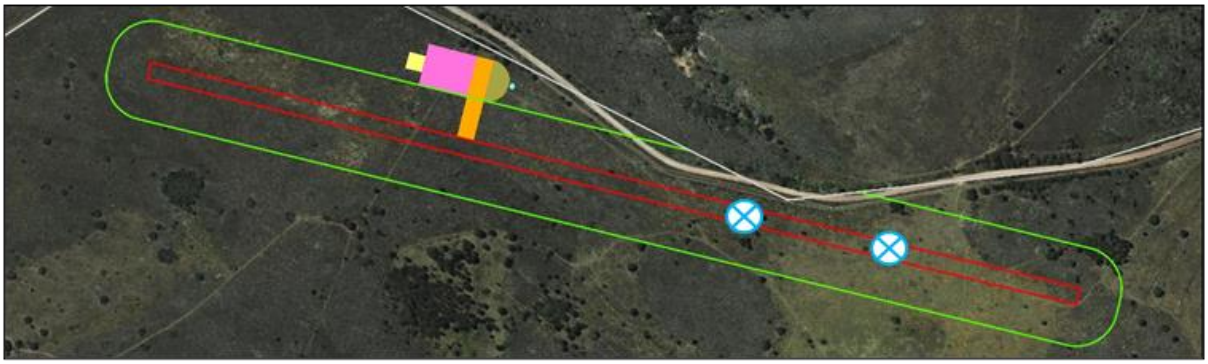
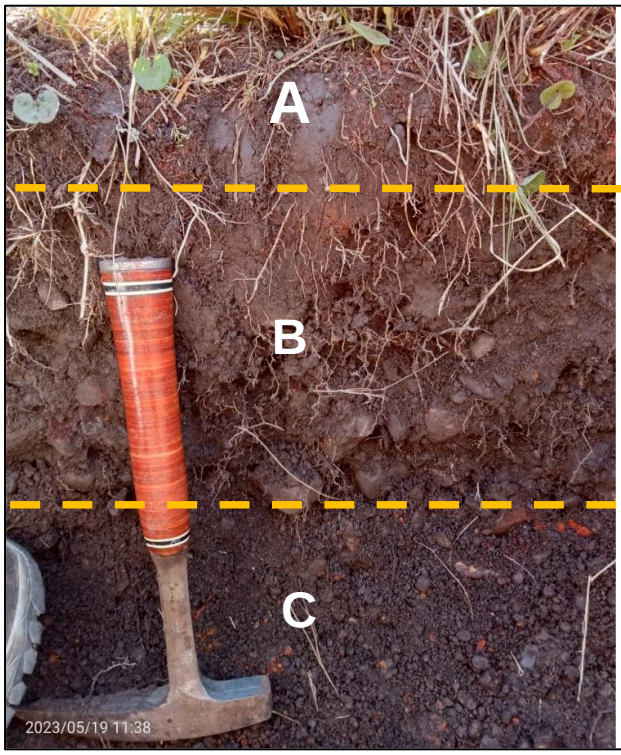


Figure 6: Approximate localities of the two test pits (TP1 & TP2).

Test Pit 1

The soil profile consists of a 100mm thick topsoil (transported dark brown silty sand) with organic matter (Layer A – Figure 7). The topsoil is underlain by a silty sandy gravel. The gravel is identified as quarztitic pebbles, cobbles and boulders with different shapes (subangular to rounded) (Layer B – Figure 7). This gravel dominated

layer is underlain by a clayey sandy pedogenic ferricrete (nodules) layer also known as “koffieklip” (Layer C – Figure 7). This nodular layer showed a very high resistance to penetration of the sharp end of a geological hammer and required many blows for excavation. The individual ferricrete nodules are also very hard to break with a geological hammer. Bedrock was not encountered in the test pit.



0 - 100mm

Dark brown, slightly moist, loose, SILTY SAND, intact, transported (organic matter present).

100 - 400mm

Dark brown orange, slightly moist, medium dense, SILTY SANDY GRAVEL, matrix supported, transported (organic matter present).

400 - 500mm

Dark brown orange, slightly moist, dense, ClAYEY SANDY FERRICRETE, pedogenic, intact.

Figure 7: Soil Profile 1.

Figure 8: 100 – 400 mm layer consisting of quarzitic pebbles, cobbles & boulders.

Test Pit 2

The soil profile also consists of a 100mm thick topsoil (transported dark brown silty sand) with organic matter (Layer A – Figure 8). The topsoil is underlain by a silty sandy gravel (quarztitic pebbles, cobbles and boulders which varies between subangular to rounded) (Layer B – Figure 8). This gravel dominated layer is underlain by a clayey sandy pedogenic ferricrete (nodules) layer (Layer C – Figure 8). This layer showed a very high resistance to penetration of the sharp end of a geological hammer and required many blows for excavation. Bedrock was not encountered in the test pit.

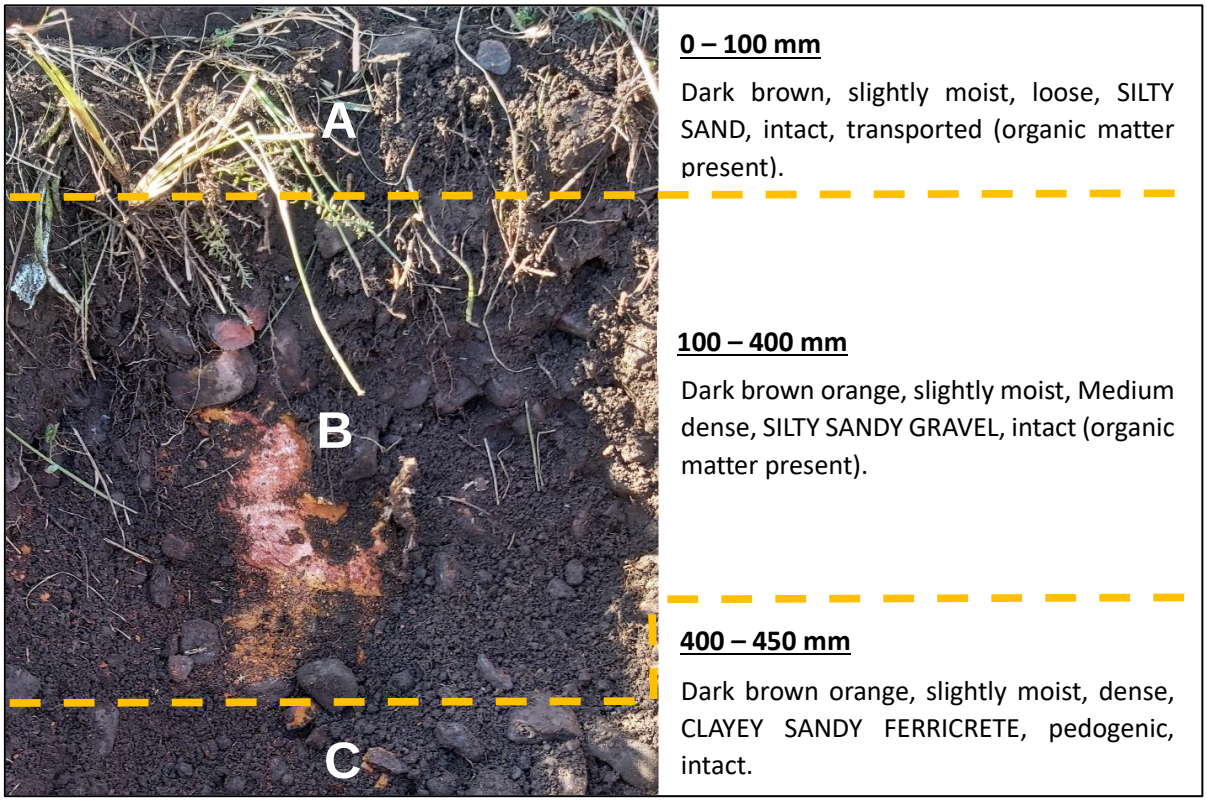


Figure 9: Soil Profile 2.

Figure 10: Stockpile of Test Pit 2 (left) and Ferricrete nodules found in Test Pit 2 (right).

4.2. General limitations

- The information contained in this report is subject to the conditions on-site on the day the site was visited (19 May 2023). It is possible that the condition of the site might change over an extended period of time as a result of either natural processes or human activity.

- The investigation is conducted within the constraints of hand excavation and two test pits were excavated. Deeper excavation would have required a TLB. All conclusions made are in accordance with the geology up to a depth of 500mm and cannot be applied to the geology deeper than 500mm.

- The investigation is conducted in accordance with the Protocols (GN 320) to confirm or dispute the geological sensitivity.

4.3. Conclusion & Recommendations

The proposed activity is deemed acceptable irrespective of the allocated high erodibility of the site according to the Screening Tool initially. Considering the lack of evident erosion in the area, the fact that there will be continues ground cover (albeit intermittently depending on frequency of flights), as well as the presence of ferricrete that has low erodibility characteristics, the sensitivity classification of HIGH is disputed. A level of LOW is more appropriate to this site and in particular the proposal activity conditions.

It is recommended, after compaction, that in-situ Dynamic Cone Penetrometer (DCP) tests be conducted to ensure that the landing strip is compacted to required standards. In addition, and to compensate for the potential long-term reduction in vegetation cover, should areas on the landing strip develop small depressions (where planes touch-down), such must be infilled with a suitable grade of compactible material and compacted to avoid unnecessary gravel.

5. References

- Hugget, R. (2011) *Fundamentals of Geomorphology.* Routledge, London.

- Johnson, M.R., Anhaeusser, C.R., Thomas, R.J. (2006) *The geology of South Africa*. Geological Society of South Africa, Johannesburg/Council of Geoscience, Pretoria.

- Stow, D. A. V. (2005) *Sedimentary Rocks in the Field.* CRC Press, New York.