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WSP Group Africa (Pty) Ltd

Attention: Anri Scheepers

**Desktop Geotechnical Assessment of a Site in Waterlands**

WSP Group Africa (Pty) Ltd (WSP) has been appointed to provide a desktop review for the expected dolomite stability of a site located in Waterlands adjacent the N3 National Highway, opposite from Vosloorus. The objective of this report is to discuss the outcome of the desktop geotechnical assessment within and around the site. The aim is to ascertain the general geotechnical conditions and the dolomitic stability within the site vicinity.

We trust that the following report of the geotechnical desktop assessment and conclusions made thereon meets your requirements. Should further detailed assessments or any clarification be required please contact me.

Yours sincerely

**Dr Robert Leyland Pri,Sci.Nat.**

Associate

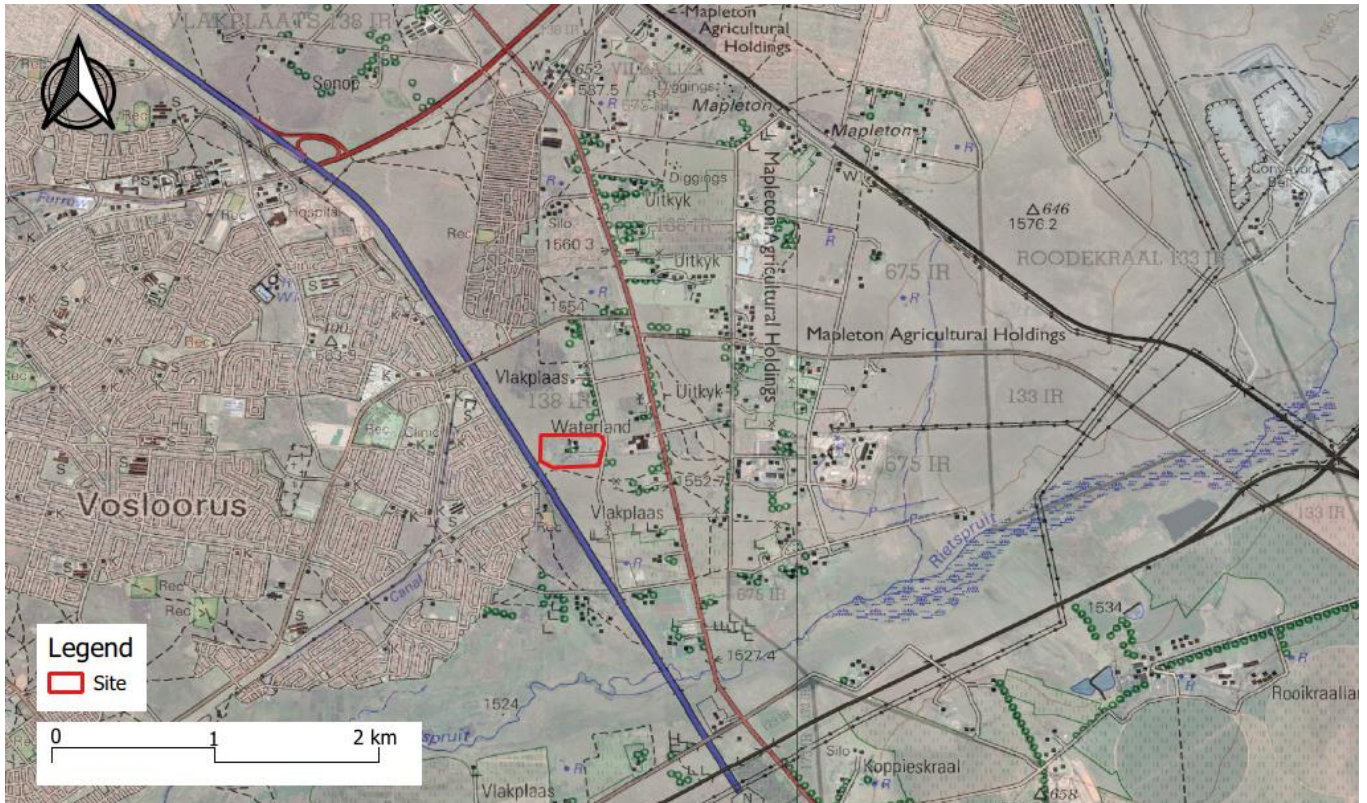
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## DESKTOP GEOTECHNICAL ASSESSMENT OF A SITE NEAR VOSLOORUS

### INTRODUCTION

WSP has performed a desktop geotechnical assessment of a site in Waterlands, near Vosloorus, Gauteng (**Figure 1**). The site occupies an area of approximately 8ha, at an altitude of 1 553m above mean sea level (amsl). The site is located within a valley that drains towards the south to the Reitspruit at an average gradient of 1.7%. The closest surface water bodies are the Reitspruit River (1.5km, south) and an unnamed canal (1.2km, west) both flowing towards the southwest.



*Figure 1. Site Location*

### GEOLOGY

According to 1:250 000 (2628 East Rand) (**Figure 2**) the site underlain by dolomite and chert of the Malmani Subgroup. Underlying dolomitic rocks are believed to be quartzites, conglomerates and shales belonging to the Black Reef Formation; these are observed along the edge of a basin dipping at 5° toward the ‘centre’ point. The eastern portion of the basin is intruded by dolerite (likely occurring as sills) and with closest mapped dolerite contact being approximately 800m east of the site.

Except for Taljaard Lime Producers Ltd and Vlaktefontein Plastic Clay Quarry situated at approximately 5km and 6km to northeast, respectively, there is no evidence of any mining activity near the site (**Figure 3**).

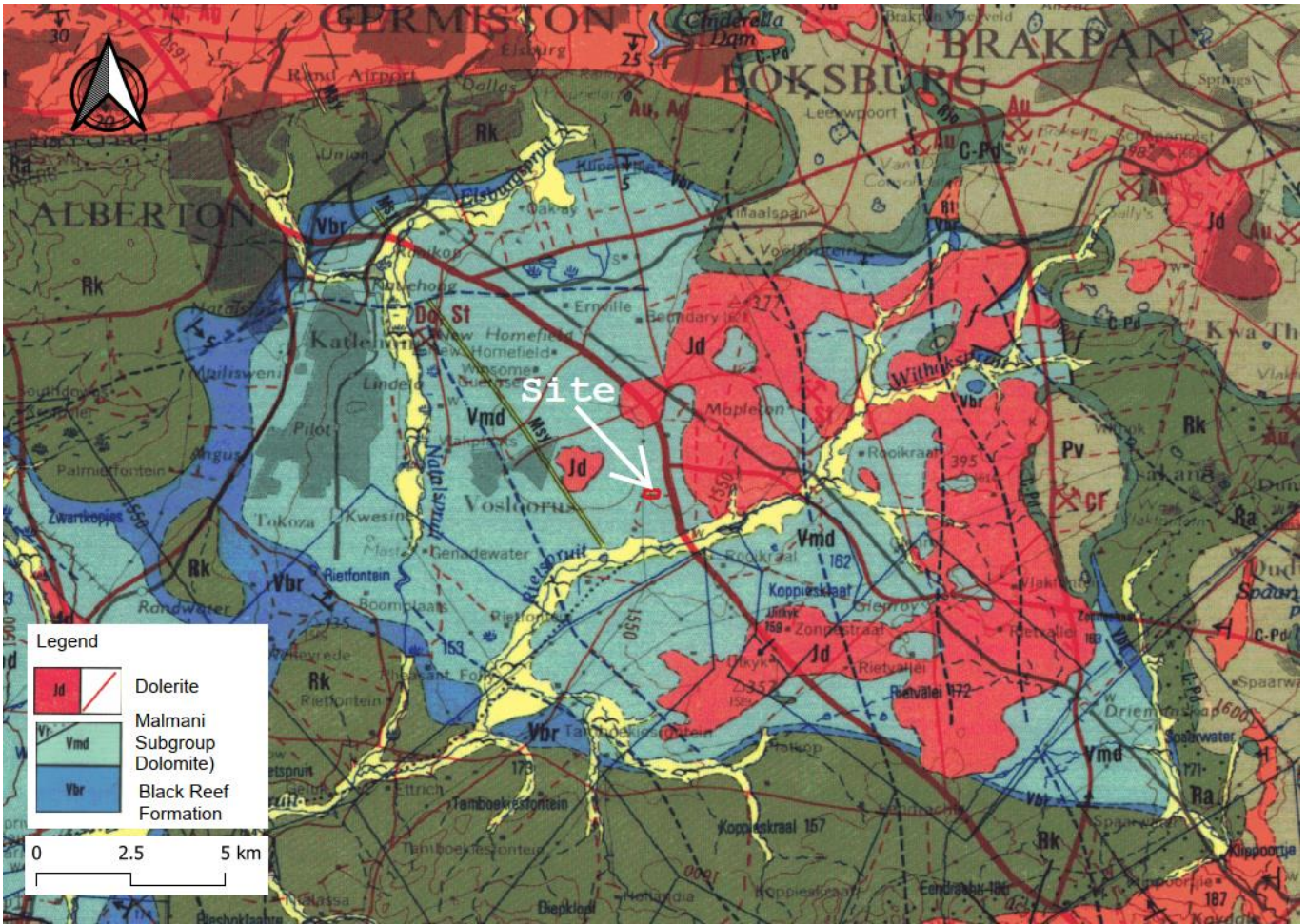


Figure 2. Site Geology

## GROUND AND GROUNDWATER CONDITIONS

According to the Klipriver/Natalspruit Dolomite Compartment Map (Department of Water Affairs, 2009) (Figure 3), the site is located within the Natalspruit East (C22C-01) compartment with groundwater depth ranging from 1.4m to 14.3m below ground level (bgl). Borehole locations and groundwater depths are comparable with those in the National Groundwater Archive database (Accessed on 25 June 2021).

The Council for Geoscience (CGS) provided a Map for Dolomite Boundaries for all previously investigated areas around the site and this includes the location of known sinkholes 300m (northeast) and 400m (southeast) from the site boundary (Figure 4).

## PREVIOUS INVESTIGATIONS

Several dolomite stability investigations have been performed in the area (Figure 4). The reports of four of the investigations performed closest to the site were obtained as part of this review. The outcomes of these investigations are discussed in the following subsections.

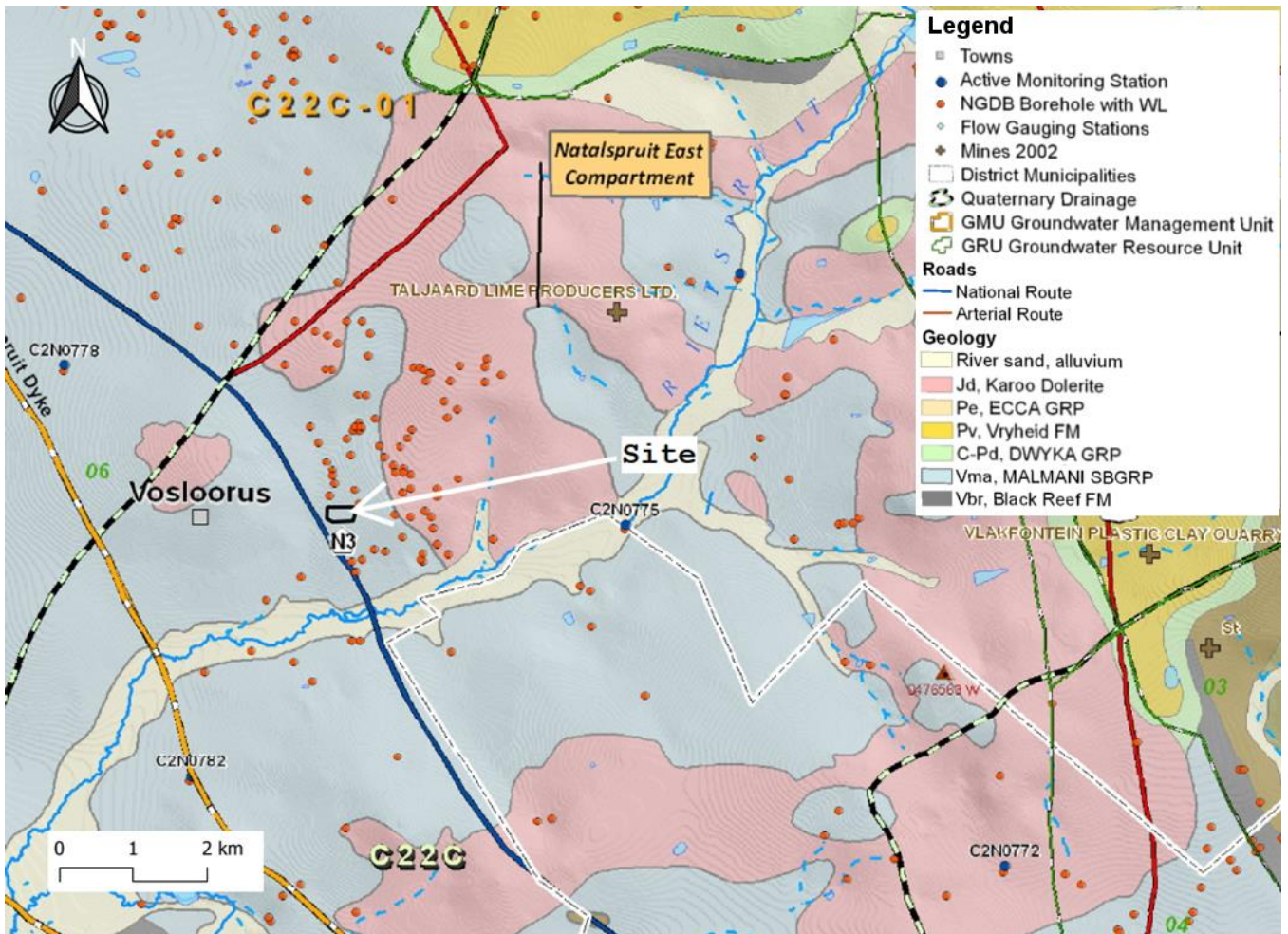


Figure 3. Site Dolomite Compartment Map

### F487 – 90588722: Dolomite Stability Investigation for Mapleton Extension 15

A dolomite stability investigation was undertaken by M.J. Van der Walt Engineering Geologist CC for the Mapleton Extension 15 (8.5 hectares) in August 2008. The F487 site is located at 0.4km (north) from the investigation area. The investigation included a gravity survey and drilling of sixteen boreholes using rotary percussion drilling.

The geological profile observed across the site varied and included up to 2m of transported soil, residual materials such as chert, Wad and “dolomite residuum” down to as deep as 20m bgl, and intact dolomite from depths as shallow as 6m bgl.

Air loss was experienced in three boreholes while cavities were encountered in two of the boreholes at 10–14m bgl and 15–17m bgl during drilling. Five out of the sixteen boreholes were found to be dry, while the rest of the boreholes recorded standing groundwater between 8.9m to 17.6m bgl.

Based on the calculated Inherent Risk Class (IRC) the site was divided into two zones; Zone A (IRC = 6–7) and Zone B (IRC = 3(b)–5), and both assigned a D4 according to the National Home Builders Registration Council (NHBRC) classification.

The risk classification indicated that Zone A be reserved for parking and ensuring the surfaces are sealed after dynamic compaction is undertaken to improve the top 6m to reduce the impact of the underlying dolomite condition. Zone B was considered suitable for light industrial and commercial development but piled foundations with spanning beams between pinnacles with suspended floors were recommended due to variable profile.

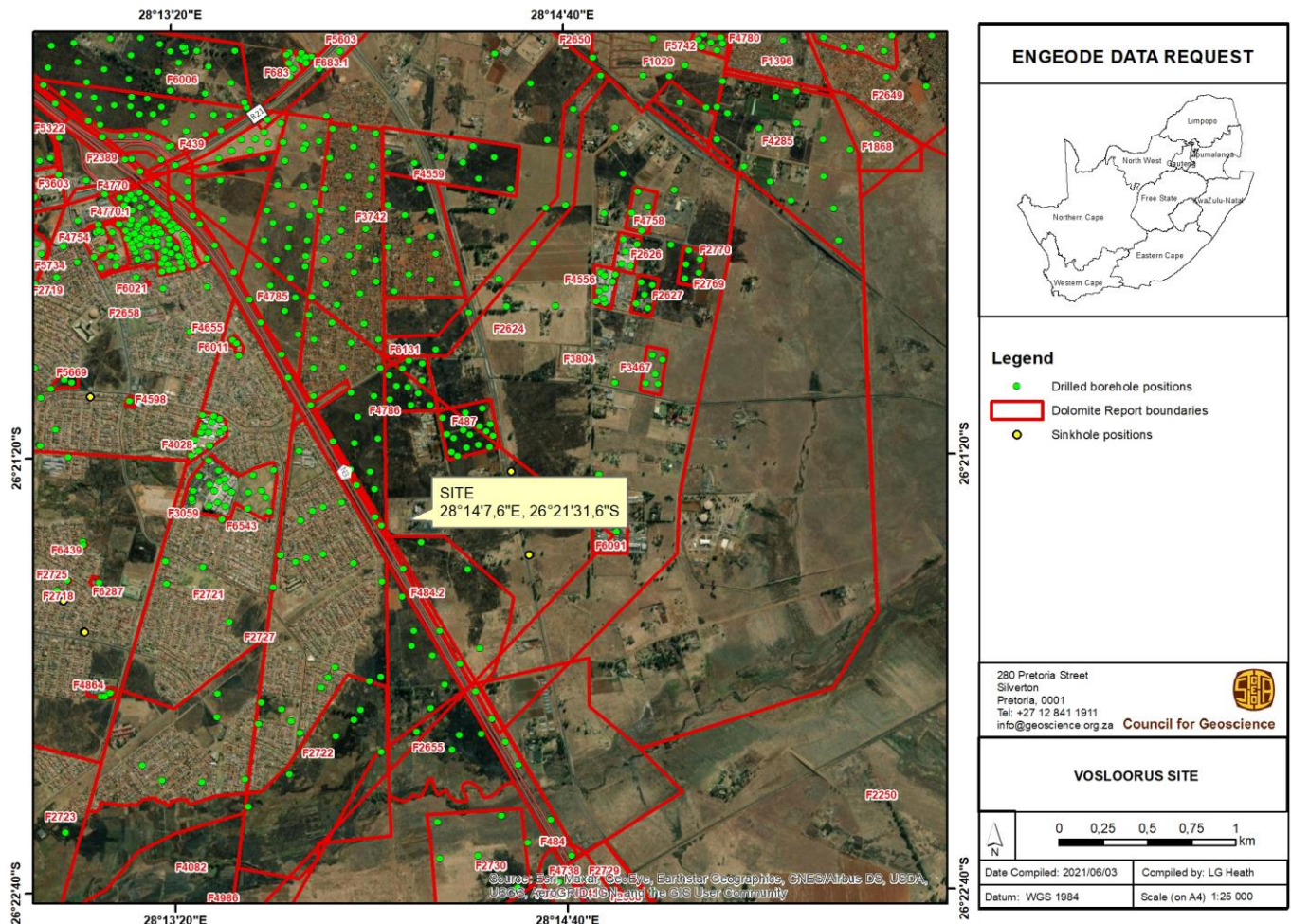


Figure 4. Dolomite investigation report numbers and site boundaries

### F4786 – 0251297: Portion 80 of the Farm Vlakplaats 138-IR Dolomite Stability Investigation

A dolomite investigation of a Portion 80 of the farm Vlakplaats (7.8ha) which included a gravity survey and drilling of ten boreholes using rotary percussion drilling was undertaken by VGI consult in December 2015. The F4786 vsite is located 0.5km (north) from the investigation area. The following information was observed during the drilling exercise:

- Transported soil varies from absent to 4m bgl
- Residual shale of the Malmani Subgroup (1m thick) was intercepted in one of the boreholes (towards the north-eastern corner of the site)
- Chert residuum was intercepted from the surface to a maximum depth of 16m bgl
- Dolomite residuum was intercepted from 1m bgl to a maximum depth of 11m bgl
- Air loss and sample loss was experienced at depths between 11m bgl and 13m bgl at one borehole located towards the western portion of the site
- Weathered dolomite was encountered at depths between 1m bgl to a maximum depth 16m bgl
- Hard rock dolomite was encountered between 6m bgl to a maximum drill depth of 21m bgl

The site was divided into three zones based on the assigned Inherent Hazard Class:

- Zone 1 (3(5)/1(4)): Eastern portion
- Zone 2 (4/1(4)): North-western portion and south-western portion
- Zone 3 (6/6)): Western portion at the middle

Zone 1 and Zone 2 were considered suitable for commercial and residential development, while Zone 3 was suitable for commercial use and all developments. However, it was recommended that all construction works be supervised by a competent person.

## **F6091: Report on Dolomite Stability Investigation Carried Out For the proposed new: Stargate Transport GC30030 Telkom Gyro Mobile Phone Based Station**

A dolomite Stability Investigation for a mobile phone tower on 78, Mapleton, Boksburg district was undertaken by JOHANN van der MERWE (Pty) Ltd in June 2020. The F6091 site is located at 0.9km (east) from the investigation area. The investigation included drilling a single rotary percussion borehole and the inspection of an open foundation for the tower.

No groundwater seepage was observed during the inspection of the excavation and the profile was observed to be:

- 0 to 0.7m bgl: Firm, sandy SILT. Transported material
- 0.7 to 1m bgl: Abundant coarse, chert gravel, clast supported in matrix. Pebble marker
- 1 to 1.7m bgl: Abundant coarse, mudrock and chert fragments clast supported sandy silt matrix. Dolomite residuum

The borehole was drilled to a depth of 54m bgl and experienced air loss at depths between 17m to 18m bgl, with a water strike at 49m bgl, and a final water rest measured at 36m bgl. A geological profile observed during the drilling was as follows:

- 0 to 7m bgl: Chert rubble
- 7 to 16m bgl: Highly weathered, soft dolomite
- 16 to 18m bgl: Stiff to soft, clay wad
- 18 to 20m bgl: Weathered, soft dolomite
- 20 to 43m bgl: Moderately weathered, medium hard dolomite
- 43 to 54m bgl: Unweathered, hard dolomite

The site was assigned a Tentative Inherent Hazard Class of 3 and considered suitable for the intended development. It was however, recommended that upper soils be replaced with a G6 material, the foundation be designed to accommodate a loss of support for a 5m diameter sinkhole and adhere to drainage precautions to minimise dolomitic impact.

## **F484 – 90575078: Transnet Pipeline: Dolomite Stability Assessment: Chainage 14.9km to 38.6km**

This information obtained from the CGS for the pipeline investigation was limited to the appendices and as such did not include a detailed description of the investigation. Nonetheless, the appendices included IRC drawings that show the pipeline alignment has an IRC of 6/1 in the site vicinity. The boreholes along the alignment illustrate the variable geotechnical conditions with the following variations observed along the alignment:

- Residual Karoo Supergroup shale directly over competent bedrock at a depth of 14m bgl
- Residual Karoo Supergroup shale directly over weathered dolomite at 19m bgl
- Competent dolomite bedrock at a depth of 3m bgl
- An absence of dolomite with Karoo mudrock materials down to a depth of 60m bgl
- Dwyka tillite and minor wad over dolomite bedrock at 10m bgl
- Hole collapses from a depth of 11m to 17m bgl causing premature stopping of drilling.

## **CONCLUSION AND RECOMMENDATION**

The desktop assessment has shown that the area surrounding the site is characterised mainly by the presence of residual soils of the dolomitic terrain in which it occurs. The depth to competent bedrock is highly variable and is covered by variable materials including potentially unstable and highly compressible wad. The site in question is expected to be underlain by similar karstified dolomitic materials that may include areas that are unsuitable for development. The presence of known sinkholes in the site vicinity further supports this. There are however also areas where significant Karoo Supergroup inliers are present but not mapped. Should the site be located on one of these areas it may be suitable for all forms of development.

A site-specific geotechnical and dolomite investigation is required to confirm the site IRC prior to any structural designs being completed. The investigation should include a gravity survey, percussion borehole drilling and inline with the procedures specified in SANS 1936:2. The final foundation designs will most likely be determined by the IRC rather than the shallow foundation conditions.

The on site materials are not expected to be suitable for use as construction material and as such suitable materials will need to be imported for most bulk earthworks or foundation or pavement layer works.



Dr Robert Leyland  
Principal Consultant