

# Geotechnical Consult Services

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**Attention: Mr. David Peinke**

## **Geological assessment: Remaining Extent of the Farm Geel Kop No 456, Siyanda District Municipality, Northern Cape Province**

Hari PV (Pty) Ltd requested Geotechnical Consult Services (GCS) to comment on the geological conditions on the farm Geel Kop No 456, Siyanda District Municipality, Northern Cape Province and the potential impact thereof for the proposed development of the Hari PV Project on the 4035ha (approx..) property in question.

This assessment will consider the basic geology, the mineral potential, the engineering geology and geohydrology of the area.

### **Regional Geology**

The Property is underlain by recent quaternary (Qg) unconsolidated sand and Tertiary, semi-consolidated calcareous sediment (T) overlying intrusive felsic rocks. The Friersdale Charnockite (Mf), a granofels containing orthopyroxene, quartz and feldspar and felsic rocks (Vaalputs Granite -Mv) and the Riemvasmaak (Mrm) Gneiss. (Figure 1).

An undifferentiated intrusion of diabase (Mga) occur close to the NE-SW trending fault (*f*). There is a NW-SE trending young diabase intrusion (Jd) cutting through the Charnockite.

The Keimoes Suite consists of a well to weakly foliated non garnetiferous and non porphyroblastic biotite, biotite hornblende and charnockitic granitoids. The emplacement of

the suite is generally related to plate tectonic processes that took place along the eastern margin of the Namaqua orogeny at approximately 1 100Ma ago. The Friersdale Charnockite is a dark-grey, unfoliated rock in which 3-15 cm ellipsoidal inclusions of mafic and quartzitic composition are commonly present. The texture is fine to medium grained.

The Vaalputs Granite (Mv) is a mesocratic (30-60% ferromagnesian minerals) well foliated adamellite (equal proportions plagioclase and potassic feldspar) granite gneiss. The Riemvasmaak (Mrm) gneiss is a pink weathering granitic gneiss with a granular or augen texture

The distribution of the calcrete outcrops suggest that their origin is more related to geomorphological and other aspects than, than to the nature and composition of the underlying rock. Both the granitoids and calc-silicate rocks are covered by a thin layer of partly to entirely calcretized sandy soil. The sandy soil has been largely produced by the in-situ mechanical weathering of the underlying rock.

### **Resource potential**

Figure 1, shows mineral occurrences identified on 1:250 000 geological map 2820 Upington with the solar PV project area shown. Mineral occurrences to the east of the farm include tungsten (W), Fluorite (Fl), Arsenic As and tin (Sn) associated with the Dysons Klip Gneiss. There are old mine workings on the farms Mc Taggerts Camp and Dysons Klip. Minor occurrences of tungsten, tin and fluorite are associated with the Riemvasmaak formation with an occurrence of Fluorite noted on Geel Kop Farm. An occurrence of beryl (Be) is also noted on Geel Kop. The occurrence is associated with the Vaalputs granite.

### **Engineering geology**

The calcareous pedogenic (calcrete) soil that develop under fluctuating water levels in the soil. The calcrete varies from nodular concretions to hardpan (rock like) layers. The strength of the calcrete is therefore variable over short distances. The calcretization in the soil on the site is poorly developed, since the soil layer is also poorly developed.

Both the calc- silicates of the granitoids and the Friersdale Charnockite have poorly developed weathering profiles due to the dry climate and the founding conditions are good due to the shallow weathering profile. Excavatability are therefore also limited to less than 2m below surface on the gentle sloping ground, and even less along ridges.

### **Geohydrology**

The farm is located within the D73F Quaternary and is situated in the Lower Orange River Water Management Area. The recorded mean annual precipitation is 84 mm per annum and the groundwater recharge is 2.1mm per year. The groundwater level of the area is

variable but generally deeper than 20m below surface Information obtained from the National borehole database indicate that shallow boreholes in the area have yields below 0.2 l/s. The water quality in the area is generally hard with elevated TDS values.

The average evaporation rate in the project area is approximately 2650mm per annum, with the highest evaporation occurring in from December to April. The water deficit for the area is in the order of 2000mm/a.

Ephemeral drainage lines are common in the area, these systems are usually active for a few hours or days and play an important role in the transport of water and sediment during storm events and should be considered in stormwater management

### **Conclusion**

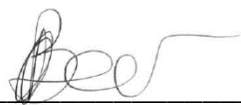
The Remaining extent of the Farm Geel Kop No 456 is located on intrusive felsic and granitic rocks that are known to have metallic mineralization. The occurrences on site is limited to fluorite and beryl, both of which have not been exploited in the past. The occurrences are unlikely to have mineable reserves.

The soil profile is generally poorly developed and mechanical weathering is prevalent. Occurrences of transported aeolian sand and calcrete may occur on lower lying areas.

No dolomitic material is present in the area.

The groundwater potential of the underling rocks is generally poor but usable groundwater intersections may occur along dykes and faults.

Kind Regards



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