PALAEONTOLOGICAL FIELD INVESTIGATION PHASE 1 REPORT

PROPOSED ACCESS ROAD

Hanover, Northern Cape Province of South Africa
Farm: Remainder of the Farm Van der Lindes Kraal No. 79
in the Emthanjeni Local Municipality
within the Pixley ka Seme District Municipality

Developer: Scatec Solar SA (Pty) Ltd
Project Company : Simacel 155 (Pty) Ltd

Heritage Consultant:
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EXECUTIVE SUMMARY

Metsi-Metseng Geological and Environmental Services CC was appointed by Jean Beater Consulting on behalf of Scatec Solar (Pty) Ltd / Simacell 155 (Pty) Ltd to undertake a Phase 1 Palaeontological Field Investigation, assessing the potential palaeontology impact of the proposed access road to connect renewable energy development sites north east of Hanover with the national road system.

This report complies with the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage on a road in excess of 300 m..

The access road on the Remainder of the Farm Van der Lindes Kraal No. 79 is situated close to the town of Hanover in the Emthanjeni Municipality in the Pixley ka Seme District of the Northern Cape. The proposed road development is to provide access to a renewable energy development from the national road network. The access gravel road will be approximately 3 km in length and less than 13.5m in width.

Prior to the field investigation a preliminary assessment (desktop study) of the topography and geology of the study areas were made using appropriate 1:250 000 geological maps in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) were identified within the study area and the known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas were identified within the development footprint to focus the field investigation's time and resources. The aim of the fieldwork was to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The study area is mainly underlain by Permian sedimentary rocks of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite dominates the high laying areas while recent Quaternary Alluvium and Coluvium deposits occur in the valleys.

The desktop study suggests that the area underlain by the Adelaide Subgroup will be highly sensitive for the palaeontological heritage. However, the field investigation results indicate that due to the coluvial deposits the potential for finding fossils are limited. The development of a road with shallow excavations will not uncover any fossil material.

There is no possibility that fossils could be encountered during shallow excavations of the Adelaide Subgroup due to deep coluvial deposits. Therefore, the palaeontological sensitivity will be low with no significant heritage impact. No palaeontological mitigation is needed for the development.

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1. INTRODUCTION

1.1. Background

Metsi-Metseng Geological and Environmental Services CC was appointed by Jean Beater Consulting on behalf of Scatec Solar (Pty) Ltd/ Simacell 155 (Pty) Ltd to undertake a Phase 1 Palaeontological Field Investigation, assessing the potential palaeontology impact of the proposed access road to connect renewable energy development sites north east of Hanover with the national road system.

This report complies with the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage for a road in excess of 300 m.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

1.2. Aims and Methodology

A Phase 1 investigation is often the last opportunity to record the fossil heritage within the development footprint. These records are very important to understand the past and form an important part of South Africa's National Estate.

Following the *"SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports"* the aims of the palaeontological impact assessment were:

- to identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assessing the level of palaeontological significance of these formations;
- to commenting on the impact of the development on these exposed and/or potential fossil resources and
- to making recommendations as to how the developer should conserve or mitigate damage to these resources.

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Priority palaeontological areas were identified within the development footprint to focus the field investigation's time and resources. The aim of the fieldwork was to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The likely impact of the proposed development on local fossil heritage was determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. The developer should be made aware of the potential for finding fossils. If fossil material is later discovered it must be appropriately protected and the discovery reported to the appropriate Heritage Authority so that any appropriate mitigation by a palaeontological specialist can be considered and implemented, at the developer's expense.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in outcrops and exposed bedrock. The chances of finding fossils during excavations by a professional palaeontologist are high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan. The mitigation should involve the comprehensive recording and collection of surface and embedded fossils along and close to the development footprint by a professional palaeontologist.

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

2. DESCRIPTION OF THE PROPOSED ACCESS ROAD

The access road on the Remainder of the Farm Van der Lindes Kraal No. 79 is situated close to the town of Hanover in the Emthanjeni Municipality in the Pixley ka Seme District of the Northern Cape (Figure 2.1).

The proposed road development is to provide access to a renewable energy development from the national road network. The access gravel road will be approximately 3 km in length and less than 13.5m in width.

Figure 2.1 Locality of the Proposed Access Road

3. GEOLOGY OF THE AREA

The study area is mainly underlain by Permian sedimentary rocks of the Karoo Supergroup (Figure 4.1). These Permian sedimentary rocks are classified as the Adelaide Subgroup (Pa) of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite (Jd) sills dominate the hilltops while the low laying areas consist of recent Quaternary (^^) Alluvium deposits.

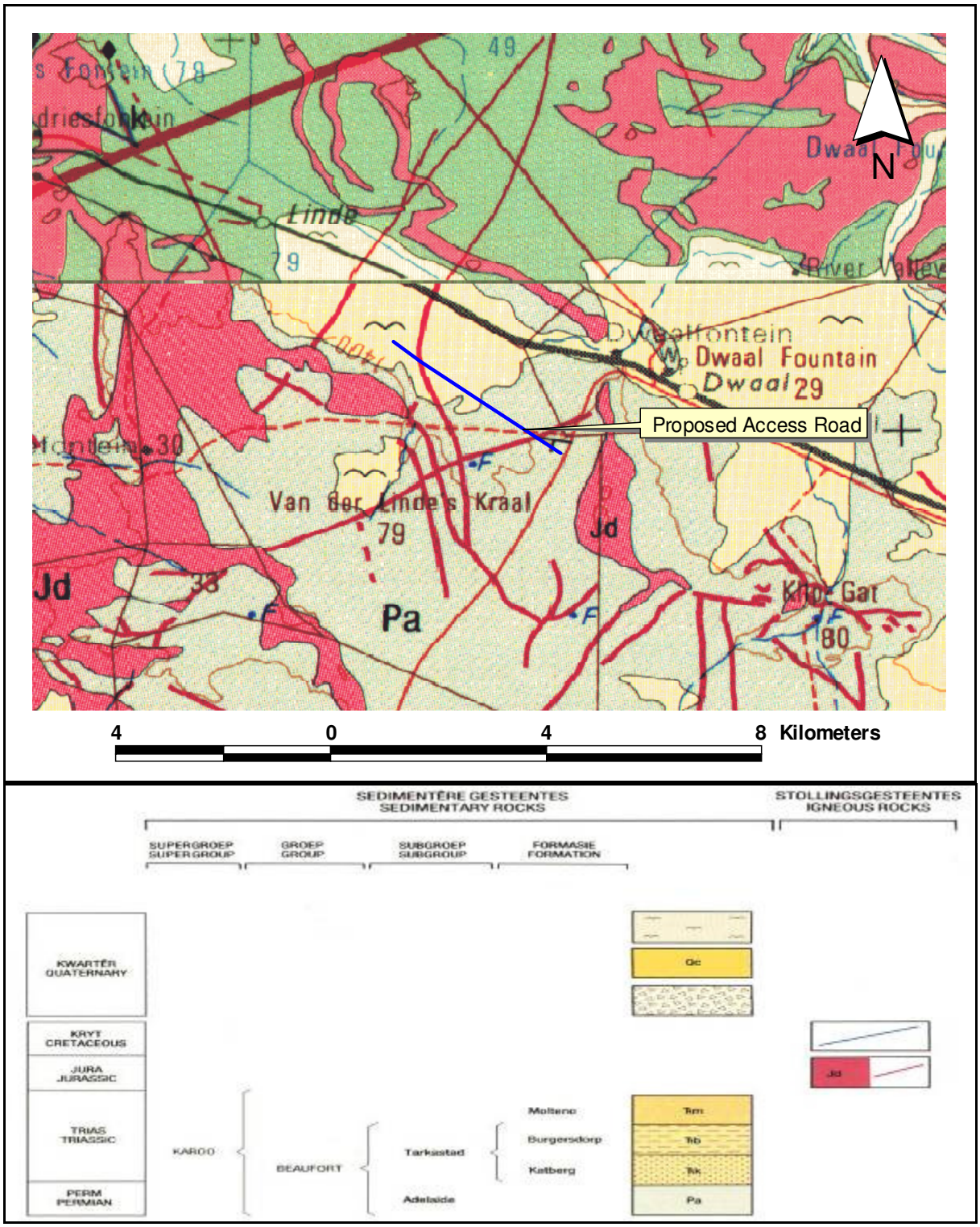

Figure 3.1 **Geology of the study area at Hanover (Geo Maps 3024 Colesberg and 3124 Middelburg)**

3.1. The Adelaide Subgroup

The Adelaide Subgroup (Pa) is interpreted as fluvial sediments with channel sandstones (meandering rivers), thin mudflake conglomerates interbedded with floodplain mudrocks (grey-green, purplish), pedogenic calcretes, playa lake and pond deposits and occasional reworked volcanic ashes (Johnson *et al*, 2006 and Almond & Pether, 2008). The Adelaide subgroup is represented by blue-grey mudstone, sandstone and siltstone.

3.2. Karoo Dolerite

Dolerite (Jd) is a very hard igneous rock that intruded the sedimentary layers and can occur either as sills or dykes. Sills can be from a few meters to tens of meters thick.

3.3. Quaternary Deposits

The Quaternary Deposits consist of alluvial deposits, deposited by rivers in the valley floors.

4. PALAEONTOLOGY OF THE AREA

4.1. The Adelaide Subgroup

The Adelaide Subgroup have a diverse continental fossil biota dominated by a variety of *Therapsids* (eg *dinocephalians, dicynodonts, gorgonopsians, therocephalians, cynodonts*) and primitive reptiles (eg *pareiasaurs*), sparse *Glossopteris* Flora (petrified wood, rarer leaves, horsetail stems), tetrapod trackways, burrows and coprolites. Freshwater assemblages include temnospondyl amphibians, palaeoniscoid fish, non-marine bivalves, phyllopod crustaceans and trace fossils (esp. Arthropod trackways and burrows, “worm” burrows, fish fin trails plant rootlet horizons) (Almond & Pether, 2008).

4.2. Karoo Dolerite

Due to the ingenious character of Karoo Dolerite it will contain no fossils.

4.3. Quaternary Deposits

No fossils are expected in the alluvial deposits of recent rivers.

5. PRELIMINARY ASSESSMENT RESULTS

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity is summarised in Table 5.1.

Table 5.1 Palaeontological Sensitivity of Geological Units on Site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Adelaide Subgroup BEAUFORT GROUP	Blue-grey mudstone, sandstone and siltstone LATE PERMIAN	Vertebrate fossils of the *Therapsids* group e.g. *Gorgonopsian* and *Dicynodonts* and Plant fossils e.g. *Glossopteris* trees and leaves.	*Dicynodon* Assemblage Zone	High sensitivity

6. FIELD INVESTIGATION

Dr Gideon Groenewald visited the access road on the Remainder of the Farm Van der Lindes Kraal No. 79 on Tuesday 15 January and Wednesday 16 January 2013. The topography of the area is flat with extensive coluvial deposits (Figures 6.1, 6.2 and 6.3). Outcrops of the Adelaide Subgroup are localised and weathered. No fossil materials were observed during the field investigation.

Figure 6.1 Access route with confined Adelaide Sandstone outcrops (GPS S 31.02072° E 24.76656°)

Figure 6.2 Hill wash obscuring outcrops of the Adelaide Subgroup (GPS S 31.02473° E 24.69023°)

7. PALAEONTOLOGICAL SENSITIVITY AND SIGNIFICANCE

The desktop study suggests that the area underlain by the Adelaide Subgroup will be highly sensitive for the palaeontological heritage. However, the field investigation results indicate that due to the coluvial deposits the potential for finding fossils are limited. The development of a road with shallow excavations will not uncover any fossil material.

Therefore, the palaeontological sensitivity will be low with no significant heritage impact as illustrated in Figure 7.1.

Figure 7.1 Palaeontological Sensitivity Localities

8. CONCLUSION AND RECOMMENDATIONS

The study area is mainly underlain by Permian sedimentary rocks of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite sills dominate the high laying areas while recent Quaternary Alluvium and Coluvium deposits occur in the river valleys.

There is no possibility that fossils could be encountered during shallow excavations of the Adelaide Subgroup due to deep coluvial deposits. Therefore, the palaeontological sensitivity will be low with no significant heritage impact. No palaeontological mitigation is needed for the development.

9. REFERENCES

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Groenewald GH.1996. Stratigraphy and Sedimentology of the Tarkastad Subgroup, Karoo Supergroup, South Africa. Unpubl PhD Thesis, University of Port Elizabeth.

Johnson MR , Anhaeusser CR and Thomas RJ (Eds) (2006). The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

Rubidge BS (ed) 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup), South Africa. South African Committee for Stratigraphy.

10. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

11. DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist