

**MAHLANGOSI SUBSIDISED HOUSING DEVELOPMENT IN  
WARD 1 OF THE UPHONGOLO LOCAL MUNICIPALITY,  
KWAZULU-NATAL: PALAEOLOGICAL DESK-TOP  
INVESTIGATION REPORT**

**FOR**

**Gert Watson**  
**K2M Environmental (Pty) Ltd**  
**Director [gert@k2m.co.za](mailto:gert@k2m.co.za)**  
**Mnini Road, Kloof**  
**3610**

by

**Dr Alan Smith**  
**Alan Smith Consulting**  
29 Browns Grove, Sherwood, Durban, 4091, South Africa  
Telephone: 031 208 6896  
[asconsulting@telkomsa.net](mailto:asconsulting@telkomsa.net)

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## Declaration of Independence

**This report has been compiled by Dr Alan Smith (Pr. Sc. Nat.) of Alan Smith Consulting, Durban. The views expressed in this report are entirely those of the author, if not then the source has been duly acknowledged. No other interest was displayed during the decision making process for the Project.**

**Specialist: Dr Alan Smith**

**Signature:** 

## EXECUTIVE SUMMARY

It is proposed to construct a subsidised housing development in Ward 1 of the Mahlangosi, Phongolo Local Municipality, near Pongola, KwaZulu-Natal. Gert Watson of K2M Environmental (Pty) Ltd requested a desk-top PIA assessment. This report was compiled by Dr Alan Smith of Alan Smith Consulting (Appendix 1). The SAHRIS Palaeosensitivity Map for this area is coded red (“very high” sensitivity; see section 4: Palaeontology).

This housing development will be underlain by: the following lithologies:

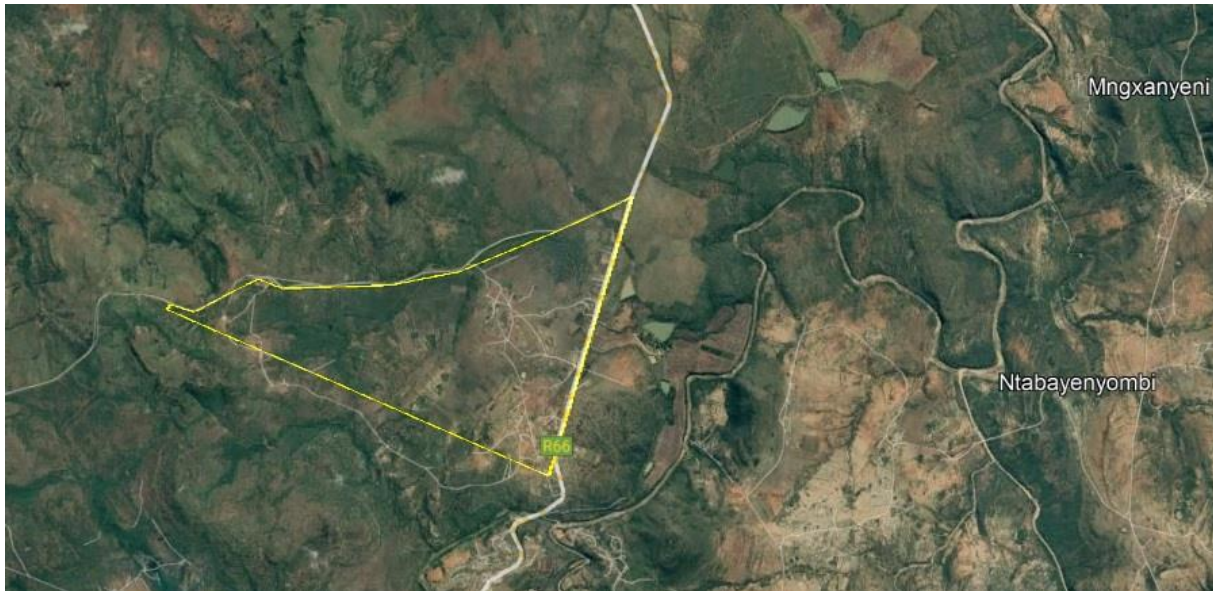
- Vryheid Formation
- Volksrust Formation
- Emakwezini Formation
- Karoo Dolerite.

This site is dominated by the Emakwezini Formation, which is known for plant fossils, but these are not significant. Both the Volksrust and Vryheid Formation do contain fossils but these are very rare. The Karoo Dolerite, being of intrusive igneous origin, is not fossiliferous.

A “Chance Find Protocol” should suffice for these lithologies (see Appendix 2) as this area is not significantly fossiliferous. No further palaeontological work is required unless triggered by the “Chance Find Protocol”.

## 1. PROPOSED PROJECT

It is proposed to construct a subsidised housing development in Ward 1, of the Uphongolo Local Municipality, KwaZulu-Natal (Figure 1). The proposed development area is approximately 713.57 ha in extent. .



*Figure 1: Location of the proposed Mahlangosi Subsidised Housing Development).*

## 2. METHODOLOGY, ASSUMPTIONS AND LIMITATIONS

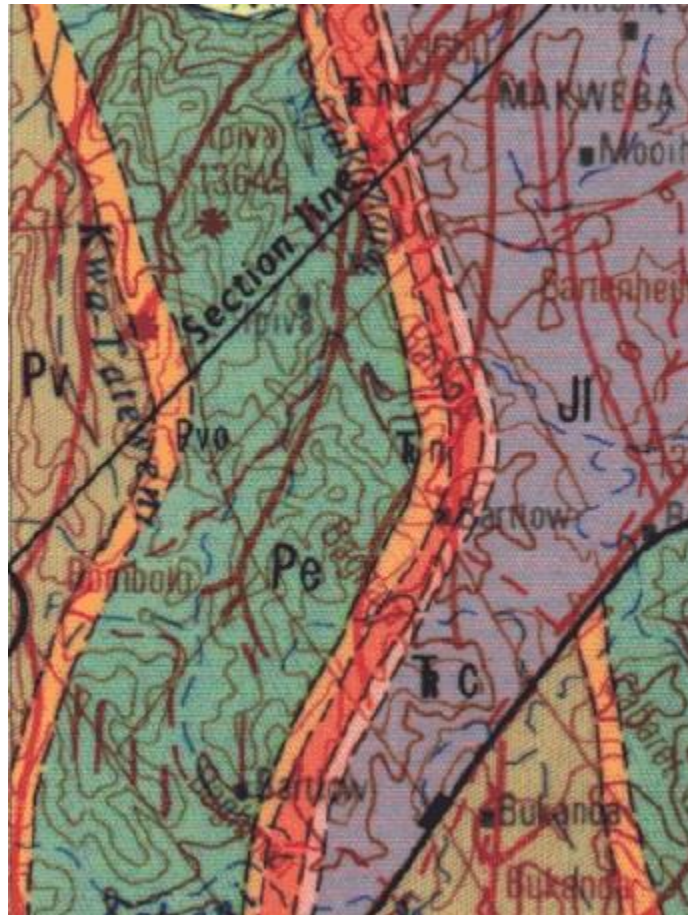
GoogleEarth, geological maps, a literature review and personal experience (see Appendix 1) were used in this desk-top research.

Assumptions were made that the maps and information given are correct.

Limitations are that no fieldwork was conducted as the request was for a Desk-Top Palaeontological Report only. In mitigation a “Chance Find Protocol” (Appendix 2) has been inserted. This should be written into the EMPr.

### 3. GEOLOGY

The proposed project footprint is located on rocks of the Karoo Supergroup. In this region the Karoo Supergroup forms part of the Lebombo Rift system. Consequently, these Formations dip at between 8-30° to the southwest (Figure 12). The thicknesses of these lithologies, included in the descriptions below, are from SACS (1980). Anticipated rock units, from the St Lucia (2732) 1:250 000 Geological map are shown in Figure 2.



*Figure 12: Extract from the St Lucia (2732) 1:250 000 Geological Map showing the lithologies likely to be encountered. These are the Vyrheid Formation (Brown: Pv), Volksrust Formation (Orange: Pvo) and the Emakwezini Formation (Light green: Pe). Karoo dolerite dykes are also likely to be present.*

### **Vryheid Formation**

The Permian aged Vryheid Formation (Kungurian Stage  $\approx$  260Ma: Green and Smith, 2012) comprises predominantly coarse-grained sandstone and siltstones, interbedded by dark shales and coal beds. The Formation is interpreted as “near-shore sandbars” and deltaic deposits that prograded into the ancient Karoo Sea. The latter was located within central part of the Gondwana supercontinent (Johnson et al, 2009).

### ***Volksrust Formation***

The Volksrust Formation is Late Permian in age (Cairncross et al. 2005). typically, it comprises a blue-black shale. This unit was deposited in generally non-marine conditions (Cataneneau et al., 1998), but pockets of marine conditions were present (Cairncross et al., 2005).

### ***Emakwezini Formation***

The Emakwazini Formation is considered a stratigraphic equivalent of the Normandien and Estcourt Formations within the eastern and north-eastern Main Karoo Basin (Bordy and Prevec, 2015). The thickness is probably in the 500-700 m range (Bordy and Prevec, 2015 and references therein). It comprises greenish to black shale with fine-to-medium-grained sandstone and coal seams (Dundee, 2830). Wave ripples are a common feature of this lithology. This marks the base of the Beaufort Group. The Beaufort Group (part of the Karoo Supergroup) is a sequence of fluvio-lacustrine sedimentary rocks that accumulated in a landlocked, intracratonic foreland basin in SW Gondwana during the Middle Permian to Middle Triassic (Neveling et al., 2005).

### ***Karoo dolerite***

This dolerite was intruded as part of the Karoo LIP (Hastie et al., 2014). This served as the plumbing that fed the Letaba Formation and other extrusive rocks.

#### 4. PALAEOLOGY

The colour coding used in the Sahris Palaeosensitivity Map is shown in Table 1 below:

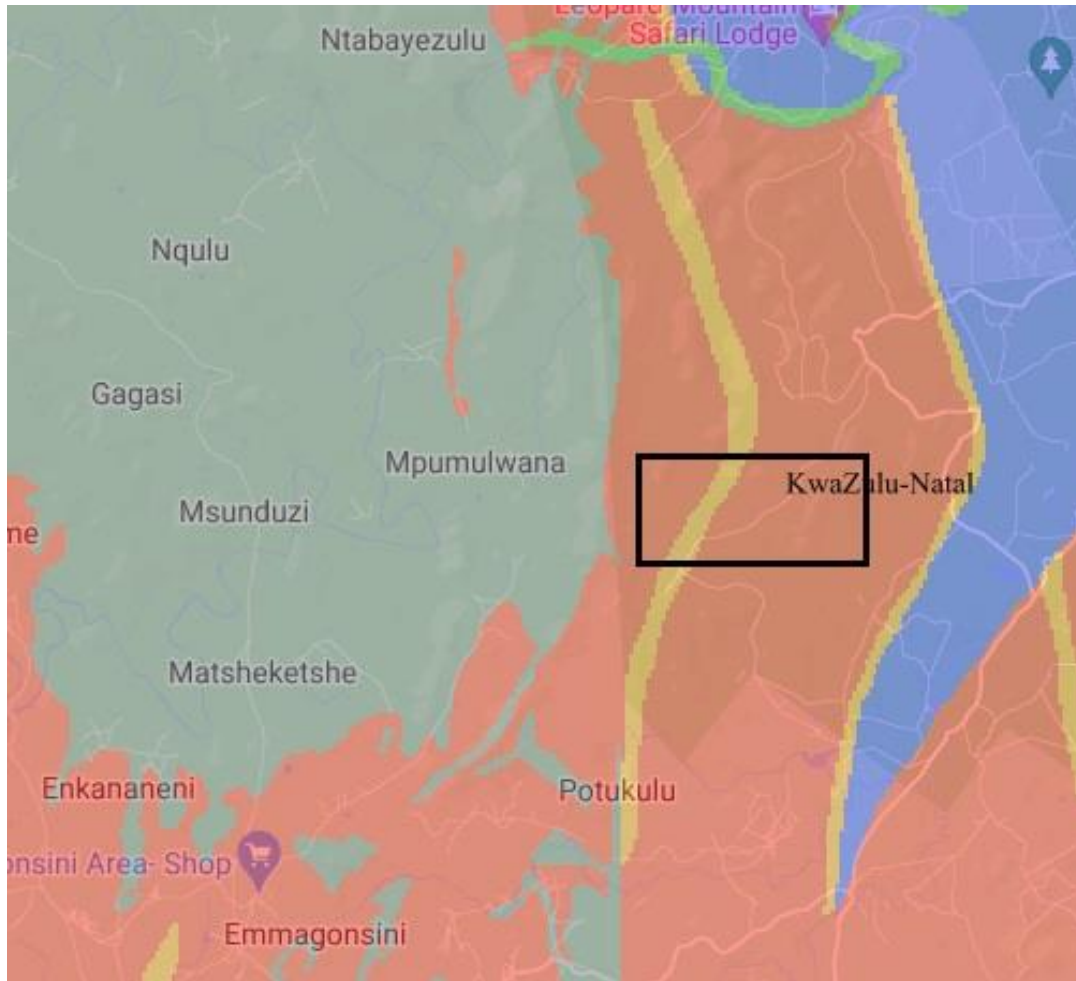
**Table 1: Summary of SAHRIS categories**

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required

The palaeosensitivity of this area, as shown in the SAHRIS Palaeosensitivity map, is provided in Figure 3. The Vryheid and Emakwizini Formations appear as red, and the Volksrust Formation as yellow.

#### Vryheid Formation

The SAHRIS Palaeosensitivity Map (Figure 3) considers the Vryheid Formation as a **Very High Palaeosensitivity Zone**. In practise, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith, 1983; Mason and Christie, 1985; Hastie et al., 2019). Groenewald (2018) pointed out that the aquatic reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the basin (MacRae, 1999). The Whitehill Formation (500 km to the southwest), within the Main Karoo Basin, *may* be a correlative of the Vryheid Formation, however they are not physically connected. Further, recent research has shown that the lower Vryheid Formation in this area has a different source (Maurice Ewing Bank) to the rest of the Vryheid Formation (Hastie et al., 2019).



**Figure 3: Approximate area of the proposed Mahlangosi Subsidised Housing Development area showing the palaeosensitivity of rocks on which it would be constructed.**

Thin (uneconomic) coal seams are known from the Vryheid Formation in this region (Tavener Smith, 1982; Hastie et al., 2019). Coal comprises compressed plant material and thus constitutes a fossil. Plants such as *glossopteris*, *gangamopteris* and *sigillaria* can be recognized, but these are common. No evidence of coal or Vryheid Formation rocks was seen on this site.

### ***The Volksrust Formation***

Unidentified trace fossils (*ichnofossils*) are common in the Volksrust Formation; unfortunately these are not photogenic as the rock is very weathered, hence they were not easily identifiable. *Ichnofossils* are common and of little Palaeontological Significance.



The bivalve, *Megadesmus*, has been recorded from the Volksrust Formation near Newcastle (Cairncross et al., 2005). This fossil is large, 9 cm dorsally and 8.4 cm laterally (Figure 4). *Megadesmus* is known from other parts of the Gondwana Supercontinent (Australia, India, Siberia, South America and Tasmania). Its presence indicates exclusively marine conditions. The implication for the northeastern Karoo Basin during the Late Permian is that a marine enclave still existed in this geographic area and that terrestrial conditions did not yet prevail, as in the southern basin region (Cairncross et al, 2005).



***Figure 4: Megadesmus bivalve. This image was obtained from Cairncross et al. (2005).***

### *Emakwezini Formation*

Fossil woods are found in the Emakwezini Formation. These are useful for interpreting regional stratigraphy (Bordy and Prevec, 2015), but are relatively common. These occur in thin coal seams and in calcareous shales. Some of these calcified shales are limestones, but these are very unusual (Figure 5). Coal formed in swamps, and the limestones probably in the vicinity of carbonated springs during hot dry climatic periods. The latter are rare.



*Figure 5: Examples of unidentified fossil woods from the Emakwezini Formation near this site. They typically occur in layers a few centimetres thick).*

Plant stem impressions were also observed in mudstone of the Emakwezini Formation.. These fossils are usually bedding-plane parallel.

### *Karoo dolerite*

This is an intrusive igneous rock and cannot be fossiliferous.

## **5. SUMMARY AND CONCLUSIONS**

This site is dominated by the Emakwezini Formation, which is known for plant fossils (Bordy, et al, 2015). For the Emakwezini a “Chance Find Protocol” should suffice (see Appendix 2). The Vryheid and Volksrust Formations are unlikely to contain any significant fossils.

A “Chance Find Protocol” has been inserted into this report. No further palaeontological work is required unless triggered by the “Chance Find Protocol”.

## 6. REFERENCES

Bordy EM; Prevec, R (2015). Lithostratigraphy of the Emakwezini Formation (Karoo Supergroup), South Africa, *South African Journal of Geology*, 307-310.

Cairncross, B; Beukes, NJ; Coetzee, LL; Rehfeld, U. (2005) The bivalve *Megadesmus* from the Permian Volksrust Shale Formation (Karoo Supergroup), northeastern Karoo Basin, South Africa: implications for late Permian Basin development. *South African Journal of Geology*, 108: 547-556.

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Hastie, WW; Watkeys, MK; Aubourg, C (2014). Magma flow in dyke swarms of the Karoo LIP: Implications for the mantle plume hypothesis. *Gondwana Research* 25 (2014) 736–755.

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Sahris Palaeosensitivity Map: <https://sahris.sahra.org.za/map/palaeo>

Watkeys, M.K., 2006. Gondwana break-up: a South African perspective. In: M.R. Johnson, C.R. Anhaeusser and R.J. Thomas (Editors), *The Geology of South Africa*, Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria, 531-539.

## APPENDIX 1: DETAILS OF SPECIALIST

### **Dr Alan Smith**

**Private Consultant: Alan Smith Consulting, 29 Brown's Grove, Sherwood, Durban, 4091**

&

**Honorary Research Fellow: Discipline of Geology, School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Durban.**

**Role:** Specialist Palaeontological Report production

#### **Expertise of the specialist:**

- PhD in Geology (University of KwaZulu-Natal), Pr. Sc. Nat., I.A.H.S.
- Expert in Vryheid Formation (Ecca Group) in northern KZN, this having been the subject of PhD.
- Scientific Research experience includes: Fluvial geomorphology, palaeoflood hydrology, Cretaceous deposits.
- Experience includes understanding Earth Surface Processes in both fluvial and coastal environments (modern & ancient).
- Alan has published in both national and international, peer-reviewed journals. He has published more than 50 journal articles with 360 citations (detailed CV available on request).
- Attended and presented scientific papers and posters at numerous international and local conferences (UK, Canada, South Africa) and is actively involved in research.

Selected recent palaeo-related work includes:

- Desktop PIA: Proposed middle income housing units on Portion 23 of Farm Lot H Weston 13026, Bruntville, Mpofana Local Municipality. Client: UMLANDO.
- Desktop PIA: Proposed ByPass Pipeline for Ulundi bulk water pipeline upgrade. Client: UMLANDO.
- Fieldwork PIA: Bhekuzulu Epangweni KZN water reticulation project, Cathkin Park. Client: Mike Webster, HSG Attorneys.
- Desktop PIA: Zuka valley, Ballito. Client: Mike Webster, HSG Attorneys.
- Mevamhlope proposed quarry palaeontology report. Client: Enviropro.
- Desktop PIA: Proposed Lovu Desalination site. Client: eThembeni Cultural Heritage.
- Desktop PIA: Tinley Manor phase 2 North & South banks: eThembeni Cultural Heritage
- Desktop PIA: Tongaat. Client: eThembeni Cultural Heritage.
- Palaeontological Assessment Reports (3) to Scatec Solar SA (Pty) Ltd on an Appraisal of Inferred Palaeontological Sensitivity for a Potential Photo Voltaic Park at (1) Farm Rooilyf near Groblershoop, N Cape; (2) Farm Riet Fountain No. Portions 1 and 6, 18km SE of De Aar, N Cape; and (3) Dreunberg, near Burgersdorp, Eastern Cape. Client: Sustainable Development Projects.

Mahlangosi Subsidised Housing Development: Desk-top PIA

## **APPENDIX 2: CHANCE FIND PROTOCOL**

This Chance Find Protocol must be included in the site EMPr.

If any fossils are found, a Palaeontologist must be notified immediately by the ECO and/or EAP and a site visit must be arranged at the earliest possible time with the Palaeontologist.

In the case of the ECO or the Site Manager becoming aware of suspicious looking palaeo-material:

- The construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.
- Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labeled, and boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

### **Functional responsibilities of the Developer**

1. At full cost to the project, and guided by the appointed Palaeontological Specialist, ensure that a representative archive of palaeontological samples and other records is assembled to characterize the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas.
3. Facilitate systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, and by providing aid in the surveying of positions where significant fossils are found.
4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.
5. Provide covered, dry storage for samples and facilities for a work area for sorting, labeling and boxing/bagging samples.

6. Costs of basic curation and storage until collected. Documentary record of palaeontological occurrences must be done.

7. The contractor will, in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which appropriate information regarding plans for excavations and work schedules must be indicated on the plan of the excavation sites. This must be done in conjunction with the appointed specialist.

8. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.

9. Locations of samples and measured sections are to be pegged, and routinely and accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any “significant fossils” are recorded during the time of excavation.