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Classification:	Internal use only		

ADDENDUM TO DRAFT CONSULTATION BASIC ASSESSMENT REPORT FOR THE REHABILITATION OF A CULVERT ALONG THE P230 FROM KM 37.0 TO KM 47.0 IN EMPANGENI, KWAZULU-NATAL

The draft consultation Basic Assessment Report (draft cBAR) made available for public review and comment on 17 July 2017 refers.

Following the release of the draft cBAR for public review and comment, AMAFA has requested that a Heritage Impact Assessment (Phase 1) is conducted for the entire length of the P230 rehabilitation from km 37.0 to km 47.0.

Please find attached:

- Phase 1 Heritage Impact Assessment (HIA) prepared by Frans Prins of Active Heritage; and
- Desktop Paleontological Impact Assessment (PIA) prepared by Dr Gideon Groenewald.

The HIA identified no heritage sites on the footprint. There is no known archaeological reason why the development may not proceed as planned. The area is also not part of any known cultural landscape. However, it should be noted that the general area is rich in archaeological and historical sites. Construction work may expose material and attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) and the KwaZulu-Natal Heritage Act (Act No. 4 of 2008) which, requires that operations that expose archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agency.

The desktop PIA indicates that the site is underlain by Swazian aged granites and metamorphic rocks as well as Permian aged sandstone and shale of the Vryheid and Volksrust Formations, Ecca Group and the Emakwezini Formation of the Karoo Supergroup. No significant fossils are expected in the Swazian aged rocks on site. No significant fossils are expected in any formation before deep excavations (>1.5m) are done. However, as soon as excavation starts, it will be very important that a suitably qualified Palaeontological Specialist be appointed to do a Phase 1 PIA and to develop a "Chance Find Protocol"

document. The CFP document along with all recommendations made by Dr Gideon Groenewald will be integrated into the EMP, to record all fossils associated with the Very Highly sensitive Karoo Supergroup rocks that underlie the majority of the development site.

The public review and comment period has been extended to Wednesday, 30 August 2017.

Kindly submit all comments on or before **30 August 2017**.

Yours faithfully
for **Royal HaskoningDHV**



Humayrah Bassa Pri.Sci.Nat.

Environmental Assessment Practitioner

**FIRST PHASE HERITAGE IMPACT ASSESSMENT
OF THE PROPOSED REHABILITATION OF A
CULVERT ALONG THE EXISTING P230 FROM KM
37,0 TO KM 47,0, EMPANGENI, KWAZULU-
NATAL**



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15 August 2017

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LIST OF ABBREVIATIONS AND ACRONYMS

EIA	Early Iron Age
ESA	Early Stone Age
HISTORIC PERIOD	Since the arrival of the white settlers - c. AD 1820 in this part of the country
IRON AGE	Early Iron Age AD 200 - AD 1000 Late Iron Age AD 1000 - AD 1830
IIA	Intermediate Iron Age
ISA	Intermediate Stone Age
LIA	Late Iron Age
LSA	Late Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998 and associated regulations (2006).
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999) and associated regulations (2000)
SAHRA	South African Heritage Resources Agency
STONE AGE	Early Stone Age 2 000 000 - 250 000 BP Middle Stone Age 250 000 - 25 000 BP Late Stone Age 30 000 - until c. AD 200

EXECUTIVE SUMMARY

A heritage impact assessment and survey of the proposed the rehabilitation of a culvert along the existing P230 from km 37, 0 to km 47, 0, Empangeni, KwaZulu-Natal identified no heritage sites on the footprint. There is no known archaeological reason why the development may not proceed as planned. The area is also not part of any known cultural landscape. However, it should be noted that the general area is rich in archaeological and historical sites. Construction work may expose material and attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) and the KwaZulu-Natal Heritage Act (Act no 4 of 2008) which, requires that operations that expose archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agency.

1 BACKGROUND INFORMATION ON THE PROJECT

Table 1. Background information

Consultant:	Frans Prins (Active Heritage) for Royal Haskoning (Pty) Ltd
Type of development:	<p>The P230 is a single carriageway road with an existing surface width of approximately 9,0m. This project aims at rehabilitating approximately 10,0km of the P230 road while increasing the width of the road to 10,0m which would consist of two 3,5m lanes; two 1,5m surfaced shoulders and the construction of 1,0m wide gravel shoulders on both sides of the road and the replacement of one culvert at a water crossing. The proposed rehabilitation work is to be carried-out using half-width construction with stop/go conditions during the day and traffic signals at night.</p> <p>The proposed rehabilitation comprises the bulk earthworks, layer works, surfacing, drainage work, ancillary works and replacement of one culvert required for the rehabilitation.</p>
Rezoning or subdivision:	Not applicable
Terms of reference	To carry out a Heritage Impact Assessment
Legislative requirements:	The Heritage Impact Assessment was carried out in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and following the requirements of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KwaZulu-Natal Heritage Act, 1997 (Act No. 4 of 2008).

1.1. Details of the area surveyed:

The project is located in the north eastern part of the Province of KwaZulu-Natal. The work to be carried-out commences at the intersection of the P393 and P230, km 37,0 to km 47,0, uMhlathuze Local Municipality at Empangeni (Fig 1). Access to the site of the works can be obtained from either the Melmoth P47/4 (R34) / Eshowe P47/4 (R66) direction at km 37,0 or from the Empangeni P230 (R34) direction at km 47,0. The P230 is tarred all the way. It traverses urban and light industrial areas in the east near Empangeni (Fig 4) and peri-urban settlements to commercial farms towards the west (Fig 5). The P230 crosses a couple of road bridges but those on or near the footprint are all younger than 60 years old as is clearly indicated by the construction date placed on these structures (Fig 7). The GPS co-ordinates of the section of the P230 earmarked for rehabilitation are:

Start: 28°44'16"S 31° 47'49"E

End: 28°44'30"S 31°52'56"E

The culvert earmarked for rehabilitation is situated between the Ngqwatayi and Siding 2043 Railway Stations on the P230 (Figs 2 & 8). The GPS co-ordinates of the structure is:

28°43'29.79"S 31° 50'14.28"E

It is difficult to confirm the exact age of the culvert as there are no as-built drawings available (Royal Haskoning Bid Document) and the culvert does not have a construction date placed on the structure (Fig 8). The bridge engineer confirms that it is definitely not older than 60 years (ibid).

2 BACKGROUND TO ARCHAEOLOGICAL HISTORY OF AREA

2.1 Archaeology

The greater Empangeni area has been sporadically surveyed for archaeological heritage sites by archaeologists previously employed by the Natal Museum, the Ondini Cultural Museum and Amafa. The most systematic surveys occurred recently in the Emakhosini Opate Park (Pelser 2013) and further south at the Umfolozi-Hluluwe

Nature Reserve. It is especially the extensive surveys conducted by Penner (1970), and Hall (1980) but also subsequent research by Feely (1980) and Anderson (1988) that has thrown light on the heritage resources of this nature reserve.

The available evidence, as captured in the KwaZulu-Natal Museum heritage site inventories, indicates that this area contains a wide spectrum of archaeological sites covering different time-periods and cultural traditions. Six Early Stone Age sites have been recorded. These sites date back to between 300 000 and 1.5 million years ago. Most of these are situated in dongas close to water with little in-situ material. An astonishing 59 Middle Stone Age sites have been recorded in the nature reserve. Middle Stone Age sites are associated with anatomically modern people and dates back to approximately 40 000 to 200 000 years ago. The vast majority of Middle Stone Age sites in the nature reserve are open-air sites. They therefore do not occur in archaeological context and have limited excavation value. Later Stone Age sites occur in various localities in the nature reserve. Thirty five Later Stone Age sites have been recorded. Although the majority of these sites are situated in open air context some are also associated with small shelters and caves. These shelters have archaeological excavation potential. The Later Stone Age is usually associated with San hunter-gatherers or their immediate predecessors and dates back to between 200 years and 30 000 years ago. Interestingly, the nature reserve also contains 11 rare examples of Zululand rock art sites. Although not as well-known as the rock art of the Drakensberg the art of this region is nevertheless unique as it is probably older and executed in a different style from the Drakensberg art.

Archaeological sites have also been recorded outside of the Umfolozi-Hluluwe Nature Reserve although our knowledge of these is more limited. Early Stone Age tools have been recorded in the greater Empangeni area. Later Stone Age tools, belonging to the San and their immediate ancestors, occur in various localities in Zulu-land some open air sites have been recorded close to Empangeni (Fig 2).

Around 1 700 years ago an initial wave of Early Iron Age People settled along the inland foot of the sand dunes on sandy but humus rich soils which would have ensured good crops for the first year or two after they had been cleared. These early agro-pastoralists produced a characteristic pottery style known as Matola. The Matola people also exploited the wild plant and animal resources of the forest and adjacent sea-shore. The communities seems to been small groups of perhaps a few dozen slash-and burn cultivators, moving into a landscape sparsely inhabited by Later Stone Age San hunter-gatherers.

By 1500 years ago another wave of Iron Age migrants entered the area. Their distinct ceramic pottery is classified to styles known as "Msuluzi" (AD 500-700), Ndongondwane (AD 700-800) and Ntshekane (AD 800-900). The vast majority of recorded sites belonging to this period occur in the Tugela River Basin below the 1000m contour to the south of the project area. Some of these, such as the

Ndondondwane and Mamba sites have been excavated by archaeologists (Maggs 1989:31; Huffman 2007:325-462).

2.2 Historical past of the greater Empangeni area

The greater Empangeni area is particularly well known for its central situation relative to the development of the Zulu state of King Shaka Zulu in the early 1800's. Later Iron Age Sites, belonging to this period, have been located in the area (Fig 3). The eMakhosini valley (Valley of the Kings) is situated nearby to the north west of Empangeni. Surrounding the valley are several stone-walled structures associated with the once powerful Buthelezi and Khumalo clans. These clans later played a significant role in the formation of the Zulu kingdom. The famous king, Shaka Zulu, was born in the valley around 1785, and it is here that his forebears, King Nkosinkulu Zulu, King Phunga, King Mageba, King Ndaba, King Jama and King Senzangakhona, lie buried. The graves and royal residences of four Zulu rulers - King Shaka, King Dingane, King Mpande and King Cetshwayo, who ruled in succession from 1816 to 1884 – are located in the area around eMakhosini. The valley is regarded as the ancestral homeland of the Zulu nation as such this valley can also be classified as a cultural landscape. KwaNobamba specifically is the area where both King Jama (King Shaka's grandfather) and King Dinuzulu had homesteads and were buried. Other important sites within the greater eMakhosini Valley includes the kwaGqokli Hill, where King Shaka achieved his first military success against the powerful Ndwandwe under King Zwide and kwaMatiwane the Hill of Execution. Both the Voortrekker leader Piet Retief and the legendary leader of the amaNgwane people inkosi Matiwane were executed by King Dingane at this locality (Oberholser 1976; Derwent 2006). Kwa Buluwayo, the military kraal of King Shaka, is situated approximately 17km to the west of the project area. The Zulu Royal footpath is also situated in this area approximately 20km to the west of the project area (Fig 3).

The colonial history of the area starts around 1820 when early English ivory traders established themselves at Port Natal (Durban). Dutch descendants (i.e. Voortrekkers) moved into the area soon after 1834 and established a short lived Boer republic called Natalia to the south of the Tugela River. However, by 1845 Natal became a British colony. In 1879 Zulu-land was invaded by British forces and the area annexed soon thereafter.

Historical era sites relating to the period of the Anglo-Zulu War of 1879 also occur in the greater Ulundi area to the immediate north west of the project area. These include the battlefield site of Ulundi, the Royal Residence of King Cetshwayo at Ondini, and King Mpande's Grave. However, none of the Anglo-Zulu War period sites occur in the immediate environs of the footprint. Cowards Bush Monument is situated approximately 20km to the west of the project area (Fig 3).

3 BACKGROUND INFORMATION OF THE SURVEY

3.1 Methodology

A desktop study was conducted of the archaeological databases housed in the KwaZulu-Natal Museum. In addition, the available archaeological literature covering the greater Ulundi and Nongoma areas was also consulted. The SAHRIS website was consulted to obtain background information on previous heritage surveys and assessments in the area. A ground survey, following standard and accepted archaeological procedures, was conducted on 8th August 2017. An area of 50m was surveyed on either side of the P230.

3.2 Restrictions encountered during the survey

3.2.1 Visibility

Visibility was good

3.2.2 Disturbance

No disturbance of any heritage sites or features was noted.

3.3 Details of equipment used in the survey

GPS: Garmin Etrek

Digital cameras: Canon Powershot A460

All readings were taken using the GPS. Accuracy was to a level of 5 m.

4 DESCRIPTION OF SITES AND MATERIAL OBSERVED

4.1 Locational data

Province: KwaZulu-Natal

Towns: Empangeni

Municipality: uMhlatuze Local Municipality King Cetshwayo District Municipality.

4.2 Description of the general area surveyed

No heritage sites or features occur within 50m from the P230 and associated culvert. Particular attention was paid to find graves in the immediate environs of rural homesteads (Fig 6) but none occur within the designated area surveyed. The culvert earmarked for rehabilitation is younger than 60 years old (Fig 8).

5 STATEMENT OF SIGNIFICANCE (HERITAGE VALUE)

As there are no heritage sites on the footprint the area is not significant in terms of heritage values. In addition, the footprint does not form part of any identified cultural landscape (Table 2). Nevertheless there is a slight possibility that excavation and construction work may expose archaeological material. Should archaeological material been exposed during construction then all development work should stop immediately and the provincial heritage agency, Amafa, must be contacted for further evaluation.

Table 2. Evaluation and statement of significance.

Significance criteria in terms of Section 3(3) of the NHRA		
	Significance	Rating
1.	Historic and political significance - The importance of the cultural heritage in the community or pattern of South Africa's history.	None.
2.	Scientific significance – Possession of uncommon, rare or endangered aspects of South Africa's cultural heritage.	None.
3.	Research/scientific significance – Potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.	None
4.	Scientific significance – Importance in demonstrating the principal characteristics of a particular class of South Africa's cultural places/objects.	None.
5.	Aesthetic significance – Importance in exhibiting particular aesthetic characteristics valued by a community or cultural group.	None.
6.	Scientific significance – Importance in demonstrating a high degree of creative or technical achievement at a particular period.	None
7.	Social significance – Strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.	None
8.	Historic significance – Strong or special association with the life and work of a person, group or organization of importance in the history of South Africa.	None.
9.	The significance of the site relating to the history of slavery in South Africa.	None.

5.1 Field Rating

The field rating criteria as formulated by SAHRA (Table 3) does not apply to the footprint as no heritage sites or features have been identified on the footprint.

Table 3. Field rating and recommended grading of sites (SAHRA 2005)

Level	Details	Action
National (Grade I)	The site is considered to be of National Significance	Nominated to be declared by SAHRA
Provincial (Grade II)	This site is considered to be of Provincial significance	Nominated to be declared by Provincial Heritage Authority
Local Grade IIIA	This site is considered to be of HIGH significance locally	The site should be retained as a heritage site
Local Grade IIIB	This site is considered to be of HIGH significance locally	The site should be mitigated, and part retained as a heritage site
Generally Protected A	High to medium significance	Mitigation necessary before destruction
Generally Protected B	Medium significance	The site needs to be recorded before destruction
Generally Protected C	Low significance	No further recording is required before destruction

6 RECOMMENDATIONS

The proposed rehabilitation of the P230 and associated culvert may proceed in terms of heritage values as no sites are in any danger of being destroyed or altered. The area is also not part of any known cultural landscape. However, it should also be pointed out that the KwaZulu-Natal Heritage Act requires that operations exposing archaeological and historical residues as well as graves should cease immediately pending an evaluation by the heritage authorities.

7 RISK PREVENTATIVE MEASURES ASSOCIATED WITH CONSTRUCTION

Construction work and excavations may yield archaeological material or even graves. If any heritage features are exposed by construction work then all work should stop immediately and the provincial heritage agency, Amafa, should be contacted for further evaluation.

8 MAPS AND PHOTOGRAPHS

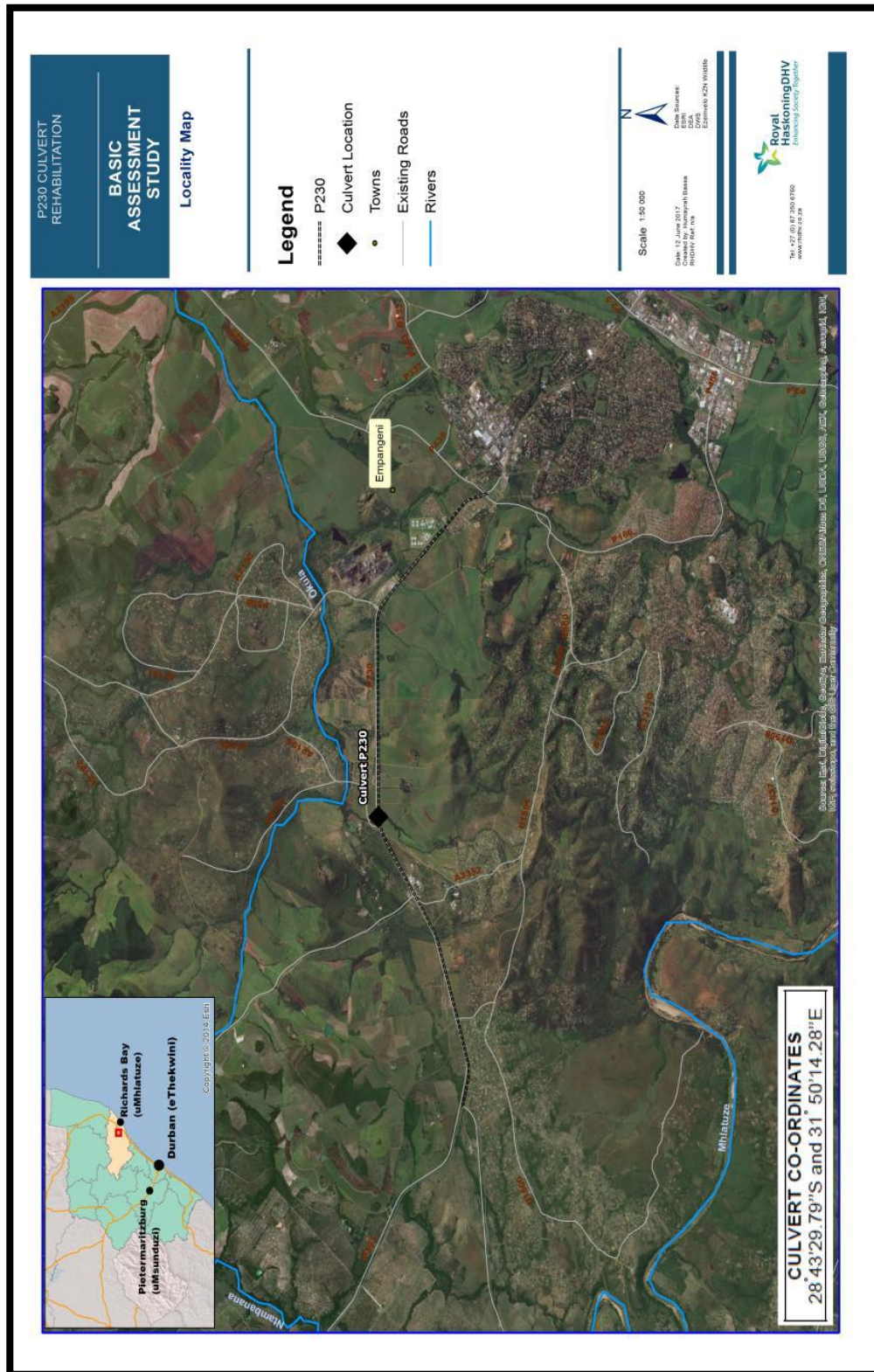


Figure 1. Map showing the locality of the P230 and associated culvert earmarked for rehabilitation (Source: Royal Haskoning).



Figure 2. Google Earth Imagery showing the location of the culvert adjacent to the P230.

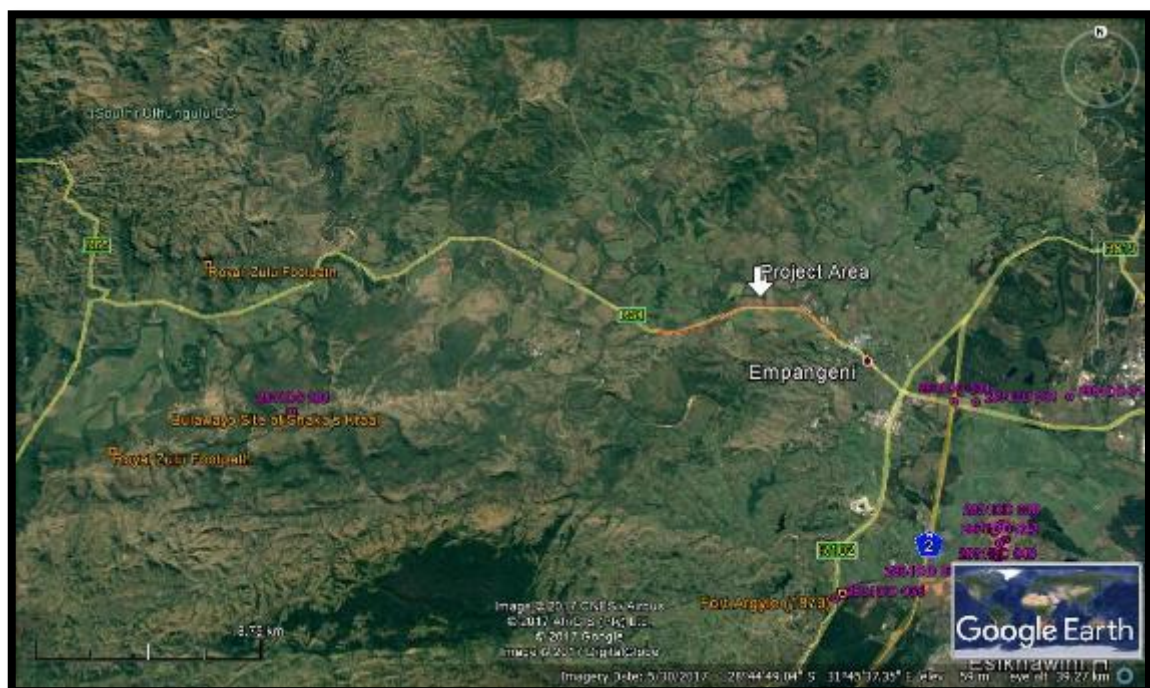


Figure 3. Google Earth Imagery showing the location of known archaeological sites (purple polygons) and historical period sites (yellow polygons) in the greater Empangeni area.



Figure 4. The eastern section of the P230 in the near vicinity of Empangeni.



Figure 5. The western section of the P230.



Figure 6. Commercial farms abuts the western section of the P230.



Figure 7. No graves were detected in association with rural homesteads situated within 50m from the P230.



Figure 8. Road bridges on the area earmarked for rehabilitation on the P230 are all younger than 60 years old.



Figure 9. *The existing culvert of the P230 is younger than 60 years old.*

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**DESKTOP PALAEOLOGICAL
ASSESSMENT AND FOR THE
PROPOSED UPGRADING AND
EXTENSION OF THE P230-CL ROAD,
UMHLATHUZE LOCAL
MUNICIPALITY, UTHUNGULU
DISTRICT MUNICIPALITY,
KWAZULU-NATAL PROVINCE.**

**FOR
Royal Haskoning DHV (Pty) Ltd**

DATE: 8 August 2017

By

**Gideon Groenewald
Cell: 078 713 6377**

EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a Desktop Palaeontological Assessment Survey for the proposed Upgrading and Extension of the P230-CL Road, Umhlathuze Local Municipality, Uthungulu District Municipality, Kwazulu-Natal Province.

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 as well as the KwaZulu-Natal Heritage Act No 4 of 2008 as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to Palaeontological Heritage within the development footprint.

The development site applicable to the application for the proposed Umhlathuze Local Municipality, Uthungulu District Municipality, Kwazulu-Natal Province is underlain by Swazian aged granites and metamorphic rocks as well as Permian aged sandstone and shale of the Vryheid and Volksrust Formations, Eccca Group and the Emakwezini Formation of the Karoo Supergroup.

No significant fossils are expected in the Swazian aged rocks on site.

No significant fossils are expected in any formation before deep excavation (>1.5m) are done. As soon as excavation starts, it will be very important that a suitably qualified Palaeontological Specialist be appointed to do a Phase 1 PIA and to develop a "Chance Find Protocol" document. The CFP document must be included as part of the EMP of this project, to record all fossils associated with the Very Highly sensitive Karoo Supergroup rocks that underlie the majority of the development site.

It is recommended that:

- The EAP and ECO must be informed of the fact that a High Palaeontological Sensitivity is allocated to the study area underlain by the Volksrust Formation and a Very High sensitivity to areas underlain by the Vryheid and Emakwezini Formations. A Phase 1 PIA document and Chance Find Protocol must be prepared in all areas where excavation will exceed 1.5m.

- Granite and metamorphic lava will not contain fossils.
- If fossils are recorded, a revised “Chance Find Protocol” must be prepared by a suitably qualified Palaeontologist and recommendations contained in the Phase 1 PIA must be approved by AMAFA and SAHRA for inclusion in the EMPr of the project.
- These recommendations must be included in the EMPr of this project.

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Figure 4 Palaeontological Sensitivity of the P230-CL route. For explanation of colour codes see Table 1 17

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INTRODUCTION

Gideon Groenewald was appointed to undertake a Desktop Palaeontological Assessment Survey for the proposed Upgrading and Extension of the P230-CL Road, Umhlathuze Local Municipality, Uthungulu District Municipality, Kwazulu-Natal Province (Figure 1).

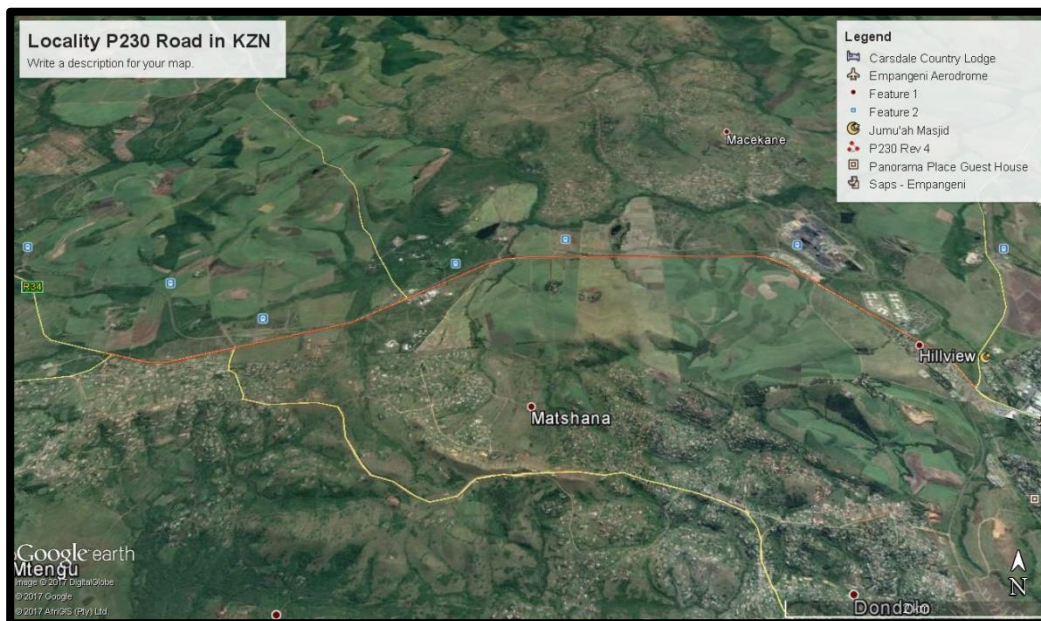


Figure 1 Locality of the study area for the upgrading of the P230-CL road in KwaZulu-Natal Province

Legal Requirements

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 as well as the KwaZulu-Natal Heritage Act No 4 of 2008 as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to Palaeontological Heritage within the development footprint.

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; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

Aims and Methodology

A Desktop investigation is often the only 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 are:

- 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 comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

Prior to a field investigation a preliminary assessment (desktop study) of the topography and geology of the study area is made using appropriate 1:250 000 geological maps (2830 Dundee) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) are identified within the study area and the known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas are identified within the development footprint to focus the field investigator's time and resources. The aim of the desktop survey is 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 is 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 minimal extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008) and Groenewald et al., (2014)	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.

GREEN	<p>Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) compulsory.</p>
BLUE	<p>Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and "Chance Find Protocol" is compulsory. The Chance Find Protocol must be included in the EMP for the project.</p>

GREY	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and "Chance Find Protocol" document is compulsory. The Chance Find Protocol must be included in the EMP of the project.</p>
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When rock units of Moderate to Very High Palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. A suitably qualified Palaeontologist must clear all projects falling on Low to Very Low Palaeontological sensitive geology.

Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including

geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc.).

Locality and Proposed Development

The P230-CL Road Development is situated to the northwest of Empangeni in the rural parts of KwaZulu-Natal. The development falls in undulating terrain underlain by clayey soils of mainly weathered rocks of several structurally fault bound Formations.

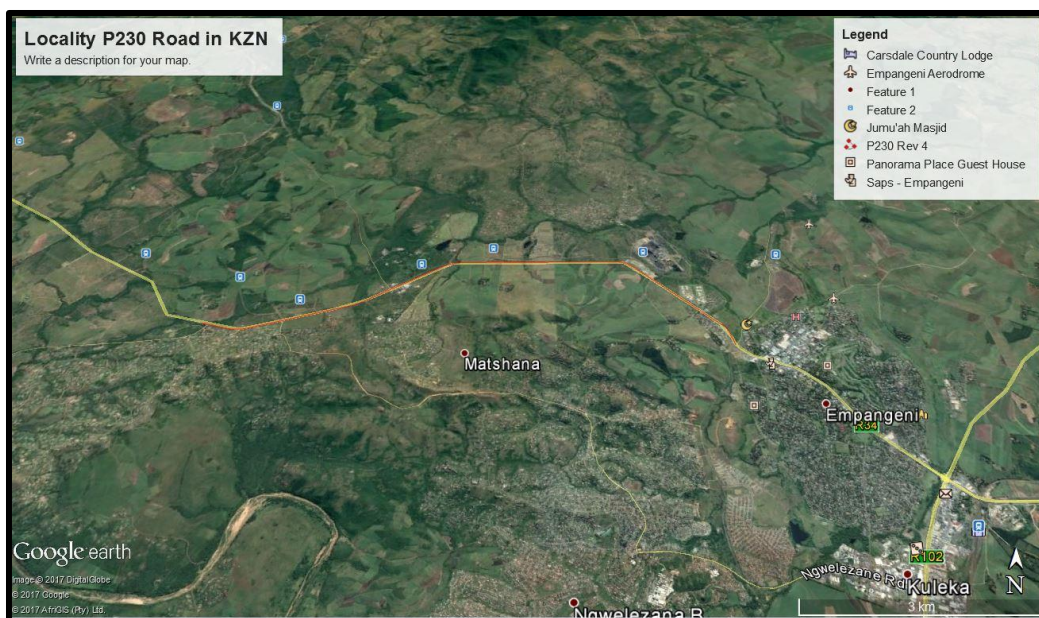


Figure 2. The study area is a linear route northwest of Empangeni in KwaZulu-Natal

GEOLOGY

The site of the development falls partly on very old, Swazian aged granites and then mostly on Permian aged sandstone and shale of the Karoo Supergroup (Figure 3).

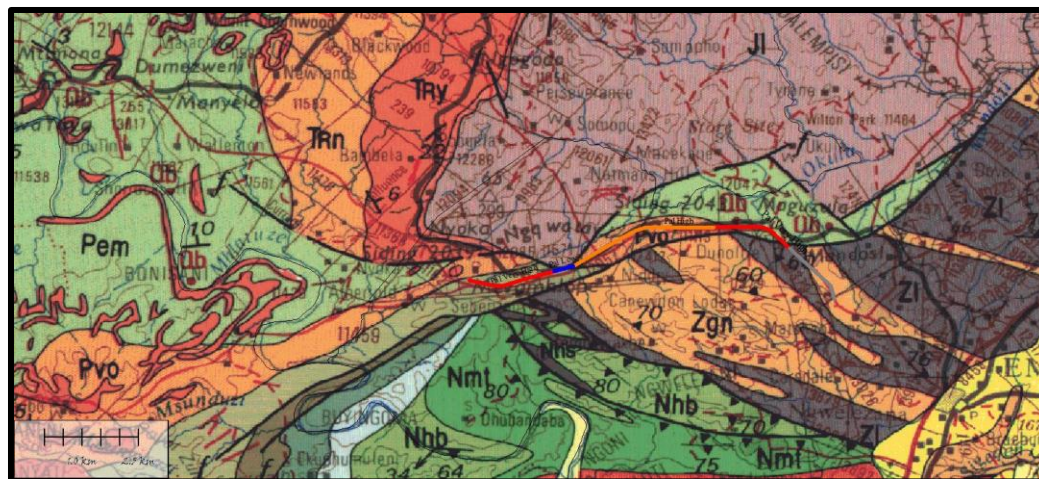


Figure 3 Geology of the rocks underlying the P230-CL route. The geology varies from Empangeni Metamorphic Suite mobile belt rocks (ZI) and granites (Zng) to Permian aged sediments of the Vryheid (Pv), Volksrust (Pvo) and Emakwezini (Pem) Formations of the Karoo Supergroup.

Swazian aged Granites (Zng)

Swazian aged granites underlies the south-eastern section of the road footprint and these deeply weathered rocks result in clay-rich soils that rarely forms good outcrops in the study area.

Empangeni Metamorphic Suite

The Swazian aged Lebana Formation metamorphic rocks are primarily lavas of ancient volcanoes that were metamorphosed during the Empangeni Structural Event.

Karoo Supergroup

Ecce Group

Vryheid Formation (Pvo)

The Permian aged Vryheid Formation is a dominantly coarse-grained sandstone with interbedded dark coloured shales and coal beds. The Formation is interpreted as a near-shore sandbar and in some cases deltaic deposit into the ancient Ecce sea that existed in this part of Gondwanaland (Johnson et al, 2009).

Volksrust Formation (Pvo)

The Permian aged Volksrust Formation is a dominantly dark coloured shale formation. The Formation is interpreted as a deep water marine shale of the ancient Ecce sea that existed in this part of Gondwanaland (Johnson et al, 2009). The upper part of the Formation is presently under scrutiny in KwaZulu-Natal and more and more evidence suggest that the higher boundary with the Beaufort Group contains convincing evidence for equating this unit with the Waterford Formation of the Ecce Group in the south of the Karoo Basin (Groenewald, 2016). More work is needed in the study area to convincingly prove this new nomenclature, which would indicate that the rocks in the study area are in fact representative of shallower marine and possibly deltaic deposits.

Emakwezini Formation (Pem)

The Emakwezini Formation (“Adelaide Subgroup, Beaufort Group, Karoo Supergroup”) crops out in a narrow strip just inland of the eastern coast of South Africa in northern KwaZulu-Natal. It is an actively mined

coal-bearing succession characterised by fining-upward successions of coarse- to fine-grained sandstones together with mudstones.

With sediments sourced from a north-easterly continental interior, the Emakwezini Formation was deposited rapidly in a fluviolacustrine setting under moist conditions capable of supporting an abundant and diverse biota. The permanently moist environment in which the Emakwezini Formation was deposited contrasts with that of the time-equivalent lower Beaufort Group units in the main Karoo Basin where environmental indicators suggest deltaic, lacustrine and meandering fluvial systems developed in a seasonally dry and more arid setting. Thus, within southern Africa, during the Middle to Late Permian, the environmental conditions, including climate, were varied leading to a mosaic of continental depositional settings (Prevec et al. 2009; Bordy and Prevec, 2009).

PALAEONTOLOGY

Swazian aged Granites (Zng)

Swazian aged granites will not contain any fossils.

Empangeni Metamorphic Suite

The Swazian aged lavas of the Lebana Formation will not contain any fossils.

Karoo Supergroup

Ecca Group

Vryheid Formation

The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile*, *Cyclodendron leslii*, *Sphenophyllum hammanskraalensis*, *Annularia sp.*, *Raniganjia sp.*, *Asterotheca spp.*, *Liknopetalon enigmata*, *Glossopteris > 20 species*, *Hirsutum 4 spp.*, *Scutum 4 spp.*, *Ottokaria 3 spp.*, *Estcourtia sp.*, *Arberia 4 spp.*, *Lidgettonia sp.*, *Noeggerathiopsis sp.* and *Podocarpidites sp.*

According to Bamford (2011) "Little data have been published on these potentially fossiliferous deposits. Around the coalmines there is

most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution.

Although no vertebrate fossils have been recorded from the Vryheid Formation, invertebrate trace fossils have been described in some detail by Mason and Christie (1985). It should be noted, however, that the aquatic reptile, *Mesosaurus*, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999; Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that *Mesosaurus* could be found in the Vryheid Formation (Catuneanu et al 2005).

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985).

Volksrust Formation

Vertebrate fossils are generally absent from the Volksrust Formation but trace fossils and unique invertebrate fossils have been recorded from the upper layers of the Volksrust Formation by several authors (Groenewald, 2012).

The bivalve *Megadesmus* is described from the Late Permian Volksrust Shale Formation in the north-eastern Karoo Basin, South Africa (Groenewald 2012). This is the first reported discovery of this genus in Africa. The fossil is large, 9 cm dorsally and 8.4 cm laterally, and both valves are articulated indicating minimum transport after death.

The bivalve was encased in interbedded siltstone-shale that constitutes the distal sediments of a prograding delta at the Beaufort –Ecca Group boundary. *Megadesmus* is known from other continents (Australia, India, Siberia, South America and Tasmania) where 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 (Groenewald, 2012).

Due to the deep weathering of rocks in the study area, fossils will only be exposed in excavations that exceed 1.5m.

Emakwezini Formation

Recent research confirms that the Emakwezini Formation contains a fossil assemblage of animal traces, insects, molluscs, arthropods, fish and plants. Previously, only *Glossopteris* leaves and *Phyllothea australis* had been described from this formation, on the basis of a few very small, scattered and poorly provenanced collections.

However, recent regional-scale sedimentary facies analysis (based on field relationships, provenance studies, palaeocurrent and subsurface data) together with palaeobotanical studies of a newly discovered, well-preserved and diverse palaeoflora from the Emakwezini Formation, have permitted a more detailed interpretation of the depositional environment. The current investigation also revealed the first evidence of the plant fossils *Dictyopteridium flabellatum*, *Rigbya arberioides*, *Lidgettonia* spp., and *Trizygia speciosa* in the upper parts of the Emakwezini Formation, strongly supporting a Late Permian age based on correlation with floras from Upper Permian units in the main Karoo Basin. In the lower part of the unit, within the partings of actively mined coal seams, preliminary investigations also show the presence of a new flora including both the glossopterid fructification *Ottokaria* sp. (only known from the Lower Permian in South Africa) and the sphenopsid *Schizoneura gondwanensis* (typical of the Upper Permian in South Africa).

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the desktop investigation. The desktop investigation confirms that the study area is underlain by relatively deep (>2m) clay soil associated with the Empangeni Metamorphic Suite and sedimentary rocks of the Karoo Supergroup.

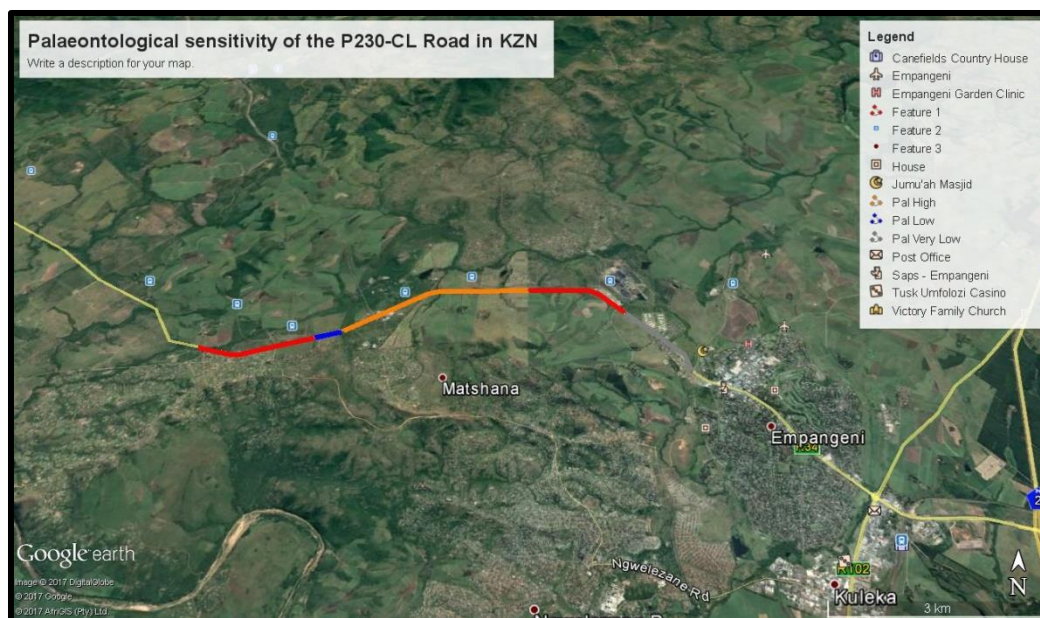


Figure 4 Palaeontological Sensitivity of the P230-CL route. For explanation of colour codes see Table 1

The areas underlain by the metamorphic rocks and granites will not yield any fossils.

The excavations for the construction of the infrastructure cutting into the Permian aged rocks of the Vryheid Formation will have a Very High likelihood of exposing plant fossils and the rocks of the Volksrust Formation will have a High sensitivity for Palaeontological Heritage. The Permian aged Emakwezini Formation is the most sensitive and have a Very High potential to contain fossils of plants as well as Insects and vertebrates of the Permian Karoo Basin of South Africa.

Due to the deep weathering it is highly unlikely that any trace fossils will be exposed before deep (>1.5m) excavations into the Vryheid, Volksrust and Emakwezini Formations (Figure 4).

Recording of fossils will contribute significantly to our understanding of previous eco-systems. A Phase 1 PIA, by a suitably qualified palaeontologist, and the preparation of a “Chance Find Protocol” by the Palaeontologist that do the Phase 1 PIA, must be included in the EMPr of the project and upgraded continuously during the construction phase when excavations of deeper than 1.5m are planned for this project.

CONCLUSION

The development site applicable to the application for the proposed Umhlathuze Local Municipality, Uthungulu District Municipality, Kwazulu-Natal Province is underlain by Swazian aged granites and metamorphic rocks as well as Permian aged sandstone and shale of the Vryheid and Volksrust Formations, Ecca Group and the Emakwezini Formation of the Karoo Supergroup.

No significant fossils are expected in the Swazian aged rocks on site.

No significant fossils are expected in any formation before deep excavation (>1.5m) are done. As soon as excavation starts, it will be very important that a suitably qualified Palaeontological Specialist be appointed to do a Phase 1 PIA and to develop a “Chance Find Protocol” document. The CFP document must be included as part of the EMPr of this project, to record all fossils associated with the Very Highly sensitive Karoo Supergroup rocks that underlie the majority of the development site.

It is recommended that:

- The EAP and ECO must be informed of the fact that a High Palaeontological Sensitivity is allocated to the study area underlain by the Volksrust Formation and a Very High sensitivity to areas underlain by the Vryheid and Emakwezini Formations. A Phase 1 PIA document and Chance Find Protocol must be prepared in all areas where excavation will exceed 1.5m.
- Granite and metamorphic lava will not contain fossils.
- If fossils are recorded, a revised “Chance Find Protocol” must be prepared by a suitably qualified Palaeontologist and recommendations contained in the Phase 1 PIA must be approved by AMAFA and SAHRA for inclusion in the EMPr of the project.
- These recommendations must be included in the EMPr of this project.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological 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).

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