



# PGS HERITAGE

**PALAEONTOLOGICAL FIELD ASSESSMENT FOR THE PROPOSED PIGGERY ON  
PORTION 46 OF THE FARM BRAKKEFONTIEN 416, WITHIN THE NELSON MANDELA  
BAY MUNICIPALITY, EASTERN CAPE**

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**PGS  
HERITAGE**



+ 27 (0) 12 332 5305



+27 (0) 86 675 8077



contact@pgsheritage.co.za



PO Box 32542, Totiusdal, 0134

Offices in South Africa, Kingdom of Lesotho and Mozambique

Head Office:  
906 Bergarend Streets  
Waverley, Pretoria,  
South Africa

Directors: HS Steyn, PD Birkholtz, W Fourie

## **Declaration of Independence**

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

## **Disclosure of Vested Interest**

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

### **PALAEONTOLOGICAL CONSULTANT:**

Banzai Environmental (Pty) Ltd

### **CONTACT PERSON:**

Elize Butler





Tel: +27 844478759

Email: elizebutler002@gmail.com

### **SIGNATURE:**



**ACKNOWLEDGMENT OF RECEIPT**

<b>Report Title</b>	<i><b>THE PROPOSED PIGGERY ON PORTION 46 OF THE FARM BRAKKEFONTIEN 416, WITHIN THE NELSON MANDELA BAY MUNICIPALITY, EASTERN CAPE</b></i>		
<b>Control</b>	<b>Name</b>	<b>Signature</b>	<b>Designation</b>
<b>Author</b>	Elize Butler		Palaeontologist
<b>Reviewed</b>	Cherene de Bruyn		Archaeologist/ PGS Heritage
<b>Reviewed</b>	Wouter Fourie		Principal Heritage Specialist
<b>Client</b>	Roberto Almanza		Habitat Link Consulting

**CLIENT:** Habitat Link Consulting (Pty) Ltd

**CONTACT PERSON:** Roberto Almanza  
 Tel: +27 82 930 8711  
 E-mail: roberto@habitatlink.co.za

**SIGNATURE:**  \_\_\_\_\_

This Palaeontological Impact Assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

*Table 1 - NEMA Table*

<b>Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017</b>	<b>Relevant section in report</b>	<b>Comment where not applicable.</b>
1.1(a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to <b>Appendix A</b>	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 9	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1 and 11	
(g) An identification of any areas to be avoided, including buffers	Section 6	No buffers or areas of sensitivity identified
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4.6 and 6	

<b>Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017</b>	<b>Relevant section in report</b>	<b>Comment where not applicable.</b>
(k) Any mitigation measures for inclusion in the EMPr	Section 7	
(l) Any conditions for inclusion in the environmental authorisation	N/A	None required
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 12	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	N/A	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 11	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was handled as part of the EIA and EMP process.
(p) A summary and copies if any comments that were received during any consultation process	N/A	Not applicable. To date no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

## EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the **Palaeontological Impact Assessment (PIA)** to assess the proposed Piggery on Portion 46 of the farm Brakkefontien 416, within the Nelson Mandela Bay Municipality, Eastern Cape. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a PIA is crucial to detect the presence of fossil material within the planned development footprint. This PIA is thus necessary to evaluate the effect of the construction on the palaeontological resources.

The proposed development of Portion 46 of the farm Brakkefontien 416, within the Nelson Mandela Bay Municipality, Eastern Cape is underlain by the Ceres Subgroup, Bokkeveld Group, Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Ceres Subgroup is Very High (Almond *et al*, 2013; SAHRIS website).

A day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 24 January 2020. No fossiliferous outcrop was found in the proposed development area. For this reason, an overall low palaeontological sensitivity is allocated to the development footprint. The apparent rarity of fossil heritage at the proposed development footprint suggests that the impact of the development on Portion 46 of the farm Brakkefontien 416, Eastern Cape will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to damaging impacts on the palaeontological heritage of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible *in situ*) and the ECO/site manager must report to SAHRA [Contact details:

Eastern Cape Provincial Heritage Resources Authority (ECPHRA); Corner Scholl and Amalinda Drive, East London, 5247. Tel: 043 745 0888. Fax: 043 7450889, [info@ecphra.org.za](mailto:info@ecphra.org.za), Web: [www.sahra.org.za](http://www.sahra.org.za)) so that mitigation can be carried out by a paleontologist.

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## **TERMINOLOGY AND ABBREVIATIONS**

### **Cultural significance**

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

### **Development**

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influences its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- carrying out any works on or over or under a place;
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- constructing or putting up for display signs or boards;
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

### **Fossil**

Mineralized bones of animals, shellfish, plants, and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

### **Heritage**

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

### **Heritage resources**

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures, and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

## Holocene

The most recent geological time period which commenced 10 000 years ago.

## Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

*Table 2 - Abbreviations*

<b>Abbreviations</b>	<b>Description</b>
ASAP	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DRDAR	Eastern Cape Department of Rural Development and Agrarian Reform
DEA	Department of Environmental Affairs
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
NMBM	Nelson Mandela Bay Municipality
PDA	Palaeontological Desktop Assessment
PIA	Palaeontological Impact Assessment
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

## 1 INTRODUCTION

The Eastern Cape Department of Rural Development and Agrarian Reform (DRDAR) appointed Habitat Link Consulting (Pty) Ltd on behalf of Mr Unathi Mafuya, to apply for an Integrated Environmental Authorisation (EA) and Waste Licence for the proposed Piggery on Portion 46 of the farm Brakkefontien 416 (Uster Rangers Hill Farm), within the Nelson Mandela Bay Municipality (NMBM), Eastern Cape (**Figure 1-Figure 3**). PGS Heritage (Pty) Ltd was appointed in turn to conduct the Heritage Impact Assessment.

200 pigs will be housed in the piggery. The development will include a grower house of 140 m<sup>2</sup>, a 180 m<sup>2</sup> breeding house and a double lagoon effluent system of 2 100 m<sup>3</sup> each as well as associated infrastructure which will include electricity, new access roads and storm water drains and water supply.

The farmer is currently farming on open land within neglected zinc structures. It is consequently the aim of the DRDAR to support the farmer with the formalisation of the piggery by creating a facility that can house a 20-sow unit (a total of 200 pigs with an average mass of 60 kg each) within a formerly disturbed area of the existing farm. The DRDAR has thus approved the application of the Uster Rangers Hill project within the Rocklands agricultural area of the NMBM.

The planned development comprises of the following:

- Site clearance including the removal and disposal of debris;
- Development of piggery housing:
  - Breeding/weaner house (180 m<sup>2</sup>)
  - Grower house (140 m<sup>2</sup>)
  - Waste handling system consisting of two (2) lagoons (2 100 m<sup>3</sup> each)
  - Carcass disposal pit
- Construction of boreholes and water reticulation system
- Electricity supply from the existing ESKOM transformers
- Construction of new access roads
- Provision of storm water drains and pipes.

The proposed development will comprise of approximately 2 000 m<sup>2</sup> of the 88-hectare property. The adjoining land is mostly undeveloped and consists of natural bush while the study area consists mostly of cleared and transformed agricultural land with some existing farm structures. The site is located between two tributaries of the Hol River (a non-perennial river feeding into the Elands River). It is thus essential that the planned development will ensure that effluent and storm water is correctly managed to avoid pollution of the watercourses).

## **2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR**

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 13 years. She has been conducting PIA's since 2014.



Figure 1: Google Earth Image (2020) of the location of the proposed Piggery on Portion 46 of the farm Brakkefontien 416 (Uster Rangers Hill Farm), within the Nelson Mandela Bay Municipality, Eastern Cape The study area is indicated in yellow.



Figure 2: Close-up Google Earth Image of the location of the proposed Piggery on Portion 46 of the farm Brakkefontien 416 (Uster Rangers Hill Farm), within the Nelson Mandela Bay Municipality, Eastern Cape The study area is indicated in yellow.

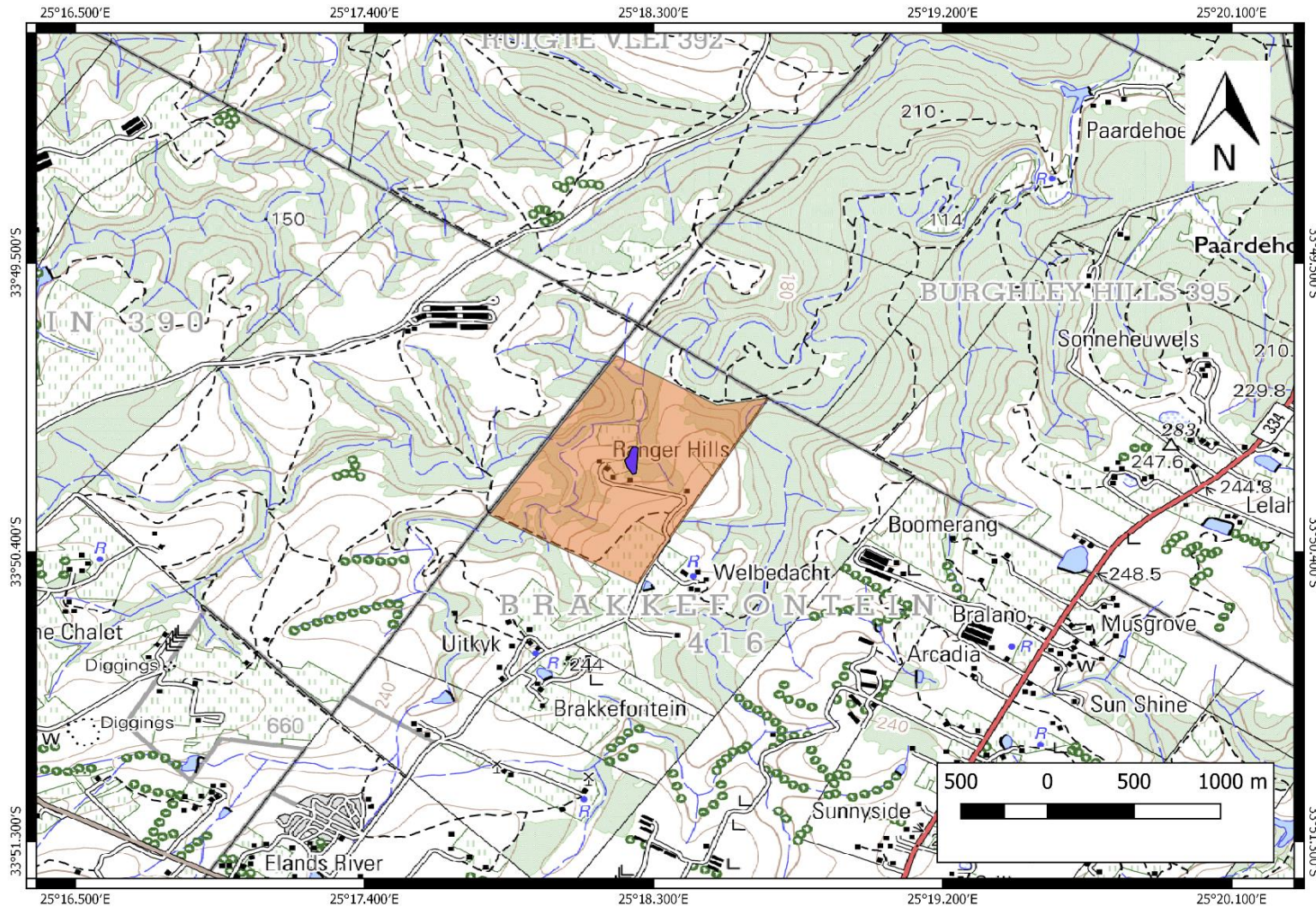


Figure 3: Locality map of the proposed Piggery on Portion 46 of the farm Brakkefontein 416 (Uster Rangers Hill Farm), within the Nelson Mandela Bay Municipality, Eastern Cape. The study area is indicated in blue.

### 3 LEGISLATION

#### 3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include “**all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**”.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This PIA forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 m<sup>2</sup> in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m<sup>2</sup> in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

### 4 OBJECTIVE

The aim of a PIA is to decrease the effect of the development on potential fossils at the development site.



According to the “SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” the purpose of the PIA are: 1) to **identify** the palaeontological importance of the rock formations in the footprint; 2) to evaluate the palaeontological magnitude of the formations; 3) to determine the **impact** on fossil heritage; and 4) to **recommend** how the property developer should guard against and lessen damage to fossil heritage.

The terms of reference of a PIA are as follows:

**General Requirements:**

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended.
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements.
- Submit a comprehensive overview of all appropriate legislation, guidelines.
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study.
- Description and location of the proposed development and provide geological and topographical maps.
- Provide Palaeontological and geological history of the affected area.
- Identification sensitive areas to be avoided (providing shapefiles/kml's) in the proposed development.
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
  - a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
  - b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
  - c. **Cumulative impacts** result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and

Implications of specialist findings for the proposed development (such as permits, licenses etc).

## 5 GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY

The geology of the proposed Piggery on Portion 46 of the farm Brakkefontien 416 (Uster Rangers Hill Farm), within the NMBM, Eastern Cape is shown on the 1:250 000 3324 Port Elizabeth Geological Map (Council for Geosciences) (**Figure 4**) with the sheet explanation by Toerien and Hill (1989). The development footprint is underlain by the Ceres Subgroup (Bokkeveld Group; Cape Supergroup). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Ceres Subgroup is Very High (Almond *et al*, 2013; SAHRIS website).

The siliclastic Cape Supergroup spans from the Early Ordovician [approximately 500 Million years ago (Ma)] to the Early Carboniferous [~330 Ma]. This Supergroup represents about 170 million years of earth's history and consists of three subdivisions namely the Table Mountain, Bokkeveld and Witteberg Groups (Broquet, 1992).

The Table Mountain Group forms the basal unit of the Supergroup. These groups are lithologically distinctive and show lateral stability throughout the Cape Fold Belt which is approximately 1000 km long and forms the southern mountain ranges of the Eastern and Western Cape Provinces (Veevers, 1994).

The Ordovician to Early Devonian Table Mountain formation is dominated by sandstone formations and the depositional environments range from fluvial to shallow marine with a glacial interval in the middle. The Table Mountain Group is overlain by the Early to Middle Devonian Bokkeveld Group which are fossiliferous sandstone and shale units. The late Devonian to Early Carboniferous Witteberg Group consists of mudrock and sandstone deposits in shallow marine, deltaic and paralic environments. The glacial Dwyka Group of the Karoo Supergroup overlies the Witteberg Group.

The Bokkeveld Group consists of a recurrent repetition of mudrocks and fine-grained sandstones. This group reaches a maximum thickness of 2200 metres in the western and 3200 metres in the eastern parts of the basin (Theron and Johnson, 1991). The Ceres Group is known for its abundant marine benthic invertebrates (Baucot, 1999) invertebrates which include bivalves, brachiopods, cephalopods, corals, echinoderms, gastropods, hyoliths and trilobites (Cooper 1982, Hiller 1990; Hiller, 1995)

Most of these fossils are abundantly found in the mudrocks of the Bokkeveld Group although some brachiopods are also found in the sandstones. Diverse trace fossils are also known from this group as well as some rare fish, bony fish, acanthodians, placoderms, and sharks as well as primitive vascular plants (psilophytes, lycopods) have been reported (Almond, 1997, 1998, Anderson, *et al* 1999).

Research has shown an abundant fossil record in the Eastern Cape compared to that of the Western Cape which could be attributed to tectonic deformation that limits the fossil collection particularly in the mudrock formations.

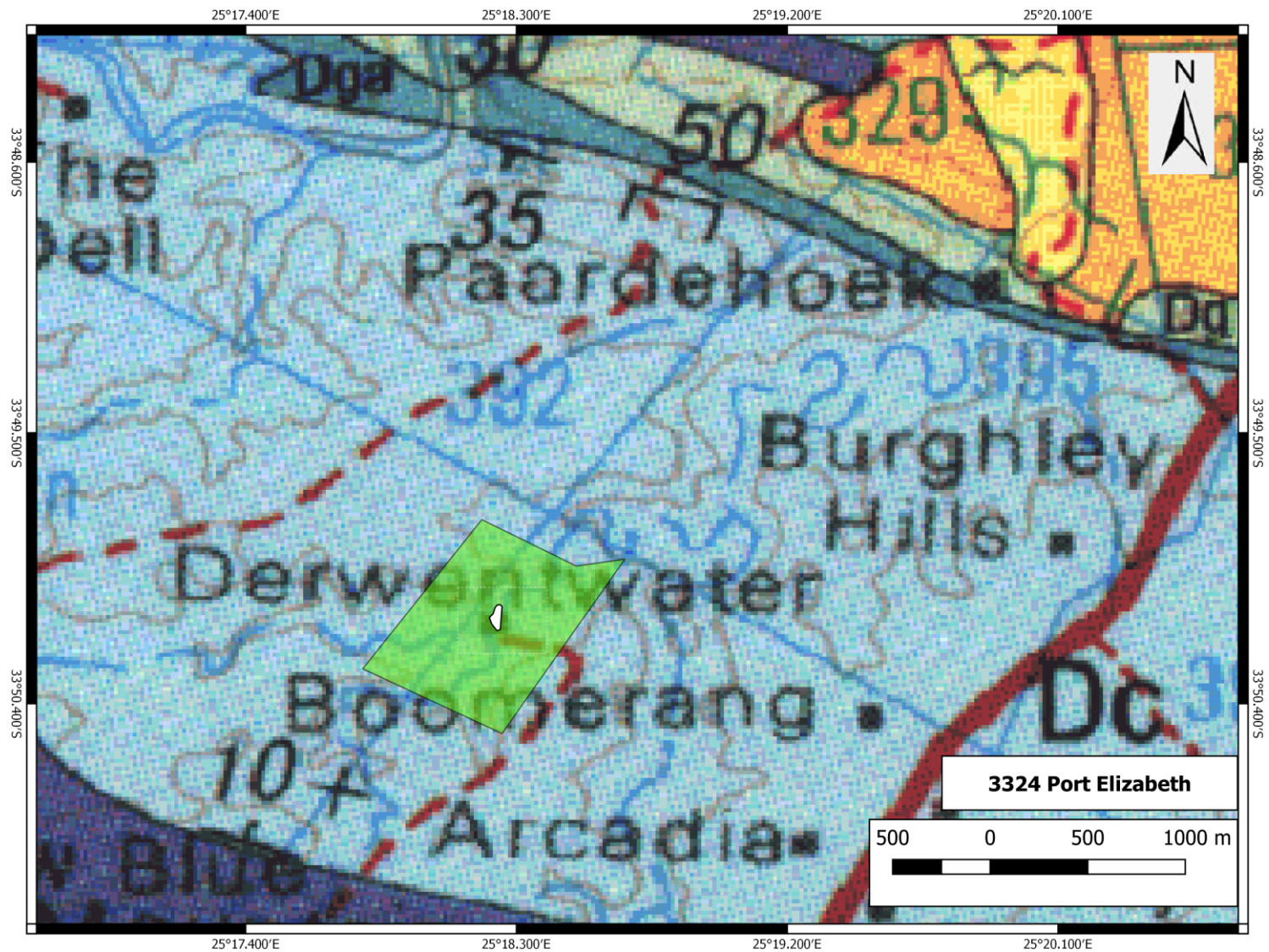
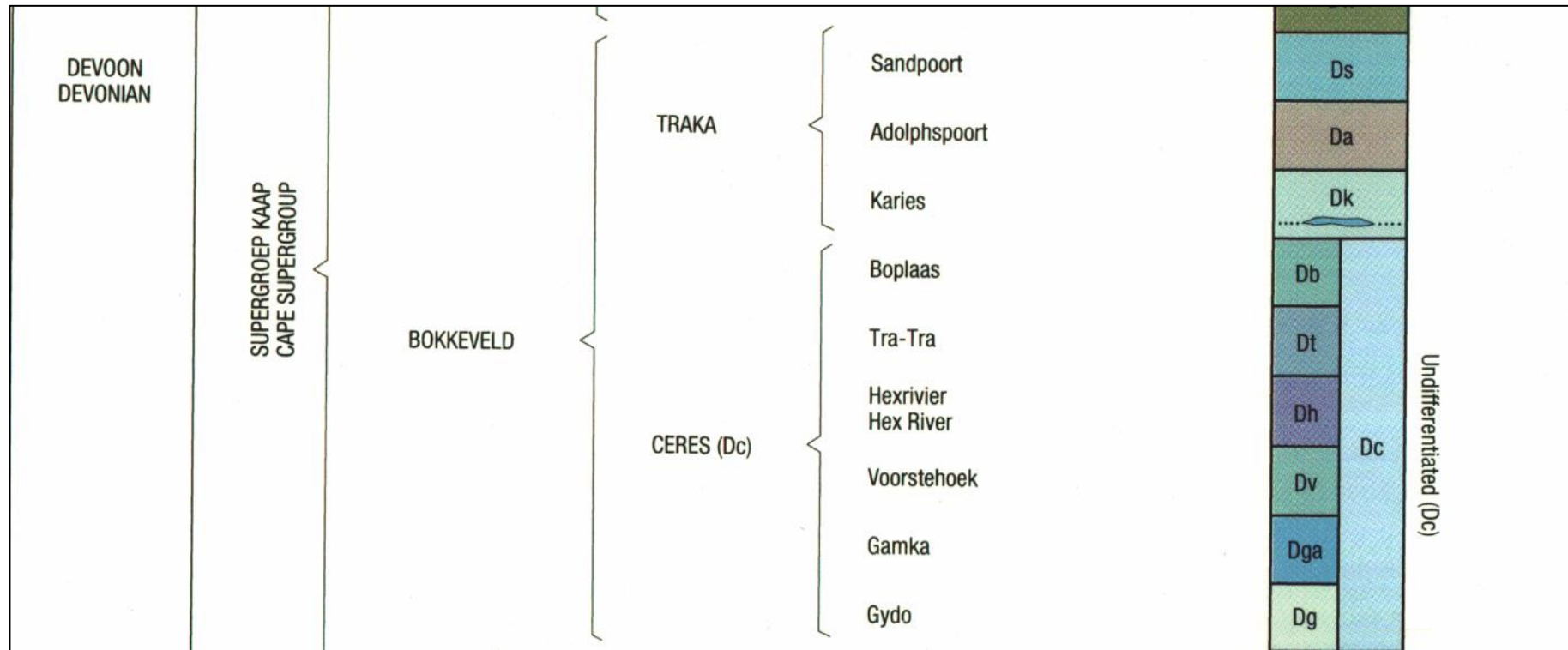


Figure 4: Surface geology of proposed Piggery on Portion 46 of the farm Brakkefontien 416 (Uster Rangers Hill Farm), within the Nelson Mandela Bay Municipality, Eastern Cape. The study area is indicated in white. Map drawn by QGIS 2.18.28



**LEGEND**

Cape Supergroup

Bokkeveld Group

**Dc**-Ceres Subgroup

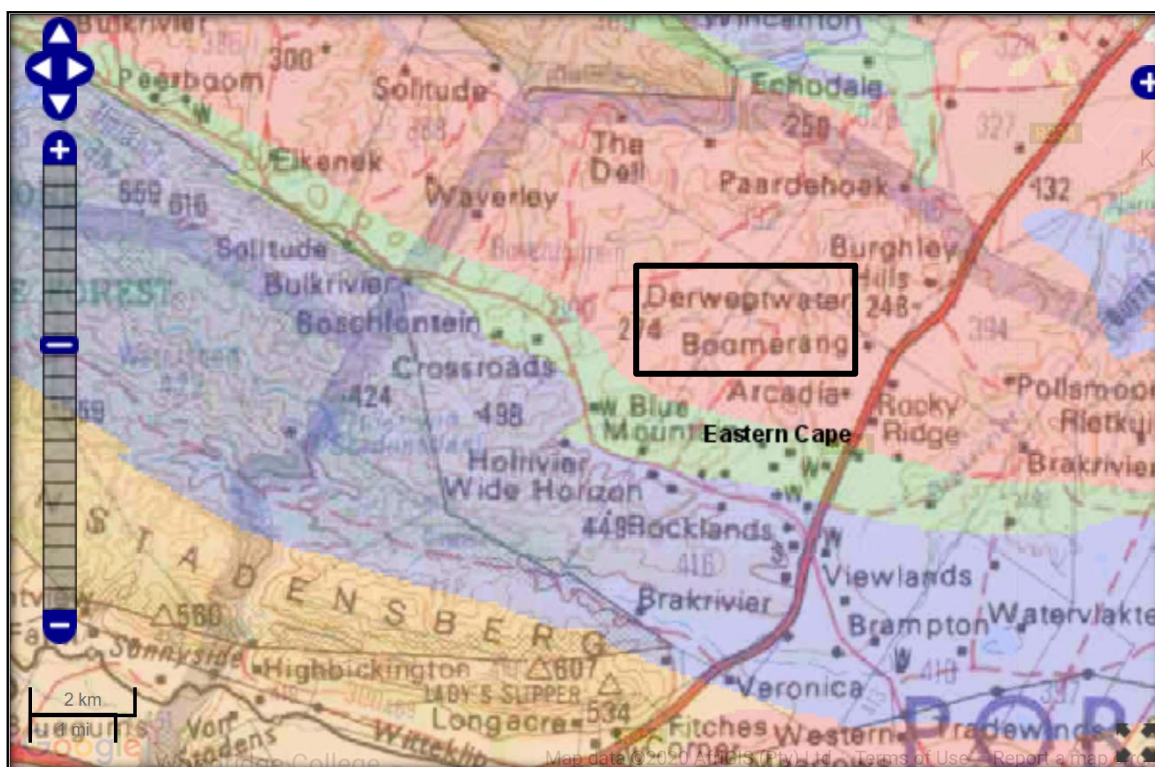


Figure 5: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences). Approximate location of the proposed development is indicated in black.

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
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

According to the SAHRIS palaeosensitivity map (**Figure 5**) there is a very high chance of finding fossils in this area.

## 6 GEOGRAPHICAL LOCATION OF THE SITE

The proposed development is approximately 35 km from the Port Elizabeth city centre and 2.2 km west of the Rocklands Road (R334). The (approximate) centre GPS coordinate is 33°50'7.12"S; 25°18'13.89"E

## 7 METHODS

The aim of a PIA is to evaluate the risk to palaeontological heritage in the proposed development. This include all trace fossils and fossils. All available information is consulted to compile a desktop study and includes: PIA reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

### 7.1 Assumptions and Limitations

When conducting a PIA several factors can affect the accuracy of the assessment. The focal point of geological maps is the geology of the area and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have not been reviewed by palaeontologists and data is generally based on aerial photographs. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is used to provide information on the existence of fossils in an area which was not yet been documented. When similar Assemblage Zones and geological formations for Desktop studies is used it is generally **assumed** that exposed fossil heritage is present within the footprint. A field-assessment is thus necessary to improve the accuracy of the desktop assessment

## 8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- 1: 250 000 3324 Port Elizabeth Geological Map (Council of Geoscience)
- A Google Earth map with polygons of the proposed development was obtained from PGS Heritage.
- 1:50 000 Topographical Map 3325 CD & 3425 AB.

## 9 SITE VISIT

As part of the PIA, a field-survey of the development footprint was conducted on 24 January 2020 to assess the potential risk to palaeontological material (fossil and trace fossils) in the proposed footprint of the development (**Figure 6-Figure 8**). A physical field-survey was conducted on foot and by motor vehicle within the proposed development footprint. The results of the field-survey, the author's experience, aerial photos (using Google Earth, 2020), topographical and geological maps and other reports from the same area) were used to assess the proposed development footprint. No consultations were undertaken for this Impact Assessment as it will be undertaken as part of the EIA process.



*Figure 6: Piggery on Portion 46 of the farm Brakkefontien 416 (Uster Rangers Hill Farm), within the NMBM, Eastern Cape.*



*Figure 7: Flat topography and very low vegetation*





*Figure 8: View over the proposed piggery.*

## **10 IMPACT ASSESSMENT METHODOLOGY AND HIERARCHY**

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the management and approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance.

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in **Table 3**.

*Table 3 - Quantitative rating and equivalent descriptors for the impact assessment criteria*

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	Proposed site	Incidental
2	LOW	Study area	Short-term
3	MODERATE	Local	Medium/High-term
4	HIGH	Regional / Provincial	Long-term
5	VERY HIGH	Global / National	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

### 10.1 Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1 000 km<sup>2</sup>) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in **Table 4** below.

*Table 4 - Description of the significance rating scale*

RATING	DESCRIPTION
5 Very high	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4 High	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3 Moderate	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2 Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1 Very low	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity are needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional

		categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	No impact	There is no impact at all - not even a very low impact on a party or system.

## 10.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 5**.

*Table 5 - Description of the significance rating scale*

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 10 km from the proposed site.
2	Study Site	The impact will affect an area not exceeding the Eskom property.
1	Proposed site	The impact will affect an area no bigger than the ash disposal site.

## 10.3 Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in

**Table 6**.

*Table 6 - Description of the temporal rating scale*

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium/High term	The environmental impact identified will operate for the duration of life of facility.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

## 10.4 Degree of Probability

Probability or likelihood of an impact occurring will be described as shown in

**Table 7** below.

*Table 7 - Description of the degree of probability of an impact occurring*

RATING		DESCRIPTION
1		Practically impossible
2		Unlikely
3		Could happen
4		Very Likely
5		It's going to happen / has occurred

## 10.5 Degree of Certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard “degree of certainty” scale is used as discussed in **Table 8**. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

*Table 8 - Description of the degree of certainty rating scale*

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.
Don't know	The consultant cannot, or is unwilling, to make an assessment given available information.

## 10.6 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus, the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\text{Impact Risk} = \frac{(\text{SIGNIFICANCE} + \text{Spatial} + \text{Temporal}) \times \text{Probability}}{3 \quad 5}$$

An example of how this rating scale is applied is shown in **Table 9**.

*Table 9 - Example of Rating Scale*

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
	Very High	Study areal	Permanent	Unlikely	
Impact on fossil Heritage	5	2	5	2	<b>1.6</b>

*Note: The significance, spatial and temporal scales are added to give a total of 12, that is divided by 3 to give a criteria rating of 4. The probability (2) is divided by 5 to give a probability rating of 0,4. The criteria rating of 4 is then multiplied by the probability rating (0,4) to give the final rating of 1,6.*

The impact risk is classified according to five classes as described in the **Table 10** below.

Table 10 - Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore, with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

### 10.7 Impact Assessment Table

Table 11 - Impact ratings for the Rocklands Piggery site

IMPACT	IMPACT DIRECTION	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Negative	VERY HIGH	Study Area	Permanent	Unlikely	
Impact on Paleontological resources	-	5	2	5	2	1,60

## 10.8 Summary of Impact Tables

The geology of the proposed Piggery on Portion 46 of the farm Brakkefontien 416 (Uster Rangers Hill Farm), within the Nelson Mandela Bay Municipality, Eastern Cape is underlain by the Ceres Subgroup (Bokkeveld Group; Cape Supergroup). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Ceres Subgroup is Very High (Almond and Pether 2008, SAHRIS website).

The impact on Fossil Heritage is DIRECT NEGATIVE. *Only the study site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent.* The impact is highly destructive, although the possibility of the impact occurring is **probable pre-mitigation and unlikely post mitigation**. The significance of the impact occurring will be **very high**. As fossil heritage will be destroyed the impact is **irreversible** but the degree to which the impact can cause irreplaceable loss of resources is LOW if proper mitigation is undertaken.

## 11 FINDINGS AND RECOMMENDATIONS

The proposed development of Portion 46 of the farm Brakkefontien 416, within the Nelson Mandela Bay Municipality, Eastern Cape is underlain by the Ceres Subgroup, Bokkeveld Group, Cape Supergroup. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Ceres Subgroup is Very High (Almond and Pether 2008, SAHRIS website).

A day site specific field survey of the development footprint was conducted on foot and by motor vehicle on 24 January 2020. No fossiliferous outcrop was found in the proposed development area. For this reason, an overall low palaeontological sensitivity is allocated to the development footprint. The apparent rarity of fossil heritage at the proposed development footprint suggests that the impact of the development near Port Elizabeth will be of a low significance in palaeontological terms. It is therefore considered that the proposed development is deemed appropriate and feasible and will not lead to damaging impacts on the palaeontological heritage of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

If fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible *in situ*) and the ECO/site manager must report to SAHRA [Contact details:

Eastern Cape Provincial Heritage Resources Authority (ECPHRA); Corner Scholl and Amalinda Drive, East London, 5247. Tel: 043 745 0888. Fax: 043 7450889, [info@ecphra.org.za](mailto:info@ecphra.org.za), Web: [www.sahra.org.za](http://www.sahra.org.za)) so that mitigation can be carry out by a paleontologist.

## 12 PROTOCOL FOR FINDS

### 12.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 25 of 1999) (NHRA)**. According to Section 3 of the Act, all Heritage resources include “**all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**”.

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

### 12.2 Background

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

### 12.3 Introduction

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Officer (EO) of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the EO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

### 12.4 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the EO or site manager. The EO

must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: [www.sahra.org.za](http://www.sahra.org.za)). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.

- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ECO (site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage authority will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ECO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once the Heritage authority has issued the written authorization, the developer may continue with the development.



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## Appendix A – Elize Butler CV

### CURRICULUM VITAE

#### ELIZE BUTLER

**PROFESSION:** Palaeontologist

**YEARS' EXPERIENCE:** 26 years in Palaeontology

**EDUCATION:** B.Sc Botany and Zoology, 1988  
University of the Orange Free State

B.Sc (Hons) Zoology, 1991  
University of the Orange Free State

Management Course, 1991  
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009  
University of the Free State

**Dissertation title:** The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

Registered as a PhD fellow at the Zoology Department of the UFS

2013 to current

**Dissertation title:** A new gorgonopsian from the uppermost *Daptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

#### MEMBERSHIP

Palaeontological Society of South Africa (PSSA)                      2006-currently

#### EMPLOYMENT HISTORY

Part-time Laboratory assistant    Department of Zoology & Entomology  
University of the Free State Zoology  
1989-1992

Part-time laboratory assistant    Department of Virology  
University of the Free State Zoology  
1992

Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–currently

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**Butler, E. 2019.** Palaeontological Exemption Letter for the proposed DMS Upgrade Project at the Sishen Mine, Gamagara Local Municipality, Northern Cape Province

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**Butler, E. 2019.** Palaeontological Impact Assessment for the proposed Umsobomvu Solar PV Energy Facilities, Northern and Eastern Cape

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- Butler, E. 2019.** Palaeontological Protocol for Finds for the proposed 16m WH Battery Storage System in Steinkopf, Northern Cape Province
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- Butler, E. 2019.** Palaeontological Exemption Letter of the proposed 2.5ml Process Water Reservoir at Gloria Mine, Black Rock, Hotazel, Northern Cape
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- Butler, E. 2019.** Palaeontological Desktop Assessment for the Proposed New Railway Bridge, and Rail Line Between Hotazel and the Gloria Mine, Northern Cape Province
- Butler, E. 2019.** Palaeontological Exemption Letter of the Proposed Mixed Use Commercial Development On Portion 17 Of Farm Boegoeberg Settlement Number 48, !Kheis Local Municipality In The Northern Cape Province
- Butler, E. 2019.** Palaeontological Desktop Assessment of the Proposed Diamond Mining Permit Application Near Kimberley, Sol Plaatjies Municipality, Northern Cape Province
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## CONFERENCE CONTRIBUTIONS

### NATIONAL

#### PRESENTATION

Butler, E., Botha-Brink, J., and F. Abdala. A new gorgonopsian from the uppermost *Dicynodon Assemblage Zone*, Karoo Basin of South Africa. 18<sup>th</sup> the Biennial conference of the PSSA 2014. Wits, Johannesburg, South Africa.

### INTERNATIONAL

Attended the Society of Vertebrate Palaeontology 73<sup>th</sup> Conference in Los Angeles, America. October 2012.

## CONFERENCES: POSTER PRESENTATION

### NATIONAL

Butler, E., and J. Botha-Brink. Cranial skeleton of *Galesaurus planiceps*, implications for biology and lifestyle. University of the Free State Seminar Day, Bloemfontein. South Africa. November 2007.

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**INTERNATIONAL VISITS**

Natural History Museum, London

July 2008

Paleontological Institute, Russian Academy of Science, Moscow

November 2014