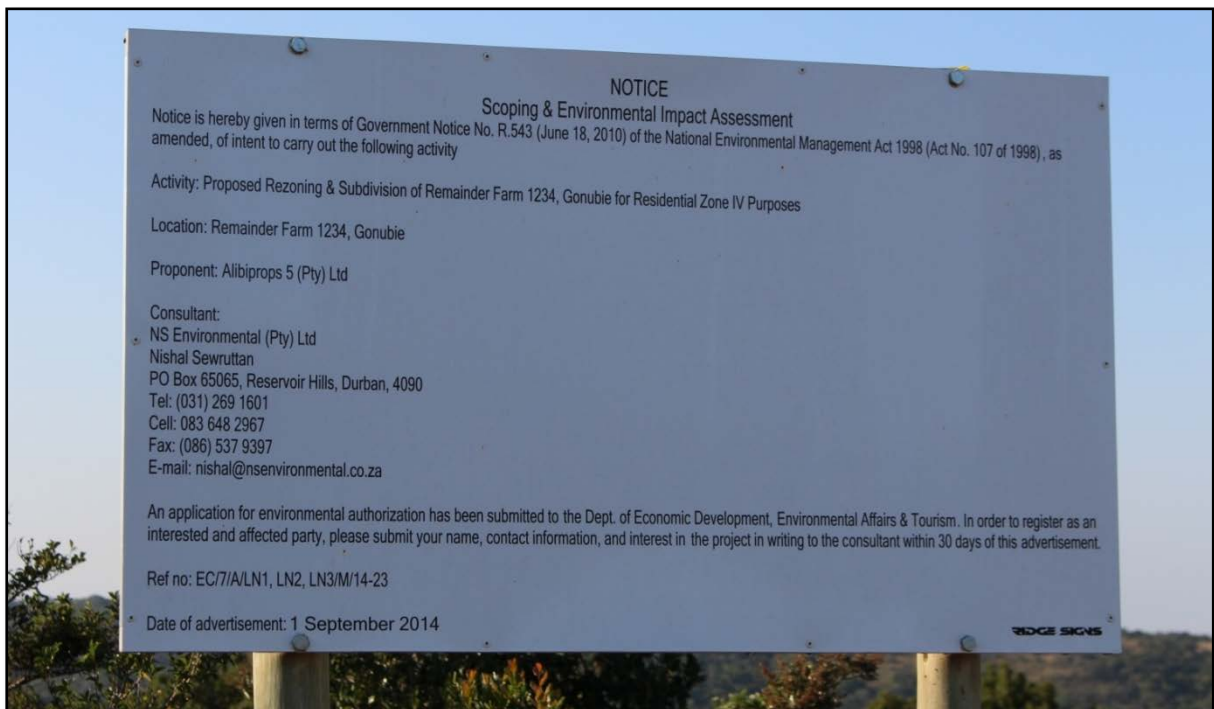


# PALAEONTOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED GONUBIE RESIDENTIAL DEVELOPMENT, BUFFALO CITY METROPOLITAN MUNICIPALITY, EAST LONDON, EASTERN CAPE



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## EXECUTIVE SUMMARY

The development of 269 different sized residential sites, 4 apartment blocks, 12 open sites and associated internal roads are proposed on the remainder of farm 1234, Gonubie, Buffalo City Metropolitan Municipality, East London. Due to Section 35 of the National Heritage Resources Act, a palaeontological impact assessment is required to detect the presence of fossil material at the proposed development site.

The development area is primarily represented by late Permian, Balfour Formation sedimentary rocks. Although the palaeontological sensitivity is rated high, the development area is an area of **with no steep river gulleys or sharp outcrops**. The lack of appropriate exposure at the proposed site indicates that the impact on palaeontological material on farm 1234, Gonubie, Buffalo Metropolitan Municipality, East London is **negligible and regarded as insignificant**.

It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development, pending the discovery or exposure of any fossil remains during the construction phase.

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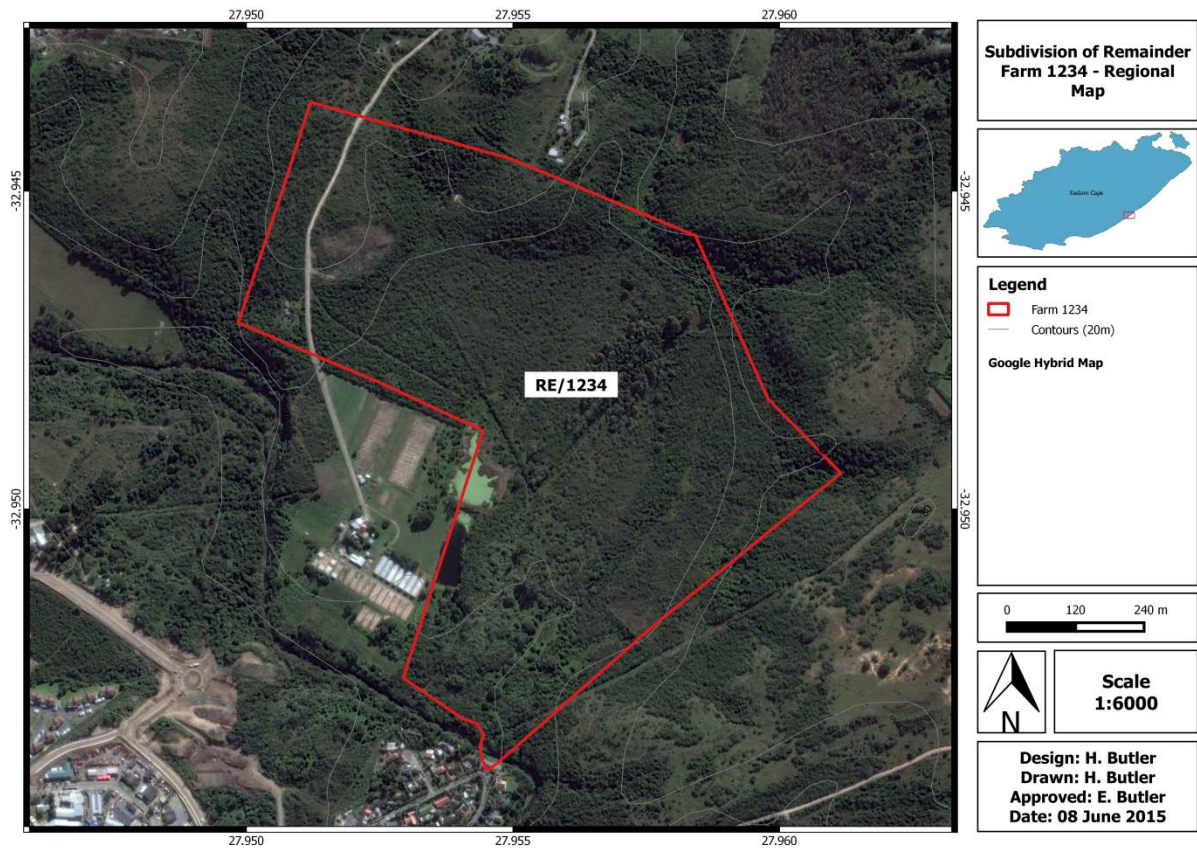
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## 1. INTRODUCTION

Alibirops 5 (Pty) Ltd appointed NS Environmental Consultancy for the subdivision and rezoning of the remainder of farm 1234 (Fig. 1-3) and the development of

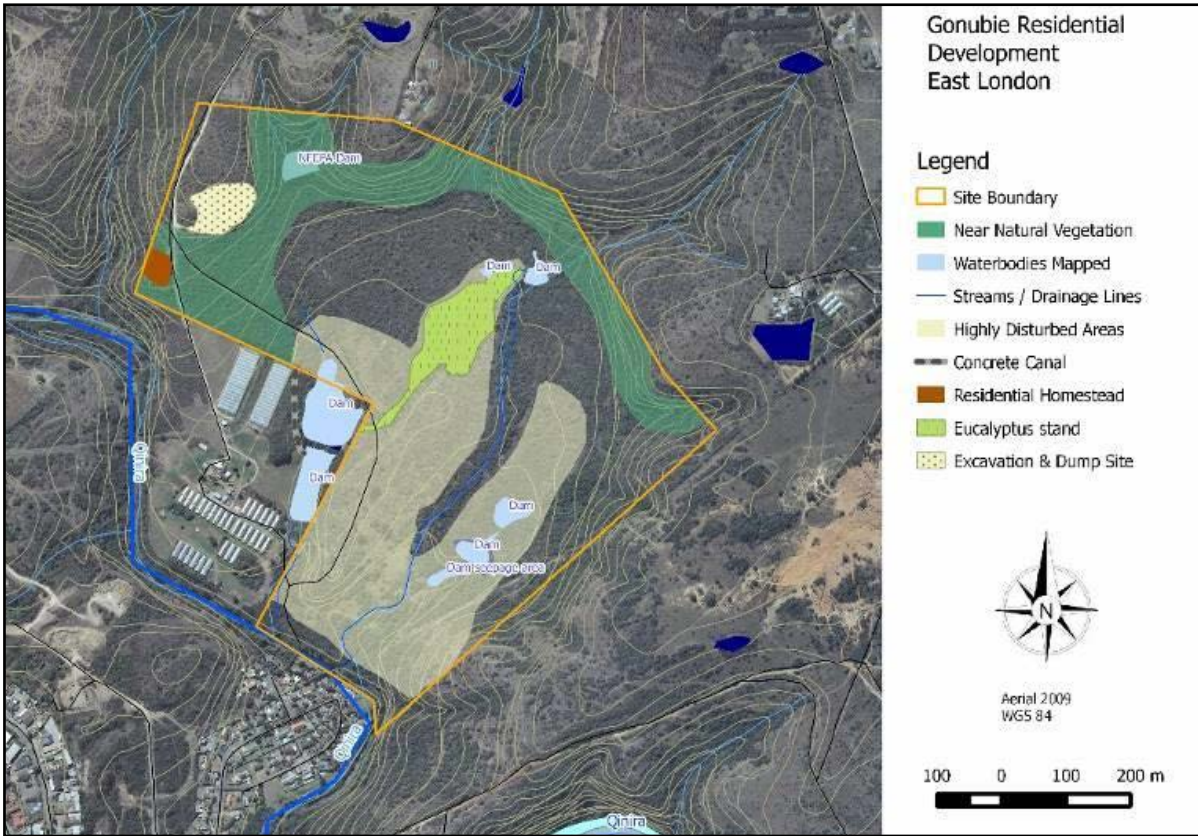
- 50 residential sites of 1000m<sup>2</sup> and above
- 9 residential sites of 600 - 1000m<sup>2</sup>
- 210 residential sites of 350 - 600m<sup>2</sup> and above
- 4 apartment blocks
- 12 open space sites as well as
- internal roads

This development will involve the construction of new buildings and will include substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb damage or destroy scientific valuable fossil heritage exposed at the surface or buried below ground. Palaeontological material is unique and non-renewable and is protected by the National Heritage Resources Act (Act No. 25 of 1999, section 35, see Appendix 1). A Palaeontological Impact Assessment of the proposed development is therefore necessary to certify that palaeontological material is either removed, or is not present.

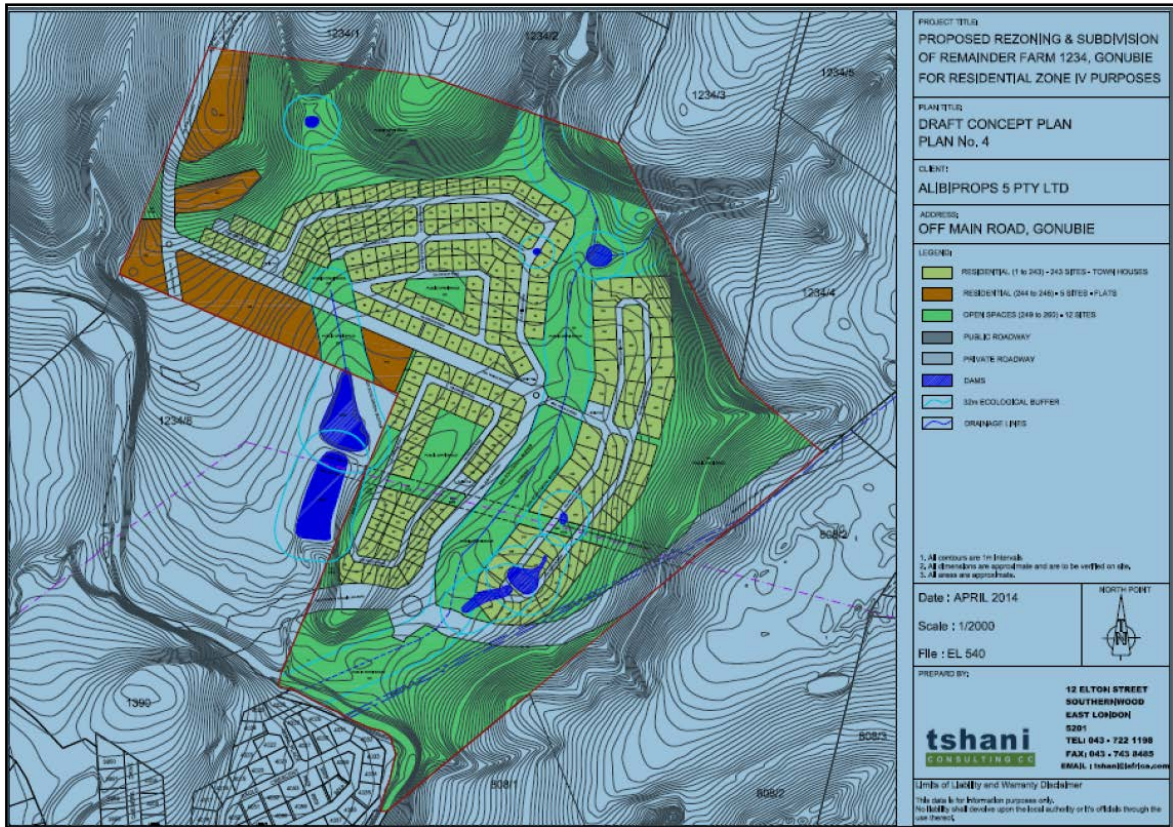


**Figure 1.** Satellite image indicating the outline of proposed development site on farm 1234 (outlined in red) Gonubie, East London (Modified from Google 2015).





**Figure 2.** Landcover map of the proposed development site on farm 1234, Gonubie, Buffalo City Metropolitan Municipality, East London. (Map provided by NS Environmental Consultancy, Durban).



**Figure 3.** The proposed layout of the development site on farm 1234, Gonubie, Buffalo City Metropolitan Municipality, East London. (Map provided by Tshani Consultants, East London).



## 1.1.Objective

To conduct a Phase I, Palaeontological Impact Assessment on farm 1234, Gonubie, Buffalo City Metropolitan Municipality, East London, and determine the impact on potential palaeontological material at this site.

When a palaeontological desktop study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; Fossil sensitivity map; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the development area. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of

- the palaeontological sensitivity of the rocks concerned and
- the nature and scale of the development itself (extent of new bedrock excavated)

When rocks of moderate to high palaeontological sensitivity are present within the development area, a field-based assessment by a professional palaeontologist is necessary. Based on this desktop data as well as a field examination of representative exposures of all major sedimentary rock present, the impact significance of the planned development is considered with recommendations for any further studies or mitigation.

## 2. BACKGROUND TO THE GEOLOGICAL AND PALAEOLOGICAL HISTORY

The Karoo Supergroup is world renowned for its terrestrial vertebrate fossils, plant assemblages, thick glacial deposits and flood basalts with their associated dolerite dikes and sills. The Karoo Supergroup strata are between 310 and 182 million years old and span the Upper Carboniferous to Middle Jurassic Periods. During this period the basin developed from an inland sea flooded by a melting ice cap, to a giant lake (Ecca Lake) fed by seasonal meandering (and periodically braided) rivers. The lake progressively shrank as it filled with sediment and the basin's rate of subsidence stabilised.

The Beaufort group consists of largely fluvial sediments which were deposited on the floodplains of these rivers. The land became progressively more arid and was covered with windblown sand just before the end of the basin's cycle. Finally the subcontinent was inundated with basaltic lava to form the capping basalts of the Jurassic aged Drakensberg Group. During the Jurassic the volcanic Drakensberg were formed and cracks in the earth's crust were filled with molten lava that cooled to form dolerite dykes. Magma injected horizontally between sediments, cooled down and formed horizontal sills of dolerite.

The **development area** is situated within the **Beaufort Group, Adelaide Subgroup (Karoo Supergroup)**, and is **primarily represented by late Permian, Balfour Formation sedimentary rocks** (Fig. 4-5). The Beaufort Group is subdivided into a series of biostratigraphic units on the basis of its faunal content namely the *Dicynodon* Assemblage Zone (Balfour Formation) and the *Lystrosaurus* Assemblage (Katberg Formation) (Fig.4).

		EAST OF 24°E	ASSEMBALGE ZONE		
PERMIAN	BEAUFORT GROUP	TARKASTAD SUBGROUP	MOLTENO F		
			BURGERSDORP F	<i>Cynognathus</i>	
			KATBERG F	<i>Lystrosaurus</i>	
		ADELAIDE SUBGROUP	BALFOUR F	Palingkloof M	
				Elandsberg M	
				Barberskrans M	<i>Dicynodon</i>
				Daggaboersnek M	
				Oudeberg M	<i>Cistecephalus</i>
				MIDDLETON F	<i>Tropidostoma</i>
				KOONAP F	<i>Pristerognathus</i>
<i>Tapinocephalus</i>					
ECCA GROUP		<i>Eodicynodon</i>			
		WATERFORD/ FORT BROWN F			

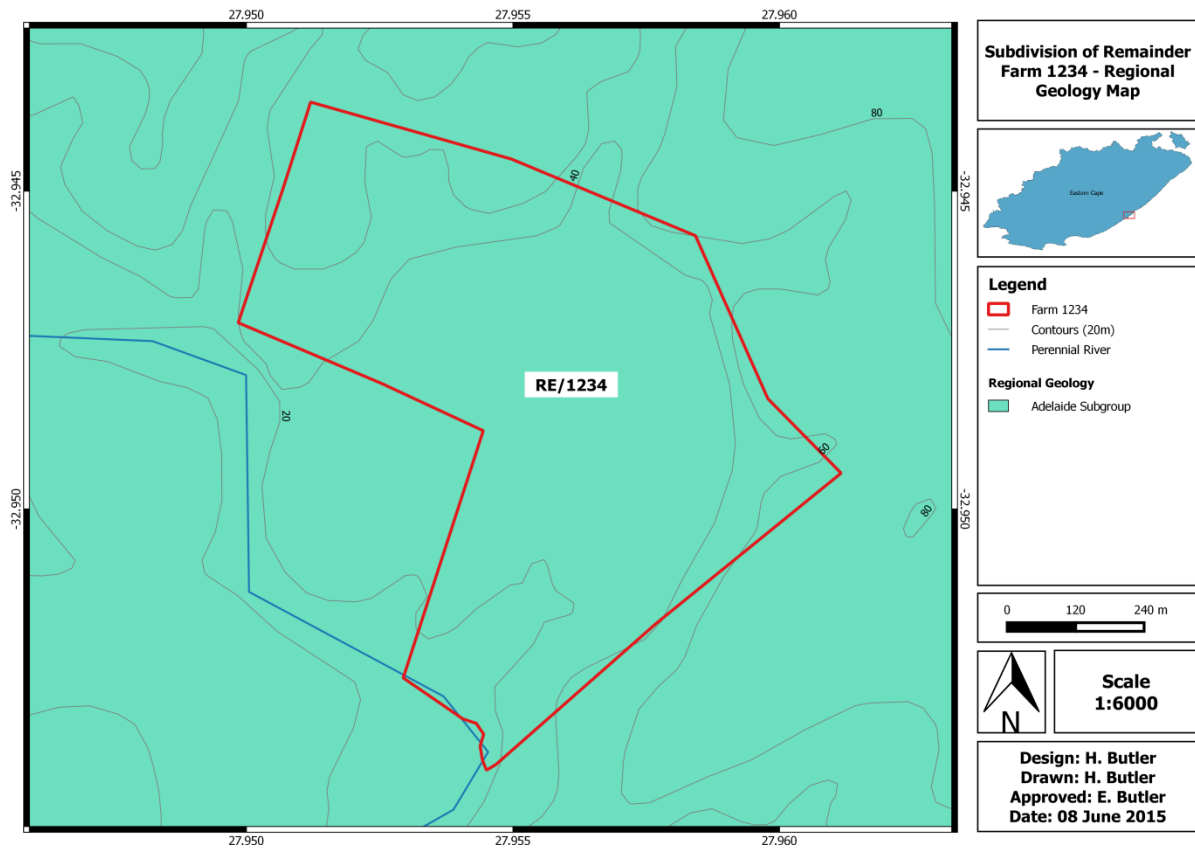
 Sandstone rich unit

**Figure 4:** Lithostratigraphic (rock-based) and biostratigraphic (fossil-based) subdivisions of the Beaufort Group with rock units and fossil assemblage zones relevant to the present study marked in red (Modified from Rubidge 1995). The subdivisions of the Beaufort Group include the Adelaide and Tarkastad Subgroups and range in age from Late Permian to Middle Triassic. Abbreviations: F. = Formation, M. = Member.

The *Dicynodon* Assemblage Zone expands into the lower Palingkloof Member of the Upper Balfour Formation. This Zone is characterized by the occurrence of the two therapsids namely *Dicynodon* and *Theriongnathus*. The *Dicynodon* Zone of the Beaufort Group shows the greatest vertebrate diversity and includes numerous well preserved genera and species of dicynodonts, biarmosuchians, gorgonopsian, therocephalian and cynodont therapsid Synapsida as well as captorhinid Reptilia and less well represented eosuchian Reptilia, Amphibia and Pisces. Trace fossils of vertebrates and invertebrates as well as *Glossopteris* flora plants have also been recovered.

The lower Palingkloof Member is of special importance as it precedes the Permo-Triassic Extinction Event which almost destroyed the vertebrate fauna and extinguished the diverse glossopterid plants.

The lower *Lystrosaurus* Assemblage Zone forms part of the Katberg Formation. Fauna and flora from this assemblage zone is rare as few genera survived the Permo-Triassic Extinction Event. The *Lystrosaurus* Assemblage Zone is characterized by the dicynodont, *Lystrosaurus*, and captorhinid reptile, *Procolophon*. The biarmosuchian and gorgonopsian therapsids did not survive into the *Lystrosaurus* Assemblage Zone although the therocephalian and cynodont Therapsida are present in moderate quantities. Captorhinid Reptilia are reduced, but this period is characterised by a unique diversity of oversize amphibians. Fossil fish, millipedes and diverse trace fossils have also been recorded.



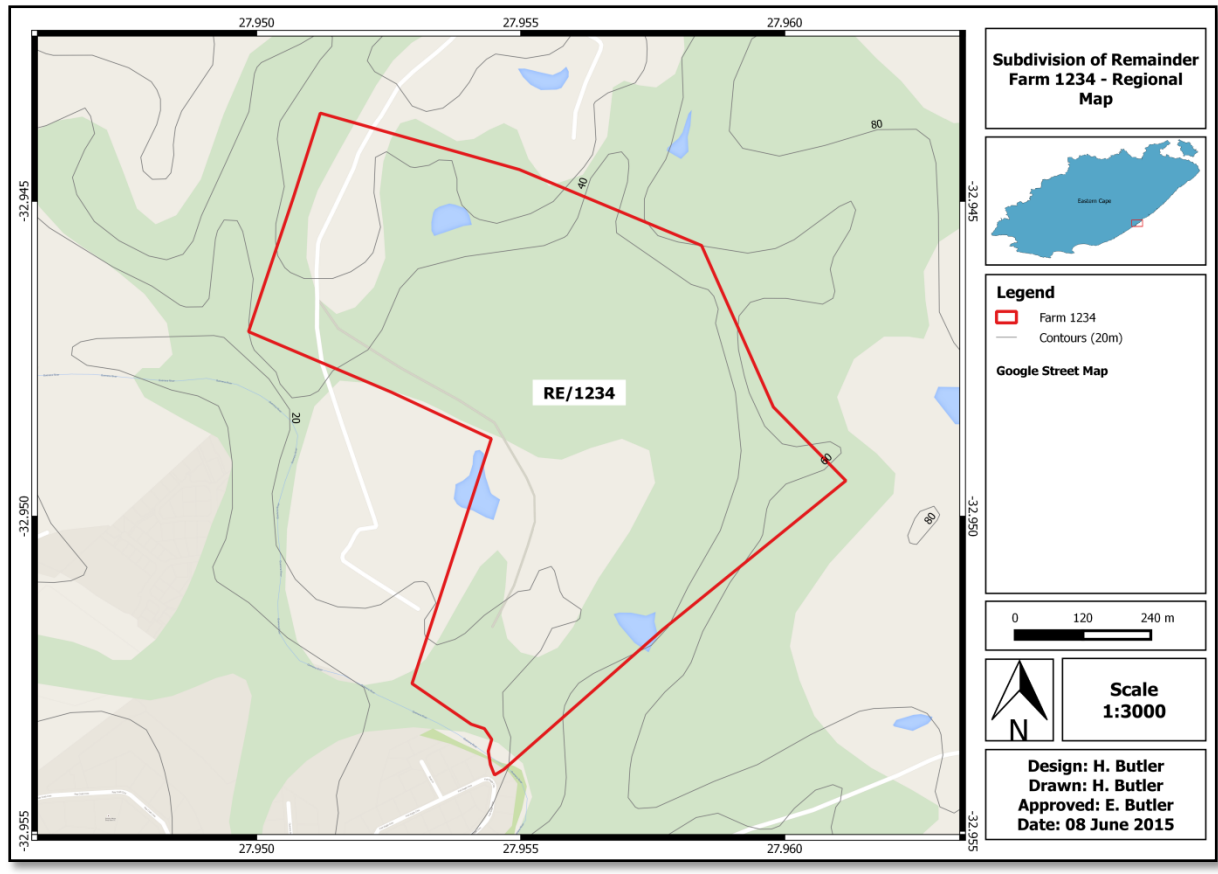
**Figure 5.** The surface geology of the development area on Farm 1234, Gonubie, Buffalo City Metropolitan Municipality, East London (bordered in red). The development area is situated within the Beaufort Group, Adelaide Subgroup (Karoo Supergroup), and is primarily represented by late Permian, Balfour Formation sedimentary rocks. (Modified from Geological map (1: 250 000) East London 3227, Council for Geoscience, Pretoria).



### 3. GEOGRAPHICAL LOCATION OF THE SITE

The proposed development site is located in Gonubie, approximately 10 km north east of East London. The development area is an area with no steep river gulleys or outcrops (Fig. 6). The centre co-ordinate of the site is 32°56'54.85"S; 27°57'22.32".

Vegetation at the site is almost natural although some areas with disturbed vegetation occur. Human activity is noticeable in the form of access paths, vehicular access tracks, and electrical infrastructure (Fig. 3). To the west of the site, a rural homestead and old excavation site exists, which has been used for dumping vehicle wreckages. Thicket vegetation is dominant with undergrowth of a grassy fynbos matrix in the lower lying mid-slope areas. Invasive Eucalyptus trees are prominent in areas of disturbance. Patches of *Stenotaphrum secundatum* also known as buffalo grass or St Augustine grass occur at the south end of the development site and may be present where agricultural activities were conducted in the past. To the south the site is enclosed by the Qinira River. Two drainage lines/water courses pass through the site in a southerly direction and in time drain into the Qinira River. Woody thicket vegetation borders the watercourses. Three water bodies are located within the development area.



**Figure 6.** Low relief of proposed development site on farm 1234 (outlined in red), Gonubie, Buffalo City Metropolitan Municipality, East London (Modified from Google Street Map 2015).



### 3.1. Site visit



Figure 7. Examples of human disturbance in the proposed development area.





Figure 8. Vegetation at the proposed development site.

## 4. METHODS

A Palaeontological Impact Assessment was conducted to assess the potential risk to palaeontological material (fossils, trace fossils) in the proposed areas of development. The author's experience, aerial photos (using Google, 2015), topographical and geological maps were used to assess the proposed area of development.

### 4.1 Assumptions and Limitations

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerized. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist.
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.
- Impact studies and other reports (*e.g.* of commercial mining companies) - is not readily available for desktop studies.

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on possible occurrence of fossils in an unexplored area. Desktop studies of this nature therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly improved through field assessment by a professional palaeontologist.



## 5. FINDINGS AND RECOMMENDATIONS

Although the palaeontological sensitivity is rated high, the development area is an area of **low relief with no steep river gulleys or sharp outcrops**. The low relief and lack of appropriate exposure at the proposed site indicates that the impact on palaeontological material on farm 1234, Gonubie, Buffalo Metropolitan Municipality, East London is **negligible and regarded as insignificant**. The impact on paleontological material on farm 1234 is thus **negligible and regarded as insignificant**. It is therefore recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development, pending the discovery or exposure of any fossil remains during the construction phase.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional paleontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

## 6. REFERENCES

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

Elize Butler has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working at the National Museum for the past 22 years and currently holds the position of Collection Manager of the Karoo Vertebrate Collection of the Palaeontology Department at the National Museum in Bloemfontein. Her current research interests comprise of Permo-Triassic vertebrate palaeobiology, with a special focus on gorgonopsians at the End-Permian Mass Extinction.

## **Declaration of Independence**

I, Elize Butler, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise my objectivity in this work.

Sincerely

A handwritten signature in black ink that reads "Butler." The signature is written in a cursive style with a large initial 'B'.

Mrs. Elize Butler

## **Appendix 1. Section 25 of the National Heritage Resources Act 1999.**

### **Heritage resources**

The various categories of heritage resources are recognised as part of the National Estate in Section 3 of The National Heritage Resources Act. This include among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

### **According to Section 25 of the National Heritage Resources Act 1999, dealing with archaeology, palaeontology and meteorites:**

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
- No person may, without a permit issued by the responsible heritage resources authority—
  - destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
  - destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
  - trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

- bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
  - serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
  - carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary