

**Phase 1 Palaeontological Impact Assessment of the
proposed Lourierpark township development on
Portion 1 of the farm Brandkop 702,
Bloemfontein, FS Province.**



Report prepared by
Paleo Field Services, PO Box 38806
Langenhovenpark 9330

Executive Summary

A Phase 1 Palaeontological Impact Assessment was carried out as part of a proposed township development on Portion 1 of the farm Brandkop 702 outside Bloemfontein, Free State Province, where the Mangaung Municipality plans to develop 2000 erven on 400ha of land. The development footprint is situated within the Beaufort Group (Karoo Supergroup), and is underlain by palaeontologically significant Adelaide Subgroup sedimentary rocks, that have been widely intruded by Jurassic-age dolerites. It is considered unlikely that the proposed development will affect palaeontological heritage resources within the superficial component (Quaternary overburden) due to the disturbed condition of the substrate and the absence of a suitable alluvial context. The palaeontological significance of **the Quaternary overburden** within the boundaries of the proposed footprint is therefore considered to be very minor. This component **is assigned a field rating of Generally Protected C (GP.C)**. The **dolerite component** is not palaeontologically vulnerable and **is assigned a field rating of Generally Protected C (GP.C)**. The proposed footprint is largely located on potentially intact sedimentary bedrock and thermally derived metasediments near dolerite intrusions, but the chances of impact on palaeontological material from fresh sedimentary bedrock strata is considered low because of the low topography terrain and the considerable Quaternary overburden that caps the study area. However, since fossil distribution within fossil-bearing rock units may vary significantly (eg. high or moderate concentration but irregular distribution), it is advised that if *in situ* fossil material is exposed as a result of excavations into fresh sedimentary bedrock, SAHRA and a professional palaeontologist are informed immediately. **The sedimentary bedrock component is assigned a field rating of Generally Protected B (GP.B)** with the recommendation that excavations into fresh sedimentary bedrock that exceeds a depth of >1m is monitored for potential palaeontological heritage during the construction phase of the development.

Table of Contents

Executive Summary.....	2
Introduction.....	4
Terms of Reference.....	5
Methodology.....	5
Field Rating	5
Locality data.....	5
Site Information.....	5
Geology.....	6
Background	6
Field Assessment.....	7
Impact Statement and Recommendation	7
References.....	8
Tables and Figures.....	10

Introduction

A Phase 1 Archaeological Impact Assessment was carried out as part of a proposed township development on Portion 1 of the farm Brandkop 702 outside Bloemfontein, Free State Province, where the Mangaung Municipality plans to develop 2000 erven on 400ha of land (**Fig.1**). The assessment is required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act (NHRA) 25 of 1999. The region's unique and non-renewable archaeological and palaeontological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources including archaeological and palaeontological sites in the area to be developed, and that make recommendations for protection or mitigation of the impact of the sites.

The NHRA identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development listed in Section 38 (1) of the NHR Act are:

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site
 - a) exceeding 5000 m² in extent; or
 - b) involving three or more existing erven or subdivisions thereof; or
 - c) involving three or more subdivisions thereof which have been consolidated within the past five years;
- The rezoning of a site exceeding 10 000 m²; or
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

A site visit and subsequent assessment took place in July 2016. The task involved identification of possible paleontological sites or occurrences in the proposed zone, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

Terms of Reference

- Identify and map possible heritage sites and occurrences using available resources.
- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

Methodology

The heritage significance of the affected area was evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature. This was followed by a field assessment by means of a pedestrian survey. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes. Relevant publications, aerial photographs (incl. Google Earth) and site records were consulted and integrated with data acquired during the on-site inspection.

Field Rating

Site significance classification standards prescribed by SAHRA (2005) were used for the purpose of this report (**Table 1**).

Locality data

Site Information

1 : 50 000 scale topographic map: 2926 AA Bloemfontein

1: 250 000 scale geological map 2926 Bloemfontein

The proposed development is located on Portion 1 of the farm Brandkop 702, situated south of and next to the R706 road to Jagersfontein, and about one kilometre west of the N1 national road going through Bloemfontein (**Fig. 2**). The study area consists of 400ha of open, flat terrain and degraded farmland (**Fig. 3**).

Site coordinates:

- A) 29°10'47.53"S 26°10'2.27"E
- B) 29°11'29.38"S 26°10'42.04"E
- C) 29°12'19.57"S 26° 9'20.84"E
- D) 29°11'28.16"S 26° 8'53.67"E

Geology

The geology of the region has been described by Theron (1963) and Johnson (2006). It is situated within the Beaufort Group (Karoo Supergroup), and is primarily represented by late Permian, Adelaide Subgroup sedimentary rocks, which are made up of alternating sandstone and mudstone layers (*Pa*) (**Fig. 4**). Dykes and sills of resistant Jurassic dolerites (*Jd*) determine the relief in the region as witnessed by the Platkop and Tafelkop koppies located north of the study area. The site is capped by younger, superficial deposits of Quaternary age. These deposits consist mainly of shallow to well-developed, windblown sand and residual soils of varying depth.

Background

The local palaeontological footprint is primarily represented by Late Permian Karoo vertebrate fauna and Quaternary macrofossils (Broom 1909 a; Broom 1909 b; Kitching 1977; Churchill *et al* 2000). The succession of Beaufort Group sedimentary rocks is subdivided into eight biostratigraphic units, called assemblage zones (Rubidge 1995) and the sedimentary strata underlying the affected area are assigned to the *Dicynodon* Assemblage Zone (AZ) (Kitching 1995) (**Fig. 4**). This assemblage zone is characterized by the presence of a distinctive and fairly common dicynodont genus. Therapsids and other vertebrate fossils from this biozone are usually found as dispersed and isolated specimens in mudrock horizons, associated with an abundance of calcareous nodules. Plant fossils (*Dadoxylon*, *Glossopteris*) and trace fossils (arthropod trails, worm burrows) are also present. The sediments assigned to the *Dicynodon* AZ are associated with stream deposits consisting of floodplain mudstones and subordinate, lenticular channel sandstones.

In more recent times the central interior and what is now the Free State Province, was once a vast and highly productive grassland ecosystem. Quaternary palaeontological sites, often associated with Stone Age artefacts, are found eroding out of Pleistocene

alluvial terraces and dongas along the Modder River and its tributaries north and east of Bloemfontein (**Fig. 5**). Some of these alluvial deposits contain numerous occurrences of *in situ* Middle and Later Stone Age material eroding out of the overbank sediments where they are often found in association large mammal fossil remains (Rossouw 1999, 2000, 2006).

Field Assessment

Results from the field assessment are summarized in **Table 2**.

The affected area is situated within the Beaufort Group, Adelaide Subgroup (Karoo Supergroup), but is primarily underlain by intrusive, Jurassic-age dolerites, which also determines the relief of the surrounding area. A pedestrian survey indicates that bedrock is capped by unconsolidated Quaternary-age sediments (Q_s), consisting of brown to red calcareous sand and residual soils ranging in depth between 250mm and 750mm (**Fig. 6**). The superficial overburden is largely degraded by previous farming activities. It thins out towards Platkop and Tafelkop, exposing dolerite and associated metasediments, primarily made up of fine to coarse-grained sandstones. The koppies are almost exclusively doleritic and not palaeontologically significant, being part of an interconnected network of igneous dolerite intrusions. These dykes intruded the local environment during the Jurassic and “cooked” the adjacent sedimentary rocks (metasediments). This had the effect of hardening the rocks and destroying any fossil plant material or physically destroying the vertebrate fossils. Intact sedimentary bedrock are largely unexposed within the study as a result of the low topography terrain. There no evidence for the accumulation and preservation of intact fossil material within the superficial Quaternary sediments.

Impact Statement and Recommendation

It is considered unlikely that the proposed development will affect palaeontological heritage resources within the superficial component (Quaternary overburden) due to the disturbed condition of the substrate and the absence of a suitable alluvial context. The palaeontological significance of the Quaternary overburden within the boundaries of the proposed footprint is therefore considered to be very minor. This component is assigned a field rating of Generally Protected C (GP.C). The dolerite component (J_d)

is not palaeontologically vulnerable and is assigned a field rating of Generally Protected C (GP.C).

The proposed footprint is largely located on potentially intact sedimentary bedrock and thermally derived metasediments near dolertite intrusions. The chances of impact on palaeontological material from fresh sedimentary bedrock strata is considered low because of the low topography terrain and the considerable Quaternary overburden that caps the study area. However, since fossil distribution within fossil-bearing rock units may vary significantly (eg. high or moderate concentration but irregular distribution), it is advised that if *in situ* fossil material is exposed as a result of excavations into fresh sedimentary bedrock, SAHRA and a professional palaeontologist are informed immediately. The sedimentary bedrock component is assigned a field rating of Generally Protected B (GP.B) with the recommendation that excavations into fresh sedimentary bedrock that exceeds a depth of >1m is monitored for potential palaeontological heritage during the construction phase of the development.

References

- Broom, R. 1909 a. On a large extinct species of *Bubalus* Annals of the South African Museum 7:219 – 280.
- Broom, R. 1909 b. On the evidence of a large horse recently extinct in South Africa. *Annals of the South African* 7.281 -282.
- Churchill, S.E., Brink, J.S., Berger, L.R. Hutchison, R.A., Rossouw L., *et. al.* 2000. Erfkroon: a new Florisian fossil locality from fluvial contexts in the western Free State, South Africa. *South.African Journal of Science* 96: 161 – 163.
- Cooke, H.B.S. 1955. Some fossil mammals in the South African Museum collections. *Annals of the South African Museum* 42(3): 161-168.
- Johnson, M.R. *et. al.* 2006. Sedimentary Rocks of the Karoo Supergroup. **In:** M.R. Johnson, *et. al.* (eds). *The Geology of South Africa*. Geological Society of South Africa.
- Kitching, J.W. 1977. Distribution of Karoo vertebrate fauna with special reference to certain genera and the bearing of this distribution on the zoning of the Beaufort Beds. *Memoirs of the BPI* 1: 131pp.

- Kitching, J.W. 1995. Biostratigraphy of the Dicynodon AZ. **In:** B.S. Rubidge, *Biostratigraphy of the Beaufort Group*. Biostrat. Ser. S.Afr. Comm. Strat. 29 – 34.
- Rossouw, L. 1999. Palaeontological and archaeological survey of the Riet River, Modder River and certain sections of the Gariep River Unpublished Report, Palaeo-Anthropological Research Group. University of the Witwatersrand.
- Rossouw, L. 2000. Preliminary species list of Late Pleistocene / Holocene fossil vertebrate remains from erosional gullies along the Modder River NE of Sannaspos, Free State Province. Unpublished Report , Palaeo- Anthropological Research Group, University of the Witwatersrand.
- Rossouw, L. 2006. Florisian mammal fossils from erosional gullies along the Modder River at Mitasrust farm, central Free State, South Africa. *Navorsinge van die Nasionale Museum* 22(6): 145-162.
- Rubidge, B. S. 1995. (ed.) *Biostratigraphy of the Beaufort Group*. Biostrat. Ser. S.Afr. Comm. Strat. 1, 1 – 45.
- Theron, J.C. 1963. Geology of Bloemfontein area. Dept. of Mines. Government Printer, Pretoria.

Tables and Figures

Table 1. Field rating categories for heritage sites as prescribed by SAHRA.

Field Rating	Grade	Significance	Mitigation
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

Table 2. Summary of impacts within the proposed footprint.

Rock types and Age	Potential heritage / Biostratigraphy	Palaeontological Significance before site visit	Potential Impact (after site visit)
Superficial deposits, soils Quaternary to Recent	Mammal fossil remains in alluvial deposits	Moderate to Low	Low
Dolerite (<i>Jd</i>) Intrusive igneous bedrock. Jurassic	No fossils	Low	Low
Adelaide Subgroup (<i>Pa</i>) Metasediments Late Permian	<i>Dicynodon</i> Assemblage Zone	Moderate to High	Low

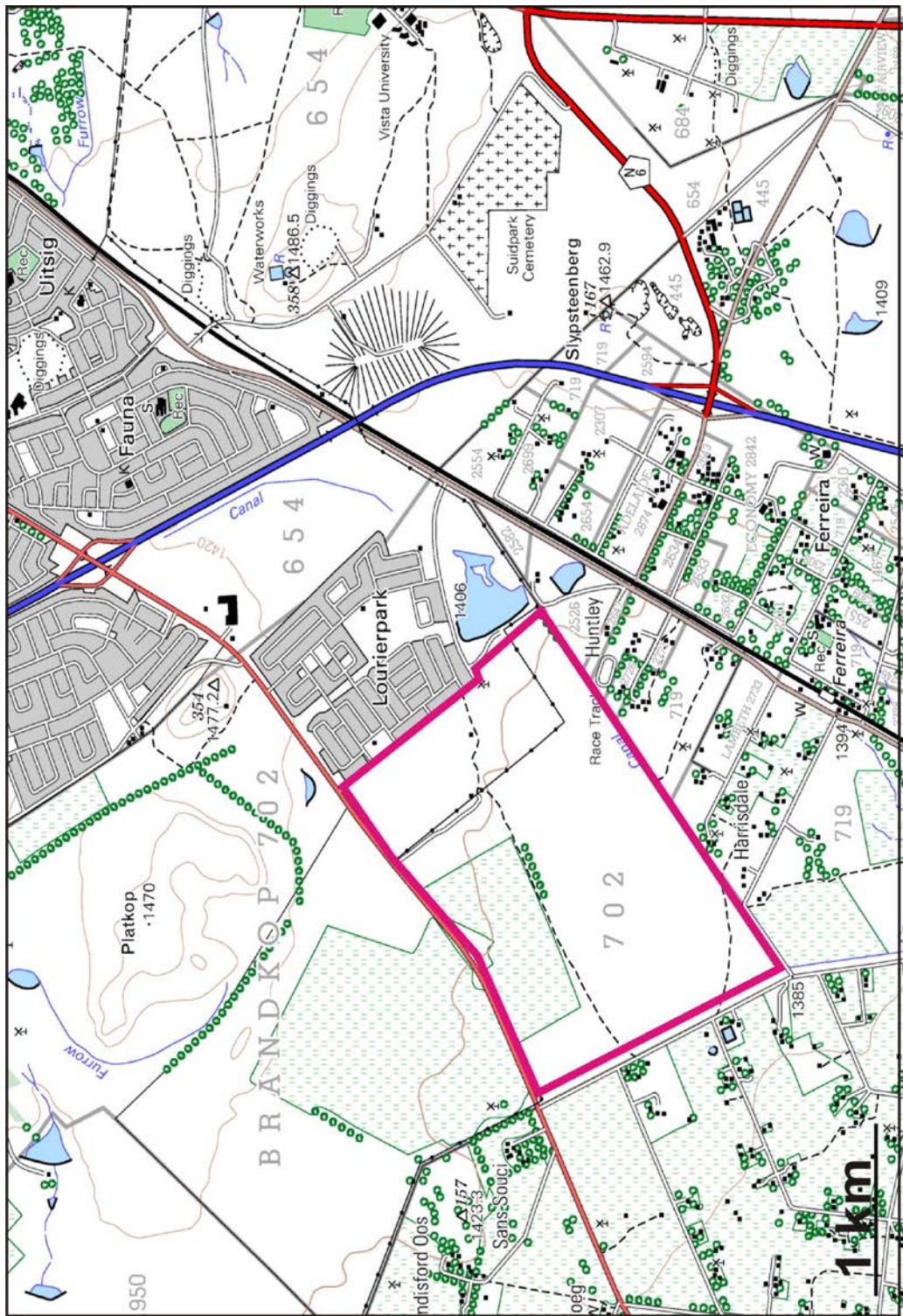


Figure 1. Map of the proposed development footprint at Portion 1 of Brandkop 702 (portion of 1:50 000 scale topographic map 2926 AA Bloemfontein).



Figure 2. Aerial view of the study area.



Figure 3. General view of the study area, looking south (top) and west (below).

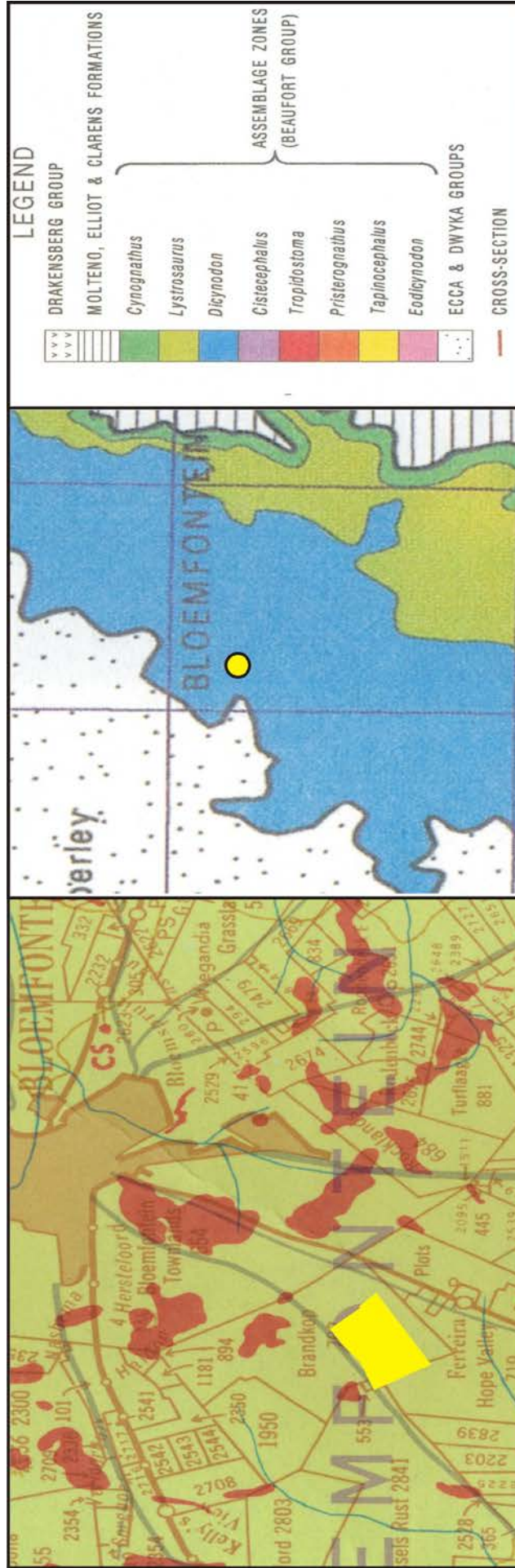


Figure 4. The study area is underlain by late Permian, Adelaide Subgroup sedimentary rocks (*Pa*) and weather-resistant resistant Jurassic dolerites (*Jd*) (portion of 1:250 000 scale geological map 2926 Bloemfontein, left map). According to the SAHRIS palaeo-sensitivity map (2015), the site is located within an area considered to be of high palaeontological sensitivity, with sedimentary strata underlying the affected area assigned to the *Dicynodon* Assemblage Zone (right map; distribution of vertebrate biozones of the Beaufort Group around Bloemfontein after Rubidge 1995).

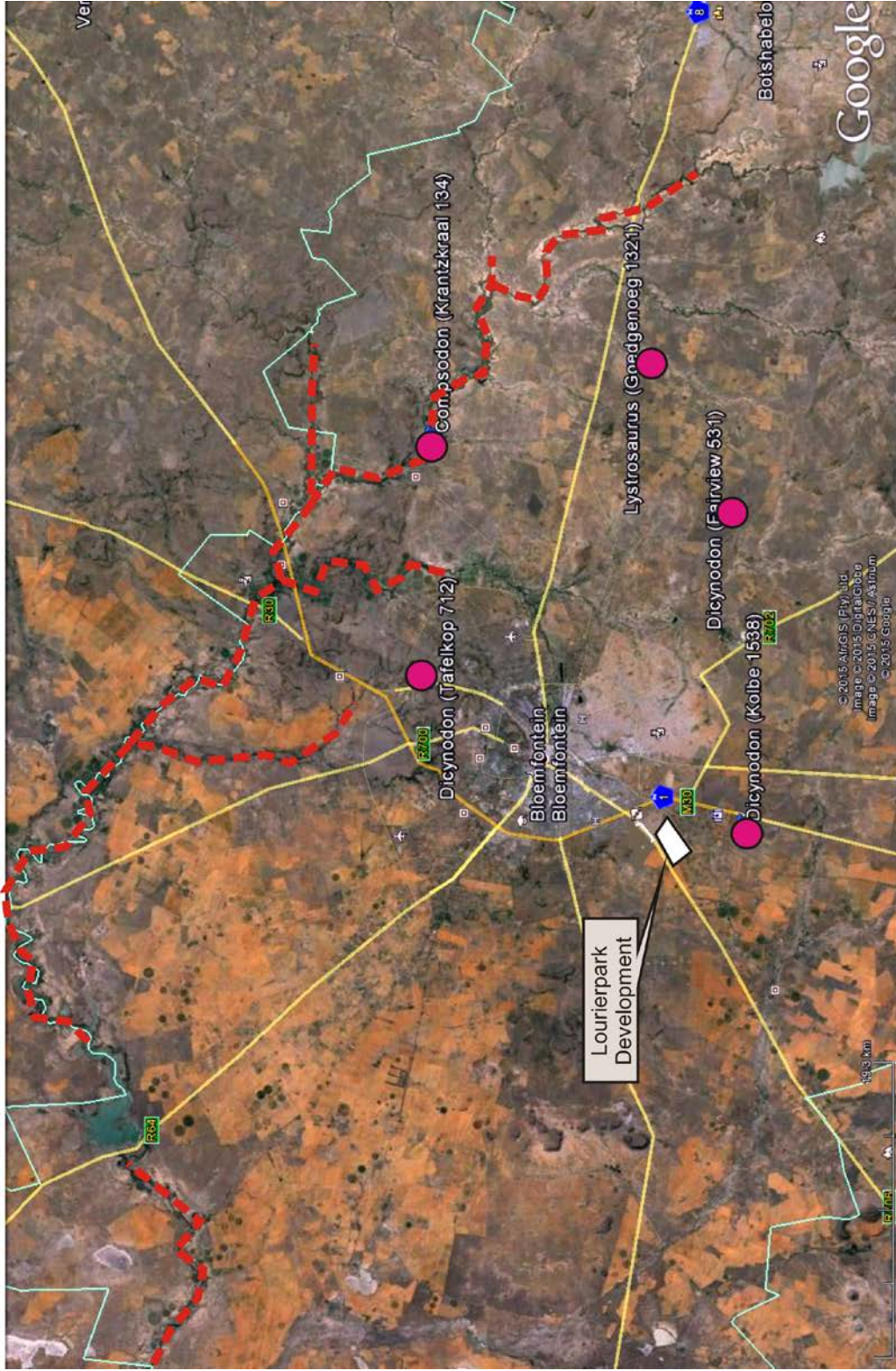


Figure 5. Position of fossil-bearing and archaeologically significant overbank sediments of the Modder River and its tributaries (red line) and recorded Karoo vertebrate fossil localities (circles) in relation to the location of the proposed development footprint.



Figure 6. The study area is represented by open, flat terrain and degraded farmland capped by unconsolidated Quaternary-age sediments; mostly brown to red calcareous sand and residual soils ranging in depth between 250mm and 750mm (top right). Scale 1 = 10 cm.