

Phase 1 Palaeontological and Archaeological Impact  
Assessment of the proposed upgrading of the existing  
raw water abstraction point from the Orange River  
outside Hopetown, NC Province.

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## Executive Summary

- At the request of MDA Environmental Consultants in Bloemfontein, a Phase 1 Palaeontological and Archaeological Impact Assessment was carried out for the proposed upgrading of the existing raw water abstraction point from the Orange River outside Hopetown in the Northern Cape Province.
- The field assessment indicates that the upgrade will primarily impact on Quaternary alluvium and geologically recent overbank sediments of the Orange River.
- Investigation of fresh exposures above the current waterline shows no evidence of intact Quaternary fossils.
- A singular Middle Stone Age flake blade was recorded on the disturbed surface of the original cutting, but no evidence was found of *in situ* or capped Stone Age artifacts.
- There are no indications of prehistoric structures or rock art within the footprint area.
- There is also no evidence of informal graves or historical structures older than 60 years within the confines of the footprint.
- The extent of the proposed upgrade is considered low in terms of palaeontological and archaeological impact.
- Recommended Grading: General Protection C (Field Rating IV C)

## **Introduction**

At the request of MDA Environmental Consultants in Bloemfontein, a Phase 1 Palaeontological and Archaeological Impact Assessment was carried out for the proposed upgrading of the existing raw water abstraction point from the Orange River outside Hopetown in the Northern Cape Province (**Fig. 1**). The extent of the proposed development (over 5000 m<sup>2</sup>) falls within the requirements for a Heritage Impact Assessment (HIA) as required by Section 38 (Heritage Resources Management) of the South African National Heritage Resources Act (Act No. 25 of 1999). The site visit and subsequent assessment took place in November 2013. The task involved identification of possible archaeological and 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.

### **Methodology**

The palaeontological and archaeological significance of the affected area was evaluated through a desktop study and carried out on the basis of existing field data, database information, published literature and maps. This was followed up with a field assessment by means of a pedestrian survey and investigation of all exposed sections within the footprint. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes.

## **Description of the Affected Area**

Maps: 1:50 000 topographical map 2924 CA Hopetown

1:250 000 geological map 2924 Koffiefontein

General Site Coordinates: 29°36'9.97"S; 24°05'41.56"E

Landowner: Thembelihle Local Municipality

The existing raw water abstraction point is located about 600m northeast of the Hopetown sewerage works on the southern bank of the Orange River (**Fig. 2 & 3**). The existing infrastructure of the facility covers approximately 5000 m<sup>2</sup> and is in generally good condition (**Fig. 4 & 5**). It consists of a 7m pipe that supplies water to a wetwell fitted with two submersible pumps. The water is pumped to a raw water storage dam that gravitates the water to the nearby water purification works. The proposed upgrade will involve a raft system in the river to accommodate the pumps to

abstract water from the river, extension of the paved road and shifting of the gantry southwards (**Fig. 6**).

### **Geology**

The region is underlain by Precambrian, Ventersdorp Supergroup lavas (Allanridge Formation, *Ra*), which is composed of resistant-weathering, dark green lavas and associated pyroclastic rocks (Zawada 1992) (**Fig. 7**). The Ventersdorp lavas are unconformably overlain by Dwyka Group tillites of the Mbizane Formation (*C-Pd*, Visser *et al.* 1977-78, 1990; Zawada 1992; Johnson *et al.* 2006), which represents valley and inlet fill deposits left behind on Ventersdorp basement rocks by retreating glaciers about 300 million years ago. These Dwyka-aged palaeovalleys bear evidence of glaciated pavements, consisting of well-preserved polished surfaces striations on basement rocks, which abound throughout the area (McLachlan and Anderson 1973). Localized outcrops of Early Permian, Whitehill Formation mudrocks (Ecca Group, *Ppw*) generally occur near Jurassic dolerite contact zones (Zawada 1992).

The Precambrian basement lavas and overlying Karoo Supergroup rocks (Dwyka and Ecca Groups) along the Orange River near Hopetown are covered with Late Cenozoic superficial deposits made up of calcretes, surface limestones, scree (*Qc*), and alluvium (*flying bird symbol in Fig. 7*).

## **Background**

### **Karoo Fossils**

The glacial tillites of the Dwyka Group are considered to be non-fossiliferous, while fossils from the early Permian Whitehill Formation (Ecca Group) mesosaurid reptiles, crustaceans, palaeoniscoid fish, fossil wood and leaves (*Glossopteris*), sponge spicules and ichnofossils (Cole and Basson 1991).

### **Dolerites**

Dolerite, in the form of dykes and sills, is common throughout the region. Regarded as feeders of Drakensberg lavas, dolerites are not palaeontologically significant and can be excluded from further consideration in the present evaluation. On the other hand, dolerite outcrop can be regarded as archaeologically significant since Stone Age lithic artifacts in the region are mostly made of hornfels, a fine-grained isotropic rock found in the hot-contact zone between the dolerites and shales in the area. As a result,

stone tool factory sites are commonly found near dolerite-shale contact zones. In addition, rock engravings in the region are consistently found on dolerite.

### **Late Cenozoic Deposits**

To the northwest of Hopetown the landscape is dissected by the ancient Koa Valley, a Miocene relic with remnants of Cenozoic fluvial deposits that has produced fossil vertebrate bone as well as fossil wood. Southwards, the Koa Valley joins an extensive system of pans fossil where vertebrate fossil remains have been identified. No fossils have been explicitly reported from late Cenozoic alluvial deposits near Hopetown yet, but a variety of fossil fauna have been retrieved from alluvial gravel terraces along the Lower Vaal River basin northeast of Kimberley (Cooke 1949; Maglio and Cooke 1978; Partridge and Maud 2000). Here, gravel terraces contain sandy lenses that have yielded several extinct vertebrate taxa including proboscidians (*Mammuthus subplanifrons* and *Elephas iolensis*), suids (*Notochoerus capensis*) and a variety of bovids.

The Stone Age archaeological footprint is well-represented north of Hopetown and around Kimberley by Early and Middle Stone Age localities from lacustrine and alluvial contexts as well as rock engravings on dolerite outcrop (**Fig. 8**). Engraving sites have been recorded on a number of farms in the Hopetown district, including Beeshoek, Brandfontein Disselfontein, Doornbult Karee Kloof Lemietoskop and Rooikop.

Hopetown itself was established in 1854. The town experienced a boom after the discovery of diamonds 1866 and 1868, which led to the famous diamond rush of the 1870's. The historical Orange River Station and blockhouse lie on the southern bank of the Orange River, 12 kilometres east of Hopetown (**Fig. 8**). South of the station lies the Doornbult concentration camp, established in 1901 by the British, which housed at least 1600 people during the Anglo-Boer War.

## **Field Assessment**

The field assessment indicates that the upgrade will primarily impact on Quaternary alluvium and geologically recent overbank sediments of the Orange River (**Fig. 9**). The substrate has already been disturbed by previous building activities when the existing raw water abstraction facility was originally constructed. Investigation of fresh exposures above the current waterline shows no evidence of intact Quaternary fossils. A singular Middle Stone Age flake blade was recorded on the disturbed

surface of the original cutting, but no evidence was found of *in situ* or capped Stone Age artifacts (**Fig. 10**). There are no indications of prehistoric structures or rock art within the footprint area. There is also no evidence of informal graves or historical structures older than 60 years within the confines of the footprint.

## **Impact Statement**

The field assessment indicates that the proposed development will primarily impact on Quaternary-age and geologically more recent alluvial deposits (**Table 1**). Impact on potentially intact Stone Age archaeological remains or Quaternary fossils is considered unlikely. The extent of the proposed upgrade is considered low in terms of palaeontological and archaeological impact.

## **Recommendation**

The terrain is not considered palaeontologically or archaeologically vulnerable and there are no major palaeontological or archaeological grounds to suspend the proposed development.

Recommended Grading: General Protection C (Field Rating IV C).

## **References**

- Cole, D.I and Basson, W.A. 1991. Whitehill Formation (Ecca Group). In M.R. Johnson (ed). *Catalogue of SA lithostratigraphic units*. SA Committee for Stratigraphy 3: 51 – 52.
- Cooke, H.B.S. 1949. Fossil mammals of the Vaal River deposits. Geological Survey of South Africa Memoir 35: 1 – 109.
- 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.
- Maglio, V.J. and Cooke, H.B.S. 1978. Evolution of African Mammals. Cambridge, Mass. Harvard University Press.
- McLachlan, I.R. and Anderson, A. 1973. A review of the evidence for marine conditions in southern Africa during Dwyka times. *Palaeontologia africana* 15: 37-64.
- Partridge, T.C. & Maud, R.R. 2000. *The Cenozoic of Southern Africa*. Oxford Monographs on Geology and Geophysics No. 40.

Visser, J.N.J., Loock, J.C. *et al.* 1977-78. The Dwyka Formation and Ecca Group, Karoo sequence in the northern Karoo Basin, Kimberley-Britstown area. *Annals of the Geographical Survey of South Africa* 12: 143 – 176.

Visser, J.N.J., von Brunn, V. and Johnson, M.R. 1990. Dwyka Group. In M.R. Johnson (ed). *Catalogue of SA lithostratigraphic units*. SA Committee for Stratigraphy 2: 15 – 17.

Zawada, P.K. 1992. *The geology of the Koffiefontein area*. Geological Survey. Pretoria. Pp 1- 30.



## Tables & Figures

**Table 1.** Summary of potential impacts at the site.

<b>Rock type / Age</b>	<b>Duration of Development</b>	<b>Palaeontological significance</b>	<b>Archaeological significance</b>	<b>Palaeontological Impact at site</b>	<b>Archaeological Impact at site</b>
Residual soils, Alluvium (Quaternary)	Permanent	High	High	Low	Low
Mbizane Formation tillites (Dwyka Group) Early Permian	N/A	Medium-High	Low	None	None
Allanridge Formation lavas, <i>Ra</i> (Ventersdorp Supergroup) Precambrian	N/A	Medium-Low	High	None	None

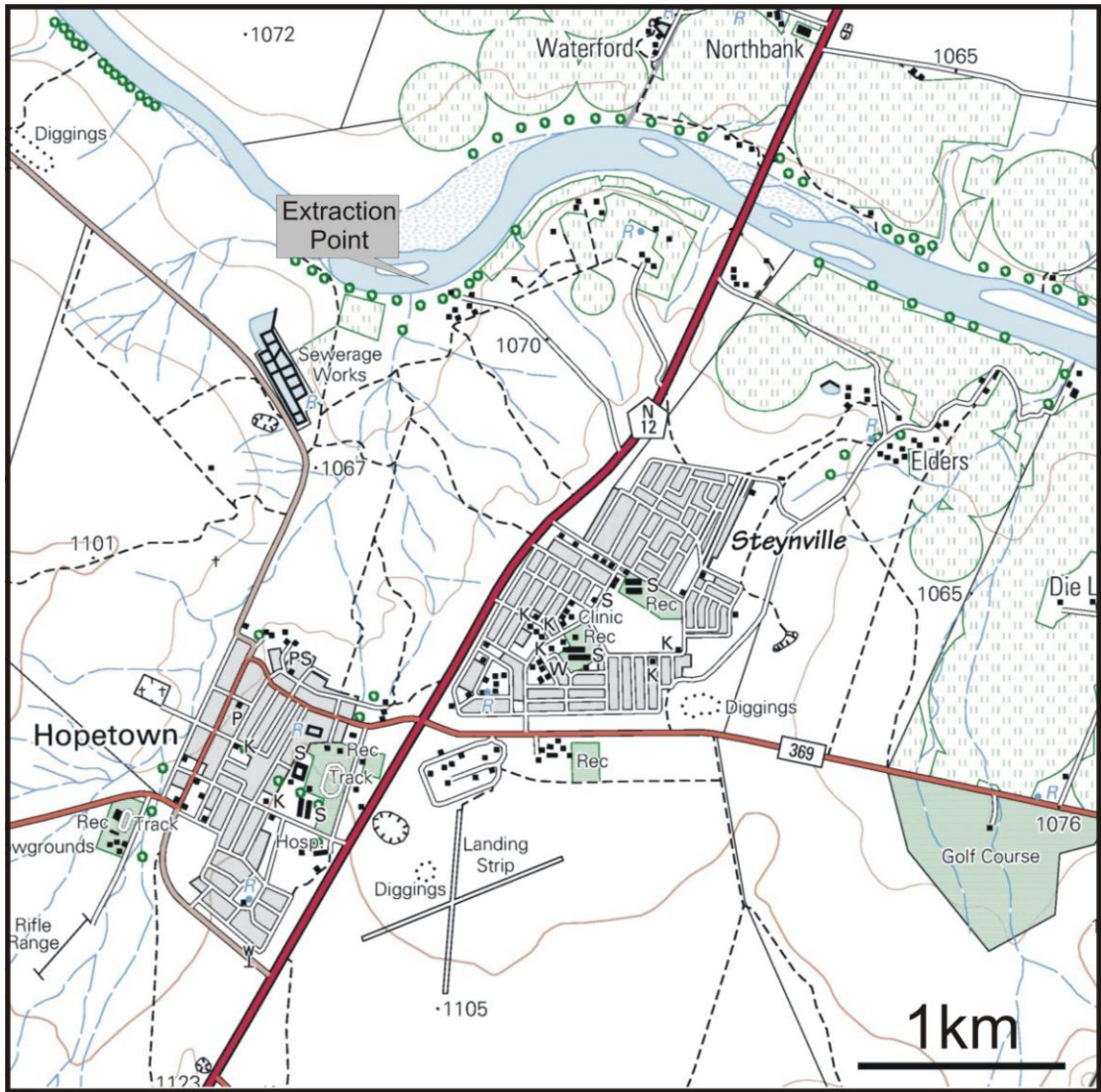


Figure 1. Hopetown and water abstraction locality (portion of 1:50 000 scale topographical map 2924 CA Hopetown).

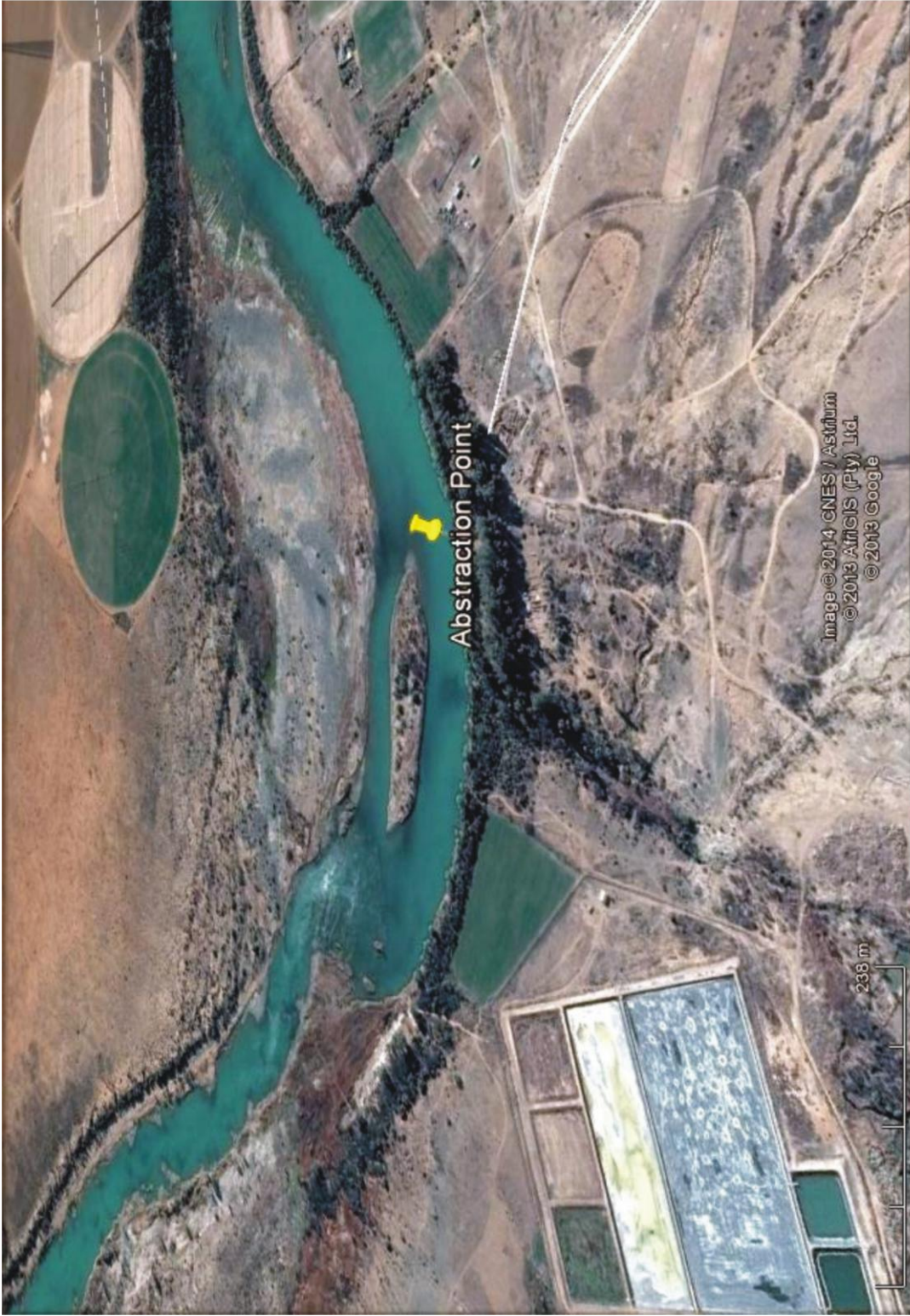


Figure 2. Aerial view of the abstraction point on the Orange River. The sewerage works is situated to the left.



Figure 3. View of the Orange River from the southern bank at the water abstraction facility, looking west.



Figure 4. Existing infrastructure at the water abstraction facility.



Figure 5. The pump house, looking east (above) and south (below, left).

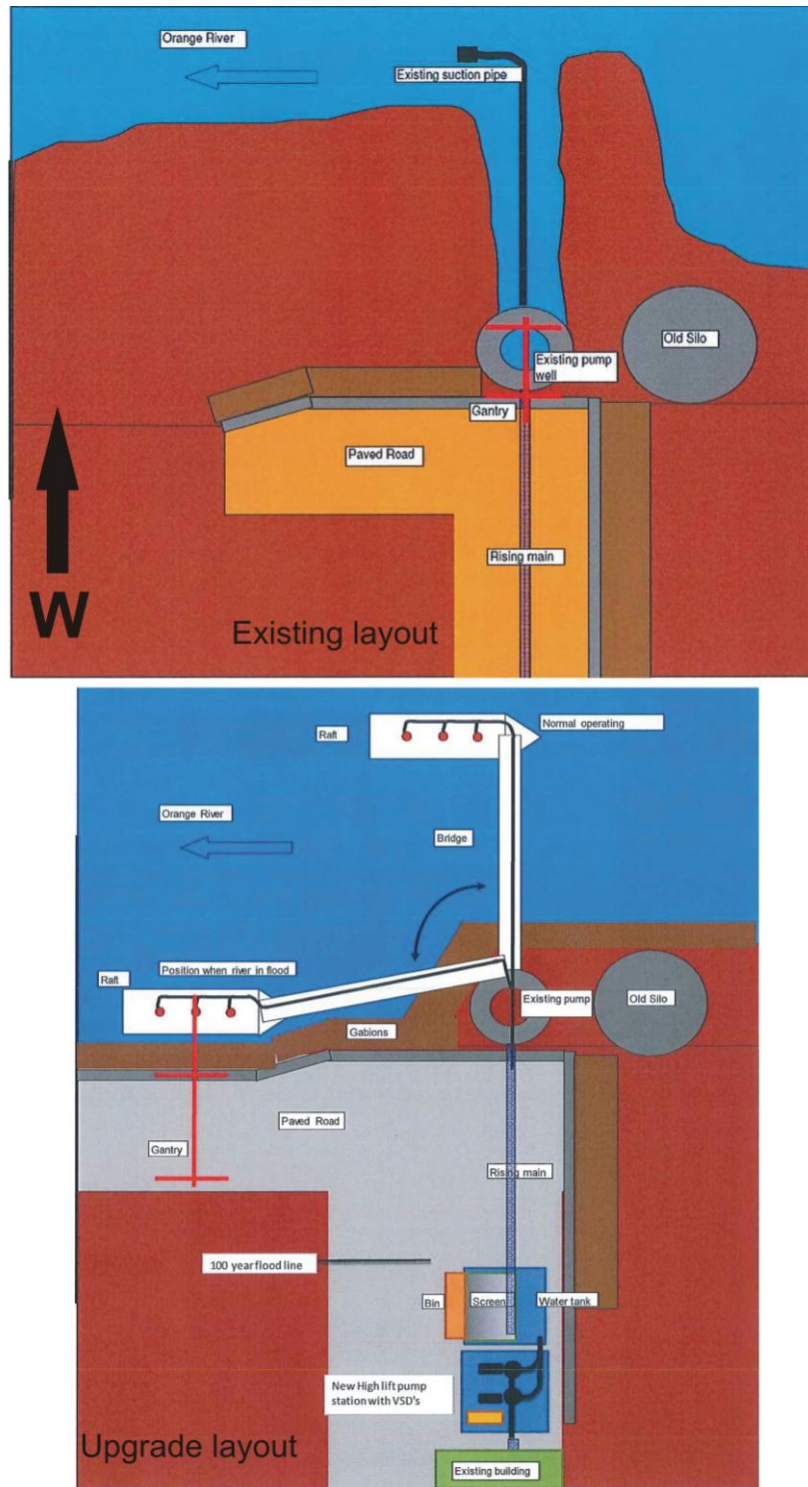


Figure 6. The proposed upgrade will involve a raft system in the river to accommodate the pumps to abstract water from the river, extension of the paved road and shifting of the gantry southwards.

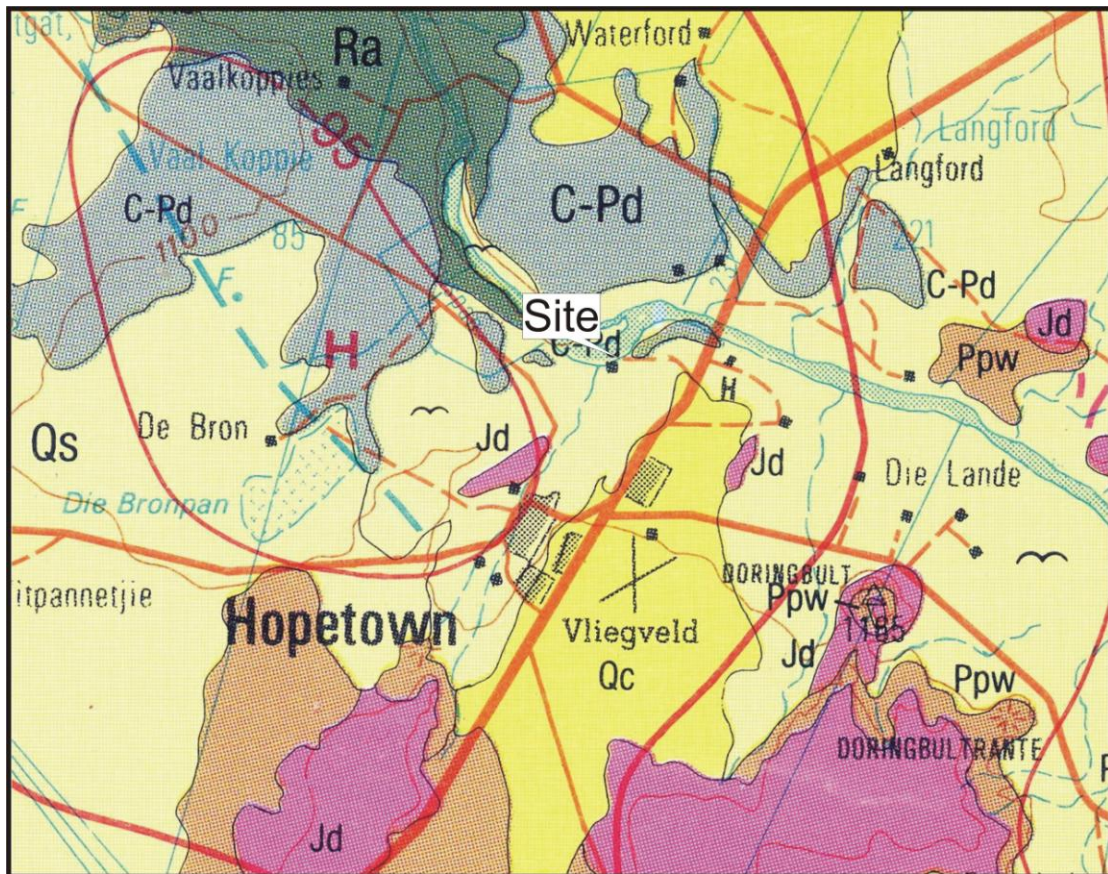
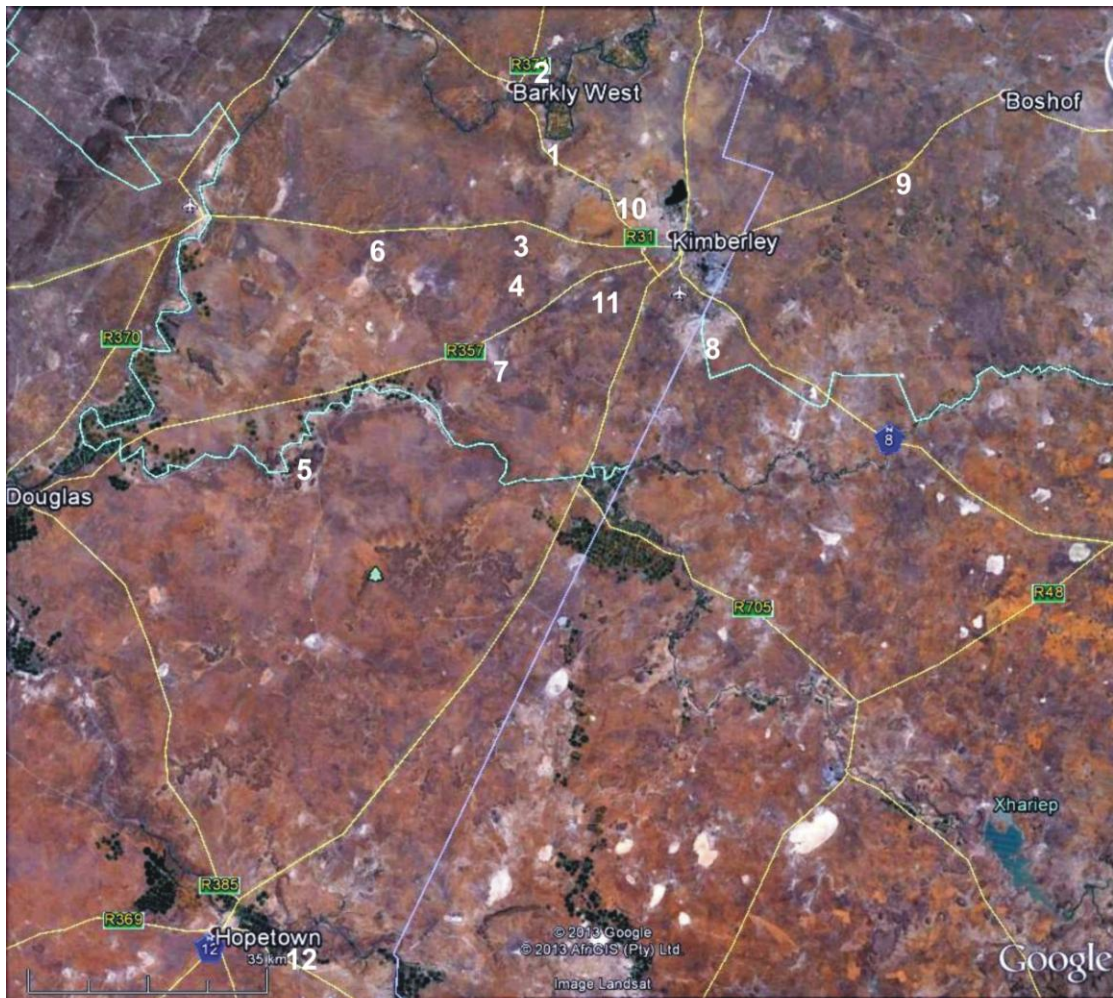


Figure 7. Portion of 1: 250 000 geological map 2924 Koffiefontein (Council for Geoscience, Pretoria). The area around Hopetown is underlain at depth by Precambrian lavas of the Allanridge Formation (Ventersdorp Group, *Ra*) as well as Dwyka tillites (Mbizane Formation, *C-Pd*) and basal Ecca mudrocks (Whitehall Formation, *Ppw*) of the Karoo Supergroup. The basement lavas and Karoo sediments are largely overlain by Late Cenozoic superficial deposits made up of calcretes, surface limestones, scree (*Qc*), and alluvium (*flying bird symbol*).





1. Pniel, Nooitgedacht & Powers Site - ESA, MSA and LSA
2. Canteen Koppie - ESA
3. Rooidam - ESA
4. Biesiesput - MSA
5. Driekopseiland - Glacial straitions, Rock engravings
6. Doornlaagte - ESA
7. Kareevloer - ESA, MSA
8. Alexandersfontein - 'palaeo-lake'
9. Liebensraum - ESA
10. Wildebeestkuil - Rock engravings
11. Witpan - Rock engravings
12. Orange River Station, Blockhouse & Concentration Camp

Figure 8. The Stone Age archaeological footprint is well-represented north of Hopetown and around Kimberley by Early and Middle Stone Age localities from lacustrine and alluvial contexts as well as rock engravings on dolerite outcrop.

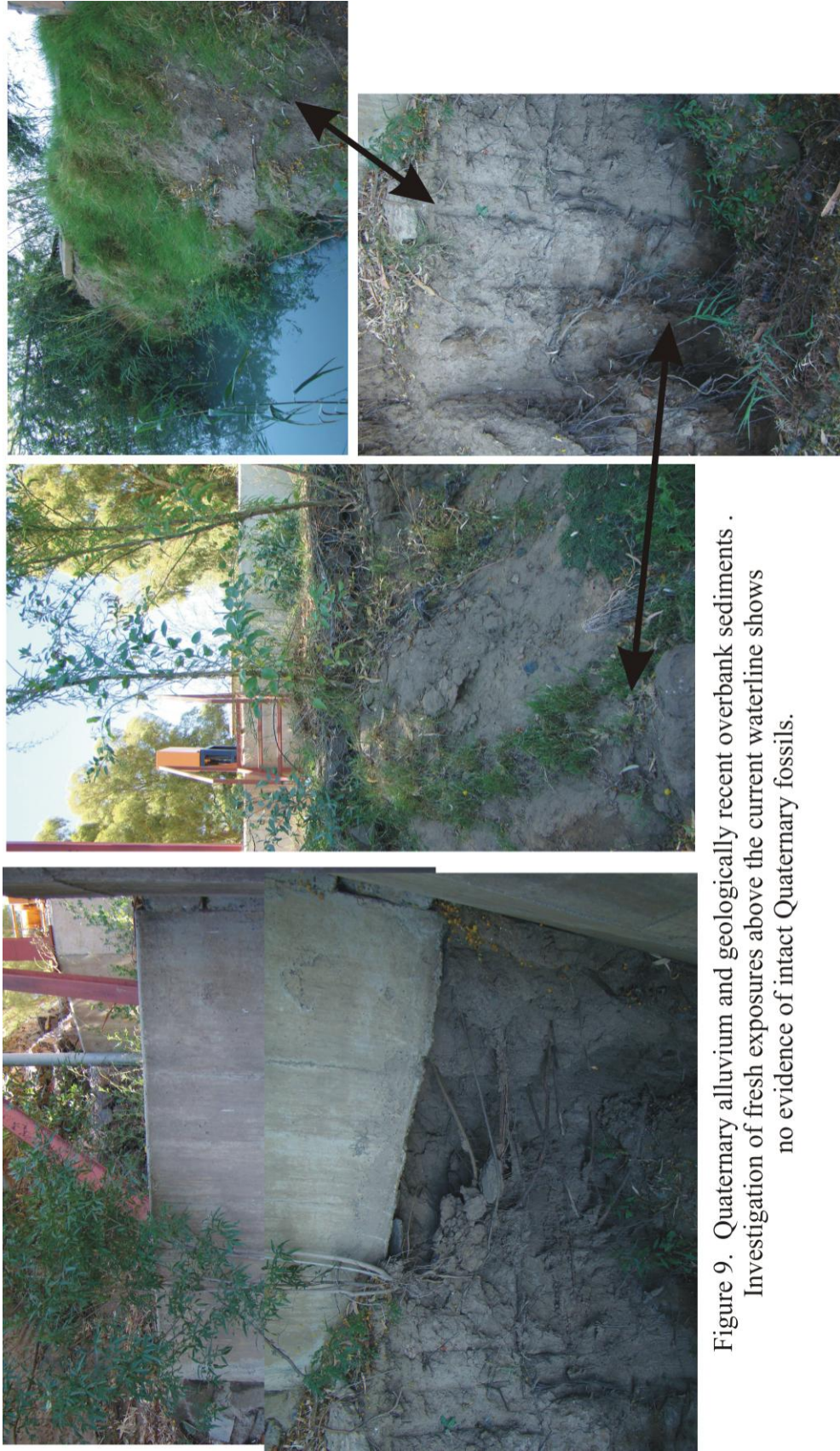


Figure 9. Quaternary alluvium and geologically recent overbank sediments .  
 Investigation of fresh exposures above the current waterline shows  
 no evidence of intact Quaternary fossils.



Figure 10. A singular Middle Stone Age flake blade was recorded on the surface of the original cutting,