

## Palaeontological heritage assessment: desktop study

### PROPOSED UPGRADE AND EXPANSION OF THE KAMIESKROON SEWERAGE OXIDATION PONDS, KAMIESBERG LOCAL MUNICIPALITY, NAMAQUA DISTRICT MUNICIPALITY, NORTHERN CAPE

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April 2020

#### Executive summary

Kamiesberg Local Municipality is proposing to upgrade and expand existing sewerage treatment infrastructure situated on Erf RE/2 on the northern side of the N7 trunk road, c.1.5 km west of the small village of Kamieskroon in the Kamiesberg Local Municipality (Namaqua District Municipality) of the Northern Cape Province. The project area is underlain at depth by Precambrian basement gneisses of the Kamiesberg Group which are unfossiliferous and covered by a thin mantle of gravelly to sandy alluvial and piedmont deposits of Late Caenozoic age which are of low palaeontological sensitivity.

The overall palaeontological impact significance of the proposed sewerage infrastructure project near Kamieskroon in terms of palaeontological heritage is considered to be VERY LOW because:

- The Precambrian metasedimentary and igneous basement rocks underlying this region at depth are entirely unfossiliferous;
- The overlying Late Caenozoic superficial deposits are generally of low palaeosensitivity;
- The project footprint is small, and is in part already highly disturbed by pre-existing sewerage infrastructure, tracks *etc*;
- The small water course just outside the eastern edge of the project area is unlikely to be associated with substantial deposits of consolidated, potentially-fossiliferous older alluvium.

**It is therefore recommended that, pending the potential exposure of significant new fossils during construction, exemption from further specialist palaeontological studies and mitigation is granted for this development.**

There are no objections on palaeontological heritage grounds to authorisation of the proposed sewerage infrastructure project. Should any substantial fossil remains (e.g. vertebrate bones and teeth, shells) be encountered during development, however, these should be reported to SAHRA for possible mitigation by a palaeontological specialist. A tabulated Chance Fossil Finds protocol is appended to this report.

## 1. Project outline

The Kamiesberg Local Municipality is proposing to upgrade and expand existing sewerage treatment infrastructure situated on Erf RE/2 the northern side of the N7 trunk road, some 1.5 km west of the small village of Kamieskroon in the Kamiesberg Local Municipality (Namaqua District Municipality), Northern Cape Province (Fig. 1). The project proposal includes the following activities (see satellite map in Fig. 2):

- Construction of oxidation ponds, with evaporation ponds, and construction of in-and outlet structures;
- Installation of HDPE-linings to waterproof the ponds;
- Reconstruction and waterproofing of the existing oxidation ponds;
- Construction of a short pipeline between the two pond sites;
- Construction of security fences and caretakers' building.

The present palaeontological heritage contributes to the broad-based Heritage Impact Assessment for the sewerage infrastructure project that is being co-ordinated by the Agency for Cultural Resource Management, ACRM (Contact details: Mr Jonathan Kaplan. Address: 5 Stuart Road, Rondebosch. P/F: 021 685 7589. M: 082 321 0172. Email: [acrm@wcacces.co.za](mailto:acrm@wcacces.co.za)). The Environmental Assessment Practitioner responsible for the NEMA Environmental Authorisation application for the proposed development is EnviroAfrica CC. (Contact details: Mr Clinton Geyser. EnviroAfrica CC. Physical address: Unit 7, Pastorie Park, Reitz St, Somerset West, 7130. Postal address: P.O. Box 5367, Helderberg, 7135 / Fax: 086 512 0154 / Tel: 021 8511616 / E-mail: [clinton@enviroafrica.co.za](mailto:clinton@enviroafrica.co.za)).



**Figure 1: Google Earth© satellite image showing the location of the sewerage infrastructure project area (orange polygons) on Erf RE/2 situated on the northern side of the N7 trunk road some 1.5 km west of the small village of Kamieskroon, Kamiesberg Local Municipality (Namaqua District Municipality), Northern Cape.**



**Figure 2: Close-up Google Earth© satellite image of the sewerage infrastructure project area with two sets of oxidation ponds surrounded by a fence (orange polygons) and joined by a pipeline (blue line).**

## 2. Geological context

The sewerage infrastructure project study area lies on the north side of the N7 trunk road some 1.5 km west of the small village of Kamieskroon (Figs. 1 & 2). The area lies within a shallow stream valley between low rounded hills of the Namaqualand *Klipkoppe* or *Hardeveld* region of the Northern Cape. The sandy to gravelly, semi-arid terrain here lies at c. 700 m amsl is partially disturbed at surface by farm tracks and pre-existing sewerage treatment infrastructure. A small, tree-lined drainage line runs north-westwards just to the east of and outside the project area.

The geology of the Kamieskroon region is shown on 1: 250 000 geology sheet 3017 Garies with a detailed sheet explanation by De Beer (2010) (Fig. 3). The region forms part of the high-lying Kamieskroon Ridge basement high which is characterised by numerous Inselberge, domes and ridges of Precambrian granitoid basement rocks (granites, gneisses etc). The intervening valleys are drained by small, intermittently-flowing streams and are mantled by unconsolidated to semi-consolidated sandy to gravelly sediments of Late Caenozoic age.

The basement rocks underlying the project area are high-grade metasediments – mapped as metapeliitic and biotite gneisses – that are assigned to the **Kamiesberg Group**. They form part of the Namaqualand Metamorphic Province of the Northern Cape and have an estimated age of about 2 Ga (billion years) (Mokolian). These metasediments are dominated by a range of gneisses that were intruded by large volumes of granitoid magmas and intensely deformed around 1 Ga (Cornell *et al.* 2006, De Beer 2010 and refs. therein). It is noted that a N-S trending fault within the basement rocks is mapped just to the east of the project area.

Stream valley floors between the Namaqualand *klipkoppe* are mantled by shallow (up to several meter-deep), unconsolidated to semi-consolidated **superficial sediments** of probable Quaternary (Pleistocene to Recent) age (*i.e.*  $\leq 2.5$  Ma). These piedmont deposits include a range of quartz-rich alluvial sands and gravels, skeletal soils, colluvial deposits such as bouldery or blocky scree, sandy, arkosic (feldspar-rich) and gravelly sheet wash and slope deposits derived from weathering of the surrounding granite-gneiss terrain. Wind-blown (aeolian) sands, possibly to equated with the Quaternary Gordonia Formation of the Kalahari Group, may occur here as well. Water courses (and any pans) may be locally associated with thick developments of calcrete (pedogenic limestone). Calcrete hardpans of probable Late Tertiary (Neogene) to Quaternary or Recent age may also occur in the subsurface.

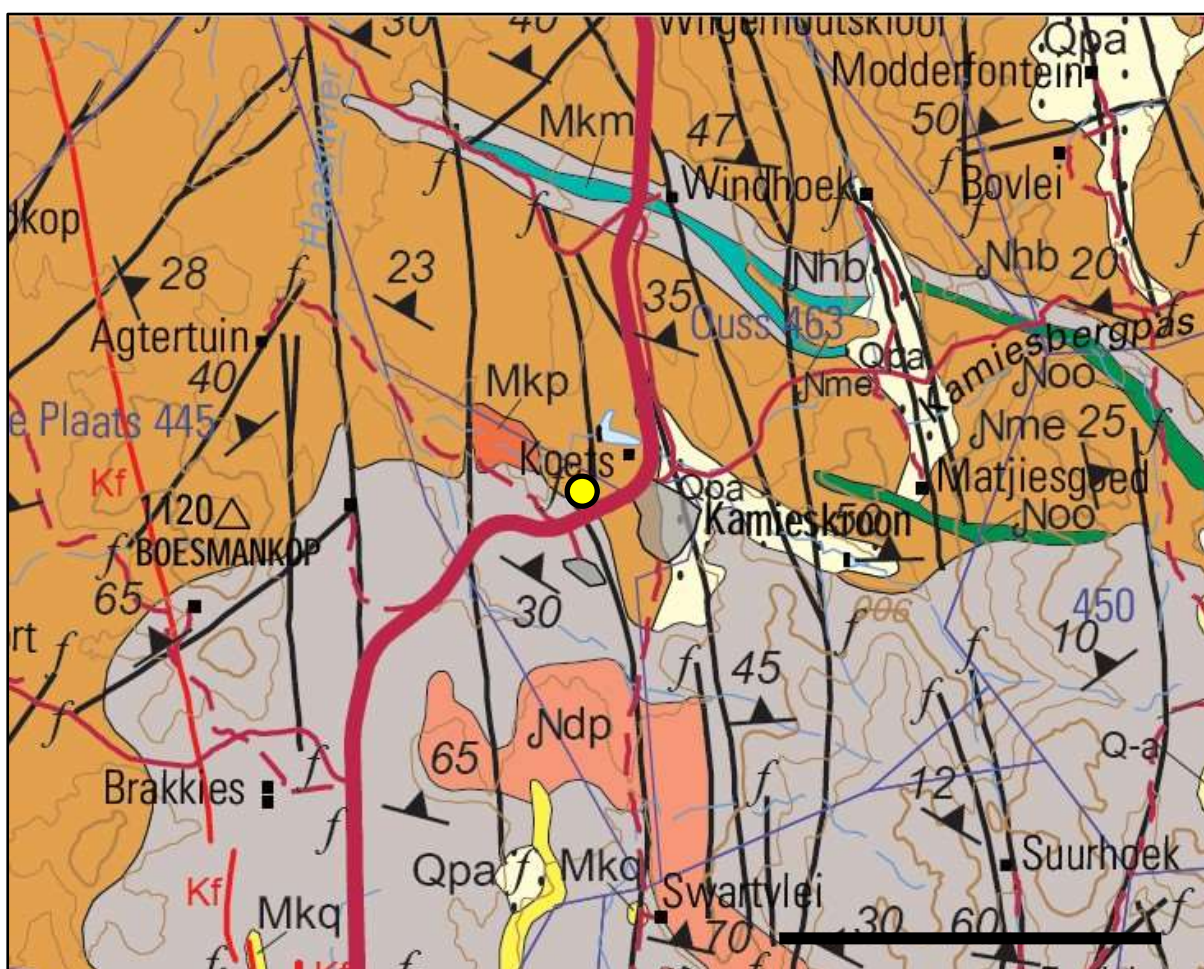


Figure 3: Extract from 1: 250 000 geological sheet 3017 Garies (Council for Geoscience, Pretoria) showing the *approximate* location of the sewerage infrastructure project area (yellow circle) on the northern side of the N7 some 1.5 km west of Kamieskroon, Kamiesberg Local Municipality (Namaqua District Municipality), Northern Cape. Scale bar = 4 km. N towards the top of the image. The bedrocks beneath the project area are underlain by unfossiliferous metapeliitic and biotite gneisses of the Kamiesberg Group (Mkp, orange). Thick alluvial or pan deposits are not mapped in this area at 1: 250 000 scale.

### 3. Palaeontological heritage

The ancient Precambrian basement rocks (highly metamorphosed sediments, igneous intrusions) of the **Namaqua-Natal Metamorphic Province** underlying the sewerage infrastructure study area near Kamieskroon at depth are entirely unfossiliferous and are therefore not of palaeontological heritage significance (Almond & Pether 2008). They are therefore not considered further here.

The overall palaeontological sensitivity of the porous and permeable, sandy to gravelly, and locally calcretised, **Late Caenozoic superficial deposits** in the Namaqualand region is generally low. The predominantly sandy superficial deposits in the study area, including the alluvial and aeolian sands and gravels, are unlikely to contain substantial fossil remains (De Beer *et al.*, 2002, Almond & Pether 2008, Almond *in* Macey *et al.* 2008). Fossil land snails have been recorded from yellowish to reddish terrestrial sands and overlying calcretes in the adjoining Springbok sheet area (Marais *et al.*, 2001). Among the limited range of other fossils that might be encountered within Late Caenozoic surface sediments in the study area are calcretized rhizoliths (root casts), termitaria and other burrows, freshwater molluscs, ostrich egg shells, sparse bones, teeth and horn cores of mammals, and tortoise remains. Finer-grained river, stream and pan sediments might contain fossils of fish, frogs, molluscs, crustaceans (crabs, ostracods, phyllopods such as conchostracans) as well as microfossils such as diatoms, palynomorphs and macroplant remains (*e.g.* wood, peats). Such fossil remains are likely to occur only sporadically. It is noted that skeletal remains of a Pliocene three-toed horse, *Hipparion*, have been recorded from a well at Areb, 65 km east of Springbok, probably in association with buried Late Tertiary river deposits comparable to those in the major Koa River palaeochannel in Bushmanland further the northeast.

### 4. Conclusions and recommendations

The overall palaeontological impact significance of the proposed sewerage infrastructure project near Kamieskroon, Namaqualand, in terms of palaeontological heritage is considered to be VERY LOW because:

- The Precambrian metasedimentary and igneous basement rocks underlying this region at depth are entirely unfossiliferous;
- The overlying Late Caenozoic superficial deposits are generally of low palaeosensitivity;
- The project footprint is small, and is in part already highly disturbed by pre-existing sewerage infrastructure, tracks *etc*;
- The small water course just outside the eastern edge of the project area is unlikely to be associated with substantial deposits of consolidated, potentially-fossiliferous older alluvium.

**It is therefore recommended that, pending the potential exposure of significant new fossils during construction, exemption from further specialist palaeontological studies and mitigation is granted for this development.**

There are no objections on palaeontological heritage grounds to authorisation of the proposed sewerage infrastructure project. Should any substantial fossil remains (e.g. vertebrate bones and teeth, shells) be encountered during development, however, these should be reported to SAHRA for possible mitigation by a palaeontological specialist. A tabulated Chance Fossil Finds protocol is appended to this report.

These mitigation recommendations should be incorporated into the Environmental Management Programme (EMPr) for the proposed development.

Please note that:

- All South African fossil heritage is protected by law (South African Heritage Resources Act, 1999) and fossils cannot be collected, damaged or disturbed without a permit from SAHRA;
- The palaeontologist concerned with potential mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (e.g. museum or university collection);
- All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies developed by HWC (2016) and SAHRA (2013).

## 5. References

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## 6. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Gauteng, Limpopo, Northwest, Mpumalanga, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has previously served as a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological

heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

### **Declaration of Independence**

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development 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 the objectivity of my performing such work.



**Dr John E. Almond,  
Palaeontologist, *Natura Viva* cc**



<b>CHANCE FOSSIL FINDS PROCEDURE: Sewerage infrastructure project area near Kamieskroon, Northern Cape</b>	
<b>Province &amp; region:</b>	Northern Cape, Namakwa District Municipality
<b>Responsible Heritage Resources Agency</b>	SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za
<b>Rock unit(s)</b>	Late Caenozoic alluvium, calcretes along water courses and calcrete hardpans
<b>Potential fossils</b>	Bones, teeth and horn cores of mammals, freshwater molluscs, calcretised termitaria and other trace fossils
<b>ECO protocol</b>	1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately ( <i>N.B.</i> safety first!), safeguard site with security tape / fence / sand bags if necessary.
	2. Record key data while fossil remains are still <i>in situ</i> : <ul style="list-style-type: none"> <li>• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo</li> <li>• Context – describe position of fossils within stratigraphy (rock layering), depth below surface</li> <li>• Photograph fossil(s) <i>in situ</i> with scale, from different angles, including images showing context (<i>e.g.</i> rock layering)</li> </ul>
	3. If feasible to leave fossils <i>in situ</i> : <ul style="list-style-type: none"> <li>• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</li> <li>• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</li> </ul>
	3. If <i>not</i> feasible to leave fossils <i>in situ</i> (emergency procedure only): <ul style="list-style-type: none"> <li>• <i>Carefully</i> remove fossils, as far as possible still enclosed within the original sedimentary matrix (<i>e.g.</i> entire block of fossiliferous rock)</li> <li>• Photograph fossils against a plain, level background, with scale</li> <li>• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags</li> <li>• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist</li> <li>• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</li> </ul>
	4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.
	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency
<b>Specialist palaeontologist</b>	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository ( <i>e.g.</i> museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.