

**DESKTOP PALAEOLOGICAL  
IMPACT ASSESSMENT REPORT IN  
RESPECT OF A PROPOSED  
VODACOM MAST ON PORTION 10  
OF THE FARM LEEUWENKLOOF 480  
JQ, NORTH WEST PROVINCE**

5 November 2018

Prepared for:  
Heritage Contracts and Archaeological  
Consulting CC

On behalf of:  
Vodacom (Pty) Ltd

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**DESKTOP PALAEOLOGICAL IMPACT ASSESSMENT REPORT IN RESPECT OF A  
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Prepared for:

Heritage Contracts and Archaeological Consulting CC

On Behalf of:

Vodacom (Pty) Ltd

Prepared By:

Dr B.D. Millstead

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## EXECUTIVE SUMMARY

A desktop Palaeontological Impact Assessment study has been conducted on the site of the proposed construction of a Vodacom (Pty) Ltd mast (with associated infrastructure) upon Portion 10 of the farm Leeuwenkloof 480 JQ, Madibeng Local Municipality, Bojanala District Municipality, Brits Magisterial District, North west Province. The project area can be located within the confines of 1:50 000 topographic map 2527DD. The proposed location co-ordinates of the mast are 25° 49' 21.75"S and 27° 49' 19.60"E. The aerial extent of the project area is ca. 10 m x 10 m (ca. 100 m<sup>2</sup>).

Vodacom (Pty) Ltd has applied for an environmental authorisation (EA) for construction of a proposed mast. Heritage Contracts and Archaeological Consulting CC, was appointed, as independent consultants, to conduct the Heritage Impact Assessment component of the application process. Heritage Contracts and Archaeological Consulting CC has retained BM Geological Services to provide a desktop Palaeontological Heritage Impact Assessment Report in respect of the proposed project that will form part of the final Heritage Impact Assessment Report that will form part of the EA.

Any negative effects emanating from the project will be local in nature, being restricted to the development area. It is anticipated, herein, that most infrastructural elements will only directly affect the surface of the site to a relatively shallow depth (< 2 m).

The entire extent of the project area is underlain by unfossiliferous Palaeoproterozoic igneous rocks and very subordinate shales of the Hekpoort Formation. The potential for a negative impact upon the palaeontological heritage of these strata has been assessed as nil, as has the significance of any negative impacts.

**This desktop study has not identified any palaeontological reason to prejudice the progression of this project; no damage mitigation programs are required to be implemented.**

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## **1 INTRODUCTION**

Vodacom (Pty) Ltd has proposed the construction of a mast (with associated infrastructure) upon Portion 10 of the farm Leeuwenkloof 480 JQ, Madibeng Local Municipality, Bojanala District Municipality, Brits Magisterial District, North West Province (Figure 1). The project area can be located within the confines of 1:50 000 topographic map 2527DD. The proposed location co-ordinates of the mast are 25° 49' 21.75"S and 27° 49' 19.60"E. The aerial extent of the project area is ca. 10 m x 10 m (ca. 100 m<sup>2</sup>).

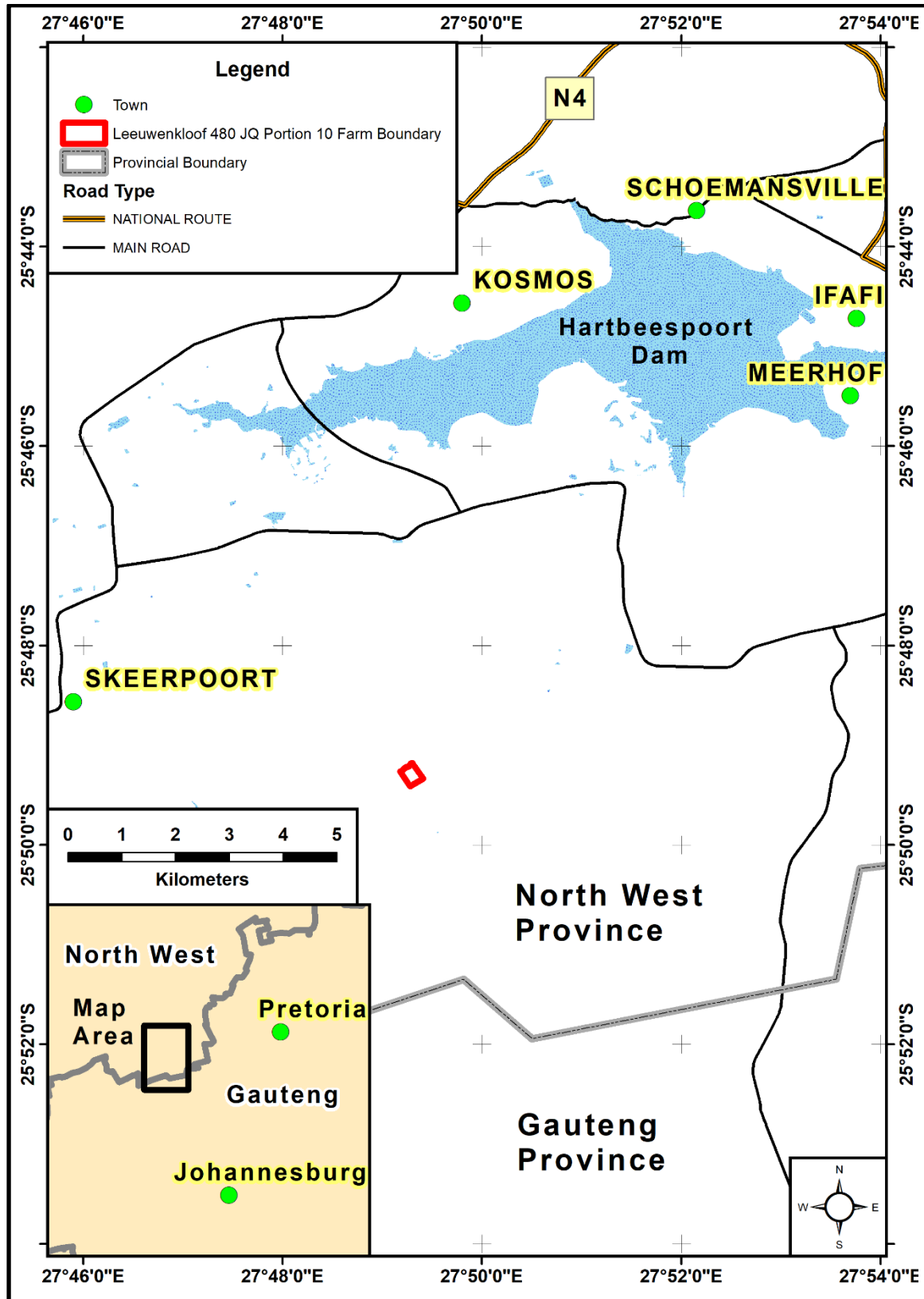
Vodacom (Pty) Ltd has applied for an environmental authorisation (EA) for construction of a proposed mast. Heritage Contracts and Archaeological Consulting CC, was appointed, as independent consultants, to conduct the Heritage Impact Assessment component of the application process. Heritage Contracts and Archaeological Consulting CC has retained BM Geological Services to provide a desktop Palaeontological Heritage Impact Assessment Report in respect of the proposed project that will form part of the final Heritage Impact Assessment Report that will form part of the EA.

## **2 TERMS OF REFERENCE AND SCOPE OF THE STUDY**

The terms of reference for this study were as follow:

- Conduct a desktop assessment of the potential impact of the proposed project on the palaeontological heritage of the project area.
- Describe the possible impact of the proposed development on the palaeontological heritage of the site, according to a standard set of conventions.
- Quantify the possible impact of the proposed development on the palaeontological heritage of the site, according to a standard set of conventions.
- Provide an overview of the applicable legislative framework.
- Make recommendations concerning future work programs as, and if, necessary.

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**Figure 1:** Map showing the location of the proposed Vodacom mast project. The outline of Portion 10 of the farm Leeuwenkloof 480 JQ is shown (red polygon).



### **3 LEGISLATIVE REQUIREMENTS**

South Africa's cultural resources are primarily dealt with in two Acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

#### **3.1 The National Heritage Resources Act**

The following are protected as cultural heritage resources by the National Heritage Resources Act:

- Archaeological artefacts, structures and sites older than 100 years.
- Ethnographic art objects (e.g. prehistoric rock art) and ethnography.
- Objects of decorative and visual arts.
- Military objects, structures and sites older than 75 years.
- Historical objects, structures and sites older than 60 years.
- Proclaimed heritage sites.
- Grave yards and graves older than 60 years.
- Meteorites and fossils.
- Objects, structures and sites of scientific or technological value

The Act also states that those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities. The national estate includes the following:

- 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 features of cultural significance.
- Geological sites of scientific or cultural importance.
- Sites of Archaeological and palaeontological importance.
- Graves and burial grounds.
- Sites of significance relating to the history of slavery.
- Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.).

#### **3.2 Need for Impact Assessment Reports**

Section 38 of the Act stipulates that any person who intends to undertake an activity that falls within the following:

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- The construction of a linear development (road, wall, power line, canal etc.) exceeding 300 m in length.
- The construction of a bridge or similar structure exceeding 50 m in length.
- Any development or other activity that will change the character of a site and exceed 5 000 m<sup>2</sup> or involve three or more existing erven or subdivisions thereof.
- Re-zoning of a site exceeding 10 000 m<sup>2</sup>.
- Any other category provided for in the regulations of SAHRA or a provincial heritage authority.

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. If there is reason to believe that heritage resources will be affected by such development, the developer may be notified to submit an impact assessment report. A Palaeontological Impact Assessment (PIA) only looks at the potential impact of the development palaeontological resources of the proposed area to be affected.

### **3.3 Legislation Specifically Pertinent to Palaeontology\***

\*Note: Section 2 of the Act defines "palaeontological" material as "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".

Section 35(4) of this Act specifically deals with archaeology, palaeontology and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

- 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 that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

- Alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above-mentioned palaeontological objects may only be disturbed or moved by a palaeontologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Further to the above point, Section 35(3) of this Act indicates that “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”. Thus, regardless of the granting of any official clearance to proceed with any development based on an earlier assessment of its impact on the Palaeontological Heritage of an area, the development should be halted and the relevant authorities informed should fossil objects be uncovered during the progress of the development.

### **3.4 The National Environmental Management Act [as amended]**

The National Environmental Management Act does not provide the detailed protections and administrative procedures for the protection and management of the nation’s Palaeontological Heritage as are detailed in the National Heritage Resources Act, but this act is more general in its application. In particular Section 2(2) of the Act states that environmental management must place people and their needs at the forefront of its concerns and, amongst other issues, serve their cultural interests equitably. Further to this point section 2(4)(a)(iii) states that disturbances of sites that constitute the nation’s cultural heritage should be avoided, and where it cannot be avoided should be minimised and remedied.

Section 23(1) indicates that a general objective of integrated environmental management is to identify, predict and evaluate the actual and potential impact of activities upon the cultural heritage. This section also highlights the need to identify options for mitigating of negative effects of activities with a view to minimising negative impacts.

In order to give effect to the general objectives of integrated environmental management outlined in the Act the potential impact on cultural heritage of activities that require authorisation or permission by law must be investigated and assessed prior to their implementation and reported to the relevant organ of state. Thus, a survey and evaluation of cultural resources must be done in areas where development projects that will potentially negatively affect the cultural heritage will be performed. During this

process the impact on the cultural heritage will be determined and proposals for the mitigation of the negative effects made.

#### **4 RELEVANT EXPERIENCE**

Dr Millstead holds a PhD in palaeontology and has previously been employed as a professional palaeontologist with the Council for Geoscience in South Africa. He is currently the principle of BM Geological Services and has sufficient knowledge of palaeontology and the relevant legislation required to produce this Palaeontological Impact Assessment Report. Dr Millstead is registered with the South African Council for Natural Scientific Professions (SACNASP), is a member of the Palaeontological Society of South Africa and the Association of Australasian Palaeontologists and is also a Fellow of the Geological Society of South Africa.

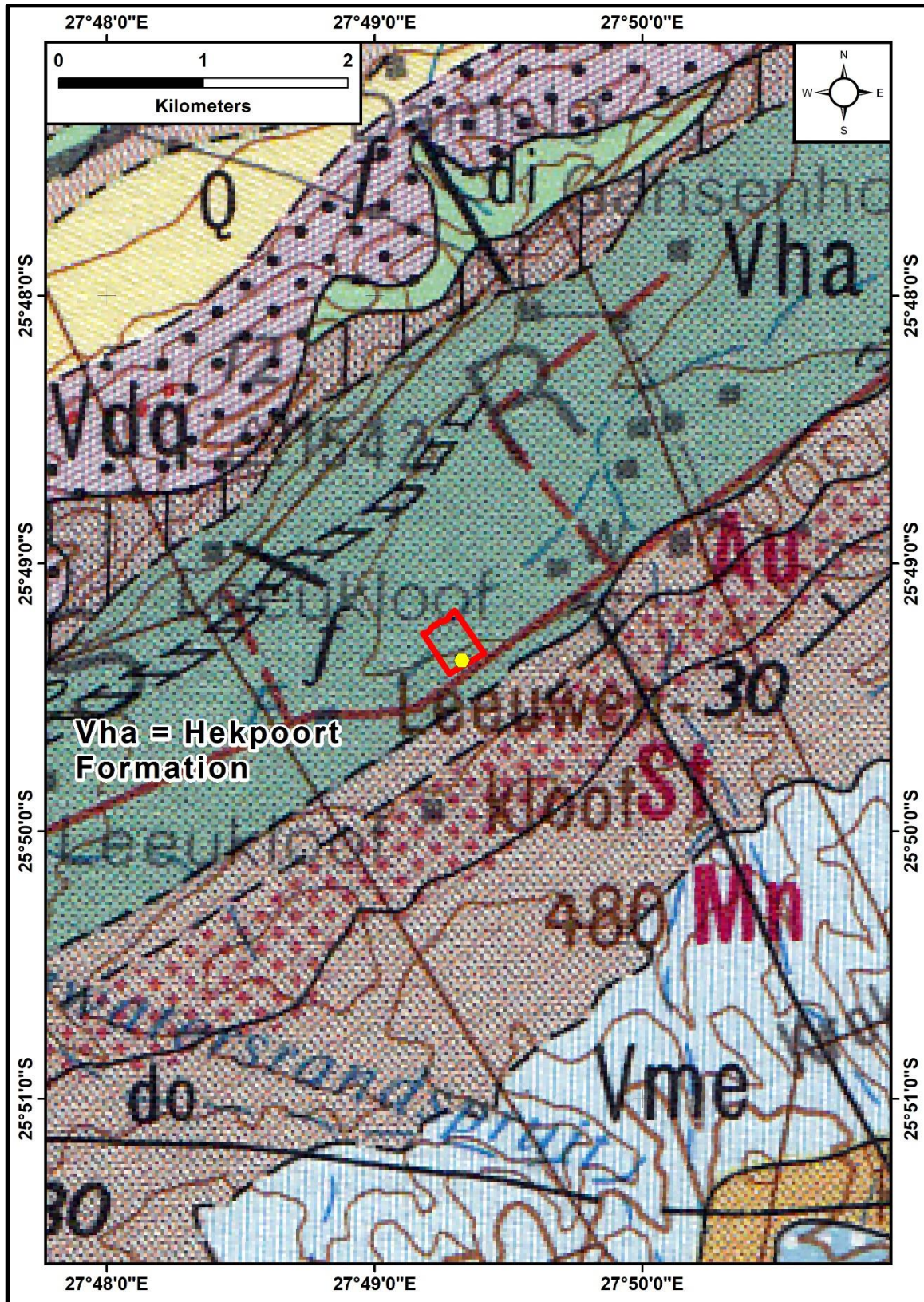
#### **5 INDEPENDENCE**

Dr Millstead was contracted as an independent consultant to conduct this desktop Palaeontological Heritage Impact Assessment study and shall receive fair remuneration for these professional services. Neither Dr Millstead nor BM Geological Services has any financial interest in either Vodacom (Pty) Ltd, the proposed mast, nor any companies or individuals associated with the project.

#### **6 GEOLOGY AND FOSSIL POTENTIAL**

Figure 2 shows that the project area is completely underlain by Palaeoproterozoic igneous and minor sedimentary rocks of the Hekpoort Formation. The Hekpoort Formation forms part of the 6-7 km thick Pretoria Group which is the uppermost stratigraphic group forming the basin-fill succession of the Transvaal Basin. A brief description of the geology of the Hekpoort Formation and its potential palaeontological contents is provided below.

Desktop Palaeontological Impact Assessment Report in respect of a proposed Vodacom mast on Portion 10 of the farm Leeuwenkloof 480 JQ, North West Province



**Figure 2:** Map of the bedrock geology underlying Portion 10 of the farm Leeuwenkloof 480 JQ (red polygon) and the proposed mast (yellow dot) and the surrounding environs (modified from Geological Survey of South Africa, 1981).

## **6.1 Hekpoort Formation**

### *6.1.1 Geology*

The rocks of the Hekpoort Formation vary up to 1140 m in thickness, but in the central portion of the Transvaal Basin (in the vicinity of the project area) it varies between 340-630 m thick (Eriksson *et al.*, 2006). The unit consists of basaltic andesitic igneous rocks. The genesis of the unit is the result of subaerial volcanism, predominantly via subaerial fissure vents; although predominantly composed of lavas locally important pyroclastic rocks are present within the unit (Oberholzer, 1995). The presence of small lacustrine shales within the sequence evince intermittent hiatuses in the volcanism (Eriksson *et al.*, 2006). Eruption began in the southern portions of the unit, with extrusion of lavas commencing during deposition of the underlying Boeshoek Formation (Reczko *et al.*, 1995).

### *6.1.2 Palaeontological potential*

There are lacustrine shales and subaerial pyroclastic units present within the sequence that may in other circumstances be fossil-bearing. However, the Palaeoproterozoic age of the unit in concert with the terrestrial depositional environments that dominate the deposition of the rocks preclude the presence of macrofossils. Indeed, despite extensive investigation of the unit by geologists, no fossil materials are known to occur within the rocks of the Hekpoort Formation. The unit is accordingly considered to be unfossiliferous.

## **7 ENVIRONMENT OF THE PROPOSED PROJECT SITE**

The project area has an aerial extent of ca. 100 m<sup>2</sup>. Examination of Google earth imagery (Figure 3) reveals that the area to be fenced off that will contain the project infrastructure lies immediately proximal to a number of residential and farm buildings and very proximal to the northern side of a road. The area underlying the project appears to have been historically cleared.

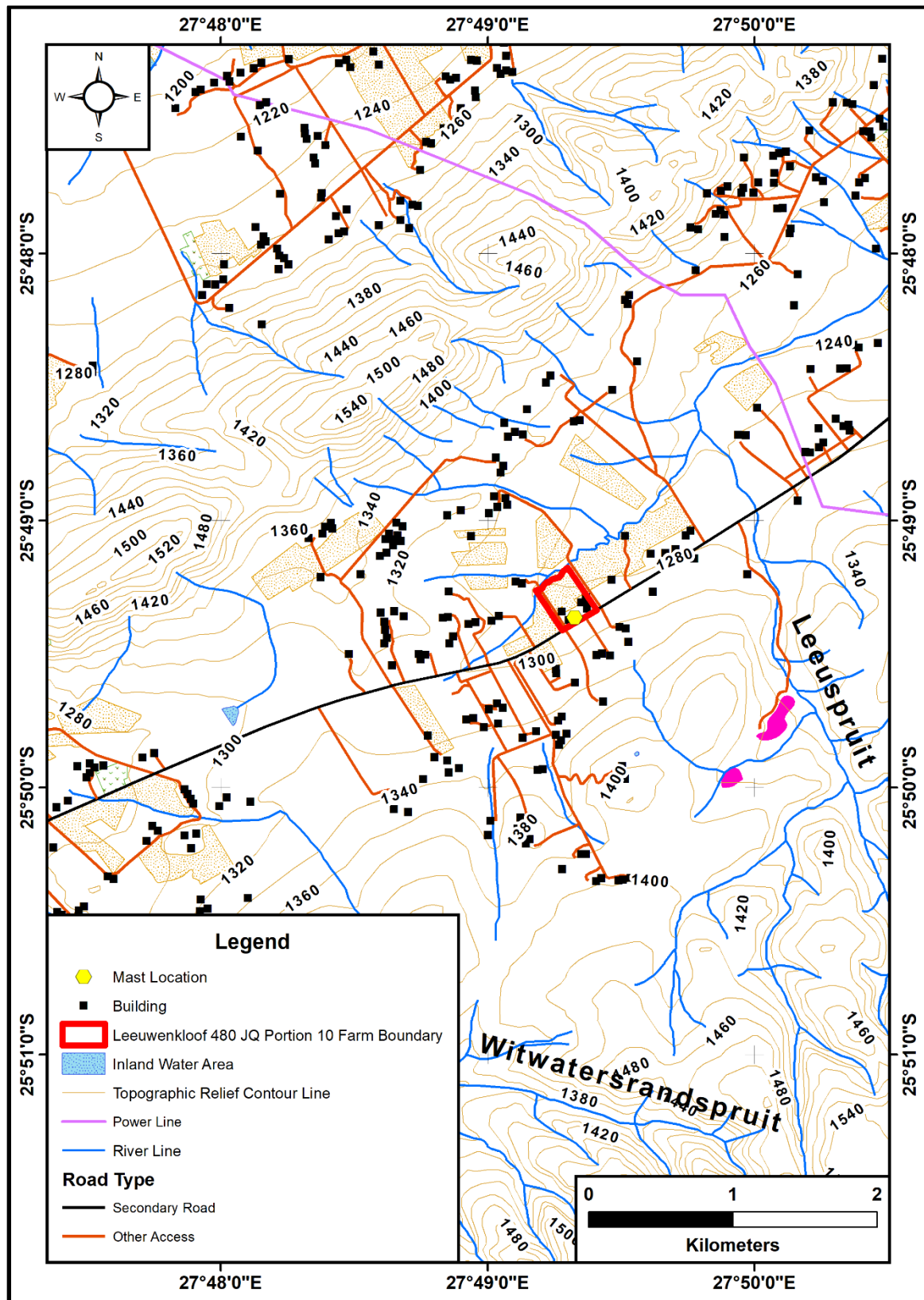
Figure 4 shows that the project area is located within the axis of a large northeast-southwest oriented valley, upon a relatively flat, featureless land surface. A prominent north-east-southwest oriented ridge lies ca. 1 km to the north of the project area and ca. 3 km to the south is a conspicuously hilly series of landforms. Figure 5 shows that the northern ridge is composed of sandstones that are stratigraphically the same as the sandstones that form the prominent Strubekop ridge in Pretoria. The hilly terrain lying to the south of the project area is underlain by carbonate sediments of the Malmani Subgroup. The hilly topography is accordingly probably represents the same karst topography that the geological unit forms elsewhere in the region. The Malmani

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**Figure 3:** Google earth image of the area underlying the project area (the white square icon) and the surrounding environs. It is evident that the project area is immediately proximal to a number of farm buildings and a northeast-southwest oriented road. The light brown area to the north of the project area lies within Portion 10 of the farm Leeuwenkloof 480 JQ and has been extensively cleared for cultivation.

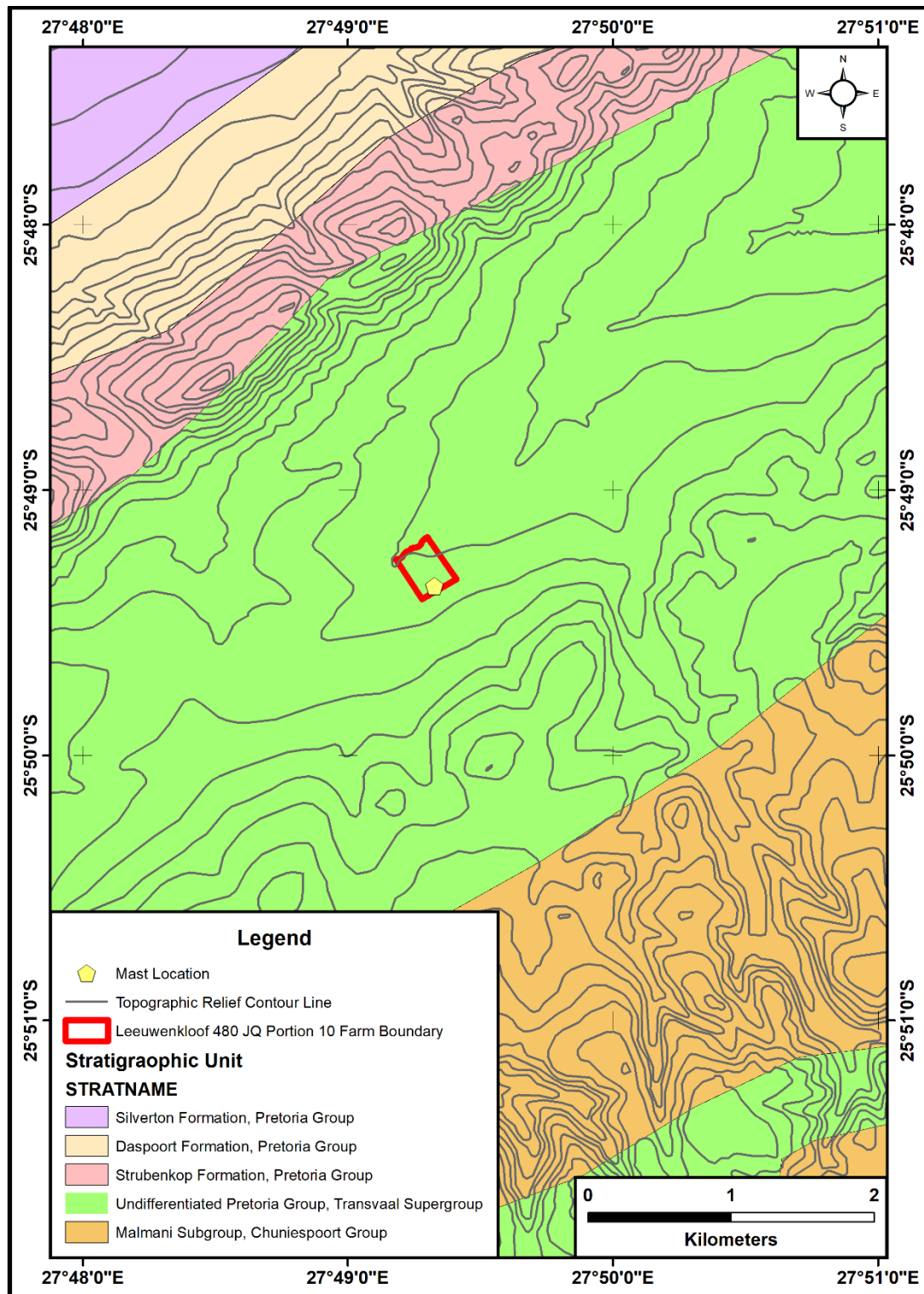
Desktop Palaeontological Impact Assessment Report in respect of a proposed Vodacom mast on Portion 10 of the farm Leeuwenkloof 480 JQ, North West Province



**Figure 4:** The environment of the project area and the surrounding environs. The topographic relief contour interval for the map is 20 m.



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**Figure 5:** Simplified geological map of the bedrock underlying the project area and the surrounding region. Superimposed over the geology are topographic relief contour lines (20 m contour interval) which show that both the sandstones of the Strubenkop Formation and the carbonate sediments of the Malmani Subgroup form elevated, hilly topography.

Subgroup strata dip to the northwest and form a prominent dip slope that is inclined towards the project area. A number of permanent and ephemeral fluvial drainage lines drain to the northwest down this dip slope towards the centre of the valley or to the southeast; the Witwatersrandspruit and the Leeuspruit are the most prominent of these streams in the vicinity of the project area. A number of much shorter fluvial drainage line flow down the scarp face of the ridge composed of Strubenkop Formation sandstones and drain to the southeast. Both sets of drainage lines coalesce in the axis of the valley and drain to the northeast (Figure 5).

The area underlying the project area and the immediate environs bears vegetation cover identified as the Andesite Mountain Bushveld type (Mucina and Rutherford, 2006). Mucina and Rutherford (2006) describe the conservation status of this vegetation biome as least threatened. However, it is evident from Figure 3 that little, if any of this original vegetation cover remains extant within the borders of Portion 10 of the farm Leeuwenkloof 480 JQ. The entire extent of the farm portion has been historically disturbed by building or cultivation activities. Accordingly, any fossil materials that may have originally occurred upon the land surface would have been destroyed by the historical activities.

## **8 OVERVIEW OF SCOPE OF THE PROJECT**

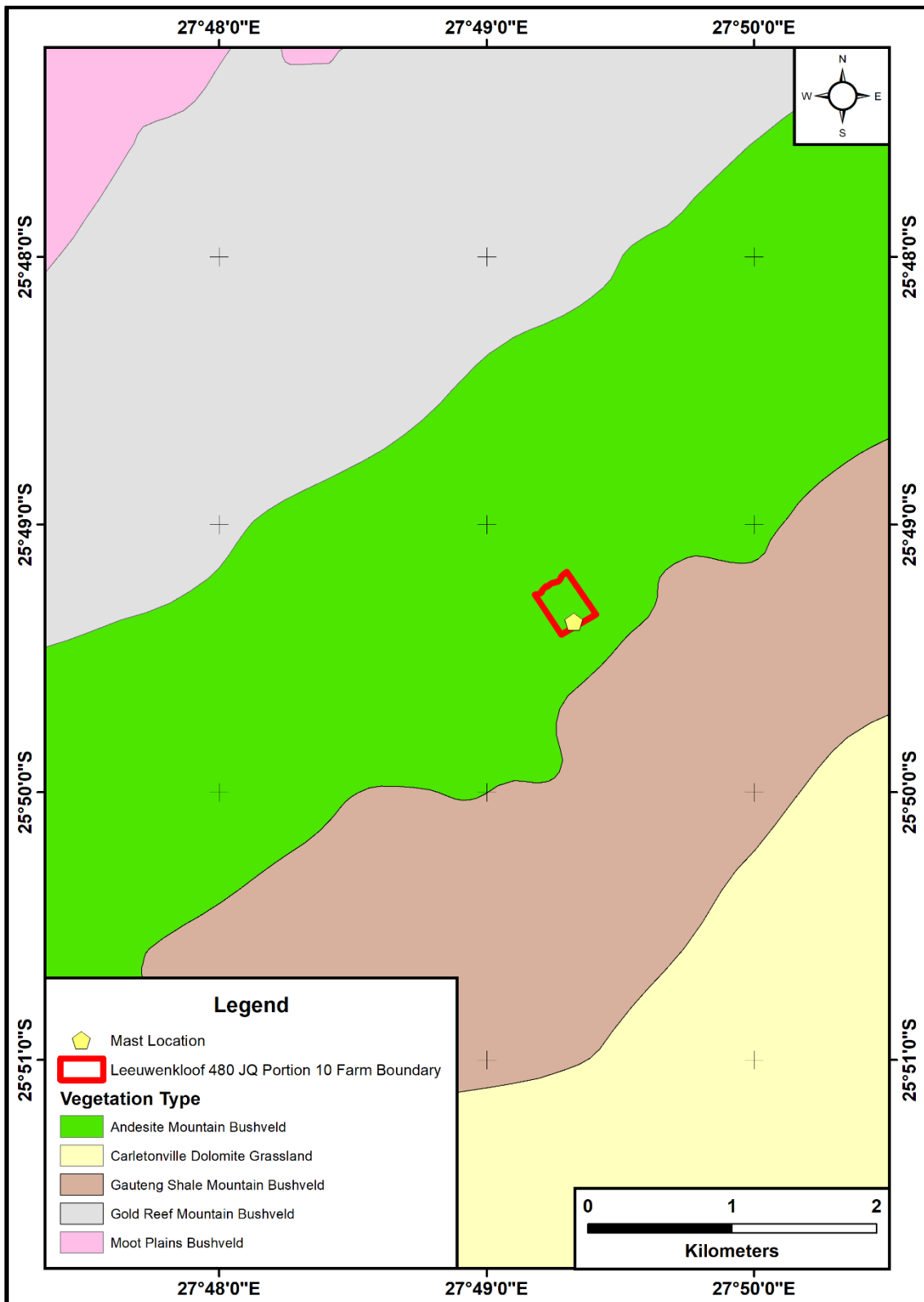
Vodacom (Pty) Ltd proposes that the following infrastructure elements will comprise the proposed mast construction project:

- 1 A site measuring approximately 10 m x 10 m in extent.
- 2 A lattice mast measuring approximately 40 m in height.
- 3 A container housing electronic equipment surrounded by a steel palisade fence.

The required infrastructure elements will all be located upon the land surface, which it is anticipated, will be cleared and flattened prior to commencement of construction. It is also anticipated that trenches will be excavated to provide foundations for the mast and that post-holes will be dug to cement-in the bases of the uprights that will form part of the steel palisade fence.

It is estimated that the maximum depth of these trenches and post-holes will be < 2 m and this marks the maximum depth of any impact upon the geology of the project area. Approximately 100 m<sup>2</sup> of the land surface will be cleared and flattened. The following impact assessment (Section 9) is made in the light of these assumptions.

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**Figure 6:** Vegetation types underlying the project area and the surrounding environs (modified from Mucina and Rutherford, 2006).

## 9 IMPACT ASSESSMENT

The potential impact of Vodacom (Pty) Ltd's proposed mast facility is categorised below according to the following criteria.

### 9.1 Nature of Impact

The potential negative impacts of the proposed project on the palaeontological heritage of the area are:

- Damage or destruction of fossil materials during the construction of project infrastructural elements to a maximum depth of associated excavations. Many fossil taxa (particularly vertebrate taxa) are known from only a single fossil and, thus, any fossil material is potentially highly significant. Accordingly, the loss or damage to any single fossil can be potentially significant to the understanding of the fossil heritage of South Africa and to the understanding of the evolution of life on Earth in general. Where fossil material is present and will be directly affected by the building or construction of the projects infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).
- Movement of fossil materials during the construction phase, such that they are no longer *in situ* when discovered. The fact that the fossils are not *in situ* would either significantly reduce or completely destroy their scientific significance.
- The loss of access for scientific study to any fossil materials present beneath infrastructural elements for the life span of the existence of those constructions and facilities.

### 9.2 Extent of impact

The possible extent of the impact of the proposed project on the palaeontological heritage of South Africa is restricted to the damage, destruction or accidental relocation of fossil material caused by the excavations and construction of the necessary infrastructure elements forming part of the project. The **extent of the area of potential impact is, accordingly, categorised as local** (i.e., restricted to the project site).

### 9.3 Duration of impact

The anticipated duration of the identified impact is assessed as potentially **long term to permanent**. This assessment is based on the fact that, in the absence of mitigation procedures (should fossil material be present within the area to be affected) the damage or destruction of any palaeontological materials will be permanent. Similarly, any fossil materials that exist below the structures and infrastructural elements that will constitute

the mast facility will be unavailable for scientific study for the life of the existence of those features.

#### **9.4 Probability of impact**

The probability of any fossil materials being present within the rocks of the Hekpoort Formation is **nil**. Accordingly, the probability of the project causing any negative impacts upon the palaeontological heritage of the Hekpoort Formation is assessed as being **nil**.

#### **9.5 Significance**

The rocks of the Hekpoort Formation are unfossiliferous. Accordingly, the significance of any negative impacts upon the palaeontological heritage of the unit resulting from the project is **nil**.

### **10 DAMAGE MITIGATION, REVERSAL AND POTENTIAL IRREVERSABLE LOSS**

The degree to which the possible negative effects of the proposed project can be mitigated, reversed or will result in irreversible loss of the palaeontological heritage can be determined as discussed below.

#### **10.1 Mitigation**

No damage mitigation protocols are required.

#### **10.2 Reversal of damage**

Any damage to, or the destruction of, palaeontological materials or the reduction of their scientific value due to a loss of their original location is **irreversible**.

#### **10.3 Degree of irreversible loss**

Once a fossil is damaged, destroyed or moved from its original position without its geographical position and stratigraphic location being recorded the **damage is irreversible**.

By their nature fossils are usually scarce and sporadic in their occurrence and the chances of negatively impacting on a fossil in any particular area are low. However, any fossil material may be of the greatest scientific importance; this is particularly true of vertebrate fossils in which many taxa are known from only one fossil. Thus, the potential always exists during construction and excavation within potentially fossiliferous rocks for the permanent and irreversible loss of extremely significant or irreplaceable

fossil material. This said, many fossils are incomplete in their state of preservation or are examples of relatively common taxa. As such, just because a fossil is present it is not necessarily of great scientific value. Accordingly, not all fossils are necessary significant culturally or scientifically significant and the potential degree of irreversible loss will vary from case to case. The judgement on the significance of the fossil must be made by an experienced palaeontologist.

## **11 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE**

The information provided within this report was derived from a desktop study of available maps and scientific literature; no direct observation was made of the area as the result of a site visit. In particular, the discussion of the geological units occurring within the project area (and as such the basis of understanding the fossiliferous potential of the area) was derived from the published 1:250 000 geological maps of the area. The accuracy of 1:250 000 geological maps is often variable; some areas being compiled from air photo interpretation or remote sensing procedures. The possibility of the presence of additional geological units being present within the project area cannot be disregarded.

Some details concerning the type of the various built infrastructure elements that will comprise this project as well as the planned resultant vertical disruption to the land surface were unknown to the author at the time of compilation of this report. Assumptions concerning the types of infrastructure elements that will be required for this project, and their effects on the bed rock, have been assumed using a worst-case scenario.

## **12 ENVIRONMENTAL IMPACT STATEMENT**

A desktop study has been conducted on the site of the proposed construction of a Vodacom (Pty) Ltd mast (with associated infrastructure) upon Portion 10 of the farm Leeuwenkloof 480 JQ, Madibeng Local Municipality, Bojanala District Municipality, Brits Magisterial District, North West Province. The project area can be located within the confines of 1:50 000 topographic map 2527DD. The proposed location co-ordinates of the mast are 25° 49' 21.75"S and 27° 49' 19.60"E. The aerial extent of the project area is ca. 10 m x 10 m (ca. 100 m<sup>2</sup>).

Any negative effects emanating from the project will be local in nature, being restricted to the development area. It is anticipated, herein, that most infrastructural elements will only directly affect the surface of the site to a relatively shallow depth (< 2 m).

The entire extent of the project area is underlain by unfossiliferous Palaeoproterozoic igneous rocks and very subordinate shales of the Hekpoort Formation. The potential for

Desktop Palaeontological Impact Assessment Report in respect of a proposed Vodacom mast on Portion 10 of the farm Leeuwenkloof 480 JQ, North West Province

a negative impact upon the palaeontological heritage of these strata has been assessed as nil, as has the significance of any negative impacts.

**This desktop study has not identified any palaeontological reason to prejudice the progression of this project; no damage mitigation programs are required to be implemented.**

### 13 REFERENCES

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