

**DESKTOP PALAEOLOGICAL
HERITAGE IMPACT ASSESSEMENT
REPORT ON THE SITE OF A
PROSPECTING AREA PROPOSED TO
BECOME AN EXTENSION OF THE
EXISTING PPC LIME ACRES QUARRY,
TO BE LOCATED TO THE IMMEDIATE
WEST AND NORTH-WEST OF THE
EXISTING PPC LIME ACREAS QUARRY
ON THE FARM CARTER BLOCK 458,
POSTMASBURG MAGISTERIAL
DISTRICT, NORTHERN CAPE
PROVINCE**

2 April 2015

Prepared for:
Heritage Contracts and Archaeological
Consulting CC

On behalf of:
Shangoni Management Services

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**DESKTOP PALAEOLOGICAL HERITAGE IMPACT ASSESSEMENT REPORT ON
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CAPE PROVINCE**

Prepared for:

Heritage Contract and Archaeological Consulting CC

On Behalf of:

Shangoni Management Services

Prepared By:

Prof B.D. Millstead

EXECUTIVE SUMMARY

Shangoni Management Services is currently in the process of updating the existing PPC Lime: Lime Acres' Environmental management Program (EMP) in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002. Furthermore, they plan on expanding the existing quarry operations onto an adjacent 124 ha area (referred to, herein, as the "Prospecting Area"). It is the Prospecting Area that forms the basis of this report and it is located immediately to the west and north-west of the existing quarry upon the Farm Carter Block 458, Postmasburg Magisterial District, Northern Cape Province.

Shangoni Management Services has appointed Heritage Contract and Archaeological Consulting CC to produce a Heritage Impact Assessment Report for the Prospecting Area. Heritage Contract and Archaeological Consulting CC has contracted 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 for the project.

The effects of the required construction operations to the geological strata underlying the project area will be restricted to the Neochaean rocks of the Campbell Rand Subgroup, Transvaal Supergroup. The Campbell Rand Subgroup is known to be dominantly composed of dolomite (carbonate) rocks. Indeed it is these dolomite rocks that form the focus of the proposed prospecting activities and any subsequent mining activities. The prospecting activities are interpreted to result in minor negative impact upon the rocks of the Campbell Rand Subgroup, but any mining activities will be completely destructive, and have a totally negative impact, upon all rocks mined. Despite these negative impacts upon the geology underlying the Prospecting Area dolomites are common within the Campbell Rand Subgroup and stromatolite assemblages are common within these dolomites. However, the stromatolite assemblages within each formation are not diverse and tend to be similar throughout large extents of the units in which they occur. Any destruction of a small area these fossils would not unduly diminish the palaeontological heritage of the unit. The probability and significance of any negative impact occurring in the rocks of the Campbell Rand Subgroup is assessed as being high, but the impact of that impact will be low.

The social benefits of the project have been classified as beneficial, herein, as the project aims to provide metallurgical dolomite for the building industry. **This desktop study has not identified any palaeontological reason to prejudice the progression of either the proposed prospecting program or any subsequent mining activities. No damage mitigation protocols need to be implemented to minimise the potential negative impact of the project.**

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1 INTRODUCTION

Shangoni Management Services is currently in the process of updating the existing PPC Lime: Lime Acres' Environmental management Program (EMP) in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002. Furthermore, they plan on expanding the existing quarry operations onto an adjacent 124 ha area (referred to, herein, as the "Prospecting Area"). It is the Prospecting Area that forms the basis of this report and it is located immediately to the west and north-west of the existing quarry upon the Farm Carter Block 458, Postmasburg Magisterial District, Northern Cape Province (Figure 1).

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2 TERMS OF REFERENCE AND SCOPE OF THE STUDY

The terms of reference for this study were as follows:-

- 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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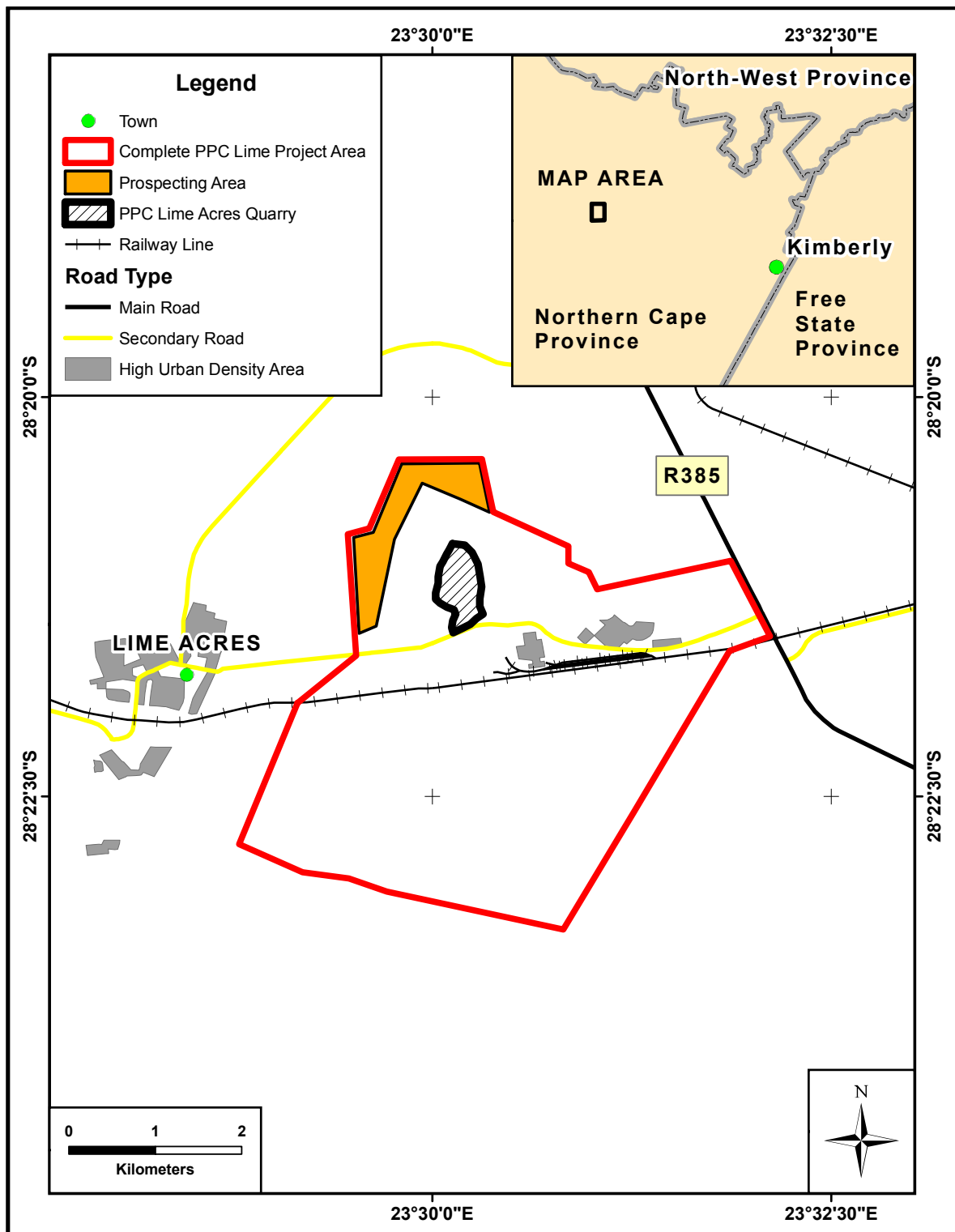


Figure 1: Location map showing the position of the proposed Prospecting Area.

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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:

- 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,

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- Any development or other activity that will change the character of a site and exceed 5 000 m² or involve three or more existing erven or subdivisions thereof,
- Re-zoning of a site exceeding 10 000 m²,
- 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.

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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]

This 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 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

Prof 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. Prof Millstead is registered with the South African Council for Natural Scientific Professions (SACNASP), and is a member of the Palaeontological Society of South African and the Geological Society of South Africa.

5 INDEPENDENCE

Prof Millstead was contracted as an independent consultant to conduct this Palaeontological Heritage Impact Assessment study and shall receive fair remuneration for these professional services. Neither Prof Millstead nor BM Geological Services has any financial interest either in PPC Cement (Pty) Ltd, the existing PPC Lime Acres lime mine 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 rocks of the Neochaean Campbell Rand Subgroup, Transvaal Supergroup. A summary of the characteristics of the Campbell Rand Subgroup and its fossiliferous potential follows.

6.1 Campbell Rand Subgroup

The Campbell Rand-Subgroup forms part of the Transvaal Supergroup within the Griqualand West Basin. Together with the correlative Malmani Subgroup, which occurs in the Transvaal Basin, the two units cover approximately 190,000 km² and probably originally covered the entire Kaapvaal Craton with an aerial extent exceeding 600,000 km² (Beukes, 1987). A single zircon obtained from tuff near the top of the Monteville Formation (the basal unit of the subgroup) has provided an age of 2555 Ma (Altermann and Nelson, 1998). Similarly, the Campbell Rand Subgroup has been dated as being approximately 2521 Ma in age by Sumner and Bowring (1996).

Significant amounts of the Campbell Rand Subgroup consist of carbonate rocks (Beukes, 1987). The Monteville, Reivelo Fairfield, Klipfontein, Papkuil, Klippankogelbeen, Gramohaan and Tsineng Formations collectively constitute the Campbell Rand Subgroup and are all predominantly comprised of grey, shallow marine dolomites, many of which are stromatolitic or contain algal mats. Indeed, the Monteville and Reivelo Formations in particular contain giant stromatolitic domes (Eriksson *et al.*, 2006). It is pertinent to note that and metallurgical dolomite is mined near Lime Acres (Altermann and

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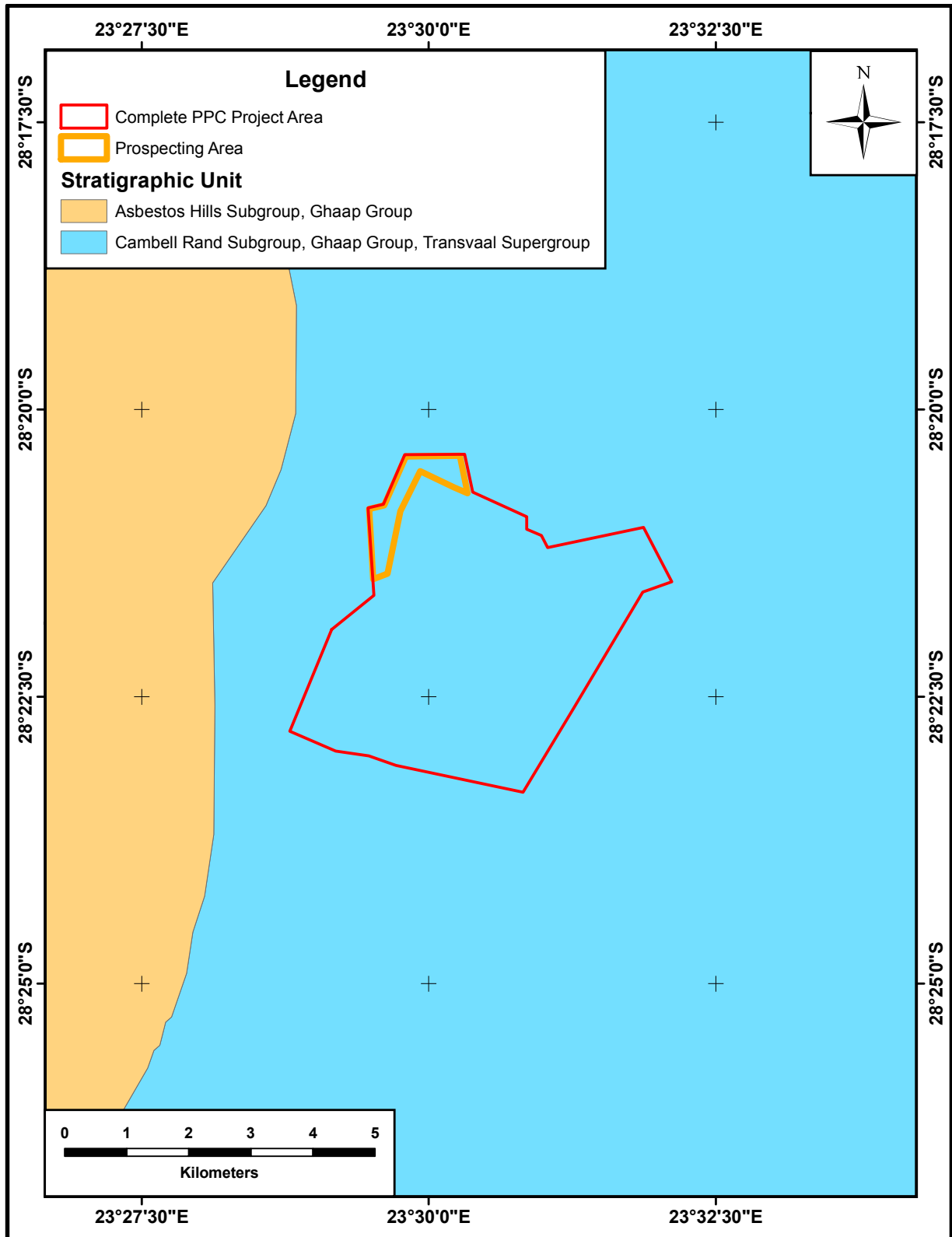


Figure 2. Geology of the area underlying the proposed Prospecting Area and its immediate environs.

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Wotherspoon, 1995) and, thus, such these dolomites may well be expected to underlie the Prospecting Area.

6.1.1 Palaeontological potential

The Monteville, Reivelo Fairfield, Klipfontein, Papkuil, Klippankogelbeen, Gramohaam and the Tsineng Formations collectively constitute the Campbell Rand Subgroup and all contain stromatolites and algal mats. The Monteville and Reivelo Formations in particular contain giant stromatolitic domes (Eriksson *et al.*, 2006). The stromatolite assemblages within the carbonates in the Transvaal Supergroup tend to be abundant where they occur and can dominate the lithology. The palaeontological potential of the Campbell Rand Subgroup is, accordingly, **high**. No other fossil macrofossils are known in any rocks of comparable age within South Africa.

7 ENVIRONMENT OF THE PROPOSED PROJECT SITE

The Proposed Prospecting Area is large, being approximately 124 ha in aerial extent. The Prospecting Area lies immediately west and north-west of the existing PPC Lime quarry and 1.5 km east of the Asbeserg hills; the town of Lime Acres lies approximately 1.3 km to the south-west (Figures 3 and 4). The land surface is flat and otherwise featureless over the majority of its extent and no significant fluvial drainage lines traverse the area, save for the presence of the Rooi Pan in the extreme northern extent of the area (Figures 3 and 5). Figure 5 also shows that the land surface is flat and otherwise featureless over the majority of its extent, with some minor surface disruption in the form of vehicle tracks.

It is evident in Figure 6 the Prospecting Area is sparsely vegetated with low trees and bushes, but is very poorly vegetated in the Rooi Pan. The vegetation cover of the Prospecting Area consists of Olifantshoek Plains Thornveld over the majority of its extent and the Southern Kalahari Salt Pans vegetation type in its northern-most extent in the Rooi Pan (Figure 6). Mucina and Rutherford (2006) describe the conservation status of both the Olifantshoek Plains Thornveld and Southern Kalahari Salt Pans vegetation type is described as being least threatened.

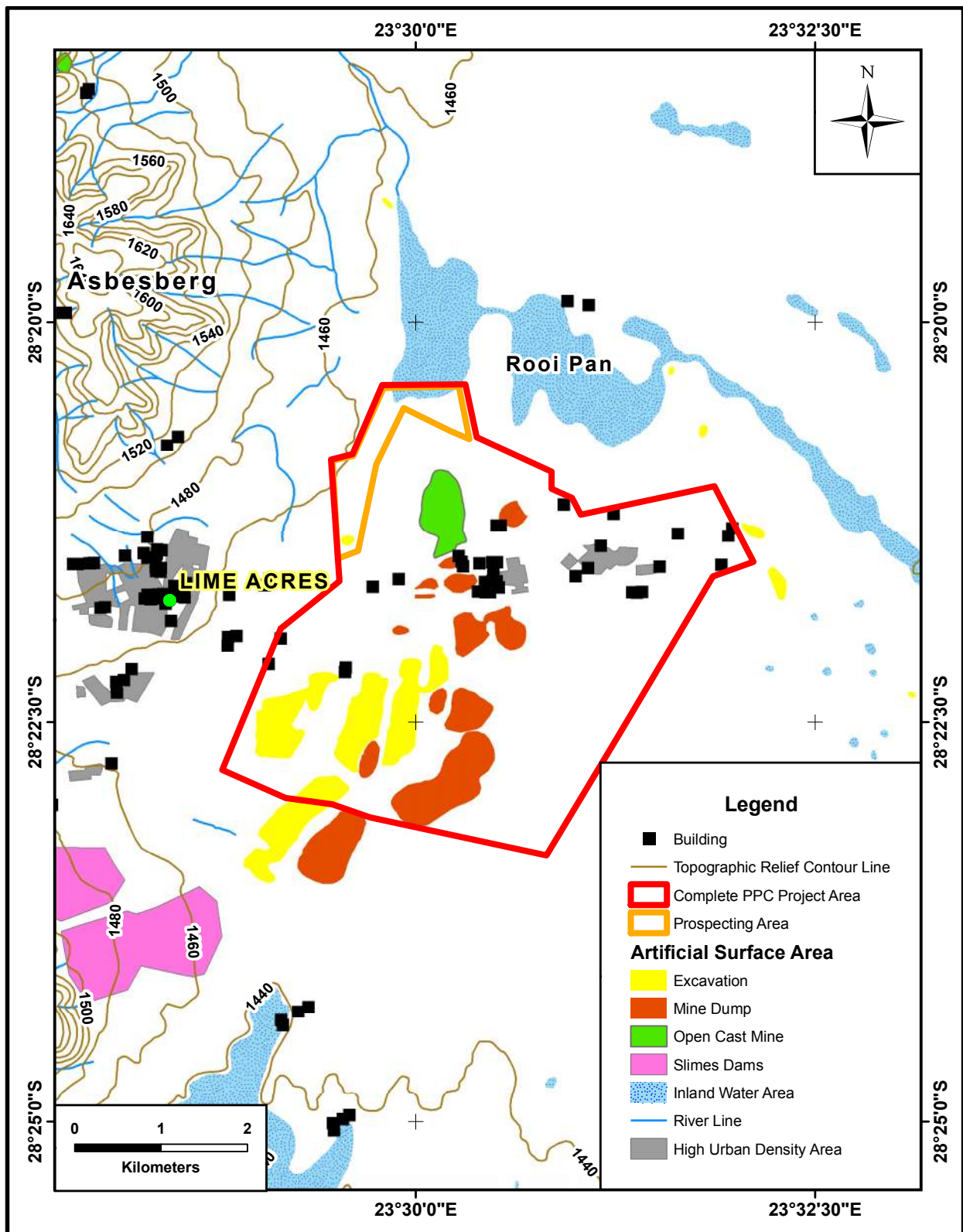


Figure 3: Map of the Prospecting Area (orange polygon) and its immediate environs. The topographic contour interval is 20 m.

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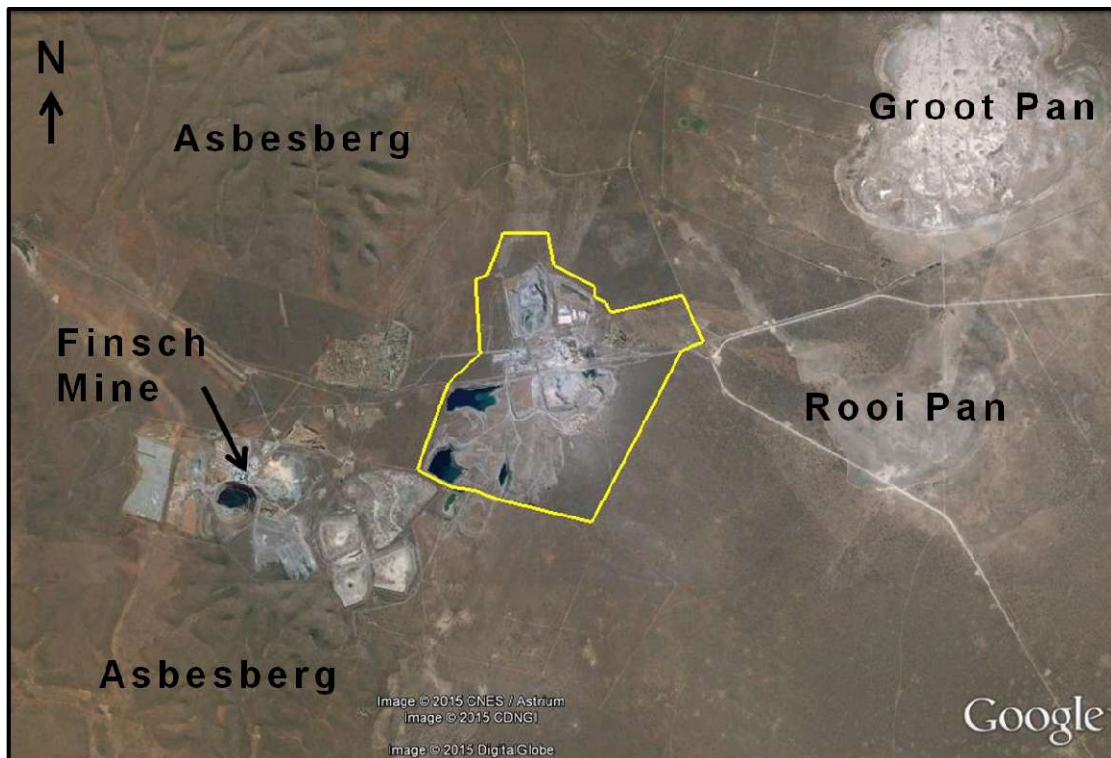


Figure 4. Google earth image of the complete PPC project area (yellow polygon) which contains the Prospecting Area.

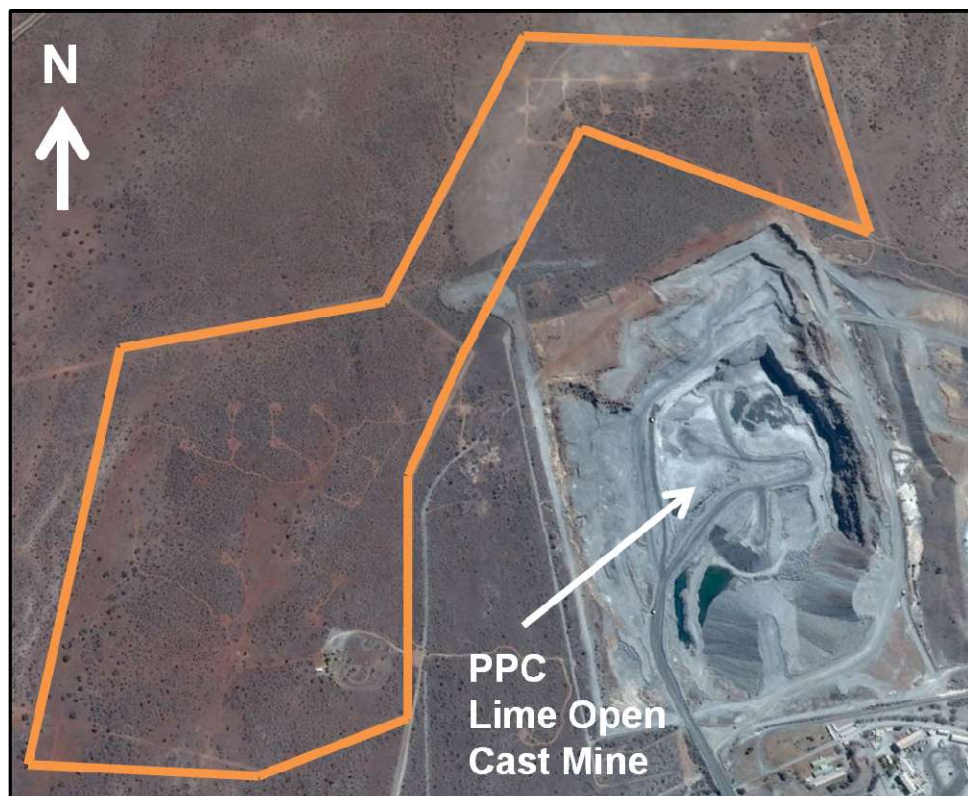


Figure 5. Close-up Google earth image of the Prospecting Area (orange polygon).

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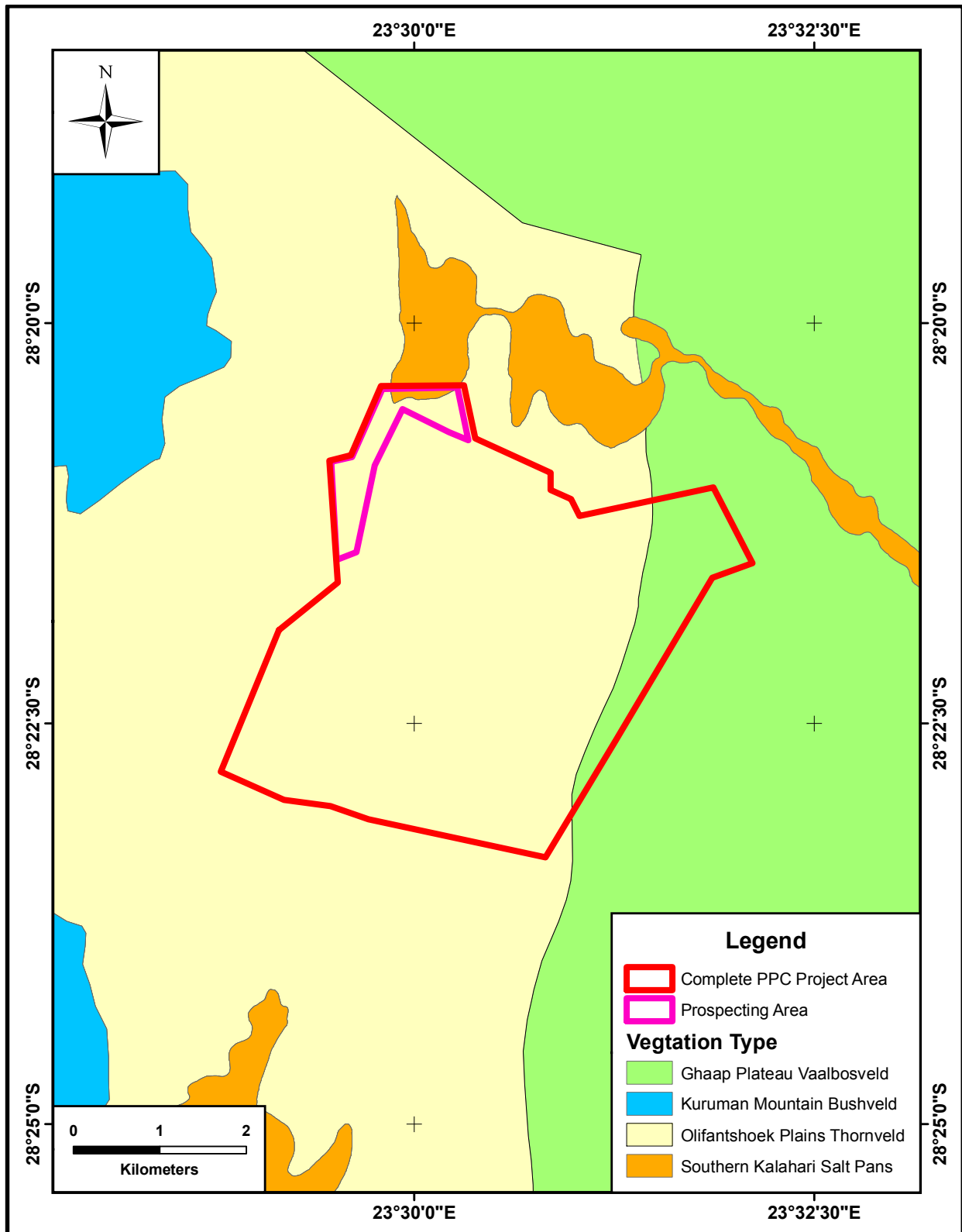


Figure 6: Map of the distribution of the vegetation veld types located beneath the Prospecting area and within its immediate environs (after Mucina and Rutherford, 2006).

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8 OVERVIEW OF SCOPE OF THE PROJECT

The footprint of the Prospecting Area is large, being approximately 124 ha in aerial extent. The proposed details are unknown to the author at the time of preparation of this report. However, normal operations and infrastructure required in similar operations are as follows:

Prospecting Phase

- Drilling of either percussion or cored boreholes,
- Digging of shallow drill fluid sumps,
- Movement of wheeled drill rigs across the land surface.

Mining Phase

- Access roads,
- Open cast mine pit (depth unknown),
- Topsoil storage heaps,
- Waste rock storage heaps.

8.1 Effect of project on the geology

It is evident from Section 8 above that any negative impacts upon the geology underlying the Prospecting Area will be restricted to the immediate land surface. However, clearly, any borehole drilling activities will affect the subsurface geology for the entire length of each borehole. However, the diameter of each borehole is very narrow (less than 20 cm) and little meaningful disruption of the geology is expected. During the mining phase, if this proceeds, both the surface and subsurface geology will be completely destroyed to a depth equivalent to the floor of the mine pit. The depth of the proposed open cast mine pit is unknown to the author, but is unlikely to exceed 100 m. However, as the mining activities will be restricted to the mining of dolomite rock, the mining activities will be restricted to, and only affect, the strata of the Campbell rand Subgroup.

9 IMPACT ASSESSMENT

The potential impact of the proposed mining area 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 those 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 project's 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 permanent 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 possible source of a less permanent negative impact on the palaeontological heritage is the loss of access for scientific research to any fossil materials that become covered by the various infrastructural elements that comprise 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 potential impact is assessed as potentially **permanent to long term**. 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 water pipeline and its associated servitude road will be

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unavailable for scientific study for the life of the existence of those features. The life of the facility is expected to be permanent herein.

9.4 Probability of impact

There are common occurrences of stromatolitic carbonate that are known to occur throughout all formations that comprise the Campbell Rand Subgroup. Where stromatolitic carbonates occur elsewhere in the Transvaal Supergroup they are richly stromatolite-bearing. Accordingly, it is extremely possible that these stromatolitic carbonates may be present within the Prospecting Area. This assumption is based on the close proximity of the Prospecting Area to the existing PPC lime mine, and the fact that the company has reason to believe that prospecting in this area will locate economically exploitable dolomite reserves. The probability of the prospecting and/or mining activities will negatively impact upon the palaeontological heritage of the area is characterised as **high**.

9.5 Significance of the impact

Where stromatolitic carbonates occur elsewhere in the Transvaal Supergroup they are richly stromatolitic throughout their extent; but they tend not to be diverse and tend to be reasonably uniform over large areas. As such, it could be expected that any negative impacts on the palaeontological heritage of the carbonates would be of **low significance** as it is unlikely that either rare or unique fossils will be negatively impacted.

The scientific and cultural significance of fossil materials is underscored by the fact that 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 construction of project infrastructural elements the result will potentially be the irreversible damage or destruction of the fossil(s).

The certainty of the exact *in situ* location of fossils and their precise location within the stratigraphic sequence is essential to the scientific value of fossils. The movement of any fossil material during the construction of the facility that results in the exact original location of the fossil becoming unknown will either greatly diminish or destroy the scientific value of the fossil.

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9.6 Severity / Benefit scale

The proposed project is categorised, herein, as being potentially **beneficial**. This classification is based on the intention that the project will potentially produce metallurgical dolomite for use in the building industry.

The probability of a negative impact on the palaeontological heritage of the project areas has been categorised as high within the Prospecting Area. However, the impact of any negative impact will be low. It is suggested, herein, that the benefits to the local community will significantly outweigh the chance and significance of any negative impacts.

9.7 Status

The proposed project would provide metallurgical dolomite for use in the building. As such, the project is determined as having a **positive status** herein.

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 to preserve the palaeontological heritage of this area and none are suggested herein.

10.2 Reversal of damage

Any damage to, or the destruction of, palaeontological materials or reduction of scientific value due to a loss of the 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**.

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 is potentially of the greatest scientific and cultural importance. 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 result of a site visit. The activities required to undertake this project and any infrastructure that may be required were not available to the author at the time of preparation of this report. In order to assess the potential impacts of the project upon the palaeontological heritage of the area assumptions were made concerning both the necessary activities and infrastructure by comparison to normal practice in other comparable exploration and mining projects in South Africa.

12 ENVIRONMENTAL IMPACT STATEMENT

A desktop Palaeontological Impact Assessment Study has been conducted on the site of a proposed prospecting project and potential open cast mine site for metallurgical dolomite. The proposed project area is moderately large extending for a length of approximately 124 ha. However, any negative impacts to the palaeontological heritage of the region will be limited to the footprint area of the required infrastructure and the extent of any impacts is accordingly characterised as being local.

The effects of the required construction operations to the geological strata underlying the project area will be restricted to the Neochaean rocks of the Campbell Rand Subgroup, Transvaal Supergroup. Dolomites are common within the Campbell Rand Subgroup, and stromatolites are common within these dolomites. However, the stromatolite assemblages within each formation are not diverse and tend to be similar throughout the units in which they occur. Any destruction of a small area these fossils would not unduly diminish the palaeontological heritage of the unit. The probability and significance of any negative impact occurring in the rocks of the Campbell Rand Subgroup is assessed as being high, but the impact of that impact will be low.

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The social benefits of the project have been classified as beneficial, herein, as the project aims to provide metallurgical dolomite for the building industry. **This desktop study has not identified any palaeontological reason to prejudice the progression of either the proposed prospecting program or any subsequent mining activities. No damage mitigation protocols need to be implemented to minimise the potential negative impact of the project.**

13 REFERENCES

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