Palaeontological Impact Assessment for the proposed construction of a reservoir for Bakubung Lodge, Pilanesberg National Park, Northwest Province

Desktop Study

For

Nuleaf planning and environmental

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Expertise of Specialist

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Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 20 year PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by, Nuleaf, Pretoria, South Africa. The views expressed in this report are entirely those of the author and Nuleaf and no other interest was displayed during the decision making process for the project.

Specialist: …….. Prof Marion Bamford……..

Signature: ……

Executive Summary

The desktop Palaeontological Impact Assessment for the proposed construction of a reservoir for Bakubung Lodge in the Pilanesburg National Park, has been completed. The rocks in the area are the ancient Pilanesburg Complex which comprises a series of volcanic eruptions and younger dykes. The rocks to the south of the site are plutonic gabbros of the Pyramid Gabbronorite, of the Bushveld Complex. Such volcanic and plutonic rocks do not contain any fossils. There is no chance of finding fossils anywhere in the Pilanesburg National Park. It is concluded that the project may continue as far as the palaeontology is concerned and no further palaeontological assessments are required.

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1. Background

Pilanesberg Resorts (Pty) Ltd has proposed to construct a new 1 Ml (1000 m^3) potable water storage reservoir to replace the various existing, aging and leaking potable water storage reservoirs at Bakubung Lodge, in the Pilanesberg National Park. As part of this proposed development the existing electric fence will need to be extended to include the proposed site within the Bakubung Lodge boundary. This will allow for safe access to the Reservoir by the lodges' maintenance staff, as well as ensuring that the reservoir will not be damaged by wildlife, such as elephant, in search of water.

Bakubung Lodge is located on Portion 6 of the farm Ledig 909JQ in the southern region of the Pilanesberg National Park, Bojanala District Municipality, Moses Kotane Local Municipality, North West Province. The proposed reservoir site is situated south of the existing Bakubung Lodge Staff Accommodation and is within the hills near the southern boundary of Pilanesberg National Park. The vegetation within the proposed reservoir footprint has been significantly impacted by bush clearing, possibly from the nearby transmission line route.

The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) requires that the proposed development must be preceded by the relevant impact assessment, in this case for palaeontology.

This report complies with the requirements of the NEMA and environmental impact assessment (EIA) regulations (GNR 982 of 2014). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
Details of the specialist who prepared the report	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990) CV attached
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
An indication of the scope of, and the purpose for which, the report was prepared	Section 1, page 3
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	n/a Seasons make no difference to fossils
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2, page 4

The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 2
An identification of any areas to be avoided, including buffers	n/a
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	n/a
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6, page 9
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a
Any mitigation measures for inclusion in the EMPr	n/a
Any conditions for inclusion in the environmental authorisation	n/a
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	n/a
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	n/a
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	n/a
A description of any consultation process that was undertaken during the course of carrying out the study	Section 3 page5
A summary and copies if any comments that were received during any consultation process	n/a
Any other information requested by the competent authority.	n/a

2. Methods and Terms of Reference

1. In order to determine the likelihood of fossils occurring in the affected area geological maps, literature, palaeontological databases and published and unpublished records must be consulted.

2. If fossils are likely to occur then a site visit must be made by a qualified palaeontologist to locate and assess the fossils and their importance.

3. Unique or rare fossils should either be collected (with the relevant South African Heritage Resources Agency (SAHRA) permit) and removed to a suitable storage and curation facility, for example a Museum or University palaeontology department or protected on site.

4. Common fossils can be sacrificed if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.

The published geological and palaeontological literature, unpublished records of fossil sites, catalogues and reports housed in the Evolutionary Studies Institute, University of the Witwatersrand, and SAHRA databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

Figure 1: Outline (thin line) of the proposed boundary fence and reservoir (heavy black line) for potable water for Bakubung Lodge, Pilanesberg National Park. Google Earth map supplied by Nuleaf.

3. Consultation Process

No consultations were carried out during the palaeontological desktop study.

4. Geology and Palaeontology

<u>Project location and geological setting</u>

The National Park is in the Pilanesberg Complex which is a region of past volcanic activity during the early Proterozoic (circa 1500 – 1200 Ma) and has a complex geology because there were probably several episodes of volcanic eruptions and younger cross-cutting dykes (Vervoerd, 2006). To the northeast of the Complex are the Lebowa Granite and Rashoop Granophyre Suites and surrounding the rest of the Complex is the Rustenburg Layered Suite (Cawthorn et al., 2006). These Suites are part of the Bushveld Complex.

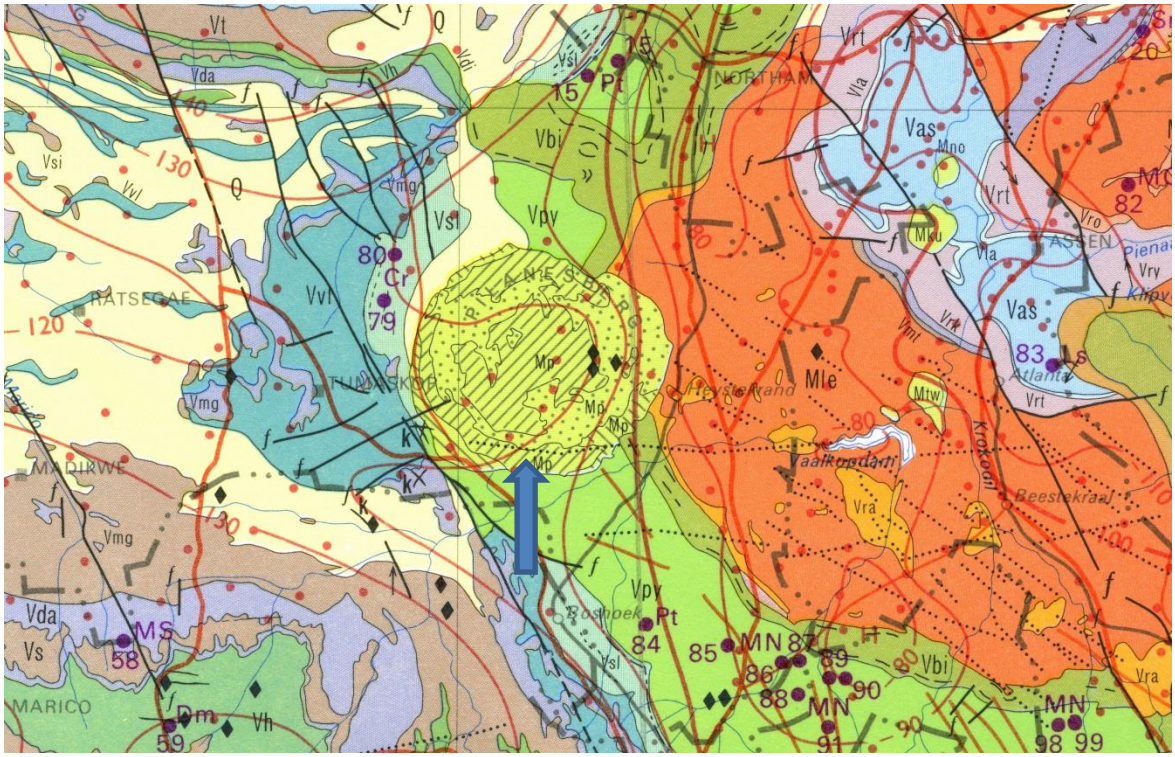

Figure 2: Geological map of Pilanesberg National Park which is the same as the Pilanesberg Complex (circle of olive-green hatched or stippled; Mp). Bakubung Lodge and the proposed site for the reservoir are to the south of the park, indicated by the blue arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Cawthorn, et al., 2006; Vervoerd, 2006). SG = Supergroup; Fm = Formation. The shaded symbols represent the geological units that are most relevant to the project.

Symbol	Group/Formation	Lithology	Approximate Age
Mp	Pilanesberg Complex or Pilanesberg Synenite	Syenite, green and white foyaite, dolerite dykes, lava, tuff	Ca 1500 – 1200 Ma
Vbi	Bierskraal Magnetite Gabbro, Upper Zone of the Rustenburg Layered Suite, western limb of Bushveld Complex	Magnetite gabbro	Ca 2050 Ma
Vvi	Villa Nora Gabbro	Gabbro, anorthosite	Ca 2050 Ma
Vpy	Pyramid Gabbronorite, Main Zone of the Rustenburg Layered Suite, western limb of the Bushveld Complex	Gabbro, norite	Ca 2050 Ma
Vmg	Magaliesberg Fm, Pretoria Group	Sandstone, sandy shoreline	Ca 2100 Ma

Geology

A variety of volcanic rocks comprise the Pilanesberg Alkaline Province or "alkaline igneous complex" because the rocks are under-saturated in silica and it is of great interest to petrologists. The farm Ledig (where Bakubung is located) has a particularly interesting mineral, called Ledig Foyaite, and it has the highest content of rare elements in the Pilansberg Complex (Vervoerd, 2006).

Adjacent to and south of the farm Ledig is the Pyramid Gabbronorite, somewhat older than the Pilanesburg Complex, but is of plutonic origin. The Bierskraal Magnetite Gabbro is also of plutonic origin. Both are part of the Bushveld Complex, Middle and Upper Zones, respectively.

Palaeontology
(Refer to Figure 3 for SAHRIS palaeosensitivity)

The oldest rocks in the area are those of the Magaliesberg Formation which has variously been interpreted as a shallow marine sandstone with tidal and shallow water structures (Eriksson et al., 2006). Since no fossils have been preserved here it is not possible to determine whether it was a closed system (non-marine) or an open marine setting (Erikssen et al., 2006). The rocks of the Bushveld Complex, the Pyramid Gabbronorite and Bierskraal Magnetite Gabbro are plutonic rocks and do not contain any fossils. The volcanic rocks of the Pilanesberg Complex do not contain any fossils either. Nowhere in the region are there potentially fossiliferous sediments.

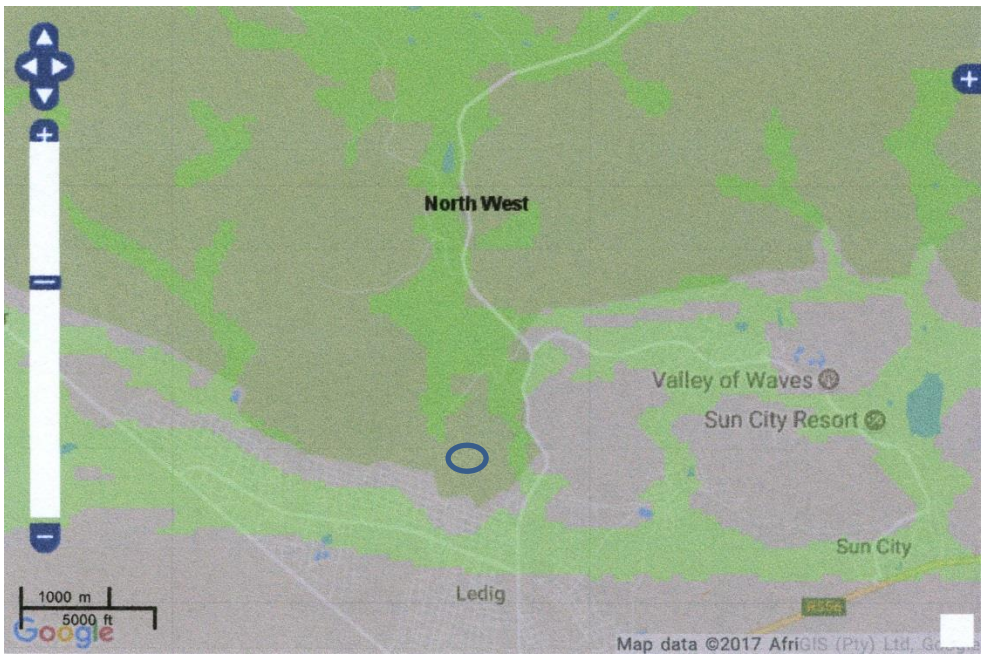

Figure 3: SAHRIS palaeosensitivity map. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

5. Impact assessment

Using the criteria in the table below, the impact of the development, construction of the reservoir, associated piping, perimeter fence and access have been assessed.

TABLE 3: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

The surface activities would not impact on the fossil heritage as the rocks are ancient and volcanic so there are no fossils present. The IMPACT is nil (according to the scheme in Table 3).

Excavation for the roads, foundations, reservoir, fencing and pipes would penetrate only a few metres below ground surface so there would be minor deterioration of the surface of sites and no impact on fossils as there are none. Therefore the SEVERITY/NATURE of the environmental impact would be L.

DURATION of the impact would be permanent: H.

The SPATIAL SCALE would be localised within the site boundary: L.

There is no chance of finding fossils anywhere on the Bakubung Lodge area and proposed Reservoir, on the Farm Ledig, either on the surface or below surface, the PROBABILITY of affecting any fossils is unlikely or seldom: L

6. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the volcanic rocks, basement rocks, dolomites, sandstones, shales, quartzites, basalts and gabbros are typical for the country and do not contain any fossil material.

7. Recommendation

It is extremely unlikely that any fossils occur in the sites for the proposed developments anywhere on the farm Ledig for the Bakubung Reservoir because the rocks are plutonic or volcanic in origin or are ancient sandstones representing nearshore or more distal seas.

As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would not be required.

8. References

Cawthorn, R.G., Eales, H.V., Walraven, F., Uken, R., Watkeys, M.K., 2006. The Bushveld Complex. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 261-281.

Erikssen, P.G., Altermann, W., Hartzer, F.J., 2006. The Transvaal Supergroup and its pre-cursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260.

Verwoerd, W.J., 2006. The Pilansberg alkaline province. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 281-383.