

**PALAEONTOLOGICAL DESKTOP ASSESSMENT OF THE PROPOSED OVERVAAL
TRUST PV FACILITY, BUFFELSPOORT,
NORTH WEST PROVINCE**

**Prepared for:
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EXECUTIVE SUMMARY

Savannah Environmental (Pty) Ltd has appointed Banzai Environmental (Pty) Ltd to undertake a Palaeontological Impact Assessment assessing the palaeontological impact of the planned construction of the Overvaal Trust PV facility, Buffelspoort, North West Province. According to the National Heritage Resources Act (Act No 25 of 1999, Section 38), a palaeontological impact assessment is required to detect the presence of fossil material within the proposed development footprint and to evaluate the impact of the construction and operation of the proposed PV facility on the palaeontological resources.

The development footprint is completely underlain by the Vaalian rocks of the Transvaal Supergroup, Pretoria Group and Magaliesberg Formation. These rocks are older than 2050 Million years, and are thus too old and too altered to contain any fossils. But, evidence of stromatolites have been found in the Magaliesberg Formation as shallow seas and a fluvial system were present in this area in the past. Microbial mats, have also been reported from this Formation. These trace fossils appear as ripple marks and raised patterns on the sandstones.

The scarcity of fossil heritage at the proposed development footprint indicate that the impact of the Overvaal PV facility will be of a low significance in palaeontological terms. Although fossils are rare in this biozone a single fossil can have a huge scientific importance as many fossil taxa are known from a single fossil.

It is therefore considered that the construction and operation of the Overvaal PV facility and associated infrastructure is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO in charge of these developments should be alerted. These discoveries ought to be secured (preferably *in situ*) and the ECO ought to alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be undertaken by a professional palaeontologist.

The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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2 INTRODUCTION

Savannah Environmental (Pty) Ltd has been appointed by PV Solutions as the independent environmental consultant, to obtain the necessary permits for the development of the Overvaal PV facility. An analysis of the project concluded that only a Heritage Impact Assessment was required to be undertaken in terms of the requirements of the National Heritage Resources Act as the project does not trigger the need for an Environmental Authorisation under NEMA. Following submission of an HIA to SAHRA, it was requested that a desktop Palaeontological Assessment be undertaken by a qualified palaeontologist as the proposed development is located within an area of High sensitivity with regards to palaeontological resources. Banzai Environmental (Pty) Ltd has in turn been appointed by Savannah to conduct the required Palaeontological Impact Assessment.

The proposed Overvaal PV facility is situated on Portion RE/23/348 of the farm Rietfontein 348. The capacity of the development will be approximately 990 kWp to be located within an area of less than 1ha. The electricity will be fed through an overhead 11kV power line into the existing on-site network. The power line will be approximately 800m long and will run from the PV facility along a dirt road to an existing transformer.



Figure 1. Locality Map of the proposed Overvaal PV facility (indicated in white), situated on Portion RE/23/348 of the farm Rietfontein 348, near Buffelspoort, North West Province.

2.1 LEGISLATION

Cultural Heritage in South Africa is managed by the National Heritage Resources Act (Act 25 of 1999). This Palaeontological Environmental Impact Assessment forms part of the Heritage Impact Assessment (HIA) and abide by the requirements of the above mentioned Act. In accordance with Section 38, an HIA is required to evaluate any potential impacts to palaeontological heritage within the site.

SECTION 25 OF THE NATIONAL HERITAGE RESOURCES ACT 25 OF 1999

The various categories of heritage resources are recognised as part of the National Estate in Section 3 of The National Heritage Resources Act. This includes:

- geological sites of scientific or cultural significance
- palaeontological sites
- palaeontological objects and material, meteorites and rare geological samples.

According to Section 35 of the National Heritage Resources Act 1999, dealing with archaeology, palaeontology and meteorites:

- The protection of archaeological and palaeontological sites and material and meteorites are the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- 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.
- No person may, without a permit issued by the legally responsible heritage resources authority—
 - 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 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 which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- When the responsible heritage resources authority has reason to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of Section 38 has been followed, it may—

- serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order; and/or
- carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary.

3 Objective

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are:

- To identify exposed and subsurface rock formations that are considered to be palaeontologically important;
- To evaluate the level of palaeontological importance of the formations;
- To comment on the impact of the development on the uncovered exposed and/or potential fossil resources; and
- To recommend how the developer ought to conserve or mitigate damage to these resources.

The objective is thus to conduct a Palaeontological Impact Assessment, which forms of part of the Heritage Impact Assessment (HIA), to determine the impact of the development on potential palaeontological material at the site.

When a palaeontological desktop/scoping study is prepared, the potentially fossiliferous rocks (i.e. groups, formations, etc.) presented within the study area are established from geological maps. The known fossil heritage within each rock unit is obtained from published scientific literature; the fossil sensitivity maps (SAHRIS); discussions with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions. This data is used to calculate the palaeontological importance/sensitivity of each rock unit of the development area on a desktop level. The probable impact of the proposed development footprint on local fossil heritage is thus established on the basis of

- the palaeontological importance of the rocks and
- the character and magnitude of the development footprint and quantity of new bedrock excavated.

Once rocks of moderate to high palaeontological sensitivity are present within the study area, a field-based assessment by a professional palaeontologist is necessary. Damaging impacts on palaeontological heritage generally only occur during the construction phase. The excavations will modify the current topography and may disrupt and destruct or permanently seal-in fossils at or below the ground surface that are then no longer accessible for scientific study.

When palaeontological mitigation is recommended, it may precede construction or, more successfully, take place during the construction phase when new, potentially fossiliferous bedrock is exposed and available for study. Mitigation comprises the sampling, collection and recording of fossils. Excavation of the fossil heritage will include obtaining a permit from SAHRA and the material will have to be housed in a permitted institution. With proper mitigation, many developments comprising bedrock excavation will have a *positive* impact on our knowledge of local palaeontological heritage.

4 GEOLOGICAL AND PALAEONTOLOGICAL HERITAGE

The development footprint is completely underlain by the Vaalian rocks of the Transvaal Supergroup, Pretoria Group and Magaliesberg Formation. The igneous Bushveld Complex intruded in the Transvaal Supergroup rocks in the Transvaal Basin. The rocks of the Transvaal Supergroup are older than 2050 Million years, and are thus too old and too altered to contain any fossils. But, evidence of stromatolites have been found in the Magaliesberg Formation (Eriksson et al., 2006) as shallow seas and a fluvial system were present in this area in the past (Eriksson et al., 1991, 1993).

Stromatolites are layered mounds, columns and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. The oxygen atmosphere that we depend on was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

Microbial mats (trace fossils of ancient unicellular algae), have been reported from the Magaliesberg Formation (Bosch and Eriksson, 2008; Eriksson et al., 2012). These trace fossils appear as ripple marks and raised patterns on the sandstones. There is however, no evidence of the animals that made the trace fossils.

4.1 GEOLOGY

The Magaliesberg Formation consists of coastal sandstone with mudrock lenses and interbeds.

5 GEOGRAPHICAL LOCATION OF THE SITE

The central coordinate of the development: 25° 49' 44.1859"S; 27° 22' 20.3542S

The proposed PV development is located within an area of less than 1Ha on the farm Rietfontein 348 Portion RE/23/348 close to Buffelspoort, North West Province. The proposed development area has been disturbed by agricultural activities.

6 METHODS

A desktop study was compiled to assess the potential risk to palaeontological material (fossils, trace fossils) in the proposed area of development. In compiling the desktop report the author's experience, aerial photos (using Google Earth, 2015), topographical and geological maps and other reports from the same area were used to assess the proposed development footprint.

6.1 ASSUMPTIONS AND LIMITATIONS

The accurateness and dependability of desktop Palaeontological Impact Assessments as part of heritage impact assessments are normally restricted by the following:

- Old fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information. Much of South Africa has not been studied palaeontologically due to there being so few palaeontologists.
- The accuracy of geological maps where knowledge may be based exclusively on aerial photographs. Sheet explanations for geological maps are unsatisfactory and the focus is not on palaeontological material.

Vast areas of South Africa have not been studied palaeontologically. Fossil data gathered from different areas but in similar Assemblage Zones might provide insight on the probable presence of fossils in an unmapped area. Desktop studies thus generally assume the presence of unexposed fossil heritage within the development areas of similar geological formations. Where extensive exposures of bedrocks or potentially fossiliferous superficial sediments are present in the development area, the dependability of a Palaeontological Impact Assessment may be enhanced through a field-survey.

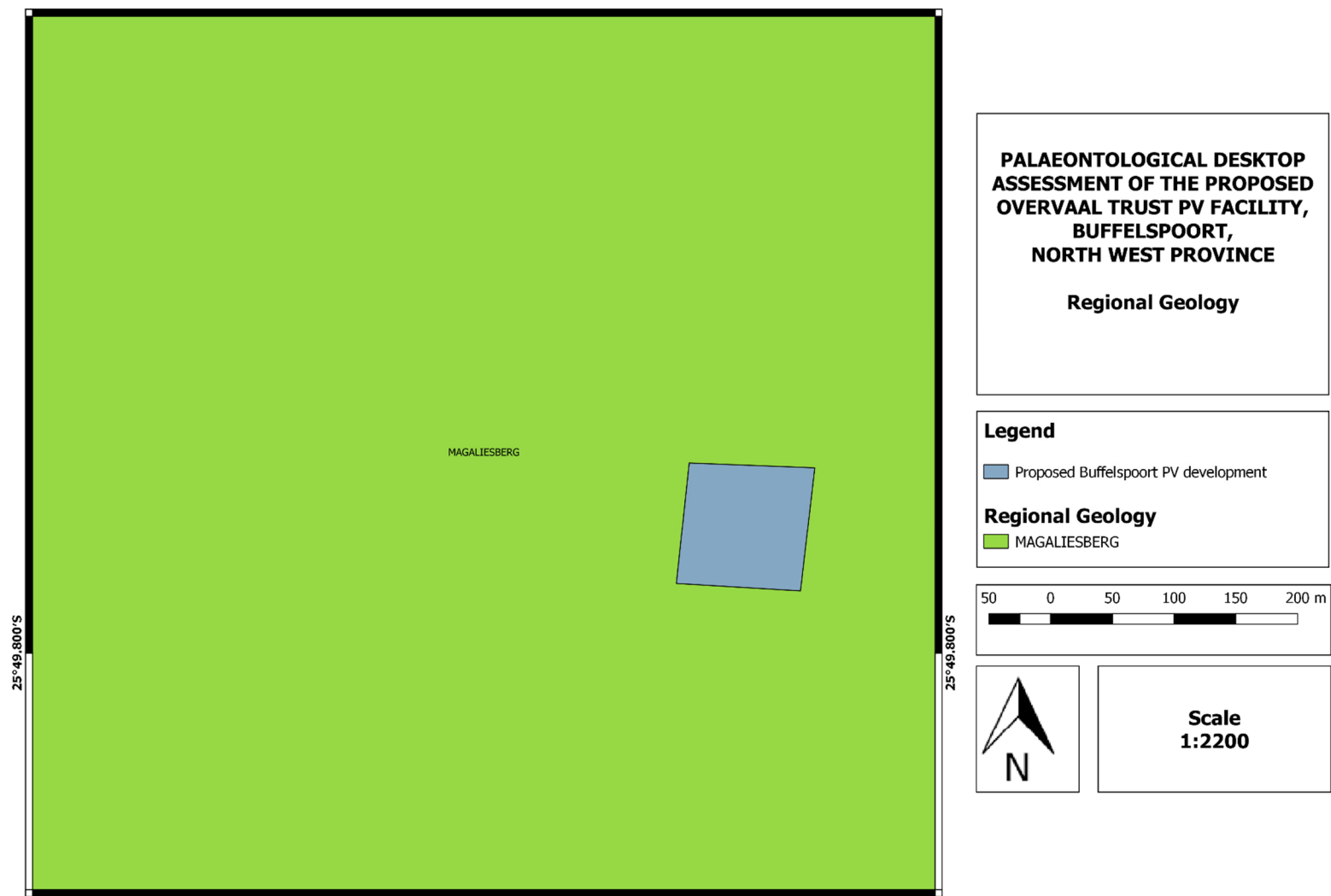


Figure 3. The surface geology of the proposed Overvaal PV facility, situated on Portion RE/23/348 of the farm Rietfontein 348, near Buffelspoort, North West Province. The development footprint is completely underlain by the Vaalian rocks of the Transvaal Supergroup, Pretoria Group and Magaliesberg Formation.

7 IMPACT ASSESSMENTS

An assessment of the impact significance of the proposed Overvaal PV facility on local fossil heritage is presented here:

7.1 Nature of the impact

Although minimal, the installation of project component will involve excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific research. According to the Geology of the study area, there is a possibility of finding fossil heritage during the construction phase of the project. No impacts are expected to occur during the operation phase.

7.2 Sensitive areas

The development footprint is completely underlain by the Vaalian rocks of the Transvaal Supergroup, Pretoria Group and Magaliesberg Formation (Fig. 3). Although fossil heritage could be present in this formation the likelihood of significant fossil heritage in the development area is considered to be of **low significance**. This could be attributed to the scarcity of fossils in the area.

7.3 Geographical extent of impact

The impact on fossil materials and thus palaeontological heritage will be limited to the construction phase when new excavations into fresh potentially fossiliferous bedrock take place. The extent of the area affected by this potential impact is restricted to the development footprint and therefore categorised as **local**.

7.4 Duration of impact

The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be **permanent**.

7.5 Potential significance of the impact

Should the project progress without safety measures the possibility of fossils being present at the proposed development site within the Magaliesberg Formation the resultant damage, destruction or inadvertent relocation of any affected fossils will be **permanent and irreversible**. Thus, any fossils occurring within the study area are potentially scientifically and culturally significant and any negative impact on them would be of **high significance**. In spite of the the rare occurrence of fossils in this biozone a single fossil can have a huge scientific significance as many fossil taxa are recognised from a solitary fossil.

7.6 Severity / benefit scale

The development of the proposed Overvaal PV project is **beneficial** on not only a local level, but regional levels as well. A potential **secondary advantage** of the construction of the project would be that the excavations may uncover fossils that were hidden beneath the surface exposures and, as such, would have remained unknown to science.

7.7 Probability of the impact occurring

Impacts on palaeontological heritage during the construction phase could potentially occur but are regarded as improbable.

7.8 Intensity

The intensity of the impact on fossil heritage is rated as **low**.

8 DAMAGE MITIGATION, REVERSAL AND POTENTIAL IRREVERSIBLE LOSS

8.1 Mitigation

In the event that fossil material exist within the development footprint any negative impact upon it could be mitigated by surveying, recording, describing and sampling of well-preserved fossils by a palaeontologist. This ought to take place after initial vegetation clearance but *before* the ground is flattened for construction. Excavation of fossil heritage will need a permit from SAHRA and the material must be housed in a permitted institution. In the event that an excavation is impossible or inappropriate the fossil or fossil locality could be protected and the site of any planned construction moved.

8.2 Degree of irreversible loss

Impacts on fossil heritage are in general irreversible. Well-documented records and additional palaeontological studies of any fossils uncovered during construction would represent a positive impact from a scientific perspective. The possibility of a negative impact on the palaeontological heritage of the area can be reduced by the execution of satisfactory damage mitigation procedures. If damage mitigation is properly undertaken the benefit scale for the project will lie within the beneficial category.

8.3 Degree to which the impact may cause irreplaceable loss of resources

Stratigraphic and geographical distribution of the Transvaal Group stromatolites, is documented in the literature. It is thus **possible** that fossil material is present on the development area. By taking a precautionary approach, a significant loss of fossil resources is not expected.

8.4 CUMULATIVE IMPACTS

The cumulative effect of the proposed development is considered to be low.

9 FINDINGS AND RECOMMENDATIONS

The development footprint is completely underlain by the Vaalian rocks of the Transvaal Supergroup, Pretoria Group and Magaliesberg Formation. The igneous Bushveld Complex intruded in the Transvaal Supergroup rocks in the Transvaal Basin. These rocks are older than 2050 Million years old, and are thus too old and too altered to contain any fossils. But, evidence of stromatolites have been found in the Magaliesberg Formation as shallow seas and a fluvial system were present in this area in the past.

Microbial mats (trace fossils of ancient unicellular algae), have been reported from the Magaliesberg Formation. These trace fossils appear as ripple marks and raised patterns on the sandstones. There are however, no evidence of the animals that made the trace fossils.

The scarcity of fossil heritage and a lack of appropriate exposure at the proposed development footprint is of low significance in palaeontological terms. **It is therefore considered that the construction and operation of the Overvaal PV facility is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area.** Thus, the construction and operation of the facility may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO in charge of these developments ought to be alerted. Discoveries ought to be secured (preferably *in situ*) and the ECO ought to alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be undertaken by a professional palaeontologist.

The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

10 ASSESSMENT OF IMPACTS

10.1 Assessment Methodology

Direct, indirect and cumulative impacts of the impacts identified above will be assessed according to the following standard methodology:

- The **nature** which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent** wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- The **duration** wherein it will be indicated whether:
 - The lifetime of the impact will be of very short duration (0 - 1 years) – assigned a score of 1;
 - The lifetime of the impact will be of short duration (2 - 5 years) – assigned a score of 2;
 - Medium-term (5 - 15 years) – assigned a score of 3;
 - Long-term (> 15 years) – assigned a score of 4; or
 - Permanent – assigned a score of 5.
- The **magnitude** quantified on a scale from 0 - 10 where 0 is small and will have no effect on the environment, 2 is minor and will result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease) and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 - 5 where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but of low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The **significance** which shall be determined through a syntheses of the characteristics described above and can be assessed as low, medium or high; and
- The **status**, which is described as positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:

$$S = (E + D + M) \times P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area);
- 30 – 60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated); and
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Impact 1: Excavation works causing disturbance to seal-in fossils at or below the ground surface

<p>Nature: Although minimal, the excavations and ground disturbance during the construction phase will involve excavations into the superficial sediment cover as well as locally into the underlying bedrock. These excavations will modify the current topography and may disrupt and destruct, or permanently seal-in fossils at or below the ground surface that are then no longer accessible for scientific research.</p> <p>This impact is likely to occur only within the construction phase. No impacts are expected to occur during the operation phase.</p>		
	Without mitigation	With mitigation
Extent	Local(1)	Local(1)
Duration	Long term/permanent (5)	Long term/permanent (5)
Magnitude	Minor (2)	Minor (1)
Probability	Improbable (2)	Improbable (1)
Significance	Low (16)	Low (14)
Status (positive or negative)	Negative	Neutral
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
<p>Mitigation: <u>Not necessary</u></p> <p>The development footprint is completely underlain by the Vaalian rocks of the Transvaal Supergroup, Pretoria Group and Magaliesberg Formation. The lack of appropriate exposure and rare occurrence of fossil heritage at the proposed development footprint indicates that the impact of the Overvaal PV facility is of low significance in palaeontological terms.</p>		
<p>Cummulative impacts: The cumulative effect of the proposed development is considered to be low.</p>		
<p>Residual Risk:</p> <p>Not applicable</p>		

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty three years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 10 years. She has been conducting Palaeontological Impact Assessments since 2014

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

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SIGNATURE:

A handwritten signature in black ink, appearing to read 'Elize Butler', is positioned to the right of the 'SIGNATURE:' label.