



PALAEONTOLOGICAL DESKTOP ASSESSMENT

DIAMOND PROSPECTING
RIGHT APPLICATION ON
PORTIONS OF FARM
VOGELSTRUISSEKUIL 400,
BOSCHPLAATS 149 AND
FARM WELVERDIENT, NEAR
WOLMARANSTAD IN THE
NORTH WEST PROVINCE

REF: NW30/5/1/1/2/13707PR

July 2023

COMPILED FOR: MILNEX CC



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 favorable 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 favorable 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 realize that a false declaration is an offense 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.

PALAEONTOLOGICAL CONSULTANT:

Banzai Environmental (Pty) Ltd

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SIGNATURE:



The heritage impact assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to Appendix A	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 4 – Methods and Terms of Reference	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontologica l history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8	-



Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Desktop Assessment	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 4 Approach and Methodology	-
(f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1, and 9	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 9	
(h) 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;	Section 5 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 9	
(k) Any mitigation measures for inclusion in the EMP	Section 10	



Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(l) Any conditions for inclusion in the environmental authorisation	Section 10	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 10	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 9	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities 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	Section 1 and 9	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental



Table 1: NEMA Table

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
		Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	



EXECUTIVE SUMMARY

Banzai Environmental was appointed by Milnex CC to conduct the Palaeontological Desktop Assessment to assess the Environmental Authorisation for the proposed Prospecting Right application to prospect for Diamonds Alluvial (DA) & Diamonds General (D) & Diamonds (DIA) including associated infrastructure, on Portion 13 (portion of portion 6) of the farm Vogelstruiskuil 400, Portion 14 (portion of portion 2) of the farm Boschplaats 149 & Portion 24 of the farm Welverdiend 151, Registration Divisions IO & HO, near Wolmaransstad in the North West Province. Under the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDIA is necessary to confirm if fossil material could potentially be present in the approved development area and to evaluate the potential impact of the proposed changes to the development on the Palaeontological Heritage.

The proposed development is underlain by the Klipriviersberg Group of the Ventersdorp Supergroup. The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Klipriviersberg Group is Low. (Almond and Pether, 2009; Almond *et al.*, 2013). The updated geology (Council for Geosciences) refined the geology and also indicates that the study area is underlain Klipriviersberg Group of the Ventersdorp Supergroup.

An overall Low palaeontological significance is allocated to the development footprint. It is therefore considered that the proposed development will not lead to detrimental impacts on the palaeontological reserves of the area and construction of the development may be authorised in its whole extent.

If Palaeontological Heritage is uncovered during surface clearing and excavations the **Chance find Protocol** attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.



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1 INTRODUCTION

Milnex CC was contracted by Me Anika Deetlefs as the independent environmental consultant to undertake the Scoping and EIA process for a Prospecting Right Application to prospect for Diamonds (Alluvial), Diamonds (General) & Diamonds (DIA) including associated infrastructure, on Portion 13 (portion of portion 6) of the farm Vogelstruiskuil 400, Portion 14 (portion of portion 2) of the farm Boschplaats 149 & Portion 24 of the farm Welverdient 151, Registration Divisions IO & HO, North West Province. The property is located approximately 34km West of the town of Wolmaransstad in the North-West Province. Banzai Environmental has in turn been employed to conduct the Palaeontological Desktop (PDA) assessment for the project.

Table 2: Site Information

Farm Name	Portion 13 (portion of portion 6) of the farm Vogelstruiskuil 400 Registration Division: IO Title Deed: T10320/1980 Extent: 44.7444 hectares North-West Province Portion 14 (portion of portion 2) of the farm Boschplaats 149 Registration Division: HO Title Deed: T10320/1980 Extent: 40.9088 hectares North-west Province Portion 24 of the farm Welverdient 151 Registration Division: HO Title Deed: T10320/1980 Extent:107.0699 hectares
Application area (Ha)	192.7231 hectares
Magisterial district:	Dr Kenneth Kaunda District Municipality Maquassi Hill Local Municipality
Registration division:	IO & HO



Distance and direction from nearest town	The property is located approximately 34km West of the town of Wolmaransstad in the North-West Province.
21-digit Surveyor General Code for each farm portion	T0IQ0000000009300010 T0IQ0000000009200019 T0IQ0000000009200020
Minerals applied for	Diamonds Alluvial (DA) Diamonds General (D) Diamonds (DIA)

Table 3: Listed activities

Listing Notice 1, (GNR 327), Activity 19: :	<i>The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;</i>
Listing Notice 1 (GNR 327), Activity 20 (Amended GNR 517: 2021): :	<i>Any activity including the operation of that activity which requires a prospecting right in terms of section 16 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014, required to exercise the prospecting right;</i>
Listing Notice 1 (GNR 327), Activity 27:	<i>"The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation."</i>
Listing Notice 2 (GNR 325), Activity 19 (Amended GNR 517: 2021):	<i>The removal and disposal of minerals which requires permission contemplated in terms of section 20 of the Mineral and Petroleum Resources Development Act, as well as any</i>



	<p><i>other applicable activity as contained in this Listing Notice, Listing Notice 1 of 2014 or in Listing Notice 3 of 2014, required to exercise the permission.</i></p>
Listing Notice 3, GNR 324, Activity 4:	<p><i>The development of a road wider than 4 metres with a reserve less than 13,5 metres. (h) North West (ii) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (iv) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority;</i></p> <p>. .</p>
Listing Notice 3, GNR 324, Activity 10:	<p><i>The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. (h) North West (iv) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority; (vi) Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland.</i></p>
Listing Notice 3 GNR 324, Activity 12:	<p><i>he clearance of an area of 300 square metres or more of indigenous vegetation; (h) North West (v) Within critical biodiversity areas identified in systematic biodiversity plans adopted by the competent authority or (vi)</i></p>



	<i>Areas within a watercourse or wetland, or within 100 metres from the edge of a watercourse or wetland</i>
<p>Prospecting right with bulk samples for the prospecting of Diamonds Alluvial (DA), Diamonds General (D) & Diamonds (DIA) including associated infrastructure, structure and earthworks.</p> <p>Please note the establishment or reclamation of residue stockpiles or residue deposits will still take place, but is now exempt from the list of Waste Management Activities (GNR 921, as amended)</p>	

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler. She has conducted approximately 400 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-nine years. She has experience in locating, collecting, and curating fossils. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

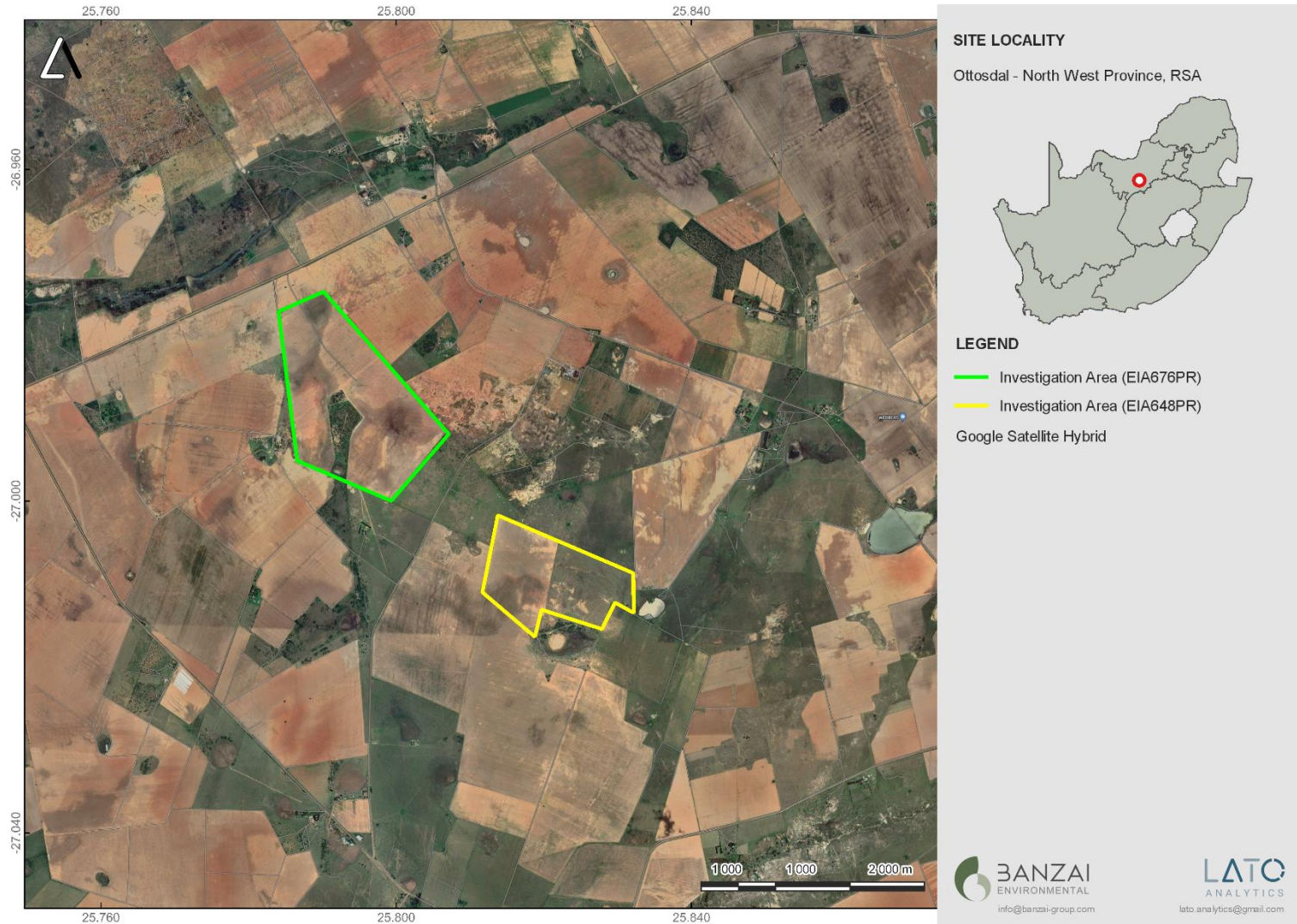


Figure 1: Regional locality of the Prospecting Right Application near Wolmaransstad in the North West Province.

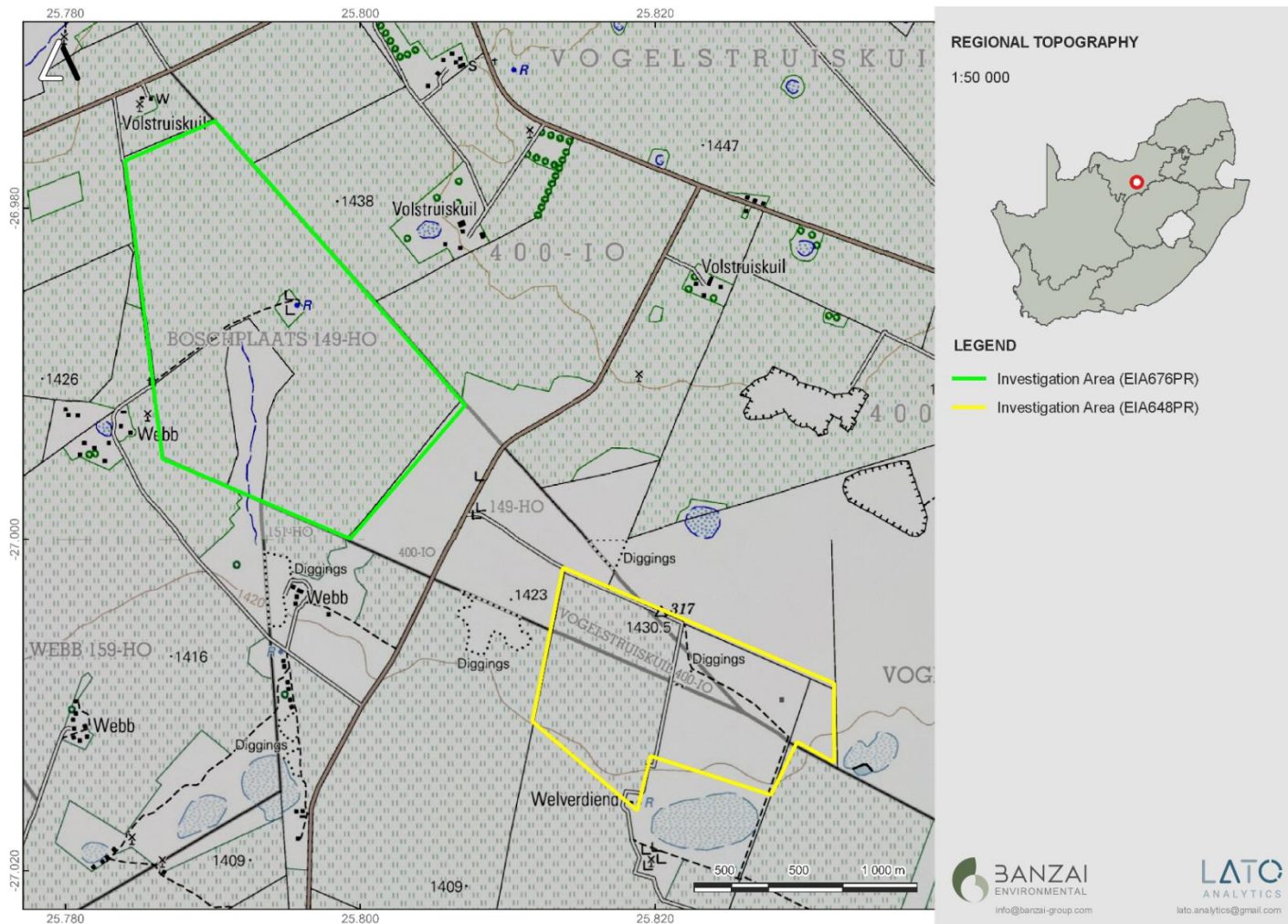


Figure 2: Locality Map of the Prospecting Right Application near Wolmaransstad in the North West Province.

3 LEGISLATION

National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **“all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens”**.

The identification, evaluation and assessment of any cultural heritage site, artefact or finds in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

- Contents of scoping report – Regulation 49
- Contents of environmental impact assessment report – Regulation 50
- Environmental management programme – Regulation 51
- Environmental management plan – Regulation 52



The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) “...identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage”.

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- (Exceeding 5 000 m² in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m² in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 METHODS AND TERMS OF REFERENCE

This study forms part of the Heritage Impact Assessment Report. According to the “SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” the purpose of the PIA is: 1) to identify the palaeontological importance of the rock formations in the footprint; 2) to evaluate the palaeontological magnitude of the formations; 3) to clarify



the **impact** on fossil heritage; and 4) to suggest how the developer might protect and lessen possible damage to fossil heritage.

The palaeontological status of each rock section is calculated as well as the possible impact of the development on fossil heritage by a) the palaeontological importance of the rocks, b) the type of development and c) the quantity of bedrock removed.

All possible information is consulted to compile a scoping report, and this includes the following: Provisional DFFE Screening Tool, SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical and geological maps as well as scientific articles of specimens from the development area and Assemblage Zones.

When the development footprint has a moderate to high palaeontological sensitivity a field-based assessment is necessary. The desktop and the field survey of the exposed rock determine the impact significance of the planned development and recommendations for further studies or mitigation are made. Destructive impacts on palaeontological heritage usually only occur during the construction phase while the excavations will change the current topography and destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

During a site investigation the palaeontologist does not only survey the development but also tries to determine the density and diversity of fossils in the development area. This is confirmed by examining representative exposures of fossiliferous rocks (sedimentary rocks contain fossil heritage whereas igneous and metamorphic rocks are mostly unfossiliferous). Rock exposures that are investigated usually contains a large portion of the stratigraphic unit, can be accessed easily and comprise of unweathered (fresh) exposed rock. These exposures may be natural (rocky outcrops in stream or river banks, cliffs, dongas) but could also be artificial (quarries, open building excavations and even railway and road cuttings). It is common practice for palaeontologist to log well-preserved fossils (GPS, and stratigraphic data) during field assessment studies.

Mitigation usually precedes construction or may occur during construction when potentially fossiliferous bedrock is exposed. Mitigation comprises the collection and recording of fossils. Preceding excavation of any fossils, a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution. When mitigation is applied correctly, a positive impact is possible as knowledge of local palaeontological heritage may be increased.

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;



- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study,
- Description and location of the proposed development and provide geological and topographical maps
- Provide palaeontological and geological history of the affected area.
- Identification of sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
 - a. **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
 - b. **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
 - c. **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

4.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations of the Geological Maps were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.



Comparable Assemblage Zones in other areas is also used to provide information on the existence of fossils in an area which has not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally **assumed** that exposed fossil heritage is present within the footprint. A field-assessment will thus improve the accuracy of the desktop assessment.

5 GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY

The proposed Prospecting Right Application near Wolmaransstad in the North West Province is depicted on the 1:250 000 Christiana 2724 (1996) and Vryburg 2624 (1993) Geological maps (Council of Geoscience, Pretoria) (**Figure 3; Table 4-5**). The proposed development is underlain by the Klipriviersberg Group (Rk) (**Figure 4**) of the Ventersdorp Supergroup. The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Klipriviersberg Group is Low (blue) (**Figure 5, Table 6**; Almond and Pether, 2009; Almond *et al.*, 2013). The updated geology (Council for Geosciences) refined the geology and also indicates that the study area is underlain by the Klipriviersberg Group (**Figure 6**) of the Ventersdorp Supergroup. In contrast with the SAHRIS PalaeoMap (Figure 5) the DFFE Screening tool indicates that the Palaeontological Sensitivity of the development footprint is Moderate (yellow) (**Figure 7-8**).

The Ventersdorp Supergroup comprise of the biggest and most wide-spread system of volcanic rocks in the Kaapvaal Craton. This Supergroup unconformably overlies the Witwatersrand Supergroup and is also unconformably overlain by the Transvaal Supergroup. The elliptical basin is approximately 300 000km² in extent. The type-area is located between Klerksdorp (North West), and Welkom and Bothaville (Free State). This Supergroup mantles most of the distribution area of the Witwatersrand Supergroup as well as the Dominion Group.

The best exposures of the Ventersdorp Supergroup are in the North West Province, but good exposures are also present in the Northern Cape Province, Gauteng, and southern Botswana. This Supergroup is divided in the Klipriviersberg Group (oldest) which is overlain by the Platberg Group followed by the sedimentary Bothaville Formation and the volcanic Allanridge Formation (uppermost Ventersdorp unit, youngest Formation) (**Figure 5**).

The Ventersdorp Supergroup is represented by the Klipriviersberg Group in the development footprint. Borehole data (SACS, 1980) has indicated that the Klipriviersberg Group is about 1931m thick. This group comprises of the following seven Formations: Venterspost-, Westonaria-, Alberton-, Orkney-, Jeannette-, Lorainne- and Edenville Formations. The Klipriviersberg Group includes basic and acid volcanics with subordinate siliclastics sediments. To date no fossils have been recorded from this group.



The Platberg Group is subdivided in four formations namely the Kameeldoorns-, Goedgenoeg-, Makwassie-, and Rietgat Formations. These formations consist of heterogenous rock varying from chemical and classic sediments, to felsic and mafic volcanics. These rocks were deposited in linear vault troughs during grabed developments (Visser et al, 1975-1976, Buck, 1980). These deep intermontane grabens formed in older underlying andesitic terranes and formed areas of alluvial fan deposits and debris as well as scree flows. Ooids and stromatolites accumulated under lacustrine conditions in fine-grained chemical and terrigenous sediments. (Buck, 1980) Stromatolites were identified in the Rietgat Formation between Prieska and Britstown. In time fluvial processes prevailed causing widespread prograding of alluvial fans across basins (Buck, 1980).

The Platberg is mostly absent in the north-east of the Ventersdorp depository while the outcrops are erratic with changes in thickness. The type-area of the Platberg Group is between Welkom and Klerksdorp and was described by Winter (1976), while the Klerksdorp area was described by J.M. Myers (1990). The Rietgat Formation crops out in the, north, northwest, and southwest of Vryburg, south-southeast of Douglas, Taungs-Hartswater area, west of Klerksdorp, T'Kuip in the Northern Cape Province and southwest of Ventersdorp. The Rietgat Formation consist of alternating sedimentary and volcanic rocks which varies in thickness across the basin.

The uppermost volcanic Allanridge Formation crops out in the North West, Northern Cape, and Free State Provinces. Witmer (1976) came to the conclusion that the Allanridge Formation has a conformable relationship with the Bothaville Formation (deeper parts of the basin) while Keyser (1998), found a very prominent unconformable relationship in the direction of the northwestern boundary of the Ventersdorp depository. The Allanridge formations consists primary of light green–grey porphyritic lava and pyroclastic rocks as well as dark-green amygdaloidal lava. The dark-green lava is the thickest unit in the Allanridge Formation. Both lava types consist of amygdales but is more widespread in the dark-green lava. The Allanridge is igneous in origin and thus unfossiliferous.

Quaternary alluvium (yellow, single bird figure), Tertiary to Quaternary calcrete or surface limestones (T-Qc; yellow) as well as the Allanridge Formation of the Ventersdorp Supergroup (Ra, dark green) surrounds the study area. In the Geotechnical report of the North West Province, Groenewald et al (2014) described these sediments as “aeolian sand, alluvium, colluvium, spring tufa (calcareous) and sinter (siliceous), lake deposits, peats, pedocretes or duricrusts (calcrete, ferricrete), soils and gravel (diamondiferous in places)”. The Quaternary superficial deposits are the youngest geological deposits formed during the most recent period of geological time (approximately 2.6 million years ago to present). Most of the superficial deposits are unconsolidated sediments and consist of gravel, sand, silt, and clay. The Quaternary deposits are important due to the palaeoclimatic changes that are reflected in the different geological formations (Hunter et al., 2006). During climate fluctuations in the Cenozoic Era most geomorphologic features where formed (Maud, 2012). Barnosky (2005) indicated that various warming



and cooling events occurred in the Cenozoic but states that climatic changes during the Quaternary Period, specifically the last 1.8 Ma, were the most drastic relative to all climate variations in the past. These climate variations were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth et al., 2004).

This pedogenic limestone deposits is up to 10 meters thick and may displace or replace near-surface bedrocks. Netterberg (1978, 1980) revived the South African calcretes and found that the calcretes comprise of glaebular calcrete (with separate nodules), hardpan calcrete that contain solid limestone and honeycomb calcrete (fusing with glaebules). These calcretes are locally conglomeratic with clasts of exotic pebbles and reworked calcretes.

The calcretes could contain mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens, and peats are recovered as well as trace fossils like vertebrate tracks, termite and insect burrows, termitaria (termite heaps/ mounds) as well as rhizoliths (root casts). Reworked Stone Age artifacts (Plio-Pleistocene) have been found in Quaternary alluvium. Some of these calcretes may be diamondiferous.

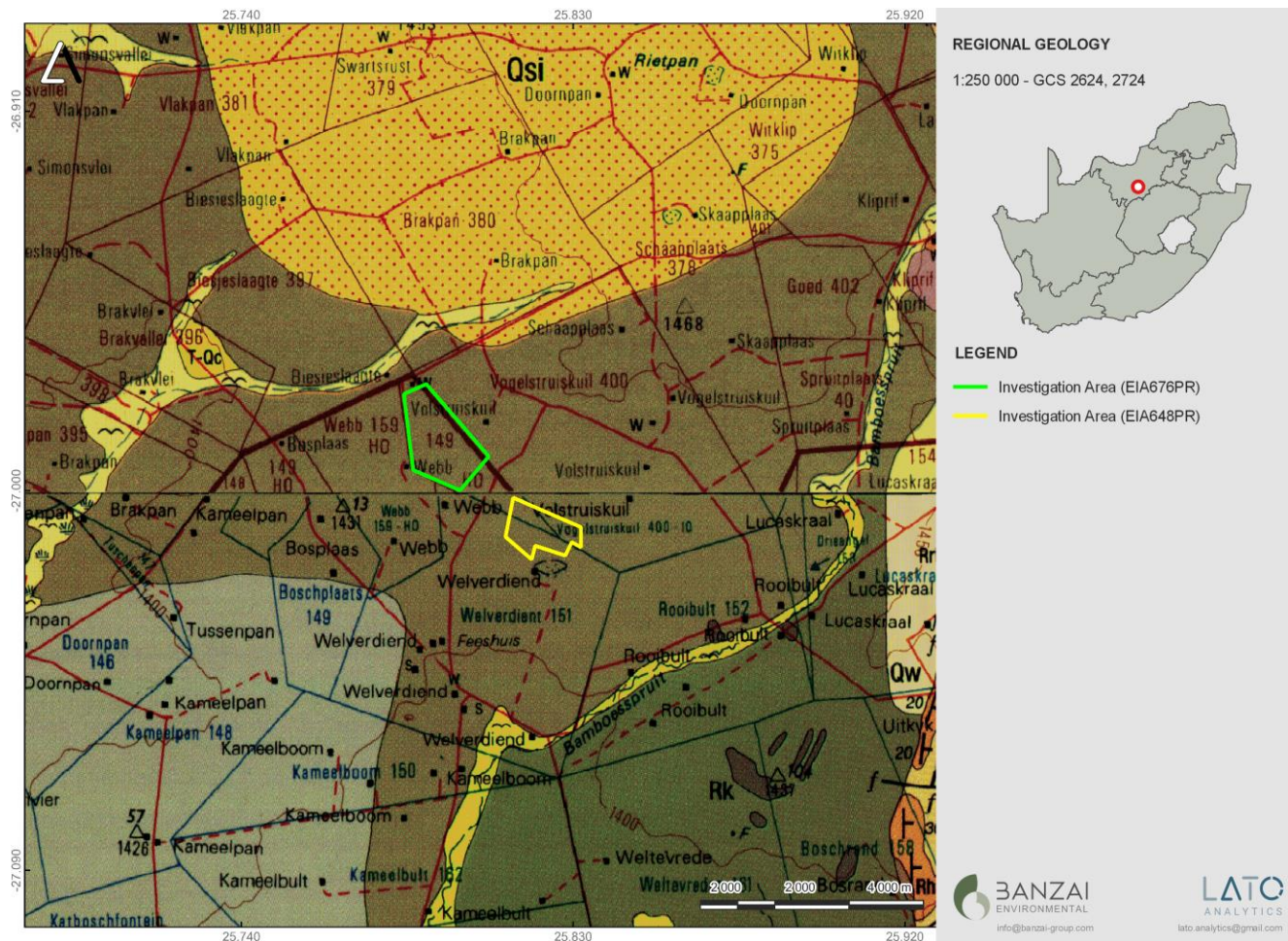


Figure 3. Extract of the 1:250 000 Vryburg 2624 (1993 and Christiana 2724 (1996) (Council of Geoscience, Pretoria) indicates that the study area near Wolmaransstad in the North West Province is underlain by the Klipriviersberg Group of the Ventersdorp Supergroup.

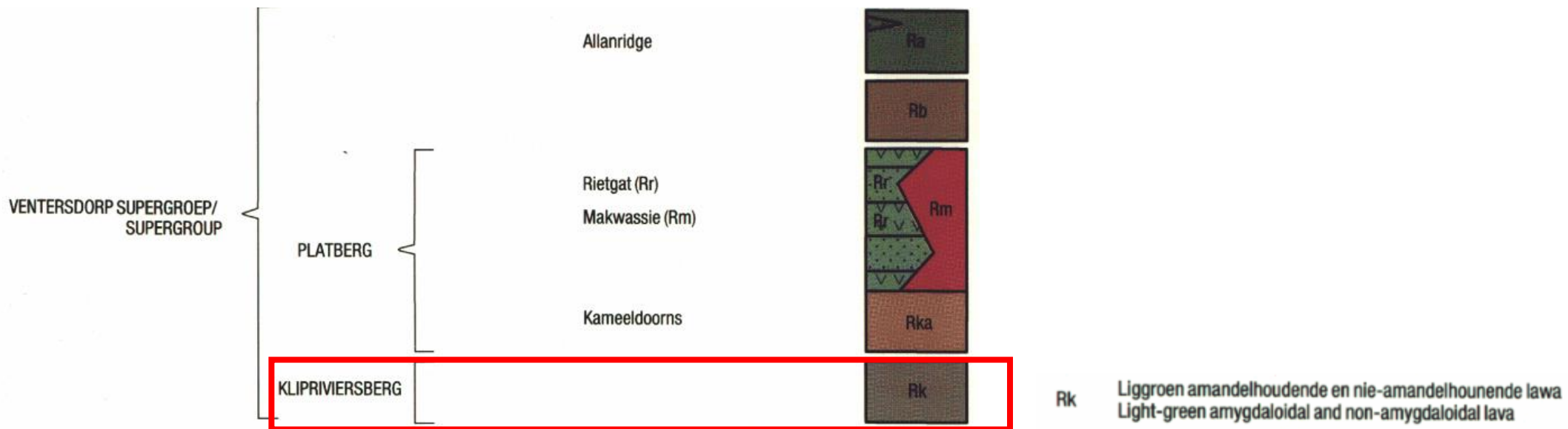


Table 4: Legend to the 1:250 000 Vryburg 2624 Geological map (1993) (Council of Geoscience, Pretoria).

Geological Group	Sub-Group	Location	Unit Name	Unit Code	Description		
RANDIAN RANDIUM	VENTERSDORP SUPERGROUP VENTERSDORP SUPERGROEP	PLATBERG	Allanridge	Ra	Basaltic amygdaloidal lava, agglomerate, tuff Basaltiese amandelhoudende lawa, agglomeraat, tuf		
			Bothaville	Rbt	Quartzite, greywacke, conglomerate Kwartziet, grouwak, konglomeraat		
			Rietgat	Rr	Basaltic amygdaloidal and porphyritic lava Basaltiese amandelhoudende en porfiritiese lawa		
			Makwassie	Rm	Quartzite (), ferruginous shale () Kwartziet (), ysterhoudende skalie ()		
			Goedgenoeg*	Rgb	Basaltic lava Basaltiese lawa		
			Kameeldoorns	Rka	Breccia, conglomerate, greywacke, shale, tuff Breksie, konglomeraat, grouwak, skalie, tuf		
			West Rand	Rk	Quartz-feldspar porphyry, feldspar porphyry Kwartz-veldspaatporfier, veldspaatporfier		
	WITWATERSRAND SUPERGROUP/ SUPERGROEP	WEST RAND WES-RAND	HOSPITAL HILL HOSPITAALHEUWEL	Syferfontein	Rs	Pinkish, coarse-grained granite Pienkerige, grofkorrelrige graniet	
				Rhenosterhoek	Rre	Amygdaloidal lava, tuff (); quartzite, tuffaceous sediments () Amandelhoudende lawa, tuf (); kwartziet, tufagtige sedimente ()	
						Rrh	Quartzite, conglomerate, lava Kwartziet, konglomeraat, lawa
						Rr	Andesitic lava Andesitiese lawa
						Rh	Quartzite, tuffaceous sediments (); Kwartziet, tufagtige sedimente ()
						Rh	Basaltic amygdaloidal and porphyritic lava Basaltiese amandelhoudende en porfiritiese lawa
						Rk	Basaltic lava Basaltiese lawa
					Rka	Breccia, conglomerate, greywacke, shale, tuff Breksie, konglomeraat, grouwak, skalie, tuf	
					Rm	Quartz-feldspar porphyry, feldspar porphyry Kwartz-veldspaatporfier, veldspaatporfier	
					Rbt	Quartzite, greywacke, conglomerate Kwartziet, grouwak, konglomeraat	
					Ra	Basaltic amygdaloidal lava, agglomerate, tuff Basaltiese amandelhoudende lawa, agglomeraat, tuf	



Table 5: Legend to the 1:250 000 Christiana 2724 Geological map (1996) (Council of Geoscience, Pretoria)



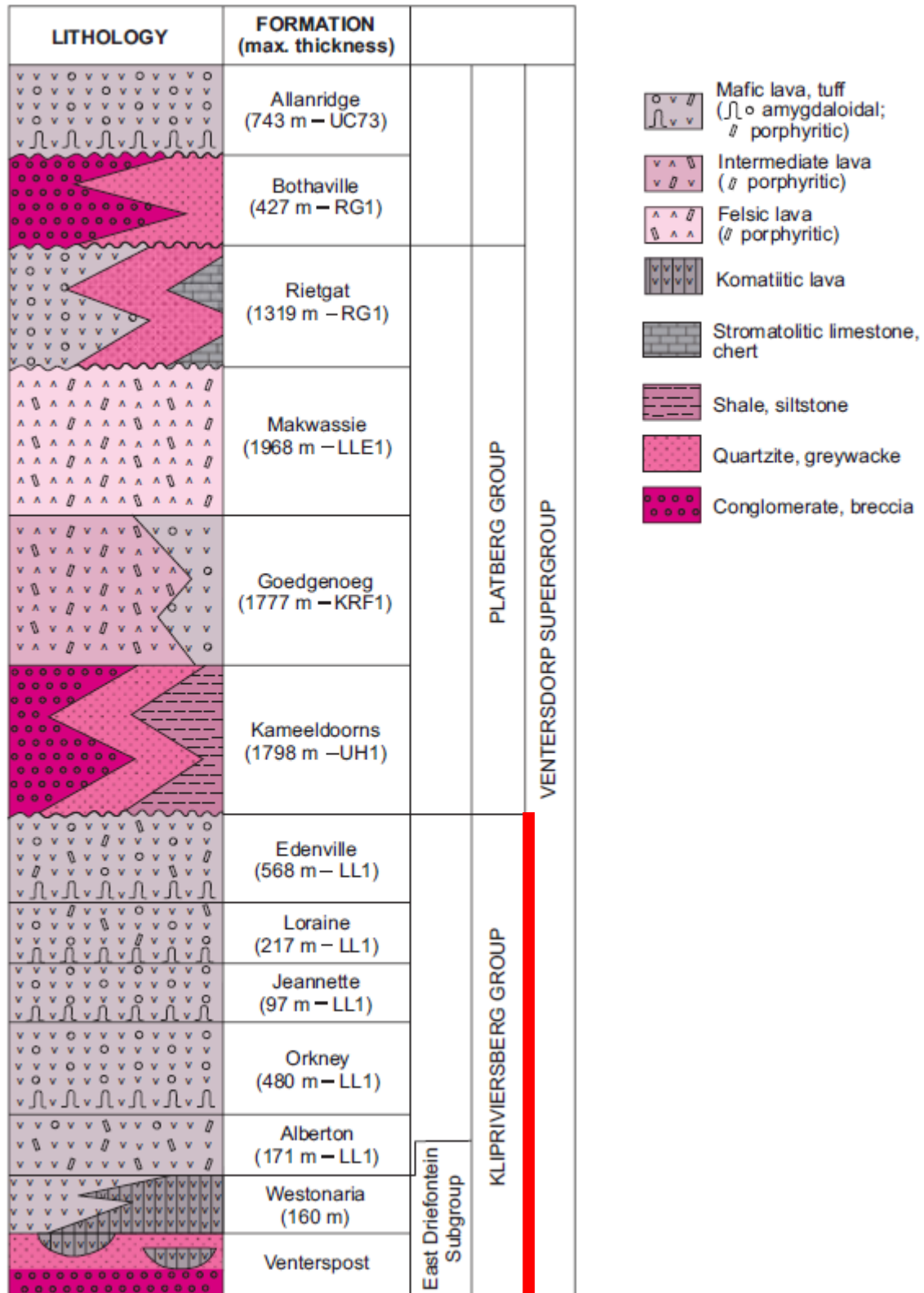


Figure 4: Ventersdorp stratigraphy (Taken from Van Der Westhuizen and Bruijn, 2006 after Winter, 1965, 1976; Linton et al., 1990 Meyers, 1990 and Meintjies, 1978). The Klipriviersberg Group is indicated by a red polygon.

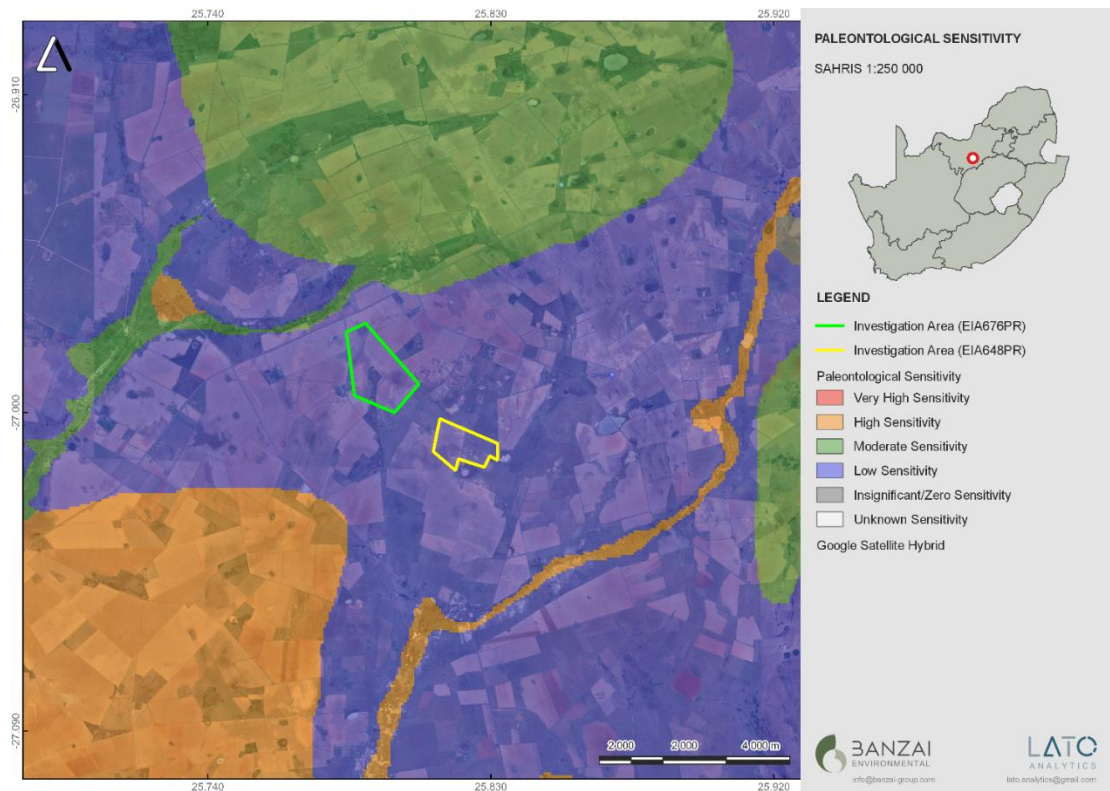


Figure 5: Extract of the SAHRIS PalaeoMap map (Council of Geosciences) indicates that the study area near Wolmaransstad in the North West Province is underlain with sediments with a Low (blue) Palaeontological Sensitivity.



Table 6: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website)

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

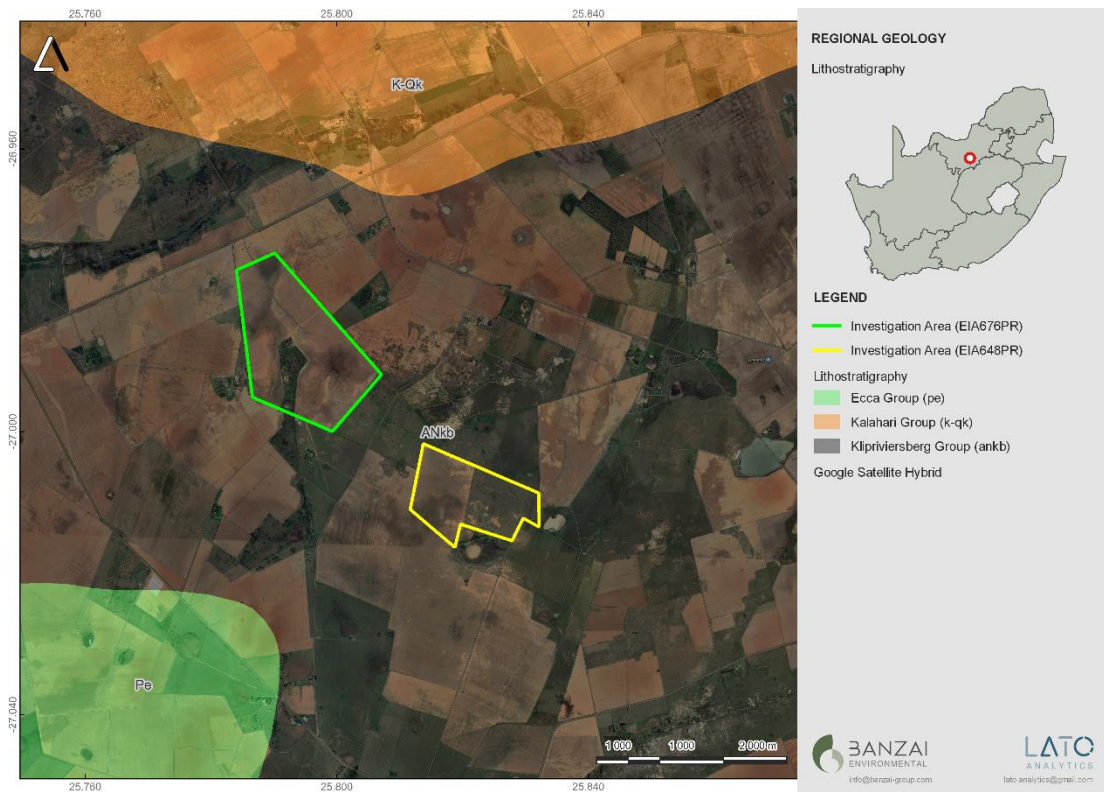


Figure 6: Updated Geology (Council of Geosciences, Pretoria) indicates that the proposed study area near Wolmaransstad in the North West Province is underlain by Klipriviersberg Group of the Ventersdorp Supergroup.

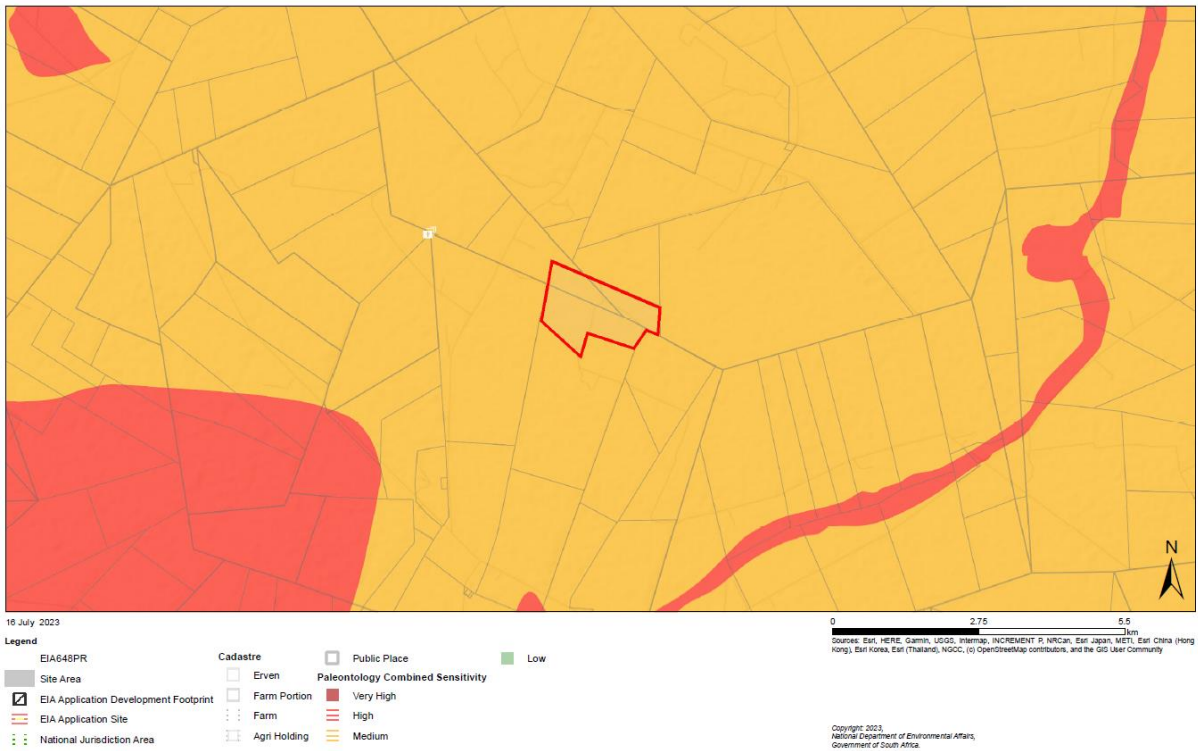


Figure 7: Palaeontological Sensitivity of the EIA648 Prospecting right study area by the National Environmental Web-bases Screening Tool.

The DFFE Screening tool indicates that the Palaeontological Sensitivity of the proposed EIA648 PR application is medium (yellow).

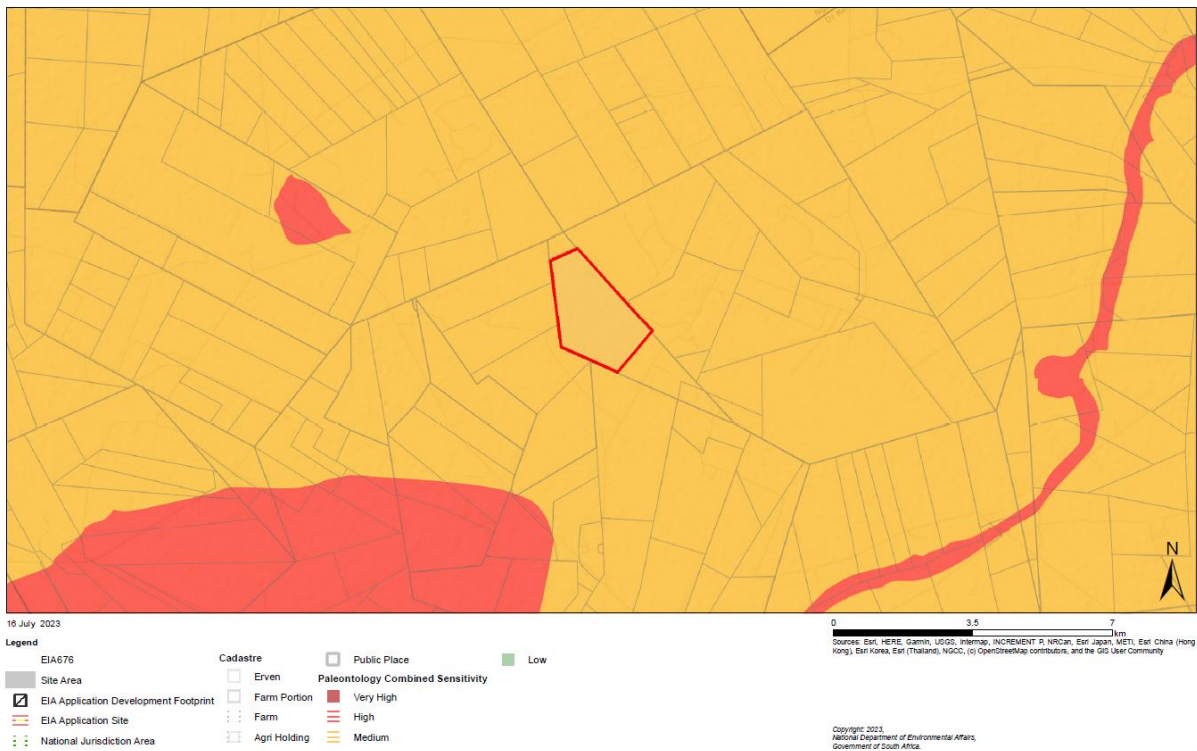


Figure 8: Palaeontological Sensitivity of the EIA676 Prospecting right study area by the National Environmental Web-bases Screening Tool.

The DFFE Screening tool indicates that the Palaeontological Sensitivity of the proposed EIA676 PR application is medium (yellow).

The Palaeontological Sensitivity of the DFFE screening tool thus indicates that the Palaeontological Sensitivity of the study areas are Medium while that of the SAHRIS Palaeomap (Figure 5, Table 6) indicates a Low Palaeontological Sensitivity.

6 GEOGRAPHICAL LOCATION OF THE SITE

The property is located approximately 34km West of the town of Wolmaransstad in the North-West Province (Figure 1-2).

Table 7: GPS coordinates

Farms	Latitude	Longitude
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<p>Portion 13 (portion of portion 6) of the farm Vogelstruiskuil 400 Registration Division: IO Title Deed: T10320/1980 Extent: 44.7444 hectares North-West Province</p>	49° 55,609''' E	27° 0' 31,279''' S
	25° 49' 9,009''' E	27° 0' 13,886''' S
	25° 48' 49,533''' E	27° 0' 6,402''' S
	25° 48' 46,809''' E	27° 0' 19,476''' S
	25° 48' 41,926''' E	27° 0' 39,786''' S
	25° 49' 7,433''' E	27° 0' 58,954''' S
	25° 49' 10,797''' E	27° 0' 46,996''' S
	25° 49' 40,164''' E	27° 0' 55,610''' S
	25° 49' 46,751''' E	27° 0' 43,769''' S
<p>Portion 14 (portion of portion 2) of the farm Boschplaats 149 Registration Division: HO Title Deed: T10320/1980 Extent: 40.9088 hectares North-west Province</p>	25° 49' 55,795''' E	27° 0' 48,228''' S
<p>Portion 24 of the farm Welverdiend 151 Registration Division: HO Title Deed: T10320/1980 Extent:107.0699 hectares</p>		

7 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- A Google Earth map with polygons of the proposed development was obtained from Milnex CC.
- 1:250 000 Christiana 2724 Geological map (1996) (Council of Geoscience, Pretoria)
- 1:250 000 Vryburg 2624 Vryburg (1993) Geological map (Council of Geoscience, Pretoria)
- Updated geology produced by the Council of Geosciences, Pretoria.
- PIAs in the Bloemhof district include that of Rubidge 2018



8 ASSESSMENT METHODOLOGY

8.1 Impact Rating System

Impact assessment must take account of the nature, scale, and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

<i>Table 8: The rating system</i>		
NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		



This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		



Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		



This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		
The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.



6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity

Table 9: Summary of Impacts

Impacts	Extent	Duration	Magnitude	Reversibility	Irreplaceable loss	Cumulative effect	Impact Significance
	1	4	1	4	4	2	14 Low

9 FINDINGS AND RECOMMENDATIONS

The proposed development is underlain by the Klipriviersberg Group of the Ventersdorp Supergroup. The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Klipriviersberg Group is Low. (Almond and Pether, 2009; Almond *et al.*, 2013). The updated geology (Council for Geosciences) refined the geology and also indicates that the study area is underlain Klipriviersberg Group of the Ventersdorp Supergroup.



An overall Low palaeontological significance is allocated to the development footprint. It is therefore considered that the proposed development will not lead to detrimental impacts on the palaeontological reserves of the area and construction of the development may be authorised in its whole extent.

If Palaeontological Heritage is uncovered during surface clearing and excavations the **Chance find Protocol** attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.



10 CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

10.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act No 25 of 1999) (NHRA)**. According to Section 3 of the Act, all Heritage resources include **“all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens”**.

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

10.2 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box



4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za. The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.

- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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APPENDIX A

ELIZE BUTLER

PROFESSION: Palaeontologist

YEARS' EXPERIENCE: 30 years in Palaeontology

EDUCATION: B.Sc Botany and Zoology, 1988
University of the Orange Free State

B. Sc (Hons) Zoology, 1991
University of the Orange Free State

Management Course, 1991
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant Department of Zoology & Entomology
University of the Free State Zoology 1989-1992

Part time laboratory assistant Department of Virology
University of the Free State Zoology 1992

Research Assistant National Museum, Bloemfontein 1993 – 1997

Principal Research Assistant National Museum, Bloemfontein
and Collection Manager 1998–currently

TECHNICAL REPORTS



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- Butler, E. 2018. Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.
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