



PALAEONTOLOGICAL
DESKTOP ASSESSMENT:
NENDIFUSION
PROSPECTING RIGHT
APPLICATION NEAR
GLAUDINA, NORTH WEST
PROVINCE

NW30/5/1/1/2/13493PR

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

CONTACT PERSON:

Elize Butler

Tel: +27 844478759

Email: info@banzai-group.com

SIGNATURE:



This Palaeontological Desktop 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: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

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 3 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 3 – 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 5 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 6 – 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 11	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1 & 12	



Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 8 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 & 12	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 12	
(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 6 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 8.1 – 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 12	
(k) Any mitigation measures for inclusion in the EMPr	Section 13	
(l) Any conditions for inclusion in the environmental authorisation	Section 13	



Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 13	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 & 12	
(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 12	-
(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 Management



Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
		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** (PDA) to assess the Palaeontology of the Prospecting Right application to prospect for Diamonds (Alluvial) & Diamonds (General), including associated infrastructure, near Glandina on the Remaining Extent of Portion 17 (portion of Portion 16), Portion 19 (portion of Portion 17), Portion 26 (portion of Portion 17) of the Farm Doornhoek 165 & Portion 7 (portion of Portion 2) of the Farm Vleeschkraal 145, Registration Division HO, North West Province. In accordance with 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 PIA is necessary to confirm if fossil material could potentially be present in the planned development area and to evaluate the potential impact of the proposed development on the Palaeontological Heritage of the area.

The geological maps as well as updated geology (Council for Geosciences) indicates that the proposed Nendifusion Prospecting Right Application near Glandina in the North West Province is underlain by the Eccca Group as well as the Bothaville Formation (Platberg Group, Ventersdorp Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Eccca Group is High while that of the Bothaville Formation is Low, thus requiring a Chance Finds Protocol that is included in this report (Almond *et al*, 2013; SAHRIS website). A Low Palaeontological significance has been allocated to the proposed development and it is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager must report to 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 carry out by a paleontologist.

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.



It is therefore considered that the proposed Prospecting Right Application will not lead to detrimental impacts on the palaeontological reserves of the area. From a Palaeontological perspective the construction of the development may be authorised in its whole extent.

Impact Summary

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Pre-Mitigation Prospecting Right Application Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	30	Negative Medium impact	15	Negative Low impact



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1 INTRODUCTION

Milnex CC was commissioned by Nendifusion (Pty) Ltd to conduct the Scoping and EIA process for the Prospecting Right application to prospect for Diamonds (Alluvial) & Diamonds (General), including associated infrastructure, near Gludina on the Remaining Extent of Portion 17 (portion of Portion 16), Portion 19 (portion of Portion 17), Portion 26 (portion of Portion 17) of the Farm Doornhoek 165 & Portion 7 (portion of Portion 2) of the Farm Vleeschkraal 145, Registration Division HO, North West Province. In turn Banzai Environmental Pty Ltd was appointed to conduct the Palaeontological Desktop Assessment for the project.

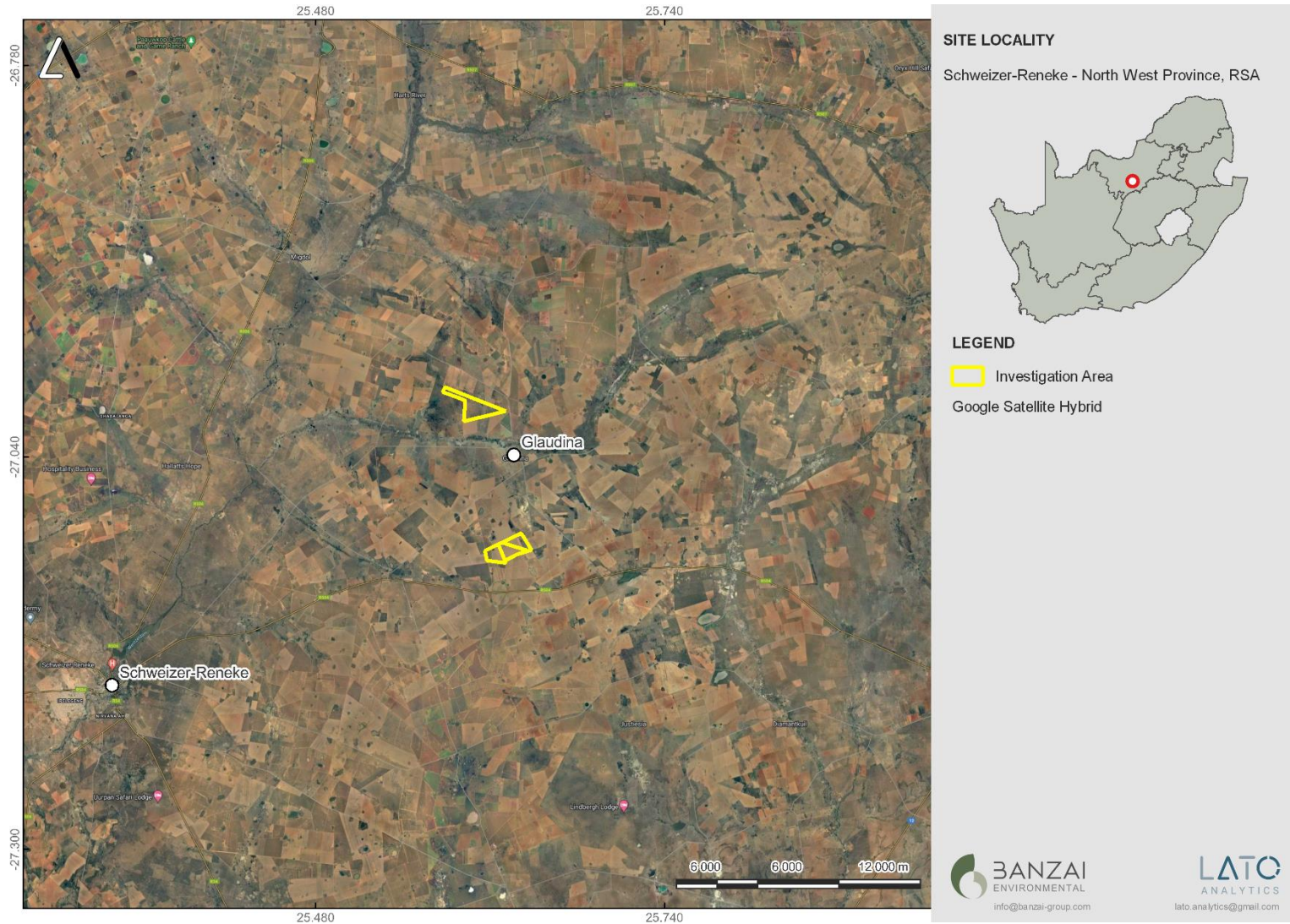


Figure 1: Google Earth Image (2023) indicating the regional locality of the proposed Nendifusion Prospecting Right Application near Glaudina in the North West Province.

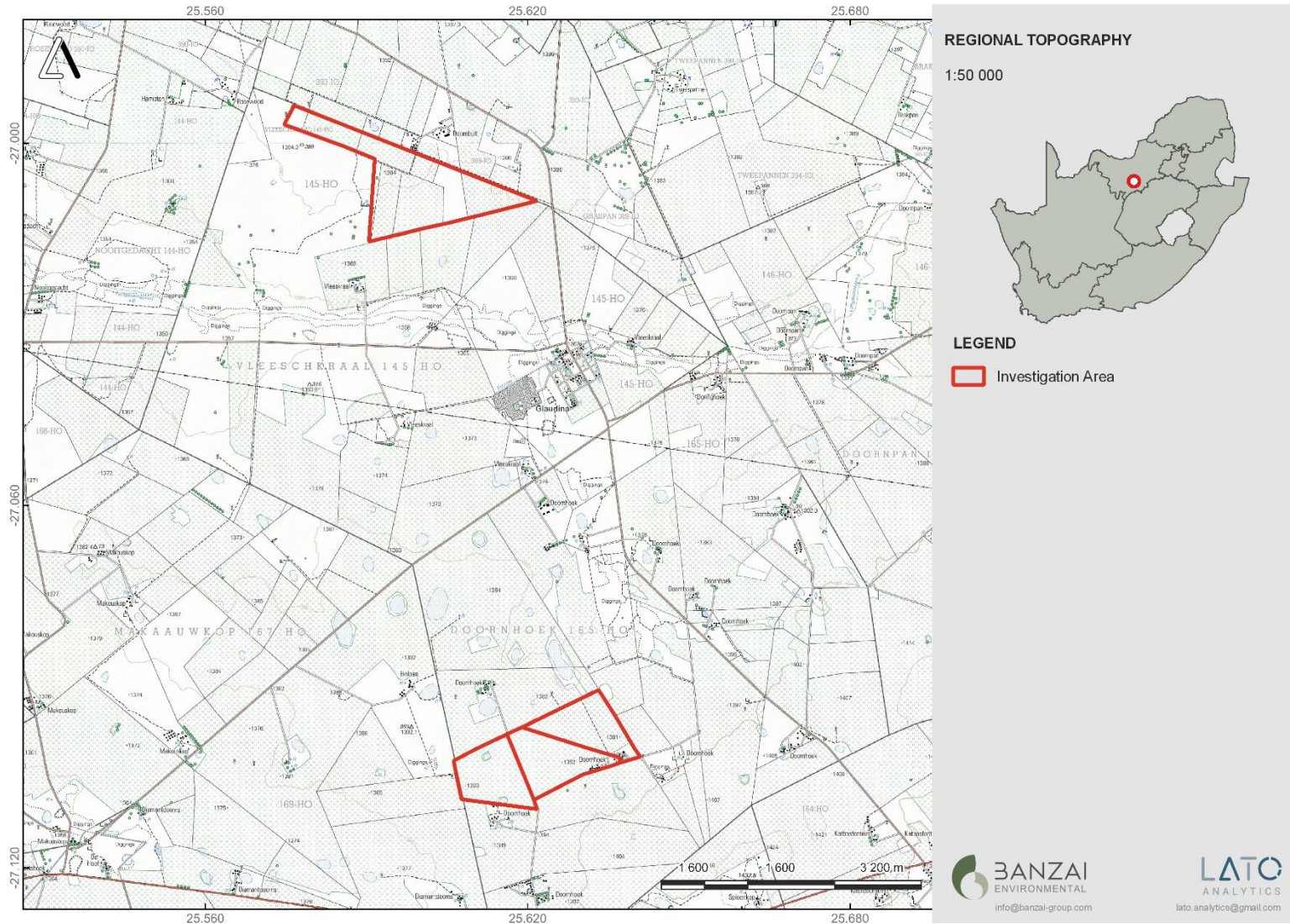


Figure 2: Regional topography of the proposed Nendifusion Prospecting Right Application near Gludina in the North West Province.



2 LEGAL MANDATE AND PURPOSE OF THE REPORT

The National Environmental Management Act (Act 107 of 1998) Section 24(5) stipulates that "listed activities" require environmental authorization by means of a Basic Assessment. Government Notice No. 982 of December 2014 EIA Regulations (as amended in April 2017) identifies the following listed activities as requiring environmental authorization:

Listing Notices: 2017 Regulations as amended	
Description of the overall activity. (Indicate Mining Right, Mining Permit, Prospecting right, Bulk Sampling, Production Right, Exploration Right, Reconnaissance permit, Technical co-operation permit, Additional listed activity)	Listing Notice 1, (GNR 327), Activity 19: 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;
	Listing Notice 1, GNR 327, Activity 20 (Amended GNR 517: 2021): "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"
	Listing Notice 1, GNR 327, Activity 27:" The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation."
	Listing Notice 2, GNR 325, Activity 19 (As Amended GNR 517: 2021): "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 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.
	Listing Notice 3, GNR 324, Activity 4: The development of a road wider than 4 metres with a reserve less than 13,5 metres. (h) North West iv. Critical Biodiversity Areas as identified in systematic biodiversity plans adopted by the Competent Authority.



<p>Listing Notice 3, GNR 324, Activity 10: 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.</p> <p>Listing Notice 3, GNR 324, Activity 12: The clearance of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan (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.</p>
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3 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler, palaeontologist of Banzai Environmental (Pty) Ltd. 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-eight years. She has 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 (PSSA) since 2006 and has been conducting PIAs since 2014.

A curriculum vitae is included in Appendix 1 of this specialist input report

4 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

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.

5 OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the “SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports” the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

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).

6 GEOLOGICAL AND PALAEOLOGICAL HISTORY

The geology of the proposed Nendifusion Prospecting Right Application near Gludina in the North West Province is depicted on the 1: 250 000 Christiana 2724 (1994) and 2824 Kimberley (1994) Geological Maps (Council for Geosciences, Pretoria) (**Figure 3, Table 2-3**). The southern portion of the proposed development is entirely underlain by the Eccca Group (Pe, khaki; Karoo Supergroup), while the northern portion of the development is underlain by the Bothaville Formation (Rb/Rbt, brown; Platberg Group, Ventersdorp Supergroup). In this area the Eccca Group is undifferentiated.

According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) (**Figure 4**) the Palaeontological Sensitivity of the Eccca Group is High, while that of the Bothaville Formation is Low. Due to the Low Palaeontological Sensitivity of the Bothaville Formation a Chance Finds Protocol was added to the report (Almond *et al*, 2013; SAHRIS website). The geology has recently been updated (Council of Geosciences, Pretoria) and also indicates that the proposed



development is underlain by the Eccca Group, (Karoo Supergroup) as well as the Bothaville Formation (Ventersburg Supergroup (**Figure 5**).

The Eccca Group (Karoo Supergroup) is a sedimentary rock sequence. This Group is Early to Late Permian in age (~289–253 Ma). The Eccca group in the study area is undifferentiated. This Permian Group consists of dark grey shale, mudstone and fine-grained sandstone (**Table 2-3**). These shale and fine-grained sandstones of the Eccca are deeply weathered and rarely exposed. Weathered outcrops are usually restricted but if present the weathering expose thinly bedded, highly weathered shale with well-defined bedding planes. These sediments are interpreted to be deep-water deposit of clays and silts in the Eccca Sea. The topography of the study area is that of rolling hills with relatively deeply incised valleys.

Trace fossils and abundant plant fossils are known from the deep-water deposits of this Group. The plant fossils are especially abundant in the sandstone rich units in the northern parts of the Basin. The first occurrence of the bivalve *Megadesmus* is reported from the upper Volksrust Shale Formation in the north-eastern Karoo Basin. This genus is well-known in deposits in India, Siberia, Australia, and South America. This is the first reported occurrence of this bivalve genus in Africa. This fossil has both valves articulated indicating minimal transport after death. This large fossil was enclosed in interbedded shale-siltstone indicating a deltaic deposition at the Beaufort -Eccca Boundary (Cairncross *et al*, 2005).

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 as well as 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).

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.

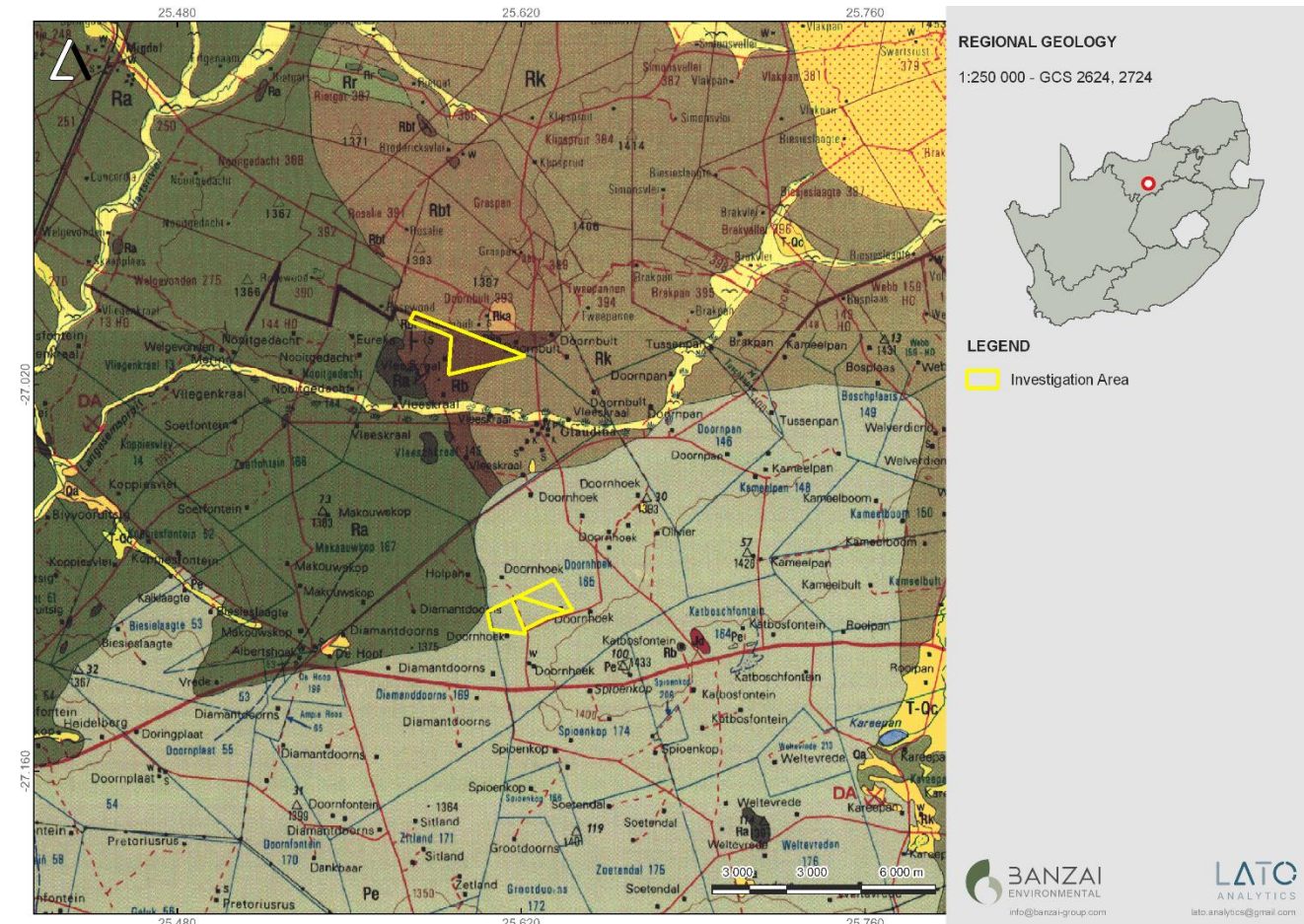


Figure 3: Extract of the 1:250 000 Christiana 2724 (1994) and 2824 Kimberley (1994) Geological Maps (Council for Geosciences, Pretoria) indicating that the Nendifusion Prospecting Right Application near Gladina in the North West Province is underlain by the Ecca Group as well as the Bothaville Formation (Platberg Group, Ventersdorp Supergroup).

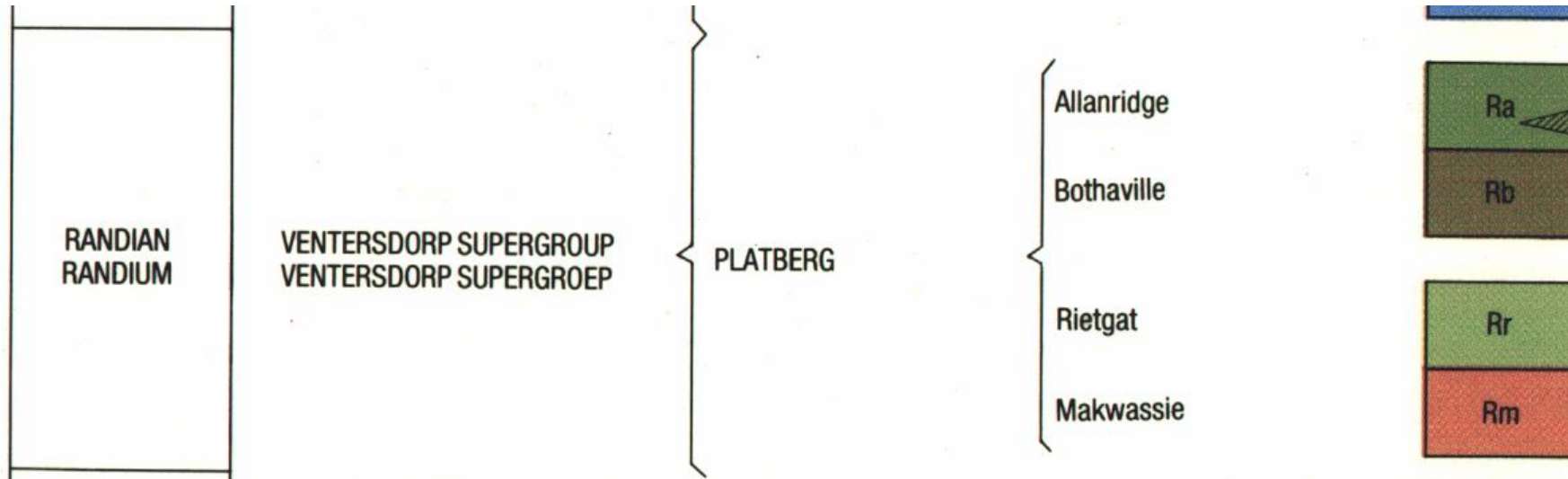


Table 2: Legend of the 1:250 000 Christiana 2724 (1994) Geological Map (Council for Geosciences, Pretoria) indicating the Nendifusion Prospecting Right Application near Glaudina in the North West Province.



	SUPERGROEP SUPERGROUP	GROEP GROUP	SUBGROEP SUBGROUP	FORMASIE FORMATION	DAGSOOM OUTCROP	SUBDAGSOOM SUBOUTCROP										
KWARTÊR QUATERNARY		KALAHARI	}	Gordonia			~	Alluvium								
					Qw	Qa	Rivierterrasgruis; diamanthoudend op plekke									
					Qg	Qg	Rooibruin tot vleeskleurige eoliese sand									
					Qa	Qa	Red-brown to flesh-coloured aeolian sand									
					T-Qc	Dw	Eoliese sand									
TERSIÊR TERTIARY							-Qc	Kalkreet								
JURA JURASSIC							Jd	Doleriet								
PERM PERMIAN	KAROO SUPERGROEP/ SUPERGROUP	ECCA (Pe)	}	Volksrust (Pvo)			Pe	Pe	Pe	Pe	Pe	Sandsteen en skalie	Pvo	Skalie en ondergeskikte sandsteen	Pv	Sandsteen en ondergeskikte skalie
				Vryheid (Pv)			-Pd	-Pd	Tilliet, moddersteen, skalie, rolblokskalie en sandsteen							
KARBOON CARBONIFEROUS		DWYKA (C-Pd)					C-Pd									



Table 3: Legend of the 1:250 000 Kimberley 2824 (1994) Geological Map (Council for Geosciences, Pretoria) indicating the Nendifusion Prospecting Right Application near Glaudina in the North West Province.



Lithology

- Ra Andesite, in places amygdaloidal and/or porphyritic; quartzite and conglomerate lens near bottom ()
Andesiet, op plekke amandelhoudend en/of porfirities; kwartsiet-en-konglomeraatlens naby onderkant ()
- Rb Quartzite, conglomerate
Kwartsiet, konglomeraat
- Rm Quartz-porphyry
Kwartsporfier
- Rr Andesite, dacite, volcanic breccia, tuff, chert
Andesiet, dasiet, vulkaniese breksie, tuf, chert

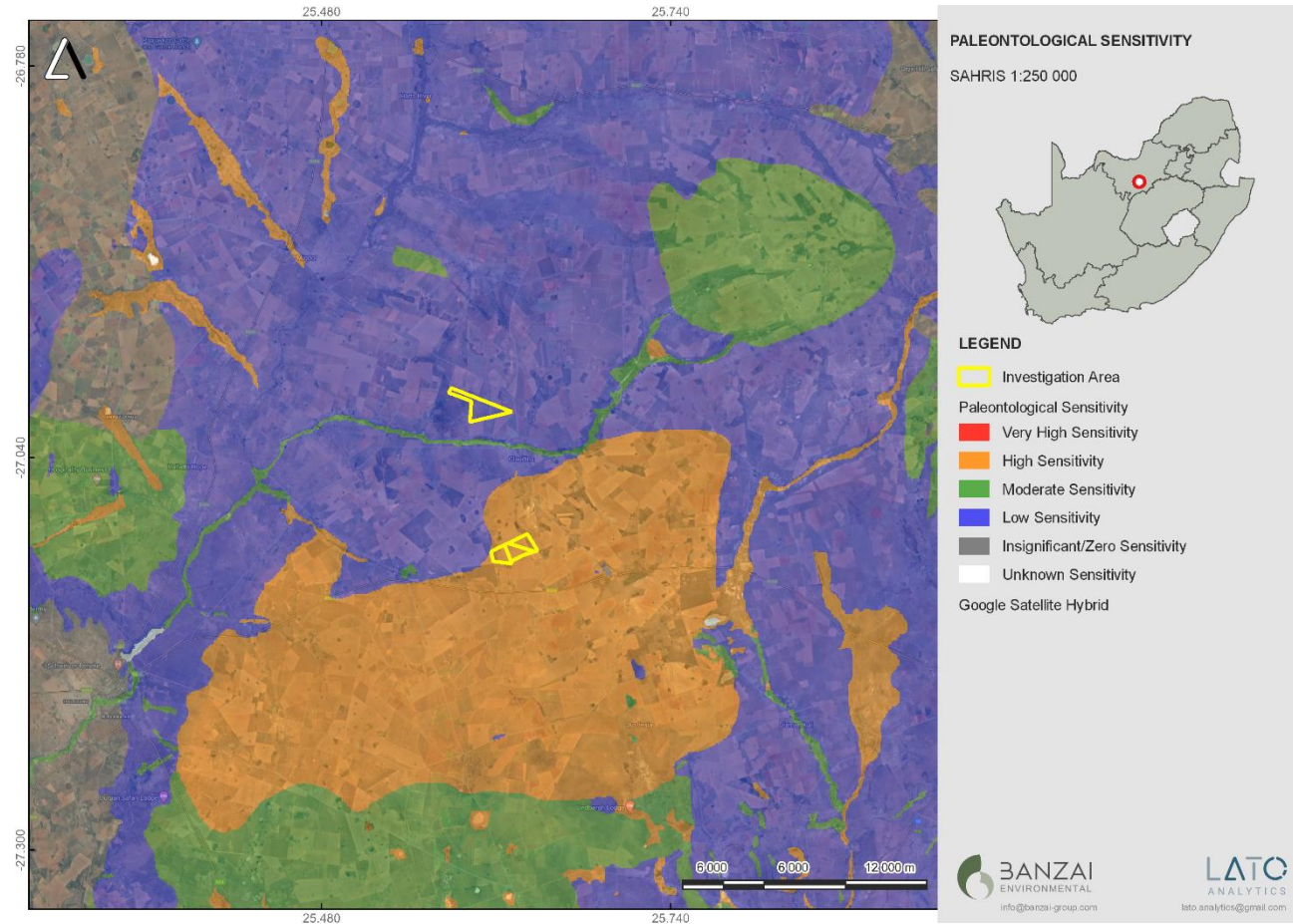


Figure 4: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the Nendifusion Prospecting Right Application near Glaudina in the North West Province



Table 4: 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.

The SAHRIS Palaeosensitivity map (**Figure 4**) indicates that the proposed development is underlain by sediments with a High (orange) Palaeontological Sensitivity.

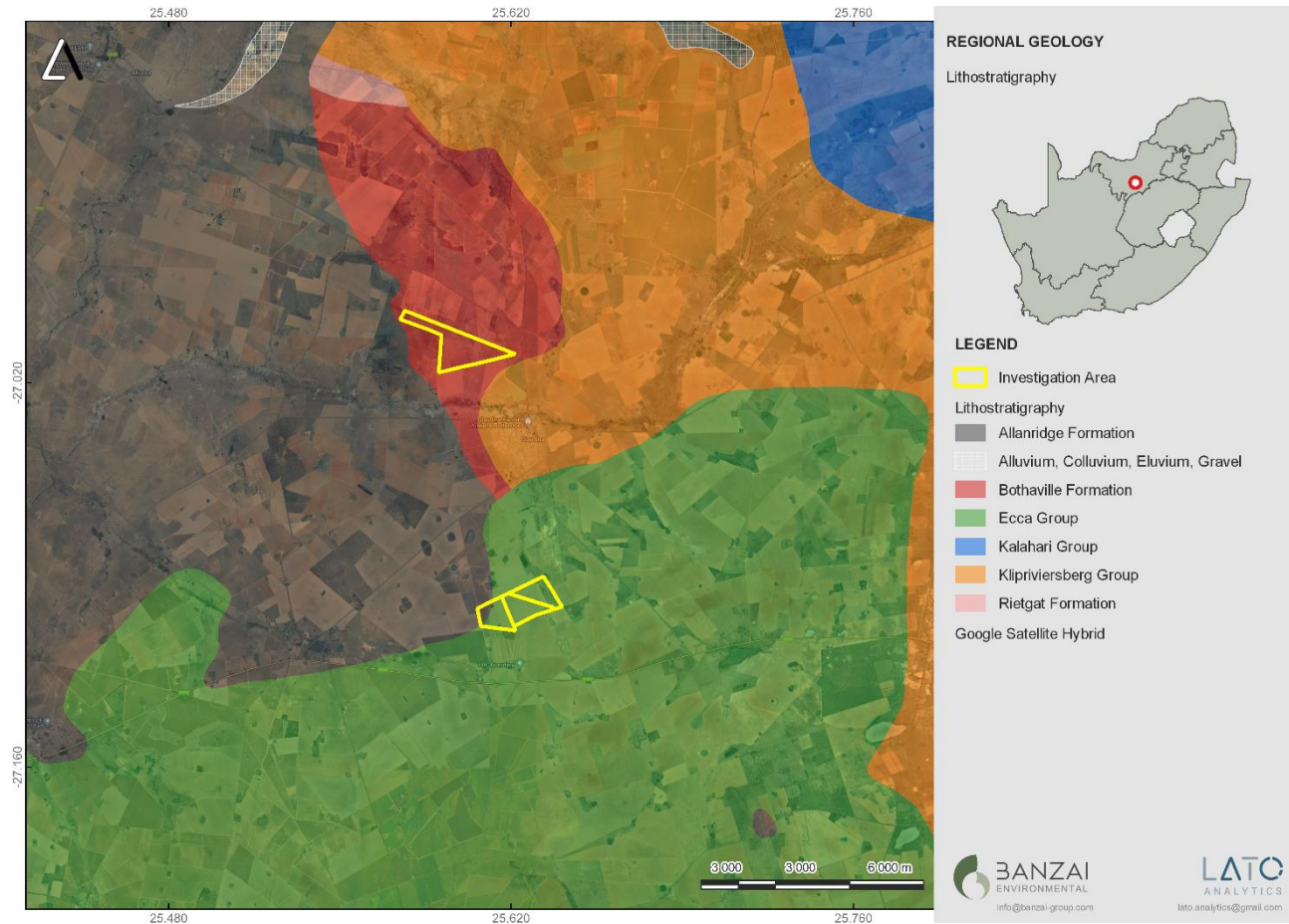


Figure 5: Updated Geology (Council of Geosciences, Pretoria) of the Nendifusion Prospecting Right Application area indicates that the area is underlain by the Bothaville Formation (Ventersdorp Group) as well as the Eccca Group.



7 GEOGRAPHICAL LOCATION OF THE SITE

Table 5:Farm descriptions	
Farm Name:	Remaining extent of portion 17 (portion of portion 16) of farm Doornhoek 165 Registration division: HO Extent: 133.1534 Ha Title deed: T21251/1996 Province: North West
	Portion 19 (portion of portion 17) of the farm Doornhoek 165 Registration division: HO Extent: 128.4798 Ha Title deed: T21251/1996 Province: North West
	Portion 26 (portion of portion 17) of the farm Doornhoek 165 Registration division: HO Extent: 128.4798 Ha Title deed: T21251/1996 Province: North West
	Portion 7 (portion of portion 2) of the farm Vleeschkraal 145 Registration: HO Extent: 355.6606 hectares Title Deed: T67136/2009 Province: North West
Application area (Ha)	745.7736ha
Magisterial district:	Dr Ruth Segomotsi District Municipality Mamusa Local Municipality
Registration division:	HO
Distance and direction from nearest town	The property is located approximately 28.5km East of Schweizer Reneke in the North West Province.
21-digit Surveyor General Code for each farm portion	T0H000000000014500007 T0H000000000016500000 T0H0000000000165000019 T0H0000000000165000026
Minerals applied for	Diamonds Alluvial (DA) Diamonds General (D)

8 METHODS

The aim of a desktop study is to evaluate the possible risk to palaeontological heritage in the proposed development. This includes all trace fossils as well as all fossils in the proposed footprint. All possible information is consulted to compile a desktop study, and this includes the following: all Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

8.1 7.1 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.

9 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 (1994) Geological Map (Council for Geosciences, Pretoria)

10 IMPACT ASSESSMENT METHODOLOGY

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 following project phases:

- Construction;
- Operation; and
- 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:

Table 6: The rating system

NATURE		
The Nature of the Impact is the possible destruction of fossil heritage		
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 (1) + probability 3) + reversibility (4) + irreplaceability (4) + duration (4) + cumulative effect (2)] x magnitude/intensity (3). 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



10.1 Summary of Impact Tables

Loss of fossil heritage will be a negative impact. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur.

Table 7: Summary of Impacts
(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

	Extent	Duration	Magnitude	Reversibility	Irreplicable loss	Cumulative effect	Impact
Pre-Mitigation	1	4	2	4	4	2	30
Post-Mitigation	1	4	1	4	4	2	15

11 FINDINGS AND RECOMMENDATIONS

The geological maps as well as updated geology (Council for Geosciences) indicates that the proposed Nendifusion Prospecting Right Application near Glaudina in the North West Province is underlain by the Ecca Group as well as the Bothaville Formation (Platberg Group, Ventersdorp Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Ecca Group is High while that of the Bothaville Formation is Low requiring a Chance Finds Protocol that is included in this report (Almond *et al*, 2013; SAHRIS website). A Low Palaeontological significance has been allocated to the proposed development and it is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area.

However, if fossil remains are discovered during any phase of construction, either on the surface or exposed by excavations the **Chance Find Protocol** must be implemented by the ECO/site manager in charge of these developments. These discoveries ought to be protected (if possible, *in situ*) and the ECO/site manager must report to 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 carry out by a paleontologist.



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.

It is therefore considered that the proposed Prospecting Right Application will not lead to detrimental impacts on the palaeontological reserves of the area. From a Palaeontological perspective the construction of the development may be authorised in its whole extent.

12 CHANCE FINDS PROTOCOL

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

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.



12.1 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

CURRICULUM VITAE: 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 and Collection Manager	National Museum, Bloemfontein 1998–2022

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