



PGS HERITAGE

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED DOMINION 3 SOLAR PARK NEAR KLERKSDORP WITHIN THE NORTH-WEST PROVINCE

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PGS Project No: 608HIA



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.

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SIGNATURE:

ACKNOWLEDGEMENT OF RECEIPT

Report Title	Palaeontological Desktop Assessment for the proposed Dominion 3 Solar Park near Klerksdorp within the North-West Province		
Control	Name	Signature	Designation
Author	Elize Butler		Palaeontologist
Reviewed			Archaeologist/Heritage Specialist/Project Manager – PGS Heritage

This Palaeontological 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	Relevant section in 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 vitae	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 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9	-
(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 7 Approach and Methodology	-
(f) details of an assessment of the specific identified sensitivity of the	Section 1 and 10	

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;		
(g) An identification of any areas to be avoided, including buffers	Section 5	No buffers or areas of sensitivity identified
(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 7.1 – 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 10	
(k) Any mitigation measures for inclusion in the EMPr	Section 1 and 10	
(l) Any conditions for inclusion in the environmental authorisation	Section 1 and 10	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 1 and 10	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 10	
(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	Section 1 and 10	-

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Relevant section in report	Comment where not applicable.
thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan		
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	
(p) A summary and copies if any comments that were received during any consultation process	N/A	
(q) Any other information requested by the competent authority.	N/A	
(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 PGS Heritage (Pty) Ltd to conduct the Palaeontological Desktop Assessment (PDA) to assess the proposed Dominion 3 Solar Park, located on the Remaining Extent of Portion 11 of Farm 425, and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province. This Solar Park forms Part of the Dominion Solar PV Cluster near Klerksdorp. 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 PDA 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 proposed Dominion 3 Solar Park is underlain by the Rietgat Formation (Platberg Group, Ventersdorp Supergroup). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Rietgat Formation is Moderate (Almond and Pether 2008, SAHRIS website).

It is therefore considered that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area. The construction and operation of the project may be authorised, as the whole extent of the development footprint is not considered sensitive in terms of palaeontological heritage. If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments 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 can be carry out by a palaeontologist.

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

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Appendix A:

Curriculum Vitae	Elize Butler
Curriculum Vitae	Prof. WA van der Westhuizen

TERMINOLOGY AND ABBREVIATIONS

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influences its stability and future well-being, including:

- construction, alteration, demolition, removal or change in use of a place or a structure at a place.
- carrying out any works on or over or under a place.
- subdivision or consolidation of land comprising a place, including the structures or airspace of a place.
- constructing or putting up for display signs or boards.
- any change to the natural or existing condition or topography of land; and
- any removal or destruction of trees, or removal of vegetation or topsoil

Fossil

Mineralized bones of animals, shellfish, plants, and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures, and equipment of cultural significance.
- places to which oral traditions are attached or which are associated with living heritage.
- historical settlements and townscapes.
- landscapes and natural features of cultural significance.
- geological sites of scientific or cultural importance.
- archaeological and palaeontological sites.
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Table 2: Abbreviations

Abbreviations	Description
AIA	Archaeological Impact Assessment
ASAP	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
ECO	Environmental Control Officer
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PDA	Palaeontological Desktop Assessment
PIA	Palaeontological Impact Assessment
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

1 INTRODUCTION

Red Rocket intends to develop a 100MW Photo Voltaic Solar Energy Facility (PVSEF) on the Remaining Extent of Portion 11 and Remaining Extent of Portion 31 of Farm 425, near Klerksdorp within the North-West Province. The proposed development is in the Klerksdorp REDZ. PGS Heritage (Pty) Ltd was employed by the Terramanzi Group to commence with a Heritage Impact Assessment (HIA) for the PV Project. In turn Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the Palaeontological Desktop Assessment (PDA) as part of the HIA.

2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This present study has been conducted by Mrs Elize Butler. She has conducted approximately 300 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-five 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.

The geology of this project was verified by Professor WA van der Westhuizen. He obtained his Ph.D. in geochemistry from the University of the Free State, South Africa, in 1984. He acted as departmental chairperson (Geology Department) from 1998 to 2013. He retired as full professor in 2015. Research in southern Africa includes the Ventersdorp Supergroup, volcanology, mineralogy, geology of eastern Namaqualand, vanadium deposits in the Otavi Mountainland. Consulting work was conducted in South Africa, Namibia, Zimbabwe, and Malawi. Prof van der Westhuizen was an author and co-author for more than 70 peer reviewed articles and more than 70 conference presentations at national and international level. Apart from being a registered professional scientist, up to his retirement he was a member of the following societies: Fellow of the Geological Society of SA, Archaeological Society of SA, International Association of Volcanology and Chemistry of the Earth's Interior, Spectroscopic Society of SA, International Liaison Group on Gold Mineralisation.

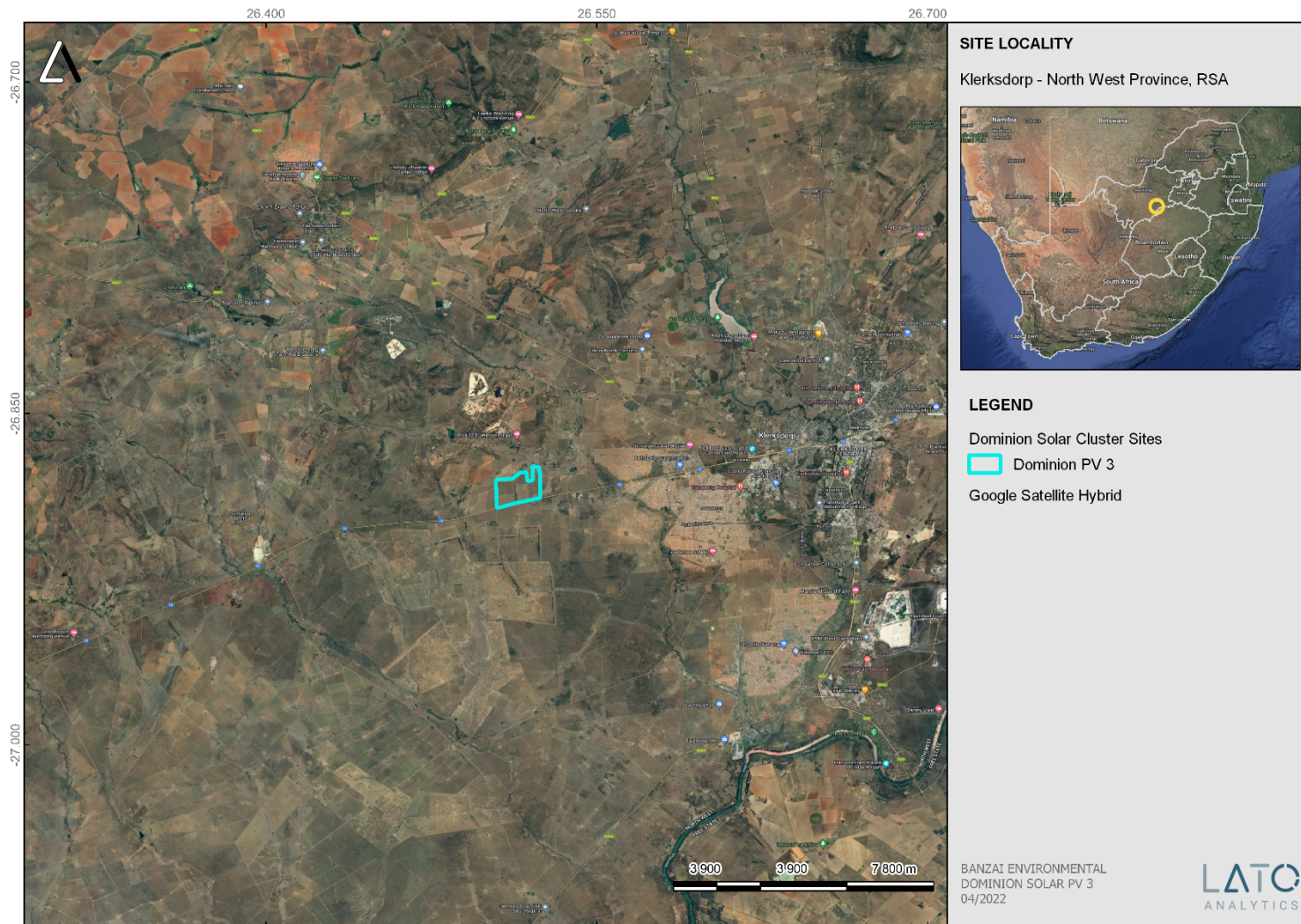


Figure 1: Google Earth Image (2022) depicting the proposed Dominion 3 Solar Park, located on the Remaining Extent of Portion 11 and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province.

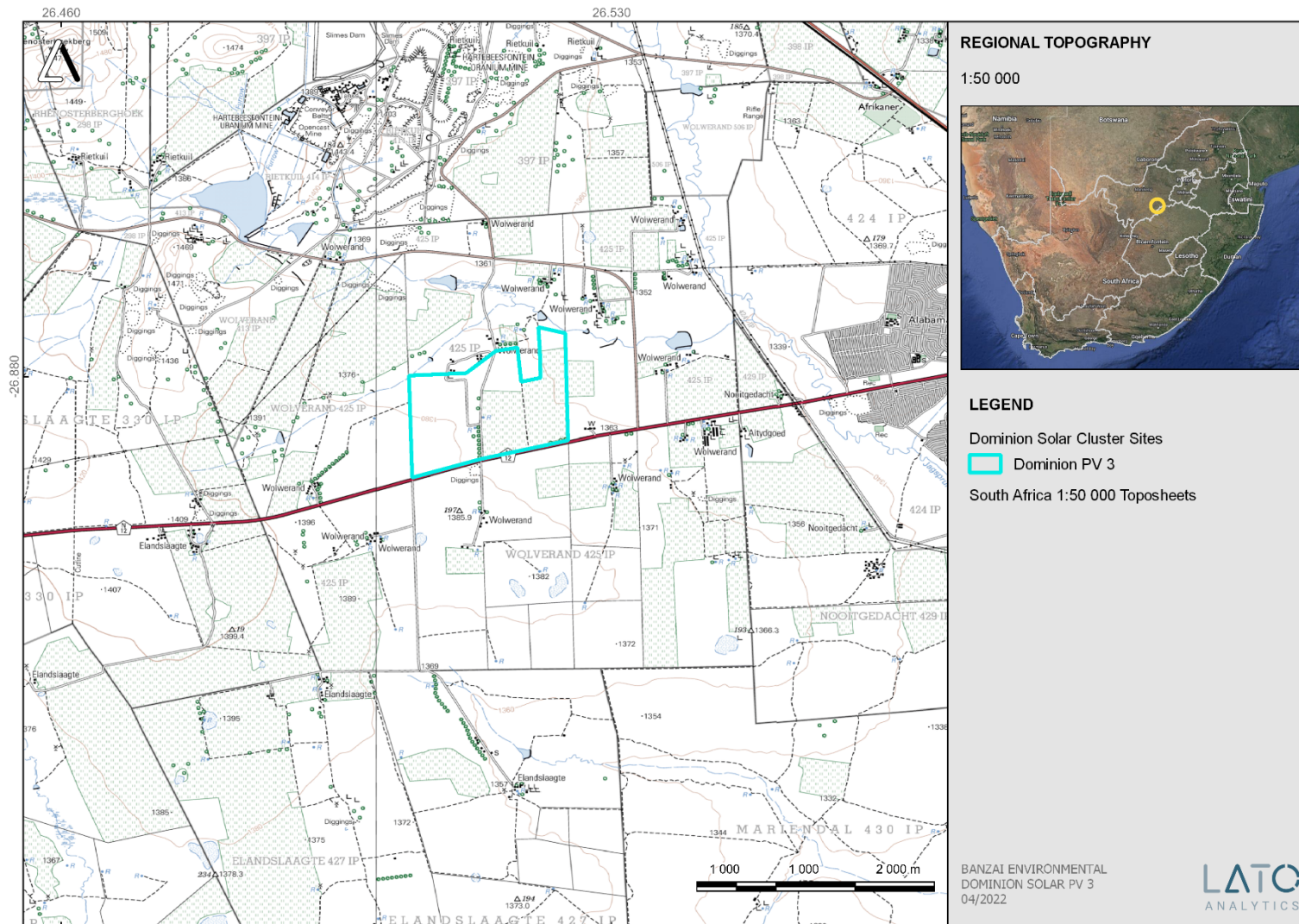


Figure 2: Extract of the 150 000 topographical map indicating the location of Dominion 3 Solar Park, located on the Remaining Extent of

Palaeontological Desktop Assessment for the proposed Dominion 3 Solar Park development

23 November 2022

Portion 11 and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province).

3 LEGISLATION

3.1 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 OBJECTIVE

The aim of a Palaeontological Impact Assessment (PIA) is to decrease the effect of the development on potential fossils at the development site.

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.

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.

Mitigation usually precede 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 as possible because our 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 sensitive areas to be avoided (providing shapefiles/kml's) 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** 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).

5 GEOLOGICAL AND PALAEOONTOLOGICAL HISTORY

The geology of the Dominion 3 Solar Park, located on Remaining Extent of Portion 11 and Remaining Extent of Portion 31 of Farm 425, near Klerksdorp within the North-West Province is depicted on the 1:250 000 Wes-Rand 2626 Geological Map (1986) (Council of Geoscience, Pretoria) (**Figure 3-6, Table 3**). The proposed development is underlain by the Rietgat Formation (R-Vr), (Platberg Group, Ventersdorp Supergroup). Recent Shape files compiled by the Council of Geosciences (Pretoria) is depicted on **Figure 6**. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Rietgat Formation is moderate (Figure 7; Almond and Pether 2008, SAHRIS website).

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 covers most of the distribution area of the Witwatersrand Supergroup as well as the Dominion Group.

Some of the best exposures of the Ventersdorp Supergroup are in the North West Province. 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 Platberg Group is subdivided in four formations namely the Kameeldoorns-, Goedgenoeg-, Makwassie-, and Rietgat Formations. The top of the Platberg Group is the Rietgat Formation. The Bothaville Formation overlies the Platberg Group with a pronounced unconformity (Winter, 1976). Winter further noted that there is no common lithology between the Bothaville Formation and the Allanridge Formation. Winter (1976) used the term Pniel Sequence for the Bothaville and the Allanridge Formations. The Pniel Sequence is not recognised by SACS. Formations of the Platberg Group 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 debris and scree flows as well as alluvial fan deposits.

The Platberg is mostly absent in the north-east of the Ventersdorp depository while the outcrops are erratic with changes in thickness. The Rietgat Formation consist of alternating sedimentary and volcanic rocks which varies in thickness across the basin. 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 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 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

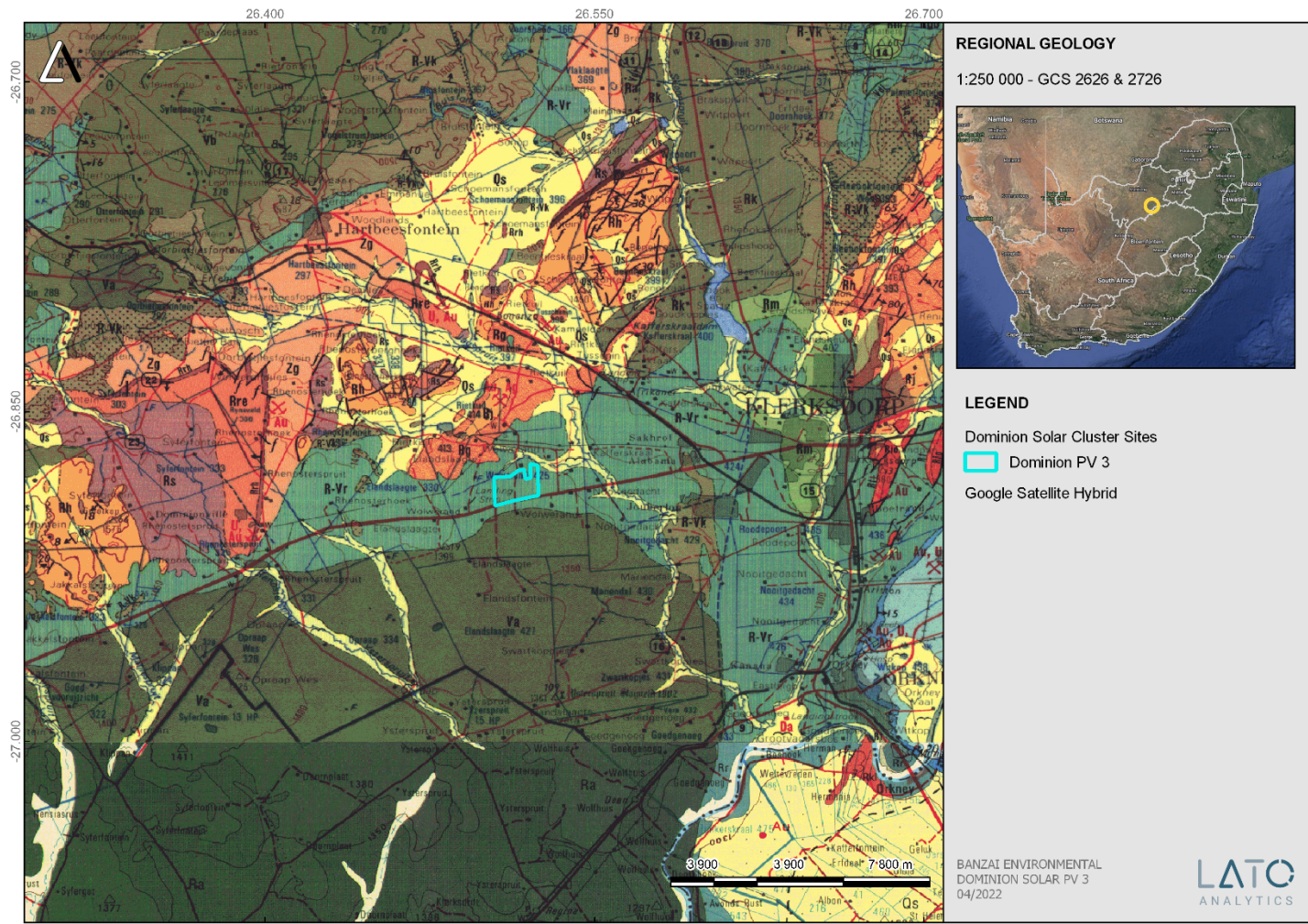


Figure 3: Extract of the 1:250 000 Wes-Rand 2626 (1986) and 2726 Kroonstad (2000) Geological Map (Council of Geoscience, Pretoria) indicating the surface geology of the proposed development in turquoise.

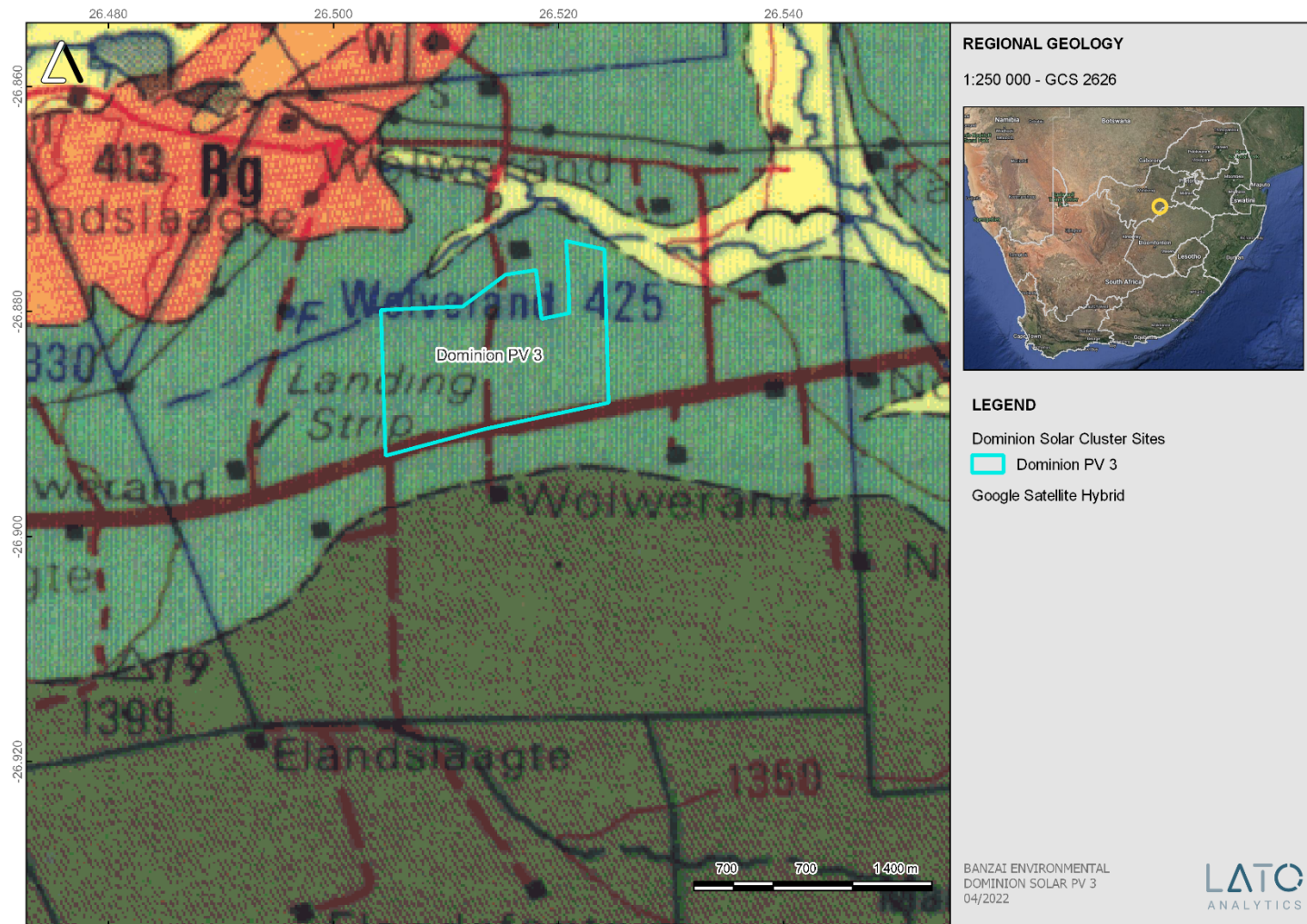
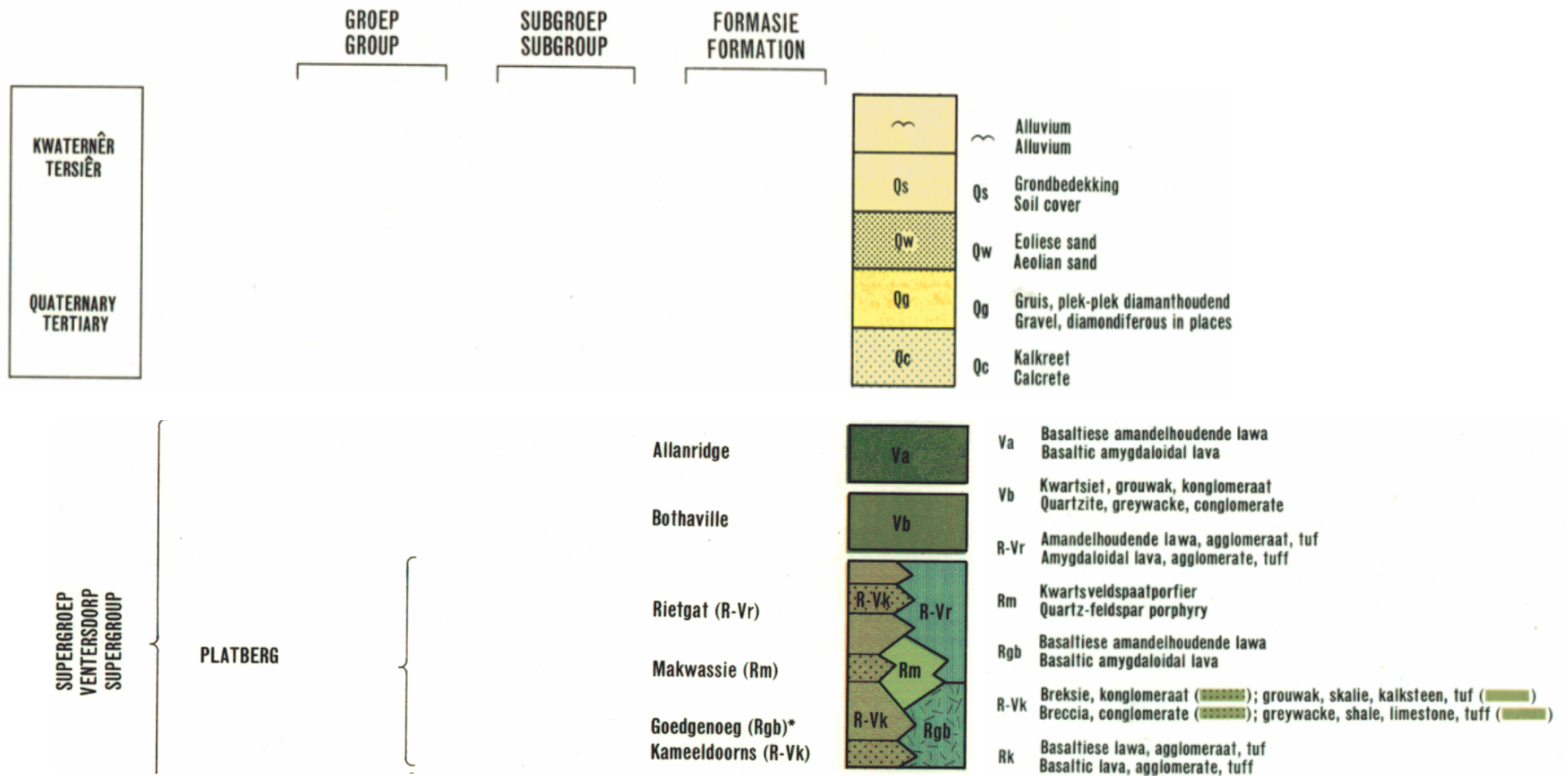


Figure 4: The proposed Dominion 3 Solar Park near Klerksdorp is underlain by the Rietgat Formation (R-Vr), (Platberg Group, Ventersdorp Supergroup).

Table 3: Legend and short explanation of the 2626 Wes-Rand Geological Map (1978) (Council of Geoscience, Pretoria)



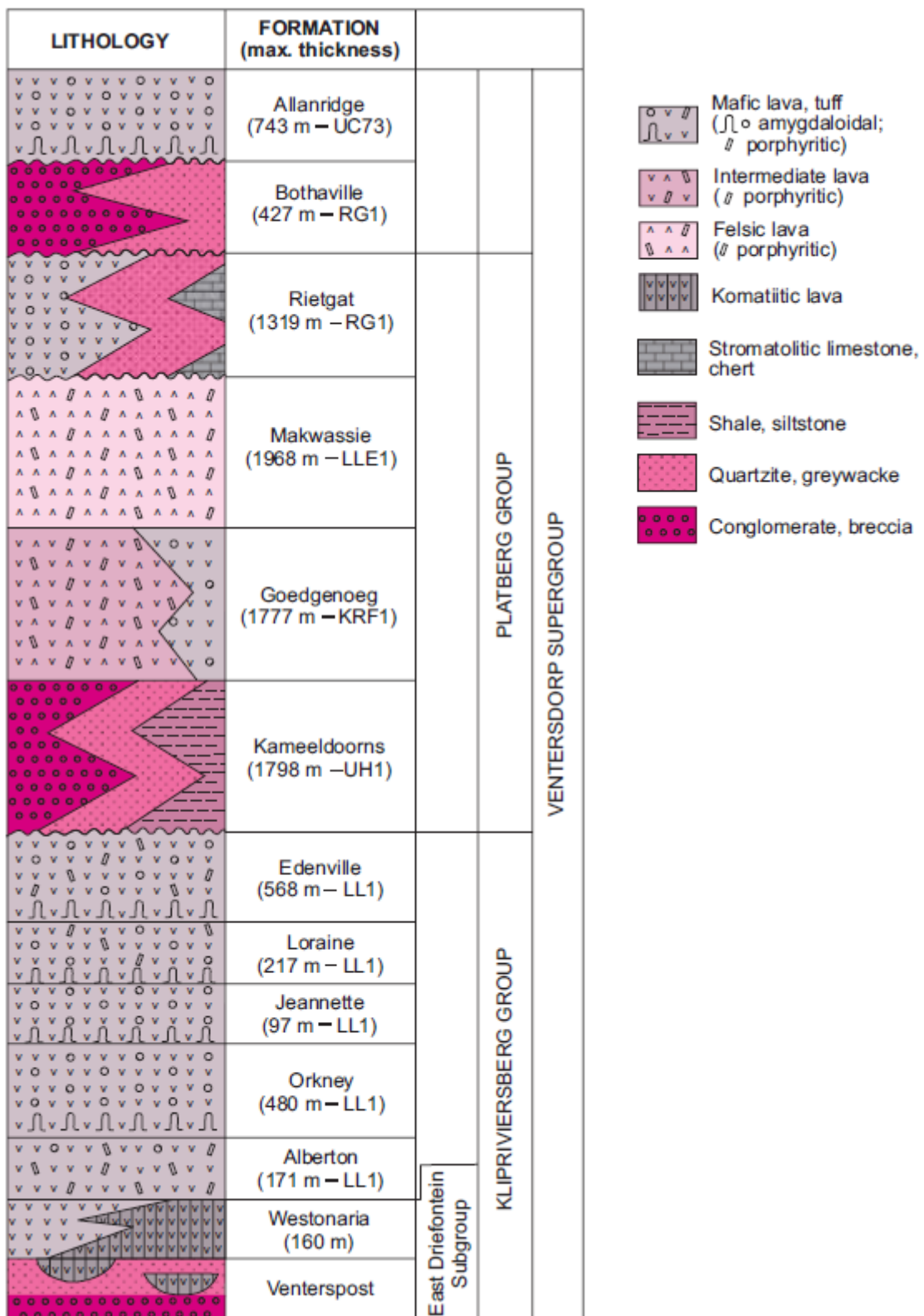


Figure 5: Ventersdorp stratigraphy (Taken from Van Der Westhuizen and Bruijn, 2006 after Winter, 1965, 1976; Linton et al., 1990 Meyers, 1990 and Meintjies, 1978).

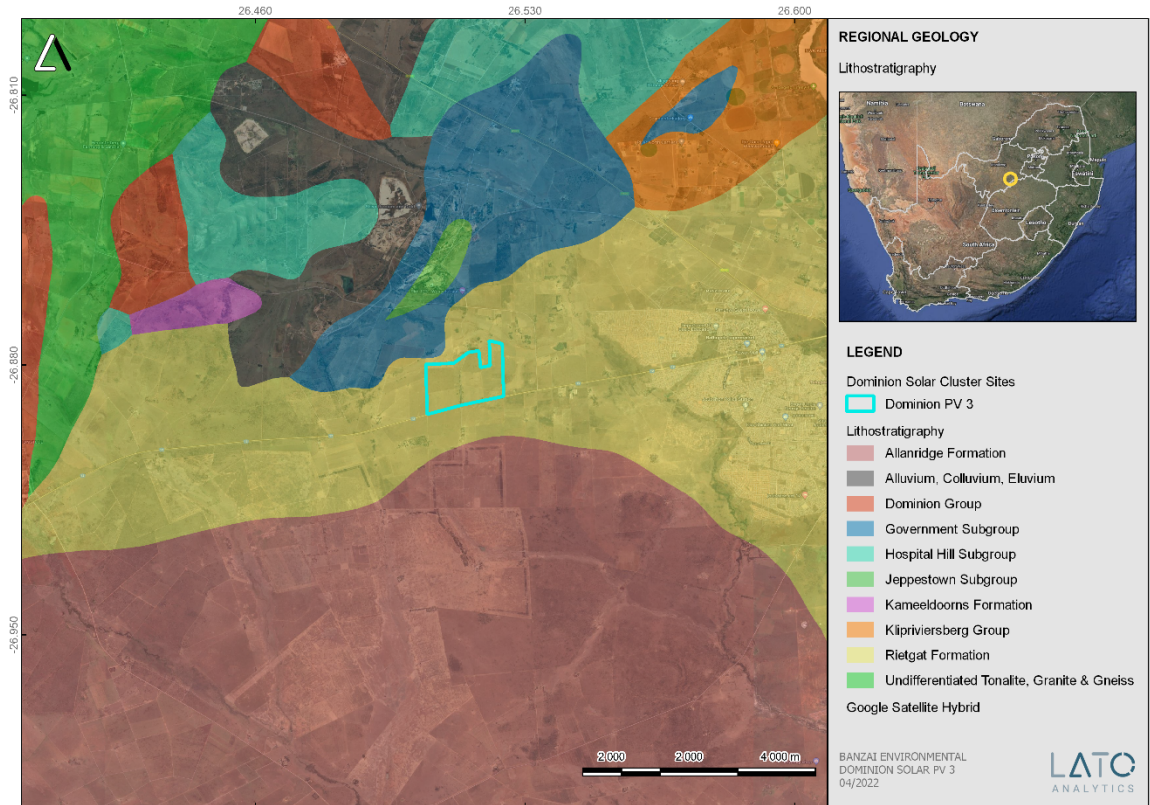


Figure 6: Shape files compiled by the Council of Geosciences (Pretoria) indicates that the proposed Dominion 3 Solar is located in the Rietgat Formation (Platberg Group, Ventersdorp Supergroup).

is depicted on Figure 6

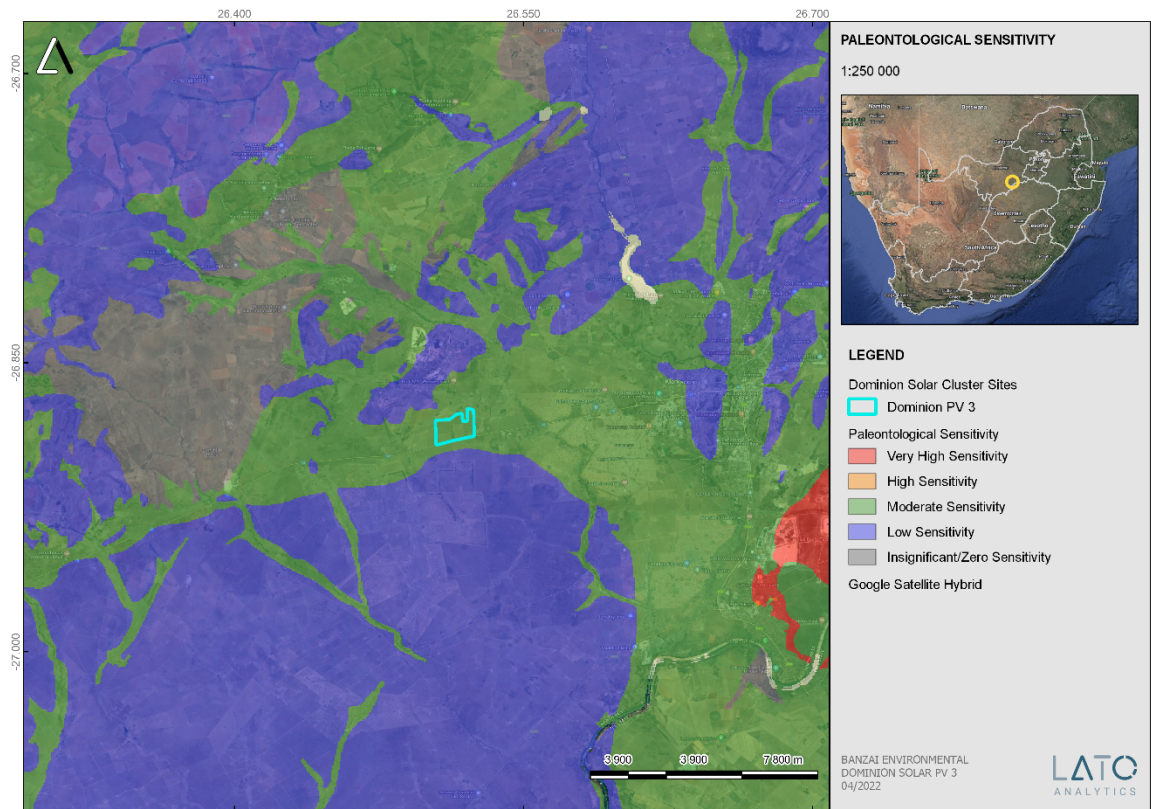


Figure 7: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development in turquoise.

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.

According to the SAHRIS Palaeo Sensitivity map (Figure 76) the proposed development is underlain by sediments of Moderate (green) Palaeontological Sensitivity. The colours on the PalaeoMap indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

6 GEOGRAPHICAL LOCATION OF THE SITE

The locality of the individual developments is as follows: (Figure 1-2).

- The proposed Dominion 3 Solar Park is located on the Remaining Extent of Portion 11 and Remaining Extent of Portion 31 of Farm 425, near Klerksdorp within the North-West Province.
- The development is approximately 14 km west of Klerksdorp.

Table 4:GPS Coordinates

Farm Portion	Latitude	Longitude
Remaining Extent of Portion 8 of Farm 425	26°53'34.16"S	26°30'16.67"E
	26°52'47.81"S	26°30'15.15"E
	26°52'46.36"S	26°30'41.38"E
	26°52'36.14"S	26°30'54.81"E
	26°52'34.77"S	26°31'4.77"E
	26°52'50.36"S	26°31'6.53"E
	26°52'48.56"S	26°31'15.41"E
	26°52'25.51"S	26°31'14.36"E
	26°52'28.14"S	26°31'26.68"E
	26°53'17.18"S	26°31'27.98"E

7 METHODS

The aim of a desktop study is to evaluate the risk to palaeontological heritage in the proposed development. This includes all trace fossils and fossils. All available information is consulted to compile a desktop study and includes Palaeontological impact assessment reports in the same area, aerial photos, and Google Earth images, topographical as well as geological maps.

7.1 Assumptions and Limitations

When conducting a PIA several factors can affect the accuracy of the assessment. The focal point of geological maps is the geology of the area, and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have not been reviewed by palaeontologists and data is generally based on aerial photographs. 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 used to provide information on the existence of fossils in an area which was not yet been documented. When similar Assemblage Zones and geological formations for Desktop studies is used it is generally **assumed** that exposed fossil heritage is present within the footprint.

8 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)
- Extract of the 1:250 000 Wes-Rand 2626 Geological Map (1986) (Council of Geoscience, Pretoria)
- Shape files compiled by the Council of Geoscience, Pretoria
- A Google Earth map with polygons of the proposed development was obtained from PGS Consultants.

9 IMPACT ASSESSMENT METHODOLOGY

9.1 IMPACT ASSESSMENTS

Table 5: Impact Table

ITEM	DEFINITION
EXTENT	
Local	Extending only as far as the boundaries of the activity, limited to the site and its immediate surroundings
Regional	Impact on the broader region
National	Will have an impact on a national scale or across international borders
DURATION	
Short-term	0-5 years
Medium-Term	5-15 years
Long-Term	>15 years, where the impact will cease after the operational life of the activity
Permanent	Where mitigation, either by natural process or human intervention, will not occur in such a way or in such a time span that the impact can be considered transient.
MAGNITUDE OR INTENSITY	
Low	Where the receiving natural, cultural or social function/environment is negligibly affected or where the impact is so low that remedial action is not required.
Medium	Where the affected environment is altered, but not severely and the impact can be mitigated successfully and natural, cultural or social functions and processes can continue, albeit in a modified way.
High	Where natural, cultural or social functions or processes are substantially altered to a very large degree. If a negative impact then this could lead to unacceptable consequences for the cultural

	and/or social functions and/or irreplaceable loss of biodiversity to the extent that natural, cultural or social functions could temporarily or permanently cease.
PROBABILITY	
Improbable	Where the possibility of the impact materialising is very low, either because of design or historic experience
Probable	Where there is a distinct possibility that the impact will occur
Highly Probable	Where it is most likely that the impact will occur
Definite	Where the impact will undoubtedly occur, regardless of any prevention measures
SIGNIFICANCE	
Low	Where a potential impact will have a negligible effect on natural, cultural or social environments and the effect on the decision is negligible. This will not require special design considerations for the project
Medium	Where it would have, or there would be a moderate risk to natural, cultural or social environments and should influence the decision. The project will require modification or mitigation measures to be included in the design
High	Where it would have, or there would be a high risk of, a large effect on natural, cultural or social environments. These impacts should have a major influence on decision making.
Very High	Where it would have, or there would be a high risk of, an irreversible negative impact on biodiversity and irreplaceable loss of natural capital that could result in the project being environmentally unacceptable, even with mitigation. Alternatively, it could lead to a major positive effect. Impacts of this nature must be a central factor in decision making.
STATUS OF IMPACT	
Whether the impact is positive (a benefit), negative (a cost) or neutral (status quo maintained)	
DEGREE OF CONFIDENCE IN PREDICTIONS	
The degree of confidence in the predictions is based on the availability of information and specialist knowledge (e.g. low, medium or high)	
MITIGATION	
Mechanisms used to control, minimise and or eliminate negative impacts on the environment and to enhance project benefits Mitigation measures should be considered in terms of the following hierarchy: (1) avoidance, (2) minimisation, (3) restoration and (4) off-sets.	

Impact Table Methodology

1. Definitions of terminology

2. Scoring System for Impact Assessment Ratings

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To comparatively rank the impacts, each impact has been assigned a score using the scoring system outlined in the Table below. This scoring system allows for a comparative, accountable assessment of the indicative cumulative positive or negative impacts of each aspect assessed.

IMPACT PARAMETER	SCORE	
Extent (A)	Rating	
Local	1	
Regional	2	
National	3	
Duration (B)	Rating	
Short term	1	
Medium Term	2	
Long Term	3	
Permanent	4	
Probability (C)	Rating	
Improbable	1	
Probable	2	
Highly Probable	3	
Definite	4	
IMPACT PARAMETER	NEGATIVE IMPACT SCORE	POSITIVE IMPACT SCORE
Magnitude/Intensity (D)	Rating	Rating
Low	-1	1
Medium	-2	2
High	-3	3
SIGNIFICANCE RATING (F) = (A*B*D)*C	Rating	Rating
Low	0 to - 40	0 to 40
Medium	- 41 to - 80	41 to 80
High	- 81 to - 120	81 to 120
Very High	> - 120	> 120

IMPACT NATURE	Loss of Fossil Heritage	STATUS	NEGATIVE	
Impact Description	Destruction of fossils			
Impact Source(s)	Direct			
Receptor(s)				
PARAMETER	WITHOUT MITIGATION	SCORE	WITH MITIGATION	SCORE
EXTENT (A)	Preferred	1	Preferred	1
	Alternative:		Alternative:	
	No-Go Alternative:		No-Go Alternative:	
DURATION (B)	Preferred	4	Preferred	4
	Alternative:		Alternative:	
	No-Go Alternative:		No-Go Alternative:	
PROBABILITY (C)	Preferred	2	Preferred	2
	Alternative:		Alternative:	
	No-Go Alternative:		No-Go Alternative:	
INTENSITY OR MAGNITUDE (D)	Preferred	-2	Preferred	-1
	Alternative:		Alternative:	
	No-Go Alternative:		No-Go Alternative:	
SIGNIFICANCE RATING (F) = (A*B*D)*C	Preferred	-16	Preferred	-8
	Alternative:		Alternative:	
	No-Go Alternative:		No-Go Alternative:	
CUMULATIVE IMPACTS	Medium			
CONFIDENCE	High			
MITIGATION MEASURES	If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments 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 can be carry out by a palaeontologist			

9.2 SUMMARY OF IMPACT TABLES

Only the site will be affected by the proposed development. The proposed development will have a negative impact on Fossil Heritage. The expected duration of the impact is assessed as potentially permanent. It is probable that the impact will occur pre-mitigation and improbable post-mitigation. As fossil heritage will be destroyed the impact is irreversible and negative.

10 FINDINGS AND RECOMMENDATIONS

The proposed Dominion 3 Solar Park is underlain by the Rietgat Formation (Platberg Group, Ventersdorp Supergroup). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Allanridge Formation is Zero while that of the Rietgat Formation is Moderate (Almond and Pether 2008, SAHRIS website).

It is therefore considered that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area. The construction and operation of the project may be authorised, as the whole extent of the development footprint is not considered sensitive in terms of palaeontological heritage. If fossil remains or trace fossils are discovered during any phase of construction, either on the surface or exposed by excavations the Environmental Control Officer (ECO) in charge of these developments 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 can be carry out by a palaeontologist.

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

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Curriculum Vitae

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Postal Address: P.O. Box 17302, Bainsvlei, 9338, Rep. of South Africa.

Cell phone. 083 625 4695.

School: Grey College Bloemfontein1968.

University Training:	B.Sc. (Geology, chemistry)	1973
	B.Sc. Honours (Geology)	1974
	M.Sc. (Geology)	1977
	Ph.D. (Geochemistry)	1984

All degrees obtained at the University of the Free State.

Research

Research included the following visits:

- 1 Mineral Exploration Research Institute (Universities of Montréal and McGill) in Montréal (1986).
- 2 Study volcanic successions in Channel Islands, France, and Whales in 1986.
- 3 Visit Australia in 1988 to study gold deposits (Kalgoorlie).
- 4 Study gold deposits in Brazil in 1991.
- 5 Excursion to the active volcanoes of Sicily and the Aeolian islands (1994).
- 6 Mineral Resource Management (value tracking) symposium in Australia in 2002.
- 7 Excursion to study high-pressure metamorphic rocks in Turkey in 2005.
- 8 Excursion to northern Spain with students from Wales and South Africa 2008.
- 9 Attended workshop on gold mineralisation in Namibia (±2007).
- 10 Visited New Zealand in 2019 to investigate volcanological aspects of active volcanoes.

Palaeontological Desktop Assessment for the proposed Dominion 3 Solar Park development

Research in southern Africa includes the Ventersdorp Supergroup, volcanology, mineralogy, geology of eastern Namaqualand, vanadium deposits in the Otavi Mountainland, Witwatersrand Supergroup and mineralisation.

Consulting work in South Africa, Namibia, Zimbabwe, and Malawi.

Author and co-author of more than 70 peer reviewed articles and more than 70 conference presentations at national and international level.

Positions held:

Employed by the University of the Free State since 1974. Started as technical assistant at the Institute for Groundwater Studies and then the Department of Geology. Promoted to X-ray fluorescence analyst in charge of the analytical laboratory and later to lecturer, senior lecturer, and associate professor.

Departmental chairperson (geology department) since 1998.

Professor and departmental chairperson from 2003 until 2013.

Supervised and co-supervised 16 M.Sc. students and 4 Ph.D. students. Involved with two more Ph.D. candidates.

Supervised 75 mini-dissertations from MRM (mineral resource management) students.

Retired end of 2015.

Appointed part-time 2016 – 2018.

Teaching

Taught courses in mineral exploration, geochemical exploration, economic geology, and analytical techniques (geochemistry).

Introduced a course in Mineral Resource Management at the University of the Free State in 2000 in collaboration with private sector (Comparex, now Business Connection) and Kumba.

Societies

Member of the following societies:

Fellow of the Geological Society of SA.

Archaeological Society of SA.

International Association of Volcanology and Chemistry of the Earth's Interior.

Spectroscopic Society of SA.

International Liaison Group on Gold Mineralisation.

Chairman Maccauw Gun Club (clay target shooting) for four years.

Registered as a professional scientist.

Most of above lapsed since retiring.

Business

Director Woodland Hills Wildlife Estate from 2001 until present (property development on the outskirts of Bloemfontein (includes houses, sectional title units and hospital).

Trustee of the Hillandale Homeowners association since inception (chairperson for four years).

Director and chairperson of the board of Hillandale Hospital (property investment and a private company leases the buildings).

Conducted some geotechnical and environmental work for Woodland Hills Wildlife Estate.