BANZAI ENVIRONMENTAL

PALAEONTOLOGICAL WALKDOWN

KLIPFONTEIN PV 2 PROJECT

FREE STATE
2022

COMPILED ON BEHALF OF:

NALA ENVIRONMENTAL

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 consider, 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: 

EXECUTIVE SUMMARY

South Africa Mainstream Renewable Power Developments (Pty) Ltd. obtained approval to develop 11 solar Energy Facilities and associated electrical infrastructure near Dealesville in the Free State. These Energy Facilities are known as the Kentani Solar Cluster. This walkdown report is for one of the 11 Energy Facilities namely the Klipfontein PV 2 Project (14/12/16/3/3/2/726).

Banzai Environmental was appointed by Nala Environmental to conduct the Palaeontological Walkdown to assess the authorised **Klipfontein PV 2 Facility and supporting electrical infrastructure**. No fossil Heritage were identified during the walkdown but this does not necessarily imply that fossil heritage is not present in the development footprint. This may be attributed to vegetation cover and unexposed fossils in the Klipfontein PV 2 study area. If undocumented fossils are uncovered during the construction phase of the development the Chance find Protocol included in this report should be implemented without delay.

Based on the walkdown, it is not expected that the proposed Klipfontein PV 2 and supporting electrical infrastructure will negatively impact on the palaeontological heritage of the development footprint. As such there is no objection to the proposed layout and final alignment of the Klipfontein PV 2 and associated infrastructure from a palaeontological perspective.

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1 INTRODUCTION

Nala Environmental (Nala) was commissioned by South Africa Mainstream Renewable Power Developments (Pty) Ltd to conduct the final layout walkdowns for the Kentani Solar Cluster near Dealsville in the Free State (**Figure 1-3**). The Kentani Energy Cluster is situated within 12km from Dealsville in the Tokologo Local Municipality (Lejweleputswa District Municipality) and about 70km north-east of Bloemfontein and 50km southeast of Boshof. This walkdown report is for the Klipfontein Solar PV 1 Facility 14/12/16/3/3/2/726 that forms part of the Kentani PV Cluster.

The Heritage Impact Assessments for the project were conducted by Dr J. Orton (Archaeology) and Dr L. Rossouw (Palaeontology).

Orton, J. July 2015. Heritage Impact Assessment: 11 Solar PV Facilities and Supporting Electrical Infrastructure near Dealesville in the Free State Province Proposed by Mainstream Renewable Power Developments (Pty) Ltd.

Rossouw, L. Palaeontological Desktop Assessment for 12 new Solar Photovoltaic facilities near Dealesville, Free State Province.

In his desktop report Dr Rossouw found that the proposed development was underlain by the Middle Permian Tierberg Formation (Ecca Group) and Quaternary alluvial deposits. He described the Tierberg Formation as poorly fossiliferous and that the Palaeontological Sensitivity of the development is Moderate. Fossil assemblages from the Tierberg Formation include fragmentary fish remains, trace fossils while plant remains comprise of petrified wood and leaves. Dolerite dykes and sills are common in the study area and as it is igneous in origin it is not palaeontologically significant. In spring and pan deposits as well as along major water courses Quaternary alluvial deposits are Highly Sensitive, while the palaeontological significance of sediments along ephemeral water courses or residual drift and sheet wash deposits is low. He recommended that the localized spring and pan dune deposits are strictly avoided and that a site visit is necessary prior to the construction phase of the projects to identify localized spring and pan dune deposits within the development footprints.

SAHRA issued their Final Comment on 27 October 2015, and requested that Ecca sediments should be avoided during construction where possible. A site visit is recommended prior to the construction phase to identify localized spring and pan dune deposits within the development footprint. Palaeontological monitoring was advised as an alternative at the start of, or during >60cm deep trench excavations into Ecca bedrock.

1.1 Background

Information extracted from the CSIR, 2016 EIA Report.
CSIR, 2016. Environmental Impact Assessment Report for the proposed Klipfontein PV 2 solar energy project and supporting electrical infrastructure near Dealesville in the Free State CSIR Report number: CSIR/CAS/EMS/ER/2014/0011/B

South Africa Mainstream Renewable Power Developments (Pty) Ltd. (Reg. No. 2009/007850/07) ("Mainstream") intends to develop 11 solar PV or CPV projects and associated electrical infrastructure near Dealesville in the Free State province, South Africa. The projects are collectively referred to as the suite of Kentani Solar Developments and are located within 12 km from Dealesville in the Tokologo Local Municipality which is located in the Lejweleputswa District Municipality, 50 km south-east of Boshof and 70 km north-east of Bloemfontein (**Figure1-3**).

Twelve separate Environmental Authorisation (EA) application forms were submitted on 17 June 2014 to the Competent Authority (CA), the National Department of Environmental Affairs (DEA), for twelve proposed projects. Following the submission of the twelve EA applications forms and Scoping Process, one of the projects, Klipfontein PV 2, was withdrawn. Therefore, only eleven projects form part of the suite of Kentani Solar Developments. The eleven projects, associated DEA reference numbers and generation capacities are shown in Table 1 below. Mainstream proposes to develop the facilities with a possible maximum installed capacity of 75 MW or 100 MW of electricity per project. Once a Power Purchase Agreement (PPA) is awarded, this facility will generate electricity for a minimum period of 20 years.

The proposed Klipfontein Solar PV 2 Facility and supporting electrical infrastructure is located approximately 3.5 km south-west of Dealesville and is accessed by an untarred road. The centre point coordinates for this project site are 28°41'10.62"S; 25°44'26.19"E.

Table 1:Proposed projects, generation capacity and land required

Project Name	DEA Reference Number	Generation Capacity (MW)	Maximum Land required (ha) for optimal efficiency
Kentani PV	14/12/16/3/3/2/724	100	~400
Klipfontein PV	14/12/16/3/3/2/722	100	~400
Braklaagte PV	14/12/16/3/3/2/727	100	~400
Meeding PV	14/12/16/3/3/2/719	100	~400
Irene PV	14/12/16/3/3/2/718	100	~400
Leliehoek PV	14/12/16/3/3/2/728	100	~400
Sonoblomo PV	14/12/16/3/3/2/723	75	~300
Klipfontein PV 2 *(this project)*	14/12/16/3/3/2/726	75	~300
Braambosch PV	14/12/16/3/3/2/725	75	~300
Boschrand PV 2	14/12/16/3/3/2/720	75	~300
Eksteen PV	14/12/16/3/3/2/717	75	~300

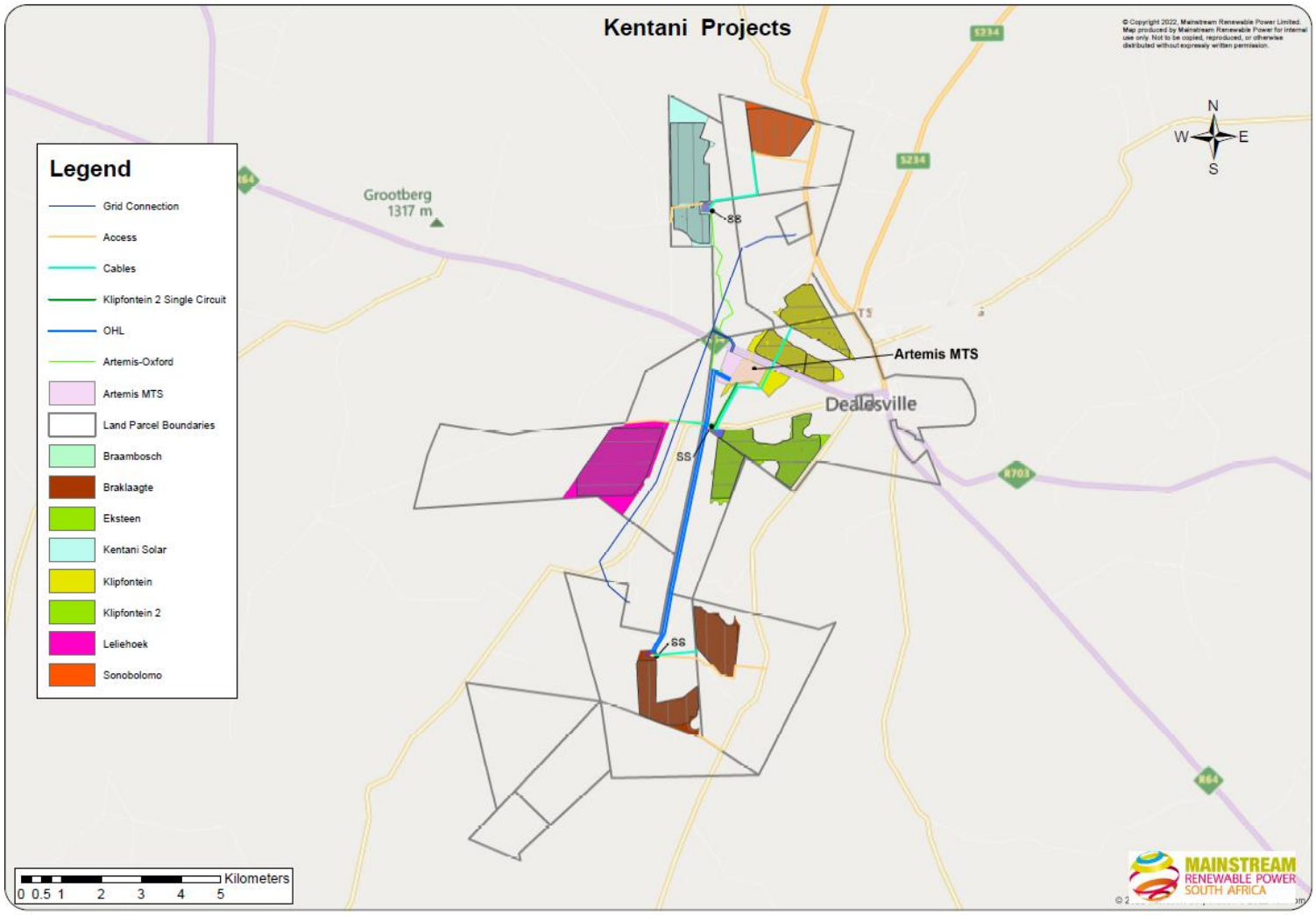

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Figure 1: Kentani PV Cluster near Dealesville in the Free State

1.2 Technical Information

Solar field

- Solar Arrays
  - Solar technology: PV or CPV; and
  - Mounting system technology: Single Axis Tracking PV, Dual Axis Tracking PV or Fixed Axis Tracking PV.
- Building infrastructure
  - Offices;
  - Operational control center;
  - Warehouse/workshop;
  - Ablution facilities;
  - Converter station;
  - Battery Facility; and
  - On-site substation and substation building.
    - Electrical infrastructure
      - 33 kV distribution lines.

Associated infrastructure

- Transmission lines;
- Underground cabling;
- Access roads;
- Internal gravel roads;
- Fencing;
- Operation and Maintenance Area;
- Laydown Area;
- Stormwater channels; and
- Water pipelines.

The solar facility will either:
1) connect via an on-site substation to a northern or southern collector substation (to be constructed) to the existing Eskom Perseus substation (located on Farm Kentani 953) or Eskom Beta substation (located on Farm Klipfontein PV 2 149), or 2) connect directly via a northern or southern collector substation (to be constructed) to the existing Eskom Perseus substation or Eskom Beta substation.

Mainstream will implement the Self-Build Option for the additional electrical infrastructure to be constructed. Following the construction phase, the electrical infrastructure will either be transferred into the ownership of Eskom or otherwise remain in the ownership of Mainstream.

Table 2: Components forming part if the solar project

Component	Description
Development Envelope	
Solar technology: PV or CPV Mounting system technology: Single Axis Tracking PV, Fixed Axis Tracking PV or Dual Axis Tracking PV	Height : 15 m
On-site substation and substation building	Height : 22 m Footprint : 500 X 500 m
Area for infrastructure including: • Guard House • Laydown area • Offices • Operational control centre • Warehouse/workshop • Converter station	Height : 3 m Footprint : 500 X 500 m
Energy Storage Facility	Height : 15 m Footprint : 10 ha
Distribution lines	2 m wide and length shown by the corridors
Internal gravel roads	Width : < 8 m
Fencing	Height : 3 m
Operation and maintenance area (including ablution facilities and offices)	Footprint : 100 X 120 m
Transmission line corridor	
132 kV underground or overhead and 275/400 kV overhead transmission lines	Height : 22 m
Collector substations	Height : 22 m Footprint : 500 X 500 m
Associated infrastructure	
Storm water channels	To be constructed alongside the roads
Water pipelines	To be constructed alongside the roads

1.3 Locality

The proposed Klipfontein Solar PV 2 Facility and supporting electrical infrastructure is located about 3,5 km south-west of Dealesville and is accessed by an untarred road. The centre point coordinates for this project site are 28°41'10.62"S; 25°44'26.19"E.

Table 3: Land portions affected by the Klipfontein Solar PV 2 Facility

LAND PORTIONS AFFECTED BY THE BUILDABLE AREA AND DISTRIBUTION LINE	SG 21 Code
Remainder of the Farm Klipfontein, No. 305, Title Deed No. T970/1915	F00400000000030500000
LAND PORTIONS AFFECTED BY THE TRANSMISSION LINE	
Remainder of Farm Oxford, Farm Number 1030, Title Deed No. T31534/2007	F00400000000103000000
Portion 1 of the Farm Walkerville, Farm Number 1031, Title Deed No. T940/1957	F00400000000103100001
Remainder of the Farm Walkerville, Farm Number 1031, Title Deed No. T939/1957	F00400000000103100000
The Farm Kentani, Farm Number 953, Title Deed No. T2881/1912	F00400000000095300000
Remainder of the Farm Klipfontein, No. 305, Title Deed No. T970/1915	F00400000000030500000
The Farm Boschrand, No. 148, Title Deed No. T14232/2000	F00400000000014800000
Remaining extent of the Farm Doornrandjes, No. 546, Title Deed No. T26617/1882	F00400000000054600000
Remainder of Farm Leliehoek, No. 748, Title Deed No. T95/2002	F00400000000074800000
Remaining extent of Farm Walvischkuil No. 749, Title Deed No. T47081/2000	F00400000000074900000*
Remainder of the Farm Braklaagte Number 149, Title Deed No. T25925/2005	F00400000000014900000

** please note that this property was not included in the initial application form submitted to the Department of Environmental Affairs but is included in the amended Environmental Authorisation application form included in this report (Appendix A).*

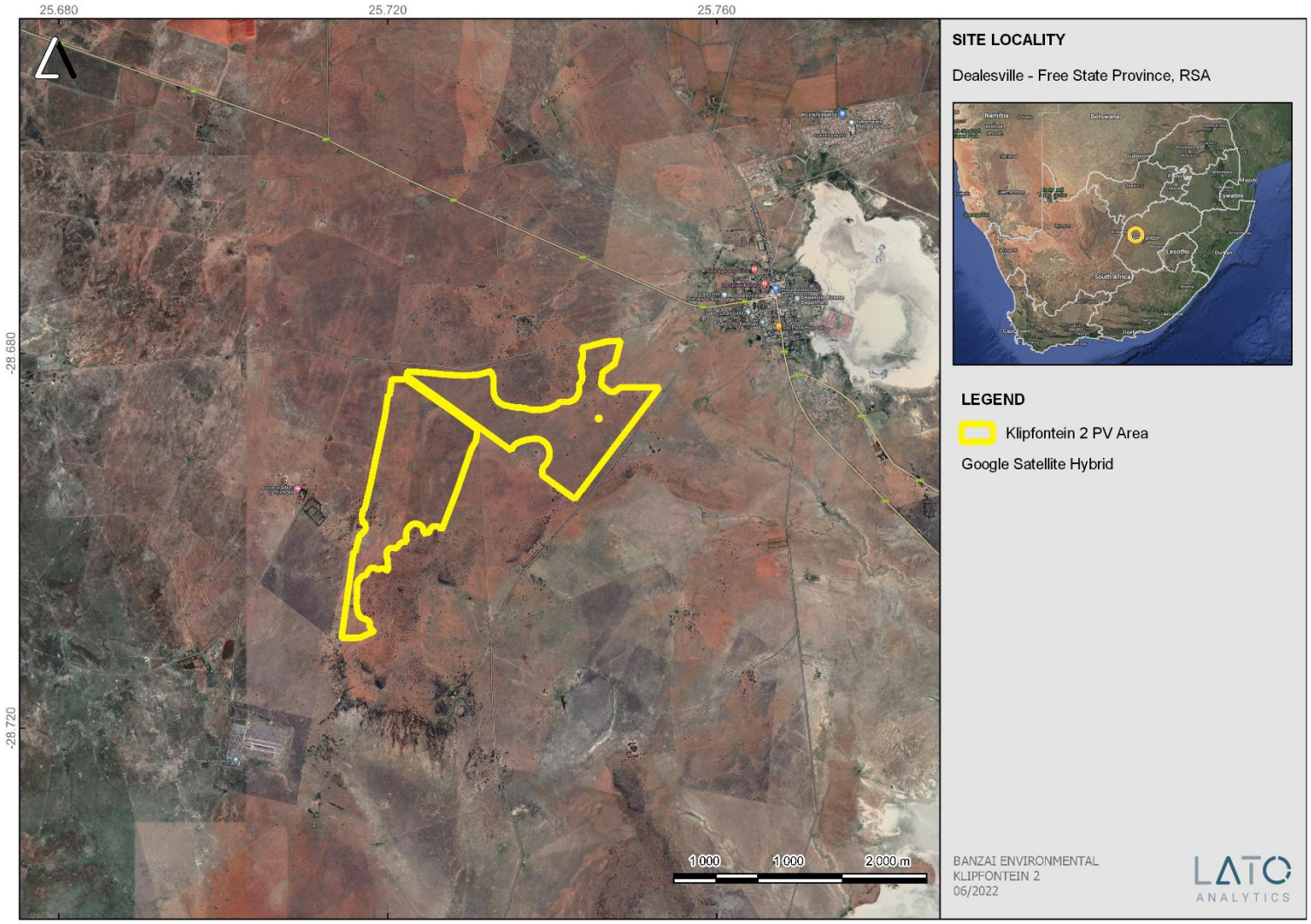

Figure 2 – Google Earth (2021) Image of the proposed Klipfontein Solar PV 2 Facility and Supporting Electrical Infrastructure near Dealesville in the Free State.

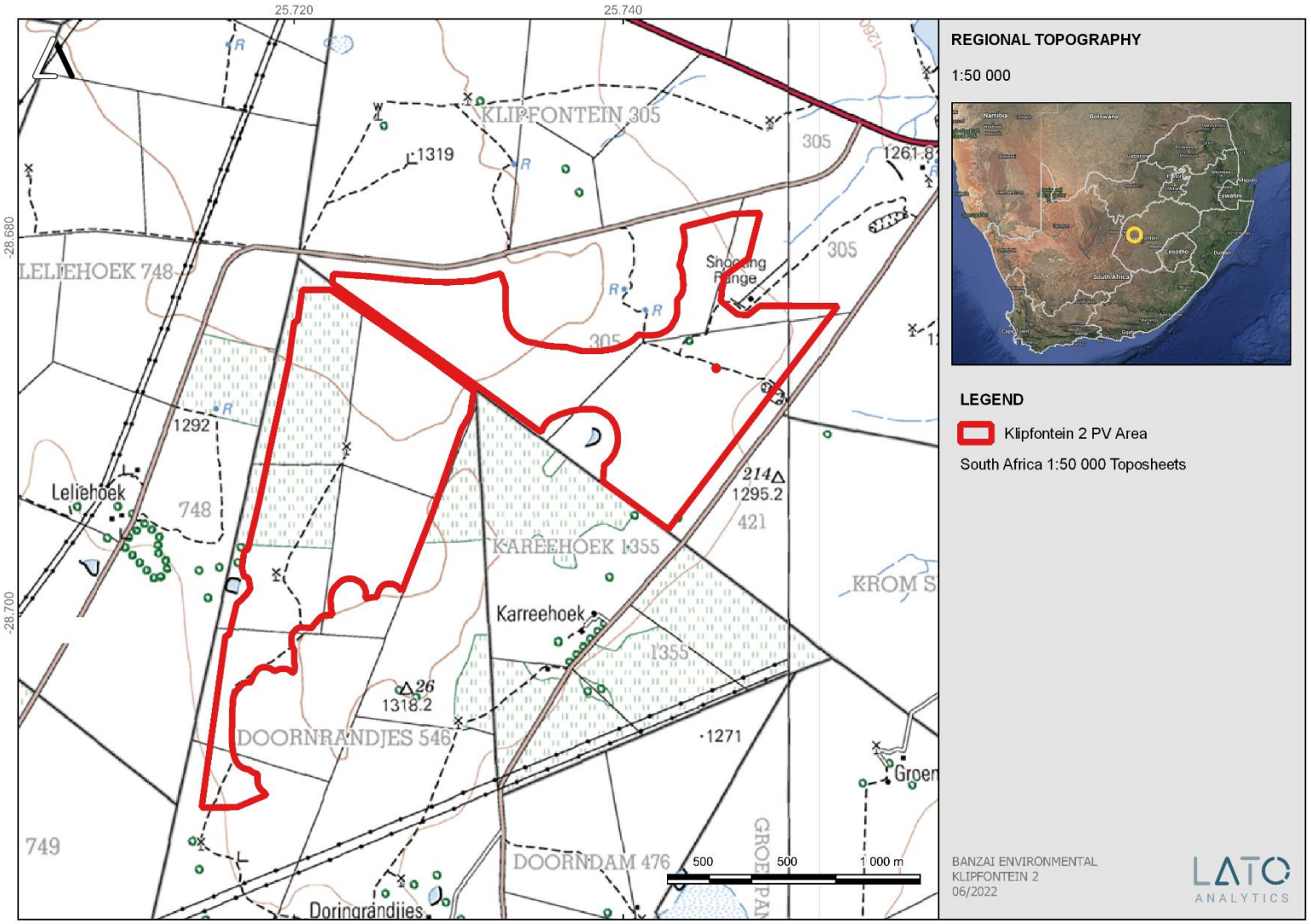

Figure 3 – Locality Map of the proposed Klipfontein Solar PV 2 Facility and Supporting Electrical Infrastructure near Dealesville in the Free State.

1.4 General Site description

Dealsville is the third largest settlement in the municipality and serves as an agricultural service center for the surrounding agricultural communities. Dealesville comprises of Dealesville town and the informal settlement Tswaraganang. Currently the area between the two areas is developed as a new residential area. Kimberley and Bloemfontein are connected through the R64 that passes through Dealesville. Only the R64 is tarred while the other roads in the town is untarred. Farm roads connects the surrounding agricultural communities to the town. Railway lines is absent in this district.

Dealesville is known for the extensive electrical infrastructure outside Dealesville. The Beta Substation is located south-west of the town while the Perseus Substation lies north-west of Dealesville. Numerous transmission lines unite at these substations and the landscape is dominated by power lines and large pylons. The Kentani Cluster are located in less than 10 km to one of the two substations (Holland, 2015)1.

The topography of the area is flat with elevations between 1200 m and 1320 m above mean sea level (AMSL) (**Figure 4**). From the Modder River the land rises gently from the south (1200 m AMSL) to a moderately rolling plateau in the north (varying between 1290 and 1320 m AMSL). Most of the Kentani Solar Cluster are situated on this plateau. Occasionally Karoo koppies are present in the area. The topography of the area is influenced by the Modder River south of the proposed development as well as al large number of endorheic pans in the surrounding landscape (Holland, 2015).

Three vegetation types occur in the study area namely the Western Free State Clay Grassland, Vaal-Vet Sandy Grassland and Highveld Salt Pans, while the fourth vegetation type Vaalbos Rocky Shrubland are not mapped within the boundaries of the current study area. Only two vegetation types, Western Free State Clay Grassland and Vaal-Vet Sandy Grassland are present in the proposed solar and supporting electricity development.

Figure 4: Typical flat view of the proposed Klipfontein PV 2 development underlain by grassy vegetation with electrical infrastructure in the background.

2 ASSESSMENT METHODOLOGY

SAHRA issued their Final Comment on 27 October 2015, and requested that Ecca sediments should be avoided during construction where possible. A site visit is recommended prior to the construction phase to identify localized spring and pan dune deposits within the development footprint

2.1 Physical Survey and Assessment:

An overall 3-day site-specific field survey of the development footprint was conducted on foot and by motor vehicle during October 2021 and February 2022.

2.2 Assumptions and Limitations

The proposed Klipfontein PV 2 study area is underlain by Quaternary sediments and Jurassic dolerite with a very small portion underlain by the Tierberg Formation (Ecca Group). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Quaternary superficial sediments is low but locally high, that of the Jurassic dolerite is Zero as it is igneous in origin and the Palaeontological Sensitivity of the Tierberg Formation is moderate (Almond and Pether, 2009; Almond *et al*., 2013).

No fossils have been located during the walk down. However, there is a distinct possibility that fossil heritage is present in the area. This may be attributed to vegetation cover and unexposed fossils. If undocumented fossils are uncovered during the construction phase of the development the Chance find Protocol included in this report should be implemented immediately.

3 GEOLOGICAL AND PALAEONTOLOGICAL HERITAGE

The authorised Klipfontein PV 2 facility near Dealsville in the Free State is depicted on the 1:250 000 2824 (1993) Kimberley Geological Map (Council of Geoscience, Pretoria). The study area is mostly underlain by Quaternary sediments (Qs; yellow) and Jurassic dolerite (Jd, red) as well as a very small portion underlain by the Tierberg Formation (Ecca Group) (**Figure 5**). Updated geology is indicated in **Figure 6**. According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Quaternary superficial sediments is low but locally high, and that of Jurassic dolerite is Zero as it is igneous in origin and the Palaeontological Sensitivity of the Tierberg Formation is moderate (Almond and Pether, 2009; Almond *et al*., 2013, **Figure 7**). Topographical as well as Google Earth images indicate that the relief of the proposed project is low, and outcrops in the area are rare.

Quaternary superficial deposits (Qs, yellow **Figure 5**; red and grey gravel, diamondiferous in places) are the youngest geological deposits formed during the most recent period of geological time namely the Quaternary (approximately 2.6 million years ago to present). Most of the superficial deposits are unconsolidated sediments and consist of calcretes, sand, silt and clay, and they form relatively thin, often discontinuous patches of sediments or larger spreads onshore.

The Quaternary deposits reveal palaeoclimatic changes in the different geological formations (Hunter et al., 2006). The climatic fluctuations in the Cenozoic Era were responsible for the formation of most geomorphologic features in southern Africa (Maud, 2012). Various warming and cooling events occurred in the Cenozoic but climatic changes during the Quaternary, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past Barnosky (2005). Climate in the Quaternary Period were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth et al., 2004).

The fossil assemblages of this Group are generally very low in diversity, but locally high and occur over a wide range. Quaternary deposits are especially important when in fluvial environments along water courses. Fossil assemblages include diatoms, gastropod shells, bivalves, ostracods and trace fossils. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil remains include mammalian bones and teeth as well as coprolites, freshwater molluscs and plant microfossils). Various authors have described fossilized hyena burrows in Late Pleistocene alluvial sediments of the Modder River (Broom 1909 a, b; Cooke 1955; Churchill et al. 2000; Rossouw 2006). Fossilized hyena lairs are occasionally located outside the present river valleys along localized spring deposits and calcified pan dunes (Scott & Brink 1991). Fossiliferous sediments (local peat deposits) occur within calcified pan dunes in this region (Horowitz et al. 1978; Scott and Klein 1981; Butzer 1984). These types of pans formed when the prevailing winds blew aeolian sands (unconsolidated material) into newly formed lunettes on the lee side of the deflation hollows and sometimes provided a site for hyena burrows and prehistoric human habitation.

Pleistocene vertebrate fossils and plant microfossils are associated with spring and pan deposits [e.g., Florisbad, (northwest of Bloemfontein, Baden Baden (north of Dealesville,) Liebenbergspan (Voigts Post), Deelpan between Bloemfontein and Petrusburg) (Brink 1987, 1988; Scott & Rossouw 2005)]. Florisbad has been declared a Provincial Heritage Site while Erfkroon is another valuable fossil site along the Modder River (15 km southwest of the southern end of the Klipfontein PV 2 Project site). Fossils in these areas occur over large areas in erosion gullies. Stone artefacts from the earlier part of the Middle Stone Age and the Later Stone Age have also been uncovered and are sometimes associate with bones (Churchill et al. 2000). The palaeontology of the Quaternary superficial deposits has been relatively neglected in the past. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter.

The **Karoo igneous province** (Jd-red**, Figure 5-6**) is one of the worlds classic continental basalt (CFB) provinces. This province consists of intrusive and extrusive rocks that occur over a large area (Duncan et al, 2006). Generally, the flood basalts do not contribute to prominent volcanic structures, but instead are formed by successive eruptions from a set of fissures that form sub-horizontal lava flows (sills and dykes) varying in thickness. This lava caps the landscape on which they erupted. As the Karoo is an old flood basalt province it is today preserved as erosional fragments of a more extensive lava cap that covered much of southern Africa in the geological past. It is estimated that the Karoo lava outcrop currently covered at least 140 000 km^2 while it was larger in the past [~2 000 000 km^2 (Cox 1970, 1972)].

The Karoo Igneous Province contains a large volume of flood basalts as well as silicic volcanic rocks. These units are comprised of rhyodacite and rhyolitic magma and crops out along the Lebombo monocline. Individual units span up to 60 km and sometimes show massive pyroclastic structures and are thus classified as rheoignimbrites. The basal lavas lie conformable on the Clarens Formation but in specific localities sandstone erosion occurred before the volcanic eruptions took place. Lock *et al* (1974) found evidence in the Eastern Cape that in the early stages of volcanism magma interacted with ground water to produce volcaniclastic deposits as well as phreatic and phreatomagmatic diatremes. Eales *et al* (1984) also found evidence of aqueous environments during early volcanism by the existence of pillow lavas and associated hyaloclastite breccias and thin lenses of fluviatile sandstones interbedded with the lowermost magmas.

The **Tierberg Formation** (Pt, orange, Figure 5) consists of a recessive-weathering, thick, mudrock-dominated succession. These rocks comprise mostly of dark, often grey to brown, well-laminated, carbonaceous shales with subordinate thin, fine-grained sandstones (Prinsloo 1989, Le Roux 1993, Viljoen 2005, Johnson et al., 2006). The Early to Middle Permian Tierberg shales were deposited in a series of offshore, quiet water environments below wave base and include basin plain, distal turbidite fan and distal pro-delta in ascending order (Viljoen 2005, Almond in Macey et al. 2011). Towards the top of the formation thin coarsening-upwards cycles occur with confined evidence of ripples and common calcareous concretions as well as soft-sediment deformation. Thin volcanic ash layers (water-lain tuffs) are known in these sediments. The Ecca Basin were a restricted, brackish water environment. The Tierberg mudrocks are often baked to a dark grey hornfels with a reddish-brown crust close to the contact with Karoo dolerite intrusions (Prinsloo 1989). The Tierberg formation is known for its rare trace fossils assemblages (Anderson 1976; De Beer et al. 2002; Viljoen 2005; Johnson et al. 2006). These trace fossil assemblages comprise of arthropod trackways and associated resting impressions, possible gastropod horizontal epichnial furrows, fish swimming trails, and burrows of different sizes. Vascular plants (including petrified wood, more abundant in the upper portion of the formation (Ryan 1967; Wickens 1996) and palynomorphs

of Glossopteris flora have been found while insects, crustaceans, shelly marine invertebrates, and fish fossils as well as microfossils have been identified (Zawada 1992, Bosch 1993).

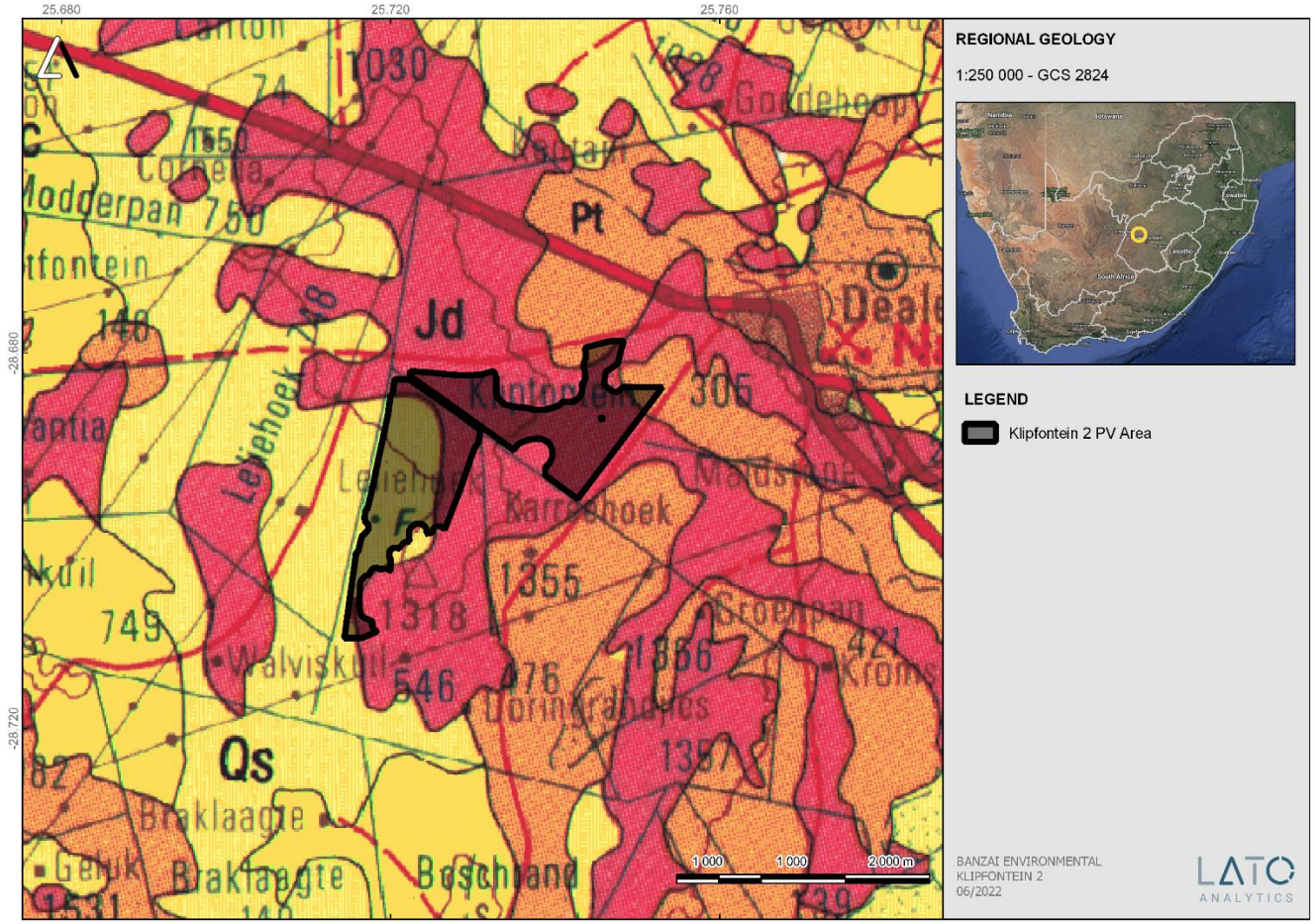

Figure 5 – Extract of the 1:250 000 Kimberley 2824 (1989) Geological map (Council of Geoscience, Pretoria) indicating the surface geology of the proposed development. The study area is mostly underlain by Quaternary sediments (Qs; yellow) and Jurassic dolerite (Jd, red) with a very small portion underlain by the Tierberg Formation, Ecca Group, Karoo Supergroup.

Table 4 – Legend of the 1:250 000 284 Kimberley Geological map (1989) (Council of Geoscience, Pretoria)

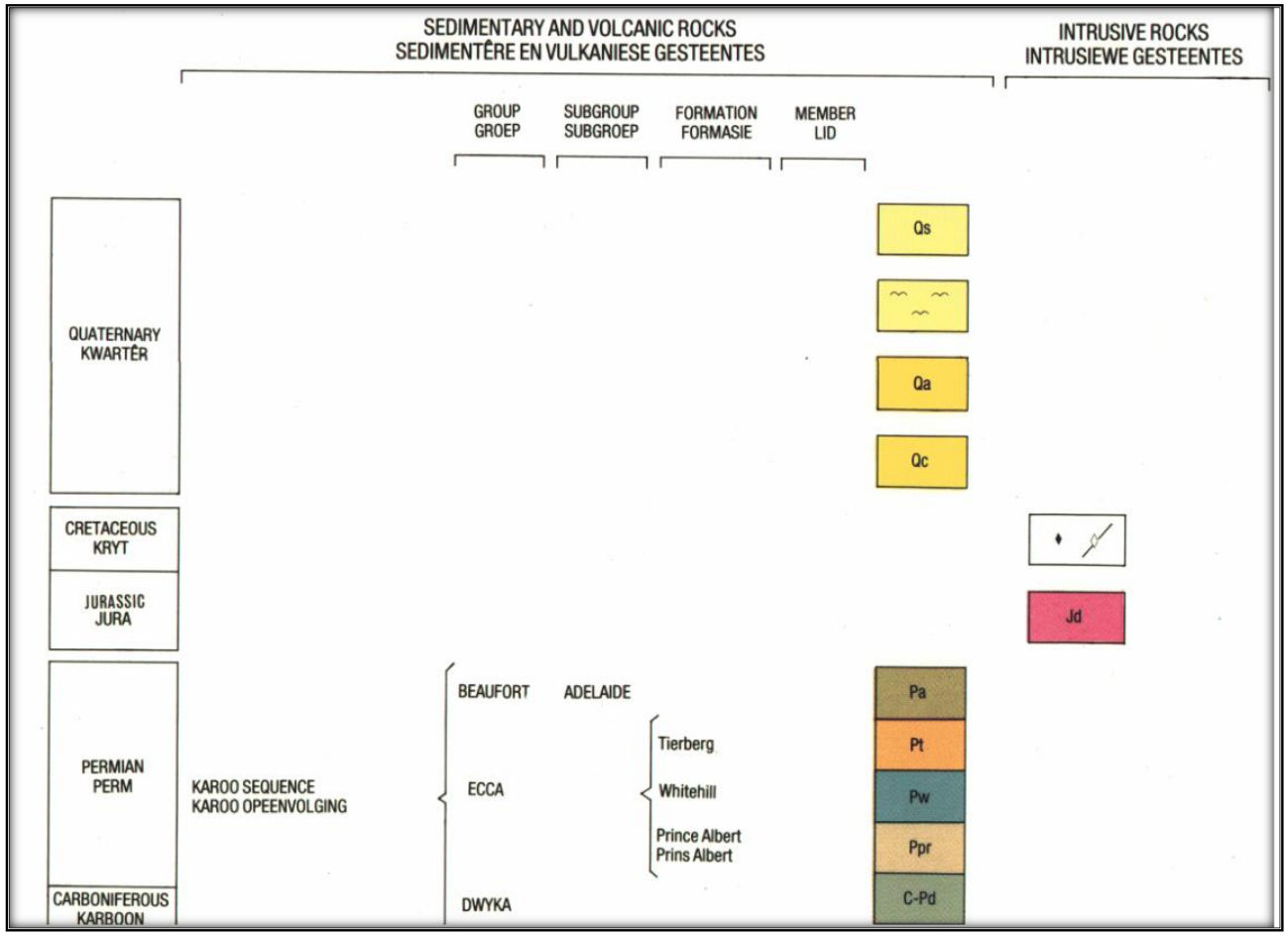

Table 5: Legend to Map and short explanation of the development and surrounding sediments (Modified from the 1:250 000 2824 Kimberley Geological Map (1993) (Council of Geoscience, Pretoria). Formations present in the development is indicated in bold

Symbol	Stratigraphy	Lithology
Qs	**Quaternary**	**Sand: Red and grey Gravel, Diamondiferous in places**
Qa	Quaternary	Alluvial diamondiferous gravel
Qc	Quaternary	Calcrete, calcified pan dune and surface limestone.
Qc	Quaternary	Calcrete
Jd	**Jurassic**	**Dolerite**
Pt	**Tierberg Formation, Ecca Group, Karoo Supergroup**	**Sandstone, siltstone, mudstone**
C-Pd	Dwyka Group, Karoo Supergroup	Tillite, sandstone, shale

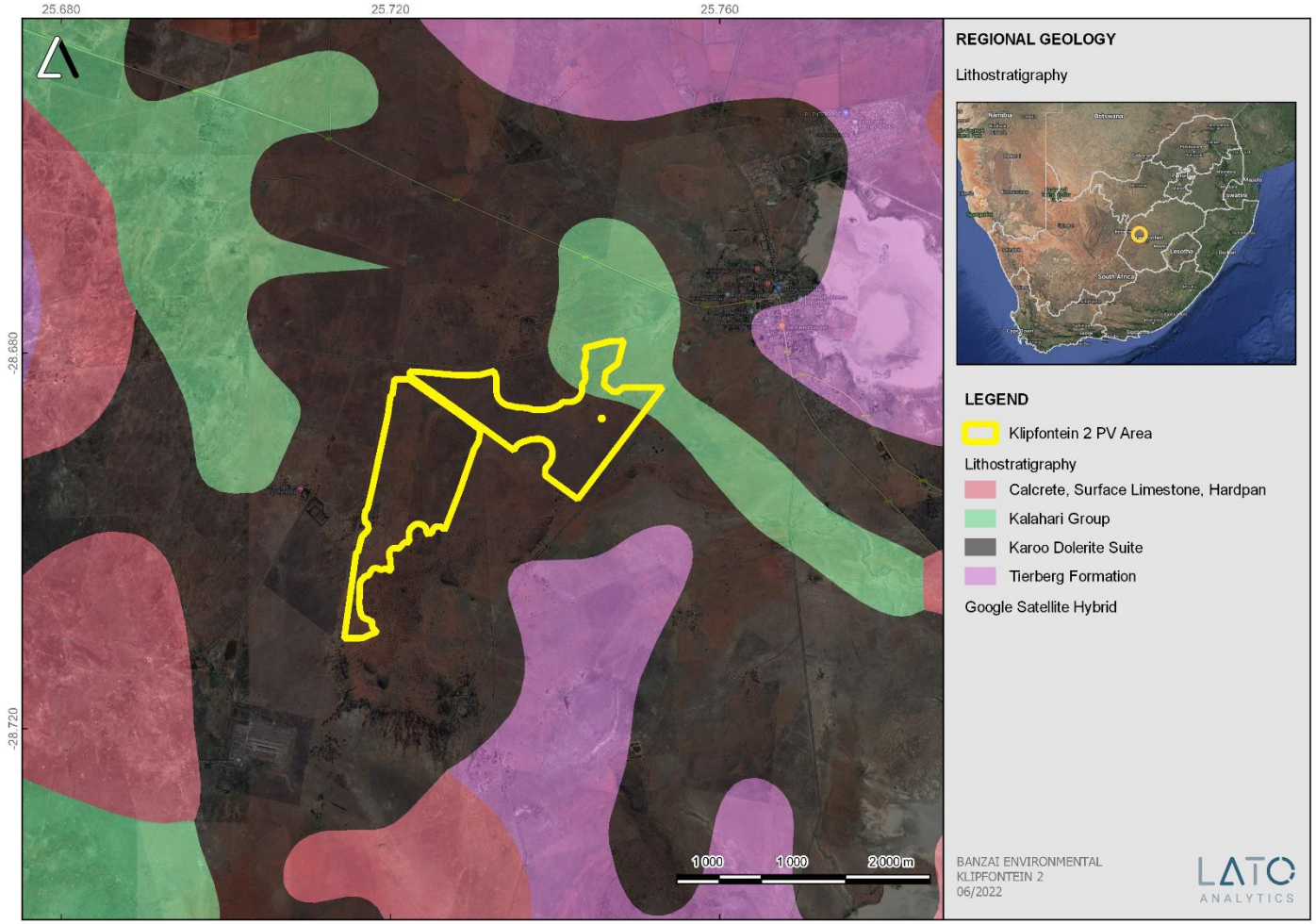

Figure 6 – Updated geology of the proposed development.

The proposed development is underlain the Kalahari Group (green), well as Karoo Dolerite. (brown)

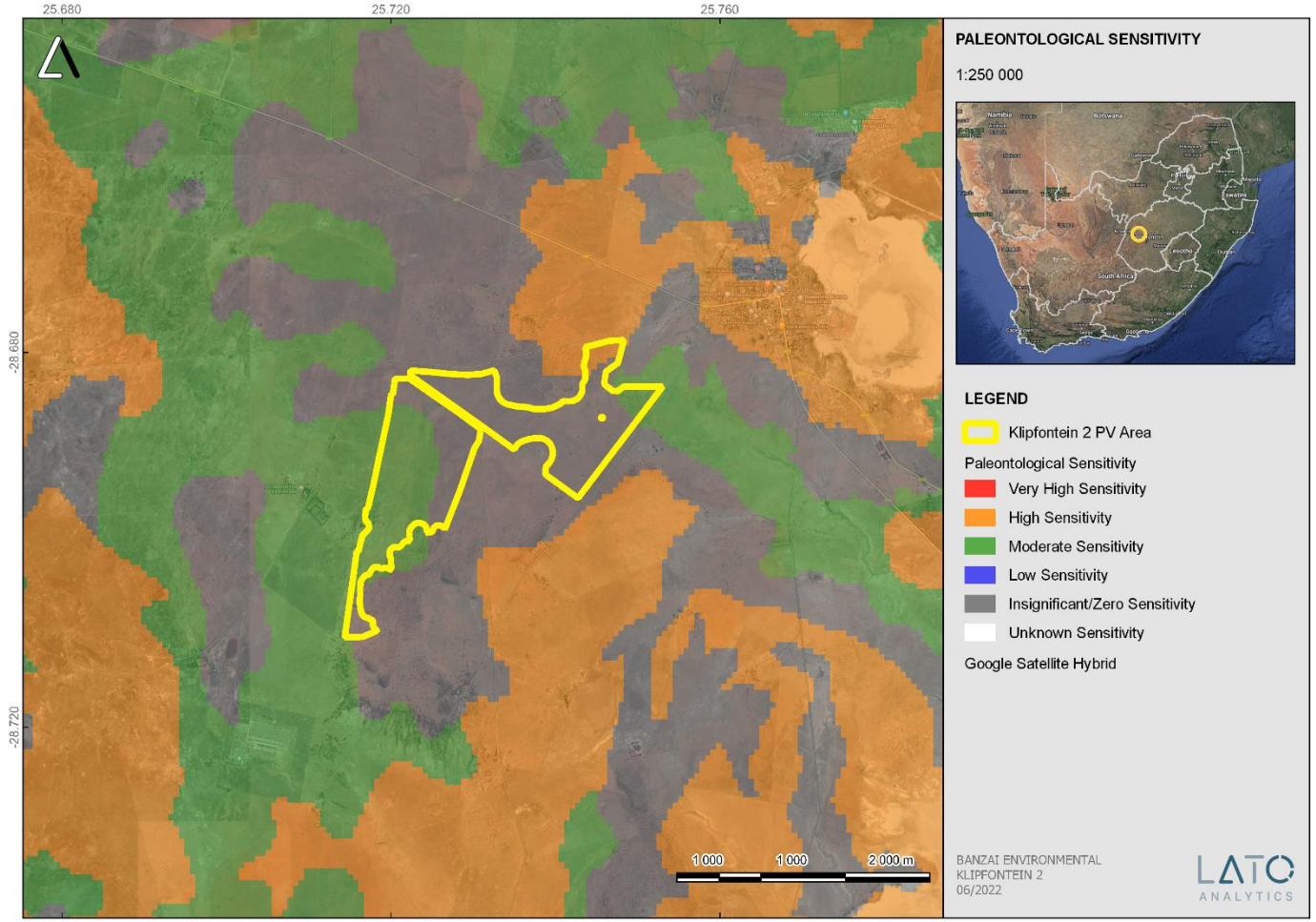

Figure 7 – Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development in yellow.

According to the SAHRIS Palaeosensitivity map (**Figure 7)** the proposed development is underlain by sediments with a High (orange), Moderate (green) and Zero (grey) Palaeontological Sensitivity.

Table 6 – Palaeontological Sensitivity on SAHRIS

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 colours on the PalaeoMap indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

4 SITE VISIT

The proposed Klipfontein PV 2 and supporting electrical infrastructure development is located just north of Dealesville. No fossil heritage was identified during the site visit.

Figure 8 – Typical grass veld and flat topography.

Figure 9 – Termite mounds distributed throughout the proposed development.

Figure 10 – Burrow pit with dolerite corestones and calcrete.

5 ASSESSMENTS OF IMPACTS

5.1 Assessment of impact to Palaeontological Resources

Based on the Palaeontological walkdown assessment for this project, the area planned for the Klipfontein PV 2 Project has an overall low palaeontological sensitivity. It is not likely that the proposed development will have a negative impact on significant palaeontological heritage. Furthermore, all recommended mitigation measures from the approved Klipfontein PV 2 Project and associated electricity infrastructure (Rossouw, 2015) will be applied.

6 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.

7 LEGISLATION

7.1 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
- 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 35, 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 m^2 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.

8 CONCLUSIONS AND RECOMMENDATIONS

Based on the Palaeontological walkdown assessment for this project, the area planned for the Klipfontein PV 2 and supporting electrical Infrastructure has an overall low palaeontological sensitivity. It is not likely that the proposed development will have a negative impact on significant palaeontological heritage. All recommended mitigation measures from the approved Klipfontein PV 2 Project (Rossouw, 2015) will be applied. This includes that Ecca sediments should be avoided during construction where possible. A site visit is recommended prior to the construction phase to identify localized spring and pan dune deposits within the development footprint.

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APPENDIX 1

CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during excavation.
Adopted form Heritage Western Cape June 2016

Introduction

This document is aimed to inform workmen and foremen working on a construction and/or mining site. It describes the procedure to follow in instances of accidental discovery of palaeontological material (please see attached poster with descriptions of palaeontological material) during construction/mining activities. This protocol does not apply to resources already identified under an assessment undertaken under s. 38 of the National Heritage Resources Act (no 25 of 1999). Fossils are rare and irreplaceable. Fossils tell us about the environmental conditions that existed in a specific geographical area millions of years ago. As heritage resources that inform us of the history of a place, fossils are public property that the State is required to manage and conserve on behalf of all the citizens of South Africa. Fossils are therefore protected by the National Heritage Resources Act and are the property of the State. Ideally, a qualified person should be responsible for the recovery of fossils noticed during construction/mining to ensure that all relevant contextual information is recorded. Heritage Authorities often rely on workmen and foremen to report finds, and thereby contribute to our knowledge of South Africa's past and contribute to its conservation for future generations.

Training

Workmen and foremen need to be trained in the procedure to follow in instances of accidental discovery of fossil material, in a similar way to the Health and Safety protocol. A brief introduction to the process to follow in the event of possible accidental discovery of fossils should be conducted by the designated Environmental Control Officer (ECO) for the project, or the foreman or site agent in the absence of the ECO It is recommended that copies of the attached poster and procedure are printed out and displayed at the site office so that workmen may familiarise themselves with them and are thereby prepared in the event that accidental discovery of fossil material takes place.

Actions to be taken

One person in the staff must be identified and appointed as responsible for the implementation of the attached protocol in instances of accidental fossil discovery and must report to the ECO or site agent. If the ECO or site agent is not present on site, then the responsible person on site

should follow the protocol correctly in order to not jeopardize the conservation and well-being of the fossil material. Once a workman notices possible fossil material, he/she should report this to the ECO or site agent.

Procedure to follow if it is likely that the material identified is a fossil:

- The ECO or site agent must ensure that all work ceases immediately in the vicinity of the area where the fossil or fossils have been found;
- The ECO or site agent must inform HWC of the find immediately. This information must include photographs of the findings and GPS co-ordinates;
- The ECO or site agent must compile a Preliminary Report and fill in the Fossil Discoveries: HWC Preliminary Record Form within 24 hours without removing the fossil from its original position.

The Preliminary Report records basic information about the find including:

- The date
- A description of the discovery
- A description of the fossil and its context (e.g. position and depth of find)
- Where and how the find has been stored
- Photographs to accompany the preliminary report (the more the better):
    - ➔ A scale must be used
    - ➔ Photos of location from several angles
    - ➔ Photos of vertical section should be provided
    - ➔ Digital images of hole showing vertical section (side);
    - ➔ Digital images of fossil or fossils.

Upon receipt of this Preliminary Report, HWC will inform the ECO or site agent whether or not a rescue excavation or rescue collection by a palaeontologist is necessary.

- Exposed finds must be stabilised where they are unstable and the site capped, e.g. with a plastic sheet or sand bags. This protection should allow for the later excavation of the finds with due scientific care and diligence. HWC can advise on the most appropriate method for stabilisation.
- If the find cannot be stabilised, the fossil may be collected with extreme care by the ECO or the site agent and put aside and protected until HWC advises on further action. Finds collected in this way must be safely and securely stored in tissue paper and an appropriate box. Care must be taken to remove the all-fossil material and any breakage of fossil material must be avoided at all costs.

- No work may continue in the vicinity of the find until HWC has indicated, in writing, that it is appropriate to proceed.

APPENDIX 2

ELIZE BUTLER

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	29 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–currently

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