BANZAI ENVIRONMENTAL

# PALAEONTOLOGICAL IMPACT ASSESSMENT

## Soyuz 4 Wind Energy Facility

NORTHERN CAPE PROVINCE

2022

COMPILED FOR:

CES – ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES

## 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: elizebutler002@gmail.com

SIGNATURE: 

The Palaeontological impact assessment report (as part of the Heritage Assessment) 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 in accordance 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 2 of Report – Contact details and company and Appendix A | - |
| (ii) The expertise of that person to compile a specialist report including a curriculum vita | Section 2 – refer to **Appendix A** | - |
| (b) A declaration that the person is independent in a form as may be specified by the competent authority | Page ii of the report | - |
| (c) An indication of the scope of, and the purpose for which, the report was prepared | Section 4 – 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; | Executive Summary, Section 10 and 11 | - |
| (d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment | Section 9 | |

Table 1: Checklist for Specialist studies in accordance 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 7 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 & 11 | |
| (g) An identification of any areas to be avoided, including buffers | Section 1 & 11 | |
| (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 & 11 | |
| (k) Any mitigation measures for inclusion in the EMPr | Section 1 & 11 | |
| (l) Any conditions for inclusion in the environmental authorisation | Section 1 & 11 | |
| (m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation | Section 1 & 11 | |
| (n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and | Section 1 and 11 | |

Table 1: Checklist for Specialist studies in accordance 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.** |
|---|---|---|
| (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 11 | - |
| (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 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 |

Table 1: Checklist for Specialist studies in accordance 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.** |
|---|---|---|
| | | 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 CES – ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES to conduct the Palaeontological Impact Assessment (PIA) to assess a Renewable Energy Cluster comprising of six Wind Energy Facilities near Britstown in the Northern Cape Province. This study focuses on Soyuz 4, a commercial Wind Energy Facility (WEF) and associated infrastructure, located approximately 58 km South of Britstown within the Ubuntu Local Municipality and the Pixley ka Seme District Municipality in the Northern Cape 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 PDA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The SOYUZ 4 WEF is underlain by Late Caenozoic alluvium, isolated Jurassic Karoo dolerite, Middle Permian Abrahamskraal Formation (Beaufort Group) as well as the Ecca Group of the Karoo Supergroup. Dolerite dykes and sills have baked the surrounding Beaufort sediments, thus compromising the fossil heritage of the area through thermal metamorphism. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the alluvium is Moderate, that of Jurassic dolerite is Zero, while that of the Abrahamskraal Formation (Beaufort Group) and Ecca Group is Very High. (Almond and Pether, 2009; Almond et al., 2013). The Very High Palaeontological Sensitivity of the Abrahamskraal Formation triggers a site investigation.

Extensive research and fossil collecting have been conducted by palaeontologists in the last few decades, however, the Britstown area have been largely neglected. A 6-day overall comprehensive site-specific field survey of the Soyuz WEF Cluster was conducted on foot and by motor vehicle in October 2022. In the area investigated no fossiliferous outcrops were recovered. This could be attributed to the dolerite intrusions that metamorphized potentially fossiliferous Beaufort sediments, low relief of the development as well as poor bedrock exposure and relative unfossiliferous superficial sediments. However, it must be emphasised that the presence of well-preserved fossils is not ruled out.

A High Palaeontological Significance has been allocated for the construction phase of the WEF development pre-mitigation and a low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the Soyuz 4

WEF development near Britstown is considered to be high pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to destructive impacts on the palaeontology of the area. The construction of the development may thus be authorized in its whole extent, as the development footprint is not considered sensitive from a palaeontological point of view. It is thus recommended that no further palaeontological heritage studies, ground truthing or specialist mitigation are required pending the discovery of new fossil assemblages.

Recommendations:

- The ECO for this project must be informed that the Abrahamskraal Formation, Adelaide Subgroup, Beaufort Group, Karoo Supergroup) and the Ecca Group of the Karoo Supergroup has a Very High Palaeontological Sensitivity.
- Basic training in identifying fossil heritage is recommended for the ECO and relevant staff. If any fossil remains or trace fossils are discovered during any phase of construction or operation, either on the surface or exposed by excavations, the ECO in charge of this development should implement the Chance find Protocol immediately. These discoveries should be protected (if possible, *in situ*) and the ECO must report such discoveries 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). Suitable mitigation (*e.g.,* recording and collection) will consequently be undertaken by a palaeontologist.
- Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
- These recommendations should be incorporated into the Environmental Management Plan for the Soyuz 4 WEF.

***Impact Summary***

| Impacts | Extent | Duration | Magnitude | Reversibility | Irreplaceable loss | Cumulative effect | Impact |
|---|---|---|---|---|---|---|---|
| **Pre-mitigation** | 1 | 4 | 3 | 4 | 4 | 4 | Negative High 48 |
| **Post mitigation** | 1 | 4 | 1 | 4 | 4 | 2 | Negative Low 15 |

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# APPENDIX A:

# 1 INTRODUCTION

The applicant Soyuz 4 (Pty) Ltd is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 46 km South of Britstown within the Ubuntu Local Municipality and the Pixley ka Seme District Municipality in the Northern Cape Province (Figure 1-3).

Five additional WEF's are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as SOYUZ 1 WEF, SOYUZ 2 WEF, SOYUZ 3 WEF, SOYUZ 4 WEF and SOYUZ 6 WEF.

A preferred project site with an extent of approximately 125 000 ha has been identified as a technically suitable area for the development of the six WEF projects. It is proposed that each WEF will comprise of up to 75 turbines with a contracted capacity of up to 480 MW. It is anticipated that each WEF will have an actual (permanent) footprint of up to 150 ha.

## 1.1 SOYUZ 4 WEF project

The Soyuz 4 WEF project site covers approximately 14 200 ha and comprises the following farm portions:

- The Farm Altringham No. 19
- The Farm No. 18
- Remaining Extent of the Farm Allemans Dam No. 17
- Remaining Extent (Portion 0) of the Farm Allemans Combuis No. 1
- Remaining Extent of Portion 1 of the Farm Combuisfonteion No. 142
- Portion 1 of the Farm Allemans Dam No. 17.

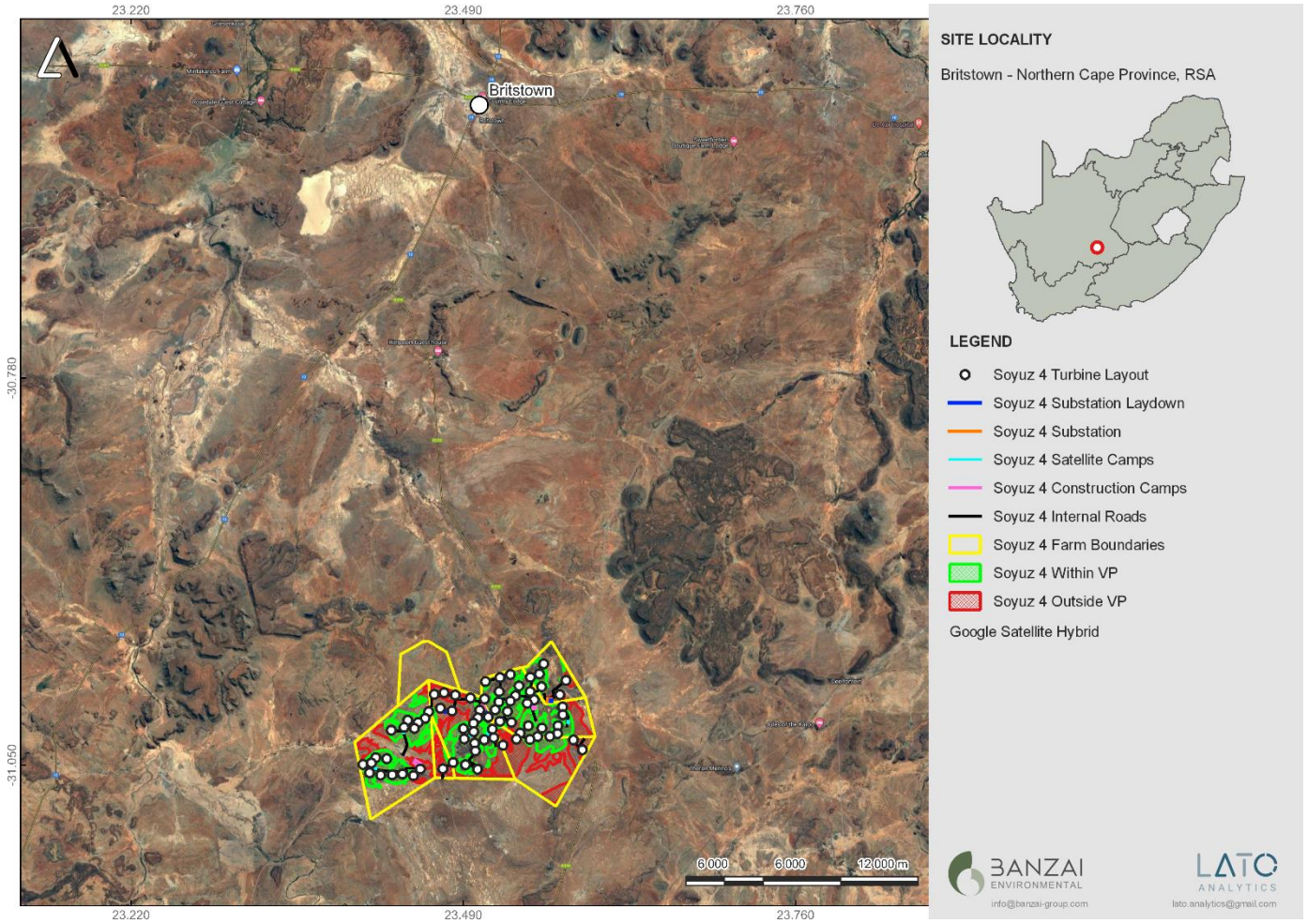



***Figure 1:*** *Regional locality of the proposed Soyuz 4 WEF in the Northern Cape.*

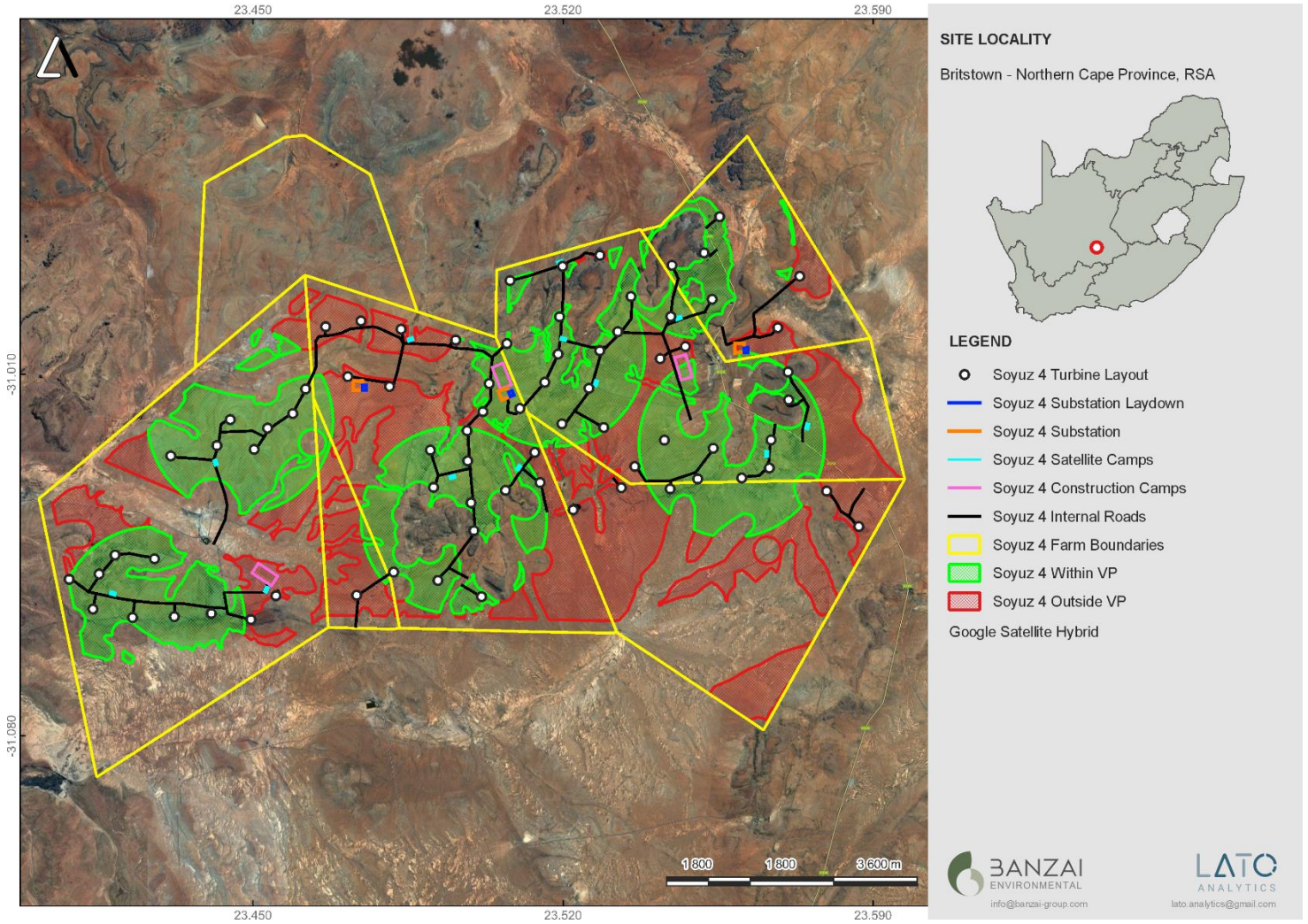



***Figure 2:*** *Proposed Soyuz 4 Wind Energy Facility near Britstown in the Northern Cape.*

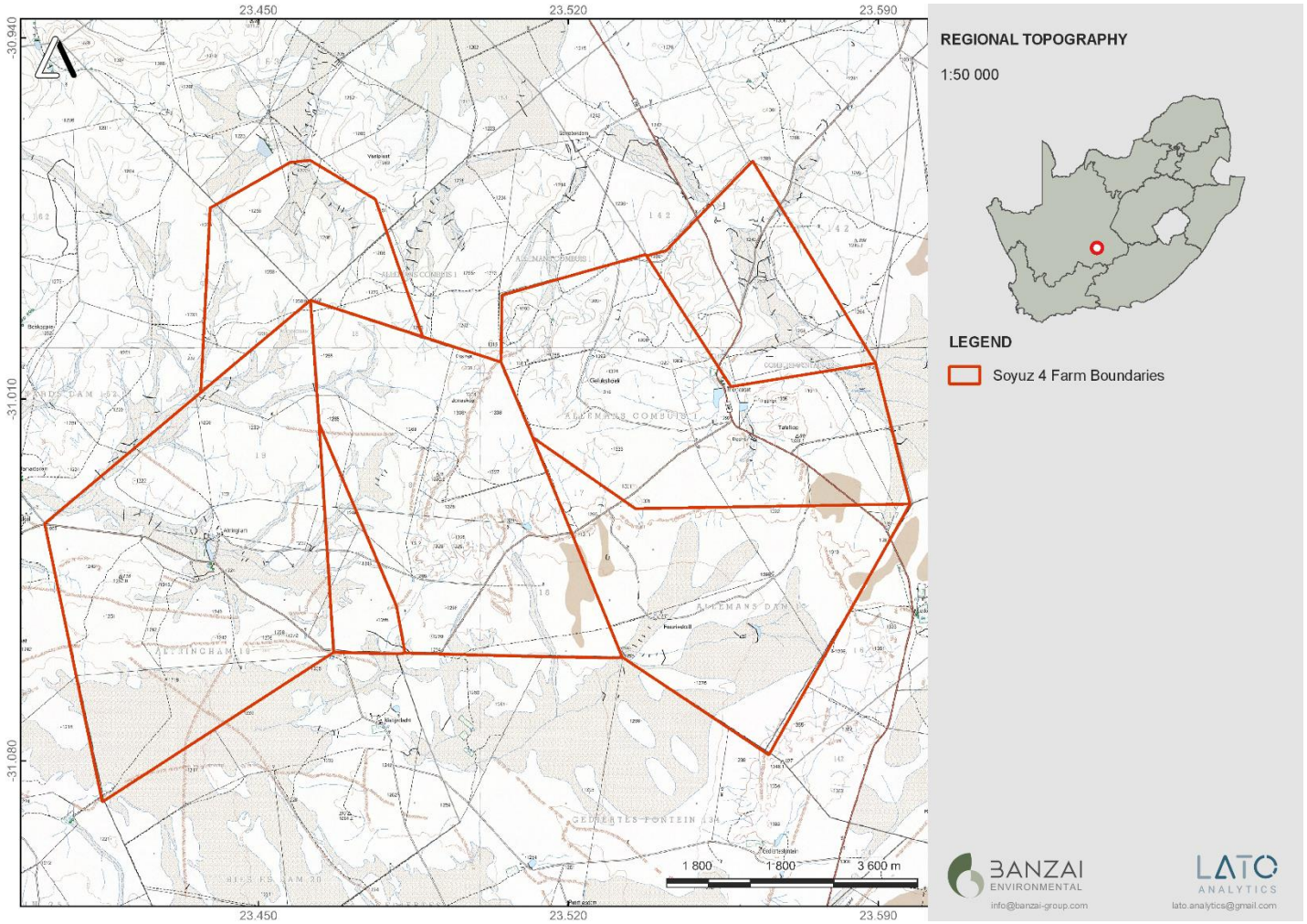



***Figure 3:*** *Topographic image of the proposed Soyuz 4 Wind Energy Facility Project.*

The SOYUZ 4 WEF project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 480 MW:

- Up to 75 wind turbines with a maximum hub height of up to 160 m and a rotor diameter of up to 200 m;
- A transformer at the base of each turbine;
- Concrete turbine foundations;
- Turbine, crane, and blade hardstands;
- Temporary laydown areas (with a combined footprint of up to 14 ha) which will accommodate the boom erection, storage, and assembly area;
- Battery Energy Storage System (with a footprint of up to 5 ha);
- Cabling between the turbines, to be laid underground where practical;
- Two on-site substations with a combined footprint of up to 4 ha in extent to facilitate the connection between the wind farm and the electricity grid;
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 12 m road corridor may be temporarily impacted upon during construction and rehabilitated to 6m wide after construction. The WEF will have a total road network of up to 125 km.
- A temporary site camp establishment and concrete batching plants (with a combined footprint of up to 2 ha); and
- Operation and Maintenance buildings (with a combined footprint of up to 2 ha) including a gate house, security building, control centre, offices, warehouses, a workshop and visitor's centre.

In order to evacuate the energy generated by the WEF to the national grid, separate Basic Assessments will be undertaken to assess two grid connection alternatives:

- Alternative 1: A 132 / 400kV overhead powerline (OHL) within a 500 m wide assessment corridor from the Switching Station on site to a proposed new 132 / 400 kV MTS located north of the WEF and adjacent to the Hydra – Kronos 400 kV line.

- Alternative 2: A 132 / 400 kV overhead powerline (OHL) within a 500 m wide assessment corridor from the Switching Station on site to a proposed new 132 / 400 kV MTS located south of the WEF and adjacent to the Droerivier - Hydra 400 kV line.

The EA applications for the wind farm project and grid connection infrastructure are being undertaken in parallel as they are co-dependent, i.e., one will not be developed without the other.

### 1.2 Legislative Context

In terms of the EIA Regulations, 2014 (as amended), the development of a WEF with a generation capacity of (or exceeding) 20 MW will require an Environmental Authorisation (EA) application supported by a full Scoping and Environmental Impact Reporting process (S&EIR).

## 2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler. She has conducted approximately 400 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-eight 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.

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

## 3 LEGISLATION

National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, which 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 has been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources 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 will inform 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.

## 4 OBJECTIVE

The aim of a Palaeontological Impact Assessment (PIA) is to minimize the potential impact of the proposed WEF 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. Destructive impacts on palaeontological heritage usually only occur during the construction phase while the excavations will change the current topography and destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

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

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

The fossil potential of the Soyuz 4 WEF development area was determined by criss-crossing the development footprint and by physically investigating the bedrock outcrops to determine the lithology and fossil content of the outcrops. Selected potentially fossiliferous sites (e.g., along drainage lines, hillslopes and erosion gullies) were specifically inspected as this region of the Great Karoo has a limited bedrock exposure. Representative investigations of crevasse splay and channel sandstones as well as Cenozoic alluvial deposits were also conducted. Fossils occurring at the surface is very unpredictable and as the area is very large and a representative sample size of the area has been investigated. The outcome of a site investigation is limited due to the time and cost of a detailed investigation. Fossil sites are usually discovered by chance and a representative subsample is more achievable. However, it is important to note that the absence of fossils in a development footprint does not necessarily mean that palaeontological significant material is not present on site (on or beneath ground surface).

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:
- 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 PALAEONTOLOGICAL HISTORY

The Soyuz 4 WEF site is depicted on the 1:250 000 Britstown 3022 (1991) and 3122 Victoria West (1989) Geological Map (Council for Geosciences, Pretoria) (Figure 4, Table 2). The project is underlain by small areas of Late Caenozoic alluvium (yellow single bird figure), Jurassic Karoo dolerite (Jd, red), the Abrahamskraal Formation (Pa- light green) (Beaufort Group) and Carnarvon Formation of the Ecca Group (Pc, bright red) of the Karoo Supergroup. This part of the basin is intruded by dolerite (Jd, red) dykes and sills and the surrounding Beaufort and Ecca Group sediments have been baked, thus compromising the fossil heritage of the area through thermal metamorphism. The Palaeontological Sensitivity Map on the South African Heritage Resources Information System (SAHRIS) database, indicates that the Palaeontological Sensitivity of the Late Caenozoic superficial deposits is Moderate, that of the Jurassic dolerite is Zero while that of the Adelaide Subgroup and the Ecca Group is Very High (Almond *et al*, 2013; SAHRIS website).

The Late Caenozoic superficial deposits are the youngest geological deposits formed during the most recent geological period. Most of the superficial deposits are unconsolidated sediments and consist of clay, gravel, sand, silt, that form relatively thin, discontinuous patches of sediments. These sediments comprise of channel, floodplain, and stream deposits.

The Late Caenozoic deposits are very important because palaeoclimatic changes are reflected in the different geological formations (Hunter *et al*., 2006). During the climate fluctuations in the Cenozoic Era most geomorphologic features in southern Africa where formed (Maud, 2012). Barnosky (2005) indicated that various warming and cooling events occurred in the Cenozoic but states that climatic changes during the Late Caenozoic Period, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past. Climate variations that occurred in the Late Caenozoic 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).

Late Caenozoic fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area. These fossil assemblages may in some cases occur in extensive alluvial and colluvial deposits. In the past, palaeontologists did not focus on Late Caenozoic superficial deposits although they sometimes comprise of significant fossil deposits. These fossil assemblages resemble modern animals and may comprise of mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Late Caenozoic deposits. Plant material such as foliage, wood, pollens, and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

A few dolerite dykes and sills are present in the development footprint while the area north and west of the development is extensively intruded by dolerite dikes and sills (Jd, red) of the Karoo Igneous Province. These dolerite intrusions have baked the surrounding potentially fossiliferous bedrock through thermal metamorphism thus influencing the quality of fossil preservation. The Karoo Igneous Province in southern Africa is a classic continental flood basalt province that was formed during the Early Jurassic Period. This province occurs over a comprehensive area in southern Africa and comprises a widespread system well developed igneous bodies (dykes, sills) that invaded the sediments of the Main Karoo Basin. Flood basalts do not typically form any visible volcanic structures, but with a series of outbursts form a suite of fissures of sub-horizontal lava flows that may vary in thickness. The Karoo is an old flood basalt province and is preserved today as erosional remnants of a more extensive lava cap that covered much of southern Africa in the geological past. This Suite is entirely unfossiliferous.

The flood plains of the Beaufort Group (Karoo Supergroup) are internationally renowned for the early diversification of land vertebrates and provide the world's most complete transition from early "reptiles" to mammals. The Beaufort Group is subdivided into a series of biostratigraphic units based on its faunal content (Figure 5; Kitching 1977; Keyser *et al*, 1977; Rubidge 1995; Smith *et al*, 2020; Viglietti 2020).

The eastern and central section of the Soyuz 4 WEF is underlain by the Abrahamskraal Formation that is biostratigraphically represented by the *Tapinocephalus* (Figure 6) and upper *Eodicynodon* AZ (Figure 7-9,). As the second oldest tetrapod biozone in the Karoo, the *Tapinocephalus* AZ is basically restricted to the Abrahamskraal Formation. The lower margin of the AZ is variable due to diachrony. This AZ comprises of the upper third of the *Abrahamskraal* Formation in the southwestern boundary of the basin. The Abrahamskraal Formation is present in the southern portion of the main Karoo Basin and consists of abundant greenish-grey and less common

reddish-brown mudrock. Subordinate light grey fine-grained sandstone is arranged in fining - upward cycles. This Formation is at its thickest (2200 to 2565 m) in the southwestern part of the basin thinning north-eastward. In the southwestern portion of the basin the Abrahamskraal Formation comprises of several arenaceous zones. These sediments were deposited on a large alluvial plain (Cole et al, 2016).

The *Tapinocephalus* AZ is characterised by the tapinocephalid dinocephalian species *Tapinocephalus atherstonei* and *Moschops capensis*, the dicynodont *Eosimops newtoni*, and *Robertia broomiana* and the pareiasaur *Bradysaurus baini*. The *Tapinocephalus* AZ is a rich tetrapod assemblage zone that consists of basal members of therapsid clades Biarmosuchia, Anomodontia, Dicynodontia, Therocephalia, and Gorgonopsia; basal members of the parareptilian clade Pareiasauria; and rare varanopids as well as derived members of the therapsid clade Dinocephalia.

This AZ includes dinocephalians (*Moschops capensis*), basal pareiasaurs (*Bradysaurus*) that co-occur with pylaecephalid dicynodonts *Eosimops*. and *Robertia*. This AZ has a maximum thickness of about 1500 m. The Assemblage Zone can be subdivided into two subzones based on the absence of the dicynodont *Diictodon feliceps*: in the lower Eosimops - Glanosuchus Subzone and the presence of Diictodon in the upper Diictodon Eosimops - Glanosuchus Subzone. The contact between these subzones is the first appearance of *Diictodon felips* at the base of the Moordenaars Member. The upper part of the biozone reflects the Capitanian mass extinction and the low diversity post extinction. The first appearance of *Endothiodon bathystoma* terminates the zone.

Rubidge et al (2000) described silicified wood fragments, leaves, and stems from this Formation while *Glossopteris* leaf impressions are abundant in the east (Mason, 2007). Bivalve fossils have been uncovered in the Formation. Trace fossils include fish trails, arthropod trackways (*Monomorphichnus and Umfolozia)* with some occurrences of therapsid footprints and vertebrate burrow casts (Smith, 1986, 1990a; Smith and Keyser, 1995a).

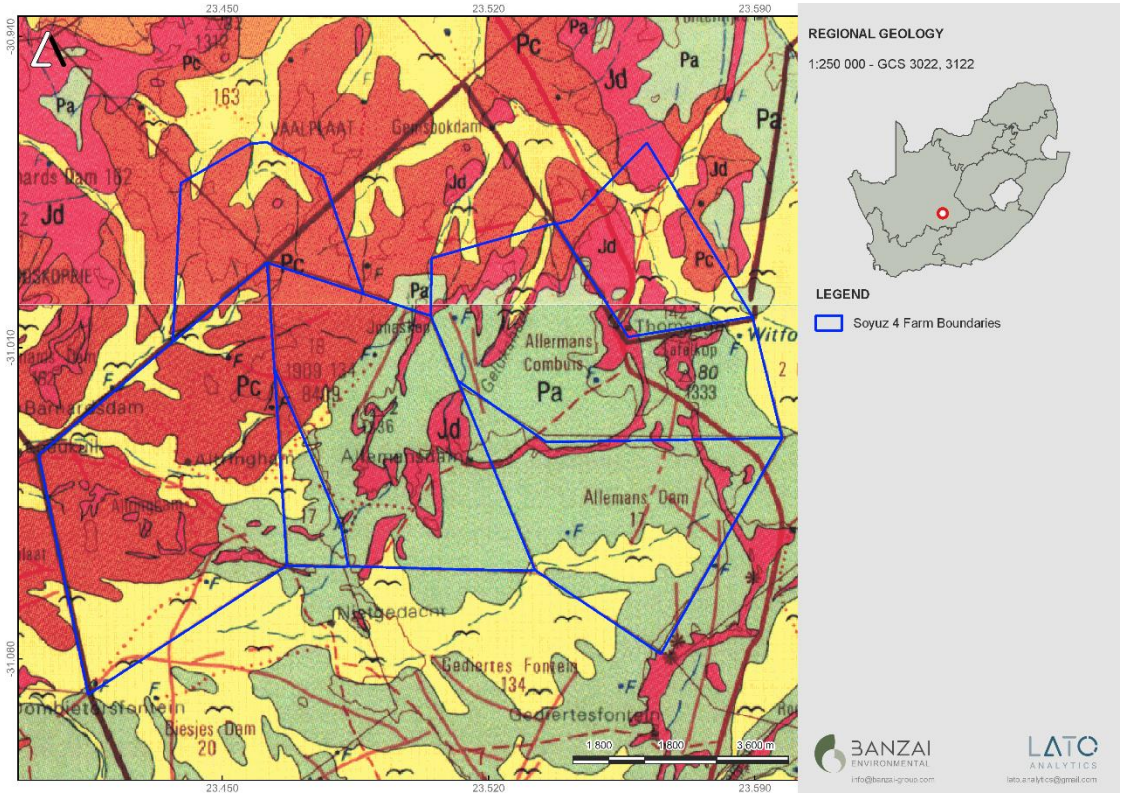



***Figure 4**: Extract of the 1:250 000 Geological map* Britstown 3022 (1991) and 3122 Victoria West (1989) Geological Map (Council for Geosciences, Pretoria) *indicating the proposed Soyuz 4 WEF in blue. The study area is underlain by the Late Caenozoic alluvium (yellow single bird figure), Jurassic dolerite (Jd, red), the Abrahamskraal Formation (Pa- light green) (Beaufort Group) as well as the Ecca Group of the Karoo Supergroup.*

Table 2: Legend of the 1:250 000 Britstown 3022 (1991) Geological Map (Council for Geosciences, Pretoria)

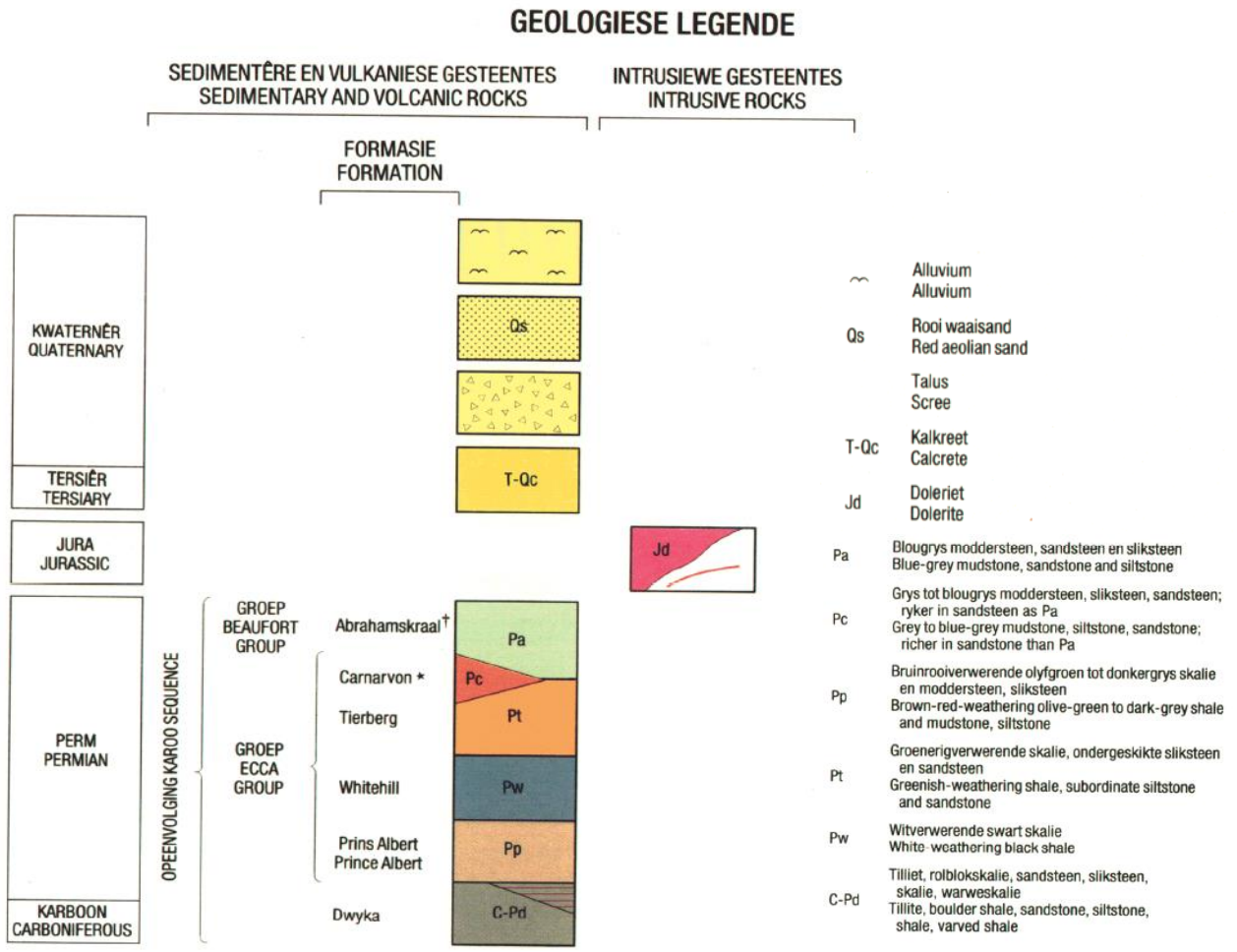
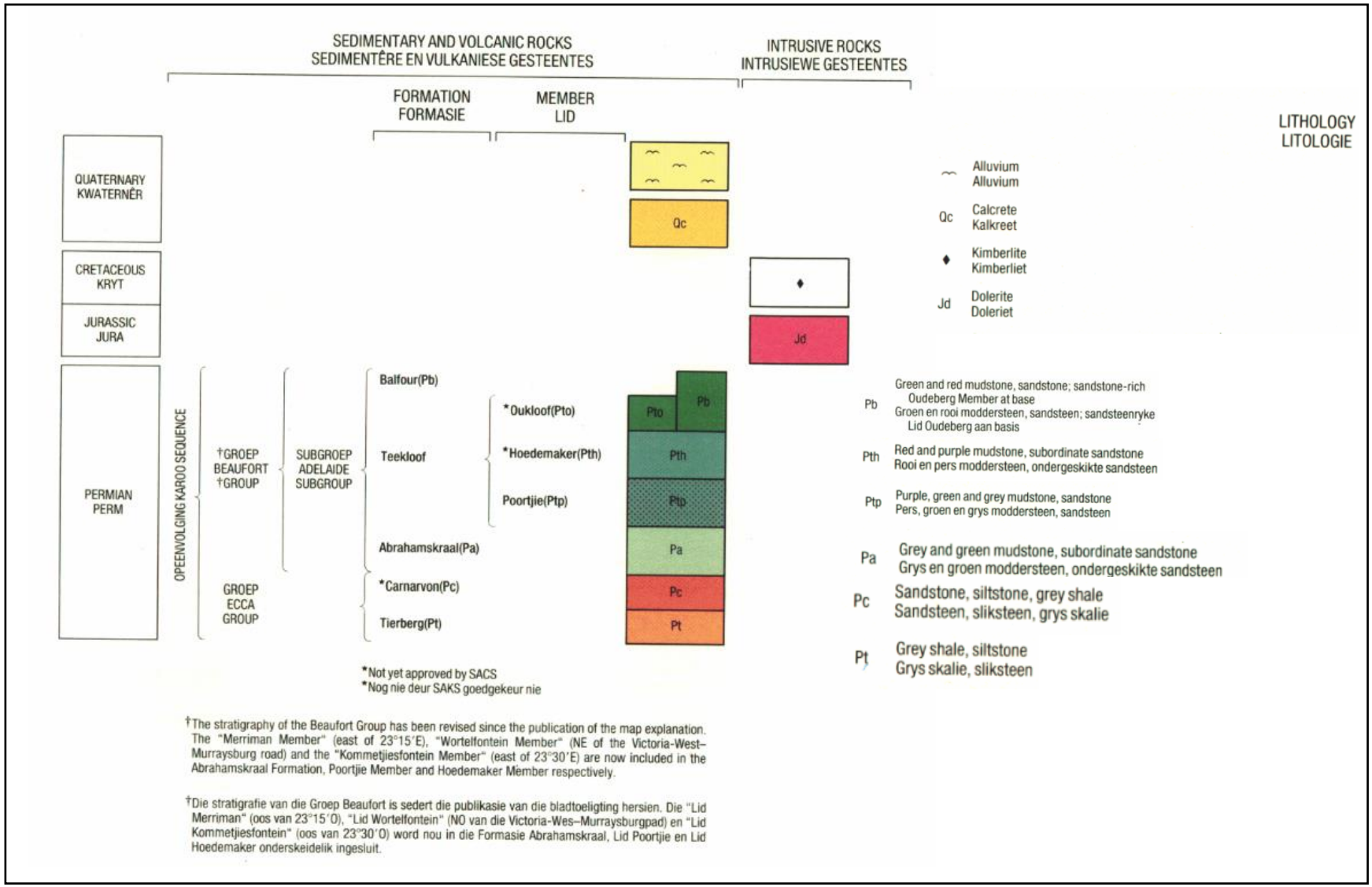


*Table 3: Legend of the 1:250 000 Victoria 3122 West (1989) Geological Map (Council for Geosciences, Pretoria)*



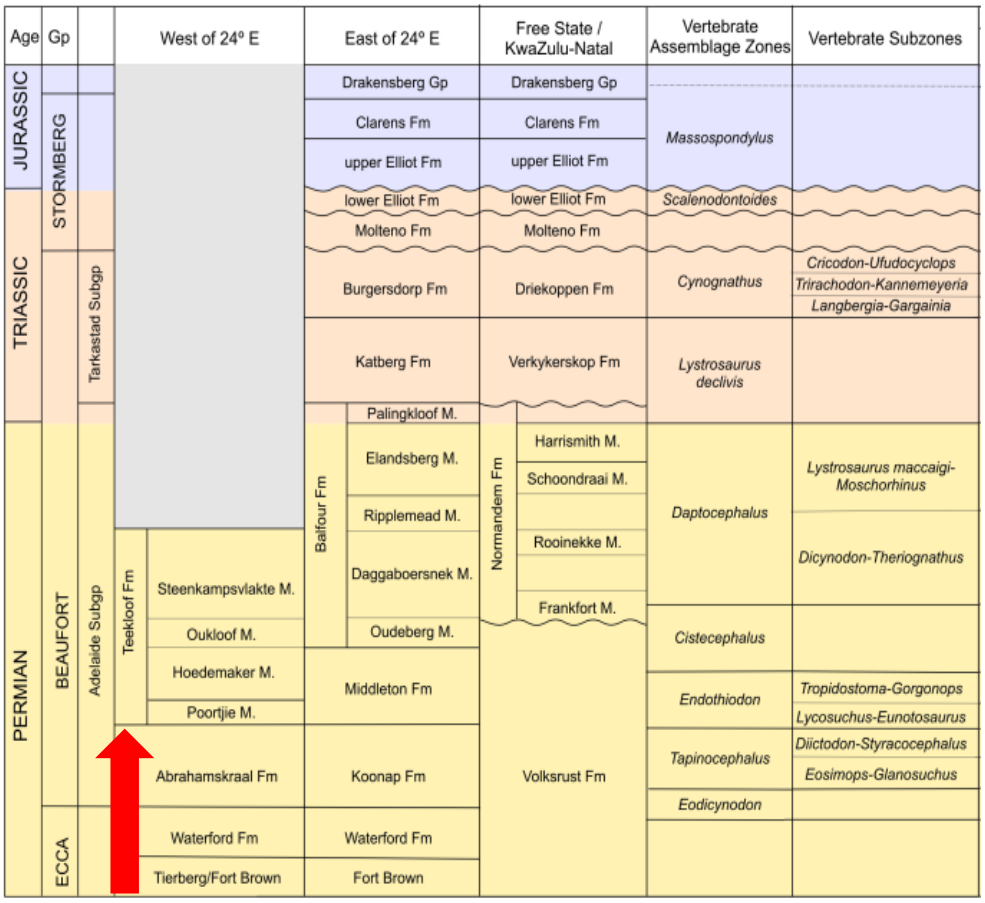



***Figure 5**: Vertebrate biozonation range chart for the Main Karoo Basin of South Africa.*

*Solid lines indicate known ranges, wavy lines indicate unconformities. (PLYCSR=Pelycosauria and MAMMFMES+Mammaliaformes. Gp=group, Subgp-Supbroup, Fm=Formation, M=Member). The proposed SOYUZ 4 WEF are indicated by the red arrow (Image taken from Smith et al, 2020).*

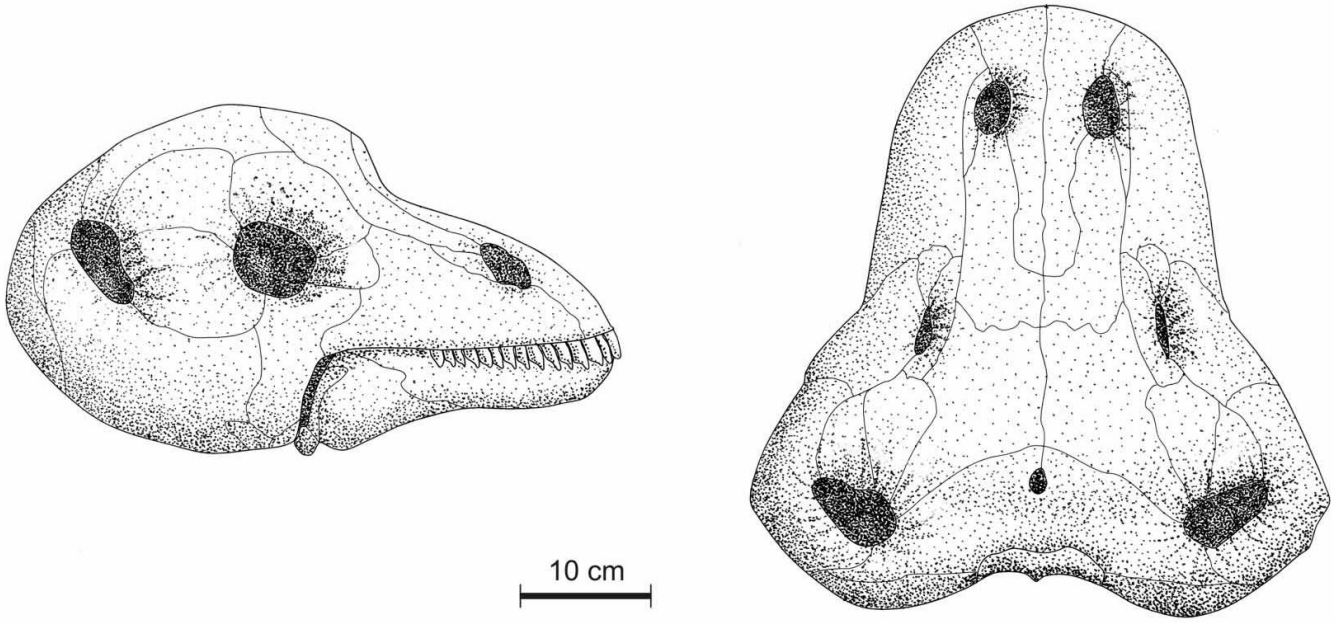



***Figure 6**: Tapinocephalus atherstonei, the index taxon of the Tapinocephalus Assemblage Zone, in lateral and dorsal view (Image taken from Day and Rubidge, 2020).*

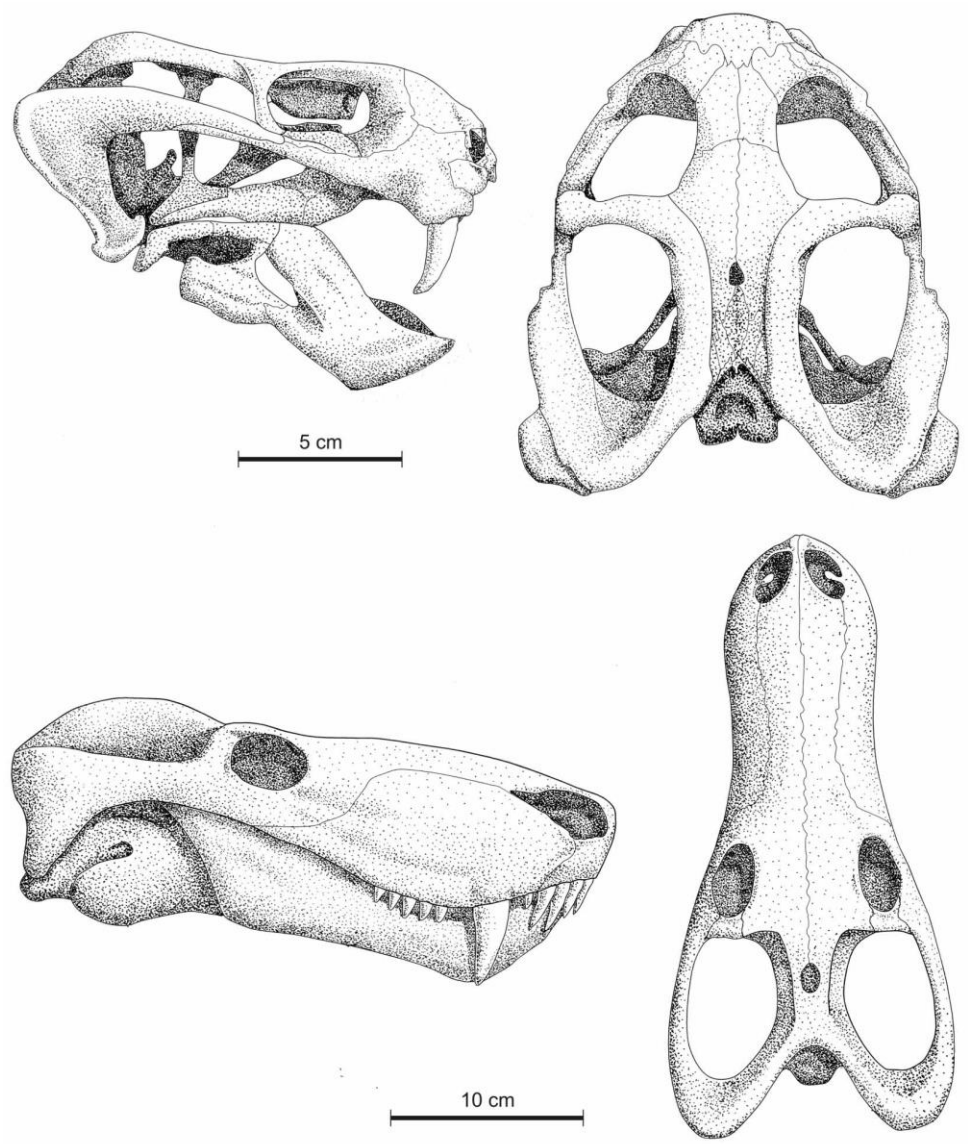



***Figure 7:*** *Lateral and dorsal view of the index taxa of the Eosimops - Glanosuchus Subzone in (top) Eosimops newtoni; (bottom) Glanosuchus macrops (Image taken from Day and Rubidge, 2020).*

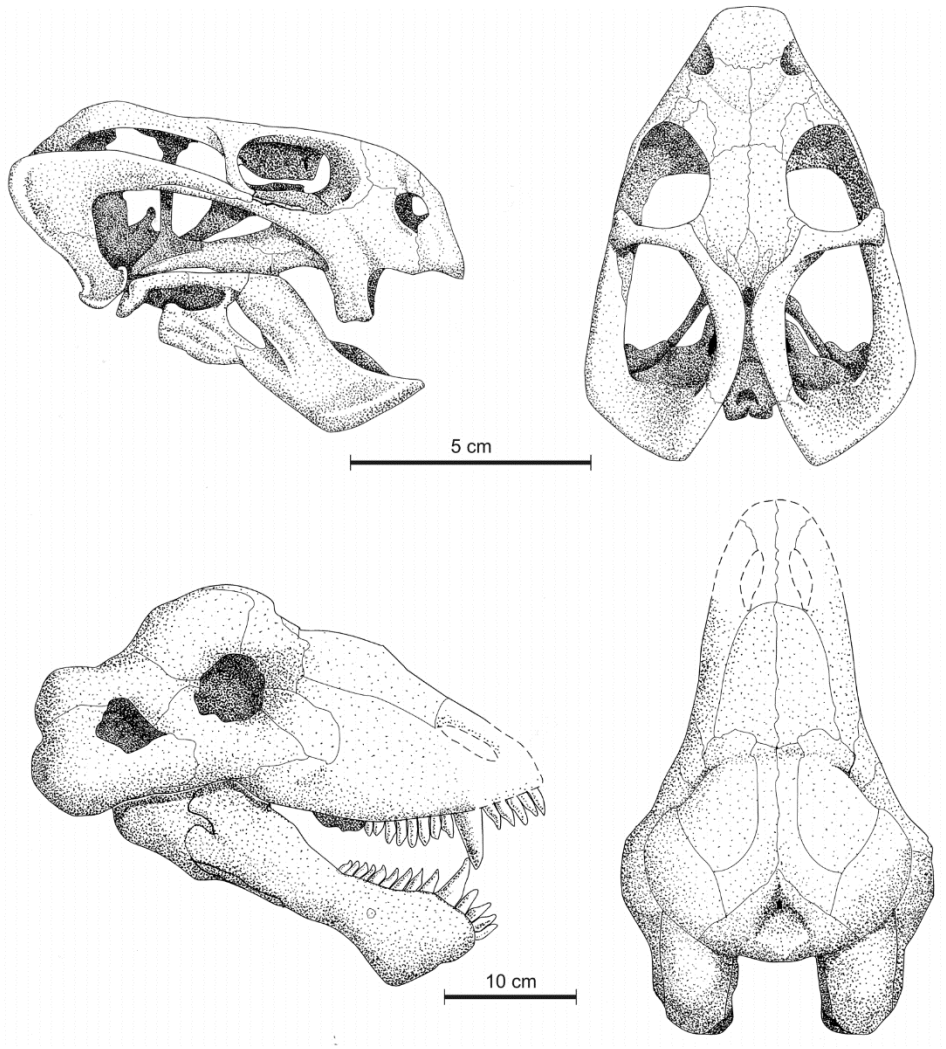



***Figure 8**: Illustration of the index taxa of the Diictodon - Styracocephalus Subzone in lateral and dorsal view. (top) Diictodon feliceps; (bottom) Styracocephalus platyrhynchus (Image taken from Day and Rubidge, 2020).*

Fossilized bones are generally encrusted with calcareous material and sometimes smaller fossils are entirely concealed in micritic nodules. In the northern margin of the basin the calcitic crusts is grey to greenish in colour while in the southern margin of the basin the nodules are very hard and often grey with orange weathering due to low-grade metamorphism related to the proximity of the Cape Fold Belt.

The lowermost biozone of the Beaufort Group occurs in the southwestern part of the main Karoo Basin and is known as the middle Permian Eodicynodon Assemblage Zone. In this biozone the basal therapsid *Eodicynodon* is the most abundant. The *Eodicynodon* AZ is 1100m at its thickest in the Prince Albert Road and thins to the west and east. This AZ documents the earliest middle Permian terrestrial environments of Gondwana. The sediments of this biozone were deposited on the southern shoreline of the Karoo Basin in a subaerial delta. This formed part of a large-scale fan system in the northeast and north within a second-order high-sand system tract.

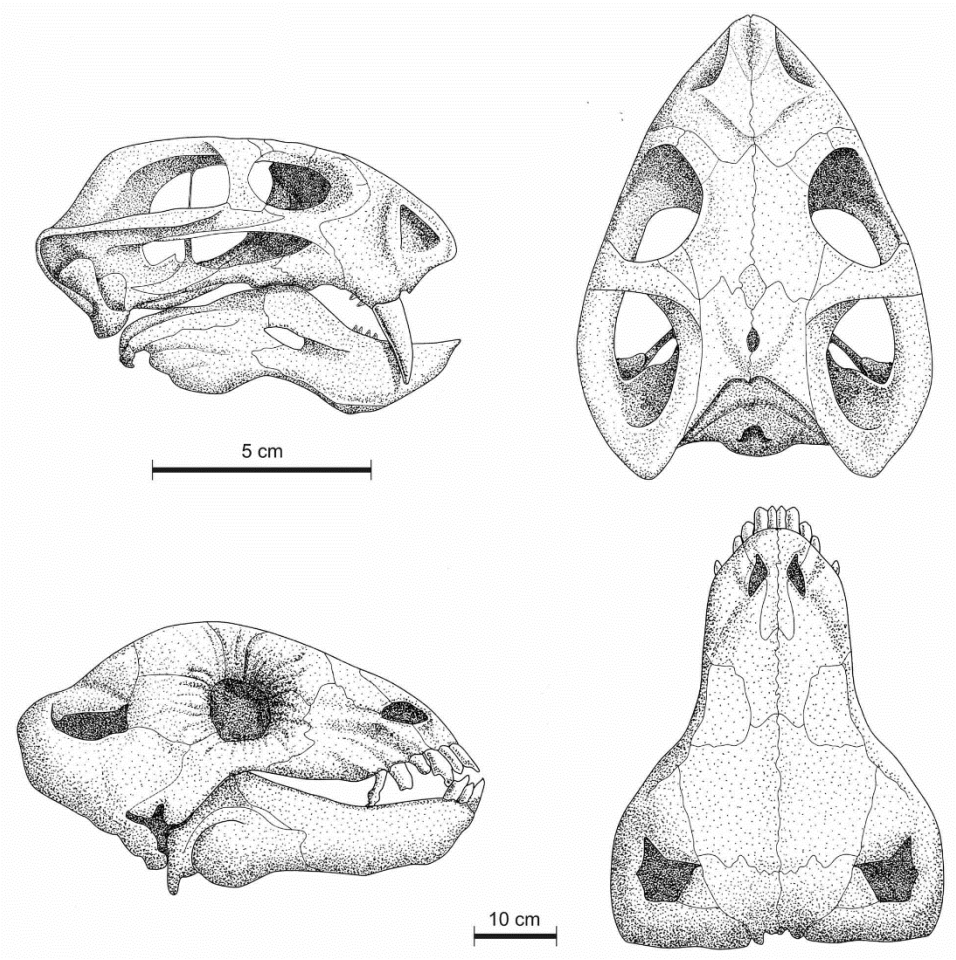



***Figure 9**:Lateral and dorsal views of biozone-defining fossils of the Eodicynodon Assemblage Zone: Eodicynodon oosthuizeni (top), Tapinocaninus pamelae (bottom) (Image taken from Rubidge and Day, 2020).*

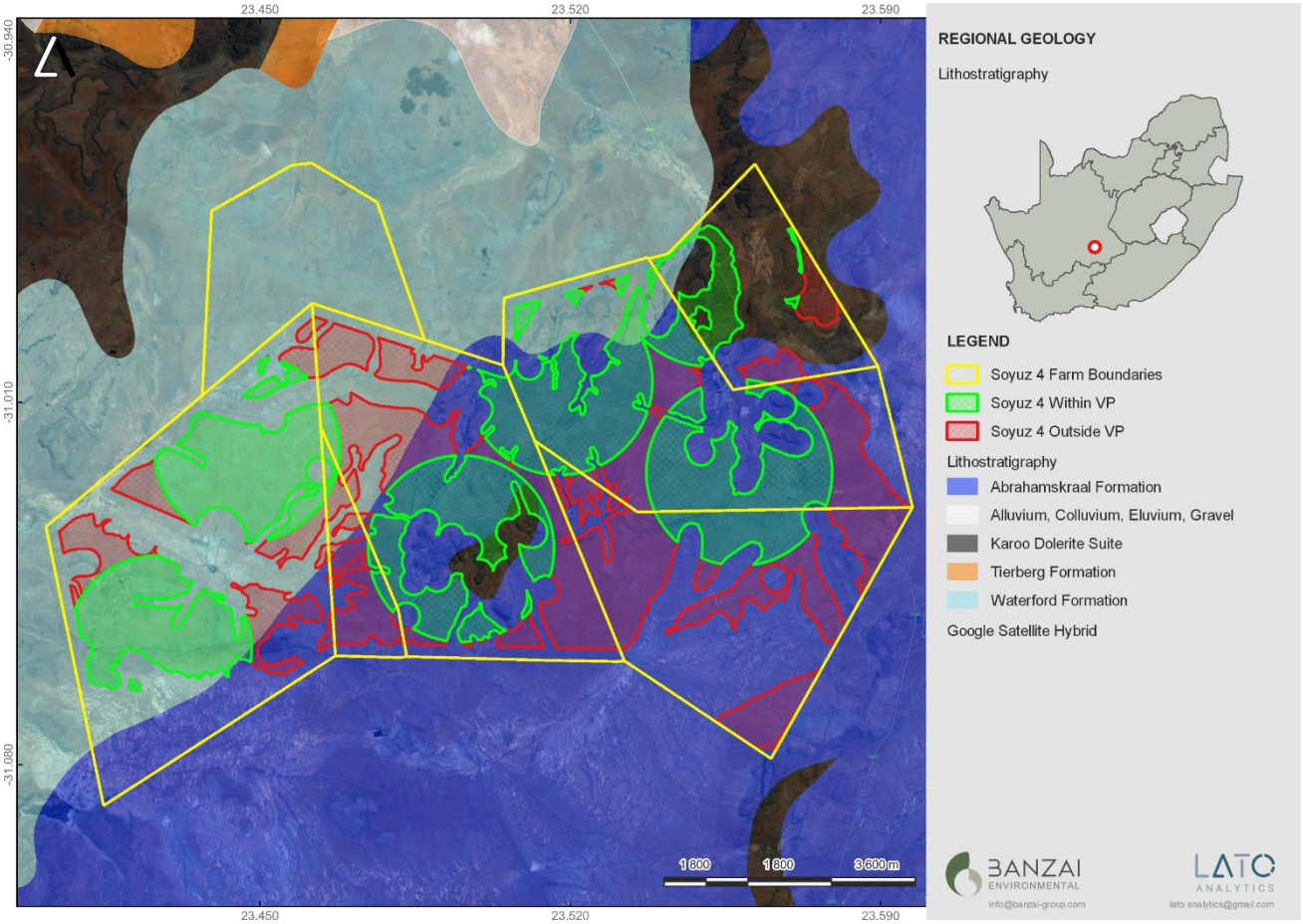



***Figure 10**: Updated geology (Council for Geosciences, Pretoria) indicates that the proposed SOYUZ 4 WEF is underlain by Jurassic Dolerite as well as the Abrahamskraal Formation (Beaufort Group) and the Waterford Formation of the Ecca Group (Karoo Supergroup).*

The 1:250 000 geological maps [Britstown 3022 (1991) and Victoria 3122 West (1989)] indicates that the development is underlain by the Carnarvon Formation of the Ecca Group. When these maps were published the Carnarvon Formation of the Ecca Group was not yet approved by SACS. Updated geology (Council for Geoscience, Figure 11) indicates that the proposed development is underlain by alluvium, colluvium, eluvium, and gravel; calcrete, surface limestones, Hardpan, and Jurassic Karoo Dolerite; the Abrahamskraal Formation as well as the Waterford Formation of the Ecca Group.

The Waterford Formation (Figure 11) of the Ecca Group is about 270 million years old and is a thick (500-770 m) deltaic deposit. The Beaufort- Ecca contact in the southern and western Karoo depicts a change from a subaqueous to a subaerial delta plain (Rubidge et al, 2000). This sandstone-rich, resistant-weathering Formation comprises of mudrock or clastic rhythmite units and very fine-grained, lithofeldspathic sandstones. Khaki to grey lithofeldspathic sandstones that may be speckled, while dark grey mudrocks are structured into broadly coarsening-upwards prograding cycles. Wave-ripple bedding planes are commonly present as well as ball-and

pillow structures. Trace fossils are common in this formation and consist of burrows, tubes, and trails. Fossil plants are represented by petrified wood and equisetaleans.

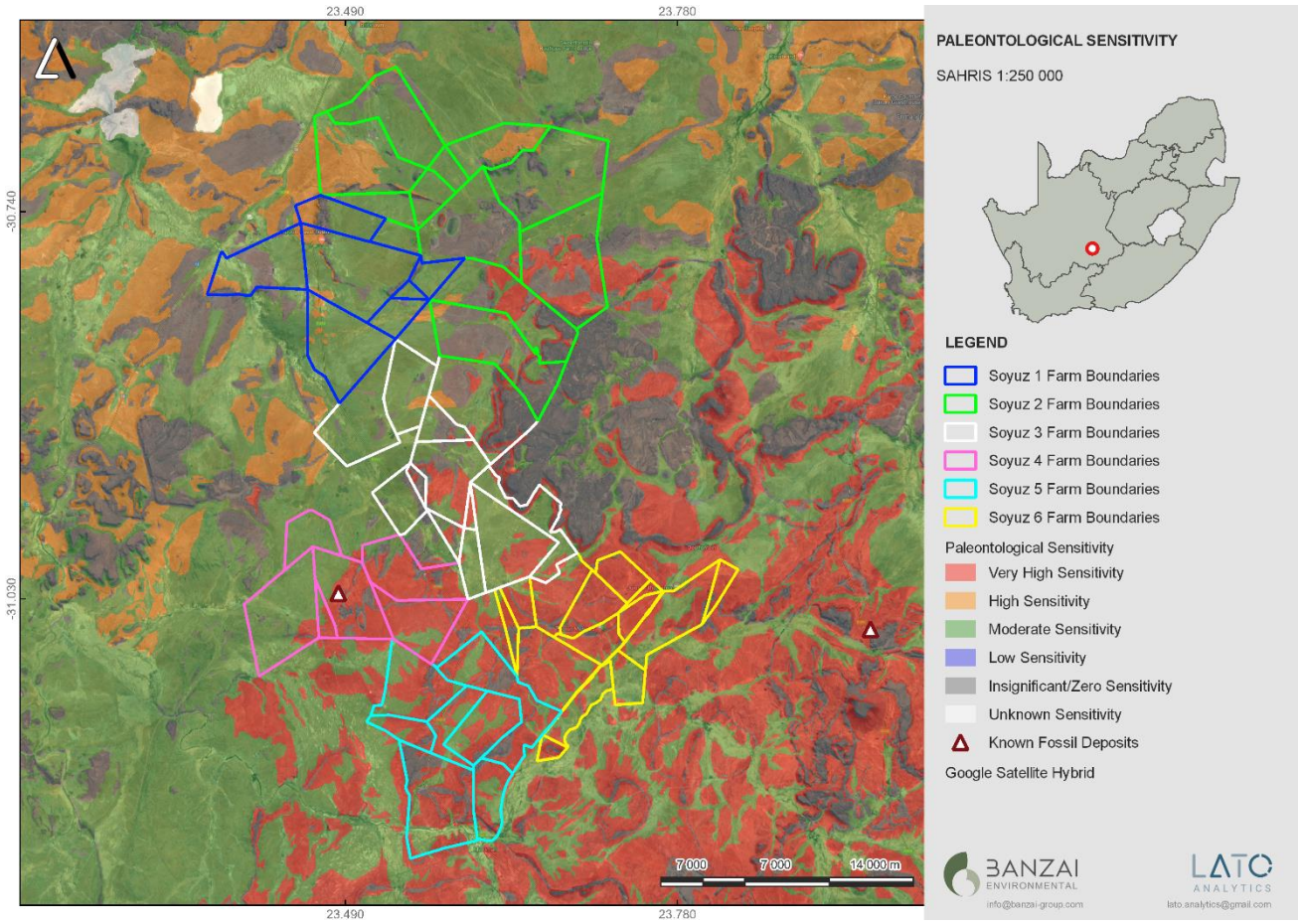



***Figure 11**: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the Soyuz 4 WEF development in pink. Fossils specified on the National Palaeontological Database are indicated by white triangles.*

The SAHRIS Palaeosensitivity map (Figure 11) indicates that the development is underlain by sediments with a Very High (red), Moderate (green) and Zero (grey) Palaeontological Sensitivity. Extensive research has been conducted in the Karoo Basin in the last decades and a National Palaeontological database has been compiled (Nicolas, 2007). This National Palaeontology Database indicates that only two fossils have been found in the Britstown area, while one was found in the SOYUZ 4 WEF footprint (indicated in Figure 11 by white triangles).

| 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. |

# 6 GEOGRAPHICAL LOCATION OF THE SITE

Soyuz 4 and associated infrastructure is located approximately 46 km South of Britstown within the Ubuntu Local Municipality and the Pixley ka Seme District Municipality in the Northern Cape Province (Figure 1-3).

# 7 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.

## 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.

Areas located elsewhere that have similar Assemblage Zones are 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 and thus this study has been commissioned.

## 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)
- Palaeontological Sensitivity Map on SAHRIS
- A Google Earth kmz files of the proposed development was obtained from CES – ENVIRONMENTAL AND SOCIAL ADVISORY SERVICES as well as background information.
- Topographic maps (1:50 000) of the 3022 Britstown area.
- 1:250 000 Britstown 3022 (1991) Geological map (Council of Geoscience, Pretoria)
- 1:250 000 Victoria West 3122 (1989) Geological Map (Council for Geosciences, Pretoria)
- A 6- day overall site-specific field survey of the WEF Cluster was conducted on foot and by motor vehicle during October 2022.

## 9 SITE VISIT

A 6- day overall site-specific field survey of the WEF Cluster was conducted on foot and by motor vehicle during October 2022. No fossiliferous outcrops were detected in the WEF footprint although a fossil was documented on the National Palaeontology Database. However, the occurrences of fossils are infrequent, rare and unpredictable.

***Figure 12**:General view over the development indicates low- lying plains (bossieveld) underlain by sandy to gravelly sediments and indicating an absence of bedrock exposures with dolerite koppies in the background.*

**Figure 13**: Unfossiliferous Dolerite koppie mantled by dolerite scree and grass and bossieveld.

**Figure 14**: *Low-lying plains with sandstone and dolerite in the foreground.*

# 10 IMPACT ASSESSMENT METHODOLOGY

## 10.1 Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

*Table 5:* 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:<br><br>(**Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity = X.**<br><br>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 |

### 10.2 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 and are regarded as having a high probability. As fossil heritage will be destroyed the impact is irreversible. The significance of the impact occurring will be high pre-mitigation and low post-mitigation.

## 11 FINDINGS AND RECOMMENDATIONS

The SOYUZ 4 WEF is underlain by Late Caenozoic alluvium, isolated Jurassic Karoo dolerite, Middle Permian Abrahamskraal Formation (Beaufort Group) as well as the Ecca Group of the Karoo Supergroup. Dolerite dykes and sills have baked the surrounding Beaufort sediments, thus compromising the fossil heritage of the area through thermal metamorphism. According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the alluvium is Moderate, that of Jurassic dolerite is Zero, while that of the Abrahamskraal Formation (Beaufort Group) and Ecca Group is Very High. (Almond and Pether, 2009; Almond et al., 2013). The Very High Palaeontological Sensitivity of the Abrahamskraal Formation triggers a site investigation.

Extensive research and fossil collecting have been conducted by palaeontologists in the last few decades, however, the Britstown area have been largely neglected. A 6-day overall comprehensive site-specific field survey of the Soyuz WEF Cluster was conducted on foot and by motor vehicle in October 2022. In the area investigated no fossiliferous outcrops were recovered. This could be attributed to the dolerite intrusions that metamorphized potentially fossiliferous Beaufort sediments, low relief of the development as well as poor bedrock exposure and relative unfossiliferous superficial sediments. However, it must be emphasised that the presence of well-preserved fossils is not ruled out.

A High Palaeontological Significance has been allocated for the construction phase of the WEF development pre-mitigation and a low significance post mitigation. The construction phase will be the only development phase

impacting Palaeontological Heritage and **no significant impacts are expected to impact the Operational and Decommissioning phases**. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The **Cumulative impacts of the Soyuz 4 WEF development near Britstown is considered to be high pre- mitigation and Low post mitigation and falls within the acceptable limits for the project**. It is therefore considered that the proposed development will not lead to destructive impacts on the palaeontology of the area. **The construction of the development may thus be authorized in its whole extent, as the development footprint is not considered sensitive from a palaeontological point of view. It is thus recommended that no further palaeontological heritage studies, ground truthing or specialist mitigation are required pending the discovery of new fossil assemblages.**

Recommendations:

- The ECO for this project must be informed that the Abrahamskraal Formation, Adelaide Subgroup, Beaufort Group, Karoo Supergroup) and the Ecca Group of the Karoo Supergroup has a **Very High Palaeontological Sensitivity**.
- Basic training in identifying fossil heritage is recommended for the ECO and relevant staff. If any fossil remains or trace fossils are discovered during any phase of construction or operation, either on the surface or exposed by excavations, the ECO in charge of this development should implement the **Chance find Protocol** immediately. These discoveries should be protected (if possible, *in situ*) and the ECO must report such discoveries 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). Suitable mitigation (*e.g.,* recording and collection) will consequently be undertaken by a palaeontologist.
- Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
- These recommendations should be incorporated into the Environmental Management Plan for the Soyuz 4 WEF.

***Impact Summary***

| Impacts | Extent | Duration | Magnitude | Reversibility | Irreplaceable loss | Cumulative effect | Impact |
|---|---|---|---|---|---|---|---|
| **Pre-mitigation** | 1 | 4 | 3 | 4 | 4 | 4 | Negative High 48 |
| **Post mitigation** | 1 | 4 | 1 | 4 | 4 | 2 | Negative Low 30 |

## 12 CHANCE FINDS PROTOCOL

A following procedure will only be followed if fossils are uncovered during excavation.

Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the National Heritage Resources Act (Act 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) of plants or animals embedded in rock. These plants and animals lived in the geologic past 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.

### 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 coordinates.

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.

In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO (site manager). 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 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

APPENDIX A

ELIZE BUTLER

CURRICULUM VITAE

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|---|---|
| PROFESSION: | Palaeontologist |
| YEARS' EXPERIENCE: | 30 years in Palaeontology |
| EDUCATION: | B.Sc Botany and Zoology, 1988<br>University of the Orange Free State |
| | B. Sc (Hons) Zoology, 1991<br>University of the Orange Free State |
| | Management Course, 1991<br>University of the Orange Free State |
| | M. Sc. *Cum laude* (Zoology), 2009<br>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<br>University of the Free State Zoology 1992 |

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|---|---|
| Research Assistant | National Museum, Bloemfontein 1993 – 1997 |
| Principal Research Assistant and Collection Manager | National Museum, Bloemfontein 1998–2022 |

TECHNICAL REPORTS

Butler, E. 2014. Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province. Bloemfontein.

Butler, E. 2014. Palaeontological Impact Assessment for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014. Bloemfontein.

Butler, E. 2015. Palaeontological impact assessment of the proposed consolidation, re-division, and development of 250 serviced erven in Nieu-Bethesda, Camdeboo local municipality, Eastern Cape. Bloemfontein.

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