PALAEONTOLOGICAL COMPLIANCE STATEMENT

132 KV GOOD HOPE OHPL WEST OF DEALESVILLE IN THE FREE STATE PROVINCE

May 2023

COMPILED FOR:

PGS HERITAGE

EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage to conduct the Palaeontological Desktop Assessment (PDA) to assess the 132 kV Good Hope overhead power line (OHPL) west of Dealsville in the Free State. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PDA is necessary to confirm if fossil material could potentially be present in the planned development area, and to evaluate the potential impact of the proposed development on the Palaeontological Heritage.

The study area is underlain by Quaternary deposits, Jurassic dolerite, as well as the Tierberg Formation of the Ecca Group (Karoo Supergroup). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Quaternary aeolian sands are Moderate, that of Jurassic dolerite is Zero and the Tierberg Formation has a High Palaeontological Sensitivity (Almond and Pether, 2009; Almond *et al*., 2013).

Updated Geology indicates that the study area is underlain by the Kalahari Group, Karoo Dolerite, and the Tierberg Formation of the Ecca Group. Topographical as well as Google Earth images indicate that the relief of the proposed project is low, and outcrops in the area are rare.

Therefore, the proposed development **will not lead** to detrimental impacts on the palaeontological reserves of the area.

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

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

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1 INTRODUCTION

The proposed 132kV Good Hope OHPL is a new Application to connect the authorised Good Hope Solar Park (consisting of the Good Hope 1&2 Solar PV Facilities) to the national grid, via the proposed Eskom Artemis Substation. Terramanzi Group (Pty) Ltd have been appointed to facilitate the Basic Assessment Reporting process to obtain Environmental Authorisation in terms of the National Environmental Management Act ("NEMA") and associated Environmental Impact Assessment ("EIA") Regulations, 2014 (as amended).

The Good Hope Solar Park consists of the authorised Good Hope 1 & 2 Solar PV Facilities and has been awarded Preferred Bidder status under Bid Window 6 of the REIPPPP; The OHPL is required to connect the Solar Park to the national grid, which will add capacity to the energy mix; Employment opportunities and skills development.

The proposed Good Hope Over Head Power Line (GHOHPL) corridor is situated just to the west of the town of Dealesville within the Tokologo Local municipality, Lejweleputswa District Municipality, Free State Province (Figure 1-2).

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 thirty years. She has experience in locating, collecting, and curating fossils. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

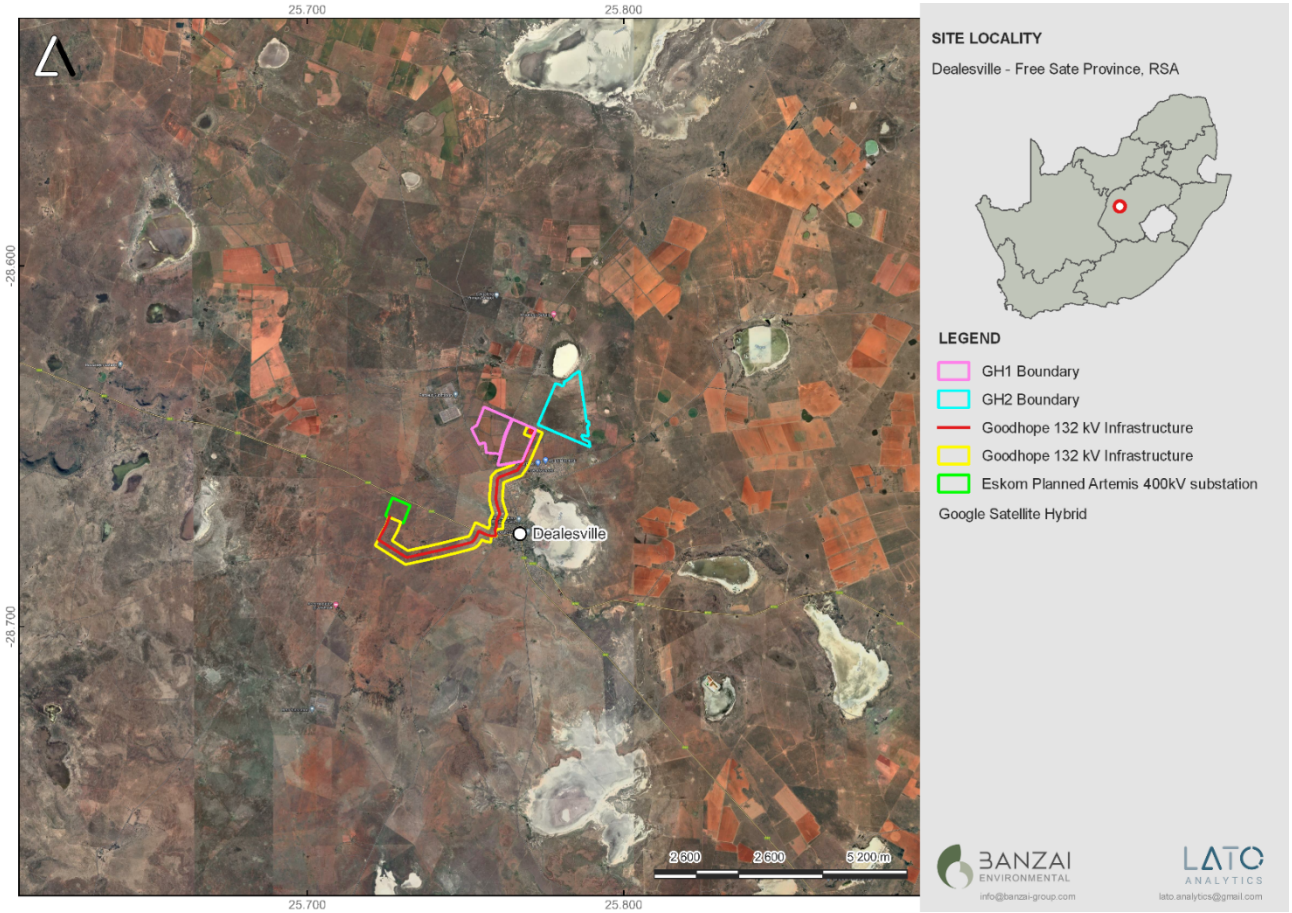


***Figure 1**: Regional locality of the Good Hope OHPL west of Dealesville in the Free State Province*

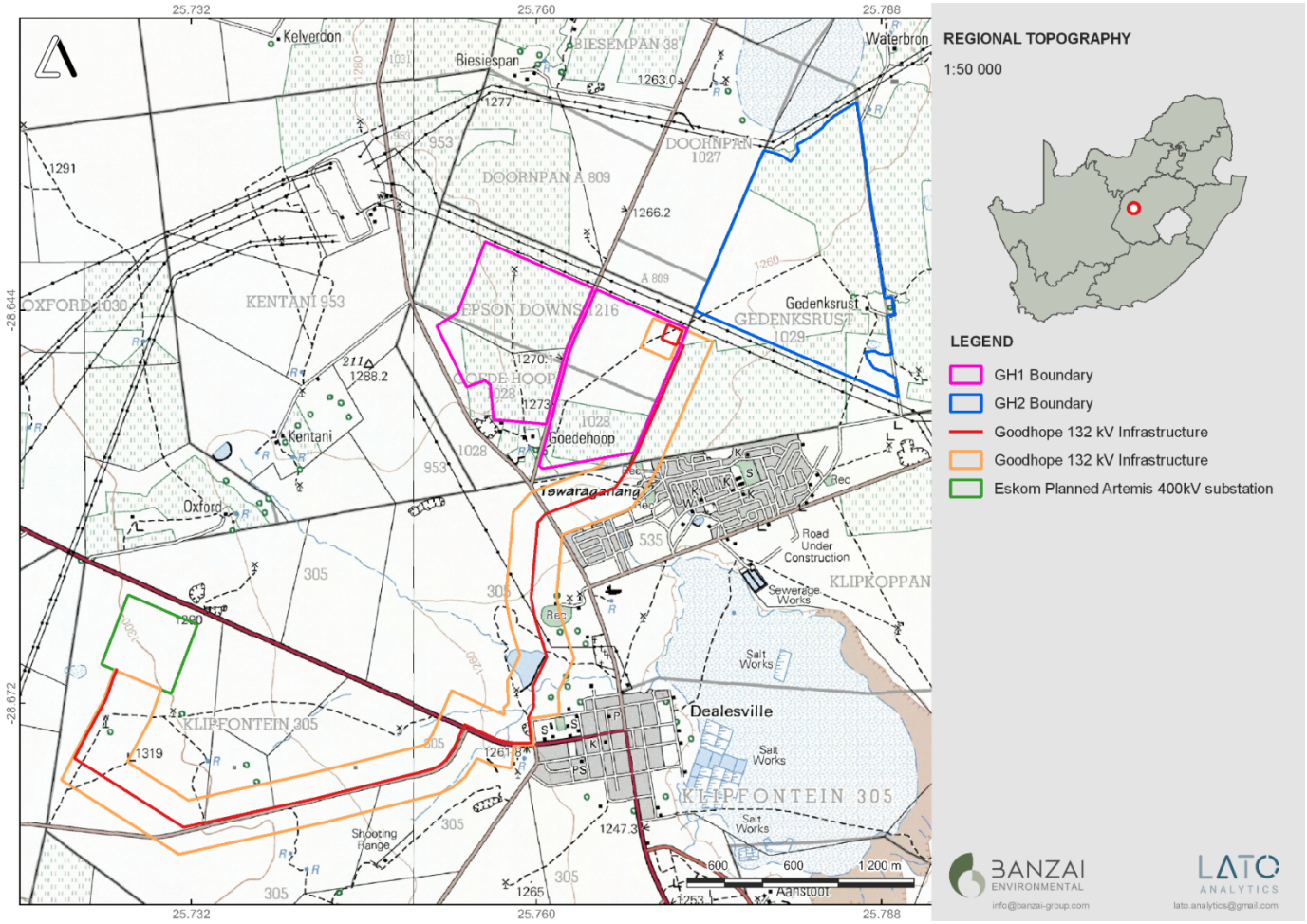


***Figure 2**: Locality Map of the Good Hope OHPL west of Dealesville in the Free State Province*

3 METHODS

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require environmental authorisation (EA) from the Competent Authority (CA), namely the Department of Small Business Development, Tourism and Environmental Affairs (DESTEA), prior to the commencement thereof.

In accordance with GN 320 of 20 March 2020 and GN 1150 of 30 October 2020[1] (i.e., "the Protocols") of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Elize Butler as Palaeontology Specialist have been commissioned to verify the sensitivity of the Good Hope OHPL under these specialist protocols.

5.1 Site Sensitivity Verification Methodology

The Palaeontology Sensitivity Verification was undertaken by the following methodology:

- The site sensitivity is established through the National Environmental Web-Based Screening Tool
- The Site is mapped on the relevant Geological Map to determine the underlying geology of the development
- Then the site is mapped on the South African Heritage Resources Information System (SAHRIS) PalaeoMap, and the Sensitivity of the proposed development established.
- Other information is obtained by using satellite imagery and
- Palaeontological Impact Assessments and Desktop Assessments of projects in the same area are studied.

3.1 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

[1] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

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

4 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The Good Hope OHPL west of Dealesville in the Free State is depicted on the 1:250 000 2824 (1993) Kimberley Geological Map (Council of Geoscience, Pretoria). The study area is underlain by Quaternary deposits (Qs, yellow), Jurassic dolerite (Jd, red), as well as the Tierberg Formation (Pt, orange) of the Ecca Group (Karoo Supergroup) (Figure 3, Table 2). The PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database indicates that the Palaeontological Sensitivity of the Quaternary sands is Moderate, that of Jurassic dolerite is Zero and the Tierberg Formation (Pt; orange) has a High Palaeontological Sensitivity (Almond and Pether, 2009; Almond *et al*., 2013; Figure 4). Recent Shape files produced by the Council of Geosciences, Pretoria) is depicted in Figure 5. Topographical as well as Google Earth images indicate that the relief of the proposed project is low, and outcrops in the area are rare.

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). Netterberg (1978, 1980) revised the South African calcretes and found that the calcretes comprise of glaebular calcrete (with separate nodules), hardpan calcrete that contain solid limestone and honeycomb calcrete (fusing with glaebules). These calcretes are locally conglomeratic with clasts of exotic pebbles and reworked calcretes. The calcretes could contain mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens, and peats are recovered as well as trace fossils like vertebrate tracks, termite and insect burrows, termitaria (termite heaps/ mounds) as well as rhizoliths (root casts). Reworked Stone Age artifacts (Plio-Pleistocene) have been found in Quaternary alluvium. Some of these calcretes may be diamondiferous.

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. 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.

The Karoo igneous province (Jd-red) is one of the world's classic continental basalt (CFB) provinces. These rocks are igneous in origin and are thus unfossiliferous and thus not discussed further in the report.

The Tierberg Formation (Pt, orange, Figure 3) 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). This 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).

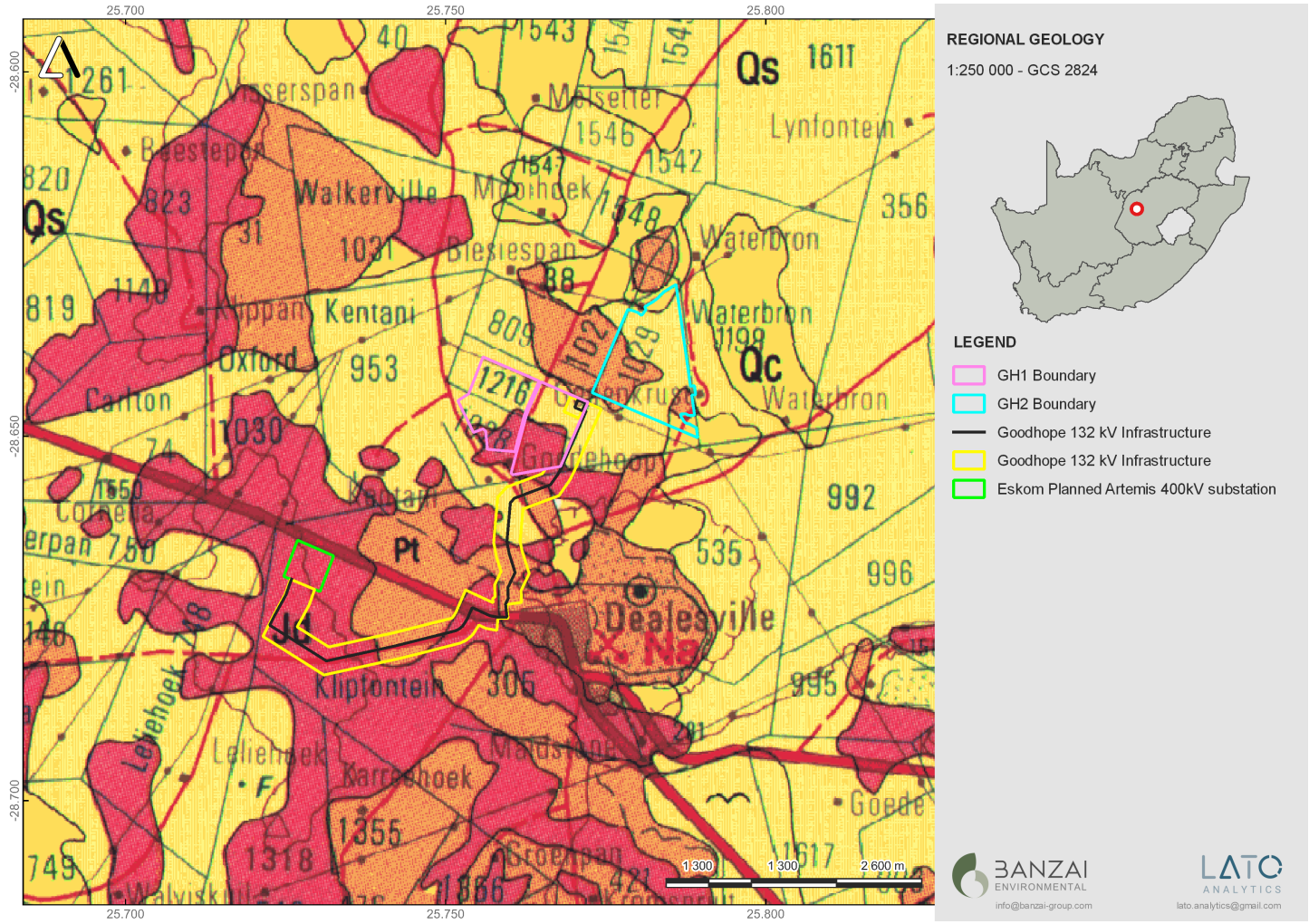
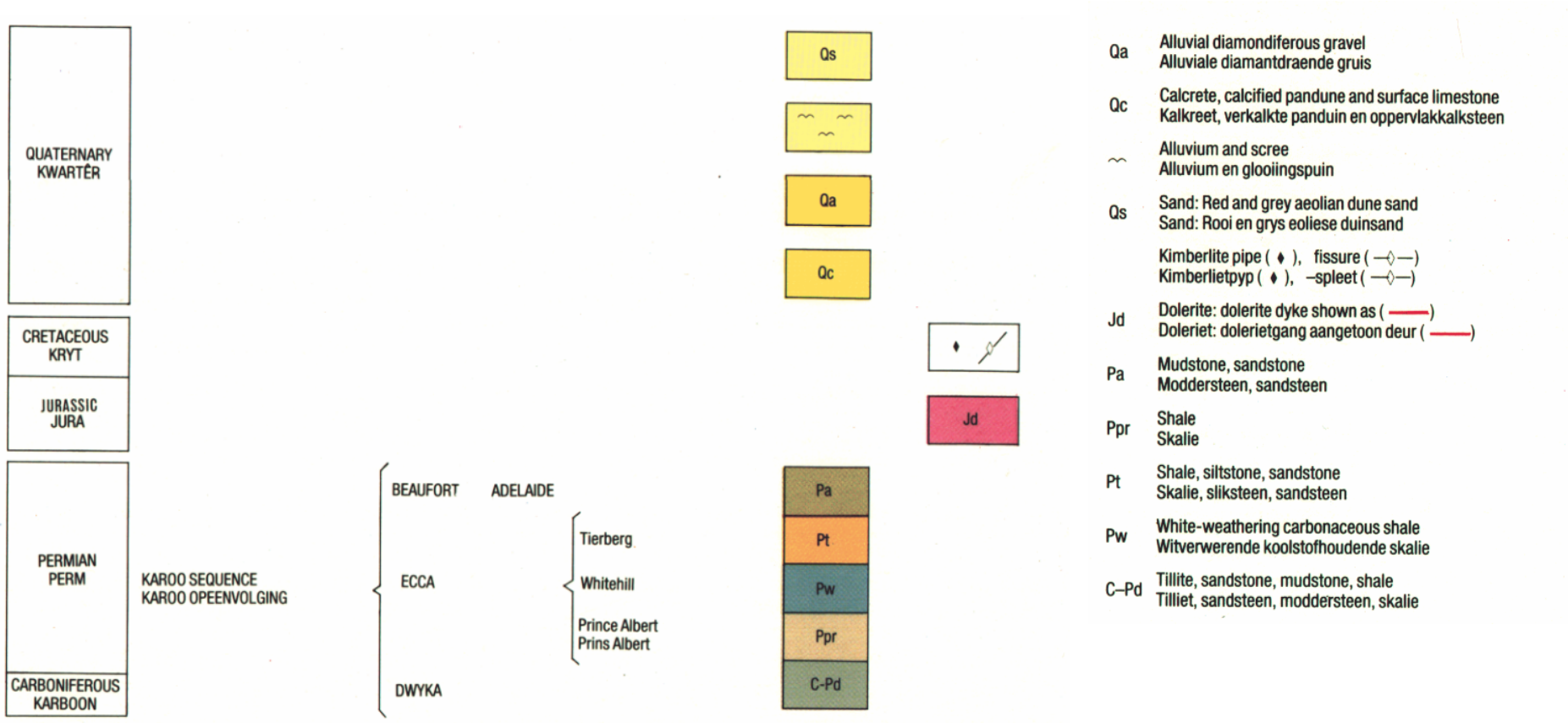


Figure 3. Extract of the 1:250 000 Kimberley 2824 Geological map (1993) (Council of Geoscience, Pretoria) indicating the geology of the Good Hope OHPL west of Dealesville in the Free State Province. The study area is underlain by Quaternary sediments (Os, yellow), Jurassic dolerite (Jd, red), and the Tierberg Formation (Pt, orange).

Table 1: Legend to the 1:250 000 Kimberley 2824 *Geological map (1993) (Council of Geoscience, Pretoria).*



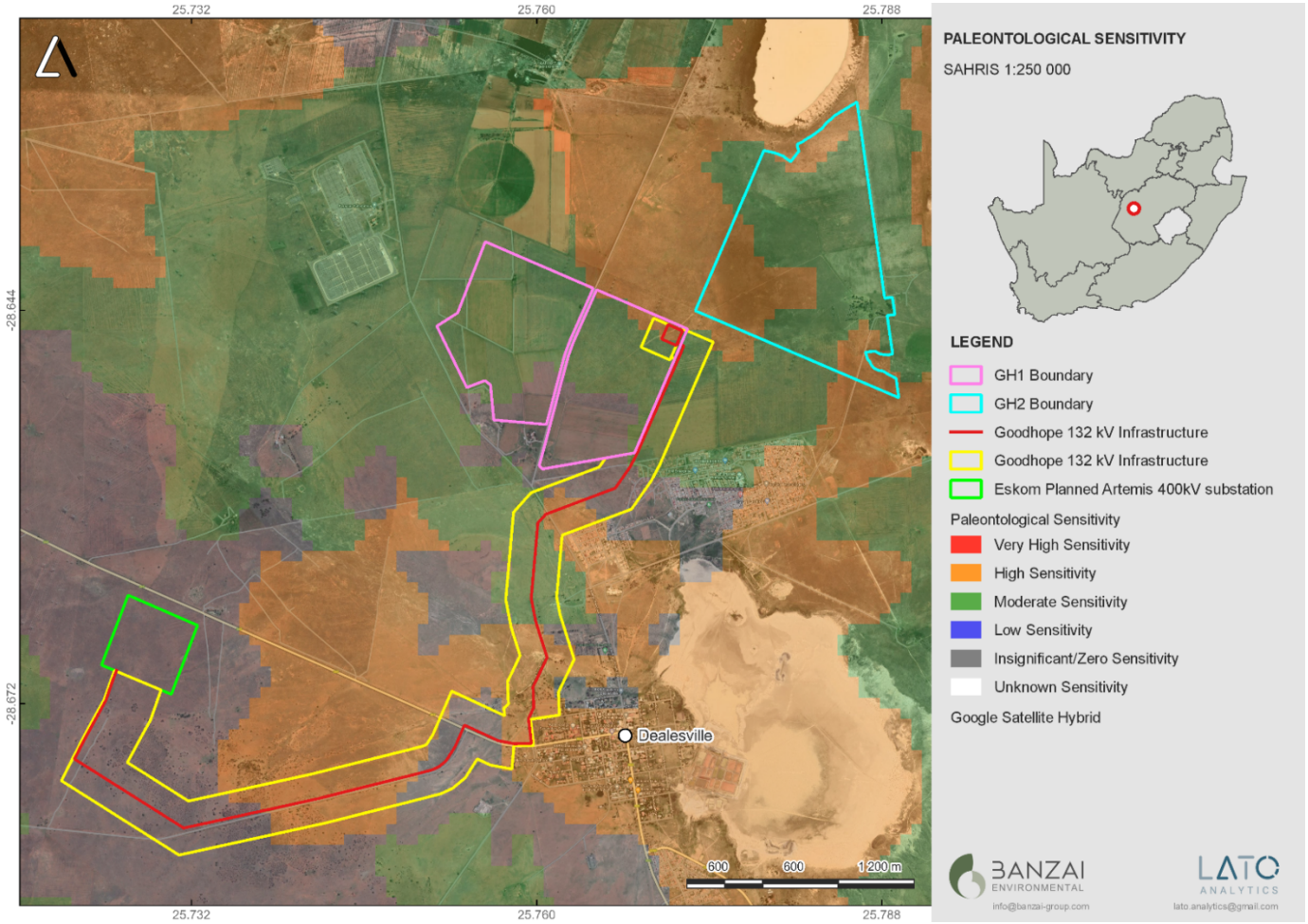


***Figure 4**: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the Palaeontological Sensitivity of the of the Good Hope OHPL west of Dealesville in the Free State Province.*

The SAHRIS Palaeomap indicates that the Palaeontological Sensitivity of the proposed development is underlain by sediments with a High (orange), Moderate (green) and Zero (grey) Palaeontological Sensitivity.

Table 2: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website

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

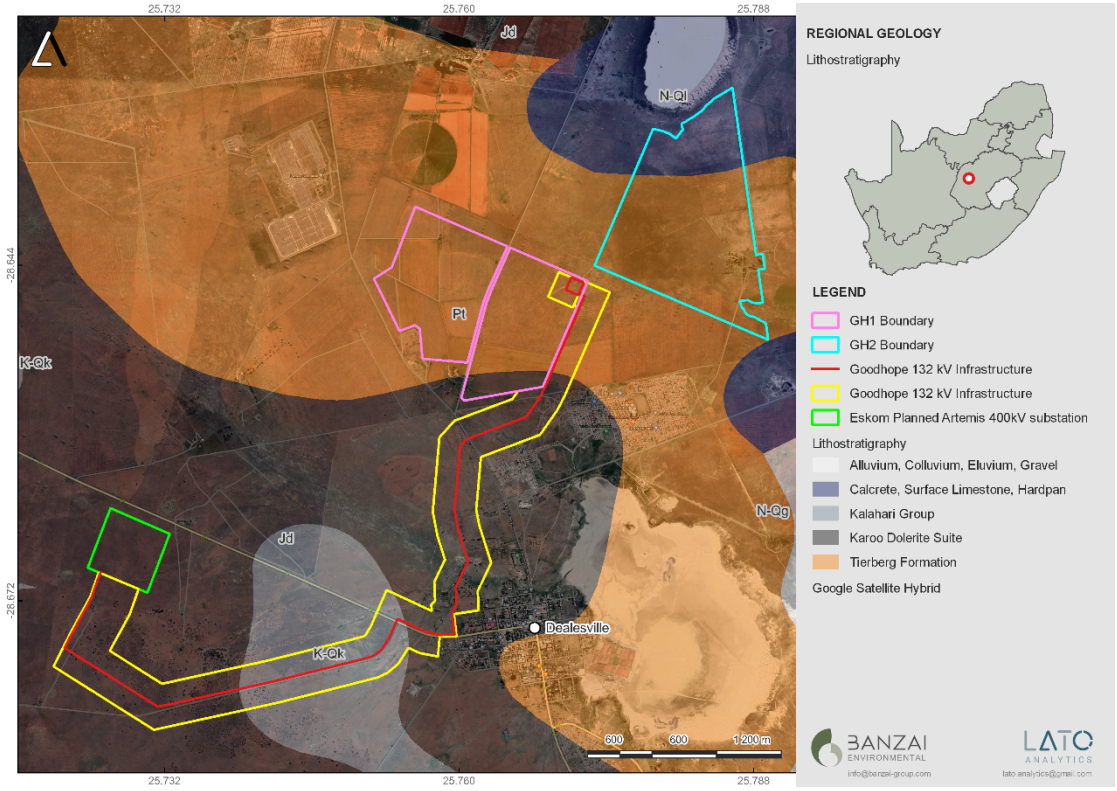


Figure 5: Updated Geology (Council of Geosciences, Pretoria) indicates that the study area is underlain by the Kalahari Group, Karoo Dolerite as well as the Tierberg Formation of the Ecca Group.

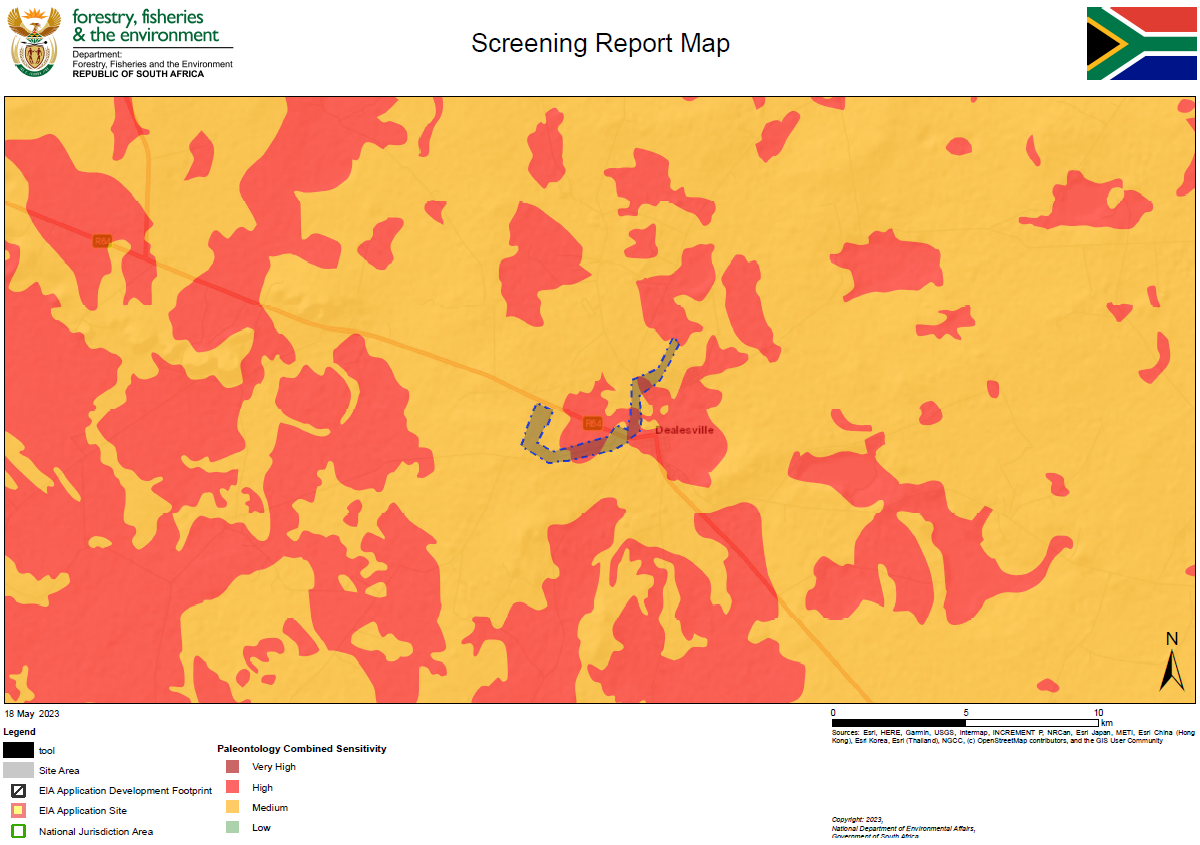


***Figure 6**: Palaeontological Sensitivity of the Good Hope OHPL near Dealsville in the Free State by the National Environmental Web-bases Screening Tool indicates that the Sensitivity of the development is High.*

The Site Sensitivities of the proposed Good Hope OHPL has been verified. From a Palaeontological point of view, it was found that: 1) The SAHRIS Palaeosensitivity map indicates that the Palaeontological Sensitivity of the development is High and 2) the National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is High.

5 FINDINGS AND RECOMMENDATIONS

The study area is underlain by Quaternary deposits, Jurassic dolerite, as well as the Tierberg Formation of the Ecca Group (Karoo Supergroup). According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Quaternary aeolian sands are Moderate, that of Jurassic dolerite is Zero and the Tierberg Formation has a High Palaeontological Sensitivity (Almond and Pether, 2009; Almond *et al*., 2013).

Updated Geology indicates that the study area is underlain by the Kalahari Group, Karoo Dolerite as well as the Tierberg Formation of the Ecca Group. Topographical as well as Google Earth images indicate that the relief of the proposed project is low, and outcrops in the area are rare.

It is therefore considered that the proposed development will not lead to detrimental impacts on the palaeontological reserves of the area.

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

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

6 CHANCE FINDS PROTOCOL

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

6.1 Legislation

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

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

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived millions of years ago. Fossils are extremely rare and irreplaceable. By studying

fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

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

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

6.2 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately stop working and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.

- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.