Application for Mining Right - Manzolwandle

Nkomazi Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province.

Farm: Portions 55,64,69,85,213, Remaining Extent of Portions 18,21,66 Tenbosch 162-JU, Portions 2,5,6 Turfbult 593-JU, Teckleburg's Ranch 548-JU

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Palaeontological Impact Assessment

Tsimba Archaeological Footprints

24 Lawson Mansions, 74 Loveday Street,

Johannesburg,

2000

061 912 5118

Ref: Pending

2020/01/10

Fossil plant – Ecca Group

A. Executive summary

Scope of the project: Tsimba Archaeological Footprints was appointed by Myezo Environmental Management Services (Pty) Ltd to undertake a Paleontological Impact Assessment (PIA) of the suitability of the proposed underground mining and a box shaft on Farms Portions 55,64,69,85,213, Remaining Extent (RE) of Portions 18,21,66 Tenbosch 162-JU, Portions 2,5,6 Turfbult 593-JU, Teckleburg's Ranch 548-JU. – in the Nkomazi Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province. Both the Environmental Screening Tool and the SAHRIS website were consulted to access the applicability of a Heritage Impact Assessment report on proposed development site. The proposed development is marked as a high fossil sensitivity area hence a Phase 1 Paleontological Impact Assessment report was compiled.

The applicant, Tenbosch Mining (Pty) Ltd is applying for a Mining Right for surface and underground mining.

The Project includes one locality (Figure 1):

Project Location: An area blocked in red 4 km west of Komatipoort, 10 km west of the Lebombo border, east of Barberton and south of the Kruger National Park in the Barberton Magisterial District. Approximate size is 8 528.95 hectares.

Legal requirements:-

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW to VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation is necessary.

Types and ranges of heritage resources as outlined in Section 3 of the NHRA:
(i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.

This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999).
Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m² in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report aims to provide comment and recommendations on the potential impacts that the proposed development project / mining could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

Outline of the geology and the palaeontology:
The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984); 1:250 000, 1:250 000 Barberton 2530 Geological Map (Walraven and Hartzer 1986).

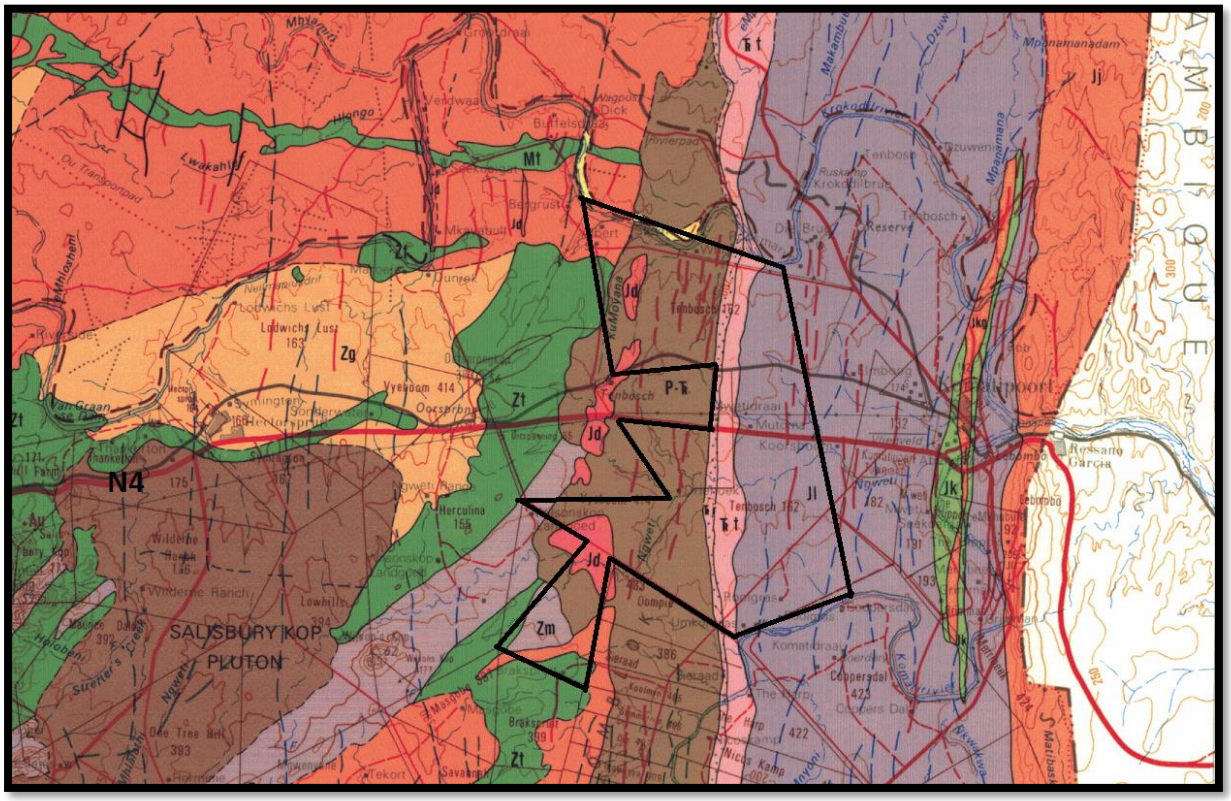

Figure: The geology of the development area.
Legend to map and short explanation.
Jd – Dolerite (dark pink). Jurassic.
Jl – Green, fine-grained mafic lava, locally porphyritic, amygdaloidal in places interlayered with rhyolite, especially near the top (purple). Letaba Formation, Lebombo Group, Karoo Supergroup. Jurassic.
TRt – Cream-coloured, fine-grained, massive sandstone (pink). Tshipise Member, Clarens Formation, Stormberg Group, Karoo Supergroup. Trias.
P-Rt – Undifferentiated Karoo Supergroup below TR t (brown). Karoo Supergroup. Permian.
Znm – Potassic gneiss and migmatite with some phenocrysts (:::); strongly porhyroblastic; veined by granodiorite (++) (amber). Nelspruit Suite.

Zm – Undifferentiated Zmb to Zmc (purple). Moodies Group, Baberton Supergroup. Zwazian.
Zt – Undifferentiated Ztk to Ztt (green). Tjakastad Formation, Onverwacht Group, Baberton Supergroup. Zwazian.
___f__ - Fault.
…… – (black) Lineament (Landsat, aeromagnetic).
------ - Concealed geological boundary.
⊥21˚ – Strike and dip of bed.
□ – Proposed development (blocked in black).

Duration, Date and Season :The survey was undertaken in December 2021 in the summer in mild and wet conditions during the official Level 1 of the Covid-19 lockdown period.

Dolerite dykes occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. Permian sediments are extensively intruded and thermally metamorphosed (baked) by sub-horizontal sills and steeply inclined dykes of the Karoo Dolerite Suite.

The Lebombo Group is divided into three formations with the Mashikiri Formation at the base, followed by the Letaba Formation (Jl), Sabie River Formation, Jozini Formation, Mbuluzi Formation and at the top the Movene Formation (Johnson 2006). The Letaba Formation formed a continues lava field across much of southern Africa.

The Clarens Formation is the lowermost formation of the Stormberg Group and has a maximum thickness of 250 m in the south. Pink and yellow sandstone is fine and never coarse. Cave and cliff formations are common. Fossils are scarce, but dinosaurs are found with the fish *Semionotus capensis* (MCCarthy and Rubidge 2005, Norman and Whitfield 2006, Snyman 1996, Visser 1998). The Tshipise Member is present here consisting of white and cream coloured sandstone with calcrete nodules, it reaches a thickness of 300 m in the west (Visser 1989). North of Swaziland the sandstones are pinkish to yellowish, with an estimated thickness of some 140 m in the Komatipoort coalfield. To the north of Swaziland, the strata underlying the Clarens Formation have not been differentiated (undifferentiated P-TR) on the published maps (Johnson *et al.* 2006).

In the project area, the Kaap Valley Pluton is surrounded by the Baberton Supergroup (Zt) which comprises the Moodies Group at the top followed by the Fig Tree Group and the Onverwacht Group. The Onverwacht Group lies at the base (7 km thick) of the Fig Tree Group and is the oldest group of rocks in the Baberton area. It has been divided into the Tjakastad and Geluk Subgroups with 6 Formations (Zwartkoppie, Kromberg, Hooggenoeg, Komati, Theespruit, Sandspruit). The Moodies Group (2.5 km thick) is named after the Moodies Hills divided into the Baviaanskop, Joe's Luck and Clutha Formations (Kent, L.E. 1980). Its age is estimated at 3 550 million years and the Moodies and Fig Tree Groups may contain micro stromatolites (McCarthy and Rubidge 2005). Cyanobacteria have been described from the Zwartkoppies Formation of the Onverwacht Group (MacRae, C. 1999).

The Nelspruit Suite (Znm) is intrusive in the Baberton Supergroup with an age of 3 075 ± 100 Ma. It is a biotite-bearing gneissose granite and migmatites.

Palaeontology - Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH** (SG 2.2 SAHRA APMHOB, 2012).

Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA).

Rock Unit	Significance/vulnerability	Recommended Action
Dolerite	Very Low	No action required
Letaba Formation	Low	Protocol for Chance Find required
Tshipise (RT-t)	High	Field assessment and protocol for finds is required hence a field study was undertaken.
Ecca Group (P-TR)	High	Field assessment and protocol for finds is required hence a field study was undertaken.
Nelspruit Suite	Very Low	No action required
Baberton Supergroup	Low	Protocol for Chance Find required

Fossils may be present in the Tshipise Member, Ecca Group and Baberton Supergroup, fossils have not been recorded from the Nelspruit Suite or Letaba and Dolerite rocks in this region.

Fossils may occur in sedimentary facies (plants, traces, bones) of the Letaba Formation. Aeolonites, belonging to the Jurassic aged Clarens Tshipise Member contain petrified logs, trace fossils of insects and dinosaur trackways (possibly *Massospondylus, Syntarsus / Coelophysis*) (Groenewald and Groenewald 2014).

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005). The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

The Nelspruit Suite has yielded no fossils. Archaean microfossils and microbial trace fossils (bacterial borings) have been recorded from cherts and volcanic glasses in the Fig Tree Group and Onverwacht Group of the Baberton Supergroup (Groenewald and Groenewald 2014).

The potential impact of the development on Nelspruit Suite fossil heritage is **HIGH** and therefore a phase 1 field study was necessary for this development (according to SAHRA protocol). A Phase 2 PIA and or mitigation are only recommended if the Phase 1: Field Study finds fossils (macro) or fossils are exposed during excavating or blasting (mining). However the Phase 1 Filed Study did not identify any fossils on site.

There is an existing PIA done in 2019 done by Singo Consulting, but at that time a professional palaeontologist was not contracted in to do the assessment and the report has some shortcomings and inaccuracies. This development will benefit from a site visit by a qualified palaeontologist in the areas where the Tshipise Member and the undifferentiated rocks are present. It was necessary to conduct a field study to make sure that undifferentiated strata will not be mined. The Tsipise report had not defined the strataas either the Vryheid , Volksrust Formations or Trias Stormberg strata.

Areas to be avoided and sensitivities:

The Project includes (Figure 1) with the above sensitivities:

An area blocked in red 4 km west of Komatipoort, 10 km west of the Lebombo border, east of Baberton and south of the Kruger National Park in the Baberton Magisterial District. Approximate size is 8 528.95 hectares. Possible threats to these areas include earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of the fossils by development, vehicle traffic, prospecting, mining, and human disturbance.

Conditions for inclusion in the EMPr include:

1) Special care must be taken during the digging, drilling, blasting, prospecting, mining, and excavating of foundations, trenches, channels and footings and removal of overburden. An appropriate Protocol and Management plan is attached for the Environmental Control Officer (Appendix 2).
2) The Environmental Control Officer must familiarise him- or herself with the formation present and its fossils and follow protocol.
3) The development may go ahead as recommended, and the ECO must survey for fossils before and or after clearing, drilling, blasting, prospecting, mining, or excavating.
4) The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during mining activities. For a chance find, the protocol is to immediately cease all mining activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. It is recommended that the EMPr be updated to include the involvement of a palaeontologist (1-day pre-mining training of ECO).

Stakeholders: Developer – Tenbosch Mining (Pty) Ltd
Environmental – Myezo Environmental Management Services (Pty) Ltd
Landowner – Several.

Recommendations:

a. There is no objection (see Recommendation B) to the development it is recommended that the project be authorised.
b. No Karoo Supergroup geological formations were found during the field survey. A Phase 2 Palaeontological Mitigation is only required if the Phase 1 Palaeontological Assessment had identified a fossiliferous formation or surface fossils or if fossils found during excavating or blasting. The Protocol for Chance Find and Management Plan is attached (Appendix 2) for the ECO.
c. This project may benefit the economy, and social development of the community.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measures.

B. Table of Contents

C. Background information on the project

Report

This report is part of an environmental impact assessment process being undertaken in terms of the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (GN R326 of 7 April 2017) of the Environmental Impact Assessment Regulations (see Appendix 3). It is also in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports, SAHRA, APMHOB, Guidelines 2012, pp 1-15 (**2)**.

Outline of development

This report discusses and aims to provide the applicant with information regarding the location of palaeontological material that will be impacted by the development. In the construction phase, it may be necessary for the applicant to apply for the relevant permit from the South African Heritage Resources Agency (SAHRA / PHRA) if a fossil is unearthed.

The applicant, Tenbosch Mining (Pty) Ltd is applying for a Mining Right for s and underground mining.

Local benefits of the proposed development include benefits to the local economy through possible job creation and local supplier procurement during the mining and operational phase of the development.

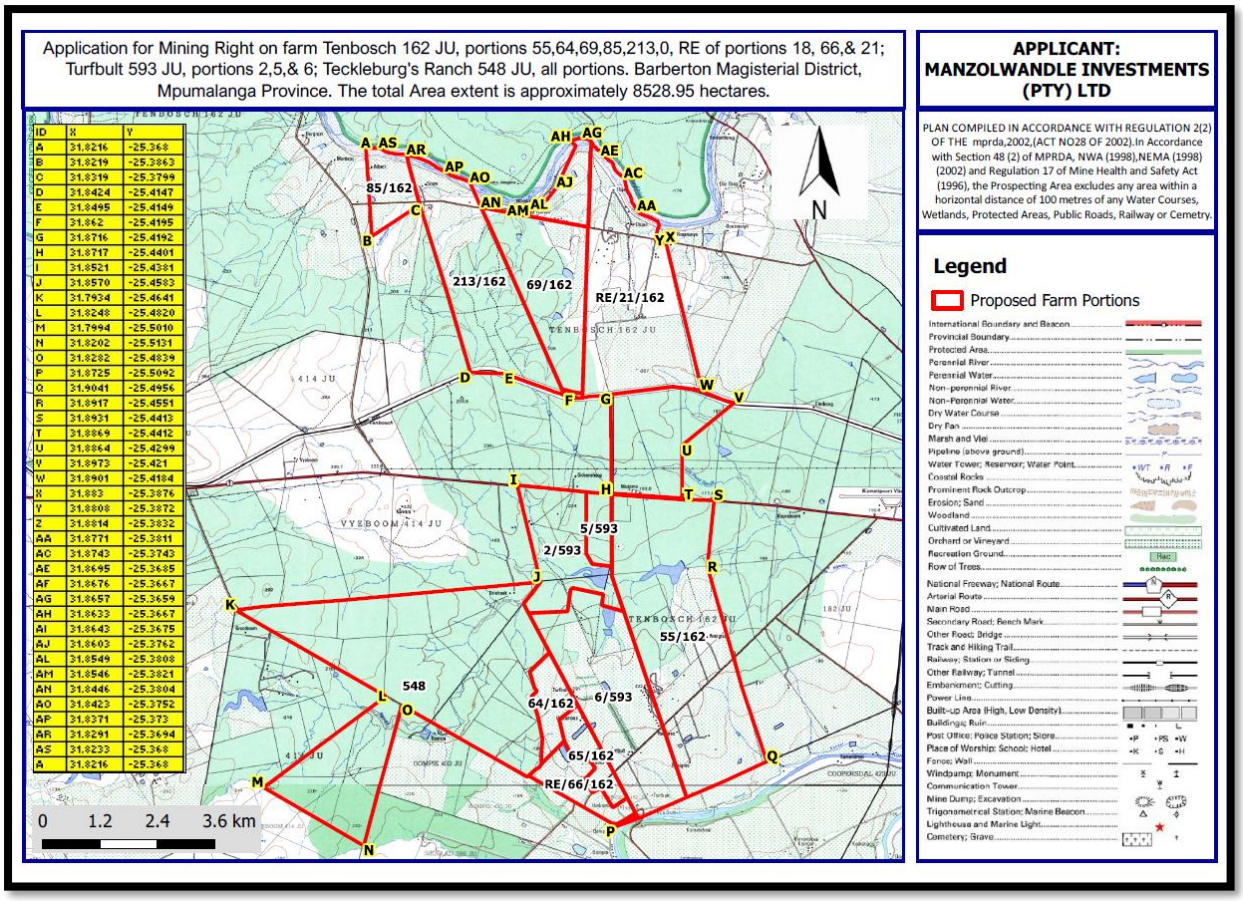

Figure 1: Topographic section showing location

Related infrastructure

1. Access roads
2. Rail siding
3. Electricity network
4. Water
5. Offices
6. Contractors yard with ablution blocks
7. Weighbridge, workshop, stores
8. Diesel storage
9. Boxcut and stockpile
10. Surface waste management
11. Crushing, screening, washing areas
12. Dump

The Project includes one locality (Figure 1):
Locality: An area blocked in red 4 km west of Komatipoort, 10 km west of the Lebombo border, east of Baberton and south of the Kruger National Park in the Barberton Magisterial District. Approximate size is 8 528.95 hectares.

<u>Rezoning/ and or subdivision of land:</u> Yes.

Name of developer and environmental consultant: Tenbosch Mining (Pty) Ltd and Myezo Environmental Management Services (Pty) Ltd.
Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: field study to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.
Short *Curriculum vitae* Dr Fourie obtained a Ph.D in Palaeontology from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. At present she is employed by Ditsong: National Museum of Natural History as curator of the large fossil invertebrate, Therapsid, dinosaur, amphibia, fish, reptile and plant collections. For the past 14 years she carried out field work in the Eastern Cape, Western Cape, Northern Cape, North West, Free State, Gauteng, Limpopo, Kwazulu Natal, and Mpumalanga Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 26 years.
Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA.

D. Description of property or affected environment
Location and depth:
The proposed Application for underground mining and a box shaft –will be situated in the Nkomazi Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province on Farms Portions 55,64,69,85,213, Remaining Extent of Portions 18,21,66 Tenbosch 162-JU, Portions 2,5,6 Turfbult 593-JU, Teckleburg's Ranch 548-JU.

Depth is determined by the related infrastructure to be developed, and the thickness of the formation in the development area, such as foundations, footings and channels. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops.

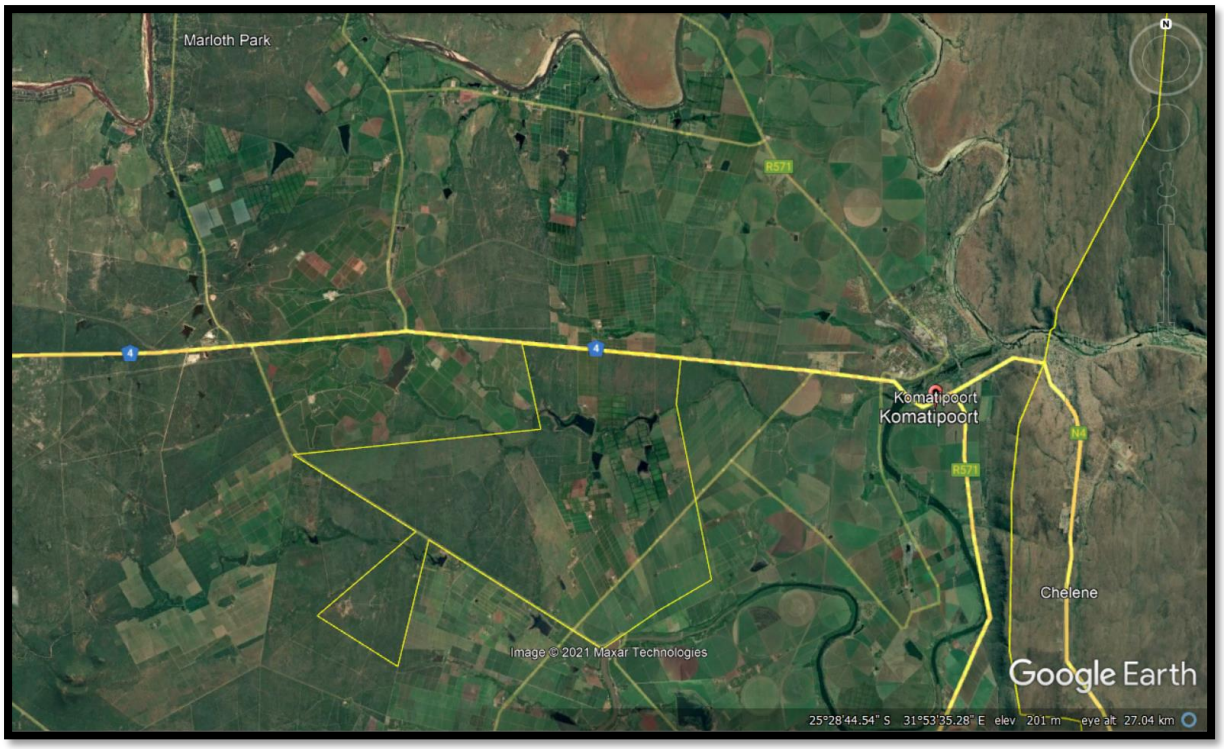

Figure 2: Location map (Myezo Environmental Management Services (Pty) Ltd)

The Project includes one locality (Figure 1) very close to the town of Komatipoort:
Locality: An area blocked in red 4 km west of Komatipoort, 10 km west of the Lebombo border, east of Baberton and south of the Kruger National Park in the Baberton Magisterial District. Approximate size is about 8 528,95 hectares.

The site is underlain by the Karoo Supergroup and the Baberton Supergroup with some minor Dolerite, Letaba Group and Nelspruit Suite.

E. Description of the Geological Setting

Description of the rock units:

The Karoo Supergroup is renowned for its fossil wealth (Kent 1980, Visser 1989). Large areas of the southern African continent are covered by the Karoo Supergroup. An estimated age is 150 – 180 Ma. and a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group, they are the Molteno, Elliot and Clarens Formations. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, and basalts (Kent 1980, Snyman 1996). The Beaufort Group is underlain by the Ecca Group which is underlain by the Dwyka Group. In the Soutpansberg are, the Karoo rocks are faulted against and overlie the Soutpansberg rocks (Norman and Whitfield 2006).

Dolerite dykes (Jd) occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. Permian sediments are extensively intruded and thermally metamorphosed (baked) by sub-horizontal sills and steeply inclined dykes of the Karoo Dolerite Suite. These early Jurassic (183 Ma) basic intrusions baked the adjacent mudrocks and sandstones to form splintery hornfels and quartzites respectively. Thermal metamorphism by dolerite intrusions tends to reduce the palaeontological heritage potential of the adjacent sediments.

The Lebombo Group is divided into three formations with the Mashikiri Formation at the base, followed by the Letaba Formation (Jl), Sabie River Formation, Jozini Formation, Mbuluzi Formation and at the top the Movene Formation (Johnson 2006). The Letaba Formation formed a continuos lava field across much of southern Africa. Above these basalts lie the Jozini Formation which forms the Lebombo Mountains (Norman, N. and Whitfield, G. 2006). A maximum thickness of 3 600 m is reached with an age of 177 ± 9 million years.

The Clarens Formation is the lowermost formation of the Stormberg Group and has a maximum thickness of 250 m in the south. Pink and yellow sandstone is fine and never coarse. Cave and cliff formations are common. Fossils are scarce, but dinosaurs are found with the fish *Semionotus capensis* (MCCarthy and Rubidge 2005, Norman and Whitfield 2006, Snyman 1996, Visser 1998). The Tshipise Member is also present here consisting of white and cream coloured sandstone with calcrete nodules, it reaches a thickness of 300 m in the west (Visser 1989). North of Swaziland the sandstones are pinkish to yellowish, with an estimated thickness of some 140 m in the komatipoort coalfield. To the north of Swaziland, the strata underlying the Clarens Formation have not been differentiated (undifferentiated P-TR) on the published maps (Johnson *et al.* 2006).

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

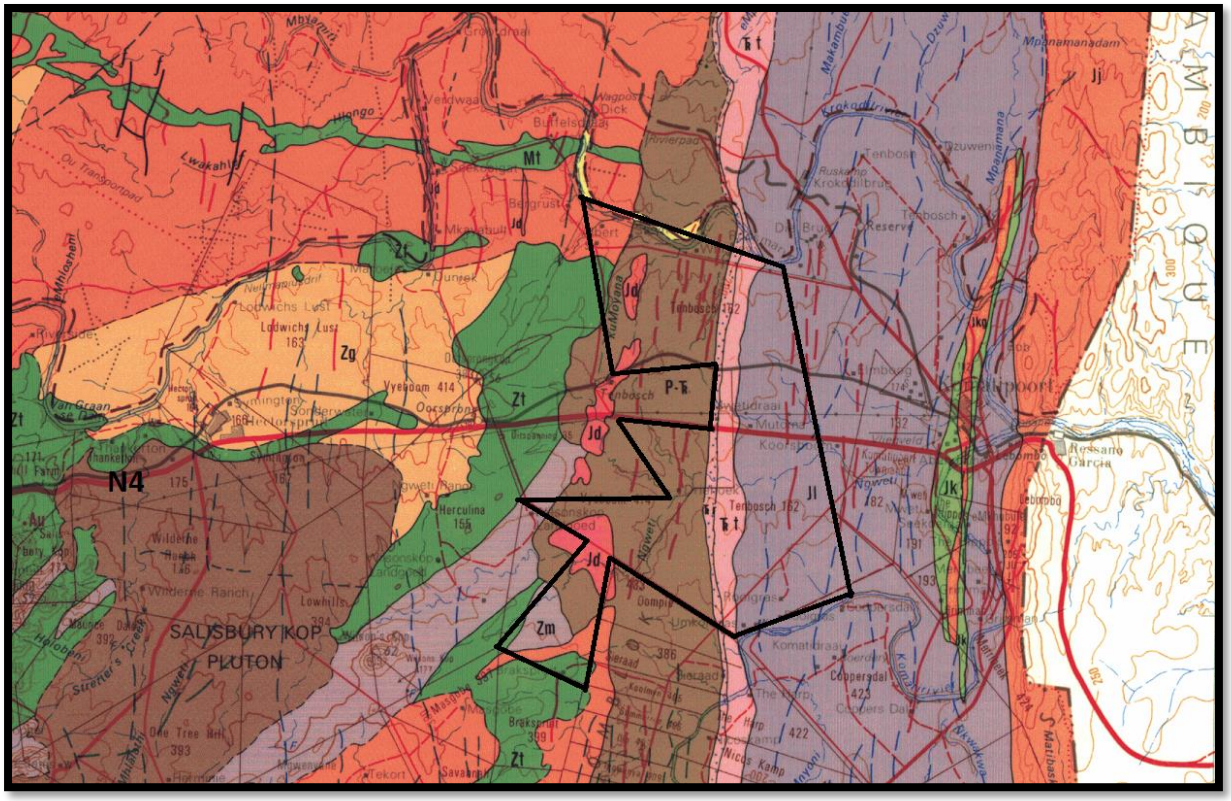

Figure 3: Excerpt of geology of the area (**1h)**.
Legend to map and short explanation.
Jd – Dolerite (dark pink). Jurassic.

Jl – Green, fine-grained mafic lava, locally porphyritic, amygdaloidal in places interlayered with rhyolite, especially near the top (purple). Letaba Formation, Lebombo Group, Karoo Supergroup. Jurassic.
TRt – Cream-coloured, fine-grained, massive sandstone (pink). Tshipise Member, Clarens Formation, Stormberg Group, Karoo Supergroup. Trias.
P-Rt – Undifferentiated Karoo Supergroup below TR t (brown). Karoo Supergroup. Permian to Triassic.
Znm – Potassic gneiss and migmatite with some phenocrysts (:::); strongly porhyroblastic; veined by granodiorite (++) (amber). Nelspruit Suite.
Zm – Undifferentiated Zmb to Zmc (purple). Moodies Group, Baberton Supergroup. Zwazian.
Zt – Undifferentiated Ztk to Ztt (green). Tjakastad Formation, Onverwacht Group, Baberton Supergroup. Zwazian.
-♦- - Vertical foliation.
…… – (black) Lineament (Landsat, aeromagnetic).
------ - Concealed geological boundary.
⊥15˚ – Strike and dip of bed.
□ – Proposed development (blocked in black).

Mining Acticities on Figure above:
C – Coal.
The mining past and present has an influence on this development.

The Timbavati gabbro (Mb) is a dyke-like differentiated intrusion of gabbro and olivine gabbro. Good exposures are present around the Timbavati River.

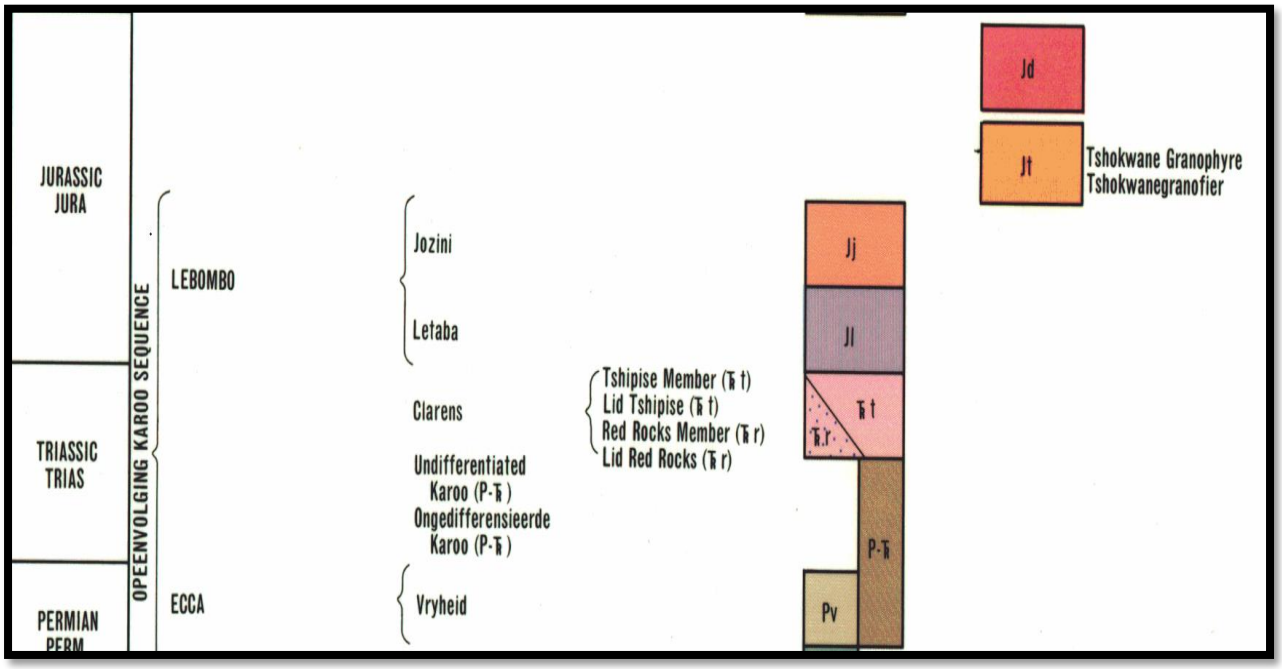

Figure 4: Karoo Supergroup distribution and lithostratigraphy (Walraven and Hartzer 1986).

Baberton lies 50 km to the southwest of Kaapmuiden, in the Kaap Valley, at the foot of the Makhonjwa Mountains. The area is famous for its lode-gold mining that started with the gold rush in 1884 and created a boom town for a few years. Notable events were the discovery of the fabulous Golden Quarry deposit on Sheba Mine and the establishment of legendary Eureka City. Products mined here are talc, ornamental stone, verdite, and asbestos (Norman, N. and Whitfield, G. 2006).

In the project area, the Kaap Valley Pluton is surrounded by the Baberton Supergroup (Zt) which comprises the Moodies Group at the top followed by the Fig Tree Group and the Onverwacht Group. The Onverwacht Group lies at the base (7 km thick) of the Fig Tree Group and is the oldest group of rocks in the Baberton area. It has been divided into the Tjakastad and Geluk Subgroups with 6 Formations (Zwartkoppie, Kromberg, Hooggenoeg, Komati, Theespruit, Sandspruit). The Fig Tree Group (2.5 km thick) is present in the Sheba Hills consisting of the Schoongezicht, Belvue Road and Sheba Formations. The Moodies Group (2.5 km thick) is named after the Moodies Hills divided into the Baviaanskop, Joe's Luck and Clutha Formations (Kent, L.E. 1980). Its age is estimated at 3 550 million years and the Moodies and Fig Tree Groups may contain micro stromatolites (McCarthy, T. and Rubidge, B.S. 2005). Cyanobacteria have been described from the Zwartkoppies Formation of the Onverwacht Group (MacRae, C. 1999).

The Nelspruit Suite (Znm) is intrusive in the Baberton Supergroup with an age of 3 075 ± 100 Ma. It is a biotite-bearing gneissose granite and migmatites.

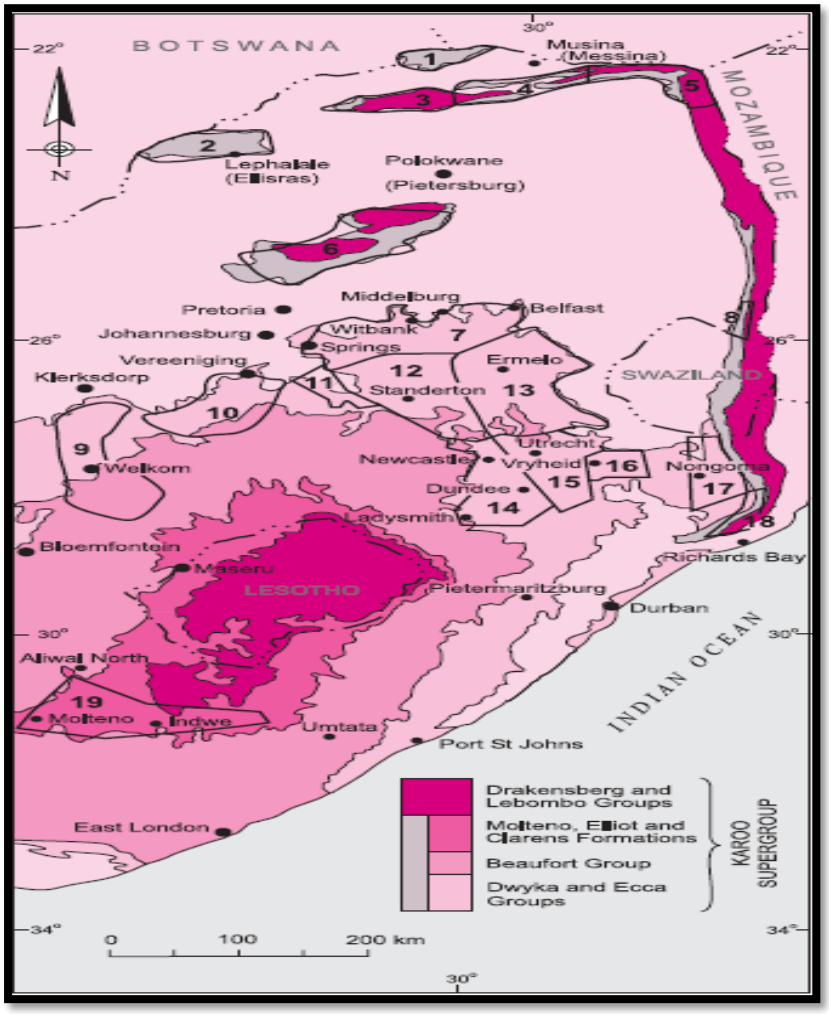

Figure 5: Figure showing coal fields of South Africa with No. 8, the Kangwane Coalfield (Johnson ed. 2006).

Coal has always been the main energy source in industrial South Africa. It is in Mpumalanga, south of the N4, that most of the coal-fired power stations are found. Eskom is by far the biggest electricity generator in Africa. Thick layers of coal just below the surface are suited to open-cast mining and where the overlying sediments are too thick, shallow underground mining. In 2003, coal was South Africa's third most valuable mineral commodity and is also used by Sasol for fuel- and chemicals-from-coal (Norman and Whitfield 2006). Grodner

and Cairncross (2003) proposed a 3-D model of the Witbank Coalfield to allow easy evaluation of the sedimentary rocks, both through space and time. Through this, one can interpret the environmental conditions present at the time of deposition of the sediments. This can improve mine planning and mining techniques. The coal-rich Vryheid Formation is underlain by the Dwyka Group and is gradually overlain by mudstones (and shale) and sandstones of the Volksrust Formation. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

Field Observations

Given below is a photographic presentation of the proposed development site.

Figure 6: Boulders on site.

Figure 7: Loose rocks on site.

Figure 8: Some boulders on site.

Figure 9: View of outcrop with boulder.

Figure 10: View a dry riverbed.

Figure 11: View of water control ditch and existing road.

G. Background to Palaeontology of the area.

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desktop and or field scoping (survey) study by a professional palaeontologist is

usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

Karoo Dolerite has no fossils recorded. Fossils may occur in sedimentary facies (plants, traces, bones) of the Letaba Formation. Aeolonites, belonging to the Jurassic aged Clarens and Tshipise Formations contain petrified logs, trace fossils of insects and dinosaur trackways (possibly *Massospondylus, Syntarsus / Coelophysis*) (Groenewald and Groenewald 2014).

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005). The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

The Nelspruit Suite has yielded no fossils. Archaean microfossils and microbial trace fossils (bacterial borings) have been recorded from cherts and volcanic glasses in the Fig Tree Group and Onverwacht Group of the Baberton Supergroup (Groenewald and Groenewald 2014).

Table 1: Taken from The Palaeotechnical Report (Groenewald and Groenewald 2014)

KAROO (Undifferentiated Karoo (P-TR; C-Jk))	DOLERITE (Jd)				Dolerite intrusions Early Jurassic 183 2 Ma	No fossils recorded	Karroo-Ferrar igneous intrusions associated with Early Jurassic global mass extinction event
	LEBOMBO		Josini (Jj) Letaba Sabi River (J; Jl; Jle)		Up to 13 km of volcanic rocks (basic and acid lavas) and rare interbedded sandstones. Early Jurassic 183 2 Ma	Fossils might occur within thin sedimentary intervals (e.g. plants, traces, bones)	
			Clarens (TR; TRc) (Probably Upper Elliot and Clarens)	Tshipise (Jt)	Cream-coloured aeolian sandstone, playa lake deposits ("Cave Sandstone") Clarens of Main Karoo Basin	Aeolianites contain petrified logs, trace fossils of insects (including controversial fossil termitaria), dinosaur trackways (possibly *Massospondylus, Syntarsus / Coelophysis*).	Stratigraphic context of dinosaur fossils often unclear in the literature. Note revised stratigraphy and correlations with Main Karoo Basin proposed in recent papers on Tuli Basin by E. Bordy (UCT): Upper Unit P-Trkb in part Red Rocks Member (Elliot Fm)
				Red Rocks (Jr)	Pale red argillaceous sandstone with calcareous concretions (fluvial / sabkha setting). White silcrete at top of succession, beneath Tshipise Mb Prob. Upper Elliot of Main Karoo Basin	Skeletal remains of dinosaurs (*Massospondylus*), possible dinosaur eggshells, dinosaur and other tracks, trace fossils of insects and root casts	

INTRUSIVE ROCKS			Z; Zg; Zgh; Zhd;Zhe; Zmg; Zgg; Zs; Zu; Zn; Znm; Zk; Zs; Zu; Z-Rg; Zkv; Zne1; Zne2; Rcu; Rry; ss; Z7; Zkv; Z8; Z55		Granites and Gneiss	No fossils recorded	
BARBERTON (Za; Zk)	MOODIES (Zm)		Zmb; Zj; Zmc; Zc; Zbv		Predominantly volcanic igneous rocks, plus some igneous intrusions, minor sediments such as banded iron formation, chert, quartzite, conglomerate, schists	Archaean microfossils and microbial trace fossils (bacterial borings) have been recorded from cherts and volcanic glasses in the Fig Tree Group Onverwacht Group of Barberton.	"Fly speck carbon" in sedimentary Uitkyk Fm of the Pietersburg Greenstone Belt, Limpopo, may be fossilised microbes,or alternatively of inorganic origin (e.g. an inorganic precipitate induced by radioactive irradiation).
	FIG TREE (Zf)		Zfs; Zb; Zfh; Zsh; Zbe				
	ONVERWACHT (Zo; Zo1)		Za; Zgk; Zh;Zh1; Zh2; Zh3; Zk; Zt; Zts; Za; Zgh; Ztt; Zt1; Zth; Zth1; Zsw; Zkr; Zkr1; Zs; Z36; Z37				

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally **LOW** to **VERY HIGH**, but here locally **HIGH** for the Tshipise and Ecca Group Formations.

Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA).

Rock Unit	Significance/vulnerability	Recommended Action
Dolerite	Very Low	No action required
Letaba Formation	Low	Protocol for Chance Find required
Tshipise (RT-t)	High	Field assessment and protocol for finds is required hence a field study was undertaken
Ecca Group (P-TR)	High	Field assessment and protocol for finds is required hence a field study was undertaken
Nelspruit Suite	Very Low	No action required
Baberton Supergroup	Low	Protocol for Chance Find required

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).
Impact: **HIGH** for the Tshipise and **LOW** for Karoo Supergroup geological formations. There are significant fossil resources that may be impacted by the development (shale).

The project includes one locality (Figure 1):
Locality: An area blocked in red 4 km west of Komatipoort, 10 km west of the Lebombo border, east of Baberton and south of the Kruger National Park in the Baberton Magisterial District. Approximate size is 8 528.95 hectares.

There is an existing PIA done in 2019 done by Singo Consulting, but at that time a professional palaeontologist was not contracted in to do the assessment and the report has some shortcomings and inaccuracies. This development will benefit from a site visit by a qualified palaeontologist in the areas where the Tshipise Member and the undifferentiated rocks are present. It may be that the undifferentiated strata will be mined, it is not defined as either the Vryheid or Volksrust Formations and could also be the Trias Stormberg strata.

F. Description of the Methodology

The palaeontological impact assessment study was undertaken in December 2021. A Phase 1: Field Study entailed a walkthrough of the surrounding portions and photographs (in 20 mega pixels) taken of the site with a digital camera (Canon PowerShot SX620HS). It was necessary to use a Global Positioning System (GPS) (Garmin eTrex 10) to record outcrops not covered with topsoil, subsoil, overburden, and vegetation. A literature survey is included and the study relied on literature, field survey and geological maps, google maps, and google earth images.

SAHRA Document 7/6/9/2/1 requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded on a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what

type of fossil and zone will be found in any particular region. Archaeozoologists can be called upon to survey for more recent fossils in the Quaternary and Tertiary deposits.

Assumptions and Limitations
The accuracy and reliability of the report **may be** limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist before, hence there was no previous literature on the study area to work with.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures (for this report all required data/information was provided).

A Phase 1 Palaeontological Impact Assessment: Field Study was undertaken before overburden was removed , it included:

1. Recommendations for the future of the site.
2. Background information on the project.
3. Description of the property of affected environment with details of the study area.
4. Description of the geological setting and field observations.
5. Background to palaeontology of the area.
6. Heritage rating.
7. Stating of significance (Heritage Value).

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes -

> Act No. 25 of 1999. National Heritage Resources Act, 1999.
> The National Estate as: 3 (2) (f) archaeological and palaeontological sites, (i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,
> Heritage assessment criteria and grading used: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance;
> (b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation.
> SAHRA is responsible for the identification and management of Grade 1 heritage resources.
> Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.
> Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.

Archaeology, palaeontology and meteorites: Section 35.
(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.
(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The phase 1 paleo study conducted for this study as part of the mitigation before the construction phase did not yield any fossil resources. The specialist study was found to be adequate at this stage. A Phase 2 paleo study will only be required if fossils are found during the construction phase.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered paleontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

G. Description of significant fossil occurrences

All Karoo Supergroup geological formations are ranked as **LOW** to **VERY HIGH**, and here the impact is potentially **HIGH** for several Groups. During the Triassic the mammals had advanced and the archosaurs now came into their own. These were crocodile-like, *Coelophysis* was one of the first dinosaurs. Other creatures

present were nothosaurs, the first plesiosaurs and ichthyosaurs, and pterosaurs. Amphibians, non-dinosaurian archosaurs, theropod dinosaurs, dinosaur eggs, therapsids, mammaliaformes, crocodilomorphs, and chelonia make up the fauna of the Elliot and Clarens Formations (Chinsamy-Turan 2012, Groenewald 1986). Aeolonites, belonging to the Jurassic aged Clarens and Tshipise Member contain petrified logs, trace fossils of insects and dinosaur trackways (possibly *Massospondylus, Syntarsus / Coelophysis*) (Groenewald and Groenewald 2014).

Fossils may occur in sedimentary facies (plants, traces, bones) of the Letaba Formation. Aeolonites, belonging to the Jurassic aged Clarens and Tshipise Member contain petrified logs, trace fossils of insects and dinosaur trackways (possibly *Massospondylus, Syntarsus / Coelophysis*) (Groenewald and Groenewald 2014).

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005). The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

Archaean microfossils and microbial trace fossils (bacterial borings) have been recorded from cherts and volcanic glasses in the Fig Tree Group and Onverwacht Group of the Baberton Supergroup (Groenewald and Groenewald 2014).

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

The threats are:-

- Earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, prospecting, mining activities and excavations.
- The sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above.

H. Stakeholder engagement.

The public participation was held as part of Environmental Authorisation process. At the time there was no specific information requested by the competent authority.

This report will be uploaded on the SAHRIS website together with supporting documents, it is expected that it is then that SAHRA might provide comments that might need to be addressed and this section will then be updated.

Areas to be avoided and sensitivities:

The Project includes (Figure 1) with the above sensitivities:

An area blocked in red 4 km west of Komatipoort, 10 km west of the Lebombo border, east of Baberton and south of the Kruger National Park in the Baberton Magisterial District. Approximate size is 8 528.95 hectares. Possible threats to these areas include earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of the fossils by development, vehicle traffic, prospecting, mining, and human disturbance.

Conditions for inclusion in the EMPr include:

5) Special care must be taken during the digging, drilling, blasting, prospecting, mining, and excavating of foundations, trenches, channels and footings and removal of overburden. An appropriate Protocol and Management plan is attached for the Environmental Control Officer (Appendix 2).

6) The Environmental Control Officer must familiarise him- or herself with the formation present and its fossils and follow protocol.

7) The development may go ahead as recommended, and the ECO must survey for fossils before and or after clearing, drilling, blasting, prospecting, mining, or excavating.

8) The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during mining activities. For a chance find, the protocol is to immediately cease all mining activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. It is recommended that the EMPr be updated to include the involvement of a palaeontologist (1-day pre-mining training of ECO).

Stakeholders: Developer – Tenbosch Mining (Pty) Ltd

Environmental – Myezo Environmental Management Services (Pty) Ltd

Landowner – Several.

Recommendations:

e. There is no objection (see Recommendation B) to the development it is recommended that the project be authorised.

f. No Karoo Supergroup geological formations were found during the field survey. A Phase 2 Palaeontological Mitigation is only required if the Phase 1 Palaeontological Assessment had identified a fossiliferous formation or surface fossils or if fossils found during excavating or blasting. The Protocol for Chance Find and Management Plan is attached (Appendix 2) for the ECO.

g. This project may benefit the economy, and social development of the community.

h. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measurers.

I. Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).
b. All information needed for the Phase 1 Palaeontological Impact Assessment and Field scope was provided by the Consultant. All technical information was provided by Myezo Environmental Management Services (Pty) Ltd
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures, especially for shallow caves.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

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Declaration (disclaimer)

I, Heidi Fourie,

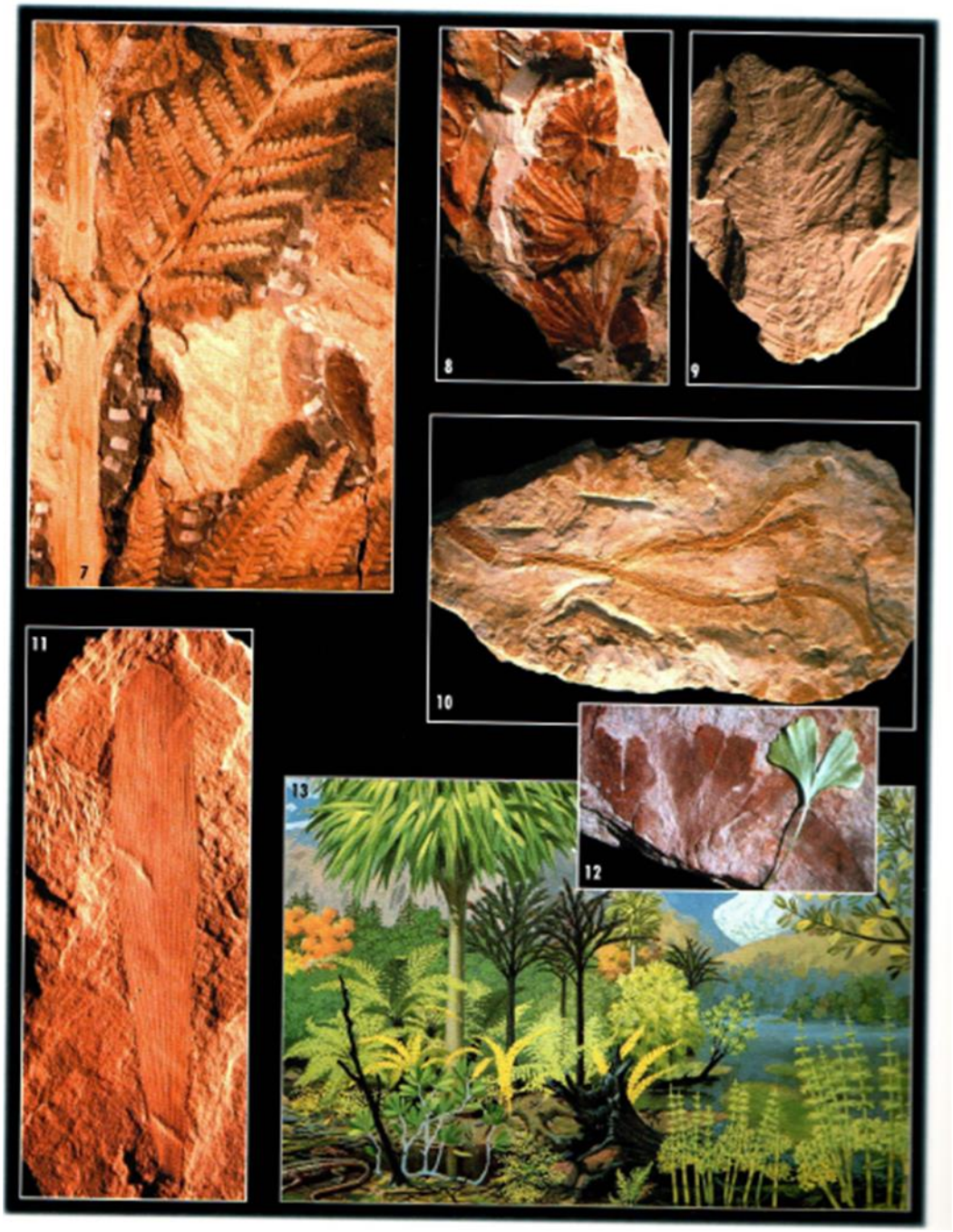
I, _____ Heidi Fourie _____, declare that –

- I act as the independent 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 favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, 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 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;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Heidi Fourie
2021/01/10

Appendix 1: Examples of plant fossils (MacRae 1999).



Appendix 2 :**Protocol for Chance Finds and Management plan**

This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and

should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr) so that when a fossil is unearthed, they can notify the relevant department and specialist to further investigate. Therefore, the EMPr must be updated to include the involvement of a palaeontologist during the digging and excavation (ground breaking) phase of the development or pre-construction training of ECO.

The EMPr already covers the conservation of heritage and palaeontological artefacts that may be exposed during construction activities:

- The protocol is to immediately cease all construction activities if a fossil is unearthed and contact SAHRA for further investigation.
- The area must be fenced-off with a 30 m barrier and the construction workers must be informed that this is a no-go area.
- If fossils were found, they must be placed in a safe area for further investigation.
- The ECO should familiarise him- or herself with the fossiliferous formations and its fossils.
- In the event that fossils are unearthed during digging, blasting, drilling or excavating the ECO should consult SAHRA or a paleontologist.
- Most Museums and some Universities have good examples of Fossils.

This palaeontological impact assessment process presented an opportunity for identification, access and possibly salvage of fossils and add to the few good plant localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

1. The developer needs to clearly stake or peg-out (survey) the areas affected by the mining/ construction/ development operations and dig representative trenches and if possible supply geological borehole data.
2. When clearing topsoil, subsoil or overburden and hard rock (outcrop) is found, the contractor needs to stop all work.

3. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
4. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
5. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.
6. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once a week).
7. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary, during Phase 2:

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.
3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.
4. Use Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils is visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

SAHRA Documents:
Guidelines to Palaeontological Permitting Policy.
Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.
Guidelines for Field Reports.
Palaeotechnical Reports for all the Provinces.

Appendix 3: Impact Statement.

The development footprint is situated on a geological layer a high palaeontological sensitivity. The nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact. The extent of the impact only extends in the region of the development activity footprint and may include transport routes. The expected duration of the impact is assessed as potentially permanent. The intensity/magnitude of the impact is moderate as it may continue in a modified way. The probability of the impact occurring will be high.

In the absence of mitigation procedures (should fossil material be identified during the operational and construction phases) the damage or destruction of any palaeontological materials will be permanent. The loss of resources occurs but natural cultural and social processes continue, albeit in a modified manner. With Mitigation the impact will be low and the cumulative impact is low. Impacts on palaeontological heritage during the construction and preconstruction phase could potentially occur but are regarded as having a moderate possibility. The significance of the impact occurring will be S = (2+5+8)4
S = 60 Medium (30-60).