

Eldorado Park Extension 7 Housing Development - Erf 5564

City of Johannesburg Metropolitan Municipality, Gauteng Province

Farm: Eldorado Park Erf 5564

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Palaeontological Impact Assessment: Desktop Study

Commissioned by: k2m

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Ref: Pending

2020/11/06

Irrigasie Formasie - Plant fossil (H. Fourie)



B. Executive summary

Outline of the development project: k2m has facilitated the appointment of Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Desktop Study of the Environmental Impact Assessment of the proposed Eldorado Park Extension 7 Housing Development - Erf 5564 in the City of Johannesburg Metropolitan Municipality, Gauteng Province on the Farm Eldorado Park Erf 5564.

The applicant, Phumaf Holdings proposes to establish housing with 112 housing units as part of the Gauteng Rapid Land Release Programme.

The Project includes one Option (Figure 2):

Option 1: An area outlined in red adjacent to vacant land to the north, Delaware Ave to the south-west, Union Avenue to the north, and Buckingham Avenue to the east. The area is approximately 1 hectare in size.

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 National Heritage Resources Act. 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 are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):

(i) (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);

None for the Klipriviersberg Group.

Summary of findings (1d): The Desktop Palaeontological Impact Assessment was undertaken in October 2020 in summer in hot and dry conditions (1c) during the official Level 1 of the covid-19 lockdown, as this is a desktop study the season and time has no influence and the following is reported:

The Project includes one Option (Figure 2):

Option 1: An area outlined in red adjacent to vacant land to the north, Delaware Ave to the south-west, Union Avenue to the north, and Buckingham Avenue to the east. The area is approximately 1 hectare in size.

The only Option presented is situated on the [Klipriviersberg Group](#), Ventersdorp Supergroup.

Recommendation:

The potential impact of the development on fossil heritage is **LOW** for the Klipriviersberg Group and therefore no further action is required for this development, if a chance fossil is found during the development a Chance Fossil Find Protocol is attached (according to SAHRA protocol)..

Concerns/threats (1g) to be added to the EMPr:

1. Threats to the National Heritage are 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, and human disturbance.
2. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden as a desktop study may have missed a fossiliferous outcrop. An appropriate Protocol and Management plan is attached for the Environmental Control Officer (Appendix 2).

The recommendations are (1ni, 1niA,1nii):

1. Mitigation may be needed (Appendix 2) if fossils are found, but it is unlikely.
2. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formations present and its fossils.
3. The development may go ahead, but the ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
4. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation.

Stakeholders: Developer – Phumaf Holdings. Section 5 Fern Ridge, 359 Pretoria Ave, Randburg, 2194.

Environmental – k2m, Postnet Suite 509, Private Bag X04, Kloof, 3640, Tel. 072 213 2028.

Landowner – City of Johannesburg.

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D. Background information on the project

Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (May 2019) of the Environmental Impact Assessment Regulations (see Appendix 2). It is also in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports (2), SAHRA, APMHOB, Guidelines 2012, Pp 1-15.

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, Phumaf Holdings proposes to establish housing with 112 housing units as part of the Gauteng Rapid Land Release Programme. The property is currently vacant with some illegal dumping.

The Project includes the following related infrastructure (1f):

- 112 housing units.
- Internal water reticulation.
- Internal sewer reticulation.
- Internal roads and stormwater structure.
- An internal MV reticulation for electricity.

Local benefits of the proposed development include benefits to the local economy through possible job creation, local inhabitants, and local supplier procurement during the construction phase as well as during the operational phase of the development.

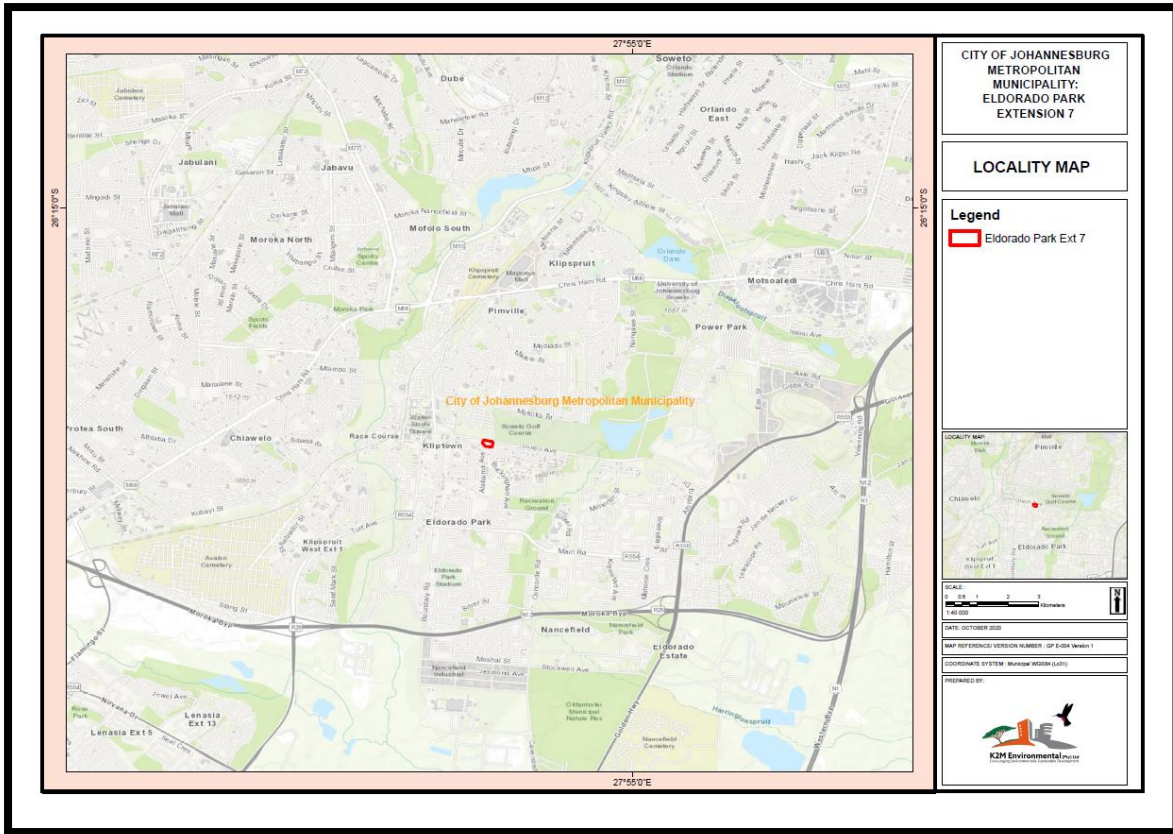


Figure 1: Topographic map (k2m)

The Project includes one Option (Figure 2):

Option 1: An area outlined in red adjacent to vacant land to the north, Delaware Ave to the south-west, Union Avenue to the north, and Buckingham Avenue to the east. The area is approximately 1 hectare in size.

Rezoning/ and or subdivision of land: Currently Residential 1 and 3.

Name of developer and Environmental consultant: Phumaf Holdings and k2m.

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.

Curriculum vitae – short (1aii, 1aii): Dr Fourie obtained a Ph.D 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. She is currently employed by Ditsong: National Museum of Natural History as Curator of the fossil plant, invertebrate, amphibian, fish, reptile, dinosaur and Therapsid collections. For the past 13 years she carried out field work in the Eastern Cape, Western Cape, North West, Northern Cape, 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 25 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.

E. Description of property or affected environment

Location and depth:

The proposed Eldorado Park Extension 7 Housing Development - Erf 5564 will be situated in the City of Johannesburg Metropolitan Municipality, Gauteng Province on Farm Eldorado Park Erf 5564.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. 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. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores and is determined by the depth of the foundations.



Figure 2: Location map (k2m).

The Project includes one Option (Figure 2) in Eldorado Park:

Option 1: An area outlined in red adjacent to vacant land to the north, Delaware Ave to the south-west, Union Avenue to the north, and Buckingham Avenue to the east. The area is approximately 1 hectare in size.

F. Description of the Geological Setting

Description of the rock units:

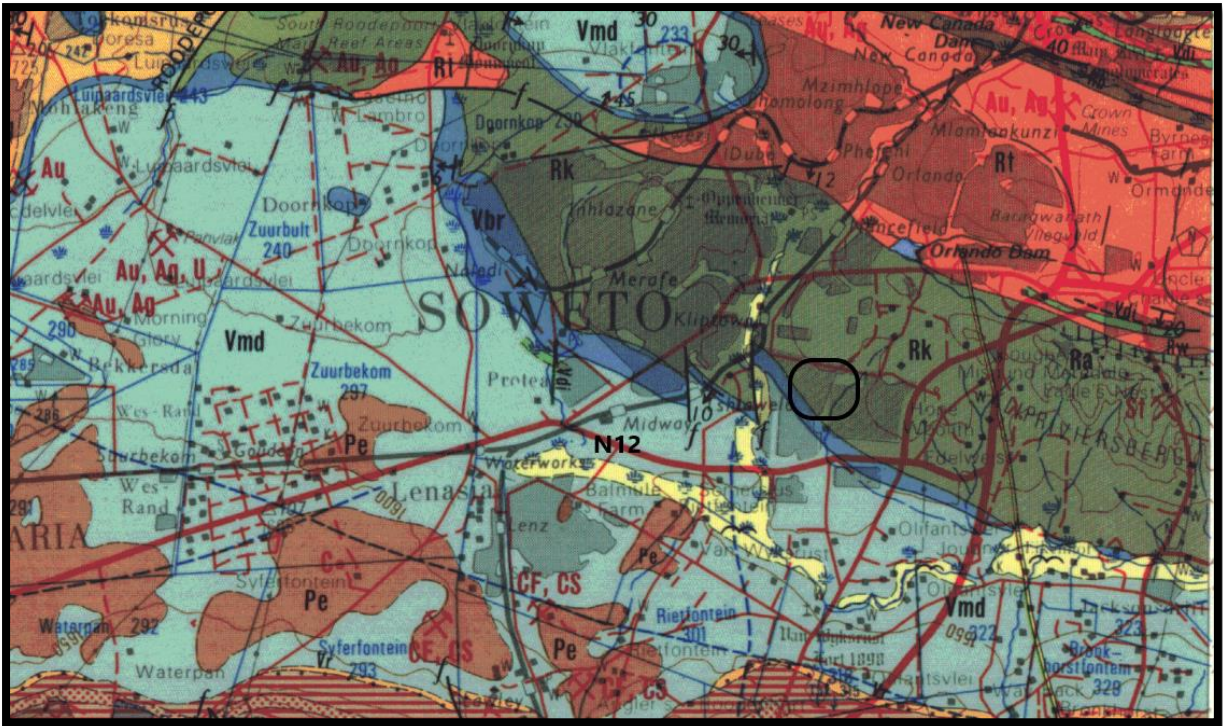


Figure 3: Excerpt of 1:250 000 Geological Map 2626 Wes Rand (Keyser 1986) (1h).

Legend to map and short explanation.

Rk – Basaltic lava, agglomerate, tuff (green). Klipriviersberg Group, Ventersdorp Supergroup. Randian.

----- (black) Lineament (Landsat, aeromagnetic).

----- - Concealed geological boundary.

⊥20° – Strike and dip of bed.

□ – Proposed development (blocked in black).

Mining Activities on Figure 3:

Ag – Silver Au - Gold St – Aggregate U - Uranium.

The mining past and present has no influence on the development.

The small North West Province farming town of Ventersdorp has given its name to this remarkable geological sequence that now occupies a northeast-trending elliptical basin more than 200 000 km² in extent. Most of the sequence is covered by younger formations. The only economic importance lies at its base in a conglomerate, developed in the Carletonville and Klerksdorp gold fields, and in places very rich in gold (Norman and Whitfield 2006).

The Ventersdorp Supergroup consists mainly of andesitic lava, tuff and agglomerate. The Klipriviersberg Group and the Platberg Group are Randian in age, where the Rietgat Formation is Vaalian in age (Sheet information 2626 Wes Rand). The Ventersdorp Supergroup sits disconformably on the Witwatersrand Supergroup and is made up of the lower Klipriviersberg Group, the middle Platberg Group, and two formations (Bothaville and Allanridge). Together it can reach a maximum thickness of 4,260 m in some areas.

A volcanic event that started 2,714 million years ago is responsible for the Klipriviersberg Group of the Ventersdorp Supergroup, further eruptions of basalt and rhyolite formed the Platberg Group (McCarthy and Rubidge 2005). The Klipriviersberg Group comprises the lowermost Westonaria, Loraine, Jeannette Agglomerate, Alberton, Orkney and the uppermost Edenville Formations (Kent 1980).

Several formations make up the Platberg Group, the Kameeldoorns, Makwassie, Rietgat, Bothaville and Allanridge (Kent 1980). It is described as an elliptical basin named after the town of Ventersdorp. Sediments accumulated in fault-bounded troughs or grabens and gold can be present (Norman and Whitfield 2006). The Platberg Group consists predominantly of Randian age and Vaalian age rocks. The Rietgat Formation which is the predominant formation in the development area sits concordantly on the Makwassie Formation consisting of green-grey amygdaloidal, porphyritic lava (Garfield Member), interlayered with shale, tuff, greywacke conglomerate, and impure lacustrine limestone with algal stromatolites (2626 Wes Rand sheet info, Kent 1980). This formation is at the top of the Platberg Group. Soils forming can be divided into three groups with the solid lavas creating excellent conditions for foundations, the residual soils and the tufts are not ideal for foundations (Snyman 1996).

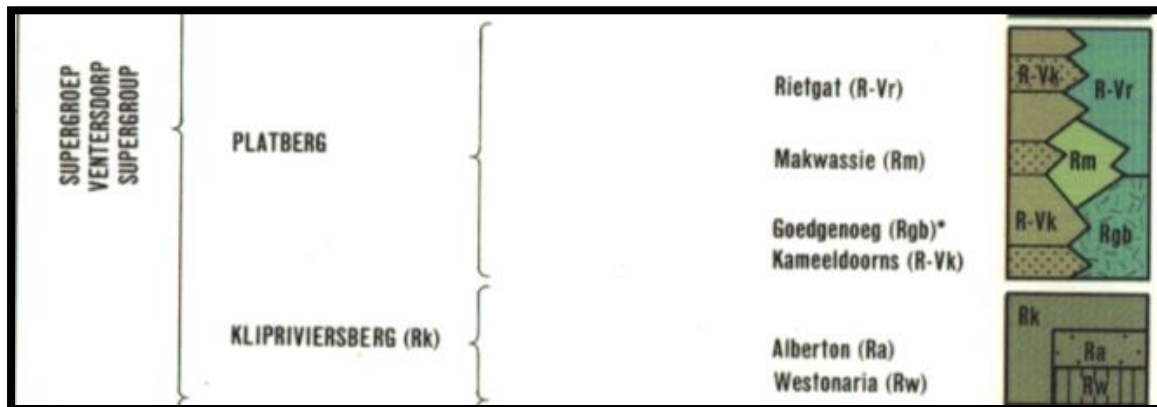


Figure 4: Lithostratigraphy (Keyser 1986).

G. Background to Palaeontology of the area (1j)

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top 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).

None for the Klipriviersberg Group.

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

PLATBERG (R-Vr)	Ra; Rb; Rm; Rma; Rgb; Rka; Rkm; Rka1; Rka2	Basic and acid volcanics with subordinate siliciclastic sediments (breccias, conglomerates, sandstones, mudrocks), with minor limestones and cherts in upper part of succession Late Archaean Randian 2.7-2.5	Lacustrine stromatolites and possible microfossils.	Fossils recorded from sediments of Platberg Group elsewhere (Northern Free State) and therefore might also be present in Gauteng
	Rietgat (Rr; Rrg; Rrg2)	Predominantly lavas with minor metasediments (fluvial and lacustrine conglomerates, breccias, minor shales, stromatolitic carbonates, cherts)	Lacustrine stromatolites reported in carbonates, of Rietgat Formation (Platberg Group); possible organic-walled microfossils in cherts. LIP (Large Igneous Province) with voluminous eruptions of basaltic and other lavas.	Stromatolites recorded from borehole cores. Any surface occurrences would be of considerable interest.
	Rm; Rgb; Rkm		Possible stromatolites	
KLIPRIVIERSBERG (Rk)	Ra; Rr; Ra1; Rwe;	Basic and acid volcanics with subordinate siliciclastic sediments	No fossils recorded	

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**.

Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA) (1cB).

Rock Unit	Significance/vulnerability	Recommended Action
Klipriviersberg Group	Low	Desktop Study, Protocol for Chance Find

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).

Impact: **LOW**. There are no significant fossil resources that may be impacted by the development (shale/dolomite).

The project includes one Option (Figure 2) with a **LOW** impact: A Desktop Study is done due to the presence of the overlying Malmani Subgroup to the west.

Option 1: An area outlined in red adjacent to vacant land to the north, Delaware Ave to the south-west, Union Avenue to the north, and Buckingham Avenue to the east. The area is approximately 1 hectare in size.

H. Description of the Methodology (1e)

The palaeontological impact assessment desktop study was undertaken in October 2020 during the official covid-19 lockdown. A Phase 1: Field Study includes a walk through and drive through of the affected portion and photographs (in 20 mega pixels) taken of the site with a digital camera (Canon PowerShot SX620HS). It may be necessary to use a Global Positioning System (GPS) (Garmin eTrex 10) to record outcrops if not covered with topsoil, subsoil, overburden, and vegetation. A literature survey is included and the study relied on literature, 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. An archaeozoologist can be called upon to survey for more recent fossils in the Quaternary and Tertiary deposits, if present.

Assumptions and Limitations (1e):-

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.
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 will include:

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 specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

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 palaeontologically 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).

I. Description of significant fossil occurrences

None for the Klipriviersberg Group.

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 to the National Palaeontological Heritage are:- earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above.

J. Recommendation (1o,1p, 1q)

- a. There is no objection (see Recommendation B) to the development, it is not necessary to request a Phase 1 Palaeontological Impact Assessment: Field Study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is **LOW**. A Phase 2 Palaeontological Mitigation is only required if a Phase 1 Palaeontological Assessment identified a fossiliferous formation or surface fossils or if fossils are found during clearing, construction excavations, drilling and blasting. The Protocol for Chance Finds and Management Plan is attached (Appendix 2) for the ECO.
- b. This project will benefit the environment, economy, and social development of the community.
- c. Preferred choice: One Option is presented and possible (see Executive Summary).
- d. The following should be conserved: if any palaeontological material is exposed during clearing, 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.
- e. Consultation with parties was not necessary.
- f. This report must be submitted to SAHRA together with the Heritage Impact Assessment.

Sampling and collecting:

Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

- a. Objections: Cautious. See heritage value and recommendation.

- b. Conditions of development: See Recommendation.
- c. Areas that may need a permit: Only if a fossil is unearthed.
- d. Permits for mitigation: **SAHRA/PHRA**.

K. 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 Palaeontological Impact Assessment was provided by the Consultant. All technical information was provided by k2m.
- 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, a 30 m no-go barrier constructed 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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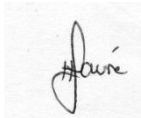
Declaration (disclaimer) (1b)

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological assessment. There are no circumstances that compromise the objectivity of me performing such work.

I accept no liability, and the client, by receiving this document, indemnifies me against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

It may be possible that the PIA Desktop Study may have missed palaeontological resources in the project area as outcrops are not always present or visible due to vegetation while others may lie below the overburden of earth and may only be present once development commences.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.



Heidi Fourie
2020/11/06

Appendix 1 (1k,1l,1m): Protocol for Chance Finds and Management plan for EMP'r

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.

The EMPr already covers the conservation of heritage and palaeontological material 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.
- A site visit is recommended after drilling, excavations and blasting and the keeping of a photographic record. A regular monitoring presence over the period during which excavations are made, by a palaeontologist, is generally not practical, but can be done during ground breaking.
- The Evolutionary Studies Institute, University of the Witwatersrand has good examples of Ecca Group Fossils.
- The developer must survey the areas affected by the development and indicate on plan where the construction / development / mining (if applicable) will take place. Trenches have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers (if present). It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

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

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage within the development area. Fossils excavated will be stored at a National Repository.

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 (if applicable)/ 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 / developer 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 2: Table of Appendix 6 requirements.

Section in Report	Point in Act	Requirement
B	1(c)	Scope and purpose of report
B	1(d)	Duration, date and season
B	1(g)	Areas to be avoided
D	1(ai)	Specialist who prepared report
D	1(aii)	Expertise of the specialist
F Figure 3	1(h)	Map
B	1(ni)(niA)	Authorisation
B	1(nii)	Avoidance, management, mitigation and closure plan
G Table 1	1(cA)	Quality and age of base data
G Table 2	1(cB)	Existing and cumulative impacts
D	1(f)	Details or activities of assessment
G	1(j)	Description of findings
H	1(e)	Description of methodology
H	1(i)	Assumptions
J	1(o)	Consultation
J	1(p)	Copies of comments during consultation
J	1(q)	Information requested by authority
Declaration	1(b)	Independent declaration
Appendix 2	1(k)	Mitigation included in EMPr
Appendix 2	1(l)	Conditions included in EMPr
Appendix 2	1(m)	Monitoring included in EMPr
D	2	Protocol or minimum standard

Appendix 3: Impact Summary

The development footprint is situated on the Klipriviersberg Group with a **low** palaeontological sensitivity. The Nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact. The probability of the impact occurring is improbable. The expected duration of the impact is assessed as potentially permanent. Only the site will be affected. In the absence of mitigation procedures (should fossil material be present within the affected area) 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 low/minor possibility. The significance of the impact occurring will be **low**.