

Protocol for finds on proposed upgrade of Rimer's Creek Water Treatment Works

Umjindi Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province

Farm: Remainder of Portion 14 Barberton Townlands 369JU

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Palaeontological Protocol for Finds

Commissioned by: Clean Stream Environmental Services

P.O. Box 647, Witbank, 1035

013 697 5021

2015/03/24

Ref:



B. Executive summary

Outline of the development project: Clean Stream Environmental Services appointed Dr H. Fourie, a palaeontologist, to provide a Paleontological Protocol for Finds for the suitability of-

The applicant, the Umjindi Local Municipality proposes to upgrade the Rimer's Water Treatment (Purification) Works on Portion 14 of the farm Barberton Townlands 369 JU, within the Barberton Nature Reserve, Umjindi Local Municipality, Ehlanzeni District Municipality, Barberton, Mpumalanga Province. These works supply Barberton and Umjindi with potable water.

This project includes one Alternative.

Alternative 1: A site of 4200 m² inside a fenced area and a site of 8100 m² outside of the existing fence. The access road covers an area of 1025 m² and the rerouted stream area is 1375 m².

The **National Heritage Resources Act 25 of 1999** 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.

This report prescribes to the Heritage Impact Assessment of Section 38 of the National Heritage Resources Act 25 of 1999.

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, 1999 (No 25 of 1999):

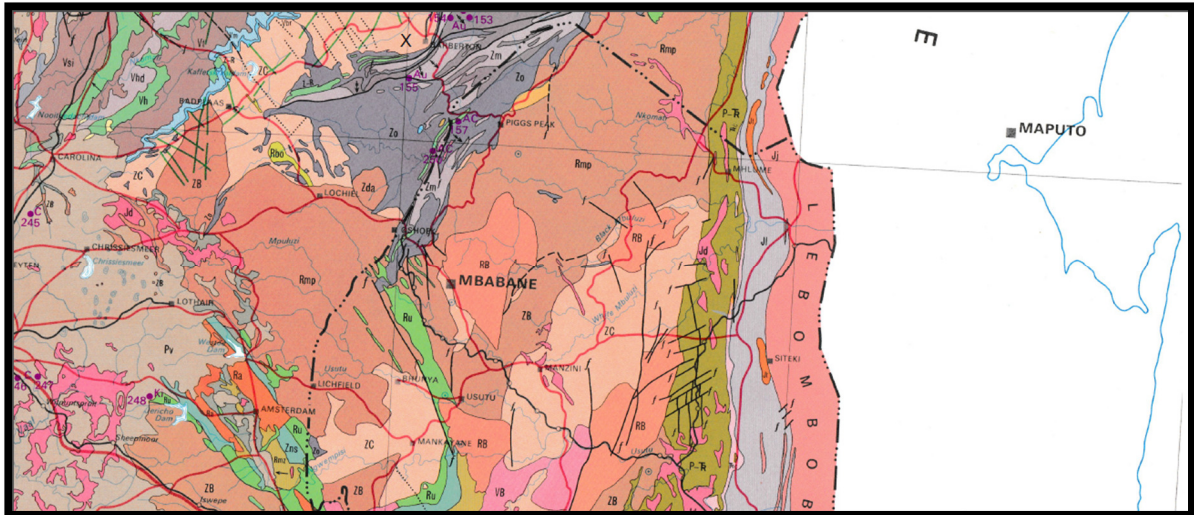
(i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.

Section 38, 1(b) requires the details of the construction of a bridge or similar structure exceeding 50m in length.

It is proposed to comment and recommend on the impact of the development on fossil heritage, and if mitigation or conservation is necessary.

Outline of the geology and the palaeontology:

The geology was obtained from the Geological Map of the Republic of South Africa, 1:100 000 (Visser 1984).



Legend to Map and short explanation (Visser 1984)

- Zka - (ZC) Tonalitic hornblende granite (amber) Cape Valley Granite.
- Zm – Sandstone, shale, conglomerate (lilac) Moodies Group, Barberton Supergroup.
- Zf – Shale, greywacke, volcanic rocks (purple) Fig Tree Group, Barberton Supergroup.
- Zo – Lava, pyroclastic rocks (dark purple) Onverwacht Group, Barberton Supergroup.
- - Lineament (possible dyke).
- f-- - Fault.
- _____ - Diabase dyke (green line)
- - Dip, steep 61° to 90°
- X – Barberton.

Mining activities:

Au – Gold.

Summary of findings: The Palaeontological Protocol for Finds is provided during March 2015, it is summer and the following is reported:

As this is a protocol for finds the date and season have no influence on the outcome. The formations present are mainly the Barberton Supergroup. The development spans over three groups (Zm, Zf, Zo), but mainly the Moodies Group, which are all Swazian in age.

It is the Fig Tree Group (Zf) that contains carbonaceous chert with primitive life forms. Chemical sediments such as fine grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. Stromatolites are accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006).

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 LOW for the Barberton Supergroup (SG 2.2 SAHRA APMHOB 2012).

Recommendation: The impact of the development on fossil heritage is LOW and therefore mitigation or conservation measures are not necessary for this development. A Phase 1 Palaeontological Assessment is not recommended. The topsoil, subsoil, overburden, inter-burden and bedrock do not need to be surveyed for fossiliferous outcrops. Protocol is attached due to the LOW sensitivity of the Barberton Supergroup (Appendix 2).

This project includes one Alternative:

Alternative 1: A site of 4200 m² inside a fenced area and a site of 8100 m² outside of the existing fence. The access road covers an area of 1025 m² and the rerouted stream area is 1375 m².

Concerns/threats:

1. Threats are earth moving equipment / machinery (front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of the fossils by development, vehicle traffic and human disturbance (not for this project).
2. No consultation with parties was necessary.

Stakeholders: Developer – Umjindi Local Municipality.

Environmental – Clean Stream Environmental Services, P.O. Box 647, Witbank, 1035. Tel. 013 697 5021.

Landowner – Umjindi Local Municipality.

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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 107 of 1998 (NEMA) [as amended] and includes Appendix 6 of the Environmental Impact Assessment Act.

Outline of development

This report discusses and aims to provide the developer with information regarding the location of palaeontological material that will be impacted by the development. In the pre-construction phase, if the palaeontological sensitivity is VERY HIGH or LOW, it may be necessary for the developer to apply for the relevant permit from the South African Heritage Resources Agency (SAHRA) and follow protocol.

The Umjindi Local Municipality proposes to upgrade the Rimer's Creek Water Treatment (Purification) Works that supplies Barberton and Umjindi with potable water from 10MI/d to a total treatment capacity of 15MI/d (BID document, BA 2015/01).

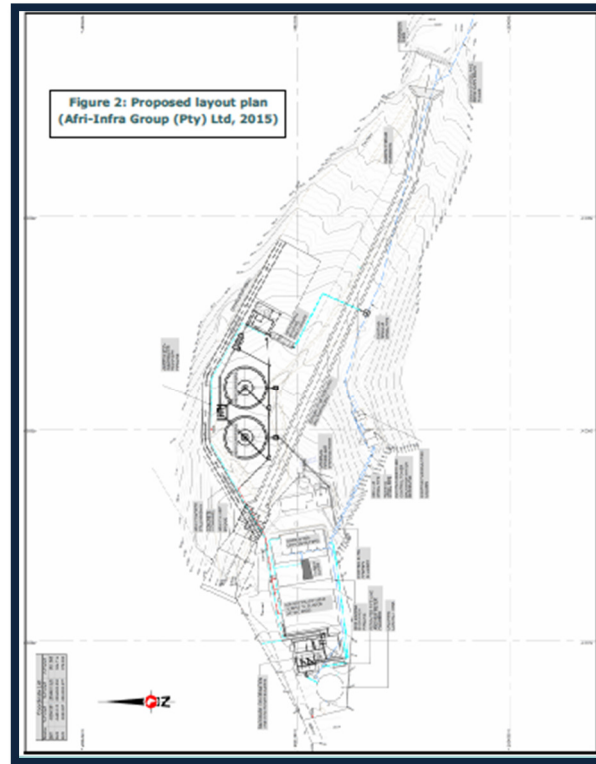
Currently, raw water for the Works is obtained from the Lomati Dam. Water from this dam flows through the Saddleback Tunnel and is released into the Rimer's Creek Weir located upstream of the Works. From the weir water is diverted via a steel gravity supply pipeline to the Works. The gravity supply pipeline that transports water directly from the Saddleback Tunnel is currently not being used as a result of corrosion caused by the high quantity of soluble irons in the raw water (BID Document).

The following infrastructure is anticipated:

1. New sedimentation tanks with sludge handling,
2. New supernatant facility with recycle pump station,

3. Three new upflow filters,
4. New chlorine dosing facility and new backwash pump station,
5. New aeration facility,
6. A new chemical dosing facility, and
7. A new access road will be constructed.
8. A diversion/rerouted reinforced concrete lined channel will also be constructed below the weir.

Figure: Proposed layout plan for the development (Figure 2, Clean Stream Environmental Services).



All of the infrastructure needed is already present such as a gravel road close by.

This project includes one Alternative:

Alternative 1: A site of 4200 m² inside a fenced area and a site of 8100 m² outside of the existing fence. The access road covers an area of 1025 m² and the rerouted stream area is 1375 m².

Rezoning/ and or subdivision of land: None.

Name of developer and consultant: Umjindi Local Municipality and Clean Stream Environmental Services.

Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a desktop palaeontological impact assessment 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.

Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. For the past nine years she carried out field work in the Eastern Cape Province and Mpumalanga Province. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 20 years.

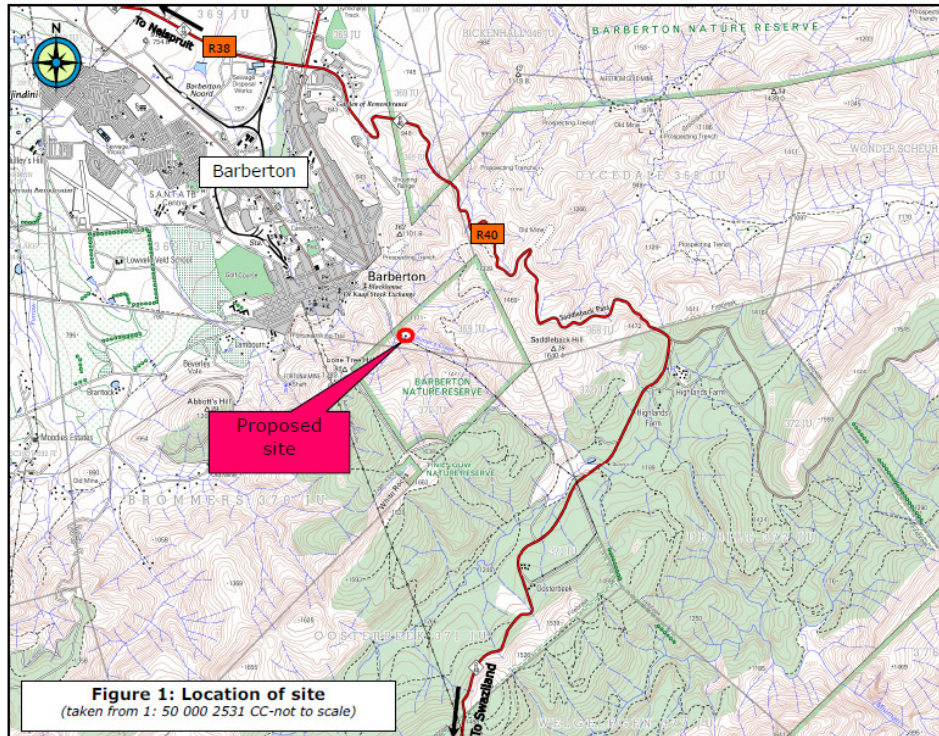
Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act no: 25 of 1999. An electronic copy of this report must be supplied to SAHRA/PHRA.

E. Description of property or affected environment

Location and depth:

The Rimer's Water Treatment Works is situated on the Remaining Extent of Portion 14 of the farm Barberton Townlands 369JU, within the Barberton Nature Reserve, to the southeast of Barberton. The site can be reached via a gravel road from Lee Street in Barberton (BID document).

Topographic Map (Provided by Clean Stream Environmental Services).



F. Description of the Geological Setting

Description of the rock units:

The development is taking place in an area covered by mostly the Barberton Supergroup sediments.

Legend to Map and short explanation (Visser 1984)

- Zka - Tonalitic hornblende granite (amber) Cape Valley Granite.
- Zm – Sandstone, shale, conglomerate (lilac) Moodies Group, Barberton Supergroup.
- Zf – Shale, greywacke, volcanic rocks (purple) Fig Tree Group, Barberton Supergroup.
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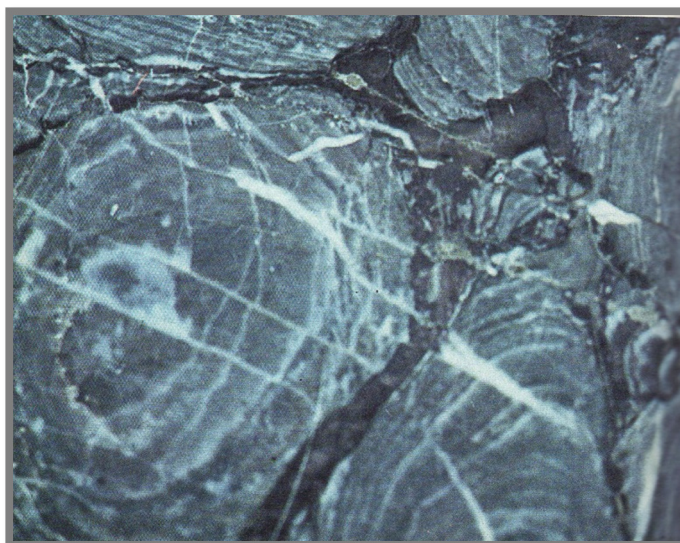
G. Background to Palaeontology of the area

Summary: When rock units of moderate to 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).

It is the Fig Tree Group (Zf) that contains carbonaceous chert with primitive life forms. Chemical sediments such as fine grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate.

Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. Stromatolites are accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006).

Stromatolites in thin section (De Zanche and Mietto 1977)



Criteria used (Fossil Heritage Layer Browser/SAHRA):

Rock unit	Significance/vulnerability	Recommended action
Barberton Sequence	Low	No palaeontological studies are required, however a protocol for finds is required.

Databases and collections: Ditsong: National Museum of Natural History.

Impact: LOW. There may be significant fossil resources (LOW) that may be impacted by the development.

H. Description of the Methodology

The protocol for finds is provided during March 2015.

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.
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. A site visit was not conducted.
7. Insufficient data from developer and exact lay-out plan for all structures.

I. Description of significant fossil occurrences (Heritage value)

All Karoo Supergroup geological formations are ranked LOW to VERY HIGH, but here the impact is potentially LOW for the Barberton Supergroup.

J. Recommendation

a. There is no objection to the development, and it is not necessary to request a Phase 1 Palaeontological Impact Assessment to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is LOW. A Phase 2 Palaeontological Mitigation will only be required if the Phase 1 Palaeontological Assessment finds fossiliferous outcrops. A Protocol for Finds is attached (Appendix 1) due to the LOW palaeontological sensitivity.

- b. This project will benefit the economy, the growth of the community and social development in general.
- c. Preferred choice: Alternative 1 as the palaeontological sensitivity is LOW. Protocol for finds is attached and significant fossil resources may be impacted by the development (Appendix 1).
- d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling, or blasting SAHRA/PRHA must be notified. All construction activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures.

Sampling and collecting:

Wherefore a permit may be needed from the South African Heritage Resources Agency (SAHRA).

- a. Objections: None.
- b. Conditions of development: See Recommendation.
- c. Areas that may need a permit: None.
- d. Permits for mitigation - needed from SAHRA / PHRA: None.

K. Conclusions

- a. All the land involved in the development was assessed and none of the property is unsuitable for development.
- b. All information needed for the Protocol for Finds was provided by Clean Stream Environmental Services.
- 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 shallow caves.
- e. Condition in which development may proceed: It is further suggested that the Occupational, Health and Safety Act is adhered to for safety and security reasons.

L. Bibliography

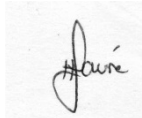
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Declaration

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 scope. There are no circumstances that compromise the objectivity of me performing such work.

Heidi Fourie accepts no liability, and the client, by receiving this document, indemnifies Heidi Fourie 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.

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

A handwritten signature in black ink, appearing to read 'Heidi Fourie', is enclosed in a light grey rectangular box.

Heidi Fourie
2015/03/24

Appendix 1:

Protocol for finds

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.

The developer must survey the areas affected by the development and then indicate on plan where the construction / development / mining 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 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. It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during 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 (in case of coal mines) 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 plant and other 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.

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).

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. Fossils likely to occur are for example the fossil plants from the Vryheid Formation, these are present in the grey shale or the invertebrates from the Dwyka Group, etc.
3. When clearing topsoil, subsoil or overburden and hard rock (outcrop) is found, the contractor needs to stop all work.
4. A Palaeontologist / Palaeobotanist (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.
5. If the Palaeontologist / Palaeobotanist is satisfied that no fossils will be destroyed or have removed fossils, development and removing of the topsoil can continue.
6. 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.
7. 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 every two weeks).
8. 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. Using 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 will reveal any fossils sandwiched between the layers.

SAHRA does have the following documents in place:

Guidelines to Palaeontological Permitting policy.

Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.

Guidelines for Field Reports.

Appendix 2: Table listing points in Appendix 6 of the Act and position in Report.

Section	Point in Act	Heading
B	1(c)	Outline of development project
	1(d)	Summary of findings
	1(g)	Concerns/threats:
	1(n)i	"
	1(n)ii	"
	1(o)	"
	1(p)	"
D	1(h)	Figures
	1(a)i	Terms of reference
G	1(e)	Description of Methodology
	1(i)	Assumptions and Limitations
I	1(f)	Heritage value
J	1(j)	Recommendation
	1(l)	"
	1(m)	Sampling and collecting
	1(k)	"
Declaration	1(b)	Declaration
Appendix 1	1(k)	Protocol for finds
	1(m)	"
	1(q)	"