

Portion 350 of the Farm The Willows 340-JR, City of Tshwane - Gauteng
City of Tshwane Metropolitan Municipality, Gauteng Province
Farm: Portion 350 The Willows-340-JR
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Palaeontological Impact Assessment: Phase 1: Field Study

Commissioned by: A. Pelser Archaeological Consulting cc
833B St Bernard Street,
Garstfontein,
0081
083 459 3091
Ref: Pending
2021/08/30

Thin section of a stromatolite (De Zanche & Mietto)



B. Executive summary

Outline of the development project: A. Pelser has facilitated the appointment of Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Phase 1: Field Study of the proposed Portion 350 of the Farm The Willows 340-JR, City of Tshwane - Gauteng Province.

The applicant, HLM Africa (Pty) Limited plans to construct a residential development and associated infrastructure on Erf 349 and Erf 350.

The Project includes one locality Option with (Figure 2):

Option 1: A roughly rectangular area blocked in red with Solomon Mahlangu Road to the east, the M6 Lynwood Road Motorway to the north and surrounded by farms and the Wapadrant neighbourhood. The area is approximately 1 984 m² (1.07 ha) 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); (d) the re-zoning of a site exceeding 10 000 m² (**1 ha**) in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report (**1c**) aims to provide comment and recommendations on the potential impacts that the proposed development project 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) and 1:250 000, 2528 Pretoria (Walraven 1978).



Figure: The geology of the development area.

Legend to Figure and short explanation.

di – Green, fine- to medium-grained diabase (green). Vaalian to post-Mockolian.

Vsi – Shale, carbonaceous in places; hornfels, chert (light brown). Silverton Formation, Pretoria Group, Transvaal Supergroup. Vaalian.

Vdq – Quartzite (purple ::). Daspoort Formation, Pretoria Group, Transvaal Supergroup. Vaalian.

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

----- - Concealed geological boundary.

⊥15° – Strike and dip of bed.

□ – Proposed development (blocked in black).

The Silverton Formation shales are rich in carbon and pyrite and show cross-bedding. Brown to khaki-weathering shales is stratigraphically below the Magaliesberg Formation. These shales are visible in road cuttings. The Silverton shale Formation is the thickest of all the shale formations of the Pretoria Group (300-3000 m). It forms wide valleys and when changed to hornfels it can be used for roof coverings (Visser 1989).

Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006). The Daspoort Formation is between 90 to 190 m thick and is directly overlain by the Silverton Formation (Visser 1989).

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 sedimentary strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, and here locally **HIGH** for the Silverton Formation and the Daspoort Formation, Pretoria Group, Transvaal Supergroup (SG 2.2 SAHRA APMHOB, 2012).

Both of the formations, the Silverton and Daspoort Formations, in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal

mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area.

Field Observation – The property is not large, but it is very overgrown and it is difficult to see outcrops. There are sandstone outcrops on the slope of the hill. Lush grass, trees and weeds are abundant. The hill is steep. Only two structures are present on site. Quartzite is present on most of the site, a very small portion of the Silverton Formation is present.

Summary of findings (1d): The Phase 1: Field Palaeontological Impact Assessment was undertaken in August 2021 in winter in mild and dry conditions (1c) during the official Adjusted Level 3 of the Covid-19 lockdown, as this is a field study the season and time has an influence and the following is reported:

The Project includes one locality Option (Figure 2) present in Wapadrant:

Option 1: A roughly rectangular area blocked in red with Solomon Mahlangu Road to the east, the M6 Lynwood Road Motorway to the north and surrounded by farms and the Wapadrant neighbourhood. The area is approximately 1 984 m² (1.07 ha) in size.

The only Option presented is situated on the shales of the **Silverton Formation and Daspoort Formation**, Pretoria Group, Transvaal Supergroup which may contain micro stromatolitic fossils.

Recommendation:

The potential impact of the development on fossil heritage is **HIGH** and therefore a Phase 1: Field Survey was necessary for this development, if a chance fossil is found during the development (according to SAHRA protocol) the Protocol is attached.

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 could have missed fossiliferous outcrops. 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.
2. No consultation with parties was necessary. 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, 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 fossil 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 – HLM Africa (Pty) Limited.

Environmental – A Pelser Archaeological Consulting cc. 833B St Bernard Street, Garstfontein, 0081. Tel: 083 459 3091.

Landowner – A. van Aswegen.

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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, HLM Africa (Pty) Limited plans to construct a residential development and associated infrastructure on Erf 349 and Erf 350.

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

- Buildings (2 houses per site)
- Driveways
- Paving
- Sewer reticulation
- Landscape and lawns
- Fence.

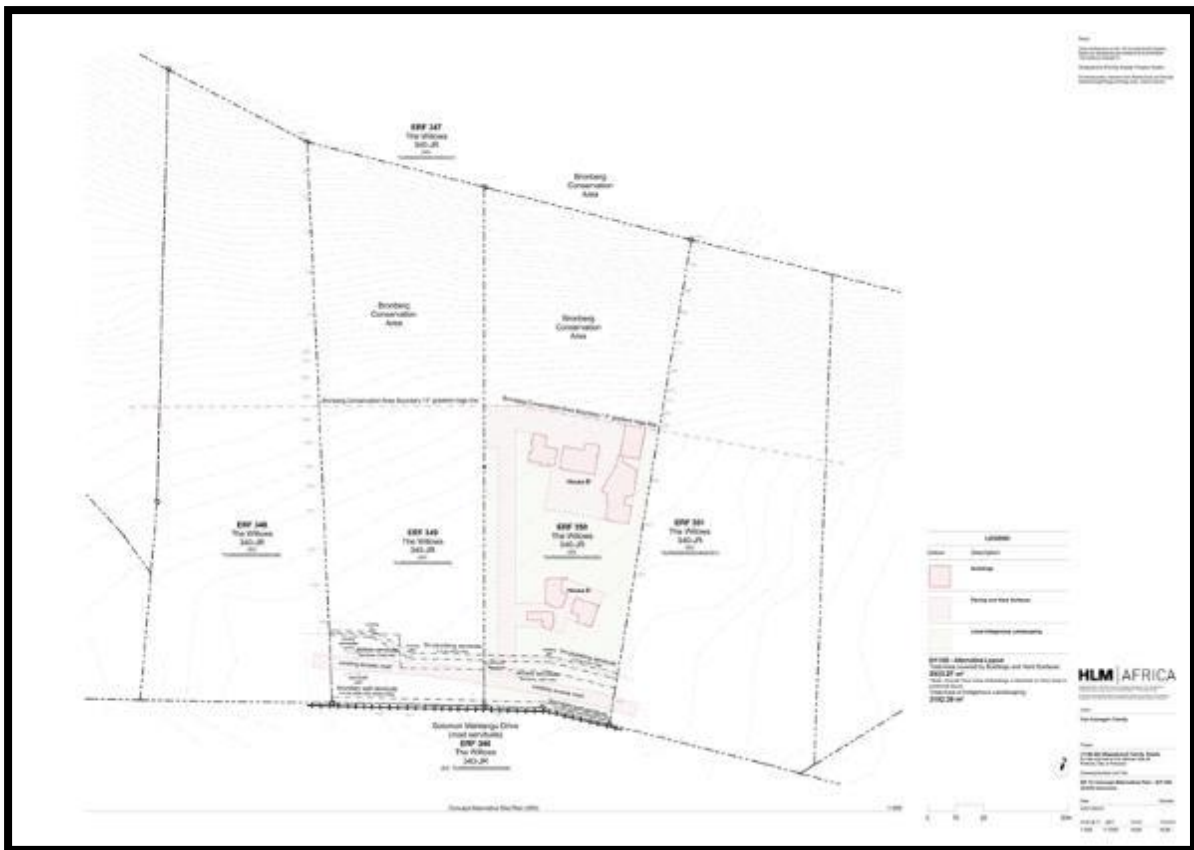


Figure 1a: Site plan with Alternative lay-out (Pelser).

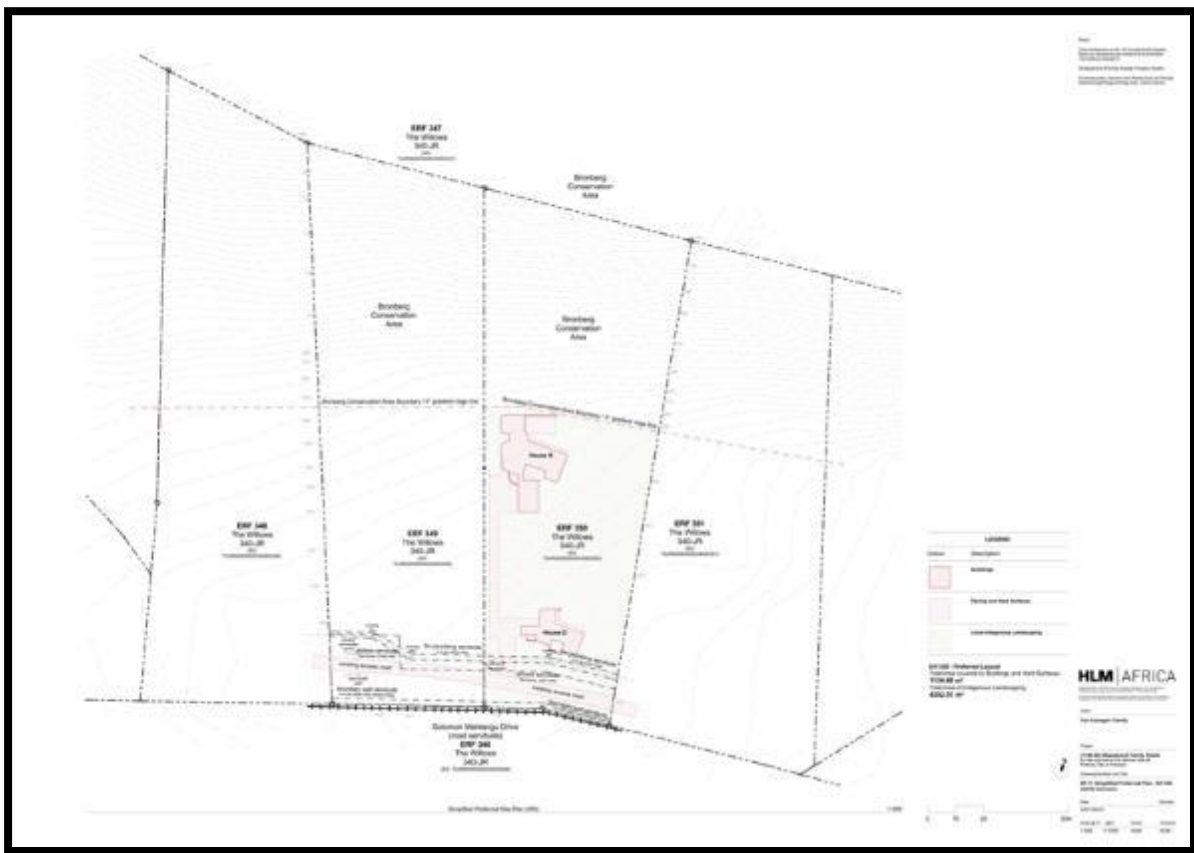


Figure 1b: Site plan with Preferred lay-out plan (Pelser).

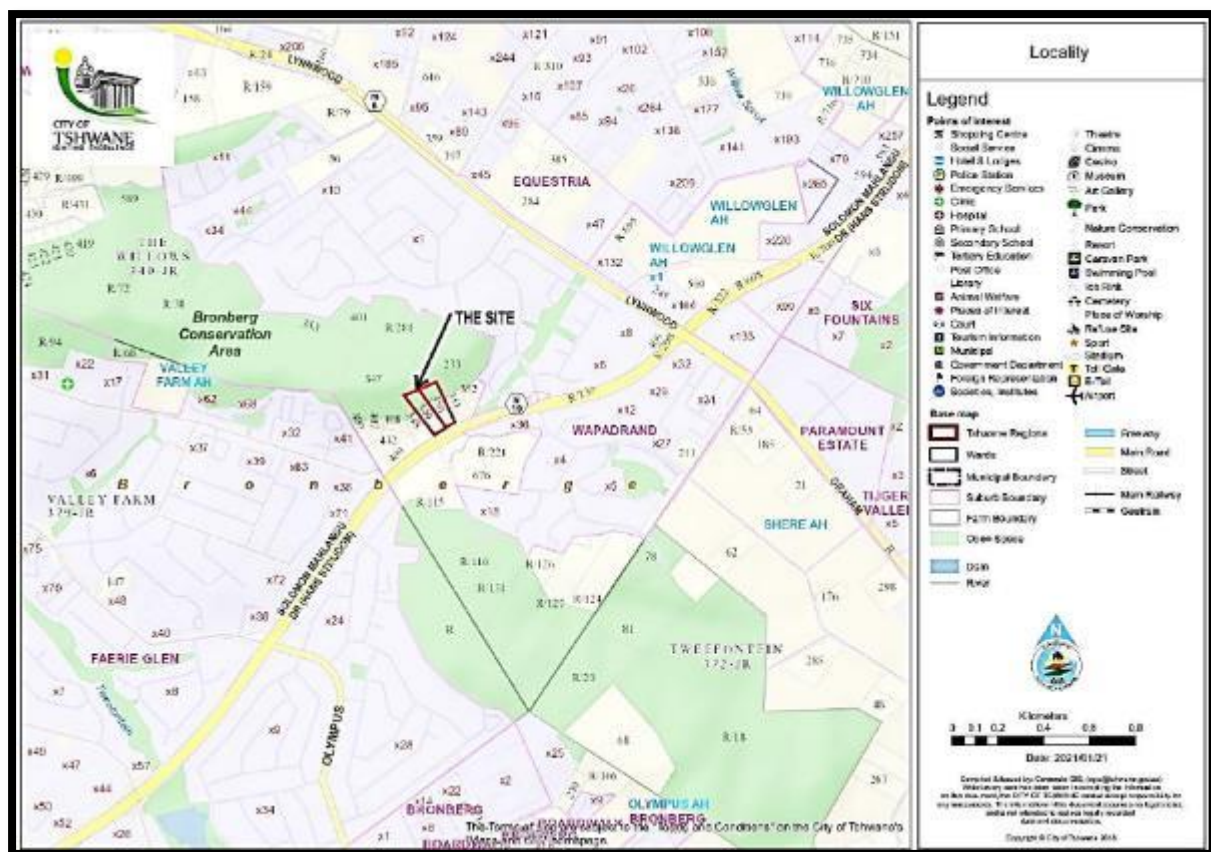


Figure 1c: Topographic map with lay-out (Pelser).

Local benefits of the proposed development include benefits to the local economy through possible job creation, poverty alleviation, social upliftment, and local supplier procurement during the construction phase.

The Project includes one locality Option (Figure 2) as shown above:

Option 1: A roughly rectangular area blocked in red with Solomon Mahlangu Road to the east, the M6 Lynwood Road Motorway to the north and surrounded by farms and the Wapadrand neighbourhood. The area is approximately 1 984 m² (1.07 ha) in size.

Rezoning/ and or subdivision of land: Residential.

Name of Developer and Environmental Consultant: HLM Africa (Pty) Limited and A. Pelsaer Archaeological Consulting cc.

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 14 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 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.

E. Description of property or affected environment

Location and depth:

The proposed Portion 350 of the Farm The Willows 340-JR will be situated in the City of Tshwane, Gauteng Province.

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 development.

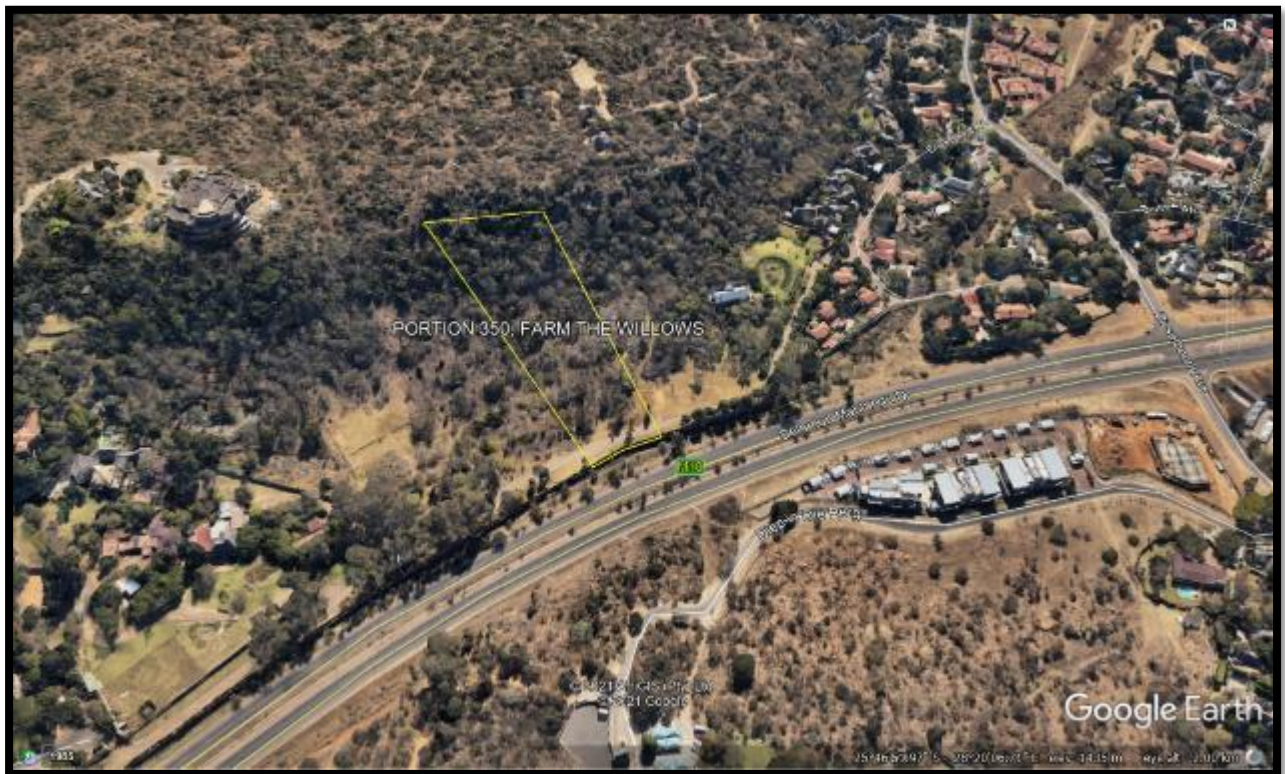


Figure 2: Google Earth location map (Pelser).

The Project includes one locality Option (Figure 2) present in Wapadrant:

Option 1: A roughly rectangular area blocked in red with Solomon Mahlangu Road to the east, the M6 Lynwood Road Motorway to the north and surrounded by farms and the Wapadrant neighbourhood. The area is approximately 1 984 m² (1.07 ha) in size.

F. Description of the Geological Setting

Description of the rock units:



Figure 3: Excerpt of 1:250 000 Geological Map (also see Figure 4) (1h).

Legend to Figure and short explanation.

di – Green, fine- to medium-grained diabase (green). Vaalian to post-Mockolian.

Vsi – Shale, carbonaceous in places; hornfels, chert (light brown). Silverton Formation, Pretoria Group, Transvaal Supergroup. Vaalian.

Vdq – Quartzite (purple ::). Daspoort Formation, Pretoria Group, Transvaal Supergroup. Vaalian.

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

----- - Concealed geological boundary.

⊥20° – Strike and dip of bed.

□ – Proposed development (blocked in black).

Mining Activities on Figure 3:

Cu – Copper SB – Building Sand.

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

There is a major fault transecting the property.

Vaalian to post-Mokolian diabase (di) intrusions occur throughout the area in the form of plates, sills and dykes. These plates are common in the Transvaal Supergroup and when present in the Pretoria Group they are referred to as the Transvaal diabase (Kent 1980, Visser 1989). The diabase sills of Bushveld age (Norman and Whitfield 2006) is typically fine-grained, green-grey with plagioclase and pyroxenes (Visser 1989).

The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Pretoria and Chuniespoort Groups as well as other smaller groups (Kent 1980, Snyman 1996). It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals (Norman and Whitfield 2006). This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and

the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006).

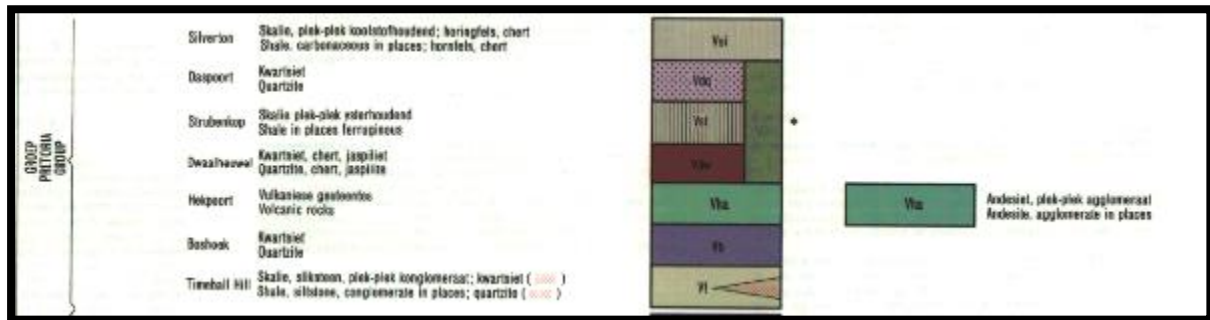


Figure 4: Lithostratigraphy (2528 Pretoria).

The Pretoria Group consists predominantly of quartzite and shale, together with a prominent volcanic unit, minor conglomerate, chemical and volcanic members. It comprises the Hekpoort Andesite, Dullstroom Basalt, Time Ball Hill, Silverton, and Magaliesberg Quartzite Formations as well as several smaller formations (in total 15) and overlies the Chuniespoort Group (Kent 1980). Both the shale and quartzite of the Pretoria Group are utilised in the building industry (Snyman 1996). The Rayton Formation (Vr) is present northeast of Pretoria and is approximately 1,200 m thick. It consists of four layers of quartzite alternating with four layers of shale (Visser 1989). In the central part of the basin the quartzite and shale overlying the Magaliesberg Quartzite are combined into the Rayton Formation because intrusion of numerous diabase sills has made it impossible to recognise all the individual formations (Kent 1980). Below the Dullstroom, Houtenbek, Steenkampsberg, Lakenvlei and Vermont Formations is the Magaliesberg Formation which is 300 m thick in the Pretoria region and up to 500 m thick in the Lowveld (Visser 1989).

The hard quartzites form prominent mountain ranges such as the Magaliesberg Mountains (McCarthy and Rubidge 2005). The Magaliesberg is a dominant feature of the Gauteng landscape, and is north-dipping (Norman and Whitfield 2006). It was shaped by glaciation during Dwyka times and then slightly modified by post-glacial erosion (McCarthy and Rubidge 2005). The Silverton Formation shales are rich in carbon and pyrite and show cross-bedding. Brown to khaki-weathering shales is stratigraphically below the Magaliesberg Formation. These shales are visible in road cuttings. The Silverton shale Formation is the thickest of all the shale formations of the Pretoria Group (300-3000 m). It forms wide valleys and when changed to hornfels it can be used for roof coverings (Visser 1989). Here the Silverton Formation is subdivided into three members, the Lydenburg Member (Vsl) at the top, Machadadorp Member (Vsm) and the Boven Member (Vsb) at the base (2430 Pilgrims Rest) (Visser 1989).

The Strubenkop Formation (Vst) is fairly thin (20-80 m) in the east, but thicker towards its central part, up to 130 m thick towards the west. It is enriched with iron in the vicinity of Pretoria. The Boshok Formation (Vb) is relatively thin (90m) and together with the Dwaalheuwel Formation (Vdw) is present in the eastern former Transvaal only consisting of quartzite. The Hekpoort Andesite Formation (Vha) is usually well developed, except for the Mokopane and Thabazimbi regions (Visser 1989) and can be up to 500 m thick with andesite, basalt and pyroclasts. These sheets are massive with an amygdaloidal crust on top (Snyman 1996). It is rich in green hornblende with an age between $2,224 \pm 21$ Ma (2626 Wes Rand sheet info). The Dwaalheuwel Formation is only present in the Mokopane area, above the Hekpoort Formation. In the east it is grouped with the Strubenkop Formation and the Daspoort Formation. The Daspoort Formation is between 90 to 190 m thick (Visser 1989).

The Time Ball Hill shale Formation (Vt) is known to contain 'algal microfossils' diagenetic in origin. Stromatolites as they are known are preserved in the subordinate carbonate rocks (Kent 1980). The Pretoria Group is clastic sedimentary in nature (Eriksson 1999). The pile of sedimentary rocks, mainly mudstones and quartzites with some basalt can collectively reach a thickness of up to 5 km. The Rooihooft Formation sits at the base of the Pretoria Group and is quite thin (10 – 150 m). The chert is present as boulders or a breccia. It is often lumped with the Time Ball Hill Formation (Visser 1989).

Field Observation – The property is not large, but it is very overgrown and it is difficult to see outcrops. There are sandstone outcrops on the slope of the hill. Lush grass, trees and weeds are abundant. The hill is steep. Only two structures are present on site. Quartzite is present on most of the site, a very small portion of the Silverton Formation is present.



Figure 5: View of Portion 350 with hill in the background.



Figure 6: Area just in front of the hill on Portion 350.



Figure 7: View towards Portion 349.



Figure 8: A Small outcrop showing quartzite of the Daspoort Formation.



Figure 9: View of Portion 349.

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).

Both formations, the Silverton and Daspoort Formations, in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area.

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. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in for example the Malmani dolomites, 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). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely.



Figure 10: Photograph of a stromatolite (E. Butler).

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

Magaliesberg (Vmg; Vmg; Vmg)		Coastal sandstones with mudrocks	Microbial mat structures (Desiccated mats sometimes resemble trace fossils)	Pretoria Group subunits with stromatolites probably also contain microfossils. This may also apply to carbonaceous mudrocks.
Igneous intrusions (Vsh; Vsh1)		Norite	No fossils recorded	
Silverton (Vs)	Lydenburg (Vld; Vld; Vld1)	Shale, mudstone and carbonate layers	Stromatolites	
	Machadodorp (Vsm; Vsm1; Vsm2; Vmc)	Fine-grained tuff and basic lava	No fossils recorded	ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN OUTCROP AREA OF CARBONATE SUBUNITS – Le Limestone Dolomites (breccias not individually mapped)
	Boven (Vsb; Vbn; Vbn1)	Marine shale and mudrocks with tuff and minor carbonates	Stromatolites	
Igneous intrusions (Vdi; di)		Igneous intrusions	No fossils recorded	
Daspoort (Vda; Vhd; Vdq; Vdp)		Alluvial, fluvial and deltaic sandstones and mudrocks, marine sediments in east	Stromatolites	Rooberg Group was previously included within top of Transvaal Supergroup but now regarded as separate succession
Strubenkop (Vs; Vst; Vst)		Lacustrine mudrocks with minor sandstone	No fossils recorded	
Dwaalshoof (Vdw; Vhd)		Alluvial sandstones, conglomerates and mudrocks	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
Silverton Formation	High	Desktop Study, Field Assessment likely
Daspoort Formation	High	Desktop Study, Field Assessment likely
Pretoria Group	Moderate	Desktop Study required

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

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

The project includes one locality Option (Figure 2) with a **HIGH** impact.

Option 1: A roughly rectangular area blocked in red with Solomon Mahlangu Road to the east, the M6 Lynwood Road Motorway to the north and surrounded by farms and the Wapadrant neighbourhood. The area is approximately 1 984 m² (1.07 ha) in size.

H. Description of the Methodology (1e)

The palaeontological impact assessment field study was undertaken in August 2021 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

Both of the formations, in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area.

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 may be necessary to request a Phase 2 Palaeontological Impact Assessment: Mitigation if a chance fossil is found, as the palaeontological sensitivity is **HIGH**. 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: Locality Option 1 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 A. Pelsers Archaeological Consulting cc.
- 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.
- 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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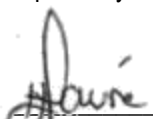
Declaration (disclaimer) (1b)

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 Palaeontological Impact Assessment 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
2021/08/30

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 may be required to survey the areas affected by the development and may have to indicate on plan where the construction / development will take place. Trenches may 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

Table 3 – EIA Criteria for Assessment of Impacts

<p><u>Extent of the Impact:</u></p> <ul style="list-style-type: none"> • (1) Site (i.e. extending only as far as the development boundary of the site area), • (2) Local/Surrounds (i.e. the area and its immediate surroundings within 5km of the site), • (3) Municipal (i.e. Local Municipality), • (4) Provincial (i.e. the relevant province - Gauteng/Limpopo/North-West/Western Cape/KZN/Free State/Eastern Cape/Mpumalanga/Northern Cape), • (5) National (i.e. South Africa), or • (6) International (i.e. Africa, Europe, USA etc). 	<p><u>Duration of the Impact:</u></p> <ul style="list-style-type: none"> • (1) Immediate (>1year), • (2) Short term (1-5 years), • (3) Medium term (6-15 years), • (4) Long term (16-30 years and/or the impact will cease after the operational life span of the project), or • (5) Permanent (no mitigation measure of natural process will reduce the impact after construction).
<p><u>Magnitude/Intensity:</u></p> <ul style="list-style-type: none"> • (0) None (where the aspect will have no impact on the environment, • (2) Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected), <p>(4) Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),</p> <p>(6) Moderate/Medium (where the affected environment is altered but natural, cultural and</p>	<p><u>Probability of occurrence:</u></p> <ul style="list-style-type: none"> • (0) None (the impact will not occur), • (1) Improbable (low likelihood – the possibility of the impact materializing is very low as a result of design, historic experience, or implementation of adequate corrective actions), • (2) Low Probability (there is a possibility that the impact will occur), • (3) Medium Probability (distinct possibility – the impact may occur), • (4) High Probability (it is most likely that the impact will occur), or

<p>social functions and processes continue albeit in a modified way), (8) High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or (10) Very High / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).</p>	<ul style="list-style-type: none"> • (5) Definite / I don't know (the impact will occur regardless of the implementation of any prevention measures and/or corrective actions, or you don't know what the probability will be based on too little published information).
<p>Status of the Impact:</p> <ul style="list-style-type: none"> • Negative Effect (i.e. at a "cost" of the environment), • Positive Effect, (i.e. a "benefit" to the environment), or • Neutral effect on the environment. <p>The impacts are to be assessed in terms of their effect on the project and the environment.</p>	<p>Degree of confidence in predictions:</p> <p>The environmental consultant &/or any relevant specialists should state what degree of confidence (low, medium or high) is there in the predictions based on the available information and level of knowledge and expertise.</p>
<p>Significance of the Impact:</p> <p>Based on the information contained in the points above, the potential impacts are assigned as significance weighting (S). This weighting is formulated by adding the sum of the numbers assigned to extent (E), duration (D) and Magnitude (M) and multiplying this sum by the probability (P) of the Impact.</p> <p>S = (E+D+M) P</p> <ul style="list-style-type: none"> • (0) No significance: (The impacts do not influence the proposed development and/or environment in any way), • (<30) Low: (The impacts will have a minor influence on the proposed development and/or environment i.e. where this impact would not have a direct influence on the decision to develop in the area. These impacts could possibly require some attention to modification of the project design where possible, or alternative mitigation. • (30-60) Moderate/Medium: (The impacts will have a moderate influence on the proposed development and/or environment. The impact can be ameliorated by a modification in the project design or implementation of effective mitigation measures i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated). • (>60) High: (i.e where the impact must have an influence on the decision process to develop in the area. The impacts will be likely to have the "no-go" implication on the development or portions of the development regardless of any mitigation measures that could be implemented. This level of significance must be well motivated. 	

Table 4 – PROPOSAL: Preferred Layout Plan for the Proposed Residential Development to be situated on Portion 350 of the farm The Willows 340JR (City of Tshwane Metropolitan Municipality, Gauteng): Heritage Impacts

*"Impact Significance is the value placed on the change by different affected parties (i.e. level of significance & acceptability). It is an anthropocentric concept, which makes use of value judgments & science-based criteria (i.e. biophysical, social & economic). Such judgment reflects the political reality of impact assessment in which significance is translated into public acceptability of impacts. The Process of determining impact significance includes the following tasks: impact identification, impact prediction and impact evaluation. The Impact Significance is determined predominantly by using systematic generic and judgmental criteria i.e. extent of spatial scale of the impact; intensity or severity of the impact; duration of the impact; mitigatory potential; acceptability; degree of certainty; status of the impact; and legal requirements."*¹ Rating of significance of each impact will be

¹ DEAT (2004) Integrated Environmental Management, Information Series, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

indicated by the following symbols: L = low; L-M = low to medium; M=medium; M-H= medium to high; H= high; VH= very high. Positive Impact = (Pos) or +; Negative Impact = (Neg) or –“.

Criteria for Assessment of Impacts:

These criteria are drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (April 1998) in terms of the Environmental Conservation Act No. 73 of 1989. The criteria include:

Nature of the impact:

The proposed development will possibly impact on some Late Iron Age stone-walling situated in the area

Extent of the Impact:

(1) Site (i.e. extending only as far as the development boundary of the site area),

Duration of the Impact:

(1) Immediate (>1year),

Magnitude/Intensity:

(6) Moderate/Medium (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),

Probability of occurrence:

(2) Low Probability (there is a possibility that the impact will occur),

Status of the Impact:

Negative Effect (i.e. at a “cost” of the environment). Should the proposed development impact on any Cultural Heritage sites (Late Iron Age stone-walling) then these sites will have to be mitigated through archaeological excavations before demolition that will ultimately remove these sites from the cultural landscape.

Degree of confidence in predictions:

Medium

Significance of the Impact:

Based on the information contained in the points above, the potential impacts are assigned as significance weighting (S). This weighting is formulated by adding the sum of the numbers assigned to extent (E), duration (D) and Magnitude (M) and multiplying this sum by the probability (P) of the Impact.

$$S=(1+1+6)2 = 16$$

(<30) Low: (The impacts will have a minor influence on the proposed development and/or environment i.e. where this impact would not have a direct influence on the decision to develop in the area. These impacts could possibly require some attention to modification of the project design where possible, or alternative mitigation.

The development footprint is situated on a geological layer with 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 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 moderate possibility. The significance of the impact occurring will be.

Alternative#1 LAYOUT PLAN:

The Willows 340-JR(City of Tshwane)

to be situated on Farm The Willows 340-JR (City of Tshwane, Gauteng Province) with associated Services infrastructure.

POTENTIAL IMPACTS on the HERITAGE ENVIRONMENT:

[NOTE: A Palaeontological Impact Assessment was conducted on the said site and the following was taken and interpreted from the specialist report contained in APPENDIX *Performed by Dr H. Fourie*"]

1. Potential Direct & Indirect Heritage Impacts

A field assessment study was undertaken to provide a heritage framework for the project area and surrounding landscape. This was augmented by a study of available historical topographical sheets and an assessment of previous heritage studies completed for the area. The field study revealed that the study area is present on the Silverton Formation. The study area was assessed in the field by way of intensive walkthroughs undertaken by one palaeontologist (Heidi Fourie). The fieldwork resulted in the identification of several outcrops.

The impact of the proposed development on the located heritage sites was assessed, and it was established that the proposed development will have a Medium Impact Risk. As a result, mitigation measures may be required for the site.

The following general mitigation measures are required:

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

On the condition that the recommendations made in this report are adhered to, no heritage reasons can be given for the development not to continue."

Nature:

CONSTRUCTION PHASE:

- The construction phase may potentially result in the loss of heritage resources buried beneath the surface.
- In this section the impact of the proposed development will be assessed.

	Without mitigation		With mitigation	
PLANNING & DESIGN PHASE				
Probability	n.a.		n.a.	
Duration	n.a.		n.a.	
Extent	n.a.		n.a.	
Magnitude	n.a.		n.a.	
Significance	n.a.		n.a.	
Status (positive or negative)	None		None	
CONSTRUCTION PHASE				
Probability	High	4	Low	2
Duration	Permanent	5	Short-term	2
Extent	Site	1	Site	1
Magnitude	Moderate	6	Low	4
Significance	Medium	48	Low	14
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	n.a.		n.a.	
Duration	n.a.		n.a.	

Extent	n.a.		n.a.	
Magnitude	n.a.		n.a.	
Significance	n.a.		n.a.	
Status (positive or negative)	n.a.		n.a.	
DECOMMISSIONING & CLOSURE PHASE				
Probability	n.a.		n.a.	
Duration	n.a.		n.a.	
Extent	n.a.		n.a.	
Magnitude	n.a.		n.a.	
Significance	n.a.		n.a.	
Status (positive or negative)	n.a.		n.a.	
Reversibility	High		Very High	
Irreplaceable loss of resources?	Moderate		Low	
Can impacts be mitigated?	Yes			
Mitigation: <ul style="list-style-type: none"> If a chance fossil is uncovered during construction, SAHRA (South Africa Heritage Resource Agency) must be notified immediately. An Environmental Control Officer (ECO) must be appointed to oversee the implementation of the Environmental Management Programme (EMPr) for the duration of the construction phase. 				
Cumulative impacts: None.				
Residual Risks: None.				

<p align="center">PROPOSAL: PREFERRED LAYOUT PLAN The Willows 340-JR(City of Tshwane) to be situated on Farm The Willows 340-JR (City of Tshwane, Gauteng Province) with associated Services infrastructure</p>				
<p>POTENTIAL IMPACTS on the HERITAGE ENVIRONMENT: [NOTE: A Palaeontological Impact Assessment was conducted on the said site and the following was taken and interpreted from the specialist report contained in APPENDIX Performed by Dr H. Fourie"]</p>				
<p>1. Potential Direct & Indirect Heritage Impacts A field assessment study was undertaken to provide a heritage framework for the project area and surrounding landscape. This was augmented by a study of available historical topographical sheets and an assessment of previous heritage studies completed for the area. The field study revealed that the study area is present on the Silverton Formation. The study area was assessed in the field by way of intensive walkthroughs undertaken by one palaeontologist (Heidi Fourie). The fieldwork resulted in the identification of several outcrops. The impact of the proposed development on the located heritage sites was assessed, and it was established that the proposed development will have a Medium Impact Risk. As a result, mitigation measures may be required for the site. The following general mitigation measures are required:</p> <ul style="list-style-type: none"> Mitigation may be needed (Appendix 2) if fossils are found. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formation present and its fossils and follow protocol. The development may go ahead, but the ECO must survey for fossils before and or after clearing, blasting, drilling or excavating. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance fossil find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. 				

On the condition that the recommendations made in this report are adhered to, no heritage reasons can be given for the development not to continue.”

Nature:

CONSTRUCTION PHASE:

- The construction phase may potentially result in the loss of heritage resources buried beneath the surface.
- In this section the impact of the proposed development will be assessed.

	Without mitigation		With mitigation	
PLANNING & DESIGN PHASE				
Probability	n.a.		n.a.	
Duration	n.a.		n.a.	
Extent	n.a.		n.a.	
Magnitude	n.a.		n.a.	
Significance	n.a.		n.a.	
Status (positive or negative)	None		None	
CONSTRUCTION PHASE				
Probability	High	4	Low	2
Duration	Permanent	5	Short-term	2
Extent	Site	1	Site	1
Magnitude	Moderate	6	Low	4
Significance	Medium	48	Low	14
Status (positive or negative)	Negative		Negative	
OPERATIONAL PHASE				
Probability	n.a.		n.a.	
Duration	n.a.		n.a.	
Extent	n.a.		n.a.	
Magnitude	n.a.		n.a.	
Significance	n.a.		n.a.	
Status (positive or negative)	n.a.		n.a.	
DECOMMISSIONING & CLOSURE PHASE				
Probability	n.a.		n.a.	
Duration	n.a.		n.a.	
Extent	n.a.		n.a.	
Magnitude	n.a.		n.a.	
Significance	n.a.		n.a.	
Status (positive or negative)	n.a.		n.a.	
Reversibility	High		Very High	
Irreplaceable loss of resources?	Moderate		Low	
Can impacts be mitigated?	Yes			
Mitigation:				
<ul style="list-style-type: none">• If a chance fossil is uncovered during construction, SAHRA (South Africa Heritage Resource Agency) must be notified immediately.• An Environmental Control Officer (ECO) must be appointed to oversee the implementation of the Environmental Management Programme (EMPr) for the duration of the construction phase.				
Cumulative impacts: None.				
Residual Risks: None.				