



## NGT ESHS Solutions

**PROJECT TITLE:**

REPORT FOR THE REFURBISHMENTS OF THE CALEDONIAN STADIUM IN  
PRETORIA, GAUTENG PROVINCE

**PROJECT REFERENCE NUMBER:**

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Paleontological Impact Assessment for the  
refurbishments of the Caledonian Stadium in Pretoria,  
Gauteng Province.

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Prof Marion Bamford for NGT ESHS has compiled this report. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision-making process for the project.

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## **EXECUTIVE SUMMARY**

NGT has been appointed to undertake the Heritage and Palaeontology studies for the proposed refurbishment of the Caledonian Stadium in Pretoria by the Tshwane Municipality. In order to comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project.

### **Conclusions:**

The site lies on the shales and sandstones of the Magaliesberg Formation, Pretoria Group, Transvaal Supergroup that is over 2100 million years old and predates and body fossils. Trace fossils have been found at other sites to the east but not recorded from here and are of geological and environmental interest.

### **Recommendations:**

It is debatable whether these trace fossils are of any palaeontological significance. Nonetheless a Fossil Chance Find Protocol has been included for the EMP. If putative fossils are found once excavations commence then a palaeontologist or geologist should be called to assess their interest and collect a representative sample. As far as the palaeontology is concerned the project can continue and no site visit is required.

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**LIST OF ABBREVIATIONS**

<b>ACRONYMS</b>	<b>DESCRIPTION</b>
<b>AUTHORITIES</b>	
ASAPA	Association of South African Professional Archaeologists
FSPHRA	Free State Provincial Heritage Resources Authority
NGT	Nurture, Grow, Treasure
SADC	Southern African Developing Community
SAHRA	South African Heritage Resources Agency
<b>DISCIPLINE</b>	
AIA	Archaeological Impact Assessment
BAR	Basic Assessment Report
CMP	Cultural Management Plan
ESA	Early Stone Age
EIAs	Environmental Impact Assessment
EMPr	Environmental Management Programme
EIA	Early Iron Age
HCMP	Heritage Cultural Management Plan Report
HIA	Heritage Impact Assessment
LIA	Late Iron Age
LSA	Late Stone Age
MIA	Middle Iron Age
MSA	Middle Stone Age
<b>LEGAL</b>	
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act



## **TERMS AND DEFINITIONS**

### ***Archaeological resources***

These include:

- Material remains resulting from human activities which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- Rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- Wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- Features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

### ***Palaeontological***

This means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial.

### ***Cultural significance***

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

### ***Development***

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in the change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

- Construction, alteration, demolition, removal or change in use of a place or a structure at a place;
- Carrying out any works on or over or under a place;

- Subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
- Constructing or putting up for display signs or boards; any change to the natural or existing condition or topography of land;
- And any removal or destruction of trees, or removal of vegetation or topsoil.

**Heritage resources:** This means any place or object of cultural significance.

## 1. BACKGROUND

NGT ESHS has been appointed to undertake the Heritage and Palaeontology studies for the proposed refurbishment of the Caledonian Stadium in Pretoria by the Tshwane Municipality. In order to comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project.

The scope of work for Caledonian stadium includes:

- Refurbishment of the existing pavilion
- Refurbishment of the existing club house
- New multipurpose hall
- New caretaker house
- New 4x guard house
- New VIP concrete grandstand
- New media concrete grandstand
- Refurbishment of concrete seating around the football stadium
- New 2x practice field
- New paved parking
- New 4x drinking fountains
- New 2x multipurpose courts (Netball and basketball)
- New 2x multipurpose courts (Tennis and volleyball)
- New Change room
- New 2x ablutions
- New boom-gates and turnstile on all 4x entrances

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
Details of the specialist who prepared the report	Appendix B
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
A declaration that the person is independent in a form as may be specified by the competent authority	Page Error! Bookmark not defined.
An indication of the scope of, and the purpose for which, the report was prepared	Section Error! Reference source not found.
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section ii Error! Reference source not found.
An identification of any areas to be avoided, including buffers	N/A
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
A description of the findings and potential implications of such findings on	Section 4

the impact of the proposed activity, including identified alternatives, on the environment	
Any mitigation measures for inclusion in the EMPr	N/A
Any conditions for inclusion in the environmental authorisation	N/A
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
A description of any consultation process that was undertaken during the course of carrying out the study	N/A
A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A



Figure 1: Google Earth map of the site of the existing Caledonian Stadium, north central Pretoria.



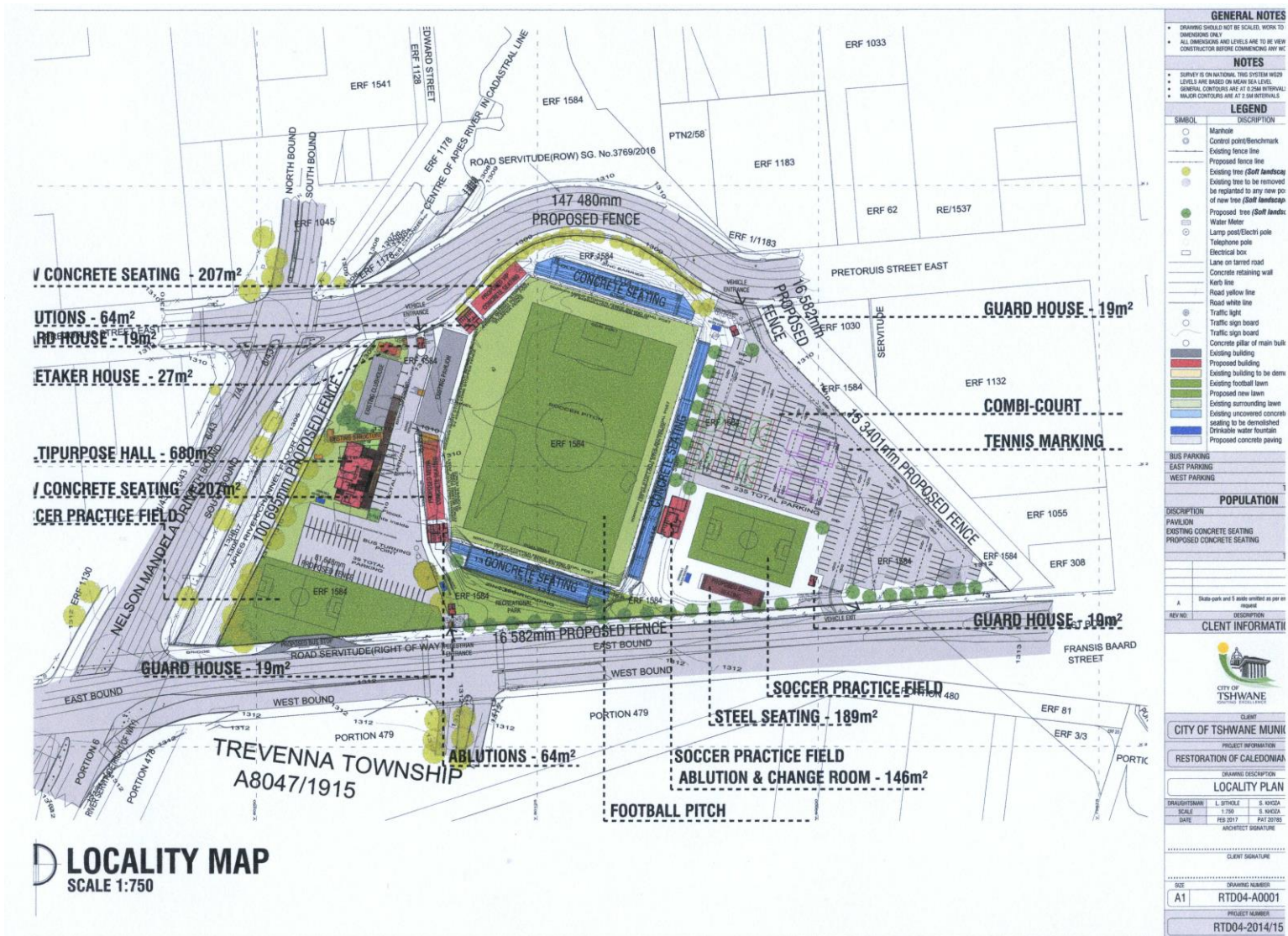


Figure 2: Detailed map of the current infrastructure and proposed refurbishment of the Caledonian Stadium, Pretoria (Supplied by KRMS PTY LTD)

The HIA developed by NGT ESHS Solutions for NGT Holdings on behalf of Antaeres (PTY) LTD

## 2. METHODS AND TERMS OF REFERENCE

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

## 3. GEOLOGY AND PALAEOLOGY

### i. Project location and geological context

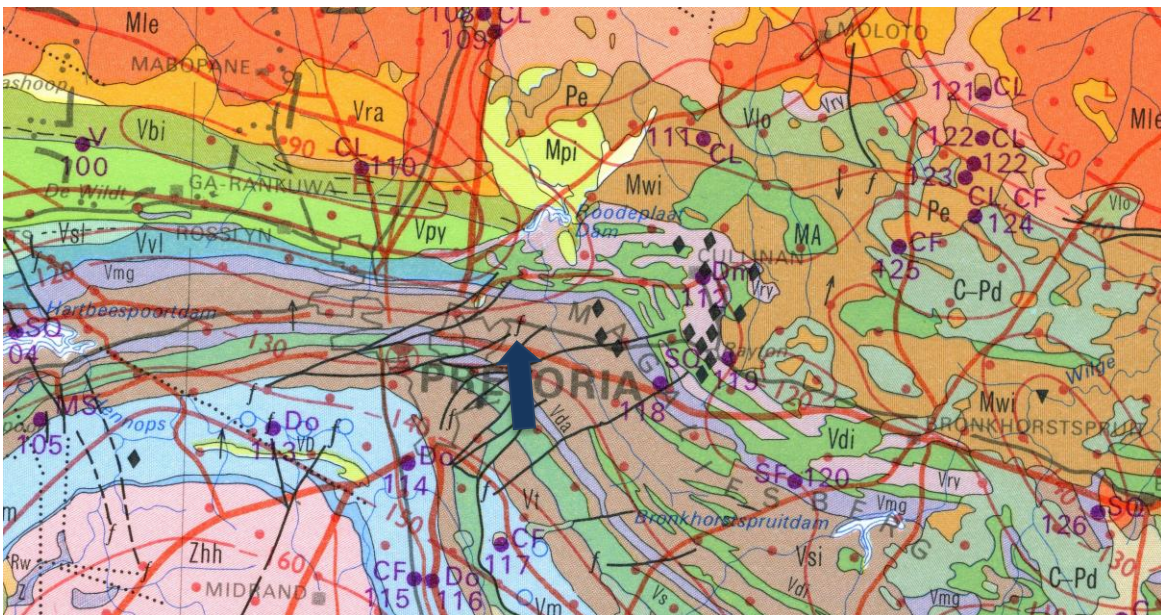


Figure 3: Geological map of the area around Pretoria The location of the proposed project is indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.



Table 2: Explanation of symbols for the geological map and approximate ages (Cawthorn et al., 2006; Erikssen et al., 2006; Johnson et al., 2006). SG = Supergroup; Fm = Formation.

Symbol	Group/Formation	Lithology	Approximate Age
Vdi	Diabase	Intrusive volcanics	
Vvi	Villa Nora Gabbro	Gabbro, anorthosite	>2050 Ma
Vpy	Pyramid Gabbro, Rustenburg Layered Suite, bushveld Complex	gabbro	>2050 Ma
Vsl	Schilpadnest Subsuite, Rustenburg Layered Suite, Bushveld Complex	Norite, pyroxenite, anorthosite	>2050 Ma
Vvl	Vlakfontein Subsuite, Rustenburg Layered Suite, Bushveld Complex	Bronzitie, harzburgite, norite	>2050 Ma
Vmg	Magaliesberg Fm, Pretoria Group, Transvaal SG	Sandstone with mudrock lenses and interbeds	Ca 2100 Ma
Vsi	Silverton Fm, Pretoria Group, Transvaal SG	Shale, basalt, tuff	Ca 2222 Ma
Vda	Daspoort Fm, Pretoria Group, Transvaal SG	Sandstone, mudrock	Ca 2222 Ma
Vs	Strubenkop Fm, Pretoria Group, Transvaal, SG	Mudrock, subordinate mudstone	Ca 2190 Ma
Vt	Timeball Hill Fm, Pretoria Group, Transvaal SG	Mudrock, diamictite, quartzite	Ca 2420 Ma
Vm	Malamani Subgroup, Chuniespoort Group, Transvaal SG	Dolomite, limestone	2642 – 2500 Ma

Dominant in this area are ancient (Mesoarchaeon) rocks of the Transvaal Supergroup, with underlying rocks of the Witwatersrand Supergroup and overlying Bushveld Intrusions. The Transvaal Supergroup is divided into two groups, the lower Chuniespoort Group, represented here by the Malmani Subgroup, and the upper Pretoria Group. The project site lies on the Magaliesberg Formation.

The Daspoort, Silverton and Magaliesberg Formations form a sequence as part of the Pretoria Group, Transvaal Supergroup, and represent rocks that are over 2100 million years old. Comprising sandstone and mudrock, the Daspoort Formation has been interpreted as representing distal fan, fluvial braid-plain, braid-delta facies with a transgressive epeiric sea to the east. In the Silverton Formation there are relatively deep-water facies, transgressive epeiric sea facies and evidence of volcanic activity mainly in the east in form of tuffs. The overlying Magaliesberg Formation represents a regressive sandy shoreline with braid-delta and high energy tidal flats (Erikssen et al., 2006).

Other rocks in the region are western exposures of the Rustenburg Layered Suite of the Bushveld Complex. These are igneous rocks that have been highly metamorphosed with a complex history that is still debated (Cawthorn et al., 2006). They will not be considered further

## ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3. The project site lies on the Magaliesberg Formation of the Pretoria Group. These rocks are ancient, much older than the origin of body fossils, (Plumstead, 1969), but there were microbes present. To the east of Pretoria some trace fossils of microbial activity have been described by Bosch and Erikssen (2017). These are called *Manchuriophycus* and look like sinuous tubes in the hard sandstone and occur with ripple marks or mudcracks (the latter two are not considered to be fossils or trace fossils).



Figure 4: SAHRIS palaeosensitivity map for the existing Caledonian Stadium in northern Pretoria. Project area is within the yellow rectangle. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; grey=zero/insignificant

From the SAHRIS map above (Figure 4) the whole area is indicated as moderately sensitive (green) to insignificant to zero sensitivity (grey) and so requires a desktop study. The suspected fossils however are trace fossils and have only been reported from east of Pretoria which is about 10km distant. No fossils have been reported in the project area.

#### 4. IMPACT ASSESSMENT

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in **Error! Reference source not found.** and Table 4:

Table 3: Criteria for assessing impacts

<b>PART A: DEFINITION AND CRITERIA</b>		
<b>Criteria for ranking of the SEVERITY/NATURE of environmental impacts</b>	<b>H</b>	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	<b>M</b>	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	<b>L</b>	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	<b>L+</b>	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	<b>M+</b>	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	<b>H+</b>	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
	<b>Criteria for ranking the DURATION of impacts</b>	<b>L</b>
<b>M</b>		Reversible over time. Life of the project. Medium term
<b>H</b>		Permanent. Beyond closure. Long term.
<b>Criteria for ranking the SPATIAL SCALE of impacts</b>	<b>L</b>	Localised - Within the site boundary.
	<b>M</b>	Fairly widespread – Beyond the site boundary. Local
	<b>H</b>	Widespread – Far beyond site boundary. Regional/ national
<b>PROBABILITY (of exposure to impacts)</b>	<b>H</b>	Definite/ Continuous
	<b>M</b>	Possible/ frequent
	<b>L</b>	Unlikely/ seldom

Table 4: Impact Assessment

<b>PART B: Assessment</b>		
<b>SEVERITY/NATURE</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	Although trace fossils have been reported from the Magaliesberg Formation they are only traces.
	<b>L+</b>	-
	<b>M+</b>	-
	<b>H+</b>	-
<b>DURATION</b>	<b>L</b>	-
	<b>M</b>	-
	<b>H</b>	Where manifest, the impact will be permanent.
<b>SPATIAL SCALE</b>	<b>L</b>	Since only the possible fossils within the area would be trace fossils on hard sandstone, the spatial scale will be localised within the site boundary.
	<b>M</b>	-
	<b>H</b>	-
<b>PROBABILITY</b>	<b>H</b>	-
	<b>M</b>	-
	<b>L</b>	It is extremely unlikely that any trace fossils would be found in the surface soils or on outcrops of hard sand. Nonetheless a chance find protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are mostly much too old to contain fossils. Furthermore, no body fossils had evolved by this time. Since there is an extremely small chance that trace fossils from the Magaliesberg Formation may be disturbed a Chance Find Protocol has been added to this report. In general, microbial trace fossils are not given much significance. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

## **5. ASSUMPTIONS AND UNCERTAINTIES**

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and do contain fossil plant, insect, invertebrate and vertebrate material. No trace fossils have been reported from this area although there is one record of microbial traces from the Magaliesberg Formation about 10 km to the east but even these are debatable. It can only be assumed that there is a very small chance of them occurring here too. The overlying modern soils would not preserve fossils.

## **6. RECOMMENDATION**

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose soils. No fossils are preserved in the igneous rocks but there is a very small chance that trace fossils might be found in the hard sandstones as these have been reported from the Magaliesberg Formation – but not from this area. Note – ripplemarks and mudcracks are not fossils at all but evidence of water and drying out muds respectively. There is a very small chance that trace fossils like *Manchuriophycus* may occur in the site so a Chance Find Protocol should be added to the EMPr: if fossils are found once excavations and building have commenced then they should be rescued, and a palaeontologist called to assess and collect a representative sample. As far as the palaeontology is concerned the project can proceed.

## 7. REFERENCES

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## 8. CHANCE FIND PROTOCOL

**Monitoring Programme for Palaeontology – to commence once the excavations begin and apply for each phase of the project.**

1. The following procedure is only required if fossils are seen on the surface and when excavations for foundations and infrastructure commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils) should be put aside in a suitably protected place. This way the building activities will not be interrupted.
3. Photographs of similar trace fossils must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 5). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Trace fossils (not mudcracks or ripple marks) that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then the site inspections by the palaeontologist will not be necessary. Annual reports by the palaeontologist must be sent to SAHRA.
8. If no fossils are found and the excavations have finished then no further monitoring is required.



**9. APPENDIX A – Examples of the trace fossils in the Magaliesberg Formation.**



*Figure 5: Vermiform trace fossil Manchuriophycus from a bedding plane in the Magaliesberg Formation east of Pretoria. Figure taken from Bosch and Erikssen (2017; Fig 7).*

## 10. APPENDIX B – Details of Specialist

### Curriculum vitae (short) - Marion Bamford PhD

January 2019

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#### ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:

1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.

1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.

1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.

1986-1989: PhD in Palaeobotany. Graduated in June 1990.

#### iii) Professional qualifications

*Wood Anatomy Training (overseas as nothing was available in South Africa):*

1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps

1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer

1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

**iv) Membership of professional bodies/associations**

- Palaeontological Society of Southern Africa
- Royal Society of Southern Africa - Fellow: 2006 onwards
- Academy of Sciences of South Africa - Member: Oct 2014 onwards
- International Association of Wood Anatomists - First enrolled: January 1991
- International Organization of Palaeobotany – 1993+
- Botanical Society of South Africa
- South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
- SASQUA (South African Society for Quaternary Research) – 1997+
- PAGES - 2008 –onwards: South African representative
- ROCEEH / WAVE – 2008+
- INQUA – PALCOMM – 2011+onwards

**vii) Supervision of Higher Degrees**

All at Wits University

Degree	Graduated/completed	Current
Honours	6	1
Masters	8	1
PhD	10	2
Postdoctoral fellows	9	3

**viii) Undergraduate teaching**

- Geology II – Palaeobotany GEOL2008 – average 65 students per year
- Biology III – Palaeobotany APES3029 – average 25 students per year
- Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology;
- Micropalaeontology – average 2-8 students per year.

### **ix) Editing and reviewing**

Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor

Guest Editor: Quaternary International: 2005 volume

Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –

Cretaceous Research: 2014 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

### **x) Palaeontological Impact Assessments**

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR

- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipportjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells

#### **xi) Research Output**

Publications by M K Bamford up to June 2018 peer-reviewed journals or scholarly books: over 125 articles published; 5 submitted/in press; 8 book chapters.

Scopus h index = 26; Google scholar h index = 30;

Conferences: numerous presentations at local and international conferences.

#### **xii) NRF Rating**

NRF Rating: B-2 (2016-2020)

NRF Rating: B-3 (2010-2015)

NRF Rating: B-3 (2005-2009)

NRF Rating: C-2 (1999-2004)