Palaeontological Impact Assessment for the proposed Hennops River Wedding and Conference Venue, Centurion, Gauteng Province GDARD Ref No: GAUT 002/21-22/E2790

Site Visit (Phase 2) Report

Prepared by

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15 September 2021

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 32 years research; 24 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Archaeological and Heritage Services Africa (Pty) Ltd, Pretoria, South Africa. 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.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A palaeontological Impact Assessment site visit was requested for the proposed development of a wedding and conference venue on Portion 200 (a portion of portion 62) of Farm Hennopsrivier 489 JQ by SAHRA (Case ID:16118). The site lies on potentially very highly fossiliferous rocs of the Malmani Subgroup.

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 site visit Palaeontological Impact Assessment (PIA) was completed for the proposed development by Bamford and House on 14th September 2021, and is reported herein.

The proposed site lies on the dolomitic Monte Christo Formation (Malmani Supergroup, Transvaal Supergroup) and some stromatolites were found during the site visit walkthrough. Since the stromatolites were not common, and no recognised palaeontological institution has sufficient storage space for large rocks of minimal interest, it is recommended that the excavated stromatolites be used on site as part of the landscaping and gardens. This way they are still visible for research and education. If the developers wish to remove stromatolites from the property they will have to apply for a SAHRA permit to do so. The photographs in Figures 6-7 can be used to identify the trace fossils.

Table of Contents

1. Background

Tshifuka Trading Enterprise Pty Ltd is proposing to develop a wedding venue and conference centre on Portion 200 (a portion of portion 62) of Farm Hennopsrivier 489 JQ. The development footprint is approximately 3,99 hectares and will include the construction and operation of the following: Driveways and walkways; Parking bays; Ponds; Tea room; Marquee lawn area; Spa, Observation decks; Overnight Chalets; Changing rooms; Chapels; Multipurpose conference rooms; Outdoor ablution facilities; Conservancy tank; Borehole; Landscaping including planting of indigenous shrubs and lawn.

The site is located in Centurion, in the Tshwane Metropolitan Municipality, on the R511 between Centurion and Hennops River town (Figure 1). An archaeological impact assessment has been completed but SAHRA requested that Paleontological site visit be completed (Case Id: 16118) because the site lies on the very highly sensitive rocks of the Malmani Subgroup.

A Palaeontological Impact Assessment site visit (phase 2) was carried out in order to comply with the regulations of 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 site visit and survey (Phase 2) Palaeontological Impact Assessment (PIA) was completed for the proposed project.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix A
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Page 1
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A for fossils
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2

f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	Section 6
h	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;	Sections 1, 6
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Appendix A
l	Any conditions for inclusion in the environmental authorisation	Section 7
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 7
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 6
nii	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	Section 6
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

Figure 1: Google Earth map of the proposed development of a wedding and conference venue on Farm Hennops River 489 with the section shown by the red outline. Map supplied by E Matenga

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 (as reported herein, and collect or rescue fossils if required);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*as indicated in section 4 below)*; and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a just a representative sample collected and housed in a recognised repository.

3. Geology and Palaeontology

i. Project location and geological context

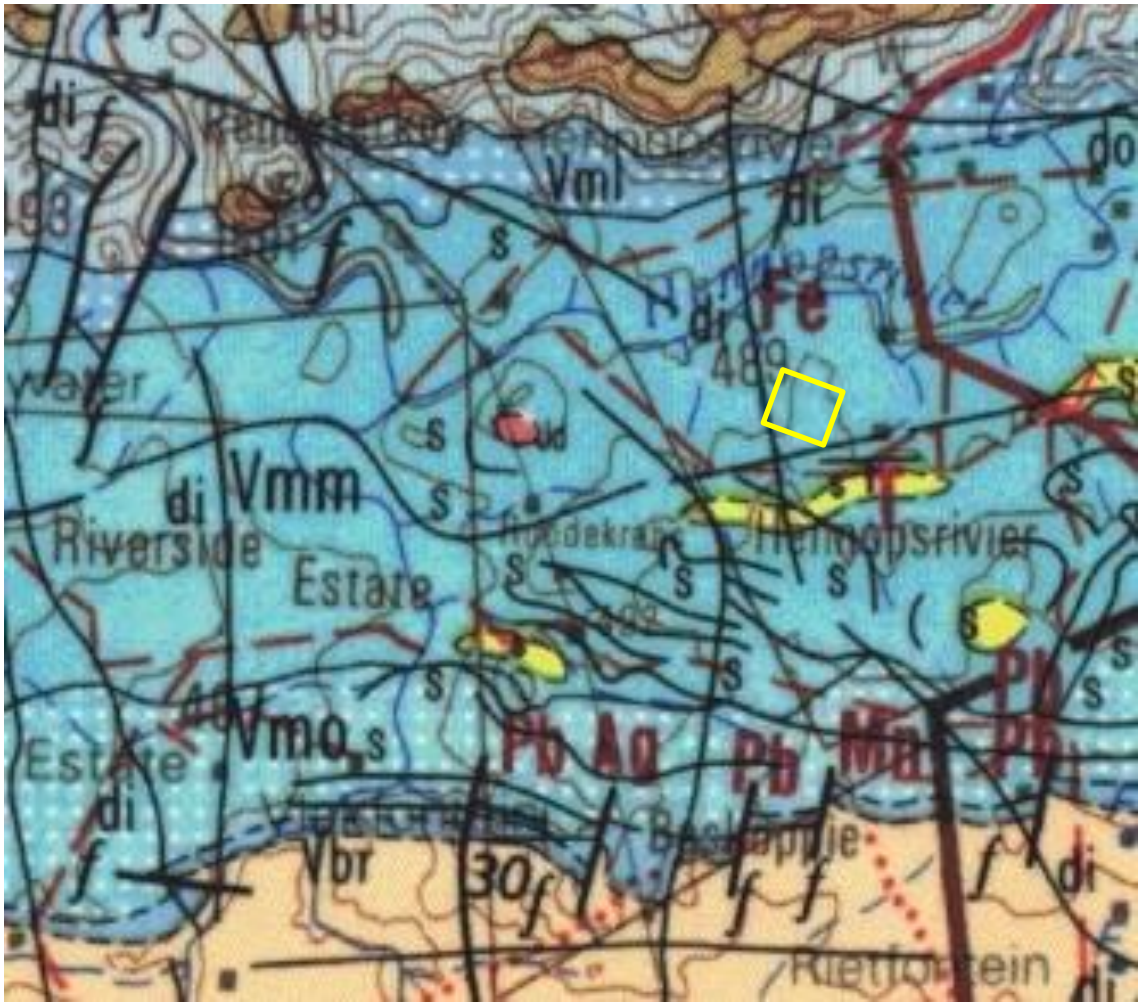

Figure 2: Geological map of the area around the Farm Hennops River 489. The location of the proposed project is indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2526 Rustenburg.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006. Zeh et al., 2020). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary sands	Alluvium, sands, scree	Last ca 2.5 Ma
di	diabase	diabase	Post Transvaal SG
Vml	Littleton Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dark chert-poor dolomite	Ca 2585 – 2480 Ma

Symbol	Group/Formation	Lithology	Approximate Age
Vmm	Monte Christo Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Chert-rich dolomite; circles = oolitic	Ca 2585 – 2480 Ma
Vmo	Oaktree Fm, Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dark chert-free dolomite	Ca 2585 – 2480 Ma
Vbr	Black Reef Fm, Transvaal SG	Quartzite, conglomerate, shale	<2618 Ma

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the south western portion of the Griqualand West Basin between the two sub-basins

The Transvaal Supergroup comprises one of world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas.

In the Transvaal Basin the Transvaal Supergroup is divided into two Groups, the lower Chuniespoort Group and the upper Pretoria Group (with ten formations; Eriksson et al., 2006). The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. The top of the Chuniespoort Group has the Penge Formation and the Duitschland Formation.

The Transvaal sequence has been interpreted as three major cycles of basin infill and tectonic activity with the first deep basin sediments forming the Chuniespoort Group, the second cycle deposited the lower Pretoria Group, and the sediments in this area are from the interim low stand that preceded the third cycle. These sediments were deposited in shallow lacustrine, alluvial fan and braided stream environments (Eriksson et al., 2012).

The Malmani Subgroup is up to 2000m thick and has been divided into five formations based on the composition of cherts, stromatolites, limestones and shales. At the base, overlying the Black Reef Formation, is the base is the Oaktree Formation that represents a transition from siliciclastic sedimentation to platform carbonates (Eriksson et al., 2006). It is composed of carbonaceous shales, stromatolitic dolomites and locally developed quartzites. Next is the **Monte Christo Formation** that has an erosive breccia base and continues with stromatolitic and oolitic platformal dolomites. Above that is the Lyttleton Formation that is composed of shales, quartzites and stromatolitic dolomites. The overlying Eccles Formation includes a series of erosion breccias that locally contain gold deposits. This mineralisation has been attributed to hydrothermal remobilisation of fluids by the Bushveld complex (Eriksson et al.,

2006). The topmost formation is the Frisco Formation that is composed mainly of stromatolitic dolomites but these become more shale rich towards the top of the sequence because of the deepening depositional environment.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3. The site for development is in the Monte Christo Formation of the Malmani Subgroup that could have stromatolitic and oolitic platformal dolomites.

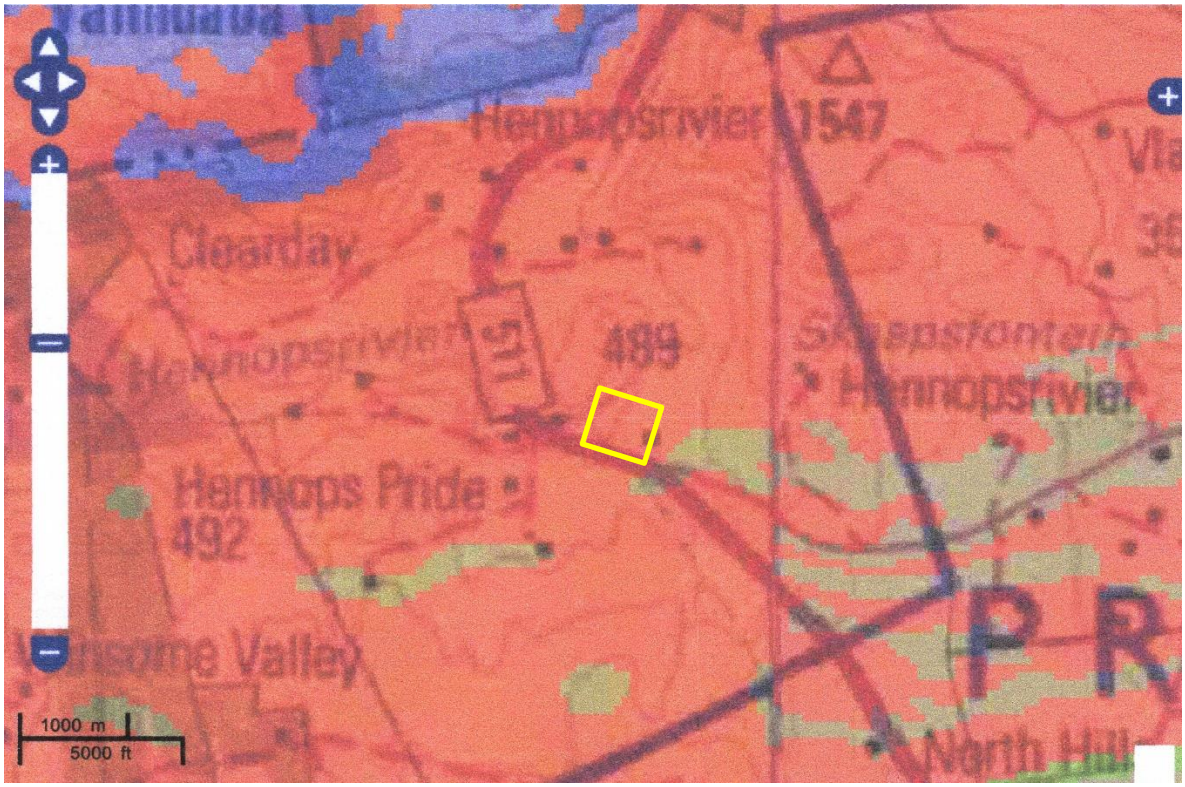

Figure 3: SAHRIS palaeosensitivity map for the site for the proposed Hennops River Venue shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

Iii **Site visit observations**

A site visit and survey of the project area was completed on 14th September. The whole area was walked through, but stops with GPS coordinates, photographs and observations were taken from a number of points. This information is presented in Table 3, Figure 4 and site photographs in Figures 5 -7. All photographs were taken by Bamford. The area had been burned to all the rocks were easily visible, however, there was evidence of the rocks having been excavated and pushed aside/dumped.

Figure 4: Google Earth map of the Hennops River venue project with pins indicating points from where observations were taken (see Table 3).

Table 3: Site visit observations (refer to Figure 4) and relevant site photographs as indicated.

GPS coordinates	Observations	Figure
Pal 1 25°50’26.26” S 27°58’51.35” E	Central high point from where general view photographs were taken. Note open view because all the vegetation has been burned recently	5 A-D
Pal 2 25°50’28.12” S 27°58’50.19” E	Dolomite ridge where many blocks have been excavated and dumped. Good exposure of the dolomite, chert bands and rare stromatolite layers (A)	6 A-D
Pal 3 25°50’20.55” S 27°58’49,94” E	Southwestern corner that is disturbed, but some in situ dolomite is visible (no stromatolites)	
Pal 4 25°50’21.77” S 27°5852.69” E	Northern margin along the river. Very few blocks or rocks close to the river	
Pal 5 25°50’28” S 27°58’48” E	Northern section where there are different types of dolomite and weathering patterns, including ripple marks (not biological so not trace fossils).	7 A-D

Figure 5: Hennops River Farm 489 site photographs for the general area. A - looking north from the centre; B – looking northeast; C – looking northwest; northern margin with the Hennops River in the valley that has deep sediments.

Figure 6: Hennops River site photographs of the different types of dolomite seen. A - unstructured dolomite with a narrow band of laminated stromatolites across the top; B – dolomite with a basal layer of breccia; C – in situ dolomite only; D – fragment of a stromatolite that has been placed with the other rocks.

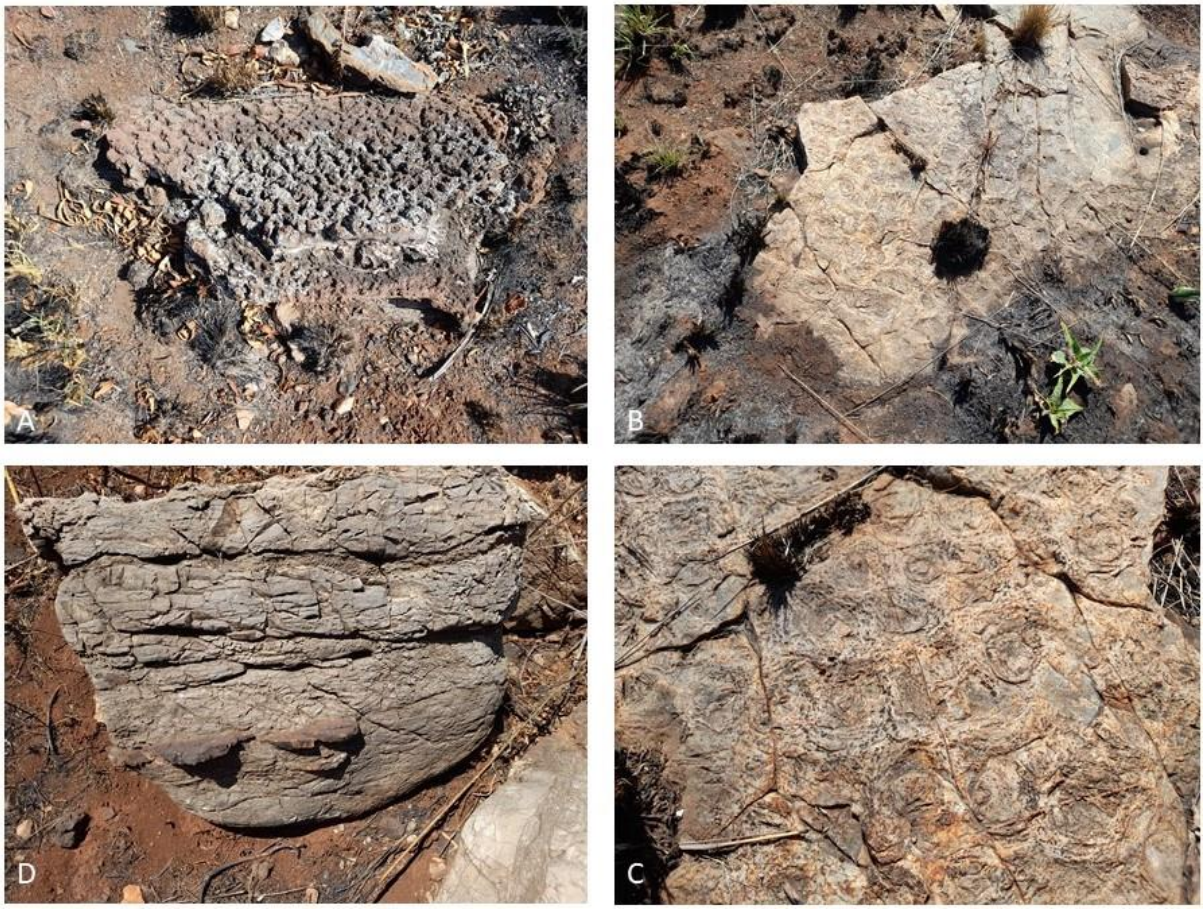

Figure 7: Hennops River site photographs showing various weathering types. A – tufted cryptalgal structures (photo is 1m wide); B – C – rippled dolarenite; D – elephant-skin type weathering of dolomite.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 4:

TABLE 4A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.

	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 4B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Soils do not preserve any fossils; the dolomites do have some stromatolites within them in the Monte Christo Fm. These have impact on people but their destruction is a loss to science. The impact would be unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since the only possible fossils within the area would be trace fossils of stromatolites in the dolomites, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	It is likely that trace fossils would be found in the dolomites.
	L	

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 the correct age and type to contain fossils, namely the Monte Christo Formation (Malmani Subgroup, Transvaal Supergroup). During the site visit we found examples of stromatolites and tufted cryptalgal structures, as well as rippled dolarenites that show evidence of ancient shoreline ripple marks.

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 trace fossils of ancient microscopic life on earth (Figure 6A, C). Stromatolites, however, are rare on the project site and the best examples were in

rocks that had been excavated and dumped so none was in situ. They were more common on the southern (higher side) and the rippled dolarenites were more common in the lower northern half of the project footprint towards the river.

6. Recommendation

Based on geology, experience and the site visit observations, dolomite is common throughout the site and most likely underlies all the shallow soils. Not all dolomite has stromatolites and they were quite rare even though the burned grass meant that all the rocks were clearly visible. The site is already highly disturbed and many chunks of rocks had been removed and dumped. Since the stromatolites were not common, and no recognised palaeontological institution has sufficient storage space for large rocks of minimal interest, it is recommended that the excavated stromatolites be used on site as part of the landscaping and gardens. This way they are still visible for research and education. If the developers wish to remove stromatolites from the property they will have to apply for a SAHRA permit to do so. The photographs in Figures 6-7 can be used to identify the trace fossils.

7. References

Beukes, N.J., 1987. Facies relations, depositional environments and diagenesis in a major early Proterozoic stromatolitic carbonate platform to basinal sequence, Campbellrand Subgroup, Transvaal Supergroup, southern Africa. Sedimentary Geology 54, 1-46.

Eriksson, P.G., Altermann, W., Hartzer, F.J., 2006. The Transvaal Supergroup and its pre-cursors. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 237-260.

Eriksson, P.G., Bartman, R., Catuneanu, O., Mazumder, R., Lenhardt, N., 2012. A case study of microbial mats-related features in coastal epeiric sandstones from the Palaeoproterozoic Pretoria Group, Transvaal Supergroup, Kaapvaal craton, South Africa; the effect of preservation (reflecting sequence stratigraphic models) on the relationship between mat features and inferred palaeoenvironment. Sedimentary Geology 263, 67-75.

Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

Zeh, A., Wilson, A.H., Gerdes, A., 2020. Zircon U-Pb-Hf isotope systematics of Transvaal Supergroup – Constraints for the geodynamic evolution of the Kaapvaal Craton and its hinterland between 2.65 and 2.06 Ga. Precambrian Research 345, 105760. https://doi.org/10.1016/j.precamres.2020.105760

Appendix A – Details of specialists

Curriculum vitae (short) - Marion Bamford PhD
January 2021

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

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	11	2
Masters	10	5
PhD	11	4
Postdoctoral fellows	10	4

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 –
Journal of African Earth Sciences: 2020 –

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
- Klipoortjie 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
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells
- McCarthy-Salene 2020 for Prescali
- VLNR Lodge 2020 for HCAC
- Madadeni mixed use 2020 for Enviropro

xi) Research Output

Publications by M K Bamford up to December 2019 peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 29; Google scholar h index = 36;
Conferences: numerous presentations at local and international conferences.

CV of Alisoun Valentine House *August 2021*

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KEY SKILLS AND ATTRIBUTES

- The stamina and ability to work effectively under pressure.
- Highly developed social and interpersonal skills.
- Good communication skills, both oral and written.
- The ability to be creative and innovative and to find workable strategies to achieve stated aims.
- Excellent organisational skills.
- The ability to analyse situations, behaviour and thinking and respond with patience and understanding.
- Research and scientific writing.

WORK HISTORY

Postdoc Fellow – Evolutionary Studies Institute
January 2019 – December 2020
January 2018 – December 2018
January 2017 – December 2020
Analysis of archaeological charcoal from an Middle Stone Age and Early Iron Age sites
Host: Professor Marion Bamford

Sessional position – School of Animal, Plant and Environmental Sciences
March 2016 – November 2016
Academic support for postgraduate students

Short term internship – University of the Witwatersrand
August – November 2015

Assistant to Editor for 'Flora of the Witwatersrand' – University of the Witwatersrand
September 2008 – February 2010
Assisted with editing and preparing the Flora for publication

Tutor at the College of Science – University of the Witwatersrand
Academic years 2000 – 2003
Responsibilities included teaching general biology to first and second year students in the College of Science; as well as marking essays and assignments.

P.A. to Director/Manager of Cowling Davies (Small Advertising/Design Studio)
April 1992 – December 1992
Responsibilities included reception work; office administration; preparation of quotations; booking media advertisements and general assistance.

Herbarium Technician - University of the Witwatersrand
October 1991 – March 1992
Responsibilities included identification, pressing and mounting of plant specimens; capturing and maintaining data in the Herbarium computer system; maintaining the collection; filing; acting as librarian for the reference book collection and assisting students with research.

EDUCATION

Doctor of Philosophy (PhD) University of the Witwatersrand (2015)
Title: Systematic Applications of Pollen Grain Morphology and Development in the Acanthaceae
Supervisor: Professor Kevin Balkwill

Master of Science (MSc) University of the Witwatersrand (1991)
Title: A developmental study of *Nephroselmis viridis* (Inouye, Suda et Pienaar) Prasinophyceae
Supervisor: Professor Richard Pienaar
Degree awarded with Distinction.

Bachelor of Science with Honours (B.Sc. Hon.) University of the Witwatersrand (1987)
Awarded the Florence D. Hancock prize for a Dissertation in Phycology (1988)

Higher Diploma in Education (Postgraduate) for Secondary Education University of the Witwatersrand (1985)
Teaching subjects: Biology and Science

Bachelor of Science (B.Sc.) University of Witwatersrand (1984)
Major: Botany
Sub-majors: Microbiology and Zoology

Matriculation Certificate Hyde Park High School (1979)
Subjects passed: English, Afrikaans, Biology, Mathematics, Geography, Home Economics

PUBLICATIONS

Young A.V. and Pienaar R.N. 1989. The ultra structure of a new species of *Nephroselmis* (Prasinophyceae). Proceedings of the Electron Microscopy Society of Southern Africa. 19: 113–114.

House A. and Balkwill K. 2013. FIB-SEM: An Additional Technique for Investigating Internal Structure of Pollen Walls. Microscopy & Microanalysis 19: 1535–1541.

House A. and Balkwill K. 2014. FIB-SEM: A new technique for investigating pollen walls. Microscopy: advances in scientific research and education (A. Méndez-Vilas, Ed.) 1: 54–58. © FORMATEX.

House A. and Balkwill K. 2016. Labyrinths, columns and cavities: new internal features of pollen grain walls in the Acanthaceae detected by FIB-SEM. Journal of Plant Research 129: 225–240.

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PALAEONTOLOGICAL IMPACT FIELD EXPERIENCE

May 2018 – SARAO Williston and Carnarvon for Digby Wells
August 2019 – Idlanga Coal MR, Rietvlei, Vryheid area – Digby Wells
September 2019 – Schmidtsdrift PR for Thaya Environmental Specialist
September 2019 – Estcourt Pvt Hospital for EnviroPro
September 2019 – Vulindlela BWS for KSEMS
November 2019 – Derseley outfall sewer for Digby Wells
June-Nov 2020 – Frankfort-Windfield 88kV line for Eskom and 1World.
October 2020 – Salene-McCarthy Manganese mine for Prescali
November 2020 – Universal Coal Ubuntu Colliery for HCAC
March 2021 – Doornhoek & Kaspersnek agriculture for Kudzala
July 2021 – Smithfield-Rouxville-Zastron Eskom PL for TheroServ
August 2021 – Dawn Park for iSquare