Palaeontological Impact Assessment for the proposed project on 31 Little Maritzburg Road, North Coast, KwaZulu Natal Province

Desktop Study (Phase 1)

For

Confluence

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Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 31 years research; 23 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Confluence, Durban, 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 was requested for proposed expansion of an existing dwelling on 31 Little Maritzburg Road, between Salt Rock and Shakas Rock, north coast, KwaZulu Natal. 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 this proposal.

The proposed site lies on the aeolianite and red and white sands and basal conglomerate of the Umkwelane Formation (formerly Berea Formation), Maputaland Group. The surface has loose sands and introduced garden vegetation and the new structures are very close to the existing house and amenities. The sands and soils on the surface will not preserve any fossils. There is a small chance that marine molluscs and shark teeth from the Umkwelane Formation (Maputaland Group) of middle Miocene to Pliocene age might be disturbed from below ground sediments. Therefore, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless fossils are found when excavations for foundations commence.

Table of Contents

1. Background

The owners of the residential property on 31 Little Maritzburg Road, on the beach between Salt Rock and Shakas Rock, north of Durban, KwaZulu Natal, propose to make four minor extensions to the existing house, the House Gotz project (Figure 1).

A Palaeontological Impact Assessment was requested for the project. 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 development and is presented herein.

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 B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
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	Yes
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
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	N/A
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;	N/A
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	Section 7, Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 7, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
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	N/A
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

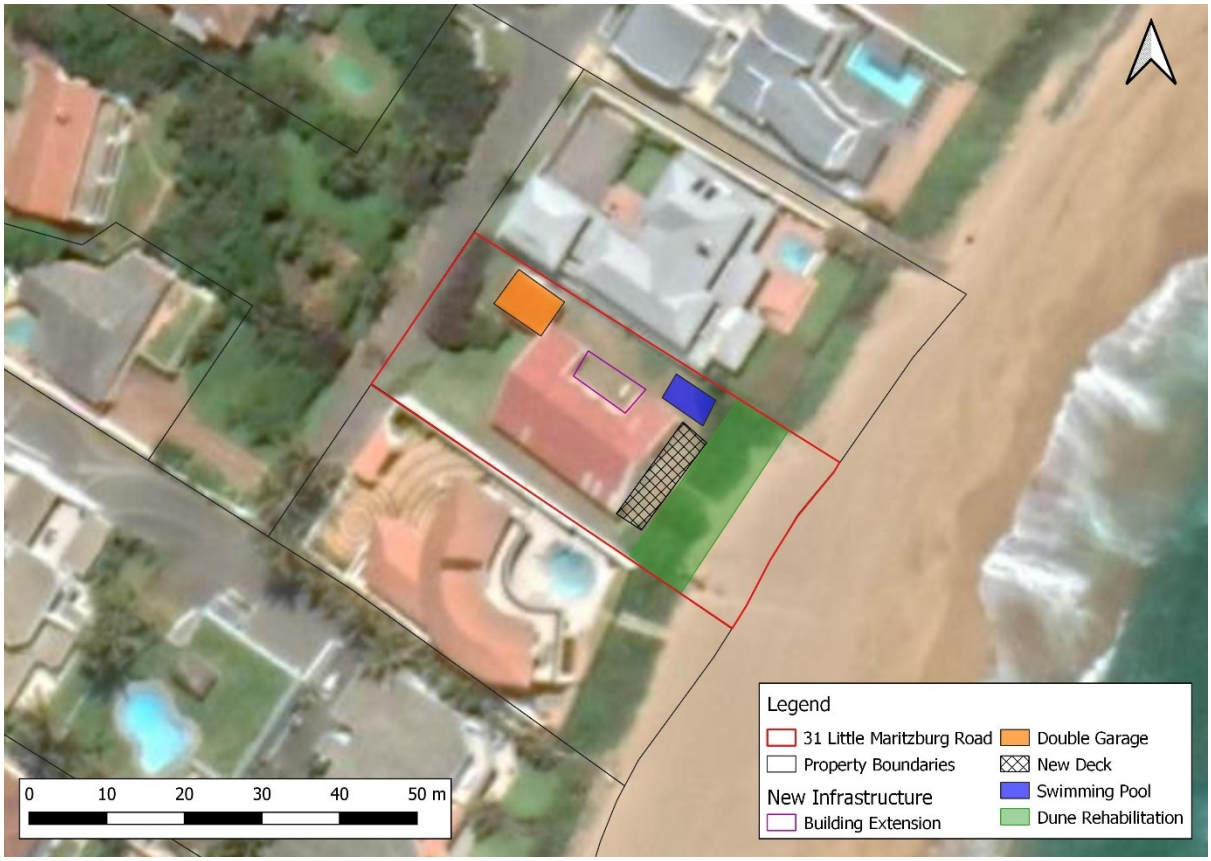

Figure 1: Google Earth map of the proposed extensions to the home at 31 Little Maritzburg Road with the section shown by the red outline. Map supplied by Confluence.

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 Palaeontology

i. Project location and geological context

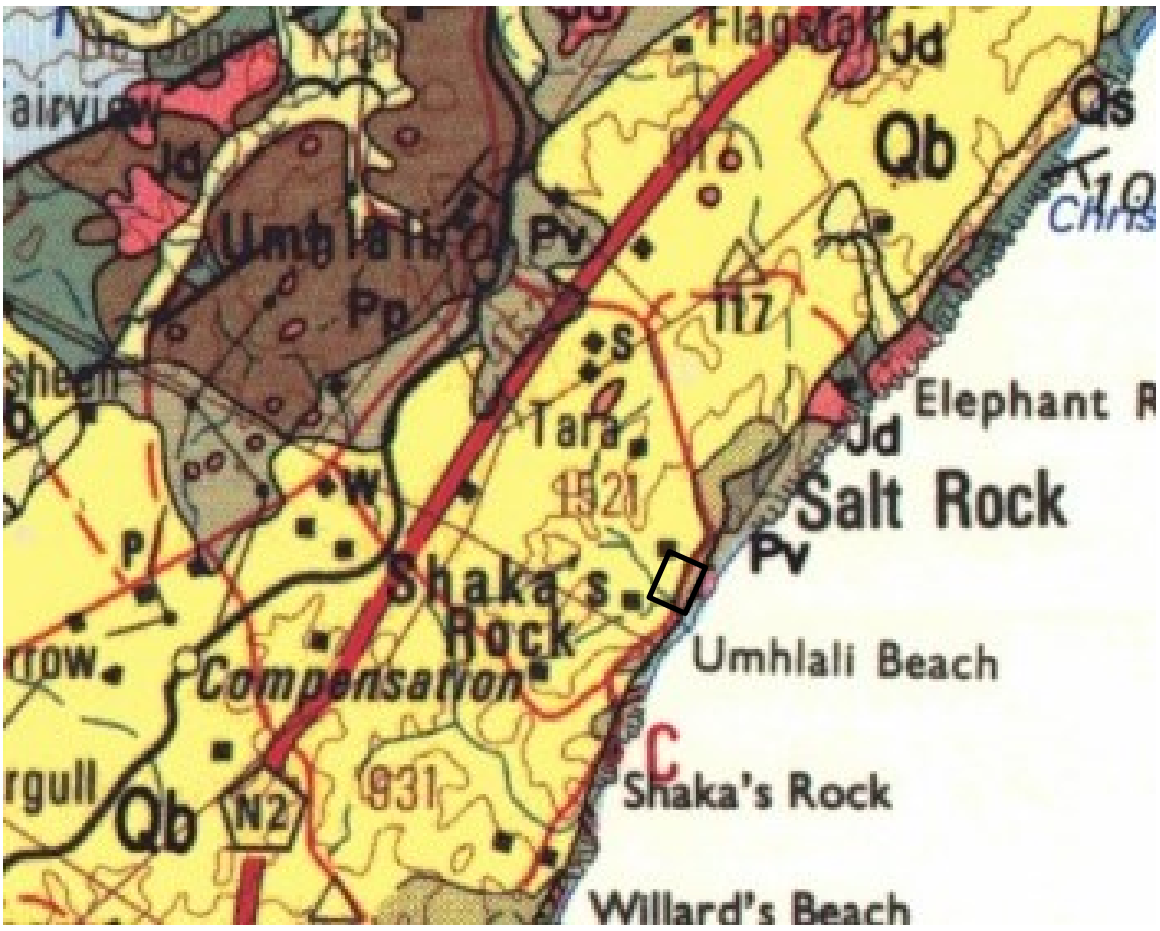

Figure 2: Geological map of the area around Little Maritzburg Road with the site shown within the black rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2930 Durban.

Table 2: Explanation of symbols for the geological map and approximate ages (Botha 1997, 2018; Johnson et al., 2006; Roberts et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Sibaya Fm, Mfolosi Subgroup, Palutaland Group	Dune sand	Holocene ca 10.5ka to present
Qb	Umkwelane Fm (formerly Berea Fm), Uloa Subgroup, Maputaland Group	Aeolianite, decalcified to "Berea-type" reddish-brown soil profile	Mid Miocene – Pliocene 10 – 2.5 Ma
Pv	Vryheid Fm, Ecca Group, Karoo SG	Shales, siltstones, sandstone, sands	Early Permian, middle Ecca
Pp	Pietermaritzburg Fm, Ecca Group, Karoo SG	Dark-grey shales	Early Permian, early Ecca
C-Pd	Dwyka Group, Karoo SG	Tillites, diamictites, shales, musdstones	Late Carboniferous to Early Permian
O-Sn	Natal Group	Micaceous sandstone, grit, conglomerate, siltstone, mudstone	Ordovician to Silurian Ca 490 – 416 Ma

The site for the proposed residential expansion is close to the coast where the young Maputaland Group sediments overlie the older Ecca Group and much older Natal Group (Figure 2, Table 3) (Johnston et al, 2006).

ii. Palaeontological context

The sediments of the Karoo Supergroup that filled in the huge Karoo Basin during Palaeozoic times have been divided into four groups, each with a number of formations within them. The basal Dwyka Group (not subdivided) is composed of the transported sediments and rocks that were entrapped in the glacial ice sheets that had formed when southern Africa was positioned over the South Pole. As the supercontinent Gondwana, of which Africa was a central part, slowly moved northwards, the ices sheets melted and dropped their rocks and sediments. These are diamictites, tillites, mudstones and rare dropstones. As the continent warmed and sediments from the northern Cargonian highlands and southern Cape Fold Mountains were washed into the basin – these are known as the Pietermaritzburg Formation. Vegetation around the basin and rivers, plus the sediments were washed into the basin and these sandstones, siltstones and mudstones are known as the Vryheid Formation. Overlying that is the Volksrust formation. Then the Beaufort Group and Stormberg Group filled the basin. The upper sediments are not present in this region. There is a big gap in time between these and the much younger sediments:

The aeolianites of the Umkwelane Formation are part of the early Miocene marine transgression that was followed by epeirogenic uplift, then a eustatic marine regression, starting in the middle Miocene (Botha, 2018). This marine regression deposited littoral marine sediments on the marine planed coastal platform that had incised across the entire range of rock types that were exposed along the eastern seaboard of southern Africa (ibid).

Ii Palaeontology

Typical fossils of the Umkwelane Formation are marine molluscs, shark teeth and foraminifera (microscopic marine organisms). The latter are not visible to the naked eye, and the molluscs are similar to the modern counterparts so would be difficult to distinguish.

The palaeosensitivity of the site is indicated as highly sensitive (orange; Figure 3) for the Umkwelane Formation, so a desktop study has been completed.

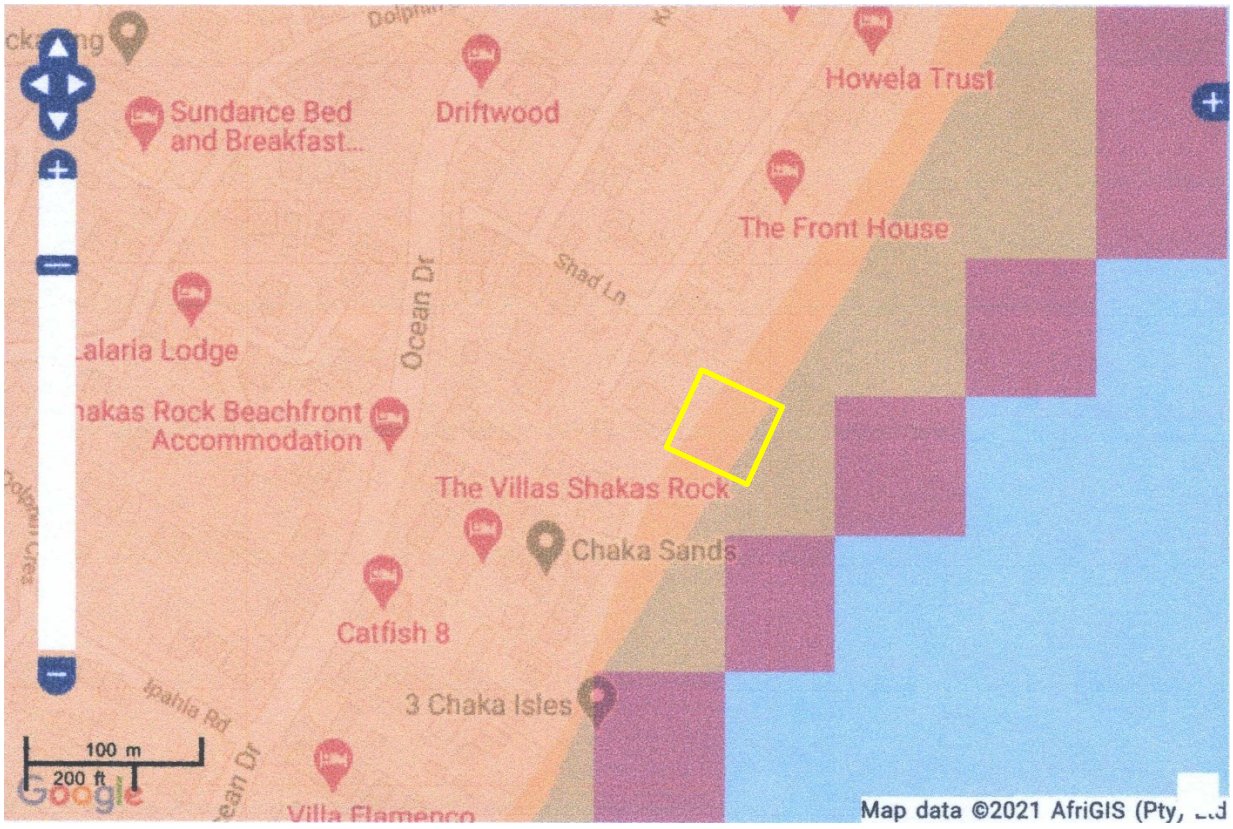

Figure 3: SAHRIS palaeosensitivity map for the site for the proposed home extension at 31 Little Maritzburg shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

TABLE 3A: 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 3B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Loose sands do not preserve plant fossils but aeolianites may do; so far there are no records from the site of marine fossils although they have been recorded from other exposures of the Umkwelane Fm. The impact would be very unlikely because the area is disturbed by vegetation.
	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 marine fossils of the Umkwelane Fm in the aeolianites, the spatial scale will be localised within the site boundary.
	M	-
	H	-

PART B: ASSESSMENT		
PROBABILITY	H	-
	M	It is very unlikely that any fossils would be found in the loose sand that covers the surface and is penetrated by tree roots. Fossils might occur in the aeolianites below the surface. Therefore, a Fossil Chance Find Protocol should be added to the eventual EMPr.
	L	

Based on the nature of the project, surface activities are unlikely to impact upon the fossil heritage because it comprises loose surface sands and exotic vegetation. The geological structures suggest that there are Umkwelane Formation aeolianites in the footprint Furthermore, the material to be excavated for foundations is the loose sand and this does not preserve fossils. Since there is a very small chance that fossils from the Umkwelane Formation may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is very 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 granites, sandstones, shales, aeolianites and sands are typical for the country and only the aeolianites might contain marine fossils. They are covered by vegetation and urban infrastructure so it not possible to determine until excavations commence.

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 surface sands of the Quaternary. There is a very small chance that fossils may occur in the aeolianites below ground so a Fossil Chance Find Protocol should be added to the EMPr: if fossils are found once excavations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

7. References

Botha, G.A., 1997. The Maputaland Group: A provisional lithostratigraphy for coastal KwaZulu-Natal. In: Botha, G.A. (Editor), Maputaland: Focus on the Quaternary evolution of the south-east African coastal plain, field guide and abstracts, INQUA Commission on Quaternary Shorelines, Africa. Subcommission, 21-26.

Botha, G.A., 2018. Lithostratigraphy of the late Cenozoic Maputaland Group. South African Journal of Geology 121, 95-108.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. 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 461 – 499.

Roberts, D.L., Botha, G.A., Maud, R.R., Pether, J., 2006. Coastal Cenozoic deposits. 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 605-628.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (marine molluscs or sharks teeth) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure4, 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 by the onsite person 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. Fossil plants or vertebrates 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 no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of marine fossils from the Miocene and Pliocene.

Figure 4: a selection of marine shells, both modern and fossil.

Figure 5: A selection of fossil shark teeth from the Alexander Formation. (From MacRae, 1999, page 267; Life Etched in Stone, Geological Society of South Africa).

Appendix B – Details of specialist

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	9	2
Masters	9	5
PhD	11	5
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
- 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

xi) Research Output

Publications by M K Bamford up to December 2020 peer-reviewed journals or scholarly books: over 140 articles published; 5 submitted/in press; 8 book chapters.
Scopus h-index = 29; Google scholar h-index = 35; -i10-index = 95
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)