10.4 The Specialist

Note: Duplicate this section where there is more than one specialist.

I ..Marion Bamford....., as the appointed specialist hereby declare/affirm the correctness of the information provided as part of the application, and that I:

- in terms of the general requirement to be independent (tick which is applicable):

X	other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or

	am not independent, but another EAP that is independent and meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);

- have expertise in conducting specialist work as required, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- will ensure compliance with the EIA Regulations 2014;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application;
- will take into account, to the extent possible, the matters listed in regulation **18** of the regulations when preparing the application and any report, plan or document relating to the application;
- will disclose to the proponent or applicant, registered interested and affected parties and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority or the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority (unless access to that information is protected by law, in which case I will indicate that such protected information exists and is only provided to the competent authority);
- declare that all the particulars furnished by me in this form are true and correct;
- am aware that it is an offence in terms of Regulation 48 to provide incorrect or misleading information and that a person convicted of such an offence is liable to the penalties as contemplated in section 49B(2) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist

Marion Bamford Consulting

Name of company

26 June 2025

Date

10.5 The Review Specialist

I ……, as the appointed review specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- am independent, and other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity;
- am fully aware of and meet all of the requirements of Regulation 13, and that failure to comply with any the requirements may result in disqualification;
- have reviewed/will review all the work undertaken by the specialist;
- have disclosed/will disclose, to the applicant, the EAP, other specialist (if any), the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

Signature of the review specialist

Name of company

Date

Palaeontological Impact Assessment for the McCain Delmas Wastewater Treatment Plant & Expansion of the Diesel Storage Facility, Mpumalanga Province

WSP Ref: 41107366

Site Visit (Phase 2)

Subcontracted by

WSP Group Africa (Pty) Ltd

23 March 2025

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

1. Executive Summary

A Palaeontological Impact Assessment was requested for the proposal by McCain Foods South Africa (Pty) Ltd to upgrade the Wastewater Treatment Plant and Diesel Tank Installation, at the Delmas plant, Mpumalanga Province.

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 walkdown Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the potentially very highly sensitive dolomites of the Malmani Subgroup (Transvaal Supergroup) that might preserve trace fossils such as stromatolites and microbialites. The site visit conducted on 17 March 2025 (summer) by palaeontologists confirmed that there were NO FOSSILS in the project footprint, on the land surface. Since it is not known what lies below the surface a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no further palaeontological impact assessment is required unless fossils are found by the contractor, environmental officer or other designated responsible person once excavations or drilling activities have commenced. Since the impact will be very low, as far as the palaeontology is concerned, the project should be authorised.
The impact pre-mitigation is LOW and the impact post-mitigation is VERY LOW.

ASPECT	SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/ PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
Palaeontology	Very High	Very Low	Palaeontological Impact Assessment	Section 7.2. SAHRA Requirements

2. Declaration of independence and summary of expertise.

a. Declaration

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by WSP Group Africa (Pty) Ltd, Midrand, 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:

b. Expertise

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, mASSAf, PSSA
Experience: 36 years research and lecturing in Palaeontology; over 28 years PIA studies and over 450 projects completed.

c. Specialist declaration of independence and statement of objectivity for the assessment.

Declaration of Independence
I, Marion Bamford, declare that –
General declaration:

- I act as the independent palaeontology practitioner in this application,
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant,
- I declare that there are no circumstances that may compromise my objectivity in performing such work,
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation,
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application,
- I have no, and will not engage in, conflicting interests in the undertaking of the activity,
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority,

- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application,
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct,
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

d. Summary of the specialist's expertise

I, Marion Bamford, am a professional Palaeontologist with a PhD in Palaeontology (Wits University, 1990). I have more than 35 years of experience in palaeontological research and have published over 190 papers in peer-reviewed journals and published more than 14 scholarly book chapters. I review manuscripts for international and local journals and also review funding proposals for international funding bodies. Currently I am the Director of the Evolutionary Studies Institute, the only palaeontological institute in Southern Africa.

I have completed more than 450 palaeontological impact assessments (desktop and site visit studies) in the last 28 years for a variety of projects (solar energy projects, wind energy projects, powerlines, roads, infrastructure, housing and retail projects and from all over South Africa. I have been subcontracted by over 30 different companies. From my own projects and training provided by me and other staff in the ESI for Palaeontological Impact Assessments, I am familiar with the legislation.

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3. Project Background

WSP Group Africa (Pty) Ltd (WSP) has been appointed by McCain Foods SA (Pty) Ltd (McCain) to undertake an Environmental Authorisation (EA) application process for proposed activities at the Delmas Plant, located in the Victor Khanye Municipality, in the Mpumalanga Province (Figures 1-3). McCain proposes to establish a wastewater treatment plant and a diesel storage facility.

Proposed wastewater treatment plant:
• McCain proposes to develop a new wastewater treatment plant to treat effluent that is generated from the manufacturing process. The plant will have a maximum daily treatment volume flowrate of 3 400 m^3/day and will be located in the northwestern corner of the site, on McCain-owned property. The effluent will be treated to meet the quality requirements that would be suitable for direct discharge to the environment, or for plant use (potable water quality). Waste activated sludge (WAS) from the treatment plant will be temporarily stored in hoppers on site and ultimately disposed offsite.
• The plant will include an anaerobic digestion process for chemical oxygen demand (COD) containing wastes on site, such as fryer waste, slivers, and other materials that are collected in the main wastewater screen and oily-water screen. The anaerobic digester will convert the COD into biogas, which can be used to either generate power or displace natural gas in the processing plant's boilers. The digester feed flow will be approximately 385 m3/day, with a total digestion volume of 9 074 m^3.
• The development fooprint for the facility will be approximately 9 000 m^2 and will include the following key infrastructure components:

- Clarifier (existing)
- Equalisation Tank
- Upflow Anaerobic Sludge Blanket (UASB) Feedtank & Pumps
- UASB Sludge
- Activated Sludge
- Waste Water Process Building
- Secondary Clarifier
- Biogas Digester
- Biogas & Power Building
- Flare

• It is understood that an EIA process for the proposed wastewater treatment plant was commenced in 2023 but was never completed. An environmental screening report and groundwater impact assessment report is available for use in this project.

Proposed diesel tank:
• McCain Delmas cumulatively stores 43.782 m^3 of diesel in various tanks on site, and proposes to install an additional 79 m^3 diesel storage tank next to a current 30 m^3 diesel tank. The proposed facility will be a self-bunded (double wall) containerised tank, with the same design as the current 30 m^3 diesel tank.

A site visit and walkdown Palaeontological Impact Assessment (PIA) was requested for the McCain Delmas project. 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), the site visit observations for the Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) - Requirements for Specialist Reports (Appendix 6). Includes the requirements from GNR Appendix 6 of GN 326 EIA Regulation 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,	Section 2
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Section 2
b	A declaration that the person is independent in a form as may be specified by the competent authority	Section 2
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 3
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 6
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 4
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 6
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 7
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 8
k	Any mitigation measures for inclusion in the EMPr	Section 10, 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 10, Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 8

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	Relevant section in report
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	Sections 8, 10
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 of any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A
2	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

Figure 1: Google Earth map of the general area to show the relative land marks. The McCain Delmas plant is shown by the yellow polygon.

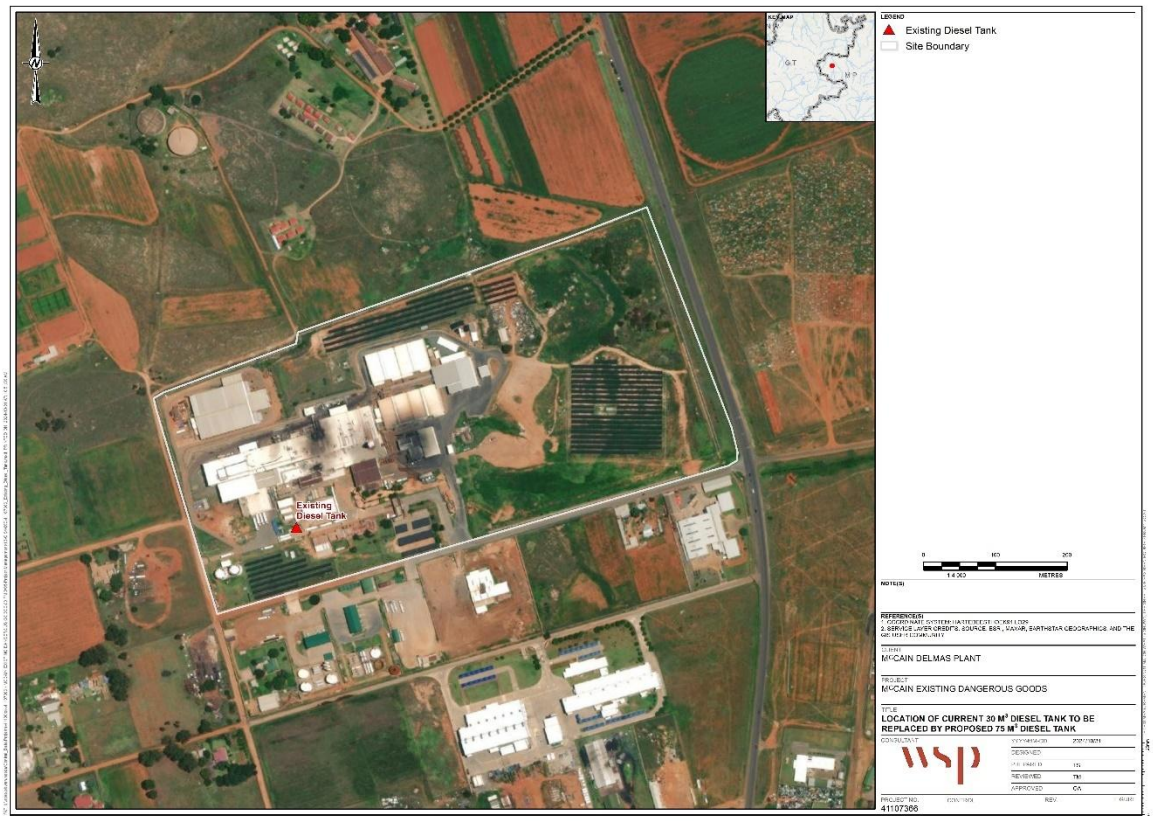

Figure 2: Arial Map of the proposed diesel tank site (red dot). Map supplied by WSP.

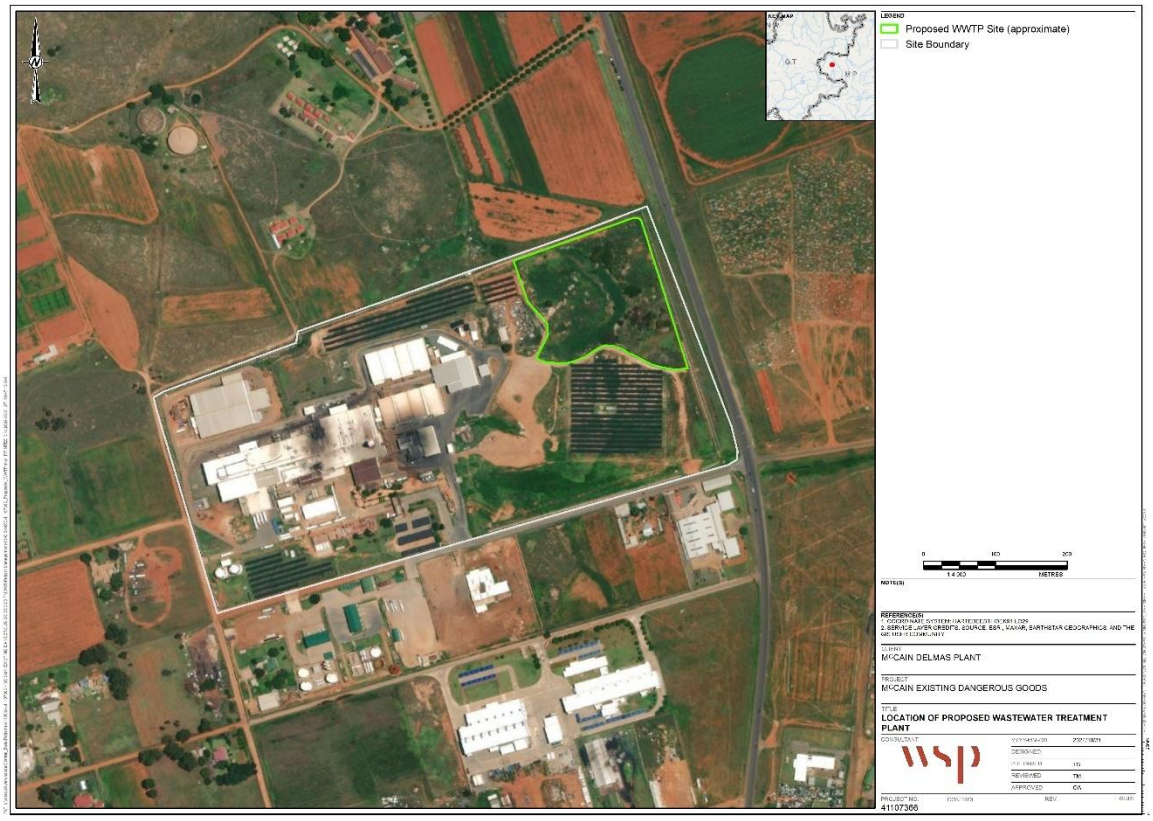

Figure 3: Aerial map to show the WWTP site for the McCain Delmas Plant (green polygon)

4. 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 include records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases; eg https://sahris.sahra.org.za/map/palaeo ; DFFE palaeosensitivity screener.
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*applicable to this assessment*);
3. Walkdown to look for fossils on the land surface (no excavations permitted) and any fossils seen must be photographed and GPS coordinates noted.
4. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility, and
5. Determination of fossils' representativity or scientific importance to decide if the fossils can be destroyed or a representative sample collected.
6. If important fossils or fossil sites are encountered recommendation can be made to avoid the site (no-no area), establish a buffer area around the site, or remove the fossils.

5. Geology and Palaeontology

i. Project location and geological context

The site lies in the Transvaal Basin that has exposures of the basal members of the Transvaal Supergroup and overlies the older rocks of the Witwatersrand Supergroup. Unconformably overlying the Transvaal Supergroup rocks are the much younger basal members of the Karoo Supergroup as this is the northern margin of the Main Karoo Basin. Along the rivers and watercourses are recent deposits of sand and alluvium, of late Quaternary age (Figure 4).

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.

Making up the lower Pretoria Group are the Rooihoogte Formation, Timeball Hill Formation and the Boshoek Formation. The Hekpoort, Dwaalheuwel, Strubenkop and Daspoort Formations form a sequence as the middle part of the Pretoria Group, Transvaal Supergroup, and represent rocks that are over 2060 million years old. The Hekpoort Formation is a massive lava deposit and is overlain by the Dwaalheuwel conglomerates, siltstone and sandstone (not present here). A hiatus separates the Strubenkop Formation slates and shales from the overlying quartzites of the Daspoort Formation. Upper Pretoria Group formations are the Silverton, Magaliesberg, Vermont, Lakenvalei, Nederhorst, Steenkampsberg and Houtenbek Formations

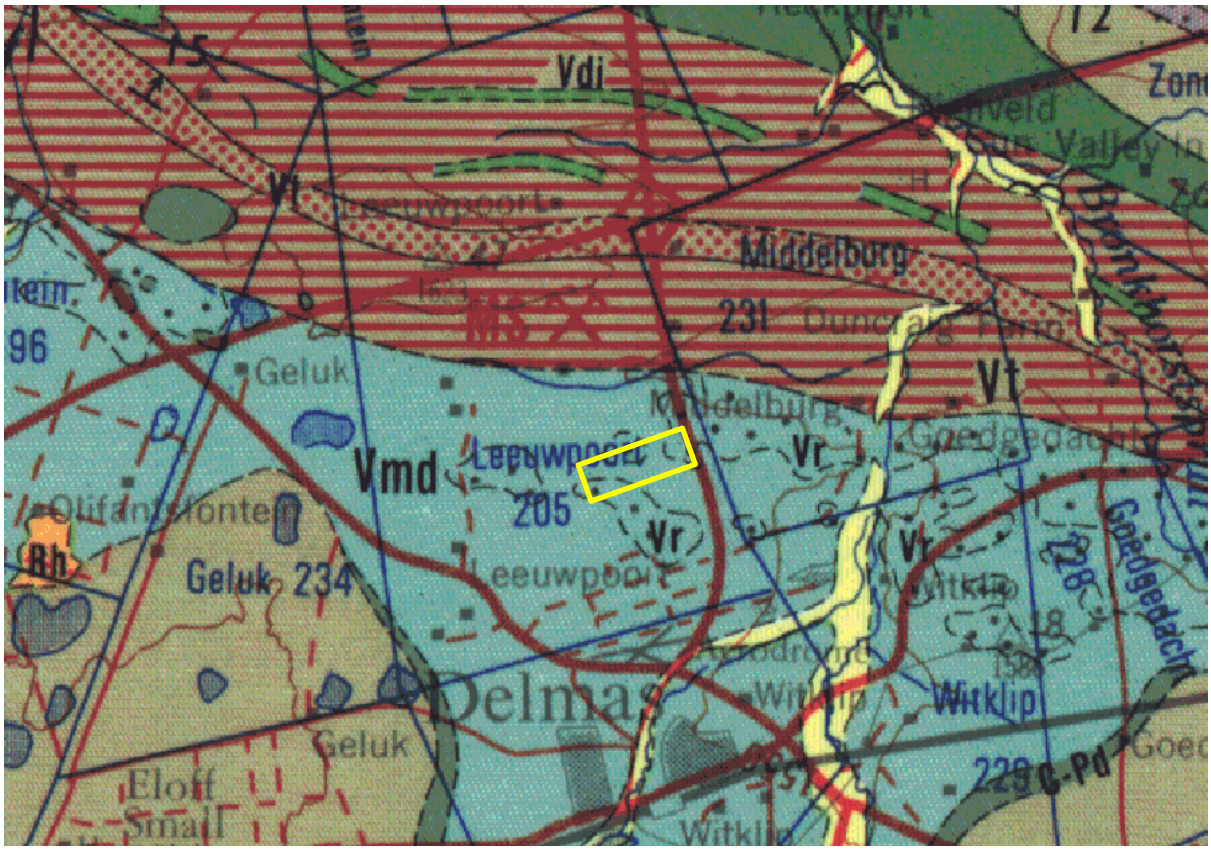

Figure 4: Geological map of the area around the McCain Delmas plant project as indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2628 East Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006; Johnson 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	Alluvium, sand, calcrete	Quaternary ca 1.0 Ma to Present
Pv	Vryheid Fm, Ecca Group, Karoo SG	Shales, sandstone, coal	Early Permian, Ca 290-280 Ma
C-Pd	Dwyka Group, Karoo SG	Diamictite, tillites, mudstone	Late Carboniferous to Early Permian
Vdi	Diabase	Intrusive volcanic rocks, solidified	Post Transvaal SG
Vr	Rooihoogte Fm, Pretoria Group, Transvaal SG	Shale	Palaeoproterozoic Ca 2420 Ma
Vt	Timeball Hill Fm, Pretoria Group, Transvaal SG	Quartzite	Palaeoproterozoic < 2420 Ma
Vmd	Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dolomite, chert	Palaeoproterozoic Ca 2750 – 2650 Ma

The Karoo Supergroup rocks cover a very large proportion of South Africa and extend from the northeast (east of Pretoria) to the southwest and across to almost the KwaZulu Natal south coast. It is bounded along the southern margin by the Cape Fold Belt and along the northern margin by the much older Transvaal Supergroup rocks. Representing some 120 million years (300 – 183Ma), the Karoo Supergroup rocks have preserved a diversity of fossil plants, insects, vertebrates and invertebrates.

Overlying the basal Dwyka Group glacigene rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In Gauteng, the Free State, Mpumalanga and KwaZulu Natal, from the base upwards are the Pietermaritzburg Formation, **Vryheid Formation** and the Volksrust Formation. All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

The Karoo Group sequence is best represented in the Main Karoo Basin but outliers of the Ecca Group occur in isolated basins in the Transvaal Basin where they unconformably overlie the much older rocks of the Transvaal Supergroup. The project lies on one example of an outlier of the Vryheid Formation (Figure 3).

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 5. The site for development is in the potentially very highly sensitive Malmani Subgroup dolomites (red) that could preserve trace fossils such as stromatolites and microbialites.

Stromatolites are the layers upon layers of inorganic materials that were deposited during photosynthesis, namely calcium carbonate, magnesium carbonate, calcium sulphate and magnesium sulphate. These layers can be in the form of flat layers, domes or columns depending on the environment where they grew (Beukes, 1987). Some environments did not form stromatolites, just layers of limestone that later was converted to dolomite. The algae that formed the stromatolites are very rarely preserved, and they are microscopic so they can only be seen from thin sections studies under a petrographic microscope.

Microbialites (sensu Burne and Moore, 1987) are organo-sedimentary deposits formed from interaction between benthic microbial communities (BMCs) and detrital or chemical sediments. In addition, microbialites contrast with other biological sediments in that they are generally not composed of skeletal remains. Archean carbonates mostly consist of stromatolites. These platforms could have been the site of early O_2 production on our planet. Stromatolites are the laminated, organo-sedimentary, non-skeletal products of microbial communities, which may have included cyanobacteria, the first photosynthetic organisms to produce oxygen. Another type of trace fossil has been termed Microbially-induced sedimentary structures (MISS sensu Noffke et al., 2001) or simply 'fossil mats' (sensu Tice et al., 2011). These include swirls, rip-ups, crinkled surfaces and wrinkles that were formed by the mucus extruded by littoral algae or microbes and bound together sand particles. Davies et al. (2016) caution against the

assumption that all such structures are microbially induced unless there is additional evidence for microbes in the palaeoenvironment.

Figure 5: SAHRIS palaeosensitivity map for the site for the proposed WWTP (northeast corner) and the diesel plant (western part on an existing built site) 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.

Nonetheless, stromatolites and microbialites are accepted as trace fossils of algal colonies. MISS could be microbially or abiotically formed. The oldest stromatolites have been recorded from the Barberton Supergroup that was deposited between 3.55 to ca. 3.20 Ga, and stromatolites still form today in warm, shallow seas (Homan, 2019).

From the SAHRIS map above the area is indicated as very highly sensitive (red) so a site visit verification is required.

iii. Site Visit Observations

Figure 6: Annotated Google Earth map for the site stops and observations (red line).

Photographs of the site visit walkdown are presented in the following Figures 7-11. The diesel storage site is already built-upon so it was not assessed.

Captions and observations for Figures 7-11 below.

Summary – the area is very disturbed and it was difficult to walk through the vegetation and look for rocky outcrops, However, none was found. No fossils were seen.

Figure 7: McCain Delmas site visit photographs. A-D – disturbed area close to the existing plant and west of the proposed area for the WWTP

Figure 8: Northern margin of the project area. A-D - Note the dense weeds and other vegetation indicating soils and disturbed areas. No rocky outcrops seen and no rocks.

Figure 9: Along the northeastern margin and boundary fence. A – close up of the ground showing compacted soils and no rocks. B-D – dense vegetation indicating soil cover.

Figure 10: Southeastern area. A-D – abundant weeds and some natural vegetation. No rocky outcrops.

Figure 11: Southern area. A-C – dense vegetation and no rocks. D – return to the large parking area.

6. Impact assessment

Assessment of Impacts and Mitigation

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

Following the mitigation sequence/hierarchy of five levels:

a) Avoid/prevent significant impact
b) Minimise
c) Rehabilitate/restore
d) Off-set
e) No-go,

mitigation in the form of removing any important fossils (steps a and b) will reduce realty the impact of this project on the palaeontological heritage.

The key objectives of the risk assessment are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Ranked criteria listed in Table 3a and the scores for the palaeontological impact are given in Table3b.

Table 3a: Impact Assessment and Scoring according to WSP protocols.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ *Significance = (Extent + Duration + Reversibility + Magnitude) × Probability*				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

Mitigation

The impact on the palaeontological heritage can be reduced greatly by a palaeontologist conducting a pre-construction site visit to look for fossils and removing any scientifically important fossils with the relevant SAHRA/AMAFA/HWC/ECPHRA permit.
(See Section 8 and Appendix A).

Positive/Negative Impact

The discovery and removal of fossils as a direct result of this project has a positive impact because prior to these excavations any particular fossils or fossil deposit were unknown to science.

Additional Environmental Impacts

As far as the palaeontology is concerned, there are no additional impacts because the fossils are inert and inactive.

Cumulative Impacts

As far as the palaeontology is concerned, there are no cumulative impacts because each site is unique and may or may not have fossils. Fossil bones may be scattered over the landscape but their distribution is erratic and unpredictable. If a bone-bed or plant

outcrop occurs this would be an aerially small concentration of fossils and very unlikely to extend beyond tens of metres. Therefore, projects on adjacent land parcels are unlikely to add any impact on this project.

No-Go areas
There are NO no-go areas because the fossils, if present, can be removed and curated in a recognised institution such as a museum or university that has the facilities to store and research the fossil material.

Impact Phase
It is only during the **Construction Phase** that there could be any impact on the palaeontological heritage because this is when the ground will be broken for excavations for foundations and infrastructure. Fossils occur in the ground. The operational and de-commissioning phases will not affect the palaeontology.

Table 3b: Potential impacts of this project. (C = Construction Phase, O = Operational Phase, D = Decommissioning phase, M = Magnitude, E = Extent, R = Reversibility, D = Duration, P = Probability, S = Significance, Ca = Character, Con = Confidence)

Aspect	Impact	C	O	D	M	E	R	D	P	S		Ca	Con
Palaeontology													
	Without Mitigation				2	1	5	4	2	24	Low	(-)	High
	With Mitigation				1	1	3	1	2	12	Very Low	(-)	High
		✓			**Mitigation Measures:** • Site visit by a palaeontologist to look for surface fossils. • Photograph then rescue the fossils but do not remove them from the site until a SAHRA permit has been obtained. • Construction phase/excavations – on-site responsible person to check new excavations for fossils. • Photograph and rescue any fossils • Send photographs to a palaeontologist to confirm the importance of the fossils: not a fossil/poor fossil/very common types – no action required OR rescue and call a palaeontologist to collect OR stop all excavations until a palaeontologist can excavate very important fossils.							
	Listing Notice 1: GNR 983 - Activity 1, 12, 19, 24 (ii); Listed Notice 2 GNR 984 – Activity 1, 4, 15												
	Without Mitigation				1	2	1	2	0	0	N/A	(-)	High
	With Mitigation				1	1	1	2	0	0	N/A	(-)	High
			x	x	**Mitigation Measures:** • N/A								

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 preserve fossils so a site visit is required by SAHRA. This was completed.

7. 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 only some might contain trace fossils or fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils. From the site visit observations there were NO FOSSILS on the land surface. It should be noted the land was very disturbed and covered with very thick vegetation cover of grasses, shrubs and trees so visibility was low. It is not known, however, what rocks or possible fossils lie below the surface until excavations have commenced.

8. Recommendation

Based on the site visit observations and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying soils of the Quaternary. Outcrops of the same formation in other parts of the country have trace fossils so there is a chance that they also occur in this area. The site visit and walk through, however confirmed that there were NO FOSSILS in the project footprint. There is a chance that fossils may occur below the ground surface in the dolomites and cherts of the Malmani Subgroup so a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once excavations for foundations and infrastructure have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be LOW pre-mitigation and VERY LOW post-mitigation, so as far as the palaeontology is concerned, so the project should be authorised.
There are no no-go areas and no buffers are required. There is no cumulative impact.

ASPECT	SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/ PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
Palaeontology	Very High	Low	Palaeontological Impact Assessment	Section 7.2. SAHRA Requirements

9. References

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10. Fossil Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling activities 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 discard must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils such as stromatolites or microbialites, plants, insects, bone or coal) 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, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 12). 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 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.

11. **Appendix A** – Examples of fossils from the Malmani Subgroup

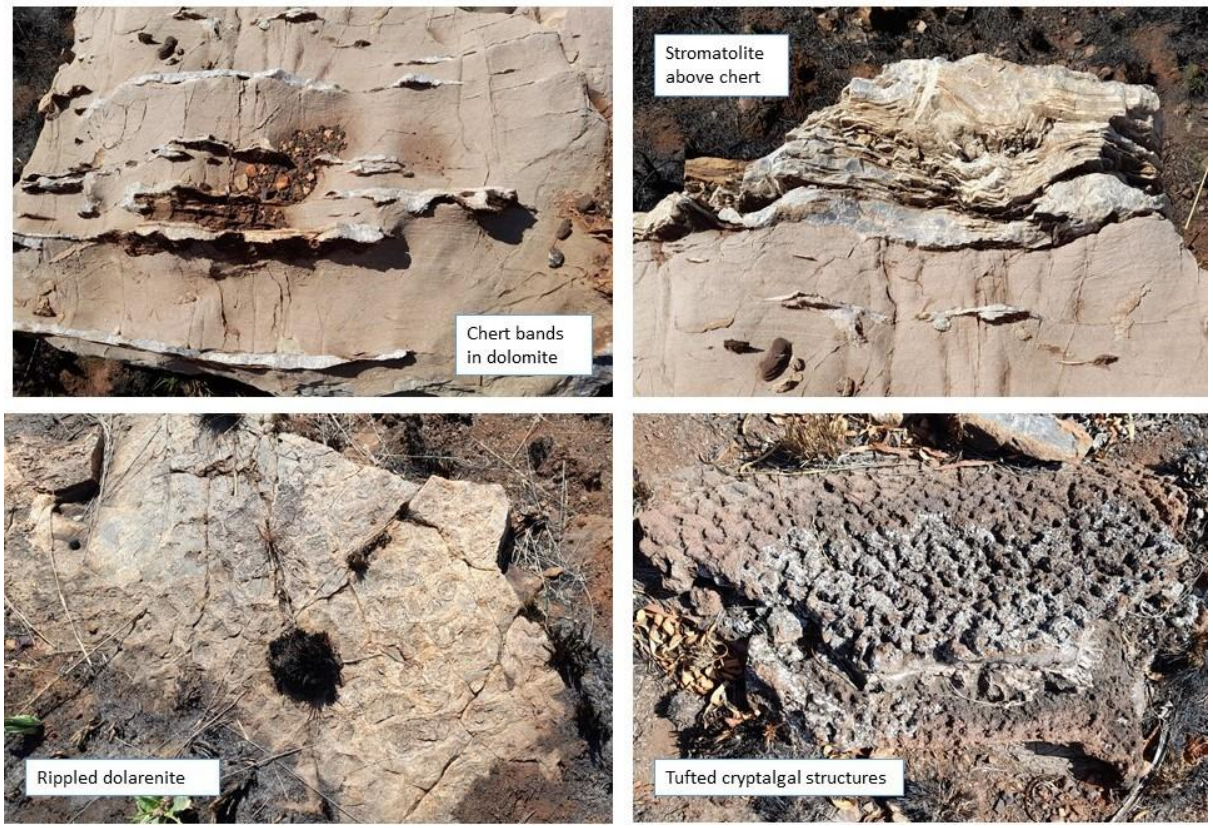

Figure 12: Photographs of stromatolites from the Malmani Subgroup to assist the on-site responsible person.

Curriculum vitae (short) - Marion Bamford PhD
May 2026

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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

v) **Supervision of Higher Degrees**

All at Wits University

Degree	Graduated/completed	Current
Honours	13	1
Masters	16	0
PhD	19	2

Postdoctoral fellows	15	3

vi) **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 12 - 20 students per year.

vii) **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 –
Associate Editor: Cretaceous Research: 2018-2020
Review of manuscripts for ISI-listed journals: 30 local and international journals

viii) **Palaeontological Impact Assessments**
28 years' experience in PIA site and desktop projects with over 450 projects completed.

Selected from recent projects only – list not complete:

- Buffalo & Lyra SEFs 2023 for Nextec
- Camel Thorn Group Prospecting Rights 2023 for AHSA
- Dalmanutha SEFs 2023 for Beyond Heritage
- Elandsfontein Residential 2023 for Beyond Heritage
- Waterkloof Samancor 2023 for Elemental Sustainability
- Zonnebloem WTP 2023 for WSP
- Elders Irrigation 2023 for SRK
- Leghoya WEFS 2023 for Red Cap & SLR
- Aberdeen Solar 1,2,3 2024 for Beyond Heritage
- BeauNero Mining 2024 for Lwethuma
- Brakfontein 264 IR Mining 2024 for Eco-elementum
- Hugo & Khoa SEFs 2024 for TerraMare
- Pakamani Senior Sec. School 2025 for Afroteam
- Ufudu SEF and Grid 2025 for CES
- Bloemhoek SEF 2025 for Beyond Heritage
- Carolina township 2026 for AEB
- Exxarro Grootgeluk Dam 2026 for Shangoni
- Gromis-Nama-Groeipunt PL 2026 for Nsovo
- Kangra Coal SEFs 2026 for Envass

ix) **Research Output**
Publications by M K Bamford up to May 2026 peer-reviewed journals or scholarly books: over 210 articles published; 5 submitted/in press; 18 book chapters.
Scopus h-index = 35; Google Scholar h-index = 48; -i10-index = 149 based on 9145 citations.
Conferences: numerous presentations at local and international conferences.