Palaeontological Impact Assessment for the proposed Clearing and cultivation of currently untransformed areas on the Farms Montrose 290 JT and Barclay Vale 288 JT, Mpumalanga Province

Desktop Study

For

Hotazel Developments No 1 (Pty) Ltd

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Expertise of Specialist

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Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 20 year PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Steven Henwood for Hotazel Developments No 1 (Pty) Ltd, South Africa. The views expressed in this report are entirely those of the author and Steven Henwood, and no other interest was displayed during the decision making process for the project.

Specialist: …….. Prof Marion Bamford……..

Signature: ……. 

Executive Summary

The desktop Palaeontological Impact Assessment for the proposed site for the construction of a hatchery at Ezinkolweni Hotazel Developments No 1 (Pty) Ltdhas been completed. The site is in the Carboniferous Dwyka Formation, and the Permian Ecca Group where there potentially could be fossil plants of the *Glossopteris* flora associated with the shales. It is possible that some fossil plants could be destroyed in the process but they have not been reported from this area and would be very sparsely distributed if present. Since there is a small chance that fossil plants could be discovered when excavations commences a Chance Find protocol and monitoring programme have been added to the report. It is concluded that the project may continue as far as the palaeontology is concerned.

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1. Background

A desktop palaeontological assessment for the proposed clearing and cultivation of currently untransformed areas on fars Montrose 290 JT and Barclay Vale 288JT has been requested. The areas are on greenfields sites and the SAHRIS palaeosensitivity map indicates that the area is of low sensitivity to no sensitivity. The coordinates for the midpoint of the sites are: Montrose: 25°25’ 18.93”S and 30°44’ 19.66”E; Barclay Vale: 25°25’ 38.81”S and 30°44’ 57.38”E.

The National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998) requires that the proposed development must be preceded by the relevant impact assessment, in this case for palaeontology.

This report complies with the requirements of the NEMA and environmental impact assessment (EIA) regulations (GNR 982 of 2014). The table below provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

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

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
Details of the specialist who prepared the report	Prof Marion Bamford
The expertise of that person to compile a specialist report including a curriculum vitae	Palaeontologist (PhD Wits 1990) CV attached
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2
An indication of the scope of, and the purpose for which, the report was prepared	Section 1, page 3
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	n/a Seasons make no difference to fossils
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2, page 4
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 2
An identification of any areas to be avoided, including buffers	n/a
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	n/a
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6, page 7
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	n/a

Any mitigation measures for inclusion in the EMPr	n/a
Any conditions for inclusion in the environmental authorisation	n/a
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8, page 8
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	n/a
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	n/a
A description of any consultation process that was undertaken during the course of carrying out the study	Section 3 page 5
A summary and copies if any comments that were received during any consultation process	n/a
Any other information requested by the competent authority.	n/a

2. Methods and Terms of Reference

1. In order to determine the likelihood of fossils occurring in the affected area geological maps, literature, palaeontological databases and published and unpublished records must be consulted.

2. If fossils are likely to occur then a site visit must be made by a qualified palaeontologist to locate and assess the fossils and their importance.

3. Unique or rare fossils should either be collected (with the relevant South African Heritage Resources Agency (SAHRA) permit) and removed to a suitable storage and curation facility, for example a Museum or University palaeontology department or protected on site.

4. Common fossils can be sacrificed if they are of minimal or no scientific importance but a representative collection could be made if deemed necessary.

The published geological and palaeontological literature, unpublished records of fossil sites, catalogues and reports housed in the Evolutionary Studies Institute, University of the Witwatersrand, and SAHRA databases were consulted to determine if there are any records of fossils from the sites and the likelihood of any fossils occurring there.

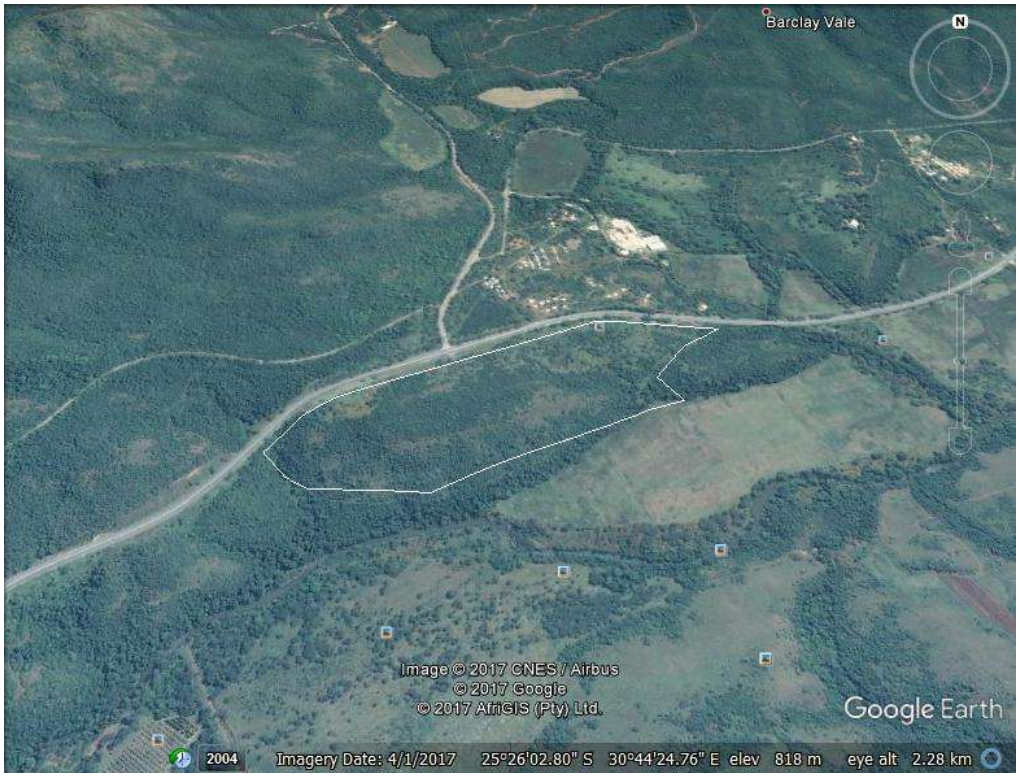

Figure 1: Google map of the farm Montrose (white outline). The road running west-east is the N4 and the road from the north is the R 559.

Figure 1: Google map of the farm Barclay Vale (white outline). The road running west-east is the N4 and the road from the north is the R 559.

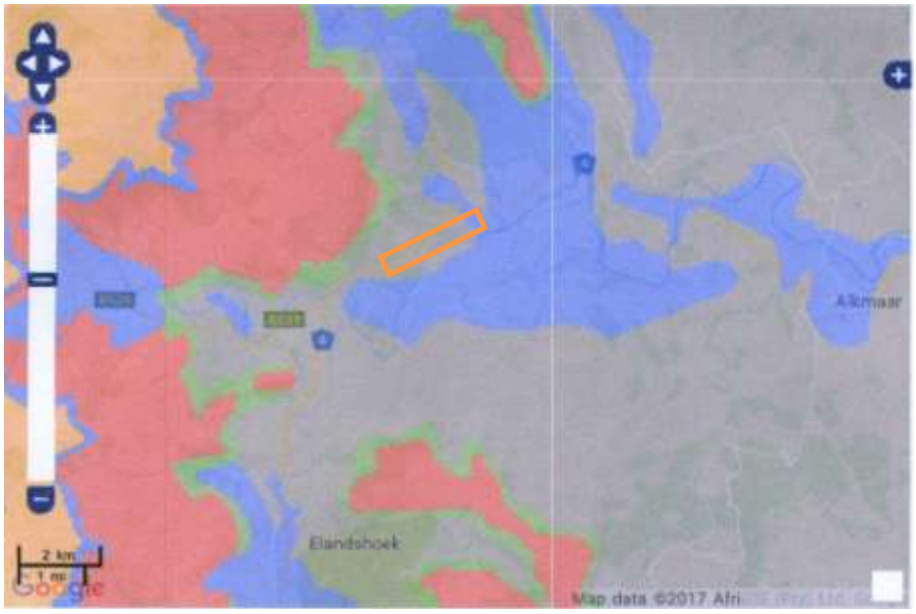

Figure 3: SAHRIS Palaeosensitivity map for the area west of Nelspruit, along the N4 highway. The proposed school site is within the prange rectangle. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

3. Consultation Process

No consultations were carried out during the palaeontological desktop study.

4. Geology and Palaeontology

<u>Project location and geological setting</u>

According to the geological map (Fig 4) the proposed hatchery site lies in the Carboniferous Dwyka Formation and Permian Ecca Group and these are “green” in the SAHRIS palaeosensitivity map (Fig 1).

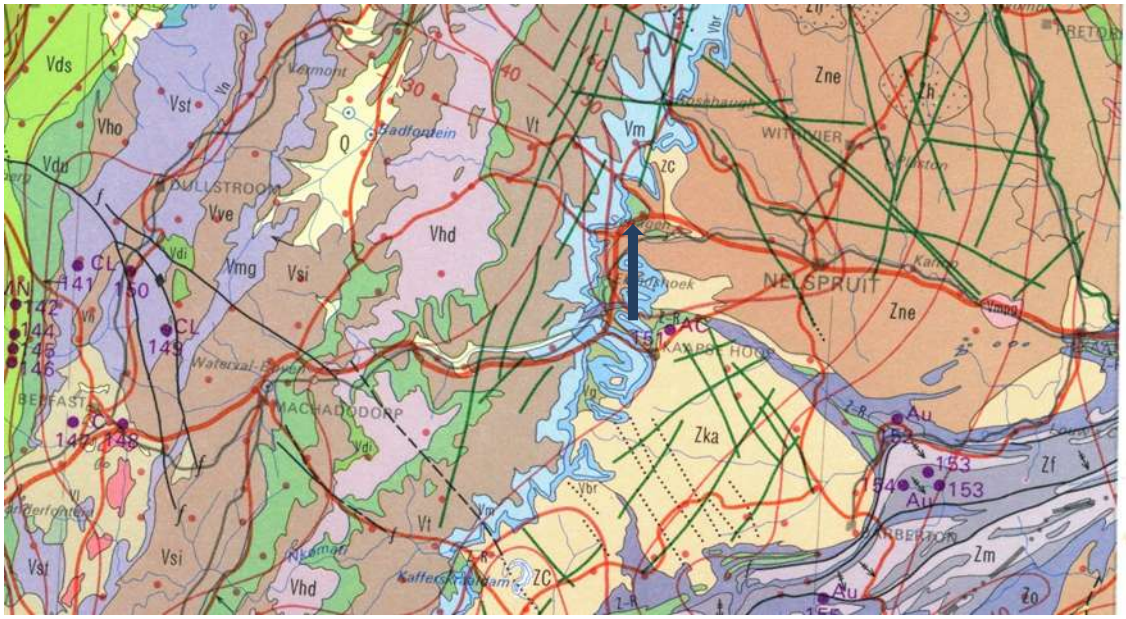

Figure 3: Geological map of the area west of Nelspruit where the farms Montrose 290 JT and Barkley Vale 288 JT are situated. The approximate location of the proposed project is indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

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

Symbol	Group/Formation	Lithology	Approximate Age
Vsi	Silverton Fm, Pretoria Group	Basalt, tuff, shale	Ca 2150 Ma
Vhd	Dwaalheuvel, Strubenkop and Daspoort Fms; Pretoria Group	Andesite, sandstone, shale	
Vh	Hekpoort Fm, Pretoria Group	Basaltic andesite, pyroclastic rocks	2224 Ma
Vti	Timeball Hill and Rooihoogte Fm, Pretoria Group	Shale, quartzite, conglomerate, breccia, diamictite	Ca 2420 Ma
Vm	Malmani subgroup, Chuniespoort Group	Dolomite, chert	2642 – 2500 Ma
Vbr	Black Reef Fm	Quartzite, conglomerate, shale, basalt	>2642 Ma
Vg	Godwan Group	Clastic sedimentary and lesser volcanic rocks, massflow diamictites and pyroclastic rocks	

Symbol	Group/Formation	Lithology	Approximate Age
Z-R	Unnamed ultrabasic rocks	Ultrabasic volcanic rocks	
Rmp	Mpuluzi Batholith (Mpuluzi Suite)	granites	Ca 3303 Ma
Zne	Nelspruit Batholith (Nelspruit Suite)	Gneiss, porphyritic granite	Ca 3303 Ma

Geology and palaeontology

The rocks in this region have been well studied as they are amongst the oldest rocks in the world. To the south east in a northeast – southwest orientation are the oldest rocks, those of the Barberton Greenstone Belt. To the west in a more north-south orientation are the Bushveld Complex rocks of the Chuniespoort and Pretoria Supergroups, while in between are the granite batholiths and plutons of the mid Archean.

Palaeontology
(Refer to Figure 3 for SAHRIS palaeosensitivity map)

Batholiths and plutons do not preserve any fossils as they are igneous in origin.
These particular ones, the Mpuluzi and Nelspruit batholiths are also too old to preserve fossils even if any life forms were around as they are over 3300 Ma. At this time there were only single-celled algae or bacteria present (Knoll, 1984).

To the west are rocks of the Pretoria Group. There are two models proposed for the formation of the Pretoria Group, that of sedimentation in a shallow marine setting or deposition in a closed basin, but there are no invertebrate fossils to support the models. More recent workers have suggested that initially there was a closed basin (Rooihooghte to Strubenkop Formations) followed by alternating transgressive and regressive cycles in a shallow marine setting (Erikssen et al., 2006), or deep marine (Erikssen et al., 2012).

Trace fossils, in the form of microbial mats that have formed on or preserved ripple marks, have been found in the Daspoort and Magaliesberg Formations (underlying and overlying the Silverton Formation, respectively; Erikssen et al., 2012; Parizot et al., 2005) but they do not provide localities. According to the authors the trace fossils would have formed on the shores of the sea (Erikssen et al., 2012), but no body fossils have been found as the rocks are too old. To date no microbial mats have been reported from the Silverton Formation.

The Black Reef Formation and Malmani Subgroup banded ironstone and dolomites, although formed by the chemical activities of ancient algae, photosynthesis and oxygen production, are not known to have preserved fossil algae near Nelspruit.

5. Impact assessment

Using the criteria in the table below, the impact of the relatively shallow excavations for the buildings and infrastructure has been assessed.

TABLE 3: 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

The surface activities would impact on the fossil heritage, only if preserved in this area, as the rocks are sedimentary and the correct age, The IMPACT is very low (according to the scheme in Table 3).

Excavation for infrastructure foundations, road access and ponds would not penetrate more than a few metres below ground and there could be minor deterioration of the surface of sites and a minor impact on any potential fossils. Therefore the SEVERITY/NATURE of the environmental impact would be L.

DURATION of the impact would be permanent: H.

Since only the possible fossils within the area would be fossil plants such as leaf impressions from the *Glossopteris* flora in the shales, the SPATIAL SCALE will be localised within the site boundary: L.

There is a very small chance of finding leaf fossils in the shales because these have been reported from the same formations but not in this particular area. However, the PROBABILITY of affecting any fossils is unlikely or seldom: L

6. 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 basement rocks, sandstones, shales, quartzites, basalts and volcanic rocks are typical for the country and do not contain any fossil material. The shales of the Ecca Group could contain impression fossils of plants of the *Glossopteris* flora, however, they have yet to be recorded from the proposed site for mining.

7. Recommendation

It is unlikely that any fossils occur in the proposed building and infrastructure sites Furthermore, no fossils have been recorded from this area. Nonetheless rocks of this type and age are potentially fossiliferous, as indicated in the SAHRIS palaeosensitivity map (Fig 1).

As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would only be required after excavations have commenced and if fossils are found by the geologist or environmental personnel.

9. References

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Figure 3: Examples of fossil leaf impressions and compressions of the *Glossopteris* flora (Ecca Group) that could possibly be found.