

**Palaeontological Impact Assessment for the proposed
Ezingolweni Hatchery inland from Port Shepstone,
southern KwaZulu-Natal Province**

Desktop Study

For

Fuze Environmental

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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 Jean Beater for Fuze Environmental Services, South Africa. The views expressed in this report are entirely those of the author, Jean Beater and Fuze Environmental Services 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 has 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.

Palaeontological Impact Assessment for the proposed Ezingolweni Hatchery inland from Port Shepstone, southern KwaZulu Natal Province

1. Background

A desktop palaeontological assessment for the proposed hatchery to be built at Ezingolweni, inland from Port Shepstone in KwaZulu Natal has been requested. The area is on a greenfields site and the SAHRIS palaeosensitivity map indicates that the area is of moderate sensitivity. The coordinates for the midpoint of the site are: 30°52'23.4"S and 31°07'11.3"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.

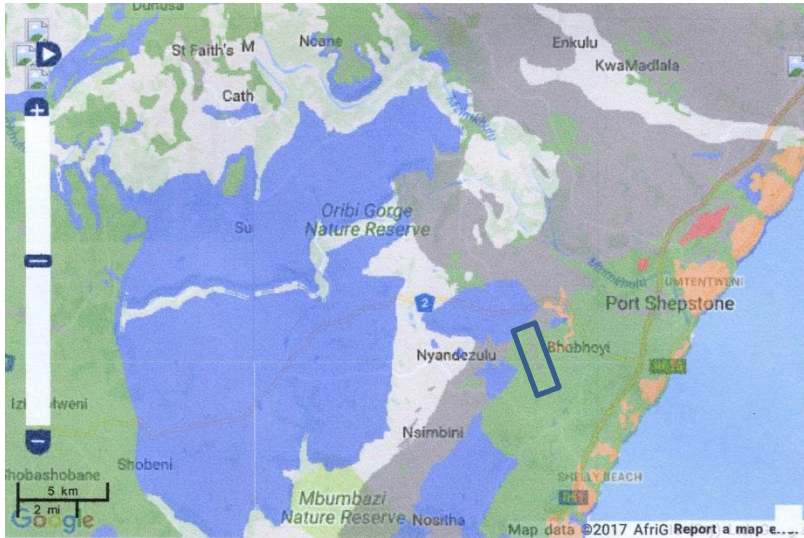


Figure 1: SAHRIS Palaeosensitivity map for the area west of Port Shepstone. The proposed school site is within the blue rectangle. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

3. Consultation Process

No consultations were carried out during the palaeontological desktop study.

4. Geology and Palaeontology

Project location and geological setting

According to the geological map (Fig 2) 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).

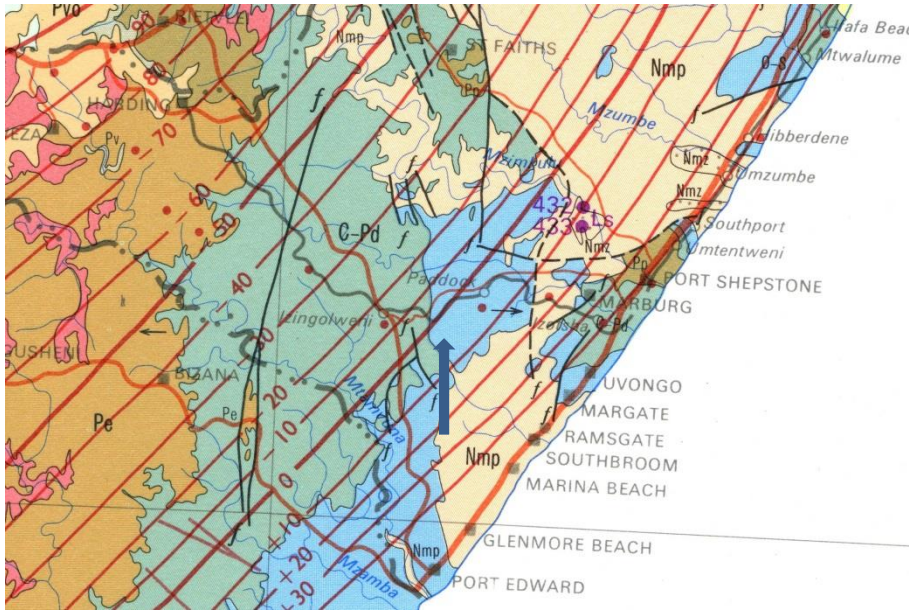


Figure 2: Geological map of the area west of Port Shepstone that has been selected for the Ezingolweni hatchery. The approximate location of the proposed project is indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

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

Symbol	Group/Formation	Lithology	Approximate Age
Pe	Ecce Group	Shale	Permian, 300-250 Ma
Pp	Pietermaritzburg Fm	Deep water shale	Lower Permian, Lower Ecce
C-Pd	Dwyka Fm	Tillites, sandstone, mudstone, shale	Carboniferous
O-S	Natal Group	Quartzitic sandstone, arkose, shale	Ordovician- Silurian
Nmp	Mzimkulu Fm, Margate terrane, Natal group	Gneiss, granulite	Ca 1240 Ma

Geology and palaeontology

The oldest rocks in the area are the gneiss and granulite of the Mzimkulu Formation (Fig 2). These are highly metamorphosed and too old to contain any body fossils.

Dwyka Group sediments are mostly tillites and these would not often contain fossils but occasionally there are fossil leaves and stems in the associated shales. Shales of the overlying Pietermaritzburg Formation are deep water deposits and do not contain fossils. The undifferentiated Ecce Group comprises shales and the age is unknown because there are no fossils. The *Glossopteris flora* is of this age (Plumstead, 1969).

The Natal Group quartzitic sandstone and arkoses are Ordovician to Silurian in age and could potentially contain ancient terrestrial fossils but none has been recorded from this area

The area is undisturbed and there is a very small chance that fossil plants could be found where new excavations are made for the hatchery, fences, buildings, access roads and sanitation.

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 there is a chance find, a monitoring protocol is recommended.

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. The procedure can be added to the EMPr.

8. 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 excavations commence.
2. When excavations begin the rocks must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, plants, insects, bone) should be put aside in a suitably protected place. This way the construction activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 4). 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. On a regular basis, to be agreed upon by the developer and the qualified palaeontologist sub-contracted for this project, the palaeontologist should visit the site to inspect the selected material and check the dumps where feasible. The frequency of inspections should be monthly until foundations are complete. However, if the onsite designated person is diligent and extracts the fossil material then inspections can be less frequent.
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 would be necessary a final report by the palaeontologist can be sent to SAHRA.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

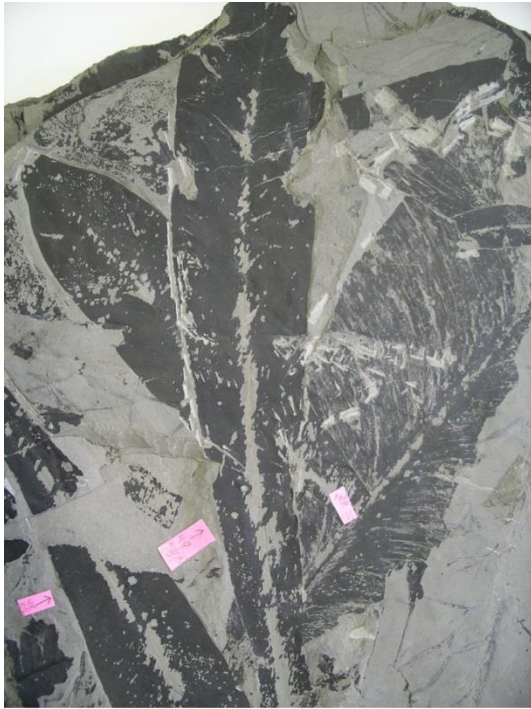
9. References

Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M., Gibson, R.L., 2006. The Namaqua-Natal Province. 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 325-379.

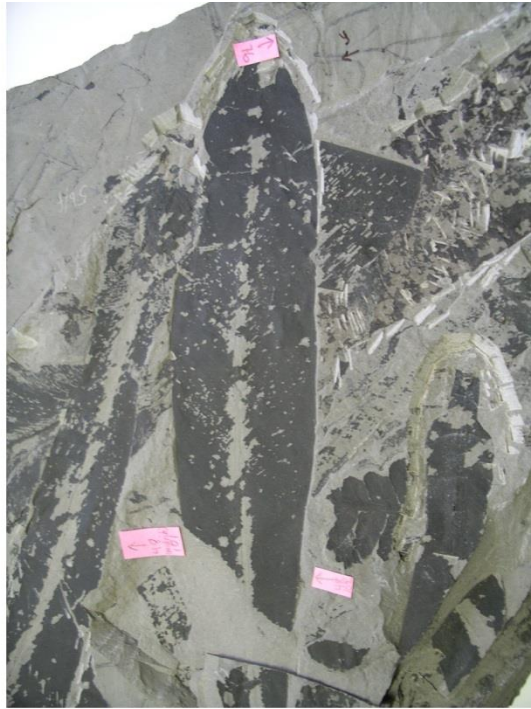
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Marshall, G.G.A., 2006. The Natal Group. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 433-441.

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.



Wide and narrow *Glossopteris* leaves



Narrow *Glossopteris* leaves



Lycopod stem with leaf abscission scars



Asterotheca (fern)

Hammanskraal fossil plants

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