

Palaeontological Impact Assessment for the proposed Kokstad CRU Housing Project, KwaZulu Natal Province

Desktop Study

For

Fuze Environmental Services

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford

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 Fuze Environmental Services. The views expressed in this report are entirely those of the author and Jean Beater and no other interest was displayed during the decision making process for the project.

Specialist: Prof Marion Bamford.....



Signature:

Executive Summary

The desktop or Phase 1 Palaeontological Impact Assessment for the proposed CRU housing project in the town of Kokstad, KwaZulu Natal is presented here. The site for the project lies on the shales and sandstones of the Adelaide subgroup, Beaufort Group which is upper Permian in age. Although these rocks could potentially contain fossils of vertebrates or plants, based on the geology, there are no records of fossils in the unpublished and published literature for the area. It is the opinion of the palaeontologist that the project may go ahead. If, in the very unlikely chance that fossils are found during excavations and construction, then a palaeontologist must be called to rescue the fossils

Palaeontological Impact Assessment for the for the proposed Kokstad CRU Housing Project, KwaZulu Natal Province

1. Background

A Phase 1 HIA was done for the proposed project by Jean Beater and this, together with SAHRA's fossil sensitivity map indicates that the project area is situated in an area of very high palaeontological / fossil sensitivity interspersed with a band of insignificant or zero fossil sensitivity. An area of very high sensitivity requires a field assessment. Due to the project area crossing both very high and insignificant areas of fossil sensitivity, a desktop study should be done by a palaeontologist and is presented here.

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 1
An indication of the scope of, and the purpose for which, the report was prepared	Section 1 (page 2)
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 buried coals
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2 (p. 3)
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	See table 3 (p. 5)
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 (p. 8)
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	n/a

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	n/a
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 have been 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.

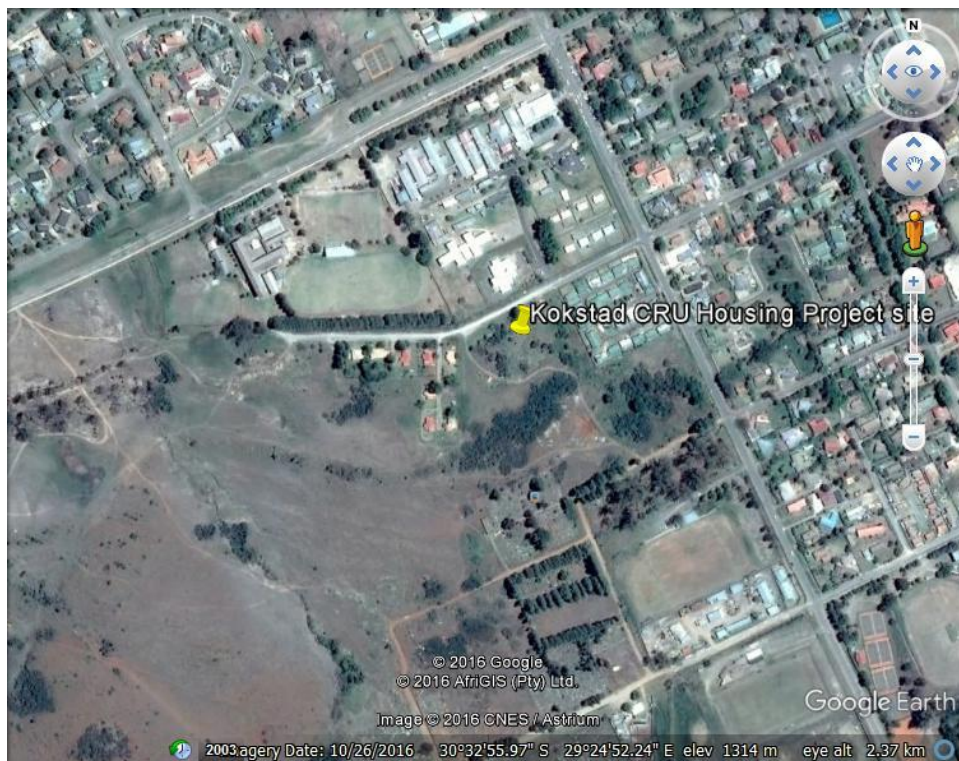


Figure 1: Location of the proposed Kokstad CRU housing development, in the town of Kokstad, KwaZulu Natal. Figure supplied by Jean Beater.

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.

3. Consultation Process

No consultations were carried out during the desktop study. Apart from reviewing interested and/or affected party (IAP) comments received by the EIA consultant during the EIA process, no other consultation took place as part of the paleontological study.

4. Geology and Palaeontology

Project location and geological setting

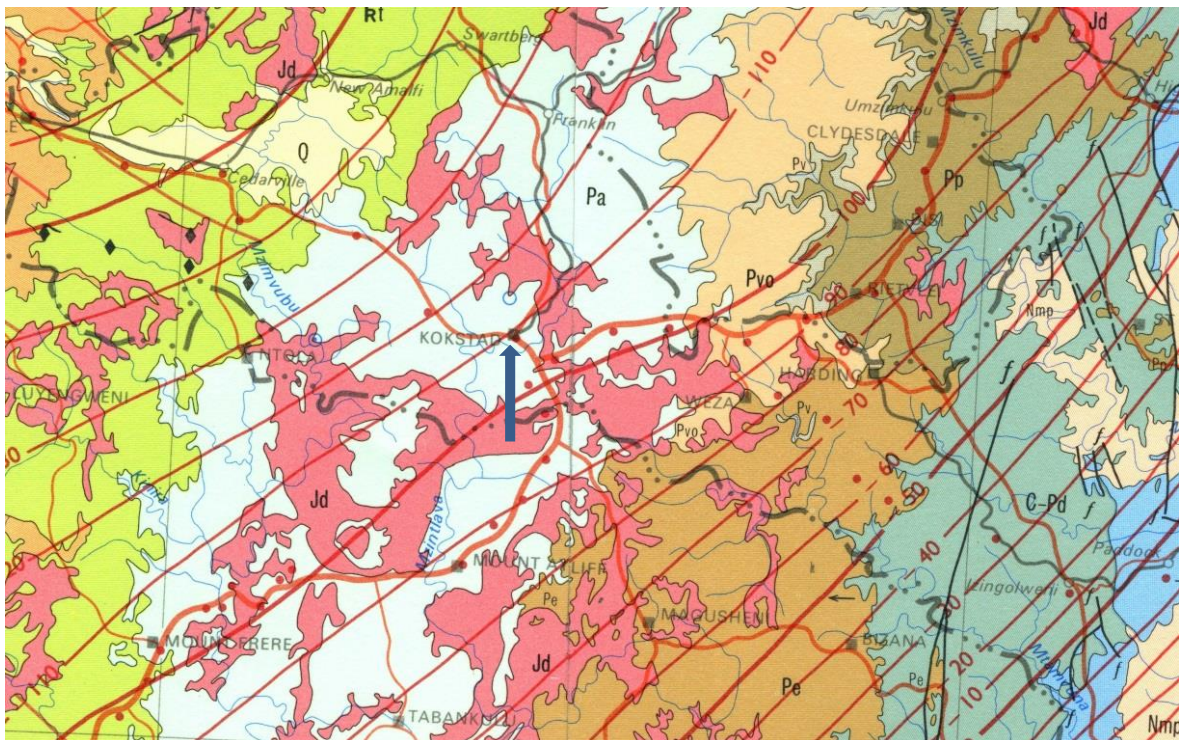


Figure 2. Geological map of the area around Kokstad and is indicated with the arrow. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 2: Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006).

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Tr-T	Tarkastad Subgroup, upper Beaufort Group	Mudstone, sandstone	Early Triassic
Pa	Adelaide Subgroup, lower Beaufort	Mudstone, sandstone	Late Permian
Pvo	Volksrust Fm, Eccca Group	shale	middle Permian
Pv	Vryheid Fm, Early Eccca Group	Sandstone, shale, coal	Early Permian
Pp	Pietermaritzburg Fm, early Eccca Group	Shale	Early Permian
Pe	Eccca Group	shale	Early Permian
C-Pd	Dwyka	Tillite, sandstone, mudstone, shale	Late Carboniferous to Early Permian

Geology

This part of KwaZulu Natal has outcrops of the underlying Adelaide subgroup and overlying Tarkastad subgroup (Beaufort Group) intersected by dolerite dykes that are Jurassic in age. The Adelaide Subgroup comprises mudstones and shales and in the southern and central parts it consists of alternating bluish-grey, greenish-grey or greyish-red mudrocks and grey sandstones. The Tarkstad Subgroup is made up of a greater abundance of both sandstone and red mudstone (Johnston et al., 2006) which represents further drying out of the region. Overall the depositional environment is interpreted to be drier than the Eccca Group, with a change from deltaic to fluvial settings, for example braided streams (Catuneanu et al., 2005). Dolerite dykes are numerous but they do not contain fossils – they tend to destroy any fossils in the immediate vicinity.

Palaeontology

The Adelaide Subgroup commonly has vertebrate fossils, fish remains, invertebrate burrows and non-marine molluscs (Johnson et al., 2006). *Glossopteris* leaves could occur in sediments of this age. Although the Beaufort Group sediments have been extensively surveyed for vertebrate fossils as part of a large project on the biozonation of the Karoo basin (Anderson and Anderson, 1985; Rubidge et al., 1995; van der Walt et al., 2010), no fossils have been recorded from the Kokstad environs.

The Tarkstad Subgroup has both mudstones and sandstones, and these tend to show fining upwards sequences that were formed by flood-basin environments of meandering rivers, respectively. Vertebrate fossils include *Lystrosaurus* and *Cynognathus* (Rubidge et al., 1995) but none has been recorded from here to date.

The SAHRIS palaeosensitivity map for the site indicates both red (highly sensitive) and grey regions (insignificant to zero) for this area. There are, however, no published records of

fossil plants or invertebrates from this area. The site is close to the town and infrastructure and a river/stream which means that the site has been disturbed by human activity as well as naturally by the stream waters. Therefore the surface will be weathered and if any fossils are present they too would be weathered. The excavations for foundations, pipes for sewage and clean water for a residential area are not likely to penetrate more than 2-3m deep. It is unlikely that any fossils, vertebrates or plants, occur in this area.

5. Impact assessment

Using the table below, the impact of this proposed scheme 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

Assessment:

The surface activities would not impact on the fossil heritage as there are no known occurrences of fossils in this area. The IMPACT is nil.

Once excavations for houses, infrastructure, water pipes etc., begin there would be minor deterioration of the site and no impact on people. Therefore the SEVERITY/NATURE of the environmental impact would be L.

DURATION of the impact would be permanent: L.

Since only the possible fossils within the housing area would be affected the SPATIAL SCALE will be localised within the site boundary: L.

Any disturbance would be on the surface and possibly a few metres below the surface. Any fossils that were present are most likely to have been destroyed by previous urban and human activities. Therefore, 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 fluvial Tarkastad and Adelaide Subgroups' rocks and associated sandstones, mudstones and shales are typical of other deposits in the Karoo Basin, so no fossil plants, animals or invertebrates will occur there.

7. Recommendation

While it is possible that fossils could occur in the proposed housing site and infrastructure area, they would not be detected until excavations begin. A site visit is therefore not feasible until such stage.

If fossil material is discovered during the development of the site, then it is strongly recommended that a professional palaeontologist be called to assess the importance and to rescue them if necessary (with the relevant Amafa permit).

If the fossil material is deemed to be of scientific interest then further visits by a professional palaeontologist would be required to collect more material and deposit a representative sample in a recognized institute for further study. No further impact assessment is required at this stage.

8. References

- Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodrumus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.
- Catuneanu, O., Wopfner, H., Eriksson, P.G., Cairncross, B., Rubidge, B.S., Smith, R.M.H., Hancox, P.J. 2005. The Karoo basins of south-central Africa. *Journal of African Earth Sciences* 43, 211–253
- 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.
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- Van der Walt, M., Day, M., Rubidge, B.S., Cooper, A.K., Netterberg, I., 2010. A new GIS based biozone map of the Beaufort Group (Karoo Supergroup), South Africa. *Palaeontologia africana* 45: 1–5.