PALAEONTOLOGICAL SPECIALIST STUDY

In terms of Section 38(8) of the NHRA

Palaeontological Assessments for the Proposed Commercial and Residential Developments on Subdivided Erven within Portion 13 of the Farm Kabeljouws 328, Jeffreys Bay, Kouga Local Municipality

Prepared by

Dewald Wilken

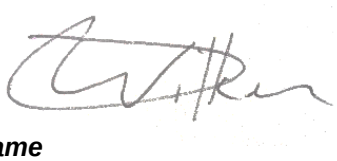
November 2022

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I, **Dewald Wilken**, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 326) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 14 of GN No. R. 326.

Signed



Name

Dewald Wilken

Date
25 November 2022

EXECUTIVE SUMMARY

A palaeontological Impact assessment was requested for the proposed construction of commercial and residential developments on subdivided erven within Portion 13 of the Farm Kabeljouws 328, Jeffreys Bay. A palaeontological impact assessment was conducted 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).

The area is underlain by the Ceres Subgroup of the Bokkeveld Group in the Cape Supergroup, and the Enon Formation of the Uitenhage Group. The Ceres Subgroup is well known for its invertebrate benthic marine fossils. The Ceres Subgroup is marked as very sensitive from a palaeontological point of view. The Enon Formation in not highly fossiliferous. Taking the red clay soil cover, and the extreme weathered state of the rock outcrops found, into account it is, although possible, unlikely that any significant fossils will be found, damaged, or lost. Therefore, the proposed activity may proceed. If any fossil material should be uncovered during bush clearing, the Chance Fossil Find Procedure at the end of this document should be followed.

CONTENTS

1. Introduction

1.1 Background Information on Project

A palaeontological impact assessment was requested for the proposed commercial and residential developments on subdivided erven within Portion 13 of the Farm Kabeljouws 328, Jeffreys Bay. A palaeontological Impact assessment was conducted 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). The screening report for an environmental authorisation as required by the 2014 NEMA EIA regulations indicated the proposed site environmental sensitivity to be very high.

Portion 13 of Kabeljouws 328 farm is located just north of Jeffreys Bay, in the Eastern Cape as seen in Figure 1. The farm is underlain by the Ceres Subgroup of the Bokkeveld Group in the Cape Super Group, and the Enon Formation of the Uitenhage Group.

Figure 1. Google Earth© satellite image of Portion 13 of Kabeljouws 328 farm in relation to Jeffreys Bay, where the commercial and residential development is proposed.

Figure 2. A more detailed photo of Portion 13 of Kabeljouws 328 farm in, where the commercial and residential developments are proposed.

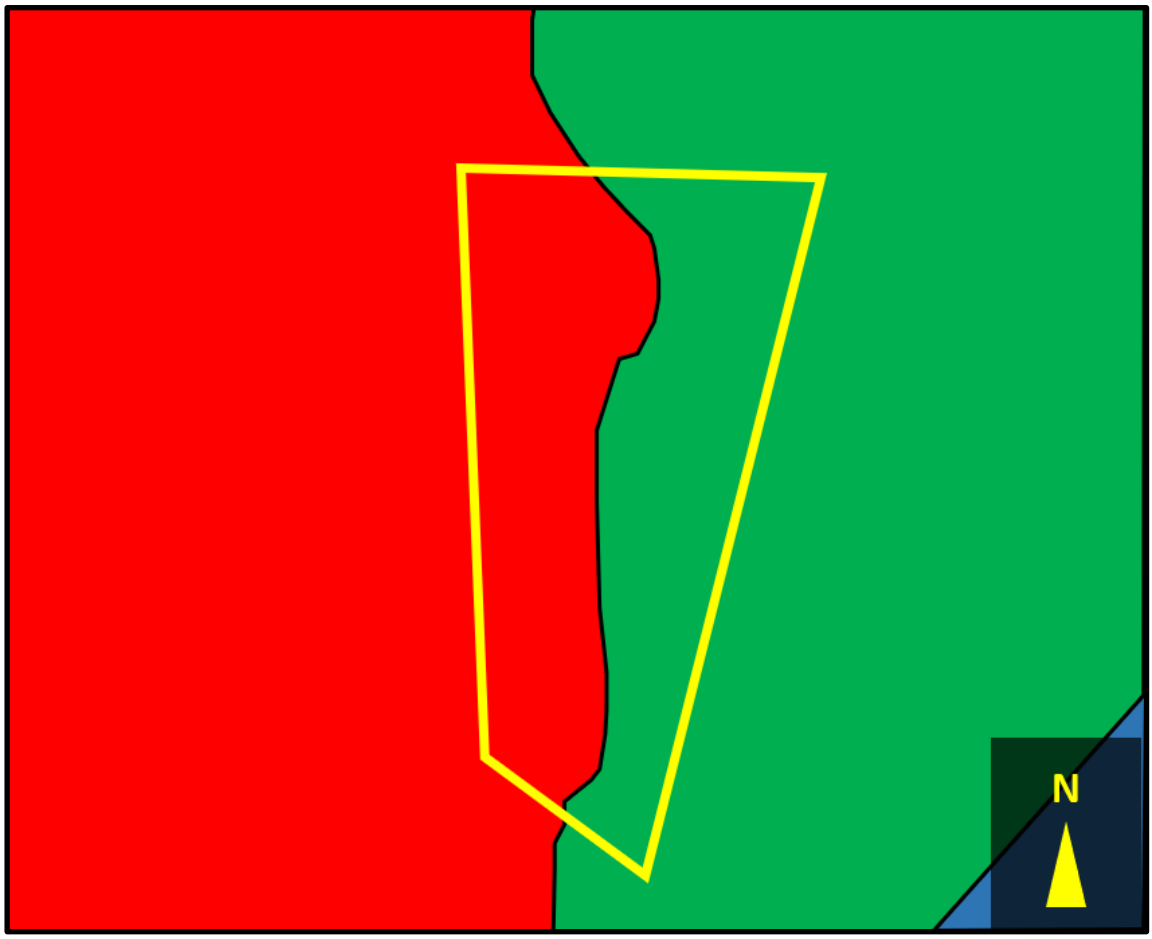


Figure 3. Palaeo-sensitivity Map. Indicating High fossil sensitivity underlying the study area in the Eastern Cape.

2. Study approach

This PIA report provides a record of the inferred palaeontological heritage resources within the study area. The identified resources have been assessed to evaluate their heritage significance in terms of the grading system outlined in Section 3 of the NHRA (Act 25 of 1999). Recommendations for specialist palaeontological mitigation are made where this is considered necessary. The report is based on (1) a review of the relevant scientific literature, including previous palaeontological impact assessments in the broader study region (*e.g.* Almond 2013). (2) published geological maps and accompanying sheet explanations (*e.g.* Toerien, D.K. (1984)). A Site Sensitivity Verification was conducted on 21 November 2022.

3. Geological and Paleontological context of the study area

The following section will provide a basic review of the relevant geology and palaeontology in the study area, as summarised in Table 1. T-Qb and Qw are modern day wind and water derived sediments and is not important for this discussion.

3.1. Uitenhage Group

The Uitenhage Group is an onshore post-Karoo Mesozoic deposit. It was predominantly deposited in a basin formed by Horst and Graben structures which formed during the breakup of Gondwana. This basin also has faults cutting the horst as seen in Figure 4. Simplified block diagram of Algoa Basin showing the floor of the basin, with the Cretaceous and younger sediment removed. 1 - Coega Fault, 2 - Commando Kraal Fault, 3 - Coega Kop. Based on reflective seismic data from Soekor. After Shone 1976.. Smaller deposits of the Uitenhage Group area are also found in Baviaanskloof, Georginda, Vlakteplaas, Oudtshoorn, Plettenberg Bay, Knysna, Herbertsdale-Mossel Bay, Heidelberg-Riversdale, Swellendam and Worcester-Robertson Basins, which are Graben and half-Graben rift basins (Muir et. al. 2017)

The Uitenhage Formation is divided into 3 formations. These are listed from oldest to youngest as the Sundays River Formation, the Kirkwood Formation, and the Enon Formation. For this study only the Enon Formation is of importance.

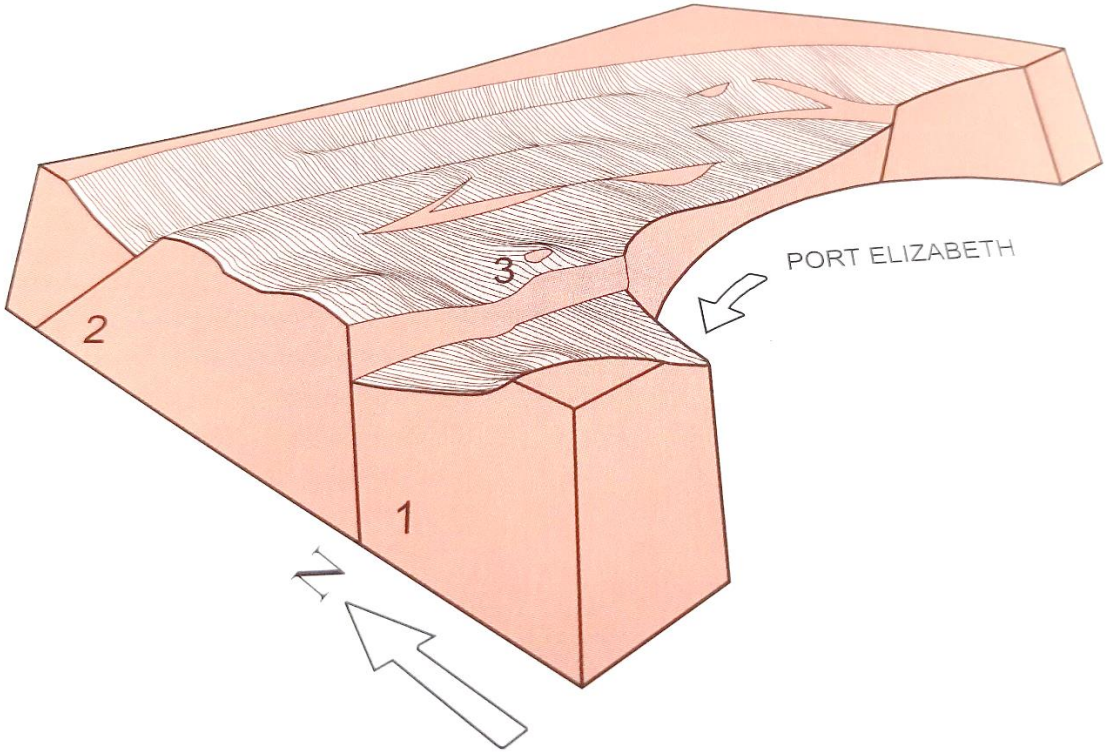


Figure 4. Simplified block diagram of Algoa Basin showing the floor of the basin, with the Cretaceous and younger sediment removed. 1 - Coega Fault, 2 - Commando Kraal Fault, 3 - Coega Kop. Based on reflective seismic data from Soekor. After Shone 1976.

3.1.1 Enon Formation

The Enon Formation formed during the breakup of Gondwana during a time of intense erosion of the rocks that constitute the Cape Fold Belt (Gresse et al. 1992).

The most characteristic feature of the Enon Formation are the conglomerates. The conglomerates consist of large, sub-rounded to rounded clasts of sheared or unsheared quartzite and sometimes slate, shale, and charcoal. Quartzite clasts are generally more rounded whereas the slate and shale clasts are angular. These conglomerate beds are interbedded with subordinate sandstone lenses ranging from white, yellow, red, and green in colour, claystone, and rare mudstone units.
Up to 70% of pebbles in the conglomerate show a preferred imbrication. These pebbles are tightly packed together with a silty/sandy matrix. A red limonitic cement binds these pebbles into a hardened cohesive mass. These conglomerate clasts are often covered in limonite, giving then a red to yellow colour. Loading has caused pebbles to crack, or form indents due to pressure solution at pebble – to – pebble contacts.

Weathering of the conglomerate matrix and cement has caused pebbles to loosen and fall out, forming caves and honeycombing of exposed cliff areas. The silty sandstone lenses in the conglomerate can be about a metre thick and does not have a large lateral extent (but are more extensive in the Gamtoos Basin). These sandstones are often infiltrated with limonite giving them a reddish colour.

Although some disarticulated bone fragments and pieces of charred fossil wood had been found a precise date on the Enon Formation could not be determined. The contact with the overlying Kirkwood Formation is seen as inter-tonguing and gradational, with sandstone in the Kirkwood formation looking very similar to that of the Enon Formation, and thin conglomerates being found within the Kirkwood Formation.

This formation originated in a high energy alluvial fan and low sinuosity river systems (McMillan et all 1997).
Fossils preservation in the formation is poor, with only some disarticulated bone fragments, silicified wood, charcoal and two therapod teeth being found in the Formation.

3.2. Bokkeveld Group

A portion of the area is underlain by the Bokkeveld Group of the Cape Supergroup. The Bokkeveld was formed due to the alternating deposition of fine-grained sand and mud. Some of the earliest work done on the Cape Supergroup was done on the invertebrate fossils of the Bokkeveld. The group attains a maximum thickness of 2200m in the west, and 3500m in the east. This group thins rapidly to the North. The Bokkeveld Group is divided into the upper Bidouw Subgroup and the lower Ceres Subgroup. Only the lower Ceres Subgroup is of interest to this study.

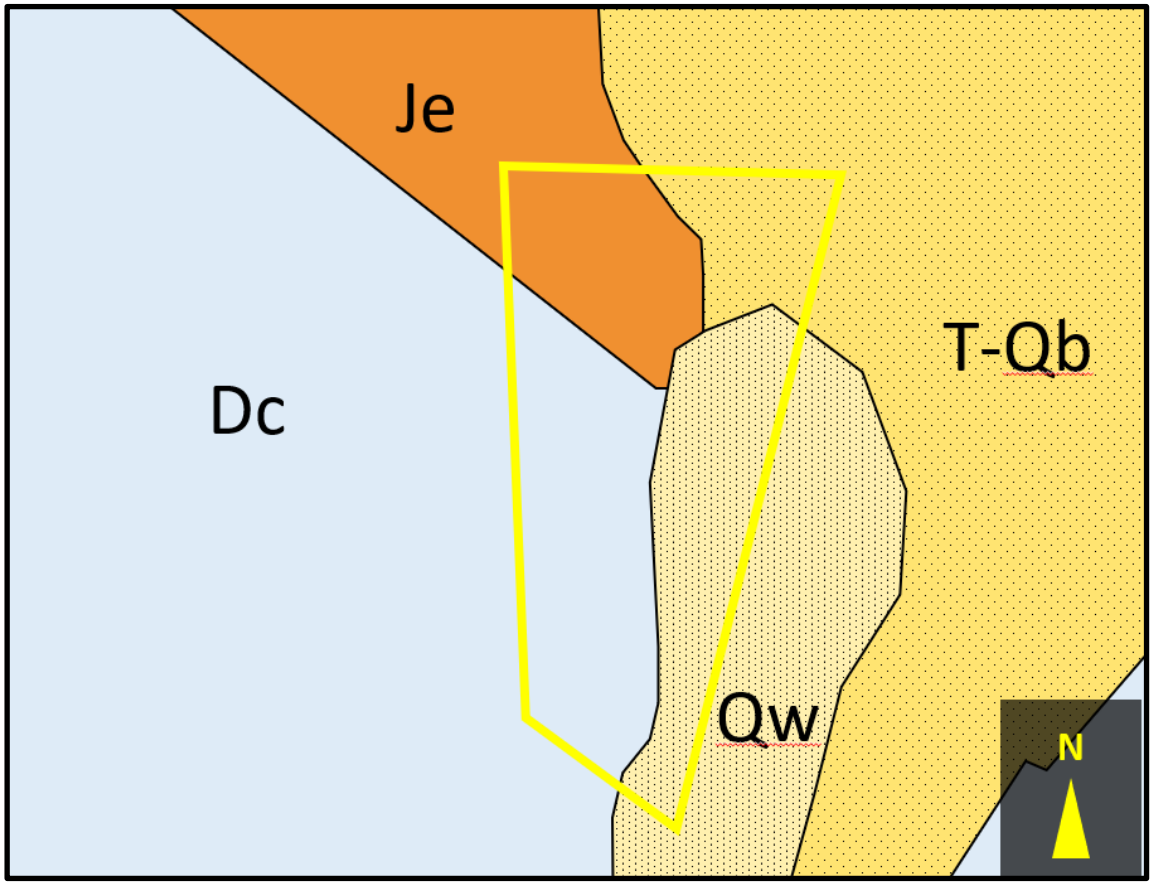


Figure 5. Geologic map of Portion 13 of Kabeljouws 328 farm, where the commercial and residential developments are proposed. Dc – Ceres Formation, Je – Enon Formation T-Qb – Alluvial sheet gravels and sands, Qw – aeolian sands -(Adapted from Toerien, (1984)).

Table 1 Explanation of symbols in Figure 5. All Formations fall within the Ceres Subgroup, in the Bokkeveld Group, of the Cape Supergroup except the Enon Formation of the Uitenhage Group. Thickness in brackets.

Symbol	Group	Subgroup	Formation	Lithology	Palaeontology
Qw				Aeolian sediment	/
T-Qb				Alluvial Sediment	/
JE	Uitenhage	-	Enon	Conglomerate, subordinate sandstone, mudstone	Silicified wood, charcoal fragments, abraded bone fragments, two theropod dinosaur teeth
Db	Bokkeveld	Ceres (Dc)	Boplaas (100)	Sandstone	Delta front, shallow marine
Dt			Tra-Tra (350)	Mudstone, Siltstone	Offshore shelf, prodelta slope
Dh			Hex Rivier (60)	Sandstone	Delta front, shallow marine
Dv			Voorstehoek (300)	Mudstone, Siltstone	Offshore shelf, prodelta slope
Dga			Gamka (200)	Sandstone	Delta front, shallow marine
Dg			Gydo (600)	Mudstone, Siltstone	Offshore shelf, prodelta slope

3.2.1. Ceres Subgroup (Lower Bokkeveld Group)

The Ceres Subgroup was deposited during the Early to Middle Devonian (140 to 390 Ma), in a shallow to moderately deep continental shelf setting. During the time of deposition, the Cape basin was situated at over 70° S and was slowly moving towards the southern palaeo-pole. The clay-rich sediments of the lower Ceres Subgroup have often suffered extensive cleavage formation in the Humansdorp – Patensie area (Haughton et al. 1937) and deep Tertiary-age chemical weathering is also evident here (Almond 2013).

The Lower Bokkeveld succession here is unvaried, consisting mostly of grey-green mudrocks with few sandstone interbeds. It is often deeply weathered to the point that the original bedding is often obscure. They display a pervasive, steeply-dipping to subvertical platy cleavage with a regional NW-SE strike (parallel to the anticlinal axis). A later crenulation cleavage is developed locally (Almond 2013). The Bokkeveld bedrocks are commonly covered in brick red terra rossa-type soils, locally gravelly, beneath less ferruginous, brownish modern soils.

The Ceres Subgroup range from 625m to 1700m from west to east. It contains 3 upward-coarsening cycles (Divided into 6 Formations). These cycles can be recognised across the entire Bokkeveld Basin.

Th 6 Formations are generally grouped together as a single stratigraphic unit (Dc) on the published 1: 250 000 geology map of the Port Elizabeth region, due to poor exposure and locally intense folding towards the eastern end of the Cape Fold Belt (Toerien and Hill 1989).
The lower cycle is represented by the Gydo and Gamka Formation, these are followed by the Voorstehoek and Tra-Tra (middle cycle) and Boplaas Formation (upper cycle).

The Ceres subgroup is characterised by abundant marine benthic invertebrate fossils. These include brachiopods (Figure 6), Bivalves, , crinoids (Figure 7) trilobites (Figure 8), cephalopods, ophiutoids (Figure 9), hyoliths, cricoconarids, corals, and gastropods. These are mostly found in mudrock. However, some brachiopod species are common in the sandstones.

The Gydo, Gamka, and Voorstehoek Formations represent the “brachiopod assemblage zone” of Theron (1972). The Hex Rivier represents the Mutationella Range Zone. Extensive bioturbation of Planolites, Skolithos, Arenicolites and other trace fossils are also present. Plant remains are found in the sandstones.

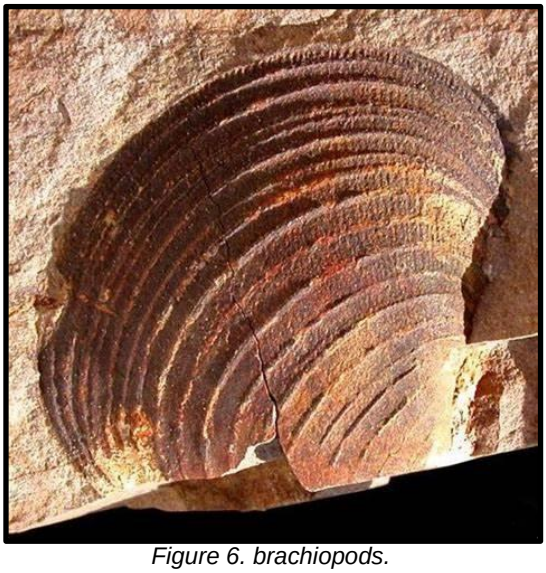


Figure 6. brachiopods.

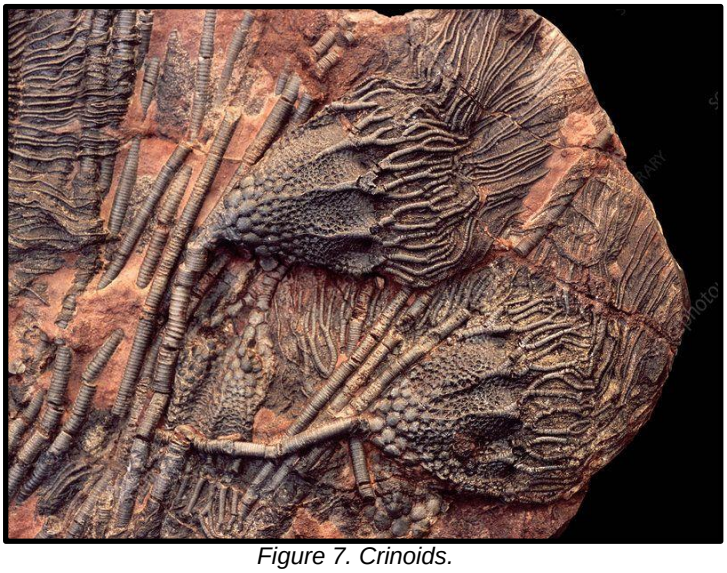


Figure 7. Crinoids.

Figure 8. Trilobite.

Figure 9. Ophiutoids.

4. Assessment of Impact of the Development

The area is underlain by the Enon Formation of the Uitenhage Group and the Ceres Subgroup of the Bokkeveld Group in the Cape Supergroup. The Enon Formation is not highly fossiliferous. The Ceres Subgroup is well known for its invertebrate benthic marine fossils. The Ceres Subgroup is marked as very sensitive from a palaeontological point of view. Taking the thickness of the red clay soil cover and the extreme weathered state of the rock outcrops found into account (Figure 11), it is, although possible, unlikely that any significant fossils will be found, damaged, or lost during construction of the proposed commercial and residential developments.

Figure 10. modern concretised shell gravel (Geo-Pick for scale).

Figure 11. Highly weathered Enon conglomerate. (Geo-Pick for scale)

Figure 12. Photo looking north over the site. Note lack of solid outcrop

Figure 13. Photo of site looking west. Jeffreys Bay to the left in the background.

Table 2. Impact Assessment Criteria pre and post Mitigation

	Pre-Mitigation		Post-Mitigation	
Criteria	**Category**	**Explanation**	**Category**	**Explanation**
Overall Nature	***Slightly Negative***	Fossil find is highly unlikely	**Slightly Negative**	Fossil find is highly unlikely
Type	***Direct***	The development will directly impact these resources	***Direct***	The development will directly impact these resources
Extent	***Site***	Impact is limited to the site footprint	***Site***	Impact is limited to the site footprint
Duration	***Short term***	Only during Construction	***Short term t***	Only during Construction
Severity	***Negative***	Fossil find is highly unlikely	***Negative***	Fossil find is highly unlikely
Reversibility	***Completely reversable***	If Fossil Find procedure is followed in case of fossil find.	***Completely reversable***	If Fossil Find procedure is followed in case of fossil find.
Irreplaceable Loss	***Resources may be partially destroyed.***	Fossil find is highly unlikely. Impact will remain negligible if the Chance Fossil Find Procedure is followed in the case of any fossil finds.	***Resources may be partially destroyed.***	Fossil find is highly unlikely. Impact will remain negligible if the Chance Fossil Find Procedure is followed in the case of any fossil finds.
Probability	***Unlikely***	Fossil find is highly unlikely	***Unlikely***	Fossil find is highly unlikely
Mitigation Potential	***High***	If the Chance Fossil Find Procedure is followed in the case of any fossil finds.	***High***	If the Chance Fossil Find Procedure is followed in the case of any fossil finds.
Impact Significance	***Negligible***	Fossil find is highly unlikely	***Negligible***	Fossil find is highly unlikely
Overall significance	***Low***		***Low***	

5. Assumptions and Uncertainties

Based on the palaeontological record and the geology of the area, it is known that the Ceres Subgroup is rich in invertebrate benthic marine fossils and trace fossils. The area under investigation is covered by a red clay layer, and the small outcrops of mudstone found are highly and deeply weathered. Therefore, the chance of finding significant fossils is possible, but small.

6. Conclusion and Recommendations

The area is underlain by the Ceres Subgroup of the Bokkeveld Group in the Cape Supergroup and the Enon Formation of the Uitenhage Group. The Ceres Subgroup is well known for its invertebrate benthic marine fossils. The Ceres Subgroup is marked as very sensitive from a palaeontological point of view. The Enon Formation is not highly fossiliferous.
Taking the red clay soil cover and the extreme weathered state of the rock outcrops found into account it is, although possible, unlikely that any significant fossils will be found, damaged, or lost. Construction of the proposed commercial and residential developments may proceed. If any fossil material should be uncovered during excavation, the Chance Fossil Find Procedure at the end of this document should be followed.

Should important new fossil remains be found the finder should alert ECPHRA (*i.e.* The Eastern Cape Provincial Heritage Resources Authority. Contact details: Ms. Ayanda MaMncwabe Mama 74 Alexander Road, King Williams Town 5600; amncwabe@gmail.com) as soon as possible. This is so that appropriate action can be taken in good time by a professional palaeontologist at the developer's expense. Palaeontological mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy). The palaeontologist concerned with mitigation work will need a valid fossil collection permit from ECPHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013). These recommendations are summarised in tabular form in Appendix 1 (Chance Fossil Finds Procedure) and should be incorporated into the Environmental Management Programme (EMPr) for the proposed development.

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Appendix 1

Chance Fossil Finds Procedure

(Adopted from the HWC Chance Fossils Finds Procedure: June 2016)

Introduction

This document is aimed to inform workmen and foremen working on a construction and/or mining site. It describes the procedure to follow in instances of accidental discovery of palaeontological material (please see attached poster with descriptions of palaeontological material) during construction/mining activities. This protocol does not apply to resources already identified under an assessment undertaken under s. 38 of the National Heritage Resources Act (no 25 of 1999).

Fossils are rare and irreplaceable. Fossils tell us about the environmental conditions that existed in a specific geographical area millions of years ago. As heritage resources that inform us of the history of a place, fossils are public property that the State is required to manage and conserve on behalf of all the citizens of South Africa. Fossils are therefore protected by the National Heritage Resources Act and are the property of the State. Ideally, a qualified person should be responsible for the recovery of fossils noticed during construction/mining to ensure that all relevant contextual information is recorded.

Heritage Authorities often rely on workmen and foremen to report finds, and thereby contribute to our knowledge of South Africa's past and contribute to its conservation for future generations.

Training

Workmen and foremen need to be trained in the procedure to follow in instances of accidental discovery of fossil material, in a similar way to the Health and Safety protocol. A brief introduction to the process to follow in the event of possible accidental discovery of fossils should be conducted by the designated Environmental Control Officer (ECO) for the project, or the foreman or site agent in the absence of the ECO It is recommended that copies of the attached poster and procedure are printed out and displayed at the site office so that workmen may familiarise themselves with them and are thereby prepared in the event that accidental discovery of fossil material takes place.

Actions to be taken

One person in the staff must be identified and appointed as responsible for the implementation of the attached protocol in instances of accidental fossil discovery and must report to the ECO or site agent. If the ECO or site agent is not present on site, then the responsible person on site should follow the protocol correctly in order to not jeopardize the conservation and well-being of the fossil material. Once a workman notices possible fossil material, he/she should report this to the ECO or site agent.

Procedure to follow if it is likely that the material identified is a fossil:

- The ECO or site agent must ensure that all work ceases immediately in the vicinity of the area where the fossil or fossils have been found;
- The ECO or site agent must inform SAHRA of the find immediately. This information must include photographs of the findings and GPS co-ordinates;
- The ECO or site agent must compile a Preliminary Report and fill in the attached Fossil Discoveries: Preliminary Record Form within 24 hours without removing the fossil from its original position. The Preliminary Report records basic information about the find including:
    - The date
    - A description of the discovery
    - A description of the fossil and its context (e.g. position and depth of find)
    - Where and how the find has been stored
    - Photographs to accompany the preliminary report (the more the better):
    - A scale must be used
    - Photos of location from several angles
    - Photos of vertical section should be provided
    - Digital images of hole showing vertical section (side);
    - Digital images of fossil or fossils.

Upon receipt of this Preliminary Report, SAHRA will inform the ECO or site agent whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- Exposed finds must be stabilised where they are unstable and the site capped, e.g., with a plastic sheet or sandbags. This protection should allow for the later excavation of the finds with due scientific care and diligence. SAHRA can advise on the most appropriate method for stabilisation.
- If the find cannot be stabilised, the fossil may be collected with extreme care by the ECO or the site agent and put aside and protected until SAHRA advises on further action. Finds collected in this way must be safely and securely stored in tissue paper and an appropriate box. Care must be taken to remove all the fossil material and any breakage of fossil material must be avoided at all costs.

No work may continue in the vicinity of the find until SAHRA has indicated, in writing, that it is appropriate to proceed.

FOSSIL DISCOVERIES: PRELIMINARY RECORDING FORM		
Name of project:		
Name of fossil location:		
Date of discovery:		
Description of situation in which the fossil was found:		
Description of context in which the fossil was found:		
Description and condition of fossil identified:		
GPS coordinates:	Lat:	Long:
If no co-ordinates available then please describe the location:		
Time of discovery:		
Depth of find in hole		
Photographs (tick as appropriate and indicate number of the photograph)	Digital image of vertical section (side)	
	Fossil from different angles	
	Wider context of the find	
Wider context of the find. Temporary storage (where it is located and how it is conserved)		
Person identifying the fossil Name:		
Contact:		
Recorder Name:		
Contact:		
Photographer Name:		
Contact:		