DESKTOP PALAEONTOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED UMLAAS PETRO PORT LOCATED ON ERF 34, UMLAAS ROAD, MKHAMBATHINI LOCAL MUNICIPALITY, CAMPERDOWN, KWAZULU-NATAL

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Declaration of Consultants independence

I, Gary Trower, am an independent consultant and have no business, financial, personal or other interest in the proposed development project in respect of which I was appointed to do a palaeontological assessment other than fair remuneration for work performed. There are no circumstances whatsoever that compromise the objectivity of this specialist performing such work.

Gary Trower

Introduction

This desktop study relates to a proposed project to develop a piece of land through the establishment of a petro port on Erf 34, Umlaas Road, Mkhambathini Local Municipality, Camperdown (Figure 1 & 2) The site is located to the west of Camperdown, adjacent to the N3 highway on a patch of land comprising degraded grassland. The proposed development is situated within an area where the underlying geology is given a moderate palaeo-sensitivity rating on the SAHRIS map (www.sahra.org.za/sahris/map/palaeo), and these deposits may contain some palaeontological material. A desktop palaeontological assessment was thus necessary to evaluate the likelihood of fossil material being present within the boundaries of the proposed development, and to evaluate whether any further palaeontological assessment is required.

In terms of the National Environmental Management Act 107 of 1998 and Section 38 (8) of the National Heritage Resources Act 25 of 1999 (sections 34-36), all aspects of heritage are protected. Proposed developments that are likely to impact on heritage resources (i.e. historical, archaeological, palaeontological & cosmological) require a desktop and/or field assessment to gauge the importance of such resources in order to ensure that such sites are not damaged or destroyed by developments which could negatively impact them. Identified heritage resources should be recorded through detailed documentation, mitigation measures applied if resources are threatened, or collection and/or a rescue excavation carried out if necessary.

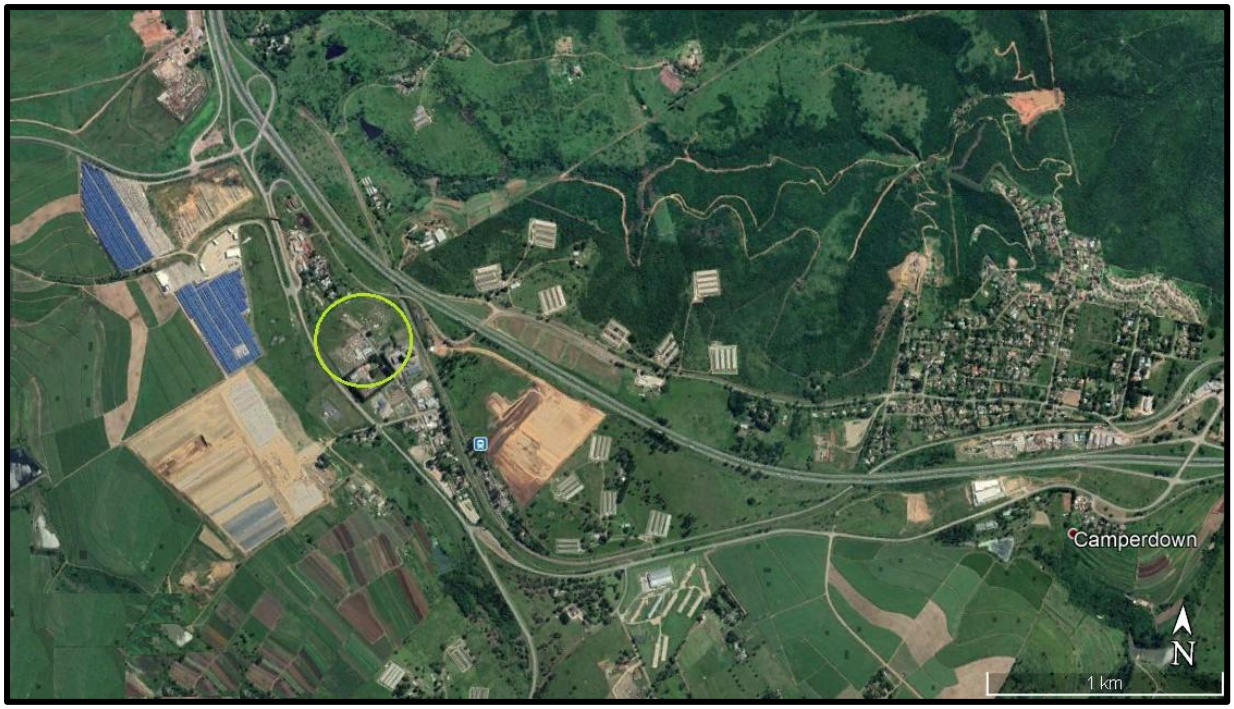

Figure 1: Satellite image showing the location of the site footprint within the regional landscape (indicated by the lime green circle), situated to the west of Camperdown and adjacent to the N3 highway. Modified from Google Earth, AfriGIS 2021

Figure 2: Satellite image showing a close-up view of the location of the site footprint (indicated by the lime green circle). As can be seen in the image, the area comprises of disturbed grassland with gravel and sand access roads. Modified from Google Earth, AfriGIS 2021

Geology

Rocks of the Karoo Basin are rich repositories for palaeontological material, necessitating measures to minimize activities which may disturb or destroy fossils preserved in underlying beds. The geology in the area of the proposed development consists of Carboniferous and early Permian deposits of the Dwyka Group. This sedimentary package accumulated as the basal deposits within a giant inland sea and comprises of diamictite, subordinate varved shale and boulder shale (Figure 3). These deposits form an important component and subdivision of the stratigraphy of the Karoo Supergroup, an extensive inland basin which preserves a rich array of fossil plants, insects, fish and tetrapod fauna which existed through the Permian and Triassic of southern Gondwana (Rubidge 2005, Smith *et al*. 1993). The existence of a depositional environment in this palaeo-landscape means that fossil lifeforms which flourished during the Carboniferous and early Permian may be present within this geological unit, and this is also the reason why it has a moderate palaeo-sensitivity rating of green (Figure 4).

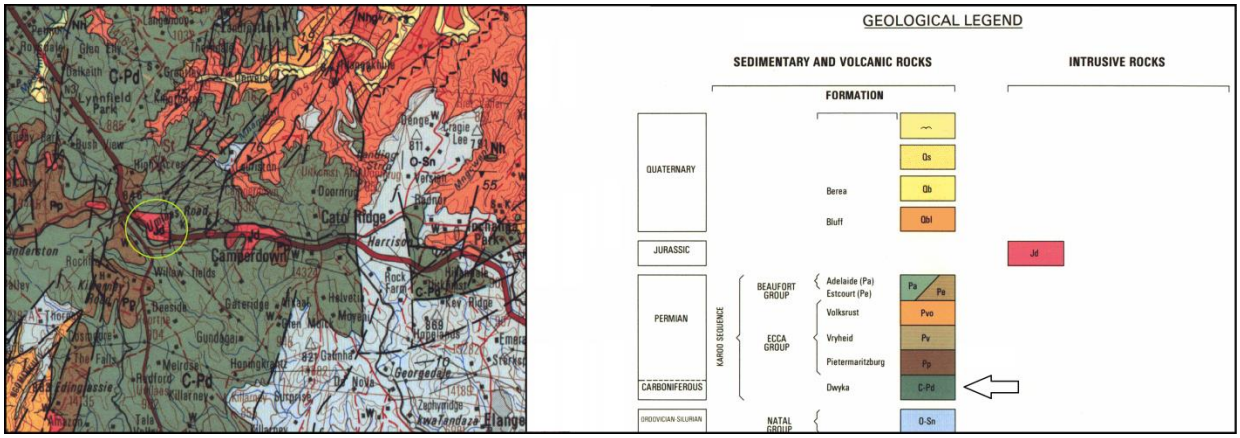

Figure 3: Map showing the geology of the region, where the proposed development will take place on top of Carboniferous to early Permian-aged deposits. These rocks form part of the Dwyka Formation (dark green), and within the site footprint are bordered by dolerite (red). Modified from 2930 Durban, 1:250 000 Geological Series, Council for Geoscience, 1988)

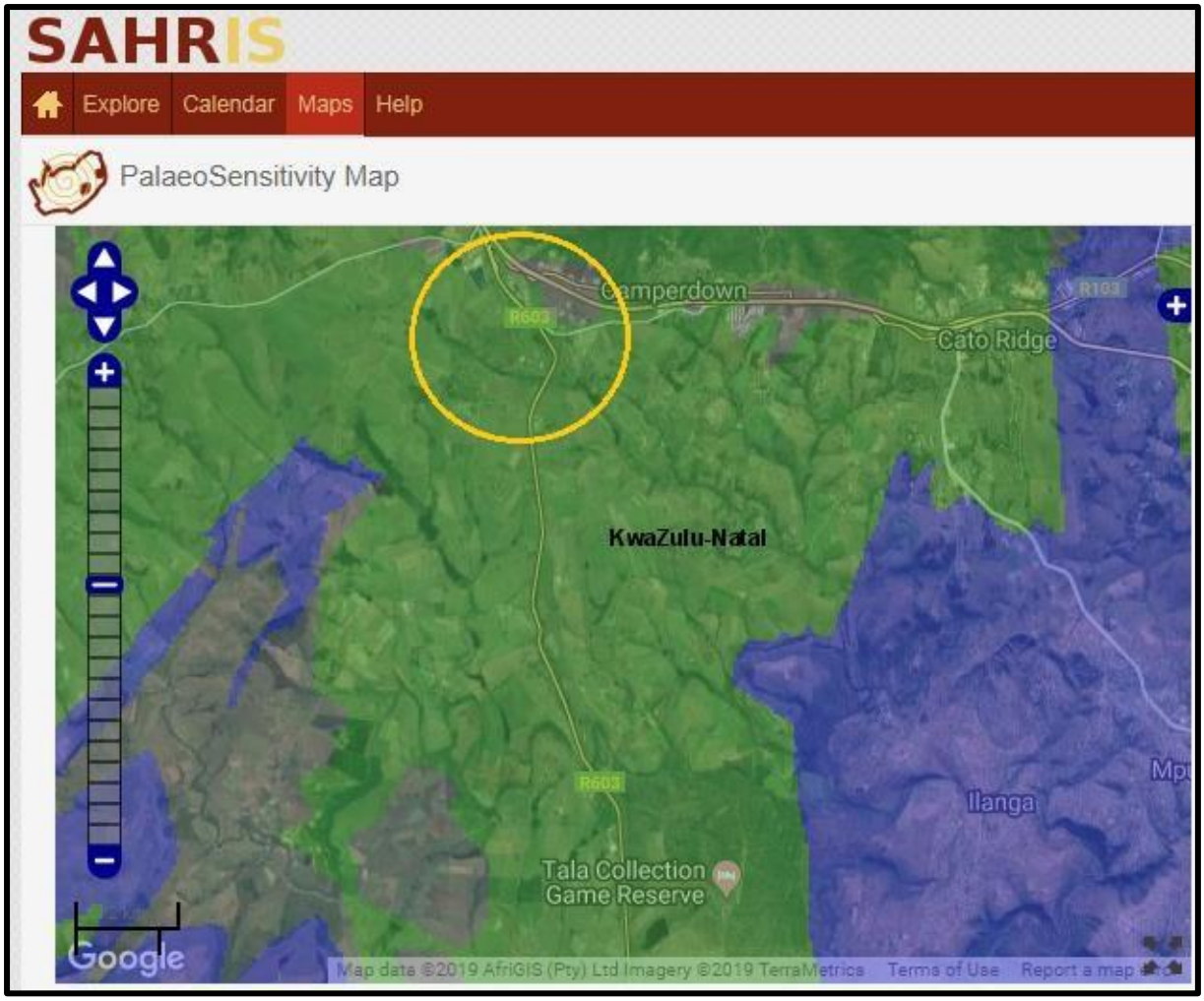

Figure 4: Map of how the geology in Fig.3 translates into palaeo-sensitivity. The geological unit which occurs beneath the site footprint has a ranking of green and corresponds to the Dwyka Formation, a rock type which forms the base of the Karoo Basin and has a low likelihood of significant fossil occurrences. The grey patches represent dolerite, an intrusive igneous rock type which has a zero palaeo-sensitivity rating and which (by its nature) has the potential to damage or destroy fossils preserved in adjacent fossiliferous beds. Modified from the SAHRIS map, www.sahra.org.za/sahris/map/palaeo

Site observations

An aerial survey of the study site was carried out using Google Earth, Google Street Maps, the relevant geology map of the area (2930 Durban) and the SAHRIS palaeo-sensitivity map. These were all used in combination to gain an understanding of the site features, as well as the underlying bedrock within the site footprint and how it ranked in terms of possible fossil occurrences.

The site footprint is located approximately 3 kilometres west of Camperdown, adjacent to the N3 highway at GPS coordinates 29º 43' 35" S, 30º 30' 09" E (Figure 1 & 2). The site consists of an open field of grassland with sand and gravel roads, and patches of cleared land. It occurs on a moderately-sensitive strip of the Dwyka Formation (Figure 3 & 4) and this geological unit is given a palaeo-sensitivity rating of green on the SAHRIS map. The likelihood of there being fossils present in this geological unit are very low as it forms the base of the Karoo Basin and these rocks were deposited under very cold, abrasive conditions (e.g. melting glaciers) where the chances of fossilization are greatly reduced. Furthermore the site occurs on a contact zone between the Dwyka Formation and intrusive lavas, where the extreme heat and pressure from the lava would have likely damaged or destroyed any potential fossils that may have been present close to the contact zone.

Several Stone Age sites occur in the greater area (ESA, ESA-MSA transition, MSA and LSA) as well as Iron Age sites (Prins 2021), therefore pottery fragments may be scattered about in the landscape and stone tools may also be present but these will mostly be out of context surface finds. Although possible, Quaternary fossils are unlikely to be preserved adjacent to the streams and rivers crossing through the region as the soil chemistry is generally unsuitable for Pleistocene fossil preservation.

To better evaluate the site, the table below summarizes the palaeontological impact significance at the site.

Assessing Impact Significance

Criteria	without mitigation	with mitigation
Extent/spatial scale of impact	local	local
Duration of impact	permanent	permanent
Intensity/severity of impact	low	low
Probability of impact	improbable	improbable
Consequence	low	low
Confidence	high	high
Significance	very low	very low
Reversibility	irreversible	
Loss of resource	low	
Mitigation potential	none	

Identified heritage resources (NHRA status)

Formal protections	
National Heritage site (Section 27)	none
Provincial Heritage site (Section 27)	none
Provisional Protection (Section 29)	none
Place listed in heritage register (Section 30)	none
General protections	
Palaeontological site or material (Section 35)	none

Contingency plan for possible palaeontological discoveries:

CHANCE FIND PROTOCOL

Based on the work of Almond *et al*. (2009) and Groenewald *et al*. (2014) and summarised on the SAHRIS website (www.sahra.org.za/sahris/map/palaeo), if a development occurs within a

red zone a desktop study is required, as well as a phase 1 Palaeontological Impact Assessment (PIA) comprising a field survey and recording of fossils. A phase 2 PIA is also required, which entails the rescue of fossil material during construction activities, as well as the compulsory application for a collection and destruction permit. If the development occurs in an orange zone, a desktop survey as well as a phase 1 PIA comprising of a field survey and collection of fossils is compulsory. A prior application for a collection permit is therefore recommended and a phase 2 PIA may be necessary during the construction phase of the project. If the development occurs in a green zone, a desktop survey as well as phase 1 PIA comprising a field survey is recommended. Lastly developments which occur in a blue or grey zone may require a desktop survey, based on the known heritage sites in the area as well as the nature of surrounding geological units.

The normal procedure for recovering palaeontological material would be to identify areas which show investigative potential through a concentration of fossils and whose recovery and preparation could address certain scientific questions. The process would then entail obtaining permission from the landowner/s and applying to SAHRA (South African Heritage Resources Agency) or another provincial heritage agency for a collection permit to excavate or remove blocks of bedrock for preparation in the lab. This is a slow and time-consuming process which requires the skills of a field archaeologist/palaeontologist to spot worthy material within geological/stratigraphic exposures, and skilled fossil excavators and/or preparators who can successfully recover fossils from sediment or slabs of bedrock.

But in the case of developments fossils may be exposed which were not being targeted as a part of a formal scientific investigation, which then requires intervention to ensure that such heritage resources are documented and evaluated, and possibly recovered. In this way, construction activities can provide an opportunity for scientists in that sediments or bedrock

and other heritage related material will be exposed which otherwise would have gone unnoticed as it was hidden from view and would have been costly to excavate.

Heritage consultants such as palaeontologists are required to evaluate proposed development sites in the hope of recording and/or recovering important objects and artefacts before they are damaged or destroyed, but during the entire timeline of a project a PIA consultant is generally only on site for a few hours. Having a palaeontologist on site to examine every scoop of a back actor/JCB would be very costly and impractical, so additional site visits may be required for certain large-scale projects, or developments in highly sensitive areas. If fossils are unearthed during the rest of the project timeline when no palaeontologist is on site, they may be difficult for the on-site layman to identify as many geological formations superficially resemble palaeontological material. Pseudo-fossils and certain mineral deposits often form into a variety of shapes which may closely resemble plant and animal fossils, making it more difficult for laypersons to positively identify chance finds in the field. With certain projects it is therefore recommended that training be provided to on-site staff on fossil identification in order to increase the chances of observing palaeontological material that may be present within the boundaries of the site footprint.

It is not the responsibility of site workers to keep an eye out for heritage objects neither are they likely to have had the appropriate training on what to look for, but they are on the ground witnessing and observing. This is a helpful tool when there is a flow of information from on-site staff to management and protocol dictates that you convey when something unusual or out of the ordinary is observed during work operations. The probability of on-site foremen or construction workers operating heavy earth moving equipment and working to a strict time schedule spotting heritage objects amongst tons of bedrock or sediment is unlikely but nonetheless possible, especially after having received basic training on what to look out for. In South Africa and around the world many important archaeological and

palaeontological discoveries have been made during construction projects, and companies and individuals can play their part by following the law and making the effort to report heritage resources which have been unearthed during digging operations. In so doing, developers can improve their public image and potentially contribute to a rare fossil or object reaching a museum or tertiary institution where it can studied and eventually displayed to the public as heritage belongs to the entire nation and should be preserved as best as possible.

If by chance fossils or any other heritage-related material were to be discovered which was not anticipated in this desktop report, construction would need to cease immediately and a protocol should be followed whereby the relevant provincial or national heritage custodians in the relevant province would need to be informed. Developers would also need to acquire the services of a suitably qualified palaeontologist to rank the significance of the discoveries. If anything relevant is observed, mitigation measures may be necessary and an application for a collection permit may be required. A site visit (Phase 1) may be necessary so that scientists can be given the opportunity to record and/or recover fossil material if it is ranked as significant and likely to make a positive contribution to the field of science.

Assumptions and limitations

According to the amended 2017 EIA regulations, various assumptions and limitations need to be stated when reporting on proposed developments. A key assumption for this report is that the kml/kmz file sent to the heritage specialist accurately conveys the layout and nature of the development, which is not always the case as plans are often revised; because the site layout has not been accurately drawn in Google Earth; or lastly because the developers have understated and downplayed the degree, severity, nature or extent of the development so as to make it seem less impactful to the environment. A further assumption is that the geological maps used in this assessment are accurate and up to date, which may not be the case as there

is a continuous refinement and revision of the geological model through new scientific research, some of which may still need to become incorporated into available maps.

A limitation with large scale maps (1:250 000) is that smaller outcrops of fossiliferous bedrock may not be indicated within the represented geological model. In addition, several potentially fossiliferous outcrops may have been weathered and eroded over millennia, buried under younger deposits such as alluvial and colluvial sediments, or capped by topsoil. Palaeontologically-sensitive bedrock may have also been metamorphosed through its contact with intrusive lavas, damaging or destroying fossil specimens along the contact zone.

The professional opinion given in this PIA report is based on the results of a thorough desktop study which was used to gauge the fossiliferous potential of the bedrock likely to be exposed during the proposed development, and the impact significance. This process involved careful scrutiny of the best available maps and data sets and all attempts were made to take a holistic, informed decision. Yet in spite of this, it is possible that fossils may be present somewhere along the route of the proposed development but are not regarded as significant enough to warrant a site visit. Moreover, certain predictions about the likelihood of encountering fossils was based on all available evidence and may prove to be less or more likely than anticipated.

As a general rule direct field observations are the best method to gauge the degree to which palaeontological material may be present on site, whether eroding out or visible on the surface. As many developments require a degree of digging down into the soil and/or underlying stratigraphy, fossils will be hidden from view due to their buried nature and will only be exposed by the action of a back-actor or once they have started eroding out from the stratigraphy they are preserved in.

Lastly, it is assumed that the developers will respect the guidelines set out in the laws of South Africa with regards to good environmental management practices and policies, and will immediately cease all construction if any fossiliferous material is discovered. It is also assumed that developers will practice integrity and embrace an unwavering mind-set with regards to respecting and protecting all aspects of heritage, including due consideration for the fact that such objects cannot simply be sacrificed to meet project deadlines.

Conclusion and recommendations

The proposed development is likely to have no impact on palaeontological resources. No further palaeontological investigation is required and the project can proceed as planned. The rock outcrops which occur beneath the site footprint are moderately-sensitive deposits, comprising Dwyka rocks which have a low possibility of containing highly significant fossil material. Furthermore, the presence of dolerite on the north-eastern edge of the site footprint further reduces the likelihood of locating undamaged fossil material. However, if any palaeontological or heritage-related material were to be unearthed during construction activities developers are reminded that according to the National Heritage Resources Act 1999 (Act No. 25) and KwaZulu-Natal Heritage Act 2008 (Act No. 4), work should immediately cease and the **Chance Find Protocol** outlined above should be followed to ensure that developments comply with the law, and to ensure that a rare object/fossil stands a good chance of being recorded and/or relocated before being damaged or destroyed by active developments which endanger them.

References

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7) Smith, R.M.H., Eriksson, P.G. and Botha, W.J. 1993. A review of the stratigraphy and sedimentary environments of the Karoo-aged basins of Southern Africa. *Journal of African Sciences 16*: 143-169