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ARCHAEOLOGICAL FOOTPRINTS (PTY) LTD

HERITAGE & PALEONTOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF NEW LOCAL ROAD 3392 (UGOMBA) (KM 0.00-KM2.99)

MAY 2020

HANSLAB ENVIRONMENTAL CONSULTANTS (PTY) LTD

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AUTHOR'S CREDENTIALS

The report was authored by Mr. Roy Muroyi (Archaeologist) and Dr. Heidi Fourie (Palaeontologist).A holder of an Honors Degree, Archaeology, Cultural Heritage and Museum Studies (Midlands State University) an MSc Archaeology Degree candidate at the University of Witwatersrand, he attended further training as a Laboratory Specialist for Human anatomy and human skeletal analysis through the University of Cape-Town human biology department in-conjunction with Cape Archaeological Surveys. Mr Muroyi has over six years industry experience , after leaving the Department of National Museums and Monuments of Botswana where he worked as an Archaeological Impact assessments adjudicating officer Mr . Muroyi then moved to South Africa where has been involved in a range of Cultural Resources Management (CRM) projects. He has so far exhumed over 500 historical burials as a professional archaeologist and carried out over 50 Heritage Impact Assessments.

Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. At present she is curator of a large fossil invertebrate collection, Therapsids, dinosaurs, amphibia, fish, reptiles, and plants at Ditsong: National Museum of Natural History. For the past 13 years she carried out field work in the North West, Western Cape, Northern Cape, Eastern Cape, Limpopo, Mpumalanga, Gauteng and Free State Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 25 years.

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DOCUMENT INFORMATION

DOCUMENT INFORMATION ITEM	DESCRIPTION
Proposed development and location	Construction of new Local Road 3392 (UGOMBA) (KM0.00 – KM2.99)
Purpose of the study	To carry out a Heritage Impact Assessment to determine the presence/absence of cultural heritage and paleontological sites and the impact of the proposed road construction
Topography	The general topography of the area can be classified as flat for the alignment. This will pose a challenge in the design of the stormwater management measures.
Municipalities	Escourt / uThukela District Municipalities, Kwazulu Natal Province
Applicant	KwaZulu-Natal Department of Transport (KZN DoT).
Reference No.	C237/1500/S/1
EAP	Hanslab Environmental Consultants 1 Sugar Close Umhlanga Ridge Umhlanga, 4139
Heritage Consultant	Tsimba Archaeological Footprints (Pty) Ltd 24 Lawson Mansions 74Loveday Street, Johannesburg, CBD Gauteng, 2000
Author (s)	Mr. Roy Muroyi (Archaeology and Heritage Specialist) Dr. Heidi Fourie (Paleontologist)

EXECUTIVE SUMMARY

This report contains a comprehensive archaeological/heritage and paleontological impact assessment investigation in accordance with the National Heritage Resources Act (Act No. 25 of 1999) (NHRA), and the KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No 5 of 2018) The report focuses on the survey results from a cultural heritage survey as requested by Hanslab Environmental Consultants. This report forms part of an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for Environmental Authorisation for the proposed Construction of new Local Road 3392 (UGOMBA).

Amafa Research Institute has asked that a full HIA coupled with a Paleontological Desktop Assessment be carried out thereafter, Amafa Research Institute in conjunction with SAHRA, will issue a decision regarding the practicability and way forward for the project. If it is deemed to be practical, a permit will be issued in terms of the NHRA and KwaZulu-Natal Heritage Act. The appointment of Tsimba Archaeological Footprints (Pty) Ltd is in terms of the National Heritage Resources Act (NHRA), No. 25 of 1999. The HIA is completed in accordance to requirements of Section 38 (1) (a) of the NHRA, No. 25 of 1999.

The aim of the heritage impact assessment is to retain the cultural significance of places and objects so they can be appreciated and enjoyed by current and future generations. The guidelines for assessing places and objects against the criteria of the National Heritage Act of 1999 are consistent with the concepts of heritage significance defined in the Australia ICOMOS Burra Charter – the Australia ICOMOS Charter for Places of Cultural Significance and the Australian Heritage Commission and Australian Committee for the International Union for the Conservation of Nature's Australian Natural Heritage Charter. These are internationally agreed heritage protection charters that South Africa is a signatory to.

The main aim of the Paleontological assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources. "Palaeontological" means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or traces.

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW** to **VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

This application takes into consideration archaeological findings that stretch into deep time, starting with australopithecines. The gradual or continuous displacement of led to the coming up of the early hominid (Homo Habilis) that was later replaced by the early crude stone tool using hominid (Homo Erectus around 1.8 million years ago). This was to be the beginning of the Early Stone Age (ESA).

Conclusions

- This study concludes that the impacts of the propose road on the cultural heritage environment will be low as there are no cultural heritage resources recorded within the proposed development project area during the survey. Several sites Stone Age archaeological sites occur South of the proposed development area (see Davis 1974). Four other sites like these occur in Sewula Gorge, Ntomdadlana, iGujwana and Selbourne. These sites are in thomveld, up to 60% of this thomveld represents a woody invasion in grasslands during the past 150 years (see Edwards 1967, p 124 and David Green pers.com. 1998). This was probably as a result of the need to control fires that would otherwise knock back young trees annually. The greater Estcourt are also carried a heavy vibration of colonial heritage in the form of Voortrekker monuments, old buildings and battlefield heritage. A rigorous Public Participation process was carried out by Hanslab to ensure the local community have identified all the graves on the homesteads along the proposed road footprint. No graves were reported by the local community.

Recommendations

- Chance Finds Procedure (CFP) should be implemented by an accredited archaeologist.
- The appointed archaeologist should develop periodic Archaeological Watching Briefs (AWB) during the construction phase of the development.

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ABBREVIATIONS

Acronyms	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GIS	Geographic Information System
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LSA	Late Stone Age
LIA	Late Iron Age
MIA	Middle Iron Age
MSA	Middle Stone Age
SAHRA	South African Heritage Resources Agency
KZNDOT	KwaZulu-Natal Department of Transport
PIA	Paleontological Impact Assessment

GLOSSARY

Achievement	▪ Something accomplished, esp. by valour, boldness, or superior ability
Aesthetic	▪ Relating to the sense of the beautiful or the science of aesthetics.
Community	▪ All the people of a specific locality or country
Culture	▪ The sum total of ways of living built up by a group of human beings, which is transmitted from one generation to another.
Cultural	▪ Of or relating to culture or cultivation.
Diversity	▪ The state or fact of being diverse; difference; unlikeness.
Geological (geology)	▪ The science which treats of the earth, the rocks of which it is composed, and the changes which it has undergone or is undergoing.
High	▪ Intensified; exceeding the common degree or measure; strong; intense, energetic
Importance	▪ The quality or fact of being important.
influence	▪ Power of producing effects by invisible or insensible means.
Potential	▪ Possible as opposed to actual.
Integrity	▪ The state of being whole, entire, or undiminished.
Religious	▪ Of, relating to, or concerned with religion.
Significant	▪ important; of consequence
Social	▪ Living, or disposed to live, in companionship with others or in a community, rather than in isolation.
Spiritual	▪ Of, relating to, or consisting of spirit or incorporeal being.
Valued	▪ Highly regarded or esteemed

1.0 INTRODUCTION

1.1 Project Background

Hanslab Environmental Consultants the independent Environmental Assessment Practitioner, was appointed by KZNDOT as the Environmental Assessment Practitioner (EAP) to prepare and to submit an application for an environmental authorisation for the proposed project known as the Construction of New Local Road 3392 (Ugomba) (km 0.00-km2.99) with reference number:***C237/1500/S/1***. The road construction will aim to address the needs of previously disadvantaged rural areas through service delivery in the form of infrastructure development to ensure the safety of all road users.

KZNDOT is also required to obtain an Environmental Authorization (EA) in terms of the National Environmental Management Act, 1998 (NEMA, 1ct No. 107 of 1998) which involves the submission of a Basic Assessment Report (BAR) and Environmental Management Programme (EMPR). A full HIA and a desktop PIA were requested by the heritage authority in terms of the South African legislation. Tsimba Archaeological Footprints was then asked to conduct these. This report was guided by the following international and heritage legislations;

- National Heritage Act, 1999 (Act No. 25 of 1999) and 2014 EIA regulations (as amended).
- KwaZulu-Natal Heritage Act, 1997 (Act No. 4 of 2008

International conventions regarding the protection of cultural resources have also been followed;

- Charter for the Protection and Management of the Archaeological Heritage (1990)
- International Charter for the Conservation and Restoration of Monuments and Sites (Venice Charter 1964)
- The Australian ICOMOS Charter for Places of Cultural Significance (The Burra Charter 2013).

1.2 Scope of works

The Proposed project scope of the activities is given in the table below;

Carriageway lane widths		**Type 7A Local Road (2.5m lane widths)**
Shoulders - left		0.45 m wide gravel shoulder
Shoulders - right		0.45 m wide gravel shoulder
Cross fall		4 %
Super elevation		6 % maximum
Cut / Fill		1 in 1.5 typical
Pavement Design	Pavement Depth	300 mm
Gravel Wearing Course Layer		150 mm
Base Layer		150 mm

Table 1: Road design standards adopted for the project

Related Infrastructure:

- Gravel road, 2-lane each 2.5m wide,
- Existing services (electrical poles, stay wire, fence line, dwellings, stormwater pipes, low level structures, grave sites, watermarks),
- Reseeding of embankments,
- 0.45 m wide shoulders,
- Culverts 600mm and 900 mm in diameter,
- Road reserve of 5m and 10m on either side, and
- Bus stops on shoulder.

2.0 DESCRIPTION OF THE RECEIVING ENVIRONMENT

2.1 Location and depth

The proposed construction of New Local Road 3392 (Ugomba) (km 0.00-km2.99) will take place in Estcourt/ uThukela District Municipalities, Kwazulu Natal Province. The road is currently in a gravel state. The length of the proposed road will be KM0.00 – KM2.99.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores. The depth of the gravel road will not exceed 150-300mm.

Figure 1: Map showing the proposed road

3.0 METHODOLOGY

3.1 Literature review

The background information search of the proposed development area was conducted following the site maps from the client. Sources used in this study included:

- Published academic papers and HIA and PIA studies conducted in and around the region where the proposed infrastructure development will take place;
- Available archaeological literature covering the Kwa-Zulu Natal province area was also consulted;
- The SAHRIS website and the National Data Base was consulted to obtain background information on previous heritage surveys and assessments in the area; and
- Map Archives - Historical maps of the proposed area of development and its surrounds were assessed to aid information gathering of the proposed area of development and its surrounds.

4.0 LEGISLATIVE FRAMEWORK

This HIA and Desktop Paleontological study is informed and conducted to fulfil the requirements of the National Heritage Resources Act (No 25 of 1999) and theKwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No 5 of 2018) which lists developments or activities that may require an HIA. Section *41 (1):- the project involves construction of a road, wall, powerline, pipeline, canal or other simila form of linear development or barrier exceeding 300m in length* The ***National Heritage Resources Act (Act No. 25 of 1999) (NHRA)*** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999): (i) (i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.

This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999) and KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No 5 of 2018) which lists developments or activities that may require an HIA. Section 41 (1) .Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) *the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m² in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.*

5.0 ARCHEOLOGICAL AND HISTORICAL BACKGROUND

The British Museum has the largest collection of stone artefacts from southern Africa in Britain. Analysis of the South African component of these collections shows that Middle Stone Age artefacts are more common than Earlier or Later Stone. The greater Estcourt area has been relatively well surveyed for archaeological sites in the past. Some sites have been recorded by cultural resource consultants who have worked in the area during the last two decades whilst archaeologists from the then Natal Museum have made various visits to the area.

5.1 Stone Age Period

The Early Stone Age sites occur close to permanent water sources. Some Middle Stone Age flakes, probably dating back to ca. 40 000 – 200 000 years ago, occur in disturbed context in dongas and road cuttings. The majority of Later Stone Age sites as well as rock art sites occur further west in the foothills of the Drakensberg. These typically occur in small shelters in the sandstone formations some leading up to the Drakensberg.

- *Early Stone Age :- : Early Stone Age (ESA) dating between 2 million years ago to about 200 000 years ago.*

The ESA is considered as the beginning of the stone tool technology. It dates back to over 2 million years ago until 200 000 years ago. This period is characterised by Oldowan and Acheulean industries. The Oldowan Industry, dating to approximately between over 2 million years and 1.7 million years predates the later Acheulean. The Oldowan Industry consists of very simple, crudely made core tools from which flakes are struck a couple of times. To date, there is no consensus amongst archaeologists as to which hominid species manufactured these artefacts. The Acheulean Industry lasted from about 1.7 million years until 200 thousand years ago. Acheulean tools were more specialized tools than those of the earlier industry. They were shaped intentionally to carry out specific tasks such as hacking and bashing to remove limbs from animals and marrow from bone were performed using the large sharp pointed artefacts known as handaxes. Cleavers, with their sharp, flat cutting edges were used to carry out more heavy duty butchering activities (Esterhuysen, 2007).

- *Middle Stone Age :- Middle Stone Age (MSA) dating between 200 000 years ago to about 30 000 years ago.*

The ESA is considered as the beginning of the stone tool technology. It dates back to over 2 million years ago until 200 000 years ago. This period is characterised by Oldowan and Acheulean industries. The Oldowan Industry, dating to approximately between over 2 million years and 1.7 million years predates the later Acheulean. The Oldowan Industry consists of very simple, crudely made core tools from which flakes are struck a couple of times. To date, there is no consensus amongst archaeologists as to which hominid species manufactured these artefacts. The Acheulean Industry lasted from about 1.7 million years until 200 thousand years ago. Residue analyses on the backed tools from South African MSA sites including those in KZN indicate that these tools were certainly used as spear heads and perhaps even arrow points (Soriano et al, 2007). A few sites with impressive MSA deposits have been excavated in KZN. Perhaps the best known ones are Sibudu Cave and Umhlatuzana Cave to the south east of the study area, and Border Cave to the north of the study area. All these sites provided impressive evidence for fine resolution data and detailed stratigraphy (Wadley & Jacobs, 2006).

Several Stone Age sites also occur in the Estcourt area of Kwa-Zulu Natal (Davis 1974). Four other sites like these occur in Sewula Gorge, Ntomdadlana, iGujwana and Selbourne. These sites are in thomveld, up to 60% of

this thomveld represents a woody invasion in grasslands during the past 150 years (see Edwards 1967, p 124; David Green pers.com. 1998). Lady et al in the book *Life at Natal writes* that this was probably as a result of the need to control fires that would otherwise knock back young trees annually. These fires were extensive and a constant feature of the dry winter months, as an account written in August 1864 indicates (1972 p. 61-63)

Figure 2: Example of Middle Stone Age archaeological tools collected from Sibidu Cave (Pic Credit Wadley et al 2006)

- *Later Stone Age :- Later Stone Age (LSA) which dates from 30 000 to about 2 000 year ago.*

The Later Stone Age is usually associated with the San (Bushmen) or their direct ancestors. The tools during this period were even smaller and more diverse than those of the preceding Middle Stone Age period. LSA tool technology is observed to display rapid stylistic change compared to the slower pace in the MSA. The rapidity is more evident during the last 10 000 years. The LSA tool sequence includes informal small blade tradition from about 22 000 – 12 000 years ago, a scraper and adze-rich industry between 12 000 – 8 000 years ago, a backed tool and small scraper industry between 8 000 – 4 000 years and ending with a variable set of other industries thereafter (Wadley, 2007). Adzes are thought to be wood working tools and may have also been used to make digging sticks and handles for tools. Scrapers are tools that are thought to have been used to prepare hides for clothing and manufacture of other leather items. Backed tools may have been used for cutting as well as tips for arrows It was also during Later Stone Age times that the bow and arrow was introduced into southern Africa – perhaps around 20 000 years ago.

5.2 Iron Age Period

The low altitude and densely wooded areas in the immediate vicinity of Estcourt have been intensely occupied by Middle and later Iron Age farmers since around 1200 AD. Some of these sites have also been excavated by Professor Oliver Davies, Dr Tim Maggs and Gavin Whitelaw of the then Natal Museum at various periods between 1978 and 2005 (Huffman 2007). The well-known Moorpark Middle Iron Age site occurs approximately 35 km to the South West of the study area.

However, eleven (11) Iron Age rock engraving sites occur in the greater Estcourt area. These engravings are usually made on dolerite outcrops in areas with an altitude above 1000 metres above sea level. The San were the owners of the land for almost 30 000 years (Mitchell 2002) but the local demography started to change soon after 2000 years ago when the first Bantu-speaking farmers crossed the Limpopo River and arrived in South Africa. Around 800 years ago, if not earlier, Bantu-speaking farmers also settled in the greater Estcourt area. Although the majority of sites constructed by these African farmers consisted of stone walling not all of them were made from stone.

6.0 HISTORICAL BACKGROUND OF THE GREATER ESTCOURT IN RELATION TO THE STUDY AREA

The closest towns to the proposed project area are Inkanyezi and Colenso which lie about 6 kilomentres west. The greater Estcourt area is rich in historical heritage mainly colonial heritage. This is evidenced by the existence of a number of vootrekker monumnents and memorials , battle field heritage as well as historical/ heritage buildings in the area.

- *Voortrekker Monuments*

Various sites in the area belong to the Voortrekker era especially former laagers such as Veglaager – now covered by the waters of Wagendrift Dam. Some of the farms in the area also contain graves and structures relating to early Voortrekker settlement such as those at the nearby Blaauwkranz and Rensburg Koppie. Many Voortrekker families were annihilated during the main Zulu attack from 16-17 February 1838 after the death of Piet Retief. The site is a national monument. The Memorial on site is on the dirt road off R103 between Colenso and Estcourt.

The Bloukrans Monument marks the communal grave of those Voortrekkers – men, women and children, along with their servants – killed on the banks of the Bloukrans River in what went down in history as nothing short of a massacre by the Zulus, in the year 1837. TheBloukrans monument can be found about 13 kilometres away from Colenso 10 kilometres on the South Western side of the proposed development area. The monument today lies on a farm but at the time this land had just been granted the Voortrekkers - who wanted to settle here after their journey from the Cape - by Dingane the king of the Zulus.

European settlement of the area started soon after 1838 when the first Voortrekker settlers marked out large farms in the area. The study area is situated adjacent to Estcourt on the Southern Side. Frans Prins's Heritage Impact Assessment carried out South –East of the proposed study area noted the existence of a Voortrekker Memorial and associated graveyard occurs about 25 kilometres -South East of the proposed study area

- *Heritage /old buildings*

The Estcourt town carries a serious vibration of heritage/historical or old buildings. These can be attributed to the colonial heritage if the town. However, the majority of these old buildings are located on farmsteads. These buildings were built by British colonists after 1850 who occupied farms previously inhabited by Voortrekker pioneers (Bizley & McKenzie 2007). Fort Durnford was built in the 1870's to combat San raids from the Drakensberg, today it houses the Estcourt Museum. This prominent heritage site displays include artefacts, fossils, relics from the Iron Age and Stone Age, old wagons and models of historic battles. One of its more charming displays is a large collection of bird's eggs donated by a local farming family.

- *Anglo-Boer War*

The town of Estcourt is also rich in battlefield heritage. Estcourt Anglo-Boer War battle sites include the Brynbella-Willow Grange. Veglaager ("Battle Laager") is the site of a battle between the Boers and Zulus in 1838. Bloukrans Memorial marks the site where Voortrekker families were killed after the murder of their leader, Piet Retief. Winston Churchill was captured by the Boers at Chievely in 1899. A memorial marks the site of the engagement during which he was captured. Anglo-Boer War activities also took place in the area and the most southern skirmish between Boer and Brit in Natal took place at Willow Grange to the immediate south of Estcourt.

6.0 DISCUSSION OF FINDINGS

The development & study area falls close to the Colenso area, within the Uthukela District Municipality. The study area is underlain by sedimentary rocks of the Permian aged Vryheid and Volksrust Formations of the Ecca Group and Permian aged Adelaide Subgroup of the Beaufort Group, Karoo Supergroup as well as a prominent Jurassic aged dolerite sill and Quaternary aged surface deposits of the Masotcheni Formation and alluvium.

The land use in the area is characterized by natural or undeveloped areas which have been partially transformed and degraded as a result of urban transformation, rural settlement, and agricultural activities in the form of livestock grazing, subsistence and commercial farming. The broad study area is bounded to the west by the R103 secondary road and the R74 bisects the south-western part of the broad study area. The dominant built-up areas within the study area include the town of Colenso, located directly east of the R103, and the residential community areas. Ezakheni C lies further in the northern reaches of the area.

The topography slopes down gradually in a southern direction, with the residential community of Ezakheni in the northern parts being located on higher ground. As such, lower lying terrain with incised valleys in the vicinity of the Bloukrans River dominates in the southern part or the area. The study area falls within the Savanna and Grassland Biomes. Within a biome, smaller groupings referred to as bioregions can be found which provide more specific but general details as to the biophysical characteristics of smaller areas. The project areas can be found within the Sub-Escarpment Savanna and Sub-Escarpment Grassland bioregions. Going into even finer detail, vegetation units are classified which contain a set of general but more local biophysical characteristics as opposed to the entire bioregion. The proposed development is found within the Thukela Thornveld, the Thukela Valley Bushveld and the KwaZulu-Natal Highland Thornveld vegetation units.

Since this is a new road contrusction, impacts are expected to be direct. Direct impacts they are caused by an action and occur at the same time and place. Since this area also has local rivers discrete impacts are also expected due to possible flash flooding. Flash flooding usually causes discrete impacts, whereas seasonal colluviation causes continuous impacts. The causal agent of an impacts in this project is road construction. Most previous studies of impacts to archaeological sites focus on the causal agent alone. Activities such as ploughing, road construction, and timber harvest are known to be potential impact agents, which may cause various types of impacts (transferal of artifacts, removal of sediments by erosion, and alteration of sediments by compaction, respectively).

The field survey investigated all fault lines, open pit and trench areas for archaeological sites, artefacts and ceramics. The Northern KZN area is known for its archaeological background hence the survey paid so much attention to such findings. No archaeological findings were found despite very good ground visibility and a number of clear river banks that could potentially yield Iron Age settlements *(see figure 9).* No graves were also identified along the proposed road route. It is however possible that graves may be found in some of the home steads that along the route *(see figure 4).* In rural setting , families usually burry their loved ones within the homestead. This is a long tradition especially the Nothern KZN area where a number of graves or burials have been found on historic Zulu homesteads.

6.1 PICTURE PRESENTATION

Figure 3: The proposed starting point of the proposed road

Figure 4: Proposed route in relation to homesteads

Figure 5: Part of the semi bush areas the road will traverse through

Figure 6: Some of the fault lines and trenches surveyed along the road reserve

Figure 7: Power lines traversing through the proposed development footprint

Figure 8: A communal water source for animals along the proposed route

Figure 9: A local river the proposed road will cross over

7.0 HERITAGE ASSESSMENT OF SIGNIFICANCE

The significance of a site can be modified or added to. Its importance can be increased by communicating the significance to more people through the media or archaeological reports. Site significance classification standards prescribed by SAHRA (2006), and acknowledged by ASAPA for the SADC region, were used for the purposes of this report.

- The main aim in assessing significance is to produce a succinct statement of significance, which summarises an item's heritage values. The statement is the basis for policies and management structures that will affect the item's future.

SAHRA's Site significance classification minimum standards			
Filed Rating	**Grade**	**Classification**	**Recommendation**
National Significance (NS)	Grade 1		Conservation; National Site nomination
Provincial Significance (PS)	Grade 2		Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)		High/ Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)		Medium Significance	Recording before destruction
Generally Protected C (GP.A)		Low Significance	Destruction

Site significance is calculated by combining the following concepts in the given formula.

S= (E+D+M) P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

The significance weightings for each potential impact are as follows:		
Aspect	**Description**	**Weight**
Probability	Improbable	1
	Probable	2
	Highly Probable	4
	Definite	5
Duration	Short term	1
	Medium term	3
	Long term	4
	Permanent	5
Scale	Local	1
	Site	2
	Regional	3
Magnitude/Severity	Low	2
	Medium	6
	High	8

Impact Significance		
It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. (S) is formulated by adding the sum of numbers assigned to Extent (E), Duration (D), and Intensity (I) and multiplying the sum by the Probability. S= (E+D+M) P		
<30	Low	Mitigation of impacts is easily achieved where this impact would not have a direct influence on the decision to develop in the area.
30-60	Medium	Mitigation of impact is both feasible and fairly easy. The impact could influence the decision to develop in the area unless it is effectively mitigated.
>60	High	Significant impacts where there is difficult. The impact must have an influence on the decision process to develop in the area.
Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological material or objects.		
	Without Mitigation	With Mitigation
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low(2)
Probability	Not Probable (2)	Not probable (2)
Significance	Low (16)	Low(16)
Status	Negative	Negative
Reversibility	Not irreversible	Not irreversible
Irreversible loss of resources	No resources were recorded	No resources were recorded
Can impacts be mitigated?	Yes, a chance find procedure should be implemented.	Yes
Mitigation: Impacts are rated as <30 (Low) Mitigation of impacts is easily achieved where this impact would not		

have a direct influence on the decision to develop in the area.

Due to the lack of apparent significant heritage resources no further mitigation is required prior to construction. A Chance Find Procedure should be implemented for the project should any sites be identified during the construction process.

7.1 Conclusions

This study concludes that the impacts of the propose road on the cultural heritage environment will be low as there are no cultural heritage resources recorded within the proposed development project area during the survey. Several sites Stone Age archaeological sites occur South of the proposed development area (see Davis 1974). Four other sites like these occur in Sewula Gorge, Ntomdadlana, iGujwana and Selbourne. These sites are in thomveld, up to 60% of this thomveld represents a woody invasion in grasslands during the past 150 years (see Edwards 1967, p 124 and David Green pers.com. 1998). This was probably as a result of the need to control fires that would otherwise knock back young trees annually. The greater Estcourt are also carried a heavy vibration of colonial heritage in the form of Voortrekker monuments, old buildings and battlefield heritage. A rigorous Public Participation process was carried out by Hanslab to ensure the local community have identified all the graves on the homesteads along the proposed road footprint. No graves were reported by the local community.

7.2 Recommendations

- Chance Finds Procedure (CFP) should be implemented by an accredited archaeologist.
- The appointed archaeologist should develop periodic Archaeological Watching Briefs (AWB) during the construction phase of the development.

8.0 PALEONTOLOGICAL STUDY

8.1 Summary

In South Africa, paleontological fossils and footprints belonging to various periods have been recorded. The finds have been recorded from around 270 million years ago to around 180 million years ago. These have often been recorded and collected in the geological layers beneath the basalts. These layers, amongst other interesting facts, provide evidence of the greatest mass extinction of species in the world around 251 million years ago towards the end of the Permian period. Some species survived this extinction as attested by abundant fossils of certain species such as Lystrosaurus found deep in the Triassic period layers. Many of these occurrences can be found within a close radius from the proposed development.

When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

8.2 Outline of the geology and the palaeontology

The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984) and 2830 Dundee, 1:250 000 geological map (Wolmarans and Linstrőm 1988). The applicant, The KZN Department of Transport proposes to upgrade three roads in the Estcourt, Colenso and Weenen areas.

The Project includes one Alternative (see map):
Alternative 1: Stretch of gravel road outlined in green (L3392) near the towns of Estcourt, Colenso and Weenen. The length of the road is 2.99 km.

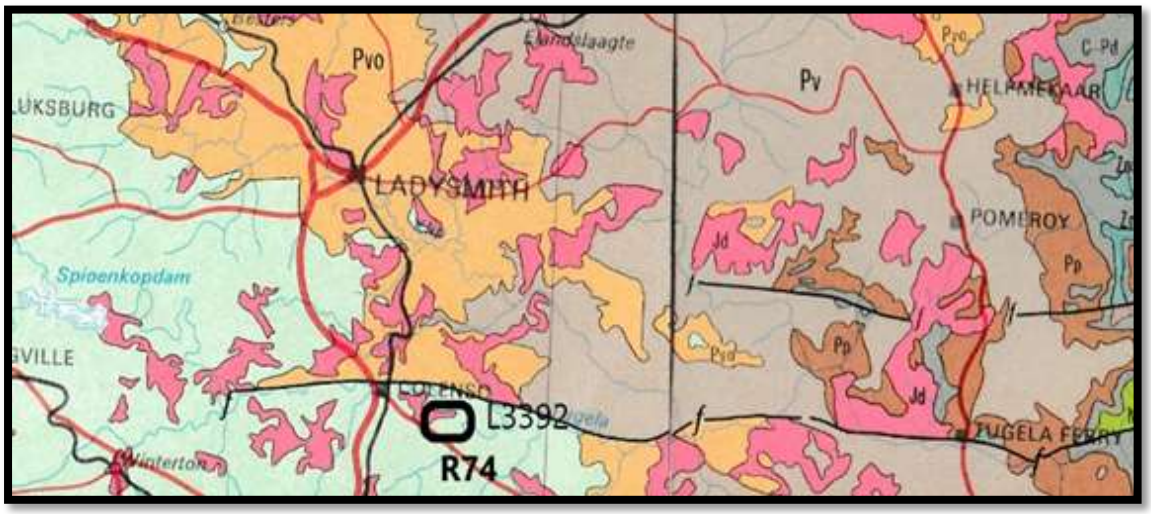

Figure 10: The geology of the development area

Legend to Map and short explanation.

Pa – Sandstone, mudstone, siltstone (green). Adelaide Subgroup, Beaufort Group, Karoo Supergroup. Early Triassic.

Pvo – Mudstone, siltstone, shale (amber). Volksrust Formation, Ecca Group, Karoo Supergroup. Permian.

Pv – Shale, shaly sandstone, grit, sandstone, conglomerate and coal in places near base and top (brown). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.

…… – (black) Lineament (Possible dyke).

--f— Fault.

⊥10˚ - Strike and dip.

□ – Approximate position of road upgrades.

Mining Activities on Figure:

None.

Mining past and present has no influence on the project.

The Adelaide Subgroup consists of up to three formations (Koonap, Middleton, Balfour). Mudrock predominates with subordinate sandstone and is Upper Permian in age. It overlies the Ecca Group conformably and is overlain by the Katberg Formation of the Tarkastad Subgroup. Siltstone beds are common (Cole *et al.* 2004). The Balfour Formation is distinguished from the Middleton Formation by the lack of 'red' mudstone and is ±2150 m. thick, whereas the Middleton Formation is ±1600 m. thick (sheet info, Kent 1980). The Abrahamskraal and Teekloof Formations also form part of the Adelaide Subgroup (Snyman 1996). Chert is present in the Abrahamskraal Formation. The Adelaide Subgroup has a maximum thickness of 1750 m. in the south (Visser 1989).

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

Kent (1980) described the Volksrust Formation as the 150-270 m of shale which overlies the Vryheid Formation. The deposition of this formation coincides with that of the Fort Brown and Waterford Formations in the south (Snyman 1996). It occurs from the south of Kwazulu-Natal into the Free State and is concordant (Visser 1989). Very little is written on the Volksrust Formation. It rests conformably on the Vryheid Formation. Fossils consist of fish scales and wood. This formation reaches thicknesses of 170-270 m (Visser 1989). A monotonous sequence of grey shale is present and fossils are significant, but very rarely recorded. Fossils include rare temnospondyl amphibian remains, invertebrates, minor coals with plant remains, petrified wood, and low-diversity marine to non-marine trace fossil assemblages (Groenewald and Groenewald 2014).

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Ecca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

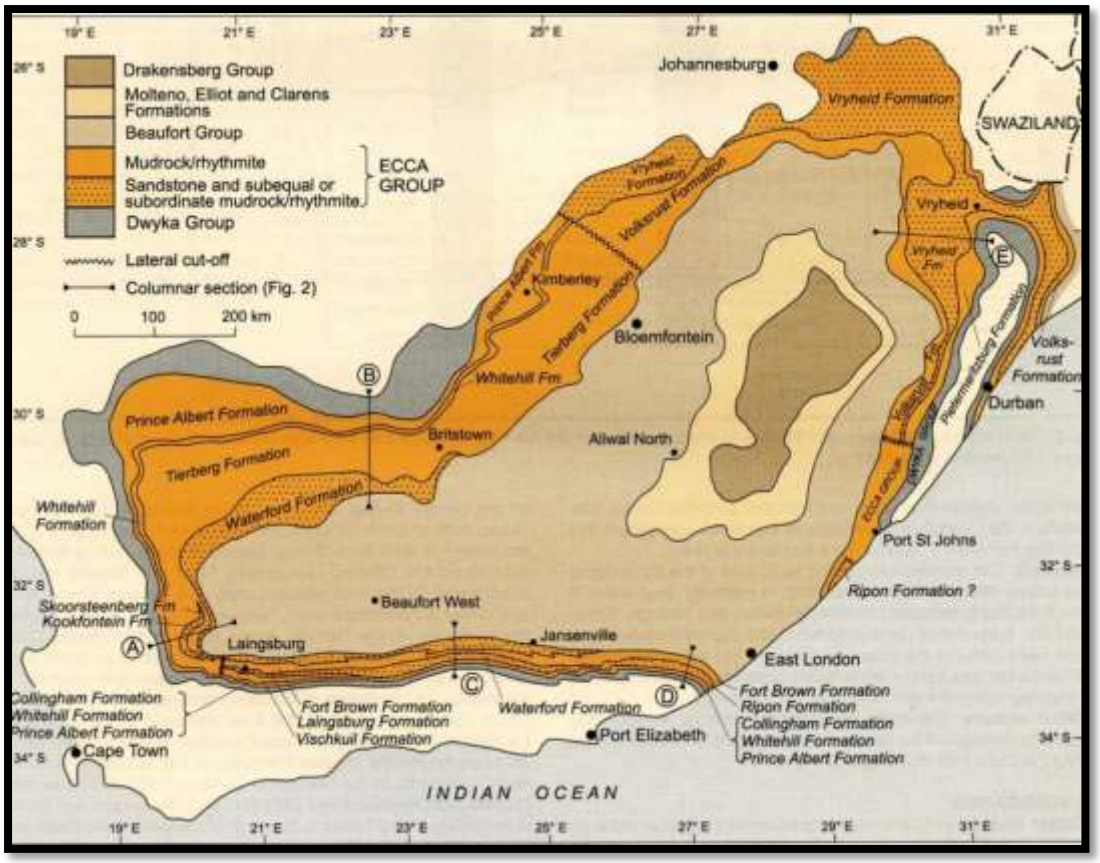

Figure 11: Extent of the Karoo Supergroup (Johnson 2009)

The rocks of the Karoo Supergroup are internationally acclaimed for their richness and diversity of fossils. The rocks of the Beaufort Group of South Africa cover approximately one-third of the land surface and have yielded an abundance of well-preserved therapsids and other tetrapods which have been used to subdivide this Group into eight faunal Assemblage Zones.

Fossil vertebrates are found in the thick mudrock of the Adelaide Subgroup. Fossils of *Diictodon, Ictidosuchops, Gorgonops* and the amphibian *Rhinesuchus* are frequently preserved as articulated skeletons within the mudrock present in the *Daptocephalus* Assemblage Zone (Figure 8). Fossil fish (*Atherstonia*) and the captorhinid *Pareiasaurus* have also been recorded. Other fossils that occur are *Procynosuchus, Tetracynodon, Lycaenops, Ictidorhinus, Dicynodon, Youngina,* to name but a few (Rubidge 1995).

Figure 12: Typical Karoo scene during the Upper Permian times (Cluver 1978)

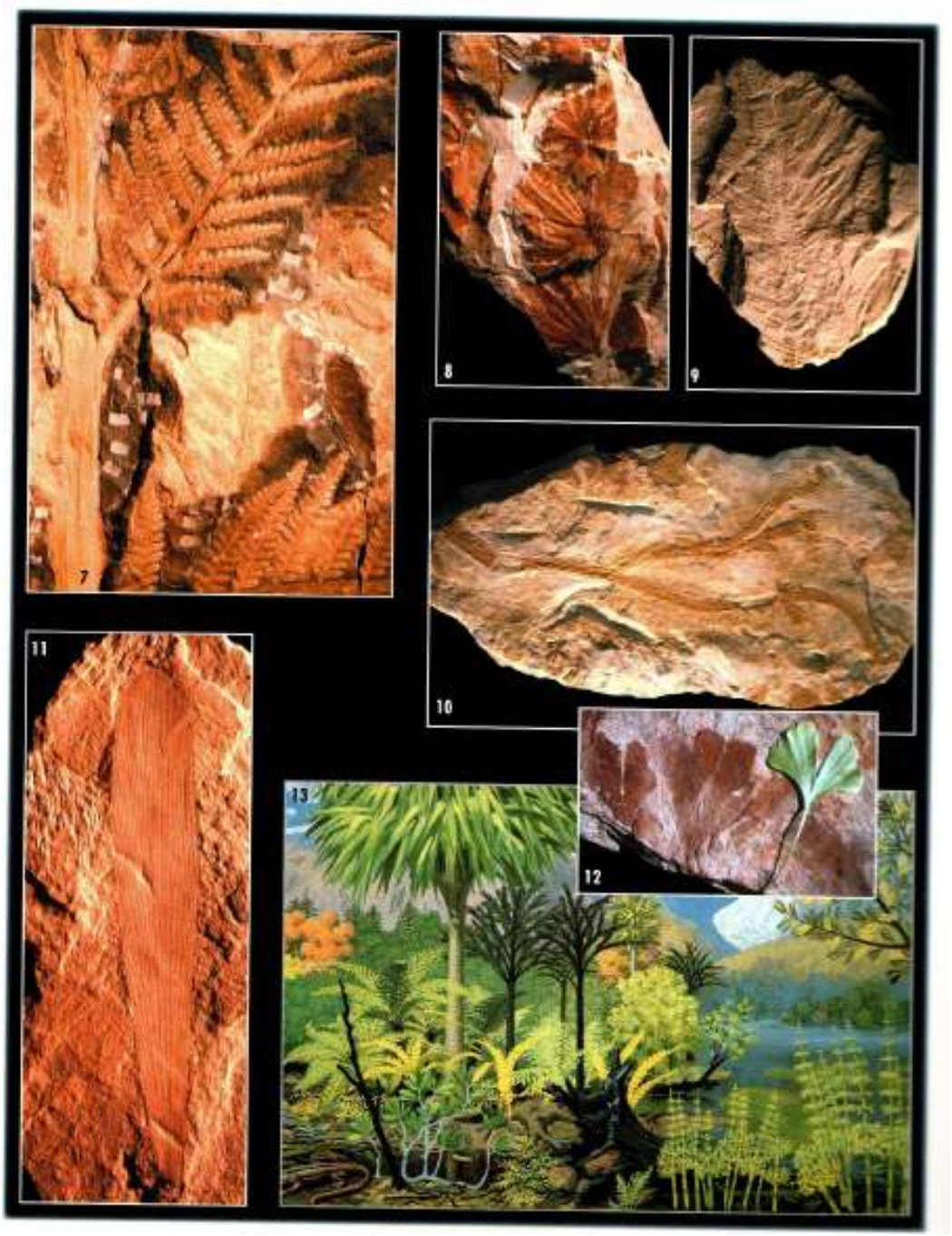

Figure 13: Examples of the Vryheid formation (MacRae 1999)

The Volksrust Formation consists of a monotonous sequence of grey shale and fossils are significant, but very rarely recorded. Fossils include rare temnospondyl amphibian remains, invertebrates, minor coals with plant remains, fish scales, petrified wood, and low-diversity marine to non-marine trace fossil assemblages (Groenewald and Groenewald 2014).

The Ecca Group, Vryheid Formation may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately

converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally LOW to VERY HIGH, but here locally **MODERATE** for the Volksrust Formation, and **VERY HIGH** for the Adelaide Subgroup and Vryheid Formation.

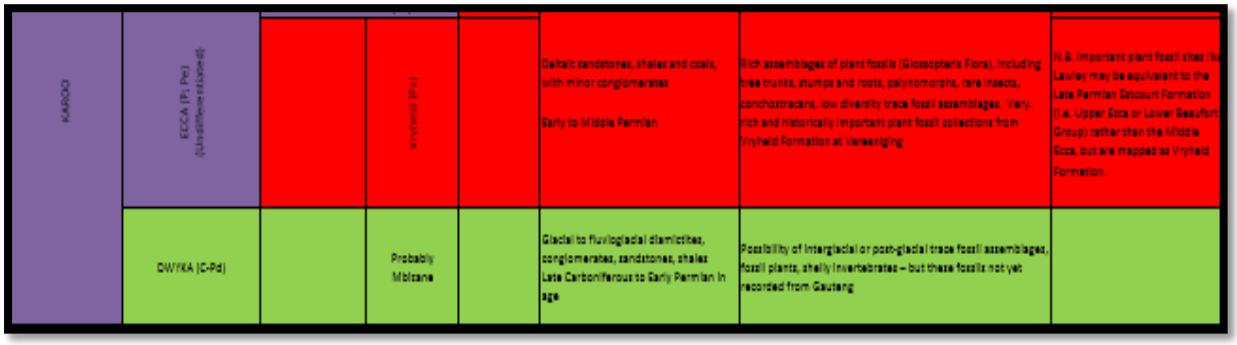

Table 2: Taken from Paleontological Report (Groenewald 2014)

Rock Unit	Significance/vulnerability	Recommended Action
Adelaide Subgroup	Very High	Field assessment and protocol for finds is required
Volksrust Formation	Moderate	Desktop survey and Phase 1 PIA is recommended
Vryheid Formation	Very High	Field assessment and protocol for finds is required

Table 3: Criteria used (Fossil Heritage Layer Browser/SAHRA)

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).
Impact: **MODERATE, VERY HIGH** for the Volksrust Formation, Adelaide Subgroup and Vryheid Formation, Beaufort Group, Karoo Supergroup. There are significant fossil resources that may be impacted by the development (mudstone, shale) and if destroyed are no longer available for scientific research or other public good (Almond, *et al.* 2009).

8.3 Description of the Methodology

The palaeontological impact assessment desktop study was undertaken in April 2020. A Phase 1: Field Survey of the affected portion will include photographs (in 7.1 mega pixels) taken of the site with a digital camera (Canon PowerShot A470). Additionally, Google.maps will be accessed on a cellular phone for navigation. A Global Positioning System (GPS) (Garmin eTrex 10) is used to record fossiliferous finds and outcrops (bedrock) when

the area is not covered with topsoil, subsoil, overburden, vegetation, grassland, trees or waste. The survey did identify the Karoo Supergroup. A literature survey is included and the study relied heavily on geological maps.

SAHRA document 7/6/9/2/1 (SAHRA 2012) requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded with a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. Archaeozoologists concentrate on more recent fossils in the quaternary and tertiary deposits.

Assumptions and Limitations (**1e)**:-
The accuracy and reliability of the report may be limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. Insufficient data from developer and exact lay-out plan for all structures.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities.
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes.

Act No. 25 of 1999. National Heritage Resources Act, 1999.
National Estate: 3 (2) (f) archaeological and palaeontological sites,
(i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,
Heritage assessment criteria and grading: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance;
(b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation.
SAHRA is responsible for the identification and management of Grade 1 heritage resources.
Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.
Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.
Archaeology, palaeontology and meteorites: Section 35.
(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

8.4 Description of significant fossil occurrences

All Karoo Supergroup geological formations are ranked as **LOW** to **VERY HIGH**, and here the impact is potentially **VERY HIGH** for the Adelaide Subgroup and Vryheid Formation and **MODERATE** for the Volksrust Formation.

Fossil vertebrates are found in the thick mudrock of the Adelaide Subgroup. Fossils of *Diictodon, Ictidosuchops, Gorgonops* and the amphibian *Rhinesuchus* are frequently preserved as articulated skeletons within the mudrock present in the *Daptocephalus* Assemblage Zone (Figure 16). Fossil fish (*Atherstonia*) and the captorhinid *Pareiasaurus* have also been recorded. Other fossils that occur are *Procynosuchus, Tetracynodon, Lycaenops, Ictidorhinus, Dicynodon, Youngina,* to name but a few (Rubidge 1995).

The Volksrust Formation consists of a monotonous sequence of grey shale and fossils are significant, but very rarely recorded. Fossils include rare temnospondyl amphibian remains, invertebrates, minor coals with plant

remains, fish scales, petrified wood, and low-diversity marine to non-marine trace fossil assemblages (Groenewald and Groenewald 2014).

Fossils likely to be found are mostly plants (Appendix 1) such as '*Glossopteris* flora' of the Vryheid Formation. The aquatic reptile *Mesosaurus* and fossil fish may also occur with marine invertebrates, arthropods and insects. Trace fossils can also be present. During storms a great variety of leaves, fructifications and twigs accumulated and because they were sandwiched between thin films of mud, they were preserved to bear record of the wealth and the density of the vegetation around the pools. They make it possible to reconstruct the plant life in these areas and wherever they are found, they constitute most valuable palaeobotanical records (Plumstead 1963) and can be used in palaeoenvironmental reconstructions.

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

The threats are:- earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction, the sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above.

8.5 Recommendation

a. There is no objection (see Recommendation B) to the development, but it is necessary to request a Phase 1 Palaeontological Impact Assessment: Field study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity of the shale is **VERY HIGH and MODERATE**. A Phase 2 Palaeontological Mitigation is only required if the Phase 1 Palaeontological Assessment identified a fossiliferous formation (Karoo Supergroup) and fossils or if fossils are found during construction or mining. Protocol is attached (Appendix 2).
b. This project may benefit the economy, the life expectancy of the community, the growth of the community and social development in general.
c. Preferred choice: No Alternatives are possible.
d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measures. A sample of shale / mudstone should be set aside if mined.

Sampling and collecting **(6m,6k)**:
Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

a. Objections: Cautious. See heritage value and recommendation.
b. Conditions of development: See Recommendation.
c. Areas that may need a permit: Yes.
d. Permits for mitigation: **Needed from SAHRA/Amafa Research Institute prior to Mitigation**.
e.

8.6 Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).

b. All information needed for the Phase 1 Palaeontological Impact Assessment and Field scope was provided by the Sub- Consultant. All technical information was provided by Hanslab Environmental Consultants.
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
d. The following should be conserved: if any palaeontological material is exposed during digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures. Especially shallow caves.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

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APPENDIX 1: PROTOCOL FOR CHANCE FINDS AND MANAGEMENT PLAN

This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr).

- The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities.
- For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. Construction workers must be informed that this is a no-go area.
- It is recommended that the EMPr be updated to include the involvement of a palaeontologist for pre-construction training of the ECO or during the digging and excavation phase of the development or a site visit once a month during construction after drilling, excavating and blasting.
- The ECO must visit the site weekly and keep a photographic record.

The developer must survey the areas affected by the development and indicate on plan where the construction / development / mining will take place. Trenches have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers. It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

The palaeontological impact assessment process presents an opportunity for identification, access and possibly salvage of fossils and add to the few good plant localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage within the development area. Fossils excavated will be stored at a National Repository.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

1. The developer needs to clearly stake or peg-out (survey) the areas affected by the mining/ construction/ development operations and dig representative trenches and if possible supply geological borehole data. When the route is better defined, it is recommended that a specialist undertake a 'walk through' of the entire road as well as construction areas, including camps and access roads, prior to the start of any construction activities, this may be done in sections.
2. Fossils likely to occur are for example the therapsids from the Middleton Formation, these are present in the mudstone (or any other fossiliferous layer ranked as VERY HIGH or HIGH) or other vertebrates from the Beaufort Group (or any other fossiliferous layer). The palaeontologist needs to survey the overburden, subsoil and topsoil at least once a week.
3. When clearing vegetation, topsoil, subsoil or overburden, hard rock (outcrop) is found, the contractor needs to stop all work.
4. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
5. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.

6. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.
7. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once every week).
8. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary during Phase 2:

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.
3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.
4. Using Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils are visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

This document forms part of the Environmental Monitoring Programme. For practical reasons a palaeontologist/palaeobotanist may be required to be on site once a week. If any fossil material is discovered then a Phase 2 rescue operation may be necessary, and a permit will be required.

The South African Heritage Resources Agency has the following documents in place:
Guidelines to Palaeontological Permitting policy.
Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.
Guidelines for Field Reports.
Palaeotechnical Reports (Eastern Cape, North West, Northern Cape, Mpumalanga, Gauteng, Western Cape, Free State, Kwazulu Natal, and Limpopo).

APPENDIX 2: LISTING POINTS IN APPENDIX 6 OF THE ACT AND POSITION IN REPORT (BOLD IN TEXT).

Section in Report	Point in Act	Heading in Report
B	1(c)	Outline of development project
	1(d)	Summary of findings
	1(g)	Concerns/threats
	1(n)i	Concerns/threats
	1(n)ii	Concerns/threats
	1(o)	Concerns/threats
	1(p)	Concerns/threats
D	1(h)	Figures
	1(a)i	Terms of reference
H	1(e)	Description of Methodology
	1(i)	Assumptions and Limitations
I	1(f)	Heritage value
J	1(j)	Recommendation
	1(l)	Recommendation
	1(m)	Sampling and collecting
	1(k)	Sampling and collecting
Declaration	1(b)	Declaration
Appendix 1	1(k)	Protocol for finds
	1(m)	Protocol for finds
	1(q)	Protocol for finds