

**HERITAGE SURVEY OF THE PROPOSED USUTHU
DAM, NONGOMA-NATAL**

**FOR ENVIROEDGE
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TABLE OF CONTENT

INTRODUCTION	4
FLORA AND FAUNA	6
KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008	12
METHOD	14
Defining significance	15
RESULTS	18
DESKTOP STUDY	18
PALAEONTOLOGICAL IMPACT ASSESSMENT	22
FIELD SURVEY	24
MANAGEMENT PLAN	30
Mitigation Measures Normally Encountered	32
Functional responsibilities of the Developer and ECO for the Project	32
Documentary record of palaeontological occurrences	33
Functional responsibilities of the appointed Palaeontologist	34
Exposure of palaeontological material	35
CONCLUSION	36
REFERENCES	36
EXPERIENCE OF THE HERITAGE CONSULTANT	37
DECLARATION OF INDEPENDENCE	37
APPENDIX A	38

TABLE OF FIGURES

FIG. 1 GENERAL LOCATION OF THE STUDY AREA	7
FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA	8
FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA (91991)	9
FIG. 4A: SCENIC VIEWS OF THE STUDY AREA	10
FIG. 4B: SCENIC VIEWS OF THE STUDY AREA	11
TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES	17
FIG. 5: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA	19
FIG. 6: STUDY AREA IN 1937	20
FIG. 7: STUDY AREA IN 1968	21
FIG. 8: PALAEOSENSITIVITY MAP	23
FIG. 9 CLIFF FACES IN THE STUDY AREA	25
FIG. 10: OVERHANG IN THE STUDY AREA	26
FIG. 11: COAL SEAM IN THE NORTHERN PART OF THE STUDY AREA	27
FIG. 12: EROSION GULLY AND ARTEFACTS IN THE STUDY AREA	29
FIG. 13: LSA ARTEFACTS ABOVE THE 400M CONTOUR LIINE	30

Abbreviations

HP	Historical Period
IIA	Indeterminate Iron Age
LIA	Late Iron Age
EIA	Early Iron Age
ISA	Indeterminate Stone Age
ESA	Early Stone Age
MSA	Middle Stone Age
LSA	Late Stone Age
HIA	Heritage Impact Assessment
PIA	Palaeontological Impact Assessment

INTRODUCTION

The Zululand District Municipality is submitting an application for Environmental Authorisation for the proposed construction the Usuthu Dam. The development proposal forms part of the Usuthu Regional Water Supply Scheme. The Usuthu Dam development proposal is to develop a storage dam as part of the Usuthu Regional Water Scheme that will enable the target demand 8.81 x 10³ Ml/annum to be supplied. This target demand allows for a supply for the next twenty years and estimated population of 401 790 by the year 2040 and the supply of 60 litres of potable water per person per day.

At present, the Nongoma and surrounding communities are mainly supplied from the Vuna and Vukwana Dams, situated on the Vuna River with a small supply from the Nhlelisa River, a tributary of the Mona River, which, in turn, flows into the Black Mfolozi River. The Vuna Dam has limited storage capacity owing to siltation of the dam, and presently serves as a diversion weir for pumping water to the Water Treatment Works, as well as pumping surplus water to the Vukwana Dam during the higher rainfall months. The Vukwana Dam Acts as an off-channel Storage Dam for the current supply scheme. In order to provide a reliable source of water to the region, and also to cater for future demand, the Usuthu Dam is planned to form an integral part of the scheme.

The Proposed Usuthu Dam will be sited on the KwaNkweme River, but will also function as an off-channel Storage Dam for the Black Mfolozi River. The existing Vuna/Vukwana scheme will then be utilised as back up should it be required. The proposed Usuthu Dam will be linked to the following infrastructural components:

- The existing abstraction weir and located on the Black Mfolozi River at 28° 2'12.40"S 31°32'38.67"E, approximately 2.3km south west of the proposed Usuthu Dam.

- The existing low lift pump station, which is proposed for upgrade to enable the pumping of water to the proposed dam, located at 28° 2'12.90"S 31°32'40.92"E.
- The new Usuthu Dam which is to be located on the KwaNkweme River, a tributary of the Black Mfolozi River.
- A new rising main pipeline from the existing low lift pump station to the new dam, including the inlet works at the dam, located at 28° 2'10.12"S 31°32'43.49"E.
- A new gravity main from the new dam to the existing water treatment works, including the outlet works at the dam.

The project area is located between Ulundi and Nongoma in the area of Usuthu, approximately 16 km south west of the town of Nongoma. The proposed dam site is located on Farm Portion 13 of 15832 of the Farm Reserve No. 12 within ward 15 of the Nongoma Local Municipality, Zululand District Municipality. The site is accessed via district Road D1820, off the R66 road between Ulundi and Nongoma. The proposed dam wall is proposed to be constructed at co-ordinates 28° 1'1.81"S 31°32'57.35"E.

Umlando was appointed by Enviroedge to undertake a heritage survey of the proposed Usuthu Dam at the full supply level. The survey did not include the various pipelines and related infrastructures.

Fig.'s 1 – 4 show the location of the development.

FLORA AND FAUNA

The proposed Usuthu Dam falls within the Savanna Biome, and Mucina and Rutherford (2006) classify this vegetation group as Northern Zululand Sourveld, (SVI22). The water abstraction and treatment works, which are located 2,3km south west of the dam are classified as Zululand Lowveld (SVI23). The dominant vegetation type is wooded grasslands with rare dense bushveld thickets. Terrain is mainly low, undulating mountains, sometimes dissected, and also some moderately undulating plains and hills. Erosion is generally moderate to high within these systems. The vegetation unit is described as vulnerable with a conservation target of 19%. Indigenous trees, shrubs and groundcovers are found within the proposed Usuthu Dam site area. Acacia sp cover a large portion of the site, with a number of Aloe sp also present. Pheonix reclinanta (Wild Date Palm) and the protected tree Sclerocarya birrea (Marula), were also noted within the development area. It is likely that groundcover species including forbes, herbs and bulbs will occur within the study area. A comprehensive vegetation and ecological assessment will be undertaken for the site to identify all species and provide localities for protected species which will require permits

FIG. 1 GENERAL LOCATION OF THE STUDY AREA



FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA



FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA 91991)

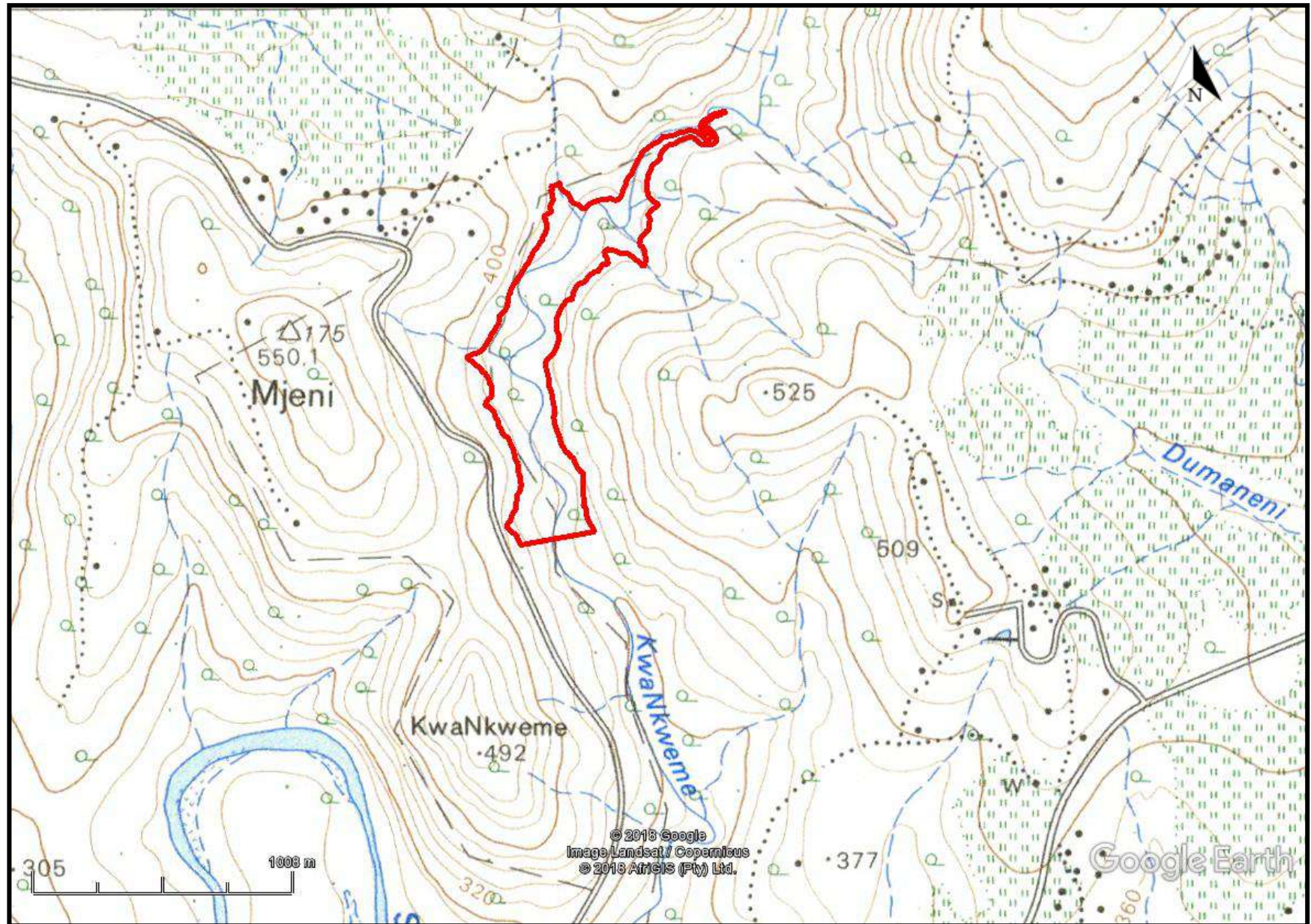


FIG. 4A: SCENIC VIEWS OF THE STUDY AREA



FIG. 4B: SCENIC VIEWS OF THE STUDY AREA



KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008

“General protection: Structures.—

- No structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.
- Where the Council does not grant approval, the Council must consider special protection in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- The Council may, by notice in the *Gazette*, exempt—
- A defined geographical area; or
- defined categories of sites within a defined geographical area, from the provisions of subsection where the Council is satisfied that heritage resources falling in the defined geographical area or category have been identified and are adequately protected in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- A notice referred to in subsection (2) may, by notice in the *Gazette*, be amended or withdrawn by the Council.

General protection: Graves of victims of conflict.—No person may damage, alter, exhume, or remove from its original position—

- the grave of a victim of conflict;
- a cemetery made up of such graves; or
- any part of a cemetery containing such graves, without the prior written approval of the Council having been obtained on written application to the Council.
- General protection: Traditional burial places.—
- No grave—
- not otherwise protected by this Act; and
- not located in a formal cemetery managed or administered by a local authority, may be damaged, altered, exhumed, removed from its original position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

The Council may only issue written approval once the Council is satisfied that—

- the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and
- the applicant and the relevant communities or individuals have reached agreement regarding the grave.

General protection: Battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, meteorite or meteorite impact sites.—

- No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.
- The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.
- No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or excavation equipment onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or

- use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.
- The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government.” (KZN Heritage Act of 2008)

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the database that has been collated by Umlando. These databases contains archaeological site locations and basic information from several provinces (information from Umlando surveys and some colleagues), most of the national and provincial monuments and battlefields in Southern Africa (<http://www.vuvuzela.com/googleearth/monuments.html>) and cemeteries in southern Africa (information supplied by the Genealogical Society of Southern Africa). We use 1st and 2nd edition 1:50 000 topographical and 1937 aerial photographs where available, to assist in general location and dating of buildings and/or graves. The database is in Google Earth format and thus used as a quick reference when undertaking desktop studies. Where required we would consult with a local data recording centre, however these tend to be fragmented between different institutions and areas and thus difficult to access at times. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The survey results will define the significance of each recorded site, as well as a management plan.

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

Heritage sites vary according to significance and several different criteria relate to each type of site. However, there are several criteria that allow for a general significance rating of archaeological sites.

These criteria are:

1. State of preservation of:

- 1.1. Organic remains:
 - 1.1.1. Faunal
 - 1.1.2. Botanical
- 1.2. Rock art
- 1.3. Walling
- 1.4. Presence of a cultural deposit
- 1.5. Features:
 - 1.5.1. Ash Features
 - 1.5.2. Graves
 - 1.5.3. Middens
 - 1.5.4. Cattle byres
 - 1.5.5. Bedding and ash complexes

2. Spatial arrangements:

2.1. Internal housing arrangements

2.2. Intra-site settlement patterns

2.3. Inter-site settlement patterns

3. Features of the site:

3.1. Are there any unusual, unique or rare artefacts or images at the site?

3.2. Is it a type site?

3.3. Does the site have a very good example of a specific time period, feature, or artefact?

4. Research:

4.1. Providing information on current research projects

4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

5.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?

5.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

6. Archaeological Experience:

6.1. The personal experience and expertise of the CRM practitioner should not be ignored. Experience can indicate sites that have potentially significant aspects, but need to be tested prior to any conclusions.

7. Educational:

7.1. Does the site have the potential to be used as an educational instrument?

7.2. Does the site have the potential to become a tourist attraction?

7.3. The educational value of a site can only be fully determined after initial test-pit excavations and/or full excavations.

8. Other Heritage Significance:

8.1. Palaeontological sites

8.2. Historical buildings

8.3. Battlefields and general Anglo-Zulu and Anglo-Boer sites

- 8.4. Graves and/or community cemeteries
- 8.5. Living Heritage Sites
- 8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

The more a site can fulfill the above criteria, the more significant it becomes. Test-pit excavations are used to test the full potential of an archaeological deposit. This occurs in Phase 2. These test-pit excavations may require further excavations if the site is of significance (Phase 3). Sites may also be mapped and/or have artefacts sampled as a form of mitigation. Sampling normally occurs when the artefacts may be good examples of their type, but are not in a primary archaeological context. Mapping records the spatial relationship between features and artefacts.

The above significance ratings allow one to grade the site according to SAHRA's grading scale. This is summarised in Table 1.

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

SITE SIGNIFICANCE	FIELD RATING	GRADE	RECOMMENDED MITIGATION
High Significance	National Significance	Grade 1	Site conservation / Site development
High Significance	Provincial Significance	Grade 2	Site conservation / Site development
High Significance	Local Significance	Grade 3A / 3B	
High Medium Significance	/ Generally Protected A		Site conservation or mitigation prior to development / destruction
Medium Significance	Generally Protected B		Site conservation or mitigation / test excavation / systematic sampling / monitoring prior to or during development / destruction
Low Significance	Generally Protected C		On-site sampling monitoring or no archaeological mitigation required prior to or during development / destruction

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. The archaeological database indicates that there are archaeological sites in the general area (fig. 5). These sites include all types of Stone Age and Iron Age sites. No sites occur in the study area.

No national monuments, battlefields, or historical cemeteries are known to occur in the study area.

The 1937 aerial photographs indicate that there are no settlements within the maximum supply level, nor within 100m of it (fig. 6). In fact, there are hardly any settlements in the general area.

The 1937 settlement pattern persists to 1968, although there is a minimal increase in settlements (fig. 7). It is only from the 1990s onwards that the area becomes more densely occupied (fig. 3).

FIG. 5: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA

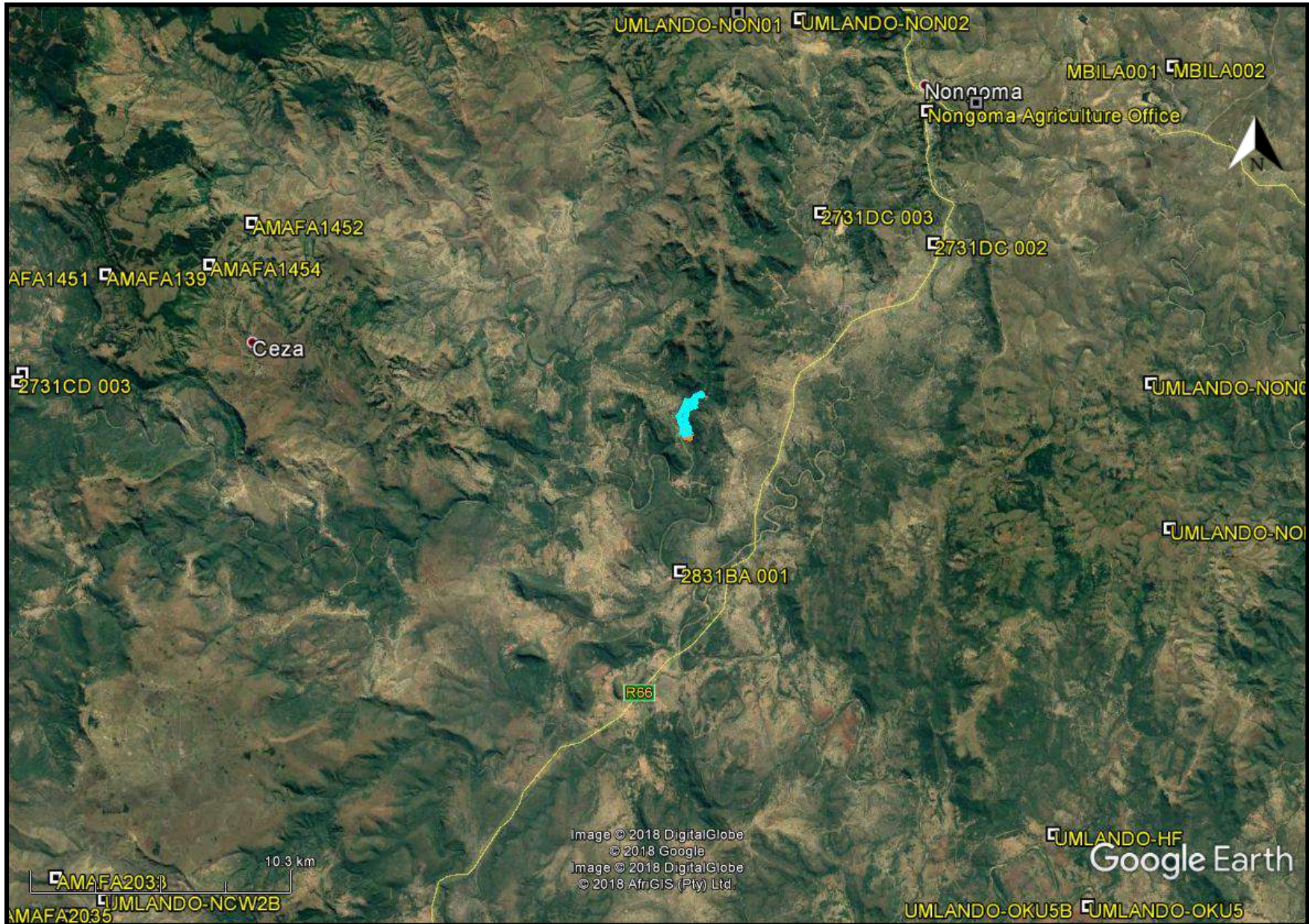
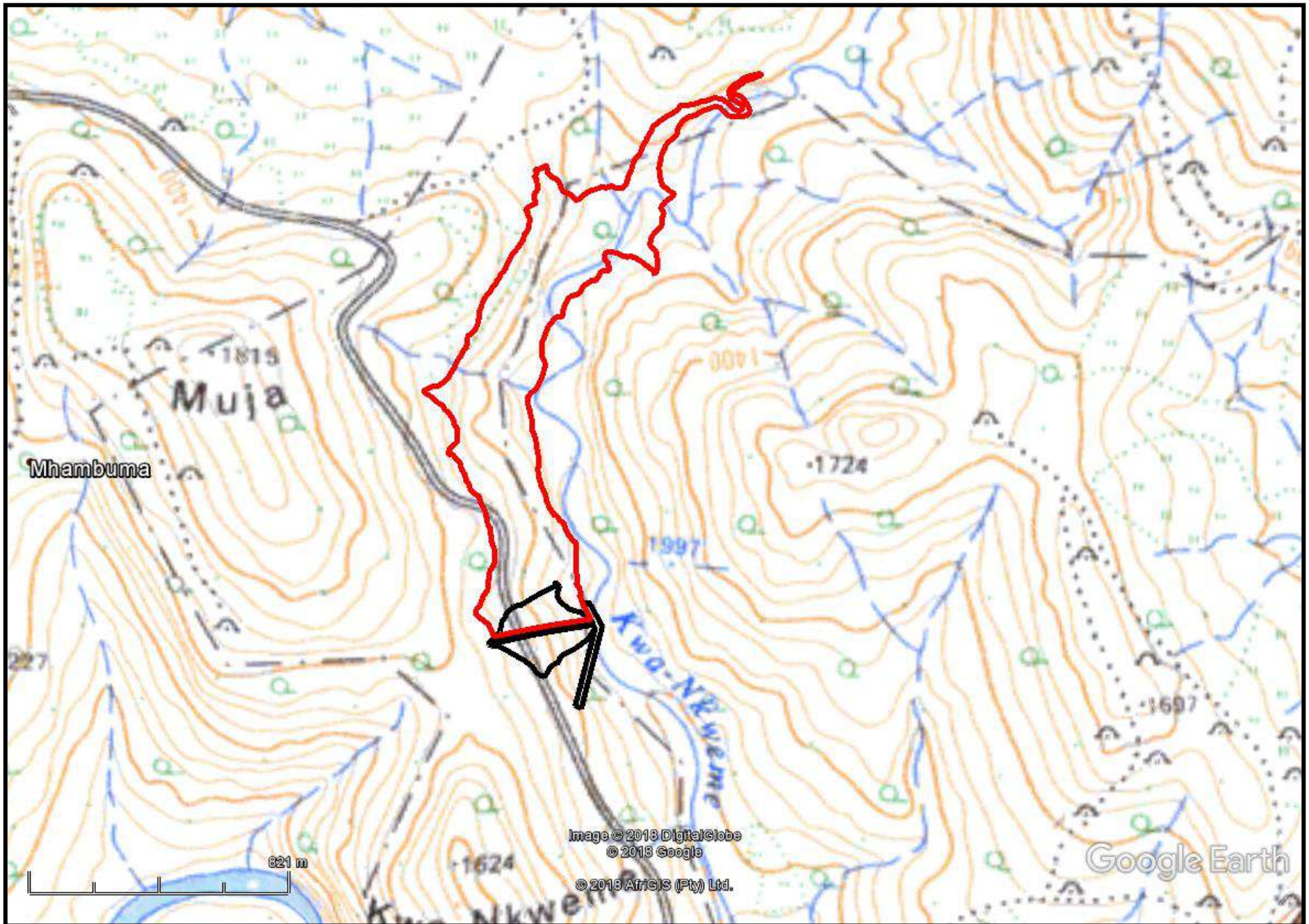


FIG. 6: STUDY AREA IN 1937¹



FIG. 7: STUDY AREA IN 1968



PALAEONTOLOGICAL IMPACT ASSESSMENT

The development site for the Usuthu Dam Development falls on Very Highly to Moderately significant sedimentary rocks (Ecca Group) that might contain significant fossils (fig. 8). Poorly preserved imprints of fossils were recorded during the first site studies in these rock formations (Archaeologist notes). The potential for finding significant vertebrate, plant and trace-fossils, in any excavation into sediments of the Vryheid Formation, Ecca Group is Very High and the cooperation of the entire team of Developer and the contractors, is of critical importance. It is essential that the excavations be monitored during the entire period of dam wall construction. That is, a “Chance Find Protocol” be updated on a regular bases during the life-time of the excavation period for the Project. It is essential that the Palaeontologist be notified of the final sign-off of the project date, for final posting of the “Chance Find Protocol” on the SAHRIS Website for record purposes.

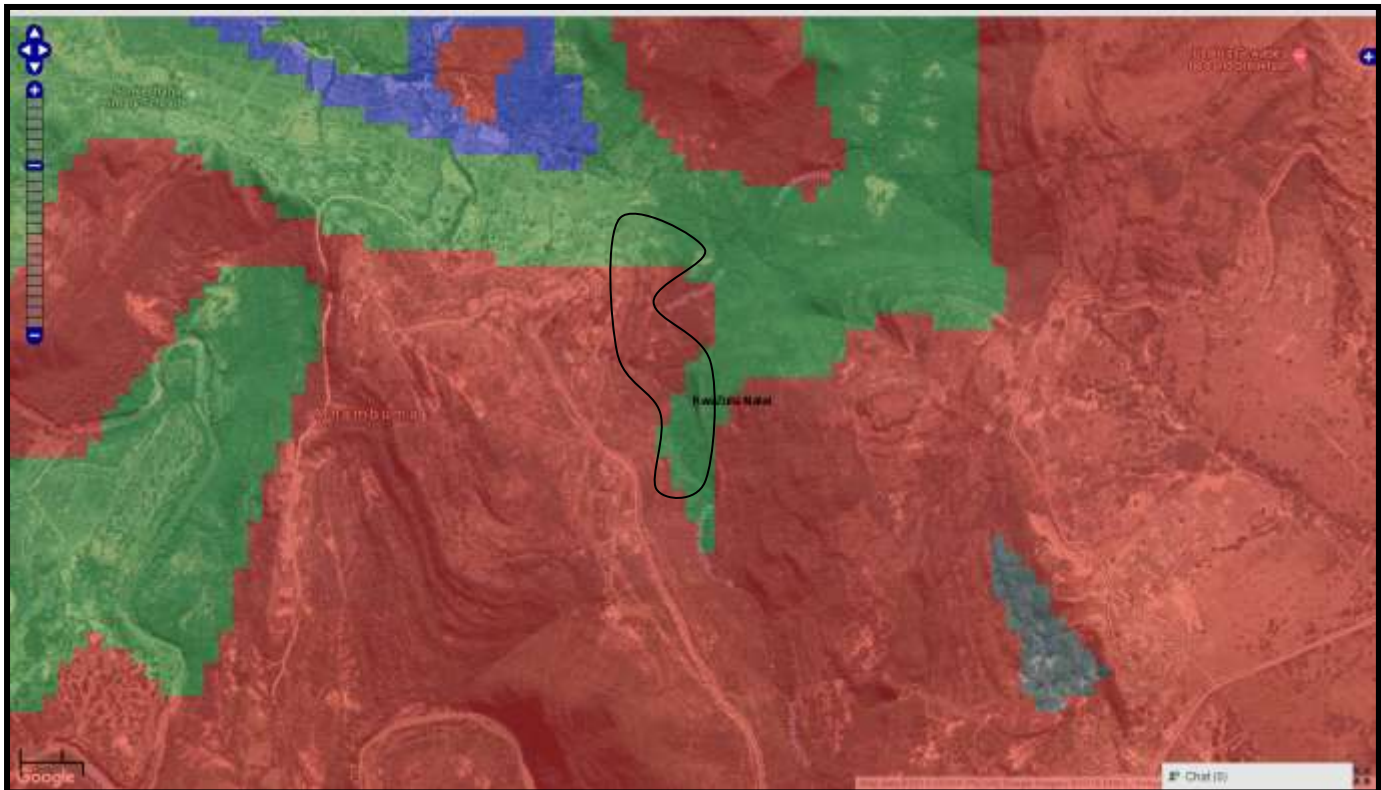
It is recommended that:

- The EAP, Project Manager and the ECO must be informed of the fact that a Moderate to Very High Palaeontological Sensitivity was allocated to the entire development and due to the highly weathered nature of the material, significant fossils is expected after the start of excavations for foundations that exceed 1.5m.
- The allocated team members in the teams of the contractor should be introduced to Palaeontological material that is likely to be found on site. A once-off information session with the Palaeontological specialist must be arranged at the start of each individual Contractual Construction Site, to present a simple and understandable (preferably audio-visual presentation) to the majority of the contractual Managers and ECO’s on site during the initial site visit as must be indicated in the EMPr for the Project.
- This “Chance Find Protocol” must be included in the EMPr of the Project and a reasonable budget must be allocated to ensure compliance with the

legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.

- The Amafa KZN and SAHRA must be informed of the content of this “Chance Find Protocol” and EMP arrangements by the EAP and Developer, for final conclusion of the Project when completed.

FIG. 8: PALAEOSENSITIVITY MAP



COLOUR	SENSITIVITY	REQUIRED ACTION
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

FIELD SURVEY

The field survey was undertaken in September 2018. Most of the area had very dense river valley vegetation resulting in poor visibility in many areas. However, the slopes in the study area tended to be steep, and would not favour human occupation. It is only in the southwestern part of the study area where the upper levels of the proposed full supply level could have had human occupation. Those areas that would have had human settlements in the past would be above the 400m contour line. This does not exclude agricultural fields or possible iron smelting areas.

The 100 year flood line covers the lower areas besides the river. When flooding occurs, these areas would experience very strong flooding due to the natural funnelling of the river in several places. I noticed non in situ rocks 4m – 5m above the river bed in areas, i.e. they were carried in by flooding. These floods would have removed any archaeological deposit.

Five cliff faces were noted from the Google Earth imagery as potential rock art sites. These areas were visited, however it was apparent that they were unsuitable for rock art. This is either because of their location, i.e. a sheer drop to the river, or the incorrect rock type. Figure 9 shows some of these cliff faces. Unfortunately the compatible rock types tend to be near the river bed and thus any potential rock art would have been eroded decades, or centuries, ago.

There are two overhangs, or shelters, between the 350m and 400m contour, on the western side of the river. One of these appeared to have potential archaeological deposit and rock art (fig. 10). However, no signs of human occupation could be found.

The northern part of the full supply level has a coal seam running through the sandstone deposit (fig. 11). This appears to be very low level coal, however it highlighted the possibility for iron smelting. The adjacent river banks were surveyed for these features, but none were noted.

FIG. 9 CLIFF FACES IN THE STUDY AREA



FIG. 10: OVERHANG IN THE STUDY AREA



FIG. 11: COAL SEAM IN THE NORTHERN PART OF THE STUDY AREA



In the northwestern part of the study area is an erosion area. The erosion gully is at least 5m deep in places and has exposed apparent palaeontological mud beds, calcrete formations, and more recently MSA and LSA tools (fig. 12). The erosion area is visible in the 1937 aerial photograph. All of the stone tools are in a secondary context, and appear to have originated further uphill. Further south, and above the full supply level, are similar stone tool occurrences (fig. 13). The tools are mostly flakes and cores. All this suggests is that the MSA and LSA occupations occur above the 400m contour line and these will not be effected.

No further mitigation is required for the archaeological component. No human graves were noted in the study area.

FIG. 12: EROSION GULLY AND ARTEFACTS IN THE STUDY AREA



FIG. 13: LSA ARTEFACTS ABOVE THE 400M CONTOUR LIINE



MANAGEMENT PLAN

In terms of the archaeology, no further mitigation is required. No archaeological sites were observed within the full supply level of the dam. While several artefacts were noted, these originate from further uphill.

No further archaeological mitigation is required. However, the management plan for the palaeontology is more involved. It is essential that the appointed palaeontologist, in consultation with the Project Environmental Manager and the contractors and ECO of the excavation works develop a short-term strategy for the recovery of significant

fossils during the excavation operation. As part of such a strategy, the discussions with the palaeontologist must include:

- Initially, and at least for the *duration of excavation*, visit the site on request of the ECO of the specific construction site, to ensure recording of all potentially significant fossil strata. Due to the longevity of this contractual involvement it is not possible to have pre-determined timing on these visits and it is a conclusion from previous excavations, that more frequent visits by the Palaeontologist during excavations into the Vryheid Formation sediments will most probably be required. Less frequent site visits are necessary during excavation into the Pietermaritzburg Formation units.
- Determine a short-term strategy and budget for the recording of significant fossils. This Strategy is simply an oral agreement on when the site is to be inspected and what the finds are that might be recorded. The site visit must include an introduction session with all the managers of the Project Team, including training of the ECO and site managers by the appointed palaeontologist, to basically train people to know what to look out for in terms of fossil heritage on site. This action will be required at the start of each individual construction activity for the duration of construction in the “greenfield sections” of the Project.
- In the case of reporting of any unusual sedimentary structures, the Palaeontologist must be notified, and a site visit must be arranged at the earliest possible time with the Palaeontologist. In the case of the site ECO or the Site Manager becoming aware of suspicious looking material that might be a “Significant Find”, the construction must be halted in that specific area and the ECO must be informed who will inform the Project Engineer. The Palaeontologist must be given enough time to reach the site and the ECO will request a Site Instruction from the Engineer to allow for removal the material before excavation continues.

Mitigation Measures Normally Encountered

1. Mitigation of palaeontological material must begin as soon as possible and preferably when “trial excavation” takes place. The appointed specialists must acquaint themselves with the operation and determine feasible mitigation strategies.
2. A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the Evolutionary Studies Institute (ESI) at WITS University, which is the closest Institute to the site.
3. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer and ECO for the Project

1. Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas. In the case of this project it is foreseen that vertebrate, plant and trace fossils will be present. *(If fossils of Carboniferous and Permian age are exposed, it will be Very Highly significant and the Palaeontologist will obviously be in close communication*

with the site ECO to act as required by AMAFA/SAHRA without causing undue standing time for the contractors).

3. “Facilitate” systematic recording of the stratigraphic and palaeo-environmental features of exposures in the fossil-bearing excavations, by allowing time to describe and measure geological sections, and by providing aid in the surveying of positions where significant fossils are found. *(In the case of this specific development, the likelihood of such finds is Very High).*
4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.
5. Provide covered, dry storage for samples and facilities that is defined as a work area for sorting, labelling and boxing/bagging of samples.
6. Costs of basic curation and storage in the sample archive at the ESI, WITS University (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees).

Documentary record of palaeontological occurrences

1. The contractors will, after consultation with the ECO and in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which the following information are indicated on the plan in the site office at the excavation site. This must be done in conjunction with the appointed specialist and form part of the on-going revision of the “Chance Find Protocol” (CFP) during the excavation stage of the project:
 - 1.1. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.
 - 1.2. Locations of samples and measured sections are to be pegged, and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any significant fossils are recorded during the time of excavation. This information must be recorded during the first site visit and a clearance from the Palaeontologist (e-mail message

will suffice) must be followed up with subsequent e-mail communications with the Site Specific ECO and Site Manager.

Functional responsibilities of the appointed Palaeontologist

1. Apply for a permit to collect fossils during the lifetime of the Project and establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata in collaboration with the ESI at WITS University, or the Rhodes University, University of KwaZulu-Natal, depending on the Expertise available at each Institute.
2. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations. A short training session, inclusive of the ECO, Project Managers and their representatives, must be presented during the second site visit to this project.
3. On the basis of the above, and evaluation during the early stages of excavation development, in collaboration with the ECO and the contractor management team, prepare more detailed practical strategies to deal with the fossils encountered routinely during excavation, as well as the strategies for major finds, must briefly be agreed on.
4. Informal on-site training in responses applicable to “normal” fossil finds must be provided for the ECO and environmental staff by the appointed specialist. This step is will only be arranged following the discovery of significant fossils at the time of the Phase 2 site visits.
5. Respond to significant finds and undertake appropriate mitigation.
6. Initially, for the first year of operation, and if the Project Manager or the appropriate ECO, indicates significant “strange looking rocks” that might be similar to the fossils indicated to the staff during the information sessions, visit at least once in twelve weeks to “touch base” with the monitoring progress. Document interim “normal” finds and undertake an inspection and

documentation of new excavation faces. A strategy for further visits during the life of the excavation must be discussed.

7. Transport of material from the site to the ESI, WITS University or the allocated Institute where an expert on the specific fossils discovered, is presently employed.
8. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at ESI, ECPTA and the South African Heritage Resources Authority (SAHRA). It must fulfil the reporting standards and data requirements of these bodies.
9. Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

Exposure of palaeontological material

1. In the event of construction exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil find, the following procedure must be adhered to:
 - 1.1 The appointed specialist or alternates (ECPTA; SAHRA; ESI WITS University, University of KZN; Rhodes University) must be notified by the responsible officer (e.g. the Chief Engineer, ECO or Contract Manager), of major or unusual discoveries during excavation, found by the Contractor Staff.
 - 1.2 Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the ESI at WITS University, or its designated representatives, have had reasonable opportunity to investigate the find. Such work will be at the expense of the Developer.

CONCLUSION

A heritage survey was undertaken for the Usuthu Dam, KZN. The survey included a field trip and a desktop PIA. The steep slopes of the river valley make it highly unlikely for archaeological sites to occur. The geological formations in the valley are not conducive for rock shelters and overhangs, except above the 400m contours. No archaeological sites occur in the areas with gentle slopes or close to the river.

Several Stone Age tools were noted throughout the study area, at various contour lines. All of these stone tools are in a secondary deposit and have washed down from higher up the hill. No human heritage sites were observed within the full supply level

The PIA noted that much of the area is in a Moderate or Highly Sensitive Palaeontological areas. The excavations for the dam wall in particular require a Chance Find Protocol, as well as extensive monitoring from the beginning of the project. The PIA aspect of the project will also require storage facilities.

The HIA and PIA for this project only covers the proposed Usuthu Dam. It does not cover any related infrastructures, such as piping to/from the dam, site offices, etc. that would occur outside the full supply level.

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Natal Museum Site Record Database
SAHRA Site Record Database
Umlando Site Record Database

EXPERIENCE OF THE HERITAGE CONSULTANT

Gavin Anderson has a M. Phil (in archaeology and social psychology) degree from the University of Cape Town. Gavin has been working as a professional archaeologist and heritage impact assessor since 1995. He joined the Association of Professional Archaeologists of Southern Africa in 1998 when it was formed. Gavin is rated as a Principle Investigator with expertise status in Rock Art, Stone Age and Iron Age studies. In addition to this, he was worked on both West and East Coast shell middens, Anglo-Boer War sites, and Historical Period sites.

DECLARATION OF INDEPENDENCE

I, Gavin Anderson, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



Gavin Anderson
Archaeologist/Heritage Impact Assessor

**APPENDIX A
PIA DESKTOP ASSESSMENT**

**DESKTOP PALAEOLOGICAL
ASSESSMENT AND "CHANCE FIND
PROTOCOL" FOR THE PROPOSED USUTHU
DAM DEVELOPMENT SOUTH OF NONGOMA
IN THE NONGOMA LOCAL MUNICIPALITY,
ZULULAND DISTRICT MUNICIPALITY,
KWAZULU-NATAL PROVINCE.**

FOR
Umlando

DATE: 28 September 2018

By

Gideon Groenewald
Cell: 078 713 6377

EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a Desktop Palaeontological Assessment for the proposed Usuthu Dam Development south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province.

The development is a well-planned Off-Stream Storage Dam Building Water Scheme in the Kwa Nkweme River (Figure 1) with water supply from the Black Mfolozi River in KwaZulu-Natal Province. The main aim is to develop off stream water storage facility that can supply in the larger Nongoma Municipal region.

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (revised 2017) as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

The development site applicable to the application for proposed Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province, is underlain by Very Highly and Moderately sensitive rocks for Palaeontological Heritage.

No significant fossils are expected to be exposed at this stage of the planning of the Project and the Palaeontological Expert does not recommend that a Phase 1 site visit is planned before significant exposure of the sediments are planned. If any formation to the contrary is recorded during the preparation phase of the development, it is very important to note that a suitably qualified palaeontologist must visit all the sites indicated as Very Highly and Moderately sensitive during the first week of excavation.

If fossils are recorded the palaeontologist must upgrade the "Chance Find Protocol" document for as required in the EMPr for the Project.

It is recommended that:

- The EAP and ECO must be informed of the fact that a Very High to Moderate value for Palaeontological sensitivity is allocated to large parts

of study area underlain by Karoo aged rocks that will most probably be exposed during the construction for the dam wall.

- No further mitigation for Palaeontological Heritage is recommended for this project **before excavation of deeper than 1.5m is done.**
- In areas where excavations **will exceed 1,5m** (see geotechnical reports) in the sections allocated a Very High and Moderately sensitivity, a suitably qualified palaeontologist must do a Phase 1 PIA and upgrade the “Chance Find Protocol” (CFP). This study must be done **during the first month of the planned excavation.**
- Recommendations contained in the resultant Phase 1 PIA and CFP must be approved by AMAFA and SAHRA for inclusion in the EMPr of the project.
- These recommendations must be included in the EMPr of this project.

CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE

Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province

Mitigation for Excavation Impact on Palaeontological Heritage Resources

It is essential that the appointed palaeontologist, in consultation with the Project Environmental Manager and the contractors and ECO of the excavation works develop a short-term strategy for the recovery of significant fossils during the excavation operation.

The development site for the Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province falls on Very Highly to Moderately significant sedimentary rocks (Ecca Group) that might contain significant fossils.

Poorly preserved imprints of fossils were recorded during the first site studies in these rock formations (Archaeologist notes). The potential for finding significant vertebrate, plant and trace-fossils, in any excavation into sediments of the Vryheid Formation, Ecca Group is Very High and the cooperation of the entire team of Developer and the contractors, is of critical importance. The interest and cooperation of the management team will be highly appreciated and it is essential that the excavations be monitored during the entire period of excavation and that this "Chance Find Protocol" be updated on a regular bases during the life-time of the excavation period for the Project. It is essential that the Palaeontologist be notified of the final sign-off of the project date, for final posting of the "Chance Find Protocol" on the SAHRIS Website for record purposes.

It is recommended that:

- The EAP, Project Manager and the ECO must be informed of the fact that a Moderate to Very High Palaeontological Sensitivity was allocated to the entire development and due to the highly weathered nature of the material, significant fossils is expected after the start of excavations for foundations that exceed 1.5m.
- The allocated team members in the teams of the contractor should be introduced to Palaeontological material that is likely to be found on site. A once-off information session with the Palaeontological specialist must be

arranged at the start of each individual Contractual Construction Site, to present a simple and understandable (preferably audio-visual presentation) to the majority of the contractual Managers and ECO's on site during the initial site visit as must be indicated in the EMPr for the Project.

- This "Chance Find Protocol" must be included in the EMPr of the Project and a reasonable budget must be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The AMAFA and SAHRA must be informed of the content of this "Chance Find Protocol" and EMPr arrangements by the EAP and Developer, for final conclusion of the Project when completed.

TABLE OF CONTENT

<u>EXECUTIVE SUMMARY</u>	40
<u>CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE</u>	42
<u>Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province</u>	42
<u>Mitigation for Excavation Impact on Palaeontological Heritage Resources</u>	42
<u>TABLE OF CONTENT</u>	44
<u>INTRODUCTION</u>	46
<u>Legal Requirements</u>	46
<u>Aims and Methodology</u>	47
<u>Scope and Limitations of the Desktop Study</u>	50
<u>Locality and Proposed Development</u>	51
<u>GEOLOGY</u>	52
<u>Karoo Supergroup</u>	53
<u>Ecca Group</u>	53
<u>Pietermaritzburg Formation (Pp)</u>	53
<u>Vryheid Formation (Pv)</u>	53
<u>PALAEOLOGY</u>	53
<u>Karoo Supergroup</u>	53
<u>Ecca Group</u>	53
<u>Pietermaritzburg Formation (Pp)</u>	53
<u>Vryheid Formation (Pv)</u>	54
<u>PALAEOLOGICAL IMPACT AND MITIGATION</u>	55
<u>CONCLUSION</u>	56
<u>REFERENCES</u>	58
<u>QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR</u>	59
<u>DECLARATION OF INDEPENDENCE</u>	59
<u>CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE</u>	60
<u>Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province</u>	60
<u>Mitigation for Excavation Impact on Palaeontological Heritage Resources</u>	60
<u>Mitigation Measures Normally Encountered</u>	61
<u>Functional responsibilities of the Developer and ECO for the Project</u>	61
<u>Documentary record of palaeontological occurrences</u>	62
<u>Functional responsibilities of the appointed Palaeontologist</u>	62
<u>Exposure of palaeontological material</u>	63
<u>CONCLUSION</u>	63

TABLE OF FIGURES

[Figure 1 Locailty of the Usuthu Dam Site](#)..... 46

[Figure 2 General layout of the Usuthu Dam site](#)**Error! Bookmark not defined.**

[Figure 3 Geology of the Study Area falls on the boundary of the underlying Pietremaritzburg Formation \(brown\) and the overlying Vryheid Formation \(grey\)](#) 52

[Figure 4 Palaeontological sensitivity of the geological formations underlying the Usuthu Dam development site](#) 55

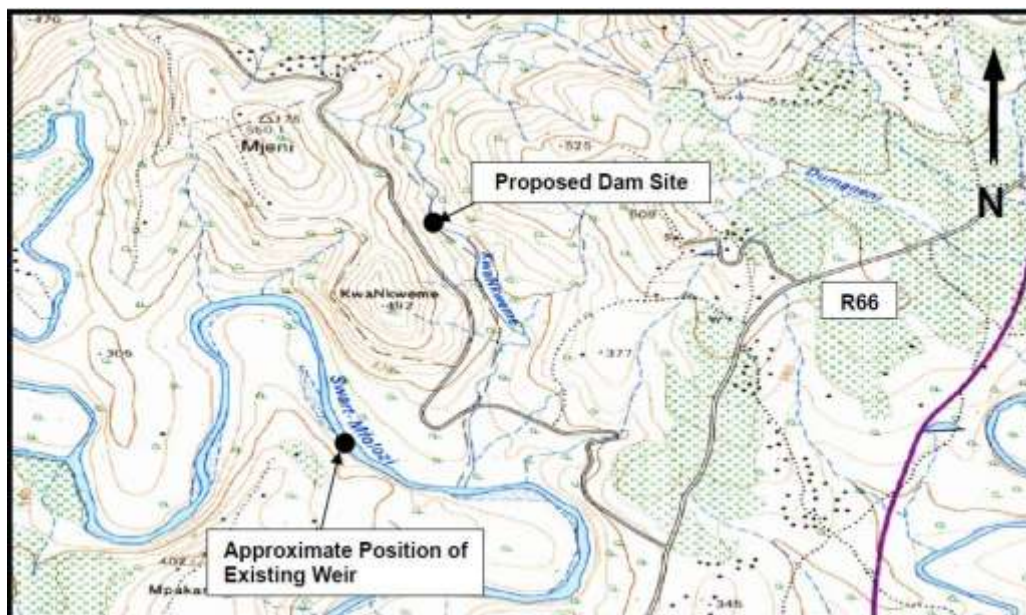
LIST OF TABLES

[Table 1 Palaeontological sensitivity analysis outcome classification](#) . 48

INTRODUCTION

Gideon Groenewald was appointed to undertake a Desktop Palaeontological Assessment for the proposed Usuthu Dam Development south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province.

The development is a well-planned Off-Stream Storage Dam Building Water Scheme in the Kwa Nkweme River (Figure 1) with water supply from the Black Mfolozi River in KwaZulu-Natal Province. The main aim is to develop off stream water storage facility that can supply in the larger Nongoma Municipal region.



Legal

Figure 1 Locailty of the Usuthu Dam Site

Requirements

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (revised 2017) as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; and
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

Aims and Methodology

A Desktop investigation is often the only opportunity to record the fossil heritage within the development footprint. These records are very important to understand the past and form an important part of South Africa's National Estate.

Following the "*SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports*" the aims of the palaeontological impact assessment are:

- to identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assessing the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

Prior to a field investigation, a preliminary assessment (desktop study) of the topography and geology of the study area is made, using appropriate 1:250 000 geological information (2830 Dundee) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) are identified within the study area and the known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas are identified within the development footprint to focus the field investigator's time and resources. The aim of the desktop survey is to document any exposed fossil material and to assess the palaeontological potential of the region in terms of the type and extent of rock outcrop in the area.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the minimal extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008) and Groenewald et al., (2014)	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.

GREEN	<p>Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) compulsory.</p>
BLUE	<p>Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and "Chance Find Protocol" is compulsory. The Chance Find Protocol must be included in the EMPr for the project.</p>

GREY	<p>Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and "Chance Find Protocol" document is compulsory. The Chance Find Protocol must be included in the EMP of the project.</p>
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When rock units of Moderate to Very High Palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. A suitably qualified Palaeontologist must clear all projects falling on Low to Very Low Palaeontological sensitive geology.

Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant

palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc.).

Locality and Proposed Development

The proposed Usuthu Dam Development is situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province (Figure 2).

The development falls in undisturbed rural terrain underlain by sandy and clayey soils of mainly weathered rocks of the Karoo Supergroup rocks.

The Usuthu Dam will act as a holding dam off-stream from the Black Umfolozi River, from where the water will be pumped into this embankment.

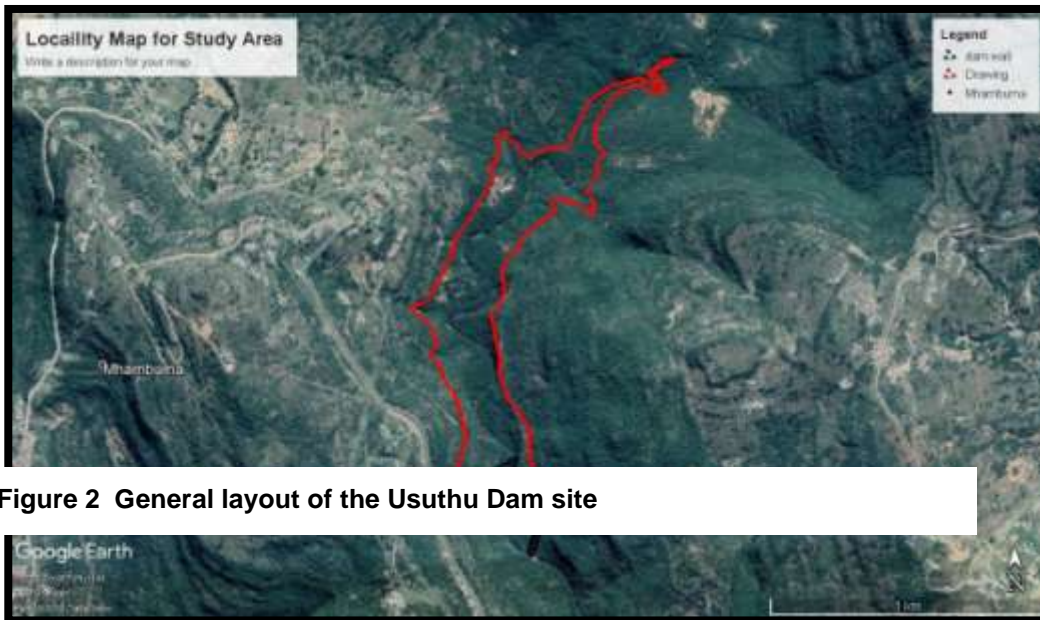


Figure 2 General layout of the Usuthu Dam site

GEOLOGY

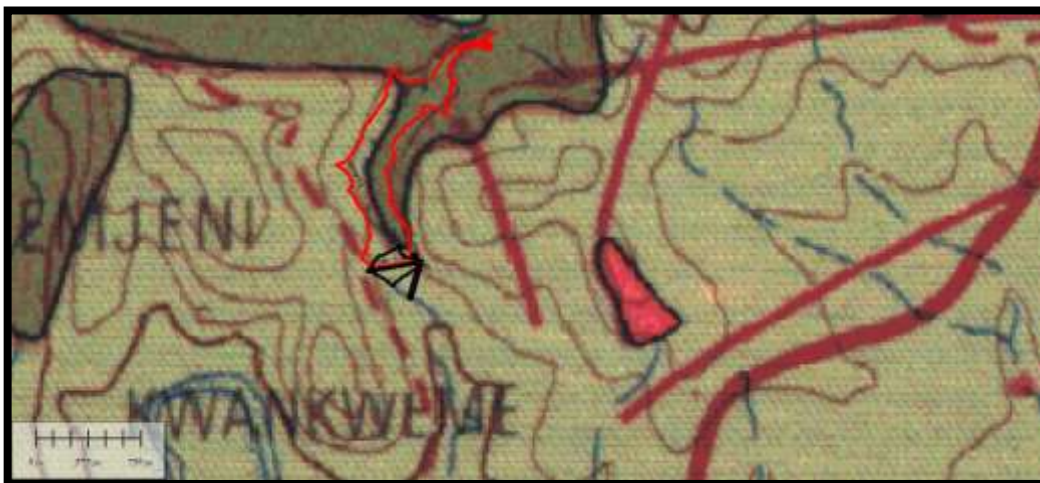


Figure 3 Geology of the Study Area falls on the boundary of the underlying Pietremaritzburg Formation (brown) and the overlying Vryheid Formation (grey)

The site of the development falls on very deep sand and clay from weathered rocks of Permian aged Pietremaritzburg and Vryheid Formations of the Ecca Group, Karoo Supergroup (Figure 3) (Johnson et al, 2009; Groenewald, 2012). The project most

probably spans a uniquely deep alluvial fill of the valley, which will not be indicated on this map due to the scale of mapping.

Karoo Supergroup

Ecca Group

Pietermaritzburg Formation (Pp)

The Pietermaritzburg Formation consists primarily of very dark shales of a deep marine deposit in this part of KZN during the existence of Gondwanaland during the Permian. The shale is not known to contain a lot of fossils but trace fossils and some plant fossils have been reported from outcrops in the northern part of KwaZulu-Natal (Johnson et al, 2009).

Vryheid Formation (Pv)

The entire development of the dam wall and spillway is underlain by the Vryheid Formation (Figure 3) where there are only very deeply weathered sandstone of this Permian aged deltaic sandstone (Johnson et al, 2009). The initial observations (Archaeological Reports) indicates outcrop of coal rich beds in the shale associated with the sandstone. The palaeo-environment is interpreted as shallow marine sand bars along a coastline that was fed by rivers from the north (Johnson et al, 2009).

PALAEONTOLOGY

Karoo Supergroup

Ecca Group

Pietermaritzburg Formation (Pp)

The Pietermaritzburg Formation is not known for significant fossils, but the upper part of this formation can contain significant trace and plant fossils. This is most probably true for the study area where the dam basin is entirely underlain by rocks of this formation, whereas the dam wall will be built on the contact of the formation with the overlying Vryheid Formation sandstone. It is very likely that plant and trace fossils will be exposed during excavations for the foundations of the dam wall as well as the spillway.

Vryheid Formation (Pv)

The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile*, *Cyclodendron leslii*, *Sphenophyllum hammanskraalensis*, *Annularia sp.*, *Raniganjia sp.*, *Asterotheca spp.*, *Liknopetalon enigmata*, *Glossopteris > 20 species*, *Hirsutum 4 spp.*, *Scutum 4 spp.*, *Ottokaria 3 spp.*, *Estcourtia sp.*, *Arberia 4 spp.*, *Lidgettonia sp.*, *Noeggerathiopsis sp.* and *Podocarpidites sp.*

According to Bamford (2011) “Little data have been published on these potentially fossiliferous deposits. Around the coalmines there is most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution.

Although no vertebrate fossils have been recorded from the Vryheid Formation, invertebrate trace fossils have been described in some detail by Mason and Christie (1985). It should be noted, however, that the aquatic reptile, *Mesosaurus*, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999; Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that *Mesosaurus* could be found in the Vryheid Formation (Catuneanu et al 2005).

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985).

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the desktop



Figure 4 Palaeontological sensitivity of the geological formations underlying the Usuthu Dam development site

investigation. The desktop investigation confirms that the study area is underlain by relatively deep (>2m) clay soil associated with Permian aged fossiliferous units (Figure 4). The study area is underlain by rocks with a Moderate and Very High sensitivity for Palaeontological Heritage (Figure 4).

The fact that the development entails very high impact excavation for the construction of the dam wall and spillway, that will exceed 1,5m, this part of the development will result in deep (>1.5m) excavations into the Vryheid Formation.

It is not recommended that a phase 1 PIA be done **before** excavation exposed significant trenching deeper than 1,5m. It is rather recommended that the ECO reports any suspicious looking material for inspection by a suitably qualified HIA and/or PIA specialist as soon as excavation for this project starts. This recommendation is based on the information supplied to the Palaeontological specialist and the fact that

significant fossils will only be exposed during blasting and excavation for the construction of the dam wall and the spillway.

No further mitigation for Palaeontological Heritage is recommended at this stage for this project. It is however recommended that a suitably qualified Palaeontologist be appointed to do a Phase 1 PIA during the time of excavation into the subsoils and rocks on site if unweathered sediments are exposed in the Ecca Group. The ECO must be vigilant and if fossils are recorded during the first week of construction period, the appointed Palaeontologist must be on site at least **once a month during large scale excavations** into the Karoo aged formations.

If any fossils are unexpectedly recorded during excavations of more than 1.5m depth, and specifically in sections allocated a red (Very High sensitivity) (Figure 4), the palaeontologist must upgrade the "Chance Find Protocol" (CFP) within the first week of exposure of these rocks in the entire study area. This CFP report must be referred to in the EMPr of the project and upgraded continuously during the construction phase where excavations of deeper than 1,5m are planned for this project.

CONCLUSION

The development site applicable to the application for proposed Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province, is underlain by Very Highly and Moderately sensitive rocks for Palaeontological Heritage.

No significant fossils are expected to be exposed at this stage of the planning of the Project and the Palaeontological Expert do not recommend that a Phase 1 site visit is planned before significant exposure of the sediments are planned. If any formation to the contrary is recorded during the preparation phase of the development, it is very important to note that a suitably qualified palaeontologist must visit all the sites indicated as Very Highly and Moderately sensitive during the first week of excavation.

If fossils are recorded the palaeontologist must upgrade the "Chance Find Protocol" document for as required in the EMPr for the Project.

It is recommended that:

The EAP and ECO must be informed of the fact that a Very High to Moderate value for Palaeontological sensitivity is allocated to large parts of study area underlain by Karoo aged rocks that will most probably be exposed during the construction for the dam wall.

No further mitigation for Palaeontological Heritage is recommended for this project **before excavation of deeper than 1.5m is done.**

In areas where excavations **will exceed 1,5m** (see geotechnical reports) in the sections allocated a Very High and Moderately sensitivity, a suitably qualified palaeontologist must do a Phase 1 PIA and upgrade the "Chance Find Protocol" (CFP). This study must be done **during the first month of the planned excavation.**

Recommendations contained in the resultant Phase 1 PIA and CFP must be approved by AMAFA and SAHRA for inclusion in the EMPr of the project.

These recommendations must be included in the EMPr of this project.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.



Dr Gideon Groenewald
Geologist

CHANCE FIND PROTOCOL FOR PALAEOLOGICAL HERITAGE

Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province

Mitigation for Excavation Impact on Palaeontological Heritage Resources

It is essential that the appointed palaeontologist, in consultation with the Project Environmental Manager and the contractors and ECO of the excavation works develop a short-term strategy for the recovery of significant fossils during the excavation operation. As part of such a strategy, the discussions with the palaeontologist must include:

- Initially, and at least for the *duration of excavation*, visit the site on request of the ECO of the specific construction site, to ensure recording of all potentially significant fossil strata. Due to the longevity of this contractual involvement it is not possible to have pre-determined timing on these visits and it is a conclusion from previous excavations, that more frequent visits by the Palaeontologist during excavations into the Vryheid Formation sediments will most probably be required. Less frequent site visits are necessary during excavation into the Pietermaritzburg Formation units.
- Determine a short-term strategy and budget for the recording of significant fossils. This Strategy is simply an oral agreement on when the site is to be inspected and what the finds are that might be recorded. The site visit must include an introduction session with all the managers of the Project Team, including training of the ECO and site managers by the appointed palaeontologist, to basically train people to know what to look out for in terms of fossil heritage on site. This action will be required at the start of each individual construction activity for the duration of construction in the “greenfield sections” of the Project.
- In the case of reporting of any unusual sedimentary structures, the Palaeontologist must be notified, and a site visit must be arranged at the earliest possible time with the Palaeontologist. In the case of the site ECO or the Site Manager becoming aware of suspicious looking material that might be a “Significant Find”, the construction must be halted in that specific area and the ECO must be informed who will inform the Project Engineer. The Palaeontologist must be given enough time to reach the site and the ECO will request a Site Instruction from the Engineer to allow for removal the material before excavation continues.

Mitigation Measures Normally Encountered

1. Mitigation of palaeontological material must begin as soon as possible and preferably when “trial excavation” takes place. The appointed specialists must acquaint themselves with the operation and determine feasible mitigation strategies.

2. A plan for systematic sampling, recording, preliminary sorting and storage of palaeontological and sedimentological samples will be developed during the early stages of the project, in collaboration with the Evolutionary Studies Institute (ESI) at WITS University, which is the closest Institute to the site.

3. Mitigation will involve an attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer and ECO for the Project

1. Ensuring, at their cost, that a representative archive of palaeontological samples and other records is assembled to characterise the palaeontological occurrences affected by the excavation operation.

2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas. In the case of this project it is foreseen that vertebrate, plant and trace fossils will be present. *(If fossils of Carboniferous and Permian age are exposed, it will be Very Highly significant and the Palaeontologist will obviously be in close communication with the site ECO to act as required by AMAFA/SAHRA without causing undue standing time for the contractors).*

3. “Facilitate” systematic recording of the stratigraphic and palaeo-environmental features of exposures in the fossil-bearing excavations, by allowing time to describe and measure geological sections, and by providing aid in the surveying of positions where significant fossils are found. *(In the case of this specific development, the likelihood of such finds is Very High).*

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.

5. Provide covered, dry storage for samples and facilities that is defined as a work area for sorting, labelling and boxing/bagging of samples.

6. Costs of basic curation and storage in the sample archive at the ESI, WITS University (labels, boxes, shelving and, if necessary, specifically-tasked temporary employees).

Documentary record of palaeontological occurrences

1. The contractors will, after consultation with the ECO and in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which the following information are indicated on the plan in the site office at the excavation site. This must be done in conjunction with the appointed specialist and form part of the on-going revision of the "Chance Find Protocol" (CFP) during the excavation stage of the project:

1.1. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.

1.2 Locations of samples and measured sections are to be pegged, and routinely accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any significant fossils are recorded during the time of excavation. This information must be recorded during the first site visit and a clearance from the Palaeontologist (e-mail message will suffice) must be followed up with subsequent e-mail communications with the Site Specific ECO and Site Manager.

Functional responsibilities of the appointed Palaeontologist

1. Apply for a permit to collect fossils during the lifetime of the Project and establishment of a representative collection of fossils and a contextual archive of appropriately documented and sampled palaeoenvironmental and sedimentological geodata in collaboration with the ESI at WITS University, or the Rhodes University, University of KwaZulu-Natal, depending on the Expertise available at each Institute.

2. Undertake an initial evaluation of potentially affected areas and of available exposures in excavations. A short training session, inclusive of the ECO, Project Managers and their representatives, must be presented during the second site visit to this project.

3. On the basis of the above, and evaluation during the early stages of excavation development, in collaboration with the ECO and the contractor management team, prepare more detailed practical strategies to deal with the fossils encountered routinely during excavation, as well as the strategies for major finds, must briefly be agreed on.

4. Informal on-site training in responses applicable to "normal" fossil finds must be provided for the ECO and environmental staff by the appointed specialist. This step is will only be arranged following the discovery of significant fossils at the time of the Phase 2 site visits.

5. Respond to significant finds and undertake appropriate mitigation.

6. Initially, for the first year of operation, and if the Project Manager or the appropriate ECO, indicates significant “strange looking rocks” that might be similar to the fossils indicated to the staff during the information sessions, visit at least once in twelve weeks to “touch base” with the monitoring progress. Document interim “normal” finds and undertake an inspection and documentation of new excavation faces. A strategy for further visits during the life of the excavation must be discussed.

7. Transport of material from the site to the ESI, WITS University or the allocated Institute where an expert on the specific fossils discovered, is presently employed.

8. Reporting on the significance of discoveries, as far as can be preliminarily ascertained. This report is in the public domain and copies of the report must be deposited at ESI, ECPTA and the South African Heritage Resources Authority (SAHRA). It must fulfil the reporting standards and data requirements of these bodies.

9. Reasonable participation in publicity and public involvement associated with palaeontological discoveries.

Exposure of palaeontological material

1. In the event of construction exposing new palaeontological material, not regarded as normative/routine as outlined in the initial investigation, such as a major fossil find, the following procedure must be adhered to:

1.1 The appointed specialist or alternates (ECPTA; SAHRA; ESI WITS University, University of KZN; Rhodes University) must be notified by the responsible officer (e.g. the Chief Engineer, ECO or Contract Manager), of major or unusual discoveries during excavation, found by the Contractor Staff.

1.2 Should a major *in situ* occurrence be exposed, excavation will immediately cease in that area so that the discovery is not disturbed or altered in any way until the appointed specialist or scientists from the ESI at WITS University, or its designated representatives, have had reasonable opportunity to investigate the find. Such work will be at the expense of the Developer.

Some poorly defined impressions of fossils were observed during the first site visit and the palaeontologist cleared the continued excavation on the proviso that any suspicious material will be indicated to the Palaeontologist via emailed photographic information.

CONCLUSION

The development site for the Usuthu Dam Development, situated south of Nongoma in the Nongoma Local Municipality, Zululand District Municipality, Kwazulu-Natal Province falls on Very Highly to Moderately significant sedimentary rocks (Ecca Group) that might contain significant fossils.

Poorly preserved imprints of fossils were recorded during the first site studies in these rock formations (Archaeologist notes). The potential for finding significant vertebrate, plant and trace-fossils, in any excavation into sediments of the Vryheid Formation, Ecca Group is Very High and the cooperation of the entire team of Developer and the contractors, is of critical importance. The interest and cooperation of the management team will be highly appreciated and it is essential that the excavations be monitored during the entire period of excavation and that this "Chance Find Protocol" be updated on a regular bases during the life-time of the excavation period for the Project. It is essential that the Palaeontologist be notified of the final sign-off of the project date, for final posting of the "Chance Find Protocol" on the SAHRIS Website for record purposes.

It is recommended that:

- The EAP, Project Manager and the ECO must be informed of the fact that a Moderate to Very High Palaeontological Sensitivity was allocated to the entire development and due to the highly weathered nature of the material, significant fossils is expected after the start of excavations for foundations that exceed 1.5m.
- The allocated team members in the teams of the contractor should be introduced to Palaeontological material that is likely to be found on site. A once-off information session with the Palaeontological specialist must be arranged at the start of each individual Contractual Construction Site, to present a simple and understandable (preferably audio-visual presentation) to the majority of the contractual Managers and ECO's on site during the initial site visit as must be indicated in the EMPr for the Project.
- This "Chance Find Protocol" must be included in the EMPr of the Project and a reasonable budget must be allocated to ensure compliance with the legal responsibility of the developer in terms of the proper conservation of and storage of Palaeontological Heritage.
- The AMAFA and SAHRA must be informed of the content of this "Chance Find Protocol" and EMPr arrangements by the EAP and Developer, for final conclusion of the Project when completed.