
**HERITAGE SURVEY OF THE PROPOSED UMHLALI
RESIDENTIAL DEVELOPMENT**

FOR TRIPLO4 SUSTAINABLE SOLUTIONS

DATE: 15 DECEMBER 2017

By Gavin Anderson

**Umlando: Archaeological Surveys and Heritage
Management**

PO Box 102532, Meerensee, 3901

Phone/fax: 035-7531785 Fax: 0865445631

Cell: 0836585362



TABLE OF CONTENT

INTRODUCTION	4
KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008	9
METHOD	11
Defining significance.....	12
RESULTS	15
DESKTOP STUDY	15
PALAEONTOLOGICAL IMPACT ASSESSMENT	20
FIELD SURVEY.....	21
CONCLUSION.....	22
REFERENCES	22
EXPERIENCE OF THE HERITAGE CONSULTANT	23
DECLARATION OF INDEPENDENCE	23
APPENDIX A	24
PALAEONTOLOGICAL DESKTOP SURVEY.....	24

TABLE OF FIGURES

FIG. 1 GENERAL LOCATION OF THE STUDY AREA.....	5
FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA	6
FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA.....	7
FIG. 4: SCENIC VIEWS OF THE PIPELINE ROUTE	8
TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES	14
FIG. 5: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA	16
Fig. 6: Original Surveyor General Map (1851)	17
FIG. 7: STUDY AREA IN 1937	18
FIG. 8: STUDY AREA IN 1968	19
FIG. 9: PALAEONTOLOGICAL SENSITIVITY OF THE STUDY AREA	20

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 proposed development site is located at Umhlali. It is approximately 10 km North of Ballito, KwaZulu-Natal. The proposed development falls within the KwaDukuza Local Municipality and iLembe District Municipality.

The client proposes a residential development within the Umhlali Village, Kwa-Zulu Natal. The proposed development will comprise of approximately 280 housing units on a Greenfield site of approximately 18 hectares. The proposed development will bisect the R102 as per the google image and proposed layout above (figure 1 and 2). Each individual housing stand will be approximately 400m², however some sites may become larger as contiguous boundaries are established. The proponent also proposes to construct one gatehouse for each side of the R102, a green open space (park / play area) and one club house with admin offices. Bulk services are available within close proximity to the proposed site and development will be linked with the existing municipal infrastructure. Electricity will be provided by KwaDukuza local municipality, whilst SembCorp Siza Water will provide the water.

The client also proposes to construct a reservoir to service the residents of the proposed development which will connect to the Siza water infrastructure.

The area is currently under sugar cultivation, and has been for several decades.

Umlando was appointed by Trplo4 Sustainable Solutions Pty (Ltd) to undertake an heritage survey of a proposed residential development at Umhlali.

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

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

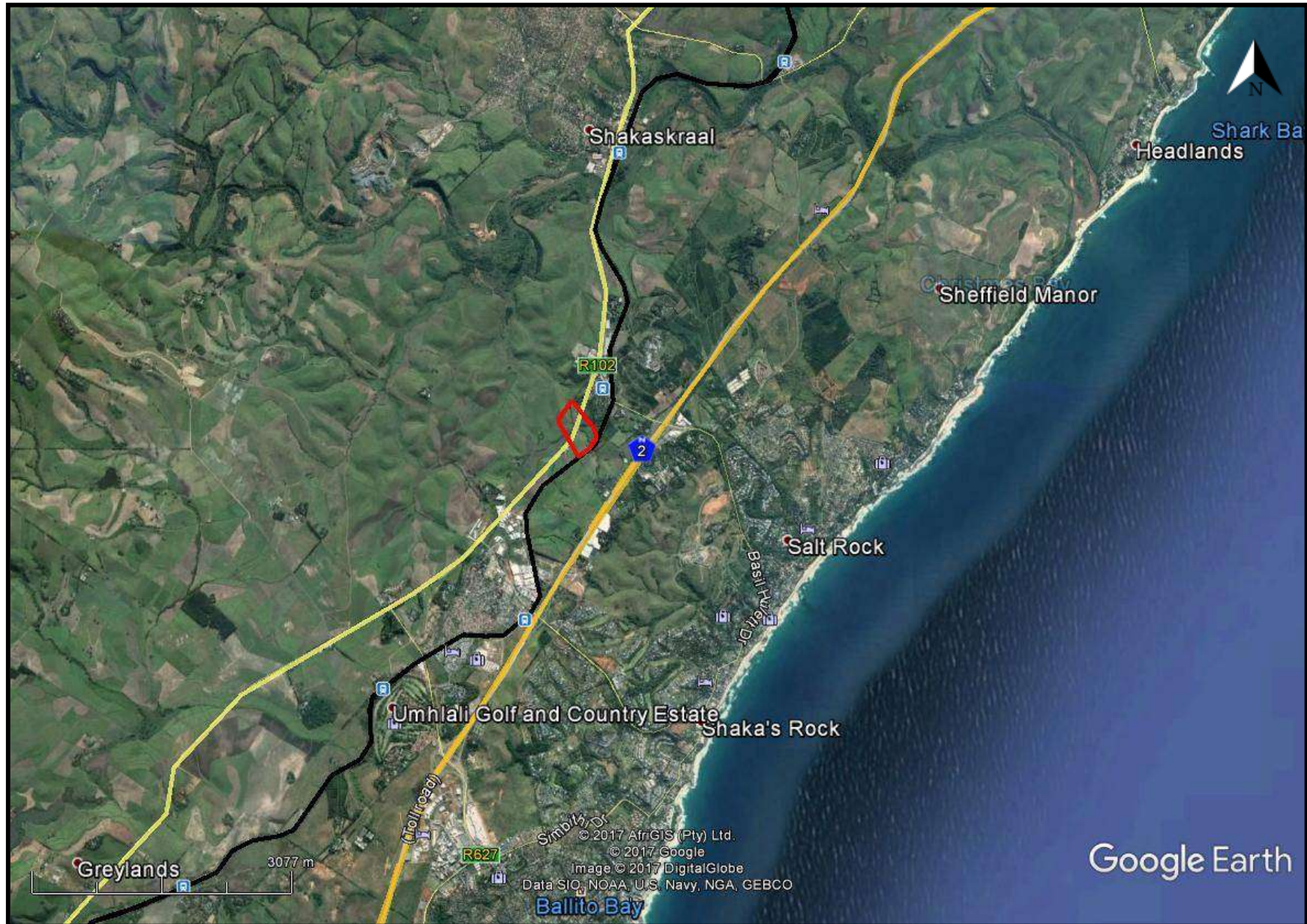
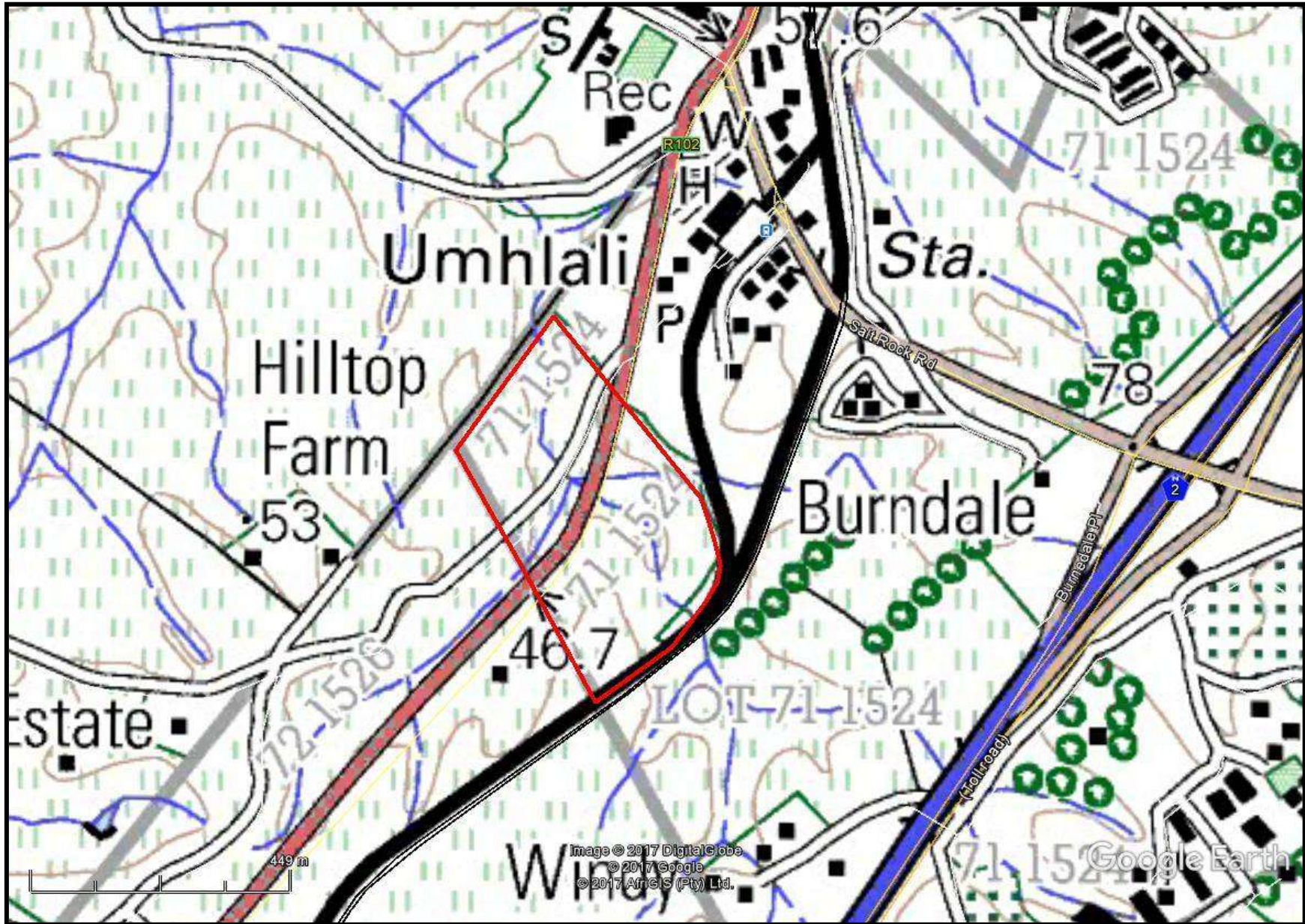


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA



FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA¹



¹ 2931AC 1968 Shakaskraal

FIG. 4: 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. 4). 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. There are several cemeteries outside of the study area.

The Surveyor General Map indicates that the land was first surveyed in 1851. No buildings are noted on the map.

The 1937 aerial photographs indicate that the study area was under sugar cane cultivation (fig. 7). No features are visible on the aerial photograph. The 1968 1:50 000 topographical map indicates the same scenario (fig. 8).

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

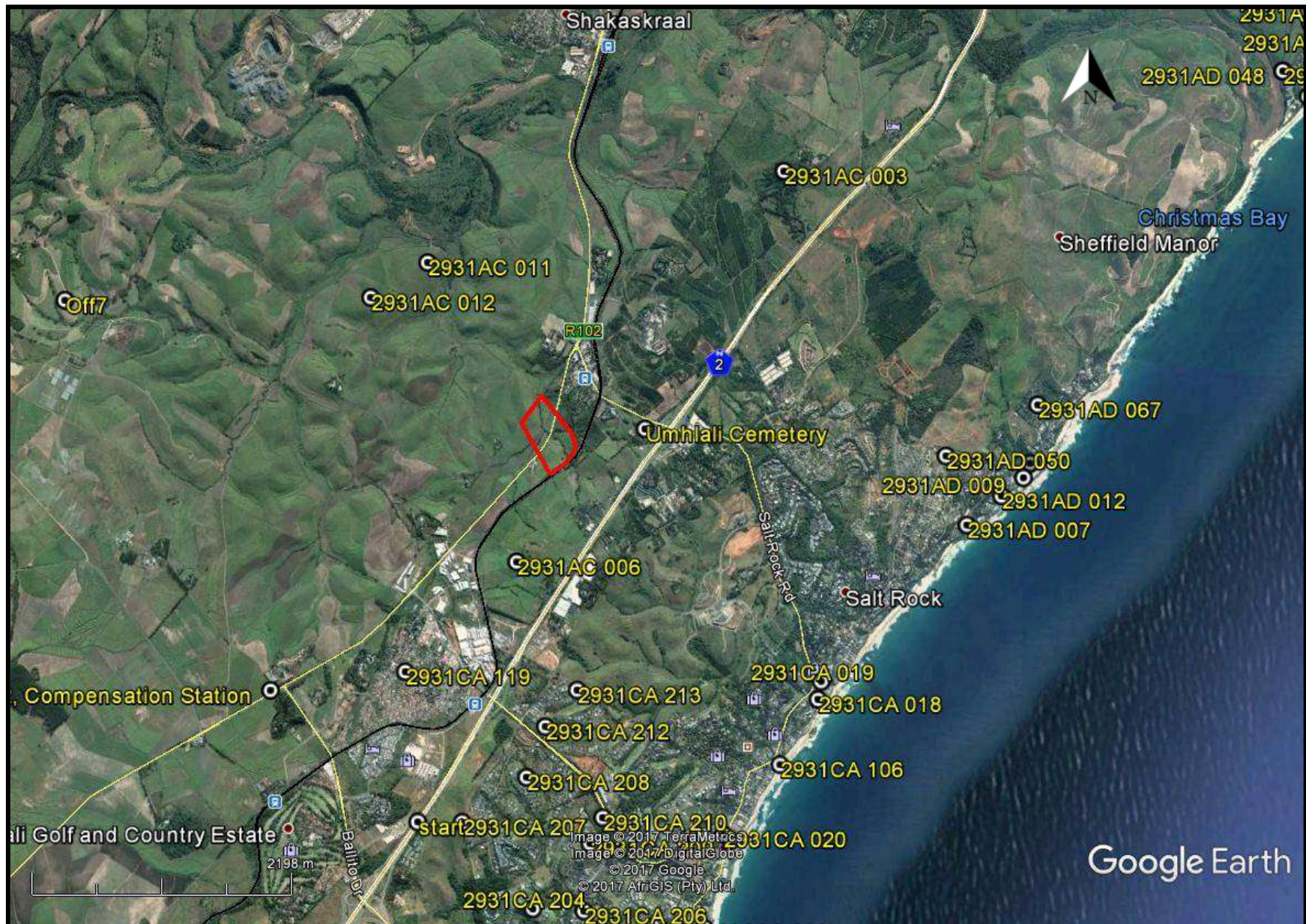


Fig. 6: Original Surveyor General Map (1851)

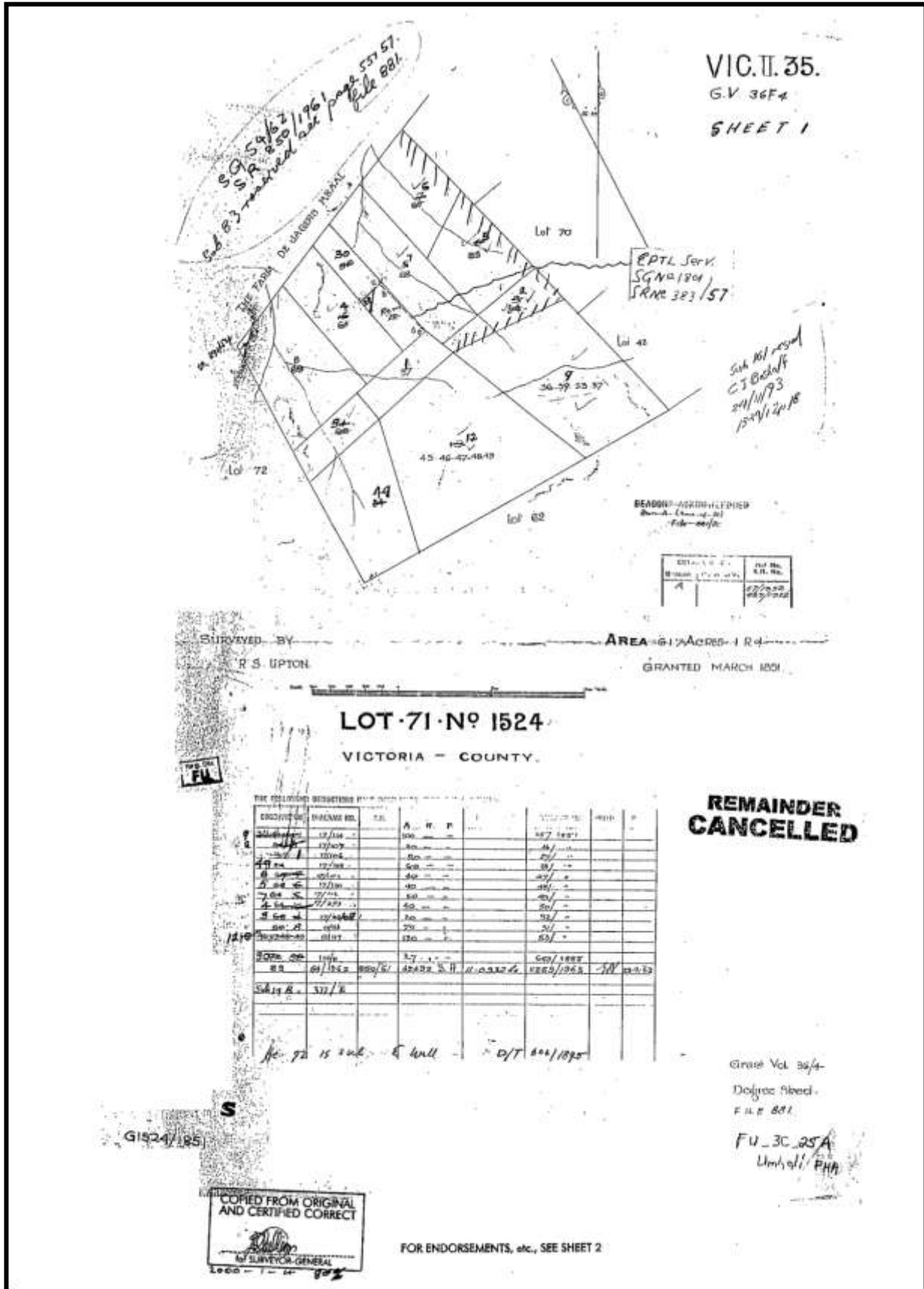
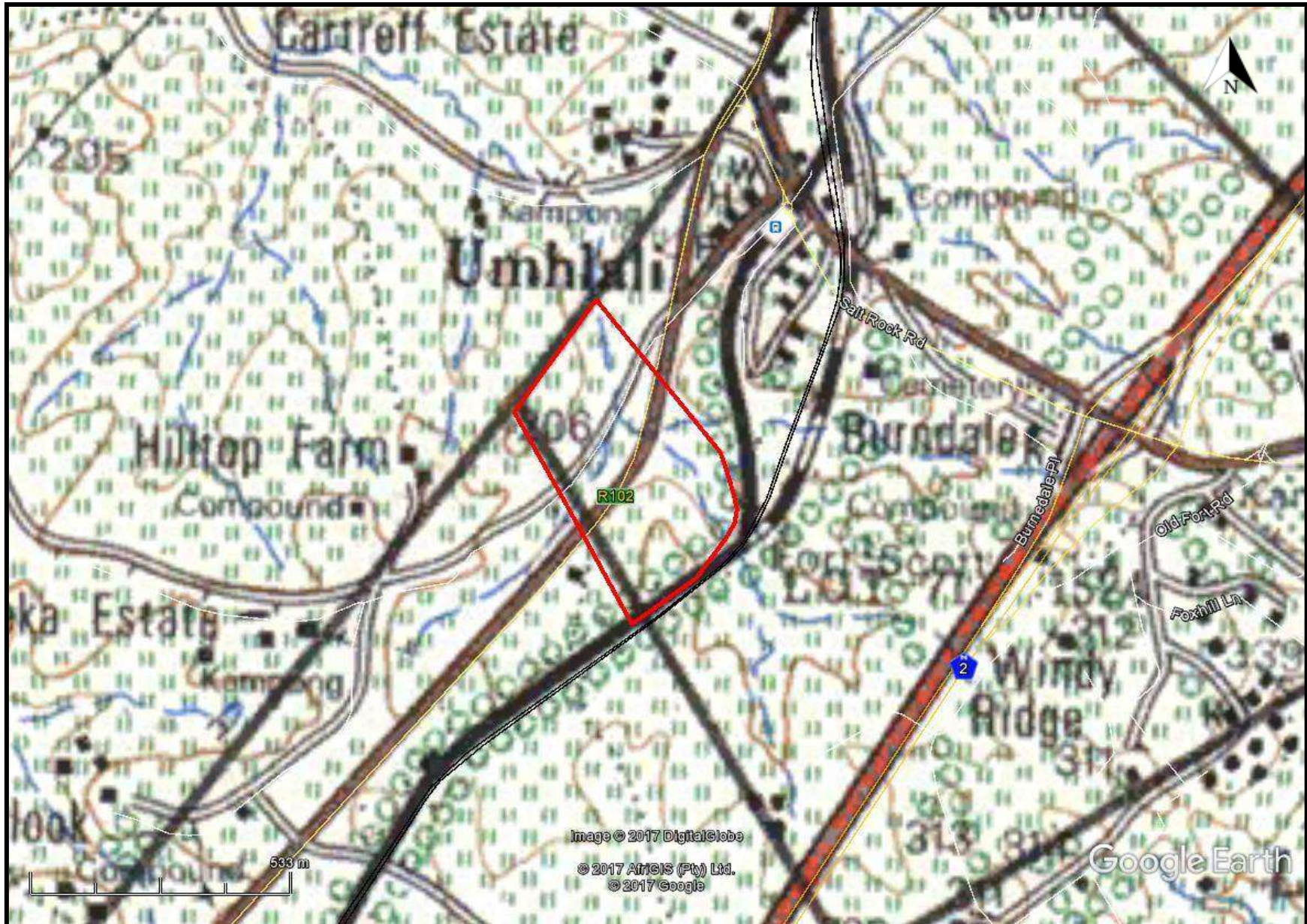


FIG. 7: STUDY AREA IN 1937²



² 117B_050_36500

FIG. 8: STUDY AREA IN 1968³



³ 2931AC 1968 Shakaskraal

PALAEONTOLOGICAL IMPACT ASSESSMENT

A palaeontological desktop study was undertaken by Dr Gideon Groenewald (Appendic A), The initial analyses on SAHRIS database suggested the area was of high palaeontological sensitivity (fig. 9).

FIG. 9: PALAEONTOLOGICAL SENSITIVITY OF THE STUDY AREA



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.

“The desktop investigation confirms that the study area is underlain by relatively deep (>2m) sandy soil associated with the Pietermaritzburg and Vryheid Formations.

The excavations for the construction of the infrastructure for this development will expose some important sandy soil deposits. Due to the deeply weathered nature of the rock formations, fossils are not expected to be commonly present before the excavation and clearing of sites for development. Judging from the Google Images, the site is overgrown with present day vegetation and it is not recommended that a Phase 1 PIA be done at this stage.

Due to the High likelihood of the discovery of significant plant fossils in the Vryheid Formation during clearing of the site for development, it is recommended that the High sensitivity for Palaeontological Heritage for the southern part of the site is retained (Figure 3). The recommendation is that a suitably accredited Palaeontologist be appointed to do a Phase 1 PIA site inspection after at least 1km² of exotic vegetation has been removed. The Palaeontologist must record all exposed plant fossil on site. A representative sample of the fossils must then be deposited at the appropriate Institution under permit from AMAFA.

The fossils finds must be recorded according to a “Chance Find Protocol” that need to be discussed with the Contractors during the initial stages of the clearing operation. This recommendation must be incorporated into the EMP of the Project.” (Groenewald Appendix A)

FIELD SURVEY

A field survey was undertaken on 12 December 20187. The study area is currently under sugar cane cultivation. The upper soils were a black clay after the rains.

No archaeological sites or artefacts were noted n the study area.

CONCLUSION

A heritage survey was undertaken for the proposed Umhlali Residential development. No archaeological sites were observed in the study area even though sites have been noted in the general area. There are no built structures in the study area.

The palaeontological sensitivity for the eastern half of the site is of very high significance. All excavations for foundations, servitudes, etc. deeper than 1.5m will require palaeontological monitoring. This needs to form part of the EMPr.

REFERENCES

Maps:

117B_050_36500 aerial photograph 1937

2931AC Shakaskraal 1:50 000 topographical map 1968, 2000

Natal Museum Site Record Database

Umlando Database

SAHRIS 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.

A handwritten signature in black ink, appearing to read 'Anderson', with a large, stylized initial 'A'.

Gavin Anderson
Archaeologist/Heritage Impact Assessor

APPENDIX A
PALAEONTOLOGICAL DESKTOP SURVEY

**DESKTOP PALAEOLOGICAL
ASSESSMENT FOR THE PROPOSED
DEVELOPMENT OF THE UMHLALI
RESIDENTIAL DEVELOPMENT IN THE
KWADUKUSA LOCAL MUNICIPALITY,
ILEMBE DISTRICT MUNICIPALITY
KWAZULU-NATAL PROVINCE.**

**FOR
Umlando**

DATE: 14 December 2017

By

**Gideon Groenewald
Cell: 078 713 6377**

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by Umlando to undertake a Desktop Survey, assessing the potential Palaeontological Impact related to an application for the proposed development of the Umhlali Residential Development in the KwaDukusa Local Municipality, iLembe District Municipality, Kwazulu-Natal Province.

The development site applicable to the application for the proposed development of the development of the Umhlali Residential Development in the KwaDukusa Local Municipality, iLembe District Municipality, Kwazulu-Natal Province is underlain by Permian aged shales of the Pietermaritzburg Formation and coarse-grained sandstone with coal beds of the Vryheid Formation, Ecca Group of the Karoo Supergroup.

No significant fossils are expected before deep excavation (>1.5m) are done and if fossils are recorded during excavations, it will contribute significantly to our knowledge of the Palaeontological Heritage of the KwaZulu-Natal Province.

It is recommended that:

The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity is allocated to the southern part of the study area. A Phase 1 PIA document is needed for this part of the project, but can only be assessed **after clearing** of the site for development have started.

Recommendations contained in the Desktop assessment must be used to compile a "Chance Find Protocol" document that needs to be included in the EMPr of the project for approval by AMAFA. The CFP must be ready for inclusion in the EMPr of the project, before the final EIA application can be presented to the Competent Authority responsible to the ROD of this EIA process. If fossils are observed during construction the HIA specialist and Palaeontologist must be informed to take immediate and appropriate action to preserve a representative sample of the fossils.

TABLE OF CONTENT

EXECUTIVE SUMMARY	26
TABLE OF CONTENT	27
INTRODUCTION	28
Legal Requirements	28
Aims and Methodology	28
Scope and Limitations of the Desktop Study	33
Locality and Proposed Development	33
GEOLOGY	34
Karoo Supergroup	35
Ecca Group	35
Pietermaritzburg Formation (Pp)	35
Vryheid Formation (Pv)	35
PALAEONTOLOGY	35
Ecca Group	35
Pietermaritzburg Formation (Pp)	35
Vryheid Formation (Pv)	35
DISCUSSION	36
PALAEONTOLOGICAL IMPACT AND MITIGATION	37
CONCLUSION	38
REFERENCES	39
QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	40
DECLARATION OF INDEPENDENCE	40

TABLE OF FIGURES

Figure 1 Locality of the Umhlali Residential Development site	34
Figure 2 Geological formations that underlies the site is the Pietermaritzburg Formation (Pp) and Vryheid Formation (Pv) of the Ecca Group	34
Figure 3 Palaeontological sensitivity of the proposed development site at Umhlali. For color coding see Table 1	38

LIST OF TABLES

Table 1 Palaeontological sensitivity analysis outcome classification .	30
----------------------------------------------------------------------------------------	----

INTRODUCTION

Gideon Groenewald was appointed by Umlando to undertake a Desktop Survey, assessing the potential Palaeontological Impact related to an application for the proposed development of the Umhlali Residential Development in the KwaDukusa Local Municipality, iLembe District Municipality, Kwazulu-Natal Province.

Legal 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 (as amended 2014 and 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 on palaeontological heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 38 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*" (amended 2017) 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 maps (2930 Durban) 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	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

	<p>professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) compulsory.</p>
<p>BLUE</p>	<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>
-------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. All projects falling on Low to Very Low Palaeontological sensitivity geology must be discussed in a Desktop Survey or a Chance Find Protocol document. If any fossils are recorded the findings and recommendations must form part of the EMP of the project.

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 Umhlali Residential Development is planned on a property north of Durban and will mainly concentrate on the supply of residential facilities and

Figure 1 Locality of the Umhlali Residential Development site
ownership of housing in this newly developed area (Figure 1).



GEOLOGY

The site of the development is underlain by rocks of the Permian aged Pietermaritzburg and Vryheid Formations of the Ecca Group of the Karoo Supergroup (Figure 2).



Figure 2 Geological formations that underlies the site is the Pietermaritzburg Formation (Pp) and Vryheid Formation (Pv) of the Ecca Group

Karoo Supergroup

The Karoo Supergroup represents a very extensive sedimentary and volcanic deposit that underlies large parts of the Province of KwaZulu-Natal and Southern Africa Johnson et al (2009).

Ecca Group

Pietermaritzburg Formation (Pp)

As Gondwana, a large super-continent that existed during the Permian, moved north towards toward the equator, thick clay and silt beds were laid down in a large sea that occupied the Karoo Basin in South Africa. These sediments, deposited in deep water, now form the shales of the Pietermaritzburg Formation of the Ecca Group in KZN. The shales of the Pietermaritzburg Formation are easily weathered and often present slope stability problems (Johnson et al, 2009).

Vryheid Formation (Pv)

The Permian aged Vryheid Formation is a thick sequence of sedimentary rocks consisting mainly of coarse-grained sandstone and interbedded black shale. These sandstones and shales were deposited along ancient sandy shorelines behind which lay vast swamplands. Burial of vegetation in the swamps eventually formed coal which is mined at various localities in the outcrop areas of the formation in South Africa (McCarthy and Rubidge, 2005; Johnson et al, 2009).

PALAEONTOLOGY

Ecca Group

Pietermaritzburg Formation (Pp)

While fossils are generally absent from the Pietermaritzburg Formation, trace fossils have been recorded from the upper layers by Linstrom (1987).

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 coal mines 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.

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 *Diplo craterion* (Mason and Christie, 1985).

DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews. No significant body fossils are known from the Pietermaritzburg Formation but some well-defined trace fossils

have been recorded. Very significant fossils has been recorded from the Vryheid Formation and the recording of plant and trace fossils from this part of the Karoo Basin will contribute significantly to our understanding of the palaeo-environments that existed during the Permian times in this part of KwaZulu-Natal

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 investigation. The desktop investigation confirms that the study area is underlain by relatively deep (>2m) sandy soil associated with the Pietermaritzburg and Vryheid Formations.

The excavations for the construction of the infrastructure for this development will expose some important sandy soil deposits. Due to the deeply weathered nature of the rock formations, fossils are not expected to be commonly present before the excavation and clearing of sites for development. Judging from the Google Images, the site is overgrown with present day vegetation and it is not recommended that a Phase 1 PIA be done at this stage.

Due to the High likelihood of the discovery of significant plant fossils in the Vryheid Formation during clearing of the site for development, it is recommended that the High sensitivity for Palaeontological Heritage for the southern part of the site is retained (Figure 3). The recommendation is that a suitably accredited Palaeontologist be appointed to do a Phase 1 PIA site inspection after at least 1km² of exotic vegetation has been removed. The Palaeontologist must record all exposed plant fossil on site. A representative sample of the fossils must then be deposited at the appropriate Institution under permit from AMAFA.

The fossils finds must be recorded according to a “Chance Find Protocol” that need to be discussed with the Contractors during the initial stages of the clearing operation. This recommendation must be incorporated into the EMP of the Project.



Figure 3 Palaeontological sensitivity of the proposed development site at Umhlali. For color coding see Table 1

CONCLUSION

The development site applicable to the application for the proposed development of the development of the Umhlali Residential Development in the KwaDukusa Local Municipality, iLembe District Municipality, Kwazulu-Natal Province is underlain by Permian aged shales of the Pietermaritzburg Formation and coarse-grained sandstone with coal beds of the Vryheid Formation, Ecca Group of the Karoo Supergroup.

No significant fossils are expected before deep excavation (>1.5m) are done and if fossils are recorded during excavations, it will contribute significantly to our knowledge of the Palaeontological Heritage of the KwaZulu-Natal Province.

It is recommended that:

The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity is allocated to the southern part of the study area. A Phase 1 PIA document is needed for this part of the project, but can only be assessed **after clearing** of the site for development have started.

Recommendations contained in the Desktop assessment must be used to compile a "Chance Find Protocol" document that needs to be included in

the EMPr of the project for approval by AMAFA. The CFP must be ready for inclusion in the EMPr of the project, before the final EIA application can be presented to the Competent Authority responsible to the ROD of this EIA process. If fossils are observed during construction the HIA specialist and Palaeontologist must be informed to take immediate and appropriate action to preserve a representative sample of the fossils.

REFERENCES

Almond J.E. and Pether J. 2008. *Palaeontological Heritage of the Western Cape.* Internal Report Heritage Western Cape.

Almond J.E., De Klerk B. and Gess R., 2009. *Palaeontological Heritage of the Eastern Cape.* Internal Report, SAHRA.

Groenewald G.H., 2012. *Palaeontological Technical Report for Kwazulu-Natal.* Internal Report, AMAFA.

Groenewald G.H., Groenewald D.P. and Groenewald S.M., 2014. *Palaeontological Heritage of the Free State, Gauteng, Limpopo, Mpumalanga and North West Provinces.* Internal Palaeotechnical Reports, SAHRA.

Johnson MR , Anhaeusser CR and Thomas RJ (Eds). 2009. *The Geology of South Africa.* GSSA, Council for Geoscience, Pretoria.

Linstrom W. 1987 *Die Geologie van die gebied Durban..* Explanation Sheet 2930 (1:250 000). Geological Survey of South. Africa.

MacRae C. 1999. *Life Etched in Stone.* Geological Society of South Africa, Linden, South Africa.

McCarthy T and Rubidge BS. 2005. *Earth and Life.* 333pp. Struik Publishers, Cape Town.

Wolmarans LG. and Du Preez JW. 1986 *The Geology of the St Lucia Area.* Explanation: Sheet 27.532 (1:250 000), Geological Survey of South. Africa.

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