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**HERITAGE SURVEY OF THE THANDSIZWE QUARRY,  
UMGUNGUNDLOVU DISTRICT MUNICIPALITY,  
KWAZULU-NATAL**

**FOR TERRATEST (PTY) LTD**

**DATE: 7 MARCH 2018**

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## TABLE OF CONTENT

<b>HERITAGE SURVEY OF THE THANDSIZWE QUARRY, UMGUNGUNDLOVU DISTRICT MUNICIPALITY, KWAZULU-NATAL</b> .....	1
INTRODUCTION.....	4
VEGETATION.....	5
<b>KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008</b> .....	10
METHOD.....	12
Defining significance.....	13
RESULTS.....	16
DESKTOP STUDY.....	16
PALAEOLOGICAL IMPACT ASSESSMENT.....	21
FIELD SURVEY.....	23
CONCLUSION.....	23
REFERENCES.....	24
<b>EXPERIENCE OF THE HERITAGE CONSULTANT</b> .....	25
<b>DECLARATION OF INDEPENDENCE</b> .....	25
APPENDIX A.....	26
PALAEOLOGICAL IMPACT ASSESSMENT.....	26

## TABLE OF FIGURES

FIG. 1 GENERAL LOCATION OF THE STUDY AREA.....	6
FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA.....	7
FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA.....	8
FIG. 4: SCENIC VIEWS OF THE PIPELINE ROUTE.....	9
TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES.....	15
FIG. 5: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA.....	17
Fig. 6: Original Surveyor General Map (1946).....	18
FIG. 7: STUDY AREA IN 1937.....	19
FIG. 8: STUDY AREA IN 1968.....	20
FIG. 9: PALAEOLOGICAL SENSITIVITY OF THE STUDY AREA.....	22

## 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

Terratest (Pty) Ltd has been appointed by Mr N. Moosa to undertake the environmental services required for the proposed development of a shale quarry on the Farm Thandisizwe No. 16691, Umgungundlovu District Municipality, KwaZulu-Natal.

The site has been previously quarried and as such a significant amount of disturbance is evident on site. Disturbance is identifiable via the following:

- Clearance of vegetation;
- Excavation of a perimeter trench;
- Access roads; and
- Existing quarry pit.

Of the 4.3ha area under application, approximately 2.15ha has been previously disturbed.

The site identified for a shale quarry has been previously utilised for the same purpose. In this regard, an existing pit, approximately 6 metres deep and 74m wide is located on the site. A shale deposit, is evident in the existing pit and as such, it is confirmed that there is a resource available to quarry.

The quarried shale will be utilised to manufacture clay bricks. In this regard, an existing clay brick factory is evident on the Farm Thandisizwe and all clay to be quarried from the pit will be transported there.

The existing pit is void of all vegetation and topsoil. The pit is proposed to be expanded.

Umlando was appointed by Terratest to undertake the HIA study. Fig.'s 1 – 4 show the location of the development.

## VEGETATION

Mucina and Rutherford (2006) note that the site is comprised of Moist Coast Hinterland Grassland which can be found in the KwaZulu-Natal and Eastern Cape Provinces from Melmoth in the north to Libode in the south (including Eshowe, New Hanover, Thornville, Richmond, Harding, Lusikisiki), generally occurring at an altitude ranging between 450 - 900m.

Typically, Moist Coast Hinterland Grassland is comprised of dense tall sour grassland dominated by unpalatable Ngongoni grass (*Aristida junciformis*). This mono-dominance is associated with low species diversity.

As illustrated by the 2008 Ezemvelo KZN Wildlife dataset, scattered pockets of transformed areas surround the site. This may largely be attributed to anthropogenic influences evident in these areas. The site is, however, considered to be considerably disturbed and thus transformed given the presence of the existing, historical shale quarry on site. The northern portion of the site is considered to be less disturbed given the fact that quarrying activities have not occurred in this area, however, access roads and the perimeter trench do transverse this portion of the site as well. The vegetation composition in this area is largely comprised of a mix of Paperbark Thorn (*Acacia Sieberiana ver woodii*) and Black Wattle (*Acacia mearnsii*) and holds limited conservation value in terms of the South African National Biodiversity Institute (SANBI).

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

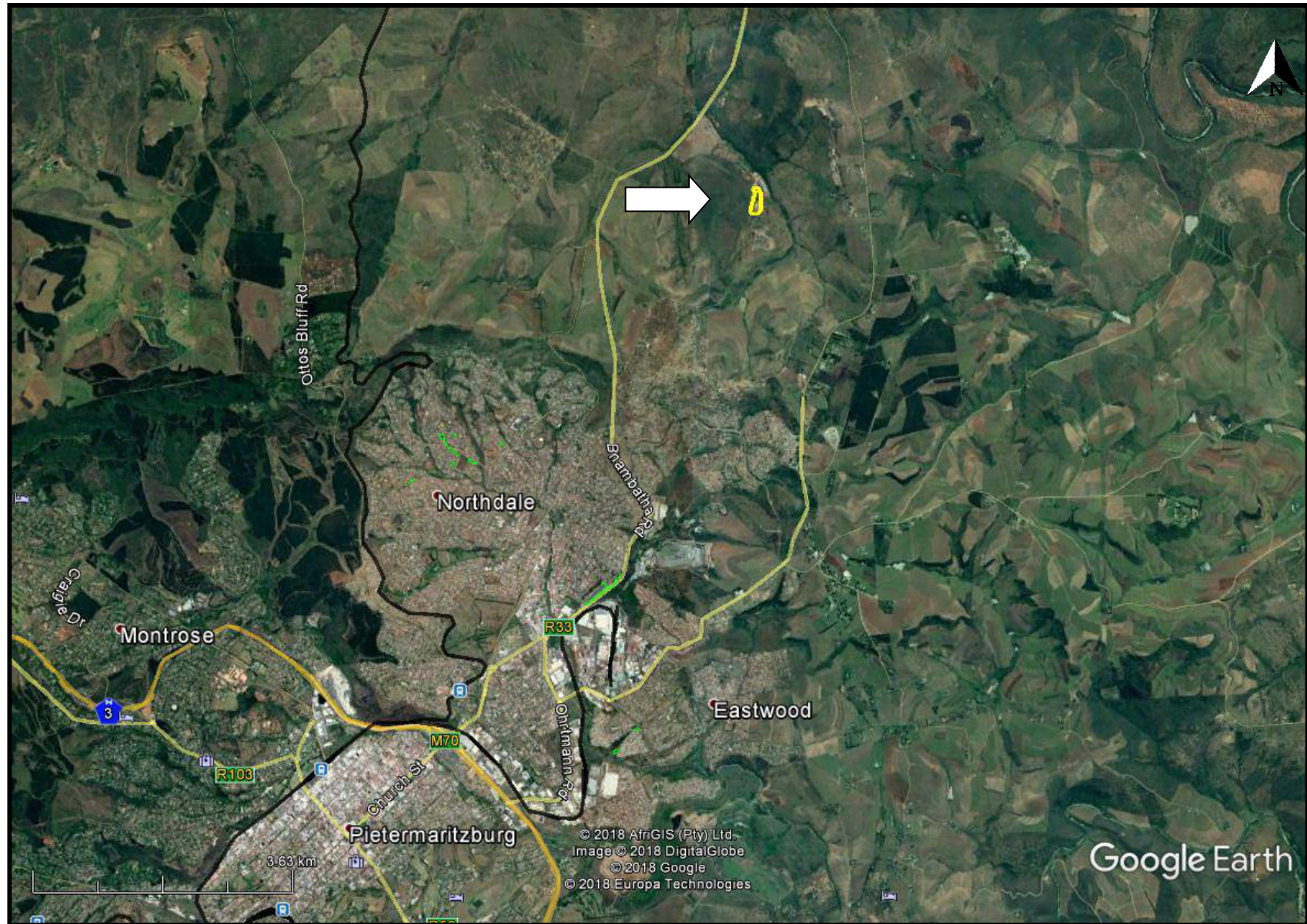


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA



FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA

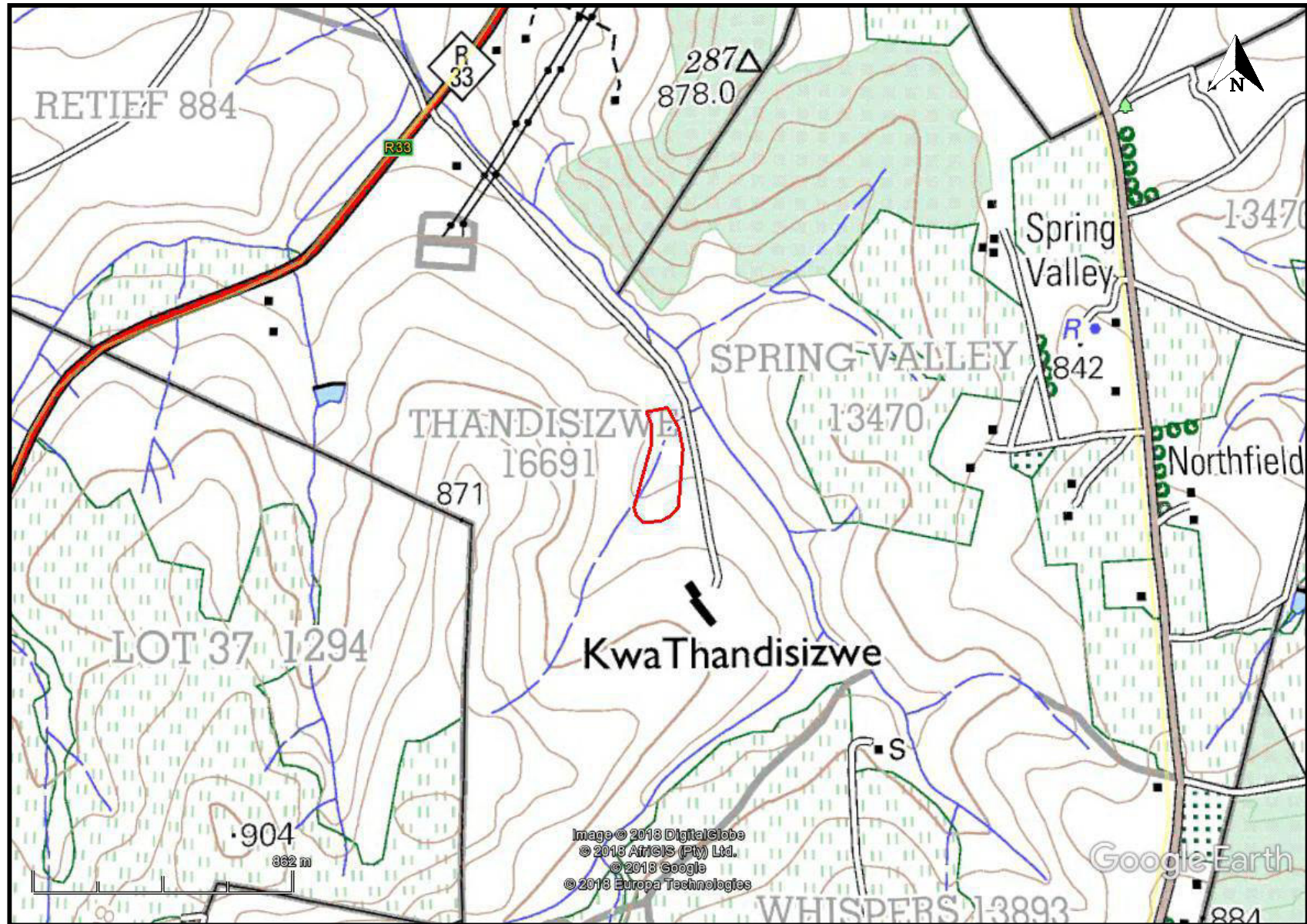




FIG. 4: SCENIC VIEWS OF THE PIPELINE ROUTE



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## 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 1<sup>st</sup> and 2<sup>nd</sup> 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**

<b>SITE SIGNIFICANCE</b>	<b>FIELD RATING</b>	<b>GRADE</b>	<b>RECOMMENDED MITIGATION</b>
<b>High Significance</b>	National Significance	Grade 1	Site conservation / Site development
<b>High Significance</b>	Provincial Significance	Grade 2	Site conservation / Site development
<b>High Significance</b>	Local Significance	Grade 3A / 3B	
<b>High Medium Significance</b>	/ Generally Protected A		Site conservation or mitigation prior to development / destruction
<b>Medium Significance</b>	Generally Protected B		Site conservation or mitigation / test excavation / systematic sampling / monitoring prior to or during development / destruction
<b>Low Significance</b>	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 Surveyor Generals map indicates the farm was first surveyed in 1946, under Erf Spring Valley 13470 (fig. 6). No buildings are noted on the diagram.

The 1937 aerial photographs indicate that there are agricultural fields and settlements to the west of the study area (fig. 7). There is a possible settlement within the study area – visible by two ‘white’ houses on the aerial photograph. All settlements from this period would probably have human graves within 50m of them.

The 1968 1:50 000 topographical map indicates that most of the area was under cultivation with some areas of afforestation (fig. 8).



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

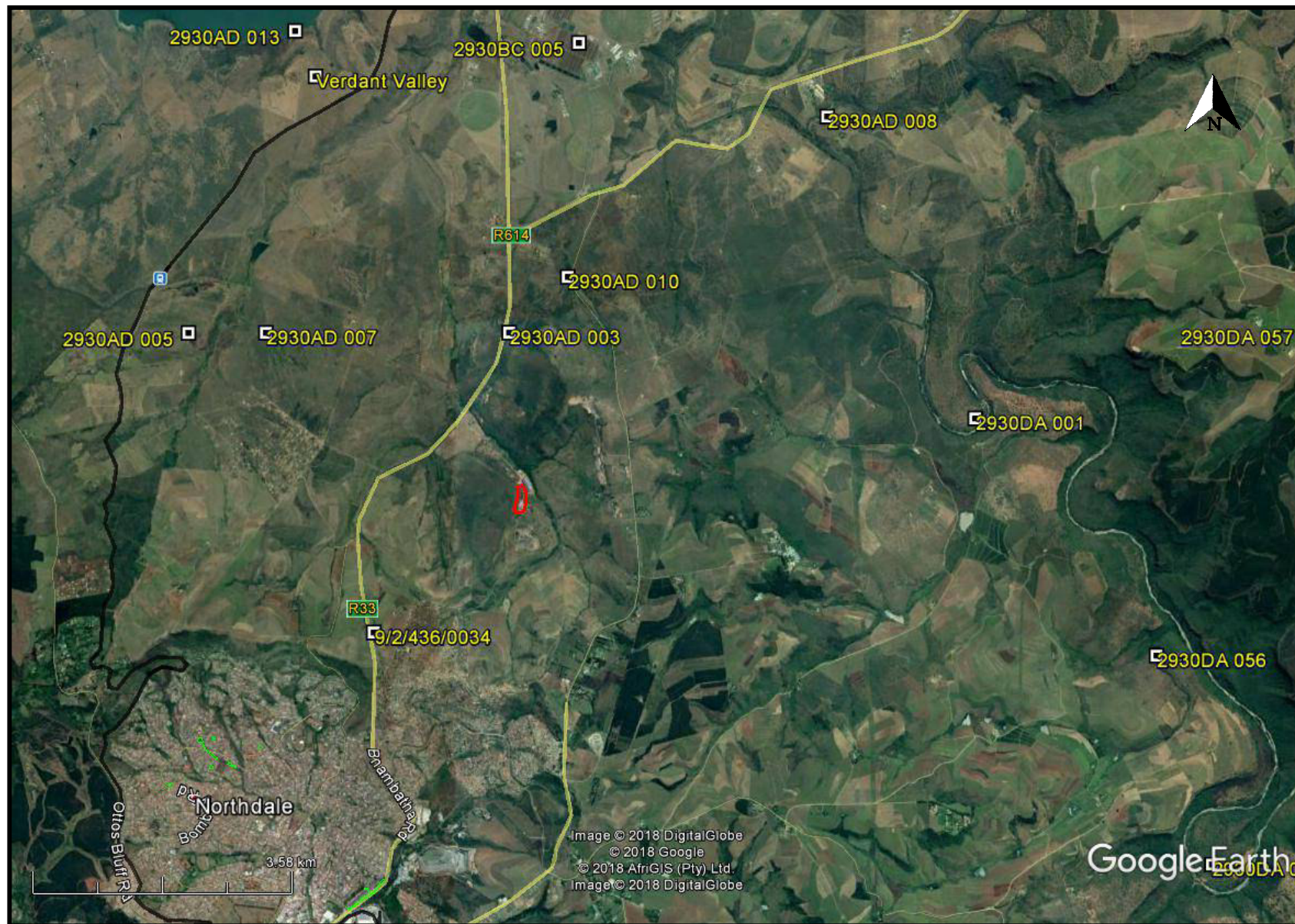


Fig. 6: Original Surveyor General Map (1946)

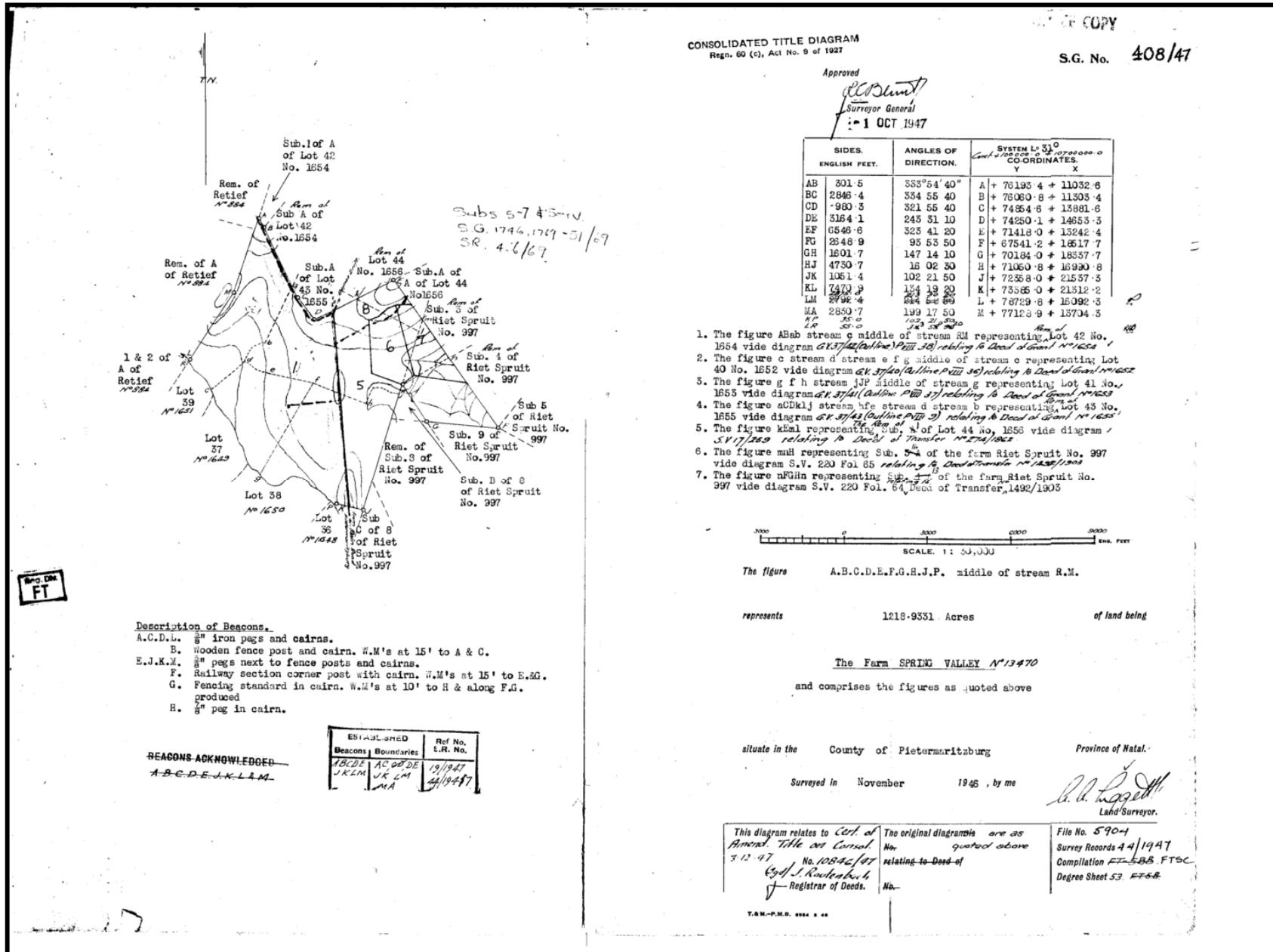


FIG. 7: STUDY AREA IN 1937

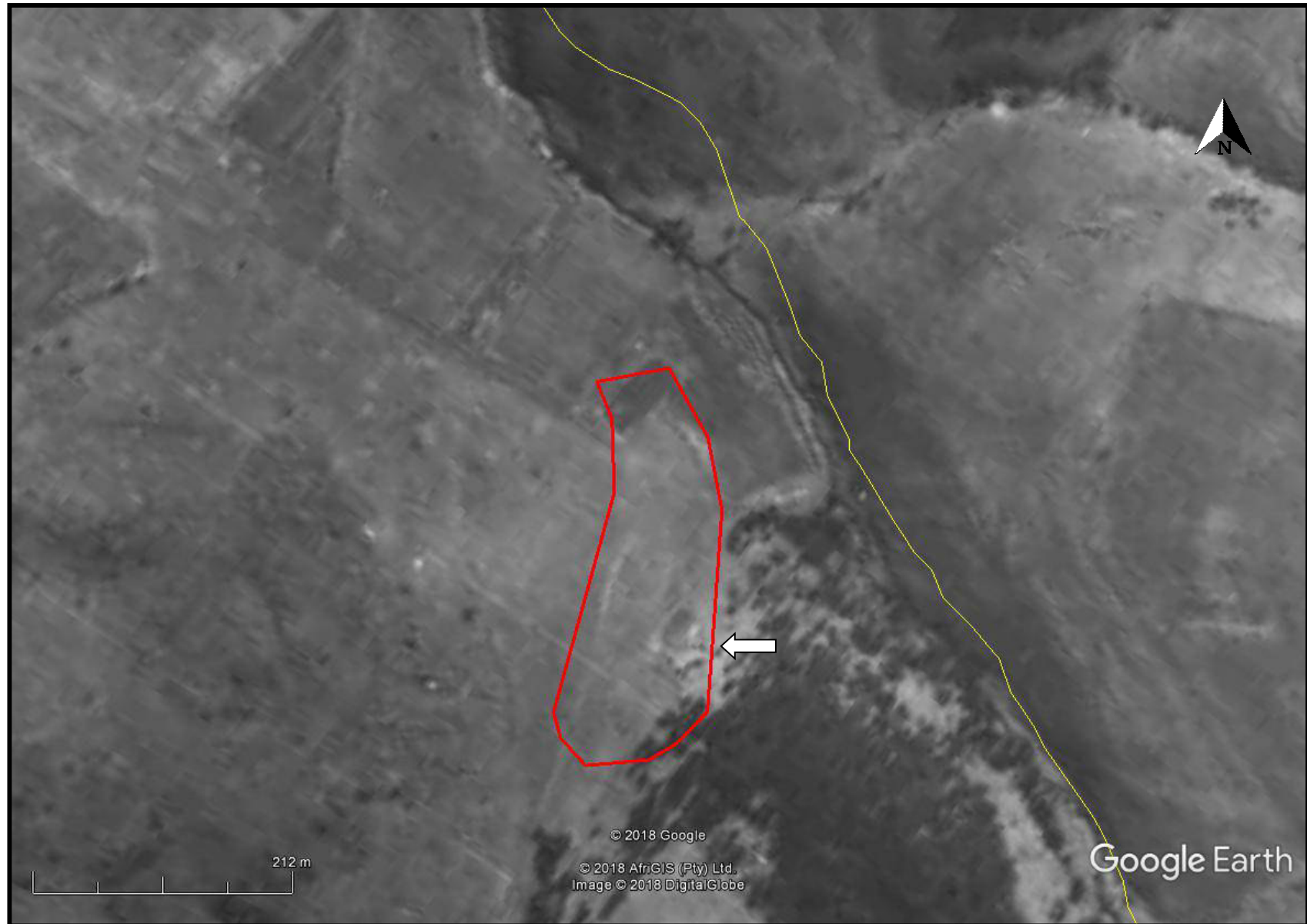
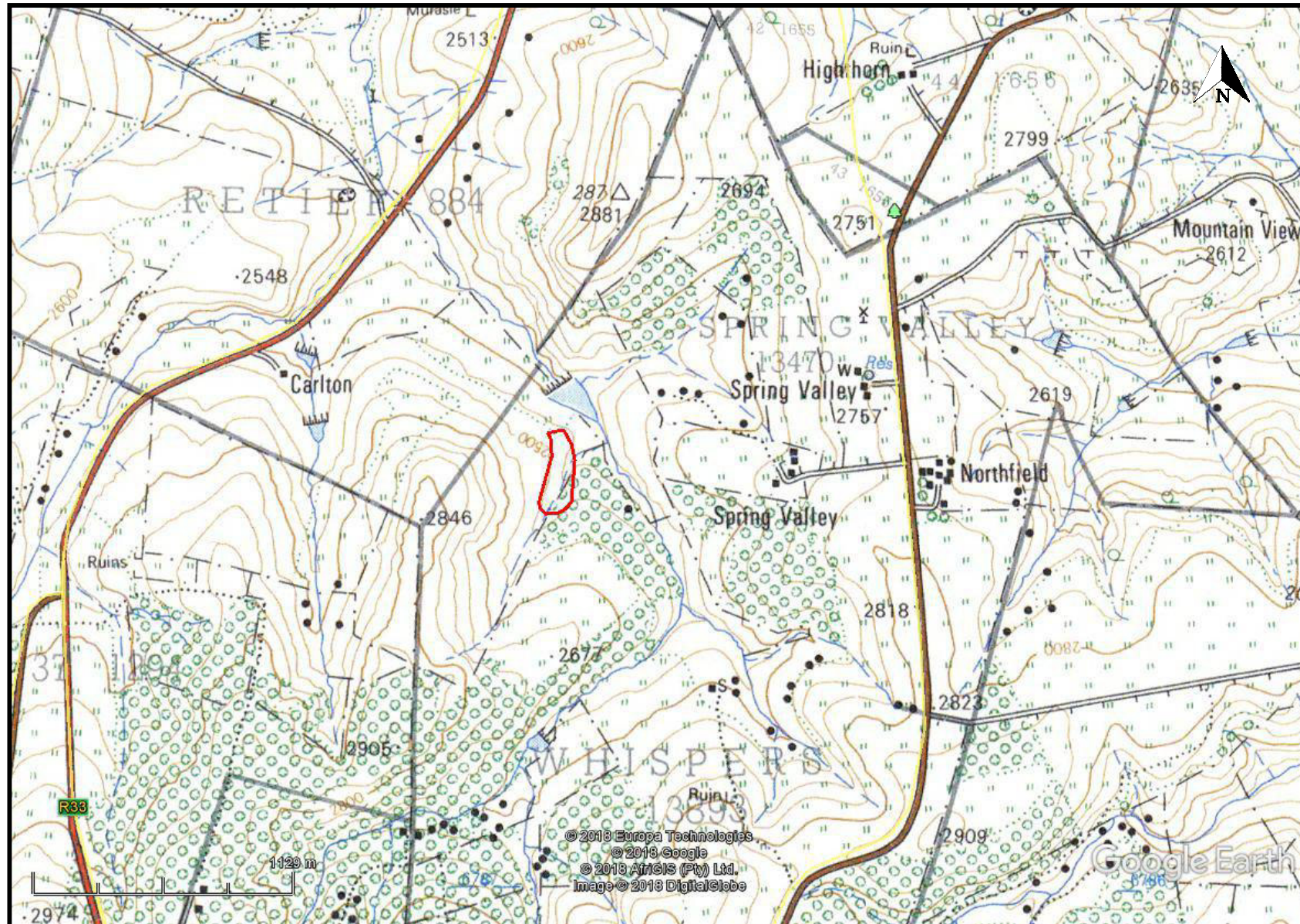


FIG. 8: STUDY AREA IN 1968



## **PALAEONTOLOGICAL IMPACT ASSESSMENT**

The PIA sensitivity indicates that the area is of moderate palaeontological sensitivity (fig. (9)). Dr. G. Groenewald undertook a field survey of the study area. His field survey confirms that the study area is underlain by deeply weathered sediments of the Pietermaritzburg Formation and some deeply weathered dolerite. The mining is not planned in dolerite terrain. The excavations for the mining of shale for this development will expose some sediments of the Pietermaritzburg Formation. Due to weathering, no well-preserved fossils were observed during the field investigation. Exposure of bedrock during excavation might however result in the exposure of significant plant and/or trace fossils of the Pietermaritzburg Formation. The Moderate palaeontological sensitivity is allocated to the entire study area

:

It is recommended that:

- The EAP and ECO must be informed of the fact that a Moderate Palaeontological sensitivity was allocated to the entire mining area that will expose sediments of the Pietermaritzburg Formation and although highly weathered, fossils might be recorded during the later phase of mining.
- If the ECO observes any structures on the bedding planes of the shale, a suitably qualified Palaeontologist must be appointed to inspect the site and produce a "Chance Find Protocol" document (CFP) that then need to be updated on a monthly basis.
- These recommendations must be included in the EMP of this project.

FIG. 9: PALAEOLOGICAL 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.

## **FIELD SURVEY**

The field survey was undertaken on 16 February 2018. Much of the site had been cleared than was originally visible on the Google Earth imagery. Only a small margin remained and this was up to the shale buffer wall.

No artefacts or features were noted in the remaining areas. The area identified from the 1937 aerial photograph has been quarried between 2006 and 2011 according to Google Earth Imagery.

No further mitigation is required.

## **CONCLUSION**

A heritage survey was undertaken for the proposed Thandasizwe Quarry. The quarry has been in existence for some time. The desktop study indicated that there was a potential for archaeological sites as well as 20<sup>th</sup> century settlements in the study area. The quarry had extended into a possible 20<sup>th</sup> century settlement, and this no longer exists.

The quarry is unlikely to yield palaeontological remains, and no further mitigation is required.

No further HIA mitigation is required for this project.

## REFERENCES

### Maps

117B\_049\_03462

SG 408/47

2830CB Pietermaritzburg 1:50 000 topographical map 1968, 2000

### Database

Natal Museum Site Record Database

SAHRIS database

Umlando database

### Literature

Mucina, L. & Rutherford, M.C. (eds) 2006. The vegetation of South Africa. Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.



### **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  
PALAEOLOGICAL IMPACT ASSESSMENT**

**PHASE 1 PALAEOLOGICAL  
ASSESSMENT FOR THE PROPOSED  
MINING ON FARM THANDISIZWE  
16691, UMSHWATHI LOCAL  
MUNICIPALITY, UMGUNGUNDLOVU  
DISTRICT MUNICIPALITY, KWAZULU-  
NATAL PROVINCE.**

**FOR**

**HIA CONSULTANTS**

**UMLANDO**

**DATE: 16 February 2018**

**By**

**Gideon Groenewald**

**Cell: 078 713 6377**

## **EXECUTIVE SUMMARY**

Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Assessment for the proposed Mining on farm Thandisizwe 16691, uMshwathi Local Municipality, UMgungundlovu District Municipality, Kwazulu-Natal Province.

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 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 for the proposed Mining on farm Thandisizwe 16691, uMshwathi Local Municipality, UMgungundlovu District Municipality, Kwazulu-Natal Province is underlain by Permian aged sedimentary rocks of the Pietermaritzburg Formation, Ecca Group of the Karoo Supergroup.

No significant fossils were observed during the field investigation. The potential for finding significant fossils in any excavation into sediments of the Pietermaritzburg Formation is Moderate, and due to the deep weathering it is recommended that no further professional mitigation is required during the excavation of material during mining of the weathered clay. If fossils are however observed during mining, the HIA consultant must be notified and the fossils collected by a suitably qualified palaeontologist. No fossils will be associated with areas underlain by dolerite.

It is recommended that:

The EAP and ECO must be informed of the fact that a Moderate Palaeontological sensitivity was allocated to the entire mining area that will expose sediments of the Pietermaritzburg Formation and although highly weathered, fossils might be recorded during the later phase of mining.

If the ECO observes any structures on the bedding planes of the shale, a suitably qualified Palaeontologist must be appointed to inspect the site and produce a "Chance Find Protocol" document (CFP) that then need to be updated on a monthly basis.

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

## TABLE OF CONTENT

<a href="#">EXECUTIVE SUMMARY</a> .....	28
<a href="#">TABLE OF CONTENT</a> .....	29
<a href="#">INTRODUCTION</a> .....	30
<a href="#">Legal Requirements</a> .....	30
<a href="#">Aims and Methodology</a> .....	31
<a href="#">Scope and Limitations of the Phase 1 Investigation</a> .....	34
<a href="#">Locality and Proposed Development</a> .....	34
<a href="#">GEOLOGY</a> .....	35
<a href="#">Ecca Group</a> .....	36
<a href="#">Pietermaritzburg Formasie (Pp)</a> .....	36
<a href="#">PALAEOLOGY</a> .....	36
<a href="#">Ecca Group</a> .....	36
<a href="#">Pietermaritzburg Formation (Pp)</a> .....	36
<a href="#">PRELIMINARY ASSESSMENT RESULTS</a> .....	36
<a href="#">FIELD INVESTIGATIONS</a> .....	36
<a href="#">PALAEOLOGICAL IMPACT AND MITIGATION</a> .....	43
<a href="#">CONCLUSION</a> .....	44
<a href="#">REFERENCES</a> .....	45
<a href="#">QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR</a> .....	46
<a href="#">DECLARATION OF INDEPENDENCE</a> .....	46

## TABLE OF FIGURES

<a href="#">Figure 1 Proposed area of application for shale mining</a> .....	30
<a href="#">Figure 2 Location north of Pietrmaritzburg</a> .....	35
<a href="#">Figure 3 Study Area in purple on Thandisizwe</a> .....	35
<a href="#">Figure 4 Points in the study area where Photographic observations were recorded (Table 2)</a> .....	38
<a href="#">Figure 6 Palaeontological sensitivity of the mining area is moderate and the chance find of fossils is not high enough to warrant a Phase 2 PIA</a> .....	43

## LIST OF TABLES

<a href="#">Table 1 Palaeontological sensitivity analysis outcome classification</a> .....	32
<a href="#">Table 2 Record of Photographic Observations (See Figure 4 for GPS sites)</a> .....	38

## INTRODUCTION

Gideon Groenewald was appointed to undertake a Phase 1 Palaeontological Assessment for the proposed Mining on farm Thandisizwe 16691, uMshwathi Local Municipality, UMgungundlovu District Municipality, Kwazulu-Natal Province (Figure 1).



**Figure 1 Proposed area of application for shale mining**

The purpose of this Phase 1 Palaeontological Impact Assessment is to identify exposed and potential Palaeontological Heritage on the site of the proposed development, to assess the impact the development may have on this resource, and to make recommendations as to how this impact might be mitigated. The field survey indicated the requirement of a “Chance Find Protocol” that will be included in this Phase 1 PIA report.

### 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 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 Phase 1 investigation is often the last 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 the field investigation a preliminary assessment (desktop study) of the topography and geology of the study area was made using appropriate 1:250 000 geological maps (2930 Durban) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) were identified within the study area and the known fossil heritage within each rock unit was inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

Priority palaeontological areas were identified within the development footprint to focus the field investigator's time and resources. The aim of the fieldwork was 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 was 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 2.1 below.

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 extent of bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

**Table 1 Palaeontological sensitivity analysis outcome classification**

<b>PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS</b>	
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, 2009) (Groenewald et al., 2014).	
<b>RED</b>	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.
<b>ORANGE</b>	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.



<p><b>GREEN</b></p>	<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) recommended.</p>
<p><b>BLUE</b></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 larger alluvium deposits. Collection of a representative sample of potential fossiliferous material is recommended.</p>
<p><b>GREY</b></p>	<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</p>

	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.
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When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

### **Scope and Limitations of the Phase 1 Investigation**

The scope of a phase 1 Investigation includes:

- an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units;
- a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports;
- data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and
- where feasible, location and examination of any fossil collections from the study area (e.g. museums).
- an on-site investigation to assess the identified palaeontological sensitive areas within the development footprint/study area rather than formal palaeontological collection. The investigation focussed on the bedrock exposure where excavations would most probably require palaeontological monitoring.

The results of the field investigation are used to predict the potential of buried fossil heritage within the development footprint. In some investigations, this involves the examination of similar accessible bedrock exposures, such as road cuttings and quarries, along roads that run parallel to or across the development footprint.

### **Locality and Proposed Development**

The study area is located on the farm Thandisizwe north of Pietermaritzburg (Figure 2).



Figure 2 Location north of Pietermaritzburg

## GEOLOGY

The study area is underlain by Permian aged sedimentary rocks of the Pietermaritzburg Formation of the Ecca Group of the Karoo Supergroup, (Figure 2).

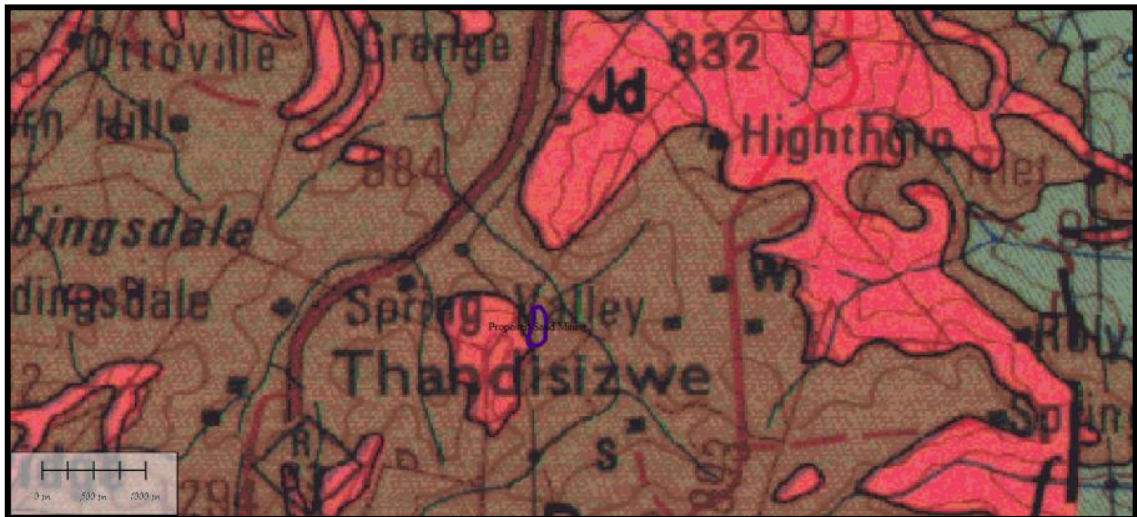


Figure 3 Study Area in purple on Thandisizwe

## **Ecca Group**

### **Pietermaritzburg Formasie (Pp)**

The Pietermaritzburg Formation underlies the entire study area and is defined by a fine-grained mudstone and shale that varies from very dark grey when not weathered to yellow-brown when highly weathered. The formation is interpreted as a deep marine shale deposit and is highly sort after material for the manufacturing of high quality bricks in KwaZulu-Natal.

## **PALAEONTOLOGY**

### **Ecca Group**

#### **Pietermaritzburg Formation (Pp)**

In this study area the Pietermaritzburg Formation is extremely weathered and the chance find of fossils is not very high. Several trace fossils has been recorded in the upper part of the formation (Johnson et al, 2009) and well-preserved plant fossils have been recorded by the author in areas closer to Pietermaritzburg where less weathered outcrops of the formation are found.

## **PRELIMINARY ASSESSMENT RESULTS**

The palaeontological sensitivity was predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity was predicted as Moderately significant, due to the potential abundance of Permian aged fossils in the Ecca Group.

## **FIELD INVESTIGATIONS**

Dr Gideon Groenewald, experienced fieldworker, and Alfred Mahlambi, technical assistant, visited the site of the proposed Mining on farm Thandisizwe 16691, uMshwathi Local Municipality, UMgungundlovu District Municipality, Kwazulu-Natal Province on Friday 16<sup>th</sup> March 2018. The topography of the area is rugged with steep middle slopes and small footslopes ending in a well-defined valley floors. The study area is on the foot slope and is mostly overgrown with high stands of grass (*Hyparrhenia* sp) and thick woody vegetation (*Akasia* sp) whereas the river floor is mostly cut onto dolerite and covered in sandy substrates and vegetation. The site of the mining area falls on highly weathered shale with well-defined fractures and bedding planes.

Excavations for the new development will expose mostly siltstone and clay-rich mudstone of the Pietermaritzburg Formation. Most of the steeper slopes are covered in dolerite scree boulders of several meters in thickness and good exposures were created by excavations into the side of the hills to do preliminary exploration for clay-rich material.


Detailed observations were recorded in the area that will be mined and observations were recorded photographically at GPS points (Figure 3 and Table 2).





Field observations were recorded photographically (Table 2).






**Figure 4** Points in the study area where Photographic observations were recorded (Table 2)




**Table 2** Record of Photographic Observations (See Figure 4 for GPS sites)




Photo	(GPS station) Coordinates	Comments	Photographic Record
1	(GPS 3581) S29° 31.212' E30° 26.421'	General view of the study site, where new excavations will expose potential trace or plant fossils	

2	(GPS 3581) S29° 31.212' E30° 26.421'	Outcrop of Pietermaritzburg Formation sediments with well-defined matchbox weathering that can be confused for fossil structures. No fossils observed.	
3	(GPS 3581) S29° 31.212' E30° 26.421'	Outcrop of Pietermaritzburg Formation sediments and laminations of iron enrichment. No fossils observed.	
4	(GPS 3581) S29° 31.212' E30° 26.421'	Typical oxidation on the shale laminations with possible trace fossils observed. The trace fossils are not well-defined and collection or preservation will not be feasible.	
5	(GPS 3591) S29° 31.258' E30° 26.350'	Deep weathering and shallow water tables that will result in water seepage into the mining area. No fossils were observed.	

6	(GPS 3591) S29° 31.258' E30° 26.350'	Relatively deep soils on weathered Pietermaritzburg Formation Shale in areas that will be excavated during mining operations. No fossils observed but excavation into the Pietermaritzburg mudstones might reveal significant fossils	
7	(GPS 3591) S29° 31.258' E30° 26.350'	Relatively deep sediments of the Permian aged Pietermaritzburg Formation that will be excavated during mining. These sediments might contain significant plant and trace fossils. No fossils were recorded during the field visit.	
8	(GPS 3601) S29° 31.304' E30° 26.370'	Deeply weathered sediments and material of the Pietermaritzburg Formation. Excavation of the material might reveal significant fossils, but no fossils were observed during this site investigation.	



<p>9</p>	<p>(GPS 3611) S29° 31.299' E30° 26.400'</p>	<p>Deeply weathered sediments and material of the Pietermaritzburg Formation, overgrown with grass and trees. Excavation of the material might reveal significant fossils, but no fossils were recorded during this site visit.</p>	
<p>10</p>	<p>(GPS 3611) S29° 31.299' E30° 26.400'</p>	<p>White shale with trace fossils that are highly weathered and not recommended for collection. These sediments might contain significant trace fossils and must be collected if encountered during mining of the shale layers. It is recommended that the ECO must be informed of the presence of these fossils and the HIA specialist must be informed if these structures are observed in the white coloured mudstone</p>	
<p>11</p>	<p>(GPS 3621) S29° 31.278' E30° 26.311'</p>	<p>Deeply weathered shale of the Pietermaritzburg Formation overgrown with grass and thorn trees. No fossils were observed in these highly weathered shale outcrops.</p>	

<p>12</p>	<p>(GPS 3621) S29° 31.278' E30° 26.311'</p>	<p>Typical layered shale of the Pietermaritzburg Formation. No fossils were recorded during this site visit.</p>	 <p>A close-up photograph showing several large, flat, layered shale rock fragments. The layers are dark grey to black, with some reddish-brown staining. The rocks are broken and scattered. A timestamp in the bottom right corner reads '16/02/2018 13:29'.</p>
<p>13</p>	<p>(GPS 3631) S29° 31.220' E30° 26.332'</p>	<p>Deeply weathered and clay-rich highly dispersive soil and sediments of the Pietermaritzburg Formation and layers of shale on the middle slope. Excavation into these sediments can reveal significant fossils during mining but no fossils were observed during this site visit.</p>	 <p>A photograph of a steep, weathered shale slope. The rock is reddish-brown and highly eroded. There is sparse green vegetation on the slope. The background shows a clear blue sky and some distant trees. A timestamp in the bottom right corner reads '16/02/2018 13:30'.</p>
<p>14</p>	<p>(GPS 3651) S29° 31.146' E30° 26.326'</p>	<p>Deep soil overgrown with vegetation on the contact of the shale with dolerite sill material. No fossils are expected from these zone.</p>	 <p>A photograph of a shale slope that is heavily overgrown with dense green vegetation, including bamboo-like plants. The soil appears deep and dark. The background shows a clear blue sky and some distant trees. A timestamp in the bottom right corner reads '16/02/2018 13:42'.</p>

## 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 field investigation (Figure 4).



**Figure 5 Palaeontological sensitivity of the mining area is moderate and the chance find of fossils is not high enough to warrant a Phase 2 PIA**

The field investigation confirms that the study area is underlain by deeply weathered sediments of the Pietermaritzburg Formation and some deeply weathered dolerite. The mining is not planned in dolerite terrain.

The excavations for the mining of shale for this development will expose some sediments of the Pietermaritzburg Formation. Due to weathering, no well-preserved fossils were observed during the field investigation. Exposure of bedrock during excavation might however result in the exposure of significant plant and/or trace fossils of the Pietermaritzburg Formation. The Moderate palaeontological sensitivity is allocated to the entire study area (Figure 4).

## **CONCLUSION**

The development site for the proposed Mining on farm Thandisizwe 16691, uMshwathi Local Municipality, UMgungundlovu District Municipality, Kwazulu-Natal Province is underlain by Permian aged sedimentary rocks of the Pietermaritzburg Formation, Ecca Group of the Karoo Supergroup.

No significant fossils were observed during the field investigation. The potential for finding significant fossils in any excavation into sediments of the Pietermaritzburg Formation is Moderate, and due to the deep weathering it is recommended that no further professional mitigation is required during the excavation of material during mining of the weathered clay. If fossils are observed during mining, the HIA consultant must be notified and the fossils collected by a suitably qualified palaeontologist. No fossils will be associated with areas underlain by dolerite.

It is recommended that:

The EAP and ECO must be informed of the fact that a Moderate Palaeontological sensitivity was allocated to the entire mining area that will expose sediments of the Pietermaritzburg Formation and although highly weathered, fossils might be recorded during the later phase of mining.

If the ECO observes any structures on the bedding planes of the shale, a suitably qualified Palaeontologist must be appointed to inspect the site and produce a "Chance Find Protocol" document (CFP) that then need to be updated on a monthly basis.

These recommendations must be included in the EMP 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