
**HERITAGE SURVEY OF THE DUBE TRADE PORT
AGRIZONE 2**

FOR DUBE TRADE PORT

DATE: 26 August 2013

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	3
KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008	7
METHOD	9
Defining significance.....	10
RESULTS	12
DESKTOP STUDY	12
FIELD SURVEY.....	17
DUB01	17
DUB02	20
DUB03	21
SHERDS.....	25
PALAEONTOLOGICAL DESKTOP IMPACT ASSESSMENT	25
MANAGEMENT PLAN	25
CONCLUSION.....	29
REFERENCES	29
APPENDIX A	30
PALAEONTOLOGICAL IMPACT ASSESSMENT	30
APPENDIX B	43
SITE RECORD FORMS	43

TABLE OF FIGURES

FIG. 1 GENERAL LOCATION OF THE STUDY AREA.....	4
FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA.....	5
FIG. 3: TOPOGRAPHICAL MAP OF THE STUDY AREA	6
FIG. 4: LOCATION OF KNOWN HERITAGE SITES IN THE GENERAL AREA	13
FIG. 5: STUDY AREA IN 1937	15
FIG. 6: STUDY AREA IN 1969	16
TABLE 1: LOCATION AND DESCRIPTION OF RECORDED SITES	17
FIG. 7: LOCATION OF RECORDED SITES	18
FIG. 8: DUBE01 LOOKING NORTHEAST	19
FIG. 9: ARTEFACTS FROM DUB01	19
FIG. 10: STONE TOOLS FROM DUB02.....	20
FIG. 11: VEGETATION AT DUB03	22
FIG. 12: EARLY IRON AGE POTTERY FRAGMENTS	22
FIG. 13: CLOSE UP VIEW OF SETTLEMENTS AT DUB03	23
FIG. 14: BUILDING REMAINS AT DUB03	24
FIG. 15: STUDY AREA AND DEVELOPMENT FOOTPRINT.....	26

INTRODUCTION

The Dube Trade Port Corporation intends to develop part of the land referred to as Agrizone 2. The development will entail the construction of greenhouses, creating platforms, and general servicing of the area. The study area occurs between the existing airport and the R102 and is approximately 92 hectares in size (fig.'s 1 – 3).

The study area is has been used for sugar cane farming for over 70 years, while some areas have reverted to low bushes and blue gum plantations. Several road servitudes occur in the study area as well.

Umlando was contracted to undertake a Phase 1 Heritage Impact Assessment of the study area. The survey recorded three archaeological sites and noted one area that was used for farm labourer's initially predating 1937.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

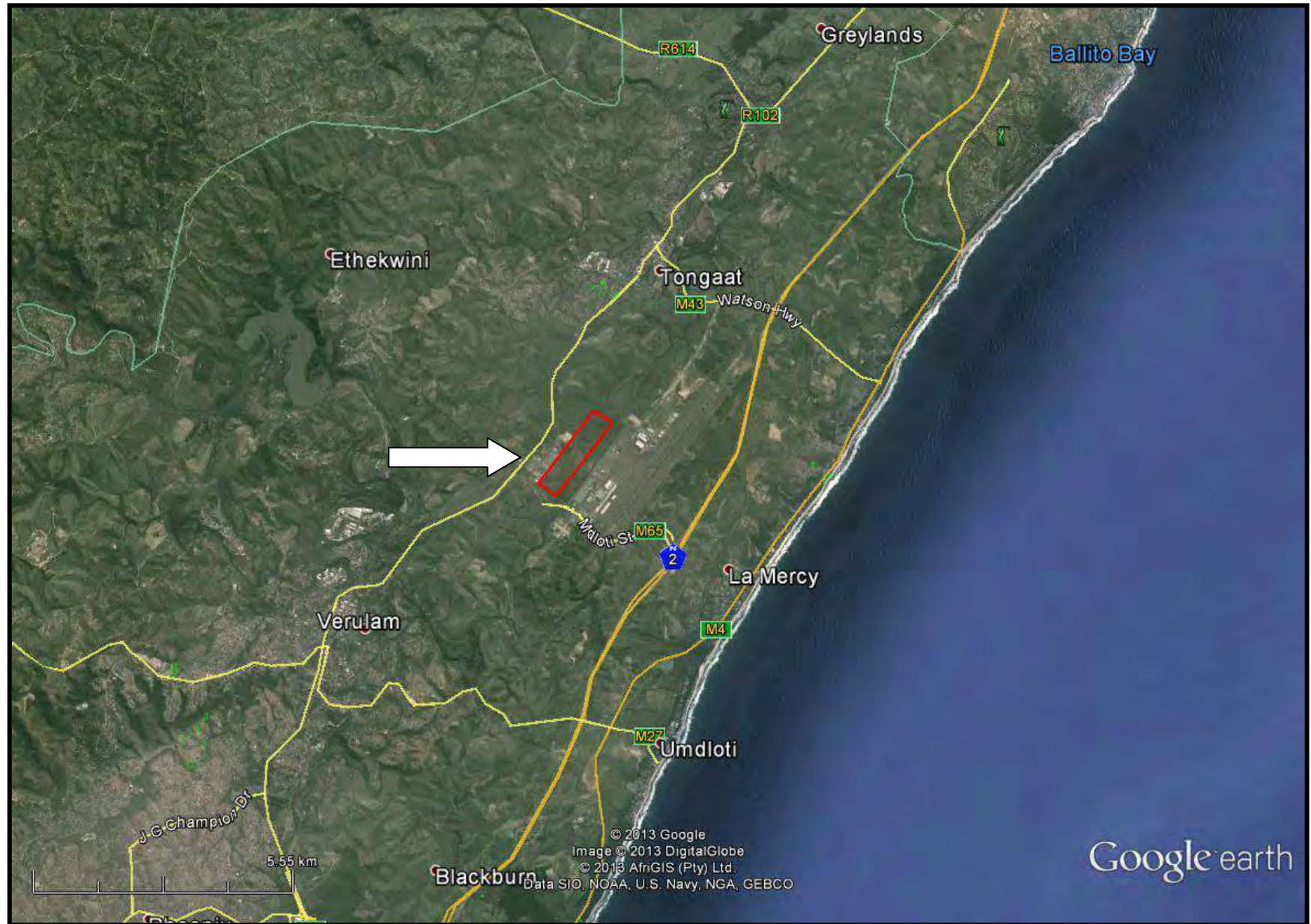
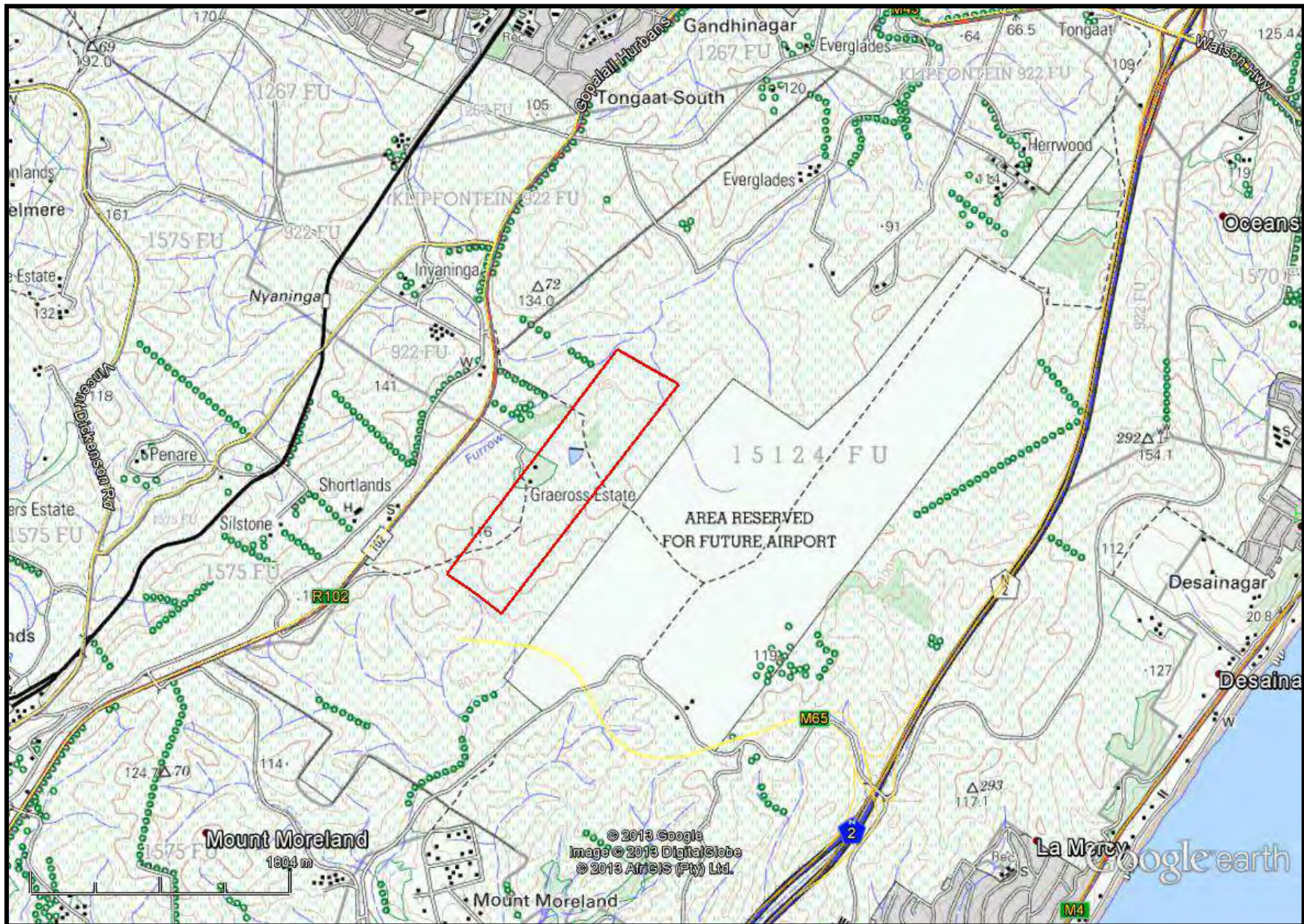


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA



FIG. 3: TOPOGRAPHICAL MAP 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. This 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.

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 previously recorded sites occur in the study area, with the exception of the original farmhouse mentioned by Kruger (2011): part of the farmhouse and/or garden occurs on the edge of 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.

FIG. 4: LOCATION OF KNOWN HERITAGE SITES IN THE GENERAL AREA



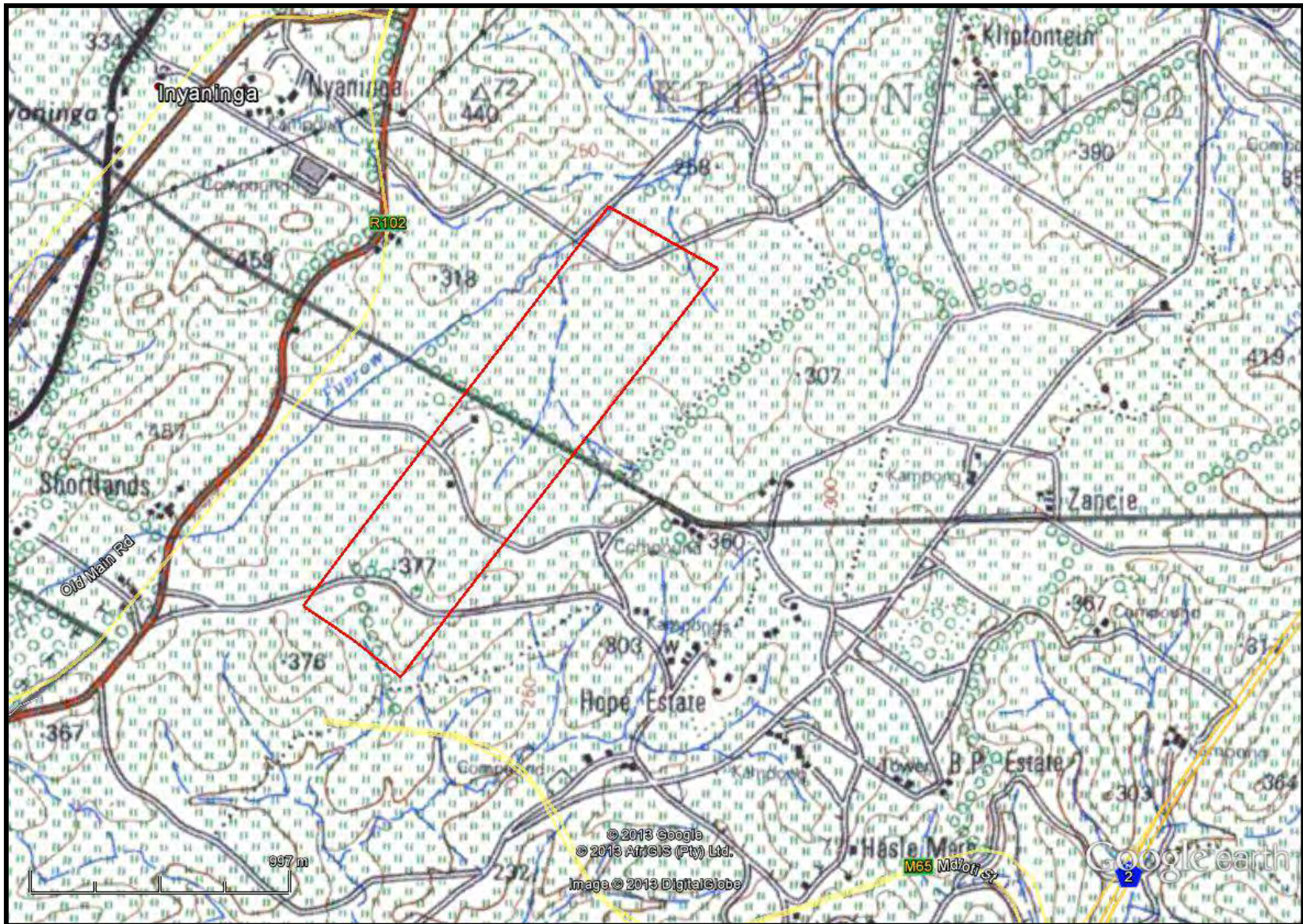
The 1937 aerial photograph (fig. 5) shows that much of the area has been used for sugar cane farming before 1937, with the exception of three hills along the north-western and north-eastern sides of the study area. The north-western hills have several trees growing on the hill, and this area is not used for sugar cane agriculture. The northeastern hill has between 10 – 20 farm labourers' houses with small agricultural fields (see yellow arrow in figure 5). This area is important as it indicates that humans were living on this hill before 1937. Since these are farm labourer's houses, there is unlikely to be a formal cemetery, and thus human remains may occur on this hill. This site is discussed further under DUB03

By 1969, the entire area has been converted to sugar cane with only two formal structures in the study area (fig. 6). This land use remained mostly the same until the construction for the Dube Trade Port began. The only difference, that the topographical maps do not show, is that the northeastern part of the study area (~500m x 800m) was not farmed at some stage and blue gums and bushes were allowed to grow.

FIG. 5: STUDY AREA IN 1937



FIG. 6: STUDY AREA IN 1969



FIELD SURVEY

Figure 7 shows the location of recorded sites. Table 1 describes the sites and lists their locations.

TABLE 1: LOCATION AND DESCRIPTION OF RECORDED SITES

NAME	LATITUDE	LONGITUDE	ALTITUDE (M)	DESCRIPTION
DUB01	-29.615295008	31.093543041	110.0	LIA pottery scattter
DUB02	-29.615157964	31.098148981	103.7	ESA and MSA stone tools
DUB03	-29.608874973	31.102822982	92.3	EIA, LIA? And old buildings.
SHERDS	-29.612338040	31.102283020	93.0	Area of ephemeral LIA pottery sherds

DUB01

DUB01 is located in the south-western corner of the study area, on a small hill (fig. 8). The site extends for ~100m x 50m in size, and much of this is on the slope. The artefacts consist of a scatter of brown thin-walled sherds, one lower grinding stone and one upper grinding stone (fig. 9). All of the sherds were undecorated and adiagnostic; however, they probably date to the LIA.

The soil is shallow with a sandstone geological layer underneath it. There is unlikely to be a deep archaeological deposit. The deposit that did occur has been disturbed by farming activity.

Significance: The site is of low significance.

Mitigation: No further mitigation is required. A permit will be required to destroy the site.

FIG. 7: LOCATION OF RECORDED SITES

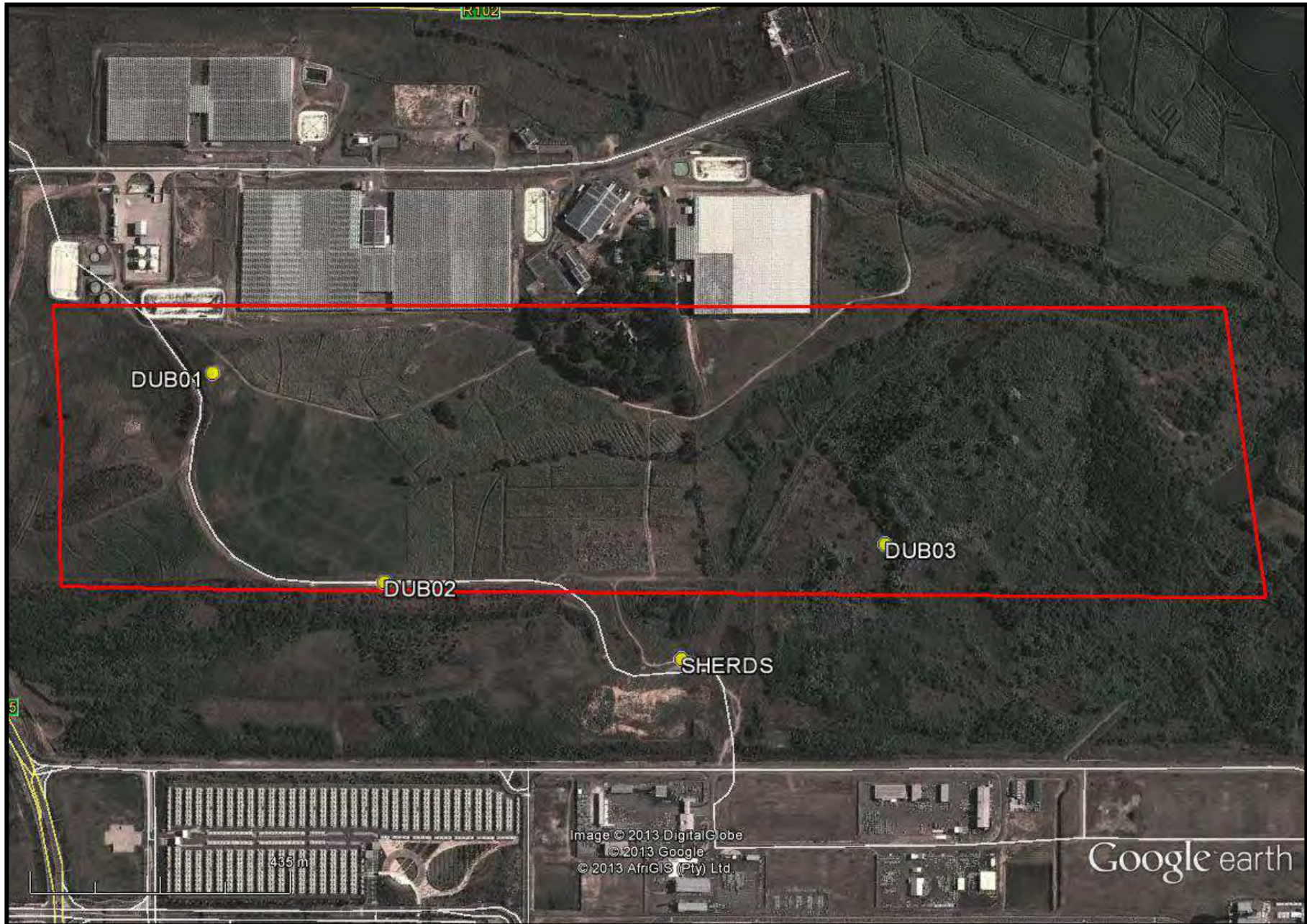


FIG. 8: DUBE01 LOOKING NORTHEAST



FIG. 9: ARTEFACTS FROM DUB01



DUB02

DUB02 is located along the eastern side of the study area and extends over the entire hill. The site consists of MSA cores and flakes of various sizes (fig. 10). All the stone tools are made from quartzite and are heavily weathered. The stone tools were noted along the track and erosion gully over a 150m distance. The stone tools have a low density, and are scattered across the hill. The soil is shallow with a sandstone geological layer underneath it. There is unlikely to be a deep archaeological deposit. The deposit that did occur has been disturbed by farming activity. The stone tools are thus in a secondary context as well.

Significance: The site is of low significance.

Mitigation: No further mitigation is required. A permit will be required to destroy the site.

FIG. 10: STONE TOOLS FROM DUB02



DUB03

DUB03 occurs along the northeastern part of the study area. The site occurs over the entire hill and is approximately 350m x 400m in size. Archaeological visibility was mostly poor due to dense bush and scrub (fig. 11). The scrub changed to dense bush to the north and northwest. Amongst the scrub are areas of open sand and a few EIA sherds were noted. The sherds were undecorated, and one bowl fragment was noted (fig. 12). The pottery sherds suggest that there was an EIA settlement on the hill.

The desktop study noted that there were several settlements on this hill in 1937 (fig.'s 5 and 13). Judging by the size of the houses, and the associated agricultural fields, these probably belong to farm labourers. It is unlikely that these people had a formal cemetery and that they rather used traditional burial practices, e.g. buried in front/inside the kraal. These would not be visible on the surface, regardless of the vegetation cover. This hill also has a deeper sandy deposit than the other hills and thus human burials may not have been disrupted with farming activity.

There are more recent structures on the hill as well, but they have been demolished. Some of the structures are made from concrete reinforced with steel bars (fig. 14)

Significance: The EIA aspect of the site is of low significance due to the low density of pottery sherds and lack of an intact deposit. The 1937 settlement could be of high significance if human remains occur.

Mitigation: My experience with EIA settlements in this area is that the archaeological deposit tends to be damaged and not worth further mitigation. It is only when high concentrations of sherds are noted, that excavations would be required. A permit for the damage to the EIA site will be required. The area around DUB03 should be revisited after bush clearance and possibly monitored during construction. This would allow for potential human remains to be noted.

FIG. 11: VEGETATION AT DUB03



FIG. 12: EARLY IRON AGE POTTERY FRAGMENTS



FIG. 13: CLOSE UP VIEW OF SETTLEMENTS AT DUB03



FIG. 14: BUILDING REMAINS AT DUB03



SHERDS

A scatter of LIA sherds occur on the eastern border of the study area and extends further east. These sherds are in an area where the topsoil has been removed. The sherds are in a secondary context and there is no archaeological deposit.

Significance: The site is of low significance.

Mitigation: No further mitigation is required

PALAEONTOLOGICAL DESKTOP IMPACT ASSESMENT

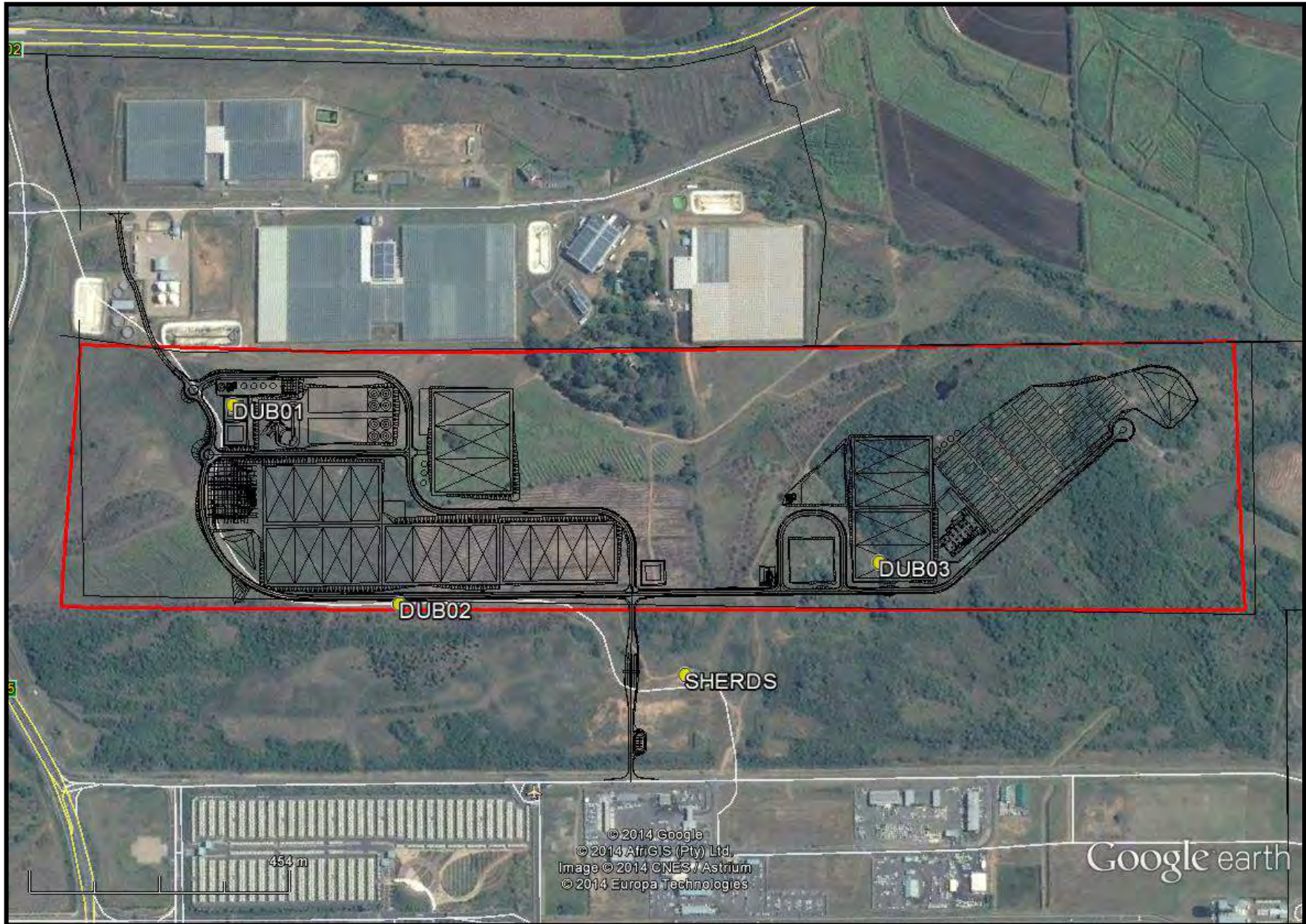
A desktop palaeontological impact assessment was undertaken (see Appendix A for full report). The study area is underlain by the Vryheid Formation: Light grey, coarse-grained sandstone and carbonaceous mudstone. The Vryheid formation is known to be very rich in plant and ichnofossils and these have a high sensitivity rating. However, since the area is overgrown and has had less weathering, the PIA has given it a moderate sensitivity rating.

Dr Groenewald suggests that any excavations deeper than approximately 2m below the current surface would require a palaeontologist on site.

MANAGEMENT PLAN

Fig. 15 shows the study area and the development footprint. The footprint will affect all three sites recorded in the survey and a permit for the (partial) destruction of the sites will be required from Amafa KZN. In addition to this, the hill around DUB03 will require a resurvey once the vegetation has been cleared, and before construction begins. This would allow for an assessment of potential human remains from the labourer's settlements. The area surrounding DUB03 should be noted as having high sensitivity of human remains that may be exposed during construction.

FIG. 15: STUDY AREA AND DEVELOPMENT FOOTPRINT



If graves are uncovered during the course of the pipeline then certain processes need to be followed. In terms of the National Heritage Resources Act (No. 25 of 1999), and KZN Heritage Act of 1997 and 2008, state those graves older than 60 years (not in a municipal graveyard) are protected, as well as all unclaimed recent graves. Only a registered undertaker should handle human remains younger than 60 years or an institution declared under the Human Tissues Act. Anyone who wishes to develop an area where there are graves older than 60 years is required to follow the process described in the legislation (section 36 and associated regulations). The specialist will require a permit from the heritage resources authority:

- Determine/ confirm the presence of the graves on the property. Normally the quickest way to proceed is to obtain the service of a professional archaeologist accredited to undertake burial relocations. The archaeologist will provide an estimate of the age of the graves. There may be a need for archival research and possibly test excavations (permit required).
- The preferred decision is to move the development so that the graves may remain undisturbed. If this is done, the developer must satisfy SAHRA/KZN Heritage that adequate arrangements have been made to protect the graves on site from the impact of the development. This usually involves fencing the grave (yard) and setting up a small site management plan indicating who will be responsible for maintaining the graves and how this is legally tied into the development. It is recommended that a distance of 10-20 m is left undisturbed between the grave and the fence around the graves.
- If the developer wishes to relocate or disturb the graves:
 - A 60-day public participation (social consultation) process as required by section 36 (and regulations - see attachment), must be undertaken to identify any direct descendants of those buried on the property. This allows for a period of consultation with any family members or community to ascertain what their wishes are for the

burials. It involves notices to the public on site and through representative media. The archaeologist, who can explain the process, may do this but for large or sensitive sites, a social consultant should be employed. Archaeologists often work with undertakers, who rebury the human remains.

- If as a result of the public participation, the family (where descendants are identified) or the community agree to the relocation process then the graves may be relocated.

- The archaeologist must submit a permit application to SAHRA/KZN Heritage for the disinterment of the burials. This must include written approval of the descendants or, if there has not been success in identifying direct descendants, written documentation of the social consultation process, which must indicate to SAHRA's satisfaction, the efforts that have been made to locate them. It must also include details of the exhumation process and the place to which the burials are to be relocated. (There are regulations regarding creating new cemeteries and so this usually means that relocation must be to an established communal rural or formal municipal cemetery.)

- Permission must be obtained before exhumation takes place from the landowner where the graves are located, and from the owners/managers of the graveyard to which the remains will be relocated.

- Other relevant legislation must be complied with, including the Human Tissues Act (National Department of Health) and any ordinances of the Provincial Department of Health). The archaeologist can usually advise about this.

CONCLUSION

A heritage survey was undertaken for the Dube Trade Port, Agrizone 2. The development will entail the construction of greenhouses, creating platforms, and general servicing of the area.

Three heritage sites were noted during the survey, as well as areas of moderate palaeontological sensitivity. Two archaeological sites are of low significance and do not require further mitigation. One site, DUB03, requires the area to be reassessed after bush clearance. The reassessment is due to the possibility of human remains from the settlements dating to the early part of the 20th century.

The PIA noted that palaeontological remains could occur at a level of 2m below the surface. A qualified palaeontologist would need to be on site where this occurs.

REFERENCES

Ethembeni. 2007. Heritage Impact Assessment Of Dube Tradeport, La Mercy, Kwazulu-Natal, South Africa. Report for Institute of Natural Resources

Seliane, M. 2012. Dube Tradeport Trade Zone Project Phase I Cultural Heritage Impact Assessment. Report for SEF.

APPENDIX A
PALAEONTOLOGICAL IMPACT ASSESSMENT

**DESKTOP PALAEOLOGICAL
ASSESSMENT OF
THE AGRIZONE STUDY AREA,
KWA-ZULU NATAL**

**FOR
Umlando**

DATE: 21 August 2013

By

**Gideon Groenewald
Cell: 082 339 9202**

TABLE OF CONTENT

INTRODUCTION	34
SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999	34
METHODOLOGY	35
GEOLOGY	37
PALAEOLOGY	38
DISCUSSION	39
MANAGEMENT PLAN	39
CONCLUSION	40
REFERENCES	40
QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	42
DECLARATION OF INDEPENDENCE	42

TABLE OF FIGURES

Figure 1 Location of the study area	34
Figure 2 Geology of the study area	37
Figure 3 Palaeontological sensitivity of the study area	40

LIST OF TABLES

Table 1 Palaeontological sensitivity analysis outcome classification	36
Table 2 Palaeontological significance of geological units on site	39

EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the Agrizone development, adjacent to the King Shaka International Airport, Durban, Kwa-Zulu Natal. The project includes the development of stands, greenhouses and general services.

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. In accordance with Section 38 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

The Study area is underlain by Permian aged sedimentary rocks of the Vryheid Formation of the Ecca Group, Karoo Supergroup. The Vryheid Formation consists of a sequence of coarse-grained sandstone and carbonaceous shales, interpreted as deltaic sedimentary deposits in localised Graben-induced basins in this part of Kwa-Zulu Natal.

The Vryheid formation is known to be very rich in plant and ichnofossils that would, in theory, allocate a high sensitivity rating for Palaeontology. Due to the fact that areas underlain by the Vryheid Formation are presently overgrown with either sugarcane fields or patches of natural vegetation, a Moderate sensitivity for Palaeontology has been allocated to this site.

The study area is underlain by sedimentary rocks of the Vryheid Formation, Ecca Group, Karoo Supergroup. The study area is allocated a Medium palaeontological sensitivity due to the fact that the entire study area is overgrown with vegetation and exposure of fossil bearing strata is only expected during deep excavations.

Recommendations:

1. The ECO and EAP must be informed of the possibility of the occurrence of fossils during deep excavations into the Vryheid Formation. If fossils are recorded, a professional palaeontologist must be appointed to record them.

INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the Agrizone development, adjacent to the King Shaka International Airport, Durban, Kwa-Zulu Natal. The project includes the development of stands, greenhouses and general services.



Figure 1 Location of the study area

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999

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. In accordance with Section 38 (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;

objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

METHODOLOGY

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 identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess 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.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps and Google Earth imagery. 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.

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

Table 1 Palaeontological sensitivity analysis outcome classification

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

The key assumption for this desktop 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.

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).

GEOLOGY

The Study area is underlain by Permian aged sedimentary rocks of the Vryheid Formation of the Eccca Group, Karoo Supergroup. The Vryheid Formation consists of a sequence of coarse-grained sandstone and carbonaceous shales, interpreted as deltaic sedimentary deposits in localised Graben-induced basins in this part of Kwa-Zulu Natal (Johnson et al, 2006).



Figure 2 Geology of the study area

PALAEONTOLOGY

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

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

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

DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews. The palaeontological significance is summarised in Table 2.

Table 2 Palaeontological significance of geological units on site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Vryheid Formation	Light grey, coarse-grained sandstone and carbonaceous mudstone PERMIAN	<i>Azaniodendron fertile</i> , <i>Cyclodendron leslii</i> , <i>Sphenophyllum hammanskraalensis</i> , <i>Annularia</i> sp., <i>Raniganjia</i> sp., <i>Asterotheca</i> spp., <i>Liknopetalon enigmata</i> , <i>Glossopteris</i> > 20 species, <i>Hirsutum</i> 4 spp., <i>Scutum</i> 4 spp., <i>Ottokaria</i> 3 spp., <i>Estcourtia</i> sp., <i>Arberia</i> 4 spp., <i>Lidgettonia</i> sp., <i>Noeggerathiopsis</i> sp. and <i>Podocarpidites</i> sp. <i>Diplocraterion</i> burrows	None	Medium sensitivity

MANAGEMENT PLAN

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 fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 above.

The palaeontological sensitivity of the development is related to the specific geology that underlies the development footprints. The Vryheid formation is known to be very rich in plant and ichnofossils that would, in theory, allocate a high sensitivity rating for Palaeontology. Due to the fact that areas underlain by the Vryheid Formation are presently overgrown with either sugarcane fields or patches of natural vegetation, a Moderate sensitivity for Palaeontology has been allocated to this site (Figure 3).



Figure 3 Palaeontological sensitivity of the study area

CONCLUSION

The study area is underlain by sedimentary rocks of the Vryheid Formation, Ecca Group, Karoo Supergroup. The study area is allocated a Medium palaeontological sensitivity due to the fact that the entire study area is overgrown with vegetation and exposure of fossil bearing strata is only expected during deep excavations.

Recommendations:

1. The ECO and EAP must be informed of the possibility of the occurrence of fossils during deep excavations into the Vryheid Formation. If fossils are recorded, a professional palaeontologist must be appointed to record them.

REFERENCES

Bamford M. 2011. Desktop study Palaeontology Ermelo to Empangeni – Eskom powerline. Internal report Bernard Price Institute for Palaeontological Research, University of the Witwatersrand.

Johnson MR , Anhaeusser CR and Thomas RJ (Eds) (2006). The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

Mason TR and Christie ADM 1986. Palaeoenvironmental significance of ichnogenus *Diplocraterion* *torell* from the Permian Vryheid Formation of the Karoo Supergroup, South Africa. *Palaeogeography, Palaeoclimatology, Palaeoecology* 53(3-4):249-265.

Modesto, SP. 2006. The cranial skeleton of the Early Permian aquatic reptile *Mesosaurus tenuidens* : implications for relationships and palaeobiology. *Zoological Journal of the Linnean Society* 146: 345–368.

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

**APPENDIX B
SITE RECORD FORMS**

UMLANDO ARCHAEOLOGICAL SITE RECORD FORM



SITE CATEGORY: (X where applicable)

Stone Age:
Early Iron Age:
Late Iron Age X
Historical Period:

Recorder's Site No.: DUB01
Official Name: 15124 FU
Local Name: Graeross Estate
Map Sheet: 2931CA Verulam
GPS reading: S29.61530 E31.09354 alt:110,

DIRECTIONS TO SITE: SKETCH OR DESCRIPTION.

From the N2, take the Airport turnoff. Once over the N2 drive for ~3.8km along the D144/Mdloti St. (i.e the link road between the N2 and the airport). Take first dirt road to the right and go up the hill behind the existing water tanks. Site is on top of the first hill.

SITE DESCRIPTION:

Type of Site: Open scatter
Merits conservation: No
Threats: Yes
What threats: Development

RECORDING:

Graphic record: Yes
Digital pictures: Xx

Tracings :

Re-drawings:

Recorder/Informant: Name: Gavin Anderson
Address: PO Box 102532, Meerensee, 3901
Date: 12/08/2013
Owner: Dube Trade Port

Description of site and artefactual content.

DUB01 is located in the south-western corner of the study area, on a small hill. The site extends for ~100m x 50m in size, and much of this is on the slope. The artefacts consist of a scatter of brown thin-walled sherds, one lower grinding stone and one upper grinding stone. All of the sherds were undecorated and undiagnostic; however, they probably date to the LIA. The soil is shallow with a sandstone geological layer underneath it. There is unlikely to be a deep archaeological deposit. The deposit that did occur has been disturbed by farming activity.

Significance: The site is of low significance.

Mitigation: No further mitigation is required. A permit will be required to destroy the site.

UMLANDO ARCHAEOLOGICAL SITE RECORD FORM



SITE CATEGORY: (X where applicable)

Stone Age: ESA, MSA

Early Iron Age:

Late Iron Age

Historical Period:

Recorder's Site No.: DUB02

Official Name: 15124 FU

Local Name: Graeross Estate

Map Sheet: 2931CA Verulam

GPS reading: S29.61516 E31.09815

DIRECTIONS TO SITE: SKETCH OR DESCRIPTION.

From DUB01, continue with the main dirt road to the hill on the east (~500m). Artefacts observable along entire road in erosion gullies.

SITE DESCRIPTION:

Type of Site: Open

Merits conservation: no

Threats: Yes

What threats: Development

RECORDING:

Graphic record: Yes

Digital pictures: x

Tracings :

Re-drawings:

Recorder/Informant: Name: Gavin Anderson

Address: PO Box 102532, Meerensee, 3901

Date: 12/08/2013

Owner: Dube Trade Port

Description of site and artefactual content.

DUB02 is located along the eastern side of the study area and extends over the entire hill. The site consists of MSA cores and flakes of various sizes. All the stone tools are made from quartzite and are heavily weathered. The stone tools were noted along the track and erosion gully over a 150m distance. The stone tools have a low density, and are scattered across the hill. The soil is shallow with a sandstone geological layer underneath it. There is unlikely to be a deep archaeological deposit. The deposit that did occur has been disturbed by farming activity. The stone tools are thus in a secondary context as well.

Significance: The site is of low significance.

Mitigation: No further mitigation is required. A permit will be required to destroy the site.

