HERITAGE SURVEY OF THE AVONDALE RESIDENTIAL DEVELOPMENT

FOR TRIPLO4 SUSTAINABLE SOULTIONS

DATE: 15 SEPTEMBER 2017

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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

Horsewood Trust “proposes the establishment of a residential housing development within Avondale, Ballito, KwaDukuza Municipality, comprising of residential units, refuge areas, 2 clubhouses and associated infrastructure. The proposed development is situated on Erven 1432, 1433 and 1447 which is currently zoned as residential as indicated within the KDM Land-Use Map and is not listed as a zoned open space or conservation area. The total size of the property is 5.1 ha and the development footprint is approximately 2.4806 ha. It must be noted that Erven 1432 and 1433 are currently being consolidated into Erf 4647. The property will be accessed via an unpaved road in the south western side. All bulk services (water, electricity, sewage) is available within close proximity to the site and the development will be linked with the existing infrastructure” (Triplo4 BID 2017:10). Umlando was contracted to undertake the HIA for the development.

ENVIRONMENT

“The proposed development is located within the Indian Ocean Coastal Belt Biome and CB3 KwaZulu-Natal Coastal Belt Grassland (Mucina and Rutherford, 2006). The vegetation and landscape features comprise of highly dissected undulating coastal plains which used to be covered with various types of subtropical coastal forest. Some primary grassland still occurs in hilly, high-rainfall areas where pressure from natural fire and grazing regimes prevailed. This vegetation unit is considered endangered and poorly protected with less than 0.6% receiving formal protection (Mucina & Rutherford, 2006). Whilst the plant species at the site of the proposed development in Avondale, KwaZulu-Natal are reminiscent of much of the greater KwaZulu-Natal region; some alien species were identified” (Triplo4 BID 2017:25).

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

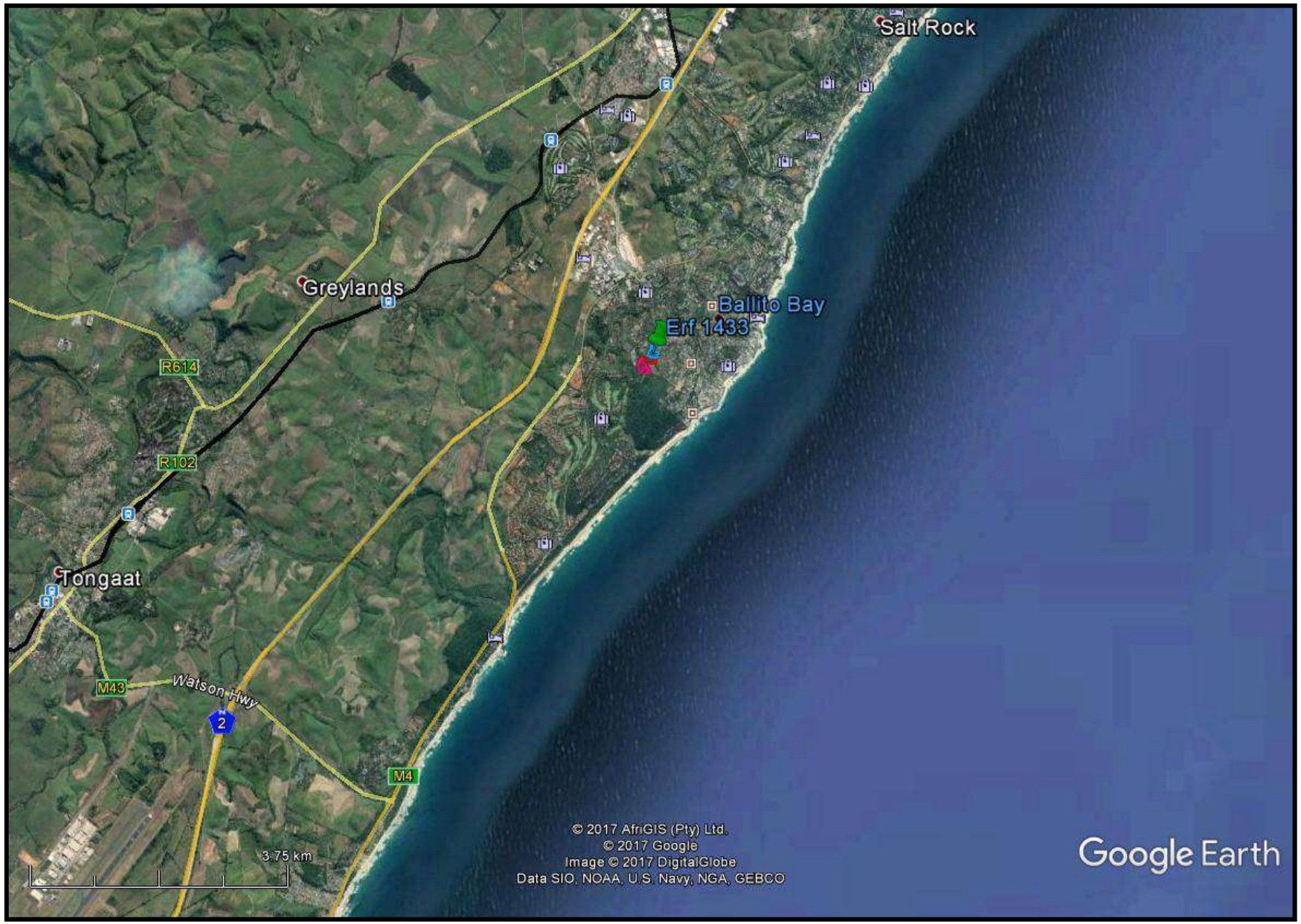


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA

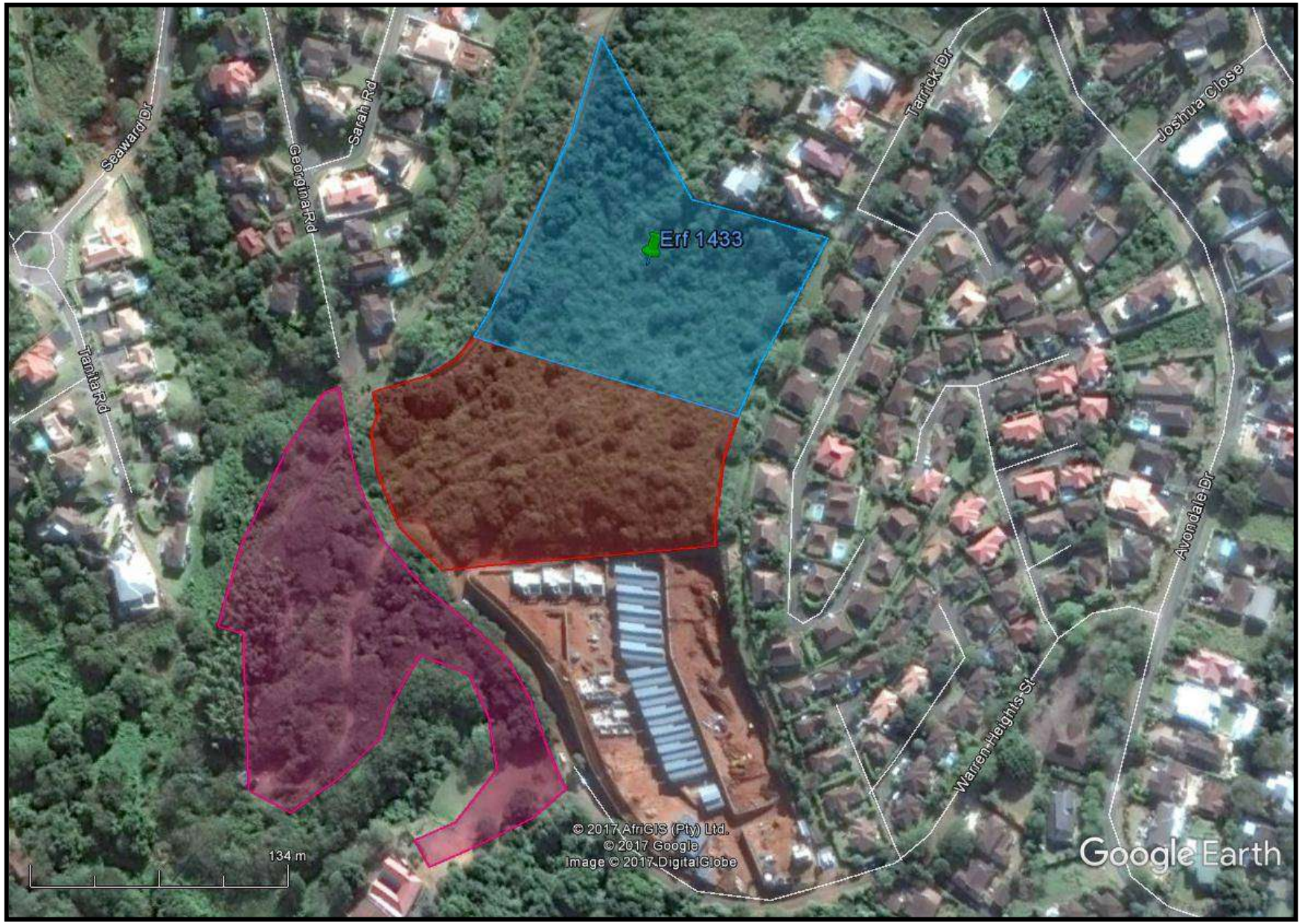


FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE STUDY AREA

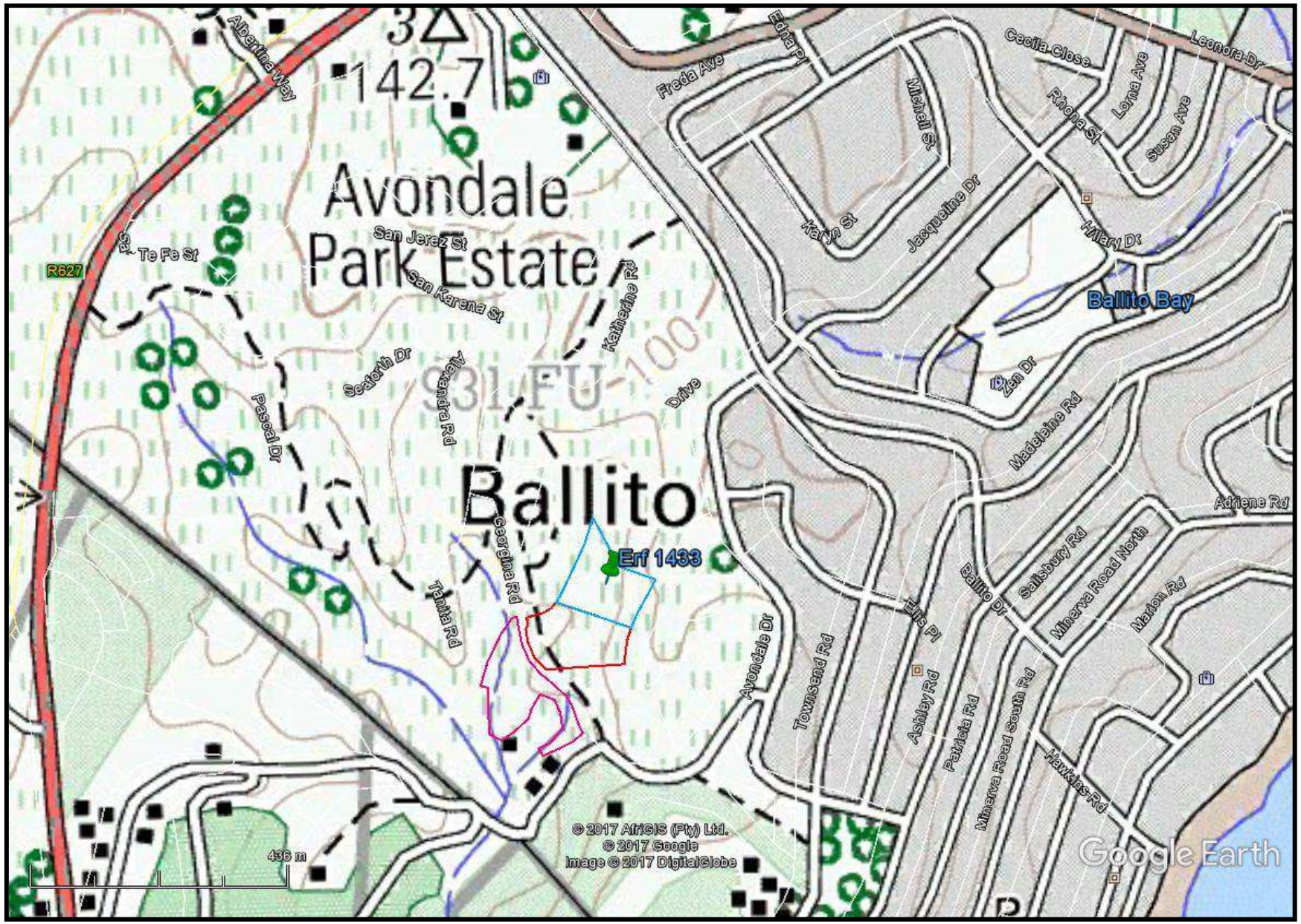


FIG. 4: SCENIC VIEWS OF THE STUDY AREA

KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008

"General protection: Structures.—

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

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

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

position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

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

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

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

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

site, palaeontological site, historic fortification, or meteorite impact site, or use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.

- The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government." (KZN Heritage Act of 2008)

METHOD

The method for Heritage assessment consists of several steps.

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

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

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

Defining significance

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

These criteria are:

1. State of preservation of:

1.1. Organic remains:

1.1.1. Faunal

1.1.2. Botanical

1.2. Rock art

1.3. Walling

1.4. Presence of a cultural deposit

1.5. Features:

1.5.1. Ash Features

1.5.2. Graves

1.5.3. Middens

1.5.4. Cattle byres

1.5.5. Bedding and ash complexes

2. Spatial arrangements:

2.1. Internal housing arrangements

2.2. Intra-site settlement patterns

2.3. Inter-site settlement patterns

3. Features of the site:

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

3.2. Is it a type site?

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

4. Research:

4.1. Providing information on current research projects

4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

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

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

6. Archaeological Experience:

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

7. Educational:

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

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

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

8. Other Heritage Significance:

8.1. Palaeontological sites

8.2. Historical buildings

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

8.4. Graves and/or community cemeteries

8.5. Living Heritage Sites

8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

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

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

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

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

RESULTS

DESKTOP STUDY

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

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

The 1937 aerial photographs indicate that this area is sugar cane fields in 1937 (fig. 6). In the southern portion of the development (pink in fig. 6) appears to have a few structures, probably labourers' housing. These are probably beehive huts.

The 1969 1:50 000 topographical map indicates that there are three structures in the lower area of the development. These are probably extensions of the 1937 structures.

The occurrence of domestic structures is important as these indicate that there will probably be human graves in the general area, especially related to the earlier settlements.

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

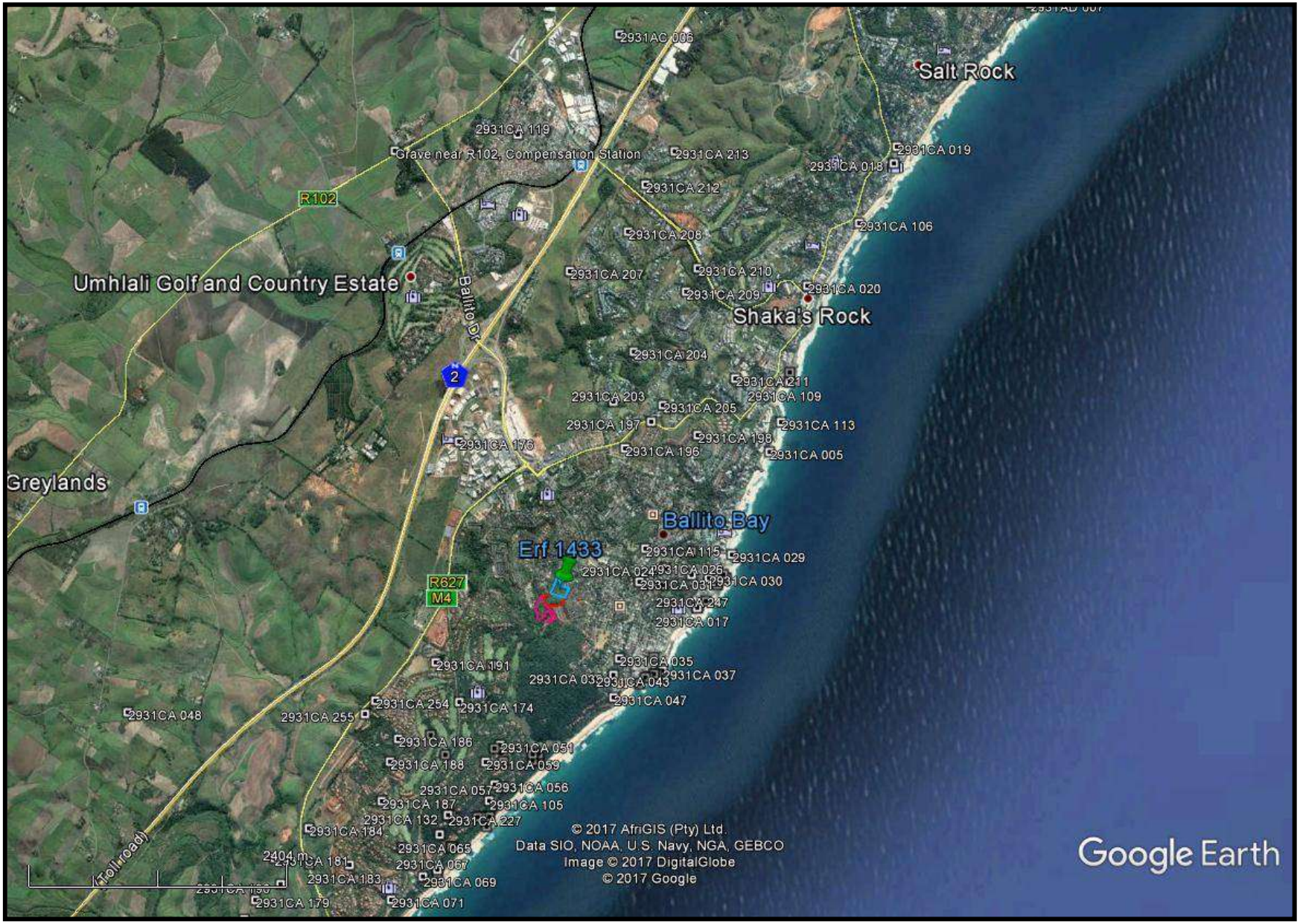
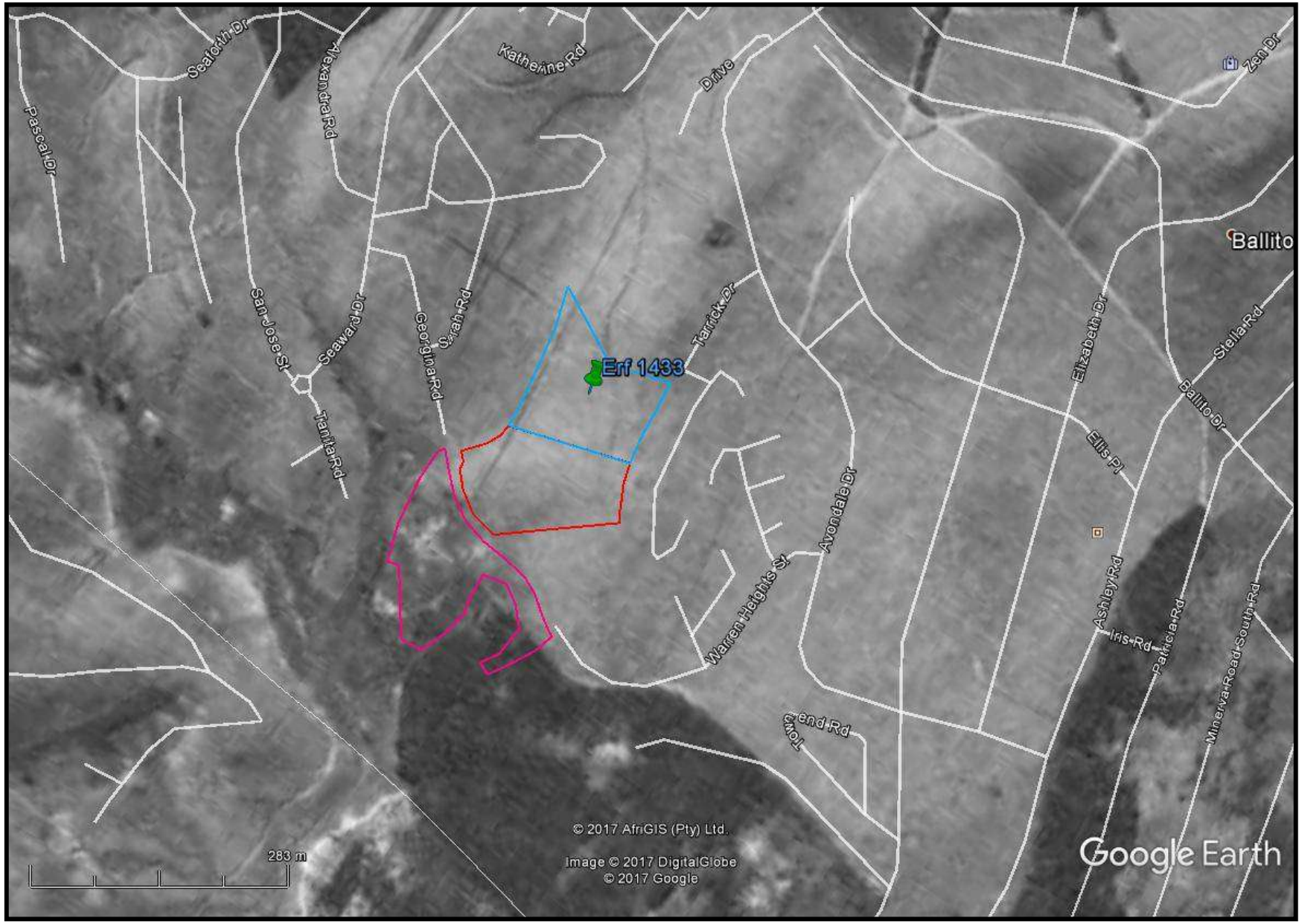
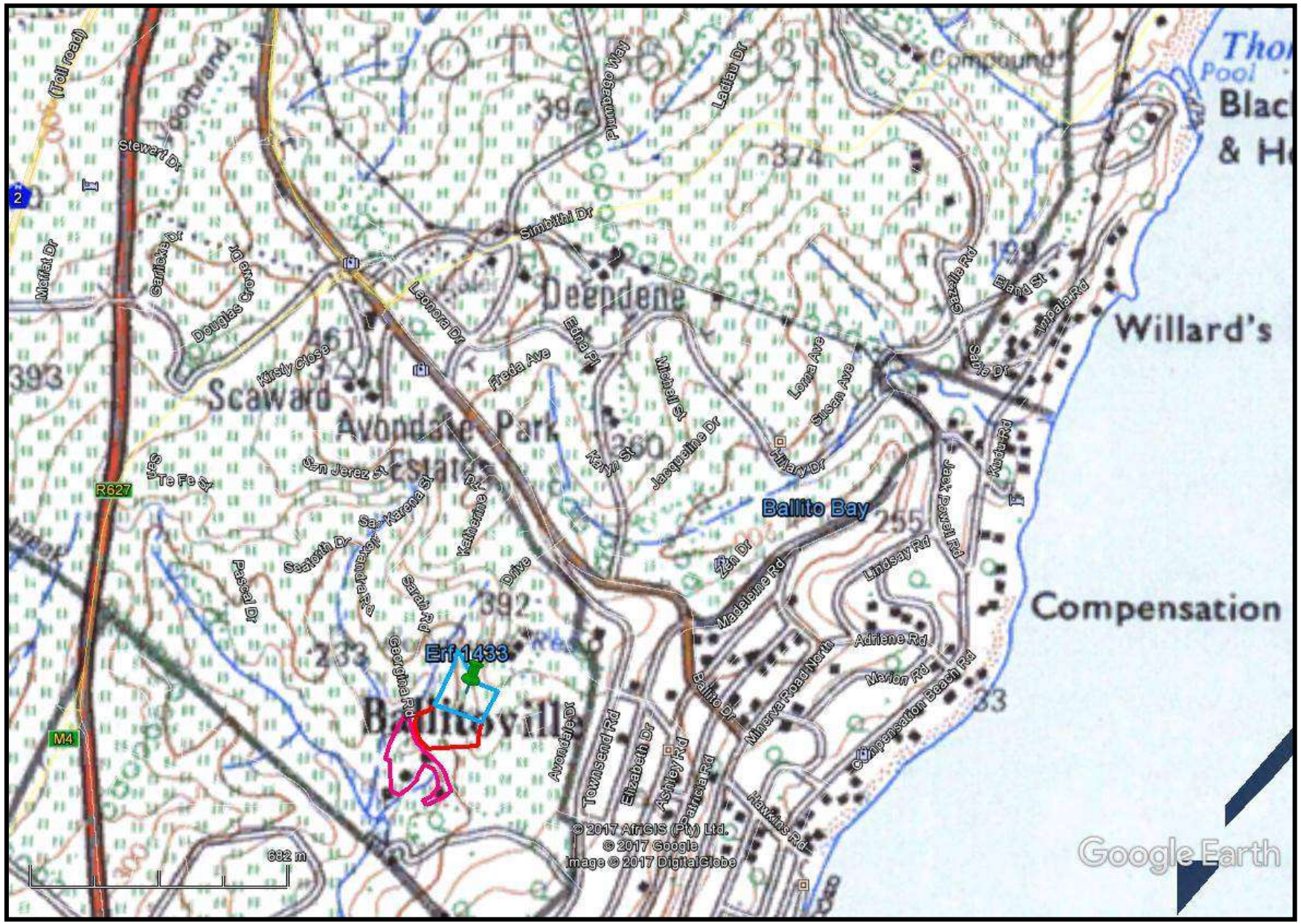


FIG. 6: STUDY AREA IN 1937[1]



[1] 117B_053_54273

FIG. 7: STUDY AREA IN 1968



PALAEONTOLOGICAL IMPACT ASSESSMENT

The desktop PIA was undertaken by Dr Gideon Groenewald (Appendix A). The development site is underlain by Quaternary aged red sand of the Berea Formation, Maputuland Group. This is of high sensitivity (fig. 8).

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

It is recommended that:

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

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

FIG. 8: PALAEONTOLOGICAL SENSITIVITY

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 first field survey was undertaken in June 2016. However, the vegetation was too dense for an accurate survey. I suggested that permission be granted by Amafa KZN to continue with the application, provided that a survey was undertaken after some areas had been cleared. This was to ensure that the development application was not delayed.

The second survey was undertaken in September 2017. Several transects were requested for clearance; however, some of the paths had not been cleared (fig. 9). The existing clearance tracts did however give a good enough indicator of the area.

The survey walked focussed in the cleared vegetation where visibility was good. No artefacts were noted on Erf 1432 and 1433; despite it note being cleared correctly. However, if there were any significant archaeological sites in the area, some artefacts would have been noted. I suggest that the area forms part of the monitoring program suggested below.

AVON01

AVON01 is a shell midden located in Erf 1447 (fig. 9). Bush clearance had exposed more of the midden from the original survey. The midden is ~4m in radius. It appears to be thin and non-compacted, judging from animal burrows in the area. No artefacts were observed with the midden. The midden consists of fragments of *Perna perna* and *Ostreidae spp.*

The lack of pottery shards and/or stone tools indicate that the midden is probably related to the houses that occur on the historical maps from the desktop. No structures were observed in the cleared tracks although building debris was noted.

The occurrences of material remains from the houses indicate that more could occur underneath the vegetation. However, the sites are not older than 100 years and are thus not archaeological. The structures or their foundations would be of two types. The original structures from the 1937 map are probably beehive huts and would have decayed by now. There might be daga floors; however, the occurrence of structures in 1969 suggests that the original floors etc were destroyed. The material and structures are not significant and the buildings in 1969 onwards are not protected by legislation.

The area is of potential significance in that there is a good probability that human remains may occur. This would be especially true for the older settlements that would have followed traditional burial practices. That is family members would be buried near the household. If human remains are found, or unearthed, in this area, then that area of construction would need to halt, and a Social impact study will be required, since the human remains are unlikely to be older than a 100 years.

FIG. 9: SHELL MIDDEN AT AVON01

Significance:

The main site and features are of low significance. However, the possible occurrence of human remains makes this a potential high significance. There is a strong link between ancestral remains and the land in which they are buried, the legislation acknowledges this. This is both a spiritual and physical link, which differs to most western concepts of death.

Mitigation:

There are three ways in which the area can be mitigated. First, the ERF1447 should be completely cleared of ground vegetation, as was undertaken with the transects. This will only need to occur on the more even parts of the site, and not the steeper slopes. This will allow an archaeologist to determine if there are any graves, or grave-like features, in the area. If graves are noted then they can be cordoned off for the time being and dealt with at a later stage through the social impact assessment. If no graves are found, then the area is monitored during initial earth moving activities. This has the benefit of giving timeous notification for potential future work, and can be calculated into the construction time frames. The required permits and advertising times can also be obtained in advance.

This is explained below.

Second, the area is monitored by an archaeologist during earthmoving activity. If human remains are found then all activity around a certain radius is halted until appropriate mitigation is undertaken. While this has the benefit of not requiring bush clearance, it does put constraints on construction, unless these delays are added into the construction timeframes.

Thirdly, the area is left as a grassed area with no sub-surface disturbance. In this way, if there are no obvious graves markers, the possible graves will not be disturbed.

I personally would opt for the first option. The process of grave removal is a lengthy process and involves several steps. Any possible graves in the Erf are probably 60 – 100 years in age.

GUIDELINES FOR HUMAN GRAVE REMOVAL

The developer must follow the guidelines mentioned below otherwise the project may be brought to halt. The process of grave removal is a complex one that requires community consultation, advertisements, several permits, and finally reburial. Moreover, those graves older than 60 years require a qualified archaeologists to undertake the entire process. This process is summarised as follows[2]:

In terms of the National Heritage Resources Act (No. 25 of 1999), and KZN Heritage Act of 1997 and 2008, graves older than 60 years (not in a municipal graveyard) are protected. Human remains younger than 60 years should be handled only by a registered undertaker 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

[2] Information supplied by SAHRA, and it applies to KZN, although falling under the KZN Heritage Act.

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. This may be done by the archaeologist, who can explain the process, 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.

MANAGEMENT PLAN

The general study area appears to be void of archaeological sites and no permits are currently required. The upper two Erf should have a final survey after the final bush clearance occurs and before construction starts.

The location of farm labourers' houses dating from 1937 to 1969 (or more recent) suggests that there is a strong possibility of human graves in Erf 1447. I proposed three ways in which this area could be mitigated and managed:

1. The area is thoroughly cleared of ground vegetation and is surveyed by an archaeologist to confirm the presence/absence of grave markers. This will allow a time to undertake the required work if there are graves before construction begins.
2. The area is monitored during earth moving activity by a qualified archaeologist for potential graves. If graves are found then all activity in a specific area stops until the process is complete.
3. The area is developed as a green space within the development plan and thus no disturbance of possible graves will occur.

The area is of high palaeontological sensitivity. Earth moving activity deeper than 1.5m will require an inspection by a qualified palaeontologist. This will not delay construction, rather work with construction to salvage any remains.

CONCLUSION

A heritage survey was undertaken for the proposed Avondale residential development. The initial survey was delayed as it required several transect to be cleared before a proper assessment can be undertaken. The survey was undertaken once Umlando was informed that the required bush clearance had been completed. No archaeological sites were noted in the transects.

The desktop study noted that there are settlements dating from 1937 to 1969. These settlements probably contain human graves. Three methods for the management of potential graves were given, of which I suggested that the area be thoroughly cleared of ground vegetation as a start. The area will also require an archaeologist on site during earth moving activity.

The palaeontological desktop indicated that a site inspection will be required if depths greater than 1.5m are reached.

REFERENCES

117B_053_54273 (1937)
2931CA Verulam 1969, 2000
Natal Museum Site Record Database
SAHRIS Database
Umlando Database

EXPERIENCE OF THE HERITAGE CONSULTANT

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

DECLARATION OF INDEPENDENCE

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

Gavin Anderson
Archaeologist/Heritage Impact Assessor

APPENDIX A

DESKTOP PIA

DESKTOP PALAEONTOLOGICAL ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF THE AVONDALE HOUSING SCHEME IN THE KWADUKUZA LOCAL MUNICIPALITY, ILEMBE DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE.

FOR

Umlando

DATE: 23 September 2017

By

Gideon Groenewald

Cell: 078 713 6377

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by Umlando to undertake a Desktop Survey, assessing the potential Palaeontological Impact related to an application for the proposed development of the Avondale Housing Scheme in the KwaDukuza Local Municipality, iLembe 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 amended 2014 and 2017) as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts on palaeontological heritage within the development footprint.

The development site applicable to the application for the proposed development of the Avondale Housing Scheme in the KwaDukuza Local Municipality, iLembe District Municipality, KwaZulu-Natal Province, is underlain by Quaternary aged red sand of the Berea Formation, Maputuland Group.

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

It is recommended that:

- The EAP and ECO must be informed of the fact that a High Palaeontological Sensitivity is allocated to the entire study area. A Phase 1 PIA document is essential for this project, but can only be assessed after clearing of the site for development have started.
- Recommendations contained in this Desktop assessment must be included in the EMPr of the project for approval by AMAFA for inclusion in the EMPr of the project, before the final EIA application can be presented to the Competent Authority responsible to the ROD of this EIA process. If fossils are observed during construction the HIA specialist and Palaeontologist must be informed to take immediate and appropriate action to preserve a representative sample of the fossils.

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Legal Requirements

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999 (as amended 2014 and 2017) as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts on palaeontological heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 38 of the Heritage Resources Act, and which therefore fall under its protection, include:

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

Aims and Methodology

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

Following the "*SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports*" (amended 2017) the aims of the palaeontological impact assessment are:

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

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

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

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

Table 1 Palaeontological sensitivity analysis outcome classification

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

GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) compulsory.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of

	mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and "Chance Find Protocol" is compulsory. The Chance Find Protocol must be included in the EMPr for the project.
GREY	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 implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill

	outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and "Chance Find Protocol" document is compulsory. The Chance Find Protocol must be included in the EMPr of the project.

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

Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used, were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of

the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

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

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

Locality and Proposed Development

The Avondale Housing Development is planned on a property west of Ballito north of Durban and will mainly concentrate on the supply of housing in this newly developed area (Figure 1).

Figure 1 Locality of the Avondale Housing Development Scheme

GEOLOGY

The site of the development falls entirely on Quaternary aged red sand dunes of the Berea Formation, Maputuland Group (Figure 2).

Figure 2 Geology of the Study Site. The entire developement falls on the Berea Formation

Maputuland Group

The Maputuland Group forms a thin blanket of Tertiary and Cretaceous successions that extend from Durban northwards into Mozambique. The less detailed subdivision of Wolmarans and Du Preez (1986) are mapped on the scale of this project and is, for reasons of simplicity, preferred to the more detailed subdivision of Johnson et al (2009).

Berea Formation (Qb)

In the study area the Bluff Formation is overlain by the Berea Formation which consists of red, orange and yellow Aeolian sand, in the form of dune cordons along the coast of KwaZulu-Natal. The Berea Formation is interpreted as the weathering product of the Bluff Formation (Wolmarans and Du Preez, 1986).

In Durban these now form the Berea and Bluff Ridges. In most areas deep weathering of old dunes has produced dark red coloured sand called the Berea Red Sand (Groenewald, 2012).

PALAEONTOLOGY

Maputuland Group

Berea Formation (Qb)

Up to date, no significant vertebrate fossils have been recorded from the Berea Formation (Wolmarans and Du Preez, 1986). Petrified wood, mainly flattened *Syzigium* logs, have however been described from the Formation.

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the desktop investigation. The desktop investigation confirms that the study area is underlain by relatively deep (>2m) sandy soil associated with red sand dunes of the Berea Formation.

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

Due to the High likelihood of the discovery of significant plant fossils with flattened *Syziguim* logs in the red sands during clearing of the site for development, it is recommended that the High sensitivity for Palaeontological Heritage for the entire site is retained (Figure 3). The recommendation is that a suitably accredited Palaeontologist be appointed to do a Phase 1 PIA site

inspection after at least 1km^2 of indigenous and/or exotic vegetation has been removed. The Palaeontologist must record all exposed Syzigium fossil logs on site. A representative sample of the fossils must then be deposited at the appropriate Institution under permit from AMAFA.

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

Figure 3 A High Palaeontological sensitivity is retained for the entire development site of this Project.

CONCLUSION

The development site applicable to the application for the proposed development of the Avondale Housing Scheme in the KwaDukuza Local Municipality, iLembe District Municipality, KwaZulu-Natal Province, is underlain by Quaternary aged red sand of the Berea Formation, Maputuland Group.

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

It is recommended that:

- The EAP and ECO must be informed of the fact that a High Palaeontological Sensitivity is allocated to the entire study area. A Phase 1 PIA document is essential for this project, but can only be assessed after clearing of the site for development have started.
- Recommendations contained in this Desktop assessment must be included in the EMPr of the project for approval by AMAFA for inclusion in the EMPr of the project, before the final EIA application can be presented to the Competent Authority responsible to the ROD of this EIA process. If fossils are observed during construction the HIA specialist and Palaeontologist must be informed to take immediate and appropriate action to preserve a representative sample of the fossils.

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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.

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