

**HERITAGE SURVEY OF THE PROPOSED
NGWEGWENI ACCESS ROAD, NKANDLA WARD 4,
UTHUNGULU DISTRICT MUNICIPALITY, KWAZULU-
NATAL**

FOR GEOFF SILK CONSULTANCY

DATE: 21 JULY 2014

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TABLE OF CONTENT

INTRODUCTION	3
KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008	8
METHOD	10
Defining significance.....	11
RESULTS	13
DESKTOP STUDY	13
DESKTOP PALEONTOLOGICAL IMPACT ASSESSMENT	19
FIELD SURVEY.....	19
MANAGEMENT PLAN	24
CONCLUSION.....	24
APPENDIX A	25
PALAEONTOLOGICAL IMPACT ASSESSMENT – DESKTOP	25

TABLE OF FIGURES

FIG. 1 GENERAL LOCATION OF THE ROAD AND QUARRIES.....	4
FIG. 2: AERIAL OVERVIEW OF THE ROAD AND QUARRY 1	5
FIG. 3: AERIAL OVERVIEW OF QUARRY 2	6
FIG. 4: TOPOGRAPHICAL MAP OF THE ROAD AND QUARRIES	7
TABLE 1: LOCATION OF SETTLEMENTS NEAR THE ROAD AND QUARRY IN 1937	14
TABLE 2: LOCATION OF SETTLEMENTS IN 1965	14
FIG. 4: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA	15
FIG. 5a: STUDY AREA IN 1937	16
FIG. 5b: STUDY AREA IN 1937	17
FIG. 6: STUDY AREA IN 1968	18
FIG 7: VIEWS OF QUARRY 1.....	20
FIG 8: VIEWS OF QUARRY 2.....	21
FIG. 9: STONE CAIRNS AT QUARRY 2	22
FIG. 10: VIEWS OF THE EXISTING ROAD	23
FIG. 11: SITE 'B2' NEAR THE ROAD	24

INTRODUCTION

The proposed Ngwegweni Access Road occurs ~5km north of Nkandla, Ward 4, Uthungulu District Municipality, Kwazulu-Natal. The project involves the upgrade of approximately 4.3kms of existing community graded roads including the installation of several 600mm diameter culverts with inlet and outlet headwalls of brick construction and storm water discharge side drains. The construction of a single culvert to provide a river/stream crossing is also required.

The current road varies in width but is between 3m and 7m in width. Some parts of the road have cuttings into embankments, or form an embankment.

Two quarries will be used for the road construction. Both quarries were previously used.

The road occurs next to existing properties that are mostly fenced off.

Figures 1 – 4 shows the locations of the road and quarries.

FIG. 1 GENERAL LOCATION OF THE ROAD AND QUARRIES

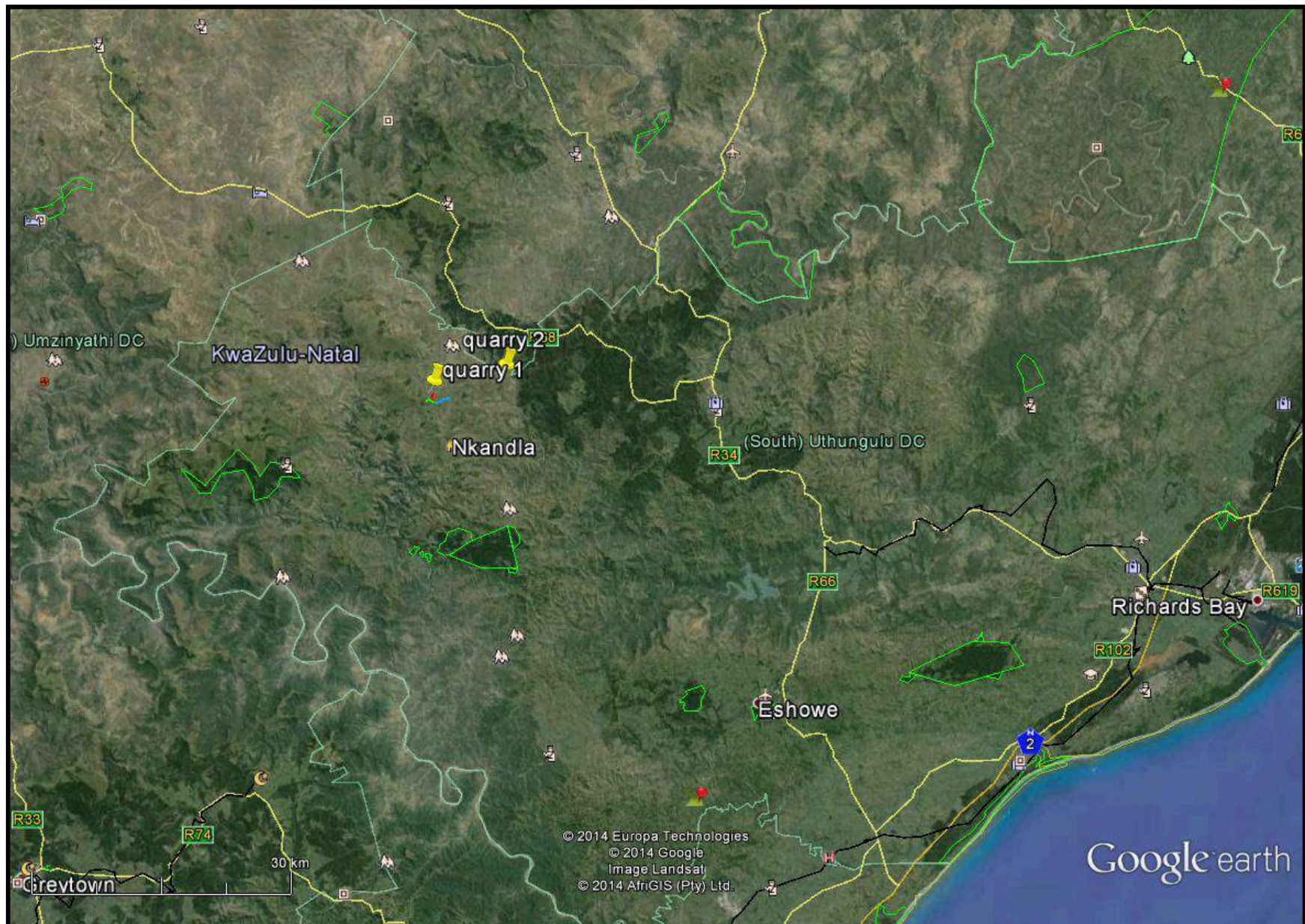


FIG. 2: AERIAL OVERVIEW OF THE ROAD AND QUARRY 1

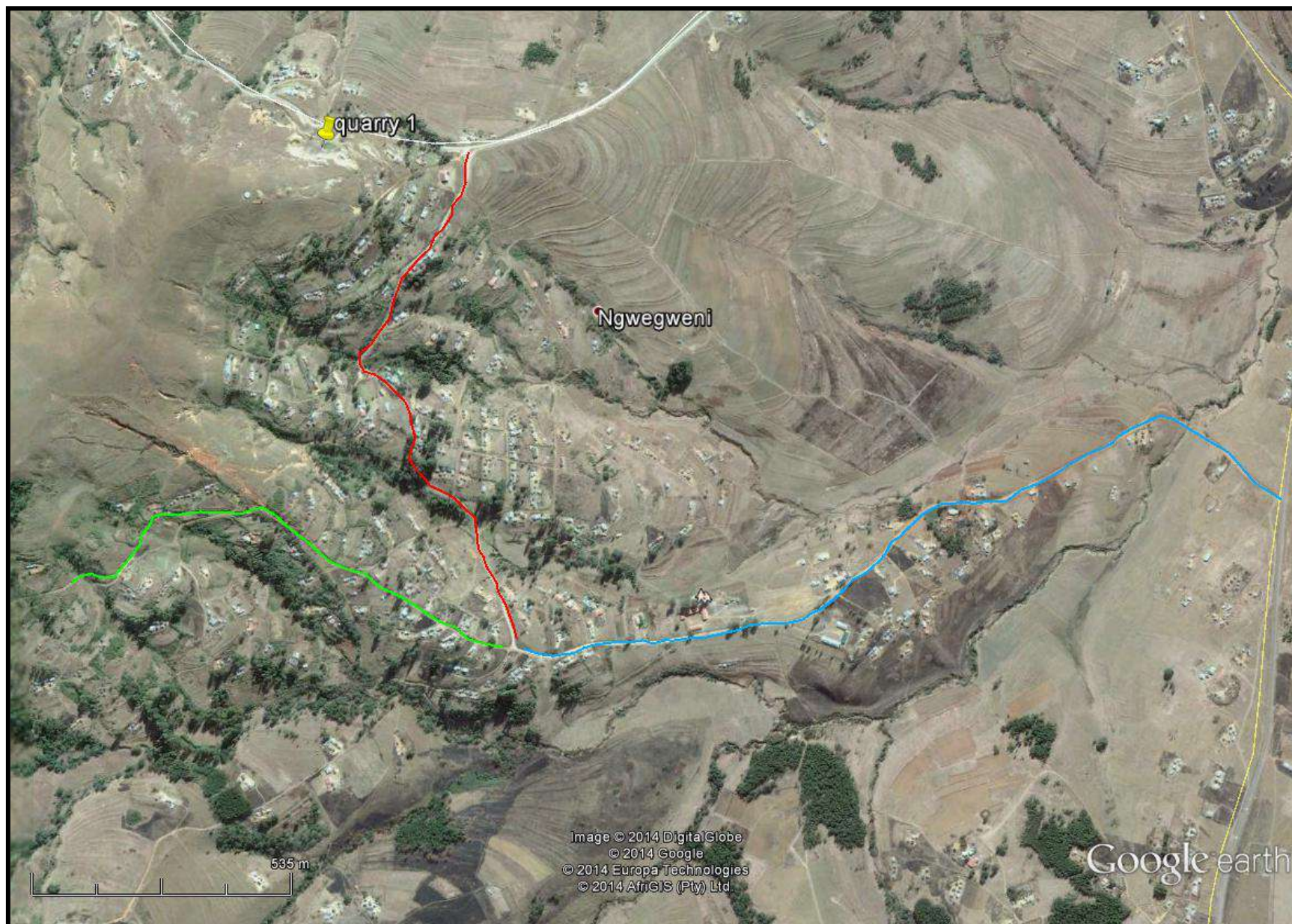
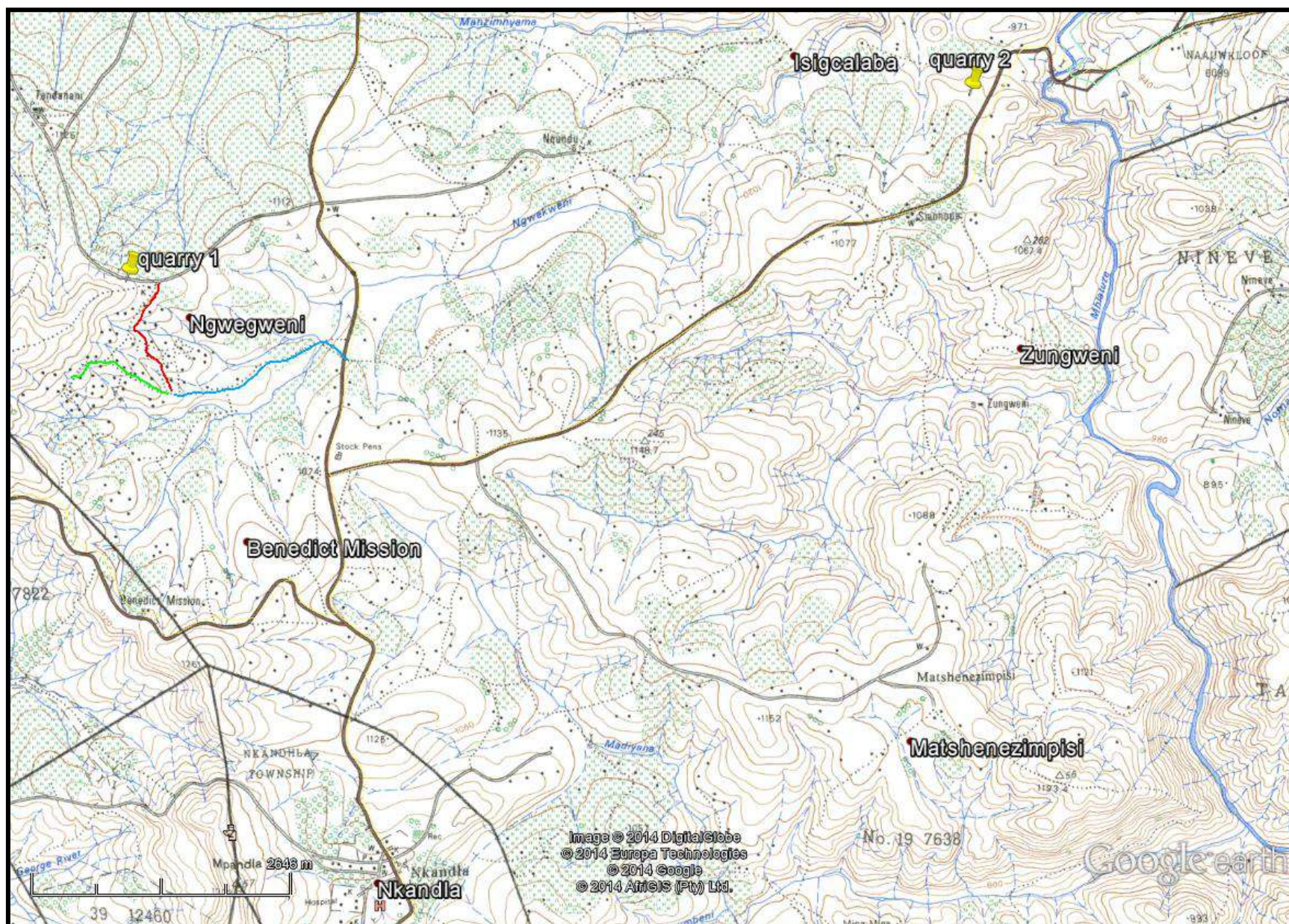


FIG. 3: AERIAL OVERVIEW OF QUARRY 2



FIG. 4: TOPOGRAPHICAL MAP OF THE ROAD AND QUARRIES



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.

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. The archaeological database indicates that there are archaeological sites in the general area (fig. 4). These sites include all types of Stone Age and Iron Age sites. No sites occur in the study area.

No national monuments, battlefields, or historical cemeteries are known to occur in the study area. There are several recorded heritage sites outside of the study area. These date to the late Iron Age, Historical Period, and the Anglo-Zulu War.

The 1937 aerial photographs indicate that the area was settled in 1937. Several settlements occur near the road and/or quarry; however, none occurs in the project footprint. The locations of these settlements are given in Table 1. There location should be noted as areas of sensitivity that could yield human remains. A 50m sensitivity area should be placed around each central point.

TABLE 1: LOCATION OF SETTLEMENTS NEAR THE ROAD AND QUARRY IN 1937

NAME	LATITUDE	LONGITUDE
a1	-28.578920586	31.076470825
a2	-28.579681989	31.070849259
a3	-28.579775744	31.070103444
a4	-28.579415227	31.069629225
a5	-28.577913189	31.065381232
a6	-28.577124407	31.063936923
a7	-28.576130879	31.067094514

The 1965 1:50 000 topographical map shows fewer settlements occurring near the project. Only site 'a1' still occurs, now called 'b'1. The location of these settlements is given in Table 2.

TABLE 2: LOCATION OF SETTLEMENTS IN 1965

NAME	LATITUDE	LONGITUDE
b1	-28.578863450	31.076592873
b2	-28.577374612	31.085467132
b3	-28.577113306	31.064217575

By 2014, all of these settlements have been cleared and/or built over

FIG. 4: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA

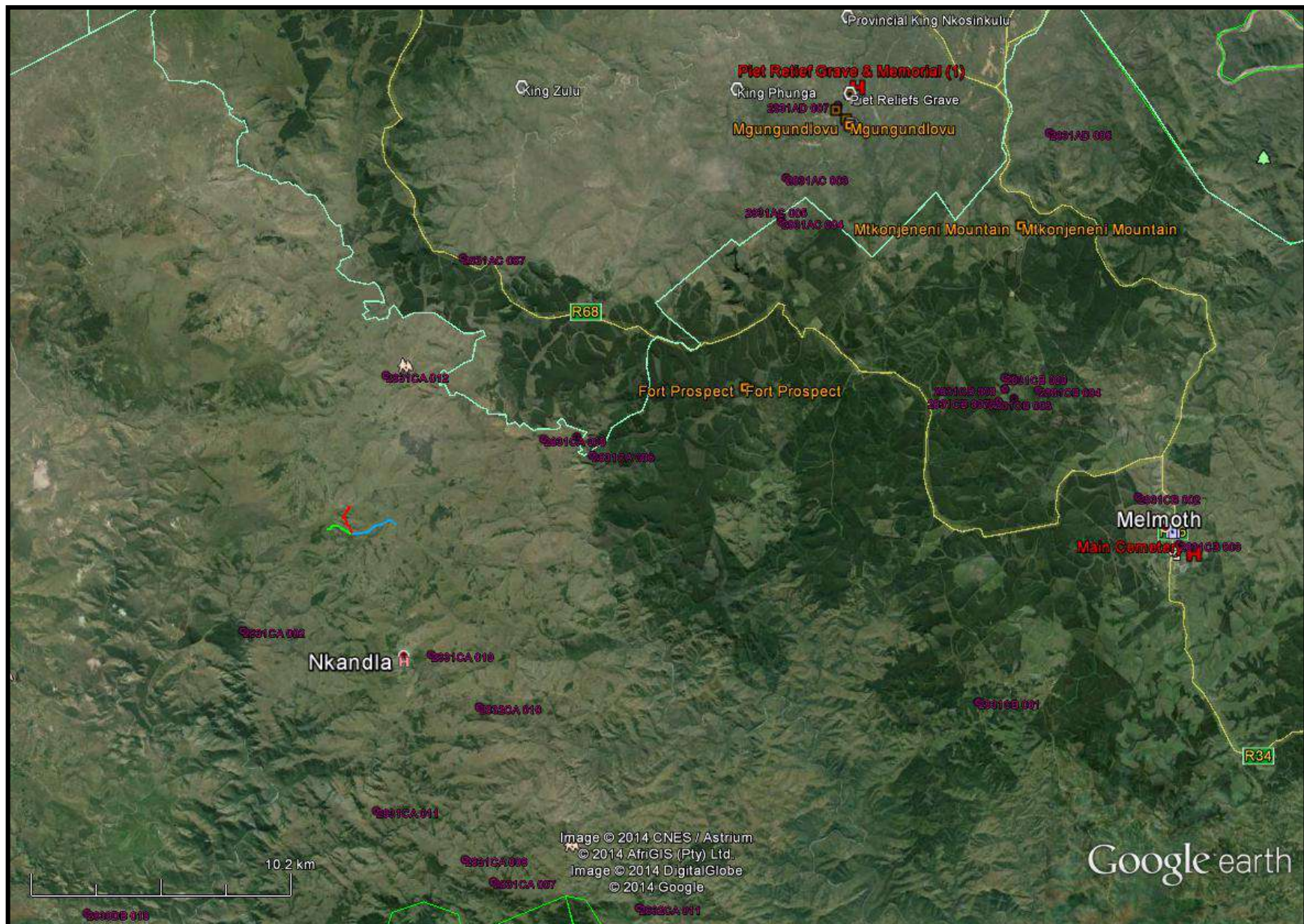


FIG. 5a: STUDY AREA IN 1937

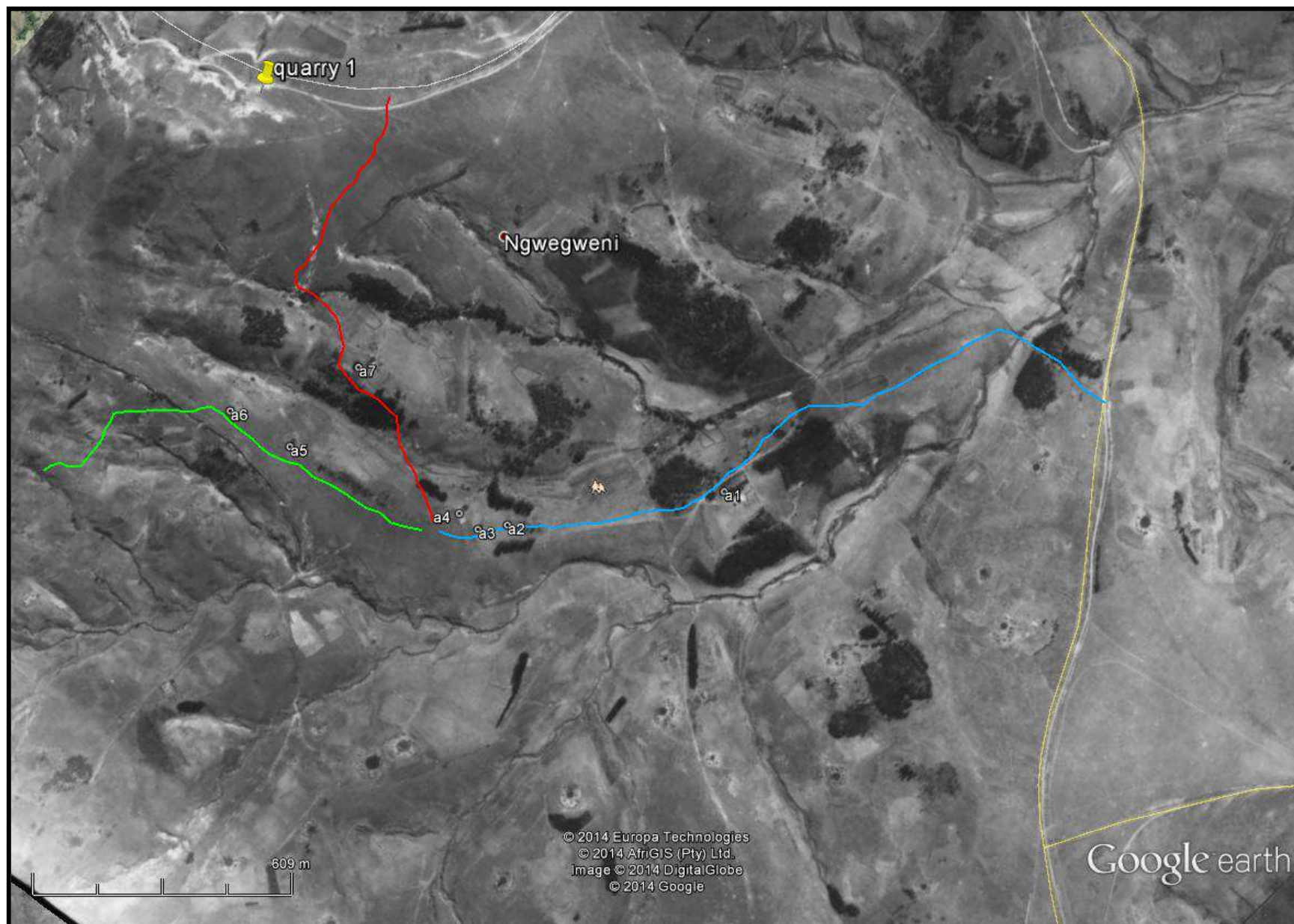
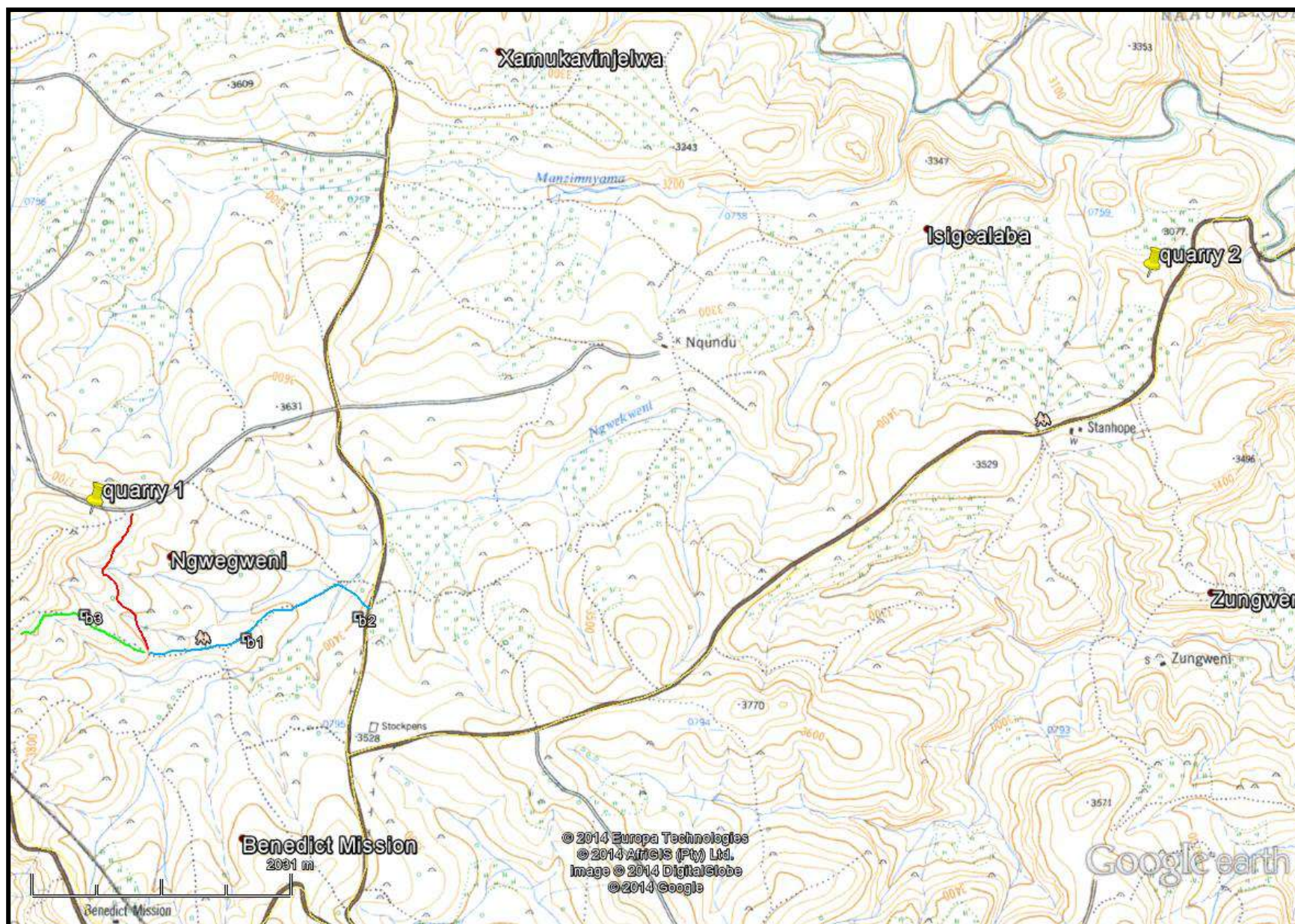


FIG. 5b: STUDY AREA IN 1937



FIG. 6: STUDY AREA IN 1968



DESKTOP PALEONTOLOGICAL IMPACT ASSESSMENT

The desktop PIA is given in Appendix A. Groenewald states:

“All sections of the road upgrade route and in the burrow pit underlain by Dwyka Tillite, where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by a Professional Palaeontologist and fossils collected according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment.”

Thus Quarry 1 will require a Phase 1 PIA if it disturbs any geological layers below the Dwyka Tillite. It is unlikely that the road will affect bedrock.

FIELD SURVEY

Both quarries are located at existing quarries. Quarry 1 occurs at the base of a hill that is being used as a water reservoir. The hill has thus been severely affected by various activities (fig. 7). No heritage sites were noted on this hill.

Quarry 2 is less disturbed by construction activity (fig. 8). On top of the hill are three stone cairns (fig. 9). These are too big to be graves, and do not have any headstones.

No heritage sites were observed along the road route. Figure 10 shows some of the route. The only site noted from the desktop is ‘b2’ (fig. 11). There are the foundations of a settlement at ‘b2’; however, it is at least 50m from the road and will thus not be affected.

FIG 7: VIEWS OF QUARRY 1



FIG 8: VIEWS OF QUARRY 2



FIG. 9: STONE CAIRNS AT QUARRY 2



FIG. 10: VIEWS OF THE EXISTING ROAD



FIG. 11: SITE 'B2' NEAR THE ROAD

MANAGEMENT PLAN

A qualified palaeontologist will need to undertake a field survey if Quarry 1 will remove material below the Dwyka Tillite layers, and if any part of the project exposes fresh bedrock. This can be confirmed with the geotechnical report.

CONCLUSION

A heritage survey was undertaken for the proposed Ngwegweni Access Road ~5km north of Nkandla. No heritage sites were observed along the route or the two quarries. Quarry 1 is of medium palaeontological significance and will require further assessment if the quarry disturbs layers below the Dwyka Formation.

No further mitigation is required.

APPENDIX A
PALAEONTOLOGICAL IMPACT ASSESSMENT – DESKTOP

**DESKTOP PALAEOLOGICAL
ASSESSMENT FOR THE PROPOSED
UPGRADE OF THE NGWEGWENI ACCESS
ROADS AND ASSOCIATED BURROW
PITS, NKANDLA LOCAL MUNICIPALITY,
KWAZULU-NATAL PROVINCE.**

**FOR
Umlando**

DATE: 21 JULY 2014

**By
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EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed upgrading of the Ngwegweni access roads, with associated burrow pits, in the Nkandla Local Municipality, KwaZulu-Natal Province. The upgrading of the roads most probably does not imply deep excavation whereas the excavation at the burrow pits will imply deep excavation.

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 routes and one of the burrow pits of the proposed upgrade of the Ngwegweni roads is underlain by Carboniferous to Permian aged tillites, diamictites and shale of the Dwyka Formation and the second burrow pit is underlain by Swazian aged basaltic and metamorphic rocks of the Hlathini Formation. Numerous fossils have been described from the Dwyka Formation whereas no fossils are expected in the Hlathini Formation. A Moderate Palaeontological sensitivity is allocated to areas underlain by the Dwyka Formation on the assumption that fresh outcrops are available, or that excavation activity will expose fresh bedrock. A Low Palaeontological sensitivity is allocated to the burrow pit on the Hlathini Formation.

The recording of significant fossils will most likely be restricted to exposure of fresh bedrock. Excavation for the upgrading of the roads will generally be restricted to a depth of 2m whereas deep excavation is foreseen at the burrow pit.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that fossils have been described from the Dwyka Formation that underlies the routes of the road and one of the Burrow Pits.
2. All sections of the road upgrade route and in the burrow pit underlain by Dwyka Tillite, where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by a Professional

Palaeontologist and fossils collected according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment.

TABLE OF CONTENT

EXECUTIVE SUMMARY	27
TABLE OF CONTENT	29
INTRODUCTION	30
SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999	30
METHODOLOGY	31
GEOLOGY	33
Nsuze Group	34
Hlathini Formation (Zh)	33
Dwyka Formation (C-Pd)	34
PALAEONTOLOGY	35
Hlathini Formation (Zh)	35
Dwyka Formation (C-Pd)	35
DISCUSSION	35
MANAGEMENT PLAN	36
CONCLUSION AND RECOMMENDATIONS	38
REFERENCES	39
QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	40
DECLARATION OF INDEPENDENCE	40

TABLE OF FIGURES

Figure 1 Locality of Ngwegweni routes and burrow pits	30
Figure 2 Geology of the study area	34
Figure 3 Palaeontological Sensitivity of the Ngwegweni road development	37

LIST OF TABLES

Table 1	Palaeontological sensitivity analysis outcome classification	32
Table 2	Palaeontological Sensitivity of geological units on site	36

INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed upgrading of the Ngwegweni access roads, with associated burrow pits, in the Nkandla Local Municipality, KwaZulu-Natal (Figure 1). The upgrading of the roads most probably does not imply deep excavation whereas the excavation at the burrow pits will imply deep excavation.



Figure 1 Locality of Ngwegweni routes and burrow pits

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 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;
- 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 Swazian aged rocks of the Nsuze Group, Pongola Supergroup and Carboniferous to Permian aged rocks of the Dwyka Formation, Karoo Supergroup (Figure 2).

Nsuze Group

Hlathini Formation (Zh)

The Hlathini Formation is a Swazian Aged sequence of basaltic lava, phyllite and quartzite that underlies the Karoo Supergroup in this part of KwaZulu-Natal.

Dwyka Formation (C-Pd)

05/08/2014

PALAEONTOLOGY

Hlathini Formation (Zh)

Due to the basaltic and metamorphic nature of the Hlathini Formation, it will not contain fossils.

Dwyka Formation (C-Pd)

Trace fossils have been recorded from the fine-grained shales of the Dwyka Group in KwaZulu-Natal (Linstrom, 1987; MacRae, 1999). All of the following could potentially be found in KwaZulu-Natal. Trackways, produced mostly by fish and arthropods (invertebrates), have been recovered in shales from the uppermost Dwyka Formation. Other trace fossils include coprolites (fossilized faeces) of chondrichthyans (sharks, skates and rays).

Body fossils include aranaceous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges), primitive starfish, orthoceroid nautiloids (marine invertebrates similar to the living *Nautilus*), goniatite cephalopods (*Eoasinites* sp.), gastropods (marine snails such as *Peruvispira viperdorfensis*), bivalves (*Nuculopsis* sp., *Phestia* sp., *Aphanaia haibensis*, *Eurydesma mytiloides*), brachiopods (*Attenuatella* sp.) and palaeoniscoid fish such as *Namaichthys schroederi* and *Watsonichthys lotzi*.

Fossil plants have also been found, including lycopods (*Leptophloem australe*), moss, leaves and stems (possibly belonging to a proto-glossopterid flora). Fossil spores and pollens (such as moss, fern and horsetail spores and primitive gymnosperm pollens) as well as fossilized wood probably belonging to primitive gymnosperms have also been recorded from Dwyka deposits (MacRae, 1999; McCarthy and Rubidge, 2005; Groenewald, 2012).

DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews.

A variety of fossils have been described from the Carboniferous to Permian aged Dwyka Formation and includes trace fossils and fossils of invertebrates and plants. The fossils are normally associated with fresh bedrock exposures where

topsoil has been removed by erosion or during excavation into the bedrock. In the case of this development deep excavation will generally be restricted to localised excavation along the road upgrades as well as in the burrow pit that is situated on the Dwyka Formation and due to the generally deep weathering in this region, a Moderate Palaeontological sensitivity is allocated to these areas. No fossils are expected in the burrow pit that is situated on the Hlathini Formation and a Low Palaeontological sensitivity is allocated to this site. The palaeontological sensitivity is summarised in Table 2.

Table 2 Palaeontological Sensitivity of geological units on site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Hlathini Formation	Basaltic lava, phyllite, quartzite SWAZIAN	None	None	Low sensitivity
Dwyka Formation	Diamictite and Tillite CARBONIFEROUS/ PERMIAN	Trace fossils and coprolites of chondrichthyans. Foraminifera, radiolarians, bryozoans, sponge spicules, primitive starfish, orthoceroid nautiloids, goniatite cephalopods, gastropods, bivalves, brachiopods, palaeoniscoid fish. Plant fossils, including lycopods, moss, leaves and stems of <i>Glossopteris</i> flora, spores and pollens	None	Moderate 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 relatively rich fossil heritage of the Dwyka Formation (Table 2) will however only be exposed in fresh bedrock and it will be difficult to identify the described fossils in deeply weathered rock, as is expected in this part of KwaZulu-Natal. For the sake of this desktop survey it is assumed that excavation of up to 2m depth will in fact expose fresh bedrock. In areas underlain by rocks of the Dwyka Formation and specifically where excavation will potentially expose fresh bedrock, a Moderate Palaeontological sensitivity is allocated to the road upgrade routes and the burrow pit. The burrow pit that falls on the Hlathini Formation will have a Low Palaeontological sensitivity.

The palaeontological sensitivity of the study area is shown in Figure 3.

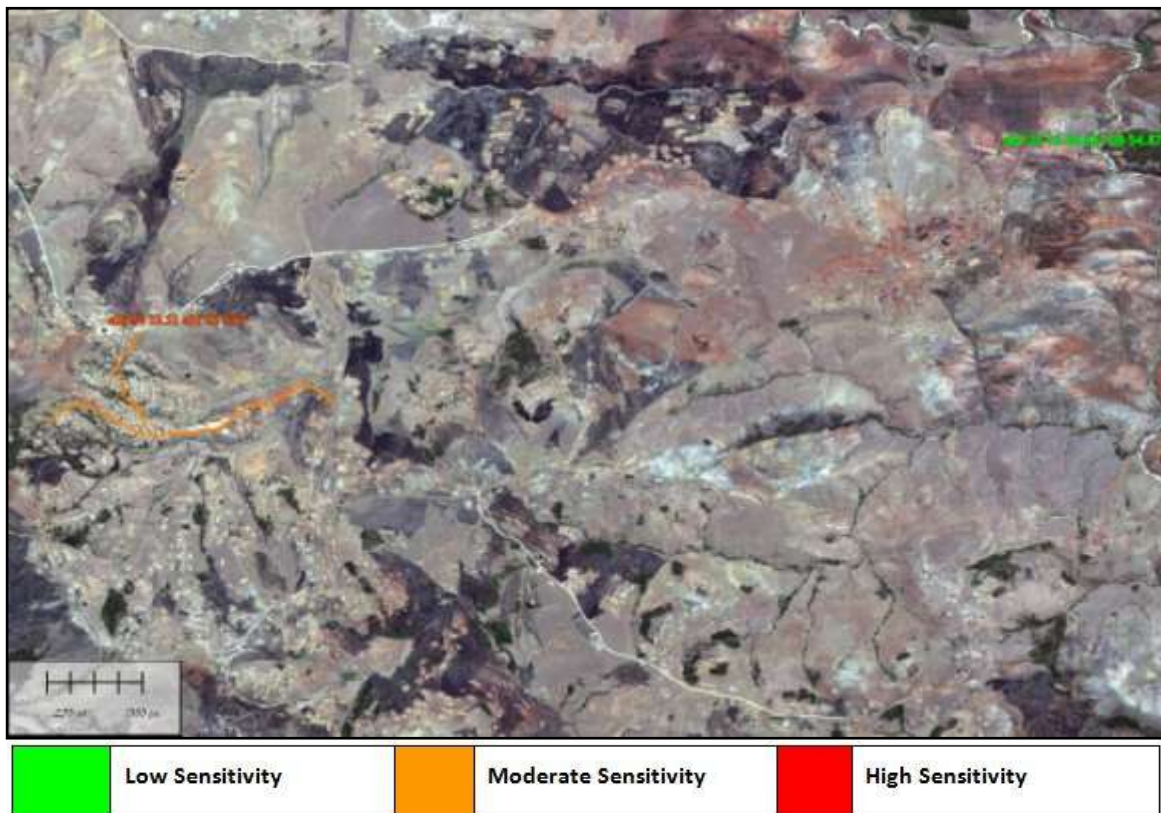


Figure 3 Palaeontological Sensitivity of the Ngwegweni road development

CONCLUSION AND RECOMMENDATIONS

The routes and one of the burrow pits of the proposed upgrade of the Ngwegweni roads is underlain by Carboniferous to Permian aged tillites, diamictites and shale of the Dwyka Formation and the second burrow pit is underlain by Swazian aged basaltic and metamorphic rocks of the Hlathini Formation. Numerous fossils have been described from the Dwyka Formation whereas no fossils are expected in the Hlathini Formation. A Moderate Palaeontological sensitivity is allocated to areas underlain by the Dwyka Formation on the assumption that fresh outcrops are available, or that excavation activity will expose fresh bedrock. A Low Palaeontological sensitivity is allocated to the burrow pit on the Hlathini Formation.

The recording of significant fossils will most likely be restricted to exposure of fresh bedrock. Excavation for the upgrading of the roads will generally be restricted to a depth of 2m whereas deep excavation is foreseen at the burrow pit.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that fossils have been described from the Dwyka Formation that underlies the routes of the road and one of the Burrow Pits.

2. All sections of the road upgrade route and in the burrow pit underlain by Dwyka Tillite, where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by a Professional Palaeontologist and fossils collected according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment.

REFERENCES

Groenewald GH. 2012. Palaeontological Technical Report for KwaZulu-Natal. Internal report – AMAFA.

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

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

MacRae C. 1999. Life Etched in Stone. GSSA Publication.

McCarthy T and Rubidge B. 2005. The Story of Earth and Life. Struik Publishers.

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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