

**HIA STUDY OF THE PROPOSED CONSTRUCTION
OF OFFTAKE 8B POTABLE WATER PIPELINE AS
PART OF THE LOWER THUKELA BULK WATER
SUPPLY, DARNALL, ILEMBE DISTRICT
MUNICIPALITY, KZN**

FOR TRIPLO4 SUSTAINABLE SOLUTIONS

DATE: 22 JANUARY 2015

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INTRODUCTION

“The proposed construction for Off Take 8D forms part of the Lower Thukela Bulk Water Supply Scheme, project initiated by iLembe District Municipality and co-funded by the Department of Water Affairs & Sanitation. The construction of Off Take 8D is part of the sections of the potable water pipeline that forms part of the broader Bulk Water Supply Scheme in the lower Thukela Region. The proposed pipeline is approximately 5.35 km in length with an outside diameter of approximately 300mm to 600 mm. The proposed Off Take 8D bulk water pipeline project makes provision for Bulk Supply of Potable water to the Lower Thukela Region.

The site is situated approx. 35km north of Ballito and approx. 2.5km north east of Glenhills in Stanger in Northern KwaZulu-Natal. The proposed development falls within the KwaDukuza Local Municipality and iLembe District Municipality” (Triplo4 BID, 2014).

Figures 1 – 3 show the location of the pipeline.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

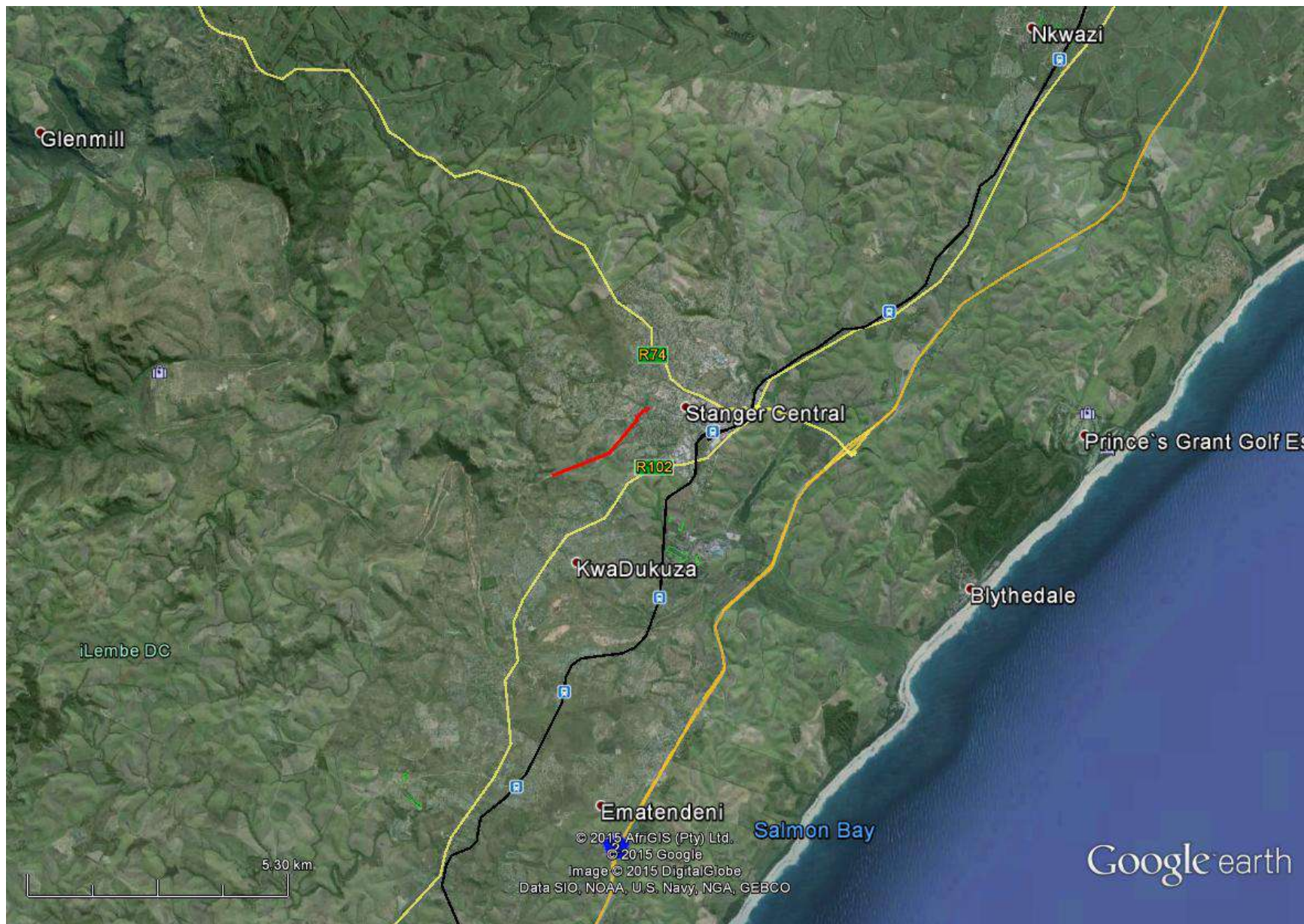


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA

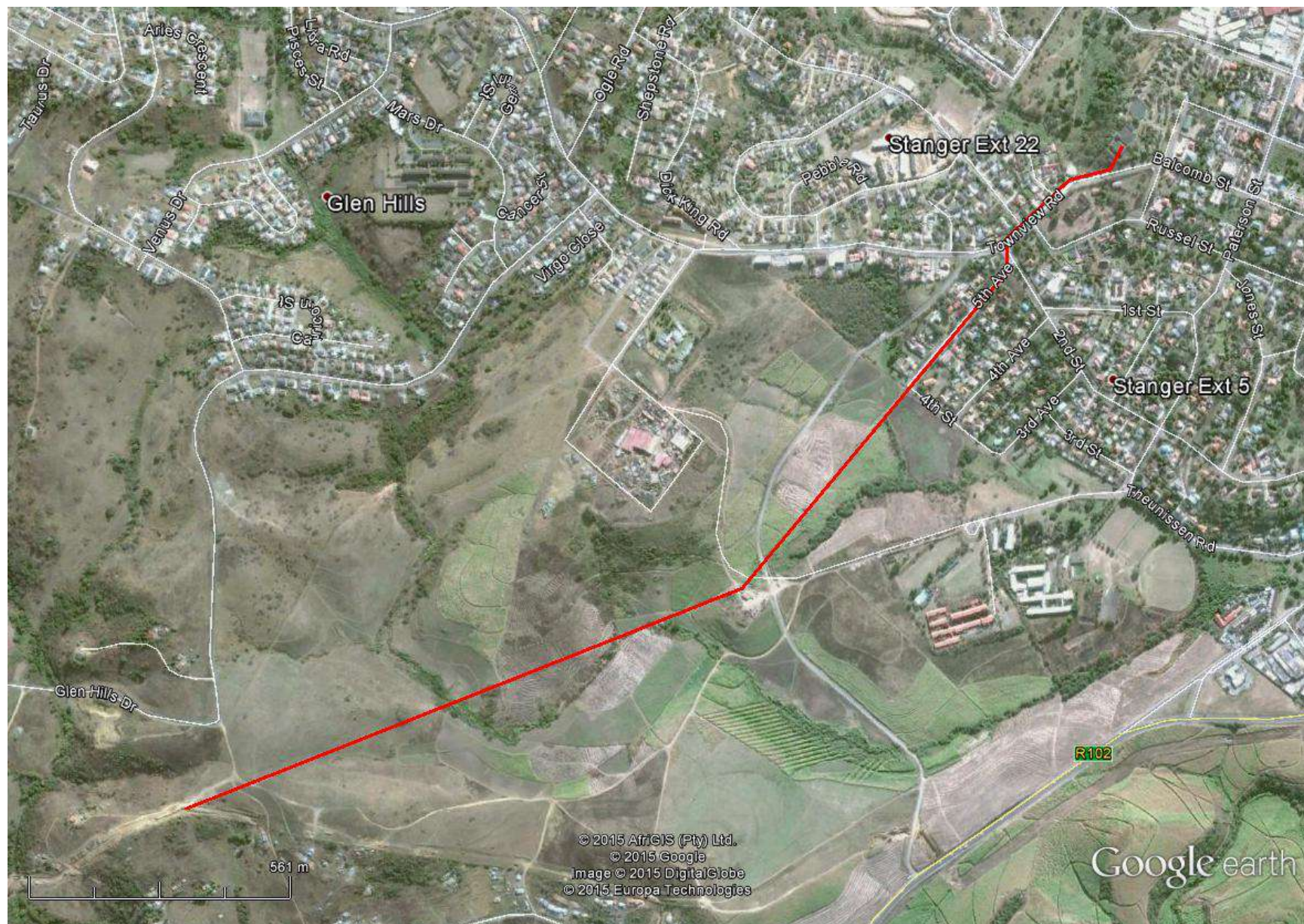
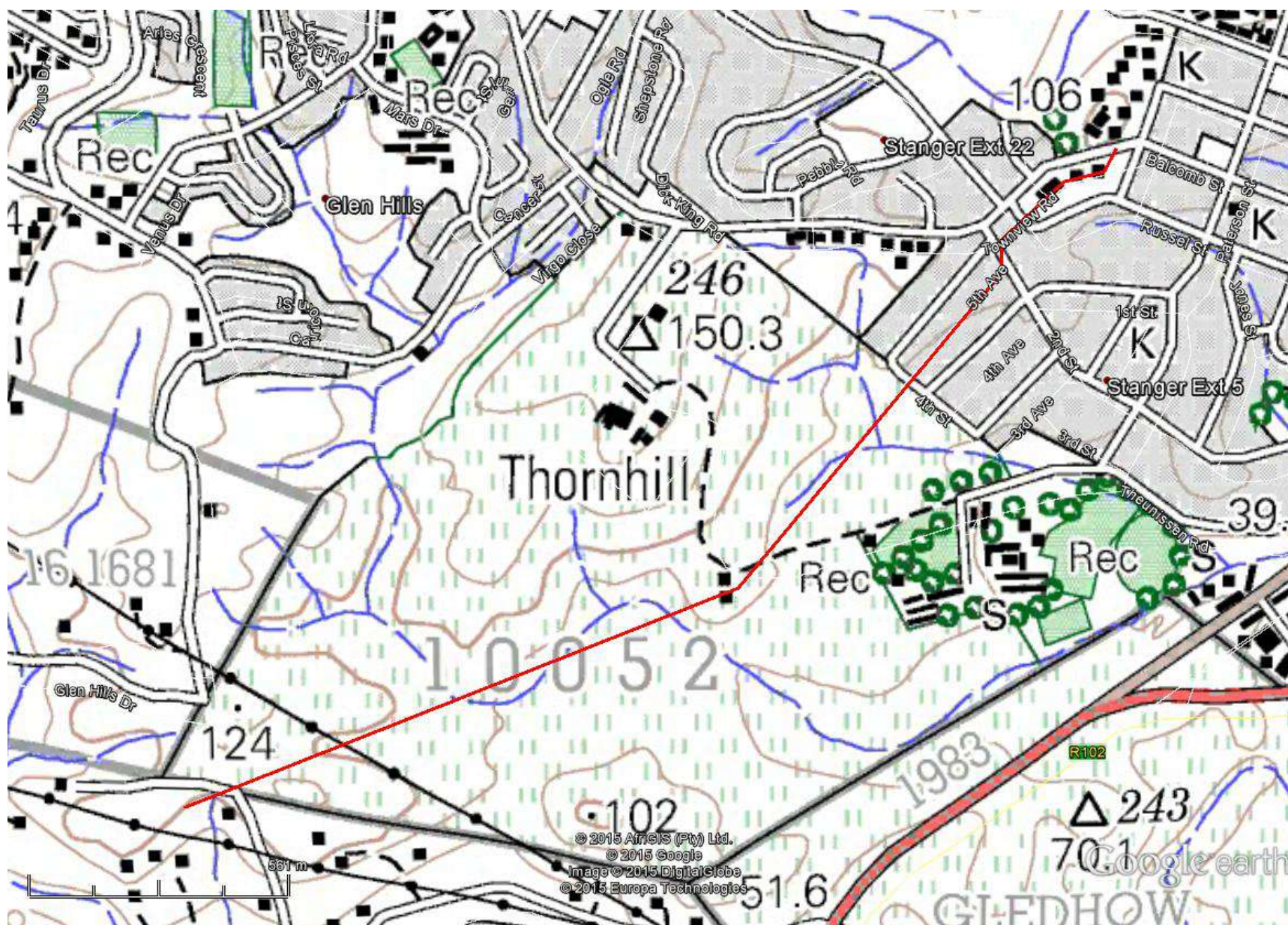


FIG. 3: TOPOGRAPHICAL MAP OF THE STUDY AREA



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. 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. I would expect a Late Iron Age site to occur all of the hills along the line route, especially the reservoir. No national monuments, battlefields, or historical cemeteries are known to occur in the study area. There are several cemeteries outside of the study area.

The 1937 aerial photographs indicate that there are five areas that have heritage sites within 50m of the servitude (fig. 5). All of these are settlements that would have human graves. The settlements are in a traditional Zulu settlement pattern, and thus graves are expected.

The 1968 topographical map indicates that only one site occurs near line. The site is a 'compound' and predates 1968 (fig. 6). This is on the border of the 60 years heritage rule for built structures, and would require further assessment if it was to be effected.

The recent aerial imagery suggests that most of the sites have been built over or damaged by as previous pipeline. Table 1 summarises the locations of the sites.

TABLE 1: LOCATION OF DESKTOP HERITAGE SITES

NAME	LATITUDE	LONGITUDE	DESCRIPTION
b1	-29.347317313	31.272934919	compound
a1	-29.351265375	31.260263604	settlement
a2	-29.351431709	31.258928894	settlement
a3	-29.351828659	31.260492209	settlement
a4	-29.352010246	31.259873758	settlement
a5	-29.342556735	31.276638258	feature

PALAEONTOLOGICAL DESKTOP IMPACT ASSESSMENT

The footprint of the proposed construction of the Off take 8b near Thornhill, Kwadukuza Local Municipality, Ilembe District Municipality, Kwazulu-Natal Province is underlain by Carboniferous to Permian aged tillite of the Dwyka Formation. Significant trace fossils have been described from the Dwyka Formation. It is expected that most of the study area will be underlain by deep soils or weathered rock and a Moderate Palaeontological sensitivity is allocated to the entire length of this development where significant trace fossils can be present in rocks exposed during excavation of trenches deeper than 1,5m.

In all areas where the Dwyka Formation is exposed or likely to be exposed during excavation (trenching of deeper than 1,5m), the ECO must report the presence of fossils and a professional palaeontologist must be appointed for appropriate action.

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



FIG. 6: STUDY AREA IN 1937

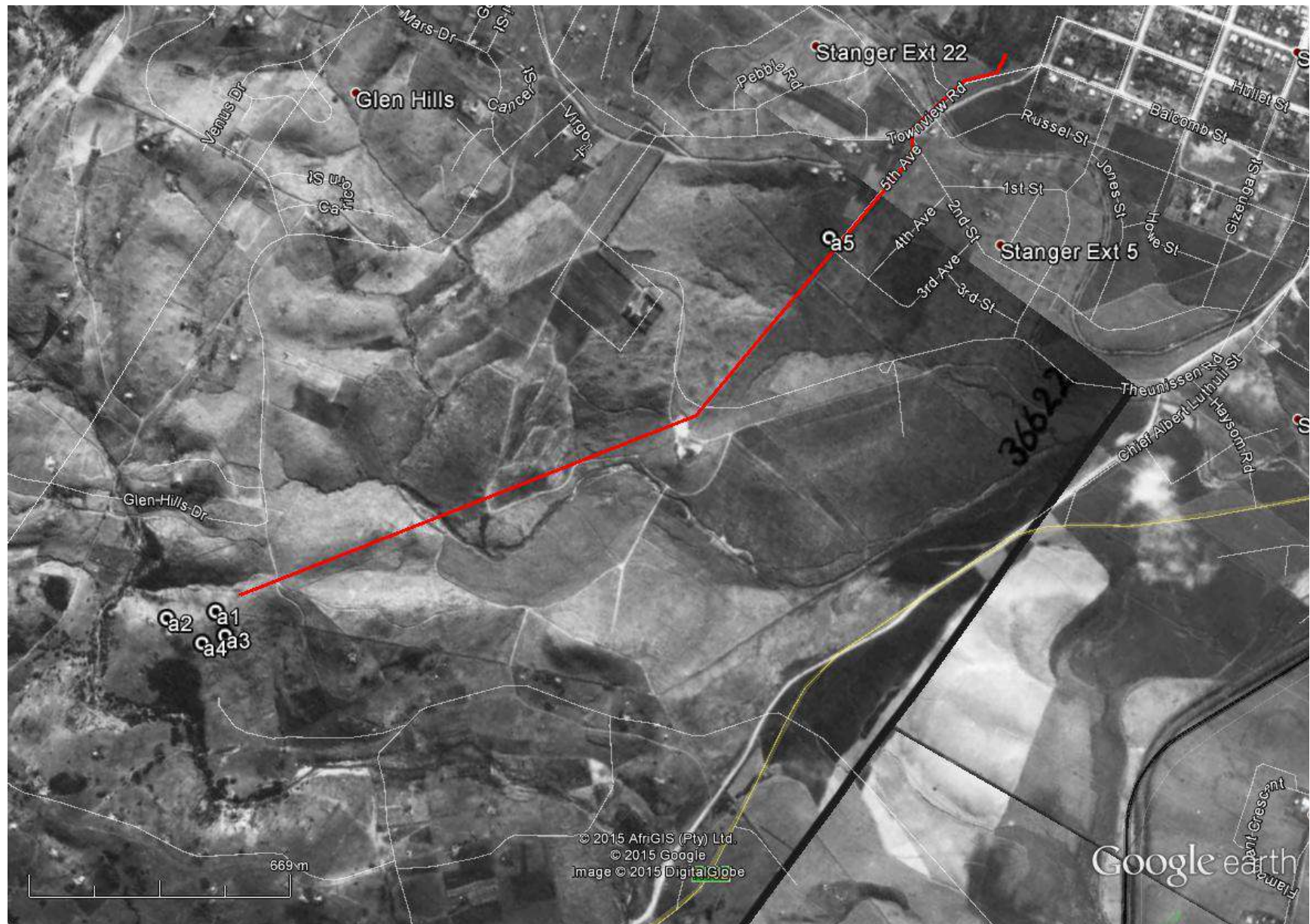
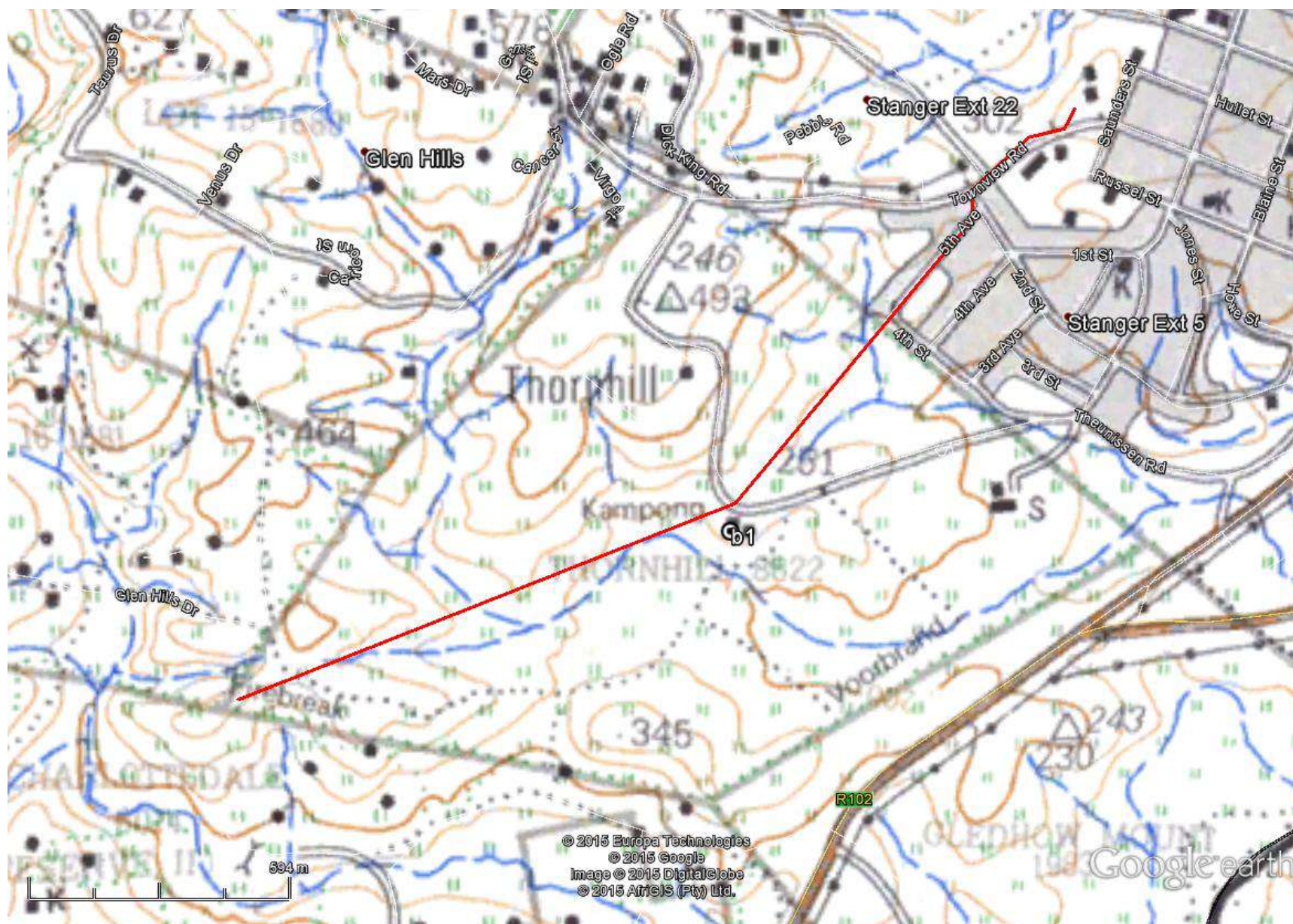


FIG. 7: STUDY AREA IN 1968



FIELD SURVEY

The field survey followed the line route. Most of the pipeline occurs just outside of the road reserve, and thus the main part of the pipeline is in already disturbed areas. Many of the sites noted in the desktop study no longer exist. This is due to road works, sugar cane farming and housing that are more recent. The sites from 1937 and 1968 would have occurred on or near the surface of the land when it was converted to sugar cane farming. Thus, ploughing activity would destroy these sites as opposed to the older sites that occur deeper below the soil.

All sites recorded at the desktop level should be treated as sensitive areas with the possibility of human remains occurring. If any human remains are uncovered during construction, then this will need to be reported to Amafa KZN, SAPS, and the ECO. Sites that are not mentioned in the Field Survey section have been destroyed/damaged.

Fig. 8 shows the general views of the pipeline route.

The site 'b1' ('compound') noted on the 1968 map will be slightly effected by the pipeline footprint (fig. 9). There is a possibility of recent historical (1940s – 1960s) middens in this area and the buildings might be older than 60 years. The pipeline should be moved slightly to the north to avoid possible disturbances to these sites. If the pipeline is not moved and the builds are to be effected, then the buildings could require further investigation. Fig. 10 shows a suggested route alternative.

FIG. 8: VIEWS ALONG THE PIPELINE

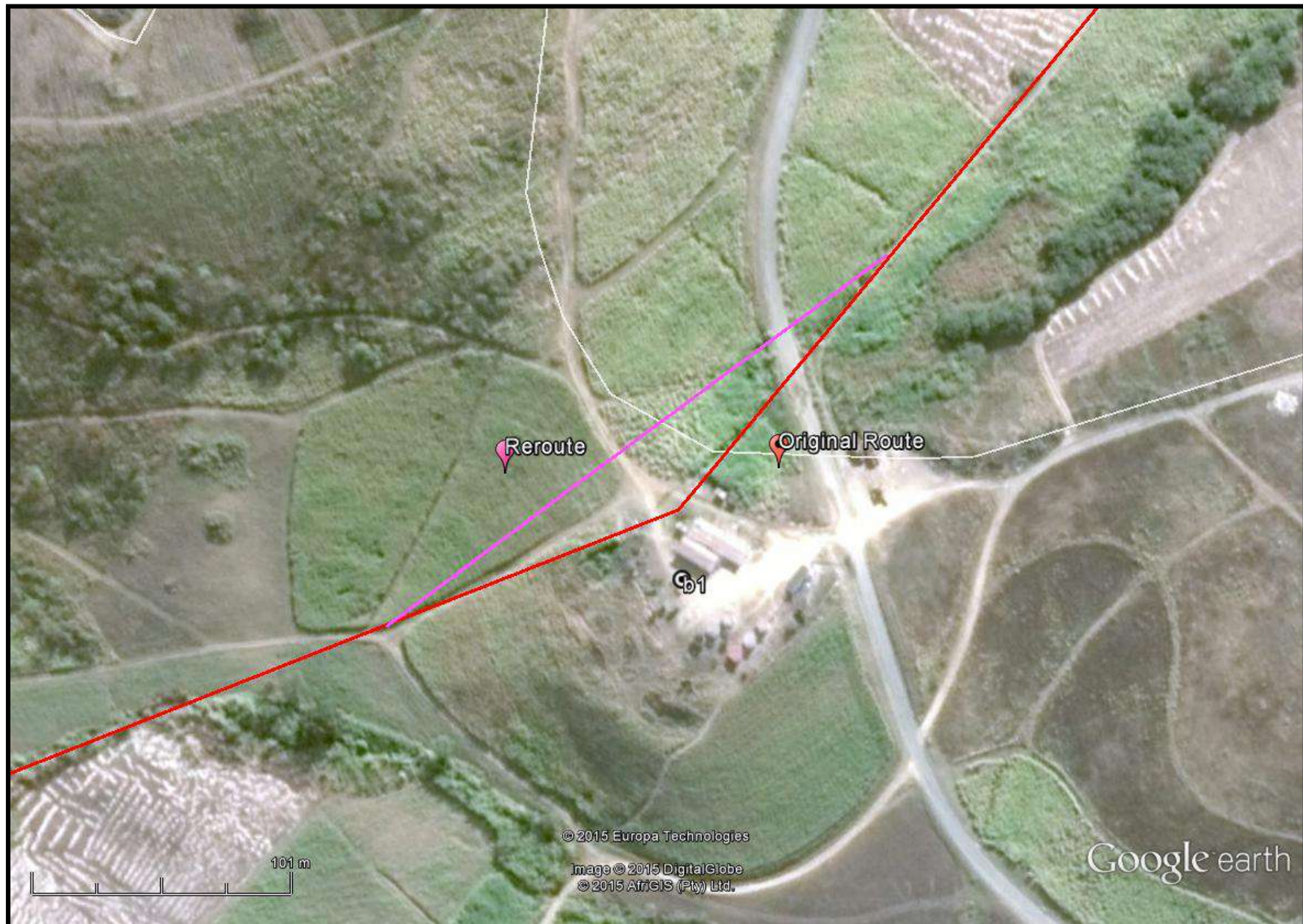


FIG. 9: ORIGINAL COMPOUND A 'B'12'¹



¹ Arrow indicates proposed line route

FIG. 10: PROPOSED REROUTING OF THE LINE



MANAGEMENT PLAN

Only one site might be effected by the current pipeline. The pipeline should be slightly rerouted to avoid possible heritage sites and damage to the buildings. A buffer of 20m should suffice between the buildings and the pipeline footprint. If the buildings are damaged or historical middens are exposed, then the construction will need to stop and an assessment made.

If the trenches are deeper than 1.5m they will likely expose palaeontological layers. A palaeontologist will be required to assess these layers.

CONCLUSION

A desktop and field heritage survey was undertaken for the Off take 8b pipeline. Several historical heritage sites were noted to have occurred near and within the proposed pipeline footprint. The area should be noted as being sensitive for possible human remains.

The field survey determined that most of these historical sites do not exist, with the exception of one building, or old compound. I suggested the line is moved slightly to the north, so that the building and/or historical middens are not exposed.

If the trenches are deeper than 1.5m, then a palaeontologist might be required to assess the exposed unweathered bedrock.

APPENDIX A
PIA DESKTOP

DESKTOP PALAEOLOGICAL ASSESSMENT FOR THE PROPOSED OFFTAKE 8b AND 8c, KWADUKUZA LOCAL MUNICIPALITY, ILEMBE DISTRICT MUNICIPALITY, KWAZULU-NATAL PROVINCE.

**FOR
Umlando**

DATE: 8 February 2015

By

**Gideon Groenewald
Cell: 082 339 9202**

EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of the Off take 8b and 8c projects near Stanger, 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 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 study area is underlain by Ordovician to Silurian aged rocks of the Natal Group and Carboniferous to Permian aged rocks of the Dwyka Formation of the Karoo Supergroup, Jurassic aged dolerite and Quaternary aged alluvium.

Off take 8b:

The footprint of the proposed construction of the Off take 8b near Thornhill, Kwadukuza Local Municipality, Ilembe District Municipality, Kwazulu-Natal Province is underlain by Carboniferous to Permian aged tillite of the Dwyka Formation. Significant trace fossils have been described from the Dwyka Formation. It is expected that most of the study area will be underlain by deep soils or weathered rock and a Moderate Palaeontological sensitivity is allocated to the entire length of this development where significant trace fossils can be present in rocks exposed during excavation of trenches deeper than 1,5m.

Off take 8c:

The footprint of the proposed construction of the Off take 8c near Thornhill, Kwadukuza Local Municipality, Ilembe District Municipality, Kwazulu-Natal Province is underlain by quartzite of the Natal Group and dolerite. No fossils have, to date, been recorded from the Natal Group sediments and no significant fossil finds are expected. Dolerite will not contain fossils. A Low Palaeontological sensitivity is allocated to areas underlain by sediments of the Natal Group and dolerite.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that significant trace fossils have been described from the Dwyka Formations that underlies Off take 8b development site.
2. All sections of the development where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by the ECO and if fossils are recorded, a professional Palaeontologist must be appointed to record and collect the fossils according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment.
3. *Specific recommendations for each offtake:*

3.1 Off take 8b

In all areas where the Dwyka Formation is exposed or likely to be exposed during excavation (trenching of deeper than 1,5m), the ECO must report the presence of fossils and a professional palaeontologist must be appointed for appropriate action.

3.2 Off take 8c

The ECO must be informed of any chance fossil finds. No further Palaeontological mitigation or assessment is recommended for these areas.

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INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of the Off take 8b and 8c projects near Stanger, KwaDukuza Local Municipality, Ilembe District Municipality, Kwazulu-Natal Province (Figures 1&2).

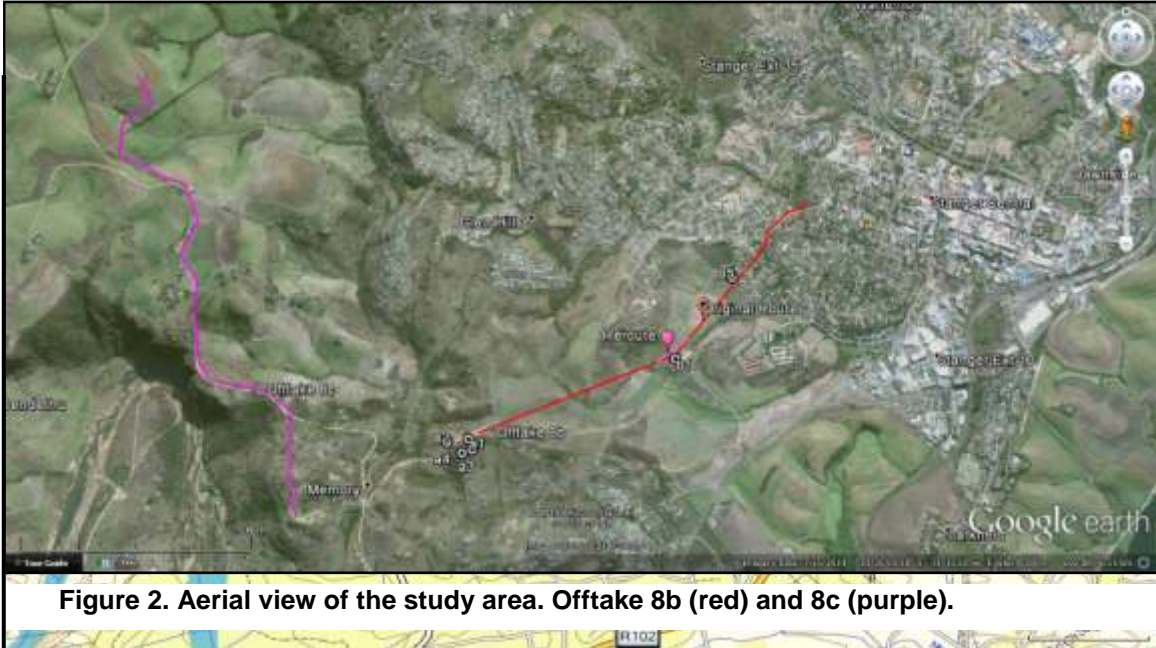


Figure 2. Aerial view of the study area. Offtake 8b (red) and 8c (purple).

Figure 1. Locality of Offtake 8b (blue) and Offtake 8c (red) near Stanger

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999 AND KWAZULU-NATAL HERITAGE ACT NO 4/2008

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 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 Ordovician to Silurian aged rocks of the Natal Group and Carboniferous to Permian aged rocks of the Dwyka Formation of the Karoo Supergroup, Jurassic aged dolerite and Quaternary aged alluvium (Figure 3).

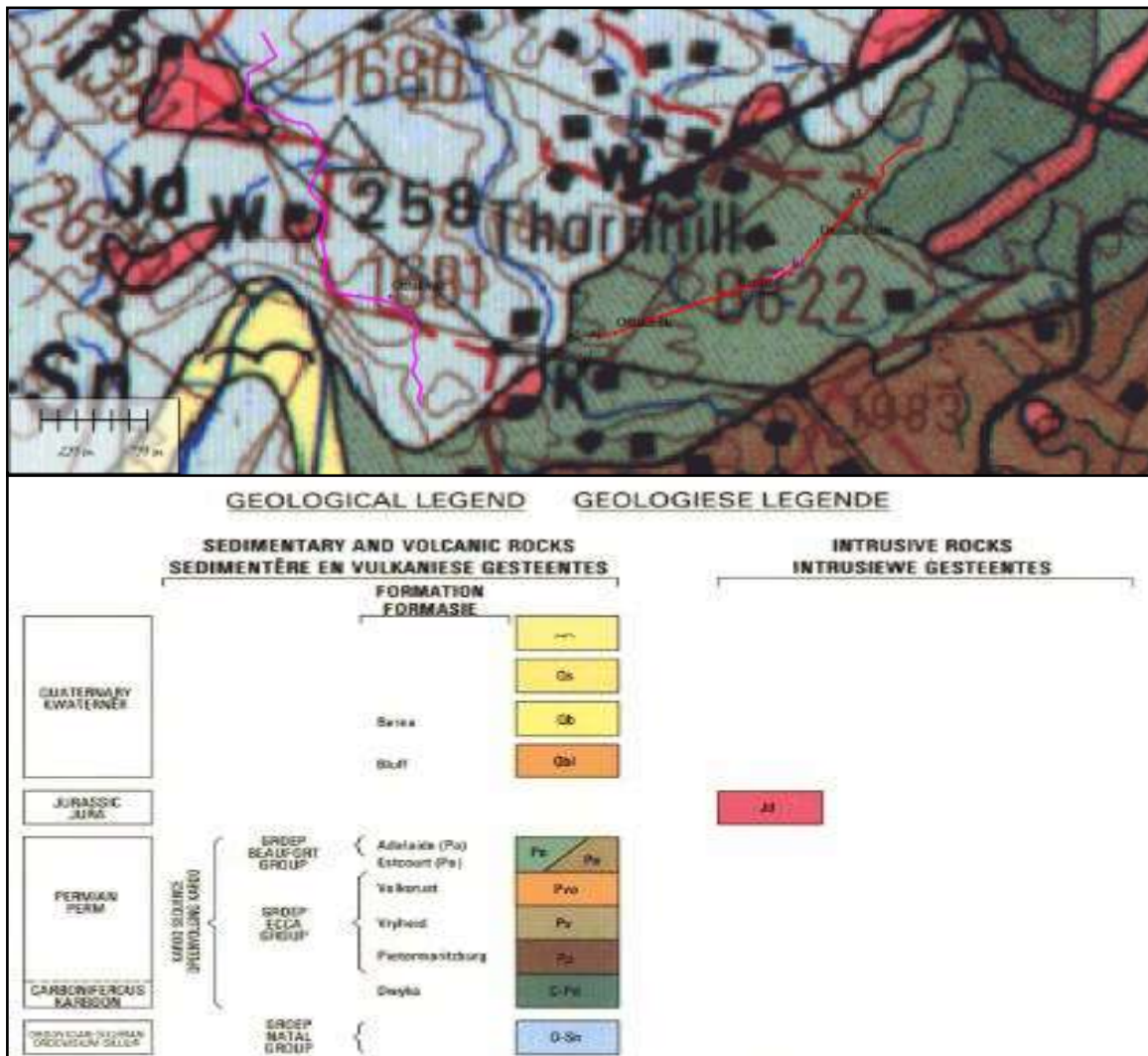


Figure 3. Geology of the study area for offtake 8b and 8c.

Off take 8c is underlain by rocks of the Natal Group and Off take 8b by rocks of the Dwyka Formation, Karoo Supergroup (Figure 3).

Natal Group (O-Sn)

The Ordovician to Silurian aged rocks of the Natal Group consists mostly of grey-coloured quartzites, indicating fluvial deposition of sand from the highlands in the northern part of QwaZulu-Natal (Johnson et al, 2006).

Dwyka Formation (C-Pd)

The Carboniferous to Permian aged Dwyka Formation consists mainly of poorly sorted tillites. The rocks overlying the Natal Group is a thick unit of tillite that was deposited in a glacial environment by retreating ice sheets about 300 million years ago.

At this time South Africa was part of the supercontinent Gondwana, which was situated near the South Pole and covered with ice. Rocks imbedded in the slowly moving ice sheets scoured and polished the underlying older rocks giving rise to glacial pavements. Striation directions indicate that ice flow was from north to south - valuable information when it comes to reconstructing Gondwana.

Dolerite (Jd)

Jurassic aged dolerite, also known as Karoo Dolerite, intruded the geological sequence during the breakup of Gondwana about 180 million years ago.

PALAEONTOLOGY**Natal Group (O-Sn)**

To date, no fossils have been recorded from the Natal Group sediments. Trace fossils are common in equivalent groups of rock in South Africa and the recording of fossils from these rock units will be significant.

Dwyka Formation (C-Pd)

Trace fossils have been recorded from the fine-grained shales of the Dwyka Formation 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 *Peruvipira 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).

Dolerite (Pd)

Due to the igneous nature of dolerite it will not contain fossils.

DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews. Significant fossils have been recorded from the Dwyka Formation and the recording of trace fossils and other fossils from this part of the Karoo Basin will contribute significantly to our understanding of the palaeo-environments that existed during the Permian. No significant fossils are expected from the Natal Group sediments and the dolerite will not contain fossils.

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

The palaeontological sensitivity of the development is related to the specific geology that underlies the development footprints. For the sake of this desktop survey it is assumed that there are significant outcrops on site, and that trenching of up to 2m depth will in fact expose bedrock of all the geological formations recorded in the desktop survey. Due to the fact that the recording of fossils will have a significant impact on our understanding of the palaeo-environments in this part of the basin, a Moderate Palaeontological sensitivity is allocated to all areas underlain by the Dwyka Formation that have a potential to have fossils at the study site. A Low Palaeontological sensitivity is allocated to areas underlain by the Natal Group quartzite as well as dolerite.

The palaeontological sensitivity of the study area is shown in Figure 4.

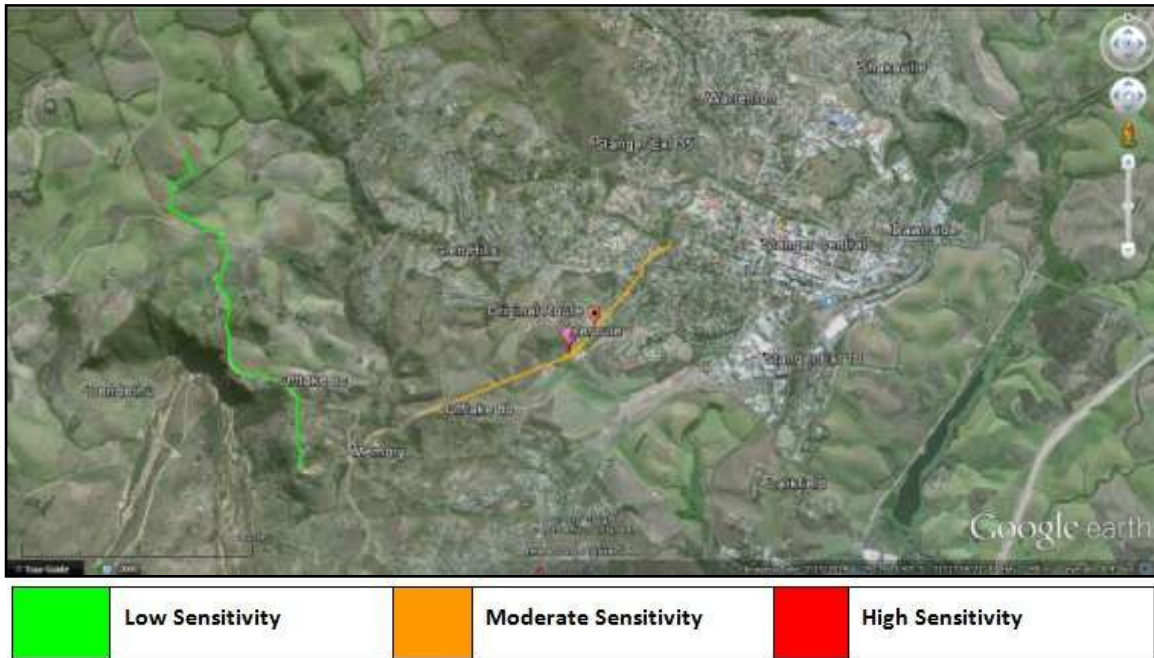


Figure 4 Palaeosensitivity of the areas underlying the routes of offtake 8b and 8c

CONCLUSION AND RECOMMENDATIONS

Off take 8b:

The footprint of the proposed construction of the Off take 8b near Thornhill, Kwadukuza Local Municipality, Ilembe District Municipality, Kwazulu-Natal Province is underlain by Carboniferous to Permian aged tillite of the Dwyka Formation. Significant trace fossils have been described from the Dwyka Formation. It is expected that most of the study area will be underlain by deep soils or weathered rock and a Moderate Palaeontological sensitivity is allocated to the entire length of this development where significant trace fossils can be present in rocks exposed during excavation of trenches deeper than 1,5m.

Off take 8c:

The footprint of the proposed construction of the Off take 8c near Thornhill, Kwadukuza Local Municipality, Ilembe District Municipality, Kwazulu-Natal Province is underlain by quartzite of the Natal Group and dolerite. No fossils have, to date, been recorded from the Natal Group sediments and no significant fossil finds are expected. Dolerite will not contain fossils. A Low Palaeontological sensitivity is allocated to areas underlain by sediments of the Natal Group and dolerite.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that significant trace fossils have been described from the Dwyka Formations that underlies Off take 8b development site.
2. All sections of the development where bedrock is exposed due to erosion or where geotechnical surveys indicate that bedrock will be exposed during excavation, must be inspected by the ECO and if fossils are recorded, a professional Palaeontologist must be appointed to record and collect the fossils according to SAHRA and AMAFA specifications as part of a Phase 1 Palaeontological Impact Assessment.

3. Specific recommendations for each offtake:

3.1 Off take 8b

In all areas where the Dwyka Formation is exposed or likely to be exposed during excavation (trenching of deeper than 1,5m), the ECO must report the presence of fossils and a professional palaeontologist must be appointed for appropriate action.

3.2 Off take 8c

The ECO must be informed of any chance fossil finds. No further Palaeontological mitigation or assessment is recommended for these areas.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

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



Dr Gideon Groenewald

Geologist