PROPOSED CONSTRUCTION OF OFF TAKE 1B POTABLE WATER PIPELINE AS PART OF THE LOWER THUKELA BULK WATER SUPPLY AT SANS SOUCIS, ILEMBE DISTRICT MUNICIPALITY, KZN

FOR

DATE: TRIPLO4 SUSTAINABLE SOLUTIONS

22 January 2015

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INTRODUCTION

"The study site is located approximately 65km to the North of Tongaat, turning inland along the P110 towards Sans Soucis. The proposed project, Off Take 1B, falls within the KwaDukuza Local Municipality and iLembe District Municipality

The proposed construction for Off Take 1B forms part of the Lower Thukela Bulk Water Supply Scheme which is a project of the iLembe District Municipality and co-funded by the Department of Water Affairs. The construction of Off Take 1B 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 located immediately outside the road reserve and is approximately 3km in length with an outside diameter of approximately 400 to 450mm. The proposed Off-Take 1b bulk water pipeline feeds into the reservoirs of Sans Soucis as the project makes provision for Bulk Supply of Potable water to communities that currently do not have access to reticulated potable water in the Lower Thukela Region" (Triplo4 BID 2013).

Figures 1 – 3 show the location of the proposed development.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

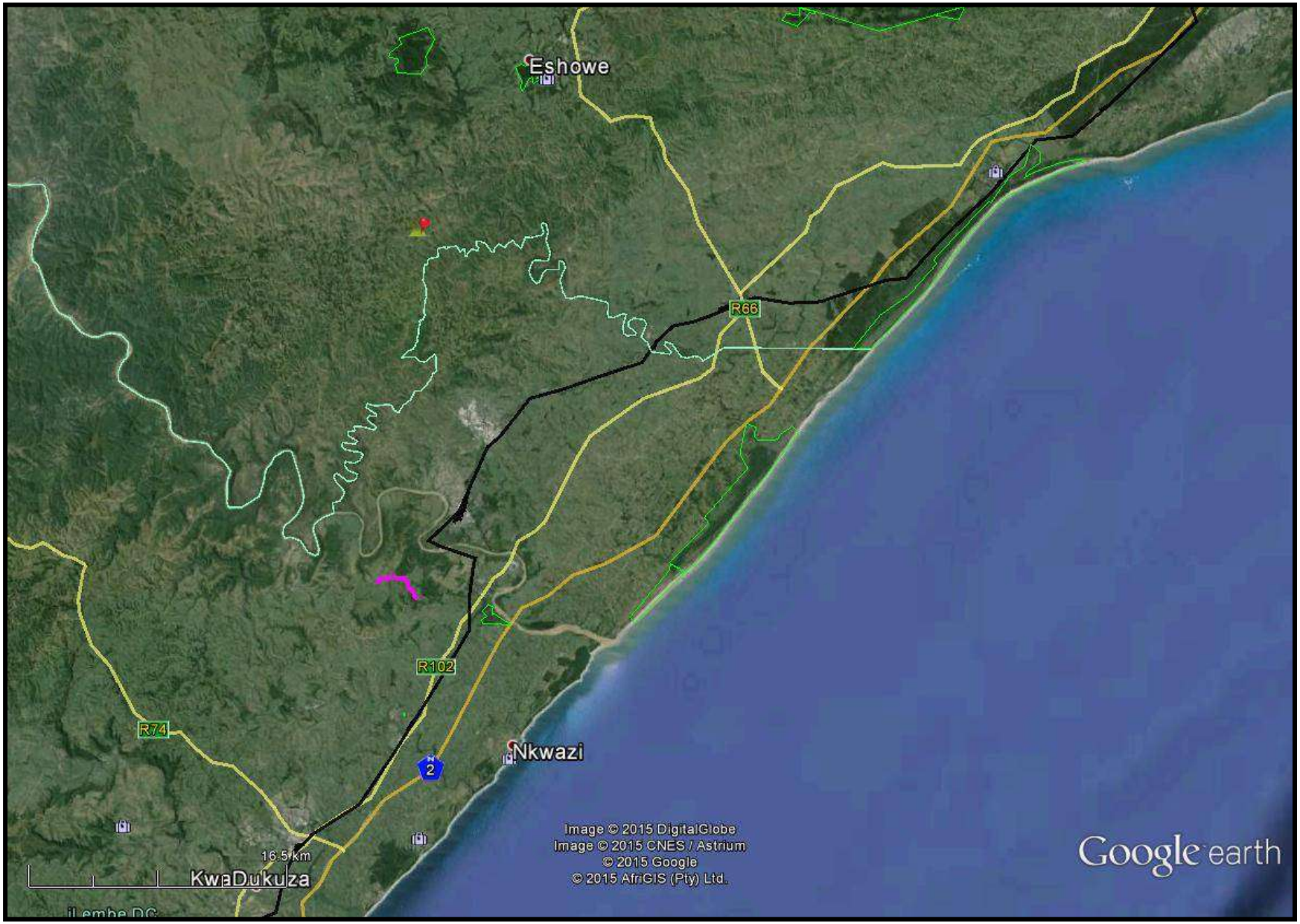


FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA

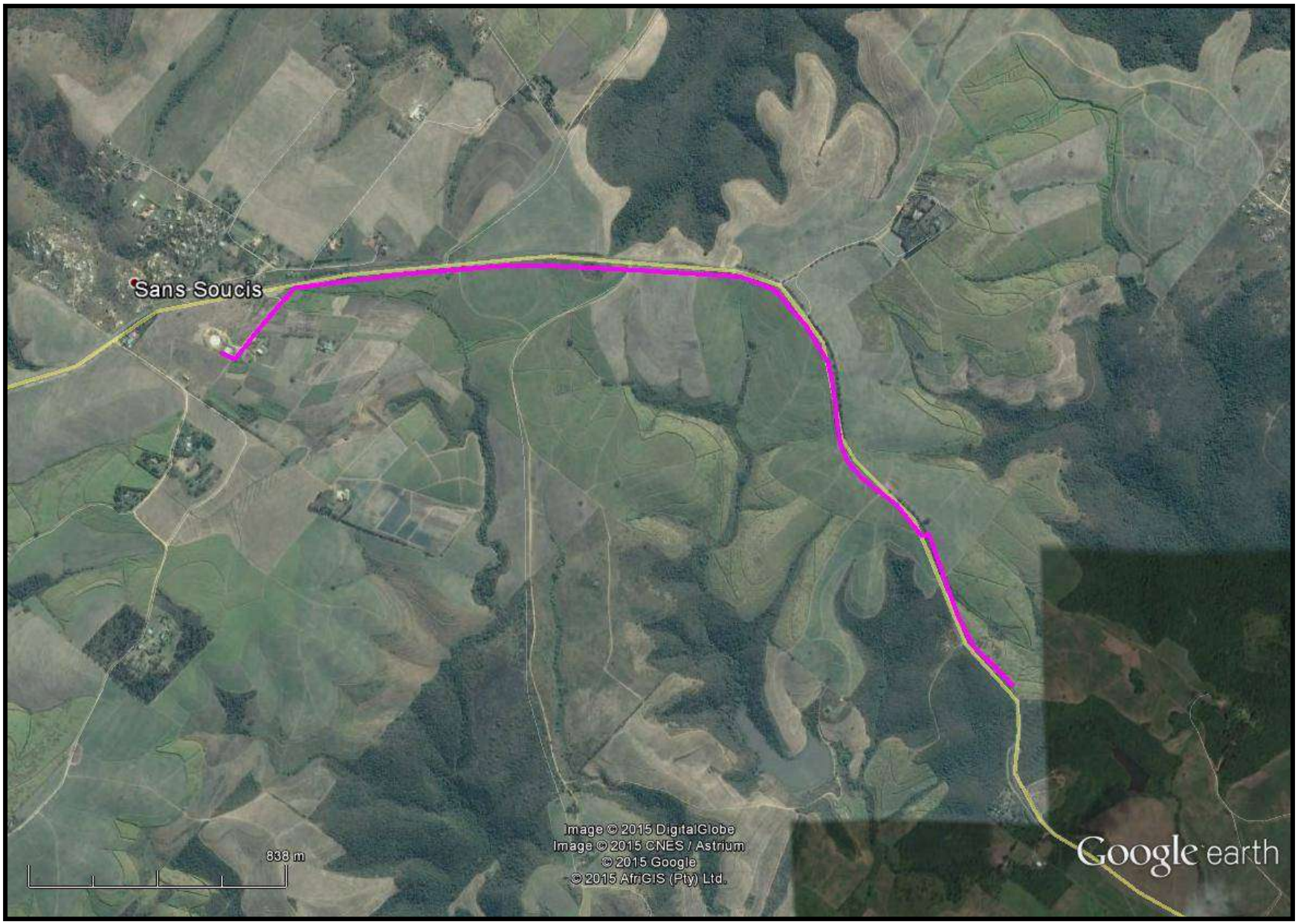
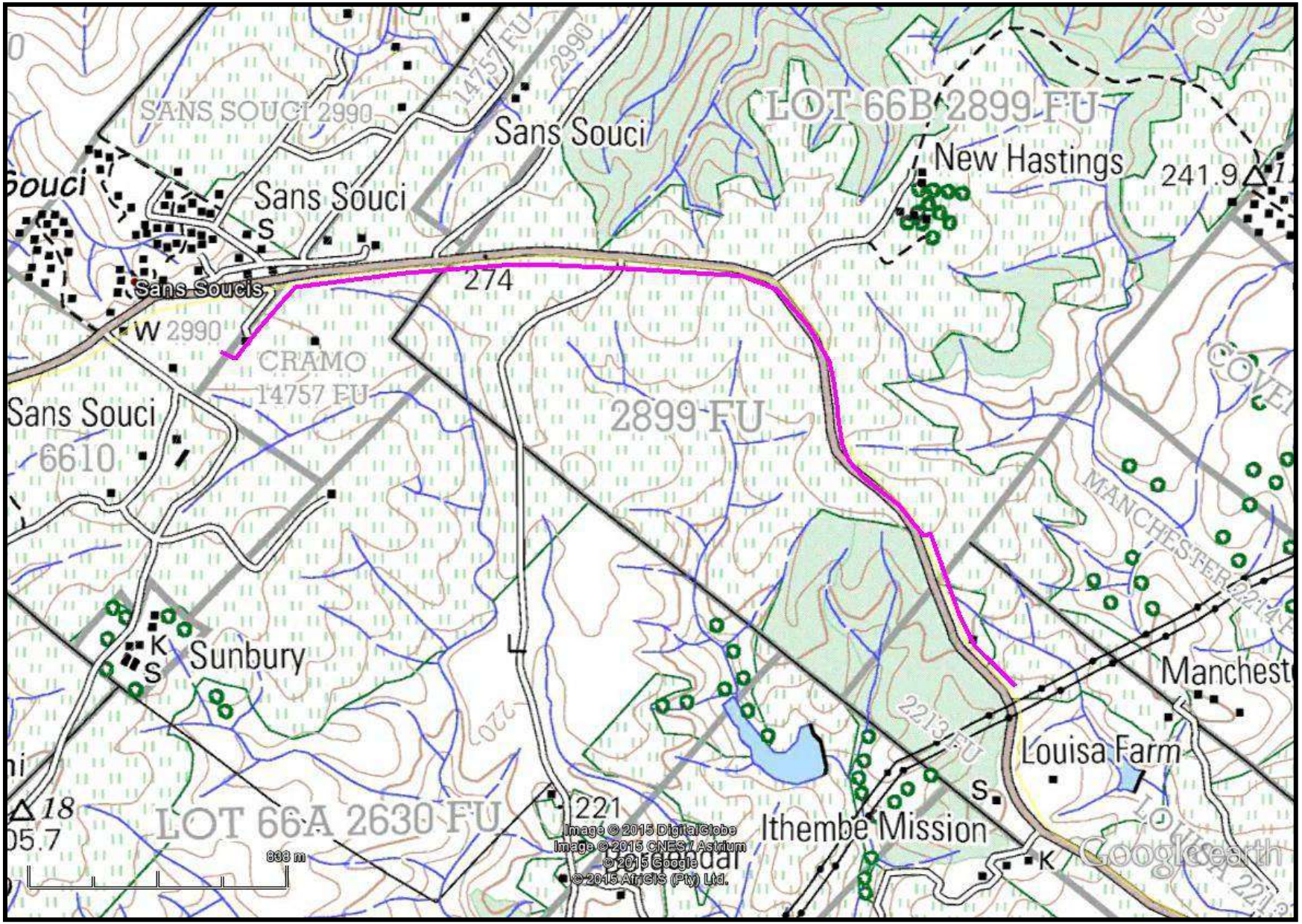


FIG. 3: TOPOGRAPHICAL MAP OF THE STUDY AREA



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. No national monuments, battlefields, or historical cemeteries are known to occur in the study area. Archaeological sites that could occur in the study area are probably vary disturbed and are of low significance, and thus would not require further mitigation. The area of the reservoir could be an exception.

The Surveyor General maps indicate the land was officially surveyed (fig. 5) in 1876, however it was presumably occupied earlier. The map for Louisa 2213

does not indicate any buildings (fig. 6). The adjacent early land parcels of Sans Souci are not currently available on the Surveyor Generals web page.

The 1937 aerial photographs indicates that there are seven built structures on or near the pipeline (fig. 7). These include farmhouses, farm buildings of various sizes, and two settlements. The human settlements could be that of farm labourers and appear to be in a traditional Zulu homestead design. They would thus contain human graves. The current pipeline route will not affect these various sites as they appear to be outside of the pipeline footprint.

The 1963 topographical map indicates that there are five heritage sites near the line. Two of these are buildings and three are settlements. Two of these settlements occur on the 1937 aerial photographs. There is a possibility that human remains will occur within these settlements; hwpoever they will probably not be affected by the line.

There are structures at a5 and b5, a7 and b3, and a6 and b4 that occur in the 2006 aerial photographs. A field survey will determine the extent of these sites in relation to the pipeline footprint. The structures at b1 have already been demolished by some current development.

The location of the desktop sites are given in Tables 1 and 2.

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

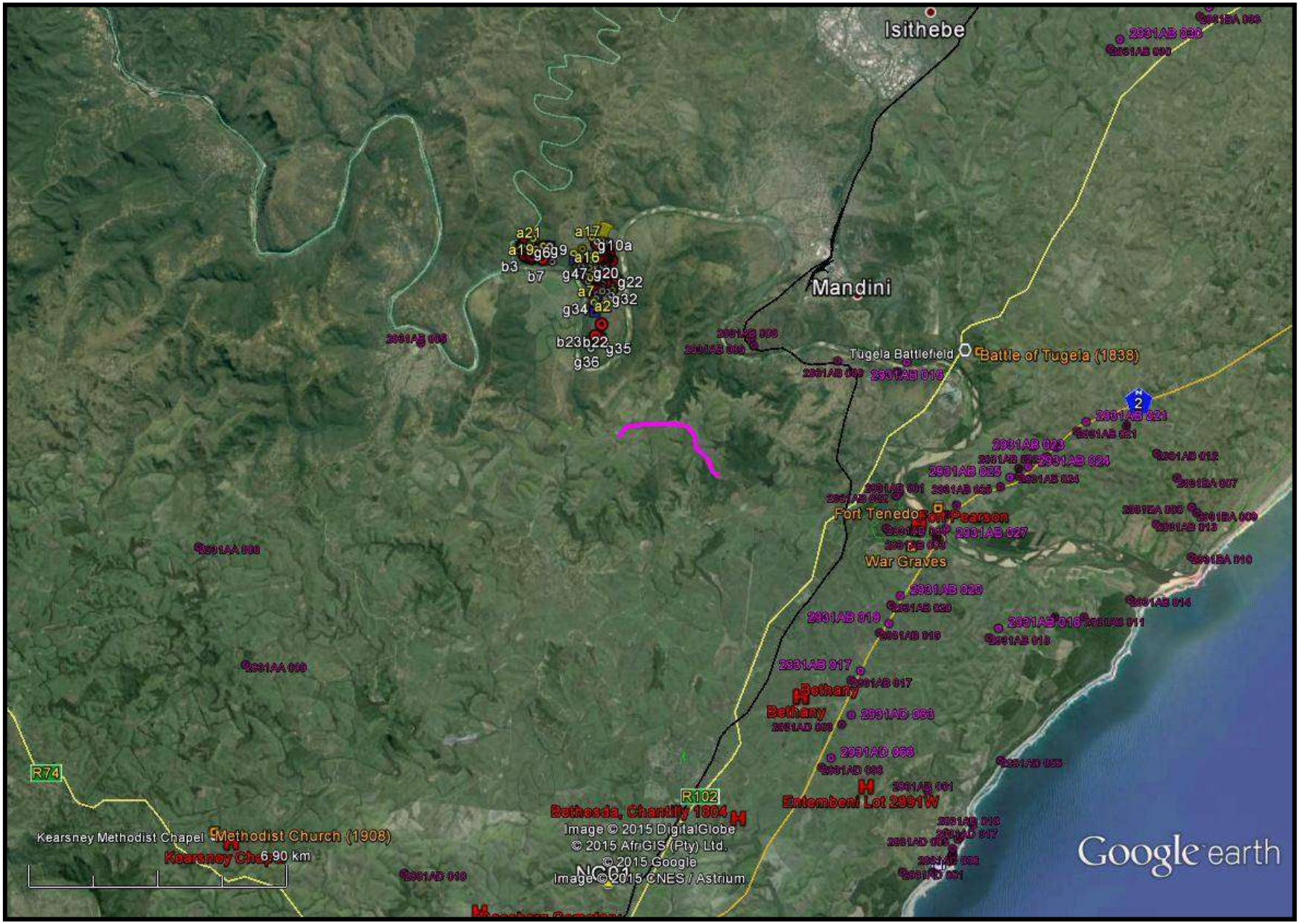
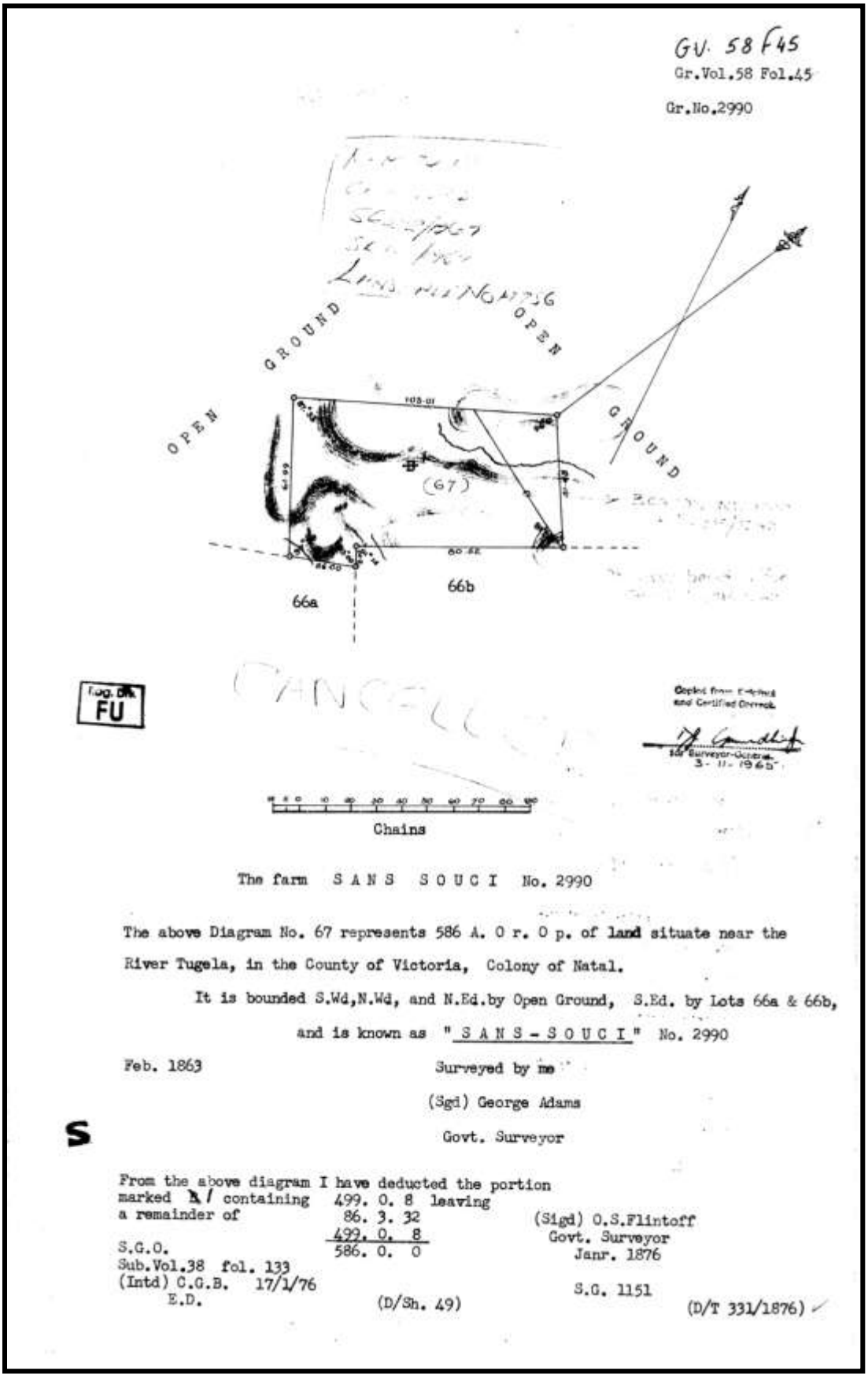


FIG. 5: SURVEYOR GENERAL DIAGRAM 1876



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OPEN GROUND OPEN GROUND

(67)

66a 66b

Chains

The farm S A N S S O U C I No. 2990

The above Diagram No. 67 represents 586 A. 0 r. 0 p. of land situate near the River Tugela, in the County of Victoria, Colony of Natal.

It is bounded S.Wd,N.Wd, and N.Ed.by Open Ground, S.Ed. by Lots 66a & 66b,

and is known as " S A N S - S O U C I " No. 2990

Feb. 1863 Surveyed by me

(Sgd) George Adams

Govt. Surveyor

From the above diagram I have deducted the portion marked A / containing 499. 0. 8 leaving a remainder of 86. 3. 32
499. 0. 8
586. 0. 0

(Sigd) O.S.Flintoff
Govt. Surveyor
Janr. 1876

S.G.O.
Sub.Vol.38 fol. 133
(Intd) C.G.B. 17/1/76
E.D.

(D/Sh. 49)

S.G. 1151

(D/T 331/1876)

FIG. 6: SURVEYOR GENERAL DIAGRAM 1860

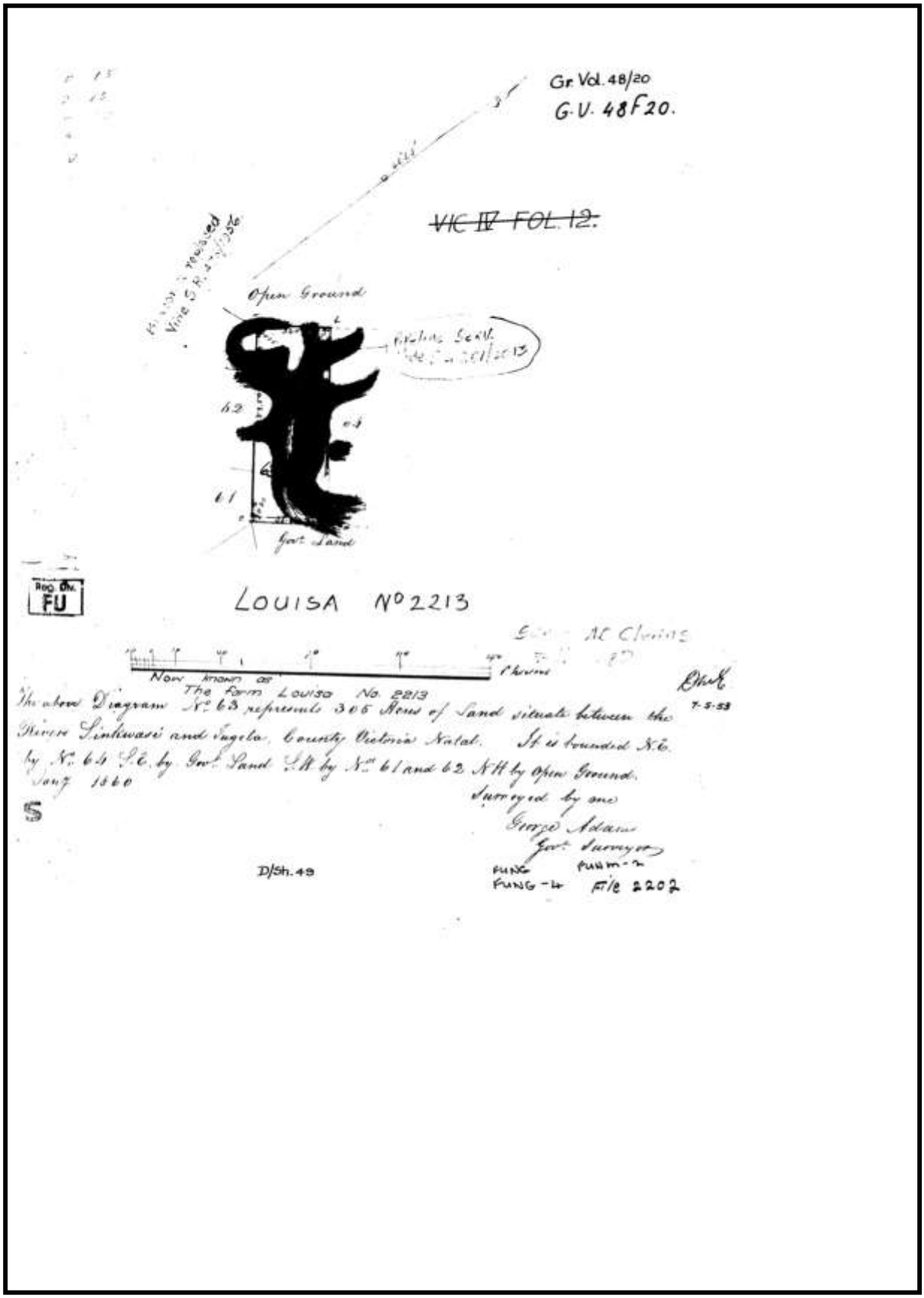

FIG. 7: STUDY AREA IN 1937

FIG. 7: STUDY AREA IN 1963

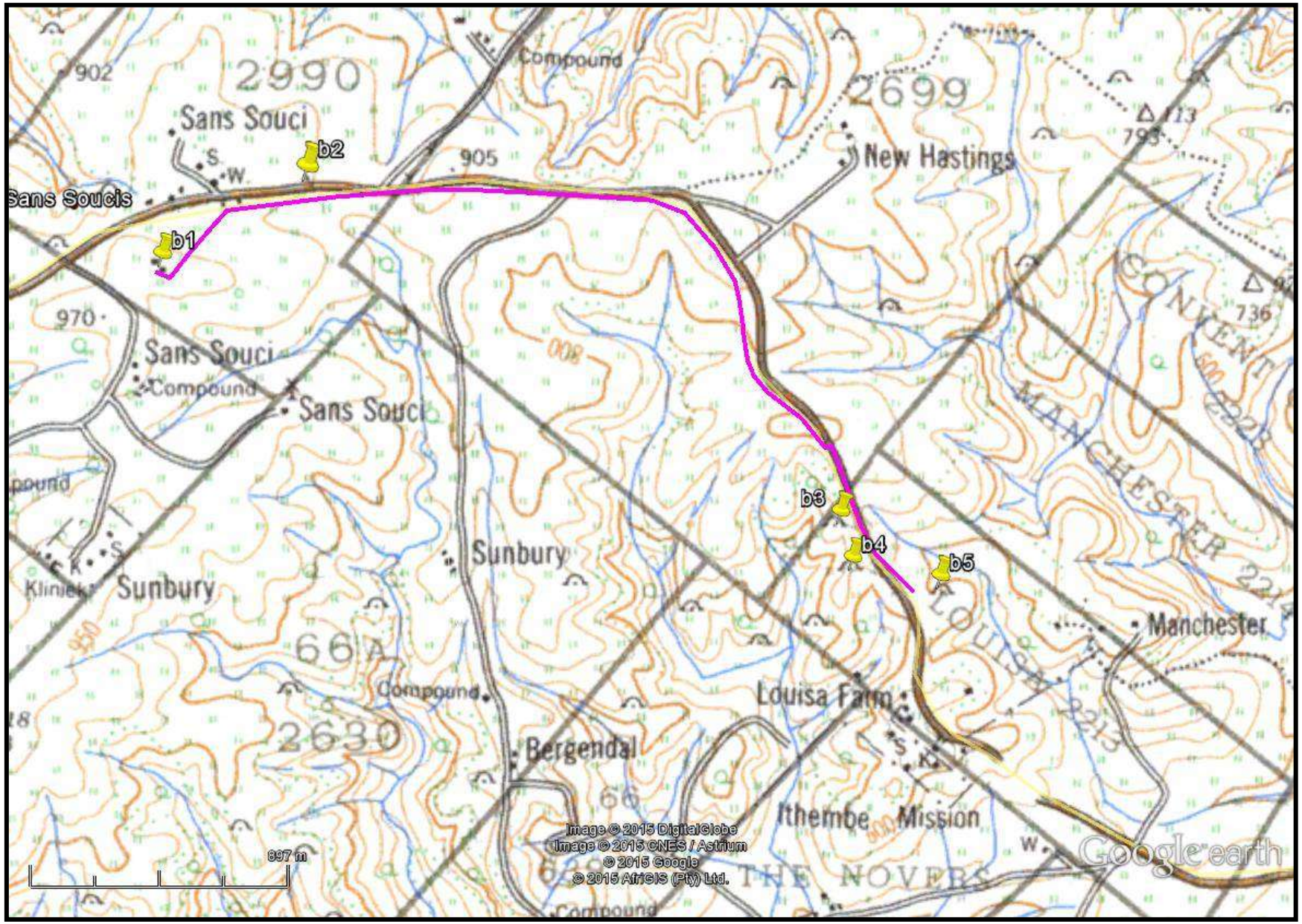

TABLE 1: LOCATION OF HERITAGE SITES IN 1937

NAME	LATITUDE	LONGITUDE	DESCRIPTION	Exists in 2006
a1	-29.187665811	31.351733503	farmhouse	Yes
a2	-29.188150473	31.350622575	structure	No
a3	-29.192112019	31.366912084	rectangular feature	Yes
a4	-29.193951496	31.369414906	structure	No
a5	-29.198853260	31.373092833	settlement	Yes
a6	-29.199445705	31.371427634	settlement	Yes
a7	-29.197460902	31.371167768	settlement	No

TABLE 2: LOCATION OF HERITAGE SITES IN 1963

NAME	LATITUDE	LONGITUDE	DESCRIPTION	Exists in 2006
b1	-29.190005647	31.346741915	2 structures	No
b2	-29.187286742	31.351859295	farmhouse	Yes
b3	-29.198075180	31.371230316	Settlement	No
b4	-29.199564747	31.371711574	Settlement	Yes
b5	-29.200152025	31.374953630	Settlement	No

PALAEONTOLOGICAL IMPACT ASSESSMENT

The footprint of the proposed construction of the Offtake 1b near Newark,Mandeni and Kwadukuza Local Municipality, Ilembe Disctrict 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. Appendix A has the full PIA desktop report.

1. The EAP and ECO of the project must be informed of the fact that significant race fossils have been described from the Dwyka and Pietermaritzburg Formations that underlies part of the development sites.

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.

The location of the Dwyka Formations need to be noted before construction, and the PIA needs to be notified, especially if these are to be disturbed. A permit for damaging and collecting fossils will be required.

FIELD SURVEY

The pipeline occurs just outside the road reserve in most places. Much of the area has thus been disturbed by road works and other servitudes. The field survey located two heritage sites and general occurrences of stone tools along the line. An ''occurrence'' implies that while these artefacts do occur in an area, they are scattered over an wide area, and do not constitute an archaeological site. The reservoir at the western part of the line has already been built and presumably destroyed those structures that occur on the 1968 map.

The location of the sites are shown in Figure 8, and listed in Table 3. Figure 9 shows parts of the line.

TABLE 3: LOCATION OF RECORDED HERITAGE SITES

NAME	LATITUDE	LONGITUDE	DESCRIPTION
SAN01	-29.187350	31.357684	MSA occurrences
SAN02	-29.199055	31.372975	Settlement
SAN03	-29.197279	31.371110	'Compound'

SAN01

SAN01 is an occurrence of Middle Stone Age stone tools that are located along various parts of the line. The tools are made from quartzite river pebbles and are observable in various gullies (fig. 9 bottom left) and excavations. These tools occur ephemerally across the landscape and an example can be seen in fig. 10.

The pipeline will pass through these isolated artefacts.

Significance: These tools are of low significance and represent the general Middle Stone Age flakes.

Mitigation: No mitigation is required

FIG. 8: LOCATION OF RECORDED SITES

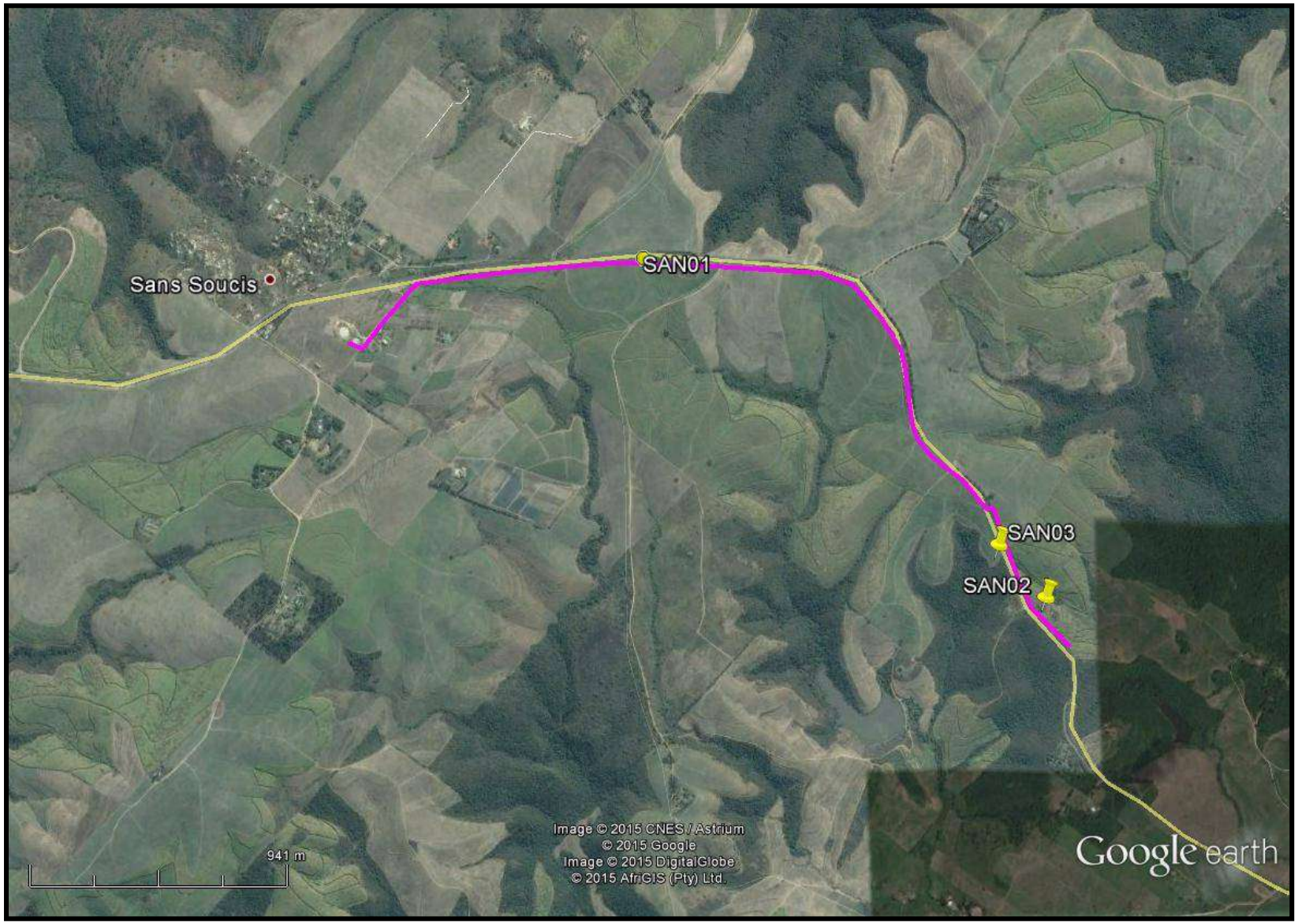

FIG. 9: SCENIC VIEWS OF THE LINE

SAN02

SAN02 is the now abandoned buildings of a ‘compound’. There are buildings in this area in 1937, however they disappear on the 1968 topographical map. These buildings (fig. 11) thus post-date 1970s, and would have destroyed much of the original buildings. The pipeline will not affect these buildings. The line occurs about 8m to the west of the buildings.

Significance: These types of buildings will always have some significance in terms of South African farm labourer practices and accommodation. The architecture tends to follow a generic pattern according to the age of the buildings. Each set of buildings should thus be assessed in their own right. While the buildings are not currently automatically protected, they should not be damaged.

Mitigation: There should be a buffer between the buildings and edge of the footprint. This buffer should be at least 5m given the small working area in this area.

FIG. 11: COMPOUND AT SAN02

SAN03

SAN03 is the remains of the settlement 'a7' identified on the 1937 aerial photograph. The site has been abandoned and is under sugar cane cultivation. Since the site is recent, most of the foundations and walls would have been destroyed by sugar cane farming, i.e. there is little deposit to preserve the site. A few isolated artefacts were observed. These include European ceramics and a Middle Stone Age flake (fig. 12). The ceramics include a teacup and a plate. The MSA artefacts include a core and a flake.

The pipeline crosses the road ~150m to the northwest: it will not affect the site.

Significance: The site is of low significance; however human remains may occur.

Mitigation: No mitigation is required

FIG. 12 ARTEFACTS FROM SAN03

CONCLUSION

A desktop heritage survey was undertaken for the Off take 1B pipeline. Several heritage sites were noted to have occurred near the proposed pipeline footprint. These sites include built structures and human settlements. The area was also noted for having low palaeontological significance, and requiring at least a desktop study. The human settlements probably have human graves, however these will be outside of the footprint.

A field survey determined that most of these site no longer exist. Those areas identified form the historical maps should be treated as general sensitive area with potential for human remains. If any human remains are uncovered during the course of construction the Amafa KZN and the SAPS need to be informed.

Only the artefacts from one site were recorded and these will not be affected. The general area has isolated occurrences of Middle Stone Age artefacts

The location of the Dwyka Formations need to be noted before construction, and the PIA needs to be notified, especially if these are to be disturbed. A permit for damaging and collecting fossils will be required.

No further mitigation is required.

APPENDIX A

PIA DESKTOP REPORT

DESKTOP PALAEONTOLOGICAL ASSESSMENT FOR THEPROPOSEDOFFTAKE 1b AND 6D, MANDENI AND KWADUKUZA LOCAL MUNICIPALITY, ILEMBE DISCTRICT MUNICIPALITY,KWAZULU-NATAL PROVINCE.

FOR

Umlando

DATE: 29 January2015

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 Offtake 1b and 6D projects near Newark andKwaDukuza, KwaDukusa and Mandeni Local Municipalities, Ilembe Disctrict 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, Carboniferous to Permian aged rocks of the Dwyka Formation, Permian aged rocks of the Pietermaritzburg Formation, Ecca Group, of the Karoo Supergroup, Jurassic aged dolerite and Quaternary aged alluvium.

Offtake 1b:

The footprint of the proposed construction of the Offtake 1b near Newark,Mandeni and Kwadukuza Local Municipality, Ilembe Disctrict 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.

Offtake 6D:

The footprint of the proposed construction of the Offtake 6D near KwaDukuza, Kwadukuza Local Municipality, Ilembe Disctrict Municipality, Kwazulu-Natal Province is underlain by Permian aged Pietermaritzburg shale and Jurassic aged dolerite. Although rare, significant trace fossils have been described from the Pietermaritzburg shale and since it is expected that most of the study area will be underlain by deep soils or weathered rock, a Moderate

Palaeontological sensitivity is allocated to the sections of this development underlain by Pietermaritzburg Formation. A Low Palaeontological sensitivity is allocated to areas underlain by dolerite.

A Moderate Palaeontological Sensitivity is therefore allocated to all sections of the development site where fossils might be present and any observation of fossils must be reported to the ECO.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that significant race fossils have been described from the Dwyka and Pietermaritzburg Formations that underlies part of the development sites.
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 Offtake 1b

In all areas where the Dwyka Formation is exposed or likely to be exposed during excavation, the ECO must report the presence of fossils and a professional palaeontologist must be appointed for appropriate action.

3.2 Offtake 6D

The ECO must inspect all excavations into Pietermaritzburg Formation shale and if fossils are present, a professional palaeontologist must be appointed to record and collect the fossils according to SAHRA and AMAFA specifications. No fossils are expected in areas underlain by dolerite and 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 Offtake 1b and 6D projects near Newark andKwaDukuza, KwaDukusa and Mandeni Local Municipalities, Ilembe Disctrict Municipality,Kwazulu-Natal Province (figure 1).

Figure 1 Locality of Offtake 1b (red) near Newark and Offtake 6D (Cyan) near Kwadukuza

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 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 Ordovician to Silurian aged rocks of the Natal Group, Carboniferous to Permian aged rocks of the Dwyka Formation, Permian aged rocks of the Pietermaritzburg Formation, Ecca Group, of the Karoo Supergroup, Jurassic aged dolerite and Quaternary aged alluvium (Figure 2).

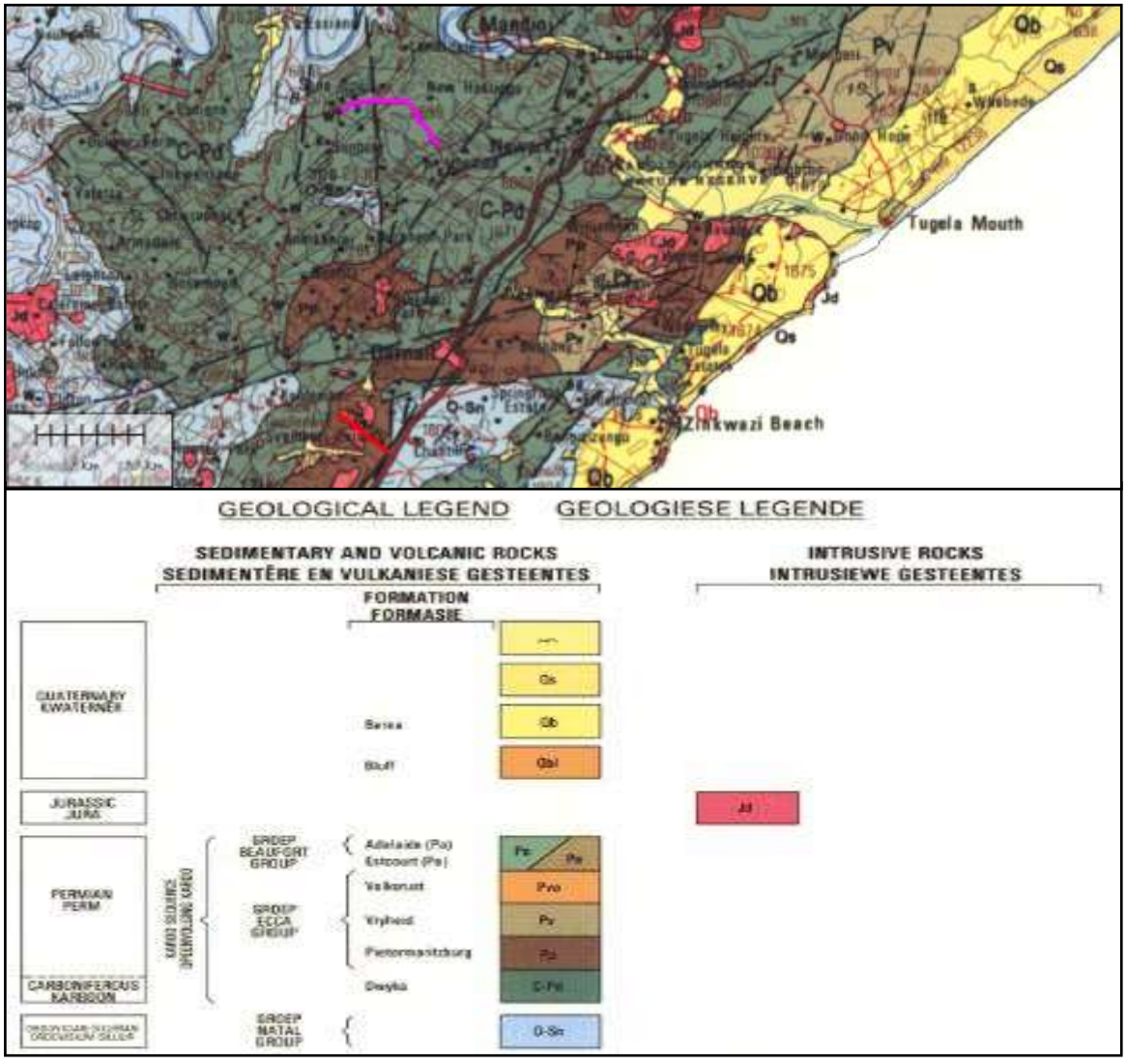

Figure 2 Geology of the study area for Offtake 1b and 6D

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

Pietermaritzburg Formation (Pp)

The Permian aged Pietermaritzburg Formation is the lower most formation of the Ecca Group, which is part of the Karoo Supergroup. The Pietermaritzburg Formation is an assemblage of fine-grained sediments, consisting mainly of dark grey mudstone and shale. The deposits represent Permian aged marine deposits in this part of Gondwanaland (Johnson et al, 2006).Basinal dark mudrocks with phosphatic / carbonate / sideritic concretions can be present.

Offshore shelf, but possibly also near shore / lacustrine / lagoonal deposits.

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

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 chondrichthyians (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 *Peruvispiraviperdorfensis*), bivalves (*Nuculopsis* sp., *Phestia* sp., *Aphanaiahaibensis*, *Eurydesmamytiloides*), brachiopods (*Attenuatella* sp.) and palaeoniscoid fish such as *Namaichthysschroederi* and *Watsonichthys lotzi*.

Fossil plants have also been found, including lycopods (*Leptophloemaustrale*), 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).

Pietermaritzburg Formation (Pp)

Fossils are generally absent from the Formation although trace fossils have been recorded from the upper layers of the Pietermaritzburg Formation by Linstrom (1987).

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. Although fossils is rarely recorded from the Dwyka and Pietermaritzburg Formations, the recording of trace fossils and other fossils from this part of the Ecca Basin will contribute significantly to our understanding of the palaeo-environments that existed during the Permian. 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 fresh 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 no significant outcrops on site, but that trenching of up to 2m depth will in fact expose fresh 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 with a potential to have fossils at the study site. A Low Palaeontological sensitivity is allocated to areas underlain by dolerite.

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

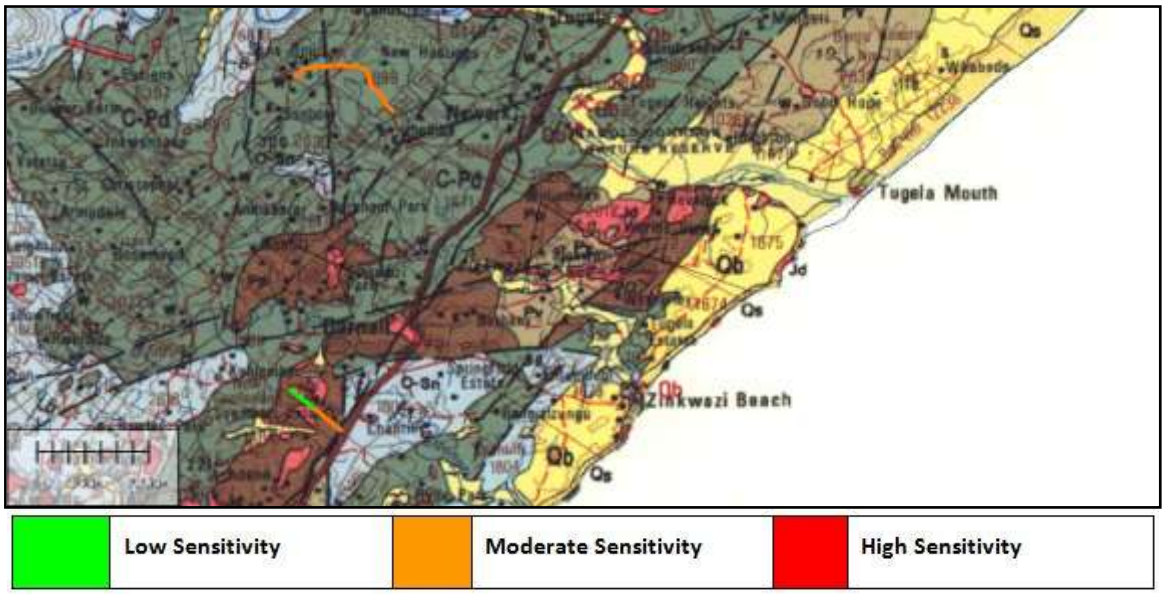

Figure 3 Palaeontological sensitivity of Offtake 1b and 6D

CONCLUSION AND RECOMMENDATIONS

Offtake 1b:

The footprint of the proposed construction ofthe Offtake 1b near Newark,Mandeni and Kwadukuza Local Municipality, Ilembe Disctrict Municipality, Kwazulu-Natal Provinceis 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.

Offtake 6D:

The footprint of the proposed construction of the Offtake 6D near KwaDukuza,Kwadukuza Local Municipality, Ilembe Disctrict Municipality, Kwazulu-Natal Province is underlain by Permian aged Pietermaritzburg shale and Jurassic aged dolerite. Although rare, significant trace fossils have been described from the Pietermaritzburg shale and since it is expected that most of the study area will be underlain by deep soils or weathered rock, a Moderate Palaeontological sensitivity is allocated to the sections of this development underlain by Pietermaritzburg Formation. A Low Palaeontological sensitivity is allocated to areas underlain by dolerite.

A Moderate Palaeontological Sensitivity is therefore allocated to all sections of the development site where fossils might be present and any observation of fossils must be reported to the ECO.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that significant race fossils have been described from the Dwyka and Pietermaritzburg Formations that underlies part of the development sites.
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 Offtake 1b

In all areas where the Dwyka Formation is exposed or likely to be exposed during excavation, the ECO must report the presence of fossils and a professional palaeontologist must be appointed for appropriate action.

3.2 Offtake 6D

The ECO must inspect all excavations into Pietermaritzburg Formation shale and if fossils are present, a professional palaeontologist must be appointed to record and collect the fossils according to SAHRA and AMAFA specifications. No fossils are expected in areas underlain by dolerite and 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