HERITAGE SURVEY OF THE PROPOSED NCAMBEDLANA BULK SEWER PIPELINE, MTHATHA, EASTERN CAPE.

FOR INDWE CONSULTANCY

DATE: 25 AUGUST 2015

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INTRODUCTION

Indwe Consultancy requested that Umlando quote for the Ncambedlana Bulk Sewer Pipeline. The project area is located approximately 5km north of Mthatha, falling to the East and to the West of the N2 National Road leading to Kokstad in the KSD Municipality, OR Tambo District Municipality Eastern Cape Province. The Northern boundary of the project is the Ncambedlana River. The development area is the Ncambedlana Smallholding farms just outside of the Mthatha CBD.

Umlando noted that the area is in a flood plain and has been heavily ploughed for decades and thus there area was of low heritage significance with the exception of the palaeontology. This report is a desktop report suggesting that no further mitigation is required apart from the palaeontological aspect, if it is affected.

The report is an updated desktop report of the study area that will recommend that the project is exempted from further HIA studies.

The new pipeline will be 5.5 km long, constructed along the southern bank of the Ncambedlana River.

The pipe sizes will vary in size relevant to the quantity of flow in that section of pipe. Preliminary calculations indicate

- that the minimum pipe diameter will be a 200 mm and the maximum a 500 mm diameter pipe.
- New sewer pump stations will be constructed.
- The sewer will ultimately connect into the new Maydene Farm sewer main (currently under construction) and convey sewerage to the main existing Mthatha Waste Water Treatment Works

Figures 1 -3 show the location of the powerline options.

FIG. 1 GENERAL LOCATION OF THE NCAMBEDLANA BSP

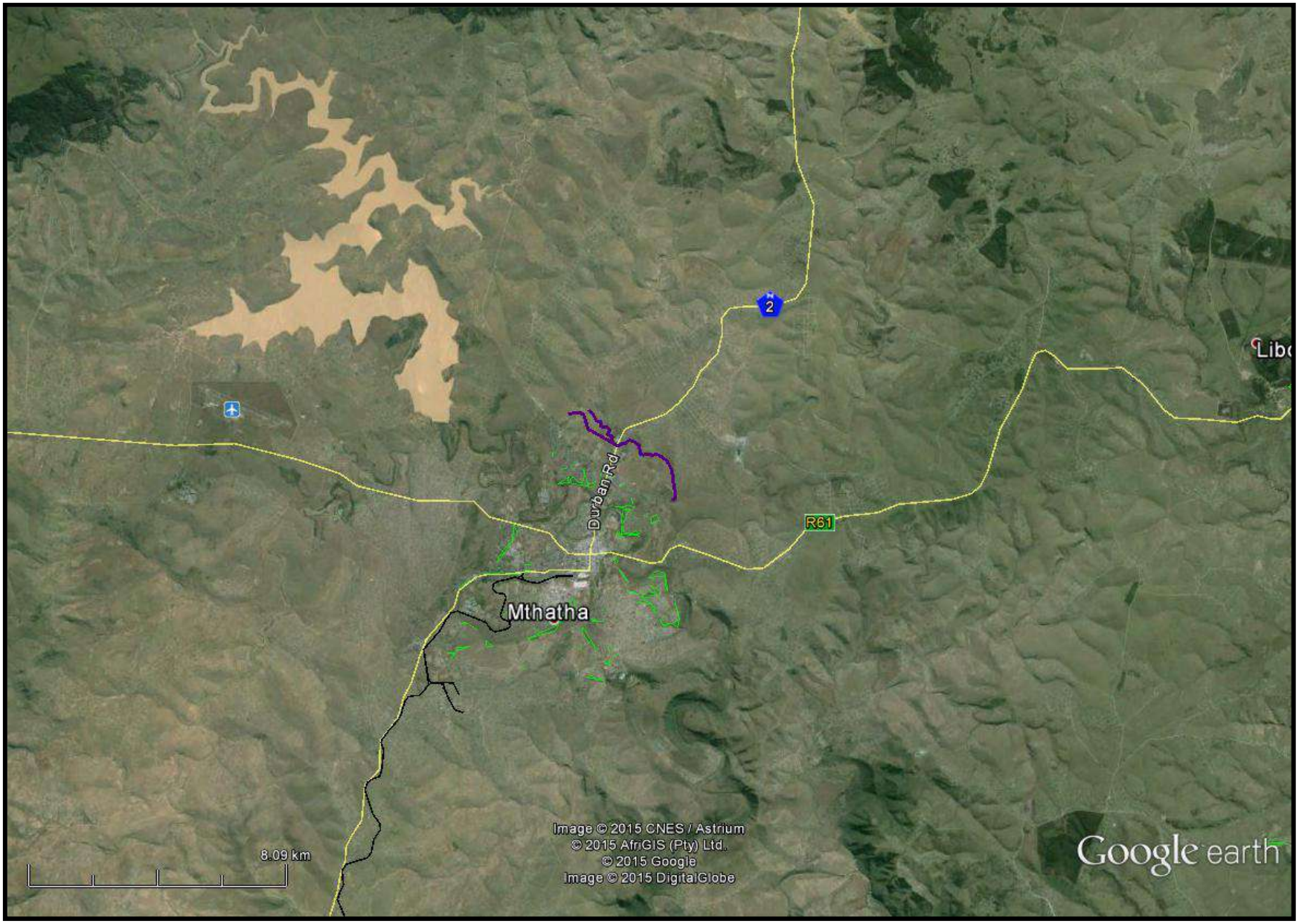


FIG. 2: AERIAL OVERVIEW OF NCAMBEDLANA BSP

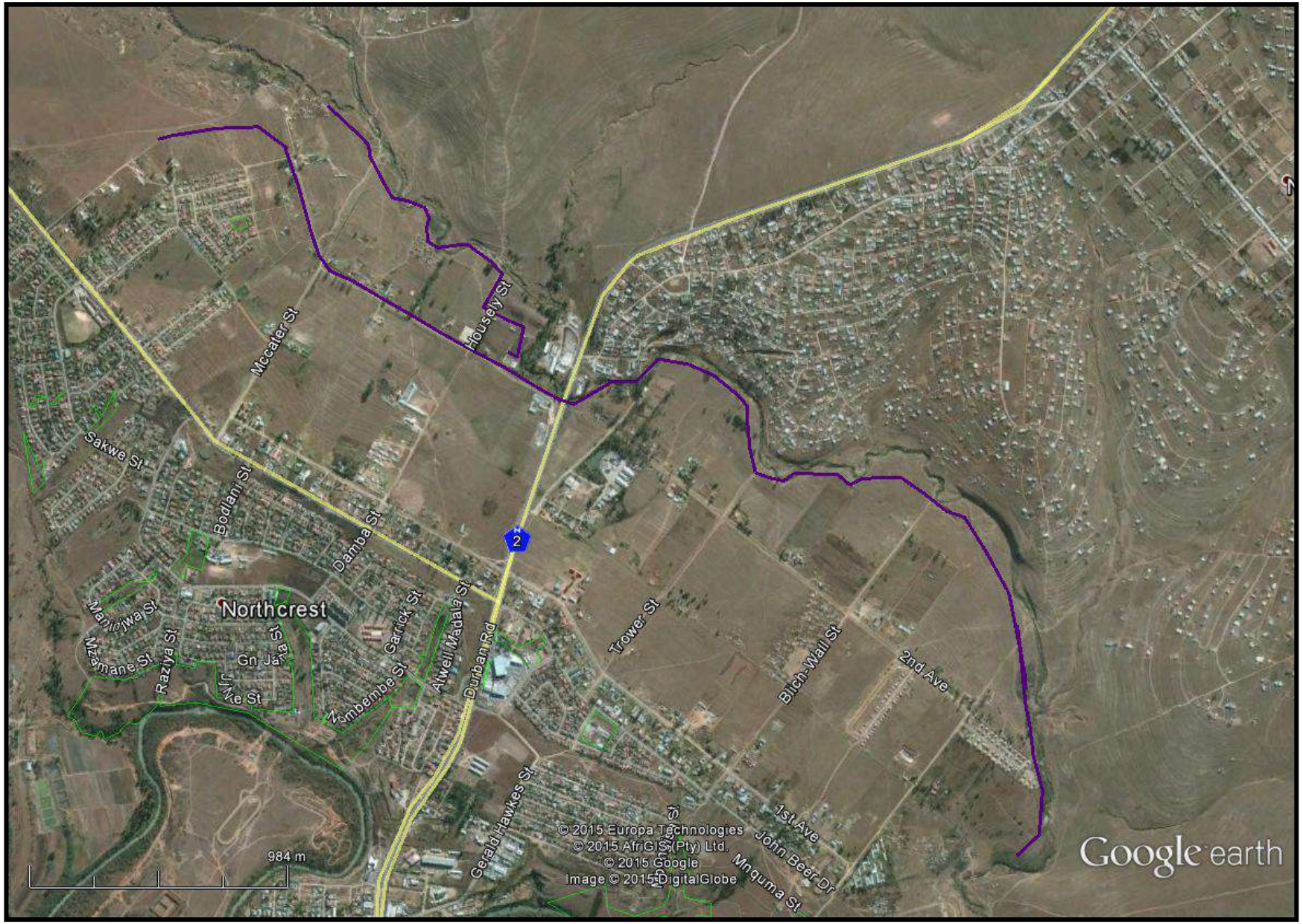
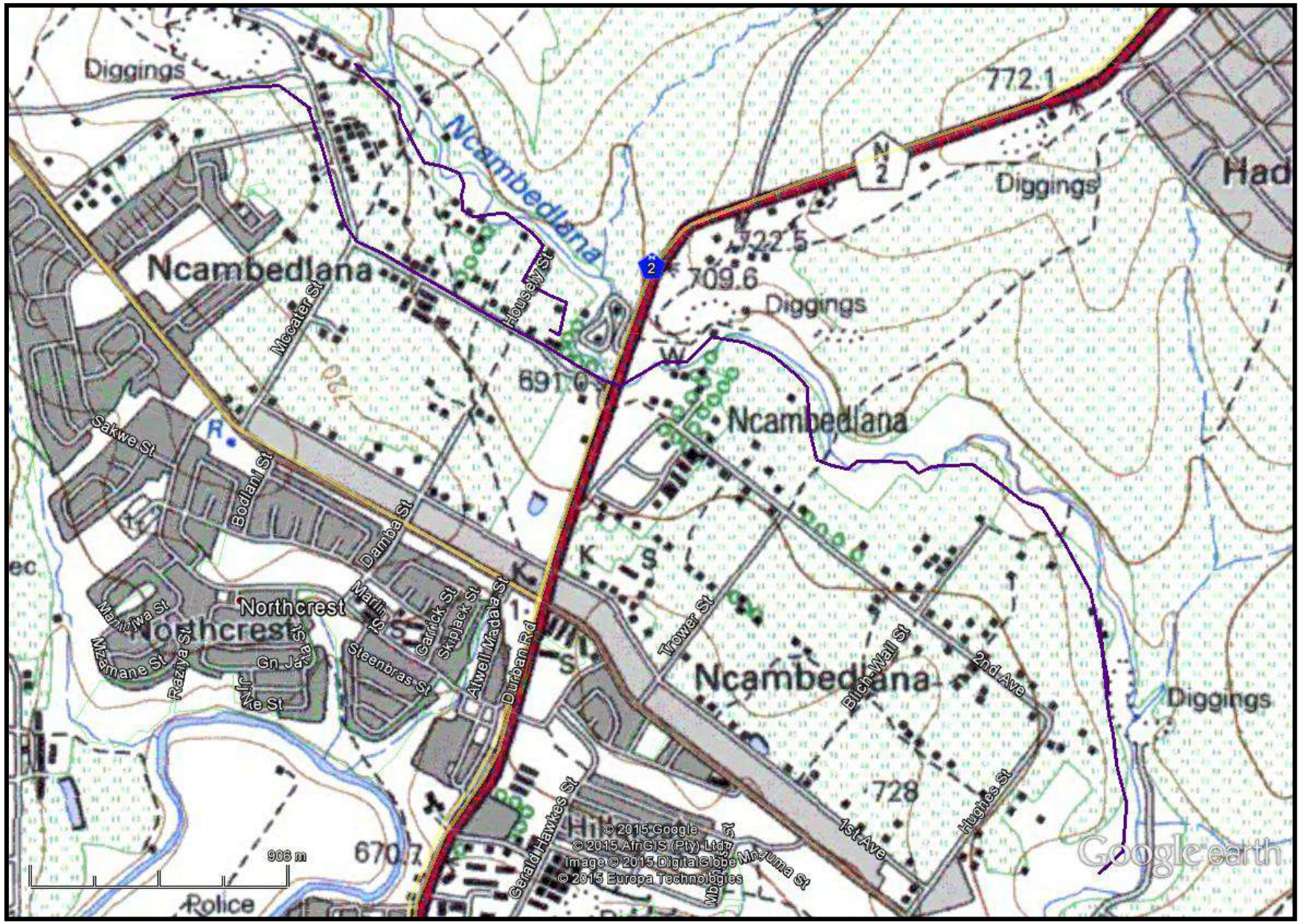


FIG. 3: TOPOGRAPHICAL MAP OF NCAMBEDLANA BSP



NATIONAL HERITAGE RESOURCES ACT OF 1999

The National Heritage Resources Act of 1999 (pp 12-14) protects a variety of heritage resources. This are resources are defined as follows:

1. **"**For the purposes of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.
2. Without limiting the generality of subsection (1), the national estate may include—
   - 2.1. Places, buildings, structures and equipment of cultural significance;
   - 2.2. Places to which oral traditions are attached or which are associated with living heritage;
   - 2.3. Historical settlements and townscapes;
   - 2.4. Landscapes and natural features of cultural significance;
   - 2.5. Geological sites of scientific or cultural importance;
   - 2.6. Archaeological and palaeontological sites;
   - 2.7. Graves and burial grounds, including—
     - 2.7.1. Ancestral graves;
     - 2.7.2. Royal graves and graves of traditional leaders;
     - 2.7.3. Graves of victims of conflict;
     - 2.7.4. Graves of individuals designated by the Minister by notice in the Gazette;
     - 2.7.5. Historical graves and cemeteries; and
     - 2.7.6. Other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
3. Sites of significance relating to the history of slavery in South Africa;
   - 3.1. Movable objects, including—

4. Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
   4.1. Objects to which oral traditions are attached or which are associated with living heritage;
   4.2. Ethnographic art and objects;
   4.3. Military objects;
   4.4. objects of decorative or fine art;
   4.5. Objects of scientific or technological interest; and
   4.6. books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).
5. Without limiting the generality of subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—
   5.1. Its importance in the community, or pattern of South Africa's history;
   5.2. Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
   5.3. Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
   5.4. Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
   5.5. Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
   5.6. Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
   5.7. Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
   5.8. Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and

5.9. sites of significance relating to the history of slavery in South Africa"

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 database contain 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.

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

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

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. No national monuments, battlefields, or historical cemeteries are known to occur along the route.

The 1955 and 1982 topographical maps (fig. 5) and 1955 aerial photographs (fig. 6) indicate that there are no heritage sites in the powerline paths. The historical maps clearly show that while the area had several settlements, these are not near the proposed line. The area has also been under cultivation for several decades and this would have .destroyed any archaeological deposit that could have occurred there.

The line is unlikely to affect cultural heritage sites.

FIG. 4: KNOWN HERITAGE SITES IN THE GENERAL AREA

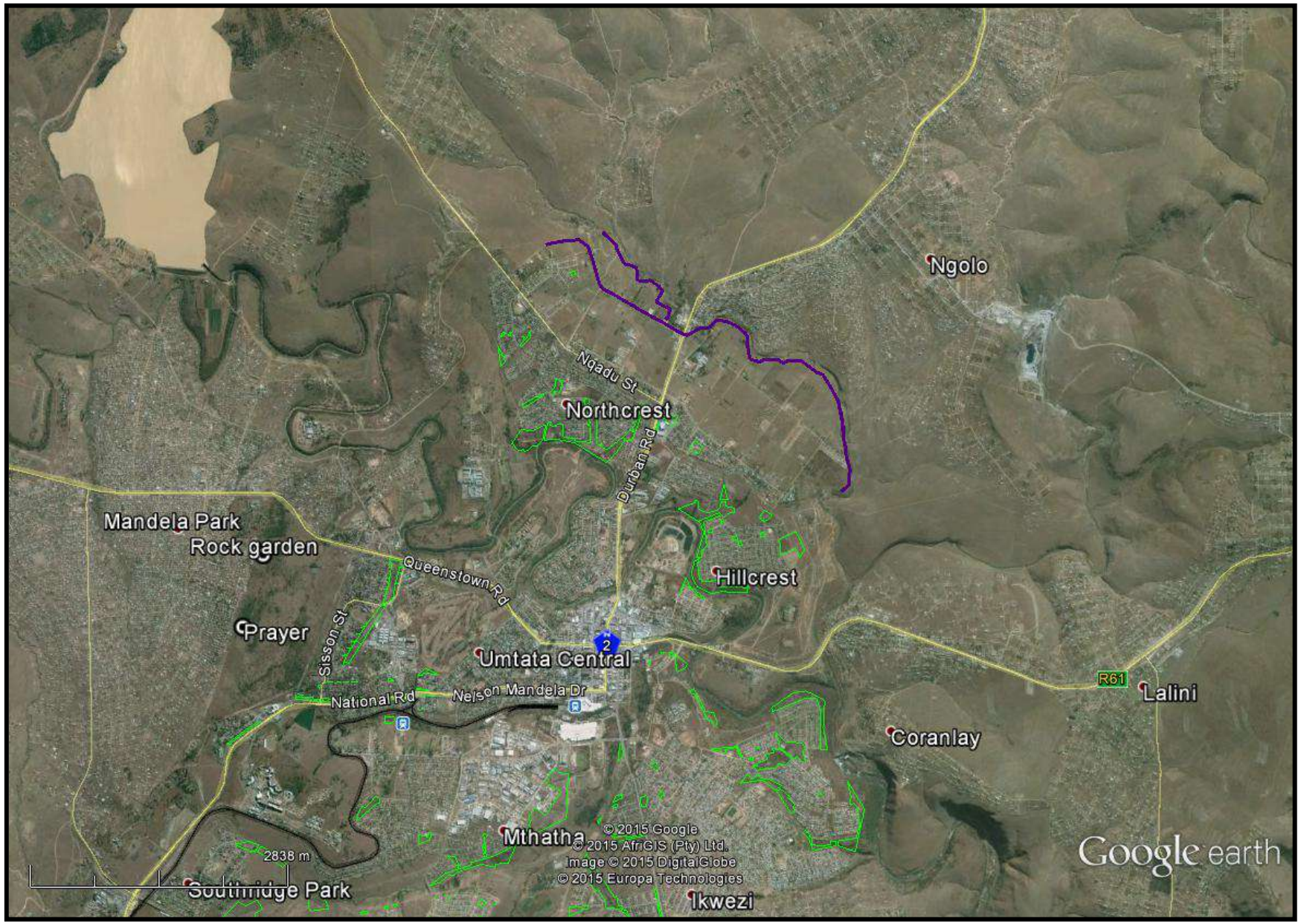


FIG. 5: STUDY AREA IN 1955 AND 1982

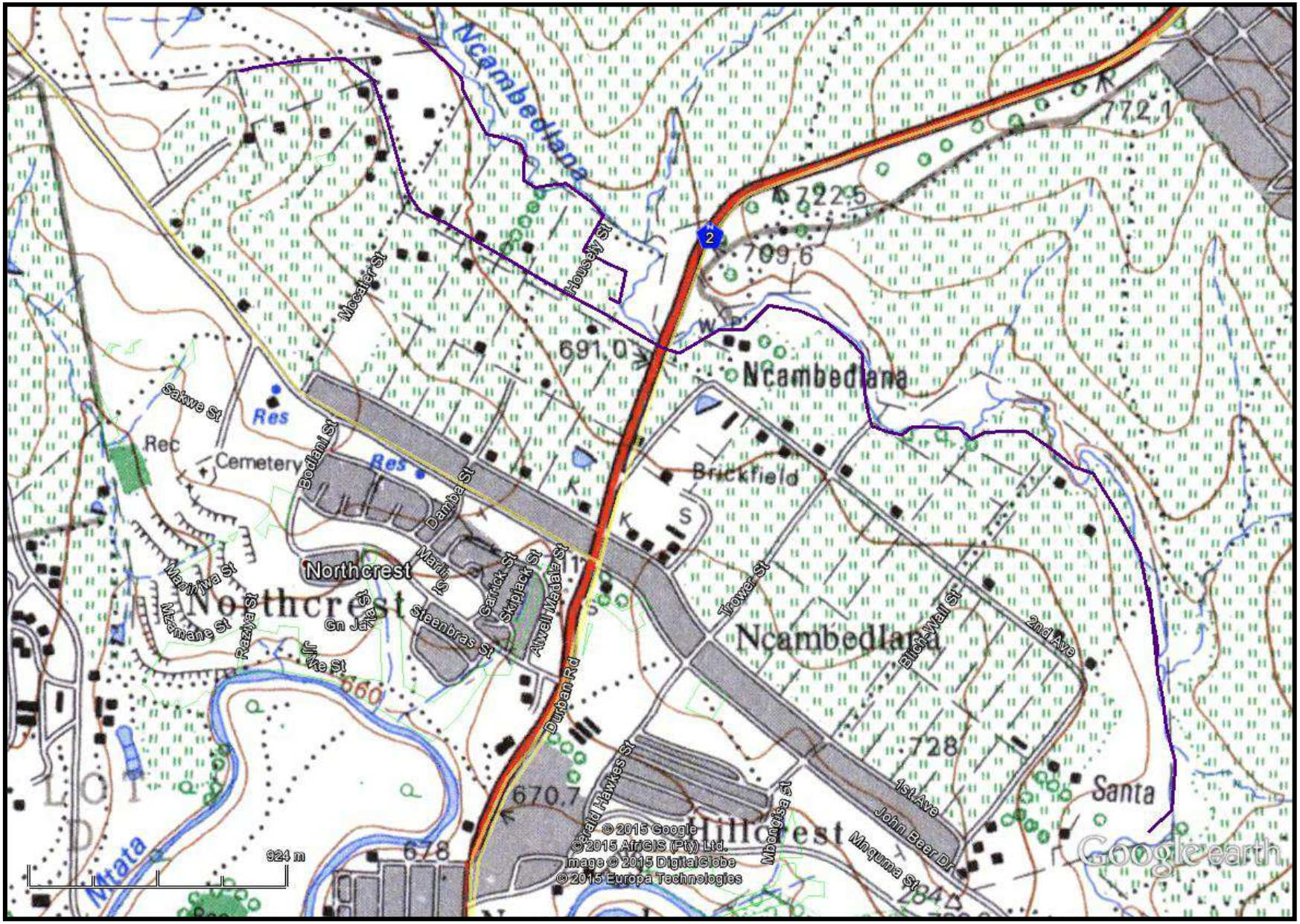


FIG. 6: STUDY AREA IN 1952

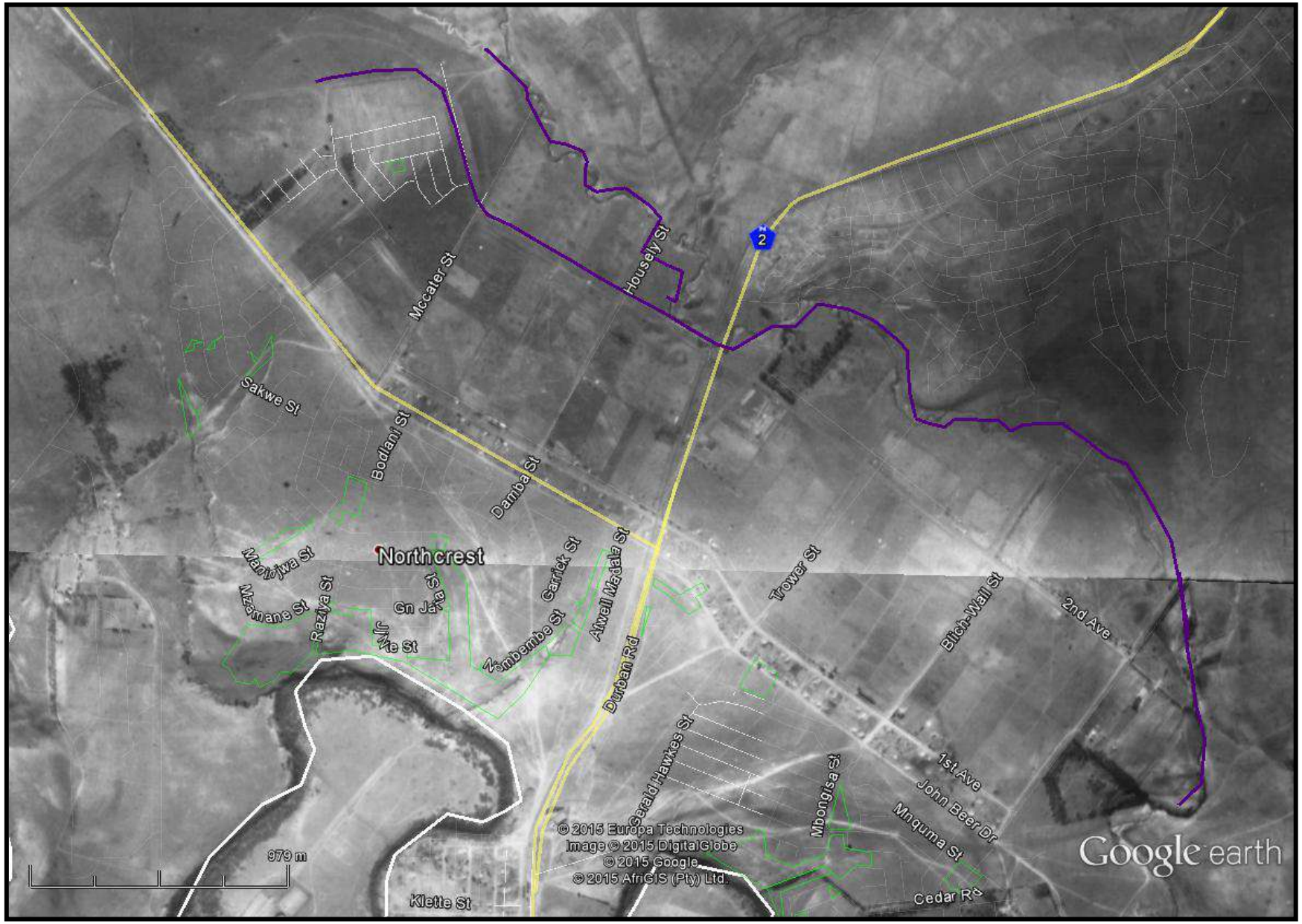


FIG. 7: PALAEONTOLOGICAL SENSITIVITY OF THE STUDY AREA

COLOUR	SENSITIVITY	REQUIRED ACTION
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

PALAEONTOLGOICAL IMPACT ASSESSMENT

The palaeontological sensitivity map indicated that the area is of very high sensitivity. “The entire study area proposed for the development of the proposed

Ncambedlana Bulk Sewer Pipeline, Mthatha KSD Municipality, OR Tambo District Municipality, Eastern Cape Province is located on areas underlain by Karoo aged sedimentary rocks of the Permian to Early Triassic Balfour Formation, Adelaide Subgroup. The study area is specifically underlain by rocks of the Palingkloof Member of this formation. Fossils are expected in these sediments, possibly cutting the significant Permian Extinction zone that records the extinction event during which 80%-90% of life on earth perished. Due to the nature of the development it is expected that most of the excavations will be at least 1,5m deep, which will lead to exposure of bedrock along the route of the proposed pipeline and fossils will be associated with the green and red mudstone of the Palingkloof Member, Balfour Formation. A Very High Palaeontological sensitivity is allocated to the entire route of the Ncambedlana Sewer development" (Groenewald 2015 – Appendix B)'

MANAGEMENT PLAN

The PIA desktop noted that a Phase 1a survey would yield little information in its current state. However, construction activity will expose fossil bearing layers and mitigation will be required. Dr. Groenewald states that a qualified palaeontologist will be required to be on site during construction activity, specifically when trenching is undertaken and that this forms part of the EMP.

The palaeontologist will record and collect fossils during this stage. Both the palaeontologist and the client will require a permit from ECHPRA. These permit application needs to be undertaken several months before construction activity begins.

The palaeontologist needs to be informed once the trenching plans are finalised.

CONCLUSION

A heritage survey was undertaken for the Ncambedlana Bulk Sewage Pipeline in Mthatha, E. Cape. Most of the line occurs in areas disturbed by cultivation and servitudes. The palaeontological impact assessment noted that the area is very sensitive for fossilised remains that will be exposed and affected by trenching activity. This will require a palaeontologist to be appointed to the project and the client needs to make adequate provision for this.

APPENDIX A:

NDULI HIA

HERITAGE SURVEY OF THE PROPOSED DEVELOPMENT AT NDULI GAME RESERVE, MTHATHA

FOR COASTAL ENVIRONMENTAL SERVICES

DATE: 29 April 2010

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INTRODUCTION

Umlando cc was contracted by Coastal Environmental Services (CES) to undertake a heritage assessment of the proposed development at Nduli Game Reserve, Umthatha, Eastern Cape (fig. 1-2). The development consists of several buildings along the south and western parts of the Reserve (fig. 3). These buildings will consist of a hotel and related structures.

The impacts on the area will be:

- Construction
- Access roads
- Servitudes related to water, sewage, electricity

The Nduli Game Reserve was declared in the late 1970s as a reserve by the then Transkei government. It was to be used as a public recreational area. Later on, it became popular for weddings at the 'Rock Garden'. In the 1980s, an area was used as a place for Christian worship. The general area appears not to have been heavily affected by human activity.

No heritage sites *per se* were observed in the study area; however, two living heritage sites were noted.

The western part of the reserve consists of a high hill with grasslands and rock outcrops (see figure 4).

FIG. 1: GENERAL LOCATION OF THE PROPOSED DEVELOPMENT

FIG. 2: PROPOSED LOCATION OF NDULI CONSERVANCY

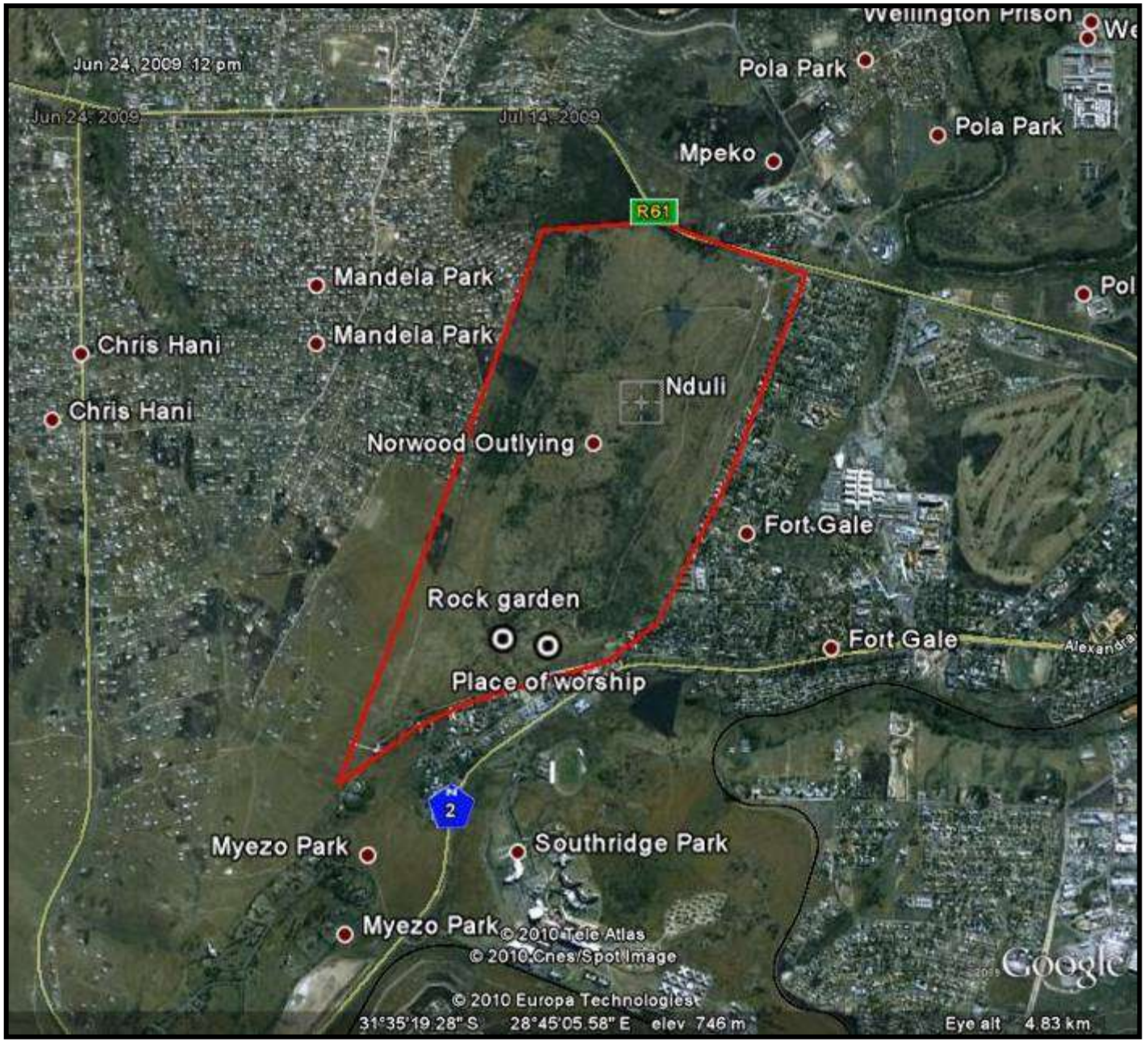

FIG. 3: LOCATION OF SITES AT NDULI CONSERVANCY

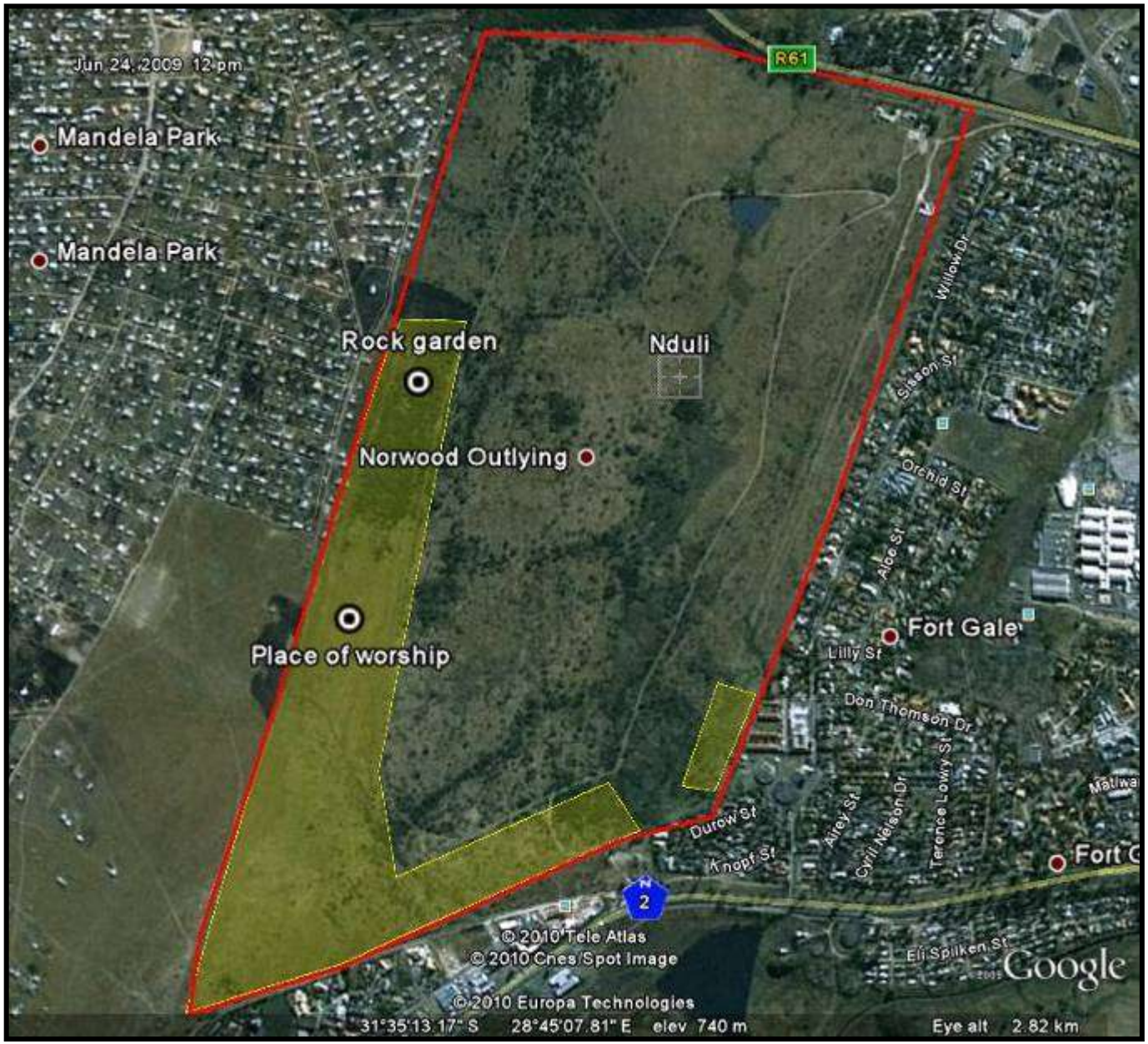
Jun 24, 2009 12 pm
R61
Mandela Park
Mandela Park
Rock garden
Nduli
Norwood Outlying
Place of worship
Fort Gale
Willow Dr
Sisson St
Orchid St
Aloe St
Lilly St
Don Thomson Dr
Durow St
Knapf St
Alvey St
Cyril Nelson Dr
Terence Lowry St
Eli Spiken St
Fort C
Matiwa
2
© 2010 Tele Atlas
© 2010 Cnes/Spot Image
© 2010 Europa Technologies
Google
31°35'13.17" S 28°45'07.81" E elev 740 m
Eye alt 2.82 km

FIG. 4: HILLS OF NDULI GAME RESERVE NORTH (TOP) AND SOUTH VIEW (BOTTOM)1

[1] Yellow arrow = place of worship; red arrow indicates approximate location of the Rock Garden

LEGISLATION PERTAINING TO HERITAGE SITES

The National Heritage Resources Act of 1999 (pp 12-14) protects a variety of heritage resources. This are resources are defined as follows:

"3. (1) For the purposes of this Act, those heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations must be considered part of the national estate and fall within the sphere of operations of heritage resources authorities.

(2) Without limiting the generality of subsection (1), the national estate may include—

(a) Places, buildings, structures and equipment of cultural significance;
(b) Places to which oral traditions are attached or which are associated with living heritage;
(c) Historical settlements and townscapes;
(d) Landscapes and natural features of cultural significance;
(e) Geological sites of scientific or cultural importance;
(f) Archaeological and palaeontological sites;
(g) Graves and burial grounds, including—
  (i) Ancestral graves;
  (ii) Royal graves and graves of traditional leaders;
  (iii) Graves of victims of conflict;
  (iv) Graves of individuals designated by the Minister by notice in the Gazette;
  (v) Historical graves and cemeteries; and
  (vi) Other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
(h) Sites of significance relating to the history of slavery in South Africa;
(i) Movable objects, including—
  (i) Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
  (ii) Objects to which oral traditions are attached or which are associated with living heritage;
  (iii) Ethnographic art and objects;
  (iv) Military objects;
  (v) objects of decorative or fine art;
  (vi) Objects of scientific or technological interest; and
  (vii) books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

(3)Without limiting the generality of subsections (1) and (2), a place or object is to be considered part of the national estate if it has cultural significance or other special value because of—

(a) Its importance in the community, or pattern of South Africa's history;
(b) Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
(c) Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
(d) Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
(e) Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;

(f) Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
(g) Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
(h) Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
(i) sites of significance relating to the history of slavery in South Africa"

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the databases. These databases contain most of the known memorials and other protected sites, battlefields and cemeteries in southern Africa. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The second step is the foot survey. 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:

9. State of preservation of:
9.1. Organic remains:
9.1.1. Faunal
9.1.2. Botanical
9.2. Rock art
9.3. Walling
9.4. Presence of a cultural deposit
9.5. Features:
9.5.1. Ash Features
9.5.2. Graves
9.5.3. Middens
9.5.4. Cattle byres
9.5.5. Bedding and ash complexes

10. Spatial arrangements:
10.1. Internal housing arrangements
10.2. Intra-site settlement patterns
10.3. Inter-site settlement patterns

11. Features of the site:
11.1. Are there any unusual, unique or rare artefacts or images at the site?
11.2. Is it a type site?
11.3. Does the site have a very good example of a specific time period, feature, or artefact?

12. Research:
12.1. Providing information on current research projects
12.2. Salvaging information for potential future research projects

13. Inter- and intra-site variability
13.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?
13.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

14. Archaeological Experience:

14.1. 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.

15. Educational:

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

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

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

16. Other Heritage Significance:

16.1. Palaeontological sites

16.2. Historical buildings

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

16.4. Graves and/or community cemeteries

16.5. Living Heritage Sites

16.6. 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

No heritage sites were observed during the survey. I did speak to the reserve manager who had no knowledge of any graves in the area. He did mention two areas that would be classified as living heritage sites.

PLACE OF WORSHIP

Mrs Nozuko Matanzima placed the memorial in 1986 (fig. 5). It was in commemoration of the fifth 'Anniversary of Women's Day of Prayer'. Since then it has been used as a general pale of worship.

The 'place of worship' is; however, in a neglected state. The corrugated iron cross has been toppled over, and the grass surrounding the memorial has not been mowed or cleared for a while.

The site would be considered as a living heritage site, and thus does not fall under the general heritage legislation.

Significance: Defining the significance of living heritage sites is difficult as it is relative. This specific site may be relevant to members of the community and the site would thus be of high significance. However, if no one uses or remembers the site any more then it would be of low significance in terms of living heritage status.

Mitigation: If the memorial plaque is in the line of development then there are several options:

1. Do not move the memorial and the cross
2. Move the memorial and cross away from the development, but keep it on the top of the hill. If it is moved, a small sign should state it has been moved.
3. Incorporate the memorial into the design of the development, e.g. make a public garden with the memorial as a centrepiece. The material originally used for the cross must remain the same.
4. If no one uses the area for worship and if there are no public objections then the memorial can be removed to a more central location, such as the picnic area near the entrance.
5. I believe the public should be consulted regarding this site and this can be undertaken by the social impact study.

FIG.5: PLACE OF WORSHIP

REG. TOOKE GARDEN OF REMEMBERANCE

The Reg. Tooke Garden of Remembrance, or colloquially referred to as 'The Rock Garden' is situated at the base of the northern part of the hill (fig. 6). I could not locate information on R. Tooke himself. The Rock Garden is now used mainly for wedding ceremonies.

The site is probably outside of the development footprint.

Significance: The site would be considered as a living heritage site, and thus does not fall under the general heritage legislation. The site would have general significance as it is in the memory of a specific person.

Mitigation: The site should not be affected by the development.

FIG.6: REG TOOKE GARDEN OF REMEMBERANCE (a.k.a THE ROCK GARDEN)

MANAGEMENT PLAN

There is no general management plan for the development. Only one site may be directly affected by the proposed development: the ‘place of worship’. The site has a living heritage status and I believe the Public Participation Process should incorporate this site. If the site is in the path of the development then it can be moved.

CONCLUSION

The heritage survey of the proposed development at Nduli Game Reserve did not observe any heritage sites. Two living heritage sites were noted, and one may be affected by the development. This site may be relocated or incorporated into the design of the proposed development.

APPENDIX A

PIA DESKTOP STUDY

DESKTOP PALAEONTOLOGICAL ASSESSMENT FOR THE PROPOSED NCAMBEDLANA BULK SEWER PIPELINE MTHATHA KSD MUNICIPALITY OR TAMBO DISTRICT MUNICIPALITY, EASTERN CAPE.

FOR

Umlando

DATE: 22 AUGUST 2015

By

Gideon Groenewald

Cell: 078 713 6377

EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed Ncambedlana Bulk Sewer Pipeline Mthatha KSD Municipality OR Tambo District Municipality, Eastern Cape

The project area is located approximately 5km North of Mthatha, falling to the East and to the West of the N2 National Road leading to Kokstad in the KSD Municipality, OR Tambo District Municipality Eastern Cape Province. The Northern boundary of the project is the Ncambedlana River. The development area is the Ncambedlana Smallholding farms just outside of the Mthatha CBD.

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

The entire study area proposed for the development of the proposed Ncambedlana Bulk Sewer Pipeline, Mthatha KSD Municipality, OR Tambo District Municipality, Eastern Cape Province is located on areas underlain by Karoo aged sedimentary rocks of the Permian to Early Triassic Balfour Formation, Adelaide Subgroup. The study area is specifically underlain by rocks of the Palingkloof Member of this formation. Fossils are expected in these sediments, possibly cutting the significant Permian Extinction zone that records the extinction event during which 80%-90% of life on earth perished. Due to the nature of the development it is expected that most of the excavations will be at least 1,5m deep, which will lead to exposure of bedrock along the route of the proposed pipeline and fossils will be associated with the green and red mudstone of the Palingkloof Member, Balfour Formation. A Very High Palaeontological sensitivity is allocated to the entire route of the Ncambedlana Sewer development.

Interpretation of the Google image reveals that very little outcrop is presently exposed and it will therefore be impractical to do a Phase 1 Palaeontological PIA at this stage of the planning process. It is proposed that a Phase 1 PIA be commissioned during excavation of the trenches for this development.

It is recommended that:

- The EAP and ECO of the project team be informed of the Very High Palaeontological sensitivity of the Palingkloof Member of the Balfour Formation, Adelaide Subgroup.
- Very little bedrock is presently exposed and it is not practical to do a Phase 1 PIA at this stage of the planning process.
- Due to the nature of the development, a suitably qualified palaeontologist must be appointed during the excavation phase of trenches, to record and collect fossils according to SAHRA specification.
- These recommendations must form part of the EMP of the project.

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INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed Ncambedlana Bulk Sewer Pipeline Mthatha KSD Municipality OR Tambo District Municipality, Eastern Cape (Figure 1)

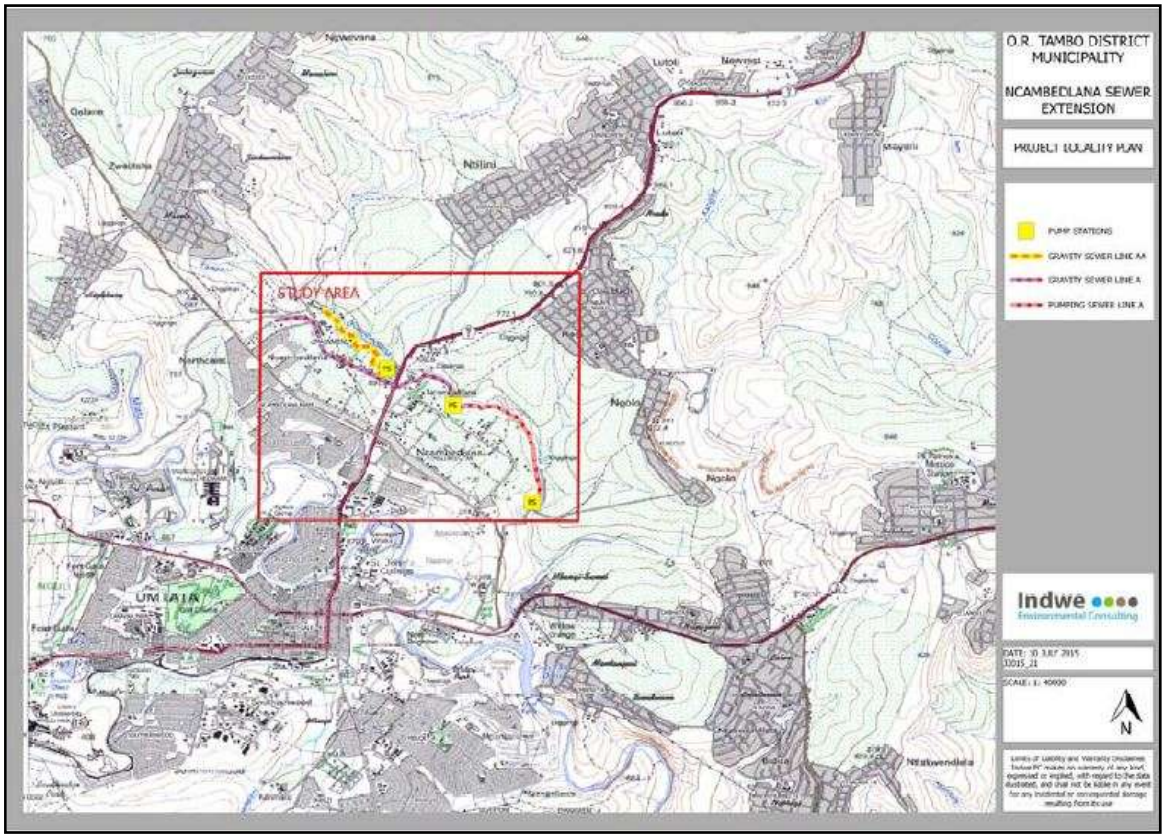

Figure 1 Locality of Study Area

In 2012 the President of South Africa announced the rejuvenation of the City of Mthatha and stated that this programme was a key Presidential Intervention Project (PIP). This rejuvenation process includes the "Breaking New Ground" (BNG) housing initiative, which seeks to deliver some 36,000 primarily low income housing units in Mthatha over a number of phases and sub-phases. In order to meet the bulk sewage requirements for this rejuvenation intervention, the OR Tambo District Municipality propose the phased refurbishment and/or upgrading of the existing bulk sewerage infrastructure as well as the phased installation of new sewerage infrastructure to accommodate the proposed new housing developments. Various sewer lines are currently under construction. A

new sewer line with pump stations is required to serve the Ncambedlana area, some 5km North of Mthatha.

The project area is located approximately 5km North of Mthatha, falling to the East and to the West of the N2 National Road leading to Kokstad in the KSD Municipality, OR Tambo District Municipality Eastern Cape Province. The Northern boundary of the project is the Ncambedlana River. The development area is the Ncambedlana Smallholding farms just outside of the Mthatha CBD.

According to the Preliminary Design Report prepared by Aseza Project Managers (2015), the sewer pipeline will have the following pertinent features:

- The new pipeline will be 5.5 km long, constructed along the southern bank of the Ncambedlana River.
- The pipe sizes will vary in size relevant to the quantity of flow in that section of pipe. Preliminary calculations indicate that the minimum pipe diameter will be a 200 mm and the maximum a 500 mm diameter pipe.
- New sewer pump stations will be constructed.
- The sewer will ultimately connect into the new Maydene Farm sewer main (currently under construction) and convey sewerage to the main existing Mthatha Waste Water Treatment Works.

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999

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

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

geological sites of scientific or cultural importance;

objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;

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

METHODOLOGY

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

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

to assess the level of palaeontological significance of these formations;

to comment on the impact of the development on these exposed and/or potential fossil resources and

to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps and Google Earth imagery. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

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

Table 1 Palaeontological sensitivity analysis outcome classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008, 2009) (Groenewald etal.,2014).	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory.

ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in larger alluvium deposits. Collection of a representative sample of potential fossiliferous material is recommended.

GREY	Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits.

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 sedimentary rocks of the Jurassic to Triassic aged Balfour Formation of the Adelaide Subgroup (Figure 2).

Adelaide Subgroup, Balfour Formation (Pa)

The Permian to Triassic aged Balfour Formation forms the upper part of the Adelaide Subgroup of the Karoo Supergroup. The formation consists of a lower sequence of interbedded green-coloured mudstone and grey sandstone, overlain by a predominantly red mudstone unit, known as the Palingkloof Member (Groenewald, 1996; Johnson et al, 2009). The Balfour Formation is interpreted as a meandering fluvial environment that gradually grades upwards into a lacustrine environment (Groenewald, 1996).

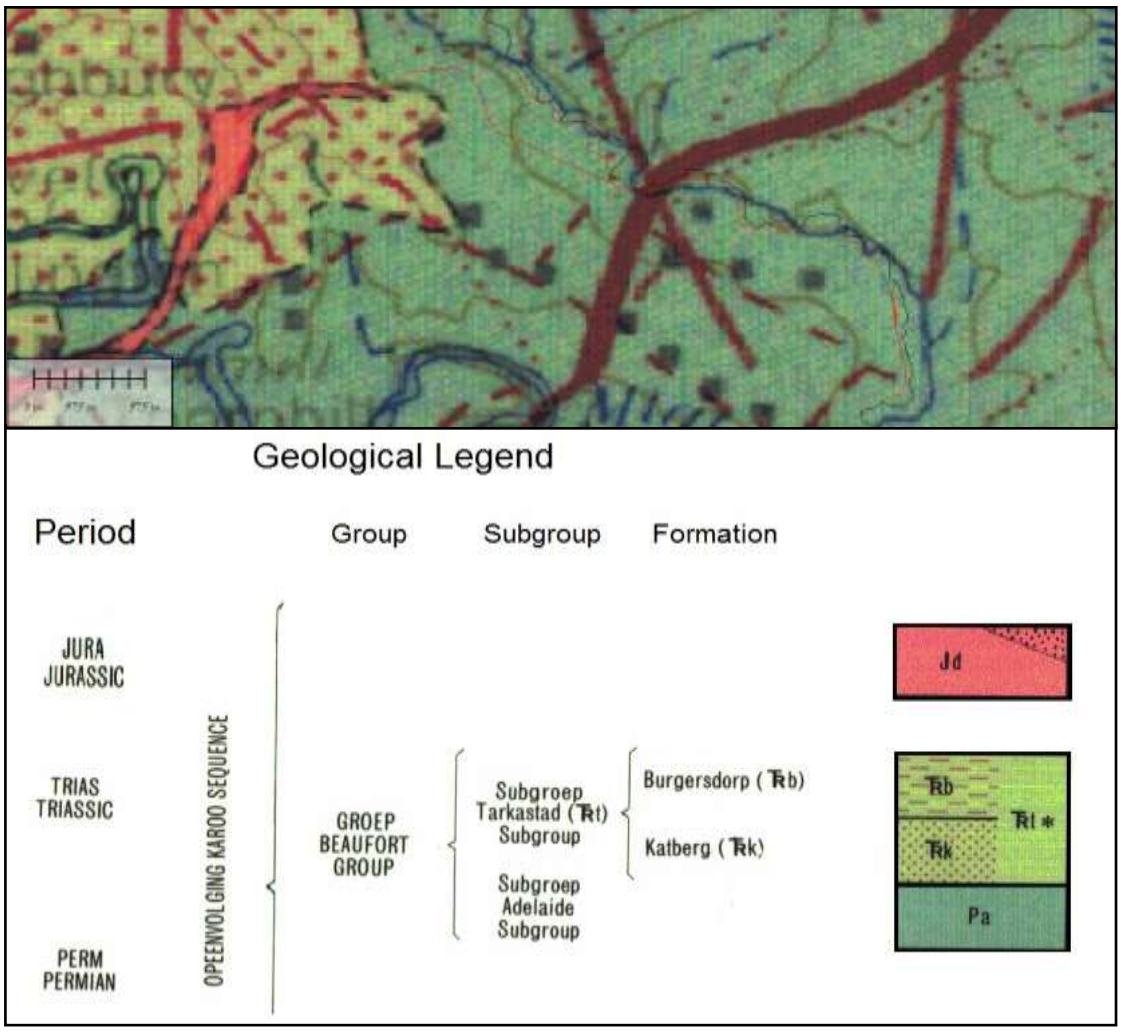

Figure 2 Geology of the Study Area

PALAEONTOLOGY

Adelaide Subgroup/Balfour Formation (Pa)

The Adelaide Subgroup, with special reference to the Balfour Formation, is highly productive as far as fossils are concerned. Fossils include plant fossils of *Glossopteris* and vertebrate fossils of the *Dicynodon* and *Lystrosaurus* Assemblage zones have been recorded from these rock units (Rubidge ed, 1995; Groenewald, 1996; Johnson et al, 2009).

The upper part of the Balfour Formation is characterised by a prominently red mudstone unit, the Triassic Palingkloof Member, dominated by the occurrence of fossils from the *Lystrosaurus* Assemblage Zone, including casts of vertebrate burrows (Groenewald, 1996).

DISCUSSION

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

Due to the number and abundance of fossils described from the Adelaide Subgroup/Balfour Formation, this unit has been allocated a Very High Palaeontological sensitivity.

Table 2 Palaeontological significance of geological units on site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Adelaide Subgroup/ Balfour Formation	Mudstone and sandstone *LATE PERMIAN/ TRIASSIC*	Plant fossils of *Glossopteris.* Numerous vertebrate fossils, most notably from animals of the Therapsid group e.g. *Gorgonopsians* and *Dicynodonts* as well as casts of vertebrate burrows	*Dicynodon* and *Lystrosaurus* Assemblage Zones	Very High 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 palaeontological sensitivity of the study area is shown in Figure 3.

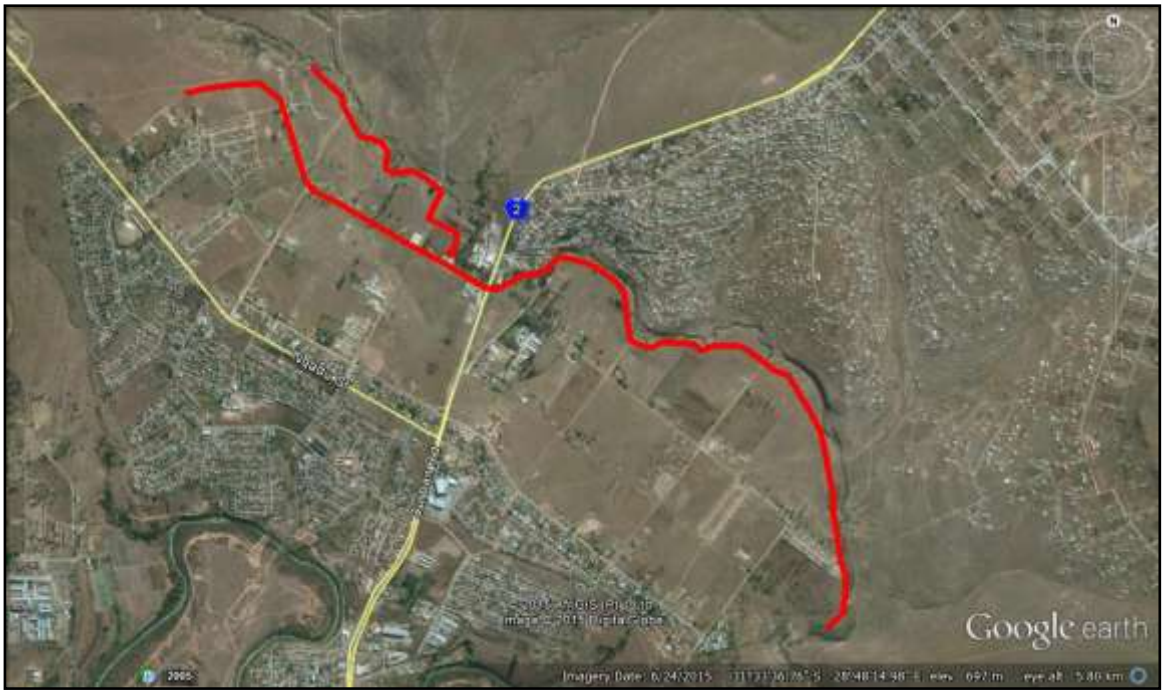

Figure 3 Palaeosensitivity for Ncambedlana Sewers. See Table 1 for explanation of colour coding.

Fossils are expected in the Permian and Triassic aged sediments, possibly cutting the significant Permian Extinction zone that records the extinction event during which 80%-90% of life on earth perished. Due to the nature of the development it is expected that most of the excavations will be at least 1,5m deep, which will lead to exposure of bedrock, belonging to the Palingkloof Member of the Balfour Formation along most of the route of the proposed pipeline. It is therefore highly likely that bedrock will be exposed during the development and fossils will be associated with the green and red mudstone of the Balfour Formation and specifically the upper part thereof, known as the Palingkloof Member, which is very rich in vertebrate as well as trace fossils of the *Lystrosaurus* Assemblage zone. A Very High Palaeontological sensitivity is allocated to the entire route of the Ncambedlana Sewer development (Figure 3).

Interpretation of the Google image reveals that very little outcrop is presently exposed and it will therefore be impractical to do a Phase 1 Palaeontological PIA at this stage of the planning process.

CONCLUSION

The entire study area proposed for the development of the proposed Ncambedlana Bulk Sewer Pipeline, Mthatha KSD Municipality, OR Tambo District Municipality, Eastern Cape Province is located on areas underlain by Karoo aged sedimentary rocks of the Permian to Early Triassic Balfour Formation, Adelaide Subgroup. The study area is specifically underlain by rocks of the Palingkloof Member of this formation. Fossils are expected in these sediments, possibly cutting the significant Permian Extinction zone that records the extinction event during which 80%-90% of life on earth perished. Due to the nature of the development it is expected that most of the excavations will be at least 1,5m deep, which will lead to exposure of bedrock along the route of the proposed pipeline and fossils will be associated with the green and red mudstone of the Palingkloof Member, Balfour Formation. A Very High Palaeontological sensitivity is allocated to the entire route of the Ncambedlana Sewer development (Figure 3).

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It is recommended that:

- The EAP and ECO of the project team be informed of the Very High Palaeontological sensitivity of the Palingkloof Member of the Balfour Formation, Adelaide Subgroup.
- Very little bedrock is presently exposed and it is not practical to do a Phase 1 PIA at this stage of the planning process.
- Due to the nature of the development, a suitably qualified palaeontologist must be appointed during the excavation phase of trenches, to record and collect fossils according to SAHRA specification.
- These recommendations must form part of the EMP of the project.

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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