HERITAGE SURVEY OF THE PROPOSED PORT ST JOHNS WASTE WATER TREATMENT WORKS

FOR EOH CES

DATE: 5 APRIL 2017

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EXECUTIVE SUMMARY

OR Tambo District Municipality is proposing the development of a new waste water treatment works with a capacity of 3.5 Ml/day to serve the town of Port St Johns. Additional pipelines and booster stations will be added.

A heritage survey was undertaken for the reservoirs and pipelines. Reservoir sites 2, 4 and 8 were given (very) high palaeontological significance if excavations went deeper than 2m and in areas that have not been affected by previous reservoirs. A geotechnical report would be able to pinpoint sensitive areas in terms of the palaeontological sensitivity.

No archaeological sites were recorded during the survey, nor are any expected to be exposed during construction.

TABLE OF CONTENT

TABLE OF FIGURES

Abbreviations

HP	Historical Period
IIA	Indeterminate Iron Age
LIA	Late Iron Age
EIA	Early Iron Age
ISA	Indeterminate Stone Age
ESA	Early Stone Age
MSA	Middle Stone Age
LSA	Late Stone Age
HIA	Heritage Impact Assessment
PIA	Palaeontological Impact Assessment

INTRODUCTION

OR Tambo District Municipality is proposing the development of a new waste water treatment works (WWTW) with a capacity of 3.5 Ml/day to serve the town of Port St Johns. The proposed treatment option is an aerated activated sludge system. It must be noted that limited sites are available to the Port St Johns LM and the nature of PSJ in terms of topography and its sensitive forest vegetation also limits the site options for the placement of a WWTW. Four site alternatives will be assessed in the draft BAR.

The locations of the four sites are shown in Figures 1 – 6.

Umlando was subcontracted by EOH Coastal Environmental Services to undertake an HIA of the area.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

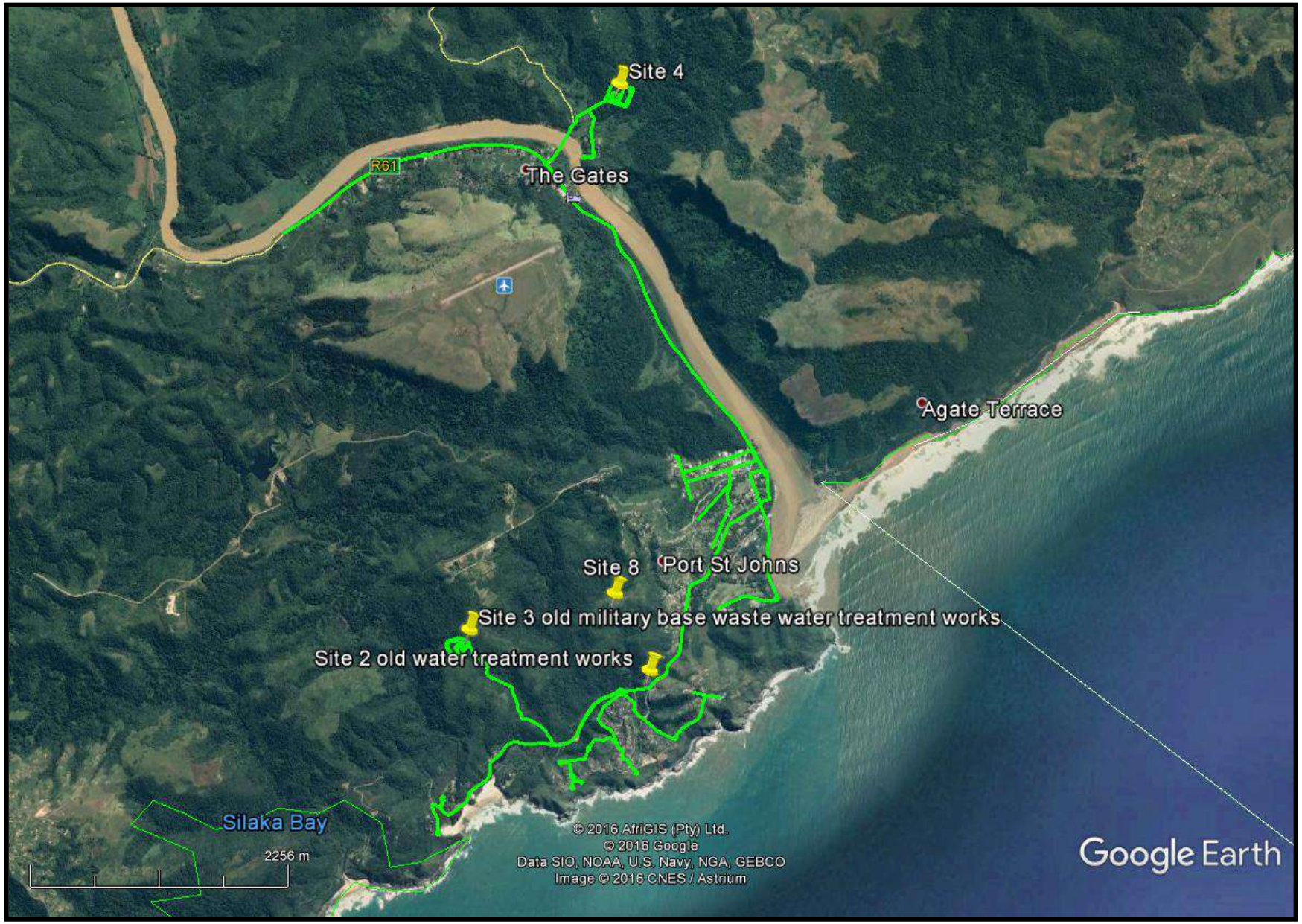


FIG. 2: TOPOGRAPHICAL MAP OF THE STUDY AREA

FIG. 3: AERIALMAP OF SITE 2

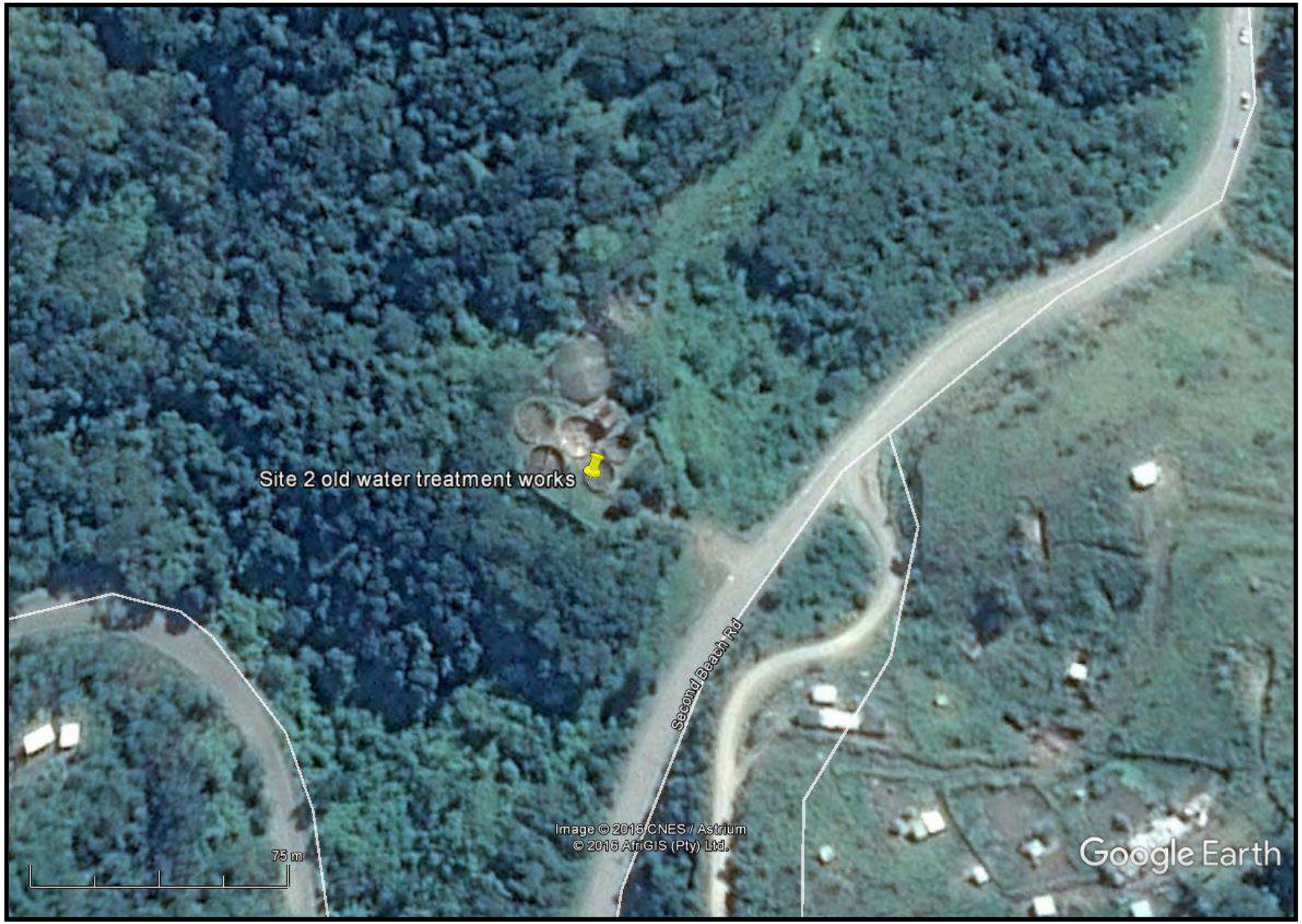


FIG. 4: AERIALMAP OF SITE 3

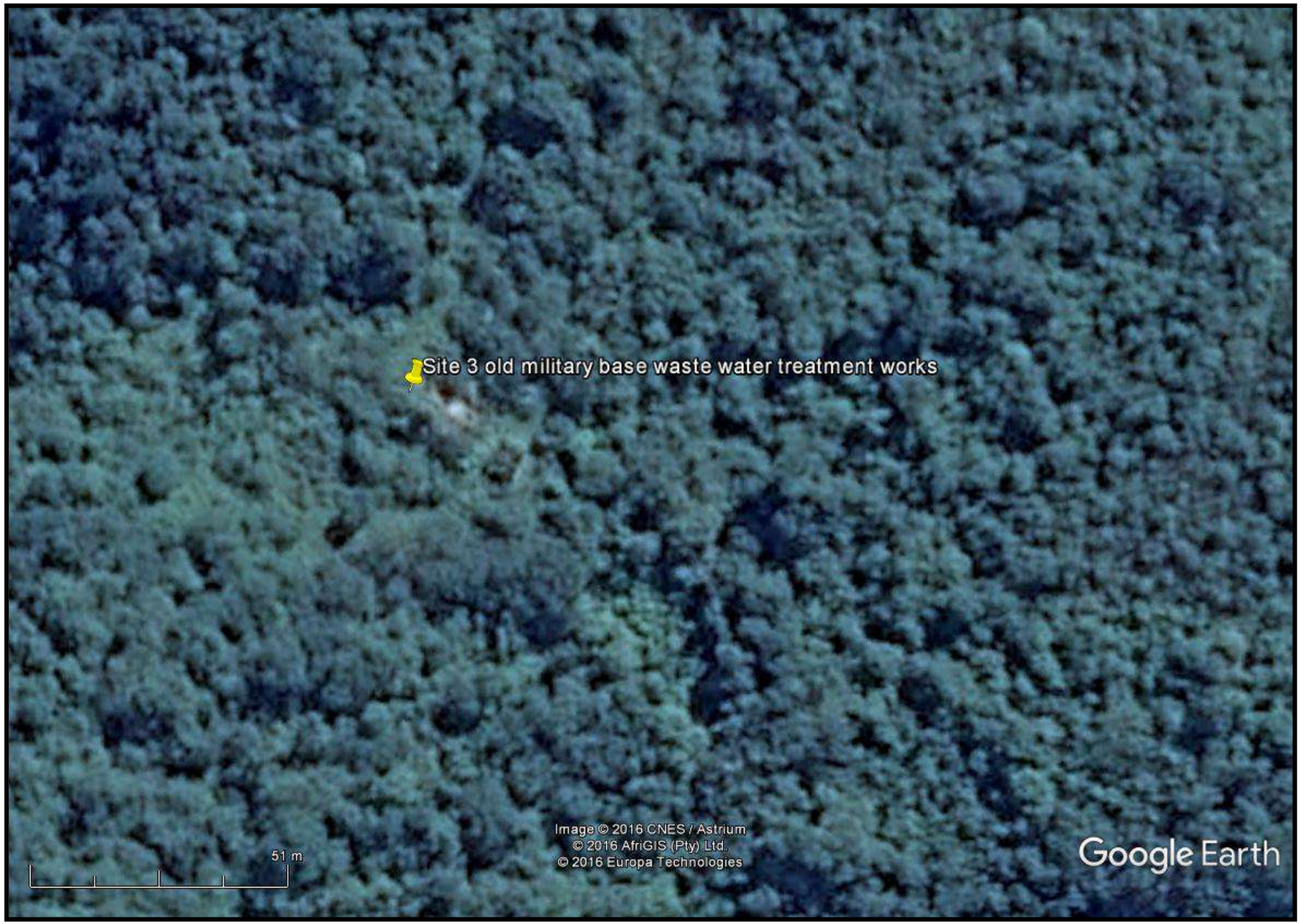
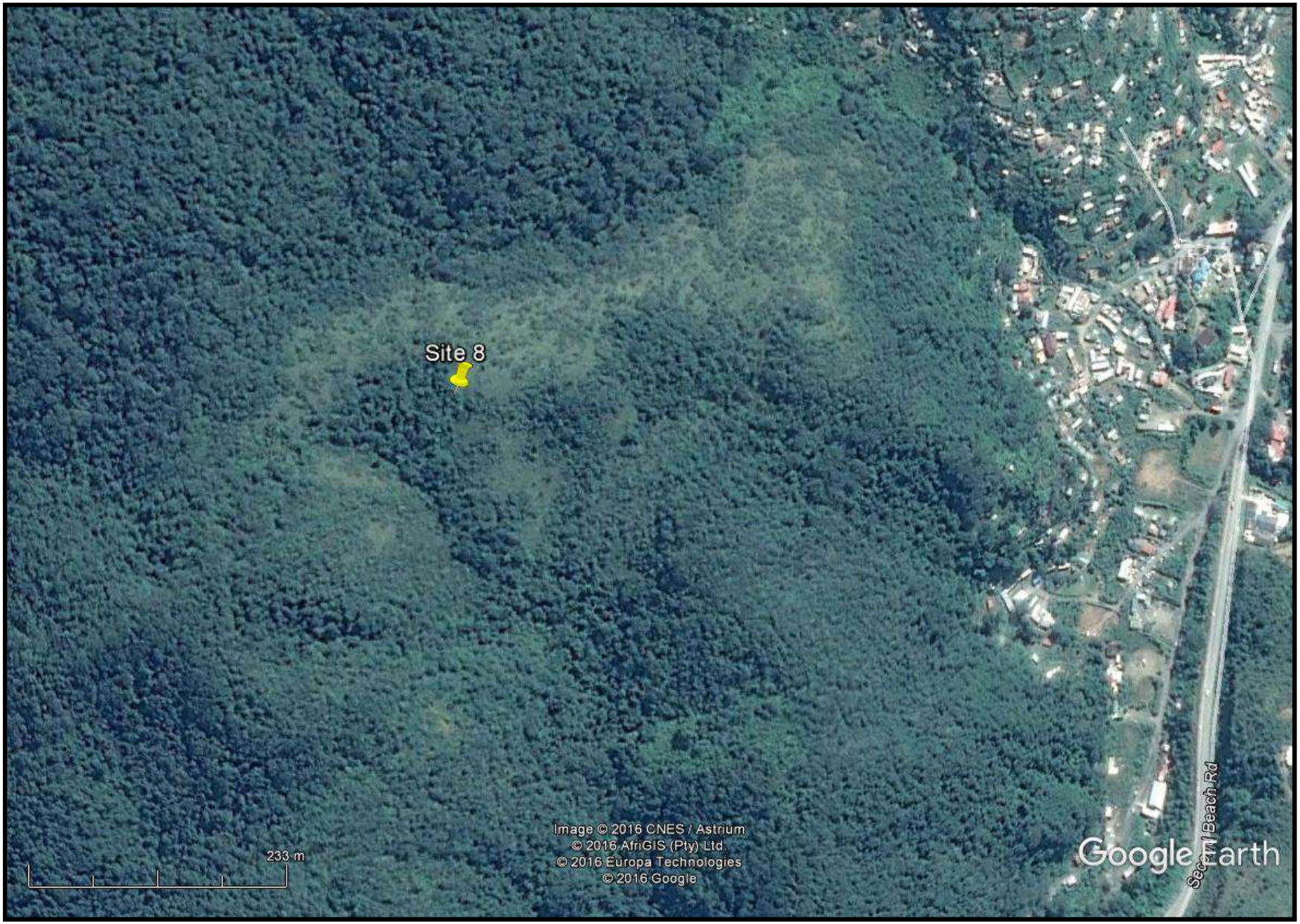


FIG. 5: AERIALMAP OF SITE 4

FIG. 6: TOPOGRAPHICAL MAP OF SITE 8



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.

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

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

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

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. I also used various sources for historical information.

PREVIOUS ACHAEOLOGICAL & HERITAGE SURVEYS

There have been no previous heritage surveys near the study areas (fig. 7). Anderson (2010, 2015) has recorded a few sites to the north. These include historical buildings (or trading stores), LIA and MSA sites.

No national monuments, battlefields, or historical cemeteries are known to occur along the route or the locations of the proposed reservoirs. Port St Johns is an historical town; however, no buildings will be affected by the proposed development.

HISTORICAL MAPS

The 1937 aerial photographs indicate that Site 2 was in indigenous forest (fig. 8). Sites 3 and 8 were in open grasslands on the top of the hill (fig. 9). Parts of site 4 appear to be in an area cleared for agriculture (fig. 10). No structures are visible on these maps.

FIG. 7: KNOWN HERITAGE SITES IN THE AREA

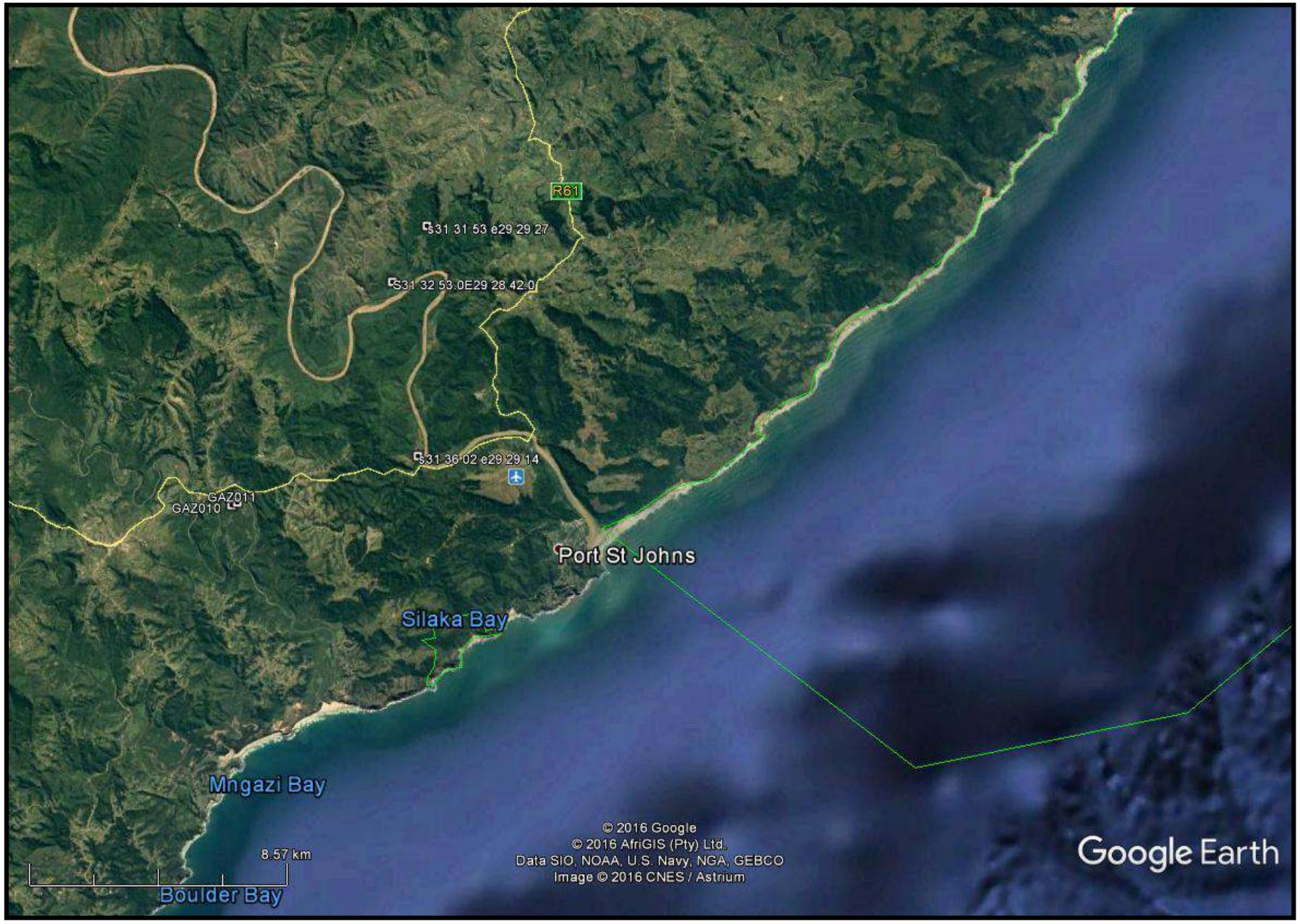


FIG. 8: AREA VIEW OF SITES 2 AND 8 IN 1937

FIG. 9: AREA VIEW OF SITE 3 IN 1937

FIG. 10: AREA VIEW OF SITE 4 IN 1937

PALAEONTOLOGICAL SENSITIVITY

A desktop PIA was undertaken for this project (see Appendix A). The results from the report indicate the area falls into three categories of sensitivity (fig. 11):

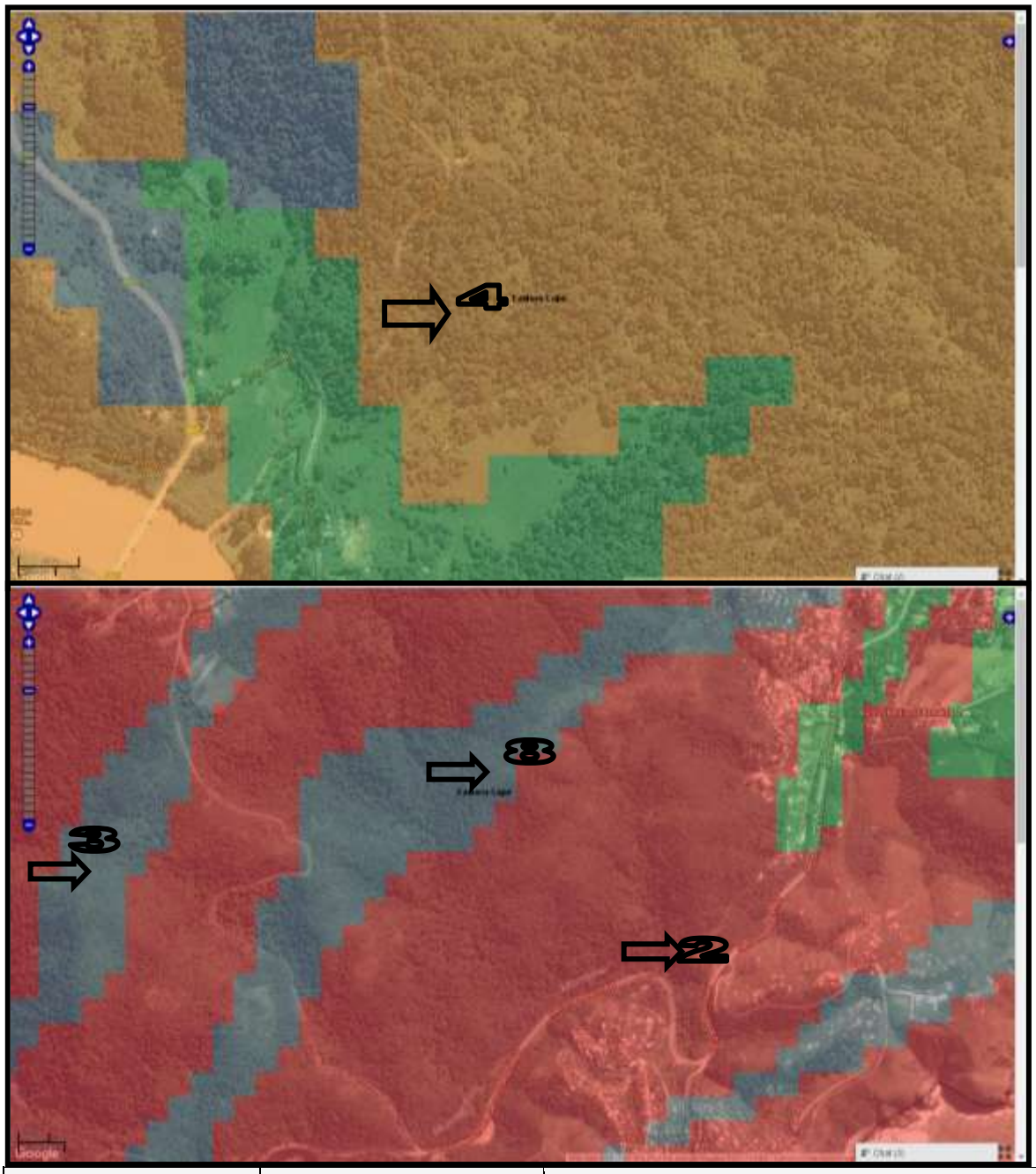
1. Grey
   1.1. Site 3 is in a insignificant/zero sensitivity, although
2. Orange
   2.1. Site 4 and 8 are in areas of high sensitivity
3. Red
   3.1. Site 2 is in an area of very high sensitivity
   3.2. The proposed pipelines in town.

The report indicates that a geotechnical report would finalise if further mitigation is required. The report also indicated that the areas for the pipelines will not uncover significant palaeontological finds.

The mitigation is as follows:

1. The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity is allocated to sites 2 and 8 whilst site 4 is allocated a High Palaeontological sensitivity with site 3 being very low in Palaeontological significance. If the geotechnical investigation indicates exposure of bedrock at sites 2, 4 and 8, a Phase 1 PIA and "Chance Find Protocol" document is essential for this project. The above is if the new WWTW occur in areas that have not been disturbed by existing structures and do not extend more than 2m below the surface.
2. It is essential that the geotechnical reports are read in conjunction with these recommendations. If there is any indication of the exposure of significant bedrock, a suitably qualified Palaeontologist must be appointed to do a Phase 1 site inspection during the first week of excavation and prepare a CFP document to be included in the EMPr for the project.
3. These recommendations must be included in the EMPr of this project.

FIG. 11: PALAEONTOLOGICAL SENSITIVITY AT THE PROPOSED RESERVOIRS



COLOUR	SENSITIVITY	REQUIRED ACTION
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required

GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

FIELD SURVEY

The field survey was undertaken in March 2017. Each proposed reservoir was surveyed, as well as the pipeline routes and pumping stations for the pipelines. The pipeline routes mostly follow existing roads

Site 2

Site 2 consists of the old water works area (fig 12). The buildings are younger than 60 years in age and do not require further mitigation. No heritage sties occur in this area.

FIG. 12: WATER TREATMENT WORKS AT SITE 2

Site 3

Site 3 is the abandoned military water works (fig 13). The buildings are younger than 60 years in age and do not require further mitigation. No heritage sties occur in this area.

FIG. 13: WATER TREATMENT WORKS AT SITE 3

Site 4

Site 4 is located north of the Mzimvubu River. The area is in dense indigenous forest resulting in poor visibility. It is unlikely for heritage sites to occur in this area.

The area is of high palaeontological sensitivity. Unlike the other areas, this site has not been disturbed by construction activity. A qualified palaeontologist might be required to inspect the site before and/or during construction. This must be made part of the management plan if this site is chosen.

Site 8

Site 8 occurs on top of the hill above Site 2 (fig. 15). The area has recently been partially cleared. No heritage sites were noted in this area.

FIG. 14: INDIGENOUS FOREST AT SITE 4

FIG. 15: SITE 8

CONCLUSION

A heritage survey was undertaken for the proposed Port St Johns Waste Water Treatment works.

No heritage sites were observed along the route and reservoir locations. Further PIA mitigation will be required if Site 4 is chosen. IF sites 2 or 8 are selected then further PIA mitigation might be required, pending the final location of the WWTW. That is if they occur on existing structures, or in adjacent areas. The latter will require further mitigation. A geotechnical report for the final WWTW location will assist in the PIA management plan.

REFERENCES

Anderson, G. 2010. Heritage Survey Of The Proposed Umgazi Citrus Project. For Coastal Environmental Services

Anderson, G. 2015. Heritage Survey Of The Port St Johns Waste Water Treatment Works, Eastern Cape. For Coastal Environmental Services

EXPERIENCE OF THE HERITAGE CONSULTANT

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

DECLARATION OF INDEPENDENCE

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

Gavin Anderson
Archaeologist/Heritage Impact Assessor

APPENDIX A

PALAEONTOLOGICAL DESKTOP STUDY

• DESKTOP PALAEONTOLOGICAL ASSESSMENT FOR THE PROPOSED WASTE WATER TREATMENT WORKS AT PORT ST JOHNS (PSJWWTW), PORT ST JOHNS LOCAL MUNICIPALITY, O.R.TAMBO DISTRICT MUNICIPALITY, EASTERN CAPE PROVINCE.

FOR

Umlando

DATE: 26 April 2017

By

Gideon Groenewald

Cell: 078 713 6377

EXECUTIVE SUMMARY

- Gideon Groenewald was appointed by Umlando to undertake a Desktop Survey, assessing the potential Palaeontological Impact related to an application for development of a Waste Water Treatment Works at Port St Johns (PSJWWTW), Port St Johns Local Municipality, O.R.Tambo District Municipality, Eastern Cape Province.

Legal Requirements

- This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. 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 development site for the proposed development of a Waste Water Treatment Works at Port St Johns (PSJWWTW), Port St Johns Local Municipality, O.R.Tambo District Municipality, Eastern Cape Province, is underlain by Permian aged sedimentary rocks of the Ecca and Beaufort Groups and dolerite of the Karoo Supergroup.

No significant fossils are expected before deep excavation (>2m) are done but if fossils are recorded during excavations, it will contribute significantly to our knowledge of the Palaeontological Heritage of the Eastern Cape Province.

It is recommended that:

The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity is allocated to sites 2 and 8 whilst site 4 is allocated a High Palaeontological sensitivity with site 3 being very low in Palaeontological significance. If the geotechnical investigation indicates exposure of bedrock at sites 2, 4 and 8, a Phase 1 PIA and "Chance Find Protocol" document is essential for this project.

It is essential that the geotechnical report is read in conjunction with these recommendations. If there is any indication of the exposure of significant bedrock, a suitably qualified Palaeontologist must be appointed to do a Phase 1 site inspection during the first week of excavation and prepare a "Chance Find Protocol" document to be included in the EMPr for the project.

These recommendations must be included in the EMPr of this project.

TABLE OF CONTENT

TABLE OF FIGURES

LIST OF TABLES

INTRODUCTION

- Gideon Groenewald was appointed by Umlando to undertake a Desktop Survey, assessing the potential Palaeontological Impact related to an application for development of a Waste Water Treatment Works at Port St Johns (PSJWWTW), Port St Johns Local Municipality, O.R.Tambo District Municipality, Eastern Cape Province.

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

Aims and Methodology

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

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

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

Prior to a field investigation a preliminary assessment (desktop study) of the topography and geology of the study area is made using appropriate 1:250 000 geological maps (3028 Kokstad) in conjunction with Google Earth. Potential fossiliferous rock units (groups, formations etc) are identified within the study area and the known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

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

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

Table 1 Palaeontological sensitivity analysis outcome classification

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

BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey and "Chance Find Protocol" is compulsory. The Chance Find Protocol must be included in the EMPr for the project.
GREY	Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of

	development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey and "Chance Find Protocol" document is compulsory. The Chance Find Protocol must be included in the EMPr of the project.

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures must be incorporated into the Environmental Management Plan. All projects falling on Low to Very Low Palaeontological sensitivity geology must be discussed in either a Phase 1 PIA or Chance Find Protocol (CFP) document that must form part of the EMPr of the project.

Scope and Limitations of the Desktop Study

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

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA and the Kingdom of Lesotho. Most development study areas have never been surveyed by a palaeontologist.

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

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

Locality and Proposed Development

The client still need to decide on one of four implementation sites for the treatment works and four sites are investigated in this report (Figure 1).

The connecting pipelines fall on mostly Very Highly Palaeontological

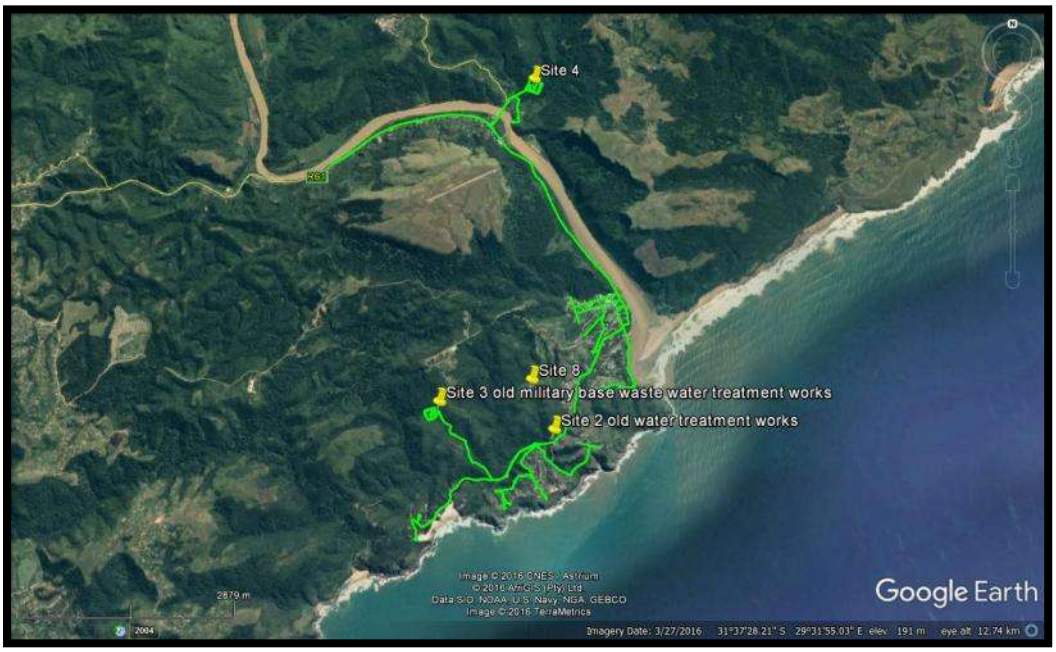

Figure 1 Locality and layout of the Port St Johns Waste Water Treatment Works proposed sites

sensitivity areas, but most of the lines are either following existing highly disturbed routes or the excavation will be into highly weathered rocks of the Ecca and Beaufort Groups, with a very low to insignificant possibility of exposing any significant fossils.

The project aims to optimise the main waste water routes linking to the most suitable site in the study area, ensuring integration of the proposed development and existing built environment as well as optimising pedestrian movement and safety of people.

GEOLOGY

The four points of interest in the study area is underlain predominantly by Permian aged rocks of the Ecca Group of the Karoo Supergroup (Figure 2).

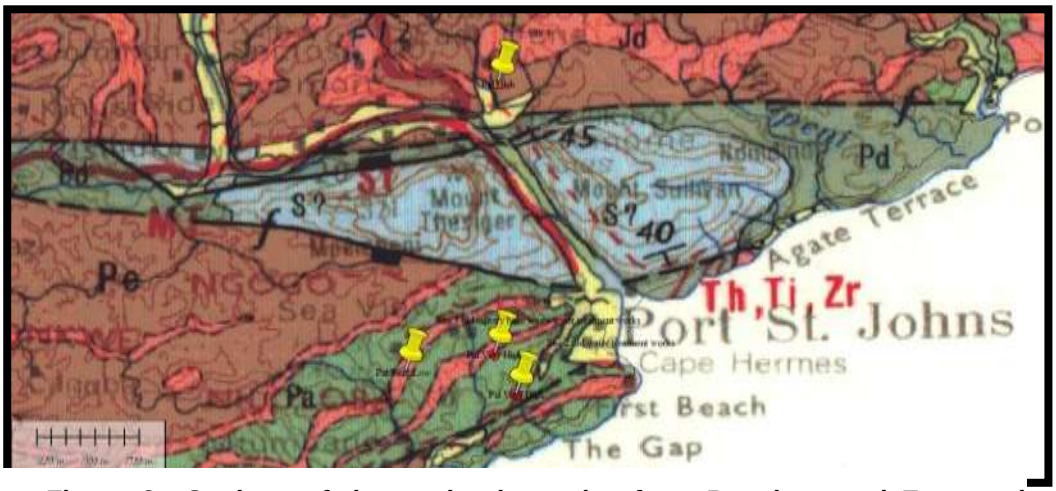

Figure 2 Geology of the study site varies from Permian aged Ecca and Beaufort Group sediments to Jurassic aged dolerite

Karoo Supergroup

Ecca Group (Pe)

The Permian aged Ecca Group consist of an assemblage of fine-grained sediments, consisting mainly of dark grey shale and subordinate sandstone layers. The deposits represent predominantly Permian aged marine deposits that were deposited in offshore shelf, but possibly also nearshore / lacustrine / lagoonal environments in this part of Gondwanaland. The upper part of the formation becomes more sandstone rich and is indicative of a westward migration of a deltaic system into the predominantly marine environments that existed during the Permian in this part of the Karoo Basin (Johnson et al, 2009).

Beaufort Group

Adelaide Subgroup (Pa)

The Permian to Triassic aged Adelaide Subgroup of the Beaufort Group is by far one of the most famous terrestrial deposit of fluvial and lacustrine sediments in South Africa (MacRae, 1999; McCarthy and Rubidge, 2005; Johnson et al, 2009). The subgroup consists predominantly of interbedded sandstone and greenish grey to maroon and red colored mudstone, representing ages of river and lake deposits that washed into an extensive part of the Karoo Basin.

Karoo Dolerite

The Jurassic aged Karoo dolerite intrusions that varies from meter scale dolerite dykes to hundreds of meters of dolerite sills, represent volcanic intrusions into the Karoo Sequence during the breakup of Gondwanaland about 182 million years ago.

PALAEONTOLOGY

Ecca Group

Ecca Group (Pe)

Trace fossils as well as well-defined plant fossils (Groenewald, 2011) have been described from the upper layers of the Formation in this part of the Karoo Basin (Johnson et al. 2009). Fossils are generally absent from the lower part of the Group although trace fossils have been recorded from the upper layers of the Pietermaritzburg Formation in KZN by Linstrom (1987).

The sandy layers in the middle Ecca Group is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. These deposits have not been mapped in detail in the study are but plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Glossopteris > 20 species, Hirsutum 4 spp., Scutum 4 spp., Ottokaria 3 spp., Estcourtia sp., Arberia 4 spp., Lidgetonnia sp., Noeggerathiopsis sp. and Podocarpidites sp.*

According to Bamford (2011) “Little data have been published on these potentially fossiliferous deposits. Around the coalmines in the north there is most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur fossil plants are usually abundant (Groenewald, 2011) and it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution.

Although no vertebrate fossils have been recorded from the Ecca Group in the study area, invertebrate trace fossils have been described in some detail by Mason and Christie (1985). It should be noted, however, that the aquatic reptile, *Mesosaurus*, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999; Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Ecca Group in the study area. If this

assumption proves correct, there is a possibility that Mesosaurus could be found (Catuneanu et al 2005).

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985).

Trace fossils have been described from the upper layers of the Ecca Group and the bivalve *Megadesmus* is described from the Late Permian Volksrust Shale Formation in the north-eastern Karoo Basin, South Africa. This was the first reported discovery of this genus in Africa. The fossil is large, 9 cm dorsally and 8.4 cm laterally, and both valves are articulated indicating minimum transport after death. The bivalve was encased in interbedded siltstone-shale that constitutes the distal sediments of a prograding delta at the Beaufort –Ecca Group boundary. *Megadesmus* is known from other continents (Australia, India, Siberia, South America and Tasmania) where its presence indicates exclusively marine conditions. The implication for the northeastern Karoo Basin during the Late Permian is that a marine enclave still existed in this geographic area and that terrestrial conditions did not yet prevail as in the southern basin region (Cairncross, 2005).

Beaufort Group

Adelaide Subgroup (Pa)

The Adelaide Subgroup is well-known for the very significant finds of plant (Glossopteris), insects and vertebrate fossils in this unit in South Africa (MacRae, 1999; McCarthy and Rubidge, 2005 and Johnson et al, 2009). Significant finds of Glossopteris leaves were recorded in quarries to the west of Port St Johns during 2011 (Groenewald, 2011) and although no known records exist of vertebrate remains discovered to date, the subgroup forms one of the most important Biostratigraphic Assemblage units in the Karoo Basin. Recording of any vertebrate remains from the study area will contribute significantly to our understanding of the biostratigraphy in this part of the Karoo Basin. Fossils that can be expected in the study area include fossils from the *Daptocephalus* and *Lystrosaurus* Assemblage Zones.

Due to the extreme depth of weathering and the lack of outcrops of bedrock in this study area, it is unlikely that any fossil material would be preserved in

significant quantities. Due to the methodology of excavation for trenching it is also unlikely that any material will remain in tacked for curation.

The EAP and ECO must however be advised to be on the lookout for suspiciously looking rocks and to report any possible fossils to the HIA specialist for further investigation. This will specifically be a requirement where excavations exceed 2m in depth at the development nodes.

Diolerite

Dolerite will not contain any fossils.

PALAEONTOLOGICAL IMPACT AND MITIGATION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews as well as information gathered during the desktop investigation. The desktop investigation confirms that the study area is underlain by fine-grained dark coloured to dark grey shale and sandstone beds of the Ecca Group of the Karoo Supergroup which normally leads to the formation of either light coloured Valsrivier Form, or dark vertic Arcadia Form soils or sand cover. Other soils forms expected in the study area underlain by rocks of the Beaufort Group includes Westleigh soils, whilst dolerite will normally be associated with red coloured highly clay-rich Hutton soil forms.

Figure 3 Palaeontological sensitivity of the four proposed sites for the development of Waste Water Treatment Works at Port St Johns in the Eastern Cape Province. For explanation of colour coding see Table 1.

The excavations for the construction of the infrastructure for this development will expose some sediments of the Ecca Group at option site 4, sedimentary rocks of the Adelaide Subgroup at site 2 and site 8, with mainly dolerite present at site 3. Due to weathering, no well-preserved fossils are expected before very deep (>2m) excavations are completed. Exposure of bedrock during excavation might however result in the exposure of significant plant and trace fossils in the shale as well as possible vertebrate fossils in the sediments of the Adelaide Subgroup that might not be mapped on the scale of the present 1:250 000 Geological Series of South Africa. Recording of fossils will contribute significantly to our understanding of previous eco-systems. A Phase 1 PIA, done by a suitably qualified palaeontologist, is only recommended if geotechnical reports

indicate a certainty that significant exposure of bedrock will result during the excavations for the Waste Water Treatment Works at sites 2 and 8. If rocks of the Adelaide Subgroup will be exposed significantly, a site visit during the first week of excavation and the formulation of a "Chance Find Protocol" is compulsory for sites 2 and 8. The chance find of significant fossils at site 4 is high if excavations will be significantly into bedrock. Site 3 falls on dolerite and no fossils are expected.

If the geotechnical research indicates that significant bedrock will be exposed at sites 2 and 8, The "Chance Find Protocol" document and its findings must form part of the EMPr for this project and presented for approval to the Eastern Cape Provincial Heritage Resources Authority (ECPHRA) and SAHRA (South African Heritage Resources Agency), before the final ROD for the EIA process can be requested from Eastern Cape Department of Economic Development Environmental Affairs and Tourism (DEDEAT).

CONCLUSION

- The development site for the proposed development of a Waste Water Treatment Works at Port St Johns (PSJWWTW), Port St Johns Local Municipality, O.R.Tambo District Municipality, Eastern Cape Province, is underlain by Permian aged sedimentary rocks of the Ecca and Beaufort Groups and dolerite of the Karoo Supergroup.

No significant fossils are expected before deep excavation (>2m) are done but if fossils are recorded during excavations, it will contribute significantly to our knowledge of the Palaeontological Heritage of the Eastern Cape Province.

It is recommended that:

The EAP and ECO must be informed of the fact that a Very High Palaeontological Sensitivity is allocated to sites 2 and 8 whilst site 4 is allocated a High Palaeontological sensitivity with site 3 being very low in Palaeontological significance. If the geotechnical investigation indicates exposure of bedrock at sites 2, 4 and 8, a Phase 1 PIA and "Chance Find Protocol" document is essential for this project.

It is essential that the geotechnical reports are read in conjunction with these recommendations. If there is any indication of the exposure of significant bedrock, a suitably qualified Palaeontologist must be appointed to do a Phase 1 site inspection during the first week of excavation and prepare a CFP document to be included in the EMPr for the project.

These recommendations must be included in the EMPr of this 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