SURVEY OF THE PROPOSED MAIDSTONE MILL EFFLUENT TREATMENT PLANT, TONGAAT

FOR TONGAAT DEVELOPMENTS

DATE: 12 SEPTEMEBR 2016

By Gavin Anderson

Umlando: Archaeological Surveys and Heritage Management

PO Box 102532, Meerensee, 3901

Phone/fax: 035-7531785 Fax: 0865445631

Cell: 0836585362

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

Umlando was appointed by Tongaat developments to undertake a heritage survey of the proposed Maidstone Mill effluent treatment plant, at Tongaat, KwaZulu-Natal.

Tongaat Hulett Development (Pty) Ltd (Tongaat Hulett) is proposing a sustainable long-term solution for managing the effluent generated at their Maidstone Sugar Mill (the Mill), located in Tongaat, eThekwini Municipality. The solution is proposed to comprise of the development of an Effluent Treatment Plant (ETP) to treat the Mill's effluent prior to discharge to the Tongaati River and a stormwater Pollution Control Dam (PCD).

The site is located within the town of Tongaat, near the northern border of the eThekwini Municipality, approximately 40 km from the centre of Durban. The footprint of the proposed project is 7 700 m3. The site of the proposed project is located on the northern bank of the Tongaati River, between the Mill's southern boundary fence and the Tongaat River flood plain.

The location of the site is shown in Figures 1 – 3. Figure 4 shows the site.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

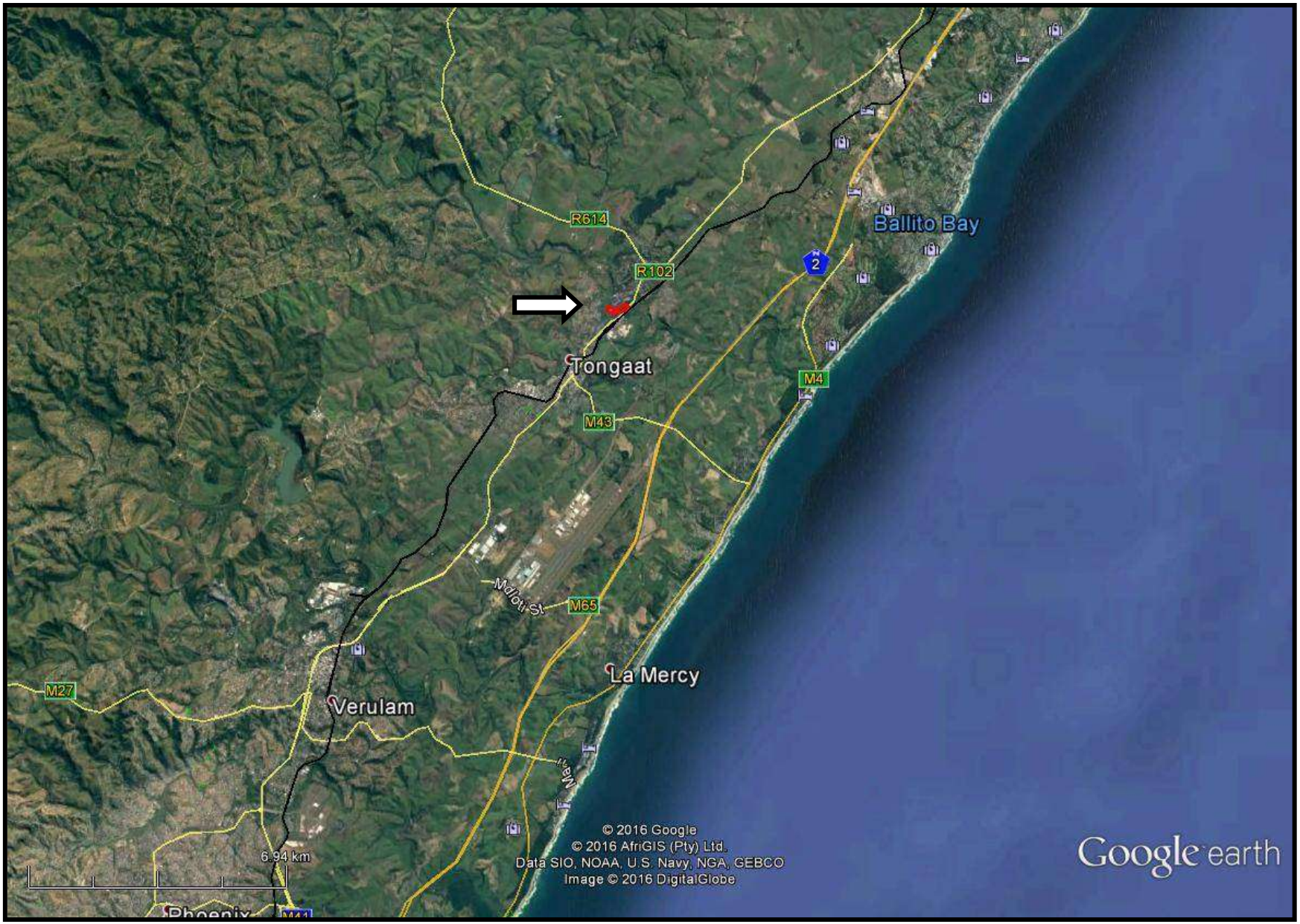


FIG. 2: AERIAL OVERVIEW OF THE APPROXIMATE FOOTPRINT

FIG. 3: TOPOGRAPHICAL OVERVIEW OF THE AREA

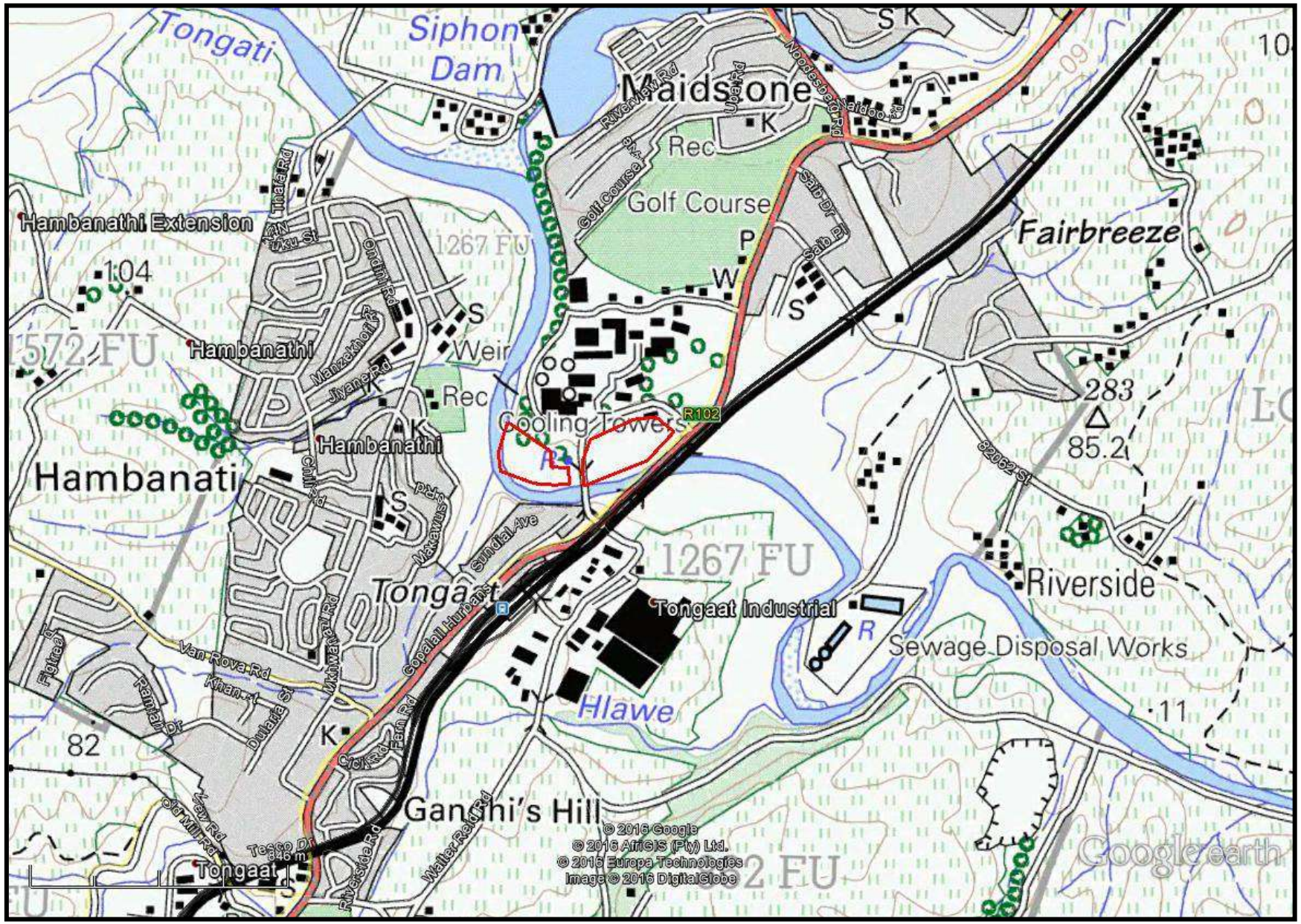


FIG. 4: SCENIC VIEWS OF THE STUDY AREA




KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008

"General protection: Structures.—

- No structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.
- Where the Council does not grant approval, the Council must consider special protection in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- The Council may, by notice in the *Gazette*, exempt—
- A defined geographical area; or
- defined categories of sites within a defined geographical area, from the provisions of subsection where the Council is satisfied that heritage resources falling in the defined geographical area or category have been identified and are adequately protected in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- A notice referred to in subsection (2) may, by notice in the *Gazette*, be amended or withdrawn by the Council.

General protection: Graves of victims of conflict.—No person may damage, alter, exhume, or remove from its original position—

- the grave of a victim of conflict;
- a cemetery made up of such graves; or
- any part of a cemetery containing such graves, without the prior written approval of the Council having been obtained on written application to the Council.
- General protection: Traditional burial places.—
- No grave—
- not otherwise protected by this Act; and
- not located in a formal cemetery managed or administered by a local authority, may be damaged, altered, exhumed, removed from its original position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

The Council may only issue written approval once the Council is satisfied that—

- the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and
- the applicant and the relevant communities or individuals have reached agreement regarding the grave.

General protection: Battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, meteorite or meteorite impact sites.—

- No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.
- The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.
- No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or excavation equipment onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or

use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.

- The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government." (KZN Heritage Act of 2008)

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the database that has been collated by Umlando. These databases contains archaeological site locations and basic information from several provinces (information from Umlando surveys and some colleagues), most of the national and provincial monuments and battlefields in Southern Africa (http://www.vuvuzela.com/googleearth/monuments.html) and cemeteries in southern Africa (information supplied by the Genealogical Society of Southern Africa). We use 1st and 2nd edition 1:50 000 topographical and 1937 aerial photographs where available, to assist in general location and dating of buildings and/or graves. The database is in Google Earth format and thus used as a quick reference when undertaking desktop studies. Where required we would consult with a local data recording centre, however these tend to be fragmented between different institutions and areas and thus difficult to access at times. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The survey results will define the significance of each recorded site, as well as a management plan.

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

Heritage sites vary according to significance and several different criteria relate to each type of site. However, there are several criteria that allow for a general significance rating of archaeological sites.

These criteria are:

1. State of preservation of:

1.1. Organic remains:

1.1.1. Faunal

1.1.2. Botanical

1.2. Rock art

1.3. Walling

1.4. Presence of a cultural deposit

1.5. Features:

1.5.1. Ash Features

1.5.2. Graves

1.5.3. Middens

1.5.4. Cattle byres

1.5.5. Bedding and ash complexes

2. Spatial arrangements:

2.1. Internal housing arrangements

2.2. Intra-site settlement patterns

2.3. Inter-site settlement patterns

3. Features of the site:

3.1. Are there any unusual, unique or rare artefacts or images at the site?

3.2. Is it a type site?

3.3. Does the site have a very good example of a specific time period, feature, or artefact?

4. Research:

4.1. Providing information on current research projects

4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

5.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?

5.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

6. Archaeological Experience:

6.1. The personal experience and expertise of the CRM practitioner should not be ignored. Experience can indicate sites that have potentially significant aspects, but need to be tested prior to any conclusions.

7. Educational:

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

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

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

8. Other Heritage Significance:

8.1. Palaeontological sites

8.2. Historical buildings

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

8.4. Graves and/or community cemeteries

8.5. Living Heritage Sites

8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

The more a site can fulfill the above criteria, the more significant it becomes. Test-pit excavations are used to test the full potential of an archaeological deposit. This occurs in Phase 2. These test-pit excavations may require further excavations if the site is of significance (Phase 3). Sites may also be mapped and/or have artefacts sampled as a form of mitigation. Sampling normally occurs when the artefacts may be good examples of their type, but are not in a primary archaeological context. Mapping records the spatial relationship between features and artefacts.

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

RESULTS

DESKTOP STUDY

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

No national monuments, battlefields, or historical cemeteries are known to occur in the study area.

The 1937 aerial photographs indicate that there are buildings in the study area. Sugar cane is being cultivated in the eastern study area.

By 1969, the buildings have been removed and the entire area is under sugar cane cultivation.

FIG. 5: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA

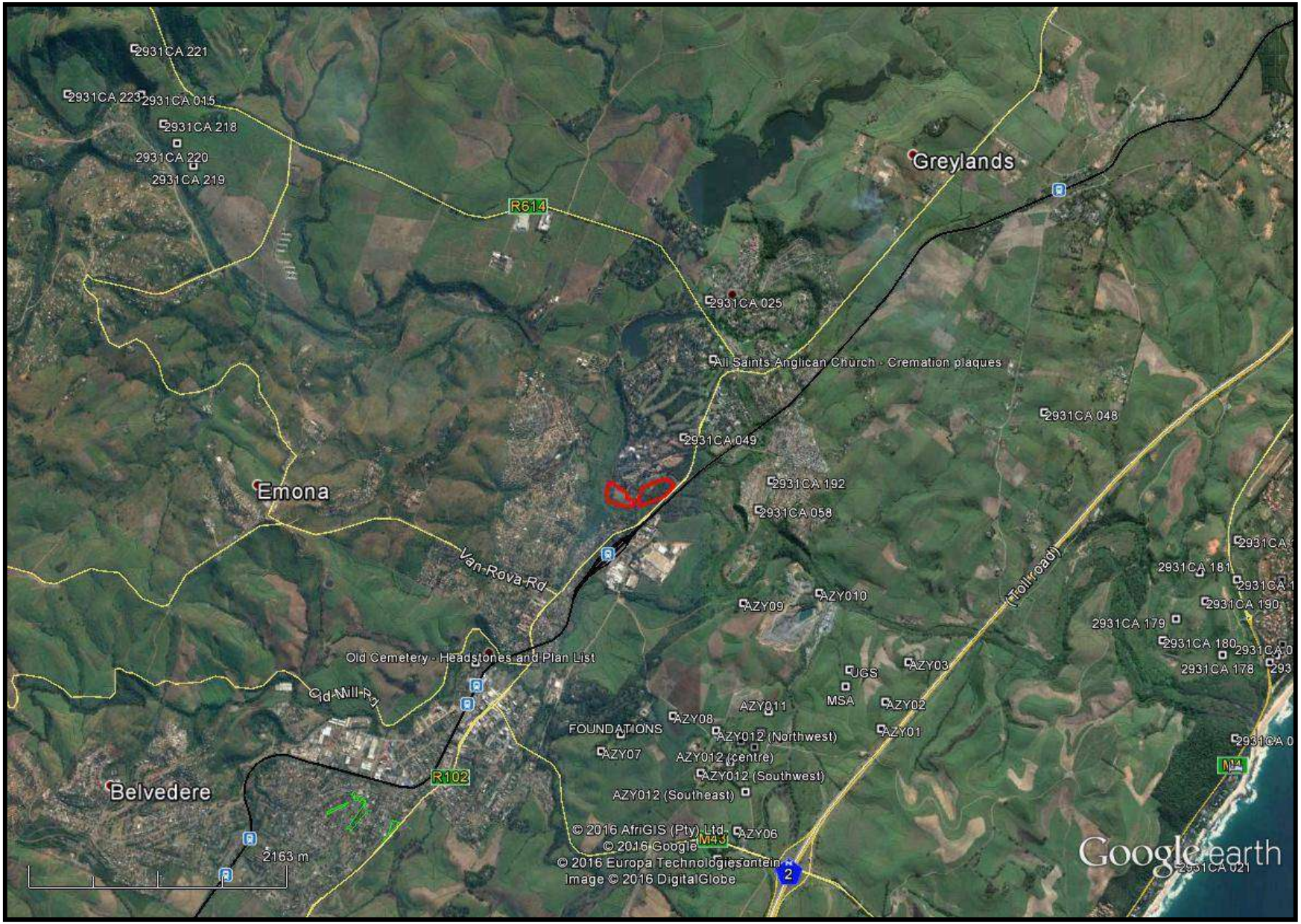


FIG. 6: STUDY AREA IN 1937

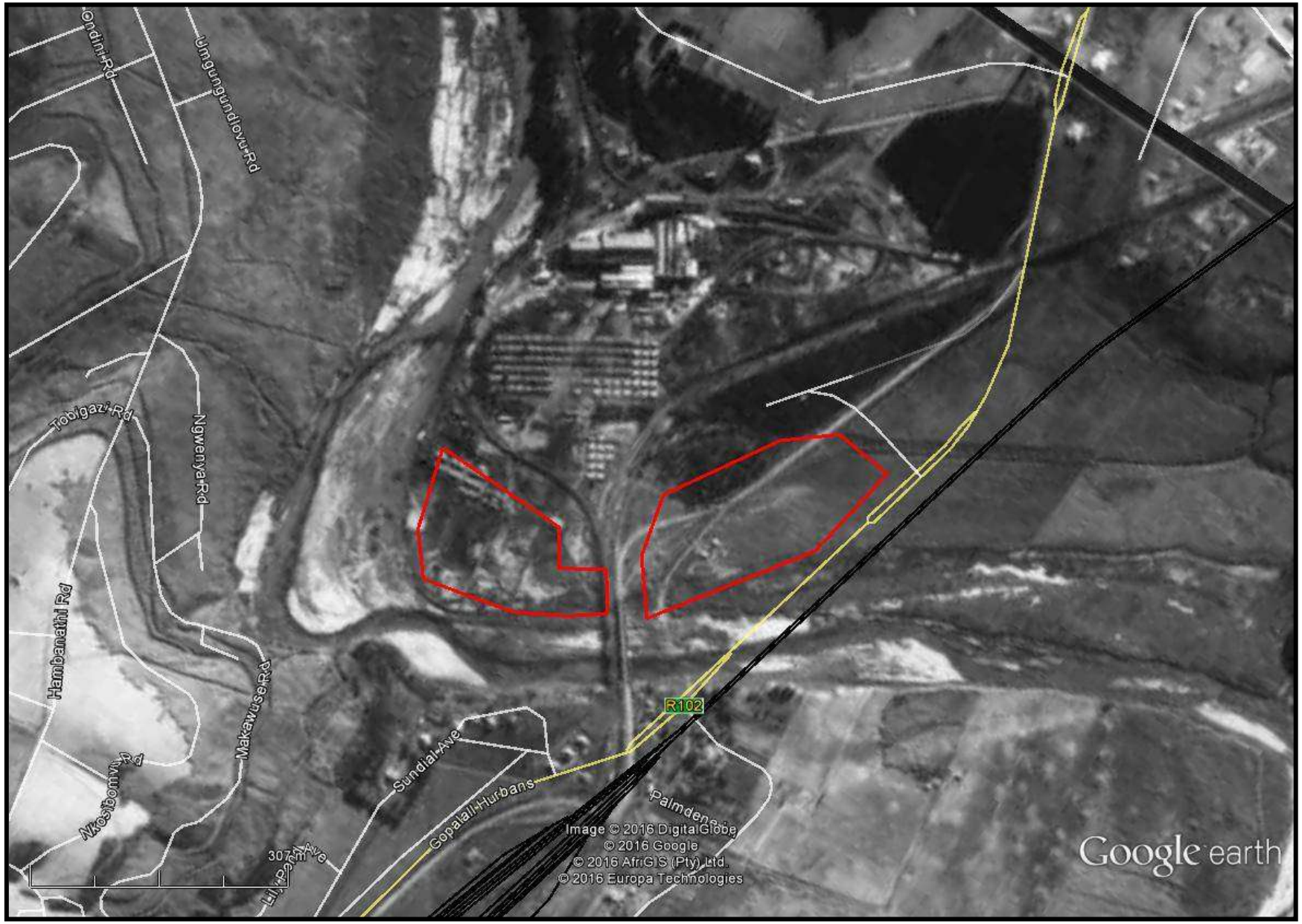
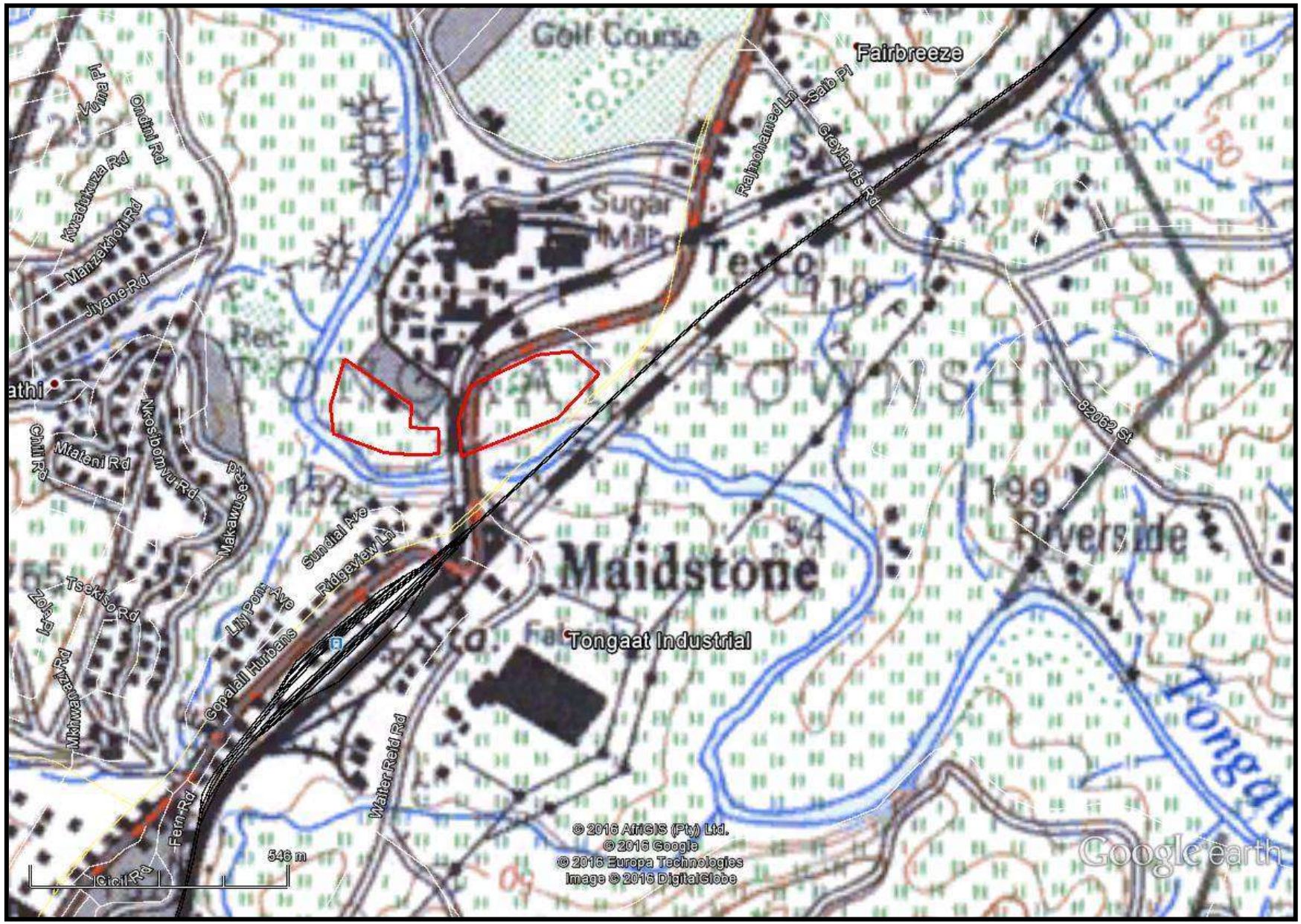


FIG. 7: STUDY AREA IN 1969



FIELD SURVEY

The study area has been levelled since the 1969 topographical map, especially the southeastern section. The western half of the footprint is currently a soccer field. The buildings and features noted in the desktop no longer exist. There is evidence of some building rubble; however, there are no foundations present, nor a clear indicator where and when the rubble originated. Some of the study area, and its access road, has been effected by a sand winnowing operation.

No heritage sites were observed in the study area.

No further heritage assessments are required.

PALAEONTOLOGICAL IMPACT ASSESSMENT

A PIA was undertaken by Dr Gideon Groenewald and is summarised below. See Appendix A for the full report. The area is in an area of medium palaeosensitivity (fig. 8).

“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 khaki-coloured to dark grey shale beds of the Pietermaritzburg Formation of the Ecca Group of the Karoo Supergroup and Alluvium of the Tongaati River which leads to dark vertic soils or sand cover.

The excavations for the construction of the infrastructure for this development will expose some sediments of the Pietermaritzburg Formation. Due to weathering, no well-preserved fossils are expected before 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 alluvium. Recording of fossils will contribute significantly to our understanding of previous eco-systems and must be reported to the HIA specialist for appropriate action.

Mitigation: The excavations for the construction of the infrastructure for this development will expose some sediments of the Pietermaritzburg Formation. Due to weathering, no well-preserved fossils are expected before 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 alluvium. Recording of fossils will contribute significantly to our understanding of previous eco-systems and must be reported to the HIA specialist for appropriate action" (Groenewald Appendix A).

FIG. 8: PALAEOSENSITIVITY MAP 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.

CONCLUSION

A heritage survey was undertaken for the proposed new Maidstone Mill effluent system, Tongaat. While an archaeological site existed on parts of the hill in the past, there are no traces of it in the study area. Similarly the buildings noted on the 1937 aerial photographs, no longer exist. The area has been flattened at some stage thereby removing any heritage features.

The area is of moderate palaeontological sensitivity. The PIA report indicates that palaeontological material could be found from depths of 2m below the surface. Any excavations nearing 2m below the current surface should have an assessment by a qualified palaeontologist.

APPENDIX A

PALAEONTOLOGICAL DESKTOP STUDY

PHASE 1 PALAEONTOLOGICAL ASSESSMENT FOR THE PROPOSED MAIDSTONE MILL EFFLUENT TREATMENT PLANT, ETHEKWINI METROPOLITAN MUNICIPALITY, KWAZULU-NATAL PROVINCE.

FOR

Umlando

DATE: 12 September 2016

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 upgrading of the waste water disposal at the Maidstone Mill Effluent Treatment Plant on the Tongati River, Ethekwini Metropolitan Municipality, KwaZulu-Natal Province.

This report forms part of the Environmental Impact Assessment 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 Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development. Geological structures associated with groundwater are mapped as well as known and potential spring sites that are part of the National Heritage of this area.

The development site for the proposed extension of the Maidstone Mill Effluent Treatment Plant on the Tongati River, Ethekwini Metropolitan Municipality, KwaZulu-Natal Province is underlain by Permian aged sedimentary rocks of the Pietermaritzburg Formation, Ecca Group of the Karoo Supergroup as well as Quaternary aged Alluvium of the Tongati River.

No significant fossils are expected before deep excavation (>2m) are done and if fossils are recorded it will contribute significantly to our knowledge of the Palaeontological Heritage of KwaZulu-Natal.

Significant Primary Groundwater Aquifers are associated with the alluvium on site and design of all water distribution and treatment works for potential polluted water must ensure that no polluted water reach these important National Heritage Sites.

It is recommended that:

The EAP and ECO must be informed of the fact that a Moderate Palaeontological Sensitivity is allocated to the study area. If fossils are observed during construction the HIA specialist and Palaeontologist must be informed to take immediate and appropriate action to preserve the fossils.

The recommendations for mitigation for prevention of groundwater pollution as discussed in the Groundwater Impact Assessment Report (SRK Report) must be adhered to.

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 upgrading of the waste water disposal at the Maidstone Mill Effluent Treatment Plant on the Tongati River, Ethekwini Metropolitan Municipality, KwaZulu-Natal Province.

This report forms part of the Environmental Impact Assessment 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 Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development. Geological structures associated with groundwater are mapped as well as known and potential spring sites that are part of the National Heritage of this area.

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 as well as the KwaZulu-Natal Heritage Act No 4 of 2008. In accordance with Section 38 of the National Resources Act No 25 of 1999 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint..

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

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens; 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 last 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 (2930 Durban) 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 1.1 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. All groundwater resources, present and potential are included in this category for Palaeontological Sensitivity
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 dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey 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. At least a Desktop Survey is recommended.

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, palaeontological mitigation measures should be incorporated into the Environmental Management Plan.

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.).
- All existing information on groundwater aquifers were recorded during this desktop survey but it is by far not a representative picture of the extent or the number of linear aquifers present in the study area. The total picture must be gained from the Specialist Report on potential impact of this project on the groundwater resources for the project.

Locality and Proposed Development

Tongaat Hulett Development (Pty) Ltd (Tongaat Hulett) is proposing a sustainable long-term solution for managing the effluent generated at their Maidstone Sugar Mill (the Mill), located in Tongaat, eThekwini Municipality. The solution is proposed to comprise of the development of an Effluent Treatment Plant (ETP) to treat the Mill's effluent prior to discharge to the Tongati River and a storm water Pollution Control Dam (PCD).

The proposed development of the proposed project, including the ETP and PCD, is considered a listed activity in terms of the National Environmental Management Act (107, 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations (2014, as amended). Environmental Authorisation (EA) is therefore required from the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA) prior to the construction and operation of the ETP and PCD (Figure 1).

Figure 1 Locality of study area

GEOLOGY

The study area is underlain predominantly by Permian aged rocks of the Pietermaritzburg Formation, Ecca Group of the Karoo Supergroup and Quaternary aged Alluvium of the Tongati River (Figure 2).

Figure 2 Geology of the study area

Ecca Group

Pietermaritzburg Formation (Pp)

The Permian aged Pietermaritzburg Formation is an assemblage of fine-grained sediments, consisting mainly of dark grey mudstone and shale. The deposits represent 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).

Alluvium

Quaternary aged sandy alluvium represent resent deposits of sand and sandy clay along the floodplains of the Tongati River in KwaZulu-Natal.

PALAEONTOLOGY

Ecca Group

Pietermaritzburg Formation (Pp)

Trace fossils as well as poorly-defined plant fossils have been described from the upper layers of the Formation (Johnson et al. 2009).

Fossils are rare and it is unlikely that the excavations for this upgrading process will expose significant remains of trace fossils that were not described before. If the ECO recognise any potential trace fossils the HIA specialist and palaeontologist must be informed to take appropriate action to preserve this information.

Alluvium

No significant fossils of Quaternaty age have been recorded from the alluvium of the Tongati River to date, but very significant fossils were recorded in similarly aged sediments elsewhere in KwaZulu-Natal, where these finds are now recorded for the first time. It is therefore recommended that the ECO must be aware of the possibility of finding vertebrate remains of Qauternary aged animals. If recorded, these remains will contribute significantly to our knowledge of the past eco-systems in this part of South Africa during the Quaternary.

GROUNDWATER AQUIFERS AND HERITAGE ITEMS

The groundwater heritage items are related to known and potential groundwater resources such as recorded natural spring sites as well as potential linear aquifers that can be affected by the proposed development.

No significant spring sites are recorded on the present edition (2930 Durban) geological map and no obviously important potential linear aquifers cut the study area. The potential pollution of groundwater resources are discussed in detail in the Groundwater Impact Assessment Report (SRK report in the EIA document) and, if the recommendations of that report are followed, no further significant influence on this National Heritage Item is foreseen by the Palaeontological Impact Specialist.

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 khaki-coloured to dark grey shale beds of the Pietermaritzburg Formation of the Ecca Group of the Karoo Supergroup and Alluvium of the Tongati River which leads to dark vertic soils or sand cover.

Figure 3 Palaeontological Sensitivity of the Study Area. A Moderate Palaeontological sensitivity is allocated to the entire area. For colour coding see Table 1.1

The excavations for the construction of the infrastructure for this development will expose some sediments of the Pietermaritzburg Formation. Due to weathering, no well-preserved fossils are expected before 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 alluvium. Recording of fossils will contribute significantly to our understanding of previous eco-systems and must be reported to the HIA specialist for appropriate action.

CONCLUSION

The development site for the proposed extension of the Maidstone Mill Effluent Treatment Plant on the Tongati River, Ethekwini Metropolitan Municipality, KwaZulu-Natal Province is underlain by Permian aged sedimentary rocks of the Pietermaritzburg Formation, Ecca Group of the Karoo Supergroup as well as Quaternary aged Alluvium of the Tongati River.

No significant fossils are expected before deep excavation (>2m) are done and if fossils are recorded it will contribute significantly to our knowledge of the Palaeontological Heritage of KwaZulu-Natal.

Significant Primary Groundwater Aquifers are associated with the alluvium on site and design of all water distribution and treatment works for potential polluted water must ensure that no polluted water reach these important National Heritage Sites.

It is recommended that:

The EAP and ECO must be informed of the fact that a Moderate Palaeontological Sensitivity is allocated to the study area. If fossils are observed during construction the HIA specialist and Palaeontologist must be informed to take immediate and appropriate action to preserve the fossils.

The recommendations for mitigation for prevention of groundwater pollution as discussed in the Groundwater Impact Assessment Report (SRK Report) must be adhered to.

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

REFERENCES

Almond J.E. and Pether J. 2008. *Palaeontological Heritage of the Western Cape.* Internal Report Heritage Western Cape.

Almond J.E., De Klerk B. and Gess R., 2009. *Palaeontological Heritage of the Eastern Cape*. Internal Report, SAHRA.

Groenewald G.H., Groenewald D.P. and Groenewald S.M., 2014. *Palaeontological Heritage of the Free State, Gauteng, Limpopo, Mpumalanga and North West Provinces*. Internal Palaeotechnical Reports, SAHRA.

Johnson MR , Anhaeusser CR and Thomas RJ (Eds). 2009. The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

Van der Walt, M., Day, M., Rubidge, B., Cooper, A.K. & Netterberg, I. 2010. A new GIS-based biozone map of the Beaufort Group (Karoo Supergroup), South Africa. Palaeontologia Africana 45, 1–5.

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