

NAGLE AND INANDA CONVEYANCE SYSTEM

FOR UMGENI WATER



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Management

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The Nagle conveyance route comprises of gravity transfer of raw water from Nagle and Inanda Dams to Wiggins Treatment Plant in Reservoir Hill through tunnels and syphons, with scour valves, air valves and isolating valves. The infrastructure is currently scheduled for maintenance and upgrades to lower the safety and environmental risk profile.

The aim of the project is to rehabilitate key infrastructure associated with the treatment and conveyance of raw and potable water to the Durban Heights and Wiggins WTP's with a view to cost effectively restoring the reliability and maintainability of infrastructure to a level that aligns with their low risk profiles.

A heritage survey was undertaken for the proposed upgrade of the aqueducts and access paths for the Nagle and Umgeni Conveyance system. The survey also included a new pipeline of about 500m from the Inanda Dam wall.

Most of the aqueducts were at river crossings, on roads, or in steep valleys and would thus not affect heritage sites. The proposed access roads occur on existing tracks and roads and would not affect heritage sites. The new pipeline mostly follows the edge of a road reserve; however, in one area it might occur near an old settlement. This area should be noted as being sensitive during construction phase.

The various upgrades will not affect any palaeontological sites.

No further heritage mitigation is required.

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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

DRAFT

INTRODUCTION

The Nagle conveyance route comprises of gravity transfer of raw water from Nagle and Inanda Dams to Wiggins Treatment Plant in Reservoir Hill through tunnels and syphons, with scour valves, air valves and isolating valves. There are two conveyance systems along the route with a combined capacity of 680 MI/d. The two route lengths are 44.5 and 43.9 km in length. The route has a starting elevation of approximately 395 maMSL and ending elevation of approximately 280 maMSL. The highest point is at 482 maMSL and the lowest point at 73 maMSL. The infrastructure is currently scheduled for maintenance and upgrades to lower the safety and environmental risk profile.

- **System 1** (Colloquially known as Nagle Aqueducts 1 and 2) comprises 11 tunnels (14.57 km) which are inter-connected by the siphons (29.7 km) comprising aqueducts #1 (DN900 steel) and #2 (DN1000 PCP and steel). Generally aqueducts #1 & #2 are aligned parallel to one another. System 1 is considered to have a capacity of 262 MI/d.

- **System 2** (Colloquially known as Nagle Aqueducts 3 and 4) comprises 6 tunnels which are inter-connected by the siphons comprising aqueducts #3 (DN1400 PCP) and #4 (DN1400 PCP). Generally aqueducts #3 & #4 are aligned parallel to one another. System 2 is considered to have a capacity of 473 MI/d.

The aim of the project is to rehabilitate key infrastructure associated with the treatment and conveyance of raw and potable water to the Durban Heights and Wiggins WTP's with a view to cost effectively restoring the reliability and maintainability of infrastructure to a level that aligns with their low risk profiles.

Works will consist of the proposed the upgrades to access routes, chambers, scour valves and pipeline.

Umlando was requested to undertake an HIA of the proposed conveyance system. Figures 1 – 4 show the location of the development.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

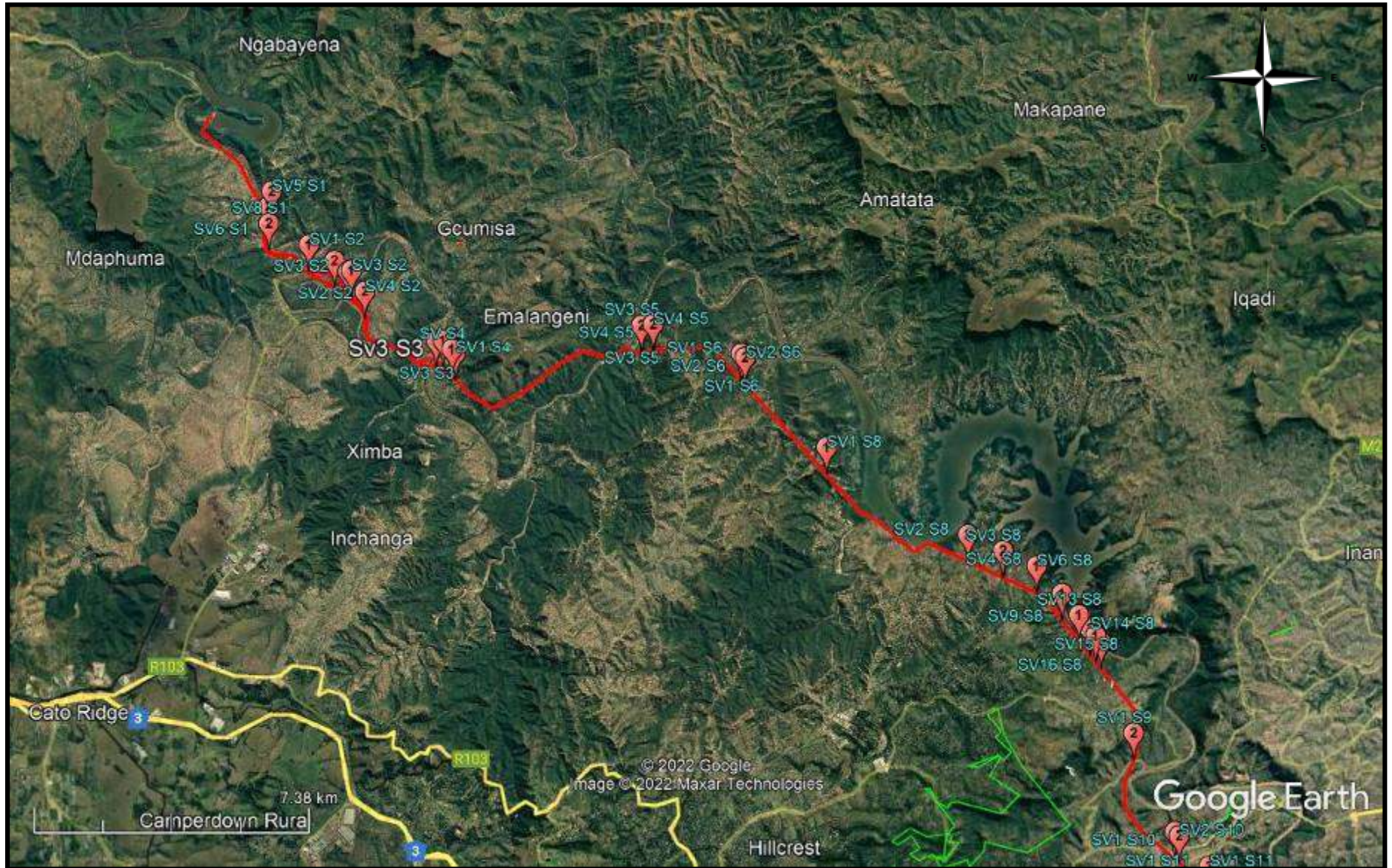


FIG. 2A: AERIAL OVERVIEW OF THE WESTERN STUDY AREA

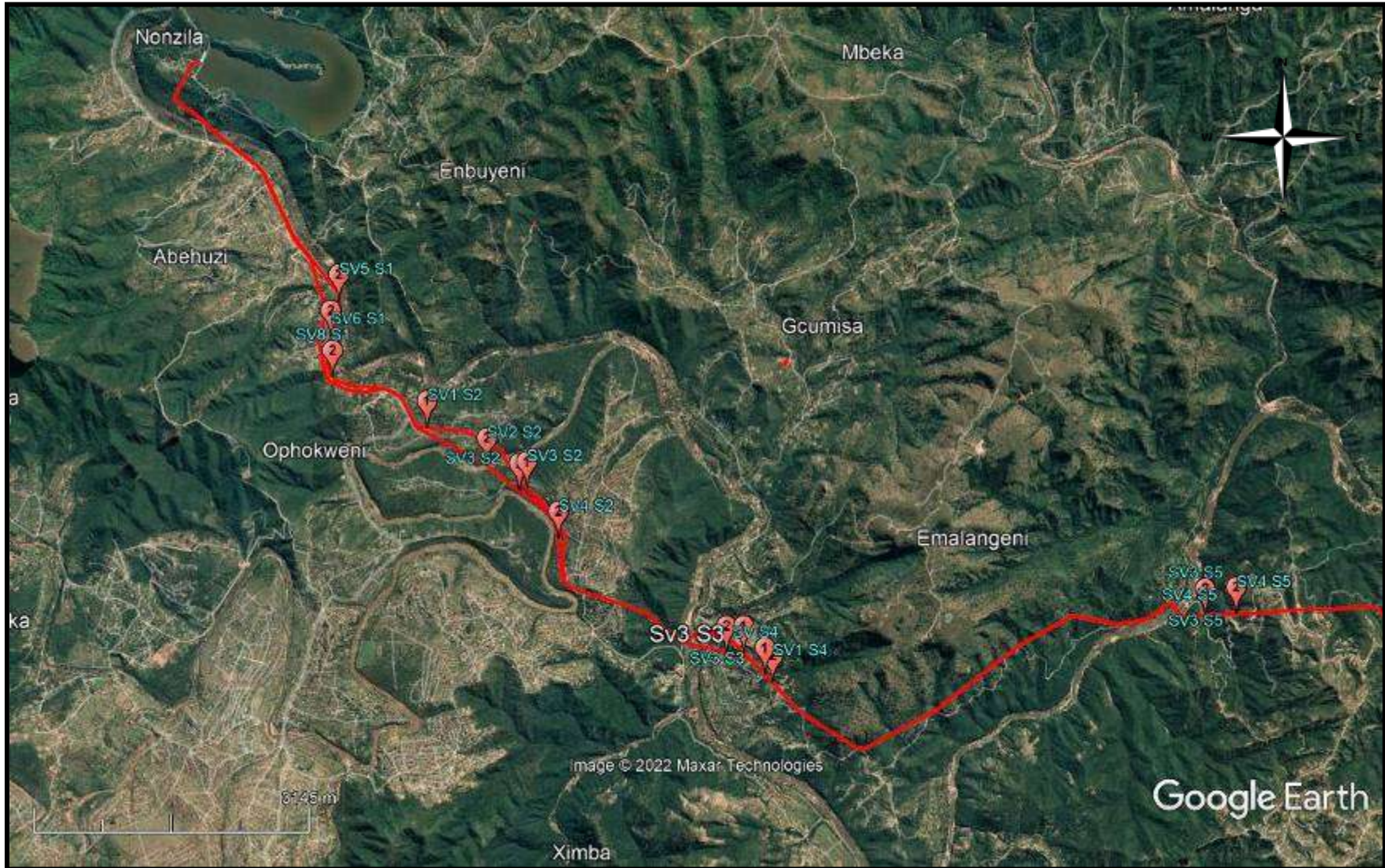


FIG. 2B: AERIAL OVERVIEW OF THE CENTRAL STUDY AREA

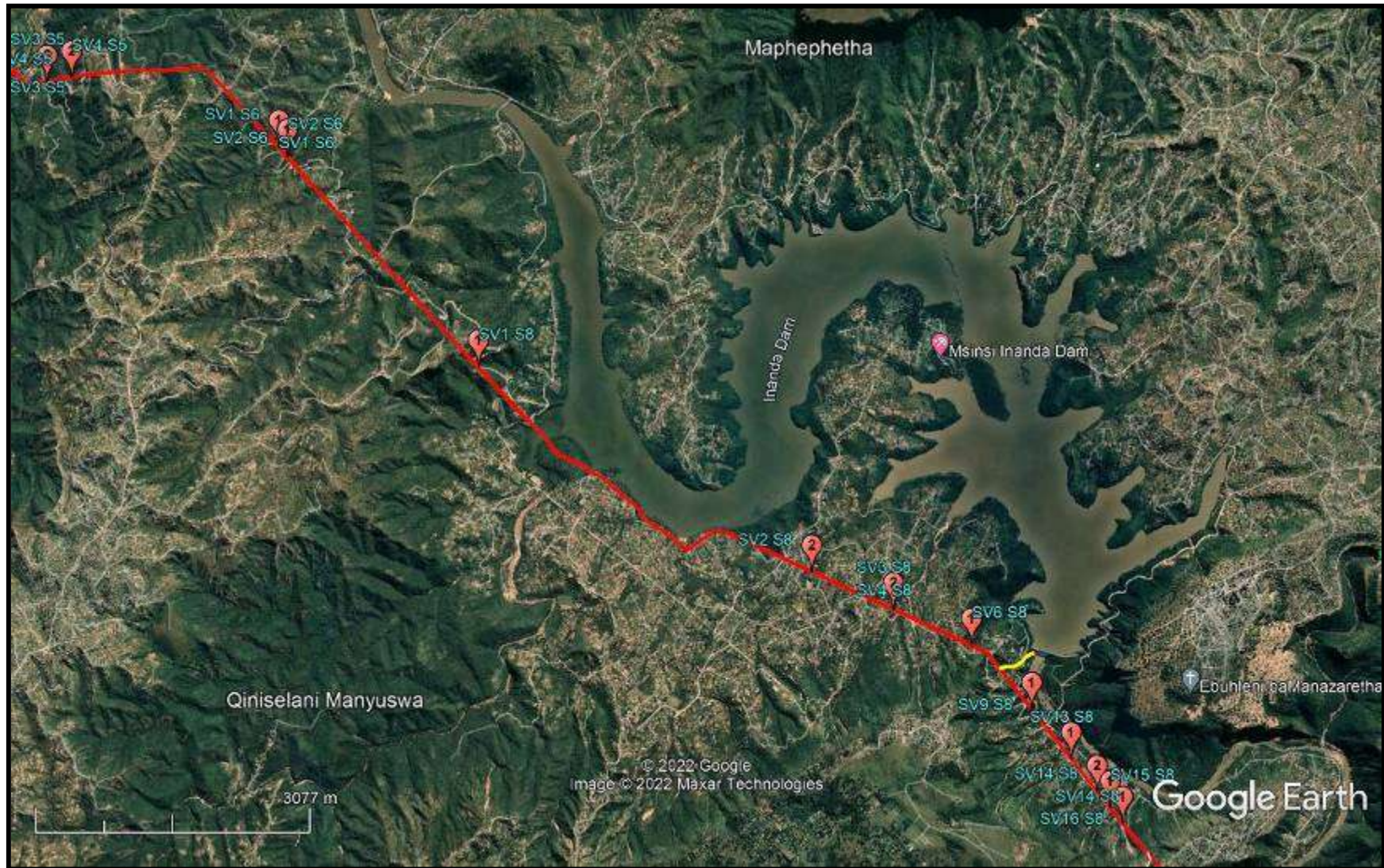


FIG. 2C: AERIAL OVERVIEW OF THE EASTERN STUDY AREA

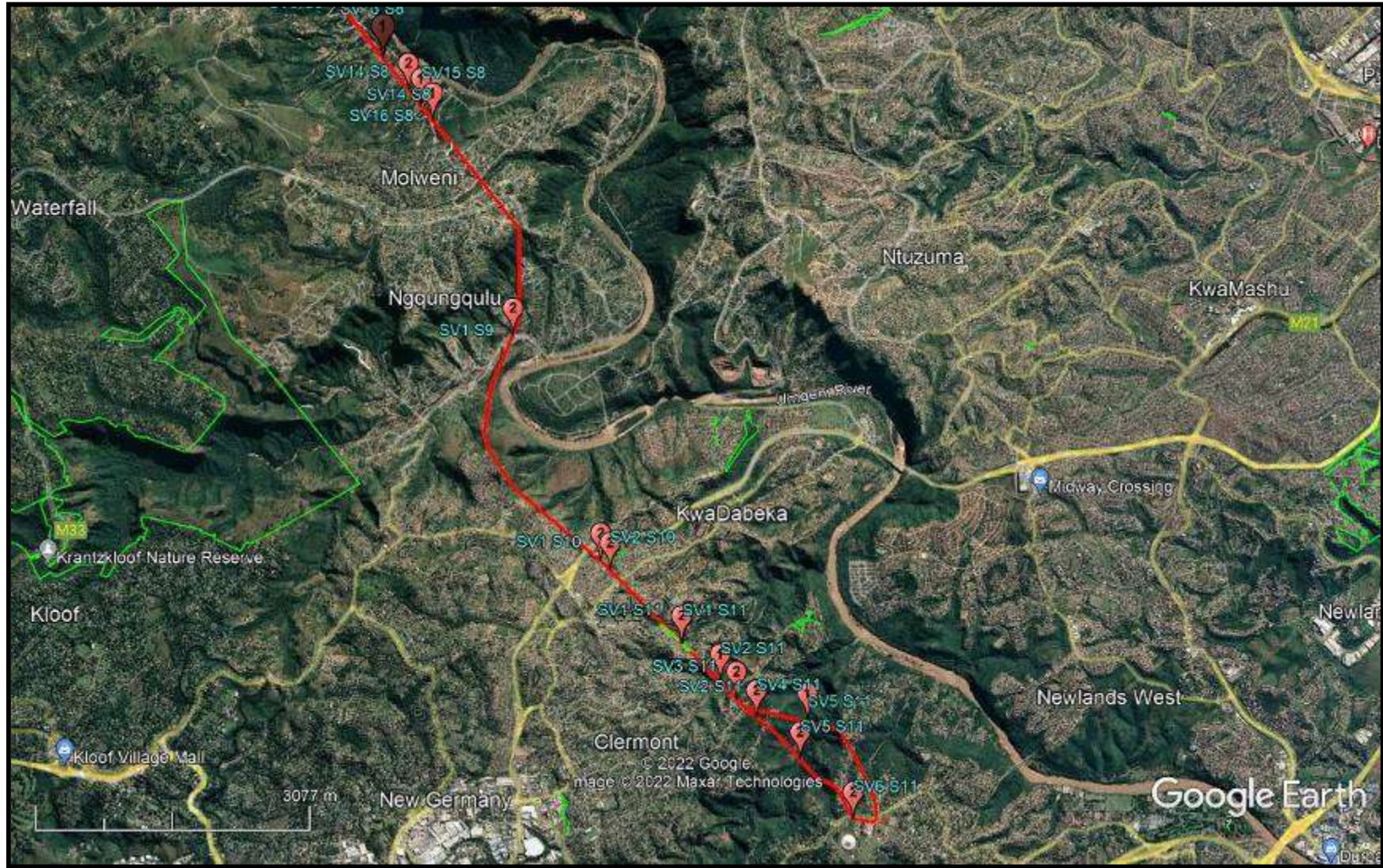


FIG. 3A: TOPOGRAPHICAL MAP OF THE NORHTERN STUDY AREA (2000)

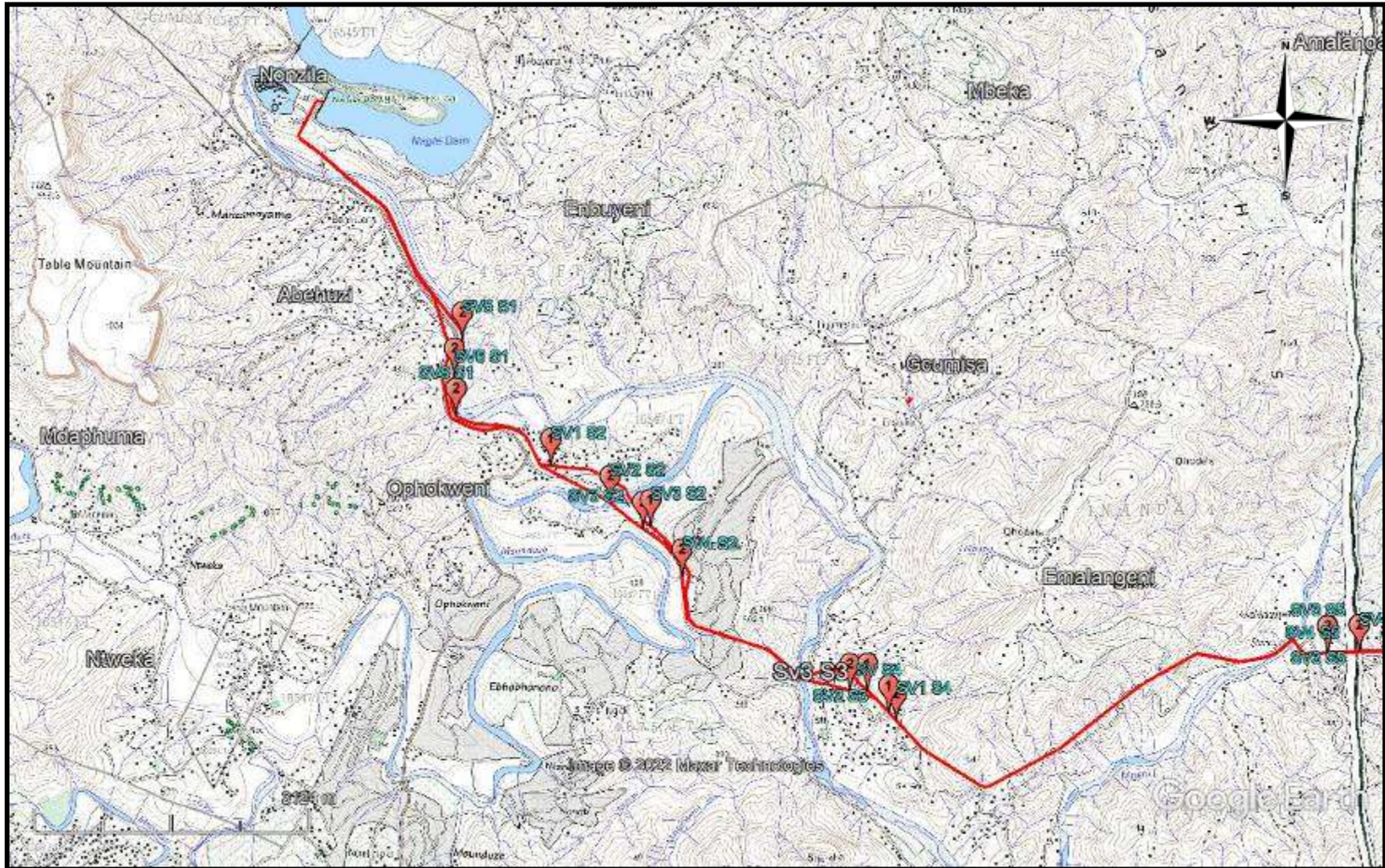


FIG. 3B: TOPOGRAPHICAL MAP OF THE CENTRAL STUDY AREA (2000)

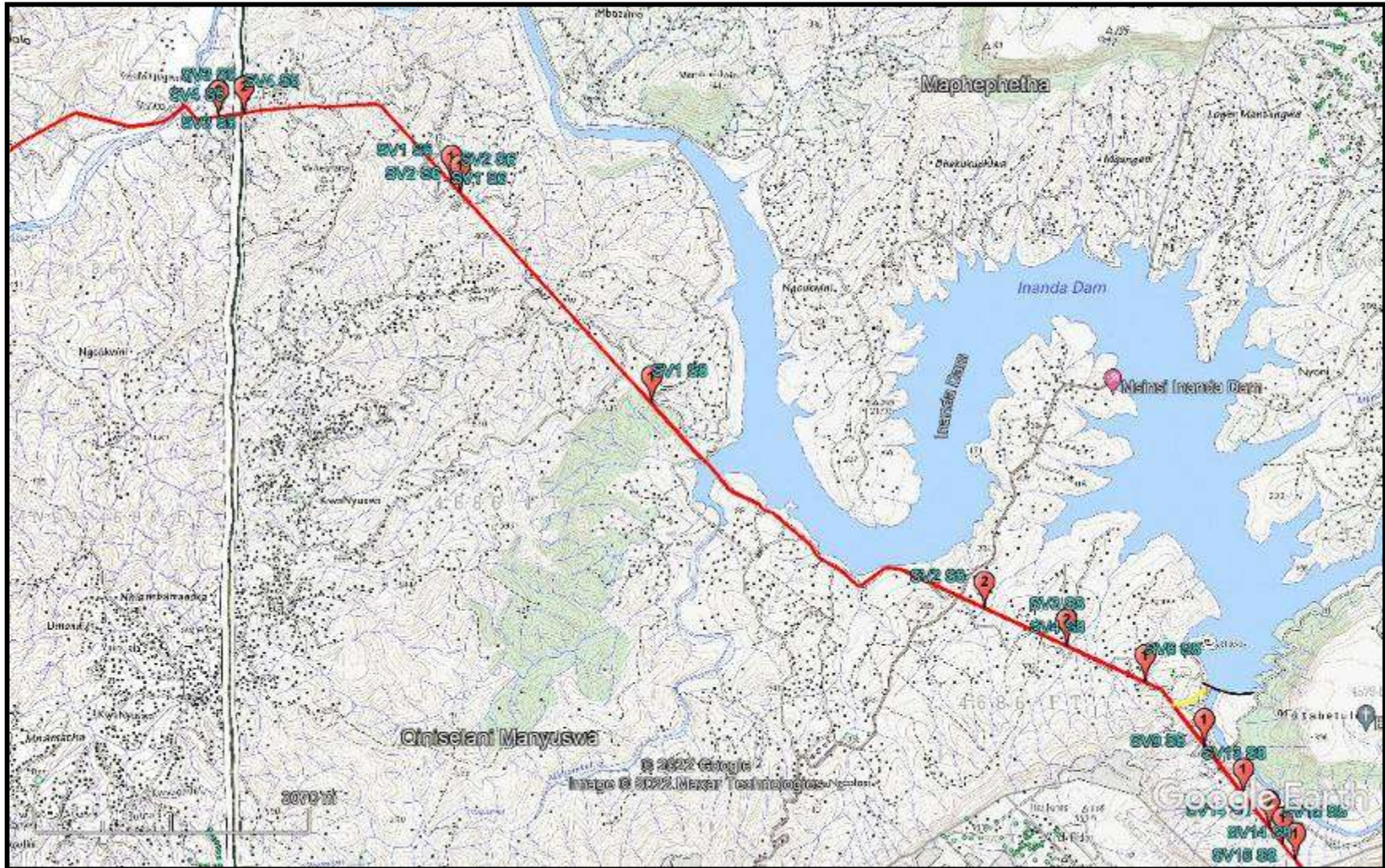


FIG. 3C: TOPOGRAPHICAL MAP OF THE SOUTHERN STUDY AREA (2000)

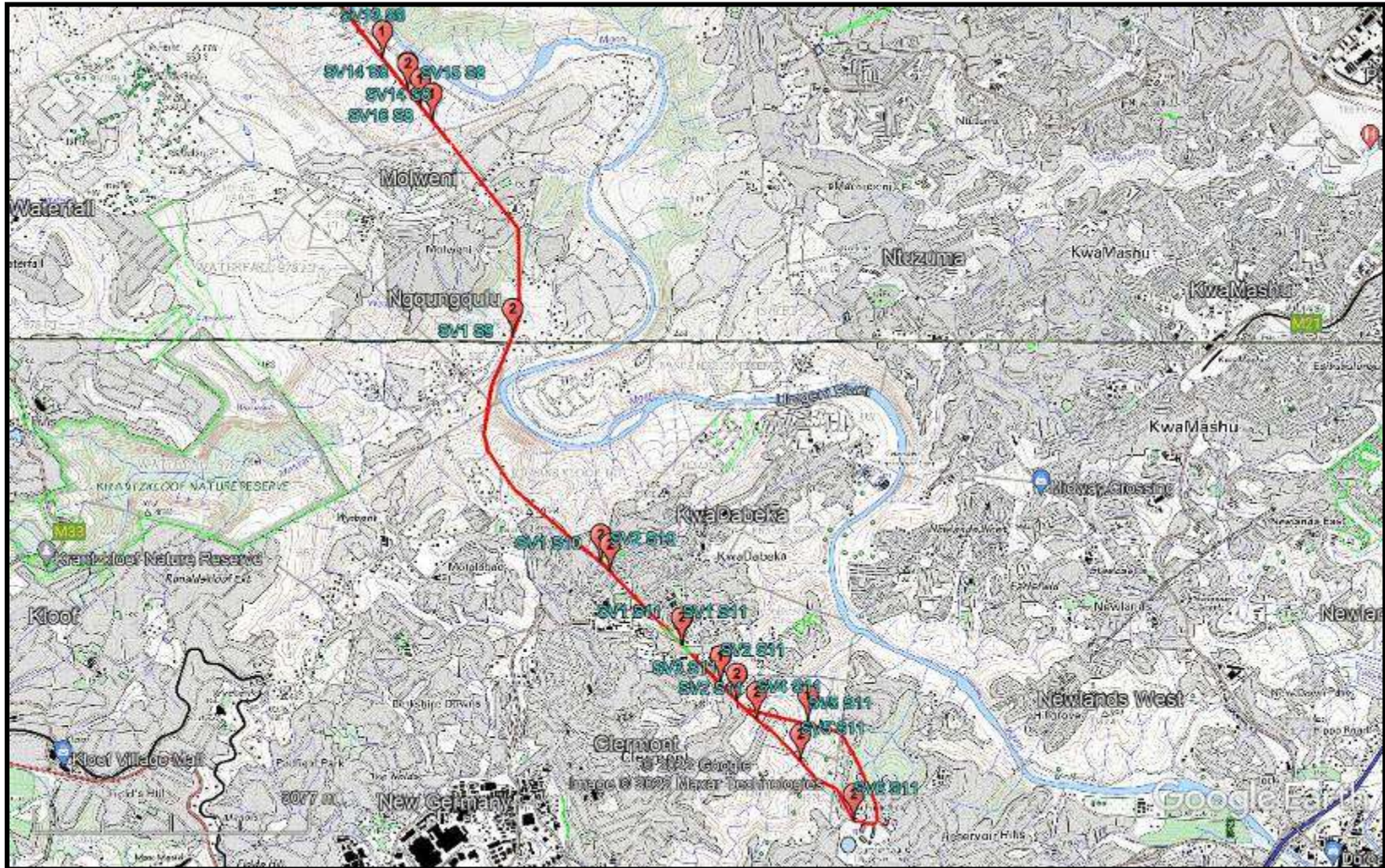


FIG. 4: SCENIC VIEWS OF THE STUDY AREA



KWAZULU NATAL AMAFA AND RESEARCH INSTITUTE, ACT 05, 2018

“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.”

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. This 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. Table 1 lists the grading system.

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 general area is known for its high concentration of archaeological sites in the Umgeni Valley (fig. 5). Archaeological surveys have occurred in the general area since the 1940s and the Inanda Dam was extensively surveyed and excavated from 1983 before the dam was completed (KZN Museum site database; Whitelaw 1994). Most of the archaeological sites are Early Stone Age scatters, and Early Iron Age village settlements. Several of these Stone Age sites occur on, or near, the existing pipeline. Prins (2015) undertook a heritage survey along the western bank of the Inanda Dam. He found scatters of Early Iron Age pottery and more recent settlements of which some were abandoned. These latter settlements may have had graves.

The 1st edition topographical maps date to 1940, 1942 and 1968 (fig. 6a - c). The maps indicate that there are very few settlements in the study area. The new pipeline from Inanda Dam wall appears to pass near a settlement dating to 1942 (S29°42'35.45; E30°51'51.20"). There are no settlements in this area in 2000.

The topography of the various parts of the study area indicates that the affected areas tend to be on steep slopes and or within a valley. This suggests there is little chance of settlements occurring where the aqueducts will be replaced. All of the houses that occur near the affected areas, especially the access paths and new pipeline, appear to be recent in age and thus unlikely to have ancestral graves on the property. The main Inanda Cemetery is nearby and would be used for burials.

FIG. 5: LOCATION OF KNOWN HERITAGE SITES IN THE GENERAL AREA

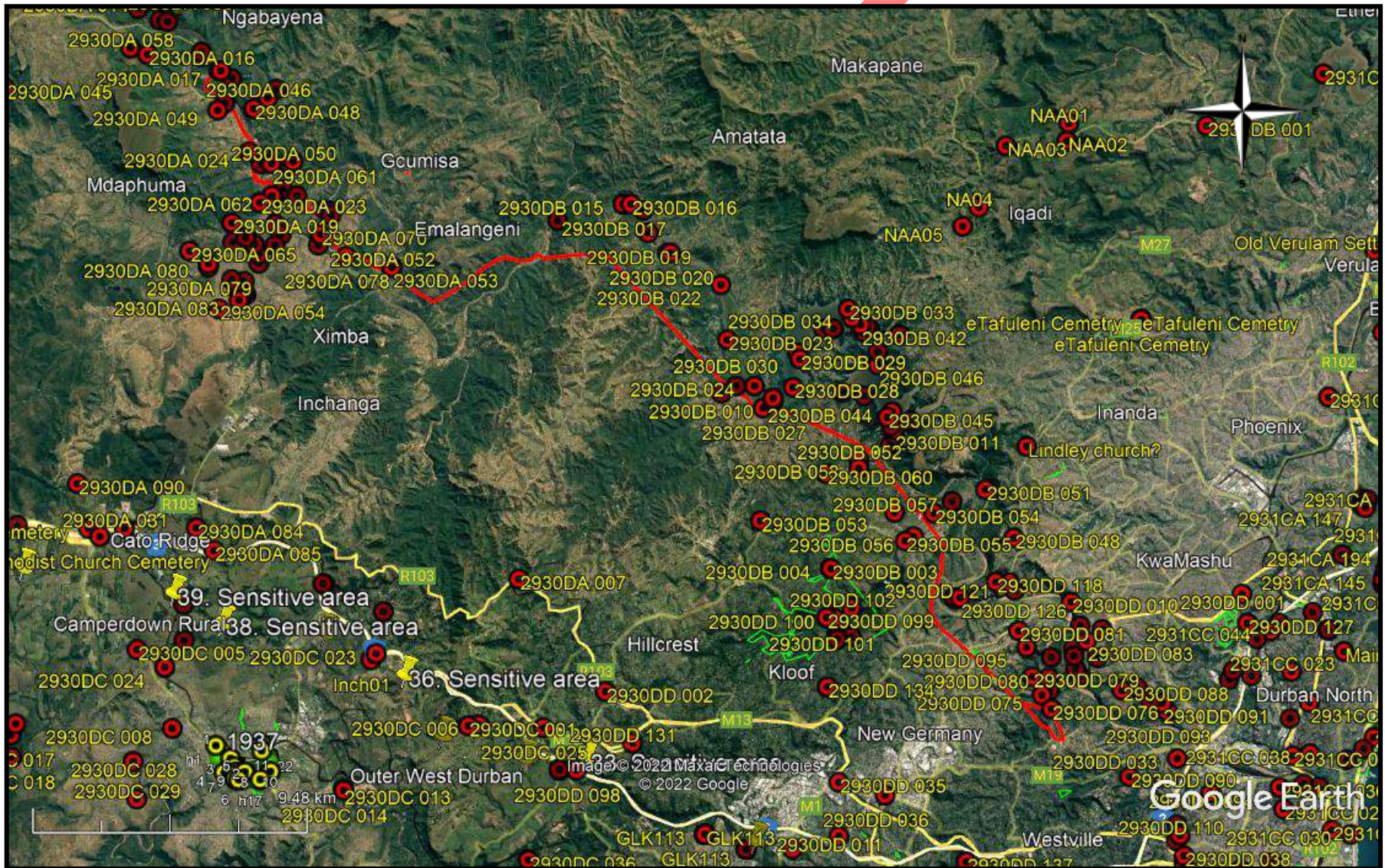


FIG. 6A: LOCATION OF THE WESTERN STUDY AREA IN 1968

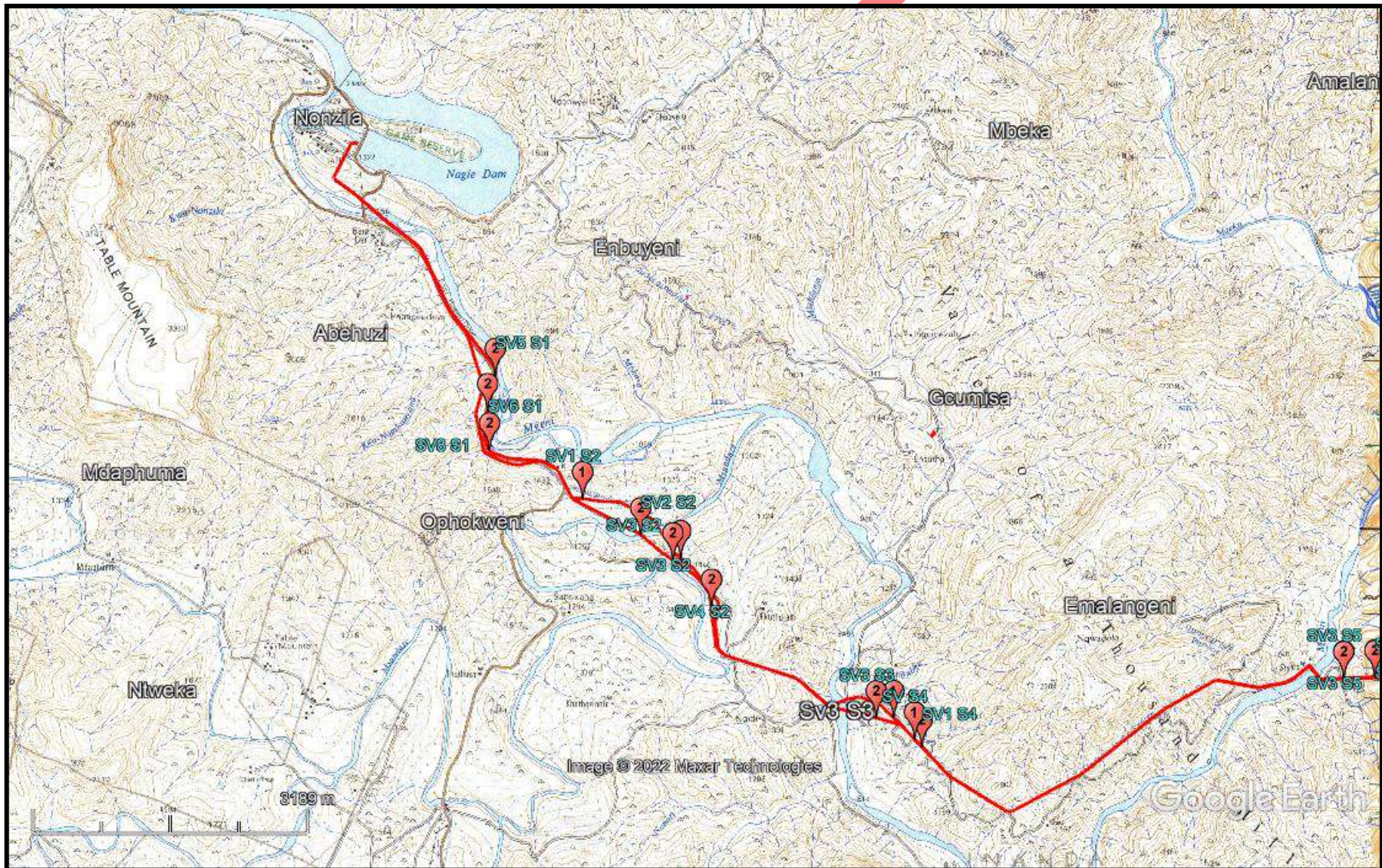


FIG. 6B: LOCATION OF THE CENTRAL STUDY AREA IN 1940 & 1968

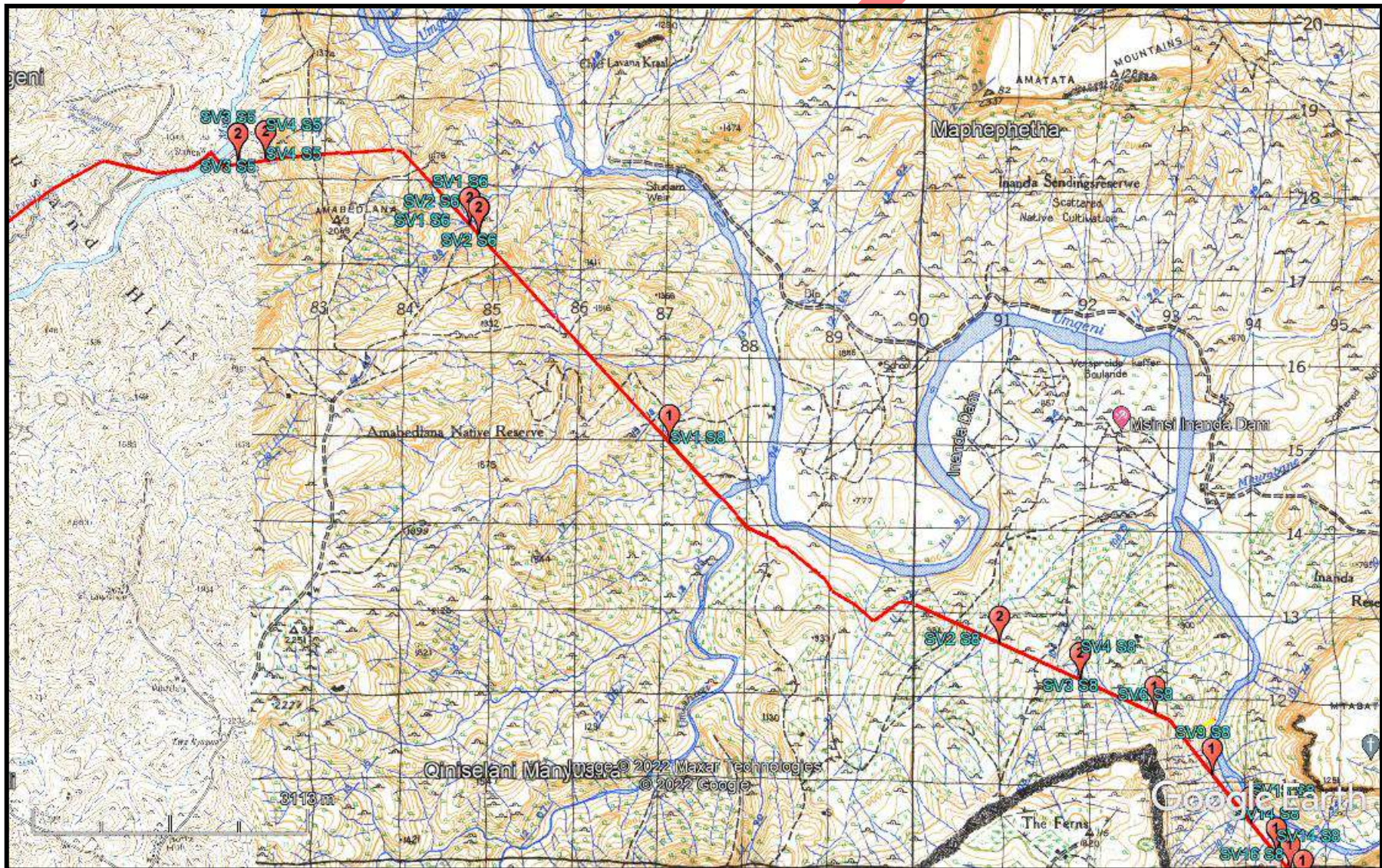
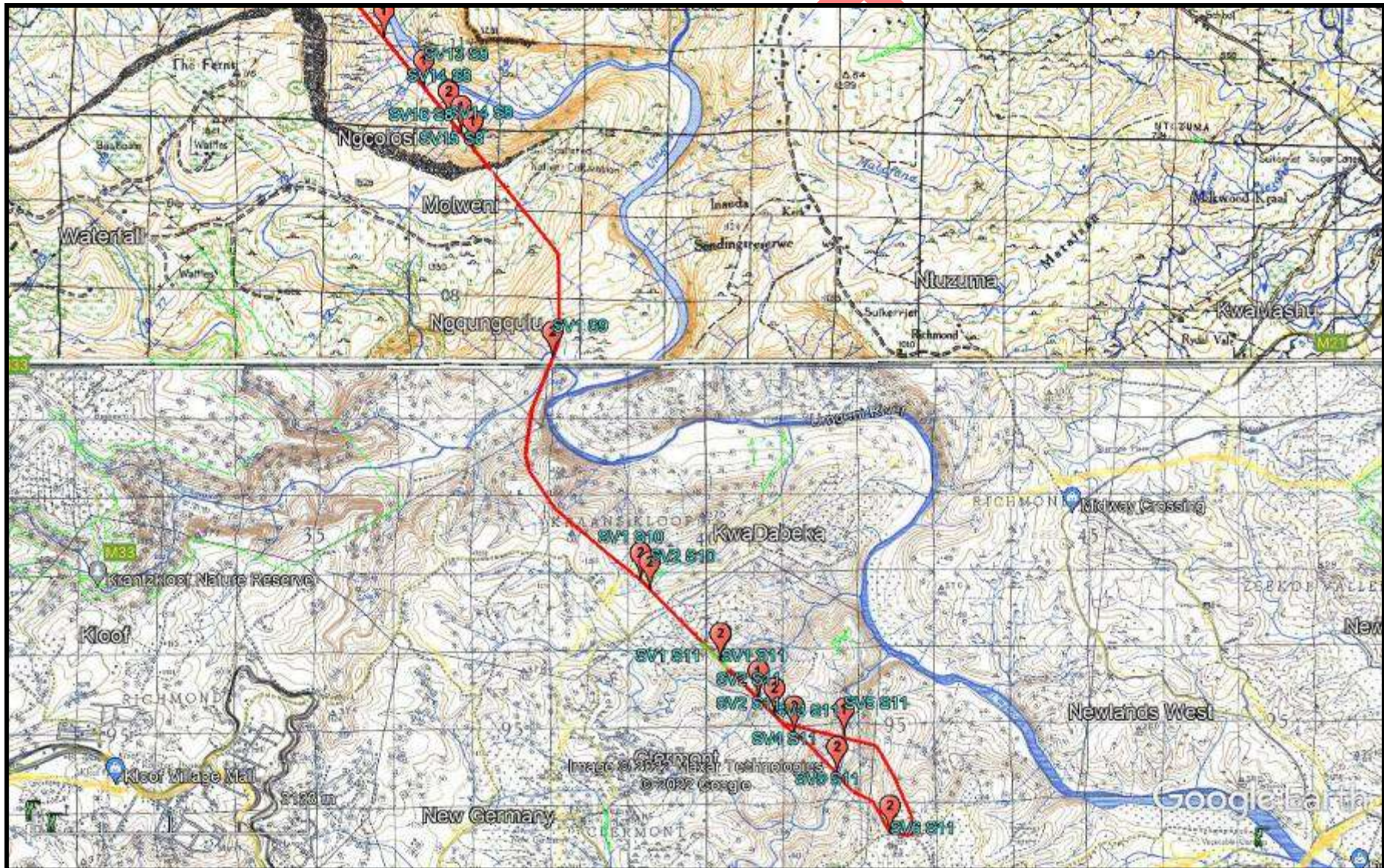


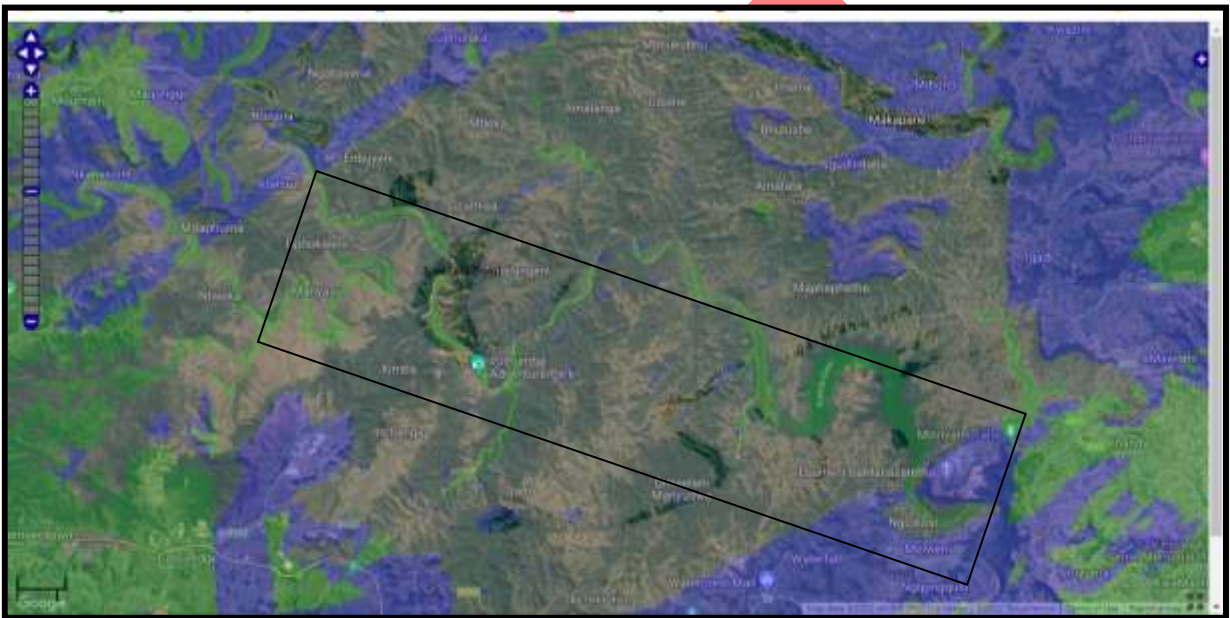
FIG. 6C: LOCATION OF THE EASTERN STUDY AREA IN 1940 & 1942



PALAEONTOLOGICAL SENSITIVITY

The area is in an area of mainly of low or no palaeontological sensitivity (fig. 8). A desktop PIA was undertaken by Dr Alan Smith who recommends that the project be exempt from further PIA mitigation (appendix A).

FIG. 7: PALAEONTOLOGICAL SENSITIVITY MAP



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

A field survey was undertaken in June 2022. Ground visibility was poor to good, as some areas were in dense bush. This did not have an effect on the outcome of the survey. The heavy rains of the last two months had disrupted some access roads and/or broken pipes at some of the aqueduct crossings. These flooded areas in turn removed any potential heritage features that may have occurred there.

Aqueducts

All of the aqueducts are between steep valley slopes, across rivers, on roads or on existing pipeline servitudes. Fig. 8 shows some of these crossings.

No heritage sites were noted at the aqueduct sites. This includes the occurrence of graves within the servitudes.

New Inanda Dam pipe

The pipe is about 500m long and extends from the Inanda Dam wall in a southwest direction to the road. The pipeline follows the road servitude for most of the distance except in one area where the desktop study noted a settlement in the general area (fig. 9). This area should have a 50m radius around it and marked as sensitive during construction. The pipeline is unlikely to affect a heritage site, but the contractor should be made aware of the possibility of potential sites. Any sites uncovered during construction should be reported to KZNARI.

Access paths

Three new access paths have been chosen. They occur alongside roads and/or areas that are already disturbed. No heritage sites were noted

FIG. 8: EXAMPLES OF AQUADUCT CROSSINGS



FIG. 9: POSSIBLE LOCATION OF 1942 SETTLEMENT



CONCLUSION

A heritage survey was undertaken for the proposed upgrade of the aqueducts and access paths for the Nagle and Umgeni Conveyance system. The survey also included a new pipeline of about 500m from the Inanda Dam wall.

Most of the aqueducts were at river crossings, on roads, or in steep valleys and this would not affect heritage sites. The proposed access roads occur on existing tracks and roads and these would not affect heritage sites. The new pipeline mostly follows the edge of a road reserve; however, in one area it might occur near an old settlement. This area should be noted as being sensitive during construction phase.

The various upgrades will not affect any palaeontological sites.

No further heritage mitigation is required.

REFERENCES

Prins, F. 2015. First Phase Heritage Impact Assessment Of The Proposed Construction Of Mphepheteni Water Pipeline, Ethekeweni District Municipality.

Whitelaw, G. 1994. KwaGandaganda: settlement patterns in the Natal Early Iron Age. *Natal Museum Journal of Humanities* 6:1 - 64

1:50 000 Topographical Maps

Aerial Photographs

Database

KZN Museum

SHARIS

Umlando

DRAFT

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
PALAEOLOGICAL LETTER OF EXEMPTION**

DRAFT



**Dr Alan Smith
Alan Smith Consulting
29 Browns Grove
Sherwood
Durban
4091**

**UMLANDO: Archaeological Surveys & Heritage
Management
PO Box 102532, Meerensee, KwaZulu-Natal 3901
phone (035)7531785 fax: 0865445631
cell: 0836585362 / 0723481327
Email:umlando@gmail.com**

Letter of Exemption from Palaeontological Impact Assessment for:

**NAGLE AND INANDA DAM WATER CONVEYANCE SYSTEM,
ETHEKWININ, KWAZULU-NATAL.**

Dear Sir

Dr Alan Smith was asked by UMLANDO: Archaeological Surveys & Heritage Management to conduct a PIA for the above named project.

The proposed development will take place in an area which is not fossiliferous. This project could intercept granite and Karoo dolerite which are not fossiliferous, by definition. Natal Group sandstone could be encountered (Sahrís green code), but no significant fossil material has ever been found here.

Consequently there is no reason to conduct a PIA for this project. Exemption from Palaeontological Impact Assessment (PIA) is therefore requested for this project.

However a “Chance Find Protocol” is attached to cover any chance find, although this eventuality is very unlikely.

Should any of the proposed plans change then the project will need to be reassessed in terms of a PIA

Dr Alan Smith.
Alan Smith Consulting
4 July, 2022



DRAFT

CHANCE FIND PROTOCOL

This Chance Find Protocol must be included in the site EMPr.

If any fossils are found, a Palaeontologist must be notified immediately by the ECO and/or EAP and a site visit must be arranged at the earliest possible time with the Palaeontologist.

In the case of the ECO or the Site Manager becoming aware of suspicious looking palaeo-material:

- The construction must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues.
- Mitigation will involve the attempt to capture all rare fossils and systematic collection of all fossils discovered. This will take place in conjunction with descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labeled, and boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.

Functional responsibilities of the Developer

1. At full cost to the project, and guided by the appointed Palaeontological Specialist, ensure that a representative archive of palaeontological samples and other records is assembled to characterize the palaeontological occurrences affected by the excavation operation.
2. Provide field aid, if necessary, in the supply of materials, labour and machinery to excavate, load and transport sampled material from the excavation areas to the sorting areas, removal of overburden if necessary, and the return of discarded material to the disposal areas.
3. Facilitate systematic recording of the stratigraphic and palaeo-environmental features in exposures in the fossil-bearing excavations, by described and measured geological sections, and by providing aid in the surveying of positions where significant fossils are found.

4. Provide safe storage for fossil material found routinely during excavation operations by construction personnel. In this context, isolated fossil finds in disturbed material qualify as “normal” fossil finds.
5. Provide covered, dry storage for samples and facilities for a work area for sorting, labeling and boxing/bagging samples.
6. Costs of basic curation and storage until collected. Documentary record of palaeontological occurrences must be done.
7. The contractor will, in collaboration with the Palaeontologist, make the excavation plan available to the appointed specialist, in which appropriate information regarding plans for excavations and work schedules must be indicated on the plan of the excavation sites. This must be done in conjunction with the appointed specialist.
8. Initially, all known specific palaeontological information will be indicated on the plan. This will be updated throughout the excavation period.
9. Locations of samples and measured sections are to be pegged, and routinely and accurately surveyed. Sample locations, measured sections, etc., must be recorded three-dimensionally if any “significant fossils” are recorded during the time of excavation.

DETAILS OF SPECIALIST

Dr Alan Smith

Private Consultant: *Alan Smith Consulting, 29 Brown's Grove, Sherwood, Durban, 4091*

&

Honorary Research Fellow: *Discipline of Geology, School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal, Durban.*

Role: Specialist Palaeontological Report production

Expertise of the specialist:

- PhD in Geology (University of KwaZulu-Natal), Pr. Sc. Nat., I.A.H.S.
- Expert in Vryheid Formation (Ecca Group) in northern KZN, this having been the subject of PhD.
- Scientific Research experience includes: Fluvial geomorphology, palaeoflood hydrology, Cretaceous deposits.
- Experience includes understanding Earth Surface Processes in both fluvial and coastal environments (modern & ancient).
- Alan has published in both national and international, peer-reviewed journals. He has published + 50 journal articles with 497 citations (detailed CV available on request).
- Attended and presented scientific papers and posters at numerous international and local conferences (UK, Canada, South Africa) and is actively involved in research.

Selected recent palaeo-related work includes:

- Desktop PIA: Proposed middle income housing units on Portion 23 of Farm Lot H Weston 13026, Bruntville, Mpofana Local Municipality. Client: UMLANDO.
- Desktop PIA: Proposed ByPass Pipeline for Ulundi bulk water pipeline upgrade. Client: UMLANDO.
- Fieldwork PIA: Bhekuzulu Epangweni KZN water reticulation project, Cathkin Park. Client: Mike Webster, HSG Attorneys.
- Fieldwork PIA: Mpungoze water supply scheme, Empangeni. Client: Enviropro.
- Fieldwork PIA: Helpmekaar Dam. Client: Afzelia environmental consultants.
- Desktop PIA: Zuka valley, Ballito. Client: Mike Webster, HSG Attorneys.
- Mevamhlope proposed quarry palaeontology report. Client: Enviropro.

- Desktop PIA: Proposed Lovu Desalination site. Client: eThembeni Cultural Heritage.
- Desktop PIA: Tinley Manor phase 2 North & South banks: eThembeni Cultural Heritage
- Desktop PIA: Tongaat. Client: eThembeni Cultural Heritage.
- Palaeontological Assessment Reports (3) to Scatec Solar SA (Pty) Ltd on an Appraisal of Inferred Palaeontological Sensitivity for a Potential Photo Voltaic Park at (1) Farm Rooilyf near Groblershoop, N Cape; (2) Farm Riet Fountain No. Portions 1 and 6, 18km SE of De Aar, N Cape; and (3) Dreunberg, near Burgersdorp, Eastern Cape. Client: Sustainable Development Projects.

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