HIA FOR THE UPGRADE OF WATER SUPPLY INFRASTRUCTURE FOR NTAMBANANA SUPPLY AREA, KZN.

FOR CIVTECH ENGINEERS

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EXECUTIVE SUMMARY

This project needs to be upgraded with a new infrastructure which among others are to construct 79.8km of bulk water pipelines of between 110 dia . 450 to supply specific reservoirs. Installation of 6 pump stations and 12 reservoirs with a total capacity of 7.5Mℓ/d. Reticulationof approximately 395km with metered connections will also form part of the project and will be implemented simultaneously with the bulk but funded separately from MIG Programme.

The Heritage Impact Assessment was undertaken in April 2022 in conjunction with the Palaeontological Impact Assessment. The desktop HIA noted that there were several houses within 100m of the proposed pipeline from the 1960s onwards. This would suggest that graves could occur near the pipeline. The desktop PIA noted that there were areas of very high sensitivity along the pipeline route.

The HIA recorded 35 heritage sites that occur within 50m of the pipeline footprint. Some of these will require the pipeline to be re-aligned. The PIA survey noted four areas that require on-site monitoring during construction phase. The monitoring must be undertaken by a suitably qualified palaeontologist. Permits for the destruction and sampling of palaeontological material will be required from KZNARI.

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
KZNARI	KwaZulu-Natal Amafa & Research Institute

INTRODUCTION

This project is for an extension of the existing water supply scheme originally named Khoza Water Supply. This project is now called Upgrade of Water Supply Infrastructure for Ntambanana Water Supply Area. The project is located in the north west part of City of uMhlathuze which is approximately 5km form Empangeni town and can be accessed via R34 and through Nseleni township. This project will serve council wards 24, 31, 31 and 33. The project area was previously served by King Cetshwayo District Municipality which is a Water Service Authority (WSA). This area was within Ntambanana Local Municipality which was dissolved I September 2012 and absolved by City of uMhlathuze whom is also a WSA. This are according to Census 2011 has 75% dependency ratio and 49% unemployment rate and is regarded as of the poorest areas. A number of funding applications were lodged for this area by the King Cetshwayo District Municipality to supply the project area with a water demand of 25ℓ/c/d. The project area is experiencing a number of water challenges, those being:

- Design philosophy adopted was uneconomical.
- Water interruptions which has created dissatisfaction to the community whom has affected illegal connections.
- Water source was unreliable and was shared with a number of water schemes.
- Poor water management with no individual household water meter installed to control water leakage and to manage water losses

This project needs to be upgraded with a new infrastructure including the construction of 79.8km of bulk water pipelines of between 110 – 450mm diameter to supply specific reservoirs. Installation of 6 pump stations and 12 reservoirs with a total capacity of 7.5Mℓ/d. Reticulation of approximately 395km with metered connections will also form part of the project and will be implemented simultaneously with the bulk but funded separately from MIG Programme.

Umlando was requested to undertake an HIA of the proposed irrigation developments. Figures 1 – 6 show the location of the development.

FIG. 1 GENERAL LOCATION OF THE PROPOSED DEVELOPMENT

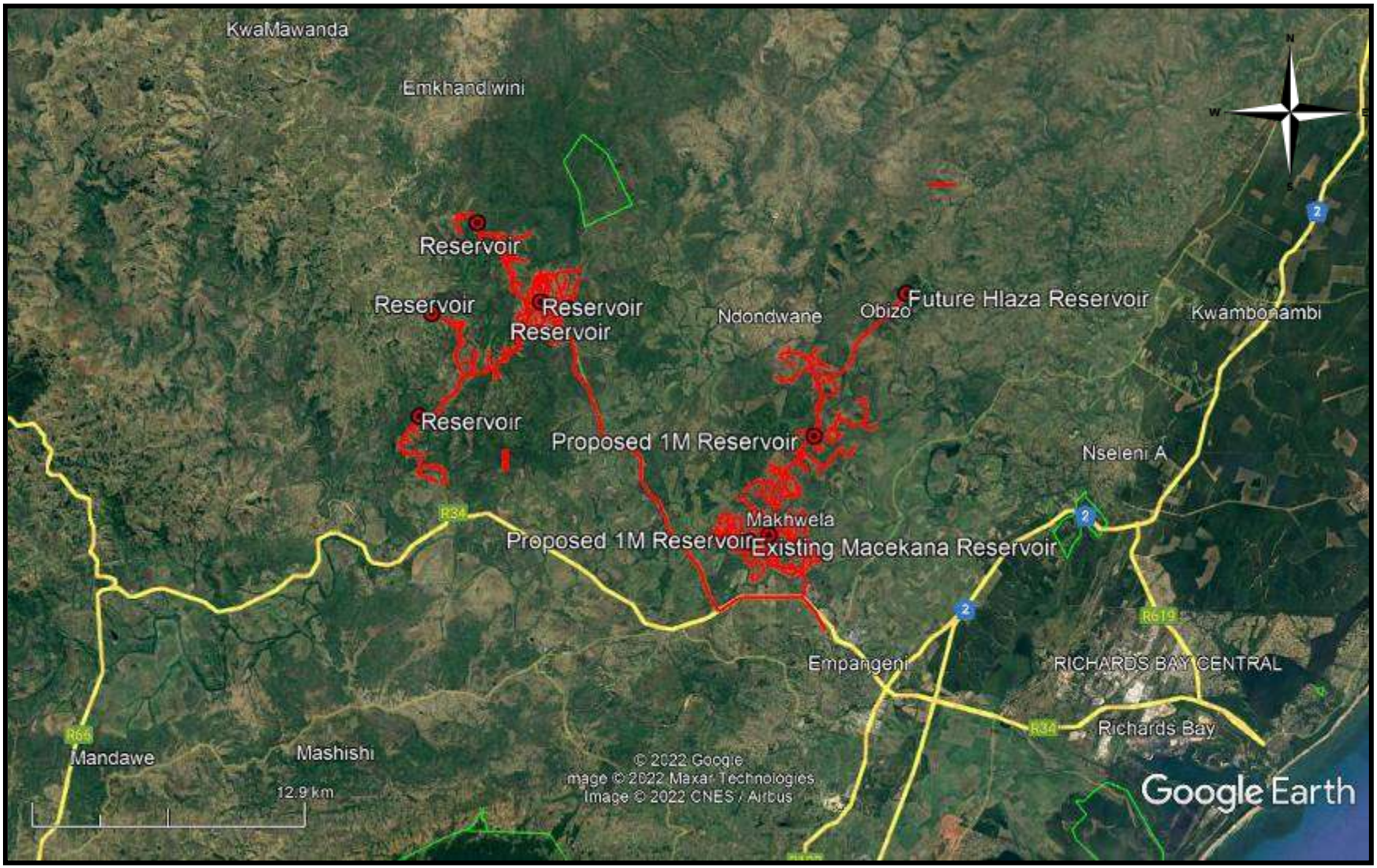


FIG. 2: AERIAL OVERVIEW OF THE PROPOSED DEVELOPMENT: WEST SECTION

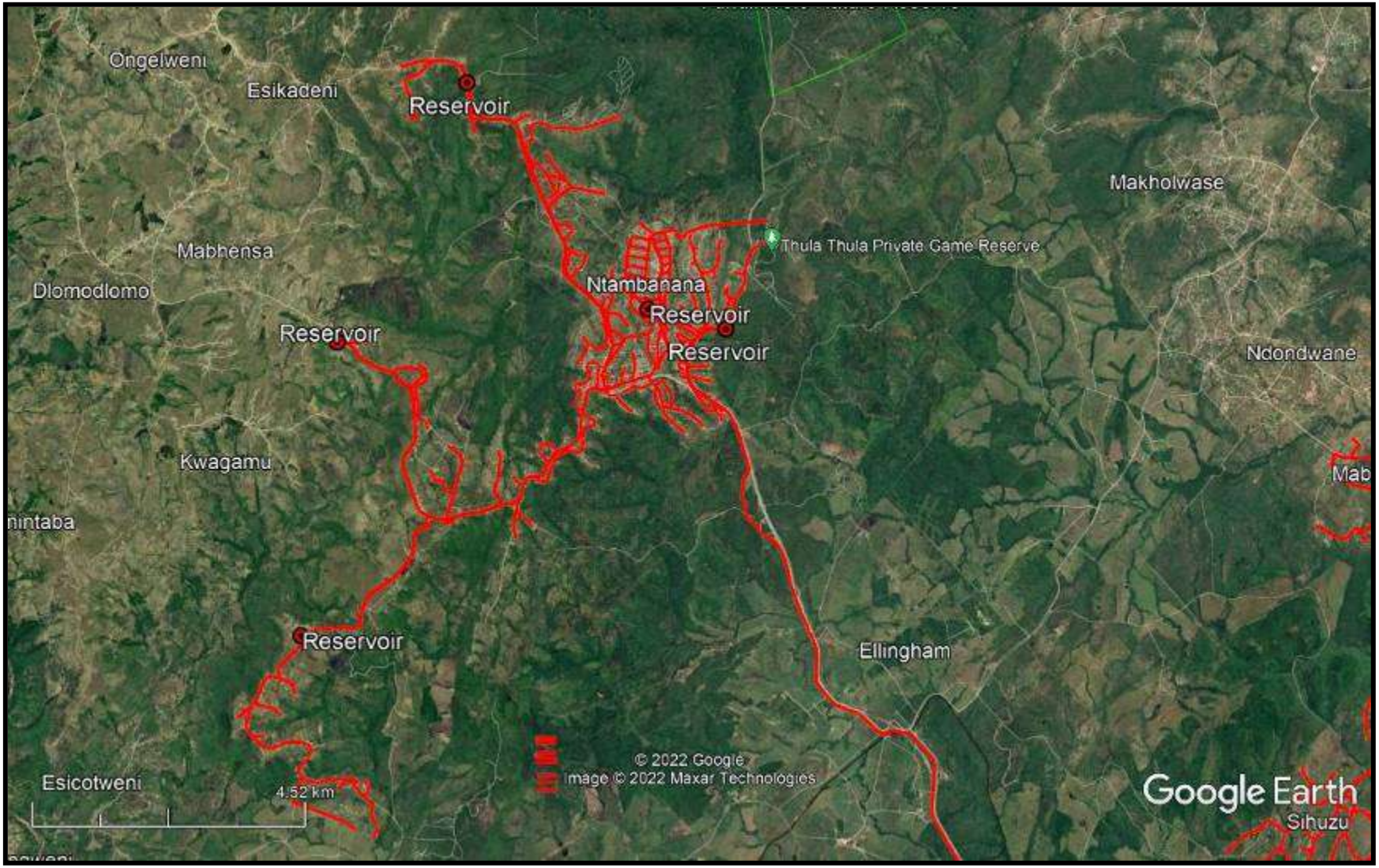


FIG. 3: AERIAL OVERVIEW OF THE PROPOSED DEVELOPMENT: EAST SECTION

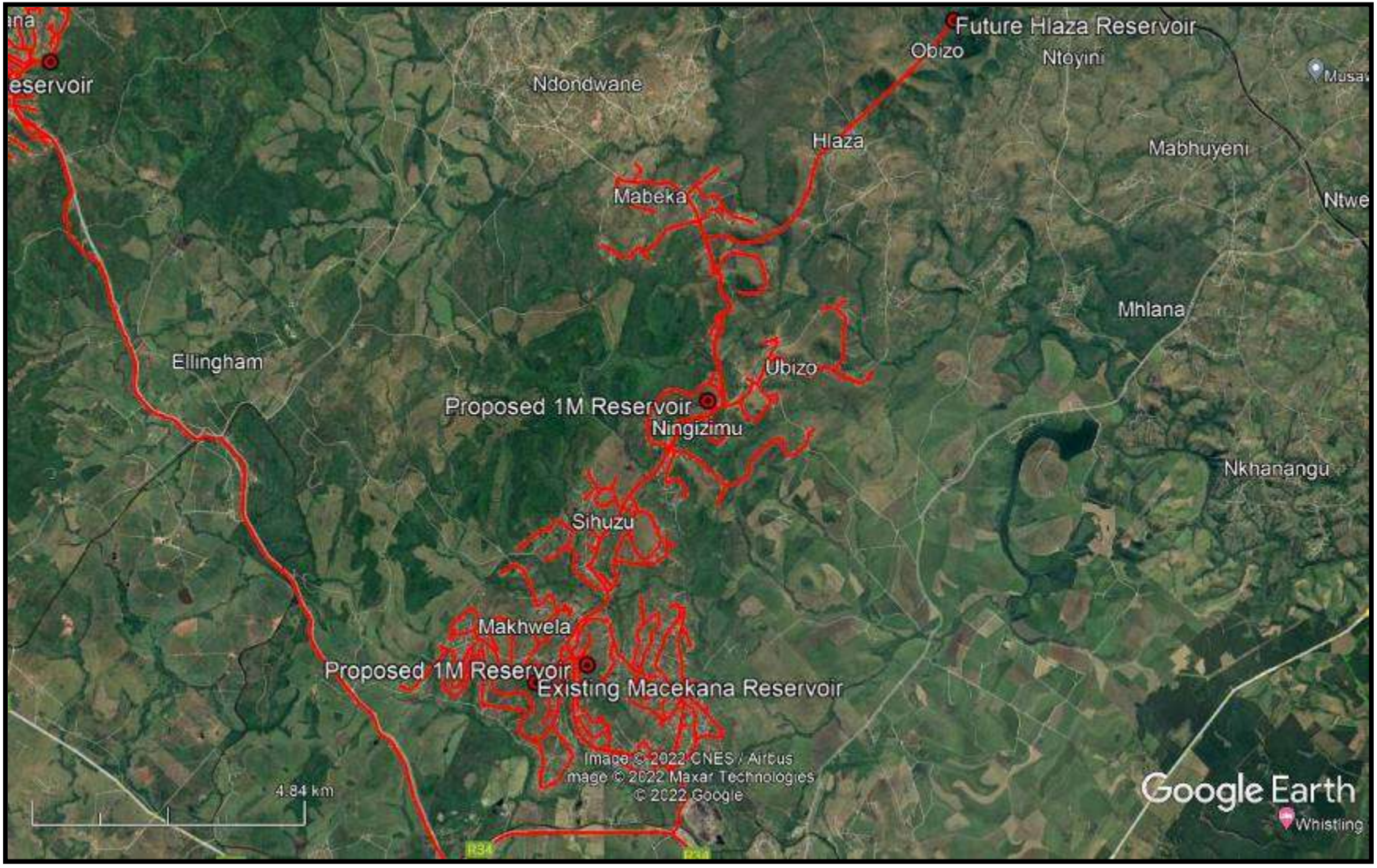


FIG. 4: TOPOGRAPHICAL MAP OF THE PROPOSED DEVELOPMENT: WEST SECTION

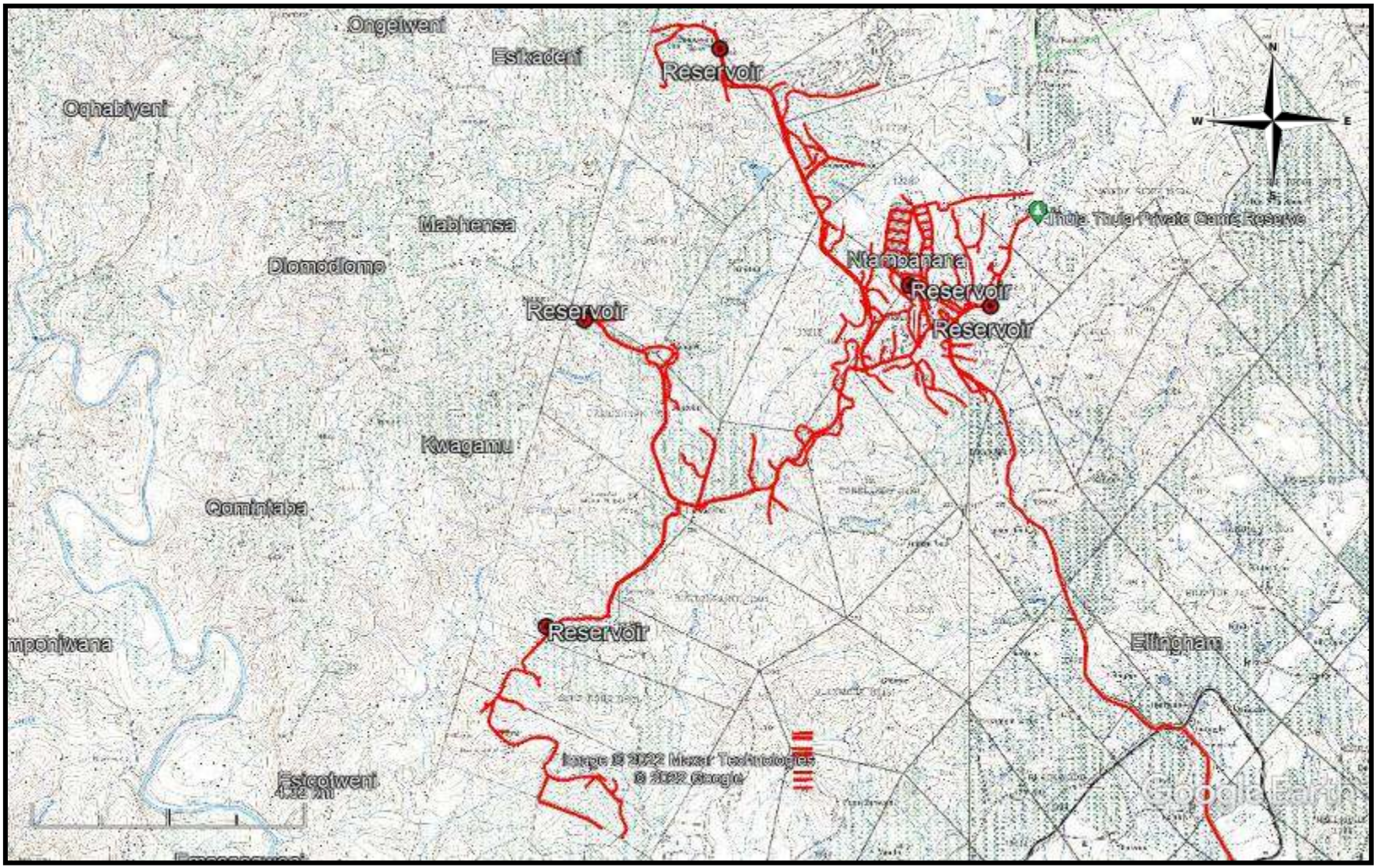


FIG. 5: TOPOGRAPHICAL MAP OF THE PROPOSED DEVELOPMENT: EAST SECTION

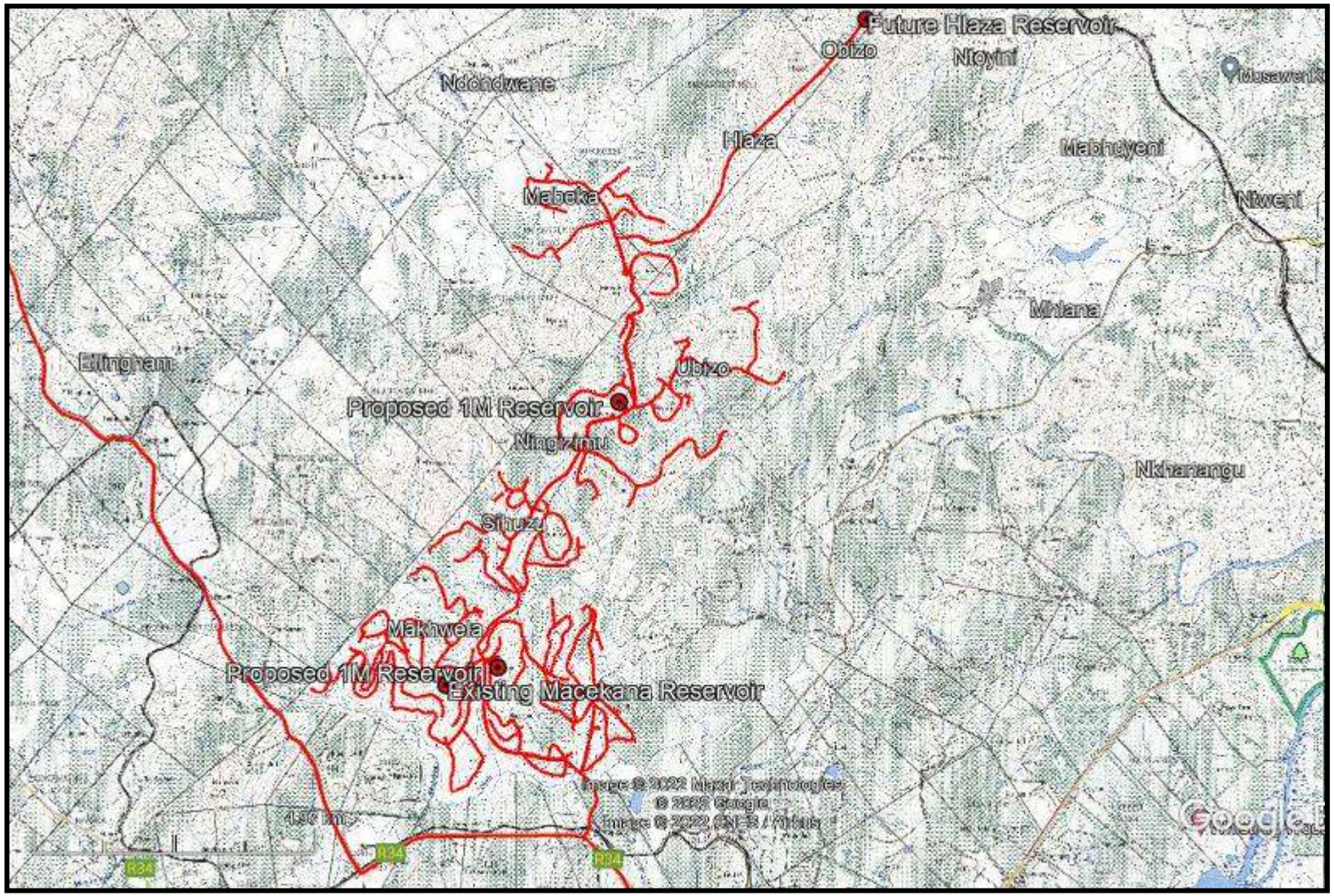


FIG. 6: SCENIC VIEWS OF THE STUDY AREA

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. Few archaeological sites occur in the general area (fig. 5). This will be a result of a lack of surveys, rather than an indication of the amount of sites. Anderson (2018) undertook a survey for the Khoza water reticulation pipeline. He recorded several human graves, *muthi* trees, Stone Age artefact scatters and Late Iron Age/Historical Period pottery sherds.

Using the historical maps to locate the occurrence of human settlements, or houses, is important. These older houses are in rural areas where traditional burial practices would be undertaken. This means that a Nguni-speaking settlement pattern will exist where graves will occur on the outskirts of the house, normally on the opposite side of the cattle byre. The graves can be 20m – 60m from the main house, or *indlu enkulu*. It is for this reason why a 50m – 100m radius around the houses from the maps is needed.

The 1937 aerial photograph indicates that there are nine houses/settlements within 100m of the footprint. Most of these occur within 50m of the footprint (Fig. 6).

The 1968 topographical map indicates that there are settlements in the general area, but they will not be affected by the proposed project (fig. 7). There is also a sharp increase in the number of houses in the general area.

FIG. 7: LOCATION OF KNOWN HERITAGE SITES IN THE GENERAL AREA

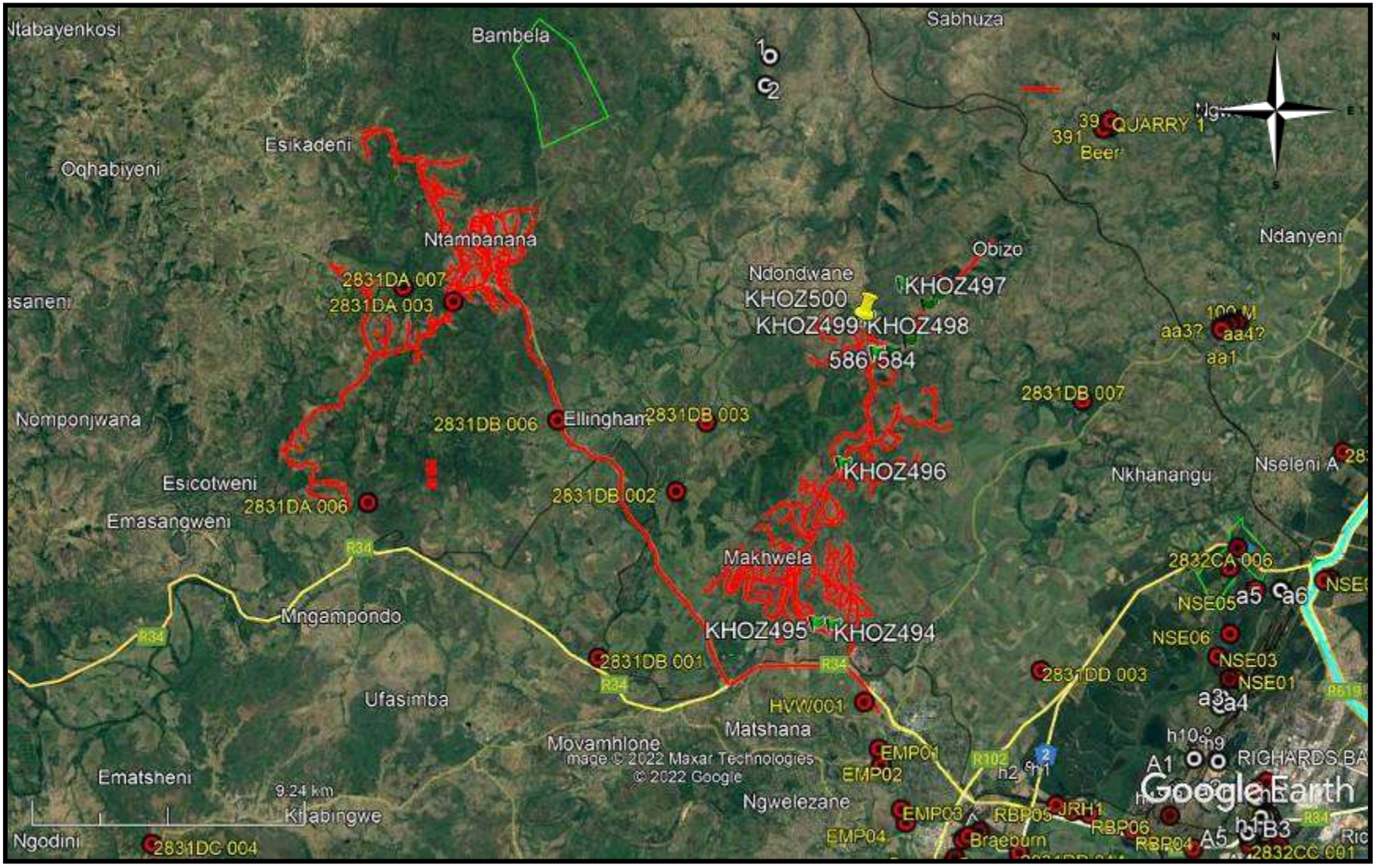


FIG. 8: LOCATION OF THE STUDY AREA IN 1937

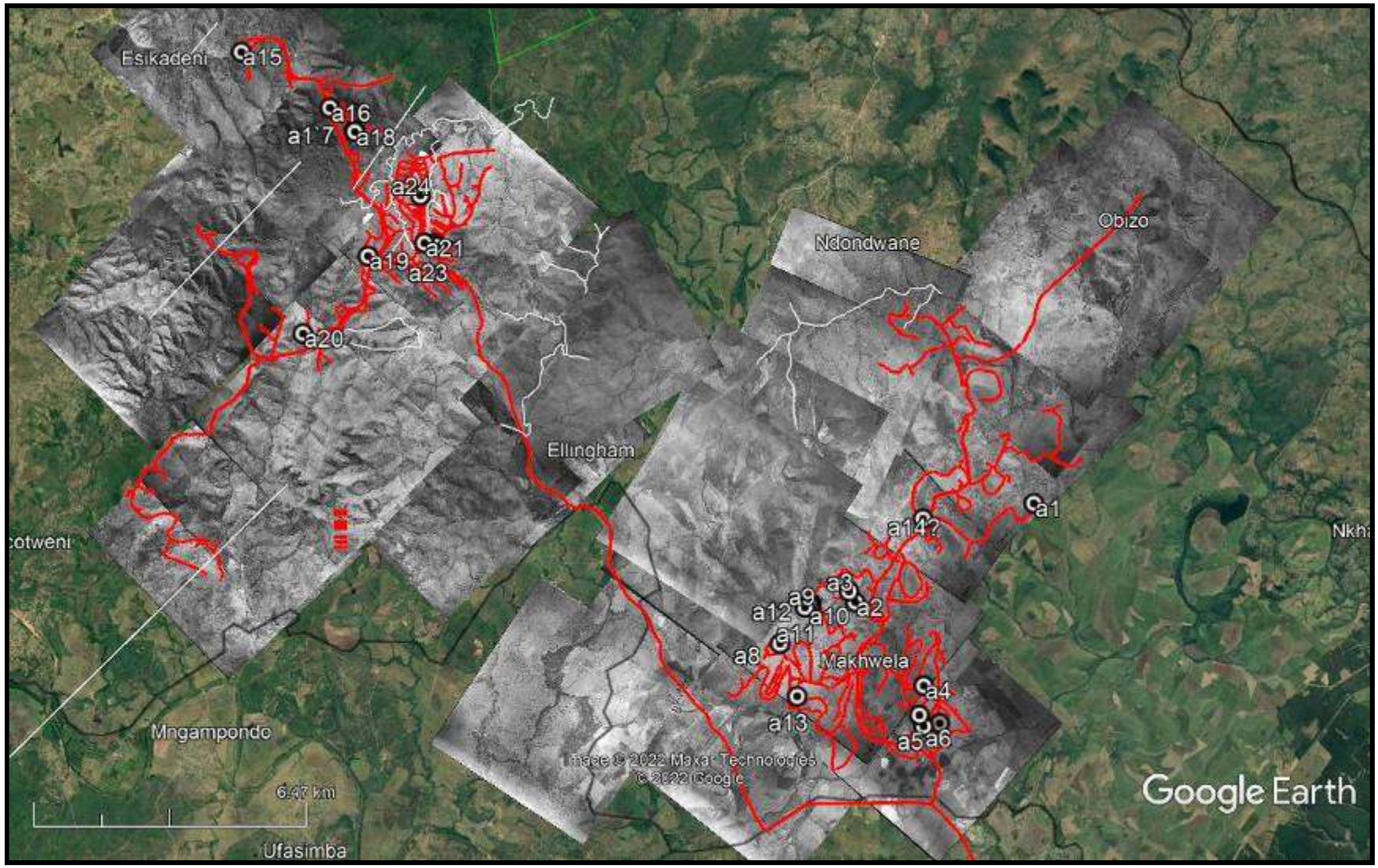
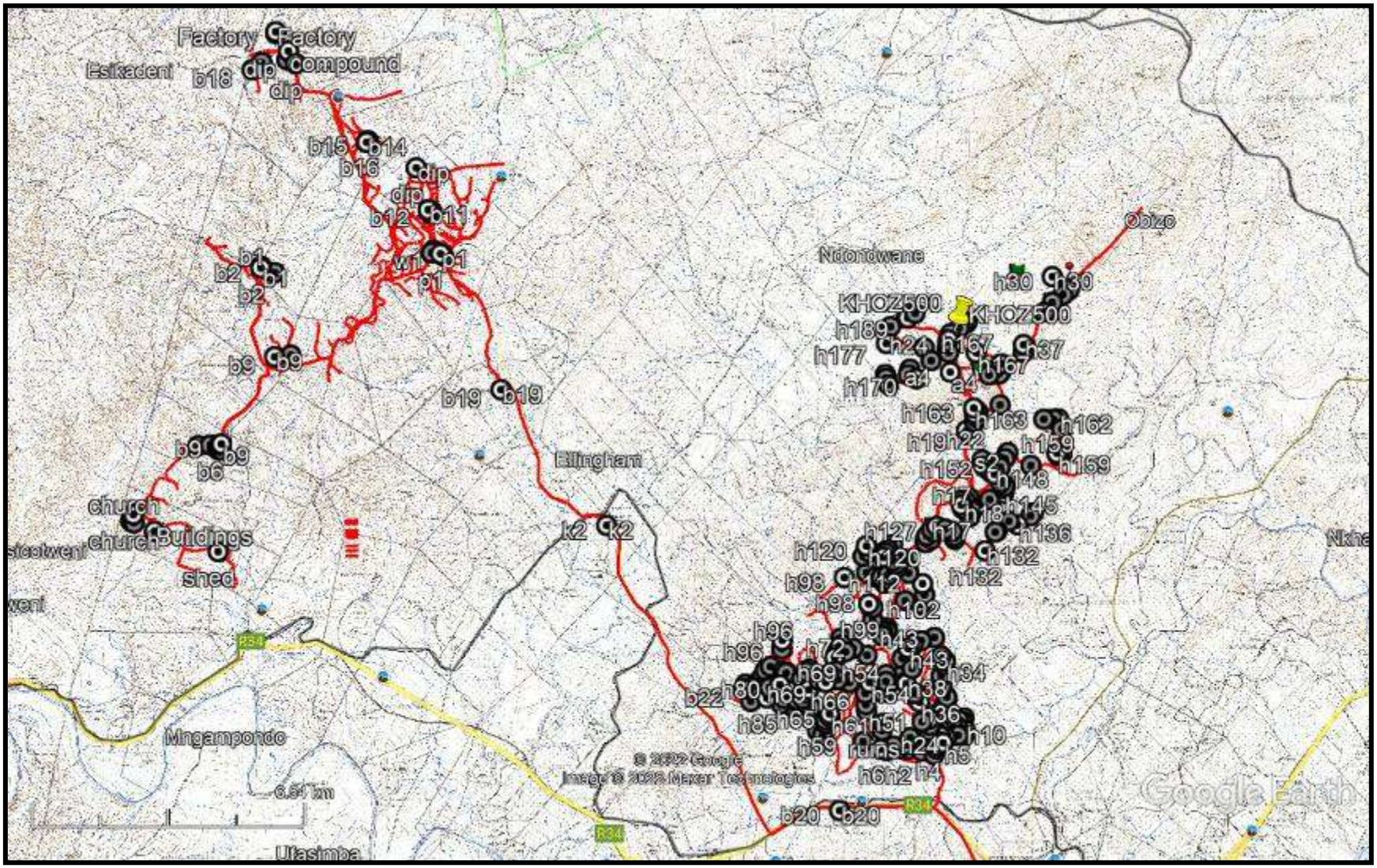


FIG. 9: LOCATION OF THE STUDY AREA IN 1964-1965



Map Date	Name	Latitude	Longitude	Description
1937	a1	-28.660821883	31.891332579	House
	a2	-28.681929264	31.847965105	House
	a3	-28.679637888	31.846440272	House
	a4	-28.699704382	31.864643357	House
	a5	-28.705970583	31.863601114	House
	a6	-28.708383292	31.864648322	House
	a7	-28.707704157	31.868541693	House
	a8	-28.690778486	31.829712472	House
	a9	-28.682727679	31.837153848	House
	a10	-28.682404569	31.836508917	House
	a11	-28.683083586	31.835772168	House
	a12	-28.682173274	31.837240721	House
	a13	-28.702009146	31.833889739	House
	a14?	-28.664142891	31.864402432	House
	a15	-28.564832979	31.698714447	House
	a16	-28.576728157	31.720232117	House
	a1`7	-28.581502884	31.726159484	House
	a18	-28.581877471	31.726313717	House
	a19	-28.608316563	31.729528795	House
	a20	-28.624828799	31.713718248	House
	a21	-28.605520877	31.743197938	House
	a22	-28.605663334	31.745664189	House
	a23	-28.606278673	31.746342495	House
	a24	-28.595393487	31.742248585	House
1965 - 1965	shed	-28.609247258	31.704146705	shed
	b1	-28.607933915	31.701036629	Building
	b2	-28.608316241	31.700932555	Building
	shed	-28.669417203	31.689723643	shed
	Buildings	-28.664914509	31.674575660	Buildings
	Ruins	-28.663084785	31.669648022	Ruins
	Ruins	-28.662716644	31.668851670	Ruins
	church	-28.661307020	31.669515206	church
	B4	-28.646516737	31.685502375	Building
	b5	-28.646349149	31.688638917	Building
	b6	-28.647407212	31.691202933	Building
	b7	-28.647245346	31.690433707	Building
	b6	-28.646358858	31.690871010	Building
	b9	-28.646127497	31.691399488	Building
	b9	-28.627428485	31.704442080	Building
	b10	-28.627042355	31.708402628	Building
	Police	-28.604989646	31.742659589	Police station
	K1	-28.604425364	31.743186004	Kraal
	p1	-28.605212972	31.744890483	Post office
	w1	-28.605649488	31.745630674	workshop
	b11	-28.595664382	31.741787282	Building
	b12	-28.596311900	31.742039436	Building
	b13	-28.596037265	31.742716339	Building
	b14	-28.581187871	31.726750420	Building
	b15	-28.580913598	31.727004966	Building
	b16	-28.580983919	31.727230201	Building
	dip	-28.564541239	31.709743269	dip
	dip	-28.563692760	31.707635316	dip
	compound	-28.561840952	31.707963864	compound
	b17	-28.564305689	31.701423073	Building

	b18	-28.565825764	31.699084037	Building
	Factory	-28.557524924	31.704693059	Factory
	Compound	-28.557931412	31.704713722	Compound
	dip	-28.586555671	31.738770568	dip
	b19	-28.634469133	31.759641425	Wychwood
	k2	-28.663795087	31.785551242	Kraal
	b20	-28.725563423	31.843078778	Building
	ruins	-28.706562417	31.853813812	Ruins
	h1	-28.708169426	31.853528882	House
	h2	-28.713525600	31.866446221	House
	h3	-28.712230983	31.866975349	House
	h4	-28.711489077	31.867318907	House
	h5	-28.710935247	31.868680297	House
	h6	-28.709929114	31.869468011	House
	h7	-28.709301316	31.867876543	House
	h8	-28.709311598	31.872377387	House
	h9	-28.709361057	31.873925508	House
	h10	-28.708179177	31.874139710	House
	h11	-28.707526482	31.872247157	House
	h12	-28.706356573	31.873622380	House
	h13	-28.705476415	31.873851113	House
	h14	-28.706017722	31.872518469	House
	h15	-28.706659766	31.870827554	House
	h16	-28.707138604	31.868620499	House
	h17	-28.708006389	31.867947365	House
	h18	-28.708321981	31.865252830	House
	h19	-28.707127575	31.865438431	House
	h20	-28.711025641	31.863706392	House
	h21	-28.709795034	31.860509165	House
	h22	-28.711379559	31.859406324	House
	h23	-28.706323926	31.863416890	House
	h24	-28.705769974	31.865122229	House
	h25	-28.705794479	31.866455254	House
	h26	-28.704461358	31.867515137	House
	h27	-28.703455023	31.868718478	House
	h28	-28.702536999	31.869291200	House
	h29	-28.701556311	31.869462552	House
	h30	-28.700977960	31.869548170	House
	h31	-28.698877708	31.868312931	House
	h32	-28.696415931	31.868160993	House
	h33	-28.693975649	31.868936219	House
	h34	-28.693162213	31.869186268	House
	h35	-28.692085640	31.868108068	House
	h36	-28.702001621	31.862751533	House
	h37	-28.700111811	31.861522505	House
	h38	-28.697958608	31.859416289	House
	h39	-28.694682863	31.860817741	House
	h40	-28.696420549	31.858037194	House
	h41	-28.693517769	31.861067653	House
	h42	-28.692529770	31.858385878	House
	h43	-28.690331015	31.859837725	House
	h44	-28.689715050	31.860990018	House
	h45	-28.688724923	31.863194460	House
	h46	-28.688063949	31.866476497	House
	h47	-28.699873304	31.853628245	House

	h48	-28.698224268	31.854805220	House
	h49	-28.697477096	31.854353770	House
	h50	-28.695960381	31.854428167	House
	h51	-28.703831453	31.849670545	House
	h52	-28.702490703	31.849444378	House
	h53	-28.700028891	31.849267806	House
	h54	-28.697720517	31.850344268	House
	h55	-28.691873710	31.849815207	House
	h56	-28.709191274	31.838884271	House
	h57	-28.708225376	31.837567266	House
	h58	-28.706622234	31.839581976	House
	h59	-28.705820925	31.839662289	House
	h60	-28.705207916	31.840575626	House
	h61	-28.704430227	31.840467853	House
	h62	-28.703119870	31.835889882	House
	h63	-28.703067425	31.831619850	House
	h64	-28.701167517	31.833937295	House
	h65	-28.699963595	31.834394397	House
	h66	-28.699187576	31.835339599	House
	h67	-28.697686612	31.845372745	House
	h68	-28.697072272	31.842475243	House
	h69	-28.697608162	31.839517240	House
	h70	-28.695842369	31.840309500	House
	h71	-28.695226571	31.842078060	House
	h72	-28.692310771	31.841741471	House
	h73	-28.691106067	31.844485619	House
	h74	-28.690491316	31.842777616	House
	h75	-28.689581467	31.843600639	House
	h76	-28.690356353	31.846376068	House
	h77	-28.697234079	31.837961752	House
	h78	-28.696833920	31.833600466	House
	h79	-28.701435473	31.832412369	House
	h80	-28.698199162	31.828263585	House
	h81	-28.701168319	31.829301292	House
	h82	-28.702345525	31.828600137	House
	h83	-28.695657499	31.829787748	House
	h84	-28.695283141	31.829025233	House
	h85	-28.701088908	31.825031487	House
	h86	-28.698814927	31.825701937	House
	h87	-28.701838644	31.821097182	House
	h88	-28.698735436	31.821462331	House
	h89	-28.698120403	31.819815347	House
	b22	-28.699163763	31.819388555	House
	h90	-28.696996271	31.823627278	House
	h91	-28.695123519	31.824694201	House
	h92	-28.694294006	31.825944388	House
	h93	-28.695362129	31.834758161	House
	h94	-28.694800168	31.835489892	House
	h95	-28.690441277	31.828749016	House
	h96	-28.688568667	31.828839993	House
	h97	-28.688190416	31.843325071	House
	h98	-28.675025281	31.844105815	House
	h99	-28.680774685	31.850206995	House
	h100	-28.674995282	31.853253342	House
	h101	-28.674915559	31.851820229	House

	h103	-28.680045477	31.859149935	House
	h102	-28.676340414	31.863390640	House
	h103	-28.678719427	31.863873208	House
	h104	-28.680753674	31.863087087	House
	h105	-28.674058619	31.859933910	House
	h106	-28.673521391	31.859889867	House
	h107	-28.671008324	31.858685683	House
	h108	-28.671142912	31.858029694	House
	h109	-28.671066645	31.856870604	House
	h110	-28.671373992	31.856017874	House
	h111	-28.674463691	31.854816616	House
	h112	-28.670607424	31.853677475	House
	h113	-28.669820893	31.853283446	House
	h114	-28.669667011	31.854267455	House
	h115	-28.668918481	31.854835650	House
	h116	-28.667920268	31.856016010	House
	h117	-28.673966795	31.849633187	House
	h118	-28.670417437	31.848734934	House
	h119	-28.669515079	31.850287178	House
	h120	-28.668153057	31.849499283	House
	h121	-28.667512819	31.864303895	House
	h122	-28.666994903	31.863997432	House
	h123	-28.666706428	31.865418664	House
	h124	-28.665977779	31.864412304	House
	h125	-28.665151914	31.866117467	House
	h126	-28.664557379	31.865548547	House
	h127	-28.663961975	31.866794612	House
	h128	-28.664517386	31.868872355	House
	h129	-28.665053738	31.870643972	House
	h130	-28.666070425	31.871125745	House
	h131	-28.666761118	31.871235553	House
	h132	-28.669193875	31.878686023	House
	h133	-28.665201387	31.881241551	House
	h134	-28.664913306	31.881700545	House
	h135	-28.662839258	31.884694739	House
	h136	-28.663605395	31.886816591	House
	h137	-28.661722924	31.890095083	House
	b22	-28.661012518	31.890816076	House
	h140	-28.658144602	31.879800840	House
	h141	-28.661869543	31.874970466	House
	h142	-28.660587850	31.875456363	House
	h143	-28.660038556	31.875664597	House
	h144	-28.658407915	31.872621102	House
	h145	-28.656861100	31.883346241	House
	b23	-28.655808444	31.883467102	House
	h146	-28.655243898	31.883657881	House
	h147	-28.654527576	31.882562126	House
	h148	-28.652697862	31.881083101	House
	h149	-28.652255999	31.880178810	House
	h150	-28.651082261	31.878613382	House
	h151	-28.649602827	31.878090777	House
	s2	-28.652224710	31.881482530	Shed
	b24	-28.651202036	31.882489978	Buildings
	h152	-28.650547190	31.880612078	House
	h153	-28.650485267	31.882141757	House

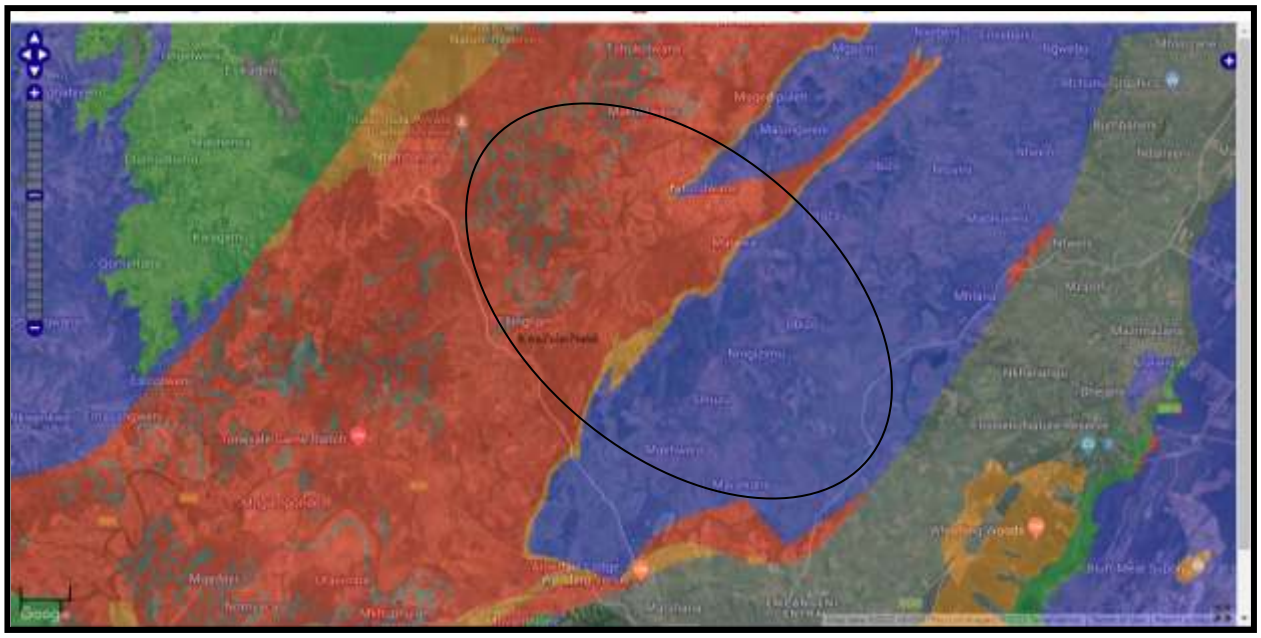
	h154	-28.649325006	31.883618419	House
	h155	-28.648029702	31.884382263	House
	h156	-28.650787257	31.890034053	House
	h157	-28.648738311	31.897072439	House
	h158	-28.648188509	31.897958460	House
	h159	-28.648143715	31.896585173	House
	h160	-28.642910405	31.897831904	House
	h161	-28.640821884	31.895831069	House
	h162	-28.640759955	31.897134646	House
	h163	-28.640808327	31.893380246	House
	h162	-28.639211264	31.876989560	House
	h163	-28.638407829	31.875944315	House
	h164	-28.637712845	31.882549324	House
	h165	-28.631238229	31.879847854	House
	h166	-28.631016616	31.882355729	House
	h167	-28.626443692	31.876767985	House
	h168	-28.628801540	31.882805522	House
	h169	-28.628175148	31.865525227	House
	h170	-28.632068031	31.861846825	House
	h171	-28.630012157	31.860290904	House
	h172	-28.631223202	31.859897432	House
	h173	-28.633339531	31.855015101	House
	h174	-28.631994328	31.854488856	House
	h175	-28.631148717	31.854291341	House
	h176	-28.625344753	31.863812888	House
	h177	-28.624428830	31.854578744	House
	h188	-28.620766446	31.855604949	House
	h189	-28.618891169	31.859848658	House
	h190	-28.618695219	31.859593284	House
	h191	-28.617882104	31.861666660	House
	h1	-28.712773233	31.863387255	House
	h2	-28.712373503	31.859822208	House
	h3	-28.712155555	31.857862376	House
	h4	-28.711617755	31.856371045	House
	h5	-28.712648821	31.854776130	House
	h6	-28.712286878	31.853231972	House
	b1	-28.710664383	31.848862102	House
	h6	-28.687637602	31.853576407	House
	h7	-28.686629170	31.854731573	House
	h8	-28.686779545	31.853595839	House
	h9	-28.685920030	31.854733907	House
	h10	-28.684407246	31.851228391	House
	h11	-28.676208933	31.853998221	House
	h12	-28.675488554	31.854995748	House
	h13	-28.672844536	31.857161249	House
	h14	-28.672161052	31.858173684	House
	h15	-28.672084096	31.856806360	House
	h16	-28.671893409	31.858788028	House
	h17	-28.659336579	31.872749738	House
	h18	-28.660083493	31.873211331	House
	h19	-28.643280994	31.874149758	House
	h20	-28.641392805	31.876273009	House
	h21	-28.640505805	31.876973383	House
	h22	-28.639612599	31.876196410	House
	h23	-28.626423096	31.869865464	House

	h24	-28.623658739	31.869808606	House
	h25	-28.622358407	31.870308316	House
	h26	-28.621069258	31.872529113	House
	h27	-28.620427165	31.873395292	House
	h288	-28.619928853	31.874384193	House
	h29	-28.619510380	31.873418161	House
	h30	-28.610007647	31.895316702	House
	h31	-28.630436000	31.882898000	House
	h32	-28.626339000	31.888313000	House
	h33	-28.612857166	31.899431222	House
	h34	-28.617701262	31.893412764	House
	h35	-28.615561414	31.895307918	House
	h36	-28.613947591	31.897889644	House
	h37	-28.624694767	31.888312028	House
	KHOZ501	-28.610867056	31.899253034	House
	KHOZ494	-28.713029206	31.861885591	House
	KHOZ495	-28.712371678	31.856079048	House
	KHOZ496	-28.663962055	31.865329186	House
	KHOZ497	-28.609162000	31.886341000	House
	KHOZ498	-28.619678000	31.873385000	Marula tree
	KHOZ499	-28.619542000	31.873631000	E ingens
	KHOZ500	-28.622446961	31.870871174	House
	a2	-28.658373483	31.873803698	House
	a1	-28.681539079	31.851279468	House
	a5	-28.625468427	31.869449383	House
	a3	-28.657686649	31.874703569	House
	a4	-28.630651986	31.870219880	House

PALAEONTOLOGICAL SENSITIVITY

The area is in an area of zero to very high palaeontological sensitivity (fig. 10). Dr Alan Smith undertook a desktop and field survey of the area (Appendix A). Twenty-eight sensitive areas were visited and assessed in terms of significance. Of these areas, five require monitoring during construction activity by a suitably qualified palaeontologist. Four of these areas will require monitoring for approximately 100m, while the fifth site will require monitoring for as long as is deemed necessary. Table 4 and Figure 49 show these sites.

FIG. 10: 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

The field survey was undertaken in April 2022. Site visibility was good in most places, especially where the pipes will be replaced (e.g. fig. 11). In most areas, the pipelines will run adjacent to the road or track, and thus not be more than 2-3m from the edge. In other areas, it is a case of upgrading and/or replacing existing pipelines. Some areas were inaccessible due to dense Acacia spp. and other vegetation regrowth. These few areas were not surveyed; however, they do not fall into sensitive areas. One section occurs in older ploughed agricultural fields in a floodplain. This is now impenetrable Acacia regrowth and was not surveyed, due to its low heritage value.

Table 3 lists the recorded sites while fig. 12 shows their locations.

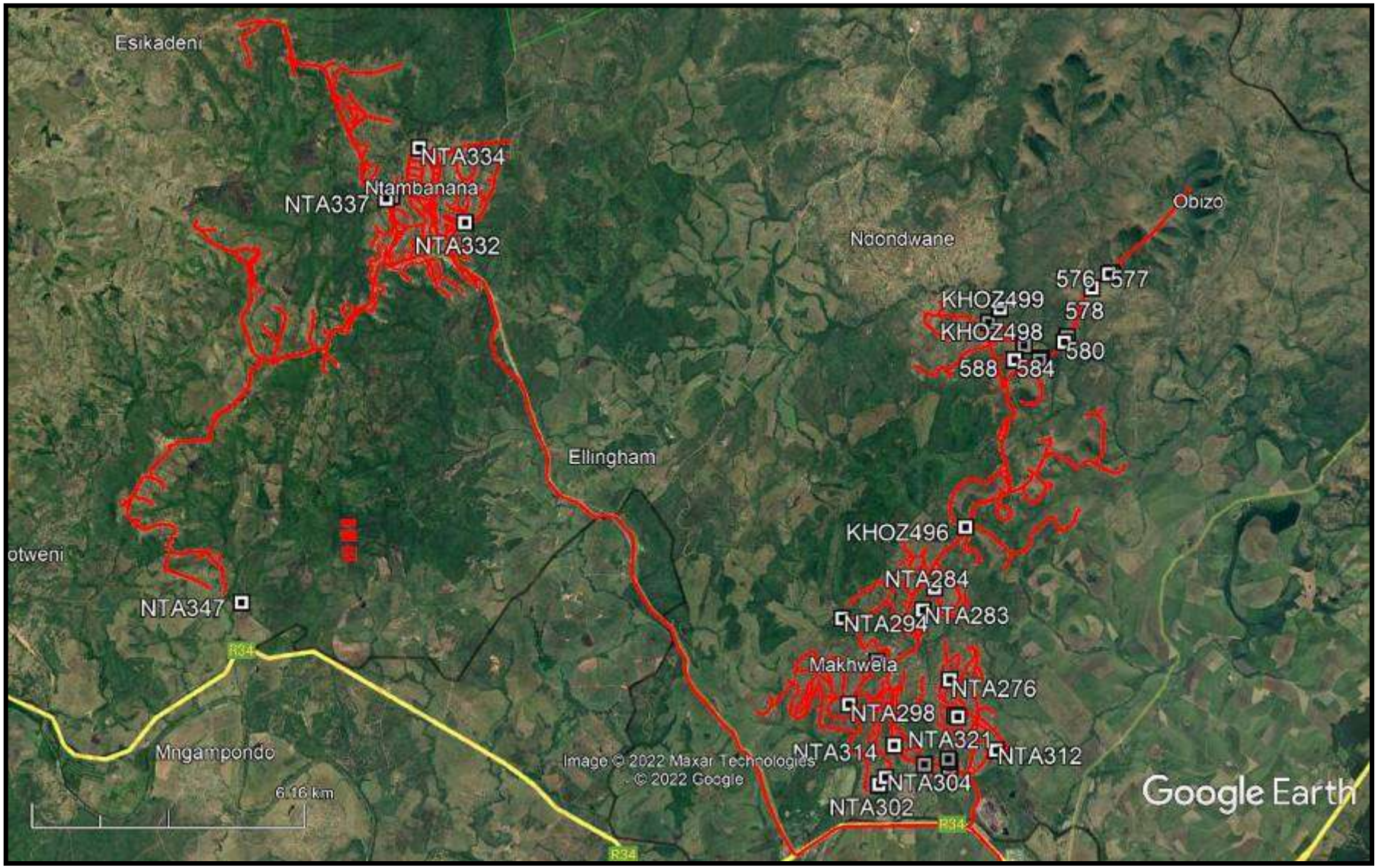
TABLE 3: LOCATION OF RECORDED SITES

Name	Latitude	Longitude	Description
NTA339	-28.596859263	31.732803083	Graves x2
NTA337	-28.597366600	31.731387300	Grave or jojo base
NTA334	-28.587029400	31.739128100	**E ingens 2**
NTA332	-28.602303300	31.749884600	**Cemetery**
NTA321	-28.702536400	31.863706500	Grave
NTA320	-28.702247514	31.863082085	E. ingens, Grave?; h36
NTA314	-28.708373196	31.848964418	Gr 6
NTA313	-28.711761900	31.861951400	Gr 8
NTA312	-28.709486898	31.872704281	Gr 9
NTA308	-28.711272500	31.861563300	Gr 7
NTA304	-28.714980110	31.847020130	Gr 4
NTA302	-28.716405600	31.845515800	Gr 3
NTA300	-28.716608700	31.845376100	Gr2
NTA298	-28.699820305	31.838318402	Temple
NTA295	-28.691253900	31.844979400	Cemetery
NTA294	-28.682523474	31.836810028	Cemetery
NTA291	-28.627089100	31.879190800	walling
NTA284	-28.676321700	31.858241500	grave
NTA283	-28.680878913	31.855597369	grave
NTA276	-28.694994585	31.861814911	graves
KHOZ500	-28.622446961	31.870871174	
KHOZ499	-28.619542000	31.873631000	E. ingens
KHOZ498	-28.619678000	31.873385000	Marula

KHOZ496	-28.663962055	31.865329186	Gr
KHOZ495	-28.712371678	31.856079048	Gr
KHOZ494	-28.713029206	31.861885591	GR
KHOZ 588	-28.630020710	31.876852953	Gr?
KHOZ 587	-28.630069175	31.876975253	Gr?
KHOZ 586	-28.630077000	31.876944000	Gr?
KHOZ 585	-28.630080000	31.876940000	Gr?
KHOZ 584	-28.630052343	31.876920766	Gr?
KHOZ 583	-28.629855000	31.883218000	H31
KHOZ 582	-28.629752000	31.883088000	H31
KHOZ 581	-28.630079000	31.882724000	H31
KHOZ 580	-28.626466000	31.888368000	0000327;h32
KHOZ 579	-28.625360000	31.889011000	0000325; 0000326
KHOZ 578	-28.615490000	31.894680000	H35; 0000323; 0000324
KHOZ 577	-28.612648000	31.898540000	Muthi tree
KHOZ 576	-28.612553000	31.899179000	Photo **0000322; graves and E. ingens; h33**
KHOZ 575	-28.612661232	31.899246774	Photo **0000322; graves and E. ingens; h33**

FIG. 11: EXAMPLES OF CURRENT PIPELINES TO BE REPLACED

FIG. 12 LOCATION OF RECORDED SITES



NTA339

NTA339 consists of two graves 8m south of the road (fig. 13). They will not be affected the pipeline as it is on the opposite side of the road.

Significance: The graves are of high significance.

Mitigation: No mitigation is required.

SAHRA Rating: 3A

FIG. 13: GRAVES AT NTA339

NTA337

NTA337 consists of one grave 7m south of the road (fig. 14). It was initially thought to be the base for a Jo-Jo tank; however, the stones are not level and follow the slope of the ground. The grave will not be affected by the pipeline.

Significance: The grave is of high significance.

Mitigation: No mitigation is required.

SAHRA Rating: 3A

FIG. 14: GRAVES AT NTA339

NTA334

NTA334 consists of two large *Euphorbia ingens* of which one is 3m from the pipeline (fig. 15). The potential grave may be affected by the pipeline.

Significance: The grave is of high significance.

Mitigation: The pipeline should be moved 5m north/northeast to avoid possible human remains.

SAHRA Rating: 3A

FIG. 15: E. INGENS AT NTA334

NTA332

NTA332 consists of a cemetery of several graves 15m from the road (fig. 16). The pipeline occurs ~10m from the graves and should be moved, as it is a bulk water pipeline.

Significance: The graves are of high significance.

Mitigation: The pipeline should be moved to the opposite side of the road, or on the road reserve in case there are unmarked graves closer to the road.

SAHRA Rating: 3A

FIG. 16: CEMETERY AT NTA332

NTA321

NTA321 consists of one grave 4m north of the road behind a fence (fig. 17). The grave will not be affected by the pipeline.

Significance: The grave is of high significance.

Mitigation: No mitigation is required.

SAHRA Rating: 3A

FIG. 17: GRAVE AT NTA321

NTA320

NTA320 consists of a large E. ingens on the edge of the track (fig. 18). The area is associated with H38 from the desktop study. The *E. ingens* will not be affected by the pipeline as it is on the opposite side of the road.

Significance: The grave is of high significance.

Mitigation: No mitigation is required.

SAHRA Rating: 3A

FIG. 18: E. INGENS AT NTA320

NTA312

NTA312 consists of one grave 10m north of the road (fig. 13). The pipeline will not affect the grave if it remains within 2m of the road reserve...

Significance: The grave is of high significance.

Mitigation: No mitigation is required.

SAHRA Rating: 3A

FIG. 19 GRAVE AT NTA312

NTA313

NTA313 consists of one grave 5m north of the road (fig. 20). The pipeline will occur within 3m of the grave and will need to be moved to the opposite side of the road.

Significance: The grave is of high significance.

Mitigation: Pipeline needs to be realigned to the other side of the road.

SAHRA Rating: 3A

FIG. 20 GRAVE AT NTA313

NTA308

NTA309 consists of one grave 5m north of the road (fig. 21). The pipeline will occur within 3m of the grave and will need to be moved to the opposite side of the road.

Significance: The grave is of high significance.

Mitigation: Pipeline needs to be realigned to the other side of the road.

SAHRA Rating: 3A

FIG. 21 GRAVE AT NTA308

NTA304

NTA304 consists of one grave 5m from the road (fig. 22). The pipeline will occur 30m from the grave and will not affect.

Significance: The grave is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 22 GRAVE AT NTA304

NTA302

NTA304 consists of one grave 7m from the road (fig. 23). The pipeline will occur on the opposite side of the road and will not affect the grave.

Significance: The grave is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 23 GRAVE AT NTA302

NTA300

NTA300 consists of one grave 7m from the road (fig. 24). The pipeline will occur on the opposite side of the road and will not affect the grave.

Significance: The grave is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 24 GRAVE AT NTA300

NTA298

NTA298 is the Vukuvunule Temple (fig. 25). The pipeline will occur in the corner of the Temple's property.

Significance: The Temple is of high local significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 25 TEMPLE AT NTA298

NTA295

NTA295 is a cemetery at least 5m – 10m from the road (Fig. 26). Some of the graves are demarcated while others appear to be mounds of sand or stone. The cemetery is approx. 50m x 35m in size. The pipeline will not affect the cemetery.

Significance: The cemetery is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 26 CCEMETERY AT NTA304

NTA294

NTA304 consists of a cemetery 8m from the road (fig. 27). The pipeline will occur between the cemetery fencing and the road and will not affect the grave.

Significance: The cemetery is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 27 CEMETERY AT NTA294

NTA291

NTA304 consists of stone walling and terracing for a house (fig. 28). No graves were observed. The pipeline will occur on the opposite side of the road and will not affect the grave.

Significance: The walling is of low significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 28: WALLING AT NTA291

NTA284

NTA284 consists of one grave 5m from the road (fig. 29). The pipeline will occur on the opposite side of the road and will not affect the grave.

Significance: The grave is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 29: GRAVE AT NTA284

NTA283

NTA283 consists of one grave 10m from the road (fig. 30). The pipeline will occur on the opposite side of the road and will not affect the grave.

Significance: The grave is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 30: GRAVE AT NTA283

NTA276

NTA276 consists of one grave 15m from the road and behind fencing (fig. 31). The pipeline will occur on the opposite side of the road and will not affect the grave.

Significance: The grave is of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 31: GRAVES AT NTA276

KHOZ494

KHOZ494 is a single grave within a fenced of garden (fig. 32). It is ~5m south of the road. The grave should not be affected by the pipeline

Significance: The grave is of high significance.

Mitigation: No mitigation is currently required as the grave is demarcated

SAHRA Rating: 3A

FIG. 32: GRAVE AT KHOZ494

*

KHOZ495

KHOZ495 is a group of six graves in a fenced of yard (fig. 33). They are about ~15m west of the road. The pipeline will not affect these graves

Significance: The graves are of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A

FIG. 33: GRAVES AT KHOZ495

KHOZ496

KHOz496 is a single grave to the west of the road (fig. 34). The grave is ~6m from the road reserve and proposed pipeline.

Significance: The grave is of high significance

Mitigation: The pipeline footprint should not extend into the fenced off area of the current yard, or it needs to move the opposite side of the road.

SAHRA Rating: 3A

FIG. 34: GRAVE AT KHOZ496

KHOZ498

KhOZ498 is an example of a tree being used for traditional medicine, or *muthi,* and is thus a heritage resource. The bark of the *Sclerocarya birrea* (Marula) has been shaved off several times and is re-used (fig. 36). Most of the trees in the area have been utilised in a similar manner.

Significance: The tree is of low significance.

Mitigation: If any Marula trees need to be removed, then they should be assessed for *muthi* marks. If they are being used, then the people neighbouring the tree needs to be consulted, as it will be a diminished resource.

SAHRA Rating: 3C

FIG. 36: MARULA TREE USED FOR *MUTHI* AT KHOZ

KHOZ499 and KHOZA450

KHOZ499 and KHOZ450 are examples of another tree of cultural importance. The *Euphorbia ingens* (pin-cushion euphorbia) is traditionally associated with human graves (fig. 37). That is, the plant was placed on top of a grave. The older *E. ingens* along the study root need to be treated as possible graves, except for those in the flood plain north of KHOZ499. The obvious younger plants are not grave markers unless they are on a cairn.

Significance: The older *E. ingens* should be treated as graves unless proven otherwise.

Mitigation: The trees should be avoided – only two were in the line of the current pipeline. However, if there is no option but to remove them, then a qualified archaeologists needs to be on site and the area below needs to be tested for possible human remains. This is done by sample excavations. Community consultation would also assist in identifying these graves if in living memory.

SAHRA Rating: 3A until proven otherwise.

FIG. 37: EUPHORBIA MARKING POSSIBLE GRAVE AT KHOZ499

KHOZ551

KHOZ551 are two graves near the Hlaza Reservoir (fig. 38). They are located 60m to the west of a track that might be an access road. .

Significance: The graves are of high significance.

Mitigation: The graves will not be affected by this pipeline.

SAHRA Rating: 3A.

FIG. 38: GRAVES AT KHOZ551

KHOZ575 & KHOZ576

The site is located near the base of the hill and beside the access road. The site consists of at least two graves under vegetation of which one is an *E. ingens* (fig. 39). The pipeline occurs 60m to the north of the graves

Significance: The graves are of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A.

FIG. 39: GRAVES AT KHOZ575 & KHOZ576

KHOZ577

The site is located near the base of the hill and beside the access road. The site consists of very large Marula tree used for *muthi* (fig. 40). The pipeline occurs 30m to the north.

The tree is unlikely to be effected by the pipeline.

Significance: The tree is of low significance.

Mitigation: If any Marula trees need to be removed, then they should be assessed for *muthi* marks. If they are being used, then the people neighbouring the tree needs to be consulted, as it will be a diminished resource

SAHRA Rating: 3C

FIG. 40: MARULA TREE AT KHOZ577

KHOZ578

The site is located on the base of a hill and next to a ruined settlement. The site consists of a cemetery of 10+ graves (fig. 41). The graves range in age and are in an approximate east-west orientation.

The pipeline will not affect the graves, if it remains next to the road.

Significance: The graves are of high significance.

Mitigation: If the access road occurs near these graves, then the graves need to be clearly demarcated with a 20m buffer between the grave and the access road.

SAHRA Rating: 3A.

FIG. 41: GRAVES AT KHOZ578

KHOZ579

The site is located on the west side of the road and ~4m from existing water servitude. The site consists of two graves that have been disturbed over time (fig. 42). The graves have sunken and the upper stone have been displaced; however, the outlines are still visible. The graves are in an east-west orientation.

The pipeline footprint will occur on the opposite side of the road.

Significance: The graves are of high significance.

Mitigation: No further mitigation is required.

SAHRA Rating: 3A.

FIG. 42: A GRAVE AT KHOZ579

KHOZ580

The site is located ~5m uphill from the road. The site consists of a grave amongst aloes and bushes (fig. 43). The grave is an east-west orientation. The grave correlates with the site 'h32' from the desktop study.

The pipeline footprint will occur on the opposite side of the road.

Significance: The grave is of high significance.

Mitigation: No further mitigation is required

SAHRA Rating: 3A.

FIG. 43: GRAVE AT KHOZ580

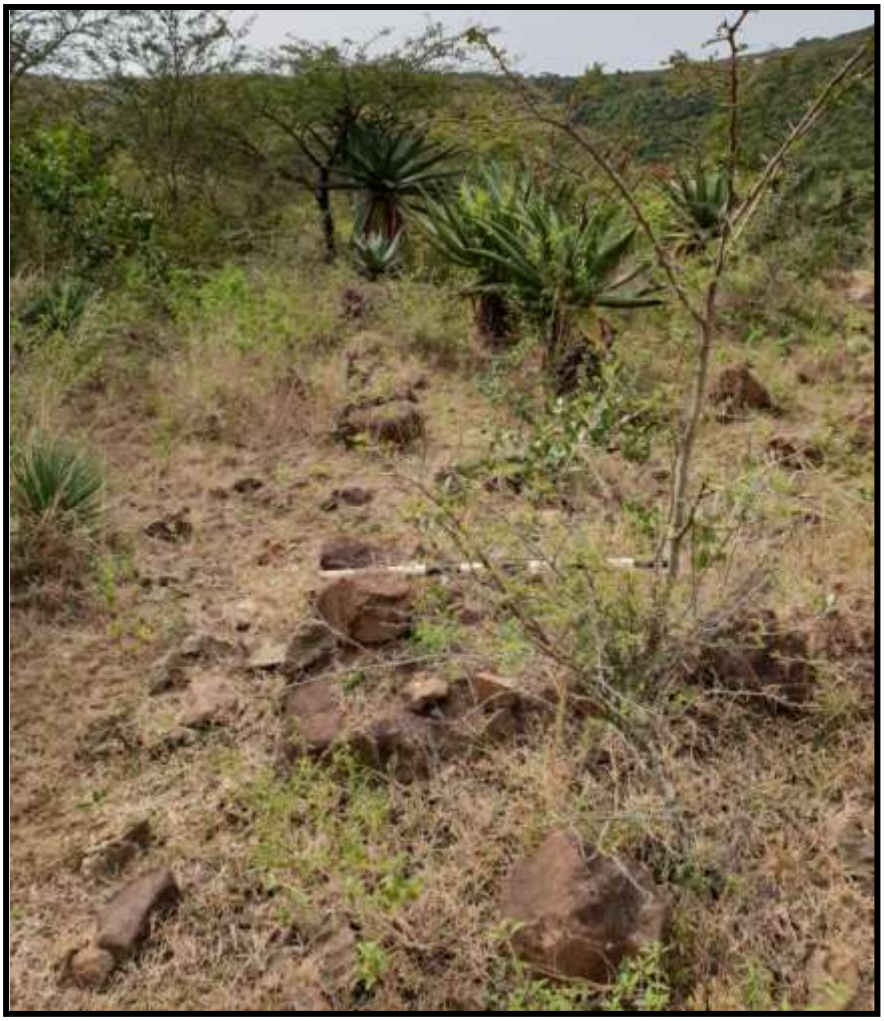
KHOZ581

The site is located uphill of the existing track. The site consists of a rectangular stone walled kraal (fig.44). There are many 1970s to recent bottles around the kraal area as well as a few pottery shards.

The pipeline is ~20m east from the kraal.

Significance: The kraal is of low significance.
Mitigation: The pipeline will not affect the kraal and no mitigation is required.
SAHRA Rating: 3C.

FIG. 44: KRA AL AT KHOZ581



KHOZ582

The site is located on the northwestern side of the servitude and is probably from the same settlement of KHOZ583. The site consists of five sunken stone cairns that are graves (fig. 45). The graves post date the 1960s.

The graves occur ~10m northeast of the line and may affect be affected by the pipeline. The pipeline will need t be moved at least 20m northeast.

Significance: The graves are of high significance.

Mitigation: The grave area needs to be demarcated before construction begins. This area needs to be assessed by the archaeologist and surveyor to ensure that other graves are not affected.

SAHRA Rating: 3A.

FIG. 45: GRAVES AT KHOZ582

KHOZ583

The site is located on the southeastern side of the servitude. The site consists of various terracing from a settlement. The terracing is under dense vegetation (fig. 46). The terracing post-dates the 1960s as indicated by the glass bottles and other modern artefacts around the area.

The pipeline occurs along the northern part of the site, and will probably damage the terracing.

Significance: The terracing is of low significance.

Mitigation: No further mitigation is required. However, the ECO and construction team should be made aware of possible graves within the terracing.

SAHRA Rating: 3A.

FIG. 46: TERRACING AT KHOZ583

KHOZ584 – KH0Z588

The site is located at the base of a hill on a terrace above a small stream. . The site consists of five stone cairns that appear to be graves (fig's. 47 - 48). The cairns are mostly hidden under bushes.

The pipeline and its footprint will occur 20m south of the cairns.

Significance: The graves are of high significance.

Mitigation: The pipeline will not affect the graves

SAHRA Rating: 3A.

FIG. 47: GRAVES AT KHOZ584

FIG. 48: GRAVES AT KHOZ586 & KHOZ587

MANAGEMENT PLAN

Three main areas require management:

1. Sites from the desktop
2. Sites from the survey
3. Palaeontological areas

Site identified from the desktop no longer exist or have been built on with new houses. These are settlements that would have had human graves associated with them, but are no longer visible. These areas need to be noted as sensitive for possible human remains. I suggest a 50m radius buffer is placed around each point from 1937 and 1964 from Table 2. This allows the construction team to plan for possible delays if any remains are exhumed during construction. Graves recorded during the survey require a 20m buffer between the edge of the grave and the footprint. This is not always possible due to roads and other buildings, and thus some leeway can be given.

In some areas, the pipeline needs to be moved to the opposite side of the road, or 5m to 20m away from a grave. Table 4 summarises the mitigation per site. The mitigation is required for the following sites:

- KHOZ500
- KHOZ499
- KHOZ498
- KHOZ 577
- NTA334
- NTA332
- NTA314
- NTA313
- NTA312
- NTA308
- KHOZ496
- KHOZ 578

- KHOZ 582

Certain areas of the pipeline require mitigation for the area with medium and high palaeontological sensitivity. These sites will require on site monitoring during construction (Table 4; Fig. 49: red sites require monitoring). Monitoring is to be undertaken by a suitably qualified palaeontologist and permits will be required for sampling and damaging fossils. Most of the monitoring will occur for approximately 100m. However, NTAM21 will require more extensive monitoring at the discretion of the palaeontologist. The monitoring of the construction phase must be suitably planned as there are limited palaeontologists who can undertake this work, and they may be linked to other projects. It will be illegal to excavate these areas without a palaeontologist on site.

A “Chance Find Protocol” that must be included into the EMPr of the project and upgraded continuously during the construction phase when excavations of deeper than 1.5m are planned for this project. The ‘Chance Find Protocol’ requires that a PIA undertakes a site visit during construction to determine if any fossils have been exposed in the designated sensitive areas. This will not hinder construction time since most of the soil samples will be on the side of the trench already. This does however entail advanced planning as there are few PIAs who can undertake the work, and they are often committed to other projects and will not to be available on short notice.

TABLE 4: MITIGATION REQUIRED FOR RECORDED SITES

Name	Latitude	Longitude	Description	Mitigation
KHOZ 576	-28.612553	31.899179	E. ingens	none
KHOZ 577	-28.612648	31.89854	Muthi tree	Do not remove tree
KHOZ 578	-28.61549	31.89468	grave	pipe must stay next to road
KHOZ 579	-28.62536	31.889011	house	none
KHOZ 580	-28.626466	31.888368	house	none
KHOZ 581	-28.630079	31.882724	H31	none
KHOZ 582	-28.629752	31.883088	H31 graves	re-assess with surveyor after final layout
KHOZ 583	-28.629855	31.883218	H31	none
KHOZ 584	-28.63005234	31.87692077	grave?	none
KHOZ 585	-28.63008	31.87694	grave?	none
KHOZ 586	-28.630077	31.876944	grave?	none
KHOZ 587	-28.63006918	31.87697525	grave?	none
KHOZ 588	-28.63002071	31.87685295	grave?	none
KHOZ494	-28.71302921	31.86188559	grave	none
KHOZ495	-28.71237168	31.85607905	grave	none
KHOZ496	-28.66396206	31.86532919	grave	none, but pipeline cannot go beyond the fence
KHOZ498	-28.619678	31.873385	Marula	do not remove
KHOZ499	-28.619542	31.873631	E. ingens	do not remove
KHOZ500	-28.62244696	31.87087117	tree	do not remove
KHOZ551	-28.610867	31.899253	grave	none
NTA276	-28.69499459	31.86181491	graves	none
NTA283	-28.68087891	31.85559737	grave	none
NTA284	-28.6763217	31.8582415	grave	none
NTA291	-28.6270891	31.8791908	walling	none
NTA294	-28.68252347	31.83681003	Cemetery	none
NTA295	-28.6912539	31.8449794	Cemetery	none
NTA298	-28.69982031	31.8383184	Temple	none
NTA300	-28.7166087	31.8453761	Grave	none
NTA302	-28.7164056	31.8455158	Grave	none
NTA304	-28.71498011	31.84702013	Grave	none
NTA308	-28.7112725	31.8615633	Grave	move to opposite side of road
NTA312	-28.7094869	31.87270428	Grave	move to opposite side of road
NTA313	-28.7117619	31.8619514	Grave	move to opposite side of road
NTA314	-28.7083732	31.84896442	Grave	move to opposite side of road
NTA320	-28.70224751	31.86308209	E. ingens, Grave?; h36	none
NTA321	-28.7025364	31.8637065	Grave	none
NTA332	-28.6023033	31.7498846	Cemetery	move to opposite side of road
NTA334	-28.5870294	31.7391281	E ingens 2	move pipeline 5m north

NTA337	-28.5973666	31.7313873	Grave or jojo base	none
NTA339	-28.59685926	31.73280308	Graves x2	none
KHOZ 575	-28.61266123	31.89924677	E. ingens	none
NTAM A	-28.5652	31.69753	Palaeontology	None
NTAM B	-28.6058	31.68769	Palaeontology	None
NTAM C	-28.6183	31.75628	Palaeontology	None
NTAM D	-28.7159	31.86725	Palaeontology	None
NTAM E	-28.6691	31.66331	Palaeontology	None
NTAM10	-28.638	31.76378	Palaeontology	None
NTAM11	-28.6286	31.75921	Palaeontology	None
NTAM12	-28.6271	31.75862	Palaeontology	Monitor during excavations. PIA discretion for distance
NTAM13	-28.6096	31.74448	Palaeontology	None
NTAM14	-28.5895	31.72519	Palaeontology	None
NTAM15	-28.6636	31.69652	Palaeontology	None
NTAM16	-28.6674	31.68057	Palaeontology	None
NTAM17	-28.6571	31.67336	Palaeontology	None
NTAM18	-28.6471	31.68204	Palaeontology	None
NTAM19	-28.625	31.72208	Palaeontology	None
NTAM2	-28.6999	31.86125	Palaeontology	None
NTAM20	-28.6221	31.72309	Palaeontology	None
NTAM21	-28.6018	31.74981	Palaeontology	None
NTAM22	-28.5917	31.75696	Palaeontology	None
NTAM23	-28.5989	31.73986	Palaeontology	None
NTAM3	-28.7079	31.84866	Palaeontology	None
NTAM4	-28.7128	31.81731	Palaeontology	None
NTAM5	-28.6923	31.80101	Palaeontology	None
NTAM6	-28.6608	31.78221	Palaeontology	
NTAM7	-28.6606	31.78031	Palaeontology	Monitor during excavations for 100m
NTAM8	-28.6585	31.77385	Palaeontology	Monitor during excavations for 100m
NTAM9	-28.6542	31.76892	Palaeontology	Monitor during excavations for 100m

FIG. 49: LOCATION OF PALAEONTOLOGICAL SITES[1]

[1] Red requires mitigation; green requires no mitigation

RECOMMENDATIONS

The proposed road upgrade will not affect most of the recorded heritage sites. However, in some cases the pipeline will need to be moved to avoid human graves, The norm is to place a 20m buffer around each grave. This is to avoid post-depositional slumping of humans within a grave and potential unmarked graves. The pipeline does however occur next to the road, and in these cases, the 20m buffer can be removed, especially when the footprint width is less then 1m. In other cases, the pipeline needs to be moved further away. The sites requiring mitigation are given on Table 4.

A 50m sensitivity buffer should be placed around the sites identified from the desktop study (i.e. Table 2). This does not mean that the pipeline may not occur here; rather that that specific house is not visible and there are potential human graves in e area. The chances of actually uncovering a grave would be very small.

If any human remains are uncovered during construction, then a 20m radius around that area must be delineated and all work must stop in that specific area: work may continue either side of the remains. The SAPS and KZNARI need to be informed and the remains may only be removed once KZNARI has granted permission and has supplied the relevant permits. These are graves outside of a formal cemetery and are thus protected by the KZNARI Act of 2018. Appendix B lists the procedure to follow if graves are unearthed.

Similarly, some trees, such as the *Euphorbia ingens, Erythrina spp. and Ziziphus spp.*, are traditional grave markers. Other trees, such as the Marula tree, are used for *muthi*, and are thus cultural resources. All of these types of trees should be avoided. Obviously young/new *E. ingens* will not be associated with graves as this custom has not been used for a few decades.

Five palaeontological sites require monitoring. Four of these sites require monitoring for approx. 100m, while the fifth site is at the discretion of the palaeontologist. The appointment of the palaeontologist must be made well in advance as permits are required from KZNARI. Furthermore, there is a distinct lack of PIAs in the country and most are booked well in advance for any work. No work may occur in any of the palaeontological areas unless they are monitored; otherwise it is an illegal activity and KZNARI may request a 'stop order' for the existing work.

Timeous appointments and planning need to be made with the palaeontologist.

I suggest a pre-construction meeting is undertaken where the palaeontological requirements are discussed with the project managers and construction managers.

CONCLUSION

A heritage desktop and field survey was undertaken for the proposed Ntambanana Water Reticulation upgrade. Much of the pipeline upgrade occurs in already existing servitudes beside the road. These lines will not affect any heritage sites except where they are within 5m of a grave or cemetery. I suggested that the pipeline be re-aligned in these cases so that it does not disturb human remains and/or unmarked graves.

Five areas require palaeontological monitoring and/or sampling during construction.

The final route can be assessed at a desktop level.

REFERENCES

Anderson, G. 2018. Heritage Survey Of The Proposed Khoza Water Supply Pipeline, Kwazulu-Natal. For Exigent Engineering.

1:50 000 Topographical Maps

2831DA Nkwalini 1965, 1981

2831DB Empangeni 1964, 1981

Aerial Photographs

117C_037_03353

117C_039_03345 – 03348

117C_041_37711 – 037716

117C_042_65799

117C_043_03388 - 03389

117C_045_37612

117C_045_65876 - 65873

117C_44_37763 – 37765

117C_0444_65818-65821

117C_050_37599 – 37600

117C_050_65886

Database

KZN Museum

SHARIS

Umlando

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

PIA SURVEY

PALAEONTOLOGICAL FIELD INVESTIGATION REPORT:
NTAMBANANA WATER PIPELINE RETICULATION PROJECT, BETWEEN EMPANGENI AND NTAMBANANA, UMHLATHUZE LOCAL MUNICIPALITY, KWAZULU-NATAL

FOR

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26 April, 2022

Declaration of Independence

This report has been compiled by Dr Alan Smith (Pr. Sc. Nat.) of Alan Smith Consulting, Durban. The views expressed in this report are entirely those of the author, if not then the source has been duly acknowledged. No other interest was displayed during the decision making process for the Project.

Specialist: Dr Alan Smith

Signature: 

EXECUTIVE SUMMARY

It is proposed to construct a water pipeline reticulation system, between Empangeni and Ntambanana, located within the uMhlathuze Local Municipality, KwaZulu-Natal. This report was compiled by Dr Alan Smith of Alan Smith Consulting (Appendix 1). This field visit was required because much of the SAHRIS Palaeosensitivity Map for this area is coded red ("very high" sensitivity; see section 4: Palaeontology). It must also be stated that this region of South Africa has not been adequately researched.

This proposed reticulation system is underlain by rocks of the Karoo Supergroup. The following rock formations (from oldest to youngest) are present:

- Volksrust Formation
- Emakwezini Formation
- Ntabene Formation
- Nyoka Formation
- Clarence Formation
- Letaba Formation
- Karoo Dolerite.

This site is dominated by the Emakwezini Formation, which is known for plant fossils, but these are not significant. For the Emakwezini Formation a "Chance Find Protocol" should suffice (see Appendix 2) with the exception of station NTAM -12 (see Appendix 3).

The carbonate-mineralised wood found at NTAM-12 should also be inspected when this part of the pipeline trench has been dug but the rock spoil is still in place. This inspection should be centred on station NTAM – 12, but not restricted to it (see Appendix 3).

The proposed water pipeline that connects the main two reticulation areas cuts through a sequence of possible fossiliferous rocks (stations NTAM 6-9; Figure 4). These lithologies are provisionally correlated with the Molteno (Ntabene), Nyoka (Elliot) and Clarence Formations (SACS, 1980) which are known to be highly fossiliferous, although nothing was found on this Field Assessment. These are very poorly exposed in this area. A careful watch should be kept when this is excavated. It is recommended that a suitably qualified palaeontologist should make a site inspection when the pipeline trench between NTAM 6

and 9 (total of 1.5km) has been excavated but while the excavated spoil is still available for inspection (see Appendix 3).

The Letaba Formation rocks (basalt) are very unlikely to be fossiliferous and the Karoo Dolerite, being of intrusive igneous origin, is not. The “Chance Find Protocol” will suffice for the Letaba Formation and the Karoo Dolerite can be ignored.

1. PROPOSED PROJECT

It is proposed to construct a water pipeline reticulation system, between Empangeni and Ntambanana, uMhlathuze Local Municipality, KwaZulu-Natal (Figure 1 & 2).

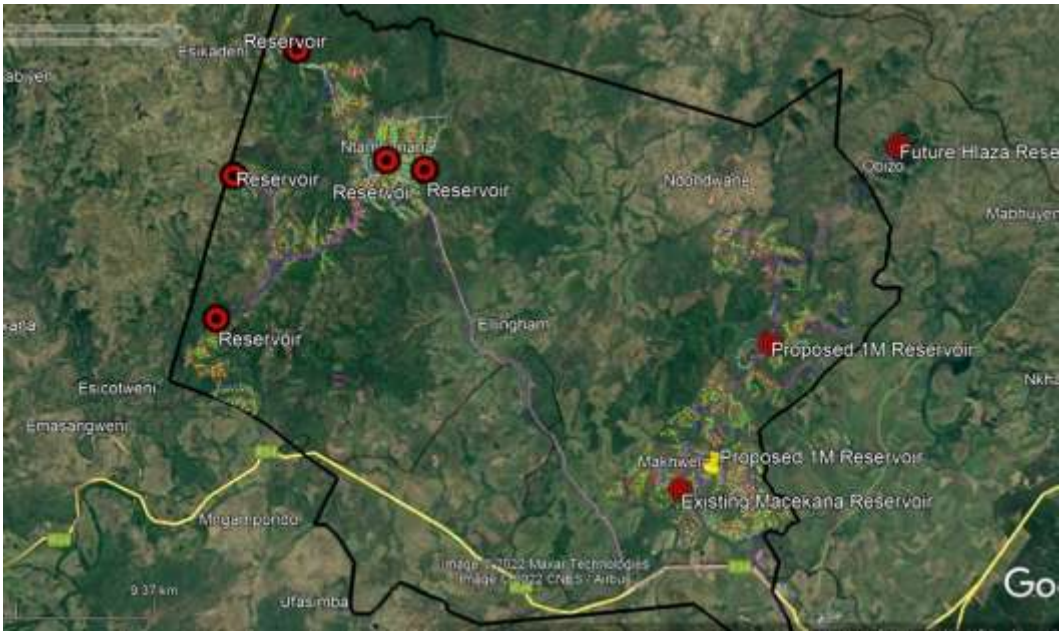

Figure 1: Location of the proposed Ntambanana water pipeline reticulation project (as supplied).

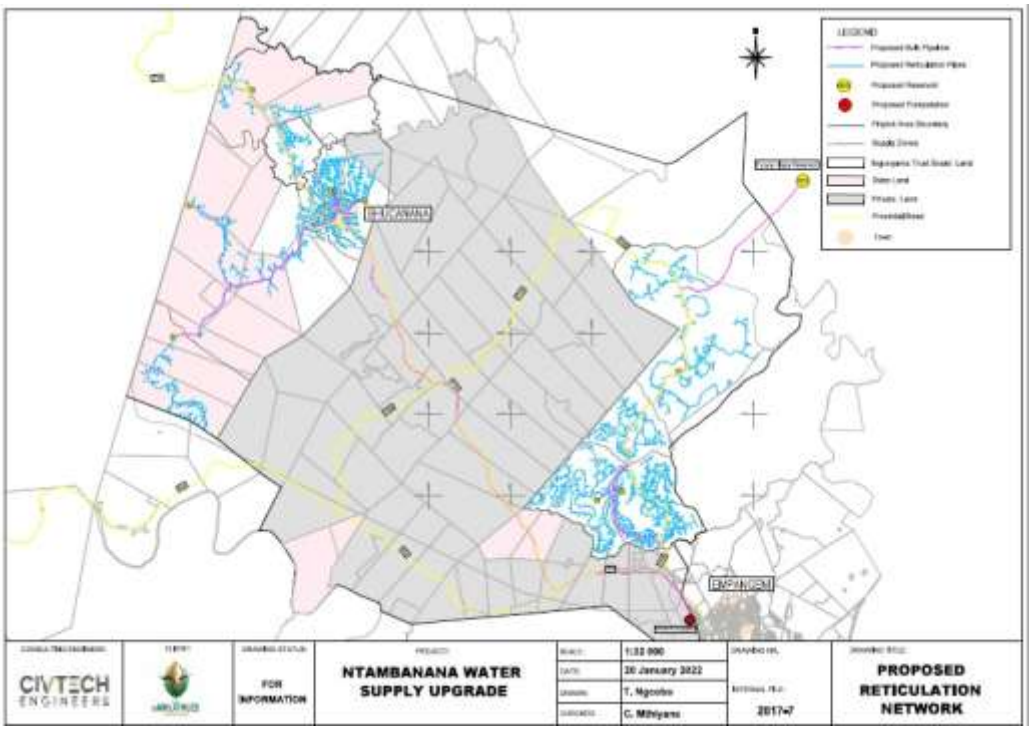

Figure 2: Water reticulation pipeline layout (figure as supplied).

2. FIELD INVESTIGATION

Sahris requirements are illustrated in Table 1 (see also section 4: Palaeontology in this document). A large part of this site where the proposed water reticulation project will be developed is coded red which is very high sensitivity which requires a field assessment (Table 1). Other colours include yellow, blue and grey (Table 1).

TABLE 1: Sahris Requirements

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.

After detailed assessment of the Dundee (2830) 1: 250 000geological map and GoogleEarth, a Field Assessment was conducted during 30-31 March, 2022. It soon became apparent that rock out crops would be rare in this area. The gps sites analysed on Day 1 and Day 2 are shown in Figures 4 and 5, respectively Details of the GPS points are provided in Appendix 3 and a photographic record of the sites inspected is provided in Appendix 4. Sites NTAM A-E were used for navigation purposes only. Road cuts, especially recent ones proved to be the best outcrop sites.

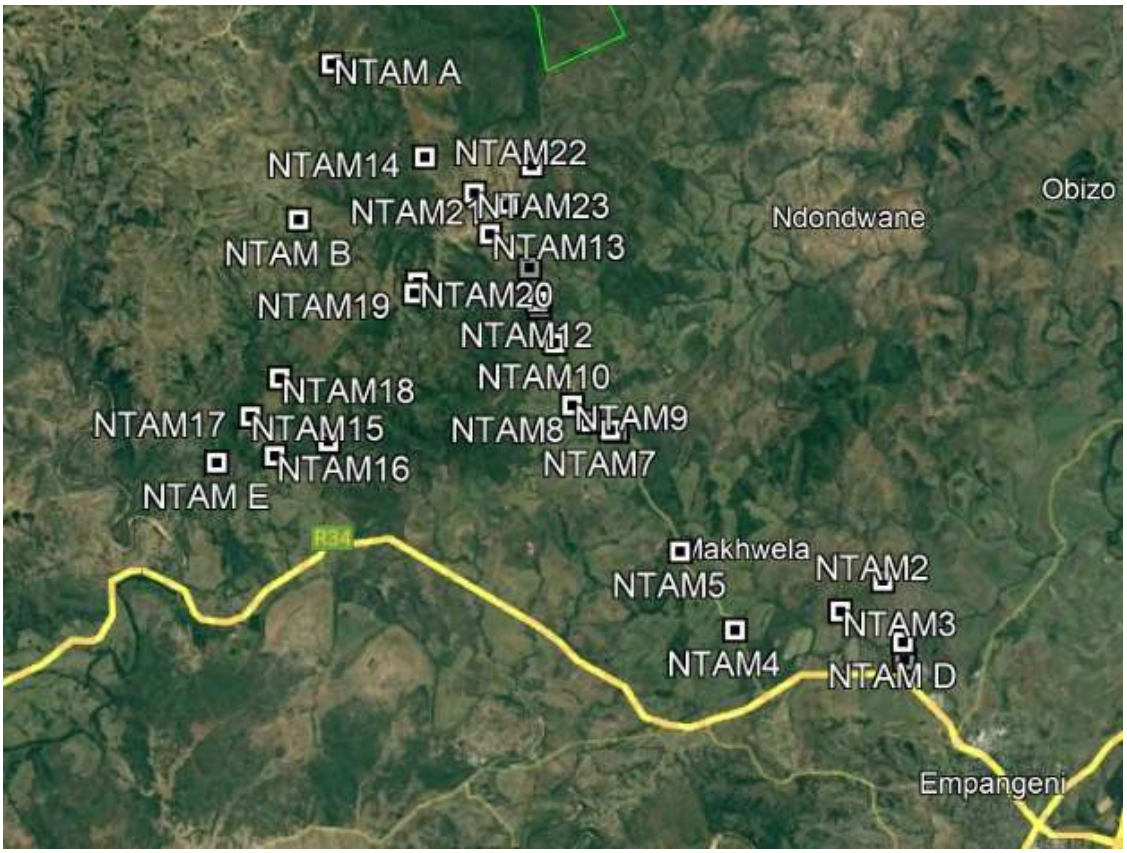

Figure 3: Field stations visited during the 30-31 March Palaeontological Field Assessment.

Table 2: Data stations used in this survey. Images not used in the main body of this report are contained in Appendix 4.

STATION No	COMMENT	FIGURE No	RECOMMENDATION
NTAM -1	Loose rocks, probably Emakwezini Formation	See Appendix 4	
NTAM-2	Letaba Formation basalt	See Appendix 4	
NTAN-3	Letaba Formation basalt	See Appendix 4	
NTAM-4	Basalt road material	See Appendix 4	
NTAM-5	Letaba Formation basalt outcrop	See Appendix 4	
NTAM-6	Nyoka Formation (Elliot?)	Fig. 5	Monitor during excavation
NTAM-7	Ntabene Formation (Molteno?)	Fig. 6	Monitor during excavation
NTAM-8	Ntabene Formation (Molteno?)	See Appendix 4	Monitor during excavation
NTAM-9	Ntabene Formation (Molteno?)	See Appendix 4	Monitor during excavation
NTAM-10	Emakwezini Formation	Fig. 7	
NTAM-11	Emakwezini Formation [thin coal seam]	See Appendix 4	
NTAM-12	Emakwezini Formation [thin wood impression seam]	Fig. 8; 16	Monitor during excavation
NTAM-13	Emakwezini Formation [wood stem impression]	Fig. 17	

NTAM-14	**Volksrust Formation**	**Fig. 9**	
NTAM-15	**Emakwezini Formation**	**See Appendix 4**	
NTAM-16	**Emakwezini Formation**	**See Appendix 4**	
NTAM-17	**Emakwezini Formation**	**See Appendix 4**	
NTAM-18	**Emakwezini Formation**	**See Appendix 4**	
NTAM-19	**Emakwezini Formation**	**Fig. 11**	
NTAM-20	**Emakwezini Formation**	**See Appendix 4**	
NTAM-21	**Shale: Formation unknown (Volksrust Fm?)**	**See Appendix 4**	
NTAM-22	**Emakwezini Formation**	**See Appendix 4**	
NTAM-23	**Dolerite Sill**	**See Appendix 4**	

Fieldwork Day One (30 March, 2022)

The southeasterly section of the proposed reticulation system is almost entirely constructed in basalt, hence fossils are extremely unlikely to be found in this area (Table 2). In contrast, the pipeline linking the proposed southeast and northwest pipeline reticulation stations will cross potentially fossiliferous rocks (Figure 4). These lithologies are illustrated in Figures 5-0.

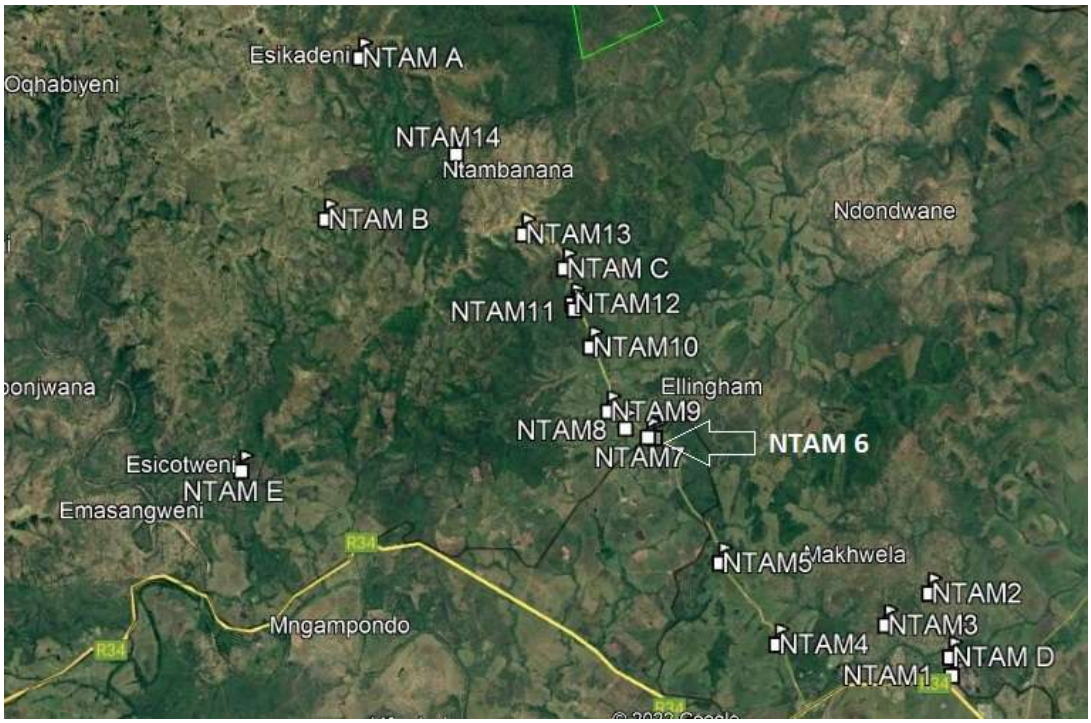

Figure 4: Day one stations visited during field visit.

Figure 5: Nyoka Formation from station NTAM-6. This is correlated with the Elliot Formation in the Main Karoo Basin, which is known to be fossiliferous (SACS, 1980). This image comprises a red shale containing a 5cm thick sandstone bed (see hammer).

Figure 6: Ntabene Formation from station NTAM-7. This is correlated with the Molteno Formation from the Main Karoo Basin which is known to be fossiliferous. Here this is a medium-grained sandstone, with thin mud chip conglomerate layers (few cms thick). This sandstone is flat-laminated with low-angle scours and thin planar crossbeds. It is interpreted as a fluvial deposit.

Figure 7: Emakwezini Formation from station NTAM-12. This comprises a mixture of greenish to black shale with fine-to-medium-grained sandstone and coal seams. Wave ripples with no preferred orientation and interference ripples observed.

Figure 8: Emakwezini Formation containing thin coal seams and fossil wood horizons (arrowed) at station NTAM 12. Refer also Fig. 14.

Figure 9: Volksrust Formation shale which has been intruded by a Karoo Dolerite Sill (NTAM14). The Volksrust Formation is very sparse palaeontologically, but can contain shell fossils.

Fieldwork Day Two (31 March, 2022)

The gps locations for Day 2 are illustrated in Figure 10. For the most part, the northwest pipeline reticulation (Figure 2) will be constructed almost Emakwezini Formation, which is potentially fossiliferous (Figure 11). Karoo Dolerite and Volksrust Formation may be encountered to a lesser extent.

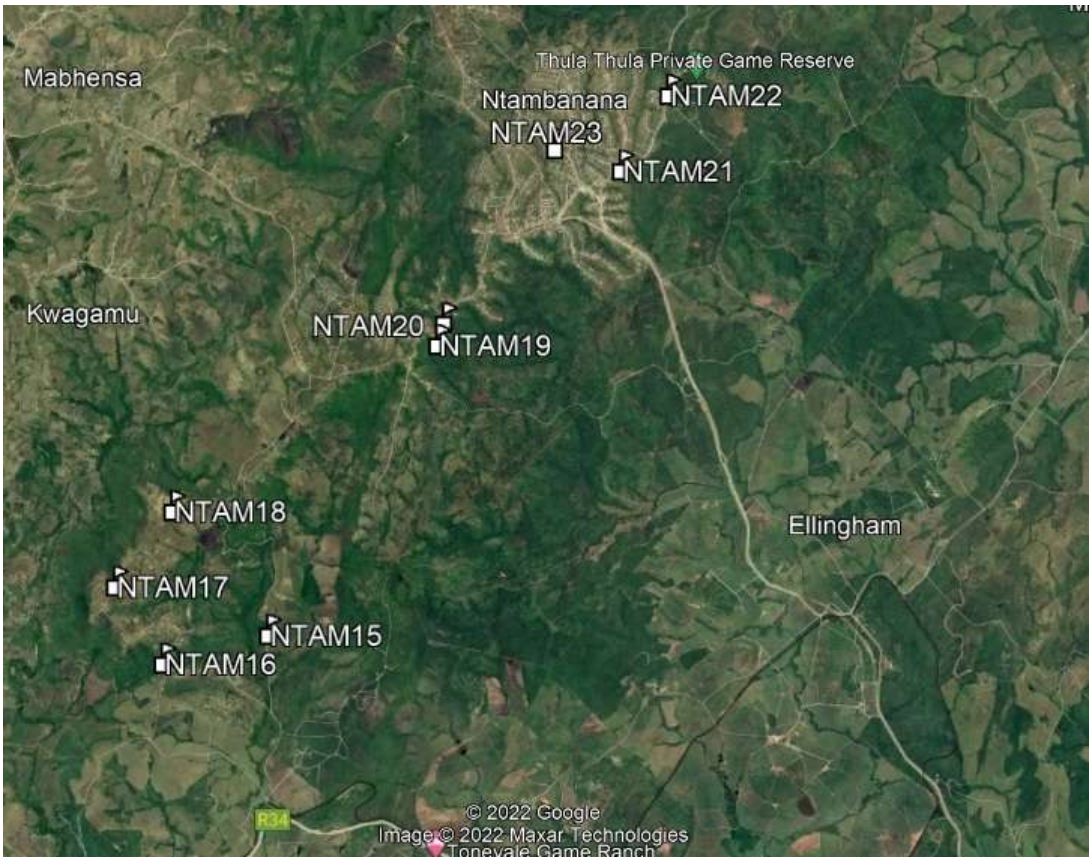

Figure 10: Day two stations visited during field visit.

Figure 11: Emakwezini Formation exposed in borrow pit (NTAM 19). This comprises a mixture of sandstone and siltstone. No fossil evidence was found in this quarry.

This part of the proposed water reticulation project is to be developed in a built up urbanized setting.

Figure 12: View to the south east from "Reservoir Hill" which is a Karoo Dolerite hill. This shows the formalized nature of Ntambanana.

3 GEOLOGY

The proposed water reticulation pipeline footprint is located on rocks of the Karoo Supergroup. Anticipated rock units, from the Dundee Geological map (Figure 12), are as follows:

- Volksrust Formation (Orange; Pvo)
- Emakwezini Formation (light green; Pem). This is the most common lithology in the area investigated. Wave ripples are a common feature of this lithology.
- Ntabene Formation (yellow; Tkn)
- Nyoka Formation (Orange; Tky)
- Clarence Formation (very thin; Tkc
- Letaba Formation (Purple; Jl)
- Karoo dolerite (Red; Jd).

In this region the Karoo Supergroup forms part of the Lebombo Rift system. Consequently, these Formations dip at between 8-30º to the southwest (Figure 13). The thicknesses of these lithologies, included in the descriptions below, are from SACS (1980).

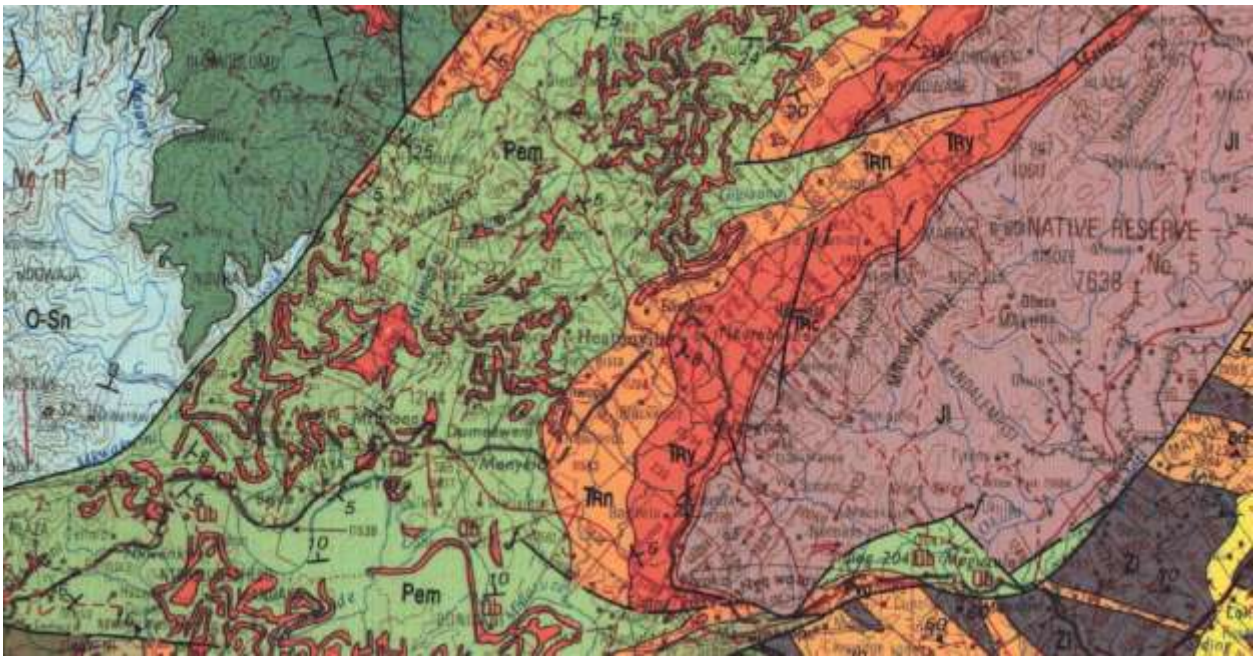

Figure 13: Extract from the Dundee (2830) 1:250 000 Geological Map. This shows the lithologies encountered. Volksrust Formation (Pvo); Emakwezini Formation (Pem); Ntabene Formation (Tkn); Nyoka Formation (Tky); Clarence Formation (very thin,

Tkc); Letaba Formation Basalt (Jl) and Karoo dolerite (red). The Volksrust Formation and Nyoka Formation appear as the same colour on the map.

Volksrust Formation

The Volksrust Formation is Late Permian in age (Cairncross et al. 2005). It typically comprises a blue-black shale (Figure 9). This unit was deposited in generally non-marine conditions (Cataneneau et al., 1998), but pockets of marine conditions were present (Cairncross et al., 2005).

Emakwezini Formation

The Emakwezini Formation (Figure 7) is considered a stratigraphic equivalent of the Normandien and Estcourt Formations within the eastern and north-eastern Main Karoo Basin (Bordy and Prevec, 2015). The thickness is probably in the 500-700 m range (Bordy and Prevec, 2015 and references therein). It comprises greenish to black shale with fine-to-medium-grained sandstone and coal seams (Dundee, 2830). This marks the base of the Beaufort Group. The Beaufort Group (part of the Karoo Supergroup) is a sequence of fluvio-lacustrine sedimentary rocks that accumulated in a landlocked, intracratonic foreland basin in SW Gondwana during the Middle Permian to Middle Triassic (Neveling et al., 2005).

Tarkastad Subgroup

The Tarkastad Subgroup, which should follow the Emakwezini Formation, the correlative of the Estcourt and Normandien Formations of the Lower Beaufort Adelaide Subgroup (Bordy and Prevec, 2015), is not found in this area. This gap of 8 Ma has been caused by erosion, possibly related to the Cape Mountain orogeny to the southwest (Hastie et al., 2019).). Further research is required

Ntabene Formation

The Ntabene Formation is described as medium-to-coarse-grained glittering sandstone (Dundee: (Geological Map) (Figure 6). The Ntabene is correlated with the coarse-

grained Molteno Formation, although their ages and correlation are uncertain (Cataneneau et al., 2005). The Molteno is 216 – 220 million years (Ma) old and occurs above an angular unconformity which marks an angular unconformity marks a phase of the Cape Mountain orogeny (Cataneneau et al., 2005)

Nyoka Formation

The Nyoka Formation is described as red and purple mudstone, interbedded with medium-grained sandstone (Dundee Geological Map) (Figure 5). This is correlated with the Elliot Formation, but as before this is still uncertain.as insufficient research has been carried out.

Clarence Formation

The Lower Jurassic Clarence Formation was not seen in outcrop although it is described in the Dundee Geological map. This map describes it as being fine-grained sandstone. The Clarence Formation is described elsewhere as an Aeolian sandstone which formed from sediments deposited in a Gondwana supercontinent-wide sand sea (Bordy and Head, 2019).

Letaba Formation

This is part of a 4.5 km thick succession of basalt (Misra et al., 2020). For the most part this is very weathered or covered in vegetation (see Appendix 4)). This basalt was extruded as part of the 184 million years (Ma) old Karoo Large Igneous Province (LIP). This event represents the onset of the break-up of the Gondwana Supercontinent (Watkeys, 2006; Hastie et al (2014).

Karoo dolerite

This dolerite was intruded as part of the Karoo LIP. This served as the plumbing that fed the Letaba Formation and other extrusive rocks.

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4. PALAEONTOLOGY

The palaeosensitivity of this area, as shown in the SAHRIS Palaeosensitivity map, is provided in Figure 13. The Letaba Formation (basalt) is reflected as blue here, Volksrust and Clarence Formations appear as yellow, whereas the remainder is red. The yellow and red coding triggered this Field Assessment.

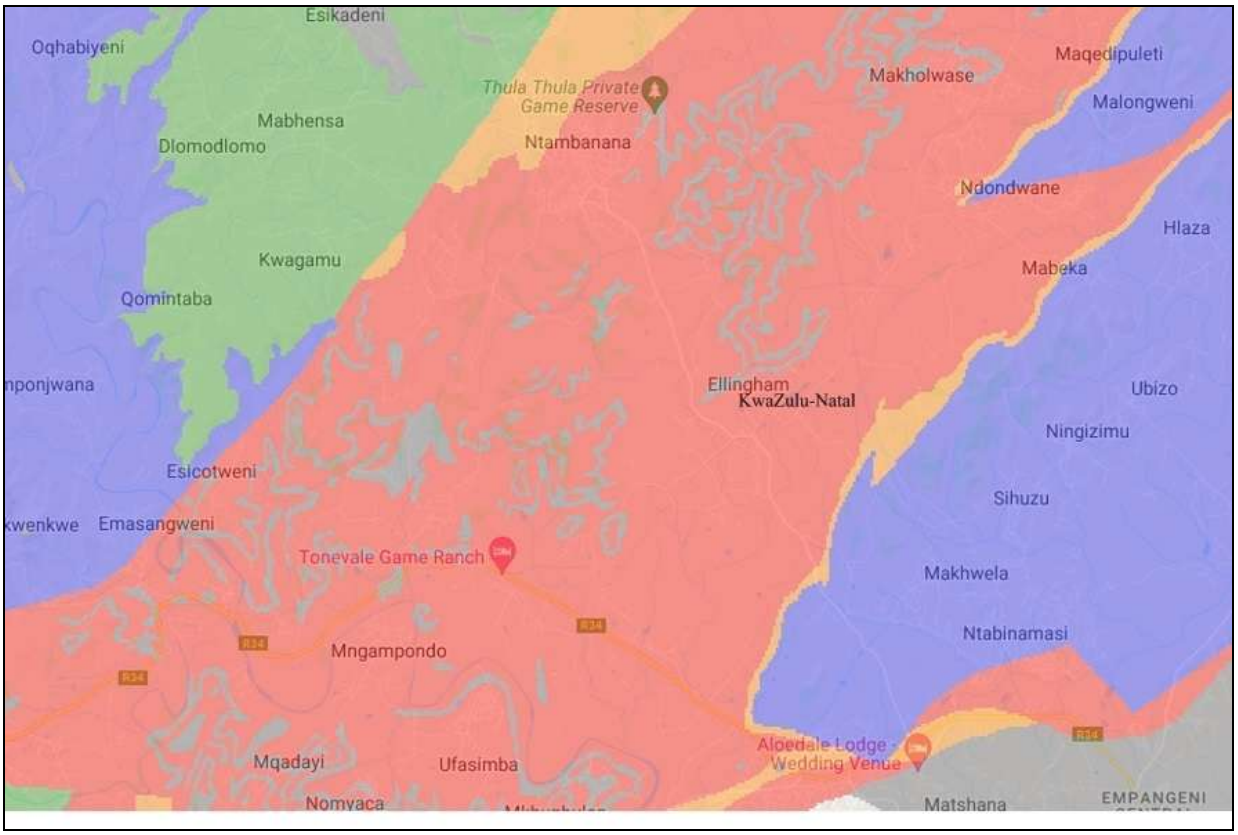

Figure 13: Palaeosensitivity of rocks in the Empangeni-to-Ntambanana water pipeline reticulation project area. The grey is Karoo Dolerite which is unfossiliferous. The blue is Letaba Formation basalt which is very unlikely to be fossiliferous.

The Volksrust Formation

Unidentified trace fossils (*ichnofossils*) are common in the Volksrust Formation; unfortunately these are not photogenic as the rock is very weathered, hence they were not easily identifiable. *Ichnofossils* are common and of little Palaeontological Significance.

The bivalve, *Megadesmus*, has been recorded from the Volksrust Formation near Newcastle (Cairncross et al., 2005). This fossil is large, 9 cm dorsally and 8.4 cm laterally (Figure 14). *Megadesmus* is known from other parts of the Gondwana Supercontinent (Australia, India, Siberia, South America and Tasmania). 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 et al, 2005).

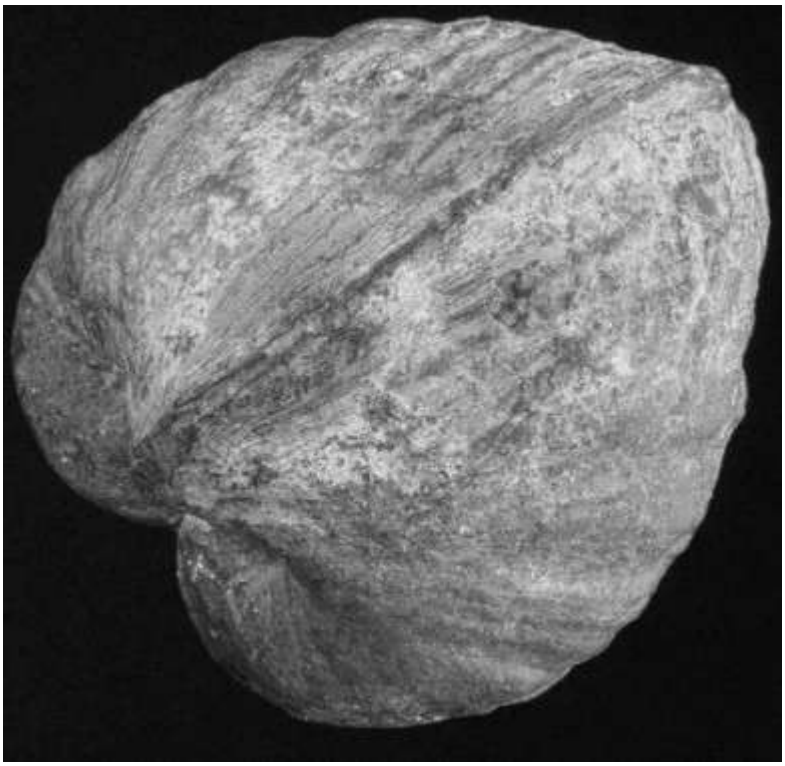

Figure 14: Megadesmus bivalve. This image was obtained from Cairncross et al. (2005).

Emakwezini Formation

Fossil woods are found in the Emakwezini Formation. These are useful for interpreting regional stratigraphy (Bordy and Prevec, 2015), but are relatively common. These were observed in thin coal seams and in calcareous shales (Figure 15). Coal formed in swamps, and the limestones probably in the vicinity of carbonated springs. The botanic fossils types could not be recognized.

Figure 15: Examples of unidentified fossil woods from the Emakwezini Formation. They typically occur in layers a few centimetres thick (NTAM-12).

Some of these shales are calcareous. In one of these locations carbonate-mineralized plant material was found. These samples have been taken for further study. To this authors knowledge these have not been reported before. Carbonate mineralized wood is not in its

self-unusual but it has not been reported before. I recommend that a competent Palaeontologist visit this site after trenching has taken place and the spoil is still on site.

Plant stem impressions were also observed in mudstone of the Emakwezini Formation (Figure 16). These fossils are usually bedding-plane parallel. While these are interesting they are common and not Palaeontologically significant.

Figure 16: Note the imprint of stem parallel to (and to the left of) the rockpick in this Emakwezini Formation rock (NTAM-13).

Ntabene Formation

The Ntabene Formation is correlated with the Molteno Formation. No fossils were found within this lithology in this area. As stated, the correlation with the Molteno Formation is provisional as it has not been established by any geological mechanism. In the Cape, the Molteno is known to be fossiliferous (Bordy et al., 2005).

Elsewhere the Molteno formation is generally composed of coarse-grained sandstones and less likely to contain fossils. However the finer-grained rocks are fossiliferous (Bordy et al., 2005) and contains plant and insect fossils (Anderson, 1974).

The Molteno Formation contains fossils of 204 plant species and 333 insect species. It is one of the richest Upper Triassic-age plant and insect assemblages. The insect fauna contains well-preserved fossil insects which are very rare (Anderson and Anderson, 1997). The dominant fossil flora is associated with seven recognized habitat types, , two of these include *Dicroidium*, an extinct arboreal genus of seed fern that grew in either riparian forests or temperate woodlands. Nineteen species of *Dicroidium* alone have been recovered from the Molteno Formation (Anderson & Anderson, 1997).

Nyoka Formation

This is correlated with the Elliot Formation. As above, this correlation is provisional and yet to be established. The Ellitot Formation is known to be fossiliferous (MacRae, 1999; Rubidge, 2005). This spans the Late Triassic to the Early Jurassic. The Elliot Formation is significant because it can contain a range of vertebrate fossils and ichnofossils (Green, 1997)..

Clarence Formation

The Clarence Formation was not exposed. According to the Dundee Geological map, this unit is fine-grained. Elsewhere it is medium-to-coarse-grained and characterized by giant crossbedding of an aeolian origin. Again, the correlation with the Clarence elsewhere is provisional and needs to be proven. Elsewhere the Clarence Formation commonly contains *skolithos* trace fossils and rare dinosaur footprints on bedding planes (Bordy and Head, 2019).

Letaba Formation

This represents a thick accumulation of basalt lava flows. Theoretically fossils could be "trapped" between the flows but none have been reported.

Karoo dolerite

This is an intrusive igneous rock and cannot be fossiliferous.

5. SUMMARY AND CONCLUSIONS

This site is dominated by the Emakwezini Formation, which is known for plant fossils (Bordy, et al, 2015). For the Emakwezini a "Chance Find Protocol" should suffice (see Appendix 2).

The proposed water pipeline cuts through a sequence of possible fossiliferous rocks (NTAM 6-9; Figure 17. These Formations are the Ntabene (correlated with the Molteno Formation), the Nyoka Formation (correlated with the Elliot Formation) and the Clarence Formation (SACS, 1980). Elsewhere these lithologies are known to be fossiliferous, but no research has been done in this part of South Africa. A careful watch should be kept when this is excavated. I recommend that a suitably qualified palaeontologist be brought on site when this undertaken. This visit should take place when trenching has taken place and the rock spoil still in place.

Figure 17: NTAM stations 6-9 is a 1.5 km stretch which should be investigated once excavation of this stretch is undertaken.

It is a further recommendation of this report that the carbonate mineralized wood material be further investigated by suitably qualified palaeontologist. This visit should take place when trenching has taken place and the rock spoil still in place.

The Letaba Formation rocks are very unlikely to be fossiliferous and the Karoo Dolerite is not. The “Chance Find Protocol” will suffice for the former and the latter can be ignored.

6. REFERENCES

Anderson, H.M. (1974). "A brief review of the flora of the Molteno Formation (Triassic), South Africa".ResearchGate. Retrieved 2019-07-07

Anderson, H.M. and Anderson, J.M., (1997). Why not look for proangiosperms in the Molteno Formation. In Proceedings 4th European Palaeobotanical and Palynological Conference. Meded. Nederl. Inst. Toegep. Geowetens. TNO (Vol. 58, pp. 73–80).

Bordy, EM; Hancox, PJ; Rubidge, BS (2005). The contact of the Molteno and Elliot formations through the main Karoo Basin, South Africa: a second-order sequence boundary. South African Journal of Geology, 2005, 108, 351-364

Bordy EM; Prevec, R (2015). Lithostratigraphy of the Emakwezini Formation (Karoo Supergroup), South Africa, South African Journal of Geology, 307-310.

Bordy, EM; Head (2019). Lithostratigraphy of the Clarens Formation (Stormberg Group, Karoo Supergroup), South Africa, South African Journal of Geology, 121.1, 119-130.

Bordy, EM; Eriksson, PG (2015). Lithostratigraphy of the Elliot Formation (Karoo Supergroup), South Africa, 118.3, 311-16.

Cairncross, B; Beukes, NJ; Coetzee, LL; Rehfeld, U. (2005) The bivalve Megadesmus from the Permian Volksrust Shale Formation (Karoo Supergroup), northeastern Karoo Basin, South Africa: implications for late Permian Basin development. South African Journal of Geology, 108: 547-556.

Catuneanu, O., Hancox, P.J., Rubidge, B.S., 1998. Reciprocal flexural behaviour and contrasting stratigraphies: a new basin development model for the Karoo retroarc foreland system, South Africa. Basin Res. 10, 417–439.

Catuneanu, O; Wopfner, H; Eriksson, PG; Cairncross, B; Rubidge, BS; Smith, RMH; Hancox, PJ (2005). The Karoo basins of south-central Africa, Journal of African Earth Sciences 43 (2005) 211–253

Dundee (2830) 125 000, Council for Geosciences, Government Printer, Pretoria

Green, D (1997). Palaeoenvironments of the Estcourt Formation (Beaufort Group), KwaZulu-Natal. MsC (unpubl.), Department of Geology and Applied Geology, University of Natal Durban.

Hastie, WW; Watkeys, MK; Aubourg, C (2014). Magma flow in dyke swarms of the Karoo LIP: Implications for the mantle plume hypothesis. Gondwana Research 25 (2014) 736–755.

Hastie, W; Watkeys, MK; Smith, AM, (2019). Tectonic significance of the sedimentary and palaeocurrent record at the eastern edge of the Karoo Basin. Journal of African Earth Sciences 158 (2019) 103543.

MacRae C. (1999). Life Etched in Stone. Geological Society of South Africa, Linden, South Africa.

Misra, S; Smith, A; Ray, D; Hastie, WW (2020). Geochemical evidence of mixing between A-type rhyolites and basalts from Southern Lebombo, South Africa: Implications for evolution of the Northern Karoo Igneous Province. Geological Journal. 2020, 1–37.

Neveling, P.J. Hancox & B.S. Rubidge (2005) Biostratigraphy of the lower Burgersdorp Formation (Beaufort Group; Karoo Supergroup) of South Africa – implications for the stratigraphic ranges of early Triassic tetrapods. *Palaeont. afr.*) 41: 81–87.

Rubidge, B.S. 2005. Re-uniting lost continents – fossil reptiles from the ancient Karoo and their wanderlust. South African Journal of Geology 108: 135-172.

SACS (South African Committee for Stratigraphy (1980). Council for Geosciences, Pretoria.

Sahris Palaeosensitivity Map: https://sahris.sahra.org.za/map/palaeo

Watkeys, M.K., 2006. Gondwana break-up: a South African perspective. In: M.R. Johnson, C.R. Anhaeusser and R.J. Thomas (Editors), The Geology of South Africa, Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria, 531-539.

APPENDIX 1: 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 more than 50 journal articles with 360 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.
- 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.

APPENDIX 2: 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.

APPENDIX 3: GPS REFERENCE POINTS

NAME	Latitude	Longitude	Elevation	Datetime (UTC)	MONITORING REQUIRED
NTAM D	-28.7159	31.86725	15.42	2022-03-30T09:51:33Z	No
NTAM E	-28.6691	31.66331	28.74	2022-03-30T09:54:11Z	No
NTAM C	-28.6183	31.75628	46.29	2022-03-30T09:56:15Z	No
NTAM A	-28.5652	31.69753	50.47	2022-03-30T09:57:27Z	No
NTAM B	-28.6058	31.68769	24.14	2022-03-30T09:58:47Z	No
NTAM1	-28.7206	31.8677	84.71	2022-03-30T10:50:49Z	No
NTAM2	-28.6999	31.86125	134.31	2022-03-30T11:15:10Z	No
NTAM3	-28.7079	31.84866	97.64	2022-03-30T11:28:13Z	No
NTAM4	-28.7128	31.81731	161.31	2022-03-30T11:58:12Z	No
NTAM5	-28.6923	31.80101	116.51	2022-03-30T12:24:23Z	No
NTAM6	-28.6608	31.78221	107.37	2022-03-30T12:49:26Z	Monitoring NTAM6(and 100m before point) to NTAM7 during excavation
NTAM7	-28.6606	31.78031	101.74	2022-03-30T12:58:30Z	As above NTAM7-8
NTAM8	-28.6585	31.77385	99.56	2022-03-30T13:20:47Z	As above NTAM8-9
NTAM9	-28.6542	31.76892	106.06	2022-03-30T13:25:22Z	Monitor NTAM9 and 100m further.
NTAM10	-28.638	31.76378	135.51	2022-03-30T13:36:08Z	No
NTAM11	-28.6286	31.75921	190.00	2022-03-30T13:59:14Z	No
NTAM12	-28.6271	31.75862	184.46	2022-03-30T14:23:32Z	Monitor during excavation – distance from point at Paleontologists discretion
NTAM13	-28.6096	31.74448	219.13	2022-03-30T14:43:59Z	No
NTAM14	-28.5895	31.72519	235.18	2022-03-30T15:04:28Z	No
NTAM15	-28.6636	31.69652	166.65	2022-03-31T09:32:05Z	No
NTAM16	-28.6674	31.68057	196.78	2022-03-31T10:02:00Z	No
NTAM17	-28.6571	31.67336	283.32	2022-03-31T10:12:39Z	No
NTAM18	-28.6471	31.68204	301.51	2022-03-31T10:23:18Z	No
NTAM19	-28.625	31.72208	325.03	2022-03-31T10:50:34Z	No
NTAM20	-28.6221	31.72309	318.27	2022-03-31T11:02:19Z	No
NTAM21	-28.6018	31.74981	278.41	2022-03-31T11:16:28Z	No
NTAM22	-28.5917	31.75696	214.72	2022-03-31T11:26:54Z	No
NTAM23	-28.5989	31.73986	268.89	2022-03-31T11:48:08Z	No

APPENDIX 4: IMAGES CAPTURED BUT NOT USED IN THIS REPORT.

STN NO	DESCRIPTION	IMAGE
1	Loose rocks, Probably Emakwezini Formation (Fm)	
2	Letaba Fm, this comprises basalts which are highly weathered.	
3	Letaba Fm, view towards proposed Reservoir site.	

4	Road to Ntanbanana. Road material is basalt but source unknown.	
5	Letaba Fm basalt exposed along the roadside. White colour is due to weathering.	
6	Nyoka Fm, correlates with the Elliot Fm	Figure 5 in report
7	Ntabene Fm, correlates with the Molteno Fm.	Figure 6 in report
8	Ntabene Fm, very weathered.	

9	Ntabene Fm (above arrow) and Emakwezini Fm (below arrow).	
10	Emakwezini Fm, note the bedding and wave ripples. See also Figure 7 in report.	
11	Emakwezini Fm, note the thin coal seam arrowed.	
12	Emakwezini Fm.	See Figures 8 and 16 in report.
13	Emakwezini Fm.	See Figure 17 in report
14	Volksrust Fm.	See Figure 9 in report

15	Emakwezini Fm quarry. See also Figure 11 in report.	
16	Emakwezini Fm exposed in borrow pit.	
17	Emakwezini Fm	No image
18	Proposed reservoir site. Emakwezini Fm but very badly weathered.	
19	Emakwezini Fm	See Figure 11 in report
20	Could be Volksrust Fm but very poorly exposed/weathered.	No image

21	Reference GPS station. Very weathered shale but Fm unknown.	
22	Emakwezini Fm poorly exposed and badly weathered at road side, Ntambanana – Phinda road.	
23	Karoo Dolerite Sill outcropping as a hill in Ntambanana	See Figure 12 in report.

APPENDIX B

GRAVE PROCEDURES

GRAVES

The developer must follow the guidelines mentioned below otherwise the project may be brought to halt.

The process of grave removals is a complex one that requires community consultation, advertisements, several permits, and finally reburial. Moreover, those graves older than 60 years require a qualified archaeologists to undertake the entire process. This process is summarised as follows[2]:

In terms of the National Heritage Resources Act (No. 25 of 1999), and KZN Amafa and Research Institute Act 5 of 2018, graves older than 60 years (not in a municipal graveyard) are protected. Human remains younger than 60 years should be handled only by a registered undertaker or an institution declared under the Human Tissues Act. Anyone who wishes to develop an area where there are graves older than 60 years is required to follow the process described in the legislation (section 36 and associated regulations). The specialist will require a permit from the heritage resources authority:

- Determine/ confirm the presence of the graves on the property. Normally the quickest way to proceed is to obtain the service of a professional archaeologist accredited to undertake burial relocations. The archaeologist will provide an estimate of the age of the graves. There may be a need for archival research and possibly test excavations (permit required).
- The preferred decision is to move the development so that the graves may remain undisturbed. If this is done, the developer must satisfy SAHRA/KZN Heritage that adequate arrangements have been made to protect the graves on site from the impact of the development. This usually involves fencing the grave(yard) and setting up a small site management plan indicating who will be responsible for maintaining the graves and how this is legally tied into the

[2] Information supplied by SAHRA, and it applies to KZN, although falling under the KZN Heritage Act.

development. It is recommended that a distance of 10-20 m is left undisturbed between the grave and the fence around the graves.

- If the developer wishes to relocate or disturb the graves:

o A 60-day public participation (social consultation) process as required by section 36 (and regulations - see attachment), must be undertaken to identify any direct descendants of those buried on the property. This allows for a period of consultation with any family members or community to ascertain what their wishes are for the burials. It involves notices to the public on site and through representative media. This may be done by the archaeologist, who can explain the process, but for large or sensitive sites a social consultant should be employed. Archaeologists often work with undertakers, who rebury the human remains.

o If as a result of the public participation, the family (where descendants are identified) or the community agree to the relocation process then the graves may be relocated.

o The archaeologist must submit a permit application to SAHRA/KZN Heritage for the disinterment of the burials. This must include written approval of the descendants or, if there has not been success in identifying direct descendants, written documentation of the social consultation process, which must indicate to SAHRA's satisfaction, the efforts that have been made to locate them. It must also include details of the exhumation process and the place to which the burials are to be relocated. (There are regulations regarding creating new cemeteries and so this usually means that relocation must be to an established communal rural or formal municipal cemetery.)

o Permission must be obtained before exhumation takes place from the landowner where the graves are located, and from the owners/managers of the graveyard to which the remains will be relocated.

o Other relevant legislation must be complied with, including the Human Tissues Act (National Department of Health) and any ordinances of the Provincial Department of Health). The archaeologist can usually advises about this.

To remove a human grave from an archaeological site requires a permit from KZAN Amafa. This will only be given to a qualified archaeologist who has experience in removing human remains. These sites tend to be older than 100 years and there are few direct claims to the remains. Direct claims tend to occur to with known historical people only. However, communities may claim ancestral remains in general if the remains are to be removed. These claims will need to be lodged with Amafa KZN.

The Archaeological project at RBM Zulti North mining lease has been continuing for 25 years now. A protocol was initiated relating to human remains in the early days of the project. The protocol is as follows:

- Human remains occur in the mining lease and will occassionaly be uncovered by the mining process. Alternatively, archaeological excavations might uncover human remains from a site.
- When human remains are found the archaeologist is informed immediately, who will come to site as soon as possible, and assess the area.
- The site is assessed and an estimated age of the site is made. If the site dates to the time when the local community lived in the area, then the human remains are considered to belong to the community. This is easily assessed by analysing the pottery decorations.
- The community is informed that their ancestral human remains have been uncovered if it is theirs. If there is time, i.e. no limits placed by mining, the community may come to the site. The interactions with the community are done via RBMs structures.
- The human remains are excavated, cleaned and documented at Umlando's offices, and then taken stored in the temporary room at RBM and then taken to KZN Amafa offices. These offices have dedicated store rooms solely for human remains.
- The human remains are kept in the store room until they can be reburied if desired. The community has access to these remains
- At the end of the mining process for that community, the ancestral remains can be returned for reburial.