

HERITAGE SURVEY OF THE PROPOSED THINA FALLS LODGE, EASTERN CAPE.

FOR IKAMVA Consulting

DATE: 2 JULY 2014

By Gavin Anderson

**Umlando: Archaeological Surveys and Heritage
Management**

PO Box 102532, Meerensee, 3901

Phone/fax: 035-7531785 Fax: 0865445631

Cell: 0836585362



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INTRODUCTION

Umlando was contracted to undertake a Heritage Impact Assessment of the proposed Thina Falls Lodge. The Thina Falls is a natural waterfall occurring on the Thina River ~18km east of Qumbu, Mhlontlo Local Municipality, Eastern Cape (fig. 1 - 3). To access the site one needs to pass Shawbury (Mission Station), that dates to 1839 (<http://www.francofrescura.co.za/mission-stations-N-S%20.html>). Many of the original buildings of Shawbury Mission still exist, but are in a poor condition.

The study area is ~6 hectares in size. Most of the study area is located on the flat flood plain, while some occurs on a steep rocky hill. The flood plain is mostly covered with *Acacia* spp. regrowth, while the hill has dense *Euphorbia* spp.

There were three access roads to the top of the Thina Falls. Two of these are no longer in use, while the third one has been extended to the Thina Falls.

The Thina Falls lodge will consist of the following key deliverables:

- A holiday Resort (chalets) with 25 bedrooms: 10 exclusive rooms and 15 rooms to accommodate low to medium income earners;
- Conference facilities;
- A restaurant with bar and a swimming pool;
- A parking area
- Ancillary structures and infrastructure such as energy source installation/connection, water and ablution facilities, etc. More specific project details will be provided as the project proceeds into the planning phase.
 - This was not covered by the HIA survey, if it is to occur outside of the study area.

FIG. 1 GENERAL LOCATION OF THE THINA FALLS LODGE STUDY AREA

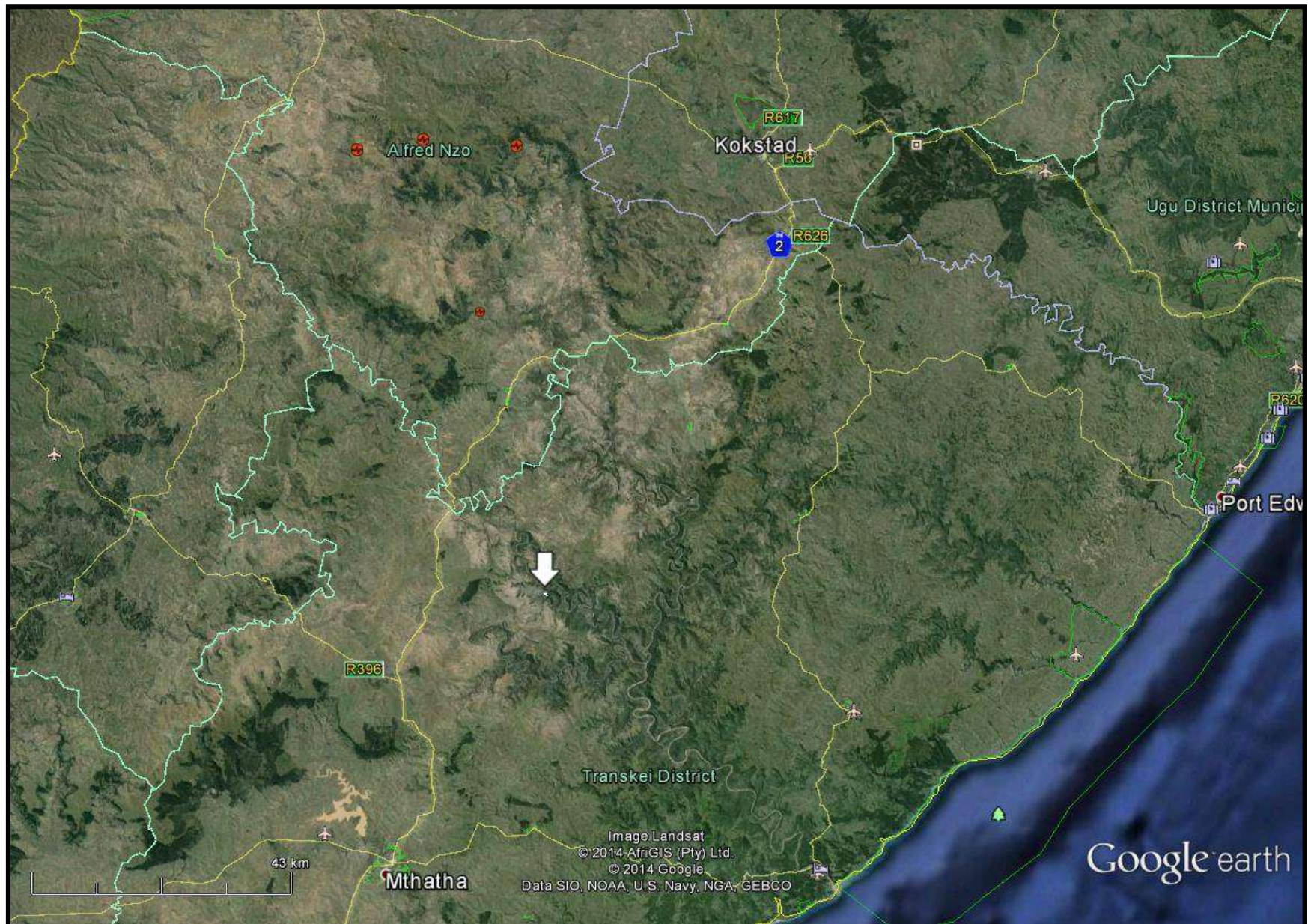


FIG. 2: AERIAL OVERVIEW OF THE THINA FALLS LODGE STUDY AREA

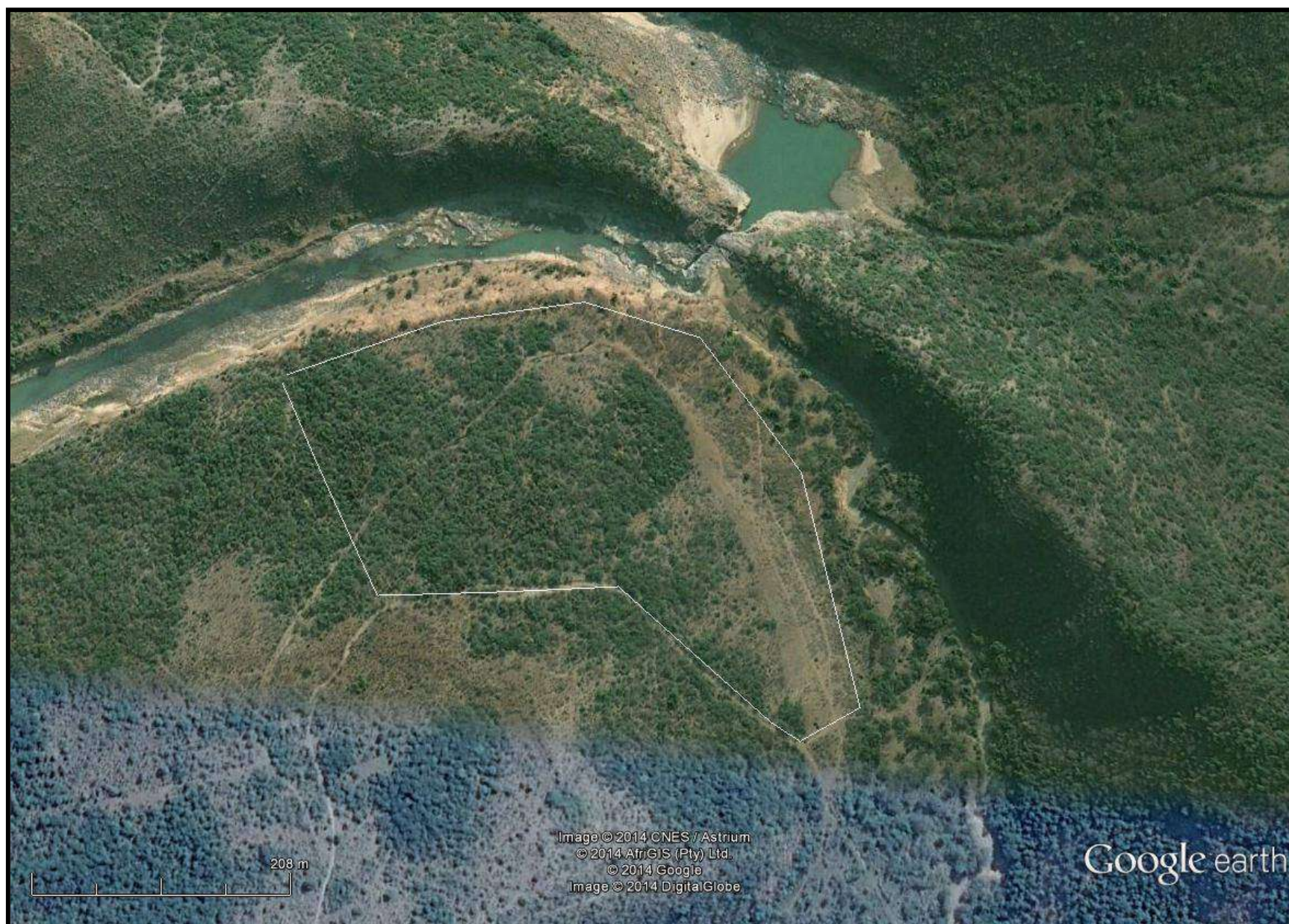
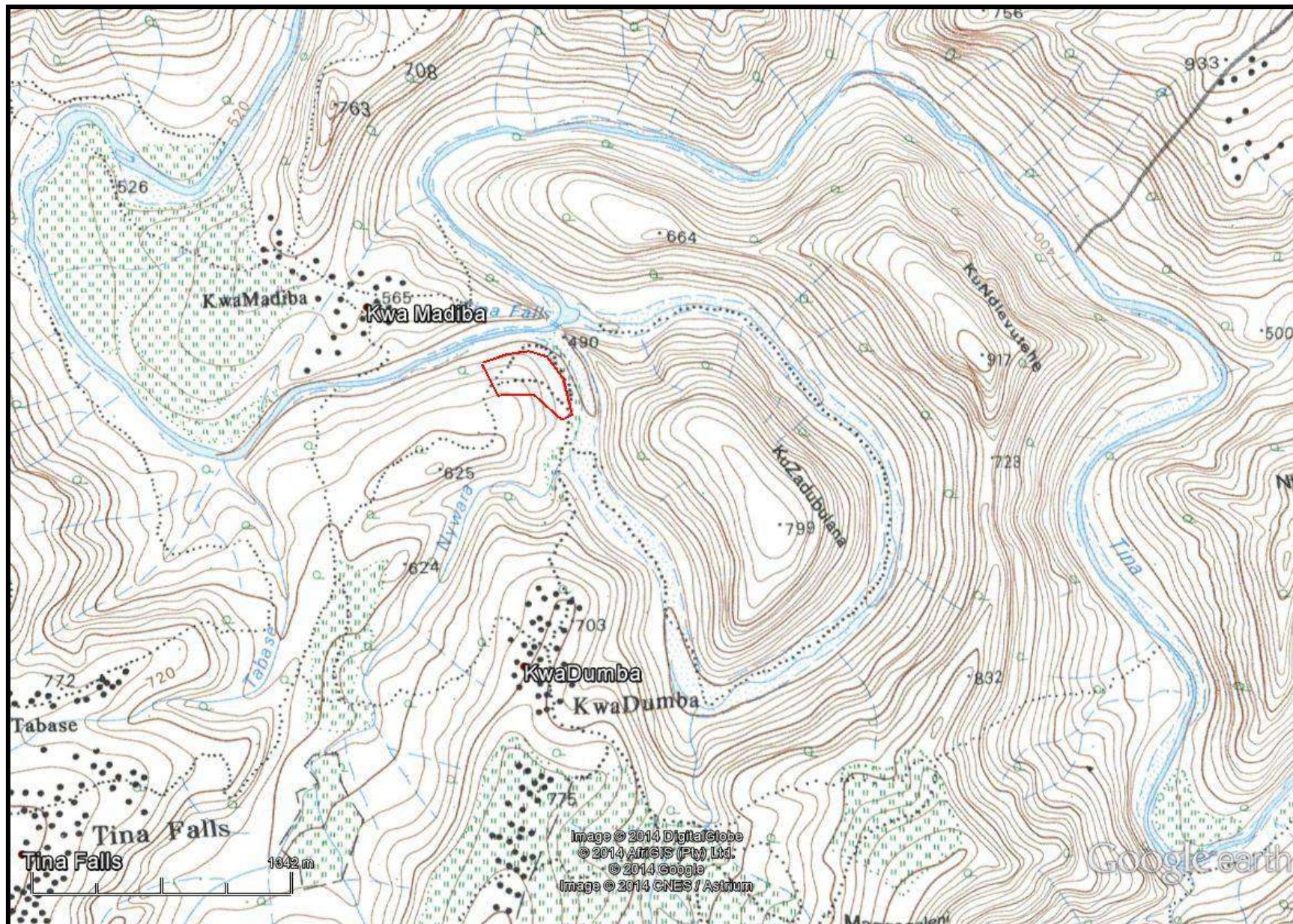


FIG. 3: TOPOGRAPHICAL MAP OF THE THINA FALLS LODGE STUDY AREA



NATIONAL HERITAGE RESOURCES ACT OF 1999

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

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

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

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

METHOD

The method for Heritage assessment consists of several steps.

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

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

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually

occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

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

These criteria are:

1. State of preservation of:

- 1.1. Organic remains:
 - 1.1.1. Faunal
 - 1.1.2. Botanical
- 1.2. Rock art
- 1.3. Walling
- 1.4. Presence of a cultural deposit
- 1.5. Features:
 - 1.5.1. Ash Features
 - 1.5.2. Graves
 - 1.5.3. Middens
 - 1.5.4. Cattle byres
 - 1.5.5. Bedding and ash complexes

2. Spatial arrangements:

- 2.1. Internal housing arrangements
- 2.2. Intra-site settlement patterns
- 2.3. Inter-site settlement patterns

3. Features of the site:

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

3.2. Is it a type site?

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

4. Research:

4.1. Providing information on current research projects

4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

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

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

6. Archaeological Experience:

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

7. Educational:

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

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

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

8. Other Heritage Significance:

8.1. Palaeontological sites

8.2. Historical buildings

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

8.4. Graves and/or community cemeteries

8.5. Living Heritage Sites

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

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

TABLE 1: SAHRA GRADINGS FOR HERITAGE SITES

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

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. No national monuments, battlefields, or historical cemeteries are known to occur in the study area (fig. 4). The nearest known heritage survey occurs near Qumbu (Anderson 2012). These sites were mainly (recent) historical sites with occurrences of stone tools.

The 1937 aerial photograph indicates that this area have several settlements in the general vicinity; however, no settlements occur in the proposed footprint (fig. 5). The locations of these settlements are given in Table 2.

TABLE 1: LOCATION OF SETTLEMENTS NEAR THE DEVELOPMENT FOOTPRINT

Name	Latitude	Longitude	Description
a1	-31.203594785	29.042211822	Settlement
a2	-31.204693114	29.043411645	Settlement
a3	-31.202683852	29.041153254	Settlement
a5	-31.201487938	29.043823798	Settlement
a6	-31.202232184	29.044063100	Settlement
a7	-31.201978212	29.044621057	Settlement
a8	-31.201498353	29.045522953	Settlement
a9	-31.199596797	29.049557929	Settlement
a10	-31.199673471	29.051791258	Settlement
a11	-31.198148504	29.051682954	Settlement
a12	-31.198968693	29.051695485	Settlement
a13	-31.198294665	29.050524576	Settlement
a14	-31.196726874	29.050268615	Settlement
a15	-31.196945119	29.051791645	Settlement
a16	-31.201971145	29.046326327	Settlement
a17	-31.200585032	29.044362954	Settlement
a18	-31.199408243	29.042294664	Settlement
a19	-31.198537158	29.049743174	Settlement
a20	-31.198505313	29.048432696	Settlement
a21	-31.201621216	29.041333031	Settlement

FIG. 4: LOCATION OF KNOWN HERITAGE SITES IN THE GENERAL AREA

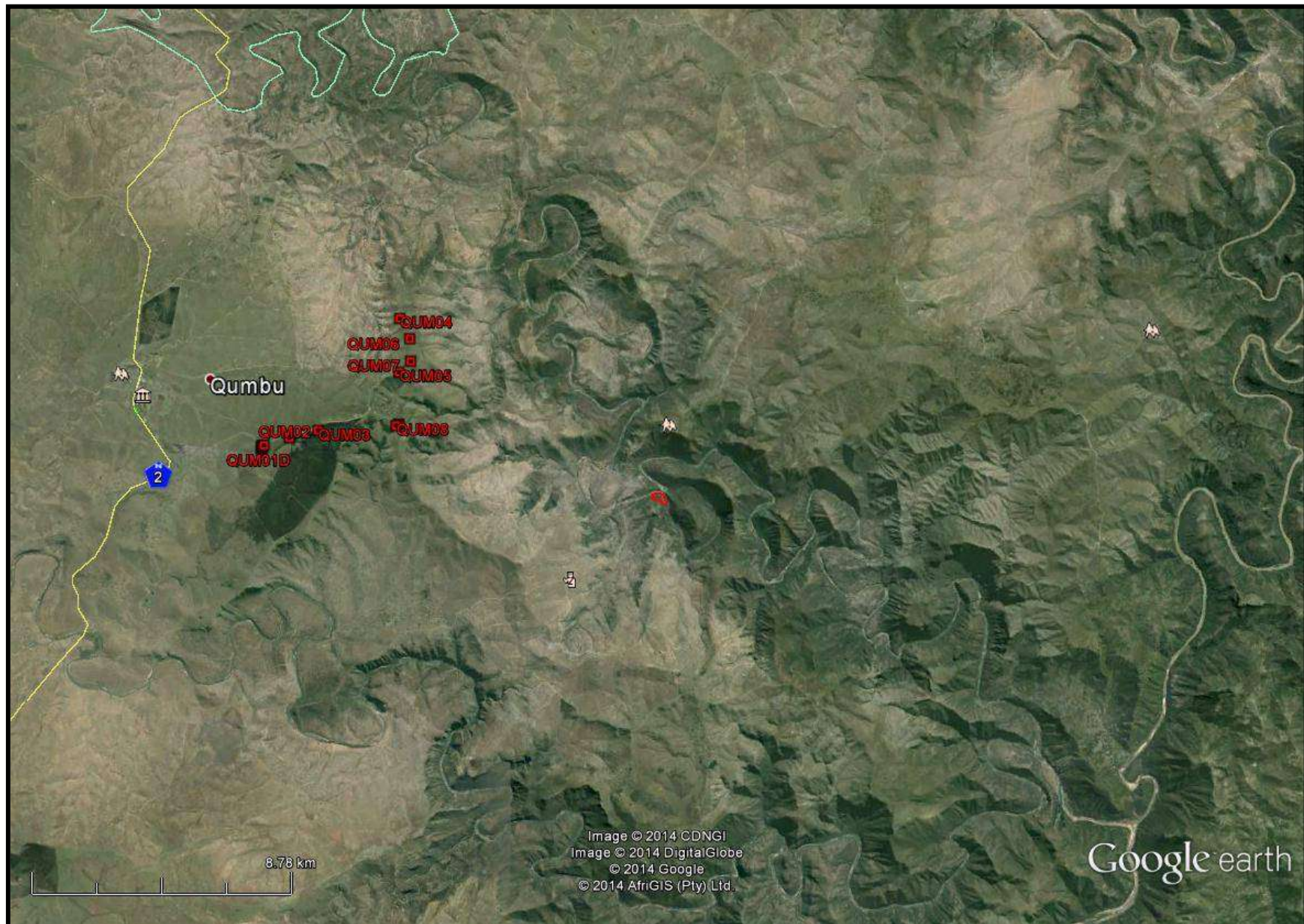


FIG. 5: LOCATION OF SETTLEMENTS IN 1937

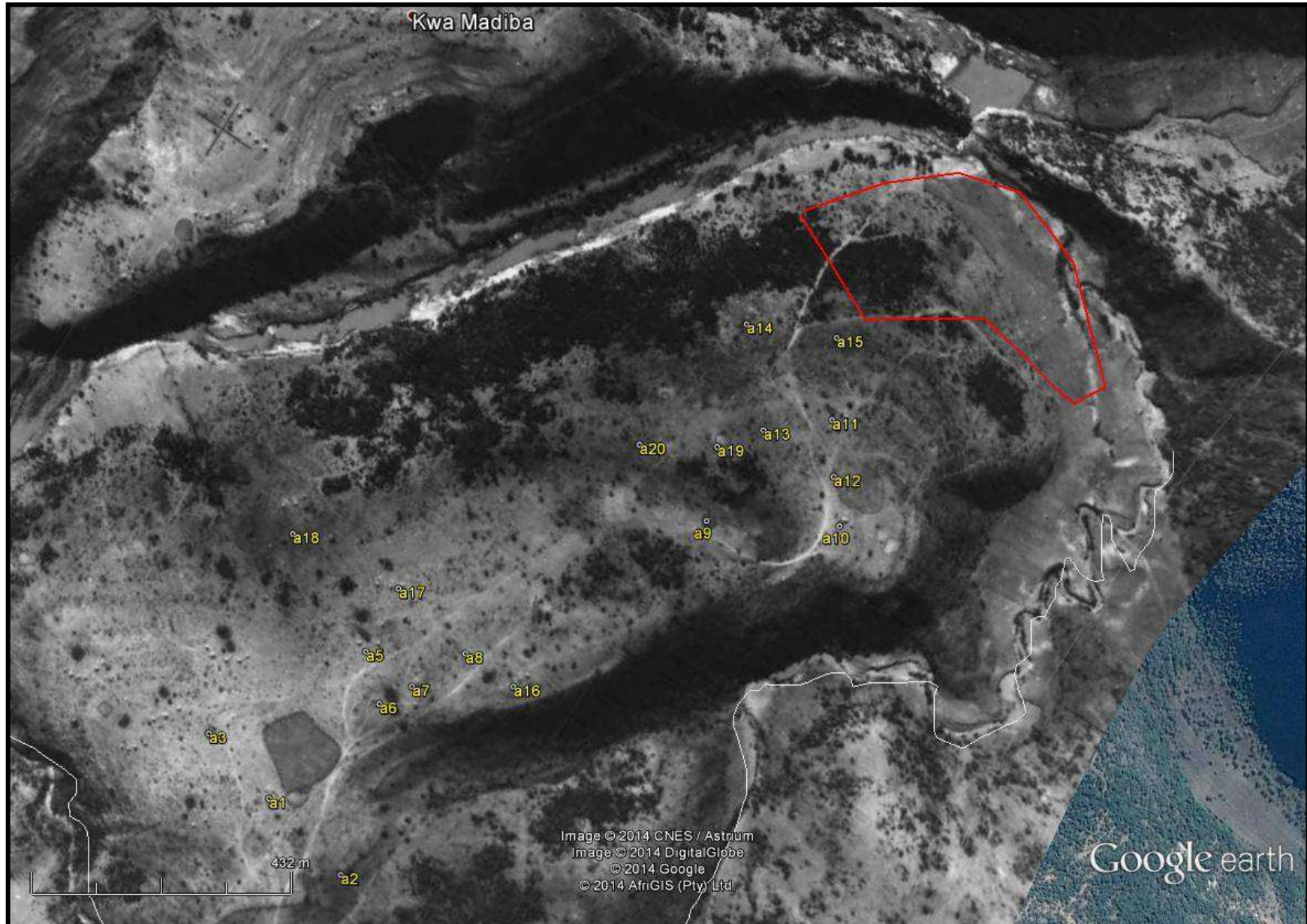
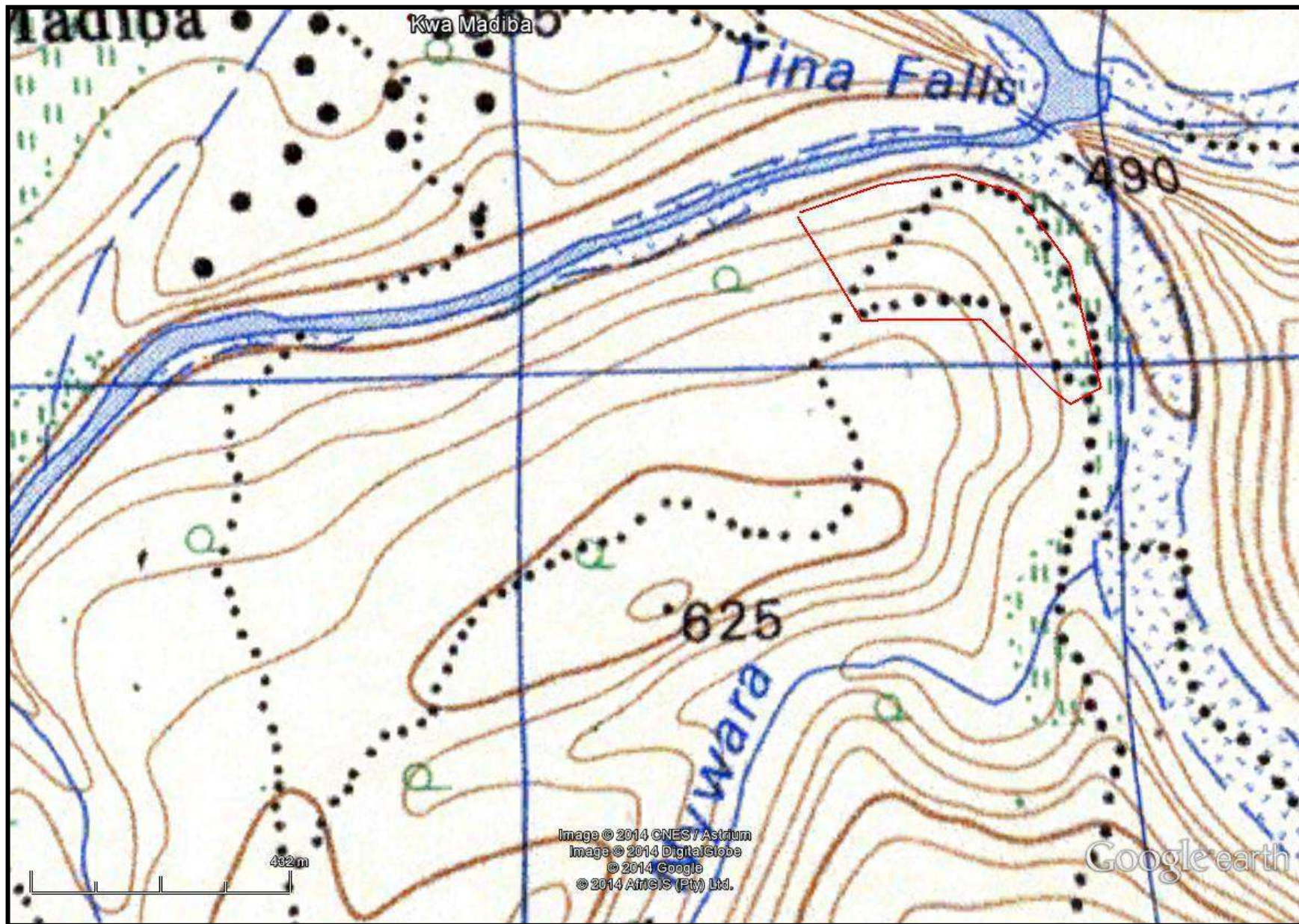


FIG. 6: LOCATION OF STUDY AREA IN 1982



The earliest 1:50 000 topographical map dates to 1982 (fig. 6). The map indicates that the 1927 settlements are no longer occupied, and that no new settlements occur.

FIELD SURVEY

The 1937 aerial photograph indicated that several settlements occur in the area surrounding the study area. There is little remaining from these settlements, except for cleared areas and remnants of walling and terracing. The occasional artefacts and possible graves were noted. Some of these settlements occur next to the various tracks. The new upgraded access road to the Thina Falls has gone through some of these sites. These sites are a1, a18, a21 and TINA03. An upper and a lower grinding stone were noted on the side of the road.

Fig. 7 shows the area of the development footprint. Table 3 lists the location of the sites.

TABLE 3: LOCATION OF RECORDED SITES AND FEATURES

NAME	LATITUDE	LONGITUDE	DESCRIPTION
GR1	-31.201948039	29.044059003	Grave?
GR2	-31.201933036	29.044485977	Grave?
GR3	-31.201949967	29.044559989	Grave?
TINA01	-31.201932030	29.043995971	Settlement - terracing
TINA02	-31.201819964	29.044546997	Settlement – centre of byre
TINA03	-31.201295005	29.042015998	Settlement – centre of byre

TINA01

TINA01 probably relates to 'a6' from the 1937 aerial photograph. The site is located next to a path near the top of the hill. Only a small terrace and two possible graves remain. The terrace is probably for a single house (fig. 8). The possible graves are two small stone cairns underneath the bush (fig. 9). No artefacts were noted in the general area.

Significance: The site is of low significance; however, the possible graves are of high significance. Possible graves should be treated as graves until they have been verified.

Mitigation: The site falls outside of the development footprint and no further mitigation is required.

SAHRA rating: 3A until the possible graves have been verified.

FIG. 7: SCENIC VIEWS OF THE AFFECTED AREA



FIG. 8: TERRACING AT TINA01



FIG. 9: POSSIBLE GRAVES AT TINA01



TINA02

TINA02 probably relates to 'a7' on the aerial photograph. The site is near the top of the hill and extends for ~50m radius. The site consists of remnants of stone walling and several stone cairns that may be graves or another type of feature. The top part of the site has several cacti growing.

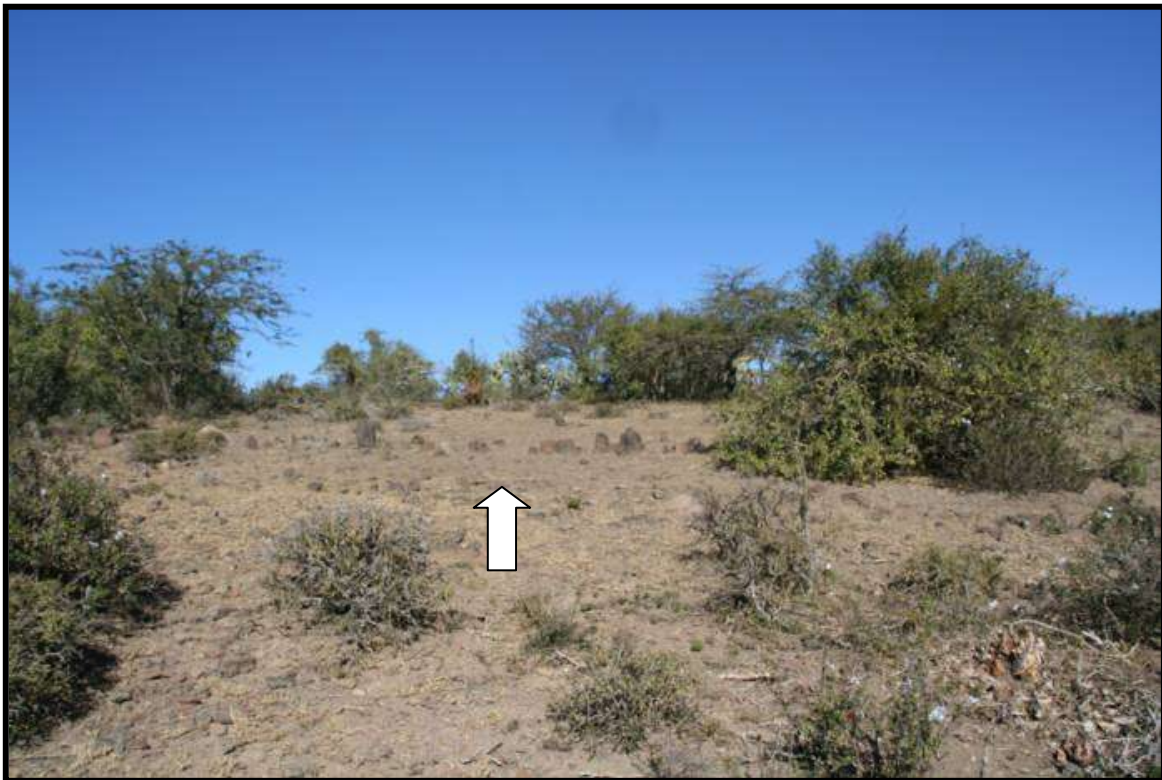
The site is the remains of a settlement that had a main kraal ~20m in diameter (fig. 10). No terraces for houses were noted.

Significance: The site is of low significance, unless graves occur.

Mitigation: No mitigation currently required.

SAHRA rating: 3A if graves occur

FIG. 10: STONE CIRCLE AT TINA02



TINA03

TINA03 is located near the main access road that has been recently upgraded. It may be related to 'a21' from the 1937 aerial photograph. The site consists of a large open area that extends for ~50m (fig. 11). Within this area are several depressions that are the remains of house foundations (fig. 12). No definitive graves were observed. Several artefacts were noted on the surface. This includes MSA flakes and an upper grinding stone used as a pestle (fig. 12).

The site noted as 'a1' on the aerial photographs, occurs just above TINA03; however, no material remains were observed on the surface.

Significance: The site is of low significance.

Mitigation: No mitigation is required but the area should be noted as being sensitive for human remains.

SAHRA rating: 3C

FIG. 11: GENERAL AREA OF TINA03



FIG. 12: ARTEFACTS OBSERVED AT TINA03



LODGE FOOTPRINT

No settlements were recorded within the given study area. However, the area does contain colluvial deposits. Several stone tools have been washed down with the deposits onto the flat area above the river. The stone tools are mostly Middle Stone Age flakes and show signs of patination and weathering. Only one Late Stone Age flake was noted. The tools are in a secondary context. Some of these tools are shown in Fig. 13. The area is not a site, but occurrences of stone tools over an area of 330m x 60m. These tools occur all over the hill above the site.

Significance: The stone tools are of low significance.

Mitigation: No further mitigation is required.

SAHRA rating: 3C

FIG. 13: ARTEFACTS OBSERVED IN THE STUDY AREA



PALAEONTOLOGICAL IMPACT ASSESSMENT

The paleontological desktop impact assessment noted that the area is of moderate to high sensitivity (see Appendix A). There is thus a strong likelihood that fossils will be exposed during construction activity.

A professional palaeontologist must be appointed to do a Phase 1 palaeontological impact assessment for areas identified with a High and Moderate sensitivity rating for the occurrence of fossils.

The development would require a permit from ECPHRA to affect palaeontological sites.

MANAGEMENT PLAN

The main study area was for the buildings related to the Thina Falls Lodge. No heritage sites were noted in this specific area. The survey did note that the upgraded access road did go through sites dating to 1937. These sites would have had human graves. Any further road upgrades in the area will need at least a desktop study, and possibly a field survey.

The 1937 aerial photograph, and Table 2, indicates where the sites closest to the road occur. A 50m buffer should be made around these points to indicate areas with potential human remains.

The stone tools located in the study area require no further mitigation.

The terms of reference for the Heritage Impact Assessment stated that the exact size of the lodge has not been finalised. The final footprint will need to be confirmed via a desktop study.

The extent of the access road(s) was not included in the study area. Any new access roads will need to be approved via a desktop study.

There was no survey to the base of the Thina Falls. I would assume that a path would be introduced at some stage. This would also require at least a desktop study.

If any road widening occurs in the area, especially near Shawbury, then this will require approval from ECPHRA. Shawbury has many historical buildings near the existing road, and these may be affected by road upgrades.

ECPHRA will need to be informed immediately if any human remains are uncovered during the course of the development.

A professional palaeontologist must be appointed to do a Phase 1 palaeontological impact assessment for areas identified with a High and Moderate sensitivity rating for the occurrence of fossils.

CONCLUSION

A heritage survey was undertaken for the proposed Eastern Cape Thina Falls Lodge. The Lodge is about 6 hectares in size and most of the development will occur in the given footprint. Only artefacts in a secondary context were noted in the study area. These are of low significance and no further mitigation is required. The lodge may use some of the tools for display purposes; however, this would require a permit from ECPHRA.

The historical maps and field survey noted that there were several settlements along the access road, and adjacent hill. Some of these settlements

have been affected by the road upgrade to the Thina Falls. These settlements would have human remains since they date to the 1930s where traditional burial methods were probably still practiced. Any developments such as road upgrades, electricity lines and water routes will need to be assessed. This can be undertaken by a desktop study.

REFERENCES

Anderson, G. 2011. Heritage Survey of the Proposed Qumbu Wind Energy Project, Eastern Cape. For C.E.S.

Methodist Missions in Southern Africa:

<http://www.francofrescura.co.za/mission-stations-N-S%20.html>

APPENDIX A
PIA REPORT

**DESKTOP PALAEOONTOLOGICAL
ASSESSMENT FOR THE PROPOSED
THINA LODGE DEVELOPMENT, O.R.
TAMBO DISTRICT MUNICIPALITY,
EASTERN CAPE PROVINCE.**

**FOR
Umlando**

DATE: 26 JUNE 2014

By

**Gideon Groenewald
Cell: 082 339 9202**

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EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed Thina Lodge development, north of Mthatha, O.R. Tambo District Municipality, Eastern Cape Province.

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

The study area is underlain by sedimentary rocks of the Jurassic to Triassic aged Balfour Formation of the Adelaide Subgroup, Beaufort Group, Karoo Supergroup as well as Quaternary aged alluvial material that fills an abandoned channel of the Thina River at this site. Jurassic aged dolerite intrusions cut across the older strata in the vicinity of the study area.

The Adelaide Subgroup, with special reference to the Balfour Formation, is highly productive as far as fossils are concerned. Fossils include plant fossils of *Glossopteris* and vertebrate fossils of the *Dicynodon* and *Lystrosaurus* Assemblage zones have been recorded from these rock units.

About 50% of the study area proposed for the development of the Thina Lodge is located on areas underlain by Karoo aged sedimentary rocks of the Permian to Early Triassic Adelaide Subgroup and notably the Balfour Formation. Fossils are expected in the Permian and Triassic sediments, cutting the significant Permian Extinction zone that records the extinction event during which 80%-90% of life on earth perished. The remainder of the study area is underlain by Quaternary aged sand and silt of an abandoned meander channel of the Thina River that might contain fossils of more recent plants and animals.

It is recommended that:

The EAP and ECO of the project team should be made aware of the possible occurrence of fossils. If any fossils are recorded during initial field visits, a trained palaeontologist must be notified to assess the finds.

A professional palaeontologist must be appointed to do a Phase 1 palaeontological impact assessment for areas identified with a High and Moderate sensitivity rating for the occurrence of fossils.

INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential Palaeontological Impact of the proposed Thina Lodge development, north of Mthatha, O.R. Thambo District Municipality, Eastern Cape Province (Figure 1).

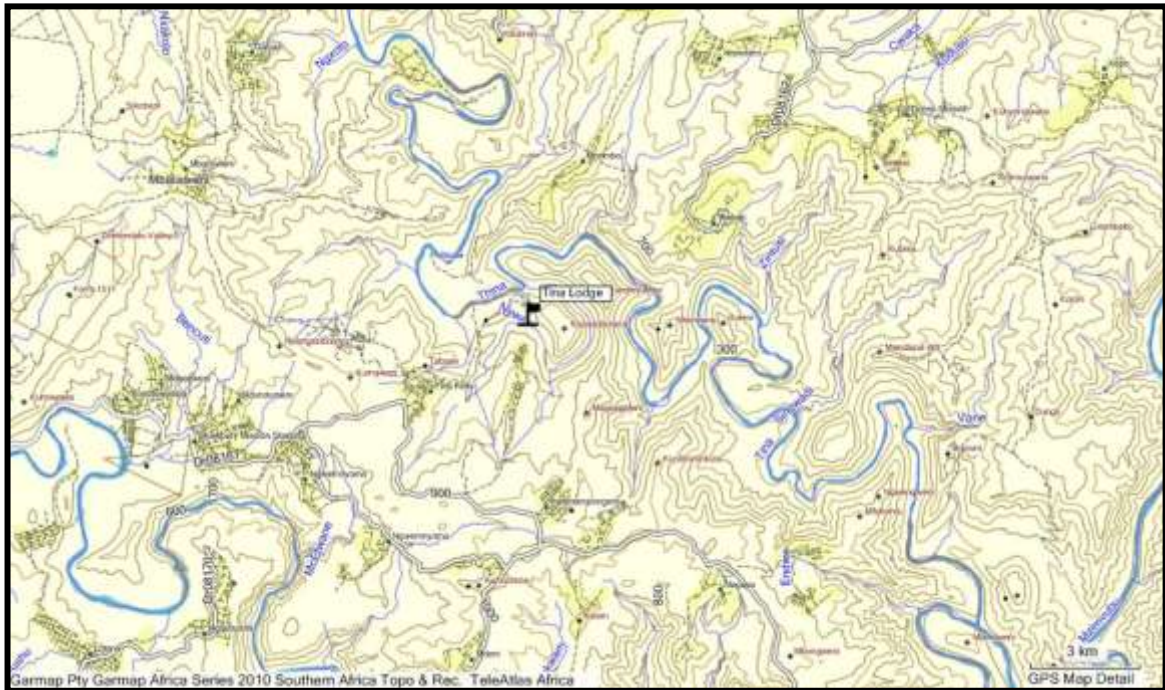


Figure 1 Locality of the proposed Thina Lodge development

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999

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

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

- geological sites of scientific or cultural importance;

objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

METHODOLOGY

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

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

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

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

Table 1 Palaeontological sensitivity analysis outcome classification

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

The key assumption for this desktop study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing.

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

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

GEOLOGY

The study area is underlain by sedimentary rocks of the Jurassic to Triassic aged Balfour Formation of the Adelaide Subgroup, Beaufort Group, Karoo Supergroup as well as Quaternary aged alluvial material that fills an abandoned channel of the Thina River at this site. Jurassic aged dolerite intrusions cut across the older strata in the vicinity of the study area.

Adelaide Subgroup, Balfour Formation (Pa)

The Balfour Formation forms the upper part of the Adelaide Subgroup of the Karoo Supergroup. The formation consists of a lower sequence of interbedded green-coloured mudstone and grey sandstone, overlain by a predominantly red mudstone unit, known as the Palingkloof Member.

The Balfour Formation is interpreted as a meandering fluvial environment that gradually grades upwards into a lacustrine environment (Groenewald, 1996).

Jurassic Dolerite (Jd)

The Jurassic dolerite intrusions are of both sills and dykes that cut the sedimentary units. The dolerite is in general very dark green to black in colour, representing magma intrusions into this part of the Karoo Basin during the break-up of Gondwanaland.

Quaternary Alluvium

The Quaternary aged alluvium that fills the abandoned channel of the Thina River at this site is a unique deposit of sand and silt that collected during the final cut-off sequence of an abandoned meander in the Thina River.

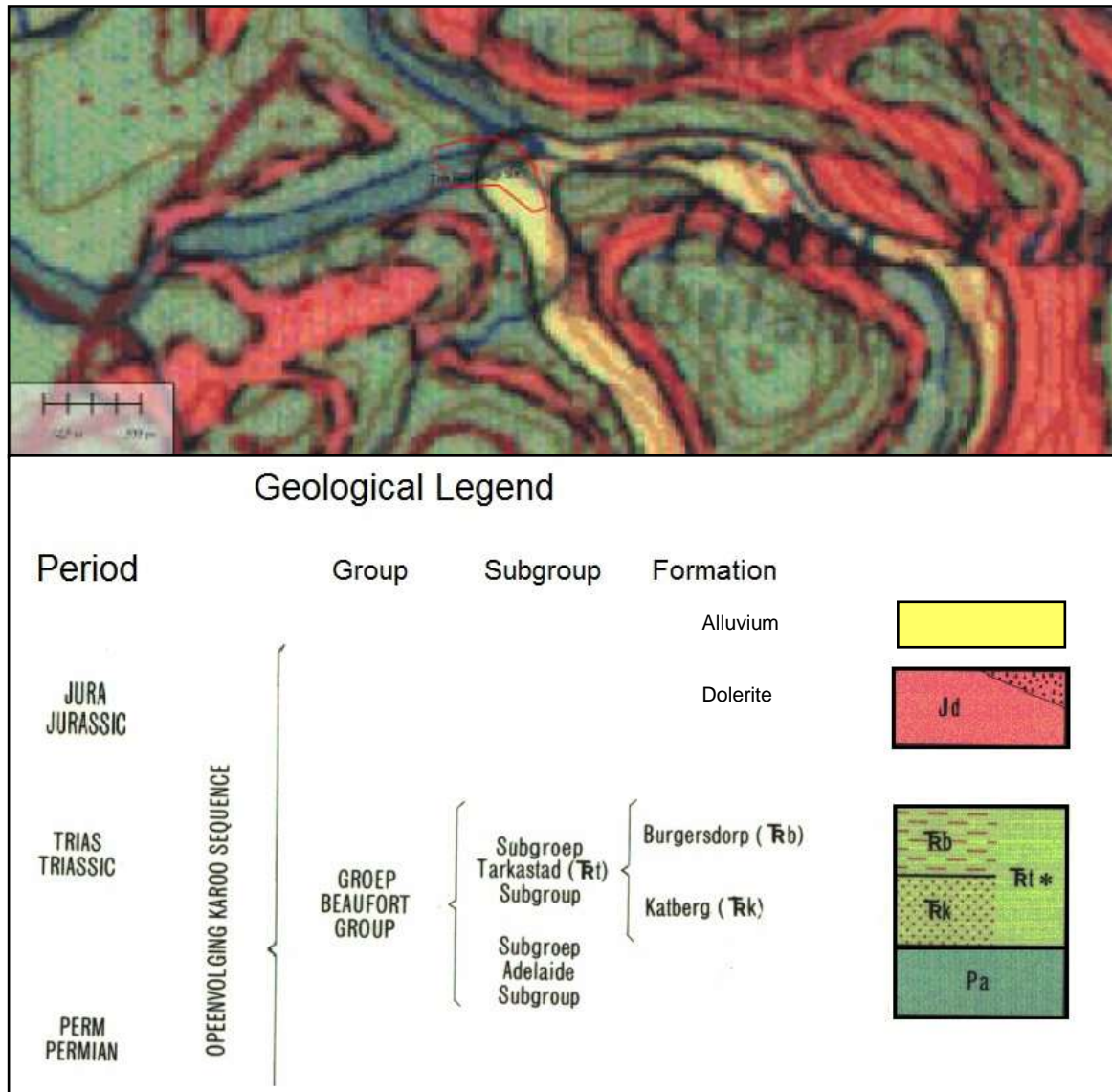


Figure 2 Geology of the area at Thina Lodge development

PALAEONTOLOGY

Adelaide Subgroup/Balfour Formation (Pa)

The Adelaide Subgroup, with special reference to the Balfour Formation, is highly productive as far as fossils are concerned. Fossils include plant fossils of *Glossopteris* and vertebrate fossils of the *Dicynodon* and *Lystrosaurus* Assemblage zones have been recorded from these rock units (Rubidge ed, 1995; Groenewald, 1996; Johnson et al, 2006).

The upper part of the Balfour Formation is characterised by a prominent red mudstone unit, the Triassic Palingkloof Member, dominated by the occurrence of

fossils from the *Lystrosaurus* Assemblage Zone, including casts of vertebrate burrows (Groenewald, 1996).

Jurassic Dolerite (Jd)

Due to the igneous nature of these rocks, they will not contain fossils.

Quaternary Alluvium

The unique accumulation of recent sediment in the abandoned cut-off channel of the Thina River might contain important fossil remains of plants and animals that will, if properly collected and interpreted, lead to a better understanding of the palaeo-environments of this river system.

DISCUSSION

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

Due to the number and abundance of fossils described from the Adelaide Subgroup/Balfour Formation, it has been allocated a High Palaeontological sensitivity. Due to the unique geographical nature of the alluvial deposits in the cut-off meander channel of the Thina River, a Moderate Palaeontological sensitivity is allocated to these deposits.

Table 2 Palaeontological significance of geological units on site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Adelaide Subgroup/ Balfour Formation	Mudstone and sandstone <i>LATE PERMIAN/ TRIASSIC</i>	Plant fossils of <i>Glossopteris</i> . Numerous vertebrate fossils, most notably from animals of the Therapsid group e.g. <i>Gorgonopsians</i> and <i>Dicynodonts</i>	<i>Dicynodon</i> and <i>Lystrosaurus</i> Assemblage Zones	High Sensitivity
Alluvium	Alluvial sand and silt <i>QUATERNARY</i>	Possible plant and vertebrate remains – potentially important indicators of palaeon-environment of the Thina River Valley		Medium Sensitivity

MANAGEMENT PLAN

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the

extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 above.

The palaeontological sensitivity of the development is related to the specific geology that underlies the development footprints. The palaeontological sensitivity of the study area is shown in Figure 3.



Figure 3 Palaeontological sensitivity of the Thina Lodge area

CONCLUSION

About 50% of the study area proposed for the development of the Thina Lodge is located on areas underlain by Karoo aged sedimentary rocks of the Permian to Early Triassic Adelaide Subgroup and notably the Balfour Formation. Fossils are expected in the Permian and Triassic sediments, cutting the significant Permian Extinction zone that records the extinction event during which 80%-90% of life on earth perished. The remainder of the study area is underlain by Quaternary aged sand and silt of an abandoned meander channel of the Thina River that might contain fossils of more recent plants and animals.

It is recommended that:

The EAP and ECO of the project team should be made aware of the possible occurrence of fossils. If any fossils are recorded during initial field visits, a trained palaeontologist must be notified to assess the finds.

A professional palaeontologist must be appointed to do a Phase 1 palaeontological impact assessment for areas identified with a High and Moderate sensitivity rating for the occurrence of fossils.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

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



Dr Gideon Groenewald
Geologist