MULILO WIND ENERGY FARM NEWCASTLE

FOR EOH COASTAL ENVIRONMENTAL SERVICES

DATE: 4 MARCH 2022

REVISION 1 30 MARCH 2022

REVISION 2 11 MAY 2022

REVISION 3: 16 JANUARY 2023

By Gavin Anderson

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

INTRODUCTION

Mulilo Renewable Project Developments (Pty) Ltd (Mulilo) is developing the Newcastle Wind Energy Facility (WEF) Complex near Newcastle in the Newcastle Local Municipality, in KwaZulu-Natal Province, comprising:

- Mulilo Newcastle Wind Power WEF (up to 200 MW and up to 45 turbines) (Scoping and Environmental Impact Assessment process);
- **Mulilo Newcastle Wind Power 2 WEF (up to 200 MW and up to 35 turbines) (Scoping and Environmental Impact Assessment process);**
- Mulilo Newcastle Wind Power grid connection infrastructure and associated powerlines (Basic Assessment process); and
- Mulilo Newcastle Wind Power 2 grid connection infrastructure and associated powerlines (Basic Assessment process).

A total of four (4) applications will be submitted to DFFE for Environmental Authorization (EA) for the Mulilo Newcastle WEF Complex. **T** This draft Environmental Impact Assessment report is for**:**

- **Mulilo Newcastle Wind Power 2 (Pty) Ltd (up to 200 MW and up to 35 turbines WEF).**

The Mulilo Newcastle Wind Power 2 (MNWP 2) WEF will be located near Newcastle, KwaZulu-Natal. The applicant, Mulilo Newcastle Wind Power 2 (Pty) Ltd, intends to develop, construct and operate an up to 200 MW WEF , approximately 15 kilometres northwest of the town of Newcastle in the Kwazulu-Natal Province. The study area is situated in the Newcastle Local Municipality, which forms part of the Amajuba District Municipality (ADM) and will have an anticipated lifespan of 20 – 25 years.

The MNWP2 WEF will consist of up to thirty-five (35) wind turbine generators, with a maximum generating output of up to two hundred (200) megawatts (MW). The proposed turbine footprints and associated facility infrastructure will cover an area of up to 87 ha after rehabilitation, depending on final layout design.

The MNWP 2 WEF infrastructure will be located on up to ten (10) land parcels with a total extent of 3,530 ha. Wind turbines are planned to be placed on five (5) of these land parcels, while infrastructure as well as the site access road may traverse up to an additional 5 properties. Therefore, a total of ten (10) properties are listed in the EA application for approval.

TABLE 1: SPECIFIC INFORMATION REQUIREMENTS FROM THE COMPETENT AUTHORITY (DFFE).

DESCRIPTION OF REQUIRED INFORMATION	DESCRIPTION OR RELEVANT SECTION IN THE REPORT			
General site information				
Description of all affected farm portions	**Farm ID**	**Farm Name**	**Farm Number**	**Area (ha)**
21-digit Surveyor General codes of all affected farm portions	N0HS000000017421 00000	Embosweni	17421	156
	N0HS000000008831 00000	Paardeplaat A Dene Heights	8831	232
	N0HS000000009389 00000	Paardeplaat A	9389	270
	N0HS000000008800 00000	Franzhoek	8800	208
	N0HS000000009390 00000	Paardeplaat B	9390	244
	N0HS000000002901 00000	Glendower	0/2901	223
	N0HS000000009439 00000	Cliffdale	9439	587
	N0HS000000009448 00000	Byron	9448	392
	N0HS000000003350 00002	Geelhoudtboom	1/3350	647
	N0HS00000000335 000000	Geelhoudtboom	RE/3350	567
Copies of deeds of all affected farm portions	Note that property title deeds are no longer available on Windeed.			
Photos of areas that give a visual perspective of all parts of the site	Photographs have been attached as Appendix E.			
Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	Photographs have been attached as Appendix E.			

The following Tables 4 to 6 summarise the key technical details for the Mulilo Newcastle Wind Power 2 WEF project:

TABLE 2: TURBINE SPECIFICATIONS

Component	Specification
WEF Capacity	Up to 200 MW
Number of Turbines	Up to 35
Hub Height	Up to 140 m
Rotor Diameter	Up to 200 m
Blade length	Up to 100 m

TABLE 3: FACILITY COMPONENT DESCRIPTIONS

Facility Component	Description
Crane platform and hardstand area	Crane platform and hardstand laydown for each turbine position.
Turbine Foundations	Reinforced Concrete Foundation. Depth: up to 3.5 m Diameter: up to 25 m per turbine Volume of concrete: up to 800 m^3 per turbine.
IPP Substation	33 kV to 132 kV collector substation to receive, convert and step-up electricity from the WEF to the 132 kV grid suitable supply. The substations maximum height will be Lightning Mast up to 25 m high. The facility will house control rooms and grid control yards for both Eskom and the IPP. Additional infrastructure includes parking, up to 2.8 m high fencing, storm water channels and culverts, ablutions, water storage tanks, septic tank, and borehole.
Construction/office yard	This includes bunded fuel areas, oil storage areas, general stores (containers) and skips.
WTG component laydown area	Temporary laydown area.
On-site concrete batching plant	Temporary on-site concrete batching plant.
Primary Site Access Roads	Site access will, where possible, make use of existing farm roads that will be upgraded and maintained for the life of the WEF. The existing roads to be upgraded will be expanded to a width of up to 9 m. New roads will be constructed (in areas where there are no existing roads) with a width of up to 9 m to the IPP substation and laydown areas. V-drains will run on both sides of the road.

Facility Component	Description
Internal roads	Roads connecting the turbine positions will where possible make use of existing farm roads that will be upgraded and maintained for the life of the plant. The existing roads to be upgraded will be expanded to a width of up to 6 m. New roads will be constructed (in areas where there are no existing roads) with a width of up to 6 m and will connect all turbines. V-drains will run on both sides of the road.
33 kV reticulation	A combination of 33 kV overhead lines and 33 kV underground cable (where technically feasible) will be used, aligned along the road network as far as possible, connecting each WTG position to the IPP substation.
Operations and maintenance (O&M) buildings	Includes other infrastructure such as parking, up to 2.8 m high fencing, storm water channels and culverts, ablutions, water storage tanks, septic tank and borehole.
Met masts	Two met masts (Up to 140 m height).

TABLE 4: FACILITY COMPONENT FOOTPRINTS.

Facility Component	Construction footprint	Final footprint after rehabilitation
Crane platform and hardstand area	Up to 0.8 ha per turbine which equates to 28 ha.	Up to 0.8 ha per turbine which equates to 28 ha.
Turbine foundations	Up to 0.06 ha per turbine which equates to 2.1 ha (included in hardstand area).	Up to 0.06 ha per turbine which equates to 2.1 ha (Included in hardstand area).
IPP substation	Up to 1 ha	Up to 1 ha
Construction/office yard	Up to 2 ha	0 ha
WTG component laydown area	Up to 4 ha	0 ha
On-site concrete batching plant	Up to 1 ha	0 ha
Temporary stockpiles	Up to 2 ha	0 ha

Facility Component	Construction footprint	Final footprint after rehabilitation
Primary site access road and reticulation	Total width of up to 15 m consisting of: • Up to 12 m wide area prepared for road and v-drain. • Up to 3 m width for underground 33 kV reticulation. Overhead lines to be used where underground cables are not technically feasible. Total length up to 10 km which equates to 15 ha.	Total width of up to 12 m consisting of: • Up to 9 m wide road. • Up to 1.5 m wide v-drain on either side of road. Total length up to 10 km, which equates to 12 ha. 33 kV underground / overhead line reticulation and stockpile areas to be rehabilitated. Final footprint up to 0.25 ha to account for cable markers and/or overhead line foundations and stays along primary site access roads.
Internal roads and reticulation	Total width of up to 12 m consisting of: • Up to 9 m wide area prepared for road and v-drain. • Up to 3 m wide area for underground 33 kV reticulation. Overhead lines to be used where underground cables are not technically feasible. Total length up to 25 km which equates to 30 ha.	Total width of up to 9 m consisting of: • Up to 6 m wide road. • Up to 1.5 m wide v-drain on either side of road. Total length up to 28 km, which equates to 25.2 ha. 33 kV underground / overhead line reticulation and stockpile areas to be rehabilitated. Final footprint up to 1 ha to account for cable markers and/or overhead line

Facility Component	Construction footprint	Final footprint after rehabilitation
		foundations and stays along internal roads.
Operations and maintenance (O&M) buildings	Up to 0.5 ha	Up to 0.5 ha
Met masts	Up to 0.002 ha per met mast which equates to 0.004 ha.	Up to 0.002 ha per met mast which equates to 0.004 ha.
Total	**Up to approximately 104 ha**	**Up to approximately 87 ha**

Umlando was requested to undertake a HIA of the proposed wind energy farm. A desktop study was undertaken in December 2022, and repeated in this report. . Figures 1 – 4 show the location of the development.

FIG. 1 GENERAL LOCATION OF THE PROPOSED DEVELOPMENT

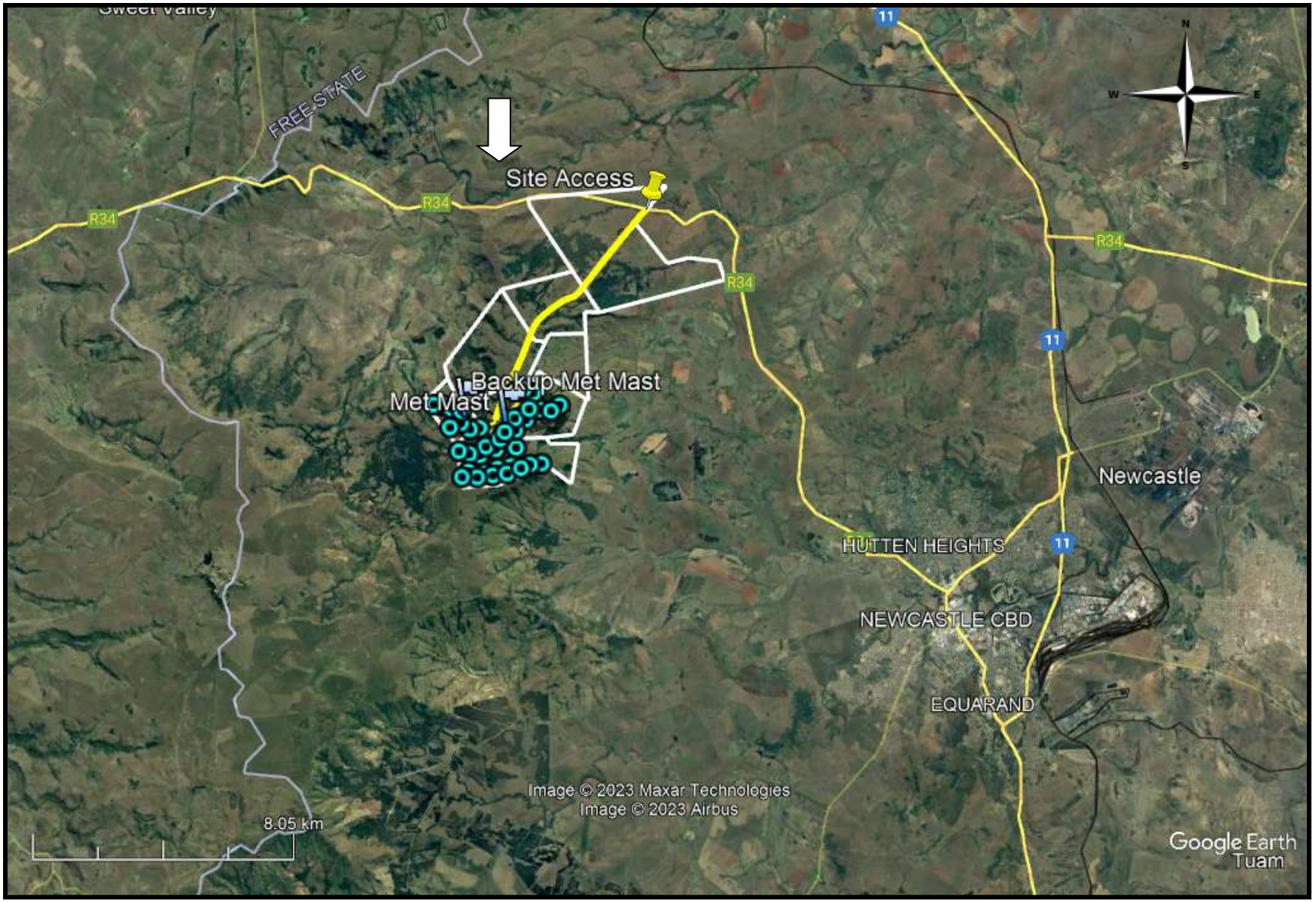


FIG. 2: AERIAL OVERVIEW OF PHASE 2

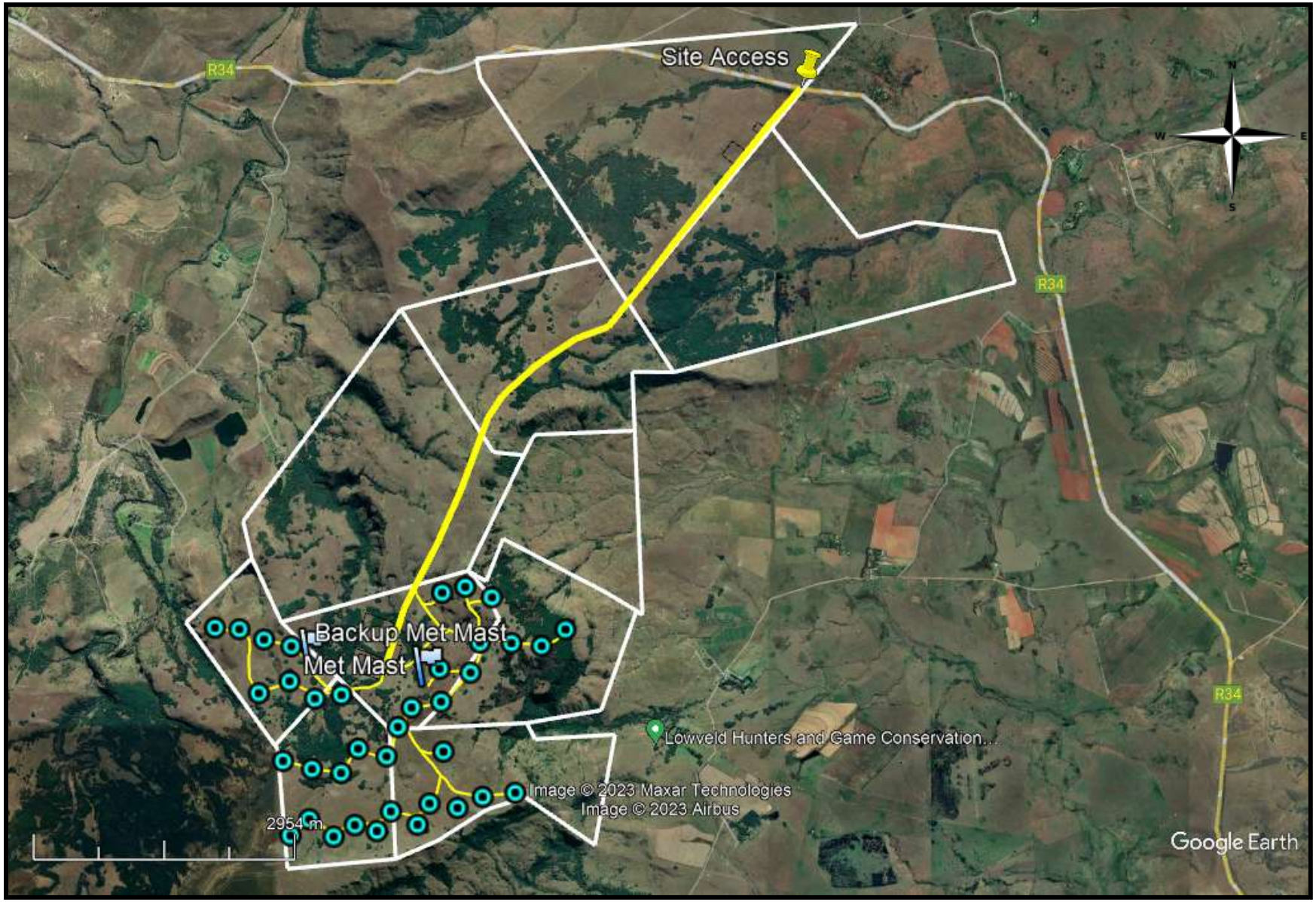
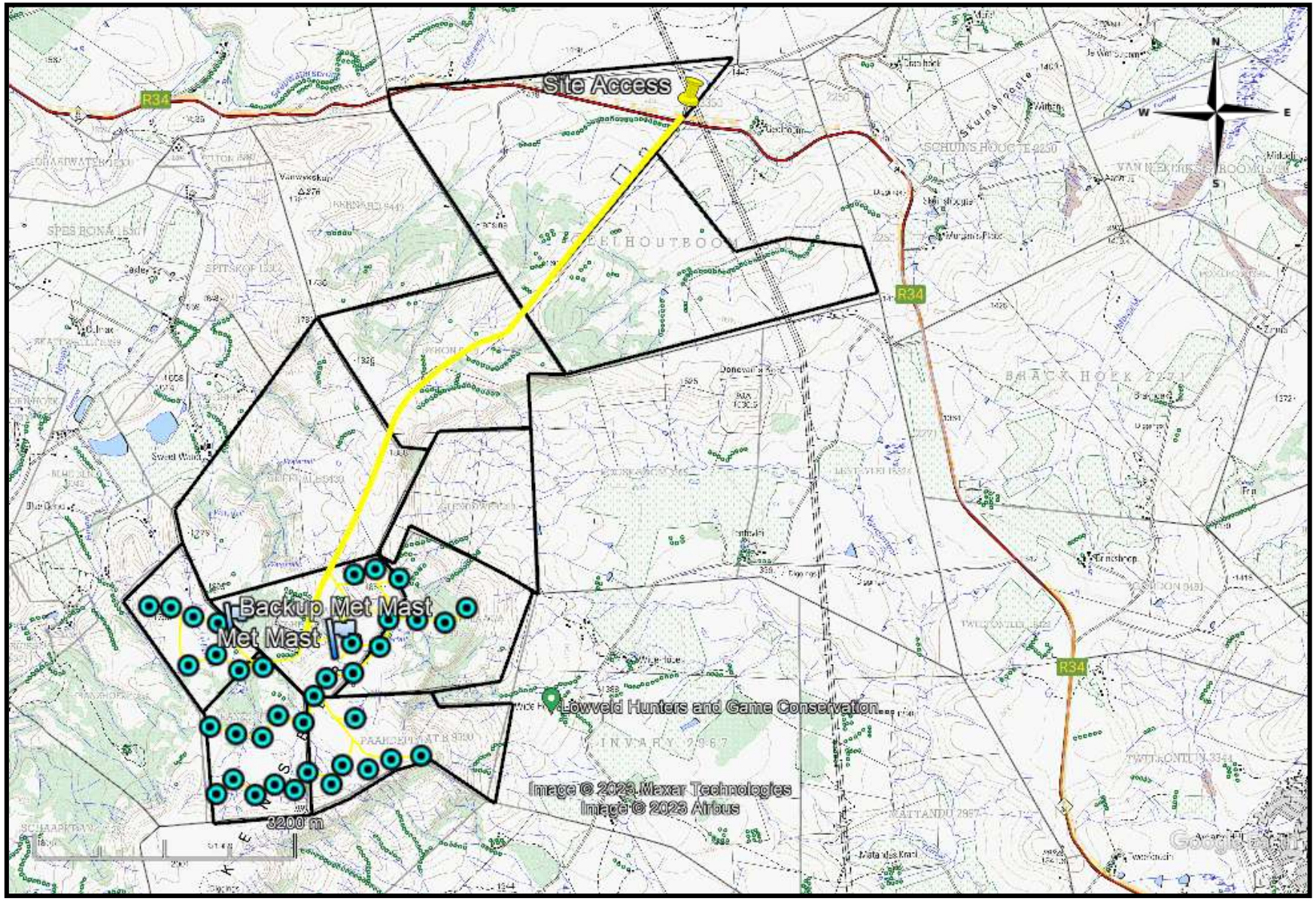


FIG. 3: TOPOGRAPHICAL MAP OF PHASE 1 & 2 (2002)



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 5: 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 did not differentiate between different phases, but the area in general. The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. Many archaeological sites occur in the general area. The archaeological sites tend to be open Stone Age and Iron Age sites of varying significance. Some historical buildings occur in the general area. These sites have been recorded through systematic surveys (fig. 5). No known heritage sites occur within the study area, or nearby to be affected by a visual impact.

The Surveyor General Maps indicate that the farms were first surveyed between 1863 and 1908 (fig.'s 6 - 14). This means the farms were rented before hand and sold thereafter. No buildings are shown on the Surveyor General maps; however, one can assume that buildings would have occurred once the farm was sold. Any buildings and/or ruins on the farms can thus be over 60 years in age and are protected by the heritage legislation. Similarly, any rubbish dumps associated with the older buildings would be protected as well.

The 1954 aerial photographs were only located after the survey (fig. 15). The photographs indicate that most of the settlements (farm houses, kraals, farm labourers' houses, etc.) occur in the northern part of the study area. These features are repeated on the 1968 topographical map.

The 1968 topographical map indicates that there are buildings, ruins and settlements within the study area (fig. 16). Human graves might be associated with some of these features. Table 2 lists these features. These features will be surveyed and assessed.

The Google Earth imagery suggests that overhangs may occur. These overhangs could have rock art and/or archaeological deposits.

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

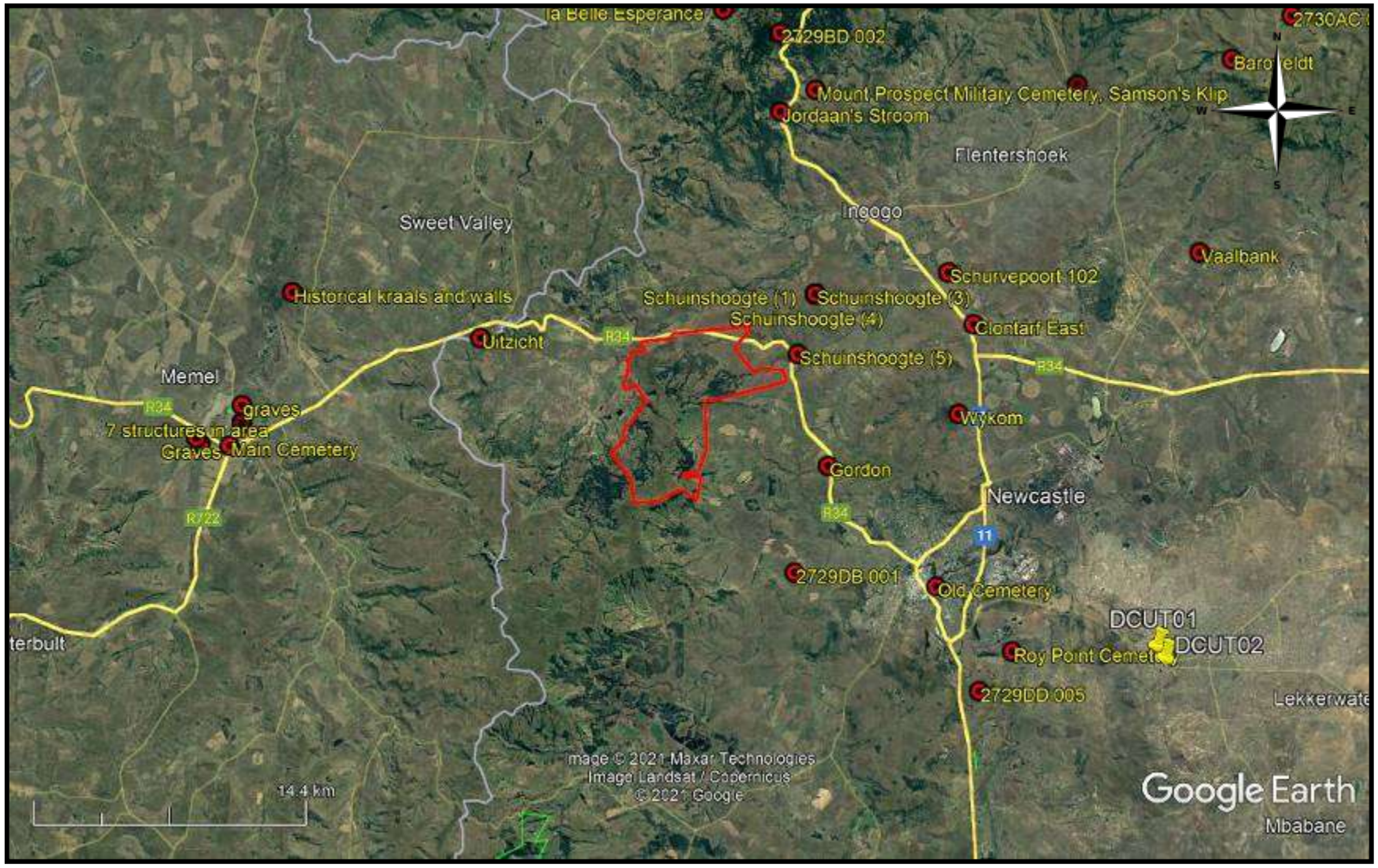
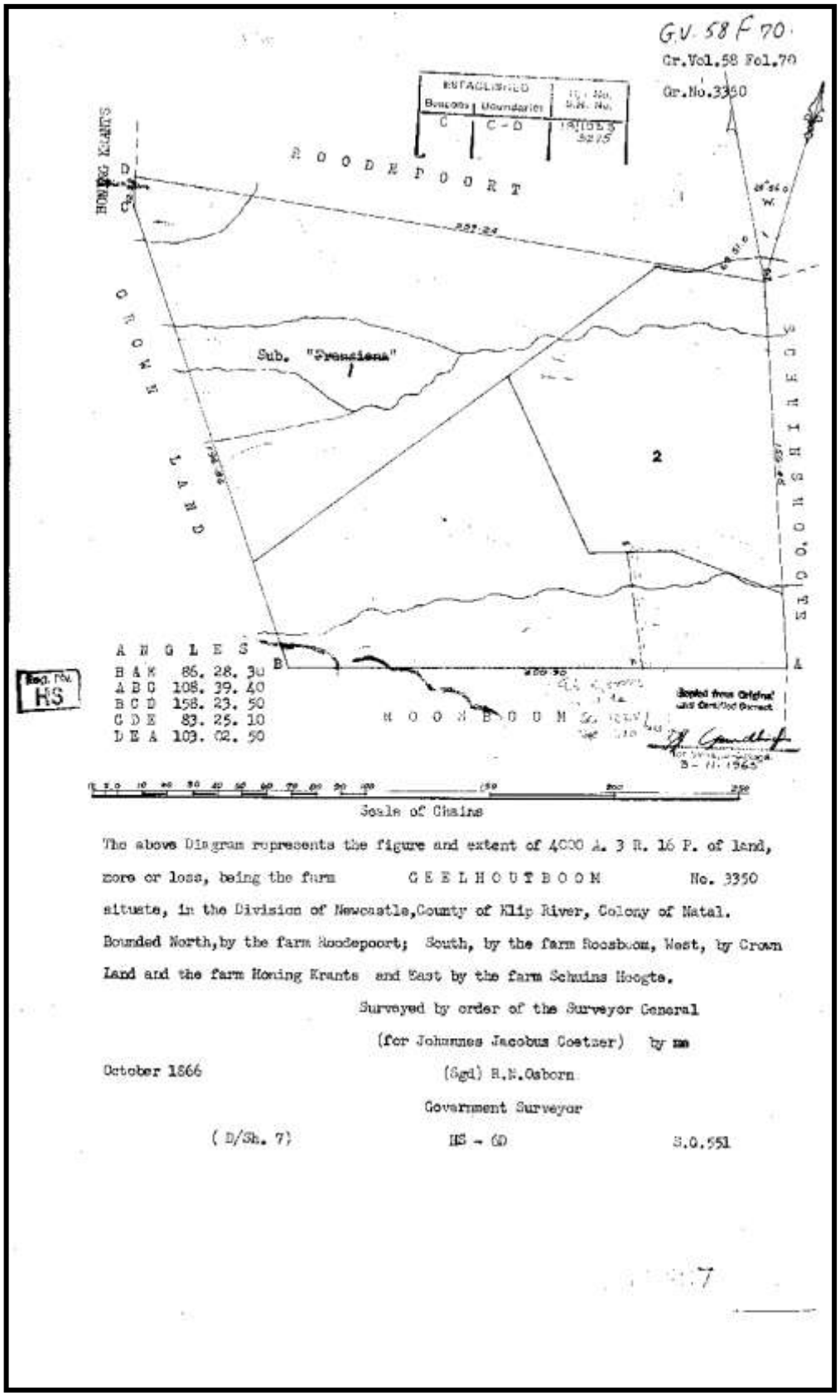


FIG. 6: GEELHOUTBOOM SGD (1866)



The above Diagram represents the figure and extent of 4000 A. 3 R. 16 P. of land, more or less, being the farm GEELHOUTBOOM No. 3350 situate, in the Division of Newcastle, County of Klip River, Colony of Natal. Bounded North, by the farm Roodepoort; South, by the farm Roosboom, West, by Crown Land and the farm Honing Krants and East by the farm Schuins Hoogte.

Surveyed by order of the Surveyor General

(for Johannes Jacobus Coetzer) by me

October 1866

(Sgd) H.N.Osborn

Government Surveyor

(D/Sh. 7) HS - 60 S.G.551

FIG. 7: BERNARD 1896

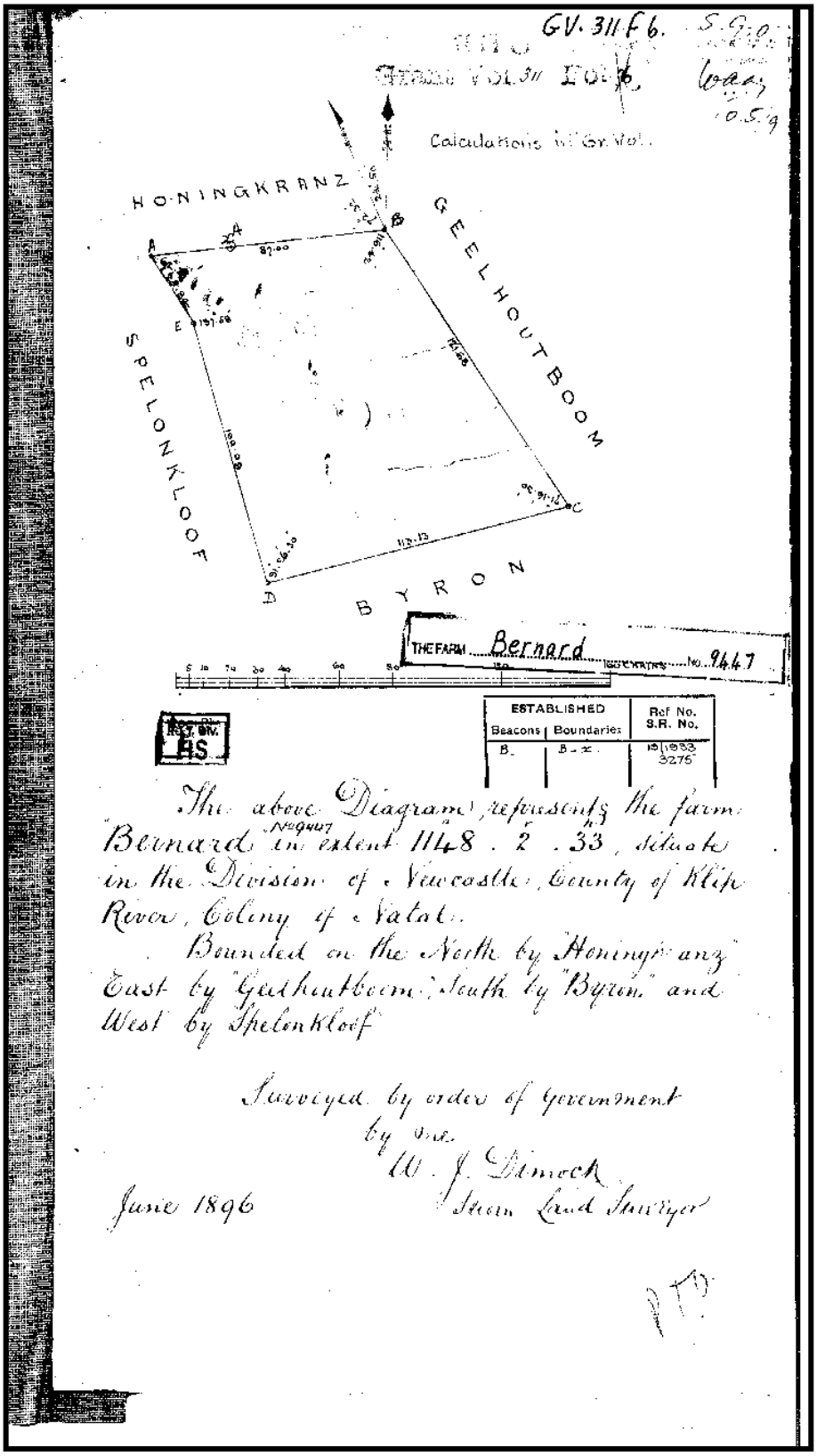


FIG. 8: SPELONKLOOF SOUTH/SPITSKOP (1898)

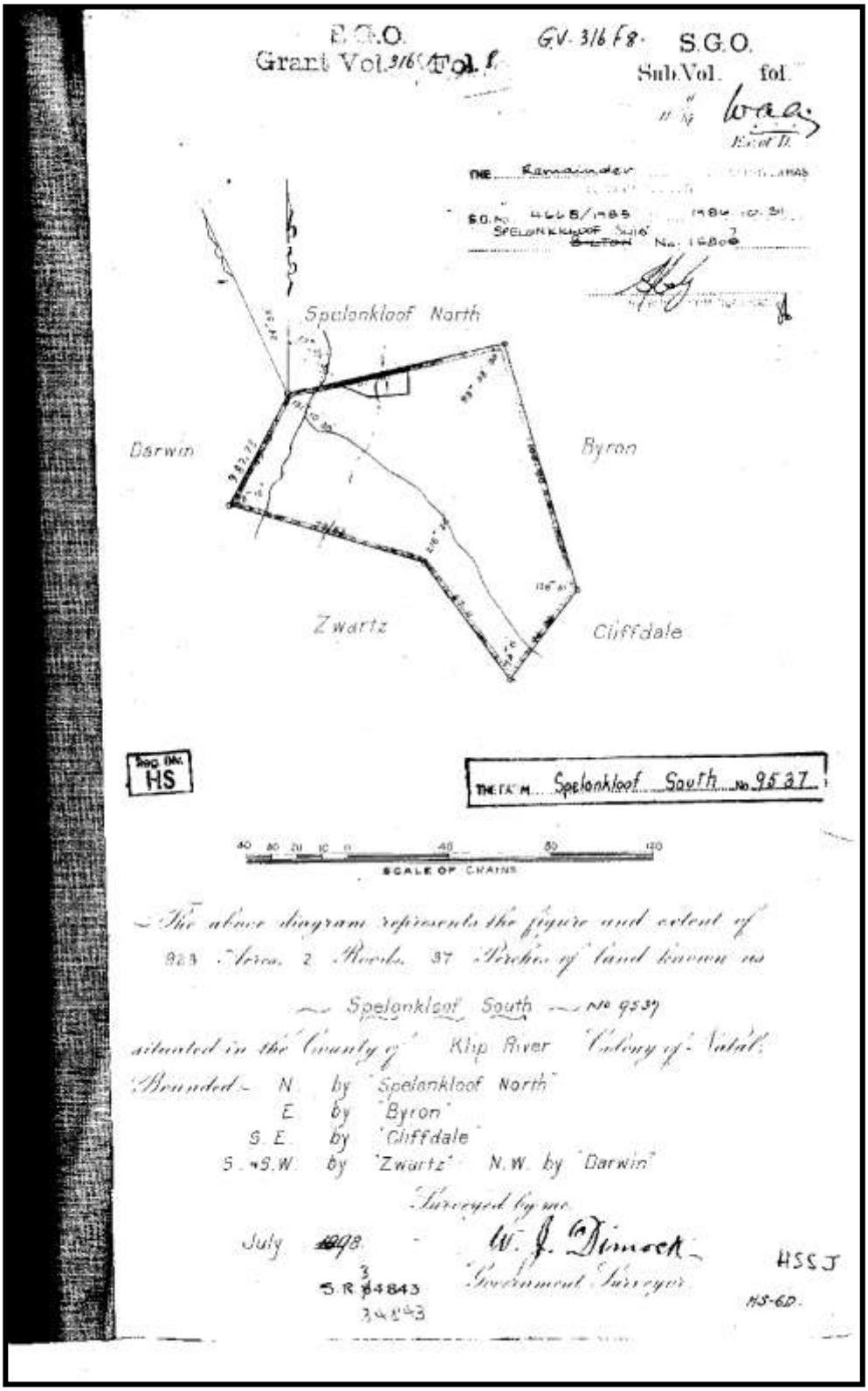


FIG. 9: BYRON 1896

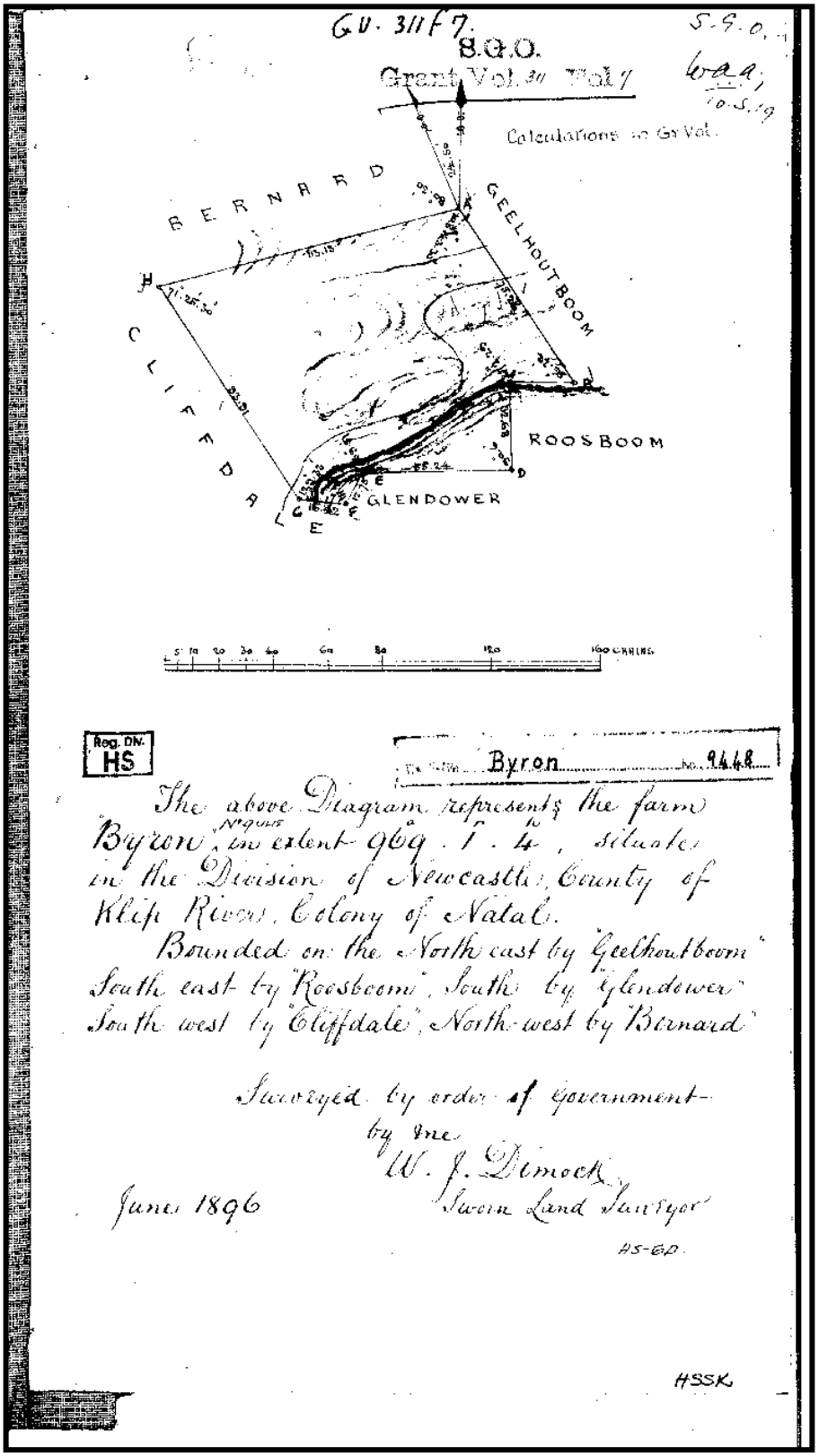


FIG. 10: CLIFFDALE 1896

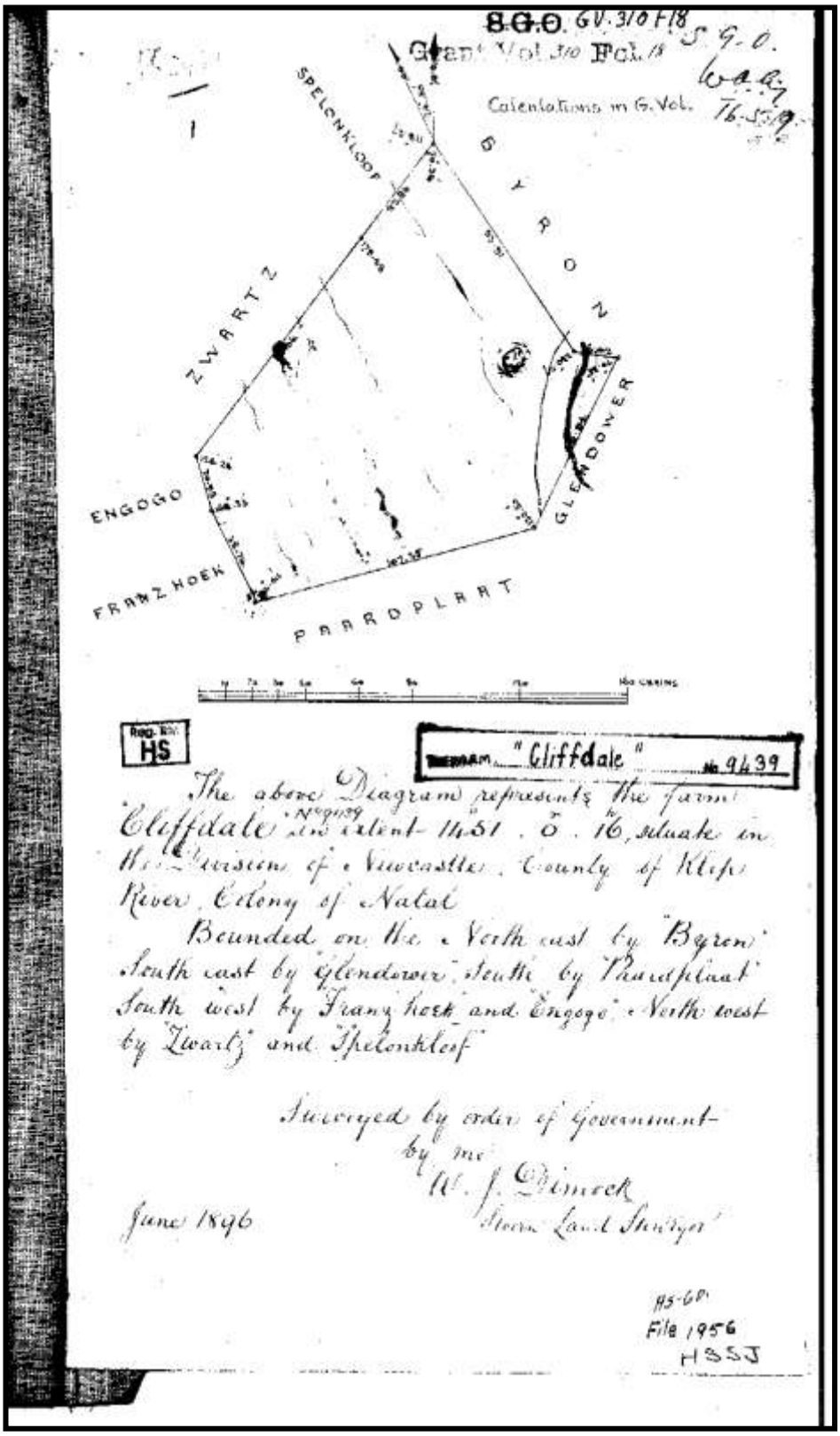
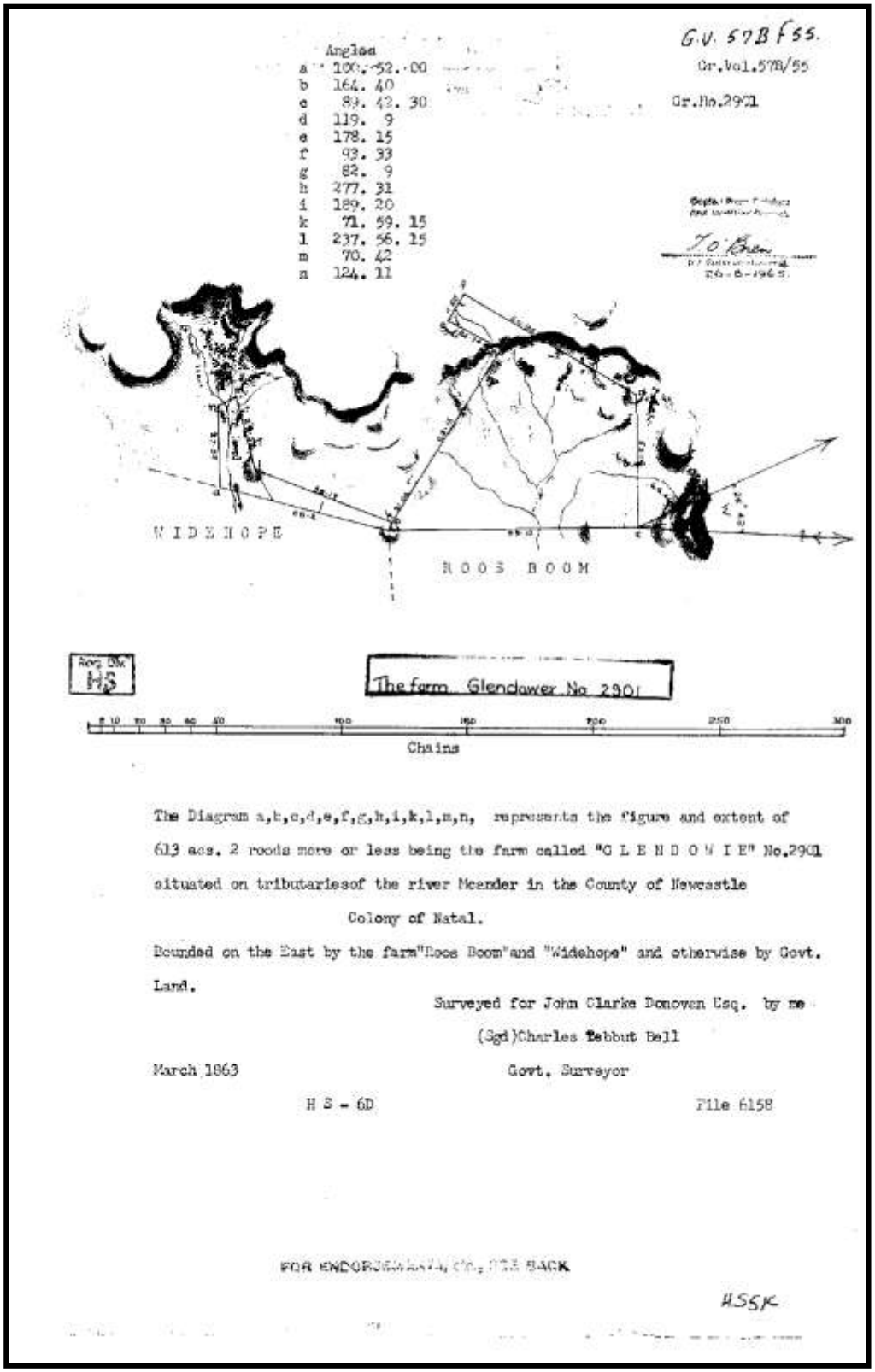


FIG. 11: GLENDOWER 1863



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	Angles
a	100. 52. 00
b	164. 40
c	89. 43. 30
d	119. 9
e	178. 15
f	93. 33
g	82. 9
h	277. 31
i	189. 20
k	71. 59. 15
l	237. 56. 15
m	70. 42
n	124. 11

26-8-1965

WIDEHOPE

ROOS BOOM

Reg. Dpt. HS

The farm Glendower No 2901

Chains

The Diagram a,b,c,d,e,f,g,h,i,k,l,m,n, represents the figure and extent of 613 acs. 2 roods more or less being the farm called "G L E N D O W E R" No.2901 situated on tributaries of the river Meander in the County of Newcastle Colony of Natal.

Bounded on the East by the farm "Roos Boom" and "Widehope" and otherwise by Govt. Land.

Surveyed for John Clarke Donovan Esq. by me

(Sgd) Charles Tebbut Bell

March 1863 Govt. Surveyor

H S - 6D File 6158

FOR ENDORSEMENT, SEE BACK

HSSK

FIG. 12: PAARDEPLAAT A /DENE HEIGHTS 1908

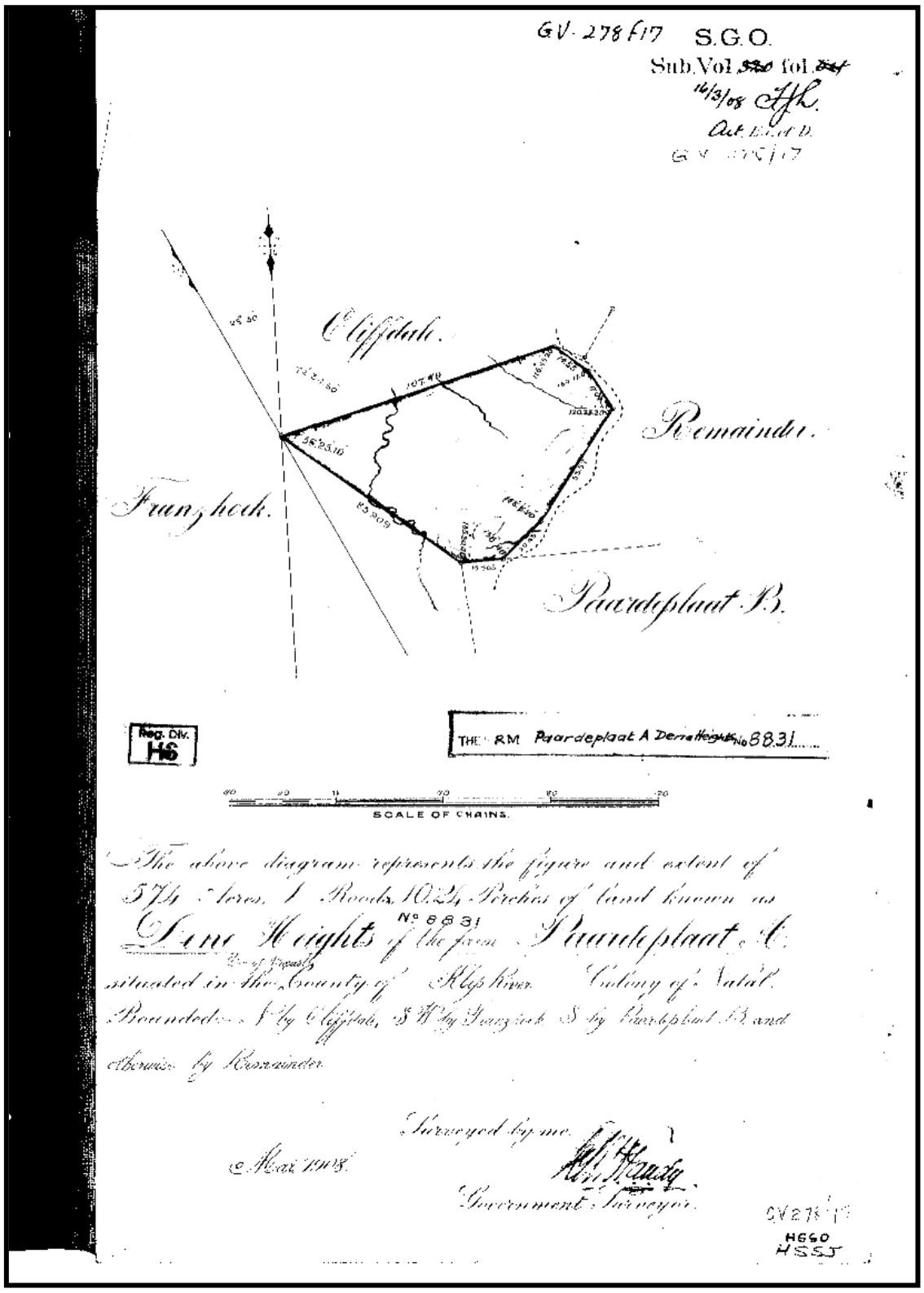


FIG. 13: PAARDEPLAAT B 1908

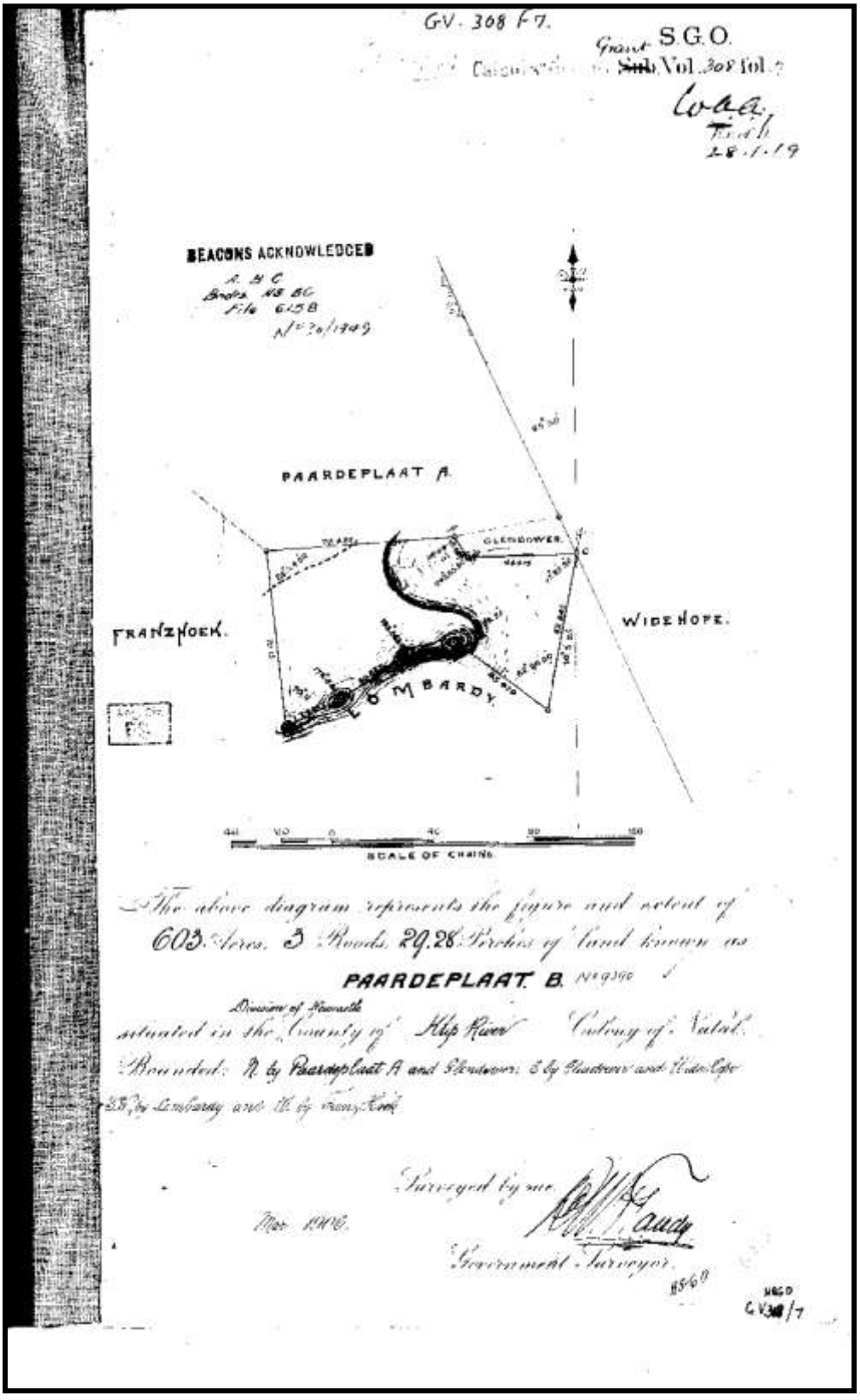


FIG. 14: FRANZHOEK 1895

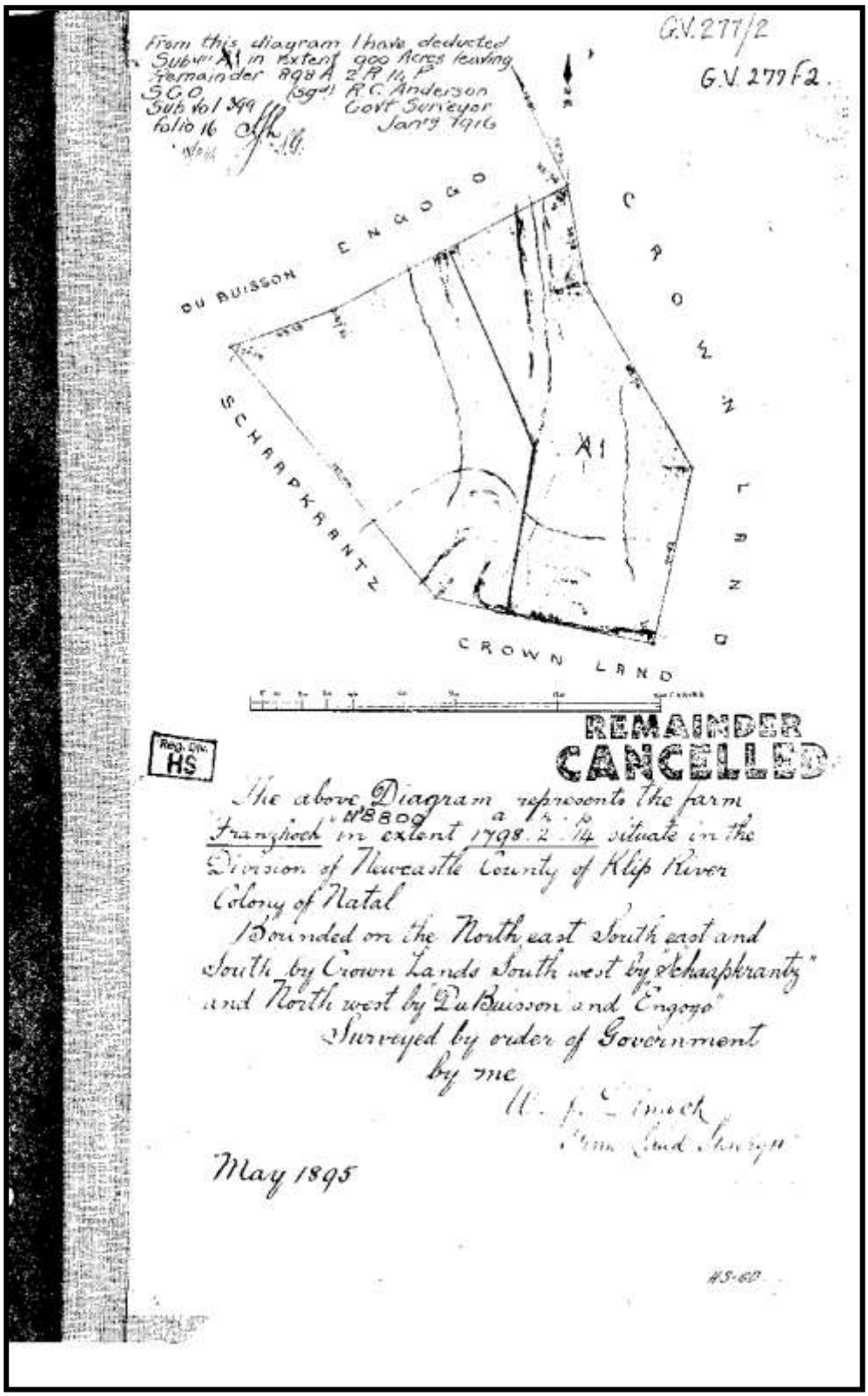


FIG. 15: NORTHERN HALF OF THE STUDY AREA IN 1954

FIG. 16: LOCATION OF THE STUDY ARE AND POSSIBLE FEATURES IN 1968

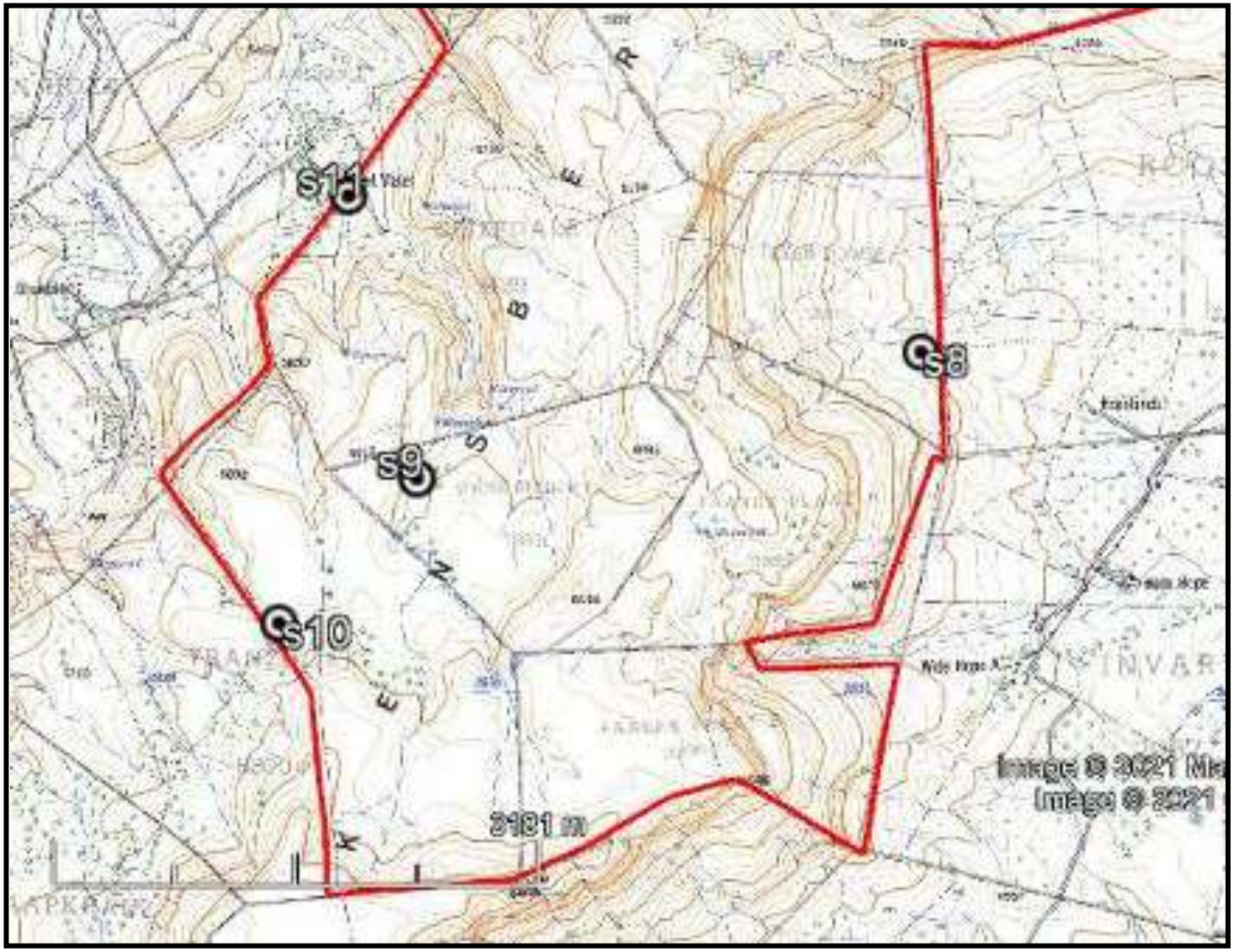


TABLE 6: LOCATION OF FEATURES IN 1953 & 1968

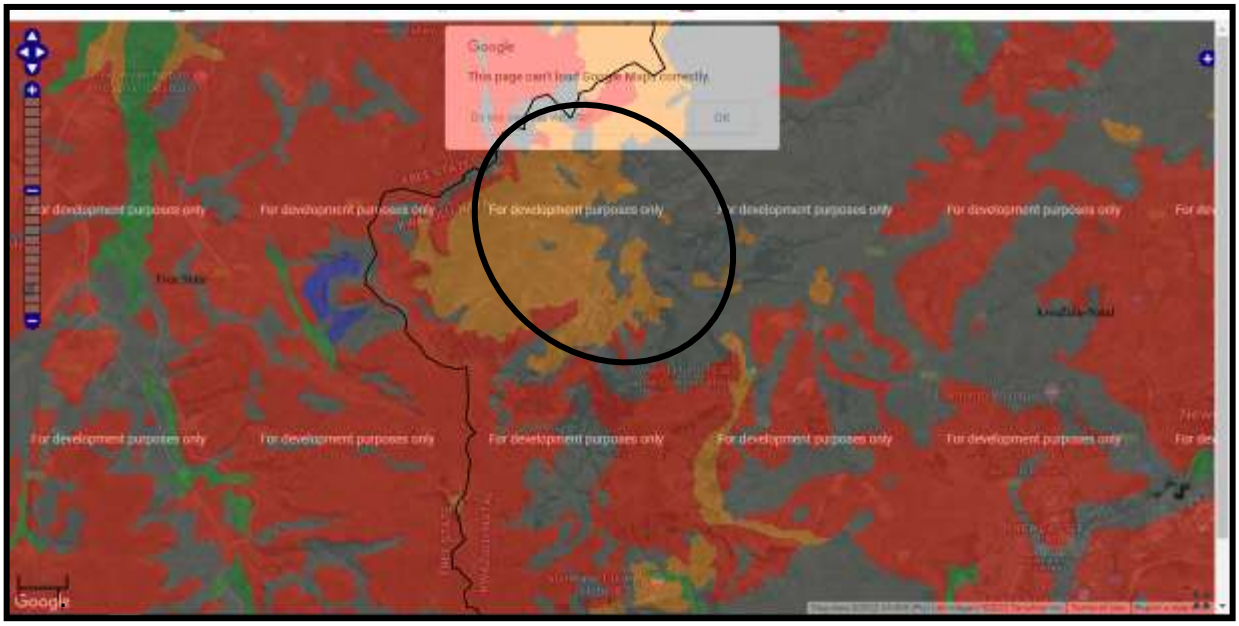
NAME	LATITUDE	LONGITUDE	DESCRIPTION
S08	-27.685969458	29.816814221	Settlement (+graves?)
S09	-27.693101999	29.784159716	Settlement (+graves?)
S10	-27.701458825	29.775206581	Settlement (+graves?)
S11	-27.676689259	29.778904654	Settlement (+graves?)

PALAEONTOLOGICAL SENSITIVITY

Dr Alan Smith (Appendix A & B) undertook the PIA desktop and fieldwork study for this project as some of the land was considered to be of high palaeontological significance (fig. 17). He states: “This site is dominated by Karoo Dolerite, which is an intrusive igneous rock and not fossiliferous. However the remaining lithologies may be fossiliferous. The areas underlain by significant fossiliferous lithologies are restricted to deep depressions and steep slopes, areas where turbine construction is very unlikely. These lithologies are adequately catered for by the “Chance find protocol” (see Appendix 2). The gridlines will cross Vryheid Formation. Although this is considered sensitive by the SAHRIS Palaeosensitivity Map, in practice no significant palaeontological material has been encountered. The gridlines follow existing industrial corridors (railway and Eskom powerline routes). For this reason it is the recommendation of this Field Report that no further palaeontological work needs to be undertaken, unless the “Chance Find Protocol” is triggered.

On a separate note, road access to the site was extremely difficult. It is presumed that a road may need to be constructed from the northern side in order to gain access to the site for the transport and assembly of heavy wind turbine equipment. A palaeontological investigation may need to be undertaken, depending on the route selected.”

FIG. 17: PALAEONTOLOGICAL SENSITIVITY MAP



COLOUR	SENSITIVITY	REQUIRED ACTION
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

FIELD SURVEY

A field survey was undertaken in February 2022. Those sites noted in the desktop study were surveyed where possible, as well as the two phases of the project. Ground visibility in the lower lying areas was poor due to the dense (grass) vegetation. Often the basic outlines of buildings could be seen, but not the detail. The extensive wattle plantations also limited access in several areas. One site, Ruins 2, could not be assessed due to a wetland on the one side and dense wattle trees on the other sides.

This area will not be affected by the WEF. Photography at many of the sites was hampered due to the long grass, especially for surface features.

No heritage sites occur within the Wind Power 2 area, they only occur in the Wind power 1 area

CONCLUSION

A HIA of the proposed Mulilo Newcastle WEF2 was undertaken at a desktop and field survey level. The desktop noted several heritage sites using topographical maps and aerial photographs.

Only four possible sites were noted in the desktop study. However the field survey confirmed that there were no heritage sites in the Phase 2 study area.

No further mitigation is required.

REFERENCES

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SG MAPS

N_3988T2
N_A413T2
N_A643T1
N_2A77T1
N_2F32T1
N_BD8DT1
N_BD8DT1
N_B49DT1
N_BB8DT1
N_8539T1

DATABASES

KZN Museum
SAHRIS
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 DESKTOP STUDY

DESK-TOP PALAEONTOLOGICAL REPORT:

PROPOSED MULILO NEWCASTLE (Pty) Ltd WIND POWER 1 AND 2 WIND FARMS BETWEEN NEWCASTLE AND MEMEL IN KWAZULU-NATAL

FOR

UMLANDO: Archaeological Surveys & Heritage Management
PO Box 102532, Meerensee, KwaZulu-Natal 3901
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by

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12 December, 2021

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

Mulilo Newcastle (Pty) Ltd proposes to construct a Wind Farm between Newcastle and Memel, within KwaZulu-Natal.

This proposed Wind Farm Footprint is underlain by rocks of the Karoo Supergroup. This contains the following lithologies:

- Karoo Dolerite
- Volksrust Formation
- Adelaide Subgroup
- Tarkastad Subgroup
- Alluvium

The Karoo Dolerite is the commonest lithology, but is not fossiliferous. Alluvium is also unlikely to be so. The Volksrust Formation could be fossiliferous, but is also unlikely as significant fossils are rare. In contrast, the Adelaide and Tarkastad Subgroups could contain significant fossil material. For this reason it is the recommendation of this report that a Palaeontological Field Assessment by a competent palaeontologist be undertaken.

1. PROPOSED PROJECT

Mulilo Newcastle (Pty) Ltd proposes to construct a Wind Farm in KwaZulu-Natal between Newcastle and Memel (Figures 1 & 2).

Figure 1: Location of the proposed Mulilo Newcastle (Pty) Ltd WEF. Source map GoogleEarth.

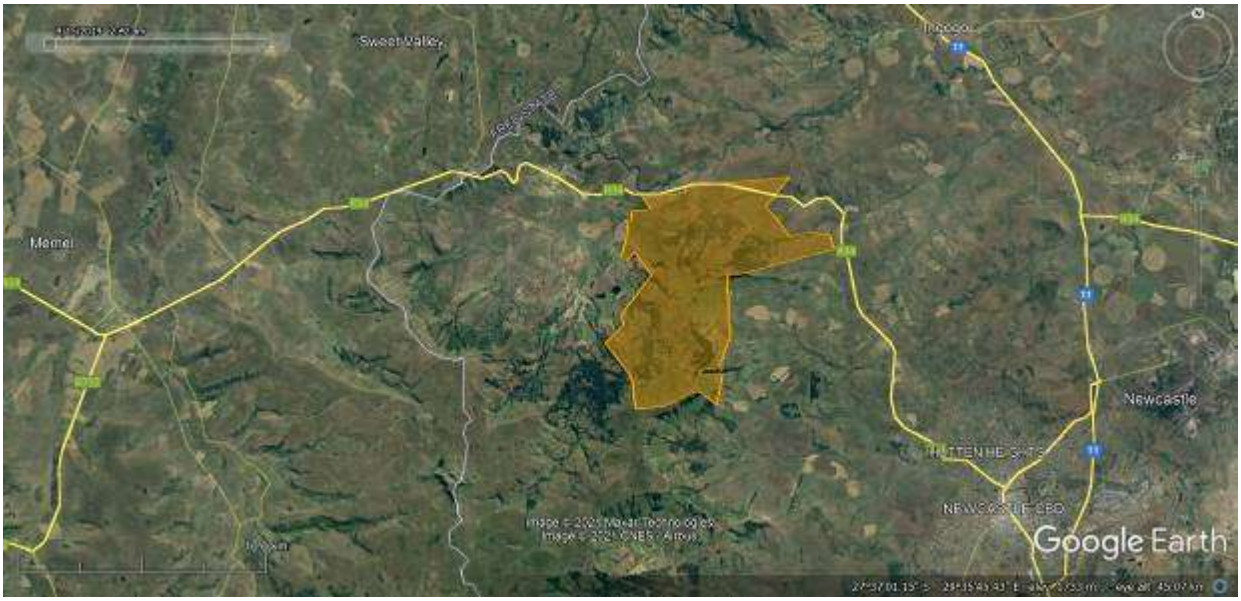

Figure 2: Zoomed in location of WEF. Source GoogleEarth.

The footprint will cover the following farms:

1. Portion 1 of the Farm Geelhoutboom No. 3350
2. Remainder Farm Bernard No. 9447
3. Remainder Farm Cliffdale No. 9439
4. Remainder Farm Spitskop No. 16302

5. Remainder Farm Byron No. 9448
6. Remainder Farm Geelhoutboom No. 3350
7. Remainder Farm Embosweni No. 17421
8. Remainder Farm Paardeplaat A Dene Heights
9. Remainder Farm Paardeplaat B No. 9390
10. Remainder Portion 1 of the Farm Franzhoek No. 8800
11. Remainder Farm Glendower No. 2901
12. Remainder Farm Lot B of Paardeplaat A No. 9389

2. GEOLOGY

The proposed project footprint site is located on Karoo Supergroup rocks (Figure 3). Anticipated rock units are as follows:

1. Dolerite (red)
2. Volksrust Formation (orange)
3. Adelaide Subgroup (Green)
4. Tarkastad Subgroup (Light green)
5. Alluvium (yellow) may be present

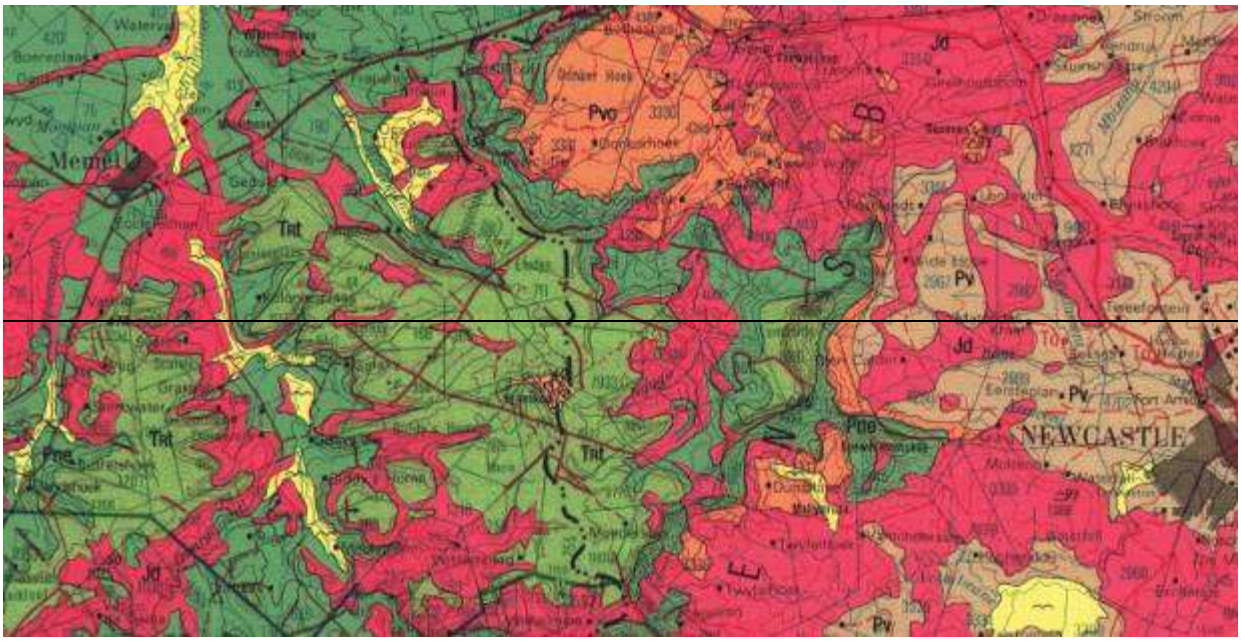

Figure 3: Extract from the Frankfort 2728 1:250 000 Geological Ma. This shows the lithologies that will be encountered. Dark Green (Pa) is described as Adelaide Subgroup, Light Green (Tkt) is Tarkastad Subgroup and Red (Jd) is Karoo Dolerite.

1. ***Karoo Dolerite***

Dolerite intrusions may be present. These are 184 million years (Ma) old and represent the onset of the break-up of the Gondwana Supercontinent (Hastie et al (2014). According to Watkeys (2006), Gondwana rifting commenced between 155 and 135 Ma.

2. Volksrust Formation

The Volksrust Formation is Late Permian in age (Cairncross et al. 2005). Typically, it comprises a blue-black shale (Figure 4). This unit was deposited in generally non-marine conditions (Cataneneau et al., 1998), but pockets of marine conditions were present (Cairncross et al., 2005). Quaternary sediments comprise alluvium (river deposits) and colluvium (hill slope deposits).

Figure 4: Example of the Volksrust Formation. This lithology is typically a blue shale and very weathered.

3. Adelaide Subgroup

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).

The Lower Beaufort Group is represented here by the Adelaide Subgroup (SACS, 1980). In Kwazulu-Natal the Adelaide Subgroup is represented by the Permian Estcourt Formation, which forms flat terrain, in the middle, by the Belmont Formation, and the upper by the Otterburn Formation (Green, 1998). This subdivision is not represented on the Frankfort 1: 250 000 geological map (Figure 3). These rocks formed from sediments originally deposited within a fluvial-floodplain constructed by meandering rivers in a semi-arid climate (Figure5), flowing into a large inland sea (Karoo Sea). Lacustrine environments alternate with fluvial environments indicating a series of transgressive-regressive lacustrine episodes (Green, 1998).

Field Investigation PIA: Newcastle Pase 1 and 2 Wind Farms

Figure 5: Example of what a channel cutting down into red shales of the Adelaide Sub-Group would look like (image near Bergville).

4. Tarkastad Subgroup

The Tarkastad Subgroup is Triassic in age (252 to 201 Ma or million years) and is characterized characterized by alternating sandstones (which crop out as cliffs) and mudstones (often red in colour). These are often arranged in fining-upward units (coarse-grained sandstone at the base and mudstones above. The original sediments were deposited by fluvial processes within an arid landscape. In this area, river flow was generally north to south. Fossils would be expected to be within the floodplain mudstones, rather than the river channels where preservation is unlikely.

5. Alluvium

This is modern sands and muds deposited along a water course.

.

3. PALAEONTOLOGY

The palaeosensitivity of this area is shown in Figure 6. It is mostly grey, which is not fossiliferous, but also contains colour codes of red and yellow. According to SAHRIS, a Field Assessment is essential for the red shaded areas, and possibly for the yellow.

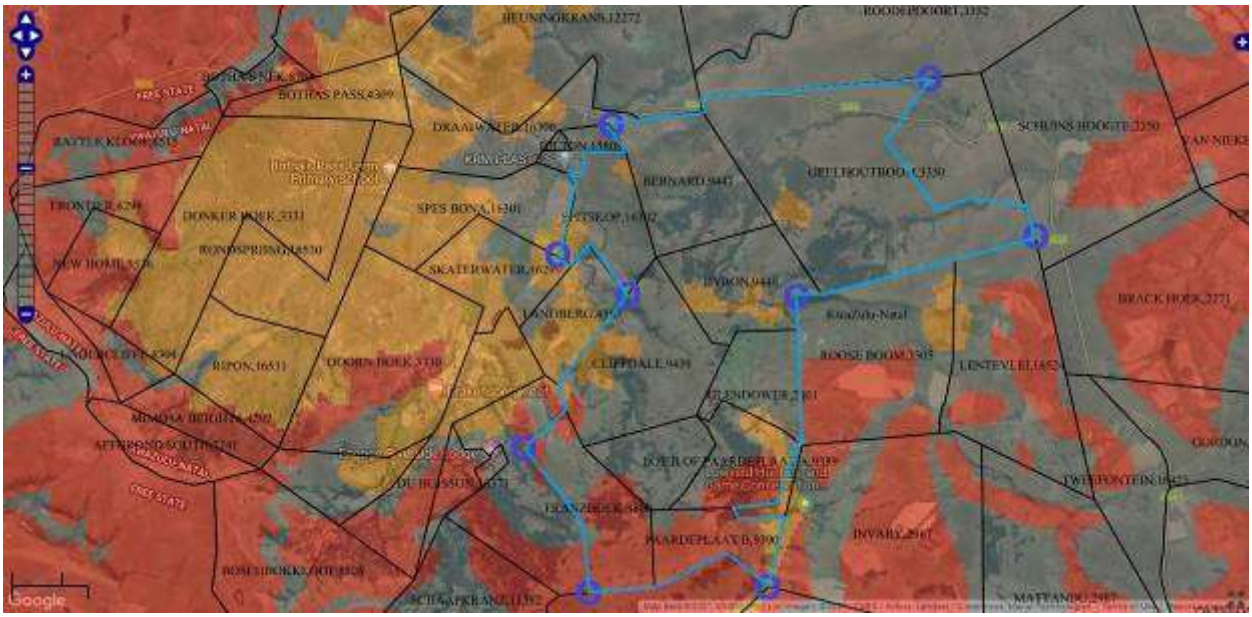

Figure 6: Palaeosensitivity of rocks in the Mulilo Newcastle WEF footprint (blue outline). Most of the area is dolerite (grey) and of no concern however the thickness of the dolerite is unknown.

The Volksrust Formation

Evidence of trace fossil bioturbation is common within the Volksrust Formation siltstones and mudstones, however the various trace fossil (ichnofossil) types are not always identifiable. These are common and of little Palaeontological Significance.

The bivalve *Megadesmus* has been recoded from the Volksrust Formation (Cairncross et al., 2005). This fossil is large, 9 cm dorsally and 8.4 cm laterally (Figure 7). *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).

Fig. 7: Megadesmus bivalve. This image was obtained from Cairncross et al. (2005).

Adelaide Subgroup

The Adelaide Subgroup may contain Permo-Triassic Boundary, if it has been preserved. The Upper Permian is separated from the Triassic by the Permo-Triassic Extension (PT Boundary), the greatest of the Phanerozoic (541Ma to present) Extinction Events. This occurrence is also known as the Great Dying, a time in Earth's history when 95% of all life on Earth became extinct. The reasons for this are still controversial. There have been five great extinction events in the Phanerozoic Era, but the Permo-Triassic Boundary represents the greatest extinction event in the Earth's history. If this is present it will be fundamental in palaeontological importance.

The P/T Boundary is expected to be found within marine sediments where a complete time deposition record may accumulate. In contrast, the Adelaide Subgroup comprises terrestrial sediments as sedimentary rocks. Preservation requires a large number of geological processes to come together, but these are less likely to take place during terrestrial deposition. Consequently the placement of the Permo-Triassic Boundary is not accurately known, if it has in fact been preserved in southern Africa. Present evidence indicates that the Permo-Triassic Boundary is unlikely to be located in the development area but must be considered.

Evidence of bioturbation is ubiquitous within the Adelaide Subgroup siltstones and mudstones, however the various trace fossil (ichnofossil) types are not always identifiable. Trace fossils are very common within the Beaufort Group (Figures 8 & 9). These have limited **Palaeontological** value.

Figure 8: Examples of trace fossils found near Bergville, similar examples could be found on the Mulilo Newcastle WEF 1 and 2 sites. This trace fossil could be *Arenicolites*.

Figure 9: Trace fossils of unknown species, possibly a shrimp that could be found in these rocks..

The Adelaide Subgroup is known internationally for its fossils (Cisneros et al., 2008). It contains plant- and animal- fossils. The latter include a wide variety of body fossils, including the mammal-like reptiles such as the Upper Permian- Dicynodon (Figure 10) and the Triassic- aged Lystrosaurus (Neveling et al., 2005) and trace fossils (Green, 1997).

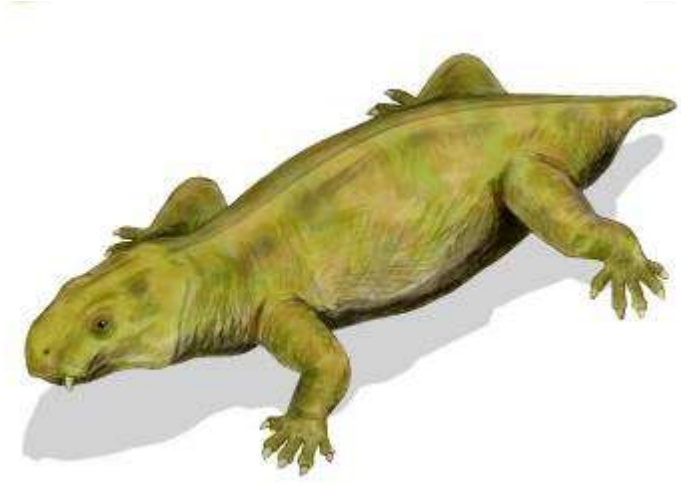

Figure 10: Dicynadon reproduction (Wikepedia).

Tarkastad Subgroup

The Tarkastad Subgroup is an important fossil bearing rock (Neveling et al., 2006). It is considered highly palaeontologically sensitive as it may record the post PT Boundary record. can be recorded within this based on the important post-extinction (PT Event) continental biotas of Early Triassic age recorded from this unit in the Main Karoo Basin (SAHRIS website). This level is known to contain palaeontologically important Early Triassic terrestrial fossils from the period around 252 million years old, or post PT Boundary (Groenewald & Kitching 1995, Rubidge 2005, Smith et al. 2012). This fauna is dominated by therapsids or “mammal-like reptiles” and other tetrapods. Rare vascular plants and some trace fossils are known. The uppermost two biozones of the Beaufort Group, the *Lystrosaurus* and *Cynognathus* assemblage zones, record terrestrial biotic recovery following the Permo-Triassic mass extinction event (Neveling et al 2006).

Karoo Dolerite

Karoo Dolerite is also present. This is an igneous intrusive rock and by definition cannot be fossiliferous.

Alluvium

Reworked palaeontological Material could be found in the Quaternary alluvium sediments, but is unlikely.

4. SUMMARY AND CONCLUSIONS

This site is dominated by Karoo Dolerite which is not fossiliferous. Similarly any alluvium can also be ignored. However the remaining lithologies may be fossiliferous. The Volksrust Formation could be fossiliferous, but is also unlikely to be so as significant fossils are rare. In

contrast, the Adelaide and Tarkastad Subgroups might contain significant fossil material. For this reason it is the recommendation of this report that a Palaeontological Field Assessment by a competent palaeontologist be undertaken.

5. REFERENCES

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Field Investigation PIA: Newcastle Pase 1 and 2 Wind Farms

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7. 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.

Field Investigation PIA: Newcastle Pase 1 and 2 Wind Farms

- 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 B
PIA FIELD SURVEY

FIELD INVESTIGATION PALAEONTOLOGICAL REPORT: PROPOSED MULILO NEWCASTLE (Pty) Ltd FOR:

- **WEF PHASE 1,**
- **WEF PHASE 2**
- **& ASSOCIATED POWER GRIDLINES**

TO BE ERECTED BETWEEN NEWCASTLE IN KWAZULU-NATAL AND MEMEL IN THE FREE STATE

FOR

UMLANDO: Archaeological Surveys & Heritage Management
PO Box 102532, Meerensee, KwaZulu-Natal 3901
phone (035)7531785 fax: 0865445631
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by

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29 Browns Grove, Sherwood, Durban, 4091, South Africa
Telephone: 031 208 6896
asconsulting@telkomsa.net

17 May, 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

Mulilo Newcastle (Pty) Ltd proposes to construct a Wind Farm within KwaZulu-Natal between the towns of Newcastle and Memel (Free State province). This report was compiled by Dr Alan Smith of Alan Smith Consulting (Appendix 1) and follows the Desk-Top PIA report recommendation that a Field Investigation should be under taken.

This proposed Wind Farm footprint (WEF Phase 1 and WEF Phase 2) is underlain by rocks of the Karoo Supergroup. The powerlines are underlain by rocks belonging to the upper Vryheid Formation. This contains trace fossils and fossil woods, but vertebrate fossils have not been recorded. A "Chance Find Protocol" will suffice for this (Appendix 2.

WEF Phase 1: This is to be developed almost entirely on dolerite which is not fossiliferous. Those that may contain fossils are depressions which are unlikely to be developed. The Chace Find Protocol (Appendix 2) will provide sufficient mitigation for these areas

WEF Phase 2: The Desk-Top PIA report (Appendix 3) indicated that the southern part of WEF Phase 2 of the Wind Farm was to be constructed on Adelaide Subgroup (Normandien Formation) and Tarkastad Subgroup. Both these subgroups are known for their vertebrate fossils. Fieldwork proves that the Frankfort (2728) 1: 125 000 geological map is incorrect at this point and that the entire plateau is dolerite and not fossilferous. Fossiliferous lithologies are present in WEF Phase 2, but these are located within depressions, areas where wind turbines are unlikely to be placed. The "Chance Find Protocol" (Appendix 2) provides sufficient mitigation.

The power gridlines traverse dolerite (non-fossiliferous) and Vryheid Formation (possible rare fossils). The dolerite can be ignored. The "Chance Find Protocol" (Appendix 2) will mitigate the Vryheid Formation.

No further palaeontological work is required for this project's current footprint (WEF Phase 1 & 2 and power gridlines).

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: 

1. PROPOSED PROJECT

Mulilo Newcastle (Pty) Ltd proposes to construct a Wind Farm in KwaZulu-Natal (KZN) between Newcastle and Memel (Figures 1 & 2). The Wind Energy Farm (WEF) footprint will cover the following farms:

13. Portion 1 of the Farm Geelhoutboom No. 3350
14. Remainder Farm Bernard No. 9447
15. Remainder Farm Cliffdale No. 9439
16. Remainder Farm Spitskop No. 16302
17. Remainder Farm Byron No. 9448
18. Remainder Farm Geelhoutboom No. 3350
19. Remainder Farm Embosweni No. 17421
20. Remainder Farm Paardeplaat A Dene Heights
21. Remainder Farm Paardeplaat B No. 9390
22. Remainder Portion 1 of the Farm Franzhoek No. 8800
23. Remainder Farm Glendower No. 2901
24. Remainder Farm Lot B of Paardeplaat A No. 9389

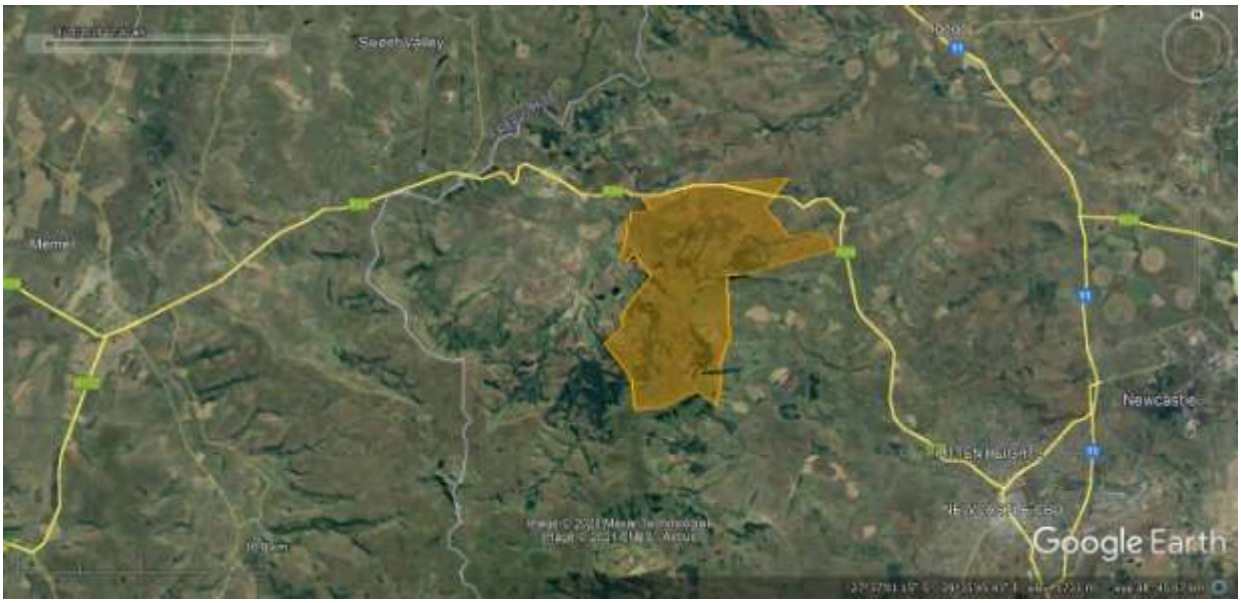

Figure 1: Location of the proposed Mulilo Newcastle (Pty) Ltd wind farm between Newcastle and Memel. Only the WEF footprint is shown. Major roads are indicated in yellow and the provincial border between KZN and the Free State is indicated in grey.

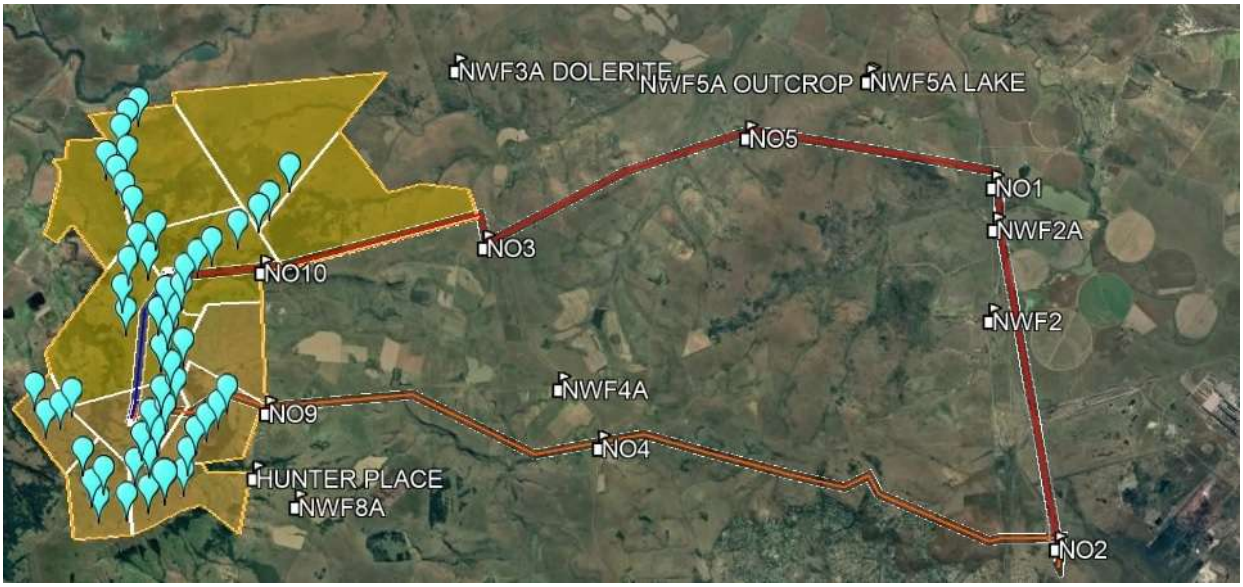

Figure 2: Zoomed in location of WEF. The blue balloons are proposed wind turbine placements. The red lines are the power line grid. The codes are positions which were visited during the ground truthing (refer Table 1).

2. GEOMORPHOLOGY

The proposed Wind Energy Farm (WEF) location is dominated by a plateau in the west and lowlands to the east. The plateau is the proposed site for the WEF and the lowland that of the connecting power grids (Figures 1 & 2). The plateau is structurally controlled by a dolerite sill. The lowlands comprise wetlands, underlain by Vryheid Formation sandstone and low, rounded dolerite hills.

3 GEOLOGY

The proposed WEF project footprint site is located on rocks of the Karoo Supergroup (Figure 3). Anticipated rock units from the Frankfort (2728) Geological map (Figure 3) are as follows:

6. Dolerite (Red)
7. Vryheid Formation (light brown: this underlies the proposed gridlines).
8. Volksrust Formation (Orange)
9. Normandien Formation of the Adelaide Subgroup (Green)
10. Tarkastad Subgroup (Light green)

Figure 3: Extract from the Frankfort 2728 1:250 000 Geological Map. This shows the lithologies encountered. Dark Green (Pa) is described as Adelaide Subgroup, Light Green (Tkt) is Tarkastad Subgroup and Red (Jd) is Karoo Dolerite.

3.1 FIELD GROUND-TRUTHING

A fieldwork investigation was undertaken during 21 – 25 March 2022. The area in question is illustrated in Figure 4. Field location points are provided in Table 1, along with key location reference points taken from the kmz files supplied.

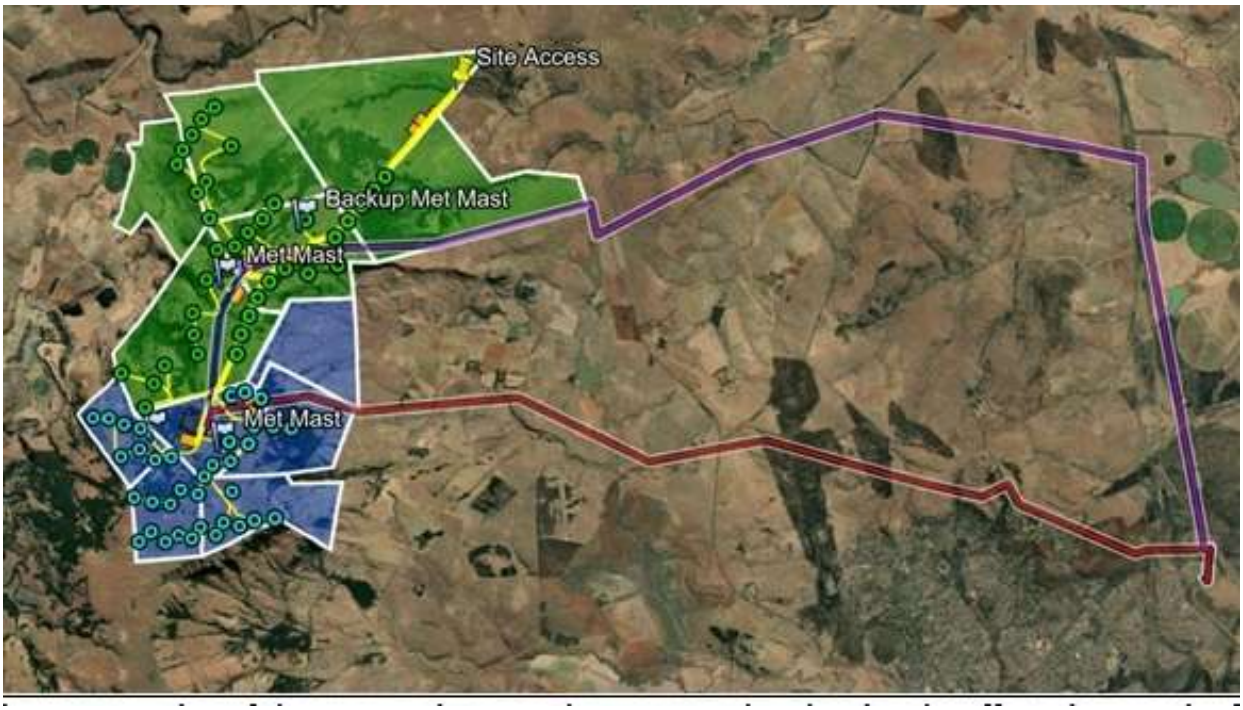

Figure 12: Location of the proposed Newcastle WEF Complex. WEF Phase 1 (Green) and WEF Phase 2 (Blue). Proposed Gridlines are shown as purple and red lines.

Table 1: Locations where data was captured during 21-25 March 2022

Name	latitude	longitude	elevation
GPS SITE VISITS			
NWF2	-27.6762	29.9663	1223.58
NWF2A	-27.6597	29.9671	1201.18
NWF5A LAKE	-27.6329	29.9413	1241.82
NWF5A OUTCROP	-27.6326	29.9417	1237.85
NWF3A DOLERITE	-27.6310	29.8573	1400.66
NWF4A	-27.6886	29.8785	1340.88
NWF8A	-27.7098	29.8247	1383.74
HUNTER PLACE	-27.7046	29.8161	1457.20
SWEETWATER	-27.6651	29.7738	1583.36
VO X CUT	-27.8293	29.6600	1867.04
MOORFIELD	-27.8758	29.7084	1779.04
TKT1	-27.7067	29.8121	1559.92
TKT VIEW	-27.7093	29.8070	1746.03
TOP GATE	-27.7090	29.8040	1852.31
T36 TO T29 JD	-27.7079	29.8011	1860.24
DOLERITE	-27.7071	29.8007	1859.83
T29 VIEW	-27.7065	29.8011	1846.11
POWER LINE REFERENCES			
NO1	-27.6521	29.9669	1209.75
NO2	-27.7174	29.9798	
NO3	-27.6629	29.8631	1385.56
NO4	-27.6992	29.8866	1320.36
NO5	-27.6431	29.9166	1212.55
NO9	-27.6929	29.8186	1358.87
NO10	-27.6674	29.8177	1318.49
TURBINE REFERENCES			
T008	-27.7109	29.7826	1435.57
T010	-27.6758	29.7888	1228.74
T011	-27.7053	29.7808	1240.42
T013	-27.7139	29.7840	1444.10
T020	-27.6936	29.7709	1235.81
T021	-27.6968	29.8084	1279.89
T029	-27.7053	29.8021	1392.88
T033	-27.7087	29.7850	1571.19
T036	-27.7090	29.8013	1397.74
TO38	-27.6518	29.7856	1223.82

3.1.1 WEF Gridlines Footprint

The proposed power gridlines were not included in the desk-top PIA, as this information was not available. When the gridlines were considered, it was found that they would cross Vryheid Formation sandstone and Karoo dolerite. The Vryheid Formation is represented by flat terrain, often covered by wetlands. The dolerite here is represented by low, rounded hills. The gridlines will follow some existing corridors occupied by Eskom powerlines and railway lines (Figure 4).

Figure 4: View across a proposed grid line location. This is the north-south section that includes the railway (location NWF2, on section NO1 to NO2, in Figure 2).

SECTION 1: NO2 – NWF2 – NWF2A - NO1 (Figure 2)

This section follows the main Newcastle Railway Line. The rock is very weathered and mostly flat and covered with wetlands. In order to traverse these wetlands, the railway line has been elevated on rock embankments (Figure 5). This rock has been sourced both locally and from elsewhere. At the extreme north of this traverse the scenery changes to flat terrain separating low, rounded dolerite hills (Figure 5).

Figure 5: Image showing the railway line embankment, Eskom electricity powerlines and the low-rounded hills to the north.

SECTION 2: NO1- NO5 – NO3 (Figure 2)

Section 2 comprises mostly low, rounded hills and wetlands, similar to Section 1. At location NO5A the rock comprises very poorly sorted-to-pebbly sandstone (Figure 5). This is very weathered, but may contain *skolithos* trace fossils.

Figure 7: Wetland at locality NWF5A. Outcrop is sparse in this region and this image was near the proposed grid line.

Figure 8: Close up of the rock outcropping in the lake at locality NWF5A. This rock is very poorly sorted, coarse-grained and cross bedded.

Figure 9: Eastward view across to the plateau. Image captured at NO5 (Figure 2).

SECTION 3: NO5 – NO3 – NO9 (Figure 2)

This was very similar to Section 3.

SECTION 4: NO5 – NWF$A – NO4 (Figure 2)

This geology was as before. The route paralleled the plateau to the west (Figure 10).

Figure 10: The flat terrain can be observed, with the plateau to the west.

SECTION 5: NO4- NWF8A – NO9 (Figure 2)

Topography was similar to before. However, Volksrust Formation was observed at point NWF8A, to the south of the proposed WEF. This rock was very weathered, however evidence of slumping on a metre-scale was observed (Figure 11).

Figure 11: Example of the Volksrust Formation. Image captured at NWF8A (Figure 2). This lithology is typically a black or blue shale, but can be brown, as in this case, when weathered. The rock shows evidence of slumping, probably indicating a deltaic origin.

3.1.2 Rocks underlain by the Proposed Turbine Farm

3.1.2.1 WEF Phase 1

Most of the proposed WEF Phase-1 is to be developed on dolerite (Figure 3). The relative competency of this rock and the forces of erosion have carved this dolerite sill into a prominent plateau (Figure 10).

3.1.2.2 WEF Phase 2

WEF Phase 2 is proposed to be erected on the southern portion of the same plateau as WEF Phase -1 (Figure 4). According to the information contained within the Frankfort 2728 1:250 000 Geological Map, the southern part of the plateau, on which the proposed WEF Phase 2 is to be constructed, would be on Normandien Formation (Adelaide Subgroup: green) and Tarkastad Subgroup (light green) rocks (Figure 12).

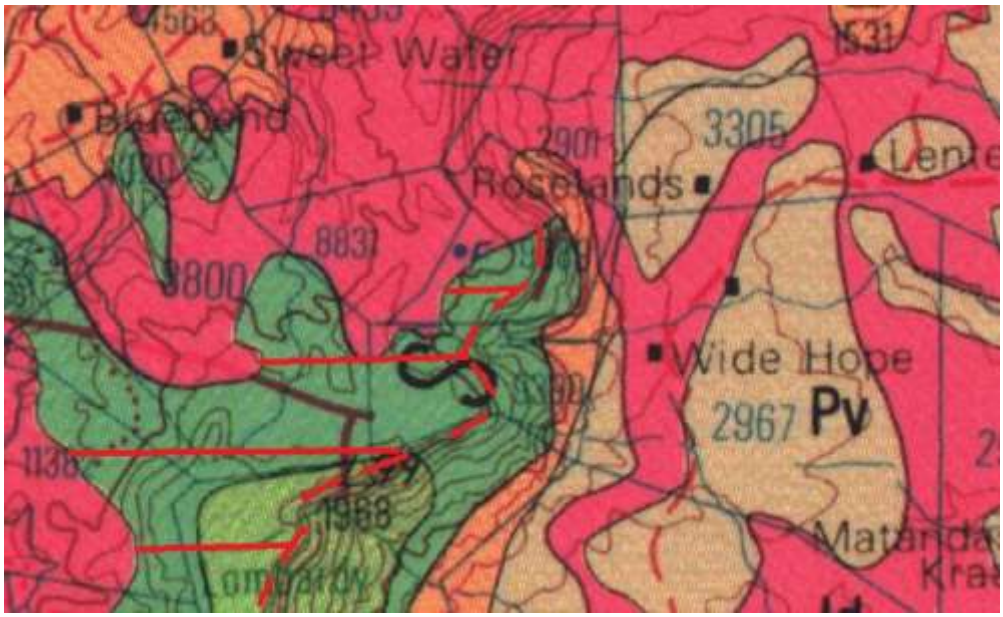

Figure 12: This extract from the Frankfort (2728) 125 000 geological map shows the actual situation. The red hashed region between the dolerite red (top, right centre) and the red dashed SW-NE line (bottom centre) is dolerite. The dashed line follows the top of a prominent dolerite cliff line (see figure .).

Road access to the proposed WEF Phase-2 site proved somewhat difficult. A field traverse from Wide Hope (Hunter Place on Figure 2) up the eastern slope of the plateau onto the southern section of the proposed wind turbine farm showed that the Frankfort Geological map is incorrect. The geology is comprised of dolerite (red: Figure 12) all the way to the red-dotted line (which marks the escarpment edge). Thus a possible problematic palaeontological section (see Palaeontology) identified from the SAHRIS Palaeosensitivity map, which is informed by the geological map, at the southern section is resolved.

Figure 13: View NW from location NO9 (Figure 2). The prominent upper cliff (top left of image) is the edge of a dolerite sill that forms the plateau on which the proposed WEF will be located. The slope leading up to the basalt plateau shows a lower cliff (right of image) which is Tarkastad Subgroup sandstone; below this is Normandien Formation (Adelaide Subgroup) marked by the grass slope. The wooded valley is underlain by Volksrust Formation sandstone.

The plateau surface varies from relatively flat to gently undulating (Figures 14 & 15).

Figure 14: Typical dolerite plateau topography. This image was captured in the location of proposed Wind Turbine 021 in the proposed WEF Phase-2 locality. This area is classified code red in the palaeosensitivity map due to the error in the Frankfort (2728) geological map. It should be classified grey, as it is of no palaeontological significance (Figure 16).

Figure 15: Surface of the dolerite sill (the sill that creates the plateau on which the proposed WEF would be erected) showing loose dolerite boulders. Image captured near the view shown in Figure 14.

3.2 SUMMARY OF GEOLOGY

3.2.1 Major Lithologies

3.2.1.1 Karoo Dolerite

This dolerite sill was intruded 184 million years (Ma) ago and represents the onset of the break-up of the Gondwana Supercontinent (Hastie et al (2014). According to Watkeys (2006), Gondwana rifting commenced between 155 and 135 million year ago (Ma).

3.2.1.2 Vryheid Formation

The Permian aged Vryheid Formation (Kungurian Stage ¬ 260Ma: Green and Smith, 2012) comprises predominantly coarse-grained sandstone and siltstones, interbedded by dark shales and coal beds. The Formation is interpreted as "near-shore sandbars" and deltaic deposits that prograded into the ancient Karoo Sea. The latter was located within central part of the Gondwana supercontinent (Johnson et al, 2009).

3.2.2 Subordinate Lithologies

These lithologies occur on the southeasterly slope below the dolerite plateau. At present there is no plan to erect turbines on this slope. Consequently, although these lithologies occur on the WEF Footprint, they are not "in play".

3.2.2.1 Volksrust Formation

The Volksrust Formation is Late Permian in age (Cairncross et al. 2005), typically, it comprises blue-black shale (Figure 4). This unit was deposited in generally non-marine conditions (Cataneneau et al., 1998), but pockets of marine conditions were present (Cairncross et al., 2005).

3.2.2.2 Normandien Formation (Adelaide Subgroup)

This occurs on the southeastern plateau slope. 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).

The Lower Beaufort Group is represented here by the Adelaide Subgroup (SACS, 1980). In Kwazulu-Natal the Adelaide Subgroup is represented by the *Permian Estcourt Formation*, which forms flat terrain, in the middle, by the *Belmont Formation*, and the upper by the *Otterburn Formation* (Green, 1998). This subdivision is not represented on the Frankfort 1: 250 000 geological map (Figure 3). These rocks formed from sediments originally deposited within a fluvial-floodplain, constructed by meandering rivers in a semi-arid climate, flowing into a large inland sea (Karoo Sea). In the rock record, lacustrine environments alternate with fluvial environments, indicating a series of transgressive-regressive lacustrine episodes (Green, 1998).

3.2.2.3 Tarkastad Subgroup

The Tarkastad Subgroup is Triassic in age (252 to 201 Ma or million years) and is characterized by alternating sandstones (which crop out as cliffs) and mudstones (often red in colour). These are often arranged in fining-upward units (coarse-grained sandstone at the base and mudstones above). The original sediments were deposited by fluvial processes within an arid landscape. In this area, river flow was generally north to south. Fossils would be expected to be within the floodplain mudstones, rather than the river channels, where preservation is unlikely.

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4. PALAEONTOLOGY

4.1 WEF Phase-1

The WEF Phase-2 area is grey with scattered yellow patches. Grey requires no palaeontological work. The yellow patches are discussed in Section: 4.3).

4.2 WEF Phase-2

The palaeosensitivity of this area, as shown in the SAHRIS Palaeosensitivity map, is provided in Figure 16. It is mostly grey (in this case, corresponding to dolerite), which is not fossiliferous. However, the southern portion is coded red and triggered a Field Assessment. Fieldwork has shown that the dolerite plateau extends beyond the Wind Farm (Figure 16). In **practice the entire proposed WEF area is located on a dolerite plateau (Figure 12).**

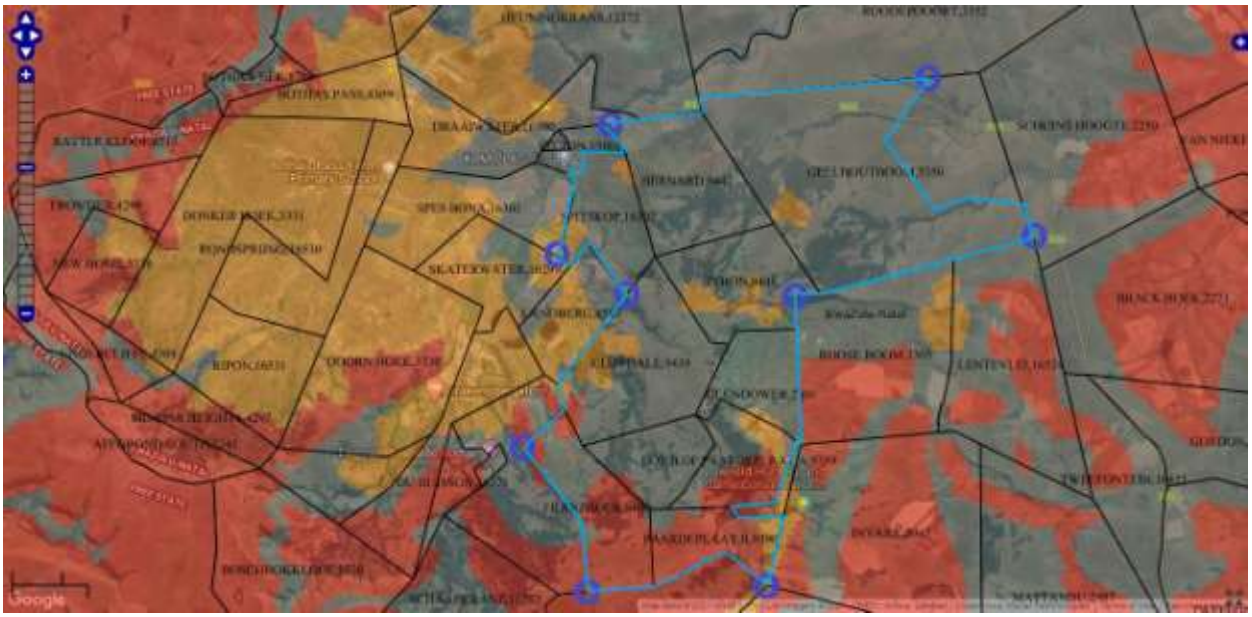

Figure 16: Palaeosensitivity of rocks in the Mulilo Newcastle WEF footprint (blue outline). Most of the area is dolerite (grey) and this includes the red patch at the southern end of the proposed WEF site (see section 3: Geology). The yellow patches are Volksrust Formation which is of lesser palaeontological significance.

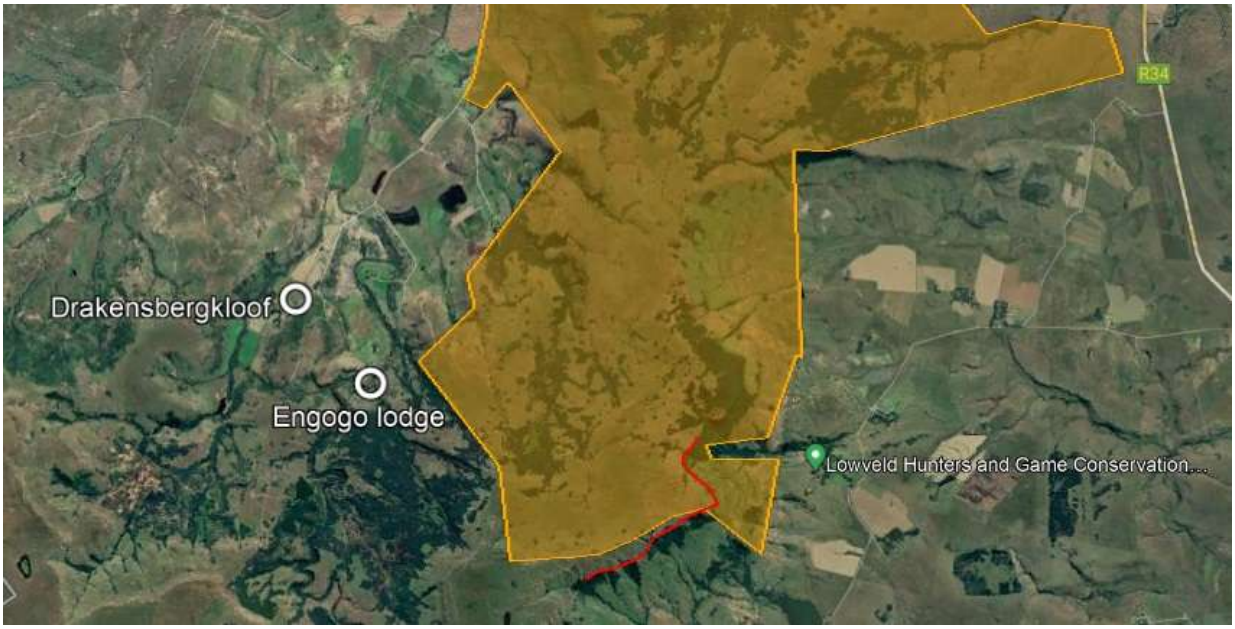

Figure 15: The red line marks the southern boundary of the Dolerite Plateau. No wind turbines are proposed to be erected southeast of the Dolerite Plateau boundary as this is a steep slope and access is difficult.

4.1.2 The Vryheid Formation

The SAHRIS Palaeosensitivity Map considers the Vryheid Formation as a **Very High Palaeosensitivity Zone**. In practice, no vertebrate fossils have been recorded from the Vryheid Formation in this area, however invertebrate trace fossils are common (Tavener Smith, 1983; Mason and Christie, 1985; Hastie et al., 2019). The aquatic reptile, *Mesosaurus* (earliest known reptile from the Karoo Basin), as well as the fish, *Palaeoniscus capensis*, have been recorded in the Whitehill Formation in the southern part of the Main Karoo basin (MacRae, 1999), in which the sediments which became lithified to become the Vryheid Formation, are believed to have been deposited. The Whitehill Formation (500 km to the southwest), within the Main Karoo Basin, *may* be a correlative of the Vryheid Formation, however they are not physically connected. Further, recent research has shown that the lower part of the Vryheid Formation in this area has a different source (Maurice Ewing Bank) to the rest of the Vryheid Formation (Hastie et al., 2019).

Coal seams are known from the Vryheid Formation in this region (Tavener Smith, 1982; Hastie et al., 2019), however at this stratigraphic level they are unlikely and if encountered will be very thin. Coal comprises compressed plant material and thus constitutes a fossil. Plants such as *glossopteris*, *gangamopteris* and *sigillaria* can be recognized, but these are common. Thin beds containing fossil woods are possible. Trace fossils are to be expected, but these are not significant.

4.3 Minor Palaeontological Implications

The area covered by high sensitivity lithologies has been significantly reduced. Minor pockets of the following lithologies, considered highly sensitive by the SAHRIS Palaeosensitivity Map may be encountered:

- **Volksrust Formation**
- **Normandien Formation (Adelaide Subgroup)**
- **Tarkastad Subgroup**

These lithologies will occur on steep slopes and in depressions, areas where wind turbines are unlikely to be located. Outcrop of these lithologies was scarce. The palaeontology of these lithologies has been adequately dealt with in the Desk-Top study (Appendix 3).

5. PALAEONTOLOGICAL IMPACT ASSESSMENT

TABLE 2: IMPACT ASSEMENT

PROJECT	PHASE 1	PHASE 2	GRIDLINES
POTENTIAL ISSUE	palaeo material loss	palaeo material loss	palaeo material loss
ALT	none	none	none
IMPACT	zero-low	zero-low	low-moderate
NATURE	neutral	neutral	negative
TYPE	direct	direct	direct
CONSEQUENCE	zero-low	zero-low	low-mod
EXTENT	phase 1	phase 2	Gridlines
DURATION	permanent	permanent	permanent
PROBABILITY	definite	definite	definite
REVERSABILITY	irreversible	irreversible	irreversibile
IRRIPLACEABLE LOSS	zero-low	zero-low	low-mod
MITIGATION POTENTIAL	chance find protocol	chance find protocol	chance find protocol
SIGNIFICANCE WITHOUT MITTIGATION	zero-low	zero-low	low-moderate
MITIGATION MEASURES	chance find protocol	chance find protocol	chance find protocol
SIGNIFICANCE WITH MITTIGATION	zero-low	zero-low	low-moderate

6. SUMMARY AND CONCLUSIONS

This site is dominated by Karoo Dolerite, which is an intrusive igneous rock and not fossiliferous. However the remaining lithologies may be fossiliferous. The areas underlain by significant fossiliferous lithologies are restricted to deep depressions and steep slopes, areas where turbine construction is very unlikely. These lithologies are adequately catered for by the "Chance find protocol" (see Appendix 2). The gridlines will cross Vryheid Formation. Although this is considered sensitive by the SAHRIS Palaeosensitivity Map, in practice no significant palaeontological material has been encountered. The gridlines follow existing industrial corridors (railway and Eskom powerline routes). For this reason it is the recommendation of this Field Report that no further palaeontological work needs to be undertaken, unless the "Chance Find Protocol" is triggered.

On a separate note, road access to the site was extremely difficult. It is presumed that a road may need to be constructed from the northern side in order to gain access to the site for the transport and assembly of heavy wind turbine equipment. A palaeontological investigation may need to be undertaken, depending on the route selected,

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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 Field Investigation PIA: Newcastle Pase 1 and 2 Wind Farms

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: DESK-TOP PALAEONTOLOGICAL REPORT:

PROPOSED MULILO NEWCASTLE (Pty) Ltd WIND POWER 1 AND 2 WIND FARMS BETWEEN NEWCASTLE AND MEMEL IN KWAZULU-NATAL

FOR

UMLANDO: Archaeological Surveys & Heritage Management
PO Box 102532, Meerensee, KwaZulu-Natal 3901
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by

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Telephone: 031 208 6896
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12 December, 2021

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

Mulilo Newcastle (Pty) Ltd proposes to construct a Wind Farm between Newcastle and Memel, within KwaZulu-Natal.

This proposed Wind Farm Footprint is underlain by rocks of the Karoo Supergroup. This contains the following lithologies:

- Karoo Dolerite
- Volksrust Formation
- Adelaide Subgroup
- Tarkastad Subgroup
- Alluvium

The Karoo Dolerite is the commonest lithology, but is not fossiliferous. Alluvium is also unlikely to be so. The Volksrust Formation could be fossiliferous, but is also unlikely as significant fossils are rare. In contrast, the Adelaide and Tarkastad Subgroups could contain significant fossil material. For this reason it is the recommendation of this report that a Palaeontological Field Assessment by a competent palaeontologist be undertaken.

1. PROPOSED PROJECT

Mulilo Newcastle (Pty) Ltd proposes to construct a Wind Farm in KwaZulu-Natal between Newcastle and Memel (Figures 1 & 2).

Figure 1: Location of the proposed Mulilo Newcastle (Pty) Ltd WEF. Source map GoogleEarth.

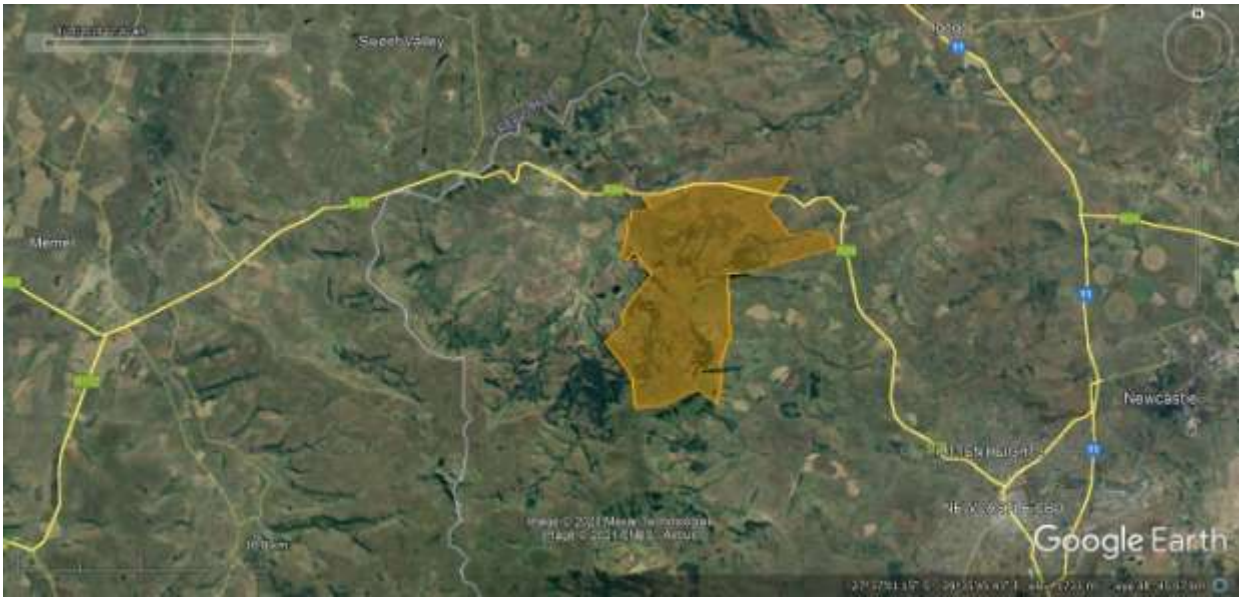

Figure 2: Zoomed in location of WEF. Source GoogleEarth.

The footprint will cover the following farms:

25. Portion 1 of the Farm Geelhoutboom No. 3350
26. Remainder Farm Bernard No. 9447
27. Remainder Farm Cliffdale No. 9439

28. Remainder Farm Spitskop No. 16302
29. Remainder Farm Byron No. 9448
30. Remainder Farm Geelhoutboom No. 3350
31. Remainder Farm Embosweni No. 17421
32. Remainder Farm Paardeplaat A Dene Heights
33. Remainder Farm Paardeplaat B No. 9390
34. Remainder Portion 1 of the Farm Franzhoek No. 8800
35. Remainder Farm Glendower No. 2901
36. Remainder Farm Lot B of Paardeplaat A No. 9389

2. GEOLOGY

The proposed project footprint site is located on Karoo Supergroup rocks (Figure 3). Anticipated rock units are as follows:

5 Dolerite (red)
6 Volksrust Formation (orange)
7 Adelaide Subgroup (Green)
8 Tarkastad Subgroup (Light green)
9 Alluvium (yellow) may be present

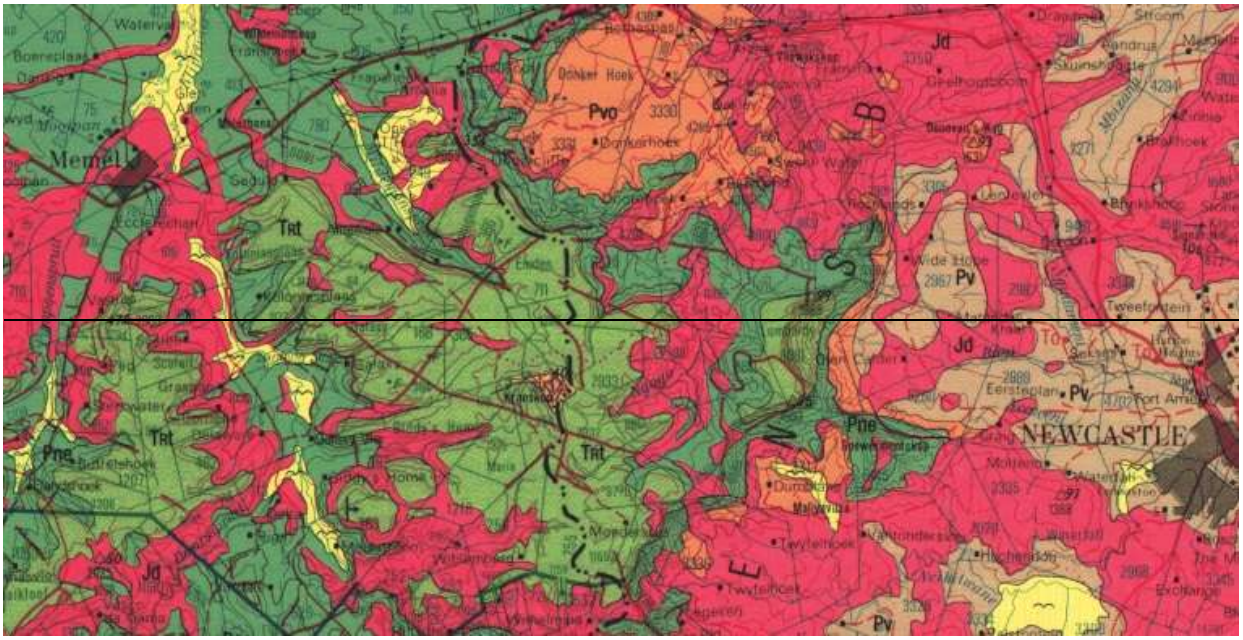

Figure 3: Extract from the Frankfort 2728 1:250 000 Geological Ma. This shows the lithologies that will be encountered. Dark Green (Pa) is described as Adelaide Subgroup, Light Green (Tkt) is Tarkastad Subgroup and Red (Jd) is Karoo Dolerite.

6. Karoo Dolerite

Dolerite intrusions may be present. These are 184 million years (Ma) old and represent the onset of the break-up of the Gondwana Supercontinent (Hastie et al (2014). According to Watkeys (2006), Gondwana rifting commenced between 155 and 135 Ma.

7. Volksrust Formation

The Volksrust Formation is Late Permian in age (Cairncross et al. 2005). Typically, it comprises a blue-black shale (Figure 4). This unit was deposited in generally non-marine conditions (Cataneneau et al., 1998), but pockets of marine conditions were present (Cairncross et al., 2005). Quaternary sediments comprise alluvium (river deposits) and colluvium (hill slope deposits).

Figure 4: Example of the Volksrust Formation. This lithology is typically a blue shale and very weathered.

8. Adelaide Subgroup

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).

The Lower Beaufort Group is represented here by the Adelaide Subgroup (SACS, 1980). In Kwazulu-Natal the Adelaide Subgroup is represented by the Permian Estcourt Formation, which forms flat terrain, in the middle, by the Belmont Formation, and the upper by the Otterburn Formation (Green, 1998). This subdivision is not represented on the Frankfort 1: 250 000 geological map (Figure 3). These rocks formed from sediments originally deposited within a fluvial-floodplain constructed by meandering rivers in a semi-arid climate (Figure5), flowing into a large inland sea (Karoo Sea). Lacustrine environments alternate with fluvial environments indicating a series of transgressive-regressive lacustrine episodes (Green, 1998).

Figure 5: Example of what a channel cutting down into red shales of the Adelaide Sub-Group would look like (image near Bergville).

9. Tarkastad Subgroup

The Tarkastad Subgroup is Triassic in age (252 to 201 Ma or million years) and is characterized characterized by alternating sandstones (which crop out as cliffs) and mudstones (often red in colour). These are often arranged in fining-upward units (coarse-grained sandstone at the base and mudstones above. The original sediments were deposited by fluvial processes within an arid landscape. In this area, river flow was generally north to south. Fossils would be expected to be within the floodplain mudstones, rather than the river channels where preservation is unlikely.

10. Alluvium

This is modern sands and muds deposited along a water course.

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3. PALAEONTOLOGY

The palaeosensitivity of this area is shown in Figure 6. It is mostly grey, which is not fossiliferous, but also contains colour codes of red and yellow. According to Sahris, a Field Assessment is essential for the red shaded areas, and possibly for the yellow.

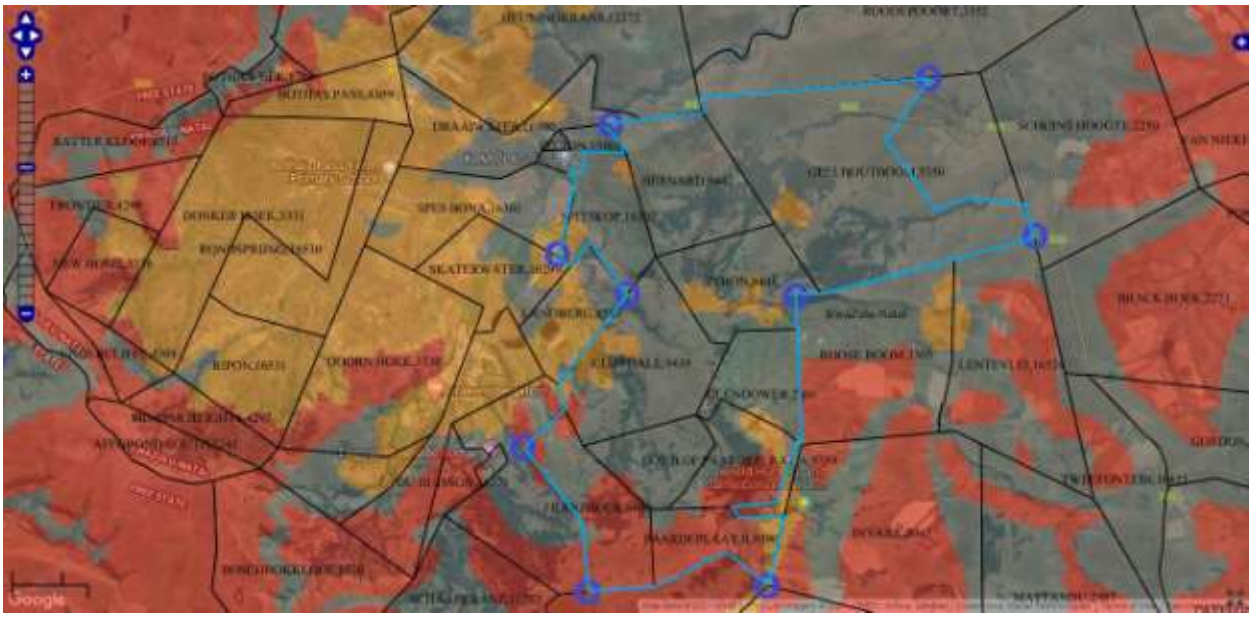

Figure 6: Palaeosensitivity of rocks in the Mulilo Newcastle WEF footprint (blue outline). Most of the area is dolerite (grey) and of no concern however the thickness of the dolerite is unknown.

The Volksrust Formation

Evidence of trace fossil bioturbation is common within the Volksrust Formation siltstones and mudstones, however the various trace fossil (ichnofossil) types are not always identifiable. These are common and of little Palaeontological Significance.

The bivalve *Megadesmus* has been recoded from the Volksrust Formation (Cairncross et al., 2005). This fossil is large, 9 cm dorsally and 8.4 cm laterally (Figure 7). *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).

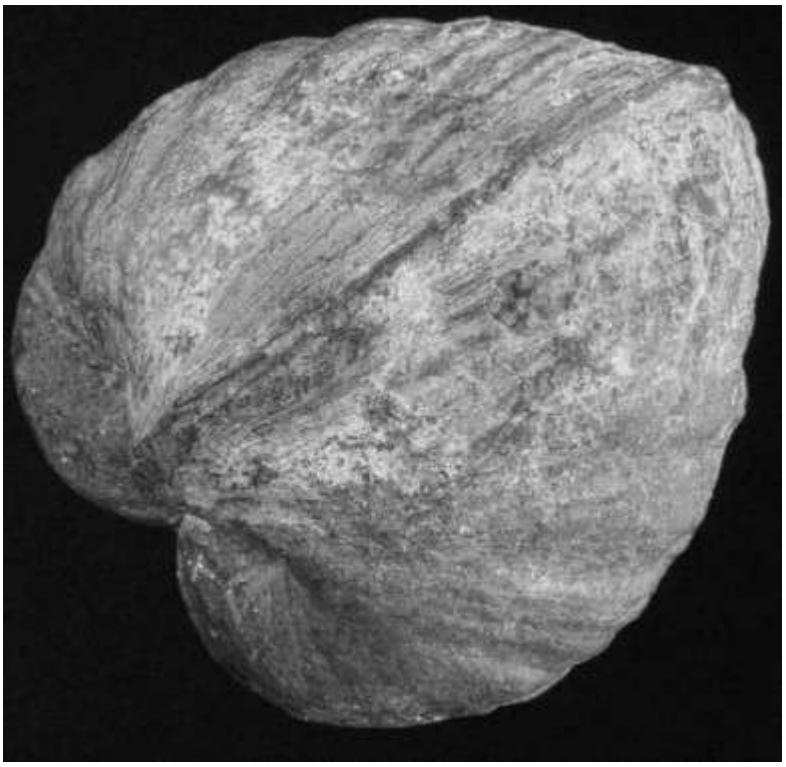

Fig. 7: Megadesmus bivalve. This image was obtained from Cairncross et al. (2005).

Adelaide Subgroup

The Adelaide Subgroup may contain Permo-Triassic Boundary, if it has been preserved. The Upper Permian is separated from the Triassic by the Permo-Triassic Extension (PT Boundary), the greatest of the Phanerozoic (541Ma to present) Extinction Events. This occurrence is also known as the Great Dying, a time in Earth's history when 95% of all life on Earth became extinct. The reasons for this are still controversial. There have been five great extinction events in the Phanerozoic Era, but the Permo-Triassic Boundary

represents the greatest extinction event in the Earth's history. If this is present it will be fundamental in palaeontological importance.

The P/T Boundary is expected to be found within marine sediments where a complete time deposition record may accumulate. In contrast, the Adelaide Subgroup comprises terrestrial sediments as sedimentary rocks. Preservation requires a large number of geological processes to come together, but these are less likely to take place during terrestrial deposition. Consequently the placement of the Permo-Triassic Boundary is not accurately known, if it has in fact been preserved in southern Africa. Present evidence indicates that the Permo-Triassic Boundary is unlikely to be located in the development area but must be considered.

Evidence of bioturbation is ubiquitous within the Adelaide Subgroup siltstones and mudstones, however the various trace fossil (ichnofossil) types are not always identifiable. Trace fossils are very common within the Beaufort Group (Figures 8 & 9). These have limited **Palaeontological** value.

Figure 8: Examples of trace fossils found near Bergville, similar examples could be found on the Mulilo Newcastle WEF 1 and 2 sites. This trace fossil could be *Arenicolites*.

Figure 9: Trace fossils of unknown species, possibly a shrimp that could be found in these rocks..

The Adelaide Subgroup is known internationally for its fossils (Cisneros et al., 2008). It contains plant- and animal- fossils. The latter include a wide variety of body fossils, including the mammal-like reptiles such as the Upper Permian- Dicynodon (Figure 10) and the Triassic- aged Lystrosaurus (Neveling et al., 2005) and trace fossils (Green, 1997).

Figure 10: Dicynadon reproduction (Wikepedia).

Tarkastad Subgroup

The Tarkastad Subgroup is an important fossil bearing rock (Neveling et al., 2006). It is considered highly palaeontologically sensitive as it may record the post PT Boundary record. can be recorded within this based on the important post-extinction (PT Event) continental biotas of Early Triassic age recorded from this unit in the Main Karoo Basin (SAHRIS website). This level is known to contain palaeontologically important Early Triassic terrestrial fossils from the period around 252 million years old, or post PT Boundary (Groenewald & Kitching 1995, Rubidge 2005, Smith et al. 2012). This fauna is dominated by therapsids or "mammal-like reptiles" and other tetrapods. Rare vascular plants and some trace fossils are known. The uppermost two biozones of the Beaufort Group, the *Lystrosaurus* and *Cynognathus* assemblage zones, record terrestrial biotic recovery following the Permo-Triassic mass extinction event (Neveling et al 2006).

Karoo Dolerite

Karoo Dolerite is also present. This is an igneous intrusive rock and by definition cannot be fossiliferous.

Alluvium

Reworked palaeontological Material could be found in the Quaternary alluvium sediments, but is unlikely.

4. SUMMARY AND CONCLUSIONS

This site is dominated by Karoo Dolerite which is not fossiliferous. Similarly any alluvium can also be ignored. However the remaining lithologies may be fossiliferous. The Volksrust Formation could be fossiliferous, but is also unlikely to be so as significant fossils are rare. In contrast, the Adelaide and Tarkastad Subgroups might contain significant fossil material. For this reason it is the recommendation of this report that a Palaeontological Field Assessment by a competent palaeontologist be undertaken.

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7. DETAILS OF SPECIALIST

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&

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.