HERITAGE IMPACT ASSESSMENT

In terms of Section 38(8) of the NHRA for the

Proposed establishment of 132kV Overhead Powerline (OHL) and 33/132kV Substation to evacuate power from the Karreebosch Wind Energy Facility (WEF) to the National Grid in the Western and Northern Cape

SAHRIS Ref:

HWC Ref:

Prepared by CTS Heritage

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For

WSP

July 2022

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EXECUTIVE SUMMARY

1. Project Name:

The proposed Karreebosch 132kV OHPL and onsite 33/132kV substation associated with the authorised Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3).

2. Location:

The proposed 132kV Karreebosch OHPL, 33/132kV substation and associated infrastructure is located 35km north of Matjiesfontein, and extends across two provinces, namely the Northern and Western Cape Provinces. The proposed Karreebosch OHPL will extend from the proposed Karreebosch onsite 33/132kV substation, which is situated in Ward 3 of the Karoo Hoogland Local Municipality in the Namakwa District Municipality in the Northern Cape into Ward 2 of the Laingsburg Local Municipality in the Central Karoo District Municipality in the Western Cape Province, where it will connect to the existing 400kV Komsberg substation via the existing Bon Espirange substation.

3. Locality Plan:

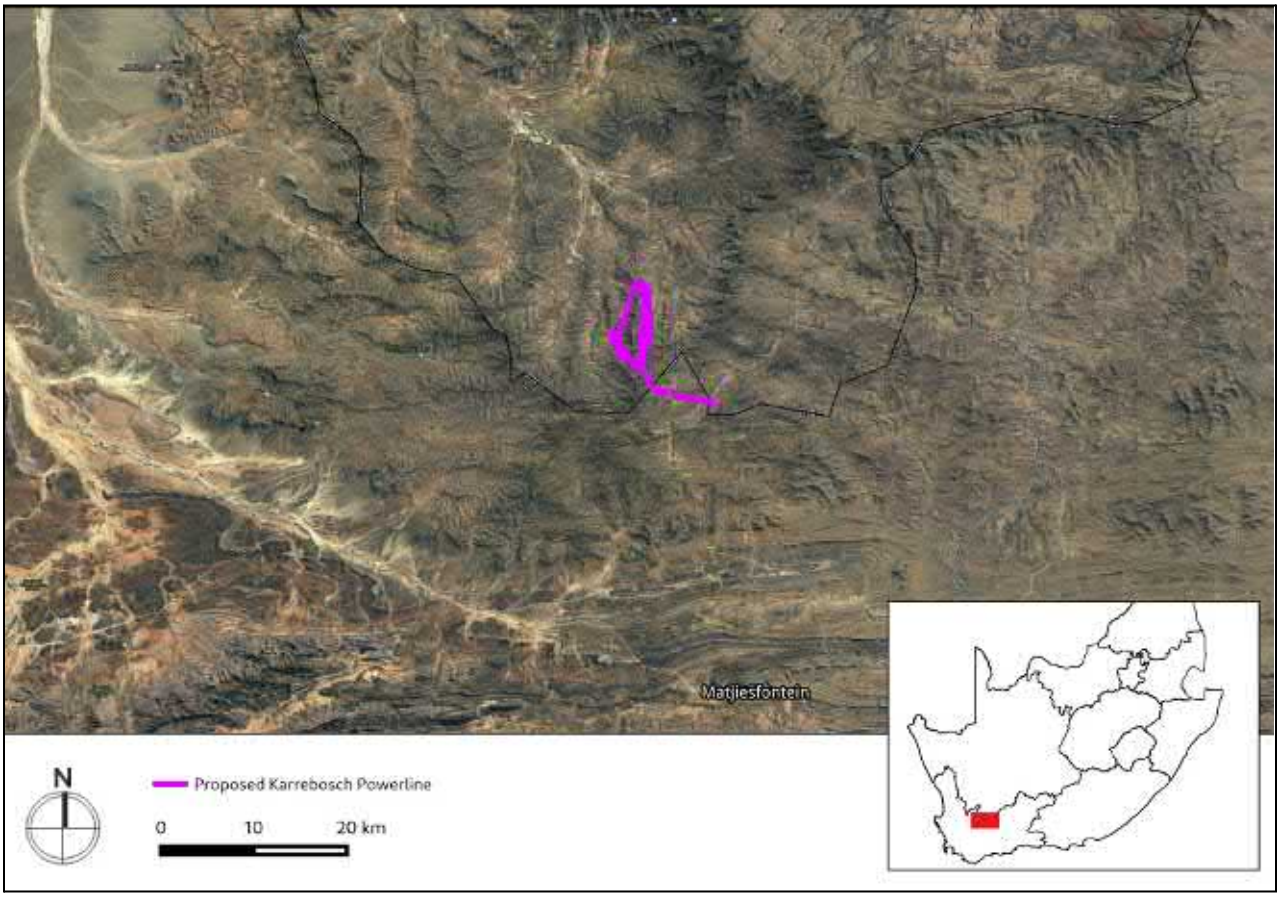

Figure A: Location of the proposed study area

4. Description of Proposed Development:

This application is for the proposed development of a 132kV twin tern double circuit OHL, 33/132 kV substation and associated infrastructure which will evacuate power from the authorised Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3, which is currently undergoing subject of a Part 2 EA amendment, final layout and EMPr approval process) and connect to the existing 400kV Komsberg substation via the existing Bon Espirange substation.. The powerline is approximately 20 km long.

5. Heritage Resources Identified in the broader study area:

POINT ID	Site Name	Description	Co-ordinates		Grading	Mitigation
Archaeology						
KRB017	Karrebosch 017	Quartzite flakes, thinly struck, prep. Platforms, MSA. Near valley floor; cores and flakes, knapping and production site	-32.85936	20.47184	NCW	NA
KRB018	Karrebosch 018	Chert flake, LSA. On top of ridge.	-32.84809	20.44152	NCW	NA
KRB019	Karrebosch 019	Quartzite flake, MSA	-32.84897	20.44073	NCW	NA
KRB020	Karrebosch 020	Quartzite flake, MSA	-32.86418	20.43635	NCW	NA
KRB021	Karrebosch 021	Chert and quartz flakes, lower grindstone near wind pump, LSA	-32.90585	20.44082	NCW	NA
KRB022	**Karrebosch 022**	**Chert flake, LSA**	**-32.88297**	**20.517862**	**NCW**	**NA**
Palaeontology						
PAL_KRB 001	Palaeo Karreebosch 001	Extensive exposure of SSE-dipping sandstone bed top with sets of small-scale wave ripples and meandering epichnial invertebrate burrows that were probably generated on the margins of a shallow floodplain pond or playa lake. Sharply overlying grey-green mudrocks show numerous ball-and-pillow load structures	32°52'37.22"S	20°29'19.68"E	IIIC	None
PAL_KRB 002	**Palaeo Karreebosch 002**	**Small (c. 6 cm wide), angular block of pale grey phosphatic concretion containing comminuted vertebrate bone and perhaps bony spines or teeth (pearly grey to black). Possibly of bony fish or – more likely - amphibian (i.e. temnospondyl) affinity. Block in surface float along shallow drainage line running along top of well-exposed grey-green mudrock package.**	**32°52'37.45"S**	**20°29'22.32"E**	**IIIB**	**Collection under workplan application of Option 1B is developed**
PAL_KRB 003	**Palaeo Karreebosch 003**	**Probably part of the same fossiliferous concretion**	**32°52'37.61"S**	**20°29'21.97"E**	**IIIB**	**Collection under workplan application of Option 1B is developed**

POINT ID	Site Name	Description	Co-ordinates		Grading	Mitigation
PAL_KRB 004	**Palaeo Karreebosch 004**	**As above (2 blocks). Probably part of the same fossiliferous concretion.**	**32°52'36.97"S**	**20°29'23.42"E**	**IIIB**	**Collection under workplan application of Option 1B is developed**
PAL_KRB 005	Palaeo Karreebosch 005	Hillslope exposure of steeply dipping, SE-facing current-rippled bed top with sparse epichnial invertebrate burrows up to c. 2 cm wide, subhorizontal with central convex core (possibly segmented) and shallow marginal grooves	32°52'39.07"S	20°29'29.12"E	IIIC	None
PAL_KRB 006	Palaeo Karreebosch 006	Dense mat of reworked reedy sphenophyte stems (horsetail ferns) preserved as compressions within dark grey siltstones, shallow stream bed exposure.	32°52'31.51"S	20°29'23.81"E	IIIC	None
PAL_KRB 007	**Palaeo Karreebosch 007**	**Stream bed and bank exposure of grey-green mudrocks of Abrahamskraal Fm with horizon containing several subcylindrical, vertical lungfish burrow casts up to 9 cm in diameter**	**32°54'53.65"S**	**20°30'56.37"E**	**IIIB**	**No impact anticipated**
PAL_KRB 008	Palaeo Karreebosch 008	Stream bed exposure of grey-green siltstone or fine-grained wacke covered by purple-brown siltstone veneer and with dense assemblage of rounded traces between 0.5 to 1 cm in diameter – probably reedy plant stem casts (e.g. sphenophytes)	32°54'52.93"S	20°30'58.94"E	IIIC	None
PAL_KRB 009	Palaeo Karreebosch 009	Stream gulley exposure of mottled grey-green to purple-brown sandstone with assemblage of rounded, oval to irregular sand-infilled casts with reduction haloes, either of plant stems or invertebrate burrows	32°54'41.76"S	20°31'10.35"E	IIIC	None
PAL_KRB 010	Palaeo Karreebosch 010	Sandstone bed top with possible effaced desiccation crack infills, assemblage of reedy plant stem casts.	32°55'11.03"S	20°31'54.90"E	IIIC	None

6. Anticipated Impacts on Heritage Resources:

The findings of this field assessment largely correlate with the findings of the ACO Associates in the HIA completed for the Karreebosch WEF (Kendrick, 2015, SAHRIS Ref 183350) and the Roggeveld WEF (Hart and Webley, 2013, SAHRIS Ref 152531). The archaeological resources identified were all *ex situ* and are of limited scientific and heritage significance.

Based on the findings of this and other assessments completed in the area, it is unlikely that the proposed development of all alternatives of the Karreebosch 132kV OHL, 33/132kV on site substation alternatives and associated infrastructure will negatively impact significant resources. This is due to the fact that 132kV lines typically have a very small development footprint and can be constructed without the large roads needed to build the WEFs. The routes chosen by the engineers for the various alternatives follow very rugged, mid-slope paths

where almost no archaeological material or ruins were found. No significant heritage resources were identified within the areas proposed for the substation alternatives. It is possible, although unlikely, that archaeological resources may be located beneath the ground surface which may be impacted during the course of development. Recommendations in this regard are included below.

In terms of impacts to palaeontological heritage, Almond (2021) concludes that "*There are no objections on palaeontological grounds to authorisation of the proposed 132 kV powerline and there is no preference on palaeontological heritage grounds for any particular on-site substation site or powerline route option among those currently under consideration. If powerline Option 1B is selected for construction, vertebrate fossil material at or in the vicinity of Locs. 454-456 on Rietfontein RE/197 must be collected by a professional palaeontologist before construction of the powerline. No further specialist palaeontological studies or mitigation are recommended for this electrical infrastructure project. These recommendations and the Chance Fossil Finds Protocol appended to this report should be included in the EMPr for the development.*" It is further recommended that, should Alternative 1B be developed, a walkdown of final alignment must be conducted by a palaeontologist with an approved workplan for the collection of sensitive fossil resources that are at risk. It is further recommended that the attached Chance Fossil Finds Procedure must be implemented throughout the construction phase of the development.

7. Recommendations:

There is no objection to the proposed development of the Karreebosch OHL and onsite substation in terms of impacts to heritage resources and there is no preferred alternative for the OHL route or onsite substation on condition that:

- Should OHL Alternative 1B be developed, a walkdown of final alignment must be conducted by a palaeontologist with an approved workplan for the collection of sensitive fossil resources that are at risk.
- The attached Chance Fossil Finds Procedure must be implemented throughout the construction phase of the development
- Should any buried archaeological resources or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The relevant heritage authority (the South African Heritage Resources Agency (SAHRA) in the Northern Cape and Heritage Western Cape (HWC) in the Western Cape) must be contacted immediately in order to determine an appropriate way forward.

8. Author/s and Date:

Jenna Lavin and Nic Wiltshire

July 2022

Details of Specialist who prepared the HIA

Jenna Lavin, an archaeologist with an MSc in Archaeology and Palaeoenvironments, and currently completing an MPhil in Conservation Management , heads up the heritage division of the organisation, and has a wealth of experience in the heritage management sector. Jenna's previous position as the Assistant Director for Policy, Research and Planning at Heritage Western Cape has provided her with an in-depth understanding of national and international heritage legislation. Her 8 years of experience at various heritage authorities in South Africa means that she has dealt extensively with permitting, policy formulation, compliance and heritage management at national and provincial level and has also been heavily involved in rolling out training on SAHRIS to the Provincial Heritage Resources Authorities and local authorities.

Jenna is a member of the Association of Professional Heritage Practitioners (APHP), and is also an active member of the International Committee on Monuments and Sites (ICOMOS) as well as the International Committee on Archaeological Heritage Management (ICAHM). In addition, Jenna has been a member of the Association of Southern African Professional Archaeologists (ASAPA) since 2009. Recently, Jenna has been responsible for conducting training in how to write Wikipedia articles for the Africa Centre's WikiAfrica project.

Since 2016, Jenna has drafted over 100 Heritage Impact Assessments throughout South Africa.

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CONTENTS

APPENDICES

1. INTRODUCTION

1.1 Background Information on Project

PERMITTING PROCESS

The entire extent of the proposed 132kV Karreebosch Overhead Powerline (OHPL), 33/132kV Substation and associated infrastructure is located within one (1) of the Strategic Transmission Corridors, namely the Central Corridor, as defined in and in terms of the procedures laid out in Government Notice (GN) No. 113. The proposed OHPL project will therefore be subject to a Basic Assessment (BA) Process in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority for this BA process is the national Department of Forestry, Fisheries and Environment (DFFE).

PROJECT LOCATION

The proposed 132kV Karreebosch OHPL, 33/132kV Substation and associated infrastructure is located 35km north of Matjiesfontein, and extends across two provinces, namely the Northern and Western Cape Provinces. The proposed Karreebosch OHPL will extend from the proposed Karreebosch onsite 33/132kV substation, which is situated in Ward 3 of the Karoo Hoogland Local Municipality in the Namakwa District Municipality in the Northern Cape into Ward 2 of the Laingsburg Local Municipality in the Central Karoo District Municipality in the Western Cape Province, where it will connect to the existing 400kV Komsberg substation via the existing Bon Espirange substation.

The proposed Karreebosch OHPL will evacuate power from the authorised Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3, which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process), located in the Northern Cape Province, and will connect to the existing Komsberg substation.

PROJECT INFRASTRUCTURE

OVERHEAD POWERLINE

The OHPL will be a 132kV twin tern double circuit overhead powerline. The powerline towers will either be steel lattice or monopole structures. Figure 1.1 below provides an example of a conventional lattice tower compared with a monopole structure. Pole positions will only be available once the powerline detail design has been completed by the Eskom Design Review Team (DRT). However, a 400m wide assessment corridor is being considered and has been walked down by the specialists for approval to allow for micro siting of tower positions once the detailed design has been completed. It is anticipated that towers will be located on average 200m to 250m apart; however, longer spans may be needed due to terrain and watercourse crossings.

SERVITUDE

A 400m wide OHPL corridor (200m on either side of the centre line) has been assessed by the specialists for the purposes of the Basic Assessment Report (BAR). The registered servitude will fall within this 400m wide assessment corridor and will be 31m wide (15.5 m on either side of the centre line). The Right of Way servitude (servitude road) will be up to 14m wide (7m on either side of the centre line), resulting in a total servitude width of 45m in total. The length of the longest powerline route alternative (Option 2C – see "Alternatives" section 5.3) is 20.52 km, which will result in a servitude area of up to 92.3 ha.

The servitude is required to ensure safe construction, maintenance and operation of the powerline. Registration of the servitude grants the operator the right to erect, operate and maintain the powerline and to access the land to carry out such activities, but it does not constitute full ownership of the land. It should be noted that the OHPL will be ceded to Eskom post-construction.

Construction and operation activities and access to the powerline will be carried out with due respect to the affected landowners. The servitude required for the Project will be registered at the Deeds Office and will form part of the title deed of the relevant properties once the environmental authorisation has been obtained.

SUBSTATIONS

The Karreebosch OHPL will be routed from the proposed onsite Karreebosch 33/132kV substation (associated with the approved Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3 which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process)) to the existing Bon Espirange substation, after which it will connect to the existing 400kV Komsberg substation. Two alternative 33/132kV onsite substation locations at the Karreebosch WEF site have been assessed as part of this BAR, each with a 200m x 150m (3 ha) footprint. A 200m assessment area surrounding the proposed substation alternatives have been included as part of this assessment for micro siting, with a slight funnel leading into the existing Bon Espirange and Komsberg substations to allow for greater flexibility for micro siting for incoming proposed line connections. The proposed Karreebosch OHPL may require an extension of the existing 400kV Komsberg substation, and therefore, the entire Komsberg substation property has been assessed as part of this BAR.

SITE ACCESS

The OHPL and associated infrastructure will be accessed via roads forming part of the authorised Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3) which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process), where possible. The preferred OHPL routing will require an associated servitude road (following beneath the proposed OHPL) to be constructed which will be used to construct, operate and maintain

the powerline. Existing roads will be used as much as possible, where feasible. However, additional access roads may be required to provide access to sections of the powerline route.

New sections of access roads will deviate off existing roads (within the 400m wide assessment corridor), as needed to access tower positions. Access roads will be mostly two-track gravel roads up to 14m in width following beneath the OHPL in order to access tower structures for construction and maintenance purposes.

ALTERNATIVES

Only one (1) OHPL route is technically feasible for the section of the proposed powerline directly preceding the existing Bon Espirange Substation and for the section connecting the Bon Espirange substation to the Komsberg substation (Bon Espirange to Komsberg Route), which is approximately 9.2 km in length. ***No alternatives can therefore be provided for these two sections of the OHPL (Route 3 and Bon Espirange to Komsberg Route).***

Six (6) OHPL route alternatives (Options 1A, 1B, 1C, 2A, 2B and 2C) are proposed between the Karreebosch WEF onsite 33/132kV substation (with substation alternatives: Option 1 and Option 2) and Route 3 preceding the existing Bon Espirange Substation. As noted above, all of the six OHPL route alternatives follow the same routing from their point of convergence on Remainder of farm Ek Kraal No.199, approximately 3.1 km before the Bon Espirange Substation, to the Komsberg Substation situated on Portion 2 of Farm Standvastigheid No. 210.

These alternatives, as depicted in the figures included in this report are described below:

- **OHPL Route Option 1:** Three (3) OHPL route alternatives are being considered for the link between Substation Option 1 and the Bon Espirange Substation and Komsberg Substation:
    - Option 1A (approximately 14.51 km in length in its entirety from Substation Option 1 to the Komsberg Substation);
    - Option 1B (approximately 17.28 km in length in its entirety from Substation Option 1 to the Komsberg Substation); and
    - Option 1C (approximately 13.91 km in length in its entirety from Substation Option 1 to the Komsberg Substation).
- **OHPL Route Option 2:** Three (3) powerline corridor route alternatives were considered for the link between Substation Option 2 and the Bon Espirange Substation and Komsberg Substation:
    - Option 2A (approximately 20.47 km in length in its entirety from Substation Option 1 to the Komsberg Substation);
    - Option 2B (approximately 16.63 km in length in its entirety from Substation Option 1 to the Komsberg Substation); and

- Option 2C (approximately 20.52 km in length in its entirety from Substation Option 1 to the Komsberg Substation).

Alternatives 1A-C feed out of Substation Option 1 proposed in the south-central portion of the Farm Klipbanksfontein 198/1. Alternatives 2A-C feed out of Substation Option 2 proposed in the south-eastern corner of Wilgebosch Rivier 188/RE.

1.2 Description of Property and Affected Environment

The proposed routes for the Karreebosch powerline connect up to the Komsberg substation in the east and traverse through sections of the now operational Roggeveld WEF before following one of two valleys that run in a north to south direction that are separated by a prominent ridge containing a number of proposed turbines for the Karreebosch WEF. Ek Kraal farm lies in much of the eastern valley and Klipbanks Fontein lies in the western valley in a more rugged area than Ek Kraal. Only very short sections of the OHL alternative route alignments cross the valley floor and tend to follow the slopes of the ridges that dominate the area. Ek Kraal has small-scale farming activities with very small patches of ground dedicated to crop agriculture along the Tankwarivier in addition to providing grazing for sheep. The valley on the western route over Klipbanks Fontein is largely vacant as most of the primary farming occurs in the next valley further west where water supplies are more predictable. Water was running in most of the rivers and streams at the time of the survey (August 2021), but the previous extended drought brought almost all farming activities in the area to the point of closure. A number of abandoned farmhouses and ruins have been documented in the area from previous surveys which confirms the rather precarious state that these farms are in due to the environment.

The region is regarded as semi-arid as it receives limited precipitation. It is located on the border of the summer and winter rainfall regions. Precipitation is in the form of snow and rain in winter, with occasional thunderstorms during the summer. The vegetation cover falls within the Roggeveld Shale Renosterveld of the Karoo Renosterveld Bioregion and consists predominantly of low shrubs and very few trees in this area.

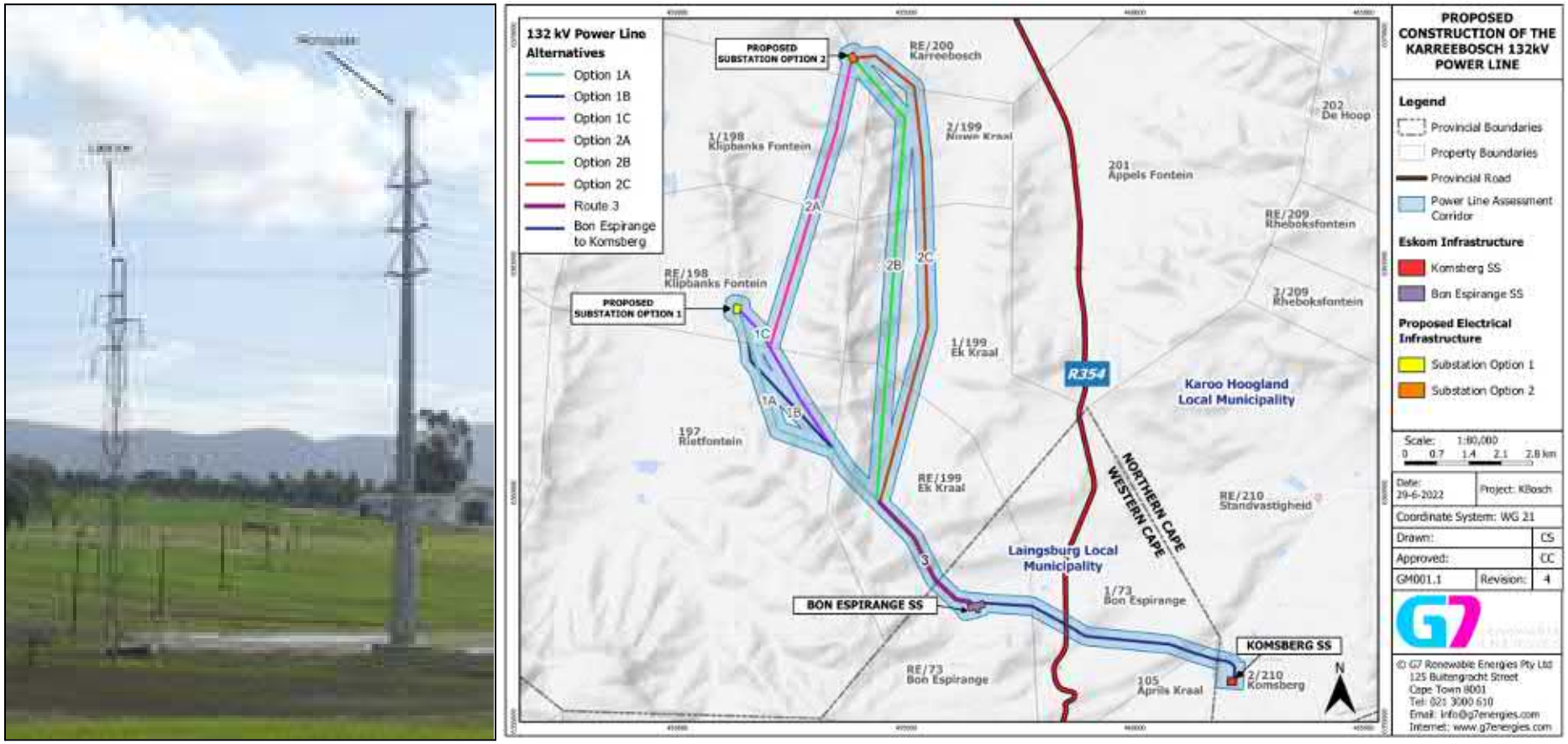

Figure 1.1 Conventional lattice powerline tower compared with a steel monopole structure and map of Powerline Route and Substation Alternatives for the Karreebosch OHPL

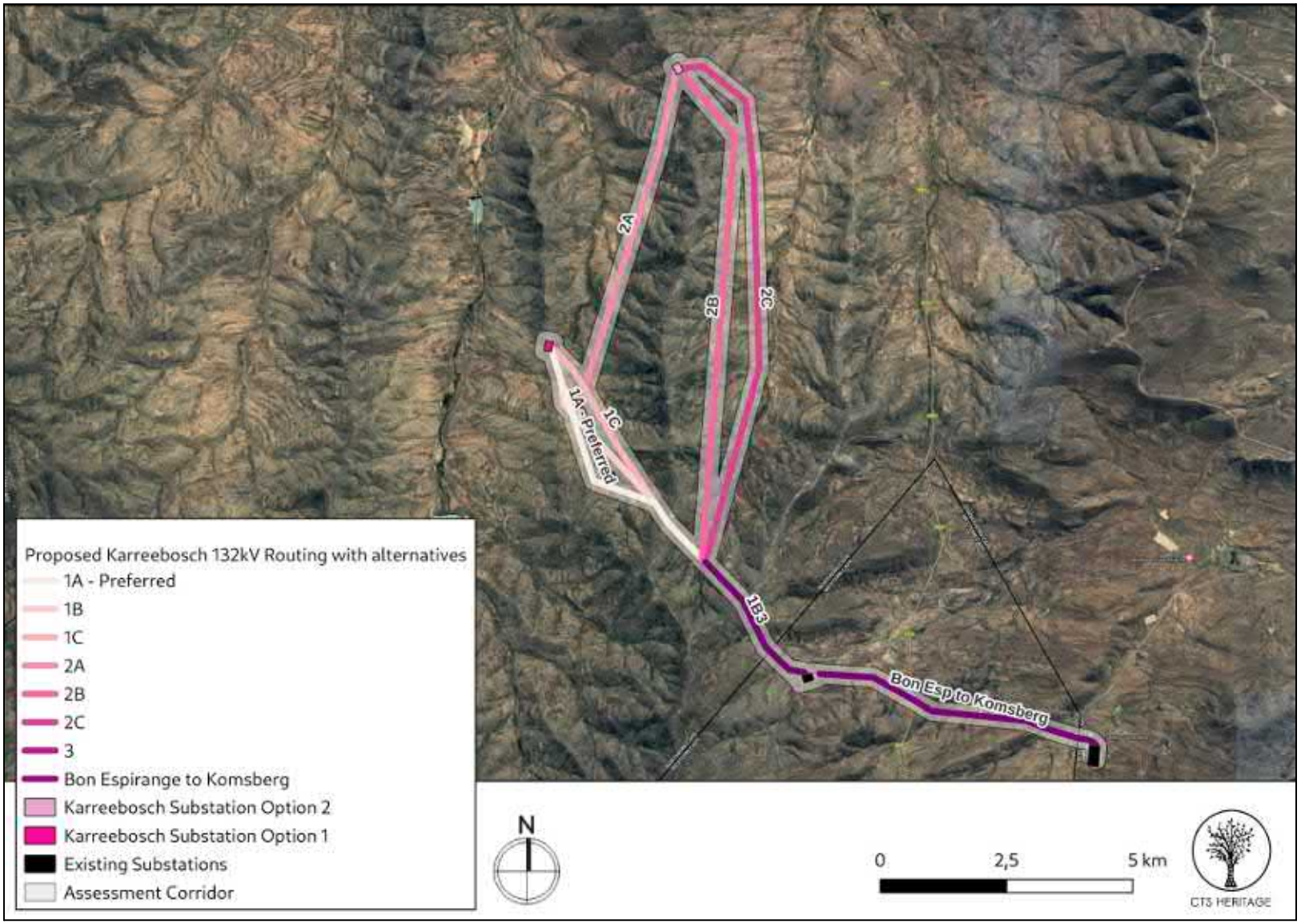

Figure 1.2: The proposed study area within which the 132kV OHL will be located

Figure 1.3: Study Area in the Northern Cape

Figure 1.4: Study Area in the Western Cape (although the shapefile provided indicates that the line does not connect to the substation, this is incorrect and the line does in fact connect)

2. METHODOLOGY

2.1 Purpose of HIA

The purpose of this Heritage Impact Assessment (HIA) is to satisfy the requirements of section 38(8), and therefore section 38(3) of the National Heritage Resources Act (Act 25 of 1999).

2.2 Summary of steps followed

- A Desktop Study was conducted of relevant reports previously written (please see the reference list for the age and nature of the reports used).
- An archaeologist conducted an assessment of the broader study area in order to determine the archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted his site visit on 13 August 2021.
- The AIA was updated to reflect the amended alignment in July 2022
- A palaeontologist conducted an assessment of the broader study area in order to determine the palaeontological resources likely to be disturbed by the proposed development. The palaeontologist conducted his site visit on 23-24 and 29 September 2021.
- The PIA was not updated to reflect the amended alignment. Due to the similarities in the 2021 and 2022 alignments, the impacts to palaeontological resources remain the same and an updated impact assessment is undertaken in this HIA report.
- The identified resources were assessed to evaluate their heritage significance.
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner.

2.3 Assumptions and uncertainties

- The *significance* of the sites and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.
- It should be noted that archaeological and palaeontological deposits often occur below ground level. Should artefacts or skeletal material be revealed at the site during construction, such activities should be halted, and it would be required that the heritage consultants are notified for an investigation and evaluation of the find(s) to take place.

However, despite this, sufficient time and expertise was allocated to provide an accurate assessment of the heritage sensitivity of the area.

2.4 Constraints & Limitations

The vegetation did not pose any challenges to the archaeological survey but much of the ground was covered in broken rock and stone eroding down the slopes of the ridges. The placement of the OHL footings predominantly lie along the middle of the slopes enroute to and from the tops of the ridges and this resulted in very few heritage observations.

2.5 Impact Assessment Methodology

Assessments of Impacts and Mitigation

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria presented in Table 1 below.

Table 1: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
environmental receptor					
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria:	S=(E+D+R+M) x P Significance=(Extent+Duration+Reversibility+Magnitude) x Probability				

IMPACT SIGNIFICANCE RATING			
Total Score	**0 – 30**	**31 to 60**	**61 – 100**
Environmental Significance Rating (Negative (-))	**Low (-)**	**Moderate (-)**	**High (-)**
Environmental Significance Rating (Positive (+))	**Low (+)**	**Moderate (+)**	**High (+)**

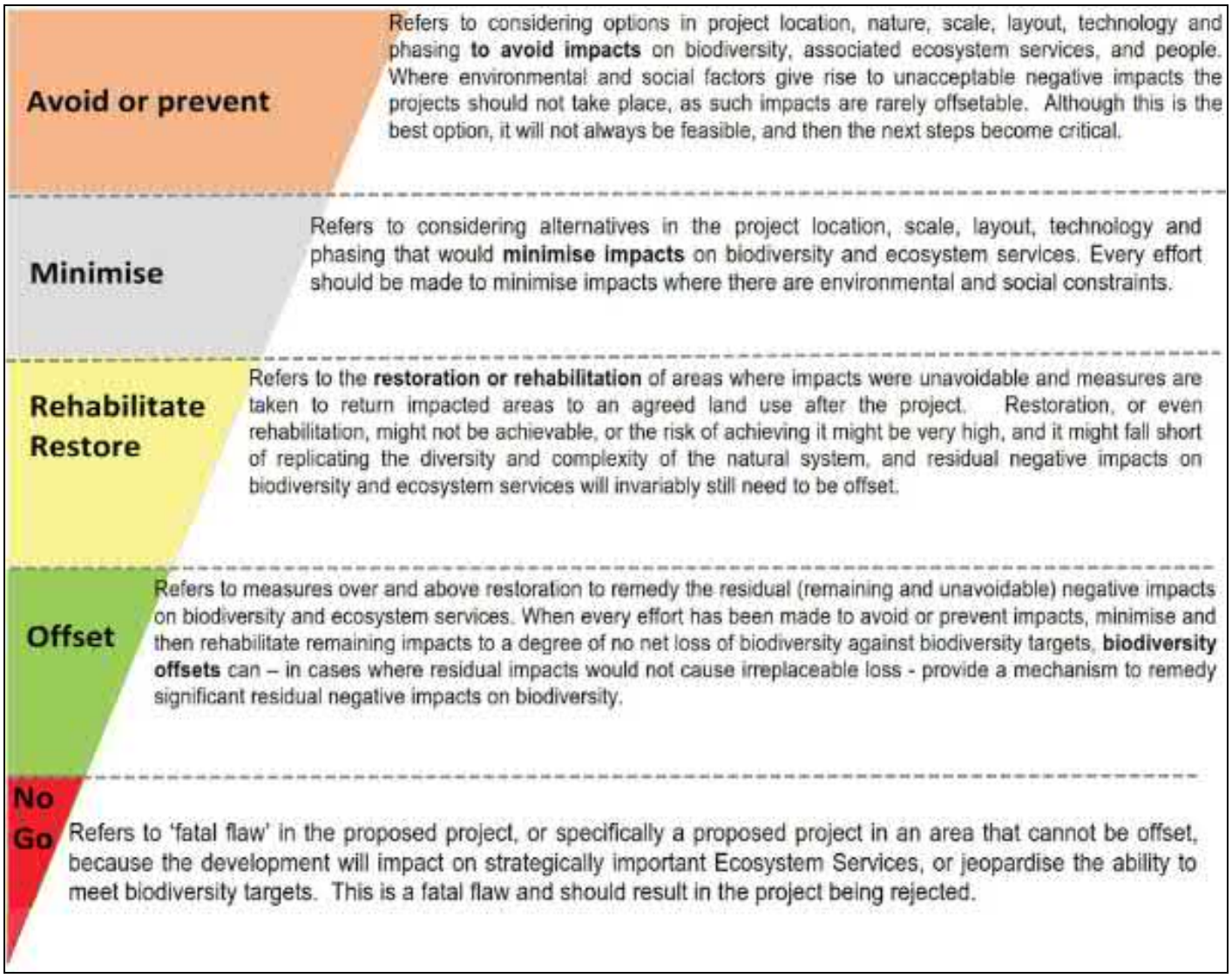

Figure 2: Mitigation Sequence Hierarchy

Impact Mitigation

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Background

The Karreebosch WEF was previously referred to as Phase 2 of the Roggeveld WEF (EA Ref: 12/12/20/1988/1/AM6). SAHRA has made numerous comments on both the Roggeveld WEF and the Karreebosch WEF from 2013 with the last comment issued on 26 September 2018 (attached). EA was granted for the Karreebosch WEF on 29 January 2016. In the EA, various requirements were stipulated in terms of impacts to Historical, Cultural and Palaeontological sites. Much of the area proposed for the development of the powerline and onsite substation was assessed as part of the HIA completed for the Karreebosch WEF (Figure 3.1) drafted by the ACO (Kendrick, 2015, SAHRIS Ref 183350). The remaining sections of the proposed powerline were assessed in the Heritage Assessments completed for the Roggeveld WEF (Hart and Webley, 2013, SAHRIS Ref 152531). The heritage information identified in these reports have been extracted and are mapped in Figure 3.2 to 3.4. These reports are also referred to below in order to provide a contextual analysis of the heritage sensitivity of the area proposed for development.

3.2 Archaeology and Built Environment Heritage

The area proposed for development has been previously assessed more than once (ACO 2013, 2015). In addition, the proposed powerline routes lie immediately adjacent to existing grid infrastructure. The original fieldwork conducted for the Roggeveld WEF HIA (2013) which covered the area proposed for development was comprehensive and remains relevant, similarly the fieldwork conducted for the Karreebosch WEF (2015).

The Karreebosch HIA (2015) "*revealed that the study area is relatively austere in terms of pre-colonial heritage, however valley bottoms contain evidence of early trekboer cultural landscapes – ruins, graves and occasional middens. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area. There are a number of existing farm houses that contain 19th century fabric, however very few of these have anything more than moderate heritage significance. Parts of the study area enjoy very high aesthetic qualities with the area known by locals as "Gods Window" having grade II aesthetic qualities, hence the significance of the study area lies mainly with its undeveloped wilderness qualities. Interestingly, pre-colonial or stone age heritage and archaeology is extremely scarce in the areas that were searched. Very few archaeological sites of these kinds were recorded despite the fact that overall 9 experienced archaeologists were involved in scouring the landscape*."

The HIA for the Karreebosch WEF notes that "*The most important colonial archaeological sites in the study area are associated with Ekkraal Valley, the Rietfontein-Wilgebosch River valley and the Krans Kraal-Karrekraal valley. The valley bottoms are archaeologically sensitive…*". Similar findings were made by ACO in their report (2010,

SAHRIS Ref: 53187) over the development area. As the proposed powerline alternatives traverse the valley areas which have been determined to be archaeologically sensitive, it is likely that significant archaeological heritage resources may be impacted by the proposed development.

According to the ACO reports (2011, 2013 and 2015), parts of the study area enjoy very high aesthetic qualities hence the significance of the study area lies mainly with its undeveloped wilderness qualities which may be negatively impacted by the development of the proposed powerline. However, it must be noted that the proposed powerline is located within a Renewable Energy Development Zone (REDZ), which has been identified for this kind of development. In REDZ areas, there is a reasonable expectation that the cultural landscape of an area will be changed to be dominated, or at least heavily altered, by renewable energy development and its associated infrastructure. In fact, this is the intention of the REDZ areas. Furthermore, the proposed powerline is located within a suite of authorised and some operational renewable energy facilities (Figure 7) and as such, the impact of this proposed powerline on the cultural landscape is likely to be negligible. No further specialist cultural landscape assessment is therefore recommended.

Table 2: Sites previously identified in and near the broader study area

SAHRIS ID	Site No.	Site Name	Site Type	Grading
35222	ROG037	Roggeveld 037	Building	Grade IIIb
35135	ROG005	Roggeveld 005	Building	Grade IIIc
35138	ROG008	Roggeveld 008	Stone walling	Grade IIIc
35152	ROG012	Roggeveld 012	Building	Grade IIIc
35154	ROG013	Roggeveld 013	Stone walling	Grade IIIc
35157	ROG014	Roggeveld 014	Transport infrastructure	Grade IIIc
35159	ROG015	Roggeveld 015	Building	Grade IIIc
35171	ROG016	Roggeveld 016	Stone walling	Grade IIIc
35172	ROG017	Roggeveld 017	Stone walling	Grade IIIc
35174	ROG019	Roggeveld 019	Stone walling	Grade IIIc
35175	ROG020	Roggeveld 020	Stone walling	Grade IIIc
35177	ROG021	Roggeveld 021	Stone walling	Grade IIIc
35178	ROG022	Roggeveld 022	Conservation Area	Grade IIIc
35191	ROG025	Roggeveld 025	Ruin> 100 years, Artefacts	Grade IIIc

SAHRIS ID	Site No.	Site Name	Site Type	Grading
35202	ROG028	Roggeveld 028	Artefacts	Grade IIIc
35204	ROG029	Roggeveld 029	Cultural Landscape	Grade IIIc
35208	ROG030	Roggeveld 030	Stone walling	Grade IIIc
35215	ROG033	Roggeveld 033	Cultural Landscape	Grade IIIc
35137	ROG007	Roggeveld 007	Burial Grounds & Graves	Grade IIIc
35201	ROG027	Roggeveld 027	Burial Grounds & Graves	Grade IIIc
35226	ROG038	Roggeveld 038	Burial Grounds & Graves	Grade IIIa
137190	KWF-005	KAREEBOSCH WIND FARM	Building	
137192	KWF-007	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137193	KWF-008	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137194	KWF-009	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137195	KWF-010	KAREEBOSCH WIND FARM	Structures	
137196	KWF-011	KAREEBOSCH WIND FARM	Structures	
137197	KWF-012	KAREEBOSCH WIND FARM	Structures	
137198	KWF-013	KAREEBOSCH WIND FARM	Structures	
137202	KWF-017	KAREEBOSCH WIND FARM	Building	
137203	KWF-018	KAREEBOSCH WIND FARM	Stone walling	
137204	KWF-019	KAREEBOSCH WIND FARM	Archaeological	
137205	KWF-020	KAREEBOSCH WIND FARM	Building	
137233	KWF-021	KAREEBOSCH WIND FARM	Stone walling	
137234	KWF-022	KAREEBOSCH WIND FARM	Stone walling	
137236	KWF-024	KAREEBOSCH WIND FARM	Stone walling	
137237	KWF-025	KAREEBOSCH WIND FARM	Stone walling	
137238	KWF-026	KAREEBOSCH WIND FARM	Stone walling	
137239	KWF-027	KAREEBOSCH WIND FARM	Structures	
137240	KWF-028	KAREEBOSCH WIND FARM	Structures	
137241	KWF-029	KAREEBOSCH WIND FARM	Structures	

SAHRIS ID	Site No.	Site Name	Site Type	Grading
137242	KWF-030	KAREEBOSCH WIND FARM	Structures	
137243	KWF-031	KAREEBOSCH WIND FARM	Structures	
137244	KWF-032	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137245	KWF-033	KAREEBOSCH WIND FARM	Structures, Artefacts	
137246	KWF-034	KAREEBOSCH WIND FARM	Structures	
137247	KWF-035	KAREEBOSCH WIND FARM	Structures	
137248	KWF-036	KAREEBOSCH WIND FARM	Stone walling	
137249	KWF-037	KAREEBOSCH WIND FARM	Stone walling	
137250	KWF-038	KAREEBOSCH WIND FARM	Structures	
137259	KWF-046	KAREEBOSCH WIND FARM	Structures	Ungraded
137260	KWF-047	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137137	BWE-048	Brandvalley Wind Energy	Deposit	
137138	BWE-049	Brandvalley Wind Energy	Deposit	
137139	BWE-050	Brandvalley Wind Energy	Deposit	
137140	BWE-051	Brandvalley Wind Energy	Deposit	

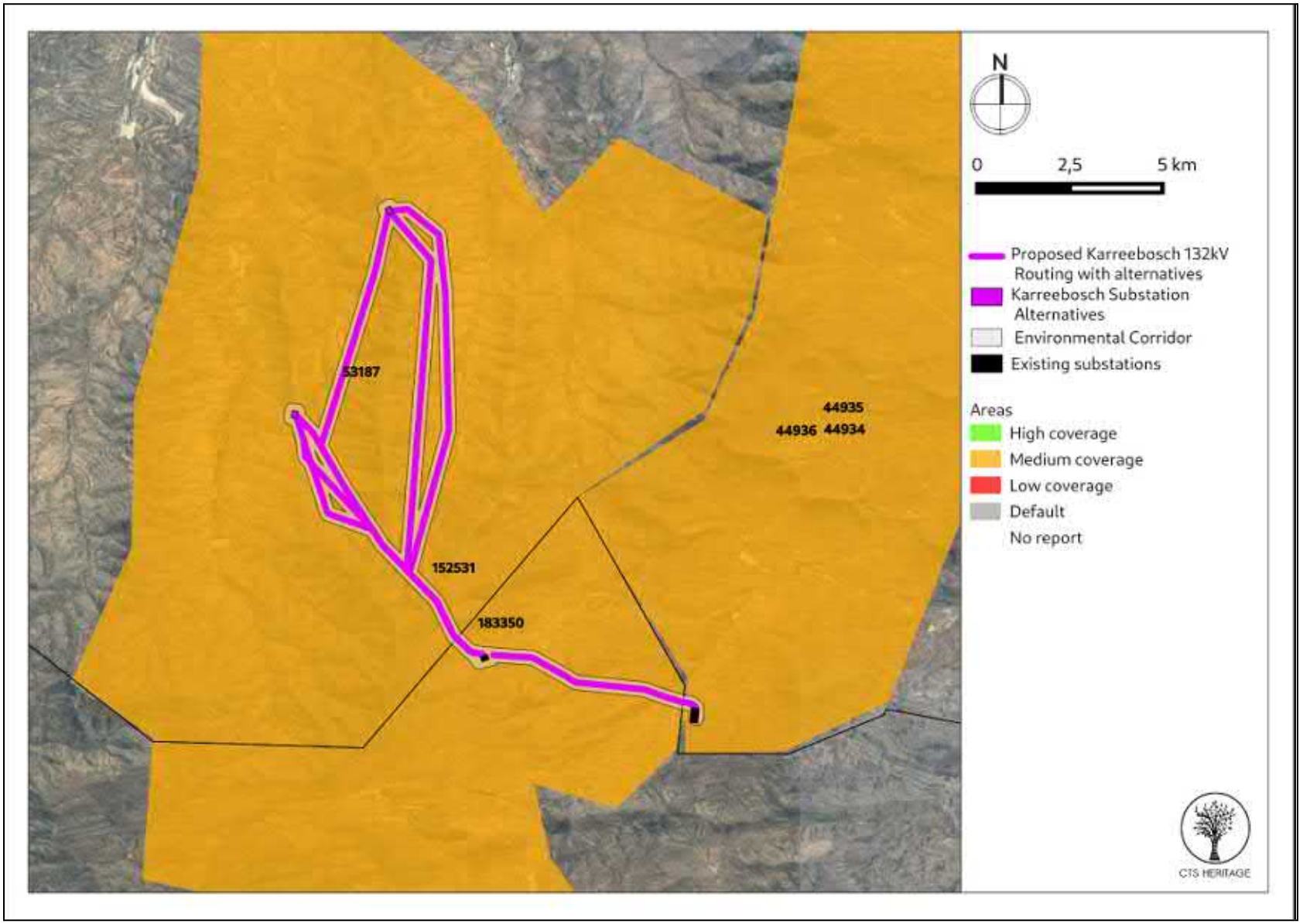

Figure 3.1: Spatialisation of heritage assessments conducted in proximity to the broader study area

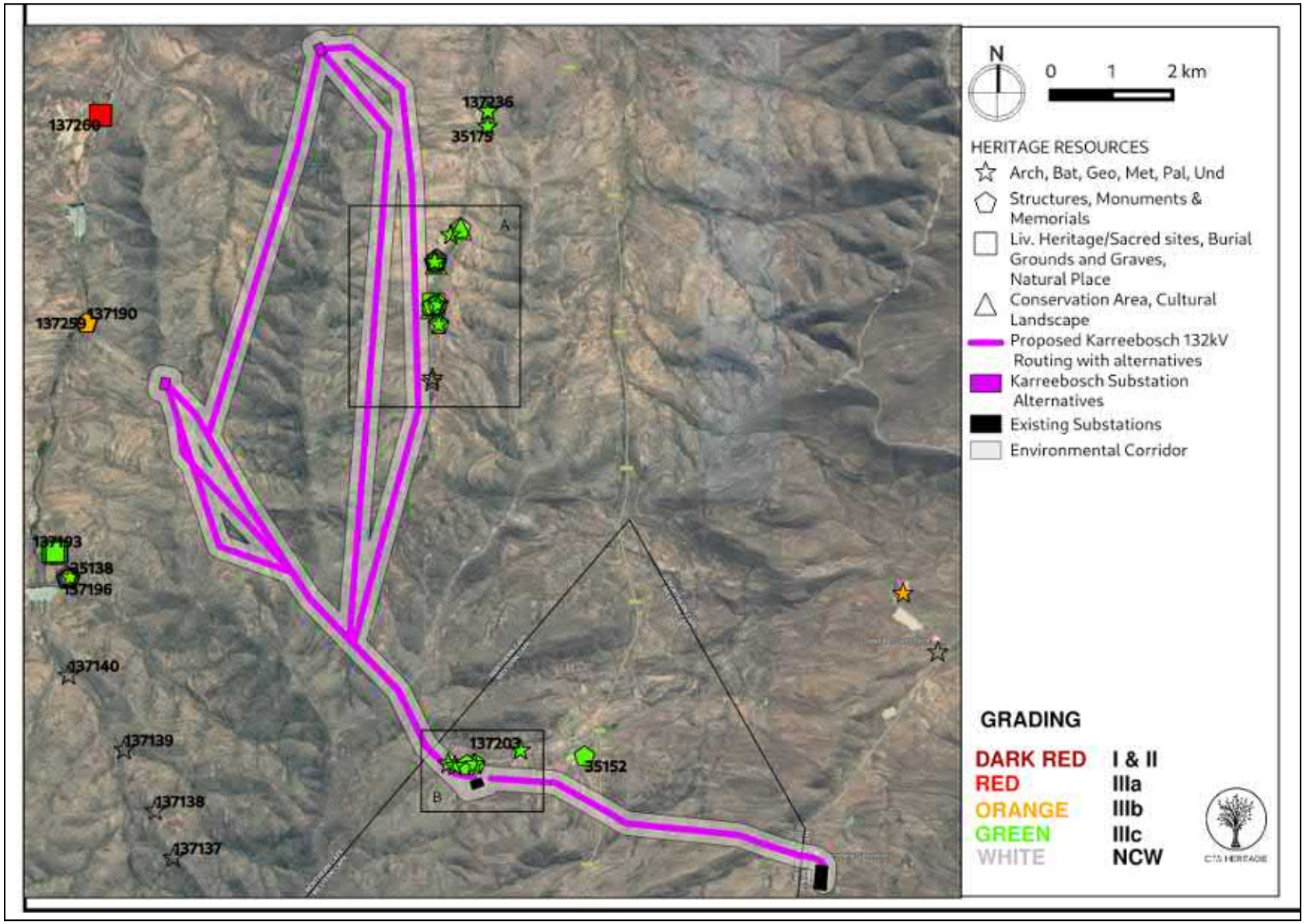

Figure 3.2: Spatialisation of heritage resources known in proximity to the broader study area

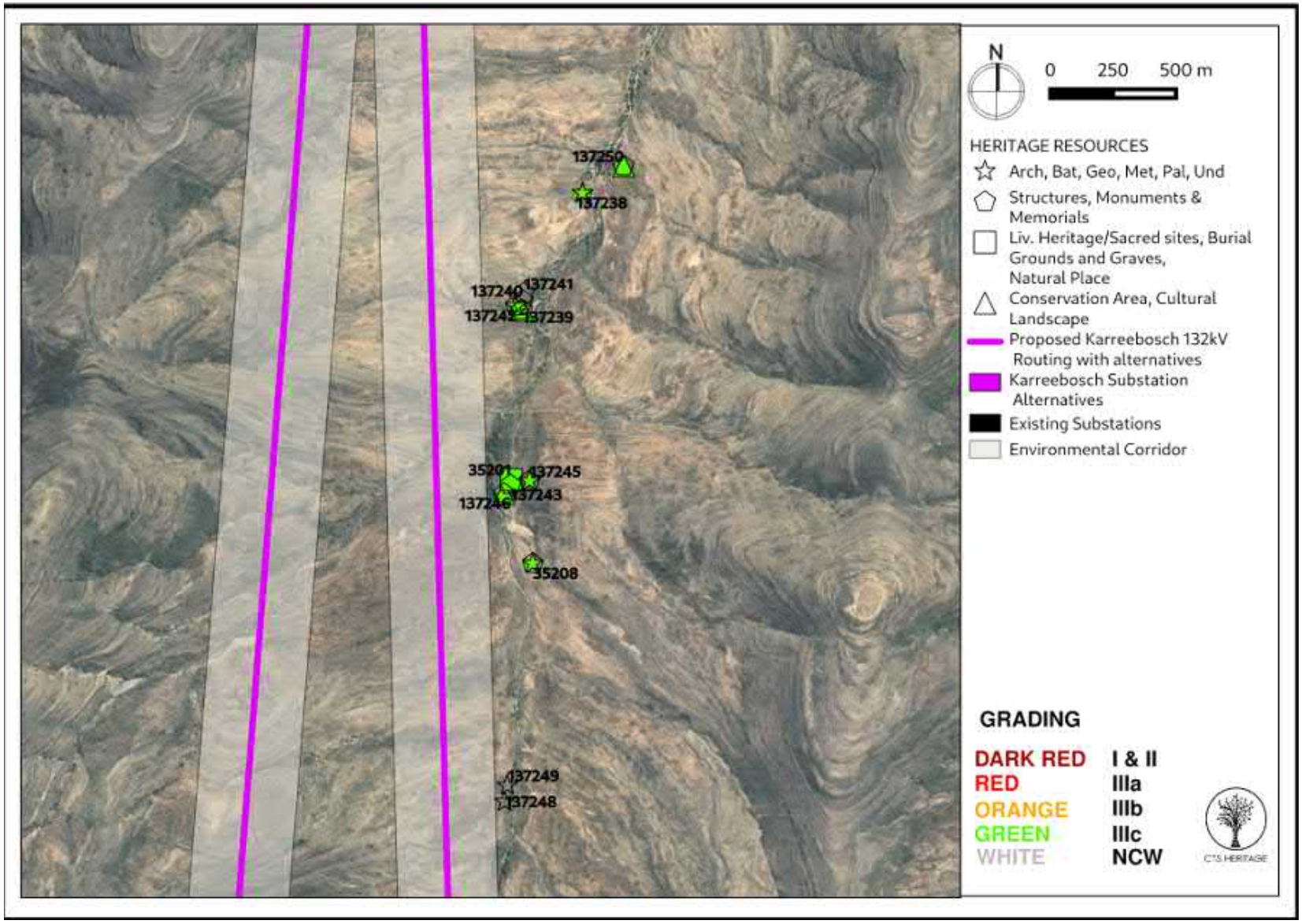

Figure 3.3: Spatialisation of heritage resources known in proximity to the broader study area - inset A

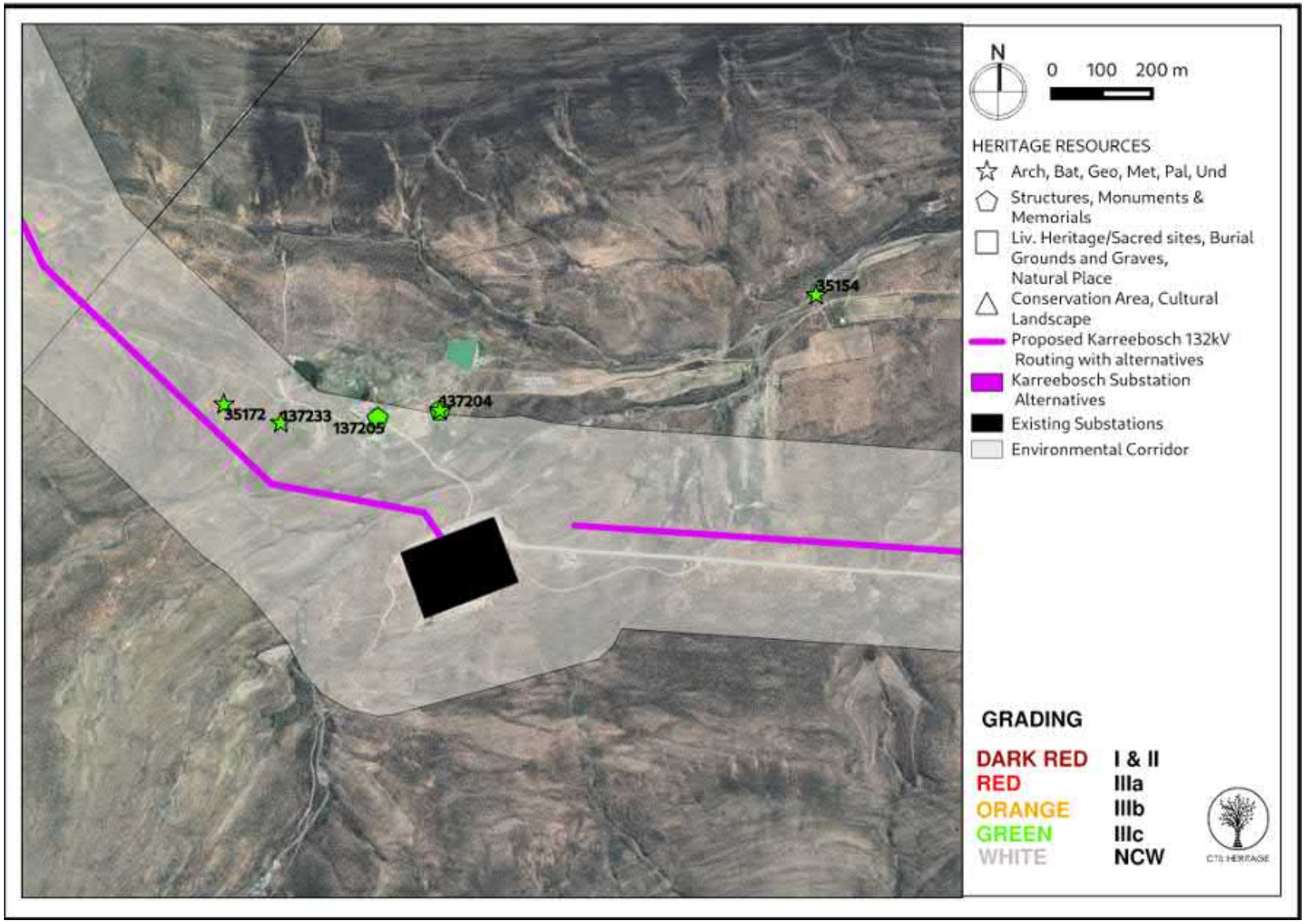

Figure 3.4: Spatialisation of heritage resources known in proximity to the broader study area - inset B

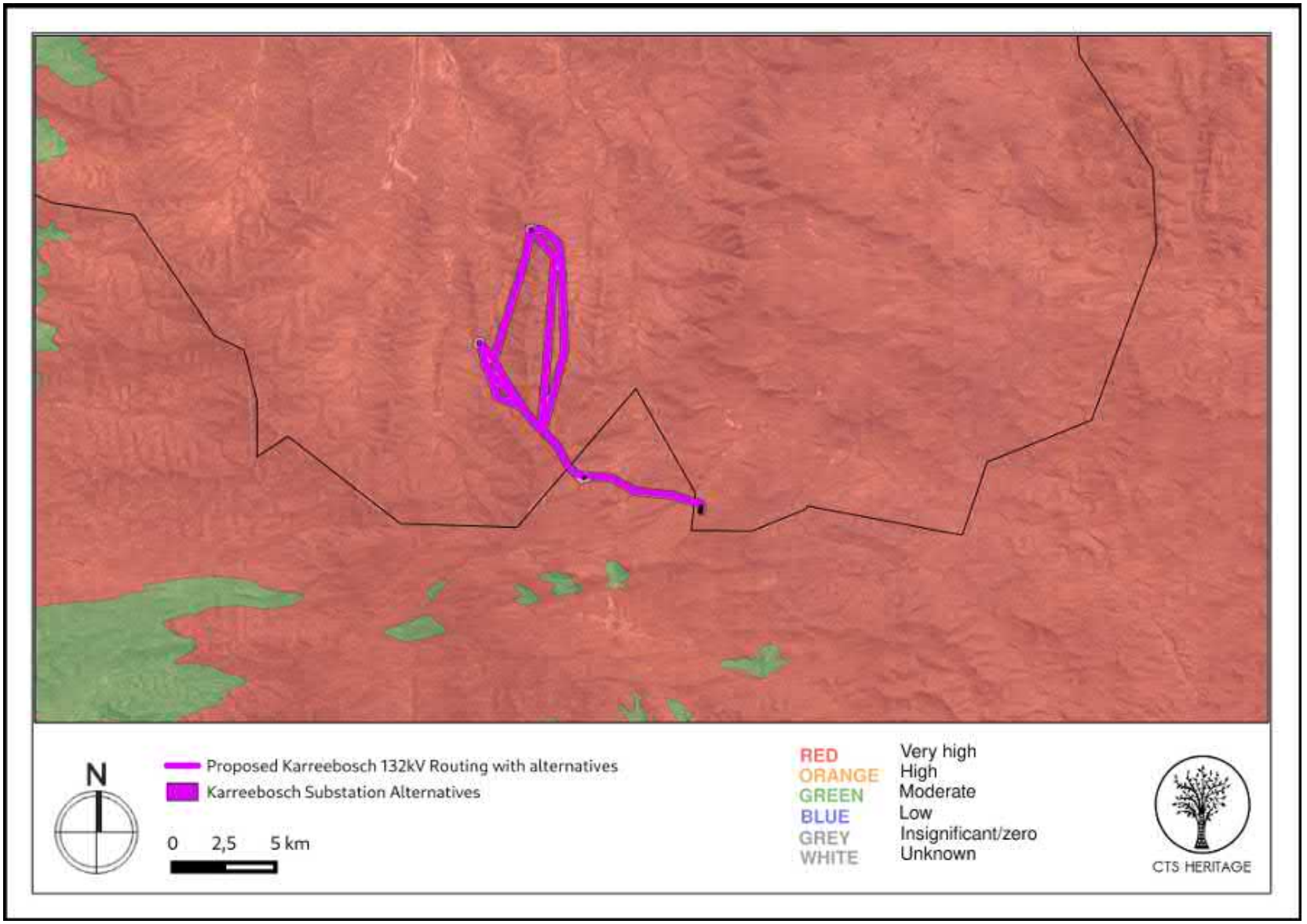

Figure 4: Palaeontological sensitivity of the area surrounding the broader study area

3.3 Palaeontology

According to the SAHRIS Palaeosensitivity Map (Figure 4 above), the area proposed for the powerline development is underlain by sediments of very high palaeontological sensitivity belonging to the Abrahamskraal Formation of the Beaufort Group. A Palaeontological Assessment was conducted by Almond (2015) for the Karreebosch WEF which covers a larger portion of the area proposed for the powerline development, and covered the proposed powerline alternatives specifically (Figure 2b, Appendix to the ACO Report 2015, SAHRIS Ref 183350).

According to Almond (2015), "*The fluvial Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) that underlies almost the entire wind farm study area is known for its diverse fauna of Permian fossil vertebrates - notably various small- to large-bodied therapsids and reptiles - as well as fossil plants of the Glossopteris Flora and low diversity trace fossil assemblages. However, desktop analysis of known fossil distribution within the Main Karoo Basin shows a marked paucity of fossil localities in the study region between Matjiesfontein and Sutherland where sediments belonging only to the lower part of the thick Abrahamskraal Formation succession are represented.*

Bedrock exposure levels in the Karreebosch Wind Farm study area are generally very poor due to the pervasive cover by superficial sediments (colluvium, alluvium, soils, calcrete) and vegetation. Nevertheless, a sufficiently large outcrop area of Abrahamskraal Formation sediments, exposed in stream and riverbanks, borrow pits, erosion gullies as well as road cuttings along the R354, has been examined during the present fieldwork to infer that macroscopic fossil remains of any sort are very rare indeed here. Exceptions include common trace fossil assemblages (invertebrate burrows) and occasional fragmentary plant remains (horsetail ferns). Levels of tectonic deformation of the bedrocks are generally low and baking by dolerite intrusions (Early Jurassic Karoo Dolerite Suite) is very minor. It is concluded that the Lower Beaufort Group bedrocks in the study area are generally of low palaeontological sensitivity and this also applies to the overlying Late Caenozoic superficial sediments (colluvium, alluvium, calcrete, soils etc)."

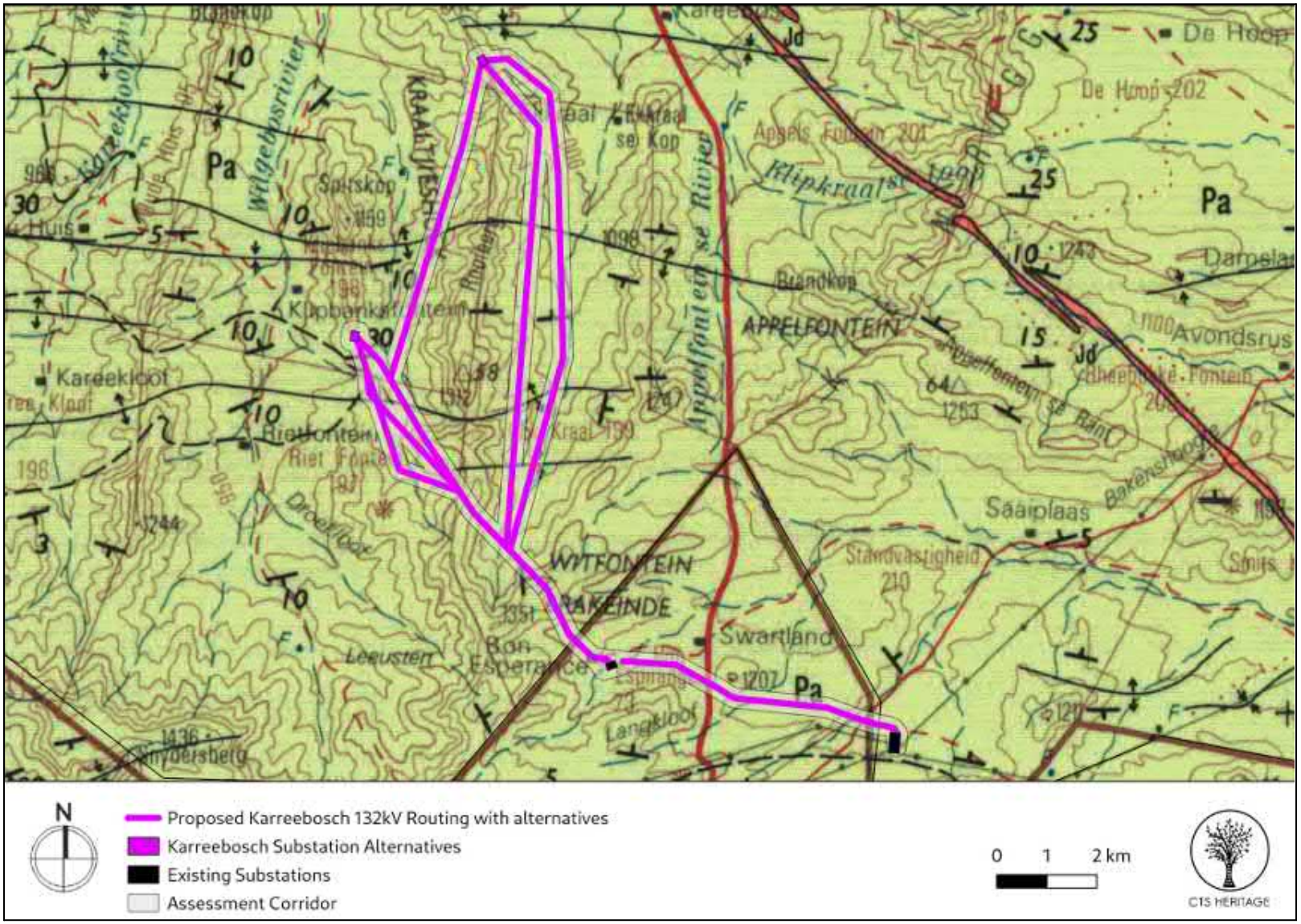

Figure 4.2 Geology Map. Extract from the CGS 3220 Sutherland Map indicating that the development area for the proposed Karreebosch Powerline is underlain by the Pa: Abrahamskraal Formation of the Beaufort Group

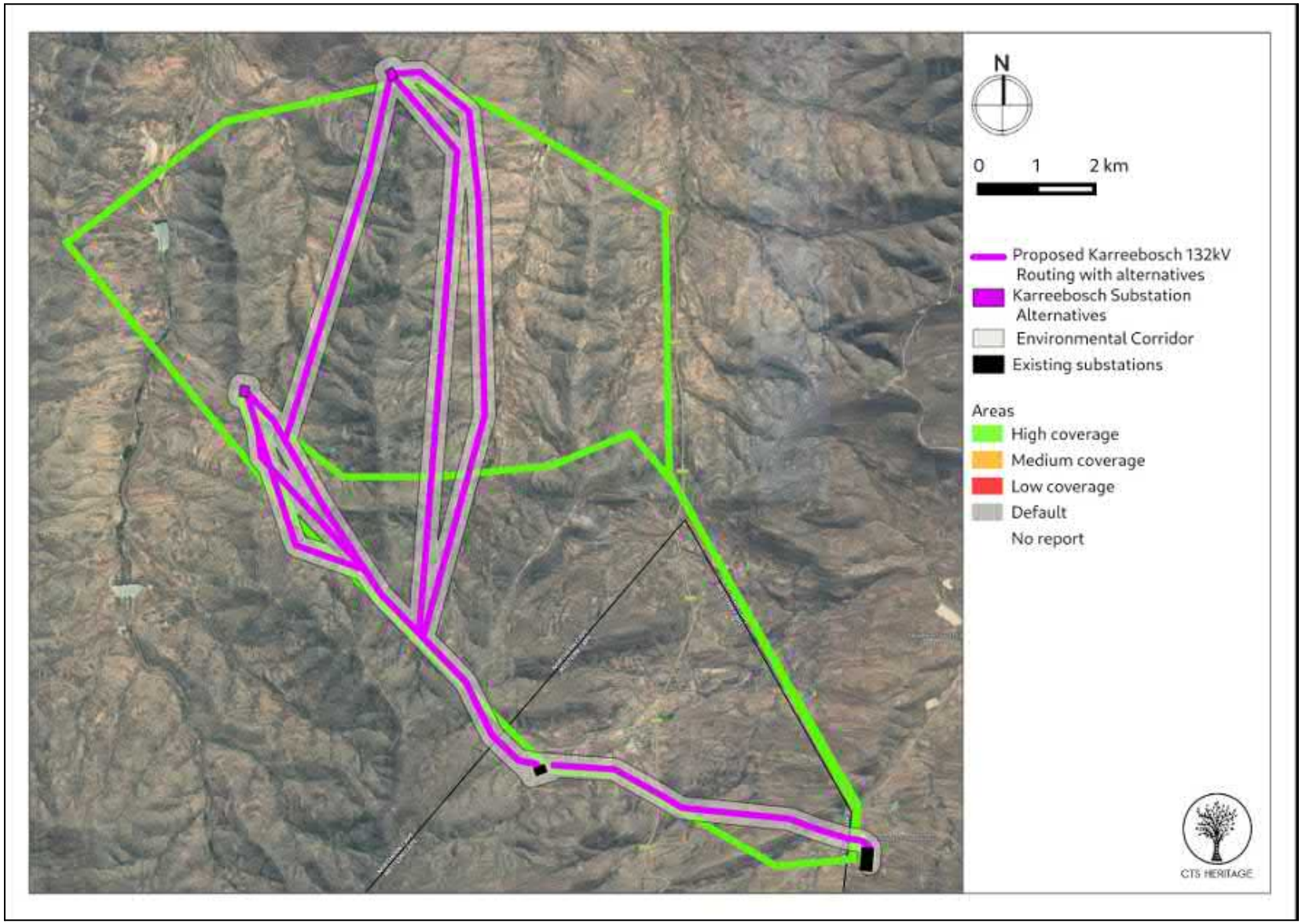

Figure 4.3 The HIA conducted by the ACO (2015) including the PIA by Dr Almond covered a powerline in the area proposed for development (SAHRIS Ref 183350).

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Archaeology

Very few archaeological resources were identified during the archaeological field assessment completed for the proposed Karreebosch OHL and substation development. The resources that were identified were all single artefact occurrences or low density artefact scatters, none of which were determined to have any scientific cultural value.

While the survey of the Karreebosch OHL and substation must be taken in context with the broader assessments of the wind farms that have necessitated the development of the OHL, the findings were particularly limited due to the route taken for the OHL. 132kV lines typically have a very small development footprint and can be constructed without the large roads needed to build the WEFs. The routes chosen by the engineers for the various alternatives follow very rugged, mid-slope paths where almost no archaeological material or ruins were found. Where archaeological material was found, lithics consisted of local quartzites used to manufacture Middle and Later Stone Age flakes as well as cherts that were sourced in the more general region such as the Tanqua and Ceres Karoo by people in the Later Stone Age.

Palaeontology

The Karreebosch OHL and substation area is underlain at depth by potentially fossiliferous continental sediments within the lower part of the Abrahamskraal Formation (Lower Beaufort Group / Adelaide Subgroup, Karoo Supergroup) of Middle Permian age. Sparse fossil assemblages in this sector of the Klein-Roggeveldberge region - including extremely rare vertebrate skeletal remains, tetrapod and lungfish burrows, invertebrate traces and vascular plants - are inferred to belong to the Eodicynodon Assemblage Zone and contribute to our understanding of the earliest terrestrial biotas that colonised the Main Karoo Basin in Middle Permian times (c. 270 Ma / million years ago). The palaeosensitivity of the project area is provisionally rated as High, based on the Lower Beaufort Group bedrocks (SAHRIS website / DFFE screening tool).

However, previous field-based palaeontological surveys in the Roggeveld WEF project area have only yielded scrappy plant remains as well as low-diversity trace fossils. With the exception of fragmentary fossil remains of very rare temnospondyl amphibians found on Rietfontein RE/197, close to the powerline Option 1B, additional fossil sites recorded during a recent 2-day palaeontological site visit to the Roggeveld WEF grid connection project area are mostly of low scientific / conservation value and lie outside or on the margins of the grid corridors under investigation.

4.2 Heritage Resources identified

Table 3: Heritage resources identified in the broader study area

POINT ID	Site Name	Description	Co-ordinates		Grading	Mitigation
Archaeology						
KRB017	Karrebosch 017	Quartzite flakes, thinly struck, prep. Platforms, MSA. Near valley floor; cores and flakes, knapping and production site	-32.85936	20.47184	NCW	NA
KRB018	Karrebosch 018	Chert flake, LSA. On top of ridge.	-32.84809	20.44152	NCW	NA
KRB019	Karrebosch 019	Quartzite flake, MSA	-32.84897	20.44073	NCW	NA
KRB020	Karrebosch 020	Quartzite flake, MSA	-32.86418	20.43635	NCW	NA
KRB021	Karrebosch 021	Chert and quartz flakes, lower grindstone near wind pump, LSA	-32.90585	20.44082	NCW	NA
KRB022	**Karrebosch 022**	**Chert flake, LSA**	**-32.88297**	**20.517862**	**NCW**	**NA**
Palaeontology						
PAL_KRB 001	Palaeo Karreebosch 001	Extensive exposure of SSE-dipping sandstone bed top with sets of small-scale wave ripples and meandering epichnial invertebrate burrows that were probably generated on the margins of a shallow floodplain pond or playa lake. Sharply overlying grey-green mudrocks show numerous ball-and-pillow load structures	32°52'37.22"S	20°29'19.68"E	IIIC	None
PAL_KRB 002	**Palaeo Karreebosch 002**	**Small (c. 6 cm wide), angular block of pale grey phosphatic concretion containing comminuted vertebrate bone and perhaps bony spines or teeth (pearly grey to black). Possibly of bony fish or – more likely - amphibian (i.e. temnospondyl) affinity. Block in surface float along shallow drainage line running along top of well-exposed grey-green mudrock package.**	**32°52'37.45"S**	**20°29'22.32"E**	**IIIB**	**Collection under workplan application of Option 1B is developed**
PAL_KRB 003	**Palaeo Karreebosch 003**	**Probably part of the same fossiliferous concretion**	**32°52'37.61"S**	**20°29'21.97"E**	**IIIB**	**Collection under workplan application of Option 1B is developed**
PAL_KRB 004	**Palaeo Karreebosch 004**	**As above (2 blocks). Probably part of the same fossiliferous concretion.**	**32°52'36.97"S**	**20°29'23.42"E**	**IIIB**	**Collection under workplan application of Option 1B is developed**
PAL_KRB 005	Palaeo Karreebosch 005	Hillslope exposure of steeply dipping, SE-facing current-rippled bed top with sparse epichnial invertebrate burrows up to c. 2 cm wide, subhorizontal with central convex core (possibly segmented) and shallow marginal grooves	32°52'39.07"S	20°29'29.12"E	IIIC	None
PAL_KRB 006	Palaeo Karreebosch 006	Dense mat of reworked reedy sphenophyte stems (horsetail ferns) preserved as compressions within dark grey siltstones, shallow stream bed exposure.	32°52'31.51"S	20°29'23.81"E	IIIC	None

POINT ID	Site Name	Description	Co-ordinates		Grading	Mitigation
PAL_KRB 007	**Palaeo Karreebosch 007**	**Stream bed and bank exposure of grey-green mudrocks of Abrahamskraal Fm with horizon containing several subcylindrical, vertical lungfish burrow casts up to 9 cm in diameter**	**32°54'53.65"S**	**20°30'56.37"E**	**IIIB**	**No impact anticipated**
PAL_KRB 008	Palaeo Karreebosch 008	Stream bed exposure of grey-green siltstone or fine-grained wacke covered by purple-brown siltstone veneer and with dense assemblage of rounded traces between 0.5 to 1 cm in diameter – probably reedy plant stem casts (e.g. sphenophytes)	32°54'52.93"S	20°30'58.94"E	IIIC	None
PAL_KRB 009	Palaeo Karreebosch 009	Stream gulley exposure of mottled grey-green to purple-brown sandstone with assemblage of rounded, oval to irregular sand-infilled casts with reduction haloes, either of plant stems or invertebrate burrows	32°54'41.76"S	20°31'10.35"E	IIIC	None
PAL_KRB 010	Palaeo Karreebosch 010	Sandstone bed top with possible effaced desiccation crack infills, assemblage of reedy plant stem casts.	32°55'11.03"S	20°31'54.90"E	IIIC	None

4.3 Mapping and spatialisation of heritage resources

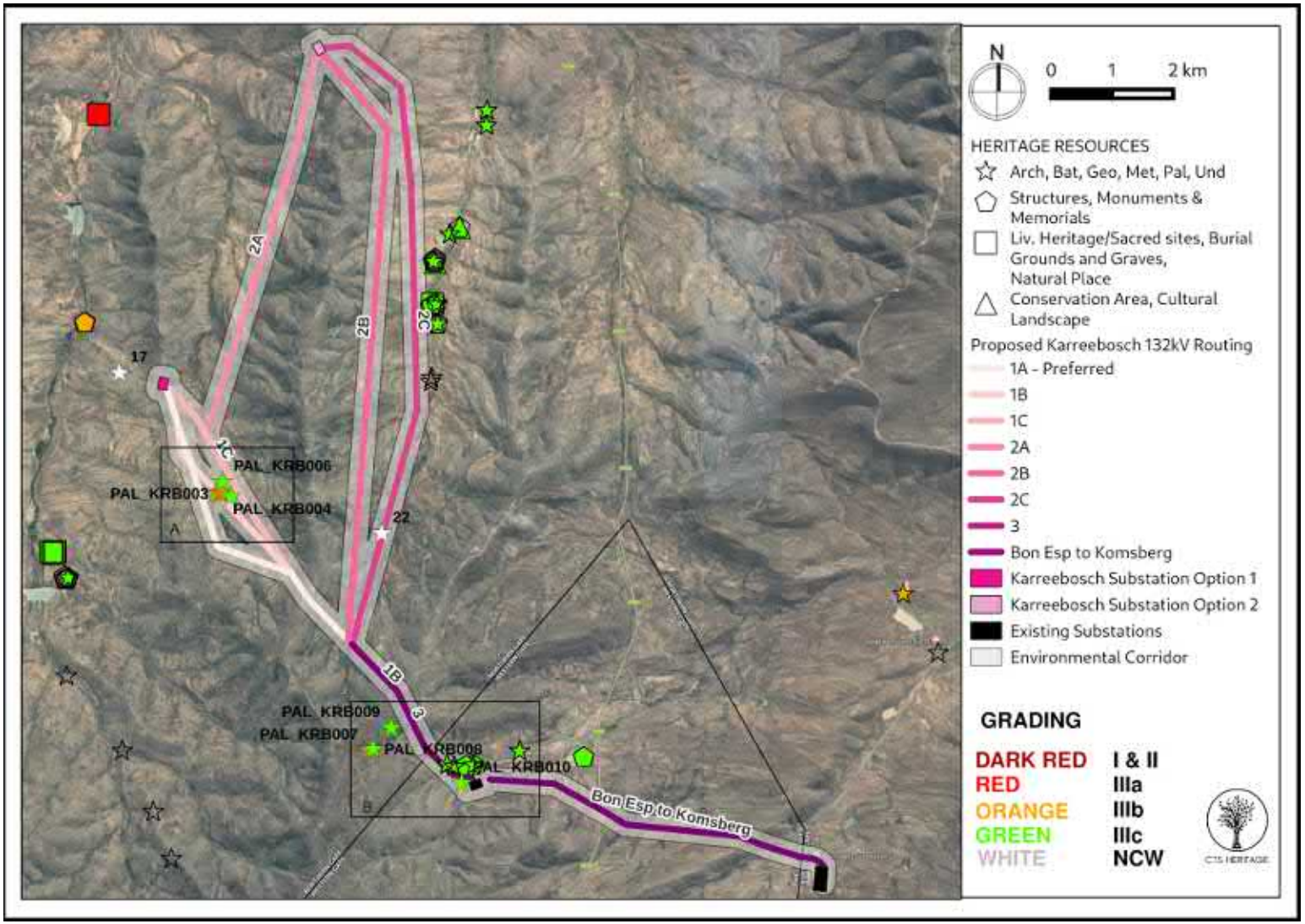

Figure 5.1: Map of heritage resources identified during the field assessment, relative to the broader study area

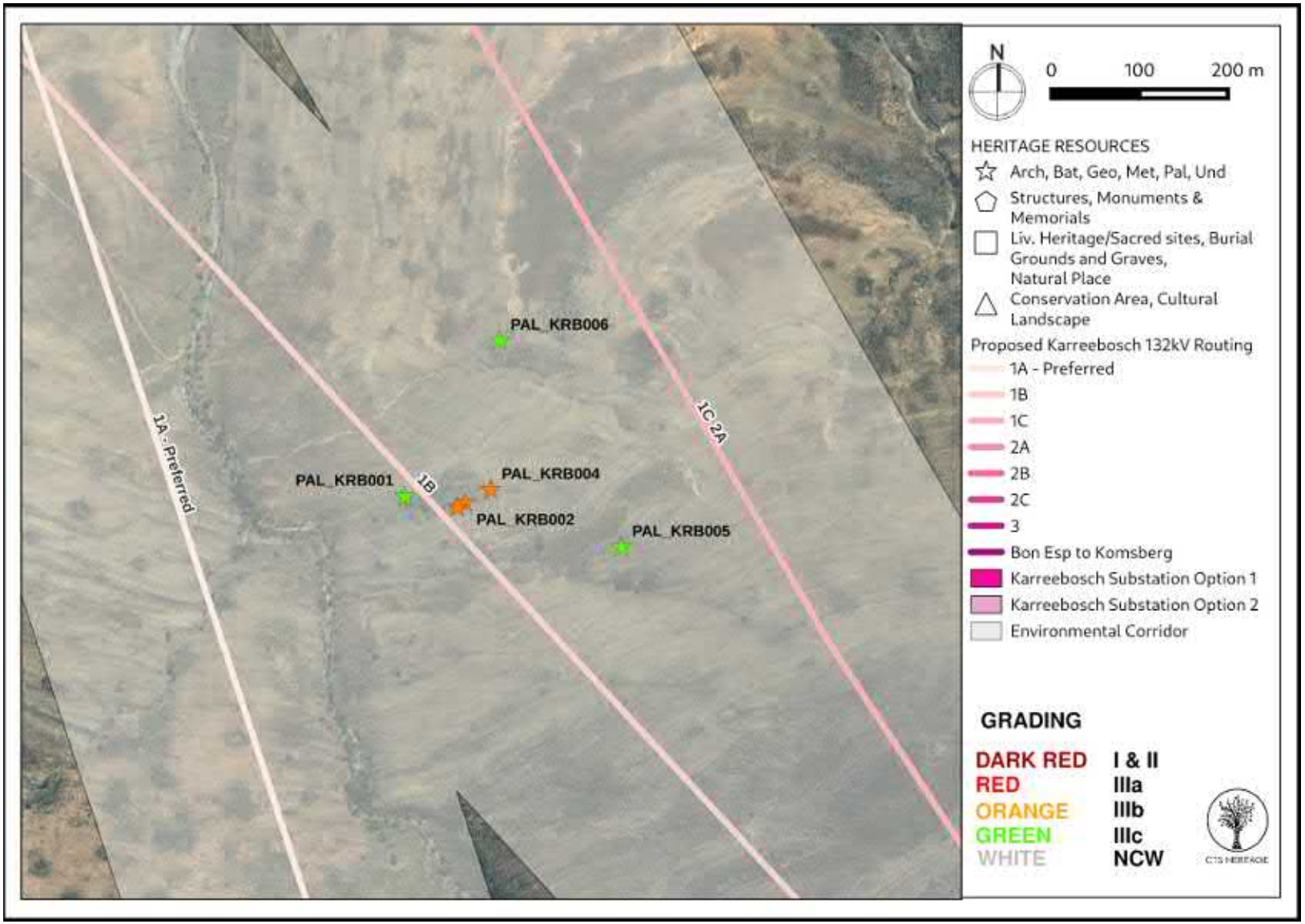

Figure 5.2: Inset A

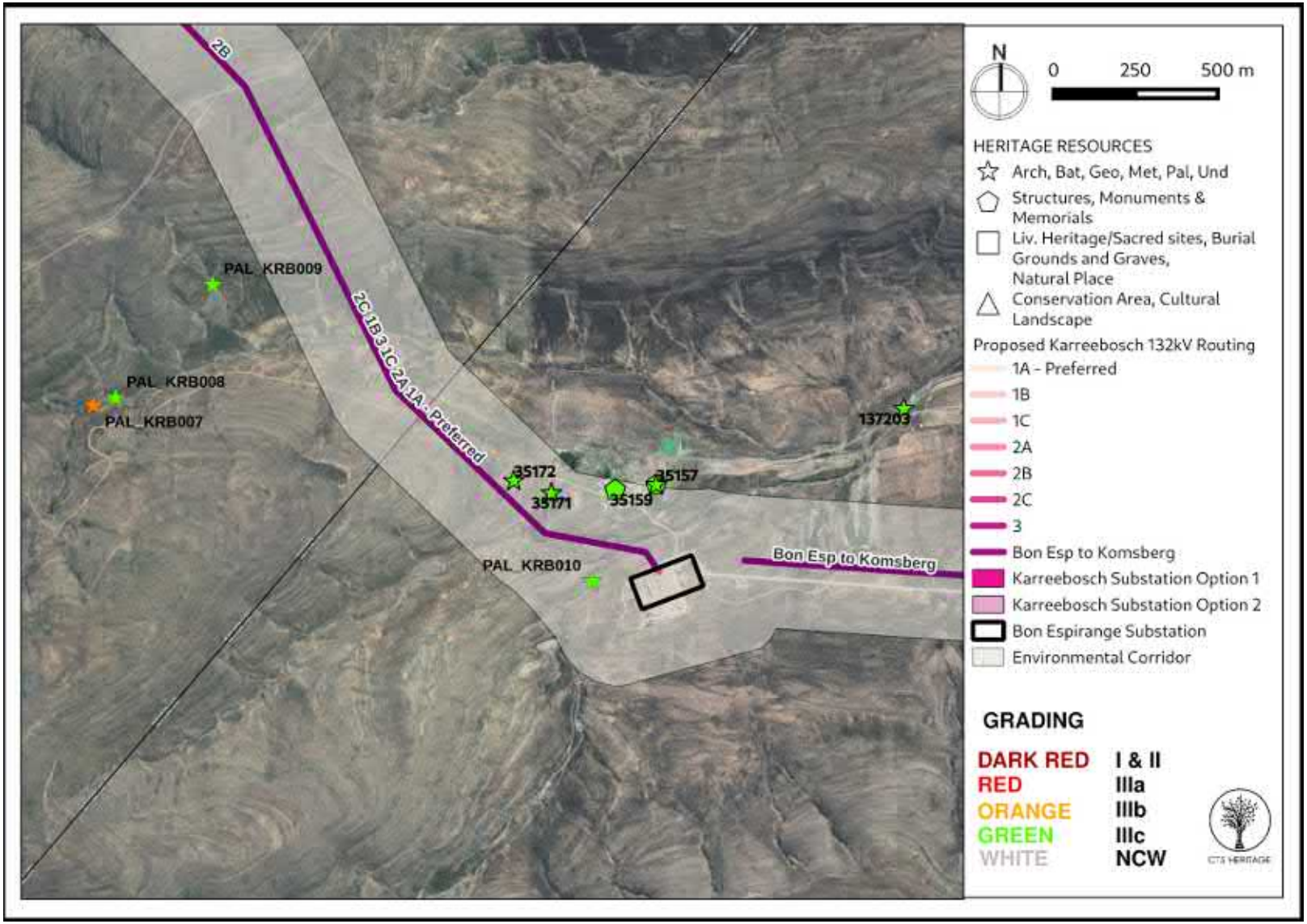

Figure 5.3: Inset B

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

Archaeology

The findings of this field assessment largely correlate with the findings of the Karreebosch HIA (2015) which "*revealed that the study area is relatively austere in terms of pre-colonial heritage, however valley bottoms contain evidence of early trekboer cultural landscapes – ruins, graves and occasional middens. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area.*"

No significant heritage resources were identified in any of the proposed alignment alternatives, with only one LSA chert flake (KRB022) identified within the alignment for Alternative Option 2C. This is likely due to the placement of the proposed powerline alternatives on ridgelines or slopes. It has been previously noted that in this area, it is the valley bottoms that are sensitive in terms of archaeology and heritage resources.

As such, no negative impact to significant archaeological heritage is anticipated and there is no preferred OHL alternative alignment or substation alternative in terms of impacts to archaeological resources.

Palaeontology

Dr Almond notes that "*No fossils were recorded within the Late Caenozoic superficial deposits in the region (colluvium, alluvium etc). The overall palaeosensitivity of the grid connection project area is inferred to be Low. However, the potential for isolated vertebrate and other fossil finds of high scientific interest – as recorded elsewhere in the Klein-Roggeveldberge region - cannot be completely discounted.*

There are no objections on palaeontological grounds to authorisation of the proposed 132 kV powerline and there is no preference on palaeontological heritage grounds for any particular on-site substation option or powerline route option among those currently under consideration. If powerline Option 1B is selected for construction, vertebrate fossil material at or in the vicinity of Locs. 454-456 on Rietfontein RE/197 must be collected by a professional palaeontologist before construction of the powerline. No further specialist palaeontological studies or mitigation are recommended for this electrical infrastructure project. These recommendations and the Chance Fossil Finds Protocol appended to this report should be included in the EMPr for the development."

Dr Almond concludes that "*Based on combined desktop and field-based palaeontological data an overall LOW palaeosensitivity for the Kareebosch WEF and grid connection project areas is inferred here. However, the potential for isolated vertebrate and other fossil finds of high scientific interest - as occasionally recorded elsewhere in the Klein-Roggeveldberge region - cannot be completely discounted.*"

Table 4: Heritage resources impact assessment table for archaeology and palaeontology

	Archaeology		Palaeontology	
CRITERIA	**Before Mitigation**	**After Mitigation**	**Before Mitigation**	**After Mitigation**
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	1	1	4	1
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	1	1	1	1
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	5	5	5	5
Impact Duration (D) The length of permanence of the impact on the environmental receptor	5	5	5	5
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	1	1	3	1
Significance (S) is determined by combining the above criteria: S=(E+D+R+M)xP	**12 Very Low**	**12 Very Low**	**45 Moderate**	**12 Very Low**
Mitigation Recommendations	None		Walkdown of final alignment with approved workplan for collection of sensitive fossil resources that are at risk if Option 1 B is developed Chance Fossil Finds Procedure must be implemented throughout the construction phase of the development	

5.2 Sustainable Social and Economic Benefit

According to the Social Impact Assessment (Barbour and van der Merwe, 2021) completed for the proposed development of the Karreebosch OHL and substation, the primary positive impact anticipated from the approval of the Karreebosch OHL and associated infrastructure is the creation of employment and business opportunities, and the opportunity for skills development and on-site training.

"*The construction phase will extend over a period of approximately 3-6 months and create in the region of 20-30 employment opportunities. The total wage bill will be in the region of R 1.5 million (2021 Rand values). Most of the low and semi-skilled employment opportunities are likely to benefit residents from local towns in the area, including Matjiesfontein, Laingsburg and Sutherland. Most the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a short term positive social benefit in an area with limited employment opportunities. A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in KH and LM.*

The capital expenditure associated with the construction of the power line will be ~18 million (2021 Rand values) and will create opportunities for the local and regional and local economy. The sector of the local economy most likely to benefit from the proposed development is the local service industry. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers on the site. However, given the relatively small scale of the development and short construction period the benefits will be limited."

Additional impacts to be derived include:

- Improve energy security and establishment of energy infrastructure.
- Creation of employment opportunities.
- Generate income for landowners.

The SIA (2021) concludes that "*The energy security benefits associated with the proposed Karreebosch WEF are dependent upon it being able to connect to the national grid via the establishment of grid connection infrastructure. The findings of the SIA indicate that the significance of the potential negative social impacts for both the construction and operational phase of the proposed 132 kV Karreebosch overhead power line are Low Negative with mitigation.*"

Based on the available information, and the finding of this assessment that the impact to heritage resources is likely to be LOW NEGATIVE after mitigation, and acknowledging that the transition to renewable energy is one of South Africa's and UNESCOs Sustainable Development Goals, it is noted that the anticipated negative impacts to

heritage resources resulting from the development, which are negligible, do not outweigh the anticipated socio-economic benefits to be derived from the approval of the project.

5.3 Proposed development alternatives

In terms of impacts to heritage resources, OHL Route Option 1B is NOT preferred from a heritage perspective due to the likely impacts to palaeontological heritage that are anticipated. There are no other OHL or substation alternative preferences from a heritage perspective on condition that the recommendations outlined below are implemented.

There is no objection to the client's preferred alternative of Option 1A and it is supported in terms of impacts to heritage resources. There are no specific mitigation measures that need to flow into the EMPr other than:

- The attached Chance Fossil Finds Procedure must be implemented throughout the construction phase of the development
- Should any buried archaeological resources or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The relevant heritage authority (the South African Heritage Resources Agency (SAHRA) in the Northern Cape and Heritage Western Cape (HWC) in the Western Cape) must be contacted immediately in order to determine an appropriate way forward.

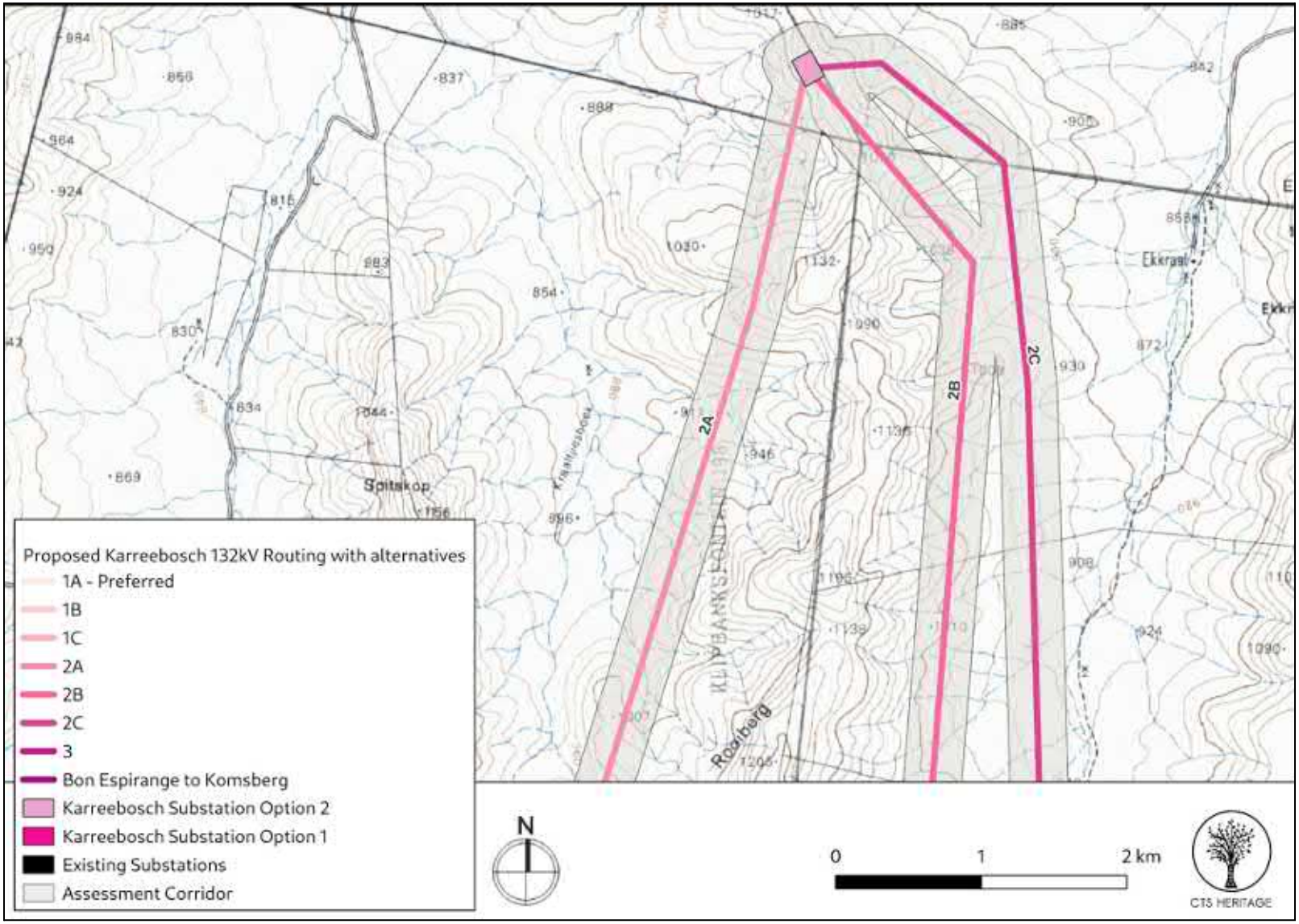

Figure 6.1 Topographic Map of the Study Area 1:50 000 (AZ08) indicating alternatives

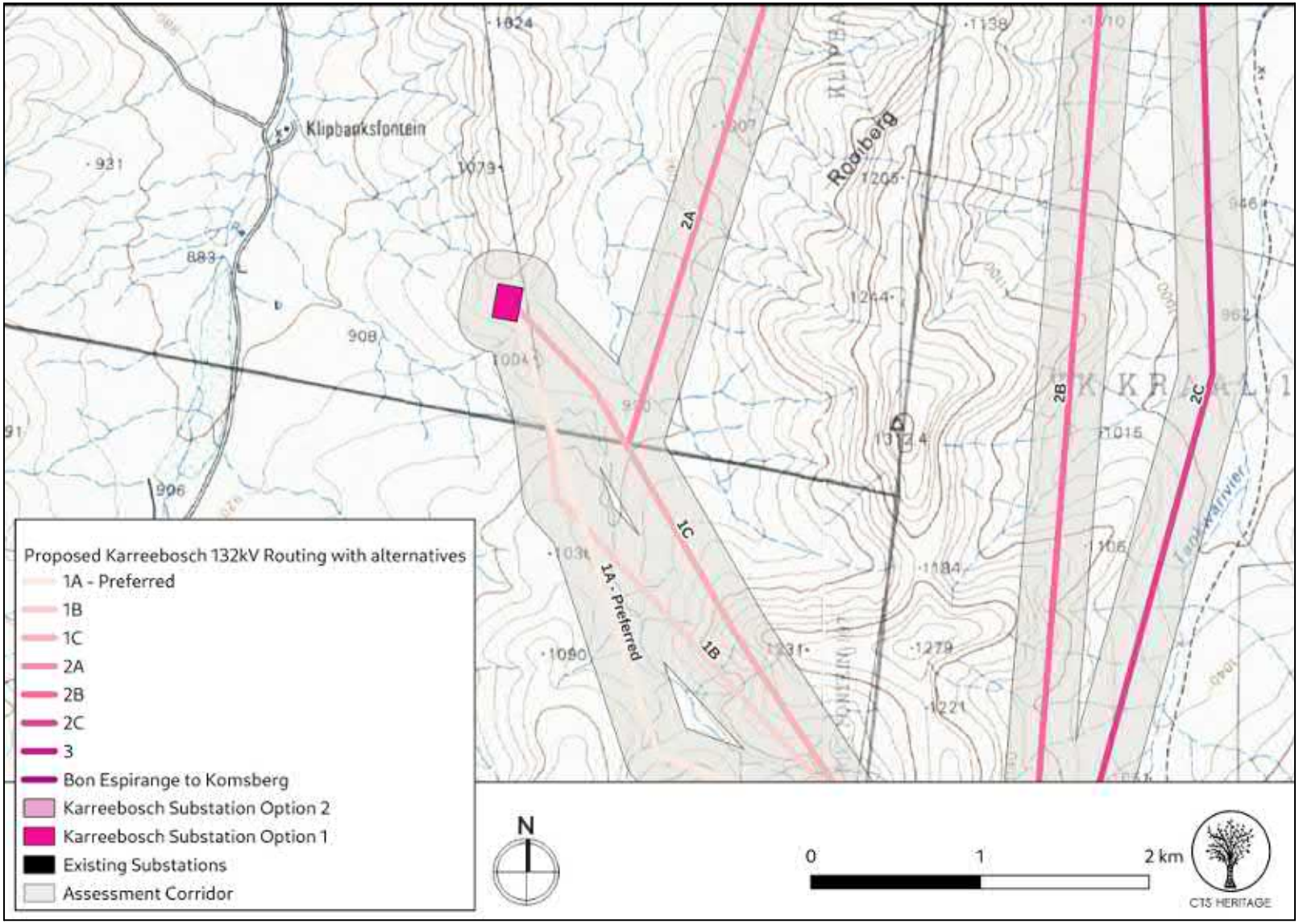

Figure 6.2 Topographic Map of the Study Area 1:50 000 (AZ08) indicating alternatives

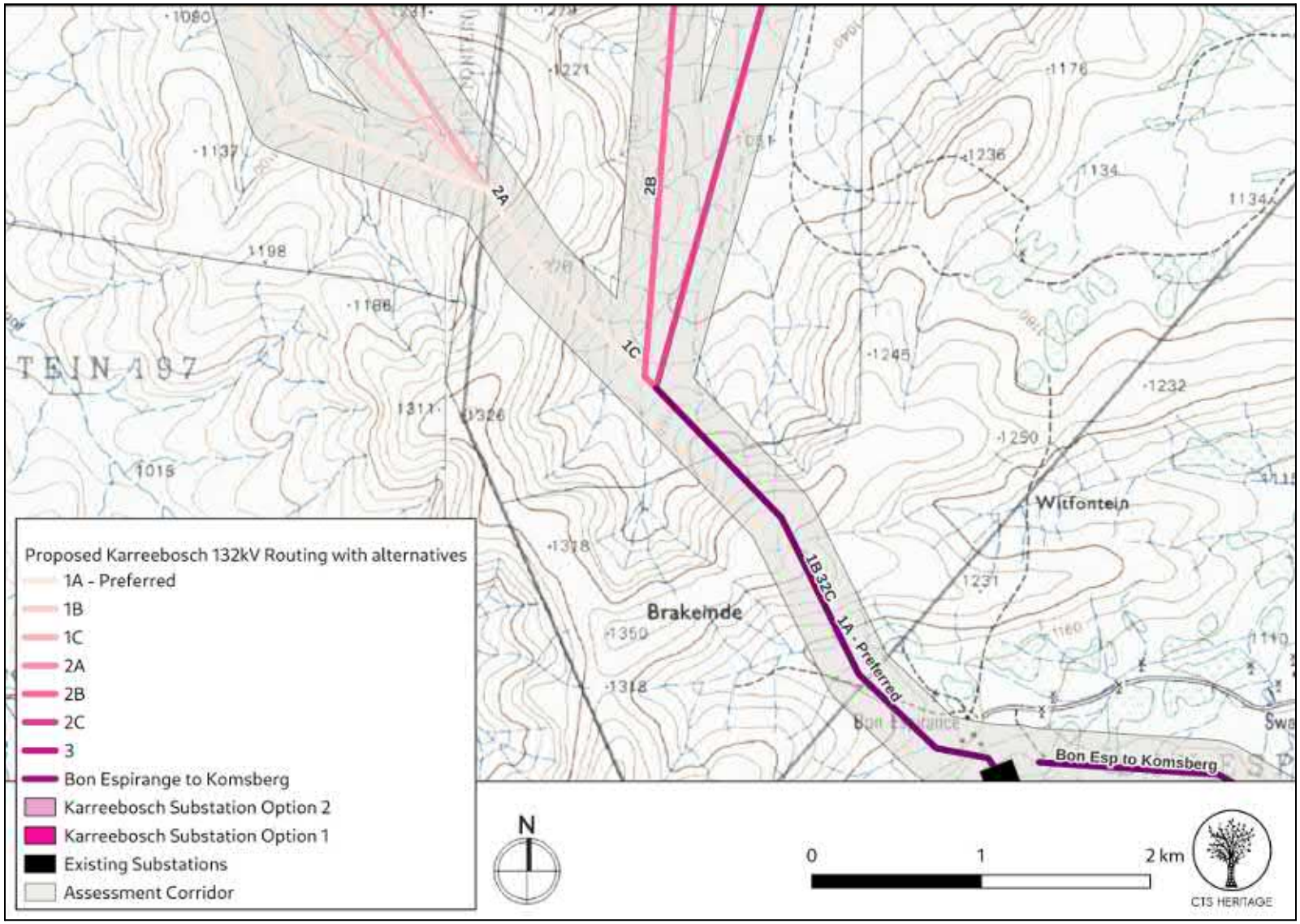

Figure 6.3 Topographic Map of the Study Area 1:50 000 (AZ08) indicating alternatives

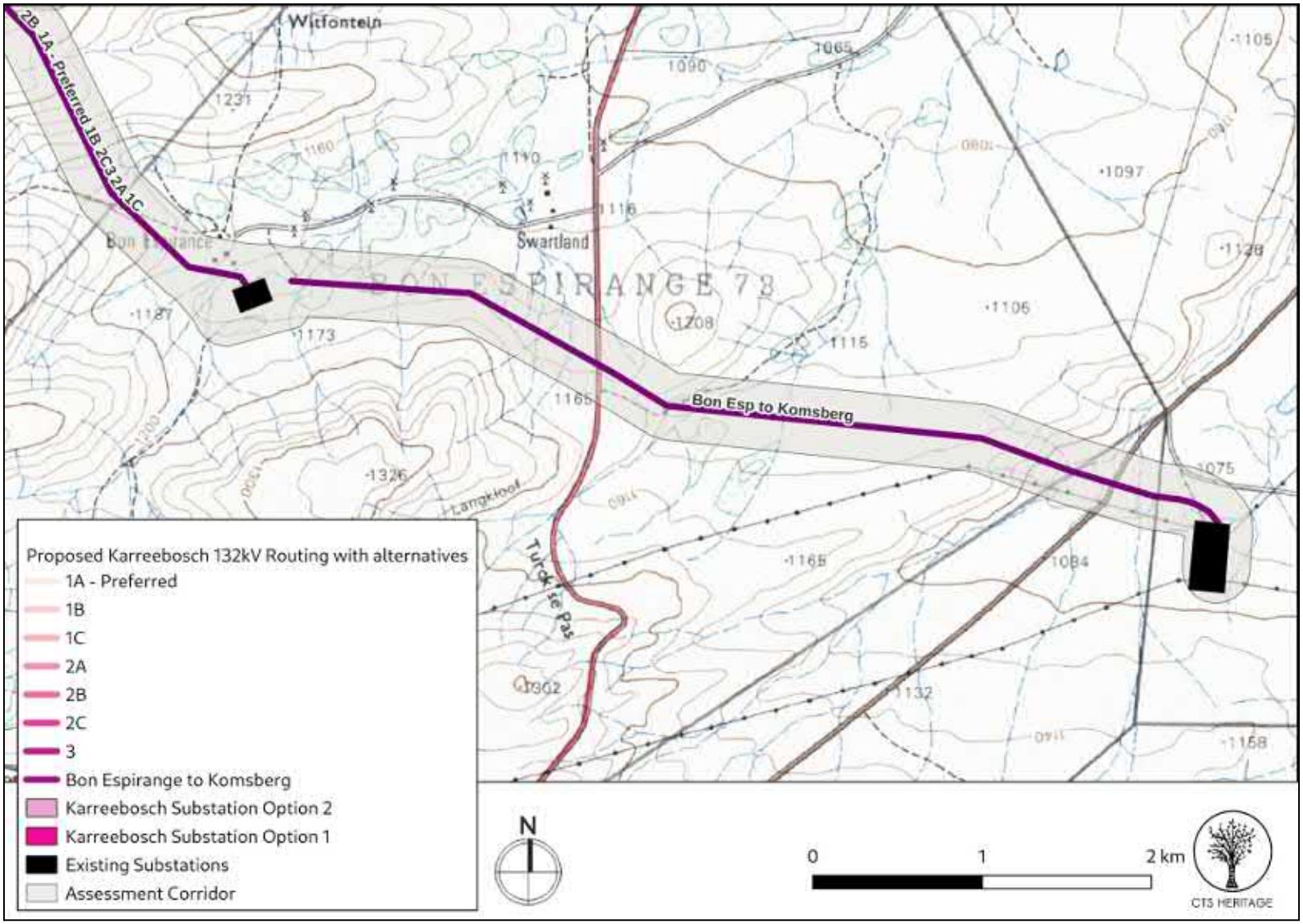

Figure 6.4 Topographic Map of the Study Area 1:50 000 (AZ08) indicating alternatives

5.4 Cumulative Impacts

The proposed Karreebosch OHL and substation will form part of the grid infrastructure required for the approved Karreeboosch WEF development. Furthermore, the proposed grid corridor is located within a belt of approved renewable energy facilities (Figure 7). In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise culturally significant landscape. The proposed grid infrastructure is therefore unlikely to result in unacceptable risk or loss, nor will the proposed development result in a complete change to the sense of place of the area or result in an unacceptable increase in impact.

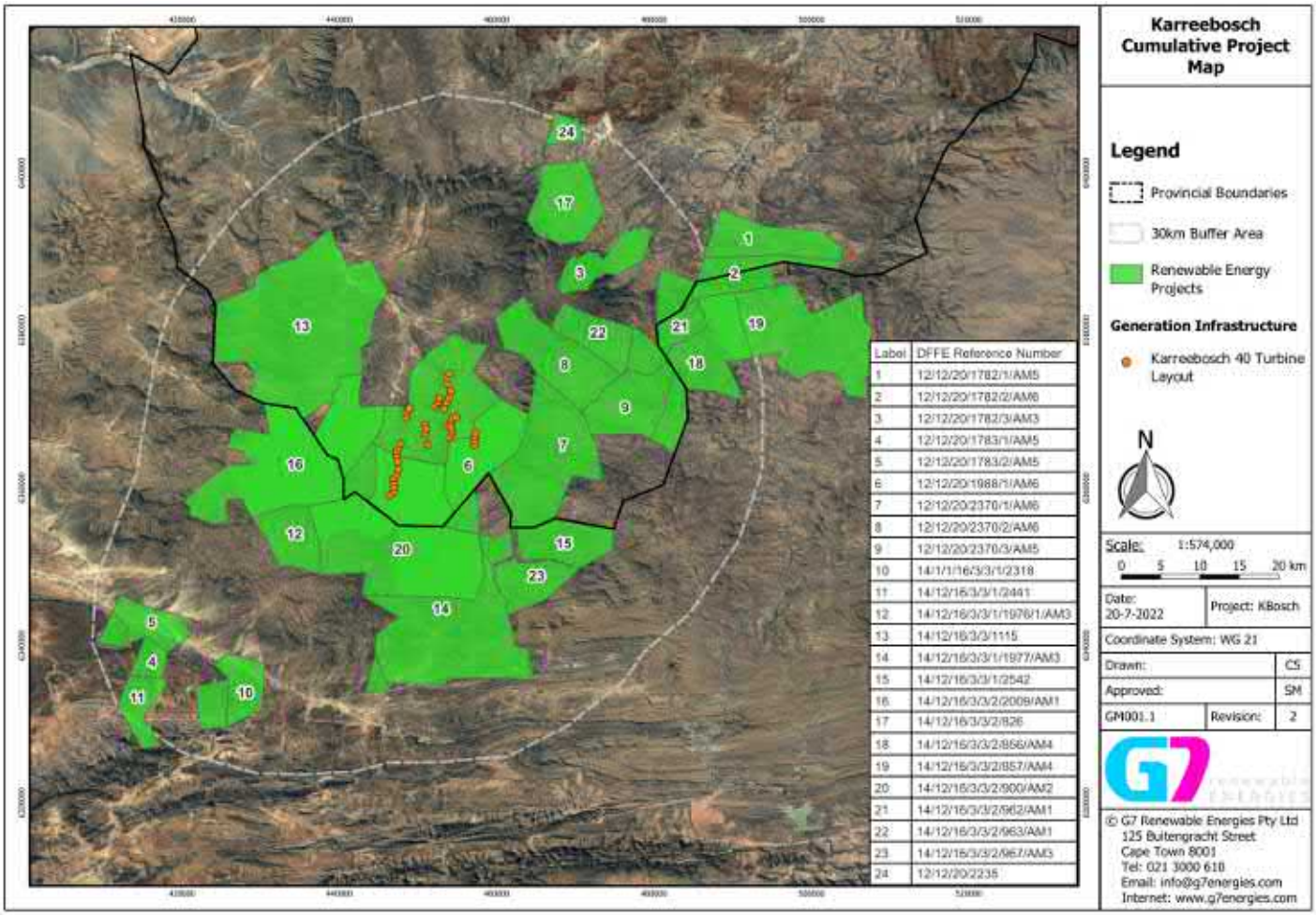

Figure 7: Map indicating renewable energy facilities that have existing environmental authorisation in proximity to the proposed development

6. RESULTS OF PUBLIC CONSULTATION

There are no registered conservation bodies for this area according to the list on the HWC Website (www.hwc.org.za checked September 2021). The local authority will be engaged with as part of the public participation required in terms of NEMA.

The public consultation process will be undertaken by the EAP during the Basic Assessment. No heritage-related comments have been received to-date. HWC is required to comment on this HIA and make recommendations prior to the granting of the Environmental Authorisation. All heritage-related comments will be included in the Comments and Responses Report of the Basic Assessment Report.

7. CONCLUSION

The findings of this field assessment largely correlate with the findings of the ACO in the HIA completed for the Karreebosch WEF (Kendrick, 2015, SAHRIS Ref 183350) and the Roggeveld WEF (Hart and Webley, 2013, SAHRIS Ref 152531). The archaeological resources identified were all *ex situ* and are of limited scientific and heritage significance.

Based on the findings of this and other assessments completed in the area, it is unlikely that the proposed development of the Karreebosch 132kV OHL, 33/132kV on site substation and associated infrastructure will negatively impact significant resources. This is due to the fact that 132kV lines typically have a very small development footprint and can be constructed without the large roads needed to build the WEFs. The routes chosen by the engineers for the various alternatives follow very rugged, mid-slope paths where almost no archaeological material or ruins were found. No significant heritage resources were identified within the areas proposed for the substation alternatives.

It is possible, although unlikely, that archaeological resources may be located beneath the ground surface which may be impacted during the course of development. Recommendations in this regard are included below.

In terms of impacts to palaeontological heritage, Almond (2021) concludes that "*There are no objections on palaeontological grounds to authorisation of the proposed 132 kV powerline and there is no preference on palaeontological heritage grounds for any particular on-site substation site or powerline route option among those currently under consideration. If powerline Option 1B is selected for construction, vertebrate fossil material at or in the vicinity of Locs. 454-456 on Rietfontein RE/197 must be collected by a professional palaeontologist before construction of the powerline. No further specialist palaeontological studies or mitigation are recommended for this electrical infrastructure project. These recommendations and the Chance Fossil Finds*

Protocol appended to this report should be included in the EMPr for the development." It is further recommended that, should Alternative 1B be developed, a walkdown of final alignment must be conducted by a palaeontologist with an approved workplan for the collection of sensitive fossil resources that are at risk. It is further recommended that the attached Chance Fossil Finds Procedure must be implemented throughout the construction phase of the development.

8. RECOMMENDATIONS

There is no objection to the proposed development of the Karreebosch OHL and onsite substation in terms of impacts to heritage resources and there is no preferred alternative for the OHL route or onsite substation on condition that:

- Should OHL Alternative 1B be developed, a walkdown of final alignment must be conducted by a palaeontologist with an approved workplan for the collection of sensitive fossil resources that are at risk.
- The attached Chance Fossil Finds Procedure must be implemented throughout the construction phase of the development
- Should any buried archaeological resources or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The relevant heritage authority (the South African Heritage Resources Agency (SAHRA) in the Northern Cape and Heritage Western Cape (HWC) in the Western Cape) must be contacted immediately in order to determine an appropriate way forward.

9. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
44934	AIA Desktop	Celeste Booth	01/08/2011	An archaeological desktop study for the proposed establishment of the Hidden Valley wind energy facility and associated infrastructure on a site south of Sutherland, Northern Cape Province
44935	AIA Phase 1	Celeste Booth	01/02/2012	A Phase 1 AIA for the proposed HIdden Valley Wind Energy Facility, near Sutherland, Northern cape Province
44936	PIA Desktop	Lloyd Rossouw	01/03/2012	Palaeontological desktop assessment of the proposed Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province
53187	HIA Phase 1	Timothy Hart, Lita Webley	01/03/2011	HERITAGE IMPACT ASSESSMENT PROPOSED WIND ENERGY FACILITY
152531	HIA Phase 1	Timothy Hart, Lita Webley	20/12/2013	Heritage Impact Assessment Report for the Phase 1 Roggeveld Wind Farm
	PIA Phase 1	John Almond	20/12/2013	Palaeontology Impact Assessment Report for the Phase 1 Roggeveld Wind Farm
183350	HIA Phase 1	Natalie Kendrick	27/10/2014	Heritage Impact Assessment for the Karreebosch Wind Farm (Phase 2 Roggeveld Wind Farm)
	PIA Phase 1	John Almond	27/10/2014	Palaeontology Impact Assessment for the Karreebosch Wind Farm (Phase 2 Roggeveld Wind Farm)
353483	AIA Phase 1	Jonathan Kaplan	1/12/2015	ARCHAEOLOGICAL IMPACT ASSESSMENT Proposed borrow pit (Karusa R354) on the Farm Karreebosch 200/1 near Sutherland, Northern Cape Assessment conducted under Section 38 (3) of the National Heritage Resource Act (No. 25 of 1999)

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APPENDICES

APPENDIX 1: Archaeological Assessment (2021, updated July 2022)

ARCHAEOLOGICAL SPECIALIST STUDY

In terms of Section 38(8) of the NHRA for a

Proposed establishment of 132kV powerline and substation to evacuate power from the Karreebosch Wind Energy Facility to the National Grid in the Western and Northern Cape

Prepared by

CTS HERITAGE

In Association with

WSP

August 2021

Updated July 2022

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EXECUTIVE SUMMARY

This application is for the proposed development of a 132kV overhead power line, onsite 33/132kV substation and associated service infrastructure which will connect to the Karreebosch Wind Energy Facility (WEF) to the national grid via the existing Eskom Komsberg substation. The powerline is approximately 20 km long. The project is situated north of the town of Matjiesfontein in the Karoo Hoogland Local Municipality and the Laingsburg Local Municipality in the Northern Cape Province and Western Cape Province.

The findings of this field assessment largely correlate with the findings of the Karreebosch HIA (2015) which "*revealed that the study area is relatively austere in terms of pre-colonial heritage, however valley bottoms contain evidence of early trekboer cultural landscapes – ruins, graves and occasional middens. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area.*"

No significant heritage resources were identified in any of the proposed alignment alternatives, with only one LSA chert flake (KRB022) identified within the alignment for Powerline Alternative Option 2C. This is likely due to the placement of the proposed powerline alternatives on ridgelines or slopes. It has been previously noted that in this area, it is the valley bottoms that are sensitive in terms of archaeology and heritage resources.

As such, no negative impact to significant archaeological heritage is anticipated and there is no preferred alternative alignment or substation in terms of impacts to archaeological resources.

Recommendations

There is no objection to the proposed development of the Karreebosch overhead powerline, substation and associated service infrastructure in terms of impacts to archaeological heritage and there is no preferred alternative on condition that:

- Should any buried archaeological resources or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The relevant heritage authority (the South African Heritage Resources Agency (SAHRA) in the Northern Cape and Heritage Western Cape (HWC) in the Western Cape) must be contacted immediately in order to determine an appropriate way forward.

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CONTENTS

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1. INTRODUCTION

1.1 Background Information on Project

PERMITTING PROCESS

The entire extent of the proposed 132kV Karreebosch Overhead Powerline (OHPL), 33/132kV Substation and associated infrastructure is located within one (1) of the Strategic Transmission Corridors, namely the Central Corridor, as defined in and in terms of the procedures laid out in Government Notice (GN) No. 113. The proposed OHPL project will therefore be subject to a Basic Assessment (BA) Process in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority for this BA process is the national Department of Forestry, Fisheries and Environment (DFFE).

PROJECT LOCATION

The proposed 132kV Karreebosch OHPL, 33/132kV Substation and associated infrastructure is located 35km north of Matjiesfontein, and extends across two provinces, namely the Northern and Western Cape Provinces. The proposed Karreebosch OHPL will extend from the proposed Karreebosch onsite 33/132kV substation, which is situated in Ward 3 of the Karoo Hoogland Local Municipality in the Namakwa District Municipality in the Northern Cape into Ward 2 of the Laingsburg Local Municipality in the Central Karoo District Municipality in the Western Cape Province, where it will connect to the existing 400kV Komsberg substation via the existing Bon Espirange substation.

The proposed Karreebosch OHPL will evacuate power from the authorised Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3, which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process), located in the Northern Cape Province, and will connect to the existing Komsberg substation.

PROJECT INFRASTRUCTURE

OVERHEAD POWERLINE

The OHPL will be a 132kV twin tern double circuit overhead powerline. The powerline towers will either be steel lattice or monopole structures. Pole positions will only be available once the powerline detail design has been completed by the Eskom Design Review Team (DRT). However, a 400m wide assessment corridor is being considered and has been walked down by the specialists for approval to allow for micro siting of tower positions once the detailed design has been completed. It is anticipated that towers will be located on average 200m to 250m apart; however, longer spans may be needed due to terrain and watercourse crossings.

SERVITUDE

A 400m wide OHPL corridor (200m on either side of the centre line) has been assessed by the specialists for the purposes of the Basic Assessment Report (BAR). The registered servitude will fall within this 400m wide assessment corridor and will be 31m wide (15.5 m on either side of the centre line). The Right of Way servitude (servitude road) will be up to 14m wide (7m on either side of the centre line), resulting in a total servitude width of 45m in total. The length of

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the longest powerline route alternative (Option 2C – see "Alternatives" section 5.3) is 20.52 km, which will result in a servitude area of up to 92.3 ha.

The servitude is required to ensure safe construction, maintenance and operation of the powerline. Registration of the servitude grants the operator the right to erect, operate and maintain the powerline and to access the land to carry out such activities, but it does not constitute full ownership of the land. It should be noted that the OHPL will be ceded to Eskom post-construction.

Construction and operation activities and access to the powerline will be carried out with due respect to the affected landowners. The servitude required for the Project will be registered at the Deeds Office and will form part of the title deed of the relevant properties once the environmental authorisation has been obtained.

SUBSTATIONS

The Karreebosch OHPL will be routed from the proposed onsite Karreebosch 33/132kV substation (associated with the approved Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3 which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process)) to the existing Bon Espirange substation, after which it will connect to the existing 400kV Komsberg substation. Two alternative 33/132kV onsite substation locations at the Karreebosch WEF site have been assessed as part of this Basic Assessment process, each with a 200m x 150m (3 ha) footprint. A 200m assessment area surrounding the proposed substation alternatives has been included as part of this assessment for micro siting, with a slight funnel leading into the existing Bon Espirange and Komsberg substations to allow for greater flexibility for micro siting for incoming proposed line connections. The proposed Karreebosch OHPL may require an extension of the existing 400kV Komsberg substation, and therefore, the entire Komsberg substation property has been assessed as part of this Basic Assessment Process.

SITE ACCESS

The OHPL and associated infrastructure will be accessed via roads forming part of the authorised Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3 which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process), where possible. The preferred OHPL routing will require an associated servitude road (following beneath the proposed OHPL) to be constructed which will be used to construct, operate and maintain the powerline. Existing roads will be used as much as possible, where feasible. However, additional access roads may be required to provide access to sections of the powerline route.

New sections of access roads will deviate off existing roads (within the 400m wide assessment corridor), as needed to access tower positions. Access roads will be mostly two-track gravel roads up to 14m in width following beneath the OHPL in order to access tower structures for construction and maintenance purposes.

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1.2 Description of Property and Affected Environment

The proposed routes for the Karreebosch powerline connect up to the existing Komsberg substation in the east and traverse through much of the now complete Roggeveld WEF before following one of two valleys that run in a north to south direction that are separated by a prominent ridge containing a number of proposed turbines for the Karreebosch WEF. Ek Kraal farm lies in much of the eastern valley and Klipbanksfontein lies in the western valley in a more rugged area than Ek Kraal. Only very short sections of the alternatives cross the valley floor and tend to follow the slopes of the ridges that dominate the area. Ek Kraal has small-scale farming activities with very small patches of ground dedicated to crop agriculture along the Tankwarivier in addition to providing grazing for sheep. The valley on the western route over Klipbanksfontein is largely vacant as most of the primary farming occurs in the next valley further west where water supplies are more predictable. Water was running in most of the rivers and streams at the time of the survey but the previous extended drought brought almost all farming activities in the area to the point of closure. A number of abandoned farmhouses and ruins have been documented in the area from previous surveys which confirms the rather precarious state that these farms are in due to the environment.

The region is regarded as semi-arid as it receives limited precipitation. It is located on the border of the summer and winter rainfall regions. Precipitation is in the form of snow and rain in winter, with occasional thunderstorms during the summer. The vegetation cover falls within the Roggeveld Shale Renosterveld of the Karoo Renosterveld Bioregion and consists predominantly of low shrubs and very few trees in this area.

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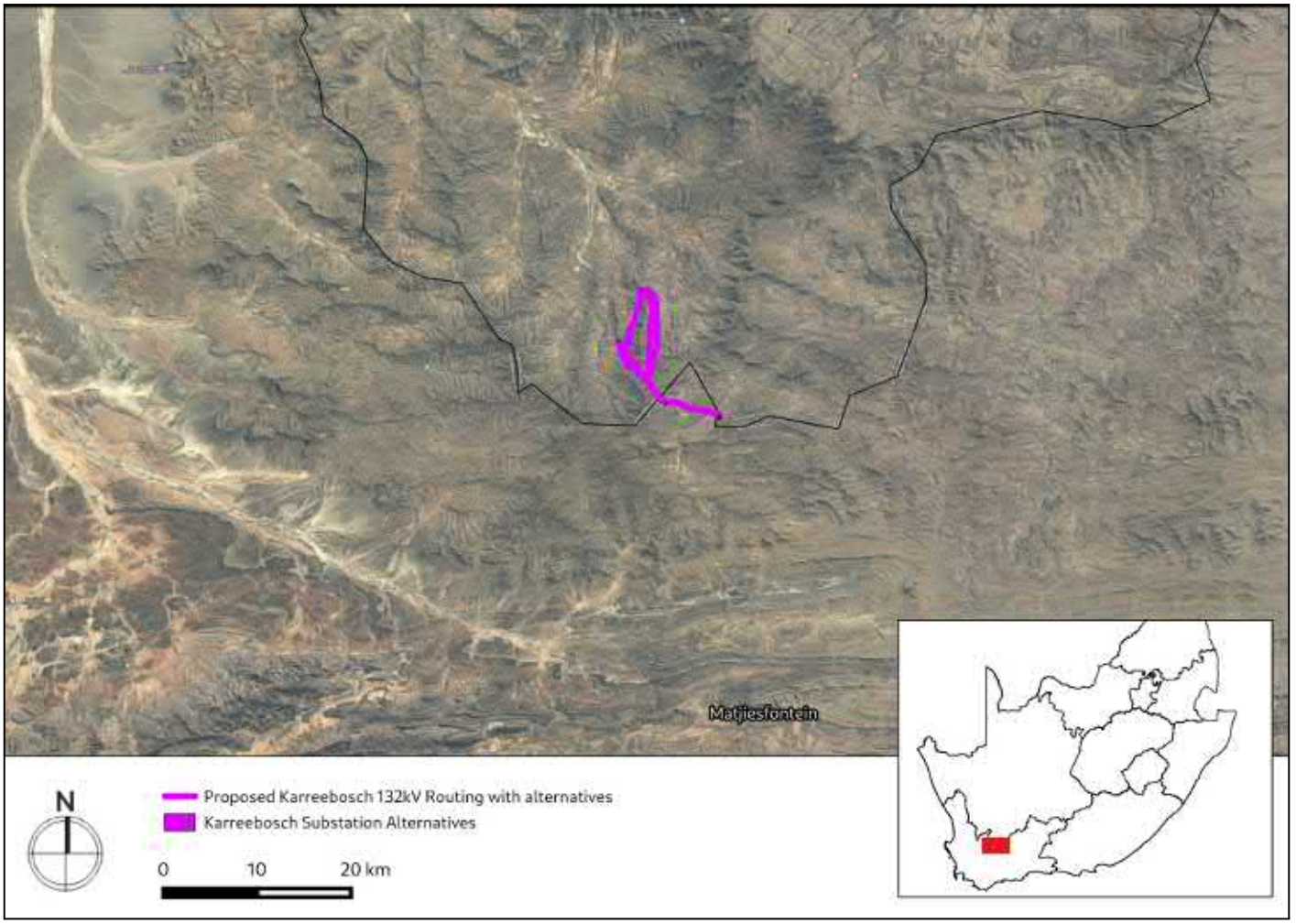

Figure 1.1: Close up satellite image indicating proposed location of study area

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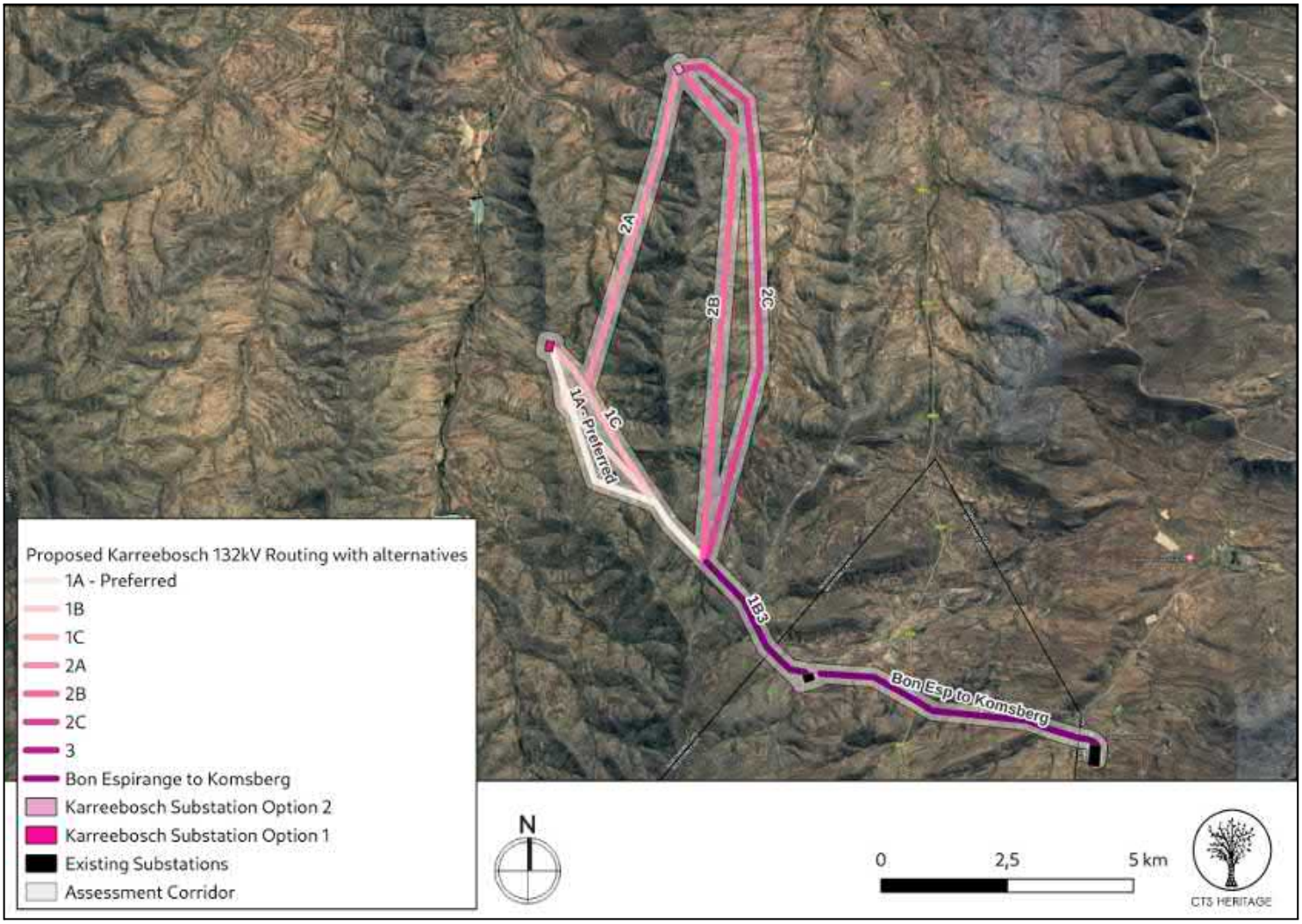

Figure 1.2: Study Area with alternatives indicated

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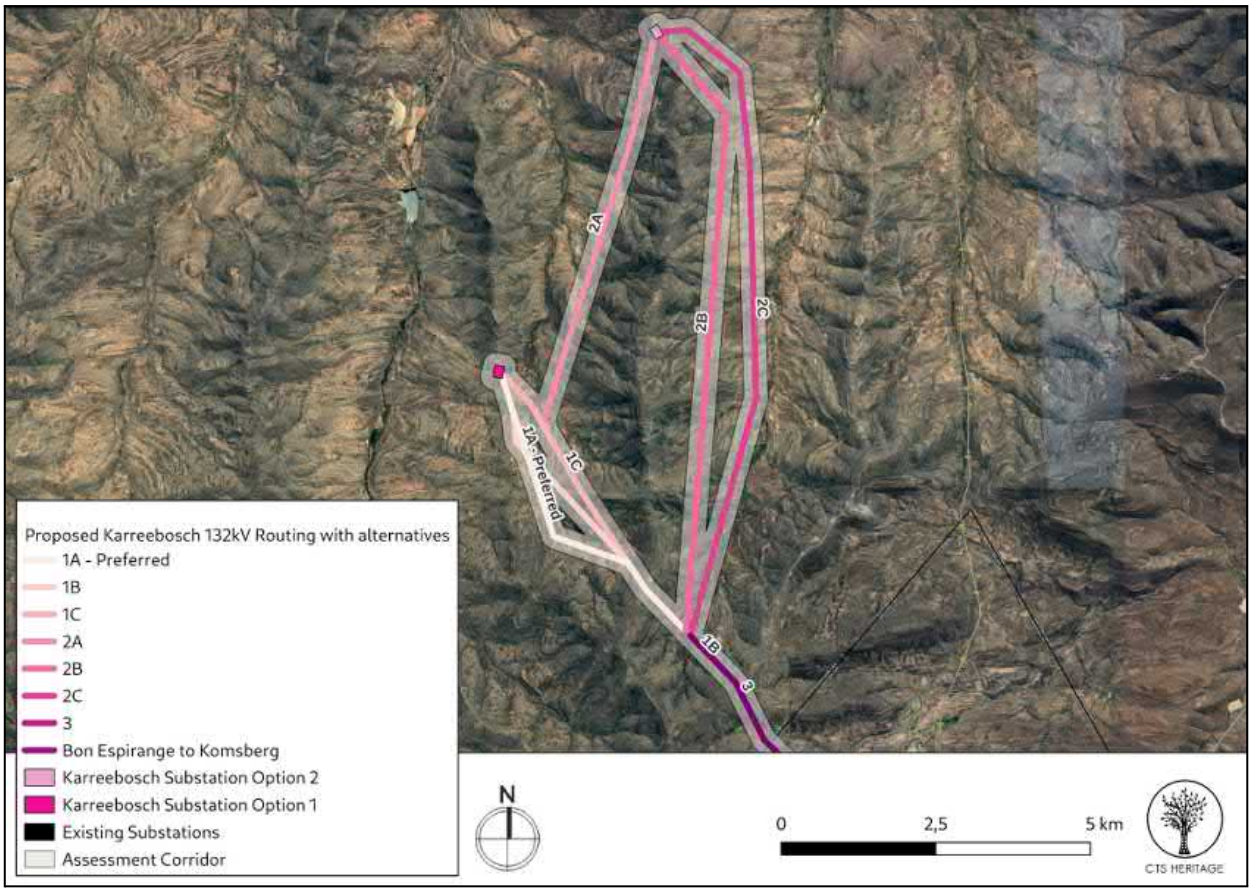

Figure 1.3: Study Area in the Northern Cape

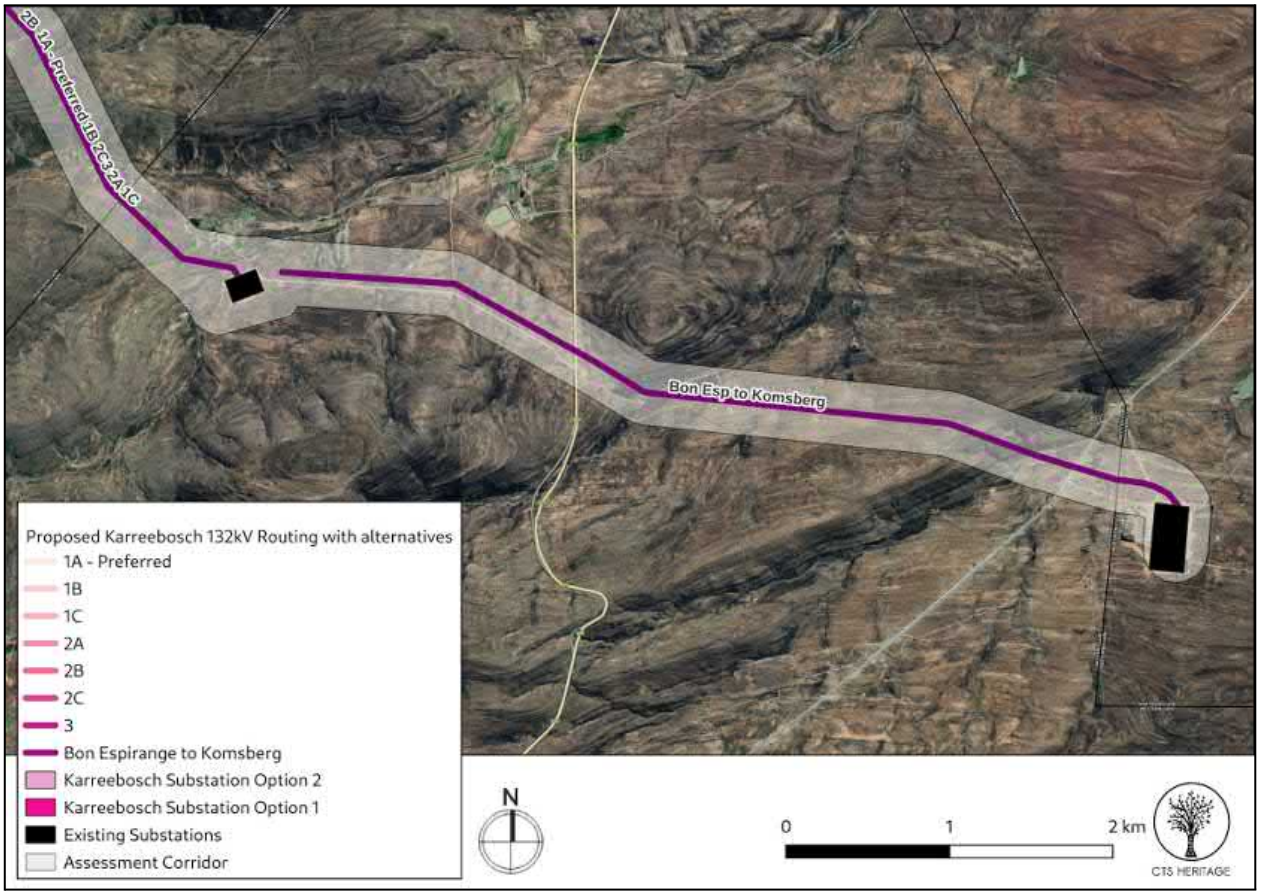

Figure 1.4: Study Area in the Western Cape

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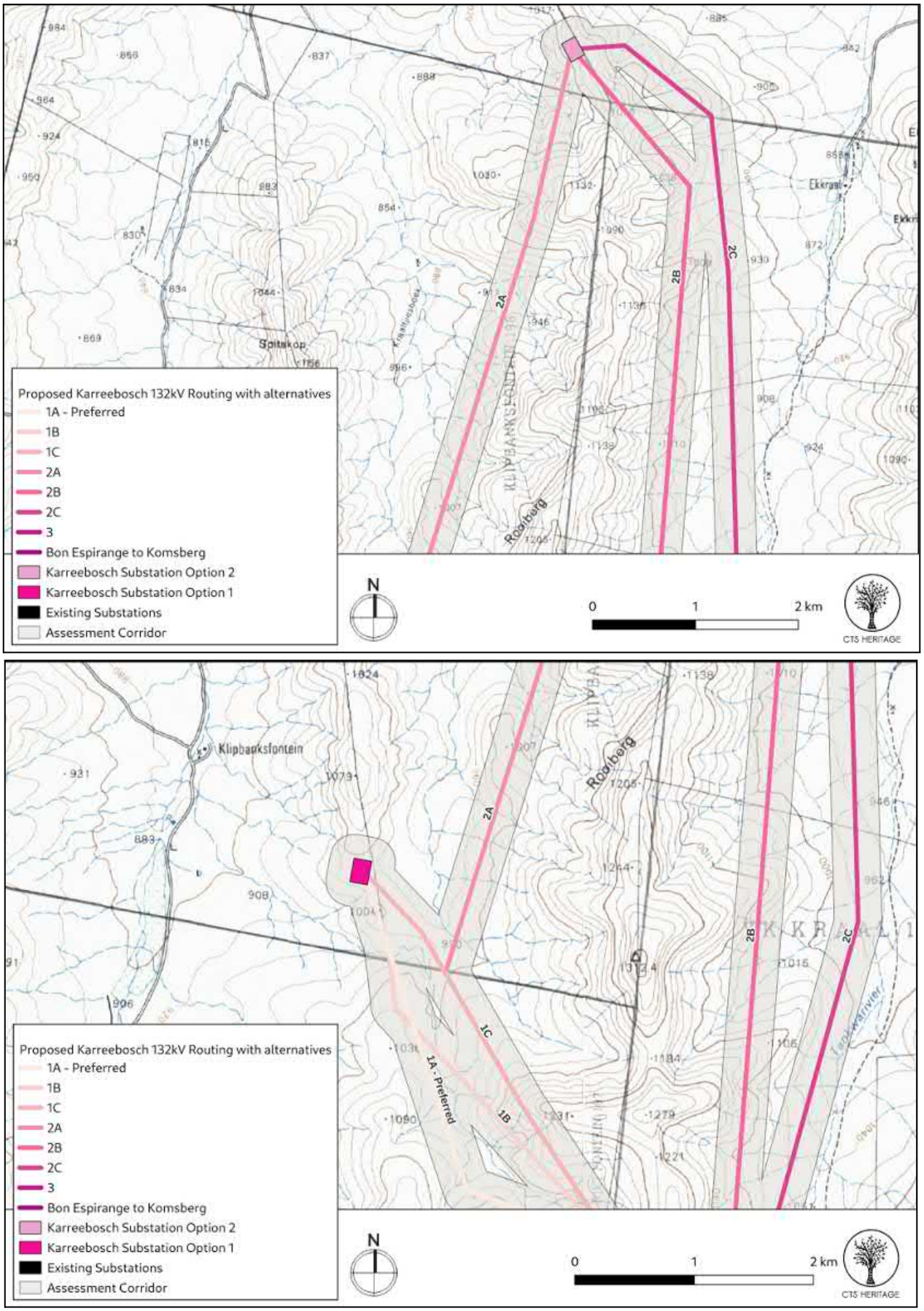

Figure 1.5: Topographic Map of the Study Area 1:50 000 (AZ08)

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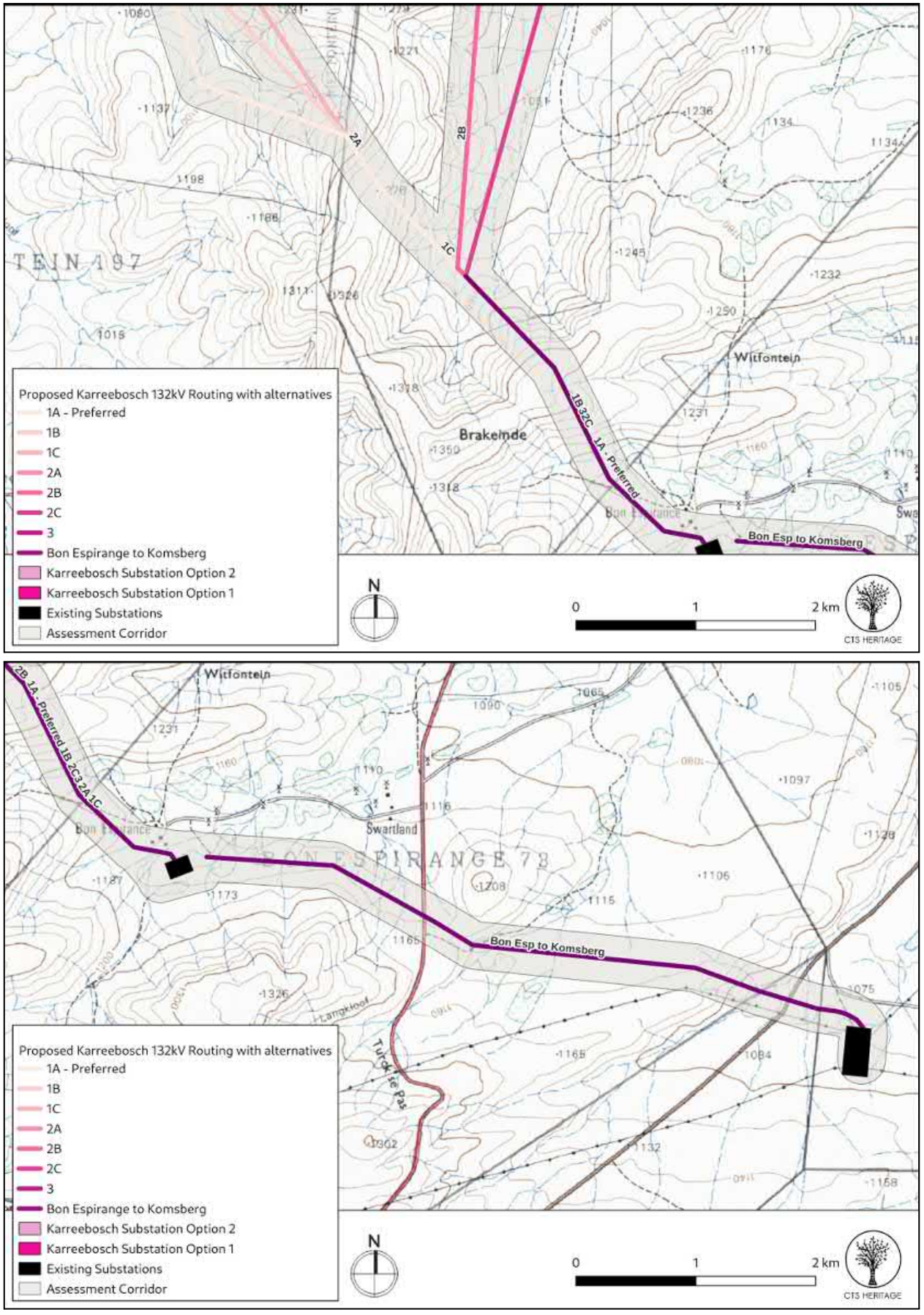

Figure 1.6: Topographic Map of the Study Area 1:50 000 (AZ08)

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2. METHODOLOGY

2.1 Purpose of Archaeological Study

The purpose of this archaeological study is to satisfy the requirements of section 38(8), and therefore section 38(3) of the National Heritage Resources Act (Act 25 of 1999) in terms of impacts to archaeological resources.

2.2 Summary of steps followed

- An archaeologist conducted a survey of the site and its environs on 13 August 2021 to determine what archaeological resources are likely to be impacted by the proposed development.
- The study area was assessed on foot in transects, photographs of the context and finds were taken, and tracks were recorded using a GPS.
- The identified resources were assessed to evaluate their heritage significance in terms of the grading system outlined in section 3 of the NHRA (Act 25 of 1999).
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner.

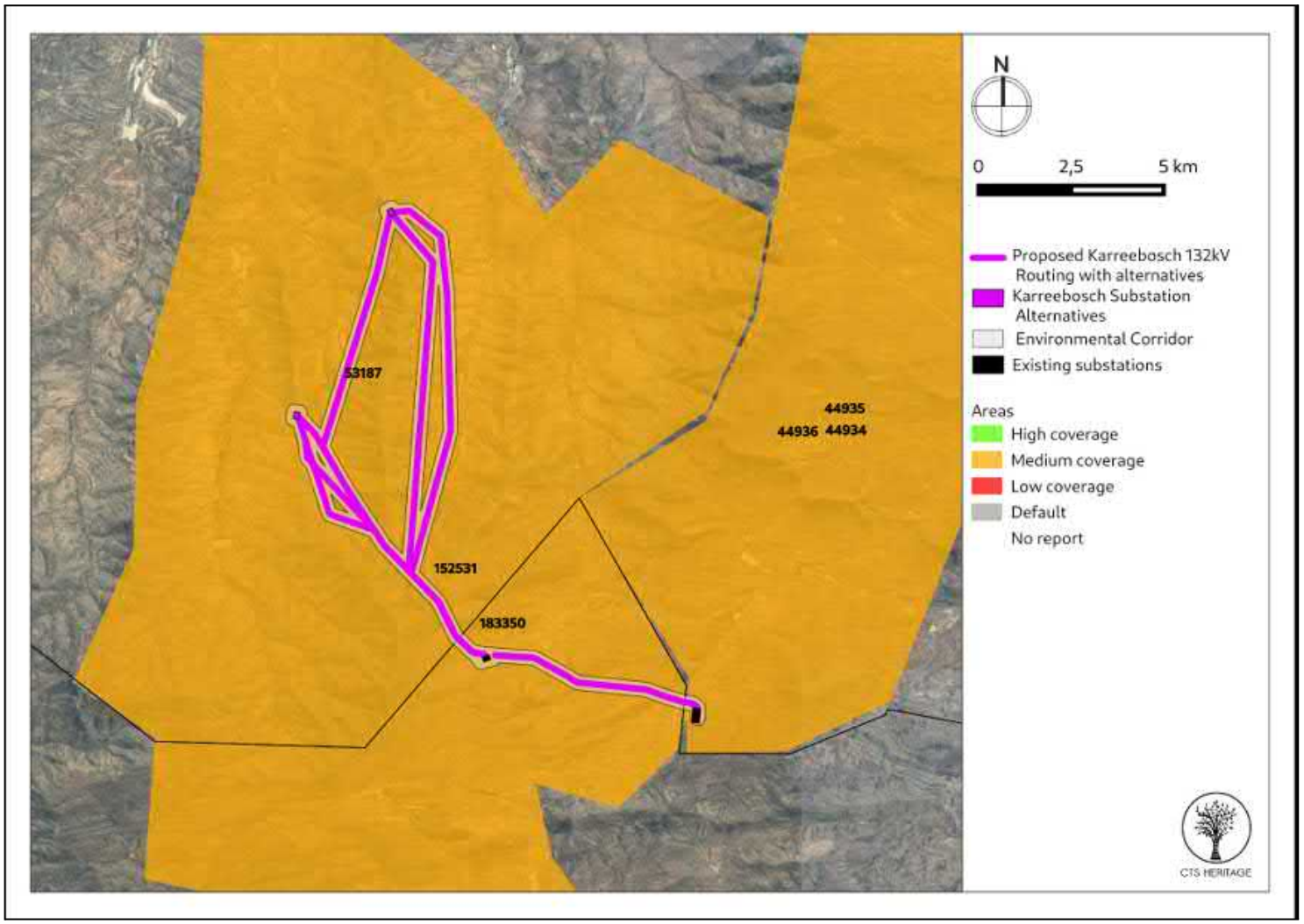

Figure 2: Close up satellite image indicating proposed location of the study area in relation to heritage studies previously conducted

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2.3 Constraints & Limitations

The vegetation did not pose any challenges to the archaeological survey but much of the ground was covered in broken rock and stone eroding down the slopes of the ridges. The placement of the OHL footings predominantly lie along the middle of the slopes en route to and from the tops of the ridges and this resulted in very few archaeological observations.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

This application is for a proposed powerline associated with the approved Karreebosch Wind Energy Facility (WEF) located in both the Western and Northern Cape Provinces (14/12/16/3/3/2/807/AM3). The Karreebosch WEF was previously referred to as Phase 2 of the Roggeveld WEF. SAHRA has made numerous comments on both the Roggeveld WEF and the Karreebosch WEF from 2013 with the last comment issued on 26 September 2018 (Case 7379 on SAHRIS). EA was granted for the Karreebosch WEF on 29 January 2016. In the EA, various requirements were stipulated in terms of impacts to Historical, Cultural and Palaeontological sites. Much of the area proposed for the development of the powerline was assessed as part of the HIA completed for the Karreebosch WEF (Figure 2 above) drafted by the ACO (Kendrick, 2015, SAHRIS Ref 183350). The remaining sections of the proposed powerline were assessed in the Heritage Assessments completed for the Roggeveld WEF (Hart and Webley, 2013, SAHRIS Ref 152531). The heritage information identified in these reports has been extracted and are mapped in Figure 3 below. These reports are also referred to below in order to provide a contextual analysis of the heritage sensitivity of the area proposed for development.

Archaeology and Built Environment Heritage

The area proposed for development has been previously assessed, more than once. In addition, the proposed powerline routes lie immediately adjacent to existing grid infrastructure. The original fieldwork conducted for the Roggeveld WEF HIA (Hart and Webley, 2013) which covered the area proposed for development was comprehensive and remains relevant, similarly the fieldwork conducted for the Karreebosch WEF (2015).

The Karreebosch HIA (2015) "*revealed that the study area is relatively austere in terms of pre-colonial heritage, however valley bottoms contain evidence of early trekboer cultural landscapes – ruins, graves and occasional middens. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area. There are a number of existing farm houses that contain 19th century fabric, however very few of these have anything more than moderate heritage significance. Parts of the study area enjoy very high aesthetic qualities with the area known by locals as "Gods Window" having grade II aesthetic qualities, hence the significance of the study area lies mainly with its undeveloped wilderness qualities. Interestingly, pre-colonial or stone age heritage and archaeology is extremely scarce in the areas that were searched. Very few archaeological sites of these kinds were recorded despite the fact that overall 9 experienced archaeologists were involved in scouring the landscape.*"

The HIA for the Karreebosch WEF (2015) notes that "*The most important colonial archaeological sites in the study area*

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are associated with Ekkraal Valley, the Rietfontein-Wilgebosch River valley and the Krans Kraal-Karrekraal valley. The valley bottoms are archaeologically sensitive…". As the proposed powerline alternatives traverse the valley areas which have been determined to be archaeologically sensitive, it is likely that significant archaeological heritage resources may be impacted by the proposed development.

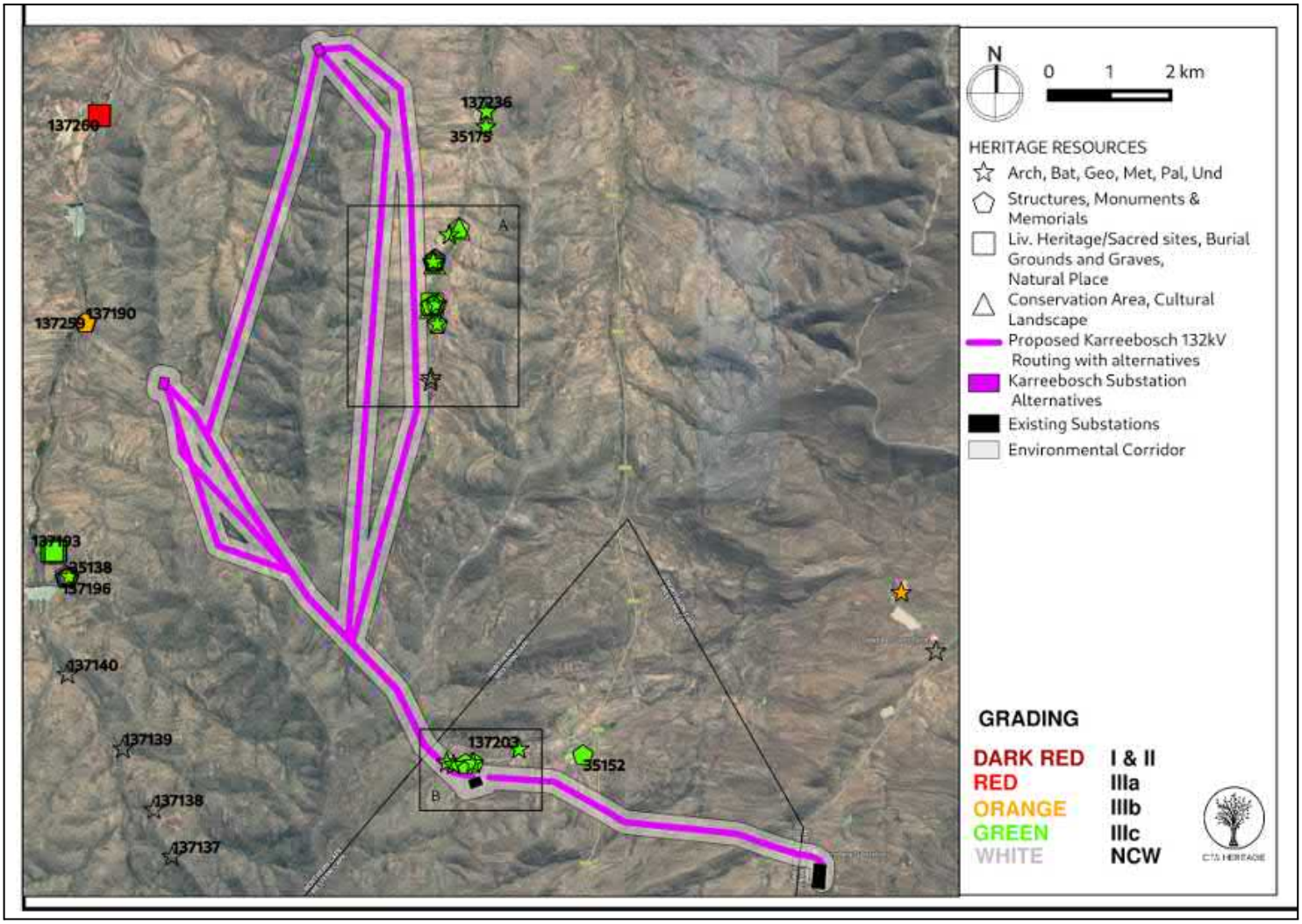

Figure 3. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated (see Heritage Screening Assessment for insets)

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4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Field Assessment

Very few archaeological resources were identified during the archaeological field assessment completed for the proposed OHL and substation development. The resources that were identified were all single artefact occurrences or low density artefact scatters, none of which were determined to have any scientific cultural value.

While the survey of the Karreebosch OHL and substation must be taken in context with the broader assessments of the wind farm that has necessitated the development of the OHL and substations, the findings were particularly limited due to the alignment of the OHL. 132kV lines which typically have a very small development footprint and can be constructed without the large roads needed to build the WEFs. The routes chosen by the engineers for the various alternatives follow very rugged, mid-slope paths where almost no archaeological material or ruins were found. Where archaeological material was found, lithics consisted of local quartzites used to manufacture Middle and Later Stone Age flakes as well as cherts that were sourced in the more general region such as the Tanqua and Ceres Karoo by people in the Later Stone Age.

There have now been a rather large number of studies conducted for the various WEFs between Sutherland, Matjiesfontein, Laingsburg and the Ceres Karoo which have greatly improved our understanding of the Stone Age and historical settlement patterns in this area. Rock art sites are rare where suitable surfaces are not found in abundance near the valley floors. Isolated Stone Age material from the Middle to the Later Stone Age is found in very low numbers on the ridges, particularly the more accessible ones. We hypothesize that these were used as lookout/observation areas by hunter-gatherers as no evidence of larger campsites were found on the ridges. The historical farms have left a more obvious trace on the valley floors where arable land was taken up for agriculture during the last couple of hundred years. This is also the ground where most of the evidence for Later and Middle Stone Age occupation areas were found.

Figure 4.1: Contextual Images taken from the northern-most point of the proposed line alternatives

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Figure 4.2: Contextual Images taken from the northern-most point of the proposed line alternatives

Figure 4.3: Contextual Images taken from the ridge between Options 2A and 2B

Figure 4.4: Contextual Images taken from the substation location in the west (Option 1) with existing turbines visible on the ridgeline

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Figure 4.5: Contextual Images taken from the farm werf at Figure 3 inset B and Figure 8.3

Figure 4.6: Contextual Images taken from the alignment running north-west to south-east indicating turbines under construction

Figure 4.7: Contextual Images taken from the alignment running north-west to south-east indicating existing turbines at Roggeveld WEF

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Figure 4.8: Contextual Images taken from the alignment running north-west to south-east indicating existing turbines at Roggeveld WEF

Figure 4.9: Contextual Images taken from the alignment running north-west to south-east indicating existing powerlines

Figure 4.9: Contextual Images taken from the alignment running north-west to south-east indicating existing powerline infrastructure

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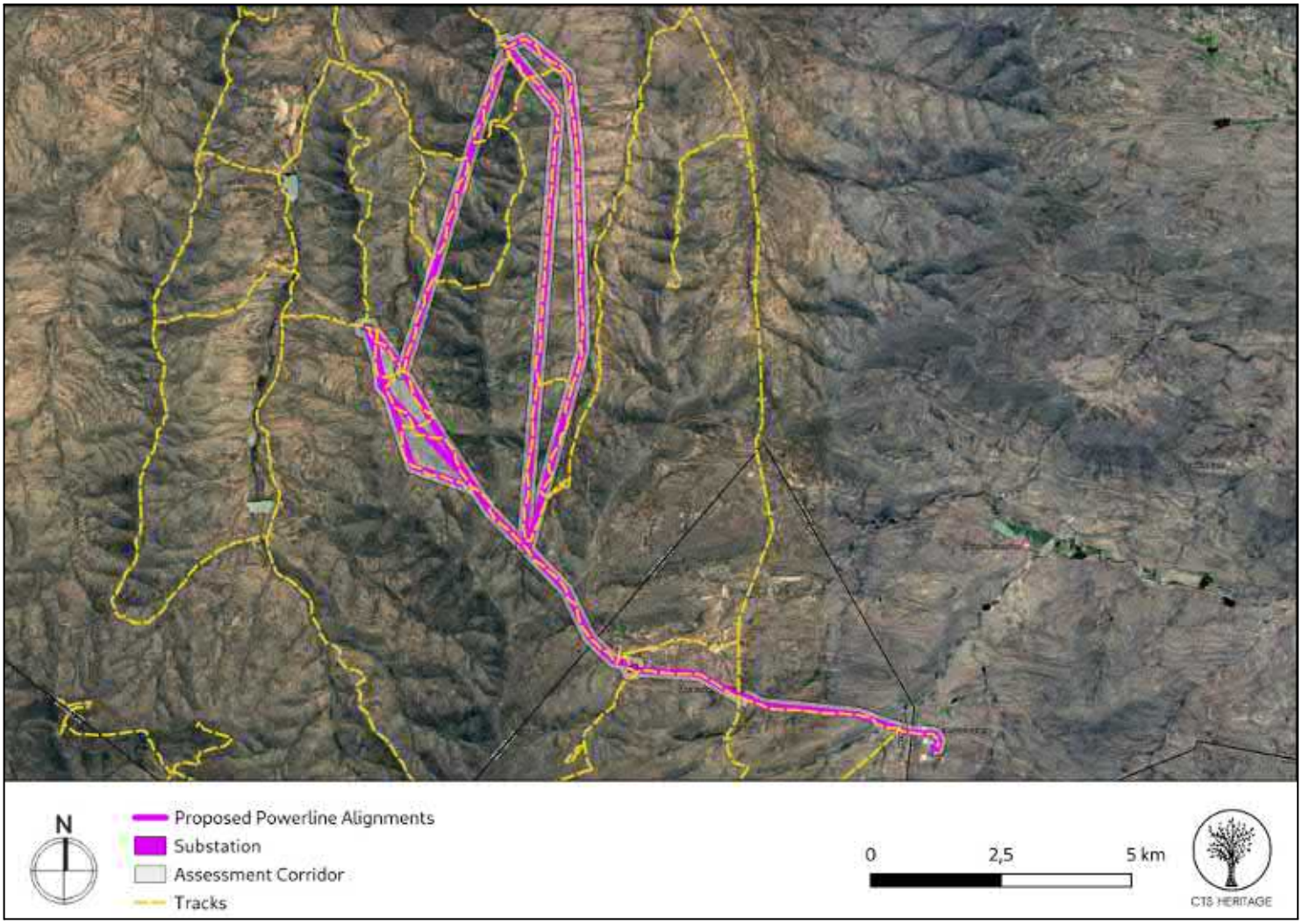

Figure 5: Overall track paths of foot survey

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4.2 Archaeological Resources identified

Table 2: Observations noted during the field assessment

Site No.	Site Name	Description	Co-ordinates		Grading	Mitigation
KRB017	Karrebosch 017	Quartzite flakes, thinly struck, prep. Platforms, MSA. Near valley floor; cores and flakes, knapping and production site	-32.85936	20.47184	NCW	NA
KRB018	Karrebosch 018	Chert flake, LSA. On top of ridge.	-32.84809	20.44152	NCW	NA
KRB019	Karrebosch 019	Quartzite flake, MSA	-32.84897	20.44073	NCW	NA
KRB020	Karrebosch 020	Quartzite flake, MSA	-32.86418	20.43635	NCW	NA
KRB021	Karrebosch 021	Chert and quartz flakes, lower grindstone near wind pump, LSA	-32.90585	20.44082	NCW	NA
KRB022	**Karrebosch 022**	**Chert flake, LSA**	**-32.88297**	**20.517862**	**NCW**	**NA**

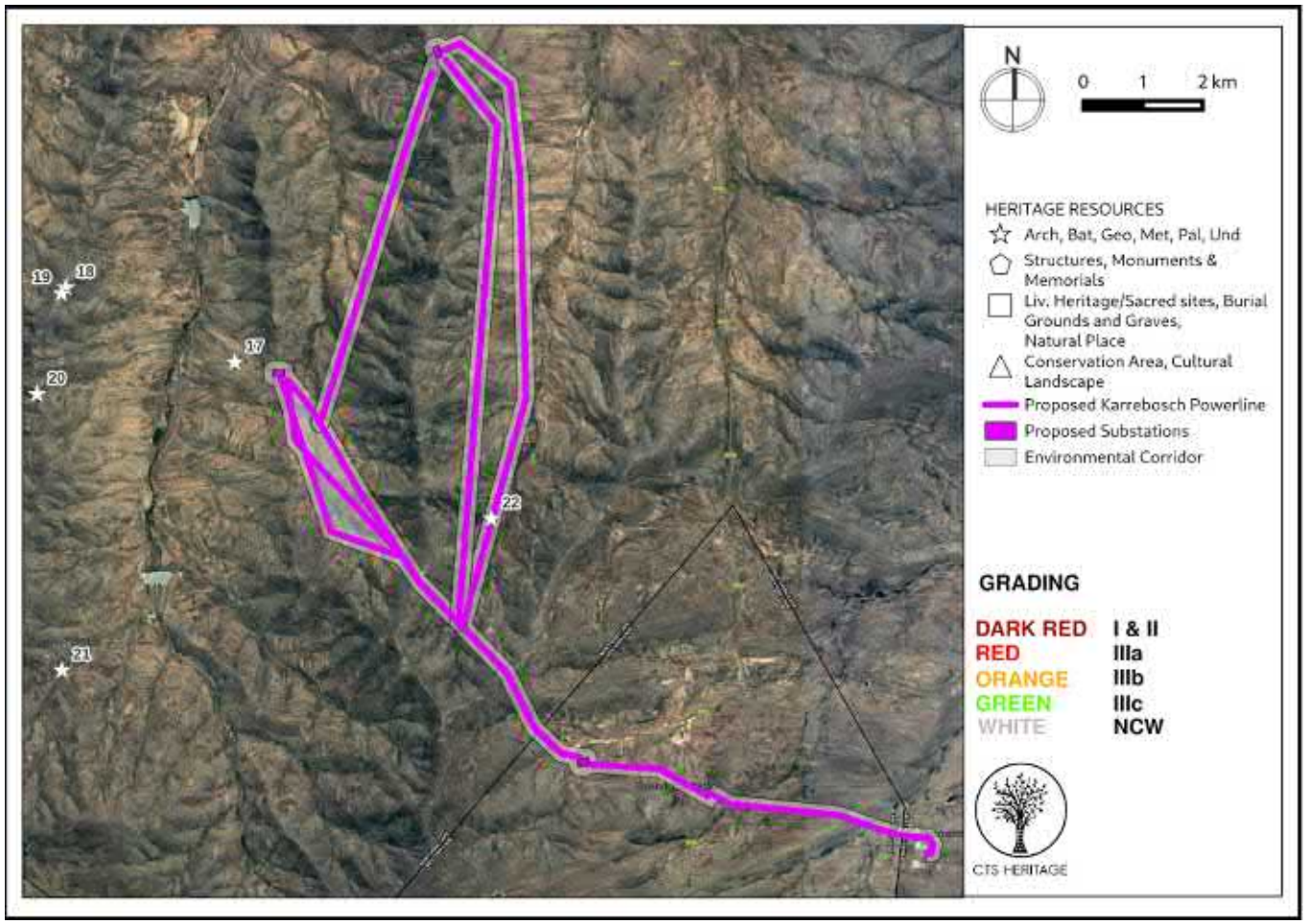

Figure 6: Map of field observations relative to the proposed development

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4.3 Selected photographic record

(a full photographic record is available upon request)

Figure 7.1: KRB017

Figure 7.2: KRB017

Figure 7.3: KRB017

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Figure 7.4: KRB018

Figure 7.5: KRB019

Figure 7.6: KRB020

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Figure 7.7: KRB021

Figure 7.8: KRB022

Figure 7.9: KRB022

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5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

The findings of this field assessment largely correlate with the findings of the Karreebosch HIA (2015) which "*revealed that the study area is relatively austere in terms of pre-colonial heritage, however valley bottoms contain evidence of early trekboer cultural landscapes – ruins, graves and occasional middens. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area.*"

No significant heritage resources were identified in any of the proposed OHL alignment alternatives or substation alternatives, with only one LSA chert flake (KRB022) identified within the alignment for OHL Alternative Option 2C. This is likely due to the placement of the proposed powerline alternatives on ridgelines or slopes. It has been previously noted that in this area, it is the valley bottoms that are sensitive in terms of archaeology and heritage resources.

As such, no negative impact to significant archaeological heritage is anticipated and there is no preferred OHL alternative alignment or substation in terms of impacts to archaeological resources.

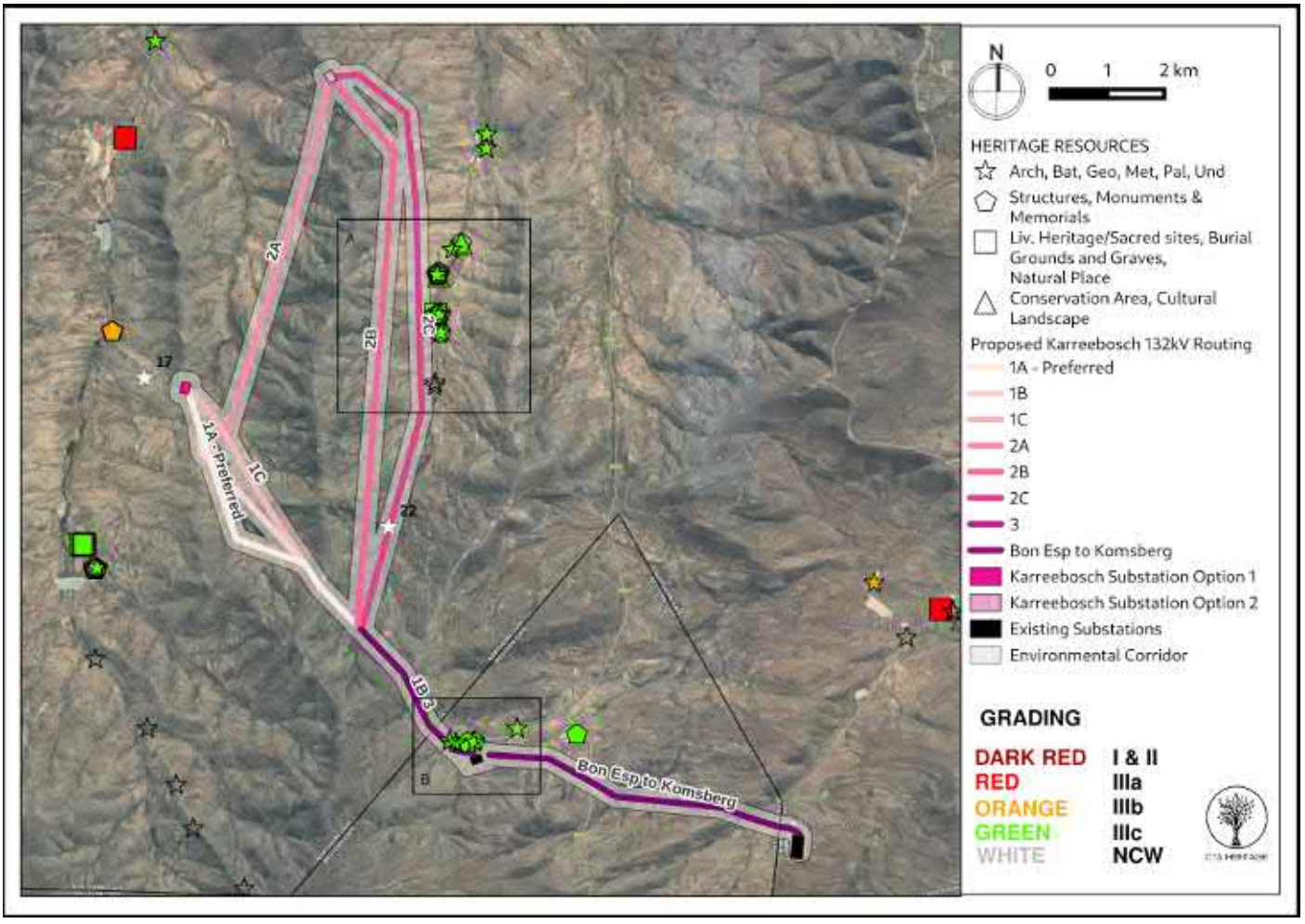

Figure 8.1: Map of all known heritage resources relative to the study area and associated archaeological sensitivity

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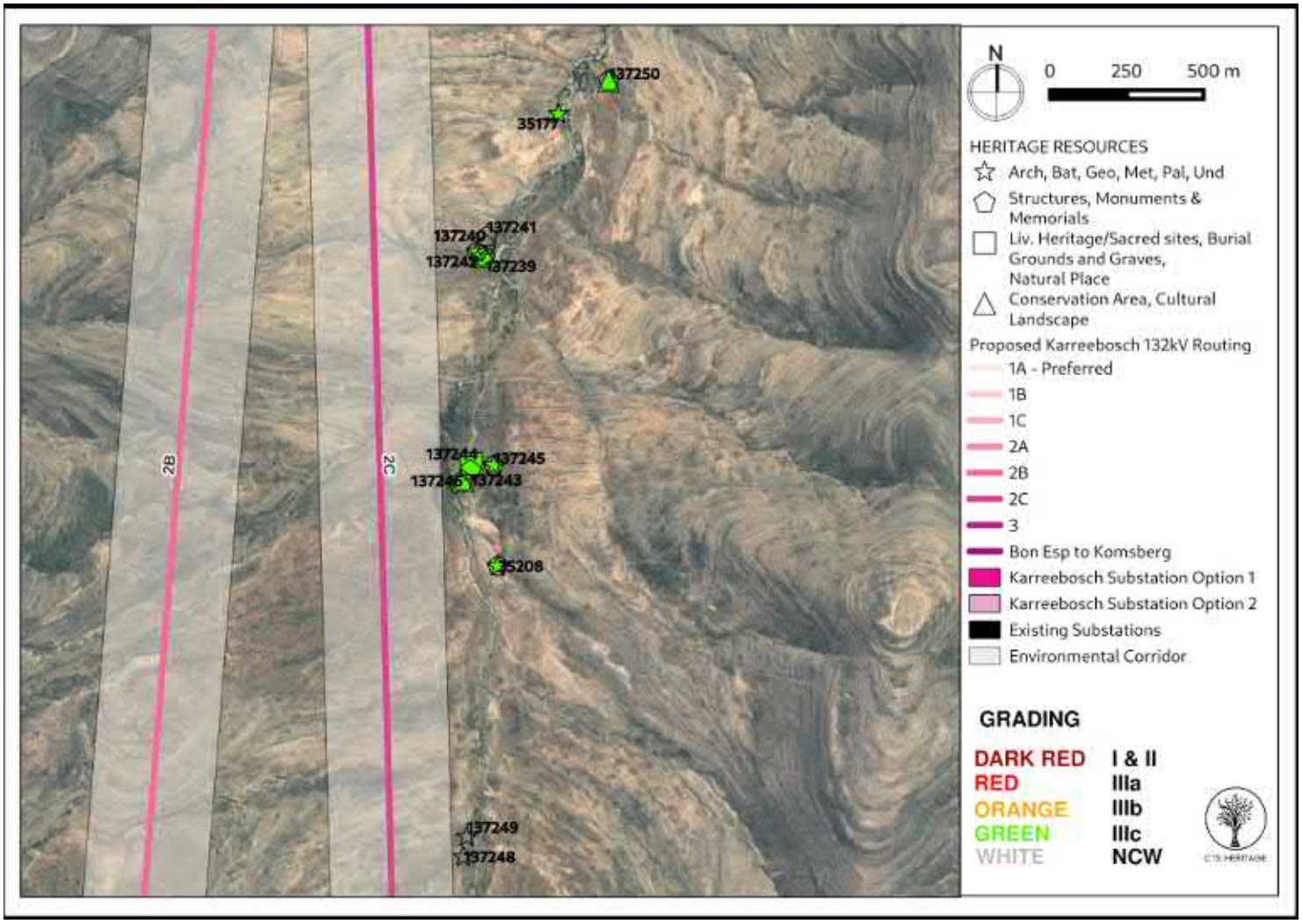

Figure 8.2: Inset A

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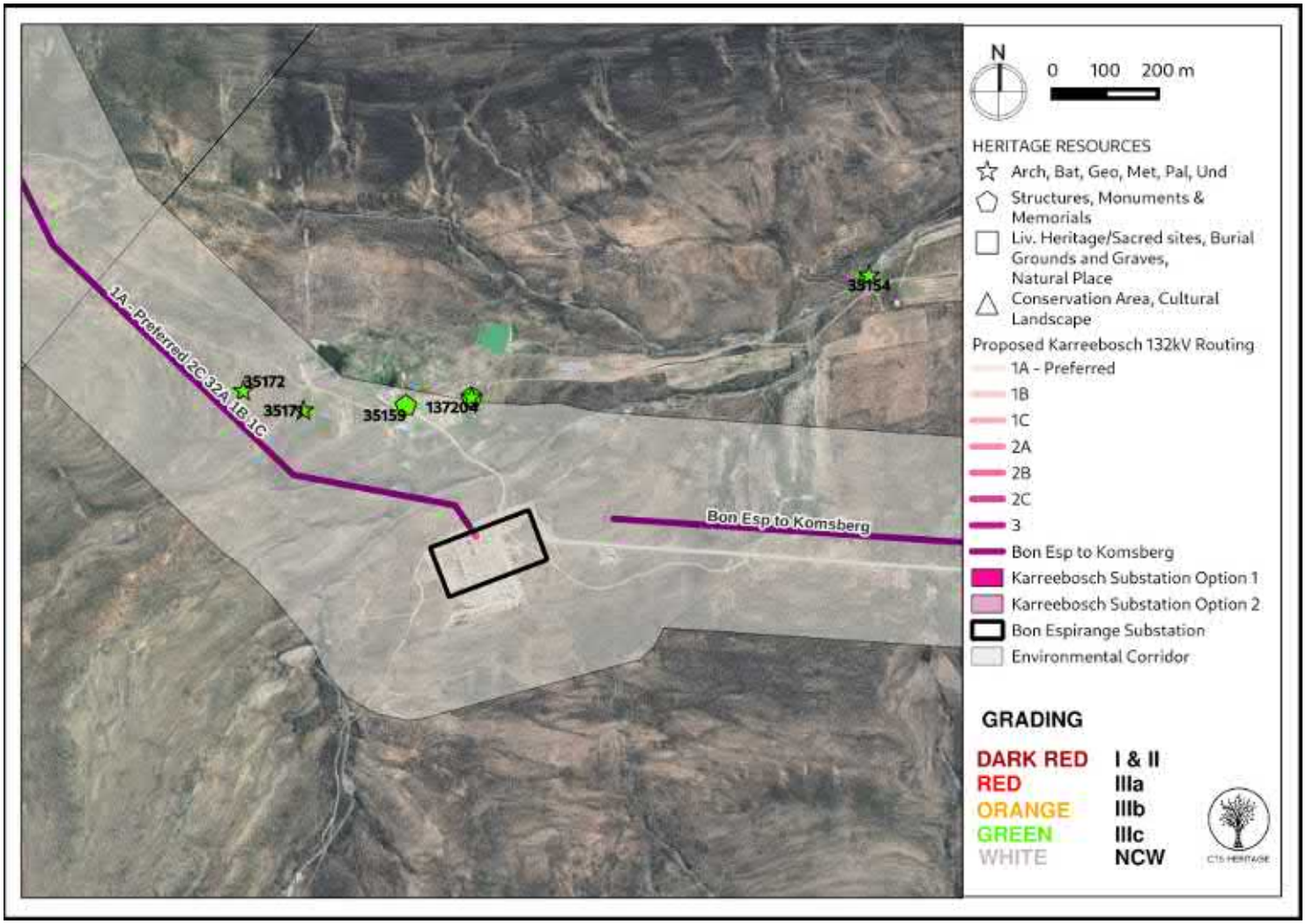

Figure 8.3: Inset B

6. CONCLUSION AND RECOMMENDATIONS

The findings of this field assessment largely correlate with the findings of the ACO in the HIA completed for the Karreebosch WEF (Kendrick, 2015, SAHRIS Ref 183350) and the Roggeveld WEF (Hart and Webley, 2013, SAHRIS Ref 152531). The archaeological resources identified were all *ex situ* and are of limited scientific and heritage significance.

Based on the findings of this and other assessments completed in the area, it is unlikely that the proposed development of the OHL, substation and associated road infrastructure will negatively impact significant resources. This is due to the fact that 132kV lines typically have a very small development footprint and can be constructed without the large roads needed to build the WEFs. The routes chosen by the engineers for the various alternatives follow very rugged, mid-slope paths where almost no archaeological material or ruins were found.

It is possible, although unlikely, that archaeological resources may be located beneath the ground surface which may be impacted during the course of development. Recommendations in this regard are included below.

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Recommendations

There is no objection to the proposed development of the Karreebosch overhead powerline, substation and associated road infrastructure in terms of impacts to archaeological heritage and there is no preferred alternative for both the OHL or substation on condition that:

- Should any buried archaeological resources or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The relevant heritage authority (the South African Heritage Resources Agency (SAHRA) in the Northern Cape and Heritage Western Cape (HWC) in the Western Cape) must be contacted immediately in order to determine an appropriate way forward.

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7. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
44934	AIA Desktop	Celeste Booth	01/08/2011	An archaeological desktop study for the proposed establishment of the Hidden Valley wind energy facility and associated infrastructure on a a site south of Sutherland, Northern Cape Province
44935	AIA Phase 1	Celeste Booth	01/02/2012	A Phase 1 AIA for the proposed HIdden Valley Wind Energy Facility, near Sutherland, Northern cape Province
44936	PIA Desktop	Lloyd Rossouw	01/03/2012	Palaeontological desktop assessment of the proposed Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province
53187	HIA Phase 1	Timothy Hart, Lita Webley	01/03/2011	HERITAGE IMPACT ASSESSMENT PROPOSED WIND ENERGY FACILITY
152531	HIA Phase 1	Timothy Hart, Lita Webley	20/12/2013	Heritage Impact Assessment Report for the Phase 1 Roggeveld Wind Farm
183350	HIA Phase 1	Natalie Kendrick	27/10/2014	Heritage Impact Assessment for the Karreebosch Wind Farm (Phase 2 Roggevelt Wind Farm)
353483	AIA Phase 1	Jonathan Kaplan	1/12/2015	ARCHAEOLOGICAL IMPACT ASSESSMENT Proposed borrow pit (Karusa R354) on the Farm Karreebosch 200/1 near Sutherland, Northern Cape Assessment conducted under Section 38 (3) of the National Heritage Resource Act (No. 25 of 1999)

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CTS HERITAGE

APPENDIX 2: Palaeontology Heritage Report (2021)

PALAEONTOLOGICAL HERITAGE: COMBINED DESKTOP & FIELD-BASED REPORT

PROPOSED DEVELOPMENT OF A 132kV OVERHEAD POWERLINE FOR THE KAREEBOSCH WIND ENERGY FACILITY TO THE EXISITING KOMSBERG MTS, KAROO HOOGLAND LOCAL MUNICIPALITY (NORTHERN CAPE PROVINCE) AND LAINGSBURG LOCAL MUNICIPALITY (WESTERN CAPE PROVINCE)

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September 2021

EXECUTIVE SUMMARY

The proposed 132kV overhead powerline to connect the authorised Karreebosch Wind Energy Facility (WEF) to the national grid *via* the existing Eskom Komsberg Main Transmission Substation (MTS) will be *c*. 20 km long and will traverse several properties within the Karoo Hoogland Local Municipality (Northern Cape Province) and the Laingsburg Local Municipality (Western Cape Province). Two on-site substation sites and several powerline corridors are currently under consideration.

The grid connection project area is underlain at depth by potentially fossiliferous continental sediments within the lower part of the Abrahamskraal Formation (Lower Beaufort Group / Adelaide Subgroup, Karoo Supergroup) of Middle Permian age. Sparse fossil assemblages in this sector of the Klein-Roggeveldberge region - including extremely rare vertebrate skeletal remains, tetrapod and lungfish burrows, invertebrate traces and vascular plants - are inferred to belong to the *Eodicynodon* Assemblage Zone and contribute to our understanding of the earliest terrestrial biotas that colonised the Main Karoo Basin in Middle Permian times (*c*. 270 Ma / million years ago). The palaeosensitivity of the project area is provisionally rated as High to Very High based on the Lower Beaufort Group bedrocks (SAHRIS website / DFFE screening tool). However, previous field-based palaeontological surveys in the Roggeveld WEF project area have only yielded scrappy plant remains as well as low-diversity trace fossils. With the exception of fragmentary fossil remains of very rare temnospondyl amphibians found on Rietfontein RE/197, close to the powerline Option 1B, additional fossil sites recorded during a recent 2-day palaeontological site visit to the Roggeveld WEF grid connection project area are mostly of low scientific / conservation value and lie outside or on the margins of the grid corridors under investigation. No fossils were recorded within the Late Caenozoic superficial deposits in the region (colluvium, alluvium *etc*). The overall palaeosensitivity of the grid connection project area is inferred to be Low. However, the potential for isolated vertebrate and other fossil finds of high scientific interest – as recorded elsewhere in the Klein-Roggeveldberge region - cannot be completely discounted.

There are no objections on palaeontological grounds to authorisation of the proposed 132 kV powerline and there is no preference on palaeontological heritage grounds for any particular on-site substation site or powerline route option among those currently under consideration. If powerline Option 1B is selected for construction, vertebrate fossil material at or in the vicinity of Locs. 454-456 on Rietfontein RE/197 must be collected by a professional palaeontologist before construction of the powerline (See Appendix 1, Fig. A2). No further specialist palaeontological studies or mitigation are recommended for this electrical infrastructure project. These recommendations and the Chance Fossil Finds Protocol appended to this report (Appendix 2) should be included in the EMPr for the development.

1. INTRODUCTION

It is proposed to construct a 132kV overhead powerline to connect the authorised Karreebosch Wind Energy Facility (WEF) to the national grid *via* the existing Eskom Komsberg Main Transmission Substation (MTS) situated towards the southeast. The proposed powerline will be approximately 20 km long. The overhead line will be a 132kV steel single or double structure with a kingbird conductor (between 15 and 20m in height above ground level). Standard overhead line construction methodology will be employed involving drill holes (typically 2 to 3m in depth), plant poles and a string conductor. It is not envisaged that any substantial excavations or stabilized backfill will be required; however, this will only be verified on site once geotechnical studies have been undertaken at each pole position during the construction phase.

The Kareebosch WEF grid connection project area is situated in the Klein-Roggeveldberge subregion of the Great Karoo, some 40 km north of the small village of Matjiesfontein and *c*. 50 km SSW of Sutherland (Fig. 1). It spans the border between the Karoo Hoogland Local Municipality in the Northern Cape Province and the Laingsburg Local Municipality in the Western Cape Province. Several route options for the grid connection running between an on-site substation (2 site options) and the Komsberg MTS are currently under consideration. The 132kV grid connection corridor options traverse the following properties:

- Wilgebosch Rivier 188 Remainder
- Ekkraal (Nuwekraal) 199 Portion 2
- Klipbanksfontein 198 Portion 1 and Remainder
- Bon Espirange 73 Portion 1 and Remainder
- Rietfontein 197
- Ekkraal (Nuwekraal) 199 Portion 1 and Remainder
- Standvastigheid 210 Portion 2 (Komsberg Substation)

The internal lines from the Karreebosch onsite substation to the Bon Espirange substation will be for Karreebosch WEF, however the line from Bon Espirange substation to the Komsberg substation will be for all three Euronotus projects.

The present combined desktop and field-based palaeontological heritage report contributes to the consolidated Heritage Basic Assessment report for the Kareebosch WEF grid connection that is being compiled by CTS Heritage, Cape Town (Contact details: Ms Jenna Lavin. CTS Heritage. 16 Edison Way, Century City, RSA. Tel: +27 (0)87 073 5739. Cell: +27 (0)83 619 0854. E-mail: info@ctsheritage.com).

2. INFORMATION SOURCES

The information used in this palaeontological heritage study was based on the following:

1. A short project outline, maps and kmz files provided by CTS Heritage, Cape Town;

2. A review of the relevant scientific literature, including published geological maps (1: 250 000 geology sheet 3220 Sutherland) and accompanying sheet explanations (*e.g.* Theron 1983);

3. Previous field-based palaeontological heritage studies within the Kareebosch WEF / Komsberg MTS project areas by Miller (2011) and Almond (2014, 2015b) as well as several further desktop and field-based palaeontological assessment studies in the broader Klein-Roggeveldberge region of the Great Karoo by the author and others (See References). It is noted that coverage of upland areas during these earlier field studies was very limited indeed;

3. Examination of relevant topographical maps (*e.g.* 1: 250 000 sheet 3220 Sutherland, 1: 50 000 sheets 3220CD Oliviersberg and 3220DC Swartland) and Google Earth© satellite images;

4. A two-day palaeontological site visit by the author and an experienced assistant during 23-24 and 29 September 2021. Given the generally limited bedrock exposure within the Klein-Roggeveldberge project area as well as access constraints in mountainous terrain, palaeontological fieldwork focused on a representative sample (*c*. 50 localities) of potentially-fossiliferous exposures of bedrock units (especially good Beaufort Group mudrock exposures) as well as of Late Caenozoic alluvial and eluvial deposits close to or within the grid connection corridor route options.

5. The author's previous field experience with the formations concerned and their palaeontological heritage (See References and also reviews of Western and Northern Cape fossil heritage by Almond & Pether 2008a, 2008b respectively).

Figure 1: Google Earth© satellite image of the Klein-Roggeveldberge region between Matjiesfontein and Sutherland in the Western and Northern Cape Provinces. The yellow polygons show land parcels concerned in the original Kareebosch WEF project area. Corridor options under consideration for the 132 kV grid connection between the Kareebosch WEF (on-site substation options SS1 & SS2) and the existing Komsberg MTS *via* the existing Eskom Bon Espirange Substation (BE SS) are shown in orange. The blue line shows the currently preferred grid connection route and the red line shows the preferred alternative route. Numbered sites in white indicate representative exposures of potentially fossiliferous bedrocks and superficial sediments examined during palaeontological fieldwork in 2014 (Almond 2014) and 2021 (present report).

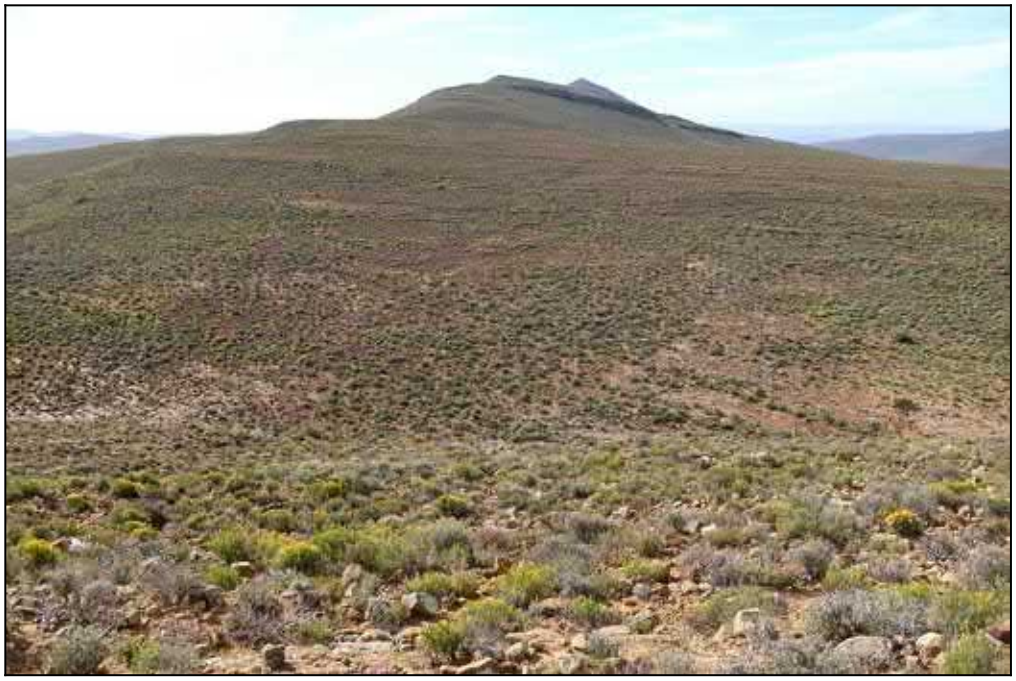


Figure 2: View NNW towards the proposed Substation Option 1 site on Klipbanksfontein 198. Note the lack of potentially fossiliferous mudrock exposures in this upland area which is largely mantled by colluvial / eluvial gravels, skeletal soils and *bossieveld* vegetation.

Figure 3: View towards the NW along the powerline route options 1A-1C across Rietfontein 197 showing the dissected mountainous terrain of the Klein-Roggeveldberge with gentle hillslopes and occasional prominent-weathering *kranzes* of sandstone. Otherwise, bedrock exposure is generally very poor in the region, especially regarding the recessive weathering mudrock facies.

Figure 4: Apart from occasional small stream gullies, the Beaufort Group bedrocks underlying most of the hilly terrain in the grid connection project area are mantled by rubbly colluvial or eluvial gravels and skeletal soils as well as karroid *bossieveld* vegetation.

Figure 5: View from the Brakeinde ridge into next valley to the north, Ekkraal 199. Bedrocks are exposed along deeper stream gullies but these will be spanned by the proposed 132 kV powerline. Anticipated impacts along drainage lines will be mainly attributable to any associated new access roads.

Figure 6: View from the SW towards the new Eskom electrical substation on Bon Espirance 73 with an existing powerline heading eastwards towards the Komsberg MTS adjacent to an upgraded access road.

Figure 7: Extensive streambed and bank exposures of Lower Abrahamskraal Formation sediments just west of the new Eskom substation on Bon Espirance 73. Bedrocks on steep south-facing slopes (cliff in background) are often partially obscured by epilithic lichens.

Figure 8: New wind farm infrastructure on Ekkraal 199, some 2 km west of the new Eskom substation on Bon Espirance 93, showing the substantial area of surface disturbance associated with even small-scale overhead powerlines (middle ground). Sectors of wind turbine access road also require the excavation of major new road cuttings into Abrahamskraal Formation bedrocks.

Figure 9: New road cuttings into maroon mudrocks along the access road to the Eskom substation on Bon Espirance 73. In practice, the recognition, sampling and recording of fossils within freshly-exposed bedrock sections is often highly problematic due to soils / dust cover and fragmentation during excavation.

Figure 10: View eastwards along the recently constructed powerline between the new substation on Bon Espirance 73 and the Komsberg MTS. Bedrock exposure in the low relief terrain here is very limited. Any palaeontological impacts are more likely to be attributable to surface clearance than to excavations for electrical pylon footings.

Figure 11: Occasional good exposures of Abrahamskraal Formation bedrocks are seen in stream gullies incising steep, SE-facing slopes to the NW of Komsberg Substation, as here on the eastern edge of Bon Espirance 73 (Hammer = 30 cm).

3. GEOLOGICAL CONTEXT

The geology of the Karreebosch WEF grid connection project area is covered by 1: 250 000 geology sheet 3220 Sutherland (Council for Geoscience, Pretoria; Theron 1983) (Fig. 12). The grid connection project area is entirely underlain at depth by Middle Permian (Wordian – Capitanian) continental sediments of the **Lower Beaufort Group** (Adelaide Subgroup, Karoo Supergroup). These predominantly fine-grained (muddy to sandy) sediments were deposited in a range of fluvial, alluvial and lacustrine (playa lake) settings within the Main Karoo Basin of South Africa. They are assigned to the lower part of the exceedingly thick **Abrahamskraal Formation** (Pa) at the base of the Lower Beaufort Group succession (Johnson *et al.* 2006, Day and Rubidge 2014, Cole *et al.* 2016 and references therein). In the Kareebosch WEF project area that is situated well to the south of the Great Escarpment the only major dolerite intrusions are a set of laterally persistent, NW-SE trending dykes of the **Karoo Dolerite Suite** that transect the eastern portion of the area. The Lower Beaufort Group bedrocks in the study area are very extensively overlain by **Late Caenozoic superficial deposits** such as scree and other slope deposits (colluvium, eluvium and hillwash), stream alluvium, down-wasted surface gravels, minor calcretes and various, predominantly skeletal soils. These geologically youthful sediments are generally of low palaeontological sensitivity. Levels of bedrock deformation within the project area are generally low. A number of E-W orientated fold axes related to the Permo-Triassic orogeny influence the Palaeozoic bedrocks while locally the finer-grained mudrocks show a well-developed tectonic cleavage.

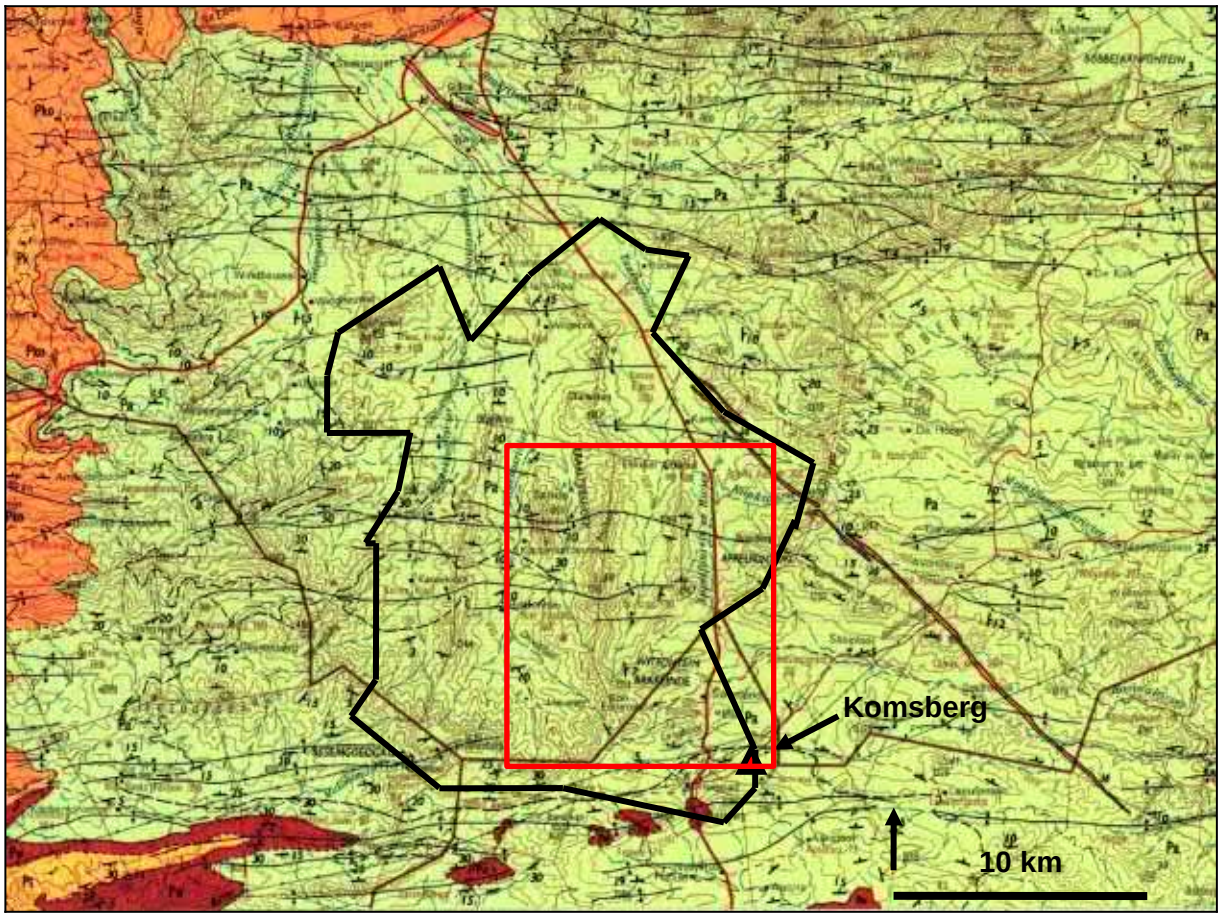
The sedimentology and lithostratigraphy of the Abrahamskraal Formation beds in the Kareebosch WEF project area have been described in some detail in the PIA report for the WEF by Almond (2014; see also Almond 2015f for the Komsberg MTS area). It is inferred that the bedrocks here are restricted to the lower part of the Abrahamskraal Formation, as indicated in the stratigraphic table in Figure 13. This is based on (1) the proximity to outcrops of the underlying deltaic Waterford Formation (uppermost Ecca Group) as well as (2) the presence of dark grey to grey-green mudrock-dominated beds lower in the succession (*e.g.* east of Rietfontein farmstead) with maroon mudrocks only appearing higher in the sequence, and generally at higher elevations, as well as (3) the presence of at least one sandstone-dominated package - possibly the Grootfontein Member of Day & Rubidge (2014) (*e.g.* turbine ridges on Ekkekraal 199, Bon Espirance 73). However, detailed field mapping would be required to confirm or refute this.

The majority of the grid connection project area comprises mountainous terrain with gentle, rocky hillslopes, broad valleys and occasional prominent-weathering, subhorizontal to dipping sandstone *kranzes* (Figs. 2 to 11). Bedrock exposure apart from the thicker channel sandstones is largely limited to stream and erosion gullies as well as the banks and beds of more deeply-incised streams along the valley bottoms. Elsewhere the Beaufort Group beds are obscured by a thin to several meter-thick mantle of rubbly colluvial, eluvial and alluvial deposits (with clasts mainly composed of Beaufort Group wacke, with minor vein quartz) as well as gravelly soils and karroid *bossieveld* vegetation. Near-surface mudrocks are often highly weathered and friable.

Typical features of the Middle Permian continental sediments of the Lower Abrahamskraal Formation within the project are illustrated in Figures 14 to 28 with explanatory figure legends. Episodes of wetter, pluvial and drier, semi-arid palaeoclimates are reflected in the Abrahamskraal sedimentological record. Wetter depositional settings on the ancient floodplain or delta platform are suggested by intervals of dark grey massive to laminated mudrocks with horizons of abundant rusty-brown, large spheroidal to irregular concretions and lenses of diagenetic ferruginous carbonate, ball-and-pillow load structures in crevasse-splay or deltaic sandstones, upward-coarsening sedimentary packages, gradational channel sandstone bases without calcrete-rich basal breccias or gullying, wave-rippled sandstone bed tops with epichnial trace fossils and crinkly microbial mat textures as well as horizons of abundant reedy plant stem casts, sphenophyte (horsetail fern) debris and lungfish burrow casts. More arid palaeoclimatic intervals are indicated by thick packages of maroon mudrocks, palaeosol horizons marked by pale grey, sphaeoidal palaeocalcrete concretions, deep sand-infilled desiccation cracks, abundant gypsum crystal pseudomorphs (“desert roses”) and sharp, gullied channel sandstone bases with well-developed basal channel breccias rich in reworked mudflakes and calcrete glaebules.

It is notable that, with the exception of minor basal channel breccias, the clastic sediments making up the Lower Abrahamskraal bedrocks are predominantly fine-grained, *viz*. claystones, siltstones and fine- to occasionally medium-grained wackes (impure, clay-rich sandstones). This reflects the very low relief of the Mid-Permian Karoo delta platform / distal alluvial floodplain as well as the considerable transport distance from the sediment source area (*i.e.* Cape Fold Belt). The rare occurrence of isolated, large clasts or *lonestones* of exotic rock types (granites / andesites / schists *etc*) within the Beaufort Group bedrocks is therefore of note (*cf* Almond 2010a, 2015e, 2017 and references therein). In some cases, petrified wood has been recorded in association with the lonestones. A single, isolated subrounded cobble of quartzitic schist or gneiss recorded on Rietfontein RE/197 is an interesting example from the present study area (Fig. 47). Plausible explanations as to how such exotic “lonestones” were introduced so far out into the Beaufort Group depository include rocks entangled among the roots of uprooted trees that were transported during major river floods or alternatively downstream ferrying by floating river ice during winter (see discussions in Broom 1912, Jordaan 1990, Loock *et al.,* 1994, p. 190).

A range of Late Caenozoic cover sediments encountered in the project area are shown in Figures 4 and 29 to 32. An interesting sedimentological feature in the present study area is the frequent occurrence of thin to thick (few dm to several meters), rubbly debris flow deposits (debrites) on lower hillslopes where they are exposed by gullying (Figs. 29 & 32). In this region they are typically pale brown and comprise poorly-sorted angular clasts of wacke suspended within a sandy to gritty or fine gravelly matrix which may show polygonal cracking (perhaps a permafrost feature). The age of the debrites is uncertain, but possibly Quaternary.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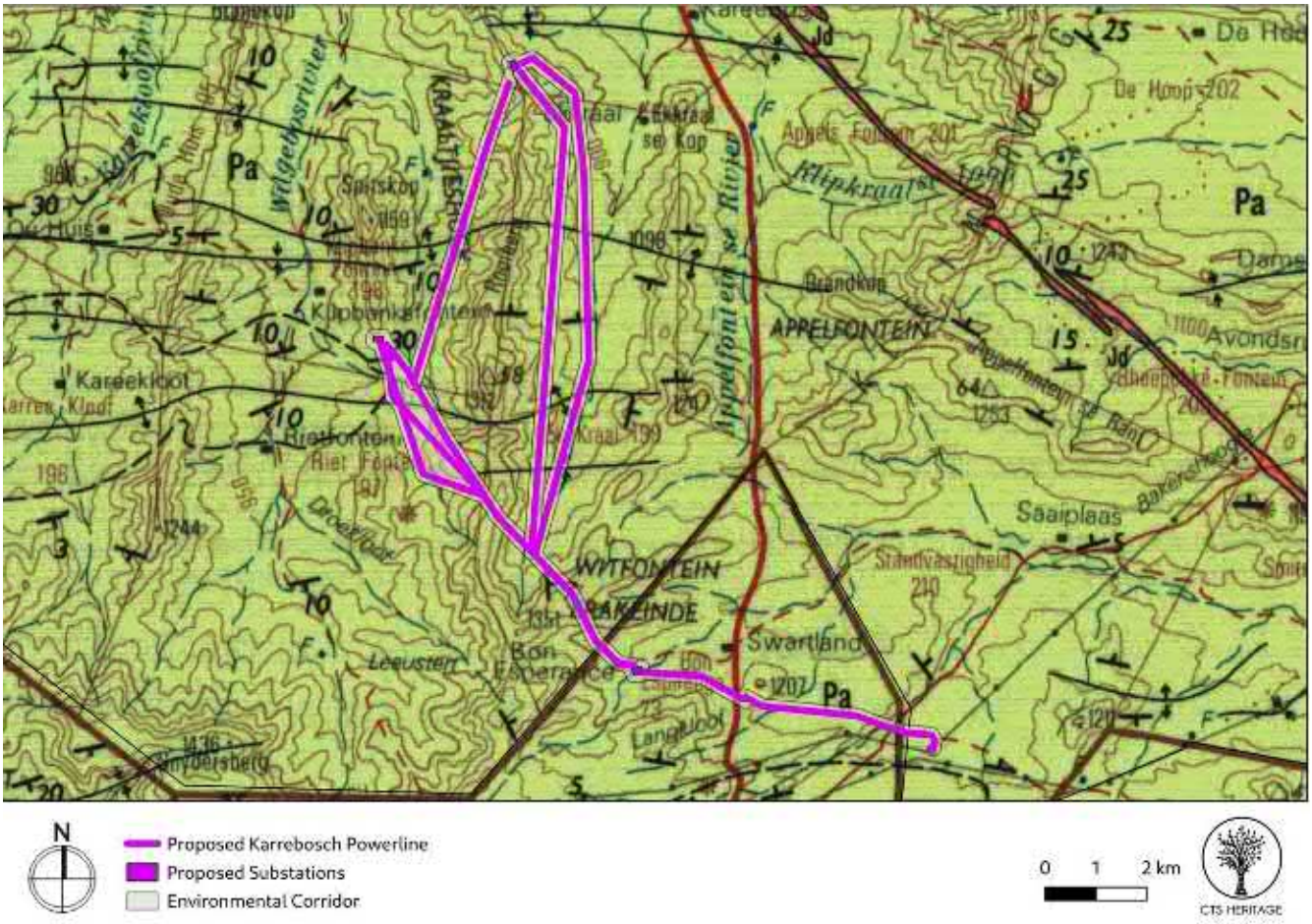

Figure 12. Extract from the 1: 250 000 scale geology sheet 3220 Sutherland (Council for Geoscience, Pretoria, 1999) showing the Karreebosch Wind Farm grid connection project area *c*. 50 km SSW of Sutherland, Northern Cape and Western Cape Provinces (Image prepared by CTS). The project area (here showing all powerline route options under consideration) is entirely underlain by Middle Permian sediments within the lower part of the Abrahamskraal Formation, Lower Beaufort Group / Adelaide Subgroup (Pa, pale green). A narrow NW-SE trending Early Jurassic dolerite dyke of the Karoo Dolerite Suite (Jd, pink) crosses the eastern portion of the WEF area but lies outside the present study area. The black dashed line marks the first appearance of maroon mudrocks within the Abrahamskraal Formation. Note also several W-E trending fold axes as well as a fault line (f-f) mapped within the study area.

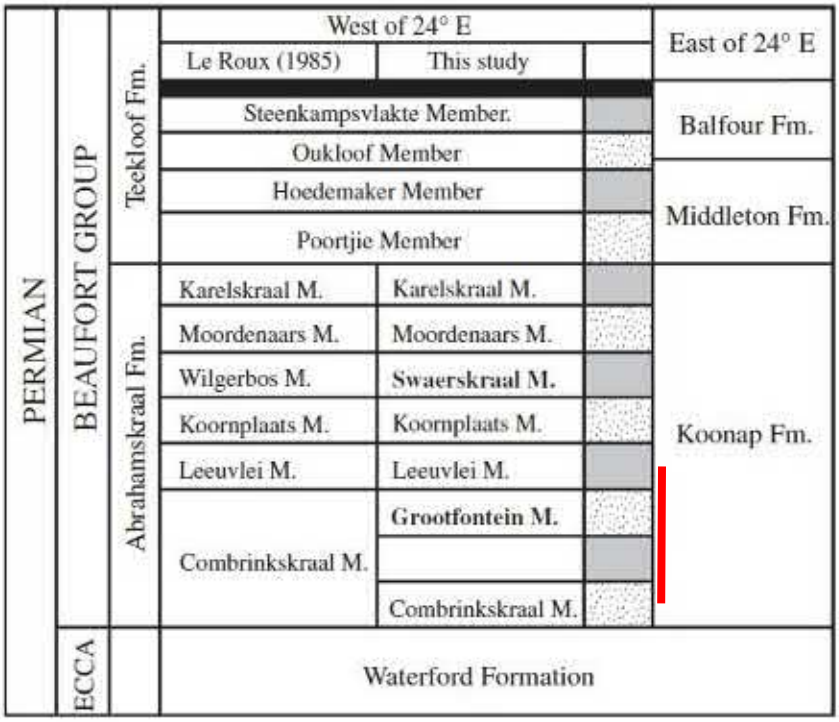

Figure 13: Revised subdivision of the Abrahamskraal Formation by Day and Rubidge (2014). The red bar indicated stratigraphic members that are probably represented within the Kareebosch WEF and grid connection project areas (This requires confirmation through further fieldwork).

Figure 14: Good stream gulley and hillslope exposure of very dark grey siltstones and thin-bedded wackes of the lower Abrahamskraal Formation, Rietfontein 197. They probably belong to the mudrock-dominated interval between the Combrinkskraal and Grootfontein Members (See Figure 13).

Figure 15: Stream gulley exposure through dark grey mudrocks and thin wackes of the lower Abrahamskraal Formation on Rietfontein 197. These beds contain occasional horizons rich in vascular plant compressions (Figure 46).

Figure 16: Dark overbank lower Abrahamskraal Formation siltstones with load structures overlain by dark grey-green, fine-grained channel wackes with a gradational contact, Rietfontein 197 (Hammer = 30 cm).

Figure 17: Vertically elongate clusters of pale silicified gypsum crystals within massive grey-green mudrocks at the locality illustrated above (Scale in cm). The gypsum pseudomorphs indicate episodes of high evaporation on the otherwise waterlogged floodplain or delta platform.

Figure 18: Horizons of large spheroidal concretions and lenses of diagenetic ferruginous carbonate within the Abrahamskraal overbank mudrocks (Rietfontein 197) suggest protracted waterlogging of the substratum. These larger concretionary bodies are rarely fossiliferous.

Figure 19: Horizons of small, sphaeroidal pedogenic carbonate concretions within Lower Abrahamskraal overbank mudrocks on Rietfontein 197 (Hammer = 30 cm). These brownish-weathering concretions with a greyish, micritic interior mark palaeosols and are a primary focus for vertebrate fossil recording.

Figure 20: Exceptionally good gully exposure of a thick, grey-green Lower Abrahamskraal Formation mudrock package overlying a well-exposed, wave-rippled sandstone bed top (on LHS), Rietfontein 197. The probable temnospondyl amphibian fossils shown in Figure 37 were recorded in shallow erosion gulley just above the mudrock cliff (arrow).

Figure 21: Detail of the wave-rippled sandstone bed top surface seen in the previous figure, probably situated on the margins of a shallow floodplain pond. The invertebrate traces shown in Figure 43 were recorded from the same locality.

Figure 22: Dark, fine-grained mudrocks of probable lacustrine origin overlying the rippled sandstone surface shown above, here containing horizons of numerous rounded ball-and-pillow structures due to sediment loading within soft, waterlogged bottom sediments (Hammer = 30 cm).

Figure 23: Prominent-weathering, thick tabular channel sandstone body of the Abrahamskraal Formation (possibly the Grootfontein Member package) on Ekkraal 199. The underlying mudrock-dominated succession is rich in maroon mudrocks, as seen in the following two figures.

Figure 24: Series of thin (1-2 m), upward-coarsening cycles of grey-green or purple-brown mudrock capped by brownish-weathering, fine-grained wackes, Ekkraal 199. The thick channel sandstone body at the head of the gulley is shown in the previous figure.

Figure 25: Close-up of upward-coarsening cycles in the same gulley on Ekkraal 199. The maroon mudrocks here may belong to the interval between the Combrinkskraal Member and Grootfontein Member sandstone packages.

Figure 26: Good erosion gulley exposures of Abrahamskraal Formation maroon mudrocks with thin crevasse-splay sandstones on Bon Espirance 73, just NW of the new substation (Hammer = 30 cm). The reddish siltstones and deep, sand-infilled desiccation cracks (arrowed) seen here indicate periods of aridity on the Middle Permian floodplain.

Figure 27: Gulley exposure of Abrahamskraal Formation beds on Bon Espirance 73, less than 1 km west of the the new substation. The pale upper mudrocks show high levels of near-surface weathering which does not favour fossil preservation or recording.

Figure 28: Several stream gullies incising steep hillslopes due west of the new substation on Bon Espirance 73 expose good sections through thin- to medium-bedded sediments of the Abrahamskraal Formation. Mottled mudrocks and wackes here commonly contain casts of reedy plant stems and rarer lungfish burrows, suggesting swampy wetland settings.

Figure 29: Thick rubbly debrite (debris flow deposit) composed of dispersed, "floating" clasts of wacke embedded within a pale brown sandy to fine gravelly matrix, stream bank exposure on Bon Espirance 73 (Hammer -= 30 cm).

Figure 30: Very thick (several meters) wedges of coarse, poorly-sorted colluvial and alluvial deposits have accumulated along valley floors in the project area, seen here on Bon Espirance 73.

Figure 31: Good streambank section through a Late Caenozoic erosional gulley incised up to several meters deep into gently dipping Abrahamskraal Formation bedrocks and infilled with a range of coarse colluvial, alluvial and debrite deposits, Bon Espirance 73.

Figure 32: Gullied hillslopes of crumbly, weathered Abrahamskraal Formation mudrocks near the Komsberg MTS are locally mantled by pale brown, gravelly debris deposits (upper LHS), eastern edge of Bon Espirance 73.

4. PALAEONTOLOGICAL HERITAGE CONTEXT

According to the latest Karoo fossil biozonation maps the lower Abrahamskraal Formation beds in the present study area, located on the south-western margins of the Lower Beaufort Group outcrop area, probably lie within the ***Eodicynodon* Assemblage Zone** of Middle Permian (Wordian) age (*c*. 268-265 Ma) (Lanci *et al.* 2013, Day & Rubidge 2014, Rubidge & Day 2020 and refs. therein) (Fig. 33). However, due to the great scarcity of fossil tetrapod records in the Klein-Roggeveldberge region as a whole, this has yet to be firmly established.

Fossil biotas of the *Eodicynodon* Assemblage Zone have been summarized by Rubidge (1995) and more recently by Smith *et al.* (2012) as well as Rubidge and Day (2020). This Middle Permian biota is characterized by a limited variety of primitive therapsids, most notably the small dicynodont *Eodicynodon* (by far the commonest taxon), very rare large-bodied herbiovorous and carnivorous dinocephalians such as *Tapinocaninus* and anteosaurids, as well as equally rare gorgonopsians and scylacosaurid therocephalians (Fig. 34). The fauna is of considerable palaeobiological significance in that it includes some of the earliest and most primitive examples of several therapsid subgroups recorded anywhere in the world. Associated fossils include disarticulated palaeoniscoid fish and amphibians (rhinesuchid temnospondyls), freshwater bivalves *plus* a small range of invertebrate ichnogenera such as the arthropod trackway *Umfolozia* and various simple horizontal burrows. Vertebrate trace fossils include horizons with subcylindrical sandstone casts of lungfish burrows as well as very occasional tetrapod burrow casts. Records of vascular plants include glossopterid “seed ferns” and the widely occurring sphenophyte ferns *Equisetum* and *Schizoneura* (Anderson & Anderson 1985, Rubidge *et al.* 2000) as well as rare lycopods *cf Cyclodendron* (Almond 2018). Dense assemblages of reedy plant stem casts (commonly mistaken for invertebrate burrows) are common in wetland deposits such as swampy lake and river margins. Petrified wood is apparently - and perhaps surprisingly - absent or very rare in the lower Abrahamskraal Formation, in contrast to the underlying Waterford Formation where well-preserved silicified logs are well-known; it is unclear why this is so. However, large linear drag marks on the tops of channel sandstones that were probably generated by sizeable floating logs have been recorded locally, close to the lower contact with the Waterford Formation (*cf* Almond 2010a).

Vertebrate skeletal fossils – especially identifiable, articulated specimens - tend to be very rare indeed in this biozone (“extremely scarce” according to Rubidge & Day 2020). This is indicated by the fossil chart of Loock *et al.* (1994) as well as the fossil site maps of Keyser & Smith (1977-78) and of Nicolas (2007) (Fig. 35). The fossils are also typically difficult to extract from their resistant rock matrix. They are mainly found within overbank, lake margin mudrocks in association with brownish-weathering pedogenic calcrete nodules or - in the case of the dinocephalians - within or at the base of channel sandstones (Smith *et al.* 2012, Rubidge & Day 2020). Several casts of large (*c*. 15 cm wide), subhorizontal to gently-inclined, straight tetrapod burrows, in one case associated with unidentified, scrappy postcranial and tooth material, are reported by Almond (2016c) from the *Eodicynodon* AZ in the Brandvalley WEF project area situated just southwest of

the present study area. The burrows reported there occur within the sandstone package along the crest of the Klein-Roggeveld Escarpment on Muishond Rivier 161 (possibly the Grootfontein Member of Day & Rubidge 2014). They may represent the oldest known tetrapod burrows reported from the Karoo Supergroup of South Africa (and even perhaps from Gondwana), although this claim remains to be confirmed. Poorly-preserved dinocephalian cranial remains (mainly preserved as moulds) have recently been reported within thick basal channel breccio-conglomerates on the farm Gats Rivier 156 some 30 km west of the present study area (Almond 2020).

These new fossils, in conjunction with spectacularly rich plant-insect Lagerstätte discovered within lacustrine deposits of the underlying Waterford Formation (Middle Permian / Roadian) near Sutherland (Moyo *et al.* 2018, Prevec & Matiwane 2018, Davids *et al.* 2018) as well as well-preserved petrified logs in the same formation, contribute to our understanding of the earliest terrestrial biotas that colonised the Main Karoo Basin in Middle Permian times (*c*. 270 Ma / million years ago).

The diverse Late Caenozoic superficial deposits within the South African interior, including the Great Karoo region, have been comparatively neglected in palaeontological terms. However, sediments associated with ancient drainage systems, springs and pans in particular may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals as well as remains of reptiles like tortoises. Other late Caenozoic fossil biotas that may occur within these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites, invertebrate burrows, rhizocretions), and plant material such as peats or palynomorphs (pollens) in organic-rich alluvial horizons and diatoms in pan sediments. In Quaternary deposits, fossil remains may be associated with human artefacts such as stone tools and are also of archaeological interest.

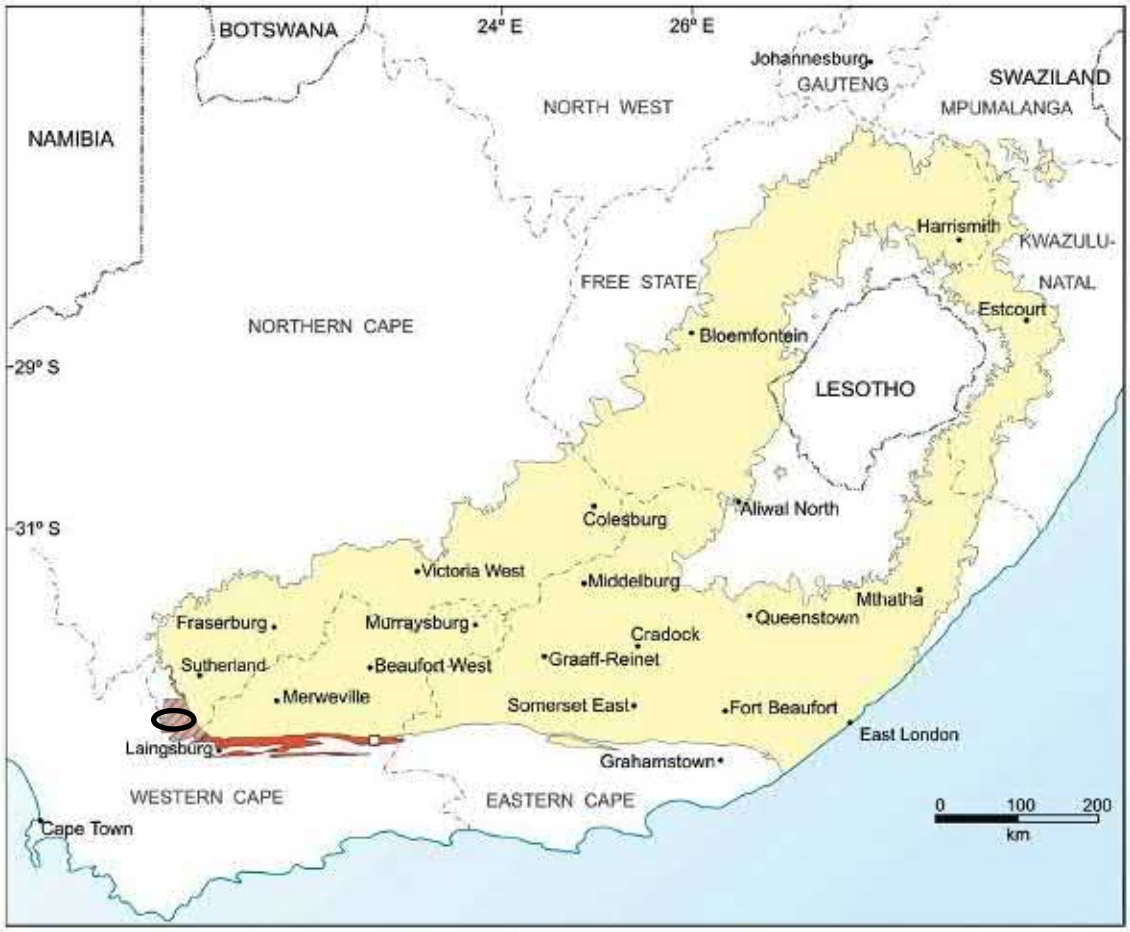

Figure 33: Distribution of the *Eodicynodon* Assemblage Zone (AZ) within the Main Karoo Basin of the RSA (Rubidge & Day 2020). The Kareebosch WEF and grid connection project area (black ellipse) to the NW of Laingsburg falls within the SW corner of the basin (area cross-hatched in red) where fossils of this assemblage zone are suspected to occur but this has not yet been firmly established.

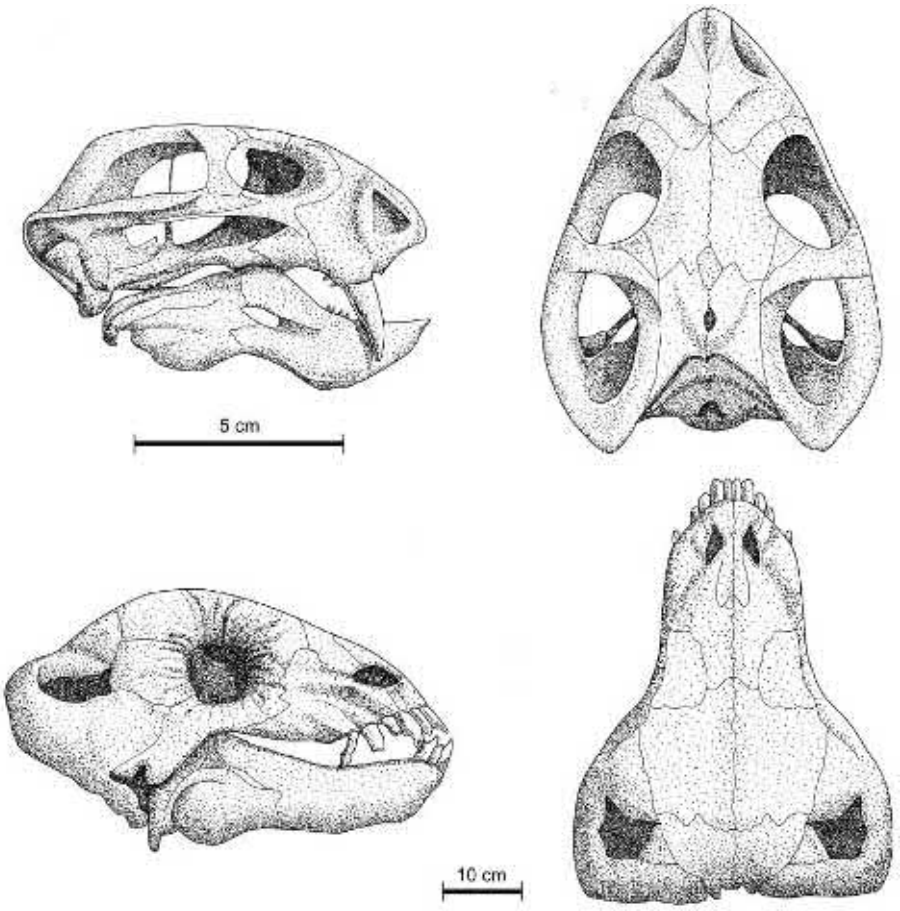

Figure 34: Key tetrapod taxa, both herbivorous therapsids, from the Middle Permian (Wordian) *Eodicynodon* Assemblage Zone of the Main Karoo Basin (from Rubidge & Day 2020). The small-bodied, toothed dicynodont *Eodicynodon* (above) is by far the commonest fossil tetrapod while rhino-sized primitive dinocephalians like *Tapinocaninus* (below) are far rarer. Occasional fossil tetrapod burrow casts in this AZ may be attributable to the former.

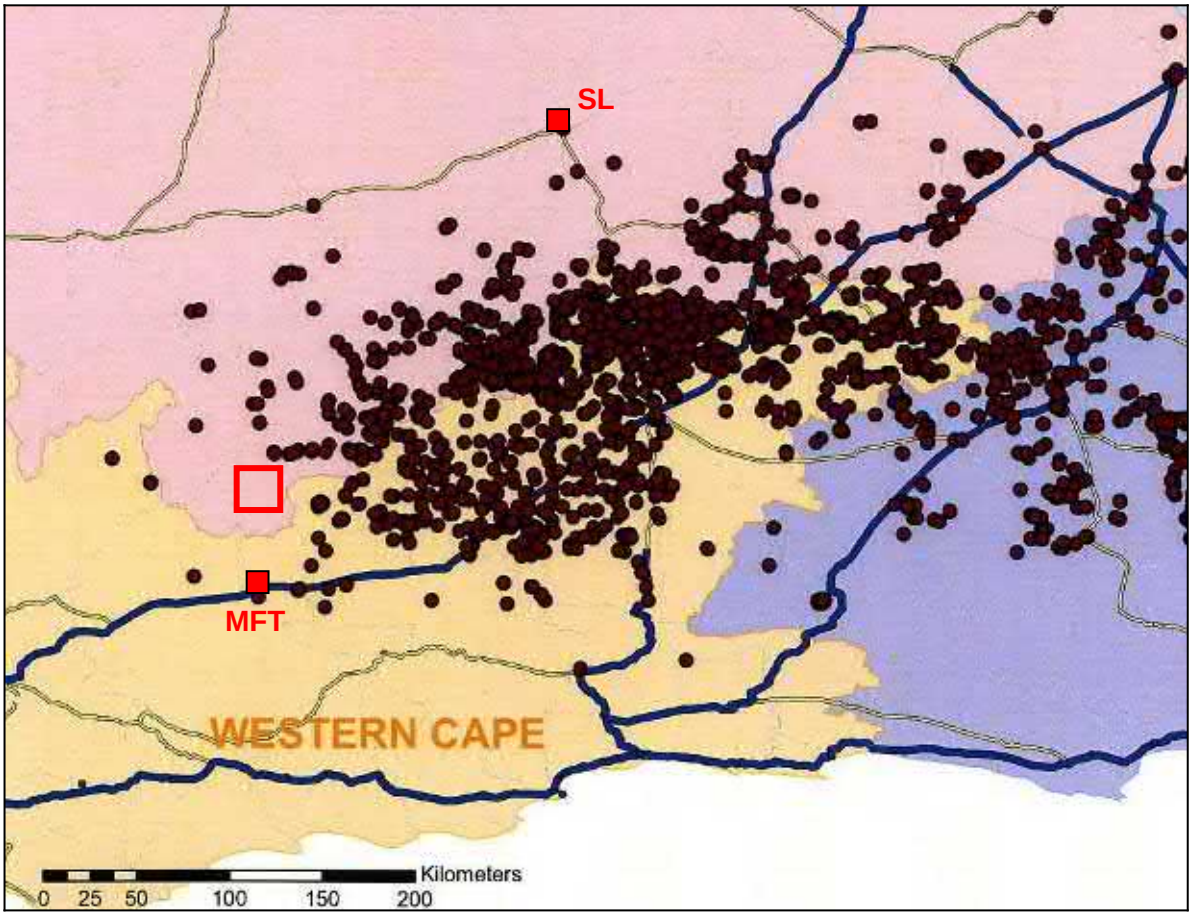

Figure 35: Distribution of recorded vertebrate fossil sites within the south-western portion of the Main Karoo Basin (modified from Nicolas 2007). The approximate location of the Kareebosch WEF and grid connection project area is indicated by the open red square. Note the paucity of known vertebrate fossil sites in this part of the Great Karoo. SL = Sutherland. MFT = Matjiesfontein.

5. RESULTS FROM PALAEONTOLOGICAL SITE VISIT, CONCLUSIONS & RECOMMENDATIONS FOR EMPR

Previous field-based PIA studies in the Kareebosch WEF project area by Miller (2011) and Almond (2014) only yielded sparse records of low diversity invertebrate trace fossil assemblages and scrappy vascular plant remains within the Abrahamskraal Formation bedrocks, with no fossils recorded within the Late Caenozoic superficial sediments. A limited number of new Abrahamskraal Formation fossil sites have been recorded during the recent site visit to the Kareebosch grid connection project area (Figs. 37 to 46). GPS locality details of the new fossil sites (see satellite maps in Appendix 1, Figures A1 & A2) are tabulated in Appendix 1 with a short description and indication of their palaeontological heritage significance (Provisional Field Rating).

Most of the new fossil material from the lower Abrahamskraal Formation comprises low diversity invertebrate trace fossil assemblages (Figs. 41 to 43), sphenophyte (reedy horsetail fern) plant debris (Fig. 46) or stem casts (Figs. 44 & 45) and lungfish burrow casts (Figs. 39 & 40), all of which are associated with swampy wetland habitats on the Middle Permian delta platform or alluvial plain. None of this material is of high scientific or conservation significance while many of the sites lie outside the grid connection project footprint (see satellite map Fig. A1 in Appendix 1), so no mitigation measures are proposed in their regard. No fossil material has been recorded within the Late Caenozoic superficial deposits.

Several small blocks of fossiliferous phosphatic concretion on Rietfontein RE/197 (Locs. 454-456, Figs. 20, 37 & 38) contain probable temnospondyl (amphibian) remains that are of considerable palaeontological interest given their low stratigraphic position within the Abrahamskraal Formation and the rarity of temnospondyl remains in the *Eodicynodon* Assemblage Zone (Prof. Bruce Rubidge, pers. comm., 2021). This material must be collected by a professional palaeontologist before construction of the powerline if Grid Option 1B is selected.

An isolated cobble of extra-basinal metamorphic rock recorded from the Abrahamskraal Fiormation outcrop area on Rietfontein RE/197 (Fig. 47) is potentially of paleobiological significance since such outsized exotic lonestones may have been transported downstream by floods in Middle Permian times, entangled among tree roots. In this case, no fossil wood was recorded in the vicinity of the lonestone site.

Given the very sparse occurrence of recorded fossils of scientific and / or conservation value in the Kareebosch WEF and grid connection project area, and their unpredictable occurrence, it is concluded that the Kareebosch grid connection project area is of LOW palaeosensitivity overall. Impacts on local palaeontological heritage resources due to the construction of the proposed *c*. 20 km long powerline are anticipated to be LOW to VERY LOW and insignificant compared with potential impacts due to construction of the WEF itself. It is noted that surface disturbance associated with any new powerline access roads in mountainous terrain is likely to have greater impact than excavations for electrical pylon footings. The potential for isolated vertebrate fossil finds of high scientific

interest - as occasionally recorded elsewhere in the Klein-Roggeveldberge region - cannot be completely discounted.

There are no objections on palaeontological grounds to authorisation of the proposed 132 kV powerline and there is no preference for any particular on-site substation site or powerline route option among those currently under consideration. If powerline Option 1B is selected for construction, vertebrate fossil material at, or in the vicinity of, Locs. 454-456 on Rietfontein RE/197 must be collected by a professional palaeontologist before construction of the powerline (See Appendix 1, satellite map Fig. A2). No further specialist palaeontological studies or mitigation are recommended for this electrical infrastructure project. These recommendations and the Chance Fossil Finds Protocol appended to this report (Appendix 2) should be included in the EMPr for the development.

5.1. Site Sensitivity Verification

Preliminary palaeosensitivity mapping suggests that the Kareebosch grid connection project area is of potentially of Very High Sensitivity on the basis of the potentially fossiliferous Lower Beaufort Group bedrocks mapped here (*e.g.* SAHRIS / DFFE palaeosensitivity maps, largely based on 1: 250 000 geological mapping; Fig. 36). Previous PIA reports for the Kareebosch WEF / Roggeveld WEF / Komsberg MTS project areas by Miller (2011) and Almond (2014, 2015b) as well as several other PIA reports by the author for renewable energy projects in the Klein-Roggeveldberge region (see References) suggest that scientifically or conservation-worthy fossil remains are, in practice, very scarce and unpredictably distributed here, even where bedrock exposure is locally good. However, a small number of important fossil sites – including exceptionally rare tetrapod skeletal remains, tetrapod burrows, amphibian trackways and swimming trails as well as vascular plant assemblages - have been recorded from the lower Abrahamskraal Formation in the Klein-Roggeveld region as a result of recent PIA field studies, including the recent visit to the Kareebosch WEF grid connection project area. Late Caenozoic superficial deposits (colluvium, alluvium, soils *etc*) that mantle most of the Lower Beaufort Group outcrop area are generally of Low to Very Low sensitivity and so far no fossils have been recorded from these younger deposits in the project area.

Based on combined desktop and field-based palaeontological data an overall LOW palaeosensitivity for the Kareebosch WEF and grid connection project areas is inferred here. However, the potential for isolated vertebrate and other fossil finds of high scientific interest - as occasionally recorded elsewhere in the Klein-Roggeveldberge region - cannot be completely discounted.

As motivated above, the provisional palaeosensitivity mapping for the Kareebosch WEF and associated grid connection corridors, based on the DFFE Screening Tool and SAHRIS website, is *contested* here.

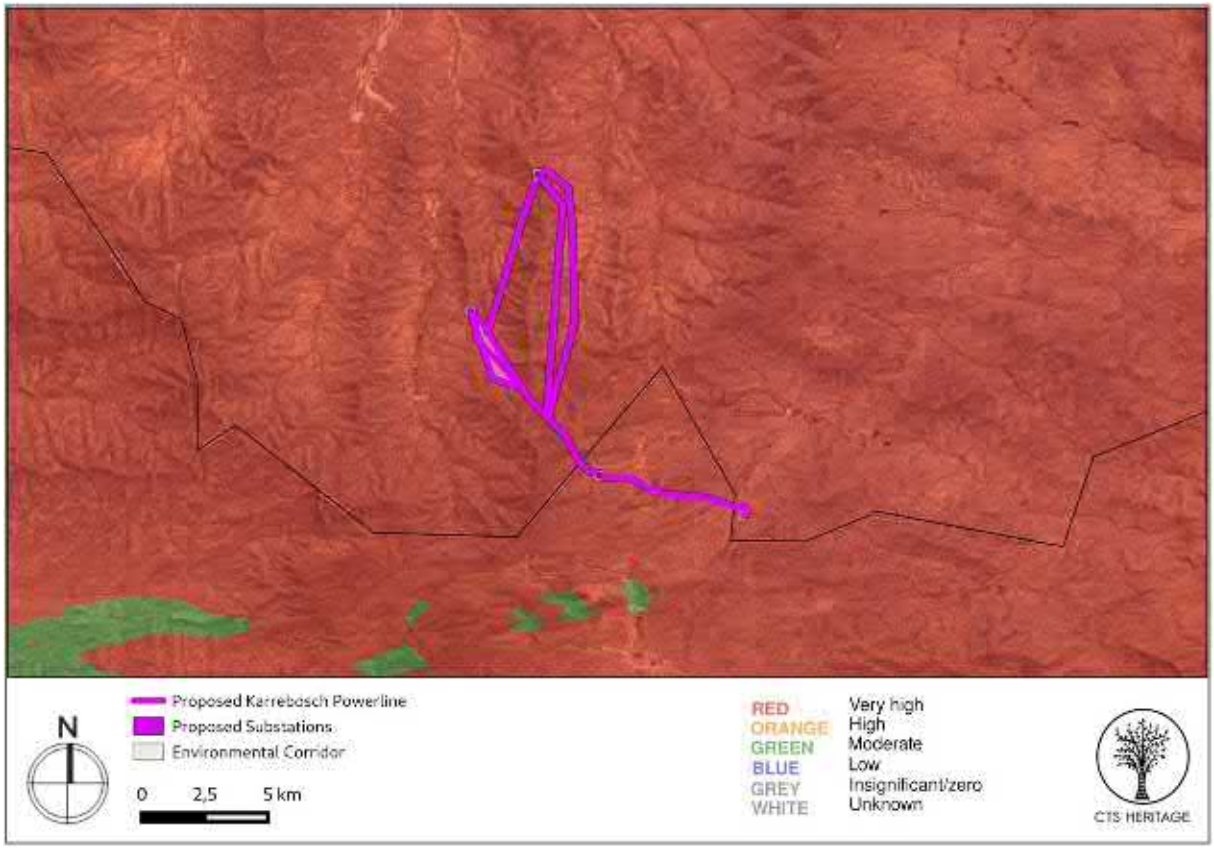

Figure 36: Palaeontological sensitivity map for the Kareebosch WEF grid connection project area (Image prepared by CTS). The provisional Very High Palaeosensitivity inferred on the map is *contested* here; in practice the area is largely of Low Palaeosensitivity, although the potential for rare, isolated occurrences of scientifically important vertebrate and other fossils cannot be discounted.

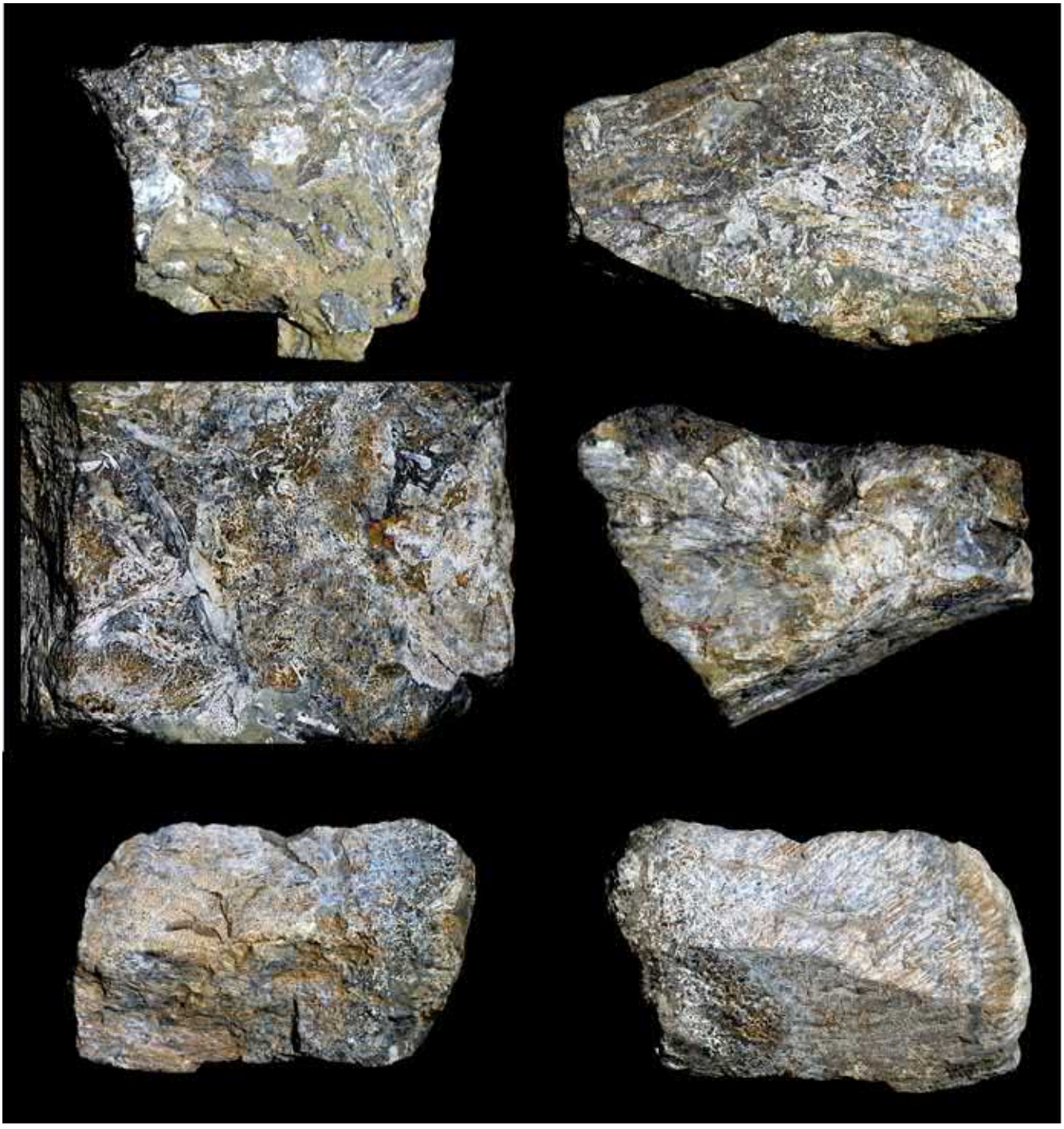

Figure 37: Several small blocky fragments (each *c*. 6 cm in maximum width) of a pale grey phosphatic concretion containing comminuted bone fragments with a dense, cancellous fabric, including possible scutes and teeth. The material probably belongs to a sizeable temnospondyl amphibian and represents one of the very few tetrapod body fossils recorded from the lowermost Abrahamskraal Formation of the Klein-Roggeveldberge region (Rietfontein RE/197, Locs. 454-456). Rare temnospondyl dermal scutes and jaws have been recorded previously from the *Eodicynodon* Assemblage Zone (Rubidge & Day 2020). See Figure 20 for setting of the fossil locality.

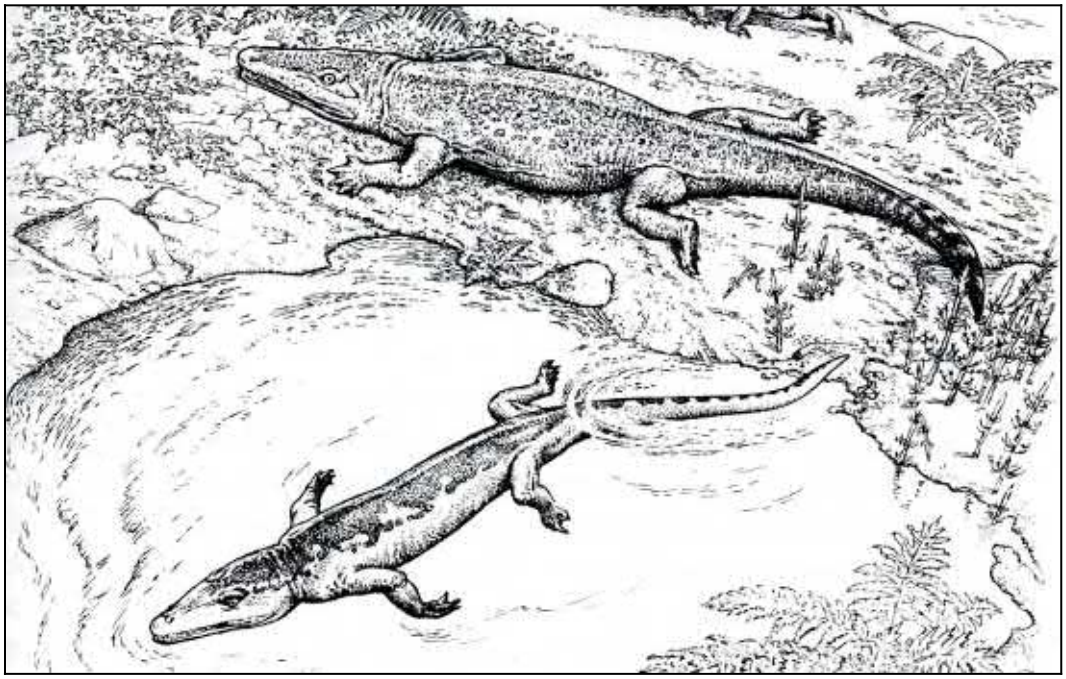

Figure 38: Temnospondyls were an important group of carnivorous, aquatic or amphibious tetrapods in the Permo-Triassic Main Karoo Basin (Modified from Benton 2003 *When life nearly died*). They are related to modern amphibians rather than crocodilian reptiles.

Figure 39: Several sandstone casts of vertical lungfish burrows embedded within crumbly, grey-green mudrocks of probable lacustrine or riverine pond origin (Scale = 15 cm) (Loc. 478, Ekkraal 199).

Figure 40: Two adjacent lungfish burrow casts weathering out to show their subcylindrical geometry (Loc. 478, Ekkraal 199). The largest cast in the assemblage is 9 cm in diameter.

Figure 41: Steeply dipping, current-rippled channel sandstone with sparse epichnial invertebrate burrows (see following figure), Rietfontein RE/197 (Loc. 460) (Hammer = 30 cm).

Figure 42: Close-up of one of the epichnial invertebrate burrows (arrowed) shown in the previous figure (Scale in cm).

Figure 43: Rippled sandstone surface with meandering epichnial furrows attributed to burrowing invertebrates in a shallow pond or playa lake setting (Scale in cm and mm), Rietfontein RE/197 (Loc. 453; see Figure 21 for context).

Figure 44: Mottled purple-brown and grey-green siltstone bedding plane containing cm-scale pale rounded sandstone casts, probably of reedy plant stems but possibly invertebrate burrows (scale in cm and mm), Ekkraal 199 (Loc. 484).

Figure 45: Dense assemblage of probable plant stems casts (*e.g.* equisetaleans) within a grey-green wacke veneered by purple-brown mudrock (Scale = 15 cm), Ekkraal 199 (Loc. 480).

Figure 46: Dense mat of reworked reedy sphenophyte stems (horsetail ferns) preserved as compressions within dark grey siltstones, shallow stream bed exposure on Rietfontein RE/197 (Loc. 463).

Figure 47: Cobble-sized exotic cobble of quartzitic schist or gneiss found in surface float on Rietfontein RE/197 (32 52 31.6 S, 20 29 23.2 E) (scale in cm). Such rare extra-basinal clasts in the Abrahamskraal Formation are potentially of paleobiological significance since they may have been transported downstream from a mountainous source area by floods in Middle Permian times, perhaps entangled among tree roots.

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7. ACKNOWLEDGEMENTS

Ms Jenna Lavin and Mr Nic Wiltshire of CTS Heritage, Cape Town are thanked for commissioning this study as well as for providing the necessary project information and for ably facilitating the field study and subsequent reporting. I am also grateful to Ms Ashlea Strong of WSP in Africa for helpful discussions on grid connection projects in the Karoo. Professor Bruce Rubidge (Wits University, Johannesberg) generously provided helpful input into the palaeontology of the Lower Beaufort Group in the Klein-Roggeveldberge Region. The companionship in the field, substantial palaeontological contributions as well as logistical backup kindly provided by Ms Madelon Tusenius are all highly appreciated, as always.

8. SHORT CV OF AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and the University of Tübingen in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa and Madagascar. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA. Since 2002 Dr Almond has also carried out numerous

palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest Province, Mpumalanga, Gauteng, KwaZulu-Natal and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has served as a member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

APPENDIX 1: KAREEBOSCH WEF GRID CONNECTION FOSSIL SITE DATA – SEPTEMBER 2021

All GPS readings were taken in the field using a hand-held Garmin GPSmap 64s instrument. The datum used is WGS 84.

Please note that:

- Locality data for South African fossil sites in *not* for public release, due to conservation concerns.
- The table does *not* represent all potential fossil sites within the project area but only those sites recorded during the field survey. The absence of recorded fossil sites in any area therefore does *not* mean that no fossils are present there.
- The detailed stratigraphic data for each site is provisional and has yet to be confirmed.

Loc.	GPS data	Comments
453	32°52'37.22" S 20°29'19.68" E	Rietfontein RE/197. Extensive exposure of SSE-dipping sandstone bed top with sets of small-scale wave ripples and meandering epichnial invertebrate burrows that were probably generated on the margins of a shallow floodplain pond or playa lake. Sharply overlying grey-green mudrocks show numerous ball-and-pillow load structures. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
454	32°52'37.45" S 20°29'22.32" E	Rietfontein RE/197. Small (c. 6 cm wide), angular block of pale grey phosphatic concretion containing comminuted vertebrate bone and perhaps bony spines or teeth (pearly grey to black). Possibly of bony fish or – more likely - amphibian (*i.e.* temnospondyl) affinity. Block in surface float along shallow drainage line running along top of well-exposed grey-green mudrock package. Proposed Field Rating IIIB Local Resource. This material must be collected by a professional palaeontologist before construction of the powerline if Grid Option 1B is selected.
455	32°52'37.61" S 20°29'21.97" E	As above. Probably part of the same fossiliferous concretion. Proposed Field Rating IIIB Local Resource. This material must be collected by a professional palaeontologist before construction of the powerline if Grid Option 1B is selected.
456	32°52'36.97" S 20°29'23.42" E	As above (2 blocks). Probably part of the same fossiliferous concretion. Proposed Field Rating IIIB Local Resource. This material must be collected by a professional palaeontologist before construction of the powerline if Grid Option 1B is selected.
460	32°52'39.07" S 20°29'29.12" E	Rietfontein RE/197. Hillslope exposure of steeply dipping, SE-facing current-rippled bed top with sparse epichnial invertebrate burrows up to *c*. 2 cm wide, subhorizontal with central convex core (possibly segmented) and shallow marginal grooves. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
463	32°52'31.51" S 20°29'23.81" E	Rietfontein RE/197. Dense mat of reworked reedy sphenophyte stems (horsetail ferns) preserved as compressions within dark grey siltstones, shallow stream bed exposure. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
478	32°54'53.65"	Ekkraal 199. Stream bed and bank exposure of grey-green mudrocks of

	S 20°30'56.37" E	Abrahamskraal Fm with horizon containing several subcylindrical, vertical lungfish burrow casts up to 9 cm in diameter. Proposed Field Rating IIIB Local Resource. No mitigation recommended since site lies outside grid corridor.
480	32°54'52.93" S 20°30'58.94" E	Ekkraal 199. Stream bed exposure of grey-green siltstone or fine-grained wacke covered by purple-brown siltstone veneer and with dense assemblage of rounded traces between 0.5 to 1 cm in diameter – probably reedy plant stem casts (*e.g.* sphenophytes). Proposed Field Rating IIIC Local Resource. No mitigation recommended. Site lies outside grid corridor.
484	32°54'41.76 20°31'10.35" E"S	Ekkraal 199. Stream gulley exposure of mottled grey-green to purple-brown sandstone with assemblage of rounded, oval to irregular sand-infilled casts with reduction haloes, either of plant stems or invertebrate burrows. Proposed Field Rating IIIC Local Resource. No mitigation recommended. Site lies outside grid corridor.
492	32°55'11.03" S 20°31'54.90" E	Bon Espirange 73. Sandstone bed top with possible effaced desiccation crack infills, assemblage of reedy plant stem casts. Proposed Field Rating IIIC Local Resource. No mitigation recommended. Site lies outside grid corridor.

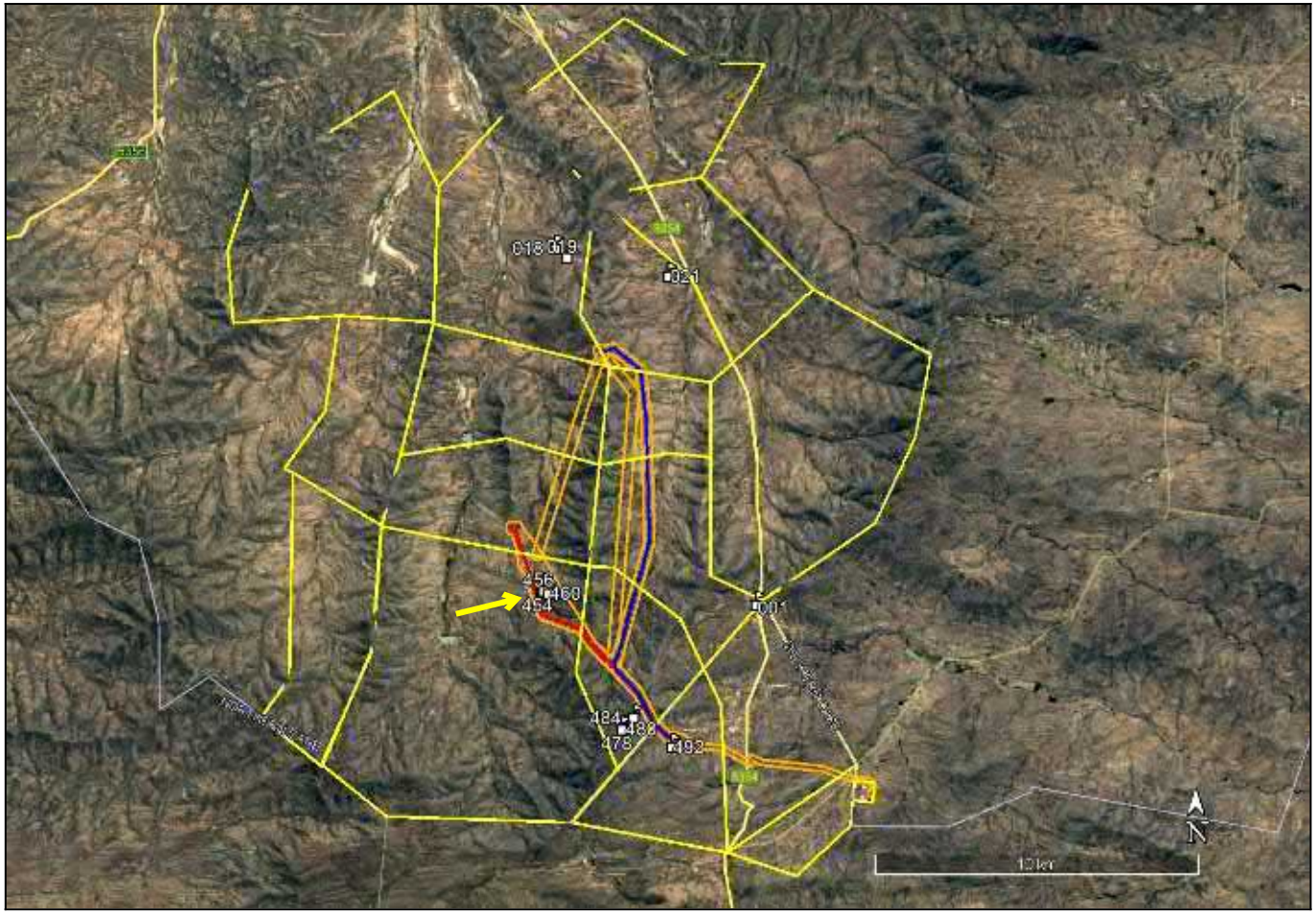


Figure A1: Google Earth© satellite image of the Kareebosch WEF (yellow polygons) and grid connection (orange corridors) project areas (See also Fig.1 for details). The sparse fossil sites recorded during the palaeontological site visit are indicated by the white numbered squares (See table above for details). Several of the fossil sites lie on the margins of, or shortly outside, the powerline corridor options and no mitigation in their regard is recommended here. A small cluster of potentially important vertebrate fossil sites lies close to the powerline option 1B (Locs. 454-456, arrowed; see also Figure A2 below). This material must be collected by a professional palaeontologist before construction of the powerline if Grid Option 1B is selected.

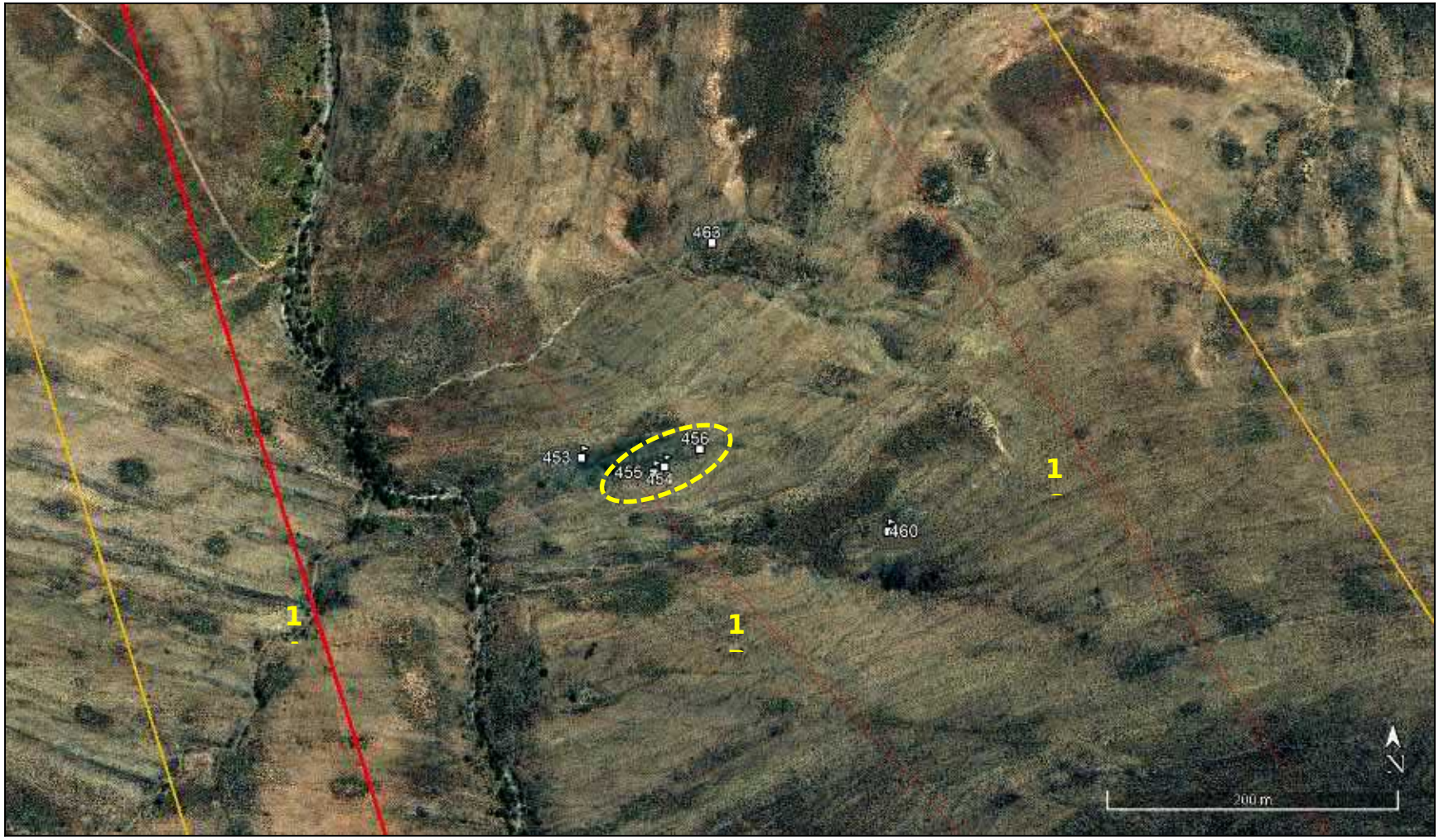


Figure A2: Detail of powerline route options 1A, 1B and 1C on part of Rietfontein RE/197 showing recorded fossil sites. If powerline Option 1B is selected for construction, vertebrate fossil material at or in the vicinity of Locs. 454-456 (yellow dashed ellipse) on Rietfontein RE/197 must be collected by a professional palaeontologist before construction of the powerline.

APPENDIX 2: CHANCE FOSSIL FINDS PROTOCOL: Kareebosch WEF grid connection to the Komsberg MTS between Matjiesfontein and Sutherland

<table>
<tr><td>Province & region:</td><td colspan="2">Western Cape (Laingsburg Local Municipality) and Northern Cape (Karoo Hoogland Local Municipality)</td></tr>
<tr><td>Responsible Heritage Resources Agency</td><td colspan="2">Heritage Western Cape for the Western Cape (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za)
SAHRA for the Northern Cape (Contact details: South African Heritage Resources Agency. 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel : 021 462 4502).</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup), Late Caenozoic alluvium, colluvium, eluvium</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Fossil vertebrate bones, teeth, large burrow casts, trackways, petrified wood, plant-rich beds in the Abrahamskraal Fm bedrocks.
Fossil mammal bones, teeth, horncores, freshwater molluscs, plant material, calcretised termitaria in Late Caenozoic alluvium.</td></tr>
<tr><td rowspan="4">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
Photograph fossils against a plain, level background, with scale
Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is</td></tr>
</table>

	appointed as soon as possible by the developer.
	5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency
Specialist palaeontologist	Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (*e.g.* museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.

APPENDIX 3: Heritage Screening Assessment and NID Submission

CTS HERITAGE

HERITAGE SCREENER

CTS Reference Number:	**CTS21_108**
HWC Ref No.	
SAHRIS Case No.	**17397**
Client:	**WSP**
Date:	**July 2022**
Title:	**Proposed establishment of 132kV powerline to evacuate power from the Karreebosch WEF to the National Grid in the Western and Northern Cape**

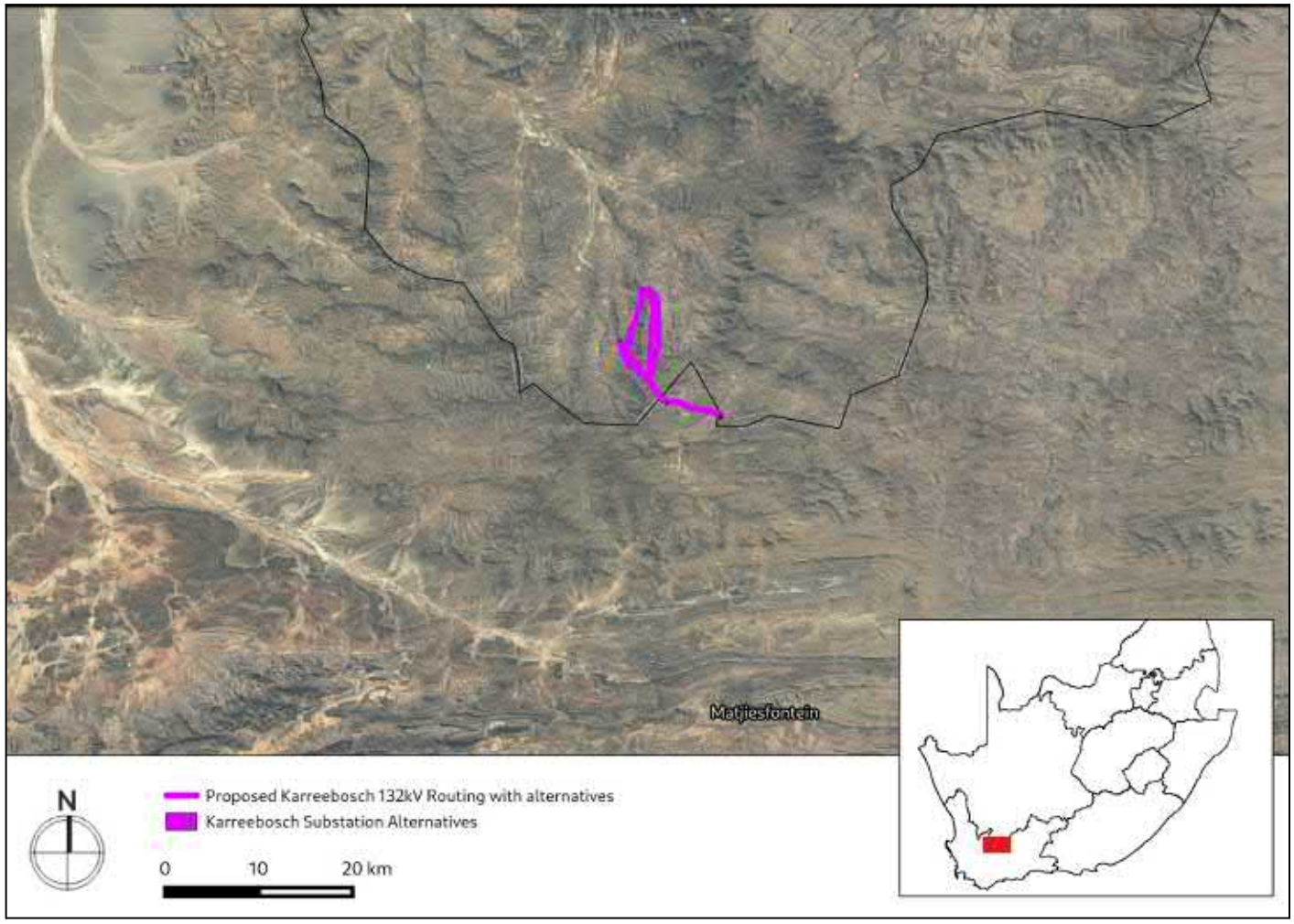


Figure 1a. Satellite map indicating the location of the proposed development in the Western and Northern Cape

CTS Heritage Recommendation	**RECOMMENDATION** **Based on the information available, it is likely that the proposed grid connection corridor will impact on significant archaeological heritage and as such, it is recommended that a Heritage Impact Assessment is conducted that complies with section 38(3) of the NHRA for the proposed development with special focus on impacts to significant archaeological heritage.**

CTS Heritage
238 Queens Road, Simons Town
Email: info@ctsheritage.com **Web:** www.ctsheritage.com

CTS HERITAGE

1. Proposed Development Summary

The proposed 132kV Karreebosch Overhead Powerline (OHPL), 33/132kV Substation and associated infrastructure is located 35km north of Matjiesfontein, and extends across two provinces, namely the Northern and Western Cape Provinces. The proposed Karreebosch OHPL will extend from the proposed Karreebosch onsite 33/132kV substation, which is situated in Ward 3 of the Karoo Hoogland Local Municipality in the Namakwa District Municipality in the Northern Cape into Ward 2 of the Laingsburg Local Municipality in the Central Karoo District Municipality in the Western Cape Province, where it will connect to the existing 400kV Komsberg substation via the existing Bon Espirange substation.

The proposed Karreebosch OHPL will evacuate power from the authorised Karreebosch Wind Energy Facility (WEF) (EA Ref: 14/12/16/3/3/2/807/AM3, which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process), located in the Northern Cape Province, and will connect to the existing Komsberg substation.

The OHPL will be a 132kV twin tern double circuit overhead powerline. The powerline towers will either be steel lattice or monopole structures. Figure 6 below provides an example of a conventional lattice tower compared with a monopole structure. Pole positions will only be available once the powerline detail design has been completed by the Eskom Design Review Team (DRT). However, a 400m wide assessment corridor is being considered (200m wide on either side of the centre line) and has been walked down by the specialists for approval to allow for micro siting of tower positions once the detailed design has been completed. It is anticipated that towers will be located on average 200m to 250m apart; however, longer spans may be needed due to terrain and watercourse crossings.

The registered servitude will fall within this 400m wide assessment corridor and will be 31m wide (15.5 m on either side of the centre line). The Right of Way servitude (servitude road) will be up to 14m wide (7m on either side of centre line), resulting in a total servitude width of 45m in total. The length of the longest powerline route alternative is 20.52 km, which will result in a servitude area of up to 92.3 ha.

The servitude is required to ensure safe construction, maintenance and operation of the powerline. Registration of the servitude grants the operator the right to erect, operate and maintain the powerline and to access the land to carry out such activities, but it does not constitute full ownership of the land. It should be noted that the OHPL will be ceded to Eskom post-construction.

Construction and operation activities and access to the powerline will be carried out with due respect to the affected landowners. The servitude required for the Project will be registered at the Deeds Office and will form part of the title deed of the relevant properties once the environmental authorisation has been obtained.

The Karreebosch OHPL will be routed from the proposed onsite Karreebosch 33/132kV substation (associated with the approved Karreebosch WEF (EA Ref: 14/12/16/3/3/2/807/AM3 which is currently undergoing a Part 2 EA amendment, final layout and EMPr approval process) to the existing Bon Espirange substation, after which it will connect to the existing 400kV Komsberg substation. Two alternative 33/132kV onsite substation locations at the Karreebosch WEF site have been assessed as part of as part of the Basic Assessment Process, each with a 200m x 150m (3 ha) footprint. A 200m assessment area surrounding the proposed substation alternatives have been included as part of this assessment for micro siting, with a slight funnel leading into the existing Bon Espirange and Komsberg substations to allow for greater flexibility for micro siting for incoming proposed line connections. The proposed Karreebosch OHPL may require an extension of the existing 400kV Komsberg substation, and therefore, the entire Komsberg substation property has been assessed as part of this BAR.

CTS HERITAGE

2. Application References

Name of relevant heritage authority(s)	SAHRA and HWC
Name of decision making authority(s)	DFFE

3. Property Information

Latitude / Longitude	32°53'48.07"S 20°30'44.56"E
Erf number / Farm number	Portion 2 (Nuwe Kraal) of Farm Ek Kraal No. 199 Remainder of Farm Wilgebosch Rivier No. 188 Remainder of farm Klipbanks Fontein No. 198 Portion 1 of Farm Klipbanks Fontein No. 198 Remainder of Farm Karreebosch No. 200 Portion 1 of Farm Ek Kraal No. 199 Remainder of Farm Ek Kraal No.199 Remainder of Farm Bon Espirange No. 73 Farm Rietfontein No. 197 Portion 1 of Farm Bon Espirange No. 73 Farm Aprils Kraal No. 105 Portion 2 of Farm Standvastigheid No. 210 RE/210 Standvastheid
Local Municipality	Laingsburg and Karoo Hoogland
District Municipality	Central Karoo and Namakwa District
Province	Western Cape and Northern Cape
Current Zoning	Agriculture

CTS HERITAGE

4. Nature of the Proposed Development

Total Area	Between 14km and 20km in length
Depth of excavation (m)	Powerline pole structures - excavations are typically 2 - 3 m in depth - often drilled not dug (depending on terrain)
Height of development (m)	Max 45m in height

5. Category of Development

x	**Triggers: Section 38(8) of the National Heritage Resources Act**
	Triggers: Section 38(1) of the National Heritage Resources Act
x	1. Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length.
	2. Construction of a bridge or similar structure exceeding 50m in length.
	3. Any development or activity that will change the character of a site-
	a) exceeding 5 000m^2 in extent
	b) involving three or more existing erven or subdivisions thereof
	c) involving three or more erven or divisions thereof which have been consolidated within the past five years
	4. Rezoning of a site exceeding 10 000m^2
	5. Other (state):

6. Additional Infrastructure Required for this Development

Substation - assume 3ha (that should include construction space. Concrete slab, transformers , buss bars etc.. Similar height to towers.

7. Mapping (please see Appendix 3 and 4 for a full description of our methodology and map legends)

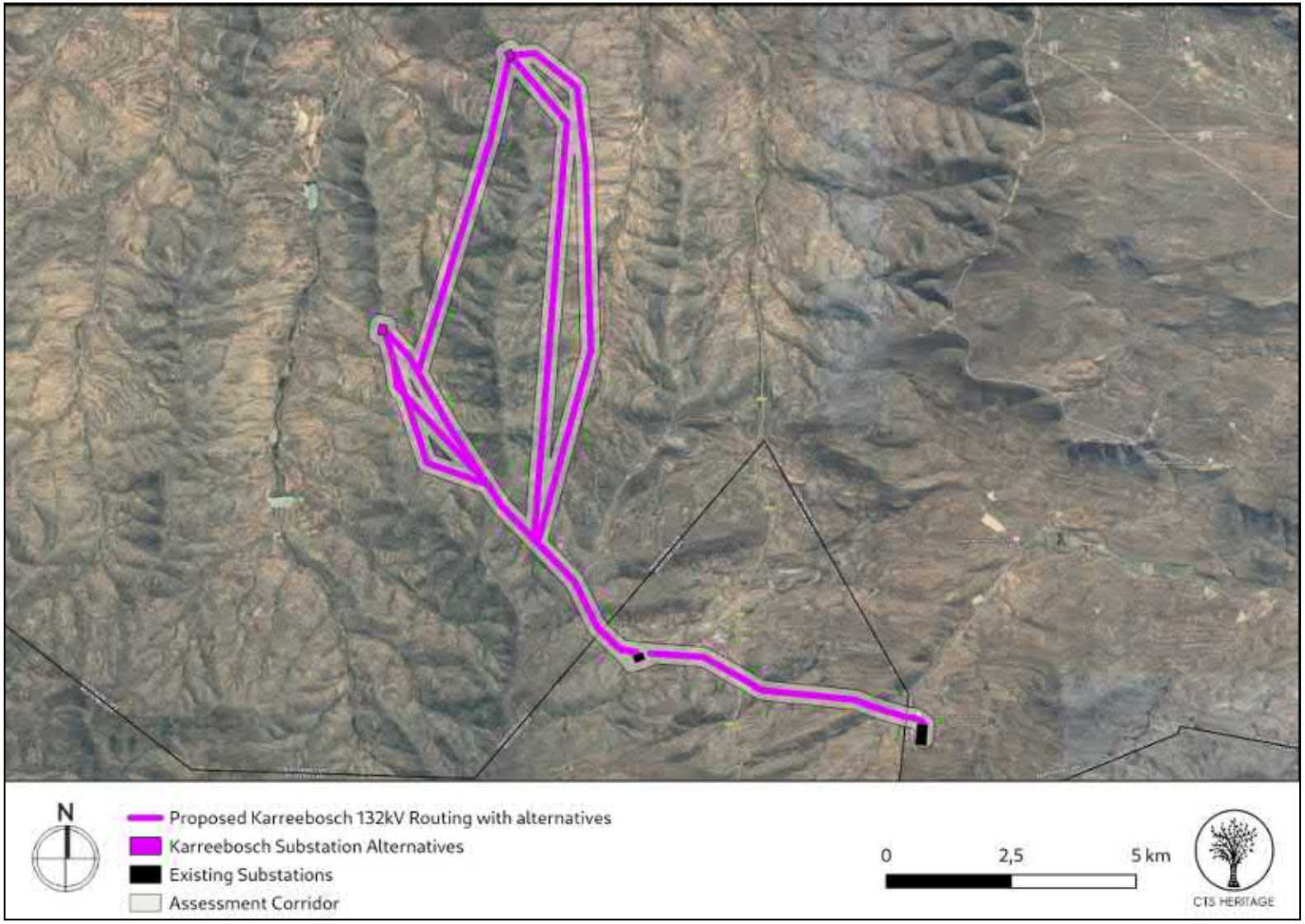


Figure 1b. Overview Map. Satellite image (2022) indicating the proposed development area

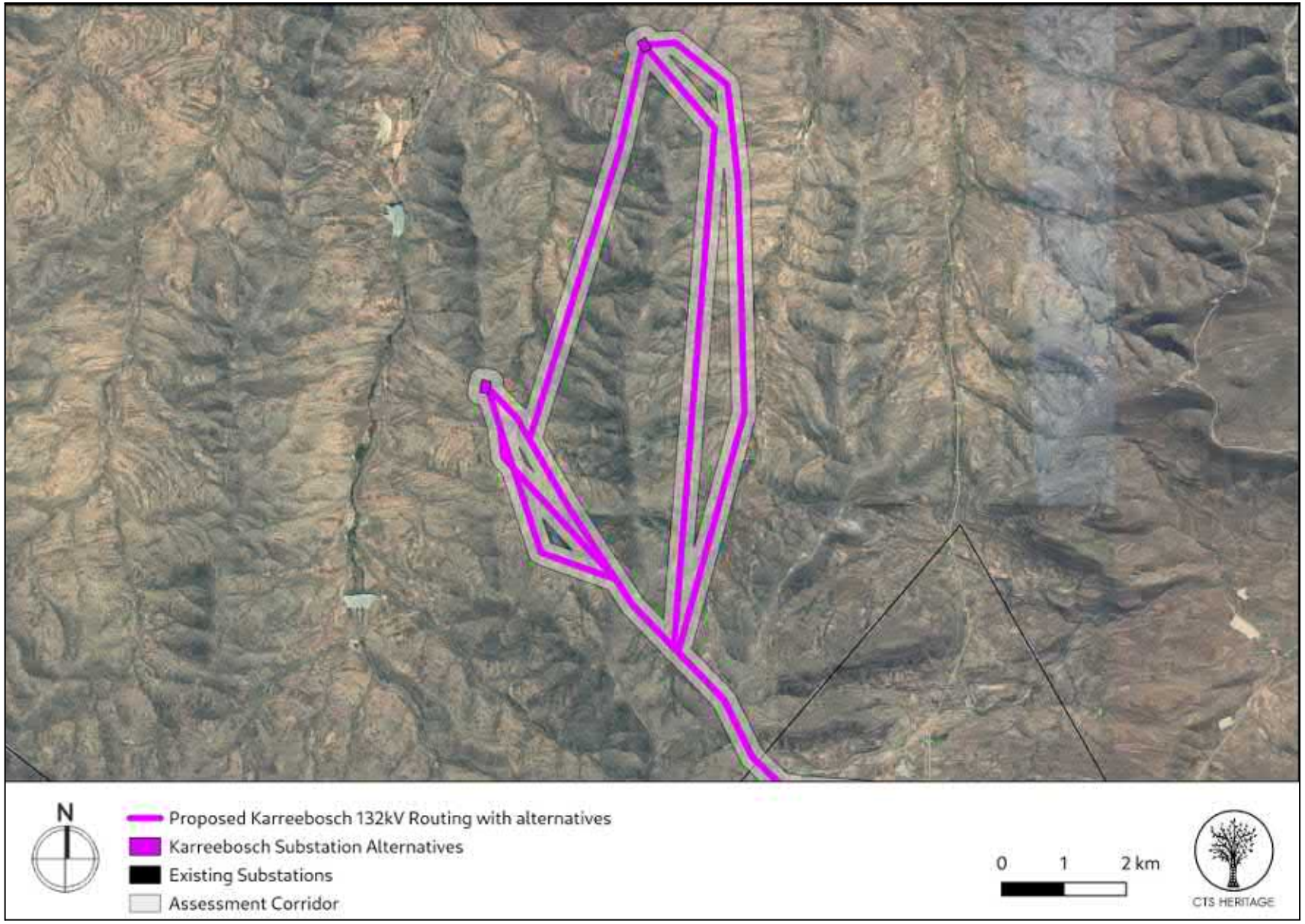


Figure 1c. Overview Map. Satellite image (2020) indicating the proposed development area in the Northern Cape

Figure 1d. Overview Map. Satellite image (2020) indicating the proposed development area in the Western and Northern Cape

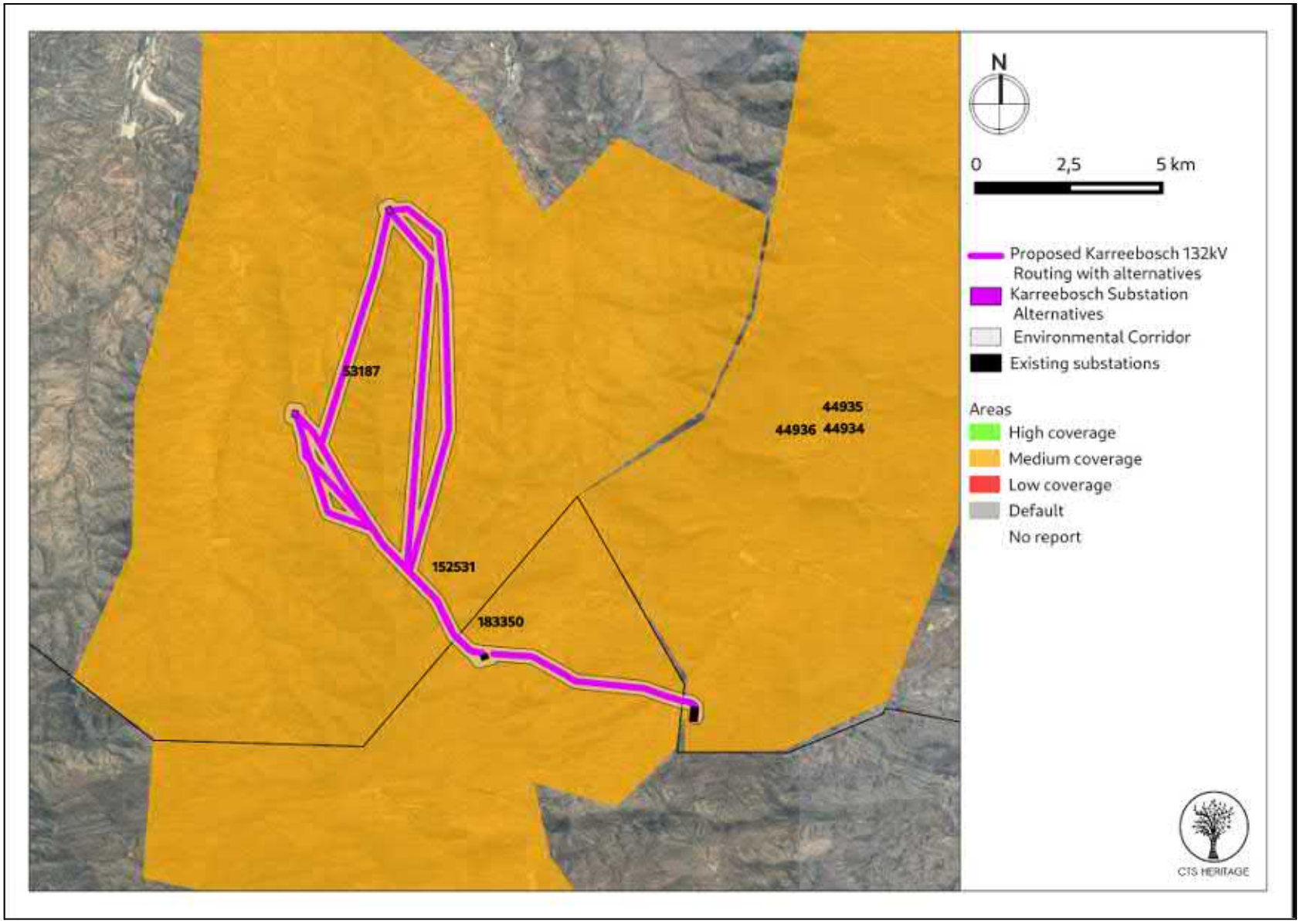


Figure 2a. Previous HIAs Map. Previous Heritage Impact Assessments covering the proposed development area with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

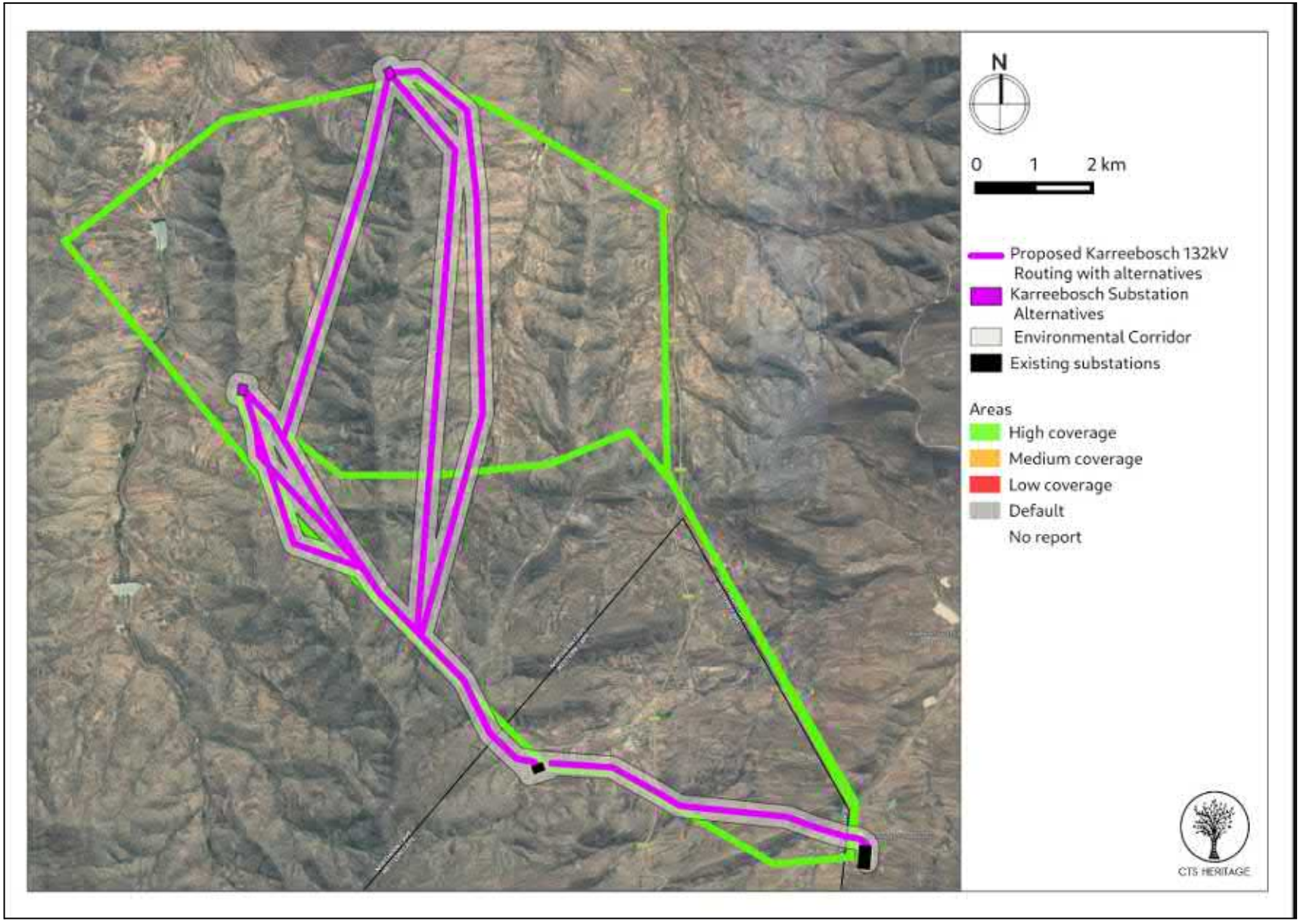


Figure 2b. Previous HIAs Map. HIA conducted by ACO including PIA by Dr Almond (2015) covered a powerline in the area proposed for development (SAHRIS Ref 183350).

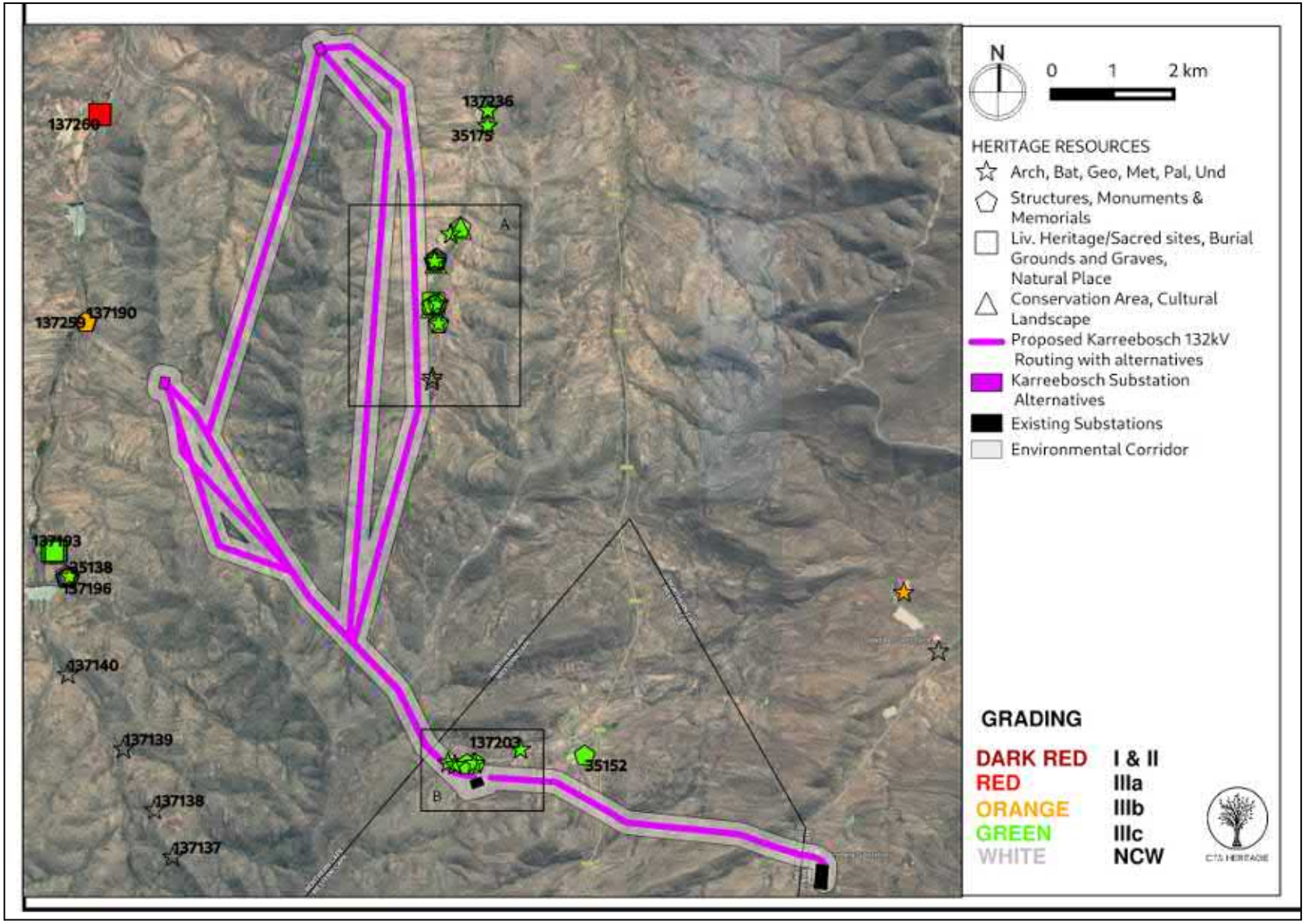


Figure 3. Heritage Resources Map. Heritage Resources previously identified within the study area, with SAHRIS Site IDs indicated in the insets below. Please See Appendix 4 for a full description of heritage resource types.

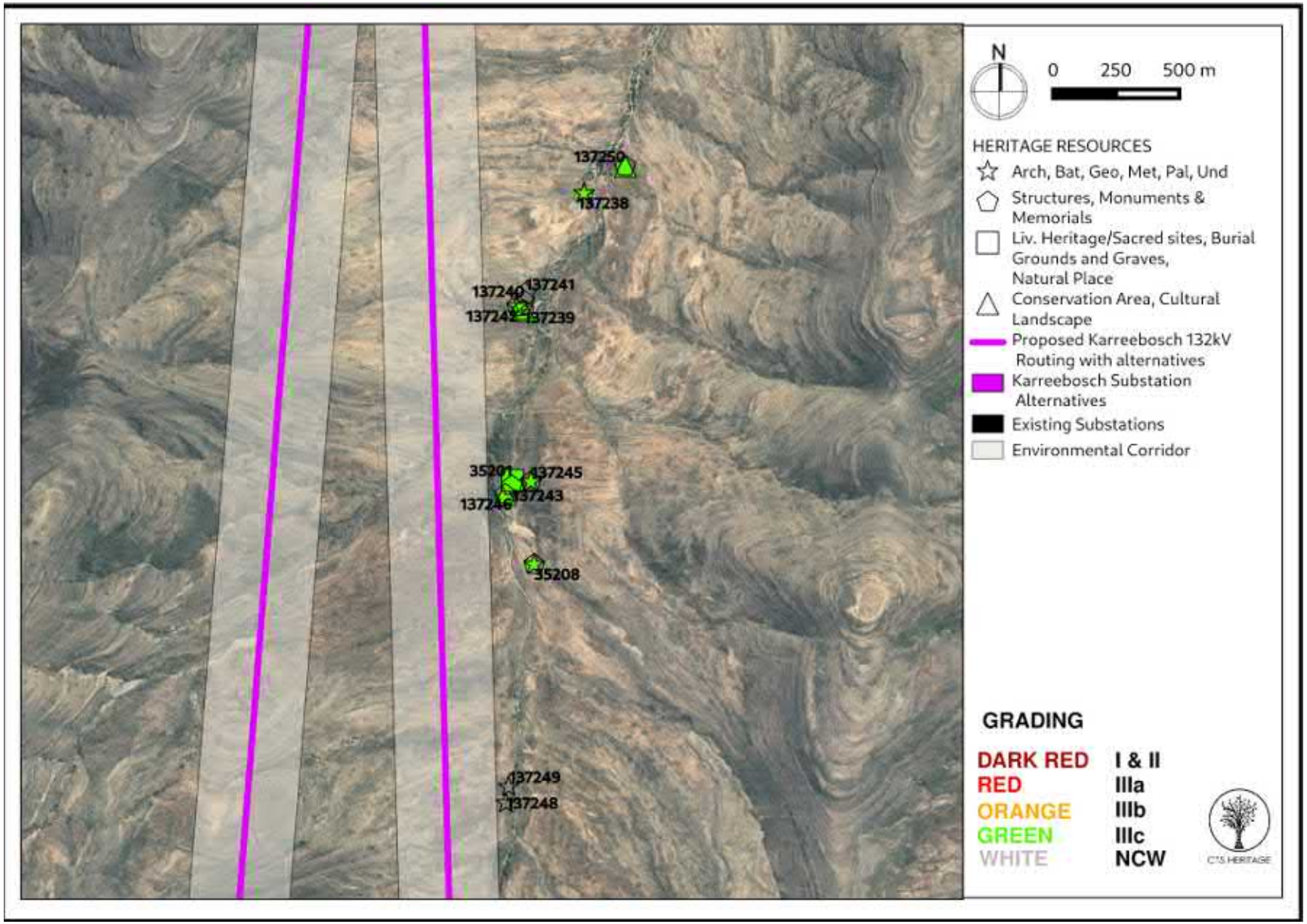


Figure 3a. Heritage Resources Map Inset A

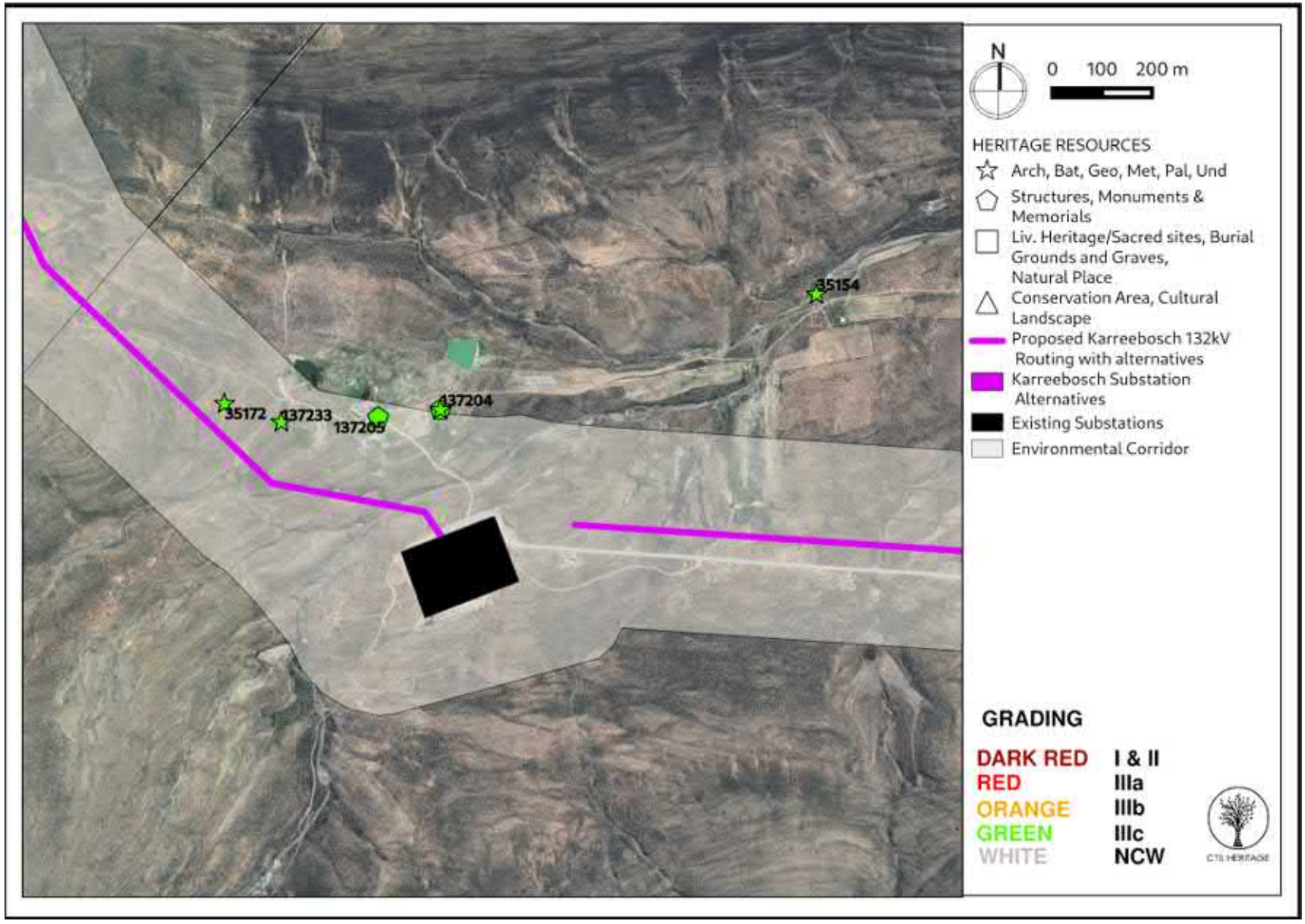


Figure 3b. Heritage Resources Map Inset B

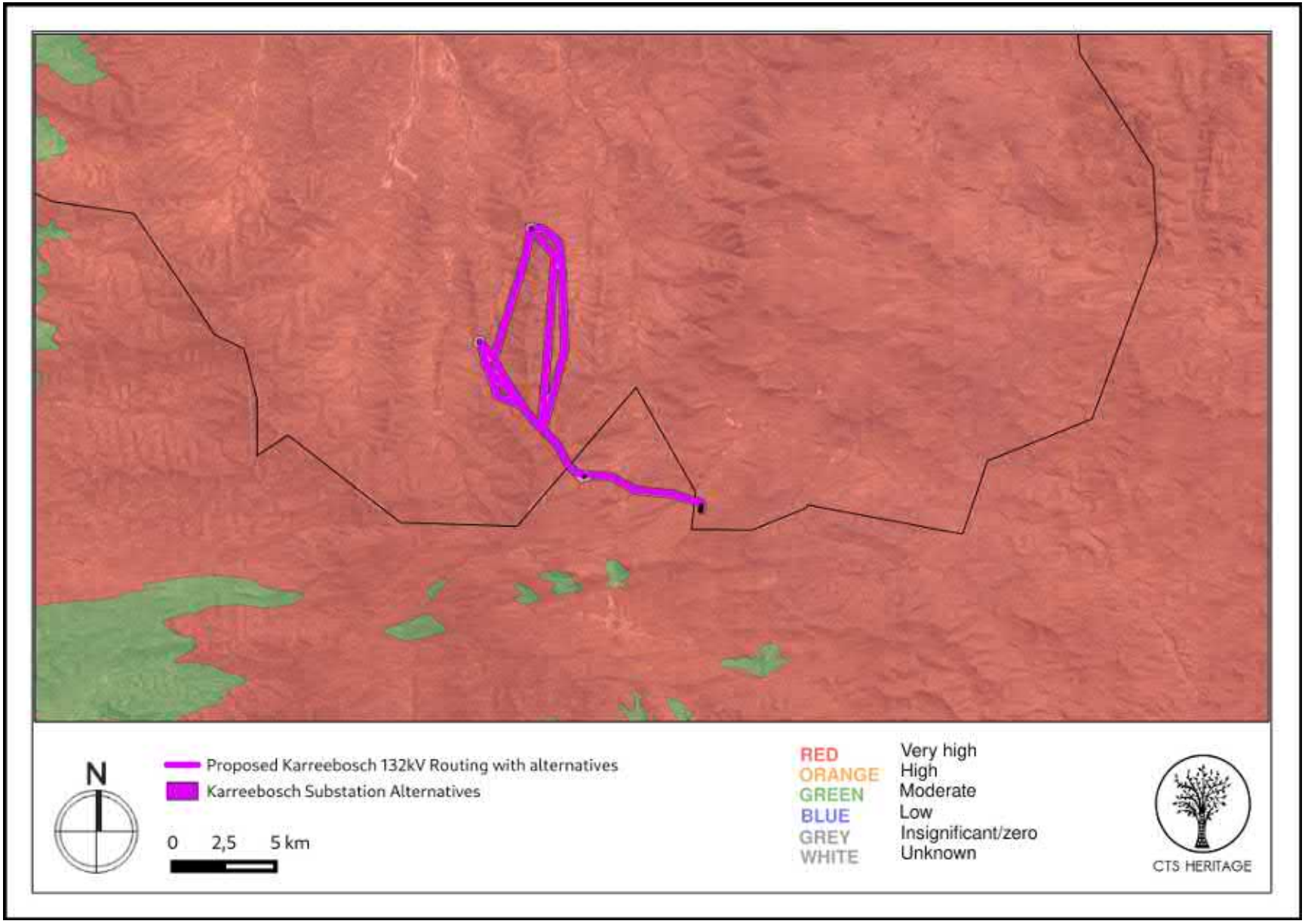


Figure 4a. Palaeosensitivity Map. Indicating fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

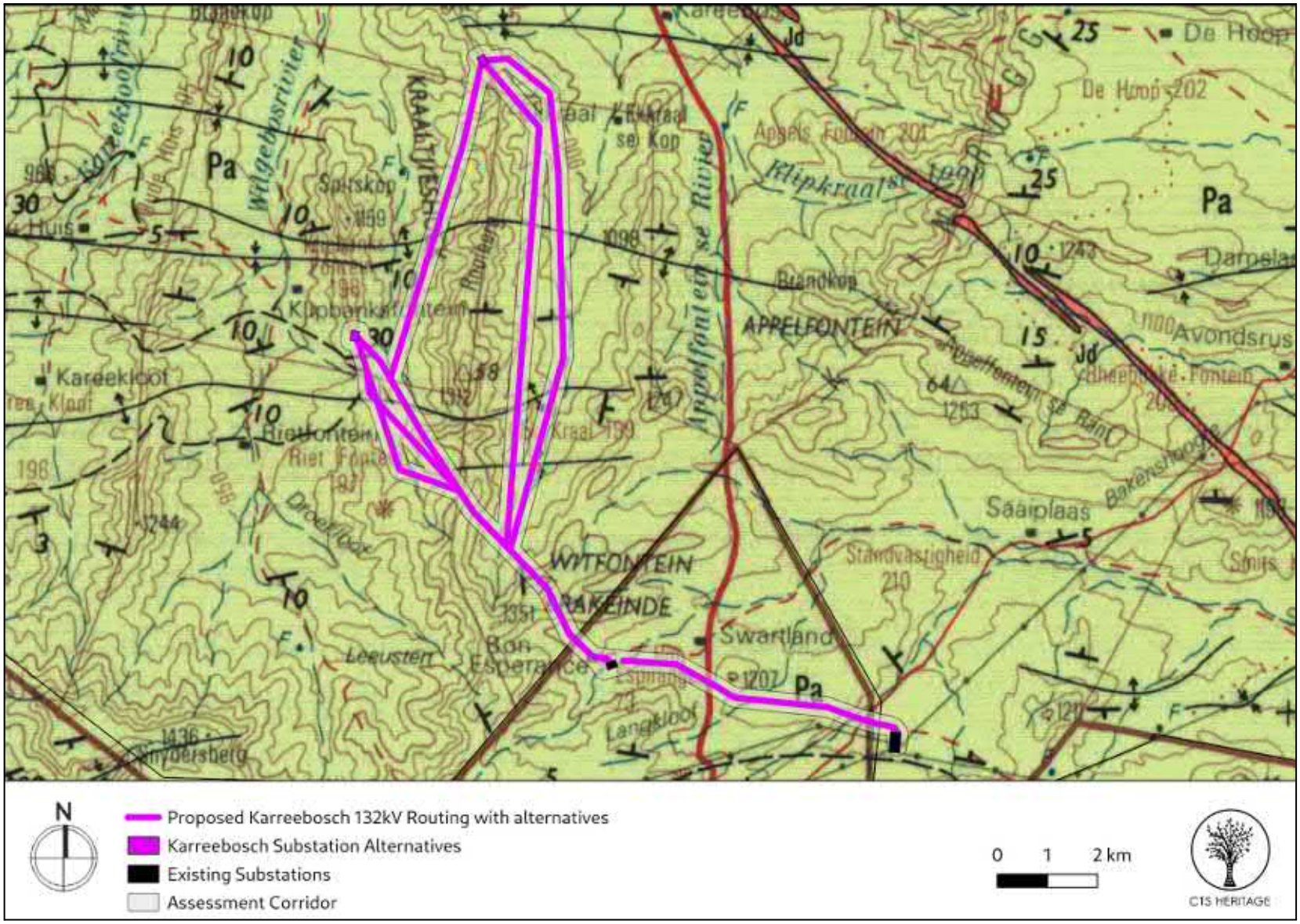


Figure 4b. Geology Map. Extract from the CGS 3220 Sutherland Map indicating that the development area for the proposed Karrebosch Powerline is underlain by the Pa: Abrahamskraal Formation of the Beaufort Group

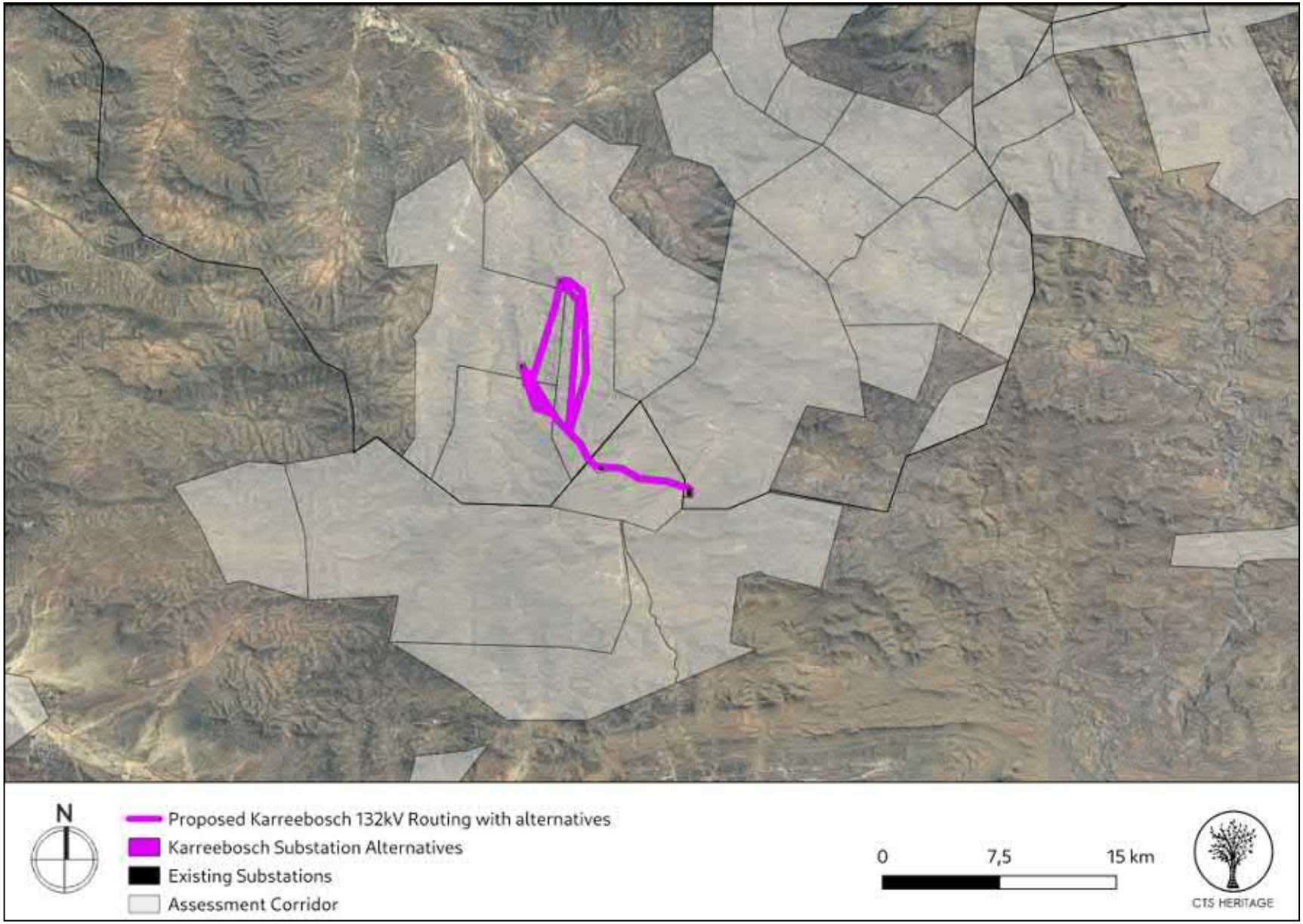
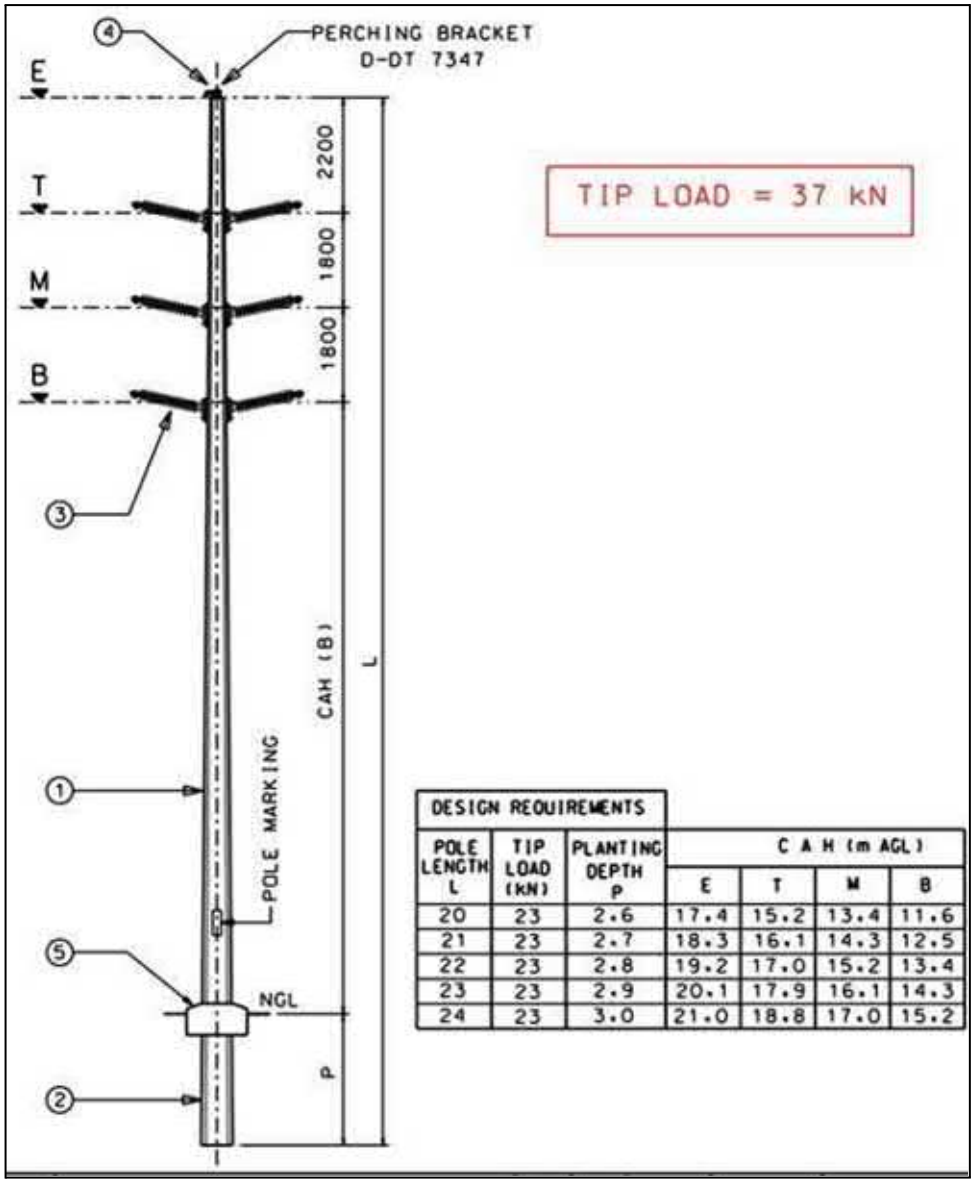
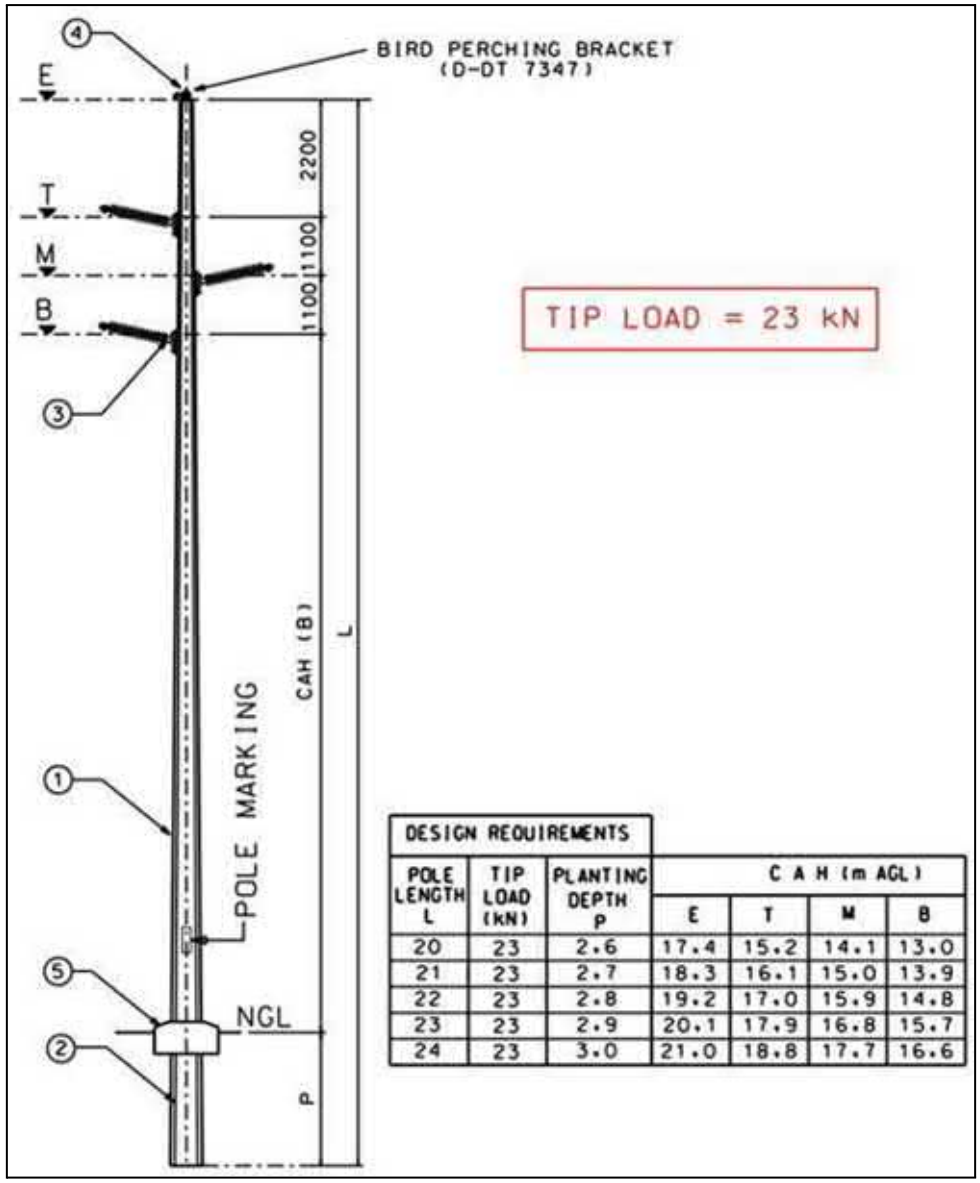


Figure 5. Cumulative Impact Map. Indicating other Renewable Energy Facilities that have been granted Environmental Authorisation (EA).



DESIGN REQUIREMENTS						
POLE LENGTH L	TIP LOAD (kN)	PLANTING DEPTH P	C A H (m AGL)			
			E	T	M	B
20	23	2.6	17.4	15.2	13.4	11.6
21	23	2.7	18.3	16.1	14.3	12.5
22	23	2.8	19.2	17.0	15.2	13.4
23	23	2.9	20.1	17.9	16.1	14.3
24	23	3.0	21.0	18.8	17.0	15.2



DESIGN REQUIREMENTS						
POLE LENGTH L	TIP LOAD (kN)	PLANTING DEPTH P	C A H (m AGL)			
			E	T	M	B
20	23	2.6	17.4	15.2	14.1	13.0
21	23	2.7	18.3	16.1	15.0	13.9
22	23	2.8	19.2	17.0	15.9	14.8
23	23	2.9	20.1	17.9	16.8	15.7
24	23	3.0	21.0	18.8	17.7	16.6

Figure 6. Typical Infrastructure. Eskom

8. Heritage Assessment

This application is for a proposed powerline associated with the approved Karreebosch Wind Energy Facility (WEF) located in both the Western and Northern Cape Provinces (14/12/16/3/3/2/807/AM3). The Karreebosch WEF was previously referred to as Phase 2 of the Roggeveld WEF. SAHRA has made numerous comments on both the Roggeveld WEF and the Karreebosch WEF from 2013 with the last comment issued on 26 September 2018 (Case 7379 on SAHRIS). EA was granted for the Karreebosch WEF on 29 January 2016. In the EA, various requirements were stipulated in terms of impacts to Historical, Cultural and Palaeontological sites. Much of the area proposed for the development of the powerline was assessed as part of the HIA completed for the Karreebosch WEF (Figure 2a and 2b above) drafted by the ACO (Kendrick, 2015, SAHRIS Ref 183350). The remaining sections of the proposed powerline were assessed in the Heritage Assessments completed for the Roggeveld WEF (Hart and Webley, 2013, SAHRIS Ref 152531). The heritage information identified in these reports has been extracted and are mapped in Figures 3, 3a and 3b above. These reports are also referred to below in order to provide a contextual analysis of the heritage sensitivity of the area proposed for development.

The area proposed for development has been previously assessed, more than once. In addition, the proposed powerline routes lie immediately adjacent to existing grid infrastructure. The original fieldwork conducted for the Roggeveld WEF HIA (Hart and Webley, 2013) which covered the area proposed for development was comprehensive and remains relevant, similarly the fieldwork conducted for the Karreebosch WEF (2015). The Karreebosch HIA (2015) "*revealed that the study area is relatively austere in terms of pre-colonial heritage, however valley bottoms contain evidence of early trekboer cultural landscapes – ruins, graves and occasional middens. These consist of collections of ruined stone and mud buildings, threshing floors and kraals located exclusively in the valley areas between the high longitudinal ridges that characterise the study area. There are a number of existing farm houses that contain 19th century fabric, however very few of these have anything more than moderate heritage significance. Parts of the study area enjoy very high aesthetic qualities with the area known by locals as "Gods Window" having grade II aesthetic qualities, hence the significance of the study area lies mainly with its undeveloped wilderness qualities. Interestingly, pre-colonial or stone age heritage and archaeology is extremely scarce in the areas that were searched. Very few archaeological sites of these kinds were recorded despite the fact that overall 9 experienced archaeologists were involved in scouring the landscape.*" The HIA for the Karreebosch WEF notes that "*The most important colonial archaeological sites in the study area are associated with Ekkraal Valley, the Rietfontein-Wilgebosch River valley and the Krans Kraal-Karrekraal valley. The valley bottoms are archaeologically sensitive...*". As the proposed powerline alternatives traverse the valley areas which have been determined to be archaeologically sensitive, it is likely that significant archaeological heritage resources may be impacted by the proposed development. Further specialist archaeological assessment is therefore recommended.

According to the SAHRIS Palaeosensitivity Map (Figure 4 above), the area proposed for the powerline development is underlain by sediments of very high palaeontological sensitivity belonging to the Abrahamskraal Formation of the Beaufort Group. A Palaeontological Assessment was conducted by Almond (2015) for the Karreebosch WEF which covers a larger portion of the area proposed for the powerline development, and covered the proposed powerline alternatives specifically (Figure 2b above, Appendix to the ACO Report 2015, SAHRIS Ref 183350). According to Almond (2015), "*The fluvial Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) that underlies almost the entire wind farm study area is known for its diverse fauna of Permian fossil vertebrates - notably various small- to large-bodied therapsids and reptiles - as well as fossil plants of the Glossopteris Flora and low diversity trace fossil assemblages. However, desktop analysis of known fossil distribution within the Main Karoo Basin shows a marked paucity of fossil localities in the study region between Matjiesfontein and Sutherland where sediments belonging only to the lower part of the thick Abrahamskraal Formation succession are represented. Bedrock exposure levels in the Karreebosch Wind Farm study area are generally very poor due to the pervasive cover by superficial sediments (colluvium, alluvium, soils, calcrete) and vegetation. Nevertheless, a sufficiently large outcrop area of Abrahamskraal Formation sediments, exposed in stream and riverbanks, borrow pits, erosion gullies as well as road cuttings along the R354, has been examined during the present fieldwork to infer that macroscopic fossil remains of any sort are very rare indeed here. Exceptions include common trace fossil assemblages (invertebrate burrows) and occasional fragmentary plant remains (horsetail ferns). Levels of tectonic deformation of the bedrocks are generally low and baking by dolerite intrusions (Early Jurassic Karoo Dolerite Suite) is very minor. It is concluded that the Lower Beaufort Group bedrocks in the study area are generally of low palaeontological sensitivity and this also applies to the overlying Late Caenozoic superficial sediments (colluvium, alluvium, calcrete, soils etc).*"

Dr Almond goes on to note that "*No areas or sites of exceptional fossil heritage sensitivity or significance have been identified within the Karreebosch Wind Farm study area. The majority of fossil sites recorded in the study region lie outside the anticipated development footprint. The common trace fossil assemblages identified in this study are of widespread occurrence within the Abrahamskraal Formation (i.e. not unique to the study area). Construction of the Karreebosch Wind Farm and associated infrastructure is therefore unlikely to entail significant impacts on local fossil heritage resources; i.e. the impact significance of the wind farm project is assessed as MINOR. The impact significance of both transmission line route options to Komsberg Substation (Figure 2b) is likewise assessed as MINOR and there is no marked preference for either route option on palaeontological grounds. Irreplaceable loss of fossil heritage is not anticipated, although it should be highlighted that any new vertebrate fossil finds made during construction (e.g. exposed in new bedrock excavations) would be of considerable scientific interest, given their rarity*." According to the HIA for the Karrebosch WEF (ACO, 2015), "*While the geology of the study area is potentially palaeontologically sensitive, very few fossils were found by either Dr Duncan Miller or Dr John Almond in the study area. No further work in this respect is recommended, other than reporting of any finds during construction to the heritage authorities.*" Due to the overlap in assessment areas (Figure 2b above), these findings can be extrapolated to the current proposed powerline development. As such, it is recommended that little new information is likely to be gained by further palaeontological fieldwork. Potential impacts to palaeontological heritage can be mitigated through the inspection of final pylon footings by a palaeontologist prior to construction.

According to various ACO reports (2011, 2013 and 2015), parts of the study area enjoy very high aesthetic qualities hence the significance of the study area lies mainly with its undeveloped wilderness qualities which may be negatively impacted by the development of the proposed powerline. However, it must be noted that the proposed powerline is located within a Renewable Energy Development Zone which has been identified for this kind of development. In REDZ areas, there is a reasonable expectation that the cultural landscape of an area will be changed to be dominated, or at least heavily altered, by renewable energy development and its associated infrastructure. In fact, this is the intention of the REDZ areas. Furthermore, the proposed powerline is located within a suite of authorised renewable energy facilities (Figure 5 above) and as such, the impact of this proposed powerline on the cultural landscape is likely to be negligible. No further specialist cultural landscape assessment is therefore recommended.

RECOMMENDATION

Based on the information available, it is likely that the proposed grid connection corridor will impact on significant archaeological heritage and as such, it is recommended that a Heritage Impact Assessment is conducted that complies with section 38(3) of the NHRA for the proposed development with special focus on impacts to significant archaeological heritage.

CTS HERITAGE

APPENDIX 1

List of heritage resources within the development area

Site ID	Site no	Full Site Name	Site Type	Grading
35222	ROG037	Roggeveld 037	Building	Grade IIIb
35135	ROG005	Roggeveld 005	Building	Grade IIIc
35138	ROG008	Roggeveld 008	Stone walling	Grade IIIc
35152	ROG012	Roggeveld 012	Building	Grade IIIc
35154	ROG013	Roggeveld 013	Stone walling	Grade IIIc
35157	ROG014	Roggeveld 014	Transport infrastructure	Grade IIIc
35159	ROG015	Roggeveld 015	Building	Grade IIIc
35171	ROG016	Roggeveld 016	Stone walling	Grade IIIc
35172	ROG017	Roggeveld 017	Stone walling	Grade IIIc
35174	ROG019	Roggeveld 019	Stone walling	Grade IIIc
35175	ROG020	Roggeveld 020	Stone walling	Grade IIIc
35177	ROG021	Roggeveld 021	Stone walling	Grade IIIc
35178	ROG022	Roggeveld 022	Conservation Area	Grade IIIc
35191	ROG025	Roggeveld 025	Ruin> 100 years, Artefacts	Grade IIIc
35202	ROG028	Roggeveld 028	Artefacts	Grade IIIc
35204	ROG029	Roggeveld 029	Cultural Landscape	Grade IIIc
35208	ROG030	Roggeveld 030	Stone walling	Grade IIIc

35215	ROG033	Roggeveld 033	Cultural Landscape	Grade IIIc
35137	ROG007	Roggeveld 007	Burial Grounds & Graves	Grade IIIc
35201	ROG027	Roggeveld 027	Burial Grounds & Graves	Grade IIIc
35226	ROG038	Roggeveld 038	Burial Grounds & Graves	Grade IIIa
137190	KWF-005	KAREEBOSCH WIND FARM	Building	
137192	KWF-007	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137193	KWF-008	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137194	KWF-009	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137195	KWF-010	KAREEBOSCH WIND FARM	Structures	
137196	KWF-011	KAREEBOSCH WIND FARM	Structures	
137197	KWF-012	KAREEBOSCH WIND FARM	Structures	
137198	KWF-013	KAREEBOSCH WIND FARM	Structures	
137202	KWF-017	KAREEBOSCH WIND FARM	Building	
137203	KWF-018	KAREEBOSCH WIND FARM	Stone walling	
137204	KWF-019	KAREEBOSCH WIND FARM	Archaeological	
137205	KWF-020	KAREEBOSCH WIND FARM	Building	
137233	KWF-021	KAREEBOSCH WIND FARM	Stone walling	
137234	KWF-022	KAREEBOSCH WIND FARM	Stone walling	
137236	KWF-024	KAREEBOSCH WIND FARM	Stone walling	
137237	KWF-025	KAREEBOSCH WIND FARM	Stone walling	

137238	KWF-026	KAREEBOSCH WIND FARM	Stone walling	
137239	KWF-027	KAREEBOSCH WIND FARM	Structures	
137240	KWF-028	KAREEBOSCH WIND FARM	Structures	
137241	KWF-029	KAREEBOSCH WIND FARM	Structures	
137242	KWF-030	KAREEBOSCH WIND FARM	Structures	
137243	KWF-031	KAREEBOSCH WIND FARM	Structures	
137244	KWF-032	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137245	KWF-033	KAREEBOSCH WIND FARM	Structures, Artefacts	
137246	KWF-034	KAREEBOSCH WIND FARM	Structures	
137247	KWF-035	KAREEBOSCH WIND FARM	Structures	
137248	KWF-036	KAREEBOSCH WIND FARM	Stone walling	
137249	KWF-037	KAREEBOSCH WIND FARM	Stone walling	
137250	KWF-038	KAREEBOSCH WIND FARM	Structures	
137259	KWF-046	KAREEBOSCH WIND FARM	Structures	Ungraded
137260	KWF-047	KAREEBOSCH WIND FARM	Burial Grounds & Graves	
137137	BWE-048	Brandvalley Wind Energy	Deposit	
137138	BWE-049	Brandvalley Wind Energy	Deposit	
137139	BWE-050	Brandvalley Wind Energy	Deposit	
137140	BWE-051	Brandvalley Wind Energy	Deposit	

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APPENDIX 2

Reference List with relevant AIAs and PIAs

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
44934	AIA Desktop	Celeste Booth	01/08/2011	An archaeological desktop study for the proposed establishment of the Hidden Valley wind energy facility and associated infrastructure on a a site south of Sutherland, Northern Cape Province
44935	AIA Phase 1	Celeste Booth	01/02/2012	A Phase 1 AIA for the proposed HIdden Valley Wind Energy Facility, near Sutherland, Northern cape Province
44936	PIA Desktop	Lloyd Rossouw	01/03/2012	Palaeontological desktop assessment of the proposed Hidden Valley Wind Energy Facility near Sutherland, Northern Cape Province
53187	HIA Phase 1	Timothy Hart, Lita Webley	01/03/2011	HERITAGE IMPACT ASSESSMENT PROPOSED WIND ENERGY FACILITY
152531	HIA Phase 1	Timothy Hart, Lita Webley	20/12/2013	Heritage Impact Assessment Report for the Phase 1 Roggeveld Wind Farm
183350	HIA Phase 1	Natalie Kendrick	27/10/2014	Heritage Impact Assessment for the Karreebosch Wind Farm (Phase 2 Roggevelt Wind Farm)
353483	AIA Phase 1	Jonathan Kaplan	1/12/2015	ARCHAEOLOGICAL IMPACT ASSESSMENT Proposed borrow pit (Karusa R354) on the Farm Karreebosch 200/1 near Sutherland, Northern Cape Assessment conducted under Section 38 (3) of the National Heritage Resource Act (No. 25 of 1999)

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APPENDIX 3 - Keys/Guides

Key/Guide to Acronyms

AIA	Archaeological Impact Assessment
DARD	Department of Agriculture and Rural Development (KwaZulu-Natal)
DEFF	Department of Environmental, Forestry and Fisheries (National)
DEADP	Department of Environmental Affairs and Development Planning (Western Cape)
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism (Eastern Cape)
DEDECT	Department of Economic Development, Environment, Conservation and Tourism (North West)
DEDT	Department of Economic Development and Tourism (Mpumalanga)
DEDTEA	Department of economic Development, Tourism and Environmental Affairs (Free State)
DENC	Department of Environment and Nature Conservation (Northern Cape)
DMR	Department of Mineral Resources (National)
GDARD	Gauteng Department of Agriculture and Rural Development (Gauteng)
HIA	Heritage Impact Assessment
LEDET	Department of Economic Development, Environment and Tourism (Limpopo)
MPRDA	Mineral and Petroleum Resources Development Act, no 28 of 2002
NEMA	National Environmental Management Act, no 107 of 1998
NHRA	National Heritage Resources Act, no 25 of 1999
PIA	Palaeontological Impact Assessment
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
VIA	Visual Impact Assessment

Full guide to Palaeosensitivity Map legend

	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/PURPLE:	LOW - no palaeontological studies are required however a protocol for chance finds is required
	GREY:	INSIGNIFICANT/ZERO - no palaeontological studies are required
	WHITE/CLEAR:	UNKNOWN - these areas will require a minimum of a desktop study.

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APPENDIX 4 - Methodology

The Heritage Screener summarises the heritage impact assessments and studies previously undertaken within the area of the proposed development and its surroundings. Heritage resources identified in these reports are assessed by our team during the screening process.

The heritage resources will be described both in terms of **type**:

- Group 1: Archaeological, Underwater, Palaeontological and Geological sites, Meteorites, and Battlefields
- Group 2: Structures, Monuments and Memorials
- Group 3: Burial Grounds and Graves, Living Heritage, Sacred and Natural sites
- Group 4: Cultural Landscapes, Conservation Areas and Scenic routes

and **significance** (Grade I, II, IIIa, b or c, ungraded), as determined by the author of the original heritage impact assessment report or by formal grading and/or protection by the heritage authorities.

Sites identified and mapped during research projects will also be considered.

DETERMINATION OF THE EXTENT OF THE INCLUSION ZONE TO BE TAKEN INTO CONSIDERATION

The extent of the inclusion zone to be considered for the Heritage Screener will be determined by CTS based on:

- the size of the development,
- the number and outcome of previous surveys existing in the area
- the potential cumulative impact of the application.

The inclusion zone will be considered as the region within a maximum distance of 50 km from the boundary of the proposed development.

DETERMINATION OF THE PALAEONTOLOGICAL SENSITIVITY

The possible impact of the proposed development on palaeontological resources is gauged by:

- reviewing the fossil sensitivity maps available on the South African Heritage Resources Information System (SAHRIS)
- considering the nature of the proposed development
- when available, taking information provided by the applicant related to the geological background of the area into account

DETERMINATION OF THE COVERAGE RATING ASCRIBED TO A REPORT POLYGON

Each report assessed for the compilation of the Heritage Screener is colour-coded according to the level of coverage accomplished. The extent of the surveyed coverage is labeled in three categories, namely low, medium and high. In most instances the extent of the map corresponds to the extent of the development for which the specific report was undertaken.

Low coverage will be used for:

- desktop studies where no field assessment of the area was undertaken;
- reports where the sites are listed and described but no GPS coordinates were provided.
- older reports with GPS coordinates with low accuracy ratings;
- reports where the entire property was mapped, but only a small/limited area was surveyed.
- uploads on the National Inventory which are not properly mapped.

Medium coverage will be used for

- reports for which a field survey was undertaken but the area was not extensively covered. This may apply to instances where some impediments did not allow for full coverage such as thick vegetation, etc.
- reports for which the entire property was mapped, but only a specific area was surveyed thoroughly. This is differentiated from low ratings listed above when these surveys cover up to around 50% of the property.

High coverage will be used for

- reports where the area highlighted in the map was extensively surveyed as shown by the GPS track coordinates. This category will also apply to permit reports.

RECOMMENDATION GUIDE

The Heritage Screener includes a set of recommendations to the applicant based on whether an impact on heritage resources is anticipated. One of three possible recommendations is formulated:

(1) The heritage resources in the area proposed for development are sufficiently recorded - The surveys undertaken in the area adequately captured the heritage resources. There are no known sites which require mitigation or management plans. No further heritage work is recommended for the proposed development.

This recommendation is made when:

- enough work has been undertaken in the area
- it is the professional opinion of CTS that the area has already been assessed adequately from a heritage perspective for the type of development proposed

(2) The heritage resources and the area proposed for development are only partially recorded - The surveys undertaken in the area have not adequately captured the heritage resources and/or there are sites which require mitigation or management plans. Further specific heritage work is recommended for the proposed development.

This recommendation is made in instances in which there are already some studies undertaken in the area and/or in the adjacent area for the proposed development. Further studies in a limited HIA may include:

- improvement on some components of the heritage assessments already undertaken, for instance with a renewed field survey and/or with a specific specialist for the type of heritage resources expected in the area
- compilation of a report for a component of a heritage impact assessment not already undertaken in the area

- undertaking mitigation measures requested in previous assessments/records of decision.

(3) The heritage resources within the area proposed for the development have not been adequately surveyed yet - Few or no surveys have been undertaken in the area proposed for development. A full Heritage Impact Assessment with a detailed field component is recommended for the proposed development.

Note:
The responsibility for generating a response detailing the requirements for the development lies with the heritage authority. However, since the methodology utilised for the compilation of the Heritage Screeners is thorough and consistent, contradictory outcomes to the recommendations made by CTS should rarely occur. Should a discrepancy arise, CTS will immediately take up the matter with the heritage authority to clarify the dispute.

APPENDIX 5 -Summary of Specialist Expertise

Jenna Lavin, an archaeologist with an MSc in Archaeology and Palaeoenvironments, and currently completing an MPhil in Conservation Management , heads up the heritage division of the organisation, and has a wealth of experience in the heritage management sector. Jenna's previous position as the Assistant Director for Policy, Research and Planning at Heritage Western Cape has provided her with an in-depth understanding of national and international heritage legislation. Her 8 years of experience at various heritage authorities in South Africa means that she has dealt extensively with permitting, policy formulation, compliance and heritage management at national and provincial level and has also been heavily involved in rolling out training on SAHRIS to the Provincial Heritage Resources Authorities and local authorities.

Jenna is a member of the Association of Professional Heritage Practitioners (APHP), and is also an active member of the International Committee on Monuments and Sites (ICOMOS) as well as the International Committee on Archaeological Heritage Management (ICAHM). In addition, Jenna has been a member of the Association of Southern African Professional Archaeologists (ASAPA) since 2009. Recently, Jenna has been responsible for conducting training in how to write Wikipedia articles for the Africa Centre's WikiAfrica project.

Since 2016, Jenna has drafted over 100 Heritage Impact Assessments throughout South Africa.