HERITAGE IMPACT ASSESSMENT

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

Proposed Grid Connection Infrastructure for the Great Karoo Wind Energy Facility development near Richmond in the Northern Cape

Prepared by CTS Heritage

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For

Savannah Environmental

March 2022

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EXECUTIVE SUMMARY

1. Site Name:

Great Karoo Renewable Energy Facility Grid Connection Infrastructure

2. Location:

Approximately 30km to 60km south west of Richmond in the Northern Cape

3. Locality Plan:

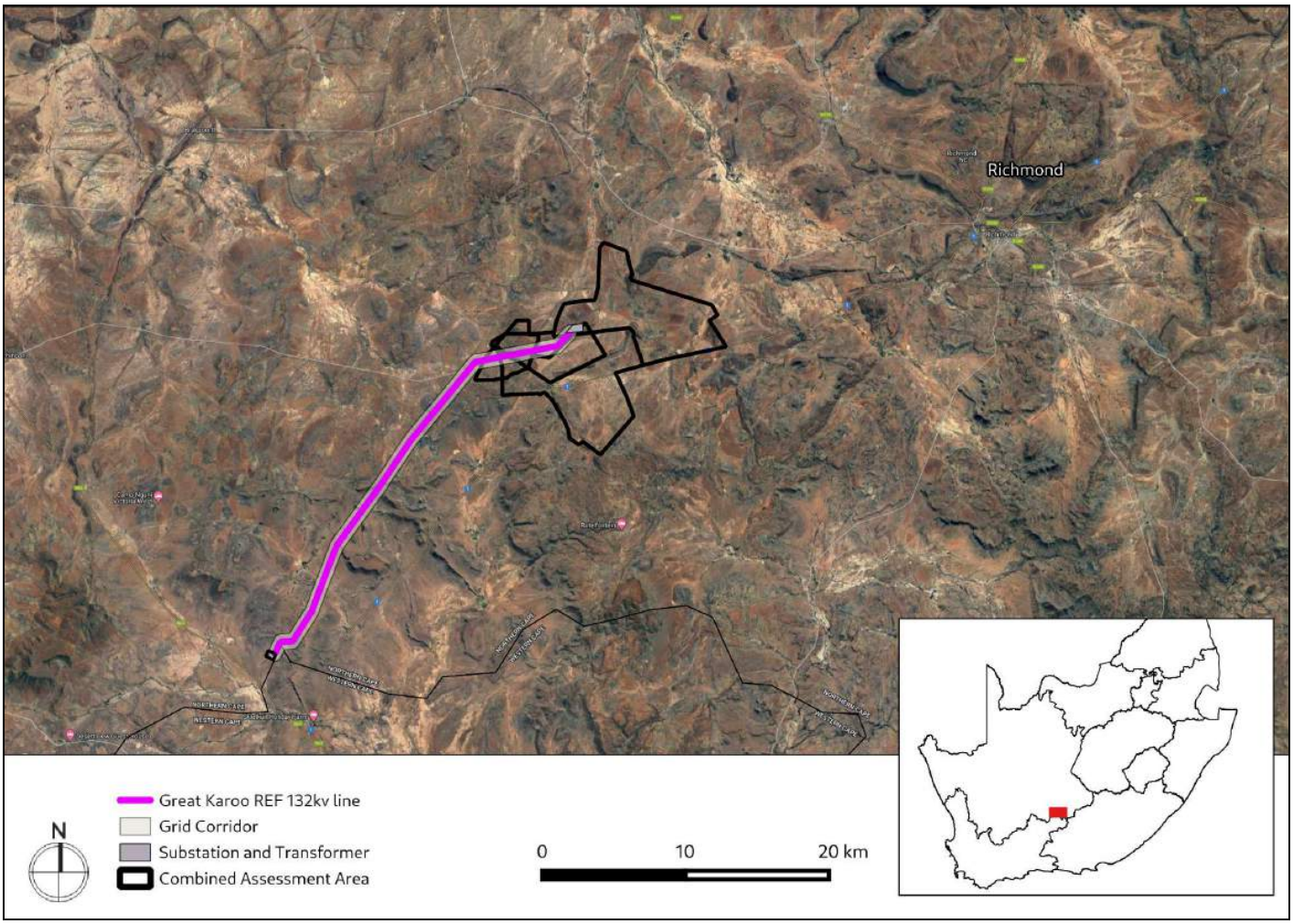

Figure 1: Location of the proposed development area

4. Description of Proposed Development:

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of a 132kV central collector substation and a 132kV double circuit power line on a site located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in

the Northern Cape Province. The collector substation that comprises, both the Eskom switching station and the IPP's substation, is proposed on Portion 0 of Farm Rondavel 85. One grid corridor has been considered for assessment and placement of the 132kV double circuit power line.

5. Heritage Resources Identified:

The landscape of the development area has been assessed for cultural heritage significance, and found to have five distinct character areas:

1. Historic movement corridors.
2. Open plains interrupted by low koppies.
3. Elevated areas with steep sided mountain ridges.
4. Areas of landscape that have been transformed by significant infrastructural development.
5. Remote landscape with wilderness qualities.

Of the five distinct character areas identified in the Cultural Landscape Assessment (Winter, 2021), the grid connection corridor falls within Area 4 - Areas of landscape that have been transformed by significant infrastructural development.

A total of 24 archaeological observations were identified along the grid corridor. None of the identified archaeological resources were determined to be conservation-worthy. Six modern windmill and water storage structures were identified within the grid alignment but none of these were determined to be conservation-worthy.

No palaeontological Very High Sensitivity / No-Go areas have been identified within the grid connection project areas. With the exception of two fossil sites of low scientific value, none of the recorded fossil sites overlaps directly with, or lies close to (< 20 m), the proposed infrastructure

6. Anticipated Impacts on Heritage Resources:

In terms of impacts to archaeological resources, the findings of this assessment largely correlate with the findings of other assessments completed in the vicinity such as the findings of the ACO (2013, SAHRIS NID 503074) who note that "Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape." This same archaeological signature has been identified within the development footprint.

No archaeological resources of significance were identified within the grid connection corridor and as such, no impact to significant archaeological heritage is anticipated.

In terms of impacts to palaeontological resources, the area proposed for development falls within a geological area that is very sensitive for impacts to significant palaeontological heritage. While the site visit conducted did not identify significant fossil material, the likelihood of uncovering significant palaeontology that is preserved below the ground surface remains high. As such, it is recommended that the attached Chance Fossil Finds Procedure be implemented for the duration of construction activities.

In terms of impacts to the Cultural Landscape, the proposed development is broadly located in an area with a culturally significant sense of place. That being said, the grid corridor follows a route of existing infrastructure. The impact to the cultural landscape of the additional infrastructure is acceptable, as it makes little material difference to the already disturbed landscape.

7. Recommendations:

Based on the outcomes of this report, it is not anticipated that the proposed development of the grid connection infrastructure will negatively impact on significant heritage resources. The following recommendations are made:

- The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

8. Author/s and Date:

Jenna Lavin

February 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 on the Executive Committee 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 250 Screening and Heritage Impact Assessments throughout South Africa.

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APPENDICES

1. INTRODUCTION

1.1 Background Information on Project

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of a 132kV central collector substation and a 132kV double circuit power line on a site located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. The collector substation that comprises, both the Eskom switching station and the IPP's substation, is proposed on Portion 0 of Farm Rondavel 85. One grid corridor has been considered for assessment and placement of the 132kV double circuit power line.

- Portion 0 of Farm Annex Rondavel 86;
- Portion 1of Farm Uit Vlugt Fontein 265;
- Portion 0 of Farm Wynandsfontein 91;
- Portion 1 of Farm Wynandsfontein 91;
- Portion 3 of Farm Vlekfontein 90;
- Portion 0 of Farm Burgersfontein 92;
- Portion of Farm Nieuwe Fontein 89;
- Portion 1 of Farm Nieuwe Fontein 89;
- Portion 0 of Farm Rondavel 85
- Portion 1 of Farm Rondavel 85;
- Portion 0 of Farm Kleinfontein 93;
- Portion 1 of Farm Bult & Rietfontein 96; and
- Remaining Extent of Portion 3 of Farm Schietkuil

The entire extent of the site falls within the Central Corridor of the Strategic Transmission Corridors. The grid connection infrastructure is known as the Great Karoo Electrical Grid Infrastructure (EGI).

The development of the 132kV central collector substation and 132kV power line is required to enable the connection for the Great Karoo Cluster of Renewable Energy Facilities, which comprises three (3) 100MW solar photovoltaic (PV) energy facilities, and two (2) 140MW wind farms, to the national grid for the evacuation of the generated electricity. The connection point into the national grid will be the existing Eskom Gamma Substation.

The projects which the proposed grid connection infrastructure will facilitate the grid connection for are known as:

- Angora Wind Farm and Merino Wind Farm;
- Nku Solar PV Energy Facility;
- Moriri Solar PV Energy Facility; and
- Kwana Solar PV Energy Facility.

Table 1: Details of the proposed grid connection infrastructure and alternatives are provided in the table below:

Corridor width (for assessment purposes)	One grid connection corridor has been identified for the assessment and placement of the grid connection infrastructure. The grid connection corridors comprise of a 1km wide power line corridor to allow for avoidance of environmental sensitivities, and suitable placement within the identified preferred corridor. Therefore, the entire corridor is being proposed for the development provided the infrastructure remains within the assessed corridor and environmental sensitivities within this corridor are avoided.
Power line capacity	580MVA at 132kV (double-circuit)
Tower height	Up to 32m
Power line servitude width	Up to 40m
Length of power line corridor alternatives	Collector Sub – Gamma ~ 37.5km
Development footprint of the Collector Substation (including the Eskom switching station)	1000mx700m
Capacity of the Collector Substation	580MVA at 132kV

1.2 Description of Property and Affected Environment

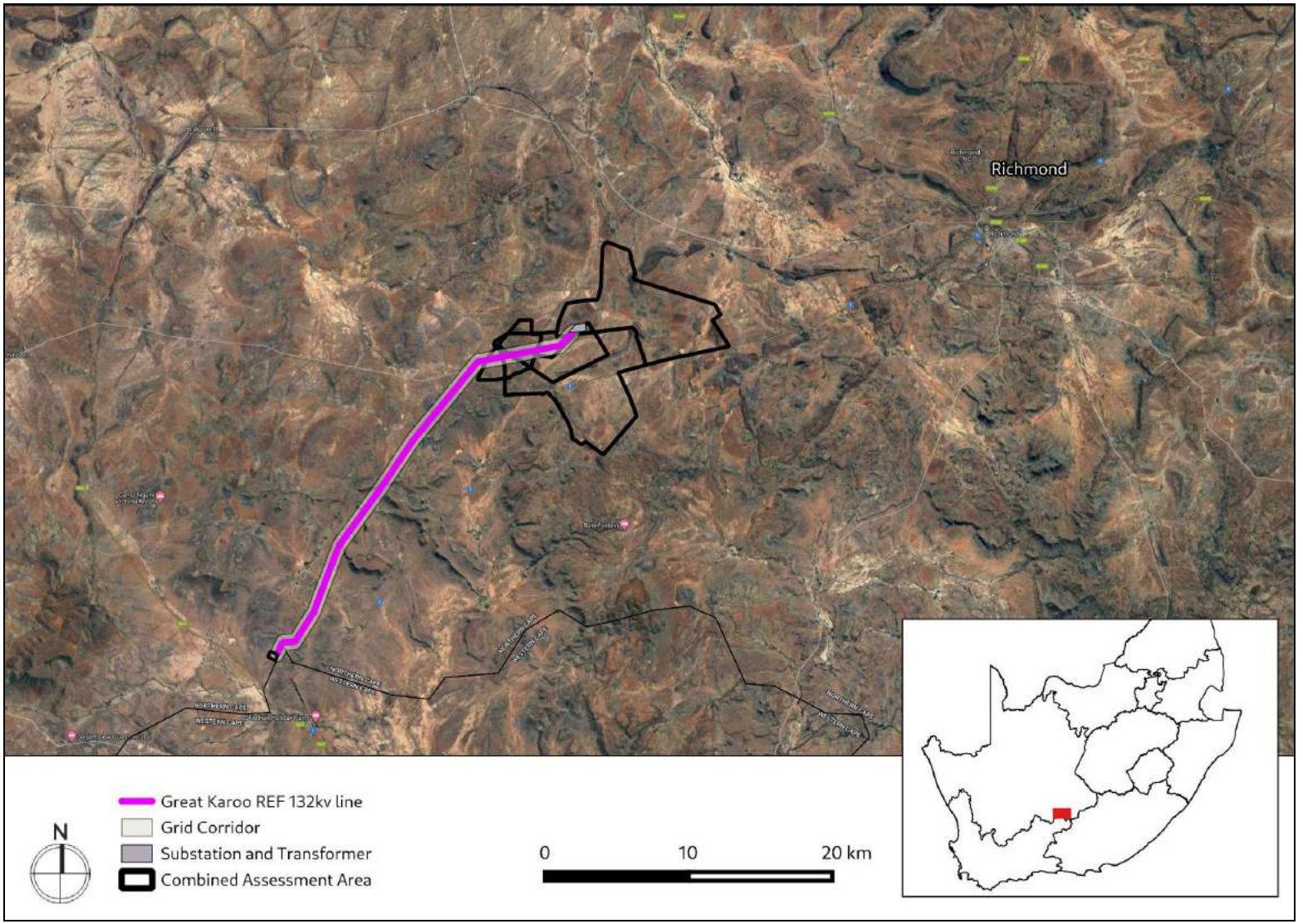
The majority of the proposed grid infrastructure is located along the northern and western end of the N1 highway about 30km southwest of Richmond in the Northern Cape. In the last two decades the N1 has become increasingly flooded with heavy trucking traffic due to the decreasing use of the railway system and the growth of the South African economy.

The area falls within the Eastern Upper Karoo region and the vegetation consists of a mix of grass and shrub dominated vegetation types. Acacia thorn trees are found in the riverine zones and much of the shrubland is currently in a very poor state due to the extended 5 year drought afflicting the area. Aeolian sands and floodplains form a thick (>1m) layer of overburden in many places surrounding the dolerite ridges and there has been extensive burial and re-surfacing of Middle Stone Age material. Later Stone Age was relatively well represented in the study area and most of the MSA and LSA material was concentrated around the lower slopes of the dolerite ridges and koppies. The dominant agricultural activity is sheep farming and a number of windmills with small farm dams were recorded that feature on the built landscape.

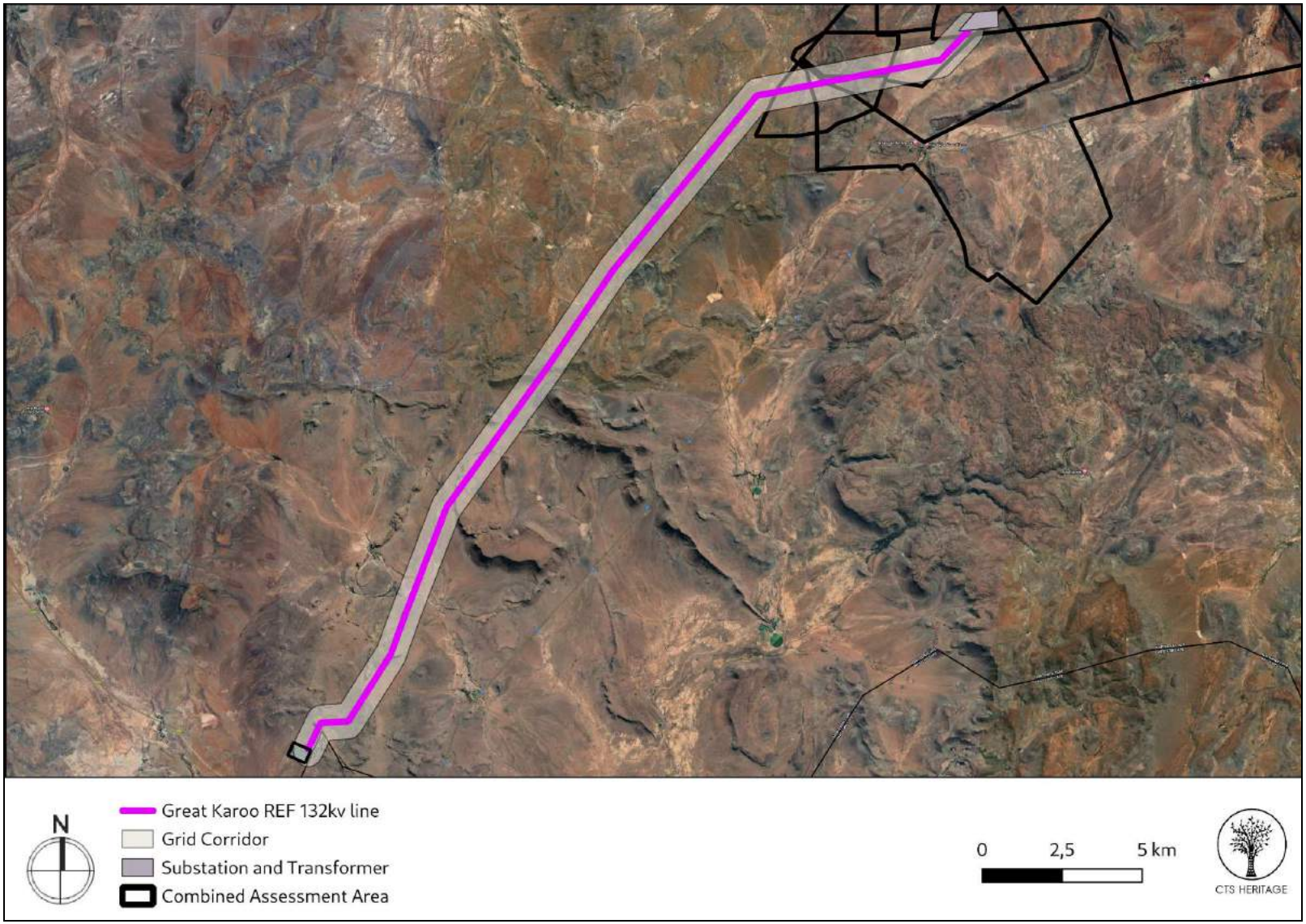
The western end of the properties hold the main route of South Africa's 765kV powerline infrastructure linking up the Western Cape to the coal-fired power stations in Mpumalanga and Gauteng.

The area proposed for development is characterised as follows in the Cultural Landscape Assessment completed for this project (Winter, 2021);

- Regional location within the eastern upper area of the Great Karoo, which is a vast arid area with a dispersed pattern of settlement, extensive stock farms, more recent game farms, and irrigation based agriculture along the rivers; the vegetation cover is low consistent with the Nama Karoo Biome (Savannah Environmental 2021).
- Very distinctive topographical conditions, with a combination of steep slopes, ridgelines, flat topped mesa mountains and rounded koppies punctuating open plains.
- Location to the southwest of Richmond, which dates to the mid 18th century; it lies in a slight depression, surrounded by rises and hillocks, the most prominent of which is Vegkop to the north of town, which shields it from the N1; it is traversed by the occasional Ongers River
- The majority of the site lies directly to the north of the N1, being partially traversed and partially bounded by it. This sector of the N1 connects Three Sisters in the south to Richmond. It crosses the R63 approximately 30 km south of the site at a point midway between Victoria West and Murraysburg. This sector of the N1 is not recognised as a scenic route however it has historic longevity.
- The N1 traversing the Great Escarpment runs largely straight, with very little topographical change. However, this consistency is interrupted on the south west approach to Richmond by topographical variety, and a threshold condition at a historic bend in the route. This is located at the south west boundary of the study area.
- The alignment of the N1 through this landscape follows an early transport and wagon route to the interior dating to, at least, the late 18th century.
- Farming settlements along this portion of the N1 are experienced as “beads on a string”, with small nodal groupings clustered on the foothills of the mountain ridges in proximity to the road.
- The distinctive nature of farming settlements within a semi-arid landscape is generally associated with a loose collection of farm buildings adjacent to watercourses and springs, and marked by clusters of tree planting, dams and wind pumps.
- Existing Eskom power lines run parallel to the northern boundary of the site and extend to the power station near the intersection of the N1 and R63.
- Located outside of the REDZ, but in proximity to other existing and proposed power facilities.



Map 1a: Proposed development relative to Richmond



Map 1b: The proposed development layout of the grid connection infrastructure

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 archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted his site visit from 11 to 16 September 2021
- A palaeontologist conducted an assessment of palaeontological resources likely to be disturbed by the proposed development. The palaeontologist conducted his site visit in November 2021
- A cultural landscape assessment was conducted that covers the proposed development area with fieldwork completed in November 2021. The results of this assessment were incorporated into this HIA.
- The identified resources were assessed to evaluate their heritage significance and impacts to these resources were assessed.
- 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 current extended drought has led to poor conditions in the veld but this has also provided very good visibility of archaeological material exposed on the surface. A series of dongas were inspected to test whether archaeological material may be buried by aeolian and flooding events and this was confirmed in some places where exposed lines of gravels containing MSA artefacts were found buried over 1m below the surface. However, the exposure of MSA and LSA material was clearly evident on the lower slopes of the dolerite koppies and this provided a fair characterisation of the buried artefacts.

The experience of the heritage practitioner, and observations made during the study, allow us to predict with some accuracy the archaeological sensitivity of the receiving environment.

2.5 Savannah Impact Assessment Methodology

Direct, indirect and cumulative impacts of the issues identified through the Scoping study, as well as all other issues identified in the EIA phase were assessed in terms of the following criteria:

- The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- The duration, wherein it will be indicated whether:
    - The lifetime of the impact will be of a very short duration (0 – 1 years) – assigned a score of 1.
    - The lifetime of the impact will be of a short duration (2 – 5 years) – assigned a score of 2.
    - Medium-term (5 – 15 years) – assigned a score of 3.
    - Long term (> 15 years) – assigned a score of 4.
    - Permanent – assigned a score of 5.
- The consequences (magnitude), quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 – 5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high.
- The status, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The significance is calculated by combining the criteria in the following formula:

S = (E + D + M) x P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area).
- 30 – 60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated).
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Desktop Assessment

Background:

The area proposed for the Great Karoo Renewable Energy Facility Projects including this proposed grid connection infrastructure is located approximately 35km southwest of Richmond in the Northern Cape, and 80km east of Victoria West outside of the identified Beaufort West REDZ (Figure 2b) along the N1. The town of Richmond was established in 1843 to service the needs of the growing farming community. It was renowned as a resort town in the 1800s for European aristocrats suffering lung disease due to its clean air and mineral-rich waters.

The central plateau of the Great Karoo, north of the Great Escarpment, falls in the Nama Karoo Biome. This is characterised by low rainfall and high temperatures, low-shrub vegetation and low relief topography punctuated by rugged outcrops. This expansive, arid region has lime-rich soils underlain by sediments of the Dwyka (glacial) formation covered by the Ecca and Beaufort groups, and is rich in substantial fossil records dating back 3 billion years (Seymour 2021). The archaeological record spans hundreds of thousands of years, with sites such as stone tool scatters typically occurring near dolerite outcrops due to the presence of underground water (Winter & Oberholzer 2013).

Historic settlement and the Cultural Landscape (Winter et al. 2021, Appendix 3)

The name Karoo has its roots in the Khoe word meaning “place of great dryness”. While used on a seasonal and nomadic basis by hunter-gather people, the uncertain access to water and grazing, and the extreme temperatures, made it less well suited to needs of pastoralist people. However, vast herds of antelope, quagga, white rhinoceros, hartebeest and ostrich moved through the landscape according to the availability water and seasonal rains.

Settled occupation of the region and the subsequent changes to the landscape followed over 100 years after the arrival of settlers in 1652. Settlement of the Cape and the privatisation of land and water alienated the Khoe people from their seasonal lands, pushing them northwards. From the 1700s, the growing settlement, hungry for more resources, followed in their wake, creating a shifting frontier of contact (Anderson 1985). This push was sanctioned by the VOC and largely undertaken by trekboers engaged in hunting, salt collection and cattle trade with inland groups. The lifestyle was essentially that of a semi-nomadic pastoralist as they followed transhumance routes dictated by annual rainfall and seasonal pastures. The expanding frontier came to a prolonged pause below the Great Escarpment, which was a natural barrier between the plains of the Karoo and the arid Central Plateau.

Settled agriculture, water management through the creation of boreholes, and extensive sheep grazing profoundly changed the landscape. A study of the survey diagrams for parent farms in the site area shows formalisation of ownership from 1835, although it is highly likely that all land with access to water and grazing was already in use, and possibly occupied, prior to its first record of survey. (Note: Access to archived title deeds is not possible under the restrictions imposed by Covid-19; historic survey diagrams have been studied in their place). The survey diagrams also paint a clear picture of the priorities in land acquisition: springs, rivers and grazing is noted.

Wool farming remained the dominant activity and benefited from the wool boom of the 1930s, which continued into the 1950s, thereafter declining, with a shift to less labour-intensive meat production (Manyani 2020). The physical impact of segregation along racial lines introduced under the Group Areas Act 1950 was localised to Richmond town, altering its urban form. It had little impact on the nearby farming settlements. The N1, completed in the 1950s, connected Cape Town to Beit Bridge and by-passed many of the smaller towns, including Richmond, which protected the historic centre but impacted urban income generated from through-travellers.

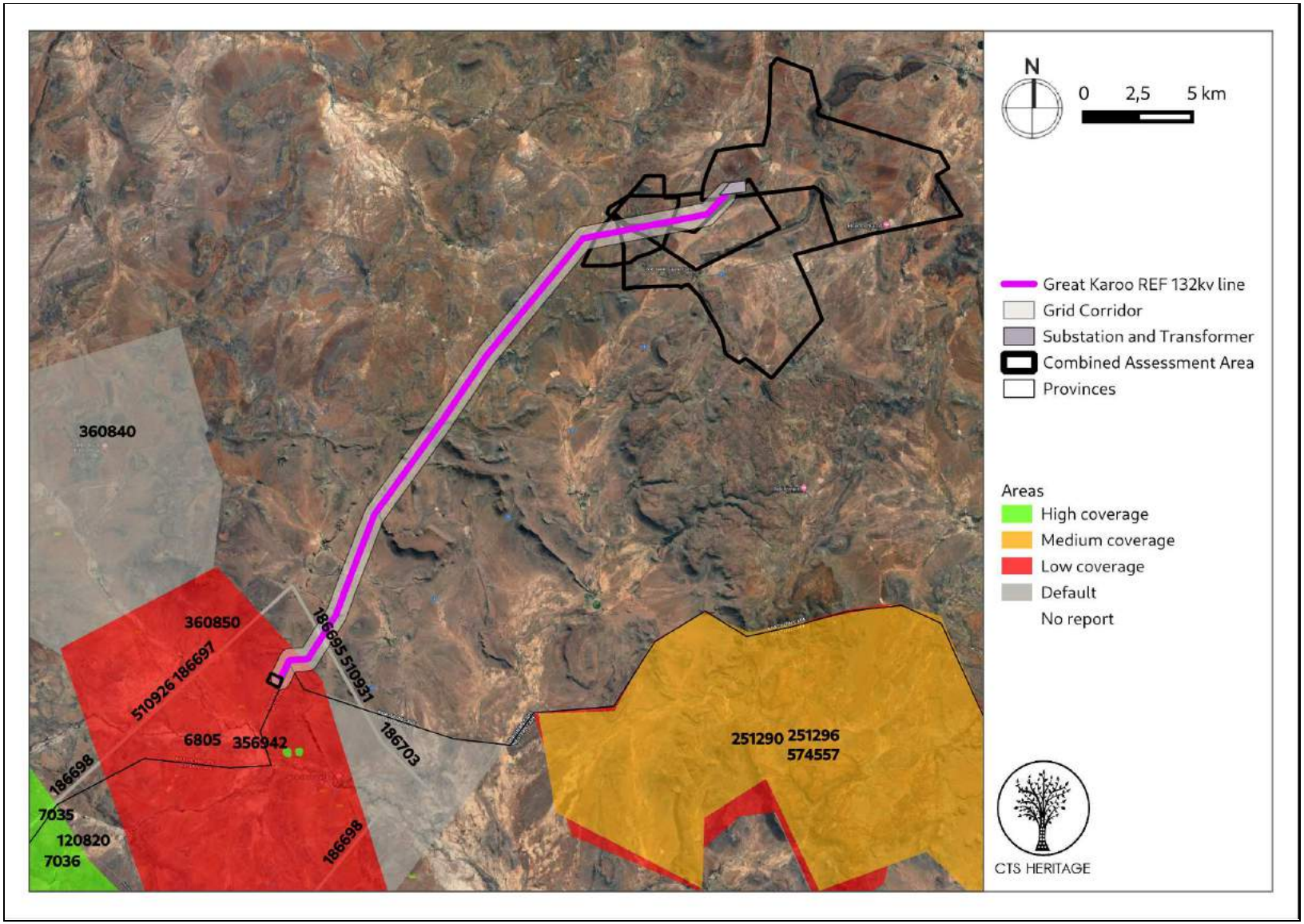
From the 1970s a process of farm consolidation, which continues to this day, was begun. Modernised farming practice and commercial opportunities stimulated farm development, with the introduction of stud, and livestock adapted for better yields. From the 1980s diversification introduced a shift to game farming, re-wilding, and more recently the introduction of nature tourism, conferences and events. The current focus on renewable energies is set to transform the landscape on a scale reminiscent of that which resulted from the introduction of wool production.

Details regarding the establishment and development of Richmond town is included in Appendix 3 and is not repeated here.

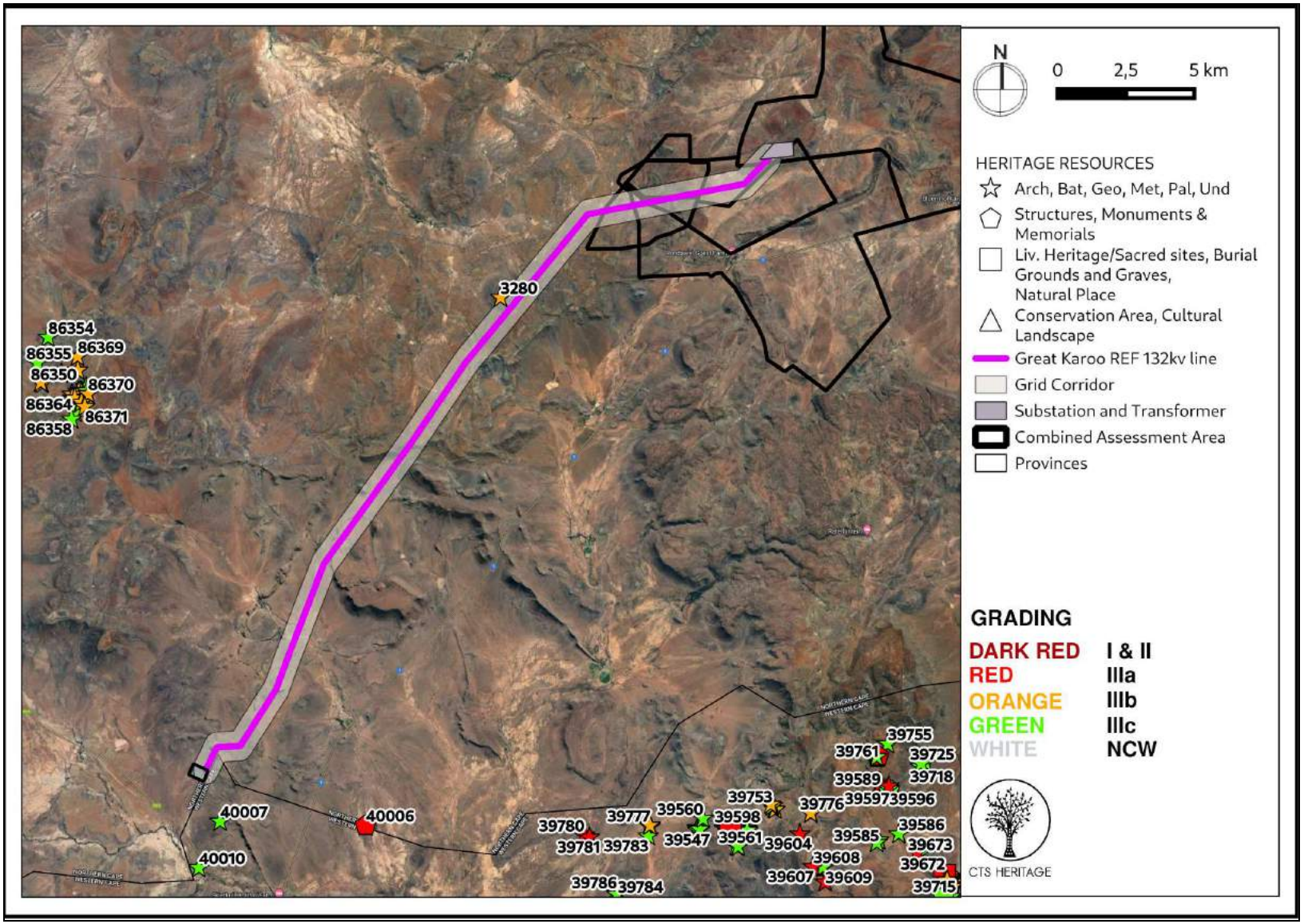
Archaeology

Very few heritage assessments have been completed within close proximity to the area proposed for development (Map 2). According to Nilssen (2014, SAHRIS NID 504763), “The Karoo houses a long and rich archaeological record dating from the earliest stages of Stone Age technology that are over a million years old, to the historic period that consists of the last few hundred years of human occupation (see Nilssen 2011 and references therein). Archaeological sites include caves and rock shelters, open air artefact scatters, rock engravings and historic structures with their associated cultural materials.” According to ACO (2013, SAHRIS NID 503074), “Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient

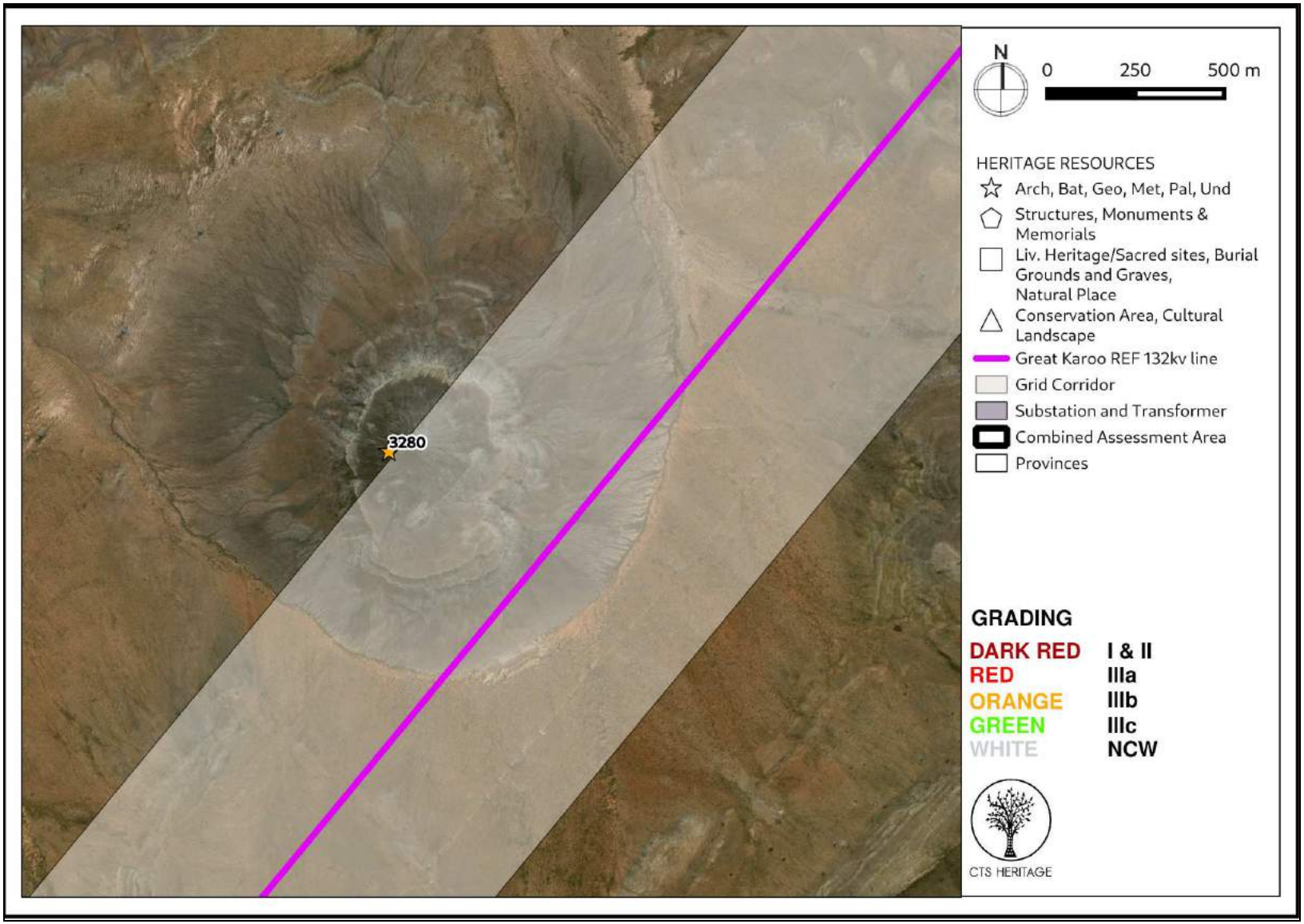
litter that occurs at a low frequency across the landscape. Where definable scatters of Early and Middle Stone Age material occur, they are considered to be significant heritage sites. More intensive occupation of the Karoo started around 13 000 years ago during the Later Stone Age, which is essentially the heritage of Khoisan groups who lived throughout the region. The legacy of the San includes numerous open sites while traces of their presence can also be found in most large rock shelters, often in the form of rock art. They frequently settled a short distance from permanent water sources (springs or waterholes) and made use of natural shelters such as rock outcrops or large boulders or even large bushes. In the Great Karoo natural elevated features such as dolerite dykes and ridges played a significant role in San settlement patterns." It is likely that similar archaeological heritage exists within the areas proposed for development and as such, impact to these resources must be assessed.



Map 2: Spatialisation of heritage assessments conducted in proximity to the proposed development (see Appendices for insets)



Map 3: Spatialisation of heritage resources known in proximity to the proposed development (see Appendices for insets)

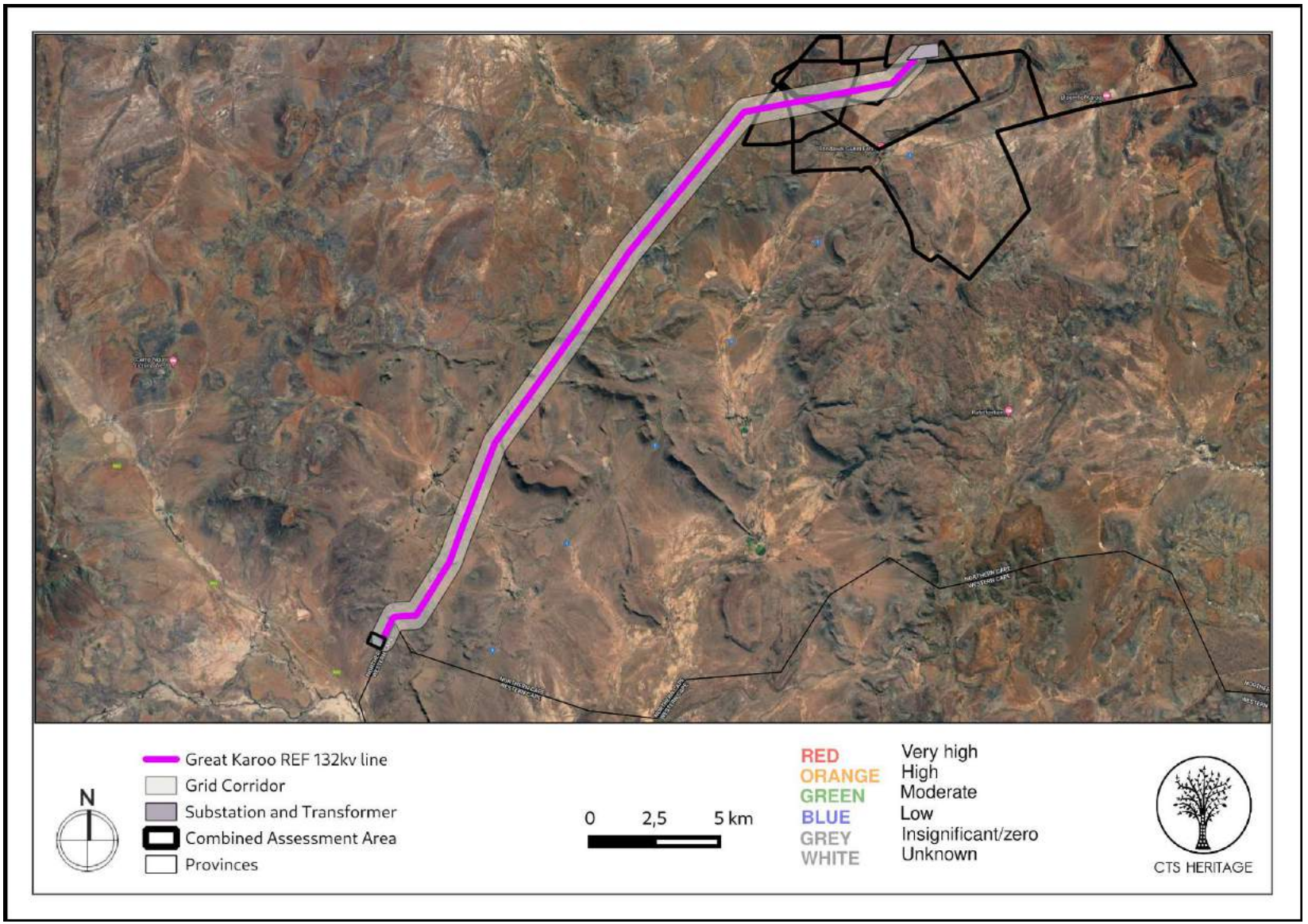


Map 3a: Inset A

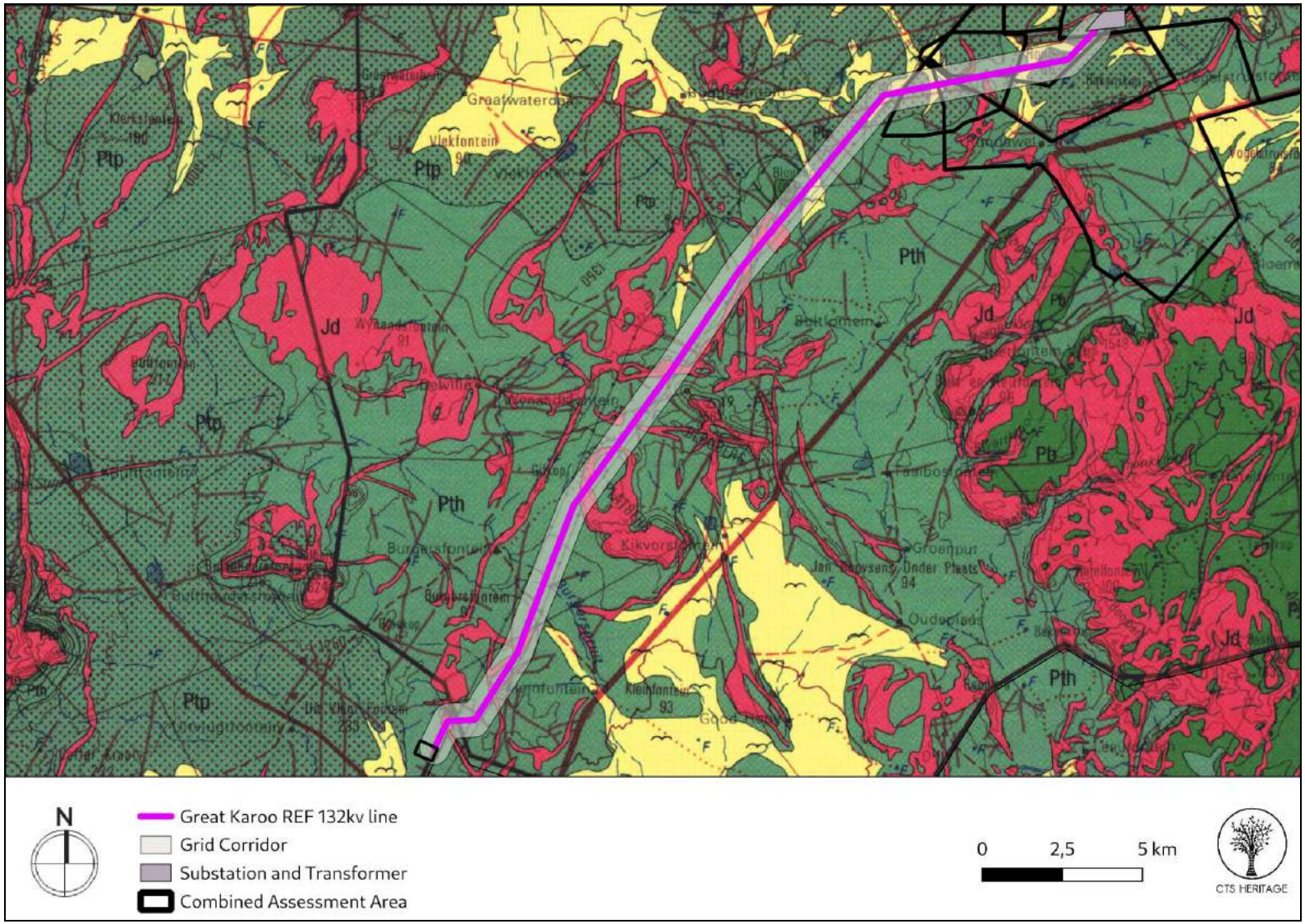
Palaeontology

According to the SAHRIS Palaeosensitivity Map (Map 4a), the area proposed for development is underlain by sediments of very high paleontological sensitivity. According to the extract from the Council for GeoSciences Map 3122 for Victoria West (Map 4b), the development area is underlain by the Abrahamskraal and Teekloof Formations, both of the Adelaide Subgroup of the Beaufort Group of sediments. According to the SAHRIS Fossil Heritage Browser and the Palaeotechnic Report for the Western Cape (Almond and Pether, 2008), the Beaufort Group sediments are known to preserve diverse terrestrial and freshwater tetrapods of *Tapinocephalus* to *Lystrosaurus* Biozones (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways) and sparse vascular plants (*Glossopteris* Flora, including petrified wood). Based on the known paleontological sensitivity of this area, it is very likely that activities associated with the development of the proposed grid connectionin frastructure and the renewable energy facilities they will cater for will negatively impact on significant fossil heritage.

Site 3280 indicated as falling just outside the grid connection corridor in Map 2a records a palaeontological site and reinforces the palaeontological sensitivity of the broader landscape.



Map 4a: Palaeontological sensitivity of the proposed development area



Map 4b: Geology Map. Extract from the CGS 3122 Victoria West Map indicating that the development area for the WEF development is underlain by sediments of Ptp: Poortjie Member and Pth: Hoedemaker Member of the Teekloof Formation of the Adelaide Subgroup and Jd: Jurassic Dolerite as well as Quaternary Sands

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Cultural Landscape and the Built Environment (Winter et al. 2021, Appendix 3)

The concept of cultural landscape gives spatial and temporal expression to the processes and products of the interaction between people and the environment. It may thus be conceived as a particular configuration of topography, geology, vegetation, land use and settlement pattern and associations which establishes some coherence of natural and cultural processes.

The site forms part of an intact cultural landscape representative of the Central Plateau of the Great Karoo possessing heritage value for historical, aesthetic, architectural, social and scientific reasons. The site possesses a number of cultural landscape qualities and elements which are outlined below.

- The location of the site on the Central Plateau of the Great Karoo, separated from the Karoo vlakte by the Great Escarpment, characterised by a combination of flat open plains punctuated by mountains and koppies.
- The vast open qualities of the landscape, which are a function of its geology, semi-arid conditions and low vegetation cover; a relatively ephemeral pattern of human intervention on the landscape resulting in a sense of remoteness and stillness, known also for its night sky.
- Historical associations with colonial expansion of the northern frontier zone in the late 18th early 19th century resulting in the further displacement of transhumant pastoralism by settled agriculture and the emergence of extensive sheep farming in the early to mid-19th century; the farms Rondawel (1835), Ratelfontein (1835), Vogelfontein (1835), Gegundefontein (1846), Bult and Rietfontein (1835) being first surveyed during this period.
- A distinctive pattern of settlement informed by access to limited water resources with small, isolated farmsteads forming green oases in the semi-arid landscape, sheltered from the heat by exotic trees and associated with springs, streams, dams and windpumps. The manner in which homesteads are positioned at the base of hills and koppies forming distinctive topographical settings. The dry-packed stone walls constructed from the local shales, and historically used for kraals, are a characteristic feature of the landscape.
- The N1 corridor following the alignment of the late 18th century route to the interior and its role as a structuring element in the landscape along which dispersed settlement has occurred like “beads on a string”. Similarly, the route connecting Richmond to Victoria West as a historic linkage route to the north of the site.
- The stretch of the N1 corridor between Rondavel and Richmond which has distinctive experiential qualities: ranging from the ‘pinch point’ condition and kink in the alignment at Rondavel as the route passes through a hilly landscape and moves away from the national grid corridor; to the straight alignment of the

route traversing an open flat landscape with expansive long views framed by mountains and koppies, and punctuated by farmstead settings; to the slight meandering and more enclosed nature of the route through undulating topography as its approaches Richmond.

- The high local and regional heritage significance of Richmond from a townscape and streetscape perspective, its role in the South African War, its distinctive topographical setting and cross route condition as part of a regional and national route network. While Richmond is located outside of the direct viewshed of the WEF portion of the proposed development, the experiential qualities of the N1 approaching the town will be potentially affected.

Archaeology (Appendix 1)

The findings of this assessment largely correlate with the findings of other assessments completed in the vicinity such as the findings of the ACO (2013, SAHRIS NID 503074) who note that "Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape." This same archaeological signature has been identified within the development footprint.

It is noted that high numbers of quarried stone artefacts predominantly from the Middle Stone Age period were found within the development area which is consistent with observations on neighbouring farms through impact assessments and research surveys. These artefacts are particularly visible in deflated open sites where the top soil has washed away onto a harder gravel surface. Despite the large number of dolerite outcrops, no engravings were found. We are not currently aware of a large number of Stone Age engravings in this area and the lack of sites found might possibly be due to the routes chosen for the access roads and turbine positions. It was noted in the field assessment that the archaeology located around the dolerite ridges is very dense and exposed and as such, we would recommend caution should changes be made to pylon positions or access roads.

Palaeontology (Appendix 2)

Fossil specimens recorded from the Teekloof Formation bedrocks during a 3-day site visit to the grid connection project area mainly comprise a handful of scrappy therapsid cranial and post-cranial material. The only specimens of potential scientific or conservation interest are several skeletal elements of a small-bodied pareiasaur reptile - possibly a juvenile or dwarf taxon. Almost all the other specimens are fragmentary and very poorly preserved due to thermal metamorphism and metasomatism (*i.e.* alteration through secondary mineralisation and dissolution by hot circulating groundwaters) during dolerite intrusion.

Thick deposits of Late Caenozoic, semi-consolidated alluvium might contain important assemblages of Plio-Pleistocene mammalian fossils (*e.g.* horn cores, bones and teeth) as well as reworked petrified wood and trace fossils (*e.g.* calcretised termitaria). However, the only fossils recorded here comprise assemblages of subvertical, calcretised rhizoliths (plant root casts) in riverbank settings. Voluminous, doleritic and quartzitic colluvial rock rubble mantling the steeper mountain slopes as well as younger alluvial sands and gravels mantling extensive *vlaktes* within the project area are unlikely to be fossiliferous.

4.2 Heritage Resources identified

The landscape of the development area has been assessed for cultural heritage significance, and found to have five distinct character areas:

1. Historic movement corridors.
2. Open plains interrupted by low koppies.
3. Elevated areas with steep sided mountain ridges.
4. Areas of landscape that have been transformed by significant infrastructural development.
5. Remote landscape with wilderness qualities.

Of the five distinct character areas identified in the Cultural Landscape Assessment (Winter, 2021), the grid connection corridor falls within Area 4 - Areas of landscape that have been transformed by significant infrastructural development.

Table 2: Cultural Landscape Character Area 4

Significance	Character	Carrying Capacity
4. Transformed landscape Electricity grid parallel to and set back from (4 km) the N1 corridor south of site.	Introduction of industrial activities and intrusion of large scale infrastructure in agricultural areas. Visual cluttering of the landscape by non-agricultural development.	Infrastructure can be concentrated in this area.

In terms of the heritage resources identified in the archaeological field assessment, see Table 3 below.

Table 3: Observations made during the archaeological field assessment

POINT ID	Site Name	Description	Period	Co-ordinates		Grading	Mitigation
GK001	Great Karoo 001	Hornfels broken up source rock, one flake	MSA	-31,67536	23,41625	NCW	NA
GK002	Great Karoo 002	Siltstone flakes and cores near dolerite boulder shelter	MSA	-31,67466	23,41763	NCW	NA
GK003	Great Karoo 003	Quarrying of hornfels and greywacke, no formal tools seen	MSA	-31,67114	23,42757	NCW	NA
GK004	Great Karoo 004	Patinated hornfels assemblage, mainly blades near dry stream bed. Not early MSA	MSA	-31,66289	23,43376	NCW	NA
GK005	Great Karoo 005	Early MSA flake, edge slightly worked	MSA	-31,65061	23,44315	NCW	NA
GK006	Great Karoo 006	Hornfels cores and flakes, one white very patinated flake with old retouched edges	MSA	-31,64028	23,44753	NCW	NA
GK007	Great Karoo 007	Hornfels flakes, cores, greywacke cores and flakes. Partially buried in Kalahari sands	MSA	-31,61139	23,45934	NCW	NA
GK008	Great Karoo 008	Fine grained hornfels flakes, microliths, LSA. Patinated and older MSA cores and flakes in natural clearing surrounded by dolerite boulders	LSA, MSA	-31,59409	23,47433	NCW	NA
GK009	Great Karoo 009	Hornfels flake, cortex remaining on dorsal	MSA	-31,56952	23,49539	NCW	NA
GK010	Great Karoo 010	Rusted large metal spanner, pole, rings associated with powerlines	Modern	-31,54909	23,51106	NCW	NA
GK011	Great Karoo 011	Windmill, concrete tank	Modern	-31,55271	23,5267	NCW	NA
GK012	Great Karoo 012	Hornfels blade flake	MSA	-31,55056	23,52993	NCW	NA
GK013	Great Karoo 013	Patinated hornfels flakes and siltstone	MSA	-31,54143	23,55346	NCW	NA
GK014	Great Karoo 014	Brick plastered tank	Modern	-31,49752	23,56122	NCW	NA
GK021	Great Karoo 021	Hornfels flake buried in donga exposure	MSA	-31,50839	23,59374	NCW	NA

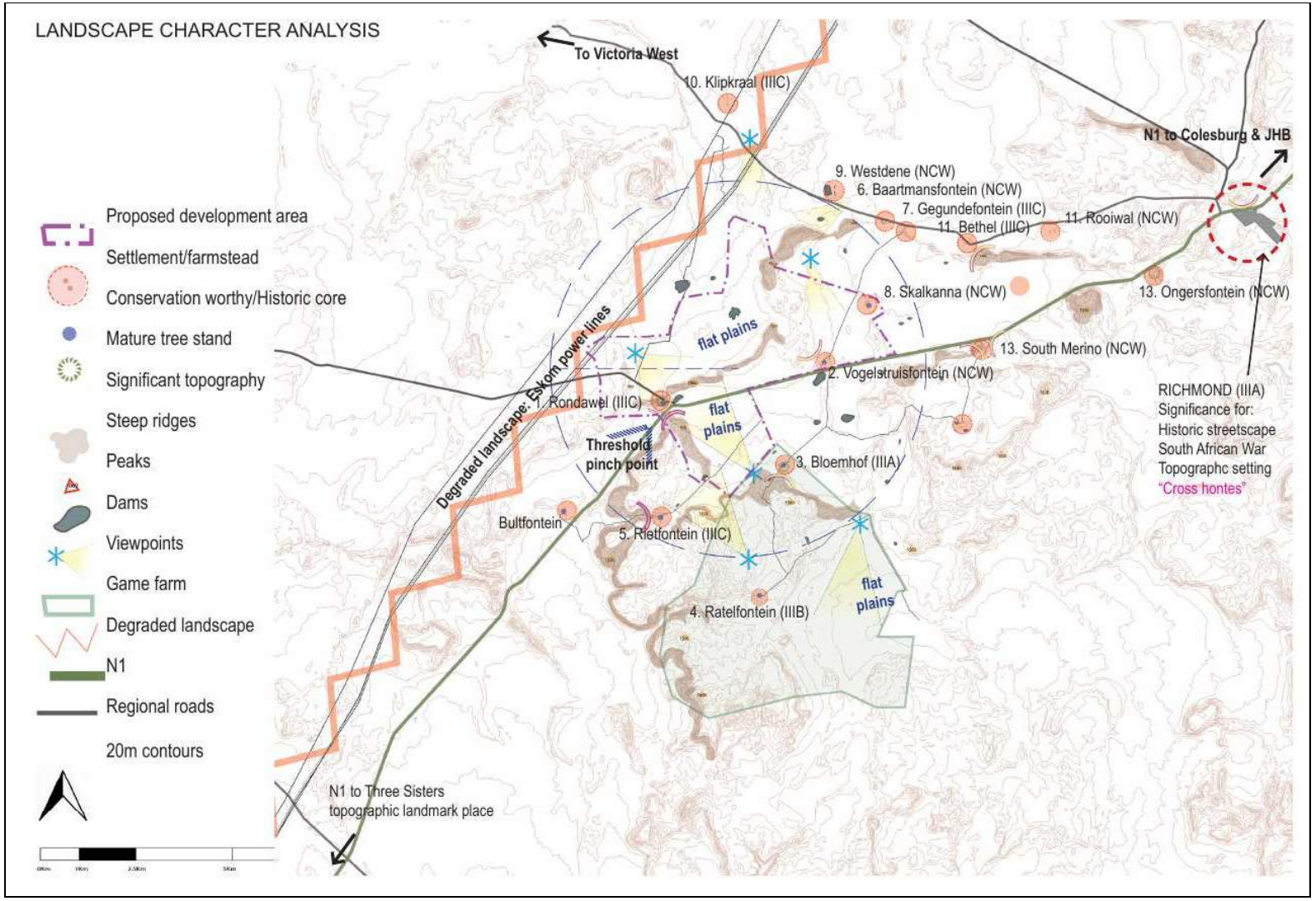
GK031	Great Karoo 031	Windmill	Modern	-31,50086	23,57677	NCW	NA
GK032	Great Karoo 032	Very thin, weathered hornfels flake	MSA	-31,49897	23,56639	NCW	NA
GK052	Great Karoo 052	Windmill	Modern	-31,480756	23,640181	NCW	NA
GK083	Great Karoo 083	Windmill	Modern	-31,49136	23,59298	NCW	NA
GK085	Great Karoo 085	Hornfels core and flakes	LSA	-31,48695	23,58745	NCW	NA
GK096	Great Karoo 096	Hornfels flake blade	MSA	-31,48828	23,5975	NCW	NA
GK098	Great Karoo 098	Windmill	Modern	-31,49582	23,59807	NCW	NA
GK125	Great Karoo 125	greywacke and hornfels cores and flakes	MSA	-31,643632	23,451292	NCW	NA
GK126	Great Karoo 126	Hornfels flakes, dorsal reduction	MSA	-31,6384659	23,45974918	NCW	NA
GK127	Great Karoo 127	Quartzite flake	MSA	-31,63040907	23,47842969	NCW	NA
GK128	Great Karoo 128	Hornfels bladelet	LSA	-31,5979548	23,50175682	NCW	NA
GK129	Great Karoo 129	greywacke core	MSA	-31,60338828	23,49861806	NCW	NA
GK130	Great Karoo 130	Hornfels blade flake	MSA	-31,61165517	23,49280684	NCW	NA
GK131	Great Karoo 131	Hornfels bladelet	LSA	-31,61571999	23,49376	NCW	NA
GK132	Great Karoo 132	Hornfels flake	MSA	-31,62469267	23,49593221	NCW	NA

In terms of the heritage resources identified in the palaeontological field assessment, see Table 4 below.

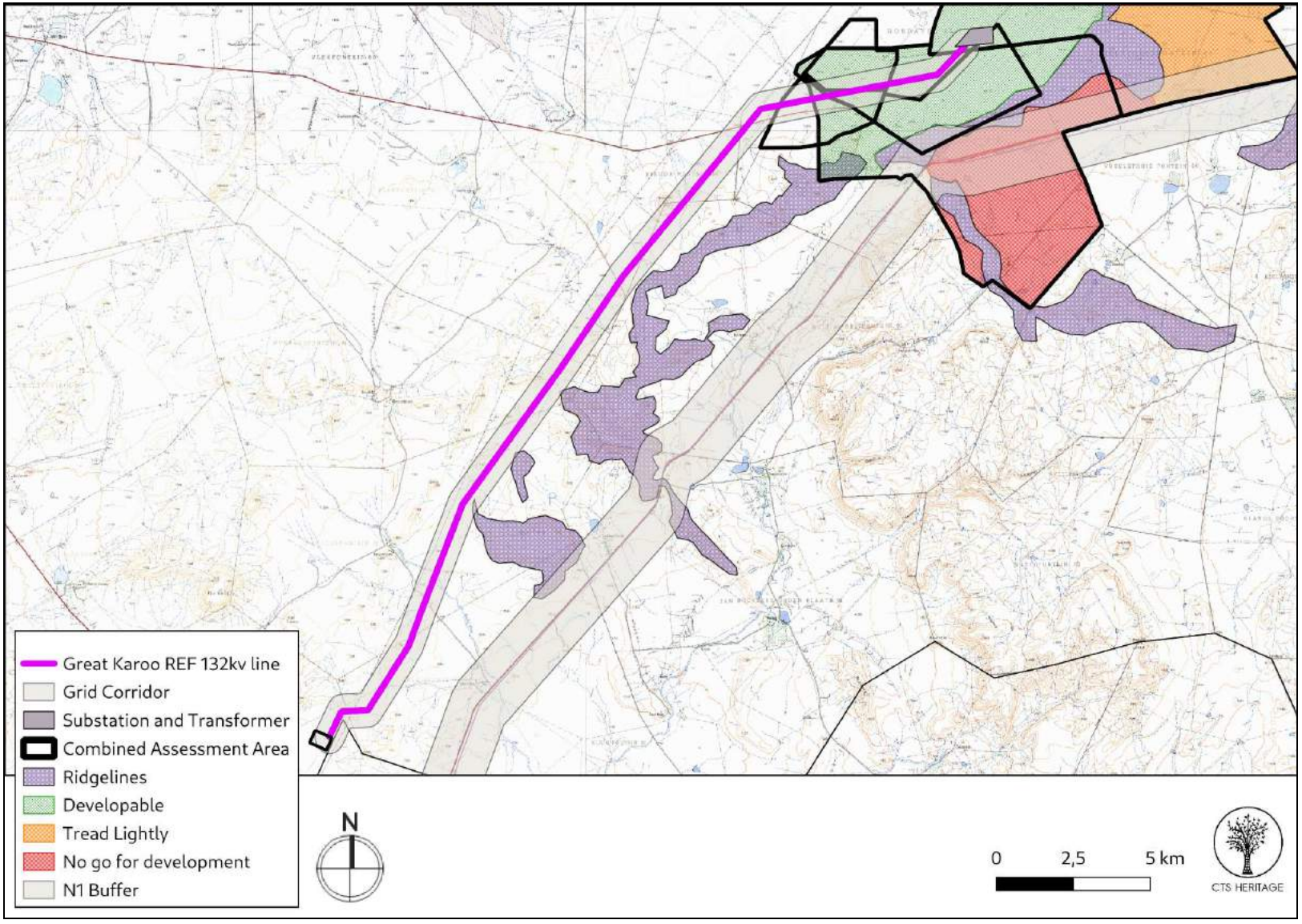
Table 4: Palaeontological observations made during the field assessment for the proposed Grid Connection Infrastructure

POINT ID	Description	Co-ordinates		Grading	Mitigation
884	Rondavel 85. Hoedemaker Member. Thin crevasse splay sandstone exposed in shallow borrow pit with sandstone-infilled mudcracks, microbial mat textures, small-scale invertebrate trace fossils (narrow horizontal burrows of undermat miners), possible vertical burrows or plant stem casts. Proposed Field Rating IIIC Local Resource. No mitigation recommended.	-31.49779201	23.59721803	IIIC	NA
896	Farm 96. "Balfour Formation" (Oukloof Member of Teekloof Fm). Scatter of baked white bone fragments of small-bodied tetrapod within quartzite surface gravels, in part preserved as moulds. Proposed Field Rating IIIC Local Resource. No mitigation recommended.	-31.54356097	23.51600602	IIIC	NA
914	Burgersfontein 92. Probable Poortjie Member, baked heterolithic package in bed of Burgerspruit. Fragment of skull (probably palate) of small tetrapod embedded within baked, grey-green wacke. Proposed Field Rating IIIC Local Resource. No mitigation recommended.	-31.63286403	23.450985	IIIC	NA
915	Burgersfontein 92. Probable Poortjie Member, bed of Burgerspruit. Postcranial bone of small tetrapod embedded within baked, grey-green wacke. Proposed Field Rating IIIC Local Resource. No mitigation recommended.	-31.63276596	23.450855	IIIC	NA
917	Burgersfontein 92. Late Caenozoic sandy to gravelly alluvium overlying calcrete-veined weathered dolerite exposed in banks of Burgerspruit. Assemblage of subvertical, subcylindrical calcretised structures – probably rhizoliths. Proposed Field Rating IIIC Local Resource. No mitigation recommended.	-31.63184898	23.44953099	IIIC	NA
918	Burgersfontein 92. Probable Poortjie Member. Crushed, baked probable small tetrapod skull within thin-bedded grey-green siltstone with possible baked gypsum roses exposed on bed of Burgerspruit. Proposed Field Rating IIIB. Site protected in river bed within standard ecological riverine buffer.	-31.63092203	23.44897603	IIIB	20m no-go buffer

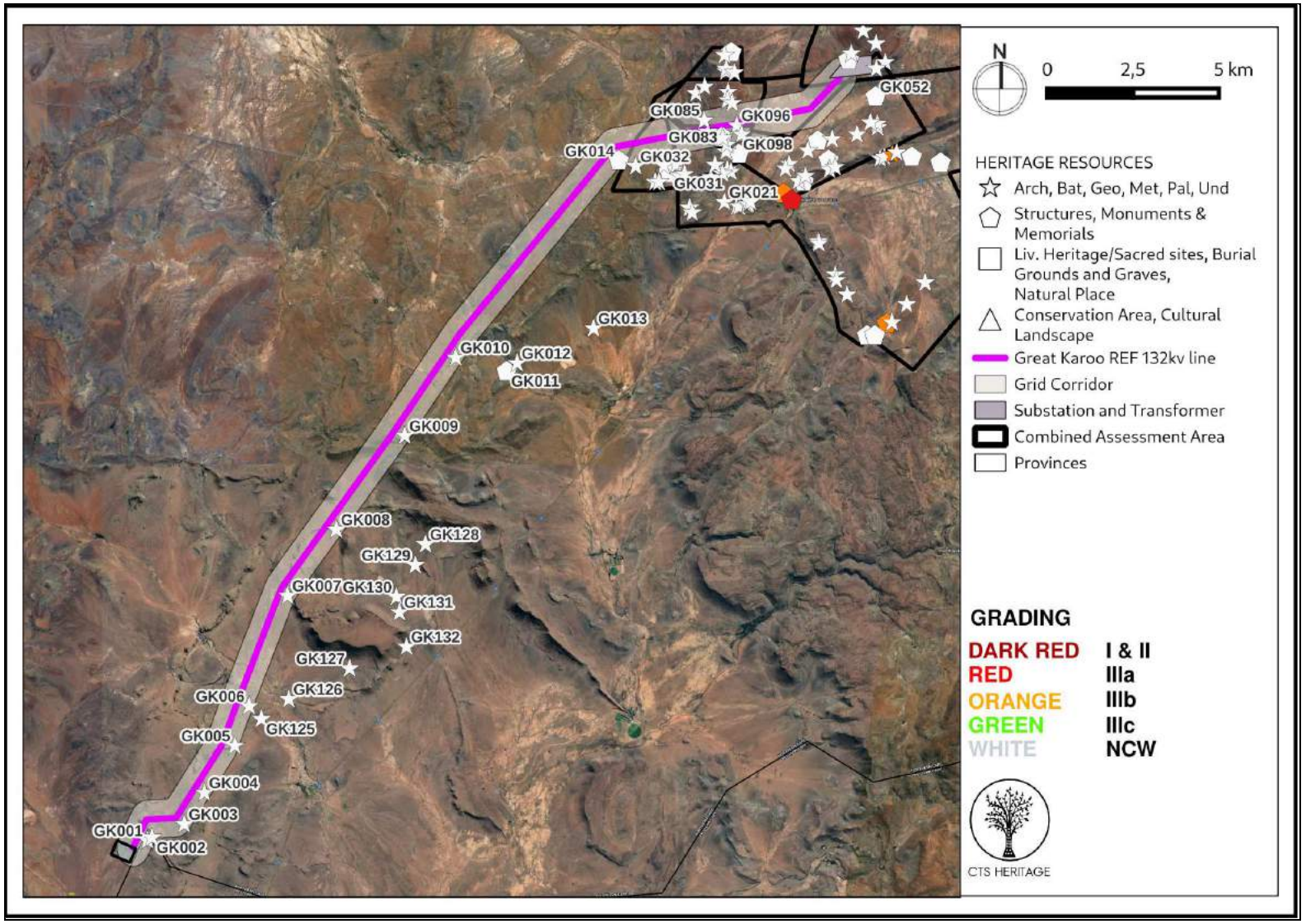
4.3 Mapping and spatialisation of heritage resources



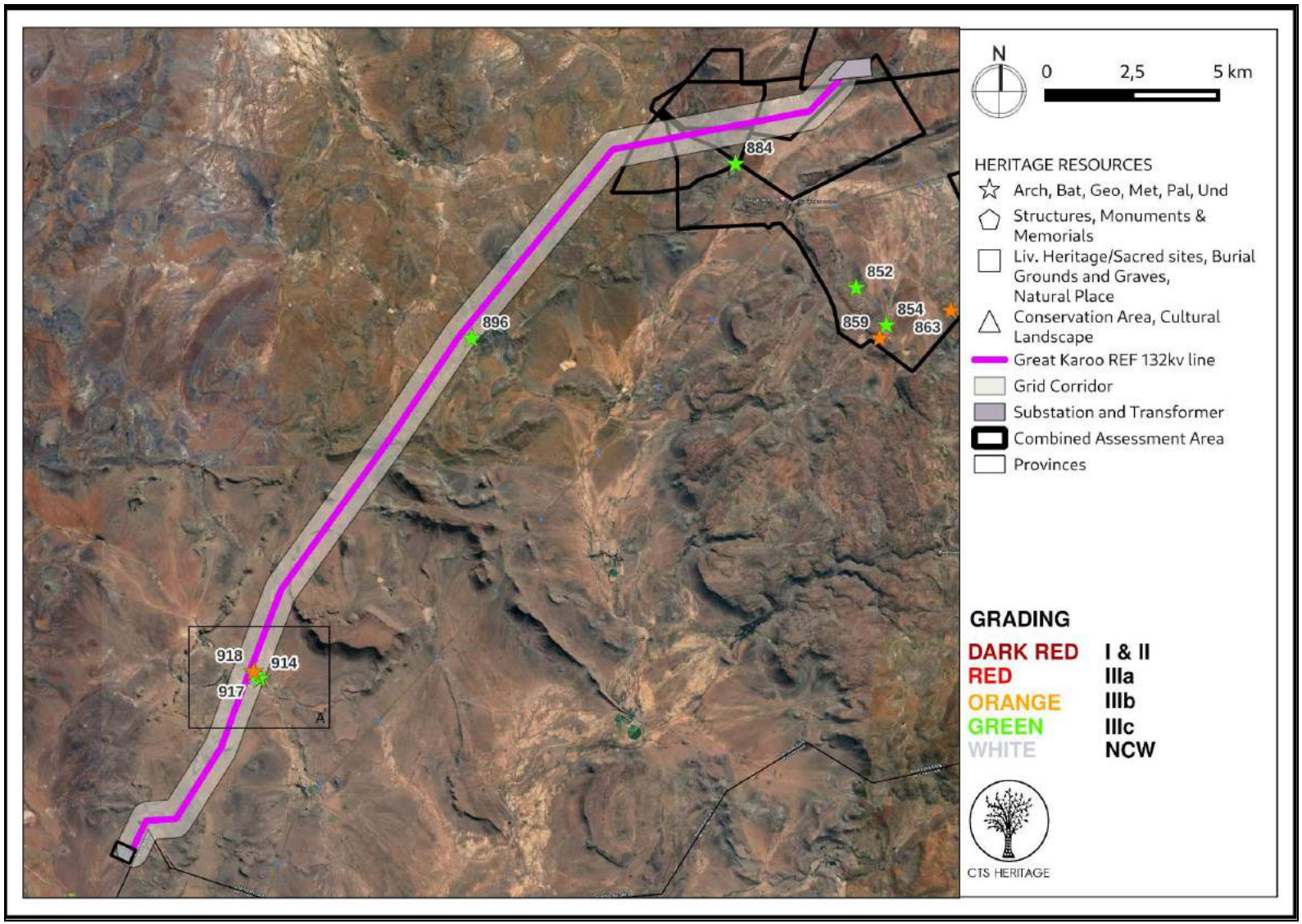
Map 5a: Map of cultural landscape heritage resources in proximity to the proposed development area



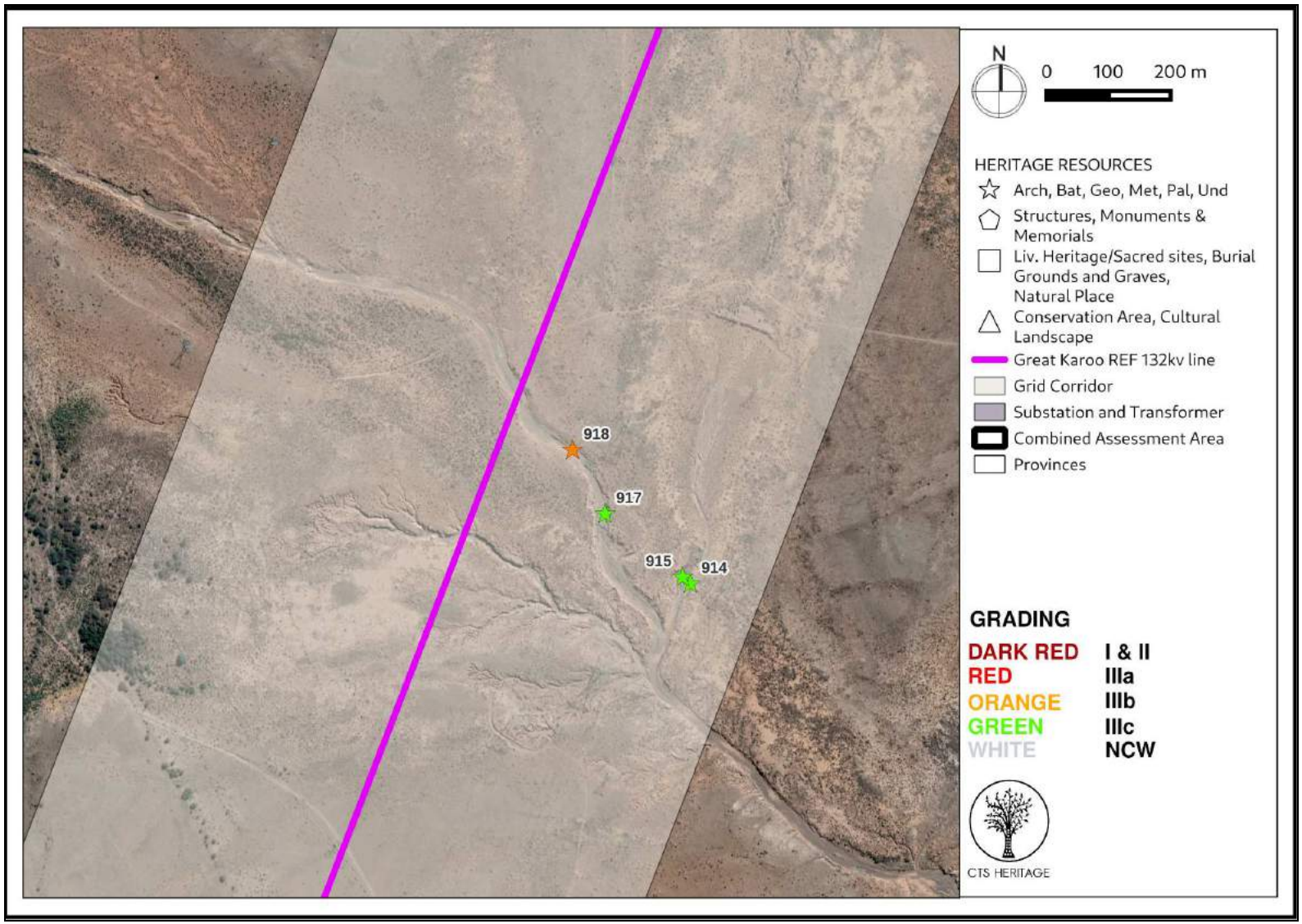
Map 5b: Map of ridgelines proximity to the proposed development area



Map 5c: Map of archaeological observations in proximity to the proposed development area - all considered to be Not Conservation-Worthy



Map 5d: Map of palaeontological heritage resources in proximity to the proposed development area



Map 5e: Inset A

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

Cultural Landscape

The grid connection corridor begins in a developable area and follows a route of existing infrastructure. Therefore the impact to the cultural landscape of the additional infrastructure is acceptable, as it makes little material difference to the already disturbed landscape. The grid connection corridor traverses adjacent to power lines where there is existing visual disturbance and it traverses further from existing dwellings and roads.

The grid connection corridor is located within an area that already contains existing grid connection infrastructure. Furthermore, the majority of the alignment is located on the far side of ridgelines which largely screen the grid connection infrastructure from the N1. In addition, the grid assessment corridor falls well away from the 1km buffer area recommended for the N1.

Table 5: Impact table for Cultural Landscape Heritage Resources

NATURE: The broader context of the area proposed for development has cultural significance that may be impacted by the proposed development				
		Before Mitigation		**After Mitigation**
MAGNITUDE	**L (4)**	While the cultural value of the pristine Karoo Landscape is very high, the location of the proposed grid connection infrastructure and its grouping with existing infrastructure means that only slight impact to the cultural landscape will result from the proposed development.	**L (4)**	While the cultural value of the pristine Karoo Landscape is very high, the location of the proposed grid connection infrastructure and its grouping with existing infrastructure means that only slight impact to the cultural landscape will result from the proposed development.
DURATION	**H (4)**	Where manifest, the impact will be long term - for the duration of the grid infrastructure lifetime	**H (4)**	Where manifest, the impact will be long term - for the duration of the grid infrastructure lifetime
EXTENT	**H (5)**	Regional	**H (5)**	Regional
PROBABILITY	**L (2)**	It is extremely unlikely that any significant cultural landscape resources will be impacted	**L (2)**	It is extremely unlikely that any significant cultural landscape resources will be impacted
SIGNIFICANCE	**L**	(5+4+4)x2=26	**L**	(5+4+4)x2=26
STATUS		Neutral		Neutral
REVERSIBILITY	**L**	Any impacts to heritage resources that do occur are reversible once the grid connection infrastructure is removed	**L**	Any impacts to heritage resources that do occur are reversible once the grid connection infrastructure is removed
IRREPLACEABLE LOSS OF RESOURCES?	**L**	Unlikely	**L**	Unlikely
CAN IMPACTS BE MITIGATED		NA		
MITIGATION: Impacts cannot be mitigated				
RESIDUAL RISK: NA				

Archaeology

A total of 24 archaeological observations were identified along the grid alignment. None of the identified archaeological resources were determined to be conservation-worthy. Six modern windmill and water storage structures were identified within the grid alignment options but none of these were determined to be conservation-worthy. Based on the outcomes of this assessment, the proposed grid corridor will not have a negative impact on any significant heritage resources.

Table 6: Impact table for Archaeological Heritage Resources

NATURE: The area proposed for development is known to conserve heritage resources of archaeological significance that may be impacted by the proposed development				
		Before Mitigation		**After Mitigation**
MAGNITUDE	**L (2)**	No significant archaeological resources were identified within the development area	**L (2)**	No significant archaeological resources were identified within the development area
DURATION	**H (5)**	Where manifest, the impact will be permanent.	**H (5)**	Where manifest, the impact will be permanent.
EXTENT	**L (1)**	Localised within the site boundary	**L (1)**	Localised within the site boundary
PROBABILITY	**L (1)**	It is extremely unlikely that any significant archaeological resources will be impacted	**L (1)**	It is extremely unlikely that any significant archaeological resources will be impacted
SIGNIFICANCE	**L**	(2+5+1)x1=8	**L**	(2+5+1)x1=8
STATUS		Neutral		Neutral
REVERSIBILITY	**L**	Any impacts to heritage resources that do occur are irreversible	**L**	Any impacts to heritage resources that do occur are irreversible
IRREPLACEABLE LOSS OF RESOURCES?	**L**	Unlikely	**L**	Unlikely
CAN IMPACTS BE MITIGATED		NA		
MITIGATION: Should any significant archaeological resources be uncovered during the course of the construction phase, work must cease in the area of the find and SAHRA must be contacted regarding an appropriate way forward.				
RESIDUAL RISK: Should any significant archaeological resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources				

Palaeontology

No palaeontological Very High Sensitivity / No-Go areas have been identified within the grid connection project areas. With the exception of two fossil sites of low scientific value, none of the recorded fossil sites overlaps directly with, or lies close to (< 20 m), proposed infrastructure and no modification of the layouts through micro-siting is proposed here on palaeontological grounds. While a number of fossil sites are recorded within the grid connection corridor, none is of conservation significance while most of the sites are already protected within standard ecological buffer zones along drainage lines. Mitigation of the known fossil sites within the grid connection project area is therefore not proposed here. The anticipated impact significance of the proposed development in terms of palaeontological heritage resources is likely to be VERY LOW due to (1) the very sparse distribution of fossil remains as well as (2) their almost universally poor preservation. Given the very uniform geological, and hence palaeontological, setting throughout the combined project areas, this assessment applies equally to the grid connection projects as well as to the grid connection corridor under consideration. The proposed grid connection is not fatally flawed from a palaeontological heritage viewpoint and there are no objections to their authorisation.

Table 7: Impact table for Palaeontological Heritage Resources

NATURE: The area proposed for development is known to conserve heritage resources of palaeontological significance that may be impacted by the proposed development				
		Before Mitigation		**After Mitigation**
MAGNITUDE	**H (8)**	No highly significant palaeontological resources were identified within the development area, however the geology underlying the development area is very sensitive for impacts to significant fossils	**H (8)**	No highly significant palaeontological resources were identified within the development area, however the geology underlying the development area is very sensitive for impacts to significant fossils
DURATION	**H (5)**	Where manifest, the impact will be permanent.	**H (5)**	Where manifest, the impact will be permanent.
EXTENT	**L (1)**	Localised within the site boundary	**L (1)**	Localised within the site boundary
PROBABILITY	**H (5)**	It is extremely likely that significant palaeontological resources will be negatively impacted	**L (1)**	It is extremely unlikely that any significant paleontological resources will be negatively impacted
SIGNIFICANCE	**H**	(1+5+8)x5=70	**L**	(1+5+8)x1=14
STATUS		Neutral		Neutral
REVERSIBILITY	**L**	Any impacts to heritage resources that do occur are irreversible	**L**	Any impacts to heritage resources that do occur are irreversible
IRREPLACEABLE LOSS OF RESOURCES?	**H**	Likely	**L**	Unlikely
CAN IMPACTS BE MITIGATED		Yes		
MITIGATION: The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities				
RESIDUAL RISK: Should any significant palaeontological resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources				

5.2 Sustainable Social and Economic Benefit

The Great Karoo EGI is directly linked to the operation of the Great Karoo Cluster of Renewable Energy Facilities and is essential infrastructure for the operation of these facilities to enable the electricity evacuation to the national grid.

In the absence of the proposed Great Karoo EGI, the renewable energy facilities will not be able to operate. Therefore, considering the dependency of the proposed renewable energy facilities on the Great Karoo EGI, the socio-economic benefits of this grid connection infrastructure is directly linked to the socio-economic benefits of the proposed renewable energy facilities that it will cater for.

As such, the anticipated socio-economic benefits of the proposed development outweigh the anticipated impacts to heritage resources.

5.3 Proposed development alternatives

Only one grid alignment is proposed for this grid connection infrastructure as mapped in Map 1a and 1b. Additional alternatives for the grid connection alignment were proposed at an earlier phase of the project, however these have been screened out as part of the Scoping Phase process.

5.4 Cumulative Impacts

At this stage, there is the potential for the cumulative impact of proposed renewable energy facilities to negatively impact the cultural landscape due to a change in the landscape character from natural wilderness to semi-industrial. Although this project falls outside of a REDZ area, it is noted that it is preferable to have renewable energy facility development clustered in an area such as a REDZ.

To address concerns about the cumulative impact of RE facilities within the greater Karoo region, a cautious approach is required in terms of assessing the desirability of such development from a cultural landscape perspective. The proposed site is located adjacent to an existing infrastructural corridor associated with the national grid, which suggests a level of suitability of RE facilities which can link in with the grid. Notwithstanding the existing infrastructure, the placement of RE facilities, both PV and WE turbines, must take cognisance of the very high visual impact on a relatively intact and representative cultural landscape, and the extremely limited ability to visually screen this infrastructural development, particularly in the case of the wind turbines.

However, as this HIA is concerned with the grid connection infrastructure, the placement of the proposed grid corridor adjacent to existing grid connection infrastructure goes some way to mitigate the negative impact of the development on heritage resources.

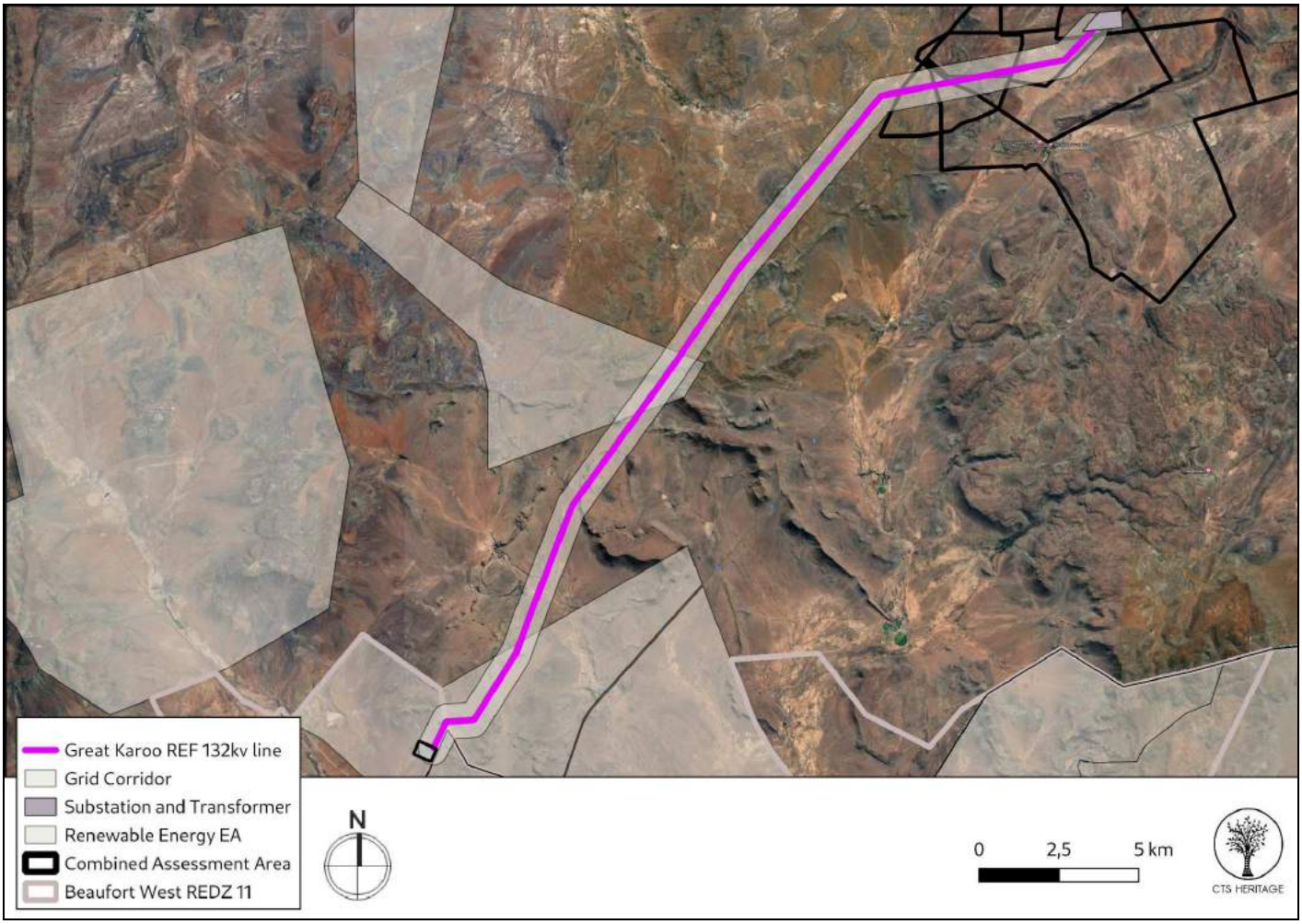


Figure 4: Approved REF projects within 50km of the proposed development area

Table 8: Cumulative Impact Table

NATURE: Cumulative Impact to the sense of place				
		Overall impact of the proposed project considered in isolation		**Cumulative impact of the project and other projects in the area**
MAGNITUDE	**L (4)**	Low	**L (4)**	Low
DURATION	**M (3)**	Medium-term	**H (4)**	Long-term
EXTENT	**L (1)**	Low	**L (1)**	Low
PROBABILITY	**L (2)**	Improbable	**H (3)**	Probable
SIGNIFICANCE	**L**	(4+3+1)x2=16	**L**	(4+4+1)x3=27
STATUS		Neutral		Neutral
REVERSIBILITY	**H**	High	**L**	Low
IRREPLACEABLE LOSS OF RESOURCES?	**L**	Unlikely	**L**	Unlikely
CAN IMPACTS BE MITIGATED		NA		NA
CONFIDENCE IN FINDINGS: High				
MITIGATION: No impacts are anticipated and as such, no mitigation is required				

6. RESULTS OF PUBLIC CONSULTATION

As this application is made in terms of NEMA, the public consultation on the HIA will take place with the broader public consultation process required for the Environmental Impact Assessment process and will be managed by the lead environmental consultants on the project.

7. CONCLUSION

In terms of impacts to archaeological resources, the findings of this assessment largely correlate with the findings of other assessments completed in the vicinity such as the findings of the ACO (2013, SAHRIS NID 503074) who note that “Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape.” This same archaeological signature has been identified within the development footprint.

No archaeological resources of significance were identified within the grid connection corridor and as such, no impact to significant archaeological heritage is anticipated.

In terms of impacts to palaeontological resources, the area proposed for development falls within a geological that is very sensitive for impacts to significant palaeontological heritage. While the site visit conducted did not identify significant fossil material, the likelihood of unv=covering significant palaeontology that is preserved below

the ground surface remains high. As such, it is recommended that the attached Chance Fossil Finds Procedure be implemented for the duration of construction activities.

In terms of impacts to the Cultural Landscape, the proposed development is broadly located in an area with a culturally significant sense of place. That being said, the grid connection corridor follows a route of existing infrastructure. The impact to the cultural landscape of the additional infrastructure is acceptable, as it makes little material difference to the already disturbed landscape..

8. RECOMMENDATIONS

Based on the outcomes of this report, it is not anticipated that the proposed development of the grid connection infrastructure will negatively impact on significant heritage resources. The following recommendations are made:

- The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

9. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
120317	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120820	HIA Phase 1	Celeste Booth	01/12/2012	An Archaeological Ground-Truthing Walk-Through For The Nobelsfontein Wind Energy Facility Situated On A Site South Of Victoria West On The Farms Nobelsfontein 227, Annex Nobelsfontein 234, Ezelsfontein 235, And Rietkloofplaaten 239, Northern Cape Province
251290	PIA Desktop	Lloyd Rossouw	01/01/2014	Combined Environmental Environmental Impact Assessment for the proposed Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Eskom Distribution Grid Connection Infrastructure near Murraysburg, Western Cape. Chapter 13: Palaeontology Impact Assessment.
251296	AIA Phase 1	Dave Halkett	01/01/2014	Combined Environmental Impact Assessment for the proposed Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Eskom Distribution Grid Connection Infrastructure near Murraysburg, Western Cape. Chapeter 13: Archaeology Impact Assessment.
356942	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	01/05/2010	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED SKIETKUIL QUARRIES 1 AND 2 ON THE FARM SKIETKUIL No. 3, VICTORIA WEST, CENTRAL KAROO DISTRICT, WESTERN CAPE PROVINCE
356942	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	01/05/2010	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED SKIETKUIL QUARRIES 1 AND 2 ON THE FARM SKIETKUIL No. 3, VICTORIA WEST, CENTRAL KAROO DISTRICT, WESTERN CAPE PROVINCE
357137	Heritage	Timothy Hart	13/10/2015	Heritage Impact Assessment for the proposed Umsinde Emoyeni Wind

	Impact Assessment Specialist Reports			Energy Facility
360840	Non Impact Assessment Related Reports	Wouter Fourie	05/03/2016	Environmental Impact Assessment of the proposed amendments to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape â€“ Specialist Heritage Opinion
360850	HIA Phase 1	Wouter Fourie	04/03/2016	Basic assessment process for Proposed development of supporting infrastructure to the Victoria West Wind Energy Facility, Victoria West
6805	AIA Phase 1	Len van Schalkwyk, Elizabeth Wahl	01/09/2007	Heritage Impact Assessment of Gamma Grassridge Power Line Corridors and Substation, Eastern, Western and Northern Cape Provinces, South Africa
7035	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	05/03/2011	A Phase 1 Archaeological Impact Assessment (AIA) for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape Province on the farms Phaisantkraal 1, Modderfontein 228, Nobelsfontein 227, Annex Nobelsfontein
7036	AIA Desktop	Celeste Booth, Natasha Higgitt	19/11/2010	An Archaeological Desktop Study for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape
8943	PIA Phase 1	Lloyd Rossouw	24/03/2011	Palaeontological desktop assessment of a commercial renewable energy facility site located approximately 34km south of Victoria West in the Western Cape Province (and Northern Cape)

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APPENDICES

APPENDIX 1: Archaeological Assessment (2021)

ARCHAEOLOGICAL SPECIALIST STUDY

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

Proposed Great Karoo Renewable Energy Facility development near Richmond in the Northern Cape

Prepared by

CTS HERITAGE

In Association with

Savannah Environmental

October 2021

CTS HERITAGE

EXECUTIVE SUMMARY

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of 2 x wind energy facilities, 3 x solar energy facilities and 5 x grid connections on sites near Richmond, Northern Cape. The cluster of projects is known as Great Karoo Renewable Energy (GKRE). As the projects fall outside of a REDZ, a full Scoping & EIA process would be required for the facilities and BA processes for the associated grid connections.

Project details are as follows:

Project NameTechnology Capacity Affected farm names

- Angora Wind Energy Facility Wind (140MW) on Rem. 85 Rondavel, 86 Annex Rondavel and Rem. 84 Vogelstruisfontein
- Merino Wind Energy Facility Wind (140MW) on Land Rem. 85 Rondavel, 86 Annex Rondavel and Rem. 84 Vogelstruisfontein
- Nku Solar PV Solar PV (100MW) on Rem. 85 Rondavel & 86 Annex Rondavel and Rem. 84 Vogelstruisfontein
- Moriri Solar PV Solar PV (100MW) on Rem. 85 Rondavel, 86 Annex Rondavel and Rem. 84 Vogelstruisfontein
- Kwana Solar PV Solar PV (100MW) on Rem. 85 Rondavel, 86 Annex Rondavel and Rem. 84 Vogelstruisfontein

Grid connection infrastructure associated with each of the above-mentioned projects will include a 132kV onsite substation and 132kV overhead power line.

The findings of this assessment largely correlate with the findings of other assessments completed in the vicinity such as the findings of the ACO (2013, SAHRIS NID 503074) who note that “Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape.” This same archaeological signature has been identified within the development footprint.

It is noted that high numbers of quarried stone artefacts predominantly from the Middle Stone Age period were found on this property which is consistent with observations on neighbouring farms through impact assessments and research surveys. These artefacts are particularly visible in deflated open sites where the top soil has washed away onto a harder gravel surface. Despite the large number of dolerite outcrops, no engravings were found. We are not currently aware of a large number of Stone Age engravings in this area and the lack of sites found might possibly be due to the routes chosen for the access roads and turbine positions. It was noted in the field assessment that the archaeology located around the dolerite ridges is very dense and exposed and as such, we would recommend caution should changes be made to turbine positions or access roads.

One archaeological site of significance was identified, Site GK048 (Grade IIIB). It is recommended that a no-go development buffer of 50m is implemented around this site to ensure that it is not impacted. The other significant resources identified include stone wall ruins (GK037, GK074 and GK105) graded IIIB and two significant farm werfs

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(GK038 and GK100) and a burial ground (GK101) graded IIIA. No-go development buffers are recommended around these sites to ensure that no impact takes place. These are illustrated in Figure 11 below.

Recommendations

Based on the outcomes of this report, it is not anticipated that the proposed development of the renewable energy facilities and its associated grid connection infrastructure will negatively impact on significant archaeological heritage on condition that::

- A 50m no-go development buffer is implemented around site GK048 (Figure 11.5)
- A 500m no-go development buffer is implemented around site GK037 (Figure 11.1), GK074 (Figure 11.2), GK105 (Figure 11.4) and GK101 (Figure 11.3)
- A 1km no-go development buffer is implemented around site GK038 (Figure 11.1) and GK100 (Figure 11.4)
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

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1. INTRODUCTION

1.1 Background Information on Project

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of 2 x wind energy facilities, 3 x solar energy facilities and 5 x grid connections on sites near Richmond, Northern Cape. The cluster of projects is known as Great Karoo Renewable Energy (GKRE). As the projects fall outside of a REDZ, a full Scoping & EIA process would be required for the facilities and BA processes for the associated grid connections.

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Grid connection infrastructure associated with each of the above-mentioned projects will include a 132kV onsite substation and 132kV overhead power line.

1.2 Description of Property and Affected Environment

The majority of the proposed solar PV and WEF infrastructure is located on Rondavel and Vogelstruisfontein farms which lie on the northern and western end of the N1 highway about 30km southwest of Richmond in the Northern Cape. A further 14 turbine positions and their associated access roads are envisaged to the south side of the N1 across the way from Rondavel farm. Rondavel is a working sheep farm but is also a prominent guest farm. In the last two decades the N1 has become increasingly flooded with heavy trucking traffic due to the decreasing use of the railway system and the growth of the South African economy.

The terrain is a mixture of nearly perfectly level ground where the solar PV installations are positioned while the wind turbine locations are mainly situated on the tops of a series of moderately high dolerite ridges and koppies. A few turbine positions are proposed on slightly elevated ground surrounding the solar PV areas. The area falls within the Eastern Upper Karoo region and the vegetation consists of a mix of grass and shrub dominated vegetation types. Acacia thorn trees are found in the riverine zones and much of the shrubland is currently in a very poor state due to the extended 5 year drought afflicting the area. Aeolian sands and floodplains form a thick (>1m) layer of overburden in many places surrounding the dolerite ridges and there has been extensive burial and re-surfacing of Middle Stone Age material. Later Stone Age was relatively well represented in the study area and most of the MSA and LSA material was concentrated around the lower slopes of the dolerite ridges and koppies. The dominant agricultural activity is sheep farming and a number of windmills with smal farm dams were recorded that feature on the built landscape. The

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western end of the properties hold the main route of South Africa's 765kV powerline infrastructure linking up the Western Cape to the coal-fired power stations in Mpumalanga and Gauteng.

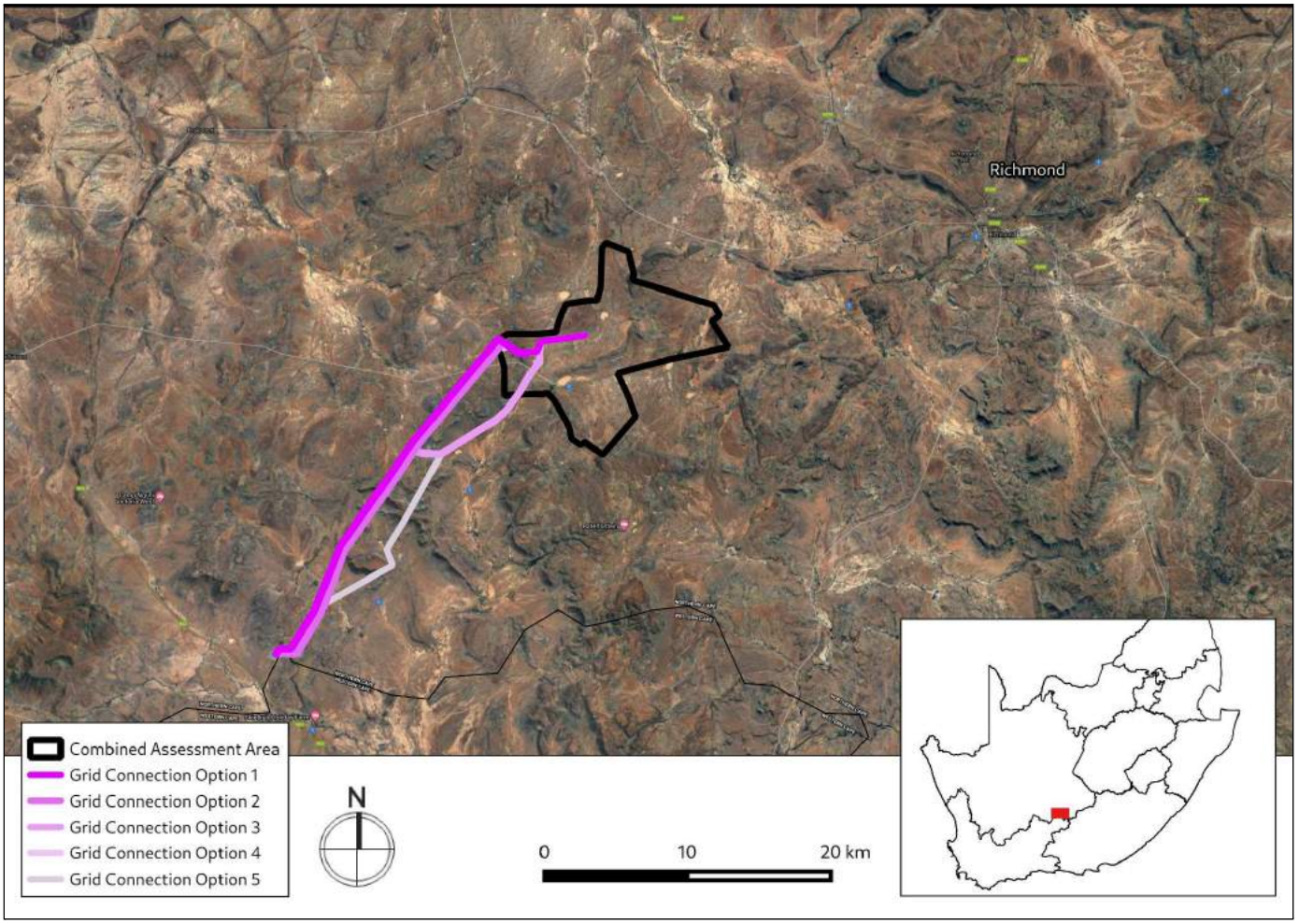

Figure 1.1: Satellite image indicating proposed location of development

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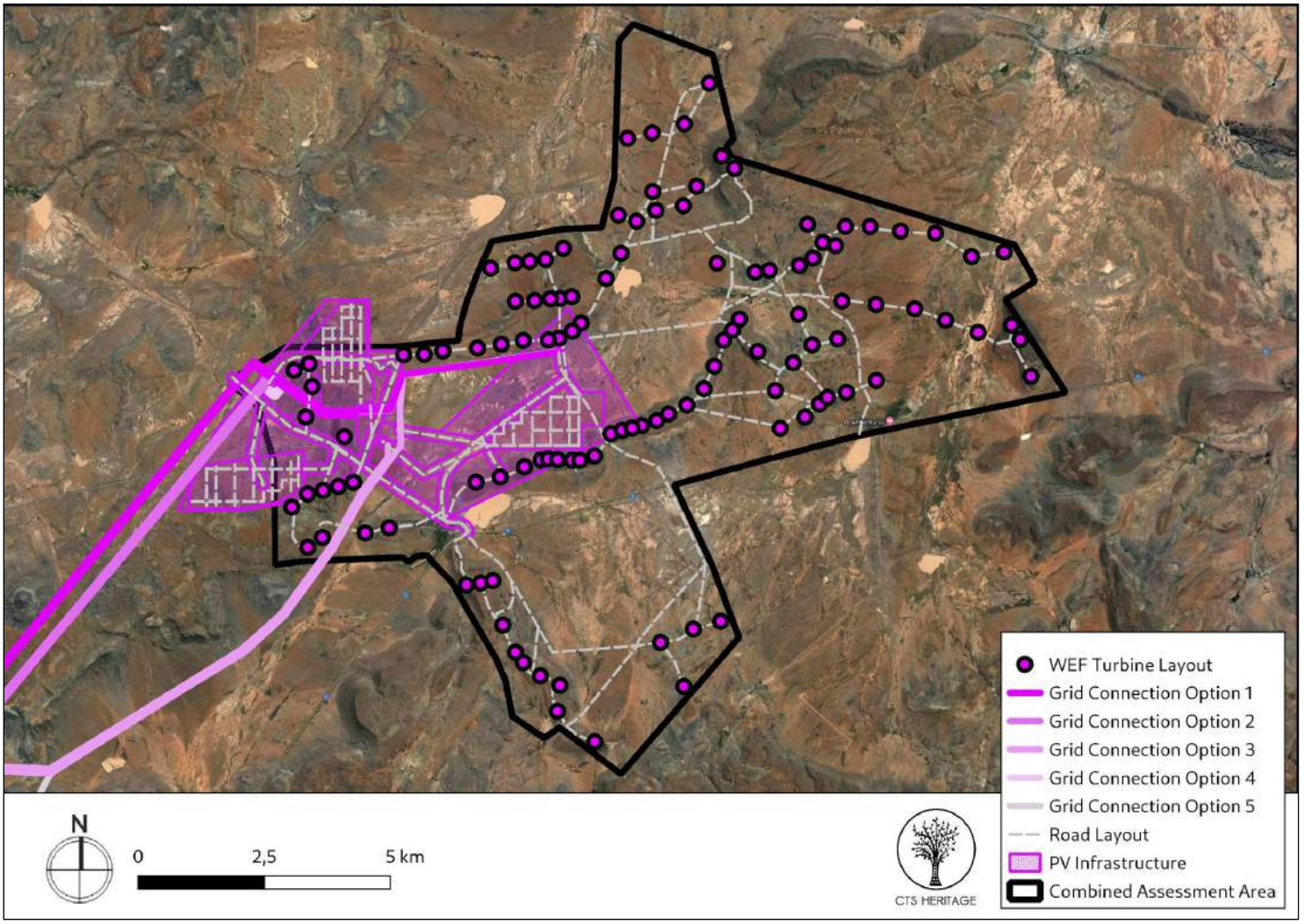

Figure 1.2: Proposed project boundary

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 from 11-16 September 2021 to determine what archaeological resources are likely to be impacted by the proposed development.
- The area proposed for development was assessed on foot, 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.

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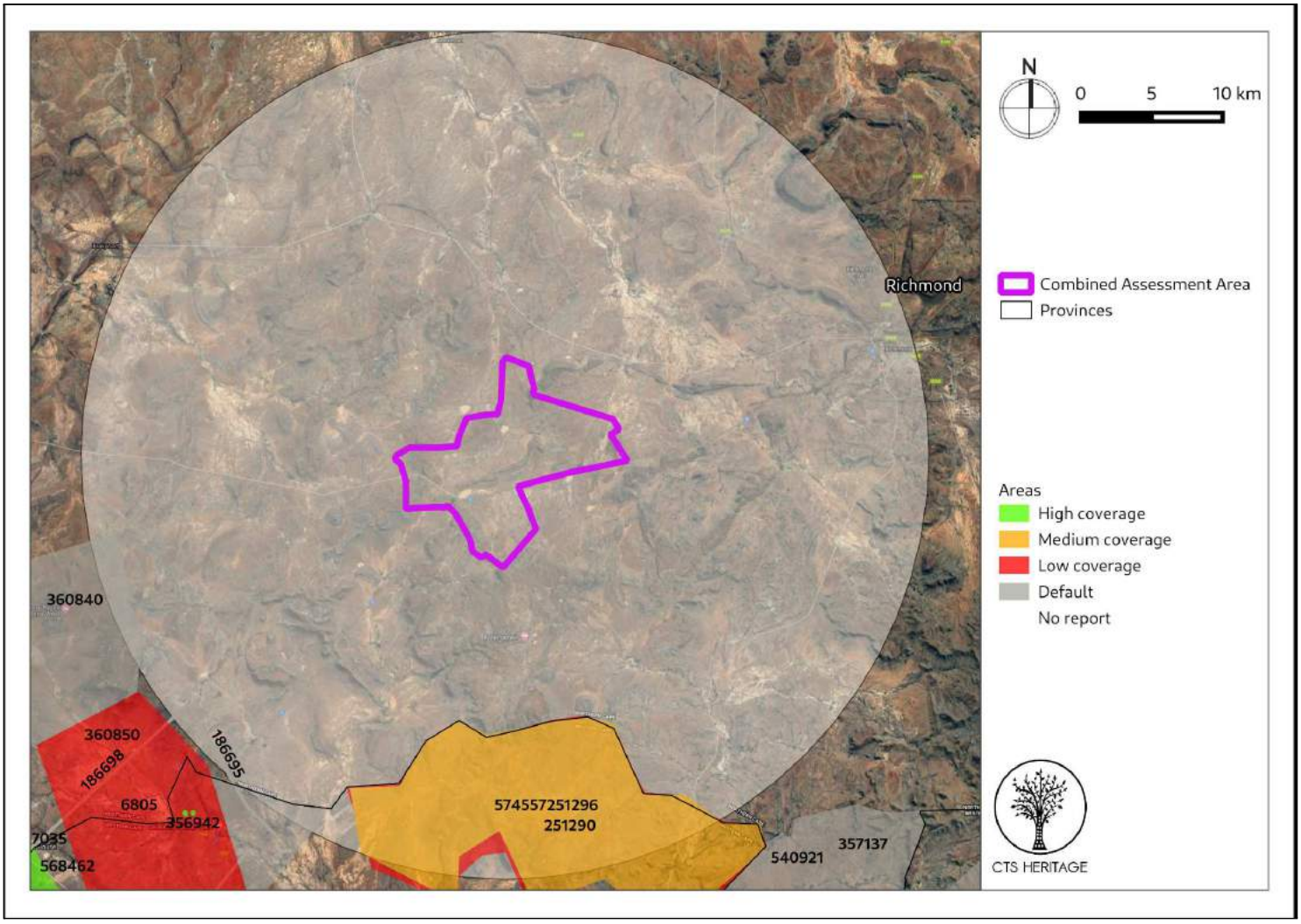

Figure 2: Close up satellite image indicating proposed location of development in relation to heritage studies previously conducted

2.3 Constraints & Limitations

The current extended drought has led to poor conditions in the veld but this has also provided very good visibility of archaeological material exposed on the surface. A series of dongas were inspected to test whether archaeological material may be buried by aeolian and flooding events and this was confirmed in some places where exposed lines of gravels containing MSA artefacts were found buried over 1m below the surface. However, the exposure of MSA and LSA material was clearly evident on the lower slopes of the dolerite koppies and this provided a fair characterisation of the buried artefacts.

The experience of the heritage practitioner, and observations made during the study, allow us to predict with some accuracy the archaeological sensitivity of the receiving environment.

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3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

Background:

The area proposed for the Great Karoo Renewable Energy Facility Projects including this proposed Wind Energy Facility is located approximately 20km southwest of Richmond in the Northern Cape, and 40km east of Victoria West outside of the identified Beaufort West REDZ (Figure 2b) along the N1. The town of Richmond was established in 1843 to service the needs of the growing farming community. It was renowned as a resort town in the 1800s for European aristocrats suffering lung disease due to its clean air and mineral-rich waters.

Archaeology

Very few heritage assessments have been completed within close proximity to the area proposed for development (Figure 2a). According to Nilssen (2014, SAHRIS NID 504763), "The Karoo houses a long and rich archaeological record dating from the earliest stages of Stone Age technology that are over a million years old, to the historic period that consists of the last few hundred years of human occupation (see Nilssen 2011 and references therein). Archaeological sites include caves and rock shelters, open air artefact scatters, rock engravings and historic structures with their associated cultural materials." According to ACO (2013, SAHRIS NID 503074), "Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape. Where definable scatters of Early and Middle Stone Age material occur, they are considered to be significant heritage sites. More intensive occupation of the Karoo started around 13 000 years ago during the Later Stone Age, which is essentially the heritage of Khoisan groups who lived throughout the region. The legacy of the San includes numerous open sites while traces of their presence can also be found in most large rock shelters, often in the form of rock art. They frequently settled a short distance from permanent water sources (springs or waterholes) and made use of natural shelters such as rock outcrops or large boulders or even large bushes. In the Great Karoo natural elevated features such as dolerite dykes and ridges played a significant role in San settlement patterns." It is likely that similar archaeological heritage exists within the areas proposed for development and as such, impact to these resources must be assessed.

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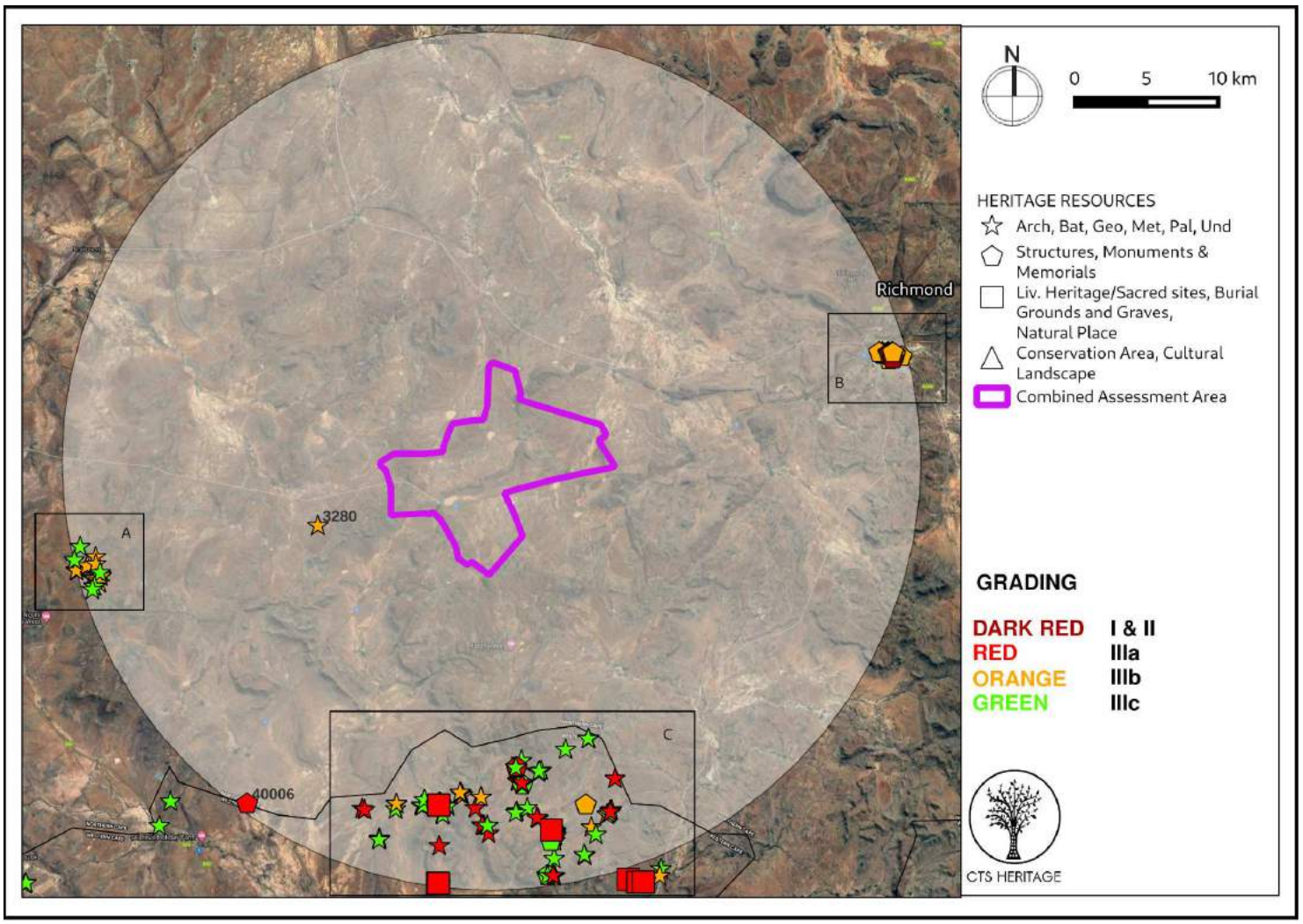

Figure 3. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated

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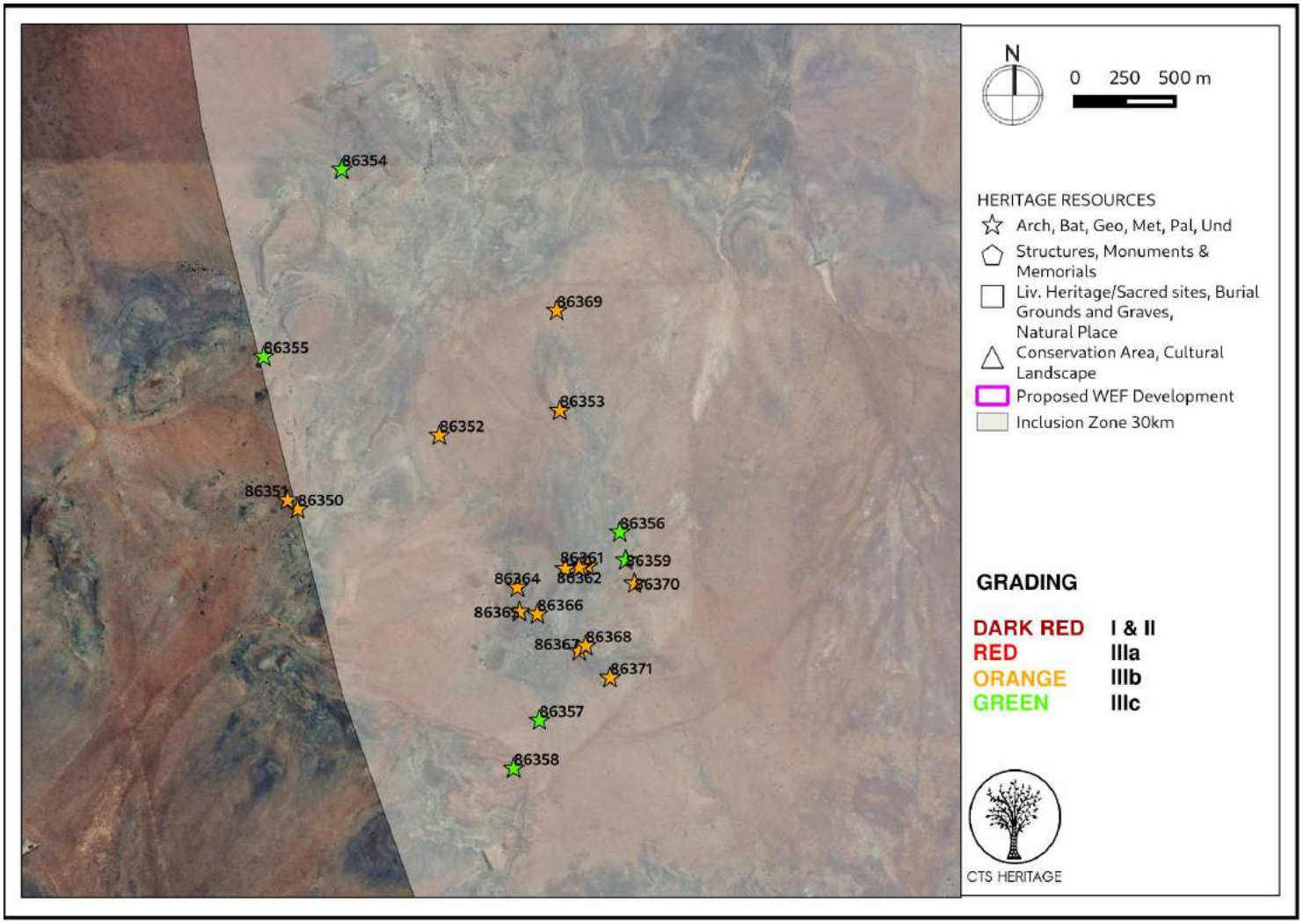

Figure 3a. Inset

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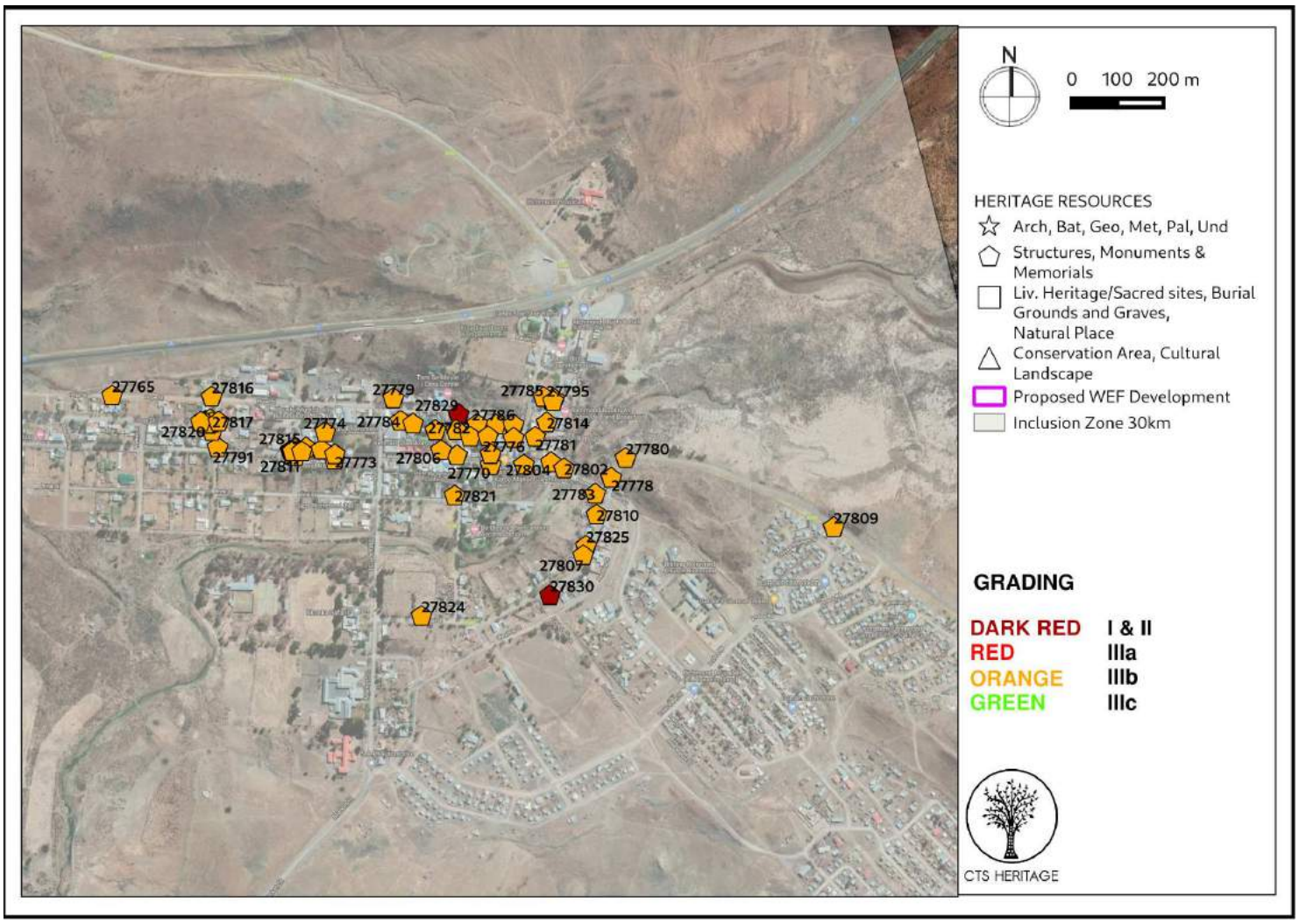

Figure 3b. Inset

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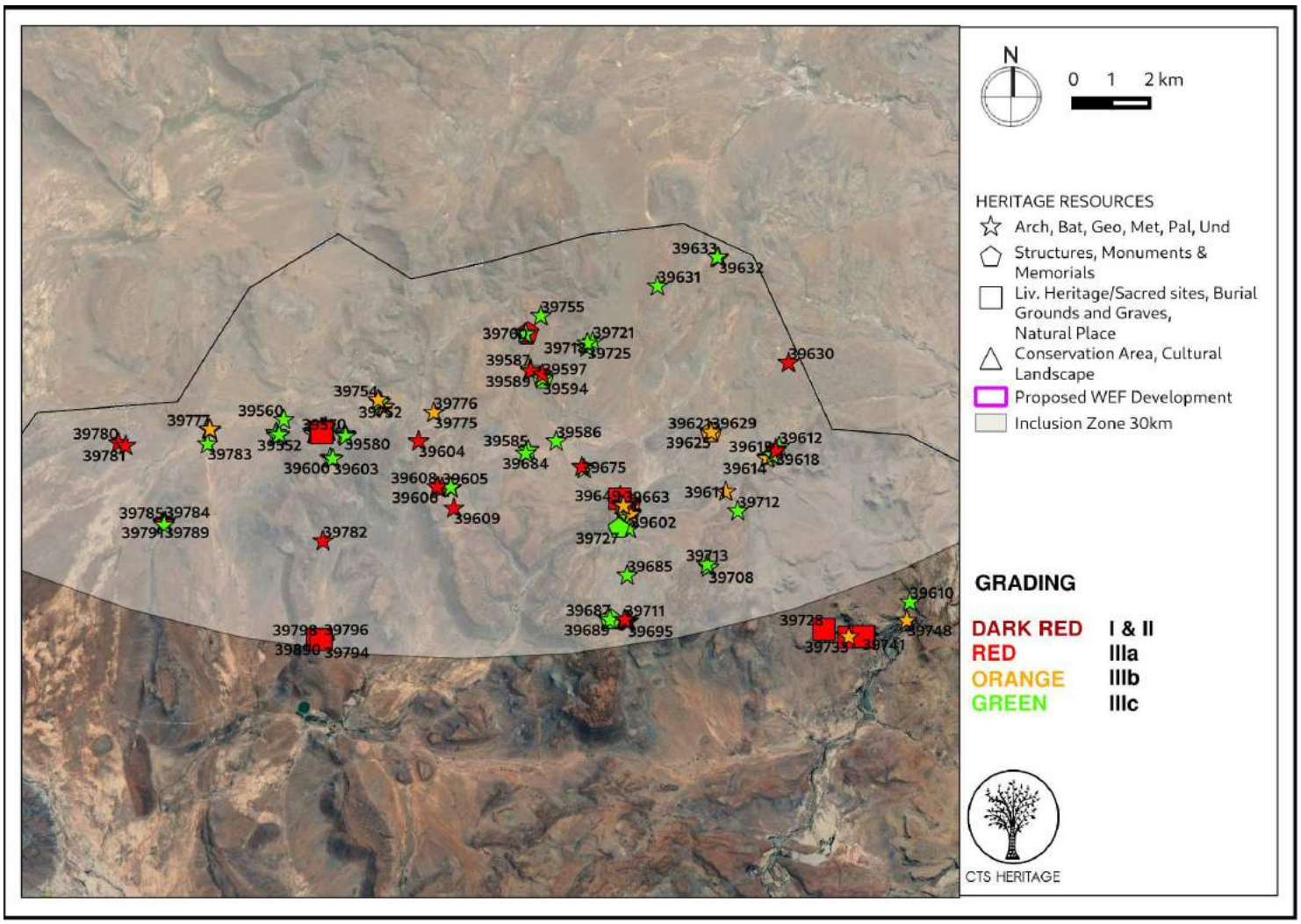

Figure 3c. Inset

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Field Assessment

No fewer than 132 locations were plotted containing historical and Stone Age heritage resources. The vast majority of these sites hold MSA material but LSA observations were well represented in the study area. The various windmills and small farm dams were recorded but are of no further concern in terms of heritage impacts anticipated by the WEFs and solar PV facilities as the current farming activities will continue beyond the establishment of the energy infrastructure. The two primary farms at Rondavel and Vogelstruisfontein will also be unaffected and a large graveyard at Vogelstruisfontein held a number of marked graves within a central stone walled compound of the Conroy, Visser and Botha families spanning the late 18th to 20th centuries. A series of unmarked graves were also found nearby and the boundary of the graveyard consists of upright dolerite slabs and broken wire fencing that has all but disappeared. The central compound and the unmarked graves are deteriorating and signs of dilapidated walls and slabs were evident.

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The Stone Age material was mainly produced on locally sourced hornfels cores. Flakes and cores in greywacke and siltstones were also found but these were far less prominent. A lower grindstone showing a clear grinding groove was found in a level sandy bay surrounded by dolerite ridges.

The relative absence of surface artefacts on the level plains, particularly where the solar PV facilities are proposed, was initially picked up as notable in the first days of the survey but subsequent inspections of the dongas in the study area revealed a lower, buried level of gravels that contained MSA artefacts. It was therefore clear that wind-blown and flooding events in the area have resulted in the burial of artefacts in many level areas. Given that the overall assessment reached over 130 observations, the Stone Age material is ubiquitous, generally dispersed across a wide area and highlights the extensive use of this landscape by people throughout the Middle and Later Stone Age.

Despite the large number of dolerite outcrops, no engravings were found. We are not currently aware of a large number of Stone Age engravings in this area and the lack of sites found might possibly be due to the routes chosen for the access roads and turbine positions. It was noted in the field assessment that the archaeology located around the dolerite ridges is very dense and exposed and as such, we would recommend caution should changes be made to turbine positions or access roads.

Figure 4.1: Existing grid infrastructure at the southern extent of the prop;osed grid connections

Figure 4.2: Existing grid infrastructure at the southern extent of the prop;osed grid connections

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Figure 4.3: Site at which Grid Option 3 links with Grid Option 2

Figure 4.4: Easternmost extent of Grid Option 5

Figure 4.5: Contextual Images - flat nature of the topography with the occasional butte

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Figure 4.6: Flat topography of the area proposed for the PV development

Figure 4.7: Contextual Images of landscape

Figure 4.8: Contextual Images of Landscape

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Figure 4.9: Contextual Images of Landscape

Figure 4.10: Contextual Images of Landscape, with the N1 running through the development area

Figure 4.11: Contextual Images of the Angora WEF area

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Figure 4.12: Contextual Images of the Angora WEF area

Figure 4.13: Contextual Images of the Angora WEF area

Figure 4.14: Contextual Images of the Angora WEF area

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Figure 4.15: Contextual Images of the Angora WEF area

Figure 4.16: Contextual Images of the Merino WEF area

Figure 4.17: Contextual Images of the Merino WEF area

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Figure 4.18: Contextual Images of the Angora WEF area

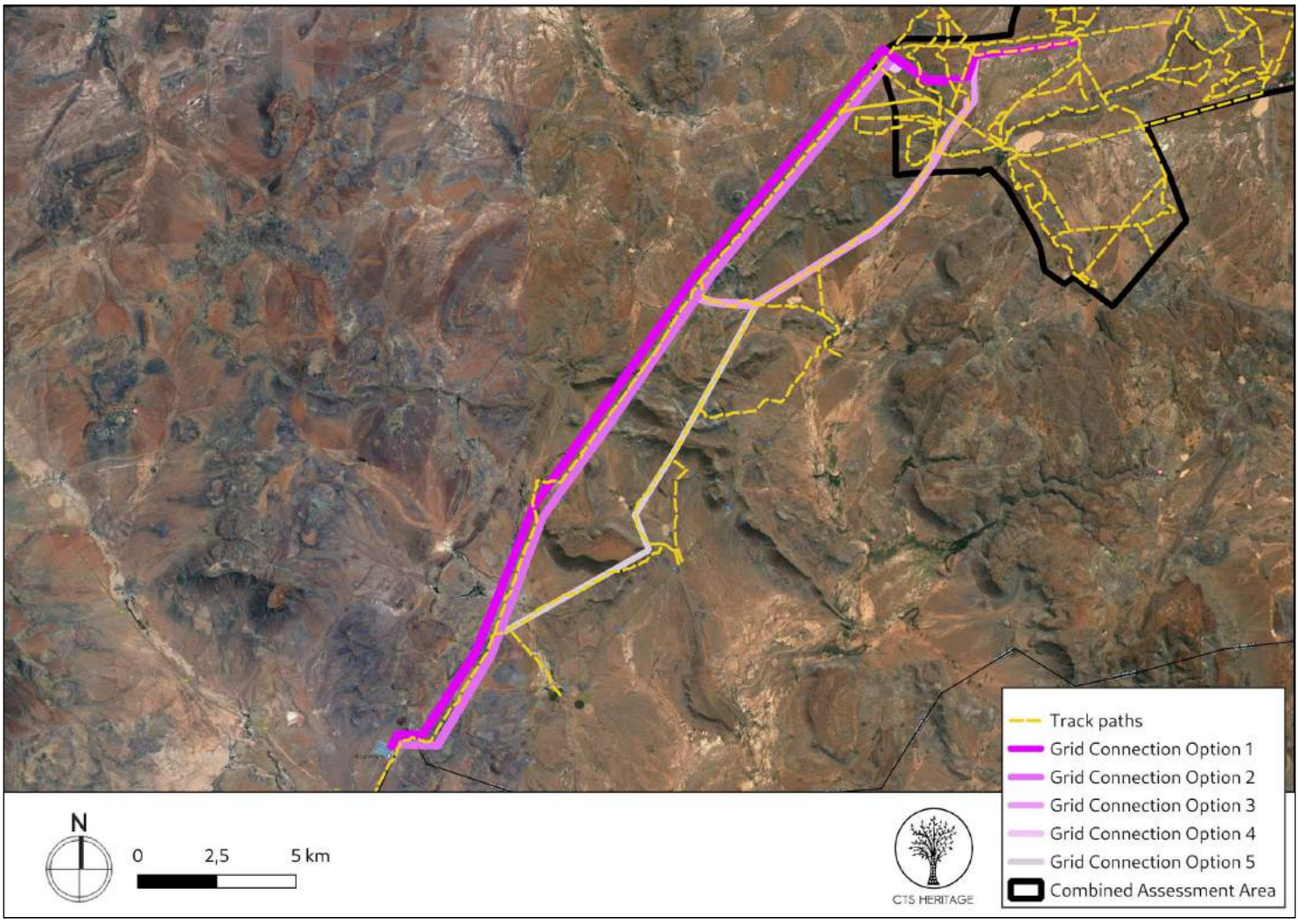

Figure 5.1: Overall track paths of foot survey for the grid connection options

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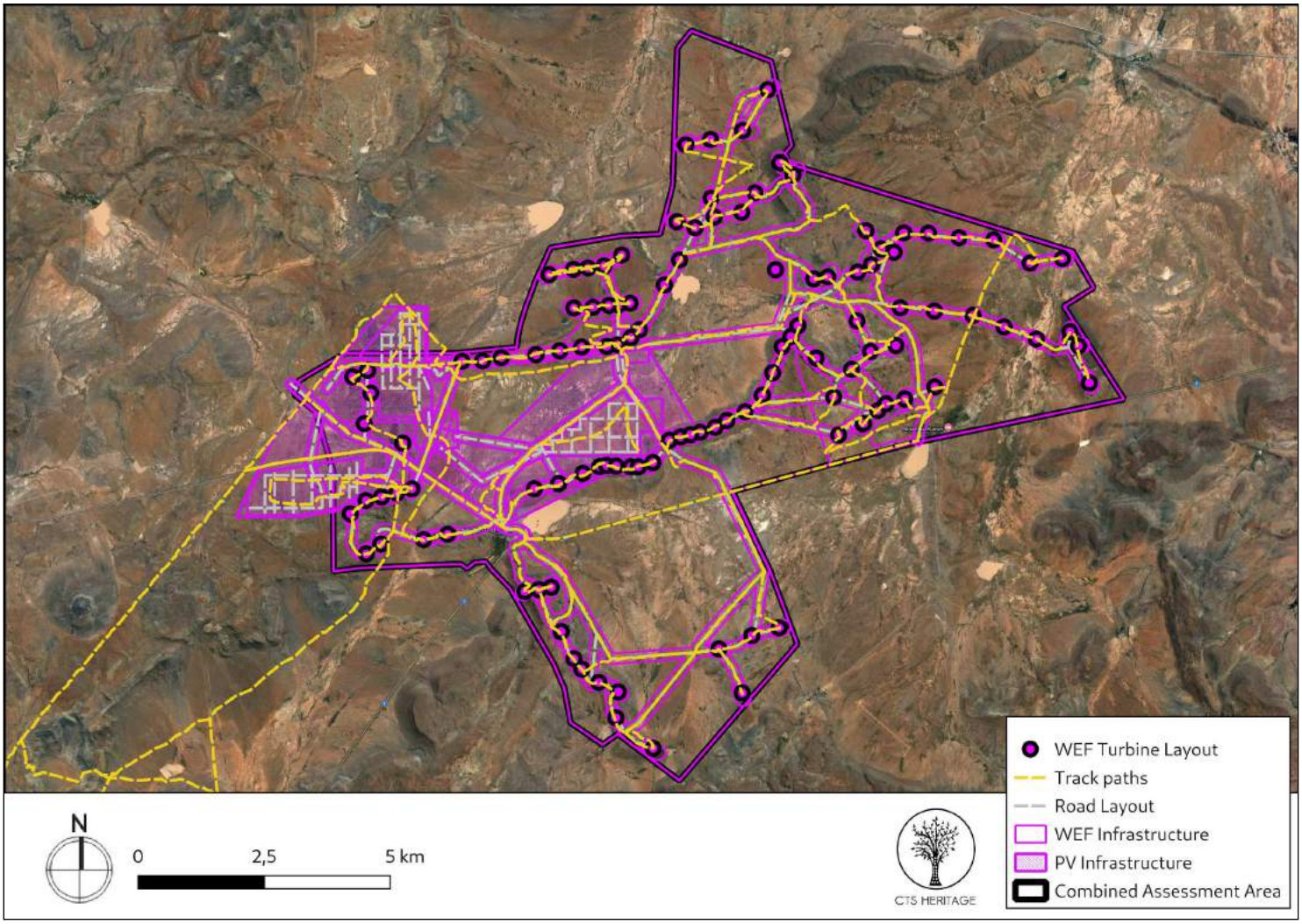

Figure 5.2: Overall track paths of foot survey for the PV and WEF

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4.2 Archaeological Resources identified

Table 1: Observations noted during the field assessment

POINT ID	Site Name	Description	Period	Co-ordinates		Grading	Mitigation
GK001	Great Karoo 001	Hornfels broken up source rock, one flake	MSA	-31.67536	23.41625	NCW	NA
GK002	Great Karoo 002	Siltstone flakes and cores near dolerite boulder shelter	MSA	-31.67466	23.41763	NCW	NA
GK003	Great Karoo 003	Quarrying of hornfels and greywacke, no formal tools seen	MSA	-31.67114	23.42757	NCW	NA
GK004	Great Karoo 004	Patinated hornfels assemblage, mainly blades near dry stream bed. Not early MSA	MSA	-31.66289	23.43376	NCW	NA
GK005	Great Karoo 005	Early MSA flake, edge slightly worked	MSA	-31.65061	23.44315	NCW	NA
GK006	Great Karoo 006	Hornfels cores and flakes, one white very patinated flake with old retouched edges	MSA	-31.64028	23.44753	NCW	NA
GK007	Great Karoo 007	Hornfels flakes, cores, greywacke cores and flakes. Partially buried in Kalahari sands	MSA	-31.61139	23.45934	NCW	NA
GK008	Great Karoo 008	Fine grained hornfels flakes, microliths, LSA. Patinated and older MSA cores and flakes in natural clearing surrounded by dolerite boulders	LSA, MSA	-31.59409	23.47433	NCW	NA
GK009	Great Karoo 009	Hornfels flake, cortex remaining on dorsal	MSA	-31.56952	23.49539	NCW	NA
GK010	Great Karoo 010	Rusted large metal spanner, pole, rings associated with powerlines	Modern	-31.54909	23.51106	NCW	NA
GK011	Great Karoo 011	Windmill, concrete tank	Modern	-31.55271	23.5267	NCW	NA
GK012	Great Karoo 012	Hornfels blade flake	MSA	-31.55056	23.52993	NCW	NA
GK013	Great Karoo 013	Patinated hornfels flakes and siltstone	MSA	-31.54143	23.55346	NCW	NA
GK014	Great Karoo 014	Brick plastered tank	Modern	-31.49752	23.56122	NCW	NA
GK015	Great Karoo 015	Hornfels flakes	MSA	-31.49997	23.59458	NCW	NA
GK016	Great Karoo 016	Density of hornfels flakes and cores higher lower down but some on top of small ridge	MSA	-31.50041	23.59568	NCW	NA
GK017	Great Karoo 017	Erosion channel showing artefact gravels 2m below aeolian overburden	MSA	-31.50095	23.5931	NCW	NA
GK018	Great Karoo 018	Thin hornfels flake point, edge retouched	MSA	-31.50189	23.58947	NCW	NA
GK019	Great Karoo 019	Hornfels bladelet	LSA	-31.50992	23.58297	NCW	NA
GK020	Great Karoo 020	Hornfels flakes patinated	MSA	-31.51111	23.5838	NCW	NA
GK021	Great Karoo 021	Hornfels flake buried in donga exposure	MSA	-31.50839	23.59374	NCW	NA
GK022	Great Karoo 022	Thin hornfels flake	MSA	-31.50938	23.59756	NCW	NA
GK023	Great Karoo 023	Thin hornfels flake	MSA	-31.50958	23.59826	NCW	NA
GK024	Great Karoo 024	Microlithic hornfels flake	LSA	-31.50907	23.60067	NCW	NA
GK025	Great Karoo 025	Hornfels core	LSA	-31.50888	23.60096	NCW	NA
GK026	Great Karoo 026	Hornfels cores and flakes	MSA	-31.5083	23.60168	NCW	NA
GK027	Great Karoo 027	Hornfels flakes	MSA	-31.49865	23.59082	NCW	NA
GK028	Great Karoo 028	Hornfels core, weathered	LSA	-31.49853	23.57938	NCW	NA
GK029	Great Karoo 029	Hornfels flakes, patinated	MSA	-31.49854	23.57903	NCW	NA

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GK030	Great Karoo 030	Hornfels blade flake, very weathered	MSA	-31.49878	23.57507	NCW	NA
GK031	Great Karoo 031	Windmill	Modern	-31.50086	23.57677	NCW	NA
GK032	Great Karoo 032	Very thin, weathered hornfels flake	MSA	-31.49897	23.56639	NCW	NA
GK033	Great Karoo 033	greywacke flake	MSA	-31.50312	23.57239	NCW	NA
GK034	Great Karoo 034	Green hornfels flake	MSA	-31.50309	23.57357	NCW	NA
GK035	Great Karoo 035	Hornfels core	MSA	-31.50148	23.5799	NCW	NA
GK036	Great Karoo 036	greywacke core	MSA	-31.50101	23.58142	NCW	NA
GK037	**Great Karoo 037**	**Stone walled ruins x 2**	**Historic**	**-31.506165**	**23.611848**	**IIIB**	**No-go development buffer of 500m**
GK038	**Great Karoo 038**	**Rondawel farmhouse complex**	**Historic**	**-31.507875**	**23.614365**	**IIIA**	**No-go development buffer of 1km**
GK039	Great Karoo 039	Windmill	Modern	-31.492339	23.622409	NCW	NA
GK040	Great Karoo 040	Windmill	Modern	-31.497367	23.62571	NCW	NA
GK041	Great Karoo 041	Hornfels flakes, cores, schist core and flakes	MSA	-31.50286	23.61655	NCW	NA
GK042	Great Karoo 042	Quarry	Modern	-31.5031	23.61808	NCW	NA
GK043	Great Karoo 043	Hornfels flakes, cores, schist core and flakes	MSA, LSA	-31.50152	23.61861	NCW	NA
GK044	Great Karoo 044	Schist early MSA flake	MSA	-31.49988	23.62598	NCW	NA
GK045	Great Karoo 045	Hornfels flakes	MSA	-31.49923	23.62776	NCW	NA
GK046	Great Karoo 046	Hornfels and greywacke flakes	MSA	-31.49696	23.64159	NCW	NA
GK047	Great Karoo 047	Siltstone and hornfels flakes, termite mound	MSA	-31.49654	23.64288	NCW	NA
GK048	**Great Karoo 048**	**Lower, ground, grindstone, greywacke flakes, cores**	**LSA, MSA**	**-31.49589**	**23.64534**	**IIIB**	**No-go development buffer of 50m**
GK049	Great Karoo 049	Ostrich eggshell piece only	LSA	-31.49539	23.64665	NCW	NA
GK050	Great Karoo 050	Thin shale flake	MSA	-31.4888	23.64082	NCW	NA
GK051	Great Karoo 051	Hornfels flakes	MSA	-31.48781	23.64071	NCW	NA
GK052	Great Karoo 052	Windmill	Modern	-31.480756	23.640181	NCW	NA
GK053	Great Karoo 053	Hornfels blade flake	MSA	-31.48751	23.6386	NCW	NA
GK054	Great Karoo 054	Patinated hornfels flake	MSA	-31.49064	23.63448	NCW	NA
GK055	Great Karoo 055	Quartzite flake large bulb of percussion, hornfels cores and flakes	MSA	-31.49191	23.62685	NCW	NA
GK056	Great Karoo 056	Thin hornfels flake	MSA	-31.49487	23.61937	NCW	NA
GK057	Great Karoo 057	Hornfels flakes	MSA	-31.49837	23.61361	NCW	NA
GK058	Great Karoo 058	Siltstone flake	MSA	-31.49961	23.61246	NCW	NA
GK059	Great Karoo 059	Windmill	Modern	-31.47116	23.63189	NCW	NA
GK060	Great Karoo 060	Patinated hornfels flake	MSA	-31.46943	23.63271	NCW	NA
GK061	Great Karoo 061	Patinated hornfels flake	MSA	-31.46118	23.63059	NCW	NA
GK062	Great Karoo 062	Hornfels core and flake	LSA	-31.46084	23.63163	NCW	NA
GK063	Great Karoo 063	Hornfels flake, greywacke flake in broken rocky area	MSA	-31.46351	23.6364	NCW	NA
GK064	Great Karoo 064	Hornfels flake	MSA	-31.46685	23.64032	NCW	NA
GK065	Great Karoo 065	Hornfels flakes	LSA	-31.47172	23.64317	NCW	NA
GK066	Great Karoo 066	Patinated hornfels flake	MSA	-31.47339	23.6404	NCW	NA
GK067	Great Karoo 067	Windmill	Modern	-31.49657	23.65129	NCW	NA

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GK068	Great Karoo 068	Windmill	Modern	-31.498092	23.660175	NCW	NA
GK069	Great Karoo 069	Patinated hornfels flake	MSA	-31.51857	23.62263	NCW	NA
GK070	Great Karoo 070	Hornfels core and flake	LSA, MSA	-31.51917	23.62275	NCW	NA
GK071	Great Karoo 071	greywacke flake blade	MSA	-31.52735	23.62783	NCW	NA
GK072	Great Karoo 072	Hornfels flake	MSA	-31.5288	23.62814	NCW	NA
GK073	Great Karoo 073	Patinated hornfels flake	MSA	-31.53259	23.63142	NCW	NA
GK074	**Great Karoo 074**	**Stone walled ruin**	**Historic**	**-31.54013**	**23.64369**	**IIIB**	**No-go development buffer of 500m**
GK075	Great Karoo 075	Windmill	Modern	-31.54335	23.63757	NCW	NA
GK076	Great Karoo 076	Ruined dam	Modern	-31.54332	23.63995	NCW	NA
GK077	Great Karoo 077	Hornfels core	MSA	-31.53989	23.64523	NCW	NA
GK078	Great Karoo 078	Hornfels flake	MSA	-31.53512	23.64977	NCW	NA
GK079	Great Karoo 079	Patinated hornfels flakes	MSA	-31.52945	23.65541	NCW	NA
GK080	Great Karoo 080	Hornfels core and flakes	MSA	-31.49512	23.59417	NCW	NA
GK081	Great Karoo 081	Hornfels core	MSA	-31.4933	23.59447	NCW	NA
GK082	Great Karoo 082	Hornfels flakes	LSA	-31.49158	23.59317	NCW	NA
GK083	Great Karoo 083	Windmill	Modern	-31.49136	23.59298	NCW	NA
GK084	Great Karoo 084	Patinated hornfels flakes	MSA	-31.48999	23.58868	NCW	NA
GK085	Great Karoo 085	Hornfels core and flakes	LSA	-31.48695	23.58745	NCW	NA
GK086	Great Karoo 086	Hornfels core	MSA	-31.47988	23.58493	NCW	NA
GK087	Great Karoo 087	Patinated hornfels flake	MSA	-31.47814	23.58762	NCW	NA
GK088	Great Karoo 088	Hornfels flake	MSA	-31.47416	23.59419	NCW	NA
GK089	Great Karoo 089	Hornfels core	MSA	-31.4735	23.5942	NCW	NA
GK090	Great Karoo 090	Patinated hornfels flake	MSA	-31.46989	23.59372	NCW	NA
GK091	Great Karoo 091	Windmill	Modern	-31.46921	23.5958	NCW	NA
GK092	Great Karoo 092	Hornfels flake	MSA	-31.47445	23.59679	NCW	NA
GK093	Great Karoo 093	Patinated hornfels flakes	MSA	-31.47954	23.59481	NCW	NA
GK094	Great Karoo 094	Patinated hornfels flakes	MSA	-31.48168	23.59467	NCW	NA
GK095	Great Karoo 095	Patinated hornfels flake	MSA	-31.48242	23.5961	NCW	NA
GK096	Great Karoo 096	Hornfels flake blade	MSA	-31.48828	23.5975	NCW	NA
GK097	Great Karoo 097	Patinated hornfels flake	MSA	-31.49064	23.599	NCW	NA
GK098	Great Karoo 098	Windmill	Modern	-31.49582	23.59807	NCW	NA
GK099	Great Karoo 099	Windmill	Modern	-31.493731	23.68202	NCW	NA
GK100	**Great Karoo 100**	**Vogelstruisfontein farmhouse complex**	**Historic**	**-31.490632**	**23.702744**	**IIIA**	**No-go development buffer of 1km**
GK101	**Great Karoo 101**	**Vogelstruisfontein graveyard surrounded by stone wall, individual dolerite boundary markers set out bigger area of unmarked graves**	**Historic**	**-31.486078**	**23.701456**	**IIIA**	**No-go development buffer of 500m**
GK102	Great Karoo 102	Windmill	Modern	-31.482254	23.707171	NCW	NA
GK103	Great Karoo 103	Hornfels flake, edge retouched	MSA	-31.4723	23.72314	NCW	NA
GK104	Great Karoo 104	Hornfels flake, possibly LSA	LSA	-31.45692	23.719209	NCW	NA
GK105	**Great Karoo 105**	**Schalkhanna red roofed farmhouse complex, stone walled kraal**	**Historic**	**-31.460227**	**23.725995**	**IIIB**	**No-go development buffer of 500m**

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GK106	Great Karoo 106	Windmill	Modern	-31.455061	23.701265	NCW	NA
GK107	Great Karoo 107	Hornfels flake	LSA, MSA	-31.468664	23.704401	NCW	NA
GK108	Great Karoo 108	greywacke core	MSA	-31.47322	23.67603	NCW	NA
GK109	Great Karoo 109	Siltstone and hornfels flakes	MSA	-31.48407	23.6799	NCW	NA
GK110	Great Karoo 110	greywacke quarrying, hornfels cores and flakes, especially in the way up	MSA	-31.49017	23.68499	NCW	NA
GK111	Great Karoo 111	Hornfels core	MSA	-31.48881	23.68984	NCW	NA
GK112	Great Karoo 112	Hornfels flake	MSA	-31.47871	23.68792	NCW	NA
GK113	Great Karoo 113	Hornfels flake, core LSA	LSA, MSA	-31.4714	23.6895	NCW	NA
GK114	Great Karoo 114	Windmill	Modern	-31.46782	23.68721	NCW	NA
GK115	Great Karoo 115	greywacke and hornfels flakes, patinated near jeep junction	MSA	-31.455371	23.668206	NCW	NA
GK116	Great Karoo 116	Windmill	Modern	-31.453894	23.676511	NCW	NA
GK117	Great Karoo 117	Siltstone flakes	MSA	-31.45151	23.67798	NCW	NA
GK118	Great Karoo 118	Hornfels blade flake	MSA	-31.44625	23.67587	NCW	NA
GK119	Great Karoo 119	Very patinated hornfels flake	MSA	-31.453605	23.655916	NCW	NA
GK120	Great Karoo 120	Hornfels flake	LSA	-31.447639	23.665162	NCW	NA
GK121	Great Karoo 121	Windmill	Modern	-31.442398	23.667416	NCW	NA
GK122	Great Karoo 122	greywacke and hornfels circular thin flake, formal	MSA	-31.438828	23.65496	NCW	NA
GK123	Great Karoo 123	Hornfels debitage not worked	MSA	-31.431445	23.668741	NCW	NA
GK124	Great Karoo 124	Windmill	Modern	-31.466957	23.679028	NCW	NA
GK125	Great Karoo 125	greywacke and hornfels cores and flakes	MSA	-31.643632	23.451292	NCW	NA
GK126	Great Karoo 126	Hornfels flakes, dorsal reduction	MSA	-31.6384659	23.45974918	NCW	NA
GK127	Great Karoo 127	Quartzite flake	MSA	-31.63040907	23.47842969	NCW	NA
GK128	Great Karoo 128	Hornfels bladelet	LSA	-31.5979548	23.50175682	NCW	NA
GK129	Great Karoo 129	greywacke core	MSA	-31.60338828	23.49861806	NCW	NA
GK130	Great Karoo 130	Hornfels blade flake	MSA	-31.61165517	23.49280684	NCW	NA
GK131	Great Karoo 131	Hornfels bladelet	LSA	-31.61571999	23.49376	NCW	NA
GK132	Great Karoo 132	Hornfels flake	MSA	-31.62469267	23.49593221	NCW	NA

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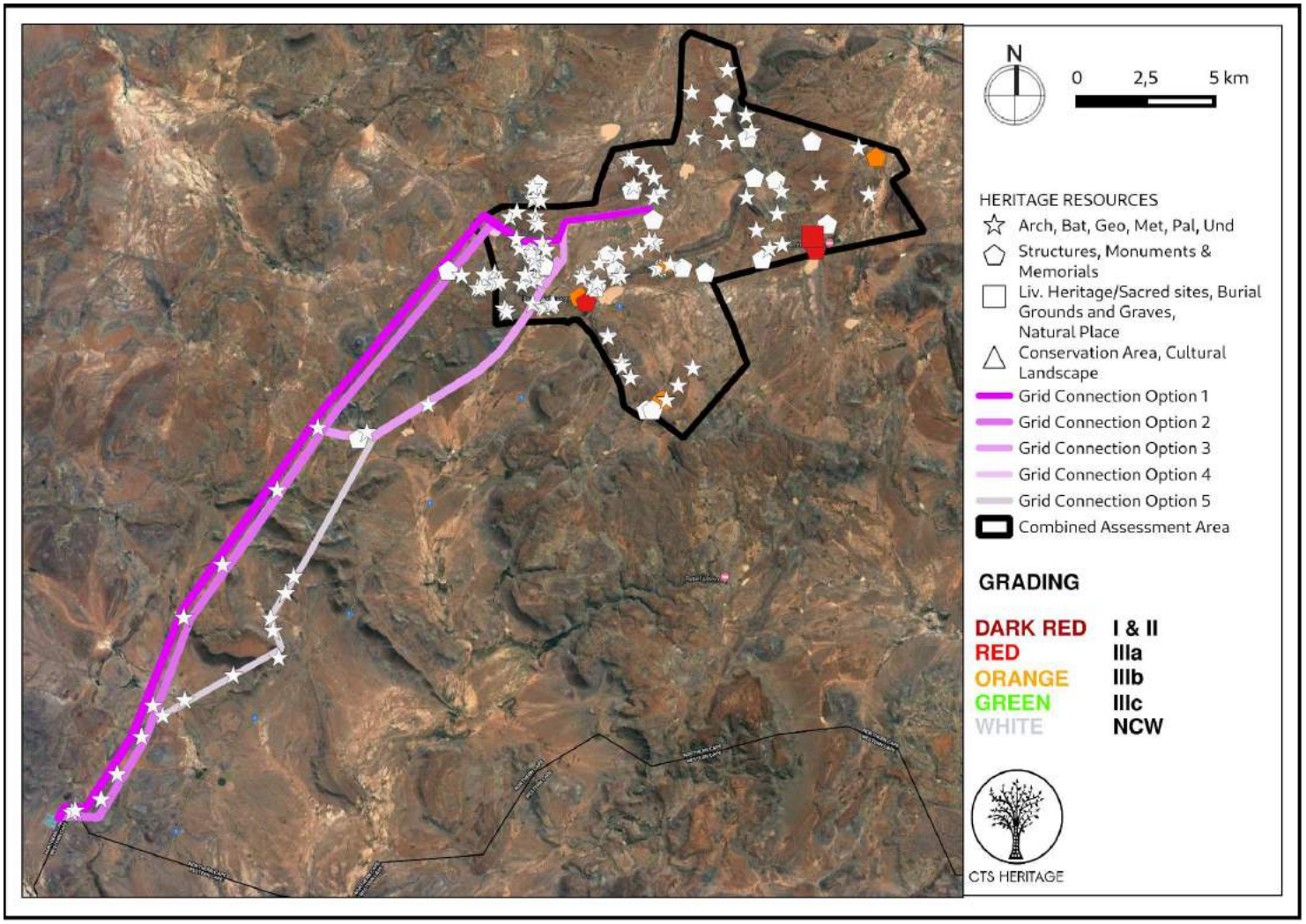

Figure 5.3: Map of all sites and observations noted within the development area

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4.3 Selected photographic record

(a full photographic record is available upon request)

Figure 6.1: Observation GK001

Figure 6.2: Observation GK011 and GK012

Figure 6.3: Observation GK019 and GK0020

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Figure 6.4: Observation GK029

Figure 6.5 Observation GK037

Figure 6.6 Observation GK038

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Figure 6.7 Observation GK048

Figure 6.8 Observation GK048

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Figure 6.9: Observation GK057 and GK058

Figure 6.10: Observation GK074

Figure 6.11: Observation GK083 and GK093

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Figure 6.12: Observation GK100

Figures 6.13: Observation GK101

Figure 6.14: Observation GK101

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Figure 6.15: Observation GK105

Figure 6.16: Observation GK105

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Figure 6.17: Observation GK115 and GK116

Figure 6.18: Observation GK125

Figure 6.19: Observation GK132

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5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

The proposed development will not have a substantial negative impact on the heritage resources identified within the proposed development area for the renewable energy facilities and the grid connection. The majority of the lithic material identified is of low significance (not conservation-worthy), and even though the resources may be destroyed during construction, the impact is inconsequential. No mitigation is required for archaeological material recorded in the footprint areas of the proposed development.

Despite the high number of observations of artefacts, these resources are common and representative of similar scatters across widespread areas of the Karoo. Despite the very high numbers of observations made, the archaeological material is ubiquitous across the entire area and in general, the results of this assessment indicate that the archaeological sensitivity of the development area is low.

Grid

A total of 24 archaeological observations were identified in the five proposed grid alignment options. None of the identified archaeological resources were determined to be conservation-worthy. Six modern windmill and water storage structures were identified within the grid alignment options but none of these were determined to be conservation-worthy. Based on the outcomes of this assessment, none of the proposed grid alternatives will have a negative impact on any significant heritage resources and as such, there is no preferred alternative in terms of impacts to heritage resources.

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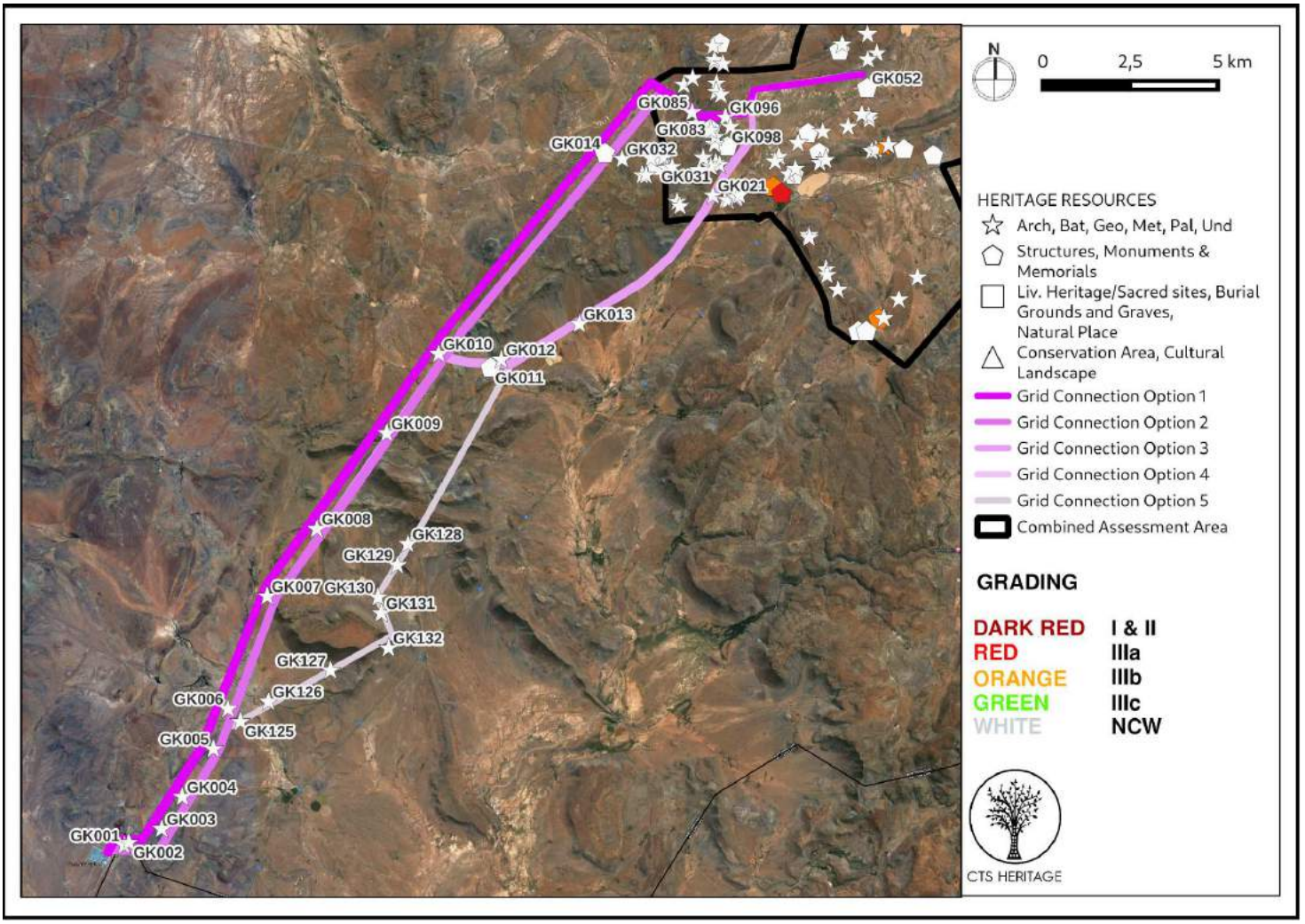

Figure 7: Map of heritage resources identified during the field assessment relative to the proposed development footprint for the grid connection options

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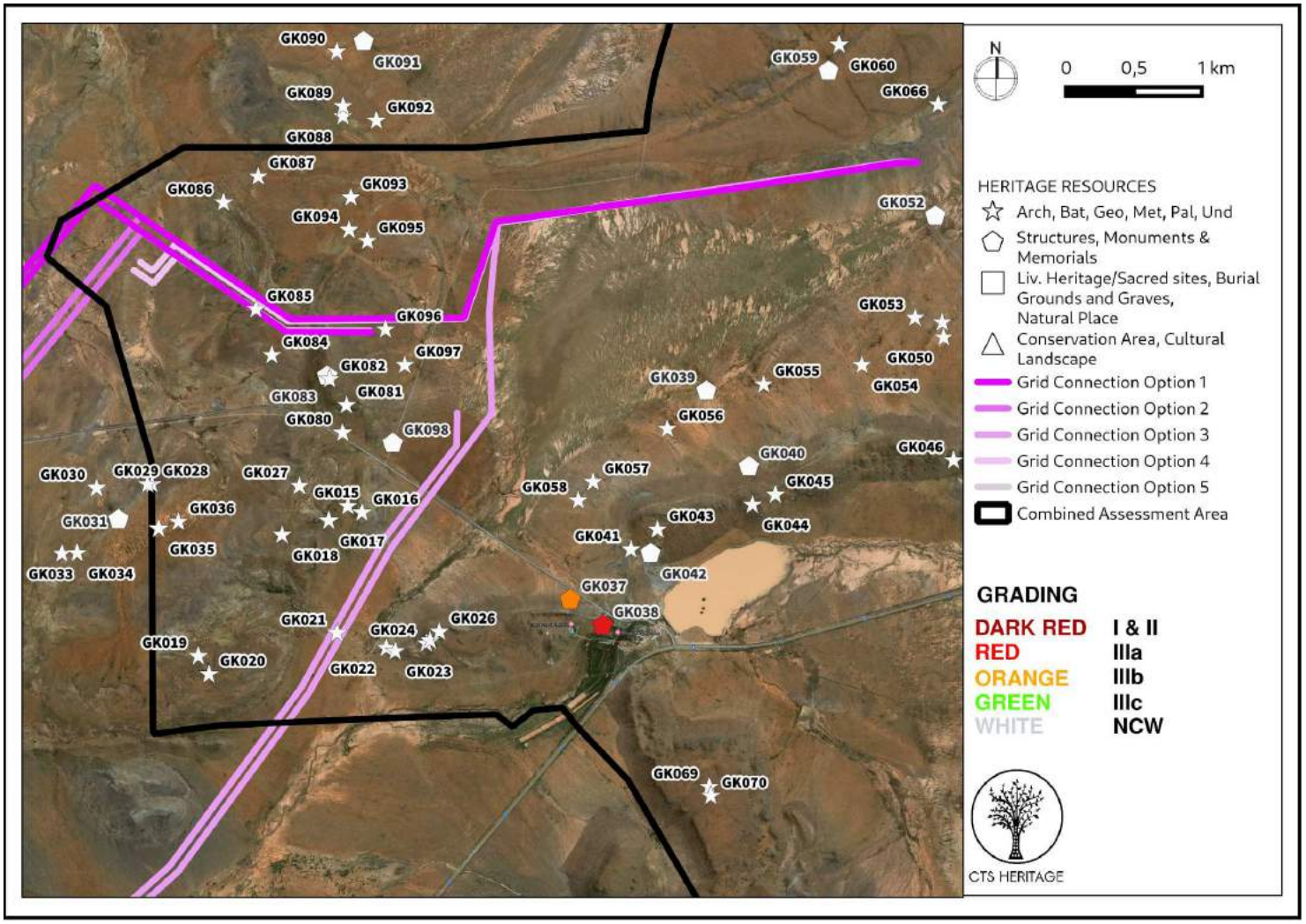

Figure 7.1: Map of heritage resources identified during the field assessment relative to the proposed grid connection options

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Merino WEF

A total of 54 archaeological observations and 13 structures were identified within the Merino WEF development area. Only one of the identified archaeological resources was determined to be conservation-worthy, Observation GK048 which is described as both MSA and LSA material including lower, ground, grindstone, greywacke flakes and cores and is graded IIIB. This site is located in close proximity to proposed wind turbines, however no impact is anticipated at this stage. To ensure that no impact occurs, it is recommended that a no-go development buffer of 50m is imposed around this site.

Thirteen structures were identified within the Merino WEF development area, the majority of which are modern windmills and dams, and one quarry. None of these were determined to be conservation-worthy. Three conservation-worthy structures were identified within this development area. Site GK038 records a rondavel farmhouse complex that has historic significance and has been graded IIIA. There is over 1km distance between this site and the nearest proposed WEF infrastructure and as such, no direct impact is anticipated. It is recommended that this 1km no-go development buffer be maintained. GK037 and GK074 record stone wall ruins and have been graded IIIB. There is more than 500m distance between these sites and the nearest proposed WEF infrastructure and as such, no direct impact is anticipated. It is recommended that this 1km no-go development buffer be maintained.

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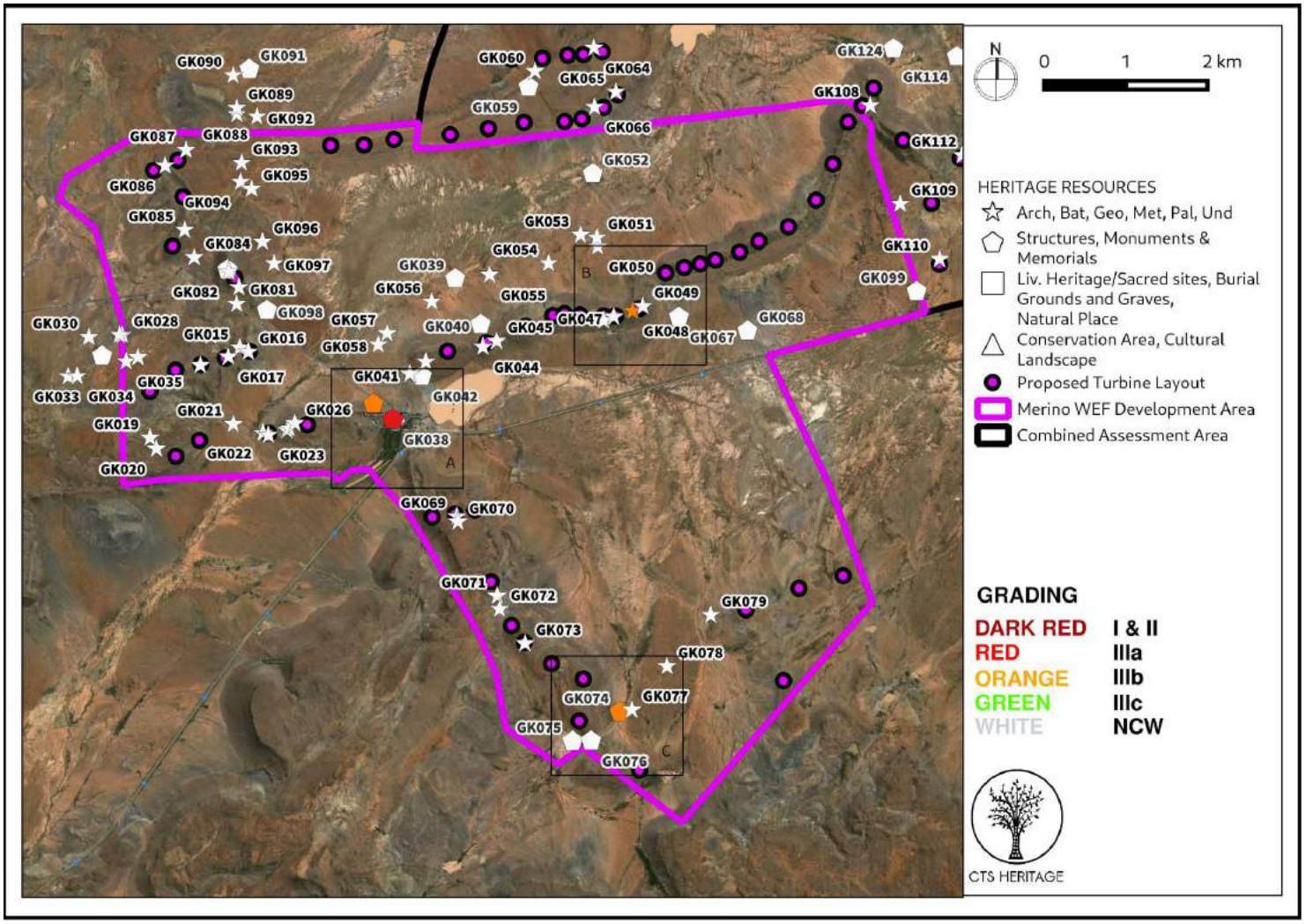

Figure 8: Map of heritage resources identified during the field assessment relative to the proposed development footprint for the Merino WEF

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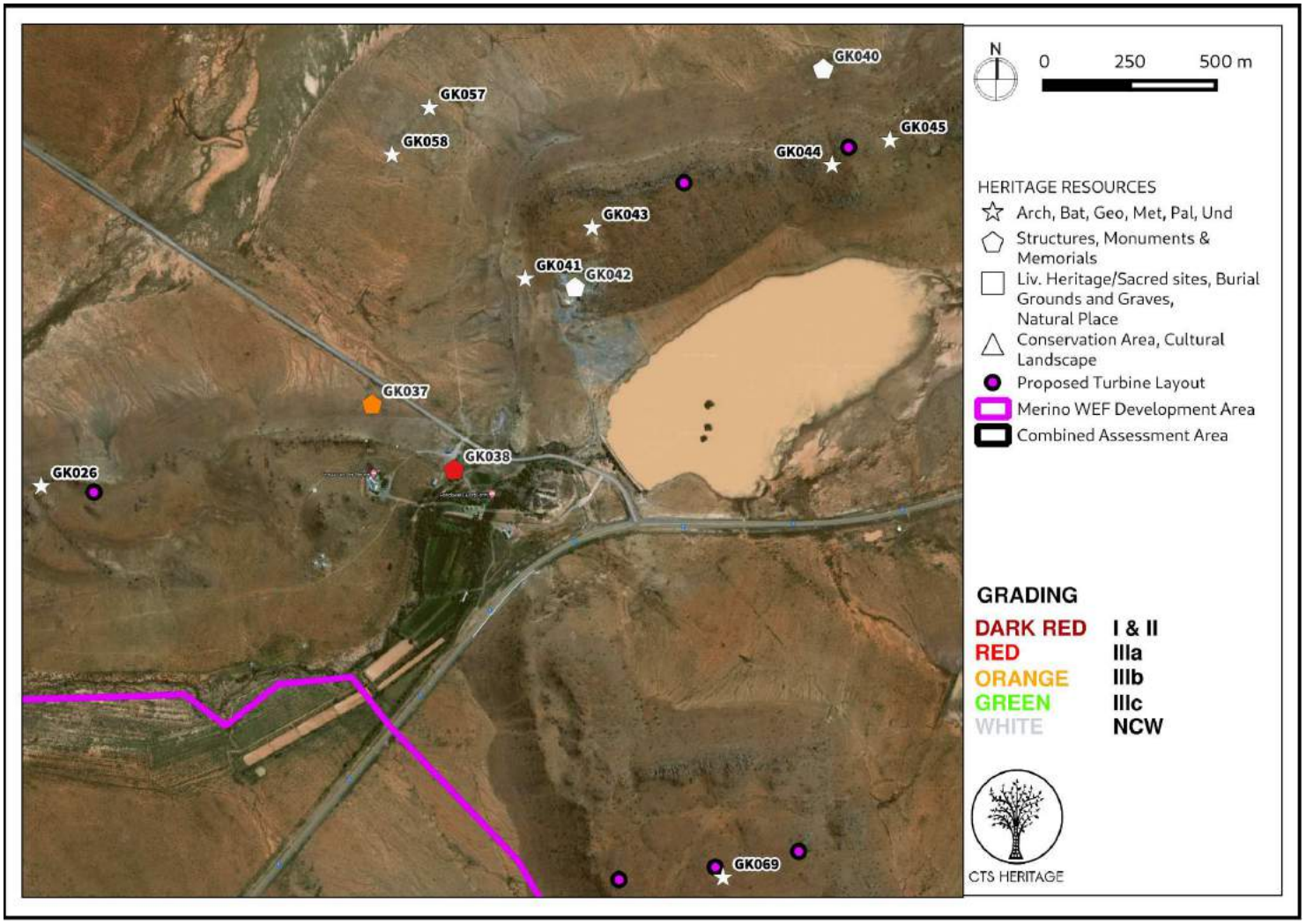

Figure 8.1: Inset A

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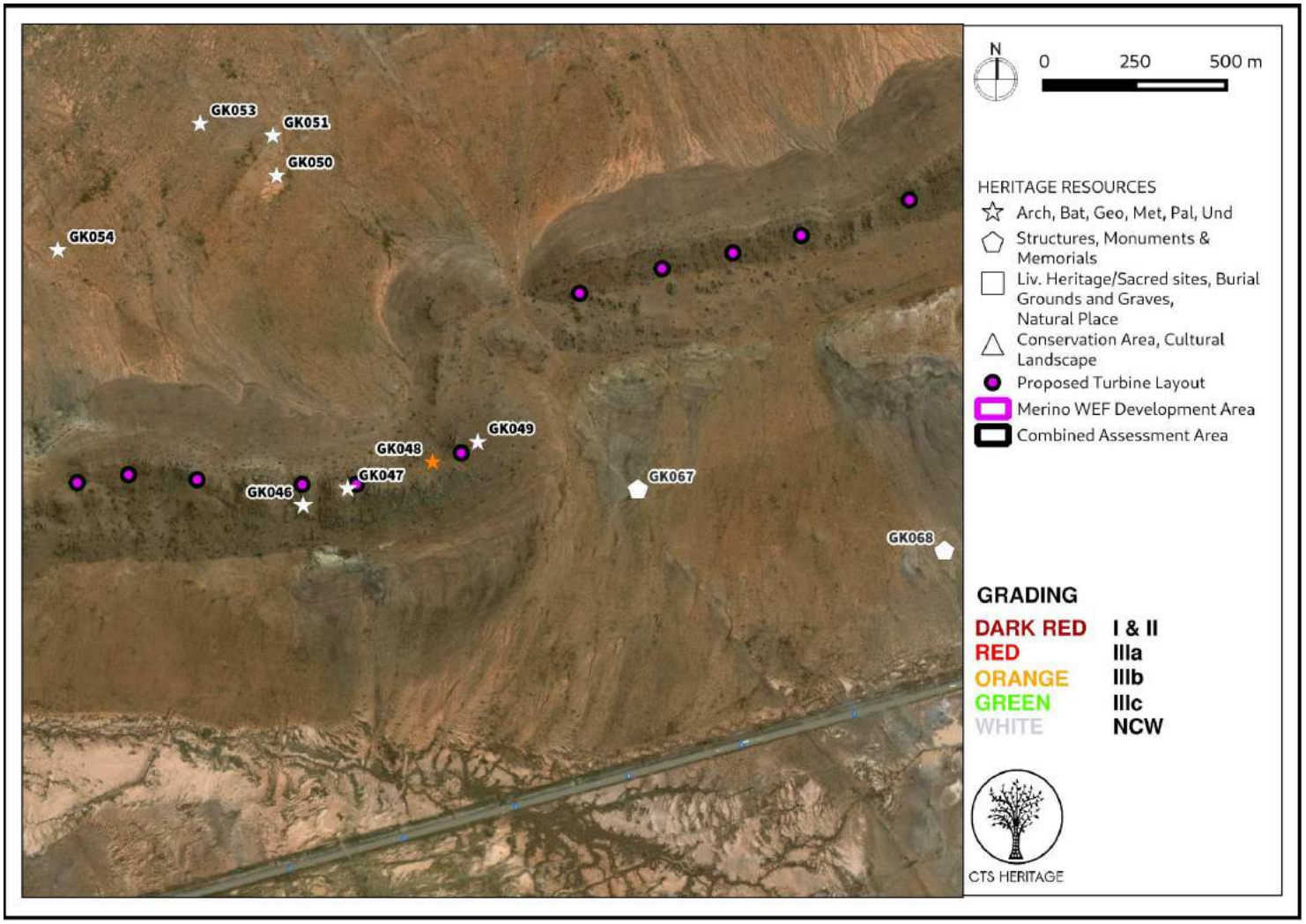

Figure 8.2: Inset B

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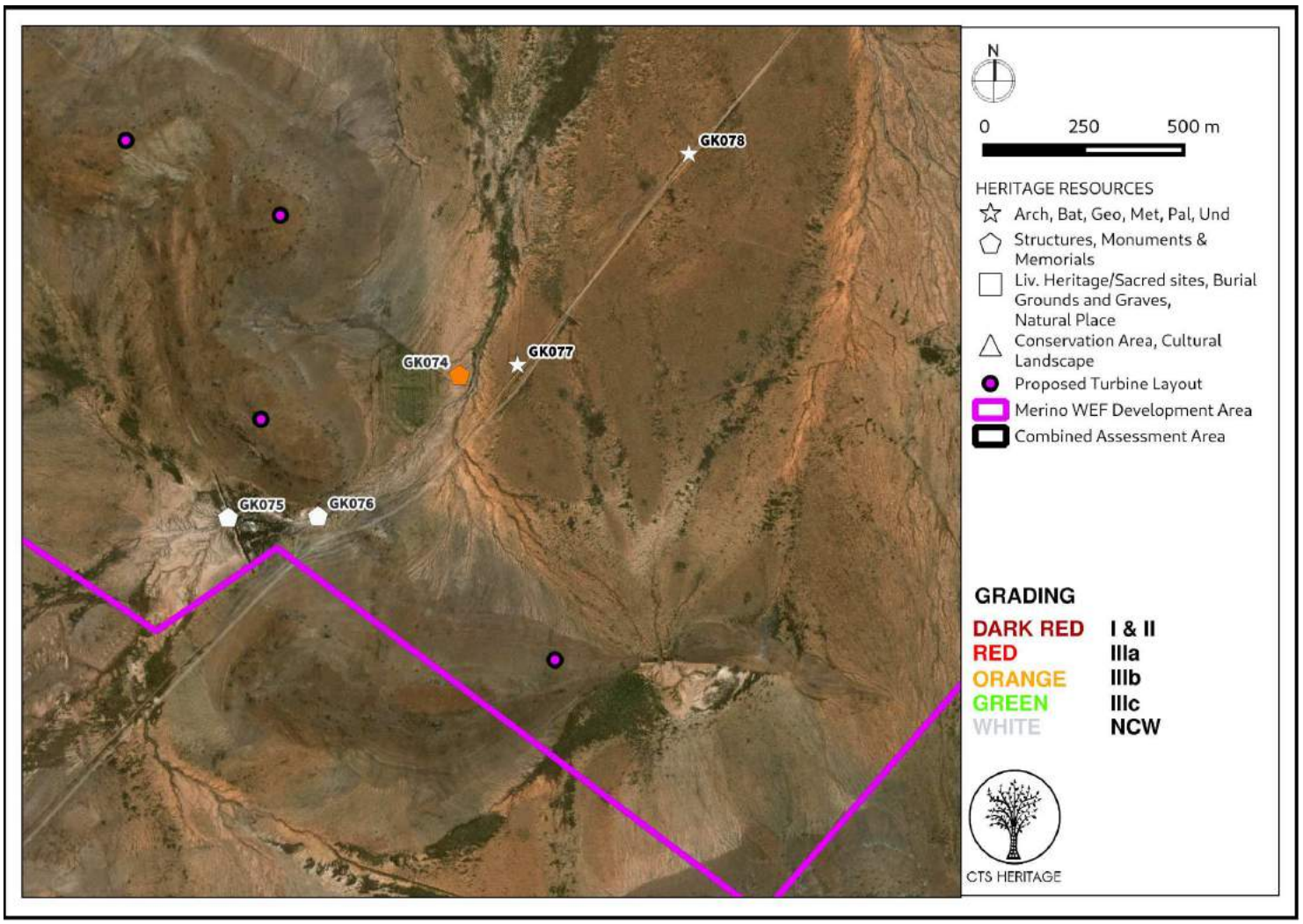

Figure 8.3: Inset C

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Angora WEF

A total of 23 archaeological observations and 10 structures were identified within the Angora WEF development area. None of the identified archaeological resources was determined to be conservation-worthy and as such, no further recommendations are made regarding the archaeological material identified.

Ten structures were identified within the Angora WEF development area, the majority of which are modern windmills which were determined to be not conservation-worthy. Two conservation-worthy structures were identified within this development area. Site GK100 records the Vogelstruisfontein farmhouse complex that has historic significance and has been graded IIIA. Site GK101 records the Vogelstruisfontein graveyard associated with this farmhouse complex and is located approximately 500m from GK100. This site is surrounded by stone wall with individual dolerite boundary markers set out to demarcate a bigger area of unmarked graves. This burial ground site is also graded IIIA. There is approximately 790m distance between site GK100 and the nearest proposed WEF infrastructure and as such, no direct impact is anticipated. It is recommended that, as with the other grade IIIA sites, this no-go development buffer be expanded to 1km. This will also ensure a 500m no-go development buffer around the burial ground site GK101.

Site GK105 records the Schalkhanna red roofed farmhouse complex which includes stone walled kraal. This site has been graded IIIB for its historic significance. A wind turbine has been proposed to be located less than 150m from this site which is likely to negatively impact on the sense of place associated with this site. It is recommended that in order to ensure that no impact takes place, a 500m no-go development buffer be implemented around this site. This will require that this turbine be moved.

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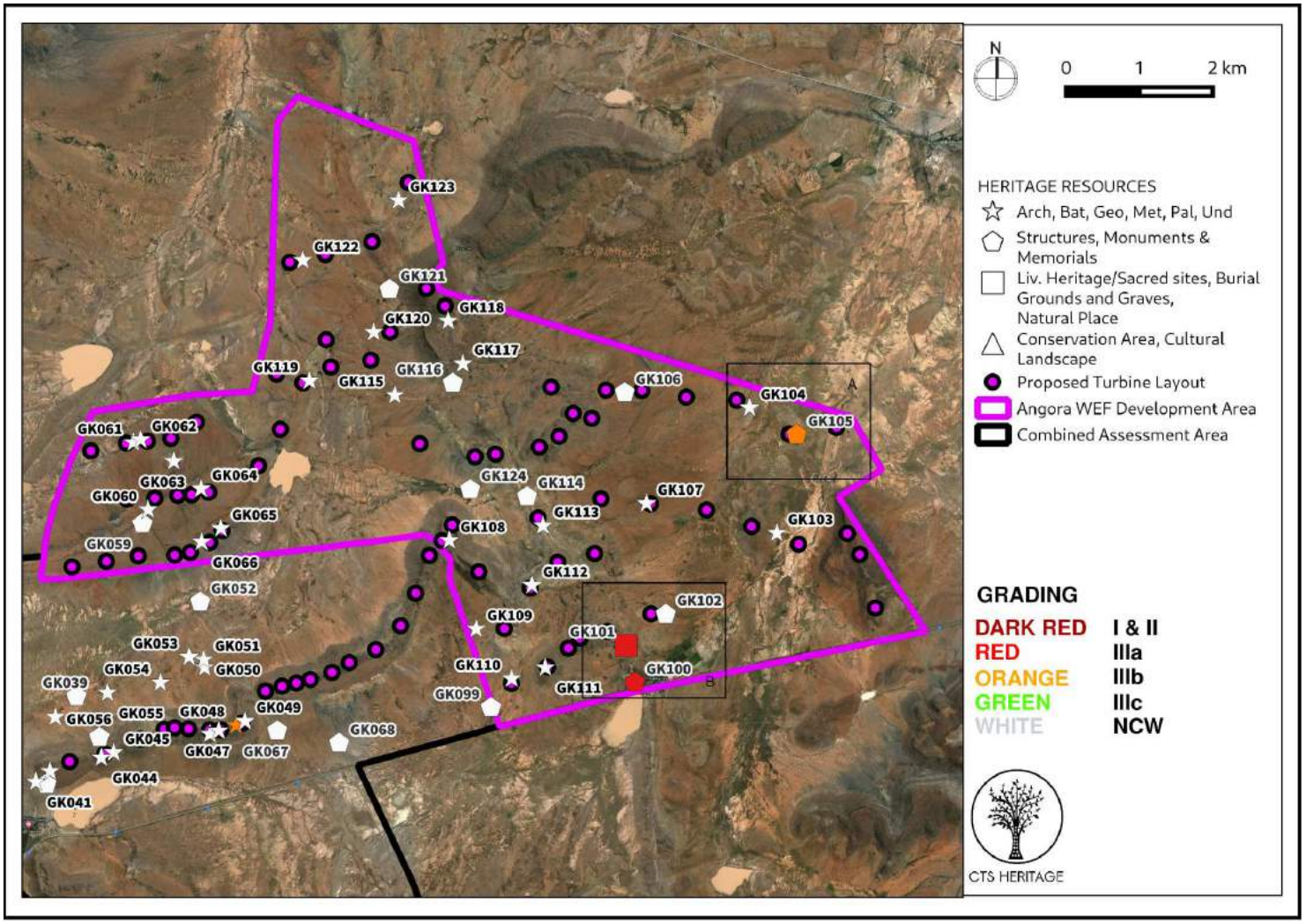

Figure 9: Map of heritage resources identified during the field assessment relative to the proposed development footprint for the Angora WEF

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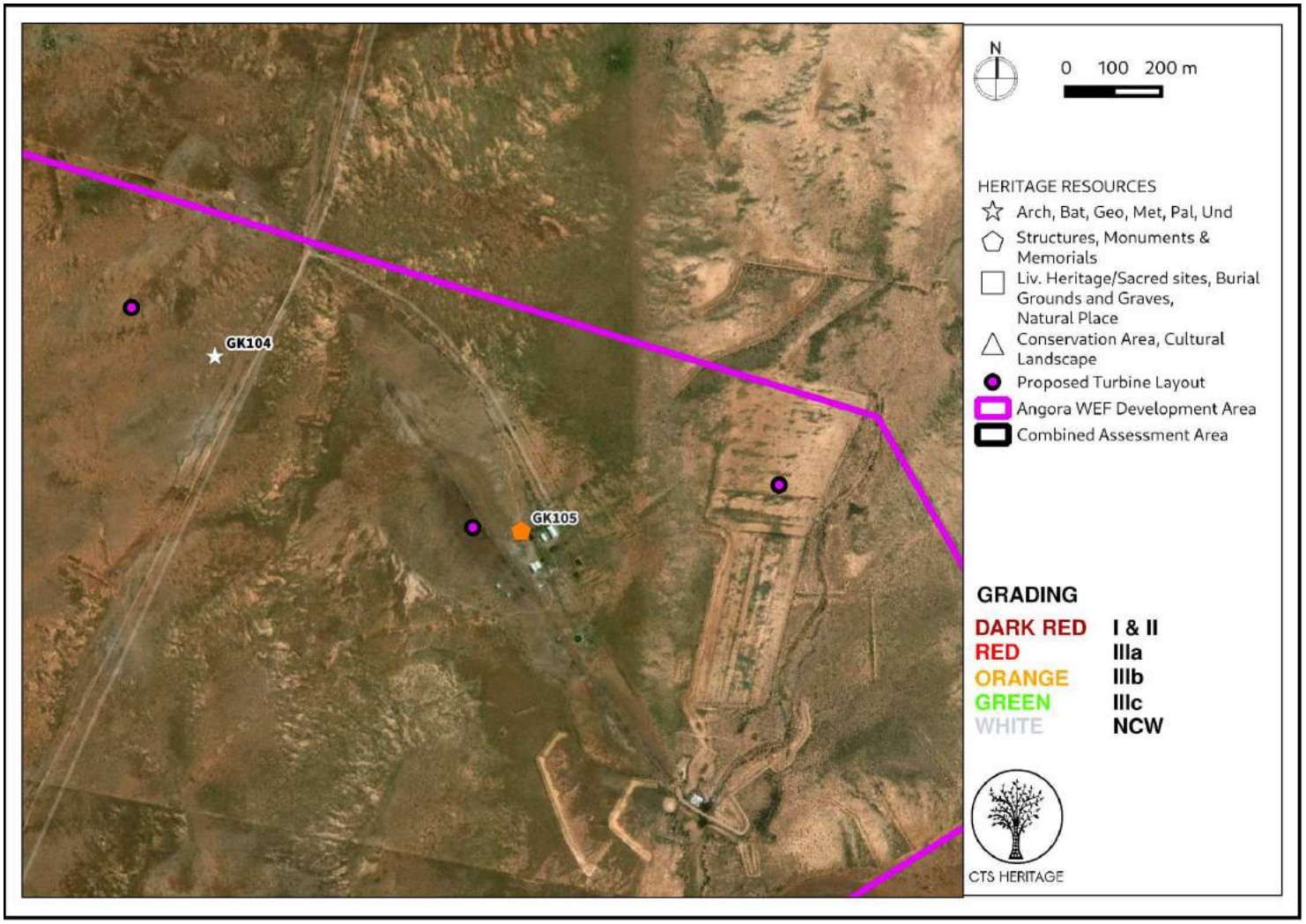

Figure 9.1: Inset A

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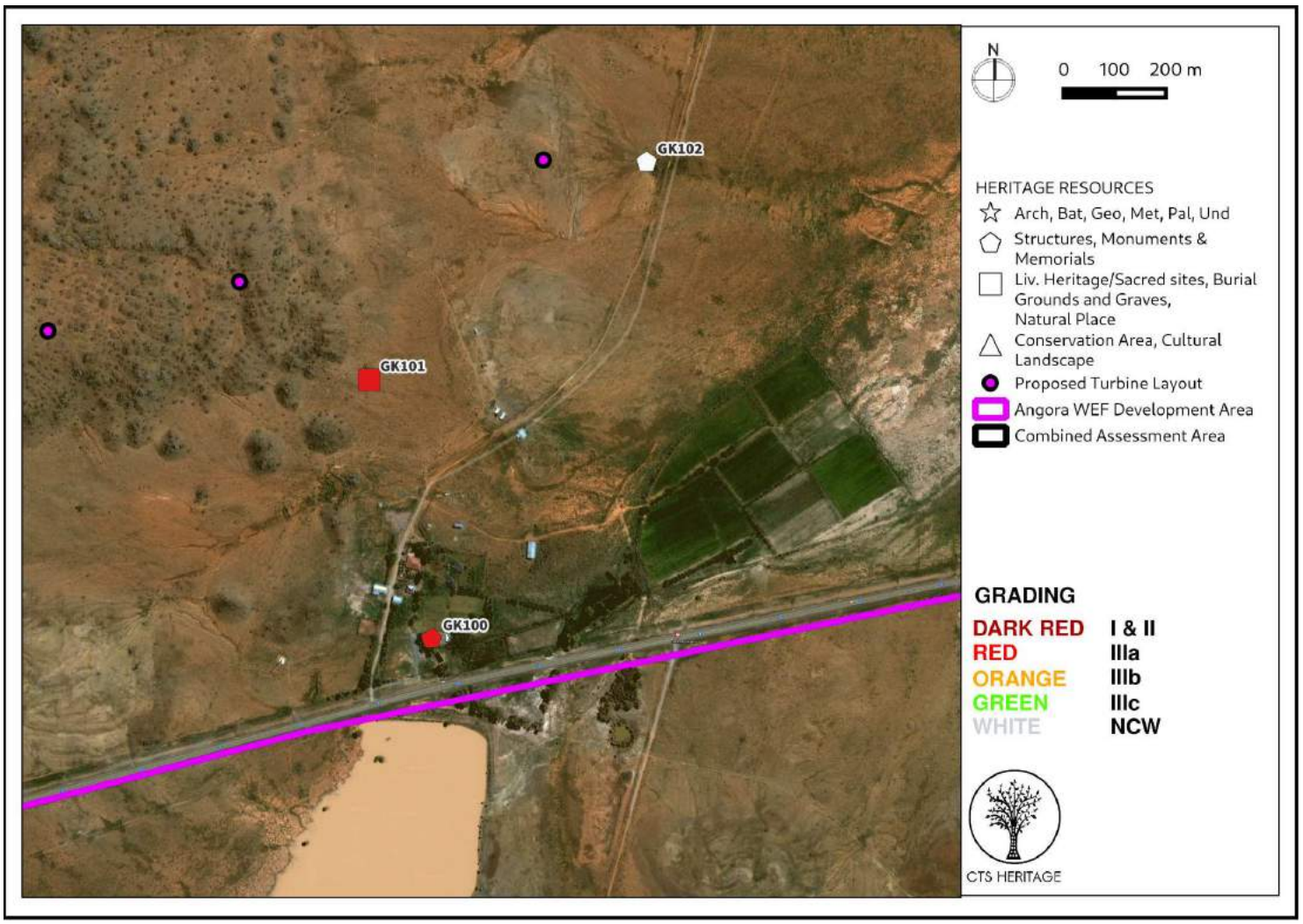

Figure 9.2: Inset B

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PV Facilities

A total of 38 archaeological observations were identified within the PV Facilities development area. None of the identified archaeological resources were determined to be conservation-worthy and no impact to any significant archaeological heritage is anticipated at this stage.

Observation GK048 which is described as both MSA and LSA material including lower, ground, grindstone, greywacke flakes and cores and is graded IIIB. This site is located approximately 180m outside of the PV Facilities development area, and as such no impact is anticipated at this stage. To ensure that no impact occurs, it is recommended that a no-go development buffer of 50m is imposed around this site.

Eight structures were identified within the PV Facilities development area, all of which are modern windmills and dams, and one quarry. None of these were determined to be conservation-worthy.

Site GK038 records a rondavel farmhouse complex that has historic significance and has been graded IIIA. Site GK037 records stone wall ruins and has been graded IIIB. Both of these sites are located outside of the PV Facilities development area and as such, no direct impact is anticipated at this stage. It is recommended that a 1km no-go development buffer be maintained around Site GK038 and a 500m no-go development buffer be maintained around Site GK037 to ensure that no impact occurs..

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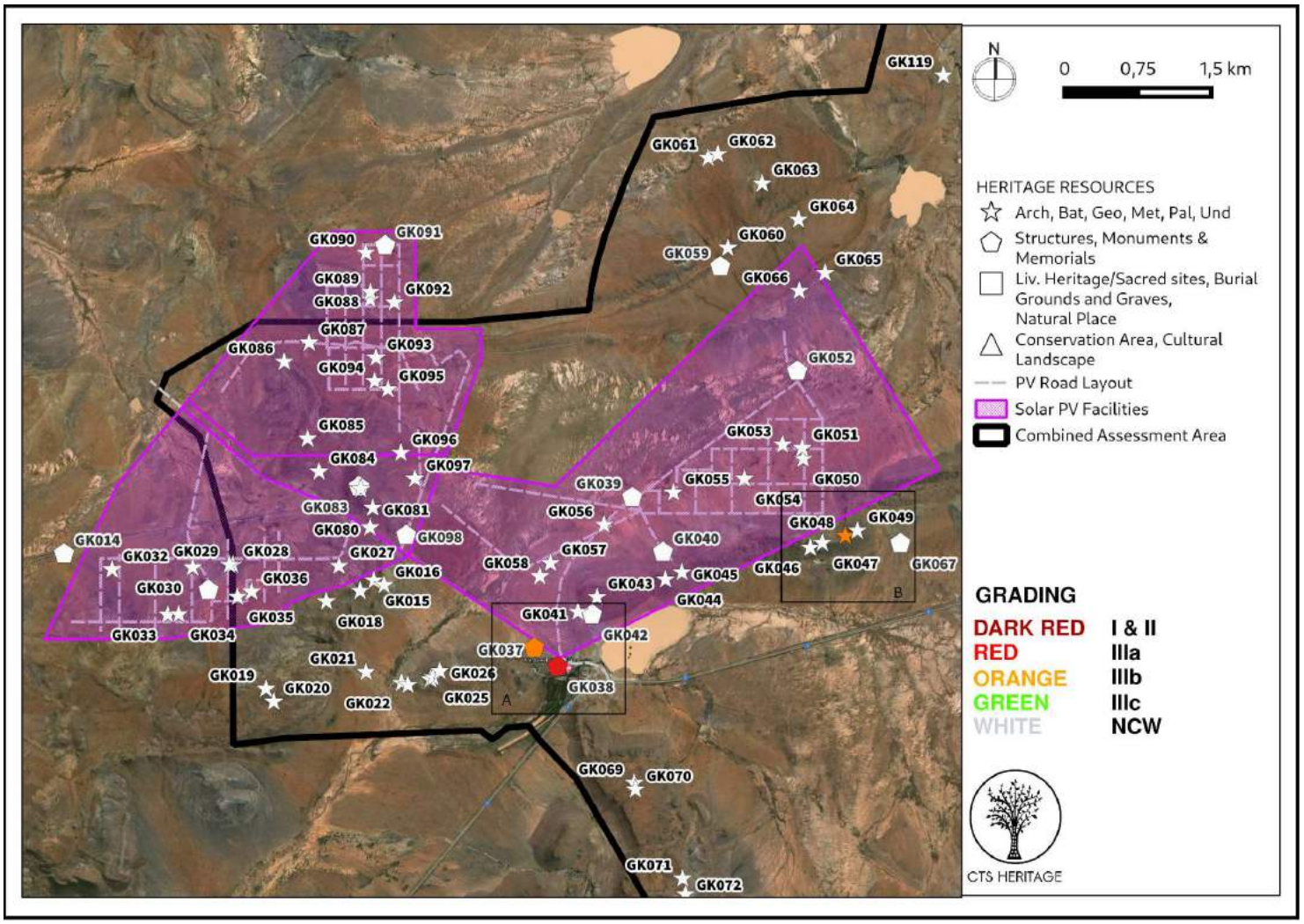

Figure 10: Map of heritage resources identified during the field assessment relative to the proposed development footprint for the PV Facilities

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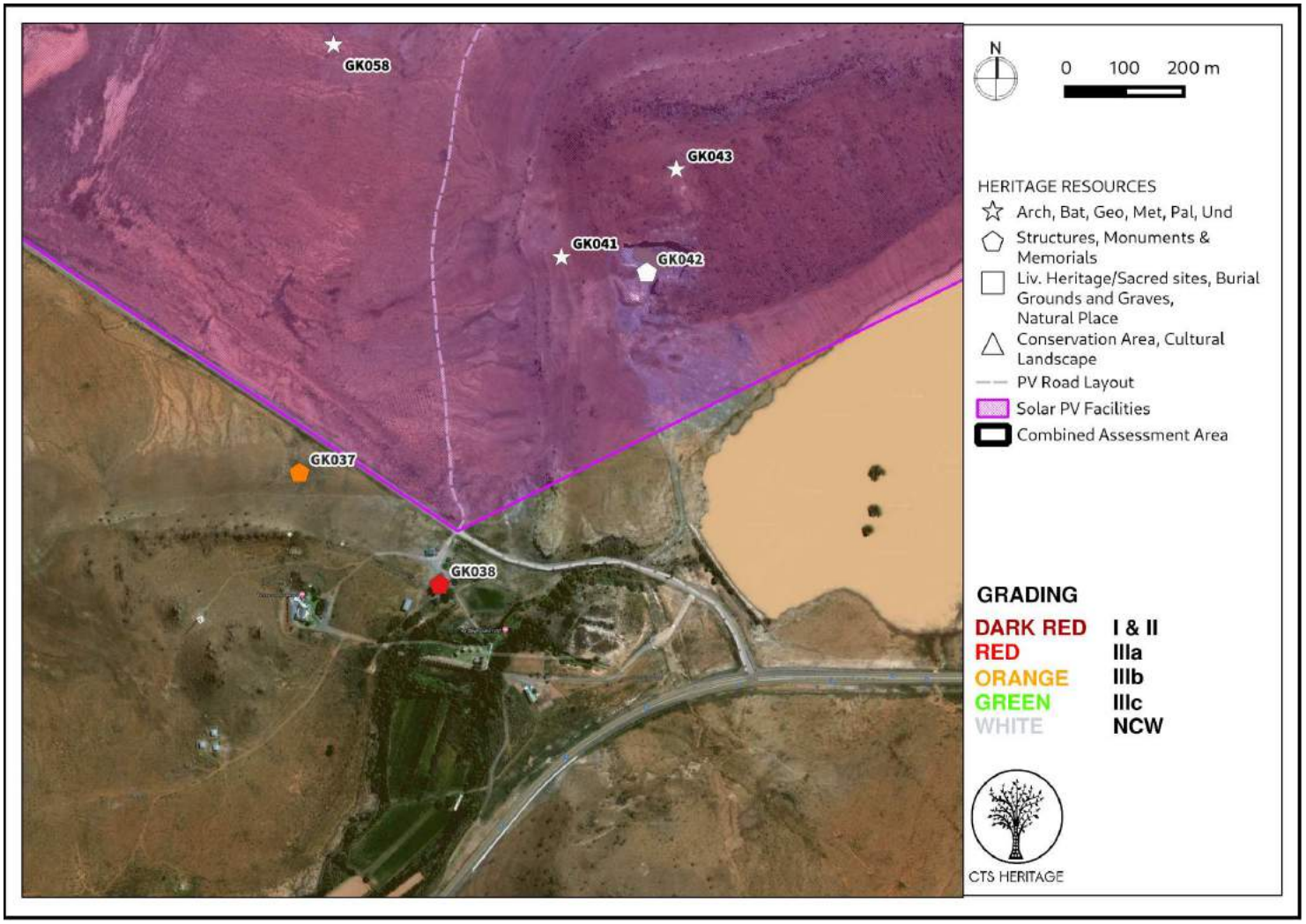

Figure 10.1: Inset A

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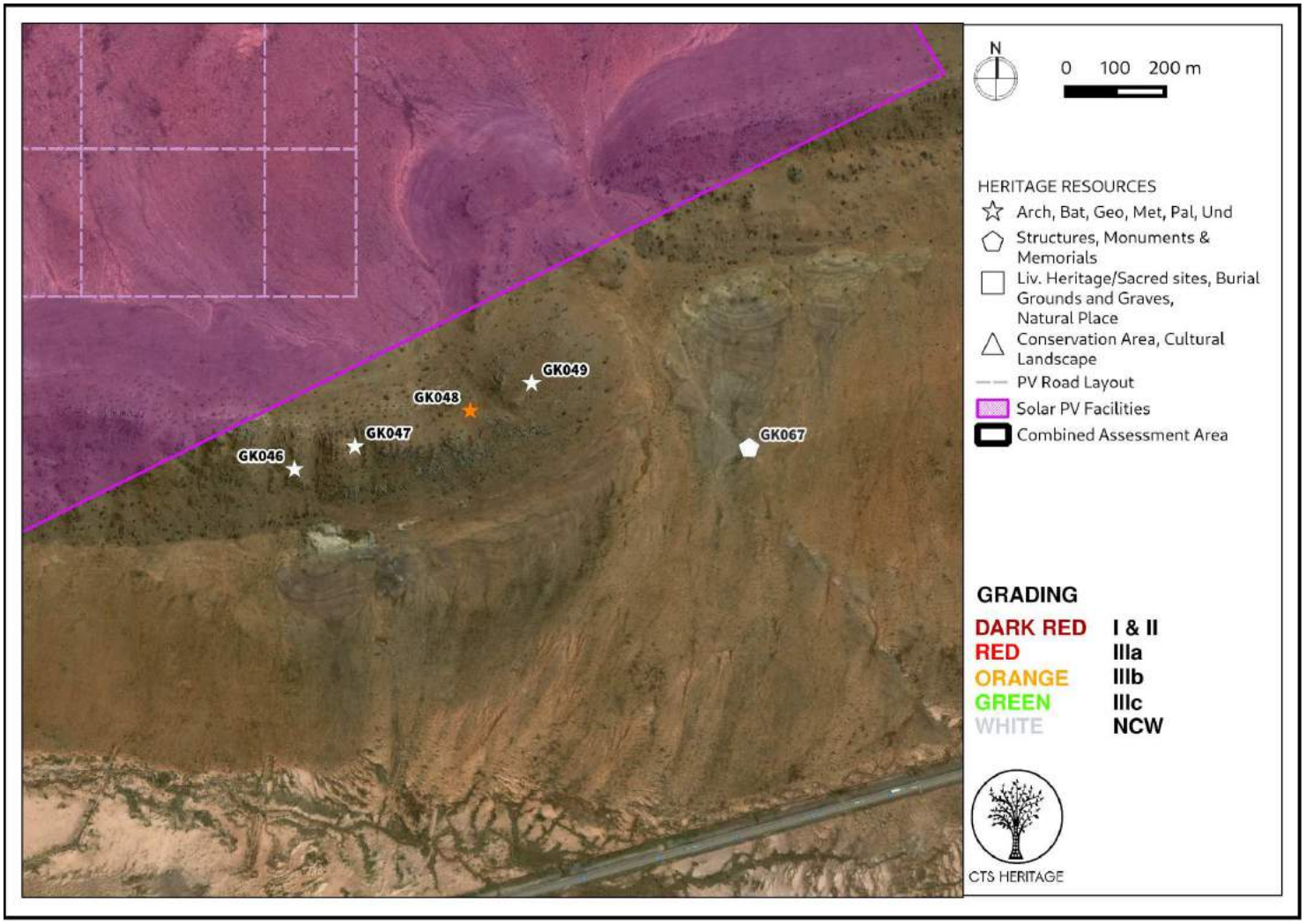

Figure 10.2: Inset B

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6. CONCLUSION AND RECOMMENDATIONS

The findings of this assessment largely correlate with the findings of other assessments completed in the vicinity such as the findings of the ACO (2013, SAHRIS NID 503074) who note that "Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape." This same archaeological signature has been identified within the development footprint.

It is noted that high numbers of quarried stone artefacts predominantly from the Middle Stone Age period were found on this property which is consistent with observations on neighbouring farms through impact assessments and research surveys. These artefacts are particularly visible in deflated open sites where the top soil has washed away onto a harder gravel surface. Despite the large number of dolerite outcrops, no engravings were found. We are not currently aware of a large number of Stone Age engravings in this area and the lack of sites found might possibly be due to the routes chosen for the access roads and turbine positions. It was noted in the field assessment that the archaeology located around the dolerite ridges is very dense and exposed and as such, we would recommend caution should changes be made to turbine positions or access roads.

One archaeological site of significance was identified, Site GK048 (Grade IIIB). It is recommended that a no-go development buffer of 50m is implemented around this site to ensure that it is not impacted. The other significant resources identified include stone wall ruins (GK037, GK074 and GK105) graded IIIB and two significant farm werfs (GK038 and GK100) and a burial ground (GK101) graded IIIA. No-go development buffers are recommended around these sites to ensure that no impact takes place. These are illustrated in Figure 11 below.

Recommendations

Based on the outcomes of this report, it is not anticipated that the proposed development of the renewable energy facilities and its associated grid connection infrastructure will negatively impact on significant archaeological heritage on condition that::

- A 50m no-go development buffer is implemented around site GK048 (Figure 11.5)
- A 500m no-go development buffer is implemented around site GK037 (Figure 11.1), GK074 (Figure 11.2), GK105 (Figure 11.4) and GK101 (Figure 11.3)
- A 1km no-go development buffer is implemented around site GK038 (Figure 11.1) and GK100 (Figure 11.4)
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

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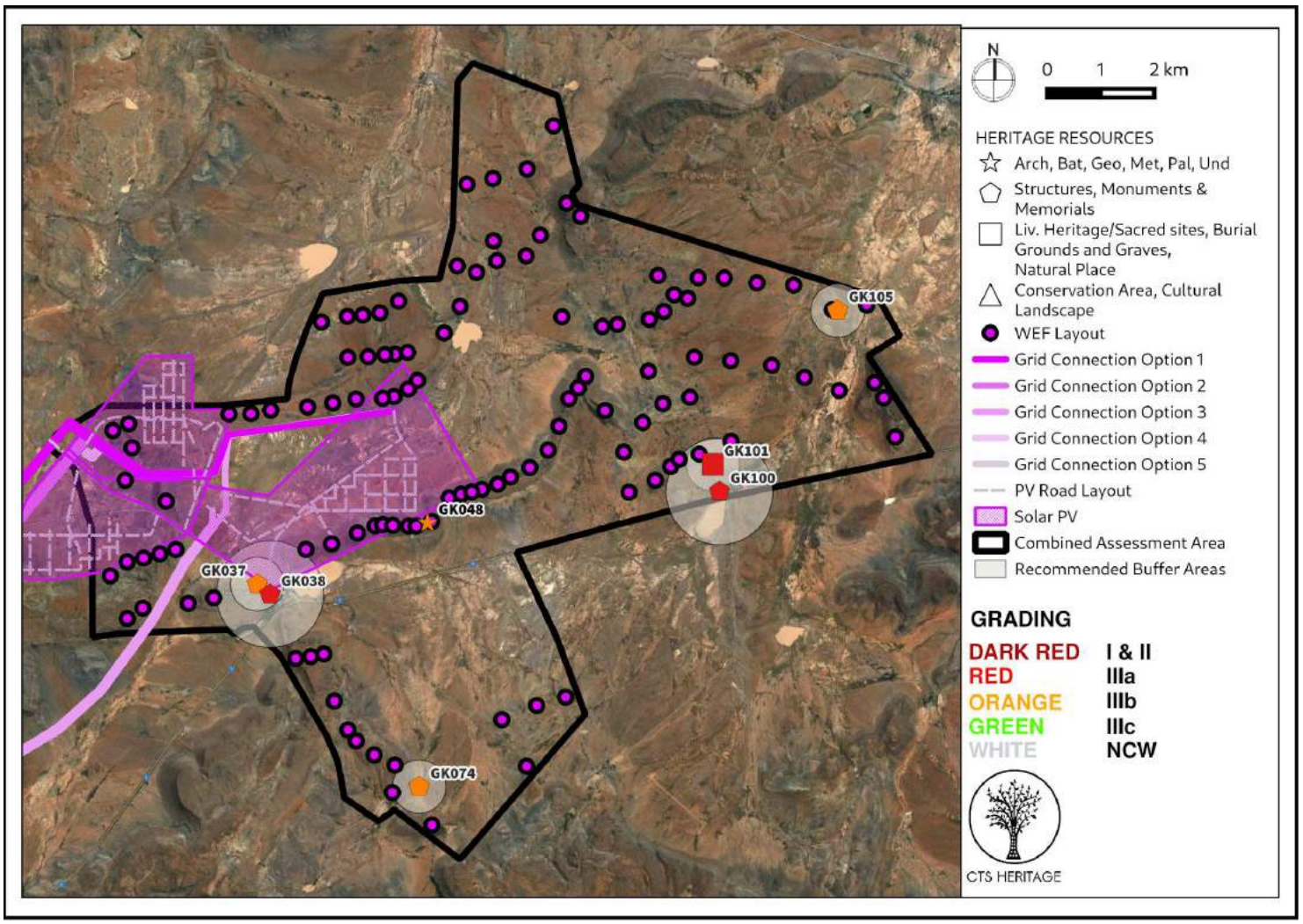

Figure 11: Map of recommended buffer areas relative to the proposed development footprint for all proposed development

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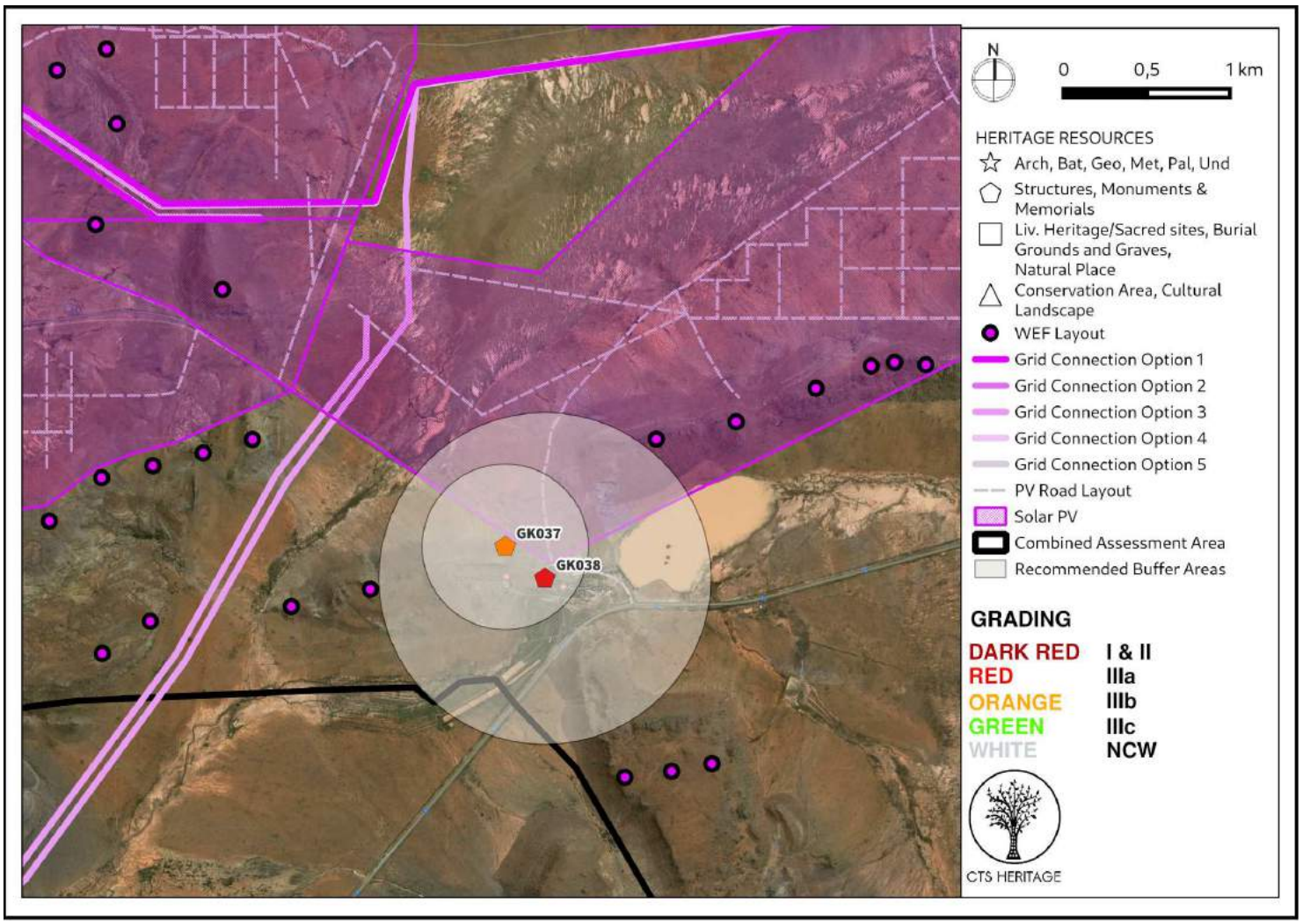

Figure 11.1: Recommended buffer around sites GK037 and GK038 relative to all proposed development

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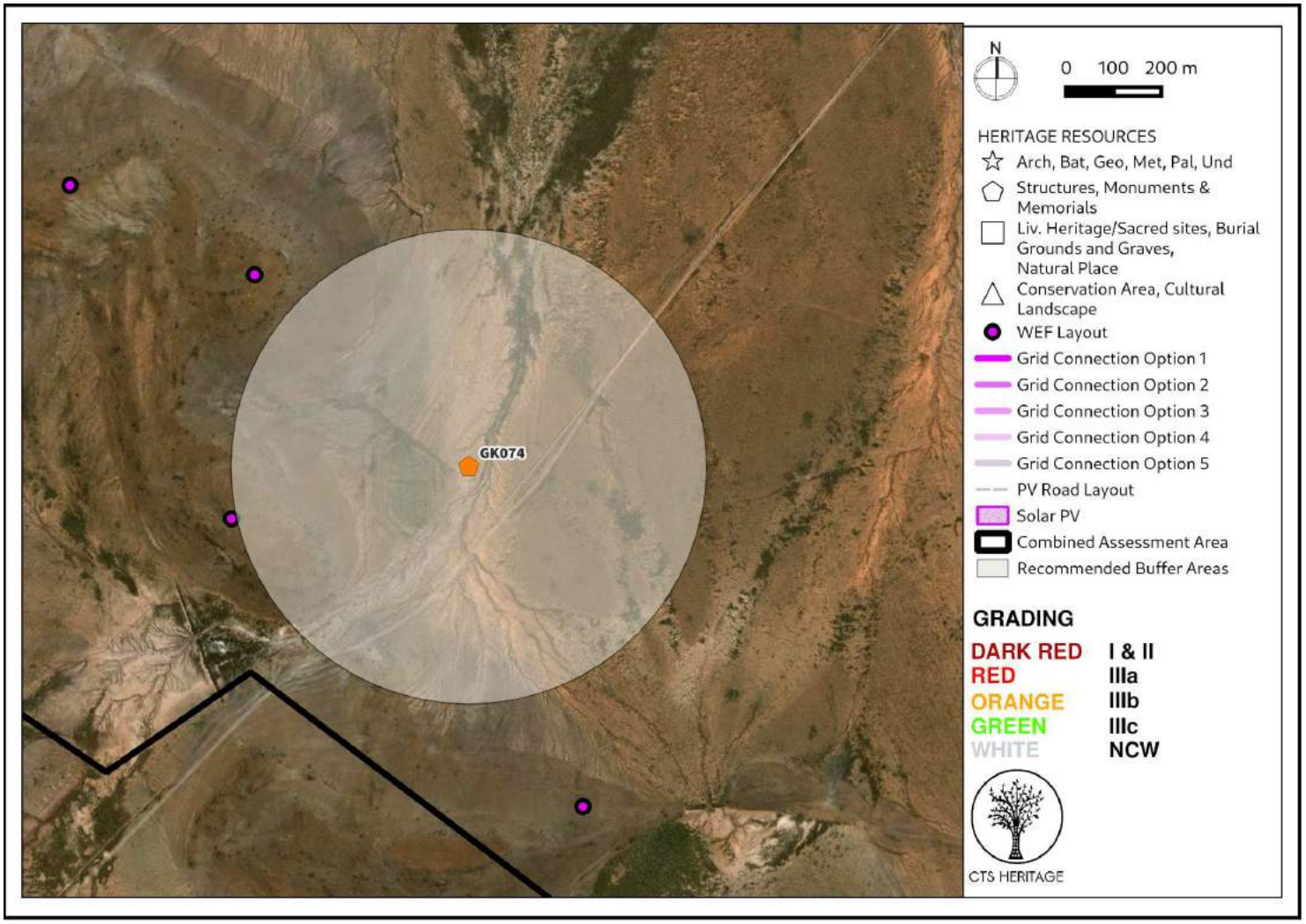

Figure 11.2: Recommended buffer around sites GK074 relative to all proposed development

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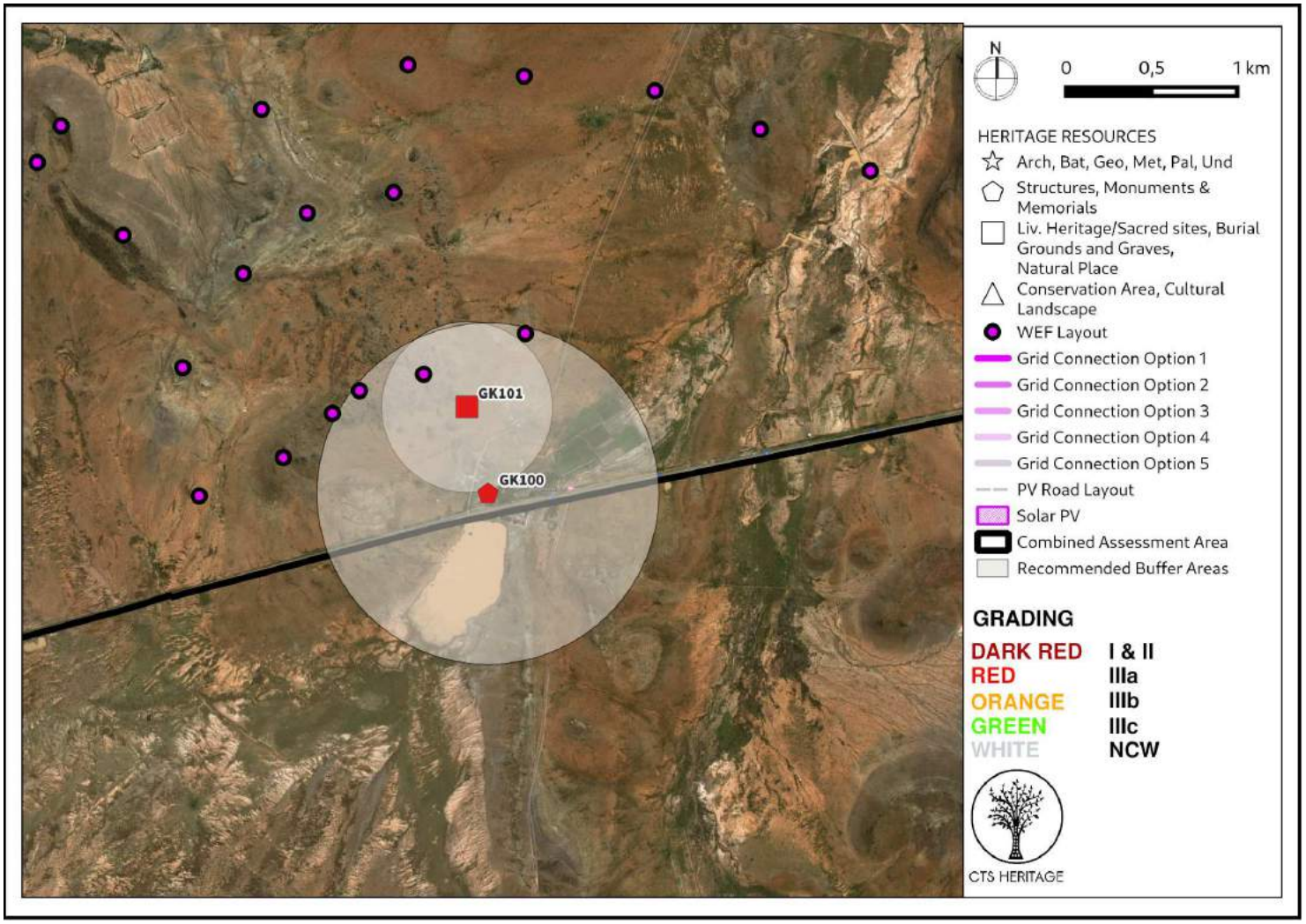

Figure 11.3: Recommended buffer around sites GK100 and GK101 relative to all proposed development

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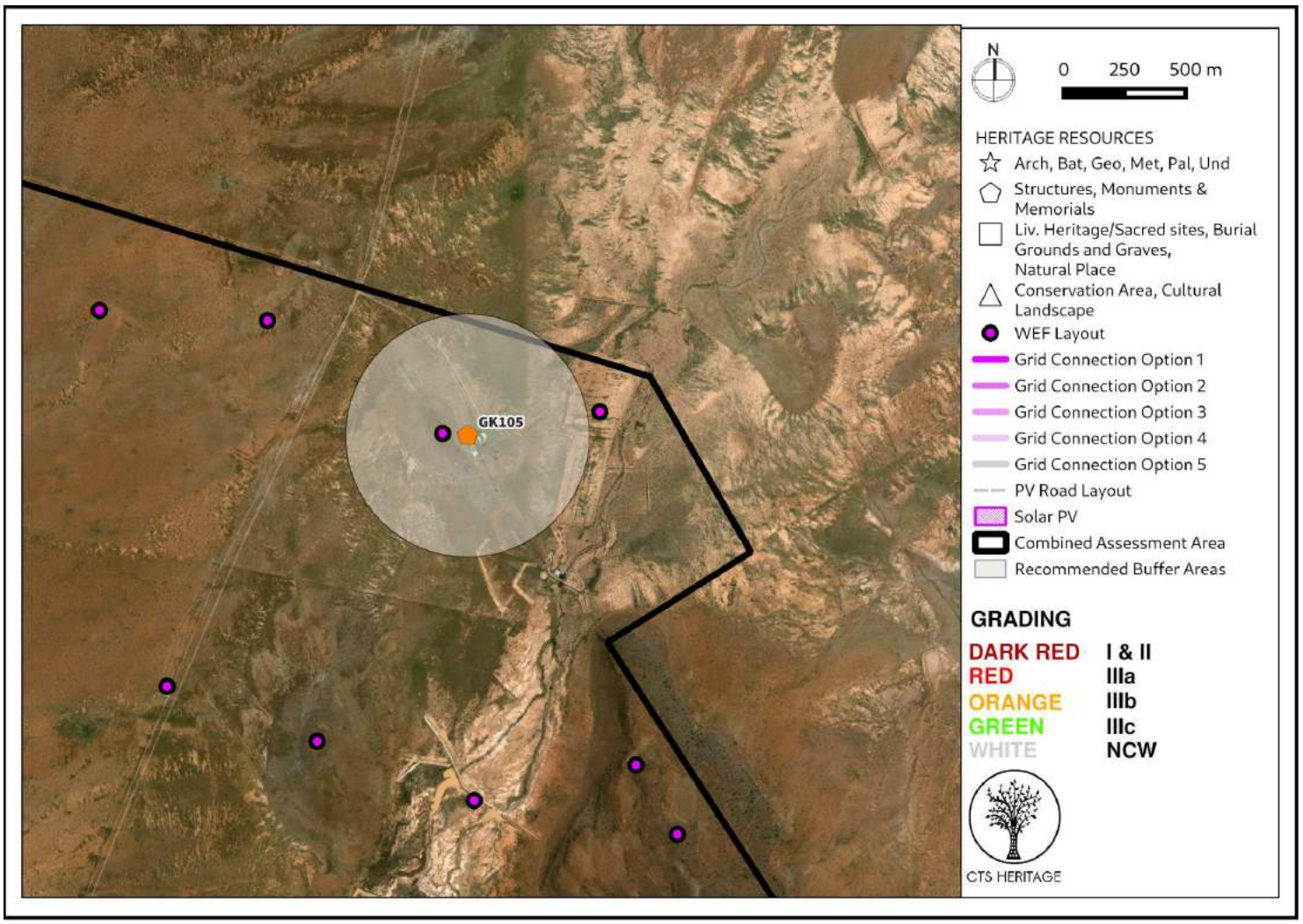

Figure 11.4: Recommended buffer around sites GK105 relative to all proposed development

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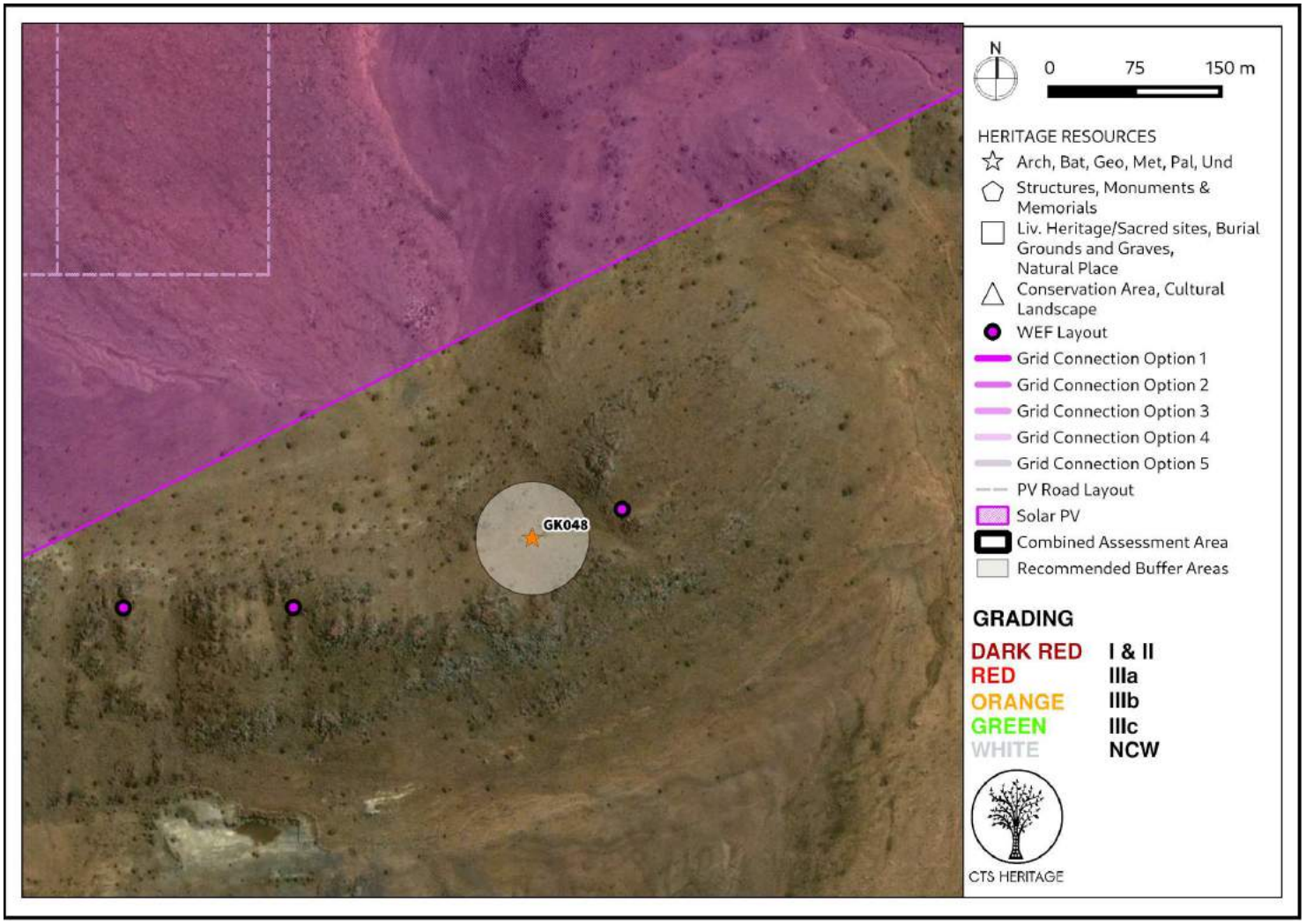

Figure 11.5: Recommended buffer around sites GK048 relative to all proposed development

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7. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
120317	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120820	HIA Phase 1	Celeste Booth	01/12/2012	An Archaeological Ground-Truthing Walk-Through For The Nobelsfontein Wind Energy Facility Situated On A Site South Of Victoria West On The Farms Nobelsfontein 227, Annex Nobelsfontein 234, Ezelsfontein 235, And Rietkloofplaaten 239, Northern Cape Province
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251296	AIA Phase 1	Dave Halkett	01/01/2014	Combined Environmental Impact Assessment for the proposed Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Eskom Distribution Grid Connection Infrastructure near Murraysburg, Western Cape. Chapeter 13: Archaeology Impact Assessment.
356942	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	01/05/2010	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED SKIETKUIL QUARRIES 1 AND 2 ON THE FARM SKIETKUIL No. 3, VICTORIA WEST, CENTRAL KAROO DISTRICT, WESTERN CAPE PROVINCE
356942	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	01/05/2010	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED SKIETKUIL QUARRIES 1 AND 2 ON THE FARM SKIETKUIL No. 3, VICTORIA WEST, CENTRAL KAROO DISTRICT, WESTERN CAPE PROVINCE
357137	Heritage Impact Assessment Specialist Reports	Timothy Hart	13/10/2015	Heritage Impact Assessment for the proposed Umsinde Emoyeni Wind Energy Facility

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360840	Non Impact Assessment Related Reports	Wouter Fourie	05/03/2016	Environmental Impact Assessment of the proposed amendments to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape â€“ Specialist Heritage Opinion
360850	HIA Phase 1	Wouter Fourie	04/03/2016	Basic assessment process for Proposed development of supporting infrastructure to the Victoria West Wind Energy Facility, Victoria West
6805	AIA Phase 1	Len van Schalkwyk, Elizabeth Wahl	01/09/2007	Heritage Impact Assessment of Gamma Grassridge Power Line Corridors and Substation, Eastern, Western and Northern Cape Provinces, South Africa
7035	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	05/03/2011	A Phase 1 Archaeological Impact Assessment (AIA) for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape Province on the farms Phaisantkraal 1, Modderfontein 228, Nobelsfontein 227, Annex Nobelsfontein
7036	AIA Desktop	Celeste Booth, Natasha Higgitt	19/11/2010	An Archaeological Desktop Study for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape
8943	PIA Phase 1	Lloyd Rossouw	24/03/2011	Palaeontological desktop assessment of a commercial renewable energy facility site located approximately 34km south of Victoria West in the Western Cape Province (and Northern Cape)

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APPENDIX 2: Palaeontological Assessment (2021)

Palaeontological heritage specialist report: combined desktop and field-based study

COMBINED PROJECT AREA FOR THE GREAT KAROO RENEWABLE ENERGY CLUSTER (ANGORA WIND FARM, MERINO WIND FARM, NKU, MORIRI & KWANA SOLAR PV FACILITIES) NEAR RICHMOND, PIXLEY KA-SEME DISTRICT, NORTHERN CAPE PROVINCE AND ASSOCIATED GRID CONNECTIONS TO THE GAMMA MTS NEAR HUTCHINSON

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December 2021

EXECUTIVE SUMMARY

Great Karoo Renewable Energy (Pty) Ltd is proposing to develop a cluster of commercial renewable energy facilities and associated infrastructure, to be known as Great Karoo Renewable Energy (GKRE), approximately 35km south-west of Richmond. The cluster comprises the adjoining **Angora Wind Farm**, **Merino Wind Farm** as well as the **Nku (PV1)**, **Moriri (PV2)** and **Kwana (PV3) Solar PV Facilities**, to be situated within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province

Fluvial to lacustrine sedimentary bedrocks of Late Permian Teekloof Formation (Lower Beaufort Group, Karoo Supergroup) in the combined GKRE and grid connection project areas are generally poorly exposed and have been thermally metamorphosed by a dense network of Early Jurassic dolerite intrusions. The Teekloof Formation sediments here have yielded very sparse, low-diversity and generally poorly preserved fossil assemblages of the *Endothiodon* and *Cistecephalus* Assemblage Zones. These fossils record the aftermath and full recovery of continental biotas of southern Gondwana from the major End Guadalupian Mass Extinction Event of ~260 million years ago (Ma).

Fossil specimens recorded from the Teekloof Formation bedrocks during a 3-day site visit to the combined GKRE and grid connection project areas mainly comprise a handful of scrappy therapsid cranial and post-cranial material. The only specimens of potential scientific or conservation interest are several skeletal elements of a small-bodied pareiasaur reptile - possibly a juvenile or dwarf taxon. Almost all the other specimens are fragmentary and very poorly preserved due to thermal metamorphism and metasomatism (*i.e.* alteration through secondary mineralisation and dissolution by hot circulating groundwaters) during dolerite intrusion. Thick deposits of Late Caenozoic, semi-consolidated alluvium might contain important assemblages of Plio-Pleistocene mammalian fossils (*e.g.* horn cores, bones and teeth) as well as reworked petrified wood and trace fossils (*e.g.* calcretised termitaria). However, the only fossils recorded here comprise assemblages of subvertical, calcretised rhizoliths (plant root casts) in riverbank settings. Voluminous, doleritic and quartzitic colluvial rock rubble mantling the steeper mountain slopes as well as younger alluvial sands and gravels mantling extensive *vlaktes* within the project area are unlikely to be fossiliferous.

A high proportion of the WEF infrastructure will be placed along upland ridges underlain by unfossiliferous intrusive dolerite and low palaeosensitivity, thermally metamorphosed Lower Beaufort Group sediments. The solar PV project areas are focused on low relief terrain that is mantled by low palaeosensitivity Late Caenozoic sediments (alluvial sands, gravels, soils) with little or no exposure of potentially fossiliferous sedimentary bedrocks. Most of the main grid connection corridor to Gamma MTS is also floored by thick, sandy to gravelly alluvium or dolerite; limited areas of sedimentary bedrock exposure here are strongly baked with few or almost no well-preserved fossils. No palaeontological Very High Sensitivity / No-Go areas have been identified within the GKRE and grid connection project areas. With the exception of two fossil sites of low scientific value, none of the recorded fossil sites overlaps directly with, or lies close to (< 20 m), the proposed WEF and solar PV project footprints and no modification of the layouts through micro-siting is proposed here on palaeontological grounds. While a number of fossil sites are recorded within the main grid connection corridor, none is of conservation significance while most of the sites are already protected within standard ecological buffer zones along drainage lines. Mitigation of the known fossil sites within the GKRE and grid connection project areas is therefore not proposed here.

Most of the proposed renewable energy project infrastructure - including wind turbines, laydown areas, underground cables, access and internal distribution roads, electrical pylons, solar panel arrays, on-site substations, BESS, site office and maintenance buildings, concrete batching plant *etc* - will overlie unfossiliferous dolerite or metamorphosed bedrocks and geologically recent superficial deposits of low palaeosensitivity. The anticipated impact significance of the proposed WEF and solar PV projects in terms of palaeontological heritage resources is likely to be VERY LOW due to (1) the very sparse distribution of fossil remains as well as (2) their almost universally poor preservation. Given the very uniform geological, and hence palaeontological, setting throughout the combined project areas, this assessment applies equally to all the proposed WEF, solar PV and grid connection projects as well as to the various grid connection corridors under consideration. There is accordingly no preference on palaeontological heritage grounds for any particular grid connection route option. The proposed renewable energy projects and grid connections are not fatally flawed from a palaeontological heritage viewpoint and there are no objections to their authorisation.

All the fossil sites recorded so far could, if necessary, be effectively mitigated through specialist palaeontological collection and recording of associated geological data, and this is likely to be the case for the great majority of any unrecorded fossil sites encountered in the pre-construction or construction phases as well. The potential for rare, unrecorded fossil sites of high scientific and/ or conservation value cannot be completely excluded, however. These are best handled through a Chance Fossil Finds Protocol driven by the responsible environmental site officers and ECO, as outlined in Appendix 3. Pending the discovery of significant new fossil remains, no further specialist palaeontological studies or mitigation are recommended for the GKRE and grid connection projects. Should specialist palaeontological mitigation be triggered by significant Chance Fossil Finds, the palaeontological specialist involved will need to submit an application for a Fossil Collection Permit (SAHRA) or Work Plan (HWC) to the relevant Provincial Heritage Resources Agency. The palaeontological studies should conform to international best practice for palaeontological fieldwork and adhere as far as possible to the minimum standards for palaeontological heritage studies developed by SAHRA (2013) and HWC (2021). The palaeontological assessment reports must be submitted for consideration to the responsible Provincial Heritage Resources Agency.

1. INTRODUCTION

1.1. Project outline and brief

The company Great Karoo Renewable Energy (Pty) Ltd is proposing to develop a cluster of commercial renewable energy facilities and associated infrastructure, to be known as Great Karoo Renewable Energy (GKRE), on a site located approximately 35km south-west of Richmond and 80km south-east of Victoria West. The proposed cluster comprises the adjoining **Angora Wind Farm**, **Merino Wind Farm** as well as the **Nku (PV1)**, **Moriri (PV2)** and **Kwana (PV3) Solar PV Facilities**, to be situated on the following land parcels within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province (Fig. 1):

- Portion 11 of Farm Gegundefontein 53
- Portion 0 of Farm Vogelstruisfontein 84
- Portion 1 of Farm Rondavel 85
- Portion 0 of Farm Rondavel 85
- Portion 0 of Farm Rondavel 85
- Portion 9 of Farm Bult
- Rietfontein 96

Detailed descriptions for each Great Karoo Renewable Energy project, listing land parcels concerned and key infrastructural components, are provided in Appendix 1. Grid connection infrastructure associated with each of the renewable energy projects will include a 132kV on-site substation and a 132kV overhead power line connecting with the existing Gamma Main Transmission Substation (MTS) near Hutchinson, located *c*. 25 km to the southwest of the core GKRE project area. Grid connection corridor route options under consideration are indicated in yellow and blue in Figure 1. It is noted that the grid corridors lie entirely within the Northern Cape, apart from a very short (< 500 m) sector just east of Gamma Substation.

Since the GKRE renewable energy projects fall outside of a gazetted Renewable Energy Development Zone (REDZ), a full Scoping & EIA process is required for the wind farm and solar PV facilities while BA processes are being undertaken for the associated grid connections.

The proposed GKRE and grid connection project area is underlain by potentially fossiliferous sedimentary rocks of Late Permian and Late Caenozoic age (Sections 2 and 3). The construction phase of the renewable energy and grid developments will entail substantial surface clearance as well as excavations into the bedrocks and superficial sediment cover (*e.g.* for wind turbine footings, laydown areas, underground cables, substation and building foundations, internal and transmission line access roads, electrical pylon footings). All these activities may adversely affect potential fossil heritage preserved at or beneath the surface of the ground within the study area by destroying,

disturbing or permanently sealing-in fossils which are then no longer available for scientific research or other public good.

The present combined desktop and field-based palaeontological heritage report will contribute to the separate broad-based heritage assessments (HIAs) of all the component projects for the GKRE and grid connections that are 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).

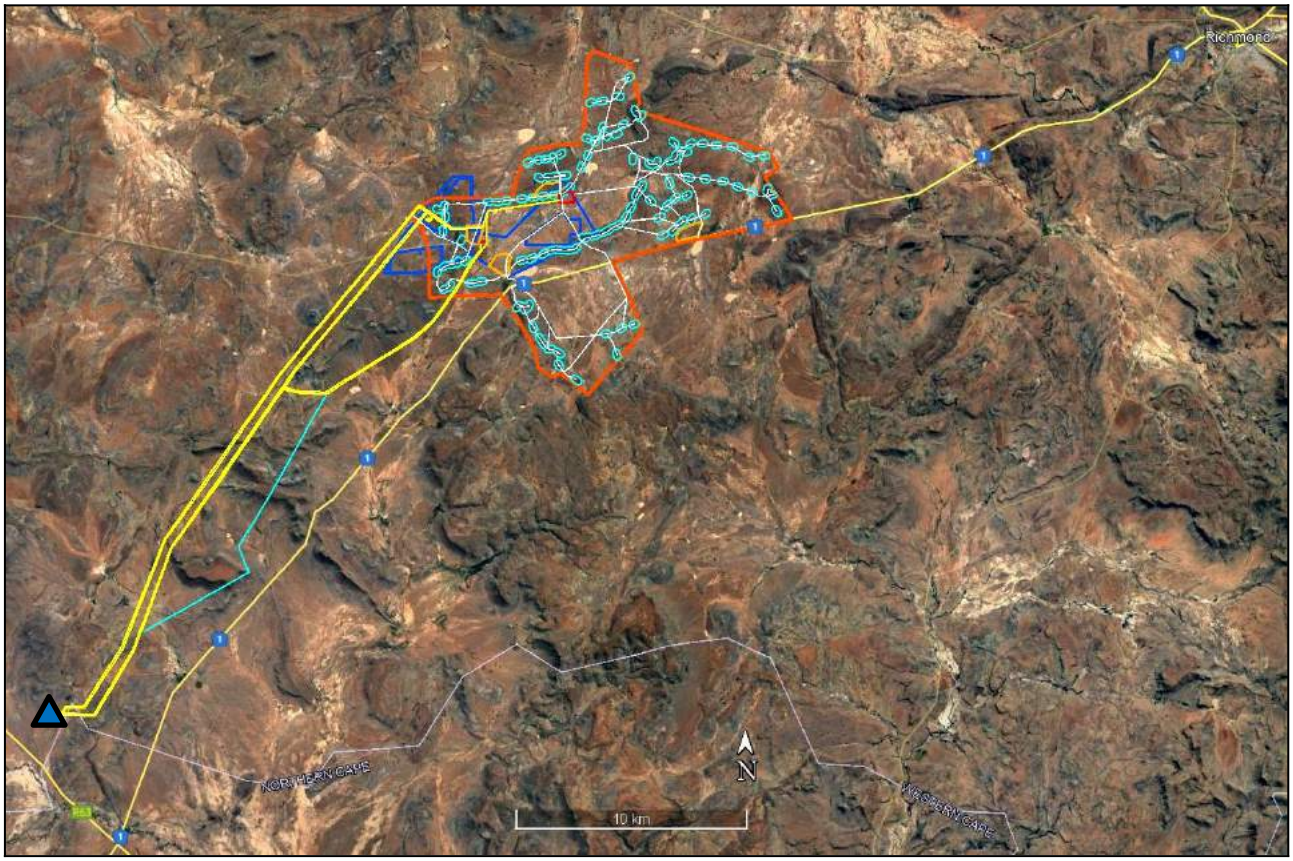


Figure 1: Google Earth© satellite image showing the location (orange polygon) of the combined project areas for the Great Karoo Renewable Energy cluster of projects near Richmond, Pixley-ka-Seme District, Northern Cape Province (WEF project areas outlined in orange; solar PV project areas outlined in dark blue). The 132 kV grid connection corridor options to the existing Gamma MTS near Hutchinson (blue triangle) are shown in yellow and pale blue. The combined GKRE and grid project area lies to the north of the N1 and almost entirely within the Northern Cape Province, except for a very short sector of grid corridor just east of the Gamma MTS.

1.2. Legislative context for palaeontological assessment studies

All palaeontological heritage resources in the Republic of South Africa are protected by the National Heritage Resources Act (Act 25 of 1999). Heritage resource management in the Western Cape is the responsibility of Heritage Western Cape (HWC) (3rd Floor, Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 9598. Fax: 021 483 9845. E-mail: hwc.hwc@westerncape.gov.za). For the Northern Cape Province the responsible body is SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za).

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act (Act 25 of 1999) include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources Agency.

(2) All archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources agency, or to the nearest local agency offices or museum, which must immediately notify such heritage resources Agency.

(4) No person may, without a permit issued by the responsible heritage resources agency—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources agency has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
(c) if mitigation is deemed by the heritage resources agency to be necessary, assist the person on whom the order has been served under paragraph *(a)* to apply for a permit as required in subsection (4); and
(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013) and Heritage Western Cape (2021).

1.3. Approach to the palaeontological heritage study (PIA)

The approach to this palaeontological heritage study is briefly as follows. Fossil bearing rock units occurring within the broader study area are determined from geological maps and satellite images. Known fossil heritage in each rock unit is inventoried from scientific literature, previous PIA assessments of the broader study region, and the author's field experience and palaeontological database. Based on this data as well as field examination of representative exposures of all major sedimentary rock units present, the impact significance of the proposed development is assessed with recommendations for any further studies or mitigation.

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc.*) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following field assessment during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to a development (Provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond & Pether 2008a, 2008b).

The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned, and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present and exposed within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development.

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally involving the recording and judicious sampling of fossil material and associated geological information (*e.g.* sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management Agency (*i.e.* Heritage Western Cape for the Western Cape, SAHRA for the Northern Cape). It should be emphasized that, *provided that appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

1.4. Assumptions & limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc.*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.
4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies.
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc.*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist. In the present case, site visits to the various loop and borrow pit study areas in some cases considerably modified our understanding of the rock units (and hence potential fossil heritage) represented there.

In the case of the present study area near Richmond the main constraint for fossil heritage studies is the very limited surface exposure of *unmetamorphosed*, potentially fossiliferous bedrocks (especially readily-weathered mudrocks) due to (1) the extensive dolerite intrusion which has thermally metamorphosed more or less all the sedimentary country rocks in the region as well as (2) the, in part related, very high levels of cover by superficial sediments such as colluvium (scree), eluvial gravels and alluvium. For the same reasons, there has been very little academic palaeontological work in this particular sector of the Main Karoo Basin. However, this is partially offset by the long (> 100 years) history of scientific fossil collection in comparable bedrock successions within the wider Victoria West region such as the Noblesfontein area, some 20 km west of Gamma Substation (see Day & Rubidge 2020a and the recent PIA report by Almond 2021). Despite these limitations, a sufficient number of reasonably informative exposures of bedrock and superficial sedimentary rock units were examined during the course of the present field survey, so confidence levels for this assessment are rated as Medium.

1.5. Information sources

The information used in this combined desktop and field-based palaeontological study was based on the following:

1. A short project outline, heritage screener reports, geological maps, palaeosensitivity maps and kmz files provided by CTS Heritage, Cape Town;
2. A review of the relevant scientific literature (especially Day & Rubidge 2020 and refs. therein), including published geological maps and accompanying sheet explanations (*e.g.* Le Roux & Keyser 1988) as well as several desktop and field-based palaeontological assessment studies in the broader Victoria West region of the Northern Cape by the author and others (*e.g.* Almond 2010a-b, 2012a-c, 2013c, 2015a-b, 2021, Rossouw 2011);
3. Examination of relevant topographical maps (*e.g.* 1: 250 000 sheet 3122 Victoria West, 1: 50 000 sheets 3123DA Ouplaas, 3123BC Bokfontein & 3123CB Bulberg) and Google Earth© satellite images;
4. A three-day palaeontological site visit by the author (28 November to 30 November 2021) which focussed on a representative sample of potentially-fossiliferous exposures of bedrock units (especially mudrock exposures) and older - probably Pleistocene - alluvial deposits within the broader GKRE and grid conection project areas. Note that

the survey did *not* focus on proposed turbine positions, many of which are situated on unfossiliferous dolerite or thermally-metamorphosed sediments, since these do not constitute the most important potential threat to local fossil heritage resources. Due to time and access constraints, most of the Option 3 and Option 6 grid corridors were *not* surveyed. However, based on satellite imagery and geological maps, these corridors have a very similar geology to those surveyed, which are all of Low to Very Low palaeosensitivity, so this omission does not seriously undermine the conclusions reached here.

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

2. GEOLOGICAL OUTLINE OF THE STUDY AREA

The combined GKRE and grid connection project area between Richmond and Hutchinson near Victoria West is situated just to the north of the N1 trunk road within the semi-arid Upper Karoo region of the Northern Cape Province (Fig. 1). It features scenically attractive, dissected, mountainous to hilly terrain with numerous low, rocky doleritic ridges and *koppies*, stepped surfaces and low *kranzes* of sandstone, rubbly alluvial fans and intervening extensive, gravelly to sandy *vlaktes* or alluvial plains (Figs. 2 to 14). The vegetation here is typical karroid *bossieveld*, often grassy in doleritic areas, and trees are largely restricted to intermittently-flowing watercourses. The dolerite ridges reach elevations of up to 1464 m amsl. while higher points within the wider region – many capped by dolerite - include Blouberg (1563 m amsl), Bloukop (1480) and Platberg (1456). Drainage in the region is complex and often internal, largely due to interruptions by the network of resistant doleritic intrusions which are often associated with springs, as suggested by several local farms names. There are no major water courses. Shallow, intermittently-flowing tributary streams feed into the Ongersrivier towards the NE, the Brakpoortrivier to the NW and, *via* the more deeply incised Burgerspruit, into the Brakrivier to the south. While dolerite intrusions are well-represented, exposure levels of sedimentary bedrocks - especially as far as the potentially fossiliferous mudrocks are concerned - are usually low to very low. This is due to extensive, thick alluvial sands and gravels in the lower-lying areas *plus* colluvium (scree) and eluvial (downwasted / relictual) gravels of dolerite and metasediments on steeper hillslopes and their marginal alluvial fans. Good, but generally small, exposures of potentially fossiliferous mudrocks are mainly located along drainage lines (*e.g.* Burgerspruit), on several steep, gullied hillslopes and in farm dams; they are often indicated by dark grey areas on satellite images but these may be deceptive (Figs. 21, 23, 33 to 37).

Figure 2: The elongate, sinuous Bakenskop dolerite ridge that runs between Rondawel and Vogelstruisfontein farmsteads, seen from the N1, with a low scarp capped by pale yellow, baked channel sandstones in the middle ground – possibly within the Poortjie Member.

Figure 3: Rugged terrain featuring small, rubbly dolerite *koppies* to the NW of Vogelstruisfontein farmstead.

Figure 4: Extensive alluvial *vlaktes* with little or no Beaufort Group bedrock exposure and ringed by dolerite ridges, as here on Vogelstruisfontein 84, are an important landscape element in the GKRE project area.

Figure 5: Common appearance of pale yellowish, baked Beaufort Group channel sandstone horizons along flanks of ridges where they are usually overwhelmed by doleritic colluvium with little or no mudrock exposure, Farm Rondavel 85.

Figure 6: Exposures of Beaufort Group mudrocks in lower-lying areas are mainly confined to shallow erosion gullies and occasional borrow pits, as here on Rondavel 85.

Figure 7: Low hills with gentle slopes (middle ground) built of baked Beaufort Group metasediments in the Miedkop area on the border between Vogelstruisfontein 84 and Gegundefontein 53. Note angular, quartzitic surface rubble in the foreground.

Figure 8: Flat terrain in the PV1 project area on Gegundefontein 53 with bedrocks entirely obscured by sandy alluvial soils, sparse surface gravels and low *bossieveld* vegetation.

Figure 9: Escarpment featuring pale yellow baked channel sandstones of the Balfour Formation capped by a rusty-brown dolerite sill, viewed southwards from the main grid corridor on Farm 96.

Figure 10: View south-westwards along the main grid connection corridor on Nieuwefontein 89 showing an extensive blanket of rubbly quartzitic surface gravels in this upland area.

Figure 11: Main grid connection corridor just north of Blouberg showing considerable range in elevation between rocky dolerite ridges in the foreground and low-relief alluvial *vlaktes* in the middle ground. The latter are flanked by occasional prominent *koppies* of Beaufort Group bedrock such as Blouberg on the left.

Figure 12: View from the main grid corridor on Farm 92 looking south-eastwards towards the dolerite-capped Platberg with an unnamed, moderately incised, sandy stream valley on the right.

Figure 13: The south-eastern slopes of Platberg, seen from the N1, showing a low *krans* of Poortjie Member channel sandstone towards the base, inclined, pale, baked sandstones higher up and a dolerite sill capping the summit plateau. The hillslopes are largely mantled by rusty-brown doleritic colluvium. One of the alternative grid connection corridor options (blue line in Figure 1) traverses these slopes but in such terrain is unlikely to have any substantial impact on fossiliferous bedrocks.

Figure 14: Most grey areas on satellite images of the south-western sector of the main grid connection corridor feature weathered, baked surface shale or crumbly mudrock overlying alluvial soils with no good exposure of potentially fossiliferous bedrock, as seen here on Farm 93.

The geology of the GKRE and grid connection project areas is outlined on the 1: 250 000 geology sheet 3122 Victoria West (Fig. 15) with a short accompanying sheet explanation by Le Roux & Keyser (1988). The project area is almost entirely underlain by Late Permian continental sediments of the **Lower Beaufort Group** (Adelaide Subgroup, Karoo Supergroup) (Johnson *et al.* 2006) (Figs. 19 to 37). According to the published geological map three subunits or members of the **Teekloof Formation** are represented within the combined project area, namely the basal sandstone-dominated **Poortjie Member** (**Ptp**), the overlying mudrock-dominated **Hoedemaker Member** (**Pth**) as well as the following sandstone package assigned to the **Oukloof Member** (See stratigraphic tables in Figs. 16 & 17). In addition, mudrocks of the **Steenkampsvlakte Member** build the summit slopes of Bloukop, close to but outside the main grid connection project area (Fig. 19). The mapping of the various Teekloof Formation members in the Richmond – Victoria West region and the associated biostratigraphy remain somewhat equivocal (*cf* Day & Rubidge 2020, Almond 2021). For some reason, the Oukloof and Steenkampsvlakte Members in or close to the study area are currently mapped within the **Balfour Formation** (**Pb**, dark green in Fig. 15) which normally occurs east of 24° East.

Yellow-weathering channel sandstones of the Poortjie Member are well exposed on the lower slopes of Blouberg and build low-lying sandstone plateaux and their fringing escarpments close to the N1 (*e.g.* Fig. 2). The more readily-weathered Hoedemaker Member is mapped in the low-relief *vlaktes* in the eastern and southern sectors of the GKRE project area as well as along the majority of the grid connection project area, but here its outcrop area appears to be exaggerated. Sandstone-rich scarps on or just outside the southern margins of the GKRE project area are assigned to the Oukloof Member ("Balfour Formation") and are also well seen on the lower slopes of Bloukop as well as

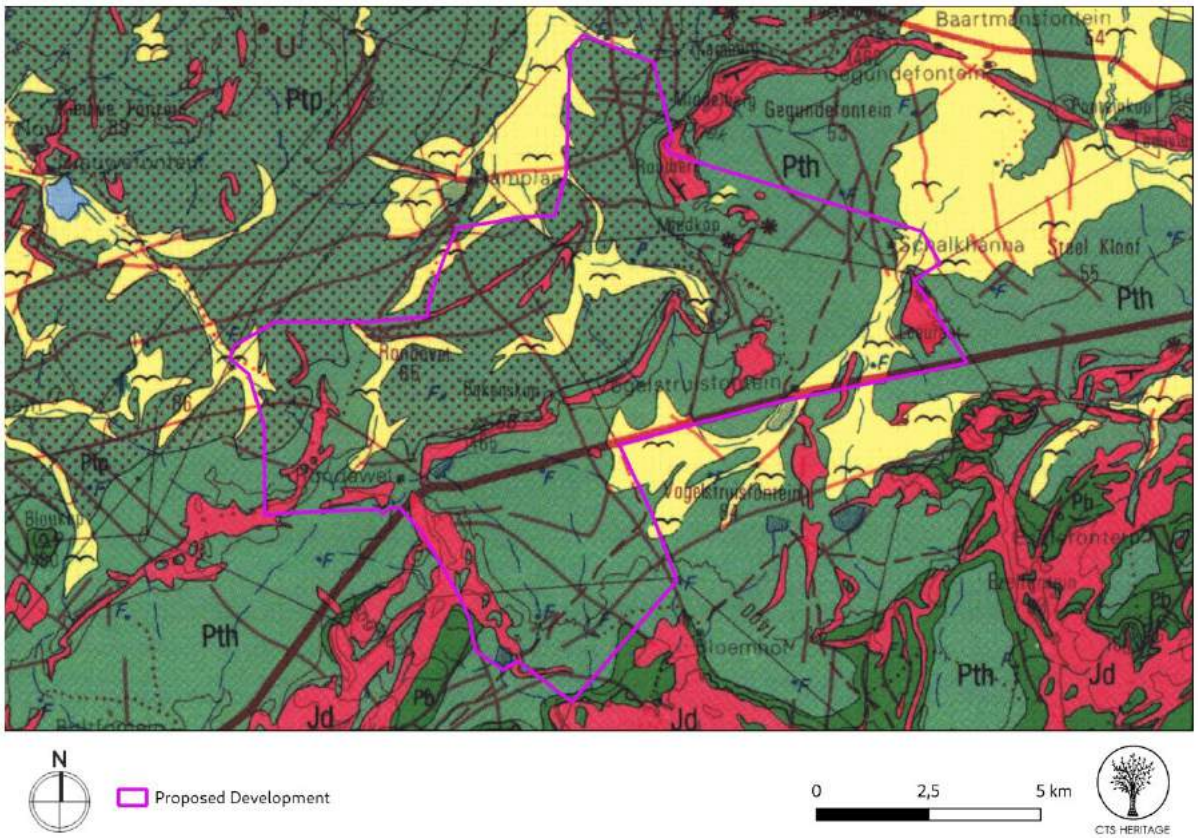
capping the escarpment to the south (*e.g.* Farm 96) (Figs. 9. 19 & 25). It is likely that the Oukloof Member outcrop afea is much more extensive than mapped.

The Late Permian sedimentary country rocks are very extensively intruded, thermally metamorphosed (baked) as well as metasomatised (altered by hot subterranean fluids) by a network of substantial dolertic sills and dykes of the Early Jurassic **Karoo Dolerite Suite** (Jd) (Duncan & Marsh 2006) (Figs. 2, 38 to 40). The intrusions are themselves unfossiliferous and underlie large portions of the proposed GKRE project and grid connection project areas (*cf* rusty-brown areas in satellite images, Fig. 1). The Karoo dolerites are a major component of the Karoo Large Igneous Province (KLIP) dated to *c*. 183 Ma. An interesting recent account of nested or stacked, saucer-shaped sill complexes and associated funnel-shaped feeders in the Victoria West region has been provided by Coetzee (2020) (See also Chevallier & Woodford 1999; Fig. 18). An earlier phase of sill complex intrusion at 184-180 Ma at shallow depths (*c*. 500 to 2000 m below surface) under a compressive stress regime was followed by intrusion of dyke swarms around 182-174 Ma in the context of crustal tension preceding Gondwana break-up.

Various types of **superficial deposits** of Late Caenozoic (Miocene / Pliocene to Recent) age mantle most of the Lower Beaufort Group sediments and intrusive dolerite bedrocks in the present study area (Figs. 41 to 48). They include pedocretes (*e.g*. calcrete hardpans and veins), voluminous colluvial slope deposits dominated by quartzite, hornfels and dolerite scree, sheet wash deposits, sandy to gravelly river channel alluvium and soils, as well as spring and pan sediments (Johnson & Keyser 1979, Le Roux & Keyser 1988, Cole *et al.,* 2004, Partridge *et al*. 2006).

The geology of most of these rock successions has been outlined in a recent field-based PIA report for the Victoria West region by Almond (2012). Representative or unusually good exposures of the various igneous and sedimentary rock units within the present GKRE and grid connection project area are provided in Figures 19 to 48 below, together with explanatory figure legends.

Figure 15 (following page): Extracts from 1: 250 000 geology sheet 3122 Victoria West showing the outline of the combined GKRE project area (wind and solar PV projects) above and the grid connection project area below (lilac polygons) (Base map published by the Council for Geoscience, Pretoria. Images prepared by CTS Heritage, Cape Town). The main rock units represented here include:
Ptp (middle green with stipple) = Middle to Late Permian Poortjie Member, Teekloof Formation (Adelaide Subgroup).
Pth (middle green without stipple) = Late Permian Hoedemaker Member, Teekloof Formation (Adelaide Subgroup).
Pb (middle green without stipple) = Late Permian Balfour Formation (Adelaide Subgroup) – but here mainly involving the basal sandstone package of the Oukloof Member (Teekloof Formation).
Jd (red) = sills and dykes of the Early Jurassic Karoo Dolerite Suite.
Pale yellow with flying bird symbol = Late Caenozoic (Neogene / Pleistocene to Recent) alluvium.
***N.B.* The mapping of the various stratigraphic subunits of the Lower Beaufort Group shown here is currently contested and may require considerable revision in future, based on detailed field mapping and collection of additional biostratigraphic data. In particular, the Hoedemaker Member outcrop area has probably been underestimated while sandstone packages of the overlying Oukloof Member might be present at higher elevations in the south.**


Ptp
Pth
Jd
Pb
Baartmansfontein
Gegundefontein
Vogelstruisfontein
Schalkhaana
Staal Kloof
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Proposed Development
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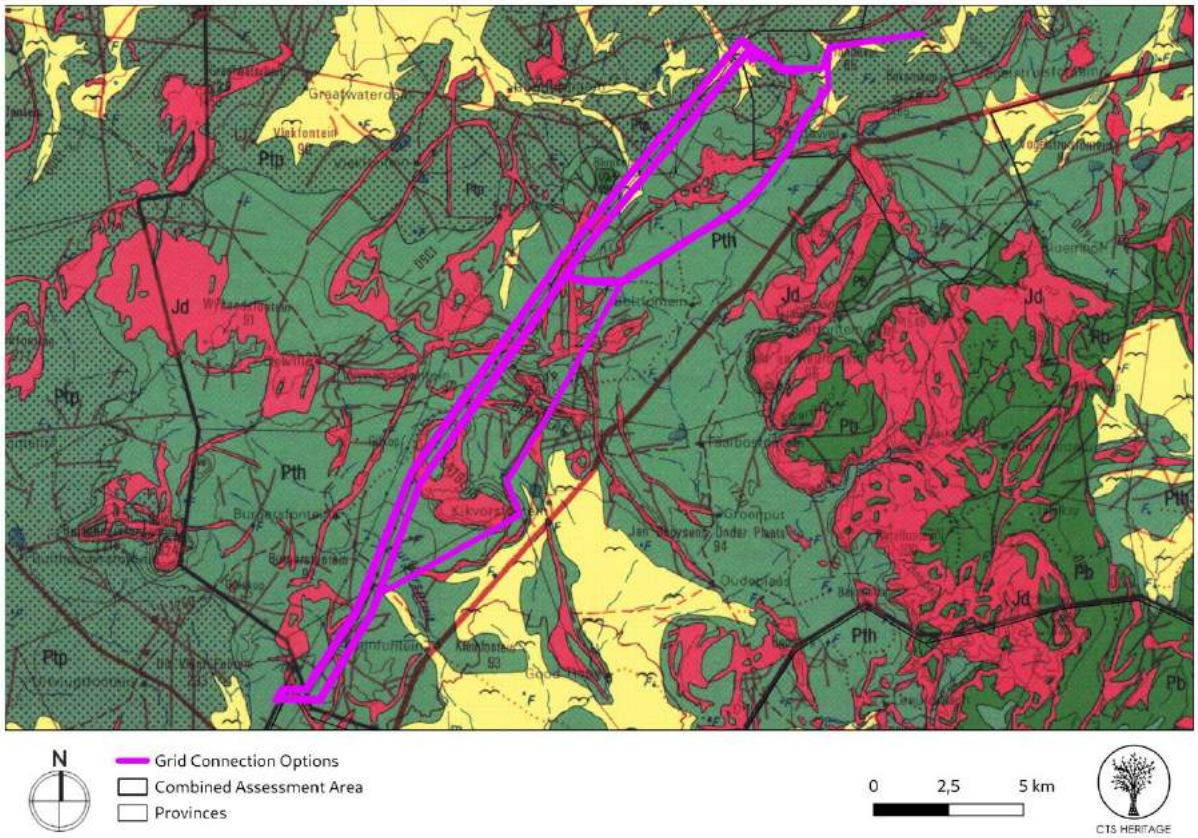
Ptp
Pth
Jd
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Groenwaterdal
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Grid Connection Options
Combined Assessment Area
Provinces
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CTS HERITAGE

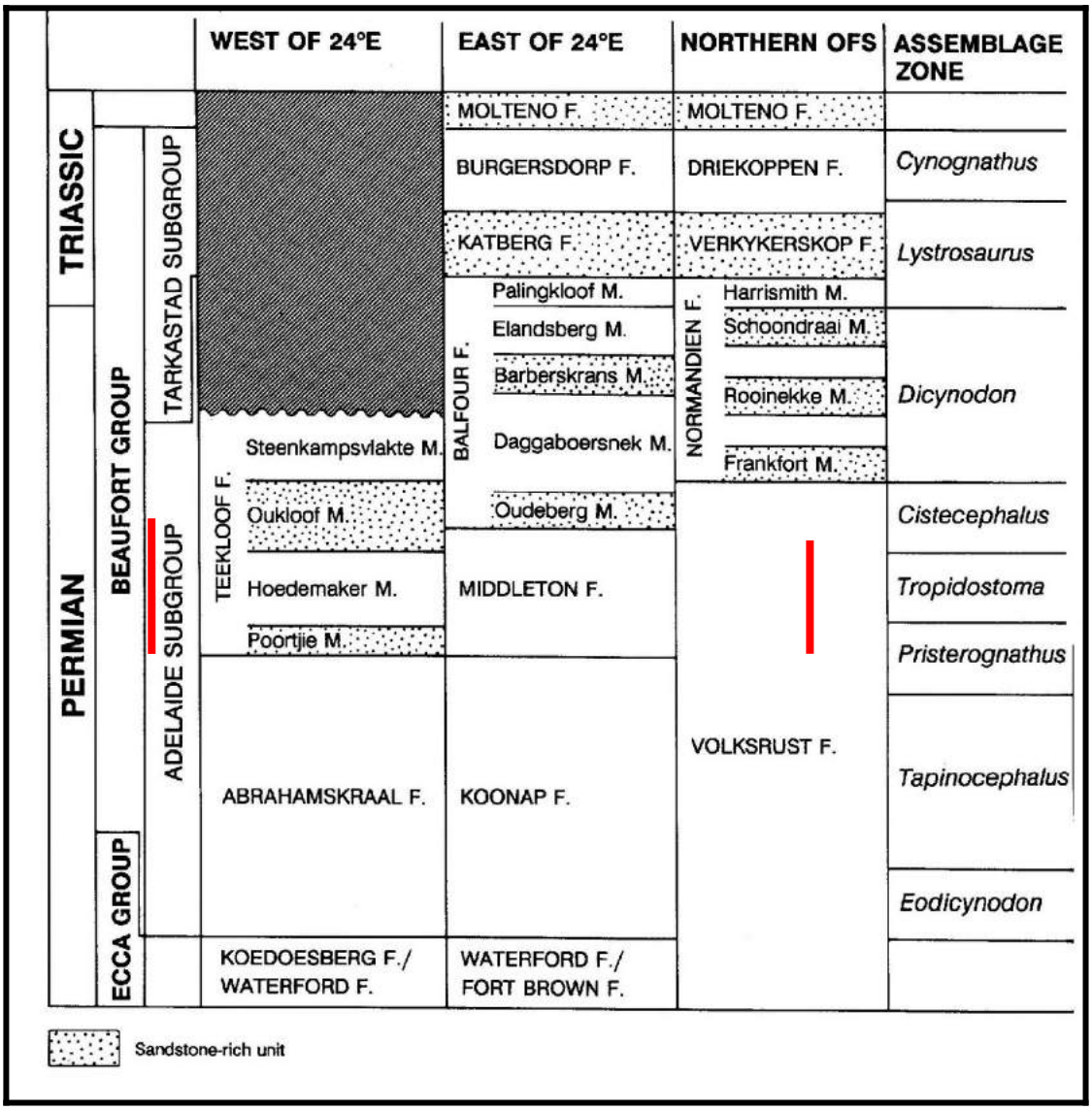

Figure 16: Stratigraphy and biostratigraphic zonation of the Beaufort Group of the Main Karoo Basin (From Rubidge (ed.) 1995). The vertical red lines indicate the Lower Beaufort subunits and fossil assemblage zones that are represented in the GKRE and grid connection project areas. However, the mapping of these subunits may require future revision while the precise, and apparently anomalous, relationship between the lithostratigraphy and successive fossil assemblages in the area south of Victoria West is currently unclear (*cf* Day & Rubidge 2020). Note that the *Pristerognathus* and *Tropidostoma* Assemblage Zones (AZ) have recently been combined within a redefined *Endothiodon* AZ (see following figure).

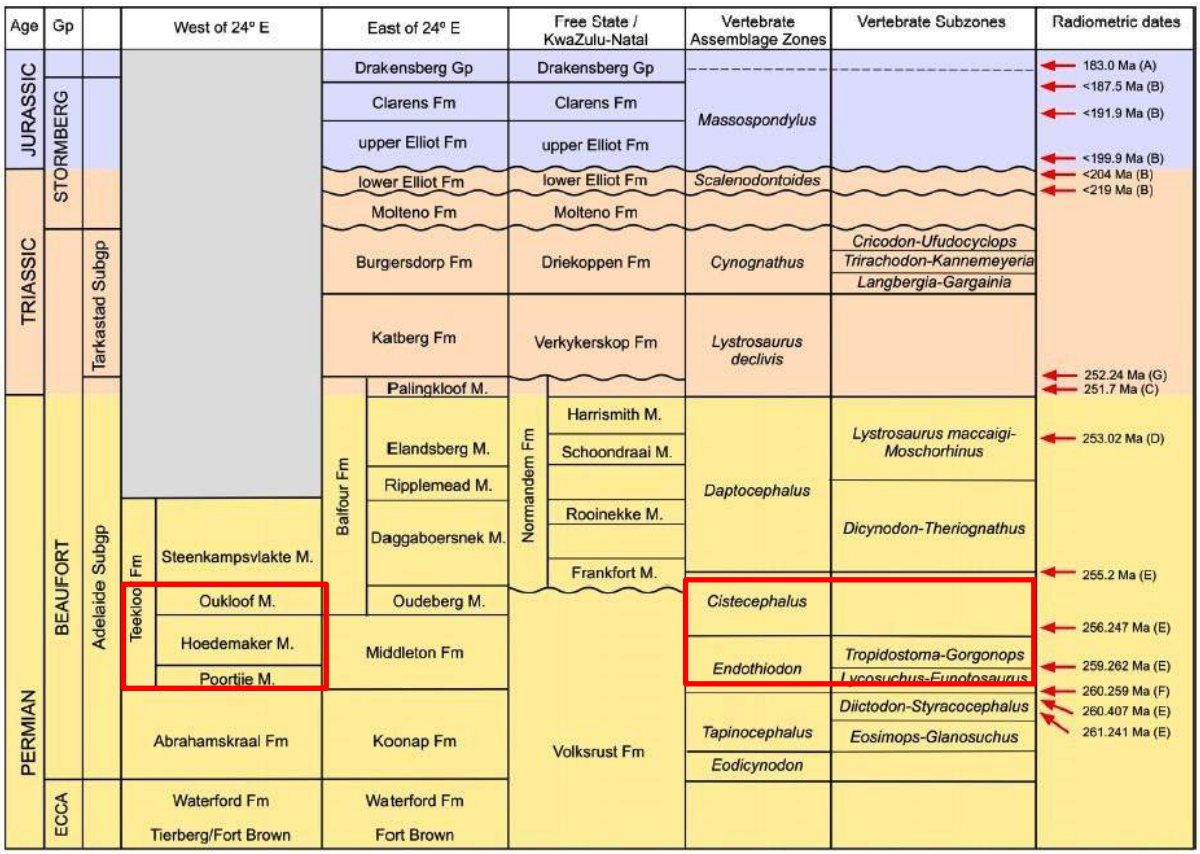

Figure 17: Revised biostratigraphic zonation of the Karoo Supergroup in the Main Karoo Basin (from Smith et al. 2020). Rock units and assemblage zones represented in the present project areas are outlined in red. *N.B.* Lower Beaufort Group sediments in the present project area (just west of 24° E) are conventionally assigned to the Teekloof Formation and dated between 260 to 255 Ma but have been assigned in part to the Balfour Formation on the published 1: 250 000 geological map (See Figs. ** and **).

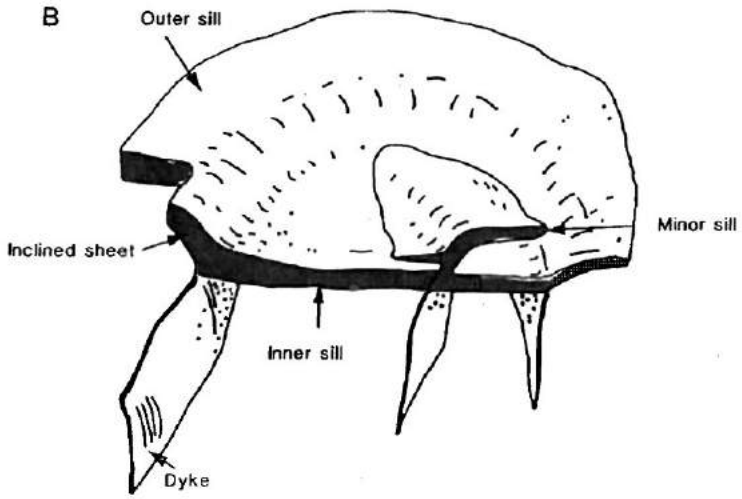

Figure 18: Reconstruction of the complex, saucer-shaped geometry of many Early Jurassic dolerite sills and associated feeder dykes of the Karoo Dolerite Suite, as well seen in the Victoria West region (from Chevallier & Woodford 1999). Stacked sets of sills, younging downwards, have been recorded here.

Figure 19: Upper portion of the Lower Beaufort Group stratigraphic succession in the study region near Richmond, as seen in the slopes of Bloukop (Farm Nieuwefontein 89), just NW of the main grid connection corridor, *viz*: the upper Teekloof Formation comprising the Oukloof Member sandstone package overlain by mudrocks of the Steenkampsvlakte Member. The latter, characterised by *Dicynodon* AZ fossil assemblages, does not occur within the present project footprint, however.

Figure 20: Lower portion of the Lower Beaufort Group (Teekloof Formation) stratigraphic succession in the study region near Richmond as seen in the slopes of Blouberg (Farm Wynandsfontein 91), just SE of the main grid connection corridor, *viz:* Poortjie Member sandstone package overlain by mudrocks and thin channel sandstones of the Hoedemaker Member, capped here by a dolerite sill.

Figure 21: Reasonably good exposure of dusky purple-brown mudrock facies of the Poortjie Member close to the main grid connection corridor on the lower slopes of Blouberg, Burgers Fontein 92.

Figure 22: Low exposure of Teekloof Formation mudrocks - mapped within the Poortjie Member - showing horizons of weathered-out, pedogenic ferruginous calcrete concretions, *vlaktes* on Gegundefontein 53. Isolated fragments of ferruginised rolled bone have been recorded in such settings (Figure 65).

Figure 23: Heterolithic package of tabular, thin-bedded sandstones and pedocrete-rich mudrocks exposed in the bed of the Burgerspruit, Burgersfontein 92 (Hammer = 30 cm). Unusually good mudrock exposures here have yielded several fragmentary and baked vertebrate fossils (Figs. 61 & 62). These beds are mapped within the Hoedemaker Member but may belong to the Poortjie Member.

Figure 24: Golden-brown, tabular channel sandstone horizons of the Poortjie Member on the eastern side of the main grid connection corridor northwest of Platberg, Burgers Fontein 92.

Figure 25: Dolerite-capped escarpment just outside the south-western margins of the GKRE project area. The sandstone package is probably the Oukloof Member of the Teekloof Formation (or alternatively the Oudeberg Member at the base of the Balfour Formation; see map Fig. 15). Note the limited exposure of potentially fossiliferous mudrocks here.

Figure 26: Thin *krans* of well-jointed, blocky-weathering, quartzitic channel sandstone on Vogelstruisfontein 84 with a higher-lying dolerite sill in the background.

Figure 27: Low ridge of tough, vuggy quartzite - a baked channel sandstone - running across the extensive *vlaktes* on Gegundefontein 53.

Figure 28: Thick breccia of reworked mudflakes and calcrete (now represented as voids due to metasomatic dissolution during dolerite intrusion) at the base of a channel sandstone at the southern end of the Rooiberg ridge on Gegundefontein 53 (Hammer = 30 cm). Unbaked Beaufort Group channel breccias often contain transported fragments of bone and teeth but, if originally present, they have probably been dissolved away here.

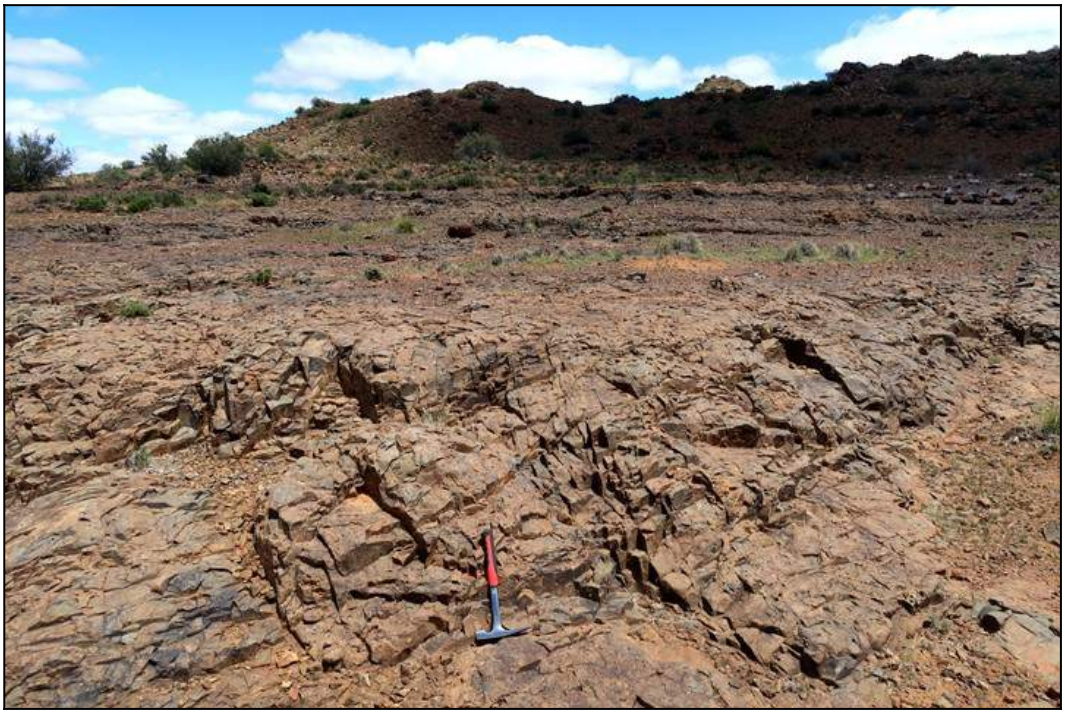

Figure 29: Densely-jointed exposure of tough, brownish-weathering, locally vuggy hornfels (baked mudrock), southern end of the Rooiberg ridge on Gegundefontein 53 (Hammer = 30 cm).

Figure 30: Stream gulley exposure of baked Beaufort Group sediments comprising typically very dark to black, blocky-weathering hornfels (an important raw material for stone artefacts locally) capped by a thin, pale brown quartzite, southern end of the Rooiberg ridge on Gegundefontein 53 (Hammer = 30 cm).

Figure 31: Baked, dark grey mudrocks and paler fine-grained sandstones of the Balfour Formation close to the main grid connection corridor on Farm 96 (hammer = 30 cm). The sandstone facies shows numerous cavities or *vugs* while the pale, irregularly rounded structures within the mudrocks are mainly calcrete concretions affected by thermal metamorphism and metasomatism by hot circulating fluids during dolerite intrusion. Any fossils originally present are likely to have been destroyed.

Figure 32: Horizon of large (meter-scale), oblate sphaeroidal concretions of ferruginous carbonate weathering out of the top of an Oukloof Member channel sandstone, southern sector of Rondavel 85 (Hammer = 30 cm).

Figure 33: Small exposure of purple-brown mudrock and thin sandstone of the Lower Beaufort Group surrounded by quartzitic and doleritic colluvial gravels, southern sector of Rondavel 85. Such isolated hillslope exposures are a key target for palaeontological recording (*cf* possible tetrapod burrow in Fig. 66 recorded here).

Figure 34: Basal contact of a baked, thin-bedded channel sandstone on Vogelstruisfontein 84 showing fallen blocks of mudflake breccia (beneath 30 cm-long hammer) and local deep erosional gullying into underlying grey-green overbank mudrocks.

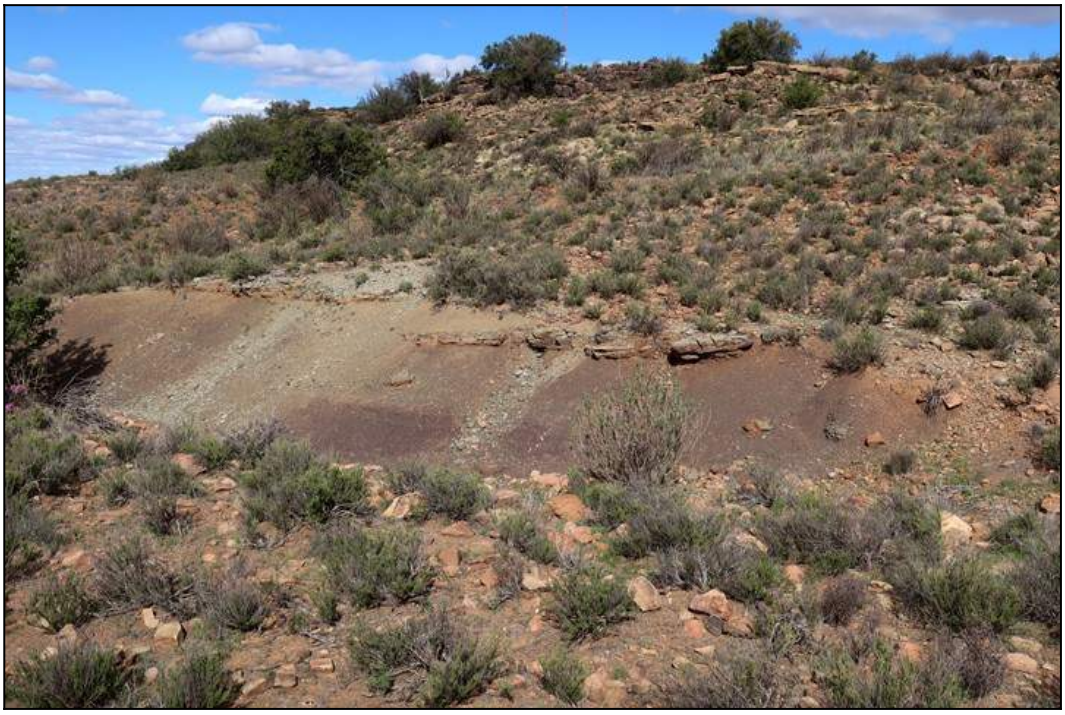

Figure 35: Hillslope gulley exposure of weathered, crumbly, purple-brown overbank mudrocks on Vogelstruisfontein 84.

Figure 36: Unusually extensive exposure of grey-green and purple-brown overbank mudrocks along a low escarpment, south-eastern sector of Rondavel 85. These beds are currently mapped within the upper Hoedemaker Member.

Figure 37: Weathered, colour-banded mudrocks exposed in a small quarry near Rondawel homestead, currently mapped within the Hoedemaker Member (*N.B.* The overlying sandstone package is mapped as Poortjie Member, which does not make stratigraphic sense).

Figure 38: Northern flank of the major Bakenskop dolerite ridge on Vogelstruisfontein 84 showing intermittent, pale exposures of an underlying baked sandstone package.

Figure 39: Dolerite dyke building the crest of a N-S trending *koppie* with a subsidiary feeder dyke on the lower slopes, Rondavel 85.

Figure 40: Olive-green, deeply-weathered, friable dolerite (*sabunga*) exposed on a lower hillslope on Gegundefontein 53.

Figure 41: Typical colluvial gravels in a region extensively intruded by dolerite, dominated by rounded, rusty-brown dolerite corestones and paler, more angular metaquartzite clasts, Gegundefontein 53 (Hammer = 30 cm).

Figure 42: Thick prism of orange-brown, well-sorted, well-bedded sandy alluvium with only sparse gravel clasts overlying Lower Beaufort Group bedrocks exposed in the deeply-incised banks of the Burgerspruit along the main grid connection corridor (Hammer = 30 cm).

Figure 43: Banks of the Burgerspruit on Burgers Fontein 92 showing partially calcretised older alluvium overlying weathered, calcrete-veined dolerite. Fossil root casts (rhizoliths) seen here are shown in more detail in Figure 68.

Figure 44: Good incised stream back section through thick, gravelly to sandy alluvial deposits as well as comparable modern stream alluvium, downstream of a farm dam on Bult and Rietfontein 96.

Figure 45: Erosion gulley section through orange-brown sandy alluvium typical of doleritic areas, Gegundefontein 53 (Hammer = 30 cm). The basal gravels overlie a composite gritty to gravelly calcrete hardpan which is in turn underlain by weathered Teekloof Formation mudrocks.

Figure 46: Three dimensional polygonal network of calcrete veins – perhaps shrinkage cracks – within older, semi-consolidated alluvial sands seen in an erosion gulley incised into older alluvial deposits on Rondavel 85.

Figure 47: Donga-eroded, thick sandy to gravelly alluvium underlying *vlaktes* in the main grid connection corridor west of Blouberg, Farm Burgers Fontein 92.

Figure 48: Typical orange-brown ferruginous sands and doleritic or quartzitic surface gravels that mantle many alluvial plains in the study area, as seen here on Vogelstruisfontein 84.

3. PALAEONTOLOGICAL HERITAGE WITHIN THE GKRE AND GRID CONNECTION PROJECT AREAS

The Late Permian Teekloof Formation bedrocks in the GKRE and grid connection project areas are characterised by fossil assemblages of what have, until recently, been termed the *Pristerognathus*, *Tropidostoma* and *Cistecephalus* Assemblage Zones (AZs) (Kitching 1977, Keyser & Smith 1977-78, Rubidge 1995, Van der Walt *et al.* 2010, Smith *et al.* 2012, 2020) (Figs. 16, 17 & 49). Recent revision of the Lower Beaufort Group biostratigraphic zonation has incorporated most of the first two assemblages into the *Endothiodon* Assemblage Zone (Day & Smith 2020). The fossils recorded within these AZs include a wide range of fossil vertebrates – especially reptiles and therapsids ("mammal-like reptiles" or protomammals"") – as well as fish, amphibians, plant remains, microfossils and trace fossils (Rubidge 1995, Rubidge 2005, Smith *et al.* 2012, Day & Smith 2020, Smith 2020). Le Roux and Keyser (1988) briefly mention fossil vertebrate taxa recorded in the Teekloof Formation in the Victoria West sheet area. In addition Kitching (1977) provides palaeofaunal lists for specific localities within the Great Karoo region, including several near Victoria West. The recent review of Beaufort Group vertebrate fossil sites by Nicolas (2007) shows a high concentration of finds along the N1 to the northeast of Three Sisters and south of Victoria but fewer sites between Victoria West and Richmond (Fig. 50). In the vicinity of dolerite intrusions the preservation of vertebrate fossils has been seriously compromised due to baking and chemical alteration, while voluminous doleritic and metasedimentary colluvium often masks the nearby fossiliferous sedimentary bedrocks. Thick deposits of older, semi-consolidated alluvium in the Karoo region may occasionally contain important assemblages of fossil vertebrates (*e.g.* Plio-Pleistocene mammal bones and teeth) as well as reworked petrified wood, trace fossils (*e.g.* calcretised termitaria, rhizoliths) and freshwater molluscs such as unionid bivalves (swan mussels).

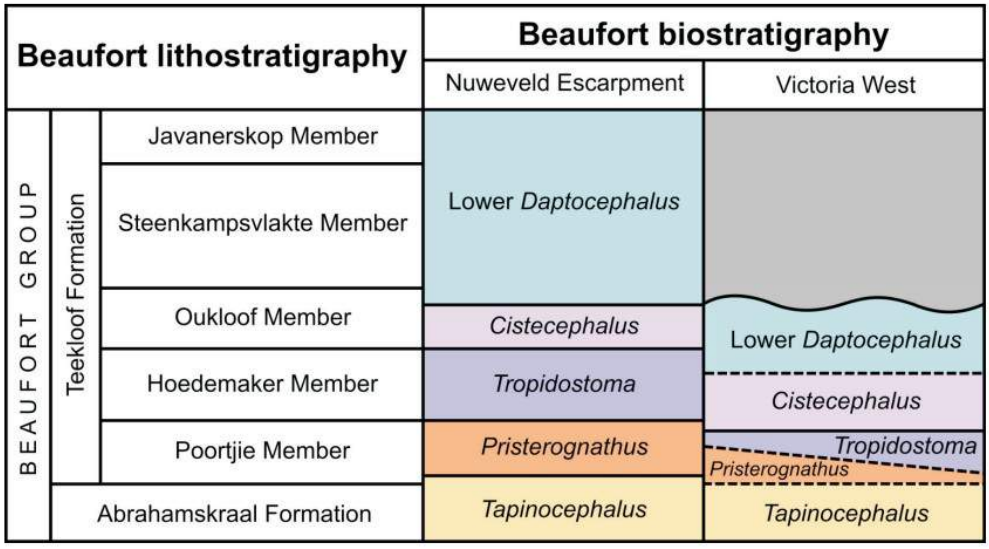

Figure 2. Relationship of Karoo biostratigraphy to the lithostratigraphy along the Nuweveld. Escarpment and in the Victoria West area. Nuweveld relationships based on Rubidge (1995), with amendments from Day *et al*. (2015) and Viglietti *et al*. (2016, 2017).

Figure 49: Table from Day and Rubidge (2020a) illustrating possible differences in the distribution of Lower Beaufort Group fossil assemblage zones in relation to the lithostratigraphy along the Nuweveld Escarpment *versus* the Victoria West region. Some of these real or apparent contrasts might be resolved by detailed geological re-mapping and palaeontological surveying in the latter area.

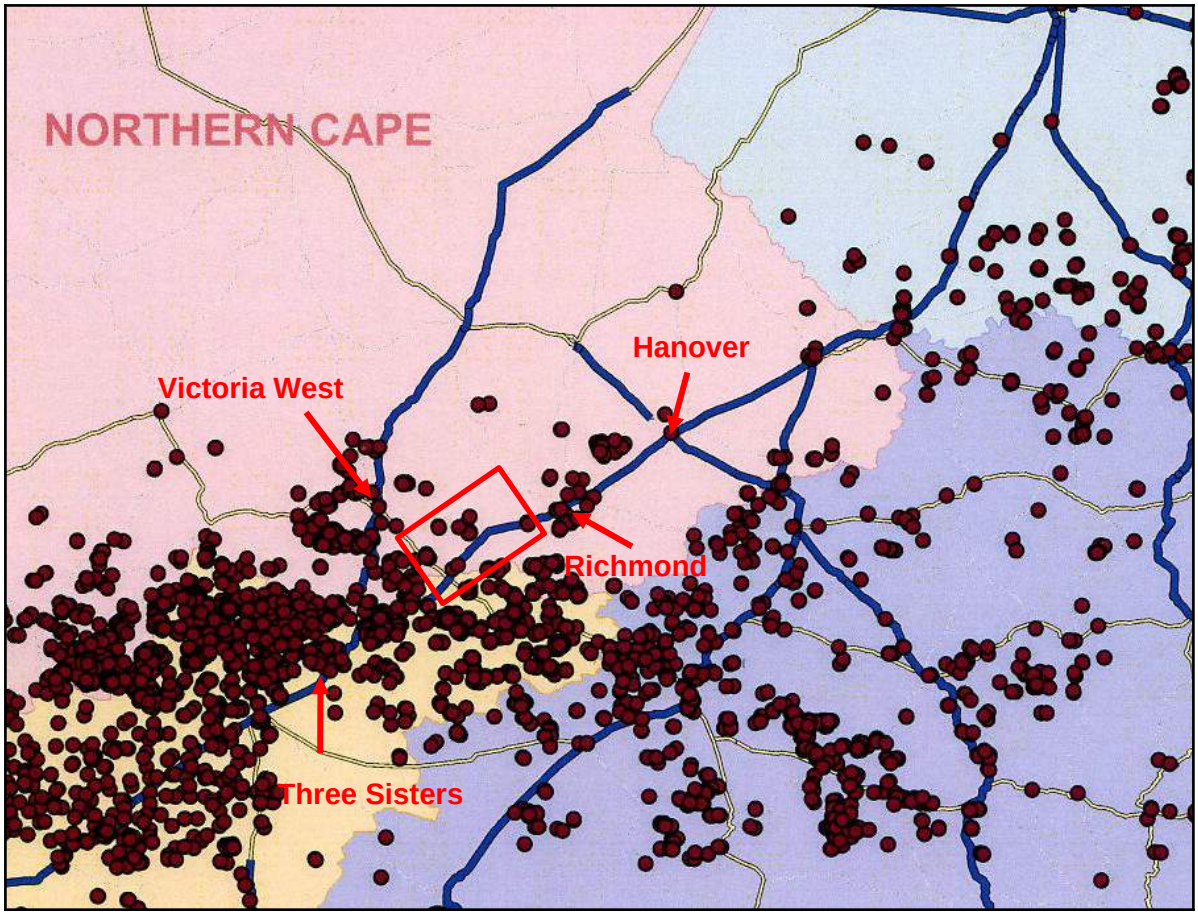

Figure 50: Distribution map of recorded vertebrate fossil sites within the Beaufort Group of the Great Karoo around the junction of the Western, Northern and Eastern Cape and the Free State (From Nicolas 2007). Few fossil sites are recorded in the vicinity of the present GKRE and grid connection project area between Richmond and Hutchinson / Gamma MTS (see red rectangle). There is a long history (> 100 years) of fossil collection by both academic palaeontologists as well as knowledgeable amateurs at sites close to Biesiespoort Station just to the west of Gamma MTS.

3.1. Fossil biotas within the Teekloof Formation : Poortjie Member

The arenaceous Poortjie Member as well as the uppermost beds of the underlying Abrahamskraal Formation are characterised palaeontologically by fossils of what was until recently termed the *Pristerognathus* Assemblage Zone (Smith & Keyser 1995a) which now forms the lower portion of a new *Endothiodon* Assemblage Zone (Day & Smith 2020). This important Late Permian, low-diversity (post-extinction recovery phase) terrestrial biota is dominated by various therapsids ("mammal-like reptiles") such as the moderate-sized therocephalian carnivore *Pristerognathus* as well as several gorgonopsian predators / scavengers and herbivorous dicynodonts. The commonest genus by far is the small burrowing dicynodont *Diictodon* (Keyser and Smith 1977-78, Smith & Keyser 1995a, MacRae 1999, Cole *et al*., 2004, Rubidge 2005, Almond 2010a, 2014a, Smith *et al.* 2012; Fig. 51 herein). There are also large, rhino-sized herbivorous pareiasaur reptiles (*Bradysaurus* spp.), the small parareptile *Eunotosaurus* (Day *et al.* 2013), crocodile-like temnospondyl amphibians (*Rhinesuchus*), palaeoniscoid fish, vascular plant fossils of the *Glossopteris* Flora

(fossil wood, leaves *etc*) and various trace fossils, including invertebrate burrows and tetrapod trackways. Rare relict dinocephalians recorded recently within the lowermost Poortjie Member are now assigned to the impoverished post-extinction biota at the top of the revised *Tapinocephalus* Assemblage Zone (Day *et al.* 2015a, 2015b, Day & Rubidge 2020b).

Most fossils in the *Pristerognathus* Assemblage Zone are found in the softer-weathering mudrock facies (floodplain sediments) that are usually only exposed on steeper hill slopes and in stream gullies. Fossils here are often associated with pedogenic limestone nodules or calcretes (Smith 1993a, Smith & Keyser 1995a). The mudrocks lie between the more resistant-weathering channel sandstones, which in the classic Poortjie Member sections along the Nuweveld Escarpment often display a distinctive "golden yellow" tint. Fossil skeletal remains also occur in the lenticular channel sandstones, especially in intraformational lag conglomerates towards the base, but are usually very fragmentary and water-worn ("rolled bone").

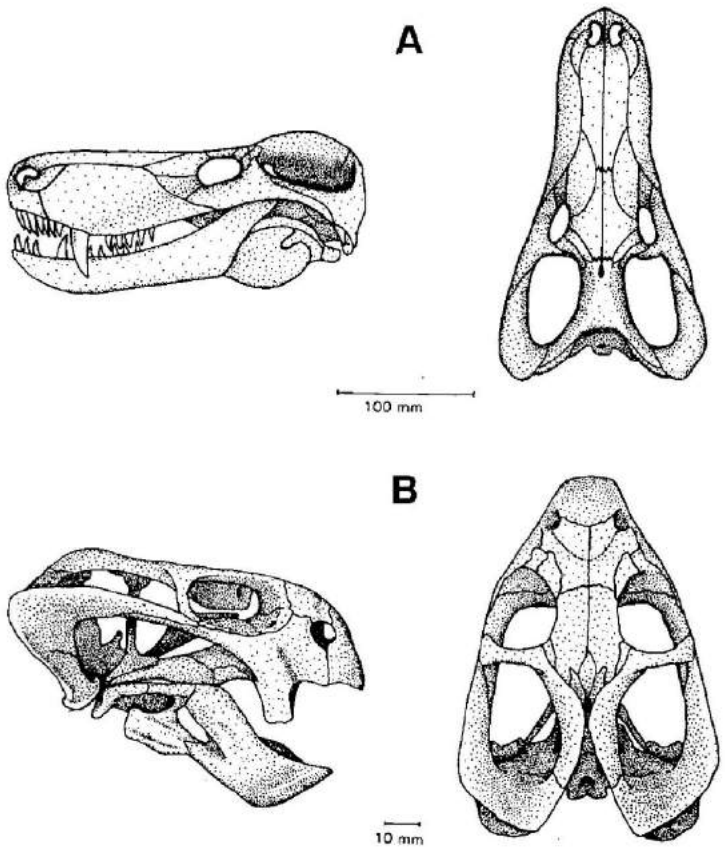

Figure 51: Skulls of typical therapsids from the *Pristerognathus* Assemblage Zone (now the lower part of the *Endothiodon* Assemblage Zone): A. the dog-sized carnivorous therocephalian *Pristerognathus* and B. the small herbivorous dicynodont *Diictodon* (From Smith & Keyser 1995a).

3.2. Fossil biotas within the Teekloof Formation: Hoedemaker Member

The *Tropidostoma* Assemblage Zone (AZ) characterizes the Hoedemaker Member of the Teekloof Formation along the Great Escarpment and elsewhere (Le Roux & Keyser 1988, Smith & Keyser, 1995b). This faunal assemblage is assigned to the early Lopingian (Wuchiapingian) Age of the Late Permian Period. It has recently been incorporated into the upper part of a revised *Endothiodon* Assemblage Zone (Day & Smith 2020).The following major categories of fossils have been recorded within *Tropidostoma* AZ sediments in well-collected sections along the Nuweveld Escarpment and elsewhere (Kitching 1977, Keyser & Smith 1977-78, Le Roux & Keyser 1988, Anderson & Anderson 1985, Smith & Keyser 1995, MacRae 1999, Cole *et al*., 2004, Smith *et al.* 2012, Day & Smith 2020):

- isolated petrified bones as well as rare articulated skeletons of terrestrial vertebrates (tetrapods) such as true reptiles (notably large herbivorous pareiasaurs) and therapsids or “mammal-like reptiles” (*e.g.* diverse herbivorous dicynodonts, flesh-eating gorgonopsians, and insectivorous therocephalians) (Fig. 52);
- aquatic vertebrates such as large temnospondyl amphibians (*Rhinesuchus* spp., usually disarticulated), and palaeoniscoid bony fish (*Atherstonia*, *Namaichthys*, often represented by scattered scales rather than intact fish);
- freshwater bivalves (*e.g. Palaeomutela*);
- trace fossils such as worm, arthropod and tetrapod burrows and trackways, coprolites (fossil droppings), fish swimming trails;
- vascular plant remains including leaves, twigs, roots and petrified woods (“*Dadoxylon*”) of the *Glossopteris* Flora (usually sparse, fragmentary), especially glossopterid trees and arthrophytes (horsetails).

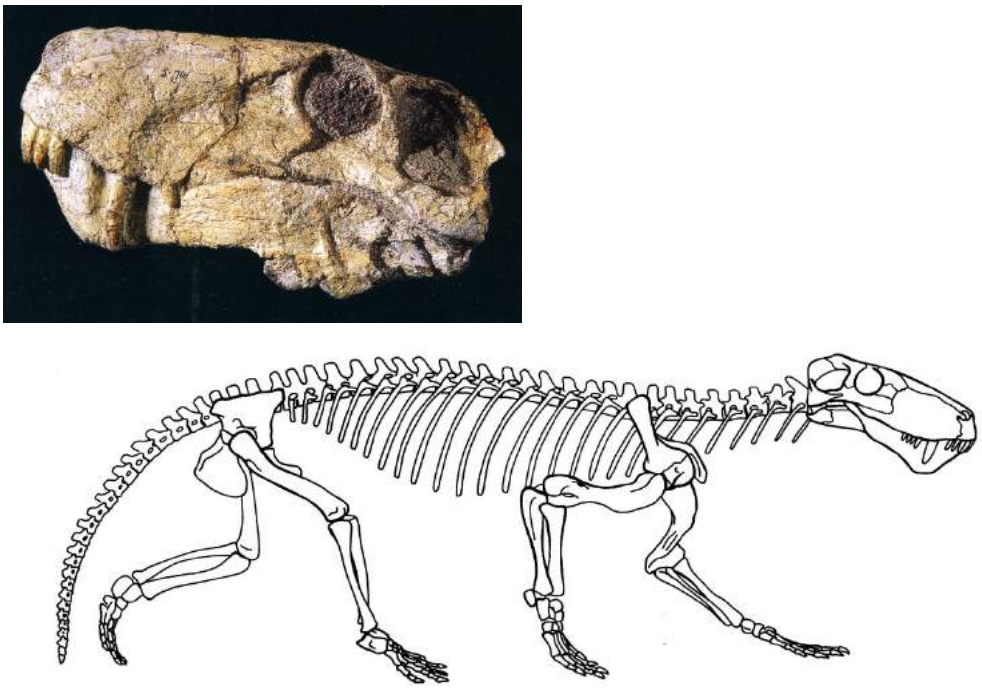

Figure 52: Skull and skeleton of a saber-toothed carnivore, the gorgonopsian *Lycaenops* – a typical, albeit rare, member of the *Tropidostoma* (now upper *Endothiodon*) Assemblage Zone.

According to Smith and Keyser (1995b) the tetrapod fauna of the *Tropidostoma* Assemblage Zone is dominated by the small burrowing dicynodont *Diictodon* that constitutes some 40% of the fossil remains recorded here. There are several genera of small-bodied toothed dicynodonts (*e.g. Emydops, Pristerodon*) as well as medium-sized forms like *Rachiocephalus* and *Endothiodon* (*cf* Cluver & King 1983, Botha & Angielczyk 2007 for more details about these genera). Carnivores are represented by medium-sized gorgonopsians (*e.g. Lycaenops, Gorgonops*; Fig. 33) as well as smaller, insectivorous therocephalians such as *Ictidosuchoides*. Among the large (2.3-3 m long), lumbering pareiasaur reptiles the genus *Pareiasaurus* replaces the more primitive *Bradysaurus* seen in older, Middle Permian Beaufort Group assemblages.

As far as the biostratigraphically important tetrapod remains are concerned, the best fossil material within the Hoedemaker Member succession is generally found within overbank mudrocks, whereas fossils preserved within channel sandstones tend to be fragmentary and water-worn (Rubidge 1995, Smith 1993b). Many vertebrate fossils are found in association with ancient soils (palaeosol horizons) that can usually be recognised by bedding-parallel concentrations of calcrete nodules. Smith and Keyser (1995b) report that in the *Tropidostoma* Assemblage Zone / Hoedemaker Member most tetrapod fossils comprise isolated disarticulated skulls and post-cranial bones, although well-articulated skeletons of the small dicynodont *Diictodon* are locally common, associated with burrows (See also Smith 1993b for a benchmark study of the taphonomy of vertebrate remains in the Hoedemaker Member near Loxton).

3.3. Fossil biotas within the Teekloof Formation: Oukloof Member

Diverse fossil assemblages from the sandstone-dominated package in the middle of the Teekloof Formation (Oukloof Member) as well as the correlative sandstone package at the base of the Balfour Formation (Oudeberg Member) are referred to the *Cistecephalus* Assemblage Zone of Late Permian (Wuchiapingian) age (*c*. 257-255 Ma). They record full recovery of continental biotas of southern Gondwana from the end-Middle Permian Mass Extinction Event of *c*. 260 Ma. Vertebrate and other fossil taxa recorded in this AZ have been outlined by Smith and Keyser (1995c), Smith *et al.* (2012) and, most recently, by Smith (2020). Terrestrial tetrapods – mainly therapsids - include a wide range of small- to large-bodied dicynodont herbivores (Fig. 53), several biarmosuchians, large gorgonopsian carnivores and a range of smaller predators such as therocephalians, cynodonts and lizard-like eureptiles (*Euparkeria*). There are also several genera of pareiasaur reptiles, such as the large *Pareiasaurus* as well as a few much smaller forms (Fig. 54). Aquatic vertebrates are represented by a limited variety of palaeoniscoid fish and rhinesuchid temnospondyl amphibians. Non-vertebrate fossil groups include freshwater bivalves, vertebrate and invertebrate trace fossils (coprolites, burrows, trackways, rhizoliths) and vascular plants of the *Glossopteris* Flora.

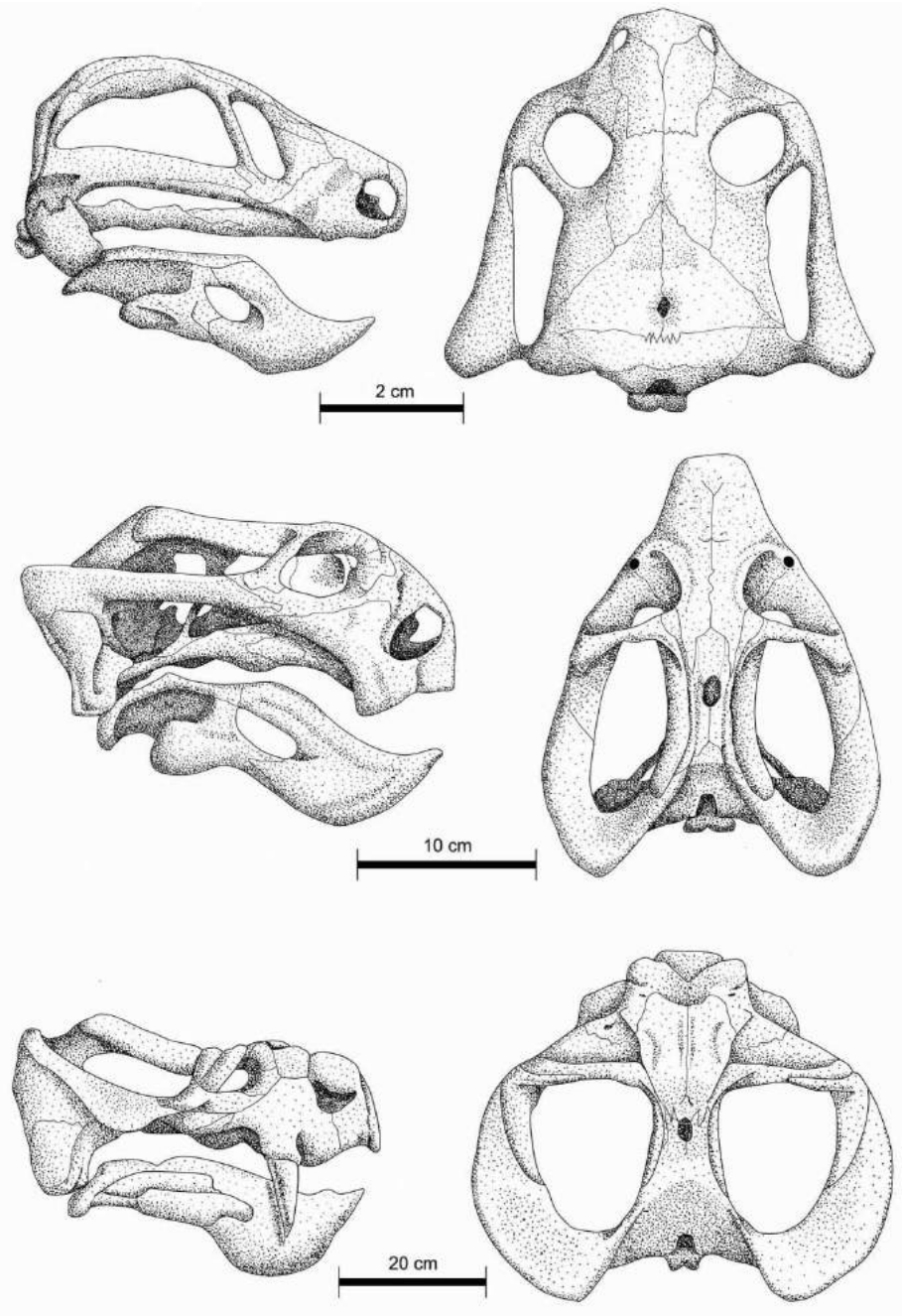

Figure 53: Skulls of key therapsids from the Late Permian *Cistecephalus* Assemblage Zone. From top to bottom these are *Cistecephalus*, *Oudenodon* and *Aulocephalodon* (from Smith 2020). All these genera of herbivorous dicynodonts shave been recorded from the Victoria West 1: 250 000 sheet area but not, to the author's knowledge, from the present project area.

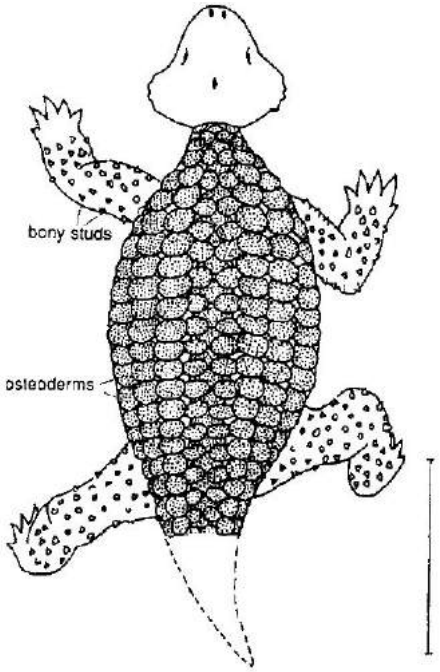

Figure 54: Reconstruction of *Anthodon*, a small-bodied pareiasaur reptile (*c*. 1.0-1.5 m long) from the Late Permian *Cistecephalus* AZ of the Main Karoo Basin showing distinctive dermal armour composed of closely spaced bony scutes or osteoderms (Image from Lee 1997). See also figures 56 to 58 below.

3.4. Teekloof fossils in the GKRE and grid connection project areas

While no historical fossil sites are indicated on the relevant 1: 250 000 Victoria West geological map (Fig. 15), or specifically mentioned here in the sheet explanation by Le Roux and Keyser (1988), a small number of vertebrate fossil sites are recorded within or close to the present project area in the database compiled by Nicolas (2007) (see Fig. 50 herein). Almost no useful palaeontological field data can be gleaned from several PIA reports relating to proposed or authorised renewable energy projects in the broader Richmond – Victoria West subregion of the Great Karoo, the great majority of which are only at desktop level (*e.g.* Rossouw 2011. 2021, Almond 2010a, 2010b, 2012a-c, 2015a, 2015b, Fourie 2016, 2021).

Few, and then generally very fragmentary and highly baked, fossil remains are recorded within channel sandstone facies of the Teekloof Formation (Figs. 63, 64). Where mudrock exposure is exceptionally good, such as long the bed of the Burgerspruit, a higher concentration of vertebrate fossils is indeed recorded but even here they tend to be sparse and fragmentary (Figs. 60 to 62). Unfossiliferous mudrocks tend to occur lower down within the Teekloof succession - within the probable Poortjie Member – and may reflect an early phase of the faunal recovery following the end Middle Permian Mass Extinction event of *c*. 260 Ma. The only potentially interesting fossils recorded during this study come from the upper parts of the Teekloof succession here (Oukoof Member).

Fossil material recorded during the recent 3-day palaeontological site visit to the combined GKRE and grid connection project area near Richmond is tabulated in Appendix 2, together with GPS locality data, a brief

description, provisional Field Rating and recommended mitigation (if any is necessary). These sites are mapped in relation to the proposed GKRE infrastructure layouts and grid connection corridor options in Figures A1 to A3 (See Appendix 2). In addition to a handful of scrappy, and often thermally metamorphosed, vertebrate skeletal remains from both sandstone and mudrock facies of the Teekloof Formation (Figs. 55 to 68), the recorded Palaeozoic fossils include a small range of trace fossils (*e.g.* equivocal tetrapod burrows and small-scale invertebrate burrows (Figs. 66 & 67). Possible plant stem casts were seen in association with pond margin palaeosurfaces, but no plant skeletal remains such as stem or leaf compression material or petrified wood.

The only fossil remains of potential scientific value recorded here are several blocks of ferruginised pedogenic calcrete containing the fragmentary post-cranial remains of a small-bodied pareiasaur reptile – either a juvenile or perhaps a member of one of the dwarf pareiasaur genera known from the *Cistecephalus* Assemblage Zone (Figs. 54, 55 to 58). The material comes from the lowest part of the Oukloof Member (Balfour Formation as mapped) and, if identifiable, might help resolve the current lithostratigraphic and biostratigraphic confusion surrounding the Teekloof succession in this subregion of the Main Karoo Basin. Among the skeletal elements preserved are partial moulds of several discoidal, ellipsoidal dermal scutes or osteoderms that characterize pareiasaur reptiles and appear to have taxonomic value (*cf* Boonstra 1934, Findlay 1970, Lee 1997, Scheyer & Sander 2009).

Please note that:

- The fossil sites recorded represent only a representative fraction of all the sites present at surface. The absence of recorded sites in an area does *not* imply that no fossils are present here, at or beneath the land surface;
- Given current considerable uncertainties concerning the mapping and lithostratigraphy of the Lower Beaufort Group bedrocks in the project area between Richmond and Victoria West (*cf* Day & Rubidge 2020a, Almond 2021), the fossils listed here (Appendix 2) are only provisionally referred, if at all, to a specific subunit or member of the Teekloof Formation.

As illustrated in satellite map Figures A1 to A3, remarkably few fossils were recorded during the 3-day site visit. This is, to a considerable extent, attributable to the extensive network of dolerite intrusions (sills, dykes *etc*) which compromise fossil preservation, exposure and recording by:

(1) Destroying or degrading fossils *in situ* through thermal metamorphosis and metasomatism, leading to white, friable bone or complete dissolution of skeletal material and associated pedocretes;
(2) Indirectly generating large volumes of rubbly colluvium composed of doleritic waste as well as resistant-weathering metaquartzite and hornfels from the metamorphic aureoles of the dolerite intrusions;
(3) Promoting the accumulation of thick prisms of sandy to gravelly alluvium overlying sedimentary bedrocks in low-lying terrain because normal denudation and drainage processes are hampered by numerous inclined sills and dykes of dolerite.

In addition, near-surface Teekloof Formation mudrock facies seen in erosion gullies, borrow pits and some hillslope exposures often appear to be highly weathered (crumbly / leached) and / or veined by secondary calcrete, further decreasing their palaeontological heritage potential (Fig. 37).

The palaeosensitivity of the GKRE and grid connection project area (dolerites, thermally metamorphosed Teekloof bedrocks, alluvial and colluvial deposits, calcrete hardpans, soils) is consequently Low to Very Low overall. As apparent on satellite images, there are very few - and then only small - good exposures of Teekloof mudrock facies (*N.B.* Several promising-looking grey areas on satellite images do not show good mudrock exposure on the ground).

The great majority of the fossils recorded are (1) fragmentary, (2) degraded by thermal metamorphosis and (3) probably represent common taxa. Within the combined GKRE project area none of the known fossil sites lies within 20 m of the proposed infrastructure footprints, so they do not warrant palaeontological mitigation. Fossil sites recorded within the grid connection corridor are all of low scientific and / or conservation value while several are protected within the standard ecological buffer zone along drainage lines. Again, no mitigation is recommended with respect to these low significance sites.

Figure 55: Several blocks of brown ferruginous carbonate containing post-cranial remains, including vertebrae, ribs and dermal scutes, of a small to medium-sized tetrapod – probably a juvenile or dwarf pareiasaur reptile (See following 3 figures for details), Oukloof Member, Rondavel 85 (Scale = 15 cm) (Loc. 863).

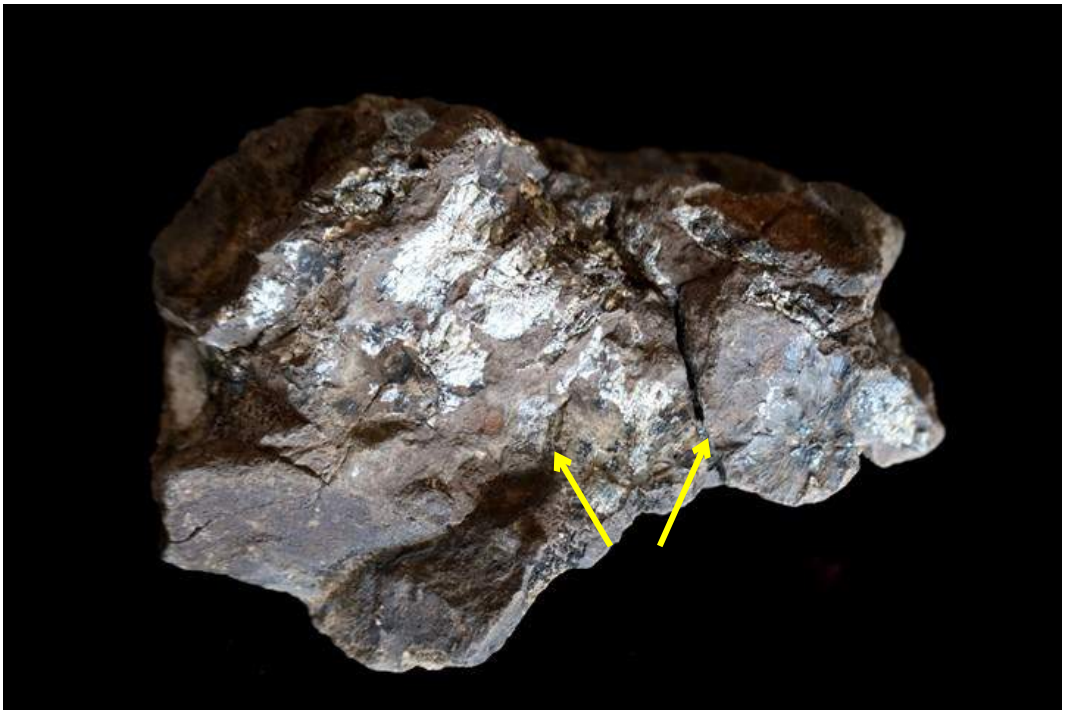

Figure 56: Close-up of two of the blocks illustrated above (specimen is *c*. 13 cm across as seen here) showing impressions of rounded dermal scutes / osteoderms (arrowed) (Loc. 863).

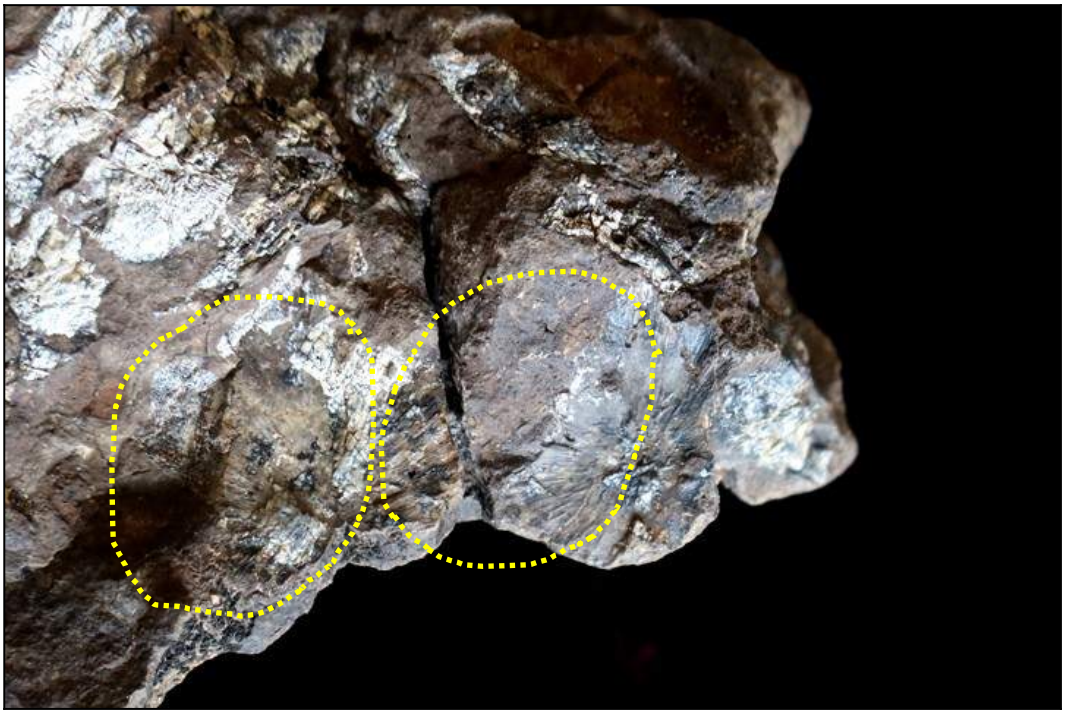

Figure 57: Close up of two adjacent dermal scutes on the specimen illustrated above, preserved in part as moulds, showing low convexity, absence of a pronounced central boss and presence of fine radial lines. The roughly elliptical scutes are very roughly 2.5 to 4 cm in maximum diameter.

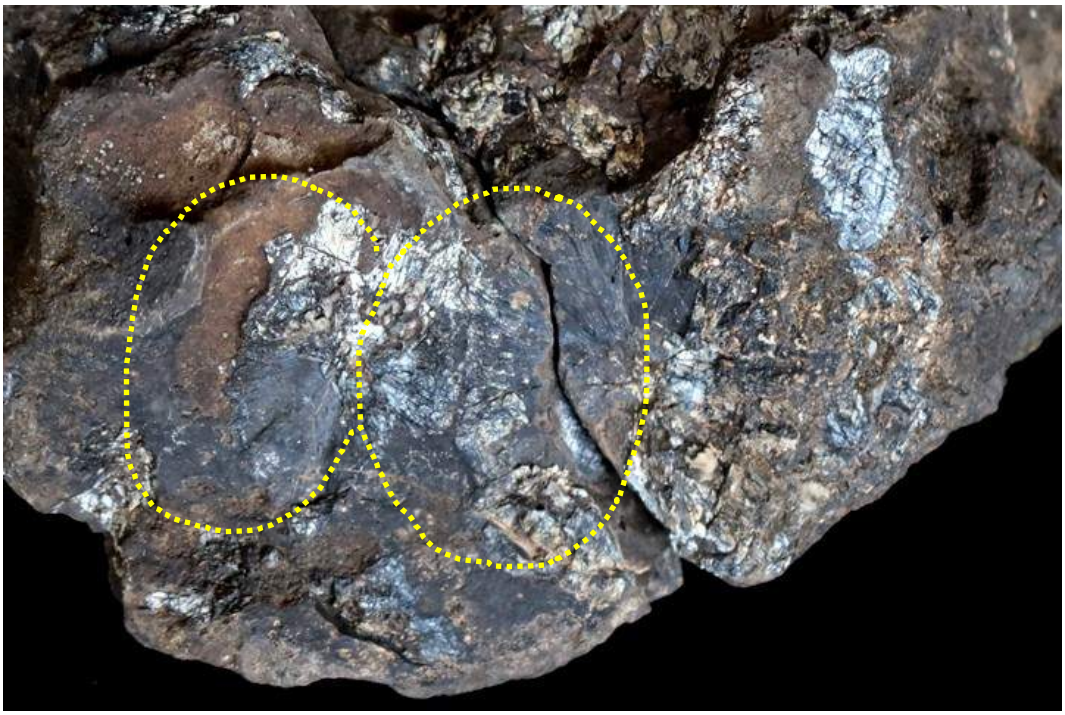

Figure 58: Two more adjoining and possibly overlapping dermal scutes, same specimen as two previous figures.

Figure 59: Distorted / crushed, baked skeletal material - possibly a small (*c*. 5 cm long) skull - embedded within a purple-brown mudflake-rich debris flow deposit, Oukloof Member, Rondavel 85 (Loc. 859).

Figure 60: Crushed and metamorphosed small tetrapod skull within baked, thin-bedded, grey-green Poortjie Member siltstone associated with possible baked gypsum roses and exposed on the bed of the Burgerspruit, Burgersfontein 92 (specimen is *c*. 6.5 cm across as seen here) (Loc. 918).

Figure 61: Fragment of skull (probably palate) of small tetrapod embedded within baked, grey-green wacke, Poortjie Member, bed of the Burgerspruit, Burgersfontein 92 (specimen is 4 cm across as seen here) (Loc. 914).

Figure 62: White, postcranial bone of a small to medium-sized tetrapod embedded within baked, grey-green wacke, Poortjie Member exposure in the bed of the Burgerspruit, Burgersfontein 92 (specimen is 8.5 cm across as seen here) (Loc. 915).

Figure 63: Small blocks of baked grey-green quartzite (largest block is *c*. 5 cm across) containing baked white bone fragments of one or more small-bodied tetrapods, Oukloof Member, Farm 96 (Loc. 896).

Figure 64: Isolated fragment of baked, whitish postcranial bone (possibly associated with pedogenic concretion) with reaction halo, embedded within pale yellowish metaquartzite quartzite channel sandstone, possibly Poortjie Member, Gegundefontein 53 (Loc. 833) (specimen is *c*. 6 cm across).

Figure 65: Small (*c*. 5.5 cm diameter), well-rounded block of ferruginised "rolled bone" in surface float among weathering-out ferruginous, purple-brown pedocrete concretions, probably of the Poortjie Member, Gegundefontein 53 (Loc. 828).

Figure 66: *Equivocal* inclined tetrapod burrow cast (*c*. 25-30 cm wide) infilled with grey-green sandstone and surrounded by crumbly purple brown mudrock, possibly Oukloof Member, Rondavel 85 (Hammer = 30 cm).

Figure 67: Upper bedding surface of a thin crevasse splay sandstone with sandstone-infilled mudcracks, microbial mat textures, narrow horizontal burrows of undermat miners and possible vertical burrows or plant stem casts (rounded features, *c*. 1 cm wide), borrow pit exposure of the Hoedemaker Member on Rondavel 85 (Loc. 884).

Figure 68: Late Caenozoic sandy to gravelly alluvium exposed in the banks of the Burgerspruit, Burgersfonteion 92 (hammer = 30 cm) (Loc. 917). The subvertical, subcylindrical structures are probably calcretised rhizoliths (plant stem or root casts).

3.4. Fossils within the Karoo Dolerite Suite

The dolerite outcrops criss-crossing the GKRE and grid connection project areas are in themselves of no direct palaeontological significance since these are high temperature igneous rocks emplaced at depth within the Earth's crust. However, as a consequence of their proximity to large dolerite intrusions, the Lower Beaufort Group country rocks in the vicinity have to a great extent been thermally metamorphosed or "baked" and metasomatised (*i.e*. recrystallised, impregnated with secondary minerals or leached by hot circulating fluids). Embedded fossil material of phosphatic composition, such as bones and teeth, has frequently been altered by baking and hot, mineral-rich circulating groundwaters – bones may become whitened and brittle or powdery, for example - and can be very difficult to extract from the hard matrix by mechanical preparation (Smith & Keyser, p. 23 *in* Rubidge 1995). Several examples of poorly preserved, thermally-altered vertebrate fossils have been recorded within the current project area (*e.g.* Figs. 60, 62 to 64). Thermal metamorphism by dolerite intrusions has therefore tended to substantially reduce the palaeontological heritage potential of adjacent Beaufort Group sediments. In addition, the large volumes of colluvial gravels of dolerite and resistant, baked metasediments (hornfels and quartzite) associated with dolerite intrusions tend to seal-in adjacent outcrop areas of Beaufort Group bedrocks whose fossils are consequently no longer inaccessible.

3.5. Fossil biotas within Late Caenozoic superficial deposits

The Quaternary to Recent superficial deposits of the Great Karoo region have been comparatively neglected in palaeontological terms for the most part. However, they may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals (*e.g.* Skead 1980, Klein 1984, MacRae 1999, Partridge & Scott 2000). These may include ancient human remains of considerable palaeoanthropological significance (*e.g*. Grine *et al.* 2007). Other late Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites, rhizoliths or plant root casts), and plant remains such as peats or palynomorphs (pollens) in fine-grained, organic-rich alluvial horizons. Quaternary alluvial sediments may contain reworked Stone Age artifacts that are useful for constraining their maximum age.

The only fossil remains recorded from the Late Caenozoic superficial deposits within the WEF project area are subcylindrical calcretized rhizoliths (root casts) within older, semi-consolidated alluvial deposits associated with major drainage lines (Figs. 43 & 68). No special mitigation is recommended for these very common fossils. No reworked petrified wood or freshwater molluscs were observed.

4. CONCLUSIONS AND RECOMMENDATIONS

The fluvial to lacustrine sedimentary bedrocks of Late Permian Teekloof Formation (Lower Beaufort Group, Karoo Supergroup) in the combined GKRE and grid connection project areas near Richmond, Northern and Western Cape Provinces, are generally poorly exposed and have also been thermally metamorphosed due to the dense network of Early Jurassic dolerite intrusions in the region. The Teekloof Formation channel sandstones and overbank mudrocks here have yielded only very sparse, low-diversity and generally poorly preserved fossil assemblages of the *Pristerognathus* and *Tropidostoma* Assemblage Zones (recently combined within the new *Endothiodon* Assemblage Zone) as well as marginal representation of the slightly younger *Cistecephalus* Assemblage Zone. These fossils record the aftermath and full recovery of continental biotas of southern Gondwana from the major End Guadalupian Mass Extinction Event of ~260 million years ago (Ma).

Fossil specimens recorded from the Teekloof Formation bedrocks during a 3-day site visit to the combined GKRE and grid connection project areas mainly comprise a handful of scrappy therapsid cranial and post-cranial material. The only specimens of potential scientific or conservation interest are several skeletal elements of a small-bodied pareiasaur reptile - possibly a juvenile or dwarf taxon. Almost all the other specimens are fragmentary and very poorly preserved due to thermal metamorphism and metasomatism (*i.e.* alteration through secondary mineralisation and dissolution by hot circulating groundwaters) during dolerite intrusion. Furthermore, because of current considerable uncertainties regarding the geological mapping of Teekloof Formation subunits within the Richmond – Victoria West region, it is usually not possible to assign the fossil sites to a specific stratigraphic member with confidence. No fossil wood has been recorded so far within the present project area.

Thick deposits of Late Caenozoic, semi-consolidated alluvium might contain important assemblages of Plio-Pleistocene mammalian fossils (*e.g.* horn cores, bones and teeth) as well as reworked petrified wood and trace fossils (*e.g.* calcretised termitaria). However, the only fossils recorded here comprise assemblages of subvertical, calcretised rhizoliths (plant root casts) in riverbank settings. Voluminous, doleritic and quartzitic colluvial rock rubble mantling the steeper mountain slopes as well as the younger alluvial sands and gravels mantling extensive *vlaktes* within the GKRE and grid connection project areas are unlikely to be fossiliferous.

A high proportion of the WEF infrastructure will be placed along upland ridges underlain by unfossiliferous intrusive dolerite and low palaeosensitivity, thermally metamorphosed Lower Beaufort Group sediments. The solar PV project areas are focused on low relief terrain that is mantled by low palaeosensitivity Late Caenozoic sediments (alluvial sands, gravels, soils) with little or no exposure of potentially fossiliferous sedimentary bedrocks. Most of the main grid connection corridor to Gamma MTS is also floored by thick, sandy to gravelly alluvium or dolerite; limited areas of sedimentary bedrock exposure here are strongly baked with few or no well-preserved fossils. No palaeontological Very High Sensitivity / No-Go areas have been identified within the GKRE and grid connection project areas. With the exception of two fossil sites of low scientific value, none of the recorded fossil sites overlaps directly with, or lies close to (< 20 m), the proposed WEF and solar PV project footprints and no modification of the layouts through micro-siting is proposed here on palaeontological grounds. While a number of fossil sites are recorded within the

main grid connection corridor, none is of conservation significance while most sites found are already protected within standard ecological buffer zones along drainage lines. Mitigation of the known fossil sites within the GKRE and grid connection project areas is not proposed here.

Most of the proposed renewable energy project infrastructure - including wind turbines, laydown areas, underground cables, access and internal distribution roads, electrical pylons, solar panel arrays, on-site substations, BESS, site office and maintenance buildings, concrete batching plant *etc* - will overlie unfossiliferous dolerite or metamorphosed bedrocks and geologically recent superficial deposits of low palaeosensitivity. The anticipated impact significance of the proposed WEF and solar PV projects in terms of palaeontological heritage resources is likely to be VERY LOW due to (1) the very sparse distribution of fossil remains as well as (2) their almost universally poor preservation. Given the very uniform geological, and hence palaeontological, setting throughout the combined project areas, this assessment applies equally to all the proposed WEF, solar PV and grid connection projects as well as the various grid connection corridors under consideration. There is accordingly no preference on palaeontological heritage grounds for any particular grid connection route option. The proposed renewable energy projects are not fatally flawed from a palaeontological heritage viewpoint and there are no objections to their authorisation.

All the fossil sites recorded so far could, if necessary, be effectively mitigated through specialist palaeontological collection and recording of associated geological data, and this is likely to be the case for the great majority of any unrecorded fossil sites encountered in the pre-construction or construction phases as well. The potential for rare, unrecorded fossil sites of high scientific and conservation value cannot be completely excluded, however. These are best handled through a Chance Fossil Finds Protocol driven by the responsible environmental site officers and ECO, as outlined in Appendix 3. Pending the discovery of significant new fossil remains, no further specialist palaeontological studies or mitigation are recommended for the GKRE and grid connection projects. Should specialist palaeontological mitigation be triggered by significant Chance Fossil Finds, the palaeontological specialist involved will need to submit an application for a Fossil Collection Permit (SAHRA) or Work Plan (HWC) to the relevant Provincial Heritage Resources Agency. The palaeontological studies should conform to international best practice for palaeontological fieldwork and adhere as far as possible to the minimum standards for palaeontological heritage studies developed by SAHRA (2013) and HWC (2021). The palaeontological assessment reports must be submitted for consideration to the responsible Provincial Heritage Resources Agency.

6. ACKNOWLEDGEMENTS

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8. QUALIFICATIONS & EXPERIENCE OF THE 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 in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. 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 palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape as well as Limpopo, Free State, Mpumalanga, KwaZulu-Natal and Northwest Provinces under the aegis of his Cape Town-based company *Natura Viva* cc. He has served for several years 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 project, 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: GREAT KAROO RENEWABLE ENERGY - PROJECT DESCRIPTIONS

Angora Wind Farm, Northern Cape Province (WEF1)– Project Description

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~29 909ha and a development area of ~4 544ha within the project site has been identified by Great Karoo Renewable Energy (Pty) Ltd as a technically suitable area for the development of the Angora Wind Farm with a contracted capacity of up to 140MW that can accommodate up to 43 turbines. The development area consists of the four (4) affected properties, which include:

- Portion 11 of Farm Gegundefontein 53
- Portion 0 of Farm Vogelstruisfontein 84
- Portion 1 of Farm Rondavel 85
- Portion 0 of Farm Rondavel 85

The Angora Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 140MW:

- Up to 43 wind turbines with a maximum hub height of up to 120m. The tip height of the turbines will be up to 165m.
- Concrete turbine foundations to support the turbine hardstands.
- Inverters and transformers.
- Temporary laydown areas which will accommodate storage and assembly areas.
- Cabling between the turbines, to be laid underground where practical.
- A temporary concrete batching plant.
- 33/132kV onsite facility substation.
- Underground cabling from the onsite substation to the 132kV collector substation.
- Electrical and auxiliary equipment required at the collector substation that serves that wind energy facility, including switchyard/bay, control building, fences, etc.
- Battery Energy Storage System (BESS).
- Access roads and internal distribution roads.
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.

The wind farm is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Angora Wind Farm under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Angora Wind Farm set to inject up to 140MW into the national grid.

Merino Wind Farm, Northern Cape Province (WEF2) – Project Description

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~29 909ha and a development area of ~5 516ha within the project site has been identified by Great Karoo Renewable Energy (Pty) Ltd as a technically suitable area for the development of the Merino Wind Farm with a contracted capacity of up to 140MW that can accommodate up to 43 turbines. The development area consists of the three (3) affected properties, which include:

» Portion 1 of Farm Rondavel 85
» Portion 0 of Farm Rondavel 85
» Portion 9 of Farm Bult & Rietfontein 96

The Merino Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 140MW:

» Up to 43 wind turbines with a maximum hub height of up to 120m. The tip height of the turbines will be up to 165m.
» Concrete turbine foundations to support the turbine hardstands.
» Inverters and transformers.
» Temporary laydown areas which will accommodate storage and assembly areas.
» Cabling between the turbines, to be laid underground where practical.
» A temporary concrete batching plant.
» 33/132kV onsite facility substation.
» Underground cabling from the onsite substation to the 132kV collector substation.
» Electrical and auxiliary equipment required at the collector substation that serves that wind energy facility, including switchyard/bay, control building, fences, etc.
» Battery Energy Storage System (BESS).
» Access roads and internal distribution roads.
» Site offices and maintenance buildings, including workshop areas for maintenance and storage.

The wind farm is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Merino Wind Farm under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Merino Wind Farm set to inject up to 140MW into the national grid.

Great Karoo Renewable Energy (Pty) Ltd is proposing the construction and operation of a photovoltaic (PV) solar energy facility and associated infrastructure on Portion 1 of Farm Rondavel 85, located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~29 909ha and a development area of ~571ha within the project site has been identified by Great Karoo Renewable Energy (Pty) Ltd as a technically suitable area for the development of the Nku Solar PV Facility with a contracted capacity of up to 100MW.

The Nku Solar PV Facility project site is proposed to accommodate the following infrastructure, which will enable the facility to supply a contracted capacity of up to 100MW:

» Solar PV array comprising PV modules and mounting structures.
» Inverters and transformers.
» Cabling between the panels.
» 33/132kV onsite facility substation.
» Cabling from the onsite substation to the collector substation (either underground or overhead).
» Electrical and auxiliary equipment required at the collector substation that serves that solar energy facility, including switchyard/bay, control building, fences, etc.
» Battery Energy Storage System (BESS).
» Site offices and maintenance buildings, including workshop areas for maintenance and storage.
» Laydown areas.
» Access roads and internal distribution roads.

The solar PV facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Nku Solar PV Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Nku Solar PV Facility set to inject up to 100MW into the national grid.

Moriri Solar Photovoltaic (PV) Energy Facility, Northern Cape Province (PV2) – Project Description

Great Karoo Renewable Energy (Pty) Ltd is proposing the construction and operation of a photovoltaic (PV) solar energy facility and associated infrastructure on Portion 0 of Farm Rondavel 85, located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~29 909ha and a development area of ~577ha within the project site has been identified by Great Karoo Renewable Energy (Pty) Ltd as a technically suitable area for the development of the Moriri Solar PV Facility with a contracted capacity of up to 100MW.

The Moriri Solar PV Facility project site is proposed to accommodate the following infrastructure, which will enable the facility to supply a contracted capacity of up to 100MW:

» Solar PV array comprising PV modules and mounting structures.
» Inverters and transformers.
» Cabling between the panels.
» 33/132kV onsite facility substation.
» Cabling from the onsite substation to the collector substation (either underground or overhead).
» Electrical and auxiliary equipment required at the collector substation that serves that solar energy facility, including switchyard/bay, control building, fences, etc.
» Battery Energy Storage System (BESS).
» Site offices and maintenance buildings, including workshop areas for maintenance and storage.
» Laydown areas.
» Access roads and internal distribution roads.

The solar PV facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Moriri Solar PV Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Moriri Solar PV Facility set to inject up to 100MW into the national grid.

Kwana Solar Photovoltaic (PV) Energy Facility, Northern Cape Province (PV3) – Project Description

Great Karoo Renewable Energy (Pty) Ltd is proposing the construction and operation of a photovoltaic (PV) solar energy facility and associated infrastructure on Portion 0 of Farm Rondavel 85, located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~29 909ha and a development area of ~991ha within the project site has been identified by Great Karoo Renewable Energy (Pty) Ltd as a technically suitable area for the development of the Kwana Solar PV Facility with a contracted capacity of up to 100MW.

The Kwana Solar PV Facility project site is proposed to accommodate the following infrastructure, which will enable the facility to supply a contracted capacity of up to 100MW:

- Solar PV array comprising PV modules and mounting structures.
- Inverters and transformers.
- Cabling between the panels.
- 33/132kV onsite facility substation.
- Cabling from the onsite substation to the collector substation (either underground or overhead).
- Electrical and auxiliary equipment required at the collector substation that serves that solar energy facility, including switchyard/bay, control building, fences, etc.
- Battery Energy Storage System (BESS).
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Laydown areas.
- Access roads and internal distribution roads.

The solar PV facility is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Kwana Solar PV Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Kwana Solar PV Facility set to inject up to 100MW into the national grid.

APPENDIX 2: GPS DATA FOR NEWLY RECORDED FOSSIL SITES WITHIN THE GKRE AND GRID CONNECTION PROJECT AREA

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:

- The fossil sites recorded represent only a representative fraction of the sites present at surface. The absence of recorded sites in an area does not imply that no fossils are present here, at or beneath the land surface.

- Given the considerable current uncertainties concerning the mapping and lithostratigraphy of the Lower Beaufort Group bedrocks in the project area (*cf* Day & Rubidge 2020a), the precise stratigraphic provenance (*e.g.* member of Teekloof Formation) of fossils listed here often remains uncertain. In most cases, the published geological map is followed, but this clearly requires revision in some areas.

Loc	GPS data	Comments
828	-31.457021003589034 23.660014998167753	Gegundefontein 53. Small (5.5 cm diam), well-rounded block of ferruginised rolled bone in surface float among weathering-out ferruginous, purple-brown pedocrete concretions, probable Poortjie Member. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
833	-31.457954999059439 23.675080966204405	Gegundefontein 53. Isolated fragment of baked, whitish postcranial bone (possibly associated with pedogenic concretion) with reaction halo embedded within pale yellowish metaquartzite quartzite channel sandstone, possibly Poortjie Member. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
852	-31.53030 23.63432	Rondavel 85. Stratigraphic level uncertain – *possibly* Oukloof Member / "Balfour Fm". Possible but *equivocal* tetrapod burrow cast (c. 25-30 cm wide), straight, inclined, infilled with grey-green sandstone and surrounded by crumbly purple brown mudrock. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
854	-31.54013 23.64365	Rondavel 85. Flaggy slabs of greenish-grey sandstone (stratigraphic provenance unclear) associated with ruined farm building showing probable sandstone-infilled mudcracks, wave rippled palaeosurfaces and invertebrate bioturbation and / or plant stem casts. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
859	-31.543518975377083 23.641590988263488	Rondavel 85. "Balfour Fm" (Oukloof Member of Teeklof Fm). Distorted / crushed, baked (v. white) skeletal material - possibly a small (*c*. 5 cm long) skull - embedded within mudflake-rich debris flow deposit. Proposed Field Rating IIIB. Professional palaeontological collection only necessary of specimen lies < 20 from project footprint.
863	-31.536312969401479 23.663475969806314	Rondavel 85. "Balfour Fm" (Oukloof Member of Teekloof Fm). Surface concentration of coffee-brown ferruginous concretionary material including several blocks containing bone preserved as moulds or silicified. Symmetrical array of low convexity, rounded plates with a radial ornamentation suggests pareiasaur reptile affinity (dermal scutes) – possibly juvenile or dwarf form. Proposed Field Rating IIIB. Professional palaeontological collection only necessary of specimen lies < 20 from project footprint.
884	-31.49779200553894 23.597218031063676	Rondavel 85. Hoedemaker Member. Thin crevasse splay sandstone exposed in shallow borrow pit with sandstone-infilled mudcracks, microbial mat textures, small-scale invertebrate trace fossils (narrow horizontal burrows of undermat miners), possible vertical burrows or plant stem casts. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
896	-31.543560968711972 23.516006022691727	Farm 96. "Balfour Formation" (Oukloof Member of Teekloof Fm). Scatter of baked white bone fragments of small-bodied tetrapod within quartzite surface gravels, in part preserved as moulds. Proposed Field Rating IIIC

		Local Resource. No mitigation recommended.
914	-31.632864028215408 23.450985001400113	Burgersfontein 92. Probable Poortjie Member, baked heterolithic package in bed of Burgerspruit. Fragment of skull (probably palate) of small tetrapod embedded within baked, grey-green wacke. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
915	-31.632765959948301 23.450854998081923	Burgersfontein 92. Probable Poortjie Member, bed of Burgerspruit. Postcranial bone of small tetrapod embedded within baked, grey-green wacke. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
917	-31.631848979741335 23.449530992656946	Burgersfontein 92. Late Caenozoic sandy to gravelly alluvium overlying calcrete-veined weathered dolerite exposed in banks of Burgerspruit. Assemblage of subvertical, subcylindrical calcretised structures – probably rhizoliths. Proposed Field Rating IIIC Local Resource. No mitigation recommended.
918	-31.630922025069594 23.448976026847959	Burgersfontein 92. Probable Poortjie Member. Crushed, baked probable small tetrapod skull within thin-bedded grey-green siltstone with possible baked gypsum roses exposed on bed of Burgerspruit. Proposed Field Rating IIIB. Site protected in river bed within standard ecological riverine buffer.

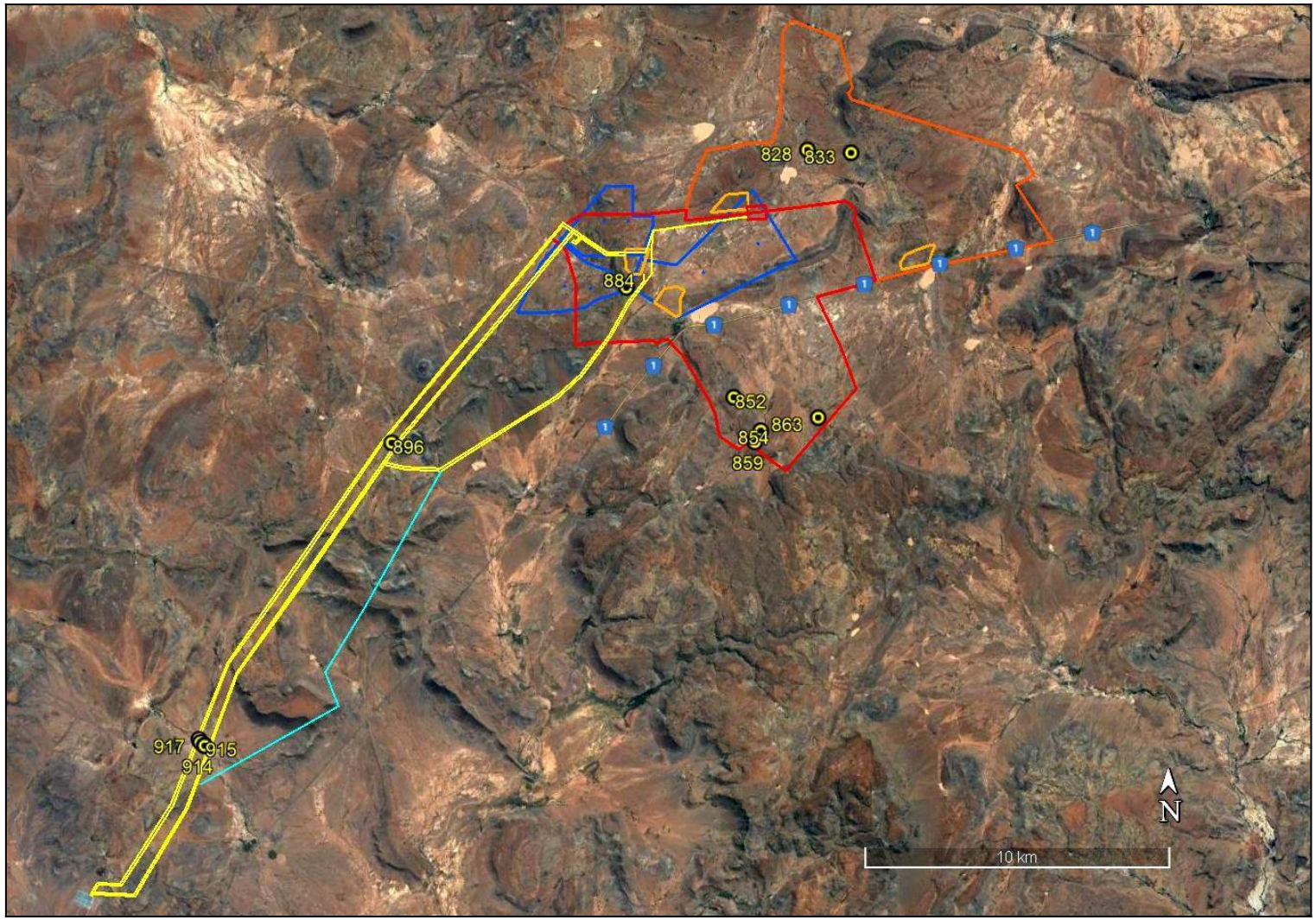

Figure A1: Google Earth© satellite image showing the newly recorded fossil sites (yellow circles) in the context of the combined GKRE (WEFs and solar PV projects) project area (orange polygon) as well as the grid connection route options to Gamma MTS (yellow and pale blue lines) between Richmond and Victoria West, Northern Cape Province. Fossil site details are provided in the table above. Almost all of the recorded fossil sites are of low scientific and / or conservation value.

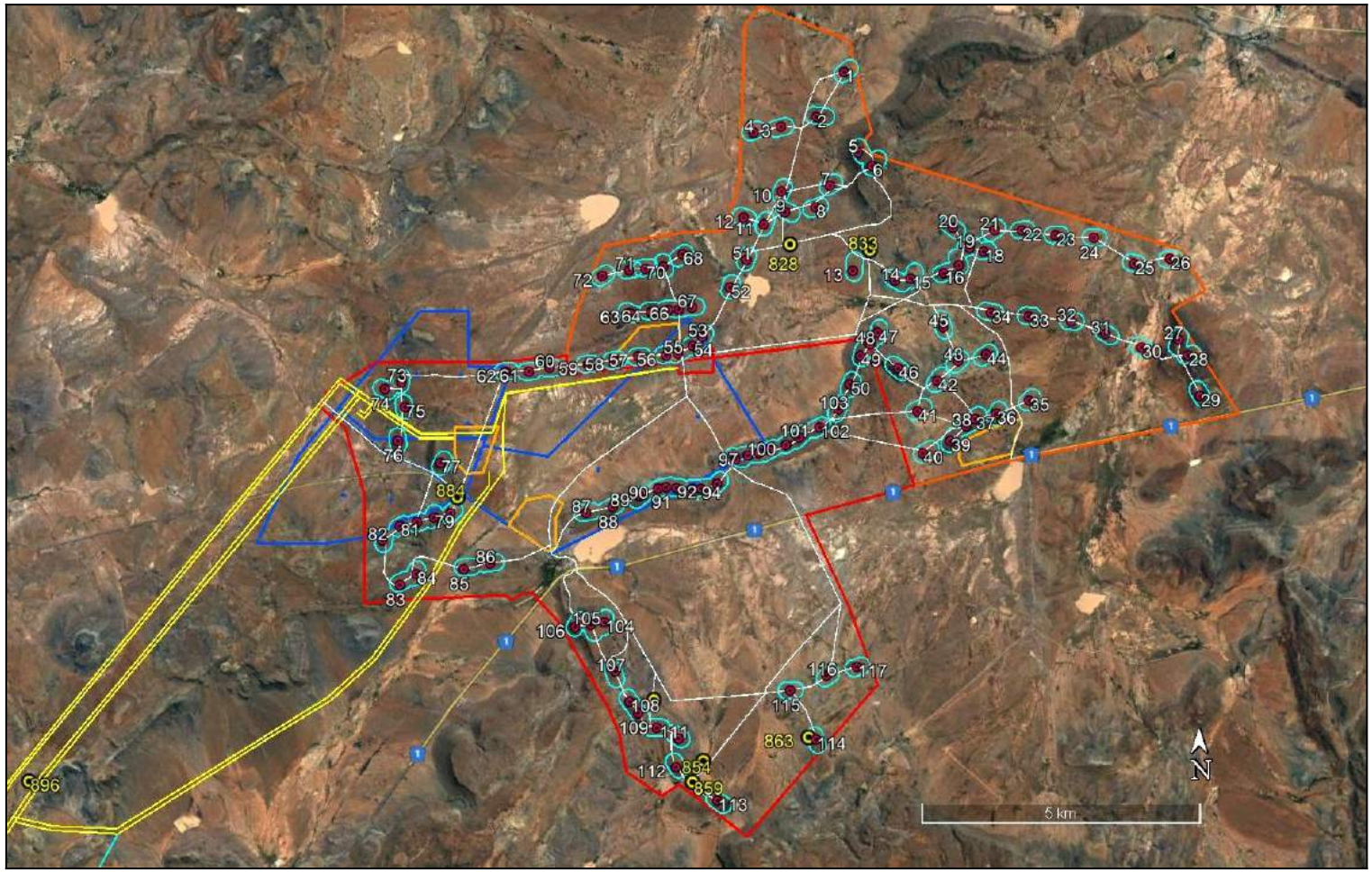

Figure A2: Google Earth© satellite image showing the newly recorded fossil sites (numbered yellow circles) in the context of the provisional layouts for the GKRE WEFs (turbine sites – red; buffers – pale blue; internal access roads – white) and solar PV project areas (dark blue polygons). With the exception of sites 828 and 884 (both of very low scientific / conservation value), all the recorded fossil sites lie well away (> 20 m) from the project footprints and no mitigation of any of these sites is recommended here.

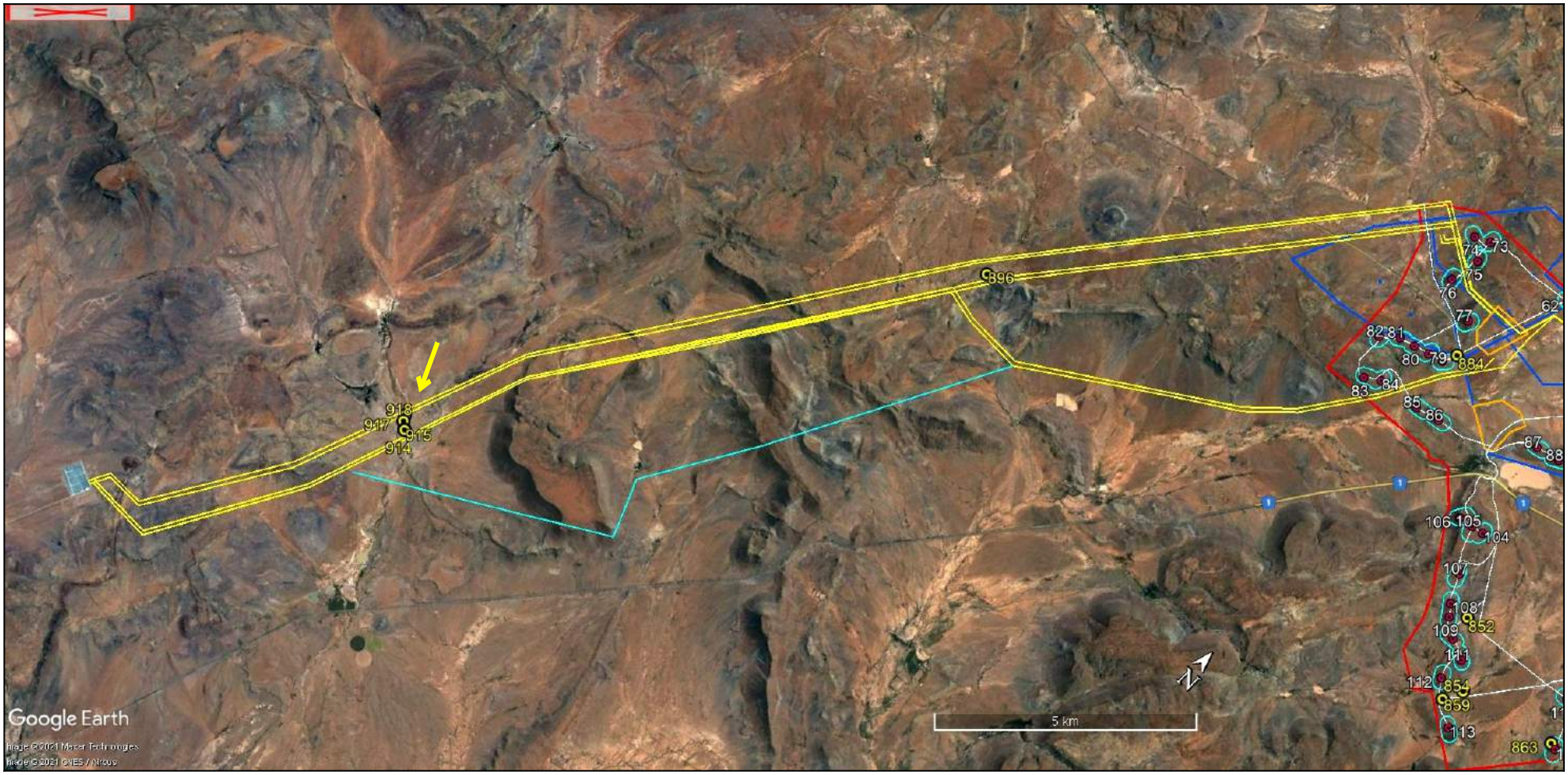

Figure A3: Google Earth© satellite image showing the newly recorded fossil sites (numbered yellow circles) in the context of the various grid connection route options (yellow, pale blue) under consideration between the GKRE project area (orange, blue polygons) and the Gamma MTS. All of the fossil sites mapped here are of low scientific and conservation value while the cluster along the Burgerspruit (arrowed) wil be protected within the standard ecological buffer along drainage lines. No specialist palaeontological mitigation of these fossil sites is therefore recommended here.

<table>
<tr><th colspan="3">APPENDIX 3. CHANCE FOSSIL FINDS PROCEDURE: GKRE renewable energy facilities and grid connections between Richmond and Victoria West</th></tr>
<tr><td>Province & region:</td><td colspan="2">Northern Cape (Pixley Ka-Seme District) and Western Cape (Central Karoo District) &</td></tr>
<tr><td>Responsible Heritage Management Agencies</td><td colspan="2">SAHRA: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za
HERITAGE WESTERN CAPE. Protea Assurance Building, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 9598. E-mail: ceoheritage@westerncape.gov.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Teekloof Formation (Lower Beaufort Group), Late Caenozoic alluvium.</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Fossil skulls, postcrania of tetrapods, amphibians, fish as well as rare petrified wood, vertebrate and invertebrate burrows within bedrocks. Mammalian bones, teeth & horn cores, freshwater molluscs, calcretised trace fossils & rhizoliths and plant material in alluvium.</td></tr>
<tr><td rowspan="5">ECO / ESO 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 appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Apply for Fossil Collection Permit Record / submit Work Plan to relevant Heritage Resources Agency. 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 Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.</td></tr>
</table>

APPENDIX 3: Cultural Landscape Assessment (2021)

CULTURAL LANDSCAPE ASSESSMENT

In terms of Section 38 (8) of the National Heritage Resources Act (Act 25 of 1999)

PROPOSED DEVELOPMENT OF:
GREAT KAROO RENEWABLE ENERGY (GKRE)
WIND ENERGY FACILITY, SOLAR ENERGY FACILITY and GRID CONNECTION

NEAR RICHMOND, NORTHERN CAPE PROVINCE

10 DECEMBER 2021

Long view towards location of proposed RE facility

Prepared for CTS Heritage

Prepared by Sarah Winter in association with Wendy Wilson

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A. INTRODUCTION

Great Karoo Renewable Energy (Pty) Ltd. proposes developing a renewable energy facility, Great Karoo Renewable Energy (GKRE), on land beside and straddling the N1 35km south-west of Richmond and 80km south-east of Victoria West, in the Northern Cape Province. The proposed development is composed of two Wind Energy Facilities (WEF), three Solar Photovoltaic (PV) Energy Facilities and five Grid Connections with overhead powerlines.

The proposed development area has a total extent of approximately 29 909ha, and can be accessed from the N1. The location falls within the jurisdiction of the Ubuntu Municipality and the Pixley Ka Seme District Municipality, and outside of any Renewable Energy Development Zone (REDZ).

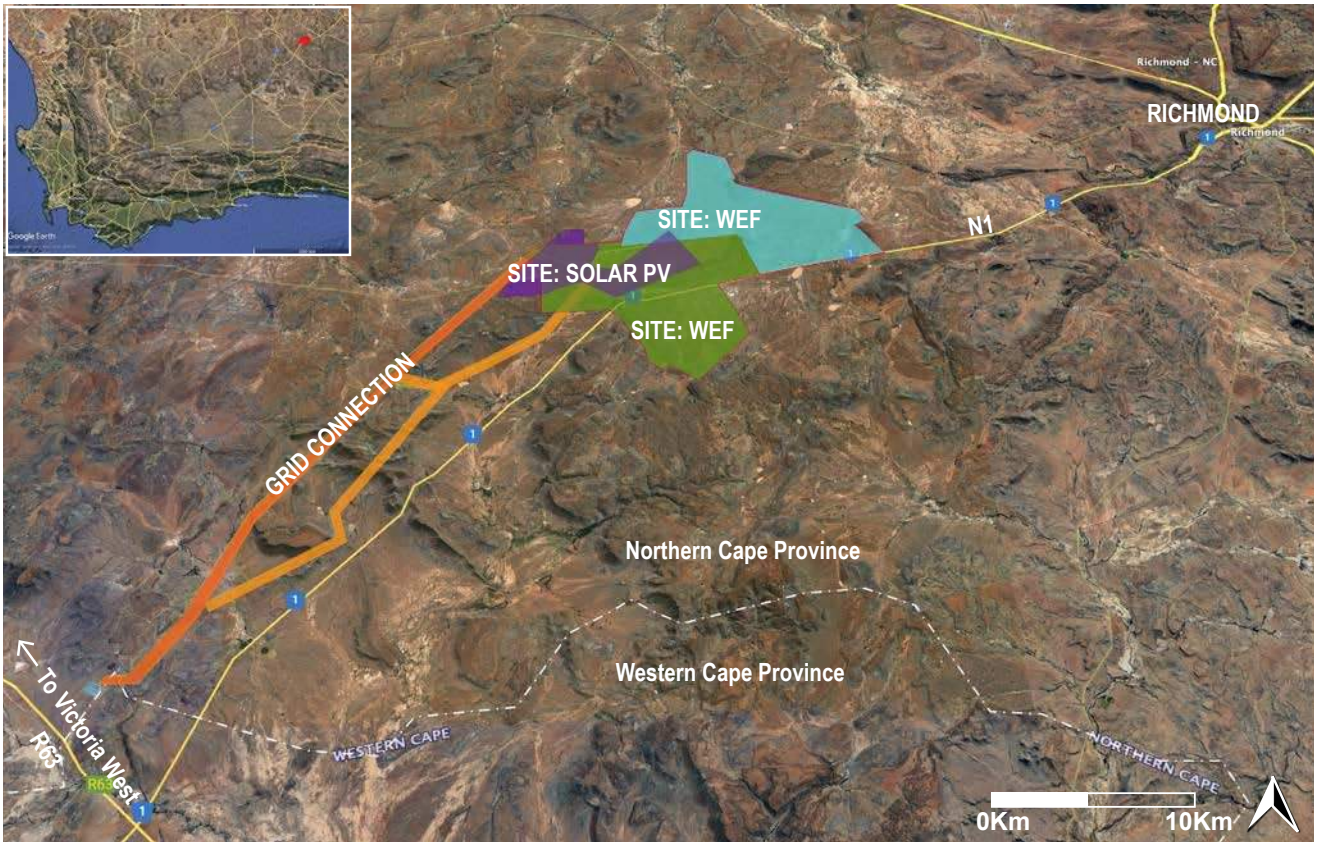


Figure 1. Site Location: Proposed GKRE Energy Facilities southwest of Richmond on the N1. (Source: Google Earth)

A.1 Study Brief and Scope of Work

The purpose of this report is to assess the project from a cultural landscape perspective as a component of an integrated heritage impact assessment (HIA) that satisfies Section 38 (3) of the National Heritage Resources Act (Act 25 of 1999; NHRA). The assessment has included the following scope of work:

- An historical overview of the site and its broader context.
- Fieldwork with particular attention on potential heritage receptors of the cultural landscape.
- A review of the visual impact assessment report.
- An assessment of heritage significance and a formulation of heritage indicators.
- An assessment of the impact of the proposals and formulation of recommendations.

This study examines the cultural landscape and sensitivities of the receiving environment, and its carrying capacity for the proposed wind, solar and grid connection facilities as a group.

A.2 Project Description

The GKRE project incorporates solar PV clusters, wind turbine clusters, the grid connection and associated infrastructure. The total affected area comprises approximately 29 909ha, made up of the development area for the WEF and PV facilities and the grid connection area.

WEF clusters:
Two adjacent facilities are proposed:

1. Angora Wind Energy Facility (140MW), with a development area of 4,544ha situated on the following land: Portion 11 of Farm Gegundefontein 53, Portion 0 of Farm Vogelstruisfontein 84, Portion 1 of Farm Rondavel 85, Portion 0 of Farm Rondavel 85.
2. Merino Wind Energy Facility Wind (140MW), with a development area of 5,516ha situated on the following land: Portion 1 of Farm Rondavel 85, Portion 0 of Farm Rondavel 85, Portion 9 of Farm Bult & Rietfontein 96.

.

The built infrastructure for both WEF clusters includes the following:

- A grouped total of up to 90 (approximately 45 per facility) concrete turbine hubs of height up to 170m with turbine tip height up to 250m.
- Concrete turbine foundations to support the turbine hardstands.
- Inverters and transformers.
- Temporary laydown areas which will accommodate storage and assembly areas.
- Cabling between the turbines, to be laid underground where practical.
- A temporary concrete batching plant.
- 33/132kV onsite facility substation.
- Underground cabling from the onsite substation to the 132kV collector substation.
- Electrical and auxiliary equipment required at the collector substation that serves that wind energy facility, including switchyard/bay, control building, fences, etc.
- Battery Energy Storage System (BESS).
- Access roads and internal distribution roads.
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.

PV Solar clusters:
Three adjacent facilities are proposed:

1. Nku Solar PV Facility (100MW) with a development area of 571ha situated on Portion 1 of Farm Rondavel 85.
2. Moriri Solar PV Facility (100MW) with a development area of 577ha situated on Portion 0 of Farm Rondavel 85.
3. Kwana Solar PV Facility (100MW) with a development area of 991ha, situated on the same land parcel as above.

The built infrastructure for the PV clusters includes the following:

- Solar PV array comprising PV modules and mounting structures.
- Inverters and transformers.

- Cabling between the panels.
- 33/132kV onsite facility substation.
- Cabling from the onsite substation to the collector substation (either underground or overhead).
- Electrical and auxiliary equipment required at the collector substation that serves that solar energy facility, including switchyard/bay, control building, fences, etc.
- Battery Energy Storage System (BESS).
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Laydown areas.
- Access roads and internal distribution roads.

Grid connection:

Proposed grid connection linking the GKRE to the existing Eskom Gamma Substation south west of the site.

Four alternatives are route options include:

- Alternative 1 and 2, which follow the corridor of the existing overhead Eskom powerline servitude connection
- Alternative 3,4 and 5 which traverse the landscape parallel to the existing grid connection, along a route nearer to the N1.

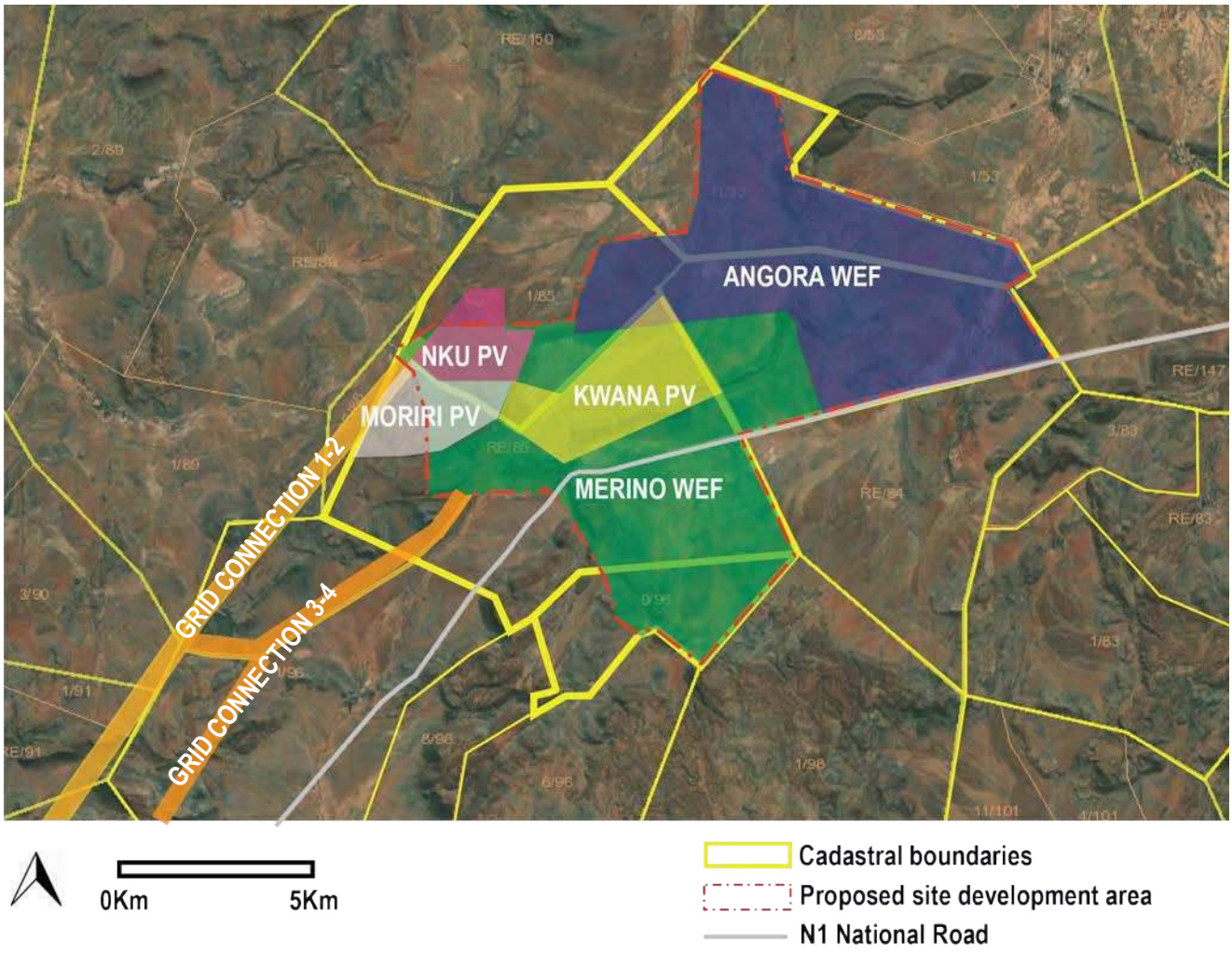


Figure 2. Proposed location of the WEF, Solar PV and grid connection facilities

A.3 Site Description

The site is characterised by the following:

- Regional location within the eastern upper area of the Great Karoo, which is a vast arid area with a dispersed pattern of settlement, extensive stock farms, more recent game farms, and irrigation based agriculture along the rivers; the vegetation cover is low consistent with the Nama Karoo Biome (Savannah Environmental 2021).
- Very distinctive topographical conditions, with a combination of steep slopes, ridgelines, flat topped mesa mountains and rounded koppies punctuating open plains.
- Location to the southwest of Richmond, which dates to the mid 18th century; it lies in a slight depression, surrounded by rises and hillocks, the most prominent of which is Vegkop to the north of town, which shields it from the N1; it is traversed by the occasional Ongers River.
- The majority of the site lies directly to the north of the N1, being partially traversed and partially bounded by it. This sector of the N1 connects Three Sisters in the south to Richmond. It crosses the R63 approximately 30 Km south of the site at a point midway between Victoria West and Murraysburg. This sector of the N1 is not recognised as a scenic route however it has historic longevity.
- The N1 traversing the Great Escarpment runs largely straight, with very little topographical change. However, this consistency is interrupted on the south west approach to Richmond by topographical variety, and a threshold condition at a historic bend in the route. This is located at the south west boundary of the study area.
- The alignment of the N1 through this landscape follows an early transport and wagon route to the interior dating to, at least, the late 18th century.
- Farming settlements along this portion of the N1 are experienced as “beads on a string”, with small nodal groupings clustered on the foothills of the mountain ridges in proximity of the road.
- The distinctive nature of farming settlements within a semi-arid landscape is generally associated with a loose collection of farm buildings adjacent to water courses and springs, and marked by clusters of tree planting, dams and wind pumps.
- Eskom power lines run parallel to the northern boundary of the site and extend to the power station near the intersection of the N1 and R63.
- Located outside of the REDZ, but in proximity to other existing and proposed power facilities.

A 3.1 Site Photographs

The following site photographs correspond with view points that characterise the broader cultural landscape qualities of the site location. These qualities are discussed and assessed in Section C.

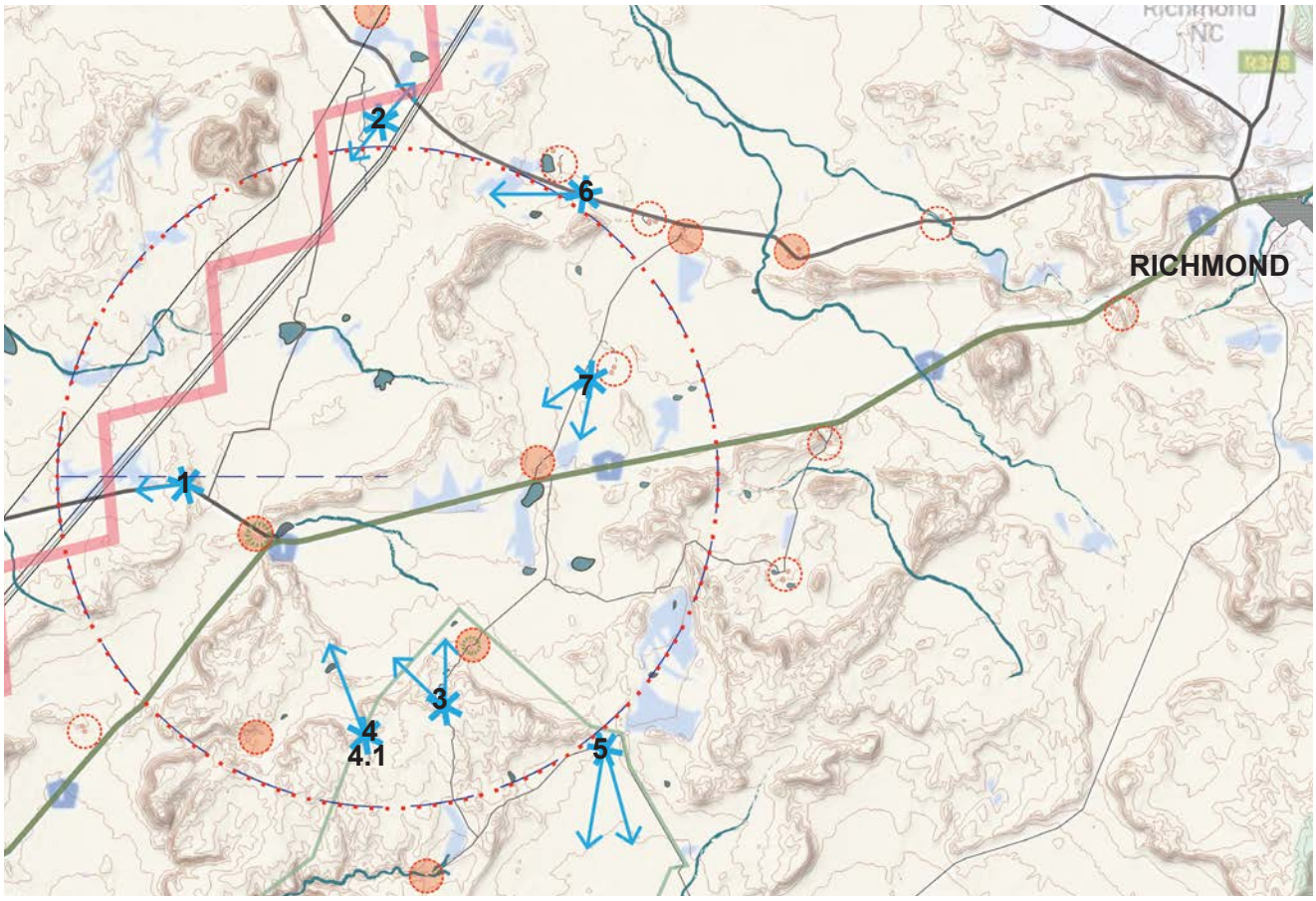
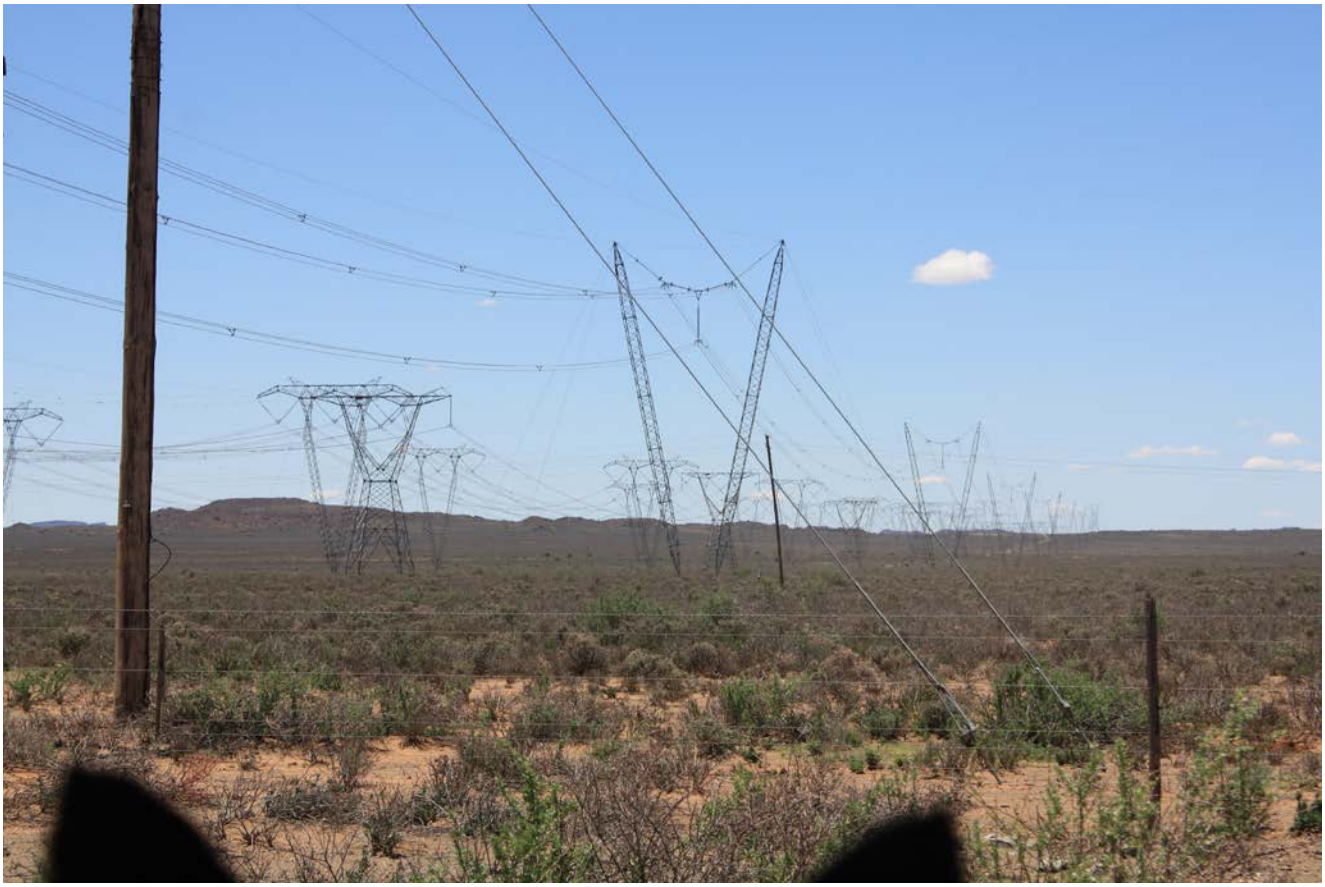
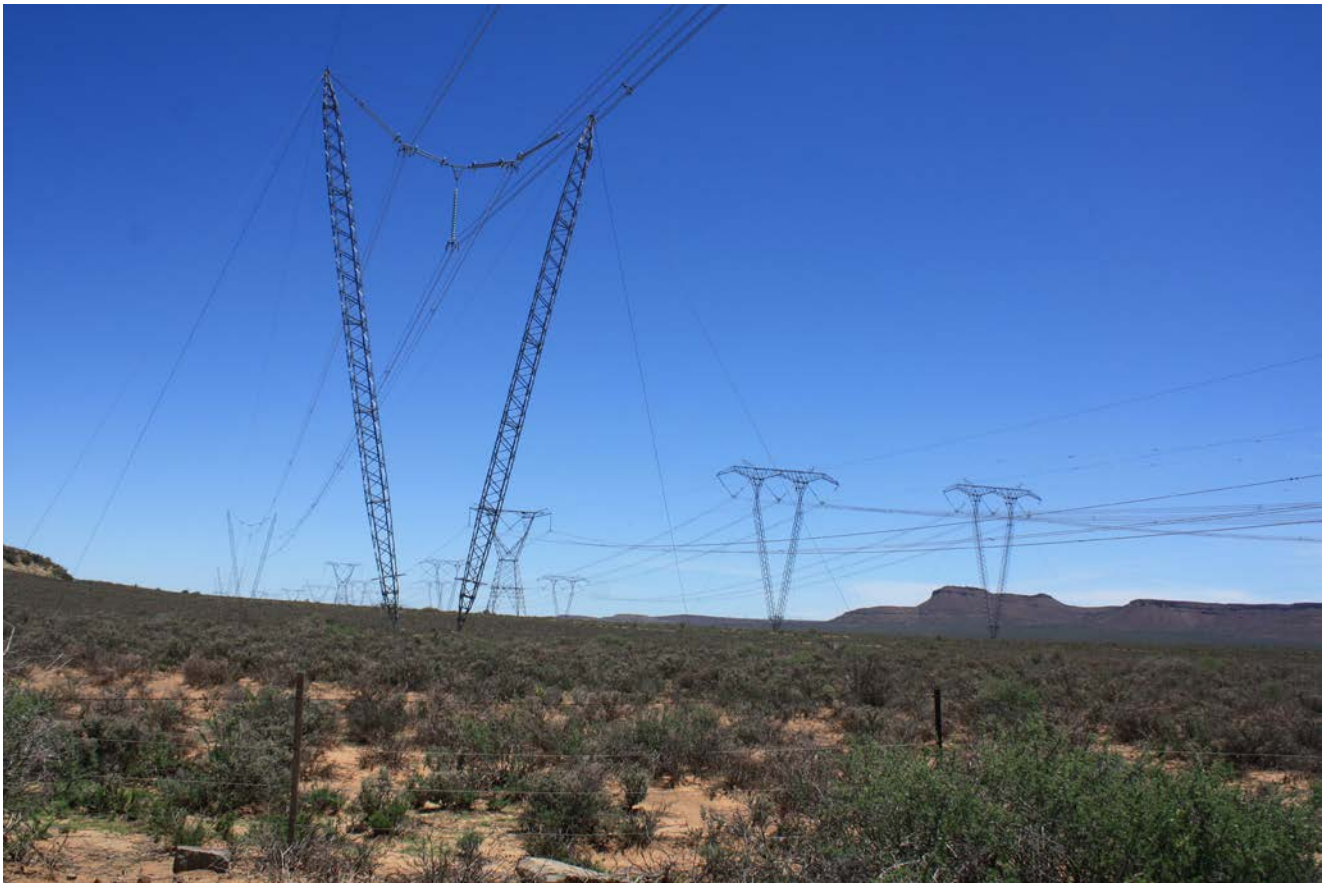


Figure 3. Diagram key to location of viewpoints.

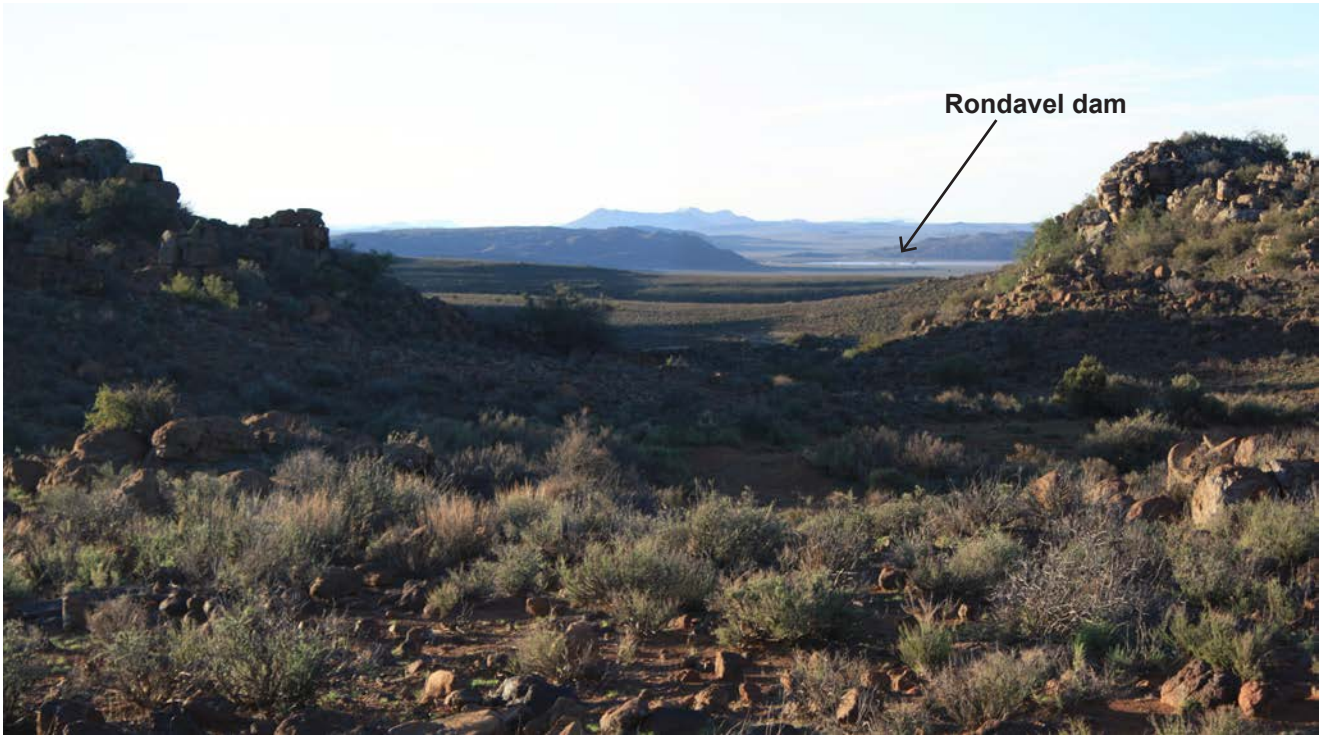
Viewpoint 1

Viewpoint 2





Viewpoint 3



Viewpoint 4

Viewpoint 4.1

Viewpoint 5

Viewpoint 6

Viewpoint 7

B. HISTORICAL CONTEXT: CULTURAL LANDSCAPE

B.1 Regional Cultural Landscape

The central plateau of the Great Karoo, north of the Great Escarpment, falls in the Nama Karoo Biome. This is characterised by low rainfall and high temperatures, low-shrub vegetation and low relief topography punctuated by rugged outcrops. This expansive, arid region has lime-rich soils underlain by sediments of the Dwyka (glacial) formation covered by the Ecca and Beaufort groups, and is rich in substantial fossil records dating back 3 billion years (Seymour 2021). The archaeological record spans hundreds of thousands of years, with sites such as stone tool scatters typically occurring near dolerite outcrops due to the presence of underground water (Winter & Oberholzer 2013).

B.1.1 Settlement Patterns

The name *Karoo* has its roots in the Khoe word meaning “place of great dryness”. While used on a seasonal and nomadic basis by hunter-gather people, the uncertain access to water and grazing, and the extreme temperatures, made it less well suited to needs of pastoralist people. However, vast herds of antelope, quagga, white rhinoceros, hartebeest and ostrich moved through the landscape according to the availability water and seasonal rains.

Settled occupation of the region and the subsequent changes to the landscape followed over 100 years after the arrival of settlers in 1652. Settlement of the Cape and the privatisation of land and water alienated the Khoe people from their seasonal lands, pushing them northwards. From the 1700s, the growing settlement, hungry for more resources, followed in their wake, creating a shifting frontier of contact (Anderson 1985). This push was sanctioned by the VOC and largely undertaken by trekboers engaged in hunting, salt collection and cattle trade with inland groups. The lifestyle was essentially that of a semi-nomadic pastoralist as they followed transhumance routes dictated by annual rainfall and seasonal pastures. The expanding frontier came to a prolonged pause below the Great Escarpment, which was a natural barrier between the plains of the Karoo and the arid Central Plateau.

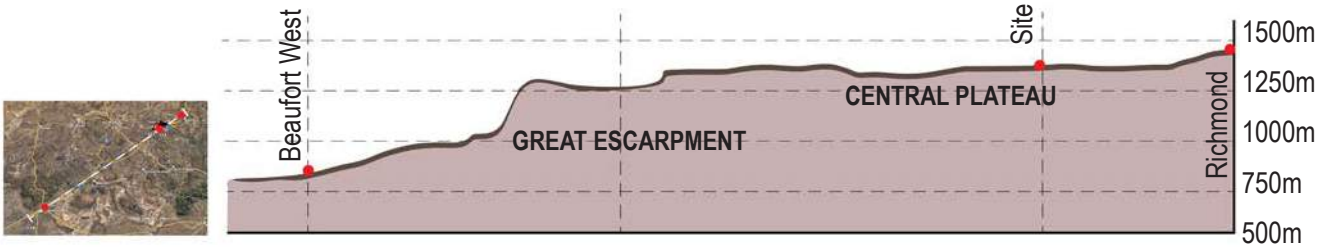


Figure 4. Graphic representation: Nuweveld Mountain defining the edge of the Great Escarpment with the Karoo Central Plateau.

B.1.2 British Colonial Period

The late 18th century was characterised by a marked increase in the rate of expansion of the boundaries of colony, with frequent conflict between groups of San and recent in-migrators - Khoe and Xhosa forced from their traditional lands, hunters, peddlers and culturally mixed groups of deserting soldiers, people escaping slavery, trekboere and others seeking economic independence.

British colonial rule brought a formalisation of land management systems. Renewable permits for loan farms had allowed stock farmers to occupy vast tracts of land without formal title, moving on when it ceased being productive. But the 1813 implementation of new landownership policy transferred loan

farms to perpetual quitrent. This imposed “settled agriculture” by requiring a farmer to stay on a defined piece of land and ended the semi-nomadic approach. On request from a potential farmer a parcel of land would be surveyed and registered (Anderson 1985). It further dispossessed Khoe and Xhosa and alienated many of the poorer trekboers who were pushed further north or subjugated to a life of labour (Guelke, Shell, 1992).

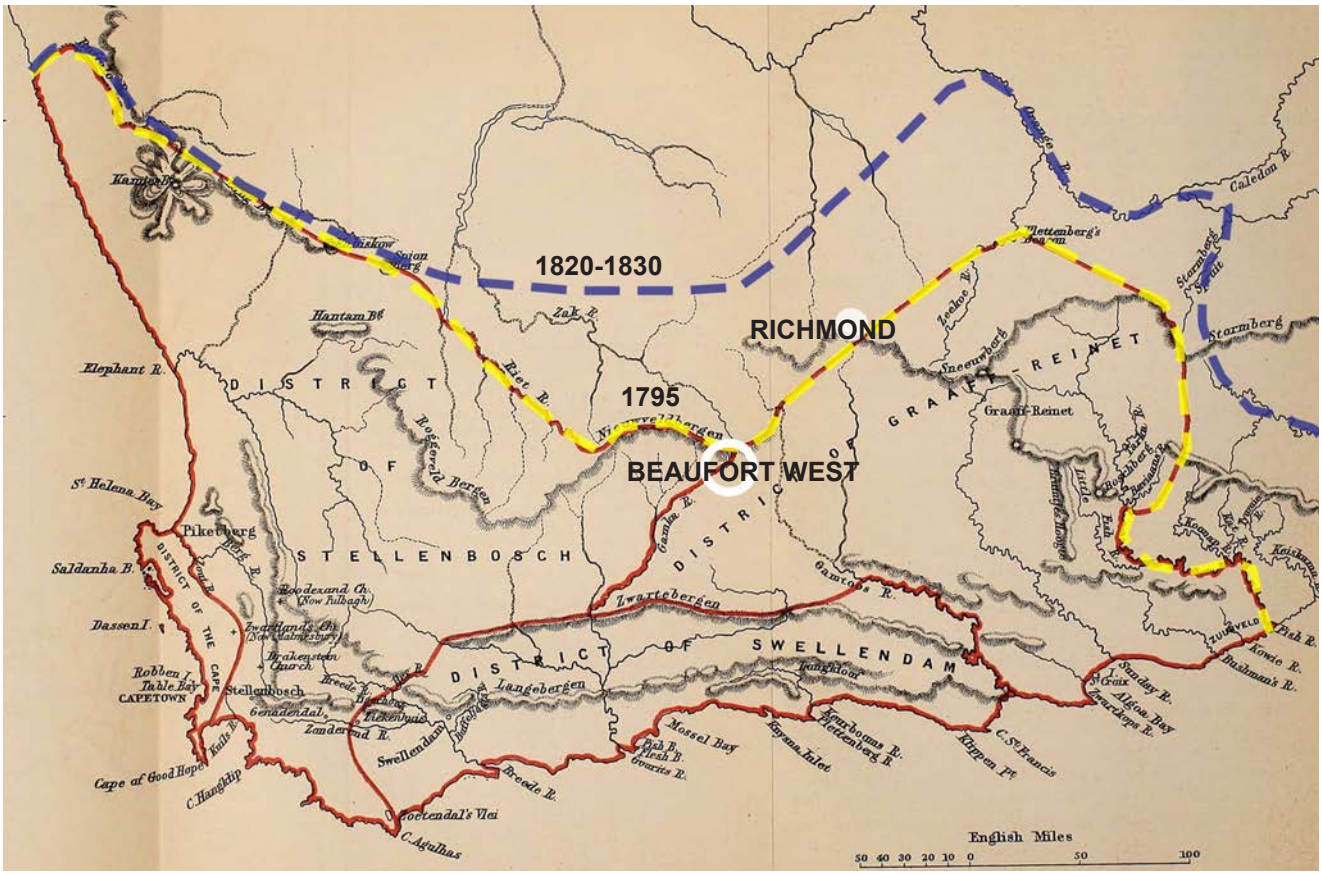


Figure 5. 1795 map of Dutch Colony districts with northern boundary - yellow dash. Blue dash shows 1820-1830 boundary following expansion northwards after British colonial takeover. The 1795 district division line followed an existing transport route, which maps to the route of the N1. (Image: Wikimedia Commons, Theal 1916)

The push north onto the inhospitable Central Plateau was accelerated by the sudden acquisition of large land parcels for the production of wool sheep. Legislation had closed the door on wine exports, while simultaneously, European industrialisation increased the wool market. Prospectors looked to the colonies, where the Beaufort West area was already established for farming the indigenous Cape sheep. It was identified as well suited to the wool producing Saxon Merino sheep and land was acquired and quickly privatised by wealthy burghers, merchants and officials. As a result of this new industry, land acquisition land ownership became crucially important and the colonial authorities were forced into playing a far more active role expanding and documenting the northern frontier (Anderson 1985).

Settled agriculture, water management through the creation of boreholes, and extensive sheep grazing profoundly changed the landscape. A study of the survey diagrams for parent farms in the site area shows formalisation of ownership from 1835, although it is highly likely that all land with access to water and grazing was already in use, and possibly occupied, prior to its first record of survey. (Note: Access to archived title deeds is not possible under the restrictions imposed by Covid-19; historic survey diagrams have been studied in their place). The survey diagrams also paint a clear picture of the priorities in land acquisition: springs, rivers and grazing is noted. The following diagram is a composite of the first survey records for quitrent farms now affected by the proposed development.

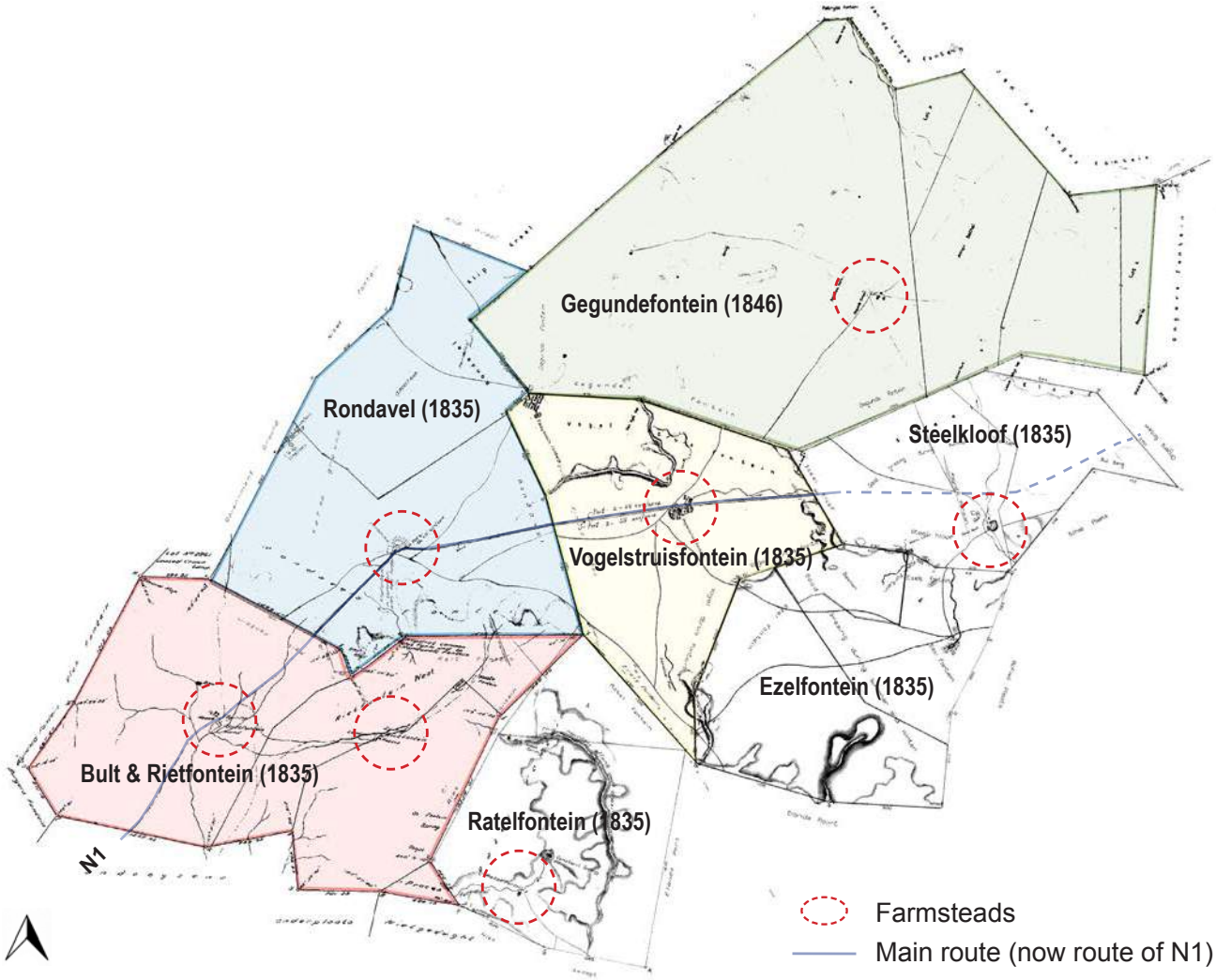


Figure 6. Composite of SG diagrams for quitrent farms first surveyed and registered in 1835. Show the identification of significant landscape features, springs, agricultural quality of the land, and regular spacing in the placement of farmsteads. Surveys pre-date the establishment of Bloemhof Farm on Ratelfontein. (Source: Surveyor General F2815/63, B273/1835, B1097/1863, B240/1835)

B.3 Establishment of Richmond

The increased settled population led in 1844 to the establishment of the church town, Richmond, on a portion of the Farm Driefontein bought from PJ Van De Merwe. The location was chosen for the three springs feeding the occasional Ongers River, a tributary of the Orange River to the north. The topography, with the Vegkop hillock and the river basin dictated a less formal town layout to the typical grid, although true to the typology, it is centred on the tall steepled Dutch Reform Church (consecrated 1847 and extended in 1909) situated on church square, which, along with the Mission Church (demolished following implementation of the Group Areas Act 1950) and market square formed the core of the historical precinct (Peters 2016).

Architectural typologies include the flat roofed “brakdak” cottages set on raised stoeps, built to the street, which was edged by the *leiwater* furrow allowing the establishment of food gardens and tree-lined main streets. Above these, *Tuishuisies*, without access to water, were built by farmers for occasional use on visits to town for trade and church events (Peters 2016). From the later 1800s, following the popularisation of corrugated iron roofing, Victorian-era commercial/residential buildings, with covered stoeps and pitched tin roofs, were added. This historic core is representative of 19th/early 20th century rural town development and contains architectural, streetscape and townscape qualities worthy of heritage protection.

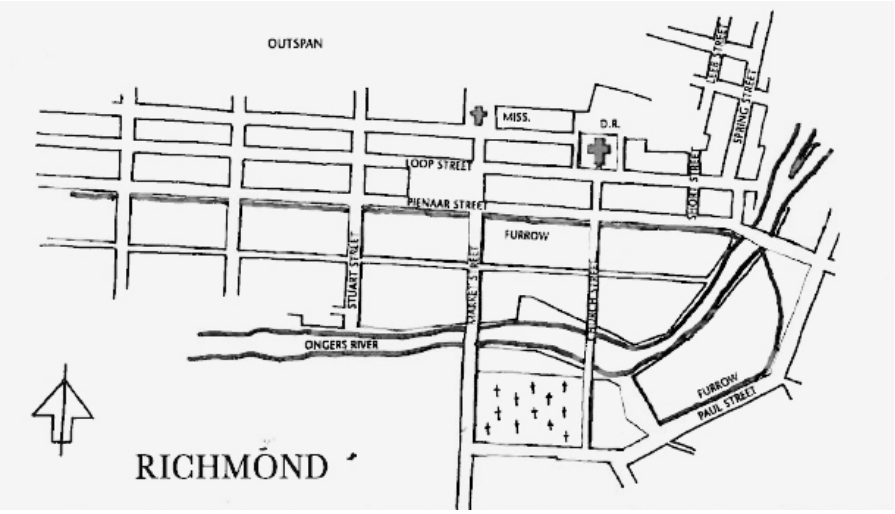


Figure 7. 1843 Richmond town plan by surveyor JL Leeb (Source: Fransen 2006: 297)

The landscape of the mid-1800s was altered by the development of the railway network. It consolidated existing lines and connected the port cities to the interior centres of production and export, such as the wool producing towns of the Great Karoo, and the diamond fields. Richmond farmers were served by Richmond Road Station and Deelfontein Station, north of town. The huge influx of people to the diamond fields increased the demand for meat production, with mutton being added to the output of local wool producing sheep farmers (Manyani 2020).

The landscape of the late 1800s was altered with the introduction of wire fences which restricted the movement of wild buck populations resulting in settled populations. The invention of the ground water pump, which dramatically improved year-round access to a steady (underground) water supply for irrigation and more intensive livestock farming, further altered the landscape (Manyani 2020). These wind pumps have become representative objects of the Karoo landscape.

The impact of the South African War (1899-1902) was limited to a series of skirmishes and battles between the Boer Commandos and British military forces in 1901, with residents of Richmond predominantly neutral or British loyalist, limiting the Commandos effectiveness. However, the landscape of the built environment was changed with a fort built on Vegkop, a defensible hill at the north entrance to Richmond town, and an extensive military base and hospital with a cemetery at Deelfontein Station.

Figure 8. 1895 Richmond Road Station (Source: DRISA PO440)

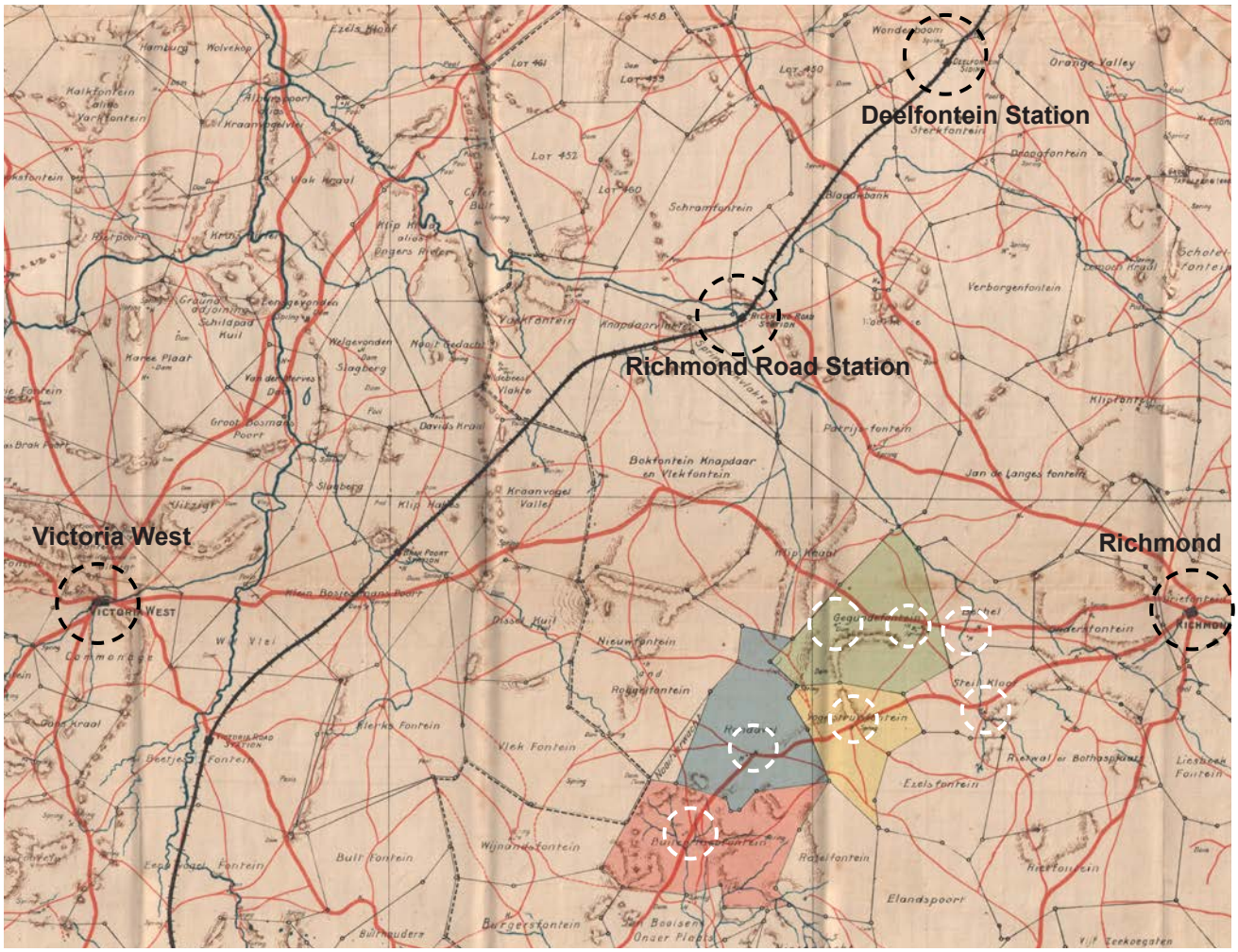


Figure 9. 1900 Survey showing major roads, railways and stations, water sources and homestead settlements. Historic farms associated with the area for the proposed development are coloured red (Bult * Rietfontein), Blue (Rondavel), yellow (Vogelstruisfontein), green (Gegundefontein). Homestead settlements identified in 1900 are circled white (Source: UCT Special Collections Islandora 24864)

The impact of the South African War (1899-1902) was limited to a series of skirmishes and battles between the Boer Commandos and British military forces in 1901, with residents of Richmond predominantly neutral or British loyalist, limiting the Commandos effectiveness. However, the landscape of the built environment was changed with a fort built on Vegkop, a defensible hill at the north entrance to Richmond town, and an extensive military base and hospital with a cemetery at Deelfontein Station.

B.3.1 20th Century Landscape

Wool farming remained the dominant activity and benefited from the wool boom of the 1930s, which continued into the 1950s, thereafter declining, with a shift to less labour-intensive meat production (Manyani 2020). The physical impact of segregation along racial lines introduced under the Group Areas Act 1950 was localised to Richmond town, altering its urban form. It had little impact on the nearby farming settlements. The N1, completed in the 1950s, connected Cape Town to Beit Bridge and by-passed many of the smaller towns, including Richmond, which protected the historic centre but impacted urban income generated from through-travellers.

From the 1970s a process of farm consolidation, which continues to this day, was begun. Modernised farming practice and commercial opportunities stimulated farm development, with the introduction of stud, and livestock adapted for better yields. From the 1980s diversification introduced a shift to game farming, re-wilding, and more recently the introduction of nature tourism, conferences and events. The current focus on renewable energies is set to transform the landscape on a scale reminiscent of that which resulted from the introduction of wool production.

C STATEMENT OF HERITAGE SIGNIFICANCE

While the National Heritage Resources Act (Act 25 of 1999; NHRA) does not specifically mention the term “cultural landscape” it is implied in its definition of terms. Section 3 (2) (b) of the NHRA includes “landscapes and natural features of cultural significance” as part of the national estate. Furthermore, Section 2(4) of the National Environmental Management Act (NEMA) regulations, in referring to the principles of environmental management and development, states that “the disturbance of landscapes and sites that constitute the nation’s cultural heritage is to be avoided, or, where it cannot be altogether avoided, is minimised and remedied.”

The concept of cultural landscape gives spatial and temporal expression to the processes and products of the interaction between people and the environment. It may thus be conceived as a particular configuration of topography, geology, vegetation, land use and settlement pattern and associations which establishes some coherence of natural and cultural processes.

The concept of cultural landscape has different meanings:

- It can have heritage significance in its own right and be worthy of formal protection under the heritage and/or environmental legislation.
- It can provide the context or setting for a specific heritage resource.
- It can provide an analytical framework within which individual heritage resources are embedded and linked (visually-spatially, thematically and temporally).

Cultural landscape assessment typically requires the following:

- Working across different scales of analysis at the regional, local and site scales.
- Working across different historical layers.
- Multi-disciplinary inputs to understanding significance.

It requires thinking beyond the picturesque qualities of place. It requires an understanding of why the scenery looks like it does. A starting point is the underlying natural landscape and how settlement occurs in the landscape in response to natural resources (topography, geology, water, climate). It also requires an understanding of the physical attributes, processes and influences that have shaped the landscape character with reference to emerging landscape patterns (and possible landscape themes) and historical layering.

This section of the report provides a statement of significance of the cultural landscape impacted by the proposed development based on an interpretation of the physical fabric, experiential qualities and associational linkages to the landscape. It is followed by the identification of character areas and the carrying capacity of the cultural landscape - or, its ability to accommodate change - so as not to damage significance (heritage indicators). This will look at no-go areas, tread lightly areas and areas more resilient for the development of WEF infrastructure.

C.1 Overall landscape

The site forms part of an intact cultural landscape representative of the Central Plateau of the Great Karoo possessing heritage value for historical, aesthetic, architectural, social and scientific reasons. The site possesses a number of cultural landscape qualities and elements which are outlined below.

- The location of the site on the Central Plateau of the Great Karoo, separated from the Karoo vlakte by the Great Escarpment, characterised by a combination of flat open plains punctuated by mountains and koppies.

- The vast open qualities of the landscape, which are a function of its geology, semi-arid conditions and low vegetation cover; a relatively ephemeral pattern of human intervention on the landscape resulting in a sense of remoteness and stillness, known also for its night sky.

- Generally a widespread archaeological signature dating to the Earlier and Middle Stone Ages described as a low frequency ancient scatter across the landscape, as well as an archaeological signature dating to the Later Stone Age. In this case, a high number of quarried stone artefacts predominantly from the Middle Stone Age period are particularly visible in deflated open sites, as well as a dense archaeology around the dolerite koppies.

- Historical associations with colonial expansion of the northern frontier zone in the late 18th early 19th century resulting in the further displacement of transhumant pastoralism by settled agriculture and the emergence of extensive sheep farming in the early to mid-19th century; the farms Rondawel (1835), Ratelfontein (1835), Vogelfontein (1835), Gegundefontein (1846), Bult and Rietfontein (1835) being first surveyed during this period.

- A distinctive pattern of settlement informed by access to limited water resources with small, isolated farmsteads forming green oases in the semi-arid landscape, sheltered from the heat by exotic trees and associated with springs, streams, dams and windpumps. The manner in which homesteads are positioned at the base of hills and koppies forming distinctive topographical settings. The dry-packed stone walls constructed from the local shales, and historically used for kraals, are a characteristic feature of the landscape.

- The N1 corridor following the alignment of the late 18th century route to the interior and its role as a structuring element in the landscape along which dispersed settlement has occurred like “beads on a string”. Similarly, the route connecting Richmond to Victoria West as a historic linkage route to the north of the site.

- The stretch of the N1 corridor between Rondavel and Richmond which has distinctive experiential qualities: ranging from the ‘pinch point’ condition and kink in the alignment at Rondavel as the route passes through a hilly landscape and moves away from the national grid corridor; to the straight alignment of the route traversing an open flat landscape with expansive long views framed by mountains and koppies, and punctuated by farmstead settings; to the slight meandering and more enclosed nature of the route through undulating topography as its approaches Richmond.

- The high local and regional heritage significance of Richmond from a townscape and streetscape perspective, its role in the South African War, its distinctive topographical setting and cross route condition as part of a regional and national route network. While Richmond is located outside of the direct viewshed of the WEF portion of the proposed development, the experiential qualities of the N1 approaching the town will be potentially affected.

LANDSCAPE CHARACTER ANALYSIS

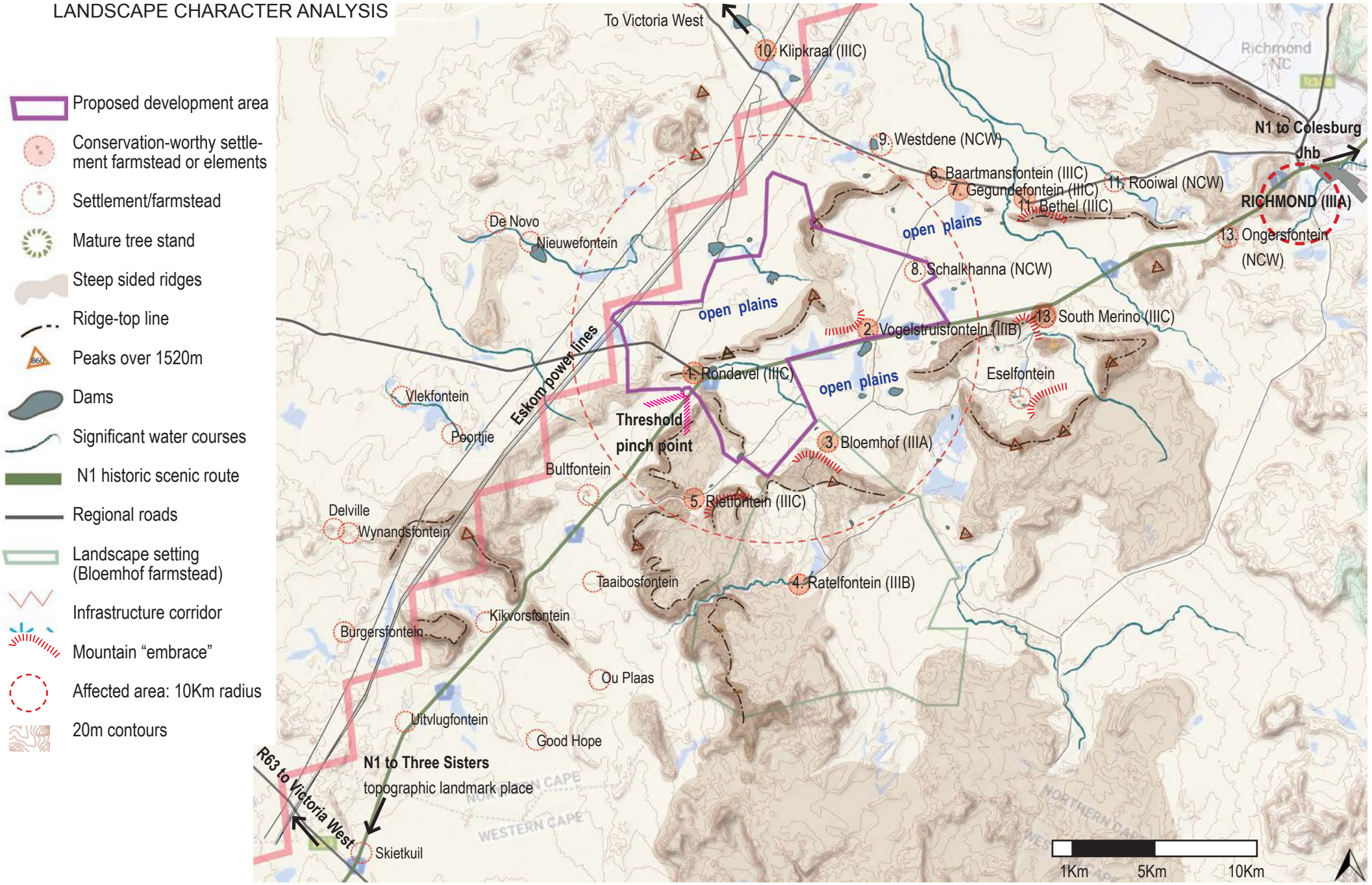


Figure 10. Cultural landscape elements

C.2 Built Landscape Elements

1. Rondavel (Grade IIIC) - Located in proposed development area

Significance and Character:

- First surveyed and granted by quitrent in 1835.
- Threshold condition: farmstead positioned at a pinch point on N1 between two mountain ridges.
- Large, distinctive dam contributes to the quality of long, layered views towards the farm.
- Described as “one of the most picturesque farms in the district” (undated brochure, Richmond Museum).
- Merino sheep breeding, augmented by tourism.
- Homestead shown on 1900 survey, with built form including late 19th/early 20th century outbuilding (grade IIIC) and a 1970s farmhouse.

2. Vogelstruisfontein (Grade IIIB) — Located in proposed development area

Significance and Character:

- First surveyed and granted by quitrent in 1835.
- The farmstead has a distinctive setting against the koppies.
- Has a perennial spring.
- Homestead shown on 1900 survey, remnant fabric may remain.
- Layout includes a late 19th early 20th century graveyard; and water dam with wind pump.
- Historically, primary agricultural product is Merino wool sheep.

3. Bloemhof (Grade IIIA) — Adjacent to south boundary of development area

Significance and Character:

- Quitrent farm Ratelfontein surveyed and registered in 1835; northern portion identified as Bloemhof c1911 Under single family ownership from 1880 farming merino sheep and jersey cattle stud farming. 1987 bought by Dr Christiaan Barnard and owned until his death. Operating as Barnard Farms (Pty) Ltd, he introduced numerous rare and exotic game species including rhino and camel (Maughn 2004). 2000 bought by current owners, re-registered as Ratelfontein Farms (Pty) Ltd in 2002
- Very intact landscape.
- Homestead built late 19th/early 20th C set against the escarpment foothills with primary views from the L-shaped veranda oriented north and east.
- Operates as a nature reserve/game farm and tourism venue, with the activities linked to, and dependent on, the landscape quality.
- Strong relationship with its setting, set back from the N1 at the base of mountain slopes, with long uninterrupted views northwards.
- A high degree of sensitivity to the impact of any wind turbines development south of the N1.

4. Ratelfontein (Grade IIIB) — South of development area

Significance and Character:

- Quitrent farm surveyed and granted in 1835, with survey diagram showing a “constant spring” and suggesting a dwelling structure in the position of the farmstead. 1987 bought by Dr Christiaan Barnard along with Bloemhof (above) and owned until his death, after which it was bought by the current owners.
- Sense of isolation: Remote Karoo landscape setting framed by escarpment ridges.
- Shielded from view of N1 by escarpment.
- Homestead set on an incline with views northwards across flat plains to the escarpment ridges.
- Structure displays late 19th/early 20th C layering; structures on the werf may include older fabric.
- Old stone kraal walling.

5. Rietfontein (Grade IIIC) — Located south of proposed development area, within 10Km

Significance and Character:

- Quitrent farm Bult and Rietfontein granted to HJ Van der Merwe in 1835. Survey diagram shows several springs. The land was divided c1879 and developed with a homestead probably at the source of the spring. House cluster now stands vacant in neglected condition.
- Sense of isolation: Remote Karoo landscape setting framed by escarpment ridges.
- Shielded from view of N1 by escarpment.
- Homestead positioned adjacent to the foothills of the escarpment, with views northwards across the flat plains.
- Homestead shown on 1900 survey. House cluster has late 19th/early 20th century architectural detailing.

6. Baartmansfontein (Grade IIIC) — Located north of proposed development area

Significance and Character:

- Farmstead on quitrent farm, Gegundefontein, first surveyed and granted in 1846.
- One of a grouping of farm settlements along the historic Victoria West-Richmond Road.
- 1970s farm house.
- Agricultural outbuildings arranged in alignment with watercourse, buildings contain late 19th early 20thC fabric.
- Mature tree stand clustered around farmhouse.
- Contributes to a pattern of settlement.

7. Gegundefontein (Grade IIIC) — Located north of proposed development area

Significance and Character:

- Quitrent farm first surveyed and granted to HJ Botha in 1835.
- One of a grouping of farm settlements along the historic Victoria West-Richmond Road.
- 1970s farmhouse.
- Homestead shown on 1900 survey. Outbuildings with layering suggesting late 19th/early 20thC.
- Stone kraal walls may include older fabric.
- Mature treed avenue approach.

8. Schalkhanna (NCW) — Located within the proposed development area

Significance and Character:

- Farmstead on quitrent farm, Gegundefontein, first surveyed and granted in 1846.
- 1970s farmhouse with agricultural outbuildings.
- Located in the open plains area.
- Farmhouse backed by a small hillock.
- Kraal structure with stone walling typical of the area.
- Modest tree cluster around homestead.
- Contributes to a pattern of settlement in terms of siting and landscape features.

9. Westdene (NCW) — Located north of proposed development area

Significance and Character:

- Farmstead on quitrent farm, Gegundefontein, first surveyed and granted in 1846.
- One of a grouping of farm settlements along the historic Victoria West-Richmond Road.
- Pine planted approach avenue.
- Agricultural building dated 1957.
- Orthogonal layout of farm buildings with central werf area and dam.
- Contributes to a pattern of settlement in terms of siting and landscape features.

10. Klipkraal (Grade IIIC) — Located north east of the proposed development area

Significance and Character:

- One of a grouping of farm settlements along the historic Victoria West-Richmond Road.
- Well developed farm werf with cluster of agricultural and residential buildings later 19th to mid 20thC, dams and mature tree stands.
- Well preserved late 19th/early 20thC outbuilding with stone plinth.
- Stone kraal.

11. Bethel (Grade IIIC) — Located north of proposed development area

Significance and Character:

- Farmstead on a portion of quitrent farm, Gegundefontein, first surveyed and granted in 1846, with portion "Bethel" subdivided in 1864, transfer to MJ van Jaarsveld and JS Burger. Transferred 1911 to BB Theron.
- One of a grouping of farm settlements along the historic Victoria West-Richmond Road.
- Homestead shown on 1900 survey, remnant fabric may remain.
- Mid-20thC and earlier 20thC farmhouses situated proximate, either side of the road.
- Located in open plains area.
- Informal grouping of agricultural and residential buildings.
- Mature tree stand and roadside planting, dam.

12. Rooiwal (NCW) — Located north of proposed development area

Significance and Character:

- Farmstead on quitrent farm, Gegundefontein, first surveyed and granted in 1846, with Lot K, Rooiwal, subdivided c1910.
- One of a grouping of farm settlements along the historic Victoria West-Richmond Road.
- Homestead built c1950s/1970s; has distinctive Cape Revival-style front gables.
- Not conservation-worthy in terms of the built form, however it contributes to a pattern of settlement.

13. Ongersfontein (NCW) — Located on the N1 +/-6Km west of Richmond

Significance and Character:

- Located on the original Ongersfontein farm grant surveyed 1835, a portion of which was subdivided for the development of Richmond town.
- Situated on the Ongersrivier which runs through Richmond.
- Homestead built c/1970s, but the werf may include older fabric.
- Contributes to a pattern of settlement through its scale, form and siting within the landscape.

14. South Merino (Grade IIIC) — Located on the N1 east of the proposed development area

Significance and Character:

- Located on quitrent farm Steelkloof first surveyed in 1835.
- Homestead shown on 1900 survey, remnant fabric may remain.
- Distinctive, mid-20th century farmhouse with a very distinctive topographical setting.
- Located in a valley, the homestead faces north with a poplar grove along the west approach and a steep rise to the east.
- Contributes to a pattern of settlement through its scale, form and siting within the landscape.

D: CHARACTER AREA ANALYSIS

The landscape of the development area has been assessed for cultural heritage significance, and found to have five distinct character areas:

1. Historic movement corridors.
2. Open plains interrupted by low koppies.
3. Elevated areas with steep sided mountain ridges.
4. Areas of landscape that have been transformed by significant infrastructural development.
5. Remote landscape with wilderness qualities.

Table 1: Character Areas

Each character area lends itself to a different carrying capacity in terms of landscape altering infrastructure development. This is analysed as follows:

Significance	Character	Carrying Capacity
1. Historic Route corridors: • N1 following alignment of a major historical linkage route with the interior, and along which a pattern of settlement has occurred	**N1 corridor:** • National transport route across an open plain. • Linkage between Richmond and Three Sisters. • Long views framed by mountains and koppies. • The section between Rondawel and Richmond traversing an intact and representative landscape of the Central Plateau of the Karoo region. • Poort-like quality of the section of the N1, with koppies either side, as it passes Rondawel. • Minimal visual intrusions.	**N1corridor:** • Infrastructure to be set back from the N1 corridor. • Infrastructure to be one-sided. • Retain openness of views predominantly to the south. • Retain the visual quality of the N1 in terms of uninterrupted views towards ridgelines, and the absence of visual intrusion (except for telecommunication towers).
• Richmond - Victoria West corridor follows alignment of a strong, historical linkage route between two towns established 1840s, and along which a pattern of settlement has occurred.	**Richmond-Victoria West corridor:** • Low traffic volume country road. • Regular pattern of settlement; farmsteads located beside the road. • Wide lateral views across open plains.	**Richmond-Victoria West corridor:** • Infrastructure to be set back from the corridor. • Infrastructure to be one sided, may transfer from side to side. • Retain the uninterrupted lateral visual quality across plains
2. Open plains • Distinctive landscape setting and edges	• Extensive, framed, layered views interrupted by koppies. • Distinctive landscape setting and edge conditions for farmstead settlements contributes to the overall 'sense of fit' within the landscape.	• Well suited to PV infrastructure. • Landscape can tolerate clustered infrastructure provided buffer areas are observed. • No orthogonal rows of turbine development.

3. Elevated ridgelines and peaks • Steep sided slopes and ridgelines of high visual significance • Significant contribution to landscape quality of this sector of the Central Karoo Plateau.	• Ridgelines and steep slopes highlight visible to long views. • Steep sided slopes to ridgeline height +/-1450m ASL; ridgetop peaks +/-1550m ASL. • Elevated zones of surveillance. • Important ridgetop watershed. • Contribute strong landscape structuring element. • Homesteads back onto foothills of steep ridges; forward facing to open plains.	• Ridgelines and peaks are highly sensitive to development. • No development on visually sensitive ridgelines. • No development on visually sensitive mountain slopes. • Infrastructure to be clustered, and positioned in dips and on contours below ridgeline.
4. Transformed landscape • Electricity grid parallel to and set back from (4Km) the N1 corridor south of site.	• Introduction of industrial activities and intrusion of large scale infrastructure in agricultural areas. • Visual cluttering of the landscape by non-agricultural development.	• Infrastructure can be concentrated in this area.
5. Remote Karoo landscape • Landscape altered by farming practice but minimal-nil infrastructural development.	• Sense of isolation: minimal visual interruption of long landscape views	• Limited carrying capacity. • Maintain scenic qualities of wilderness-type landscape. • Avoid development on elevated exposed slopes because of their high visibility from surroundings.

The following map (figure 11) identifies these character areas, placing emphasis on the proposed development site.

LANDSCAPE CHARACTER AREAS — INDICATORS TO CARRYING CAPACITY

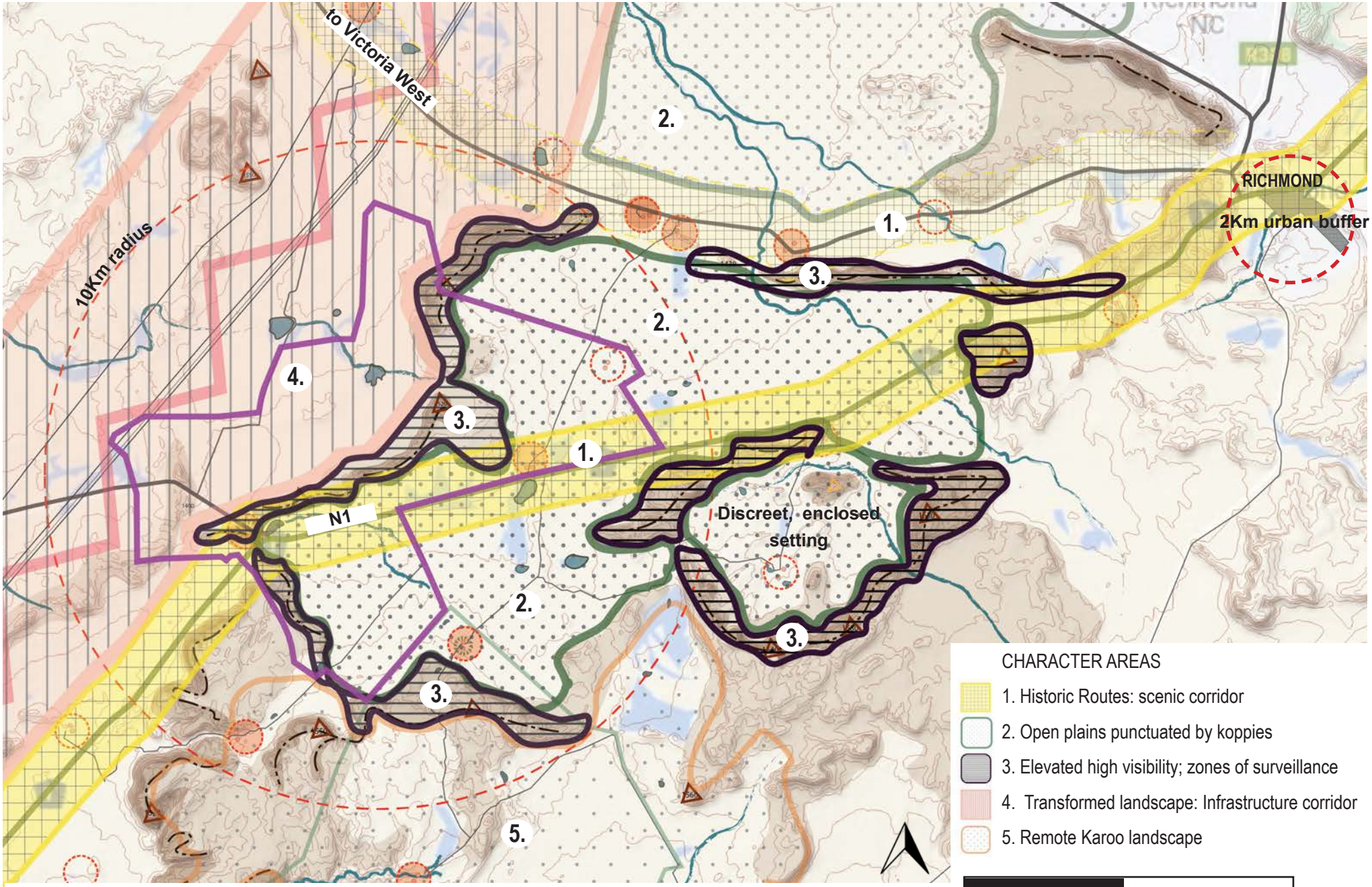


Figure 11. Landscape character areas, with emphasis on the proposed development site

E: HERITAGE MANAGEMENT IMPLICATIONS

E.1 Principles

These principles are derived from international best practice as contained in various International Charters on Conservation and a number of local adaptations, and apply to this cultural landscape assessment.

- **Landscape significance** - acknowledge the overall natural and cultural landscape, and the layered pattern of settlements in response to the natural landscape over time.
- **Landscape integrity** – retain the essential character and intactness of wilderness, rural and urban areas in the face of fragmentation through unstructured urbanisation and commercial agriculture.
- **Landscape connectivity** – retain the continuity and interconnectedness of wilderness and agricultural landscapes, including ecological corridors and green linkages.
- **Landscape setting** – maintain the role of the natural landscape as a "container" within which settlements are embedded, the landscape providing the dominant setting or backdrop.
- **The logic of landscape** – recognise the intrinsic characteristics and suitability of the landscape and its influence on land use, settlement and movement patterns, in response to geology, topography, water, soil types and microclimate.

Principles applied to the proposed development site:

1. The proposed site is located outside of a RED Zone. To address concerns about the cumulative impact of RE facilities within the greater Karoo region, a cautious approach is required in terms of assessing the desirability of such development from a cultural landscape perspective.

2. The proposed site is located adjacent to an existing infrastructural corridor associated with the national grid, which suggests a level of suitability of RE facilities which can link in with the grid. Notwithstanding the existing infrastructure, the placement of RE facilities, both PV and WE turbines, must take cognisance of the very high visual impact on a relatively intact and representative cultural landscape, and the extremely limited ability to visually screen this infrastructural development, particularly in the case of the wind turbines.

E.2 Heritage Indicators

The character area analysis provides an assessment of what each area can accommodate from a RE perspective. These are divided into three zones, as follows:

1. "No go" areas,
2. "Tread lightly" areas suitable to PV only (subject to site specific constraints)
3. Developable areas suitable for infrastructure (PV and wind turbines)

Table 2: Heritage Receptors

The following table identifies development sensitivities relevant to the proposed development area and its vicinity. This information serves as a guide to the possible carrying capacity of landscape features and character areas.

Resource	No-go areas	Tread lightly areas	Developable areas
Richmond town	2000m buffer	2-4 Km	>4 Km
Scenic historic routes	1000m buffer either side	1000 - 2500m	>2,5 Km
Farmsteads: Graded IIIA, B, C	1000m buffer	1000 - 2000m	>2Km
Farmsteads: NCW	500m	500 - 1000m	>1Km
Rivers, dams, water features	250m	250 - 500m	>500m
Ridgelines, peaks	Feature; 250m from ridgeline top	250 - 500m	>500m
Steep slopes	Slopes >1:4	slopes >1:10	<1:10

Heritage receptors adapted from Oberholzer 2020

WEF Turbine placement - position ("where"):

The indicators are to be aligned with the visual sensitivity analysis and to include the following:

- Setback from the N1 and the Victoria West-Richmond corridors by at least 1000m on either side.
- The siting of turbines to be one side of the N1 only, rather than straddling both sides to avoid a canyon effect resulting from the impact of the height of the turbines.
- Avoid steep or elevated topography, ridgelines or koppies.
- Setback from graded resources and farmstead settlements IIIA, IIIB and IIIC, by 1000m.
- Setback from farmsteads forming part of the settlement pattern by at least 500m
- Prioritise placement behind the mountain ridgelines running parallel to and north of the N1.
- Concentrate placement in proximity to the existing infrastructure.

Turbine placement - principles ("how"):

The following general principles apply to the turbine layout:

- Avoid an orthogonal pattern in favour or a more organic pattern.
- Turbines should be clustered or read as single elements the landscape, as opposed to being aligned in a row in visual spatial proximity of each other.
- Avoid continuous or unbroken swathes of infrastructural interventions, especially as viewed from the N1.
- Avoid a stacking effect of the alignment of turbines, especially as viewed from the N1. A staggered setback line is preferable.

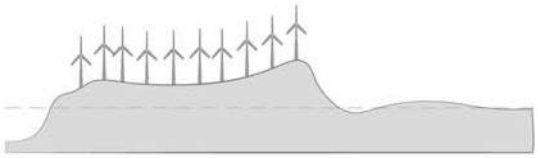
Solar PV placement ("where" and "how"):

The following general principles apply to the PV layout:

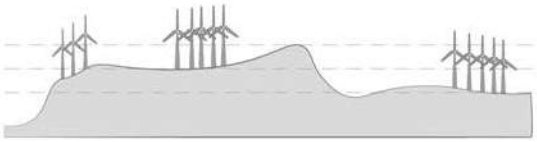
- Avoid steep slopes.
- Avoid proximity to historic corridors.
- Avoid placement within viewshed of farmsteads.

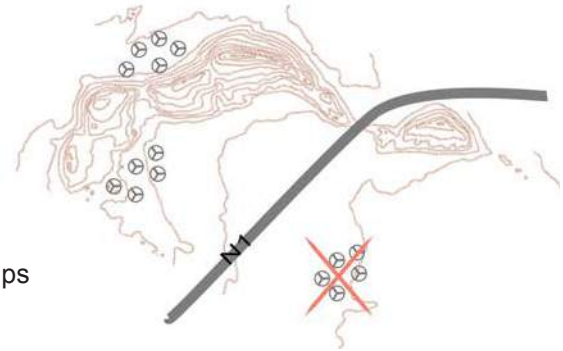
The indicators are aligned with the visual sensitivity analysis (see figure 15).

PRINCIPLES OF WEF TURBINE PLACEMENT

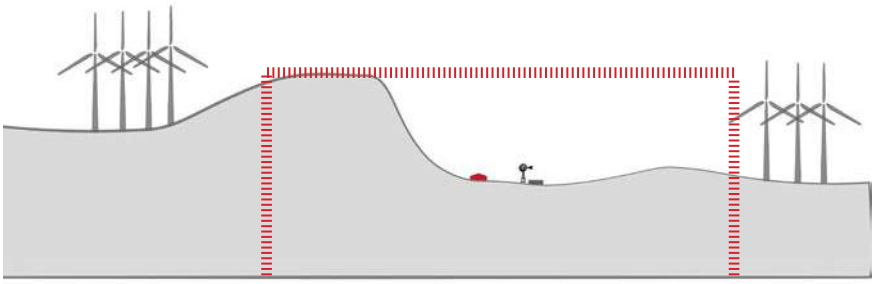


Do not follow an orthogonal pattern
Avoid ridgelines

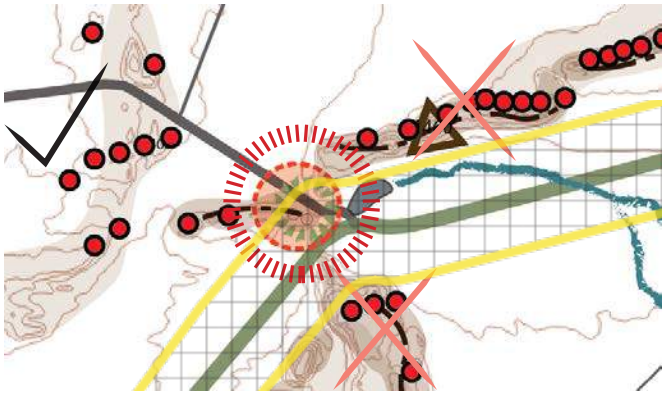




Cluster turbines
Do not cluster on both sides of N1
Place in visually shielded areas and topographic dips
Locate in areas of existing infrastructure



Maintain 1000m protective area around Graded heritage resources and farmsteads IIIA, IIIB, IIIC.
Maintain 500m protective area around farmsteads forming part of the settlement pattern.



Cluster turbines
Do not cluster on both sides of road corridor
Avoid ridgelines
Retain 1000m buffer either site of road corridor
Maintain 1000m protective area around graded farmsteads

HERITAGE MANAGEMENT IMPLICATIONS

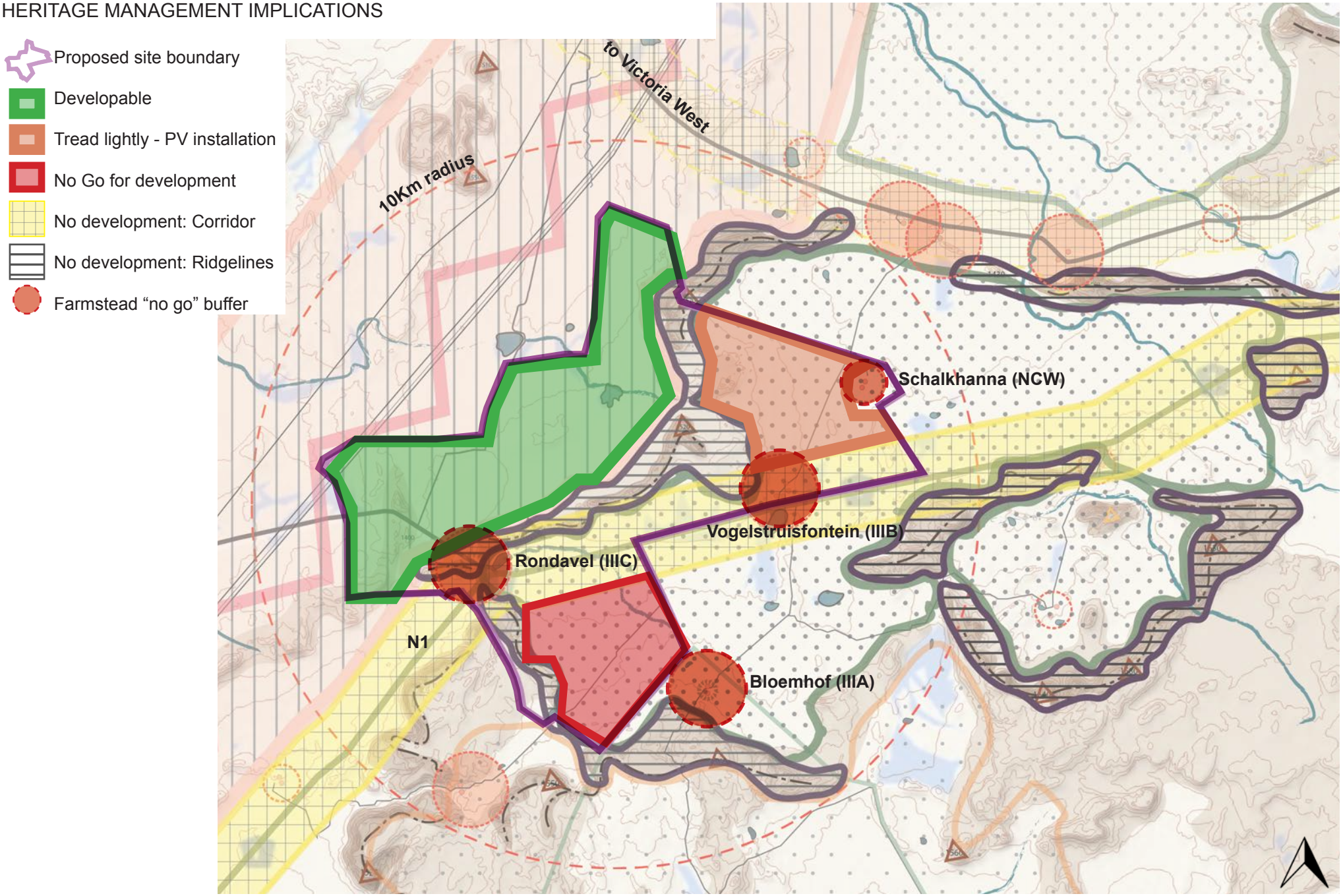


Figure 12. Analysis of character areas and developable zones

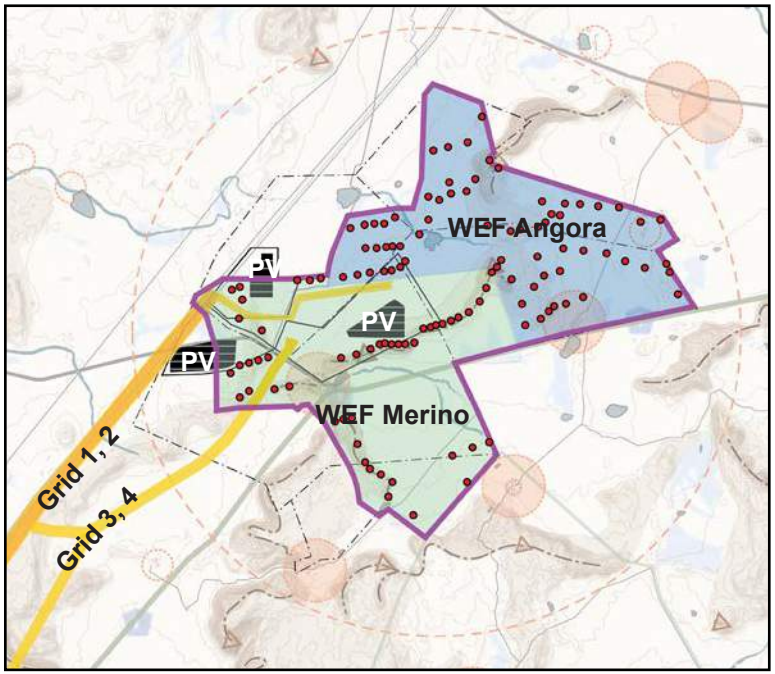
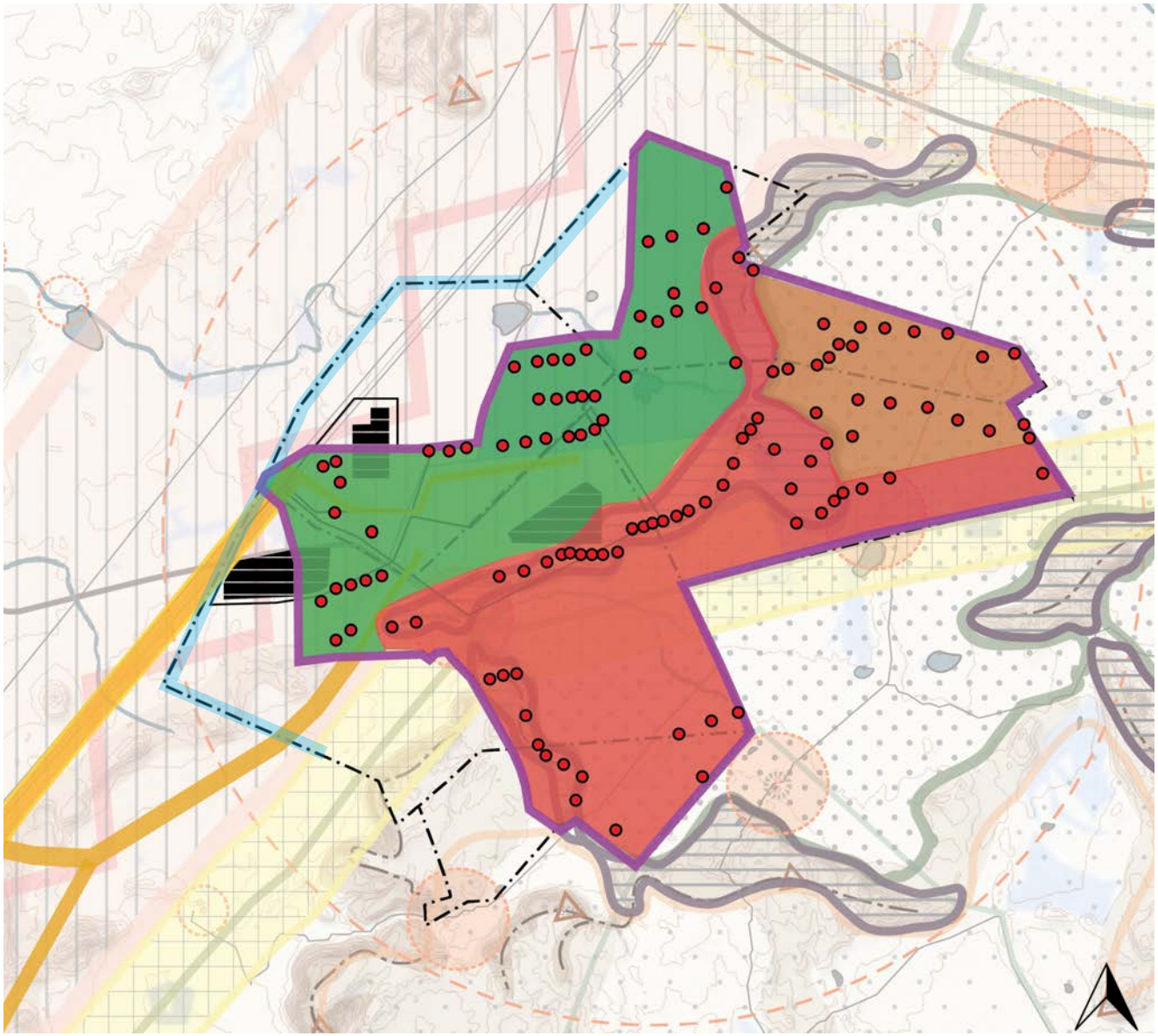


Figure 13. Proposed placement of WEF, PV and grid options



Proposed site boundary

Cadastral boundaries (TBC)

Developable for WEF

Tread lightly - PV installation

No Go for development

Proposed PV development area

Proposed WEF turbine development position

Cadastral boundary (TBC) extent for development

Figure 14. Overlay: development sensitivities and proposed development. This demonstrates the positions to be avoided for proposed wind turbine placement.
Note: cadastral boundaries suggest that there is developable area north and west of the proposed site boundary

F. SUMMARY OF THE VISUAL IMPACT ASSESSMENTS

Summary of the "Visual Assessment, Input for Scoping Report" by du Plessis, LOGIS November 2021, a desktop assessment of the impact of the proposed three solar PV and two wind energy developments.

The location of the site of proposed development is identified as agricultural, with a "rural and natural character" (Du Plessis 2021). It is described as remote from any major metropolitan area, with a number of homestead settlements within the study area. The N1 is described as a "connecting spine". It has high scenic value resulting from the open landscape with topographical features of a predominantly natural character.

Photovoltaic Energy Facilities: Nku, Kwana, Moriri

A 6Km visual radius incorporates the area of potential visual influence. The infrastructure of the three proposed solar installations has relatively constrained dimensions and includes PV panels, inverters and BESS. Examined individually, impact to each site is assessed as follows:

- Nku: PV development represents a fairly limited visual exposure contained to a 6Km radius and concentrated to the north east. The area of greatest visual impact (1-3Km radius) falls mostly on farmland but does include the Rondavel homestead and portion the N1 at its outer limit.
- Kwana: The low rise nature of the PV facility, and the ridgeline along the south of the portion of the development area contains the visual impact to the north of the site, with it being largely shielded from the N1, although visible in the 3Km radius of Rondavel settlement.
- Moriri: This is located to the north west limit of the development zone with visual exposure greatest to the north and east into an area traversed by existing Gamma power lines.

The anticipated result of the PV installation is a potential impact to the visual character and sense of place of the Rondavel farmstead settlement, the road which meets the N1 at Rondavel, and potentially a portion of the N1. This is assessed as a long term negative impact of moderate to high significance, and a Visual Impact Assessment is recommended to determine more precisely the impact, absorption capabilities and recommended mitigation options.

Wind Energy Facilities: Merino and Angora

The height of the tall wind turbine structures, and the relatively flat topography results in a large core area of potential visual exposure. The WEF structures have high visual prominence and represent a high visual impact on the rural character and sense of place. There introduces an added negative visual impact to tourist facilities at Rondavel and Bloemhof farms. The visual absorption capacity of the natural vegetation is not great.

- Large core area of visual exposure within a **5Km radius**. This includes visual impact to farmsteads Schalkhanna, Vogelstruisfontein, Rondavel (all on the development site), Bloemhof, Gegundefontein, Rietfontein, Excelsior and Westdene. Clear visibility of the turbines from the N1 and the two lesser roads is also anticipated.
- The visual exposure remains high to a **10Km radius**, particularly to the north east and south west, impacting farmsteads and a section of the N1 within that visual zone.
- From the longer **10-20Km radius** distance, visual exposure is reduced and interrupted by hills and ridges particularly to the south east and north west, however, local farmsteads and a section of the R398 remain exposed.
- From a **30Km radius**, visual exposure is much reduced with Richmond, which falls within this zone, not exposed.

The nature of the impact of the proposed turbines is assessed as high to very high negative, affecting the rural, natural setting within a radius up to 10Km but potentially further. The visual impact of the supporting infrastructure (BESS and substations) is assessed to be more localised. Once the turbine placement is established, a Visual Impact Assessment is recommended to determine the visual impact of the finalised layout: the cumulative impacts, visual absorption capability and possible mitigation.

Recommendations

Based on provisional turbine placement and proposed grid alternatives, the Visual Assessment concludes that:

- Ridges, hills and other elevated topographical features are No Go areas for turbine infrastructure.
- No development in a 1000m buffer area around homesteads and dwellings.
- No development within a 1000m buffer area either side of N1 and local road corridors.
- Grid connection alternatives 1 and 2 are preferred as they traverse adjacent to power lines where there is existing visual disturbance; they traverse further from existing dwellings and roads.
- Grid connection alternatives 3, 4, 5 should be avoided as they traverse topographical units such as Platberg and Blouberg.

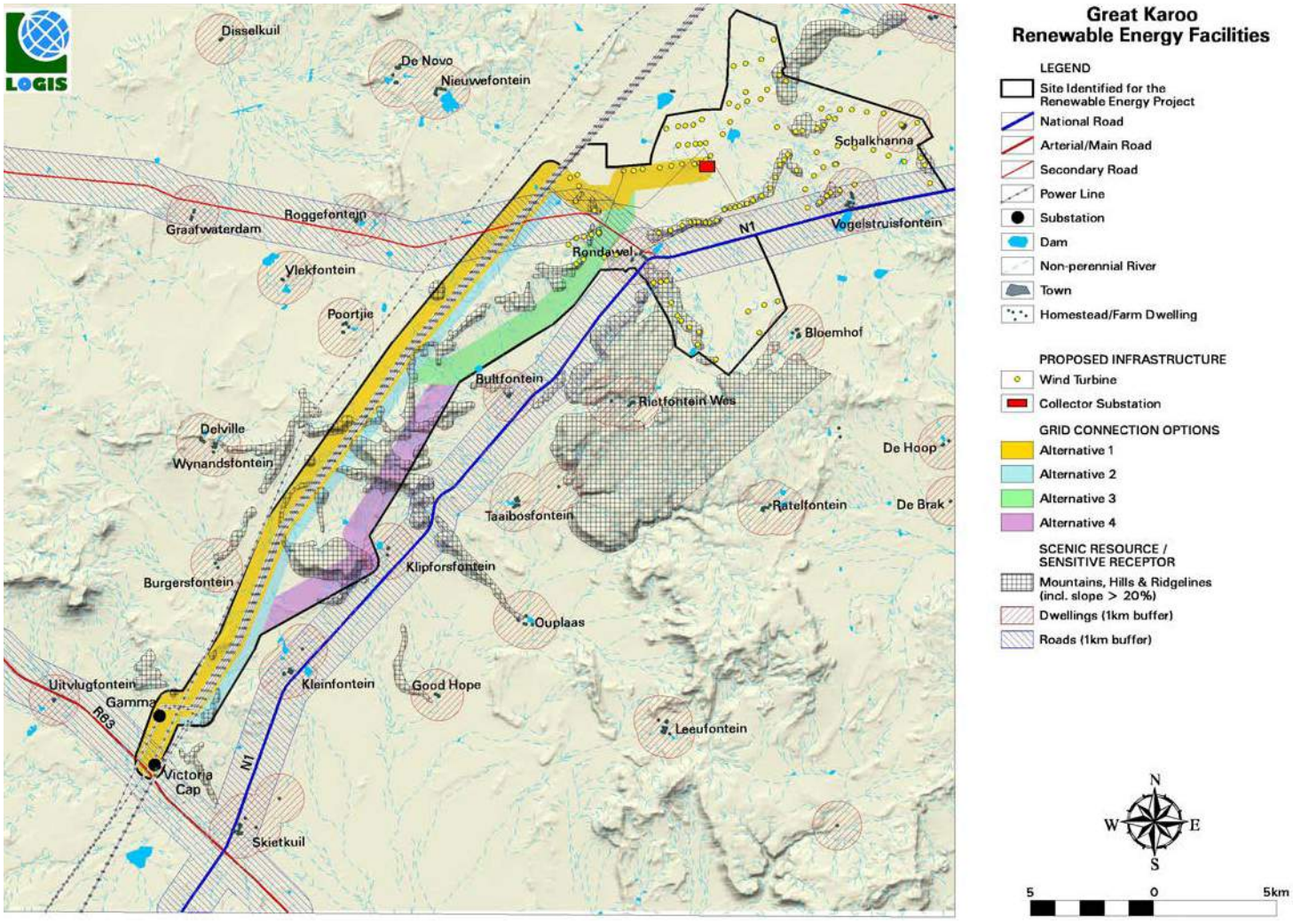


Figure 15. Visual assessment of necessary buffer areas and no go areas. (Images: Du Plessis)

G. ASSESSMENT OF HERITAGE IMPACTS

The principle of a renewable energy facility in this location is supported from a cultural landscape perspective provided that the infrastructure is located in areas able to tolerate the impact of the high degree of change. However, as shown by figures 12 and 13 (above), portions of the proposed site are unable to tolerate infrastructure development: steep, high visibility slopes and ridgelines; N1 corridor; farmstead settlements. No development should be allowed in these locations as the impact to the character and sense of place will be devastating.

Impact: Solar PV

The proposed solar PV facility, with a minor amendment to the proposed positioning to avoid high visibility sloped inclines, can be accommodated within an acceptable level of impact. Furthermore, the areas described by the character areas study as “tread lightly” zones have the capacity to accommodate some PV installation.

Impact: Wind energy turbines

The scale, height and impact to landscape of the concrete turbine foundations, access roads and internal distribution roads of the proposed development of the wind turbines represents a high negative impact to the cultural landscape. This is only acceptable in the character area of the north west portion of the development site, which is identified as “developable”. Development of WEF turbines should be limited to that sector of the proposed site, which is able to accommodate development of this type.

The proposed positioning of turbines on ridgelines, in proximity to farmsteads, and in locations south of the N1 is not appropriate and should be revised.

The development could extend north west, into the transformed landscape area beyond the boundaries of the proposed area for development.

Impact: Grid Connection

The alternatives 1 and 2 of the grid connection begin in a developable area and follow a route of existing infrastructure. Therefore the impact to the cultural landscape of the additional infrastructure is acceptable, as it makes little material difference to the already disturbed landscape. Alternatives 1 and 2 are therefore preferred to the other alternatives presented, which are to be avoided. An assessment of these alternatives is adequately addressed in the Visual Assessment (see figure 18).

Table 3: Comparison Visual Assessment and Cultural Landscape

The table below demonstrates shared conclusions regarding the areas that are highly sensitive to the impact of RE development infrastructure.

Resource	Visual Impact Assessment	Cultural Landscape Assessment
Routes & roads	1000m buffer either side	1000m buffer either side
Farmsteads and dwellings	1000m buffer	Graded: 1000m buffer NCW: 500m buffer
Ridgelines, peaks	No go	No go
Steep slopes	No go >20%	No go slopes >25%
Rivers, dams, water features	-	No go 250 - 500m

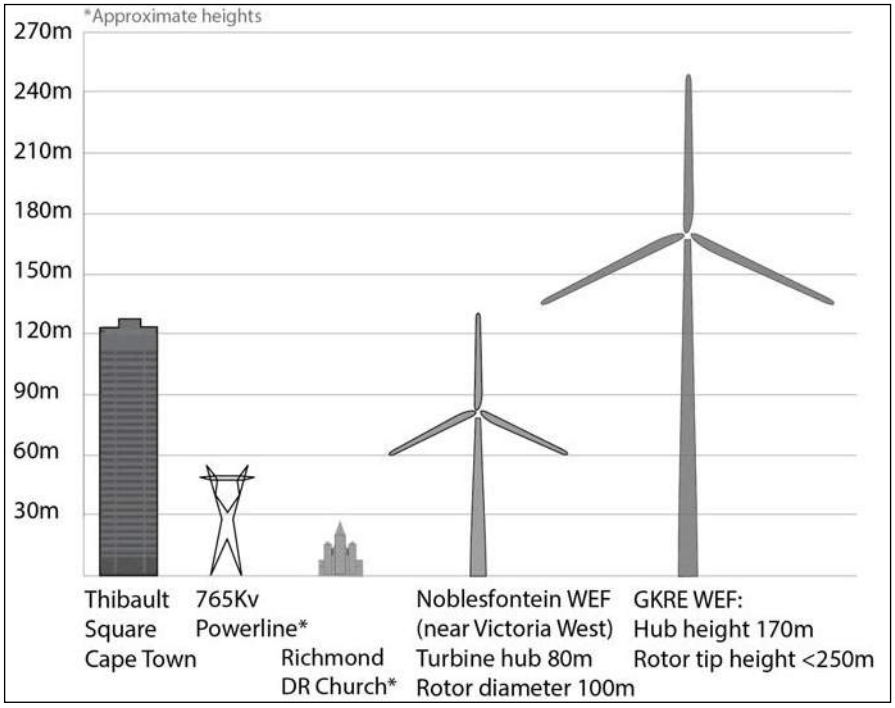


Figure 16. Diagrammatic representation of relative heights.

RELATIVE AVERAGE HEIGHTS:

- Open plains 1350m ASL
- Ridge lines 1450m ASL
- Peaks 1550m ASL
- Turbine height to rotor tip: 250m

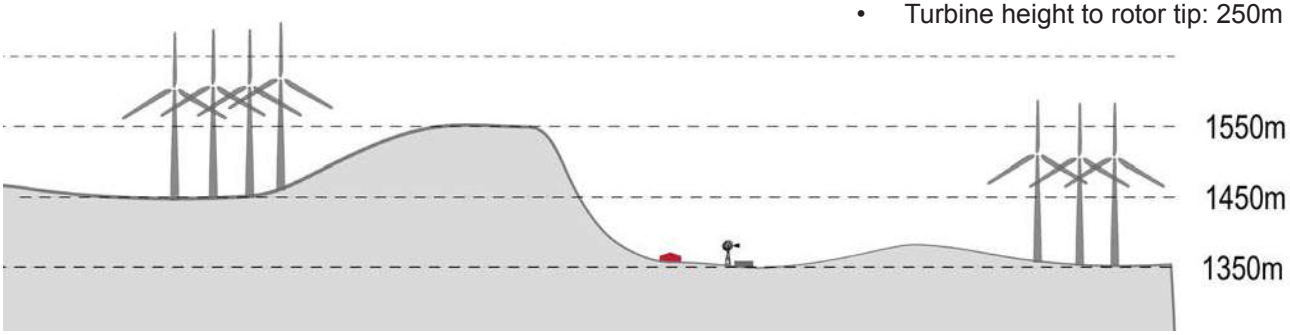


Figure 17. Visual impact in landscape

Figure 18. Wind farm and road infrastructure in the landscape: example of Wind Farm Hopefield with 37 turbines with a hub height of 95m and rotor diameter of 100m (total height 145m). (Image: Windbase.eu)

H. CONCLUSION AND RECOMMENDATIONS

The site forms part of an intact cultural landscape representative of the Central Plateau of the Great Karoo possessing heritage value for historical, aesthetic, architectural, social and scientific reasons.

The site possesses a number of landscape elements contributing to a composite cultural landscape including topographical features, open plains, water features, historic scenic routes and farmsteads.

The landscape affected by the proposed development has a number of character areas within varying significances and sensitivities to accommodate RE infrastructure culminating in the identification of no-go areas, tread-lightly areas and areas more resilient to WEF as illustrated in Figure 12, as well as a number of design indicators for placement of RE infrastructure. The impact on cultural landscape resources is illustrated by Figures 13, 14 and 15 and as summarised as follows:

1. The proposed solar PV facility, with a minor amendment to the proposed positioning to avoid high visibility sloped inclines, can be accommodated within an acceptable level of impact. Furthermore, the areas described by the character areas study as “tread lightly” zones have the capacity to accommodate some PV installation.

2. Many of the WEF turbines are located in no-go areas and would thus need to be removed or repositioned to less sensitive locations to ensure an acceptable level of impact from a cultural landscape perspective. Such development is only acceptable in the character area of the north-west portion of the development site. The proposed positioning of turbines on ridgelines, in proximity to farmsteads, and in locations south of the N1 is not acceptable and should be revised.

3. Alternatives 1 and 2 of the grid connection follow a route of existing infrastructural corridor. The impact to the cultural landscape of the additional infrastructure is acceptable, as it makes little material difference to the already disturbed landscape. Alternatives 1 and 2 are therefore preferred to the other alternatives presented, which are to be avoided.

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APPENDIX 4: Heritage Screening Assessment

CTS HERITAGE

HERITAGE SCREENER

CTS Reference Number:	**CTS21_114**
SAHRIS Reference:	
Client:	**Savannah Environmental (Pty) Ltd**
Date:	**September 2021**
Title:	**Proposed Great Karoo Renewable Energy Facility development grid connection near Richmond in the Northern Cape**

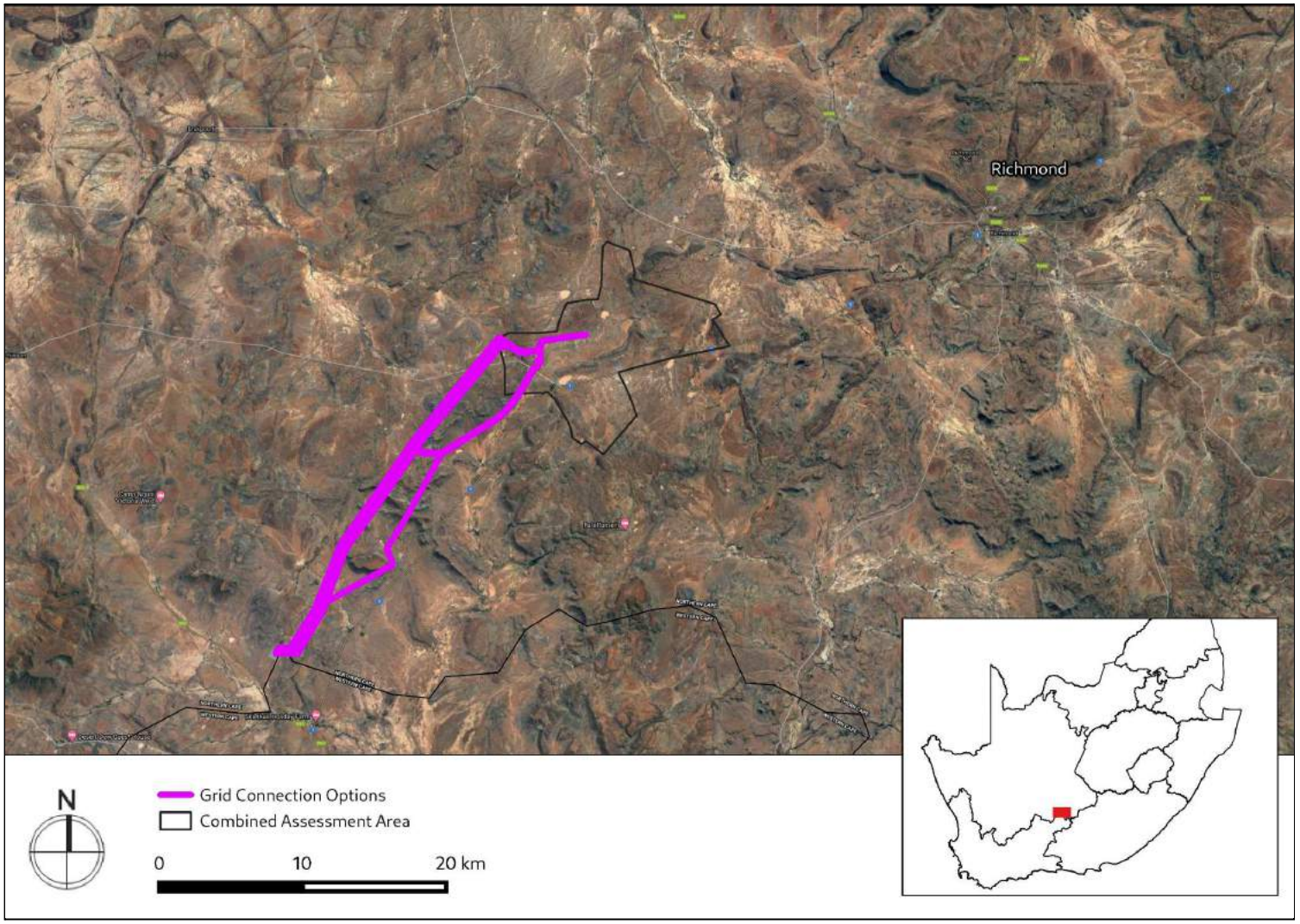

Figure 1a. Satellite map indicating the location of the proposed development in the Northern Cape

CTS Heritage
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1. Proposed Development Summary

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of 2 x wind energy facilities, 3 x solar energy facilities and 5 x grid connections on sites near Richmond, Northern Cape. The cluster of projects is known as Great Karoo Renewable Energy (GKRE). As the projects fall outside of a REDZ, a full Scoping & EIA process would be required for the facilities and BA processes for the associated grid connections.

Project details are as follows:

Project NameTechnology Capacity Affected farm names

- Angora Wind Energy Facility Wind (140MW) on Rem. 85 Rondavel, 86 Annex Rondavel and Rem. 84 Vogelstruisfontein
- Merino Wind Energy Facility Wind (140MW) on Land Rem. 85 Rondavel, 86 Annex Rondavel and Rem. 84 Vogelstruisfontein

Grid connection infrastructure associated with each of the above-mentioned projects will include a 132kV onsite substation and 132kV overhead power line.

2. Application References

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

3. Property Information

Latitude / Longitude	
Erf number / Farm number	
Local Municipality	
District Municipality	
Province	
Current Use	
Current Zoning	

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4. Nature of the Proposed Development

Total Area	
Depth of excavation (m)	
Height of development (m)	

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
	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-
x	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

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

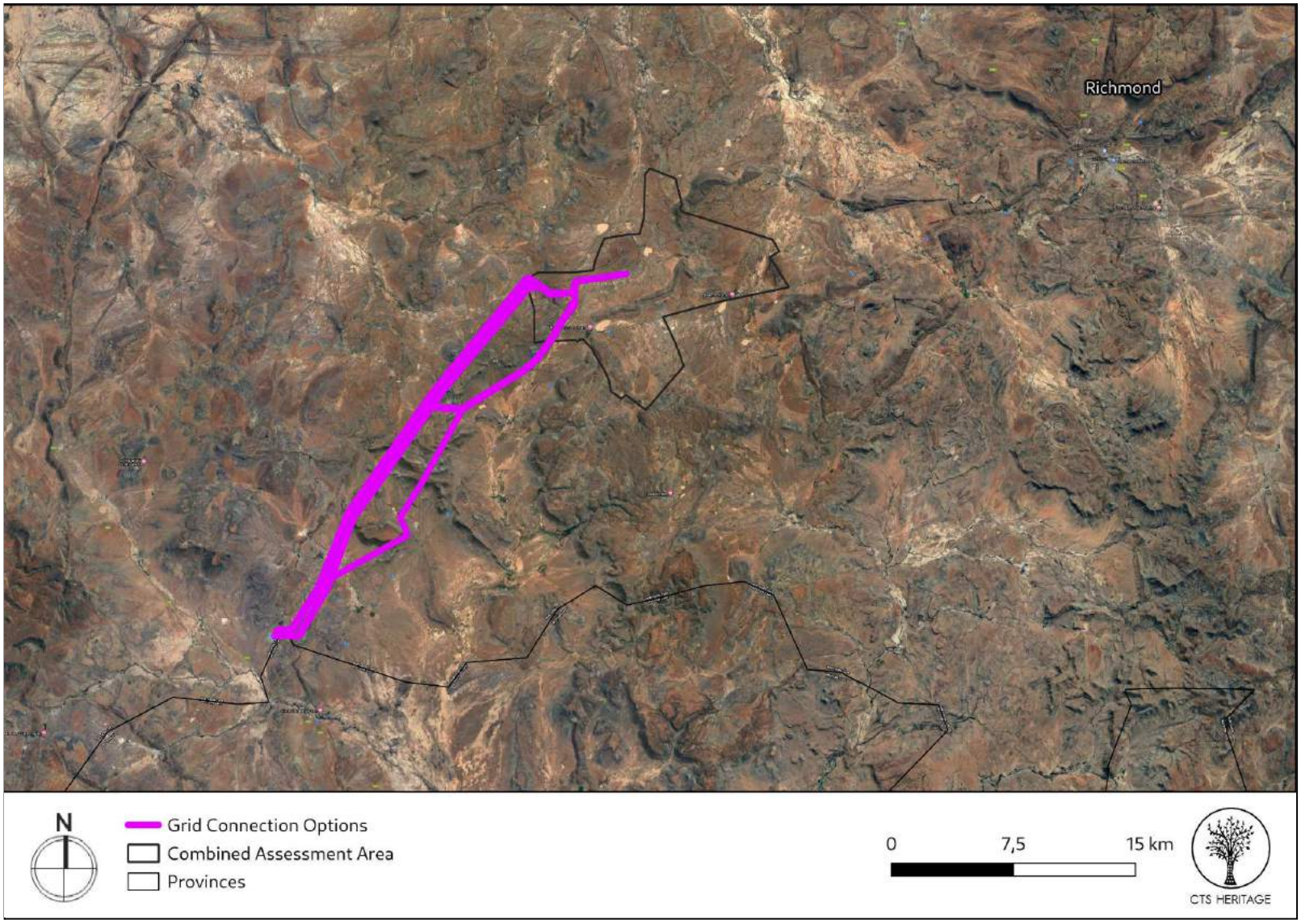

Figure 1b. Overview Map. Satellite image (2020) indicating the proposed development area relative to Richmond

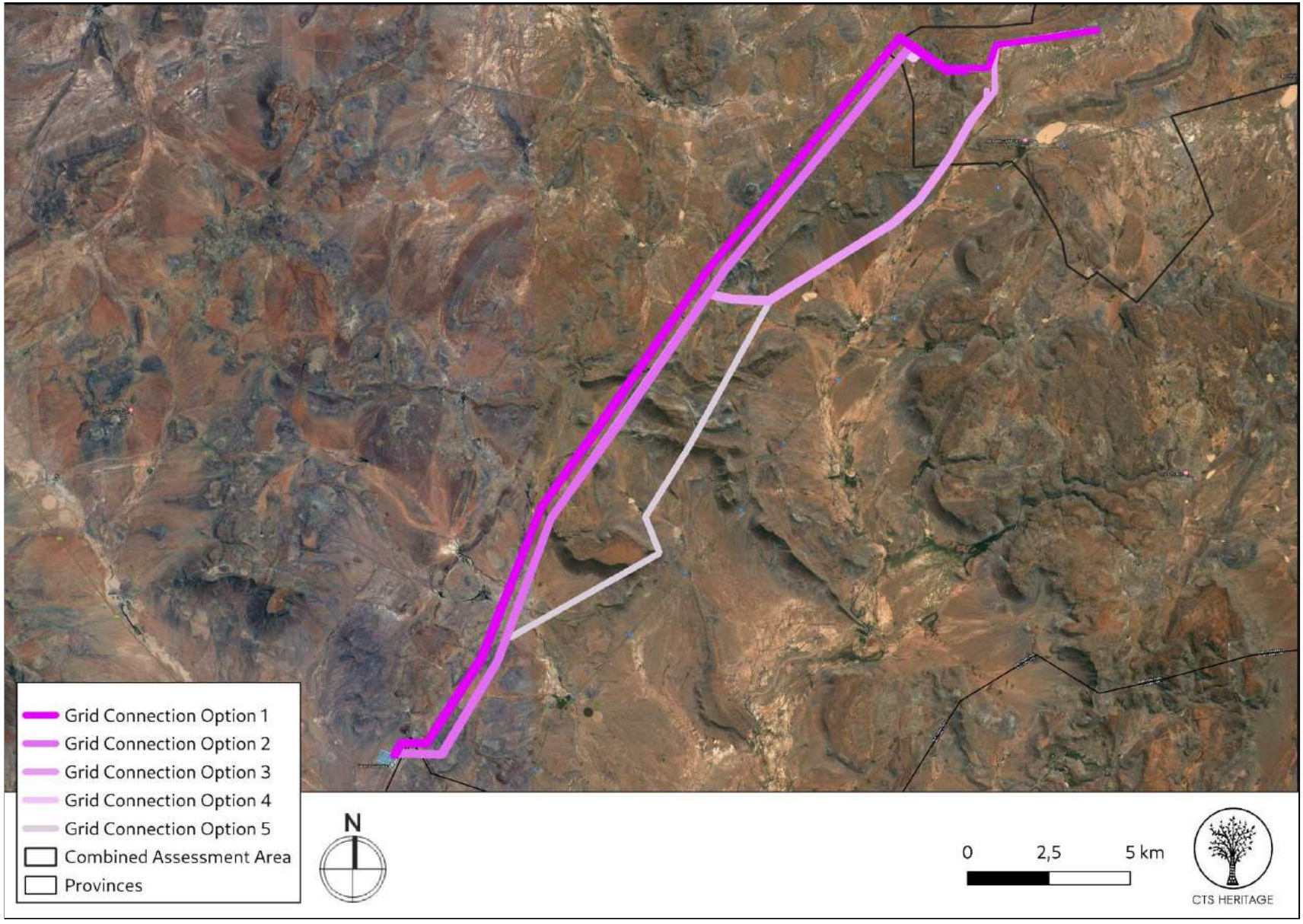

Figure 1c. Overview Map. Satellite image (2020) indicating the proposed development area

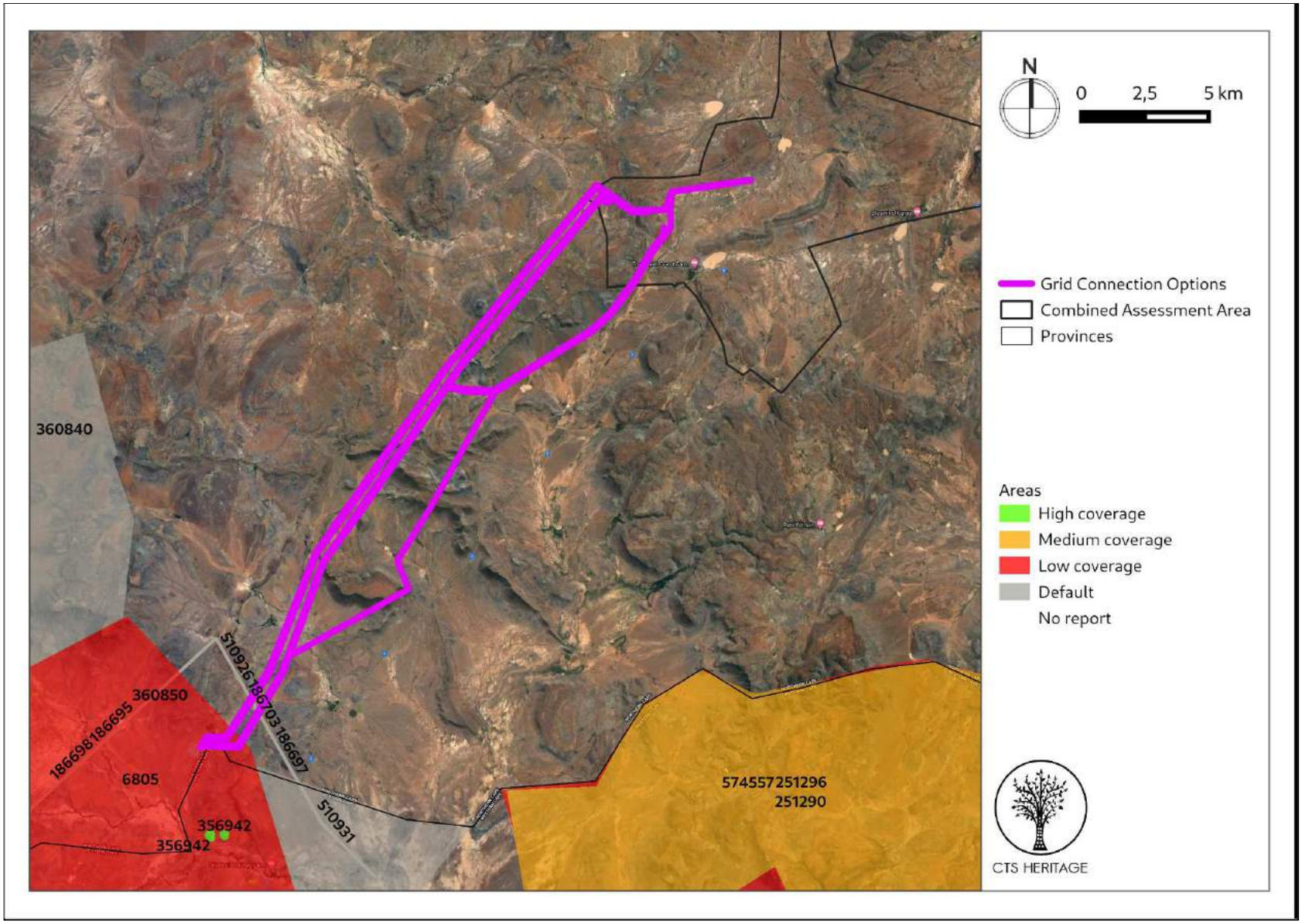

Figure 2a. Previous HIAs Map. Previous Heritage Impact Assessments covering the proposed development area with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

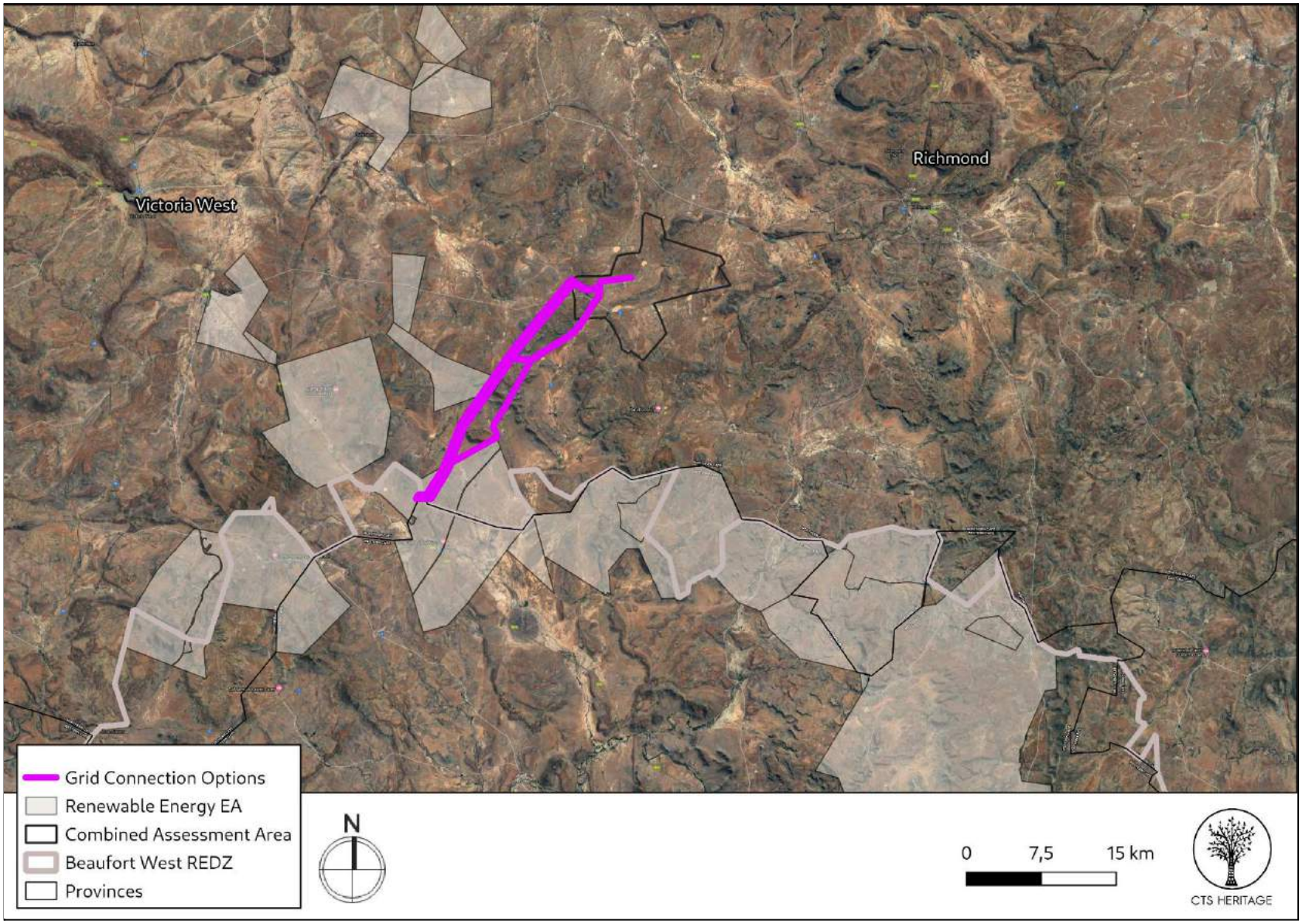

Figure 2b. Previous Reports Map. Map indicating the boundaries of the Beaufort West REDZ and the renewable energy developments that have received Environmental Authorisation

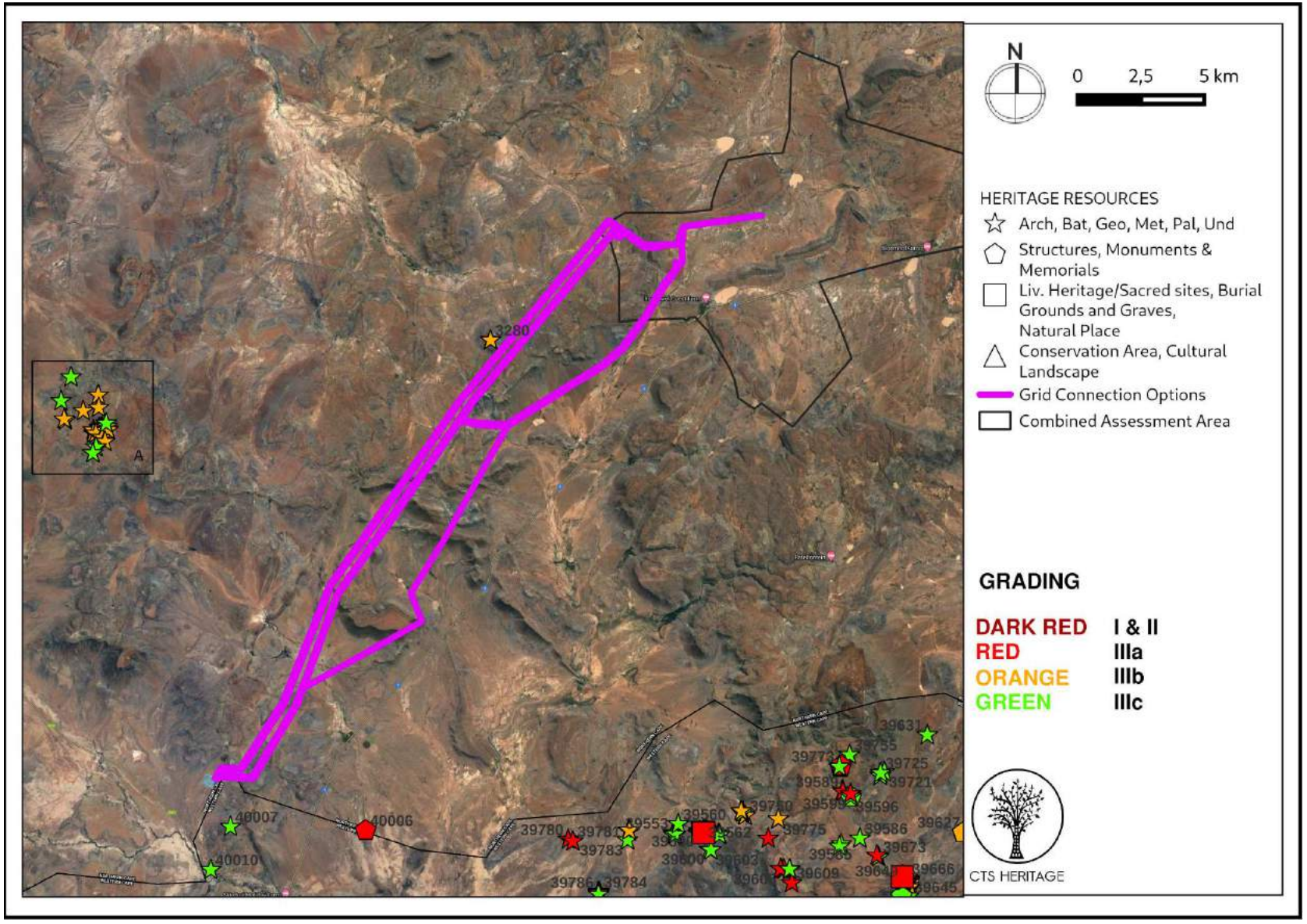

Figure 3. Heritage Resources Map. Heritage Resources previously identified within the study area, with SAHRIS Site IDs indicated in the insets below. Please See Appendix 4 for full description of heritage resource types.

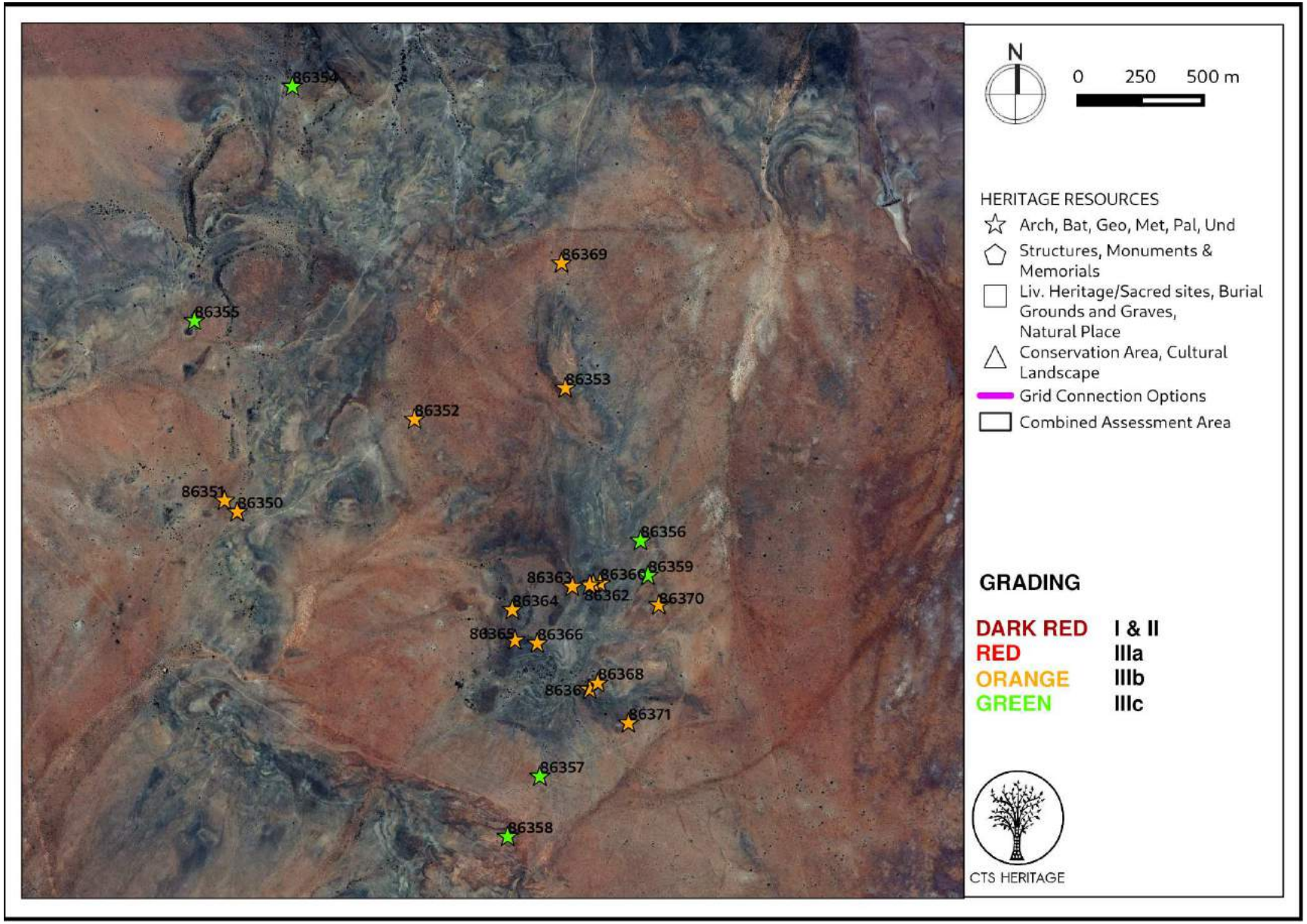

Figure 3a. Heritage Resources Map Inset A

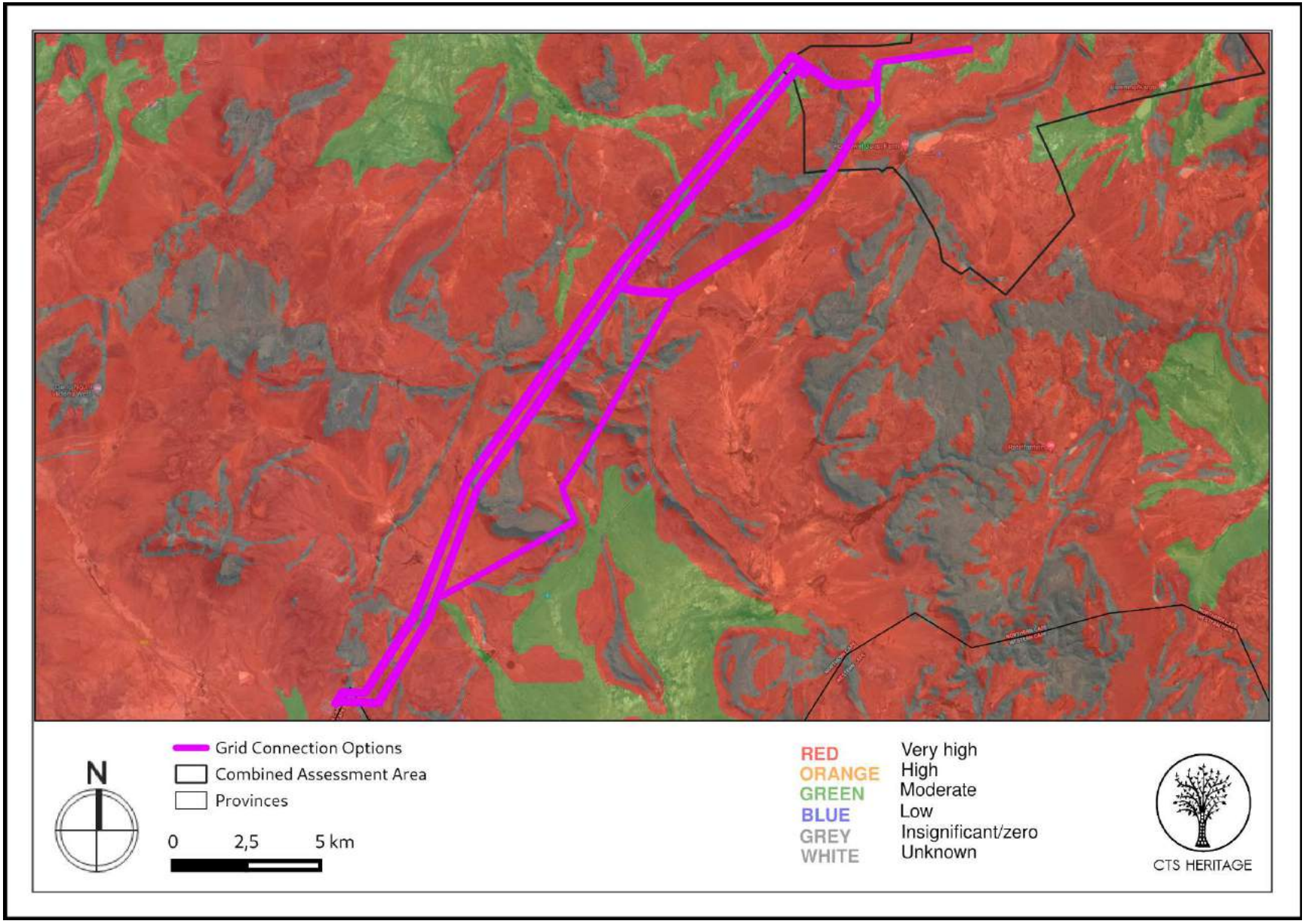

Figure 4a. Palaeosensitivity Map. Indicating fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

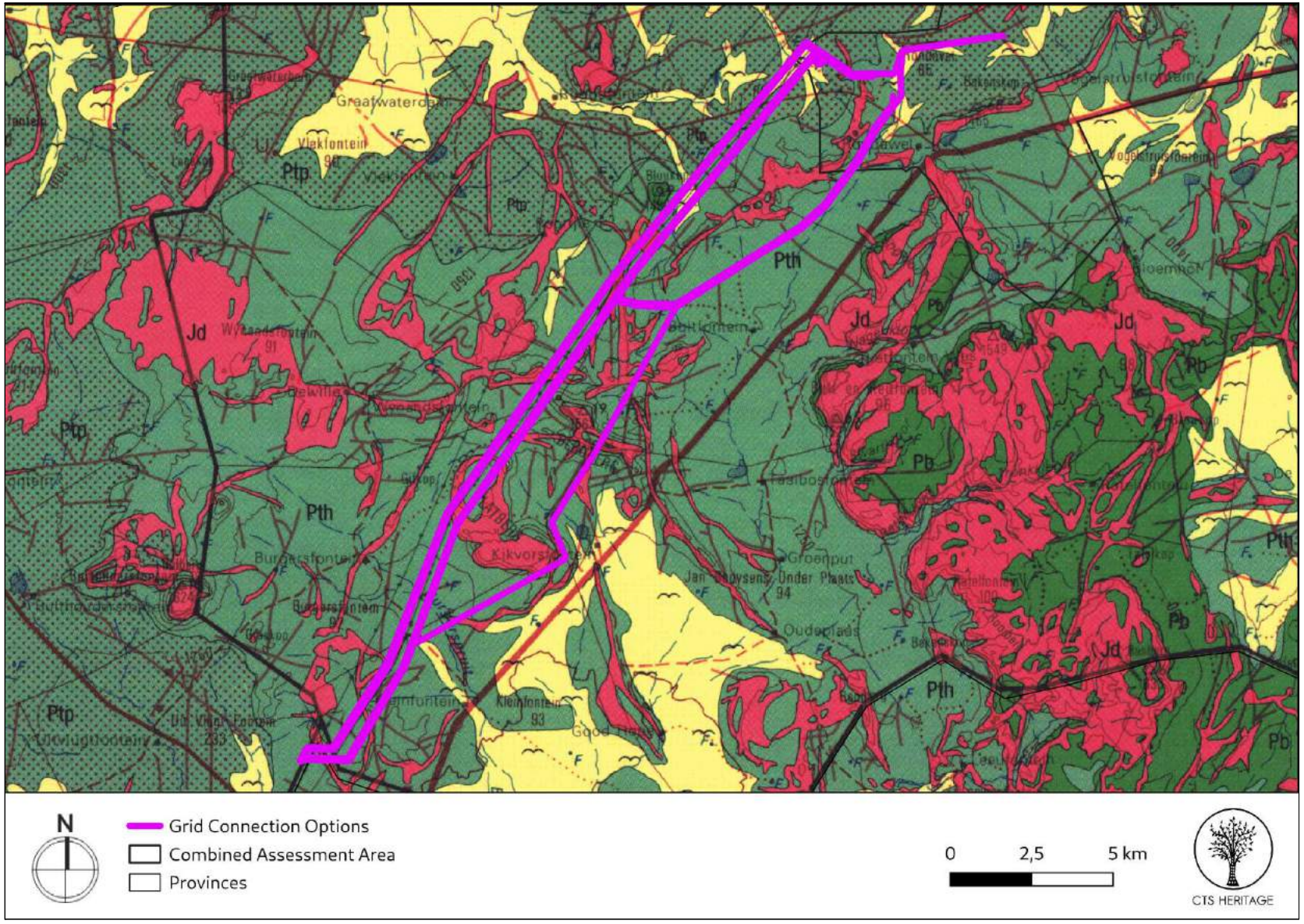

Figure 4b. Geology Map. Extract from the CGS 3122 Victoria West Map indicating that the development area for the WEF development is underlain by sediments of Ptp: Poortjie Member and Pth: Hoedemaker Member of the Teekloof Formation of the Adelaide Subgroup and Jd: Jurassic Dolerite as well as Quaternary Sands

8. Heritage Assessment

The area proposed for the Great Karoo Renewable Energy Facility Projects including this proposed Grid Connection is located approximately 20km southwest of Richmond in the Northern Cape, and 40km east of Victoria West outside of the identified Beaufort West REDZ (Figure 2b) along the N1. The town of Richmond was established in 1843 to service the needs of the growing farming community. It was renowned as a resort town in the 1800s for European aristocrats suffering lung disease due to its clean air and mineral-rich waters.

Cultural Landscape

The name 'Karoo' has its roots in the Khoisan word meaning 'place of great dryness'. It once supported large grassy flatlands and the San and Khoekhoen migrated across the region for hunting and grazing purposes. Less than two hundred years ago large herds of antelope still roamed the grass plains. With the occupation of the area by stock farmers the sheep gradually replaced the game and the grass receded along with changing grazing and weather patterns (Winter et al 2009; Winter & Oberholzer 2013). By the late 17th century, the Khoenhoen had moved from the region into the more water rich southern Karoo and the coastal plains. During the early colonial period, the harshness of the Karoo region formed an almost impenetrable barrier from the Cape to the interior for colonial explorers, hunters and travellers. The 18th century was characterized by a marked increase in the rate of expansion of the boundaries of the settlement at the Cape. This was associated with the emergence of the migrant stock farmer (trekboer) (Guelke 1982 In Winter et al 2009). Early routes into the interior largely followed the tracks initially used by migrating herds of game or the cattle herds and sheep flocks of the Khoekhoen on their seasonal route between coastal and inland grazing grounds. These routes were later reinforced by generations of trek farmers moving between the markets at the Cape and their farms (Winter et al 2009).

Permanent settlement of the region only really occurred in the 19th century with towns being established near permanent water sources. It was during this period that Beaufort West was established as a drostdy in 1818 on the farm Hooyvlakte. In the same year, a mission station was established at Kookfontein, just outside Beaufort West (Winter et al 2009). Beaufort West became the first municipality in South Africa on 3 February 1837 and had the country's first town hall. When the railroad reached the town in 1880 it became a marshalling yard and locomotive depot and today it is the largest town in the Karoo. A number of the significant heritage resources located in close proximity to the proposed development are located within Beaufort West and are associated with the early colonial history of the town (Figure 3a and Appendix 1).

The proposed development is located along the N1 which is used as a main transport route from the Western Cape to Gauteng through the Northern Cape. In addition, the area proposed for development has limited topography that could screen the proposed development (Figure 5a and 5b). It is therefore very likely that the proposed development will have a negative impact on the cultural and scenic value of the landscape.

Archaeology

Very few heritage assessments have been completed within close proximity to the area proposed for development (Figure 2a). According to Nilssen (2014, SAHRIS NID 504763), "The Karoo houses a long and rich archaeological record dating from the earliest stages of Stone Age technology that are over a million years old, to the historic period that consists of the last few hundred years of human occupation (see Nilssen 2011 and references therein). Archaeological sites include caves and rock shelters, open air artefact scatters, rock engravings and historic structures with their associated cultural materials." According to ACO (2013, SAHRIS NID 503074), "Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape. Where definable scatters of Early and Middle Stone Age material occur, they are considered to be significant heritage sites. More intensive occupation of the Karoo started around 13 000 years ago during the Later Stone Age, which is essentially the heritage of Khoisan groups who lived throughout the region. The legacy of the San includes numerous open sites while traces of their presence can also be found in most large rock shelters, often in the form of rock art. They frequently settled a short distance from permanent water sources (springs or waterholes) and made use of natural shelters such as rock outcrops or large boulders or even large bushes. In the Great Karoo natural elevated features such as dolerite dykes and ridges played a significant role in San settlement patterns." It is likely that similar archaeological heritage exists within the areas proposed for development and as such, impact to these resources must be assessed.

Palaeontology

According to the SAHRIS Palaeosensitivity Map (Figure 4a), the area proposed for development is underlain by sediments of very high paleontological sensitivity. According to the extract from the Council for GeoSciences Map 3122 for Victoria West, the development area is underlain by the Abrahamskraal and Teekloof Formations, both of the Adelaide Subgroup of the Beaufort Group of sediments. According to the SAHRIS Fossil Heritage Browser and the Palaeotechnic Report for the Western Cape (Almond and Pether, 2008), the Beaufort Group sediments are known to preserve diverse terrestrial and freshwater tetrapods of *Tapinocephalus* to *Lystrosaurus* Biozones (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways) and sparse vascular plants (*Glossopteris* Flora, including petrified wood). Based on the known paleontological sensitivity of this area, it is very likely that activities associated with the development of the proposed WEF and grid connections will negatively impact on significant fossil heritage.

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APPENDIX 1

List of heritage resources within close proximity to the development area

Site ID	Site no	Full Site Name	Site Type	Grading
27793	9/2/078/0012-036	29 Loop Street, Richmond	Building	Grade IIIb
27791	9/2/078/0012-037	115 Pienaar Street, Richmond	Building	Grade IIIb
27825	9/2/078/0005	214 Paul Street, Richmond	Building	Grade IIIb
27826	9/2/078/0012-001	247 Church Street, Richmond	Building	Grade IIIb
27823	**9/2/078/0012-002**	**170 Pienaar Street, Richmond**	**Building**	**Grade IIIb**
27824	**9/2/078/0012-006**	**208 Paul Street, Richmond**	**Building**	**Grade IIIb**
27821	**9/2/078/0012-007**	**258 Church Street, Richmond**	**Building**	**Grade IIIb**
27822	9/2/078/0012-008	60 Loop Street, Richmond	Building	Grade IIIb
27818	9/2/078/0012-009	152 Pienaar Street, Richmond	Building	Grade IIIb
27819	9/2/078/0012-010	148 Pienaar Street, Richmond	Building	Grade IIIb
27820	9/2/078/0012-011	15 Loop Street, Richmond	Building	Grade IIIb
27816	9/2/078/0012-012	260 Hope Street, Richmond	Building	Grade IIIb
27817	9/2/078/0012-013	19 Loop Street, Richmond	Building	Grade IIIb
27813	9/2/078/0012-014	156 Pienaar Street, Richmond	Building	Grade IIIb
27814	9/2/078/0012-015	14 Spring Street, Richmond	Building	Grade IIIb
27815	9/2/078/0012-016	158 Pienaar Street, Richmond	Building	Grade IIIb

27811	9/2/078/0012-017	120 Pienaar Street, Richmond	Building	Grade IIIb
27812	9/2/078/0012-018	56 Loop Street, Richmond	Building	Grade IIIb
27808	9/2/078/0012-019	26 Loop Street, Richmond	Building	Grade IIIb
27809	9/2/078/0012-020	Paul Street, Richmond	Building	Grade IIIb
27810	9/2/078/0012-021	216 Paul Street, Richmond	Building	Grade IIIb
27806	9/2/078/0012-022	160 Pienaar Street, Richmond	Building	Grade IIIb
27807	9/2/078/0012-023	241 Paul Street, Richmond	Building	Grade IIIb
27803	9/2/078/0012-024	144 Pienaar Street, Richmond	Building	Grade IIIb
27804	9/2/078/0012-025	129 Pienaar Street, Richmond	Building	Grade IIIb
27805	9/2/078/0012-026	140 Pienaar Street, Richmond	Building	Grade IIIb
27801	9/2/078/0012-027	132 Pienaar Street, Richmond	Building	Grade IIIb
27802	9/2/078/0012-028	Eastern end of Pienaar Street, Richmond	Building	Grade IIIb
27800	9/2/078/0012-030	141 Pienaar Street, Richmond	Building	Grade IIIb
27797	9/2/078/0012-031	127 Pienaar Street, Richmond	Building	Grade IIIb
27798	9/2/078/0012-032	113 Pienaar Street, Richmond	Building	Grade IIIb
27794	9/2/078/0012-033	11 Spring Street, Richmond	Building	Grade IIIb
27795	9/2/078/0012-034	12 Spring Street, Richmond	Building	Grade IIIb
27796	9/2/078/0012-035	33 Loop Street, Richmond	Building	Grade IIIb
27792	9/2/078/0012-038	118 Pienaar Street, Richmond	Building	Grade IIIb

27789	9/2/078/0012-039	23 Loop Street, Richmond	Building	Grade IIIb
27790	9/2/078/0012-040	116 Pienaar Street, Richmond	Building	Grade IIIb
27787	9/2/078/0012-041	Erf 220, 37 Loop Street, Richmond	Building	Grade IIIb
27788	9/2/078/0012-042	Richmond Museum, 17 Loop Street, Richmond	Building	Grade IIIb
27785	9/2/078/0012-043	13 Spring Street, Richmond	Building	Grade IIIb
27786	9/2/078/0012-044	24 Loop Street, Richmond	Building	Grade IIIb
27782	9/2/078/0012-045	42 Loop Street, Richmond	Building	Grade IIIb
27783	9/2/078/0012-046	168 Pienaar Street, Richmond	Building	Grade IIIb
27784	9/2/078/0012-047	54 Loop Street, Richmond	Building	Grade IIIb
27780	9/2/078/0012-048	219 Paul Street, Richmond	Building	Grade IIIb
27781	9/2/078/0012-049	28 Loop Street, Richmond	Building	Grade IIIb
27777	9/2/078/0012-050	145 Pienaar Street, Richmond	Building	Grade IIIb
27778	9/2/078/0012-051	217 Paul Street, Richmond	Building	Grade IIIb
27779	9/2/078/0012-052	270 Hope Street, Richmond	Building	Grade IIIb
27775	9/2/078/0012-053	67 Loop Street, Richmond	Building	Grade IIIb
27776	9/2/078/0012-054	38 Loop Street, Richmond	Building	Grade IIIb
27772	9/2/078/0012-055	40 Loop Street, Richmond	Building	Grade IIIb
27773	9/2/078/0012-056	Pienaar Street, Richmond	Building	Grade IIIb

27774	9/2/078/0012-057	21 Loop Street, Richmond	Building	Grade IIIb
27770	9/2/078/0012-058	146 Pienaar Street, Richmond	Building	Grade IIIb
27771	9/2/078/0012-059	Erf 622, 46 Loop Street, Richmond	Building	Grade IIIb
27768	9/2/078/0012-060	35 Loop Street, Richmond	Building	Grade IIIb
27769	9/2/078/0012-061	142 Pienaar Street, Richmond	Building	Grade IIIb
27765	9/2/078/0012-062	268 Hope Street, Richmond	Building	Grade IIIb
27766	9/2/078/0012-063	66 Loop Street, Richmond	Building	Grade IIIb
86360	VIWB011	Victoria West Bultfontein 011	Artefacts	Grade IIIb
86361	VIWB012	Victoria West Bultfontein 012	Artefacts	Grade IIIb
86362	VIWB013	Victoria West Bultfontein 013	Artefacts	Grade IIIb
86363	VIWB014	Victoria West Bultfontein 014	Artefacts	Grade IIIb
86364	VIWB015	Victoria West Bultfontein 015	Artefacts	Grade IIIb
86365	VIWB016	Victoria West Bultfontein 016	Artefacts	Grade IIIb
86366	VIWB017	Victoria West Bultfontein 017	Artefacts	Grade IIIb
86367	VIWB018	Victoria West Bultfontein 018	Artefacts	Grade IIIb
86354	VIWB005	Victoria West Bultfontein 005	Artefacts	Grade IIIc
86359	VIWB010	Victoria West Bultfontein 010	Artefacts	Grade IIIc
86368	VIWB019	Victoria West Bultfontein 019	Artefacts	Grade IIIb
86369	VIWB020	Victoria West Bultfontein 020	Artefacts	Grade IIIb

86370	VIWB021	Victoria West Bultfontein 005	Artefacts	Grade IIIb
86371	VIWB022	Victoria West Bultfontein 022	Artefacts	Grade IIIb
27829	9/2/078/0003	Dutch Reformed Church, Loop Street, Richmond	Building	Grade II
27830	9/2/078/0004	De Oude Dak, 237 Paul Street, Richmond	Building	Grade II
39608	MUR050	Murraysburg 050	Rock Art	Grade IIIa
39624	MUR066	Murraysburg 066	Artefacts	Grade IIIb
39659	MUR093	Murraysburg 093	Stone walling	Grade IIIb
27799	9/2/078/0012-029	22 Spring Street, Richmond	Building	Grade IIIb
3280	Roggefontein Farm		Palaeontological	Grade IIIb
39547	MUR001	Murraysburg 001	Artefacts	Grade IIIc
39548	MUR002	Murraysburg 002	Artefacts	Grade IIIc
39549	MUR003	Murraysburg 003	Artefacts	Grade IIIc
39550	MUR004	Murraysburg 004	Stone walling	Grade IIIc
39551	MUR005	Murraysburg 005	Artefacts	Grade IIIc
39552	MUR006	Murraysburg 006	Artefacts	Grade IIIa
39553	MUR007	Murraysburg 007	Artefacts	Grade IIIc
39554	MUR008	Murraysburg 008	Artefacts	Grade IIIc
39555	MUR009	Murraysburg 009	Artefacts	Grade IIIc

39556	MUR010	Murraysburg 010	Artefacts	Grade IIIc
39559	MUR013	Murraysburg 013	Artefacts	Grade IIIc
39560	MUR014	Murraysburg 014	Artefacts	Grade IIIc
39565	MUR019	Murraysburg 019	Artefacts	Grade IIIb
39566	MUR020	Murraysburg 020	Artefacts	Grade IIIc
39567	MUR021	Murraysburg 021	Stone walling	Grade IIIb
40006	GRA001	Grassridge 001	Building	Grade IIIa
39568	MUR022	Murraysburg 022	Artefacts	Grade IIIc
39569	MUR023	Murraysburg 023	Artefacts	Grade IIIc
39570	MUR024	Murraysburg 024	Rock Art	Grade IIIb
39571	MUR025	Murraysburg 025	Artefacts	Grade IIIc
39572	MUR026	Murraysburg 026	Rock Art	Grade IIIa
39573	MUR027	Murraysburg 027	Rock Art	Grade IIIa
39574	MUR028	Murraysburg 028	Rock Art	Grade IIIa
39575	MUR029	Murraysburg 029	Rock Art	Grade IIIa
39576	MUR030	Murraysburg 030	Rock Art	Grade IIIa
39577	MUR031	Murraysburg 031	Rock Art	Grade IIIa
39578	MUR032	Murraysburg 032	Rock Art	Grade IIIa
39579	MUR033	Murraysburg 033	Rock Art	Grade IIIa

39580	MUR034	Murraysburg 034	Artefacts	Grade IIIc
39581	MUR035	Murraysburg 035	Artefacts	Grade IIIc
39582	MUR036	Murraysburg 036	Artefacts	Grade IIIc
39583	MUR037	Murraysburg 037	Stone walling	Grade IIIa
39584	MUR038	Murraysburg 038	Stone walling	Grade IIIb
39585	MUR107	Murraysburg 107	Archaeological	Grade IIIc
39586	MUR108	Murraysburg 108	Artefacts	Grade IIIc
39587	MUR109	Murraysburg 109	Stone walling	Grade IIIc
39588	MUR039	Murraysburg 039	Artefacts	Grade IIIc
39589	MUR110	Murraysburg 110	Stone walling	Grade IIIa
39590	MUR040	Murraysburg 040	Artefacts	Grade IIIc
39591	MUR111	Murraysburg 111	Structures	Grade IIIc
39592	MUR041	Murraysburg 041	Artefacts	Grade IIIb
39594	MUR113	Murraysburg 113	Archaeological	Grade IIIa
39595	MUR042	Murraysburg 042	Artefacts	Grade IIIb
39596	MUR112	Murraysburg 112	Structures	Grade IIIc
39597	MUR114	Murraysburg 114	Artefacts	Grade IIIc
39598	MUR043	Murraysburg 043	Artefacts	Grade IIIc
39599	MUR115	Murraysburg 115	Artefacts	Grade IIIa

39600	MUR044	Murraysburg 044	Artefacts	Grade IIIc
39602	MUR116	Murraysburg 116	Artefacts	Grade IIIa
39603	MUR045	Murraysburg 045	Artefacts	Grade IIIc
39604	MUR046	Murraysburg 046	Artefacts	Grade IIIa
39605	MUR047	Murraysburg 047	Rock Art	Grade IIIa
39606	MUR048	Murraysburg 048	Rock Art	Grade IIIa
39607	MUR049	Murraysburg 049	Rock Art	Grade IIIa
39609	MUR051	Murraysburg 051	Rock Art	Grade IIIa
39611	MUR053	Murraysburg 053	Rock Art	Grade IIIb
39612	MUR054	Murraysburg 054	Artefacts	Grade IIIc
39613	MUR055	Murraysburg 055	Rock Art	Grade IIIb
39614	MUR056	Murraysburg 056	Artefacts	Grade IIIb
39615	MUR057	Murraysburg 057	Artefacts	Grade IIIb
39616	MUR058	Murraysburg 058	Artefacts	Grade IIIc
39617	MUR059	Murraysburg 059	Artefacts	Grade IIIc
39618	MUR060	Murraysburg 060	Artefacts	Grade IIIa
39619	MUR061	Murraysburg 061	Artefacts	Grade IIIa
39620	MUR062	Murraysburg 062	Stone walling	Grade IIIa
39621	MUR063	Murraysburg 063	Artefacts, Stone walling	Grade IIIc

39622	MUR064	Murraysburg 064	Artefacts, Stone walling	Grade IIIa
39625	MUR067	Murraysburg 067	Building, Artefacts	Grade IIIa
39626	MUR068	Murraysburg 068	Artefacts	Grade IIIa
39627	MUR069	Murraysburg 069	Artefacts	Grade IIIa
39628	MUR070	Murraysburg 070	Artefacts	Grade IIIa
39629	MUR071	Murraysburg 071	Artefacts	Grade IIIa
39630	MUR072	Murraysburg 072	Artefacts	Grade IIIa
39631	MUR073	Murraysburg 073	Artefacts	Grade IIIc
39632	MUR074	Murraysburg 074	Artefacts	Grade IIIc
39633	MUR075	Murraysburg 075	Artefacts	Grade IIIc
39634	MUR076	Murraysburg 076	Artefacts	Grade IIIc
39635	MUR077	Murraysburg 077	Artefacts	Grade IIIa
39636	MUR078	Murraysburg 078	Artefacts, Building	Grade IIIb
39637	MUR079	Murraysburg 079	Artefacts	Grade IIIb
39638	MUR080	Murraysburg 080	Artefacts	Grade IIIa
39639	MUR081	Murraysburg 081	Artefacts	Grade IIIc
39640	MUR082	Murraysburg 082	Archaeological	Grade IIIb
39641	MUR083	Murraysburg 083	Artefacts	Grade IIIa
39642	MUR084	Murraysburg 084	Stone walling	Grade IIIc

39643	MUR085	Murraysburg 085	Stone walling	Grade IIIa
39644	MUR086	Murraysburg 086	Stone walling	Grade IIIa
39645	MUR117	Murraysburg 117	Artefacts	Grade IIIa
39646	MUR087	Murraysburg 087	Stone walling	Grade IIIa
39647	MUR118	Murraysburg 118	Artefacts	Grade IIIa
39651	MUR090	Murraysburg 090	Artefacts	Grade IIIb
39652	MUR119	Murraysburg 119	Stone walling	Grade IIIa
39653	MUR120	Murraysburg 120	Stone walling	Grade IIIa
39654	MUR091	Murraysburg 091	Building	Grade IIIa
39655	MUR121	Murraysburg 121	Structures	Grade IIIb
39656	MUR092	Murraysburg 092	Stone walling	Grade IIIb
39657	MUR122	Murraysburg 122	Structures	Grade IIIb
39658	MUR123	Murraysburg 123	Stone walling	Grade IIIa
39660	MUR124	Murraysburg 124	Stone walling	Grade IIIa
39661	MUR125	Murraysburg 125	Artefacts	Grade IIIa
39663	MUR094	Murraysburg 094	Building	Grade IIIb
39664	MUR095	Murraysburg 095	Stone walling	Grade IIIc
39665	MUR096	Murraysburg 096	Artefacts	Grade IIIa
39666	MUR097	Murraysburg 097	Stone walling	Grade IIIc

39667	MUR098	Murraysburg 098	Artefacts	Grade IIIa
39668	MUR099	Murraysburg 099	Artefacts	Grade IIIa
39669	MUR100	Murraysburg 100	Artefacts	Grade IIIc
39670	MUR101	Murraysburg 101	Artefacts	Grade IIIc
39672	MUR103	Murraysburg 103	Artefacts	Grade IIIb
39673	MUR104	Murraysburg 104	Stone walling	Grade IIIc
39675	MUR106	Murraysburg 106	Artefacts, Stone walling	Grade IIIa
39676	MUR126	Murraysburg 126	Artefacts	Grade IIIa
39677	MUR127	Murraysburg 127	Artefacts	Grade IIIa
39678	MUR128	Murraysburg 128	Artefacts	Grade IIIa
39679	MUR129	Murraysburg 129	Artefacts	Grade IIIa
39680	MUR130	Murraysburg 130	Rock Art	Grade IIIb
39682	MUR132	Murraysburg 132	Stone walling	Grade IIIc
39684	MUR131	Murraysburg 131	Archaeological	Grade IIIc
39685	MUR133	Murraysburg 133	Archaeological	Grade IIIc
39686	MUR134	Murraysburg 134	Stone walling	Grade IIIc
39687	MUR135	Murraysburg 135	Structures	Grade IIIc
39689	MUR136	Murraysburg 136	Artefacts	Grade IIIc
39690	MUR137	Murraysburg 137	Artefacts	Grade IIIa

39691	MUR138	Murraysburg 138	Rock Art	Grade IIIa
39693	MUR139	Murraysburg 139	Rock Art	Grade IIIa
39695	MUR140	Murraysburg 140	Rock Art	Grade IIIb
39698	MUR143	Murraysburg 143	Artefacts	Grade IIIb
39700	MUR141	Murraysburg 141	Archaeological	Grade IIIa
39701	MUR142	Murraysburg 142	Rock Art	Grade IIIa
39702	MUR144	Murraysburg 144	Artefacts	Grade IIIb
39703	MUR145	Murraysburg 145	Rock Art	Grade IIIa
39704	MUR146	Murraysburg 146	Rock Art	Grade IIIa
39705	MUR147	Murraysburg 147	Rock Art	Grade IIIa
39708	MUR150	Murraysburg 150	Artefacts	Grade IIIc
39711	MUR148	Murraysburg 148	Rock Art	Grade IIIa
39712	MUR149	Murraysburg 149	Artefacts	Grade IIIc
39713	MUR151	Murraysburg 151	Artefacts	Grade IIIc
39715	MUR153	Murraysburg 153	Stone walling	Grade IIIc
39718	MUR155	Murraysburg 155	Artefacts	Grade IIIc
39721	MUR154	Murraysburg 154	Artefacts	Grade IIIc
39725	MUR156	Murraysburg 156	Artefacts	Grade IIIc
39727	MUR152	Murraysburg 152	Structures	Grade IIIc

39749	MUR174	Murraysburg 174	Artefacts	Grade IIIb
39750	MUR175	Murraysburg 175	Artefacts	Grade IIIb
39751	MUR176	Murraysburg 176	Artefacts	Grade IIIc
39752	MUR177	Murraysburg 177	Artefacts	Grade IIIc
39753	MUR178	Murraysburg 178	Artefacts	Grade IIIc
39754	MUR179	Murraysburg 179	Artefacts	Grade IIIb
39755	MUR180	Murraysburg 180	Artefacts	Grade IIIc
39756	MUR181	Murraysburg 181	Artefacts	Grade IIIc
39757	MUR182	Murraysburg 182	Archaeological	Grade IIIc
39758	MUR183	Murraysburg 183	Archaeological	Grade IIIc
39759	MUR184	Murraysburg 184	Structures	Grade IIIa
39760	MUR185	Murraysburg 185	Structures	Grade IIIa
39761	MUR186	Murraysburg 186	Structures	Grade IIIa
39773	MUR187	Murraysburg 187	Artefacts	Grade IIIc
39774	MUR188	Murraysburg 188	Artefacts	Grade IIIc
39775	MUR189	Murraysburg 189	Artefacts	Grade IIIb
39776	MUR190	Murraysburg 190	Artefacts	Grade IIIb
39778	MUR192	Murraysburg 192	Stone walling	Grade IIIc
39779	MUR193	Murraysburg 193	Archaeological	Grade IIIb

39780	MUR194	Murraysburg 194	Battlefield	Grade IIIa
39781	MUR195	Murraysburg 195	Artefacts	Grade IIIa
39782	MUR196	Murraysburg 196	Stone walling	Grade IIIa
39783	MUR197	Murraysburg 197	Rock Art	Grade IIIc
39784	MUR198	Murraysburg 198	Rock Art	Grade IIIa
39785	MUR199	Murraysburg 199	Rock Art	Grade IIIa
39786	MUR200	Murraysburg 200	Rock Art	Grade IIIa
39787	MUR201	Murraysburg 201	Rock Art	Grade IIIa
39788	MUR202	Murraysburg 202	Rock Art	Grade IIIa
39789	MUR203	Murraysburg 203	Rock Art	Grade IIIa
39790	MUR204	Murraysburg 204	Rock Art	Grade IIIa
39791	MUR205	Murraysburg 205	Rock Art	Grade IIIa
39792	MUR206	Murraysburg 206	Rock Art	Grade IIIc
39793	MUR207	Murraysburg 207	Stone walling	Grade IIIc
39794	MUR208	Murraysburg 208	Stone walling	Grade IIIc
39795	MUR209	Murraysburg 209	Stone walling	Grade IIIc
39796	MUR210	Murraysburg 210	Stone walling	Grade IIIc
39797	MUR211	Murraysburg 211	Stone walling	Grade IIIb
39623	MUR065	Murraysburg 065	Building	Grade IIIb

39649	MUR088	Murraysburg 088	Stone walling	Grade IIIb
39650	MUR089	Murraysburg 089	Stone walling	Grade IIIb
39777	MUR191	Murraysburg 191	Artefacts	Grade IIIb
39561	MUR015	Murraysburg 015	Burial Grounds & Graves	Grade IIIa
39562	MUR016	Murraysburg 016	Burial Grounds & Graves	Grade IIIa
39563	MUR017	Murraysburg 017	Burial Grounds & Graves	Grade IIIa
39564	MUR018	Murraysburg 018	Burial Grounds & Graves	Grade IIIa
39671	MUR102	Murraysburg 102	Burial Grounds & Graves	Grade IIIa
39798	MUR212	Murraysburg 212	Burial Grounds & Graves	Grade IIIa
39890	MUR213	Murraysburg 213	Burial Grounds & Graves	Grade IIIa
86350	VIWB001	Victoria West Bultfontein 001	Artefacts	Grade IIIb
86351	VIWB002	Victoria West Bultfontein 002	Artefacts	Grade IIIb
86352	VIWB003	Victoria West Bultfontein 003	Artefacts	Grade IIIb
86353	VIWB004	Victoria West Bultfontein 004	Artefacts	Grade IIIb
86355	VIWB006	Victoria West Bultfontein 006	Artefacts	Grade IIIc
86356	VIWB007	Victoria West Bultfontein 007	Artefacts	Grade IIIc
86357	VIWB008	Victoria West Bultfontein 008	Artefacts	Grade IIIc
86358	VIWB009	Victoria West Bultfontein 009	Artefacts	Grade IIIc

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APPENDIX 2

Reference List with relevant AIAs and PIAs

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
120317	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120325	HIA Phase 1	Celeste Booth, Sholeen Shanker	01/12/2012	An archaeological ground-truthing walk-through for the proposed substation and associated overhead power line for the Nobelsfontein Wind Energy Facility situated on a site south of Victoria West on the Farm Nobelsfontein 227, Northern Cape Province
120820	HIA Phase 1	Celeste Booth	01/12/2012	An Archaeological Ground-Truthing Walk-Through For The Nobelsfontein Wind Energy Facility Situated On A Site South Of Victoria West On The Farms Nobelsfontein 227, Annex Nobelsfontein 234, Ezelsfontein 235, And Rietkloofplaaten 239, Northern Cape Province
251290	PIA Desktop	Lloyd Rossouw	01/01/2014	Combined Environmental Environmental Impact Assessment for the proposed Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Eskom Distribution Grid Connection Infrastructure near Murraysburg, Western Cape. Chapter 13: Palaeontology Impact Assessment.
251296	AIA Phase 1	Dave Halkett	01/01/2014	Combined Environmental Impact Assessment for the proposed Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Eskom Distribution Grid Connection Infrastructure near Murraysburg, Western Cape. Chapeter 13: Archaeology Impact Assessment.
356942	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	01/05/2010	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED SKIETKUIL QUARRIES 1 AND 2 ON THE FARM SKIETKUIL No. 3, VICTORIA WEST, CENTRAL KAROO DISTRICT, WESTERN CAPE PROVINCE
356942	AIA Phase 1	Johan Binneman, Celeste	01/05/2010	A PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) FOR THE PROPOSED

		Booth, Natasha Higgitt		SKIETKUIL QUARRIES 1 AND 2 ON THE FARM SKIETKUIL No. 3, VICTORIA WEST, CENTRAL KAROO DISTRICT, WESTERN CAPE PROVINCE
357137	Heritage Impact Assessment Specialist Reports	Timothy Hart	13/10/2015	Heritage Impact Assessment for the proposed Umsinde Emoyeni Wind Energy Facility
360840	Non Impact Assessment Related Reports	Wouter Fourie	05/03/2016	Environmental Impact Assessment of the proposed amendments to the Environmental Authorisation for the Mainstream Renewable Power South Africa Wind Energy Project near Victoria West in the Northern Cape â€“ Specialist Heritage Opinion
360850	HIA Phase 1	Wouter Fourie	04/03/2016	Basic assessment process for Proposed development of supporting infrastructure to the Victoria West Wind Energy Facility, Victoria West
6805	AIA Phase 1	Len van Schalkwyk, Elizabeth Wahl	01/09/2007	Heritage Impact Assessment of Gamma Grassridge Power Line Corridors and Substation, Eastern, Western and Northern Cape Provinces, South Africa
7035	AIA Phase 1	Johan Binneman, Celeste Booth, Natasha Higgitt	05/03/2011	A Phase 1 Archaeological Impact Assessment (AIA) for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape Province on the farms Phaisantkraal 1, Modderfontein 228, Nobelsfontein 227, Annex Nobelsfontein
7036	AIA Desktop	Celeste Booth, Natasha Higgitt	19/11/2010	An Archaeological Desktop Study for the proposed Karoo Renewable Energy Facility on a site south of Victoria West, Northern and Western Cape
8943	PIA Phase 1	Lloyd Rossouw	24/03/2011	Palaeontological desktop assessment of a commercial renewable energy facility site located approximately 34km south of Victoria West in the Western Cape Province (and Northern Cape)

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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)
DEA	Department of Environmental Affairs (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 since 2016, 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 on the Executive Committee 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 and Screening Assessments throughout South Africa.

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APPENDIX 5: Chance Fossil Finds Procedure

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CHANCE FINDS OF PALAEONTOLOGICAL MATERIAL

(Adopted from the HWC Chance Fossils Finds Procedure: June 2016)

Introduction

This document is aimed to inform workmen and foremen working on a construction and/or mining site. It describes the procedure to follow in instances of accidental discovery of palaeontological material (please see attached poster with descriptions of palaeontological material) during construction/mining activities. This protocol does not apply to resources already identified under an assessment undertaken under s. 38 of the National Heritage Resources Act (no 25 of 1999).

Fossils are rare and irreplaceable. Fossils tell us about the environmental conditions that existed in a specific geographical area millions of years ago. As heritage resources that inform us of the history of a place, fossils are public property that the State is required to manage and conserve on behalf of all the citizens of South Africa. Fossils are therefore protected by the National Heritage Resources Act and are the property of the State. Ideally, a qualified person should be responsible for the recovery of fossils noticed during construction/mining to ensure that all relevant contextual information is recorded.

Heritage Authorities often rely on workmen and foremen to report finds, and thereby contribute to our knowledge of South Africa's past and contribute to its conservation for future generations.

Training

Workmen and foremen need to be trained in the procedure to follow in instances of accidental discovery of fossil material, in a similar way to the Health and Safety protocol. A brief introduction to the process to follow in the event of possible accidental discovery of fossils should be conducted by the designated Environmental Control Officer (ECO) for the project, or the foreman or site agent in the absence of the ECO It is recommended that copies of the attached poster and procedure are printed out and displayed at the site office so that workmen may familiarise themselves with them and are thereby prepared in the event that accidental discovery of fossil material takes place.

Actions to be taken

One person in the staff must be identified and appointed as responsible for the implementation of the attached protocol in instances of accidental fossil discovery and must report to the ECO or site agent. If the ECO or site agent is not present on site, then the responsible person on site should follow the protocol correctly in order to not jeopardize the conservation and well-being of the fossil material.

Once a workman notices possible fossil material, he/she should report this to the ECO or site agent.Procedure to follow if it is likely that the material identified is a fossil:

- The ECO or site agent must ensure that all work ceases immediately in the vicinity of the area where the fossil or fossils have been found;
- The ECO or site agent must inform SAHRA of the find immediately. This information must include photographs of the findings and GPS co-ordinates;
- The ECO or site agent must compile a Preliminary Report and fill in the attached Fossil Discoveries: Preliminary Record Form within 24 hours without removing the fossil from its original position. The Preliminary Report records basic information about the find including:
    - The date
    - A description of the discovery
    - A description of the fossil and its context (e.g. position and depth of find)
    - Where and how the find has been stored
    - Photographs to accompany the preliminary report (the more the better):
        - A scale must be used
        - Photos of location from several angles
        - Photos of vertical section should be provided
        - Digital images of hole showing vertical section (side);
        - Digital images of fossil or fossils.

Upon receipt of this Preliminary Report, SAHRA will inform the ECO or site agent whether or not a rescue excavation or rescue collection by a palaeontologist is necessary.

- Exposed finds must be stabilised where they are unstable and the site capped, e.g. with a plastic sheet or sand bags. This protection should allow for the later excavation of the finds with due scientific care and diligence. SAHRA can advise on the most appropriate method for stabilisation.
- If the find cannot be stabilised, the fossil may be collect with extreme care by the ECO or the site agent and put aside and protected until SAHRA advises on further action. Finds collected in this way must be safely and securely stored in tissue paper and an appropriate box. Care must be taken to remove the all fossil material and any breakage of fossil material must be avoided at all costs.

No work may continue in the vicinity of the find until SAHRA has indicated, in writing, that it is appropriate to proceed.

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FOSSIL DISCOVERIES: PRELIMINARY RECORDING FORM		
Name of project:		
Name of fossil location:		
Date of discovery:		
Description of situation in which the fossil was found:		
Description of context in which the fossil was found:		
Description and condition of fossil identified:		
GPS coordinates:	*Lat:*	*Long:*
If no co-ordinates available then please describe the location:		
Time of discovery:		
Depth of find in hole		
Photographs (tick as appropriate and indicate number of the photograph)	*Digital image of vertical section (side)*	
	Fossil from different angles	
	Wider context of the find	
Temporary storage (where it is located and how it is conserved)		
Person identifying the fossil Name:		
Contact:		
Recorder Name:		
Contact:		
Photographer Name:		
Contact:		

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