

HERITAGE IMPACT ASSESSMENT

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

Development of the grid connection infrastructure for the Carolus Solar PV1 Facility near De Aar, Northern Cape Province

SAHRIS Ref:

Prepared by CTS Heritage



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For

Savannah Environmental

July 2022



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EXECUTIVE SUMMARY

1. Site Name:

Grid connection infrastructure for the Carolus Solar PV Facility

2. Location:

Farm Wag 'n Bietjie 5, Portion 1 of Farm Riet Fountain 6, Portion 3 and 4 of Farm Carolus Poort 3

3. Locality Plan:

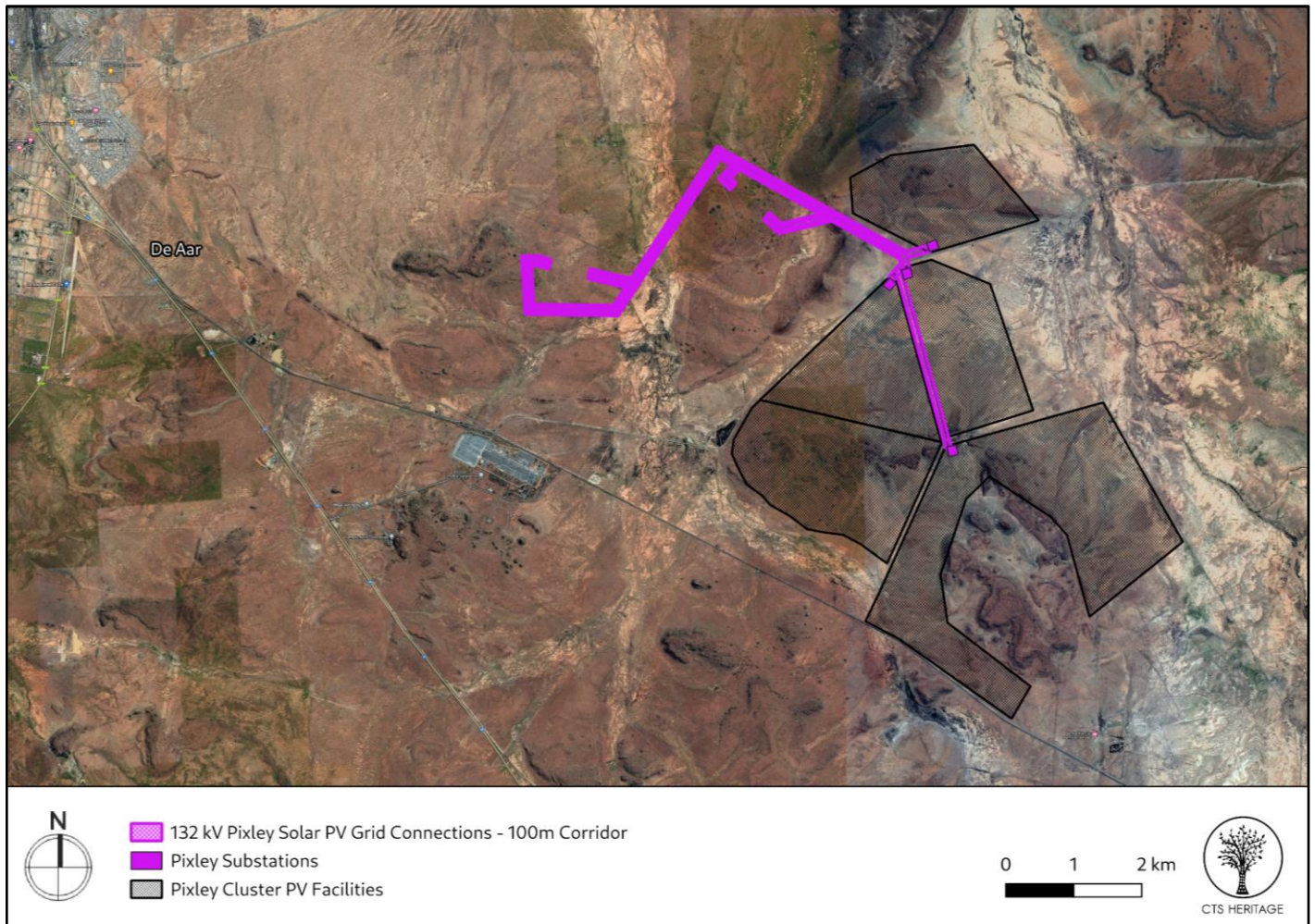


Figure A: Location of the proposed study area

4. Description of Proposed Development:

Carolus Solar PV1 (Pty) Ltd is planning the construction and operation of grid connection infrastructure consisting of up to a 132kV Double circuit power line on Portion 3 of the Farm Carolus Poort No.3, the infrastructure will be located approximately 10km east of De Aar within the Emthanjeni Local Municipality in the Northern Cape Province.

5. Heritage Resources Identified in and near the study area:



Site No.	Site Name	Description	Density m2	Period	Co-ordinates		Grading	Mitigation
Pixley Park Field Assessment								
076	Grid	Hornfels blade, edge retouched	0 to 5	MSA	-30.68882022	24.14215164	NCW	NA
077	Grid	Early MSA siltstone flake edge retouched	0 to 5	MSA	-30.68839403	24.13644379	NCW	NA
078	Grid	Old farm dam, earthen	n/a	Modern	-30.68789437	24.13177839	NCW	NA
079	Grid	Hornfels core and flake, edge retouched	0 to 5	MSA	-30.68242723	24.11585108	NCW	NA
Other fieldwork conducted								
004		Still bay point, blades, hornfels, burnt bone, on top of dolerite outcrop with good views	5-10	MSA	-30.68097	24.11972	IIC	30m no-go buffer
006	Grid	Single long hornfels blade flake retouched near windmill	0-5	MSA	-30,67512	24,1188	NCW	NA
007	Grid	Two unworked hornfels flakes	0-5	MSA	-30,6751	24,12113	NCW	NA
008	Grid	Hornfels flake, unworked, heavily patinated	0-5	MSA	-30,67872	24,12576	NCW	NA
009	Grid	Hornfels core	0-5	MSA	-30,67845	24,12653	NCW	NA
010	Grid	Heavily patinated hornfels flakes in a small clearing	0-5	MSA	-30,67832	24,12772	NCW	NA
011	Grid	Three hornfels flakes, one with edge retouch	0-5	MSA	-30,67847	24,12838	NCW	NA
012	Grid	Thumbnail scraper, msa hornfels blade and flakes	10-30	MSA, LSA	-30,67917	24,12871	NCW	NA
013	Grid	Hornfels point, edge retouched	0-5	MSA	-30,68179	24,12737	NCW	NA
014	Grid	LSA and MSA site with mainly LSA hornfels flakes and pottery	30+	MSA, LSA	-30.68296	24.12708	IIIB	100m no go buffer
016	Grid	heavily patinated hornfels blade retouched	0-5	MSA	-30,68002	24,11668	NCW	NA
017	Grid	Unworked siltstone and hornfels flakes	0-5	MSA	-30,67955	24,11629	NCW	NA
019	Grid	Hornfels chunks in edge of pan	0-5	LSA	-30,68099	24,11445	NCW	NA
020	Grid	Large hornfels point, and flake	0-5	MSA	-30,6824	24,11505	NCW	NA0



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025	Grid	hornfels bladelet with hinge terminations on dorsal, hornfels core with less than 10% cortex left	0-5	MSA	-30,68546	24,11078	NCW	NA
028	Grid	Small hornfels point with hafted platform retouch	0-5	MSA	-30,68891	24,10134	NCW	NA
029	Grid	Two heavily patinated hornfels flakes near low dolerite outcrop	0-5	MSA	-30,68995	24,10013	NCW	NA
033	Grid	Hornfels flake with very finely struck secondary scars on dorsal	0-5	MSA	-30,68823	24,09485	NCW	NA
035	Grid	Two hornfels flakes in amongst dolerite outcrops	0-5	MSA	-30,68906	24,09129	NCW	NA
037	Grid	Hornfels flakes, segment	0-5	MSA	-30,69021	24,09002	NCW	NA
039	Grid	Hornfels flakes, one retouched all around, triangular point	0-5	MSA	-30,69163	24,09172	NCW	NA
047	Grid	Hornfels flakes in jeep track	0-5	MSA	-30,68724	24,09022	NCW	NA

6. Anticipated Impacts on Heritage Resources:

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage.

As indicated above, the results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and the majority of these are therefore not archaeologically significant. In general, the construction of powerlines is not impactful on archaeological sites and the siting of pylons can be made through most of the area without causing significant damage to archaeological sites.

Based on experience, other reports and the lack of any significant previously recorded fossils from the area, it is unlikely that any fossils would be preserved in the Tierberg Formation or Adelaide Subgroup. Nonetheless, a Fossil Chance Find Protocol should be added to the EMP.

7. Recommendations:



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There is no objection to the proposed development as described above in terms of impacts to heritage resources on condition that:

- A 100m no-go development area must be implemented around site 014
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities
- An inspection of excavations is undertaken by a palaeontologist during the construction phase.
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.



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Details of Specialist who prepared the HIA

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

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

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



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1. INTRODUCTION

1.1 Background Information on Project

Carolus Solar PV1 (Pty) Ltd is planning the construction and operation of grid connection infrastructure consisting of up to a 132kV Double circuit power line on Portion 3 of the Farm Carolus Poort No.3, the infrastructure will be located approximately 10km east of De Aar within the Emthanjeni Local Municipality in the Northern Cape Province.

The Grid connection infrastructure will include a 132 kV IPP Substation and a powerline with a capacity up to 132 kV which is being assessed within a 300m wide and between 3.3km and 9.3km long corridor connecting to either the new proposed Vetlaagte MTS or the new proposed Wag-'n-Bietjie MTS, which will respectively be located on the farm Vetlaagte (RE/4) or Wag 'n Bietjie (RE/5).

The Vetlaagte MTS will loop into the Hydra-Perseus 2 or Hydra-Perseus 3 line (400 kV). Substations on either end of the line: Hydra and Perseus. The Wag-'n-Bietjie MTS will loop into the Hydra-Beta 1 line (400 kV). Substations on either end of the line: Hydra and Beta. These sites are currently under a separate BAR process.

The grid connection corridor will consist of:

- Onsite 132kV IPP Substation including the HV Step Up transformer, MV Interconnection building (footprint up to 100m x 100m located within the 300m wide corridor).
- Onsite 132kV Eskom switching station - 100m x 100m and 30m height, metering, relay & control buildings, laydown area, ablutions with conservancy tanks and water storage tanks, and access roads which is handed back to Eskom (Separate EA).
- 132kV Overhead Power Line (OHPL) – 30m height from the switching station to the Main Transmission Substation (MTS) located on either Vetlaagte (RE/4) or Wag en Bittje (RE/5) farms which will be handed back to Eskom (within 300m wide corridor and a 31m wide servitude).
- Access roads to substation sites (up to 8 m wide) and service tracks (up to 6 m wide) where no existing roads are available.

Mulilo has a number of other wind and solar PV developments in the area around De Aar (in various phases of development, from feasibility studies to operational projects). Mulilo has acquired a great deal of experience regarding site conditions, community and specialist engagement. Mulilo has used this experience to ensure all the required studies are conducted and permits are obtained in a manner that ensures successful execution of these projects. Mulilo hopes to build on this experience with the development of Carolus Solar PV1.

Regarding site desirability, various specialist studies have already been conducted that indicate site conditions favourable to the development of a solar PV facility. De Aar also has excellent solar resources when compared to most other regions in South Africa.



By developing this cluster of PV projects, Mulilo will be able to potentially share infrastructure between the different PV facilities. This will result in lower tariffs for each of the individual projects. The lower tariffs will result in cost savings to both Eskom and electricity consumers in South Africa.

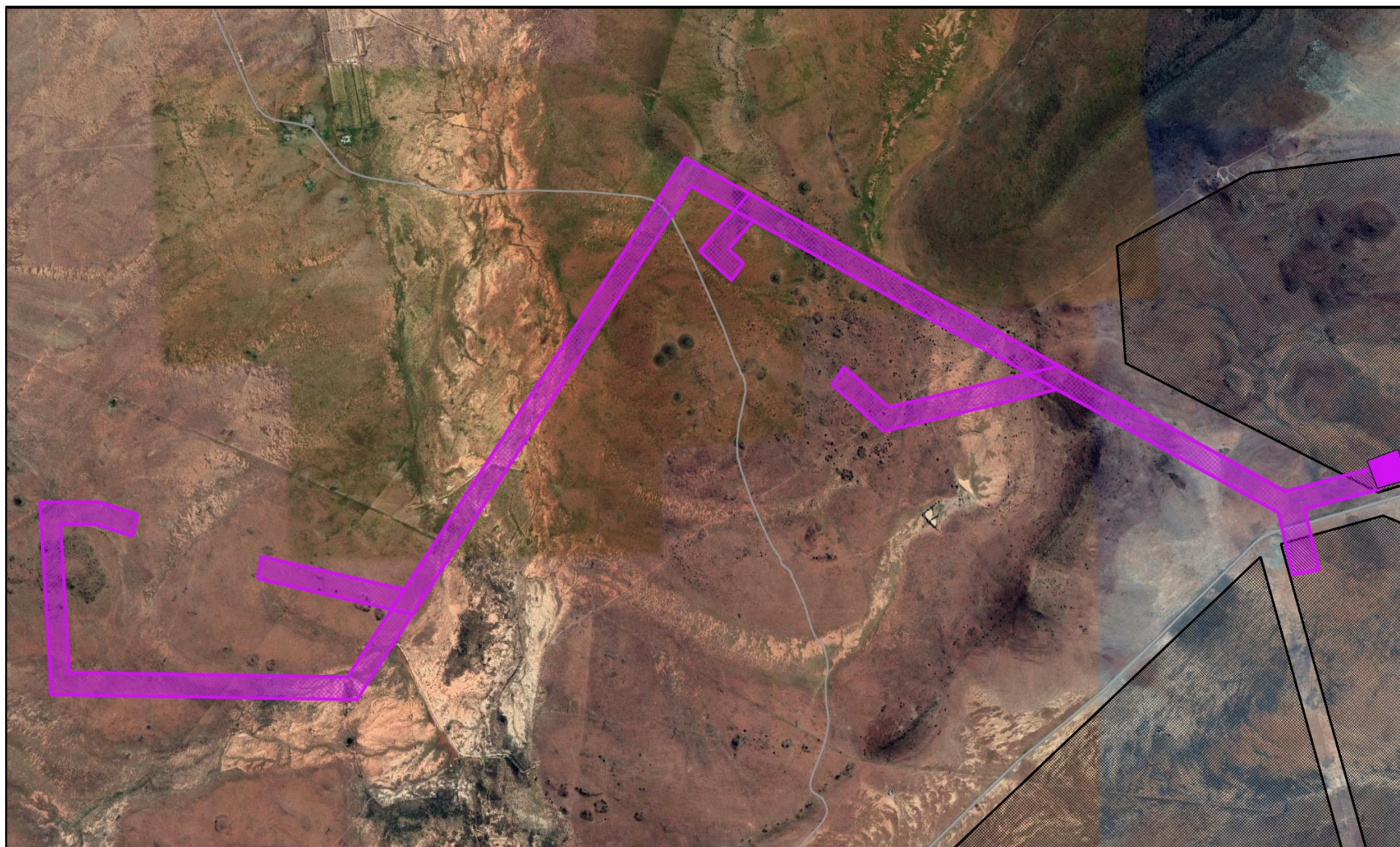
1.2 Description of Property and Affected Environment

The four Pixley Park solar PV projects lie on three farms, Wag 'n Bietjie 5, Riet Fountain 6 and Carolus Poort 3. These properties are to the east and north east of the Hydra substation which is roughly 10km south of De Aar in the Northern Cape. A number of renewable energy projects, particularly solar PV farms, have been proposed immediately surrounding this substation and three completed solar farms lie north and northwest such as De Aar Solar and Paarde Valley. A completed 144MW wind farm lies on the plateau north east of the development. Large 765kV powerlines traverse the area connecting up the grid to and from the Hydra substation. The northern boundary at Carolus Poort holds a prominent koppie while smaller dolerite outcrops run in a west to east line on Wag 'n Bietjie 5. Another dolerite ridge lies on Riet Fountain 6 but much of the development footprint has been planned to avoid this rocky topography.

The designated areas for the solar PV farms mostly fall on flat grassland dotted with typical Karoo windmills, kraals and tanks for sheep and cattle farming. The vegetation is typical of the Karoo and the grassland was dense enough over much of the site to hamper visibility of archaeological material lying on the surface, especially due to the recent high rainfall this year.




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 132 kV Carolus Solar PV1 Grid Connection - 100m Corridor

 Carolus Solar PV1 SS

 Pixley Cluster PV Facilities

0 0,5 1 km



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Figure 1.1: The proposed development area



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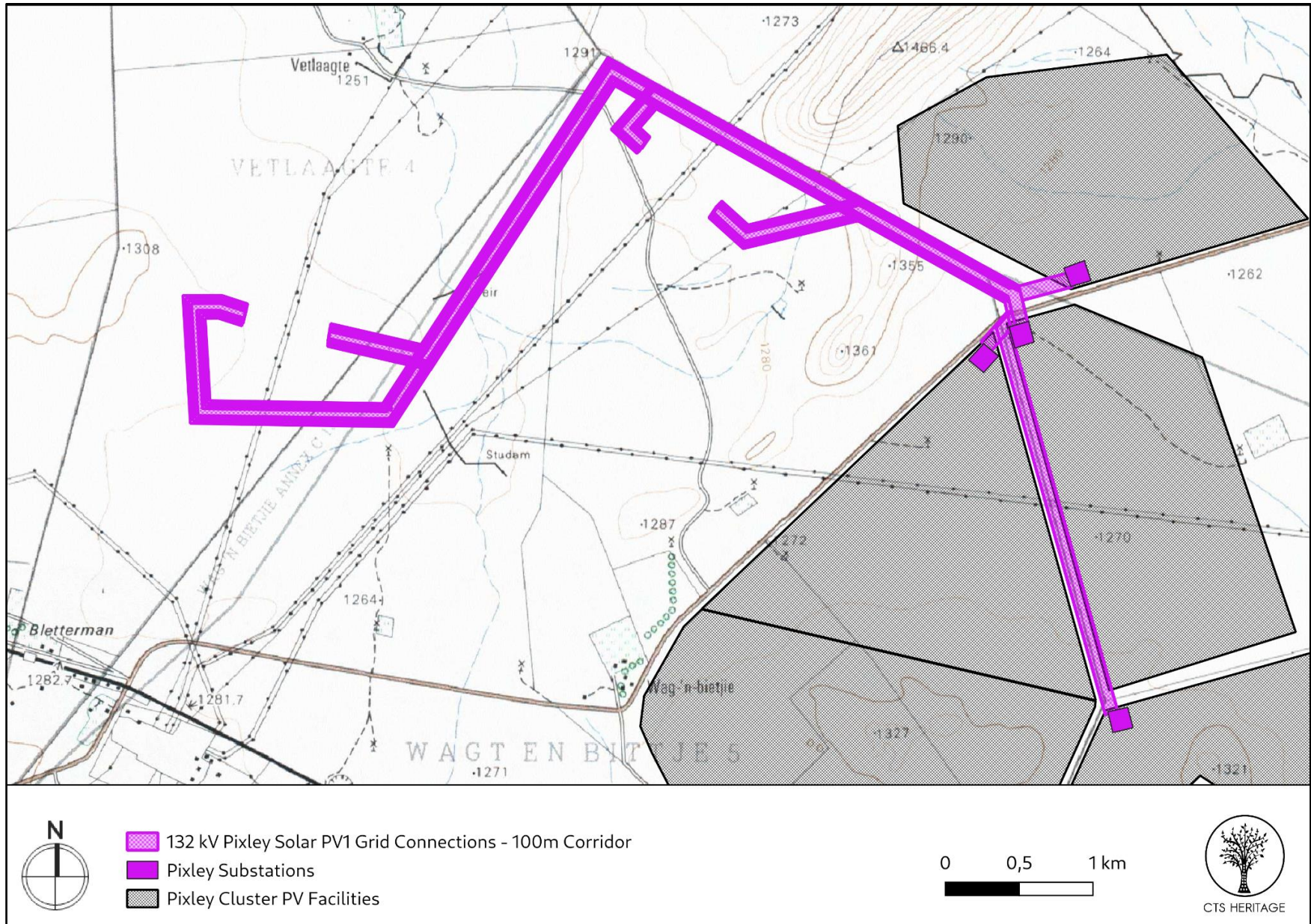


Figure 1.2: Study Area reflected on the 1:50 000 Topo Map



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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) (Appendix 1)
- An archaeologist conducted an assessment of the broader study area in order to determine the archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted his site visit on 7-11 February and 23-24 May 2022 (Appendix 2)
- The information from a number of relevant archaeological assessments conducted by CTS Heritage on adjacent properties (November 2021 and March 2022) was collated with the results from the above field assessments
- A Desktop Palaeontology Assessment was completed (June 2022)
- The identified resources were assessed to evaluate their heritage significance and potential impacts to these resources were interrogated
- 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.



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2.4 Constraints & Limitations

Recent good rains in the area had significantly elevated the vegetation density (mostly grassland) for the survey but sufficient open ground was found throughout the study area to properly document the archaeological material. Much of the project area is relatively flat and easily traversed which enabled very high survey coverage to be achieved. Archaeological visibility was very high in the areas on and immediately adjacent to the dolerite outcrops where most of the archaeological material is concentrated.

2.5 Savannah Impact Assessment Methodology

Direct, indirect and cumulative impacts of the issues identified through the Basic Assessment process 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.



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- 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:

$$S = (E + D + M) \times P$$

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).



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3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Desktop Assessment

De Aar was originally established on the Farm "De Aar." The name means "the artery," a reference to its underground water supply. The Cape Government Railways were founded in 1872, and the route that the government chose for the line to connect the Kimberley diamond fields to Cape Town on the coast, ran directly through De Aar. Because of its central location, the government also selected the location for a junction between this first railway line, and the other Cape railway networks further east, in 1881. In 1899 two brothers who ran a trading store and hotel at the junction, Isaac and Wulf Friedlander, purchased the farm of De Aar. Following the Anglo Boer War, the Friedlander brothers surveyed the land for the establishment of a town. The municipality was created a year later in 1900.

Orton (2012) writes that "The colonial period history of the area is not that old. While the town of De Aar only dates back to 1903, just after the cessation of the 1899-1902 Anglo-Boer War, farms were given out and surveyed in the 1800s." He goes on to note that "The railway junction dates to 1881 when Cape Town and Kimberley were linked by rail after diamonds were discovered at the latter town. It was very important to the British during the Anglo-Boer War since railway lines from Cape Town and Port Elizabeth joined here and extended on through Kimberly to Mafikeng (AngloBoerWar.com 2011). De Aar was also the site of the first use of wireless telegraphy in South Africa where the British employed it to maintain communications between their various columns operating in the area. However, owing to the climatic conditions in the Karoo, the wireless sets, which were designed for shipboard use, could not perform properly and were soon withdrawn from inland service (Baker 1998). The town was laid out around the railway junction on the farm De Aar which was purchased in 1889 by Isaac and Wolf Friedlander, who ran a trading store and hotel at the railway junction. After the war, the brothers established the town." Orton (2012) also notes that "Two Provincial Heritage Sites occur in De Aar. These are the "Olive Schreiner house" and the "St Paul's Church". At least one other building is listed (SAHRA, n.d.). Many of the older buildings in the town are early 20th century, including some art deco, but the majority of structures date to the mid- to late 20th century. De Aar is well known as one of the places where Olive Schreiner lived. She and her husband were there from 1907 to 1914."

Kruger (2012) describes the development area as "characterised by flat undulating Karoo vegetation comprised of relatively sparse scrub and grasses, with dolerite hills in the surrounding landscape. Large portions of the land is currently devoted to livestock farming but a number of solar energy facilities are to be constructed on farms around De Aar. Shallow soils covers a combination of calcrete, shale and dolerite substrates, and large sections in the landscape are exposed to sheet erosion, specifically along low lying areas and drainage lines. Dolerite and sandstone is present, while exotic rocks occur in the gravel of the Orange River bed and terraces. These provided suitable material for stone tool production during the Earlier, Middle and Later Stone Ages."



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Archaeology

As part of the 2012 process for approval of the Vetlaagte Solar Energy Facility located immediately adjacent to the proposed development area, Kruger conducted a detailed Heritage Impact Assessment of the area. According to Kruger (2012), “During the survey, widespread Middle Stone Age (MSA) material, including characteristic formal MSA stone tools such as points, blades and scrapers were documented in the survey area along a north-south oriented drainage on the (western) periphery of the property. The lithic remains occur in three large scatters and, almost without exception, in low lying areas along non-perennial drainage lines and wetland areas where precipitation and groundwater have exposed the stone tools, originally deposited on a decomposed calcrete rock layer approximately 30cm sub surface. Preliminary examinations of some of the lithics indicated that a number of flakes displayed faceted platforms, characteristic of the MSA.” Part of the study area for the Wag ‘n Bietjie development assessed in this report is located within the drainage described above. It is therefore likely that the proposed development will impact on significant MSA archaeology.

Kruger (2012) also documented historical period remains, “specifically the old Vetlaagte homestead with restored farmhouse, outbuildings, midden and labourers quarters, as well as a dilapidated dam wall constructed in the drainage line east of the farmstead are present on the property. The date of construction of the farm house is denoted by a year count (“1930”) on the front gable of the structure. The entire farmstead is situated in an area excluded from the solar farm development. A small family graveyard, associated with the farmstead at Vetlaagte, also occurs in the exclusion zone about 100m north of the farm house.”

In his assessment of areas adjacent to this proposed development, Orton (2012) found that “All the archaeological finds on Badenhorst Dam Farm were pre-colonial, but nevertheless, different types were present. This farm also had areas with artefacts best described as being ‘background scatter’. The grass cover, however, meant that fewer such areas were identified. Most were in open, silty patches that clearly hold water in the rainy season...” Orton (2012) found LSA artefacts associated with the ridge running through the property that he assessed, and MSA artefacts from a pan-like area. He noted that “the artefacts in the flatter areas here appeared to be of much lower density and far fewer occurrences were recorded. However, stone artefact scatters with spatial integrity were more common. These were predominantly LSA and very much focused on the rocky ridges crossing the farm.”

Orton (2012) noted that the spatially constrained scatters of artefacts that he identified “are almost certain to indicate places where people camped and the durable stone artefacts are now all that remains as evidence. It is also notable that their locations are not random – they are placed on level areas and saddles along the ridges. One of these LSA scatters, DAR2011/019 (#026) included a thumbnail scraper indicative of a mid- to late Holocene age. Some of the artefacts here were very black and shiny indicating recent flaking and deposition.” Orton (2012) also



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identified a number of piled stone structures. These appeared to be concentrated on one particular dolerite ridge and, unlike those from elsewhere in the Karoo, only one may have been a kraal. He determined that these structures are likely to be pre-colonial in age as similar piles have been recorded in an almost certain pre-colonial context in the Seacow River valley (Hart 1989). Orton (2012) also identified a number of engraved rocks that date to the LSA and historical times. All of Orton's findings (2012) are mapped in Figure 3 and 3b. While these resources fall outside of this development area, they give an indication of the likely archaeological sensitivity of the development area under consideration in this assessment.

A recent field assessment on an adjacent farm conducted by CTS Heritage found that "The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage." The report goes on to note that "Two sites warranted protection with an interesting scatter of Still Bay tools on top of a dolerite outcrop with excellent views of the surrounding area. It is highly unlikely this area will be developed and it is recommended that infrastructure is not placed on this outcrop. Another site was found warranting a III B rating with pottery, bone and an extensive stone tool assemblage amongst the dolerite outcrops on the eastern end of the property. Again, this site has been demarcated as sensitive and the project team has been advised to avoid this area when finalising the layouts. A minimum buffer of 100m is recommended from this site (Wag n Bietjie 014). The rest of the observations are typical of the area and are ubiquitously distributed in low densities of less than 5 artefacts per observation." Similar heritage resources are likely to be located within the area proposed for development.



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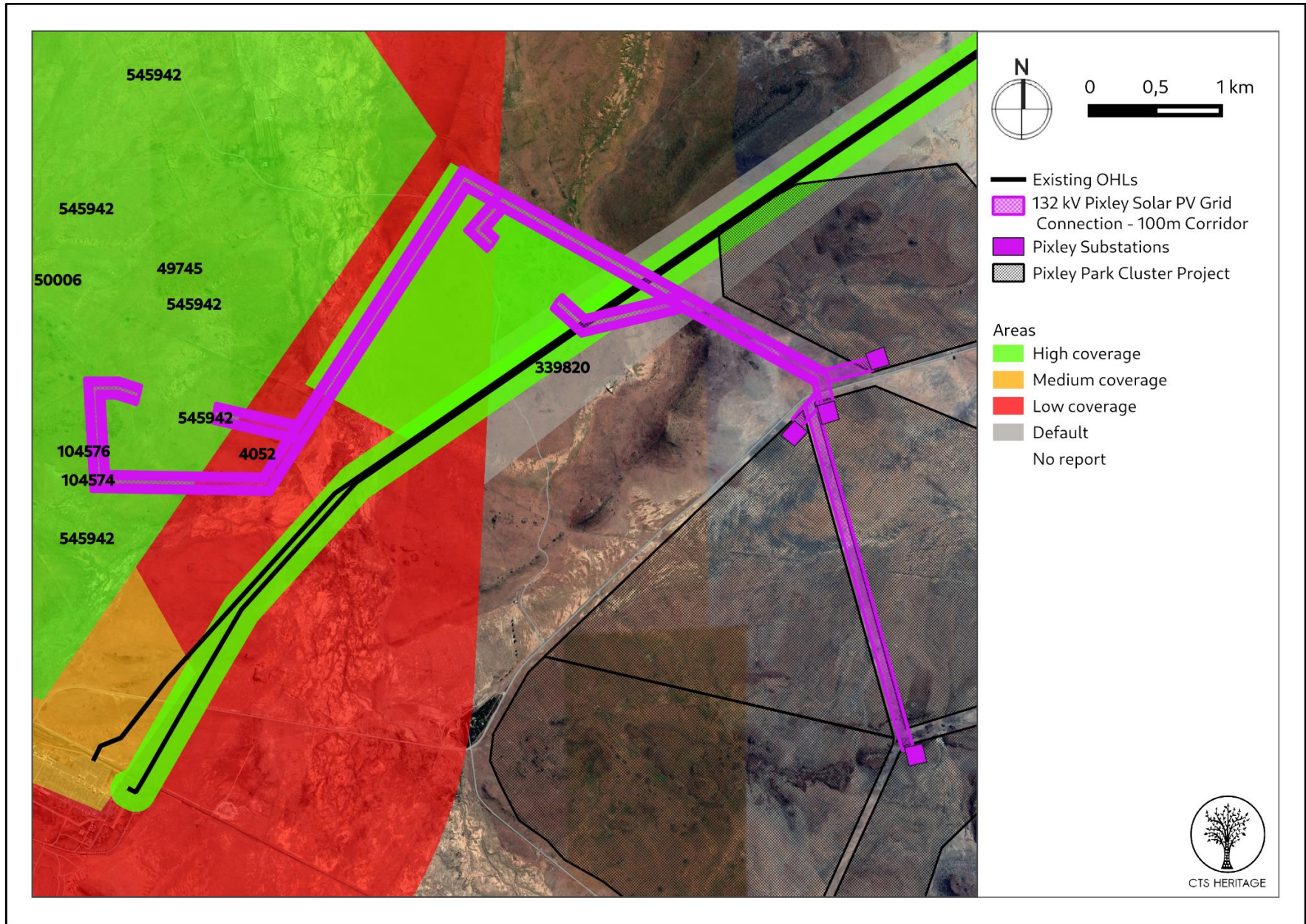


Figure 2.1: Spatialisation of heritage assessments conducted in proximity to the broader study area



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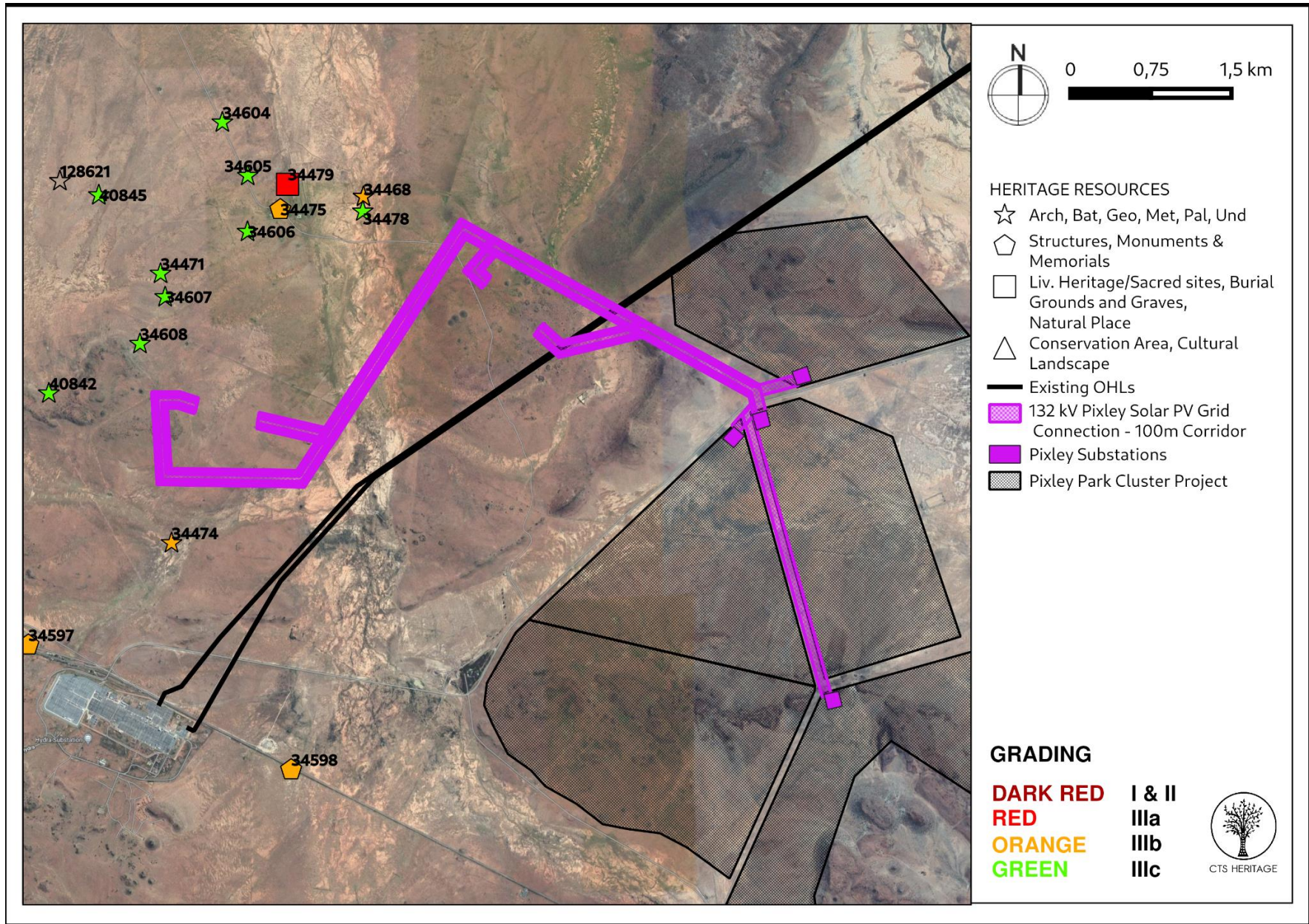


Figure 2.2: Spatialisation of heritage resources known in proximity to the broader study area



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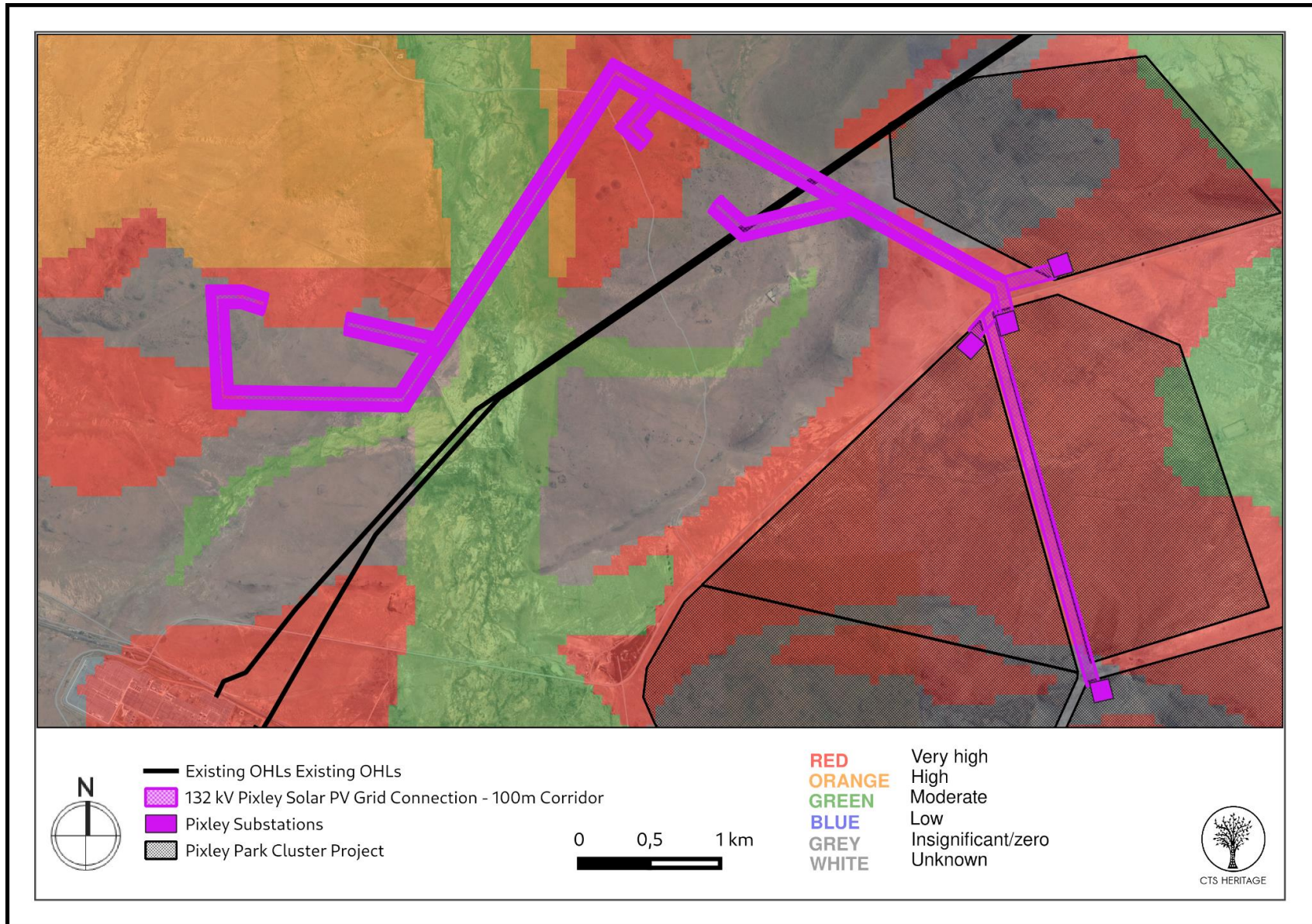


Figure 3.1: Palaeontological sensitivity of the area surrounding the broader study area



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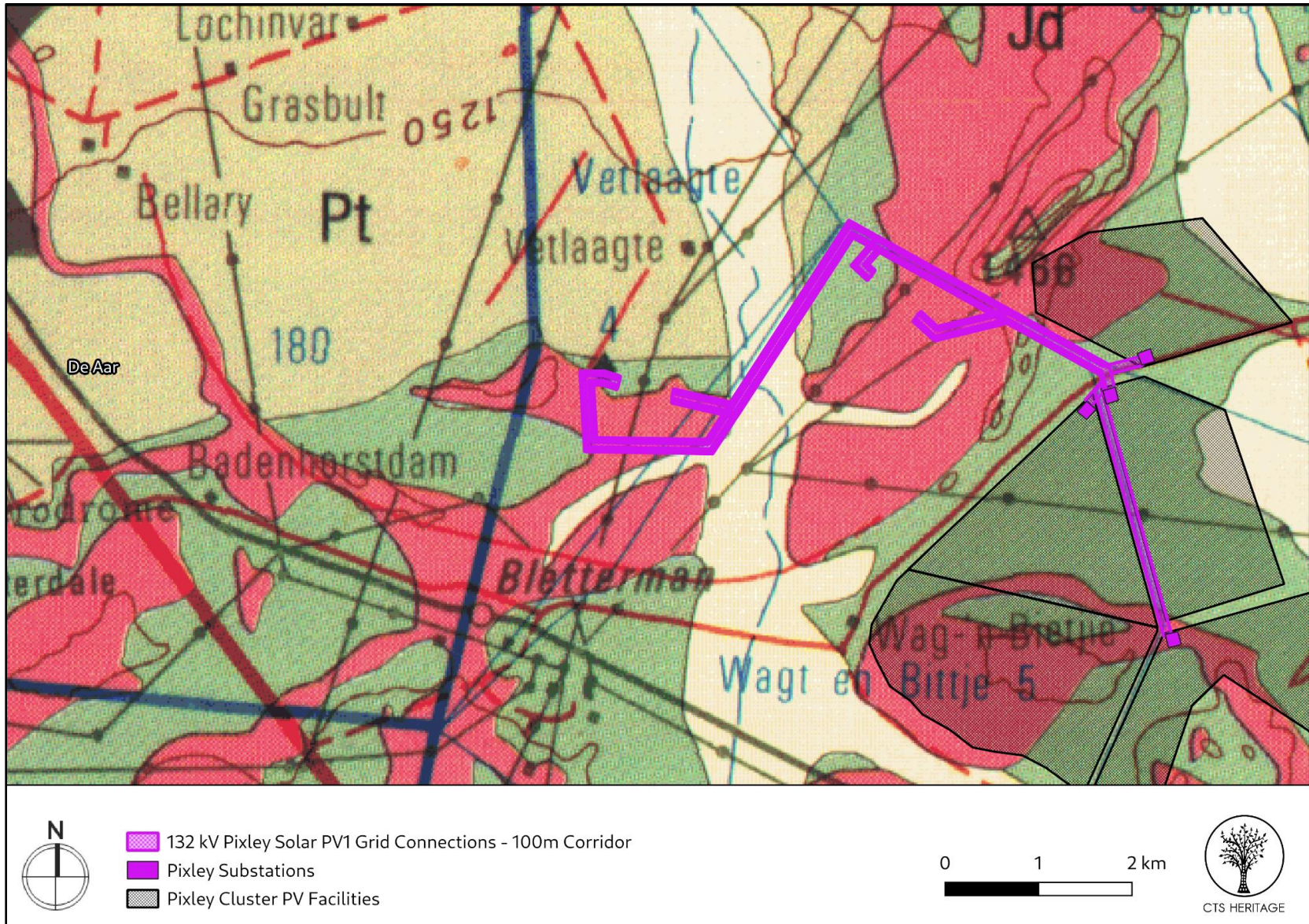


Figure 3.2: Geology Map. Extracted from the Council for GeoSciences Map 3024 for Colesburg indicating that the development area is underlain by Jd: Jurassic Dolerite, Pt (lighter green): Tierberg Formation of the Ecca Group and Pa (darker green): Adelaide Subgroup of the Beaufort Group



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3.2 Palaeontology

According to the SAHRIS Palaeosensitivity Map (Figure 4a), the area proposed for development is underlain by sediments of moderate, high and very high paleontological sensitivity. According to the extract from the Council for GeoSciences Map 3024 for Colesburg, the development area is underlain by Jurassic Dolerite, the Tierberg Formation of the Ecca Group and the Adelaide Subgroup of the Beaufort Group as well as Quaternary sands associated with the drainage lines.

As part of the process completed in 2012 for the approved neighbouring Vetlaagte Solar Energy Facility, Almond completed a field-based palaeontological assessment. Almond (2012) found that “The potentially fossiliferous sediments of the Late Palaeozoic Karoo Supergroup (Ecca and Lower Beaufort Groups) that underlie the study area are almost entirely mantled in a thick layer of superficial deposits of probable Pleistocene to Recent age. These include various soils, gravels and – at least in some areas - a well-developed calcrete hardpan. The upper Ecca Group bedrocks in the northern portion of the study area contain locally abundant fossil wood (of palaeontological interest for dating and palaeoenvironmental studies), as well as low diversity non-marine trace fossil assemblages typical of the Waterford Formation, rather than the Tierberg Formation as mapped. No vertebrate fossils and only scattered woody plant impressions of the Permian Glossopteris Flora were observed within the Lower Beaufort Group rocks that are very poorly exposed in the southern portion of the Vetlaagte study area. Trace fossils, silicified wood and rare vertebrate remains (therapsids, parareptiles) of the Middle Permian Pristerognathus Assemblage Zone have recently been recorded from this succession in the De Aar region (Almond 2010b). Extensive dolerite sills and dykes of the Early Jurassic Karoo Dolerite Suite intruding the Karoo Supergroup sediments are entirely unfossiliferous, as are rare intrusive kimberlite pipe rocks of Cretaceous age. The diverse superficial deposits within the three study areas (e.g. soils, gravels, alluvium, calcrete hardpans) are of low palaeontological sensitivity as a whole. Abundant fragments of reworked fossil wood material of Ecca provenance occur widely within subsurface and surface gravels overlying the Ecca Group outcrop area.”

Almond (2012) concludes that “The construction of new access roads and transmission lines in this region are likewise considered to be of low significance as far as fossil heritage is concerned... In view of the overall low significance of the proposed development on palaeontological heritage resources, it is concluded that no further palaeontological heritage studies or specialist mitigation are required for these small PV projects, pending the exposure of any substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood) during the construction phase.”



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4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Archaeology

Over 79 archaeological observations were made during the survey of the broader area and only 4 observations were made within the grid connection alignment proposed for the Carolus PV development. Hornfels dominated the assemblages with smaller numbers of flakes struck from siltstones. While the vast majority of the scatters were made during the Middle Stone Age, there was also a relatively clear Later Stone Age presence in the study area. Many examples of blade forms were found which are typical of the Still Bay period (>70 000 years BP). Relatively dense Later Stone Age sites were found on the far eastern end of Wag 'n Bietjie and these date within the last 2000 years due to the presence of pottery in these sites.

Five archaeological sites across the broader survey area are significant enough to require buffer zones around them to avoid negative impacts from solar PV panels, roads and other related infrastructure. Three of these are rock art sites with engravings on dolerite boulders that were graded with local medium significance (IIIB) and two LSA sites were identified with relatively dense scatters of stone tools. None of these are located within the proposed grid alignment for the Carolus PV development.

The rest of the observations do not warrant further study as they are typical of the area and are ubiquitously distributed in low densities of less than 5 artefacts per observation.

Palaeontology

- The Palaeontological Sensitivity of the **Tierberg Formation** is classified as **High Risk** by SAHRIS. The most abundant fossils from the formation are trace fossils. These include approximately ten ichnogenera including invertebrate burrows (e.g. *Planolites*, *Palaeophycus*), arthropod trackways (e.g. *Umfolozia*), and fish swimming trails (e.g. *Undichna*). Rare microvertebrate remains (fish scales and teeth) in calcareous concretions as well as plant fossils (leaves and petrified wood) have also been recovered (Van Dijk, Channing & Van Den Heever, 2002; Almond, 2008; Almond, 2013). If the Tierberg Formation exposures in the area are instead Waterford Formation deposits, these sediments have yielded poorly preserved tetrapod remains (possibly temnospondyl), microvertebrates (fish scales), fish coprolites, non-marine bivalves, trace fossils (e.g. invertebrate burrows *Scoyenia*), and plant fossils (e.g. petrified wood and *Glossopteris*) (Rubidge, Hancox & Catuneanu, 2000; Johnson, Anhaeuser & Thomas, 2006; Almond, 2013).
- The Palaeontological Sensitivity of the **Adelaide Subgroup** is classified as **Very High Risk** by SAHRIS. The unit contains a highly diverse tetrapod assemblage and three Assemblage Zones: the *Tapinocephalus*, *Endothiodon*, and *Cistecephalus* Assemblage Zones (Day & Rubidge, 2020; Day & Smith, 2020; Rubidge &



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Day, 2020). These have yielded amphibian fossils (including temnospondyls like *Rhinesuchus*), Pantestudines (e.e. *Eunotososaurus*), therapsids (including biarmosuchians, anomodonts, gorgonopsians and therocephalians) as well as fish (e.g. *Namaichthys*). Plant fossils (including petrified wood, plant remains, leaf & stem impressions), non-marine molluscs, and trace fossils (trackways, invertebrate burrows, coprolites) have also been recovered in the Adelaide Subgroup (Johnson, Anhaeuser & Thomas, 2006; Bordy & Prevec, 2008; Bordy, Linkermann & Prevec, 2011; Bamford, Cairncross & Lombard, 2020; Almond, 2021). Previous surveys in the area (22 km South-East of current proposed area) have reported that “Due to the generally very poor exposure of Lower Beaufort Group (Adelaide Subgroup) bedrocks in the region between De Aar and Hanover, there have been very few identifiable vertebrate or other fossil finds here. Fragmentary skeletal remains of small-bodied therapsids, mainly dicynodonts, as well as of the small tortoise-like reptile *Eunotososaurus* have been recorded from the Lower Beaufort Group near De Aar [...] (Day *et al.*, 2013) but these belong to a slightly older horizon within the Lower Beaufort Group than those in the present study area. Associated fossils near De Aar include scrappy plant remains – mainly sphenophyte ferns and well-preserved silicified wood – as well as low-diversity trace fossil assemblages.” (Almond, 2021).

- The Palaeontological Sensitivity of the **Jurassic Dolerite** is classified as **Insignificant/Zero** by SAHRIS. The igneous intrusive origin of the Jurassic dolerite dykes makes it unlikely that they contain fossils.
- The Palaeontological Sensitivity of the **Quaternary deposits** is classified as **Moderate** by SAHRIS. Although present, the fossil record of the Quaternary Sands is sporadic and not very diverse. Aeolian dunes are not likely to preserve fossil material, however, calcretisation of burrows (including termites) and root casts (rhizoliths) can occur. Fossils that have been recorded include ostrich egg shells (*Struthio*), shells of land snails (e.g. *Trigonephrus*), bivalves and gastropods (e.g. *Corbula*, *Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones). The Mokolanen calcretes have also yielded calcretised burrows (including termites), root casts (rhizoliths) as well as mammalian ichnofossils (Malherbe, 1984; Almond & Pether, 2008). Previous surveys in the area (22 km South-East of current proposed area) have yielded petrified wood fossils reworked from Permian sedimentary deposits, but no vertebrate or invertebrate fossils (Almond, 2021).



4.2 Heritage Resources identified

A total of 4 archaeological observations were made within the area proposed for the Carolus PV development.

Table 1: Archaeological resources identified within the development footprint

Site No.	Site Name	Description	Density m2	Period	Co-ordinates		Grading	Mitigation
<i>Pixley Park Field Assessment</i>								
076	Grid	Hornfels blade, edge retouched	0 to 5	MSA	-30.68882022	24.14215164	NCW	NA
077	Grid	Early MSA siltstone flake edge retouched	0 to 5	MSA	-30.68839403	24.13644379	NCW	NA
078	Grid	Old farm dam, earthen	n/a	Modern	-30.68789437	24.13177839	NCW	NA
079	Grid	Hornfels core and flake, edge retouched	0 to 5	MSA	-30.68242723	24.11585108	NCW	NA
<i>Other fieldwork conducted</i>								
004		Still bay point, blades, hornfels, burnt bone, on top of dolerite outcrop with good views	5-10	MSA	-30.68097	24.11972	IIC	30m no-go buffer
006	Grid	Single long hornfels blade flake retouched near windmill	0-5	MSA	-30,67512	24,1188	NCW	NA
007	Grid	Two unworked hornfels flakes	0-5	MSA	-30,6751	24,12113	NCW	NA
008	Grid	Hornfels flake, unworked, heavily patinated	0-5	MSA	-30,67872	24,12576	NCW	NA
009	Grid	Hornfels core	0-5	MSA	-30,67845	24,12653	NCW	NA
010	Grid	Heavily patinated hornfels flakes in a small clearing	0-5	MSA	-30,67832	24,12772	NCW	NA
011	Grid	Three hornfels flakes, one with edge retouch	0-5	MSA	-30,67847	24,12838	NCW	NA
012	Grid	Thumbnail scraper, msa hornfels blade and flakes	10-30	MSA, LSA	-30,67917	24,12871	NCW	NA
013	Grid	Hornfels point, edge retouched	0-5	MSA	-30,68179	24,12737	NCW	NA
014	Grid	LSA and MSA site with mainly LSA hornfels flakes and pottery	30+	MSA, LSA	-30.68296	24.12708	IIIB	100m no go buffer
016	Grid	heavily patinated hornfels blade retouched	0-5	MSA	-30,68002	24,11668	NCW	NA
017	Grid	Unworked siltstone and hornfels flakes	0-5	MSA	-30,67955	24,11629	NCW	NA
019	Grid	Hornfels chunks in edge of	0-5	LSA	-30,68099	24,11445	NCW	NA



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		pan						
020	Grid	Large hornfels point, and flake	0-5	MSA	-30,6824	24,11505	NCW	NA
025	Grid	hornfels bladelet with hinge terminations on dorsal, hornfels core with less than 10% cortex left	0-5	MSA	-30,68546	24,11078	NCW	NA
028	Grid	Small hornfels point with hafted platform retouch	0-5	MSA	-30,68891	24,10134	NCW	NA
029	Grid	Two heavily patinated hornfels flakes near low dolerite outcrop	0-5	MSA	-30,68995	24,10013	NCW	NA
033	Grid	Hornfels flake with very finely struck secondary scars on dorsal	0-5	MSA	-30,68823	24,09485	NCW	NA
035	Grid	Two hornfels flakes in amongst dolerite outcrops	0-5	MSA	-30,68906	24,09129	NCW	NA
037	Grid	Hornfels flakes, segment	0-5	MSA	-30,69021	24,09002	NCW	NA
039	Grid	Hornfels flakes, one retouched all around, triangular point	0-5	MSA	-30,69163	24,09172	NCW	NA
047	Grid	Hornfels flakes in jeep track	0-5	MSA	-30,68724	24,09022	NCW	NA

4.3 Mapping and spatialisation of heritage resources

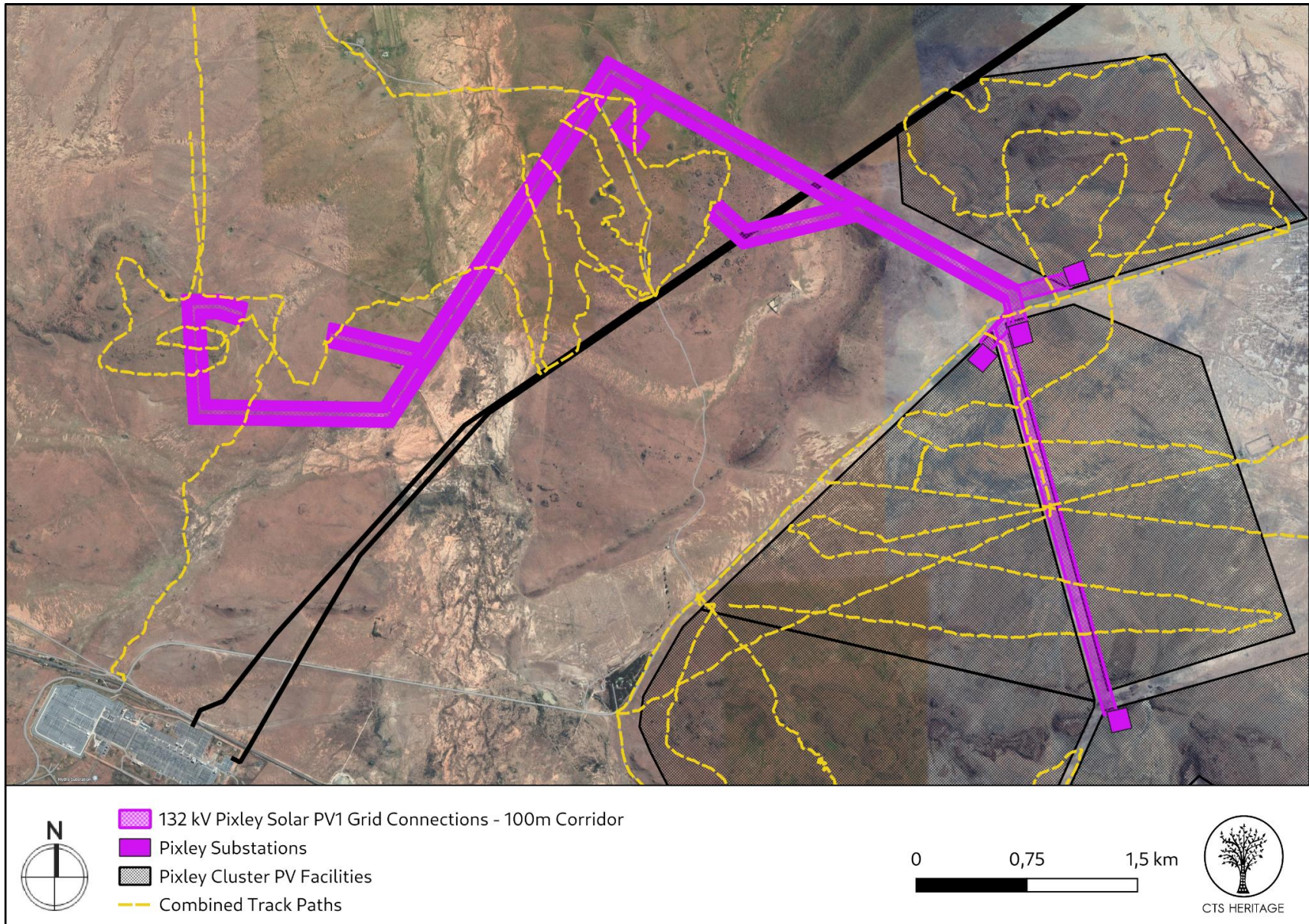


Figure 4: Map of combined track paths over the area proposed for development



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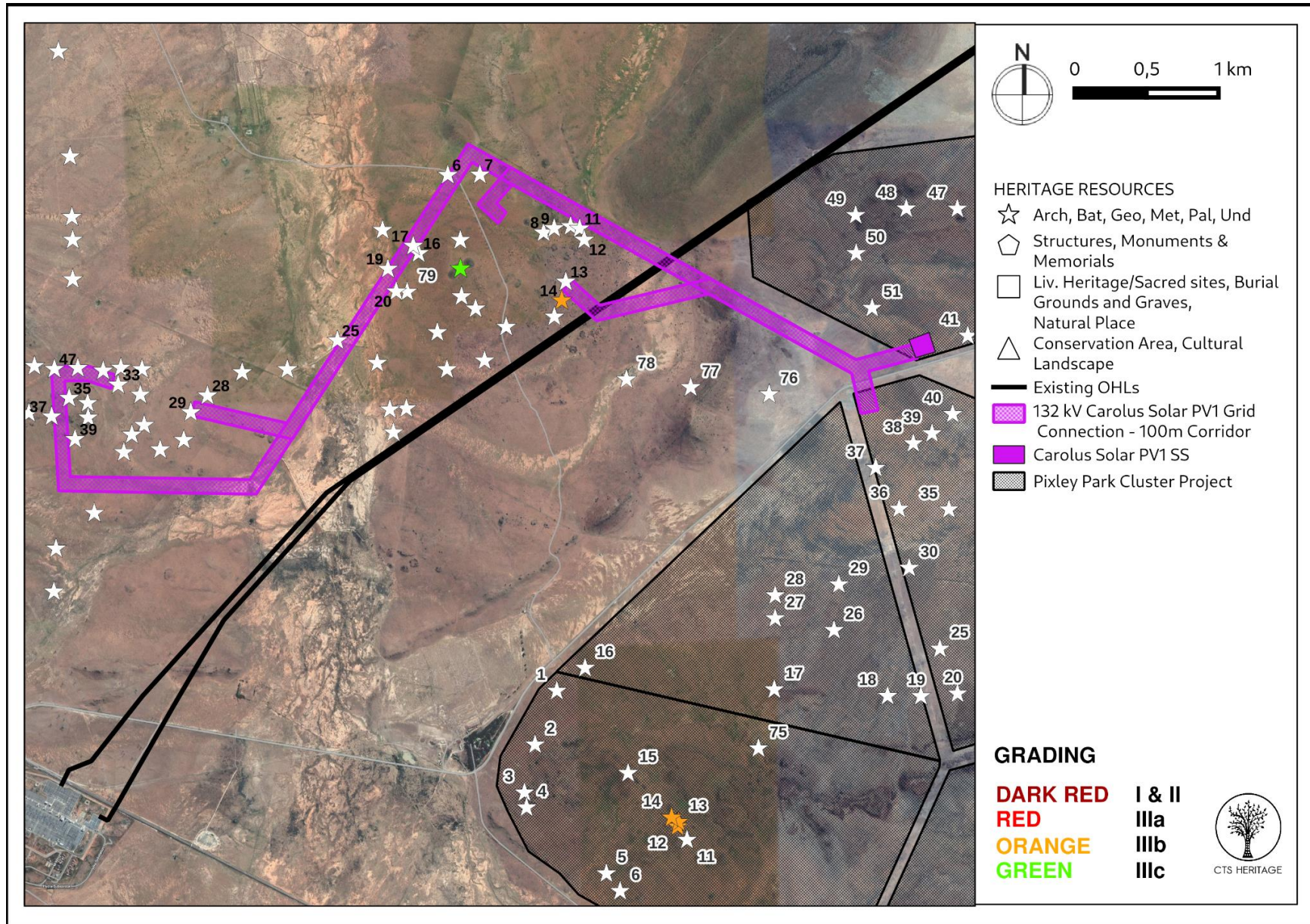


Figure 5: Map of heritage resources identified during the field assessment, relative to the proposed development (see Table 1 and 2). The sites marked as WHITE are not considered to be conservation-worthy



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5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

No impacts to heritage resources are anticipated for the Design and Pre-Construction Phase, and the Post-Construction and Operational Phase. The only anticipated impacts are likely during the construction phase.

Archaeology

The results of the archaeological field assessment conducted largely aligns with the findings of previous archaeological assessments completed in the vicinity of the proposed development. The archaeological resources identified within the development area are dominated by Later and Middle Stone Age flakes, which corresponds with similar findings of others (Kruger, 2012). All of the archaeological resources identified within the area proposed for the Carolus PV grid connection infrastructure in this field assessment have been determined to be not conservation-worthy. As such, these resources have been sufficiently recorded and there is no objection to the proposed development in these locations from an archaeological perspective.

The construction of the powerlines is not impactful on archaeological sites and the siting of pylons can be made through most of the area without causing significant damage to archaeological sites. The only significant site located in close proximity to the proposed grid alignment is site 014 which is described as “LSA and MSA site with mainly LSA hornfels flakes and pottery”. This site has been graded IIIB and a no-development buffer of 100m is recommended around this site.

The archaeological field assessments identified no structures or other kinds of heritage resources located within the areas proposed for development other than those outlined above.



Table 4.1: Impacts of the proposed development on archaeological resources

NATURE: It is possible that buried archaeological resources may be impacted by the proposed development in the preferred location				
		Without Mitigation		With Mitigation
MAGNITUDE	L (3)	No archaeological resources of significance were identified within the development area.	L (3)	No archaeological resources of significance 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)	Limited to the development footprint	L (1)	Limited to the development footprint
PROBABILITY	L (1)	It is likely that resources will be impacted	L (1)	It is unlikely that resources will be impacted
SIGNIFICANCE	L	$(3+5+1) \times 1 = 9$	L	$(3+5+1) \times 1 = 9$
STATUS		Negative		Negative
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	Not Likely
CAN IMPACTS BE MITIGATED		Yes		
MITIGATION:				
<ul style="list-style-type: none"> • A 100m no-go development area must be implemented around site 014 • Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward. 				
RESIDUAL RISK:				
None				



Palaeontology

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and some do contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils. Almond (2010) found no fossils of significance during his site visit to Vetlaagte, and the Wag ‘n Bietjie farm has the same lithology. It is unknown what lies below the surface.

Based on previous surveys in the area, the presence of superficial deposits (probable Pleistocene to Recent age) covering the fossiliferous sediments (Ecca and Beaufort Groups), as well as the extensive network of intrusive dolerite dykes and sills that bake (thermally metamorphose) adjacent mudrocks, it is anticipated that the impact of the development will mainly be **LOW to MODERATE**.

Table 4.2: Impacts of the proposed development to palaeontological resources

NATURE: It is possible that buried palaeontological resources may be impacted by the proposed development in the preferred location				
		Without Mitigation		With Mitigation
MAGNITUDE	L (1)	According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development of the PV facilities is underlain by sediments that have very high palaeontological sensitivity.	L (1)	According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development of the PV facilities is underlain by sediments that have very high palaeontological sensitivity.
DURATION	H (5)	Where manifest, the impact will be permanent.	H (5)	Where manifest, the impact will be permanent.
EXTENT	L (1)	Limited to the development footprint	L (1)	Limited to the development footprint
PROBABILITY	L (1)	It is unlikely that significant fossils will be impacted	L (1)	It is unlikely that significant fossils will be impacted
SIGNIFICANCE	L	(1+5+1)x1=7	L	(1+5+1)x1=7
STATUS		Negative		Negative
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	Not Likely
CAN IMPACTS BE MITIGATED		Yes		
MITIGATION:				
<ul style="list-style-type: none"> The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities Should any previously unrecorded palaeontological resources be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward. 				
RESIDUAL RISK:				
None				



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5.2 Sustainable Social and Economic Benefit

TBA

5.3 Proposed development alternatives

TBA

5.4 Cumulative Impacts

The proposed grid infrastructure is associated with the development of a group of proposed renewable energy facilities that are located within a cluster of approved renewable energy facilities (Map 5) located outside of De Aar. In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise culturally significant landscape. The proposed development is therefore unlikely to result in unacceptable risk or loss, nor will the proposed development result in a complete change to the sense of place of the area or result in an unacceptable increase in impact due to its location as one of many renewable energy facilities in this area.



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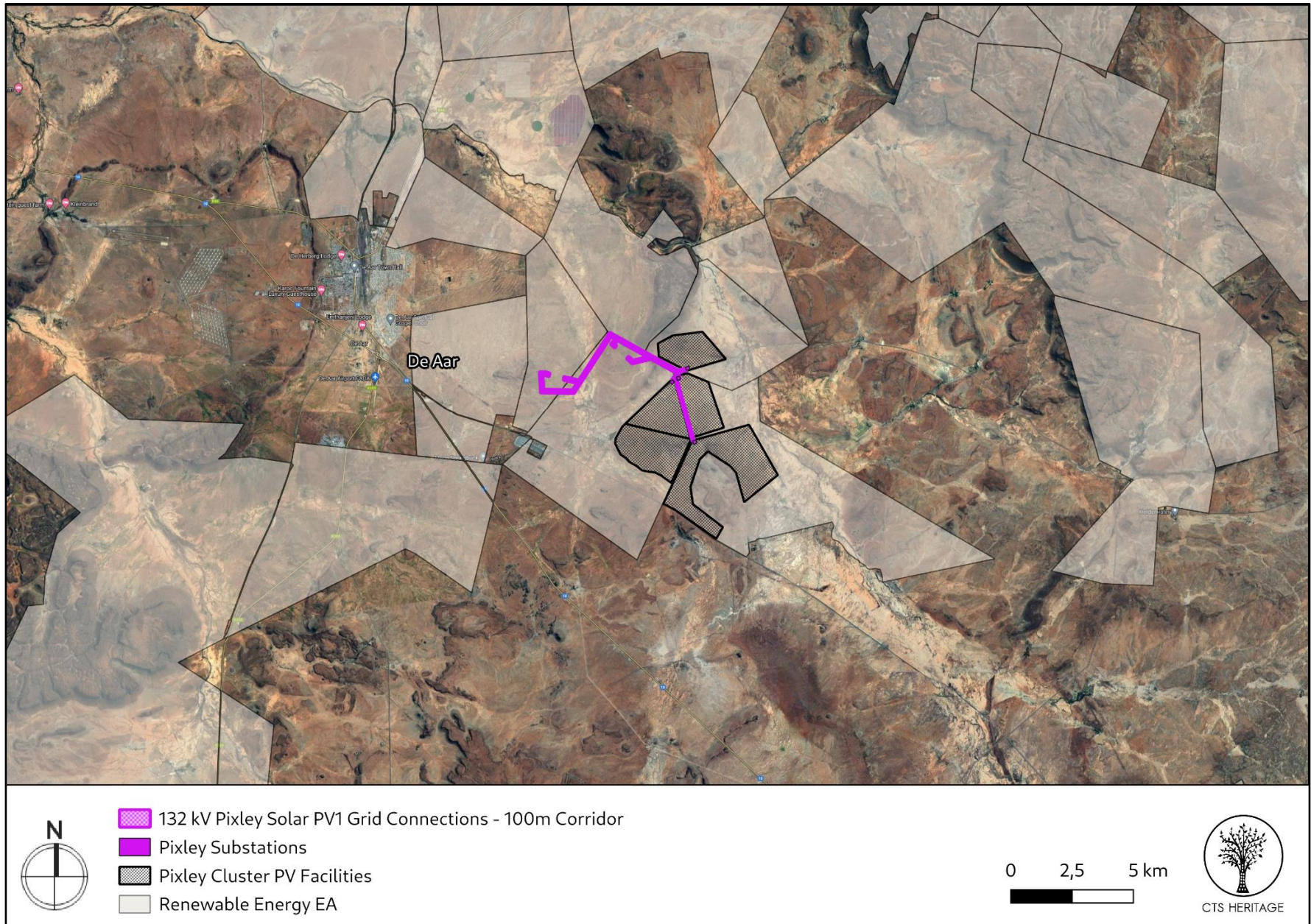


Figure 6: Map indicating the location of authorised renewable energy facilities in proximity to the proposed development



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6. RESULTS OF PUBLIC CONSULTATION

The public consultation process will be undertaken by the EAP during the EIA. No heritage-related comments have been received to-date. SAHRA is required to comment on this HIA and make recommendations prior to the granting of the Environmental Authorisation.

7. CONCLUSION

The overall archaeological sensitivity of the development area with regard to the preservation of Early, Middle and Later Stone Age archaeology as well as Khoe and San heritage, early colonial settlement is regarded as very high. Despite this, the field assessment conducted for this project has demonstrated that the specific area proposed for development has low sensitivity for impacts to significant archaeological heritage.

As indicated above, the results of this assessment align with the findings of other specialists such as Morris (2011) who notes that ephemeral MSA and LSA scatters are the dominant archaeological signature of the area and the majority of these are therefore not archaeologically significant. In general, the construction of powerlines is not impactful on archaeological sites and the siting of pylons can be made through most of the area without causing significant damage to archaeological sites.

Based on experience, other reports and the lack of any significant previously recorded fossils from the area, it is unlikely that any fossils would be preserved in the Tierberg Formation or Adelaide Subgroup. Nonetheless, a Fossil Chance Find Protocol should be added to the EMP.

8. RECOMMENDATIONS

There is no objection to the proposed development as described above in terms of impacts to heritage resources on condition that:

- A 100m no-go development area must be implemented around site 014
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities
- An inspection of excavations is undertaken by a palaeontologist during the construction phase.
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.



9. REFERENCES

Heritage Impact Assessments				
NID	Author(s)	Date	Type	Title
104574	Heritage Scoping	Wouter Fourie	10/10/2012	Heritage Scoping Report for the Proposed Wind Farm Facility for Renosterberg Wind Energy Company (RWEC) near Petrusville, Northern Cape Province
104576	Heritage Scoping	Wouter Fourie	10/10/2012	Heritage Scoping Report for the Proposed Solar PV Facility for Renosterberg Wind Energy Company (RWEC) near Petrusville, Northern Cape Province
104804	PIA Desktop	John E Almond	01/09/2012	Palaeontological specialist assessment: desktop study PROPOSED RENOSTERBERG SOLAR PV AND WIND ENERGY FACILITIES NEAR DE AAR, NORTHERN CAPE PROVINCE
133138	HIA Phase 1	Jayson Orton, Lita Webley	09/07/2013	HERITAGE IMPACT ASSESSMENT FOR MULTIPLE PROPOSED SOLAR ENERGY FACILITIES
133536	Palaeontological Specialist Reports	John E Almond	01/07/2013	PALAEONTOLOGICAL SPECIALIST STUDY
133536	Palaeontological Specialist Reports	John E Almond	01/07/2013	PALAEONTOLOGICAL SPECIALIST STUDY
163982	Palaeontological Specialist Reports		31/08/2013	Palaeontological specialist assessment: combined desktop and field study: Proposed development PV Solar Facility near De Aar, Northern CApe Province
163994		Wouter Fourie	03/08/2013	Proposed PV Facility: Heritage Impact Report
177599	AIA Phase 1	Jonathan Kaplan	01/04/2010	ARCHAEOLOGICAL IMPACT ASSESSMENT PROPOSED PHOTOVOLTAIC POWER GENERATION FACILITY IN DE AAR NORTHERN CAPE
177600	Site Inspection Report	Will Archer, Jonathan Kaplan	01/05/2012	Reconnaissance and plan for further mitigation: sites impacted on by proposed photovoltaic power generation facility in De Aar Northern Cape
256408	Palaeontological Specialist Reports	John E Almond	16/07/2013	Palaeontological Specialist Study: Combined Desktop and Field-based Assessments - Proposed Photovoltaic (Solar) Energy Facilities on Badenhorst Dam Farm near De Aar, Northern Cape
256413	Heritage	Jayson Orton	09/07/2013	Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities



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	Impact Assessment Specialist Reports			on De Aar 180/1 (Badenhorst Dam Farm), De Aar, Northern Cape
339820	Heritage Impact Assessment Specialist Reports	Lita Webley, Jayson Orton	01/12/2011	Proposed De Aar Wind Energy Facility on the North and South Plateau, Northern Cape Province
339824	Heritage Impact Assessment Specialist Reports	Lita Webley, David Halkett	01/06/2015	Addendum: Proposed Wind Energy Facility situated on the Eastern plateau (South) near De Aar, Northern Cape Province.
4052	HIA Phase 1	Albert van Jaarsveld	01/03/2006	Hydra-Perseus and Beta-Perseus 765 kV Transmission Power Lines Environmental Impact Assessment. Impact on Cultural Heritage Resources
49745	AIA Phase 1	Neels Kruger	01/03/2012	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF DEMARCATED SURFACE AREAS ON THE OF THE FARM VETLAAGTE 4, DE AAR, NORTHERN CAPE PROVINCE
49843	PIA Phase 1	John E Almond	01/05/2012	PALAEONTOLOGICAL SPECIALIST STUDY: COMBINED DESKTOP AND FIELD-BASED ASSESSMENTS Proposed solar power generation facilities on the remaining extent of the farm Vetlaagte No. 4, De Aar, Northern Cape Province
50006	HIA Phase 1	Jayson Orton	20/02/2012	HERITAGE IMPACT ASSESSMENT FOR THREE SOLAR ENERGY FACILITIES AT DE AAR, WESTERN CAPE
53198	HIA Phase 1	Elize Becker	20/04/2012	Phase 2 Heritage Impact Assessment De Aar Solar One Photovoltaic Power Project Heritage Impact Assessment Phase 2
53200	Heritage Scoping	Elize Becker	18/01/2012	HERITAGE IMPACT ASSESSMENT SCOPING REPORT Prepared for De Aar Solar One Photovoltaic Power Plant, Northern Cape
58989	PIA Desktop	James Brink	10/08/2012	A Palaeontological Desktop Study of the Area to be Affected by the Proposed Photovoltaic Power Project on Portion 3 of Farm Hartebeestplaats 135
8378	HIA Phase 1	Jayson Orton	29/02/2012	HIA for three solar energy facilities at the De Aar, Northern Cape (Paarde Valley, Badenhorst Dam Farm and Annex Du Plessis Dam Farm)
89361	HIA Phase 1	Neels Kruger	01/03/2012	ENNEX DEVELOPMENTS: PROPOSED ESTABLISHMENT OF A SOLAR ENERGY FACILITY NEAR DE AAR, NORTHERN CAPE PROVINCE Phase 1 Archaeological Impact Assessment Report



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APPENDICES



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APPENDIX 1: Heritage Screening Assessment (2022)



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APPENDIX 2: Archaeological Assessment (2022)



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APPENDIX 3: Palaeontological Assessment (2022)



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APPENDIX 4: Chance Fossil Finds Procedure