Appendix E6

Heritage and Palaeontological Impact Assessment

HERITAGE IMPACT ASSESSMENT

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

Proposed Development of the Angus Solar Power Plant, near Carletonville, Gauteng and North West Province

Prepared by CTS Heritage

CTS HERITAGE

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For

Solis Environmental

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EXECUTIVE SUMMARY

1. Site Name:

Angus SPP and BESS

2. Location:

The proposed development forms part of the Pluto PV cluster developments that lie just within the western borders of the Gauteng Province and are split roughly in two areas north and south of the N14 highway linking Ventersdorp to Krugersdorp.

3. Locality Plan:

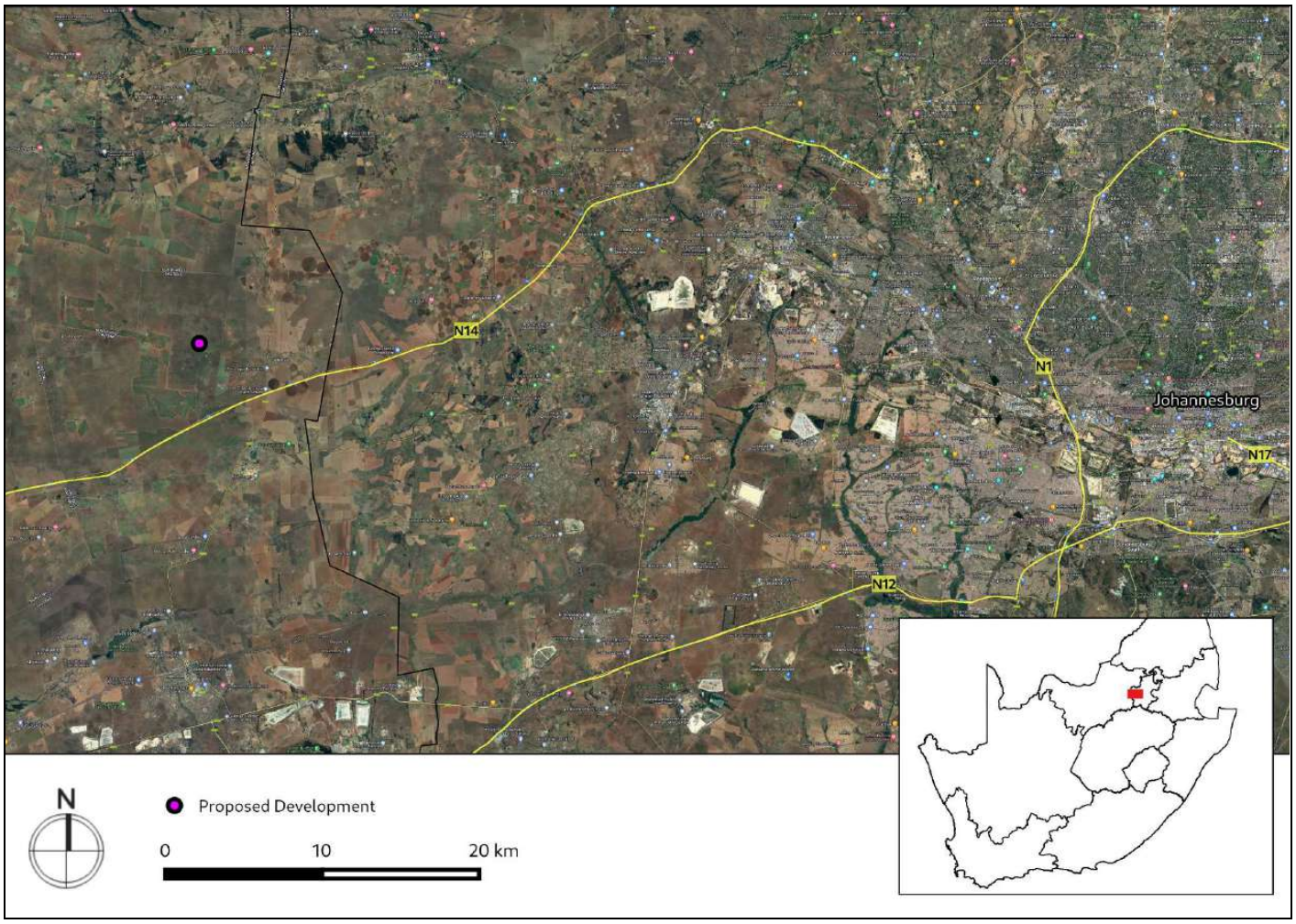

Figure A: Location of the proposed development area

4. Description of Proposed Development:

This application is for the proposed development of four 250MW solar energy facilities and their grid connection infrastructure located approximately 17km north of Carletonville in the Gauteng Province. The project assessed in this report is:

- Angus SPP proposed by Angus Solar Power Plant (RF) (Pty) Ltd

5. Heritage Resources Identified:

The field assessment did not document any significant archaeological remains that fall within the area proposed for development, however the proposed PV panel infrastructure does impact slightly on the Grade IIIC Leeupan Farm Werf identified as site 036. It is recommended that the werf as mapped in Figures 6.1 and 6.2 is excluded from the Angus SPP development footprint.

6. Anticipated Impacts on Heritage Resources:

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources. The field assessment did not document any significant archaeological remains that fall within the area proposed for development, however the proposed PV panel infrastructure does impact slightly on the Grade IIIC Leeupan Farm Werf identified as site 036. It is recommended that the werf as mapped in Figures 6.1 and 6.2 is excluded from the Angus SPP development footprint.

There are no objections on palaeontological heritage grounds. The proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils (Appendix 2).

7. Recommendations:

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

- It is recommended that the werf as mapped in Figures 6.1 and 6.2 is excluded from the Angus SPP development footprint.
- The HWC 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 HWC must be alerted immediately to determine an appropriate way forward.

Details of Specialist who prepared the HIA

Jenna Lavin, an archaeologist with an MSc in Archaeology and Palaeoenvironments, 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. 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

This application is for the proposed development of four 250MW solar energy facilities and their grid connection infrastructure located approximately 17km north of Carltonville in the Gauteng Province. The project assessed in this report is:

- Angus SPP proposed by Angus Solar Power Plant (RF) (Pty) Ltd

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e. semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - To produce up to 250MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the Yield.
- Wiring to Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.
- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV and higher. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into the step up transformers to 132kV. An onsite substation will be required to step the voltage up to 132kV, after which the power will be evacuated into the national grid via a switching station and Li-Lo connection on the Olifantsnek/Wildfontein 132kV Overhead Line or to a new proposed collector substation to step the voltage up from 132KV to 275/400KV in order to evacuate the power into the national grid at the same voltage level as the MTS via a proposed 132/275/400KV power line. Whilst Tuli Solar Power Plant (RF) (Pty) Ltd has not yet received a cost estimate letter from Eskom, it is expected that generation from the facility will tie in with a newly proposed collector substation Generation from the facility will tie in with the on-site step up and switching substation that will be connected to a newly proposed collector substation, the collector substation will be connected to a newly proposed MTS to be connected to the existing Pluto 400/275/22kV MTS. The connection power line will be constructed within the limits of the grid connection corridor. The project will generate up to 250MW of electricity. Refer to the Figure below.

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4m underground as far as practically possible.
- Supporting Infrastructure – All associated infrastructure will be constructed within the limits of the infrastructure and ancillary complex which will include an on-site substation, Battery Energy Storage System, Operations and Maintenance buildings etc.
- Battery storage – A Battery Storage Facility with a maximum height of 8m and a maximum volume of 1,740 m^3 of batteries and associated operational, safety and control infrastructure.
- Roads – Access will be obtained via a public gravel road off of the R500 regional road to the east of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 metres will be used.

Table 1 Technical details the proposed facility

Component	Description / dimensions
Height of PV panels	6 metres
Area of PV Array	500 Hectares (Development footprint)
Number of inverters required	Minimum 50
Area occupied by inverter / transformer stations / substations / BESS	All associated infrastructure will be constructed within the limits of the infrastructure and ancillary complex. On site Substation: 2.4 ha Collector Substation: 4 ha BESS: 8 ha Central inverters + LV/MV trafo: 750 m^2
Capacity of on-site substation	On-site substation: 33/132 kV Collector substation: 132KV MTS: 132/275/400KV
Capacity of the power line	132/275/400 KV
Area occupied by both permanent and construction laydown areas	Permanent project area: 500 Hectares Construction laydown area: ~20 ha
Area occupied by buildings	Infrastructure & Ancillary Complex: 19.3 ha
Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3 Capacity ~up to 500MWh
Length of access roads	3 km
Width of access roads	8 m – 10 m

Length of internal roads	18.01 km
Width of internal roads	4 m – 6 m
Length of perimeter roads	9.65 km
Width of perimeter roads	6 m – 8 m
Grid connection corridor width	102 m up to 1.4 km
Grid connection corridor length	Approximately 10 km
Power line servitude width	132KV line – 31 m 275KV line – 47 m 400KV line – 55 m
Height of power line	132KV line – 32 m 275KV line – 32 m 400KV line – 40 m
Height of fencing	Approximately 2.5 m

1.2 Description of Property and Affected Environment

The Pluto PV cluster developments lie just within the western borders of the Gauteng Province and are split roughly in two areas north and south of the N14 highway linking Ventersdorp to Krugersdorp. A number of 400 kV and 132 kV overhead powerlines intersect at the large Pluto substation and these PV developments aim to connect up to the grid using their proximity to this grid interchange. The main landmarks south of the N14 are the Wildfontein and De Pan farms as well as various diggings for a large sand mining operation. Most of the farms are growing maize on a commercial scale as well as grazing areas for cattle.

Randfontein is only about 15km east of the development area and most of the larger farms have subsequently been subdivided off into smaller peri-urban plots. A range of small businesses can be found on the way towards Randfontein and Krugersdorp and the Western Deep gold mines in and around Carletonville lie about 17km south of the development area. Traffic levels are therefore relatively high with farming and mining trucks regularly moving through the study area.

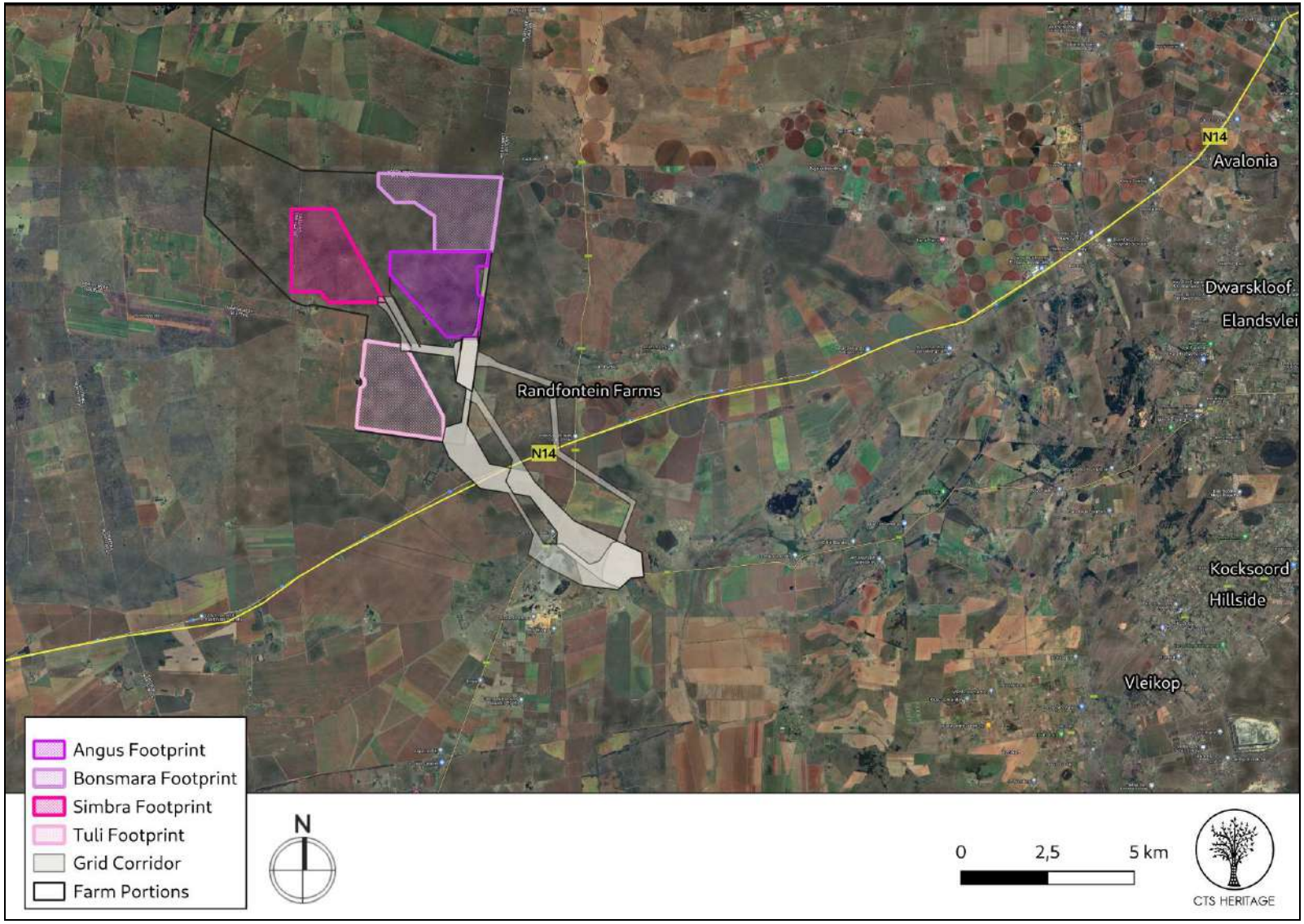

Figure 1.1: Proposed development relative to the N14

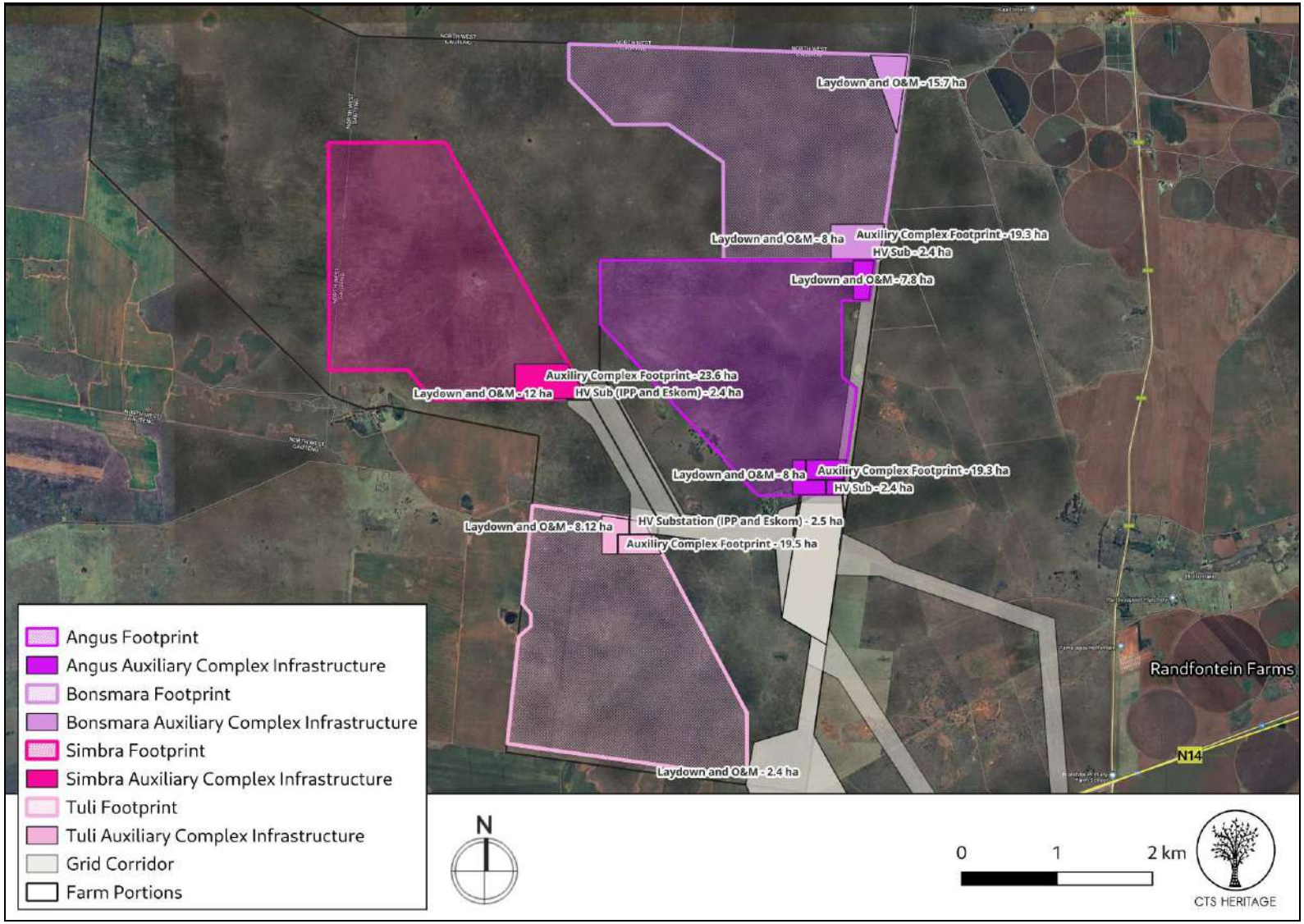

Figure 1.2: The proposed development layout

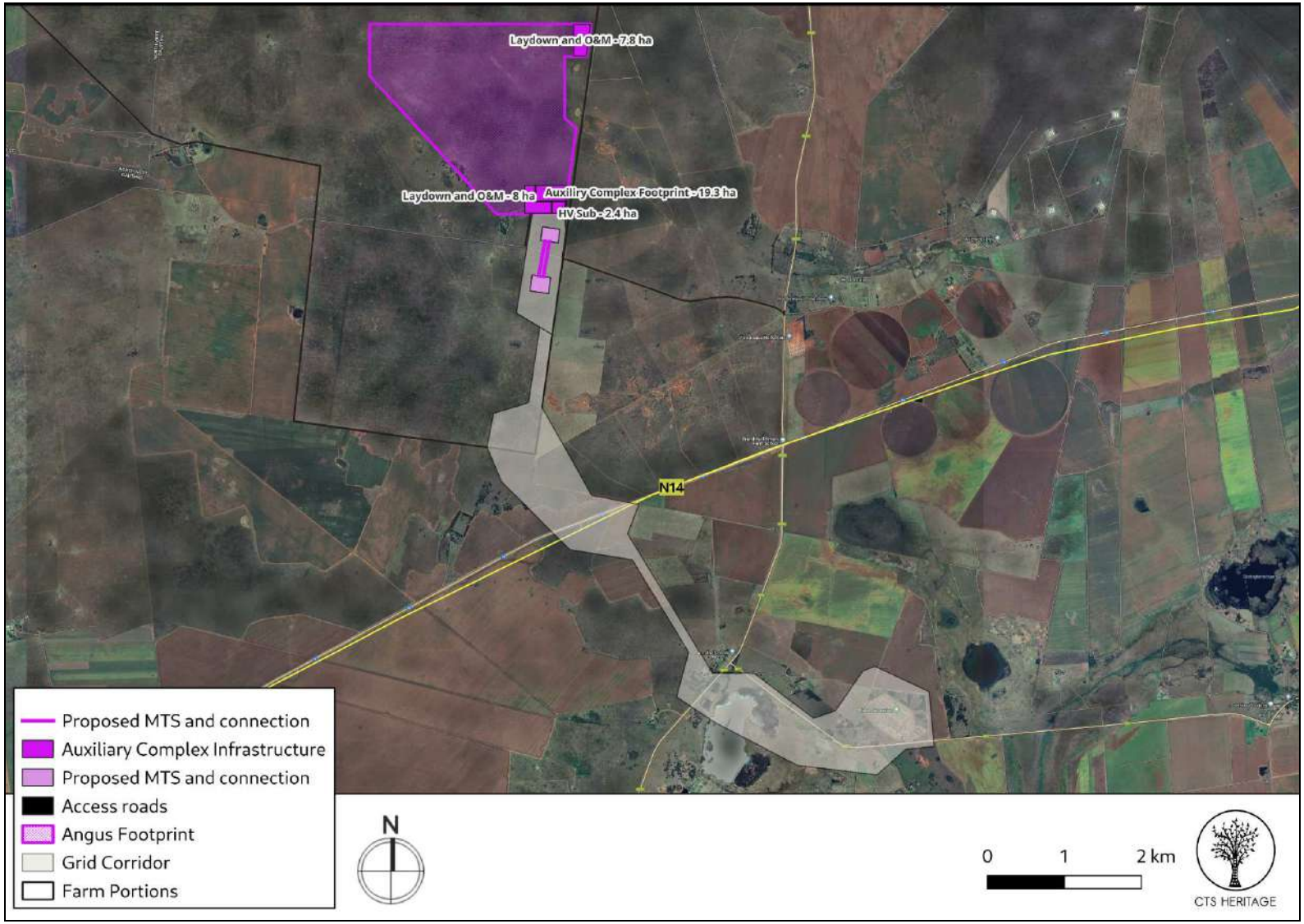

Figure 1.3: The proposed development layout of Angus SPP and BESS

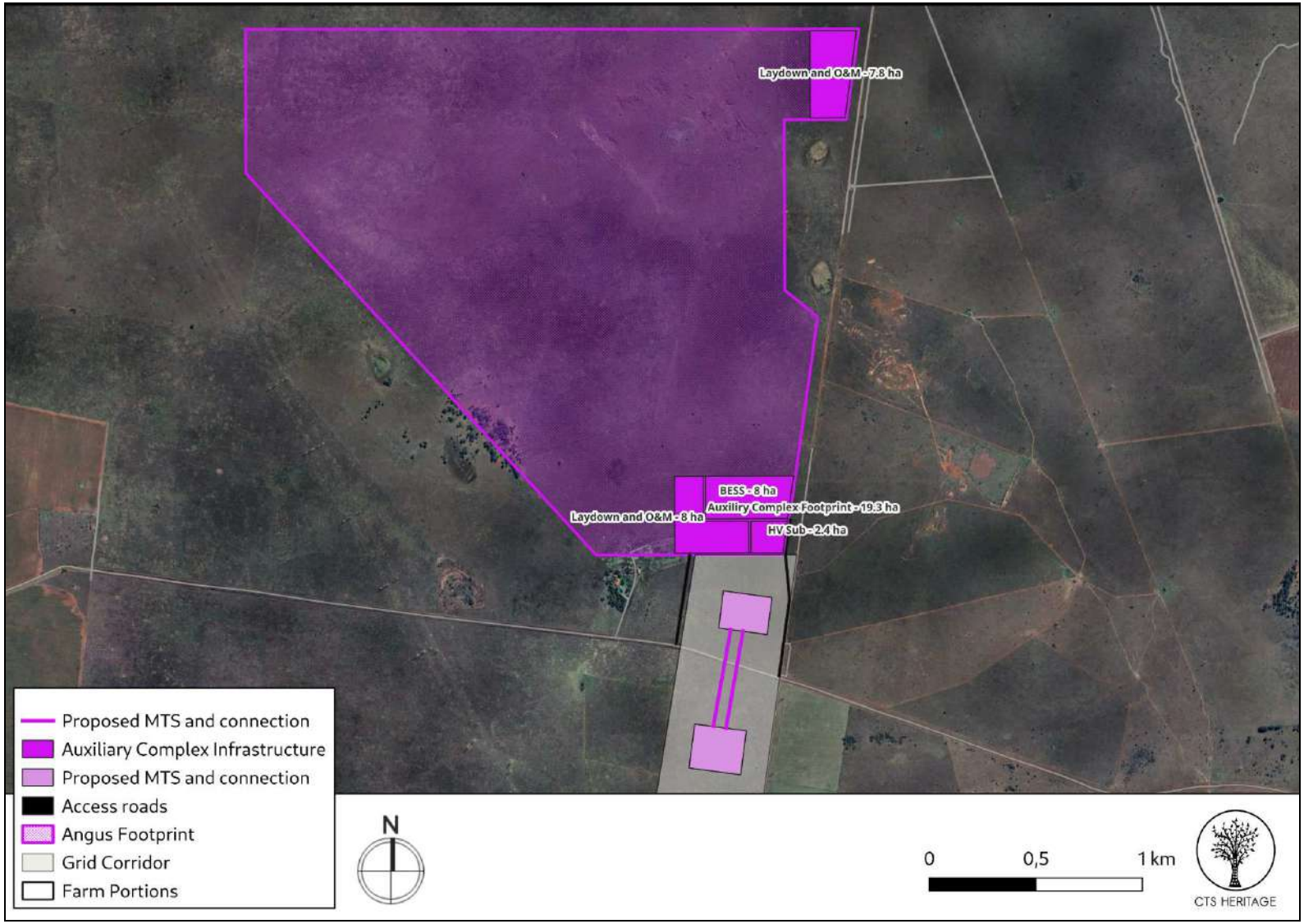

Figure 1.4: The proposed development layout of Angus SPP and BESS

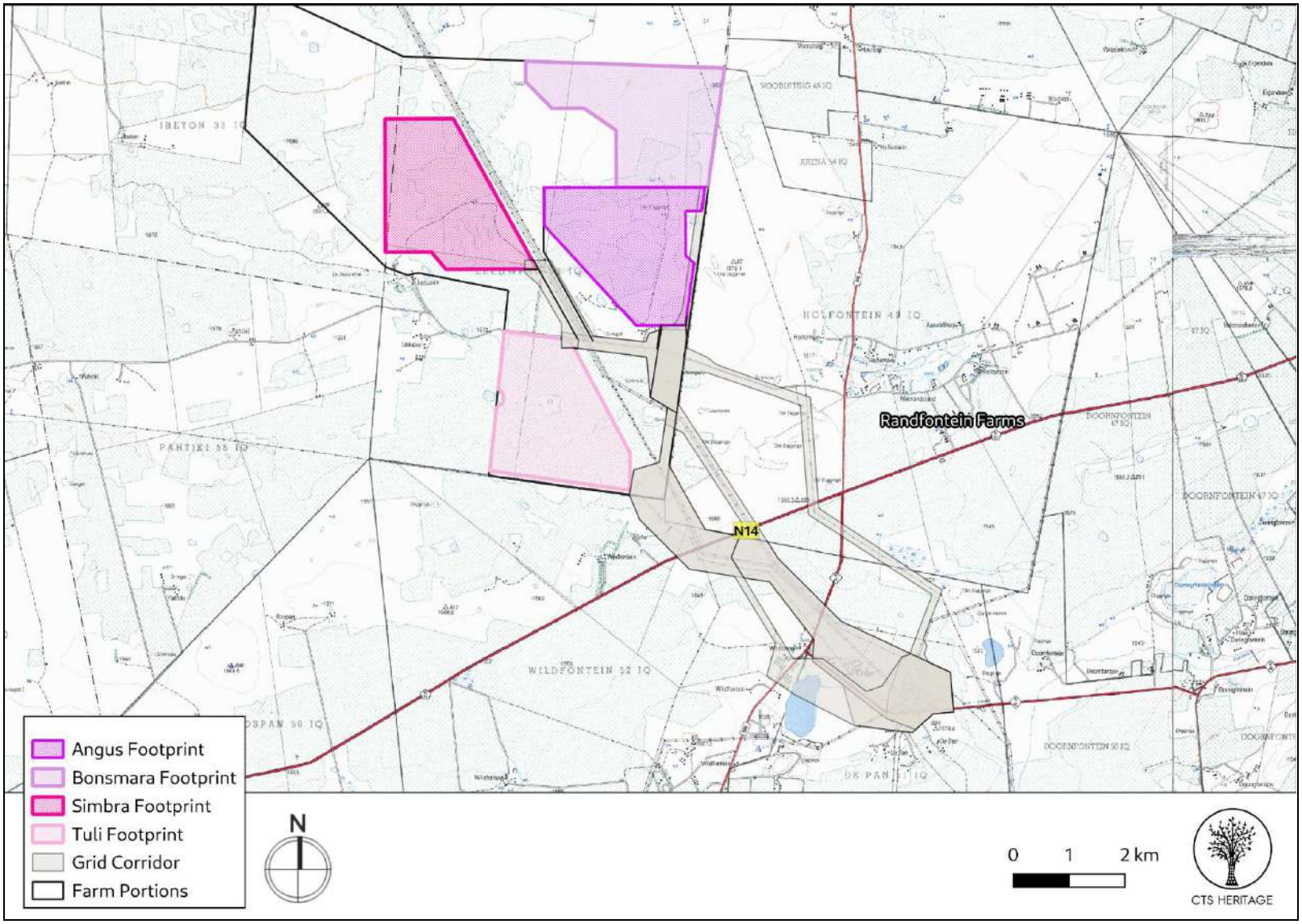

Figure 1.5: The proposed development layout on an extract of the 1:50 000 Topo Map

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 a survey of the site and its environs on 27 to 29 March 2023 to determine what archaeological resources are likely to be impacted by the proposed development.
- A palaeontologist conducted a field assessment of palaeontological resources likely to be disturbed by the proposed development on 23 and 24 March 2023.
- 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

While much of the study area is covered in maize fields, the access tracks and exposed areas of ground were inspected to assess whether Stone Age material eroding out of the disturbed areas could be located and recorded. Where maize fields were absent, deep grass had been planted and maintained to cover grazing

grounds for cattle. Very little, if any, of the terrain has not been transformed by farming activities of one kind or another. The survey therefore succeeded in locating a number of graves, built environment structures and ruins but very little Stone Age archaeology can be found in the area under the current conditions.

2.5 Solis Impact Assessment Methodology

The environmental assessment aims to identify the various possible environmental impacts that could result from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in the Table below.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact the following criteria is used:

Table 1: The rating system

NATURE
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.

GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.

2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

The area proposed for development is located approximately 17km north of Carletonville within the Merafong Municipality. Carltonville was developed by various mining companies from 1937 onwards, but was not officially incorporated until 1959, and was subsequently recognised as a provincial town in 1967. Surrounding Carletonville are a number of privately owned gold-mining township villages and contractor labour quarters established by the mining companies on land owned by the mines. The area surrounding Carletonville is dominated by a cultural landscape that is shaped and defined by the historic and on-going mining activities associated with the Witwatersrand. A detailed archaeological background of the area is provided by Du Pisanie and Nel (2012, SAHRIS NID 104305) and is therefore not repeated here. It is sufficient to note that no significant Early, Middle or Later Stone Age sites are known from this broader area, however sites representing the Iron Age occupation of the region are present in the broader context.

Birkholtz and Groenewald (2016, SAHRIS NID 369805) completed an HIA on a property located immediately south of the area proposed for development. They describe the broader areas as "The overall study area can be described as generally undulating with a number of extensive pans located within this area… While the overall study area is mostly utilised for agricultural activities, the proposed development bulk sample area that was assessed in the field is characterised by agricultural fields (maize), a large number of small livestock camps associated with stud farming (cattle) as well as Eskom power lines." The N14 is an historic scenic route that runs between Ventersdorp and Pretoria and is likely based on the original wagon route used for this journey. This route is located approximately 1.5km south of the Tuli SPP Footprint area. In general, for the development of PV infrastructure and its associated grid connection infrastructure, it is preferred for such development to be clustered with existing development, such as mining or residential development, in order to reduce the perception of urban and infrastructure sprawl across an otherwise agricultural landscape.

Birkholtz and Groenewald (2016) go on to note that examples of published excavated archaeological sites from the general surroundings of the study area include the Later Stone Age and Iron Age sites located along the Magaliesberg Mountains and sites of international palaeoanthropological significance such as Sterkfontein and Kromdraai, both located within the Cradle of Humankind World Heritage Site located approximately 33km north-east of the study area. Birkholtz and Groenewald (2016) note that the nearest published excavated archaeological site to the present study area is the underground cavern system known as Lepalong, that was used as shelter by the Kwena ba Modimosa ba Mmatau during the turmoil of the Difaqane/Mefaqane. According to Birkholtz and Groenewald (2016), oral histories indicate that Lepalong was occupied from 1827 into the 1830s (Reid & Lane, 2003). Lepalong is located some 25km south-west of the study area.

According to Du Pisanie and Nel (2016, SAHRIS NID 356134), "With the onset of the Transvaal and South African

Wars, Gatsrand became a strategic location for British troops who occupied Potchefstroom. This region was located in close proximity to the Western Railway, which provided a tactical advantage. To exploit and protect this advantage, three blockhouses were constructed on the farms Driefontein 113 IQ and Driefontein 355 IQ. These structures were not identified during the pre-disturbance survey and it is assumed that they no longer exist. The next major event to take place in this region was the discovery of gold, which facilitated the establishment of several towns from the 1920s, an increase in population and an increase in services. Early mines established include Venterspost (1934), Libanon (1936), West Driefontein (1945), East Driefontein (1968) and later Kloof (1968). Shaped by these events and activities the study area has through time transformed into a historic mining landscape." In their Heritage Impact Assessment located nearby, Du Pisanie and Nel (2016, SAHRIS NID 356134) identified a number of heritage resources, the majority of which were determined to be not conservation-worthy. The nature of the resources identified include burials and burial grounds (graded IIIA) as well as historic and modern farm structures. Similar resources are likely to be present within the proposed development areas.

According to the SAHRIS Palaeosensitivity Map, the Proposed Development Areas are located within areas that have variable palaeontological sensitivity but all areas have sediments that have high and very high palaeontological sensitivity. According to the extract from the Council of GeoScience Map for West Rand 2626, the very highly sensitive formations that may be impacted include the Malmani Subgroup. The Malmani Subgroup is known to preserve a range of shallow marine to intertidal stromatolites (domes, columns *etc*), organic-walled microfossils and includes FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS such as in the Cradle of Humankind.

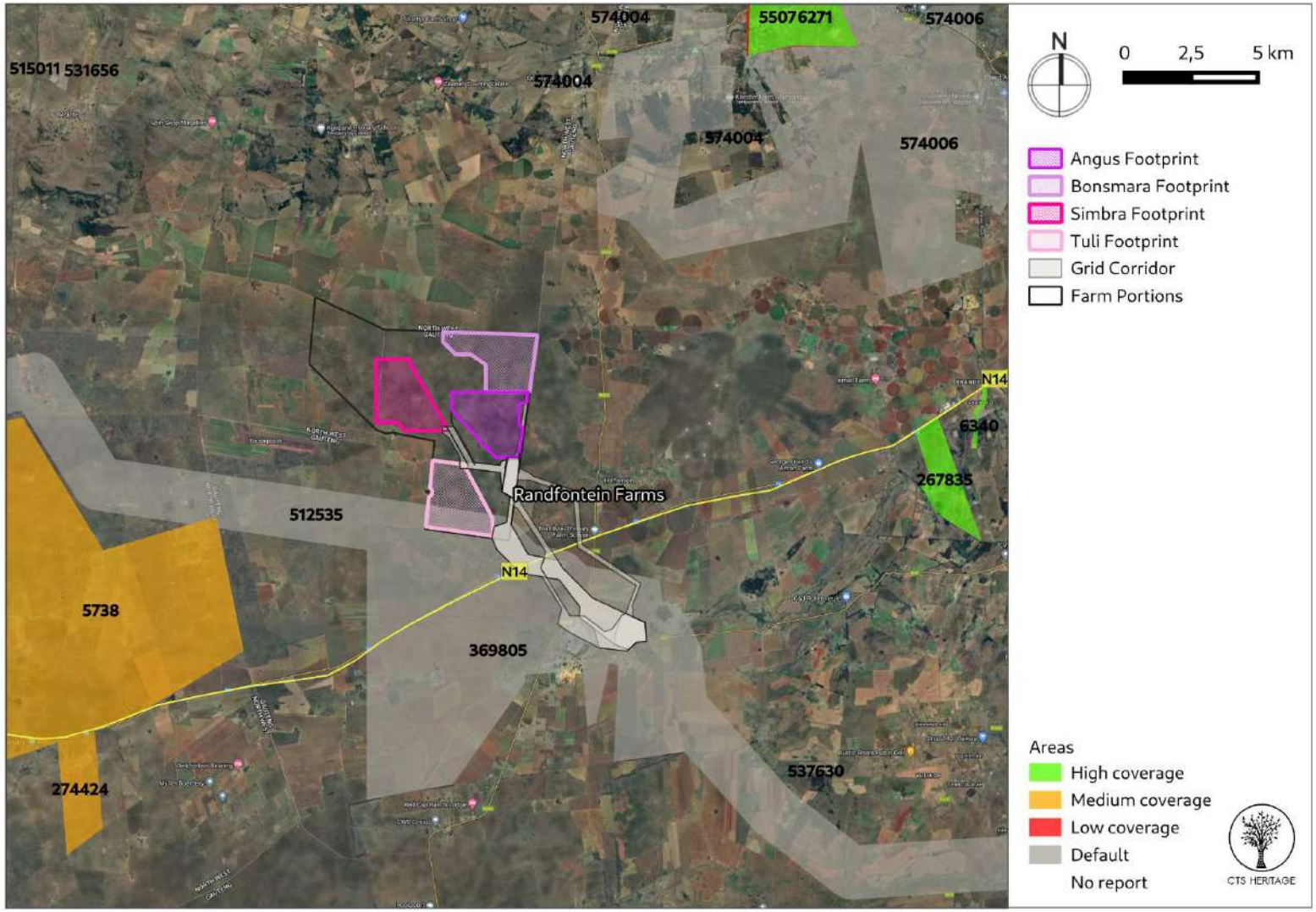

Figure 2.1: Spatialisation of heritage assessments conducted in proximity to the proposed development

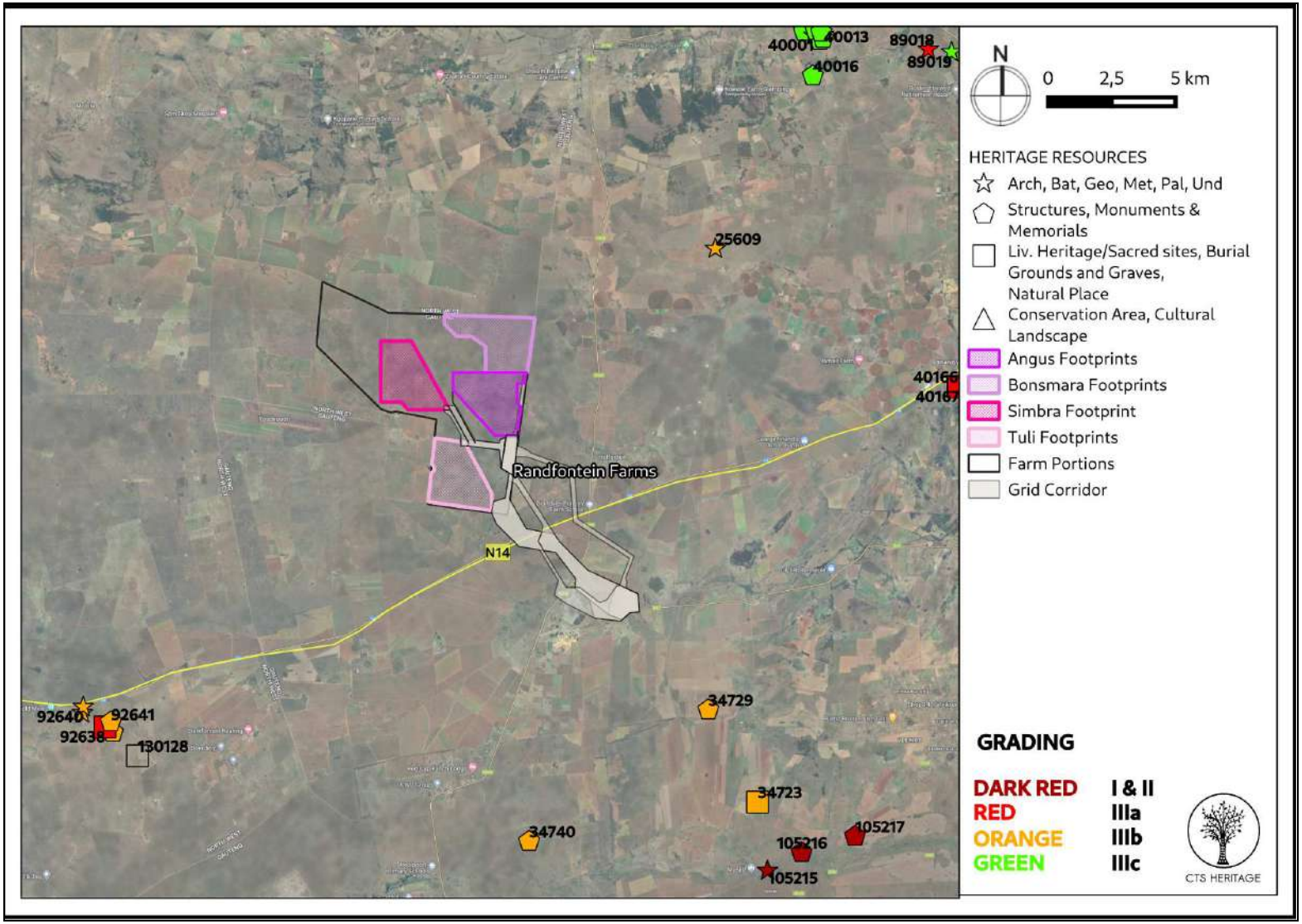

Figure 2.2. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated within 10km. Please See Appendix 4 for full description of heritage resource types.

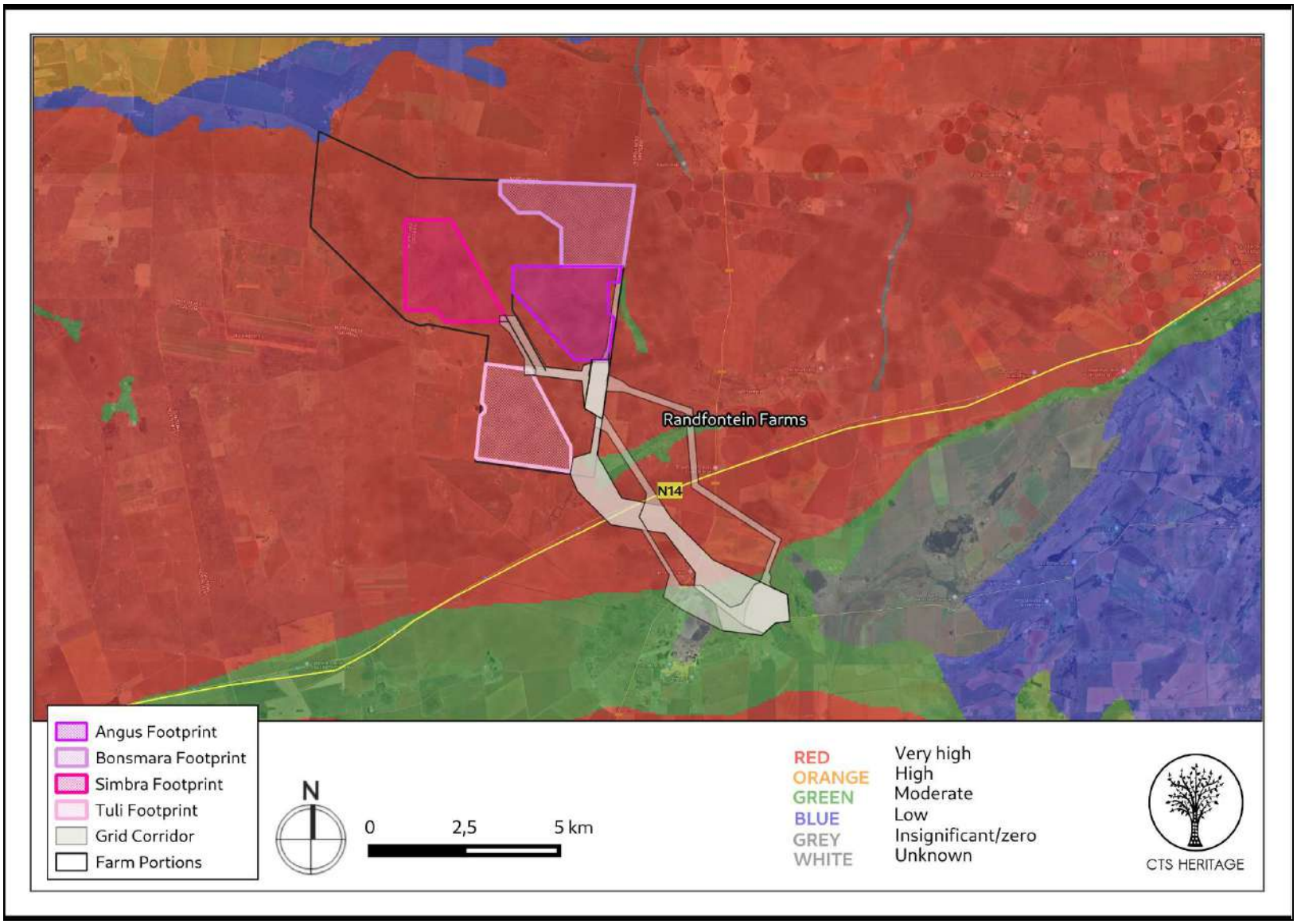

Figure 3.1: Palaeontological sensitivity of the proposed development area

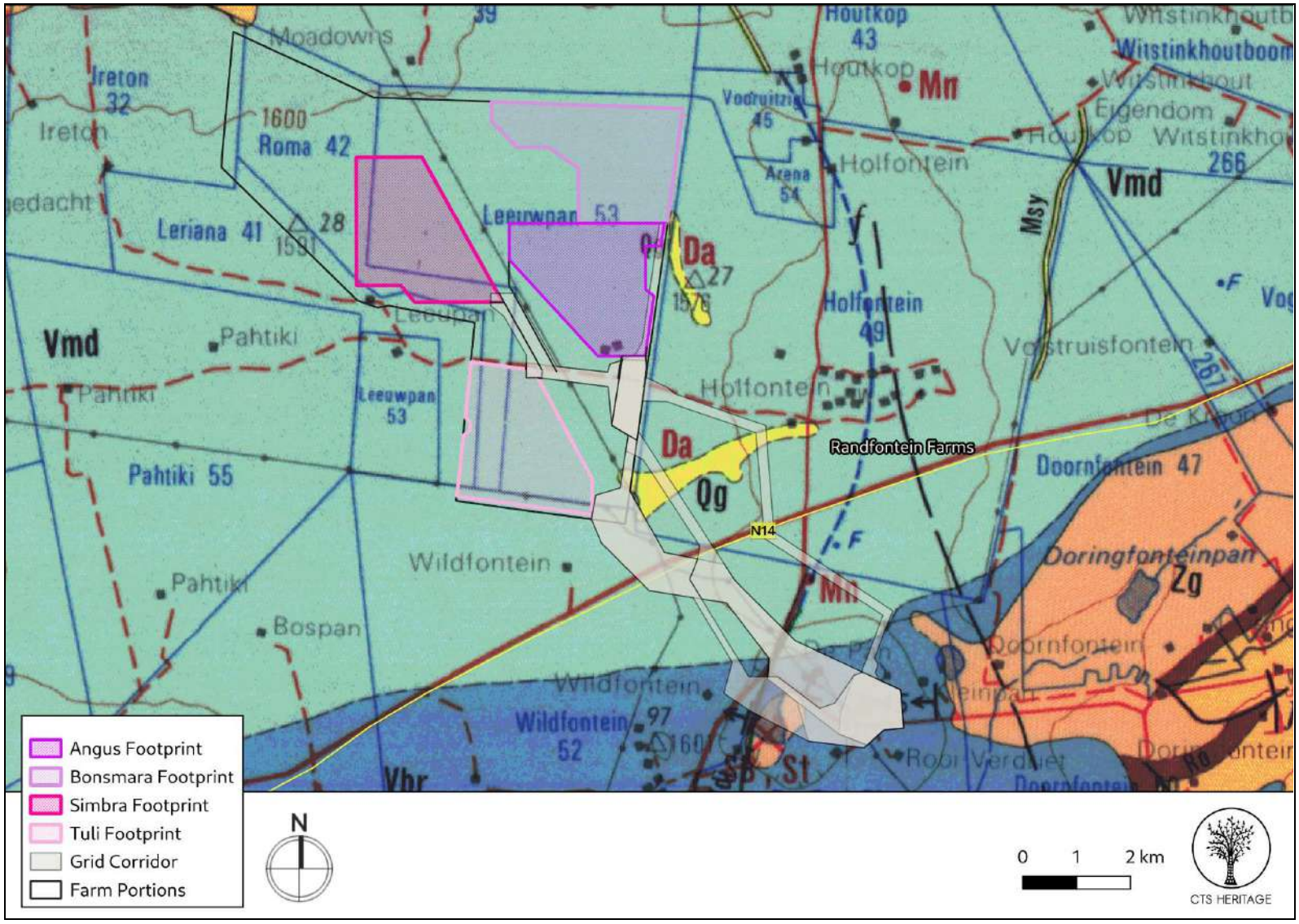

Figure 3.2. Geology Map. Extract from the CGS Map 2626 for West Rand indicating that the development area is underlain by Vmd: Malmani Subgroup sediments of the Chuniespoort Group

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Archaeology (Appendix 1)

38 observations were made during the survey and ruins from the mid 1950s onwards dominated the recordings which reflect the changing circumstances and fortunes of farming and mining in the area. Old mining diggings were recorded on Leeuwpan farm but these were not rated as having conservation worthy significance given that a variety of better sites representative of the industrial archaeology of mining in the area can be found to the south near Carletonville. A fairly large modern graveyard with graves from the 1980s into the 21st century was located in the road reserve at the sand mining entrance near De Pan and the possibility of unmarked graves near the ruins and informal settlements clustered around the farms should be taken into account in the planning of the PV infrastructure. The overall heritage sensitivity of the area is very low given that the majority of the farms were built since the 1950s and have intensively transformed the landscape for maize and cattle agriculture servicing the major metropolitan area of Johannesburg.

The field assessment did not document any significant archaeological remains that fall within the area proposed for development, however the proposed PV panel infrastructure does impact slightly on the Grade IIIC Leeupan Farm Werf identified as site 036. It is recommended that the werf as mapped in Figures 6.1 and 6.2 is excluded from the Angus SPP development footprint.

Palaeontology (Appendix 2)

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of Very High fossil sensitivity (Figure 3.1). The study area is entirely underlain by the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS), indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while Groenewald et.al (2014) allocated a High Sensitivity to the Group. Updated Geology (Council of Geosciences) confirms that the Angus SPP is underlain by the Malmani Subgroup.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 23 March 2023. Site access was a problem and only one weathered stromatolite was identified in the Pluto Cluster footprint. This stromatolite forms part of a pile of rock that was removed from the agricultural land. Most probably other stromatolites are also present in the SPP footprint. However, due to preservation, mitigation it is not recommended as other well-preserved stromatolites have been identified in the area

4.2 Heritage Resources identified

Table 1: Heritage Resources identified

Obs#	Project	Description	Type	Period	Density	Latitude	Longitude	Grade	Mitigation
014	NA	Mud daub ruined building	Ruin	Historic	n/a	-26.227136	27.412758	IIIC	No impact anticipated
028	NA	Graveyard in triangular patch of ground in Road reserve. At least 50 graves, stone with headstones. 1980s onwards, at least from the dated headstones	Graves/BurialGrounds	Modern	n/a	-26.23175	27.420221	IIIA	No impact anticipated 100m Buffer
036	Angus PV	Leeuwpan werf, mid 20th c + ruin next to large walled kraal	Structure	Historic/ Modern	n/a	-26.159432	27.406307	IIIC	Werf area to be excluded from development

4.3 Mapping and spatialisation of heritage resources

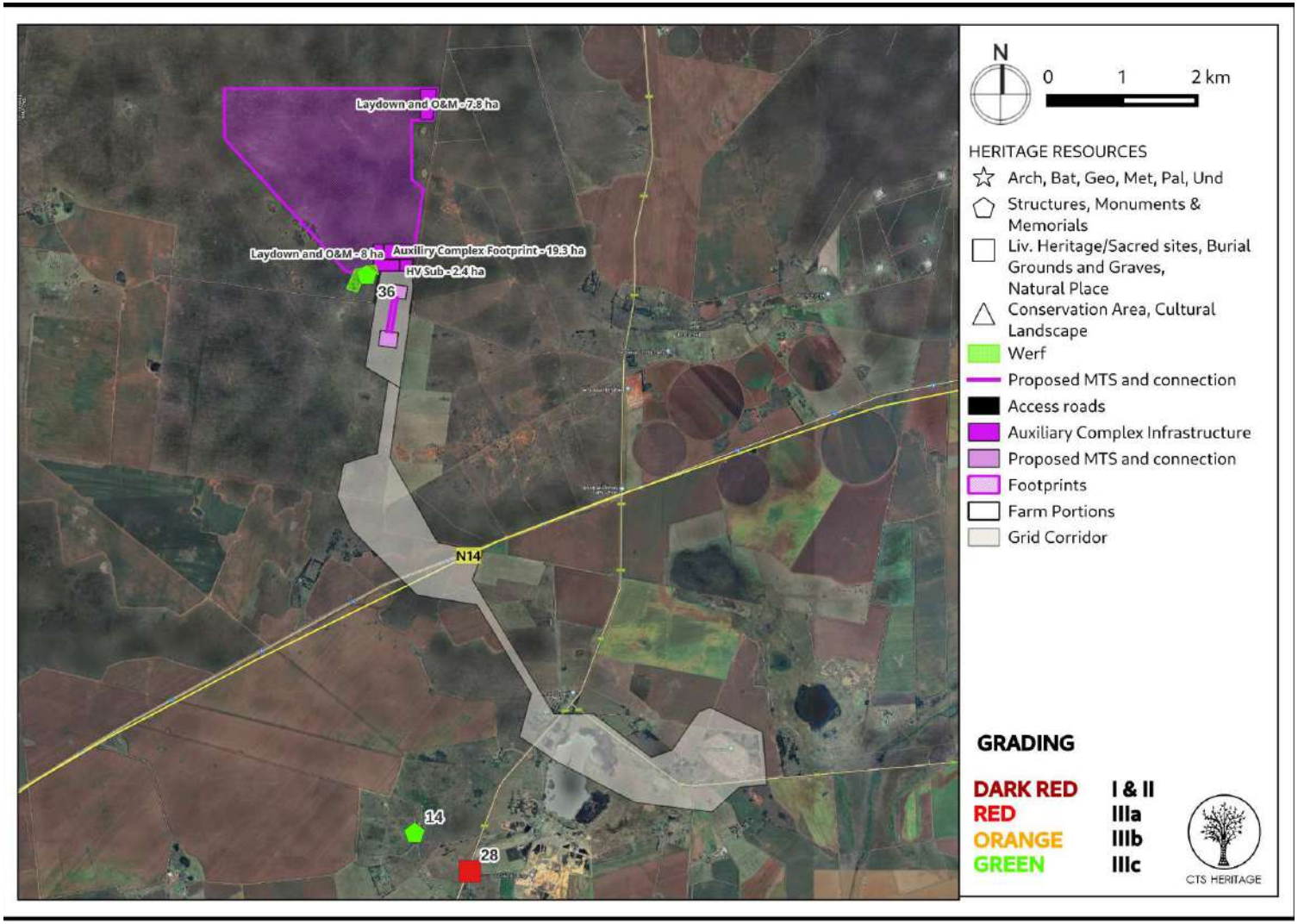

Figure 6.1: Map of known heritage resources relative to the proposed development area

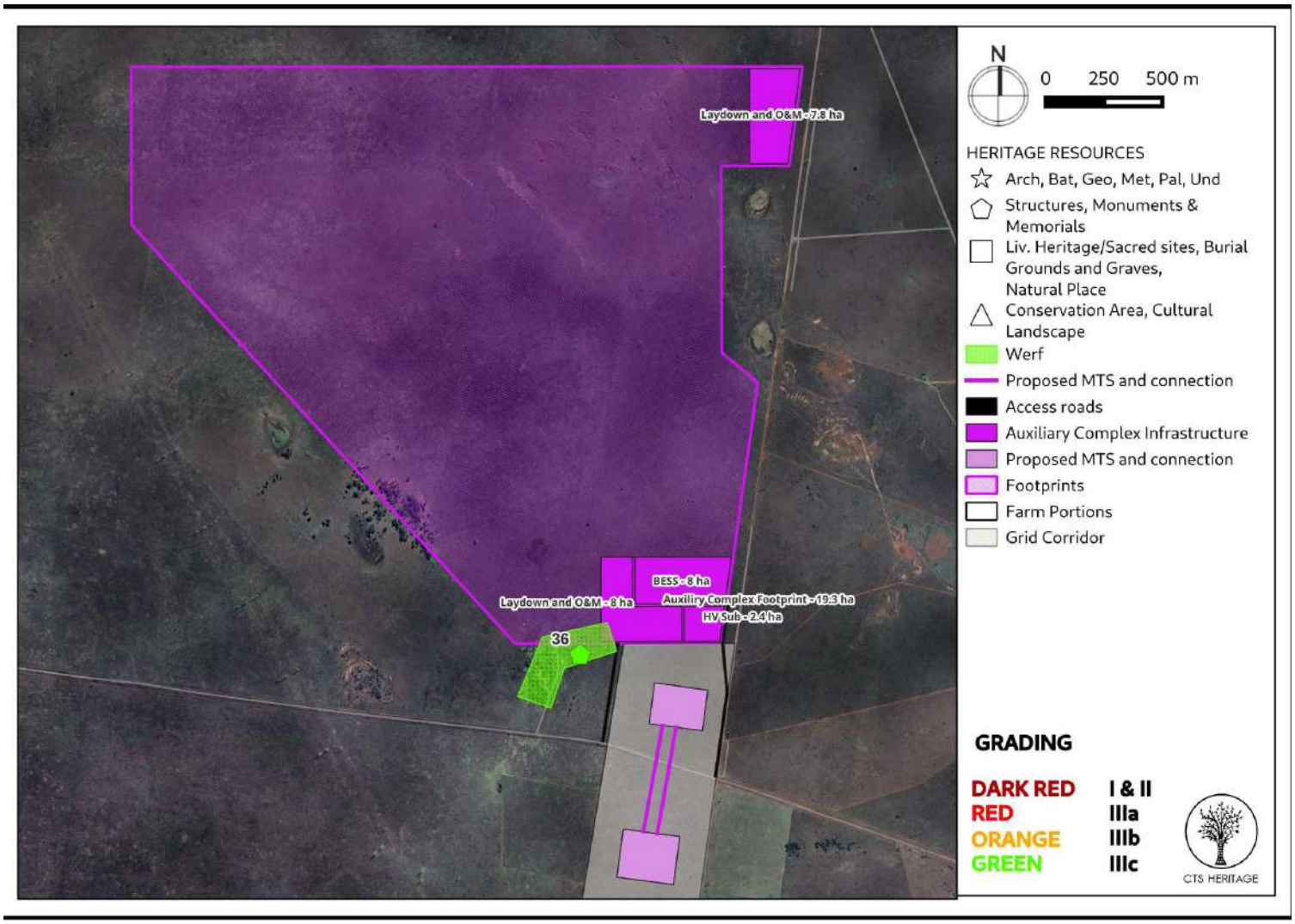

Figure 6.2: Map of known heritage resources relative to the proposed development area

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

Due to the nature of heritage resources, impacts to archaeological and palaeontological heritage resources are unlikely to occur during the PLANNING, OPERATIONAL and DECOMMISSIONING phases of the project. Potential impacts to the cultural landscape throughout the OPERATIONAL phase are discussed in the section below that deals with Cumulative Impacts. The impacts discussed here pertain to the CONSTRUCTION phase of the project.

The majority of the heritage observations made within the development area relate to the historic mining and agricultural occupation of the broader area. Most of these observations relate to structures and ruins of structures that have been determined to have no cultural value. These have been determined to be Not Conservation-Worthy and are not considered further here.

Three heritage resources that have cultural value were identified in this assessment. Sites 014 and 036 relate to structures and have been graded IIIC for their contextual heritage value. Neither of these structures is located within any of the areas proposed for development and as such, it is not anticipated that any of these structures will be negatively impacted by the proposed development of either the SPPs or their electronic grid infrastructure.

Site 028 represents a modern graveyard (1980's) with a number of human remains interred here. Due to the high levels of social and spiritual value associated with human remains, graveyards are accorded high levels of local significance and as such, are graded IIIA. Although Site 028 is located far from the area proposed for development and as such, is unlikely to be directly impacted by the development, a 100m buffer around this site is recommended to ensure that no indirect impact takes place to this significant site.

The field assessment did not document any significant archaeological remains that fall within the area proposed for development, however the proposed PV panel infrastructure does impact slightly on the Grade IIIC Leeupan Farm Werf identified as site 036. It is recommended that the werf as mapped in Figures 6.1 and 6.2 is excluded from the Angus SPP development footprint.

A high Palaeontological Significance has been allocated for the construction phase of the SPP development pre-mitigation and a low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the SPP development is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may

thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

Table 3: Assessment of impacts

NATURE		
Destruction of significant archaeological and palaeontological heritage during the construction phase of development.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
4	Complete loss of resources	The impact results in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		

3	Medium cumulative impact	The impact would result in minor cumulative effects.

SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	**Impact significance rating**	**Description**
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.

5.2 Sustainable Social and Economic Benefit

According to the SIA completed for this project, "Several potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are so significant as to allow them to be classified as "fatal flaws".

Based on the social impact assessment, the following general conclusions and findings can be made:

- The development of the Angus SPP will generate employment opportunities for individuals from the Carletonville and surrounding communities. During the construction phase, approximately 300 job opportunities will be created, providing a temporary source of employment. Specifically, this would benefit the Merafong City LM and JB Marks LM as a large proportion of the population is not economically active or is unemployed. Following the construction phase, a limited number of job opportunities will be available during the operational phase. By reducing the region's dependency and boosting overall quality of life, the Angus SPP will contribute significantly to the community's economic growth.
- The implementation of the Angus SPP is expected to enhance the skill development in the community and lead to better employment opportunities. This, in turn, will equip the workers with valuable knowledge and skills that can be beneficial for their future professional endeavours. Consequently, the overall educational level of the people residing in the Merafong LM and JB Marks LM is expected to improve.
- The Merafong City LM's and JB Marks LM's economy has the potential to benefit from the proposed project by fostering entrepreneurial growth and opportunities, particularly for local businesses in Carletonville. These businesses, involved in the provision of general materials, goods, and services during both the construction and operational phases, are likely to experience positive impacts. Furthermore, the cumulative effects of developing additional solar facilities to the currently proposed facilities could amplify these benefits.

- The proposed development of the Angus SPP represents an investment in non-polluting and renewable energy infrastructure. In comparison to energy generated through the combustion of fossil fuels, this presents a favourable social benefit for society.
- It should be noted that the perceived benefits associated with the Angus SPP, which include renewable energy generation and local economic and social development, outweigh the perceived negative impacts associated with the project.
- The proposed development of the Angus SPP could reduce current loadshedding associated with the country, specifically reducing the current strain on Eskom power generation facilities. Not only would it increase our green energy generation, but reduce strain imposed on companies as a result of loadshedding. In return this could lead current future work opportunities to be of a more stable nature and not impose additional strain on companies.

As such, on condition that the recommendations outlined below are implemented, the anticipated socio-economic benefits to be derived from the project outweigh negative impacts to heritage resources.

5.3 Proposed development alternatives

The DEAT 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single preferred project proposal. An initial site assessment was conducted by the developer the affected properties and the farm portions were found favorable due to its proximity to grid connections, solar radiation, ecology and relative flat terrain. These factors were then taken into consideration and avoided as far as possible.

The following alternatives were considered in relation to the proposed activity and all specialists should also make mention of these:

<u>No-go alternative</u>

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facility and the supporting social and economic development in the area would be lost if the status quo persist.

Location alternatives

No other possible sites were identified on the Farm Leeuwpan No. 697. This site is referred to as the preferred site. Some limited sensitive features occur on the site. The size of the site makes provision for the exclusion of any sensitive environmental features that may arise through the EIA proses.

Technical alternatives: Powerlines

It is expected that generation from the facility will tie in with the on-site step up and switching substation that will be connected to a newly proposed collector substation, the collector substation will be connected to a newly proposed MTS to be connected to the existing Pluto 400/275/22kV MTS.

The connection power line will be constructed within the limits of the grid connection corridor.

Battery storage facility

It is proposed that a nominal up to 500 MWh Battery Storage Facility for grid storage would be housed in stacked containers, or multi-storey building, with a maximum height of 8m and a maximum volume of 1,740m^3 of batteries and associated operational, safety and control infrastructure. Three types of battery technologies are being considered for the proposed project: Lithium-ion, Sodium-sulphur or Vanadium Redox flow battery. The preferred battery technology is Lithium-ion.

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

Design and layout alternatives

Design alternatives will be considered throughout the planning and design phase and specialist studies are expected to inform the final layout of the proposed development.

Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon (Mono-facial and Bi-facial) and thin film. The technology that (at this stage) proves more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability.

However, due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

As no significant heritage resources have been identified within the areas proposed for development, there are no preferred alternatives for this project from a heritage perspective.

5.4 Cumulative Impacts

The geographic area of evaluation is the spatial boundary in which the cumulative effects analysis was undertaken. The spatial boundary evaluated in this cumulative effects analysis generally includes an area of a 30km radius surrounding the proposed development – refer to below.

The geographic spread of PV solar projects, administrative boundaries and any environmental features (the nature of the landscape) were considered when determining the geographic area of investigation. It was argued that a radius of 30km would generally confine the potential for cumulative effects within this particular environmental landscape. The geographic area includes projects located within the Gauteng Province. A larger geographic area may be used to analyse cumulative impacts based on the specific temporal or spatial impacts of a resource. For example, the socioeconomic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource where it differs from the general area of evaluation described above.

In terms of cumulative impacts to heritage resources, impacts to archaeological and palaeontological resources are sufficiently dealt with on a case by case basis. The primary concern from a cumulative impact perspective would be to the cultural landscape. The cultural landscape is defined as the interaction between people and the places that they have occupied and impacted. In some places in South Africa, the cultural landscape can be more than 1 million years old where we find evidence of Early Stone Age archaeology (up to 2 million years old), Middle Stone Age archaeology (up to 200 000 years old), Later Stone Age archaeology (up to 20 000 years old), evidence of indigenous herder populations (up to 2000 years old) as well as evidence of colonial frontier settlement (up to 300 years old) and more recent agricultural layers.

Modern interventions into such landscapes, such as renewable energy development, constitute an additional layer onto the cultural landscape which must be acceptable in REDZ areas, however outside of REDZ areas, such projects must be very carefully considered.

The primary risk in terms of negative impact to the cultural landscape resulting from renewable energy development lies in the eradication of older layers that make up the cultural landscape. There are various ways that such impact can be mitigated, and these are dealt with in the VIA completed for this project.

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 agricultural landscape. The landscape within which the proposed project areas are located, is not worthy of formal protection as a heritage resource and has the capacity to accommodate such development from a heritage perspective.

Table 4: A summary of related facilities, that may have a cumulative impact, in a 30 km radius of the Pluto SPP Cluster

Site name	Distance from study area	Proposed generating capacity	DEFF reference	EIA process	Project status
Portion 3 (Portion Of Portion 2 Of The Farm Rietpoort 395	19km	15 MW	12/12/20/2330	BAR	Approved
Portion 1, 2, 4, 5 and 6 of the Farm Uitval 280	23km	200 MW	14/12/16/3/3/2/919	Scoping and EIA	Approved
Jersey Solar Power Plant	30KM	350 MW	14/12/16/3/3/2/2257	Scoping and EIA	In process
Carmel Solar 1	28km	240 MW	To be obtained	Scoping and EIA	In process
Varkenslaagte Solar	28km	240 MW	To be obtained	Scoping and EIA	In process
Tuli Solar Power Plant	0km	250MW	14/12/16/3/3/2/2351	Scoping and EIA	In process
Bonsmara Solar Power Plant	0km	250MW	14/12/16/3/3/2/2352	Scoping and EIA	In process
Simbra Solar Power Plant	0km	250MW	14/12/16/3/3/2/2354	Scoping and EIA	In process

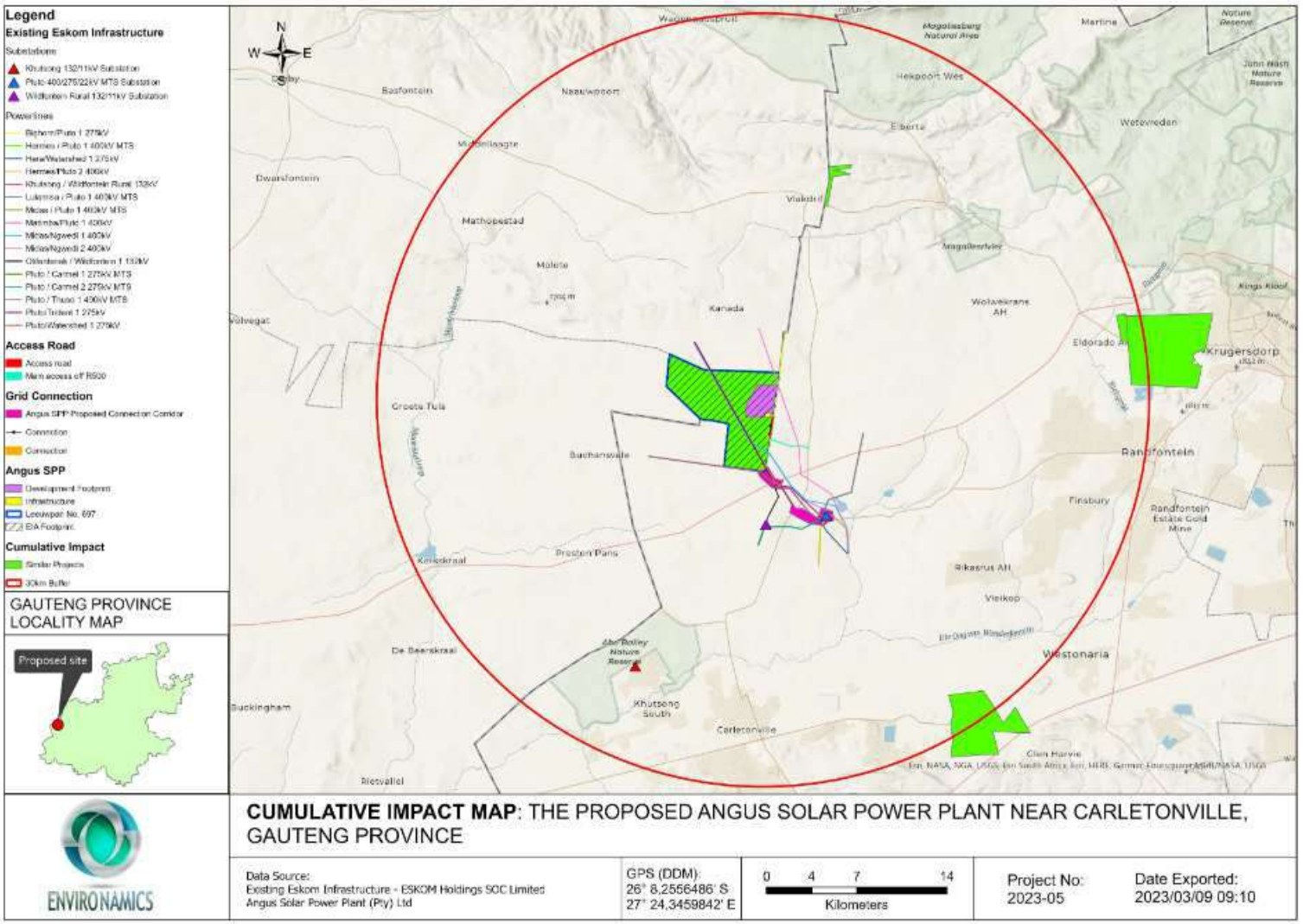

Figure 7: Map of known heritage resources relative to the proposed development area for the Angus SPP

5.5 Site Verification

PV Facility

According to the DFFE Screening Tool analysis, the development area has VERY HIGH levels of sensitivity for impacts to palaeontological heritage and LOW levels of sensitivity for impacts to archaeological and cultural heritage resources. The results of this assessment in terms of site sensitivity are summarised below:

- The cultural value of the broader area is low (LOW)
- No significant archaeological resources were identified within the development area (LOW)
- 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 (VERY HIGH)

As per the findings of this assessment, and its supporting documentation, the outcome of the sensitivity verification confirms the results of the DFFE Screening Tool for Palaeontology and for Archaeology and Cultural Heritage. This evidence is provided in the body of this report and in the appendices (Appendix 1, 2 and 3).

Grid Connection

According to the DFFE Screening Tool analysis, the development area has VERY HIGH levels of sensitivity for impacts to palaeontological heritage and LOW levels of sensitivity for impacts to archaeological and cultural heritage resources. The results of this assessment in terms of site sensitivity are summarised below:

- The cultural value of the broader area is low (LOW)
- No significant archaeological resources were identified within the development area (LOW)
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As per the findings of this assessment, and its supporting documentation, the outcome of the sensitivity verification confirms the results of the DFFE Screening Tool for Palaeontology and for archaeology and cultural heritage. This evidence is provided in the body of this report and in the appendices (Appendix 1, 2 and 3).

Substation

According to the DFFE Screening Tool analysis, the development area has LOW levels of sensitivity for impacts to archaeological and cultural heritage resources. No sensitivity level was provided for palaeontology. The results of this assessment in terms of site sensitivity are summarised below:

- The cultural value of the broader area is low (LOW)
- No significant archaeological resources were identified within the development area (LOW)
- 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 (VERY HIGH)

As per the findings of this assessment, and its supporting documentation, the outcome of the sensitivity verification confirms the results of the DFFE Screening Tool for Archaeology and Cultural Heritage. This evidence is provided in the body of this report and in the appendices (Appendix 1, 2 and 3).

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

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources. The field assessment did not document any significant archaeological remains that fall within the area proposed for development, however the proposed PV panel infrastructure does impact slightly on the Grade IIIC Leeupan Farm Werf identified as site 036. It is recommended that the werf as mapped in Figures 6.1 and 6.2 is excluded from the Angus SPP development footprint.

There are no objections on palaeontological heritage grounds. The proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils (Appendix 2).

8. RECOMMENDATIONS

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

- It is recommended that the werf as mapped in Figures 6.1 and 6.2 is excluded from the Angus SPP development footprint.
- The HWC 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 HWC must be alerted immediately to determine an appropriate way forward.

9. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
267835	HIA Phase 1	Stephan Gaigher	29/10/2014	HIA for the proposed Vogelstruisfontein Sand Mine
274424	AIA Phase 1	Jaco van der Walt	04/06/2015	Heritage Opinion For the Proposed Prospecting Activities on the farm Rooipan 96 IQ, Ventersdorp, North West Province.
332672	AIA Phase 1	Eric Ndivhuho Mathoho	04/03/2015	Archaeological Impact Assessment for proposed development of Magalies Cemetery and Waste Transfer Station, Portion 22 of the farm Rietpoort 395JQ, Mogale City Local Municipality, Gauteng Province
369805	Heritage Impact Assessment Specialist Reports	Polke Birkholtz, Gideon Groenewald	11/08/2016	ENVIRONMENTAL MANAGEMENT PLAN AMENDMENT FOR THE PROPOSED APPLICATION TO AMEND THE APPROVED PROSPECTING RIGHT WORK PROGRAMME FOR THE BULK SAMPLING AREA OF THE RECENT PLACER PROJECT, ON THE FARMS WILDFONTEIN 52 IQ AND DE PAN 51 IQ, MERAFONG CITY LOCAL MUNICIPALITY, RANDFONTEIN MAGISTERIAL DISTRICT, GAUTENG PROVINCE
5118	AIA Phase 1	Johnny Van Schalkwyk	01/02/2008	Heritage Survey Report for the Development of Water Pipelines for the Droogeheuvel and Middelvlei Townships, Randfontein, Gauteng Province
5507	AIA Phase 1	Udo Kusel	01/11/2005	Cultural Heritage Resources Impact Assessment of the Farm Zuikerboschfontein 151 IQ and Portion 10 (Portion of Portion 8) of the Farm Steenekoppie 153 IQ Magaliesburg
5523	AIA Phase 1	Polke Birkholtz	08/04/2003	Cultural Heritage Assessment as Part of the EMP Report for the Proposed Impafa/Pamodzi OpenCape Archaeological Survey CCt Gold Mine on the Farm Middelvlei 255 IQ
5738	AIA Phase 1	Cobus Dreyer	04/03/2006	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Developments at the Farms Bovenste Oog 68 IQ (Mooi River), Digby Plain 63 IQ, Sommerville 62 IQ, Preston Pans 59 IQ and Dryland 64 IQ, Ventersdorp, North West Province
6271	AIA Phase 1	Wouter Fourie, M Ramsden	01/08/2002	Blaauwbank Historic Gold Mine, Magaliesberg: Cultural Heritage Scoping
6340	AIA Phase 1	Wouter Fourie, Jaco van der Walt	08/12/2005	Portion of the Proposed Pipeline from Brandvlei to Krugersdorp on the Farm Brandvlei 261 IQ, District Mogale City, Gauteng Province
104305	AIA Phase 1	Justin du Piesanie,	01/05/2012	Phase 1 Heritage Impact Assessment of the proposed Geluksdal Tailings Storage Facility and Pipeline Infrastructure

		Johan Nel		
356134	Heritage Impact Assessment Specialist Reports	Justin du Piesanie, Johan Nel	13/01/2016	Environmental Impact Assessment for Sibanye Gold Limited's West Rand Tailings Retreatment Project - Heritage Impact Assessment

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APPENDICES

APPENDIX 1: Archaeological Assessment (2023)

ARCHAEOLOGICAL SPECIALIST STUDY

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

Proposed Pluto BESS and SPP Cluster

Prepared by

CTS HERITAGE
Jenna Lavin
And Nicholas Wiltshire

In Association with

EnviroNamics

May 2023

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EXECUTIVE SUMMARY

This application is for the proposed development of four 250MW solar energy facilities and their grid connection infrastructure located approximately 17km north of Carletonville in the Gauteng Province. The four projects assessed in this report are:

- Angus SPP proposed by Angus Solar Power Plant (RF) (Pty) Ltd
- Bonsmara SPP proposed by Bonsmara Solar Power Plant (RF) (Pty) Ltd
- Simbra SPP proposed by Simbra Solar Power Plant (RF) (Pty) Ltd
- Tuli SPP proposed by Tuli Solar Power Plant (RF) (Pty) Ltd

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources, and no archaeological remains of significance were identified within any of the areas proposed for development.

Recommendations

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

- 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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CONTENTS

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1. INTRODUCTION

1.1 Background Information on Project

This application is for the proposed development of four 250MW solar energy facilities and their grid connection infrastructure located approximately 17km north of Carletonville in the Gauteng Province. The four projects assessed in this report are:

- Angus SPP proposed by Angus Solar Power Plant (RF) (Pty) Ltd
- Bonsmara SPP proposed by Bonsmara Solar Power Plant (RF) (Pty) Ltd
- Simbra SPP proposed by Simbra Solar Power Plant (RF) (Pty) Ltd
- Tuli SPP proposed by Tuli Solar Power Plant (RF) (Pty) Ltd

1.2 Description of Property and Affected Environment

The Pluto PV cluster developments lie just within the western borders of the Gauteng Province and are split roughly in two areas north and south of the N14 highway linking Ventersdorp to Krugersdorp. A number of 400 kV and 132 kV overhead powerlines intersect at the large Pluto substation and these PV developments aim to connect up to the grid using their proximity to this grid interchange. The main landmarks south of the N14 are the Wildfontein and De Pan farms as well as various diggings for a large sand mining operation. Most of the farms are growing maize on a commercial scale as well as grazing areas for cattle.

Randfontein is only about 15km east of the development area and most of the larger farms have subsequently been subdivided off into smaller peri-urban plots. A range of small businesses can be found on the way towards Randfontein and Krugersdorp and the Western Deep gold mines in and around Carltoneville lie about 20km south of the development area. Traffic levels are therefore relatively high with farming and mining trucks regularly moving through the study area.

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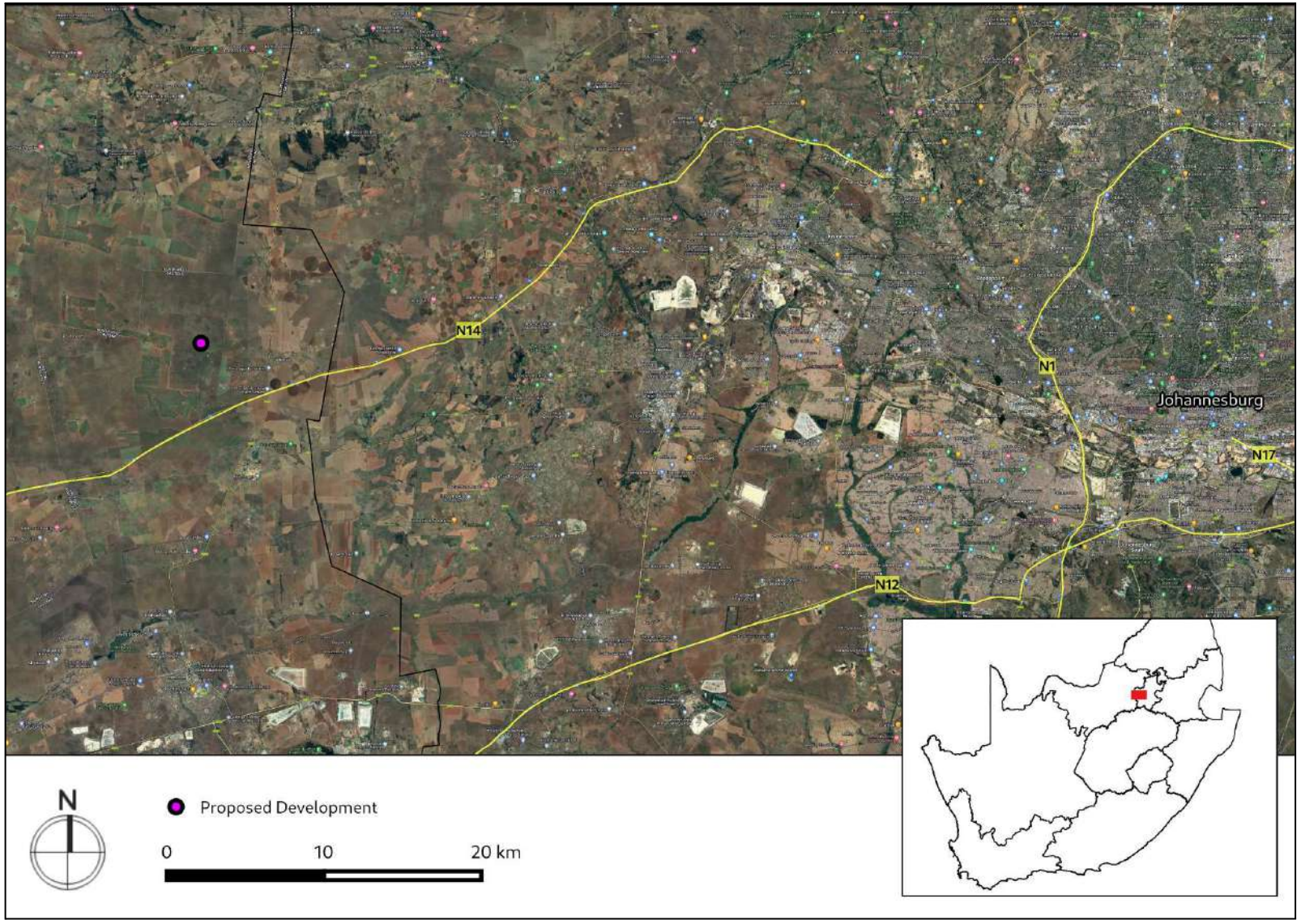

Figure 1.1: Satellite image indicating proposed location of development

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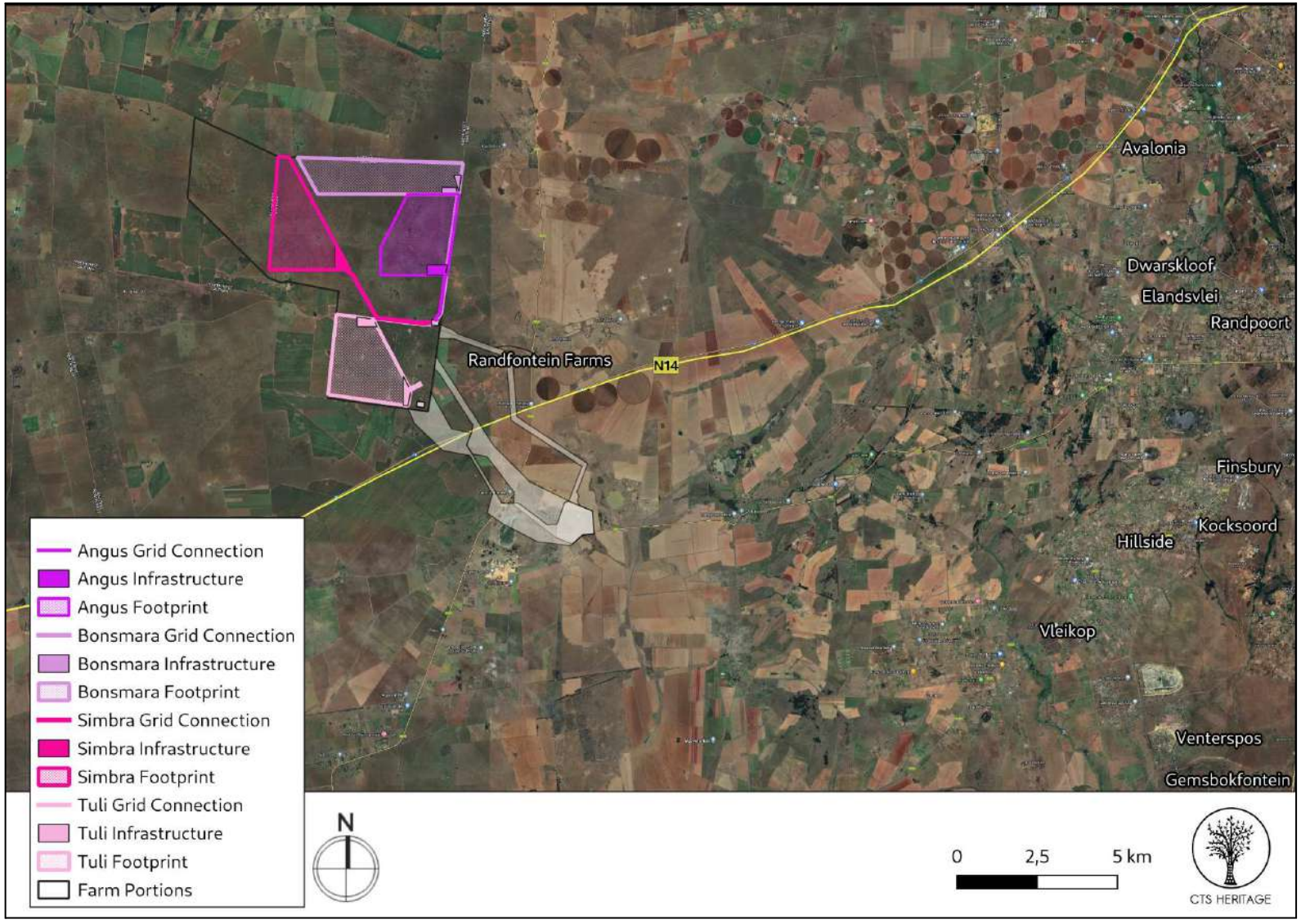

Figure 1.2: Proposed project boundary

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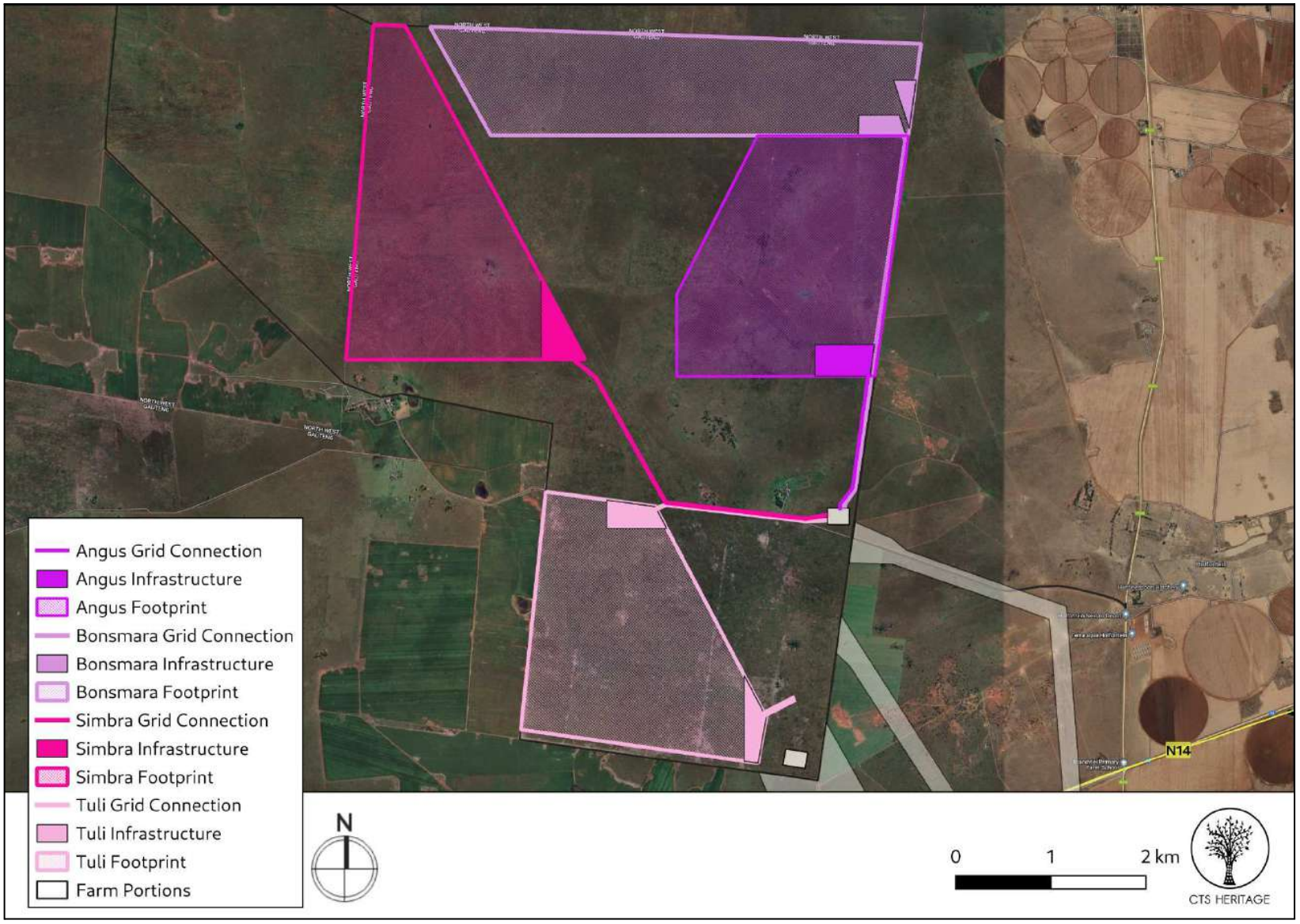

Figure 1.3. Overview Map. Satellite image (2022) indicating the proposed development area at closer range.

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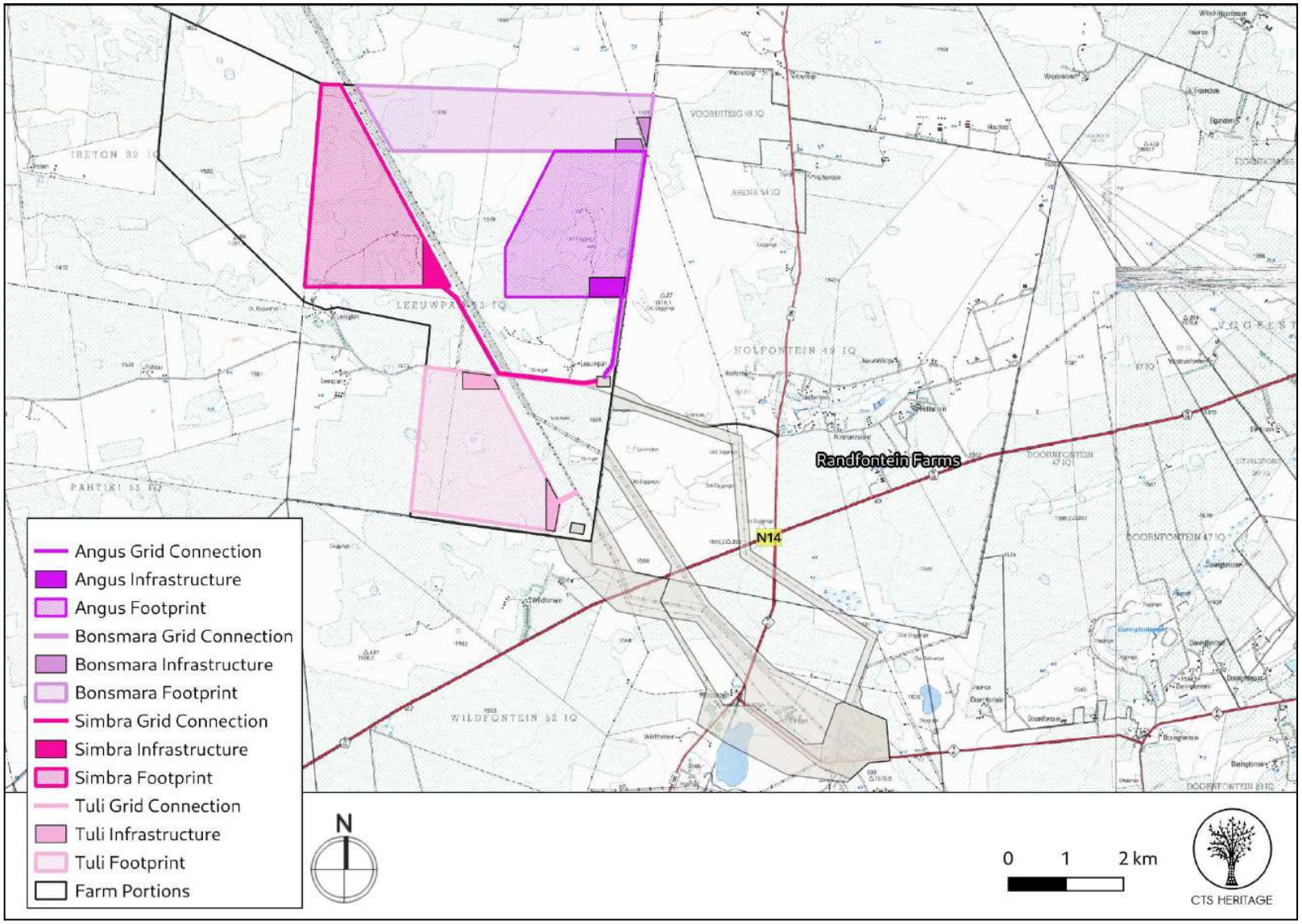

Figure 1.4. Overview Map. Extract from the 1:50 000 Topo Map for this area

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2. METHODOLOGY

2.1 Purpose of Archaeological Study

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

2.2 Summary of steps followed

- An archaeologist conducted a survey of the site and its environs on 27 to 29 March 2023 and 11 May 2023 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.

2.3 Constraints & Limitations

While much of the study area is covered in maize fields, the access tracks and exposed areas of ground were inspected to assess whether Stone Age material eroding out of the disturbed areas could be located and recorded. Where maize fields were absent, deep grass had been planted and maintained to cover grazing grounds for cattle. Very little, if any, of the terrain has not been transformed by farming activities of one kind or another. The survey therefore succeeded in locating a number of graves, built environment structures and ruins but very little Stone Age archaeology can be found in the area under the current conditions.

Subsequent to the completion of the field assessment, the location of the Simbra PV Facility was moved north from its original position in the south. As such, a foot survey for this PV facility was completed on 11 May 2023.

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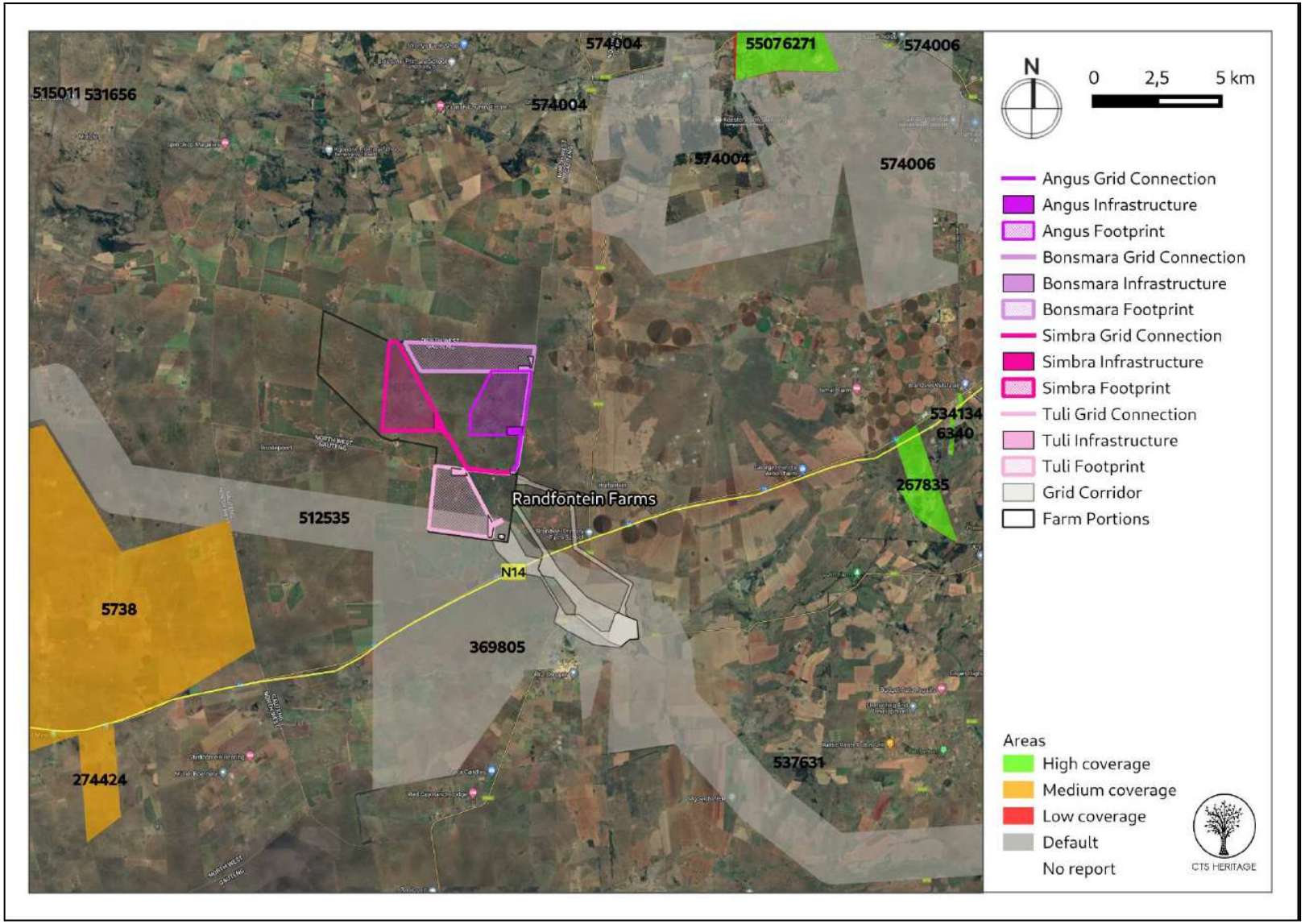

Figure 2: Close up satellite image indicating proposed location of development in relation to heritage studies previously conducted

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3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

The area proposed for development is located approximately 20km north of Carletonville within the Merafong Municipality. Carletonville was developed by various mining companies from 1937 onwards, but was not officially incorporated until 1959, and was subsequently recognised as a provincial town in 1967. Surrounding Carletonville are a number of privately owned gold-mining township villages and contractor labour quarters established by the mining companies on land owned by the mines. The area surrounding Carletonville is dominated by a cultural landscape that is shaped and defined by the historic and on-going mining activities associated with the Witwatersrand. A detailed archaeological background of the area is provided by Du Pisanie and Nel (2012, SAHRIS NID 104305) and is therefore not repeated here. It is sufficient to note that no significant Early, Middle or Later Stone Age sites are known from this broader area, however sites representing the Iron Age occupation of the region are present in the broader context.

Birkholtz and Groenewald (2016, SAHRIS NID 369805) completed an HIA on a property located immediately south of the area proposed for development. They describe the broader areas as "The overall study area can be described as generally undulating with a number of extensive pans located within this area… While the overall study area is mostly utilised for agricultural activities, the proposed development bulk sample area that was assessed in the field is characterised by agricultural fields (maize), a large number of small livestock camps associated with stud farming (cattle) as well as Eskom power lines." The N14 is an historic scenic route that runs between Ventersdorp and Pretoria and is likely based on the original wagon route used for this journey. This route is located approximately 1.5km south of the Tuli PV Footprint area. In general, for the development of PV infrastructure and its associated grid connection infrastructure, it is preferred for such development to be clustered with existing development, such as mining or residential development, in order to reduce the perception of urban and infrastructure sprawl across an otherwise agricultural landscape.

Birkholtz and Groenewald (2016) go on to note that examples of published excavated archaeological sites from the general surroundings of the study area include the Later Stone Age and Iron Age sites located along the Magaliesberg Mountains and sites of international palaeoanthropological significance such as Sterkfontein and Kromdraai, both located within the Cradle of Humankind World Heritage Site located approximately 33km north-east of the study area. Birkholtz and Groenewald (2016) note that the nearest published excavated archaeological site to the present study area is the underground cavern system known as Lepalong, that was used as shelter by the Kwena ba Modimosa ba Mmatau during the turmoil of the Difaqane/Mefaqane. According to Birkholtz and Groenewald (2016), oral histories indicate that Lepalong was occupied from 1827 into the 1830s (Reid & Lane, 2003). Lepalong is located some 25km south-west of the study area.

According to Du Pisanie and Nel (2016, SAHRIS NID 356134), "With the onset of the Transvaal and South African Wars, Gatsrand became a strategic location for British troops who occupied Potchefstroom. This region was located in close proximity to the Western Railway, which provided a tactical advantage. To exploit and protect this advantage, three blockhouses were constructed on the farms Driefontein 113 IQ and Driefontein 355 IQ. These structures were not identified during the pre-disturbance survey and it is assumed that they no longer exist. The next major event to take

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place in this region was the discovery of gold, which facilitated the establishment of several towns from the 1920s, an increase in population and an increase in services. Early mines established include Venterspost (1934), Libanon (1936), West Driefontein (1945), East Driefontein (1968) and later Kloof (1968). Shaped by these events and activities the study area has through time transformed into a historic mining landscape." In their Heritage Impact Assessment located nearby, Du Pisanie and Nel (2016, SAHRIS NID 356134) identified a number of heritage resources, the majority of which were determined to be not conservation-worthy. The nature of the resources identified include burials and burial grounds (graded IIIA) as well as historic and modern farm structures. Similar resources are likely to be present within the proposed development areas.

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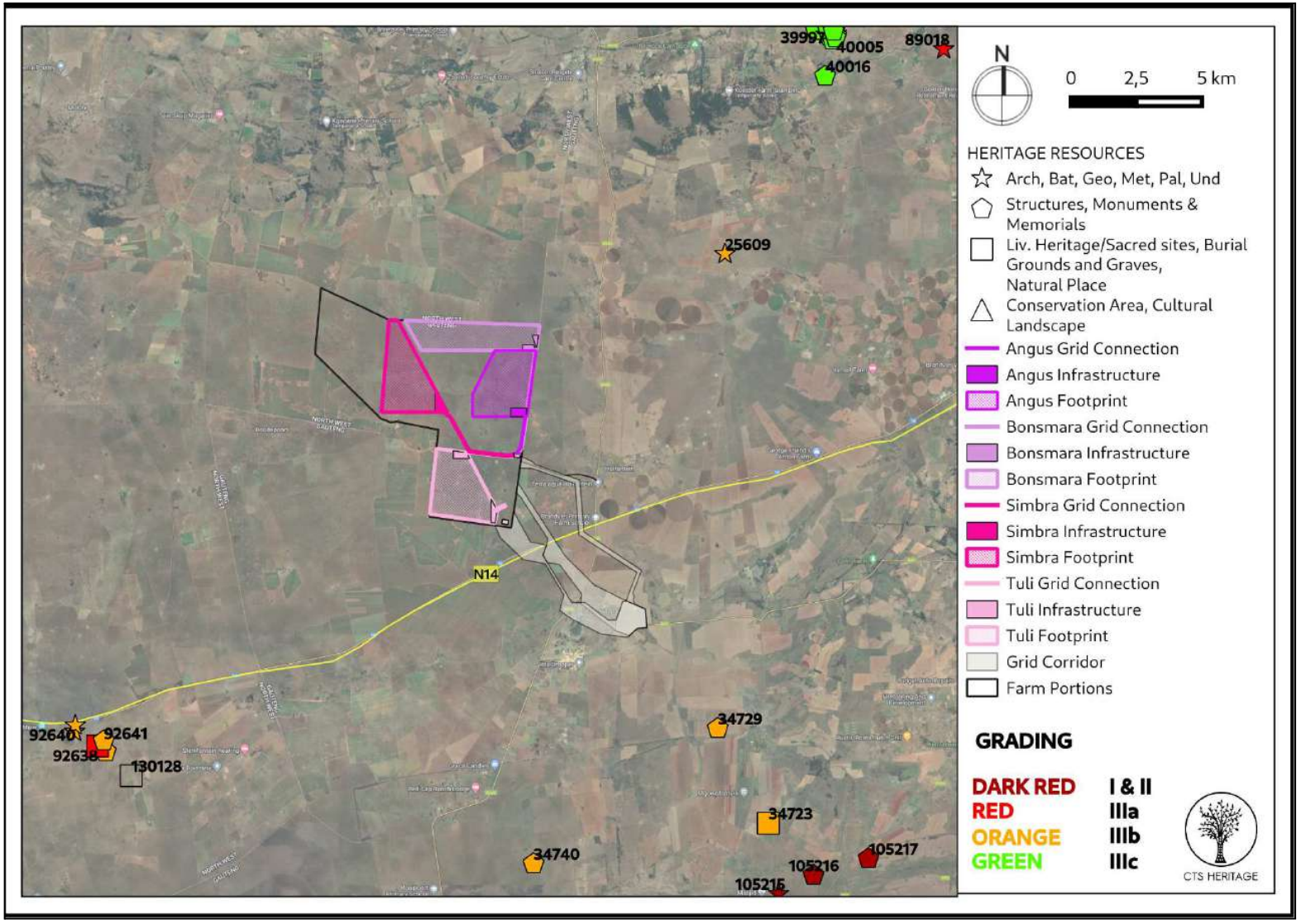

Figure 3.1 Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated

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4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Field Assessment

38 observations were made during the survey and ruins from the mid 1950s onwards dominated the recordings which reflect the changing circumstances and fortunes of farming and mining in the area. Old mining diggings were recorded on Leeuwpan farm but these were not rated as having conservation worthy significance given that a variety of better sites representative of the industrial archaeology of mining in the area can be found to the south near Carletonville. A fairly large modern graveyard with graves from the 1980s into the 21st century was located in the road reserve at the sand mining entrance near De Pan and the possibility of unmarked graves near the ruins and informal settlements clustered around the farms should be taken into account in the planning of the PV infrastructure. The overall heritage sensitivity of the area is very low given that the majority of the farms were built since the 1950s and have intensively transformed the landscape for maize and cattle agriculture servicing the major metropolitan area of Johannesburg.

Figure 4.1: View along the R41 with Randfontein in the distance.

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Figure 4.2: view of the large overhead powerlines crisscrossing the study area that connect to Pluto substation

Figure 4.3: Pluto substation

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Figure 4.4: View onto De Pan farm with 400 kV transmission lines in the foreground.

Figure 4.5: Flowering cosmos along the edges of the grazing fields.

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Figure 4.6: The grass covering the grazing areas obscures the visibility of Stone Age and Iron Age material.

Figure 4.7: Patch of ground near Wildfontein with stand of gum trees to the left.

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Figure 4.8: View of Wildfontein farm

Figure 4.9: View of Wildfontein farm

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Figure 4.10: View of jeep tracks servicing the farms where some Stone Age material was located in a disturbed context.

Figure 4.11: View from the N14 highway over the study site.

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Figure 4.12: View of the connecting OHLs through Leeuwpan farm

Figure 4.13: Grassland, maize and soya fields in and around the Leeuwpan area.

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Figure 4.14: Looking northwards over the study area north of the N14

Figure 4.15: Multiple OHLs heading to the Pluto substation and onto the mining areas such as Carletonville.

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Figure 4.16: Grazing grounds near the old diggings.

Figure 4.17: Grazing grounds near the old diggings.

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Figure 4.18: View of the area at the old diggings.

Figure 4.19: View of the study area

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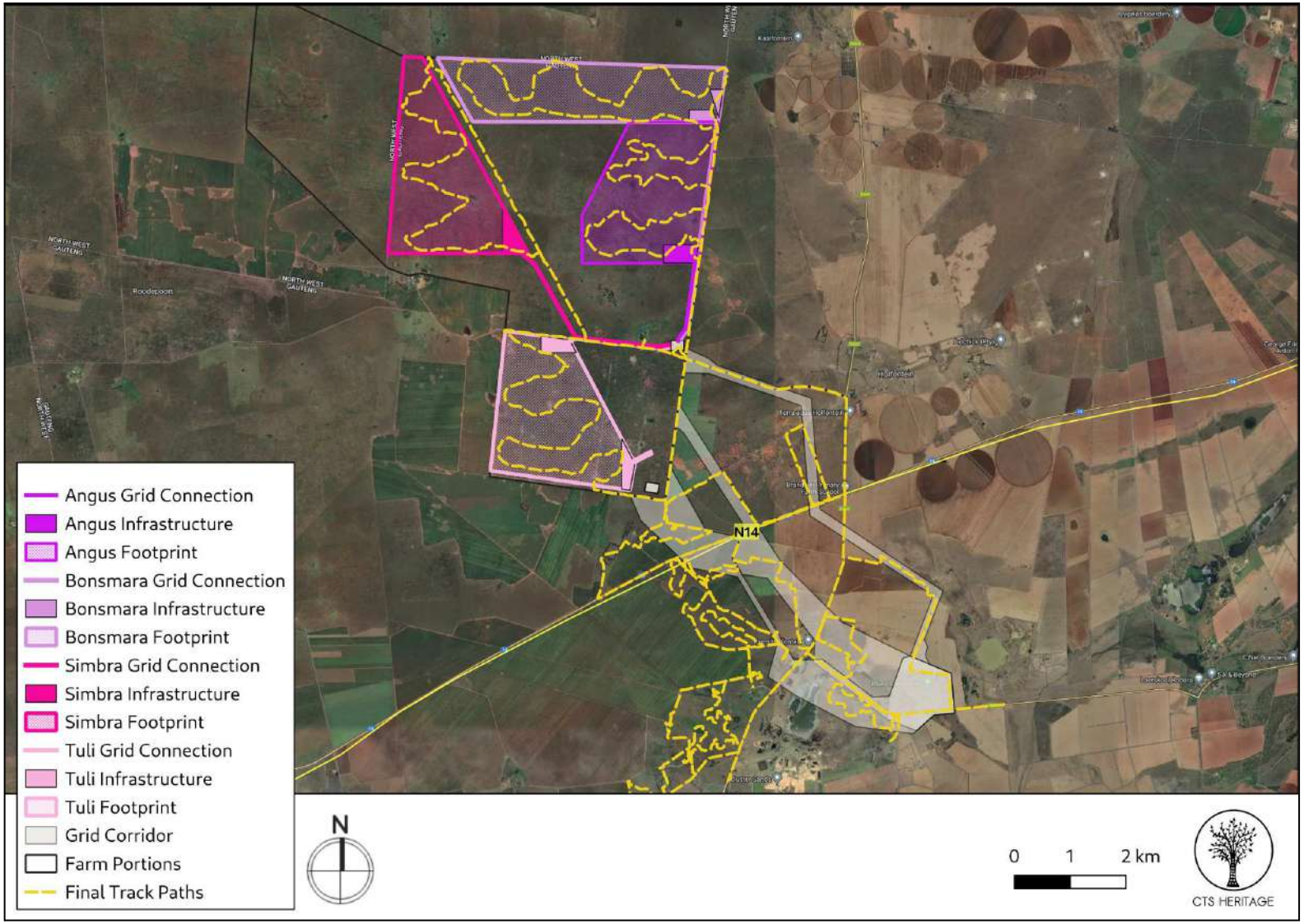

Figure 5.1: Overall track paths of foot survey for development

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4.2 Archaeological Resources identified

Table 1: Heritage Resources identified

Obs#	Project	Description	Type	Period	Density	Latitude	Longitude	Grade	Mitigation
001	Angus Grid	Informal settlement at De Pan near Pluto substation	Structure	Modern	n/a	-26.220611	27.451688	NCW	NA
002	Angus Grid	Ruined concrete block building	Structure	Modern	n/a	-26.222441	27.449444	NCW	NA
003	Angus Grid	Row of informal houses	Structure	Modern	n/a	-26.224097	27.449299	NCW	NA
004	Angus Grid	Old mining area at De Pan	Mining	Historic	n/a	-26.225049	27.447957	NCW	NA
005	Angus Grid	De Pan farm, mostly modern post 1950s	Structure	Modern	n/a	-26.226666	27.448314	NCW	NA
006	Angus Grid	Old stone walled stock kraal	Ruin	Historic	n/a	-26.221139	27.445686	NCW	NA
007	Angus Grid	Holfontein farm, large silos, cattle and maize farming	Structure	Modern	n/a	-26.21066	27.433178	NCW	NA
008	NA	De Pan mining area, operated by Cluster Sand mining	Mining	Modern	n/a	-26.230671	27.43146	NCW	NA
009	NA	Stone walled kraal	Structure	Historic	n/a	-26.230734	27.416694	NCW	NA
010	NA	Mix of formal and informal settlement	Structure	Modern	n/a	-26.231981	27.413805	NCW	NA
011	NA	Wildfontein farm, modern	Structure	Modern	n/a	-26.236082	27.407918	NCW	NA
012	NA	Wildfontein farm, modern (second werf)	Structure	Modern	n/a	-26.232294	27.408617	NCW	NA
013	NA	Modern farm infrastructure, in states of disrepair, missing roof etc	Structure	Modern	n/a	-26.230207	27.407691	NCW	NA
014	NA	Mud daub ruined building	Ruin	Historic	n/a	-26.227136	27.412758	IIIC	No impact anticipated
015	NA	Concrete block ruin	Ruin	Modern	n/a	-26.228186	27.412711	NCW	NA
016	NA	Brick built ruin	Ruin	Modern	n/a	-26.229068	27.411752	NCW	NA
017	NA	Row of 4 ruined concrete buildings	Ruin	Modern	n/a	-26.227437	27.41353	NCW	NA
018	NA	Large pile of cleared stone	Observation	Modern	n/a	-26.22283	27.408576	NCW	NA
019	NA	Wildfontein, modern house, rock piles, ruined building without roof	Structure	Modern	n/a	-26.21629	27.425818	NCW	NA
020	NA	Linear stone walling feature	Structure	Historic	n/a	-26.214795	27.425358	NCW	NA
021	NA	Stone kraal in bushes and piled stones	Structure	Historic	n/a	-26.214609	27.425042	NCW	NA
022	NA	Wildfontein, modern homestead with ruined corrugated iron shed	Structure	Modern	n/a	-26.218	27.424118	NCW	NA
023	Angus Grid	3 ruins, 1 clay brick, 2 concrete brick	Structure	Modern	n/a	-26.208352	27.428406	NCW	NA
024	Angus Grid	Quartzite flake in spill heap	Artefacts	MSA	0 to 5	-26.207472	27.424707	NCW	NA
025	Angus Grid	Mounds related to mining diggings	Mining	Historic	n/a	-26.20756	27.424608	NCW	NA

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026	NA	Quartzite flake on rocky area	Artefacts	MSA	0 to 5	-26.2222	27.41957	NCW	NA
027	NA	Hornfels adze	Artefacts	LSA	0 to 5	-26.224521	27.413749	NCW	NA
028	NA	Graveyard in triangular patch of ground in Road reserve. At least 50 graves, stone with headstones. 1980s onwards, at least from the dated headstones	Graves/BurialGrounds	Modern	n/a	-26.23175	27.420221	IIIA	No impact anticipated 100m Buffer
029	Angus Grid	Modern buildings in stand of gum trees (Holfontein/Wildfontein)	Structure	Modern	n/a	-26.212462	27.43076	NCW	NA
030	NA	Wildfontein, circa 1950 werf, corrugated iron roofs	Structure	Modern	n/a	-26.196559	27.397348	NCW	NA
031	NA	Concrete block ruin (Wildfontein)	Ruin	Modern	n/a	-26.193547	27.403136	NCW	NA
032	NA	1940s/50s werf, ruin (Wildfontein)	Ruin	Modern	n/a	-26.193665	27.403601	NCW	NA
033	NA	1940s/50s werf, ruin (Wildfontein)	Ruin	Modern	n/a	-26.193046	27.404658	NCW	NA
034	NA	1940s/50s werf, ruin (Wildfontein)	Ruin	Modern	n/a	-26.193414	27.405203	NCW	NA
035	Angus Grid	Ruin, brick and concrete (Wildfontein)	Ruin	Modern	n/a	-26.191706	27.409577	NCW	NA
036	Angus PV	Leeuwpan werf, mid 20th c + ruin next to large walled kraal	Structure	Historic/ Modern	n/a	-26.159432	27.406307	IIIC	No impact anticipated
037	Angus PV	Chert flakes and cores in diggings	Artefacts	MSA	0 to 5	-26.145187	27.413164	NCW	NA
038	Angus PV	Diggings (mining)	Mining	Historic	n/a	-26.140901	27.410332	NCW	NA

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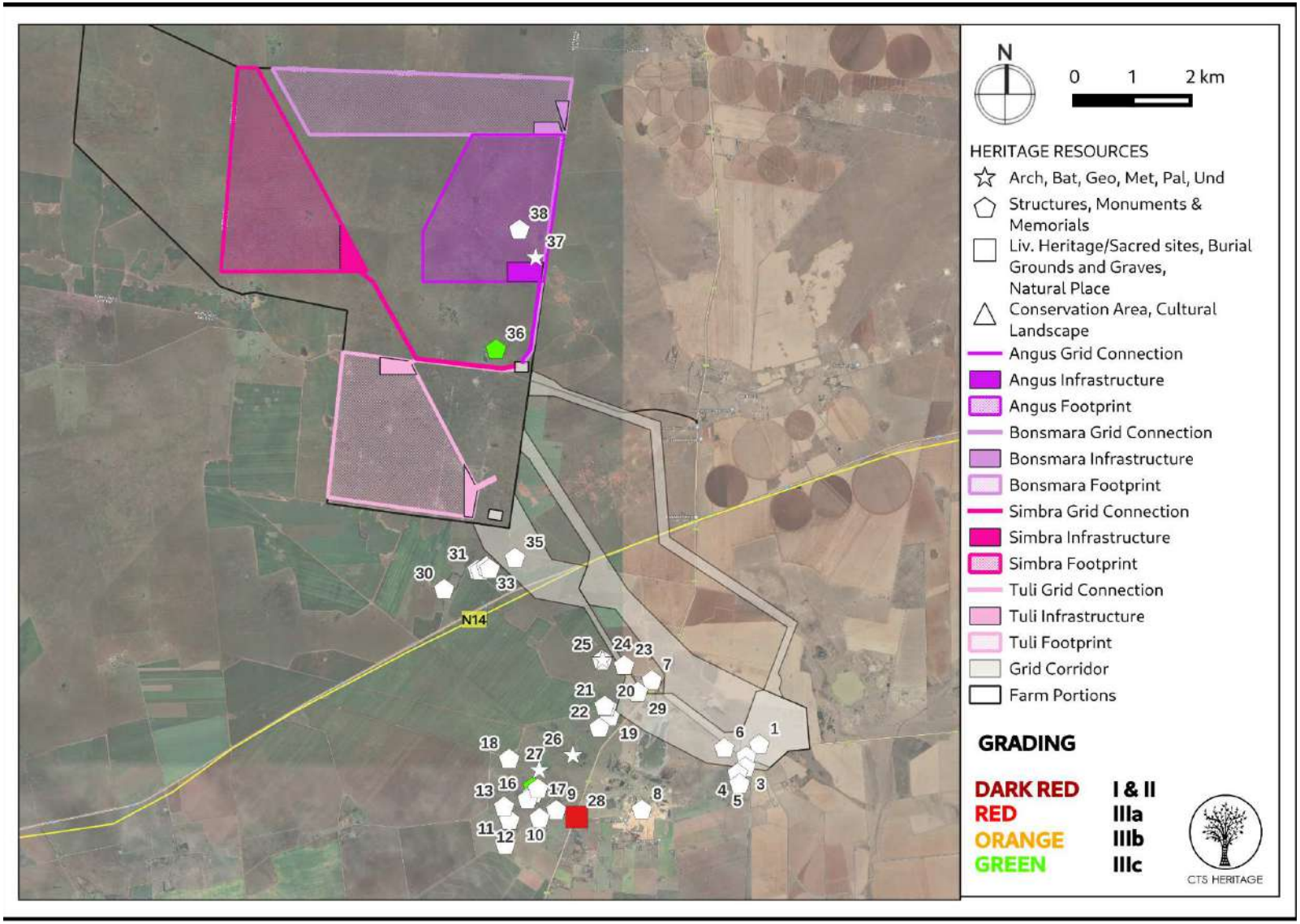

Figure 6.1: Map of all sites and observations noted within the development area

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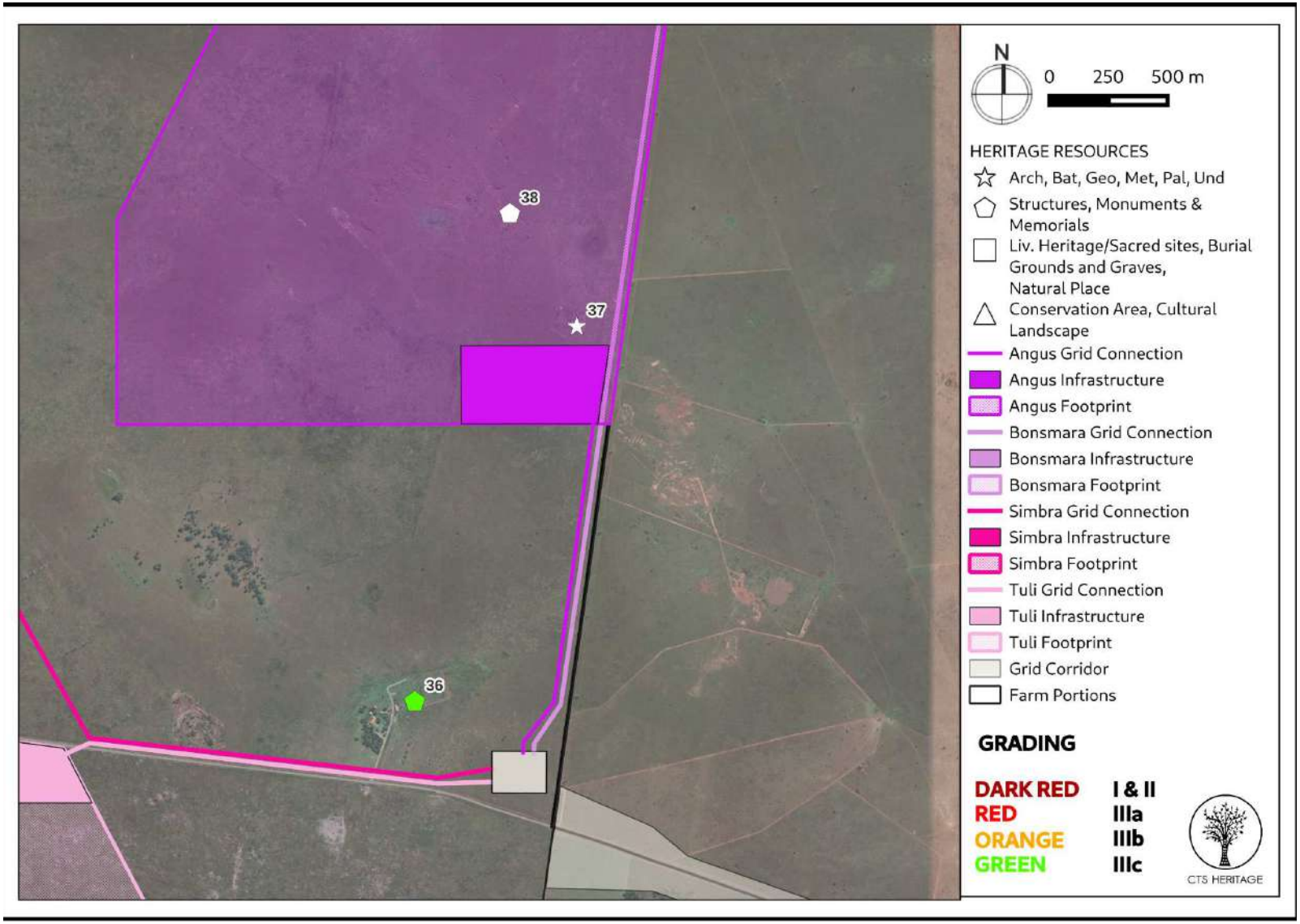

Figure 6.2: Map of all sites and observations noted within the development area

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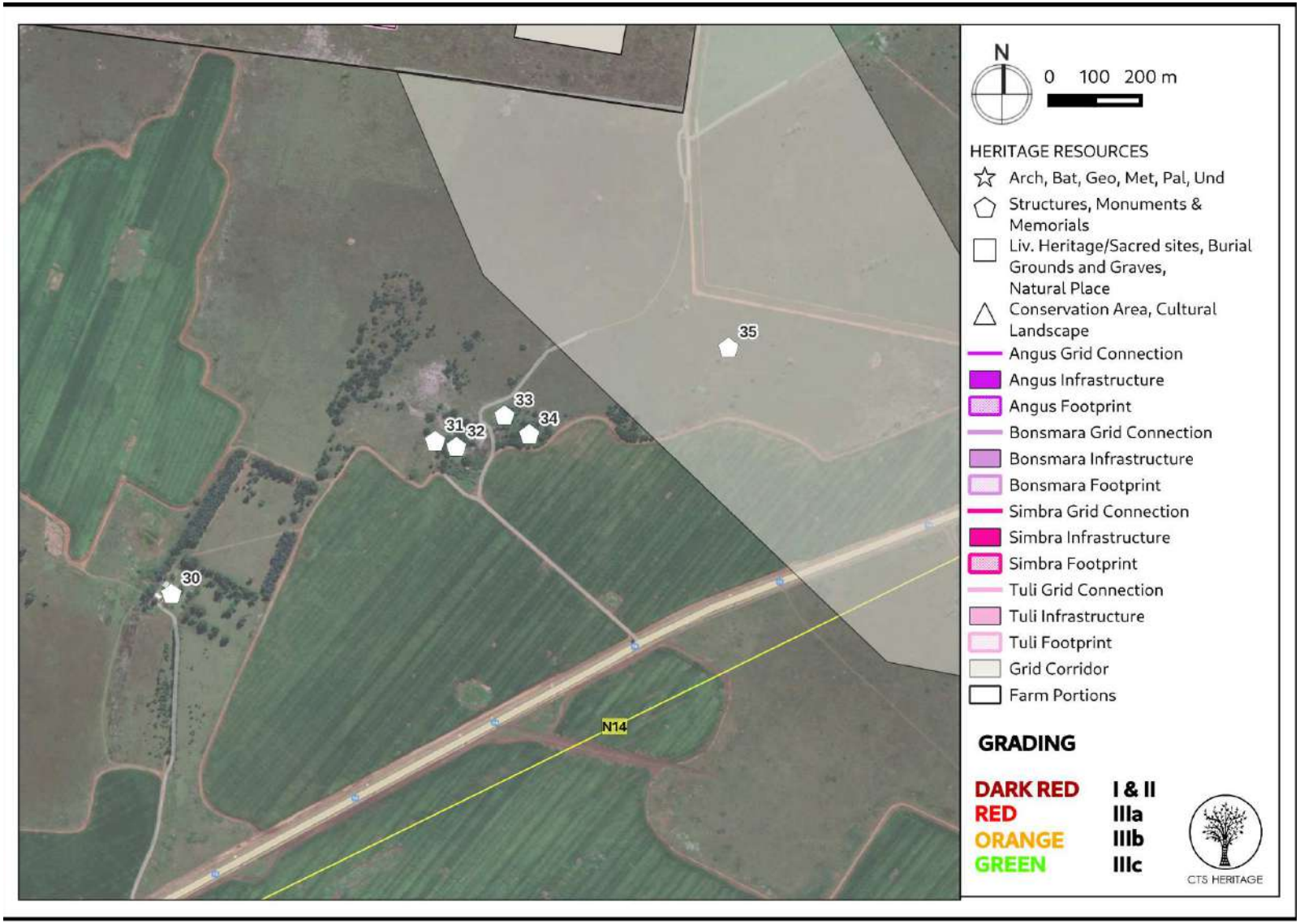

Figure 6.3: Map of all sites and observations noted within the development area

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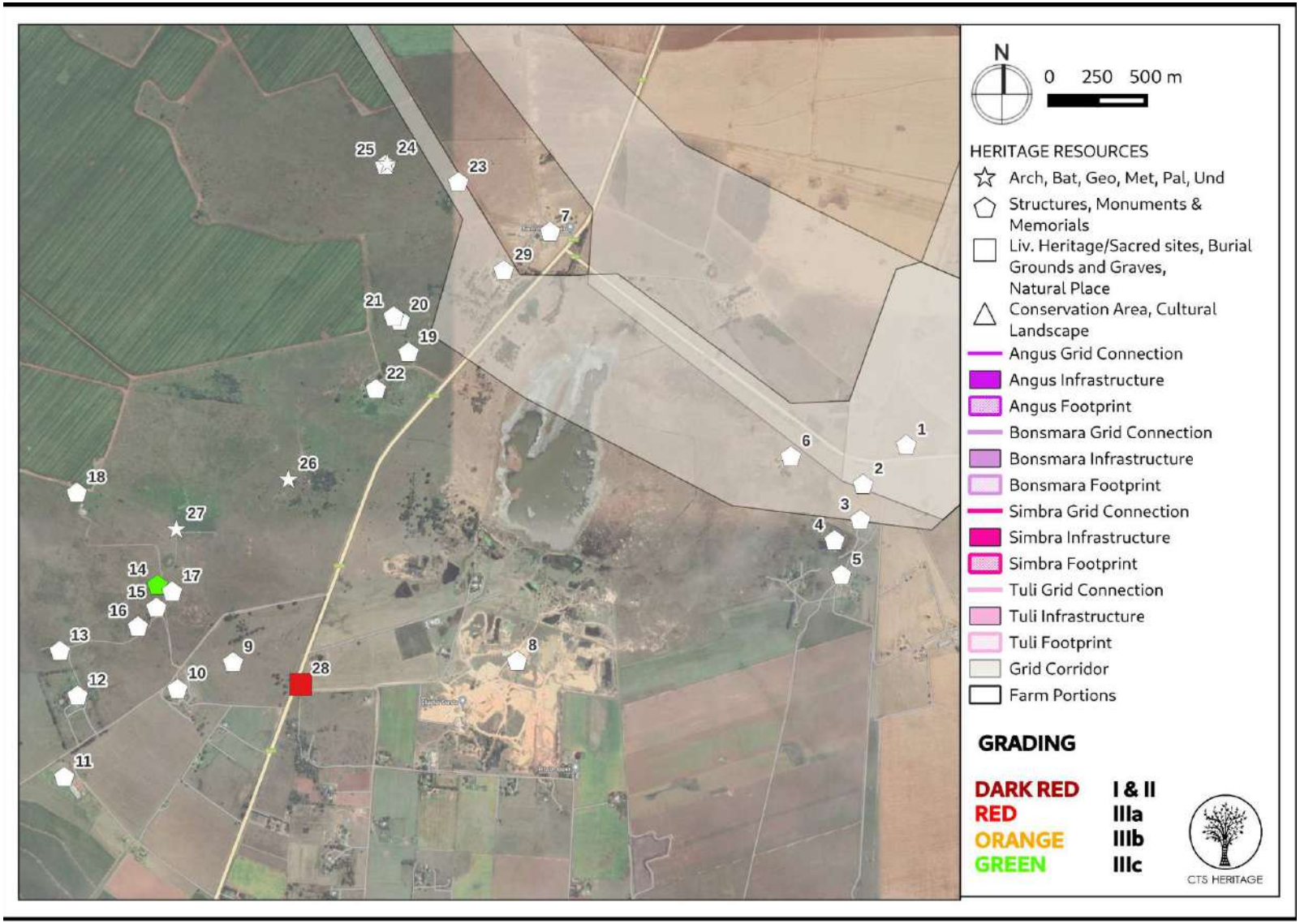

Figure 6.4: Map of all sites and observations noted within the development area

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4.3 Selected photographic record

(a full photographic record is available upon request)

Figure 7.1: Observation 001

Figure 7.2: Observation 002

Figure 7.3: Observation 003 and 004

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Figure 7.4: Observation 005 and 006


Figure 7.5: Observation 007 and 008


Figure 7.6: Observation 009 and 010

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Figure 7.7: Observation 011 and 012


Figure 7.8: Observation 013 and 014


Figure 7.9: Observation 015 and 016

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Figure 7.10: Observation 017 and 018

Figure 7.11: Observation 019 and 020

Figure 7.12: Observation 021 and 022

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Figure 7.13: Observation 023 and 024


Figure 7.14: Observation 025 and 026


Figure 7.15: Observation 027 and 029

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Figure 7.16: Observation 028

Figure 7.17: Observation 028

Figure 7.18: Observation 030 and 031

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Figure 7.19: Observation 032 and 033

Figure 7.20: Observation 034 and 035

Figure 7.21: Observation 036

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Figure 7.22: Observation 037

Figure 7.23: Observation 038

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5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Archaeological Resources

The majority of the heritage observations made within the development area relate to the historic mining and agricultural occupation of the broader area. Most of these observations relate to structures and ruins of structures that have been determined to have no cultural value. These have been determined to be Not Conservation-Worthy and are not considered further here.

Three heritage resources that have cultural value were identified in this assessment. Sites 014 and 036 relate to structures and have been graded IIIC for their contextual heritage value. Neither of these structures is located within any of the areas proposed for development and as such, it is not anticipated that any of these structures will be negatively impacted by the proposed development of either the SPPs or their electronic grid infrastructure.

Site 028 represents a modern graveyard (1980's) with a number of human remains interred here. Due to the high levels of social and spiritual value associated with human remains, graveyards are accorded high levels of local significance and as such, are graded IIIA. Although Site 028 is located far from the area proposed for development and as such, is unlikely to be directly impacted by the development, a 100m buffer around this site is recommended to ensure that no indirect impact takes place to this significant site.

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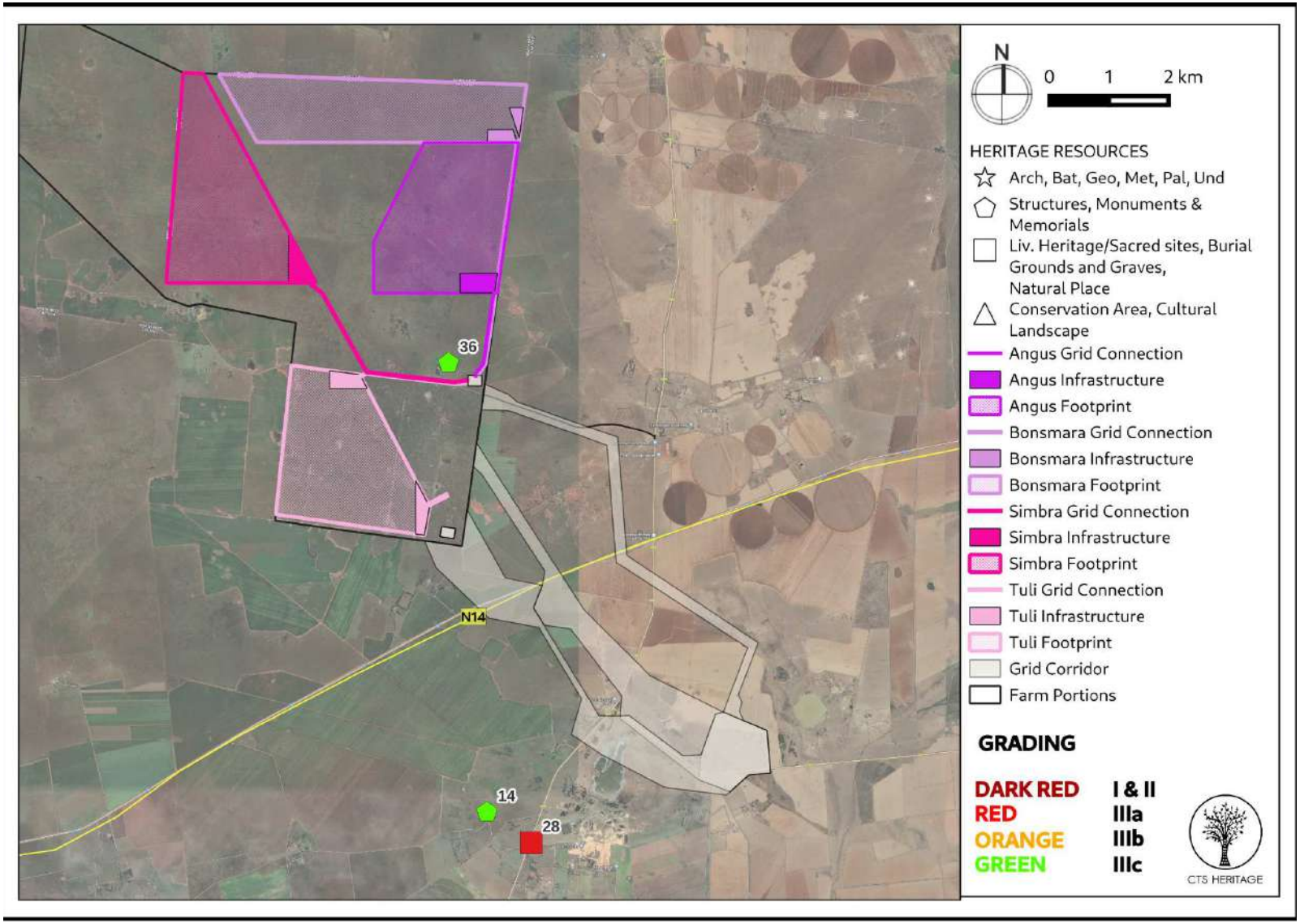

Figure 8: Map of all sites and observations noted within the development area

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6. CONCLUSION AND RECOMMENDATIONS

The survey proceeded with no major constraints and limitations, and the project area was comprehensively surveyed for heritage resources, and no archaeological remains of significance were identified within any of the areas proposed for development.

Recommendations

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

- 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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7. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
267835	HIA Phase 1	Stephan Gaigher	29/10/2014	HIA for the proposed Vogelstruisfontein Sand Mine
274424	AIA Phase 1	Jaco van der Walt	04/06/2015	Heritage Opinion For the Proposed Prospecting Activities on the farm Rooipan 96 IQ, Ventersdorp, North West Province.
332672	AIA Phase 1	Eric Ndivhuho Mathoho	04/03/2015	Archaeological Impact Assessment for proposed development of Magalies Cemetery and Waste Transfer Station, Portion 22 of the farm Rietpoort 395JQ, Mogale City Local Municipality, Gauteng Province
369805	Heritage Impact Assessment Specialist Reports	Polke Birkholtz, Gideon Groenewald	11/08/2016	ENVIRONMENTAL MANAGEMENT PLAN AMENDMENT FOR THE PROPOSED APPLICATION TO AMEND THE APPROVED PROSPECTING RIGHT WORK PROGRAMME FOR THE BULK SAMPLING AREA OF THE RECENT PLACER PROJECT, ON THE FARMS WILDFONTEIN 52 IQ AND DE PAN 51 IQ, MERAFONG CITY LOCAL MUNICIPALITY, RANDFONTEIN MAGISTERIAL DISTRICT, GAUTENG PROVINCE
5118	AIA Phase 1	Johnny Van Schalkwyk	01/02/2008	Heritage Survey Report for the Development of Water Pipelines for the Droogeheuvel and Middelvlei Townships, Randfontein, Gauteng Province
5507	AIA Phase 1	Udo Kusel	01/11/2005	Cultural Heritage Resources Impact Assessment of the Farm Zuikerboschfontein 151 IQ and Portion 10 (Portion of Portion 8) of the Farm Steenekoppie 153 IQ Magaliesburg
5523	AIA Phase 1	Polke Birkholtz	08/04/2003	Cultural Heritage Assessment as Part of the EMP Report for the Proposed Impafa/Pamodzi OpenCape Archaeological Survey CCt Gold Mine on the Farm Middelvlei 255 IQ
5738	AIA Phase 1	Cobus Dreyer	04/03/2006	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Developments at the Farms Bovenste Oog 68 IQ (Mooi River), Digby Plain 63 IQ, Sommerville 62 IQ, Preston Pans 59 IQ and Dryland 64 IQ, Ventersdorp, North West Province
6271	AIA Phase 1	Wouter Fourie, M Ramsden	01/08/2002	Blaauwbank Historic Gold Mine, Magaliesberg: Cultural Heritage Scoping
6340	AIA Phase 1	Wouter Fourie, Jaco van der Walt	08/12/2005	Portion of the Proposed Pipeline from Brandvlei to Krugersdorp on the Farm Brandvlei 261 IQ, District Mogale City, Gauteng Province
104305	AIA Phase 1	Justin du Piesanie, Johan Nel	01/05/2012	Phase 1 Heritage Impact Assessment of the proposed Geluksdal Tailings Storage Facility and Pipeline Infrastructure
356134	Heritage Impact Assessment Specialist Reports	Justin du Piesanie, Johan Nel	13/01/2016	Environmental Impact Assessment for Sibanye Gold Limited's West Rand Tailings Retreatment Project - Heritage Impact Assessment

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APPENDIX 2: Palaeontological Assessment (2023)

BANZAI ENVIRONMENTAL

PALAEONTOLOGICAL IMPACT ASSESSMENT

THE DEVELOPMENT OF ANGUS SOLAR POWER PLANT NEAR CARLETONVILLE, GAUTENG PROVINCE

2023

COMPILED FOR: CTS Heritage

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations.

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: info@banzai-group.com

SIGNATURE: 

The Palaeontological impact assessment report has been compiled considering the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

***Table 1**: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)*

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 3 of Report – Contact details and company and Appendix A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 3 – refer to **Appendix A**	-
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report	-
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 5 – Objective	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 6 – Geological and Palaeontological history	-
(cB) A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 11	-

(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1;10 & 12	
(e) A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 8 Approach and Methodology	-
(f) Details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative	Section 1; 6 & 11	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 12	
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 6 – Geological and Palaeontological history	
(i) A description of any assumptions made and any uncertainties or gaps in knowledge	Section 8.1 – Assumptions and Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 12	
(k) Any mitigation measures for inclusion in the EMPr	Section 13	
(l) Any conditions for inclusion in the environmental authorisation	Section 13	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 13	

(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 & 12	
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and		
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 1 and 12	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) process
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised
(q) Any other information requested by the competent authority	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be	Section 4 compliance with	

applied to a specialist report, the requirements as indicated in such notice will apply	SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by CTS Heritage to conduct the Palaeontological Impact Assessment (PIA) to assess Angus Solar Power Plant (SPP) near Carletonville, Gauteng Province. The Angus SPP forms part of the Pluto Cluster near Carletonville. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The study area is entirely underlain by Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS), indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while Groenewald et.al (2014) allocated a High Sensitivity to the Group. Updated Geology (Council of Geosciences) confirms that the Angus SPP is underlain by the Malmani Subgroup.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 23 March 2023. Site access was a problem and only one weathered stromatolite was identified in Pluto Cluster footprint. This stromatolite forms part of a pile of rock that was removed from the agricultural land. Most probably other stromatolites are also present in the SPP footprint. However, due to preservation, mitigation it is not recommended as other well-preserved stromatolites have been identified in the area. A high Palaeontological Significance has been allocated for the construction phase of the SPP development pre-mitigation and a low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the SPP development is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

Recommendations:

- The ECO for this project must be informed that the Malmani Subgroup has a Very High Palaeontological Sensitivity.
- If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out.
- Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).
- These recommendations should be incorporated into the Environmental Management Plan for the Angus Solar Power Plant.

Impact Summary

Environmental parameter	**Issues**	**Rating prior to mitigation**	**Average**	**Rating post mitigation**	**Average**
Planning Phase Angus SPP	No Impact	0	No Impact	0	No Impact
Construction Stage Angus SPP Loss of fossil heritage	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	51	Negative Medium impact	17	Negative Low impact
Operational Phase Angus SPP	No Impact	0	No Impact	0	No Impact
Decommissioning Phase Angus SPP	No Impact	0	No Impact	0	No Impact

It is therefore considered that the proposed Angus SPP will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised in its whole extent.

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Appendix A: CV

1. INTRODUCTION

The Angus Solar Power Plant near Carletonville in Gauteng is proposed (Figure 1-2). The SPP forms part of the Pluto Renewable Energy Cluster near Carletonville.

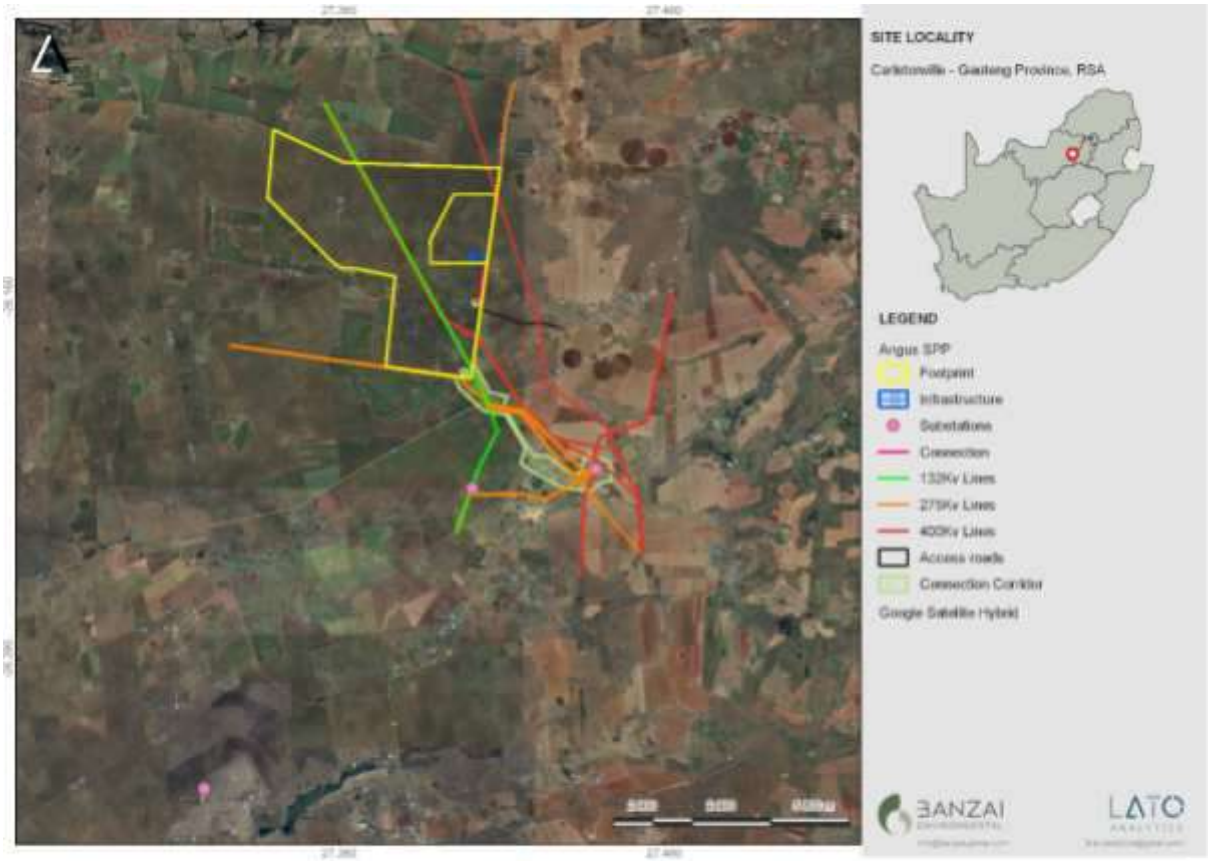


Figure SEQ Figure * ARABIC 1:*Regional locality of the proposed Angus Solar Power Plant near Carletonville in Gauteng Province.*

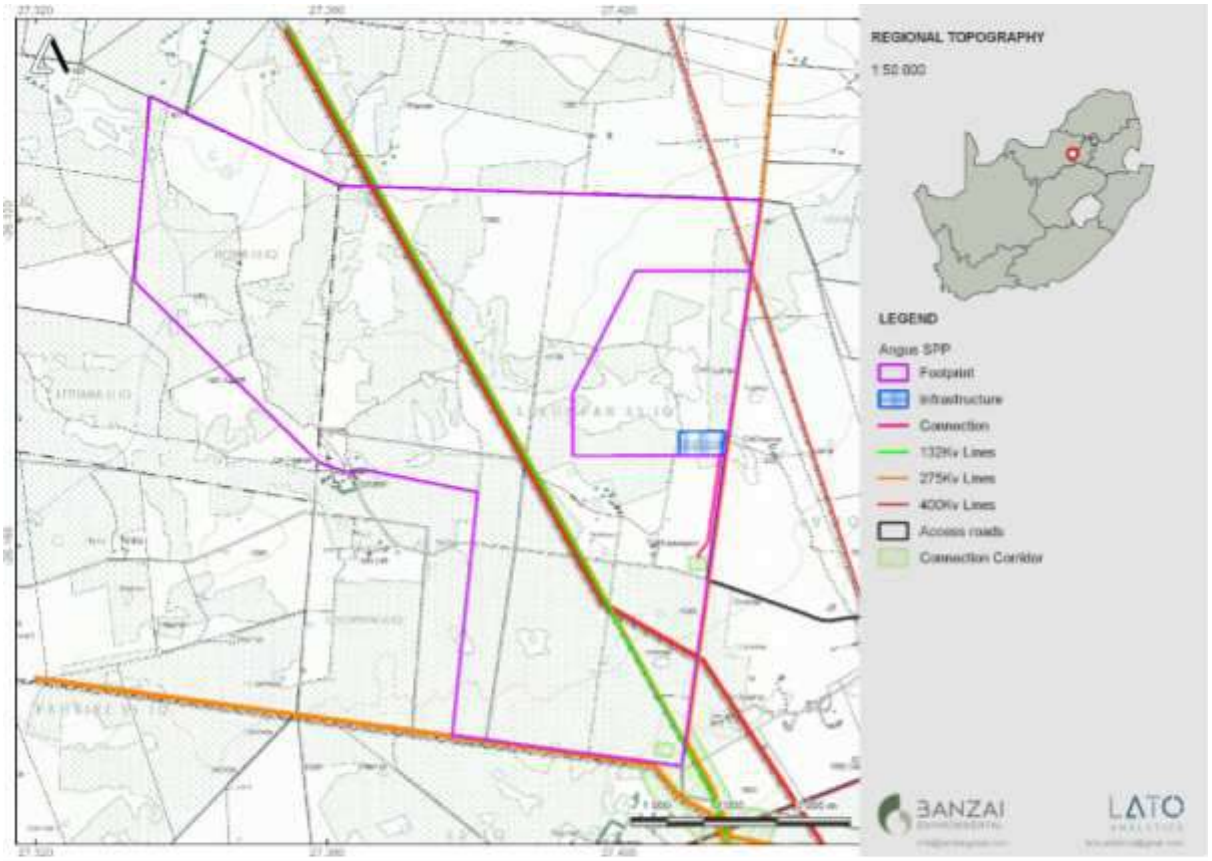


***Figure SEQ Figure * ARABIC 2**:Locality map of the proposed Angus Solar Power Plant near Carletonville in Gauteng.*

***Table 2**:General site information*	
Description of affected farm portion	Solar Power Plant: Farm Leeuwpan No. 697 Grid Connection Corridor: Portion 87 of the Farm De Pan 51; Portion 88 of the Farm De Pan 51; The Remaining Extent of the Farm De Pan 51; Portion 5 of the Farm De Pan 5; Portion 90 of the Farm De Pan 51 ; Portion 1 of the Farm De Pan 51; Portion 100 of the Farm Wildfontein No. 52 ; Portion 34 of the Farm Holfontein No. 49 ;
Province	Gauteng
District Municipality	West Rand District Municipality
Local Municipality	Merafong City Local Municipality
Ward numbers	1
Closest towns	Carletonville is located approximately 17km south of the proposed development.
21 Digit Surveyor General codes	Solar Power Plant: Farm Leeuwpan No. 697 T0IQ00000000069700000 Grid Connection Corridor: Portion 87 of the Farm De Pan 51 T0IQ00000000005100087 Portion 88 of the Farm De Pan 51 T0IQ00000000005100088 The Remaining Extent of the Farm De Pan 51 T0IQ00000000005100000 Portion 5 of the Farm De Pan 5 T0IQ00000000005100005 Portion 90 of the Farm De Pan 51 T0IQ00000000005100090 Portion 1 of the Farm De Pan 51 T0IQ00000000005100001

	Portion 100 of the Farm Wildfontein No. 52 T0IQ000000000005200100 Portion 34 of the Farm Holfontein No. 49 T0IQ000000000004900034
Type of technology	Photovoltaic solar facility
Structure Height	Panels ~ 6m; Buildings ~ 6m; Power line ~ 32m; and Battery storage facility ~ 8m.
Battery storage	Within a 4-hectare area of the infrastructure and ancillary complex
Surface area to be covered (Development footprint)	Approximately 500 ha[1]
EIA footprint	Assessed 4272 ha
Structure orientation	The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is in order to capture the most sun.
Generation capacity	Up to 250MW

1.1 Technical Details

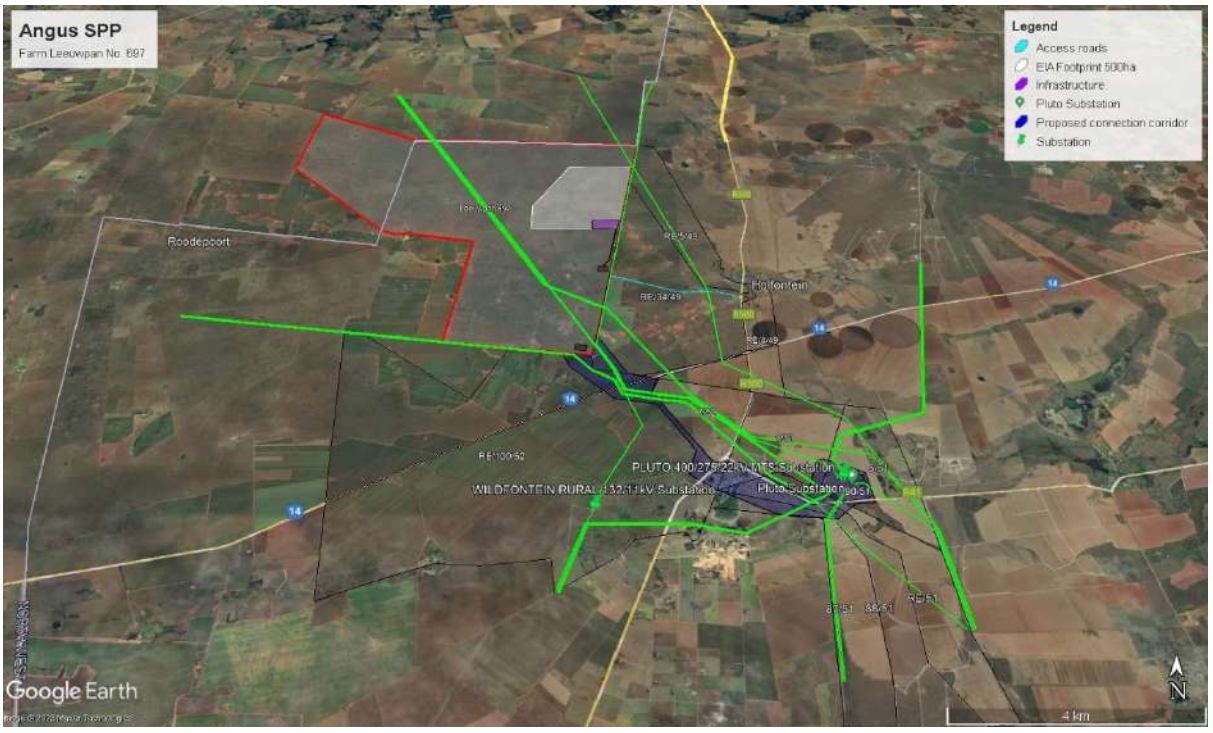
The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e. semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - To produce up to 250MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the yield.

[1] The development footprint is subject to change following specialist input.

- Wiring to Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV and higher. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into the step-up transformers to 132kV. An onsite substation will be required to step the voltage up to 132kV, after which the power will be evacuated into a new proposed collector substation to step the voltage up from 132KV to 275/400KV in order to evacuate the power into the national grid at the same voltage level as the MTS via the proposed 132/275/400KV power line. Whilst Angus Solar Power Plant (RF) (Pty) Ltd has not yet received a cost estimate letter from Eskom, it is expected that generation from the facility will tie in with a newly proposed collector substation to be connected to the existing Pluto 400/275/22kV MTS, it may also be required to create a 132KV feeder bay and transformation at Pluto MTS in order to connect the collector substation at the MTS with a single or double circuit 132KV connection line. The connection power line will be constructed within the limits of the grid connection corridor. The project will generate up to 250MW of electricity. Refer to the Figure below.



Angus SPP powerline corridor

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4m underground as far as practically possible.

- Supporting Infrastructure – All associated infrastructure will be constructed within the limits of the infrastructure and ancillary complex which will include an on-site substation, Battery Energy Storage System, Operations and Maintenance buildings etc.

- Battery storage – A Battery Storage Facility with a maximum height of 8m and a maximum volume of 1,740 m^3 of batteries and associated operational, safety and control infrastructure.
- Roads – Access will be obtained via a public gravel road off of the R500 regional road to the east of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.

Table 3:Technical details for the proposed facility

Height of PV panels	6 meters
Area of PV Array	500 Hectares (Development footprint)
Number of inverters required	Minimum 50
Area occupied by inverter / transformer stations / substations / BESS	Central inverters+ LV/MV trafo: 750 m^2 Substation: 1.5 ha BESS: 4 ha
Capacity of on-site substation	132kV
Capacity of the power line	132kV
Area occupied by both permanent and construction laydown areas	Permanent Laydown Area: 500 Hectares Construction Laydown Area: ~20 ha
Area occupied by buildings	Infrastructure & Ancillary Complex: 20 ha
Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3 Capacity ~up to 500MWh
Length of access roads	To be confirmed with the layout of the facility
Width of access roads	8 m – 10 m
Length of internal roads	To be confirmed with the layout of the facility
Width of internal roads	4 m – 6 m
Length of perimeter roads	To be confirmed with the layout of the facility
Width of perimeter roads	6 m – 8 m
Grid connection corridor width	102 m up to 1.4 km
Grid connection corridor length	Approximately 7 km
Power line servitude width	32m
Height of fencing	Approximately 2.5 m
Height of PV panels	6 meters

1.2 Consideration of Alternatives

The DEAT 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single preferred project proposal. An initial site assessment was conducted by the developer the affected properties and the farm portions were found favorable due to its proximity to grid connections, solar radiation, ecology and relative flat terrain. These factors were then taken into consideration and avoided as far as possible.

The following alternatives were considered in relation to the proposed activity and all specialists should also make mention of these:

No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facility and the supporting social and economic development in the area would be lost if the status quo persist.

Location alternatives

No other possible sites were identified on the Farm Leeuwpan No. 697. This site is referred to as the preferred site. Some limited sensitive features occur on the site. The size of the site makes provision for the exclusion of any sensitive environmental features that may arise through the EIA proses.

Technical alternatives: Powerlines

It is expected that generation from the facility will tie in with a newly proposed collector substation to be connected to the existing Pluto 400/275/22kV MTS, it may also be required to create a 132KV feeder bay and transformation at Pluto MTS in order to connect the collector substation at the MTS with a single or double circuit 132KV connection line.

The connection power line will be constructed within the limits of the grid connection corridor.

Battery storage facility

It is proposed that a nominal up to 500 MWh Battery Storage Facility for grid storage would be housed in stacked containers, or multi-storey building, with a maximum height of 8m and a maximum volume

of 1,740m^3 of batteries and associated operational, safety and control infrastructure. Three types of battery technologies are being considered for the proposed project: Lithium-ion, Sodium-sulphur or Vanadium Redox flow battery. The preferred battery technology is Lithium-ion.

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

Design and layout alternatives

Design alternatives will be considered throughout the planning and design phase and specialist studies are expected to inform the final layout of the proposed development.

Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon (Mono-facial and Bi-facial) and thin film. The technology that (at this stage) proves more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability. However, due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

2. LEGAL MANDATE AND PURPOSE OF THE REPORT

The National Environmental Management Act identifies listed activities (in terms of Section 24) which are likely to have an impact on the environment. These activities cannot commence without obtaining an EA from the relevant competent authority. Sufficient information is required by the competent authority to make an informed decision and the project is therefore subject to an environmental assessment process which can be either a Basic Assessment Process or a full Scoping and Environmental Impact Assessment process.

The EIA Regulations No. 324, 325, and 327 outline the activities that may be triggered and therefore require EA. The following listed activities with special reference to the proposed development is triggered:

***Table 4**:Listed activities (SPPs)*

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(i)	• *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* • Activity 11(i) is triggered as the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area.
GNR. 327 (as amended in 2017)	Activity 28(ii)	• *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."* • Activity 28(ii) is triggered as portions of the affected farm has been previously used for grazing and the property will be re-zoned to "special" use.
GNR. 327 (as amended in 2017)	Activity 24(ii)	• *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters;* • Activity 24(ii) is triggered as the access road will be between 8 and 10 meters in width.
GNR. 327 (as amended in 2017)	Activity 56 (ii):	• *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* • Activity 56 (ii) is triggered as the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres.
GNR. 325 (as amended in 2017)	Activity 1	• *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."*

		• Activity 1 is triggered since the proposed photovoltaic solar facility will generate up to 250 megawatts electricity through the use of a renewable resource.
GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • More than 20 hectares of indigenous vegetation will be cleared.

The activities triggered under Listing Notice 1 and 2 (Regulation 327 & 325) for the project implies that the development is considered as potentially having an impact on the environment and therefore require the implementation of appropriate mitigation measures. The listed activities indicated above are subject to change with the input from specialists.

3. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

This study has been conducted by Mrs Elize Butler. She has conducted approximately 300 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in Palaeontology for more than twenty-eight years. She has experience in locating, collecting, and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa (PSSA) since 2006 and has been conducting PIAs since 2014.

4. LEGISLATION

4.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

The identification, evaluation and assessment of any cultural heritage site, artefact or finds in the South African context is required and governed by the following legislation:

- National Environmental Management Act (NEMA) Act 107 of 1998
- National Heritage Resources Act (NHRA) Act 25 of 1999

- Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36
- Heritage Resources Management – Section 38

MPRDA Regulations of 2014

Environmental reports to be compiled for application of mining right – Regulation 48

- Contents of scoping report – Regulation 49
- Contents of environmental impact assessment report – Regulation 50
- Environmental management programme – Regulation 51
- Environmental management plan – Regulation 52

The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "*…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*".

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This Palaeontological Impact assessment forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to Section 38 (1), an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- the construction of a bridge or similar structure exceeding 50 m in length.
- any development or other activity which will change the character of a site—
- (Exceeding 5 000 m^2 in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m² in extent.
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

5. OBJECTIVE

The objective of a Palaeontological Impact Assessment (PIA) is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to identify the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the palaeontological importance of the formations 3) to determine the impact on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study,

- Description and location of the proposed development and provide geological and topographical maps
- Provide palaeontological and geological history of the affected area.
- Identification of sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    a. Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    b. Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity.
    c. Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

6. GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the proposed Angus Solar Power Plant near Carletonville in Gauteng is depicted on the 1: 250 000 West Rand 2626 (1986) Geological Map (Council for Geosciences, Pretoria) (Figure 3, Table 5). The study area is underlain by Precambrian dolomites and associated marine sedimentary rocks that are allocated to the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). The Malmani Subgroup in this area is undifferentiated (Figure 3-4, Table 5). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 2013) (Figure 5). The Updated Geology (Council of Geosciences) confirms the geology and indicates that the proposed development is underlain by the Malmani Subgroup (Figure 6).

The Malmani Subgroup carbonates of the Transvaal Basin comprise of an assortment of stromatolites (microbial laminates), ranging from supratidal mats to intertidal columns and large subtidal domes (Eriksson *et al.* 2006). Stromatolites are layered mounds, columns and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a

single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-bases life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. These algae photosynthesised in the low oxygen atmosphere and deposited layer upon layer of calcium sulphate, magnesium sulphate and calcium carbonate as well as other compounds to form these domes. Researchers have examined and classified the stromatolite structures but seldomly find preserved algal cells. The oxygen atmosphere that we depend on today was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Eriksson and Altermann, 1998). Detailed descriptions of South African Archaean stromatolites are available in the literature (Altermann, 2001; Buick, 2001; and Schopf, 2006). The Malmani stromatolites literature includes articles by Truswell and Eriksson (1972, 1973, 1975), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner (2000), Schopf (2006).

The Malmani Subgroup succession is about 2 km-thick and consists of a series of formations of oolitic and stromatolitic carbonates (limestones and dolomites), black carbonaceous shales and minor secondary cherts. The Malmani Dolomites also consist of historic lime mines, and palaeocave fossil deposits. Dolomite (limestone rock) forms in warm, shallow seas from slow gathering remainders of marine microorganisms and fine-grained sediment. Dolomites of the Malmani Subgroup has a higher magnesium content than other limestones. These materials contain high levels of calcium carbonate and are often referred to as *carbonates*.

Currently very few palaeontologists study stromatolites but geologists find the stromatolites interesting because they reveal the change from a reducing environment (that is an oxygen-poor) to an oxidizing environment (oxygen--rich). This transition is known as the Great Oxygen Event (Eroglu et al., 2017).

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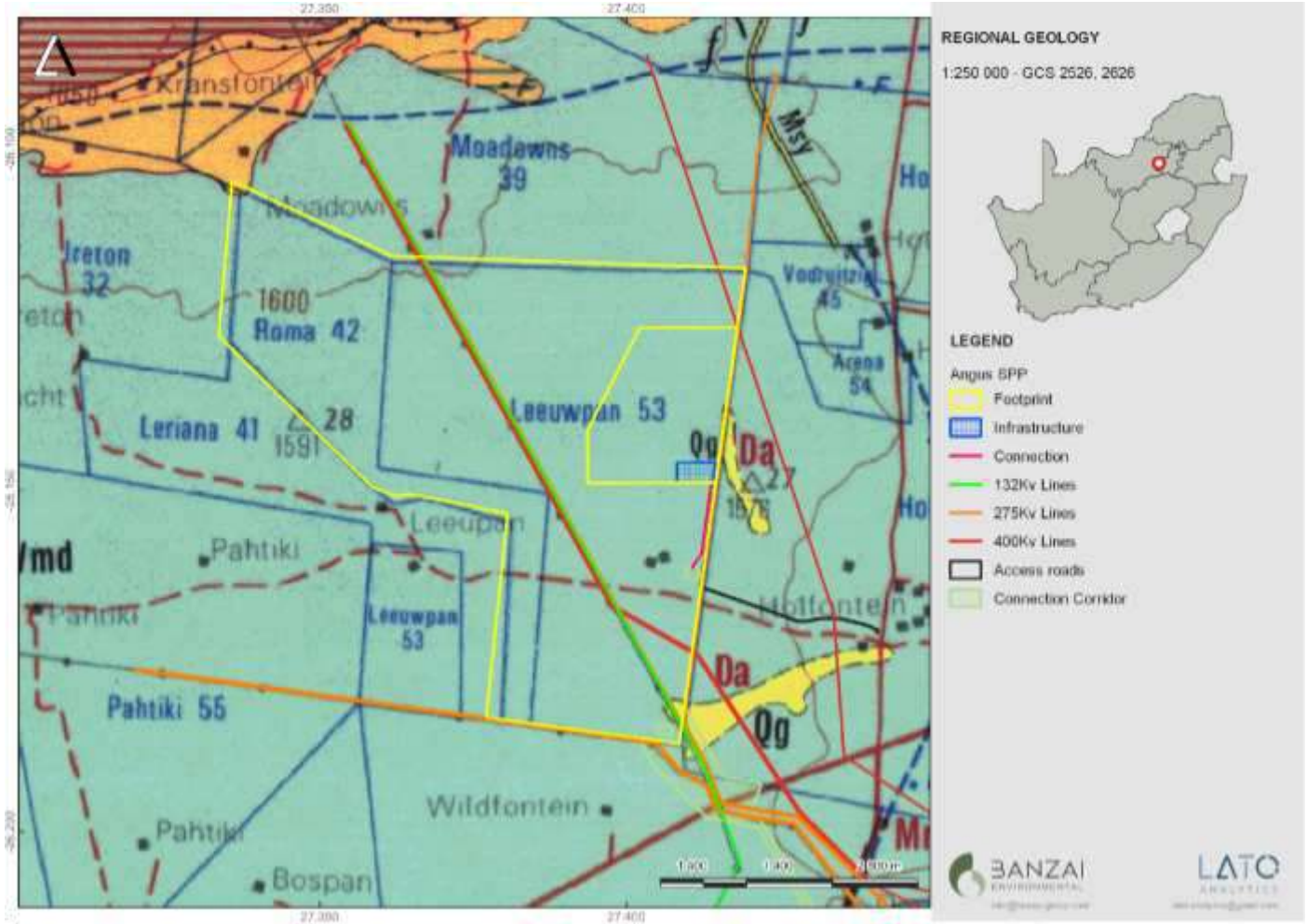
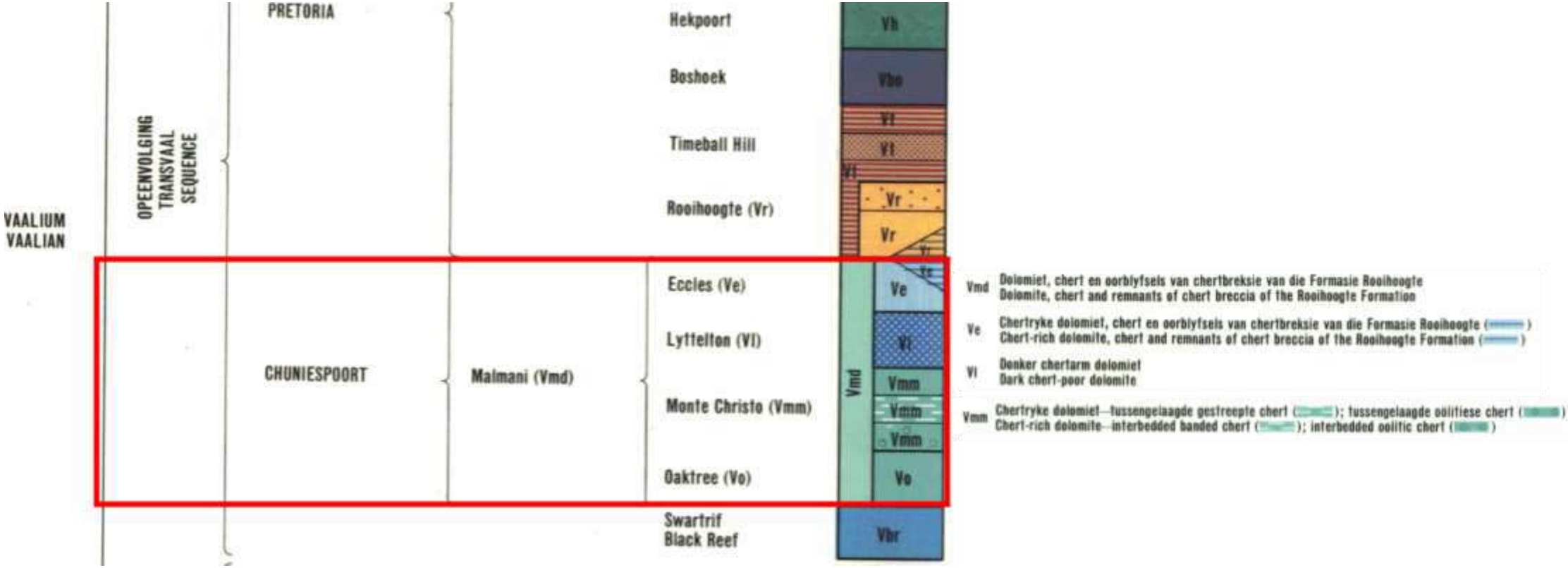


***Figure SEQ Figure * ARABIC 3**: Extract of the 1:250 000 2626 West Rand (1986) Geological Map (Council for Geosciences, Pretoria) indicating the proposed Angus SPP development.*

The proposed development is underlain by the Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup.

***Table SEQ Table * ARABIC 5**: Legend to the Wes Rand 2626 (1986) Geological Map (Council for Geoscience, Pretoria).*

Relevant sediments are indicated in a red square.



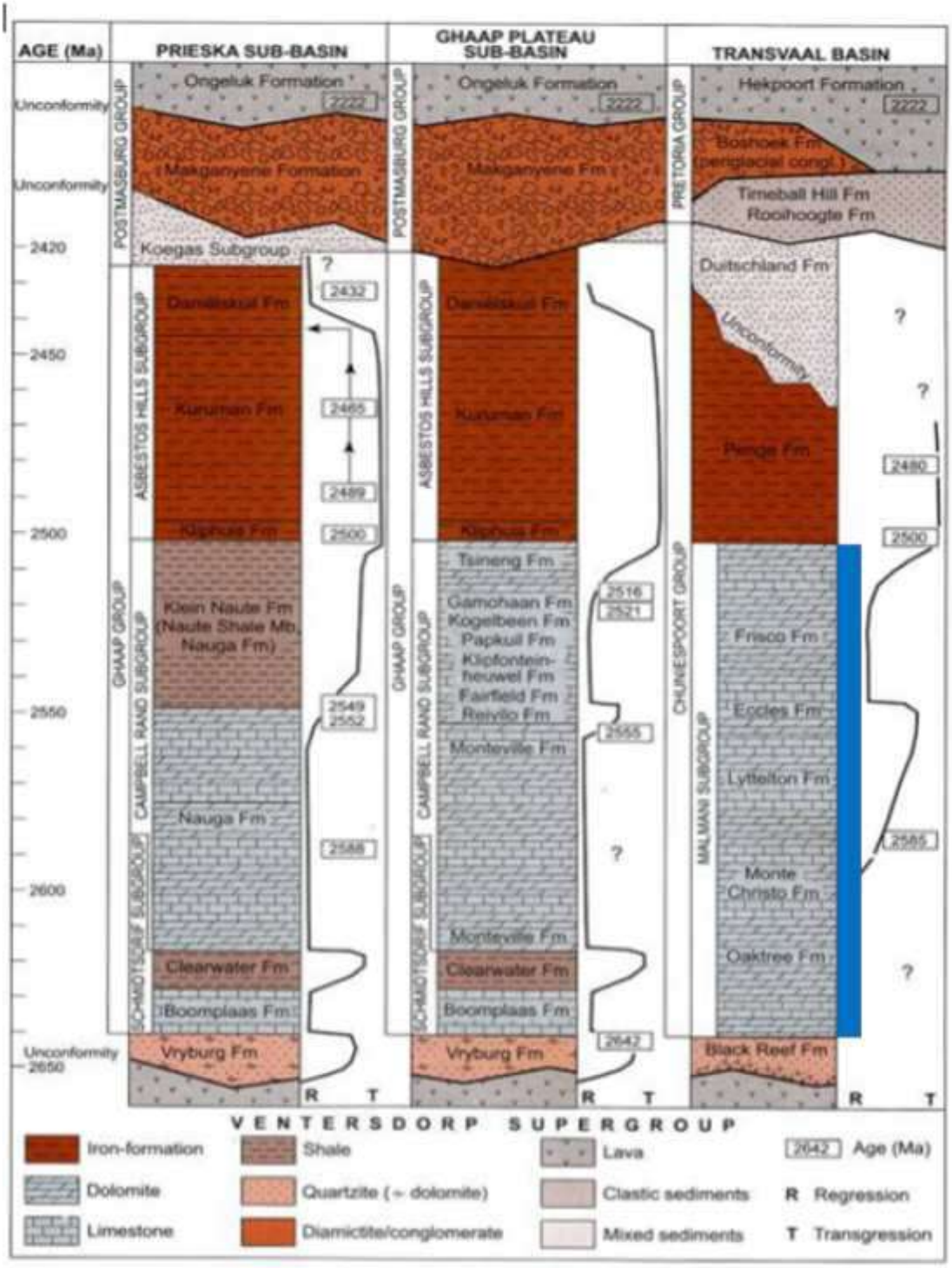


***Figure SEQ Figure * ARABIC 4**: Stratigraphy of the Transvaal Supergroup of the Transvaal Basin. The proposed development is indicated in blue (Eriksson, et al. 2006).*

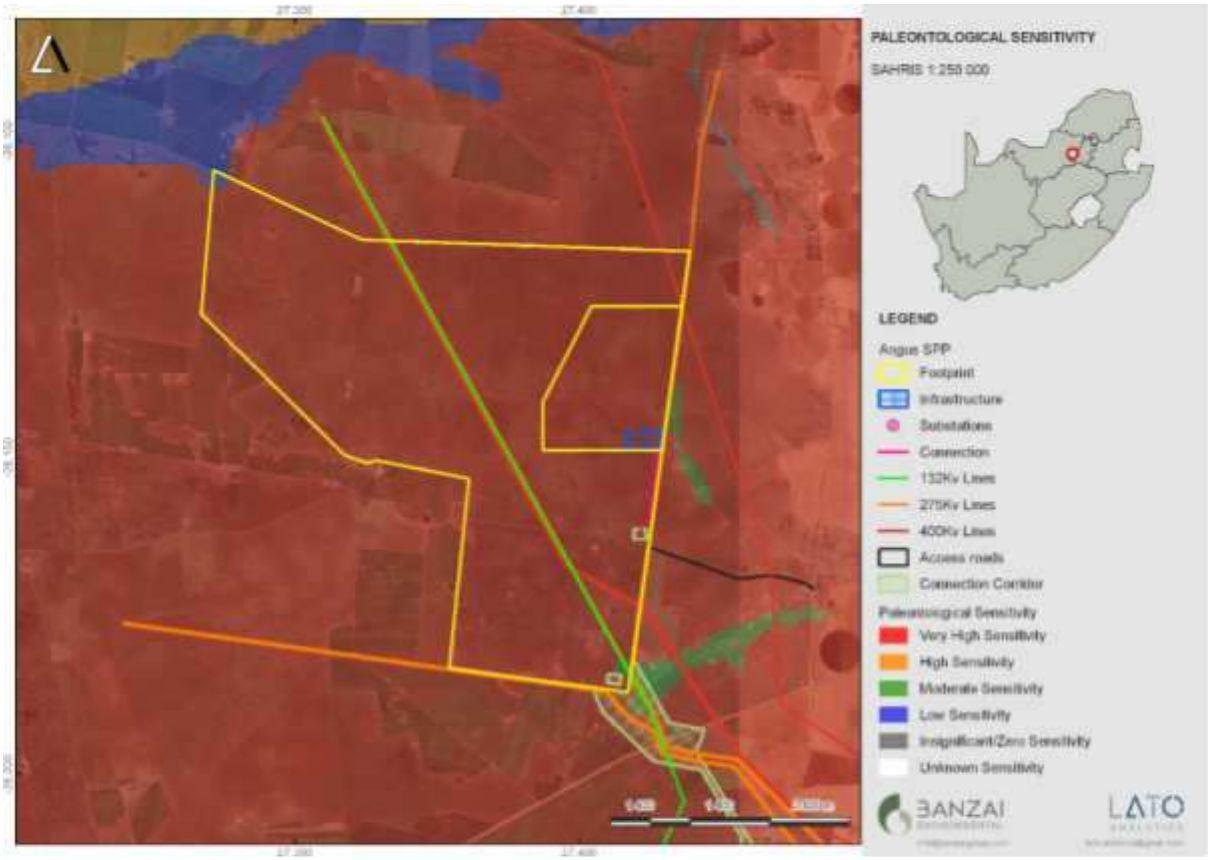


***Figure SEQ Figure * ARABIC 5**: Extract of the 1 in 250 000 SAHRIS PalaeoMap (Council of Geosciences) indicating the proposed Angus SPP development.*

***Table 6**:Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website).*

Colour	Sensitivity	Required Action
RED	**VERY HIGH**	**Field assessment and protocol for finds is required**
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

The

SAHRIS Palaeosensitivity map (**Figure 5**) indicates that the proposed development is underlain by sediments with a Very High (red) Palaeontological Sensitivity.

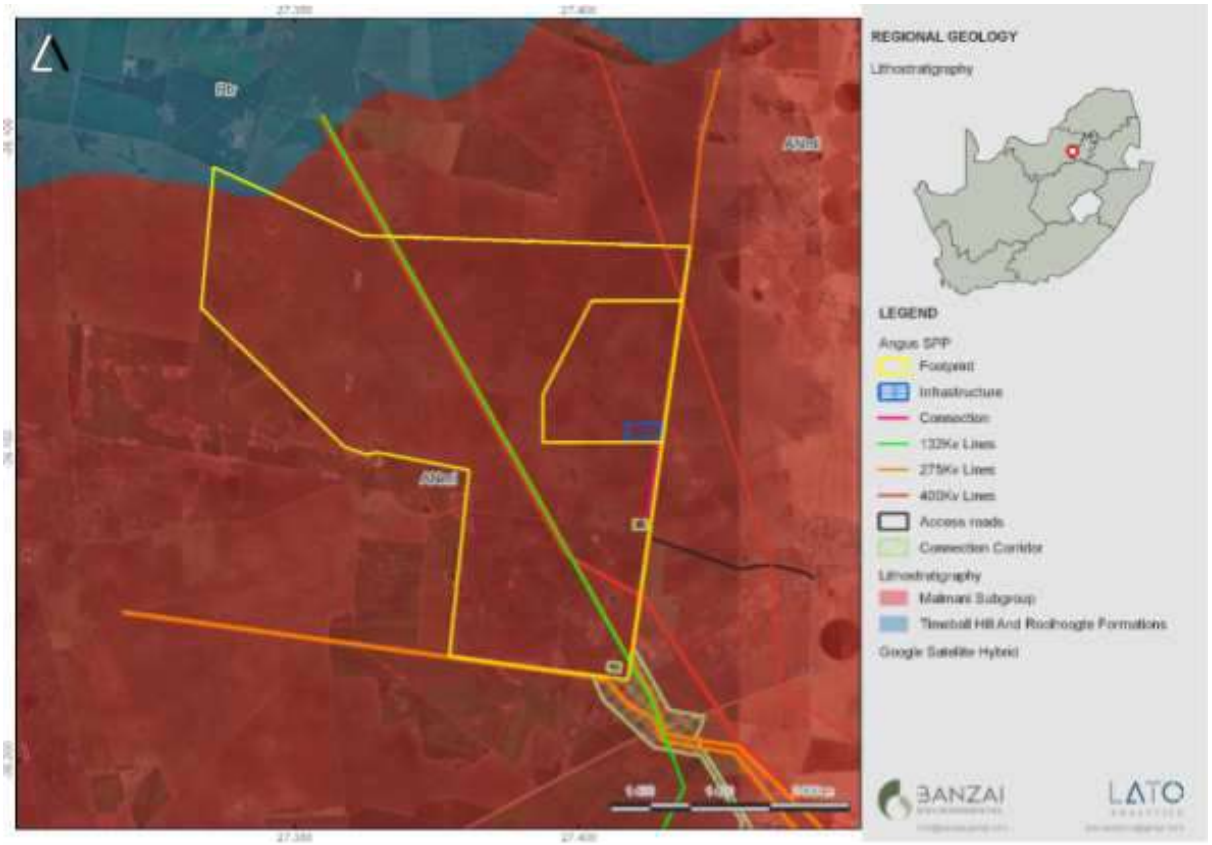


Figure SEQ Figure * ARABIC 6: *Updated Geology (Council of Geosciences, Pretoria) of the proposed Angus SPP development indicates that the development is underlain by the Malmani Subgroup.*

Solar Facilities around the Angus SPP will have a Zero to Very High Palaeontological Sensitivity. However, it is important to note that the quality of preservation of these different sites will most probably vary and it is thus difficult to allocate a Cumulative Sensitivity to the projects. If all the mitigation measures are carried out, a conservative estimate of the Cumulative impacts on fossil Heritage will vary between Low and Medium.

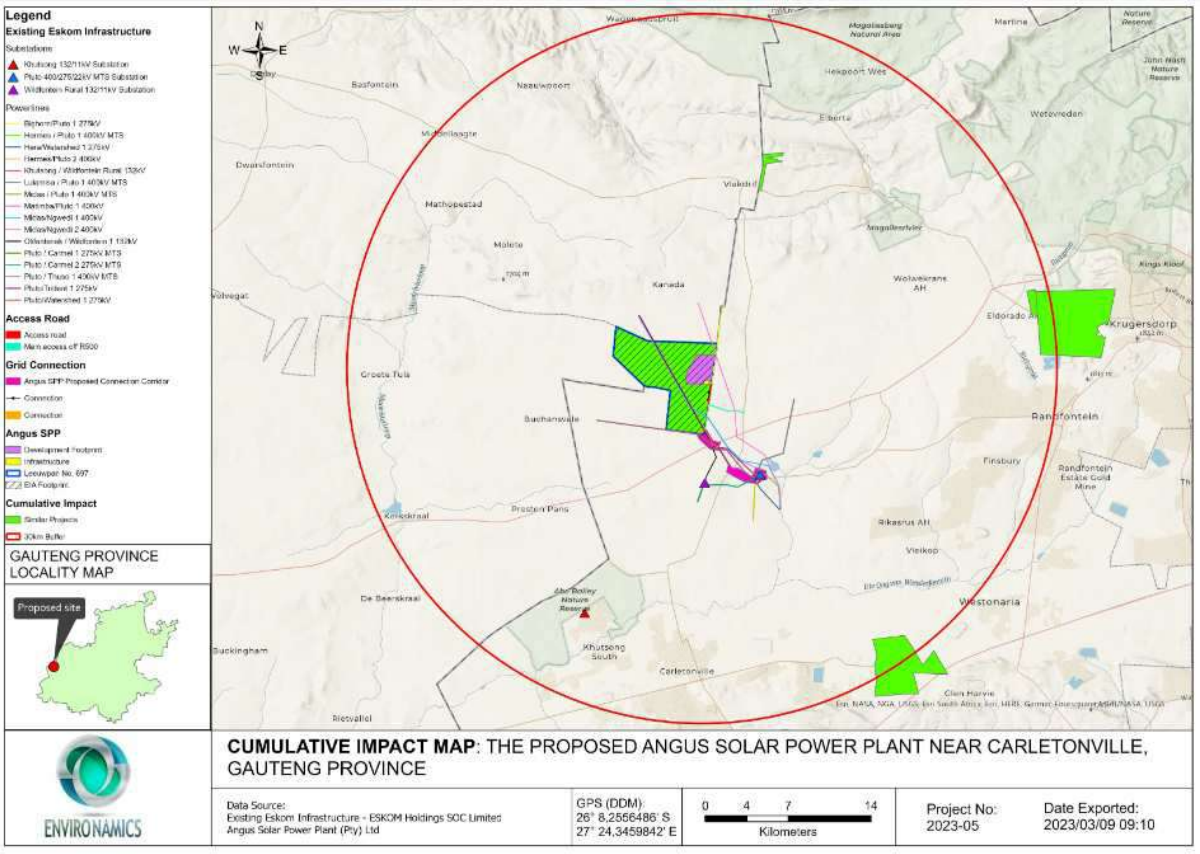


***Table 7**: A summary of related facilities, that may have a cumulative impact, in a 30 km radius of the Angus SPP*

Site name	Distance from study area	Proposed generating capacity	DEFF reference	EIA process	Project status
Portion 3 (Portion of Portion 2 of the Farm Rietpoort 395	14.5km	15 MW	12/12/20/2330	BAR	Approved
Portion 64 (A Portion of Portion 1) of the Farm Waterval 174	28km	25 MW	12/12/20/2537	Scoping and EIA	Approved
Portion 57 (A Portion of Portion 1) of the Farm Waterval 174	27.5KM	70 MW	12/12/20/2539	Scoping and EIA	In process
Portion 1, 2, 4, 5 and 6 of the Farm Uitval 280	25.6km	200 MW	14/12/16/3/3/2/919	Scoping and EIA	In process
Farm Brickvale 161	27.3km	19.9 MW	14/12/16/3/3/1/636	BAR	In process
Tuli Solar Power Plant	0km	250MW	To be obtained	Scoping and EIA	In process
Bonsmara Solar Power Plant	0km	250MW	To be obtained	Scoping and EIA	In process
Simbra Solar Power Plant	0km	250MW	To be obtained	Scoping and EIA	In process

It is unclear whether other projects not related to renewable energy is or has been constructed in this area, and whether other projects are proposed. In general, development activity in the area is focused on agriculture and mining. It is quite possible that future solar farm development may take place within the general area.

7. GEOGRAPHICAL LOCATION OF THE SITE

Carletonville is located about 17km south of the proposed development (Figure 1-2).

8. METHODS

The aim of a desktop study is to evaluate the possible risk to palaeontological heritage in the proposed development. This includes all trace fossils as well as all fossils in the proposed footprint. All possible information is consulted to compile a desktop study, and this includes the following: all Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical as well as geological maps.

8.1 Assumptions and Limitations

The focal point of geological maps is the geology of the area and the sheet explanations of the Geological Maps were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is also used to provide information on the existence of fossils in an area which has not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally **assumed** that exposed fossil heritage is present within the footprint. A field-assessment will thus improve the accuracy of the desktop assessment.

9. ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website
- A Google Earth kmz files, background information as well as screening report of the proposed development was obtained from Environamics.
- Google Earth© satellite imagery.
- 1:250 000 Pretoria 26268 (1978) West Rand (Council for Geosciences, Pretoria),
- Published geological and palaeontological literature as well as
- Relevant PIAs in the area that includes that of Bamford 2021; Groenewald, 2016.

- A one day-comprehensive site-specific field survey of the development footprint was conducted on foot and motor vehicle on 23 March 2023.

10. SITE VISIT

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 23 March 2023. Site access was a problem and only one weathered stromatolite was identified in the Pluto Cluster footprint. This stromatolite forms part of a pile of rock that was removed from the agricultural land. However, due to preservation, mitigation it is not recommended as other well-preserved stromatolites have been identified in the area (personal observation).

***Figure SEQ Figure * ARABIC 8**:Study area located on a very flat topography, covered by lush vegetation.*

***Figure SEQ Figure * ARABIC 9**:Quartzite, breccia, metamorphized sandstone and a stromatolite removed from agricultural land and dumped together.*

-26.168472 27.405925

***Figure SEQ Figure * ARABIC 10**: Weathered stromatolite found loose in the figure above.*

-26.168472 27.405925

11. IMPACT ASSESSMENT METHODOLOGY

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 4.1.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

***Table 8**:The rating system*

NATURE		
Loss of fossil heritage.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after

		construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation

		and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.

3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96		The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

Impact rating

Impacts	Extent	Duration	Probability	Magnitude	Reversibility	Irreplaceable loss	Cumulative effect	Impact
Pre-mitigation	1	4	3	4	4	4	2	Negative High 54
Post mitigation	1	4	2	1	4	4	2	Negative Low 17

Table 9:*Summary of Impacts*

SPECIALIST STUDY	IMPACT	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Palaeontological Impact Assessment	Disturbance, damage or destruction of legally protected fossil heritage within the development footprint during the construction phase	54	17	The ECO for this project must be informed that the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) is Very High Palaeontological Sensitivity. If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out. Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

				These recommendations should be incorporated into the Environmental Management Plan for the Angus Solar Power Plant.

12. FINDINGS AND RECOMMENDATIONS

The study area is entirely underlain by Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS), indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while Groenewald et.al (2014) allocated a High Sensitivity to the Group. Updated Geology (Council of Geosciences) confirms that the Angus SPP is underlain by the Malmani Subgroup.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 23 March 2023. Site access was a problem and only one weathered stromatolite was identified in the Pluto Cluster footprint. This stromatolite forms part of a pile of rock that was removed from the agricultural land. However, due to preservation, mitigation it is not recommended as other well-preserved stromatolites have been identified in the area. A high Palaeontological Significance has been allocated for the construction phase of the SPP development pre-mitigation and a low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the SPP development is considered to be medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils.

Recommendations:

- The ECO for this project must be informed that the Malmani Subgroup has a Very High Palaeontological Sensitivity.
- If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out.
- Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an

official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

- These recommendations should be incorporated into the Environmental Management Plan for the Angus Solar Power Plant.

13. CHANCE FINDS PROTOCOL

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the National Heritage Resources Act (Act No 25 of 1999) (NHRA). According to Section 3 of the Act, all Heritage resources include "all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Site Officer (ESO) or site manager of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ESO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately stop working and all work that could impact that finding must cease in the immediate vicinity of the find.
- The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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APPENDIX A

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 years in Palaeontology
EDUCATION:	B.Sc Botany and Zoology, 1988 University of the Orange Free State
	B. Sc (Hons) Zoology, 1991 University of the Orange Free State
	Management Course, 1991 University of the Orange Free State
	M. Sc. *Cum laude* (Zoology), 2009 University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

MEMBERSHIP
Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–2022

TECHNICAL REPORTS

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Butler, E. 2018. Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.

Butler, E. 2018. Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.

Butler, E. 2018. Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.

Butler, E. 2018. Palaeontological Field Assessment for the proposed re-alignment and de-commissioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

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Butler, E. 2018. Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.

Butler, E. 2018. Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.

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Butler, E. 2018. Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province. Bloemfontein.

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Butler, E. 2018. Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein.
Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of a new 11kV (1.3km) Power Line to supply electricity to a cell tower on farm 215 near Delportshoop in the Northern Cape. Bloemfontein.
Butler, E. 2018. Palaeontological Field Assessment of the proposed construction of a new 22 kV single wood pole structure power line to the proposed MTN tower, near Britstown, Northern Cape Province. Bloemfontein.
Butler, E. 2018. Palaeontological Exemption Letter for the proposed reclamation and reprocessing of the City Deep Dumps in Johannesburg, Gauteng Province. Bloemfontein.

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Butler, E. 2018. Proposed Kalabasfontein Mine Extension project, near Bethal, Govan Mbeki District Municipality, Mpumalanga. Bloemfontein.

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Butler, E. 2018. Environmental Impact Assessment (EIA) for the Proposed 325mw Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in the Northern Cape Province.

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Butler, E., 2019. Recommended Exemption from further Palaeontological Studies for Proposed formalisation of Gamakor and Noodkamp low-cost Housing Development, Keimoes, Gordonia Rd, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

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Butler, E., 2019. Palaeontological Desktop Assessment of The Expansion of The Jan Kempdorp Cemetery on Portion 43 Of Farm Guldenskat 36-Hn, Northern Cape Province

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Butler, E., 2019. Palaeontological Impact Assessment of the proposed new Township Development, Lethabo Park, on Remainder of Farm Roodepan No 70, Erf 17725 And Erf 15089, Roodepan Kimberley, Sol Plaatjies Local Municipality, Frances Baard District Municipality, Northern Cape

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Butler. E., 2022.Palaeontological Desktop Assessment to assess the proposed Dominion 3 Solar Park, located on the Remaining Extent of Portion 11 of Farm 425, and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province

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Butler. E., 2022. Palaeontological Impact Assessment for the Proposed Power Line as part of the Paleso Solar Power Plant near Viljoenskroon in the Free State

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APPENDIX 3: Heritage Screening Assessment

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HERITAGE SCREENER

CTS Reference Number:	**CTS23_039**
SAHRIS Ref	
Client:	**Environamics**
Date:	**March 2023**
Title:	**Proposed development of the Pluto PV Facility Cluster and Grid Connection near Roodepoort, Gauteng**

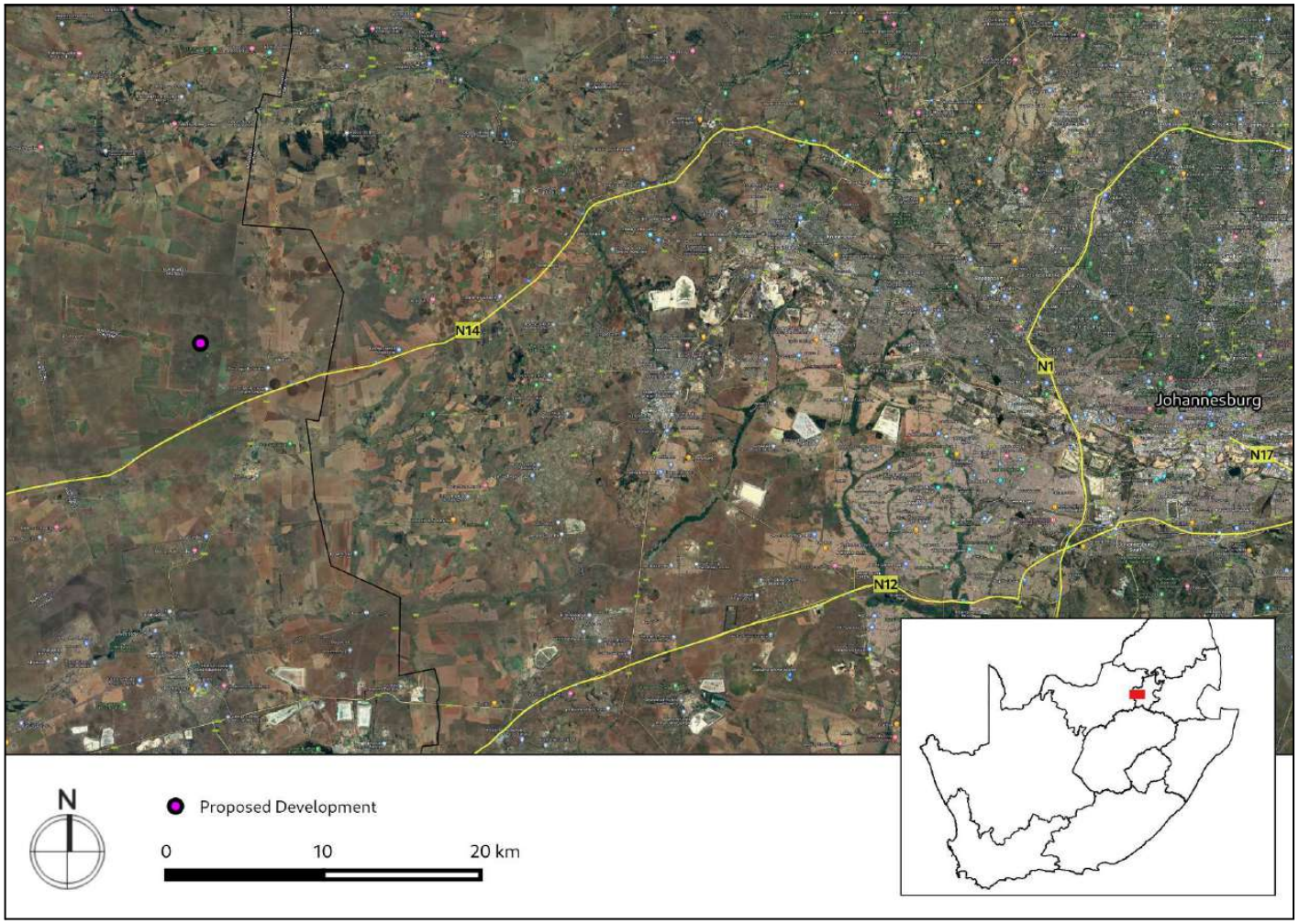

Figure 1a. Satellite map indicating the location of Oribi Solar PV Energy Facility in the Gauteng Province

Recommendation:	**RECOMMENDATION** **The area proposed for development is located in an area of high archaeological and palaeontological sensitivity. It is recommended that a full HIA be undertaken to assess the impacts likely to result from the proposed development of the PV facility and associated grid connections.**

CTS HERITAGE

1. Proposed Development Summary

This application is for the proposed development of four 250MW solar energy facilities and their grid connection infrastructure located approximately 17km north of Carltonville in the Gauteng Province. The four projects assessed in this report are:

- Angus SPP proposed by Angus Solar Power Plant (RF) (Pty) Ltd
- Bonsmara SPP proposed by Bonsmara Solar Power Plant (RF) (Pty) Ltd
- Simbra SPP proposed by Simbra Solar Power Plant (RF) (Pty) Ltd
- Tuli SPP proposed by Tuli Solar Power Plant (RF) (Pty) Ltd

2. Application References

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

3. Property Information

Latitude / Longitude	26° 9'24.59"S 27°23'46.55"E
Erf number / Farm number	Farm Leeuwpan 697
Local Municipality	Merafong Local Municipality
District Municipality	West Rand District Municipality
Province	Gauteng
Current Use	Agriculture
Current Zoning	Agriculture

4. Nature of the Proposed Development

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

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

TBA

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

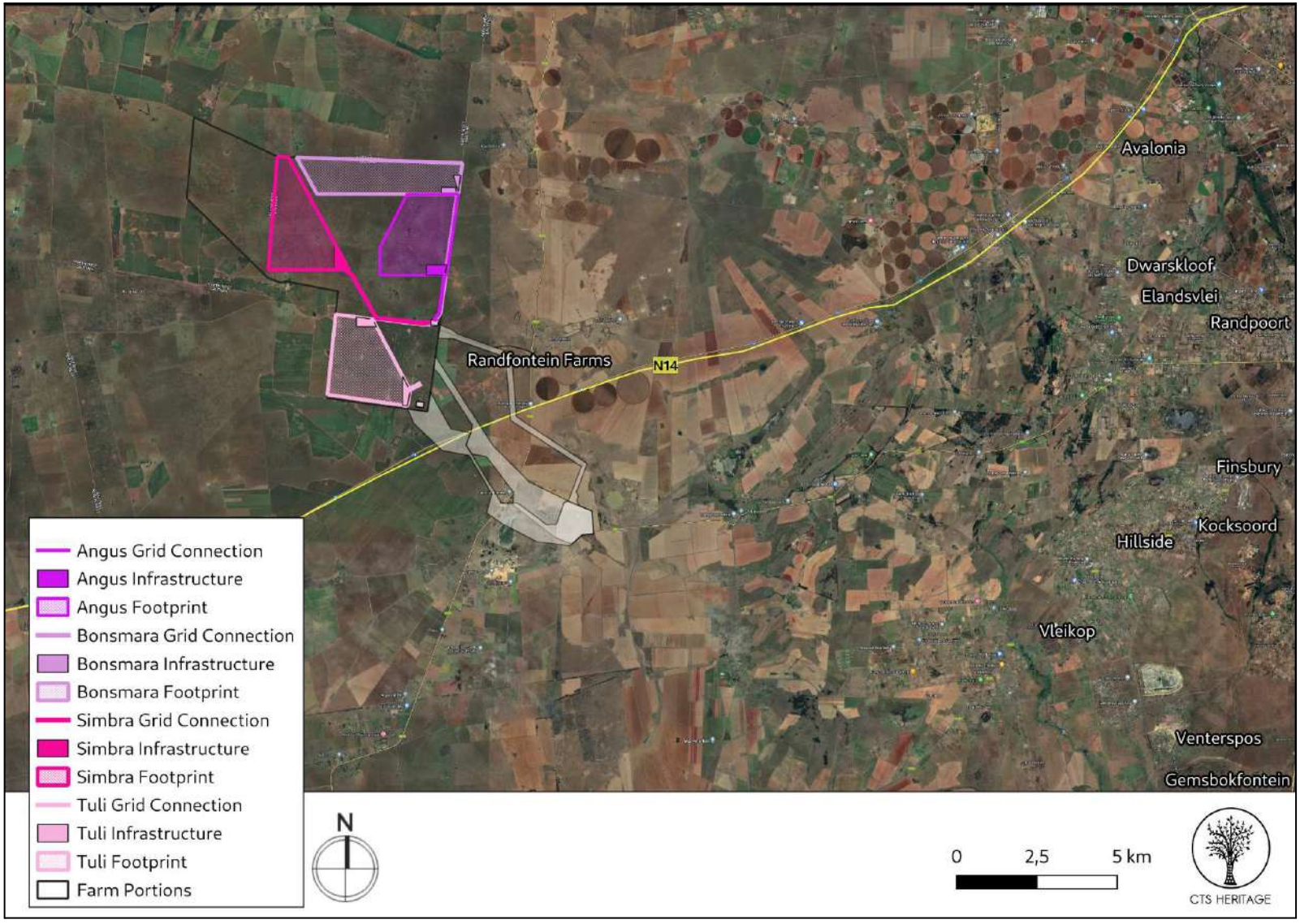

Figure 1b Overview Map. Satellite image (2022) indicating the proposed development area.

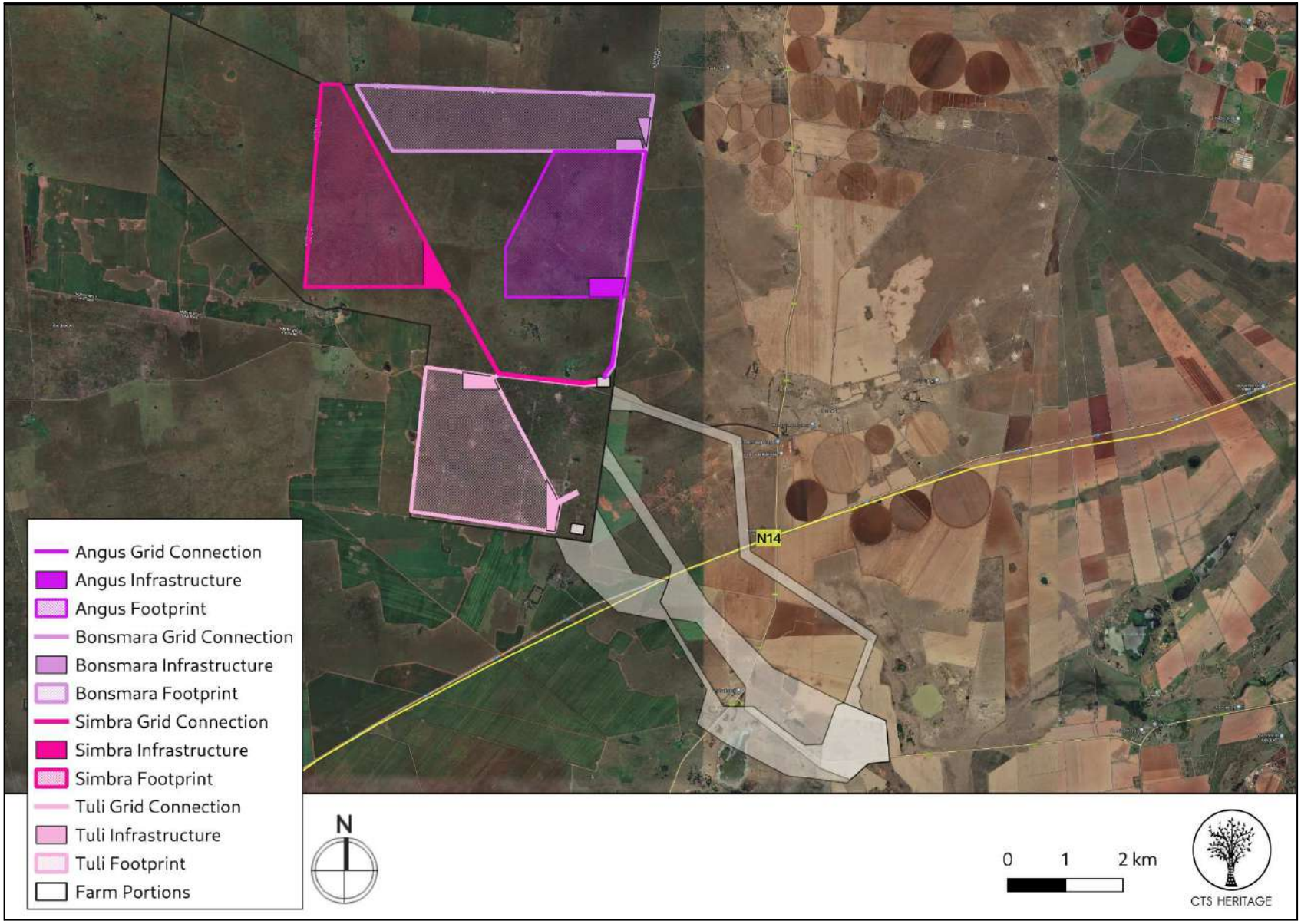

Figure 1c Overview Map. Satellite image (2022) indicating the proposed development area, close up.

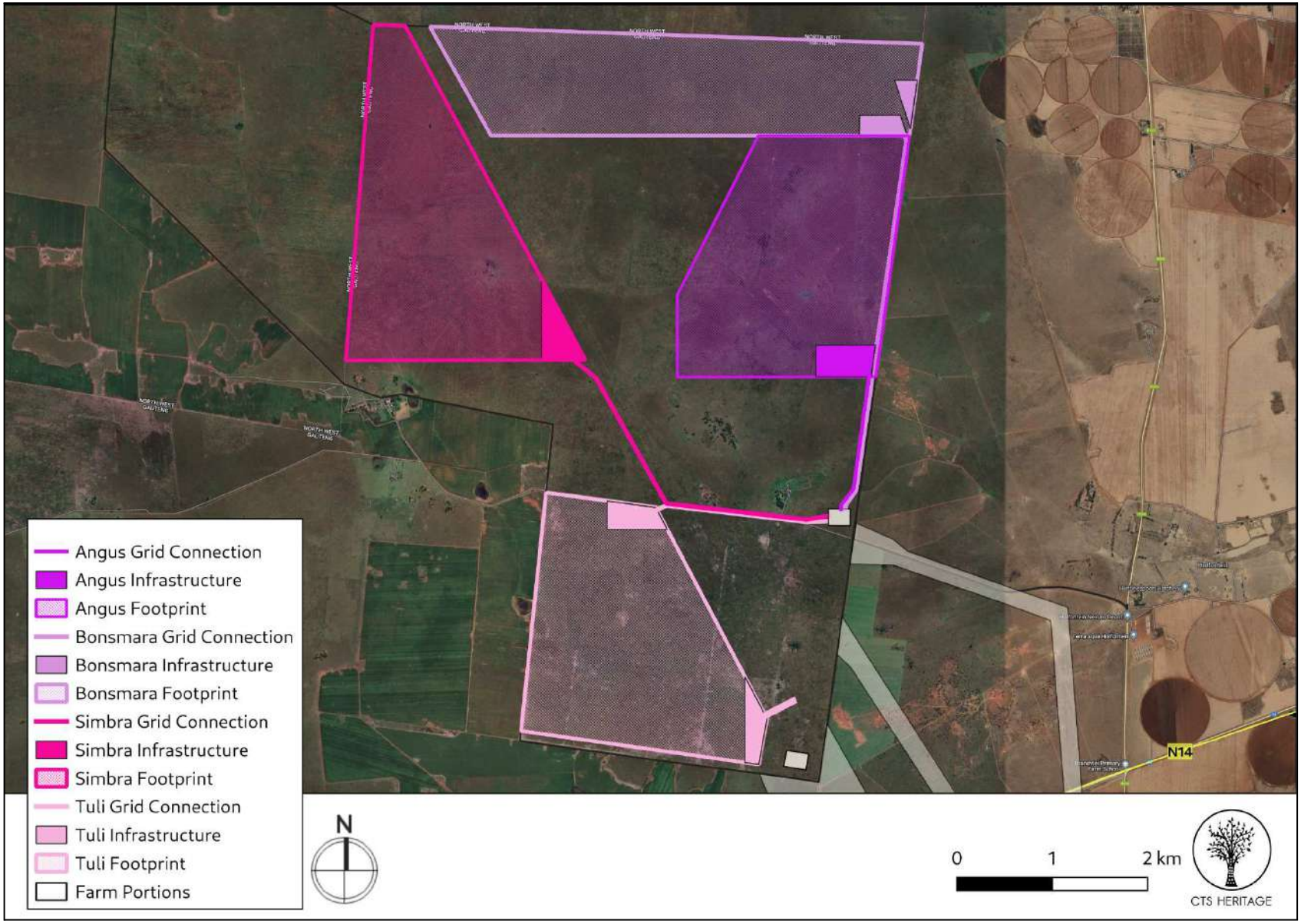

Figure 1d Overview Map. Satellite image (2022) indicating the proposed development area, close up.

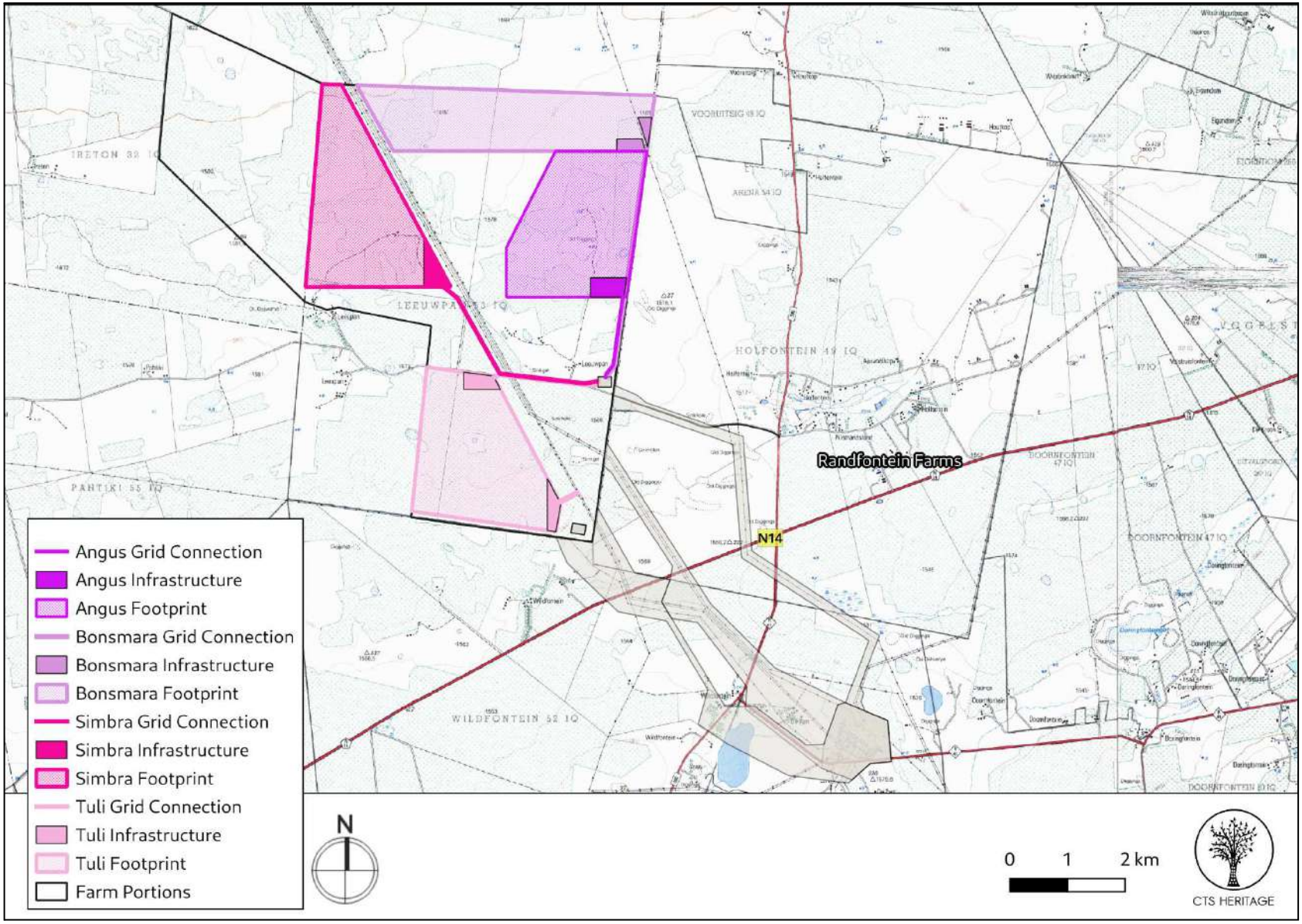

Figure 1e Overview Map. Extract from the 1:50 000 Topo map for the development area.

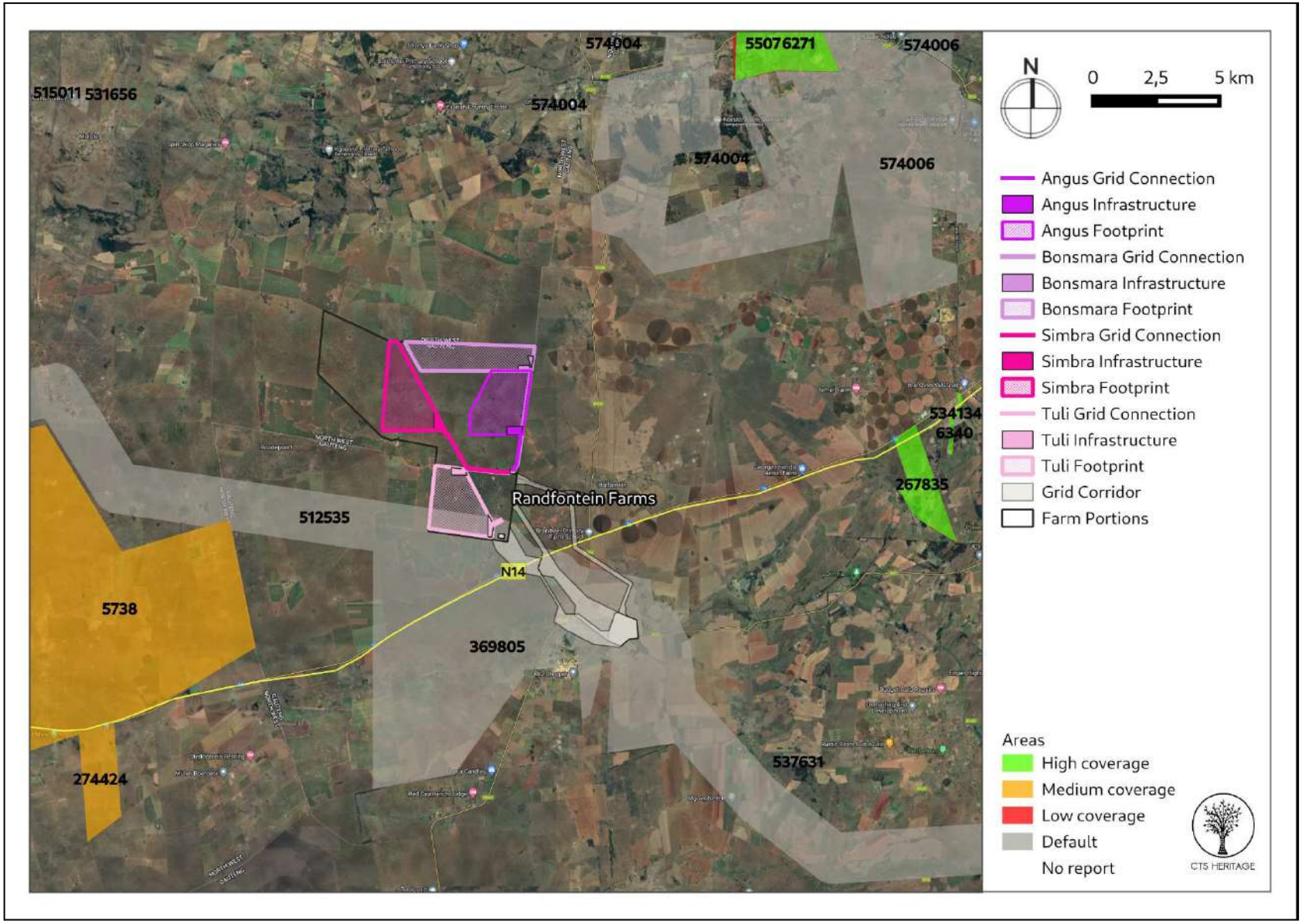

Figure 2. Previous HIAs Map. Previous Heritage Impact Assessments surrounding the proposed development area within 15km, with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

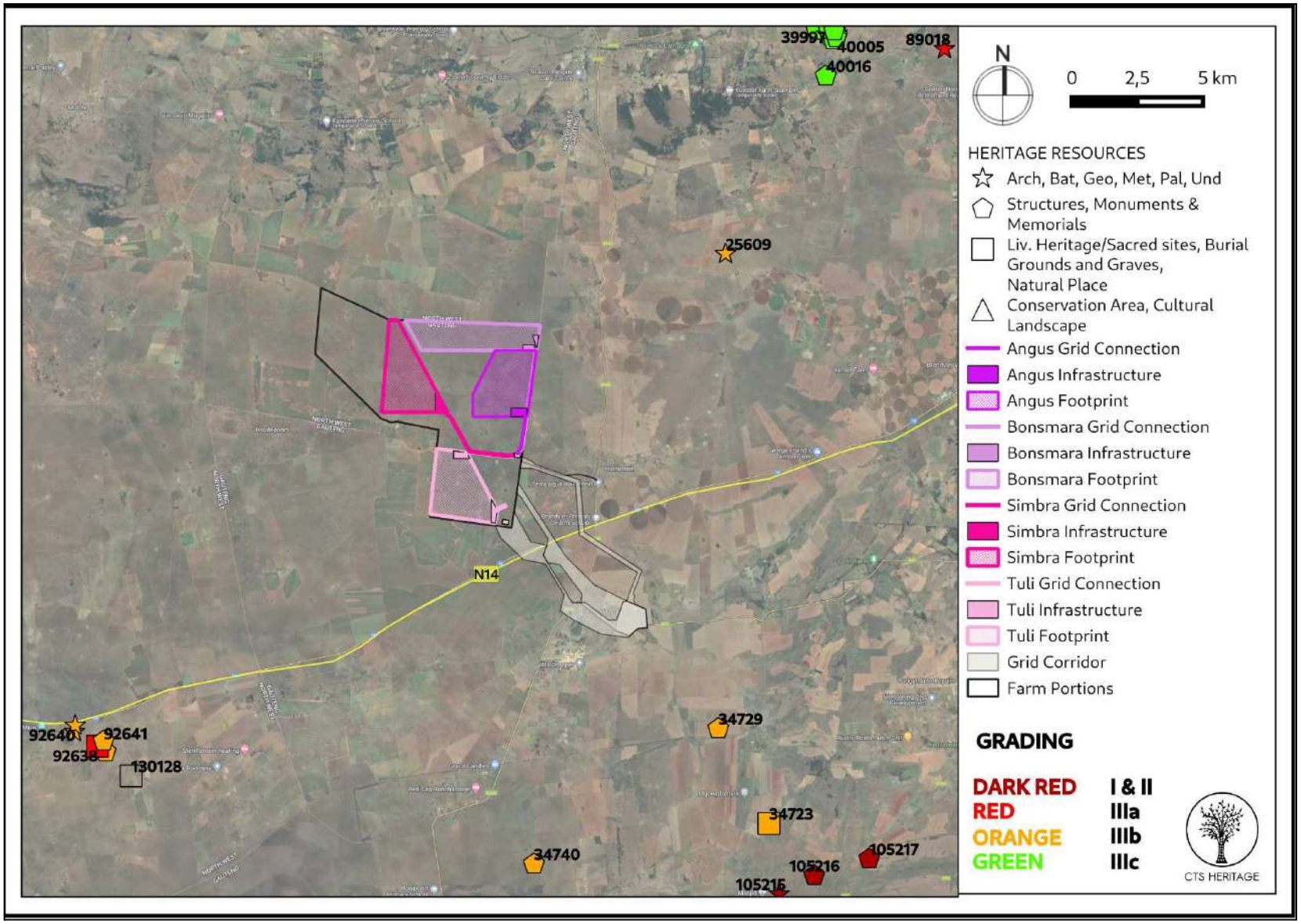

Figure 3. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated within 10km. Please See Appendix 4 for full description of heritage resource types.

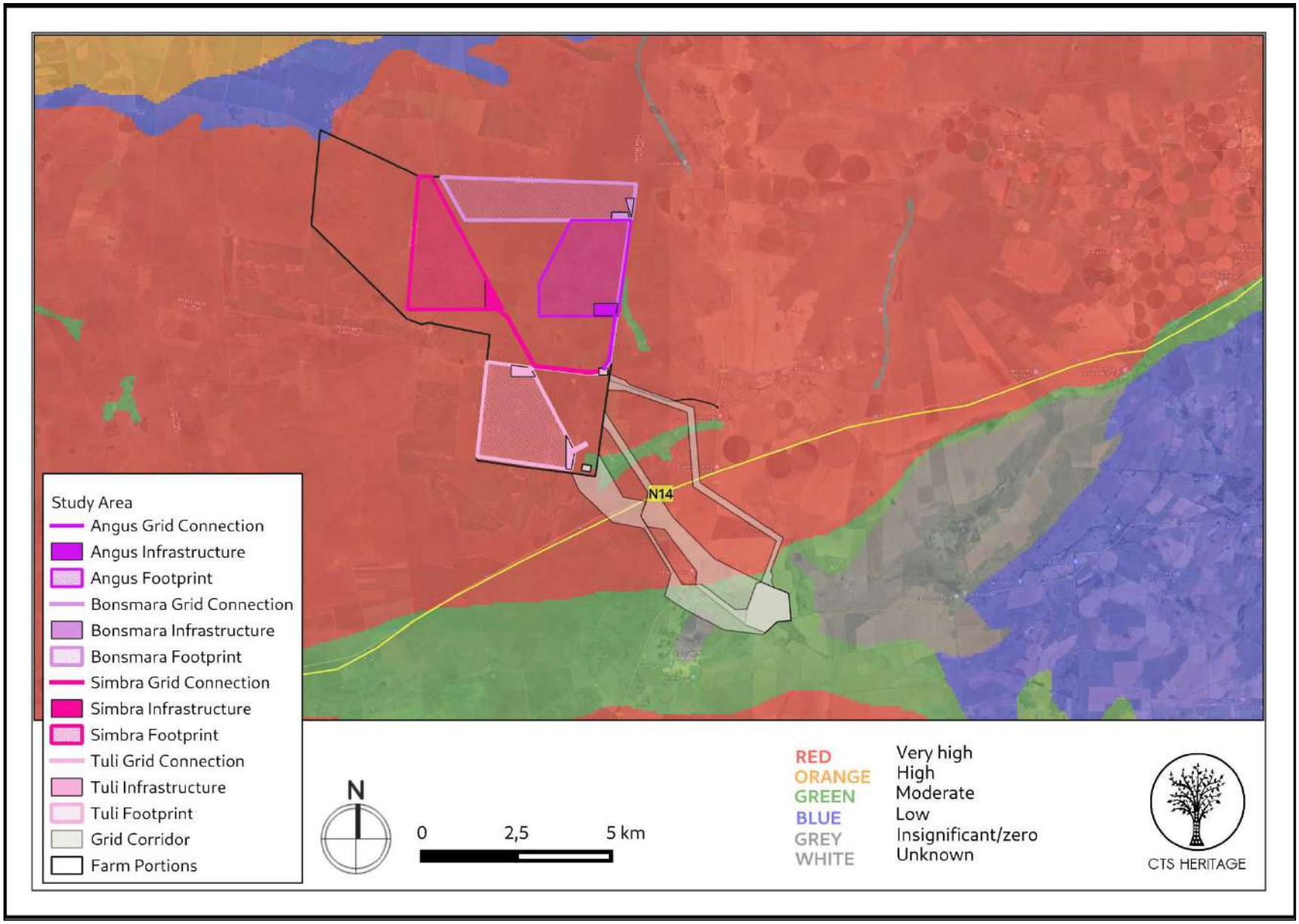

Figure 4.1. Palaeosensitivity Map. Indicating very high fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

Figure 4.2. Geology Map. Extract from the CGS Map 2626 for West Rand indicating that the development area is underlain by Vmd: Malmani Subgroup sediments of the Chuniespoort Group

8. Heritage Assessment

The area proposed for development is located approximately 20km north of Carltonville within the Merafong Municipality. Carltonville was developed by various mining companies from 1937 onwards, but was not officially incorporated until 1959, and was subsequently recognised as a provincial town in 1967. Surrounding Carltonville are a number of privately owned gold-mining township villages and contractor labour quarters established by the mining companies on land owned by the mines. The area surrounding Carltonville is dominated by a cultural landscape that is shaped and defined by the historic and on-going mining activities associated with the Witwatersrand. A detailed archaeological background of the area is provided by Du Pisanie and Nel (2012, SAHRIS NID 104305) and is therefore not repeated here. It is sufficient to note that no significant Early, Middle or Later Stone Age sites are known from this broader area, however sites representing the Iron Age occupation of the region are present in the broader context.

Birkholtz and Groenewald (2016, SAHRIS NID 369805) completed an HIA on a property located immediately south of the area proposed for development. They describe the broader areas as “The overall study area can be described as generally undulating with a number of extensive pans located within this area… While the overall study area is mostly utilised for agricultural activities, the proposed development bulk sample area that was assessed in the field is characterised by agricultural fields (maize), a large number of small livestock camps associated with stud farming (cattle) as well as Eskom power lines.” The N14 is an historic scenic route that runs between Ventersdorp and Pretoria and is likely based on the original wagon route used for this journey. This route is located approximately 1.5km south of the Tuli PV Footprint area. In general, for the development of PV infrastructure and its associated grid connection infrastructure, it is preferred for such development to be clustered with existing development, such as mining or residential development, in order to reduce the perception of urban and infrastructure sprawl across an otherwise agricultural landscape.

Birkholtz and Groenewald (2016) go on to note that examples of published excavated archaeological sites from the general surroundings of the study area include the Later Stone Age and Iron Age sites located along the Magaliesberg Mountains and sites of international palaeoanthropological significance such as Sterkfontein and Kromdraai, both located within the Cradle of Humankind World Heritage Site located approximately 33km north-east of the study area. Birkholtz and Groenewald (2016) note that the nearest published excavated archaeological site to the present study area is the underground cavern system known as Lepalong, that was used as shelter by the Kwena ba Modimosa ba Mmatau during the turmoil of the Difaqane/Mefaqane. According to Birkholtz and Groenewald (2016), oral histories indicate that Lepalong was occupied from 1827 into the 1830s (Reid &Lane, 2003). Lepalong is located some 25km south-west of the study area.

According to Du Pisanie and Nel (2016, SAHRIS NID 356134), “With the onset of the Transvaal and South African Wars, Gatsrand became a strategic location for British troops who occupied Potchefstroom. This region was located in close proximity to the Western Railway, which provided a tactical advantage. To exploit and protect this advantage, three blockhouses were constructed on the farms Driefontein 113 IQ and Driefontein 355 IQ. These structures were not identified during the pre-disturbance survey and it is assumed that they no longer exist. The next major event to take place in this region was the discovery of gold, which facilitated the establishment of several towns from the 1920s, an increase in population and an increase in services. Early mines established include Venterspost (1934), Libanon (1936), West Driefontein (1945), East Driefontein (1968) and later Kloof (1968). Shaped by these events and activities the study area has through time transformed into a historic mining landscape.” In their Heritage Impact Assessment located nearby, Du Pisanie and Nel (2016, SAHRIS NID 356134) identified a number of heritage resources, the majority of which were determined to be not conservation-worthy. The nature of the resources identified include burials and burial grounds (graded IIIA) as well as historic and modern farm structures. Similar resources are likely to be present within the proposed development areas.

According to the SAHRIS Palaeosensitivity Map, the Proposed Development Areas are located within areas that have variable palaeontological sensitivity but all areas have sediments that have high and very high palaeontological sensitivity. According to the extract from the Council of GeoScience Map for West Rand 2626, the very highly sensitive formations that may be impacted include the Malmani Subgroup. The Malmani Subgroup is known to preserve a range of shallow marine to intertidal stromatolites (domes, columns *etc*),

organic-walled microfossils and includes FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS such as in the Cradle of Humankind.

RECOMMENDATION

The area proposed for development is located in an area of high archaeological, palaeontological and palaeontological sensitivity. It is recommended that a full HIA be undertaken to assess the impacts likely to result from the proposed development of the PV facility and associated grid connections.

9. Impact Assessment

Table 1: Construction Phase

Specialist Study	Impact	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Archaeology	Destruction of significant archaeological heritage	Negative low impact	Negative low impact	Implement recommended buffer areas
Palaeontology	Destruction of significant palaeontological heritage	Negative low impact	Negative low impact	Implement Chance Finds Protocol
Cultural Landscape	Destruction of significant cultural landscape heritage	Negative low impact	Negative low impact	Implement VIA recommendations

Table 2: Operational Phase

Specialist Study	Impact	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Archaeology	Destruction of significant archaeological heritage	Negative low impact	Negative low impact	Implement recommended buffer areas
Palaeontology	Destruction of significant palaeontological heritage	Negative low impact	Negative low impact	Implement Chance Finds Protocol
Cultural Landscape	Destruction of significant cultural landscape heritage	Negative low impact	Negative low impact	Implement VIA recommendations

Table 3: Decommissioning Phase

Specialist Study	Impact	PRE-MITIGATION RATING	POST MITIGATION RATING	SUMMARY OF MITIGATION MEASURES
Archaeology	Destruction of significant archaeological heritage	Negative low impact	Negative low impact	Implement recommended buffer areas

Palaeontology	Destruction of significant palaeontological heritage	Negative low impact	Negative low impact	Implement Chance Finds Protocol
Cultural Landscape	Destruction of significant cultural landscape heritage	Negative low impact	Negative low impact	Implement VIA recommendations

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APPENDIX 1: List of heritage resources in proximity to the development area

Site ID	Site no	Full Site Name	Site Type	Grading
25609	ZF-01	Zandfontein 380 JQ	Settlement	Grade IIIb
44442	ZUIK-STEEN11	Zuikerboschfontein-Steenekoppie 11	Structures	Grade IIIb
44443	ZUIK-STEEN12	Zuikerboschfontein-Steenekoppie 12	Archaeological	Grade IIIa
39996	BLAUW01	Blauwbank 01	Artefacts, Archaeological	Grade IIIc
39997	BLAUW02	Blauwbank 02	Structures	Grade IIIc
39998	BLAUW03	Blauwbank 03	Stone walling	Grade IIIc
39999	BLAUW04	Blauwbank 04	Structures	Grade IIIc
40000	BLAUW05	Blauwbank 05	Structures	Grade IIIc
40001	BLAUW06	Blauwbank 06	Stone walling	Grade IIIc
40002	BLAUW07	Blauwbank 07	Structures	Grade IIIc
40003	BLAUW08	Blauwbank 08	Structures	Grade IIIc
40004	BLAUW09	Blauwbank 09	Archaeological	Grade IIIc
40005	BLAUW010	Blauwbank 010	Structures	Grade IIIc
40013	BLAUW011	Blauwbank011	Structures	Grade IIIc
40014	BLAUW012	Blauwbank012	Structures	Grade IIIc
40015	BLAUW013	Blauwbank013	Structures	Grade IIIc
40016	BLAUW014	Blauwbank014	Structures	Grade IIIc

40017	BLAUW015	Blauwbank015	Structures	Grade IIIc
34729	GKD006	Geluksdal 006	Building	Grade IIIb
34740	GKD013	Geluksdal 013	Building	Grade IIIb
34723	GKD001	Geluksdal 001	Burial Grounds & Graves	Grade IIIb
105215	NZASM_SWL_051	Water tower at Bank Station	Artefacts	Grade II
105216	NZASM_SWL_052	Wonderfonteinspruit Bridge	Bridge	Grade II
105217	NZASM_SWL_053	Culvert at Kocksrust AH	Transport infrastructure	Grade II
92637	Rooipan 02	Rooipan96/02	Building	Grade IIIb
92638	Rooipan 03	Rooipan96/03	Burial Grounds & Graves	Grade IIIa
92639	Rooipan 04	Rooipan96/04	Artefacts	Grade IIIb
92640	Rooipan 05	Rooipan96/05	Artefacts	Grade IIIb
92641	Rooipan 01	Rooipan96/01	Building	Grade IIIb
130128	2724DA/ Electrical Infrastructure/ Farm Wildfontein/ Site 1	Burial site	Burial Grounds & Graves	Ungraded

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APPENDIX 2: Reference List

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
267835	HIA Phase 1	Stephan Gaigher	29/10/2014	HIA for the proposed Vogelstruisfontein Sand Mine
274424	AIA Phase 1	Jaco van der Walt	04/06/2015	Heritage Opinion For the Proposed Prospecting Activities on the farm Rooipan 96 IQ, Ventersdorp, North West Province.
332672	AIA Phase 1	Eric Ndivhuho Mathoho	04/03/2015	Archaeological Impact Assessment for proposed development of Magalies Cemetery and Waste Transfer Station, Portion 22 of the farm Rietpoort 395JQ, Mogale City Local Municipality, Gauteng Province
369805	Heritage Impact Assessment Specialist Reports	Polke Birkholtz, Gideon Groenewald	11/08/2016	ENVIRONMENTAL MANAGEMENT PLAN AMENDMENT FOR THE PROPOSED APPLICATION TO AMEND THE APPROVED PROSPECTING RIGHT WORK PROGRAMME FOR THE BULK SAMPLING AREA OF THE RECENT PLACER PROJECT, ON THE FARMS WILDFONTEIN 52 IQ AND DE PAN 51 IQ, MERAFONG CITY LOCAL MUNICIPALITY, RANDFONTEIN MAGISTERIAL DISTRICT, GAUTENG PROVINCE
5118	AIA Phase 1	Johnny Van Schalkwyk	01/02/2008	Heritage Survey Report for the Development of Water Pipelines for the Droogeheuvel and Middelvlei Townships, Randfontein, Gauteng Province
5507	AIA Phase 1	Udo Kusel	01/11/2005	Cultural Heritage Resources Impact Assessment of the Farm Zuikerboschfontein 151 IQ and Portion 10 (Portion of Portion 8) of the Farm Steenekoppie 153 IQ Magaliesburg
5523	AIA Phase 1	Polke Birkholtz	08/04/2003	Cultural Heritage Assessment as Part of the EMP Report for the Proposed Impafa/Pamodzi OpenCape Archaeological Survey CCt Gold Mine on the Farm Middelvlei 255 IQ
5738	AIA Phase 1	Cobus Dreyer	04/03/2006	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Developments at the Farms Bovenste Oog 68 IQ (Mooi River), Digby Plain 63 IQ, Sommerville 62 IQ, Preston Pans 59 IQ and Dryland 64 IQ, Ventersdorp, North West Province
6271	AIA Phase 1	Wouter Fourie, M Ramsden	01/08/2002	Blaauwbank Historic Gold Mine, Magaliesberg: Cultural Heritage Scoping
6340	AIA Phase 1	Wouter Fourie, Jaco	08/12/2005	Portion of the Proposed Pipeline from Brandvlei to Krugersdorp on the Farm Brandvlei 261 IQ, District Mogale

		van der Walt		City, Gauteng Province
104305	AIA Phase 1	Justin du Piesanie, Johan Nel	01/05/2012	Phase 1 Heritage Impact Assessment of the proposed Geluksdal Tailings Storage Facility and Pipeline Infrastructure
356134	Heritage Impact Assessment Specialist Reports	Justin du Piesanie, Johan Nel	13/01/2016	Environmental Impact Assessment for Sibanye Gold Limited's West Rand Tailings Retreatment Project - Heritage Impact Assessment

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APPENDIX 3 - Keys/Guides

Key/Guide to Acronyms

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

Full guide to Palaeosensitivity Map legend

	RED:	VERY HIGH - field assessment and protocol for finds is required
	ORANGE/YELLOW:	HIGH - desktop study is required and based on the outcome of the desktop study, a field assessment is likely
	GREEN:	MODERATE - desktop study is required
	BLUE/PURPLE:	LOW - no palaeontological studies are required however a protocol for chance finds is required
	GREY:	INSIGNIFICANT/ZERO - no palaeontological studies are required
	WHITE/CLEAR:	UNKNOWN - these areas will require a minimum of a desktop study.

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APPENDIX 4 - Methodology

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

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

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

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

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

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

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

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

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

DETERMINATION OF THE PALAEONTOLOGICAL SENSITIVITY

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

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

DETERMINATION OF THE COVERAGE RATING ASCRIBED TO A REPORT POLYGON

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

Low coverage will be used for:

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

Medium coverage will be used for

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

High coverage will be used for

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

RECOMMENDATION GUIDE

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

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

This recommendation is made when:

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

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

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

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

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

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

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

APPENDIX 5 -Summary of Specialist Expertise

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

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

Since 2016, Jenna has drafted over 70 Heritage Impact Assessments throughout South Africa.

CTS HERITAGE

APPENDIX 4: Project Technical Information

PROJECT DESCRIPTION DOCUMENT:

15 August 2023

THE DEVELOPMENT OF ANGUS SOLAR POWER PLANT NEAR CARLETONVILLE, GAUTENG PROVINCE

ENVIRONAMICS

PROJECT DETAIL

DFFE Reference No's. : 14/12/16/3/3/2/2351

Project Title : The Development of the Angus Solar Power Plant, near Carletonville, Gauteng Province

Authors : Ms. Christia van Dyk
Ms. Mary-Jane Khanyile

Client : Angus Solar Power Plant (RF) (Pty) Ltd

Report Status : Project Description Document: Technical Details

Submission date : 15 August 2023

When used as a reference this report should be cited as: Environamics (2023). Project Description Document: The Development of the Angus Solar Power Plant near Carletonville, Gauteng Province

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1 INTRODUCTION

This document provides the technical details of the project description for the proposed Angus Solar Power Plant to be assessed and considered as part of the Scoping and EIA processes.

1.1 PROJECT SCHEDULE

Table 1.1 provides a summary of the EIA process and future steps to be taken. It is envisaged that the EIA process should be completed by March 2024.

Table 1.1: Project schedule

Activity	Prescribed timeframe	Timeframe
Site visits	-	February 2023
Public participation (BID)	30 Days	March – April 2023
Conduct specialist studies	2 Months	Feb. – Apr. 2023
Submit application form and DSR	-	May 2023
Public participation (DSR)	30	May – June 2023
Submit FSR	44	June 2023
Approval of Final Scoping Report	43 Days	August 2023
Submit Draft EIR & EMPr	106 Days	31 August 2023
Public participation (DEIR)	30 Days	Aug. – Sept.
Submission of FEIR & EMPr	-	September 2023
Decision	107 Days	February 2024
Public participation (decision) & submission of appeals	20 Days	Feb. – Mar. 2024

2 TECHNICAL DETAILS

This section aims to provide a description of the technical details of the proposed project.

2.1 ANGUS SOLAR POWER PLANT

2.1.1 The location of the activity and property description

Table 2.1: General site information

Description of affected farm portion	Solar Power Plant: Farm Leeuwpan No. 697 Grid Connection Corridor: Portion 87 of the Farm De Pan 51; Portion 88 of the Farm De Pan 51; The Remaining Extent of the Farm De Pan 51; Portion 5 of the Farm De Pan 5; Portion 90 of the Farm De Pan 51 ; Portion 1 of the Farm De Pan 51; Portion 100 of the Farm Wildfontein No. 52 ; Portion 34 of the Farm Holfontein No. 49 ;
Province	Gauteng
District Municipality	West Rand District Municipality
Local Municipality	Merafong City Local Municipality
Ward numbers	1
Closest towns	Carletonville is located approximately 17km south of the proposed development.
21 Digit Surveyor General codes	Solar Power Plant: Farm Leeuwpan No. 697

	T0IQ00000000069700000 <u>Grid Connection Corridor:</u> Portion 87 of the Farm De Pan 51 T0IQ00000000005100087 Portion 88 of the Farm De Pan 51 T0IQ00000000005100088 The Remaining Extent of the Farm De Pan 51 T0IQ00000000005100000 Portion 5 of the Farm De Pan 5 T0IQ00000000005100005 Portion 90 of the Farm De Pan 51 T0IQ00000000005100090 Portion 1 of the Farm De Pan 51 T0IQ00000000005100001 Portion 100 of the Farm Wildfontein No. 52 T0IQ00000000005200100 Portion 34 of the Farm Holfontein No. 49 T0IQ00000000004900034
Type of technology	Photovoltaic solar facility
Structure Height	Panels ~ 6m; Buildings ~ 6m; Power line ~ 32m; and Battery storage facility ~ 8m.
Battery storage	Within a 4-hectare area of the infrastructure and ancillary complex
Surface area to be covered (Development footprint)	Approximately 500 ha
EIA footprint	Assessed 4272 ha

Structure orientation	The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is in order to capture the most sun.
Generation capacity	Up to 250MW

2.1.2 Technical details

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e. semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - To produce up to 250MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the yield.

- Wiring to Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV and higher. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into the step-up transformers to 132kV. An onsite substation will be required to step the voltage up to 132kV, after which the power will be evacuated into a new proposed collector substation to step the voltage up from 132KV to 275/400KV in order to evacuate the power into the national grid at the same voltage level

as the MTS via the proposed 132/275/400KV power line. Whilst Angus Solar Power Plant (RF) (Pty) Ltd has not yet received a cost estimate letter from Eskom, it is expected that generation from the facility will tie in with a newly proposed collector substation Generation from the facility will tie in with the on-site step up and switching substation that will be connected to a newly proposed collector substation, the collector substation will be connected to a newly proposed MTS to be connected to the existing Pluto 400/275/22kV MTS. The connection power line will be constructed within the limits of the grid connection corridor. The project will generate up to 250MW of electricity. Refer to the Figure below.

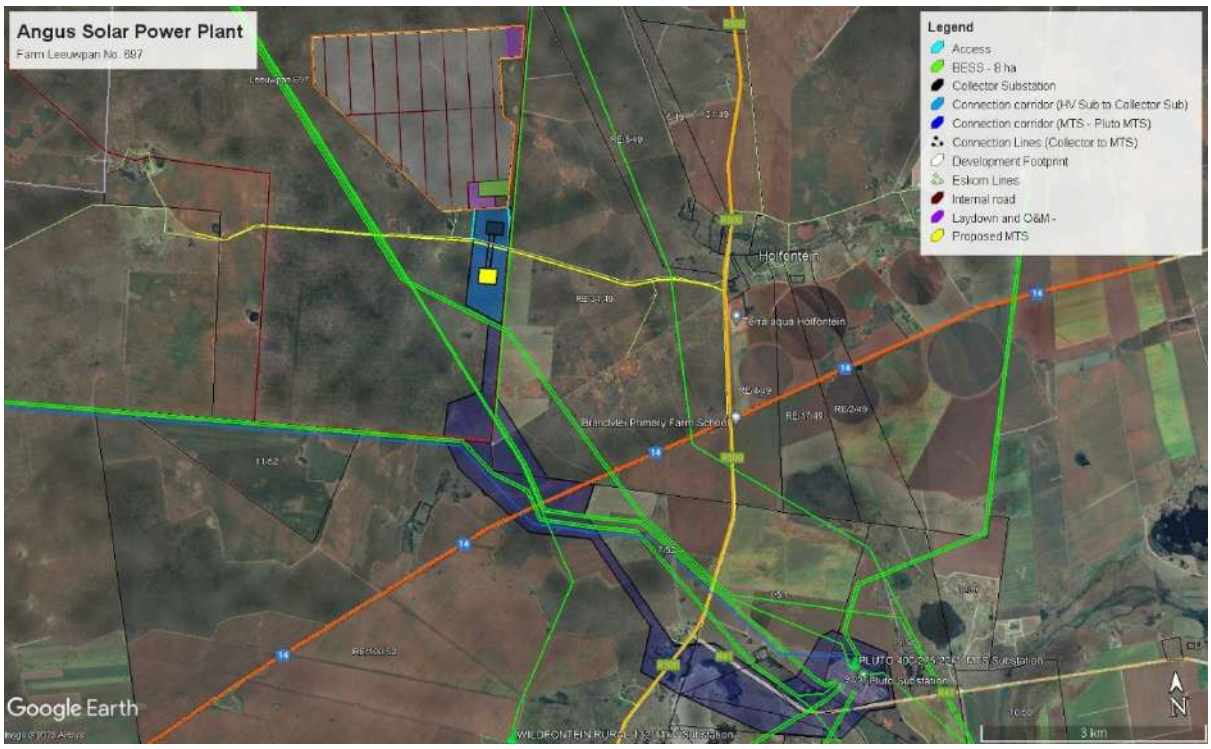

Figure 2-1: Angus SPP powerline corridor and grid connection infrastructure.

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4m underground as far as practically possible.
- Supporting Infrastructure – All associated infrastructure will be constructed within the limits of the infrastructure and ancillary complex which will include an on-site substation, Battery Energy Storage System, Operations and Maintenance buildings etc.
- Battery storage – A Battery Storage Facility with a maximum height of 8m and a maximum volume of 1,740 m^3 of batteries and associated operational, safety and control infrastructure.

- Roads – Access will be obtained via a public gravel road off of the R500 regional road to the east of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.

Table 2.2: Technical details for the proposed facility

Component	Description / dimensions
Height of PV panels	6 meters
Area of PV Array	500 Hectares (Development footprint)
Number of inverters required	Minimum 50
Area occupied by inverter / transformer stations / substations / BESS	All associated infrastructure will be constructed within the limits of the infrastructure and ancillary complex. On site Substation: 2.4 ha Collector Substation: 4 ha BESS: 8 ha Central inverters + LV/MV trafo: 750 m^2
Capacity of on-site substation	On-site substation: 33/132 kV Collector substation: 132KV MTS: 132/275/400KV
Capacity of the power line	132/275/400 KV
Area occupied by both permanent and construction laydown areas	Permanent project area: 500 Hectares Construction laydown area: ~20 ha
Area occupied by buildings	Infrastructure & Ancillary Complex: 19.3 ha
Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3 Capacity ~up to 500MWh
Length of access roads	3 km
Width of access roads	8 m – 10 m
Length of internal roads	18.01 km
Width of internal roads	4 m – 6 m
Length of perimeter roads	9.65 km
Width of perimeter roads	6 m – 8 m
Grid connection corridor width	102 m up to 1.4 km
Grid connection corridor length	Approximately 10 km
Power line servitude width	132KV line – 31 m 275KV line – 47 m 400KV line – 55 m
Height of power line	132KV line – 32 m 275KV line – 32 m 400KV line – 40 m
Height of fencing	Approximately 2.5 m

2.1.3 Consideration of alternatives

The DEAT 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single preferred project proposal. An initial site assessment was conducted by the developer the affected properties and the farm portions were found favorable due to its proximity to grid connections, solar radiation, ecology and relative flat terrain. These factors were then taken into consideration and avoided as far as possible.

The following alternatives were considered in relation to the proposed activity and all specialists should also make mention of these:

No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facility and the supporting social and economic development in the area would be lost if the status quo persist.

Location alternatives

No other possible sites were identified on the Farm Leeuwpan No. 697. This site is referred to as the preferred site. Some limited sensitive features occur on the site. The size of the site makes provision for the exclusion of any sensitive environmental features that may arise through the EIA proses.

Technical alternatives: Powerlines

It is expected that generation from the facility will tie in with the on-site step up and switching substation that will be connected to a newly proposed collector substation, the collector substation will be connected to a newly proposed MTS to be connected to the existing Pluto 400/275/22kV MTS.

The connection power line will be constructed within the limits of the grid connection corridor.

Battery storage facility

It is proposed that a nominal up to 500 MWh Battery Storage Facility for grid storage would be housed in stacked containers, or multi-storey building, with a maximum height of 8m and a maximum volume of 1,740m^3 of batteries and associated operational, safety and control infrastructure. Three types of battery technologies are being considered for the proposed project: Lithium-ion, Sodium-sulphur or Vanadium Redox flow battery. The preferred battery technology is Lithium-ion.

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

Design and layout alternatives

Design alternatives will be considered throughout the planning and design phase and specialist studies are expected to inform the final layout of the proposed development.

Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon (Mono-facial and Bi-facial) and thin film. The technology that (at this stage) proves more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability. However, due to the rapid technological advances being made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

3 LEGAL MADATE

3.1 LEGAL MANDATE AND PURPOSE OF THE REPORT

The National Environmental Management Act identifies listed activities (in terms of Section 24) which are likely to have an impact on the environment. These activities cannot commence without obtaining an EA from the relevant competent authority. Sufficient information is required by the competent authority to make an informed decision and the project is therefore subject to an environmental assessment process which can be either a Basic Assessment Process or a full Scoping and Environmental Impact Assessment process.

The EIA Regulations No. 324, 325, and 327 outline the activities that may be triggered and therefore require EA. The following listed activities with special reference to the proposed development is triggered:

Table 3.3: Listed activities (SPPs)

Relevant notice:	**Activity No (s)**	**Description of each listed activity as per project description**:
GNR. 327 (as amended in 2017)	Activity 11(i)	• *"The development of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."* • Activity 11(i) is triggered as the proposed photovoltaic solar facility will transmit and distribute electricity of 132 kilovolts outside an urban area.
GNR. 327 (as amended in 2017)	Activity 28(ii)	• *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."*

		• Activity 28(ii) is triggered as portions of the affected farm has been previously used for grazing and the property will be re-zoned to "special" use.
GNR. 327 (as amended in 2017)	Activity 24(ii)	• *"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters;* • Activity 24(ii) is triggered as the access road will be between 8 and 10 meters in width.
GNR. 327 (as amended in 2017)	Activity 56 (ii):	• *"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres…"* • Activity 56 (ii) is triggered as the existing access to the affected property does not have a reserve and will need to be widened by more than 6 metres.
GNR. 325 (as amended in 2017)	Activity 1	• *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more."* • Activity 1 is triggered since the proposed photovoltaic solar facility will generate up to 250 megawatts electricity through the use of a renewable resource.
GNR. 325 (as amended in 2017)	Activity 15	• *"The clearance of an area of 20 hectares or more of indigenous vegetation."* • More than 20 hectares of indigenous vegetation will be cleared.

The activities triggered under Listing Notice 1 and 2 (Regulation 327 & 325) for the project implies that the development is considered as potentially having an impact on the environment and therefore require the implementation of appropriate mitigation

measures. The listed activities indicated above are subject to change with the input from specialists.

4 CUMMULATIVE EFFECTS ASSESSMENT

4.1 INTRODUCTION

The EIA Regulations (as amended in 2017) determine that cumulative impacts, "*in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*." Cumulative impacts can be incremental, interactive, sequential or synergistic. EIAs have traditionally failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires coordinated institutional arrangements;
- Complexity - dependent on numerous fluctuating influencing factors which may be completely independent of the controllable actions of the proponent or communities; and
- Project level investigations are ill-equipped to deal with broader biophysical, social and economic considerations.

Despite these challenges, cumulative impacts have been afforded increased attention in this Basic Assessment Report and for each impact a separate section has been added which discusses any cumulative issues, and where applicable, draws attention to other issues that may contextualise or add value to the interpretation of the impact – refer to Appendix E. This chapter analyses the proposed project's potential cumulative impacts in more detail by: (1) defining the geographic area considered for the cumulative effects analysis; (2) providing an overview of relevant past and present actions in the project vicinity that may affect cumulative impacts; (3) presenting the reasonably foreseeable actions in the geographic area of consideration; and (4) determining whether there are adverse cumulative effects associated with the resource areas analysed.

The term "Cumulative Effect" has for the purpose of this report been defined as: the summation of effects over time which can be attributed to the operation of the project itself, and the overall effects on the ecosystem of the site that can be attributed to the project and other existing and planned future projects.

4.2 GEOGRAPHIC AREA OF EVALUATION

The geographic area of evaluation is the spatial boundary in which the cumulative effects analysis was undertaken. The spatial boundary evaluated in this cumulative effects analysis generally includes an area of a 30km radius surrounding the proposed development – refer to below.

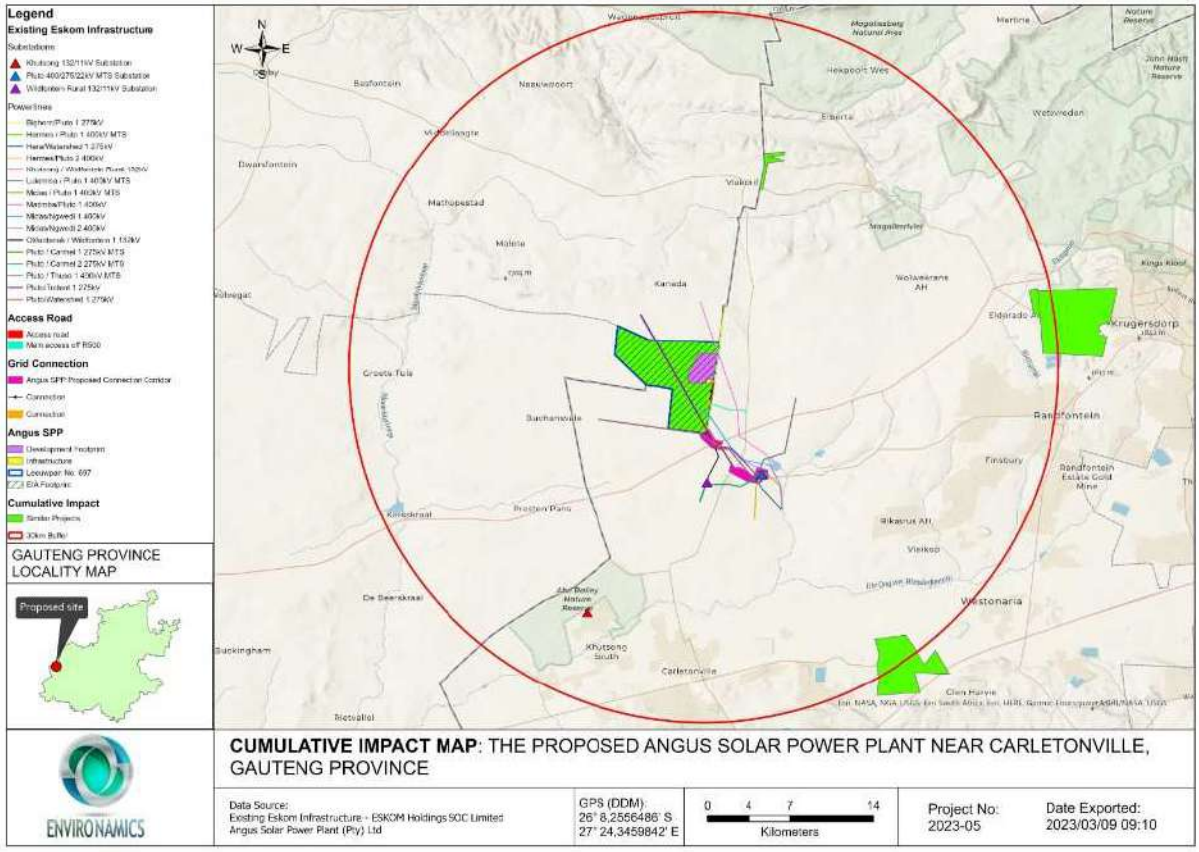

Figure 4-2: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines for the Angus Solar Power Plant.

The geographic spread of PV solar projects, administrative boundaries and any environmental features (the nature of the landscape) were considered when determining the geographic area of investigation. It was argued that a radius of 30km would generally confine the potential for cumulative effects within this particular environmental landscape. The geographic area includes projects located within the Gauteng Province. A larger geographic area may be used to analyse cumulative impacts based on the specific temporal or spatial impacts of a resource. For example, the socioeconomic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource where it differs from the general area of evaluation described above.

4.3 TEMPORAL BOUNDARY OF EVALUATION

A temporal boundary is the timeframe during which the cumulative effects are reasonably expected to occur. The temporal parameters for this cumulative effects analysis are the anticipated lifespan of the Proposed Project, beginning in 2025 and extending out at least 20 years, which is the minimum expected project life of the proposed project. Where appropriate, particular focus is on near-term cumulative impacts of overlapping construction schedules for proposed projects in the area of evaluation.

4.4 OTHER PROJECTS IN THE AREA

The following section provides details on existing and project being proposed in the geographical area of evaluation.

4.4.1 Existing projects in the area

Table 4.4: A summary of related facilities, that may have a cumulative impact, in a 30 km radius of the **Angus SPP**

Site name	Distance from study area	Proposed generating capacity	DEFF reference	EIA process	Project status
Portion 3 (Portion Of Portion 2 Of The Farm Rietpoort 395	14.5km	15 MW	12/12/20/2330	BAR	Approved
Portion 64 (A Portion Of Portion 1) Of The Farm Waterval 174	28km	25 MW	12/12/20/2537	Scoping and EIA	Approved
Portion 57 (A Portion Of Portion 1) Of The Farm Waterval 174	27.5KM	70 MW	12/12/20/2539	Scoping and EIA	In process

Portion 1, 2, 4, 5 and 6 of the Farm Uitval 280	25.6km	200 MW	14/12/16/3/3/2/919	Scoping and EIA	In process
Farm Brickvale 161	27.3km	19.9 MW	14/12/16/3/3/1/636	BAR	In process
Tuli Solar Power Plant	0km	250MW	14/12/16/3/3/2/2353	Scoping and EIA	In process
Bonsmara Solar Power Plant	0km	250MW	14/12/16/3/3/2/2352	Scoping and EIA	In process
Simbra Solar Power Plant	0km	250MW	14/12/16/3/3/2/2354	Scoping and EIA	In process

It is unclear whether other projects not related to renewable energy is or has been constructed in this area, and whether other projects are proposed. In general, development activity in the area is focused on agriculture. It is quite possible that future solar farm development may take place within the general area.

***It is important that each specialist consider the possible cumulative impacts that the project could have if all the projects within the geographical area where to be approved.*

5 ASSESSMENT METHODOLOGY

5.1 METHOD OF ENVIRONMENTAL ASSESSMENT

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site,

local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 5.1.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

5.1.1 Impact Rating System

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 5.5: The rating system

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.

2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct

		human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon		

completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.

4	High cumulative impact	The impact would result in significant cumulative effects

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could

		be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

***Each specialist should use the rating system supplied to conduct their impact assessment.*