HERITAGE IMPACT ASSESSMENT

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

Proposed development of the Makoaneng Solar Power Plant near Bloemfontein, Free State Province

Prepared by CTS Heritage

CTS HERITAGE

Jenna Lavin

For

Solis Environmental

July 2023

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EXECUTIVE SUMMARY

1. Site Name:

Makoaneng SPP and BESS

2. Location:

Farm Nakob No. 750, Portion 1 of the farm Avondzon No. 278, Remaining Extent of the farm Selborne No. 392, Farm Buxton No. 581 and the Farm Goedehoop No. 251, situated within the Masilonyana Local Municipality area of jurisdiction.

3. Locality Plan:

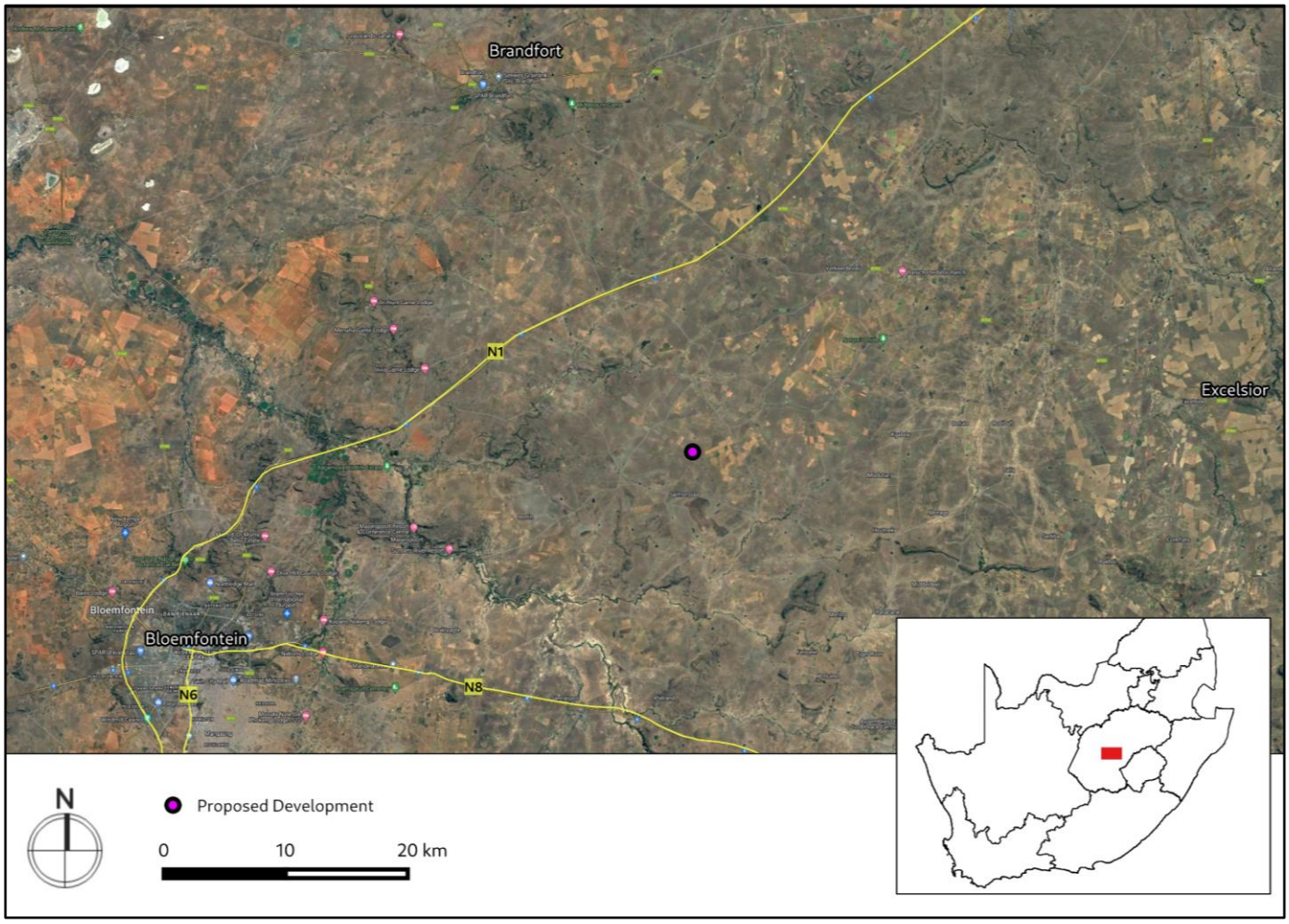

Figure A: Location of the proposed development area

4. Description of Proposed Development:

Makoaneng Solar Power Plant (RF) (Pty) Ltd intends to develop a 550 MW photovoltaic solar facility and associated infrastructure on the Farm Nakob No. 750, Portion 1 of the farm Avondzon No. 278, Remaining Extent of the farm

Selborne No. 392, Farm Buxton No. 581 and the Farm Goedehoop No. 251, situated within the Masilonyana Local Municipality area of jurisdiction. The town of Bloemfontein is located approximately 40 km southwest of the proposed development. The total footprint of the project will approximately be 844 hectares (including supporting infrastructure on site), within the assessed 1260 hectares. Two infrastructure and ancillary complexes (IAC) are proposed for the facility, infrastructure and ancillary complex 1 (IAC1) and infrastructure and ancillary complex 2 (IAC2). IAC 2 will be connected to IAC 1 via an internal connection, from where the generated electricity will be evacuated to the national grid via the existing Eskom Harvard/Merapi 1 275/22kV Existing Line. The full extent of the two Infrastructure and Ancillary complexes must be assessed for the placement of the substations and BESS.

5. Heritage Resources Identified:

Heritage Resources identified

Obs#	Description	Type	Period	Density	Latitude	Longitude	Grade	Mitigation
002	Graveyard, 7 graves. 1931 - 1993. Smit and Brown family	Graves/BurialGrounds	Historic	n/a	-28.957478	26.641703	IIIA	100m Buffer
003	Ruined stone walled farm building	Ruin	Historic	n/a	-28.956694	26.643179	IIIC	50m Buffer
004	Older part of werf, altered, with stone kraal	Structure	Historic	n/a	-28.9578	26.642961	IIIC	50m Buffer
007	Earlier ruin, stone walled oven nearby	Structure	Historic	n/a	-28.959604	26.650425	IIIC	Area to be excluded
009	Larger rectangular stone kraal	Structure	Historic	n/a	-28.961574	26.650449	IIIC	Area to be excluded
012	Stone walled pigsty	Structure	Historic	n/a	-28.982829	26.651798	IIIC	50m Buffer
013	Large stone kraal	Structure	Historic	n/a	-28.98413	26.652583	IIIC	50m Buffer
014	Goedehoop graveyard, 3A. Pretorius family, 1908-1963	Graves/BurialGrounds	Historic	n/a	-28.984523	26.654467	IIIA	100m Buffer
015	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.982425	26.656433	IIIC	Area to be excluded
016	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.982645	26.656437	IIIC	Area to be excluded
017	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.982542	26.656053	IIIC	Area to be excluded
018	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.983187	26.656577	IIIC	Area to be excluded
019	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.98333	26.655978	IIIC	Area to be excluded
021	Ruins and stone walled kraal	Ruin	Historic	n/a	-28.966562	26.613668	IIIC	50m Buffer

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, and no significant archaeological material remains were documented. The significant heritage resources identified within the development area relate to the agricultural past. Recommendations are made in Table 3 to ensure that these significant resources are not negatively impacted by the proposed development.

There are no objections on palaeontological heritage grounds. Any fossil finds, most likely in the Adelaide Subgroup sediments and Quaternary Sands, are to be reported by the developer. Should important fossil material be found during excavations, the attached Fossil Finds Procedure must be implemented (Appendix 2).

7. Recommendations:

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

- The mitigation measures detailed in Table 3 and mapped in Figures 7.1 and 7.2 are implemented. The Final Layout provided adheres to these recommendations (Figure 9)
- The attached Chance Finds Procedure must be implemented for the duration of the construction phase
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

8. Author/s and Date:

Jenna Lavin

July 2023

Details of Specialist who prepared the HIA

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

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

Since 2016, Jenna has drafted over 250 Screening and Heritage Impact Assessments throughout South Africa.

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CONTENTS

APPENDICES

1. INTRODUCTION

1.1 Background Information on Project

Makoaneng Solar Power Plant (RF) (Pty) Ltd intends to develop a 550 MW photovoltaic solar facility and associated infrastructure on the Farm Nakob No. 750, Portion 1 of the farm Avondzon No. 278, Remaining Extent of the farm Selborne No. 392, Farm Buxton No. 581 and the Farm Goedehoop No. 251, situated within the Masilonyana Local Municipality area of jurisdiction. The town of Bloemfontein is located approximately 40 km southwest of the proposed development. The total footprint of the project will approximately be 844 hectares (including supporting infrastructure on site), within the assessed 1260 hectares. Two infrastructure and ancillary complexes (IAC) are proposed for the facility, infrastructure and ancillary complex 1 (IAC1) and infrastructure and ancillary complex 2 (IAC2). IAC 2 will be connected to IAC 1 via an internal connection, from where the generated electricity will be evacuated to the national grid via the existing Eskom Harvard/Merapi 1 275/22kV Existing Line. The full extent of the two Infrastructure and Ancillary complexes must be assessed for the placement of the substations and BESS.

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 550MW, the proposed facilities 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 mounted on a single axis tracking system in order to capture the most sun.

- 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. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is approximately 480V and this is fed into step up transformers to 132kV. An onsite facility substation and switching stations will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid via the proposed power line. Generation from the facility will tie in with the existing Eskom Harvard/Merapi 1 275/22kV Existing Line. The connection power line will be constructed within the limits of the grid connection corridor. Two infrastructure and ancillary complexes (IAC) are proposed for the facility, infrastructure and ancillary

complex 1 (IAC1) and infrastructure and ancillary complex 2 (IAC2). The facility substations will be constructed within the Infrastructure and Ancillary Complexes. IAC 2 will be connected to IAC 1 via an internal connection, from where the generated electricity will be evacuated to the national grid via the existing Eskom Harvard/Merapi 1 275/22kV Existing Line. Both the internal connection corridor and the National Grid Connection corridors must be assessed for the placement of the power line. The two infrastructure and ancillary complexes (IAC) that are proposed for the facility must be fully assessed for the placement of a substation and BESS.

- 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, 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 an existing grave road off of the N1 National Road. 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 for the proposed facility

Component	Description / dimensions
Height of PV panels	6 metres
Area of PV Array	844 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. BESS: 5.5 ha Substation: 3.6 ha (IPP step-up and Eskom switching/collector) Central inverters + LV/MV trafo: 750 m^2
Capacity of on-site substation	132kV
Capacity of the power line	132kV
Area occupied by both permanent and construction laydown areas	Permanent project Area: 844 hectares Construction laydown area 1: within ~ 18 hectares Construction laydown area 2: within ~ 20 hectares
Area occupied by supporting infrastructure	Infrastructure & Ancillary Complex 1: ~ 20 hectares Infrastructure & Ancillary Complex 2: ~ 15 hectares

Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3
Length of access roads	Preferred Access Road= 15 km; Alternative/Temporary Access Road= 18 km
Width of access roads	8 m to 10 m
Length of internal roads	TBC
Width of internal roads	4 m – 6 m
Length of perimeter roads	TBC
Width of perimeter roads	6 m – 8 m
Grid connection corridor width (connection to national grid)	157 m up to 164 m
Grid connection corridor length (connection to national grid)	177 m
Internal grid connection corridor width	40 m up to 80 m in the widest sections
Internal grid connection corridor length	3,2 km
Power line servitude width	32m
Height of fencing	2.5 metres

1.2 Description of Property and Affected Environment

The Makoaneng solar project is situated about 35km northeast of Bloemfontein beyond the Maselspoort resort. The core of the study area has three werfs at Mareesrust, Gerritsrust and Selborne. Enkeldoring's werf is on the border of the northwest corner and Goedehoop borders the southeast end of the site. Most of the farming in the area is run by large agri businesses and cattle grazing areas are interspersed with soya and maize fields. Some of the werfs are in a ruined state while others are in a poor state and are currently occupied by farm workers.

The farms are accessed and connected via a series of farm roads and jeep tracks and the terrain is generally flat across the bulk of the study site. However, low hills form northeast of the project near Rietfontein farm and the Osspruit river feeds into that area. A 275kV overhead powerline running between Bloemfontein and Excelsior clips the northern end of the study site.

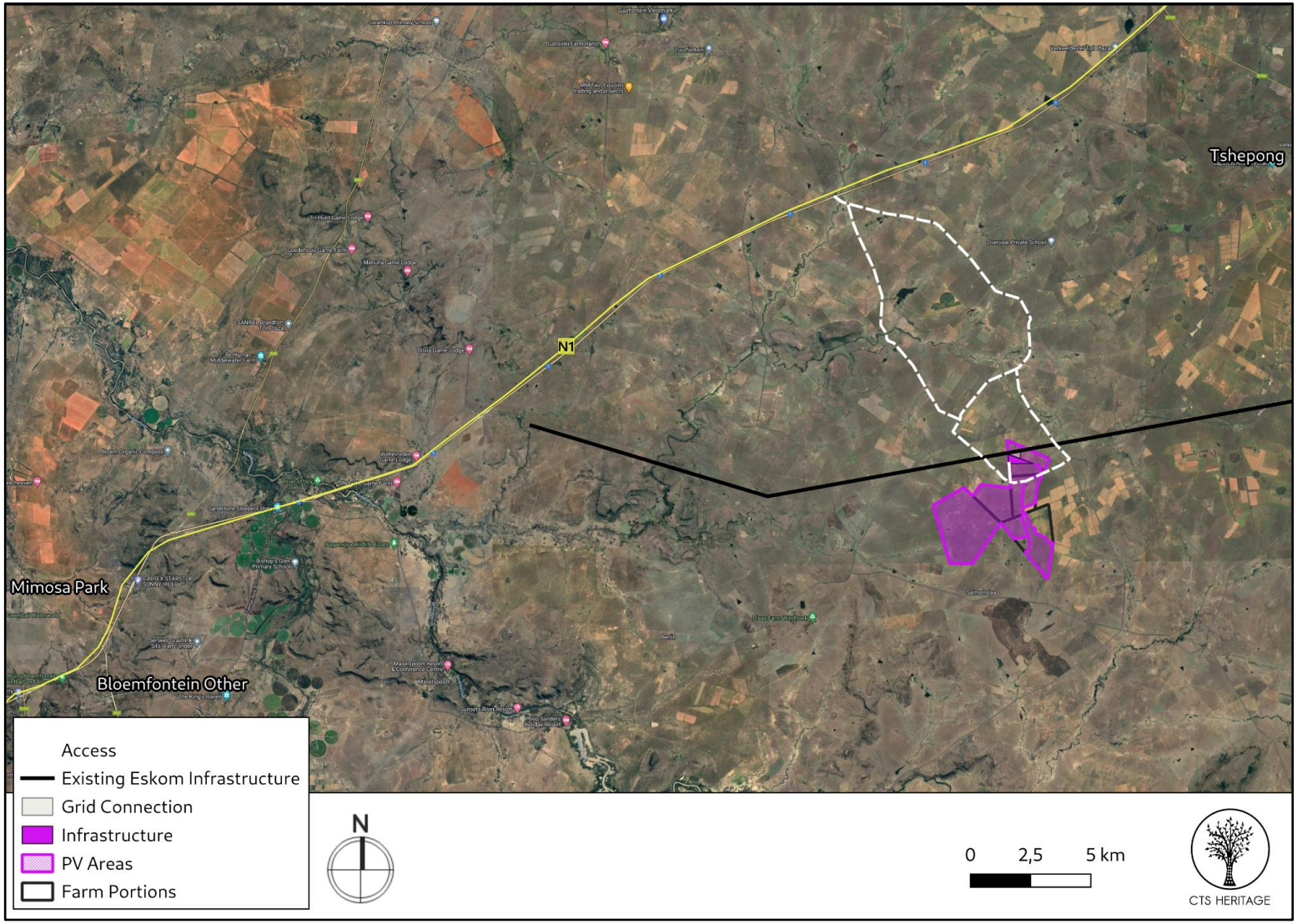

Figure 1.1: Proposed development relative to Bloemfontein

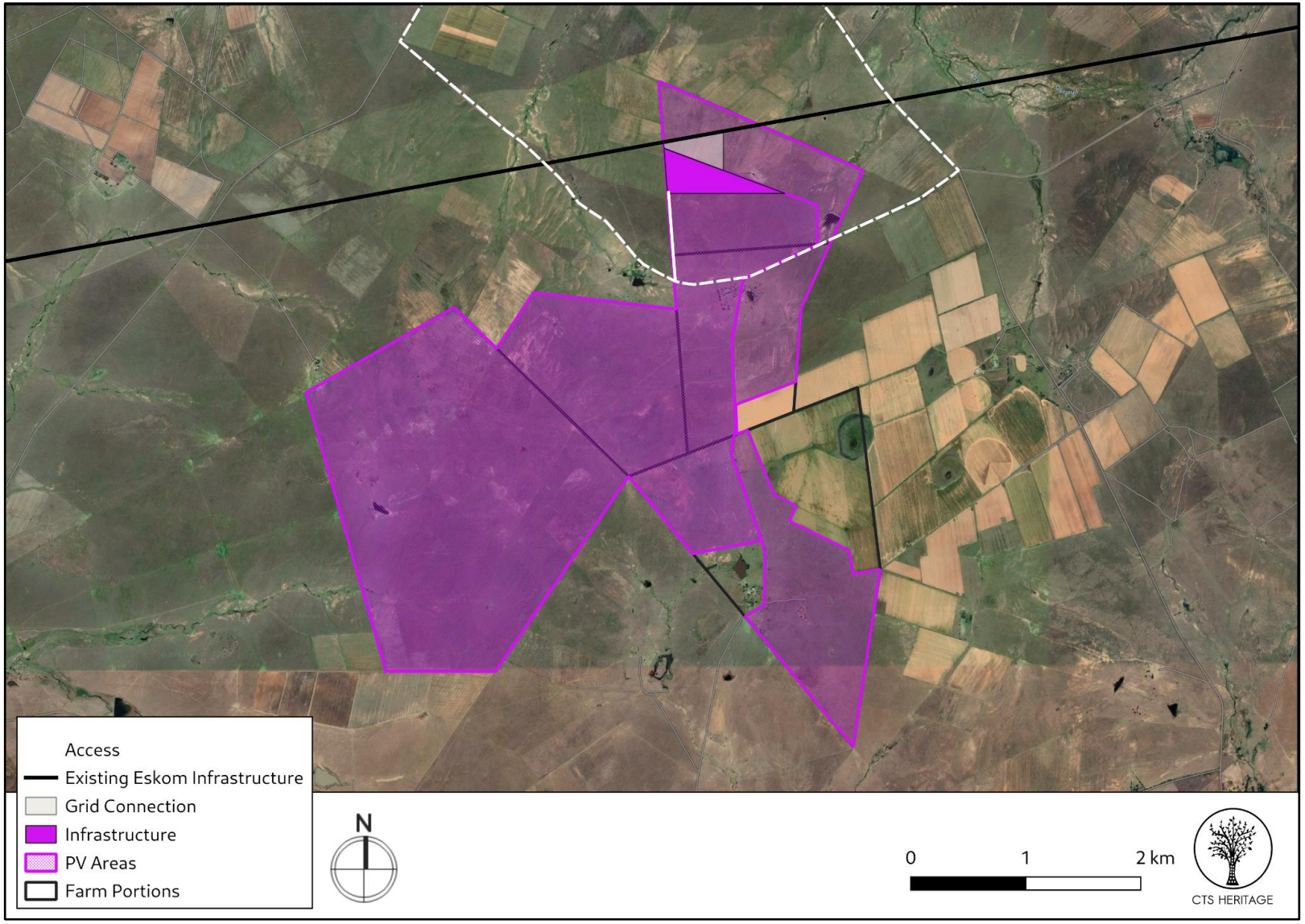

Figure 1.2: The proposed development layout assessed in the EIA

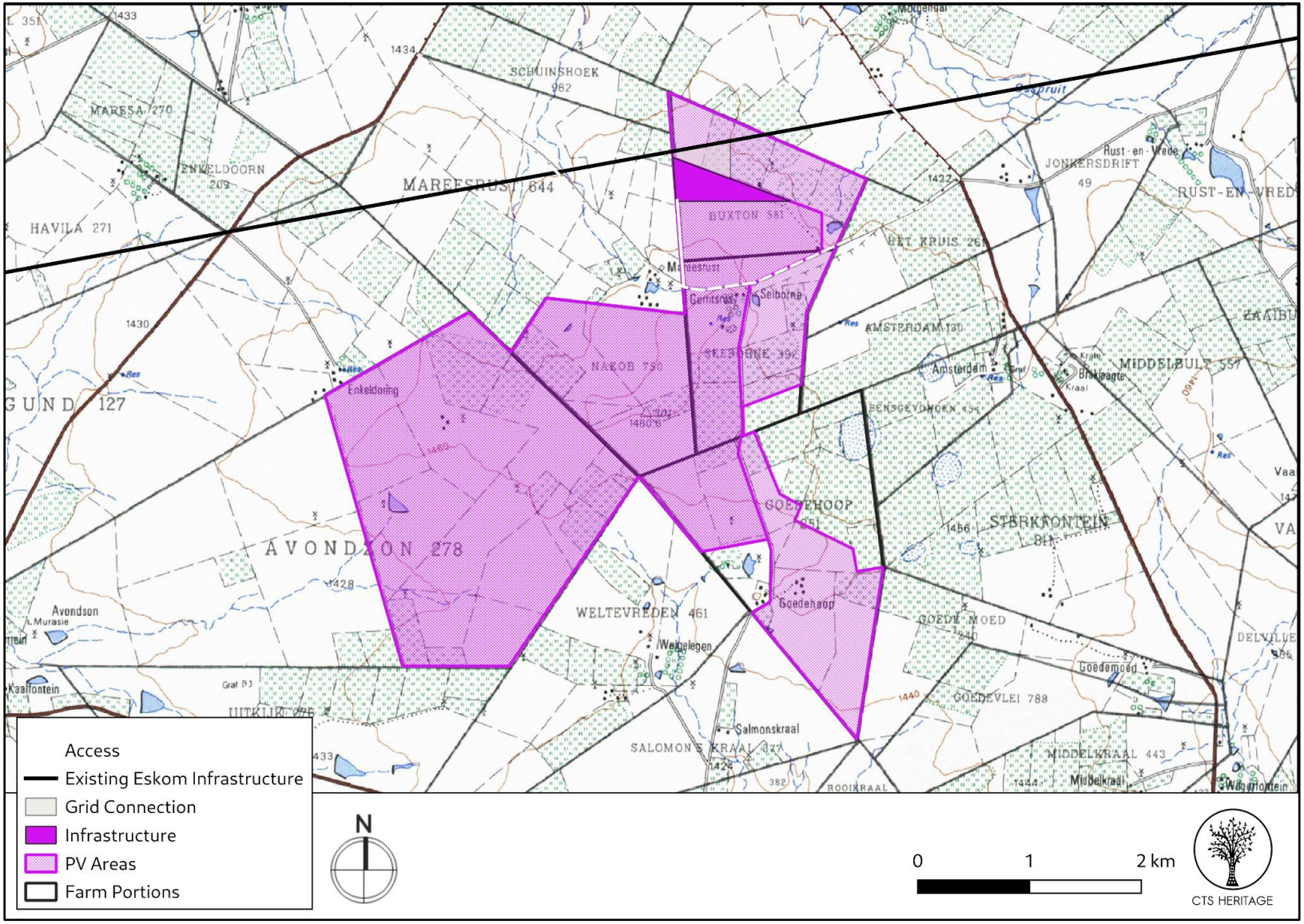

Figure 1.3: The proposed development layout assessed in the EIA on an extract of the 1:50 000 Topo Map

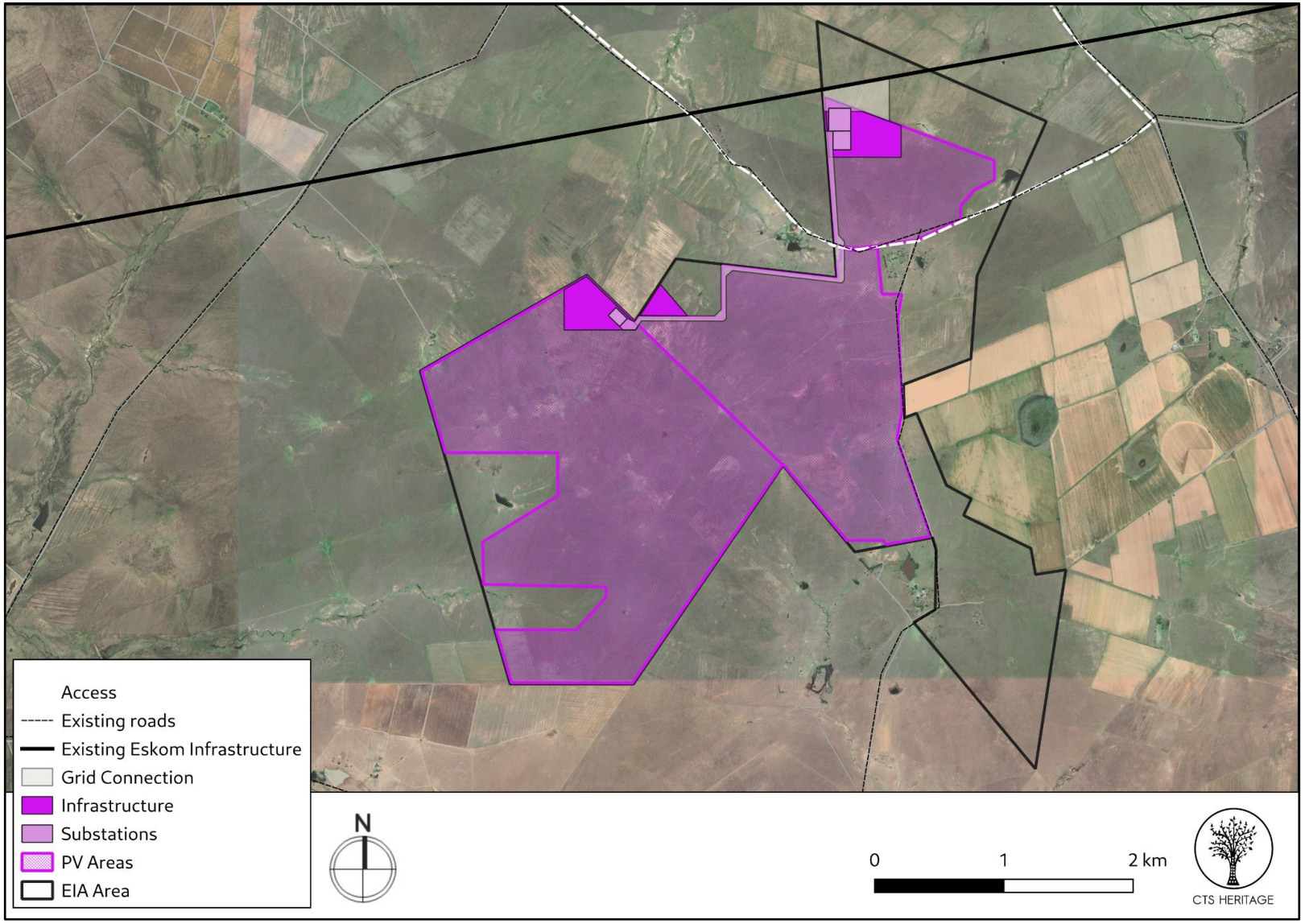

Figure 1.4: The Final development layout as a result from the findings in the EIA

2. METHODOLOGY

2.1 Purpose of HIA

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

2.2 Summary of steps followed

- A Desktop Study was conducted of relevant reports previously written (please see the reference list for the age and nature of the reports used)
- An archaeologist conducted an assessment of archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted his site visit on 21 March 2023
- A palaeontologist conducted a field assessment of palaeontological resources likely to be disturbed by the proposed development on 20 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

The study area consists of a mix of veld used for cattle grazing and completely ploughed fields for maize and soya crop agriculture. The areas left fallow that were currently not covered in crops were also heavily vegetated by grass and weeds which followed the heavy rains that had fallen over the summer period. Visibility was therefore

very low for identifying archaeological material on the surface and exposed jeep tracks and eroded areas were inspected in an attempt to address the low visibility offered during the survey.

2.5 Solis Environmental 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 2: The rating system

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3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Desktop Assessment

Background

The area proposed for development is located approximately 40km northeast of the centre of Bloemfontein. Prior to its establishment in 1846, the area is said to have been the location of an !Orana settlement and subsequently a Boer settlement. With colonial policy shifts, the region changed into the Orange River Sovereignty (1848–54) and eventually the Orange Free State Republic (1854–1902). From 1902 to 1910 it served as the capital of the Orange River Colony and since that time as the provincial capital of the Free State. In 1910 it became the Judicial capital of the Union of South Africa. The area proposed for development is located in close proximity to a number of structures and werfs. The age and heritage significance of these farm structures will need to be established through a site visit. It is recommended that a no development buffer of 500m is implemented around each werf that is determined to have cultural value.

According to Roodt (2012, SAHRIS NID 48744), "Historically, the area north of Bloemfontein is known for military activities that took place here during the South African War (1900 - 1902). Evidence of fortification can be found on the hills around Bloemfontein…" It is possible such evidence may be present within the area proposed for development.

Archaeological sensitivity

Bloemfontein is located on the edges of the Great Karoo. Scattered throughout the Karoo is evidence of historic and prehistoric occupation in the form of Early, Middle and Later Stone Age lithics and other material remains. The descendents of the historic and prehistoric occupants of the region are found in the indigenous Khoe and San, as well as modern inhabitants of the area.

Tomose (2013) notes that the earliest evidence of Iron Age communities in the Free State is documented in the south-eastern region of the Free State where they came into contact with the San people. Most of the existing evidence about the Iron Age communities in the Free State dates to the 16th and 18th when they moved across the Vaal River coming to contact with the San hunter-gather people (Klatzow 1994). Numerous stone wall structures and pottery dating to this period have been recorded and lie on the frontier zone where the San people come into contact with agro-pastoralist (Thorp 1996). Stonewalls are one major characteristic of the Iron Age people. However, they are not the only characteristic of features of the Iron Age. Huffman (1982) described cattle dug, both vitrified and unverified, as one of the Iron Age traits. He also included pits and burials, with some located inside the cattle kraals (ibid)."

No significant archaeological heritage resources have been identified within close proximity to the area proposed for development (Figure 3), however it is clear that no heritage impact assessments have been conducted in close proximity to the development area (Figure 2). It is therefore possible, although unlikely, that significant archaeological heritage resources are located within the area proposed for development.

Palaeontology

According to the SAHRIS Palaeosensitvity Map (Figure 4), the study area is underlain by sediments of zero and very high palaeontological sensitivity. The sediments underlying the study area include Karoo Dolerite which has no palaeontological sensitivity. According to the Council of GeoScience 2826 Winberg Map (Figure 5), the development area is also underlain by sediments of the Karoo Supergroup including the Adelaide Subgroup (Pa) which have very high palaeontological sensitivity. This formation forms part of the Dicynodon and Lystrosaurus assemblage zones and is known to include fossils of fish, amphibians, reptiles, therapsids and vertebrate burrows. Diverse terrestrial and freshwater tetrapods of *Pristerognathus* to *Dicynodon* Assemblage Zones (amphibians, true reptiles, synapsids – especially therapsids) have been found in this formation, as well as, palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse to rich assemblages of vascular plants (*Glossopteris* Flora, including spectacular petrified logs) and insects. Based on the known palaeontological sensitivities of the Adelaide Subgroup, it is recommended that a palaeontological assessment of the areas proposed for development is completed and anticipated impacts to such resources assessed.

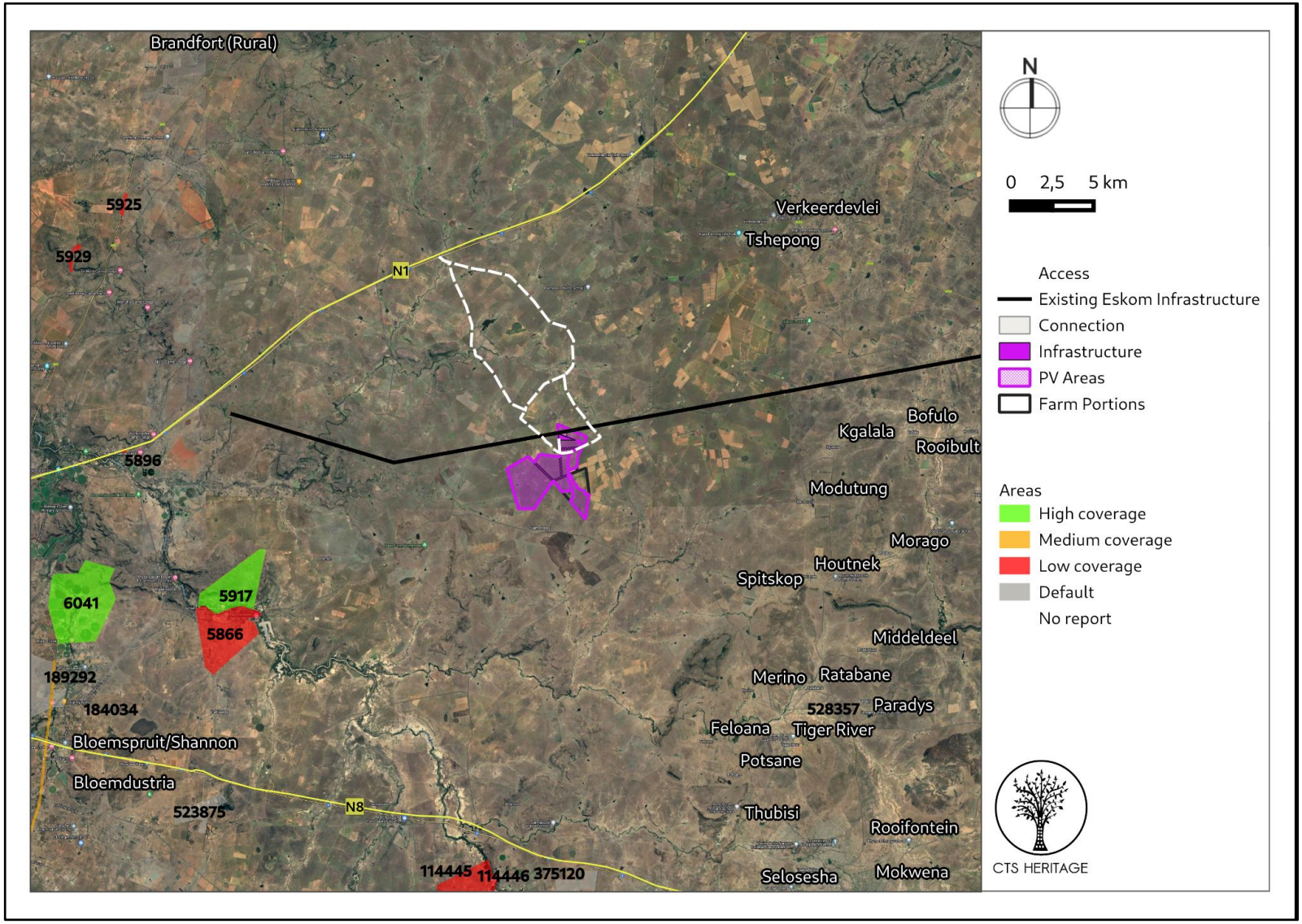

Figure 2: Spatialisation of heritage assessments conducted in proximity to the proposed development

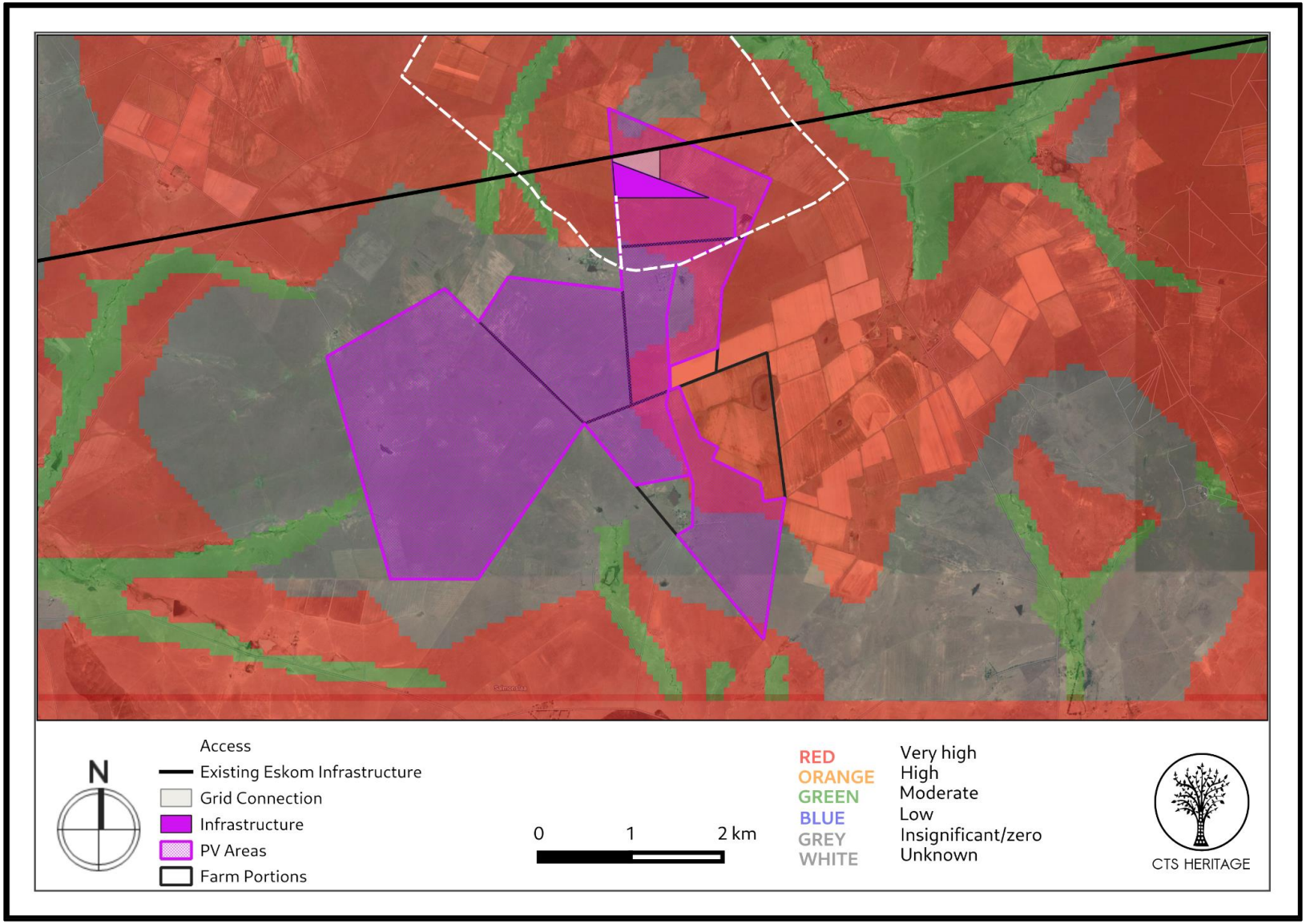

Figure 3.1: Palaeontological sensitivity of the proposed development area

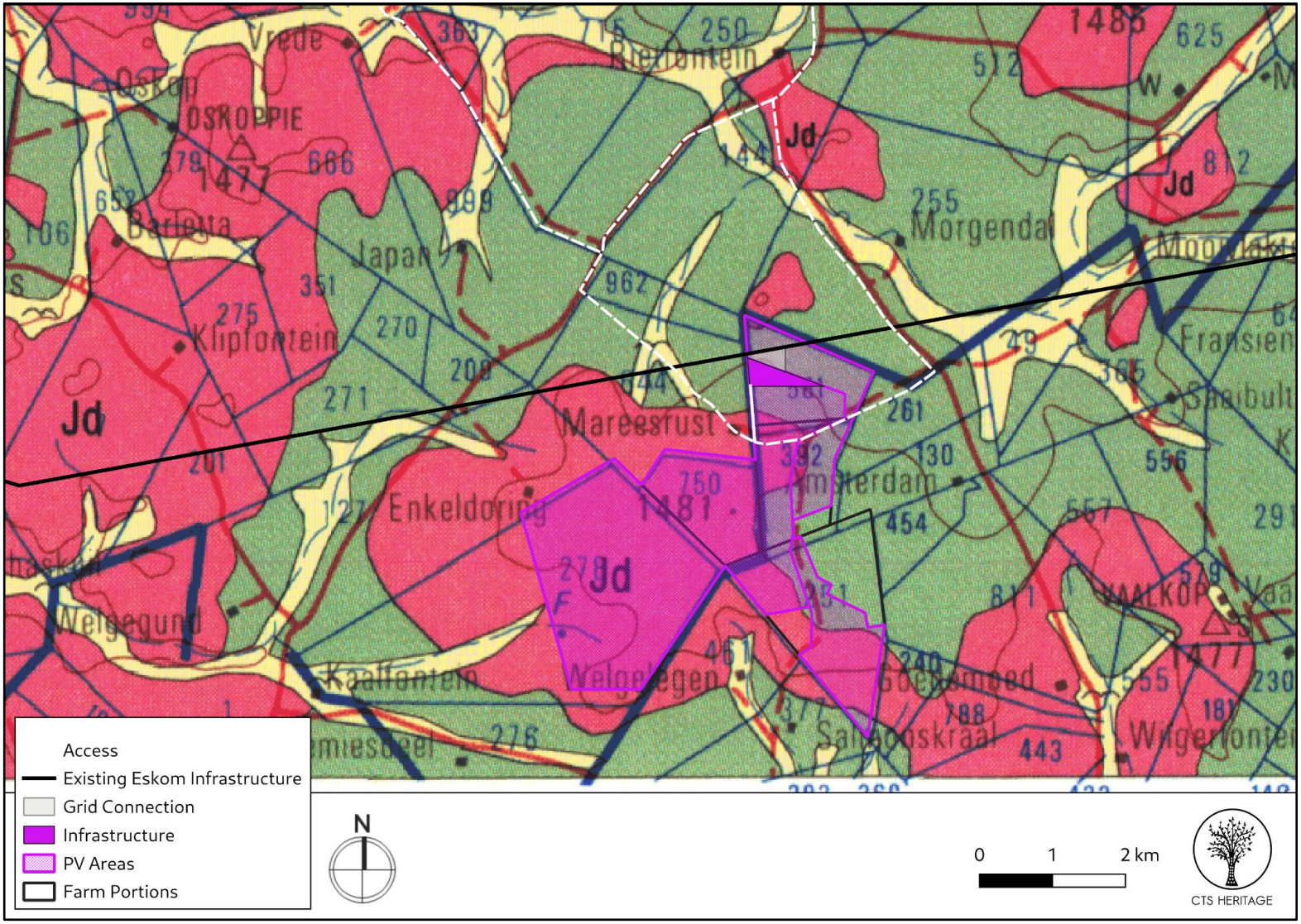

Figure 3.2. Geology Map. Extract from the CGS 2826 Winberg Geology Map indicating that the development area is underlain by sediments of the Adelaide Subgroup of the Beaufort Group (Pa) and Jurassic Dolerite (Jd)

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

Archaeology (Appendix 1)

Over 20 observations were made during the field assessment. A few CCS and hornfels flakes were found in exposed areas with evidence of Later Stone Age material and it is likely that exposed Middle and Early Stone Age material could be located closer to the Osspruit. No open scatters dating to these periods were found in the study area and this is not surprising given the intense farming that has taken place over the last century. The majority of the heritage resources found consisted of early 20th century occupation of the area in the form of the farm graveyards at Mareesrust and Goedehoop, stone walled kraals and outbuildings and the main werfs which have been altered over the last 50 years before falling into various states of disuse in the last decades. While the Mareesrust werf and its associated buildings and graveyard fall just outside the study area, the Selborne/Gerritsrus werf and ruins do lie inside and a couple of historic stone kraals and ruins have been graded as having low local significance. These can easily be avoided in the planning of the infrastructure needed for the solar project. The Enkeldoring werf lies just outside the boundary of the development but the Goedehoop werf has a number of ruined buildings east of the farm track leading into the main werf that fall inside the study area. There is also a graveyard south of these ruins that is fenced off that should be avoided in the planning of the panels and access routes.

Palaeontology (Appendix 2)

The proposed Makoaneng SPP is underlain by Permian aged sandstone and shale of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup). According to the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) the Palaeontological Sensitivity of the Adelaide Subgroup (Beaufort Group) is Very High (Almond and Pether, 2009; Almond *et al.*, 2013, Groenewald et al 2014). Updated Geology (Council of Geosciences) indicates that the proposed development is primarily underlain by the Balfour Formation of the Adelaide Subgroup. The Very High Palaeontological Sensitivity of the Balfour Formation triggered a site investigation.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 20 March 2023. The study area has a very flat topography with isolated ground surface outcrops. No fossils were detected in the development area. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of a Low significance in palaeontological terms. 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.

4.2 Heritage Resources identified

Table 3: Heritage Resources identified

Obs#	Description	Type	Period	Density	Latitude	Longitude	Grade	Mitigation
002	Graveyard, 7 graves. 1931 - 1993. Smit and Brown family	Graves/BurialGrounds	Historic	n/a	-28.957478	26.641703	IIIA	100m Buffer
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014	Goedehoop graveyard, 3A. Pretorius family, 1908-1963	Graves/BurialGrounds	Historic	n/a	-28.984523	26.654467	IIIA	100m Buffer
015	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.982425	26.656433	IIIC	Area to be excluded
016	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.982645	26.656437	IIIC	Area to be excluded
017	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.982542	26.656053	IIIC	Area to be excluded
018	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.983187	26.656577	IIIC	Area to be excluded
019	Ruined vernacular stone buildings, at least 5	Ruin	Historic	n/a	-28.98333	26.655978	IIIC	Area to be excluded
021	Ruins and stone walled kraal	Ruin	Historic	n/a	-28.966562	26.613668	IIIC	50m Buffer

4.3 Mapping and spatialisation of heritage resources

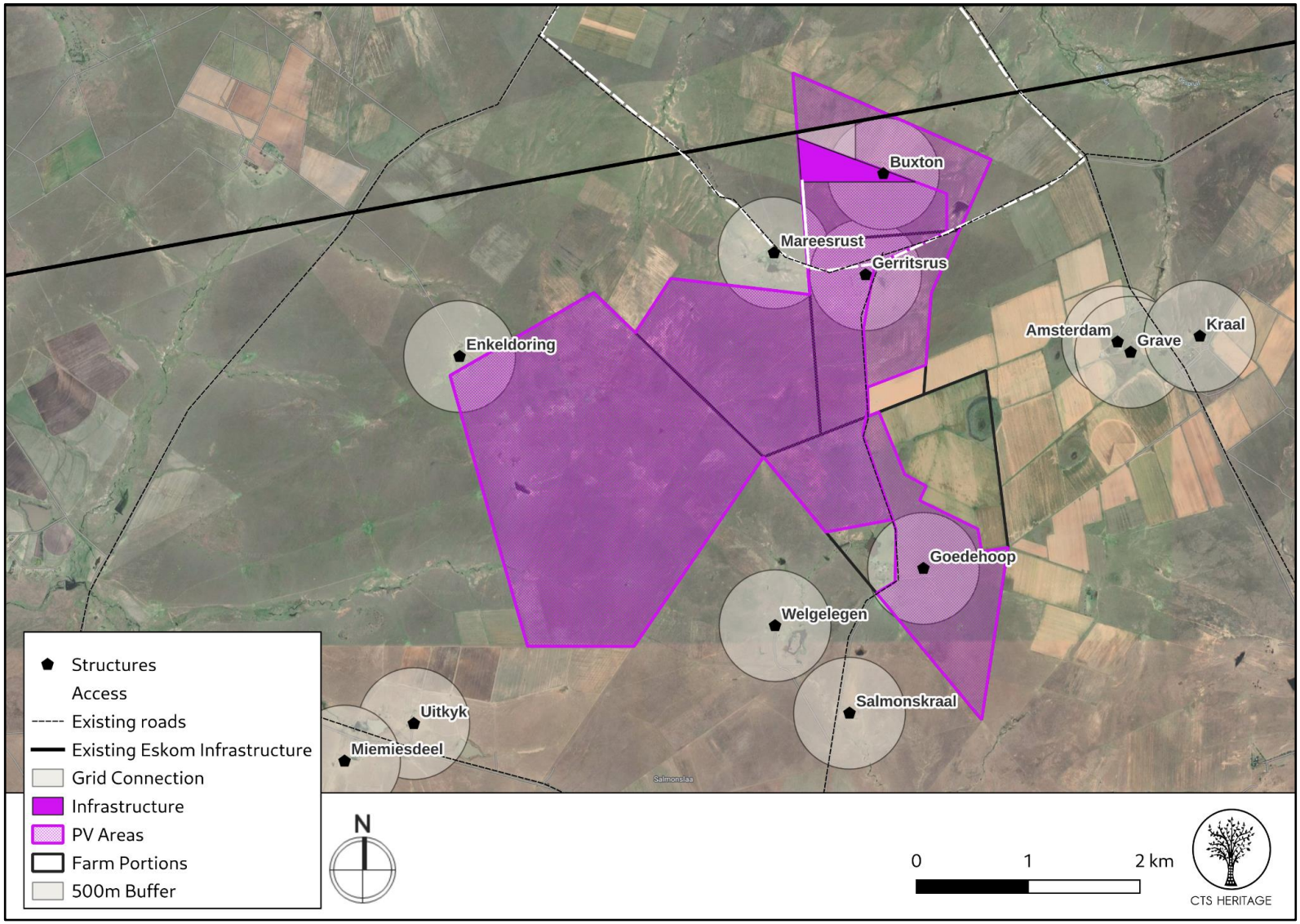

Figure 6.1: Map of potential heritage resources relative to the proposed development area extracted from the 1:50 000 Topo Map

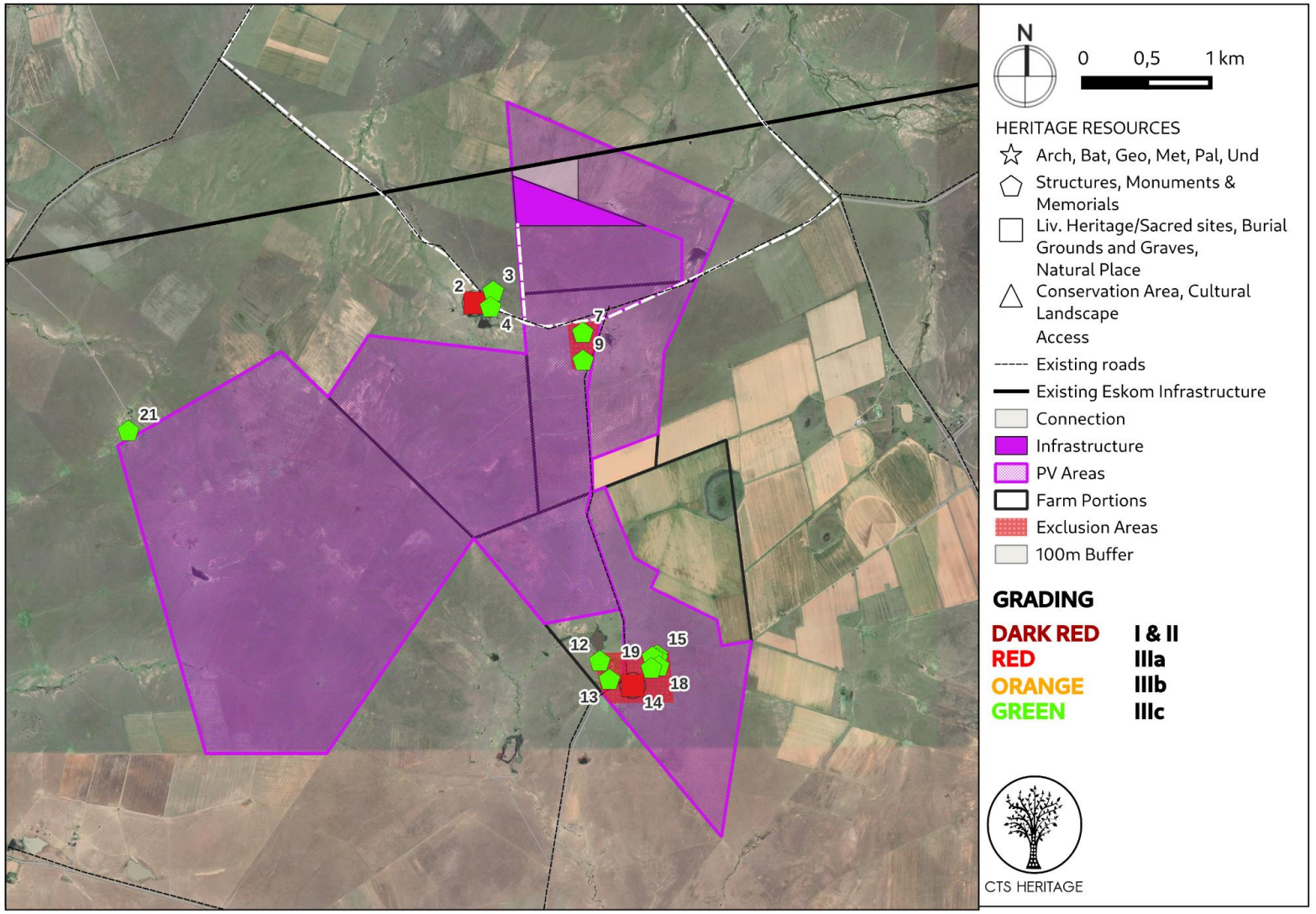

Figure 6.2: Map of all sites and observations noted within the development area with recommended mitigation measures

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.

Access Road

The proposed access road to the facility is aligned along existing gravel roads. These roads are likely to require widening and formalisation through tarring. As the access roads are already present, and as the archaeological sensitivity of the broader area has been shown to be limited, it is not anticipated that the upgrade of these existing roads for access purposes will negatively impact on any significant archaeological resources.

PV Facility

No significant Stone Age or Iron Age archaeology was documented within the footprint of the area proposed for development. The findings of the field assessment have confirmed which of the structures identified in Figure 6.1 have cultural value and therefore require further mitigation. The heritage resources identified relate predominantly to the historic agricultural practices of the area and include the ruins of old farm infrastructure, old farm werfs and associated burial grounds and graves. As these resources are associated with historic farm werfs, they are clustered into four groups, two of which fall within the area proposed for development. These clusters are centred around the Gerritsrus farm werf and the Goedehoop farm werf.

The heritage resources identified at the Gerritsrus werf include a ruin, a stone-walled oven and a kraal. It is likely that associated archaeological heritage is buried in the vicinity of these visible structures and as such, it is recommended that an area encompassing these ruins and any potential buried archaeology is excluded from the development footprint. This exclusion area is mapped in Figure 7.1.

The heritage resources identified near the Goedehoop farm werf include a family burial ground and a number of ruined stone vernacular buildings. This burial ground and the ruins are clearly associated with the Goedehoop werf which is already excluded from the development footprint in the layout provided. In order to ensure that these ruined structures and the burial ground is not impacted by the development, it is recommended that these heritage resources are also excluded from the development footprint. This exclusion area is mapped in Figure 7.2.

While it is not likely that the other heritage resources identified will be directly negatively impacted by the proposed development, it is imperative that these resources not be accidentally impacted and as such, no development buffer areas are recommended for these sites in Table 2.

As noted above, the study area has a very flat topography with isolated ground surface outcrops. No fossils were detected in the development area. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of a Low significance in palaeontological terms. 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.

Table 4: Assessment of impacts

[illegible]		
[illegible]		
[illegible]		
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]		
[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]		
[illegible]	[illegible]	[illegible]

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		
in respect of the project activity in question.		
3	Medium cumulative impact	The impact would result in minor cumulative effects.

SIGNIFICANCE		
significance rating; the resultant value acquires a weighted characteristic which can be measured and assigned a		
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.

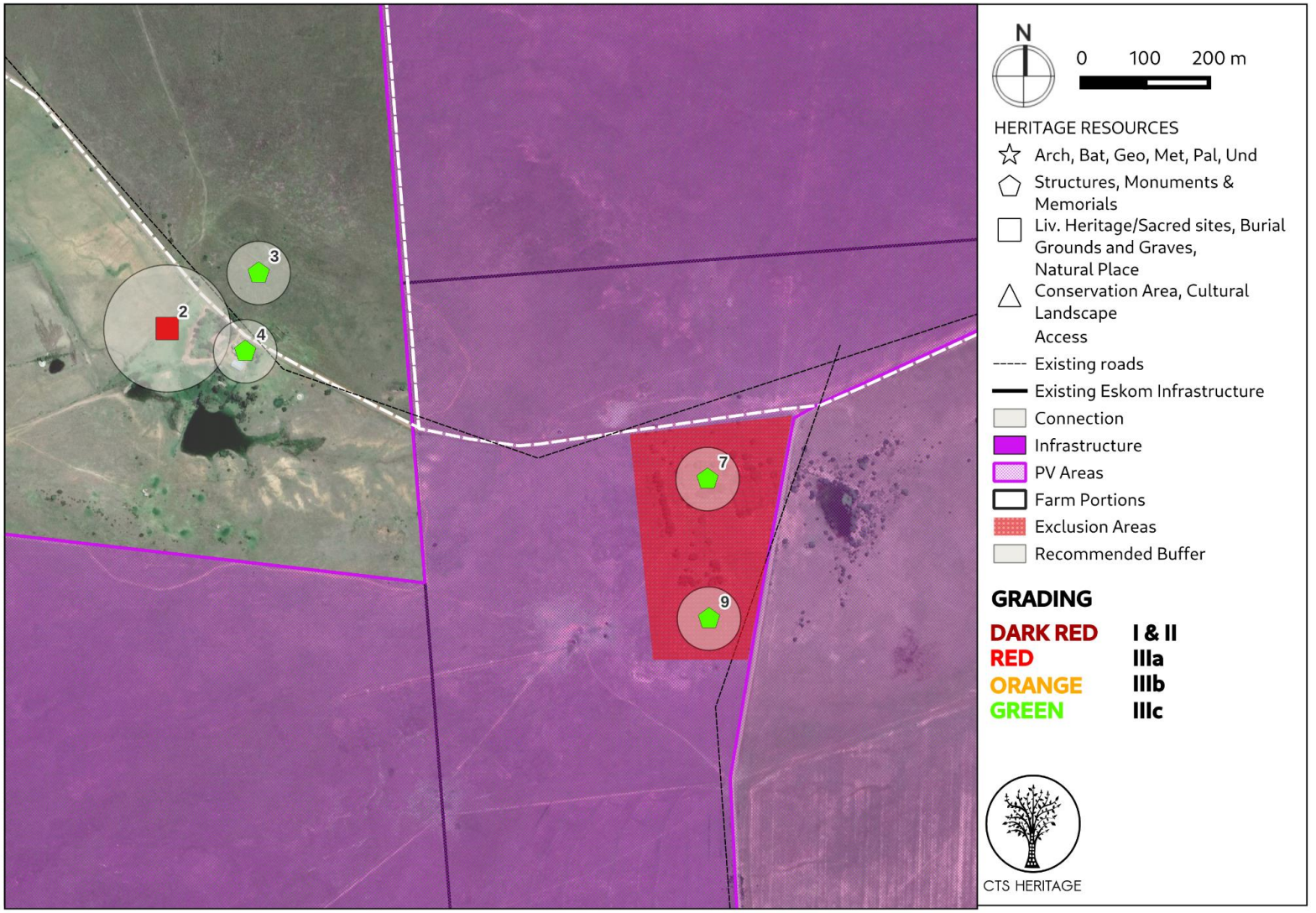

Figure 7.1: Map of all sites and observations noted within the development area with recommended mitigation measures at Gerritsrus

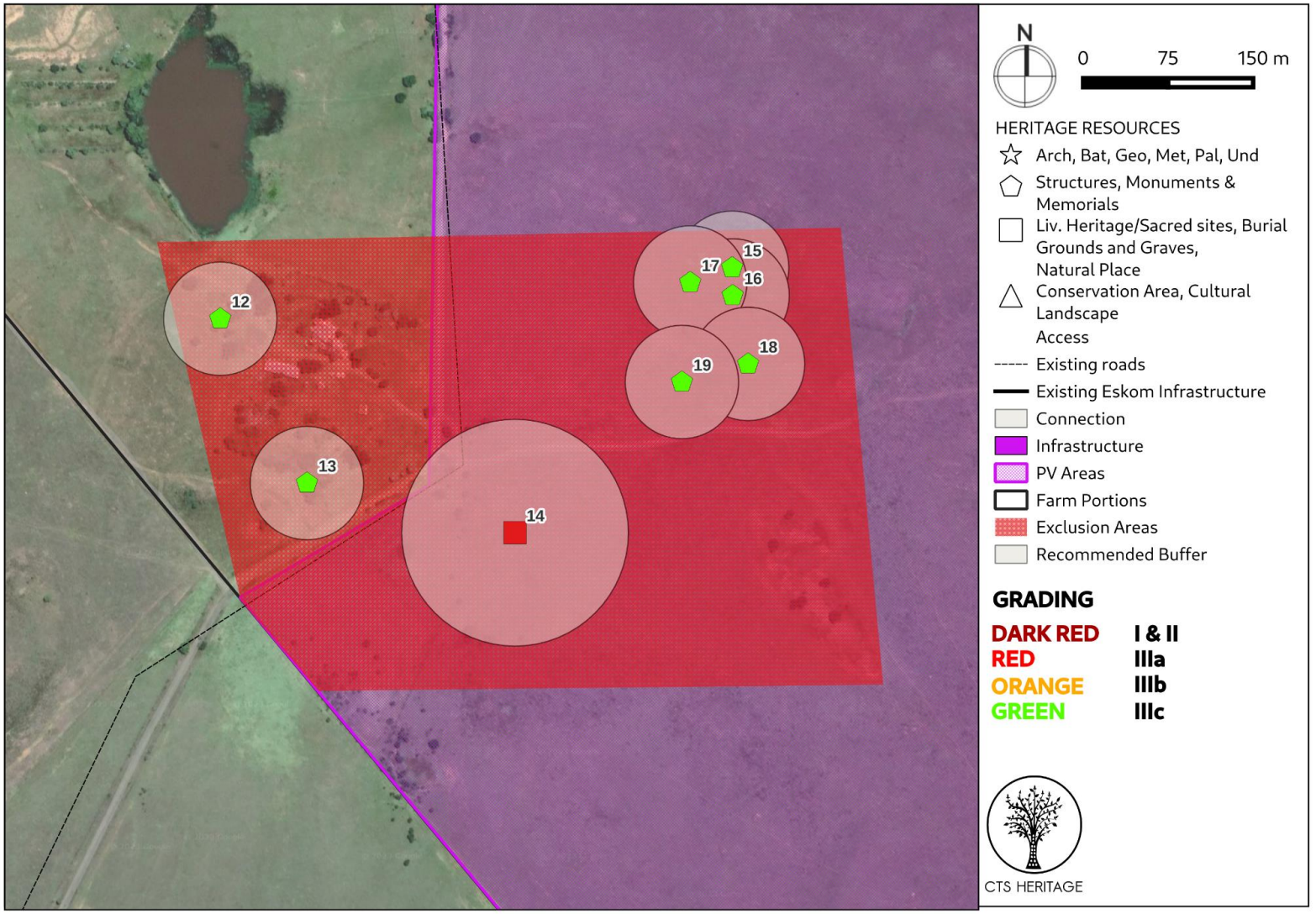

Figure 7.2: Map of all sites and observations noted within the development area with recommended mitigation measures at Goedehoop

5.2 Sustainable Social and Economic Benefit

The following socio-economic benefits are anticipated to be derived from the project:

Local economic growth - The proposed project will contribute to local economic growth by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Province. The project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally. The development of the photovoltaic solar facility will in turn lead to growth in tax revenues for local municipalities and sales of carbon credits, resulting in increased foreign direct investment.

Social benefits - The project activity is likely to have significant long-term, indirect positive social impacts that may extend to a regional and even national scale. The larger scale impacts are to be derived in the utilisation of solar power and the experience gained through the construction and operation of the PV facility. In future, this experience can be employed at other similar solar installations in South Africa.

Provision of job opportunities - The main benefit of the proposed development operating in the area is that local companies or contractors will be hired for the duration of the construction period. The operational phase will provide permanent job opportunities to the local communities from the surrounding area since security guards and general labourers will be required on a full-time basis. Approximately 500 employment opportunities will be created during the construction and operational phases.

Indirect socio-economic benefits - The increase in the demand for services such as accommodation, transportation, security, general maintenance and catering will generate additional indirect socio-economic benefits for the local community members.

On condition that the final layout indicated in Figure 1.4 and Figure 9 is implemented, the anticipated socio-economic benefits outweigh the anticipated 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:

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 Nakob No. 750, Portion 1 of the farm Avondzon No. 278, Remaining Extent of the farm Selborne No. 392, Farm Buxton No. 581 and the Farm Goedehoop No. 251. 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 process.

Technical alternatives: Powerlines

It is expected that generation from the facility will tie in with the existing Eskom Harvard/Merapi 1 275/22kV Existing 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 150 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 the final layout adheres to the recommendations in this report and as such, no impact to significant heritage resources is anticipated, there is no preferred alternative from a heritage perspective. The final layout is mapped in Figure 9 which depicts the recommended Exclusion Areas and identified heritage resources.

5.4 Cumulative Impacts

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. It is important to note that the cumulative impact assessment for a particular project, like what is being done here, is not the same as an assessment of the impact of all surrounding projects. The cumulative assessment for this project is an assessment only of the impacts associated with this project, but seen in the context of all surrounding impacts. It is concerned with this project's contribution to the overall impact, within the context of the overall impact. But it is not simply the overall impact itself.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

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. 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.

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 proposed development may therefore result in unacceptable risk or loss, as the proposed development may result in a change to the sense of place of the area as this development is located outside of a REDZ area.

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. The proposed development is located sufficiently far from significant roads and features that impact is unlikely. Additional mitigation measures to limit the negative impact to the cultural landscape are included below.

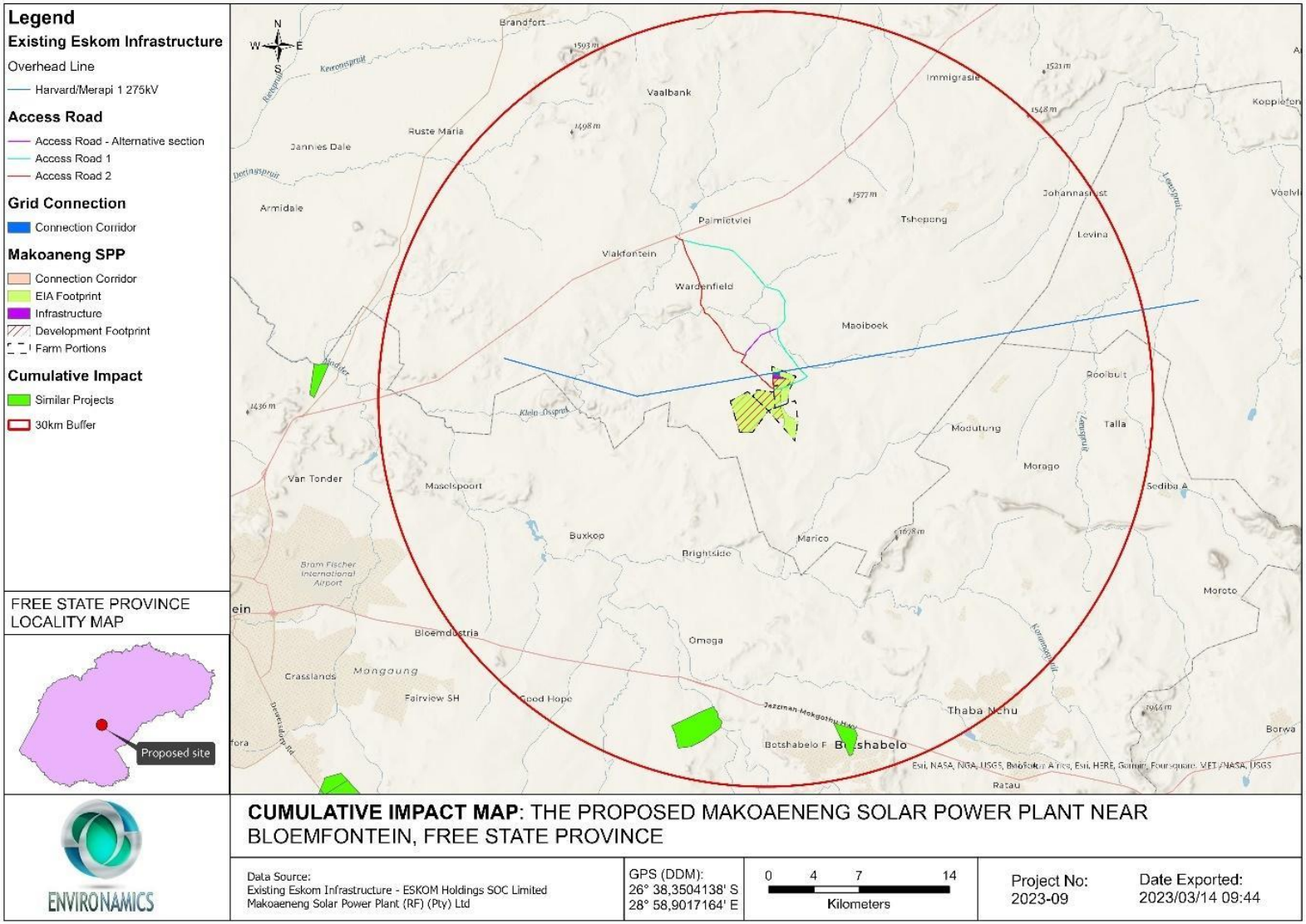

Figure 8: Geographic area of evaluation with utility-scale renewable energy generation sites and power lines

5.5 Site Verification

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 moderate (MEDIUM)
- Some significant archaeological resources were identified within the development area (MEDIUM)
- 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 disputes the results of the screening tool for archaeology and cultural heritage - this should be considered to be MEDIUM. 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, and no significant archaeological material remains were documented. The significant heritage resources identified within the development area relate to the agricultural past. Recommendations are made in Table 3 to ensure that these significant resources are not negatively impacted by the proposed development.

There are no objections on palaeontological heritage grounds. Any fossil finds, most likely in the Adelaide Subgroup sediments and Quaternary Sands, are to be reported by the developer. Should important fossil material be found during excavations, the attached Fossil Finds Procedure must be implemented (Appendix 2).

The final layout adheres to the recommendations made in this report and others, and is mapped in Figure 9 which depicts the recommended Exclusion Areas and identified heritage resources relative to the final proposed development layout..

8. RECOMMENDATIONS

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

- The mitigation measures detailed in Table 3 and mapped in Figures 7.1 and 7.2 are implemented. The Final Layout provided adheres to these recommendations (Figure 9)
- The attached Chance Finds Procedure must be implemented for the duration of the construction phase
- 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.

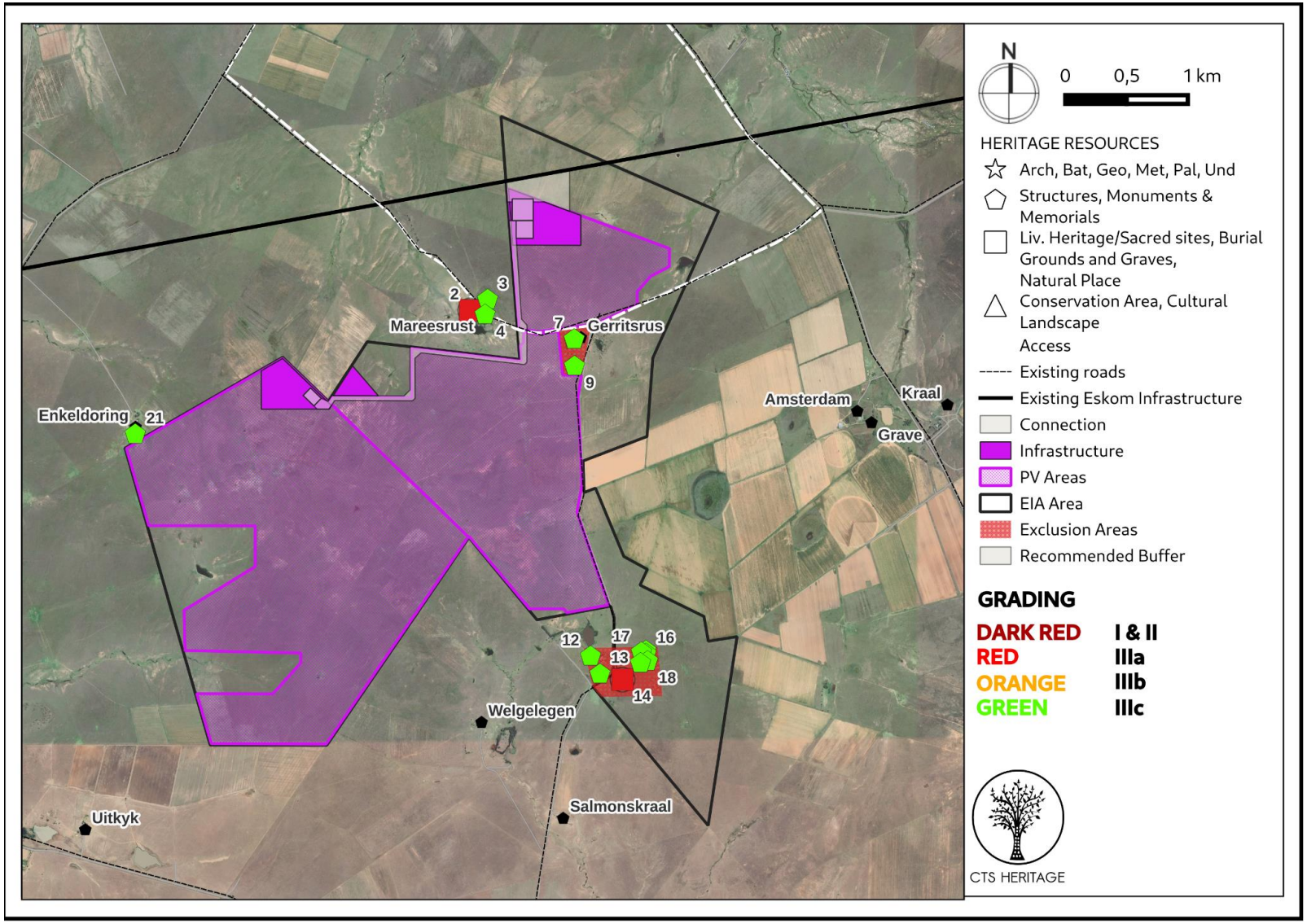

Figure 9: Final Layout mapped relative to the findings of the HIA (July 2023)

9. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
110093	PIA Desktop	Job M. Kibii		Palaeontological Impact Assessmnent Deskop Study Report for the Proposed Merapi (Excelsior) PV Solar Energy Facilities
110094	HIA Phase 1	Nkosinathi Godfrey Tomose		Heritage Imapct Assessment Study for the Proposed PV Solar Energy Facilities, near Excelsior, Free State Province
159786	HIA Phase 1	Quahnita Samie	18/03/2014	Heritage Impact Assessment for Subdivision 3 of the Farm Sunnyside No. 2620 Bram Fischer Airport, Bloemfontein
159965	PIA Desktop	John E Almond	01/01/2013	Palaeontological specialist assessment: desktop study PROPOSED DEVELOPMENT OF THE BOULEVARD PRECINCT, BRAM FISCHER AIRPORT, SUBDIVISION 3 OF THE FARM SUNNYSIDE NO. 2620 NEAR BLOEMFONTEIN, MANGAUNG METROPOLITAN MUNICIPALITY, FREE STATE
159967	AIA Desktop	Dave Halkett	01/11/2013	A DESKTOP ARCHAEOLOGICAL IMPACT ASSESSMENT OF THE BOULEVARD PRECINCT, BRAM FISCHER AIRPORT, BLOEMFONTEIN
184034	HIA Letter of Exemption	Lloyd Rossouw	12/12/2014	Exemption from a Phase 1 Heritage Impact Assessment for the extension of an existing gravel quarry on farm Roodewal 292, Bloemfontein, Free State Province
189292	HIA Letter of Exemption	Lloyd Rossouw	05/12/2014	Exemption from a Phase 1 Heritage Impact Assessment for a proposed new water pipeline from the outfall water treatment works to the Renostespruit, Bloemfontein, Free State Province
5866	AIA Phase 1	Cobus Dreyer	08/04/2003	Archaeological and Historical Assessment of the Proposed Developments on the Farm Krantzkaal 134
5883	AIA Phase 1	Cobus Dreyer	17/08/2005	First Phase Archaeological and Heritage Assessment of the Proposed Residential Developments on Plots 18, 20 & 21 on the Farm Deales Gift 2804, Bloemfontein
5896	AIA Phase 1	Cobus Dreyer	22/11/2006	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Borrow Pit Sites Along the N1 Main Road Between Bloemfontein & the Verkeerdevlei Toll Gate, Free State
5907	AIA Phase 1	Cobus Dreyer	20/01/2008	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Developments at the Bloemfontein Turf Club, Bloemfontein

5909	AIA Phase 1	Cobus Dreyer	10/03/2008	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Eastern Ring Road Developments at Bloemfontein
5913	AIA Phase 1	Cobus Dreyer	20/08/2008	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Developments at the Bloemfontein Airport Access Road, Bloemfontein
5917	AIA Phase 1	Cobus Dreyer	23/10/2006	First Phase Archaeological and Cultural Heritage Investigation of the Proposed Residential Developments, on Subdivision 2 of the Farm Bergkraal 2213, Bloemfontein
5918	AIA Phase 1	Cobus Dreyer	05/10/2007	First Phase Archaeological and Cultural Heritage Investigation of the Proposed Residential Developments on the Remainder of the Farm Bergkraal 2213, Bloemfontein
5925	AIA Phase 1	Cobus Dreyer	05/02/2004	First Phase Heritage/Archaeological Assessment of the Proposed R30 Toll Plaza, Brandfort
5929	AIA Phase 1	Cobus Dreyer	05/07/2006	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Residential Development at Daskop 615, Brandfort, Free State
5936	AIA Phase 1	Cobus Dreyer	23/06/2006	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Township Developments at Excelsior, Free State
6041	AIA Phase 1	Cobus Dreyer	29/05/2007	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Residential Developments at the Farm Donkerhoek 392, Bloemfontein, Free State
7258	AIA Phase 1	Karen Van Ryneveld	17/01/2008	Addendum to the 'Phase 1 Archaeological Impact Assessment: Extension to Mahlatswetsa Township, Excelsior, Free State, South Africa'
7259	AIA Phase 1	Karen Van Ryneveld	17/11/2007	Phase 1 Archaeological Impact Assessment: Extension to Mahlatswetsa Township, Excelsior, Free State, South Africa

APPENDICES

CTS HERITAGE

APPENDIX 1: Archaeological Assessment (2023)

CTS HERITAGE

APPENDIX 2: Palaeontological Assessment (2023)

APPENDIX 3: Heritage Screening Assessment