HERITAGE IMPACT ASSESSMENT

(REQUIRED UNDER SECTION 38(8) OF THE NHRA (No. 25 OF 1999)

FOR THE PROPOSED STILFONTEIN SOLAR ENERGY FACILITIES CLUSTER AND ASSOCIATED INFRASTRUCTURE, NORTHWEST PROVINCE.

Type of development:

Renewable Energy (Solar Photovoltaic)

Environmental Impact Assessment Practitioner:

SRK Consulting

Developer:

South Africa Mainstream Renewable Power Developments (Pty) Ltd (Mainstream)

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Responsibility	Name	Qualifications and Certifications	Date
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Date	Report Reference Number	Description of Amendment
1 June 2022	2259	Technical Revision
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REPORT OUTLINE

Appendix 6 of the GNR 326 EIA Regulations published on 7 April 2017 (as amended) provides the requirements for specialist reports undertaken as part of the environmental authorisation process. In line with this, Table 1 provides an overview of Appendix 6 together with information on how these requirements have been met.

Table 1. Specialist Report Requirements.

Requirement from Appendix 6 of GN 326 EIA Regulation 2017	Chapter
(a) Details of - (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Section A Separate CV
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	*Declaration of Independence*
(c) Indication of the scope of, and the purpose for which, the report was prepared	Section 1
(cA)an indication of the quality and age of base data used for the specialist report	Section 3.4 and 7.1.
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9
(d) Duration, Date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.4
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of site plan identifying site alternatives;	Section 8 and 9
(g) Identification of any areas to be avoided, including buffers	Section 8 and 9
(h) 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 8
(I) Description of any assumptions made and any uncertainties or gaps in knowledge	Section 3.7
(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 or activities;	Section 1.3
(k) Mitigation measures for inclusion in the EMPr	Appendix 1
(l) Conditions for inclusion in the environmental authorisation	Appendix 1
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Appendix 1
(n) Reasoned opinion - (i) as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (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	Appendix 1
(o) Description of any consultation process that was undertaken during the course of preparing the specialist report	Section 6
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 5
(q) Any other information requested by the competent authority	N.A

Executive Summary

SRK was appointed by South Africa Mainstream Renewable Power Developments (Pty) Ltd, which proposes the construction and operation of the nine (9) photovoltaic (PV) facilities with up to 150 MW generation capacity each, and associated infrastructure. The facilities will be known as the Stilfontein PV Cluster and are located in the City of Matlosana and JB Marks Local Municipalities, within the Dr Kenneth Kaunda District Municipality in the North West province. The assessment area, comprising the nine PV sites and associated grid infrastructure, is located approximately 6 km east of the town of Stilfontein along the N12. The assessment area is situated within a Renewable Energy Development Zone (REDZ) known as the Klerksdorp REDZ (REDZ10) and within the Central Strategic Transmission Corridor (STC).

The Stilfontein PV Cluster comprises nine proposed PV facilities, each with an assessment area of ~220 to 405 ha: Spoonbill (Project 1), Sunbird (Project 2), Swallow (Project 3), Snipe (Project 4), Shrike (Project 5), Stilfontein (Project 6), Sparrow (Project 7), Starling (Project 8) and Swift (Project 9). Separate environmental applications will be submitted for the individual PV facilities and each of the grid connections through separate Basic Assessment (BA) processes. The different projects are outlined in Table 2.

Table 2. Projects within the SPV Cluster

Property name, number and portion	SG Code	Coordinates	Property size	Development footprint
Spoonbill PV				
Stilfontein RE26/408	T0IP00000000040800026	26°50'26.62"E, 26°47'58.21"S	393 ha	345 ha
Witstinkhoutbaken 1/409	T0IP00000000040900001	26°51'8.26"E, 26°48'26.52"S	163 ha	
Doornplaat RE4/410	T0IP00000000041000004	26°51'32.02"E, 26°48'4.86"S	679 ha	
Sunbird PV				
Stilfontein RE26/408	T0IP00000000040800026	26°50'26.62"E, 26°47'58.21"S	393 ha	280 ha
Witstinkhoutbaken 1/409	T0IP00000000040900001	26°51'8.26"E, 26°48'26.52"S	163 ha	
Doornplaat RE4/410	T0IP00000000041000004	26°51'32.02"E, 26°48'4.86"S	679 ha	
Swallow PV				
Stilfontein RE26/408	T0IP00000000040800026	26°50'26.62"E, 26°47'58.21"S	393 ha	310 ha
Witstinkhoutbaken 1/409	T0IP00000000040900001	26°51'8.26"E, 26°48'26.52"S	163 ha	
Doornplaat RE4/410	T0IP00000000041000004	26°51'32.02"E, 26°48'4.86"S	679 ha	
Snipe PV				
Witstinkhoutbaken 1/409	T0IP00000000040900001	26°51'8.26"E, 26°48'26.52"S	163 ha	310 ha
Doornplaat RE4/410	T0IP00000000041000004	26°51'32.02"E, 26°48'4.86"S	679 ha	
Shrike PV				

Property name, number and portion	SG Code	Coordinates	Property size	Development footprint
Rietfontein RE/388	T0IP00000000038800000	26°50'14.98"E, 26°45'54.58"S	691 ha	405 ha
Rietfontein 82/388	T0IP00000000038800036	26°51'2.51"E, 26°45'27.39"S	341 ha	
Stilfontein PV				
Rietfontein RE/388	T0IP00000000038800000	26°50'14.98"E, 26°45'54.58"S	691 ha	280 ha
Rietfontein 82/388	T0IP00000000038800036	26°51'2.51"E, 26°45'27.39"S	341 ha	
Doornplaat 3/410	T0IP00000000041000003	26°52'25.98"E, 26°47'48.70"S	951 ha	
Sparrow PV				
Doornplaat 3/410	T0IP00000000041000003	26°52'25.98"E, 26°47'48.70"S	951 ha	330 ha
Flint 1/411	T0IP00000000041100001	26°53'27.69"E, 26°47'29.68"S	149 ha	
Starling PV				
Doornplaat 3/410	T0IP00000000041000003	26°52'25.98"E, 26°47'48.70"S	951 ha	275 ha
Swift PV				
Doornplaat 3/410	T0IP00000000041000003	26°52'25.98"E, 26°47'48.70"S	951 ha	220 ha
Flint 1/411	T0IP00000000041100001	26°53'27.69"E, 26°47'29.68"S	149 ha	

Beyond Heritage was appointed to conduct a Heritage Impact Assessment (HIA) for the project, following the terms of reference for all specialists consisting of an integrated report with information common to all projects as outlined under Table 1 with appendices per project that covers PV project-specific information. The study area was assessed on desktop level and by a non-intrusive pedestrian field survey and key findings of the assessment include:

- The project area is mainly marked by Quaternary sands and soils and is primarily used for grazing;
- Known heritage sites in the larger area consist of Rock Engraving sites, one which is a National Monument located ~ 14 km northeast of the Project;
- Heritage finds in the Project area are limited to a low-density scatter of Stone Age material, ephemeral remains of ruins, a stone wall enclosure, and a burial site;
- According to the SAHRA Paleontological sensitivity map the study area is of very high palaeontological significance. The completed site visit confirmed that there are no fossils visible on the surface, it is not known if fossils occur below ground but if any are discovered when excavations commence, they should be removed, and a palaeontologist called to assess their scientific importance. The geology is the same throughout the project footprint so there is no no-go area and no preferred alternative. Since the impact is insignificant, as far as the palaeontology is concerned, the project should be authorised.

None of the recorded sites is of high significance apart from the burial site that is of high social significance and no fatal flaws were recorded. The impacts to heritage resources is low provided that the recommendations in this report are adhered to, and subject to the South African Heritage Resource Authority (SAHRA)'s approval.

Recommendations:

- Monitoring of the development by the ECO during construction (monitoring detailed in Section 10.2) to implement the Chance Find Procedure (detailed in Section 10.1);

Site specific recommendations are included in Table 3

Table 3. Recorded sites and recommendations in Stilfontein PV Cluster:

Label	Description	Significance	PV Facility	Recommendations
SF001	Low density MSA scatter.	GP C Low Significance	Swift Project 9	• Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
SF002	Low density MSA scatter.	GP C Low Significance	MTS	• Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
SF003	Low density MSA scatter.	GP C Low Significance	Starling Project 8	• Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
SF004	Isolated lithic Artefact.	GP C Low Significance	Stilfontein Project 6	• Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
SF005	Isolated lithic artefact.	GP C Low Significance	Stilfontein Project 6	• Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
SF006	Isolated Lithic artefact	GP C Low Significance	Snipe Project 4	• Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
SF007	Low density lithic scatter.	GP C Low Significance	Sunbird Project 2	• Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
SF008	Historical Farmstead	GP C Low Significance	Sunbird Project 2	• Monitoring of development by the ECO during construction to implement the Chance Find Procedure.
SF009	Stone wall	GP C Low Significance	Swallow Project 3	• Site SF009 should preferably be avoided with a 30 m buffer. If not possible the site should be mapped and recorded prior to applying for a destruction permit
SF010	A small stone-built structure	GP C Low Significance	No Impact	• No mitigation required.

SF011	Burial site	GP A High Significance	Sunbird Project 2	• Avoid the burial site with a 60 m buffer, the burial site should be demarcated, maintained and access for family should be ensured. • Compilation and Implementation of a grave management plan for Project 2 Sunbird.
SF101	Ruin foundation	GP C Low Significance	Shrike Project 5	• Monitoring of the development by the ECO during construction to implement the Chance Find Procedure.
SF102	Ruin	GP C Low Significance	Shrike Project 5	• Monitoring of the development by the ECO during construction to implement the Chance Find Procedure.
SF103	Stone and cement platform	GP C Low Significance	Sunbird Project 2	• No Mitigation required.

Declaration of Independence

Specialist Name	Jaco van der Walt
Declaration of Independence	I declare, as a specialist appointed in terms of the National Environmental Management Act (Act No 108 of 1998) and the associated 2014 Environmental Impact Assessment (EIA) Regulations (as amended), that I: • I act as the independent 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 favourable to the applicant; • I declare that there are no circumstances that may compromise my objectivity in performing such work; • I have expertise in conducting the specialist report relevant to this application, 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 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; • All the particulars furnished by me in this form are true and correct; and • I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.
Signature	
Date	04/05/2022

a) Expertise of the specialist

Jaco van der Walt has been practising as a CRM archaeologist for 15 years. He obtained an MA degree in Archaeology from the University of the Witwatersrand focussing on the Iron Age in 2012 and is a PhD candidate at the University of Johannesburg focussing on Stone Age Archaeology with specific interest in the Middle Stone Age (MSA) and Later Stone Age (LSA). Jaco is an accredited member of ASAPA (#159) and have conducted more than 500 impact assessments in Limpopo, Mpumalanga, North West, Free State, Gauteng, KZN as well as he Northern and Eastern Cape Provinces in South Africa.

Jaco has worked on various international projects in Zimbabwe, Botswana, Mozambique, Lesotho, DRC Zambia, Guinea, Afghanistan, Nigeria and Tanzania. Through this, he has a sound understanding of the IFC Performance Standard requirements, with specific reference to Performance Standard 8 – Cultural Heritage.

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ABBREVIATIONS

ASAPA: Association of South African Professional Archaeologists
BGG Burial Ground and Graves
BIA: Basic Impact Assessment
CFPs: Chance Find Procedures
CMP: Conservation Management Plan
CRR: Comments and Response Report
CRM: Cultural Resource Management
DFFE: Department of Fisheries, Forestry and Environment,
EA: Environmental Authorisation
EAP: Environmental Assessment Practitioner
ECO: Environmental Control Officer
EIA: Environmental Impact Assessment*
EIA: Early Iron Age*
EIA Practitioner: Environmental Impact Assessment Practitioner
EMPr: Environmental Management Programme
ESA: Early Stone Age
ESIA: Environmental and Social Impact Assessment
GIS Geographical Information System
GPS: Global Positioning System
GRP Grave Relocation Plan
HIA: Heritage Impact Assessment
LIA: Late Iron Age
LSA: Late Stone Age
MEC: Member of the Executive Council
MIA: Middle Iron Age
MPRDA: Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MSA: Middle Stone Age
NEMA National Environmental Management Act, 1998 (Act No. 107 of 1998)
NHRA National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID Notification of Intent to Develop
NoK Next-of-Kin
PRHA: Provincial Heritage Resource Agency
SADC: Southern African Development Community
SAHRA: South African Heritage Resources Agency

**Although EIA refers to both Environmental Impact Assessment and the Early Iron Age both are internationally accepted abbreviations and must be read and interpreted in the context it is used.*

GLOSSARY

Archaeological site (remains of human activity over 100 years old)
Early Stone Age (~ 2.6 million to 250 000 years ago)
Middle Stone Age (~ 250 000 to 40-25 000 years ago)
Later Stone Age (~ 40-25 000, to recently, 100 years ago)
The Iron Age (~ AD 400 to 1840)
Historic (~ AD 1840 to 1950)
Historic building (over 60 years old)

1 Introduction and Terms of Reference

Beyond Heritage was appointed to conduct a HIA for the proposed development of nine Solar Photovoltaic (PV) facilities and associated infrastructure, comprising access roads, nine on-site substations, nine grid connections and one MTS to evacuate the energy from each PV Facility to the national grid. The project is located ~20km south-west of Potchefstroom and ~6 km north-east of Stilfontein, in the North West Province (Figure 1.1 to 1.3) and within the Klerksdorp Renewable Energy Development Zone (REDZ). The SPV Facilities and associated infrastructure are located on a number of farms collectively referred to as the Stilfontein PV Cluster. The specialist report informs the Basic Assessment Reports (BAR) and Environmental Management Programmes (EMPr) compiled for the individual projects that form part of the overall Stilfontein Cluster development.

The aim of the study was to survey the proposed development footprint to identify and document cultural heritage sites, and to assess their importance within local, provincial, and national context. It serves to assess the impact of the proposed project on heritage resources, and to submit appropriate recommendations with regard to management measures that might be required to manage any discovered heritage resources in a responsible manner. It is also conducted to protect, preserve, and develop such resources within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999). The report outlines the approach and methodology utilized before and during the survey, which includes review of relevant literature (Phase 1); physical surveying of the area on foot and by vehicle (Phase 2) and reporting the outcome of the study (Phase 3).

During the survey, heritage resources identified within the project area were limited to low density scatters of Stone Age material, ruins and a burial site. General site conditions and features on sites were recorded by means of photographs, GPS locations and site descriptions. Possible impacts were identified and mitigation measures are proposed in the report.

SAHRA as a commenting authority under section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) require all environmental documents, compiled in support of an Environmental Authorisation application as defined by NEMA EIA Regulations section 40 (1) and (2), to be submitted to SAHRA for commenting. Upon submission to SAHRA the project will be automatically given a case number as reference. As such the EIA report and its appendices must be submitted to the case as well as the EMPr, once it is completed by the Environmental Assessment Practitioner (EAP).

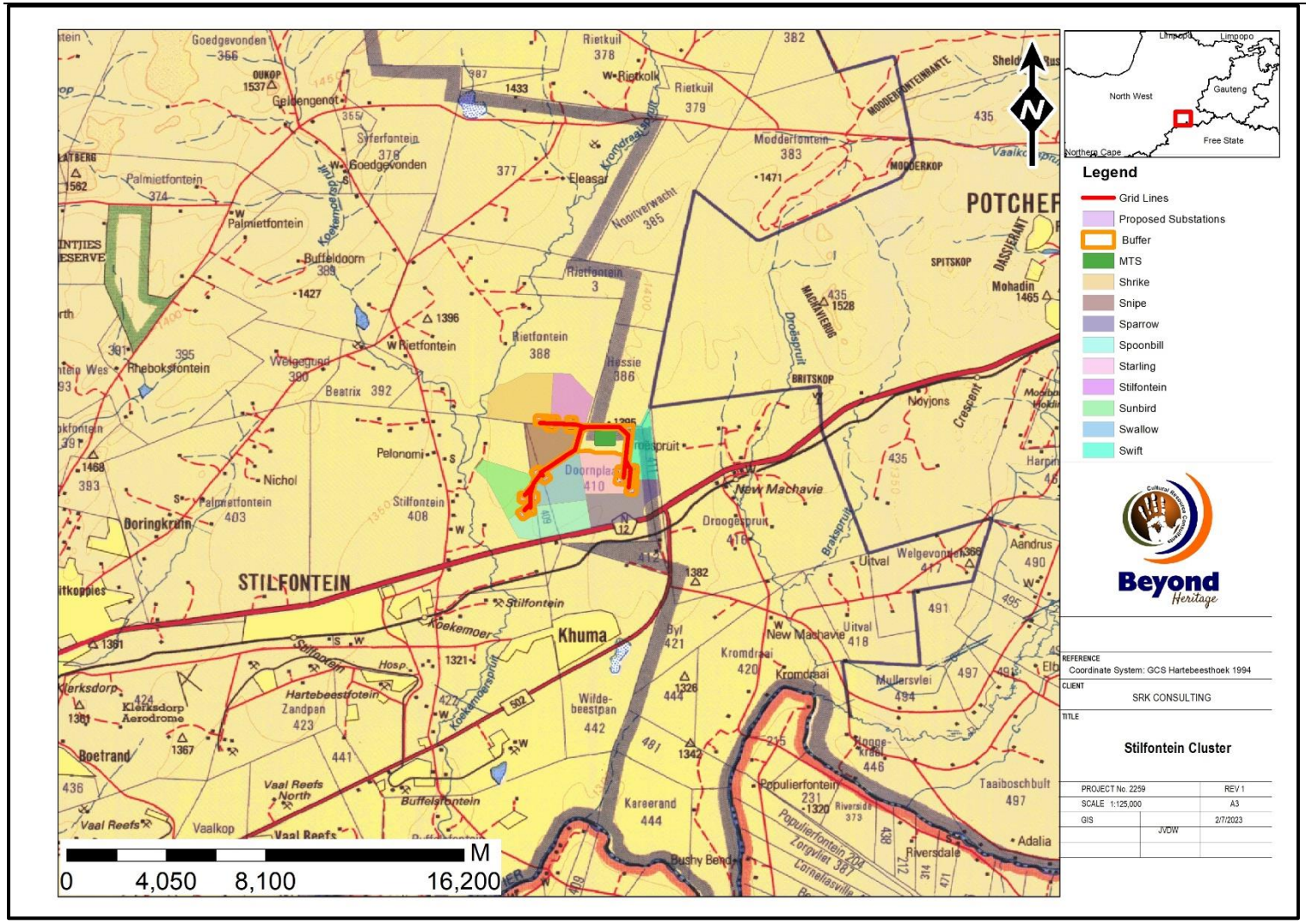

Figure 1.1. Regional setting of the projects within the Stilfontein PV Cluster (1: 250 000 topographical map).

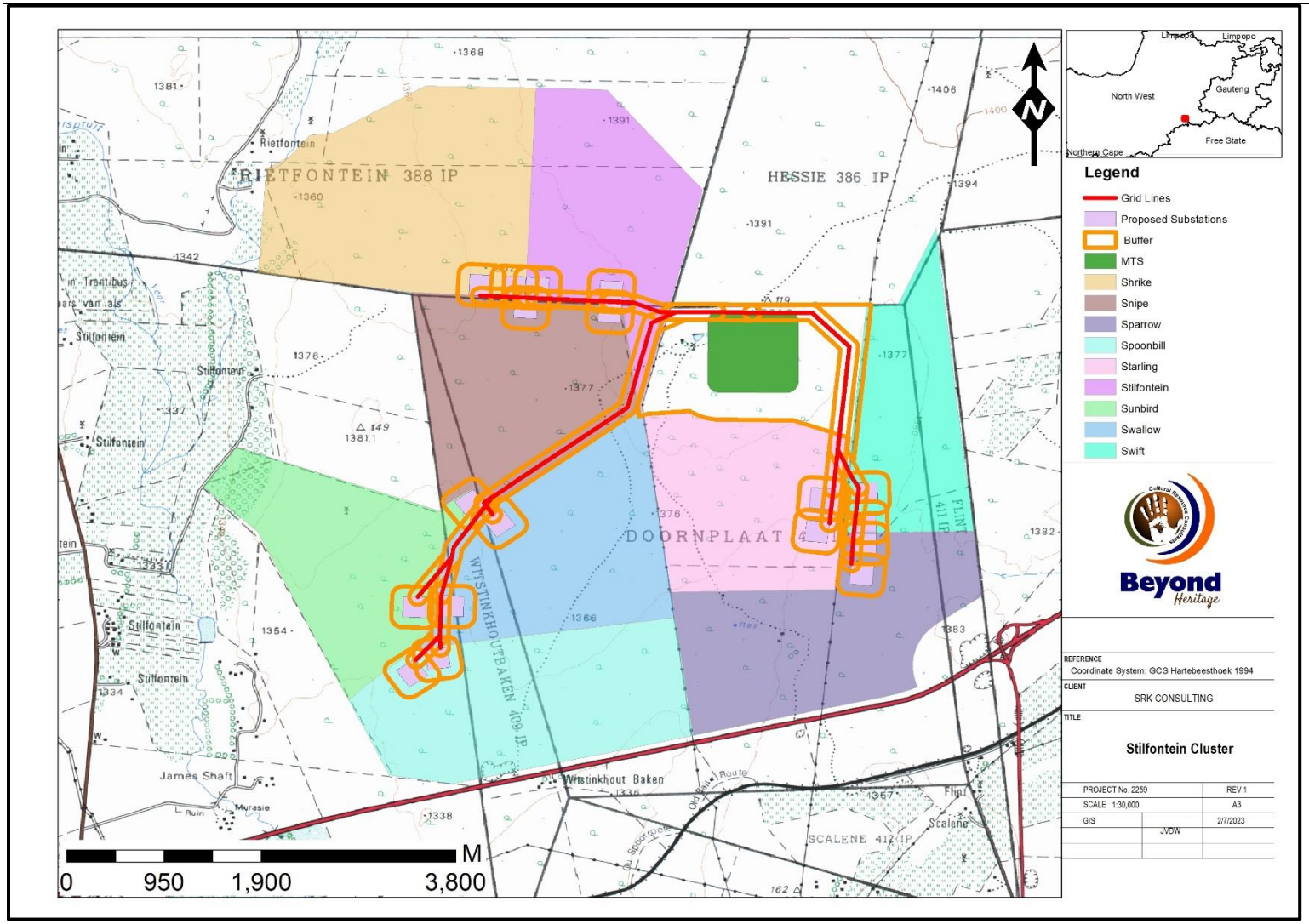

Figure 1.2. Local setting of the projects within the Stilfontein PV Cluster, (1: 50 000 topographical map)

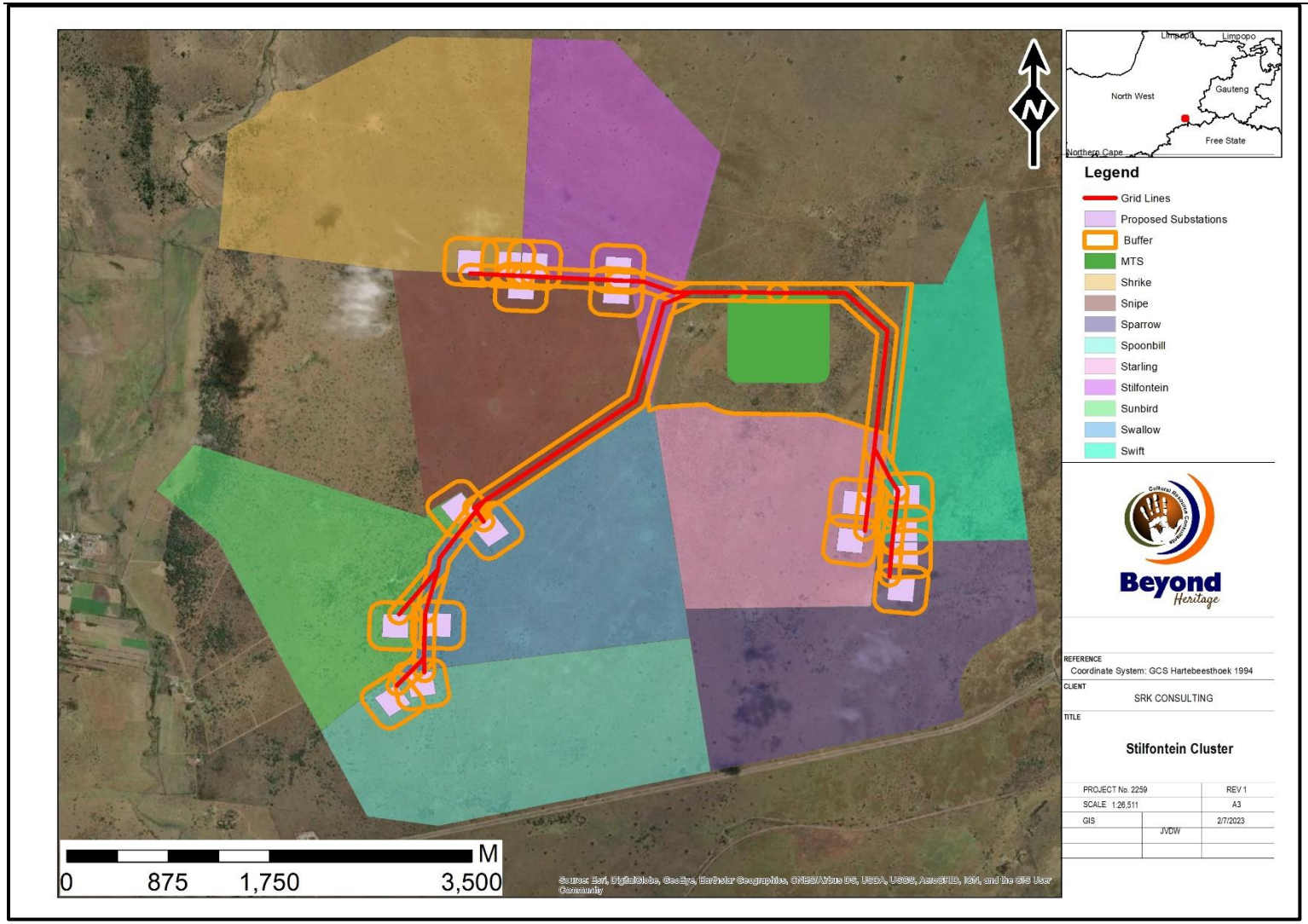

Figure 1.3. Aerial image of the study area.

1.1 Terms of Reference

Field study
Conduct a field study to: (a) locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources affected by the proposed development.

Reporting
Report on the identification of anticipated and cumulative impacts the operational units of the proposed project activity may have on the identified heritage resources for all 3 phases of the project; i.e., construction, operation and decommissioning phases. Consider alternatives, should any significant sites be impacted adversely by the proposed project. Ensure that all studies and results comply with the relevant legislation, SAHRA minimum standards and the code of ethics and guidelines of ASAPA.

To assist the developer in managing the discovered heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999).

1.2 Project Description

Mainstream proposes to develop the Stilfontein PV Cluster, which comprises nine up to 150 MW PV facilities, including grid connections, BESS and associated infrastructure.

1.2.1 PV Facilities

The Stilfontein Cluster comprises nine proposed PV facilities, each with a development area of ~220 to 405 ha: Spoonbill (Project 1), Sunbird (Project 2), Swallow (Project 3), Snipe (Project 4), Shrike (Project 5), Stilfontein (Project 6), Sparrow (Project 7), Starling (Project 8) and Swift (Project 9) (see **Error! Reference source not found.**).

Each PV facility comprises the following key components:

- PV single axis tracking arrays with a maximum export capacity of up to 150 MW and a maximum height of up to 5 m. Panel technology will be either monofacial or bifacial;
- Internal gravel roads with a maximum width of up to 12 m;
- Power transformers;
- Fencing and lighting;
- Material laydown areas;
- Stormwater infrastructure;
- Water supply and water storage infrastructure;
- Offices, including ablutions with septic / conservancy tank sewage treatment infrastructure;
- Operational control centre and maintenance area;
- Battery Energy Storage System (BESS);

- IPP-side of the 11-33/132kV on-site substation, each serving one PV facility. The proposed step-up substation facility will have a development footprint of up to 4 ha, with a 100 m wide buffer around each on-site substation to accommodate powerline tie-ins at any point of the substation and other associated activities. Two alternative locations are identified for each substation;
- Medium voltage 11-33kV underground cabling and / or overhead power lines between the PV facilities and on-site substation;
- Material laydown area (temporary for construction phase and permanent for operation phase).

The associated grid infrastructure for the whole Stilfontein Cluster will consist of the following:

- Nine 11-33/132kV substations, each serving one PV facility. The proposed step-up substation facility will have a development footprint of up to 4 ha, with a 100 m wide buffer around each substation to accommodate powerline tie-ins at any point of the substation and other associated activities. The substation will consist of an IPP portion (100m x 200m) and an Eskom portion (100m x 200m) that will make up the total 4 hectares assigned for the substation as per the assessment area. This report will cover the Eskom portion, as the IPP portion is covered in the facility report as part of a separate environmental authorisation application. Two alternative locations are identified for each substation with a technically preferred site identified.
- 11-33kV underground cabling and overhead power lines between the PV facilities and the substations;
- One 132/400kV Main Transmission Substation (MTS). The proposed step-up MTS will be developed within a ~36 ha development area that is buffered by a 100 m wide powerline buffer interconnection area around the MTS substation to accommodate 132 kV powerline tie-ins at any point of the MTS.
- 132kV above ground powerlines from the 11-33/132kV on-site substations to the 132/400kV MTS;
- 400kV Loop In / Loop Out powerlines from the MTS to connect to the existing 400kV PLUTO / HERMES 1 and 2 powerlines. A total area of ~215 ha, located between the two existing Hermes/Pluto 400 kV lines east and west of MTS, was assessed to allow flexibility for the proposed 400 kV Loop in – Loop out transmission line to the existing Hermes/Pluto 1 and Hermes/Pluto 2 lines. The exact point of the Loop in – Loop out will be advised by Eskom due to the highly technical nature of the interconnection.
- Offices, including ablutions with septic tank/ conservancy tank sewage treatment infrastructure;
- Material laydown areas (temporary for construction phase and permanent for operation phase).

Nineteen separate applications will be submitted for the individual project components as follows:

- 9 x PV applications
- 9 x grid infrastructure applications
- 1 x MTS application.

Project / Application-specific information is provided in Appendix 1.

1.3 Alternatives

1.3.1 Location Alternatives

1.3.1.1 PV Projects

Mainstream conducted an internal constraint mapping exercise to identify the project buildable area for the Stilfontein Cluster that has the least environmental impact, based on a number of criteria, including the following:

- Avoidance of environmentally sensitive areas, e.g. Critical Biodiversity Areas (CBAs) and watercourses;
- Avoidance of socially sensitive areas, e.g. inhabited areas or cultivated land;
- Location within a REDZ and STC;
- Approval by affected landowners;
- Suitable terrain for the establishment of PV arrays, requiring a minimum of earth works;
- Sufficient available area to site all projects of the cluster;
- Good accessibility via existing roads;
- Proximity of tie-in points to the Eskom grid; and
- Availability of local grid capacity.

The identified project area satisfies all the above criteria, which makes the identified site ideally suited. The identified available buildable area has been fully allocated to the nine proposed PV facilities and associated infrastructure that comprise the Stilfontein Cluster. As such, no alternative sites are being assessed for the PV facilities.

1.3.1.2 Substations

Two alternative on-site substation locations were identified per project. A technically preferred substation location was indicated for each project.

1.3.2 Activity Alternatives

The proposal is to generate renewable power as part of the REIPPP. The project lies within the Klerksdorp REDZ which was specifically identified for the deployment of large-scale PV facilities. As such, there are no reasonable activity alternatives.

1.3.3 Technology Alternatives

1.3.3.1 Cell Technology

Three cell technology alternatives are considered:

- Monocrystalline Modules;

- Polycrystalline Modules; and
- Thin Film Modules.

1.3.3.2 Panel Technology

Two panel technology alternatives are considered namely:

- Monofacial panels; and
- Bifacial panels.

Bifacial panels may be technically preferred as they have a:

- Higher yield per module area unit;
- Lower light-induced degradation (LID);
- Longer operational lifetime; and
- Comparable cost (bifacial modules marginally more expensive per produced energy unit).

1.3.3.3 Mounting Technology

Mainstream considered various mounting technologies during the pre-feasibility stage:

- *Fixed axis:* A fixed-tilt system positions the modules at a "fixed" tilt and orientation. This reduces the accuracy of solar panel placement and energy output;
- *Single axis tracking:* This system has a single degree of flexibility that serves as an axis of rotation and is usually aligned along a North-South path (see **Error! Reference source not found.**). It allows the panels to follow the sun daily from east to west. This system is cheaper, more reliable and has a longer lifespan than a dual axis system. It can increase energy production by ~25% to 35% relative to fixed axis systems (SolarReviews, 2022), (energysage, n.d.), but energy production is lower than for dual axis systems; and
- *Dual axis tracking:* This system allows for movement along two axes (see **Error! Reference source not found.**), which offers a wider range of motion and thus increase the accuracy in directional positioning of solar panels. It allows the panels to follow the sun daily from east to west and additionally corrects for seasonal north-south sun movement. The dual axis system thereby allows for ~40% higher energy output than for fixed axis systems (SolarReviews, 2022) (energysage, n.d.). However, the system is mechanically complex and more susceptible to break down, it has a lower lifespan and is unreliable during cloudy or overcast weather.

Single axis tracking is the only mounting technology alternative considered in the BAR.

1.3.3.4 BESS Technology

Mainstream considered two battery technology alternatives during the pre-feasibility stage:

- *Solid State Batteries* typically consist of a graphite anode, metal-oxide cathode, and an electrolyte gel packaged in a flat pouch or rolled up like a jelly-roll. Solid-state battery electrolytes typically consist of Lead Acid (Pb), Nickel Cadium (NiCad), Lithium-Ion (Li-ion), Sodium Sulphur (NaS) or Sodium Nickle Chloride / Zebra (NaNiCl). Sealed thermal management systems within the batteries contain coolants and refrigerants (ethylene glycol and tetrafluoroethane).

- *Redox Flow Batteries* contain a battery cell with flowable electrolyte pumped between storage tanks (see **Error! Reference source not found.**). Electrolyte is pumped through the cell for charging or discharging and is stored in separate tanks for longer duration storage. The electrolyte storage tanks and cells are installed in a specially prepared shipping container (see **Error! Reference source not found.**). The containers typically have secondary and tertiary containment for the electrolyte fluid (Platte River Power Authority, 2017). The two electrolyte storage tanks can also be directly placed within a berm wall to prevent leakage of the electrolyte chemical into the surrounding environment.

Solid state is Mainstream's technically preferred BESS technology, and the only battery technology alternative considered in the BAR.

1.3.3.5 The No-Go Alternative

The No-Go alternative implies that the project will not be implemented, attendant environmental impacts will not occur, and additional renewable electricity will not be generated by this project.

2 Legislative Requirements

The HIA, as a specialist report for the EIA, is required under the following legislation:

- National Heritage Resources Act (NHRA), Act No. 25 of 1999)
- National Environmental Management Act (NEMA), Act No. 107 of 1998 - Section 23(2)(b)

A Phase 1 HIA is a pre-requisite for development in South Africa as prescribed by SAHRA and stipulated by legislation. The overall purpose of heritage specialist input is to:

- Identify any heritage resources, which may be affected;
- Assess the nature and degree of significance of such resources;
- Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;
- Assess the negative and positive impact of the development on these resources; and
- Make recommendations for the appropriate heritage management of these impacts.

The HIA should be submitted, as part of the impact assessment report or EMPr, to the PHRA if established in the province or to SAHRA. SAHRA will ultimately be responsible for the evaluation of Phase 1 HIA reports upon which review comments will be issued. 'Best practice' requires Phase 1 HIA reports and additional development information, as per the impact assessment report and/or EMPr, to be submitted to SAHRA after completion of the study. SAHRA accepts Phase 1 HIA reports authored by professional archaeologists, accredited with ASAPA or with a proven ability to do archaeological work.

Minimum accreditation requirements include an Honours degree in archaeology or related discipline and 3 years post-university CRM experience (field supervisor level). Minimum standards for reports, site documentation and descriptions are set by ASAPA in collaboration with SAHRA. ASAPA is based in South Africa, representing professional archaeology in the SADC region. ASAPA is primarily involved in the overseeing of ethical practice and standards regarding the archaeological profession. Membership is based on proposal and secondment by other professional members.

Phase 1 HIAs are primarily concerned with the location and identification of heritage sites situated within a proposed development area. Identified sites should be assessed according to their significance. Relevant conservation or Phase 2 mitigation recommendations should be made. Recommendations are subject to evaluation by SAHRA.

Human remains older than 60 years are protected by the National Heritage Resources Act, with reference to Section 36. Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act), as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36[5]) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in this age category, located inside a formal cemetery administrated by a local authority, require the same authorisation as set out for graves younger than 60 years, in addition to SAHRA authorisation. If the grave is not situated inside a formal cemetery, but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws, set by the cemetery authority, must be adhered to.

Human remains that are less than 60 years old are protected under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance No. 7 of 1925), as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning; or in some cases, the MEC for Housing and Welfare. Authorisation for exhumation and reinternment

must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. To handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

3 Methodology

3.1 Literature Review

A brief survey of available literature was conducted to extract data and information on the area in question to provide general heritage context into which the development would be set. This literature search included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS).

3.2 Genealogical Society and Google Earth Monuments

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where sites of heritage significance might be located; these locations were marked and visited during the fieldwork phase. The database of the Genealogical Society was consulted to collect data on any known graves in the area.

3.3 Public Consultation and Stakeholder Engagement:

Stakeholder engagement is a key component of any EA process, it involves stakeholders interested in, or affected by the proposed development. Stakeholders are provided with an opportunity to raise issues of concern (for the purposes of this report only heritage related issues will be included). The aim of the public consultation process conducted by the EAP was to capture and address any issues raised by community members and other stakeholders during key stakeholder and public meetings. Informal consultation with landowners was also conducted by the heritage team.

3.4 Site Investigation

The aim of the site visit was to:

a) survey the proposed project area to locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest;
b) record GPS points of sites/areas identified as significant areas;
c) determine the levels of significance of the various types of heritage resources recorded in the project area.

Table 4: Site Investigation Details

	Site Investigation
Date	7th to 14th February 2022, i.e. a total of six days of fieldwork by two archaeologist and 10 – 11 February 2023 , i.e. two days of field work by two archaeologists.
Season	Summer – The site is characterised by dense vegetation cover limiting archaeological visibility. The Stilfontein SPV Cluster footprint was sufficiently covered to understand the heritage character of the area and tracklogs of the survey paths for each project are provided in the project-specific Appendix 1.

3.5 Site Significance and Field Rating

Section 3 of the NHRA distinguishes nine criteria for places and objects to qualify as 'part of the national estate' if they have cultural significance or other special value. These criteria are:

1. Its importance in/to the community, or pattern of South Africa's history;
2. Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;

3. Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
4. Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
5. Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
6. Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
7. Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
8. Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
9. Sites of significance relating to the history of slavery in South Africa.

The presence and distribution of heritage resources define a 'heritage landscape'. In this landscape, every heritage resource is relevant. In addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area, or a representative sample, depending on the nature of the project.

In the case of the proposed project, the local extent of its impact necessitates a representative sample and only the footprint of the areas demarcated for development were surveyed. In all initial investigations, however, the specialists are responsible only for the identification of resources visible on the surface.

This section describes the evaluation criteria used for determining the significance of archaeological and heritage sites. The following criteria were used to establish site significance with cognisance of Section 3 of the NHRA:

- The unique nature of a site;
- The integrity of the archaeological/cultural heritage deposits;
- The wider historic, archaeological, and geographic context of the site;
- The location of the site in relation to other similar sites or features;
- The depth of the archaeological deposit (when it can be determined/is known);
- The preservation condition of the sites; and
- Potential to answer present research questions.

In addition to this, criteria field ratings prescribed by SAHRA (2006), and acknowledged by ASAPA for the SADC region, were used for the purpose of this report (Table 4). The recommendations for each site should be read in conjunction with section 10 of this report.

Table 5: Heritage significance and field ratings

FIELD RATING	*GRADE*	*SIGNIFICANCE*	*RECOMMENDED MITIGATION*
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP. A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP. B)	-	Medium significance	Recording before destruction

Generally Protected C (GP.C)	-	Low significance	Destruction

3.6 Impact Assessment Methodology provided by SRK

Potential impacts of the proposed project were identified based on the baseline data, project description, review of other studies for similar projects and professional experience.

Practical mitigation and optimisation measures that can be implemented effectively to reduce or enhance the significance of impacts were identified. The impact significance was re-rated assuming the effective implementation of mitigation measures.

Impacts are rated according to SRK's prescribed impact assessment methodology presented below.

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring, including possible irreversibility of impacts and/or loss of irreplaceable resources, and the **probability** that the impact will occur.

The criteria used to determine impact consequence are presented in the table below.

Table 6. **Criteria used to determine the consequence of the impact**

Rating	Definition of Rating	Score
A. *Extent* *– the area (distance) over which the impact will be experienced*		
Local	Confined to project area (e.g. the development site and immediate surrounds)	1
Regional	The region (e.g. municipality or Quaternary catchment)	2
(Inter) national	Nationally or beyond	3
B. ***Intensity*** *– the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered and/or irreplaceable resources[1] are lost	3
C. ***Duration*** *– the timeframe over which the impact will be reversed*		
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years or irreversible	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Table 7. Method used to determine the consequence score

***Combined Score* (A+B+C)**	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Once the consequence was derived, the probability of the impact occurring was considered, using the probability classifications presented in the table below.

Table 8. Probability classification

Probability *– the likelihood of the impact occurring*	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall **significance** of impacts was determined by considering consequence and probability using the rating system prescribed in the table below.

Table 9. Impact significance ratings

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Finally, the impacts were also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below.

Table 10. **Impact status and confidence classification**

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity/development.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity/development.

- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity/development.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity/development.
- **HIGH**: the potential impact **will** affect the decision regarding the proposed activity/development.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Practicable mitigation and optimisation measures are recommended, and impacts are rated in the prescribed way both without and with the assumed effective implementation of mitigation and optimisation measures. Mitigation and optimisation measures are either:

- **Essential**: measures that must be implemented and are non-negotiable; and
- **Best Practice:** recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the applicant if not implemented.

3.7 Limitations and Constraints of the study

The authors acknowledge that the brief literature review is not exhaustive on the literature of the area. Due to the nature of heritage resources and limitations to pedestrian surveys, the possibility exists that some features or artefacts may not have been discovered/recorded. Therefore, the possible occurrence of graves and other cultural material cannot be excluded. This limitation is successfully mitigated with the implementation of a chance find procedure and monitoring of the study area by the Environmental Control Officer (ECO).

This report only deals with the footprint area of the proposed development and consisted of non-intrusive surface surveys. This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components will be highlighted through the public consultation process if relevant. It is possible that new information could come to light in future, which might change the results of this Impact Assessment.

4 Description of Socio-Economic Environment

The project extends in the Municipalities of the City of Matlosana and the JB Marks Municipality and the following information was obtained on the municipalities:

According to the IDP for the City of Matlosana and estimates based on the population growth rate of SA Statistics (1.04%) and the Matlosana Socio- Economic Report, the City of Matlosana has a total population of 438 486 people, of whom 103 407 (92%) are urbanised and 35 079 (8%) are rural. (Mining villages form part of the urban areas). The largest population concentrations are in Jouberton (31%), Kanana, Khuma and Tigane, which represent 67% of the total urban population. The City of Matlosana has a population density of 123 persons per km² people of which 92% are urbanised and 8% rural. Economic drivers in the area are mostly mining and agriculture.

The IDP for the JB Marks Local municipality states that the population of JB Marks Municipality has increased from 219 463 to 243 527 between 2011 and 2016. Most of the population is made up of black Africans. Gold mining is the dominant economic activity in the district, with Potchefstroom and Ventersdorp being the only exceptions. While Ventersdorp to the north-west of Potchefstroom focuses on agricultural activity, Potchefstroom's economic activity is driven by services and manufacturing.

5 Results of Public Consultation and Stakeholder Engagement

Adjacent landowners and the public at large will be informed of the proposed activity as part of the BA process by the EAP. Site notices and advertisements notifying interested and affected parties will be placed at strategic points and in local newspapers as part of the process. If any heritage concerns are raised, it will be addressed in an amended report.

In addition, the heritage team consulted with the owner of the farm Doornplaat regarding possible heritage resources located within the study area. He indicated a burial site (SF011) and a demolished homestead (SF008) in the Sunbird PV Facility and a stone walled enclosure (SF009) located within Swallow PV Facility.

6 Literature / Background Study

6.1 Literature Review (SAHRIS)

The area under investigation was not previously covered by heritage surveys, but a few HIAs have been conducted in the immediate area. Studies conducted in the general area that were consulted are listed in Table 11.

Table 11. Studies conducted in the greater area.

Author	Year	Project	Findings
Kusel, U.	2007	Cultural Heritage Resources Impact Assessment Of Portions 252, 413 & 449 Of The Farm Hartbeesfontein 297 Ip Matlosana Local Municipality North West Province	Iron Age
J.A. van Schalkwyk	2010	Heritage Impact Assessment For The Proposed Hermes/Dominion Reefs 132kv Power Line Development, Klerksdorp Magisterial District, North West Province	No sites
Coetzee, F.	2012	Cultural Heritage Scoping Survey of the proposed Kabi Witkop Solar PV Facility near Orkney, Kenneth Kaunda District Municipality, North West Province.	Known Stone age, Iron Age and Anglo Boer War sites were noted.
Van der Walt, J.	2016	Archaeological Impact Assessment – Buffels Solar 1, North West Province.	No sites
Van der Walt, J.	2016	Archaeological Impact Assessment – Buffels Solar 2, North West Province.	No sites
Van der Walt, J	2016	AIA Orkney Solar Farm, Northwest Province	Burial sites
Van der Walt, J.	2022 a	Heritage Impact Assessment of the Roan 1 PV Development, North West Province.	Stone Age artefacts in varying densities as well as a stone cairn of unknown purpose and a degraded dwelling complex
Van der Walt, J.	2022 b	Heritage Impact Assessment of the Roan 2 PV Development, North West Province.	Stone Age scatters, ruins, and historical mining infrastructure
Van der Walt, J.	2022 c	Heritage Impact Assessment for the proposed Doornhoek 1 PV Facility and Associated Infrastructure, Klerksdorp, North West Province	MSA Scatter
Van der Walt, J.	2022 d	Heritage Impact Assessment for the proposed Doornhoek 2 PV Facility and Associated Infrastructure, Klerksdorp, North West Province	Ruins and a Stone Age Scatter

6.1.1 Google Earth and The Genealogical Society of South Africa (Graves and burial sites)

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological and historical sites might be located. The database of the Genealogical Society of South Africa indicated no known grave sites within the study area.

6.2 Archaeological Background

The archaeological record for the greater study area consists of the Stone Age and Iron Age.

6.2.1.1 Stone Age

The Stone Age is divided into the Early; Middle and Late Stone Age. It refers to the earliest period of occupation of South Africa when people mainly relied on stone for their tools.

Earlier Stone Age (ESA): The period from ± 2.5 million yrs. - ± 250 000 yrs. ago. Acheulean stone tools are dominant. No Acheulean sites are on record near the study area, but isolated finds may be possible. However, isolated finds have little value. Therefore, the project is unlikely to disturb a site of significance. The lack of any ESA sites was confirmed during the field investigation.

Middle Stone Age (MSA): The Middle Stone Age includes various lithic industries in SA dating from ± 250 000 yrs. – 25 000 yrs. before present. This period is first associated with archaic *Homo sapiens* and later *Homo sapiens sapiens*. Material culture includes stone tools with prepared platforms and stone tools attached to handles.

Later Stone Age (LSA): The period from ± 25 000-yrs before present to the period of contact with either Iron Age farmers or European colonists. This period is associated with *Homo sapiens sapiens*. Material culture from this period includes: microlithic stone tools; ostrich eggshell beads and rock art. Sites located in the open are usually poorly preserved and therefore have less value than sites in caves or rock shelters.

Since there are no caves in the study area no Stone Age sites of significance are expected. The well-known rock art site of Bosworth that also included Later Stone Age artifacts (Mason 1962) is located in the region but will not be affected by the proposed Project.

6.2.1.2 The Iron Age

The Iron Age as a whole represents the spread of Bantu speaking people and includes both the pre-Historic and Historic periods. It can be divided into three distinct periods:

Early Iron Age: Most of the first millennium AD.
Middle Iron Age: 10th to 13th centuries AD.
Late Iron Age: 14th century to colonial period.

The Iron Age is characterised by the ability of people to manipulate and work Iron ore into implements that assisted them in creating a favourable environment to make a better living. Few sites dating to the Iron Age have been recorded for the study area.

However, towards Zeerust and towards Mafikeng, the area is well known for Later Iron Age stone walled settlements archaeologically referred to as Molokwane settlements (Pistorius 1992, Booyens 1998, Huffman 2007). Late Iron Age sites in the larger geographical area are located north and west of the town of Klerksdorp (Bergh 1999: 6-7). Some well-known examples are Platberg (Wells 1933) and

Buisfontein (Thabeng) (Maggs 1976). Another site is Palmietfontein (30 km north of Klerksdorp), excavated in 1975 by D.A. White. An article on this work also indicated that the area north of Klerksdorp is relatively rich in terms of Late Iron Age sites, and that the Rolong capital of Thabeng lies within this area (White 1977: 89). Based on the research by Huffman it is possible that sites are related to the Olifantspoort facies of the Urewe Tradition, dating to around AD 1500-1700, and the Thabeng facies of the same tradition (AD 1700-1840) could possibly be found in the area (Huffman 2007).

6.3 Historical Information

Klerksdorp was founded in 1837 when the Voortrekkers settled on the banks of the Schoonspruit, which flows through the town. The first settlers included C.M. du Plooy, he claimed a farm of about 160 km² and called it Elandsheuwel. Du Plooy gave plots of land and communal grazing rights on this farm to other Voortrekkers in return for their assistance in building a dam and an irrigation canal. This collection of smallholdings was later given the name of Klerksdorp after the first magistrate of the area, Jacob de Clerq (https://www.britannica.com/place/Klerksdorp) In August 1886, gold was discovered in the Klerksdorp district as well as on the Witwatersrand about 160 km to the east. Fortune-seekers descended on the small village, turning it into a town with 70 taverns and even a stock exchange of its own. The nature of the gold reef demanded expensive and sophisticated equipment to mine and extract the gold, causing the majority of diggers to move away in the late 1890's and a decline in the gold mining industry. Stilfontein town was established in 1949 as a residential centre for the surrounding mines (Hartebeesfontein, Buffelsfontein and Stilfontein).

During the Second Boer War (1899-1902), there were many battles in the area and the area also housed a large concentration camp. The most famous battle in the Klerksdorp area is the Battle of Ysterspruit. The Boer General, Koos de la Rey, achieved a great victory here and the battle is one of the most celebrated of the general's career. It was this battle in which the Boer soldiers pioneered the art of firing from horseback.

On April 11, 1920, Rooiwal, near Klerksdorp, saw the battle of Rooiwal, the last major engagement of the war, where a Boer charge was beaten off by entrenched British troops. Just under a thousand graves of the victims of the concentration camps, namely Boer women and children, can still be visited today in the old cemetery just outside of Klerksdorp.

Klerksdorp was connected by rail to Krugersdorp on 3 August 1897 and to Kimberley in 1906. The gold mining industry was revived by large mining companies in 1932, causing the town to grow, which accelerated after World War II.

7 Description of the Physical Environment

The Project area is characterised by open fields used for grazing marked by thickets of trees and dense grass cover, limiting archaeological and palaeontological ground visibility. The topography is slightly undulating with no major focal points like hills or pans present, but quartzite outcrops and exposures of dolomite is found regularly throughout the area.

Infrastructure development is limited throughout the area and (apart from powerlines) limited to farming related activities such as water reservoirs, drinking troughs, fences, and small gravel roads. A series of features related to historical prospecting activities were also noted and characterised by large piles of excavated rocks as well as a deep trench in one location on the farm Flint 411.

The study area falls within the Dry Highveld Grassland Bioregion as described by Mucina *et al* (2006) with the vegetation described as Klerksdorp thornveld. Land use in the general area is characterized by agriculture, dominated by cattle farming as well as mining activities. General site conditions are illustrated in Figure 7.1 to 7.4.

Figure 7.1.Dense vegetation limits ground visibility.

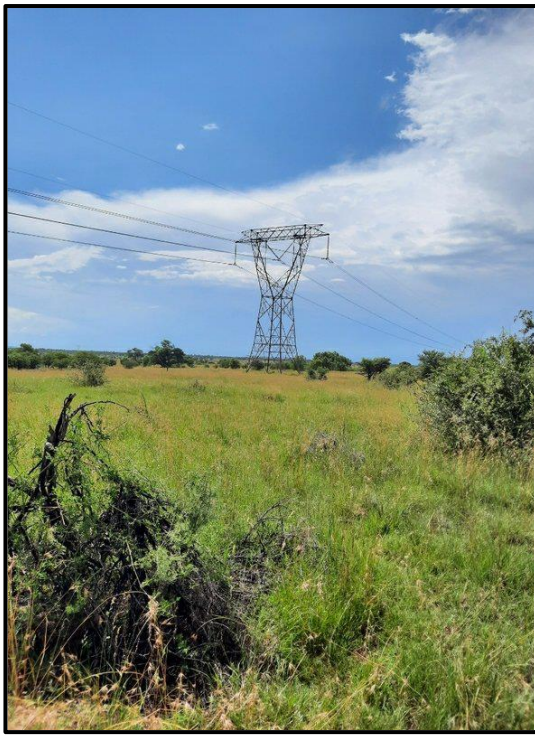

Figure 7.2. Existing powerlines traversing the study area.

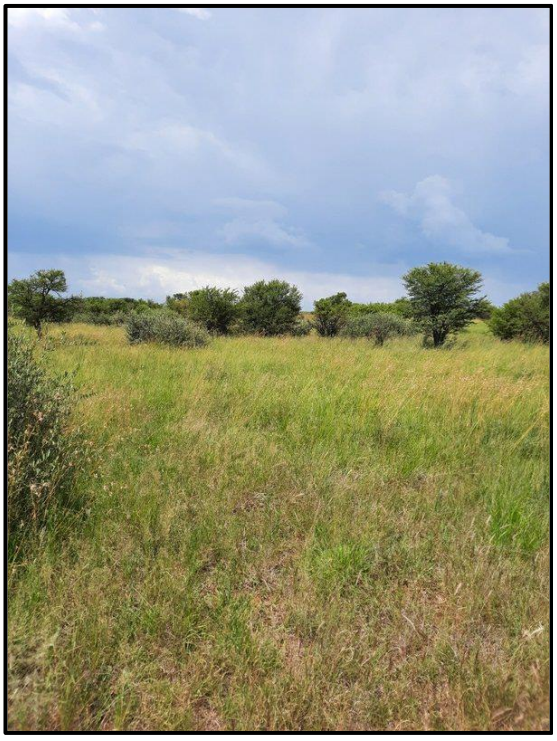

Figure 7.3. General site conditions.

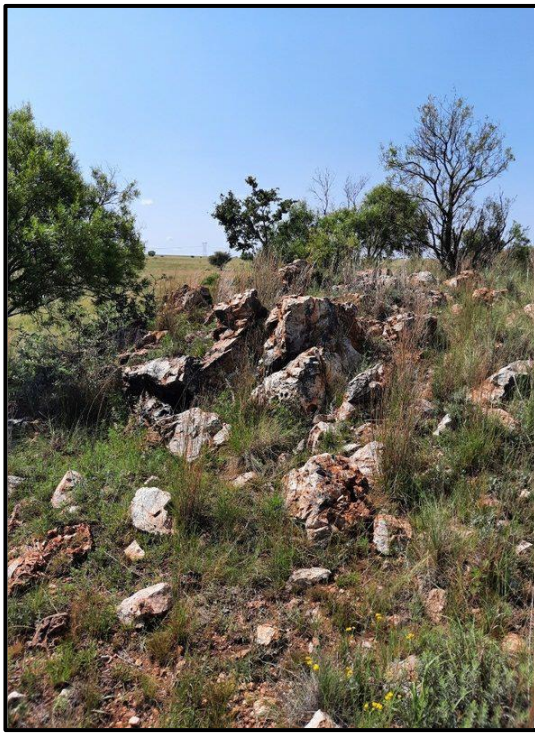

Figure 7.4. General site conditions – quartz outcrop.

8 Baseline Conditions

8.1 Heritage Resources

Since there are no caves in the study area, no Stone Age sites of significance are expected. Low density scatters of MSA artefacts that are of low significance are recorded to the north and west of the study area (van der Walt 2022 a, b, c, d) and similar occurrence are expected for the study are due to the readily available quartzite used as raw material by Stone Age knappers to fashion their tools. The well-known rock art site of Bosworth that also included LSA artifacts (Mason 1962) is located to the northwest of the Project area and isolated finds dating to this period is possible.

Late Iron Age sites in the larger geographical area are located north and west of Klerksdorp (e.g., Bergh 1999, Wells 1933, Maggs 1976 and White 1977). Based on the research by Huffman (2007) it is possible that these sites are related to the Olifantspoort facies of the Urewe Tradition, dating to around AD 1500-1700, and the Thabeng facies of the same tradition (AD 1700-1840). These sites are marked by stone walled settlements readily visible from aerial photographs, and although sites dating to this period are known from the larger area, none is found within the Project footprint.

During the survey of the Stilfontein SPV cluster footprint low-density scatters of MSA artefacts as well as a burial site and the ephemeral remains of ruins were recorded. Recorded observations are numbered numerically with the prefix SF for Stilfontein and their location relative to the SPV cluster illustrated in Figure 8.1.

General site descriptions are provided in the project-specific Appendix 1.

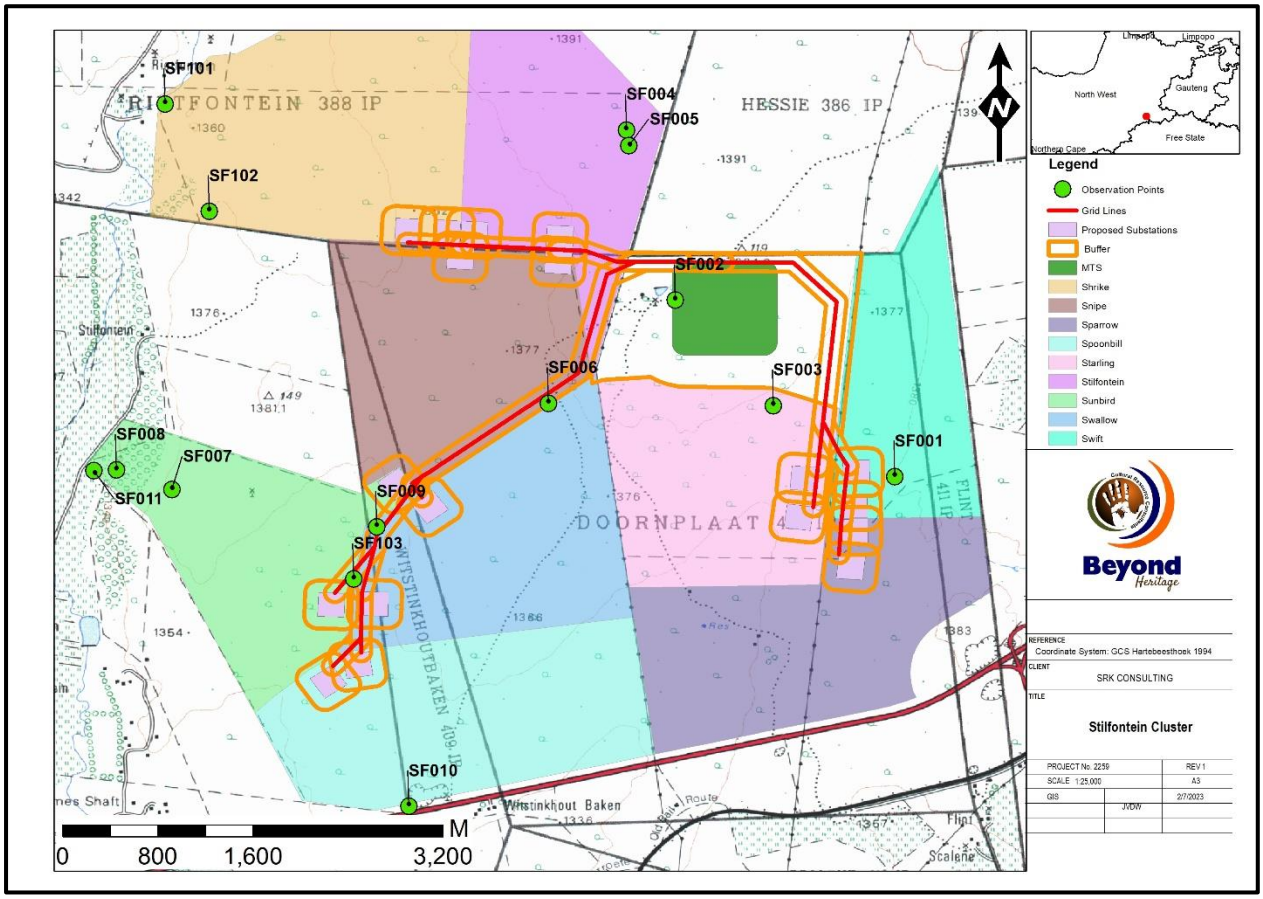

Figure 8.1. Recorded observation in relation to the PV layout.

Table 12. Recorded heritage observations

Label	Description	Longitude	Latitude	Significance	PV Facility
SF001	Low density MSA scatter.	26,88707	-26,7909	GP C Low Significance	Swift Project 9
SF002	Low density MSA scatter.	26,87045	-26,7776	GP C Low Significance	MTS
SF003	Low density MSA scatter.	26,87787	-26,7855	GP C Low Significance	Starling Project 8
SF004	Isolated lithic Artefact.	26,86674	-26,7647	GP C Low Significance	Stilfontein Project 6
SF005	Isolated lithic artefact.	26,86691	-26,7659	GP C Low Significance	Stilfontein Project 6
SF006	Isolated Lithic artefact	26,86083	-26,7854	GP C Low Significance	Snipe Project 4
SF007	Low density scatter.	26,83232	-26,7919	GP C Low Significance	Sunbird Project 2
SF008	Historical Farmstead	26,82813	-26,7904	GP C Low Significance	Sunbird Project 2
SF009	Stone wall	26,84784	-26,7947	GP C Low Significance	Swallow Project 3
SF010	A small stone-built structure	26,85027	-26,8159	GP C Low Significance	No direct Impact (20 m outside of Spoonbill PV)
SF011	Burial site	26,82642	-26,7905	GP A High Significance	Sunbird Project 2
SF101	Ruin foundation	26,83182	-26,7627	GP C Low Significance	Shrike Project 5
SF102	Ruin	26,83516	-26,7708	GP C Low Significance	Shrike Project 5
SF103	Stone and cement platform	26,8461	-26,7987	GP C Low Significance	Sunbird Project 2

8.2 Cultural Landscape

The study area is in a rural setting and characterised by cultivation and agricultural activities with a historical layering consisting of Stone Age sites as outlined above with modern infrastructure elements that is limited to agricultural infrastructure, remnants of mining activity, powerlines and gravel roads.

8.3 Paleontological Heritage

This section was authored by Prof Marion Bamford (Bamford 2022).

8.3.1 Geological assessment

The proposed project lies in the southwestern part of the Transvaal Basin where the lower rocks of the Transvaal Supergroup are exposed, in particular the dolomites of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup; ca 2585-2480 Ma), shown in the geological map (Figure 8.2).

The Late Archaean to early Proterozoic Transvaal Supergroup is preserved in three structural basins on the Kaapvaal Craton (Eriksson et al., 2006). In South Africa are the Transvaal and Griqualand West Basins, and the Kanye Basin is in southern Botswana. The Griqualand West Basin is divided into the Ghaap Plateau sub-basin and the Prieska sub-basin. Sediments in the lower parts of the basins are very similar but they differ somewhat higher up the sequences. Several tectonic events have greatly deformed the southwestern portion of the Griqualand West Basin between the two sub-basins.

In the Transvaal Basin the Transvaal Supergroup is divided into two Groups, the lower Chuniespoort Group and the upper Pretoria Group (with ten formations; Eriksson et al., 2006). The Chuniespoort Group is divided into the basal Malmani Subgroup that comprises dolomites and limestones and is divided into five formations based on chert content, stromatolitic morphology, intercalated shales and erosion surfaces. The top of the Chuniespoort Group has the Penge Formation and the Duitschland Formation.

Making up the lower Pretoria Group are the Timeball Hill Formation and the Boshoek Formation. The Hekpoort, Dwaalheuwel, Strubenkop and Daspoort Formations form a sequence as the middle part of the Pretoria Group, Transvaal Supergroup, and represent rocks that are over 2060 million years old. The Hekpoort Formation is a massive lava deposit and is overlain by the rest of the Transvaal Supergroup.

The Transvaal sequence has been interpreted as three major cycles of basin infill and tectonic activity with the first deep basin sediments forming the Chuniespoort Group, the second cycle deposited the lower Pretoria Group, and the sediments in this area are from the interim lowstand that preceded the third cycle. These sediments were deposited in shallow lacustrine, alluvial fan and braided stream environments (Eriksson et al., 2012).

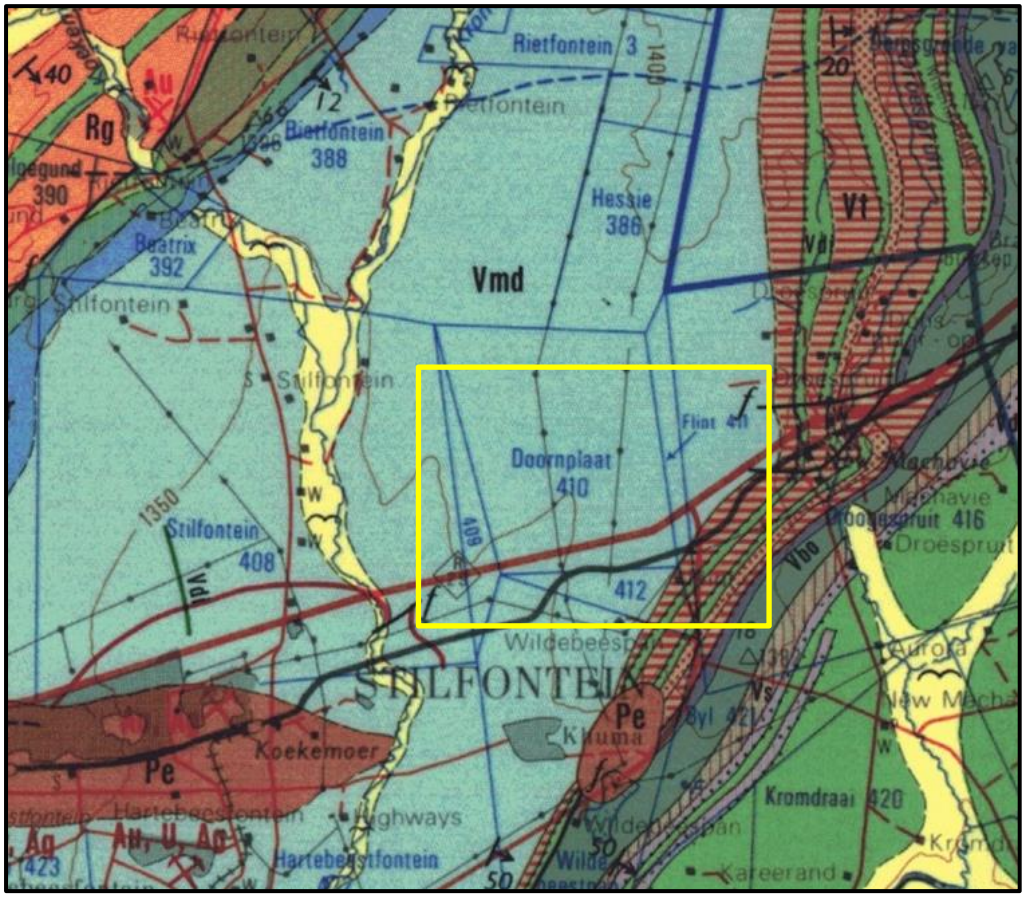

Figure 8.2. Geological map of the area around the proposed Stilfontein PV cluster project indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 1. Map enlarged from the Geological Survey 1: 250 000 map 2626 West Rand.

Table 13: Explanation of symbols for the geological map and approximate ages (Eriksson et al., 2006; Zeh et al., 2020). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qg	Quaternary	Alluvium, sand, gravel	Neogene, ca 2.5 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pe	Vryheid Fm, Ecca Group, Karoo SG	Shales, sandstone, coal	Early Permian, Middle Ecca
Vdi	diabase	Diabase	Post-Transvaal SG
Vh	Hekpoort Fm, Pretoria Group, Transvaal SG	Andesite, agglomerate, tuff	
Vt	Timeball Hill Fm Pretoria Group, Transvaal SG	Quartzite	< 2420 Ma
Vbr	Black Reef Fm, Transvaal SG	Quartzite, conglomerate, shale, basalt	Ca 2650 – 2640 Ma
Vmd	Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dolomite, chert	Ca 2750 – 2650 Ma
R-Vr	Rietgat Fm, Platberg Group, Ventersdorp SG	Amygdaloidal lava, agglomerate, tuff	
Rg	Government Subgroup, West Rand Group, Witwatersrand SG	Quartzite, shale, greywacke, conglomerate	

8.3.2 Palaeontological assessment

The Transvaal Supergroup rocks represent, on a very large scale, a sequence of sediments filling the basins under conditions of lacustrine, fluvial, volcanic and glacial cycles in a tectonically active region. The predominantly carbonaceous sediments are evidence of the increase in the atmosphere of oxygen produced by algal colony photosynthesis, the so-called Great Oxygen Event (ca 2.40 – 2.32 Ga) and precursor to an environment where diverse life forms could evolve. The Neoarchean-Paleoproterozoic Transvaal Supergroup in South Africa contains the well-preserved stromatolitic Campbellrand -Malmani carbonate platform (Griqualand West Basin – Transvaal Basin respectively), which was deposited in shallow seawater shortly before the Great Oxidation Event (GOE).

The Transvaal Supergroup comprises one of world's earliest carbonate platform successions (Beukes, 1987; Eriksson et al., 2006; Zeh et al., 2020). In some areas there are well preserved stromatolites that are evidence of the photosynthetic activity of blue green bacteria and green algae. These microbes formed colonies in warm, shallow seas and deposited layer upon layer of minerals, often in domes or columns. The minerals are predominantly calcium carbonate, calcium sulphate, magnesium carbonate and magnesium sulphate. Only very rarely are the bacteria and algae preserved but the stromatolites are traces of their activity, hence call trace fossils. These fossils are protected by legislation, therefore the Malmani Subgroup palaeosensitivity is very high (Figure 8.3).

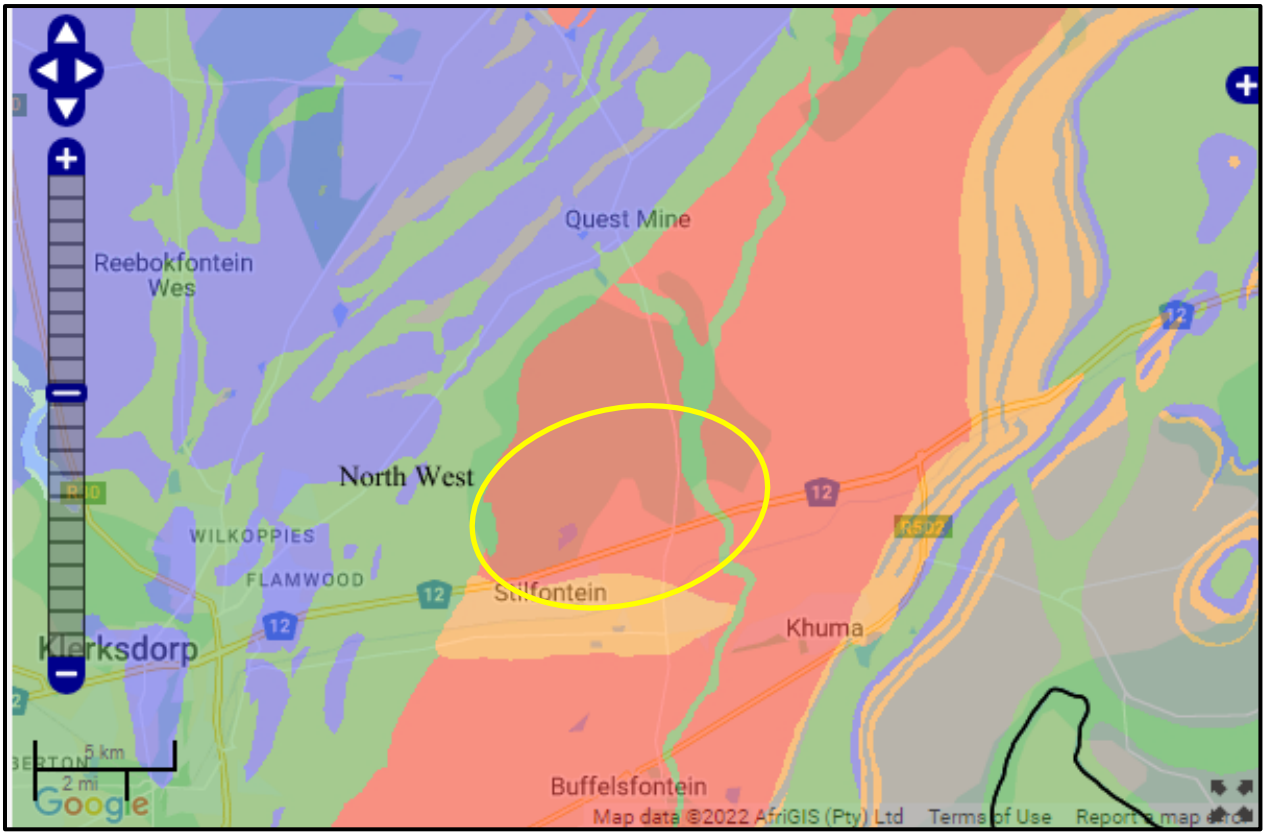

Figure 8.3. SAHRIS paleo sensitivity map for the site for the proposed Stilfontein PV cluster shown within the yellow circle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The fossils that occur in these ancient carbonate platforms are trace fossils known as stromatolites. Stromatolites are the trace fossils that were formed by colonies of green algae and blue-green algae (Cyanobacteria) that grew in warm, shallow marine settings. These algae were responsible for releasing oxygen via the photosynthetic process where atmospheric carbon dioxide and water, using energy from the sun, are converted into carbon chains and compounds that are the building blocks of all living organisms. The released carbon dioxide initially was taken up by the abundant reducing minerals to form oxides, e.g. iron oxide. Eventually free oxygen was released into the atmosphere, and some was converted into ozone by the bombardment of cosmic rays. The ozone is critical for the filtering out of harmful ultraviolet rays.

Stromatolites are the layers upon layers of inorganic materials that were deposited during photosynthesis, namely calcium carbonate, magnesium carbonate, calcium sulphate and magnesium sulphate. These layers can be in the form of flat layers, domes or columns depending on the environment where they grew (Beukes, 1987). Some environments did not form stromatolites, just layers of limestone that later was converted to dolomite. The algae that formed the stromatolites are very rarely preserved, and they are microscopic so they can only be seen from thin sections studies under a petrographic microscope. The area was walked by foot, looking for rocky outcrops that could be dolomite and perhaps have stromatolites preserved. Photographs were taken of various features (Figures 8.4 – 8.8).

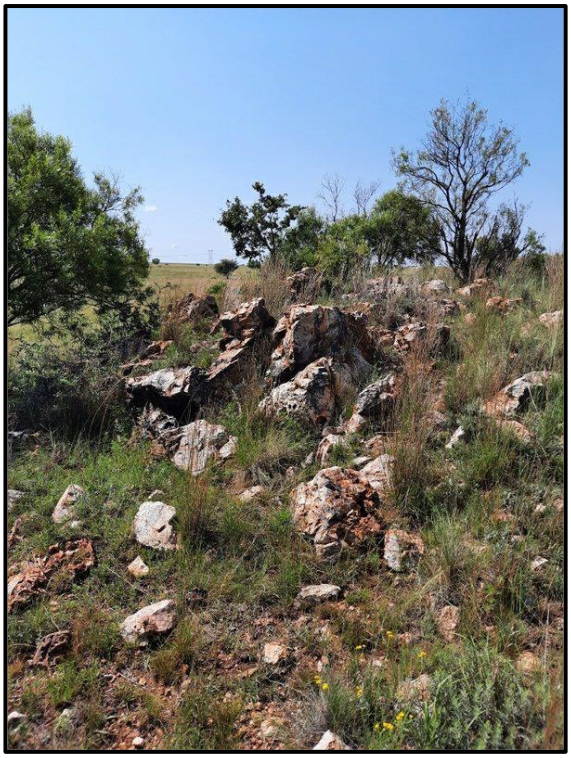

Figure 8.4. Quartzite outcrops with no fossils preserved.

Figure 8.5. Quartzite outcrops with no fossils preserved.

Figure 8.6. An exposure of dolomite with the typical “elephant skin” texture but no stromatolites.

Figure 8.7. Where the gravelly and pebbly soils are thin the vegetation is less dense. No fossils.

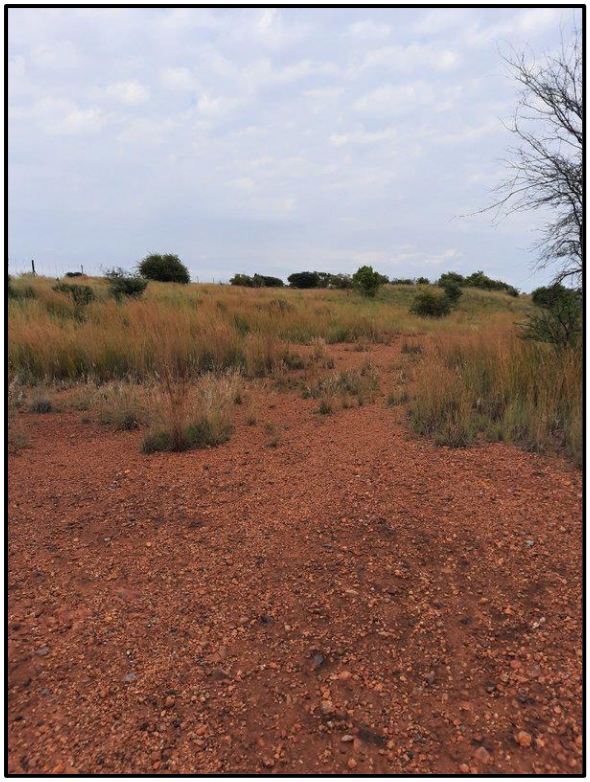

Figure 8.8. Site visit photograph to show the general topography. Note the sparse grass cover where the pebbly soils are thin. No fossils are visible.

9 Potential Impact

Impacts to heritage resources without mitigation within the project footprint will be permanent and negative and occur during construction activities. Isolated Stone Age scatters recorded at SF 001 – SF 007 are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. The impact of these observations is therefore low.

The recorded built environment features (SF008, SF010, SF101, SF102 and SF103) have no aesthetic, historical or architectural potential and the sites are of low significance and require no pre construction mitigation if they are disturbed by the final project footprint. However, although unlikely, these features could be associated with unmarked graves which would then be of high significance. Feature SF009 does not conform to the more modern structural features, and avoidance of the feature is preferable but if this is not possible, this feature should be mapped prior to applying for a destruction permit.

Graves are of high social significance and any impact to the burial site at SF011 will be high.

Any additional effects to subsurface heritage resources can be successfully mitigated by implementing a chance find procedure. **Site-specific mitigation measures are outlined in the project-specific Appendix 1** and recommendations in this report should be implemented during all phases of the project. With the implementation of the recommended mitigation measures, the impact of the project on heritage resources is expected to be low during all phases of the development.

9.1 Impacts related to the Project.

Impacts to heritage resources without mitigation within the project footprint will be permanent and negative and occur during the pre-construction and construction activities. It is assumed that the pre-construction and construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can impact on heritage features and impacts include destruction or partial destruction of non-renewable heritage resources. Impacts during the operation phase are considered to affect the cultural landscape and sense of place.

The main cause of impacts to archaeological resources is physical disturbance of the material itself and its context during removal of topsoil and vegetation as well as the excavations associated with the establishment of infrastructure. In terms of this project the main source of impacts will happen during the following activities.

- Establishment of new roads and upgrade of existing roads;
- Earthworks for temporary infrastructure including laydown areas;
- Visual impact of the PV Facility on the landscape and sense of place;
- Excavation and levelling of the PV facility footprint;
- Trenches for cables and erection of powerlines;
- Excavations during construction of the sub stations.

9.1.1 Construction phase

It is assumed that the construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can have a negative and irreversible impact on heritage features if any occur. Impacts include destruction or partial destruction of non-renewable heritage resources.

9.1.2 Operation Phase

No impacts are expected during the operation phase.

Project-specific impact ratings are provided in Appendix 1.

9.2 Cumulative Impacts

Cumulative impacts are combined impacts of other past, present, or reasonably foreseeable future actions/projects (Cornell Law School Information Institute, 2020). The importance of identifying and assessing cumulative impacts is that the whole is greater than the sum of its parts.

Cumulatively, projects proposed for the Stilfontein Cluster and the additional projects identified in Table 15, if developed, can have a negative impact on heritage resources in the area if such sites are destroyed unknowingly. However, the additional impact can be successfully mitigated with the implementation of a chance find procedure, which is common practice during construction.

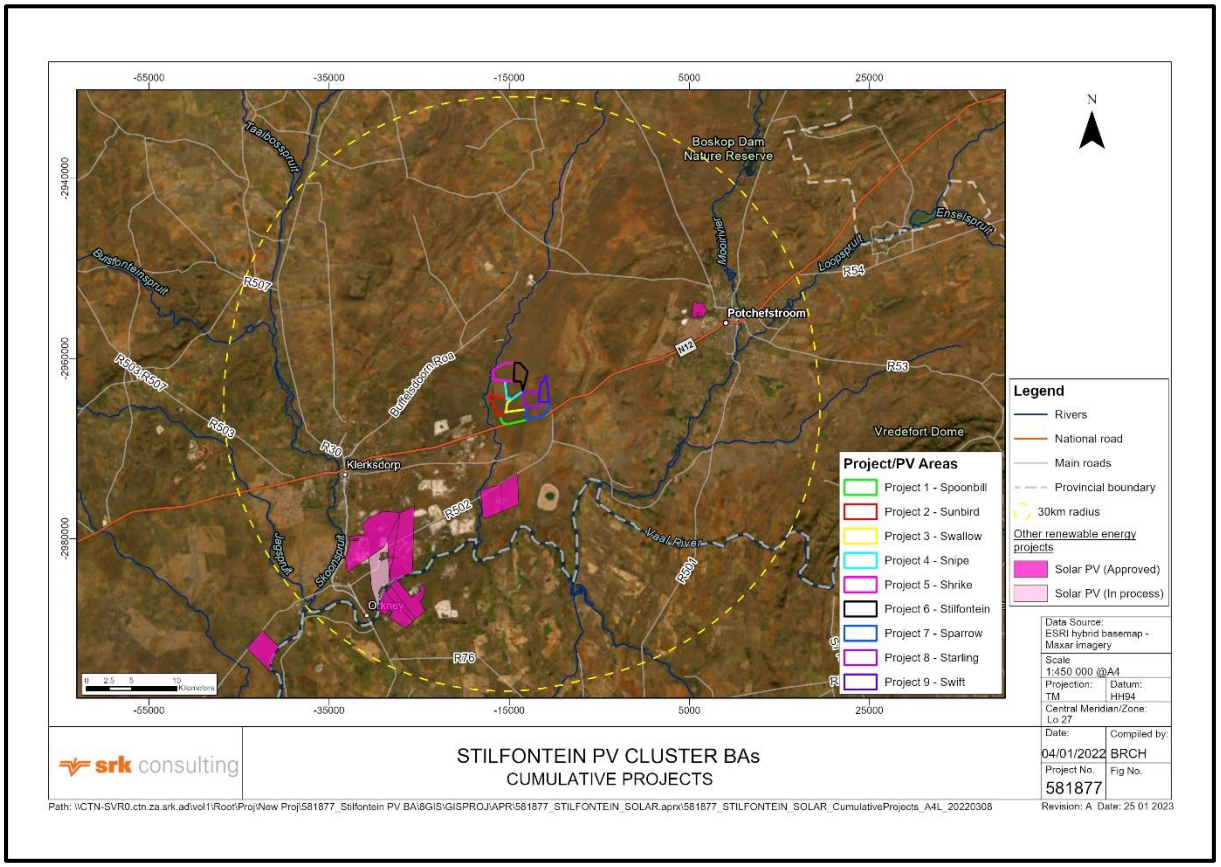

Figure 9.1. Other projects in relation to the SPV Cluster (Source: DFFE Q3 2022 REEA database).

Table 14. Other PV projects in surrounding area.

Project	DFFE Reference	Capacity	EA Status
Kabi Vaalkop PV Facility	12/12/20/2513/4/AM1	n/a	Approved
Kabi Vaalkop PV Facility	12/12/20/2513/4	75 MW	Approved
YMS Mineral Resources PV Plant	12/12/20/2629/AM1	20 MW	Approved
Buffels Solar PV 1	14/12/16/3/3/2/777	75 MW	Approved
Buffels Solar PV 2	14/12/16/3/3/2/778	100 MW	Approved
Orkney Solar PV	14/12/16/3/3/2/954/AM1	100 MW	Approved
Vaal River Solar 3 PV facility	12/12/20/2513/3/AM6	250 MW	Approved
Witkop Solar PV II	12/12/20/2507/2	61 MW	In process
Paleso Solar PV	14/12/16/3/3/1/2365	150 MW	Approved
Siyanda Solar PV	14/12/16/3/3/2/1/2369	150 MW	Approved

9.2.1 Cumulative Impact Assessment Table

Table 15.Cumulative impact of the Stilfontein PV Cluster and other projects on heritage resources.

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Possible	**VERY LOW**	– ve	High
Mitigation measures: • Implement a chance find procedure (Section 10.1) for the Project and monitoring of the development footprint by the ECO during construction. • Avoid high significance burial site at Site SF011 with a 60 m buffer, the burial site and buffer should be fenced, maintained and access for family should be ensured. • Site SF009 should preferably be avoided with a 30 m buffer. If not possible the site should be mapped and recorded prior to applying for a destruction permit								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Improbable	**VERY LOW**	– ve	High

10 Conclusion and recommendations

The Project area is marked by Quaternary sands and soils and is used for grazing. Based on the desk-based assessment and field survey undertaken for the Project, the area is considered to be of low heritage potential. Some heritage sites of significance are known in the wider geographical area, consisting of Rock Engraving sites, one with the Bosworth site which is a National Monument located ~ 14 km northeast of the Project. Heritage finds in the Project area are limited to a low-density scatter of Stone Age material and the ephemeral remains of ruins that are of low heritage significance and do not warrant pre-construction mitigation. A stone walled enclosure is also of low significance but will require some mitigation if impacted on and a burial site that should be preserved *in-situ*.

Although the SAHRIS palaeosensitivity map indicated that the site is very highly sensitive for palaeontology, the site visit confirmed that there are no fossils visible on the land surface of the project footprint.

The impact to heritage resources is low provided that the recommendations in this report (notably implementation of a chance find procedure) are adhered to, and once approval has been granted by the South African Heritage Resource Authority (SAHRA). As far as the heritage is concerned, the project should be authorised. From a heritage perspective there is no “preferred alternative” and the buffer zone at SF011 is considered as a no-go area.

10.1 Recommendations:

- Implement a chance find procedure (detailed in Section 10.1) for the Project and monitoring of the development footprint by the ECO and the following site specific recommendations:
  - SF001 to SF007 - Isolated Stone Age scatters are out of context and scattered too sparsely to be of significance apart from mentioning them in this report. No further mitigation is required.
  - SF008 - Monitoring of development by the ECO during construction to implement the Chance Find Procedure.
  - SF009 - Site SF009 should preferably be avoided with a 30 m buffer. If not possible the site should be mapped and recorded prior to applying for a destruction permit
  - SF010 - No mitigation required.
  - SF011 - Avoid the burial site with a 60 m buffer, the burial site should be demarcated, maintained and access for family should be ensured and the compilation and Implementation of a grave management plan for Project 2 Sunbird.
  - SF101 - Monitoring of the development by the ECO during construction to implement the Chance Find Procedure.
  - SF102 - Monitoring of the development by the ECO during construction to implement the Chance Find Procedure.
  - SF103 - No Mitigation required.

10.2 Chance Find Procedures

10.2.1 Heritage Resources

The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped, and a qualified archaeologist must be contacted for an assessment of the find and therefore chance find procedures should be put in place as part of the EMPr. A short summary of a Chance Find Procedure is discussed below and monitoring guidelines for this procedure are provided in Section 10.2.

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area.
- The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

10.2.2 Chance find protocol for Palaeontology – to commence once the excavation activities begin.

1. The following procedure is only required if fossils are seen on the surface and when excavations commence.
2. When excavations begin the rocks must be given a cursory inspection by the environmental control officer or designated person. Any fossiliferous material (trace fossils, stromatolites, plants, insects, bone or coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 4.1). This information will be built into the EMPr's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.

5. If there is any possible fossil material found by the developer/environmental control officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

10.2.2.1 Examples of fossils from the Malmani Subgroup

Figure 10.1: Photographs of stromatolites as seen in the field.

10.3 Monitoring requirements for the project.

Day to day monitoring can be conducted by the Environmental Control Officers (ECO) or other responsible persons. The ECO or other responsible persons should be trained along the following lines:

- *Induction training:* Responsible staff identified by the developer should attend a short course on heritage management and identification of heritage resources.
- *Site monitoring and watching brief*: As most heritage resources occur below surface, all earth-moving activities need to be routinely monitored in case of accidental discoveries. The greatest potential impacts are from pre-construction and construction activities. The ECO or other designated responsible person should monitor all such activities daily. If any heritage resources are found, the chance finds procedure must be followed as outlined above.

Table 16. Monitoring requirements for the project.

Heritage Monitoring					
Aspect	**Area**	**Responsible for monitoring and measuring**	**Frequency**	**Proactive or reactive measurement**	**Method**
Cultural Heritage Resources Chance Finds	Entire project area	ECO or other responsible persons	Weekly (Pre construction and construction phase)	Proactively	• If risks are manifested (accidental discovery of heritage resources) the Chance Find Procedure should be implemented: 1. Cease all works immediately; 2. Report incident to the Sustainability Manager; 3. Contact an archaeologist/ palaeontologist to inspect the site; 4. Report incident to the competent authority; and 5. Employ reasonable mitigation measures in accordance with the requirements of the relevant authorities. • Only recommence operations once impacts have been mitigated.

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Sahra Report Mapping Project Version 1.0, 2009

Appendix 1: Project Specific Results

Project 2: Sunbird PV

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Project Reference:

Project number 2259

Report date:

May 2022

Revised February 2023

1. Introduction

Mainstream proposes to develop the Sunbird PV facility with a generating capacity of up to 150 MW on the following farm portions:

- Stilfontein RE26/408
- Witstinkhoutbaken 1/40
- Doornplaat RE4/410

The Project is located approximately 20 km south-west of Potchefstroom and 6 km north-east of Stilfontein, in the Northwest Province (Figure 1.1) and within the Klerksdorp Renewable Energy Development Zone (REDZ).

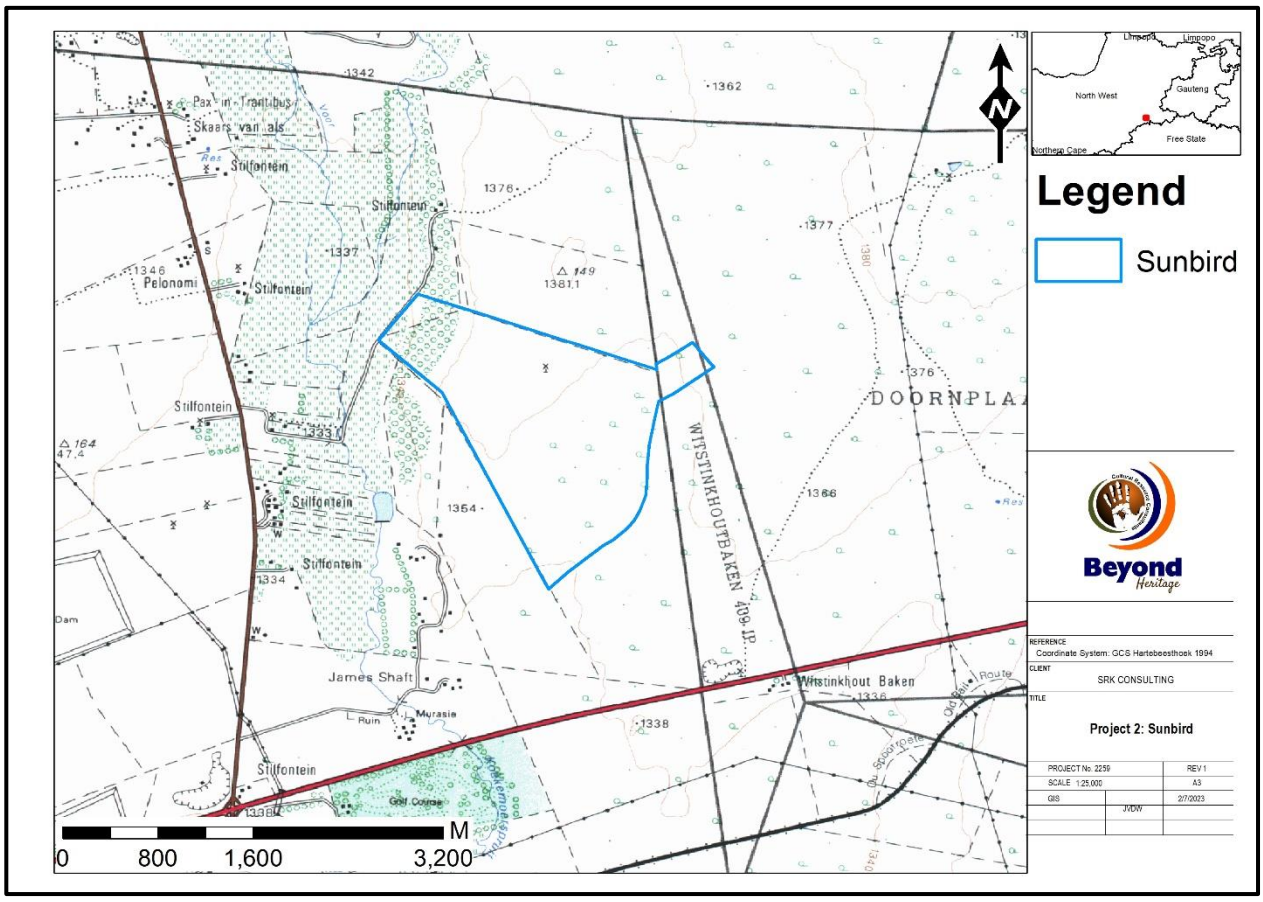

Figure 1.1. Local setting of the Project (1: 50 000 topographical map).

2. Findings of the survey

The topography of the study area is flat without any focal points like hills or pans that would have attracted human occupation in antiquity and is considered to be of low archaeological potential. This was confirmed during a physical walkthrough (Figure 2.1) of the study area and archaeological finds were limited to a low density (<2 artefacts per m²) of miscellaneous Stone Age flakes and chunks recorded as observation point SF007 scattered over an area of 4x4 meters. Additional Heritage observations included the ephemeral remains of what could have been a farmstead (SF008), a burial site (SF011), a stone packed feature (SF009) and a modern stone and cement platform (SF103) as indicated in Table 1 and Figure 2.2.

Table 1. Heritage observations recorded in and around the study area.

Label	Description	Longitude	Latitude	Significance
SF007	Low density Stone Age scatter	26,83232	-26,7919	GP C Low Significance
SF008	Ephemeral remains of a Farmstead	26,82813	-26,7904	GP C Low Significance
SF009	Stone Wall	26,84784	-26,7947	GP C Low Significance
SF011	Burial site	26,82642	-26,7905	GP A High Significance
SF103	Stone and cement platform	26,8461	-26,7987	GP C Low significance

The low-density open-air scatter at SF007 is considered as background scatter (Orton 2016) that is generally speaking of low significance and has a field rating of GP C. An overgrown grave with a headstone (inscription Catherina Marule and undated), and the ruin of a farmstead was recorded as SF011 and SF008 respectively. Graves are always of high social significance and SF011 has a GP A field rating, whilst the degraded ruin's potential to contribute to aesthetic, historic, scientific and social aspects are non-existent and the feature has no heritage value and therefore has a field rating of GP C.

SF103 was recorded on the periphery of the study area. It is a 4x1 meter cement and stone structure situated in a wooded area south of the main lodge of the farm. The feature resembles possible agricultural structures. The northern side of the feature resembles structures built for feeding livestock and is not considered a heritage resource. Feature SF009 does not conform to the more modern structural features, and avoidance of the feature is preferable but if this is not possible, this feature should be recorded and mapped prior to applying for a destruction permit.

SF008 and SF103 are not indicated on historical maps (Figure 2.11 and 2.12) and are assumed to be younger than 60 years and therefore not protected by the NHRA. It should be noted that sites like SF008 can be associated with the graves of stillborn children which would then be of high social significance.

General site conditions of recorded resources are illustrated in Figure 2.3 – 2.10.

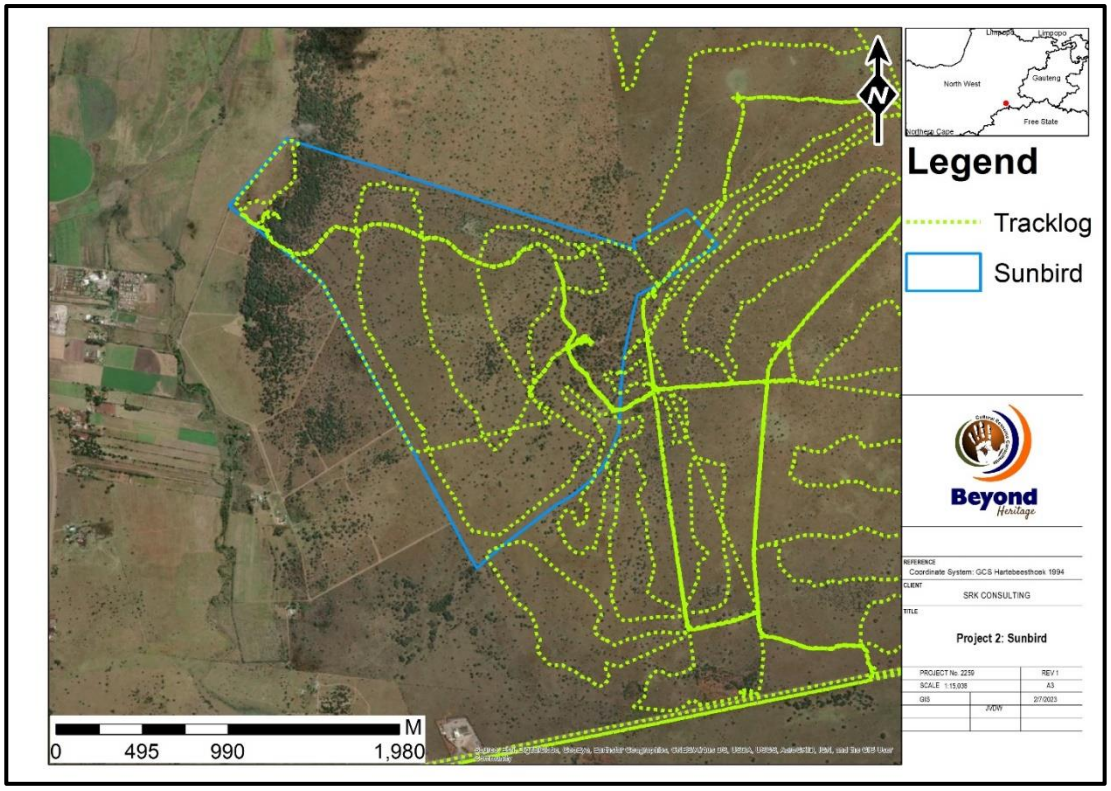

Figure 2.1. Tracklogs of survey paths in green.

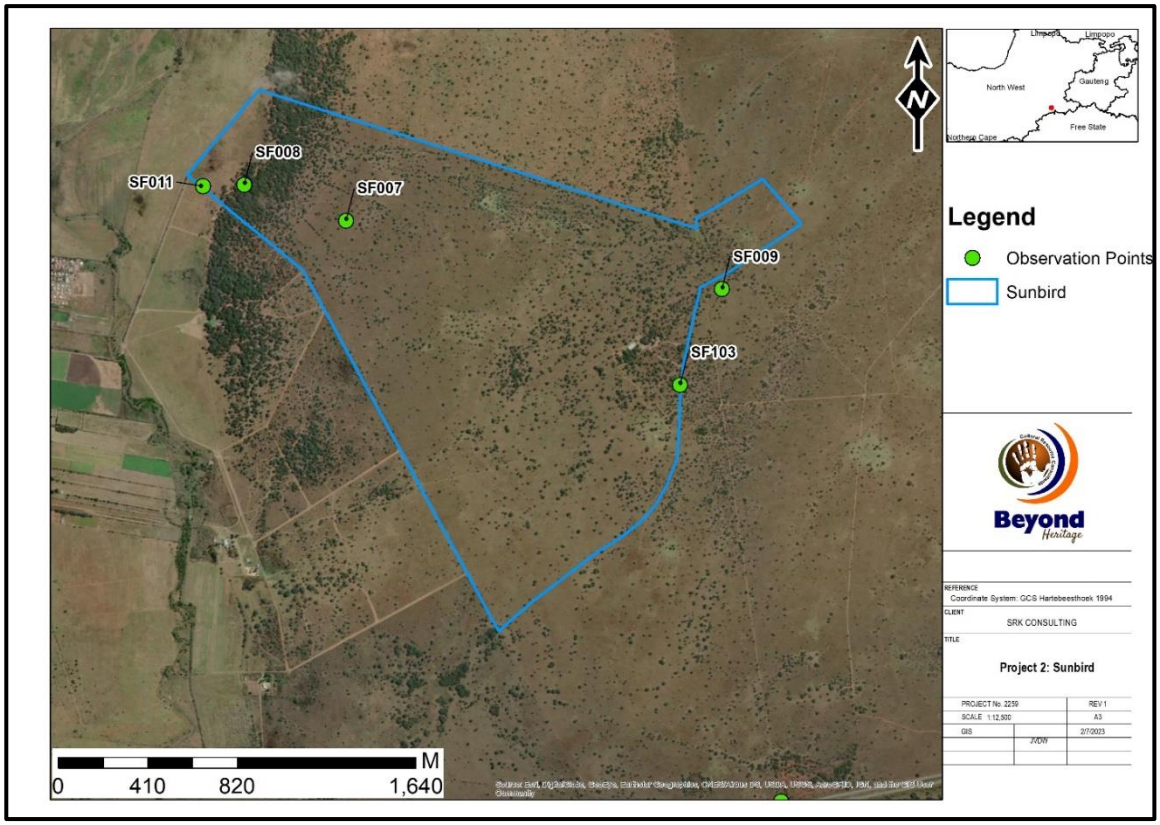

Figure 2.2. Heritage observations in relation to the Project area.

Figure 2.3. Ventral view of miscellaneous chert lithics at SF 07.

Figure 2.4. General site conditions at SF07.

Figure 2.5. General site conditions at SF008.

Figure 2.6. Stone built section of walling.at SF008.

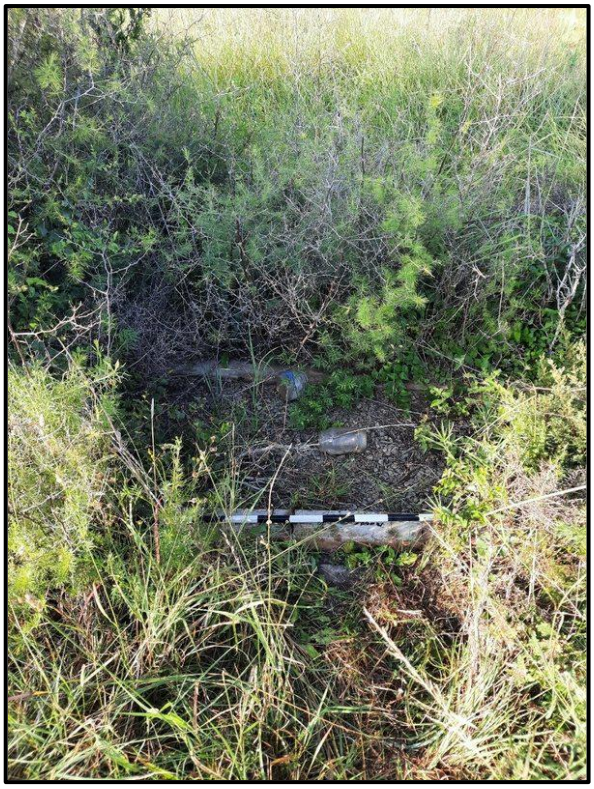

Figure 2.7. General site conditions at SF 011.

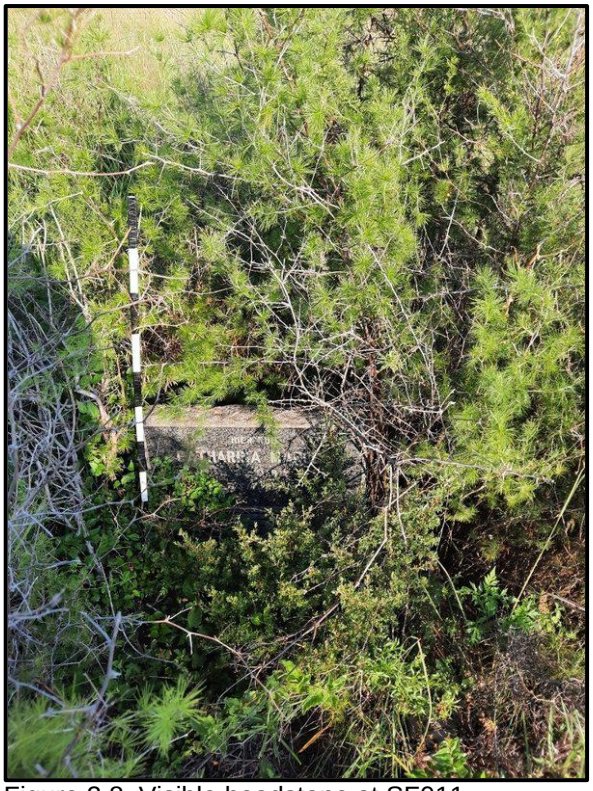

Figure 2.8. Visible headstone at SF011.

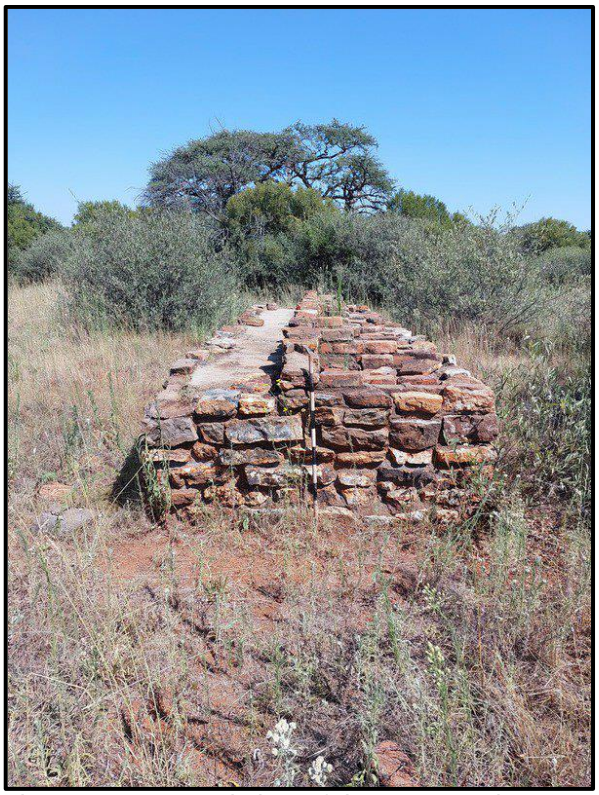

Figure 2.9. General view of the stone and cement feature at SF103. Image facing north.

Figure 2.10. General view of the stone and cement feature at SF103. Image facing west.

Cultural landscape

The study area is currently used for agricultural purposes and infrastructure in the general area is limited to roads, fences and powerlines with no developments within the Project footprint indicated prior to 1996 (Figure 2.11 to 2.12).

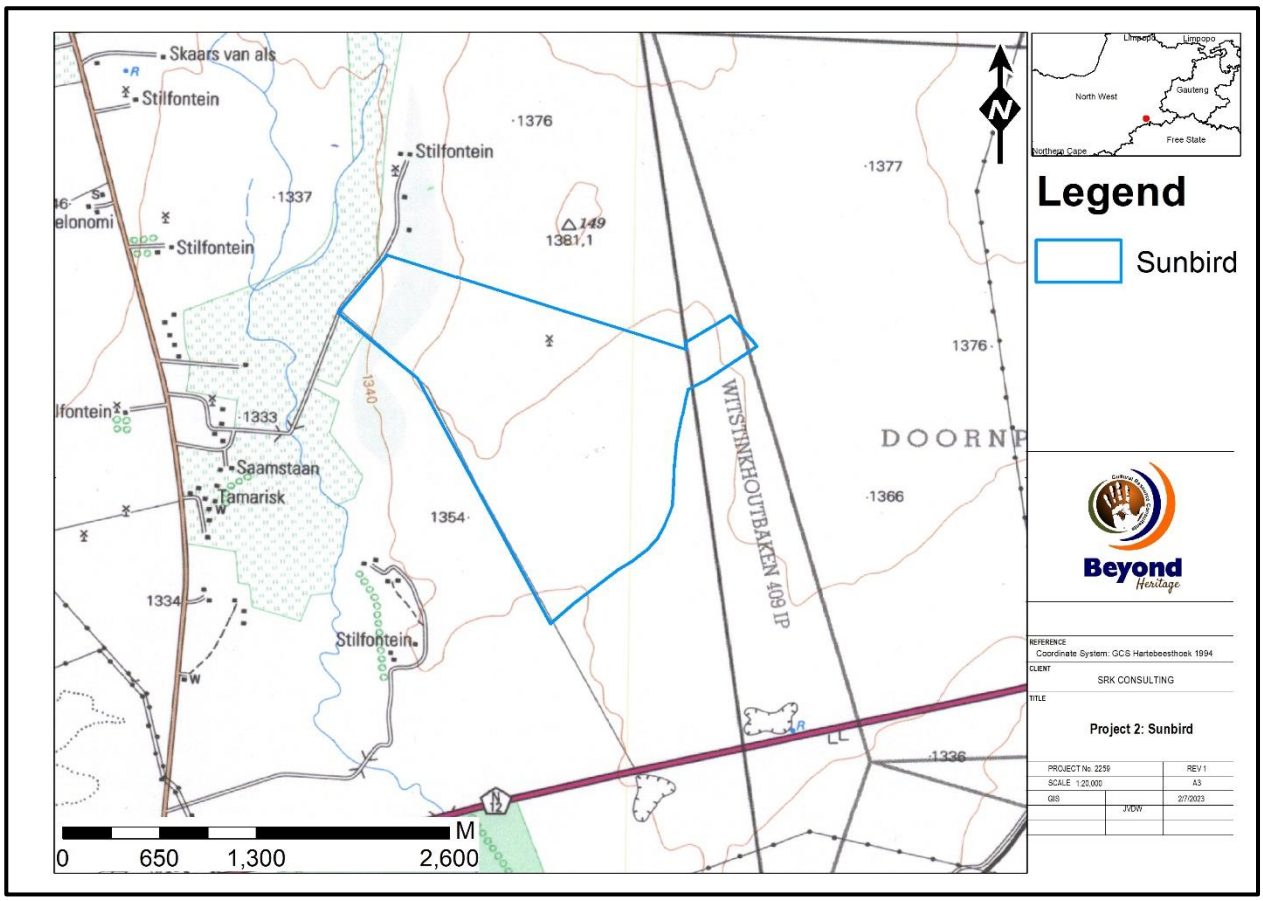

Figure 2.11. 1996 Topographic map of the Project showing no developments in the study area apart from a windpump.

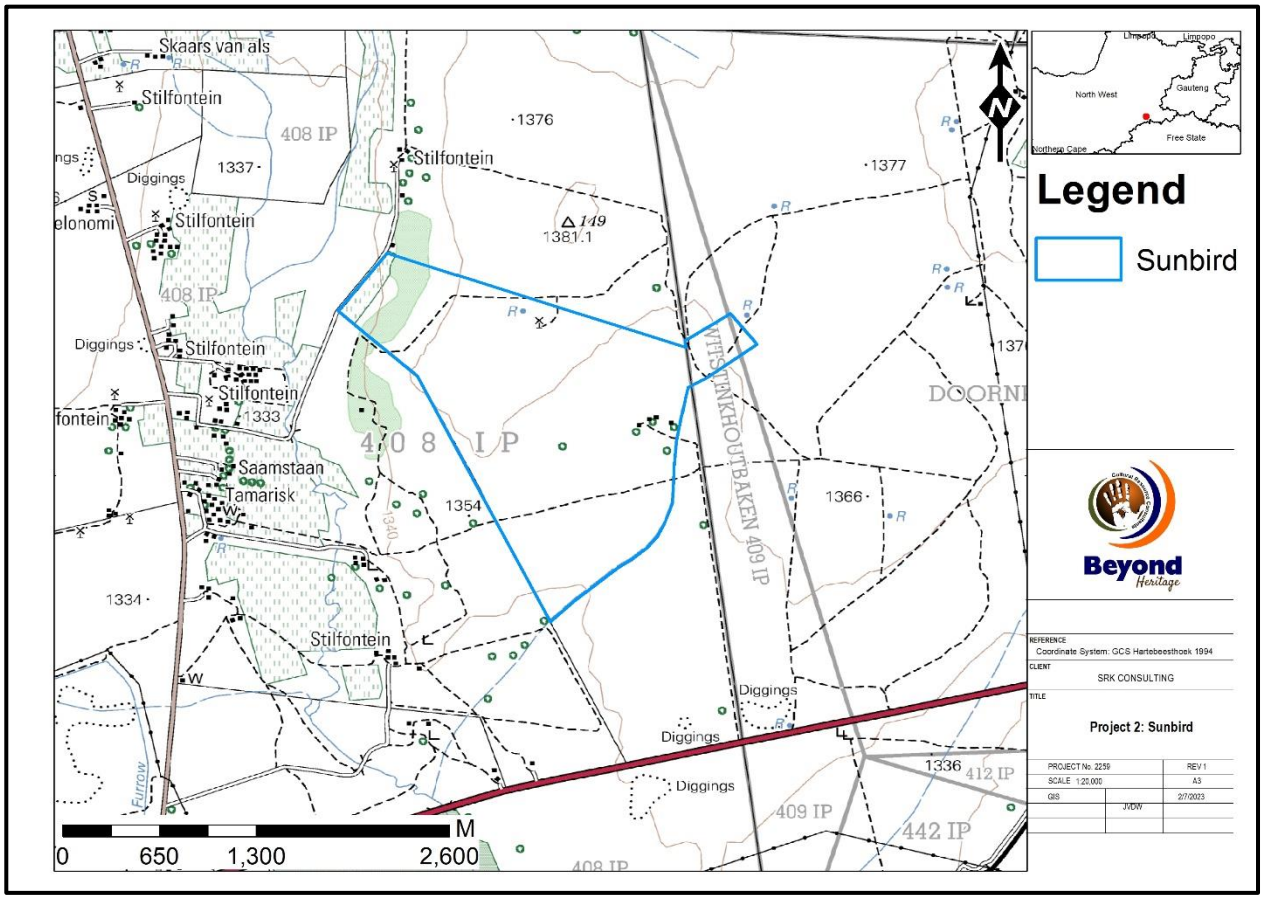

Figure 2.12. 2006 Topographical map of the Project indicating no developments in the study area apart from a windpump, reservoir and some small tracks and structures in the eastern portion.

3. Potential Impacts

Impacts to heritage resources without mitigation within the project footprint will be permanent and negative and occur during the pre-construction and construction activities. It is assumed that the pre-construction and construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can impact on heritage features and impacts include destruction or partial destruction of non-renewable heritage resources. Impacts during the operation phase is considered to affect the cultural landscape and sense of place.

The main cause of impacts to archaeological resources is physical disturbance of the material itself and its context during removal of topsoil and vegetation as well as the excavations associated with the establishment of infrastructure. In terms of this project the main source of impacts will happen during the following activities.

- Establishment of new roads and upgrade of existing roads;
- Earthworks for temporary infrastructure including laydown areas;
- Visual impact of the PV Facility on the landscape and sense of place;
- Excavation and levelling of the PV facility footprint;
- Trenches for cables and erection of powerlines;
- Excavations during construction of the sub stations;
- Influx of people into the study area that could desecrate the burial site.

No impacts on heritage resources or paleontological resources are expected during the operation phase.

3.1. Potential Impact: Loss of heritage resources

The best way to mitigate impacts to the recorded sites is through avoidance. However, the Stone Age scatter at SF007 is out of context and scattered too sparsely to be of significance apart from mentioning it in this report and do not warrant further mitigation if impacted on. The ruins at SF103 and SF008 are of no heritage value and if impacted on the impact is low and no further mitigation is required. Impacts to the burial site SF011 will be permanent and irreversible. The impact will be high due to the high social significance of burial sites and this area should be seen as a no-go area. SF009 does not conform to the more modern structural features, and avoidance of the feature is preferable but if this is not possible, this feature should be recorded and mapped prior to applying for a destruction permit.

Impacts of the project on heritage resources can be mitigated to an acceptable level with the implementation of the recommendations in this report and a Chance Find Procedure and Monitoring during all phases of the development (Table 2).

Table 2. Impacts on heritage resources during the construction phase.

	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Local 1	High 2	Long-term 3	**High** **6**	Probable	**HIGH**	– ve	High
Essential mitigation measures: • Monitoring of the development by the ECO or designated responsible person (focusing on built environment sites SF007, SF008, SF103) during construction to implement the Chance Find Procedure if required; • Site SF009 should preferably be avoided with a 30 m buffer. If not possible the site should be mapped and recorded prior to applying for a destruction permit; • Avoid the grave at Site SF011 with a 60 m buffer, the grave should be demarcated, maintained and access for family should be ensured • Compilation and Implementation of a grave management plan.								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Possible	**VERY LOW**	– ve	High

3.2. Potential Impact: Loss of Fossils

There are no fossils above ground, as confirmed by the site visit, but as part of the implementation of the Stilfontein PV Cluster and infrastructure, excavations for foundations, pipes, cables and fibres will disturb fossils below the ground – only if they are present.

The fossils that might be below ground are trace fossils such as stromatolites. They are common in the Malmani Subgroup, and furthermore, they are traces of microbial activity not fossils of the microbes (bacteria and algae). This reduces their scientific value. If such trace fossils are found, removed and housed in a research institute or museum for future research, this will have a positive impact.

The impact is assessed to be insignificant with the implementation of mitigation (removal and collection) (Table 3). There are no alternatives because the whole area is on the same rock type.

Table 3. Significance of loss of fossils

	Extent	**Intensity**	**Duration**	**Consequence**	**Probability**	**Significance**	**Status**	**Confidence**
Without mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Improbable	**Insignificant**	- ve	High
Best Practice mitigation measures: • Put aside and photograph any fossils found during excavations and send pictures to a palaeontologist to assess their scientific importance. If deemed important, the palaeontologist must obtain a SAHRA permit and remove the stromatolites to a recognised repository.								
With mitigation	Local 1	Medium 2	Short-term 1	**Very Low** **4**	Possible	**Insignificant**	+ ve	High

4. Conclusion

The study area is rural in character and the impact area is undeveloped. The proposed site is covered in quaternary soils and used for grazing with no major focal points like rocky outcrops or pans that would have attracted human occupation in antiquity. Examination of historical topographic maps and aerial images also showed no structures or stone walled settlements in the study area and the impact footprint is considered to be of low archaeological potential. This was confirmed during a physical walkthrough of the study area and archaeological finds were limited to a low density (<2 artefacts per m²) of miscellaneous Stone Age flakes and chunks recorded as observation point SF007 scattered over an area of 4x4 meters. These scatters are of low significance and do not warrant further mitigation. Additional Heritage observations included the ephemeral remains of what could have been a farmstead (SF008) and a modern stone and cement platform (SF103) that is both of low significance and similarly also do not require further mitigation if impacted on. Of high social significance is a burial site (SF011) that is a no-go area and should be preserved *in-situ*. SF009 does not conform to the more modern structural features, and avoidance of the feature is preferable but if this is not possible, this feature should be recorded and mapped prior to applying for a destruction permit.

According to the SAHRA Paleontological sensitivity map the study area is of very high significance, the site visit however confirmed that there are no fossils visible on the surface. It is not known if fossils occur below ground, but if any are discovered when excavations commence, they should be removed, and a palaeontologist called to assess their scientific importance.

Impacts on heritage resources through the Sunbird PV facility can be mitigated to an acceptable level, and it is recommended that the project can commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA.

4.1. Recommendations for condition of authorisation

The following recommendations for Environmental Authorisation apply and the project may only proceed based on approval from SAHRA:

Recommendations:

- Monitoring of the development by the ECO or designated responsible person during construction to implement the Chance Find Procedure if required;
- Avoid the burial site at SF011 with a 60 m buffer, the site should be demarcated, maintained and access for family should be ensured;
- Site SF009 should preferably be avoided with a 30 m buffer. If not possible the site should be mapped and recorded prior to applying for a destruction permit
- Compilation and Implementation of a grave management plan.

4.2. Chance Find Procedures

4.2.1. Heritage Resources

The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped, and a qualified archaeologist must be contacted for an assessment of the find and therefore chance find procedures should be put in place as part of the EMPr. A short summary of a Chance Find Procedure is discussed below and monitoring guidelines for this procedure are provided in Section 4.5.

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area.
- The senior on-site Manager will inform the ECO or designated responsible person of the chance find and its immediate impact on operations. The ECO or designated responsible person will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

4.2.2. Chance find protocol for Palaeontology – to commence once the excavation activities begin.

1. The following procedure is only required if fossils are seen on the surface and when excavations commence.

2. When excavations begin the rocks must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, stromatolites, plants, insects, bone or coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones (for example see Figure 4.1). This information will be built into the EMPr's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

4.2.2.1. Examples of fossils from the Malmani Subgroup

Figure 4.1: Photographs of stromatolites as seen in the field.

4.3. Reasoned Opinion

The overall impact of the project on heritage resources is considered to be low and residual impacts can be managed to an acceptable level through implementation of the recommendations made in this report. The project is acceptable from a heritage perspective and the socio-economic benefits also outweigh the possible impacts of the development if the correct mitigation measures are implemented for the project.

4.4. Potential risk

Potential risks to the proposed project are the occurrence of intangible features and unrecorded cultural resources (of which graves and subsurface material like fossils are the highest risk). This can cause delays during construction, as well as additional costs involved in mitigation and possible layout changes.

4.5. Monitoring Requirements

Day to day monitoring can be conducted by the Environmental Control Officers (ECO) or designated responsible person. The ECO or other responsible persons should be trained along the following lines:

- *Induction training:* Responsible staff identified by the developer should attend a short course on heritage management and identification of heritage resources.
- *Site monitoring and watching brief*: As most heritage resources occur below surface, all earth-moving activities need to be routinely monitored in case of accidental discoveries. The greatest potential impacts are from pre-construction and construction activities. The ECO or designated responsible person should monitor all such activities daily. If any heritage resources are found, the chance finds procedure must be followed as outlined above.

Table 4. Monitoring requirements for the project.

Heritage Monitoring					
Aspect	**Area**	**Responsible for monitoring and measuring**	**Frequency**	**Proactive or reactive measurement**	**Method**
Cultural Heritage Resources Chance Finds	Entire project area	ECO or designated responsible person	Weekly (Pre construction and construction phase)	Proactively	• If risks are manifested (accidental discovery of heritage resources) the chance find procedure should be implemented: 1. Cease all works immediately; 2. Report incident to the Site Manager; 3. Contact an archaeologist/ palaeontologist to inspect the site; 4. Report incident to the competent authority; and 5. Employ reasonable mitigation measures in accordance with the requirements of the relevant authorities. • Only recommence operations once impacts have been mitigated.