SEELO ALPHA SOLAR PV (RF) (PTY) LTD

PROPOSED SEELO ALPHA 240MW SOLAR PHOTOVOLTAIC (PV) AND BATTERY ENERGY STORAGE SYSTEM (BESS) PROJECT NEAR THE TOWN OF CARLETONVILLE, NORTH WEST PROVINCE, SOUTH AFRICA

HERITAGE IMPACT ASSESSMENT

31 AUGUST 2023 (Revision 3)

Submitted to : Nemai Consulting (PTY) Ltd

Prepared by:

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NITAI CONSULTING

SPECIALIST ENVIRONMENTAL CONSULTING

The heritage impact assessment report has been compiled considering the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

Requirements of Appendix 6 – GN R326 EIAs Regulations (2014, amended 2017)	**Relevant section in report**
1.(1) (a) (i) Details of the specialist who prepared the report	Section 1.1.3 of Report
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.1.3 and of Report and **Appendix 2**
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page iii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
(cA) An indication of the quality and age of base data used for the specialist report	N/A
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 6
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7
(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 a site plan identifying site alternatives;	Section 5.4 and 5.5, Section 6
(g) An identification of any areas to be avoided, including buffers	Section 6
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**Appendix 1**
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
(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	Sections 6, 11
(k) Any mitigation measures for inclusion in the EMPr	Section 8, 11
(l) Any conditions for inclusion in the environmental authorisation	N/A
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 13
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 8, 12
(o) A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process will be handled as part of the EIAs and EMPr process.

Requirements of Appendix 6 – GN R326 EIAs Regulations (2014, amended 2017)	**Relevant section in report**
(p) A summary and copies if any comments that were received during any consultation process	Not applicable. To date no comments have been raised regarding heritage resources that require input from a specialist.
(q) Any other information requested by the competent authority.	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 38(3) of the NHRA

Declaration of Independence

The report has been compiled by Nitai Consulting (Pty) Ltd, an appointed Heritage Specialist for Nemai Consulting for the Proposed 240MW Seelo Alpha Solar Photovoltaic & Battery Energy Storage Systems Project near Carletonville, North West Province, South Africa. The views contained in this report are purely objective and no other interests are displayed during the decision-making processes discussed in the Heritage Impact Assessment Process.

I, Jennifer Kitto, declare that –

General declaration:

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

- *I realise that a false declaration is an offence in terms of regulation 71 of the NEMA Regulations and is punishable in terms of section 24F of the NEMA.*

Disclosure of Vested Interest

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

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PRINCIPAL HERITAGE PRACTITIONER – Jennifer Kitto

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ACKNOWLEDGEMENT OF RECEIPT

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SIGNATURE - _____

Executive Summary

The Applicant has proposed the development of the Seelo Alpha 240MW Solar PV with BESS Project near Carletonville, in the North West Province, South Africa. The electricity generated by the Project will be injected into the national grid via the existing Eskom 132 kV distribution system. The Applicant intends to bid for the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

The Seelo Alpha Solar PV project is located on Portion 2 of Farm 96 (Rooipan) IQ and will cover up to approximately 355ha in extent of the total 898.29ha of the farm portion. The project is intended to generate up to 240MW.

Methodology/ Significance Assessment

Both the archaeological and historical literature review and the site survey fieldwork identified no archaeological, cultural (graves) or historical heritage resources occurring within or adjacent to the project area footprint – original layout. However, the project footprint layout was adjusted (moved to the north by 300m) subsequent to the field survey. There is a low possibility that some heritage resources, specifically, informal graves or burial sites or archaeological material could be uncovered.

Identification of Activities, Aspect and Impacts

The project area that will be impacted by the proposed solar PV project contains some areas that are currently used for cattle and game grazing activities.

The impact significance of the project on graves and cemeteries is low as no definite grave sites were identified.

The impact significance of the proposed project on protected historical structures is low as no historical structures were identified.

The impact significance of the proposed project on archaeological resources is low as no archaeological sites or material were identified.

Mitigation Measures

The proposed Seelo Alpha Solar PV project should not impact on heritage resources as no heritage resources were identified within or adjacent to the project footprint area - original layout. However, the project footprint layout was adjusted (moved to the north by 300m) subsequent to the field survey. As no heritage resources were identified within the original footprint area, it is considered unlikely that any heritage resources would be identified within the additional area. However, there is a low possibility that sub-surface heritage resources, specifically, informal graves or burial sites or archaeological material could be uncovered. The General Heritage Management Guidelines contained in this report should be noted and implemented, if necessary.

A separate palaeontological assessment has been undertaken as the project area falls into an area of Very High fossil sensitivity. The assessment will indicate if significant/sensitive fossils will be impacted by the proposed project and provide mitigation measures and the way forward.

Conclusion

No fatal flaws were identified during this study, therefore, it is the considered opinion of the heritage specialist that construction of the proposed PV facility and BESS within the project footprint can proceed. There are no objections from a heritage perspective if the recommendations and General Heritage Management Guidelines contained in this report are implemented where necessary.

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List of Abbreviations

APHP	Association of Professional Heritage Practitioners
ASAPA	Association of Southern African Professional Archaeologists
BESS	Battery Energy Storage System
CRM	Cultural Resources Management
DALRRD	Department of Agriculture, Land Reform & Rural Development
DFFE	Department of Forestry, Fisheries and Environment
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EAP	Environmental Assessment Practitioner
EIA	Early Iron Age
EMPr	Environmental Management Programme
ESA	Early Stone Age
GIS	Geographic Information System
ha	Hectare
HIA	Heritage Impact Assessment
IAP	Interested and Affected Party
IAIAsa	International Association for Impact Assessment South Africa
km	Kilometre (1 000m)
LIA	Late Iron Age
kV	Kilo Volt
LSA	Later Stone Age
MSA	Middle Stone Age
MTS	Main Transmission Station
NEMA	National Environmental Management Act (No. 107 of 1998)
NHA	National Health Act, (No. 61 of 2003)
NHRA	National Heritage Resources Act (No 25 of 1999)
NHS	National Heritage Site
PHRA	Provincial Heritage Resources Authority
PV	Photo Voltaic
NW HRA	North West Heritage Resources Authority
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SAHRA	South African Heritage Resources Agency

1 INTRODUCTION

The Applicant has proposed the development of the Seelo Alpha 240MW Solar PV with BESS Project near Carletonville, in the North West Province, South Africa. The electricity generated by the Project will be injected into the national grid via the existing Eskom 132 kV distribution system. The Applicant intends to develop and sell the project for the purposes of the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or private sale.

The Seelo Alpha Solar PV project is located on Portion 2 of Farm 96 (Rooipan) IQ and will cover up to approximately 355ha in extent of the total 898.29ha of the farm portion. The project is intended to generate up to 240MW AC.

Nitai Consulting has been appointed by Nemai Consulting to conduct the Heritage Impact Assessment (HIA) specialist study.

1.1 Scope & Terms of Reference for the HIA report

1.1.1 Summary of Key Issues & Triggers Identified During Scoping

In terms of the NHRA, the following proposed activities trigger the need for a Heritage Impact Assessment (HIA):

- Potential occurrence of heritage resources, graves and structures older than 60 years within the Project's footprint.
- Proposed development that is more than 5000m^2
- Proposed linear development that is longer than 300m
- Proposed development where an impact assessment is triggered in terms of NEMA.

1.1.2 Approach

- Undertake a Heritage Impact Assessment in accordance with the NHRA.
- Identify and map all heritage resources in the area affected, as defined in Section 2 of the NHRA, including archaeological sites on or near (within 100m of) the proposed developments.
- Assess the significance of such resources in terms of the heritage assessment criteria as set out in the regulations.
- Assess the impacts of the Project on such heritage resources.
- Prepare a heritage sensitivity map (GIS-based), based on the findings of the study.
- Identify heritage resources to be monitored.
- Comply with specific requirements and guidelines of NW PHRA and SAHRA.

1.1.3 Nominated Specialist Details

Organisation:	Nitai Consulting
Name:	Jennifer Kitto
Qualifications:	BA Archaeology and Social Anthropology; BA (Hons) Social Anthropology
No. of years' experience:	24
Affiliation (if applicable):	Association of Southern African Professional Archaeologists (ASAPA) - Technical member No.444 International Association for Impact Assessment (IAIAsa) – Member No. 7151

1.2 Project Description

The Applicant has proposed the development of the Seelo Alpha 240MW Solar PV with BESS Project near Carletonville, in the North West Province, South Africa The electricity generated by the Project will be injected into the national grid via the existing Eskom 132 kV distribution system. The Applicant intends to develop and sell the project for the purposes of the current and future Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)or private sale.

The Seelo Alpha Solar PV project is located on Portion 2 of Farm 96 (Rooipan) IQ and will cover up to approximately 355ha in extent of the total 898.29ha of the farm portion. The project is intended to generate up to 240MW AC.

The Project is located in the most eastern part of the North West Province (at the boundary between North West and Gauteng) and falls within the Dr Kenneth Kaunda District Municipality and the JB Marks Local Municipality. The site is located approximately 13km to the north-west of the town of Carletonville and is bisected by the D331 road. The property earmarked for the Project [Portion 2 of Farm 96 (Rooipan) IQ] covers a combined area of approximately 898.29 ha, of which the buildable area determined by the engineering team is approximately 355 ha.

2 LEGISLATION

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by various pieces of legislation, including the National Heritage Resources Act, 25 of 1999 (NHRA) and associated Regulations, National Environmental Management Act,

Act 107 of 1998 (NEMA) and associated Regulations and, as well as the National Health Act, Act No. 61 of 2003 (NHA), specific Regulations governing human remains.

2.1 National Heritage Resources Act, No 25 of 1999 (NHRA)

The NHRA is the defines cultural heritage resources (section 3), provides protection to specific types of heritage resources (sections 34, 35, 36) and also requires an impact assessment of such resources for specific development activities (section 38(1)). Section 38(8) further allows for cooperation and integration of the management of such impact assessment between the national or provincial heritage authority (SAHRA or a PHRA) and the national environmental authority (DEFF).

In terms of section 38(1)(a) of the NHRA, the specific types of development activity that may require a Heritage Impact Assessment (HIA) include: the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length. As the proposed solar PV project is larger than 5000m^2, this study falls under s38(8) and requires comment from the relevant heritage resources authority. (South African Heritage Resources Authority-SAHRA and/or the Free State Provincial Heritage Authority).

Sections 34-36 of the NHRA further stipulate the protections afforded to specific types of heritage resources, *i.e*. structures older than 60 years (s34); archaeological, palaeontological, meteorites (s35); graves and burial grounds (s36), as well as the mitigation process to be followed if these resources need to be disturbed. The construction of the solar PV project and powerline may result in impacts to any of these types of heritage resources.

2.2 National Environmental Management Act, Act 107 of 1998 (NEMA)

NEMA states that an integrated Environment Management Plan (EMP) should, (23 -2 (b)) "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage". In addition, the NEMA and associated Regulations GNR 982 (Government Gazette 38282, 14 December 2014, amended 2017) state that, "the objective of an environmental impact assessment process is to, … identify the location of the development footprint within the preferred site … focussing on the geographical, physical, biological, social, economic, *cultural and heritage aspects* of the environment" (GNR 982, Appendix 3(2)(c), emphasis added).

The EIA Regulations, 2014 (as amended), published in GNR 982 of 2014 (Government Gazette 38282) promulgated under the (NEMA) contain specific requirements to be addressed in the different types or impact assessment repots (Regulations 19, 21 and 23) as well as requirements for Specialist Reports (Appendix 6).

2.3 The National Health Act, No. 61 of 2003 (NHA), Regulations 2013

In the case of graves and/or burial grounds that could be impacted by a proposed development, and which are identified through an impact assessment, specific Regulations relating to the Management of Human Remains (GNR 363 of 2013 in Government Gazette 36473) address the exhumation and reburial of human remains: Regulations 26, 27 and 28.

3 Assumptions and Constraints

This assessment assumes that all the information provided by the Applicant and Environmental Assessment Practitioner (EAP) regarding the project footprint (Including the powerline) is correct and current.

The large area of the project footprint meant that it was not feasible to undertake a pedestrian survey of the whole area and the fieldwork therefore comprised a combination of vehicle and pedestrian investigation. Most of the project area was covered in medium length to short grass with other vegetation resulting in fair heritage visibility. However, in some areas there was much longer vegetation which meant reduced heritage visibility in those areas. Therefore, there is a possibility that some heritage resources were not identified, specifically, informal graves or burial sites.

4 Project Description

4.1 Location

The Project is located in the most eastern part of the North West Province, South Africa (at the boundary between North West and Gauteng) and falls within the Dr Kenneth Kaunda District Municipality and the JB Marks Local Municipality. The site is located approximately 13km to the north-west of the town of Carletonville and is bisected by the D331 road (**Figure 1**).

The property earmarked for the Project [Portion 2 of Farm 96 (Rooipan) IQ] covers a combined area of approximately 898.29 ha, of which the buildable area determined by the engineering team is approximately 355 ha (**Figure 2**).

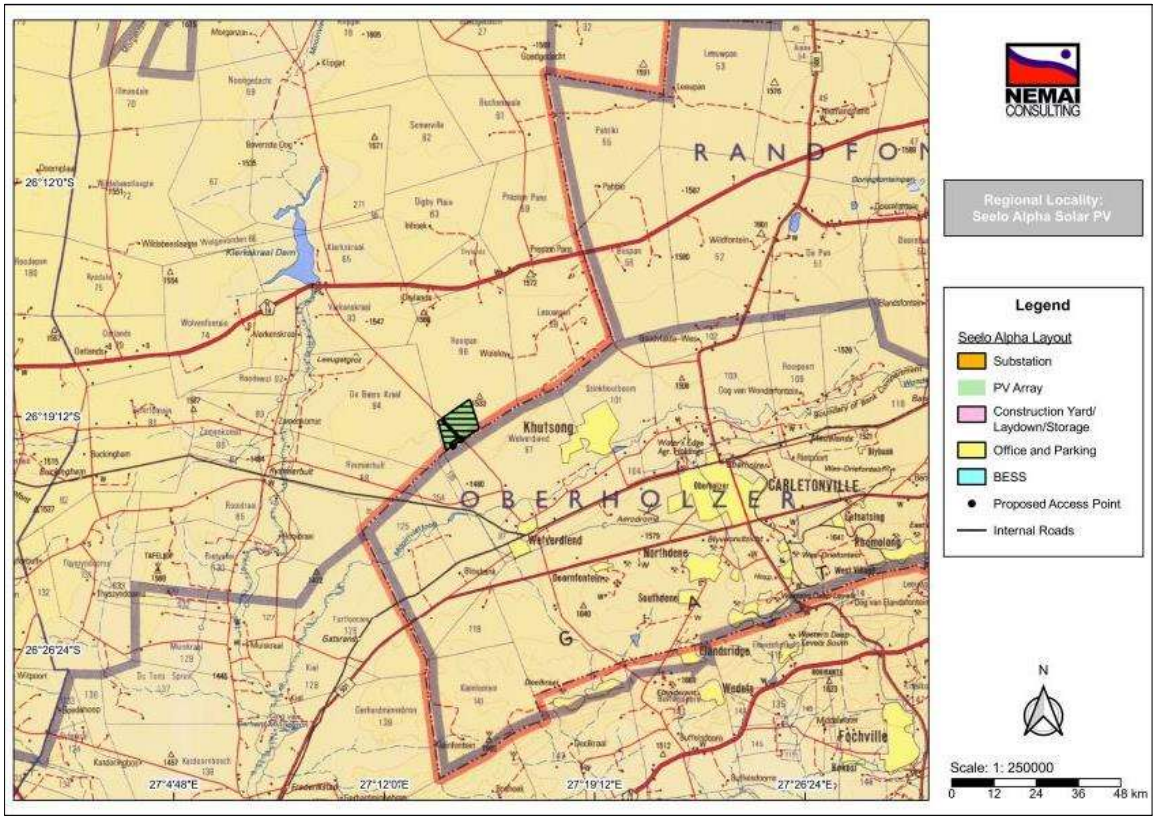

Figure 1: Seelo Alpha Solar PV Locality near Carletonville (Nemai 2023)

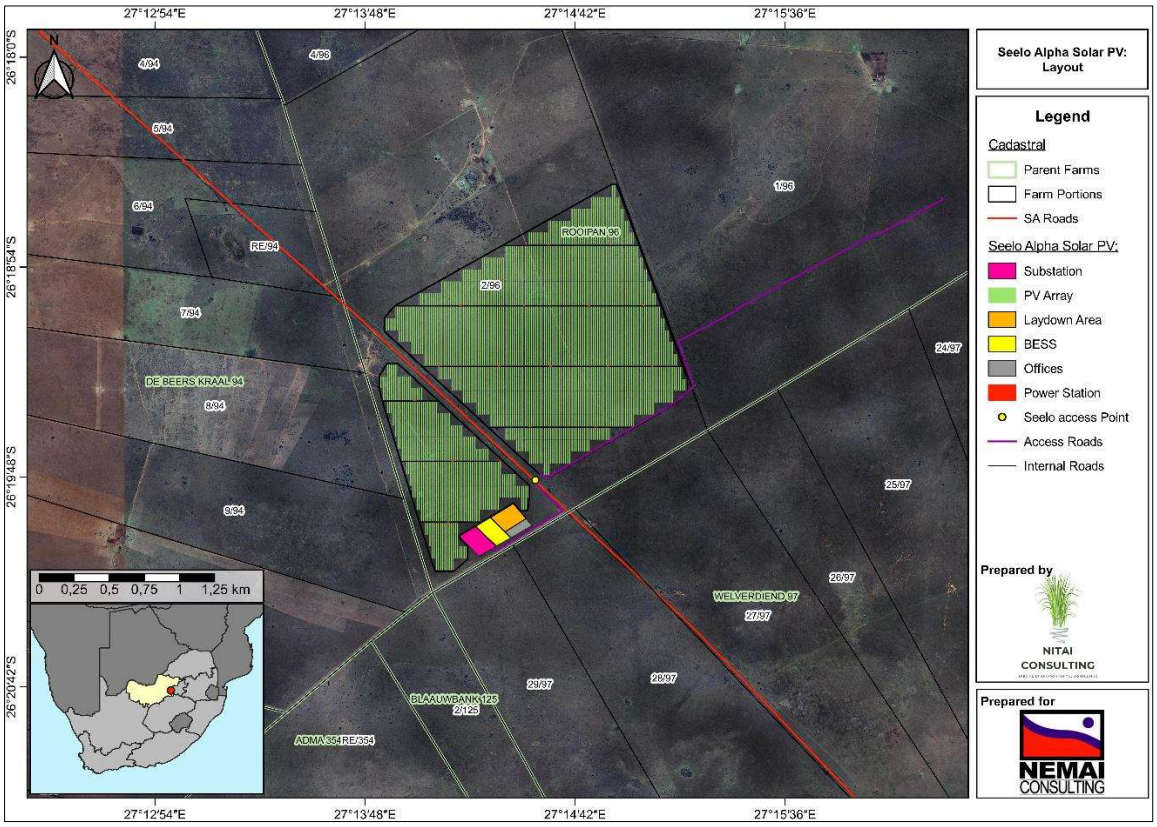

Figure 2: Seelo Alpha Solar PV Project Layout (Nitai 2023)

4.2 Project Technical Details

4.2.1 Solar Technology

Solar energy facilities operate by converting solar energy into a useful form (i.e. electricity). The use of solar energy for electricity generation is a non-consumptive use of a natural resource and consumes no fuel for continuing operation. Solar power produces an insignificant quantity of greenhouse gases over its lifecycle as compared to conventional coal-fired power stations. The operational phase of a solar facility does not produce carbon dioxide, sulphur dioxide, mercury, particulates, or any other type of air pollution, as fossil fuel power generation technologies do.

4.2.2 PV Technology Overview

PV technology produces direct current (DC) which is then converted to alternating current (AC) via power electronic inverters. The main technology categories are crystalline modules (mono or poly), thin film, and concentrated photovoltaics (CPV). **Figure 3** below provides an overview of a typical Solar PV Power Plant.

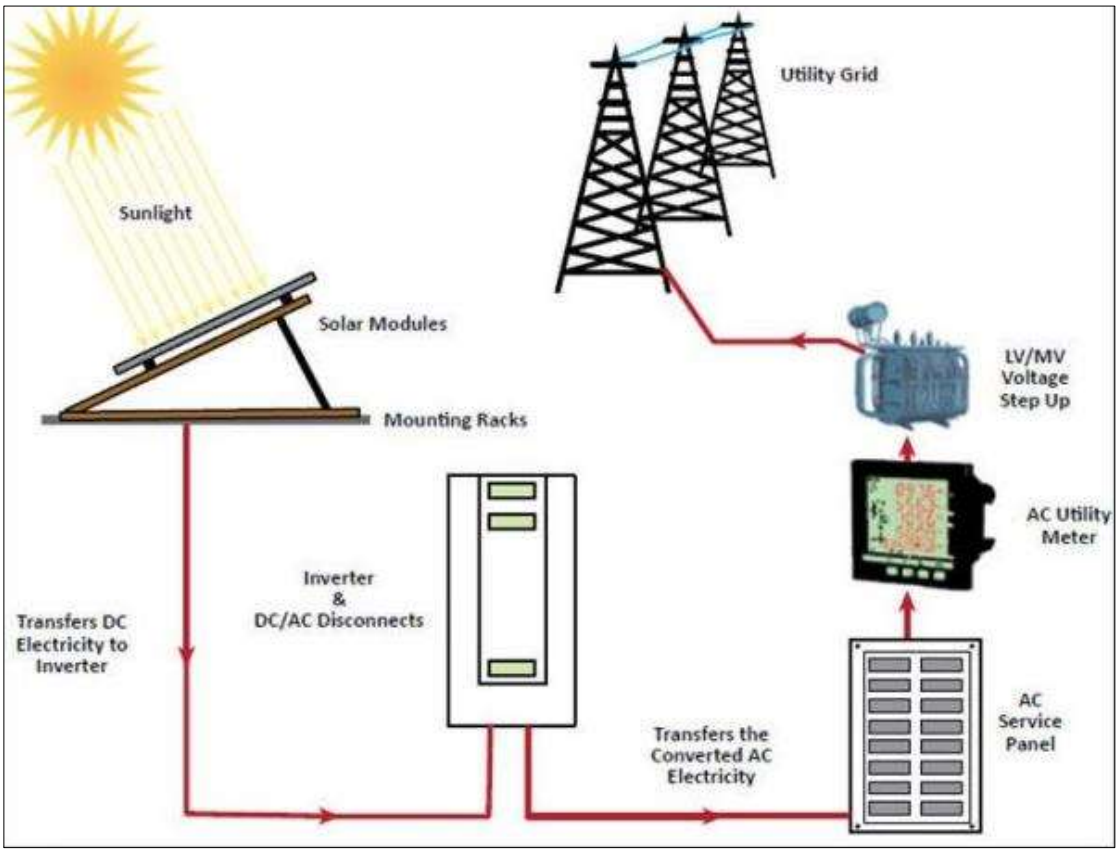

Figure 3: Overview of Solar PV Power Plant (International Finance Corporation, 2015. Utility-Scale Solar Photovoltaic Power Plan.)

The proposed Solar PV Projects have a design life of a minimum of 25 years. The extension of the life of the plant will be considered when assessing the plant's economic viability to remain operational after its end of life.

4.2.3 Overview of Technical Details:

The technical details of the proposed Seelo Alpha Solar PV Plant are captured in Table 1 below.

Table 1: Technical details of the proposed PV Plant

No.	Component	Description / Dimensions
1.	Height of PV panels	± 1-6m
2.	Area of Project (excl. access roads)	Total area of ± 355 ha
3.	Area of PV Arrays only	Total area of ± 345 ha
4.	No of PV Modules	± 525 000
5.	Number of inverters required	Approximately 70
6.	Area occupied by inverter / transformer stations / substations	▪ Area occupied by inverter stations (± 70 inverter stations) = ± 0.5 ha ▪ Area occupied by the facility transformer stations = ± 0.5 ha ▪ Area occupied by facility (step-up/switching) substation = ± 3 ha
7.	Capacity of on-site substation	132/ 33 kV
8.	BESS	BESS = ± 3 ha
9.	Area occupied by both permanent and construction laydown areas	Construction laydown areas = ± 2 ha ▪ Operation & Maintenance infrastructure = ± 1 ha ▪ Total combined = ± 3 ha
10.	Area occupied by buildings	± 3 ha Including Operational Control Centre, Operation and Maintenance Area / Warehouse / Workshop and Office, Ablution Facilities and Substation Building
11.	Length of internal roads	± 21km
12.	Width of internal roads	▪ The internal roads = 12 m reserve and road width of 6 m. ▪ Access roads = 14 m reserve and road width of 8 m.
13.	Proximity to grid connection	Approximately 12.5 km 132 kV transmission line from PV Site to existing Eskom's Carmel Main Transmission Substation
14.	Height of fencing	Up to 3.5m
15.	Type of fencing	Type will vary (e.g., welded mesh, palisade and electric fencing)

4.2.4 Project Layout

The overall layout of the Solar PV Plant is shown in **Figure 2** above. The desirability of the earmarked site for the development of the proposed Solar PV Plant is due to the following key characteristics:

- Solar Irradiation: The feasibility of a solar facility, is dependent on the direct solar irradiation levels.
- Topography: The suitability of the surface area is an important characteristic for the construction and operation of solar facilities. Most of the site has a low gradient slope and is suitable for this development.
- Grid connection: The electricity generated by the Solar PV Plant will be injected into the national grid via the existing Eskom 132 kV distribution system. The PV Site is located relatively close to the Eskom grid.
- Extent of site: The overall extent of the site is sufficient for the installation of the PV facility.
- Site access: The site can be accessed via the District Road D331, which bisects the site.

4.2.5 Components of the Proposed Solar PV Plant

The Project consists of the following systems, sub-systems or components (amongst others):

- PV panel arrays, which are the subsystems which convert incoming sunlight into electrical energy;
- Mounting structures to support the PV panels;
- On-site inverters to convert DC to facilitate AC connection between the solar energy facility and electricity grid;
- BESS;
- IPP substation;
- Eskom switching substation (the dedicated grid connection for the proposed Project, which includes a 132/33 kV switching substation, does not form part of the current application for EA);
- Cabling between the Project's components, to be laid underground (where practical);
- Administration Buildings (Offices);
- Workshop areas for maintenance and storage;
- Temporary and permanent laydown areas;
- Internal access roads and perimeter fencing of the footprint;
- High Voltage (HV) Transformers; and
- Security Infrastructure.

4.3 Battery Energy Storage System (BESS)

The Battery Energy Storage System (BESS) allows for the storage of surplus energy generated by the solar PV facility for later use. The BESS enables a balance between supply and demand of electricity during the day and uses the stored energy during peak demand periods (i.e., morning and evenings). Energy generated from the PV panel array is DC and is converted to an AC by the inverters and then transferred to the onsite substation where it is determined if the energy should be stored or evacuated. When the energy is required, it is evacuated into the grid network. Should the energy not be required, it is transferred to the BESS and

stored for later use. A BESS typically either consists of stacked containers or a multistorey building with a maximum height of 8 m and will have a footprint of up to 3 ha.

4.4 Grid Connection

It is proposed that a 33/132 kV substation is constructed, hereafter referred to as the IPP substation, which will include inverter-stations, transformers, switchgear and internal electrical reticulation. It is estimated that the maximum size of the facility substation will not exceed 1.5 hectare (ha). The electricity generated will be transmitted to the Eskom switching substation located immediately adjacent to the IPP substation. Thereafter, the generated electricity is to be transmitted with a 132 kV Overhead Power Line to connect to the existing Carmel Main Transmission Substation. The location and installation of the 132 kV line is subject to a separate EIA process.

5 STATUS QUO ANALYSIS

5.1 General Existing Condition of Receiving Environment

The Project is located approximately 15km north-west of the town of Carletonville's business district (CBD) and falls within Ward 28 of the JB Marks Local Municipality (JBMLM), in the North West Province of South Africa. District Road D331 bisects the site. The Project's PV Site is vacant and was historically used for agricultural purposes. Agriculture is the dominant land use in the Project area. The following land uses are encountered around the Project's PV Site:

- Farming activities on the property and surrounding properties;
- The Abe Bailey Provincial Nature Reserve is located 300m south-east of the site; and
- The National Road (N14) is located approximately 10km north of the site which provides regional access to the area.

The project area terrain is situated on the southern section of Portion 2 of Farm 96 (Rooipan) IQ. The general area is covered mostly with a grassland which varies from short and sparse to tall and dense. The terrain is mostly flat, however, there are signs of previous and recent disturbance, e.g. several dumps of soil and rock were scattered all over the property, and there was a minor sinkhole which contained an animal burrow. The current use of the property is grazing (cattle and game). The area is dominated by dolomite outcrops as well as quartzite/sandstone outcrops. A large number of sinkholes and subsidences occur in the area.

Figure 4: View of the footprint area, showing the short dense grass and isolated acacia bushes, as well as one of the soil dumps

Figure 5: General View of vegetation covering most of the project footprint

Figure 6: View showing excavation for livestock waterhole on the western side of the west section of the Alpha solar project footprint

Figure 7: View of a few of the soil and rock dumps in the central section of the project footprint

Figure 8: View of sinkhole with animal burrow in the western section of the project footprint

Figure 9: View of the grass cover and a large soil and rock dump in the east section of the project footprint

Figure 10: View of the dense vegetation with scattered stands of acacia on the east section of the project footprint

Figure 11: View of the low bushes in another area of the east section of the project footprint

5.2 Cultural-Heritage Receiving Environment

5.2.1 DFFE Environmental Screening Tool

The DFFE Environmental Screening Tool was accessed for information on the cultural-heritage sensitivity of the general region. This tool indicated that the Archaeological and Cultural Heritage Sensitivity of the general region is Low (**Figure 12**). However, the Palaeontological sensitivity of the region is indicated as being of High sensitivity (**Figure 13**).

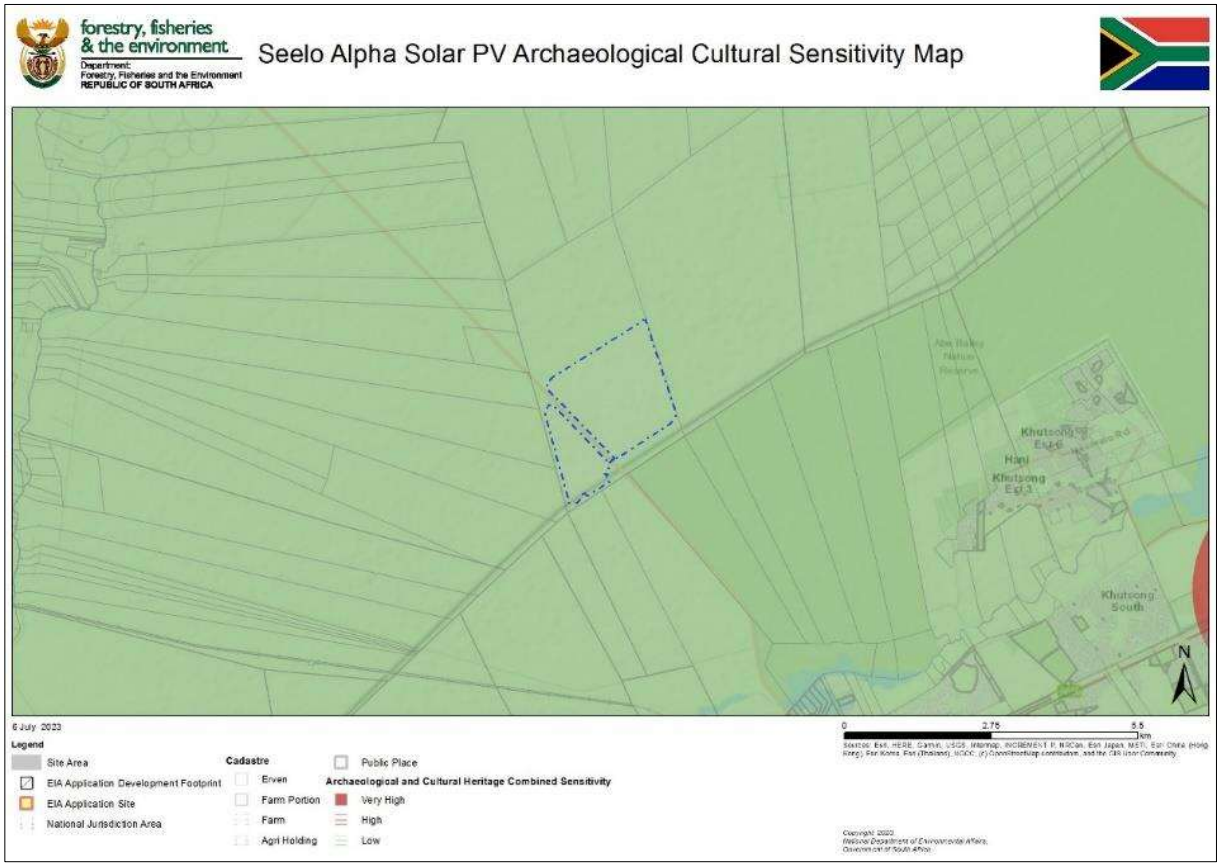

Figure 12: Archaeological Cultural Sensitivity map indicating that the project footprint is located within a region of low heritage sensitivity (DFFE Screening Tool).

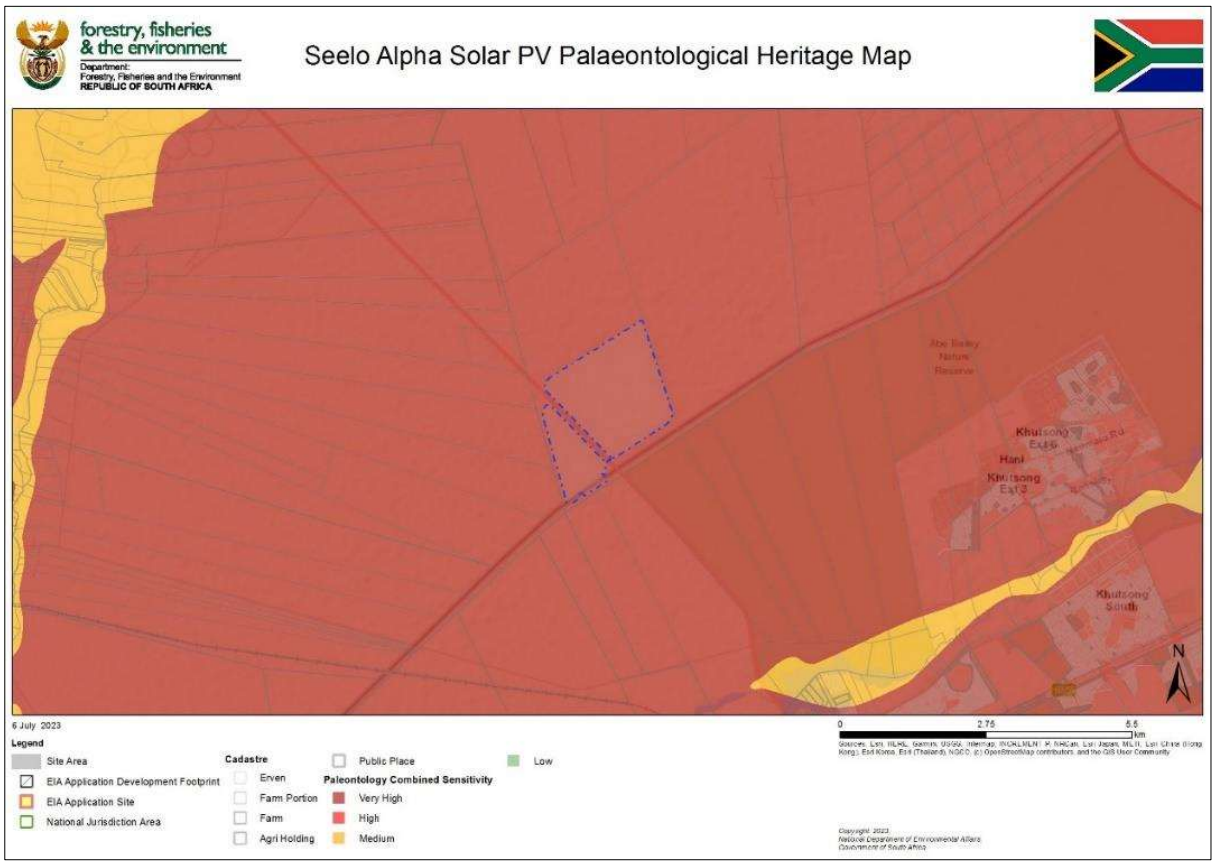

Figure 13: Palaeontological Sensitivity map indicating that the project footprint is located within a region of High palaeontological sensitivity (DFFE Screening Tool).

5.2.2 Historical Background of Surrounding Region (archaeological and historical literature survey)

The archaeological history of the area can broadly be divided into a Stone Age, Iron Age and Historic or Colonial Period. An archaeological and historical overview of the general region is presented below.

The Stone Age

The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian which comprises more refined stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates to approximately 1.5 million years ago. No significant ESA sites are known from the area. However, a few isolated finds of ESA material were recorded roughly 50km to the southeast of the study area around the Waterpan area (Fourie and Kitto 2021). Other known sites dating to the Acheulian period sites have been recorded mainly quite a distance away e.g: the Amcor factory site in Vereeninging, Kantienkoppie in Vanderbijlpark and Acacia Rd, Northcliff in Johannesburg (Bergh 1999). Some rock engravings were recorded close to Carletonville (Bergh 1999).

The Middle Stone Age (MSA) is associated with flakes, points and blades manufactured by means of the prepared core technique. This phase is furthermore associated with modern humans and complex cognition (Wadley, 2013). No significant MSA sites are known in the region of the study area.

The Later Stone Age (LSA) is the third archaeological phase identified and this is characterised by very small stone tools known as microliths, as well many rock art sites (paintings and engravings). LSA stone artefacts are more specialised, in that specific tools were created for specific purposes (Mitchell 2002) and they commonly include tools such as scrapers and segments, and sometimes bone points. The LSA is further defined by evidence of ritual practices and complex societies (Deacon & Deacon 1999). This period is associated with hunter-gatherers (San) as well as early pastoralists (Khoekhoe) and continued until the arrival of Iron Age and European communities (and often for quite a while after that).

The Iron Age

The Iron Age in South Africa (AD 1600 – AD 1840) encompasses pre-colonial farming communities and is associated with both agricultural and pastoralist farming activities, metal working, cultural customs such as lobola and stone-walled settlements known as the 'Central Cattle Pattern' (Huffman, 2007).

The entire Carletonville/Westonaria region, including the Gatsrand range that spans east to west from Orange farm in the east to the Potchefstroom in the west, is scattered with stone walled complexes associated with the early Iron Age farming communities. Studies by Fourie (1997) and Vorster (1969, 1983) have shown that the Gatsrand range, between Waterpan and Jachtfontein in the east and Glenharvie in the west, was settled by the Bakwena-Bamare-a-Phogole people from the 1700s up to the Difaqane period (Fourie and Kitto 2021).

Historical/Colonial Period

From approximately the 1820s., During the so-called Difaqane, the Khumalo Ndebele (also known as the Matabele) of Mzilikazi established themselves along the banks of the Vaal River (Bergh, 1999). Although the study area is located some distance north of the Vaal River, it can be expected that the influence area of the Matabele would have included the study area as well. In c. 1827 the Matabele moved further north and settled along the Magaliesberg Mountain and in 1832 they settled along the Marico River (Fourie and Kitto. 2021).

In 1836 the first Voortrekker parties started crossing the Vaal River and between 1839 – 1840, the first farms were established by the Voortrekkers in the general region of the study area. The district of Potchefstroom was also established in 1839 (Bergh, 1999), which included the project area.

In 1898 the first gold-mining activity occurred in the region, when the Pullinger brothers started drilling boreholes and intersected the Ventersdorp Contact Reef (VCR) and Middelvlei Reef (MR) at depth. In 1909 a shaft was sunk, but it became flooded with water from the dolomites, and was abandoned (https://www.sibanyegold.co.za/operations/kloof/history).

The South African War (1899 – 1902) was fought between the Boer Republics of the Transvaal and Free State and Great Britain, but is referred to as the South African War as the victims and participants of the war were not restricted to British or Boer citizens only. Although there is evidence that troops of both the British and the Boer forces were present throughout the general region, including the Carletonville/Westonaria area (van der Bergh, 2009), no evidence for battles or skirmishes from within the

study area was found during the desktop study. However, evidence was found for a skirmish that took place 23km to the south of the study area (Fourie and Kitto. 2021).

This incident was an ambush planned for the morning of 5 September 1900 by Commandant Danie Theron and his scouts together with General Liebenberg and members of the Potchefstroom Commando. A large British convoy comprising 1,000 men was expected to be moving from Johannesburg to Potchefstroom. However, the planned attack was jeopardised by the unexplained absence of Genl. Liebenberg. Theron and one of his men went to look for Liebenberg and when Theron came to the ridge south of the wagon road where Liebenberg and his men should have been stationed, he was apparently surprised by a British scouting force instead. Nevertheless, he killed three of the British soldiers on the hill before firing on the British column apparently as a bluff. The British forces started shelling the summit of the hill with howitzers and Theron was killed. The British forces subsequently buried Theron on the border between the farms Buffelsdoorn and Elandsfontein with the three British soldiers he had killed. However, a few months later, (in September 1900), Theron's body was exhumed by his men and buried in the Pienaar family cemetery on the farm Elandsfontein. After the war (on 10 March 1903) his men exhumed his body again and buried him next to the grave of his fiancé at Eikenhof, south of Johannesburg (Fourie and Kitto 2021). Subsequently, in 1950, The Danie Theron Monument was unveiled on the summit of the ridge where he died. The monument was built with funds collected by the Voortrekker organisation (http://www.afrikanergeskiedenis.co.za/presidente/monumente-en-erfenisterreine/danie-theronmonument-gatsrand/).

Between 1930-1932 the discovery of the West Wits Line goldfields contributed to the revival of the South African gold industry. According to Davenport (2013), Guy Carleton Jones, the consulting engineer for Goldfields, and Dr Leopold Reinecke, Goldfield's consulting geologist, hired Dr Rudolph Krahmann to conduct a magnetic survey of the farms that lay to the south-west of Randfontein to trace the magnetic shale beds believed to be associated with gold-bearing conglomerates of the Witwatersrand system. The survey did plot magnetic shales at depth in the area south-west of Randfontein. Consequently, Goldfields secured options over a large amount of land that covered 30 000 mining claims and stretched 50km from the west of Randfontein to the Mooi River. The effects of the Depression on the South African economy meant that the only other mining house willing to invest in the potential new goldfield was Anglo American. A subsidiary company, West Witwatersrand Areas Limited, was established on 12 November 1932, by Goldfields with the assistance of Anglo American. The institution of an extensive drilling programme by West Wits intersected payable reef and revealed the existence of two new gold-bearing conglomerates: the Ventersdorp Contact Reef and the Carbon Leader Reef (Davenport, 2013).

In November 1946, the company West Witwatersrand Areas Limited applied to the administrator of Transvaal to proclaim Twyfelvlakte for the purpose of a town to accommodate the increased population resulting from the establishment of the mines Blyvooruitzicht and West Driefontein during the 1930s and 1940s. The application was approved on 20 January 1948 and the town of Carletonville was established and named after Guy Carleton Jones (Van Eeden, 1998).

Khutsong, a Tswana word meaning ‘place of peace or rest,’ was set up in 1958 as a satellite township to house mining labourers outside the ‘whites-only’ town of Carletonville (Kirshner and Phokela 2010; Raper 2014).

In September 1973 eleven miners were shot by police when demonstrating for increased wages at the Western Deep Levels Gold Mine at Carletonville (Reddy 1992).

5.2.3 Cartographic findings

An assessment of available historical topographical maps was undertaken to establish a historic layering for the study area. Overlays of the maps were made on Google Earth. These historic maps are valuable resources in identifying possible heritage sites and features located within the study area. It should be noted that the earliest edition of the map sheets for this area dates to the 1950s (see **Figure 14** below). As the first edition of this sheet dates to 1953, it was not considered necessary to examine the later edition map sheets. Any heritage resources that are 60 years or older would be depicted on the 1953 edition sheet. The topographical maps were obtained from the Department of Agriculture Land Reform and Rural Development (DALRRD) in Cape Town. It should be noted that the project footprint falls between two topographic map sheets, as set out below.

The following 1:50 000 map sheets were assessed for the Seelo Alpha Solar PV footprint: 2627AC Rysmierbult Edition 1 1953 and 2627AD Carletonville Edition 1 1958.

The Rysmierbult sheet was surveyed in 1953 and drawn in 1959 by the Trigonometrical Survey Office of the Union of South Africa from aerial photographs taken in 1948.

The Carletonville sheet was surveyed in 1958 and drawn in 1955 by the Trigonometrical Survey Office of the Union of South Africa from aerial photographs taken in 1948.

As can be seen in **Figure 14**Error! Reference source not found.**,** the combination of the 1953 and 1958 edition sheets depict no heritage features within or immediately adjacent to the Seelo Alpha Solar PV footprint. The only man-made feature depicted is a quarry located just outside (south) of the southern boundary of the footprint area.

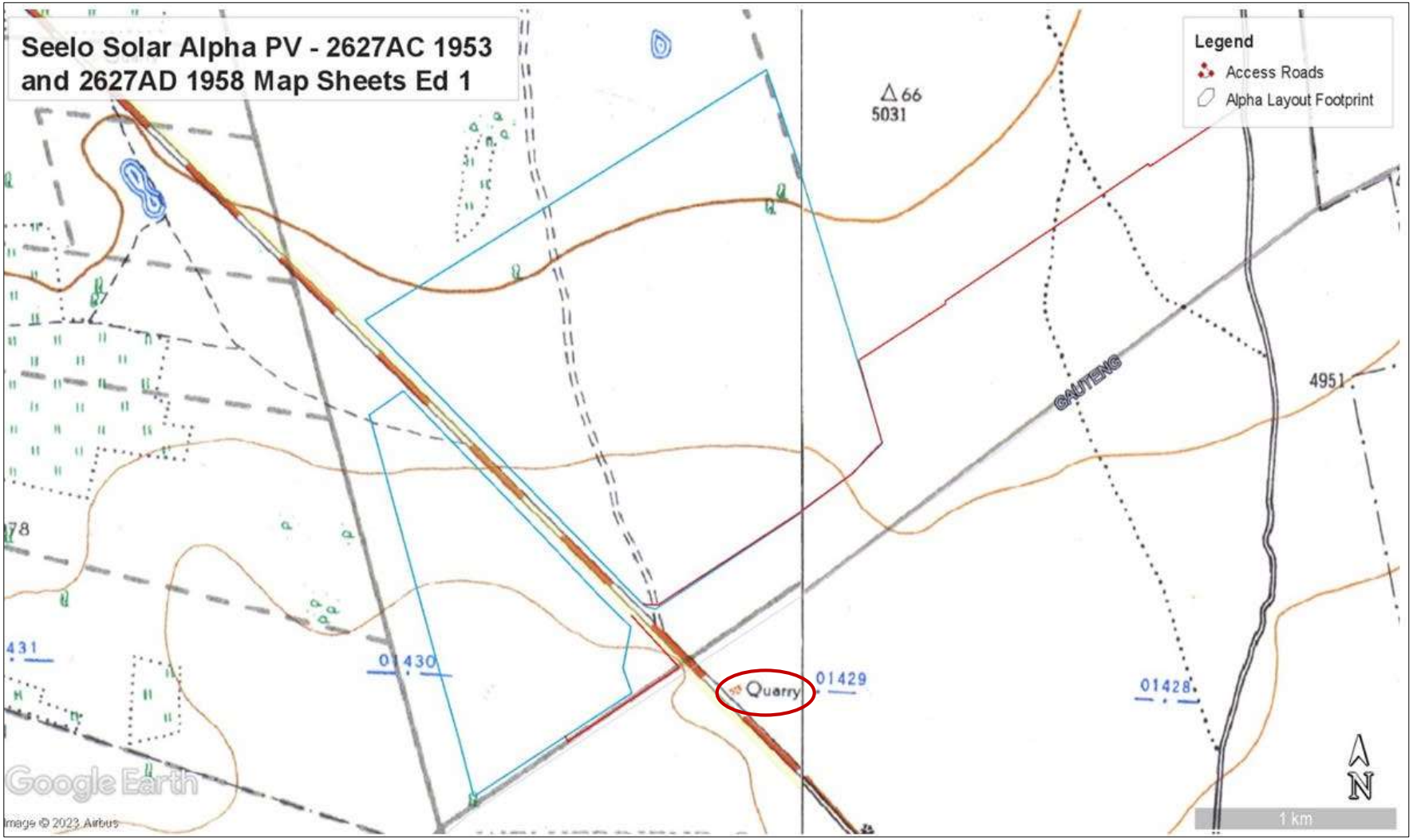

Figure 14: Enlarged view of 2627AC 1953 and 2627AD 1958 sheets shows no heritage features depicted within or immediately adjacent to the Seelo Alpha Solar PV footprint (blue polygons). The only man-made feature depicted is a quarry located just outside (south) of the southern boundary of the footprint area(red circle)

5.3 Previous HIA reports in the area

A search on the South African Heritage Resources Information System (SAHRIS) has identified several Heritage Impact Assessments conducted in the general region of the study area. The project area of one of these reports covered portion 5 of the Farm Rooipan 96 IQ, located immediately north of portion 2 which contains the current project area (vd Walt 2015). Only two sites of cultural significance were identified: an informal cemetery and two dolomite outcrops (possible fossils).

Dreyer, C. 2006. *A First Phase Archaeological and Cultural Heritage Assessment of the Proposed Developments at the Farms Bovenste Oog 68IQ (Mooi River), Digby Plain 63 IQ, Somerville 62 IQ, Preton Pans 59 IQ and Drylands 64 IQ, Ventersdorp, Gauteng*. Several heritage sites were identified on the farm Bovenste Oog, including: historical structure remains (farm houses and kraal), Iron Age stone-walled structures, historical prospecting holes and mine shafts and a graveyard as well as three separate graves.

Van Schalkwyk, J. 2014. *Cultural Heritage Assessment for the Libanon 132kv Loop-In Line, Carletonville Region, Westonaria Magisterial District, Gauteng Province*. For GIBB Engineering and Architecture. No sites, features or objects of cultural heritage significance were identified in the development area.

Van der Walt, J. 2015. *Heritage Opinion for the Proposed Prospecting Activities on the farm Rooipan 96 IQ, Ventersdorp, North West Province*. Within the study area 4 areas of interest were recorded. These consisted of a farm house complex and farm labourer complex, an informal cemetery and two areas where dolomite is exposed.

Fourie, W, J Kitto and G Groenewald. 2016. *Environmental Impact Assessment Process: 200 Megawatt Photovoltaic Energy Facility Proposed for Sibanye Gold, West Witwatersrand, Gauteng - Heritage Impact Assessment.* A total of nine heritage resources were identified. Three of the sites were recent historical structures. Six of the sites contained historical structures as well as a possible grave site.

Fourie, W; J Kitto and I Smeyatsky. 2019. *HIA for Westrand Strengthening Project, Spanning Randfontein, Krugersdorp & Westonaria, Westrand District Municipality, Gauteng Province*. The project was a proposed new 400-kV Transmission line from the Pluto Substation to the Westgate Substation and for the loop inns/outs connecting the Hera-Westgate 400-kV line. West Rand District Municipality, Gauteng. The study identified 23 heritage sites which included 12 burial grounds, (four were municipal cemeteries) and 11 historical structures or dwellings.

Muroyi, R. 2020. *Phase 1 HIA for the proposed Khutsong South Ext. 8 Development, Merafong City Local Municipality, West Rand District Municipality, Gauteng*. This background study revealed that there are no archaeological sites within the immediate vicinity of the proposed development site.

Fourie W and J Kitto. 2021. *Heritage Impact Assessment as part of the Environmental Impact Assessment Report for the New 200MW Photovoltaic Energy Facility Proposed For Sibanye Gold, West Rand District, Gauteng*. This study covered the routes for proposed transmission lines associated with the PV facility. The

total number of sites identified as potentially affected by the transmission lines was 28. These included: two grave sites, several historical farmsteads and associated agricultural enclosures or walls, two recent farmsteads, three historical mine-related structures, one a religious site and one isolated prehistoric stone tool.

5.4 Palaeontological sensitivity

Note that this section was compiled by the author and not by a palaeontological specialist. A basic palaeontological sensitivity was determined using the SAHRIS database South African Palaeontological Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo). This map indicates that the project footprint falls within an area where the underlying geology has Very High fossil sensitivity (red) (see **Figure 15** below). A Site Sensitivity Verification (SSV) was undertaken by an appointed palaeontologist which confirmed the very high sensitivity.

Due to the underlying geology being of Very High sensitivity for fossils, a separate palaeontological assessment has been undertaken by a professional palaeontologist which will indicate if significant/sensitive fossils will be impacted by the proposed project and provide recommendations and mitigation measures.

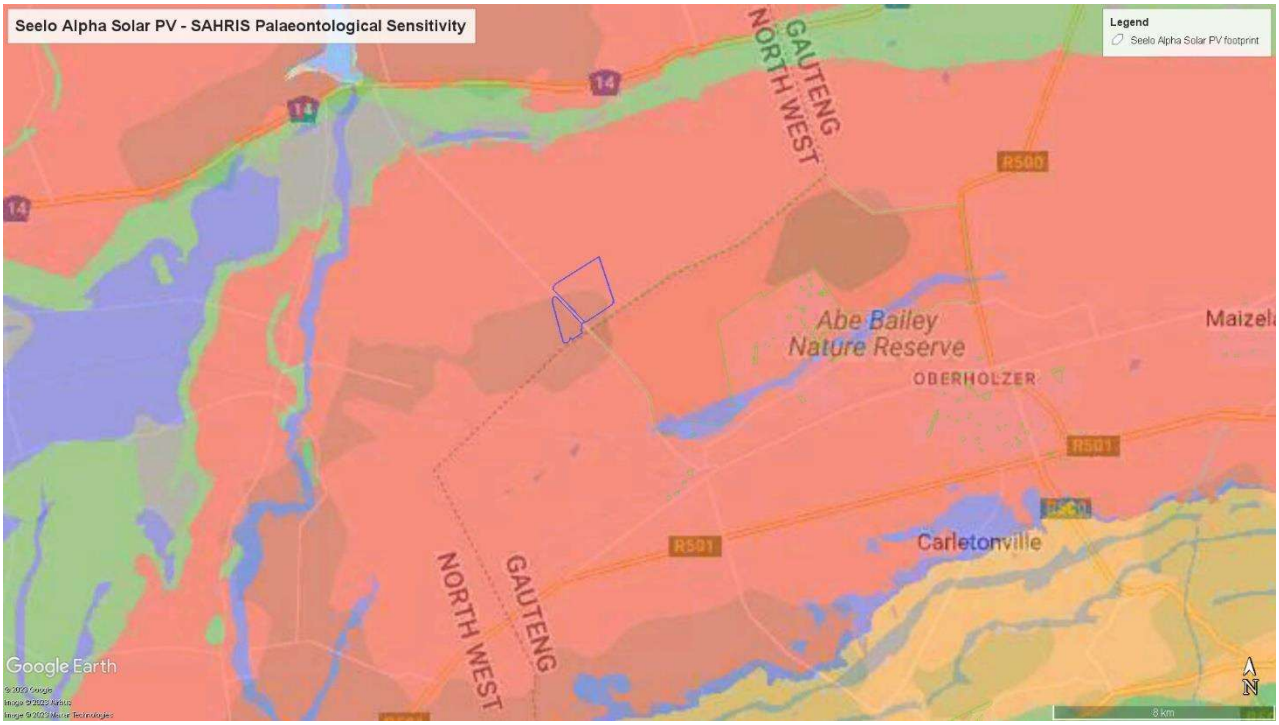

Figure 15: SAHRIS Palaeontological sensitivity map overlain on the Seelo Alpha Solar PV project footprint (purple polygon). The underlying geology is shown as of Very High fossil sensitivity (red).

Table 2: SAHRIS Fossil Map Palaeontological Sensitivity Ratings and Required Actions

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

5.5 Findings of the Historical Desktop Study

The general overview from the historical desktop study has shown that various archaeological and historical resources can be expected to occur in the project area. Furthermore, the examination of the earliest edition (1953 and 1958) of the 1:50 000 topographical maps produced by overlying the maps with satellite Imagery (Google Earth) has shown that there are no heritage features depicted within the project footprint.

The Site Survey fieldwork provided confirmation that no visible heritage resources occur within and close to the project area footprint.

6 SITE SURVEY/FIELDWORK RESULTS

The survey of the Seelo Solar Alpha project footprint took place over one day (19 January 2023) by the author (heritage specialist) as part of a specialist team and accompanied by the landowner. A vehicle was used to access the project footprint area and the survey was conducted by both vehicle and on foot (at selected areas). The survey covered as much of the project footprint area as was feasibly accessible, given the tall grass covering several areas.

The author used a Global Positioning System (GPS) application to navigate access roads in the study area and for recording the tracklog of the survey and waypoints of the identified heritage resources. A Sony digital camera was used for photographic recording of identified heritage resources and general images of the project study area.

The survey aimed to find and identify archaeological and other heritage resources such as burial grounds and graves (BGG), archaeological material or sites, historic built environment and landscape features of

cultural heritage significance. The inspection of the area that was surveyed identified no visible heritage resources within or adjacent to the project footprint (**Figure 16**).

However, the project footprint layout was adjusted (moved to the north by 300m) subsequent to the field survey. As no heritage resources were identified within the original footprint area, it is considered unlikely that any heritage resources would be identified within the additional area. However, there is a low possibility that sub-surface heritage resources, specifically, informal graves or burial sites or archaeological material, could be uncovered.

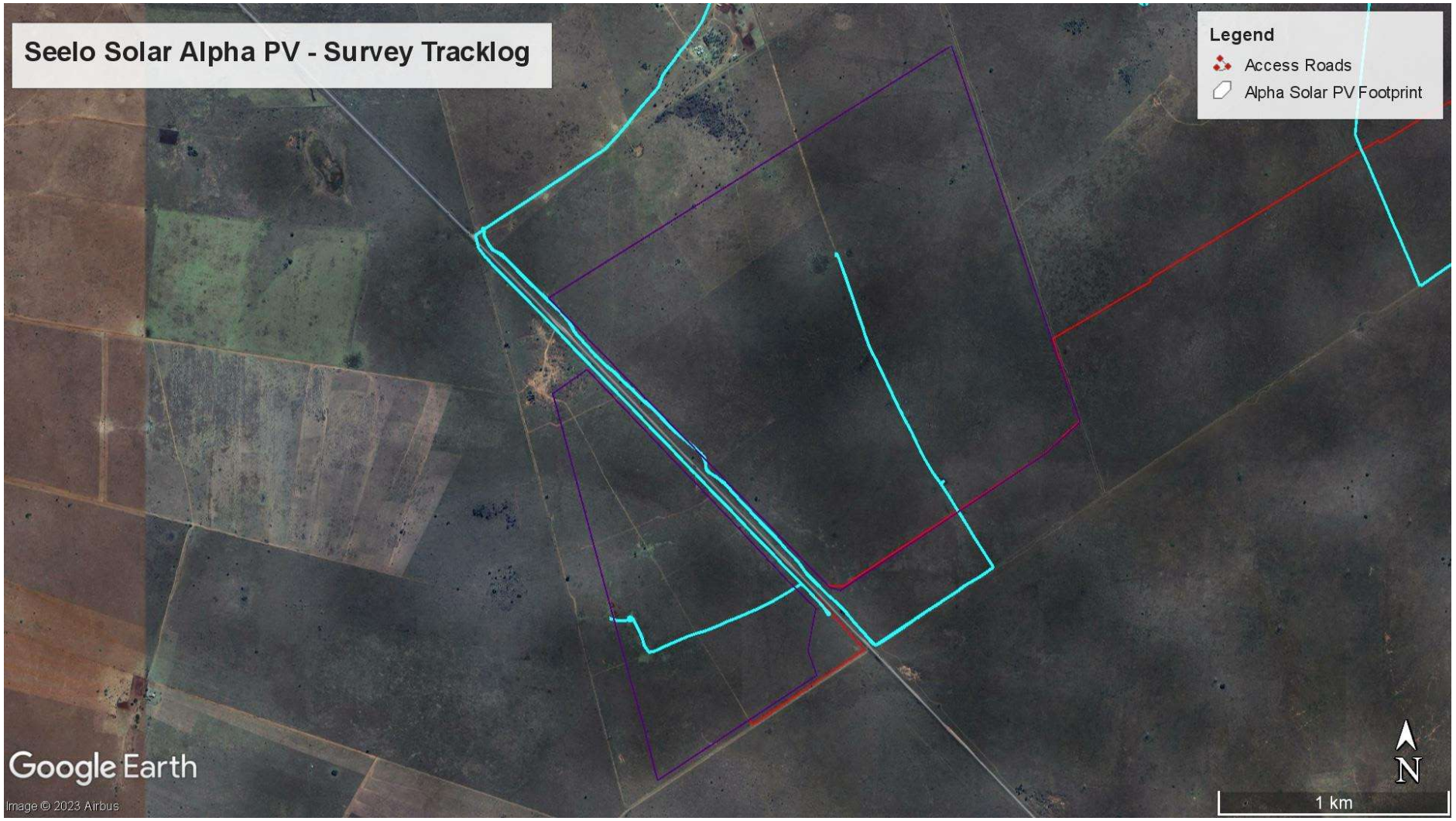

Figure 16: Site Survey Tracklog overlaid on the project layout. No heritage resources were identified within the project footprint

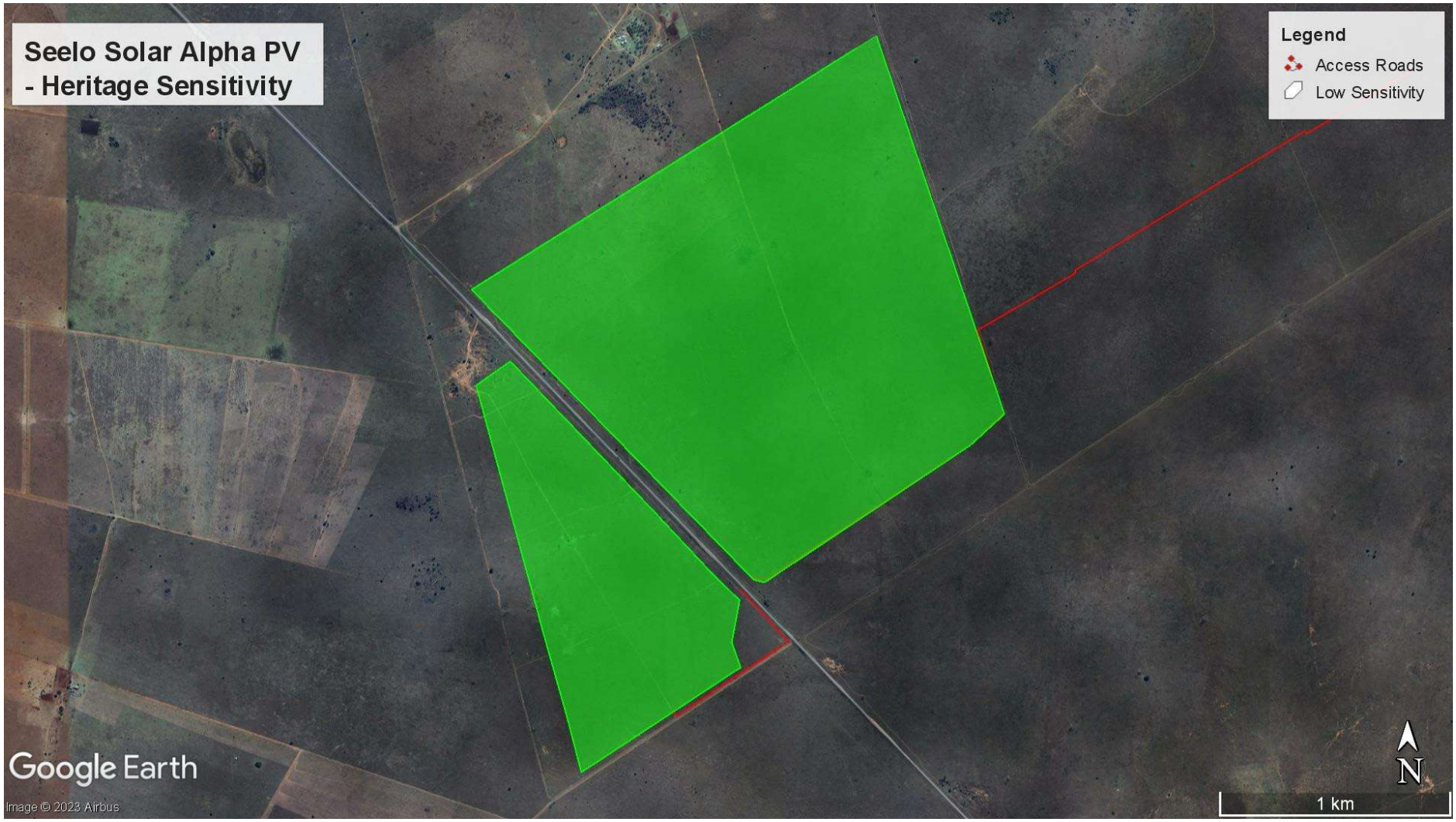

Figure 17: Site Sensitivity of the project layout is considered low as no heritage resources were identified within the project footprint

7 SIGNIFICANCE ASSESSMENT

Methodology for Assessing Heritage Site Significance

The applicable maps, tables and figures are included, as stipulated in NHRA and NEMA. The HIA process consists of three steps:

Literature Review

The desktop literature review provided information on the Heritage Background of the general region and project area. This included investigating published sources as well as past HIA studies conducted for the project area and surrounding region. An examination of historical 1:50 000 topographical maps and/or archival maps (if available) was also undertaken. The relevant early editions of the 2627AC and 2627AD topographical map sheets were obtained from the Department of Rural Development & Land Reform, Cape Town.

A number of internet sites were also accessed for information including, https://www.sibanyegold.co.za; http://www.afrikanergeskiedenis.co.za and https://www.atlanticphilanthropies.org

Literature resources accessed are listed in Table 3.

Table 3: Literature sources accessed

Source	Information
Background Information Document - Nemai	Project location and description details
Published and unpublished sources and Past HIAs	Historical and archaeological background on Carletonville and surrounding region
Directorate: National Geo-spatial Information of the Department of Rural Development & Land Reform, Cape Town	Historical topographic maps, 1:50 000 2627AC Rysmierbult Edition 1 1953 and 2627AD Carletonville Edition 1 1958

Field Survey

A physical Site Inspection or Field Survey was conducted, predominantly by vehicle with selected areas traversed on foot, through the project area by an experienced heritage specialist as part of a specialist team. This focussed on identifying and documenting heritage resources situated within and immediately adjacent to the proposed project area footprint, such as graves, historical structures or remains and archaeological sites or material.

HIA Report

The final step involved the recording and documentation of the identified heritage resources, the assessment of such resources in terms of heritage significance and impact assessment criteria, producing a heritage sensitivity map and compiling the heritage impact assessment report with constructive recommendations for mitigation, if required.

Impacts on these sites by the development will be evaluated as follows:

Site Significance

Site significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. The update classification and rating system as developed by Heritage Western Cape (2021) is implemented in this report.

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016), were used for the purpose of this report (Table **4** and Table **5**).

Table 4: Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 5: Rating system for built environment resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority.	Exceptionally High Significance
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. These are heritage resources which are significant in the context of an area.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they should receive maximum protection at local level.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context of a townscape, neighbourhood, settlement or community.	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples. They would receive less stringent protection than Grade IIIA buildings and sites at local level.	Medium Significance
IIIC	Such a resource is of contributing significance to the environs These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e., in large part due to its contribution to the character or significance of the environs. These buildings and sites should, as a consequence, only be regulated if the significance of the environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	Low Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant and approved by the authority. Section 34 can even be lifted by the PHRA for structures in this category if they are older than 60 years.	Not Conservation worthy – no research potential or other cultural significance

Table 6: Site significance classification standards as prescribed by SAHRA.

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	Very High - of National Significance	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	Very High – of Provincial Significance	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

8 IDENTIFICATION OF IMPACTS

8.1 Impacts and Mitigation Framework

All impacts are analysed in the section to follow with regard to their nature, extent, magnitude, duration, probability and significance.

ISO 14001-2004 defines impacts as “any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s environmental aspects”.

When considering an assessment of the impacts and their mitigation, the following definitions as per Table 7 apply.

Table 7: Impact and Mitigation Quantification Framework

Nature	The project could have a positive, negative or neutral impact on the environment.
Extent	**Local** – extend to the site and its immediate surroundings. **Regional** – impact on the region but within the province. **National** – impact on an interprovincial scale. **International** – impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources: **Low** – natural and socio-economic functions and processes are not affected or minimally affected. **Medium** – affected environment is notably altered; natural and socio-economic functions and processes continue albeit in a modified way. **High** – natural or socio-economic functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	**Short term** – 0-5 years. **Medium term** – 5-11 years. **Long term** – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. **Permanent** – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	**Almost certain** – the event is expected to occur in most circumstances. **Likely** – the event will probably occur in most circumstances. **Moderate** – the event should occur at some time. **Unlikely** – the event could occur at some time. **Rare/Remote** – the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact’s importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- **0** – Impact will not affect the environment. No mitigation necessary. **1** – No impact after mitigation. **2** – Residual impact after mitigation. **3** – Impact cannot be mitigated.
Mitigation	Information on the impacts together with literature from socio-economic science journals, case studies and field work will be used to provide mitigation recommendations to ensure that any negative impacts are decreased and positive benefits are enhanced.
Monitoring	Monitoring usually involves developing and implementing a monitoring programme to identify deviations from the proposed action and to manage any negative impacts. The recommended mitigation measures will also include monitoring measures.

Table 8: Impact Methodology Table

Nature			
Negative	Neutral	Positive	
-1	0	+1	
Extent			
Local	Regional	National	International
1	2	3	4
Magnitude			
Low	Medium	High	
1	2	3	
Duration			
Short Term (0-5yrs)	Medium Term (5-11yrs)	Long Term	Permanent
1	2	3	4
Probability			
Rare/Remote	Unlikely	Moderate	Likely	Almost Certain
1	2	3	4	5
Significance			
No Impact/None	No Impact After Mitigation/Low	Residual Impact After Mitigation/Medium	Impact Cannot be Mitigated/High
0	1	2	3

8.2 Identification of Activities and Aspects

An "Activity" is defined as a distinct process or risks undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation (International Organization for Standardization, 2011).

An aspect is defined as elements of an organisation's activities or products or services that can interact with the environment.

In order to capture the impacts associated with the proposed infrastructure, an activity – aspect – impact table was created refer to Table 9 below.

Table 9: Activity, Aspects and Impacts of the Project

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Site clearance/ construction camp	Heritage	N/A	Damage to unidentified graves
Construction	Heritage	N/A	Damage to unidentified graves
Operation	Heritage	N/A	N/A

8.3 Impact and Mitigation Assessment

The Seelo Alpha Solar PV project should not impact on heritage resources as no heritage resources were identified within or adjacent to the project footprint area- original layout. However, the project footprint layout was adjusted (moved to the north by 300m) subsequent to the field survey. As no heritage resources were identified within the original footprint area, it is considered unlikely that any heritage resources would be identified within the additional area. However, there is a low possibility that sub-surface heritage resources, specifically, informal graves or burial sites or archaeological material could be uncovered.

8.4 Impacts During the Planning, Construction and Operation Phases

As no impact on heritage resources is anticipated, no impact/mitigation tables have been generated.

8.5 Cumulative Impacts

The project area and surrounding region has been affected by impacts of activities occurring in the past, current activities and proposed future developments. These will be discussed below.

Past impacts: The past HIA reports recovered from the SAHRIS database indicated that the Seelo Alpha Solar PV project footprint and surrounding region has been affected by several development and other activities that would have disturbed the heritage resources which occur in the area. These include: a prospecting project proposed for the northern section of the farm Rooipan 96 IQ (which could have indirectly impacted the current project area), a solar PV project closer to Carletonville, the construction of several powerlines, and the development and later expansion of the Khutsong township which is located directly south of the project area. Most of these developments could have impacted previously identified heritage resources which were historical structures or grave sites and of low or medium to high heritage significance.

Current impacts: the immediate area of the Seelo Alpha Solar PV footprint is affected by cattle and game farming activities, as well as the existing roads running to the south of and through the proposed Project footprint. No heritage resources were identified; however, as there is always a low possibility that sub-surface graves or archaeological material could occur, a chance finds procedure is included in the general heritage management guidelines (see **Section 11**).

Future impacts: two Solar PV projects (Seelo Beta and Seelo Charlie) are proposed for development in the immediately adjacent area of the Seelo Alpha Solar PV footprint, both located immediately east of the Seelo Alpha PV project. No heritage impacts were recorded in the HIA reports for these two adjacent projects (Beta and Charlie). In addition, a 200 MegaWatt (MW) PV Energy Facility for Sibanye Gold has been approved in Westonaria Local Municipality, Gauteng which is located approximately 29km east of the Seelo Alpha Solar PV project. While several heritage resources of low to medium

significance (historical structures and two possible grave sites) were recorded for the Sibanye Gold PV project HIA report, these heritage resources would have been affected only indirectly.

Overall, the cumulative impacts for both the immediate project area and the general region are considered low to medium for Heritage resources (before mitigation), and additional project impacts are not expected to increase the significance of the existing baseline impacts, where the cumulative unmitigated impact will probably be of a low to medium significance. The impact is going to happen and will be long-term in nature, however the impact risk class (after mitigation) will be Low.

Table 10: Cumulative Impact - Heritage Resources

Environmental Feature	Heritage resources					
Project life cycle	Construction and Operation					
Potential Impact	The extent that the addition of this project will have on the overall impact of developments in the region on heritage resources					
Possible damage to or destruction of identified heritage resources	Although several HIA reports for previous projects within the greater region identified various heritage resources (including historical structures, graves, historical mining or prospecting remains and a few Iron Age stone-walled structures), no heritage resources were identified within the Alpha Solar PV project footprint or the HIA reports for the two proposed solar PV projects immediately adjacent (Seelo Beta and Seelo Charlie).					
Possible damage to or destruction of unidentified heritage resources	There is a low possibility that sub-surface heritage resources could exist within the Alpha project footprint (graves, archaeological material) and therefore a Chance Find procedure should be included in the EMPr.					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Regional	Medium	Permanent	Moderate	1
After Mitigation	Positive	Regional	Low	Long-term	Unlikely	0
Significance of Impact	As no heritage resources were identified within the Alpha Solar PV project footprint or either of the two immediately adjacent solar PV project footprints (Beta and Charlie) it is considered that the additional load on the overall impact on heritage resources will be low.					

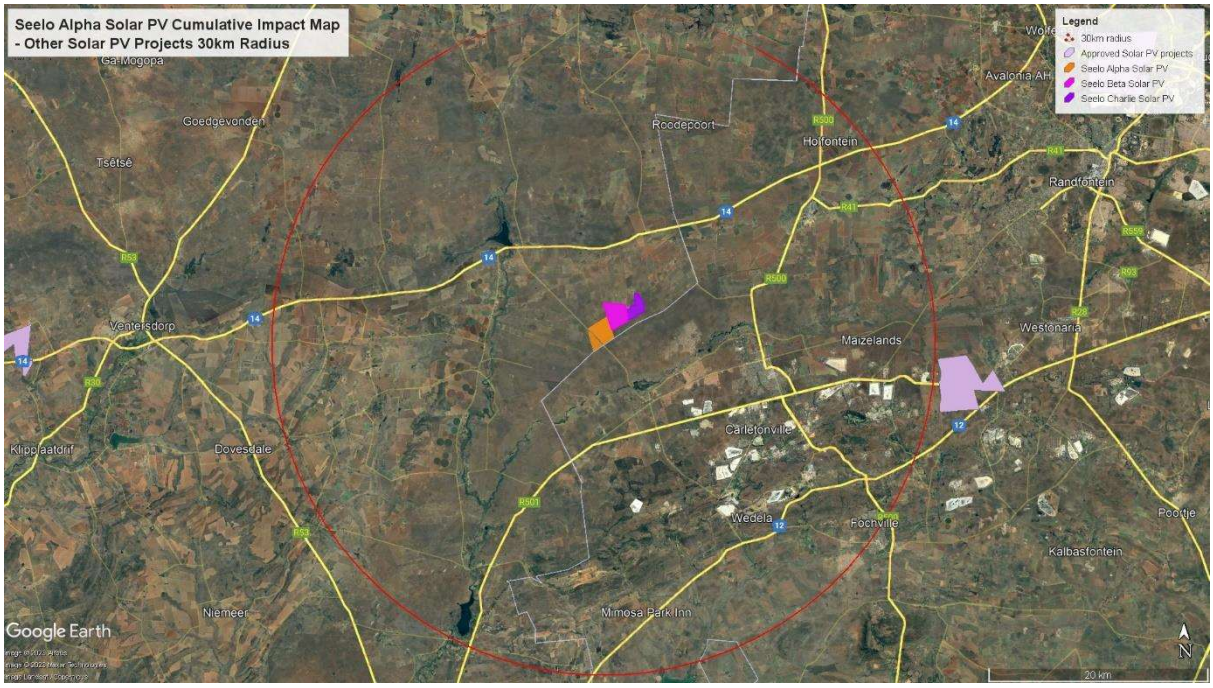

Figure 18: Cumulative Impact Map showing all known Solar PV projects within 30km radius of Seelo Solar Alpha (orange polygon)

9 ALTERNATIVES

9.1 Introduction

Alternatives are the different ways in which the Project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for a project.

9.2 Site Alternatives

The selected PV Site was identified through a prefeasibility study/screening process which took into consideration a set of location factors. The location factors which favour the selected PV site include:

- Suitable solar irradiation levels;
- Proximity to and availability of grid connection point. Many areas in South Africa do not have available generation connection capacity of the transmission network. The site is located approximately 13km from a grid connection point that has confirmed capacity to evacuate the electricity generated;
- Flat topography;
- Low agricultural sensitivity;

- Suitable site access; and
- Availability of the particular property for the development of a PV facility.

As a process was followed to identify the site for the proposed PV facility based on the application of the above location factors, alternative sites are not proposed for this project.

9.3 Layout / Design Alternatives

It is anticipated that the space available at the PV Site will be adequate to position the facility and its associated infrastructure to avoid areas of sensitive environmental features, which have been determined in the EIA phase through the specialist studies.

Through the environmental screening process and with input from specialists, the initial layout was refined to take sensitive environmental features and a required buffer from the neighbouring Abe Bailey Nature Reserve into consideration.

9.4 Technology Alternatives

9.4.1 PV Technology

Very few technological options exist as far as PV technologies are concerned; those that are available are usually differentiated by climatic conditions that prevail. The impacts of the different PV technologies on the environment are very similar. The construction, operation and decommissioning activities associated with the facility will all be the same, irrespective of the chosen technology. Both technology alternatives are considered reasonable and relevant to this application, based on the current technology available and potential engineered simplification of solar tracking systems in the coming years.

The Fixed and Tracking PV panel technologies are both considered for the proposed Solar PV Facility. The different solar PV panel technologies are briefly discussed in the following subheadings:

- Fixed / mounted PV panels; and,
- Tracking PV panels (these solar panels rotate to follow the sun's movement/trajectory).

9.4.1.1 Fixed Mounted PV System

In a fixed mounted PV System (**Figure 19**), the PV panels are installed at a pre-determined angle from which they will not move during the lifetime of the plant's operation. The limitations imposed on this system due to its static placement are countered by the fact that the PV panels are able to absorb incident radiation reflected from surrounding objects. In addition, the misalignment of the angle of the PV panels have been shown to affect the efficiency of energy collection only marginally. There are advantages which are gained from fixed mounted systems, and includes the following:

- The maintenance and installation costs of a fixed mounted PV system are lower than that of a tracking system, which is mechanically more complex given that these PV mountings include moving panels;

- Fixed mounted PV systems are an established technology with a proven track record in terms of reliable functioning. In addition, replacement parts are able to be sourced more economically and with greater ease than with alternative systems; and,
- Fixed mounted systems are robustly designed and able to withstand greater exposure to winds than tracking systems. A typical fixed structure will have two rows of twenty (20) modules (2 strings). The modules are placed in portrait arrangement. The foundation technology is usually a direct-driven (rammed) installation, with a ramming depth subject to the soil characteristics, or reinforced concrete strip footings.

Figure 19: Example of Fixed Solar Panels (Nemai 2023)

9.4.1.2 Dual Axis Tracking System

In a dual axis tracking system, PV panels are fixed to mountings which track the sun's trajectory. There are various tracking systems namely a single axis tracker or a dual axis tracker. A 'single axis tracker' will track the sun from east to west, while a 'dual axis tracker' will in addition be equipped to account for the seasonal waning of the sun. These systems utilise moving parts and complex technology, including solar irradiation sensors to optimise the exposure of PV panels to sunlight. Tracking systems are a new technology and, as such, are more complex to operate in South Africa. This is due to:

- A high degree of maintenance is required due to the nature of the machinery used in the system, which consists of numerous components and moving parts. A qualified technician is

required to carry out regular servicing of these tracking systems, which are normally located in remote areas.

- The cost of the system is necessarily higher than a fixed mounted system due to the maintenance required for this system and given that separate mountings need to be placed apart from one another to allow for their tracking movement; and,
- A power source is needed to mechanically drive the tracking system and this would offset a certain portion of the net energy produced by the plant. However, the additional improvements in capacity factor and efficiency may make a tracking system attractive despite these challenges. This can only be determined with a financial model during the more detailed design phase of the project.

9.4.2 BESS Technology

As technological advances within battery energy storage systems (BESS) are frequent, two BESS technology alternatives are considered namely, solid state battery electrolytes and redox-flow technology.

9.5 No-Go Option

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the Project is included in the evaluation of the alternatives.

The no-go alternative can be regarded as the baseline scenario against which the impacts of the Project are evaluated. This implies that the current status and conditions associated with the proposed Project footprint will be used as the benchmark against which to assess the possible changes (impacts) associated with the Project.

In contrast, should the proposed Project not go ahead, any potentially significant environmental issues would be irrelevant, and the status quo of the local receiving environment would not be affected by the project-related activities. The objectives of the Project, including the benefits (such as the exploitation of SA's renewable energy resources, potential economic development and related job creation, and increased security of electricity supply), will not materialise.

The no-go alternative will be assessed during the EIA Phase, taking into consideration the findings of the specialist studies and the outcomes of public participation (amongst others).

10 STATEMENT OF IMPACT SIGNIFICANCE

The project area that will be impacted by the proposed Seelo Alpha Solar PV project contains some areas that are currently used for cattle and game farming activities.

The impact significance of the project on graves and cemeteries is **low** as no definite grave sites were identified.

The impact significance of the proposed project on protected historical structures is **low** as no historical structures were identified.

The impact significance of the proposed project on archaeological resources is **low** as no archaeological sites or material were identified.

It should be noted that the project footprint layout was adjusted (moved to the north by 300m) subsequent to the field survey. As no heritage resources were identified within the original footprint area, it is considered unlikely that any heritage resources would be identified within the additional area. However, there is a low possibility that sub-surface heritage resources, specifically, informal graves or burial sites or archaeological material, could be uncovered (see General Heritage Management Guidelines below).

11 HERITAGE MANAGEMENT GUIDELINES

11.1 General Management Guidelines

The following general heritage management guidelines should be followed:

1. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:
    a. Heritage;
    b. Graves;
    c. Archaeological finds; and
    d. Historical Structures.

    This module must be tailor made to include all possible finds that could be expected in that area of construction. Possible finds include:
    a. Unidentified graves or burials;
    b. Historical structure remains;
    c. Palaeontological deposits such as bones and teeth or plant fossils.
2. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
3. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
4. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.

5. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
6. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
7. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made.
8. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

12 Recommendations and Conclusion

The proposed Seelo Alpha Solar PV project should not impact on heritage resources as no heritage resources were identified within or adjacent to the project footprint area - original layout. However, the project footprint layout was adjusted (moved to the north by 300m) subsequent to the field survey. As no heritage resources were identified within the original footprint area, it is considered unlikely that any heritage resources would be identified within the additional area. However, there is a low possibility that sub-surface heritage resources, specifically, informal graves or burial sites or archaeological material, could be uncovered. The General Heritage Management Guidelines contained in this report should be noted and implemented, if necessary.

Due to the underlying geology being of Very High sensitivity for fossils, a separate palaeontological assessment has been undertaken by a professional palaeontologist which will indicate if significant/sensitive fossils will be impacted by the proposed project and provide recommendations and mitigation measures.

No fatal flaws were identified during this study, therefore, it is the considered opinion of the heritage specialist that the construction of the proposed Solar PV & BESS project within the footprint can proceed. There are no objections from a heritage perspective provided the recommendations and General Heritage Management Guidelines contained in this report are implemented where necessary.

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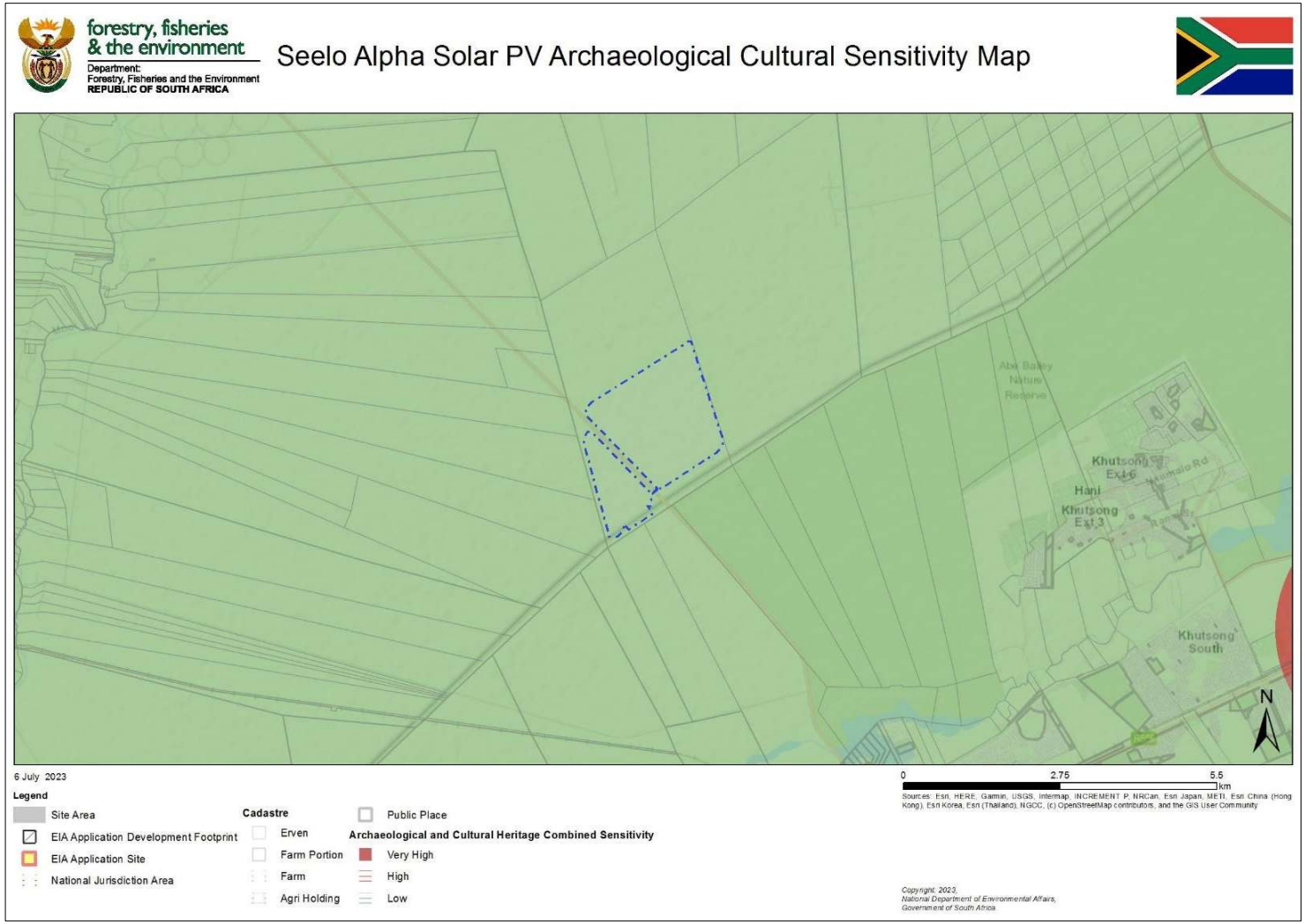
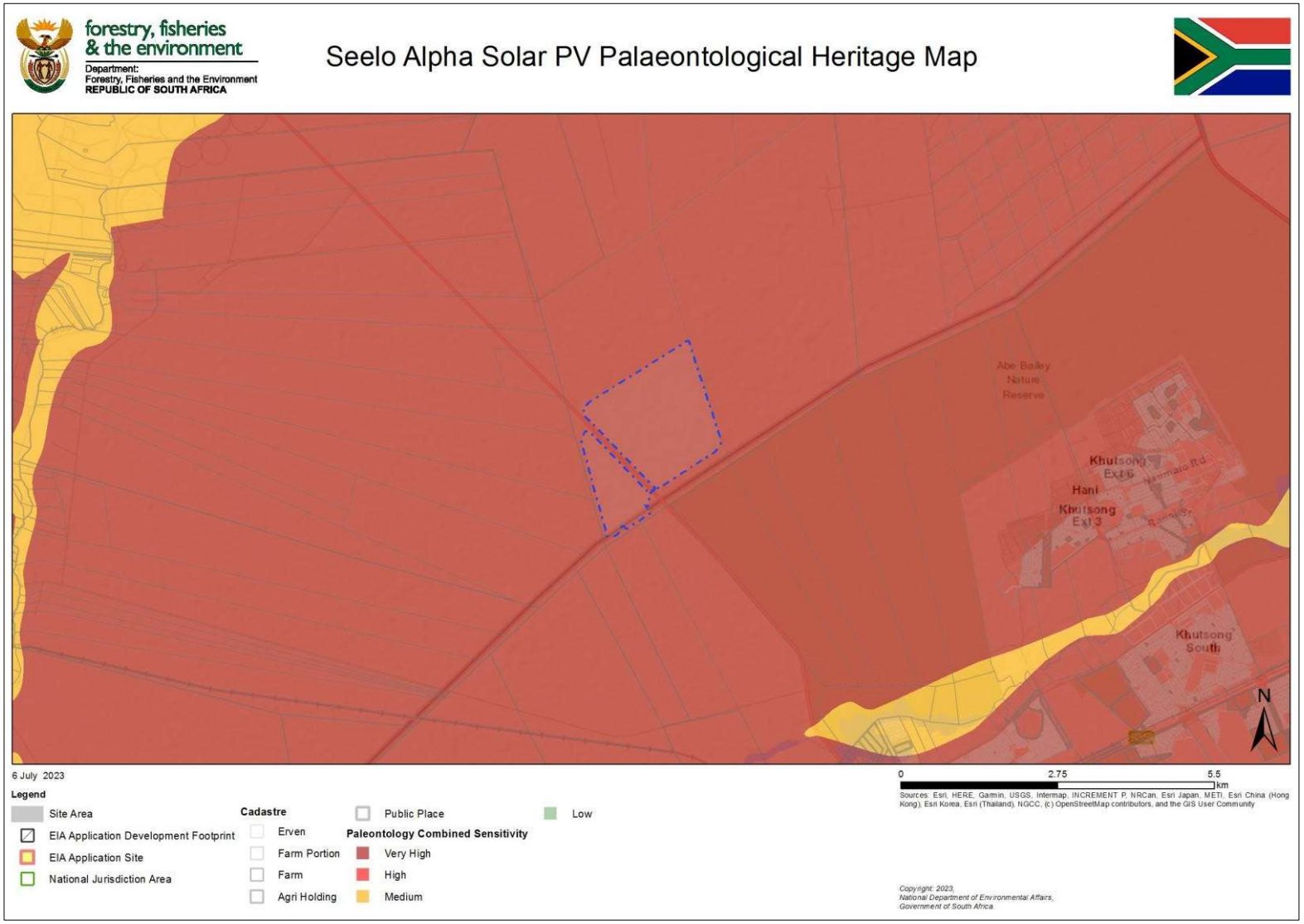
APPENDIX 1: HERITAGE SENSITIVITY MAP/S

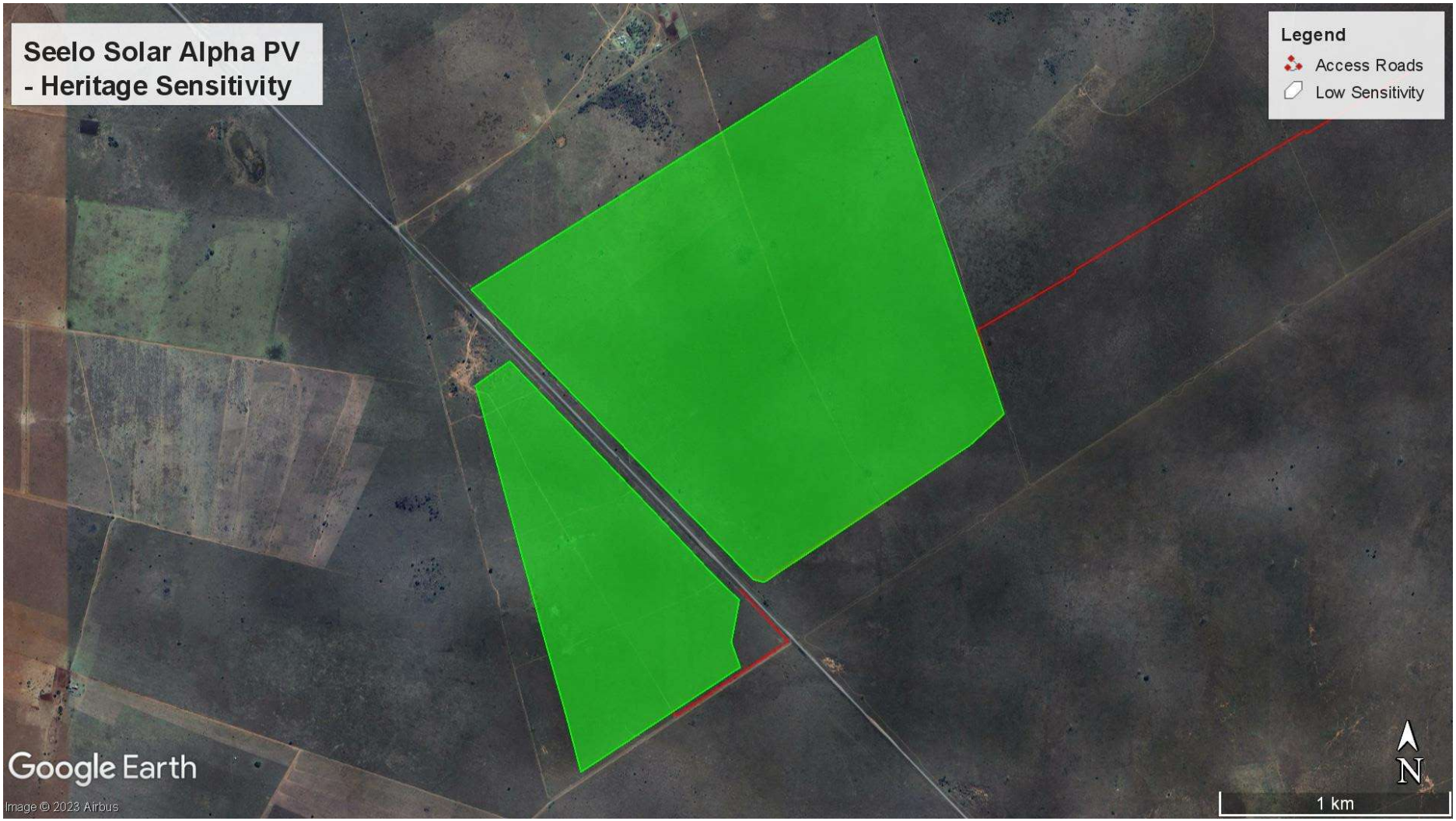
1. Cultural Heritage Sensitivity map from DFFE Screening tool



2. Palaeontological Sensitivity map from DFFE Screening tool



3. Heritage Sensitivity Maps based on the Site Inspection / Field survey and topographical map sheet



APPENDIX 2: CURRICULUM VITAE OF HERITAGE SPECIALIST

1 Personal Particulars

Profession:	Heritage Specialist
Date of Birth:	11 September 1966
Name of Firm:	Nitai Consulting
Name of Staff:	Jennifer Kitto
Nationality:	RSA
Membership of Professional Societies	Association of Southern African Professional Archaeologists (444); International Association for Impact Assessment South Africa (7151)

2 Education:

BA Hons Social Anthropology, WITS, South Africa, 1994

BA. Archaeology and Social Anthropology, WITS, South Africa, 1993

Higher National Diploma, Practical Archaeology, Dorset Institute for Higher Education (now Bournemouth University), UK, 1989

3 Employment Record:

2022 – Present Heritage Specialist, Nitai Consulting

Conduct Heritage Impact Assessments;

2012 – 2021 Heritage Specialist, PGS Heritage (Pty) Ltd

Conduct Heritage Impact Assessments

Compile Desktop Historical Research

Compile Heritage Audit and Management Plans

Compile and submit permit applications to National and Provincial Heritage Authorities for Section 34 building alterations and demolitions (under National Heritage Resources Act, 25 of 1999)

Compile and submit permit applications to Provincial and Municipal Health Authorities for Section 36 relocations of graves and burial grounds (under National Heritage Resources Act, 25 of 1999 and National Health Act, No 61 of 2003)

2008 – 2011 Cultural Heritage Officer (National), Burial Grounds and Graves Unit: South African Heritage Resources Agency (SAHRA)

Review and assessing permit applications for relocation of historical graves and burial grounds.

1998 – 2008 Cultural Heritage Officer (Provincial), Provincial Office – Gauteng: SAHRA

Review and comment on heritage and archaeological impact reports

Research for the nomination and grading process for related to the declaration of specific heritage resources as National Heritage Sites

Monitoring of certain archaeological and built environment National Heritage Sites (e.g. The Cradle of Humankind World Heritage Site)

4 Selected Consultancies

4.1 GDID East Corridor, OHS Implementation, Tambo Memorial Regional Hospital (as sub-contractor to PGS Heritage (Pty) Ltd

2022 Independent Heritage Specialist, Compile Historical Archival Report of Tambo Hospital Boksburg, Gauteng for PGS Heritage (Pty) Ltd, Finalise HIA Report and submit HIA report to Gauteng Provincial Heritage Resources Authority

4.2 GDID East Corridor, OHS Implementation, Tembisa Regional Hospital (as sub-contractor to PGS Heritage (Pty) Ltd

2022 Independent Heritage Specialist, Compile Historical Archival Report of Tembisa Hospital, Ekurhuleni, Gauteng for PGS Heritage (Pty) Ltd, Finalise HIA Report and submit HIA report to Gauteng Provincial Heritage Resources Authority.

4.3 Kroonstad Solar PV Facilities

2022/2023 Heritage Specialist, Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Identify, assess and map all heritage resources associated with the three solar PV facilities

4.4 Kroonstad South Solar PV Facilities

2022/2023 Heritage Specialist, Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Undertake Heritage Impact Assessment of all heritage resources associated with the five solar PV facilities

4.5 Rustenburg Solar PV Facilities

2022/2023 Heritage Specialist, Development of three Solar PV facilities near Rustenburg, North West Province, South Africa, Undertake Heritage Impact Assessment all heritage resources associated with the three solar PV facilities.

4.7 Decommissioning of Komati Power Station

2023, Heritage Specialist, Proposed Decommissioning of the Komati Power Station, Middelburg, Mpumalanga, Undertake Heritage Impact Assessment of all heritage structures within the power station

5 Languages:

English - excellent speaking, reading, and writing

Afrikaans –fair speaking, reading and writing

SEELO SOLAR PV – ALPHA

ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME: SITE SENSITIVITY VERIFICATION REPORT

The National Web-based Environmental Screening Tool identified a Site Environmental sensitivity of **Low** for Archaeological Cultural Sensitivity for the proposed development site (see **Figure 1**, below). The proposed project site was first examined at a desktop level using early edition historical topographic maps (for the Archaeological Cultural heritage theme). This was followed by an on-site inspection.

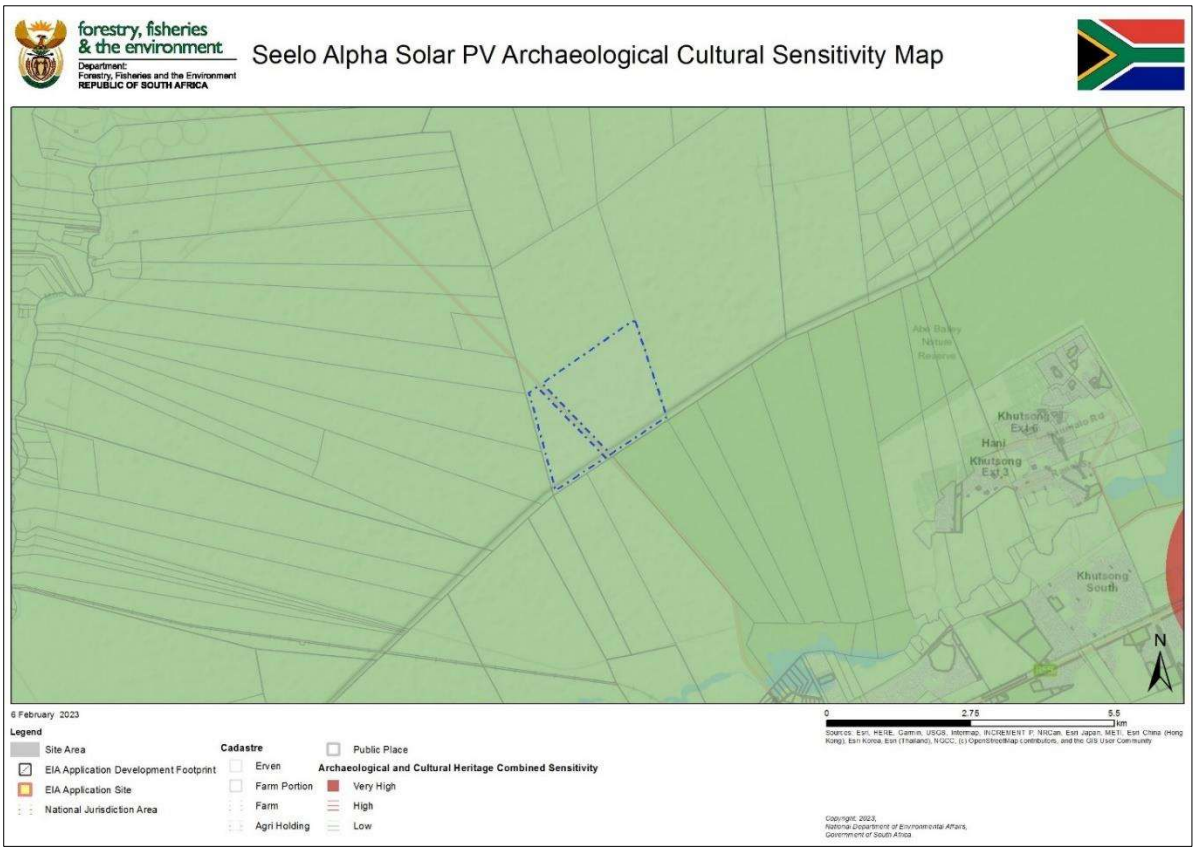


Figure 1: Archaeological Cultural Sensitivity map indicating that the project footprint is located within a region of low archaeological and cultural heritage sensitivity (DFFE Screening Tool).

Desktop Assessment

An assessment of available historical topographical maps was undertaken to establish a historic layering for the study area. Overlays of the maps were made on Google Earth. These historic maps are valuable resources in identifying possible heritage sites and features located within the study area. It should be noted that the earliest edition of the map sheets for this area dates to the 1950s (see **Figure 2** Error! Reference source not found.below). As the first edition of the two sheets utilised dates to 1953

and 1958, it was not considered necessary to examine the later edition map sheets. Any heritage resources that are 60 years or older would be depicted on the 1953 and 1958 edition sheets. The topographical maps were obtained from the Department of Agriculture, Land Reform and Rural Development (DALRRD) in Cape Town.

The following 1:50 000 map sheets were assessed for the Seelo Alpha Solar PV footprint: 2627AC Rysmierbult Edition 1 1953 and 2627AD Carletonville Edition 1 1958. The 2627AC map was surveyed in 1953 and drawn in 1955 by the Trigonometrical Survey Office of the Union of South Africa from aerial photographs taken in 1948. The 2627AD map was surveyed in 1958 and drawn in 1959 by the Trigonometrical Survey Office of the Union of South Africa from aerial photographs taken in 1948.

As can be seen in **Figure 2,** which is a composite of the 1953 and 1958 1st edition maps, no heritage features are depicted within the Seelo Alpha Solar PV footprint. The only man-made feature depicted is a quarry located just outside (south) of the southern boundary of the footprint area.

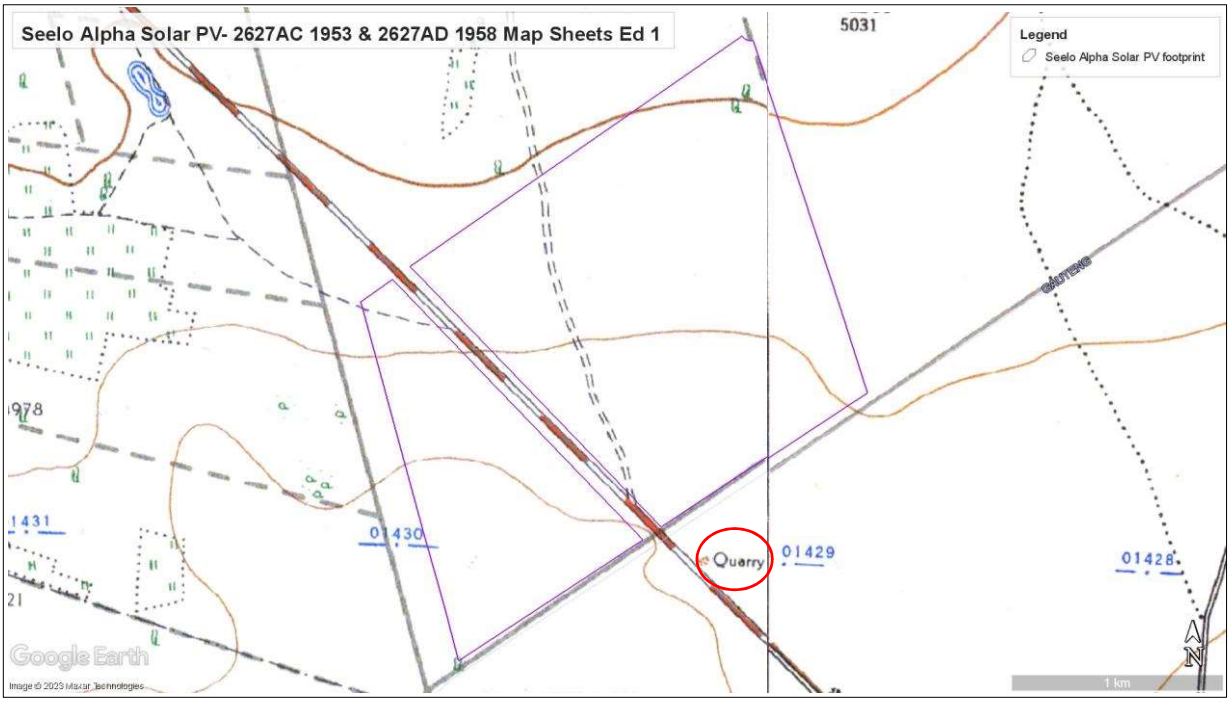


Figure 2: Enlarged view of Ed 1 topographic map sheets 2627AC 1953 and 2627AD 1958, depicting no heritage features within the Seelo Alpha Solar PV footprint. The only man-made feature depicted is a quarry located just outside(south) of the southern boundary of the footprint area (red polygon)

On-site Inspection

The project area terrain is situated on the southern section of Portion 2 of Farm 96 (Rooipan). The general area is covered mostly with a grassland which varies from shorter to long and dense. The terrain is mostly flat, however, there are signs of previous and recent disturbance, e.g. several dumps

of soil and rock were scattered all over the property, and there was a minor sinkhole which contained an animal burrow. The current use of the property is cattle and game farming (grazing).

The on-site inspection (conducted on 19 January 2023) of the study area identified no visible archaeological or cultural heritage resources within or close to the Seelo Alpha Solar PV footprint area.

It was noted that the project area is dominated by dolomite outcrops as well as quartzite/sandstone outcrops. Several sinkholes and subsidences were also noted in the area.

Conclusion/Recommendations

1. Based on the Site Sensitivity Verification, the environmental sensitivity of Low for the Archaeological and Cultural Heritage Theme is confirmed.
2. However, although no visible archaeological or cultural heritage resources were identified within or close to the Seelo Alpha Solar PV project footprint, since the extent of the study area is larger than 5000m^2, a Heritage Impact Assessment is required in terms of section 38(1)(a) of the National Heritage Resources Act (No 25 of 1999).

Status Quo/Baseline Receiving Environment photographs

Figure 3: View of the footprint area, showing the short dense grass and isolated acacia bushes, as well as one of the soil dumps

Figure 4: View showing excavation for livestock waterhole on the west section of the project footprint

Figure 5: View of sinkhole with animal burrow in the west section of the project footprint

Figure 6: View of a few of the soil and rock dumps in the east section of the project footprint

Figure 7: : View of the grass cover and a large soil and rock dump in the east section of the project footprint