DANFIR (PTY) LTD: PHOTOVOLTAIC POWER PLANT DEVELOPMENT ON PORTION 2 OF THE FARM VLAKPAN 59, HOPETOWN, NORTHERN CAPE PROVINCE

Archaeological Impact Assessment

Prepared for: Danfir (Pty) Ltd
Document version 2.0 (Final)
Compiled by N. Kruger

November 2014

AGES
Purpose with Passion

Proudly Supporting
TOUCHING AFRICA

Prepared by

ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF A DEMARCATED SURFACE PORTION ON THE FARM VLAKPAN 59 FOR THE PROPOSED VLAKPAN PHOTOVOLTAIC POWER PLANT DEVELOPMENT, SIYANCUMA LOCAL MUNICIPALITY, PIXLEY KA SEME DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

November 2014

Document Version 1 (Draft): May 2014
Document Version 2 (Final): November 2014

Conducted on behalf of:

Danfir (Pty) Ltd
AGES Gauteng

Compiled by:

Nelius Kruger (BA, BA Hons. Archaeology Pret.)

Reviewed by:

Engela Grobler

GAUTENG PROVINCE: The Village Office Park (Block E),309 Glenwood Road, Pretoria 0081, Postnet no 74, Private Bag X07, Arcadia, 0007 Tel: +27-12 751 2160 Fax: +27 (0) 86 607 2406 www.ages-group.com

Although Africa Geo-Environmental Services Gauteng (Pty) Ltd exercises due care and diligence in rendering services and preparing documents, Africa Geo-Environmental Services Gauteng (Pty) Ltd accepts no liability, and the client, by receiving this document, indemnifies Africa Geo-Environmental Services Gauteng (Pty) Ltd and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by Africa Geo-Environmental Services Gauteng (Pty) Ltd and by the use of the information contained in this document.

Africa Geo-Environmental Services Gauteng (Pty) Ltd promotes the conservation of sensitive archaeological and heritage resources and therefore uncompromisingly adheres to relevant Heritage Legislation (National Heritage Resources Act no. 25 of 1999, Human Tissue Act 65 of 1983 as amended, Removal of Graves and Dead Bodies Ordinance no. 7 of 1925, Excavations Ordinance no. 12 of 1980). In order to ensure best practices and ethics in the examination, conservation and mitigation of archaeological and heritage resources, Africa Geo-Environmental Services Gauteng (Pty) Ltd follows the Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment as set out by the South African Heritage Resources Agency (SAHRA) and the CRM section of the Association for South African Professional Archaeologists (ASAPA).

DECLARATION

I, Nelius Le Roux Kruger, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed Vlakpan Solar Park Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, including the relevant Heritage Legislation (National Heritage Resources Act no. 25 of 1999, Human Tissue Act 65 of 1983 as amended, Removal of Graves and Dead Bodies Ordinance no. 7 of 1925, Excavations Ordinance no. 12 of 1980), the Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment (SAHRA and the CRM section of ASAPA), regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

_____

SIGNATURE OF SPECIALIST

Company: Africa Geo-Environmental Services Gauteng (Pty) Ltd.

Date: 10 November 2014

EXECUTIVE SUMMARY

This report details the results of an Archaeological Impact Assessment (AIA) study on Portion 2 of the farm Vlakpan 59, subject to an Environmental Impact Assessment (EIA) process for the proposed Vlakpan Solar Park Project in the Siyancuma Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province. The report includes background information on the area's archaeology, its representation in southern Africa, and the history of the larger area under investigation, survey methodology and results as well as heritage legislation and conservation policies. A copy of the report will be supplied to the South African Heritage Resources Agency (SAHRA) and recommendations contained in this document will be reviewed.

A number of archaeological and historical studies have been conducted in the Hopetown and Kimberley areas along the Vaal River and many of these studies infer a varied and rich heritage landscape. For the Vlakpan Solar Park Project, two initial footprint areas (Alternative 1 & 2) were identified and at least 6 areas of archaeological or heritage potential were located during AIA surveys of the two areas in March and September 2014**.** A third footprint alternative (Alternative 3) covering up to **210ha** of less sensitive areas across Alternative 1 and 2 was then proposed which incorporated initial recommendations pertaining to these sensitive heritage receptors and this alternative has been designed to avoid impact on heritage receptors.

Stone Age:

During this study it was found that cultural material in this area occurs in lower lying areas, predominantly in association with exposed decomposing calcrete horizons in Hutton Sands. The occurrence of these Stone Tools strongly suggests that similar sites could be located elsewhere in the study area, potentially sub-surface. This is due to the area's close proximity to the Vaal River which renders it is prone to alluvial deposits that could burry potential Stone Age material. It is therefore recommended that a suitably qualified heritage practitioner be appointed by the developer for the general monitoring of the development during all stages of the project. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.

- A low density Middle Stone Age Scatter (**Site AGES-VP59-SA01, S29.42905 E23.26861)** occurs along a quarry site on the north-eastern periphery of footprint Alternative 1. This area has been adversely altered by quarry and digging activities and the occurrence is of limited scientific value due to the mixing of artefacts and the low density of the lithics. This artefact scatter is in a temporally mixed and secondary or derived context and therefore, it is considered to be of low archaeological significance. Two additional medium density lithic scatters (**Site AGES-VP59-SA02, S29.42706 E23.26129 & Site AGES-VP59-SA04, S29.43394 E23.25879)** occur in footprint Alternative 1; the first along a discreet ridge in the north-east sector of the study area, and the second near the windmill and cattle pen to the south. Formal tools have been identified among lithics scatters at the sites but since the sites are in both cases temporally mixed and contextually derived, these archaeological occurrences are considered to be of medium-low significance. A further medium density lithic scatter (**Site AGES-VP59-SA06, S29.42176 E23.24882)** occurs in footprint Alternative 2; along the same discreet ridge noted above. A number of formal tools have been identified here and the archaeological occurrences are considered to be of medium significance. In all cases, these sites are situated away from the preferred footprint Alternative 3 and no impact on the resources is foreseen. However, it is recommended that that any activities pertaining to the development in the area be monitored by a Heritage Specialist or Enviromental Control Officer (ECO) in order to regularly assess and ensure the preservation and conservation of these features, and to to avoid any possible impact on previously undetected heritage remains.

- Two Earlier Stone Age handaxes and rough stone flakes and cores were recorded along a small ridge in the north-eastern sector of footprint Alternative 1 (**Site AGES-VP59-SA03, S29.42879 E23.26317)**. Even though the material has been temporally mixed and derived pf primary contextually, they are considered to be representative of the archaeological record of the immediate surroundings and the presence of formal tools is significant. In addition, a high density scatter of Earlier and Middle Stone Age material occurs at a watering holed and windmill approximately 200m north of footprint Alternative 2 in the direction of the large salt pan (**Site AGES-VP59-SA05, S29.418268 E23.252394).** A large number of formal tools such as hand axes, cleavers chopping tools are present at the site and the occurrence is significant. None of these sites occur in the preferred footprint Alternative 3 and no impact on the resources is foreseen. However, it is recommended that that any activities pertaining to the development in the area be monitored by a Heritage Specialist or Enviromental Control Officer (ECO) in order to regularly assess and ensure the preservation and conservation of these features, and to to avoid any possible impact on previously undetected heritage remains.
- To compensate for potential future cumulative impacts, it is recommended that all Stone Age localities be avoided by the implementation 20m conservation buffers around each of the locations. Should any of the sites be directly impacted by development activities, it is recommended that they be recorded and that the cultural and archaeological context of the heritage resources be established by means of a limited Phase 2 Specialist Study. This study should minimally include a surface sampling and consequent analysis of the stone artefacts by a qualified Stone Age specialist, in order to elucidate the understanding of the development and spread of the MSA in the area. The Specialist should obtain the necessary permits from SAHRA for the in-situ analysis, possible collection and photography of the artefacts during the study.

A Palaeontological Impact Assessment is recommended for the study area and, should fossil remains such as fossil fish, reptiles or petrified wood be exposed during construction, these objects should carefully safeguarded and the relevant heritage resources authority (SAHRA) should be notified immediately so that the appropriate action can be taken by a professional palaeontologist. It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. Here, care should be taken around rock faces and outcrops in the larger landscape, as rock art is known to occur on these outcrops. Water sources such as salt pans, drainage lines and rivers should also be regarded as potentially sensitive in terms of possible Stone Age deposits. The possible existence of Historical Period resources deriving from the area's more recent history should also be considered. Ultimately, it is essential that the archaeological and cultural heritage of the Northern Cape Province be respected. Should human remains be discovered at any stage, these should be reported to the Heritage Specialist and relevant authorities (SAHRA) and development activities should be suspended until the site has been inspected by the Specialist. The Specialist will advise on further management actions and possible relocation of human remains in accordance with the Human Tissue Act (Act 65 of 1983 as amended), the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the National Heritage Resources Act (Act no. 25 of 1999) and any local and regional provisions, laws and by-laws pertaining to human remains. A full social consultation process should occur in conjunction with the mitigation of cemeteries and burials.

Heritage resources have been documented on Portion 2 of the farm Vlakpan 59 but no impact on these resources by the proposed Vlakpan Photovoltaic Power Plant is foreseen. In the opinion of the author of this Archaeological Impact Assessment Report, the proposed Vlakpan Solar Park Project may proceed from a culture resources management perspective, provided that mitigation measures provided in this assessment (monitoring, avoidance), endorsed by the relevant Heritage Resources authority, are implemented.

NOTATIONS AND TERMS

Absolute dating:
Absolute dating provides specific dates or range of dates expressed in years.

Archaeology:
The study of the human past through its material remains.

Archaeological record:
The archaeological record minimally includes all the material remains documented by archaeologists. More comprehensive definitions also include the record of culture history and everything written about the past by archaeologists.

Artefact:
Entities whose characteristics result or partially result from human activity. The shape and other characteristics of the artefact are not altered by removal of the surroundings in which they are discovered. In the southern African context examples of artefacts include potsherds, iron objects, stone tools, beads and hut remains.

Assemblage:
A group of artefacts recurring together at a particular time and place, and representing the sum of human activities.

^{14}C or radiocarbon dating:
The ^{14}C method determines the absolute age of organic material by studying the radioactivity of carbon. It is reliable for objects not older 70 000 years by means of isotopic enrichment. The method becomes increasingly inaccurate for samples younger than ±250 years.

Ceramic Facies:
In terms of the cultural representation of ceramics, a facies is denoted by a specific branch of a larger ceramic tradition. A number of ceramic facies thus constitute a ceramic tradition.

Ceramic Tradition:
In terms of the cultural representation of ceramics, a series of ceramic units constitutes as ceramic tradition.

Context:
An artefact's context usually consists of its immediate *matrix*, its *provenience* and its *association* with other artefacts. When found in *primary context*, the original artefact or structure was undisturbed by natural or human factors until excavation and if in *secondary context,* disturbance or displacement by later ecological action or human activities occurred.

Culture:
A contested term, "culture" could minimally be defined as the learned and shared things that people have, do and think.

Cultural Heritage Resource:
The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

Cultural landscape:
A cultural landscape refers to a distinctive geographic area with cultural significance.

Cultural Resource Management (CRM):
A system of measures for safeguarding the archaeological heritage of a given area, generally applied within the framework of legislation designed to safeguard the past.

Ecofact:
Non artefactual material remains that has cultural relevance which provides information about past human activities. Examples would include remains or evidence of domesticated animals or plant species.

Excavation:
The principal method of data acquisition in archaeology, involving the systematic uncovering of archaeological remains through the removal of the deposits of soil and the other material covering and accompanying it.

Feature:
Non-portable artefacts, in other words artefacts that cannot be removed from their surroundings without destroying or altering their original form. Hearths, roads, and storage pits are examples of archaeological features

GIS:
Geographic Information Systems are computer software that allows layering of various types of data to produce complex maps; useful for

predicting site location and for representing the analysis of collected data within sites and across regions.

Historical archaeology:
Primarily that aspect of archaeology which is complementary to history based on the study of written sources. In the South African context it concerns the recovery and interpretation of relics left in the ground in the course of Europe's discovery of South Africa, as well as the movements of the indigenous groups during, and after the "Great Scattering" of Bantu-speaking groups – known as the *mfecane* or *difaqane*.

Impact: A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.

Iron Age:
Also known as "Farmer Period", the "Iron Age" is an archaeological term used to define a period associated with domesticated livestock and grains, metal working and ceramic manufacture.

Lithic:
Stone tools or waste from stone tool manufacturing found on archaeological sites.

Management / Management Actions:
Actions – including planning and design changes - that enhance benefits associated with a proposed development, or that avoid, mitigate, restore, rehabilitate or compensate for the negative impacts.

Matrix:
The material in which an artefact is situated (sediments such as sand, ashy soil, mud, water, etcetera). The matrix may be of natural origin or human-made.

Megalith:
A large stone, often found in association with others and forming an alignment or monument, such as large stone statues.

Midden:
Refuse that accumulates in a concentrated heap.

Microlith:
A small stone tool, typically knapped of flint or chert, usually about three centimetres long or less.

Monolith:
A geological feature such as a large rock, consisting of a single massive stone or rock, or a single piece of rock placed as, or within, a monument or site.

Phase 1 CRM Assessment:
An Impact Assessment which identifies archaeological and heritage sites, assesses their significance and comments on the impact of a given development on the sites. Recommendations for site mitigation or conservation are also made during this phase.

Phase 2 CRM Study:
In-depth studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required. Mitigation / Rescue involves planning the protection of significant sites or sampling through excavation or collection (in terms of a permit) at sites that may be lost as a result of a given development.

Phase 3 CRM Measure:
A Heritage Site Management Plan (for heritage conservation), is required in rare cases where the site is so important that development will not be allowed and sometimes developers are encouraged to enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

Prehistoric archaeology:
That aspect of archaeology which concerns itself with the development of humans and their culture before the invention of writing. In South Africa, prehistoric archaeology comprises the study of the Early Stone Age, the Middle Stone Age and the greater part of the Later Stone Age and the Iron Age.

Probabilistic Sampling:
A sampling strategy that is not biased by any person's judgment or opinion. Also known as statistical sampling, it includes systematic, random and stratified sampling strategies.

Provenience
Provenience is the three-dimensional (horizontal and vertical) position in which artefacts are found. Fundamental to ascertaining the provenience of an artefact is *association,* the co-occurrence of an artefact with other archaeological remains; and *superposition,* the

principle whereby artefacts in lower levels of a matrix were deposited before the artefacts found in the layers above them, and are therefore older.

Random Sampling:
A probabilistic sampling strategy whereby randomly selected sample blocks in an area are surveyed. These are fixed by drawing coordinates of the sample blocks from a table of random numbers.

Relative dating:
The process whereby the relative antiquity of sites and objects are determined by putting them in sequential order but not assigning specific dates.

Remote Sensing:
The small or large-scale acquisition of information of an object or phenomenon, by the use of either recording or real-time sensing device(s) that is not in physical or intimate contact with the object (such as by way of aircraft, spacecraft or satellite). Here, ground-based geophysical methods such as Ground Penetrating Radar and Magnetometry are often used for archaeological imaging.

Rock Art Research:
Rock art can be "decoded" in order to inform about cultural attributes of prehistoric societies, such as dress-code, hunting and food gathering, social behaviour, religious practice, gender issues and political issues.

Scoping Assessment:
The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision making is expected to focus and to ensure that only key issues and reasonable alternatives are examined. The outcome of the scoping process is a Scoping Report that includes issues raised during the scoping process, appropriate responses and, where required, terms of reference for specialist involvement.

Sensitive:
Often refers to graves and burial sites although not necessarily a heritage place, as well as ideologically significant sites such as ritual / religious places. *Sensitive* may also refer to an entire landscape / area known for its significant heritage remains.

Site (Archaeological):
A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity. These include surface sites, caves and rock shelters, larger open-air sites, sealed sites (deposits) and river deposits. Common functions of archaeological sites include living or habitation sites, kill sites, ceremonial sites, burial sites, trading, quarry, and art sites,

Slag:
The material residue of smelting processes from metalworking.
Stone Age:
An archaeological term used to define a period of stone tool use and manufacture.

Stratigraphy:
This principle examines and describes the observable layers of sediments and the arrangement of strata in deposits

Stratified Sampling:
A probabilistic sampling strategy whereby a study area is divided into appropriate zones – often based on the probable location of archaeological areas, after which each zone is sampled at random.

Systematic Sampling:
A probabilistic sampling strategy whereby a grid of sample blocks is set up over the survey area and each of these blocks is equally spaced and searched.

Tradition:
Artefact types, assemblages of tools, architectural styles, economic practices or art styles that last longer than a phase and even a horizon are describe by the term *tradition*. A common example of this is the early Iron Age tradition of Southern Africa that originated ± 200 AD and came to an end at about 900 AD.

Trigger: A particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an *issue* and/or potentially significant *impact* associated with that proposed development that may require specialist input. Legal requirements of existing and future legislation may also trigger the need for specialist involvement.

Tuyère:
A ceramic blow-tube used in the process of iron smelting / reduction.

LIST OF ABBREVIATIONS

Abbreviation	Description
AGES	Africa Geo Environmental Services Gauteng Pty Ltd
ASAPA	Association for South African Professional Archaeologists
AIA	Archaeological Impact Assessment
BP	Before Present
BCE	Before Common Era
CRM	Culture Resources Management
EIA	Early Iron Age (also Early Farmer Period)
EIA	Environmental Impact Assessment
EFP	Early Farmer Period (also Early Iron Age)
ESA	Earlier Stone Age
GIS	Geographic Information Systems
HIA	Heritage Impact Assessment
ICOMOS	International Council on Monuments and Sites
K2/Map	K2/Mapungubwe Period
LFP	Later Farmer Period (also Later Iron Age)
LIA	Later Iron Age (also Later Farmer Period)
LSA	Later Stone Age
MIA	Middle Iron Age (also Early later Farmer Period)
MRA	Mining Right Area
MSA	Middle Stone Age
NHRA	National Heritage Resources Act No.25 of 1999, Section 35
PFS	Pre-Feasibility Study
PHRA	Provincial Heritage Resources Authorities
SAFA	Society for Africanist Archaeologists
SAHRA	South African Heritage Resources Association
YCE	Years before Common Era (Present)

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 BACKGROUND

1.1 Scope and Motivation

AGES Gauteng was commissioned by Danfir (Pty) Ltd for an Archaeological Impact Assessment (AIA) study of Portion 2 of the farm Vlakpan 59, subject to an Environmental Impact Assessment (EIA) process for the proposed Vlakpan Solar Park Project, Siyancuma Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province. The rationale of this AIA is to determine the presence of heritage resources such as archaeological and historical sites and features, graves and places of religious and cultural significance in previously unstudied areas; to consider the impact of the proposed project on such heritage resources, and to submit appropriate recommendations with regard to the cultural resources management measures that may be required at affected sites / features.

1.2 Project Direction

AGES's expertise ensures that all projects be conducted to the highest international ethical and professional standards. As archaeological specialist for AGES, Mr Neels Kruger acted as field director for the project; responsible for the assimilation of all information, the compilation of the final consolidated AIA report and recommendations in terms of heritage resources on the demarcated project areas. Mr Kruger is an accredited archaeologist and Culture Resources Management (CRM) practitioner with the Association of South African Professional Archaeologists (ASAPA), a member of the Society for Africanist Archaeologists (SAFA) and the Pan African Archaeological Association (PAA) as well as a Master's Degree candidate in archaeology at the University of Pretoria.

1.3 Project Brief

A Photovoltaic (PV) Power Plant, known as the Vlakpan Solar Park Solar Park is proposed on the farm Vlakpan (982.7512 ha in extent). At the site, two initial footprint areas (Alternative 1 & 2, See Figure 1-1 & Figure 1-2) were identified and at least 6 areas of archaeological or heritage potential were located during AIA surveys of the two areas**.** A third footprint alternative (Alternative 3, See Figure 1-3) covering up to **210ha** of less sensitive areas in Alternative 1 & 2 was then proposed which incorporated initial recommendations pertaining to these sensitive heritage receptors and this alternative has been designed to avoid impact on heritage receptors. The solar facility will have a maximum generating capacity **up to 75 MW.** The facility will comprise several arrays (strings) of PV modules mounted on frames; the associated infrastructure and structures will consist of:

- internal and external access roads and a small parking area;
- fencing of the plant and video security control systems;
- foundations / mini piles for the mounted Photovoltaic arrays;
- electricity access point for the construction phase, operation phase (if necessary) and UPS (Uninterruptible Power Supply) devices;
- water access point and/or water extraction on-site from borehole(s), water supply pipelines, water treatment;
- sewage system and storm water collection system;
- workshop & warehouse,
- offices & administrative area;
- cabling linking Photovoltaic strings and other internal cabling;
- medium voltage stations designed to host DC/AC inverters and medium voltage power transformers;
- one medium voltage receiving station, linking in parallel all the medium voltage stations; (xii) one small on-site high-voltage substation with high-voltage power transformer(s),
- stepping up the voltage to the voltage of the Eskom's grid, control building(s) and one busbar with

metering and protection devices (also called "switching station");
- two new small sections of high-voltage power line allowing **the Eskom "Greefspan - Mooidraai" 132 kV power line** - crossing the project site - to loop in and out of the 132 kV busbar of the new on-site loop-in loop-out substation.

The PV plant will mainly consist of the following components:

- **Photovoltaic cells and photovoltaic modules**: PV cells are made in silicone and act as a semiconductor used to produce the photovoltaic effect. Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic module. The facility will use photovoltaic modules with high efficiency.
- **Support structures:** PV modules will be assembled on steel or aluminium frames. At this stage, the preferred technology for the mounting system is **the horizontal single-axis trackers**, depicted in Figure 1. Each tracker is composed by several PV arrays North-South oriented and linked by a horizontal axis, driven by a motor. The horizontal axis allows the rotation of the PV arrays toward the West and East direction, in order to follow the daily sun path.
- **Strings and string boxes:** the PV modules are connected in series in order to form PV strings, so that the string voltage fits into the voltage range of the DC/AC inverters. PV strings are devised in order to be connected to DC-connection boxes (string boxes) with a parallel connection solution (PV sub-field). String Boxes monitor the currents in photovoltaic modules and can promptly diagnose faults. String boxes are also designed with a general circuit breaker in order to disconnect the photovoltaic sub-fields from the DC/AC inverters.
- **Medium voltage stations:** Each medium-voltage station is designed to host one or more DC/AC inverters, and one or more medium-voltage power transformers. The DC/AC inverters are deemed to convert the direct current (DC) to alternating current (AC) at low voltage; subsequently the AC will pass through a medium-voltage power transformer in order to step-up the voltage up to 20/22 kV.
- **Medium-voltage receiving station:** The energy from the medium voltage stations will be collected into one medium voltage receiving station, linking in parallel all the PV fields of the PV generator.
- **High-voltage loop-in loop-out substation:** from the medium-voltage receiving station, the electrical energy will be delivered to one small on-site high-voltage substation with two or more high-voltage power transformers (one as spare), stepping up the voltage to the voltage of the Eskom grid. Furthermore, the on-site high-voltage substation will be equipped with a control building and one busbar with metering and protection devices (also called "switching station"). New sections of 132 kV line for the connection to the Eskom grid: from the busbar of the high voltage substation, two overhead power lines - 100 m long - will deliver the energy to Eskom's "Greefspan -Mooidraai" 132 kV power line, crossing the project site.
- **Interventions** on the Eskom's network: the connection may also entail interventions on the Eskom "Greefspan -Mooidraai" 132 kV power line and/or on the Eskom network

Other key features of the project are to ensure a high level of reliability, operational and maintenance safety, low water consumption. The expected operational life of the plant is deemed of approximately 25-30 years.

The construction and the commissioning of the PV plant is expected to last **maximum 15 months.**

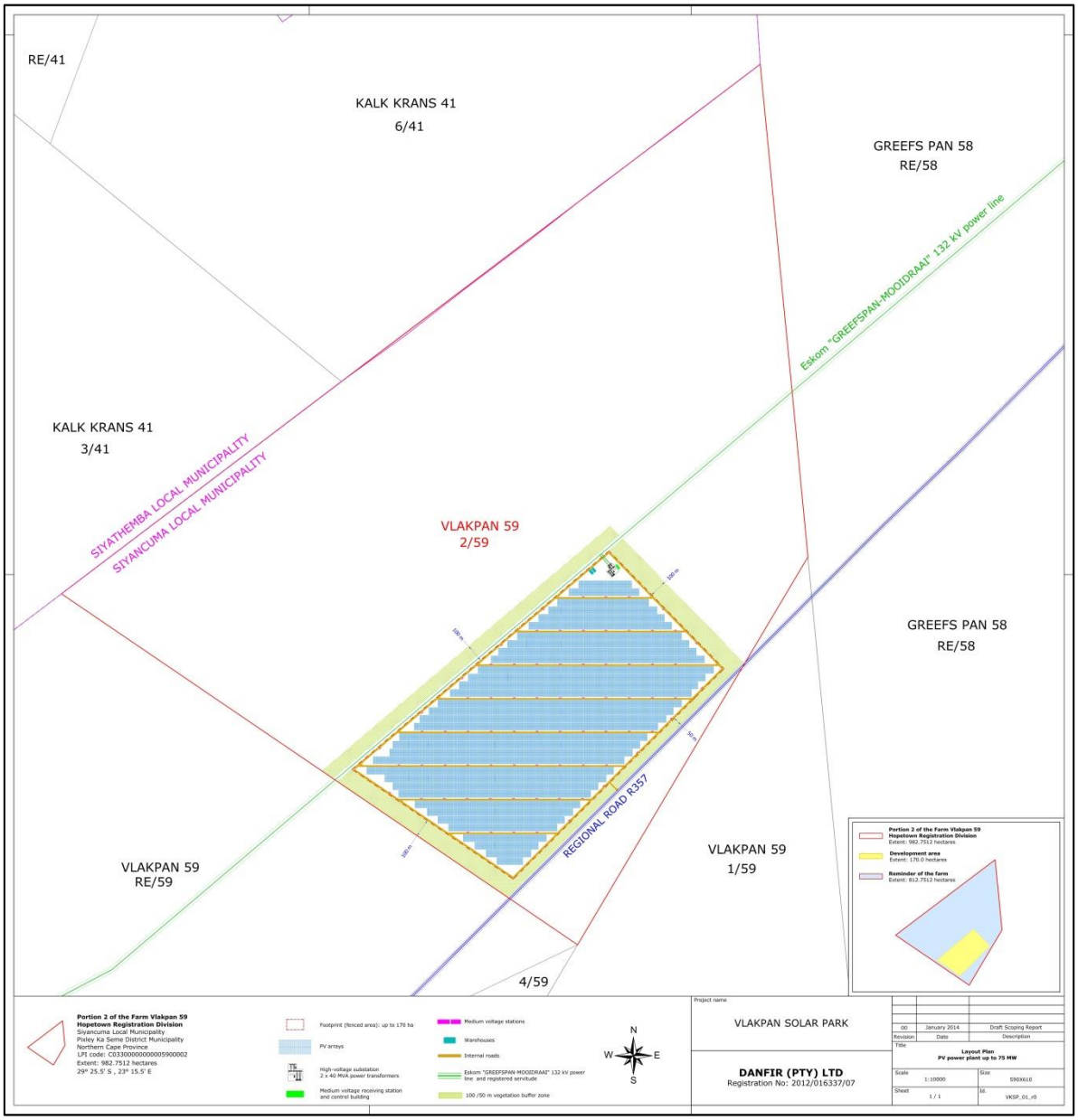

Figure 1-1: Map representation of the initial proposed footprint Alternative 1 for the Vlakpan Solar Park Development.

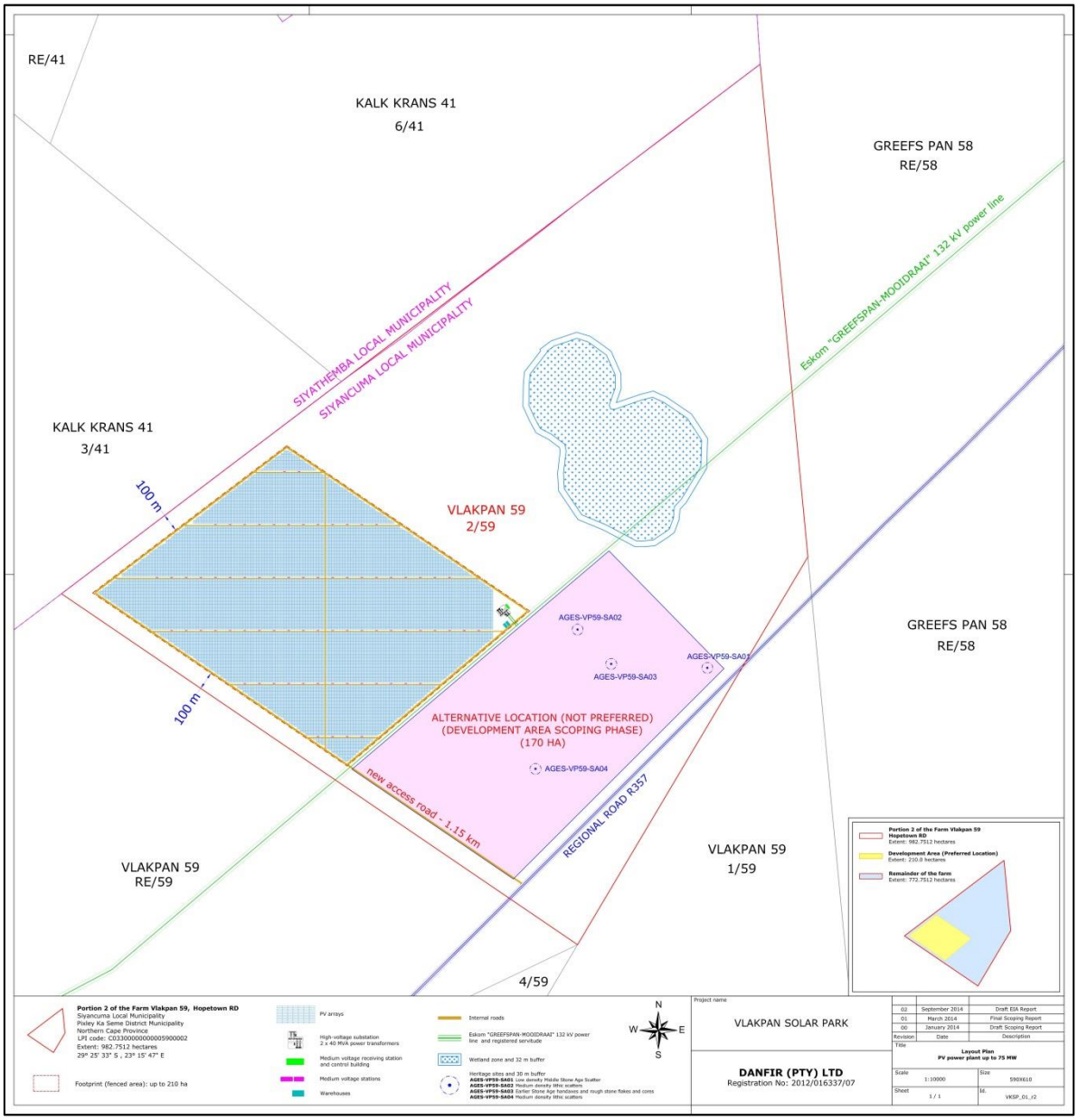

Figure 1-2: Map representation of the initial proposed footprint Alternative 2 for the Vlakpan Solar Park Development.

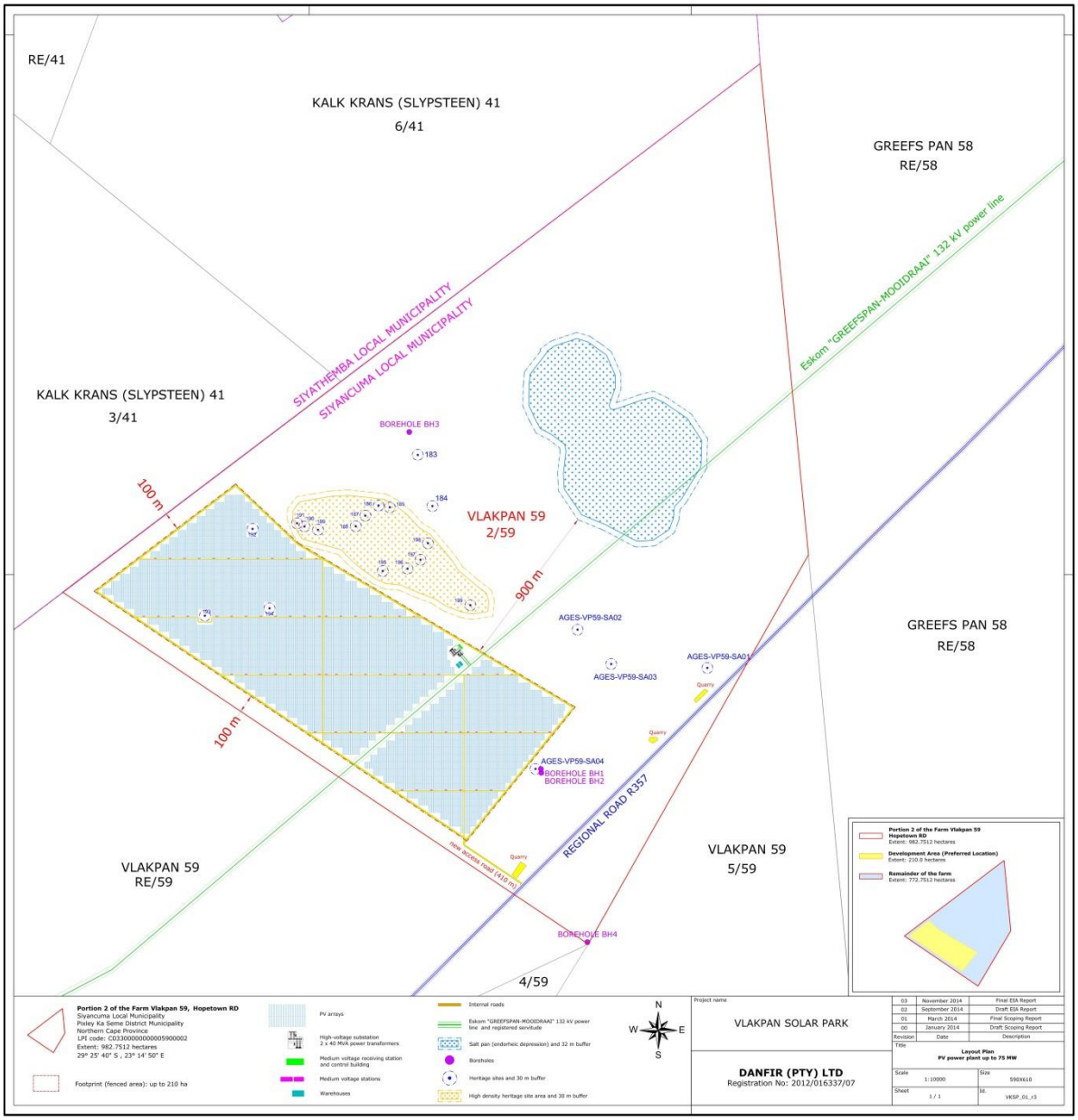

Figure 1-3: Map representation of the proposed footprint Alternative 3 across less sensitive areas of Alternative 1 & 2, the preferred site for the Vlakpan Solar Park Development.

1.4 Terms of Reference

Heritage specialist input into the Environmental Impact Assessment (EIA) process is essential to ensure that through the management of change, developments still conserve our heritage resources. Heritage specialist input in EIA processes can play a positive role in the development process by enriching an understanding of the past and its contribution to the present. It is also a legal requirement for certain development categories which may have an impact on heritage resources (Refer to Section 1.5.2.).

Thus, EIAs should always include an assessment of Heritage Resources. The heritage component of the EIA is provided for in the **National Environmental Management Act, (Act 107 of 1998)** and endorsed by section 38 of the **National Heritage Resources Act (NHRA - Act 25 of 1999)**. In addition, the NHRA protects all structures and features older than 60 years (see Section 34 of the Act), archaeological sites and material (see Section 35 of

the Act) and graves as well as burial sites (see Section 36 of the Act). The objective of this legislation is to enable and to facilitate developers to employ measures to limit the potentially negative effects that the development could have on heritage resources.

Based hereon, this project functioned according to the following **terms of reference for** heritage specialist input**:**

- *Provide a detailed description of all archaeological artefacts, structures (including graves) and settlements which may be affected, if any.*
- *Assess the nature and degree of significance of such resources within the area.*
- *Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance.*
- *Assess any possible impact on the archaeological and historical remains within the area emanating from the proposed development activities.*
- *Propose possible heritage management measures provided that such action is necessitated by the development.*
- *Liaise and consult with the South African Heritage Resources Agency (SAHRA)).*

1.5 CRM: Legislation, Conservation and Heritage Management

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

1.5.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and their provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

a. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act of 1999 a historical site is any identifiable building or part thereof, marker, milestone, gravestone, landmark or tell older than 60 years. This clause is commonly known as the “60-years clause”. Buildings are amongst the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Iron Age settlements. “Tell” refers to the evidence of human existence which is no longer above ground level, such as building foundations and buried remains of settlements (including artefacts).

The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects, meteorites and rare geological specimens
- visual art objects
- military objects
- numismatic objects
- objects of cultural and historical significance
- objects to which oral traditions are attached and which are associated with living heritage

- objects of scientific or technological interest
- any other prescribed category

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

b. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and the Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities.

1.5.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas to be developed and (b) make recommendations for protection or mitigation of the impact on the sites.

The National Heritage Resources Act (Act No. 25 of 1999, section 38) provides guidelines for Cultural Resources Management and prospective developments:

"38. *(1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:*

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site:

(i) exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

And:

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(a) The identification and mapping of all heritage resources in the area affected;

(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(c) an assessment of the impact of the development on such heritage resources;

(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) plans for mitigation of any adverse effects during and after the completion of the proposed development (38. [3] 1999:64)."

Consequently, section 35 of the Act requires Heritage Impact Assessments (HIAs) or Archaeological Impact Assessments (AIAs) to be done for such developments in order for all heritage resources, that is, all places or objects of aesthetic, architectural, historic, scientific, social, spiritual, linguistic or technological value or significance to be protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60 years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects.

2 REGIONAL CONTEXT

2.1 Area Location

The study area is located on Portion 2 of the farm Vlakpan 59, Hopetown, Siyancuma Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province. The proposed project is situated south-west of the town of Douglas towards Hopetown, with the footprint planned to the south of the Eskom Greefspan -Mooidraai" 132 kV power line. The site is situated at **S29.432657° E23.258560°** on 1:50 000 map sheet 2923AD (see Figure 2-1).

The R357 regional road passed directly south-east of the farm and similarly forms the south-eastern border of the study area.

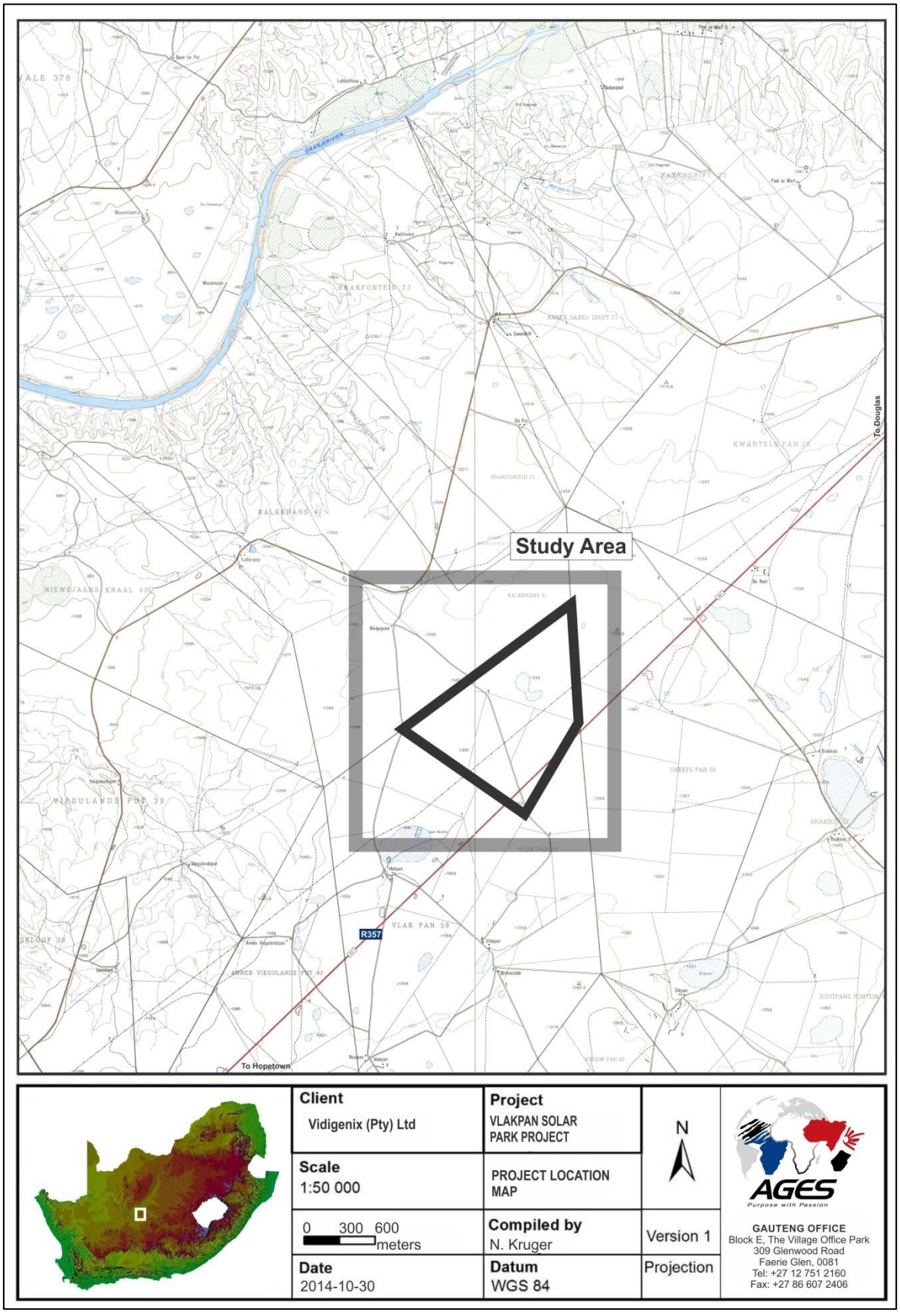

Figure 2-1: 1:50 000 Map representation of the location of the Vlakpan Solar Park Development location (2923AD).

2.2 Area Description: Receiving Environment[1]

The development site lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant. The topography across the site is slightly to moderately undulating The major land use of the study area as classified by the Environmental Potential Atlas of South Africa (2000) is vacant / unspecified land. The bulk of surface sediments consist of orange-red windblown Hutton Sands that are moderately disturbed by human related activities, animal trampling, Aardvark and porcupine burrowing and termite activity. Underlying the Hutton Sands, and also exposed in places is a calcrete deposit/surface that sometimes includes clasts and stone artefacts. Also exposed in places are pebble to boulder sized sub-angular to rounded gravels including mostly quartzite - but also andesite - clasts and these alluvial deposits are referred to as Older Gravels.

Figure 2-2: General surroundings on a central portion of the farm Vlakpan at the time of the field survey (March 2014).

2.3 Site Description

The farm Vlakpan is constituted mostly out of open and sparse plains dominated by Karoo shrubs, grasses – including “Bushman” grass - and small/short trees of mostly Acacia species. However, a slight vegetation change, indicated by the occurrence of a discreet ridge occurs towards the east of the site where larger rocks, deep red sands and scrub vegetation are more prevalent. Numerous termite hills and burrows of Aardvark and porcupine occur across the site. Evidence for modern human related activities include single vehicle tracks, fencing, wind mills and associated pipes, free-standing dams and animal feeding and watering troughs. Two small quarries, possibly sources of calcrete occur in the south-eastern and north-eastern extremities of the farm. The current land-use of the proposed development site is grazing by livestock and game, with a small section under irrigation being used for planted pastures. Neighbouring farms are being used for livestock grazing and game farming, with mining further away from the site. The chosen site is suitable for the installation of a photovoltaic (PV) power plant. It is appropriate morphologically (flat terrain) and regarding the favourable radiation conditions. The available radiation allows a high rate of electric energy production, as a combination of latitude-longitude and climatic conditions. A large pan, situated north-west of the study area represents the Highveld Salt Pans vegetation type on site (see Figure 3-1). These pans represent depressions containing temporary water bodies. On the pan edges open to sparse dwarf shrub land may develop, especially when under heavy grazing pressure.

[1] see Henning, B. 2014. **AN ENVIRONMENTAL REPORT ON THE ECOLOGY (FLORA AND FAUNA) FOR THE PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON PORTION 2 OF THE FARM VLAKPAN 59, NORTHERN CAPE PROVINCE**

3 METHOD OF ENQUIRY

3.1 Sources of Information

Data from detailed desktop, aerial and field studies were employed in order to sample surface areas systematically and to ensure a high probability of heritage site recording.

3.1.1 Desktop Study

A desktop study was prepared in order to contextualize the proposed project within a larger historical milieu. The study focused on relevant previous studies, archaeological and archival sources, aerial photographs, historical maps and local histories, all pertaining to the Douglas area and the larger landscape of this section of the Northern Cape Province.

3.1.2 Aerial Representations and Survey

Aerial photography is often employed to locate and study archaeological sites, particularly where larger scale area surveys are performed. This method was applied to great success in the pedestrian survey for the project where contour lines of elevations, depressions, variation in vegetation, soil marks and landmarks were examined. Specific attention was given to shadow sites (shadows of walls or earthworks which are visible early or late in the day), crop mark sites (crop mark sites are visible because disturbances beneath crops cause variations in their height, vigour and type) and soil marks (e.g. differently coloured or textured soil (soil marks) might indicate ploughed-out burial mounds). Attention was also given to moisture differences, as prolonged dampening of soil as a result of precipitation frequently occurs over walls or embankments (see Figure 3-1).

By superimposing high frequency aerial photographs with images generated with Google Earth, potential sensitive areas were subsequently identified, geo-referenced and transferred to a handheld GPS device. In addition, based on existing knowledge of the local heritage landscape, the corridor was divided into smaller survey zones centred around areas of higher site catchment probability (where human activity was likely to occur in prehistoric and historic times e.g. around water sources, near soils fit for agriculture, on ridges). These survey zones were then transferred to a handheld GPS device. These areas served as referenced points from where further vehicular and pedestrian surveys were carried out.

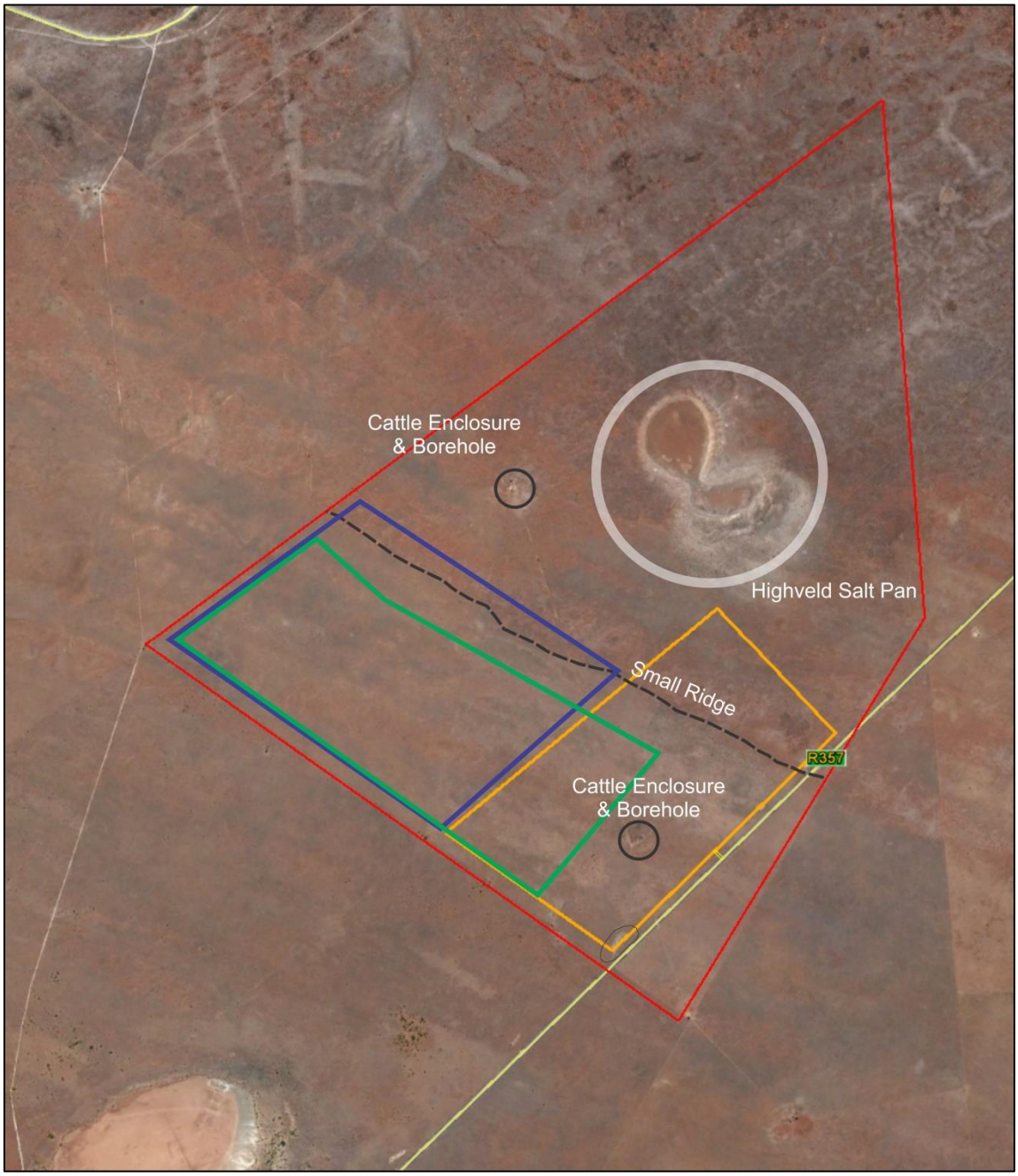

Figure 3-1 Aerial imagery of the farm Vlakpan, indicating landscape features such as pans and a small ridge which appears to give an indication of the locations of surface Stone Age occurrences. Vlakpan farm is indicated in red, footprint Alternative 1 is indicated in yellow, footprint Alternative 2 is indicated in blue and the preferred site (Alterative 3) is indicated in green.

3.1.3 Field Survey

Archaeological survey implies the systematic procedure of the identification of archaeological sites. Archaeological surveys of the footprint areas proposed for the Vlakpan Solar Park project was conducted in March and September 2014. The process encompassed a systematic field survey in accordance with standard archaeological practice by which heritage resources are observed and documented. In order to sample surface areas systematically and to ensure a high probability of site recording the footprint areas were systematically surveyed on foot and by motor vehicle, GPS reference points were visited and random spot checks were made (see detail in previous section). Transects were walked across the entire study areas and where gravels were

exposed transects were closely spaced, but where ground surfaces consisted of Hutton Sands transects were further apart (see Figure 3-2, GPS track-log is available in .gpx format from the author). This strategy was used because archaeological remains occurred more commonly and in higher numbers in areas containing exposed calcrete and gravels than in areas where surface sediments consist of sands. All identified archaeological occurrences were mapped but only higher density scatters and representative samples were photographed and described, using a Garmin E-trex Legend GPS and a Canon 450D Digital camera. Real time aerial orientation, by means of a mobile Google Earth application was also employed to investigate possible disturbed areas during the survey.

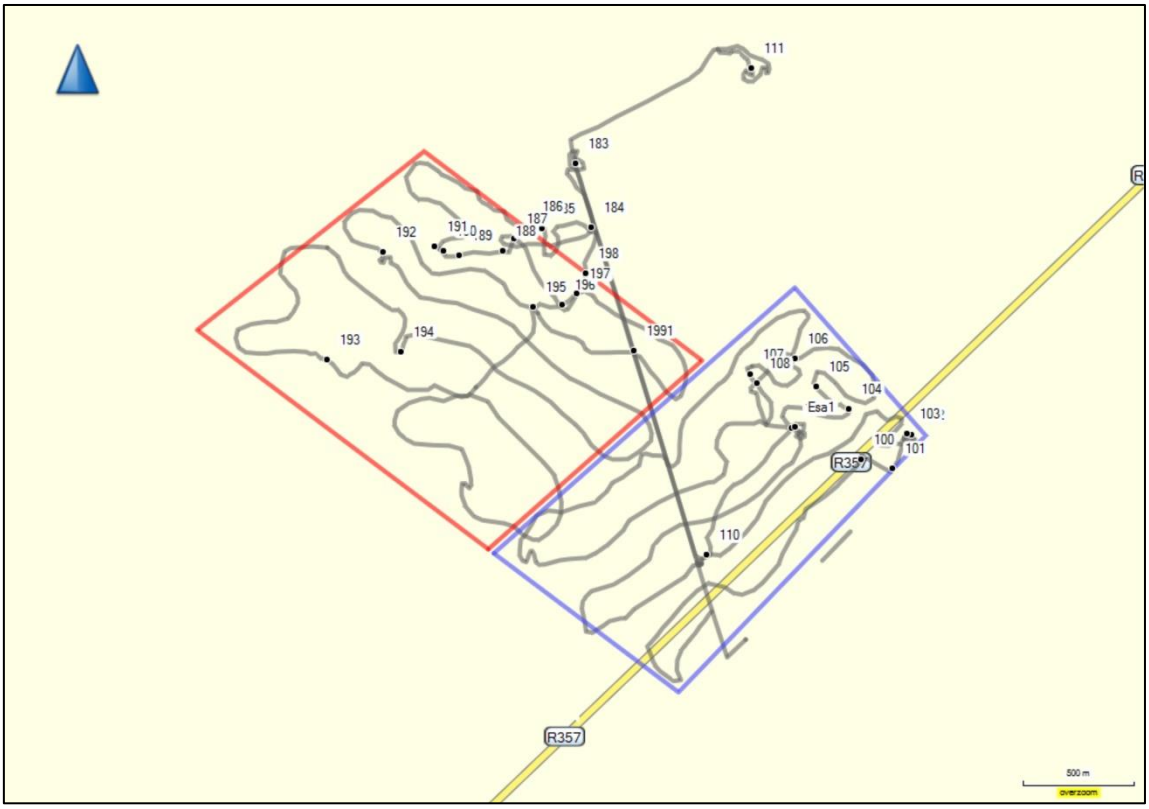

Figure 3-2 Garmin map indicating plotted GPS tracks of foot and vehicular surveys. The footprint Alternative 1, surveyed in March is indicated in blue and footprint Alternative 2, surveyed in September is indicated in red.

As most archaeological material occur in single or multiple stratified layers beneath the soil surface, special attention was given to disturbances, both man-made such as roads and clearings, as well as those made by natural agents such as burrowing animals and erosion.

3.1.4 General Public Liaison

Correspondence with the owner of Vlakpan briefly provided information on the general history of the area, possible locations of heritage resources and brief commentaries on the recent history of the farm. He pointed to the fact that, according to his knowledge, no heritage resources was present on the farm portion subject to this AIA Study.

3.2 Limitations

3.2.1 Access

The farm Vlakpan is accessed directly via the R357 regional road, which runs on the south eastern boundary of the abovementioned property. Access control is applied to the farm portions relevant to this assessment but no restrictions were encountered during the site visit as the author of this report was granted access by the owner of the farm. A number of farm service roads provided vehicular access to most areas within the demarcated footprint area.

3.2.2 Visibility

The surrounding vegetation in the study area is mostly comprised out of mixed grasslands and scattered trees with the occurrence of semi-arid succulents in places. The general visibility at the time of the AIA surveys (March & September 2014) ranged between moderate visibility in areas where human disturbance was prevalent (around cattle enclosures and drinking troughs), and moderate to low in portions of more pristine grassland in the study area (see Figures 3-2 to 3-9). In single cases during the survey sub-surface inspection was possible. Where applied, this revealed no archaeological deposits.

Figure 3-3: View of general surroundings in footprint Alternative 1 on Vlakpan, looking south.

Figure 3-4: View of diggings at a quarry to the south-eastern periphery of footprint Alternative 1.

Figure 3-5: Wind mills and cattle pens in a central portion of footprint Alternative 1.

Figure 3-6: Ant hills in Hutton Sands towards the northern sector of footprint Alternative 1.

Figure 3-7: Diggings at a quarry along the north-eastern border of footprint Alternative 1.

Figure 3-8: Deep red sands along the western portion of footprint Alternative 1.

Figure 3-9: Tall grasses along the south-western periphery of footprint Alternative 1 and the eastern periphery of footprint Alternative 2 and 3.

Figure 3-10: General surroundings in footprint Alternative 2 and 3.

Figure 3-11: General surroundings in footprint Alternative 2 and 3.

Figure 3-12: Exposed rock along a salt pan west of the study area on the farm Vlakpan.

3.2.3 Limitations and Constraints

Even though a systematic transect survey was carried out at Vlakpan, the site investigation focused around areas tentatively identified as sensitive and of high heritage probability (i.e. those noted during the aerial survey) as well as areas of high human settlement catchment. The following constraints were encountered:

- **Survey Time and Extent:** Survey time proved to be somewhat of a constraint due to the relatively large surface extent of the footprint area. Therefore, pedestrian site surveys focused around areas tentatively identified as sensitive (i.e. along drainage lines and those noted during the aerial survey) during aerial surveys.
- **Visibility:** Visibility constrained site identification in areas with denser surface cover, as well as portions where vegetation is more pristine.

Thus, even though it might be assumed that survey findings are representative of the heritage landscape of the project area for the Vlakpan Solar Park, it should be stated that the possibility exists that individual sites could be missed due to the localised nature of some heritage remains as well as the possible presence of sub-surface archaeology. Therefore, maintaining due cognisance of the integrity and accuracy of the archaeological survey, it should be stated that the heritage resources identified during the study do not necessarily represent all the heritage resources present in the project area. The subterranean nature of some archaeological sites, dense vegetation cover and visibility constraints sometimes distort heritage representations and any additional heritage resources located during consequent development phases must be reported to the Heritage Resources Authority or an archaeological specialist.

3.3 Impact Assessment

For consistency among specialists, the impact assessment ratings for this report in Section 6 were done using the Plomp[2] impact assessment matrix scale supplied by AGES. Each heritage receptor in the study area is given an impact assessment. A cumulative assessment for the proposed project is also included.

4 RESULTS: ARCHAEOLOGICAL SURVEY

Heritage resources identified in the Vlakpan Solar Park study area were arbitrarily coded **AGES-VP59-SAxx** (AGES Vlakpan 59 Stone Age Site).

4.1 The Stone Age

Material representative of the Earlier, Middle and Later Stone Age occur frequently in low lying areas on plains and calcrete exposures in Hutton sands along the banks of the Vaal River. This presence of Stone Age people in the landscape can probably be attributed to the abundance of locally available raw material for the manufacture of stone tools. Similarly, during the site investigation Stone Age specimens from the entire span of the Stone Age were identified, in the survey area, in most cases in association with exposed decomposed calcrete deposits, but those of Middle Stone Age (MSA) origin are more common than Earlier Stone Age (ESA) and Later Stone Age (LSA) artefacts. The density of the scatters were arbitrarily estimated by placing a one-meter drawing frame, sub-divided into quadrants, on a randomly-selected area displaying higher amounts of surface lithics. By plotting the counts of all lithic elements present in the 1x1 metre square relative density per m^2 was established and rated on a scale of low (<10), medium (10-20) and high (>20). This method has been adapted as expedient and non-invasive sampling technique that is particularly useful in value assessment of lithic occurrences during Phase 1 AIA's (see Van Der Ryst 2012).

- **Site AGES-VP59-SA01: S29.42905 E23.26861 (Low Density MSA Scatter)**

A low density Middle Stone Age Scatter was identified along a quarry site on the north-eastern periphery of footprint Alternative 1. The lithic remains are scattered as individual artefacts where precipitation and groundwater, as well as digging at the quarry have exposed the stone tools. A number of side scrapes and a broken point, as well as flakes were noted here. Typologically, the artefacts can tentatively attribute to the Middle Stone Age. This area has been adversely altered by quarry and digging activities and the occurrence is of limited scientific value due to the mixing of artefacts and the low density of the lithics. This low density artefact scatter is in a temporally mixed and secondary or derived context and therefore, is considered to be of low to no archaeological significance.

[2] Plomp, H.,2004

Figure 4-1: View of stone exposures at Site AGES-VP59-SA01.

Figure 4-2: MSA artefacts from Site AGES-VP59-SA01; a broken point (left) and highly weathered scrapers (centre and right).

- **Site AGES-VP59-SA02: S29.42706 E23.26129 (Medium Density MSA Scatter)**
- **Site AGES-VP59-SA04: S29.43394 E23.25879 (Medium Density MSA Scatter)**
- **Site AGES-VP59-SA06: S29.42176 E23.24882 (Medium Density MSA Scatter)**

Three medium density lithic scatters were identified in the study area. Site **AGES-VP59-SA02** occurs along a discreet ridge in the north-east sector of footprint Alternative 1 and Site **AGES-VP59-SA04** occurs near the windmill and cattle pen in the southern sector of footprint Alternative 1. The third scatter, Site **AGES-VP59-SA06** occurs along the northern outcrop of the same discreet ridge noted above along the northern periphery of

footprint Alternative 2. In all cases, the scatters seem to occur in areas where decomposed calcrete rock layers covered with deep red sands have been exposed. Although there may be some mixing of an earlier MSA assemblage with a few lithics from the more recent LSA utilization, the surface collection shows a predominant MSA signature. Preliminary examinations of some of the lithics, which includes formal tools such as scrapers, blades and points, and a possible adze, indicated that a number of flakes displayed facetted platforms, characteristic of the MSA. Here, prepared cores show evidence of the use of the Levallois technique, where surfaces on the core are shaped in order to generate a specific formal tool when flaked from the core. Use wear and marks are clearly visible on formal tools. The raw material used in the production of the lithics is mostly hornfels but fine-grained lithologies such as jasper and chalcedonies were also used. It is not possible to assign an age estimate without an in-depth analysis of a more representative sample. At this stage it would be prudent to say that these open-air collections probably represent a palimpsest of visits by prehistoric groups up to the MSA. Due to their temporally mixed and contextually derived nature, these archaeological occurrences are considered to be of medium-low significance but it should be noted that they are considered to be representative of the archaeological record of the immediate surroundings.

Figure 4-3: Stone tools from Site AGES-VP59-SA02; core (left), blade (centre) and a small scraper (right).

Figure 4-4: Secondary retouch visible on a broken point from Site AGES-VP59-SA02.

Figure 4-5: A weathered points from Site AGES-VP59-SA04.

Figure 4-6: Secondary retouch on fine grained points from Site AGES-VP59-SA06.

Figure 4-7: Highly watered points from Site AGES-VP59-SA06.

Figure 4-8: An awl (left) and a core (right) from Site AGES-VP59-SA06.

Figure 4-9: Large side scrapers from Site AGES-VP59-SA06.

- **Site AGES-VP59-SA03: S29.42879 E23.26317 (Medium-Low Density ESA Scatter)**

Two Earlier Stone Age hand axes and rough stone flakes and cores were recorded along a small ridge in the north-eastern sector of footprint Alternative 1. The ESA materials are heavily weathered with reddish-brown patination. Previous research by the McGregor Museum in Kimberly, attributed related occurrences in the area to the Earlier Stone Age, specifically the Fauresmith – Acheulean timespan at about 600 000 years ago (e.g. Beaumont & Morris 1990). Even though the material has been temporally mixed and derived pf primary contextually, they are considered to be representative of the archaeological record of the immediate surroundings and the presence of formal tools is significant. However, considering the low density of artefact distribution the site is of medium-low significance.

Figure 4-10: View of general surroundings at Site AGES-VP59-SA03.

Figure 4-11: Highly weathered hand axes from Site AGES-VP59-SA03.

- **Site AGES-VP59-SA05: S29.418268 E23.252394 (High Density ESA & MSA Scatter)**

A high density scatter of Earlier and Middle Stone Age material occurs at a watering holed and windmill approximately 200m north of footprint Alternative 2 in the direction of the large salt pan. Here, hand axes, cleavers, chopping tools, cores and rough stone flakes were recorded in deep red sands. Specifically, large quantities of large, rough blades possibly dating to the earlier part of the MSA were noted. In most cases, the materials are heavily weathered with reddish-brown patination. As noted above, previous research by the McGregor Museum in Kimberly, attributes related occurrences in the area to the Earlier Stone Age, specifically

the Fauresmith – Acheulean timespan at about 600 000 years ago. The presence of core tools, flakes and debris suggest that the area was a lithic manufacturing site. A large number of formal tools is present at the site and the occurrence is therefore significant.

Figure 4-12: View of general surroundings at Site AGES-VP59-SA05, windmill in the background.

Figure 4-13: Selection of highly weathered hand axes from Site AGES-VP59-SA05.

Figure 4-14: Selection of large, highly weathered early MSA blades from Site AGES-VP59-SA05.

Figure 4-15: A large rock from which an unused stone has been sourced. The point of percussion on the core (left) and the bulb of percussion on the flake (right) are indicated by white arrows.

4.2 The Iron Age Farmer Period

No Iron Age (Farmer Period) occurrences were observed in the survey area.

4.3 Historical / Colonial Period and recent times

No Historical / Colonial Period occurrences were observed in the survey area.

4.4 Graves

No graves or burial sites were observed in the survey area. In the event of any site/feature not noted in this report being found (this could include an unmarked grave or an ostrich eggshell cache) in the course of development of the proposed Solar Park, SAHRA should be contacted immediately, so that the find can be investigated and mitigation measures recommended.

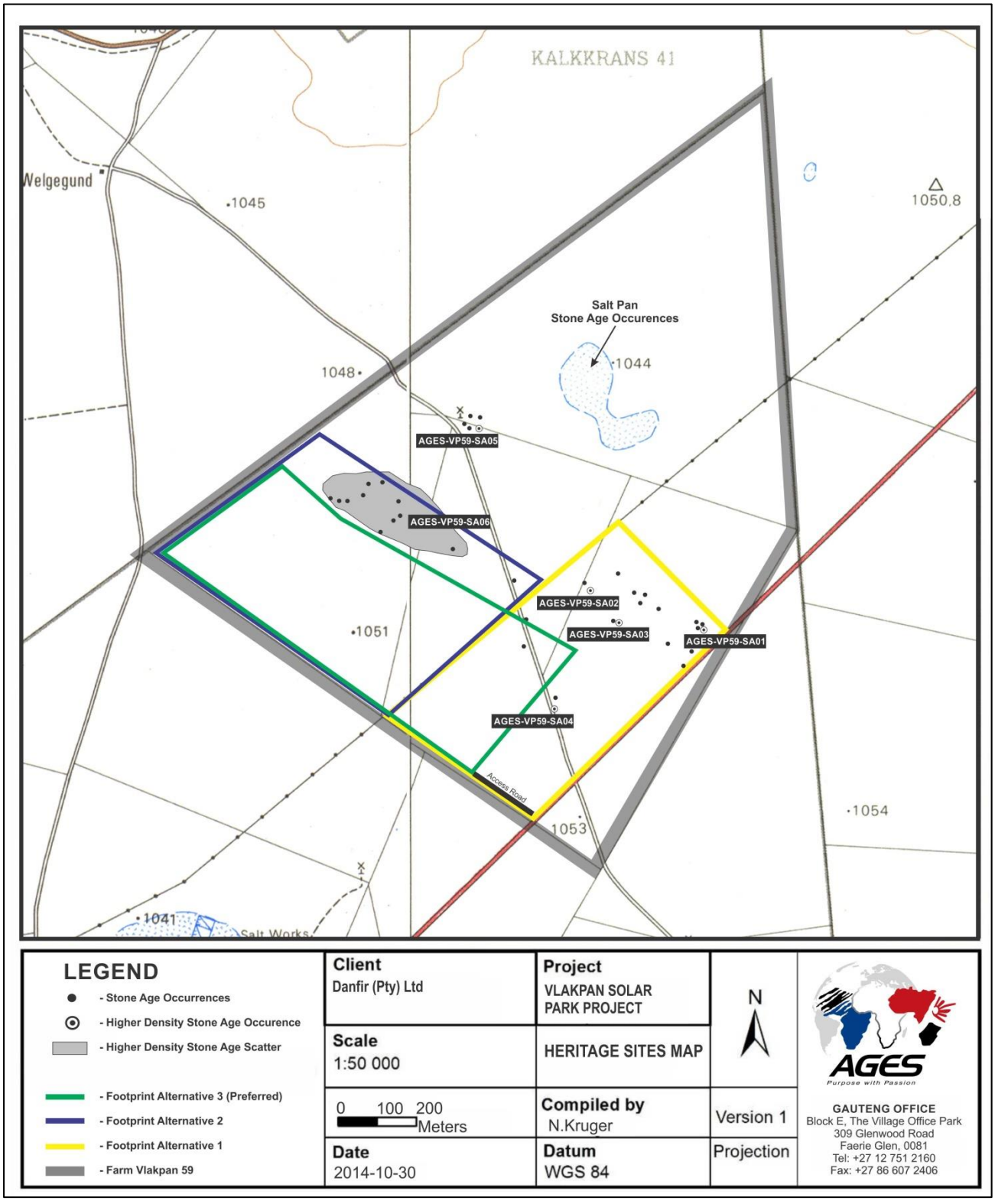

Figure 4-16: Map of heritage sites discussed in the text.

5 ARCHAEO-HISTORICAL CONTEXT

5.1 The archaeology of Southern Africa

Archaeology in southern Africa is typically divided into two main fields of study, the **Stone Age** and the **Iron Age** or **Farmer Period**. The following table provides a concise outline of the chronological sequence of periods, events, cultural groups and material expressions in Southern African pre-history and history.

Table 1 Chronological Periods across southern Africa

Period	Epoch	Associated cultural groups	Typical Material Expressions
Early Stone Age 2.5m – 250 000 YCE	Pleistocene	Early Hominins: *Australopithecines* *Homo habilis* *Homo erectus*	Typically large stone tools such as hand axes, choppers and cleavers.
Middle Stone Age 250 000 – 25 000 YCE	Pleistocene	First *Homo sapiens* species	Typically smaller stone tools such as scrapers, blades and points.
Late Stone Age 20 000 BC – present	Pleistocene / Holocene	*Homo sapiens sapiens* including San people	Typically small to minute stone tools such as arrow heads, points and bladelets.
Early Iron Age / Early Farmer Period 300 – 900 AD	Holocene	First Bantu-speaking groups	Typically distinct ceramics, bead ware, iron objects, grinding stones.
Middle Iron Age (Mapungubwe / K2) / early Later Farmer Period 900 – 1350 AD	Holocene	Bantu-speaking groups, ancestors of present-day groups	Typically distinct ceramics, bead ware and iron / gold / copper objects, trade goods and grinding stones.
Late Iron Age / Later Farmer Period 1400 AD -1850 AD	Holocene	Various Bantu-speaking groups including Venda, Thonga, Sotho-Tswana and Zulu	Distinct ceramics, grinding stones, iron objects, trade objects, remains of iron smelting activities including iron smelting furnace, iron slag and residue as well as iron ore.
Historical / Colonial Period ±1850 AD – present	Holocene	Various Bantu-speaking groups as well as European farmers, settlers and explorers	Remains of historical structures e.g. homesteads, missionary schools etc. as well as, glass, porcelain, metal and ceramics.

5.1.1 The Stone Ages

- **The Earlier Stone Age (ESA)**

Earlier Stone Age deposits typically occur on the flood-plains of perennial rivers and may date to between 2 million and 250 000 years ago. These ESA open sites sometimes contain stone tool scatters and manufacturing debris ranging from pebble tool choppers to core tools such as handaxes and cleavers. These stone tools were made by the earliest hominins. These groups seldom actively hunted and relied heavily on the opportunistic scavenging of meat from carnivore fill sites.

- **The Middle Stone Age (MSA)**

The majority of Middle Stone Age (MSA) sites occur on flood plains and sometimes in caves and rock shelters. Sites usually consist of large concentrations of knapped stone flakes such as scrapers, points and blades and associated manufacturing debris. Tools may have been hafted but organic materials, such as those used in hafting, seldom remain preserved in the archaeological record. Limited drive-hunting activities are also associated with the MSA.

- **The Later Stone Age (LSA)**

Sites dating to the Later Stone Age (LSA) are better preserved in rock shelters, although open sites with scatters of mainly stone tools can occur. Well-protected deposits in shelters allow for stable conditions that result in the preservation of organic materials such as wood, bone, hearths, ostrich eggshell beads and even bedding

material. By using San (Bushman) ethnographic data a better understanding of this period is possible. South African rock art is also associated with the LSA.

5.1.2 The Iron Age Farmer Period

- **Early Iron Age (Early Farming Communities)**

The Early Iron Age (also Early Farmer Period) marks the movement of Bantu speaking farming communities into South Africa at around 200 A.D. These groups were agro-pastoralists that settled in the vicinity of water in order to provide subsistence for their cattle and crops. Artefact evidence from Early Farmer Period sites is mostly found in the form of ceramic assemblages and the origins and archaeological identities of this period are largely based upon ceramic typologies and sequences, where diagnostic pottery assemblages can be used to infer group identities and to trace movements across the landscape. Early Farmer Period ceramic traditions are classified by some scholars into different "streams" or trends in pot types and decoration that, over time emerged in southern Africa. These "streams" are identified as the Kwale Branch (east), the Nkope Branch (central) and the Kalundu Branch (west). More specifically, in the northern regions of South Africa at least three settlement phases have been distinguished for prehistoric Bantu-speaking agropastoralists. The first phase of the Early Iron Age, known as Happy Rest (named after the site where the ceramics were first identified), is representative of the Western Stream of migrations, and dates to AD 400 - AD 600. The second phase of Diamant is dated to AD 600 - AD 900 and was first recognized at the eponymous site of Diamant in the western Waterberg. The third phase, characterised by herringbone-decorated pottery of the Eiland tradition, is regarded as the final expression of the Early Iron Age (EIA) and occurs over large parts of the North West Province, Northern Province, Gauteng and Mpumalanga. This phase has been dated to about AD 900 - AD 1200. Early Farmer Period ceramics typically display features such as large and prominent inverted rims, large neck areas and fine elaborate decorations. The Early Iron Age continued up to the end of the first millennium AD.

- **Middle Iron Age / K2 Mapungubwe Period (early Later Farming Communities)**

The onset of the middle Iron Age dates back to ±900 AD, a period more commonly known as the Mapungubwe / K2 phase. These names refer to the well known archaeological sites that are today the pinnacle of South Africa's Iron Age heritage. The inhabitants of K2 and Mapungubwe, situated on the banks of the Limpopo, were agriculturalists and pastoralists and were engaged in extensive trade activities with local and foreign traders. Although the identity of this Bantu-speaking group remains a point of contestation, the Mapungubwe people were the first state-organized society southern Africa has known. A considerable amount of golden objects, ivory, beads (glass and gold), trade goods and clay figurines as well as large amounts of potsherds were found at these sites and also appear in sites dating back to this phase of the Iron Age. Ceramics of this tradition take the form of beakers with upright sides and decorations around the base (K2) and shallow-shouldered bowls with decorations as well as globular pots with long necks. (Mapungubwe). The site of Mapungubwe was deserted at around 1250 AD and this also marks the relative conclusion of this phase of the Iron Age.

- **Later Iron Age (Later Farming Communities)**

The late Iron Age of southern Africa marks the grouping of Bantu speaking groups into different cultural units. It also signals one of the most influential events of the second millennium AD in southern Africa, the difaqane. The difaqane (also known as "the scattering") brought about a dramatic and sudden ending to centuries of stable society in southern Africa. Reasons for this change was essentially the first penetration of the southern African interior by Portuguese traders, military conquests by various Bantu speaking groups primarily the ambitious Zulu King Shaka and the beginning of industrial developments in South Africa. Different cultural groups were scattered over large areas of the interior. These groups conveyed with them their customs that in the archaeological record

manifest in ceramics, beads and other artefacts. This means that distinct pottery typologies can be found in the different late Iron Age groups of South Africa.

- **Bantu Speaking Groups in the South African interior**

It should be noted that terms such as "Nguni", "Sotho", "Venda" and others refer to broad and comprehensive language groups that demonstrated similarities in their origins and language. It does not imply that these Nguni / Sotho groups were homogeneous and static; they rather moved through the landscape and influenced each other in continuous processes marked by cultural fluidity.

Ethnographers generally divide major Bantu-speaking groups of southern Africa into two broad linguistic groups, the Nguni and the Sotho with smaller subdivisions under these two main groups. Nguni groups were found in the eastern parts of the interior of South Africa and can be divided into the northern Nguni and the southern Nguni. The various Zulu and Swazi groups were generally associated with the northern Nguni whereas the southern Nguni comprised the Xhosa, Mpondo, Thembu and Mpondomise groups. The same geographically based divisions exist among Sotho groups where, under the western Sotho (or Tswana), groups such as the Rolong, Hurutshe, Kwena, Fokeng and Kgatla are found. The northern Sotho included the Pedi and amalgamation of smaller groups united to become the southern Sotho group or the Basutho. Other smaller language groups such as the Venda, Lemba and Tshonga Shangana transpired outside these major entities but as time progressed they were, however to lesser or greater extend influenced and absorbed by neighbouring groups.

5.1.3 Historical and Colonial Times and Recent History

The Historical period in southern Africa encompass the course of Europe's discovery of South Africa and the spreading of European settlements along the East Coast and subsequently into the interior. In addition, the formation stages of this period are marked by the large scale movements of various Bantu-speaking groups in the interior of South Africa, which profoundly influenced the course of European settlement. Finally, the final retreat of the San and Khoekhoen groups into their present-day living areas also occurred in the Historical period in southern Africa.

5.2 The Orange River around Douglas Area: Specific Themes

The history of the Northern Cape Province is reflected in a rich archaeological landscape, mostly dominated by Stone Age occurrences. Most of our knowledge of the archaeology of the region is largely dependent on the work undertaken by Humphreys & Thackeray (1983) on the Ghaap escarpment, as well as that of Beaumont (1990). A number of Archaeological Impact Assessments (e.g. Beaumont, Morris, Kaplan, Becker & Kruger) have been done in the larger Kimberley area. Generally, numerous sites documenting Earlier, Middle and Later Stone Age habitation occur across the province, mostly in open air locales or in sediments alongside rivers or pans. In addition, a wealth of Later Stone Age rock art sites, most of which are in the form of rock engravings are to be found in the larger landscape. These sites occur on hilltops, slopes, rock outcrops and occasionally in river beds. Sites dating to the Iron Age occur in the extreme north eastern part of the Province and environmental factors delegated that the spread of Iron Age farming westwards from the 17th century was constrained mainly to these areas. However, evidence of an Iron Age presence as far as the Upington area in the eighteenth century occurs in this area. Moving into recent times, the archaeological record reflects the development of a rich colonial frontier, characterised by, amongst others, a complex industrial archaeological landscape such as mining developments at Kimberley, which herald the modern era in South African history.

5.2.1 The Early and Middle stone Ages in the Northern Cape

The archaeological record of this region involves the timespan from the Earlier Stone Age (1 500 000 to about 270 000 years ago), through the Middle Stone Age (about 270 000 - 40 000 years ago), to the Later Stone Age. Towards the east the last 2000 years showed an increase in ceramic sites as well as Iron Age expansions sometimes in conjunction with Stone Age communities (Morris & Beaumont 2004). Of particular interest are Pleistocene sites along the Vaal and Orange Rivers (e.g. Helgren 1979; Beaumont & Morris 1990; Beaumont& McNabb 2000). Late Holocene material with pottery is also known to occur on the river banks, while rock engravings are richly distributed in the region, inter alia at Kgatlane and Blaauwboschdrift near Douglas (Wilman 1933; Morris 1988).

The Stone Age record contains material spanning the Early, Middle and Later Stone Age periods and rock engravings are relatively common and were also recorded in the surroundings of Prieska (Morris 2005 and Rossouw 2007). Acheulian and LSA collections from Douglas and Hopetown are housed in the Iziko and McGregor Museums. Stone artefacts are made in a variety of raw materials including banded ironstone, andesite, quartzite, dolerite and hornfels, but banded ironstone is notably the most common (Beaumont 2005, 2006, 2007 & 2008 and Rossouw 2007).

Although Early Stone Age (ESA) artefacts have been recorded, these mainly consist of flakes and cores commonly based on quart zite cobbles, but formal ESA tools such as hand axes and cleavers are absent (Beaumont 2005, 2006 & 2007). An extensive surface scatter of small hand axes is supposed to occur some 10km upstream from Prieska (Beaumont 2007). It is possible that this is Fauresmith material, which is a transitional stone tool industry between the ESA and Middle Stone Age (MSA). The presence of stone artefacts representing this transitional Fauresmith industry and/or late phase of the Acheulian is frequently identified in the surrounding environment (Beaumont 2005 & 2008 and Rossouw 2007). Stone artefacts of MSA origin appear to be the most commonly occurring archaeological materials in the surrounding landscape (Beaumont 2005 & 2008, Dreyer 2005, Rossouw 2007 and Van Ryneveld 2005 & 2006). Typically the MSA material consists of isolated stone artefacts and low density artefact scatters that include Llevallois cores, flakes and blades with faceted or prepared platforms, and the dominant formal tools are irregular scrapers (Van Ryneveld 2006). Banded ironstone is the most commonly used raw material. Although stone artefacts of Later Stone Age (LSA) origin are reported to occur in the surrounding area, these seem to be less common than specimens of MSA age (Rossouw 2007 and Van Ryneveld 2005). Overall, Stone Age materials are scattered thinly over the modern land surface and to date, the Stone Age finds are considered to be of low to no archaeological significance (see all references below). This is due to the low frequencies of occurrences, temporally mixed assemblages, and the fact that artefacts are found in disturbed, derived and unstratified contexts.

Beaumont (2005) describes Early, Middle and Later Stone Age material north of Prieska, and van Ryneveld (2006) describes MSA and LSA lithics dominated by banded ironstone near Prieska. Relatively large numbers of MSA and LSA tools, including some enigmatic pieces, were documented about 5 kms north east of Prieska alongside the Prieska-Douglas road (Kaplan 2011). At Bundu near Copperton (about 60 west of Prieska), a series of dried up deflated pans have been excavated by Kiberd (2002, 2006). Pans would have acted as focal points for grazing animals, but also a source of water. A complex series of sedimentary features and horizons in these pans may be broadly coeval with periods of climatic change in the region (Kiberd 2006). Archaeological material was recovered from throughout the sedimentary sequence. Large numbers of LSA tools occur on the surface of the pan and within the upper red sands and include micro-lithictools, while below the red sands, MSA lithics mainly in quartzite, and preserved faun a were found. ESA tools, preserved fauna and even the possible discovery of an ESA hearth, which may be older than 300 000 years, was also excavated. Similarly, large

quantities of ESA tools and material was noted in, and around the large deflated pan on the farm Vlakpan (see Image 5-1 & Image 5-2).

Figure 5-1: Stone Age exposures along a large Salt Pan on the farm Vlakpan, west of the study area.

Figure 5-2: Earlier Stone Age tools occurring along a large salt pan on Vlakpan, west of the study area

5.2.2 Rock Markings

Rock engravings are mostly situated in the semi-arid plateau with most of these engravings situated at the Orange – Vaal basin, Karoo and Namibia. The upper Vaal, Limpopo basin and eastern Free State regions have a small quantity of rock engravings as well. Generally, rock paintings exist at cave areas and rock engravings at open surface areas. The Cape interior consists of a technical, formal and thematic variation between and within sites (Morris 1988). Two major techniques existed namely the incised and pecked engravings. Morris (1988) indicated technical and formal characteristics through space and a sharp contrast exists between engravings positioned north of the Orange River that are mostly pecked and those in the Karoo where scraping was mostly used. According to Morris (1988) hairline engravings occur at the North and the South, but they are rare at the Vryburg region. Finger painting techniques mostly occur at the Kuruman Hills, Asbestos Mountains, Ghaap Escarpment, Langeberg, Koranaberg ranges, scattered sites at the Karoo and the Kareeberge (Morris 1988). The development petroglyphs (i.e. carving or line drawing on rock) were associated with three different types of techniques, namely incised fine lines, pecked engravings and scraped engravings. According to Peter Beaumont the pecked and scraped engravings at the Upper Karoo are coeval (i.e. having the same age or date of origin) (Beaumont P B et al. 1989). Dating of rock art includes the use of carbonate fraction dating of ostrich eggshell

pieces, dating of charcoal and ostrich eggshell at various rock art shelters. Unifacial points, double segments and thin – walled sherds may indicate the presence of the Khoikhoi at the Northern Cape during 2500 BP (years Before the Present) (Beaumont 1989).

5.2.3 Iron Age / Farmer Period Sites

The beginnings of the Iron Age (Farmer Period) in southern Africa are associated with the arrival of a new Bantu speaking population group at around the third century AD. These newcomers introduced a new way of life into areas that were occupied by Later Stone Age hunter-gatherers and Khoekhoe herders. Distinctive features of the Iron Age are a settled village life, food production (agriculture and animal husbandry), metallurgy (the mining, smelting and working of iron, copper and gold) and the manufacture of pottery. Stone ruins indicate the occurrence of Iron Age settlements in the Northern Cape specifically at sites such as Dithakong where evidence exists that the Thlaping used to be settled in the Kuruman – Dithakong areas prior to 1800 (Humphreys 1976). Here, the assessment of the contact between the Stone Age, Iron Age and Colonial societies are significant in order to understand situations of contact and assimilation between societies. As an example, Trade occurred between local Thlaping Tswana people and the Khoikhoi communities. It means that the Tswana traded as far south as the Orange River at least the same time as the Europeans at the Cape (Humphreys 1976).

Morris (1990) reports that the area to the west of the Langeberg was once settled by the BaTlhaping. He notes that 35 km due north of Witsand lies the modern farm of Nokanna, which he says equates with the former BaTlhaping capital of Nokana or Nokaneng. Historically, the Trekboers traversed this area during the late 19th century. More recent research by Jacobs shows occupational Tswana site to occur during the later "Bantu Expansion" and "Proto-Difiqane between c1750 and 1830 in the study area. Specifically the Tlhaping and Tlharo chiefdoms are referred to here (N. J. Jacobs, 199). It is even suggested that some Sotho-Tswana people might have preceded the Tlhaping and Tlharo in this region. This is however not a recent postulations since Ellenberger and MacGregor already proposed earlier Iron Age communities in these areas as early as 1912 (Ellenberger & MacGregor, 1912).

5.2.4 Later History: Historical archaeology and living heritage

Evidence for the Anglo-Boer Wars that occurred between around 1880 and 1902 comes in the form of stone wall ruins and associated tin cans (Dreyer 2005). Prior to this, and of significance to the national economy, was the discovery of diamonds in the Kimberley area in 1866. This event is commemorated by a National Heritage Site where the “Eureka” diamond was discovered by a young boy on the farm De Kalk 37 (Van Ryneveld 2005). Other remains from these early diamond mining activities that were undertaken between the latter part of the 19th century and the early 1900s include graves, glass, tins and calcrete foundations for tents (Beaumont 2006). The town of Hopetown was founded in 1850 when Sir Harry Smith extended the northern frontier of the Cape Colony to the Orange River. A handful of settlers claimed ground where there was a natural ford over the Orange River, and by 1854 a frontier town had developed. Hopetown was named after William Hope, Auditor-General and Secretary of the Cape Colony Government at the time. The town was a quiet farming area until several large diamonds, most notable the Eureka Diamond and the Star of South Africa were discovered there between 1867 and 1869. The Cape Government Railways were founded in 1872, and the Cape government decided to run the main western line, between the Kimberley diamond fields and Cape Town on the coast, directly through Hopetown. The ford was upgraded to a railway bridge in 1884. The small town of Douglas was founded in 1848 as a mission station on the farm Backhouse by the Reverend Isaac Hughes. In 1867, a group of Europeans from Griquatown signed an agreement giving them the right to establish a town. The town was named after General Sir Robert Percy Douglas, Lieutenant Governor of the Cape Colony

The farm Vlakpan, as with other farms in the Hopetown and Douglas areas was founded in the 1870's.

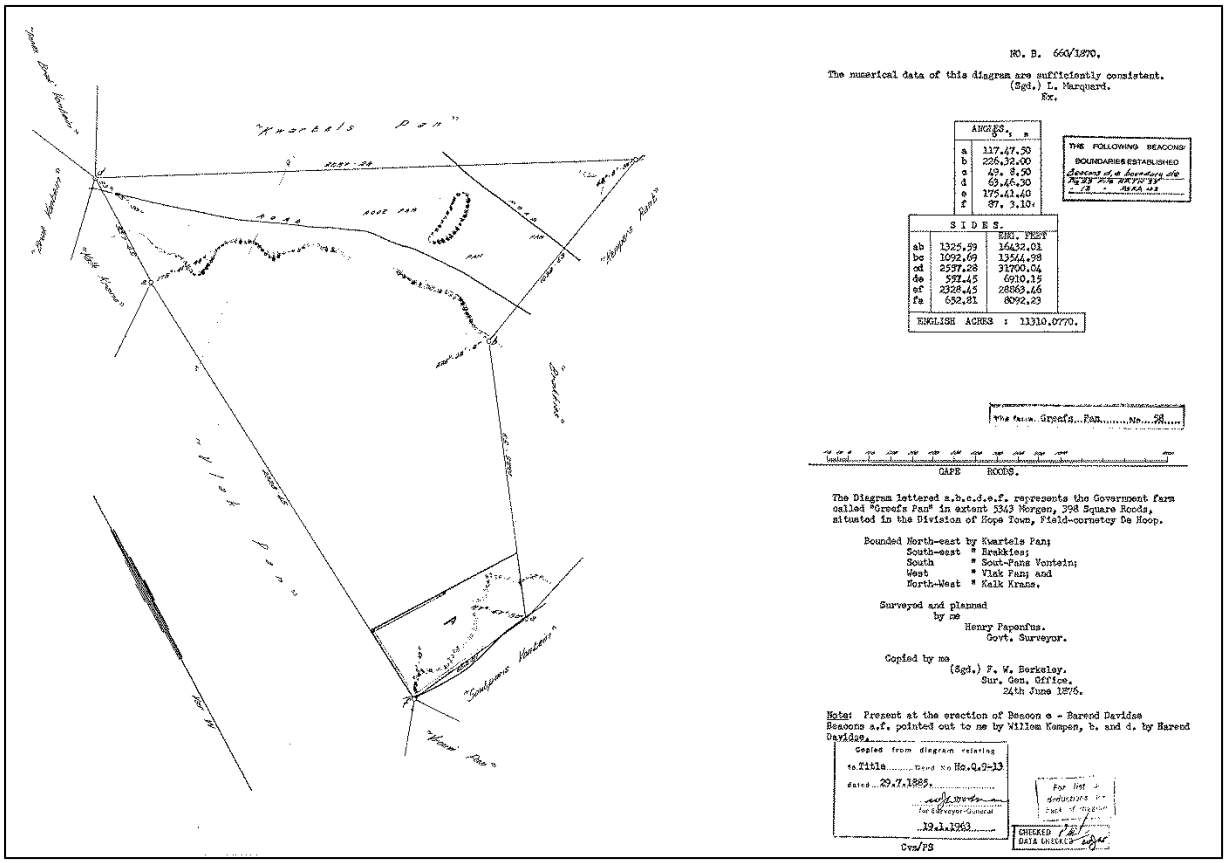

Figure 5-3: The original title deed for the farm Vlakpan c. 1876.

6 RESULTS: STATEMENT OF SIGNIFICANCE AND IMPACT RATING

6.1 Heritage resources management and conservation

Archaeological sites, as previously defined in the National Heritage Resources Act (Act 25 of 1999) are places in the landscape where people have lived in the past – generally more than 60 years ago – and have left traces of their presence behind. In South Africa, archaeological sites include hominid fossil sites, places where people of the Earlier, Middle and Later Stone Age lived in open sites, river gravels, rock shelters and caves, Iron Age sites, graves, and a variety of historical sites and structures in rural areas, towns and cities. Palaeontological sites are those with fossil remains of plants and animals where people were not involved in the accumulation of the deposits. The basic principle of cultural heritage conservation is that archaeological and other heritage sites are valuable, scarce and *non-renewable.* Many such sites are unfortunately lost on a daily basis through development for housing, roads and infrastructure and once archaeological sites are damaged, they cannot be re-created as site integrity and authenticity is permanently lost. Archaeological sites have the potential to contribute to our understanding of the history of the region and of our country and continent. By preserving links with our past, we may not be able to revive lost cultural traditions, but it enables us to appreciate the role they have played in the history of our country.

6.2 Categories of significance

Rating the significance of archaeological sites, and consequently grading the potential impact on the resources is linked to the significance of the site itself. The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences. The guidelines as provided by the NHRA (Act No. 25 of 1999) in Section 3, with special reference to subsection 3 are used when determining the cultural significance or other special value of archaeological or historical sites. In addition, ICOMOS (the Australian Committee of the International Council on Monuments and Sites) highlights four cultural attributes, which are valuable to any given culture:

- *Aesthetic value:*

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria include consideration of the form, scale, colour, texture and material of the fabric, the general atmosphere associated with the place and its uses and also the aesthetic values commonly assessed in the analysis of landscapes and townscape.

- *Historic value:*

Historic value encompasses the history of aesthetics, science and society and therefore to a large extent underlies all of the attributes discussed here. Usually a place has historical value because of some kind of influence by an event, person, phase or activity.

- *Scientific value:*

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality and on the degree to which the place may contribute further substantial information.

- *Social value:*

Social value includes the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a certain group.

It is important for heritage specialist input in the EIA process to take into account the heritage management structure set up by the NHR Act. It makes provision for a 3-tier system of management including the South Africa Heritage Resources Agency (SAHRA) at a national level, Provincial Heritage Resources Authorities (PHRAs) at a provincial and the local authority. The Act makes provision for two types or forms of protection of heritage resources; i.e. formally protected and generally protected sites:

Formally protected sites:

- Grade 1 or national heritage sites, which are managed by SAHRA
- Grade 2 or provincial heritage sites, which are managed by the provincial HRA.
- Grade 3 or local heritage sites.

Generally protected sites:

- Human burials older than 60 years.
- Archaeological and palaeontological sites.
- Shipwrecks and associated remains older than 70 years.
- Structures older than 60 years.

With reference to the evaluation of sites, the certainty of prediction is definite, unless stated otherwise and if the significance of the site is rated high, the significance of the impact will also result in a high rating. The same rule applies if the significance rating of the site is low. The significance of archaeological sites is generally ranked into the following categories.

Table 2: Heritage Site Significance Ratings

Significance	Rating Action
No significance: sites that do not require mitigation.	None
Low significance: sites, which may require mitigation.	2a. Recording and documentation (Phase 1) of site; no further action required 2b. Controlled sampling (shovel test pits, augering), mapping and documentation (Phase 2 investigation); permit required for sampling and destruction
Medium significance: sites, which require mitigation.	3. Excavation of representative sample, C14 dating, mapping and documentation (Phase 2 investigation); permit required for sampling and destruction [including 2a & 2b]
High significance: sites, where disturbance should be avoided.	4a. Nomination for listing on Heritage Register (National, Provincial or Local) (Phase 2 & 3 investigation); site management plan; permit required if utilised for education or tourism
High significance: Graves and burial places	4b. Locate demonstrable descendants through social consulting; obtain permits from applicable legislation, ordinances and regional by-laws; exhumation and reinterment [including 2a, 2b & 3]

Furthermore, the significance of archaeological sites was based on six main criteria:

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter),
- Social value,
- Uniqueness, and
- Potential to answer current and future research questions.

A fundamental aspect in assessing the significance and protection status of a heritage resource is often whether or not the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research potential must be assessed and mitigated in order to gain data / information, which would otherwise be lost.

6.3 Potential Impacts and Significance Ratings[4]

The following section provides a background to the identification and assessment of possible impacts and alternatives, as well as a range of risk situations and scenarios commonly associated with heritage resources management. The section ultimately provides a guideline (Section 6.3.1, Section 6.3.2 & Section 6.3.3) for the rating of impacts and recommendation of management actions for sites of heritage potential in the Vlakpan Solar Park Project Area.

[4] Based on: W inter, S. & Baumann, N. 2005. *Guideline for involving heritage specialists in EIA processes: Edition 1.*

6.3.1 General assessment of impacts on resources

Generally, the value and significance of archaeological and other heritage sites might be impacted on by any activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). Thus, the destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. However, in the long run, the proximity of operations in any given area could result in secondary indirect impacts. The EIA process therefore specifies impact assessment criteria which can be utilised from the perspective of a heritage specialist study which elucidates the overall extent of impacts.

A. HERITAGE SPECIFIC DIRECT IMPACT ASSESSMENT

Nature of the impact

This is an assessment of the nature of the impact of the activity on a heritage resource, with some indication of its positive and/or negative effect/s. It is strongly informed by the statement of resource significance. In other words, the nature of the impact may be historical, aesthetic, social, scientific, linguistic or architectural, intrinsic, associational or contextual (visual or non-visual). In many cases, the nature of the impact will include more than one value.

Confidence

This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of Consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Impact Significance

The significance of impacts can be determined through a synthesis of the aspects produced in terms of the nature and degree of heritage significance and the nature, duration, intensity, extent, probability and confidence of impacts and can be described as:

- Low; where it would have a negligible effect on heritage and on the decision
- Medium, where it would have a moderate effect on heritage and should influence the decision.
- High, where it would have, or there would be a high risk of, a big effect on heritage. Impacts of high significance should have a major influence on the decision;
- Very high, where it would have, or there would be high risk of, an irreversible and possibly irreplaceable negative impact on heritage. Impacts of very high significance should be a central factor in decision-making.

B. ENVIRONMENTAL IMPACT ASSESSMENT (PLOMP 2004)

An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a

project need. The significance of the impacts will be determined through a synthesis of the criteria below (Plomp, 2004):

Probability

This should describe the likelihood of the impact actually occurring indicated as:

- Improbable, where the possibility of the impact to materialize is very low either because of design or historic experience;
- Probable, where there is a distinct possibility that the impact will occur;
- Highly probable, where it is most likely that the impact will occur; or
- Definite, where the impact will definitely occur regardless of any mitigation measures

Duration

The lifetime of the impact:

- Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a time span shorter than any of the phases.
- Medium term: The impact will last up to the end of the phases, where after it will be negated.
- Long term: The impact will last for the entire operational phase of the project but will be mitigated by direct human action or by natural processes thereafter.
- Permanent: Impact that will be non-transitory. Mitigation either by man or natural processes will not occur in such a way or in such a time span that the impact can be considered transient.

Of relevance to the duration of an impact are the following considerations:

- Reversibility of the impact; and
- Renewability of the heritage resource.

Scale / Extent

Here it should be indicated whether the impact will be experienced:

- On a site scale, i.e. extend only as far as the activity;
- Within the immediate context of a heritage resource;
- On a local scale, e.g. town or suburb
- On a metropolitan or regional scale; or
- On a national/international scale.

Magnitude / Severity

Here it should be established whether the impact should be indicated as:

- Low, where the impact affects the resource in such a way that its heritage value is not affected;
- Medium, where the affected resource is altered but its heritage value continues to exist albeit in a modified way;
- High, where heritage value is altered to the extent that it will temporarily or permanently be damaged or destroyed.

Significance (of the heritage resource)

This is a statement of the nature and degree of significance of the heritage resource being affected by the activity. From a heritage management perspective it is useful to distinguish between whether the significance is embedded in the physical fabric or in associations with events or persons or in the experience of a place; i.e. its visual and non-visual qualities. This statement is a primary informant to the nature and degree of significance of an impact and thus needs to be thoroughly considered. Consideration needs to be given to the significance of a heritage resource at different scales (i.e. site specific, local, regional, national or international) and the relationship between the heritage resource, its setting and its associations.

- Negligible: The impact is non-existent or unsubstantial and is of no or little importance to any stakeholder and can be ignored.
- Low: The impact is limited in extent, has low to medium intensity; whatever its probability of occurrence is, the impact will not have a material effect on the decision and is likely to require management intervention with increased costs.

  Moderate: The impact is of importance to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.

The impact could render development options controversial or the project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in mitigation.

6.3.2 Direct impact rating

Direct or primary effects on heritage resources occur at the same time and in the same space as the activity, e.g. loss of historical fabric through demolition work. **Indirect effects or secondary effects** on heritage resources occur later in time or at a different place from the causal activity, or as a result of a complex pathway, e.g. restriction of access to a heritage resource resulting in the gradual erosion of its significance, which is dependent on ritual patterns of access. The following table provides an outline as to the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected.

Table 3: Direct Impact Assessment Criteria

	TYPE OF DEVELOPMENT			
HERITAGE CONTEXT	**CATEGORY A**	**CATEGORY B**	**CATEGORY C**	**CATEGORY D**
CONTEXT 1 High heritage Value	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected	Very high heritage impact expected
CONTEXT 2 Medium to high heritage value	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected
CONTEXT 3 Medium to low heritage value	Little or no heritage impact expected	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected
CONTEXT 4 Low to no heritage value	Little or no heritage impact expected	Little or no heritage impact expected	Minimal heritage value expected	Moderate heritage impact expected
NOTE: A DEFAULT "LITTLE OR NO HERITAGE IMPACT EXPECTED" VALUE APPLIES WHERE A HERITAGE RESOURCE OCCURS OUTSIDE THE IMPACT ZONE OF THE DEVELOPMENT.				

HERITAGE CONTEXTS	**CATEGORIES OF DEVELOPMENT**
Context 1: Of high intrinsic, associational and contextual heritage value within a national, provincial and local context, i.e. formally declared or potential Grade 1, 2 or 3A heritage resources	**Category A: Minimal intensity development** - No rezoning involved; within existing use rights. - No subdivision involved. - Upgrading of existing infrastructure within existing envelopes

Context 2: Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources. **Context 3:** Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources **Context 4:** Of little or no intrinsic, associational or contextual heritage value due to disturbed, degraded conditions or extent of irreversible damage.	- Minor internal changes to existing structures - New building footprints limited to less than 1000m2. **Category B: Low-key intensity development** - Spot rezoning with no change to overall zoning of a site. - Linear development less than 100m - Building footprints between 1000m2-2000m2 - Minor changes to external envelop of existing structures (less than 25%) - Minor changes in relation to bulk and height of immediately adjacent structures (less than 25%). **Category C: Moderate intensity development** - Rezoning of a site between 5000m2-10 000m2. - Linear development between 100m and 300m. - Building footprints between 2000m2 and 5000m2 - Substantial changes to external envelop of existing structures (more than 50%) - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 50%) **Category D: High intensity development** - Rezoning of a site in excess of 10 000m2 - Linear development in excess of 300m. - Any development changing the character of a site exceeding 5000m2 or involving the subdivision of a site into three or more erven. - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 100%)

6.4 Site significance and impact rating

Refer to Section 6.3.1, Section 6.3.2 & Section 6.3.3 for background on the rating of impacts and recommendation of management actions for sites of heritage potential. Impact thresholds and management measures for the sites are further discussed in section 6.3.5.

6.4.1 Site AGES-VP59-SA01: Low Density MSA Scatter

1. SITE DESCRIPTION : Middle Stone Age Scatters							
1.1 General Site Description							
Low and Density MSA Scatters							
1.2 Site features / artefacts / Other							
Site Location							
Province / District	Northern Cape Province			Map Number	2923AD		
Farm / Settlement / Zone	Vlakpan 59						
Co-ordinates	**Site AGES-VP59-SA01**	**S29.42905**		**E23.26861**			
Site Type							
Surface sites	**X**			Caves and rock shelters			
Larger open-air sites				Sealed sites (deposits			
River deposits				Other			
Site Function							
Living / habitation				Kill			
Ceremonial				Burial			
Trading / Barter				Art			
Quarry / Mining / Smelting				Other	**X - unknown**		
Site Placement							
Valley floor		Hill top		Vlei/swamp		River Mouth	

Dam		River Bank		Slope		Plains	X
Other / Comments							
Vegetation							
Riverine forest		Bushveld		Savannah		Mountain forest	
Thornveld		Grassland	X	Cultivated	X	Other	
Age Classification							
Stone Age	X	Early Iron Age		Middle Iron Age		Later Iron Age	
Historical		Other					
Material Culture							
Midden		House Remains		Stone Walling		Stone Structures	
Granary		Grinding Stone (L)		Grinding Stone (U)		Granary Stand	
Metal		Ceramics (Potter)		Ceramics (Porcelain)		Stone (non-lithic)	X
Metal slag		Tuyere		Fauna		Bead (Glass)	
Bead (OES / Shell)		Glass		Lithics	X	Smelting Residues	
Other:				Other:			

1.3 Site Condition

The site integrity has been compromised due to the mixing of artefact and the loss of primary context.

2. SITE EVALUATION

2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.			X
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.			X
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.		X	
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.			X
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			X
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.		X	
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			X
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.			X
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			X
It has significance relating to the history of slavery in South Africa.			X
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.		X	

2.2 Field Register Rating	
National/Grade 1 [should be registered, retained]	
Provincial/Grade 2 [should be registered, retained]	
Local/Grade 3A [should be registered, mitigation not advised]	
Local/Grade 3B [High significance; mitigation, partly retained]	
Generally Protected A [High/Medium significance, mitigation]	
Generally protected B [Medium significance, to be recorded]	
Generally Protected C [Low significance, no further action]	X

2.3 Sphere of Significance	High	Medium	Low
International			
National			

Provincial			
Local			X
Specific community			

3. IMPACT RATING AND MITIGATION

3.1 Impact assessment

APPROXIMATE DISTANCE FROM DEVELOPMENT: 100+ METERS

NATURE OF IMPACT: HISTORICAL, SCIENTIFIC.

EXTENT OF IMPACT: Local

SPECIALIST LEVEL OF CONFIDENCE IN DEGREE OF IMPACT AND SEVERITY: High

3.2 Impact Significance and Severity

		Without Management*	With Management*
General assessment of impacts on resource (Refer to Section 7.3.1)	Duration	**Permanent**	**Short Term**
	Intensity	**Low**	**Low**
	Probability	**Improbable**	**Improbable**
	Impact Significance	**Low**	**Negligible**

3.3 Direct Impact Rating

Direct impact on resource	None (the potential development does not adversely or positively affect the heritage resource)	X
	Peripheral / Indirect (the heritage resource or its setting is located in proximity to the footprint of the potential development)	
	Destruction / Direct (the heritage resource or site is physically located within the footprint of the potential development)	

Direct impact rating (Refer to Section 7.3.2) Note that a default "no impact expected" value applies where a heritage resource occurs outside the impact matrix or applicable conservation buffers of the development.	**No Heritage Impact Expected.**

3.4 Recommended Management* (refer to section 7.3.3)

Avoidance / Monitoring

Comments on recommended management

Avoidance: Management of development process in order to avoid impact on the resources.
Monitoring: It is necessary that the sites be monitored to ensure that previously undetected heritage resources are not impacted on.

4. APPLICABLE LEGISLATION AND LEGAL REQUIREMENTS

- **National Heritage Resources Act (Act no. 25 of 1999)**
- **Local and regional provisions, laws and by-laws**

6.4.2 Site AGES-VP59-SA02: S29.42706 E23.26129 (Medium Density MSA Scatter)
Site AGES-VP59-SA04: S29.43394 E23.25879 (Medium Density MSA Scatter)
Site AGES-VP59-SA06: S29.42176 E23.24882 (Medium Density MSA Scatter)

1. SITE DESCRIPTION : Middle Stone Age Scatters

1.2 General Site Description

Low Density MSA Scatters

1.2 Site features / artefacts / Other

Site Location

Province / District	Northern Cape Province	Map Number	2923AD
Farm / Settlement / Zone	Vlakpan 59		

Co-ordinates	**Site AGES-VP59-SA02**	**S29.42706**	**E23.26129**
	Site AGES-VP59-SA04	**S29.43394**	**E23.25879**
	Site AGES-VP59-SA06	**S29.42176**	**E23.24882**

Site Type			
Surface sites	X	Caves and rock shelters	
Larger open-air sites		Sealed sites (deposits	
River deposits		Other	

Site Function			
Living / habitation		Kill	
Ceremonial		Burial	
Trading / Barter		Art	
Quarry / Mining / Smelting		Other	X - unknown

Site Placement							
Valley floor		Hill top		Vlei/swamp		River Mouth	
Dam		River Bank		Slope		Plains	X
Other / Comments							

Vegetation							
Riverine forest		Bushveld		Savannah		Mountain forest	
Thornveld		Grassland	X	Cultivated	X	Other	

Age Classification							
Stone Age	X	Early Iron Age		Middle Iron Age		Later Iron Age	
Historical		Other					

Material Culture							
Midden		House Remains		Stone Walling		Stone Structures	
Granary		Grinding Stone (L)		Grinding Stone (U)		Granary Stand	
Metal		Ceramics (Potter)		Ceramics (Porcelain)		Stone (non-lithic)	X
Metal slag		Tuyere		Fauna		Bead (Glass)	
Bead (OES / Shell)		Glass		Lithics	X	Smelting Residues	
Other:				Other:			

1.3 Site Condition

The site integrity has been compromised due to the mixing of artefact and the loss of primary context.

2. SITE EVALUATION

2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.		X	
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.		X	
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.		X	
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.		X	
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			X
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.		X	
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			X
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.		X	
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			X
It has significance relating to the history of slavery in South Africa.			X
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.		X	

2.2 Field Register Rating	
National/Grade 1 [should be registered, retained]	
Provincial/Grade 2 [should be registered, retained]	
Local/Grade 3A [should be registered, mitigation not advised]	
Local/Grade 3B [High significance; mitigation, partly retained]	
Generally Protected A [High/Medium significance, mitigation]	
Generally protected B [Medium significance, to be recorded]	X
Generally Protected C [Low significance, no further action]	

2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local		X	
Specific community			

3. IMPACT RATING AND MITIGATION

3.1 Impact assessment

APPROXIMATE DISTANCE FROM DEVELOPMENT: 100+ METERS

NATURE OF IMPACT: HISTORICAL, SCIENTIFIC.

EXTENT OF IMPACT: Local

SPECIALIST LEVEL OF CONFIDENCE IN DEGREE OF IMPACT AND SEVERITY: High

3.2 Impact Significance and Severity

		Without Management*	With Management*
General assessment of impacts on resource (Refer to Section 7.3.1)	Duration	**Permanent**	**Short Term**
	Intensity	**Low**	**Low**
	Probability	**Improbable**	**Improbable**
	Impact Significance	**Negligible**	**Negligible**

3.3 Direct Impact Rating

Direct impact on resource	None (the potential development does not adversely or positively affect the heritage resource)	X
	Peripheral / Indirect (the heritage resource or its setting is located in proximity to the footprint of the potential development)	
	Destruction / Direct (the heritage resource or site is physically located within the footprint of the potential development)	

Direct impact rating (Refer to Section 7.3.2) Note that a default "no impact expected" value applies where a heritage resource occurs outside the impact matrix or applicable conservation buffers of the development.	**No Heritage Impact Expected.**

3.4 Recommended Management* (refer to section 7.3.3)

Avoidance / Monitoring

Comments on recommended management

Avoidance: Management of development process in order to avoid impact on the resources.
Monitoring: It is necessary that the sites be monitored to ensure that heritage resources are not impacted on.

4. APPLICABLE LEGISLATION AND LEGAL REQUIREMENTS

- **National Heritage Resources Act (Act no. 25 of 1999)**
- **Local and regional provisions, laws and by-laws**

6.4.3 Site AGES-VP59-SA03: (Low Density ESA Scatter)

1. SITE DESCRIPTION : Earlier Stone Age Scatters

1.3 General Site Description

Low Density ESA Scatters

1.2 Site features / artefacts / Other			
Site Location			
Province / District	Northern Cape Province	Map Number	2923AD
Farm / Settlement / Zone	Vlakpan 59		
Co-ordinates	**Site AGES-VP59-SA03**	**S29.42879**	**E23.26317**

Site Type			
Surface sites	**X**	Caves and rock shelters	
Larger open-air sites		Sealed sites (deposits	
River deposits		Other	

Site Function			
Living / habitation		Kill	
Ceremonial		Burial	
Trading / Barter		Art	
Quarry / Mining / Smelting		Other	**X - unknown**

Site Placement							
Valley floor		Hill top		Vlei/swamp		River Mouth	
Dam		River Bank		Slope		Plains	**X**
Other / Comments							

Vegetation							
Riverine forest		Bushveld		Savannah		Mountain forest	
Thornveld		Grassland	**X**	Cultivated	**X**	Other	

Age Classification							
Stone Age	**X**	Early Iron Age		Middle Iron Age		Later Iron Age	
Historical		Other					

Material Culture							
Midden		House Remains		Stone Walling		Stone Structures	
Granary		Grinding Stone (L)		Grinding Stone (U)		Granary Stand	
Metal		Ceramics (Potter)		Ceramics (Porcelain)		Stone (non-lithic)	**X**
Metal slag		Tuyere		Fauna		Bead (Glass)	
Bead (OES / Shell)		Glass		Lithics	**X**	Smelting Residues	
Other:				Other:			

1.3 Site Condition

The site integrity has been compromised due to the mixing of artefact and the loss of primary context.

2. SITE EVALUATION

2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.		**X**	
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.		**X**	
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.		**X**	
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.		**X**	
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			**X**
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.		**X**	

It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			X
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.		X	
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			X
It has significance relating to the history of slavery in South Africa.			X
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.		X	

2.2 Field Register Rating	
National/Grade 1 [should be registered, retained]	
Provincial/Grade 2 [should be registered, retained]	
Local/Grade 3A [should be registered, mitigation not advised]	
Local/Grade 3B [High significance; mitigation, partly retained]	
Generally Protected A [High/Medium significance, mitigation]	X
Generally protected B [Medium significance, to be recorded]	
Generally Protected C [Low significance, no further action]	

2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local		X	
Specific community			

3. IMPACT RATING AND MITIGATION

3.1 Impact assessment

APPROXIMATE DISTANCE FROM DEVELOPMENT: 100+ METERS

NATURE OF IMPACT: HISTORICAL, SCIENTIFIC.

EXTENT OF IMPACT: Local

SPECIALIST LEVEL OF CONFIDENCE IN DEGREE OF IMPACT AND SEVERITY: High

3.2 Impact Significance and Severity

		Without Management*	With Management*
General assessment of impacts on resource (Refer to Section 7.3.1)	Duration	**Permanent**	**Short Term**
	Intensity	**Low**	**Low**
	Probability	**Improbable**	**Improbable**
	Impact Significance	**Negligible**	**Negligible**

3.3 Direct Impact Rating

Direct impact on resource	None (the potential development does not adversely or positively affect the heritage resource)	X
	Peripheral / Indirect (the heritage resource or its setting is located in proximity to the footprint of the potential development)	
	Destruction / Direct (the heritage resource or site is physically located within the footprint of the potential development)	

Direct impact rating (Refer to Section 7.3.2) Note that a default "no impact expected" value applies where a heritage resource occurs outside the impact matrix or applicable conservation buffers of the development.	**No Heritage Impact Expected.**

3.4 Recommended Management* (refer to section 7.3.3)

Avoidance / Monitoring

Comments on recommended management

Avoidance: Management of development process in order to avoid impact on the resources.
Monitoring: It is necessary that the sites be monitored to ensure that previously undetected heritage resources are not impacted on. If further impact occurs, or is envisaged at any stage of development and operation the following will be required:

- **Documentation of sites, surface sampling.**

- **Further desktop study to more accurately ascertain context of sites.**

Relevant Permitting from Heritage Resources Authority.

4. APPLICABLE LEGISLATION AND LEGAL REQUIREMENTS

- **National Heritage Resources Act (Act no. 25 of 1999)**
- **Local and regional provisions, laws and by-laws**

6.4.4 Site AGES-VP59-SA05: (High Density ESA & MSA Scatter)

1. SITE DESCRIPTION : Earlier and Middle Stone Age Scatters							
1.4 General Site Description							
High Density ESA and MSA Scatters							
1.2 Site features / artefacts / Other							
Site Location							
Province / District	Northern Cape Province			Map Number	2923AD		
Farm / Settlement / Zone	Vlakpan 59						
Co-ordinates	**Site AGES-VP59-SA05**	**S29.418268**		**E23.252394**			
Site Type							
Surface sites	**X**			Caves and rock shelters			
Larger open-air sites				Sealed sites (deposits			
River deposits				Other			
Site Function							
Living / habitation				Kill			
Ceremonial				Burial			
Trading / Barter				Art			
Quarry / Mining / Smelting				Other	**X - unknown**		
Site Placement							
Valley floor		Hill top		Vlei/swamp		River Mouth	
Dam		River Bank		Slope		Plains	**X**
Other / Comments							
Vegetation							
Riverine forest		Bushveld		Savannah		Mountain forest	
Thornveld		Grassland	**X**	Cultivated	**X**	Other	
Age Classification							
Stone Age	**X**	Early Iron Age		Middle Iron Age		Later Iron Age	
Historical		Other					
Material Culture							
Midden		House Remains		Stone Walling		Stone Structures	
Granary		Grinding Stone (L)		Grinding Stone (U)		Granary Stand	
Metal		Ceramics (Potter)		Ceramics (Porcelain)		Stone (non-lithic)	**X**
Metal slag		Tuyere		Fauna		Bead (Glass)	
Bead (OES / Shell)		Glass		Lithics	**X**	Smelting Residues	
Other:				Other:			

1.3 Site Condition
The site integrity has been compromised due to the mixing of artefact and the loss of primary context.

2. SITE EVALUATION			
2.1 Heritage Value (NHRA, section 2 [3])	**High**	**Medium**	**Low**
It has importance to the community or pattern of South Africa's history or pre-colonial history.		X	
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.		X	
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.		X	
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.		X	
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			X
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.		X	
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			X
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.		X	
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			X
It has significance relating to the history of slavery in South Africa.			X
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.		X	

2.2 Field Register Rating	
National/Grade 1 [should be registered, retained]	
Provincial/Grade 2 [should be registered, retained]	
Local/Grade 3A [should be registered, mitigation not advised]	
Local/Grade 3B [High significance; mitigation, partly retained]	
Generally Protected A [High/Medium significance, mitigation]	
Generally protected B [Medium significance, to be recorded]	X
Generally Protected C [Low significance, no further action]	

2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local		X	
Specific community			

3. IMPACT RATING AND MITIGATION
3.1 Impact assessment
APPROXIMATE DISTANCE FROM DEVELOPMENT: 100+ METERS
NATURE OF IMPACT: HISTORICAL, SCIENTIFIC.
EXTENT OF IMPACT: Local
SPECIALIST LEVEL OF CONFIDENCE IN DEGREE OF IMPACT AND SEVERITY: High
3.2 Impact Significance and Severity

		Without Management*	With Management*
General assessment of impacts on resource (Refer to Section 7.3.1)	Duration	**Permanent**	**Short Term**
	Intensity	**Low**	**Low**
	Probability	**Improbable**	**Improbable**
	Impact Significance	**Negligible**	**Negligible**

3.3 Direct Impact Rating

Direct impact on resource	None (the potential development does not adversely or positively affect the heritage resource)	X
	Peripheral / Indirect (the heritage resource or its setting is located in proximity to the footprint of the potential development)	
	Destruction / Direct (the heritage resource or site is physically located within the footprint of the potential development)	
Direct impact rating (Refer to Section 7.3.2) Note that a default "no impact expected" value applies where a heritage resource occurs outside the impact matrix or applicable conservation buffers of the development.		**No Heritage Impact Expected.**
3.4 Recommended Management* (refer to section 7.3.3)		
Avoidance / Monitoring		
Comments on recommended management		
Avoidance: Management of development process in order to avoid impact on the resources. **Monitoring: It is necessary that the sites be monitored to ensure that heritage resources are not impacted on.**		
4. APPLICABLE LEGISLATION AND LEGAL REQUIREMENTS		
- **National Heritage Resources Act (Act no. 25 of 1999)** - **Local and regional provisions, laws and by-laws**		

6.5 Discussion: Evaluation of Results

Previous studies conducted in the larger Hopetown and Kimberley areas suggest a rich and diverse archaeological landscape and cognisance should nonetheless be taken of archaeological material that might be present in surface and sub-surface deposits along drainage lines and at water and salt pans. The following impact assessment discussion summarises the extent of heritage significance and impact on resources, cognisant of this rich larger archae-historical landscape (refer to Table 6 for impact assessment matrix).

Sites dating to the **Stone Age Period** in occur in the study area.

- A low density Middle Stone Age Scatter (**Site AGES-VP59-SA01, S29.42905 E23.26861)** occurs along a quarry site on the north-eastern periphery of footprint Alternative 1. This area has been adversely altered by quarry and digging activities and the occurrence is of limited scientific value due to the mixing of artefacts and the low density of the lithics. Two additional medium density lithic scatters (**Site AGES-VP59-SA02, S29.42706 E23.26129 & Site AGES-VP59-SA04, S29.43394 E23.25879)** occur in footprint Alternative 1. Formal tools have been identified among lithics scatters at the sites but since the sites are in both cases temporally mixed and contextually derived, these archaeological occurrences are considered to be of medium-low significance. A further medium density lithic scatters (**Site AGES-VP59-SA06, S29.42176 E23.24882)** occurs in footprint Alternative 2 where number of formal tools have been identified and the occurrences are considered to be of medium significance. In all cases, these sites are situated away from the preferred footprint Alternative 3 and no impact on the resources is foreseen.

  As such, the significance of the impact on the heritage resources is considered to be NEGLIBLE and this rating is anticipated to remain unchanged provided that the recommended mitigation measures (monitoring, avoidance) for the sites be implemented, if / when required.

- Two Earlier Stone Age handaxes and rough stone flakes and cores recorded along a small ridge in the north-eastern sector of footprint Alternative 1 (**Site AGES-VP59-SA03, S29.42879 E23.26317)** are considered to be representative of the archaeological record of the immediate surroundings and the presence of formal tools is significant. In addition, a high density scatter of Earlier and Middle Stone Age material occurs at a watering holed and windmill approximately 200m north of footprint Alternative 2 in the direction of the large salt pan (**Site AGES-VP59-SA05, S29.418268 E23.252394).** A large

number of formal tools such as hand axes, cleavers chopping tools are present at the site and the occurrence is significant. None of these sites occur in the preferred footprint Alternative 3 and no impact on the resources is foreseen.

As such, the significance of the impact on the heritage resources is considered to be NEGLIBLE and this rating is anticipated to remain unchanged provided that the recommended mitigation measures (monitoring, avoidance) for the sites be implemented, if / when required.

Heritage resources have been documented on Portion 2 of the farm Vlakpan 59 but no impact on these resources by the proposed Vlakpan Photovoltaic Power Plant is foreseen. In the opinion of the author of this Archaeological Impact Assessment Report, the proposed Vlakpan Solar Park Project may proceed from a culture resources management perspective, provided that mitigation measures provided in this assessment (monitoring, avoidance), endorsed by the relevant Heritage Resources authority, are implemented.

Table 6: Impact assessment matrix for the proposed footprint area of the Vlakpan Photovoltaic Power Plant development during the Pre-Construction, Construction, Operation and Closure Phases. Unique weight values indicated below

Site	Activity	Impact	P	D	S	M/S	Significance Before Mitigation		Mitigation Measures	P	D	S	M / S	Significance After Mitigation	
Pre-Construction, Construction, Operation and Closure									**Pre-Construction and Construction Phase**						
Site AGES-VP59-SA01 Site AGES-VP59-SA02 Site AGES-VP59-SA03 Site AGES-VP59-SA04 Site AGES-VP59-SA05 Site AGES-VP59-SA06	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	5	5	1	2	40	Low	Monitoring	1	1	1	2	4	Negligible

Aspect	Description	Weight	Aspect	Description	Weight	Aspect	Description	Weight	Aspect	Description	Weight	Aspect	Description	Weight
Probability	**Improbable**	**1**	Duration	**Short term**	**1**	Scale	**Local**	**1**	Magnitude/Severity	**Low**	**2**	Significance	Sum(Duration, Scale, Magnitude) x Probability	
	Probable	**2**		**Medium term**	**3**		**Site**	**2**		**Medium**	**6**		**Negligible**	**<20**
	Highly Probable	**4**		**Long term**	**4**		**Regional**	**3**		**High**	**8**		**Low**	**<40**
	Definite	**5**		**Permanent**	**5**								**Moderate**	**<60**
													High	**>60**

6.6 Heritage Management Actions

Recommendations for relevant heritage resources management actions are vital to the conservation of heritage resources. Recommended management actions may include the following:

- **No further action / Monitoring**

Where no heritage resources have been documented, heritage resources occur well outside the impact zone of any development or the primary context of the surroundings at a development footprint has been largely destroyed or altered, no further immediate action is required. Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage\ remains are destroyed.

- **Avoidance**

This is appropriate where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. Mitigation is not acceptable or not possible. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources.

- **Mitigation**

This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated to a degree of medium to low significance, e.g. the high to medium impact of a development on an archaeological site could be mitigated through sampling/excavation of the remains. Not all negative impacts can be mitigated.

- **Compensation**

Compensation is generally not an appropriate heritage management action. The main function of management actions should be to conserve the resource for the benefit of future generations. Once lost it cannot be renewed. The circumstances around the potential public or heritage benefits would need to be exceptional to warrant this type of action, especially in the case of where the impact was high.

- **Rehabilitation**

Rehabilitation is considered in heritage management terms as a intervention typically involving the adding of a new heritage layer to enable a new sustainable use. It is not appropriate when the process necessitates the removal of previous historical layers, i.e. restoration of a building or place to the previous state/period. It is an appropriate heritage management action in the following cases:

- The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.

- Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal

loss of historical fabric.

- Where the rehabilitation process will not result in a negative impact on the intrinsic value of the resource.

- **Enhancement**

Enhancement is appropriate where the overall heritage significance and its public appreciation value are improved. It does not imply creation of a condition that might never have occurred during the evolution of a place, e.g. the tendency to sanitize the past. This management action might result from the removal of previous layers where these layers are culturally of low significance and detract from the significance of the resource. It would be appropriate in a range of heritage contexts and applicable to a range of resources. In the case of formally protected or significant resources, appropriate enhancement action should be encouraged. Care should,

however, be taken to ensure that the process does not have a negative impact on the character and context of the resource. It would thus have to be carefully monitored.

The following heritage management actions are recommended for heritage resources documented in the Vlakpan Photovoltaic Power Plant footprint and study areas:

Site Site AGES-VP59-SA01 Site AGES-VP59-SA02 Site AGES-VP59-SA03 Site AGES-VP59-SA04 Site AGES-VP59-SA05 Site AGES-VP59-SA06	Mitigation: Action	Responsible Party	Time Frame
	Mitigation Surface collection and sampling of MSA artefacts by a Stone Age Specialist.	Qualified Stone Age Specialist Tertiary institution.	Before construction commences, during construction phases,
X	**Monitoring** Periodic monitoring of excavation activities during the construction period to ensure that no sub- surface deposits are missed	Contracted heritage practitioner, ECO	During construction period.
X	**Avoidance** Steps to adjust development planning in order not to impact on resources.	Developer, in conjunction with contracted heritage practitioner	During construction period.

7 RECOMMENDATIONS

The larger landscape around Hopetown and Kimberley along the Vaal River is rich in pre-historical and historical remnants but areas directly adjacent to the farm Vlakpan seem to have been less densely occupied during prehistoric and historic times. Cognisant of this landscape and the need for the conservation of its heritage resources, the following recommendations are made based on general observations in the proposed Vlakpan Solar Park Development Area:

- A Palaeontological Impact Assessment is recommended for the study area and, should fossil remains such as fossil fish, reptiles or petrified wood be exposed during construction, these objects should carefully safeguarded and the relevant heritage resources authority (SAHRA) should be notified immediately so that the appropriate action can be taken by a professional palaeontologist.
- During this study it was found that cultural material in this area occurs in lower lying areas, predominantly in association with exposed decomposing calcrete horizons in Hutton Sands. The occurrence of these Stone Tools strongly suggests that similar sites could be located elsewhere in the study area, potentially sub-surface. This is due to the area's close proximity to the Vaal River which renders it is prone to alluvial deposits that could burry potential Stone Age material. It is therefore recommended that a suitably qualified Heritage Specialist or Enviromental Control Officer (ECO) appointed by the developer for the general monitoring of the development during all stages of the project in order to regularly assess and ensure the preservation and conservation of these features, and to to avoid any possible impact on previously undetected heritage remains. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- A low density Middle Stone Age Scatter (**Site AGES-VP59-SA01, S29.42905 E23.26861)** occurs along a quarry site on the north-eastern periphery of footprint Alternative 1. This area has been adversely altered by quarry and digging activities and the occurrence is of limited scientific value due to the mixing of artefacts and the low density of the lithics. Two additional medium density lithic scatters (**Site AGES-VP59-SA02, S29.42706 E23.26129 & Site AGES-VP59-SA04, S29.43394 E23.25879)** occur in footprint Alternative 1. Formal tools have been identified among lithics scatters at the sites but since the sites are in both cases temporally mixed and contextually derived, these archaeological occurrences are considered to be of medium-low significance. A further medium density lithic scatters (**Site AGES-VP59-SA06, S29.42176 E23.24882)** occurs in footprint Alternative 2 where number of formal tools have been identified and the occurrences are considered to be of medium significance. Two Earlier Stone Age handaxes and rough stone flakes and cores recorded along a small ridge in the north-eastern sector of footprint Alternative 1 (**Site AGES-VP59-SA03, S29.42879 E23.26317)** are considered to be representative of the archaeological record of the immediate surroundings and the presence of formal tools is significant. In addition, a high density scatter of Earlier and Middle Stone Age material occurs at a watering holed and windmill approximately 200m north of footprint Alternative 2 in the direction of the large salt pan (**Site AGES-VP59-SA05, S29.418268 E23.252394).** A large number of formal tools such as hand axes, cleavers chopping tools are present at the site and the occurrence is significant. Since footprint Alternative 3 was specifically designed cognisant of these sensitive heritage receptors, to avoid impact on heritage receptors, no impact on the resources is foreseen. However, as stated above it is recommended that that any activities pertaining to the development in the area be monitored by a Heritage Specialist or Enviromental Control Officer (ECO) in order to avoid any possible impact on previously undetected heritage remains. In addition, to compensate for potential future cumulative

impacts, it is recommended that all Stone Age localities be avoided by the implementation 20m conservation buffers around each of the locations. Should any of the sites be directly impacted by development activities, it is recommended that they be recorded and that the cultural and archaeological context of the heritage resources be established by means of a limited Phase 2 Specialist Study. This study should minimally include a surface sampling and consequent analysis of the stone artefacts by a qualified Stone Age specialist, in order to elucidate the understanding of the development and spread of the MSA in the area. The Specialist should obtain the necessary permits from SAHRA for the in-situ analysis, possible collection and photography of the artefacts during the study

- It is essential that cognisance be taken of the larger archaeological landscape of the area in order to avoid the destruction of previously undetected heritage sites. It should be stated that it is likely that further undetected archaeological remains might occur elsewhere in the Study Area along water sources and drainage lines, fountains and pans would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the Solar Parks.

In addition to these site-specific recommendations, careful cognizance should be taken of the following:

- Water sources such as drainage lines, fountains and salt pans would often have attracted human activity in the past.
- As Palaeontological remains occur where bedrock has been exposed, such geological features should be regarded as sensitive in terms of impacts on fossilized resources.

8 GENERAL COMMENTS AND CONDITIONS

This AIA report serves to confirm the extent and significance of the heritage landscape of the proposed Vlakpan Solar Park Development area. The larger heritage horizon encompasses rich and diverse archaeological landscapes and cognisance should be taken of heritage resources and archaeological material that might be present in surface and sub-surface deposits. If, during construction, any possible archaeological material culture discoveries are made, the operations must be stopped and a qualified archaeologist be contacted for an assessment of the find. Such material culture might include:

- Formal Earlier Stone Age stone tools such as handaxes, choppers and cleavers.
- Formal Middle Stone Age stone tools such as points, blades and scrapers.
- Formal Later Stone Age stone tools such a microlithic blades, points and scrapers.
- Lithic residues and debris such as stone cores and flakes.
- Decorated and undecorated potsherds.
- Iron objects.
- Beads made from ostrich eggshell and glass.
- Ash middens and cattle dung deposits and accumulations.
- Animal bones and faunal remains.
- Human remains/graves.
- Stone walling or any sub-surface structures.

- Historical glass, tin or ceramics.
- Fossils.

If such site were to be encountered or impacted by any proposed developments, recommendations contained in this report, as well as endorsement of mitigation measures as set out by SAHRA, the National Resources Act and the CRM section of ASAPA will be required. Please note that this report is an archaeological scoping study only and does not include or exempt other required heritage impact assessments.

It must be emphasised that the conclusions and recommendations expressed in this archaeological heritage sensitivity investigation are based on the visibility of archaeological sites/features and may not therefore, represent the area's complete archaeological legacy. Many sites/features may be covered by soil and vegetation and might only be located during sub-surface investigations. If subsurface archaeological deposits, artefacts or skeletal material were to be recovered in the area during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately **(*cf.* NHRA (Act No. 25 of 1999)**, Section 36 (6)).

It must also be clear that Archaeological Specialist Reports will be assessed by the relevant heritage resources authority. The final decision rests with the heritage resources authority, which should give a permit or a formal letter of permission for the destruction of any cultural sites.

9 BIBLIOGRAPHY

Beaumont P B et al., 1989, Patterns in the Age and Context of Rock Art in the Northern Cape, *The South African Archaeological Bulletin*, Vol. 44, No. 150, pp. 73-81

Beaumont, P & Morris, D. 1990. Guide to archaeological sites in the Northern Cape. *McGregor Museum, Kimberley*

Beaumont, P.B., Smith, A.B. & Vogel, J.C. 1995. Before the Einiqua: The Archaeology of the Frontier Zone. In A.B. Smith (ed.) Einiqua/and, pp. 236 - 264. Rondebosch, UCT Press

Beaumont, P.B., 2004. Kathu Pan and Kathu Townlands/Uitkoms. In: Morris, D. & Beaumont, P.B. (Eds.), Archaeology in the Northern Cape: Some Key Sites. Southern African Association for Archaeologists Postconference Excursion, Kimberley, McGregor Museum: pp. 50–53;

Bergh,J.S.1999. Geskiedenisatlas van Suid-Afrika: die vier noordelike provinsies. Pretoria: J.L. van Schaik

Deacon,J. 1996.Archaeology for Planners, Developers and Local Authorities. National Monuments Council. Publication no. P021E.

Deacon, J.1997. Report: Workshop on Standards for the Assessment of Significance and Research Priorities for Contract Archaeology. In: Newsletter No 49, Sept 1998. Association for Southern African Archaeologists.

Guelke L and Shell Robert, 1992, Landscape of Conquest: Frontier Water Alienation and Khoikhoi Strategies of Survival, 1652 – 1780, *Journal of Southern African Studies*, Vol. 18, No. 4, pp. 803 – 824.

Hall, M. 1987. The Changing Past :Farmers, Kings & Traders in Southern Africa 200 – 1860 Cape Town, Johannesburg: David Philip

Hall, M. 1996. Archaeology Africa. Cape Town, Johannesburg: David Philip

Hallett R, 1984, Desolation on the Veld: Forced Removals in South Africa, *African Affairs*, Vol. 83, No. 332, pp. 301-320.

Humphreys, A.J.B. & Thackeray, A. 1. 1983. Ghaap and Gariep: Later Stone Age studies in the Northern Cape. The South African Archaeological Society Monograph Series No 2. Cape Town.

Kaplan, J. 2012. Archaeological Impact Assessment the proposed Construction of a 132kV powerline from the new proposed Smitskloof substation to the existing Mooidraai substation in the Northern Cape. ACRM Cape Town

Kaplan, J. 2011. Archaeological Impact Assessment the proposed Kwheza Power Energy Generation Facility near Prieska Northern Cape Province. Report prepared for Cape Lowlands Environmental Services. ACRM Cape Town.

Kaplan, J.2010. Archaeological Impact Assessment proposed photovoltaic power generation facility in Copperton, Northern Cape. Report prepared for DJ Environmental Consultants. ACRM Cape Town

Kruger,N.2012. Sishen Western Waste Rock Dumps: Sishen Iron Ore Mine, Kgalagadi District Municipality, Northern Cape Province. Phase 1 Archaeological Impact Assessment Report. Pretoria: AGES Gauteng (Pty)Ltd.

Morris, D. 1988. Engraved in Place and Time: A review of variability in the rock art of the Northern Cape and Karoo. South African Archaeological Bulletin 43: 109-121.

Morris, D. 1990. West of the Langeberg: Witsand and Nokaneng. In Guide to Archaeological sites in the Northern Cape. (eds) Beaumont, P. & Morris, D.

Morris, D. 2007a. Archaeological Specialist Input with respect to upgrading railway infrastructure on the Sishen-Saldanha Ore Line: borrow pits at Loop 16

Morris, D. 2011. Archaeological Impact Assessment Phase 1 (upgraded): Proposed expanded development of PV Power Station at Greefspan, near Douglas, Northern Cape. Kimberley: McGregor Museum.

Phillipson, D.W. 1985. African Archaeology (second edition). Cambridge: Cambridge University Press

Renfrew, C & Bahn, P. 1991. Archaeology: Theories, Methods and Practice USA: Thames & Hudson

Sharer, A.J & Ashmore, W 1979. The Nature of Archaeological Data California: Benjamin/Cummings Publishing

Snyman P H R, 1985, Postmasburg en die tweede Vryheidsoorlog, *The South African Military Society*, Vol. 6 No. 6, pp 1-8.

Swanepoel, N. et al (Eds.) 2008. Five hundred years rediscovered. Johannesburg: Wits University Press

Soriano, S, Villa, P & Wadley, L. 2007. Blade technology and tool forms in the Middle Stone Age of South Africa: the Howiesons Poort and post-Howiesons Poort at Rose Cottage Cave. *Journal of Archaeological Science* 34:681-703.

Webley, L & Halkett, D. 2008. Phase 1 Heritage Impact Assessment: proposed prospecting on the Farm Adams 328 and Erin 316 Kuruman. Ga-segonyana Municipality. in the Northern Cape. Report prepared for Zama Mining Resources (Pty) Ltd. Archaeology Contracts Office, Department of Archaeology, University of Cape Town.

Wilkins, J. & Chazan, M. 2012. Blade production ~500 thousand years ago at Kathu Pan 1, South Africa: support for a multiple origins hypothesis for early Middle Pleistocene blade technology. Journal of Archaeological Science

Webley, L. 1990. The use of stone 'scrapers' by semi-sedentary pastoralist groups in Namaqualand, South Africa. South African Archaeological Bulletin 45:28-32.

Webley, L.; Lanham, J. & Miller, D. March 2010. Scoping Heritage Impact Assessment: Proposed prospecting on 20* farms in the Olifantshoek and Kuruman areas of the Northern Cape

Human Tissue Act and Ordinance 7 of 1925, Government Gazette, Cape Town

National Resource Act No.25 of 1999, Government Gazette, Cape Town

http://csg.dla.gov.za/index.html
Accessed 2014-05-15