



**TITA ENERGY (PTY) LTD: PHOTOVOLTAIC POWER PLANT
DEVELOPMENT ON PORTION 1 OF THE FARM AVONDALE 410,
UPINGTON, NORTHERN CAPE PROVINCE**

Archaeological Impact Assessment

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

April 2014



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ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF A DEMARCATED SURFACE PORTION ON THE FARM AVONDALE 410 FOR THE PROPOSED AVONDALE 1 PHOTOVOLTAIC POWER PLANT DEVELOPMENT, //KHARA HAIS LOCAL MUNICIPALITY, ZF MGCWU DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

April 2014

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I, Nelius Le Roux Kruger, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed Avondale 1 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;
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- 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 April 2014

EXECUTIVE SUMMARY

This report details the results of an Archaeological Impact Assessment (AIA) study on Portion 1 of the farm Avondale 410, subject to an Environmental Impact Assessment (EIA) process for the proposed Avondale 1 Solar Park Project in the //Khara Hais Local Municipality, Zf Mgcawu 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 Upington area and many of these studies infer a varied and rich heritage landscape. However, the landscape directly surrounding the Avondale property seems to have been relatively sparsely populated by humans in the past, possibly as a result of the general scarcity of sustainable water sources as well as the absence of hills or outcrops for shelter. For the Avondale 1 Solar Park Project, an initial footprint area was identified and at least 7 areas of archaeological or heritage potential were located during the AIA survey of this project footprint area covering approximately **380ha** in total. The footprint area was then revised to incorporate initial recommendations pertaining to these sensitive heritage receptors.

Stone Age:

During this study it was found that cultural material, specifically Stone Age scatters in this area occur in lower lying areas, predominantly in association with exposed decomposing calcrete horizons. The abundance of locally available raw material implies a prominent Stone Age presence and specifically Middle Stone Age (MSA) artefacts consisting of cores, blades and scrapers occur widely in the area. **Site AGES-DA1400-SA01** comprises a low density Middle Stone Age scatter of low significance. The site occurs away from the development footprint but should any activities occur in this area, it is recommended that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains. A medium density MSA scatters (**Site AGES-AD410-SA02**, occur along the southern portion of the farm Avondale. The site occurs away from the development footprint but should any activities occur in this area, it is recommended that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains. A medium-low density Middle Stone Age scatters (**Site AGES-AD410-SA03**) were documented in a central portion of the property and, are of limited significance. It The site occurs away from the development footprint but should any activities occur in this area, it is recommended that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains. Another medium density MSA scatter (**Site AGES-AD410-SA04**) occurs at a water pan in central sections of the property. These MSA representations are of scientific interest due to the occurrence of formal diagnostic MSA lithics and the site should be monitored during construction and operational phases of the development. Even though the site is excluded from the proposed development it does occur close to the development footprint. It is recommended that, should if this MSA scatter be directly impacted by development activities, the site be recorded and that the cultural and archaeological context of the heritage resource 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. Another medium-low density Middle Stone Age scatter (**Site AGES-AD410-SA05**) occurs in a northern portion of the study area near the proposed footprint, and is of limited significance. It is recommended that any activities pertaining to the

development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains. Finally, a medium-low density Middle Stone Age scatter (**Site AGES-AD410-SA06**) occurs in the footprint of the Solar Park development. However, the feature is of limited significance and it is recommended that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains.

The distribution pattern of Stone Age material on Avondale 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 Orange 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.

Historical/ Colonial Period:

The Historical Period Avondale farmhouse and labourers quarters (**Site AGES-AD410-HP01**) occur in the south-eastern corner of the study area. The structures are older than 60 years and are of medium heritage significance. The site occurs on the margin of the development area and will probably not be impacted on by the proposed development. However, should the structures / features be directly impacted by development activities, the sites should be carefully documented and a destruction permit from the relevant heritage resources authority (SAHRA) should be obtained.

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.

Heritage resources have been documented in the Avondale 1 Photovoltaic Power Plant footprint area and impact on these resources is anticipated. However, in the opinion of the author of this Archaeological Impact Assessment Report, the proposed Avondale 1 Solar Park Project on Portion 1 of the Farm Avondale 410 may proceed from a culture resources management perspective, provided that mitigation measures provided in this assessment, endorsed by the relevant Heritage Resources authority, are implemented where applicable.

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.

¹⁴C or radiocarbon dating:

The ¹⁴C 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.

Oral Histories:

The historical narratives, stories and traditions passed from generation to generation by word of mouth.

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 \pm 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)

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1 BACKGROUND

1.1 Scope and Motivation

AGES Gauteng was commissioned by Tita Energy (Pty) Ltd for an Archaeological Impact Assessment (AIA) study of Portion 1 of the farm Avondale 410, subject to an Environmental Impact Assessment (EIA) process for the proposed Avondale 1 Solar Park Project, //Khara Hais Local Municipality, Zf Mgcawu 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 Avondale 1 Solar Park Solar Park is proposed on the farm Avondale where an area covering 200ha has initially been identified as alternative for the plant (see Figure 1-1). However, this footprint area was significantly altered to incorporate recommendations pertaining to sensitive ecological, heritage and geo-hydrological specialist recommendations see (Figure 1-2).

The solar facility will have a maximum generating capacity **up to 75 MW**. As noted above, the PV power plant will cover a footprint (fenced area) **up to 180 ha** within the study area, 1430 ha in extent. 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").

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.
- **Interventions on the Eskom's network:** the connection may also entail interventions in the "Garona - Gordonia" 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.

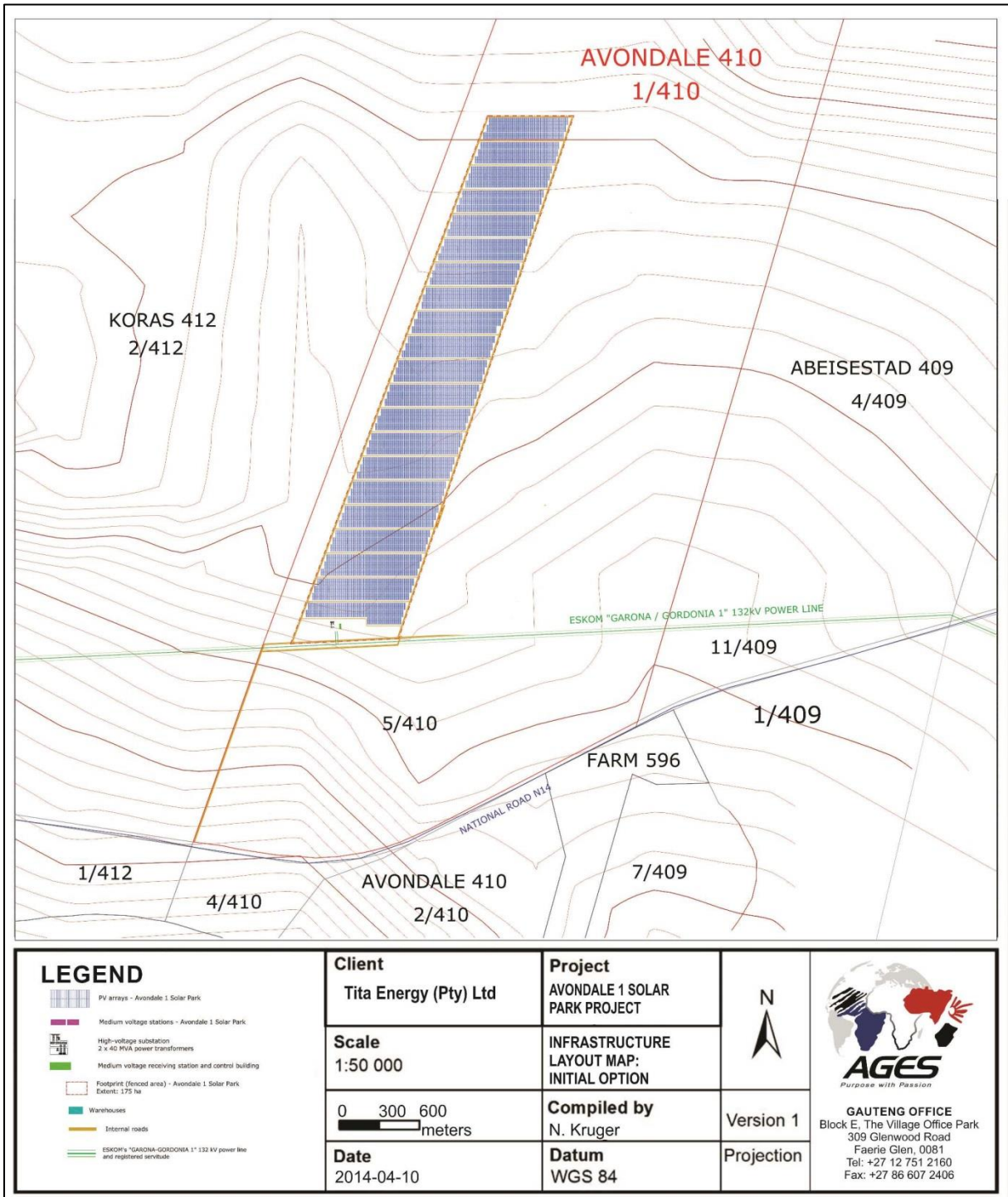


Figure 1-1: Map representation of the initial footprint proposed for the Avondale 1 Solar Park Development.

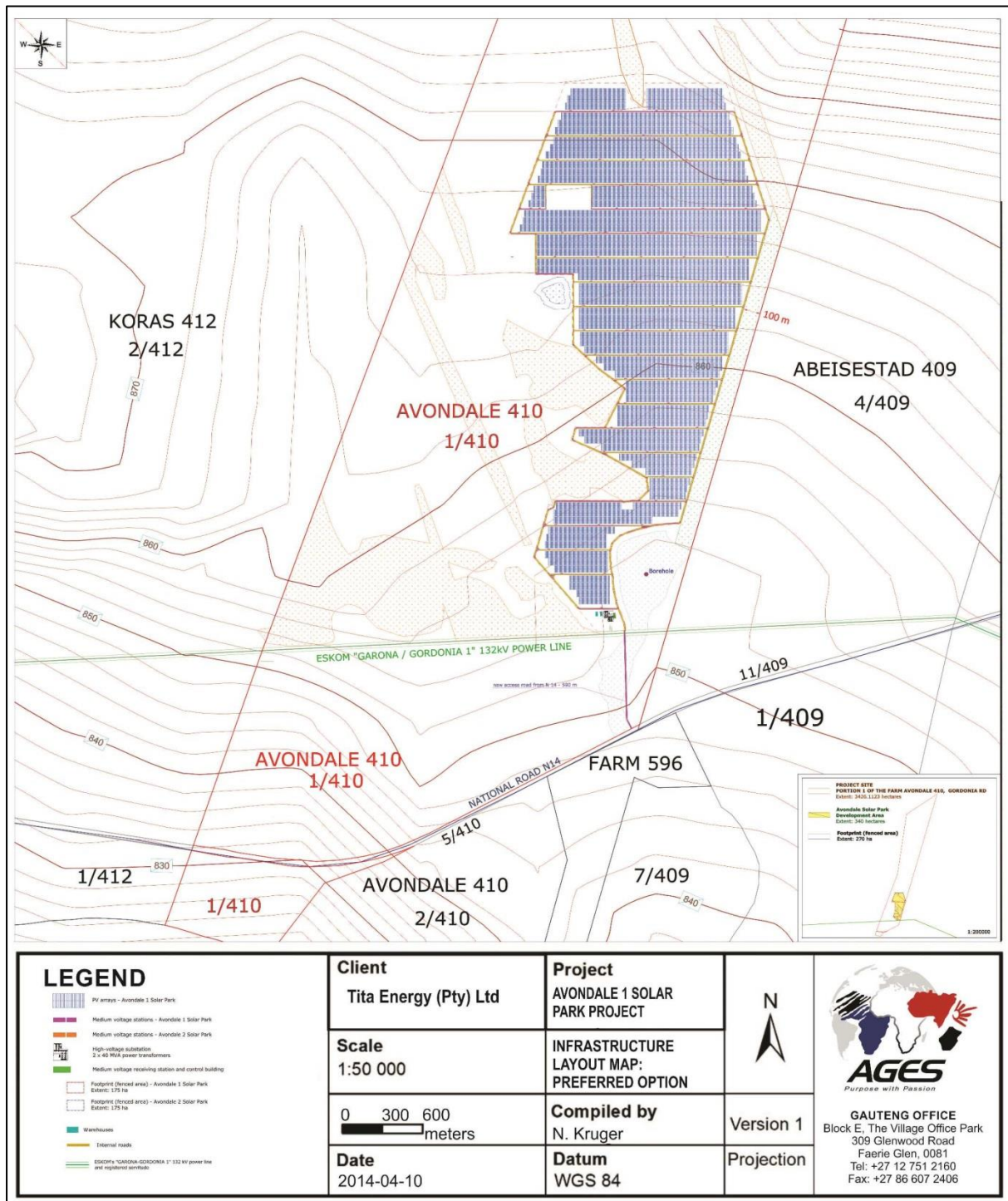


Figure 1-2: Map representation of the revised and preferred footprint area for the Avondale 1 Solar Park Development.

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 m² 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 m² 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 1 of the Avondale 410, //Khara Hais Local Municipality, Zf Mgcawu District Municipality, Northern Cape Province. The proposed project is situated slightly north-east of Upington, with the footprint planned to the north of the Eskom "Garona - Gordonia" 132 kV power line, generally at **S28°21'35.55" E21°33'39.48"** (1:50 000 Map Reference 2821BC) (see Figure 2-1).

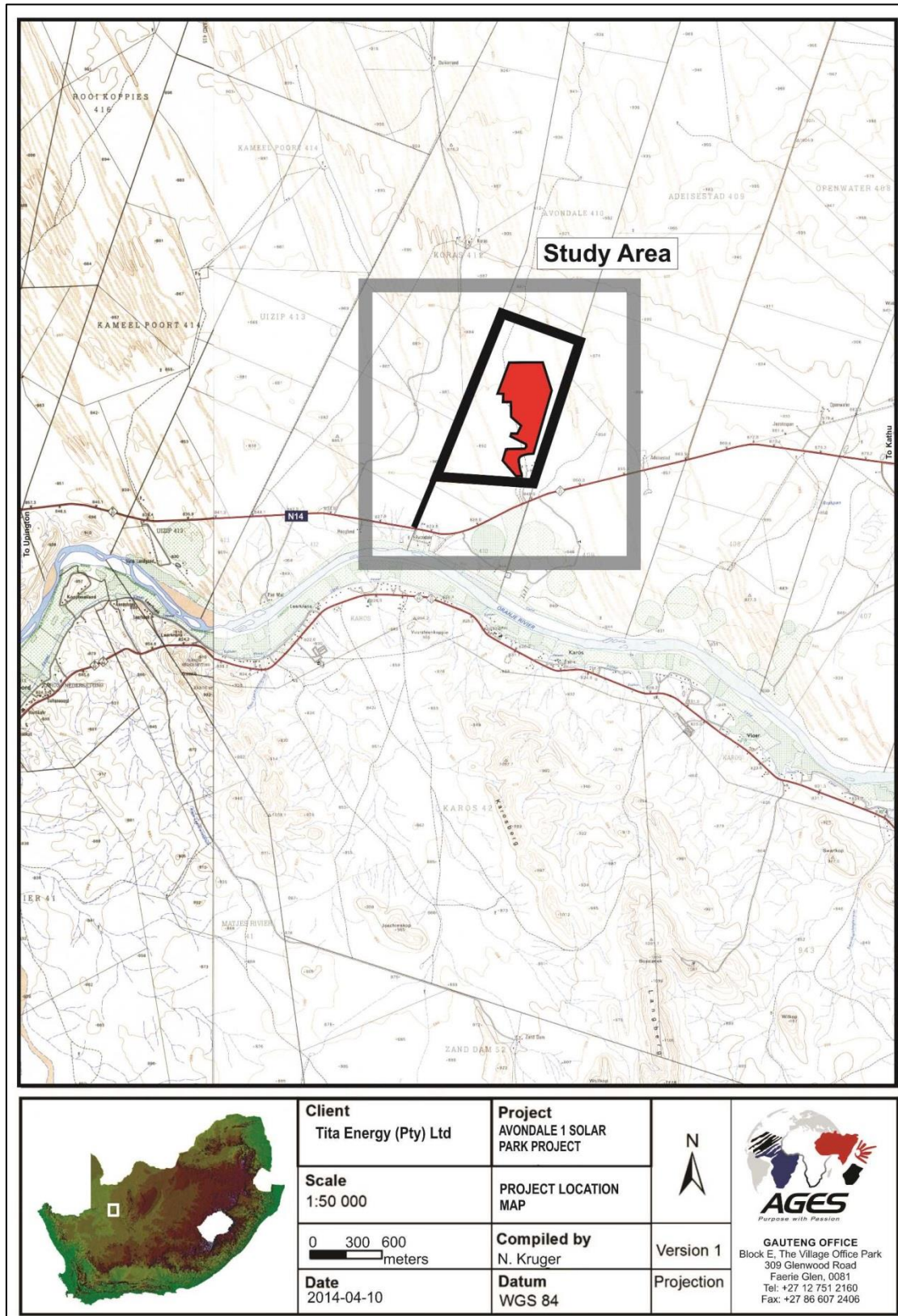


Figure 2-1: 1:50 000 Map representation of the location of the Avondale 1 Solar Park Development location (2821BC). The farm Avondale is indicated in black outline and the proposed project footprint is shaded in red.

2.2 Area Description: Receiving Environment¹

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 most recent classification of the area by Mucina & Rutherford (2006) shows that the sites forms part of the Gordonia Dunveld vegetation type. The landscape features of the Gordonia Dunveld vegetation type are mostly parallel dunes with an open shrubland woody structure and ridges of grassland dominated by *Stipagrostis amabilis* on the dune crests and *Acacia haematoxylon* on the dunes slopes.



Figure 2-2: General surroundings on a central of the farm Avondale at the preferred footprint area for in the Avondale 1 Solar Park, at the time of the field survey (March 2014).



Figure 2-3: General surroundings towards the western boundary farm Avondale, note dune occurrences.

¹see Henning, B. 2014. AN ENVIRONMENTAL REPORT ON THE ECOLOGY (FLORA AND FAUNA) FOR THE PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON PORTION 1 OF THE FARM AVONDALE 410, NORTHERN CAPE PROVINCE

2.3 Site Description

The farm Avondale is constituted out of 2 land facets namely dunes as high-gradient hills in the western and northern section of the site, and slightly undulating plains on shallow calcareous soils across the remainder of the site. As such, the western portion of the property, where the preferred site for the solar facility has been demarcated, is characterized by dunes and relatively heavy vegetation. The eastern and northern portions of the farm less densely vegetated, and covered in mostly soft red sands and decomposing calcrete formations. A small calcrete quarry occurs in the south-eastern extremity 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. Existing infrastructure comprises several dams/water holes, concrete drinking troughs, feeding bins and a farmstead. 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.

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 Uppington 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.

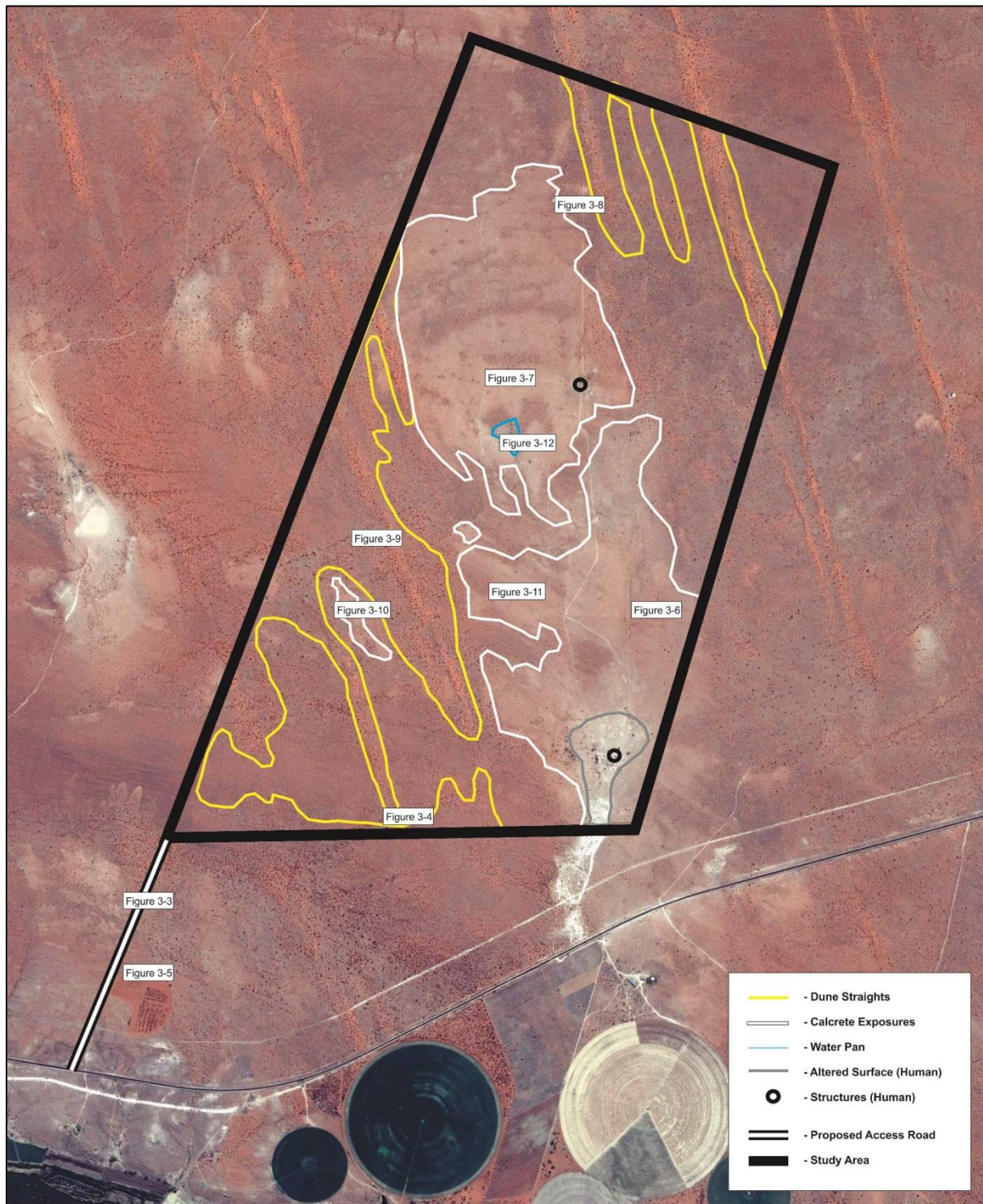


Figure 3-1 Aerial imagery of the farm Avondale, indicating the extent of dune occurrences (yellow lines) as well as calcrete exposures (white lines) which also seems to give an indication of the locations of surface Stone Age occurrences. The geographical locations where Figures 3-3 to 3-11 were captured are indicated for reference.

3.1.3 Field Survey

Archaeological survey implies the systematic procedure of the identification of archaeological sites. An archaeological survey of the footprint areas proposed for the Avondale 1 Solar Park project was conducted in March 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 corridor was systematically surveyed on foot and by motor vehicle, GPS reference points were visited and random spot checks were made (see detail in previous section). Using a Garmin E-trex Legend GPS objects and structures of archaeological / heritage value were recorded and photographed with 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.

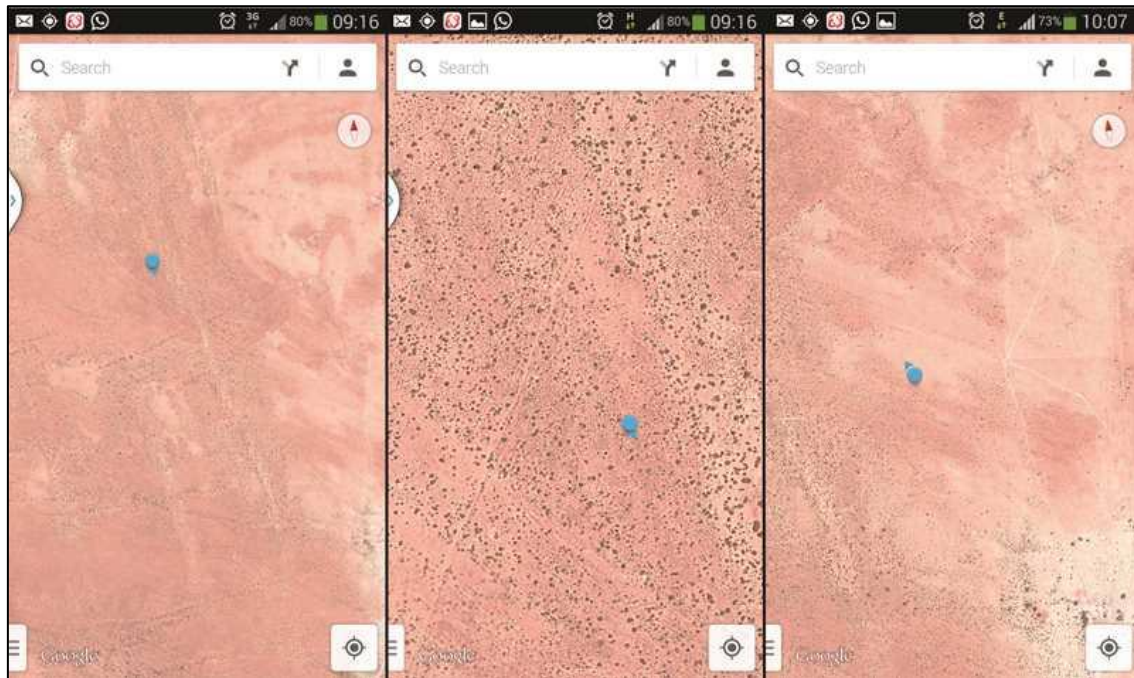


Figure 3-2: Captured screen contents of real time mobile aerial orientation representations employed during the field survey, current field location indicated by blue marker.

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 Avondale 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

Portion 1 of the farm Avondale is accessed directly via the N14 national route which connects to the towns of Upington and Kathu. 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 western portion of Avondale is covered in more dense Thornveld vegetation and visibility proved to be a constraint when approaching the study. The eastern portion of the property is covered in less dense vegetation and archaeological visibility was consequently better in these areas. The general visibility at the time of the initial AIA survey (March 2012) therefore ranged between moderate to high visibility in areas to the east, and moderate visibility in the central and western portions of the study area (see Figures 3-3 to 3-12). In single cases during the survey sub-surface inspection was possible. Where applied, this revealed no archaeological deposits.

(Refer to Figure 3-1 for geographical references to site images)



Figure 3-3: View of the study area at the proposed access road route, looking south.



Figure 3-4: View of the southern periphery of the study area.



Figure 3-5: Disturbed and altered surface cover along the southern periphery of the study area.



Figure 3-6: View of calcrete exposures along a central portion of the farm Avondale.



Figure 3-7: View of calcrete exposures along a central portion of the farm Avondale.



Figure 3-8: View dunes and drainage line along the western portion of Avondale.



Figure 3-9: View dune veld along the western portion of Avondale



Figure 3-10: Sand cover and calcrete exposures in a north-western portion of Avondale



Figure 3-11: General surroundings on an eastern portion of Avondale

3.2.3 Limitations and Constraints

The pedestrian site survey for the Avondale 1 Solar Park Project AIA primarily 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 tow 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 Avondale 1 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 Plomp² 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 Avondale 1 Solar Park study area were arbitrarily coded **AGES-AD410-SAxx** (AGES Avondale 410 Stone Age Site) and **AGES-AD410-HPxx** ("AGES Avondale 410 Historical Period Site).

4.1 The Stone Age

Middle Stone Age and Later Stone Age scatters and quarries occur frequently in low lying areas on plains between dune straights and outcrops in the Uppington area. 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.

During the site survey, widespread Middle Stone Age (MSA) material was documented in the survey area, specifically near water sources and in most cases in association with exposed decamping calcrete deposits. 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 m² 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).

² Plomp, H., 2004

- **Site AGES-AD410-SA01: S28.37551 E21.55070 (Low Density MSA Scatter)**

A low density Middle Stone Age Scatter was identified along the initial proposed route for the access road south of the study area. The lithic remains are scattered as individual artefacts where precipitation and groundwater have exposed the stone tools. Typologically, the artefacts can tentatively attribute to the Middle Stone Age. This area has been adversely altered by agricultural activities and the occurrence is of limited scientific value due to the mixing of artefacts and the low density of the lithics.



Figure 4-1: View of crop fields at Site AGES-AD410-SA01.



Figure 4-2: A retouched blade from Site AGES-AD410-SA01.

- **Site AGES-AD410-SA02: S28.37023 E21.55361 (Medium Density MSA Scatter)**
- **Site AGES-AD410-SA04: S28.35224 E21.57061 (Medium Density MSA Scatter)**

Two medium density scatters lithic scatters were identified in low lying areas, the first along a rocky outcrop to the southern periphery of the study area and the other near a small natural water pan in a central portion of the study area where precipitation and groundwater have exposed the stone tools, originally deposited below and within a decomposed calcrete rock layer. 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, indicated that a number of flakes displayed faceted 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. 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. The sites bear scientific value and potential, and are of medium significance.



Figure 4-3: View of general surroundings at Site AGES-AD410-SA02.



Figure 4-4: View of a small water pan at Site AGES-AD410-SA04.

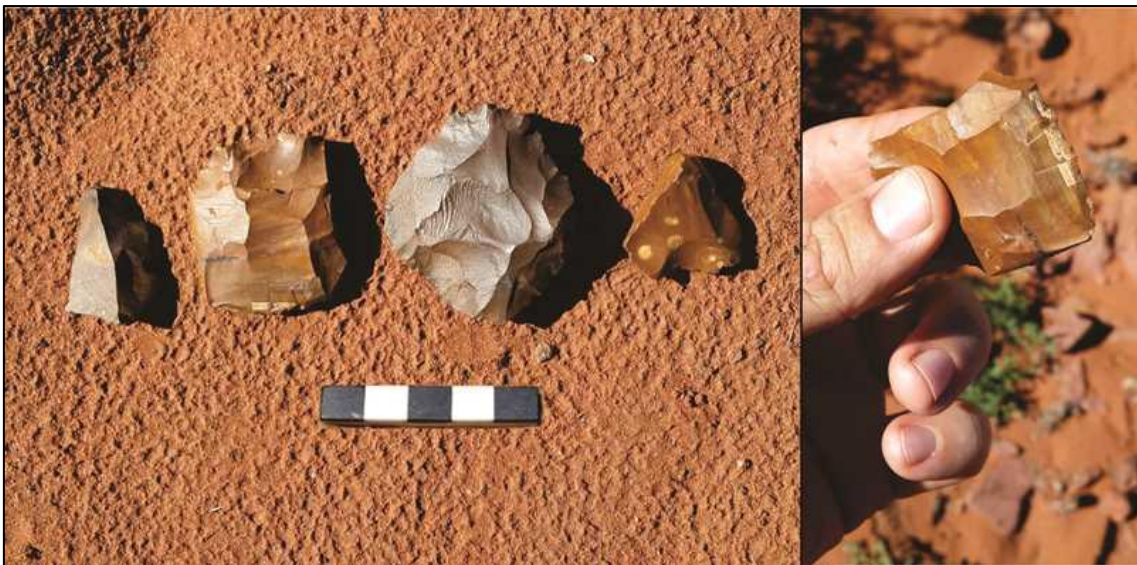


Figure 4-5: Surface collection of MSA lithics on image right; point (right), side scraper (middle) and end scraper (middle left) from Site AGES-AD410-SA02. Note secondary retouch on end scraper on image right.



Figure 4-6: Highly weathered MSA lithics from Site AGES-AD410-SA04.



Figure 4-7: Secondary retouch visible on point and scraper from Site AGES-AD410-SA04.



Figure 4-8: Secondary retouch visible on two weathered points from Site AGES-AD410-SA04.

- Site AGES-AD410-SA03: S28.36356 E21.56461 (Medium-Low Density MSA Scatter)
- Site AGES-AD410-SA05: S28.34918 E21.56790 (Medium-Low Density MSA Scatter)
- Site AGES-AD410-SA06: S28.34647 E21.57269 (Medium-Low Density MSA Scatter)

A number of medium-low density lithic scatters were observed across the study area. More specifically, three scatters, clustered along accrete occurrences in central portions of the study were documented where precipitation and groundwater have exposed the stone tools. Not many formal tools were noted with but the collection shows a predominant MSA signature. 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. These sites are probably of limited scientific value due to the low occurrence of diagnostic lithics and the general loss of context due to the displacement of tools by natural processes.

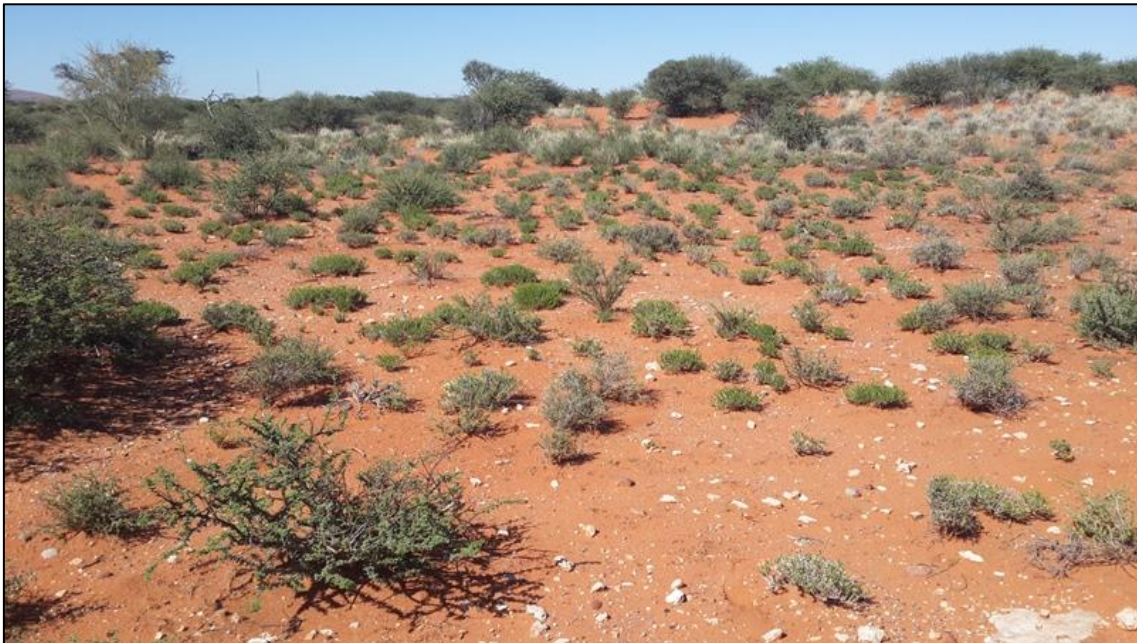


Figure 4-9: View of general surroundings at Site AGES-AD410-SA03.



Figure 4-10: View of general surroundings at Site AGES-AD410-SA05. Note calcrete surface occurrences.



Figure 4-11: View of general surroundings at Site AGES-AD410-SA06.



Figure 4-12: Secondary retouch visible on MSA flake (left), weathered broken blade (centre) and point (right) from Site AGES-AD410-SA05 and Site AGES-AD410-SA06.



Figure 4-13: A selection of weathered cores and possible chopper from Site AGES-AD410-SA03.

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

- Site AGES-AD410-HP01: S28.36684 E21.57506 (Historical Period Structures)

Upton is surrounded by farming communities and Historical and Colonial Period houses, labourer's quarters and other related infrastructure occur across the landscape. A small farm house structures and two other associated buildings (farmworkers houses) occur in the south-eastern corner of the study area. The flat-roofed farm house structure is approximately 12m x 4m in extent with a car port added at the back. The farmworker houses are smaller and measures approximately 5m x 4m. These structures have been altered and recent upgrades on the structure walls are visible. According to the farm owner, the small farm house was the original

Avondale residence and it was occupied through the 20th century until the late 1960's. The structure is thus older than 60 years and of historical importance. It is currently used to store cattle feed.



Figure 4-14: The old Avondale farmhouse and farmsteads (Site AGES-AD410-HP01)



Figure 4-15: Worker's houses at the Avondale farmsteads at Site AGES-AD410-HP01.

4.4 Graves

No graves or burial sites were observed in the survey area.

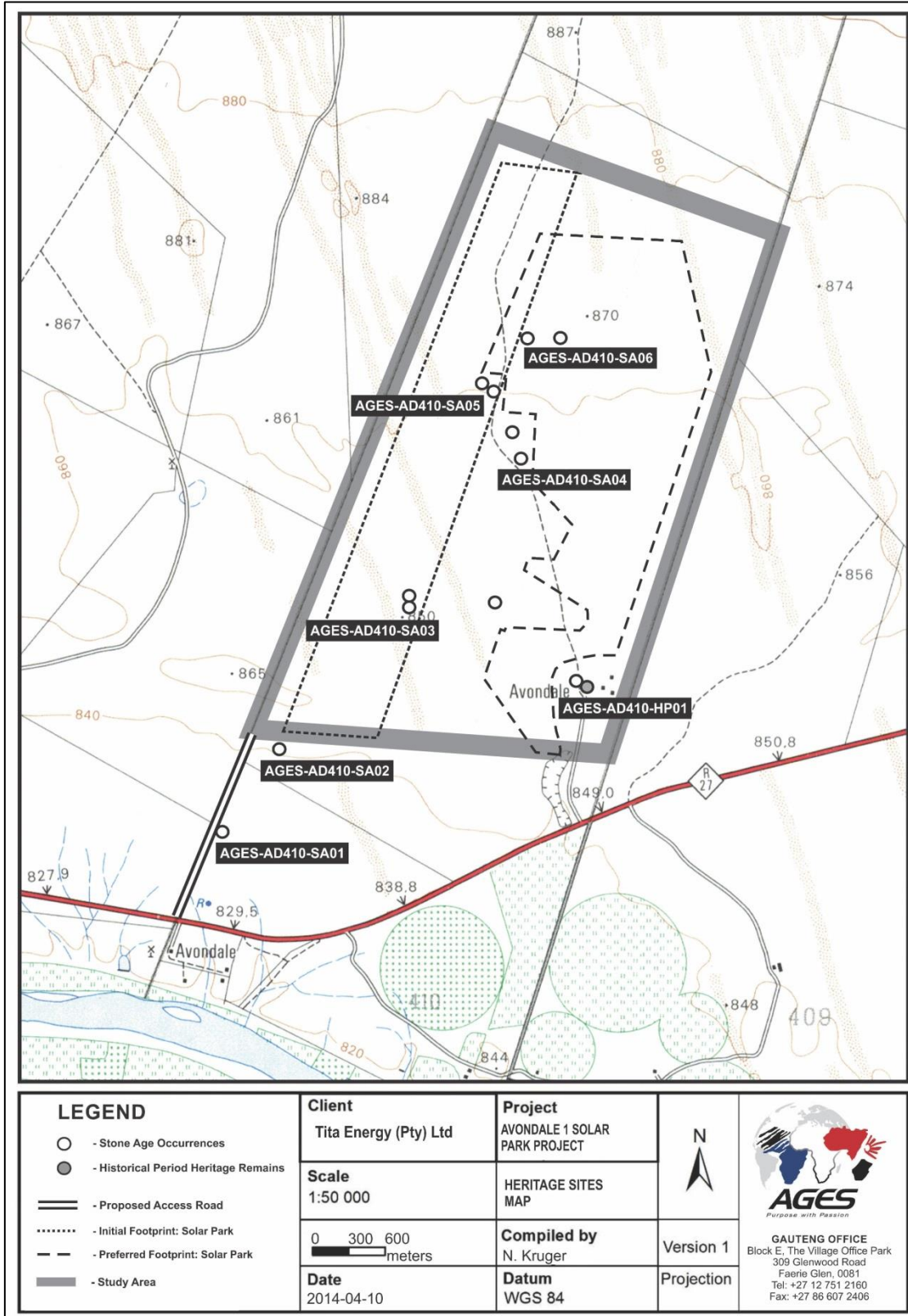


Figure 4-16: Map of heritage sites discussed in the text.

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: <i>Australopithecines</i> <i>Homo habilis</i> <i>Homo erectus</i>	Typically large stone tools such as hand axes, choppers and cleavers.
Middle Stone Age 250 000 – 25 000 YCE	Pleistocene	First <i>Homo sapiens</i> species	Typically smaller stone tools such as scrapers, blades and points.
Late Stone Age 20 000 BC – present	Pleistocene / Holocene	<i>Homo sapiens sapiens</i> 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 kill 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 extent 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 Upington Area: Specific Themes

The history of the Northern Cape Province is reflected in a rich archaeological landscape, mostly dominated by Stone Age occurrences. However, Webley & Halkett (2008) have noted that there has been very little archaeological work undertaken north of Kuruman, but there are reports of rock engravings to the north of the town. Most of our knowledge of the archaeology of the region is largely dependent on the work undertaken by Humphreys & Thackeray (1983) to the south of Kuruman, and 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 Kuruman 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 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 Previous Research Studies

A large number of heritage studies have been conducted in the larger Upington area. Most of these studies have emanated from Impact Assessment measures for EIA purposes commissioned by the private sector. These studies all point to a landscape of limited human ecology, probably the result of scarce water sources and the general absence of and hills or outcrops for shelter. Some of the studies include:

Heritage Impact Assessment for the Proposed Establishment of the Ilanga Solar Thermal Power Plant, near Upington, Northern Cape

Heritage Impact Assessment of the proposed Hydropower station on the Orange River at Neus Island on the farm Zwartbooisberg, east of Kakamas, Northern Cape

First Phase Archaeological & Heritage Assessment of the Housing Developments at Melkstroom 563, Upington, Northern Cape

Phase 1 Archaeological Impact Assessment Report on Portions of the Farm Alheit near Kakamas, Siyanda District Municipality, Northern Cape Province.

HIA for the construction of five substations along the Sishen-Saldanha railway line.

Report on a Phase 1 Archaeological Assessment of the site of proposed Borrow Pits for road- building purposes along Road MR 897 in the vicinity of Swartkop, Jooste Island, near Upington, Northern Cape.

Report on a Phase 1 Archaeological Assessment of the site of proposed Borrow Pits for road- building purposes along Road DR 3322 at Karakoel near Upington, Northern Cape.

Heritage Impact Assessment Report for the Proposed Establishment of the African Rainbow Energy, Upington.

Heritage Scoping Assessment for the Proposed Establishment of the Medenergy Upington PV Power Plant.

Archaeological Impact Assessment for the Environmental Impact Management Plan for the Proposed Upington Solar Thermal Plant, Northern Cape Province.

Heritage Impact Assessment for the Proposed Kangnas Wind and Solar Energy Facilities, Namakwa Magisterial District, Northern Cape

Proposed Kwartelspan PV Power Station I and Associated Infrastructure, Pixley ka Seme District Municipality, Northern Cape Province.

5.2.2 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). In contrast with this the areas towards the west could possibly sustain specialized foraging for much longer. In the absence of rock outcrops, no rock art sites are known.

Earlier Stone Age sites have been documented to the south of Eenzaamheid Pan in areas strewn with Dwyka tillite, which provided ample raw material. John Masson (2006) has reported such material at Eenzaamheid Pan. Other known sites in the region are Biesje Poort 2, about 10 km to the west, where an extensive Doornfontein site was dated to 1400 BP (Beaumont et al. 1995), and Renosterkop, 10km to the south west, where two Ceramic LSA sites were found, the one, in a small shelter (Morris & Beaumont 1991). This site and another cave site closer to Keimoes (Smith 1995), are the only regional sites to have yielded stratified successions, with both indicating a MSA presence of likely early MIS 5 age and then LSA occupations of the Holocene. Some Acheulean sites are found on the farms Droëhout and Ratel Draai, however these are not stratified (Beaumont et al. 1995).

Late Holocene Later Stone Age (LSA) sites are often mentioned in surveys in the wider region and along the Orange River (e.g. Morris & Beaumont 1991; Beaumont et al. 1995). These are most probably short-duration occupations by groups of hunter-gatherers. In contrast, there are substantial herder encampments along the Orange River floodplain itself (Morris & Beaumont 1991) and in the hills north of Kakamas (Parsons 2003). Beaumont et al. (1995:240-1) notes a widespread low-density stone artefact scatter of Pleistocene age across much of Bushmanland to the south where raw materials from Dwyka glacial till produced mainly quartzite cobble. Similar occurrences have been noted north of Upington closer to the study area, in situations where raw materials are abundant. Systematic collections of this material at Olyvenkolk south west of Kenhardt and Maans Pannen east of Gamoep could be separated out by abrasion state into a fresh component of Middle Stone Age (MSA) with prepared cores, blades and points, and a large aggregate of moderately to heavily weathered Earlier Stone Age (ESA) (Beaumont et al. 1995).

Very low density "off-site" scatters of ESA and MSA material has been noted over large areas on plains both north and south of the Orange River where raw materials are less readily to hand. These most likely reflect opportunistic knapping of nodules of raw material. These once again could also be anticipated on site (Parsons 2003). Webley (2009) mentions the possibility of discovering Middle Stone Age artifacts on the dune plains. Such artifacts have been reported by Morris (2007a) from the Groblershoop area, while Webley, Lanham & Miller (2010) have recovered similar scatters to the east of the Langeberg. These have been found on the edge of calcrete-lined pans and in road cuttings (Webley & Halkett, 2010). Both Middle and Later Stone Age sites have been reported from amongst the dunes to the south of the Langeberg, at Witsand (Morris 1990). The LSA here is classified as Wilton and includes scrapers and backed pieces. Some sites also contain pottery and are termed Ceramic LSA assemblages. Webley, Lanham & Miller (2010) have found a ceramic LSA site on the farm Gaston some 20km northeast in the foothills of the Langeberg Mountains (Webley & Halkett, 2010).

5.2.3 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).

5.2.4 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 Tlhaping 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 Tlhaping 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-Difqane 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).

5.2.5 Later History: Historical archaeology and living heritage

The German missionary Rev Schröder founded the town of Upington, originally known as Olijvenhoutsdrift, in 1871 as part of a mission station. The town was renamed in 1884 after Sir Thomas Upington, who was the

Prime Minister of the Cape Colony and who visited the town in 1884. In 1895 British Bechuanaland became part of the Cape Colony, which meant that the Lower Orange River regions, Gordonias, Namaqualand and Bushman land, now fell under the Cape Colonial Government. The farm Avondale was established in 1892.

During the Anglo-Boer War, areas around Kuruman to the east played a strategic role and towns such as Postmasburg, situated about 200km east of Upington, acted as an important link between the Boer forces from Transvaal to the Cape Colony south of the Orange River, providing ammunition and horses (Snyman 1985). The oral and written history of the Northern Cape pertaining to the last centuries is relatively abundant resulting from an assimilation of local folklore and Historical sources such as missionary accounts. The Historical period commenced when pioneers (in most cases, missionaries) arrived between the nineteenth century and early twentieth century, depending on the region. Later, larger populations established villages in the area, some of which are often still occupied today. During the 1930's some of the Tswana communities consisted of a wealth of cattle that could be used to gain capital and purchase additional land. The Khoisan and Khoikhoi communities were not so lucky, because they were mostly used as labourers at various Tswana and European households (Wylie 1989).

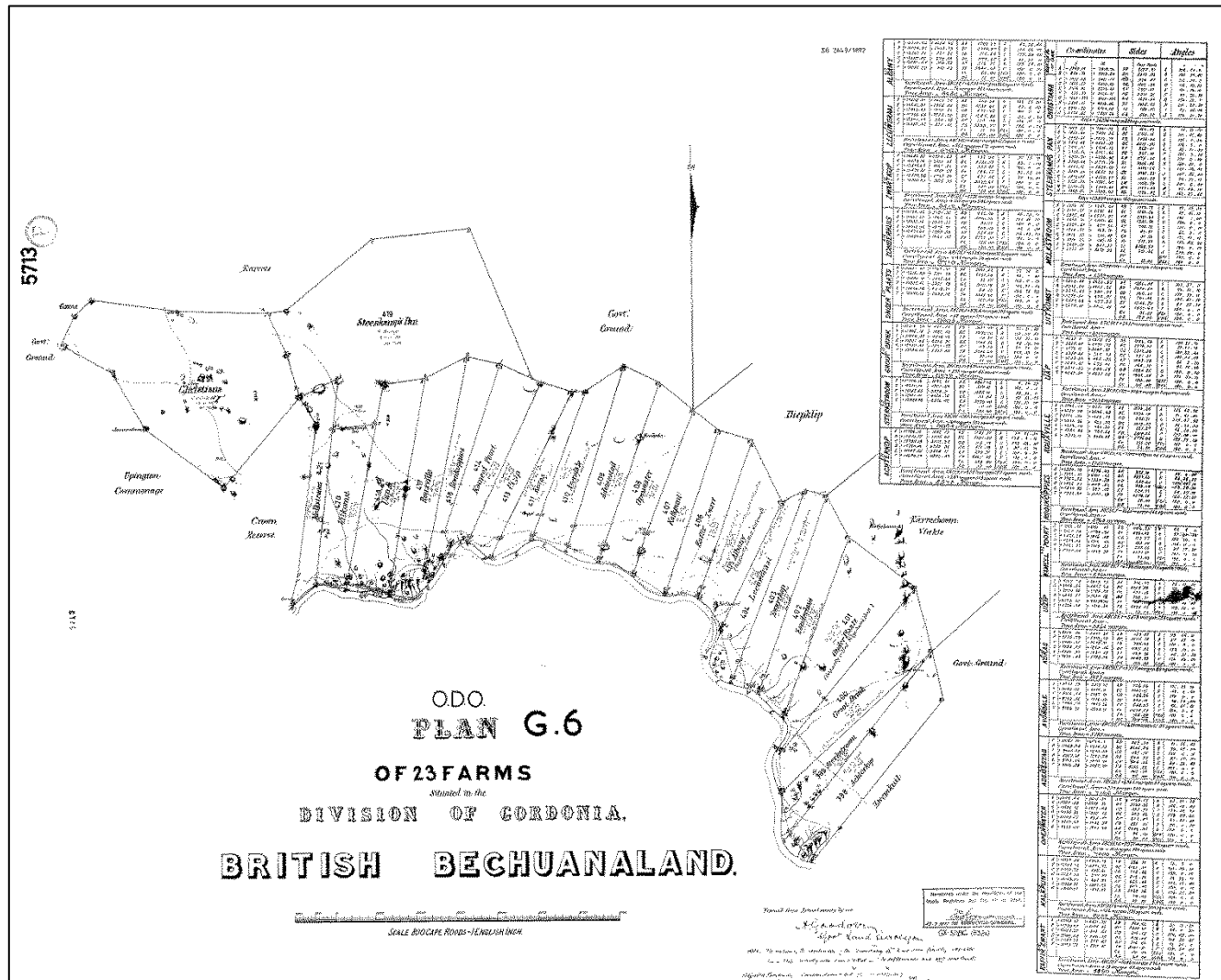


Figure 5-1: Historical map of proclaimed farms in “British Bechuanaland” dating to the last part of the 19th century.

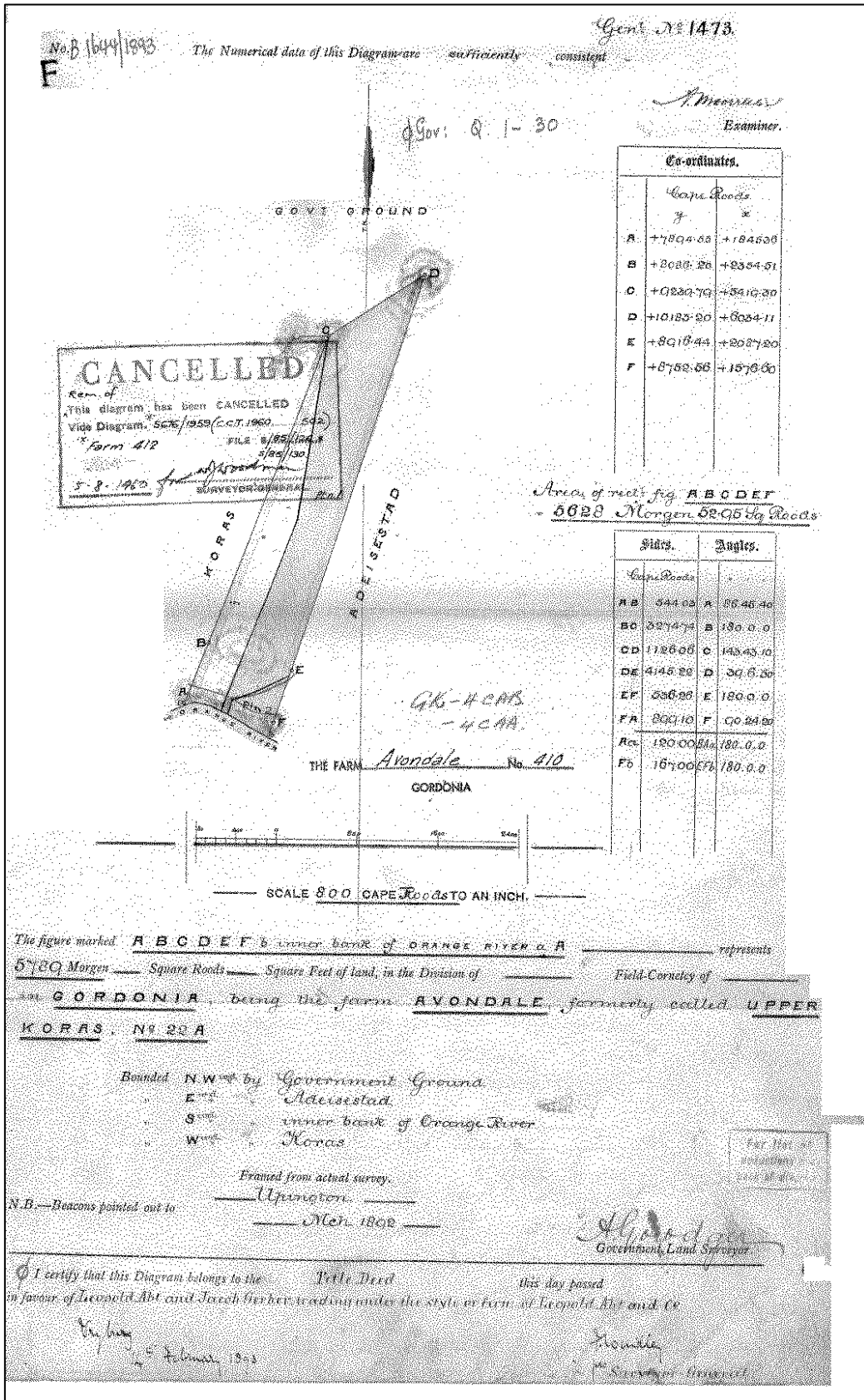


Figure 5-2: The original title deed for the farm Avondale c. 1892.

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 Ratings⁴

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 Avondale 1 Solar Park Project Area.

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.

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

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

HERITAGE CONTEXT	TYPE OF DEVELOPMENT			
	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			
<p>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</p> <p>Context 2: Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources.</p> <p>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</p> <p>Context 4: Of little or no intrinsic, associational or contextual heritage value due to disturbed, degraded conditions or extent of irreversible damage.</p>	<p>Category A: Minimal intensity development</p> <ul style="list-style-type: none"> - No rezoning involved; within existing use rights. - No subdivision involved. - Upgrading of existing infrastructure within existing envelopes - Minor internal changes to existing structures - New building footprints limited to less than 1000m². <p>Category B: Low-key intensity development</p> <ul style="list-style-type: none"> - 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%). <p>Category C: Moderate intensity development</p> <ul style="list-style-type: none"> - 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%) <p>Category D: High intensity development</p> <ul style="list-style-type: none"> - 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-AD410-SA01: Low Density MSA Scatter

1. SITE DESCRIPTION : Middle Stone Age Scatters							
1.1 General Site Description							
Low and Medium Density MSA Scatters							
1.2 Site features / artefacts / Other							
Site Location							
Province / District	Northern Cape Province			Map Number	2821BC		
Farm / Settlement / Zone	Avondale 410						
Co-ordinates	Site AGES-AD410-SA01	S28.37551	E21.55070				
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		Cultivated	X	Other	X - Karroid
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			
General assessment of impacts on resource (Refer to Section 7.3.1)		Without Management*	With Management*
	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 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-AD410-SA02 Medium Density MSA Scatters

1. SITE DESCRIPTION : Middle Stone Age Scatters							
1.2 General Site Description							
Medium Density MSA Scatters							
1.2 Site features / artefacts / Other							
Site Location							
Province / District	Northern Cape Province			Map Number	2821BC		
Farm / Settlement / Zone	Avondale 410						
Co-ordinates	Site AGES-AD410-SA02		S28.37023		E21.55361		
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		Cultivated	X	Other	X - Karroid
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	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 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. If further impact occurs, or is envisaged at any stage of development and operation the following will be required: <ul style="list-style-type: none"> - 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	
<ul style="list-style-type: none"> - National Heritage Resources Act (Act no. 25 of 1999) - Local and regional provisions, laws and by-laws 	

6.4.3 Site AGES-AD410-SA03: Medium-Low Density MSA Scatters

1. SITE DESCRIPTION : Middle Stone Age Scatters							
1.3 General Site Description							
Medium-Low and Medium Density MSA Scatters							
1.2 Site features / artefacts / Other							
Site Location							
Province / District	Northern Cape Province			Map Number	2821BC		
Farm / Settlement / Zone	Avondale 410						
Co-ordinates	Site AGES-AD410-SA03		S28.36356		E21.56461		
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		Cultivated X		Other X - Karroid
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								
General assessment of impacts on resource						Without Management*	With Management*	

(Refer to Section 7.3.1)	Duration	Permanent	Short Term
	Low	Moderate	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 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			
<ul style="list-style-type: none"> - National Heritage Resources Act (Act no. 25 of 1999) - Local and regional provisions, laws and by-laws 			

6.4.4 Site AGES-AD410-SA04: Medium Density MSA Scatters

1. SITE DESCRIPTION : Middle Stone Age Scatters							
1.4 General Site Description							
Medium Density MSA Scatters							
1.2 Site features / artefacts / Other							
Site Location							
Province / District	Northern Cape Province			Map Number	2821BC		
Farm / Settlement / Zone	Avondale 410						
Co-ordinates	Site AGES-AD410-SA04		S28.35224	E21.57061			
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		Cultivated	X	Other	X - Karroid

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: 50 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			
General assessment of impacts on resource (Refer to Section 7.3.1)		Without Management*	With Management*
	Duration	Permanent	Short Term
	Intensity	Low	Low
	Probability	Probable	Improbable
	Impact Significance	High	Negligible
3.3 Direct Impact Rating			
Direct impact on resource	None (the potential development does not adversely or positively affect the heritage resource)		
	Peripheral / Indirect (the heritage resource or its setting is located in proximity to the footprint of the potential development)		X
	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.		Low Heritage Impact Expected.	
3.4 Recommended Management* (refer to section 7.3.3)			
Avoidance / Monitoring			
Comments on recommended management			
<p>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. If further impact occurs, or is envisaged at any stage of development and operation the following will be required:</p> <ul style="list-style-type: none"> - 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			
<ul style="list-style-type: none"> - National Heritage Resources Act (Act no. 25 of 1999) - Local and regional provisions, laws and by-laws 			

6.4.5 Site AGES-AD410-SA05: Medium-Low Density MSA Scatters

1. SITE DESCRIPTION : Middle Stone Age Scatters			
1.5 General Site Description			
Medium-Low and Medium Density MSA Scatters			
1.2 Site features / artefacts / Other			
Site Location			
Province / District	Northern Cape Province	Map Number	2821BC
Farm / Settlement / Zone	Avondale 410		
Co-ordinates	Site AGES-AD410-SA05	S28.34918	E21.56790
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		Cultivated	X	Other	X - Karroid
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: 50 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	
	Low	Low	Low	
	Probability	Probable	Improbable	
	Impact Significance	Moderate	Negligible	
3.3 Direct Impact Rating				
Direct impact on resource	None (the potential development does not adversely or positively affect the heritage resource)			
	Peripheral / Indirect (the heritage resource or its setting is located in proximity to the footprint of the potential development)			X
	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.		Low 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				
<ul style="list-style-type: none"> - National Heritage Resources Act (Act no. 25 of 1999) - Local and regional provisions, laws and by-laws 				

6.4.6 Site AGES-AD410-SA06: Medium-Low Density MSA Scatters

1. SITE DESCRIPTION : Middle Stone Age Scatters			
1.6 General Site Description			
Medium-Low and Medium Density MSA Scatters			
1.2 Site features / artefacts / Other			
Site Location			
Province / District	Northern Cape Province	Map Number	2821BC
Farm / Settlement / Zone	Avondale 410		
Co-ordinates	Site AGES-AD410-SA06	S28.34647	E21.57269
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	
Dam		River Bank	
		Slope	
Other / Comments			
Vegetation			
Riverine forest		Bushveld	
		Savannah	
Thornveld		Grassland	
		Cultivated	X
		Mountain forest	
		Other	X - Karroid
Age Classification			
Stone Age	X	Early Iron Age	
		Middle Iron Age	
Historical		Other	
		Later Iron Age	
Material Culture			
Midden		House Remains	
		Stone Walling	
Granary		Grinding Stone (L)	
		Grinding Stone (U)	
Metal		Ceramics (Potter)	
		Ceramics (Porcelain)	
Metal slag		Tuyere	
		Fauna	
Bead (OES / Shell)		Glass	
		Lithics	X
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: 0 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			
General assessment of impacts on resource (Refer to Section 7.3.1)		Without Management*	With Management*
	Duration	Permanent	Short Term
	Low	Moderate	Low
	Probability	Definite	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)		
	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)		X
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.		Moderate 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			
<ul style="list-style-type: none"> - National Heritage Resources Act (Act no. 25 of 1999) - Local and regional provisions, laws and by-laws 			

6.4.7 Site AGES-AD410-HP01: Historical Period Structures

1. SITE DESCRIPTION : Recent Historical Remains			
1.7 General Site Description			
The remains of two foundation structures.			
1.2 Site features / artefacts / Other			
Site Location			
Province / District	Northern Cape Province	Map Number	2821BC
Farm / Settlement / Zone	Avondale 410		

Co-ordinates	Site AGES-AD410-HP01	S28.36684	E21.57506
Site Type			
Surface sites	X	Caves and rock shelters	
Larger open-air sites		Sealed sites (deposits)	
River deposits		Other	
Site Function			
Living / habitation	X	Kill	
Ceremonial		Burial	
Trading / Barter		Art	
Quarry / Mining / Smelting		Other	X – Refuse
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	
		Cultivated	X
		Other	Karroid
Age Classification			
Stone Age		Early Iron Age	
		Middle Iron Age	
		Later Iron Age	
Historical	X	Other	X – recent historical / contemporary
Material Culture			
Midden	X	House Remains	X
		Stone Walling	
		Stone Structures	X
Granary		Grinding Stone (L)	
		Grinding Stone (U)	
		Granary Stand	
Metal	X	Ceramics (Potter)	
		Ceramics (Porcelain)	X
		Stone (non-lithic)	X
Metal slag		Tuyere	
		Fauna	X
		Bead (Glass)	
Bead (OES / Shell)		Glass	X
		Lithics	
		Smelting Residues	
Other: X - Plastics	Other: X - Wood		
1.3 Site Condition			
The integrity of the sites have been severely compromised as a result of natural agents and poor site preservation.			
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: 500+ METERS			
NATURE OF IMPACT: HISTORICAL, AESTHETIC, SOCIAL, SCIENTIFIC, ARCHITECTURAL			
EXTENT OF IMPACT: Local			
SPECIALIST LEVEL OF CONFIDENCE IN DEGREE OF IMPACT AND SEVERITY: High			
3.2 Impact Significance and Severity			
General assessment of impacts on resource (Refer to Section 7.3.1)		Without Management*	With Management*
	Duration	Permanent	Short Term
	Intensity	Low	Low
	Probability	Definite	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)		
	Peripheral / Indirect (the heritage resource or its setting is located in proximity to the footprint of the potential development)		X
	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.		Moderate Heritage Impact Expected.	
3.4 Recommended Management* (refer to section 7.3.3)			
Monitoring			
Comments on recommended management			
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			
<ul style="list-style-type: none"> - 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 Upington area 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 pans. The following impact assessment discussion summarises the extent of heritage significance and impact on resources, cognisant of this rich larger archaeological landscape (refer to Table 6 for impact assessment matrix).

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

- Stone Age material occurs across the study area. A low density Middle Stone Age scatter occurs at **Site AGES-AD410-SA01**. These Stone Age occurrences and its cultural context is probably of low scientific value due to the low frequency of lithics and formal diagnostic tools as well as the general loss of site context. The site is situated away from demarcated development areas and the impact on the site by the proposed activity is considered to be none. **The significance of the impact on the heritage resources is considered to be NEGLIBLE but the threshold of the impact can be limited to a NEGLIBLE impact by the implementation of mitigation measures (monitoring) for the sites, if / when required.**
- A medium density MSA scatters (**Site AGES-AD410-SA02**) are of scientific interest due to the occurrence of formal diagnostic MSA lithics. The site is situated away from demarcated development areas and the impact on the site by the proposed activity is considered to be none. **The significance of the impact on the heritage resources is considered to be NEGLIBLE and this rating is expected to remain the same by the implementation of mitigation measures (monitoring) for the sites, if / when required.**
- A medium-low density Middle Stone Age scatter occurs at **Site AGES-AD410-SA03**. These Stone Age occurrences and its cultural context is probably of low scientific value due to the low frequency of lithics and formal diagnostic tools as well as the general loss of site context. The site is situated away from demarcated development areas and the impact on the site by the proposed activity is considered to be none. **The significance of the impact on the heritage resources is considered to be NEGLIBLE and this rating is expected to remain the same by the implementation of mitigation measures (monitoring) for the sites, if / when required**
- Another medium density MSA scatters (**Site AGES-AD410-SA04**) are of scientific interest due to the occurrence of formal diagnostic MSA lithics. The site is situated near the demarcated development area and the impact on the site by the proposed activity is considered to be peripheral where the impact might result in the possible confusing of the archaeological context and potential loss of archaeological material. **The significance of the impact on the heritage resources is considered to be LOW but the threshold of the impact can be limited to a NEGLIBLE impact by the implementation of mitigation measures (avoidance, mitigation, conservation, documentation, monitoring) for the sites, if / when required.**
- Another medium-low density Middle Stone Age scatter occurs at **Site AGES-AD410-SA05**. These Stone Age occurrences and its cultural context is probably of low scientific value due to the low frequency of lithics and formal diagnostic tools as well as the general loss of site context. The site is situated near the demarcated development area and the impact on the site by the proposed activity is considered to be peripheral where the impact might result in the possible confusing of the archaeological context and potential loss of archaeological material. **The significance of the impact on the heritage resources is considered to be LOW but the threshold of the impact can be limited to a NEGLIBLE impact by the implementation of mitigation measures (avoidance, mitigation, conservation, documentation, monitoring) for the sites, if / when required. by the implementation of mitigation measures (monitoring) for the sites, if / when required.**
- An additional medium-low density Middle Stone Age scatte occurs at **Site AGES-AD410-SA06**. These Stone Age occurrences and its cultural context is probably of low scientific value due to the low

frequency of lithics and formal diagnostic tools as well as the general loss of site context. The site is situated within the demarcated development area and the impact on the site by the proposed activity will be direct and of permanent duration where in essence, the impact might result in the possible confusing of the archaeological context and potential loss of archaeological material. **The significance of the impact on the heritage resources is considered to be LOW but the threshold of the impact can be limited to a NEGLIBLE impact by the implementation of mitigation measures (monitoring) for the sites, if / when required.**

Structures dating to the **Historical / Colonial Period** in occur in the study area.

- The Historical Period farm house and associated farmstead buildings at **Site AGES-AD410-HP01** is older than 60 years, and these resources are therefore of heritage value. The sites are situated outside the footprint area but within the larger survey area and the impact on the sites by the proposed activity will be peripheral and of permanent duration where in essence, the impact might result in the possible destruction of sites. **The significance of the impact on the heritage resources is considered MODERATE but the threshold of the impact can be limited to a NEGLIBLE impact by the implementation of mitigation measures (avoidance, monitoring) for the site, if / when required.**

Heritage resources have been documented in the Avondale 1 Photovoltaic Power Plant footprint areas and impact on these resources is anticipated. However, in the opinion of the author of this Archaeological Impact Assessment Report, the proposed Avondale 1 Solar Park Project on Portion 1 of the Farm Avondale 410 may proceed from a culture resources management perspective, provided that mitigation measures provided in this assessment, endorsed by the relevant Heritage Resources authority, are implemented where applicable.

Table 6: Impact assessment matrix for the proposed footprint area of the Avondale 1 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-AD410-SA01	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	1	5	1	2	8	Negligible	Monitoring / Avoidance	1	1	1	2	4	Negligible
Site AGES-AD410-SA02	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	1	5	1	4	10	Negligible	Monitoring / Avoidance	1	1	1	2	4	Negligible
Site AGES-AD410-SA03	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	1	5	1	2	8	Negligible	Monitoring / Avoidance	1	1	1	2	4	Negligible
Site AGES-AD410-SA04	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	2	5	1	6	24	Low	Monitoring / Avoidance	1	1	1	2	4	Negligible
Site AGES-AD410-SA05	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	2	5	1	4	20	Negligible	Monitoring / Avoidance	1	1	1	2	4	Negligible
Site AGES-AD410-SA06	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	5	5	1	2	40	Low	Monitoring / Avoidance	1	1	1	2	4	Negligible
Site AGES-AD410-HP01	Pre-Construction, Construction, Operation and Closure	Loss of Heritage Resource and Attributes	4	5	1	4	40	Low	Monitoring / Avoidance	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

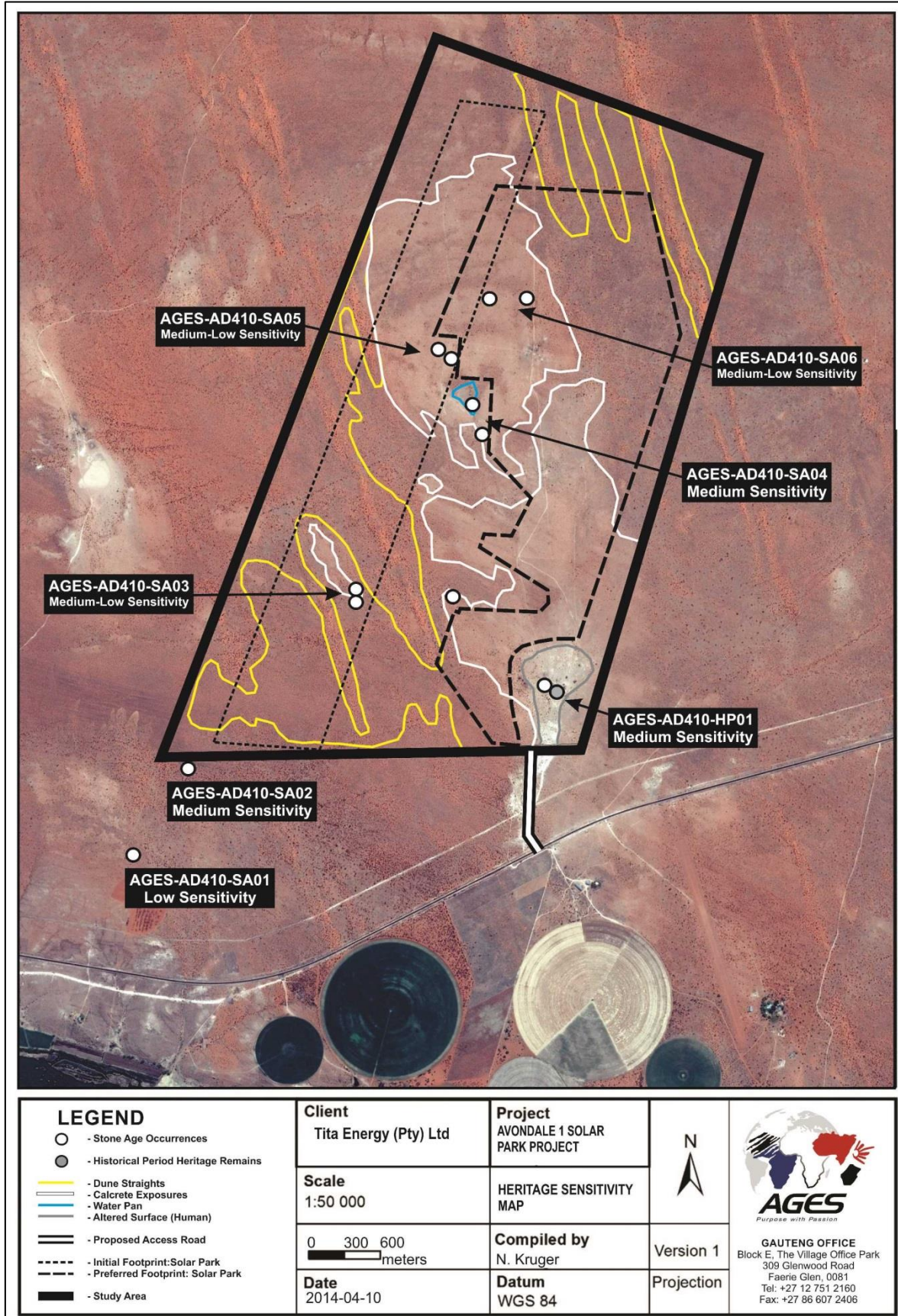


Figure 6-1: Heritage sensitivity map for the Avondale 1 Photovoltaic Power Plant Project.

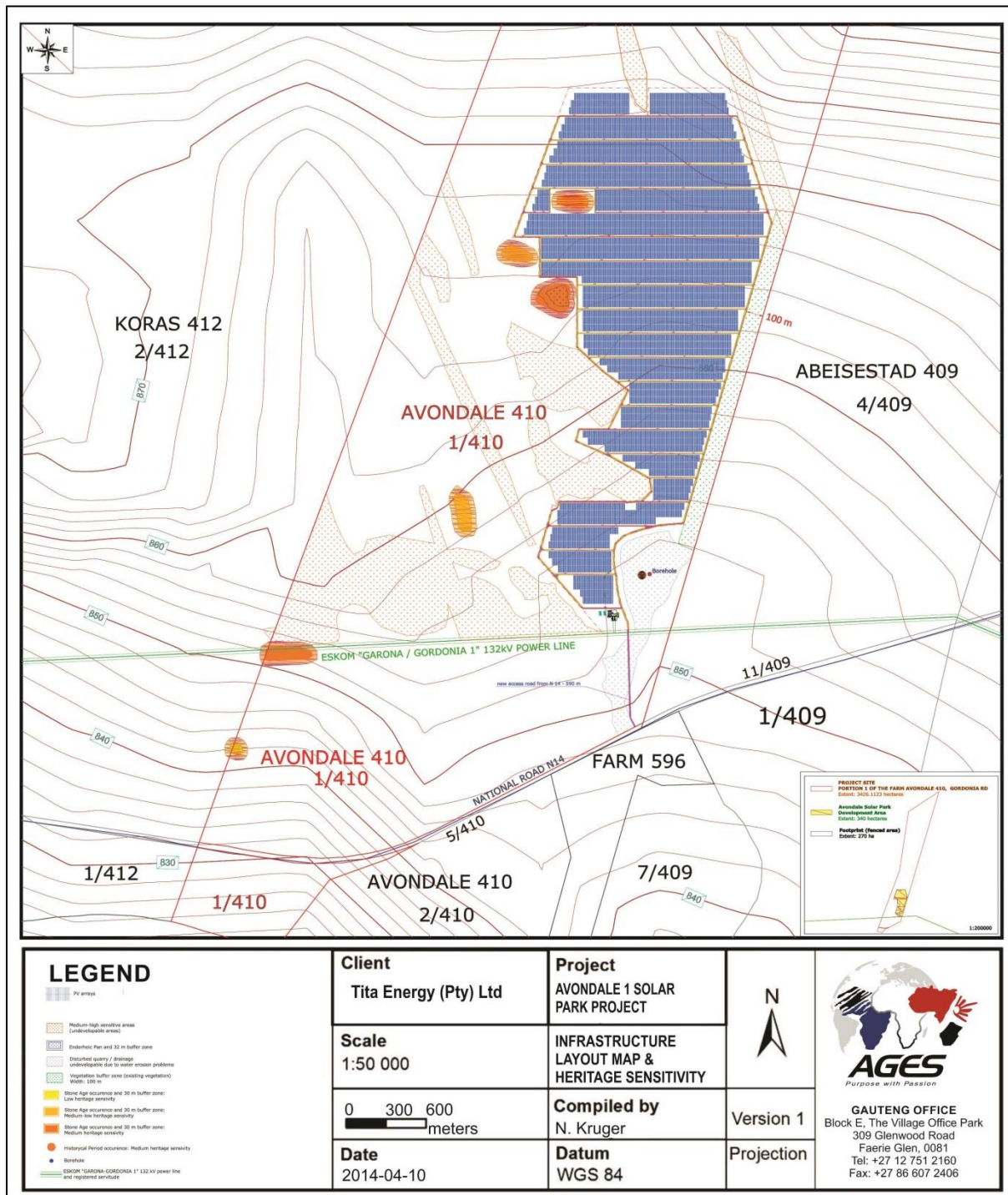


Figure 6-2: Preferred infrastructure options in relation to sensitive heritage receptors, and suggested heritage conservation buffers.

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.

- **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 Avondale 1 Photovoltaic Power Plant footprint and study areas:

Site		Mitigation: Action	Responsible Party	Time Frame
AGES-AD410-SA01 AGES-AD410-SA02 AGES-AD410-SA03 AGES-AD410-SA04 AGES-AD410-HP01	AGES-AD410-SA06			
		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	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 Upington is rich in pre-historical and historical remnants but areas directly adjacent to the farm Avondale 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 Avondale 1 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 be 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. 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 Orange River which renders it prone to alluvial deposits that could bury 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.
- **Site AGES-DA1400-SA01** comprises a low density Middle Stone Age scatter of low significance. The site occurs away from the development footprint but should any activities occur in this area, it is recommended that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains.
- A medium density MSA scatters (**Site AGES-AD410-SA02**), occur along the southern portion of the farm Avondale. The site occurs away from the development footprint but should any activities occur in this area, it is recommended that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains.
- A medium-low density Middle Stone Age scatters (**Site AGES-AD410-SA03**) were documented in a central portion of the property and, are of limited significance. The site occurs away from the development footprint but should any activities occur in this area, it is recommended that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains.
- Another medium density MSA scatter (**Site AGES-AD410-SA04**) occurs at a water pan in central sections of the property. These MSA representations are of scientific interest due to the occurrence of formal diagnostic MSA lithics and the site should be monitored during construction and operational phases of the development. Even though the site is excluded from the proposed development it does occur close to the development footprint. It is recommended that, should this MSA scatter be directly impacted by development activities, the site be recorded and that the cultural and archaeological context of the heritage resource 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.
- Another medium-low density Middle Stone Age scatter (**Site AGES-AD410-SA05**) occurs in a northern portion of the study area near the proposed footprint, and is of limited significance. It is recommended

that that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains.

- Finally, a medium-low density Middle Stone Age scatter (**Site AGES-AD410-SA06**) occurs in the footprint of the Solar Park development. However, the feature is of limited significance and it is recommended that that any activities pertaining to the development in the area be monitored in order to avoid any possible impact on previously undetected heritage remains.
- The Historical Period Avondale farmhouse and labourers quarters (**Site AGES-AD410-HP01**) occur in the south-eastern corner of the study area. These features, which are of medium heritage significance, occur on the margin of the development area and will probably not be impacted on by the proposed development. However, should the structures / features be directly impacted by development activities, the sites should be carefully documented and a destruction permit from the relevant heritage resources authority (SAHRA) should be obtained.
- 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 cognisance should be taken of the following:

- Water sources such as drainage lines, fountains and 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 Avondale 1 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.

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