

Phase 1a Archaeological Impact Assessment

Proposed development of Ephraim Sun Solar PV Development near Upington on Remainder of portion 62 (portion of portion 9) (Vryheid) of Farm Vaalkoppies no 40. Including Potential Grid Connections Across Portions of the Farm Vaalkoppies 40/3, 9, 52 & 66; Farm 555/7; and Erven 73 & 19951, //Khara Hais Municipality, Kenhardt District, Northern Cape Province

prepared for

PERCEPTION Planning, P.O. Box 9995, George, 6530, Western Cape,
Cell: 082 568 4719, E-mail: perceptionenvplg@gmail.com, **Applicant: Ephraim Sun (Pty) Ltd.** / Solek Innovations (Pty) Ltd t/a Solek, No 14 Stoffel Smith Road, Stellenbosch, 7600, thys@solek.co.za

by



Dr. Peter Nilssen, PO Box 2635, Mossel Bay, 6500
044 691 0051 | 0827835896 | peter@carm.co.za

12 October 2015

1. Executive Summary

The report presented here provides archaeological input for the broader integrated Heritage Impact Assessment that forms part of the Environmental Impact Assessment process for the proposed development of the Ephraim Sun PV Solar Development to be situated approximately 15 km east-south-east of Upington in the Northern Cape. The approximately 200 ha development footprint of the proposed solar facility will be located within a larger study area of about 580 ha. The study reported here covers the larger study area as well as the various options for the proposed 132kV overhead power line that will be the grid connection between the solar facility and the Gordonia Substation.

Previous archaeological studies in the surrounding environment showed that no significant archaeological sites occur in the immediate vicinity of the current study area. Although numerous Stone Age stone artefacts were recorded in the studied areas covered by this assessment, they occur as isolated finds that are temporally mixed, in derived and unstratified contexts and that lack organic remains and other cultural materials. No other tangible heritage resources were identified. As a result, the archaeological record in the studied areas is considered to be of low significance, and therefore, it is recommended that no further archaeological investigation or work is required prior to the development.

On archaeological grounds there are no fatal flaws associated with the proposed development activities, and therefore, there are no objections to the authorization of the proposed development of the Ephraim Sun PV Solar Development and associated grid connection route options to the Gordonia Substation.

Recommended Mitigation Measures;

- Archaeological resources identified during this study do not require further recording/studies, and because they are considered to be of low heritage value and have been adequately recorded through this assessment, it is suggested that they can be disturbed or damaged without a permit from SAHRA.*
- The development may benefit from having an on-site display of the Stone Age archaeological record in the area, though this will require negotiation with and permission from SAHRA.*

Required Mitigation Measures;

- In the event that excavations and earthmoving activities expose significant archaeological or heritage resources, such activities must stop and SAHRA must be notified immediately.*
- If significant archaeological or heritage resources are exposed during construction activities, then they must be dealt with in accordance with the National Heritage Resources Act (No. 25 of 1999) and at the expense of the developer.*
- In the event of exposing human remains during construction, the matter will fall into the domain of the South African Heritage Resources Agency (Mrs*

Colette Scheermeyer) and will require a professional archaeologist to undertake mitigation if needed. Such work will also be at the expense of the developer.

2. Name, Expertise and Declaration

I, Peter Nilssen (PhD in archaeology, University of Cape Town, 2000), herewith confirm that I am a Professional member - in good standing - of the Association of South African Professional Archaeologists (ASAPA), including the Cultural Resource Management section of the same association (ASAPA professional member # 097). I am an accredited Principal Investigator for archaeozoology (specialist analysis), coastal & shell midden and Stone Age; Field Director for Colonial Period; Field Supervisor for Iron Age and Rock Art.

As the appointed independent specialist (archaeologist) for this project hereby declare that I:

- act as an independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 (specifically in terms of regulation 13 of GN No. R. 982) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- am aware that a false declaration is an offence in terms of regulation 48 of GN No. R. 982.



Signature of the specialist:

Name of company: Dr Peter Nilssen

Date: **12 October 2015**

Table of Contents

Content	Page
1. Executive Summary _____	2
2. Name, Expertise and Declaration _____	4
3. Introduction _____	6
3.1. Background _____	6
3.2. Purpose and Scope of the Study _____	7
3.3. Study Areas _____	7
3.4. Approach to the Study _____	9
3.5. Assumptions, Limitations and Gaps in Knowledge _____	10
4. Results _____	11
4.1. Archaeological Background - Desktop Study & Literature Review _____	11
4.2. Archaeological Foot Survey - Ephraim Sun PV Solar Development and 132kV Overhead Power Line Route Options _____	12
5. Sources of Risk, Impact Identification and Assessment _____	14
5.1. Ephraim Sun PV Solar Development and 132kV Overhead Power Line Route Options _____	14
5.2. No-Go Option _____	15
6. Recommended and Required Mitigation Measures _____	18
7. References _____	18
8. Figures and Plates _____	20
Appendix A: Relevant Heritage Legislation _____	33

3. Introduction

3.1. Background

The below provides background to the required assessment for the proposed development of the Ephraim Sun Solar PV Development, which is based on information supplied by Mr Dale Holder of Cape Environmental Assessment Practitioners (Pty) Ltd (Cape EAPrac). Cape EAPrac is facilitating the Environmental Impact Assessment (EIA) process while Perception Planning is undertaking the integrated Heritage Impact Assessment (HIA). The report presented here comprises the archaeological component of the HIA. Contact details for Perception Planning are given on the title page of this report.

The applicant, Ephraim Sun (Pty) Ltd., is a renewable energy developer SPV established for the sole purpose of developing the proposed solar facility. The applicant is proposing to establish a commercial solar energy facility on Remainder of portion 62 (portion of portion 9) (Vryheid) of Farm Vaalkoppies no 40. In total, the affected area is approximately 4696ha in extent and is situated about 15km ESE of Upington in the //Khara Hais Municipality, Northern Cape Province (Figures 1, 2 & 3).

The development footprint includes the total footprint of PV panels, auxiliary buildings, onsite substation, inverter stations and internal roads. While the initial study area is approximately 580ha in extent, the total footprint of Ephraim Sun will not exceed 200ha in extent.

The net generating capacity of the facility is (AC) 75MW with an installed capacity (DC) of +/-90MW. The solar technology will be PV and/or concentrated PV with fixed, single or double axis tracking technology. The capacity and dimensions of the PV field will be 75 MWp AC yield with a footprint of not more than 200ha. The structure height will be less than 10 meters. The total surface area to be covered (including associated infrastructure such as roads) will be approximately 200ha. The lay down areas will be between 2ha and 5ha but will not exceed 5ha in extent.

Various grid connection options are being investigated. All of the grid connections are planned to connect to the Gordonia substation and will run across Portions of the Farm Vaalkoppies 40/3, 9, 52 & 66; Farm 555/7; and Erven 73 & 19951 in the //Khara Hais Municipality, Northern Cape Province (Figures 2 & 3). The facility will connect to the substation via own-built 132kV lines or by a "loop-in loop-out" line to the existing Gordonia-Kleinbegin 1 or to the planned Ilanga CSP project 132kV power lines. The various power line / servitude options are shown in Figures 2 & 3. Only a single line will be built. The height of the Power Line will be <25m as is usual for monopole steel structures and the servitude will be about 32m in width.

Additional infrastructure: Auxiliary buildings of approximately 2ha in extent that will function as ablution, workshops, storage areas, site offices, etc. Perimeter fencing will not exceed 5m in height. Access roads will not exceed 8m in width. The length of these access roads is dependent on the specific scenarios.

Detailed specifications and development layouts of the proposed solar facility will be guided and determined by the findings of the Environmental Impact Assessment (EIA) process.

Activities associated with the proposed development trigger Sections 38(1)(a) - linear development exceeding 300m in length - and 38(1)(c)(i) - area development exceeding

5000m² - of the National Heritage Resources Act (Act 25 of 1999), and therefore, this author was appointed to provide archaeological input for the broader integrated HIA in terms of Section 38(8) of the National Heritage Resources Act.

The first phase of the archaeological input involved a Scoping Archaeological Impact Assessment (SAIA) which provided a preliminary report on the findings made during a detailed archaeological foot survey of the affected landscape (Nilssen 2015). The archaeological survey focused on the larger study area for the solar facility and the proposed grid connection route options for a 132kV overhead power line to the Eskom Gordonia Substation (Figures 2 & 3). The current phase of the HIA process involves a Phase 1a Archaeological Impact Assessment (AIA), which presents a more detailed report on the archaeological investigation for the proposed development of the Ephraim Sun Solar PV Development and its associated infrastructure. This report is a required component of the integrated Heritage Impact Assessment that is being compiled by Perception Planning.

3.2. Purpose and Scope of the Study

The overall purpose of the AIA is to assess the sensitivity of archaeological resources in the affected area, to determine the potential impacts on such resources, and to avoid and/or minimize such impacts by means of management and/or mitigation measures. This AIA report forms part of the Integrated HIA and meets standards required by the South African Heritage Resources Agency (SAHRA) in terms of the National Heritage Resources Act, No. 25 of 1999.

The objectives of the Archaeological Impact Assessment are:

- To assess the nature and sensitivity of archaeological resources in the affected environment;
- To identify the impact of the proposed development on such resources as well as options for mitigation in order to minimize potential negative impacts and to make recommendations for mitigation where necessary; and
- To identify archaeological resources and issues that may require further investigation.

Terms of Reference (ToR):

- a) Locate boundaries and extents of the study areas.
- b) Conduct a detailed foot survey of the study areas to identify and record all archaeological resources.
- c) Assess the impact of the proposed development on such resources according to assessment criteria provided by Cape EAPrac.
- d) Recommend mitigation measures and additional studies where necessary.
- e) Prepare and submit a report that meets standards required by Heritage Authorities in terms of the National Heritage Resources Act, No. 25 of 1999

3.3. Study Area

The Ephraim Sun Solar PV Development with solar panel arrays and associated infrastructure will have a development footprint area of about 200ha that will be contained entirely within the larger study area as indicated by the yellow polygons in Figures 2 and 3. The larger study area is situated some 15 km ESE from the centre of Upington, and is accessible by vehicle via a gravel road leading south from the N10 national road that is signposted as Kleinbegin (Figures 1 & 2). The E-W flowing Orange River and associated

canal system is situated to the north of the N10 and the surrounding land use is rural and agricultural.

The bulk of the study area is essentially flat and is situated in a slight depression with low ridges and koppies to both the west and east, and with moderate to small intervening drainage lines with a mainly northerly orientation, sloping down gently towards the Orange River in the north. Vegetation is open and sparse, and dominated by Karoo shrubs, some grasses and a few small/short trees of mostly *Acacia* species that cluster along the main drainage lines running through the study area. Consequently, there are large expanses of exposed ground surfaces and archaeological visibility is excellent. Surface sediments are mostly stony with quartz and quartzite dominating over most of the affected area and these lie in and atop beige to brown to reddish sands that are variable in coarseness. These geological deposits appear to be alluvial gravels that are also exposed in stream cuttings. A few rocky outcrops of quartz, quartzite and calcrete also occur in the area. Examples of the affected environment are shown in Plates 1, 2 and 3.

Relatively recent human-related disturbances to the environment include a gravel road, single vehicle gravel tracks, two freestanding concrete dams (disused), feeding and watering troughs for cattle, cattle grazing, fencing, and a few areas of minor earthmoving. Apart from sheet wash as well as shallow erosion gullies associated with the drainage lines, there is considerable burrowing by smaller and larger mammals though no archaeological remains were found in association with animal burrows. Overall, the study area is relatively undisturbed with little negative impact on the existing archaeological record apart from natural erosion processes.

Several portions of the proposed grid connection options were covered during the archaeological investigation for the proposed Joram Solar Facility (Nilssen 2014b). The receiving environment for the grid connection route options is essentially the same as that described above for the PV footprint area. However, the affected environment changes to residential and urban once the grid connection route to the Gordonia Substation crosses the N10 national road and Orange River to the north. The northern portion of the grid connection route - from point A to point B in Figures 2 & 5 - was studied for the proposed Joram Solar Facility (Nilssen 2014b). From about 1km south of the Orange River and all the way to the Gordonia Substation in the north, the landscape has undergone considerable development and disturbances in the recent past. These include roads (gravel and the N10), agricultural activities (e.g. vineyards, orchards), structures, fencing, earthmoving activities, canals and residential developments between the Gordonia Substation and the northern banks of the Orange River. A clear servitude for overhead power lines exists in this northern portion of the power line route. Gravels in this northern section are dominated by banded ironstone, but there is considerable disturbance to surface sediments even in the undeveloped areas along the existing power line servitude (Nilssen 2014b).

Coordinate data for the larger study area for the Ephraim Sun solar panel array are given in Table 1 below. Coordinate data for alternative on-site substation localities and grid connection route options are available on request.

Table 1. Coordinate data for boundary points of the larger study area of the Ephraim Sun solar panel array (see Figure 3).

Name	Description	Datum: WGS84 Lat/Lon decimal degrees	Datum: WGS84 Grid: SA National
A	Ephraim Sun PV boundary point	S28.49346 E21.36303	21 Y-035544 X3153183
B	Ephraim Sun PV boundary point	S28.49354 E21.37249	21 Y-036471 X3153194
C	Ephraim Sun PV boundary point	S28.51268 E21.37241	21 Y-036457 X3155315
D	Ephraim Sun PV boundary point	S28.51262 E21.37662	21 Y-036869 X3155311
E	Ephraim Sun PV boundary point	S28.52862 E21.37665	21 Y-036866 X3157083
F	Ephraim Sun PV boundary point	S28.52877 E21.37070	21 Y-036283 X3157098
G	Ephraim Sun PV boundary point	S28.52133 E21.36423	21 Y-035653 X3156272
H	Ephraim Sun PV boundary point	S28.52135 E21.36072	21 Y-035309 X3156273
I	Ephraim Sun PV boundary point	S28.52450 E21.35780	21 Y-035022 X3156621
J	Ephraim Sun PV boundary point	S28.52449 E21.35134	21 Y-034390 X3156618
K	Ephraim Sun PV boundary point	S28.51888 E21.35128	21 Y-034385 X3155996
L	Ephraim Sun PV boundary point	S28.51628 E21.35303	21 Y-034558 X3155708
M	Ephraim Sun PV boundary point	S28.51377 E21.35421	21 Y-034674 X3155431
N	Ephraim Sun PV boundary point	S28.50830 E21.35612	21 Y-034863 X3154825
O	Ephraim Sun PV boundary point	S28.50305 E21.36344	21 Y-035582 X3154245

3.4. Approach to the Study

This assessment was conducted with accepted best practice principles and in accordance with guidelines and minimum standards as set out by the Department of Environmental Affairs and Development Planning and the South African Heritage Resources Agency (DEA&DP 2005, SAHRA 2007).

An overview of the archaeological desktop study and literature review is presented below in the results section.

In order to assess the nature and significance of the archaeological record in the affected area, a comprehensive foot survey was performed. The extent of the area covered by the foot survey was based on the provisional development layout plan including the footprint area for the solar facility and the own built power line route options (Figure 2). Note that certain areas of the solar facility as well as portions of the power line route options were covered during the assessment for the Joram Solar Facility and associated grid connection options, and therefore, those areas were not surveyed again for the current investigation (Nilssen 2014b). The significance of archaeological resources were assessed in terms of their content and context. Attributes considered in determining significance include artefact and/or ecofact types, rarity of finds, exceptional items, organic preservation, aesthetic appeal, potential for future research, density of finds and the context in which archaeological traces occur.

On behalf of Ephraim Sun (Pty) Ltd., Mr Dale Holder of Cape EAPrac provided background information, terms of reference, locality maps and provisional development layout plans for the proposed activity. The land owner, Mr Sterling Strauss, was contacted for permission to access the study area and provided keys to access various parts of the property. The entire archaeological survey was conducted independently and on foot.

Due to low, open vegetation and large expanses of exposed ground surfaces, access and archaeological visibility was excellent and allowed for a thorough assessment of the archaeological record in the larger study area and along the proposed grid connection options. Because this author is familiar with the archaeological record in the immediate surroundings, and because of excellent archaeological visibility, survey walk tracks were spaced from about 50m to 100m apart. The relatively large spaces between survey tracks is justified by this author's familiarity with the study area and its archaeological contents as well as the low density and overall uniformity of the archaeological record in the receiving environment.

Survey tracks were fixed with a hand held Garmin Camo GPS to record the search area (Figures 4 and 5, gpx tracking file is available from author). The position of identified archaeological occurrences, observations and photo localities were also fixed by GPS and a full data set is available on request. Digital audio notes and a comprehensive, high quality digital photographic record were also made.

3.5. Assumptions, Limitations and Gaps in Knowledge

This assessment is based on the assumption that the solar panel arrays and associated infrastructure of the proposed Ephraim Sun Solar PV Development will be contained within the larger study area and that the proposed power line route options as indicated in Figures 2 and 3 will not be rerouted. In the event that the impacted areas are modified, then a further archaeological investigation may be required. It is also assumed that all background information and layout plans provided by Cape EAPrac are correct and current. Once all participating specialists' input are considered and incorporated into the final development layout plan, Cape EAPrac will circulate the final layout plan to participating specialists for their consideration and approval.

This assessment is specifically for the footprint of the proposed solar facility and corridors of the proposed power line routes and does not apply to, and may not be used for, any other future developments on the remainder of the affected properties.

High densities of alluvial gravels, that include a high proportion of quartz, were very slow and difficult to assess since it is not feasible to individually inspect every stone. Nevertheless, and although some artefacts in quartz almost certainly went undetected, a careful assessment allowed for the identification of numerous Stone Age artefacts and if present, higher density scatters would certainly have been readily visible to the trained eye.

There were no further limitations to the study since all relevant portions of the affected areas were accessible on foot and archaeological visibility is excellent, and therefore, it is considered that sufficient observations were made for the purpose of this assessment. Due to the fact that parts of the archaeological record may be covered by surface sediments, this study is limited to such resources exposed on the surface and in disturbed contexts. Consequently, it cannot be ruled out that additional archaeological resources may be exposed during the construction phase of the development.

At present there are no gaps in knowledge regarding the proposed development.

4. Results

4.1. Archaeological Background - Desktop Study & Literature Review

A literature review of previous archaeological and heritage-related work in the surrounding area was conducted in part by using information from the Report Mapping Project of the SAHRA-APM Unit as well as SAHRIS. Most of the reports cited here were downloaded from the SAHRA/SAHRIS web site.

Very little archaeological research has been conducted in this portion of South Africa and the bulk of information concerning the history and archaeology of the area was obtained through heritage and archaeological studies associated with environmental impact assessments for a variety of development activities.

It is evident from earlier studies that structures, graves as well as remnants of the Anglo-Boer War characterize the archaeological record of the historic period in the surroundings of Upington. The bulk of human occupation of the general surroundings, however, relates to the pre-historic period where Rock Art and herder sites as well as artefacts of the Early Stone Age, Middle Stone Age and Later Stone Ages are represented. No significant archaeological sites were identified in the immediate surroundings of the affected area and stone artefacts - made in a variety of raw materials - are most commonly found in low density scatters across the landscape. Overall, the Stone Age finds made in the area are considered to be of low archaeological significance because of the absence of organic and other cultural remains, their low frequencies, temporally mixed nature as well as their disturbed, derived and unstratified contexts (e.g., Beaumont 2006a, b, c, d & e, Beaumont 2008, Dreyer 2006, Kaplan 2008, Morris 2006 & 2013, Nilssen 2012 & 2014b, Pelsler 2012, Webley and Halkett 2010).

In an archaeological study conducted on the same broader property for the Joram Solar Facility, this author concluded that "although numerous Stone Age stone artefacts were recorded in the studied areas covered by this assessment, they occur as isolated finds or in very low density scatters that are temporally mixed, in derived and unstratified contexts and that lack organic remains and other cultural materials. No other tangible heritage resources were identified. Consequently, the archaeological record in the studied areas is considered to be of low significance, and therefore, it is recommended that no further archaeological studies are required prior to the development" (Nilssen 2014b, executive summary).

In addition to the above, the next nearest archaeological study, which consists of the same environmental setting, geological sediments and overall context as that of the current study areas, was undertaken a few kilometres to the east of the proposed Ephraim Sun PV Solar Development and power line route options (Nilssen 2012). The main findings of the latter investigation were that "Although numerous Stone Age artefacts were identified along most of the studied area, these are scattered on the surface in low densities and occur mostly as isolated finds. No faunal remains or other cultural materials were seen. The vast bulk of specimens are in quartz with only a few pieces made in banded ironstone. A few artefacts of potentially Middle Stone Age (MSA) origin were seen, but the overwhelming majority are of the Later Stone Age (LSA). Because Stone Age artefacts identified in the study area occur as isolated finds or in low density artefact scatters that are in a temporally mixed and derived context, these materials are considered to be of low archaeological significance. Apart from the above-mentioned archaeological materials, no other heritage related resources or issues were identified during the study" (Nilssen 2012, pg 8 & 9).

Since the bulk of the archaeological record in the immediate surroundings is that of the Stone Age period, a brief overview of the technology associated with the development of archaic and modern humans during this era is given below.

Early Stone Age (ESA) materials including Acheulian hand axes, cleavers and chopping tools that may date from as early as 2.7 million years ago and come to end about 300 000 years ago is the earliest evidence for the tool-making human ancestors occupying this area. Such artefacts are usually found among alluvial gravels. While present, ESA artefacts are fairly rare and are usually found in disturbed or derived contexts where they are mixed with artefacts of more recent Stone Age times.

The Middle Stone Age (MSA) starts about 300 000 years ago and the interface between the ESA and MSA is sometimes marked by a stone tool industry known as the Fauresmith, where small hand axes appear to indicate the transition from archaic humans to *Homo sapiens*. In the main, however, MSA stone artefacts are characterised by flake and blade industries where evidence for core preparation - also known as the Levallois technique - is seen on prepared or faceted platforms of flakes and blades. Convergent flakes or points are also one of the markers of the MSA period. Like the ESA specimens, though more numerous, stone artefacts of MSA origin also occur among alluvial gravels and are commonly mixed with artefacts of both ESA and Later Stone Age origin. Unfortunately, no other cultural materials or faunal remains are associated with these artefacts when found in exposed contexts.

The Later Stone Age (LSA) starts about 40 000 years ago and is characterised by substantial technological improvements over the MSA industries. Advancements on previous technologies and new technologies as well as cultural developments include the widespread occurrence of rock art (cave paintings and rock engravings), decorative objects (ostrich egg shell beads, marine shell pendants and beads, ochre), human burials with grave goods including painted stones, an expanded stone tool kit, microlithic stone tool industries (often associated with composite tools such as bow and arrow hunting), bone tools, tortoise carapace bowls, ostrich egg shell containers, fire making sticks and so on. Due to the non-preservation of organic remains in exposed contexts such as the affected environment, the archaeological traces of the LSA occupants is limited to stone artefacts. While LSA stone artefacts are common in the landscape, they occur in low densities - often in isolation, are mixed with ESA and MSA specimens and lack organic and cultural remains. As a result, these materials are generally of low scientific value.

The bulk of archaic human (ESA) and human (MSA to recent) occupation of this area involves the Stone Age era, and therefore, the most significant cultural layer in this area involves the pre-colonial cultural landscape and its sense of place (see UNESCO 2008 for definitions, significance and preservation of cultural landscapes).

4.2. Archaeological Foot Survey - Ephraim Sun PV Solar Development and 132kV Overhead Power Line Route Options

Note that the northern portion of the proposed 132kV power line route between points A and B as indicated in Figures 2 and 5 were previously studied by this author (Nilssen 2014b). The latter study concluded that no significant archaeological resources occur in this portion of the power line route and that there are no objections to the proposed linear development.

The entire archaeological inspection was conducted on foot over a period of 6.5 days from 19 to 25 May 2015. A total distance of just over 103km was walked, covering an area of approximately 250ha in extent (Figure 4). Archaeological visibility was excellent with exposed ground surfaces accounting for between 70 and 90% of the landscape.

The archaeological record observed during this study is very similar to that recorded on the adjacent study area that was investigated for the proposed Joram Solar Facility (Nilssen 2014b). The same suite of artefacts was observed, but occur in notably lower densities than that seen during the study for the Joram Solar Facility. The only identified archaeological remains are those of Stone Age origin. While numerous stone artefacts were seen, they are very thinly scattered across the landscape. At no point were any artefact scatters of significant densities observed, and no habitation sites were identified. In addition to their low densities, the value of the archaeological record is further diminished by its temporally mixed nature and the entire absence of any other cultural, organic or faunal remains.

Materials of Early Stone Age (ESA) origin are notably less common than those of the Middle Stone Age (MSA) and Later Stone Age (LSA) and ESA specimens include flakes, cores and bifacially retouched hand axes and cleavers. No "chopper" tools were seen. It appears that most specimens of ESA origin are in quartzite and are usually heavily patinated. Some specimens cannot be attributed to either MSA or ESA since many of the MSA specimens are also patinated. Some artefacts, therefore, are likely of either ESA or MSA origin. It is estimated that the ESA fraction of the recorded stone artefact assemblage is about 5% (as described in Nilssen 2014b).

MSA specimens are notably more common than those of the ESA, but also considerably less common than those of LSA origin. The MSA fraction of the overall stone artefact assemblage is estimated to be about 25%. MSA specimens include Fauresmith type hand axes, convergent flakes, blades, cores (including disc and blade cores), flakes, large scrapers, possible notched pieces/adzes and possible hammer stones. Prepared platforms are common, particularly on convergent flakes and blades and artefacts are in quartzite, quartz and banded ironstone. No raw material is notably more common than others. Due to their mixed context, some artefacts could not be assigned definitively to either MSA or LSA origins, and in particular, quartz does not appear to become as obviously patinated as quartzite (as described in Nilssen 2014b).

Specimens of LSA origin are notably more frequent than those of the ESA or MSA and comprise about 70% of the total stone artefact assemblage. Specimens include adzes, notched pieces, scrapers, hammer stones, an upper grind stone, cores (including disc cores though no bladelet cores were identified), flakes and flaked pieces, and like the MSA materials, specimens are mostly in quartz, quartzite and banded ironstone. Quartz and banded ironstone appear to be the preferred raw materials. Adzes and notched pieces are by far the most common formal tools followed by scrapers (as described in Nilssen 2014b).

Artefacts of ESA, MSA and LSA origin are all deflated / eroded onto the same surfaces and are thus lacking in context. A few examples reflecting a representative sample of recorded specimens are shown in Plates 4 through 8. Two cement dams and a few feeding / watering troughs were the only built structures seen on the affected property. No other tangible heritage related resources were observed.

Significance and Recommendation: The archaeological record in the proposed development areas is considered to be of low significance and it is recommended that no further studies or mitigation is required. It is considered that the documentation of the

archaeological record in the affected areas made during the current study is sufficient. It is suggested that the entire larger study area for the solar panels is suitable for development, as are all six options for the power line route. There are no fatal flaws or constraints from an archaeological perspective, and therefore, there are no objections to the proposed linear and area developments associated with the Ephraim Sun PV Solar Development.

5. Sources of Risk, Impact Identification and Assessment

Because archaeological resources are non-renewable and each archaeological occurrence is unique, it is important that areas affected by development are assessed for the presence and sensitivity of such resources prior to development. The proposed Ephraim Sun PV Solar Development and associated power lines will involve area and linear developments respectively and these could have a permanent negative impact on archaeological resources. This study has shown that archaeological resources do occur in the affected environment, but that they are of low significance. The purpose of this AIA is to assess the sensitivity of archaeological resources in the affected areas, to determine the potential impacts on such resources, and to avoid and/or minimize such impacts on sensitive resources through management and/or mitigation measures.

Direct negative impacts on archaeological resources will occur during the construction and installation phase of the proposed development. Indirect and cumulative impacts will occur during the operational phase of the development.

While numerous artefacts of Stone Age origin were identified in the study areas, no significant archaeological sites were recorded and based on the surface finds, it is highly improbable that significant archaeological sites are currently buried beneath surface sediments.

The below criteria for assessment are drawn from the EIA Regulations that were published in April 1998 by the South African Department of Environmental Affairs and Tourism. The format of impact tables presented below were provided by Cape EAPrac.

5.1. Ephraim Sun PV Solar Development and 132kV Overhead Power Line Route Options

Note that, while the below presents the combined assessment of both the linear and area developments, the solar facility and power line route options are presented separately in the impact table below (Table 2).

Nature of Impact

The construction and installation phase of the development as detailed in Section 3.1 above will involve considerable disturbance to surface and sub-surface sediments. Such activities will have a significant and permanent negative impact on archaeological resources identified in the study area. The operational phase, long term and cumulative, will have a negligible impact on archaeological resources.

Extent of Impact

The impact will be local, confined to the larger study area for the solar panel arrays and corridors of the power line route options. However, since the archaeological record is

considered to be of low significance and because it has been adequately documented during this study, the impact will not change the heritage value of the immediate and surrounding environment (local, provincial or national).

Duration of Impact

Long term to permanent.

Intensity

High.

Probability of Occurrence

Definite

Legal Requirements

While archaeological resources identified during this assessment are protected by Section 35(4)(a) of the National Heritage Resources Act (Act 25 of 1999), which states that "No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite", it is suggested that, due to their low significance and because they have been adequately recorded during this study, a permit is not required from the heritage authorities.

Status of the Impact

Negative for archaeological resources, but positive for the development.

Accumulative Impact

Because the archaeological record in the study area is considered to be of low significance and because it has been adequately recorded during this investigation it is considered that the cumulative impact on the archaeological record is negligible, and that this negative impact is graded as low.

Degree of Confidence in Prediction

High

5.2. No-Go Option

Table 2 summarizes the impacts of the no development option.

Nature of Impact

In the absence of development, the continued farming activities (cattle grazing) and natural erosion and disturbance by burrowing animals will have a slow negative impact on the archaeological record.

Extent of Impact

Local, existing and continued.

Duration of Impact

Continual.

Intensity

low.

Probability of Occurrence

low.

Legal Requirements

none.

Status of the Impact

Neutral.

Accumulative Impact

Low, existing and continual.

Degree of Confidence in Prediction

Medium.

As outlined in section 3.1 above, the proposed development will involve construction and installation activities that will have a permanent negative impact on archaeological resources identified in this study. However, the archaeological resources are considered to be of low significance and their destruction will not have a negative impact on the heritage value of the area.

Overall, from an archaeological perspective there are no fatal flaws, and therefore, no objections to the authorization of the proposed development of the Ephraim Sun PV Solar Development and associated grid connection route options to the Gordonia Substation.

Table 2. Summary of impacts on archaeological resources associated with the Ephraim Sun PV Solar Development (Ephraim Sun), 132kV overhead power line routes (power lines) and the No-Go option (NO-GO).

<u>Alternative</u>	<u>Nature of impact</u>	<u>Extent of impact</u>	<u>Duration of impact</u>	<u>Intensity</u>	<u>Probability of occurrence</u>	<u>Status of the impact</u>	<u>Degree of confidence</u>	<u>Level of significance</u>	<u>Significance after mitigation</u>
Ephraim Sun	Construction & Installation	Local	Long term to permanent	High	Definite	Negative for archaeological resources; positive for development	High	Low	Low
Ephraim Sun	Operational	Local	Long term to permanent	Low	Low	Neutral	High	Low	Low
Power lines	Construction & Installation	Local	Long term to permanent	Low	Low to medium	Negligibly negative	High	Low	Low
Power lines	Operational	Local	Long term to permanent	Low	Low	Neutral	High	Low	Low
NO-GO	Farming activities	Local	Long term to permanent	Low	Low to medium	Neutral	Medium	Low	Low

6. Recommended and Required Mitigation Measures

Recommended Mitigation Measures;

- Archaeological resources identified during this study do not require further recording/studies, and because they are considered to be of low heritage value and have been adequately recorded through this assessment, it is suggested that they can be disturbed or damaged without a permit from SAHRA.
- The development may benefit from having an on-site display of the Stone Age archaeological record in the area, though this will require negotiation with and permission from SAHRA.

Required Mitigation Measures;

- In the event that excavations and earthmoving activities expose significant archaeological or heritage resources, such activities must stop and SAHRA must be notified immediately.
- If significant archaeological or heritage resources are exposed during construction activities, then they must be dealt with in accordance with the National Heritage Resources Act (No. 25 of 1999) and at the expense of the developer.
- In the event of exposing human remains during construction, the matter will fall into the domain of the South African Heritage Resources Agency (Mrs Colette Scheermeyer) and will require a professional archaeologist to undertake mitigation if needed. Such work will also be at the expense of the developer.

7. References

Beaumont, P.B. 2006a. Phase 1 Heritage Impact Assessment Report on a Planned Residential Development Flanking Dakota Drive in Upington, //Khara Hais Municipality, Northern Cape Province.

Beaumont, P.B. 2006b. Phase 1 Heritage Impact Assessment Report on a Planned Extension of the Louisvaleweg Township, //Khara Hais Municipality, Northern Cape Province.

Beaumont, P.B. 2006c. On a Planned Extension of the Leerkrantz Township, Siyanda District Municipality, Northern Cape. An unpublished report by The McGregor Museum.

Beaumont, P.B. 2006d. Phase 1 Heritage Impact Assessment Report on a Planned Extension Flanking Rondonstraat, //Khara Hais Municipality, Northern Cape Province.

Beaumont, P.B. 2006e. Phase 1 Heritage Impact Assessment Report on a Planned Extension of the Raaswater Township, Siyanda District Municipality, Northern Cape Province.

Beaumont, P.B. 2008. Phase 1 Heritage Impact Assessment Report on a Portion of the Farm Keboes 37, near Kanoneiland, Siyanda District Municipality, Northern Cape Province.

DEA&DP, 2005. Guidelines for Involving Specialists in EIA Processes.

Dreyer, C. 2006. First Phase Archaeological and Cultural Heritage Assessment of the Proposed Concentrated Solar Thermal Plant (Csp) at the Farms Olyvenhouts Drift, Upington, Bokpoort 390 and Tampansrus 294/295, Groblershoop, Northern Cape.

Kaplan, J.M. 2008. An Archaeological Assessment of Two Borrow Pits Alongside DR 3321 Uap, Northern Cape Province. An unpublished report by the Agency for Cultural Resources Management.

Morris, D. 2006. Archaeological Specialist Input to the EIA Phase for the Proposed Aries-Garona Eskom Transmission Power Line, Northern Cape and Comment on Garona Substation Extension. An unpublished report by The McGregor Museum.

Morris, D. 2013. RE Capital 3 Solar Development on the property Dyasons Klip west of Upington, Northern Cape: Scoping phase Heritage Input. An unpublished report by The McGregor Museum.

Nilssen, P.J. 2015. Scoping Archaeological Impact Assessment. Proposed development of Ephraim Sun Solar PV Development near Upington on Remainder of portion 62 (portion of portion 9) (Vryheid) of Farm Vaalkoppies no 40., //Khara Hais Municipality, Northern Cape Province

Nilssen, P.J. 2014a. Scoping Archaeological Impact Assessment. Proposed development of Joram Solar Facility near Upington on Remainder of Portion 62 and a Portion of Portion 9 of the Farm Vryheid No. 40, //Khara Hais Municipality, Northern Cape Province.

Nilssen, P.J. 2014b. Phase 1a Archaeological Impact Assessment. Proposed development of Joram Solar (Photovoltaic) Facility on a Portion of the Farm Vaal Koppies 40/ Remainder Portion 60, Including Potential Grid Connections Across Portions of the Farm Vaal Koppies 40/3, 9, 52 & 66; Farm 555/7; and Erven 73 & 19951, Kenhardt District, Northern Cape Province

Nilssen, P. 2012. Phase 1a Archaeological Impact Assessment. The Proposed Building and Operation of a Bulk Water Supply Line near Upington on Remaining Extent of the Farm Vaalkoppies No. 40, //Khara Hais Municipality, Northern Cape Province

Pelser, A.J. 2012. A Report on a Heritage Impact Assessment (HIA) for the Proposed Photo-Voltaic Solar Power Generation Plant on the Farm Padrooi 13 near the Augrabies Falls National Park in the Northern Cape.

SAHRA APM, 2007. Guidelines: Minimum Standards for Archaeological & Palaeontological Components of Impact Assessment Reports.

UNESCO, 2008. Operational guidelines for the implementation of the World Heritage Convention, 2008.

Webley, L and Halkett, D. 2010. An Archaeological Impact Assessment (Report 4): Proposed Construction of a Substation Between Aries-Garona and Associated Loop In and Loop Out Lines, North-West of Kenhardt in the Northern Cape

8. Figures and Plates (on following pages)

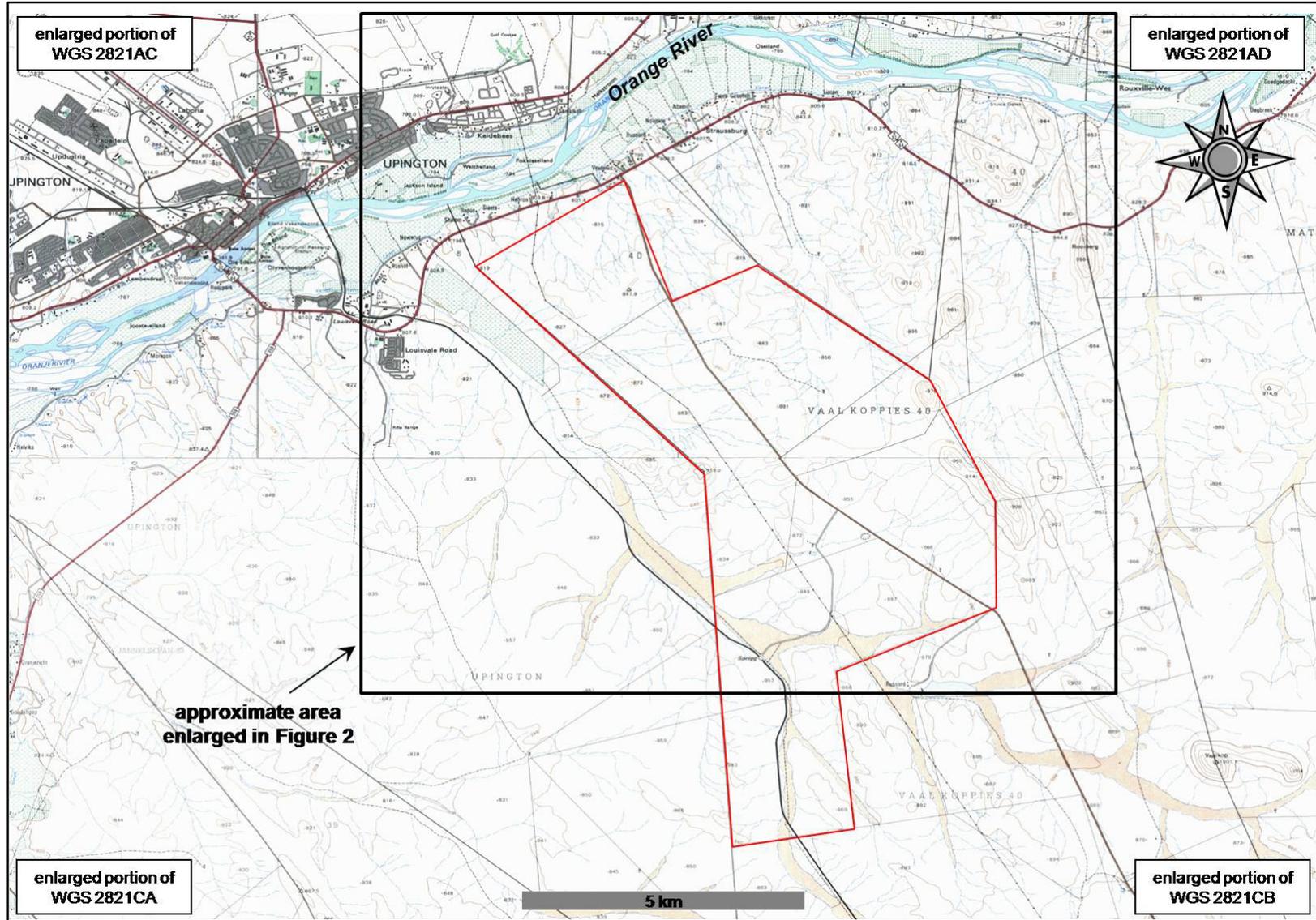


Figure 1. Location of affected properties (red polygon) relative to Upington, Northern Cape Province. (Map - The Chief Directorate, Surveys & Mapping, Mowbray).

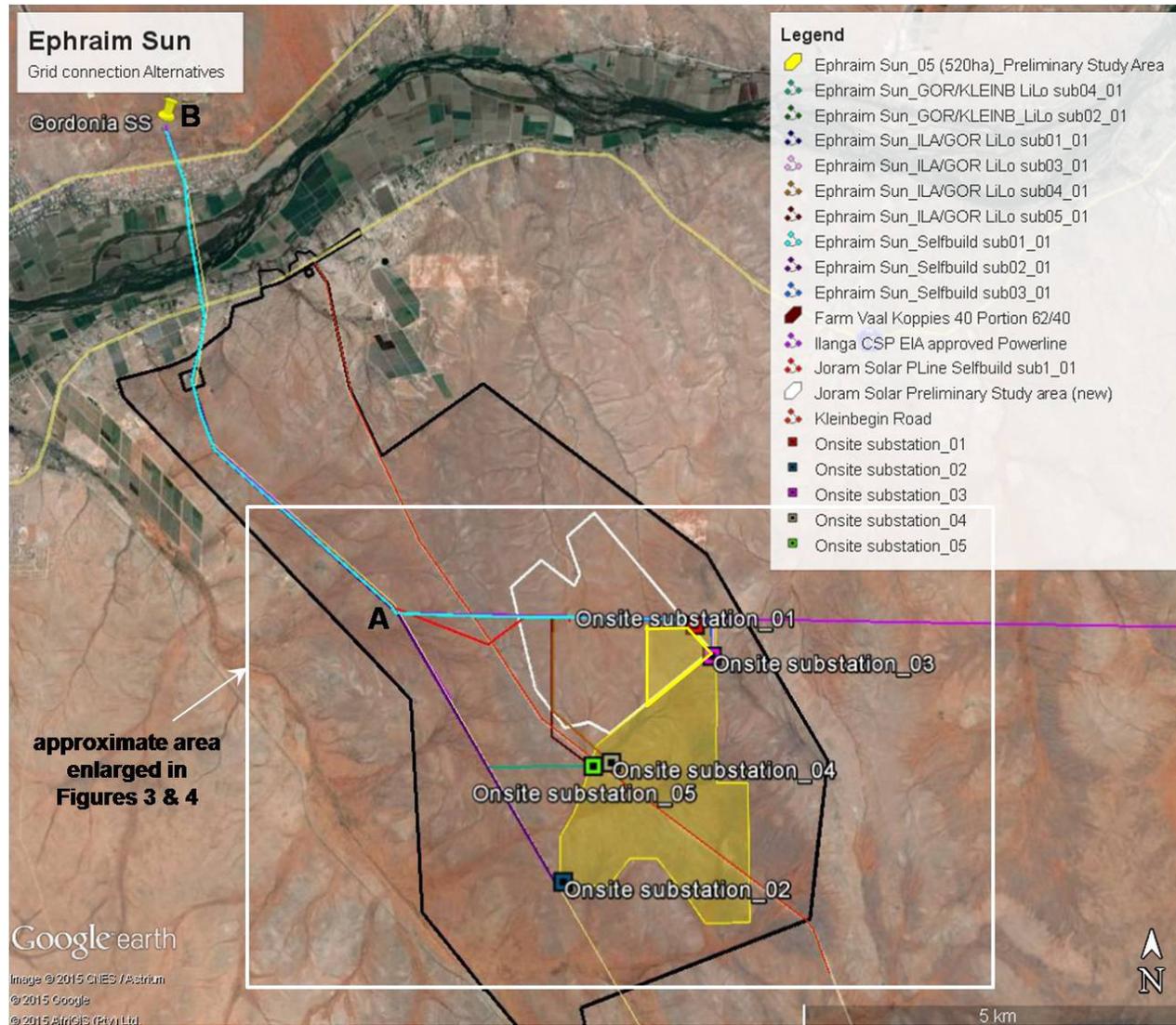


Figure 2. Provisional development layout of the broader 580 ha study area for solar panels (yellow polygon), on site substation localities, and various route options for the own built 132kV power line. Courtesy of Cape EAPrac.

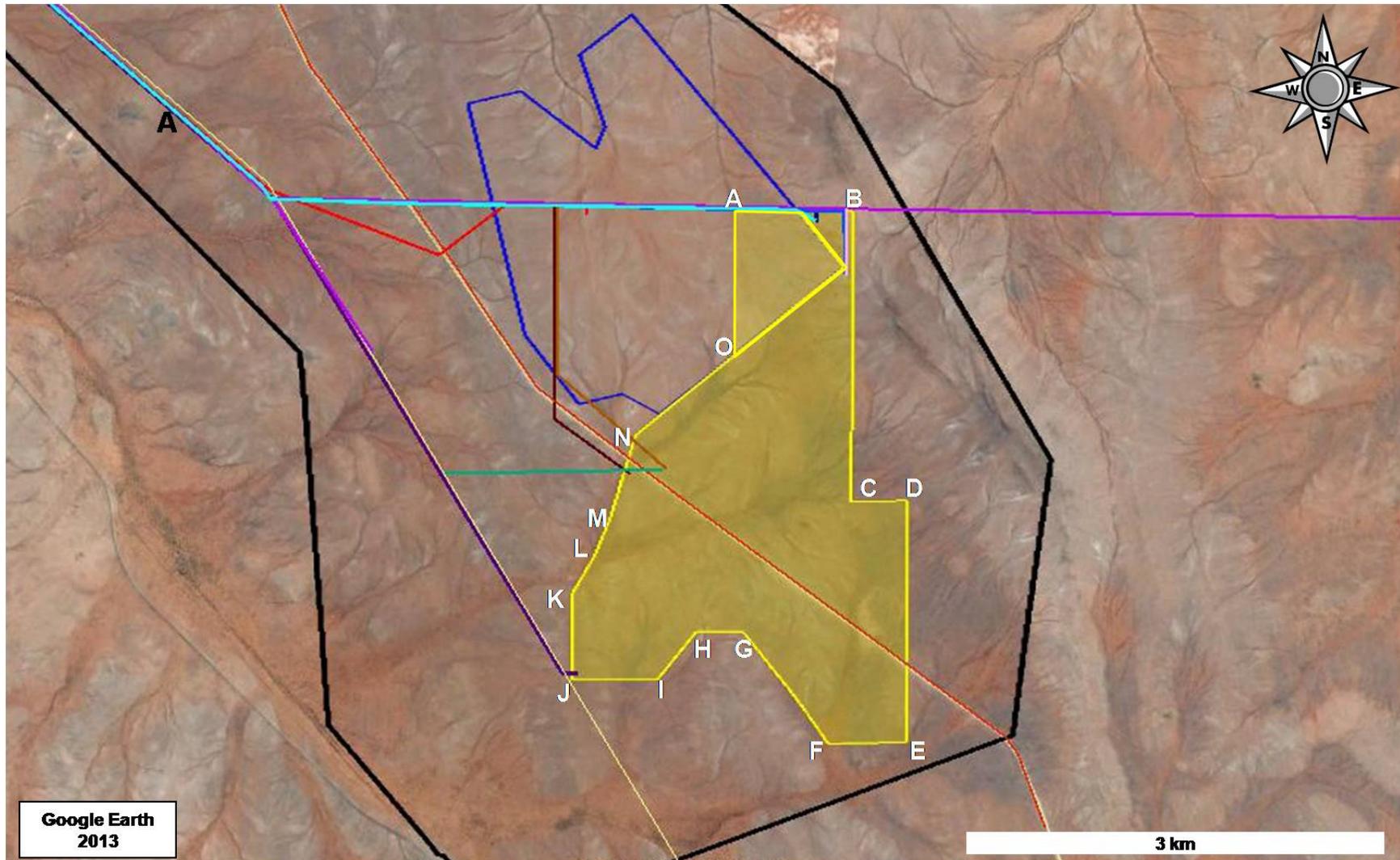


Figure 3. Enlarged from Figure 2 showing provisional development layout of the broader 580 ha study area for solar panels (yellow polygon), various route options for the own built 132kV power line and the former study area for the Joram Solar Facility (blue polygon). Courtesy of Cape EAPrac. Coordinate data for boundary points (white capital letters) are given in Table 1.

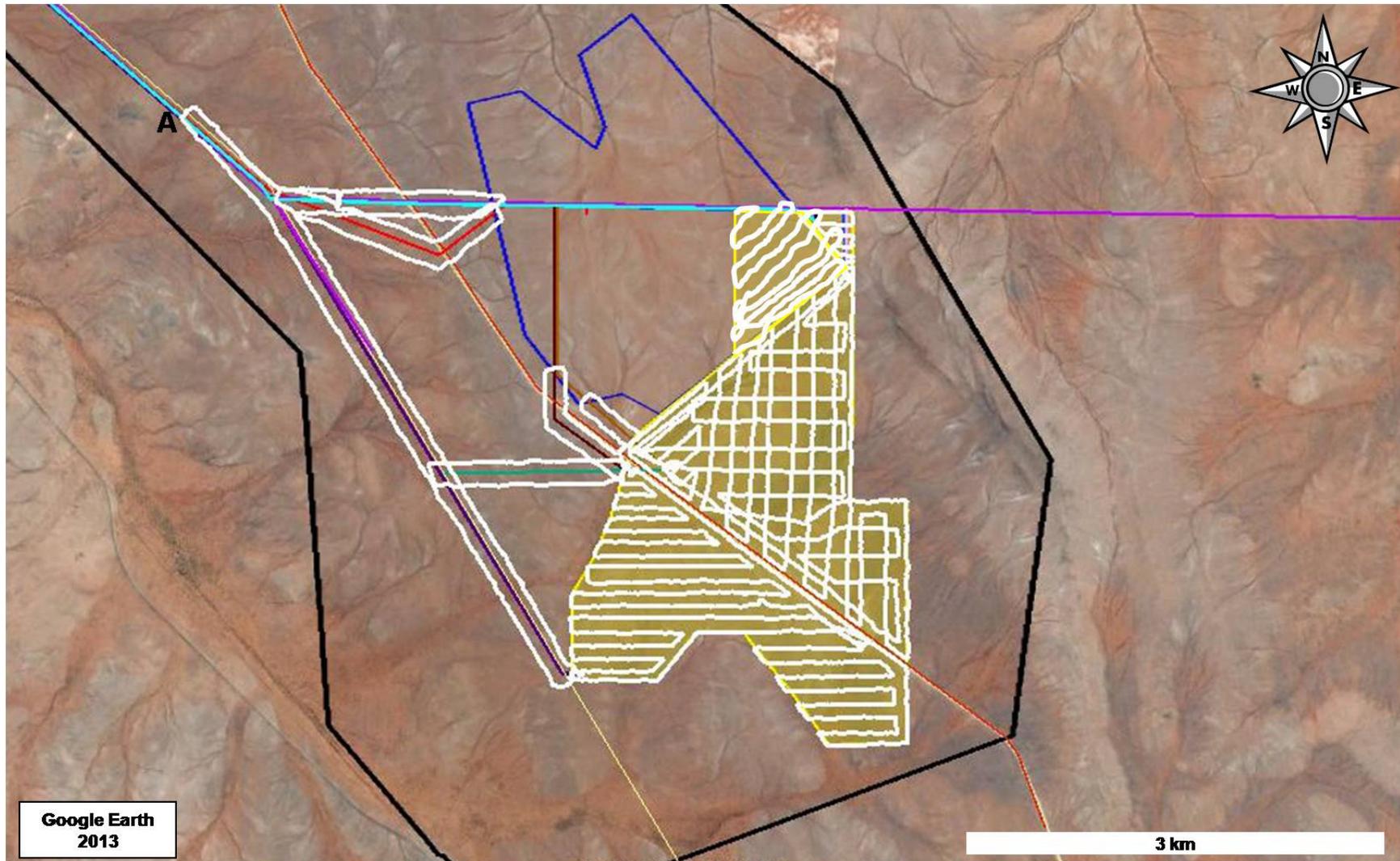


Figure 4. Area enlarged from Figure 2 showing archaeological survey walk tracks (white lines) covering proposed development areas. Blue polygon represents the studied area for the Joram Solar Facility. Note that portions not covered here (power line routes) were studied for the Joram Solar Facility including the power line corridor to the Gordonia Substation north of the Orange River as indicated in Figures 2 & 5 (see Nilssen 2014).

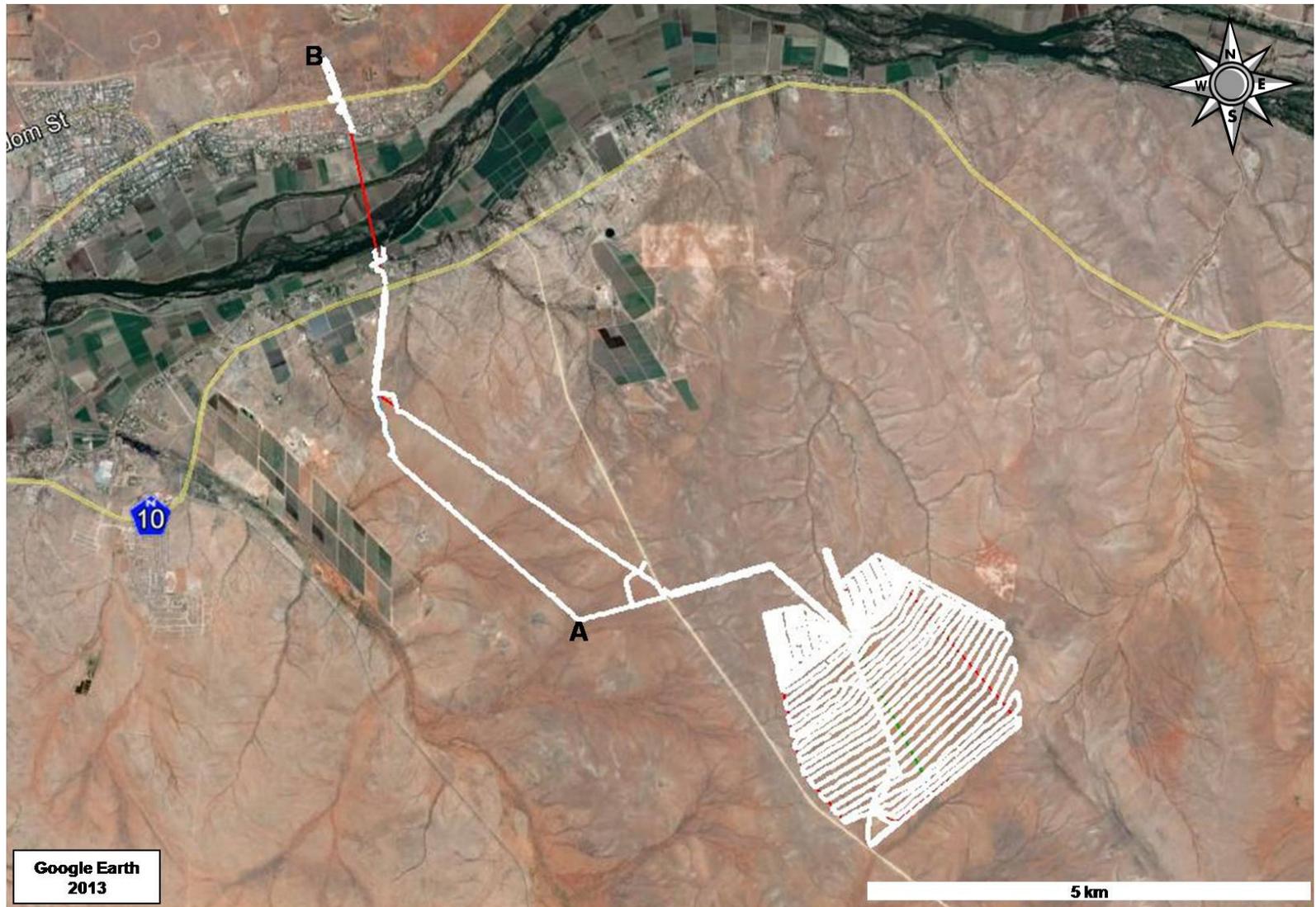


Figure 5. White lines represent survey tracks generated during the archaeological investigation for the proposed Joram Solar Facility, including the portion between points A and B that form part of the study of the overhead power line route presented here (Nilssen 2014b).



Plate 1. Examples of the affected environment showing topography, vegetation cover and exposed surfaces and sediments.



Plate 2. Examples of the affected environment showing extensive animal burrowing, topography, vegetation cover, rocky outcrops, alluvial gravels and soft surface sediments.

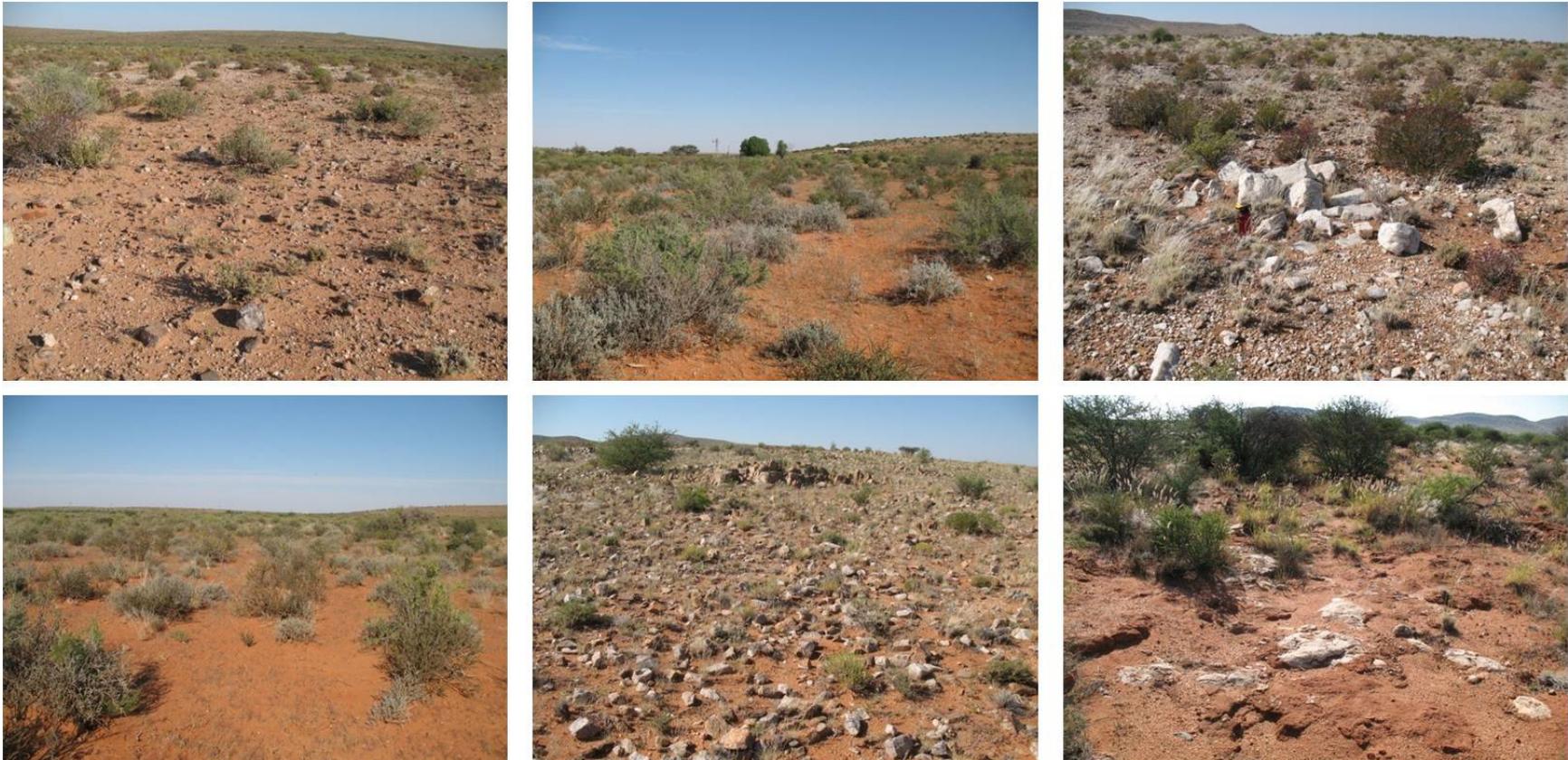


Plate 3. Examples of the affected environment showing quartz dominated gravels, topography, vegetation cover, quartz outcrops, exposed surfaces and exposed calcrete in drainage line.

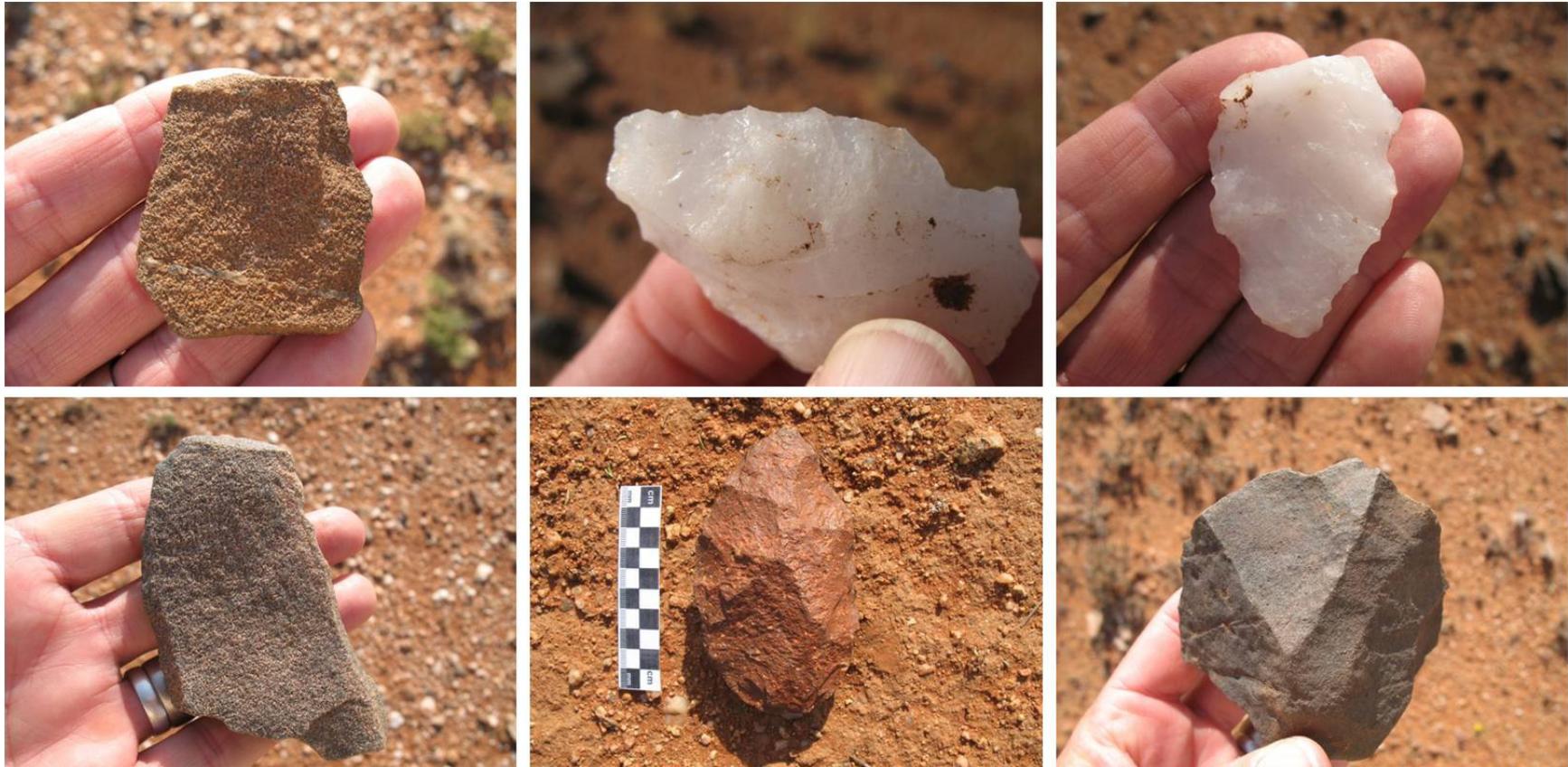


Plate 4. Examples of archaeological occurrences showing a mix of Early Stone Age (top left and bottom left and middle), Middle Stone Age (bottom right) and Later Stone Age specimens (top middle and right).



Plate 5. Examples of archaeological occurrences showing a mix of Later Stone Age and Early Stone Age (top middle) specimens.



Plate 6. Examples of archaeological occurrences showing a mix of Later Stone Age and Early Stone Age (bottom middle) specimens.



Plate 7. Examples of archaeological occurrences showing a mix of possible Middle Stone Age (top left) and Later Stone Age specimens.



Plate 8. Examples of archaeological occurrences showing a mix of possible Middle Stone Age (top left), Later Stone Age (top middle and bottom left) and Early Stone Age (top right and bottom middle and right) specimens.

Appendix A

Legislation relevant to archaeology and palaeontology taken from the National Heritage Resources Act (Act 25 of 1999)

Archaeology, palaeontology and meteorites

35. (1) Subject to the provisions of section 8, the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority: Provided that the protection of any wreck in the territorial waters and the maritime cultural zone shall be the responsibility of SAHRA.

(2) Subject to the provisions of subsection (8)(a), all archaeological objects, palaeontological material and meteorites are the property of the State. The responsible heritage authority must, on behalf of the State, at its discretion ensure that such objects are lodged with a museum or other public institution that has a collection policy acceptable to the heritage resources authority and may in so doing establish such terms and conditions as it sees fit for the conservation of such objects.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) 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.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—

(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;

(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and

(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

(6) The responsible heritage resources authority may, after consultation with the owner of the land on which an archaeological or palaeontological site or a meteorite is situated, serve a notice on the owner or any other controlling authority, to prevent activities within a specified distance from such site or meteorite.

(7) (a) Within a period of two years from the commencement of this Act, any person in possession of any archaeological or palaeontological material or object or any meteorite which was acquired other than in terms of a permit issued in terms of this Act, equivalent provincial legislation or the National Monuments Act, 1969 (Act No. 28 of 1969), must lodge with the responsible heritage resources authority lists of such objects and other information prescribed by that authority. Any such object which is not listed within the prescribed period shall be deemed to have been recovered after the date on which this Act came into effect.

(b) Paragraph (a) does not apply to any public museum or university.

(c) The responsible authority may at its discretion, by notice in the Gazette or the Provincial Gazette, as the case may be, exempt any institution from the requirements of paragraph (a) subject to such conditions as may be specified in the notice, and may by similar notice withdraw or amend such exemption.

(8) An object or collection listed under subsection (7)—

(a) remains in the ownership of the possessor for the duration of his or her lifetime, and SAHRA must be notified who the successor is; and

(b) must be regularly monitored in accordance with regulations by the responsible heritage authority.

Legislation relevant to the proposed activity under consideration taken from the National Heritage Resources Act (Act 25 of 1999)

Heritage resources management

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 50 m 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.