

Phase1a Archaeological Impact Assessment

Proposed development of the AMDA Alpha PV (Solar Energy Facility) on Portion 1 of N'Rougas Zuid No 121, Strausheim, and Overhead Power Line Grid Connection to the Eskom Nieuwehoop MTS Sub-Station across Portion 3 of Gemsbok Bult No120, Kenhardt Registration Division, Northern Cape Province

Prepared for

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1. Executive Summary

This report provides input to the archaeological component of the integrated Heritage Impact Assessment that forms part of the Environmental Impact Assessment process for the proposed development of the AMDAAAlpha PVsolar facility to be situated about 28 km NNE of Kenhardt in the Northern Cape. The study reported here covers the 250 ha development lease and footprint area, the proposed overhead power line grid connection corridor, on site collector sub-stationas well as the access road.

The proposed development activities will involve area and linear developments that could have a permanent negative impact on archaeological resources. Direct negative impacts on archaeological resources will occur during the construction and installation phase. Indirect and cumulative impacts will occur during the operational phase and as a result of other potential future developments in the surrounding area.

Earlier heritage related work in the area concludes that archaeological resources are particularly rare in the surroundings of Kenhardt. Overall, archaeological materials are most commonly clustered around existing and ancient drainage lines, pans, and ridges with rocky outcrops, and are generally absent from flatlands removed from existing or ancient water sources. Based on the findings of previous investigations, it was expected to find mainly Stone Age materials in the affected area with lesser potential for the occurrence of historic heritage resources.

While a very ephemeral background scatter of temporally mixed Stone Age stone artefacts was identified in the study areas, these are considered to be of low significance and require no further investigation or mitigation. Their disturbance or destruction will not have a negative impact on the heritage value of the area. No archaeological resources were seen in animal burrows, so it is unlikely that significant archaeological sites are currently buried beneath surface sediments.

A damaged and disturbed pan site with a few Stone Age implements was identified along the grid connection corridor. This site is considered to be of low significance and its disturbance or destruction will not detract from the heritage value of the area. No further investigation or mitigation of this locality is required.

Several Stone Age quartz quarry sites were documented. Although these sites contain temporally mixed Stone Age materials and preserve no faunal, organic or other cultural materials, some are considered to represent fine examples of Stone Age quarrying of quartz in prehistoric times for the manufacture of stone tools. With increased alternative energy and a variety of other developments in the Northern Cape, it is possible that the cumulative impact of such developments in the area could obliterate these types of archaeological resources. It is recommended, therefore, that four of these sites be conserved in perpetuity as part of the National Estate and for potential future research. This recommendation was accepted by the applicant as is reflected in the avoidance of the fore mentioned sites in the revised development layout plans. In lieu of such protection and conservation, it is further recommended that the remainder of these quarry sites do not require sampling and that, because they were adequately recorded during this investigation and are considered to be of low significance, permits are not required for their disturbance or destruction.

The proposed development will involve construction and installation activities that will have a permanent negative impact on archaeological resources identified in this study.

However, a representative sample of the archaeological resources will be conserved and the remainder are considered to be of low significance, and therefore, their destruction will not have a negative impact on the heritage value of the area.

From an archaeological perspective, provided that the below recommendations are considered and/or implemented, there are no fatal flaws, and therefore, there are no objections to the authorization of the proposed development of the AMDA Alpha SEF and associated on-site collector sub-station, overhead power line grid connection and access road. The positive impact of the development is that it will allow for the conservation of archaeological resources that may otherwise have been overlooked or destroyed.

Recommended Mitigation Measures;

- Four of the Stone Age quartz quarry sites identified in the AMDA Alpha SEF PV area and grid connection corridor were selected for protection and conservation in perpetuity. These include sites at waypoints 122A, 136, 140 and 130 & 131. A temporary fence should be erected around these sites in the presence of an archaeologist prior to the construction phase of development to ensure that they are not damaged or destroyed. Such management measures should be included in the Construction and Operational Environmental Management Plan for the development. Given the fore-mentioned conservation measures, the likely disturbance or destruction of the remaining quarry sites will have a negligible negative impact on the heritage value of the area. It is further recommended that the remainder of these quarry sites do not require sampling and that, because they were adequately recorded during this investigation and are considered to be of low significance, permits are not required for their disturbance or destruction. The latter suggestion may require SAHRA's formal approval.
- Although unlikely, the presence of sub-surface archaeological resources cannot be ruled out entirely, it is recommended that the Environmental Management Plan for the construction phase of development makes provision for archaeological training of the appointed Environmental Control Officer (ECO). This will allow for the ECO to recognise archaeological remains if they are exposed during construction, and to alert the authorities or a suitably accredited archaeologist, who should be called to site to assess the finds and to determine mitigation measures if necessary. Such work will be at the expense of the developer.

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. Such resources must be handled 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 and will require a professional archaeologist to undertake mitigation if needed. Such work will also be at the expense of the developer.

2. Name, Biosketch 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 archaeology and Stone Age archaeology; Field Director for Colonial Period; Field Supervisor for Iron Age and Rock Art, and am suitably qualified and experienced for the archaeological investigation conducted for this project.

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, 2014 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, 2014 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:

Date: **23 July 2016**

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3. Introduction

3.1. Background to Development Proposal

The applicant, AMDA Alpha (Pty) Ltd, is proposing the establishment of a commercial solar photovoltaic energy facility (SEF) on Portion 1 of N'Rougas Zuid No 121, situated in the District of Kenhardt, Northern Cape Province. The entire property is 5232.8138 ha in extent, while the initial study area is 900 ha and the development lease area is approximately 250 ha in extent, and is located about 28 km NNE of Kenhardt in the Northern Cape Province (Figures 1 & 2).

The proposed photovoltaic (PV) SEF will have a net generating capacity of 75 MW (AC) with an installed capacity of 85 MW (DC). The proposed technology is Solar PV on fixed tilt structures or single axis tracking technology. The structure will be fixed-tilt in a north facing orientation or mounted on horizontal axis trackers, tracking from east to west. The dimensions or extents of the development components are as follows: Solar PV field footprint = 185ha, project sub-station = 1ha, collector sub-station = 1ha, buildings = 1.5ha, roads = 22km long at 6m wide = 13.2ha, permanent lay down areas = 7ha and construction lay down areas = 12ha. The solar field tracker structure height is approximately 3.5m, while the perimeter fence will be a 2.4m high multi-strand electric security fence.

The proposed SEF project will connect to the Eskom Nieuwehoop MTS sub-station near Kenhardt as indicated in Figure 2. The sub-station to connect the facility has a confirmed capacity of 245MW - Eskom letter for REIPPPP Bid window 4 accelerated programme & 750MW in GCCA 2022 June 2015. The project sub-station will connect to the collector sub-station via a single 132kV overhead line. The collector sub-station will connect to Nieuwehoop MTS sub-station via a single 132kV overhead line. The power line route will be approximately 5.5km in length and will run from the collector sub-station on the property, across Portion 3 of Gembok Bult No 120 to the Nieuwehoop MTS sub-station. The proposed grid connection route is shown in Figures 2 and 3. The power line will be 25m in height with a servitude width of 50m.

Additional infrastructure includes; water transported from Municipal source or borehole, auxiliary electricity supply from Eskom, and sewerage by conservancy tank. A new access road will be built across the property from the Kenhardt - Louisvale district road (see Figure 2).

Detailed specifications and development layouts of the proposed solar facility and associated infrastructure was guided and determined by the Environmental Impact Assessment (EIA) process, and specifically, by the location and extents of archaeological resources identified during this investigation. The revised and preferred development layout plan is shown in Figures 3 and 4.

Activities associated with the proposed development trigger the National Heritage Resources Act (NHRA, Act 25 of 1999), and therefore, this author was appointed to provide archaeological input for the broader integrated Heritage Impact Assessment (HIA) that is being undertaken by Mr Stefan de Kock of Perception Planning in terms of Section 38(8) of the NHRA. Mr Dale Holder of Cape Environmental Assessment Practitioners (CapeEAPrac) is facilitating the EIA process. Contact details for Perception Planning and the applicant are given on the title page of this report.

The first phase of archaeological input to the integrated HIA involved a Scoping Archaeological Impact Assessment (SAIA) which provided a summary on the findings made

during previous archaeological and heritage related investigations in the surroundings of the current study area (Nilssen 2016a). The current phase of the HIA process involves a Phase 1a Archaeological Impact Assessment (AIA), which presents a more detailed report on the findings made during an archaeological investigation for the proposed development of the AMDA Alpha PV solar facility and its associated infrastructure. This report is a required component of the integrated HIA 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 nature and sensitivity of archaeological resources in the affected area, to determine the potential impacts of development 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 the environmental assessment practitioner (Cape EAPrac).
- d) Recommend management and/or 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. Description of Property / Affected Environment

The proposed AMDA Alpha solar photovoltaic energy facility (AMDA Alpha SEF) will be located on a portion of Portion 1 of N' Rougas Zuid No 121, which is about 28 km NNE of Kenhardt in the District of Kenhardt, Northern Cape Province (Figures 1 & 2). The entire property is some 5233ha in extent, while the development lease area is approximately 250 ha in extent. The proposed grid connection from the AMDA Alpha SEF to the Eskom Nieuwehoop MTS sub-station will traverse Portion 3 of Gemsbok Bult No 120 (see Figures 2 & 3). Note that the latter farm portion is also labelled as Portion 3 of Paardeneiland 344 120 on some maps. The Nieuwehoop MTS sub-station is situated approximately 1km WNW of the Rugseer Railway Station (Figure 2). The study site is readily accessible by vehicle by taking the Louisvale turn-off from the R27 some 11 km north of Kenhardt. The larger study area is located to the east of the gravel road some 17 km from the R27. Coordinates for the proposed development activities are given in Table 1 below.

The following description applies to the larger study area as indicated with a red polygon in Figure 2 as well as the access road and grid connection route also indicated in Figure 2. The environmental setting (terrain, topography, geological sediments and vegetation) of the proposed PV area, access road as well as the grid connection route are very similar. Examples of the affected environment described below are shown in Plates 1 through 6.

While the terrain is essentially flat with minor undulation in places, there are distinct high lying areas as well as low “hills” that consist mainly of quartz outcrops. The most prominent high point in the study area is a low hill with a quartz outcrop at its peak, which is situated at the central meeting point of the AMDA Alpha, AMDA Bravo and AMDA Charlie study areas (see 122A in Figure 6). Some of the areas within the larger study site that are at higher elevation than the surrounding landscape are indicated with dashed black lines in Figure 2. Although variations in elevation are seemingly insignificant, it appears that the higher lying areas were preferred points of human activity in prehistoric times. Several small intermittent streams are present that drain to the West and North West, and which are clearly visible in Google Earth imagery (Figure 2). A few small pans, some still containing water after recent rains at the time of conducting the field work for this assessment, occur mostly on higher lying areas.

In addition to quartz outcrops, a few other low rocky outcrops also occur, and according to geological maps, these are associated with the Namaqua and Natal Metamorphic Provinces, but may also include the Kalahari or Vanrhynsdorp and Nama Groups (Almond & Pether 2009). Some of these outcrops appear to be dolerite while others are of a quartzitic or sandstone nature. Calcrete is also present at the surface in places and occurs both in bedded and nodular form. Large animal burrows truncate sub-surface calcrete at several localities. Surface sediments are variable across the study area, but generally, finer sediments are more commonly associated with intermittent streams in the low lying areas while coarser, angular to sub-angular fluvial gravels appear more common on slopes and higher ground. What appears to be a coarser version of the orange to red Kalahari or Hutton Sands is dominant, but soft sediments vary somewhat across the landscape.

Overall, vegetation is low, open and sparse, though thicker and higher stands occur along intermittent streams and drainage lines. Consequently, archaeological visibility is excellent across the entire study area. Vegetation consists of grasses, bush and some thorny scrubs as well as the occasional and mainly isolated specimens of quiver tree (*Aloe dichotoma*).

The surrounding land use is agricultural and undeveloped and is mainly used for the grazing of small domestic stock (sheep) and game animals. Relatively recent human related disturbances to the environment include the gravel road to Louisvale, vehicle and animal tracks, fencing, windmills/boreholes and associated small free-standing dams, watering and feeding troughs for domestic stock, medium and small scale quarrying / borrow pits as well as overhead power lines. Natural disturbances include burrowing by large and small animals. Modest erosion occurs along intermittent streams and several highly polished Middle Stone Age stone artefacts suggest considerable wind erosion (sandblasting) through deep time.

Table 1. Coordinate data for the larger study area, AMDA Alpha SEF footprint, grid connection (overhead power line), access road and on-site collector sub-station and Nieuwehoop MTSSub-station sites(see Figures 2& 4).

Name	Description	Datum: WGS84 Lat/Lon decimal degrees	Datum: WGS84 Grid: SA National
A	boundary point of larger study area (Figure 2)	S29.10719 E21.27632	21 Y-026896 X3221181
B	boundary point of larger study area (Figure 2)	S29.10785 E21.29579	21 Y-028792 X3221259
C	boundary point of larger study area (Figure 2)	S29.11363 E21.30335	21 Y-029526 X3221901
D	boundary point of larger study area (Figure 2)	S29.13009 E21.30295	21 Y-029482 X3223726
E	boundary point of larger study area (Figure 2)	S29.13337 E21.29074	21 Y-028293 X3224086
F	boundary point of larger study area (Figure 2)	S29.13300 E21.27299	21 Y-026566 X3224042
G	boundary point of larger study area (Figure 2)	S29.11450 E21.27278	21 Y-026550 X3221991
AA	main boundary point of AMDA Alpha (Figure 4)	S29.11651 E21.28769	21 Y-028001 X3222217
AB	main boundary point of AMDA Alpha (Figure 4)	S29.11648 E21.30345	21 Y-029535 X3222217
AC	main boundary point of AMDA Alpha (Figure 4)	S29.12953 E21.30265	21 Y-029453 X3223664
AD	main boundary point of AMDA Alpha (Figure 4)	S29.13176 E21.28773	21 Y-028001 X3223907
GC1	point along Grid Connection (Figure 2)	S29.13431 E21.30153	21 Y-029343 X3224193
GC2	point along Grid Connection (Figure 2)	S29.15115 E21.32077	21 Y-031210 X3226065
Nieuwehoop MTS	Eskom's Nieuwehoop MTS Sub-Station (Figure 2)	S29.15024 E21.33732	21 Y-032821 X3225969
Rd1	point on access road (Figure 2)	S29.11700 E21.27071	21 Y-026348 X3222267
Rd2	point on access road (Figure 2)	S29.11713 E21.28796	21 Y-028027 X3222286
Collector SS	on-site Collector Sub-Station (Figure 2)	S29.13426 E21.28773	21 Y-028000 X3224185

3.4. Description of Methodology

The overall purpose of an AIA is to perform a survey of the affected areas in order to identify, record and rate the significance of archaeological resources, to assess the impact of the proposed area and linear developments on such resources and to recommend management and mitigation measures where necessary. 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).

Presented below in section (4.1) are the results of an archaeological desktop study and literature review that were conducted as part of this assessment.

To assess the nature and significance of the archaeological record in the affected area, it was necessary to conduct a comprehensive foot survey. The latter focused on the provisional development layout plans including the approximately 900 ha portion of the larger property as well as the power line route and access road options (see Figures 2 & 5).

The potential for different landforms, sediments or landscape features to contain archaeological traces was assessed according to type, such as rocky surfaces, sandy surfaces, cultivated areas, previously developed or disturbed areas, rock shelters, and so on. Overall, the significance of archaeological occurrences or sites was assessed against results of previous archaeological studies in the region as well as their content and context. Attributes that were 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 AMDA Alpha (Pty) Ltd., Mr Dale Holder of Cape EAPrac provided background information, terms of reference, locality maps, provisional development layout plans for the proposed activity and contact details for the property owners. Permission and keys to access the property was obtained from Mr Hendri van Wyk (Jnr). Thereafter the entire archaeological survey was conducted independently and on foot.

Open vegetation and large expanses of exposed ground surfaces provided excellent archaeological visibility and allowed for a good understanding of the archaeological record in the area based on surface observations. Due to excellent visibility and, as it turned out, very sparse and predictable archaeological occurrences, survey walk tracks were spaced between about 60 and 100m apart. After gaining a more detailed understanding of the nature of the archaeological record in the study area, the survey transects were set further apart to an average of about 100m. Due to open and mostly low vegetation, any landscape features such as rocky outcrops or pans, or cultural resources such as ruins with a vertical aspect, would be easily detectable in the landscape. Areas with disturbed sediments such as animal burrows, erosion gullies and borrow pits or excavations were inspected for potential sub-surface archaeological traces.

Survey walk tracks were fixed with a hand held Garmin Etrex30x GPS to record the search area (Figures 5 through 7, gpx tracking file is available from author). The position of identified archaeological occurrences and sites, observations and photo localities were fixed by GPS and such data are available from the author on request. Due to the insignificant nature of identified and recorded isolated Stone Age occurrences, these are not indicated individually in Figures 6 and 7, and a table with coordinate data for these is not provided. More substantial archaeological occurrences or sites are indicated with labelled red polygons in Figures 6 and 7, and their coordinates and summary descriptions are presented in Table 2. Data imprints on photographs in Plates 1 through 6 show direction of view, meters above sea level and GPS coordinates. In one or two instances the direction of view is incorrect due to compass calibration settings. Plates 7 through 27 show a representative sample of the isolated archaeological occurrences and sites identified and recorded in the studied areas. Because Stone Age quartz quarry sites were found to be very similar in context and content, only representative examples are shown in the fore mentioned Plates. Digital audiovisual notes, and a comprehensive, high quality digital photographic record were also made with a Nikon Coolpix AW130 digital camera. A complete data set for all finds and observations are available from this author on request.

3.5. Assumptions, Limitations and Gaps in Knowledge

This assessment assumes that the proposed AMDA Alpha SEF will be contained within the 250 ha study and development lease area and that the proposed overhead power line and access road alignments as indicated in Figures 2 and 3 will not be rerouted, except for the purposes of avoiding relevant archaeological sites. In the event that the impacted areas are moved or altered, then, depending on the nature of changes, a further archaeological investigation may be required. It is also assumed that all background information and revised development layout plans provided by Cape EAPrac are correct and current. The revised development layout plans shown in Figures 3 and 4 have taken into account the archaeological constraints resulting from this investigation and assessment, and are approved by this author.

This assessment is specifically for the footprint of the AMDA Alpha SEF and corridors of the proposed power line and access road routes and does not apply to, and may not be used for, any other future developments on the remainder of the affected property that was not covered by this investigation.

High concentrations of quartz dominated gravels caused the foot survey to be slow in certain areas, and it is highly likely that some isolated quartz artefacts were missed in these instances. It is unlikely, however, that higher density artefact scatters were overlooked. 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 entirely 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 web site (<http://www.sahra.org.za/sahris/map/reports>). Further pertinent information from related reports was obtained from references cited below.

To the best of my knowledge, no archaeological or heritage related study has been undertaken on the affected property. Most of the information concerning the history and archaeology of the surroundings was obtained through heritage and archaeological studies associated with environmental impact assessments for a variety of development activities. More recently, the bulk of these assessments are associated with the development of alternative energy facilities and particularly solar energy facilities and associated infrastructure.

The Northern Cape Province has a rich and long archaeological record that spans the entire Stone Age, includes a few potential remnants of Iron Age sites further to the east, rock art sites with both engraved and painted rock surfaces, traces of the Anglo-Boer war, indigenous and colonial contact sites and more recent historic occupation and development of the region. A detailed and general account of the history, heritage resources and associated hominin and human behaviours in this portion of South Africa has already been written and is not repeated here (e.g. Küsel and Küsel 2015). Of relevance here is the nature of the archaeological record in the surroundings of the present study area, which give an indication of the type of heritage resources that are expected to occur in the proposed development site.

Overall, there is a widespread, but ephemeral scatter of Stone Age stone artefacts across the landscape that is of low heritage value due to its temporally mixed nature and the absence of faunal, organic and other cultural remains. Higher density scatters of stone artefacts are commonly associated with pans, drainage lines and rocky outcrops or ridges. The entire range of the Stone Age sequence is found in varying proportions of representation, but includes Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) materials. MSA and ESA artefacts are more common than materials of LSA origin. Stone artefact scatters are usually located in areas with exposed gravels, and are less common to absent in areas with sandy surface sediments (Kaplan 2011a, 2011b, 2012a & 2012b, Nilssen 2015, Orton 2011a, 2011b, 2014a & 2014b, Orton & Webley 2013a, Pelsner 2011 and Webley & Halkett 2010 & 2012). Archaeological resources are said to be particularly rare in the surroundings of Kenhardt. A study along the Hartebeest River

near Kenhardt, a setting where such resources are expected to be more common, found very few archaeological traces (Morris 2009). This pattern of very low hominin and human occupation of the surrounding environment is almost certainly due to the lack of predictable water sources. Although rock art has been documented in the region, there are no known rock art sites in the immediate surroundings of Kenhardt (Morris 1988, Morris & Beaumont 1994, Orton 2013, Orton & Webley 2012a and Rudner & Rudner 1968).

As in prehistoric times, historic occupation of the surroundings is very scanty, and very large farms result in farmsteads being widely separated in the landscape. The bulk of the farmsteads, as well as the majority of structures in the town of Kenhardt, are of recent 20th century origin (Orton 2014a). The only proclaimed heritage site in the surroundings of the present study area is a pioneer house, one of the oldest buildings in Kenhardt, built in 1897, which is a registered Provincial Heritage Site (Orton 2014a).

"The Anglo-Boer War played an important role in the central parts of South Africa leaving many traces of its events. Block houses, battlefields and graves litter the region. Kenhardt only saw a small amount of action. On 25th February 1900 Koos Jooste and Andries de Wet occupied Kenhardt with 12 men. They fired on the town guard when ordered to halt, but eventually took over the town and locked the town officials in jail for a few days before ordering them to leave town. On 1 March 1900, 200 recruits joined the Boer forces in Kenhardt. They were addressed by Commandant Lucas Steenkamp, after which they went into training. On hearing of the British approach, a group of 130 men under Field Cornet Borrius moved to Rietfontein, 2 km south of Kenhardt, to defend the town from British forces who were on their way to the lower Orange River Valley to suppress the Boers in the area. However, before the arrival of the British, the forces at Kenhardt decided to surrender due to a decision made by a Boer war council in Upington on 20th March to disband the rebel force. By the end of March the 6 week uprising of the Cape Afrikaners in the region had ended. On 31st March the British reoccupied Kenhardt, stationing a small garrison in the town. After a failed Boer uprising in the North Western Cape, many rebels were detained by the British and, with the jail in Upington totally full by April 1900, more than 100 rebel Boers were detained in a camp outside Kenhardt. As part of a string of executions across the Cape, two Boer rebels, H.L. Jacobs and A.C. Jooste, were executed in Kenhardt by the British on 24 July 1901, on accusations of treason. In January 1902 a British force of about 800 men began gathering at Kenhardt. They left on 10 January to quell the Boer force in Kakamas. On 11 January the battle of Kakamas began and ended with a victory for the Boers when the British departed on 13 January" (Orton 2014a, pages 9 & 10).

Heritage related finds made during heritage and archaeological impact assessments in the surroundings of the present study area include the following (arranged alphabetically by report authors): cultural materials of Stone Age and historic origin were identified in certain parts of the studied area, but none were located in the development footprints, due to the potential presence of significant heritage resources it is recommended that the selected development areas undergo a detailed ground truthing investigation prior to commencement of construction. Gaigher noted that most studies in the area reported a general scarcity of heritage resources in the surrounding environment and that scatters of Stone Age implements are the most common (Gaigher 2013); very low density scatters of Stone Age implements mainly in quartz that are considered to be of low significance, quartz outcrops with evidence of flaking for the procurement of raw materials to make stone artefacts, the best archaeological resources are stone artefact scatters of mainly LSA origin and that are associated with pans (water sources), some of these scatters included ostrich eggshell fragments and a few pieces of bone, a single ESA hand axe was identified, one historical, rock lined stock post including a few pieces of historic material culture such as metal, ceramics and glass, a possible grave, the LSA sites around pans are considered to be of

medium significance and would require mitigation in the event that they will be impacted by development (Orton 2014a); very low density scatters of Stone Age implements mainly in quartz, but also in quartzite and other raw materials, that are considered to be of low significance, most of these artefacts appear to be of MSA origin, due to their low significance it is recommended that no mitigation is required, a few quartz outcrops with evidence of flaking for the procurement of raw materials to make stone artefacts, a pan lying outside the study area was fringed by four probably LSA stone artefact scatters in quartz including a lower grindstone, due to the absence of fauna or other cultural remains these scatters were considered to be of low significance, the larger of two rocky hills on the property contained heritage resources in the form of quartz stone artefact scatters, a historical stock post, and a small rock shelter contained a few stone artefacts, fragments of bottle glass and a piece of metal, items of historic age, mainly glass, were found elsewhere in the study area (Orton 2014b); very low densities of MSA artefacts identified at quartz outcrops, flake and blade technology suggests MSA age and the dominant artefact type are irregular scrapers, due to their very low densities these finds are considered to be of low significance and it is recommended that they can be disturbed without a permit from SAHRA (van Ryneveld 2007); a few stone tools were observed but do not constitute any major sites (Williams 2014).

Overall, a pattern emerges showing that archaeological resources are most commonly clustered around existing and ancient drainage lines, pans, and ridges with rocky outcrops, and that heritage resources are generally absent from flatlands that are some distance from existing or ancient water sources. Further, Stone Age occurrences are more common among gravels as opposed to sandy surface sediments. Based on the findings of the above impact assessments, it is likely to find mainly Stone Age materials in the affected area with lesser potential for the occurrence of historic heritage resources.

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 and fluvial 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 are limited to stone artefacts. While LSA stone artefacts are common in the landscape, they occur in low densities - often in isolation, are sometimes 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: AMDA Alpha PV Footprint & Access Road

A comprehensive archaeological foot survey of the affected areas (AMDA Alpha SEF PV area, on-site collector sub-station, access road and grid connection route) was conducted over 4 days from 24 to 27 April 2016. A total distance of some 54 km was walked, covering an area of at least 160 ha in extent (Figures 6 & 7). Archaeological visibility was excellent with open vegetation providing about 90% of exposed ground surfaces that were open for inspection and assessment. Due to high concentrations of quartz dominated gravels in several localities, survey was often slow and it is highly likely that individual specimens in quartz were missed. Higher density scatters of stone artefacts, however, would certainly have been detected. Apart from the below archaeological resources, no other tangible heritage resources were identified and built structures on the property are all modern, including a free-standing dam, windmill / borehole, watering and feeding troughs that are of no obvious heritage value. A summary of finds, significance and recommendations is given in Table 2 below.

Isolated Stone Age Occurrences

A few hundred isolated Stone Age stone artefacts were identified in the AMDA Alpha SEF PV area and within the access road and grid connection corridors. A representative sample of isolated stone artefacts identified in the AMDA Alpha SEF PV area is shown in Plates 7 through 19.

Although densities of isolated stone artefact occurrences are very low in the landscape, there is a distinct pattern of artefact numbers increasing on higher ground, and specimens are most commonly found among exposed gravels. Stone artefact specimens of Later Stone Age (LSA) origin are marginally more common than those of the Middle Stone Age (MSA), but Early Stone Age (ESA) implements are notably fewer and rare. Specimens of the different Stone Age periods are distinguishable by technology and type as well as degrees of weathering and patination.

LSA and MSA stone tool types include a variety of cores, flaked pieces, flakes, chunks, chips and a few hammer stones. Retouched pieces are remarkably common and are dominated by a variety of scrapers and notched pieces or adzes of both LSA and MSA origin. MSA tools also include a few blades and convergent flakes or points, some of which display prepared striking platforms produced by the Levallois technique. A few small bifacial hand axes of Fauresmith type were also identified and mark the transition from the ESA

(Acheulian) to the MSA. Specimens of ESA origin are rare and include heavily weathered and patinated flakes, flaked pieces and a crude bifacially worked piece. No classic bifacial hand axes or cleavers (typical of the Acheulian) were recorded in the AMDA Alpha SEF PV area, suggesting that the ESA here might be of Oldowan rather than Acheulian age. Due to their occurrence in exposed and sometimes eroded contexts, artefacts are temporally mixed and faunal, organic and other cultural materials are entirely absent.

Likely proportionate to its abundance in the landscape, quartz is by far the most common raw material used for the manufacture of stone tools, followed by quartzite of varying colour and quality. Only a few stone artefacts are made in other fine grained raw material including chert and possibly silcrete and banded ironstone.

Significance and Recommendation

An ephemeral, very low density stone artefact background scatter consisting mainly of isolated Stone Age material of different ages were identified in the study area. These finds are not associated with any organic, faunal or other cultural remains. As a result, these heritage resources are considered to be of low archaeological significance and are designated a field rating of Generally Protected C. Because they were adequately documented during this study, it is suggested that no further investigation or recording is needed before development commences. It is also recommended, that due to their low significance, a permit for their disturbance or destruction is not required from the heritage authorities.

Stone Age Quartz Quarry Sites

Due to excellent archaeological visibility and low, open vegetation; quartz outcrops were clearly visible in the landscape from a distance of at least 50 m or more. Larger outcrops are visible from several hundred meters. Evidence for prehistoric flaking is present at nearly all outcrops of quartz. Fifteen Stone Age quartz quarry sites were recorded and mapped including waypoint 122A and waypoints 133 through 146. Three further quartz quarry sites were identified, but are not included in the below descriptions nor Table 2 as two are very small and contain very ephemeral scatters of quartz while the third was partially disturbed by a vehicle track, fencing, bore hole / wind mill and free-standing dam that occur at the southern boundary of the study area. Overall, the quarry sites are very similar in nature, context, content and the age of archaeological resources, and therefore, they are not described individually. They do, however, vary considerably in size and frequencies of archaeological remains. The below description of the nature, context and contents of the quarry site at waypoint 122A is applicable to the remaining quarry sites.

Waypoint 122A is the apex and approximate centre point of a quartz "hill" or outcrop that is a high point from which one looks down over the surrounding landscape in all directions. The perimeter of this site extends beyond the AMDA Alpha SEF PV area into the AMDA Bravo and AMDA Charlie SEF PV areas, and covers an area of about 3.75 ha in extent as shown in Figures 4 and 6 and Plate 20. In addition to large outcrops of *in situ* quartz that frequently display evidence of flaking (quarrying), the ground is littered with loose quartz rocks and nodules, many (thousands) of which are archaeological (Plates 20, 21 & 22). Archaeological specimens in quartz are of LSA and MSA age with no definitive ESA pieces, but the latter cannot be ruled out. The bulk of stone artefacts include a variety of cores, flaked pieces, flakes, chunks and chips while a few pieces display scraper and adze retouch. A few hammer stones were also noted. Artefacts in other raw materials, mostly quartzite, are rare and while most of these are of MSA and LSA age, a few pieces of greater antiquity were also seen. Formal tools in other raw material are also dominated by scrapers

and adzes or notched pieces. No faunal, organic or other cultural remains are preserved in these exposed contexts.

Waypoints 136 and 140 are two near continuous quartz outcrops and Stone Age quartz quarry sites with a combined extent of about 1.1 ha (Figures 4 & 6). The nature, context, contents and age of these archaeological resources are the same as those described above for waypoint 122A (Plates 23 & 24). In addition, however, a classic Fauresmith type hand axe made in quartz was identified at Waypoint 136 (Plate 24). No faunal, organic or other cultural remains are preserved.

Significance and Recommendation

Although these sites contain temporally mixed Stone Age materials and preserve no faunal, organic or other cultural materials, some are considered to represent fine examples of Stone Age quarrying in prehistoric times, and therefore, are given a field rating of Grade IIIc. Minimally, they are classified as Generally Protected C. It is noted that similar quartz quarry sites were recorded by other investigators in the surrounding environment and that none of those sites were recommended for sampling or conservation (Orton 2014a & 2014b and Van Ryneveld 2007). With increased alternative energy and a variety of other developments in the Northern Cape, it is possible that the cumulative impact of such developments in the area could obliterate these types of archaeological resources. It is recommended, therefore, that a few of these sites be conserved in perpetuity as part of the National Estate and for potential future research. It is suggested that, for the AMDA Alpha SEF PV area, sites at Waypoints 122A and 136 & 140 be conserved. A temporary fence should be erected around these sites prior to the construction phase of development to ensure that they are not damaged or destroyed. Such management measures should be included in the Construction and Operational Environmental Management Plan for the development. This recommendation was accepted by the applicant as is reflected in the avoidance of the fore mentioned sites in the revised development layout plan shown in Figure 4. In lieu of such protection and conservation, it is further recommended that the remainder of these quarry sites do not require sampling and that, because they were adequately recorded during this investigation and are considered to be of low significance, permits are not required for their disturbance or destruction. The latter suggestion may require SAHRA's approval.

4.3. Archaeological Foot Survey: Grid Connection

A comprehensive archaeological foot survey of the grid connection corridor was conducted on 25 April 2016 (Figure 7). Archaeological visibility was excellent with open vegetation providing about 90% of exposed ground surfaces that were open for inspection and assessment. Examples of the affected environment along the grid connection corridor are shown in Plates 5 & 6. In some areas survey was slow due to high concentrations of quartz dominated gravels and it is likely that individual specimens in quartz were missed. Higher density scatters of stone artefacts, however, would certainly have been detected. Built structures are limited to a bore hole and free standing cement dam as well as plastic water tanks / reservoirs. A summary of finds, significance and recommendations are given in Table 2 below.

Isolated Stone Age Occurrences

About 20 isolated Stone Age stone artefacts were identified in the grid connection corridor and were mostly found in association with gravels. A representative sample of these is shown in Plates 25 & 26. Specimens include a mix of LSA and MSA pieces and only one or two pieces of likely ESA origin were seen. The latter designation is based on very heavy weathering and patination on a flake or two. LSA and MSA artefacts include cores, flaked

pieces, flakes, convergent flakes, chips and chunks and two hammer stones. Formal tools are limited to scrapers, including a thumbnail scraper in clear quartz, and notched pieces or adzes. A single Fauresmith hand axe with a broken tip was also recorded. Most artefacts are in quartz with only a few made in quartzite. No faunal, organic or other cultural remains are associated with the isolated stone artefact occurrences.

Significance and Recommendation

A background scatter of isolated Stone Age materials of different ages was identified along the overhead power line corridor. Due to their isolated, temporally mixed nature as well as the absence of organic, faunal or other cultural remains, these heritage resources are considered to be of low archaeological significance and are designated a field rating of Generally Protected C. It is suggested that, because they were adequately recorded during this study, no further investigation or work is needed prior to development. Due to their low significance, it is recommended that a permit for their disturbance or destruction is not required from the heritage authorities.

Stone Age Quartz Quarry Sites

Two Stone Age quartz quarry sites, associated with quartz outcrops, were recorded and mapped at Waypoints 129 and 130 & 131 (Figures 3 & 7). Overall, these quarry sites are very similar in nature, context and content as well as the age of archaeological resources as those described above for the AMDA Alpha SEF PV area. While the site at waypoint 129 is of moderate size, the one at waypoints 130 & 131 is extensive, covering an area of nearly 5 ha. Numerous *in situ* outcrops of quartz display evidence of quarrying in the form of large flake scars and crushing at points of impact (Plate 26). Scattered among and beyond these *in situ* outcrops are thousands of archaeological pieces in quartz including a variety of cores, flakes, chunks, chips, hammer stones and modest numbers of pieces displaying scraper and adze retouch (Plates 26 & 27). Stone artefacts in other raw materials are rare and likely part of the very low density background scatter of temporally mixed Stone Age specimens. As with the other quarry sites, no faunal, organic or other cultural remains are preserved at these localities.

Significance and Recommendation

Although these sites contain temporally mixed Stone Age materials and preserve no faunal, organic or other cultural materials, the quarry site at waypoints 130 & 131 is considered to be a fine example of Stone Age quarrying in prehistoric times, and therefore, is given a field rating of Grade IIIc. Minimally, it is classified as Generally Protected C. For the same reasons given above for the proposed conservation of a few quartz quarry sites in the AMDA Alpha SEF PV area, it is recommended that the site at waypoints 130 & 131 be conserved in perpetuity. A temporary fence should be erected around this site before construction commences to avoid damage or disturbance. Management measures for this site should be included in the Construction and Operational Environmental Management Plan for the development. This recommendation was accepted by the applicant and Figure 3 shows that the proposed grid connection route will run to the north of the site. It appears that the grid connection route will also avoid the quarry site at waypoint 129.

Damaged Pan Site

Waypoint 155 marks a disturbed and damaged pan site with a very ephemeral scatter of a handful of isolated and temporally mixed Stone Age stone artefacts (Figure 7 and Plate 6). Artefact densities are the same as the background scatter seen in other parts of the study area. The locality was disturbed during the installation of the existing overhead power

line to the Nieuwehoop MTS substation and a single vehicle service / maintenance track runs through it.

Significance and Recommendation

Although the few Stone Age stone artefacts associated with this disturbed locality are protected, this occurrence is considered to be of no heritage value and low significance. No further work is needed and it is recommended that a permit for this site is not necessary. In addition, it is likely that the grid connection will run to the north of this locality and that it will not be further impacted by the proposed development.

Table 2. Summary of archaeological occurrences and sites identified in the AMDA Alpha SEF PV area, Collector Sub-Station and corridors for the proposed Grid Connection and Access Road routes. Wpnt = waypoint number, Signif= Significance, med = medium, C&OEMP = Construction & Operational Environmental Management Plan .

Wpnt	Development Zone	Coordinates WGS 84 Decimal Degrees	Description	Signif	Management or Mitigation
none	AMDA Alpha, Access Road, Collector SS, Grid Connection	Occur throughout study area, but more common on higher ground	Temporally mixed Stone Age materials including stone artefacts only that are of LSA, MSA and ESA origin	low	none
122A	AMDA Alpha, AMDA Bravo & AMDA Charlie	Centred on S29.11683° E21.28738°	Extensive Stone Age quartz quarry site covering an area of 3.75 ha	Med-low	Conserve, include in C&OEMP
129	Grid Connection	Centred on S29.14962° E21.32032°	Stone Age quartz quarry site of 2790 m ² in extent	low	none
130 & 131	Grid Connection	Centred on S29.15075° E21.31853°	Extensive Stone Age quartz quarry site covering an area of 4.9 ha	Med-low	Conserve, include in C&OEMP
133	AMDA Alpha	Centred on S29.11783° E21.29060°	Small Stone Age quartz quarry site of 700 m ² in extent	low	none
134	AMDA Alpha	Centred on S29.11932° E21.29129°	Stone Age quartz quarry site of 2800 m ² in extent	low	none
135	AMDA Alpha	Centred on S29.12515° E21.29185°	Stone Age quartz quarry site of 1740 m ² in extent	low	none
136	AMDA Alpha	Centred on S29.12489° E21.29382°	Large Stone Age quartz quarry site of 4670 m ² in extent	Med-low	Conserve, include in C&OEMP
137	AMDA Alpha	Centred on S29.12480° E21.29877°	Stone Age quartz quarry site of 1970 m ² in extent	low	none
138	AMDA Alpha	Centred on S29.12502° E21.30198°	Small Stone Age quartz quarry site of 1220 m ² in extent	low	none
139	AMDA Alpha	Centred on S29.12561° E21.29639°	Small Stone Age quartz quarry site of 920 m ² in extent	low	none

Wpnt	Development Zone	Coordinates WGS 84 Decimal Degrees	Description	Signif	Management or Mitigation
140	AMDA Alpha	Centred on S29.12548° E21.29411°	Large Stone Age quartz quarry site of 3200 m ² in extent	Med-low	Conserve, include in C&OEMP
141	AMDA Alpha	Centred on S29.12845° E21.29356°	Small Stone Age quartz quarry site of 1170 m ² in extent	low	none
142	AMDA Alpha	Centred on S29.12878° E21.29440°	Stone Age quartz quarry site of 3720 m ² in extent	low	none
143	AMDA Alpha	Centred on S29.12953° E21.29403°	Small Stone Age quartz quarry site of 770 m ² in extent	low	none
144	AMDA Alpha	Centred on S29.13086° E21.29556°	Small Stone Age quartz quarry site of 1030 m ² in extent	low	none
145	AMDA Alpha	Centred on S29.13108° E21.29846°	Small Stone Age quartz quarry site of 1140 m ² in extent	low	none
146	AMDA Alpha	Centred on S29.13152° E21.29711°	Stone Age quartz quarry site of 3070 m ² in extent	low	none
155	Grid Connection	Centred on S29.15101° E21.33321°	Damaged and disturbed pan site with ephemeral and temporally mixed Stone Age stone artefacts,	low	none

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 AMDA Alpha SEF and associated on-site collector sub-station, grid connection and access road 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. 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 and as a result of other potential future developments in the surrounding area.

While a very ephemeral background scatter of temporally mixed Stone Age stone artefacts were identified in the study areas, these are considered to be of low significance and require no further investigation or mitigation. Their disturbance or destruction will not have a negative impact on the heritage value of the area. No archaeological resources were seen in

animal burrows, so it is unlikely that significant archaeological sites are currently buried beneath surface sediments.

Several Stone Age quartz quarry sites were documented and four of these were selected for conservation in perpetuity. The motivation for their conservation is given above and they are good examples of prehistoric quarrying of raw material for the manufacture of stone tools. In order to protect these sites, the applicant has revised the development layout plans accordingly. Their protection and management should be included in the Construction and Operational Environmental Management Plan. Given the fore-mentioned conservation measures, the disturbance or destruction of the remaining quarry sites resulting from the proposed development will have a negligible negative impact on the heritage value of the area.

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 was provided by Cape EAPrac.

The following focuses on the impact of the AMDA Alpha SEF and associated infrastructure, overhead power line (grid connection) route and access road on identified archaeological resources that will not be conserved in perpetuity (see Table 3 below).

Nature of Impact

The construction and installation phase of the development as outlined in Section 3.1 above will involve considerable disturbance to surface sediments and modest disturbance to sub-surface sediments. Such activities will have a significant and permanent negative impact on archaeological resources identified in the study area. However, representative samples of the archaeological record in the study area will be protected and conserved. The operational phase, long term and cumulative developments will have a negligible impact on archaeological resources.

Extent of Impact

The impact will be local, confined to the 250 ha development footprint and lease area, power line routes and access road. Because a representative sample of the archaeological record will be conserved, 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 (only high for construction phase of PV area - remainder will be low).

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, given the conservation of a representative sample of the archaeological record and due to the low significance of the remaining sites (and because they have been adequately documented

during the study presented here), a permit for destruction is not required from the heritage authorities.

Status of the Impact

Positive for both archaeological resources and the development.

Accumulative Impact

Because a representative sample of the archaeological record in the study area will be conserved and the remainder is considered to be of low significance; and because it has been adequately recorded during this investigation it is considered that the cumulative impact of the proposed development as well as potential future developments in the area will be negligible. This negative impact is graded as low.

Degree of Confidence in Prediction

High

In the event of the **No-Go Option**:

Nature of Impact

In the absence of development, the continued farming activities (domestic stock and game 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

medium.

Legal Requirements

none.

Status of the Impact

Neutral.

Accumulative Impact

Low, existing and continual.

Degree of Confidence in Prediction

Medium.

Table 3. Summary of impacts on archaeological resources associated with the AMDA Alpha SEF (AMDA Alpha), 132kV overhead power line (power lines), access road 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>
AMDA Alpha	Construction & Installation	Local	Long term to permanent	High	Definite	Positive for archaeological resources; positive for development	High	Low	Low
AMDA Alpha	Operational	Local	Long term to permanent	Low	Low	Neutral	High	Low	Low
Power lines	Construction & Installation	Local	Long term to permanent	Medium	Low to medium	Negligibly negative	High	Low	Low
Power lines	Operational	Local	Long term to permanent	Low	Low	Neutral	High	Low	Low
Access road	Construction	Local	Long term to permanent	High	Definite	Negligibly negative	High	Low	Low
Access road	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[U1]

6. Conclusions and Recommendations

The proposed AMDA Alpha SEF and associated on-site collector sub-station, grid connection and access road will involve area and linear developments respectively and these could have a permanent negative impact on archaeological resources. 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 and as a result of other potential future developments in the surrounding area.

While a very ephemeral background scatter of temporally mixed Stone Age stone artefacts were identified in the study areas, these are considered to be of low significance and require no further investigation or mitigation. Their disturbance or destruction will not have a negative impact on the heritage value of the area. No archaeological resources were seen in animal burrows, so it is unlikely that significant archaeological sites are currently buried beneath surface sediments.

A damaged and disturbed pan site with ephemeral Stone Age implements was identified along the grid connection corridor. This site is considered to be of low significance and its disturbance or destruction will not detract from the heritage value of the area. No further investigation or mitigation of this locality is required.

Several Stone Age quartz quarry sites were documented and four of these were selected for conservation in perpetuity. Although these sites contain temporally mixed Stone Age materials and preserve no faunal, organic or other cultural materials, some are considered to represent fine examples of Stone Age quarrying in prehistoric times. With increased alternative energy and a variety of other developments in the Northern Cape, it is possible that the cumulative impact of such developments in the area could obliterate these types of archaeological resources. It is recommended, therefore, that a few of these sites be conserved in perpetuity as part of the National Estate and for potential future research. This recommendation was accepted by the applicant as is reflected in the avoidance of the fore mentioned sites in the revised development layout plan shown in Figure 4. In lieu of such protection and conservation, it is further recommended that the remainder of these quarry sites do not require sampling and that, because they were adequately recorded during this investigation and are considered to be of low significance, permits are not required for their disturbance or destruction.

The proposed development will involve construction and installation activities that will have a permanent negative impact on archaeological resources identified in this study. However, a representative sample of the archaeological resources will be conserved and the remainder are considered to be of low significance, and therefore, their destruction will not have a negative impact on the heritage value of the area.

From an archaeological perspective, provided that the below recommendations are considered and/or implemented, there are no fatal flaws, and therefore, there are no objections to the authorization of the proposed development of the AMDA Alpha SEF and associated on-site collector sub-station, overhead power line grid connection and access road. The positive impact of the development is that it will allow for the conservation of archaeological resources that may otherwise have been overlooked or destroyed.

Recommended Mitigation Measures;

- Four of the Stone Age quartz quarry sites identified in the AMDA Alpha SEF PV area and grid connection corridor were selected for protection and conservation in perpetuity. These include sites at waypoints 122A, 136 & 140 and 130 and 131. A

temporary fence should be erected around these sites in the presence of an archaeologist prior to the construction phase of development to ensure that they are not damaged or destroyed. Such management measures should be included in the Construction and Operational Environmental Management Plan for the development. Given the fore-mentioned conservation measures, the disturbance or destruction of the remaining quarry sites resulting from the proposed development will have a negligible negative impact on the heritage value of the area. It is further recommended that the remainder of these quarry sites do not require sampling and that, because they were adequately recorded during this investigation and are considered to be of low significance, permits are not required for their disturbance or destruction. The latter suggestion may require SAHRA's formal approval.

- Although unlikely, the presence of sub-surface archaeological resources cannot be ruled out entirely, it is recommended that the Environmental Management Plan for the construction phase of development makes provision for archaeological training of the appointed Environmental Control Officer (ECO). This will allow for the ECO to recognise archaeological remains if they are exposed during construction, and to alert the authorities or a suitably accredited archaeologist, who should be called to site to assess the finds and to determine mitigation measures if necessary. Such work will be at the expense of the developer.

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. Such resources must be handled 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 and will require a professional archaeologist to undertake mitigation if needed. Such work will also be at the expense of the developer.

7. References

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8. Figures and Plates (on following pages)

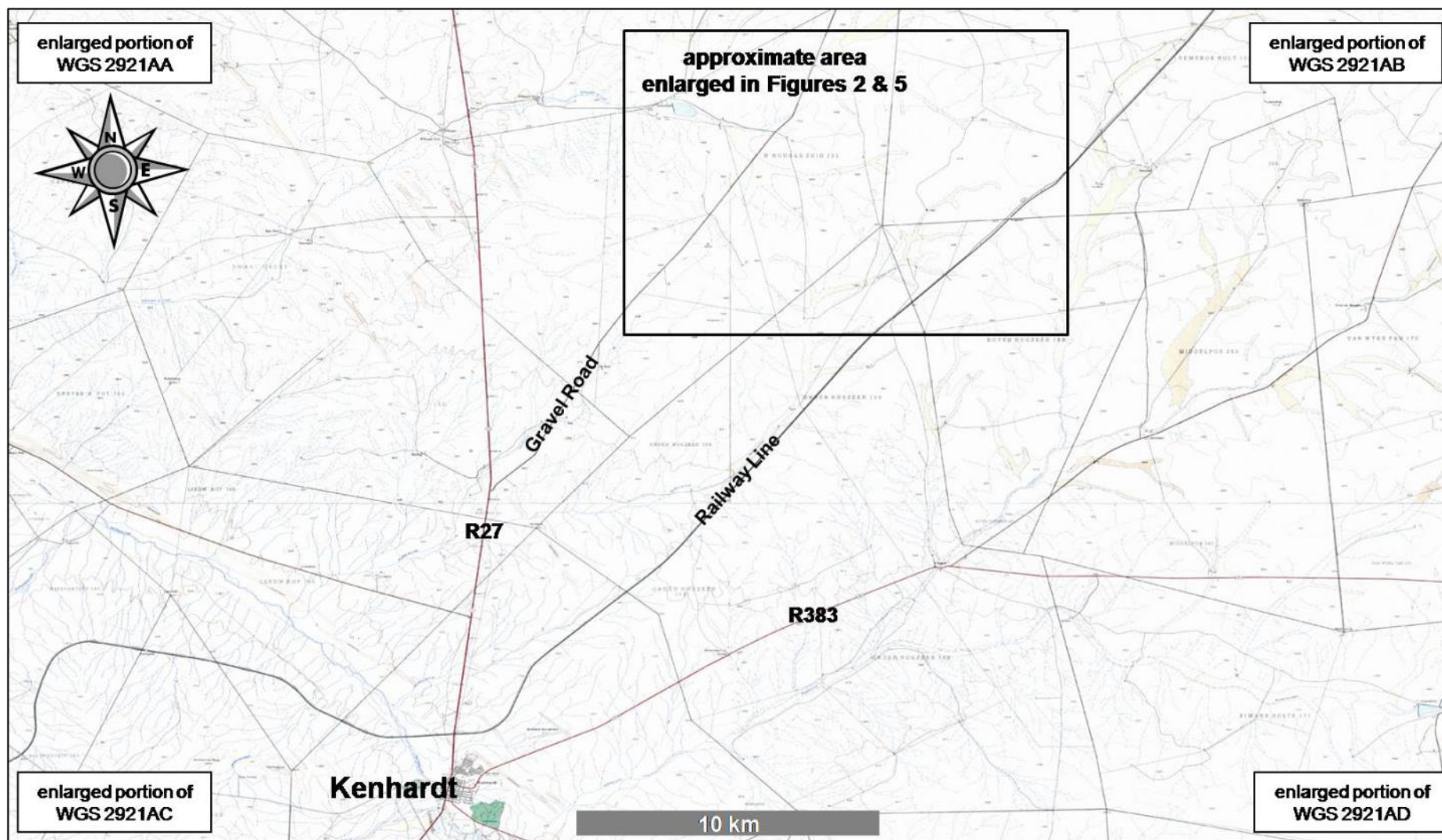


Figure 1. General location of study area relative to Kenhardt, Northern Cape Province. Relevant 1:50 000 maps are 2921AA, 2921AB, 2921AC& 2921AD(courtesy of Chief Directorate, Surveys & Mapping, Mowbray).

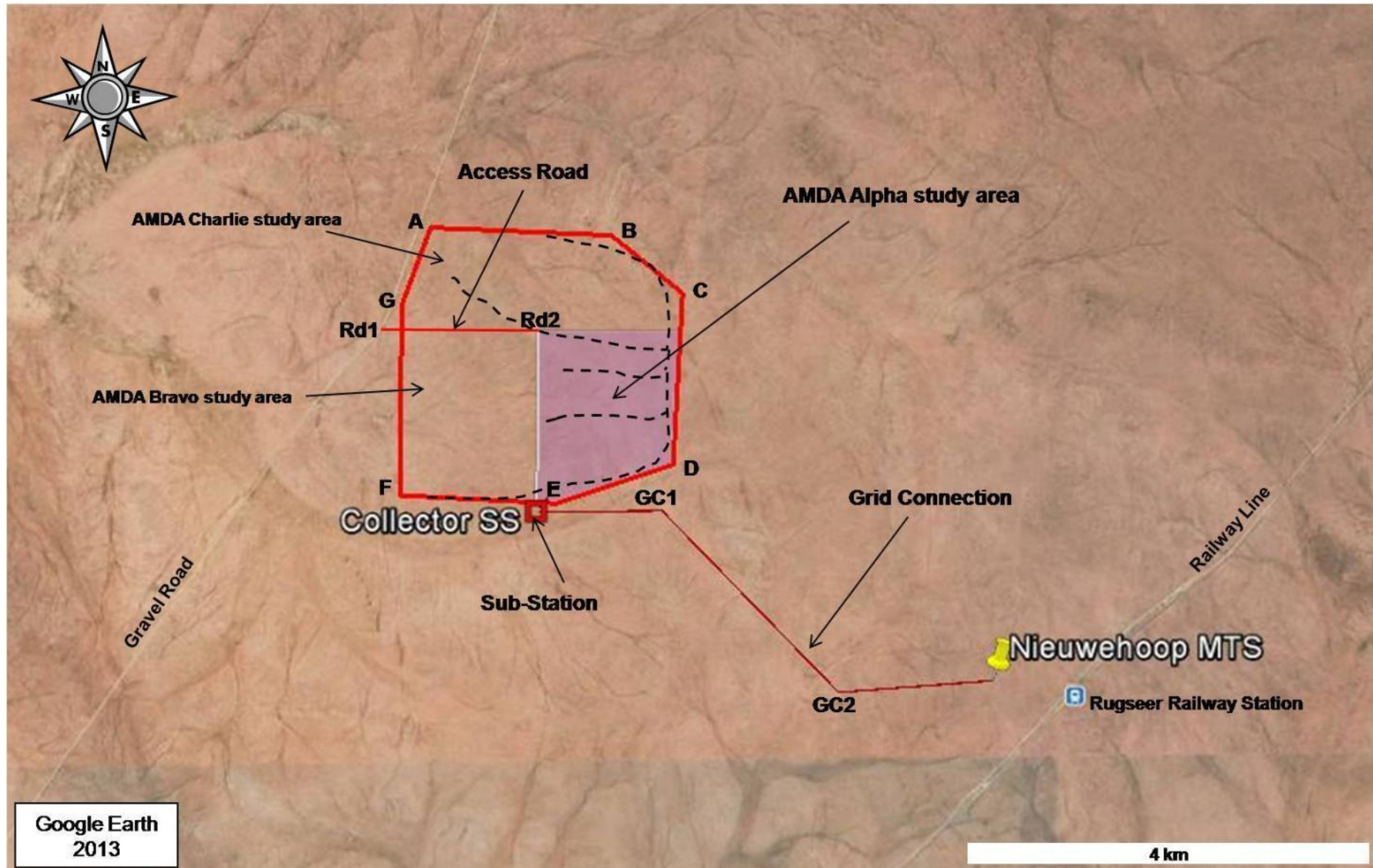


Figure 2. Provisional development layout showing development footprint & study areas, access road and grid connection route. High lying areas indicated with dashed black lines. Coordinates for boundary points, access road, grid connection and sub-stations are given in Table 1.

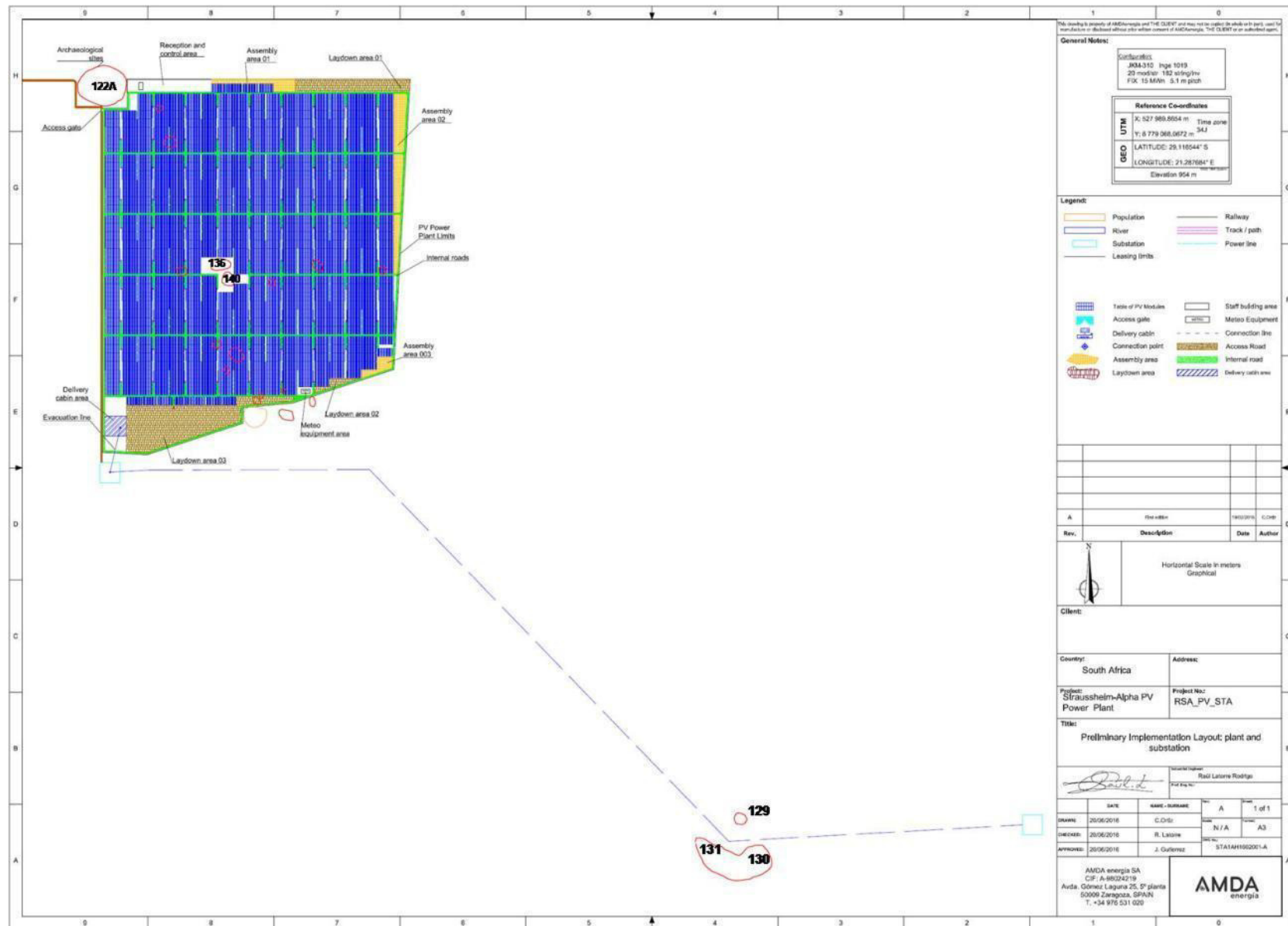


Figure 3. Revised development layout plan for AMDA Alpha SEF and Grid Connection (courtesy of the applicant). Note that sites selected for conservation are avoided.

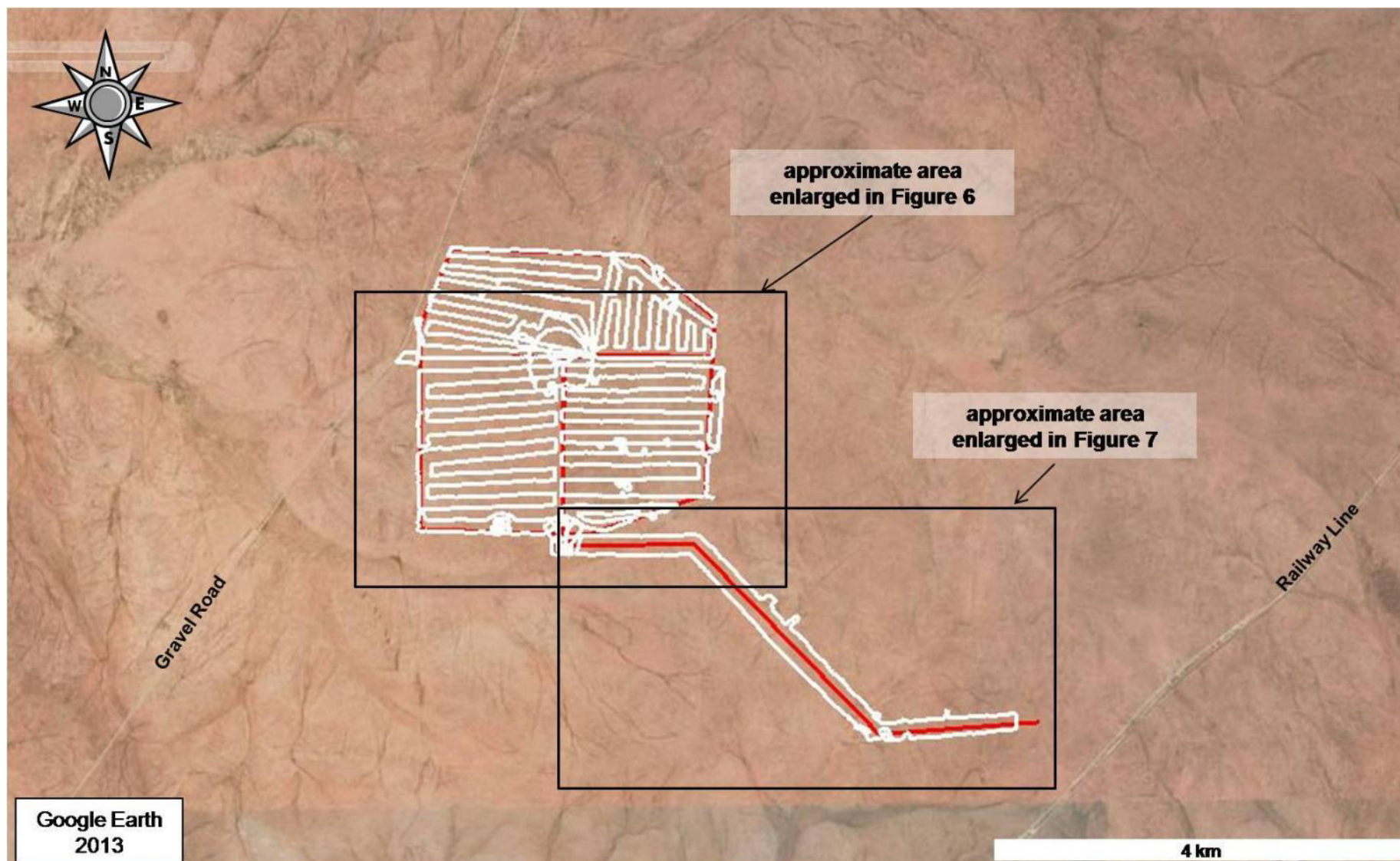


Figure 5. Provisional development layout showing development footprint & study areas and grid connection route (red) Archaeological survey walk tracks are indicated with white lines.

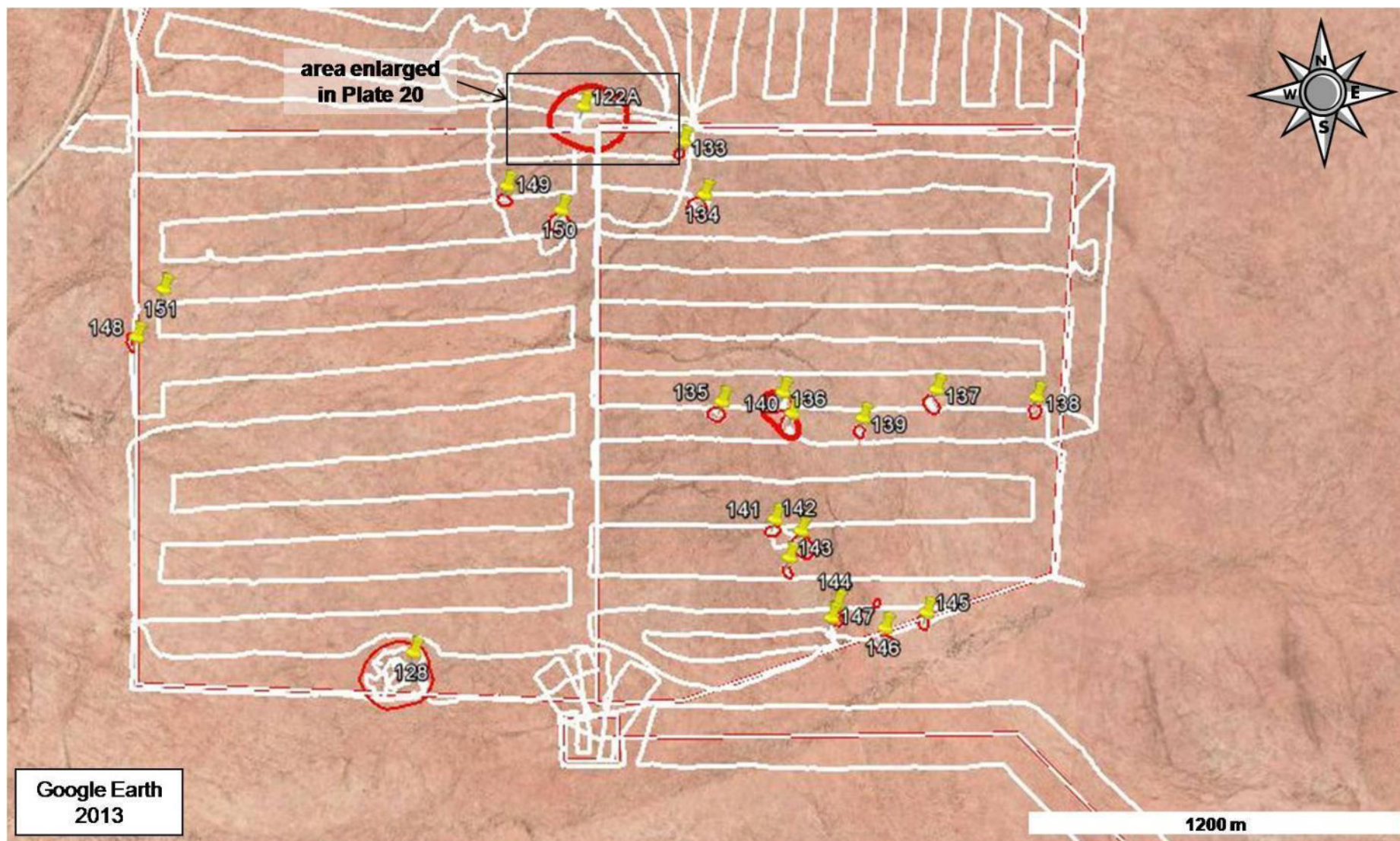


Figure 6. Area enlarged from Figure 5 showing archaeological survey walk tracks (white lines) and archaeological sites (labelled red polygons). Bold red polygons indicate sites selected for conservation (waypoints 122A, 136 & 14).

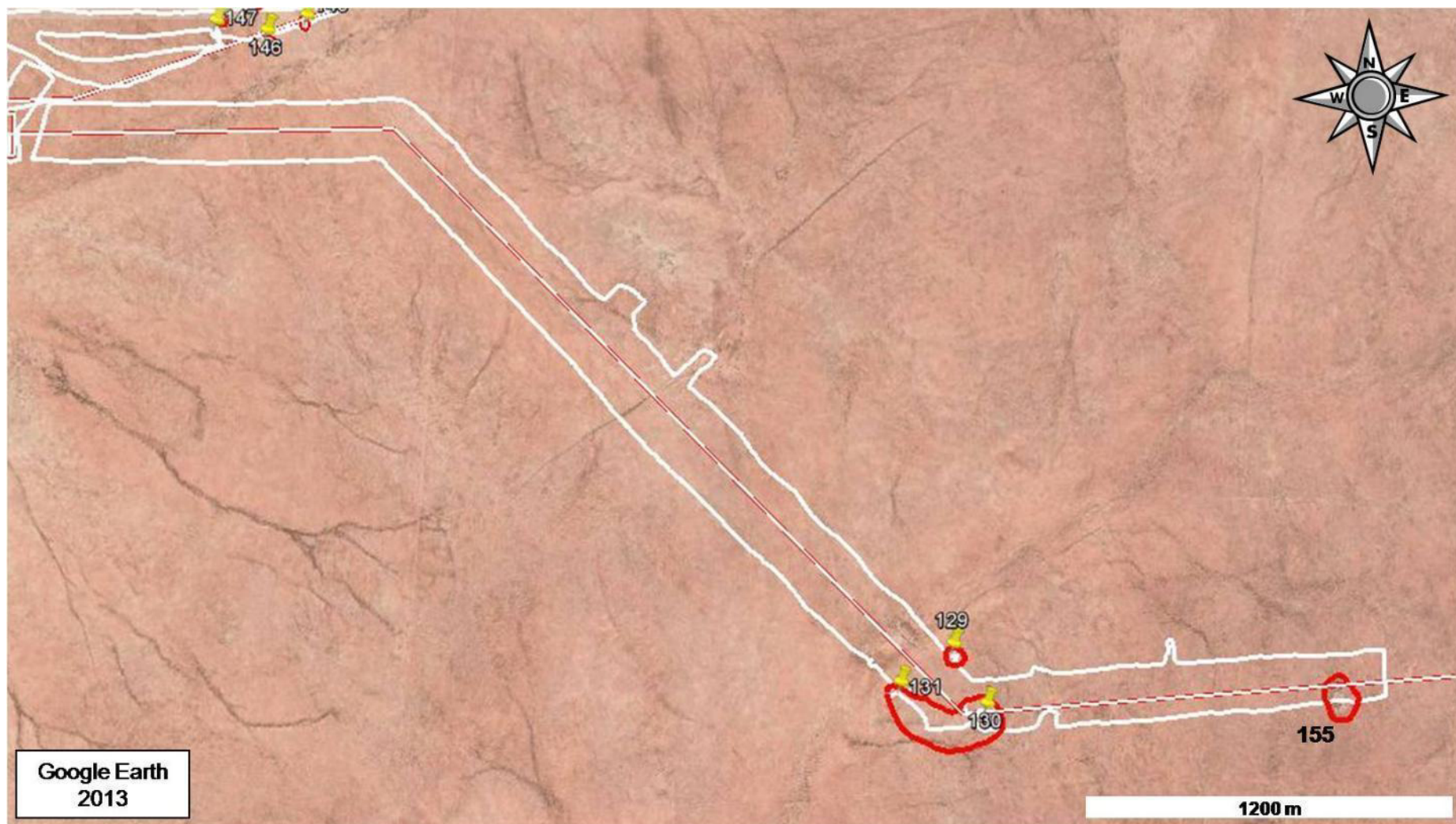


Figure 7. Area enlarged from Figure 5 showing archaeological survey walk tracks (white lines) and archaeological sites (labelled red polygons). Red polygon at waypoints 130 & 131 indicates area of Stone Age quartz quarry site selected for conservation.

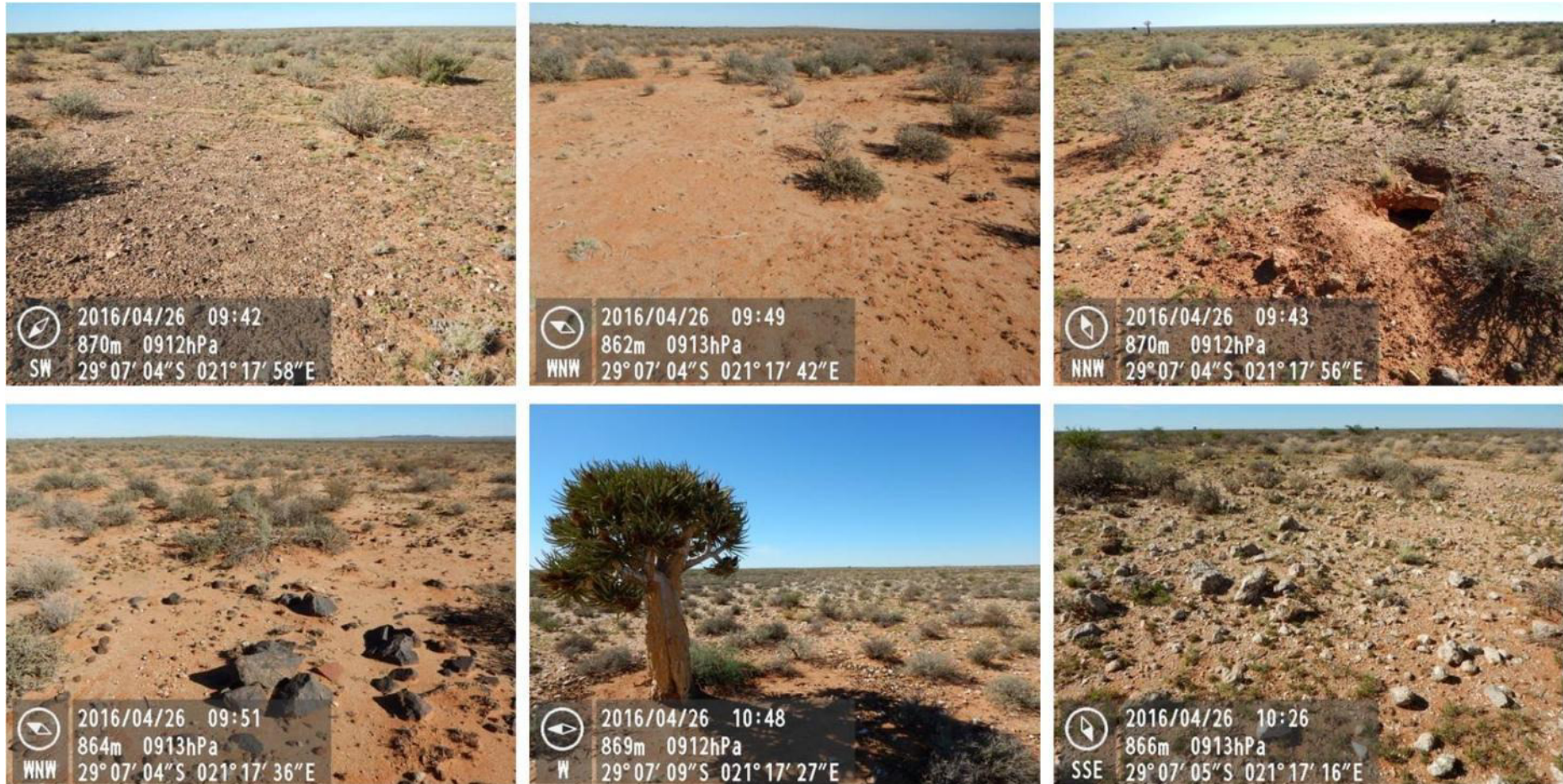


Plate 1. Examples of the affected environment of the AMDA Alpha SEF study areas showing flat terrain, low and open vegetation, recent disturbances (burrows) and exposed surfaces of soft surface sediments, gravels and low rocky outcrops.

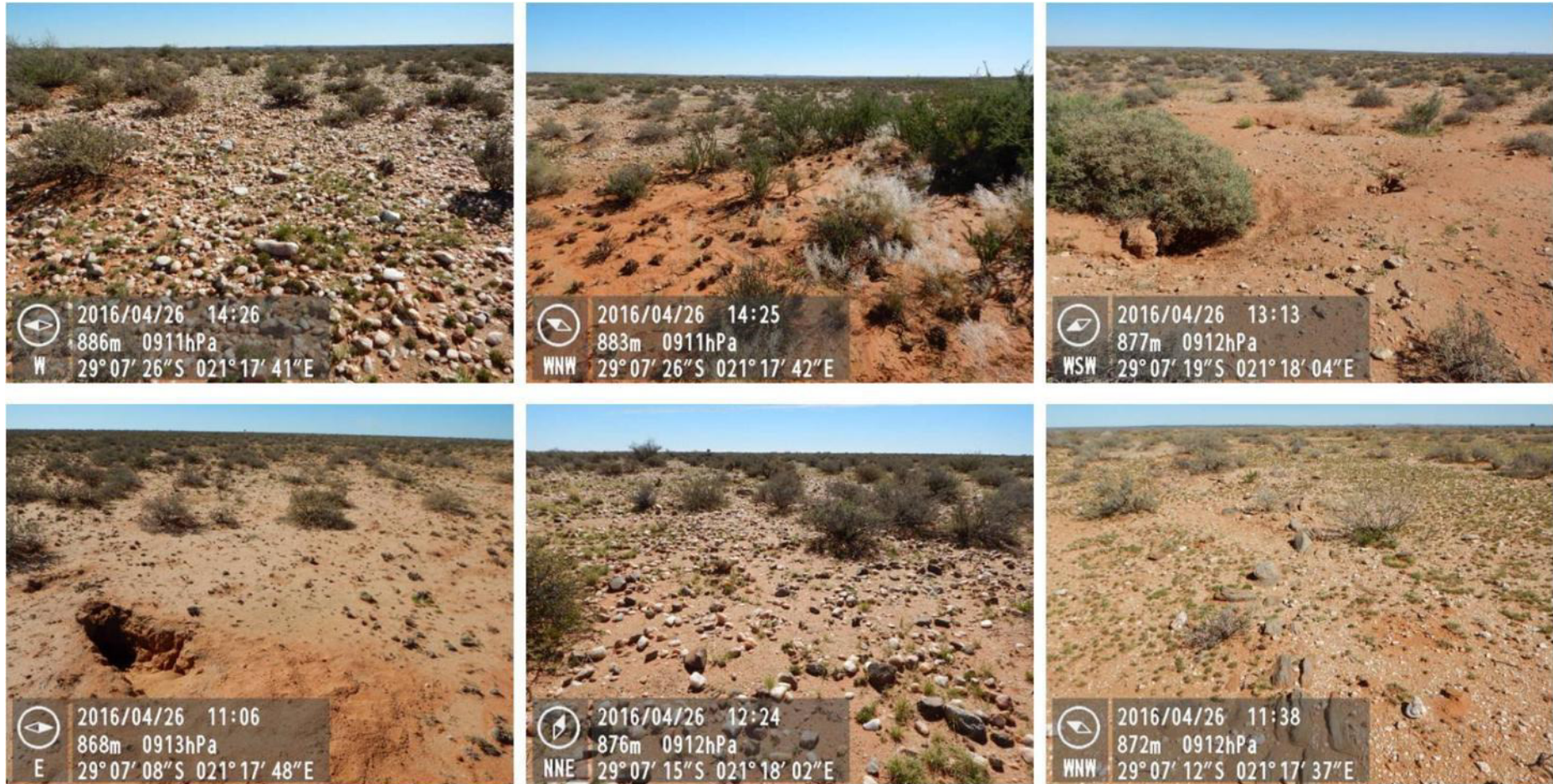


Plate 2. Examples of the affected environment of the AMDA Alpha SEF study areas showing exposed quartz dominated gravels, flat terrain, low and open vegetation, animal burrows, exposed ground surfaces and low rocky outcrops.

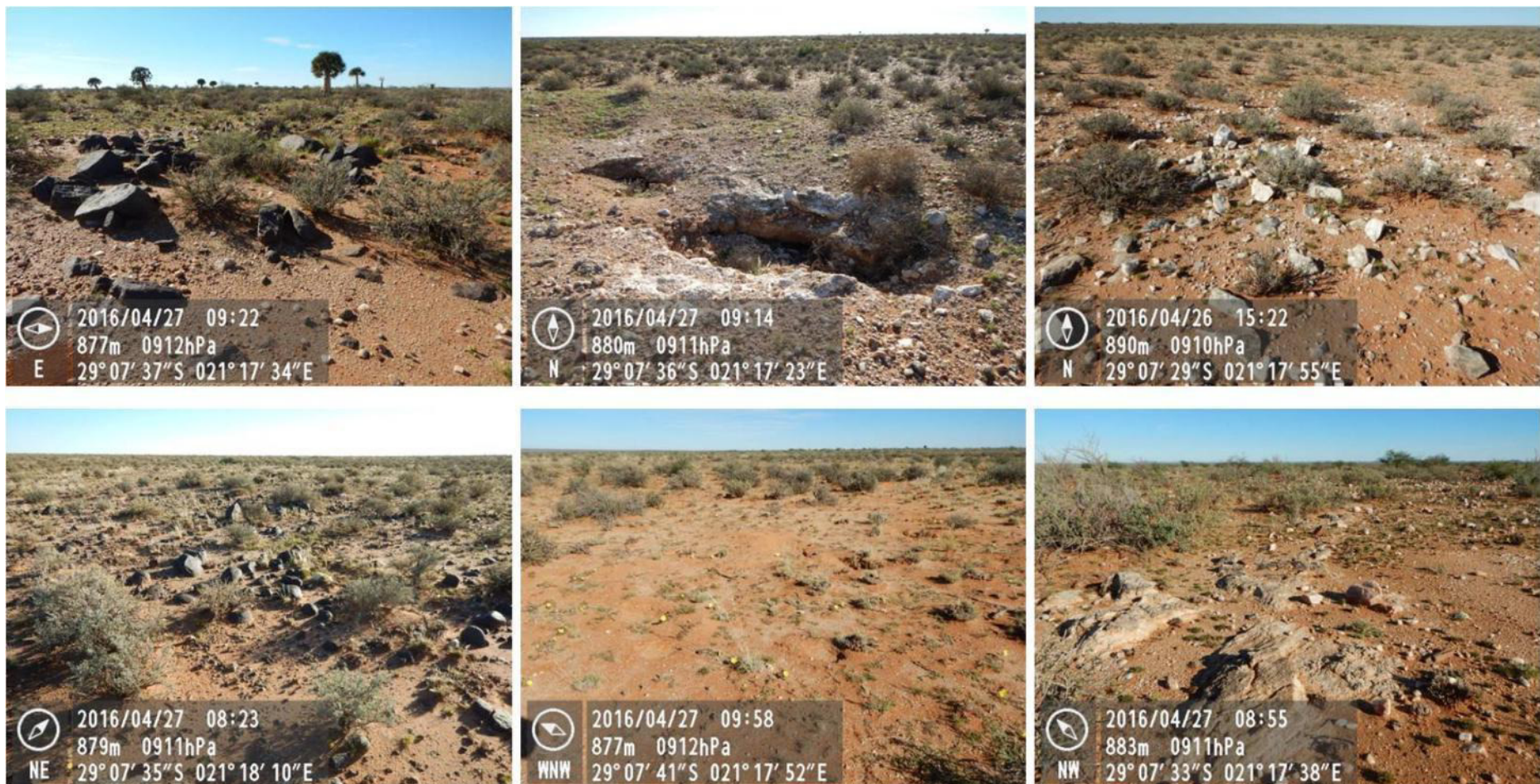


Plate 3. Examples of the affected environment of the AMDA Alpha SEF study areas showing low rocky outcrops, burrows into calcrete, exposed ground surfaces and quartz dominated gravels, flat terrain and low and open vegetation.

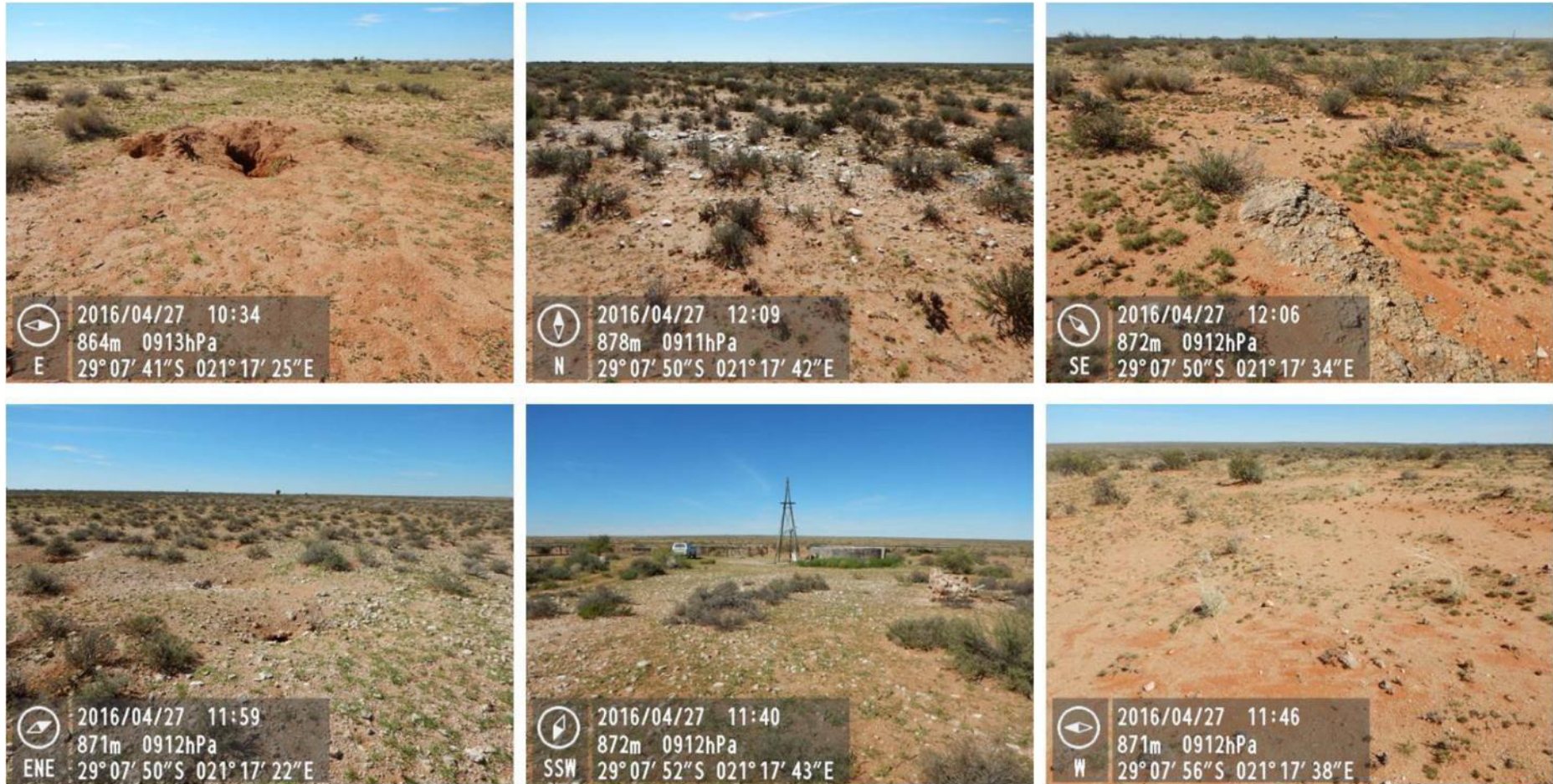


Plate 4. Examples of the affected environment of the AMDA Alpha SEF study areas showing flat terrain, animal burrows, exposed ground surfaces and quartz dominated gravels, low and open vegetation, low rocky outcrops and recent developments including bore hole, free-standing cement dam, fencing and watering and feeding troughs.

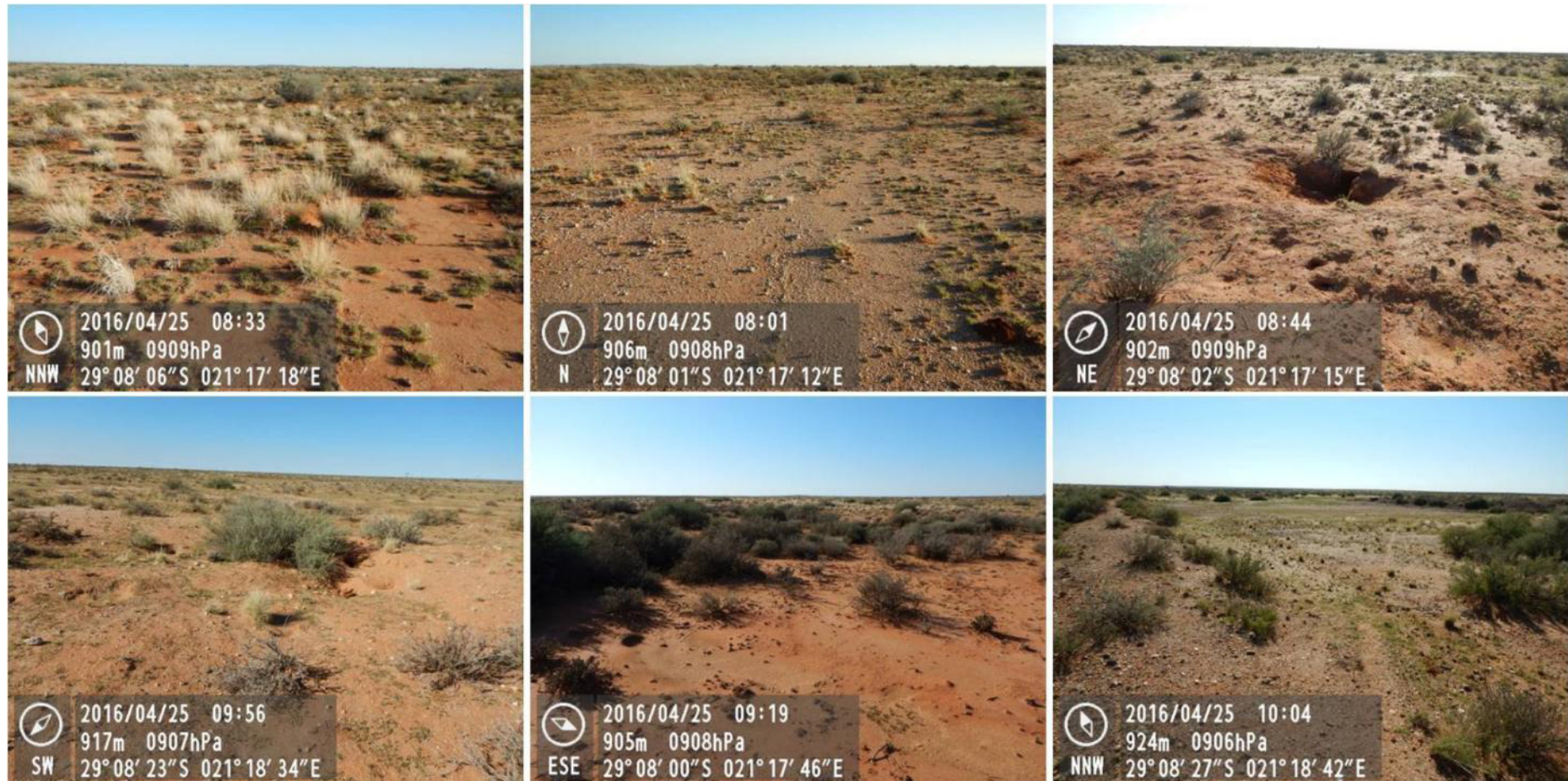


Plate 5. Examples of the affected environment along the overhead power line grid connection route showing flat terrain, low and open vegetation, exposed ground surfaces and gravels, animal burrows and recent earthmoving activities (bottom right).



Plate 6. Examples of the affected environment along the overhead power line grid connection route showing recent earthmoving activities, vehicle track, the Nieuwehoop MTS sub-station, disturbed pan site at locality 155 (bottom left), exposed ground and quartz dominated gravels, flat terrain, low and open vegetation and recent developments including bore hole, free-standing cement dam, fencing, plastic water tanks, and watering and feeding troughs for domestic stock.



Plate 7. Examples of isolated Stone Age stone artefacts of MSA and LSA origin including retouched flakes (scraper and adze / notched pieces) and a heavily weathered and patinated flake of possible ESA age (bottom middle). Specimens in quartzite and quartz.



Plate 8. Examples of isolated Stone Age stone artefacts of either MSA or LSA origin including retouched flakes (scraper and adze / notched pieces), a flaked in situ piece of quartz (bottom middle, scale in cm) and a small hammer stone (bottom right).



Plate 9. Examples of isolated Stone Age stone artefacts of MSA or LSA origin including flaked pieces, flakes, retouched flakes (quartz scraper at bottom left) and a quartz core (bottom right). Specimens in quartzite and quartz.



Plate 10. Examples of isolated Stone Age stone artefacts of MSA or LSA origin including a quartz core, flake and pieces with scraper retouch (bottom left and middle). The pieces on the right are very heavily patinated and weathered suggesting they may be of ESA origin though the blade at bottom right has a prepared platform typical of the MSA. Specimens in quartz and quartzite.



Plate 11. Examples of isolated Stone Age stone artefacts of LSA and possible MSA origin including a quartz core, quartzite scraper, adzes or notched pieces and a combination scraper / adze in quartzite (bottom right).



Plate 12. Examples of isolated Stone Age stone artefacts of MSA or LSA origin including cores and flakes while the specimen at bottom right is a heavily weathered and patinated bifacially flaked piece in quartzite of ESA and possible early ESA (Oldowan) age.



Plate 13. Examples of isolated Stone Age stone artefacts including quartz and quartzite cores and pieces with scraper retouch. The flake at middle top is heavily weathered and patinated and likely of ESA origin while the remainder are of LSA and MSA age. Specimens in quartz and quartzite.



Plate 14. Examples of isolated Stone Age stone artefacts including a convergent flake with weathered and patinated surfaces (possible ESA or early MSA), flakes and pieces with scraper retouch (bottom left and middle).



Plate 15. Examples of isolated Stone Age stone artefacts including flakes with adze and scraper retouch. Specimens in quartz, chert, possible banded ironstone and quartzite.



Plate 16. Examples of isolated Stone Age stone artefacts including glassy quartz flake with scraper and adze retouch (LSA), heavily weathered and patinated flakes in quartzite of likely ESA origin (top right and bottom left), large quartz core (bottom middle), Fauresmith type bifacially flaked quartz (bottom right).



Plate 17. Examples of isolated Stone Age stone artefacts including Fauresmith type specimens (top left and bottom right), convergent flake with prepared platform (top), and pieces with adze and scraper retouch. Specimens in quartz and quartzite.



Plate 18. Examples of isolated Stone Age stone artefacts including broken Fauresmith type bifacial in quartz (top left), quartzite scraper (top middle), polished quartzite core (top right), flake, heavily weathered and patinated core (bottom middle) and blade.



Plate 19. Examples of isolated Stone Age stone artefacts of MSA origin.

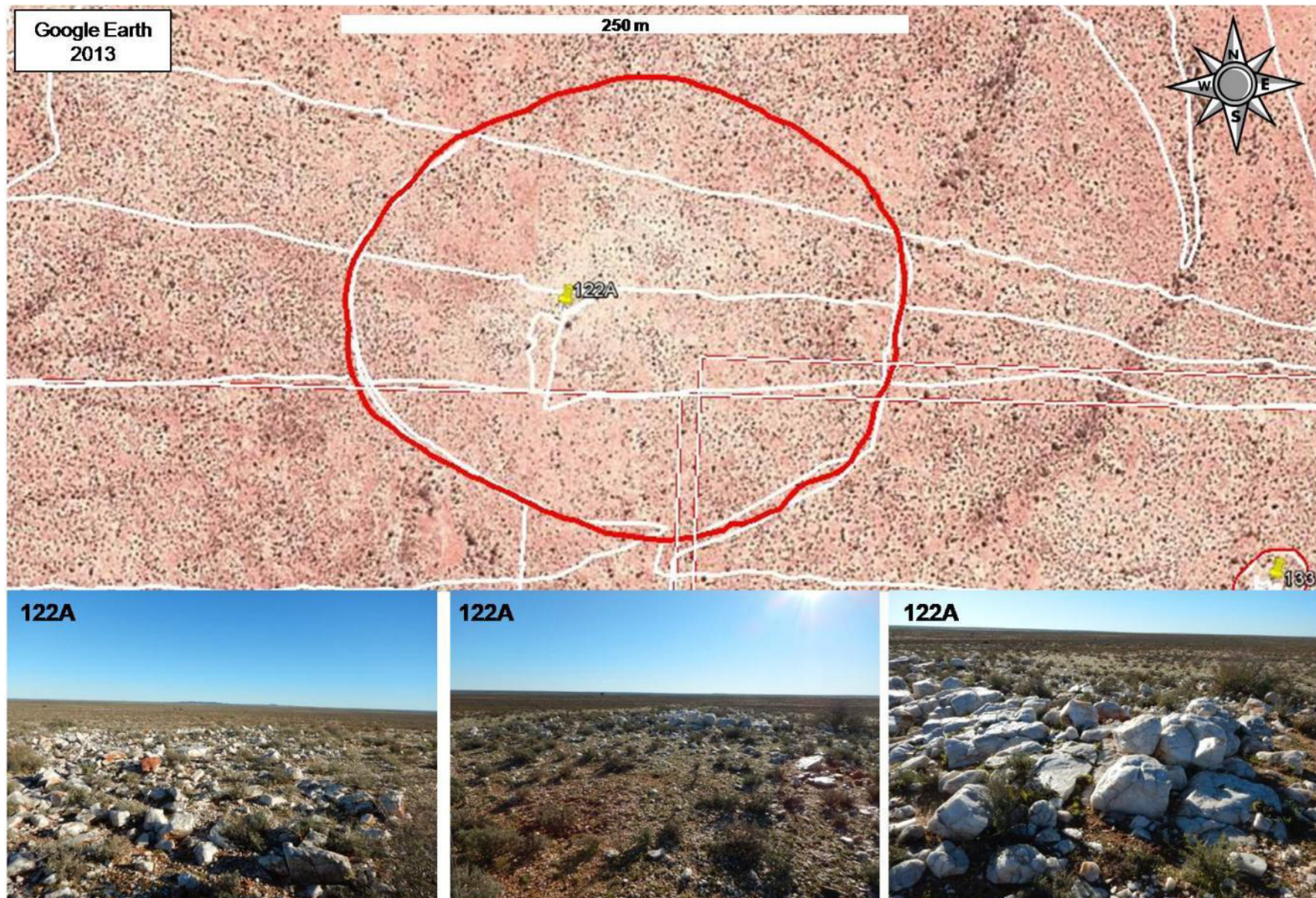


Plate 20. Stone Age quartz quarry site at waypoint 122A. Red polygon indicates extent of site. Note that 122A is at one of the highest points in the study area providing a good vantage point over the surrounding landscape.



Plate 21. Examples of worked quartz in the quartz quarry site at waypoint 122A. Note quartz cores, flakes, chunks and chips.



Plate 22. Examples of worked quartz in the quartz quarry site at waypoint 122A. Note quartz flakes, chunks and chips.



Plate 23. Quartz outcrop and Stone Age quartz quarry site at waypoints 136 and 140. Bottom images show *in situ* pieces of flaked / quarried quartz.

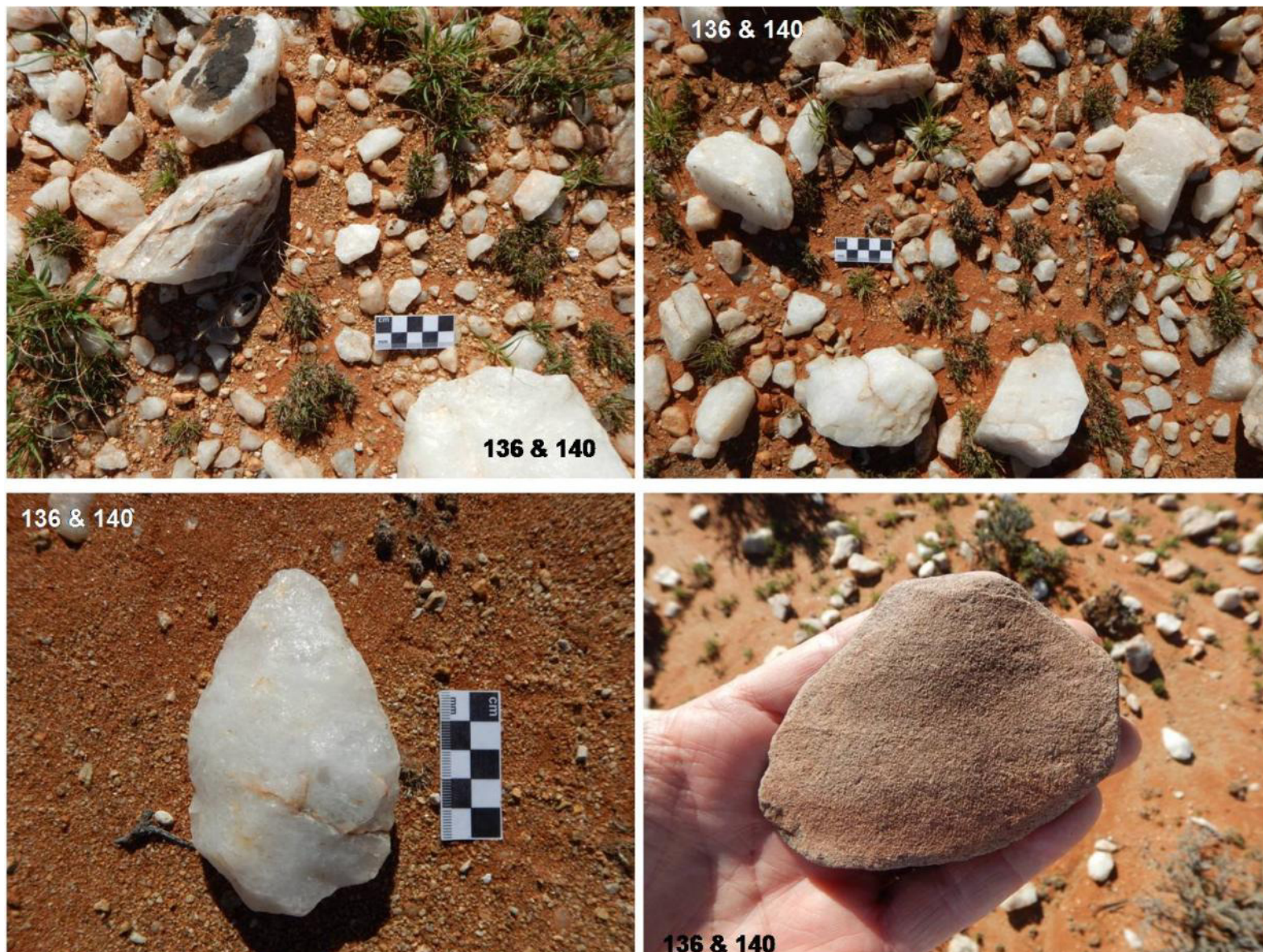


Plate 24. Top images show examples of worked quartz including cores, flakes, chunks and chips. These sites contain thousands of archaeological pieces in quartz. Bottom left shows a classic Fauresmith hand axe found at waypoint 136 and bottom right is a flake of likely ESA age.



Plate 25. Examples of isolated Stone Age stone artefacts identified along the grid connection corridor showing flakes, a convergent flake or point, an adze, a broken Fauresmith hand axe (bottom right), a core and a thumbnail scraper (bottom right). Specimens are in quartz.

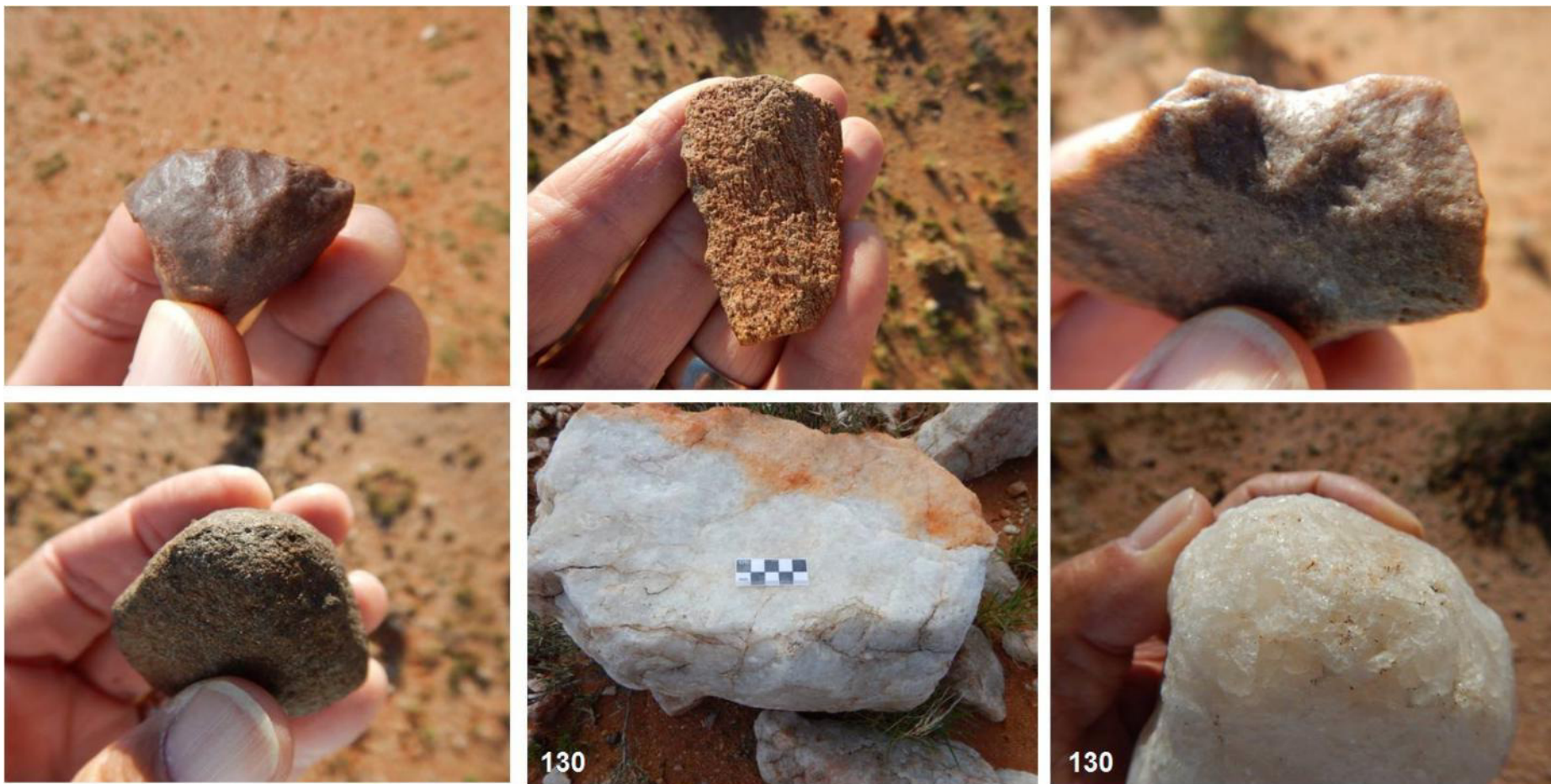


Plate 26. Examples of isolated Stone Age stone artefacts identified along the grid connection corridor including an end scraper (top left), heavily weathered and patinated flake of likely ESA age (top middle), adze or notched piece (top right), small hammer stone (bottom left), flaked *in situ* piece of quartz (bottom middle) and a quartz hammer stone (bottom right). Specimens are in quartzite and quartz.



Plate 27. Quartz outcrop and Stone Age quartz quarry site along grid connection route at waypoints 130 & 131 showing quartz outcrop and quartz dominated gravels, flaked *in situ* pieces of quartz and ground surfaces littered with flakes, chunks and chips in quartz.

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.