HERITAGE IMPACT ASSESSMENT: PROPOSED HYPERION SOLAR DEVELOPMENT 3, LYNDOCH 432/REM, KURUMAN MAGISTERIAL DISTRICT, NORTHERN CAPE

Required under Section 38(8) of the National Heritage Resources Act (No. 25 of 1999).

SAHRA Case No.: 12967

Report for:

Savannah Environmental (Pty) Ltd
P.O. Box 148, Sunninghill, 2157
Tel: 011 656 3237
Email: shaun@savannahsa.com

On behalf of:

Hyperion Solar Development 3 (Pty) Ltd

Dr Jayson Orton
ASHA Consulting (Pty) Ltd
40 Brassie Street, Lakeside, 7945
Tel: (021) 783 0557 | 083 272 3225
Email: jayson@asha-consulting.co.za

27 March 2019

EXECUTIVE SUMMARY

ASHA Consulting (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed development of the Hyperion Solar Development 3 (HSD3) near Kathu, Northern Cape. The project would be located on Farm Lyndoch 432/Remainder, just south of the north-western corner of the property. Four access road alternatives are being considered.

The site is flat and is traversed by an ephemeral watercourse, the Vlermuisleegte. The proposed development will be located on red sand to the west of the watercourse. Vegetation consists of thorn bushes and trees scattered across a grassy plain.

Palaeontological materials are most likely to occur close to the watercourse, while archaeological artefacts were seen in gravels associated with the edge of the watercourse and also on a low rise at the southern edge of the HSD3 development area. These gravels likely extend beneath the sand throughout the study area but at an unknown depth, which means that impacts cannot easily be quantified. The cultural landscape of the broader study area is a recent one focused on mining and electrical developments. The addition of a new solar energy facility is thus not seen as a concern as the landscape will be able to absorb this change.

Impacts to palaeontological resources are expected to be of low significance both before and after mitigation, while those to archaeological resources would potentially be medium before mitigation and low after mitigation. Potential impacts to graves are of low significance because of the extremely low likelihood of finding any during construction. There are no fatal flaws in terms of heritage and the existing buffers along the Vlermuisleegte and around the low rise are sufficient to protect known heritage resources. The access road alignments would have variable impacts with those in or close to the Vlermuisleegte – Alternatives 1 and 2 – being of medium significance and those further away – Alternatives 3 and 4 – being of low significance before mitigation. After mitigation all negative impacts would be of low significance. The potential exists for positive cumulative impacts to occur within the region because of the new knowledge that may arise as a result of archaeological mitigation work.

It is suggested that the proposed facility will not result in highly significant impacts to heritage resources and the project should be authorised, but subject to the following conditions:

- A chance finds procedure for fossils should be incorporated into the EMPr for the project;
- Once geotechnical work has been done on the site an archaeologist should be appointed to conduct test excavations and sampling of the archaeology in areas where *in situ* gravel will be intersected by foundations, cable trenches and/or access roads. This work should aim primarily to understand the distribution of archaeology on the landscape, although if any dense archaeology is encountered it may be necessary to expand excavations; and
- If any fossils, archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.

Glossary

Background scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency.

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Fauresmith: A period right at the end of the Early Stone Age when very small handaxes were made.

Handaxe: A bifacially flaked, pointed stone tool type typical of the Early Stone Age.

Holocene: The geological period spanning the last approximately 10-12 000 years.

Hominid: a group consisting of all modern and extinct great apes (i.e. gorillas, chimpanzees, orangutans and humans) and their ancestors.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Leegte: An Afrikaans word that has no direct English translation. It translates loosely to 'dry watercourse' but carries the implication that water seldom or never flows in it.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

BIF: Banded Iron Formation

CRM: Cultural Resources Management

ECO: Environmental Control Officer

EO: Environmental Officer

EIA: Environmental Impact Assessment

ESA: Early Stone Age

GP: General Protection

GPS: Global Positioning System

HIA: Heritage Impact Assessment

LSA: Later Stone Age

MSA: Middle Stone Age

NBKB: Ngwao-Boswa Ya Kapa Bokoni

NEMA: National Environmental Management Act (No. 107 of 1998)

NHRA: National Heritage Resources Act (No. 25) of 1999

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

Contents

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to conduct an assessment of the potential impacts to heritage resources that might occur as a result of the proposed development of the Hyperion Solar Development 3 (HSD3; S27° 33' 49.0" E23° 04' 36.0") and associated infrastructure near Kathu, Kuruman Magisterial District, Northern Cape (Figure 1). The project would be located on farm Lyndoch 432/Remainder, just north of the south-western corner of the property (Figure 2). Four access road alternatives are being considered over various properties surrounding the site (Table 1), while a perimeter road within Lyndoch 432/rem would link the facility to the final chosen access road.

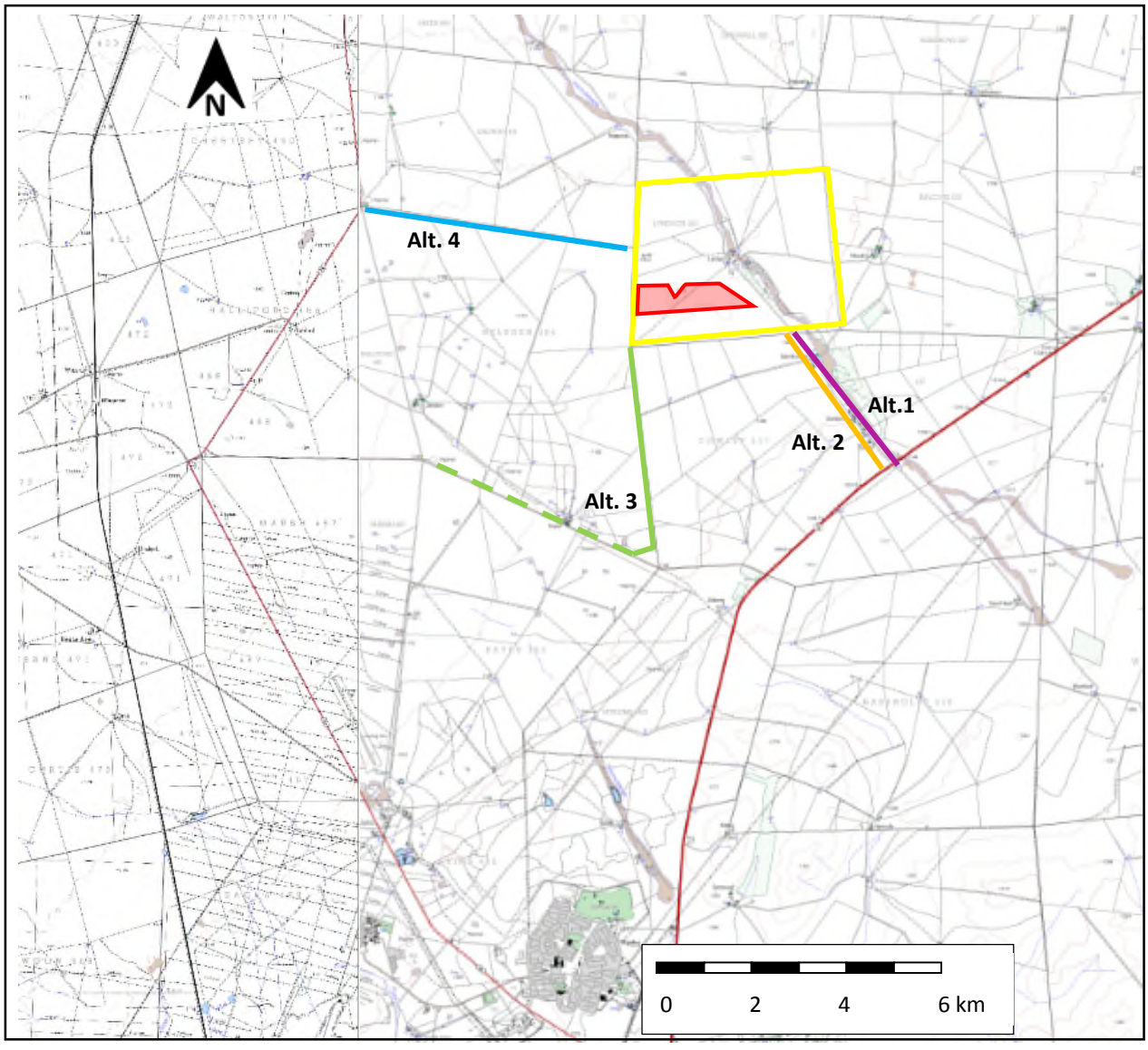

Figure 1: *Extract from 1:50 000 topographic map 2723CA showing the location of the project site (yellow polygon) and proposed development area (red shaded polygon). The four access roads are as labelled with the dashed section of Alternative 3 indicating an existing gravel road that would be upgraded. Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.*

Figure 2: *Aerial view of the broader study area showing the project site (yellow polygon), proposed HSD3 development area (grey hatched area), four access road alternatives (See Fig. 1 for labels) and the proposed perimeter access road (white line along western and southern margins of the site).*

Table 1: *Properties traversed by the four proposed access road alternatives.*

Alternative	Properties
1	Lyndoch 432/rem Cowley 432/rem, 432/1, 432/2
2	Lyndoch 432/rem Cowley 432/rem, 432/1, 432/2
3	Lyndoch 432/rem Selsden 464/1 Kathu 465/rem Halliford 466/1 Marsh 467/rem
4	Lyndoch 432/rem Selsden 464/rem, 464/1 Halliford 466/rem

1.1. Project description

Hyperion Solar Development 3 (Pty) Ltd is proposing the development of one of four solar energy facilities on an approximately 1600ha site near Kathu, in the Northern Cape Province. Each project would be up to 75MW in capacity and require about 180ha of land. However, approximately 200ha

is being investigated per project. The present report considers the project just north of the south-western corner of the site. It is known as Hyperion Solar Development 3.

The proposed project will comprise the following key infrastructure and components:

- Arrays of PV panels (static or tracking PV system) with a contracted capacity of up to 75MW.
- Mounting structures to support the PV panels.
- On-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and distribution power transformers.
- An on-site substation to facilitate the connection between the project and the Eskom electricity grid.
- A new 132kV power line[1] between the on-site substation and the existing Ferrum Substation or national grid.
- Cabling between the project's components (to be laid underground where practical).
- Battery storage mechanism with a storage capacity of up to 300MWh.
- Water purification plant.
- Site Offices and Maintenance Buildings, including workshop areas for maintenance and storage.
- Batching plant.
- Temporary laydown area.
- Main access road to the site, internal access roads and fencing around the development area.

Four alternatives, with a 20 m wide corridor for each, have been proposed for the main access road. These are as follows:

- Alternative 1: This alternative entails the upgrade of approximately 3.6km of the existing T26 gravel road situated between the project site and the N14 National Road. The existing road will be upgraded from approximately 5m to 9m in width.
- Alternative 2: This alternative entails the establishment of a new access road approximately 3.6km in length and 9m in width. The new access road is proposed to be located adjacent to the existing T26 gravel road but slightly further to the west.
- Alternative 3: This alternative entails the establishment of a new access road approximately 5.1km in length and 9m in width and the upgrade of approximately 10.3km of the existing T25 gravel road from approximately 5m in width to 9m in width.
- Alternative 4: This alternative entails the establishment of a new access road approximately 6.2km in length and 9m in width situated between the western boundary of the project site and the R380 regional road.

1.1.1. Aspects of the project relevant to the heritage study

All aspects of the proposed development are relevant since excavations for foundations and/or services may impact on archaeological and/or palaeontological remains, while all above-ground aspects create potential visual (contextual) impacts to the cultural landscape and any significant heritage sites that might be visually sensitive.

[1] The construction of the 132kV overhead power line will be assessed as part of a separate Basic Assessment process which will consider feasible alternatives for the power line route.

1.1.2. Consideration of alternatives

As described above, four access road alignments are being considered for assessment. Alternative locations were initially considered for the PV development to the east of the Vlermuisleegte but have been excluded based on ecological sensitivity. As such, no alternatives for the PV development are considered in the EIA Phase.

1.2. Terms of reference

ASHA was asked to compile a heritage impact assessment in support of an Environmental Impact Assessment (EIA) being carried out for the project. The assessment must be informed by both desktop research and fieldwork.

1.3. Scope and purpose of the report

An HIA is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued by them for consideration by the National Department of Environmental Affairs (DEA) who will review the Environmental Impact Assessment Report (EIA) and grant or refuse authorisation. The HIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the Environmental Management Programme (EMPr) and/or the conditions of authorisation should this be granted.

1.4. The author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in South Africa (primarily in the Western Cape and Northern Cape provinces) since 2004 (please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP; Member #43) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

1.5. Declaration of independence

ASHA Consulting (Pty) Ltd and its consultants have no financial or other interest in the proposed development and will derive no benefits other than fair remuneration for consulting services provided.

2. HERITAGE LEGISLATION

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old as well as military remains more than 75 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: "any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith";
- Palaeontological material: "any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace";
- Archaeological material: a) "material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures"; b) "rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation"; c) "wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation"; and d) "features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found";
- Grave: "means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place"; and
- Public monuments and memorials: "all monuments and memorials a) "erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government"; or b) "which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual."

Section 3(3) describes the types of cultural significance that a place or object might have in order to be considered part of the national estate. These are as follows:

a) its importance in the community, or pattern of South Africa's history;
b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;

e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
f) its importance in demonstrating a high degree of creative or technical achievement at a particular period;
g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
i) sites of significance relating to the history of slavery in South Africa.

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate. Furthermore, some of the points in Section 3(3) speak directly to cultural landscapes.

Section 38(8) of the NHRA states that if an impact assessment is required under any legislation other than the NHRA then it must include a heritage component that satisfies the requirements of S.38(3). Furthermore, the comments of the relevant heritage authority must be sought and considered by the consenting authority prior to the issuing of a decision. Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to a Scoping and EIA process. The present report provides the heritage component. Ngwao-Boswa Ya Kapa Bokoni (Heritage Northern Cape; for built environment and cultural landscapes) and the South African Heritage Resources Agency (SAHRA for archaeology and palaeontology) are required to provide comment on the proposed project in order to facilitate final decision making by the DEA.

3. METHODS

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the proposed development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The 1:50 000 map and historical aerial images were sourced from the Chief Directorate: National Geo-Spatial Information.

3.2. Field survey

In order to inform the layout/development footprint of the proposed facility, the entire project site was subjected to a foot survey (Figure 3). In terms of access roads, Alternative 1 was examined from the vehicle with regular stops to look at the substrate, a part of Alternative 3 was examined on foot, while Alternatives 2 and 4, which were not yet proposed at the time of the field survey, were not examined at all. The survey was carried out on 20 to 22 July 2018. This was in winter, when the grass was slightly less dense and ground visibility was slightly improved. During the survey, the positions of finds and survey tracks were recorded on a hand-held Global Positioning System (GPS) receiver set to the WGS84 datum. Because of the difficulty in seeing anything more than some 10 to 20m away, the site was scrutinised on aerial photography and any potentially interesting locations were

marked on the GPS for checking in the field. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

3.3. Specialist studies

Dr John Almond of Natura Viva cc was subcontracted to provide specialist palaeontological input relevant to the entire project site. Due to the nature of the project site and the expected palaeontology, this input was desktop-based. The report is included as Appendix 4 within this HIA.

Figure 3: *Aerial view of the study area showing the project site (yellow polygon), development area, grey hatched polygon), access road alternatives (purple, orange, green and blue lines) and the survey tracks (pink lines).*

3.4. Impact assessment

For consistency among specialist studies, the impact assessment was conducted through application of a scale supplied by Savannah Environmental as follows:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:

- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
- medium-term (5–15 years) – assigned a score of 3;
- long term (> 15 years) - assigned a score of 4; or
- permanent - assigned a score of 5;

» The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

» The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

» the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and

» the **status**, which will be described as either positive, negative or neutral.

» the degree to which the impact can be reversed.

» the degree to which the impact may cause irreplaceable loss of resources.

» the degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:

S=(E+D+M)P

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),

» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),

» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

3.5. Grading

Section 7(1) of the NHRA provides for the grading of heritage resources into those of National (Grade I), Provincial (Grade II) and Local (Grade III) significance. Grading is intended to allow for the

identification of the appropriate level of management for any given heritage resource. Grade I and II resources are intended to be managed by the national and provincial heritage resources authorities respectively, while Grade III resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended under S.7(2) that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. SAHRA (2007) has formulated its own system[2] for use in provinces where it has commenting authority. In this system, sites of high local significance are given Grade IIIA (with the implication that the site should be preserved in its entirety) and Grade IIIB (with the implication that part of the site could be mitigated and part preserved as appropriate) while sites of lesser significance are referred to as having 'General Protection' (GP) and rated as GP A (high/medium significance, requires mitigation), GP B (medium significance, requires recording) or GP C (low significance, requires no further action).

3.6. Assumptions and limitations

The field study was carried out at the surface only and hence any completely buried archaeological or palaeontological sites would not be readily located, although it is known that the gravels underlying the sand contain many thousands of stone artefacts. It is also not always possible to determine the depth of archaeological material visible at the surface or known to occur beneath it. The dense thorn bushes in places, especially in the north-eastern part of the project site, made survey difficult and the long grass inhibited visibility. Given the sand cover and the lack of artefacts therein, it was assumed that this pattern would hold true throughout the project site and, as such, more attention was paid to examining the areas close to the Vlermuisleegte in order to better characterise the archaeology of the area. As noted above, the access roads were not completely surveyed. It should also be noted that after the scoping phase Alternative 3 was moved to the western side of a fence while the survey looked at the area to the east. However, given the uniformity of the archaeology noted in the surveyed areas and especially the lack of archaeology away from the Vlermuisleegte, these factors are not expected to limit the outcome of this report.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The HSD3 site lies about 13.5 km north of Kathu within a rural area. Although much iron ore mining occurs in the area, it is concentrated in the area to the west and southwest of Kathu. Kathu is a modern town developed in connection with the iron ore industry and has in recent years also had some solar energy facilities constructed – a large such facility lies 6.5 km southwest of the present site and another lies 14 km to the west. The N14 road passes about 5.5 km to the southeast of the project site.

4.2. Site description

The overall project site is very flat with the main topographic feature being the low-lying Vlermuisleegte which traverses the project site diagonally from the northwest to the southeast

[2] The system is intended for use on archaeological and palaeontological sites only.

(Figures 4 & 5). This dry watercourse lies several meters below the level of the surrounding plains. The plains are covered in red sand and grass with many bushes and some larger camelthorn trees (Figures 6-9). In a few places close to the Vlermuisleegte there was some calcrete exposed. This calcrete likely extends beneath the surface of the site but its overall extent remains unknown (Figure 10). Lower down the geological profile, and closer to the river, there is gravel on the surface. This likely extends beneath the calcrete where the latter occurs. In the Vlermuisleegte, solid bedrock was encountered in one place only (Figure 11; although the *leegte* itself was not really surveyed). The proposed HSD3 development area is flat and sandy with its eastern margin abutting the Vlermuisleegte. The only variation is a low gravel-covered hill that lies along the northern margin of the development area.

Figure 4: *View towards the northeast across the Vlermuisleegte showing a gravel-rich part of the western bank.*

Figure 5: *View towards the southwest across the Vlermuisleegte showing a sandy bank. The farmstead lies on the skyline (arrowed).*

Figure 6: *View towards the east across the north-western part of the site where larger trees were relatively uncommon.*

Figure 7: *View towards the west across the north-eastern part of the site where larger trees were relatively common.*

Figure 8: *View towards the southeast across the eastern part of the site in an area with open grassy areas between the dense clusters of thorn bushes.*

Figure 9: *View of a burrow showing the clean red sand that occurs beneath the grass.*

Figure 10: *Calcrete exposed beneath the red sand close to the Vlermuisleegte.*

Figure 11: *View across the only bedrock exposure on site. It lies within the channel of the Vlermuisleegte whose depth below the plains is evident here.*

The two surveyed access road alternatives were found to be very different in character. The existing access road which would be upgraded, referred to as access Alternative 1, is a gravel road that in places has been scraped into the *in situ* gravel. In other areas, where it traverses sandy ground, gravel has been imported to make the road surface. Figures 12 to 15 show this road. Alternative 3 runs over sandy ground and the southern part of the north-south section has been cleared of vegetation as a fire break (Figures 16 and 17). Alternatives 2 and 4, although not physically examined, are expected to be similarly sandy in nature.

Figure 12: *View along access road Alternative 1 towards the northwest.*

Figure 13: *View along access road Alternative 1 towards the northwest.*

Figure 14: *View along access road Alternative 1 towards the southeast.*

Figure 15: *View across access road Alternative 1 towards the northeast.*

Figure 16: *View towards the north along a section of the Alternative 3 access road alignment (note that the currently proposed alignment is to the left of the fence in this view).*

Figure 17: *View towards the south along a section of the Alternative 3 access road alignment (note that the currently proposed alignment is to the right of the fence in this view).*

5. ARCHAEOLOGICAL AND HISTORICAL CONTEXT

This section of the report establishes what is already known about heritage resources in the vicinity of the study area. What is found during the field survey may then be compared with what is already known in order to gain an improved understanding of the significance of the newly reported resources.

5.1. Archaeological aspects

The vicinity of Kathu has long been known to have highly significant archaeological resources and there is a very large body of literature related to archaeological work and research in the area. The region is perhaps most well-known for the extensive deposits of Early Stone Age (ESA) material that have been described. Most research has been centred on the site of Kathu Pan, but Kathu Townlands has also seen considerable attention. Due to the amount of literature associated with the Kathu area, only certain relevant papers and reports were consulted in compiling the summary that follows. It should be noted that several Kathu sites, together known as the Kathu Complex, have been formally graded as a Grade 1 heritage resource indicating that the collection of sites has been accorded national significance. The archaeological resources within and beyond the proposed declaration area are under continued threat from development in the vicinity. Several of these archaeological localities are reviewed individually, where after some general comments are provided. Figure 18 shows the locations of these sites relative to Kathu and the present project site. Archaeology tends to be physically associated with gravel deposits; to the south of Kathu, the surface sands are underlain directly by calcrete rather than gravel. The lack of known archaeological sites near the current project site does not indicate a lack of archaeological deposits north of Kathu. This paucity is more of a reflection of this area being largely unexamined by archaeologists.

5.1.1. Kathu Pan

Kathu Pan (KP1) is the most studied and best-known site in the area, and has the longest history of research. It was discovered in 1974 (Beaumont 1990) and reported in popular literature the following year (Anonymous 1975). The site is a natural sinkhole located within a large pan that, under natural conditions, would have filled with water in summer (owing to the rising water table during the summer rainy season) and become a valuable water supply for prehistoric populations (Van Zinderen Bakker 1995). It has produced a sequence of ESA deposits including some Fauresmith material and evidence for the onset of the Middle Stone Age (MSA) some 500 000 years ago (Wilkins 2013). Wilkins *et al.* (2012) have studied fracture patterns on points from the site and determined that they were used in a hafted manner as spear tips. The site has also yielded very early evidence for blade production (Wilkins & Chazan 2012). A special feature of KP1 is the fact that faunal remains have been preserved. Such preservation is unusual for Kathu. These remains include species such as hippopotamus that point to a far wetter environment than exists in the region today (Klein 1988).

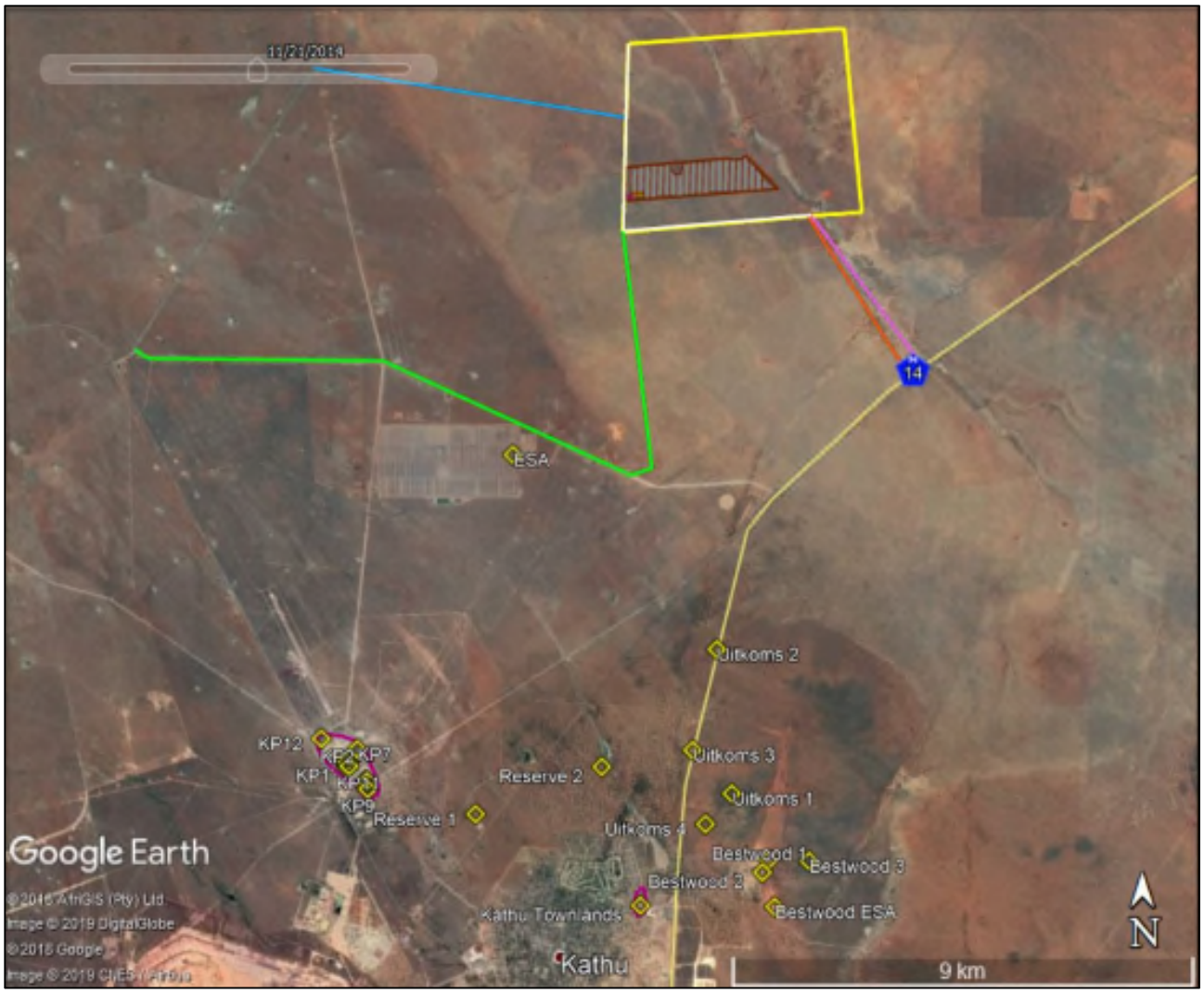

Figure 18: *Aerial view of the Kathu area showing the locations of previously recorded archaeological occurrences (labelled yellow symbols). Key as per Figures 1 and 2.*

The sequence described by Klein (1988:11), from top to bottom, is as follows:

» Approximately 1.5 m of organic silty sands containing Iron Age and Later Stone Age (LSA) material;
» Between 0.9 m and 1.7 m of less organic silty sand containing rare LSA artefacts;
» Approximately 0.8 m of poorly sorted gravelly sand with many MSA artefacts and associated faunal remains; and
» About 3.5 m to 4 m of medium to fine-grained sand containing fossil spring deposits that in turn contain abundant ESA artefacts and associated fauna.

This sequence makes the site one of only a handful in the country to preserve deposits pertaining to all three Stone Ages. Dreyer (2013) notes a circle of standing stones whose function he could not determine. However, his description and illustrations are clearly of a *trapvloer* (threshing floor) which serves to add a historical layer to the site. Porat *et al.* (2010: table 4) obtained optically stimulated luminescence and electron spin resonance/U-series dates on the deposits. The Fauresmith ESA was dated to about half a million years ago, while an age of 330 000 to 250 000 years was obtained for the MSA. Ages of 17 500 to 15 500 years and 10 500 to 9500 years were

obtained for the LSA levels. Artefactual material supports quite recent occupation near the surface (Porat *et al.* 2010). On the basis of the presence of the teeth of the extinct elephant *Elephas recki*, Klein (2000) reports that the lowest archaeological layer, containing Acheulean artefacts, is likely to be between 1 million and 500 000 years old. Importantly, the ESA stone artefacts are reported to be fresh and unabraded (Porat *et al.* 2010).

5.1.2. Kathu Townlands

The Kathu Townlands site lies across the surface of a low rise within the bounds of the town of Kathu. It was first reported in 1980 and had initial excavations carried out by Beaumont in 1982 and 1990 (Beaumont 1990). Due to proposed development on the site, mitigation work was carried out to enable a better understanding of the deposits (Walker *et al.* 2013). The archaeological material was found to occur within a dense accumulation of banded iron formation (BIF) rubble with a sandy matrix directly over bedrock. The artefacts from both the Beaumont and Walker excavations lack evidence of water transport, but damage to the artefacts does indicate mechanical damage through redeposition subsequent to the ESA occupation (Walker *et al.* 2014).

5.1.3. Bestwood

Archaeological sites were first reported at Bestwood by Dreyer (2008). Further research has been undertaken there by Chazan *et al.* (2012). They described two sites, designated Bestwood 1 and Bestwood 2. These are both windows into a larger landscape of artefacts that have been exposed by sand quarrying activity within a sandy valley. A third site, Bestwood 3, is located on the hilltop along the east side of this valley (not to be confused with Uitkoms 1 which is located on the hilltop to the west of the valley). Their initial investigation at Bestwood 1 revealed a lithic industry characterized by well-made hand-axes, well-retouched scrapers, occasional blades and a great diversity of core types (Chazan *et al.* 2012:331). They conclude that the site represents an ESA living surface. Again, the artefacts are fresh which militates against extensive transport and long-term exposure.

Walker *et al.* (2013) note that excavations at Bestwood 1 demonstrated that this material is present *in situ* in a single horizon beneath the covering sands. This horizon is artefactually similar to the surface exposures at Bestwood 3 and Uitkoms 1. Given these observations (as well as other currently unpublished work done at Bestwood), it seems that the archaeological deposit extends beyond the limits of the quarries, across the landscape and connects the two hilltop exposures as a continuous horizon. They also note the presence of ESA material in another quarry to the south (indicated in Figure 18 above as Bestwood ESA).

5.1.4. Uitkoms

The farm Uitkoms to the northeast of Kathu has also yielded various archaeological occurrences. Beaumont has named these occurrences as Uitkoms 1, 2, 3 and 4. Uitkoms 1 appears to be similar to Kathu Townlands 1 in terms of artefact density and debitage frequency, but occurs on a hilltop. Indeed, in his first published description of Uitkoms 1, he considered these sites to be connected as one continuous landscape of artefacts (Beaumont 2004). Uitkoms 4 is largely buried beneath surface sands in a manner similar to Bestwood 1 and 2, “where bifaces are very similar to those from the quarries, but with a formal tool incidence about a thousand times higher, and like that at a typical occupation site” (Beaumont 2008b:3). The Uitkoms 2 & 3 localities appear to be first described by

Beaumont (2007). He describes these sites as follows: “In mid-2006, two road cuttings along the N14 further towards Kuruman were also seen to contain ESA artefacts in a thin rubble of jaspilite and below red sand. One of these, Uitkoms 3, suggests that the Uitkoms 1 site also extends over the north-western side of the Kathu hill (Fig. 1). The other, Uitkoms 2, could represent the extreme western limit of a site that may range over two upslope hills on Hartnolls” (Beaumont 2007: 1-2).

5.1.5. General comments

The above sites show that archaeological materials are fairly widespread around Kathu and the area is best regarded as an archaeological landscape rather than a collection of individual sites. Indeed, in his discussion of precolonial cultural landscapes, Orton (2016:124) cited the Kathu area as an example of a Type 4 landscape which was described as a large area “containing multitudes of artefacts or occurrences not separable into individual sites”.

A large number of impact assessments have been carried out in the Kathu area. Although some have discovered valuable archaeological heritage sites, others report little or nothing. It is currently unclear if these differences are due to varying methodologies employed by different observers (for example the methods employed in distinguishing between a ‘site’ and ‘background scatter’), variations in surface geomorphology, or actual differences in the nature of the archaeological deposits as manifested on the surface. Gaigher (2013) examined an area to the southwest of the present study area and reported very little archaeological material. Just to the east, Orton and Walker (2015) found that calcrete was exposed in the western part of their study area and artefacts were virtually absent. Also, in this area, Orton (2015) noted MSA artefacts scattered around two pans. Towards the east, the calcrete gave way to BIF gravel and the number of artefacts seen climbed dramatically. In a survey further south, Dreyer (2010) found nothing. Morris (2014) examined already disturbed areas to the east of Kathu and found nothing except some artefacts and banded ironstone fragments that were in obvious secondary context related to the on-going construction activities there. By contrast, surveys on Hartnolls to the northwest of Kathu have revealed extensive archaeological deposits said to be similar to those of Kathu Townlands and those found at Bestwood (Beaumont 2007; Dreyer 2006).

De Jong (2008) reports that rock engravings are also known from the Kathu area. He does not provide locations for these engravings, nor citations for their publication. The present literature review has revealed no primary archaeological sources to substantiate this statement.

Humphreys (1976) has considered the evidence for the southern limit of Late Iron Age occupation in the area and concluded that there was likely some occupation of the Kathu area from at least about AD 1700 onwards. However, reliable documentary evidence from the 19th century points to Iron Age people not being present much further southwest than Kuruman (Figure 19). Nevertheless, that they did live in the present study area at some point is testified to by the reporting of an Iron Age site close to Kathu (Reserve 1). This site is reported by Beaumont (2006: 3) who describes it as: “an Iron Age (Tswana?) ceramic surface scatter” and states that it was excavated in 1989. Unfortunately, he provides no description or further reference. Enquiries at McGregor Museum have not been able to produce any further documentation on this site. Dreyer (2012) surveyed the same property again and, although he marks the site on a map, he provides no commentary at all – as such no further description of this site can be provided here.

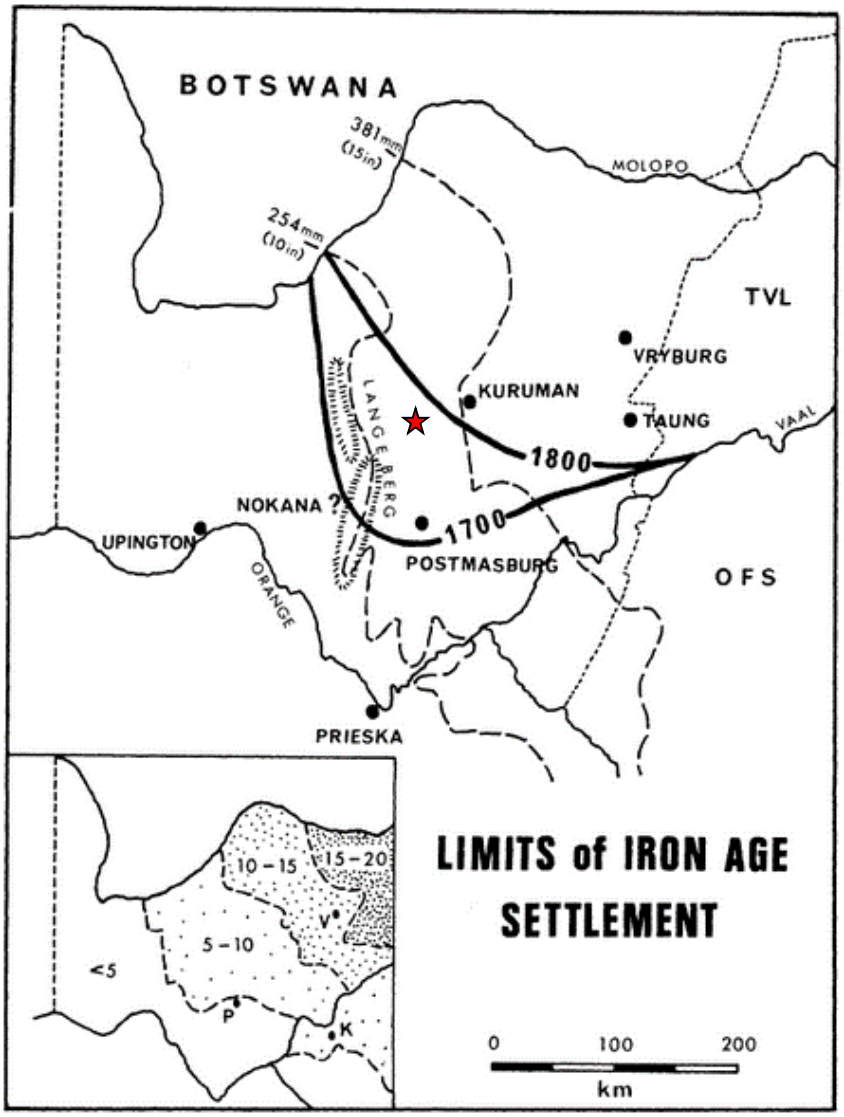

Figure 19: *Map showing the approximate south-western limits of Iron Age settlement in the Northern Cape. Source: Humphreys (1976: fig. 1). The red star indicates the position of Kathu.*

5.2. Historical aspects

Although a town named Kathu (or variations thereof) can be found on maps going back to the 1890s, the modern town of Kathu only dates back to the 1970s when iron ore mining commenced. Aerial photographs from 1957 show no mining and no development of any sort in the town area.

The Langeberg Rebellion was an important historical event to have occurred in the area. The following description is based on Saker and Aldridge (1971). The former Crown Colony of British Bechuanaland was annexed by the Cape Colony on 16th November 1895. Just over a year later, in December 1896 and January 1897, revolts – collectively known as the Langeberg Rebellion – broke out in the area. Over the following months they took root in the Langeberg Mountains, west of modern-day Kathu, and were only suppressed by the Government in August 1897. The discontent among the Tlhaping and Tlharo people had arisen some years earlier when, in 1884, about 75% of their land was taken away from them. Two years later the Land Commission met to settle land claims after the demise of the Boer Republics of Stellaland and Goshen, but little was done to help the Tlhaping and Tlharo. Although ten Native Reserves were proclaimed, 1400 square miles of crown

land was made available for white settlement – this created further friction and unhappiness. In addition to the loss of their land, the Tswana chiefs were losing their authority. Eventually, on 27 November 1896, seventeen head of cattle strayed out of the Taungs Reserve and were shot. This appears to have been the critical moment when the rebellion began.

The farm Lyndoch 432 was first surveyed in 1893 and owned by the Government of the Cape Colony. A subsequent survey diagram dated 1911 shows a house and a well situated in the centre of what is now the remainder of Lyndoch (Figure 20). The subdivision into Portion 1 (in the north) and a remainder (in the south) was carried out in 1969 and registered in 1971. Superimposition of this 1911 diagram on a modern aerial photograph places the well close to where the owner noted a well to have been in the past, but no structure lies where the house is marked. A road leading from Kathu onto the south-western corner of the property is also marked but no sign of this road is visible on 1957 and modern aerial views or the 1971 topographic map. This makes it more likely that all these features date to the time of compilation of the 1911 diagram. It seems very unusual, however, that the road would be completely invisible by 1957. In any case, not all these features are likely to have been surveyed and may be inaccurately depicted. The 1957 photograph shows the project site to be devoid of development beyond the farm complex that was already extant (Figure 21). The number of structures at the farm complex has increased dramatically in recent decades (Figures 22 & 23).

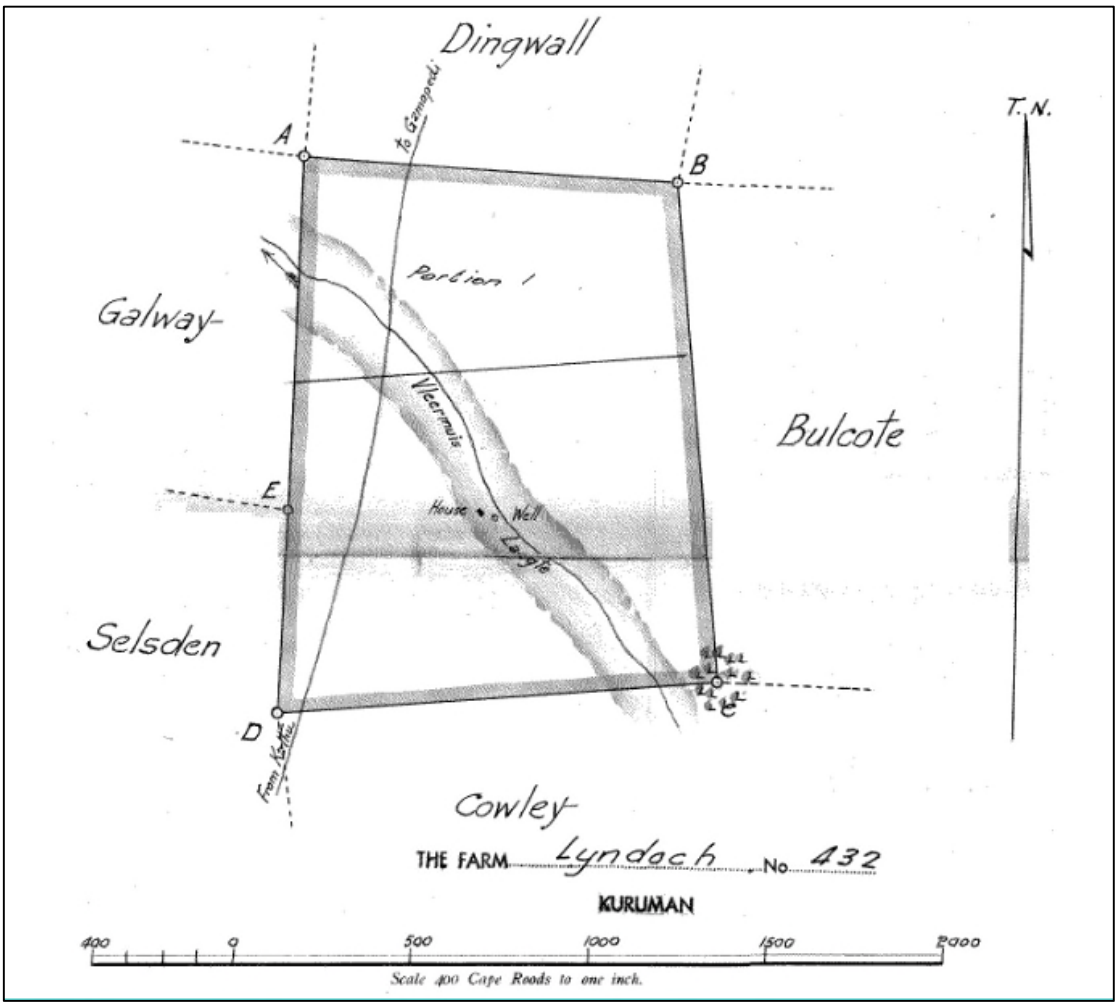

Figure 20: *Survey diagram of Lyndoch 432 dated 1911 and showing the subdivision into two portions. The southern portion (the remainder) is of concern here.*

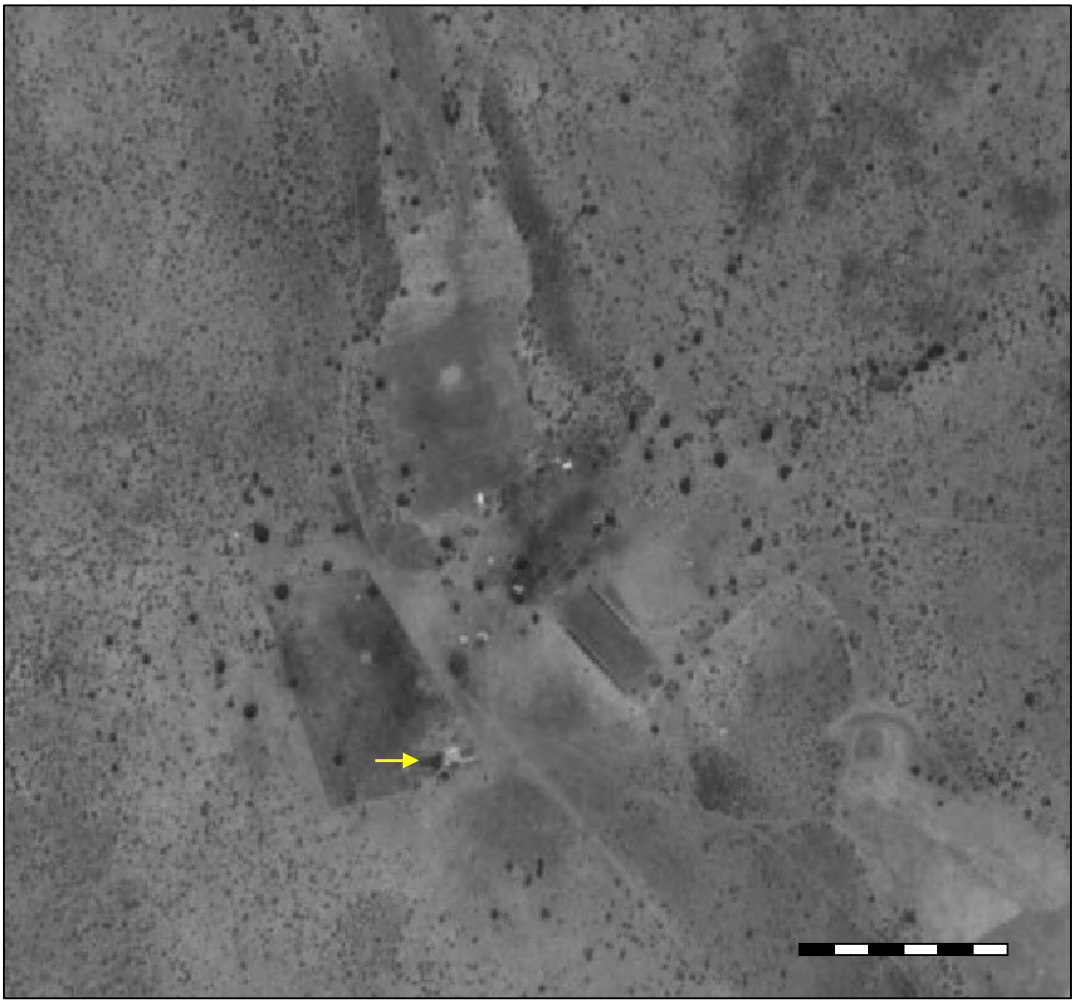

Figure 21: *Aerial photograph from 1957 (Job 391, strip 8, photograph 2004). The yellow arrow marks the farmhouse which is still present, but renovated.*

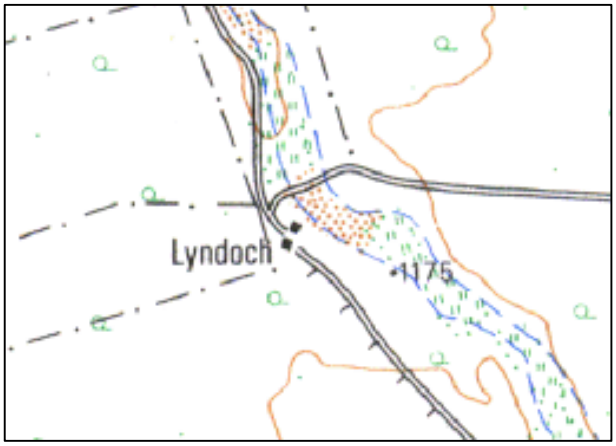

Figure 22: *Extract from the 1971 topographic map showing the extent of development of the farm complex.*

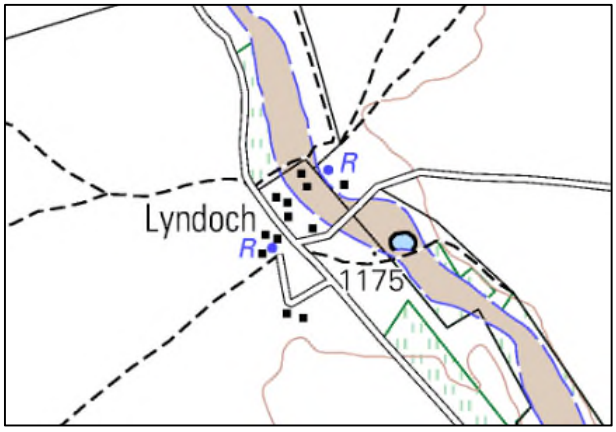

Figure 23: *Extract from the 2001 topographic map showing the extent of development of the farm complex.*

6. FINDINGS OF THE HERITAGE STUDY

The findings of the field survey are listed in Appendix 2 and mapped in Appendix 3.

6.1. Palaeontology

Almond (2018) summarises the geology and expected palaeontology for the project site. The basement rocks in the region are of lava with an outcrop occurring on the project site in the Vlermuisleegte. Thick deposits of calcrete up to five million years old overlie the bedrock over much of the broader area. These in turn are overlain by gravel and then, at the surface, red Kalahari sand. Although the SAHRIS Palaeosensitivity Map indicates the area to be of moderate to high sensitivity (Figure 24), Almond (2018), based on his own field experience from other projects, suggests that it should better be regarded as of generally low sensitivity with the possibility of small pockets of high sensitivity occurring in places. The main concern is likely to be the potential occurrence of mammalian remains in solution hollows in the calcrete or associated with old pan or *vlei* deposits along drainage lines. Almond (2018) recommended a buffer of 50 m from the Vlermuisleegte in order to avoid chance finds of such fossil localities. A far larger buffer has already been incorporated into the project design to protect other types of heritage resources which means that significant palaeontological impacts are unlikely to occur. No palaeontological resources were seen during the field survey.

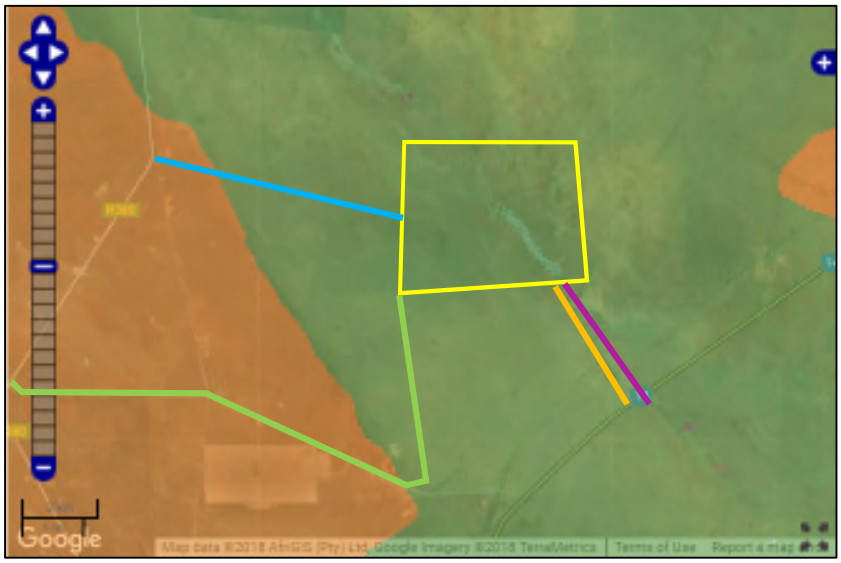

Figure 24: *Extract from the SAHRIS Palaeosensitivity Map showing the entire project site to be of moderate sensitivity (green shading). Parts of access Alternatives 3 (blue line) and 4 (green line) cross areas of high palaeontological sensitivity (orange shading). The yellow polygon indicates the site, while the coloured lines are the access road alternatives.*

6.2. Archaeology

The field survey revealed that, with one exception, the red sand covering much of the site is sterile of archaeological materials. The exception was a light scatter of artefacts with a few gravel clasts, some 70 m to the east of the Vlermuisleegte in the centre of the project site (waypoint 1185; Figure 25). These included a long, thin blade and were of indeterminate age. The only other places where

stone artefacts (the only archaeology noted) were seen was where gravel was present. This was in two locations: along the banks of the Vlermuisleegte and on a low gravel hill on the northern margin of the proposed HSD3 development area. Because of this very limited distribution of archaeology, a general discussion relating to the entire project site is presented here in order to provide a better understanding of the archaeology of the area.

Figure 25: *Artefacts from waypoint 1185. This was the only scatter seen in a sandy context. Scale in cm.*

Almost everywhere that gravel was seen exposed, stone artefacts were identified (Figures 26 to 29). These artefacts were almost exclusively of BIF, but rare quartz flakes were also noted. It was quite clear, however, that the density of artefacts varied considerably from place to place. It was noticeable that towards the north of the proposed project site calcrete started to appear in the farm track along the south-western side of the Vlermuisleegte. The density of artefacts was observed to drop off as the calcrete increased.

Figure 26: *The gravel context in which the artefacts at waypoint 1163 were found.*

Figure 27: *Artefacts at waypoint 1163. Scale is in cm intervals.*

Figure 28: *Artefacts at waypoint 1163. Scale is in cm intervals.*

Figure 29: *Artefacts at waypoint 1179 including one in quartz. Scale is in cm intervals.*

The most interesting artefact seen during the survey was located in an open test excavation (apparently a search for diamonds) on the north-eastern bank of the Vlermuisleegte at waypoint 1187. A standing section of about 1m high had artefacts present in it (Figure 30). One of these was a broken bifacial point of the sort commonly referred to as a 'Still Bay point' after the location where such artefacts were first described (Figure 31). The Still Bay period is part of the MSA and dates to between 77 and 70 000 years ago (Lombard *et al.* 2012).

Figure 30: *The standing section in which artefacts were seen at waypoint 1187.*

Figure 31: *The bifacial point fragment located at waypoint 1187. Scale in cm intervals.*

Archaeology was also seen along the current access road, which runs alongside the Vlermuisleegte (this is Access Alternative 1). Once more, the artefact density was strongly variable, but wherever there was gravel present, there were also artefacts (Figures 32 & 33). In some places it was evident that gravel had been imported to surface the road. This gravel, too, contained artefacts. A number of excavations alongside the road were present and examined for archaeology.

The artefacts seemed to be from the MSA with ESA and LSA types absent. This is in contrast to the archaeology in and around Kathu town to the south which is strongly dominated by the ESA.

Figure 32: *Artefacts seen at waypoint 1200 along the Alternative 1 access road alignment. Scale is in cm intervals.*

Figure 33: *Artefacts seen at waypoint 1200 along the Alternative 1 access road alignment. Scale is in cm intervals.*

The only variation from the flat sandy plains on either side of the Vlermuisleegte was the low gravel hill just mentioned (Figure 34). As expected, this gravel area also contained stone artefacts (Figure 35).

Figure 34: *View of the low gravel hill to the south of the project site and at which many artefacts were seen.*

Figure 35: *Artefacts from waypoint 1216 on the gravel hill south of the project site. Scale in cm intervals.*

6.3. Graves

Several graves were identified on the farm. An informal farm workers' graveyard was located at waypoint 1158 (Figure 36). There were five 'stone-packed' graves present but just one had a 'headstone' which was made from a piece of corrugated iron (Figure 37). Another sheet of flat metal was found in the grass and had once been part of one of the graves. It was dated (1973). This was the only date associated with the five graves. The graves were packed with a variety of materials sourced from the farm including stones, bricks and fragments of broken asbestos sheeting. Very close by, at waypoint 1157, there was a single more formal grave (Figure 38). Its headstone indicated

the date of death as being 8 October 1928. According to the landowner, the grave is somewhat of a mystery because some years ago some family of the deceased came to remove the remains to another location but, despite excavating the grave and some of the surrounding area no remains were located. The grave was then rebuilt in the same location and left as is. A fragment of mortar was found in the grass which supports this destruction and rebuilding. These graves are all within the development exclusion zone near the farm buildings. To the east of the Vlermuisleegte a suspicious collection of stone was located in a sandy area on the upper part of the bank of the leegte (Figure 39). No other stone were present in the vicinity and the collection is clearly anthropogenic. It may represent a grave.

Figure 36: *View of the area at waypoint 1158 in which five graves were found.*

Figure 37: *The single 'headstone' located at waypoint 1158.*

Figure 38: *The grave at waypoint 1157.*

Figure 39: *The collection of stones located at waypoint 1181.*

6.4. Built environment

There were no buildings located within the proposed HSD3 development area. However, several buildings are present within the project site and along the Alternative 1 and 2 access road alignments. According to the landowner, the oldest structures on the farm date to the 1940s

(Figures 40 & 41). An examination of them showed that they were fairly generic disused farm structures and not of any significance. The presence of a rondavel is somewhat unusual but still of no obvious significance. A *waterput* (water well) used to be present close to the rondavel but has been filled in. It was not seen during the survey. The main house on the farm was originally an older building but it has been completely renovated and is now essentially modern. Some labourers' cottages near the main farm house and two other houses to the east of the Vlermuisleegte are modern. Two farm houses and some associated outbuildings lie close to access road Alternatives 1 and 2 (Figures 42 & 43). They all appear to date no earlier than the mid-20th century and none carry any heritage significance. The house at waypoint 1195 and one close to waypoint 2003 are both older than 60 years as testified by their presence on the 1957 aerial photograph (Job 391, strip 9, photograph 2030).

Figure 40: *The earliest house on the property at waypoint 1161.*

Figure 41: *Outbuildings at waypoint 1162.*

Figure 42: *Farmhouse along the current access road at waypoint 1195.*

Figure 43: *Farmhouse along the current access road at waypoint 1197.*

6.5. Cultural landscape

There are two aspects to the cultural landscape. One is the precolonial cultural landscape of archaeological materials that occurs widely in the area, while the other is the 20th century surface

landscape related to farming. The archaeological landscape has been considered under Section 6.2 above and is not repeated here.

The more recent agricultural landscape on site is very poorly developed in terms of human interventions. It is focused on livestock farming but with some agriculture along the Vlermuisleegte. The landscape includes farm tracks, fences, fields in the leegte, and the structures. Electrical developments and mining dominate the broader landscape around Kathu, including a large solar development some 6 km southwest of the HSD3 development area.

6.6. Summary of heritage indicators

The only heritage issues of concern here are palaeontology and archaeology. Although they might occur anywhere in the landscape, the chances of significant fossils are virtually zero away from the Vlermuisleegte. Archaeology is associated with the gravels that underlie the surface sand which also means that away from the *leegte*, where the sand gets thicker, the chances of impacts would generally diminish. This pattern is not likely to be uniform, however, because very deep sand (>2 m) occurs along the southern boundary of the site alongside the *leegte* (a sand mine is operating there), while the gravel protrudes at the surface about 1.4 km southwest of the *leegte* along the southern margin of the proposed HSD3 development area.

6.7. Statement of significance and provisional grading

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Palaeontological resources are not known from the study area but should any fossils be found then they would most likely be of low to medium heritage significance, depending on what they are and where they were found. There is, nevertheless, always the very small chance that a find of high significance could be made. Overall, a field rating of GP B is applied to palaeontology.

The vast majority of the archaeological resources on the site are likely to be of low cultural significance for their scientific value. However, denser clusters of artefacts may have medium cultural significance for their scientific value because of the contribution that they might make to an understanding of the declared Grade 1 Kathu Complex cultural landscape to the south. Overall, a field rating of GP A is applied to archaeology on this project site.

Graves are deemed to have high cultural significance for their social and historical value and would be considered Grade IIIA resources. No graves protected under the NHRA are known from the project site.

The structures on and near the project site all have low cultural significance for their architectural and historical values.

The surface cultural landscape has low cultural significance for its aesthetic value. The broader archaeological cultural landscape around Kathu is considered under archaeology.

7. ASSESSMENT OF IMPACTS

This impact assessment only considers palaeontology, archaeology (including the precolonial cultural landscape) and graves because these are the only aspects of heritage that may possibly experience direct impacts. No structures will be directly impacted and none have enough significance to warrant consideration of contextual impacts. Similarly, the cultural landscape is not assessed as being culturally significant and with other solar energy developments occurring in the area and setting a precedent, this aspect is of no concern. Those impacts that are identified for further assessment would all occur during the construction phase with no further impacts taking place during the operation and decommissioning phases.

Impact assessments are provided for the proposed PV development, the four proposed access road alternatives and the perimeter road. Note that no assessments are provided for the small water treatment plant because there will be no impacts at all related to the installation of this facility. Cumulative impacts are noted for each type of heritage but are also provided with a separate assessment considering impacts to all heritage resources. These impacts are based on a total of twenty-one approved solar energy facilities located within 30 km of the present project site. These facilities are mapped in Appendix 3. Four of them have already been constructed.

7.1. Potential impacts to palaeontological resources

Potential impacts to palaeontological resources would occur during the construction phase only and would be direct impacts. The spatial extent of impacts would be limited to the local area but the chances of impacts occurring are deemed to be very limited. There are no fatal flaws in terms of palaeontology and the significance of potential impacts before mitigation is rated as **low**. With mitigation, which would involve protecting and reporting any chance finds, the significance would still be **low** (Table 2). Note that this assessment applies equally to the proposed development site, the perimeter road and the four access road alternatives. No road alternative is favoured since Alternative 1 is already a disturbed alignment and the other three alternatives may not reach beneath the surficial sand and underlying gravels.

Table 2: *Assessment of palaeontological impacts for HSD3, the perimeter road and the Alternative 1 to 4 access roads.*

Nature: Direct destruction of fossil materials during construction activities.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Very improbable (1)
Significance	**22 (Low)**	**8 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Implementation of a chance find procedure. Chance finds to be protected *in situ* and reported. Further actions can then be taken if deemed necessary.		

Cumulative impacts: The chances of significant materials being uncovered here and in the surrounding area are so small that it is highly unlikely that any fossils lost would result in significant cumulative impacts. Potential cumulative impacts to palaeontology are thus rated as being of **low** significance.
Residual Impacts: It is not possible to locate every single fossil and there is always a possibility that fossil materials will be lost during the development process. These are generally likely to be isolated examples with low significance.

Measures for inclusion in the draft Environmental Management Programme (EMPr) are as follows:

OBJECTIVE: To minimise the destruction of fossils	
Project component/s	All components requiring subsurface excavations (e.g. foundations, cable trenches, roadworks).
Potential Impact	Destruction of fossils.
Activity/risk source	All bulk earthworks.
Mitigation: Target/Objective	To increase the likelihood of noticing fossils and ensure appropriate actions are taken.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Environmental Officer (EO) to alert workers to the importance of reporting fossil bones seen on site.	EO	Before and during construction.

Performance Indicator	The reporting of fossils will indicate that the measure has been successfully applied.
Monitoring	The ECO should check whether any finds have been made and ensure that these get reported.

7.2. Potential impacts to archaeological resources

Potential impacts to archaeological resources would occur during the construction phase only and would be in the form of direct impacts. The spatial extent of impacts would generally be limited to the local area but it should be remembered that all archaeology in the Kathu region has the potential to add value to the Grade I Kathu Complex. Impacts of some sort are highly probable because of the widespread distribution of archaeology within the gravels of the area but in areas with deeper sand the chances are greatly diminished. There are no fatal flaws in terms of archaeology. The significance of potential impacts before mitigation for HSD3 and Access Road Alternative 1 is rated as **medium** (56 points; Tables 3 & 4), while Access Road Alternative 2, which is slightly further from the Vlermuisleegte is rated **medium** (42 points; Table 4). With mitigation, which would involve test excavations and sampling of the archaeology as well as protecting and reporting any chance finds, the significance would be **low** (Tables 3 & 4). The test excavations and any sampling that becomes required should be carried out prior to construction. For Access Road Alternatives 3 and 4 and the perimeter road, which are all likely to be over deeper sand, the probability of impacts occurring is far lower with the significance before and after mitigation being **low** (Tables 4 & 5). Due to the deeper sand cover and shallow impacts for Access Road Alternatives 3 and 4 and the perimeter road, no mitigation aside from the reporting of chance finds has been proposed.

Table 3: *Assessment of archaeological impacts for HSD3.*

Nature: Direct destruction of archaeological materials during construction activities.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**56 (Medium)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Test excavations and sampling of artefacts and also protection and reporting of chance finds for further actions as needed. Geotechnical investigations can inform on where gravel is likely to be intersected during development and mitigation work should focus on such areas.		
Cumulative impacts: The destruction of any archaeology around the Kathu Complex would be considered to be a negative cumulative impact but, pending the significance of the materials on site being found to be high, such cumulative impacts are unlikely to be of concern. Potential cumulative impacts to archaeology are thus rated as being of **low** significance. Because the site is dominated by MSA archaeology rather than the ESA that is prevalent elsewhere, sampling of this archaeology may in fact result in a positive cumulative impact in terms of our understanding of the regional archaeological sequence.		
Residual Impacts: It is not possible to locate every single stone artefact and there is a possibility that artefacts may be lost during the development process. Of concern would be the loss of denser patches of archaeology but this cannot yet be determined because the vast majority of material lies deeply buried. Successful sampling of the archaeology on site would greatly reduce the residual impacts.		

Table 4: *Assessment of archaeological impacts for the four access road alternatives.*

Nature: Direct destruction of archaeological materials during construction activities.								
	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Regional (3)	Local (1)	Regional (3)	Local (1)	Regional (3)	Local (1)	Regional (3)	Local (1)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)	Moderate (6)	Minor (2)	Moderate (6)	Minor (2)	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)	Probable (3)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)
Significance	**56 (Medium)**	**16 (Low)**	**42 (Medium)**	**16 (Low)**	**28 (Low)**	**16 (Low)**	**28 (Low)**	**16 (Low)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can impacts be mitigated?	Yes		Yes		Yes		Yes	

Mitigation: Test excavations and sampling of artefacts and also protection and reporting of chance finds for further actions as needed. Geotechnical investigations can inform on where gravel is likely to be intersected during development and mitigation work should focus on such areas.
Cumulative impacts: The destruction of any archaeology around the Kathu Complex would be considered to be a negative cumulative impact but, pending the significance of the materials on site being found to be high, such cumulative impacts are unlikely to be of concern. Potential cumulative impacts to archaeology are thus rated as being of **low** significance. Because the site is dominated by MSA archaeology rather than the ESA that is prevalent elsewhere, sampling of this archaeology may in fact result in a positive cumulative impact in terms of our understanding of the regional archaeological sequence.
Residual Impacts: It is not possible to locate every single stone artefact and there is a possibility that artefacts may be lost during the development process. Of concern would be the loss of denser patches of archaeology but this cannot yet be determined because the vast majority of material lies deeply buried. Successful sampling of the archaeology on site would greatly reduce the residual impacts.

Table 5: *Assessment of archaeological impacts for the perimeter road.*

Nature: Direct destruction of archaeological materials during construction activities.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**28 (Low)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Protection and reporting of chance finds for further actions as needed.		
Cumulative impacts: The destruction of any archaeology around the Kathu Complex would be considered to be a negative cumulative impact but, pending the significance of the materials on site being found to be high, such cumulative impacts are unlikely to be of concern. Potential cumulative impacts to archaeology are thus rated as being of **low** significance. Because the site is dominated by MSA archaeology rather than the ESA that is prevalent elsewhere, sampling of this archaeology may in fact result in a positive cumulative impact in terms of our understanding of the regional archaeological sequence.		
Residual Impacts: It is not possible to locate every single stone artefact and there is a possibility that artefacts may be lost during the development process. Of concern would be the loss of denser patches of archaeology but this cannot yet be determined because the vast majority of material lies deeply buried. Successful sampling of the archaeology on site would greatly reduce the residual impacts.		

Measures for inclusion in the draft EMPr are as follows:

OBJECTIVE: To minimise the destruction of significant archaeological resources	
Project component/s	All components requiring subsurface excavations (e.g. foundations, cable trenches, roadworks).
Potential Impact	Destruction and disturbance of stone artefacts.
Activity/risk source	All bulk earthworks.
Mitigation: Target/Objective	To rescue significant archaeological artefacts and data prior to disturbance or destruction.

Mitigation: Action/control	**Responsibility**	**Timeframe**

Test excavations and sampling of artefacts to be carried out prior to development (PV site and Access Road Alternatives 1 and 2 only).	Archaeologist	6 months before construction.

Performance Indicator	The successful completion of archaeological mitigation and rescuing of data.
Monitoring	The EO should ensure that the mitigation work has been completed and a comment issued by SAHRA prior to the commencement of construction.

7.3. Potential impacts to unmarked graves

Potential impacts to unmarked graves would occur during the construction phase only and would be in the form of direct impacts. The spatial extent of impacts would be very limited. Because graves are so rarely encountered in the local landscape, the probability of graves being impacted within the development area is deemed to be very low. There are no fatal flaws in terms of graves since, although they are important, their locations cannot be predicted and they can only be dealt with on a case by case basis if discovered during construction. Because of the very low probability of impacts occurring, the significance of potential impacts before mitigation is rated as **low**. With mitigation, which would involve reporting and exhuming graves, the significance would remain **low** (Table 6). Note that this assessment applies equally to the proposed development area and all three access road alternatives.

Table 6: *Assessment of impacts to graves for HSD3, all four access road alternatives and the perimeter road.*

Nature: Direct destruction of graves during construction activities.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Very improbable (1)	Very improbable (1)
Significance	**12 (Low)**	**8 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: *In situ* protection and reporting of any graves discovered during construction work so that they can be recorded and removed to safety.		
Cumulative impacts: Because graves are very rarely found in the area, no significant cumulative impacts to graves are expected. Potential cumulative impacts to graves are thus rated as being of **low** significance.		
Residual Impacts: There may still be graves that are never identified and preserved or rescued. However, for preserved or rescued graves there would be almost zero residual impact.		

Measures for inclusion in the draft EMPr are as follows:

OBJECTIVE: To minimise the destruction of graves	
Project component/s	All components requiring subsurface excavations (e.g. foundations, cable trenches, roadworks).
Potential Impact	Destruction and disturbance of graves.
Activity/risk source	All bulk earthworks.
Mitigation: Target/Objective	To rescue human remains prior to disturbance or destruction.

Mitigation: Action/control	**Responsibility**	**Timeframe**
EO to alert workers to the possibility of encountering human remains.	EO	Before and during construction.

Performance Indicator	The successful rescue of any human remains exposed during construction.
Monitoring	The EO should check whether any finds have been made and ensure that these get reported.

7.4. Cumulative impacts to heritage resources

In general, the HSD3 proposal will likely result in minimal impacts to heritage resources. The most significant are likely to be to archaeological resources. Given that the site seems to be dominated by MSA archaeology rather than ESA, as occurs more frequently closer to Kathu (and within the Grade 1 archaeological landscape), the opportunity to explore the archaeology can be seen as a positive cumulative impact of medium significance for regional archaeology (Table 7).

Table 7: *Cumulative impact assessment for all aspects of heritage related to HSD3 and related infrastructure.*

Nature: Direct impacts to heritage resources. The focus is on archaeological resources which have the greatest potential for significant impacts and which can be physically disturbed or destroyed during construction activities.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Regional (3)	Low (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (33)**
Status (positive/negative)	Negative	Positive
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Confidence in findings: High.		
Mitigation: Test excavations and sampling of artefacts and also protection and reporting of chance finds for further actions as needed. Geotechnical investigations can inform on where gravel is likely to be intersected during development and mitigation work should focus on such areas.		

7.5. Existing impacts to heritage resources

There are currently no obvious threats to heritage resources on the site aside from the natural degradation, weathering and erosion that will affect fossils, archaeological materials and their contexts. This is slightly enhanced along the gravel road due to vehicular traffic.

7.6. Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many vantage points is undesirable. Because of the height of the majority of the proposed development and that of the camelthorn trees in the area, such an impact is not envisaged.

8. EVALUATION OF IMPACTS RELATIVE TO SUSTAINABLE SOCIAL AND ECONOMIC BENEFITS

Section 38(3)(d) of the NHRA requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

It is unlikely that highly significant impacts to heritage resources will occur and the provision of a stable electricity supply is considered to be of more concern. The project will also provide jobs during both its construction and operation phases.

9. CONCLUSIONS

Impacts to palaeontology and archaeology may occur during the construction phase but these can be easily mitigated and/or managed. Impacts to graves could occur but the chances are extremely small. The landscape is characterised by mining and energy developments / infrastructure and will be able to absorb the proposed development. There are no fatal flaws in terms of heritage. The heritage buffers around the Vlermuisleegte and the raised gravel hill at the northern edge of the HSD3 development area were instituted during the scoping phase to protect known archaeological resources and the river buffer also covers the area deemed most sensitive in terms of palaeontology. These buffers have been respected by the proposed development layout and no further buffers are required.

Four alternatives were considered for the access road. Alternatives 1 and 2, because they run close to the Vlermuisleegte and have a fair chance of intersecting artefact-bearing gravel, are considered to be slightly more sensitive from an archaeological point of view, while Alternatives 3 and 4, which are likely to run over far deeper sand, are of lesser archaeological sensitivity and are thus equally preferred from a more general heritage point of view. Given that (1) the Alternative 1 alignment is already disturbed (current farm access road), (2) there is a potential positive cumulative impact through enhancing our understanding of the regional archaeological sequence, and (3) reuse of this

alignment would prevent the destruction of currently undisturbed areas, Alternative 1 is seen as the overall preferred alternative access road from a heritage point of view.

Although no structures are affected by the current proposal, it is noted that buildings older than 60 years of age are present in the area and if any alteration to them was considered at a later stage then this would need to be under a Section 34 permit issued by the responsible heritage resources authority.

Overall, it is likely that the proposed HSD3 development and its associated roads and facilities will have a low negative impact on heritage resources once mitigation has been applied and might even result in positive cumulative impacts to archaeology. There are no fatal flaws and it is concluded that the development is acceptable in heritage terms.

10. RECOMMENDATIONS

It is suggested that the proposed development and associated infrastructure will not result in significant negative impacts to heritage resources and that it should be authorised in full. The following recommendations should be included in the authorisation conditions or EMPr as appropriate:

- A chance finds procedure for fossils should be incorporated into the EMPr for the project;
- Once geotechnical work has been done on the site an archaeologist should be appointed to conduct test excavations and sampling of the archaeology in areas where *in situ* gravel will be intersected by foundations, cable trenches and/or access roads (this is expected to be in the HSD3 and access Alternative 1 and 2 footprints). This work should aim primarily to understand the distribution of archaeology on the landscape, although if any dense archaeology is encountered it may be necessary to expand excavations; and
- If any fossils, archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.

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APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 40 Brassie Street, Lakeside, 7945
Telephone: (021) 789 0327
Cell Phone: 083 272 3225
Email: jayson@asha-consulting.co.za

Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science)	1997
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP) membership number: 43

- Accredited Professional Heritage Practitioner

➢ *Memberships and affiliations:*

South African Archaeological Society Council member	2004 – 2016
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
UCT Department of Archaeology Research Associate	2013 – 2017
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –
Kalk Bay Historical Association	2016 –
Association of Professional Heritage Practitioners member	2016 –

Fieldwork and project experience:

Extensive fieldwork and experience as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Feasibility studies:

- Heritage feasibility studies examining all aspects of heritage from the desktop

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - Desktop-based Letter of Exemption (for the South African Heritage Resources Agency)
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies
  - Phase 1 archaeological test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
  - Duinefontein, Gouda, Namaqualand
- MSA rock shelters
  - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
  - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
  - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
  - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
  - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
  - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
  - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
  - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

Awards:

Western Cape Government Cultural Affairs Awards 2015/2016: Best Heritage Project.

APPENDIX 2 - List of finds

Waypoint	Location	Description	Significance
1157	S27 33 15.6 E23 05 01.4	Isolated grave of Johanna Cornelia Sutherland dated 8 October 1928. According to the land owner, many years ago the family of the deceased came to exhume the grave and remove the remains to another location, presumably closer to home, but no remains were found. The granite grave covering and headstone were dismantled and a large area searched. On finding nothing the grave covering was rebuilt in the original location. Despite the lack of human remains the site is still considered as a grave site but the significance is reduced.	GPA
1158	S27 33 15.6 E23 04 57.9	Five graves of past farm workers. Only one is dated and is believed to be the most recent. It is dated with painted writing on a metal sheet which is lying loose in the grass and it is thus uncertain which grave it belongs to. The inscription names the person as 'Tities Manyana Katerina' and notes the date of death as '0_.05.1973' and date of burial as '12.05.1973'. The month is not completely clear but May seems most likely. She was born on 02.08.1935. Another grave has a metal sheet standing at the head but there is no inscription. All five graves are 'stone-packed' graves but using various items from the vicinity, a few stones, some bricks and some fragments of asbestos sheeting.	IIIA
1159	S27 33 22.8 E23 05 03.4	Loose cluster of calcrete rocks near the farm house. Their function has never been known but it is clear they were brought there by people.	---
1160	S27 33 14.1 E23 05 13.2	The cement foundation of a now-demolished house that was originally built in the 1940s when the farm was acquired by the present owner's family. From the surrounding rubble, it was built with a mixture of commercial and home-made bricks. Local gravel was used in the cement and in the bricks.	---
1161	S27 33 16.7 E23 05 06.1	The original house on the Lyndoch farm dating to the 1940s.	GPC
1162	S27 33 15.0 E23 05 07.0	Original outbuildings dating to the 1940s.	GPC
1163	S27 33 13.8 E23 05 01.9	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1164	S27 33 06.4 E23 05 01.2	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA

1165	S27 32 57.8 E23 04 58.4	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1166	S27 32 56.0 E23 04 56.5	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1167	S27 32 46.8 E23 04 56.7	An area of exposed bedrock within the Vlermuisleegte and surrounded by a very low density artefact scatter.	GPC
1168	S27 32 43.2 E23 04 51.7	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1169	S27 32 40.9 E23 04 50.8	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1170	S27 32 39.9 E23 04 50.3	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1171	S27 32 34.2 E23 04 47.8	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1172	S27 32 29.6 E23 04 44.8	First exposure of calcrete seen in the track while proceeding towards the north. The gravel has diminished dramatically here.	---
1173	S27 32 27.0 E23 04 43.1	Another exposure of calcrete in the track. Some gravel noted within the calcrete but very little in the vicinity.	---
1174	S27 32 25.0 E23 04 40.9	Stone artefacts on the south-western bank of the Vlermuisleegte and associated with a calcrete substrate. It is clear that there are very few artefacts here compared to where the gravel is dense.	GPC
1175	S27 32 23.8 E23 04 40.0	Stone artefacts on the south-western bank of the Vlermuisleegte and associated with a calcrete substrate. It is clear that there are very few artefacts here compared to where the gravel is dense. One flake has a calcrete coating on its ventral surface indicating its age as predating the formation of the calcrete.	GPC
1176	S27 32 23.8 E23 04 38.6	An exposure of solid calcrete at the point where it disappears under the sand towards the southwest.	---
1177	S27 32 39.6 E23 04 42.9	Isolated calcrete block on the sand. Only recorded because it must have been carried there. It is about 175 m from the edge of the Vlermuisleegte.	---
1178	S27 32 39.3 E23 04 49.2	Stone artefacts on the south-western bank of the Vlermuisleegte but located on the sandy substrate that overlies the gravel bed.	GPA
1179	S27 32 39.9 E23 04 49.6	Stone artefacts on the south-western bank of the Vlermuisleegte but located on the sandy substrate that overlies the gravel bed.	GPA
1180	S27 32 49.4 E23 04 58.2	Very ephemeral scatter of stone artefacts close to the bedrock outcrop in the Vlermuisleegte noted under waypoint 1167.	GPC
1181	S27 32 46.0 E23 05 01.8	Loose scatter of rocks on the sand about 50 m northeast of the edge of the Vlermuisleegte. It has	IIIA

		been disturbed by burrowing animals and may represent a grave. The rocks have definitely been carried there. The grading applied follows the precautionary principle.	
1182	S27 32 32.1 E23 04 54.8	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1183	S27 32 31.1 E23 04 54.2	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1184	S27 32 26.0 E23 04 51.8	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1185	S27 33 09.4 E23 05 14.5	Scatter of stone artefacts on a sandy substrate and located about 70 to 100 m northeast of the Vlermuisleegte. Very little gravel is present (more than half of all stones are artefactual).	GPA
1186	S27 32 49.3 E23 05 00.8	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1187	S27 32 50.3 E23 05 00.6	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte but revealed in a prospecting excavation. De Beers had searched for diamonds along the banks of the Vlermuisleegte in the past and the excavation was left open. Artefacts were seen in the section and these included a broken bifacially flaked artefact that was very likely a bifacial point.	GPA
1188	S27 33 00.0 E23 05 05.4	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1189	S27 33 01.3 E23 05 06.6	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1190	S27 33 03.8 E23 05 07.3	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1191	S27 33 05.4 E23 05 07.7	Stone artefacts in gravel along the north-eastern bank of the Vlermuisleegte.	GPA
1192	S27 33 20.4 E23 05 09.4	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1193	S27 35 37.1 E23 07 08.2	An exposure of solid calcrete in the current access road.	---
1194	S27 35 31.2 E23 07 03.0	Stone artefacts in imported road gravel on current access road.	---
1195	S27 35 24.0 E23 06 56.4	House on west side of current access road.	Local significance
1196	S27 35 18.2 E23 06 52.4	Stone artefacts in gravel on and beneath current access road along the south-western bank of the Vlermuisleegte.	GPA
1197	S27 35 12.3 E23 06 44.6	House on east side of current access road.	Local significance
1198	S27 34 58.1 E23 06 32.0	Stone artefacts in imported road gravel on current access road. Excavation alongside the road shows deep sand cover.	---

1199	S27 34 50.7 E23 06 27.6	An exposure of solid calcrete in the current access road.	---
1200	S27 34 47.1 E23 06 25.9	Stone artefacts in gravel on and beneath current access road along the south-western bank of the Vlermuisleegte.	GPA
1201	S27 34 41.0 E23 06 22.1	Stone artefacts in gravel on and beneath current access road along the south-western bank of the Vlermuisleegte. An excavation alongside the road goes directly into dense gravel.	GPA
1202	S27 34 31.8 E23 06 15.8	An exposure of solid calcrete in the current access road.	---
1203	S27 34 27.8 E23 06 12.6	Stone artefacts in gravel on and beneath current access road along the south-western bank of the Vlermuisleegte. This is a high point along the road.	GPA
1204	S27 34 25.0 E23 06 09.6	Stone artefacts in gravel on and beneath current access road along the south-western bank of the Vlermuisleegte. An excavation alongside the road goes directly into dense gravel.	GPA
1205	S27 34 16.8 E23 06 02.4	Stone artefacts in imported road gravel on current access road. Excavation alongside the road shows deep sand cover.	---
1206	S27 33 53.7 E23 05 43.9	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1207	S27 33 26.6 E23 05 21.4	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1208	S27 33 21.4 E23 05 13.5	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1209	S27 34 11.1 E23 06 03.7	Stone artefacts in gravel along the south-western bank of the Vlermuisleegte.	GPA
1210	S27 33 31.8 E23 05 15.8	Low density stone artefacts with some gravel on sandy substrate near the south-western bank of the Vlermuisleegte.	GPC
1211	S27 33 34.1 E23 05 17.0	Low density stone artefacts with some gravel on sandy substrate near the south-western bank of the Vlermuisleegte.	GPC
1212	S27 33 53.4 E23 05 30.2	Calcrete exposure in sandy area.	---
1213	S27 33 52.3 E23 05 30.0	Calcrete exposure in sandy area.	---
1214	S27 33 40.1 E23 05 24.2	Calcrete exposure in sandy area.	---
1215	S27 33 39.7 E23 04 25.0	Edge of a raised area of gravel with artefacts.	GPA
1216	S27 33 40.5 E23 04 23.7	Stone artefacts in gravel on raised gravel area.	GPA
1217	S27 33 43.4 E23 04 23.4	Edge of a raised area of gravel with artefacts.	GPA
1218	S27 33 42.1 E23 04 21.6	Edge of a raised area of gravel with artefacts.	GPA

1219	S27 33 38.9 E23 04 20.5	Edge of a raised area of gravel with artefacts.	GPA
1220	S27 33 36.1 E23 04 23.8	Edge of a raised area of gravel with artefacts.	GPA
1221	S27 33 34.2 E23 04 22.0	Edge of a raised area of gravel with artefacts.	GPA
1222	S27 33 33.6 E23 04 20.1	Cement reservoir built with modern bricks.	---
1223	S27 33 15.0 E23 03 54.7	Stone artefacts in gravel on a very small raised gravel area. Trig bacon built on this area.	GPC
1224	S27 34 07.5 E23 06 00.7	Gravel exposure with artefacts in quarry on the south-western bank of the Vlermuisleegte.	GPA
1225	S27 34 05.9 E23 05 55.1	Gravel exposure with artefacts in quarry on the south-western bank of the Vlermuisleegte.	GPA
1226	S27 34 08.9 E23 05 51.7	Gravel exposure with artefacts in disused quarry on the south-western bank of the Vlermuisleegte.	GPA
1227	S27 34 07.5 E23 05 48.3	Area with volcanic bedrock exposed at the surface.	---
1228	S27 33 54.1 E23 05 40.9	Area of the access road that has been graded down into the gravel with artefacts.	GPA
1229	S27 33 33.5 E23 05 20.6	Area of the access road that has been graded down into the gravel with artefacts.	GPA

APPENDIX 3 – Mapping

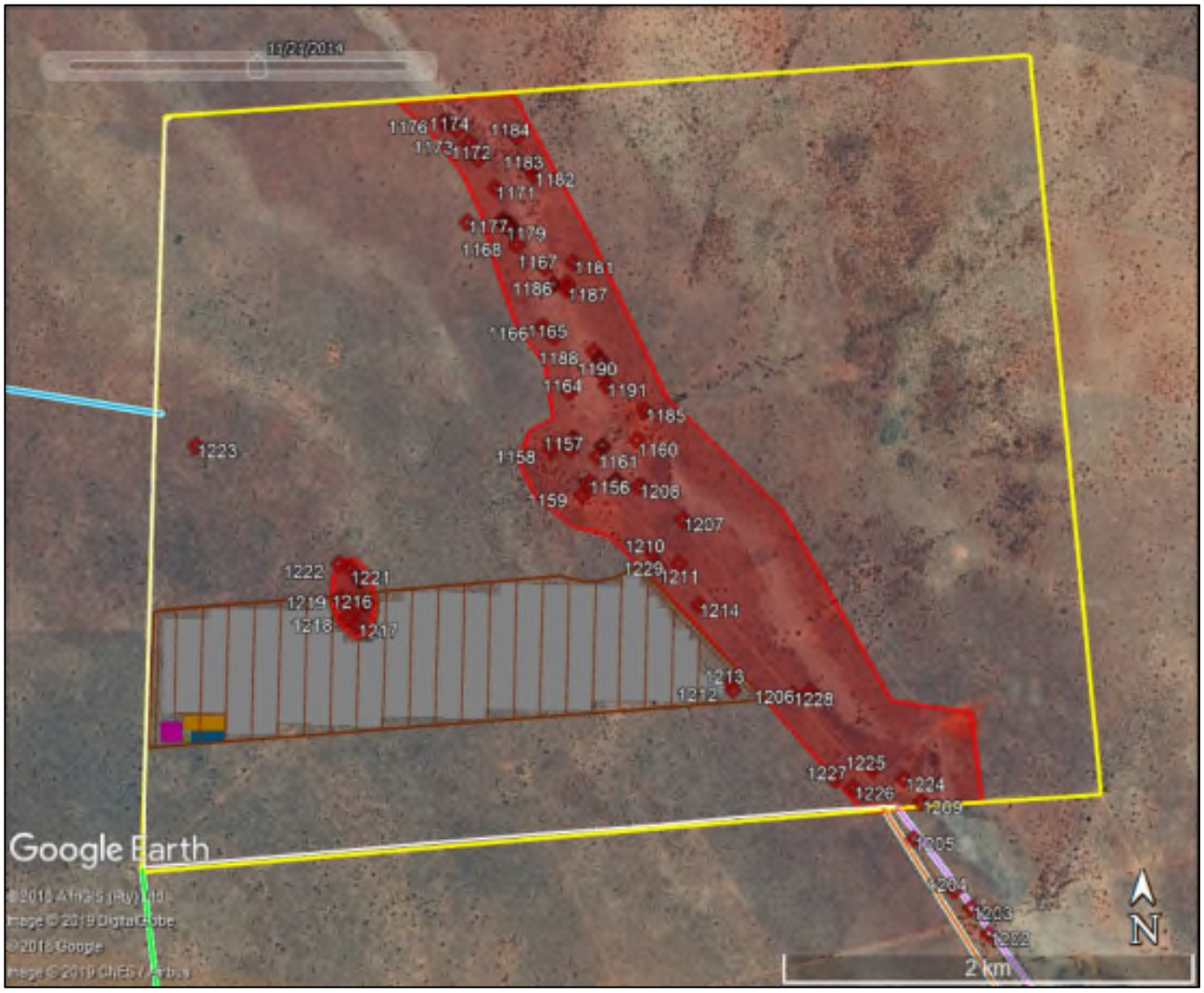

Figure A3.1: *Aerial view of the project site (yellow polygon) showing the HSD3 development area (grey hatched polygon), heritage finds (numbered red symbols) and heritage no-go area for PV development (red shaded area).*

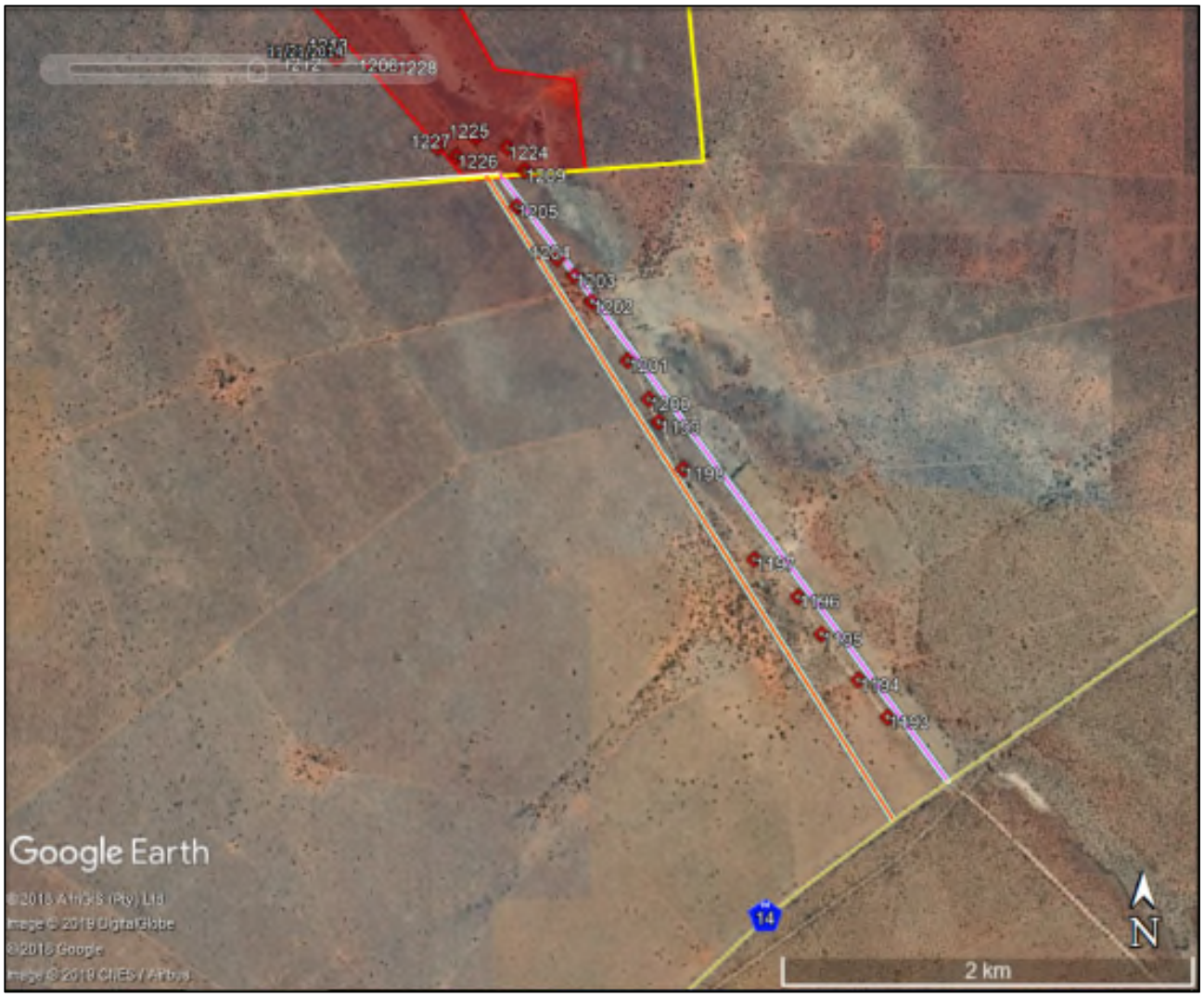

Figure A3.2: *Aerial view of the Alternative 1 and 2 access roads (purple and orange lines respectively) showing the heritage finds (numbered red symbols) and heritage no-go area for PV development (red shaded area).*

Figure A3.3: *Aerial view of the central part of the project site showing the HSD3 development area (grey hatched polygon), heritage finds (numbered red symbols) and heritage no-go areas for PV development (red shaded areas).*

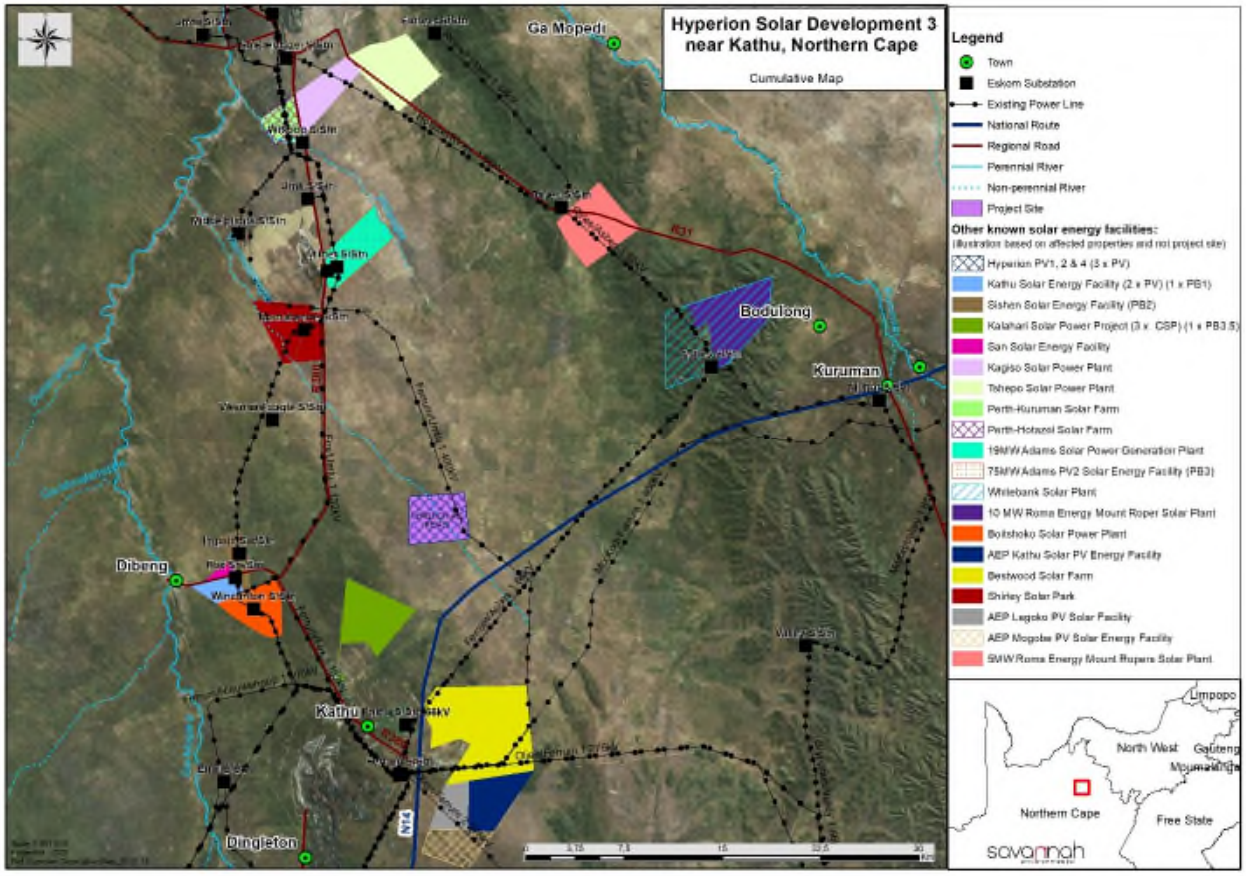

Figure A3.4: *Map of other solar energy facilities within 30 km of the site considered in the assessment of cumulative impacts.*

APPENDIX 4 – Palaeontological input

KATHU HYPERION SOLAR PROJECT NEAR KATHU, NORTHERN CAPE: PALAEONTOLOGICAL HERITAGE DESKTOP INPUT

John E. Almond PhD (Cantab.)
***Natura Viva* cc,**
PO Box 12410 Mill Street,
Cape Town 8010, RSA
naturaviva@universe.co.za

August 2018

Natura Viva cc was asked to provide desktop palaeontological input to the Heritage Impact Assessment studies being carried out on the Farm Lyndoch 432/remainder, near Kathu, where four solar energy facilities are being proposed. The palaeontological study was to cover the entire project site.

1. GEOLOGICAL CONTEXT

The Hyperion Solar Development area on the farm Lyndoch 432 is situated in flat-lying arid terrain at c. 1100-1200 m amsl on the north-western side of the N14 Kathu – Kuruman tar road. *c*. 16 km NNE of Kathu, Northern Cape (Fig. 1). The geology of the Kathu region is shown on 1: 250 000 geological map 2722 Kuruman (Council for Geoscience, Pretoria) (Fig. 2), for which a sheet explanation has not yet been published, and is also outlined in previous palaeontological assessment reports by the author and others (e.g. Almond 2014, 2015a, 2015b, Pether 2011).

The Kathu region is largely underlain by Late Caenozoic continental sediments of the **Kalahari Group** (Partridge *et al.* 2006). Much of the broader study area overlies thick calcretes of the Mokolanen Formation which could be up to 5 million years old (Tl, yellow in Fig. 2). Locally overlying these are gravels of the Obobogorop Formation (not mapped) and red Kalahari aeolian sands of the **Gordonia Formation**. These last are of Pleistocene to Recent age and are mapped over most of the project site (Qs, pale yellow in Fig. 2). A SE-NW trending drainage line called the Vlermuisleegte (one of two local watercourses with this name) runs through the project site and is likely to be associated with substantial calcretised deposits – including possible palaeo-*vlei* or pan deposits and alluvial gravels - as well as unconsolidated alluvium (*cf* Almond 2013a, 2013b).

Small inliers of Precambrian (Proterozoic) basaltic to andesitic lavas of the **Ongeluk Formation** (Postmasburg Group) dated to 2.2 Ga (Eriksson *et al.* 2006) crop out in the north-central and southern portions of the site (Vo, dark green in Fig. 2). These volcanic rocks form the basement to the Caenozoic Kalahari Group sediments in the region.

2. PALAEONTOLOGICAL HERITAGE

Proterozoic (Precambrian) volcanic bedrocks of the Ongeluk Formation are entirely unfossiliferous. The overlying Kalahari Group deposits in the Kathu area are considered to be of generally low palaeontological sensitivity (*cf* Almond 2014, 2015a, 2015b, Pether 2011), although localised areas of high sensitivity may occur. The main palaeontological heritage concern in the present case would be Quaternary mammalian remains (bones, teeth and horncores), trace fossils and plant fossils associated with solution hollows as well as ancient pan or *vlei* deposits along drainage lines, such as have been recorded from the well-known Kathu Pan site situated *c*. 5.5. km NW of Kathu town (Beaumont 1990, Beaumont 2004, Beaumont *et al.* 1984) (See also Almond 2013a, 2013b).

3. RECOMMENDATIONS

Away from major drainage lines the project site is of low palaeontological sensitivity and no further specialist palaeontological studies or mitigation are recommended here. Since a 120 m buffer zone on either side of the Vlermuisleegte drainage line on Lyndoch 432 has been excluded from the development, the probability of significant

impacts on palaeontological heritage is considered to be very low (but not zero). Should any solar facility infrastructure (including solar panels, access roads, buildings) be planned within this buffer, the environmental control officer (ECO) should be alerted to the greater possibility of fossil remains here, as outlined above. A protocol for Chance Fossil Finds for the construction phase of the development is appended to this report.

4. KEY REFERENCES

ALMOND, J.E. 2013a. Proposed 16 Mtpa expansion of Transnet's existing manganese ore export railway line & associated infrastructure between Hotazel and the Port of Ngqura, Northern & Eastern Cape. Part 1: Hotazel to Kimberley, Northern Cape. Palaeontological specialist assessment: combined desktop and field-based study, 85 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2013b. Proposed new railway compilation yard at Mamathwane near Hotazel, John Taolo Gaetsewe District Municipality, Northern Cape. Palaeontological specialist assessment: combined desktop and field-based study, 29 pp. Natura Viva cc, Cape Town.

ALMOND, J.E. 2014. Residential development on Remainder and Portion 3 of Farm Bestwood RD 459 in Kathu, Gamagara Municipality, Northern Cape Province. Palaeontological specialist assessment: desktop study , 33 pp. Cape Town: Natura Viva cc.

ALMOND, J.E. 2015a. Proposed AEP Mogobe Solar PV Energy Facility on farm 460 Legoka near Kathu, Gamagara Municipality, Northern Cape. Unpublished report prepared for Cape EAPrac. Cape Town: Natura Viva cc.

ALMOND, J.E. 2015b. Rezoning and subdivision of Farm Uitkoms No. 462, Portion 1, Kathu, Gamagara Municipality, Northern Cape province. Palaeontological specialist assessment: desktop study, 25 pp. Cape Town, Natura Viva cc.

BEAUMONT, P.B. 1990. Kathu Pan. In: Beaumont, P.B. & Morris, D. (Eds.) Guide to archaeological sites in the Northern Cape, pp. 75-100 *plus* table 1, figs 1-19. McGregor Museum, Kimberley.

BEAUMONT, P.B. 2004. Kathu Pan and Kathu Townlands / Uitkoms. In: Archaeology in the Northern Cape: some key sites, pp. 50-53 plus 4 pages of figs. McGregor Museum, Kimberley.

BEAUMONT, P.B., VAN ZINDEREN BAKKER, E.M. & VOGEL, J.C. 1984. Environmental changes since 32, 000 BP at Kathu Pan, Northern Cape. In: Vogel, J.C. (Ed.) Late Cenozoic palaeoclimates of the southern hemisphere, pp. 329-338. Balkema, Rotterdam.

ERIKSSON, P.G., ALTERMANN, W. & HARTZER, F.J. 2006. The Transvaal Supergroup and its precursors. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 237-260. Geological Society of South Africa, Marshalltown.

PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Marshalltown: Geological Society of South Africa.

PETHER, J. 2011. Brief palaeontological impact assessment (desktop study) proposed Kathu and Sishen Solar Energy Facilities Portions 4 & 6 of the farm Wincanton 472 Kuruman District, Northern Cape. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Kommetjie: John Pether.

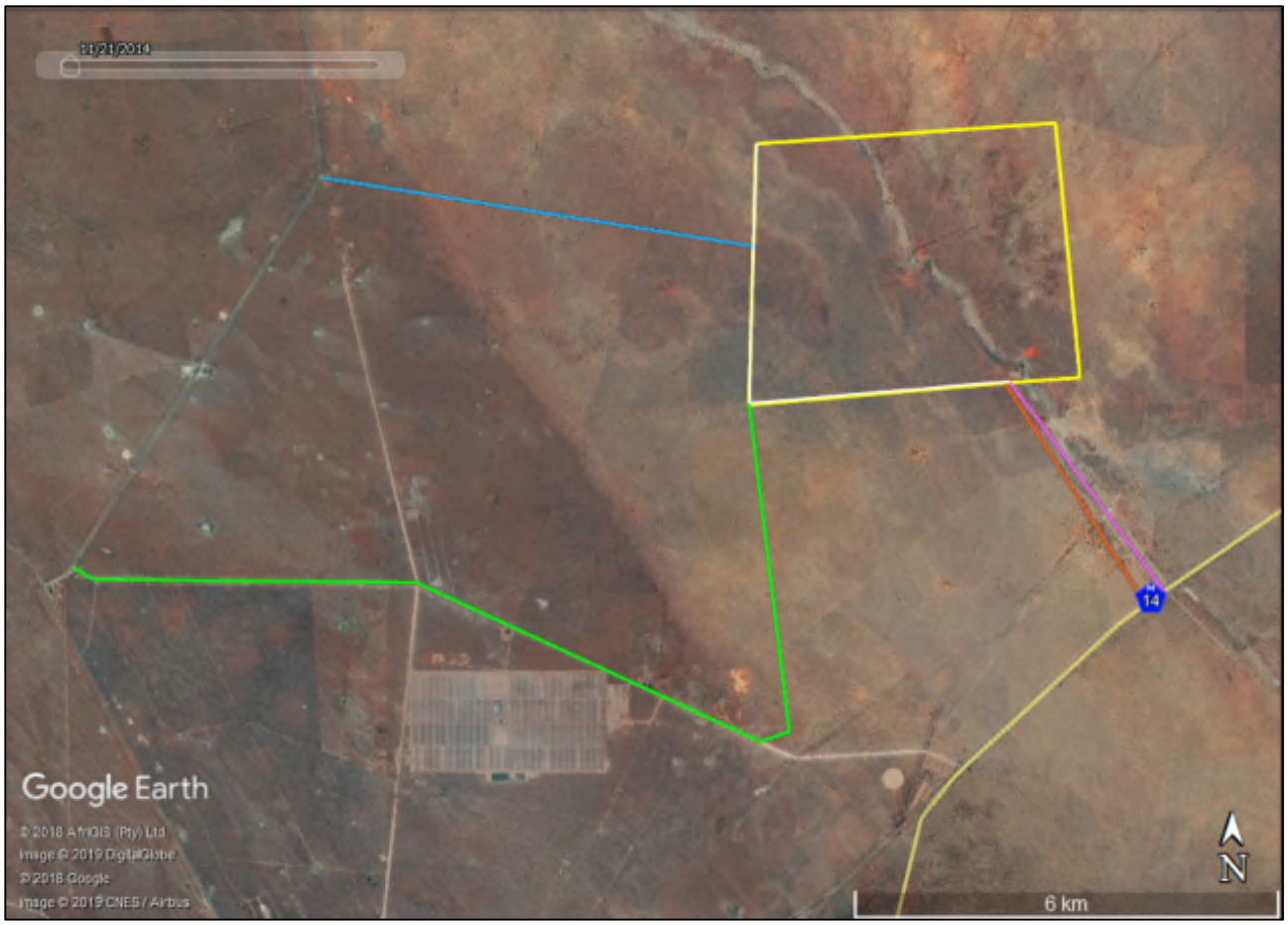

Figure 1. Google Earth© satellite image of the project site on Farm Lyndoch 432 near Kathu, Northern Cape (green polygon) together with four access road alternatives (coloured lines). Note the Vlermuisleegte drainage line running SE-NW across the project site; this zone is probably associated with consolidated fluvial and possible pan or *vlei* deposits that may be of high palaeontological sensitivity.

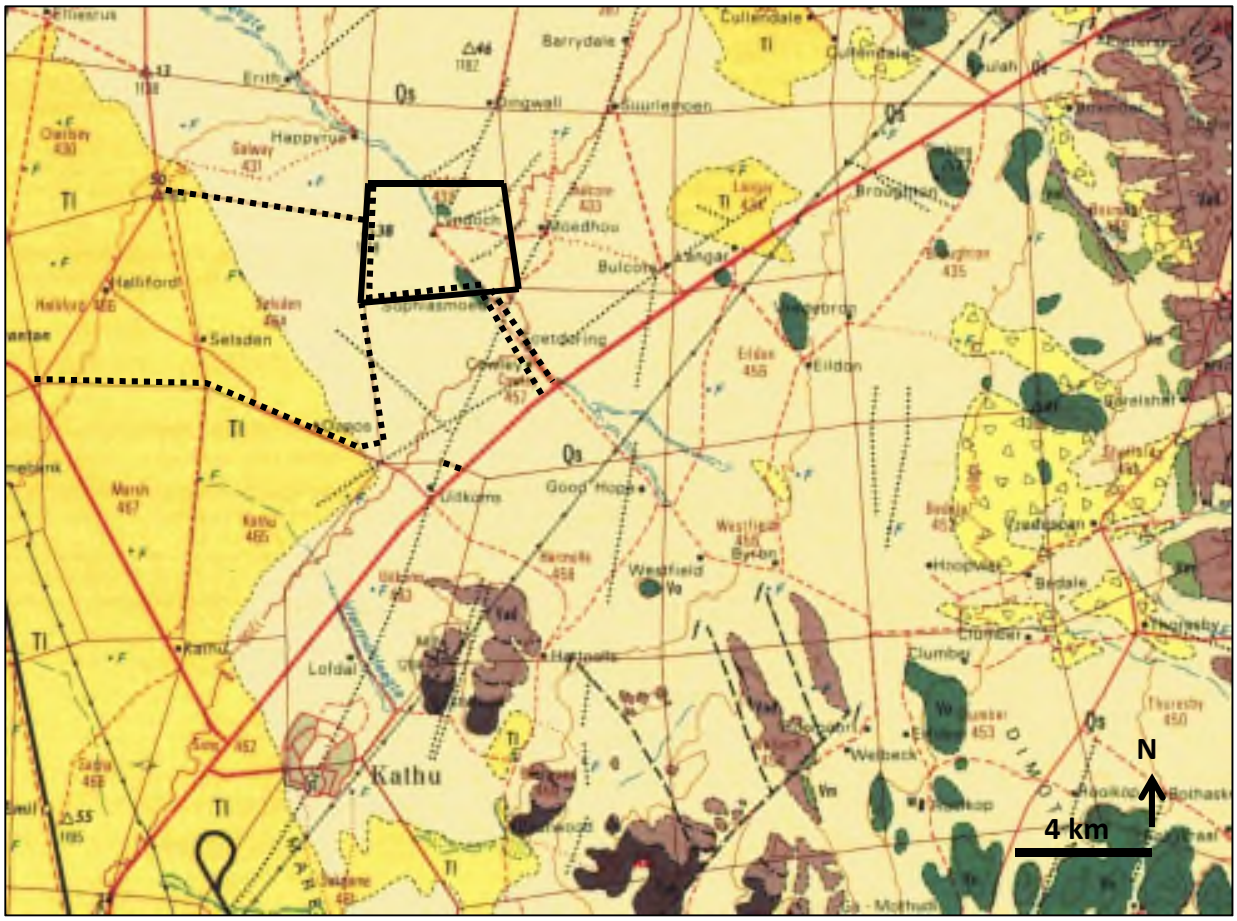

Figure 2. Extract from 1: 250 000 geological map 2722 Kuruman (Council for Geoscience, Pretoria) showing the location of the project site on farm Lyndoch 432 to the NW of the N14 near Kathu, Northern Cape (black polygon) together with the four access road alternatives and perimeter road (black dotted lines). Note that the road and railway networks shown here are out of date.

Geological units represented within the broader study region on sheet 2722 Kuruman include the following (*N.B.* Some of these units are only represented subsurface within the study area itself):

Vo (dark green) – Ongeluk Formation lavas (Postmasburg Group)
Tl (dark yellow) – calcretes ("surface limestone") of the Kalahari Group
Qs (pale yellow) – aeolian sands of the Gordinia Formation, Kalahari Group
Blue stippled areas = pans and water courses (usually dry)

5. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Mpumalanga, Free State, Limpopo, Northwest and KwaZulu-Natal under the aegis of his Cape Town-based company *Natura Viva* cc. He has been a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

APPENDIX 5 – Chance Fossil Finds Procedure

<table>
<tr><td colspan="3">CHANCE FOSSIL FINDS PROCEDURE: HYPERION SOLAR DEVELOPMENT 1 PROJECT NEAR KATHU</td></tr>
<tr><td>Province & region:</td><td colspan="2">NORTHERN CAPE, Kuruman District</td></tr>
<tr><td>Responsible Heritage Management Authority</td><td colspan="2">SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Kalahari Group, consolidated older alluvial / pan / vlei deposits along the Vlermuisleegte</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Bones, teeth, horn cores of mammals as well as calcretised burrows (e.g. termite nests, plant root and stem casts) , non-marine molluscs</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• Alert Heritage Management Authority and project palaeontologist (if any) who will advise on any necessary mitigation
• Ensure fossil site remains safeguarded until clearance is given by the Heritage Management Authority for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
• Photograph fossils against a plain, level background, with scale
• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
• Alert Heritage Management Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Management Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Management Authority</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Management Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Management Authority minimum standards.</td></tr>
</table>