SolarReserve SA (Pty) Ltd

Proposed Rooipunt Solar Power Park near Upington, KAI !GARIB Municiaplity, Northern Cape Province

Heritage Impact Assessment

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Declaration of Independence

The report has been compiled by PGS Heritage an appointed Heritage Specialist for Worley Parson RSA. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes discussed in the Heritage Impact Assessment Process that includes the Scoping as well as this final report

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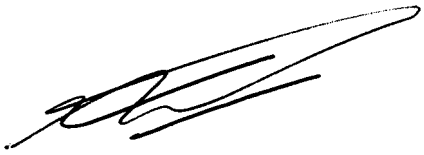

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EXECUTIVE SUMMARY

PGS Heritage was appointed by Worley Parson RSA to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed Solar Power Park for SolarReserve SA (Pty) Ltd, Farm Rooipunt 617, Gordonia RD, Siyanda District Municipal Region, Northern Cape.

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The Heritage Scoping Report has shown that the surrounding areas around the study area have a rich historical and archaeological history.

The field work that feeds into the Heritage Impact has utilised the findings of the Scoping report to guide this work. The field work identified a total of 46 heritage sites with the following heritage classification, mitigation and impacted on by the proposed layouts:
Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The Heritage Scoping Report has shown that the surrounding areas around the study area have a rich historical and archaeological history.

The field work that feeds into the Heritage Impact has utilised the findings of the Scoping report to guide this work. The field work identified a total of 37 heritage sites with the following heritage classification, mitigation and impacted on by the proposed layouts:

Stone Age Find Spots

The field work identified numerous areas where low density scatters of Middel and Later Stone Age lithics were found. As no context and in situ preservation were identified these sites were grade as of low heritage significance and rated as **Grade 4C**.

All three layout options will impact directly on the 17 find spots identified. The impact significance is rated as Low.

No further mitigation is envisaged at these find spots. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Stone Age Exposures

During the field work 5 Stone Age Exposures were identified. These surface scatters do not exclude the possibility of subsurface material the site is rated as **Grade 4B**.

Of the three layout options **the Southern Option impacts on all the sites**. **The Northern and Western Options** impacts on 3 of the 5 exposures identified. The impact significance is rated as Low-Medium significance

Mitigation required for these sites will be:

1. Monitoring during construction in at each of the exposures identified by a qualified archaeologist, managed through an agreed upon watching brief.
2. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Possible herder sites

One possible herder site was identified during the survey. No other material or deposits were identified but does not exclude the possibility of subsurface material; the site is rated as **Grade 4B**.

The site is situated on the edge of proposed infrastructure for all three alternatives and no impact is foreseen if the site is excluded from the footprint area. The overall impact on this site is seen as LOW- MEDIUM during the life of the project and minimal mitigation will be required.

Mitigation required for this site will be:

1. Exclude from the footprint area with a 20 meter buffer.
2. Monitoring during construction, managed through an agreed upon watching brief.
3. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Historical structures associated with mining and prospecting

The tungsten mine and building ruins (***Figure 14*** **and** ***Figure 15***) present in the south-eastern section of the property dates from the early 1940 to 1970.

As the site has been utilised over a period of 30 years from 1940 some of the mining structures are older than 60 years, and protected under Section 34 of the NHRA, the sites are rated as **Grade 4A** and will require further mitigation.

Of the three layout options the Southern Option impacts on the least amount of historical mining infrastructure. However documentation of the mining landscape will have to include the two sites not impacted by the Southern Option.

The overall impact on these sites is seen as **MEDIUM NEGATIVE** during the construction phase and **LOW NEGATIVE** during operational and closure phases of the project and minimal mitigation will be required.

Mitigation that will be required for these sites will be:

1. Some of the structures associated with mining is older than 60 years and protected under Section 34 of the NHRA, and thus require permitting before such structures are to be demolished.
2. It is recommended that the historical and mining structure be documented as part of a cultural landscape layout plan and where build structures are present these are to be documented by plan sketches and photographs before applying for destruction permits from the Provincial Heritage Authority - Ngwao Boswa Kapa Bokone, Heritage Northern Cape (Boswa).
3. Investigate Site 39, as the possibility exists that it may be a grave, through test excavation to determine if the structure is a grave.
4. Monitoring during construction, managed through an agreed upon watching brief.
5. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Cultural Landscape

Due to the landscape's topography the solar park infrastructure will be prominent in the landscape and alter the rural appearance. Due to the remoteness of the area the impact on

the experience of the cultural landscape is not foreseen to be significant. Mitigation as recommended in the Visual Assessment should be able to mitigate any impacts on the cultural landscape to an acceptable level.

The overall impact on the heritage resources is seen as acceptably low through the implementation of the recommended mitigation measures and general heritage management guidelines as listed in Section 5 of this HIA report.

Palaeontology

Almond (2012) (**Appendix A**) found that the "*overall impact significance of the proposed solar park development is likely to be LOW because:*

Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity;
Extensive, deep excavations are unlikely to be involved in this sort of solar park project.

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary."

Evaluation of Layout Options

Evaluation of the three layout Options, has shown that the Northern and Western options impacts on the least amount of heritage site with a total count of 35 out of 37 sites:

Layout Option	Heritage Site Count
Northern Option	35
Southern Option	36
Western Option	35

The cumulative impact by all three options is however seen as equivalent for all three and no one of the options carry a preference with regards to impact on heritage resources.

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1 INTRODUCTION

PGS Heritage was appointed by Worley Parson RSA to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed Solar Power Park for SolarReserve SA (Pty) Ltd, Farm Rooipunt 617, Gordonia RD, Siyanda District Municipal Region, Northern Cape.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed development area. The Heritage Impact Assessment aims to inform the EIA in the development of a comprehensive EMP to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This Heritage Impact Assessment Report was compiled by PGS Heritage (PGS).

The staff at PGS has a combined experience of nearly 40 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Wouter Fourie, Principal Investigator for this project, is an Accredited Heritage Practitioner with the APHP (Association of Professional Heritage Practitioners – Western Cape) and the two field archaeologist, Henk Steyn and Marko Hutton are registered with the Association of Southern African Professional Archaeologists (ASAPA) and has CRM accreditation within the said organisation.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company Natura Viva cc. He is 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).

1.3 Assumptions and Limitations

Not subtracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist had been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development the procedures and requirements pertaining to graves and burials will apply as set out below.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

i. National Environmental Management Act (NEMA) Act 107 of 1998
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
iv. Development Facilitation Act (DFA) Act 67 of 1995

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

i. National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
    b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
    c. Environmental Impacts Assessment (EIA) – Section (32)(2)(d)
    d. EMP (EMP) – Section (34)(b)
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
    a. Protection of Heritage resources – Sections 34 to 36; and
    b. Heritage Resources Management – Section 38
iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
    a. Section 39(3)
iv. Development Facilitation Act (DFA) Act 67 of 1995
    a. The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34 (1) of the NHRA states that "no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…". The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage". In accordance with legislative requirements and EIA rating criteria, the regulations of SAHRA and ASAPA have also been incorporated to ensure that a comprehensive legally compatible HIA report is compiled.

Terminology

Abbreviations	***Description***
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
PSSA	Palaeontological Society of South Africa
ROD	Record of Decision
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

Archaeological resources

This includes:

i. 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;

ii. 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;

iii. 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 in the Maritimes Zones Act, 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;

iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in the change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
ii. carrying out any works on or over or under a place;
iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
iv. constructing or putting up for display signs or boards;
v. any change to the natural or existing condition or topography of land; and
vi. any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 400 000 and 2500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 30 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's associated with iron working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 30-300 000 years ago associated with early modern humans.

Palaeontology

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.

Refer to **Appendix C** for further discussions on heritage management and legislative frameworks

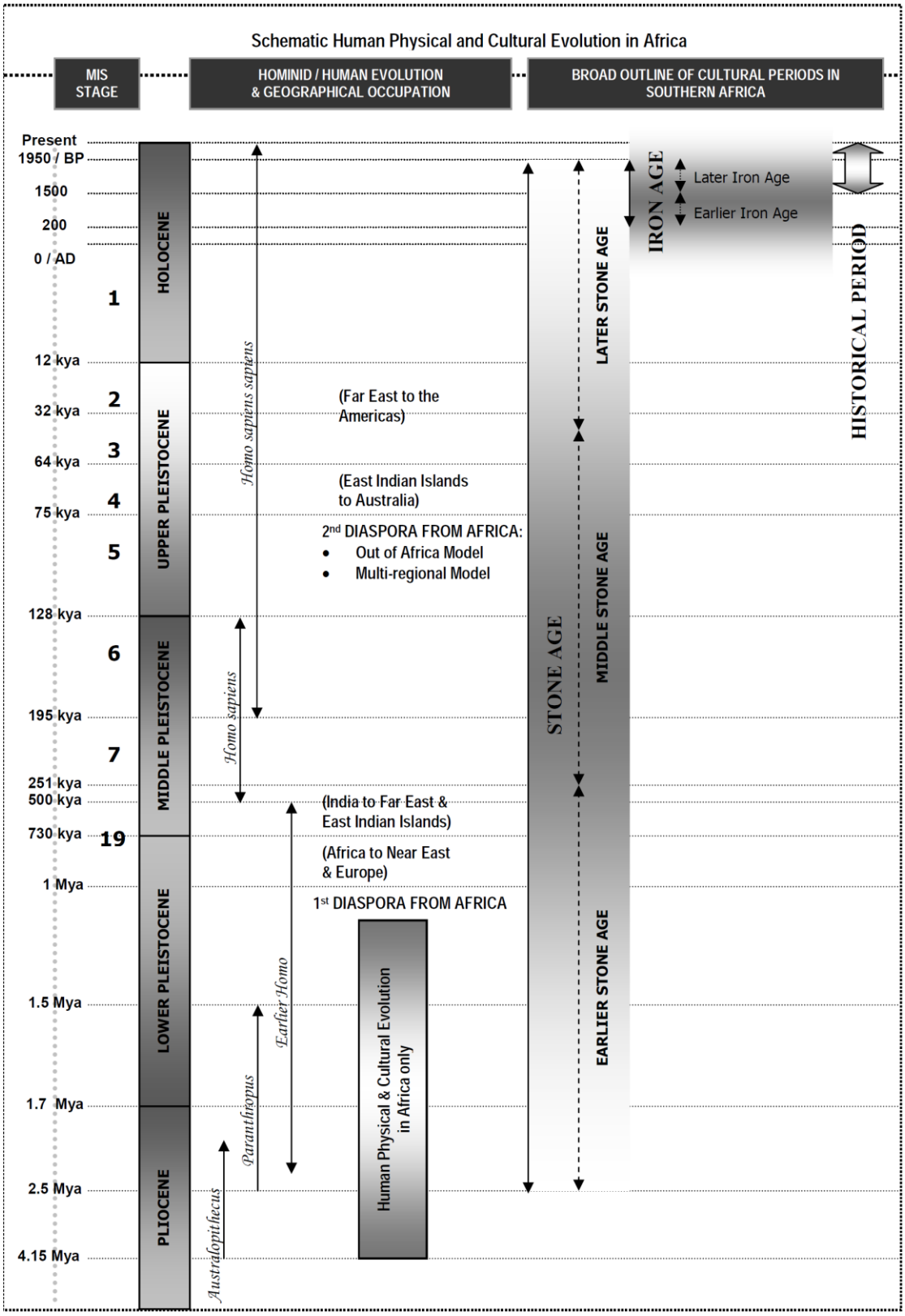

Figure 1 – Human and Cultural Time line in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Location	(S28.52806 E21.04526), The proposed development site is situated an approximate 20 - 25 kilometres outside of the town Upington.
Land	2180 Hectares of land under option.
Land Description	The land is currently utilised for grazing purposes and consists of grass land over most of the property.

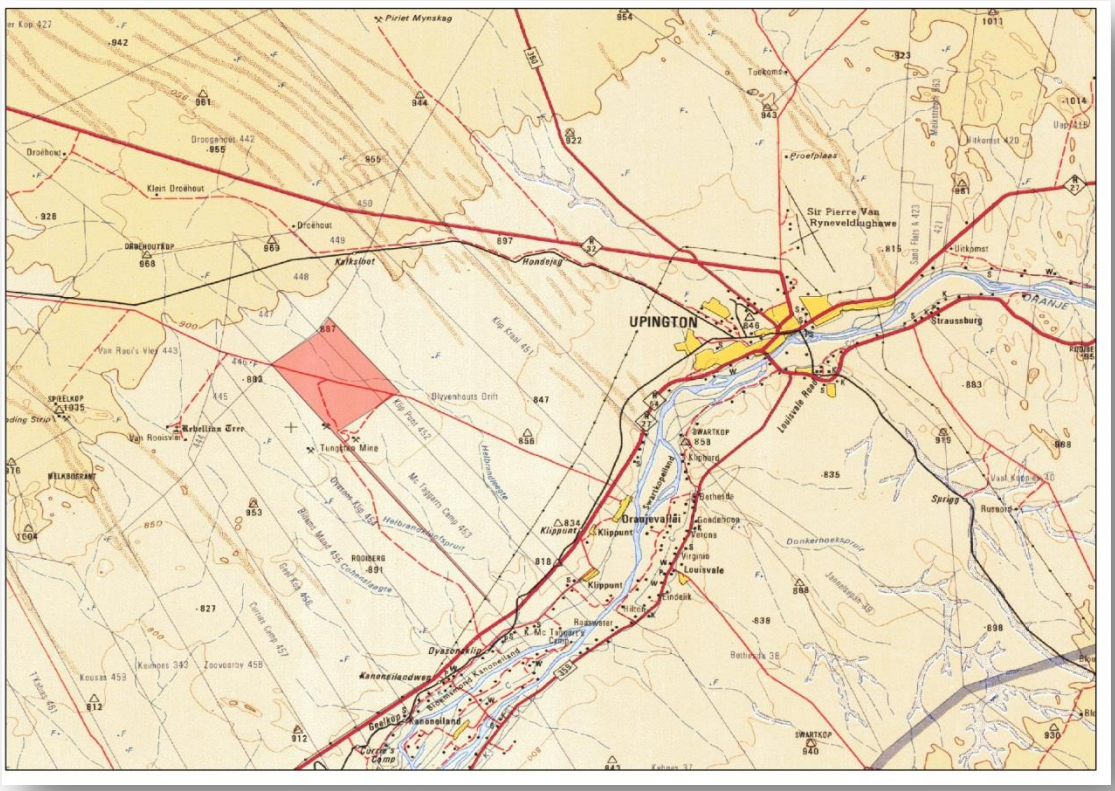

Figure 2 - Rooipunt locality

2.2 Technical Project Description

The following brief project description for the solar plant has been abstracted from the Background Information Document prepared by Worley Parsons RSA (Pty) Ltd.

1. The CSP plant being considered is a molten salt-type, central receiver (tower) technology. The plant requires approximately 6 km^2 of low-relief terrain and will primarily comprise the following four components:

Solar Field - consists of all services and infrastructure related to the management and operation of the heliostats (reflective mirrors). It is estimated that approximately 17 000 heliostats with an area of approximately 65 m^2 each will be required for the solar field in order to obtain a power output of approximately 100 MW;

Molten Salt Circuit - includes the thermal storage tanks for storing liquid salt, a concentration receiver/tower, pipelines and heat exchangers;

The Power Block – housing the steam turbine;

Auxiliary facilities and infrastructure - includes a condenser-cooling system, electricity transmission lines to allow for grid connection, access routes, water treatment and supply amenities and a CSP plant start-up energy supply unit (gas or diesel generators).

2. The PV development will consist of photo-voltaic solar panels that will occupy up to 450 ha of the site area in total. The PV will be developed in three blocks of 150 ha. Each block of 150 ha will produce 75 MW. The PV development will produce 225 MW of power in total. The panels will be situated in rows extending across the site in lines. PV panels are typically up to 15 m^2 in size and the rows will be approximately 1 km in length, made up of approximately 100 m sections depending on the final design and layout of the development. The panels will be mounted on metal frames with a maximum height of approximately 3 m above the ground, supported by concrete or screw pile foundations, and they will face north in order to capture the maximum sunlight. The facility will either be a fixed PV plant where the solar panels are stationary; or a tracking PV plant where the solar panels rotate to track the sun's movement (the exact type of PV plant system will be determined following on-site solar resource modelling and detailed development design). A detailed technical description for this project has not yet been developed.

The proposed development area is mainly underlain by unfossiliferous basement rocks (granites, gneisses *etc.*) but also features a variety of Late Caenozoic superficial sediments, some of which may contain sparse fossil remains.

Three layout options have been put forward for the proposed development:

- Southern Option (***Figure 3*****);**
- Western Option (***Figure 4***); and

- Northern Option (***Figure 5***).

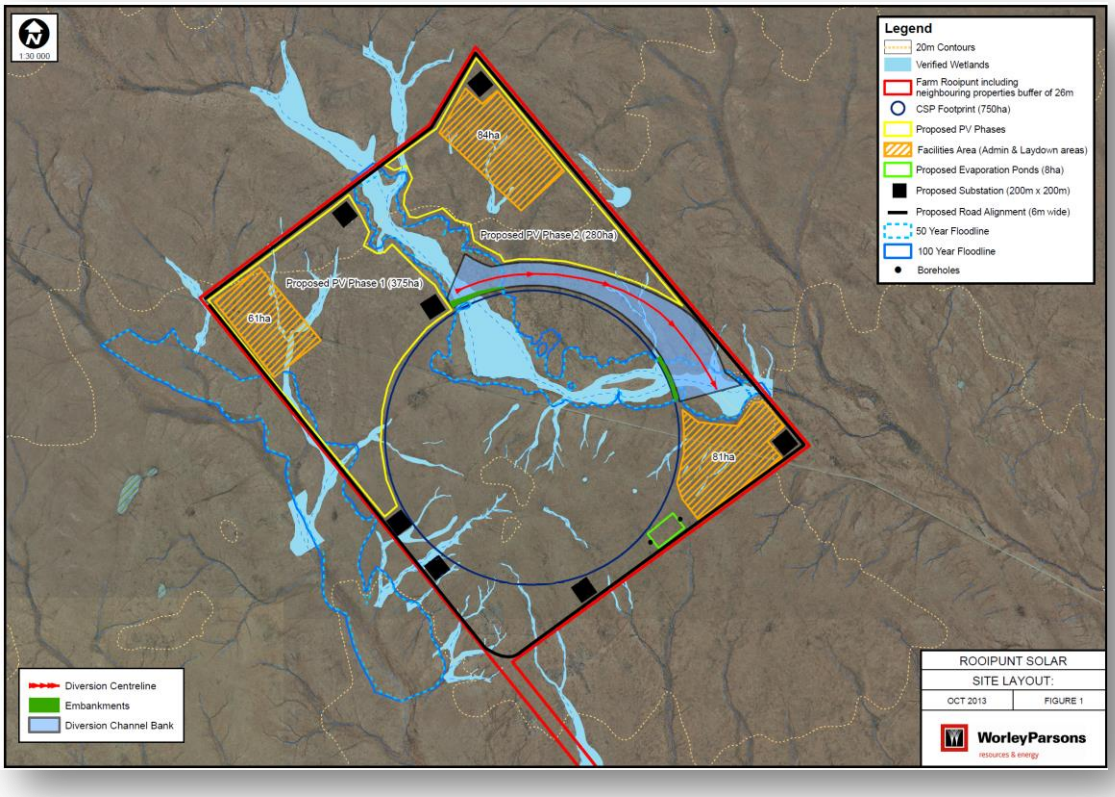

Figure 3 – Proposed Southern Layout Option

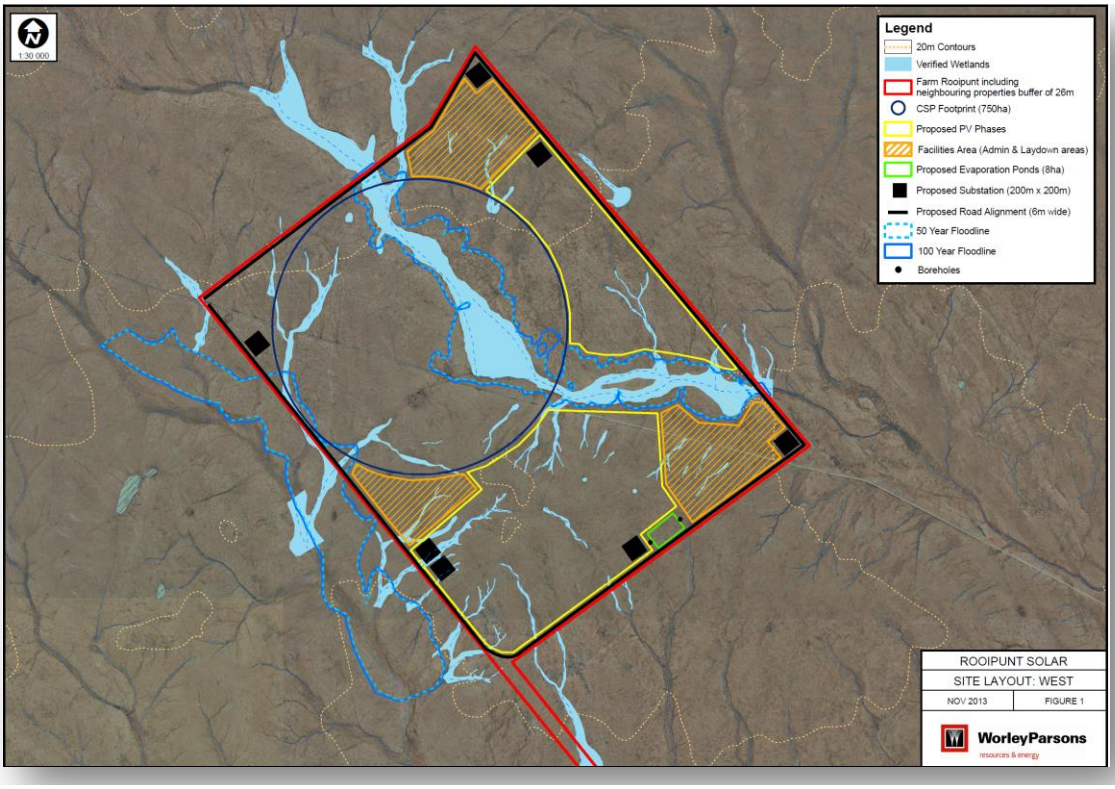

Figure 4 – Proposed Western Layout Option

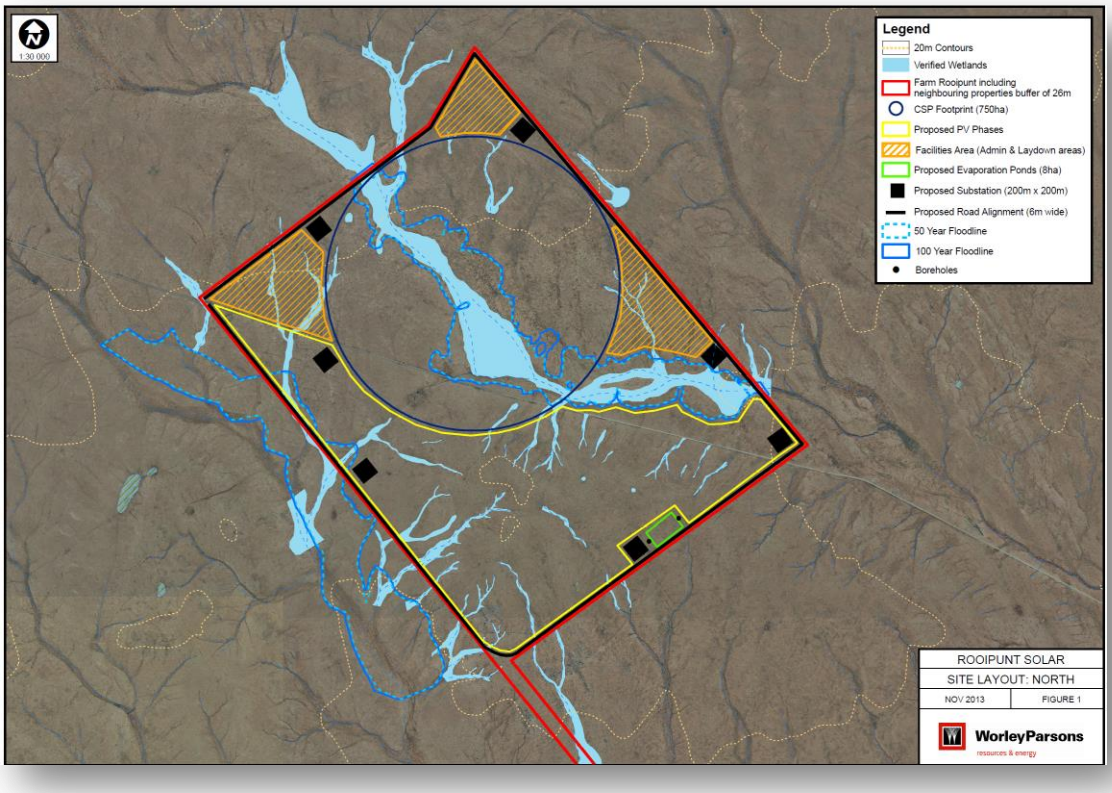

Figure 5 – Proposed Northern Layout Option

3 CURRENT STATUS QUO

3.1 Site Description

The property (**Figure 6**) is situated just north of the N14 road between Upington and Keimoes a (**Figure 7**), and is serviced by a dirt road that turns north towards the site around the 12 kilometre marker on the N14. The farm is also divided by the dirt road into two

sections (

Figure 8).

The northern section of the property is characterised by a large dry river bed draining south east toward the Gariep River. The southern section has s small ridge that acts as watershed between the dry river bed of the northern section and another dry river bed just to the south west of the property.

The south eastern section of the property is also characterised by old mining activity that left large open trenches in the area (**Figure 9**).

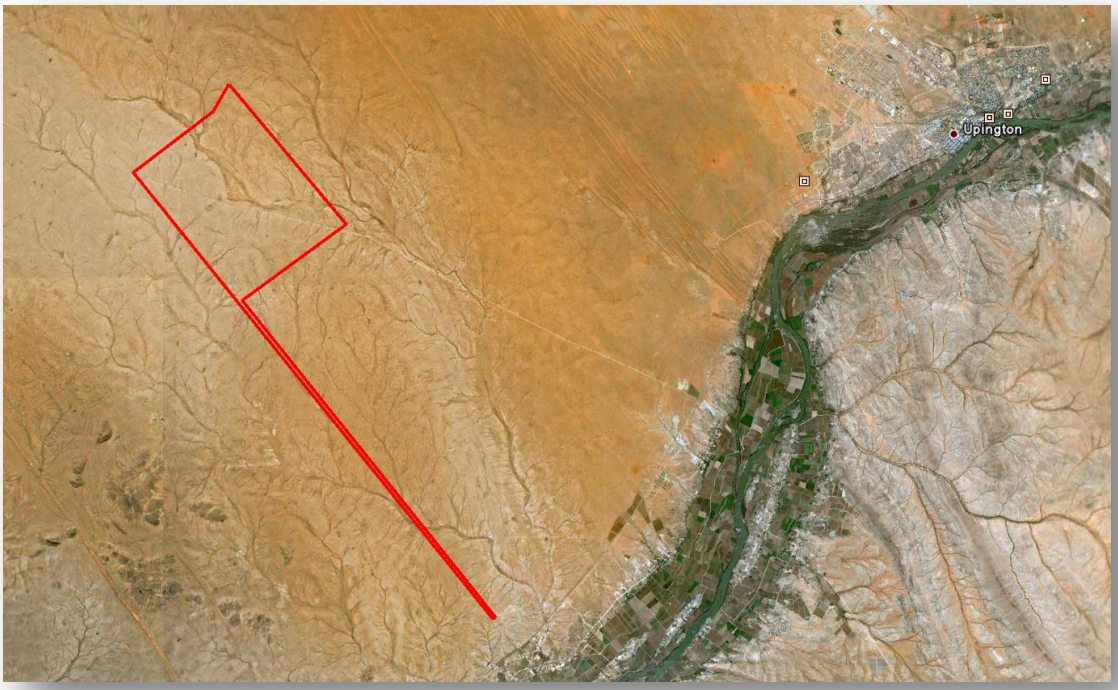

Figure 6 – Aerial view of study area

Figure 7 – View from small rocky outcrop

Figure 8 – View from dirt road cutting through the property

Figure 9 – Historical mining activities in south western corner of the project area

Current structures on the property consist of some old ruins associated with the mining activity and more recent subsistence farmers (**Figure 10**).

Figure 10 – Current structure on property

3.1.1 Archival findings

The archival research focused on available information sourced that was used to compile a background history of the study area and surrounds. This data then informed the possible heritage resources to be expected during field surveying.

Palaeontology (Refer to Annexure A for full Report)

The fossil record of the **Kalahari Group** is generally sparse and low in diversity (Almond & Pether 2008). The **Gordonia Formation** dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying rocks may lead to the rapid

calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (e.g. Hodotermes, the harvester termite), ostrich egg shells (Struthio) and shells of land snails (e.g. Trigonephrus) (Almond 2008a, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (e.g. Corbula, Unio) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle et al., 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the **Gordonia Formation** is therefore considered to be low.

Late **Caenozoic calcretes** may also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within **Kalahari Group** sediments and calcretes, notably those associated with ancient alluvial gravels and pans (cf Almond 2008a).

However, these fossil assemblages are generally sparse, low in diversity, and occur over a wide geographic area, so the palaeontological sensitivity of the calcretes within the study area is rated as low. This applies equally to the thin veneer of other surface deposits (rocky scree, stream alluvium etc) within this highly arid region.

Alluvial gravels of the Orange River of Miocene and younger age are locally highly fossiliferous (e.g. Hendy 1984, Schneider & Marias 2004, Almond 2009 and extensive references therein). As argued above, these are not mapped within the study area are probably not present there. However, the possibility of fossiliferous Orange River alluvial deposits on the south-eastern margins of the study area should be borne in mind.

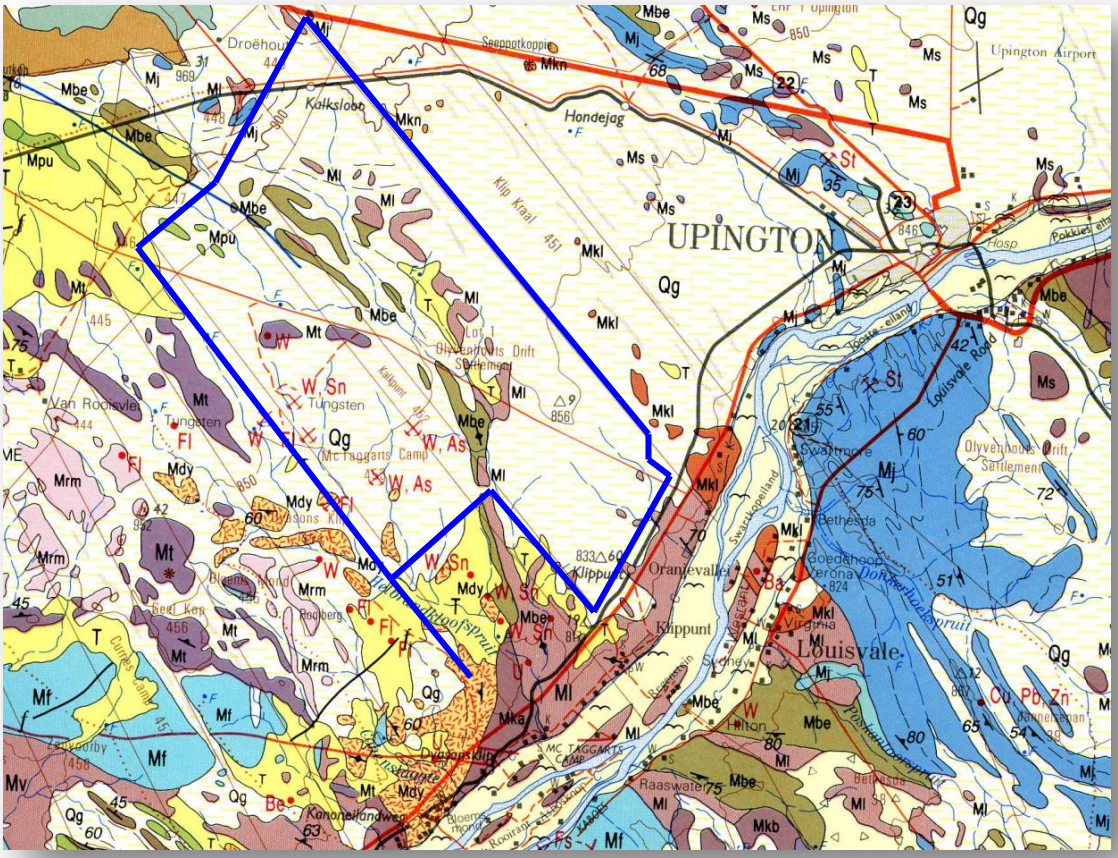

Figure 11 – Extract from 1: 250 000 geological map 2820 Upington (Council for Geoscience, Pretoria) showing approximate location of proposed Rooipunt Solar Power Plant study area c. 5 km NE of Upington, Northern Cape Province (blue polygon)

Archaeological background

Due to the nature of the environment, stratigraphic sequences are rare in excavations, providing very little information about the chronology and lifeways of the people who lived in the region in pre-historic times. Sites usually comprise of open sites where the majority of evidence of human occupation are scatters of lithics (Beaumont et al. 1995).

Early Stone Age (400 000 – 2 million BP)

Human presence in the Orange River region goes back to the Early Stone Age. The Orange River area was marginal or uninhabited for much of the ESA and MSA periods, although Achuleun era lithics such as blades and prepared cores are present. Very few formal tools such as cleavers and handaxes are found. One site with a stratigraphic sequence has been

excavated 35 km southeast of Upington with Achuleun lithics much like that dated elsewhere to 350 000 - 300 000 BP (Beaumont et al. 1995).

Middle Stone Age (30 000 – 300 00 BP)

MSA period stone tools in this region are characterised by blades, convergent flakes and points, as well as advanced prepared cores. There are few extensive MSA sites in the region. The most significant MSA site excavated in the region is located 35 km southwest of Prieska. Here stone tools, ostrich eggshell fragments and the bones of large mammals were found at what is thought to be a base camp for ancestral modern humans. MSA lithics were also found at Zoovoorbij near Keimoes where Levallois platform preparation was used (Beaumont et al. 1995).

Later Stone Age (30 000 BP – recent times)

Our knowledge of the Later Stone Age in the Orange River region is far better than of earlier periods. The earlier LSA sequence is comprised of undated Oakhurst-type tools, followed by a local Wilton industry named Sprinkbokoog. This tradition is characterised by high usage of cryptocrystalline silicates, such as chalcedony, to make backed blades. Other formal tools include small scrapers, bladelets and backed blades. Springbokoog lithics are mostly dated to two periods: 4300-4200 BP and 2600-2300 BP (Beaumont et al. 1995).

Pottery was introduced into the area 2300 years ago and there are two discrete, contemporary stone tool industries associated with pottery remains: Swartkop and Doornfontein. Swartkop is likely to have developed out of Springbokoog and is characterised by acircular blades as part of the unmodified flake component, a high proportion of backed blades, coarse undecorated pottery shards that commonly contain grass temper, and a few iron items. These sites are usually found near water sources, such as pans and springs, or on the sides of low hills. Stone circles and ovals are sometimes found at these sites and may represent the bases of dwellings. A late phase of this industry can be linked with the /Xam San who lived in the Karoo (Beaumont et al. 1995).

The Doornfontein industry is characterised by the predominance of coarse irregular flakes, frequent use of quartz as a raw material, and very little retouch. Many ceramics are found, which are amphora-like in shape with grit temper and decoration on the necks and rims. Later sites contain some large ostrich eggshell beads, iron objects, and coarser shards with

grass temper. Doornfontein sites are found along the Orange River and nearby permanent water sources. This tradition may be associated with Khoekhoen groups, who probably moved into the Orange River area in approximately 2100 BP. Unfortunately, it is difficult to find sites along the river due to agricultural activities and siltation from annual flooding (Beaumont et al. 1995).

Zoovoorbij (Smith 1995) is a rare cave site a few kilometres north of the river between Keimoes and Upington. Interestingly, the occupants mined ochre at the site. The site has a few early MSA layers, characterised by large flake Levallois tools. In the above LSA layers, there were very few formal tools, some micro-blades, bone tools, ostrich eggshell artefacts, and fine grit-tempered pottery. The assemblage from nearby Renosterkop is very similar. Dates from these layers suggest LSA occupation occurred between 2800 and 3080 BP. The assemblage includes Springbokoog and Doornfontein traditions.

Several grave sites have also been excavated at different sites along the Middle Orange, marked by conical stone cairns. Skeletons were usually in a flexed position and there were very few grave goods. Interestingly, red ochre and ashes were found in several graves. A few glass trade beads were also found, dating to between the fifteenth and nineteenth century. These burials date to the historical period and are similar in style to the burial practices of recent Khoekhoen peoples (Morris 1995).

Rock engravings

Rock engravings are principally found in the interior of South Africa and are plentiful in the Northern Cape (Dowson 1992). However, they are concentrated in the Richtersveld to the north west, the Vaal-Harts region to the east and the Karoo south of the Orange (Morris 1988). Here, they have been associated with the /Xam San and their ancestors (Deacon 1997). Engravings are found on rocky outcrops, river beds and boulders. They are made by pecking away the surface of the rock with another rock, incising it with a sharp stone or scraping it off with another stone (Dowson 1992).

Common subjects include large game animals such as eland, rhinoceros, elephants, gemsbok, giraffe and quagga. Human figures are not commonly depicted. Therianthropes (part human, part animal figures) are sometimes depicted, as well as other non-real elements. Geometrics such as grids, zigzags, circles with rays and dots are also commonly

found. Human and animal footprints are also sometimes found. Unfortunately, there are no scientific methods for securely dating engravings and research into this is still at an experimental stage (Dowson 1992).

Most engravings were made by the San and were associated with their religious beliefs and rituals. San shamans went into trance to perform certain tasks such as controlling game, protecting the group and rainmaking. Certain animals were believed to hold supernatural power and thus many of the engraved animals can be seen as both sources and symbols of supernatural power. The places where engravings were made were also sources of supernatural power, especially in rainmaking rituals. Certain geometrics such as zigzags and dots are likely to have been associated with forms called entoptics seen whilst in trance (Dowson 1992).

Some engravings–particularly those featuring nonentoptic geometrics and aprons–were probably made by Khoekhoen people. Similar motifs are found in finger painted Khoekhoen rock art sites in certain regions of the Northern Cape, especially in the Vaal-Harts region to the east. A few Khoekhoen rock art sites have been identified in the Middle Orange area. They are typified by finger paintings and roughly pecked engravings of geometrics that are located near water sources (Smith & Ouzman 2004). The complex issues of ethnicity and authorship of engravings are still being researched.

Historical background

Early inhabitants

This region is very arid and many groups were attracted to the comparative abundance of plant and animal life that was found at the Orange River. The first records of Europeans travelling to the Middle Orange River were that of Wikar and Gordon in the 1770s. These records give us an idea of how the people of this area lived prior to colonial contact. At this time, both San (Bushman) hunter-gatherers and Einiqua Khoekhoen pastoralist groups were living in the Middle Orange River area. The Einiqua kept herds of sheep, goats and cattle, grew dagga, hunted and fished. The groups living in the Rooipunt vicinity were the Koow Einas, Naw Einas, Hoekeikoa, Noueikoa San groups and the Gyzikoa, Kaukoa and Aukokoa Khoekhoen. Generally, there were good relations between these groups. They also interacted with Tswana groups living to the north east. These relations included

intermarriage and the Gyzikoa were partly of Tswana descent (Penn 2005). This is also borne out in skeletal evidence from the archaeological record (Morris 1995).

Towards the end of the eighteenth century, many groups of mixed Khoekhoen, European and other ethnicities often called Oorlams or Bastaards moved into the Middle Orange area as colonial expansion pushed the northern frontier further back. Many of these groups were disposed to violence and caused much upheaval in the region, bringing to an end traditional life for most groups. Einiqua identity eventually disappeared and assimilated with the Koranna (Penn 2005). The early decades of the nineteenth century saw the intrusion of larger numbers of ruffians and pariahs from the Cape colony such as English deserters, fugitives, escapes slaves, and cattle thieves (Strauss 1979)

Koranna resistance

By the mid-nineteenth century, the Middle Orange River was home to several small Koranna groups of mixed ancestry, mostly of Khoekhoen descent, who originated in the south-western Cape (Penn 2005). These armed and mounted groups attracted people of other descent such as colonial fugitives, escaped slaves, San, and Griqua individuals who were also seeking the freedom of the frontier. From areas such as the Middle Orange River, they raided the Cape colony as well as neighbouring groups (Strauss 1979). The islands in this river were especially significant, as they constituted virtually impenetrable strongholds, allowing the Koranna to retain their independence (Penn 2005).

The Cat Koranna under Klaas Lukas were based at Olyvenhouts Drift. His allies, Gert Perkat and Klaas Papier lived nearby. Together they mustered about 200 armed men. South of them were Jan Kivido and a Griqua, Piet Rooy, who could muster 150 men. Southwest of them was Gert Ruiters with a group of about 60 men. Cupido Pofadder was based at Kakamas with a group that numbered about 200 men. The Afrikaners, a Griqua Oorlams group, lived below the Augrabies Falls (Strauss 1979).

In 1847, the area south of the Orange, known as Bushmanland, was annexed by the Cape colony and from the 1850s magistrates were appointed (Penn 2005). By 1862, trekboers had settled at the Orange River in considerable numbers. This affected the economies of local pastoralist groups, especially their ability to move in search of fresh grazing. As contestation

over resources increased, raiding escalated and by the late 1860s, this area became one of violence and turmoil (Strauss 1979).

In July 1867, major conflict arose amongst these Koranna groups regarding chieftainship and they separated into two opposing factions. This resulted in many Koranna people being reduced to starvation. By 1868, Jan Kivido and Piet Rooy emerged as the most powerful men on this section of the Orange with their ability to attract men through plunder gained by successful raids and trade networks with the Colony and the Tswana (Strauss 1979).

Colonial control of the area was extended in 1868 when Maximillian Jackson was appointed Magistrate at Kenhardt to the south of the Orange. Several commandos of up to 300 men were sent to attack the Koranna raiders of the Middle Orange, who retreated to their island strongholds. Eventually, the colonists decided to starve out the Koranna, cutting off their food supplies and access to water sources. This tactic proved successful, many of the leaders were arrested, and their groups disbanded. Pofadder and Lukas signed a treaty with the colonial government and each of them became the leader of a part of 'Koranaland' between Augrabies Falls and Griqualand West on the north side of the river. The Rooipunt area formed part of Upper Koranaland under Lukas (Strauss 1979).

During the 1870s, hostility towards the colonial government grew amongst the San, Koranna and African groups along the Middle Orange, culminating in a revolt in 1878. Klaas Lukas moved to the defensive location of the islands and was joined by many supporters. After several unsuccessful campaigns against the rebels, Jackson resigned and was replaced by Captain McTaggart at the end of 1878. His camp was located southeast of Rooipunt. He launched a successful attack on the islands, scattering the leaders of the rebellion and taking many captives. Kanoneiland gets its name from such attacks and, according to local lore, the Koranna tried to engineer a homemade cannon either from a hollowed-out tree or by loading metal scraps into an old cannon, with disastrous results, killing several bystanders (Serfontein 1972; Willcox 1986).

Eventually the leaders were also captured and sent to Robben Island, ending the rebellion. Most of the inhabitants of Koranaland were sent to work in the Cape colony except for a few San individuals who acted as guides for colonial officials (Strauss 1979). The memory of Koranna such as Piet Rooy persists in the place names of the area, including Rooipunt. Baster families of mixed European, Khoekhoen and slave descent were allowed to settle in the area

and it is likely that the first owners of the farms in the Rooipunt area were Basters. By the end of the century, however, most land around Upington had fallen into European hands (Legassick 1996).

European settlement

European settlement of the Upington area had its inception with the establishment of a mission station by Christiaan Schroder of the Dutch Reformed Church at Olyvenhouts Drift in 1871. He moved away from the area for several years when the area became too unstable and returned in 1883 with the Lutzes, who started a shop, as well as a teacher (Serfontein 1972). Schroder built the first canal along the Orange in 1883 and later built canals at Keimoes and Kakamas with the help of Johann Lutz (Willcox 1986). However, more recent research suggests that Schroder merely followed the example of a Baster farmer and former slave, Abraham September, who first constructed a canal along the Orange. The village of Upington was surveyed in the mid-1880's and the first plots were allocated (Legassick 1996). Schroder was appointed Superintendant and Minister of the colony (Willcox 1986). In 1896, Olyvenhouts Drift was renamed Upington, after Sir Thomas Upington. There was a severe drought that year and large numbers of farmers sought the fertility of the Orange (Serfontein 1972). In 1898, Kakamas became the site of a work colony for farmers impoverished by the recent drought and rinderpest outbreak (Willcox 1986).

Boer-Briton conflict

During the twentieth century, the history of Upington shifts from being a frontier of the Cape colony to being a border of the Union with German-governed South West Africa (Namibia). The South African War that took place between 1899-1902 took on distinctive tones in the Northern Cape. Although no famous battles occurred in the Upington area, the region was very much involved in the hostilities. The situation was complicated by its proximity to South West Africa. The Germans in Europe were very sympathetic towards the Boers and supported their cause in the war. There were also many Afrikaners settled in the southern regions of South West and commandos often crossed the border (Dedering 2000). For a time the area between south of the Orange was dominated by Boer guerrillas, who found much support in the region. They set up a short-lived Republican government in 1900, in which the minister Schroder was a landdrost. The British in the Northern Cape relied mostly on a Baster corps, the Northern Border Scouts, to repel Boer commandoes in the

area. Many skirmishes took place in the Kakamas, Keimoes and Upington areas (Legassick 1994). Schroder was later imprisoned for his support of the Boers, after which his health deteriorated (Serfontein 1972).

Tension lingered amongst certain groups after the South African War and the establishment of the Union of South Africa. This boiled over in 1914 after it was announced that South Africa would be allying with Britain against the Germans in what became the First Wold War and would invade South West Africa. Many Afrikaners did not support this decision. One such person was ex-Boer General Manie Maritz, then district staff officer in charge of the German border region near Upington (Davenport 1963). He gathered his forces at Van Rooysvlei to the northwest of Rooipunt, marked on maps as 'Rebellion Tree', and informed them of his decision to rebel against the government. He mustered approximately a thousand men (Serfontein 1972). They occupied Keimoes and attacked Nous to the south and Lutzputs to the north. In January 1915, they attacked Upington but failed. Most of the leaders of the rebellion were arrested but Maritz escaped to South West Africa and later Europe. Soon after this rebellion, a German force under Major Ritter invaded and a battle ensued against Union forces near Kakamas (Willcox 1986).

Conclusion

This short study shows that, although seemingly marginal and remote, the Upington area has a complex history and was very much involved in wider historical events and processes that occurred both in South Africa and internationally.

3.1.2 Findings of the Heritage Scoping Document

The findings can be compiled as follow and is combined to produce a heritage sensitivity map for the project:

Palaeontology

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary.

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels subsequently be identified (e.g. during geotechnical investigations) within the south-eastern

sector of the study area, however, these should be assessed by a professional palaeontologist before construction commences. The purposes of the field assessment study would be (a) to identify the rock units actually present, (b) to carry out judicious sampling of any fossil heritage currently exposed, together with pertinent geological and palaeontological data, (c) to determine the likely impact of the proposed development on local fossil heritage based on the new field-based information, and finally (d) to make recommendations for any no-go areas, buffer zones or further palaeontological mitigation deemed necessary for this project (e.g. comprehensive pre-construction sampling of near-surface surface fossil material, palaeontological monitoring of excavations). Note that further mitigation may be most useful during the construction phase of the development while fresh, potentially fossiliferous bedrock is still exposed.

Archaeology

The possibility of archaeological finds in the study area has been indicated by previous research in the greater Upington area. This is confirmed by an initial site visit by an archaeologist from PGS to the study area. Concentrations of Stone Age artefact around the dry rivers were found as well as spot finds in the flat sandy areas.

Other sensitive area maybe the rocky outcrops occurring in some areas on the farm.

Figure 12 – Cores and flakes found in area during site visit

Figure 13 – Possible archaeological sensitive area in study area

Although the current owners indicated no knowledge of rock art it is recommended that special attention is given to rocky areas as such sites could be prevalent.

Historical

The tungsten mine and building ruins (***Figure 14*** **and** ***Figure 15***) present in the south-eastern corner of the property is a possible heritage sensitive site will be research further during the EIA phase of the project.

Figure 14 – Structure that is part of ruins of tungsten mine

Figure 15 – Remains of tungsten mine

To be able to compile a heritage management plan to be incorporated into the EMP the following further work was required for the HIA for inclusion in the EIA.

Archaeological walk through the whole of the study area, with specific attention given to the areas around river beds, outcrops and historical structures will be required.

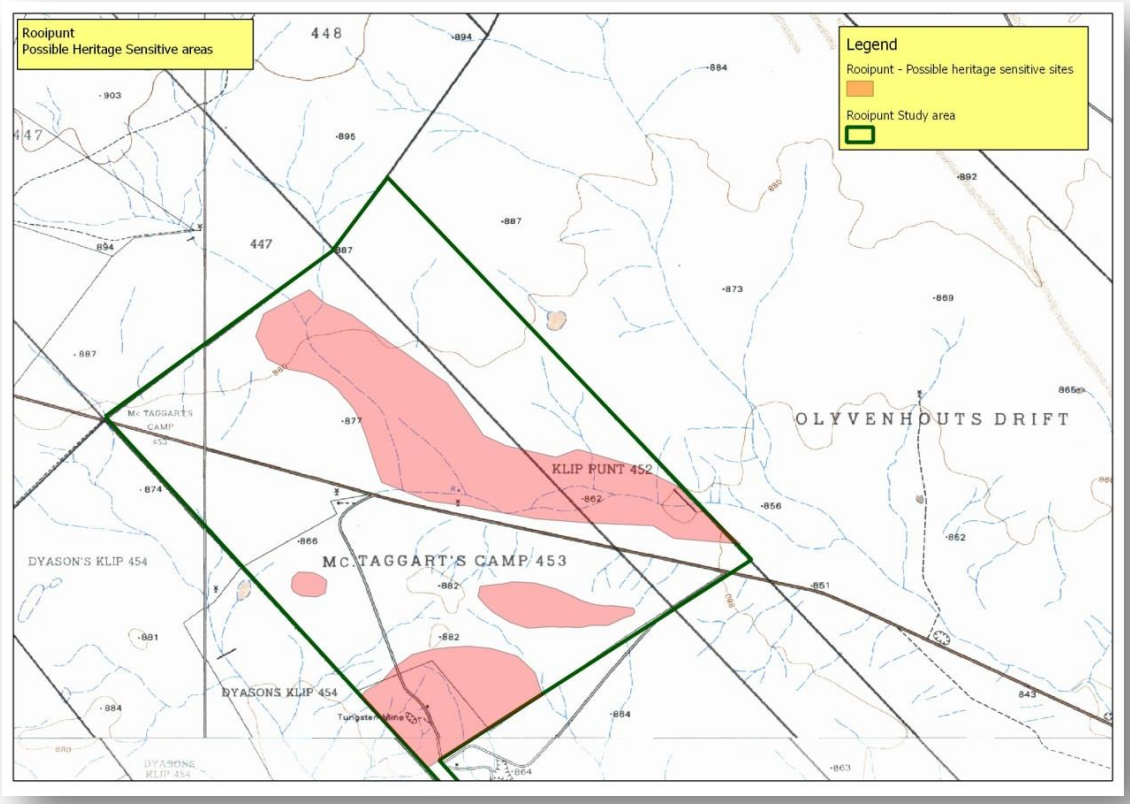

Figure 16 – Heritage Sensitivity Map

3.2 Findings of field work

A follow up visit to the study area was conducted in April 2012 with the aim of conducting an archaeological survey of the development area and giving particular attention to the areas identified during the Scoping phase as being potentially sensitive. The focus of the field work was on the identified sensitive areas and natural features in the landscape that is usually associated with human settlement.

The footprint area for this project covers approximately 2000 hectares in total. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, a controlled-exclusive surface survey was conducted over a period of 5 days on foot and vehicle by an archaeologist of PGS.

The find during the field work can be divided into the following categories of heritage resources:

1. Stone Age Find Spots
2. Stone Age Exposures

3. Possible herder sites
4. Historical structures associated with mining and prospecting

3.2.1 Stone Age Find Spots

The field work identified numerous areas where low density scatters of Middel and Later Stone Age lithics were found (**Figure 17**). A few single occurrences of ESA lithics were also discovered during the field work. Most of these scatters were found where pebble layers were exposed or quarts outcrops in the area (**Figure 18**). This mostly occurred along dry river beds and pans that occur in the study area. As no context and in situ preservation were identified these sites were grade as of low heritage significance and rated as **Grade 4C**.

WP no	Coords	Description	Layout Option Impact
32	S28.47930 E21.00749	Single MSA/LSA flake	N, W, S
33	S28.48165 E21.00295	Single LSA flake	N, W, S
34	S28.48096 E21.00247	Single LSA flake	N, W, S
35	S28.47742 E21.00232	Two MSA/LSA Artefacts (Core & Flake)	N, W, S
36	S28.48464 E21.00679	Single MSA/LSA flake	N, W, S
37	S28.48496 E21.01018	Single MSA/LSA flake	N, W, S
38	S28.49166 E21.01486	Two MSA/LSA flakes	N, W, S
43	S28.49792 E21.02999	Single MSA/LSA flake	N, W, S
45	S28.48058 E21.02954	Single MSA/LSA flake	N, W, S
49	S28.46981 E21.01993	Single MSA/LSA flake	N, W, S
50	S28.45426 E21.02379	Three MSA/LSA artefacts. 1 broken blade, 1 large flake & 1 waste flake	N, W, S
51	S28.46611 E21.00835	Single MSA/LSA flake/core	N, W, S
52	S28.46446 E21.00598	Three ESA/MSA artefacts. 1 core, 1 large utilised flake & 1 possible quartz flake	N, W, S
53	S28.46338 E21.00125	Two MSA/LSA artefacts. 1 retouched flake (LSA) and 1 waste flake (LSA/MSA)	N, W, S
54	S28.46001 E21.00626	Three MSA/LSA artefacts. Two flakes and 1 broken blade	N, W, S
60	S28.46818 E21.03212	Single MSA/LSA fake/core	N, W, S

61	S28.46291 E21.01770	Single ESA flake	N, W, S

Figure 17 – MSA/LSA core and flake, typical of find spots

Figure 18 – Quartz outcrop in study area

Impact Rating

POTENTIAL ENVIRONMENTAL	CRITERIA					S	SIGNIFICANCE		
IMPACT	Nature	P	D	S	M	TOTAL	L	M	H
CONSTRUCTION	-	2	5	1	2	16	L		
CONSTRUCTION MITIGATION	--	2	4	1	2	14	L		
OPERATION	-	1	5	1	2	8	L		
OPERATION MITIGATION	-	1	4	1	2	7	L		
CLOSURE	-	2	5	1	2	16	L		
CLOSURE MITIGATION	-	2	4	1	2	14	L		

The overall impact on these finds spots is seen as **LOW** during the life of the project and no mitigation will be required.

Mitigation

No further mitigation is envisaged at these find spots. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

3.2.2 Stone Age Exposures

During the field work 5 Stone Age Exposures were identified. The exposures can be described as low density surface scatters with no associated structures or deposits visible and in most cases an ephemeral site. These surface scatters do not exclude the possibility of subsurface material the site is rated as **Grade 4B**.

Site no	Coords	Description	Layout Option Impact	Mitigation
47	S28.48032 E21.03280	Very low density surface scatter of MSA artefacts	N, W, S	Monitor
48	S28.49591 E21.01541	Anvil rock. Smooth rock used as an anvil, period unknown. Very close to Site 48 - might have been used during its construction.	N, W, S	
55, 57	S28.47804 E21.04925	Several MSA/LSA artefacts scattered around a quartz outcrop. Notably a hammer stone and a convergent flake/point	N, W, S	
58	S28.47602 E21.03511	Low density scatter of ESA artefacts next to a dry stream. Area of 50m2. Several flakes and cores.	S	Monitor
59	S28.47660 E21.03266	Low density scatter of ESA artefacts next to the same dry stream as 58. At least 2 Acheulean handaxes were noted as well as several very large flakes.	S	Monitor

Figure 19 – LSA lithics typical of exposures

Figure 20 – Quartz outcrop where Exposures 55 and 57 where identified

Figure 21 – Exposure 58 close to a dry river bed

Impact Rating

POTENTIAL ENVIRONMENTAL	CRITERIA					S	SIGNIFICANCE		
IMPACT	Nature	P	D	S	M	TOTAL	L	M	H
CONSTRUCTION	-	2	5	1	2	16	L		
CONSTRUCTION MITIGATION	--	2	4	1	2	14	L		
OPERATION	-	1	5	1	2	8	L		
OPERATION MITIGATION	-	1	4	1	2	7	L		
CLOSURE	-	2	5	1	2	16	L		
CLOSURE MITIGATION	-	2	4	1	2	14	L		

The overall impact on these finds spots is seen as **LOW- MEDIUM** during the life of the project and minimal mitigation will be required.

Of the three layout options **the Southern option** impacts on all 5 sites, while the Western and Northern option impacts on 3 of the five sites.

Mitigation

1. Monitoring during construction in at each of the exposures identified by a qualified archaeologist, managed through an agreed upon watching brief.
2. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

3.2.3 Possible herder sites

The site is situated on the eastern border of the property within the servitude allocated in the larger development area. The site consists of an elliptical stone wall constructed at the base of a quartz outcrop and resembles the small stone kraals constructed by herders. No other material or deposits were identified but does not exclude the possibility of subsurface material; the site is rated as **Grade 4B**.

Site no	Coords	Description	Layout Option Impact	Mitigation
56	S28.47824 E21.04959	Elliptical stone wall enclosure at the base of a quartz outcrop. Approximately 7mx4m.	N, W, S	Monitor

Impact Rating

POTENTIAL ENVIRONMENTAL	CRITERIA					S	SIGNIFICANCE		
IMPACT	Nature	P	D	S	M	TOTAL	L	M	H
CONSTRUCTION	-	1	5	1	2	8	L		
CONSTRUCTION MITIGATION	--	1	4	1	2	7	L		
OPERATION	-	1	5	1	2	8	L		
OPERATION MITIGATION	-	1	4	1	2	7	L		
CLOSURE	-	1	5	1	2	8	L		
CLOSURE MITIGATION	-	1	4	1	2	7	L		

The overall impact on this site is seen as **LOW- MEDIUM** during the life of the project and minimal mitigation will be required.

The site is situated on the edge of proposed infrastructure for all three alternatives and no impact is foreseen if the site is excluded from the footprint area.

Mitigation

1. Exclude from the footprint area with a 20 meter buffer.
2. Monitoring during construction, managed through an agreed upon watching brief.
3. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

3.2.4 Historical structures associated with mining and prospecting

The tungsten mine and building ruins (***Figure 14*** **and** ***Figure 15***) present in the south-eastern section of the property dates from the early 1940 to 1970. Tungsten prospecting on the Gordonia Region can be traced back to the mid 1930's when companies like the South African Tungsten (Proprietary) Limited lead by Messrs Berwick and Morcing. The most prominent tungsten deposits in the Northern Cape is situated on the farm

- Van Rooi's Vley –Boksputs tungsten-tin deposit; and
- Renosterkop tin-tungsten- zinc deposit, just to the west of the current study area

These deposits were discovered in1938 and the first tungsten produced in 1941. However most of these deposits are mined out.

The tungsten mine in the study area is described in the Northern Cape Provincial Growth and Development Strategy (2004),

"*The Mc Taggart's Cam p and Dyason's Klip Tungsten-tin deposits are located some 20 km southwest of Upington, in close proximity to Van Rooi's Vley. Mineralisation occurs in thin steeply dipping (50--60°) vein that have similar geologic al characteristics to those of the Van Rooi's Vley deposit, but the resources are much smaller. Drilling by Anglo Vaal showed that the ore zone had closed off before a depth of 80 m was reached on one of the deposits. Mining took place intermittently from the early 1940s to approximately 1970. These deposits could possibly be worked on a small scale with an increase in the price of Tungsten*" (Northern Cape, 2004)

As the site has been utilised over a period of 30 years from 1940 some of the mining structures are older than 60 years, and protected under Section 34 of the NHRA, the sites are rated as **Grade 4A** and will require further mitigation.

Site no	Coords	Description	Layout Option Impact	Mitigation
39	S28.49326 E21.02046	Remains of an unidentified, roundish structure. Outside chance that it is a grave. Some associated cultural material (rusted cans). Associated with mine infrastructure. Single upright cement slab were observed in the centre of the structure.	N, W, S	Document as part of larger distribution of mining activity. Test excavation to determine if the structure is a grave.
40	S28.49445 E21.02806	Mine quarry	N, W, S	Document as part of larger distribution of mining activity.
41	S28.49380 E21.02833		N, W, S	Document as part of larger distribution of mining activity.
42	S28.49522 E21.03005	Mine quarry	N, W, S	Document as part of larger distribution of mining activity.
44	S28.49289 E21.02099	Remains of a rectangular structure (7mx4m) and an associated round structure (4m diameter). Probably living quarters & kraal.	N, W, S	
46	S28.48547 E21.04029	Mine quarry	N, W, S	Document as part of larger distribution of mining activity.
48	S28.49521 E21.01537	Shed constructed of corrugated iron. Might have been a storage shed for explosives. Associated with mining infrastructure.	N, W, S	Document as part of larger distribution of mining activity.
62	S28.47536 E21.02525	Rectangular dam, age unknown but probably not older than 60 years	N, W, S	Document as part of larger distribution of mining activity.
63	S28.47678 E21.02494	Rectangular structure and associated round dam. Possibly a pump house.	N, W, S	Document as part of larger distribution of mining activity.

		Age unknown but probably not older than 60 years		
64	S28.49324 E21.02073	Very faint remains of a small rectangular structure. Associated with mining infrastructure. Single upright stone were noted in the centre of the structure. Purpose unknown.	N, W, S	Document as part of larger distribution of mining activity.
65	S28.49423 E21.02195	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N, W, S	Document as part of larger distribution of mining activity.
66	S28.49456 E21.02250	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N, W	Document as part of larger distribution of mining activity.
67	S28.49474 E21.02297	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N, W, S	Document as part of larger distribution of mining activity.
68	S28.49588 E21.02224	Remains of stone building. Probably workers accommodation associated with mining infrastructure	N, W	Document as part of larger distribution of mining activity.

Figure 22 – Stone built structure at point 65

Figure 23 – Rectangular dam

Figure 24 – Corrigated explosives magazine

Figure 25 – Mining quarry at Site 42

Impact Rating

POTENTIAL ENVIRONMENTAL	CRITERIA					S	SIGNIFICANCE		
IMPACT	Nature	P	D	S	M	TOTAL	L	M	H
CONSTRUCTION	-	4	5	1	6	44		M	
CONSTRUCTION MITIGATION	--	4	5	1	2	32		M	
OPERATION	-	1	5	1	2	8	L		
OPERATION MITIGATION	-	1	4	1	2	7	L		
CLOSURE	-	2	5	1	6	22	L		
CLOSURE MITIGATION	-	2	5	1	2	16	L		

The overall impact on these sites is seen as **MEDIUM NEGATIVE** during the construction phase and **LOW NEGATIVE** during operational and closure phases of the project and minimal mitigation will be required.

Of the three layout options the **Southern Option** impacts on the least amount of historical mining infrastructure. However documentation of the mining landscape will have to include the two sites not impacted by the Southern Option.

Mitigation

1. Some of the structures associated with mining is older than 60 years and protected under Section 34 of the NHRA, and thus require permitting before such structures are to be demolished.
2. It is recommended that the historical and mining structure be documented as part of a cultural landscape layout plan and where build structures are present these are to be documented by plan sketches and photographs before applying for destruction permits from the Provincial Heritage Authority - Ngwao Boswa Kapa Bokone, Heritage Northern Cape (Boswa).
3. Investigate Site 39, as the possibility exists that it may be a grave, through test excavation to determine if the structure is a grave.
4. Monitoring during construction, managed through an agreed upon watching brief.
5. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

3.3 Cultural Landscape

Heritage significance of the cultural landscape is derived from the interaction between the natural landscape, such as valleys, undulating plains and rivers courses usually framed by

mountain ranges or accentuated by ridges and koppies, and access routes, human settlements and farmsteads. Also interacting with these physical entities are intangible and historic landscapes and events that is known to have added to the cultural fabric of a place or area.

The evaluation of the study area and surrounds as demarcated shown the area to be rich in heritage resources spanning the archaeological to historical timeframe.

The cultural landscape of the study area has a wilderness/rural appearance, no large industrial installations occur within the vicinity and the historical mining activity has been defunct for the past 40 years.

Due to the landscape's topography the solar park infrastructure will be prominent in the landscape and alter the rural appearance. Due to the remoteness of the area the impact on the experience of the cultural landscape is not fore seen to be significant and provisionally rate as follows:

Impact Rating

POTENTIAL ENVIRONMENTAL	CRITERIA					S	SIGNIFICANCE		
IMPACT	Nature	P	D	S	M	TOTAL	L	M	H
CONSTRUCTION	-	3	2	2	6	30		M	
CONSTRUCTION MITIGATION	--	3	2	2	4	24	L		
OPERATION	-	3	4	1	2	21	L		
OPERATION MITIGATION	-	1	4	1	2	14	L		
CLOSURE	-	3	2	1	4	14	L		
CLOSURE MITIGATION	-	2	2	1	4	14	L		

Mitigation

The visual impact of the proposed solar park on the cultural landscape will be addressed in the Visual Impact Assessment of the EIA, as well as the possible mitigation measures. These mitigation measures will in most instances also alleviate impacts on the cultural landscape.

3.4 Palaeontology

Almond (2012) (Appendix A) found that the "*overall impact significance of the proposed solar park development is likely to be LOW because:*

Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity;
Extensive, deep excavations are unlikely to be involved in this sort of solar park project.

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary."

4 CONCLUSIONS AND RECOMMENDATIONS

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The Heritage Scoping Report has shown that the surrounding areas around the study area have a rich historical and archaeological history.

The field work that feeds into the Heritage Impact has utilised the findings of the Scoping report to guide this work. The field work identified a total of 46 heritage sites with the following heritage classification, mitigation and impacted on by the proposed layouts:

Stone Age Find Spots
The field work identified numerous areas where low density scatters of Middel and Later Stone Age lithics were found. As no context and in situ preservation were identified these sites were grade as of low heritage significance and rated as **Grade 4C**.

All three layout options will impact directly on the 17 find spots identified. The impact significance is rated as Low.

No further mitigation is envisaged at these find spots. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Stone Age Exposures

During the field work 5 Stone Age Exposures were identified. These surface scatters do not exclude the possibility of subsurface material the site is rated as **Grade 4B**.

Of the three layout options **the Southern Option impacts on all the sites**. **The Northern and Western Options** impacts on 3 of the 5 exposures identified. The impact significance is rated as Low-Medium significance

Mitigation required for these sites will be:

3. Monitoring during construction in at each of the exposures identified by a qualified archaeologist, managed through an agreed upon watching brief.
4. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Possible herder sites

One possible herder site was identified during the survey. No other material or deposits were identified but does not exclude the possibility of subsurface material; the site is rated as **Grade 4B**.

The site is situated on the edge of proposed infrastructure for all three alternatives and no impact is foreseen if the site is excluded from the footprint area. The overall impact on this site is seen as LOW- MEDIUM during the life of the project and minimal mitigation will be required.

Mitigation required for this site will be:

4. Exclude from the footprint area with a 20 meter buffer.
5. Monitoring during construction, managed through an agreed upon watching brief.
6. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Historical structures associated with mining and prospecting

The tungsten mine and building ruins (***Figure 14*** **and** ***Figure 15***) present in the south-eastern section of the property dates from the early 1940 to 1970.

As the site has been utilised over a period of 30 years from 1940 some of the mining structures are older than 60 years, and protected under Section 34 of the NHRA, the sites are rated as **Grade 4A** and will require further mitigation.

Of the three layout options the Southern Option impacts on the least amount of historical mining infrastructure. However documentation of the mining landscape will have to include the two sites not impacted by the Southern Option.

The overall impact on these sites is seen as **MEDIUM NEGATIVE** during the construction phase and **LOW NEGATIVE** during operational and closure phases of the project and minimal mitigation will be required.

Mitigation that will be required for these sites will be:

6. Some of the structures associated with mining is older than 60 years and protected under Section 34 of the NHRA, and thus require permitting before such structures are to be demolished.
7. It is recommended that the historical and mining structure be documented as part of a cultural landscape layout plan and where build structures are present these are to be documented by plan sketches and photographs before applying for destruction permits from the Provincial Heritage Authority - Ngwao Boswa Kapa Bokone, Heritage Northern Cape (Boswa).
8. Investigate Site 39, as the possibility exists that it may be a grave, through test excavation to determine if the structure is a grave.
9. Monitoring during construction, managed through an agreed upon watching brief.
10. Inclusion of training of construction staff on possible heritage finds in the induction program is however recommended.

Cultural Landscape

Due to the landscape's topography the solar park infrastructure will be prominent in the landscape and alter the rural appearance. Due to the remoteness of the area the impact on the experience of the cultural landscape is not foreseen to be significant. Mitigation as recommended in the Visual Assessment should be able to mitigate any impacts on the cultural landscape to an acceptable level.

The overall impact on the heritage resources is seen as acceptably low through the implementation of the recommended mitigation measures and general heritage management guidelines as listed in Section 5 of this HIA report.

Palaeontology

Almond (2012) (**Appendix A**) found that the "*overall impact significance of the proposed solar park development is likely to be LOW because:*

Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses etc.) or mantled by superficial sediments (wind-blown sands, alluvium etc.) of low palaeontological sensitivity;
Extensive, deep excavations are unlikely to be involved in this sort of solar park project.

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary."

Evaluation of Layout Options

Evaluation of the three layout Options, has shown that the Northern and Western options impacts on the least amount of heritage site with a total count of 35 out of 37 sites:

Layout Option	Heritage Site Count
Northern Option	35
Southern Option	36
Western Option	35

The cumulative impact by all three options is however seen as equivalent for all three and no one of the options carry a preference with regards to impact on heritage resources.

5 HERITAGE MANAGEMENT GUIDELINES

5.1 General Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-

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

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

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

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

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

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

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

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

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the South African Heritage Resources Agency (SAHRA) needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

  This survey and evaluation must include:

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

  (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Cultural Resources Act;

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

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

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

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

(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:

   a. Heritage;

   b. Graves;

   c. Archaeological finds; and

   d. Historical Structures.

   This module must be tailor made to include all possible finds that could be expected in that area of construction.

4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.

5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.

6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.

7. After mitigation an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.

8. If during the initial survey sites of cultural significance is discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.

9. In the event that human remains are uncovered or previously unknown graves are discovered a qualified archaeologist needs to be contacted and an evaluation of the finds made.

10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA needs to be followed. This includes an extensive social consultation process.

The purpose of an archaeological/palaeontological monitoring programme[1] is:

- To allow, within the resources available, the preservation by record of archaeological/palaeontological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works
- To provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological/palaeontological find has been made for which the resources allocated to the watching brief itself are not sufficient to support treatment to a satisfactory and proper standard.
- A monitoring is not intended to reduce the requirement for excavation or preservation of known or inferred deposits, and it is intended to guide, not replace, any requirement for contingent excavation or preservation of possible deposits.
- The objective of the monitoring is to establish and make available information about the archaeological resource existing on a site.

PGS can be contacted on the way forward in this regard.

Table 1: Roles and responsibilities of archaeological and heritage management

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should sit in at all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology supportive team
If chance finds and/or graves or burial grounds are identified during construction or	The client	Archaeologist and a competent archaeology

[1] [1] The definition of an archaeological/palaeontological monitoring programme is a formal program of observation and investigation conducted during any operation carried out for non-archaeological reasons. This will be within a specified area or site on land, inter-tidal zone or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.

operational phases, a specialist must be contacted in due course for evaluation.		supportive team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

5.2 All phases of the project

5.2.1 Archaeology

Based on the findings of the HIA, all stakeholders and key personnel should undergo an archaeological induction course during this phase. Induction courses generally form part of the employees' overall training and the archaeological component can easily be integrated into these training sessions. Two courses should be organised – one aimed more at managers and supervisors, highlighting the value of this exercise and the appropriate communication channels that should be followed after chance finds, and the second targeting the actual workers and getting them to recognize artefacts, features and significant

sites. This needs to be supervised by a qualified archaeologist. This course should be reinforced by posters reminding operators of the possibility of finding archaeological/palaeontological sites.

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area and small scale infrastructure development associated with the project.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making and to make the correct judgment on which actions should be taken. A responsible archaeologist/palaeontologist must be appointed for this commission. This person does not have to be a permanent employee, but needs to sit in at relevant meetings, for example when changes in design are discussed, and notify SAHRA of these changes. The archaeologist would inspect the site and any development recurrently, with more frequent visits to the actual workface and operational areas.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMP) of the project. Should an archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project

thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological/palaeontological monitoring programme.

5.2.2 Graves

In the case where a grave is identified during construction the following measures must be taken.

Mitigation of graves will require a fence around the cemetery with a buffer of at least 20 meters.

If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a rescue permit must be applied for with SAHRA and the local South African Police Services must be notified of the find.

Where it is then recommended that the graves be relocated a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation
iii. Newspaper Notice indicating the intent of the relocation
iv. A permit from the local authority;
v. A permit from the Provincial Department of health;
vi. A permit from the South African Heritage Resources Agency if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
vii. An exhumation process that keeps the dignity of the remains intact;
viii. An exhumation process that will safeguard the legal implications towards the developing company;
ix. The whole process must be done by a reputable company that are well versed in relocations;
x. The process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

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Appendix A

PALAEONTOLOGICAL DESKTOP STUDY

PALAEONTOLOGICAL SPECIALIST STUDY: DESKTOP ASSESSMENT

Proposed Rooipunt Solar Power Park on Farm Rooipunt 617, near Upington, Gordonia District, Northern Cape Province

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SUMMARY

The company SolarReserve SA (Pty) LTD is proposing to construct a 325 MW Solar Power Park on the Farm Rooipunt 617, Gordonia RD, Siyanda District Municipal Region in the Northern Cape. The planned solar park will comprise both photovoltaic (PV) and concentrated solar power (CSP) components. The proposed development site is situated on the northern side of the Orange River approximately 20 - 25 km west of the town of Upington.

The study area for the proposed solar park near is underlain at depth by a range of Precambrian basement granitic and metamorphic rocks that are entirely unfossiliferous. Most of the study area is mantled by a range of Late Caenozoic superficial deposits including Quaternary to Recent wind-blown sands of the Gordonia Formation (Kalahari Group) and calcretes (pedogenic limestones) of comparable age, all of which are of low palaeontological sensitivity. Fossil-rich Late Tertiary to Quaternary alluvial gravels are known elsewhere along the banks of the Orange River in the Gordonia region but are not mapped within the study area which lies 2 km or more north of the river. Extensive, deep excavations are unlikely to be involved in this sort of solar park project. The overall impact significance of the proposed development is therefore likely to be LOW and no fatal flaws, no-go areas or buffer zones for palaeontological heritage resources have been identified by this desktop study. No further specialist palaeontological studies, monitoring or mitigation are recommended for this development.

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels subsequently be identified within the study area (*e.g.* during geotechnical investigations), however, these should be assessed by a professional palaeontologist before construction commences, with recommendations for any appropriate mitigation action. The resulting report, to be submitted to SAHRA, should make specific recommendations for any no-go areas, buffer zones or specialist mitigation required during the pre-construction or construction phases. The palaeontologist concerned with field assessment and mitigation work will need a valid fossil collection permit from SAHRA.

1. INTRODUCTION

The company SolarReserve SA (Pty) LTD is proposing to construct a 325 MegaWatt (MW) Solar Power Park on the Farm Rooipunt 617, Gordonia RD, Siyanda District Municipal Region in the Northern Cape. The planned solar park will comprise both photovoltaic (PV) and concentrated solar power (CSP) components. The proposed development site is situated on the northern side of the Orange River approximately 20 - 25 kms west of the town of Upington (Figs. 1 & 2). The development site is located within the institutional boundaries of the Khara Hais Local and Siyanda District Municipalities.

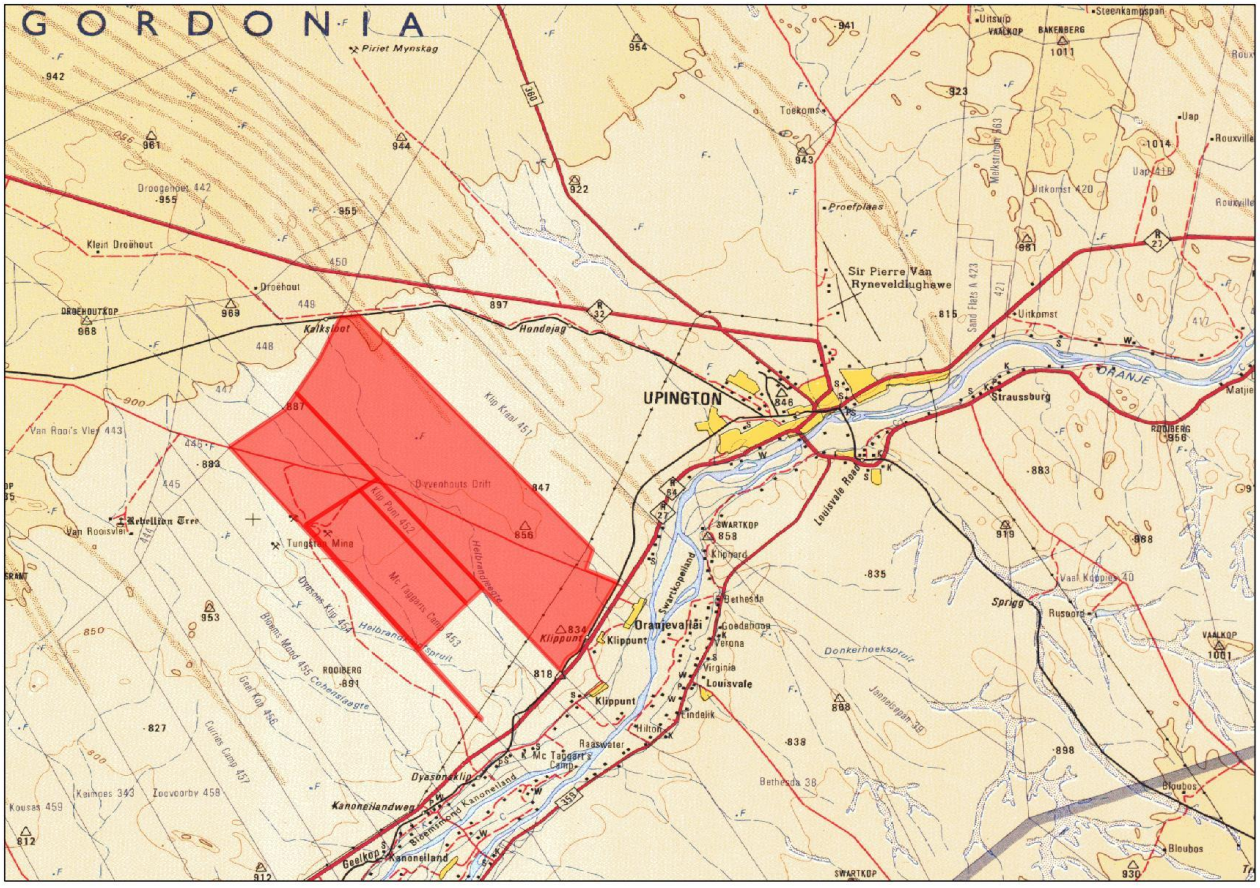

Fig. 1. Extract from 1: 250 000 topographical map 2820 Upington showing location of the proposed Rooipunt Solar Power Plant study area (red polygon) located c. 20-25 km west of Upington, Northern Cape (Image kindly provided by PGS (Pty) Ltd).

The following brief project description for the solar plant has been abstracted from the Background Information Document prepared by WorleyParsons RSA (Pty) Ltd, PO Box 93155, Menlo Park 0102, South Africa, dated October 2011:

1. The CSP plant being considered is a molten salt-type, central receiver (tower) technology. The plant requires approximately 6 km^2 of low-relief terrain and will primarily comprise the following four components:

Solar Field - consists of all services and infrastructure related to the management and operation of the heliostats (reflective mirrors). It is estimated that approximately 17 000 heliostats with an area of approximately 65 m^2 each will be required for the solar field in order to obtain a power output of approximately 100 MW;

Molten Salt Circuit - includes the thermal storage tanks for storing liquid salt, a concentration receiver/tower, pipelines and heat exchangers;

The Power Block – housing the steam turbine;

Auxiliary facilities and infrastructure - includes a condenser-cooling system, electricity transmission lines to allow for grid connection, access routes, water treatment and supply amenities and a CSP plant start-up energy supply unit (gas or diesel generators).

2. The PV development will consist of photo-voltaic solar panels that will occupy up to 450 ha of the site area in total. The PV will be developed in three blocks of 150 ha. Each block of 150 ha will produce 75 MW. The PV development will produce 225 MW of power in total. The panels will be situated in rows extending across the site in lines. PV panels are typically up to 15 m^2 in size and the rows will be approximately 1 km in length, made up of approximately 100 m sections depending on the final design and layout of the development. The panels will be mounted on metal frames with a maximum height of approximately 3 m above the ground, supported by concrete or screw pile foundations, and they will face north in order to capture the maximum sunlight. The facility will either be a fixed PV plant where the solar panels are stationary; or a tracking PV plant where the solar panels rotate to track the sun's movement (the exact type of PV plant system will be determined following on-site solar resource modelling and detailed development design). A detailed technical description for this project has not yet been developed.

The proposed development area is mainly underlain by unfossiliferous basement rocks (granites, gneisses *etc*) but also features a variety of Late Caenozoic superficial sediments, some of which may contain sparse fossil remains.

The extent of the proposed development (over 5000 m^2) falls within the requirements for a Heritage Impact Assessment (HIA) as required by Section 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999). The various categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance

- palaeontological sites
- palaeontological objects and material, meteorites and rare geological specimens

Minimum standards for the palaeontological component of heritage impact assessment reports are currently being developed by SAHRA. The latest version of the SAHRA guidelines is dated May 2007.

SolarReserve SA (Pty) LTD has appointed Worley Parsons RSA as independent Environmental Assessment Practitioners in support of an application for Environmental Authorisation (DEA Reference: 12/12/20/2488) and a Waste Management License. The Heritage Impact Assessment for this project is being conducted by PGS Heritage and Grave Relocation Consultants, PO Box 32542, Totiusdal, 0134, RSA who have commissioned the present desktop palaeontological study.

2. APPROACH & METHODOLOGY

2.1. Details of specialist

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, Free State and Mpumalanga under the aegis of his Cape Town-based company *Natura Viva* cc. He is 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).

2.2. General approach used for palaeontological impact desktop studies

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc*) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development (Provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature of the development itself, most notably the extent of fresh bedrock excavation envisaged.

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted. Most detrimental impacts on palaeontological heritage occur during the construction phase when fossils may be disturbed, destroyed or permanently sealed-in during excavations and subsequent construction activity. Where specialist palaeontological mitigation is recommended, this may take place before construction starts or during the construction phase while fresh, portentially fossiliferous bedrock is still exposed for study. Mitigation usually involves the judicious sampling, collection and recording of fossils as well as of relevant contextual data concerning the surrounding sedimentary matrix. It should be emphasised that, *provided* appropriate mitigation is carried out, many developments involving bedrock excavation actually have a *positive* impact on our understanding of local palaeontological heritage. Constructive collaboration between palaeontologists and developers should therefore be the expected norm.

2.3. Information sources

The information used in this fossil heritage screening study was based on the following:

1. A short project outline in the BID document prepared by WorleyParsons RSA (Pty) Ltd ;

2. A review of the relevant scientific literature, including published geological maps and accompanying sheet explanations;

3. Previous palaeontological assessments for developments in the Upington region by the author (*e.g.* Almond 2011).

2.4. Assumptions & limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have *never* been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g*. of commercial mining companies) - that is not readily available for desktop studies;

5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the present case the main factor constraining the reliability of the assessment of fossil heritage within the development area is uncertainty as to whether or not ancient alluvial deposits of the Orange River (which might be richly fossiliferous) are present here.

3. DESCRIPTION OF THE STUDY AREA

3.1. Location and brief description of study area

The broader study area for the proposed Roipunt solar park is situated on arid terrain at about 800 to 900m amsl on the northern side of the Orange River some 20-25 km west of the town of Upington (Fig. 1). The N14 tar road and railway between Upington and Keimoes run along the southeastern boundary of the area, close to the northern banks of the Orange River, while the N10 tar road and railway to Karaburg run just to the north of the area. Most of the study area is sandy and of low relief, with a few isolated, rocky Inselberge projecting up to 856m amsl above the sandy plains. The latter slope gently south-eastwards down to the Orange River and are dissected by shallow dendritic drainage systems of intermittently flowing streams. Linear sand dunes with NW-SE trending crests are clearly visible on satellite images of the area to the east of the solar park study area.

3.2. Geology of the study area

The geology of the study area near Upington is shown on the 1: 250 000 geology map 2820 Upington (Council for Geoscience, Pretoria; Fig. 2 herein). A comprehensive sheet explanation for this map has been published by Moen (2007).

According to the 1: 250 000 geology map (Fig. 2) the study area of the proposed Rooipunt solar park is underlain at depth by a range of ancient Precambrian basement rocks – largely high grade metamorphic rocks (*e.g.* gneisses, metapelites) and intrusive granitoids – that belong to the Namaqua-Natal Province of Mid Proterozoic (Mokolian) age (Cornell *et al.* 2006, Moen 2007). These basement rocks are approximately two to one billion years old and entirely unfossiliferous (Almond & Pether 2008). They only crop out as small, isolated *Inselberge* and will probably not be directly impacted by the proposed solar park development. They will therefore not be described any further here.

The greater part of the Rooipunt study area is mantled by superficial sediments of Late Caenozoic (*i.e.* Late Tertiary or Neogene to Recent) age. Small patches of Late Tertiary to Quaternary calcretes (T, darker yellow in Fig. 2) or pedogenic limestones occur in the central sector. Some of these may be correlated with the Pleistocene or Late Pliocene Mokalanen Formation of the Kalahari Group, while others may be of younger age (Partridge *et al.* 2006, Moen 2007). They include horizons of layered to structureless or nodular calcretes overlying basement rocks that are usually less than 3m thick and often partially covered by wind-blown sands.

Most of the remainder of the study area is covered by fine-grained aeolian (wind-blown) sands of the Gordonia Formation (Qg, pale yellow I Fig. 2), the youngest, Pleistocene to Recent, subunit of the Kalahari Group. Prominent NW-SE trending linear dunes of orange-hued sands are clearly visible on satellite images of the region to the east of the study area. The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw 1991, Haddon (2000) and Partridge *et al.* (2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle *et al*., 1983, p. 291). Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch.

Much of the arid terrain within the study area is doubtless mantled with a spectrum of other coarse to fine-grained surface deposits such as rocky soils, downwasted gravels, colluvium (slope deposits, *e.g.* around margins of basement *Inselberge*), sheet wash and alluvium of the numerous intermittently flowing streams. Since these deposits are generally young and largely unfossiliferous, they will not be treated further here.

The southeastern edge of the study site is some 2 km away from the present course of the Orange River and elevated perhaps 10m or more higher that this above mean sea level. It is considered unlikely that significant outcrops of ancient (Late Tertiary) Orange River alluvial gravels (*terrasgruis*) are present within this area, and none are mapped here on the 1: 250 000 Upington geology sheet. It is noted, however, that according to Moen (2007) terrace gravels occur "all along the river" within 2km of the present banks and at elevations of up to 45 m (rarely as high as 85m) above the present flood plain. It is possible that some of the pale grey – rather than orange - areas seen in or around the southeastern study area on satellite images may represent silty or coarser alluvial deposits. It is noted that the site lies on the inside of a marked bend in the course of the Orange River, a situation where older point bar alluvial deposits left behind by lateral channel migration may perhaps be expected. Any remaining uncertainty on this palaeontologically important point can only be resolved by fieldwork.

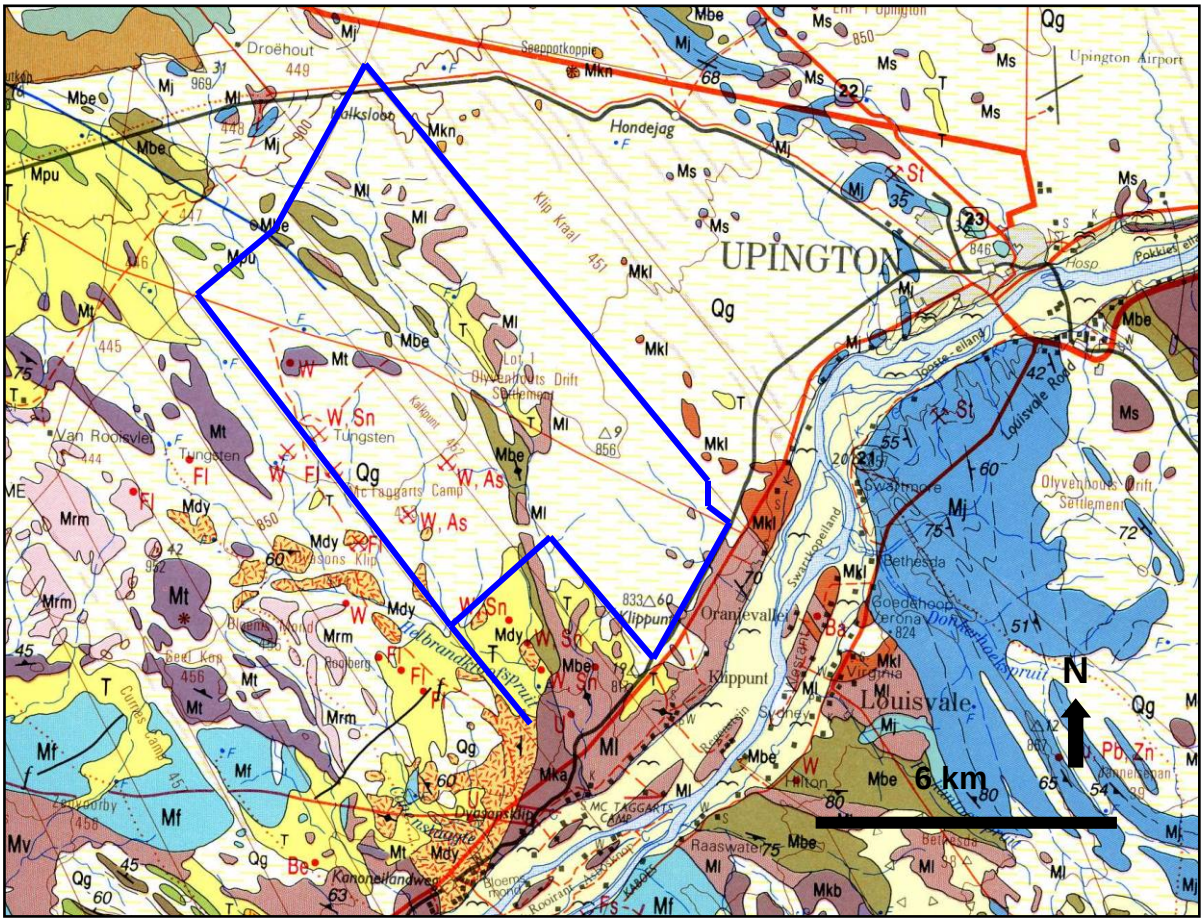

Fig. 2. Extract from 1: 250 000 geological map 2820 Upington (Council for Geoscience, Pretoria) showing approximate location of proposed Rooipunt Solar Power Plant study area c. 5 km NE of Upington, Northern

Cape Province (blue polygon). Potentially fossiliferous sedimentary rock units mapped within the study area include:

Qg (white with yellow stripes) = red aeolian (wind-blown) sand of Gordonia Formation (Kalahari Group)
T (yellow) = Late Caenozoic calcretes (Kalahari Group in part)

The remaining area is underlain by small inliers of unfossiliferous Precambrian (Middle Proterozoic / Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province, including a range of highly metamorphosed sediments and intrusive igneous rocks (*e.g.* Mbe Areachap Sequence, Mt – Korannaland Sequence, Ml – granites of Keimoes Suite).

The overall palaeontological sensitivity of the entire study area is LOW.

4. PALAEONTOLOGICAL HERITAGE

The fossil record of the Kalahari Group is generally sparse and low in diversity (Almond & Pether 2008). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying rocks may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (*e.g. Trigonephrus*) (Almond 2008a, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle *et al*., 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low.

Late Caenozoic calcretes may also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels and pans (*cf* Almond 2008a). However, these fossil assemblages are generally sparse, low in diversity, and occur

over a wide geographic area, so the palaeontological sensitivity of the calcretes within the study area is rated as low. This applies equally to the thin veneer of other surface deposits (rocky scree, stream alluvium *etc*) within this highly arid region.

Alluvial gravels of the Orange River of Miocene and younger age are locally highly fossiliferous (*e.g.* Hendy 1984, Schneider & Marias 2004, Almond 2009 and extensive references therein). As argued above, these are not mapped within the study area are probably not present there. However, the possibility of fossiliferous Orange River alluvial deposits on the south-eastern margins of the study area should be borne in mind (See following section).

5. INDENTIFICATION OF POTENTIAL IMPACTS *plus* RECOMMENDED MITIGATION

The proposed Rooipunt solar park development near Upington is located in an area that is in part underlain by potentially fossiliferous sedimentary rocks of Late Caenozoic age, mainly Quaternary to Recent calcretes and wind-blown sands (Fig. 2).

The construction phase of the solar park will entail fresh excavations into the superficial sediment cover (soils, alluvium *etc*) and perhaps also into the underlying bedrock. These notably include excavations for the solar panel foundations, buried cables (probably around 1m deep), new gravel roads with drainage trenches, and associated building infrastructure (*e.g.* concentration tower, power block, administration buildings). In addition, sizeable areas of bedrock may be sealed-in or sterilized by infrastructure such as the CSP solar field, ancillary buildings as well as a new gravel road system.

All these developments may adversely affect fossil heritage at or near the surface within the study area by destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

Once constructed, the operational and decommissioning phases of the solar energy facility will not involve further adverse impacts on palaeontological heritage, however.

The overall impact significance of the proposed solar park development is likely to be LOW because:

Most of the study area is underlain by unfossiliferous igneous and metamorphic basement rocks (granites, gneisses *etc*) or mantled by superficial sediments (wind-blown sands, alluvium *etc*) of low palaeontological sensitivity;

Extensive, deep excavations are unlikely to be involved in this sort of solar park project.

Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed solar park development and in the author's opinion no further specialist palaeontological studies for this project are necessary.

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels subsequently be identified (*e.g.* during geotechnical investigations) within the south-eastern sector of the study area, however, these should be assessed by a professional palaeontologist before construction commences. The purposes of the field assessment study would be (a) to identify the rock units actually present, (b) to carry out judicious sampling of any fossil heritage currently exposed, together with pertinent geological and palaeontological data, (c) to determine the likely impact of the proposed development on local fossil heritage based on the new field-based information, and finally (d) to make recommendations for any no-go areas, buffer zones or further palaeontological mitigation deemed necessary for this project (*e.g.* comprehensive pre-construction sampling of near-surface surface fossil material, palaeontological monitoring of excavations). Note that further mitigation may be most useful during the construction phase of the development while fresh, potentially fossiliferous bedrock is still exposed.

In all cases, whether or not a professional palaeontologist is involved in mitigation:

The ECO responsible for the development should be aware of the possibility of important fossils being present or unearthed on site and should monitor all substantial excavations into fresh (*i.e.* unweathered) sedimentary bedrock for fossil remains;
In the case of any significant fossil finds (*e.g.* vertebrate teeth, bones, burrows, petrified wood, calcretised termitaria) during construction, these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to the relevant heritage management authority (SAHRA) so that any appropriate mitigation by a palaeontological specialist can be considered and implemented, at the developer's expense;
These recommendations should be incorporated into the EMP for the solar park development.

6. RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

According to the National Heritage Resources Act (Act 25 of 1999, Sections 3 and 35) all geological sites of scientific or cultural importance, palaeontological sites, palaeontological objects and material, meteorites and rare geological specimens are regarded as part of the National Estate and are protected by law.
According to Section 35 of the Act, no person may, without a permit issued by the responsible heritage resources authority:

destroy, damage, excavate, alter, deface or otherwise disturb any palaeontological site;

destroy, damage, excavate, remove from its original position, collect or own

any palaeontological material or object;

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

bring onto or use at a palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of palaeontological material or objects.

The extent of the proposed solar park development (over 5000 m^2) falls within the requirements for a Heritage Impact Assessment (HIA) as required by Section 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999). Where fossil heritage may be present, a specialist palaeontological study forms an integral part of such a HIA and its conclusions and recommendations would need to be combined with those of other heritage specialists as an integrated heritage study.

7. DISCUSSION & CONCLUSIONS

The study area for the proposed Rooipunt solar park near Upington is underlain at depth by a range of Precambrian basement granitic and metamorphic rocks that are entirely unfossiliferous. Sizeable areas of Late Caenozoic superficial deposits include Quaternary to Recent wind-blown sands of the Gordonia Formation (Kalahari Group) and calcretes (pedogenic limestones) of comparable age, all of which are of low palaeontological sensitivity. Fossil-rich Late Tertiary to Quaternary alluvial gravels are known elsewhere along the banks of the Orange River in the Gordonia region but are not mapped within the study area which lies 2 km or more north of the river. Extensive, deep excavations are unlikely to be involved in this sort of solar park project. The overall impact significance of the proposed development is therefore likely to be LOW and no no-go areas or buffer zones for palaeontological heritage resources have been identified by this desktop study. No further specialist palaeontological studies, monitoring or mitigation are recommended for this development.

Should outcrop areas of potentially fossiliferous ancient Orange River alluvial gravels subsequently be identified within the study area (*e.g.* during geotechnical investigations), however, these should be assessed by a professional palaeontologist before construction commences, with recommendations for any appropriate mitigation action. The resulting report, to be submitted to SAHRA, should make specific recommendations for any no-go areas, buffer zones or specialist mitigation required during the pre-construction or construction phases. The palaeontologist concerned with field assessment and mitigation work will need a valid fossil collection permit from SAHRA.

8. ACKNOWLEDGEMENTS

Mr Wouter Fourie of PGS Heritage and Grave Relocation Consultants, PO Box 32542, Totiusdal, is thanked for commissioning this study and for kindly providing all the necessary background information.

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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 Mainstream solar park development projects, 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**

The following will be required to manage the heritage resources within the final corridor alignment.

6.1 Methodology

Aerial Photographical Survey

Aerial photographs will be utilised to identify possible places where archaeological sites might be located.

Physical Surveying

The fieldwork component will consist of a selective walk through/site visit of the proposed alignment and is aimed at locating heritage resources falling within (and directly adjacent to) the proposed alignment. The locations of all heritage resources that are recorded during the survey will be documented using a hand-held GPS. Furthermore, the documentation will reflect a brief qualitative description and statement of significance for each site and includes a photographic record of all the sites.

It is important to also note that informal social consultation (i.e. with local community members, residents and knowledgeable individuals) will be undertaken during the fieldwork component. The aim of social consultation is to identify any tangible and intangible resources (i.e. sacred places, myths and indigenous knowledge systems) that may exist.

6.2 Deliverable

A report will be written which would include the following components:

- The identification and mapping of all heritage resources in the affected area;
- An assessment of the significance of such resources in terms of the heritage assessment criteria;

- An assessment of the impact of the development of such heritage resources;
- If heritage resources will be adversely affected by the proposed development, consideration of the
- alternatives; and
- Proposed mitigation of any adverse effects during and after the completion of the proposed development.

Appendix C

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the new legislation, permits are required to damage, destroy, alter, or disturb them. People who already possess material are required to register it. The management of heritage resources are integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have interest in the graves: they may be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle will be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the construction company's cost. Thus, the construction company will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection, to all historic and pre-historic cultural remains, including graves and human remains.

3.2 Graves and cemeteries

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and

regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

Appendix D

HERITAGE ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

The Heritage Impact Assessment (HIA) report to be compiled by PGS Heritage and Grave Relocation Consultants (PGS) for the proposed Humansrus Project will assess the heritage resources found on site. This report will contain the applicable maps, tables and figures as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consisted of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the Heritage Scoping Report completed by PGS for this site.

- Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by qualified archaeologists444qsddd'='[', aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

- Step III – The final step involved the recording and documentation of relevant archaeological resources, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and constructive recommendations

The significance of heritage sites was based on four main criteria:

- **site integrity** (i.e. primary vs. secondary context),
- **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
    - Density of scatter (dispersed scatter)
        - Low - <10/50m^2
        - Medium - 10-50/50m^2
        - High - >50/50m^2
- **uniqueness** and
- **potential** to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate pylon position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

- Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report.

Table 2: Site significance classification standards as prescribed by SAHRA

FIELD RATING	**GRADE**	**SIGNIFICANCE**	**RECOMMENDED MITIGATION**
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Grade 4A (GP.A)	-Grade 4A	High / Medium Significance	Mitigation before destruction
Grade 4B (GP.B)	Grade 4B	Medium Significance	Recording before destruction
Grade 4C(GP.A)	Grade 4C	Low Significance	Destruction

Appendix E

THE SIGNIFICANCE RATING SCALES FOR THE EIA

IMPACT ASESSMENT METHODOLOGY

Determination of Impact Significance

The information presented above in terms of identifying and describing the aspects and impacts is summarised in tabular form and significance is assigned with supporting rational.

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which has already been assessed by the relevant specialist as and when required.

In order to assess the significance of each impact, the following ranking scales will be employed:

Table 1: Impact Significance Ranking Scales

PROBABILITY:	DURATION:
5 - Definite/don't know 4 - Highly probable 3 - Medium probability 2 - Low probability 1 - Improbable 0 - None	5 - Permanent 4 - Long-term (impact ceases after the operational life of the activity) 3 - Medium-term (5-15 years) 2 - Short-term (0-5 years) 1 - Immediate
SCALE:	**MAGNITUDE:**
5 - International 4 - National 3 - Regional 2 - Local 1 - Site only	10 - Very high/don't know 8 - High 6 - Moderate 4 - Low 2 - Minor 0 - None

Once the above factors had been ranked for each impact, the overall significance of each impact was assessed using the following formula:

(Potential Significance) = (*Magnitude* + *Duration* + *Scale*) x *Probability*

The potential significance (PS) has a maximum rating of 100 points. Environmental impacts are rated as having either a High(H), a Moderate(M) or a Low(L) significance according to the following scale:

PS ≥ 60 = High Environmental Significance

60 < PS ≥ 30 = Moderate Environmental Significance

PS < 30 = Low Environmental Significance

Significance will thus be classified according to the following:

- **Low:** Low Environmental Significance – Mitigation easily achieved or little is required;
- **Moderate:** Moderate Environmental Significance – Mitigation is both feasible and fairly easily possible; and
- **High:** High Environmental Significance – Adverse Impact. Mitigation, if possible, is often difficult, expensive and time consuming.

The Potential Environmental Impact Significance can then be calculated for each impact at the various stages of the project before and after mitigational measures are implemented. The various stages of the project can be classified as follows:

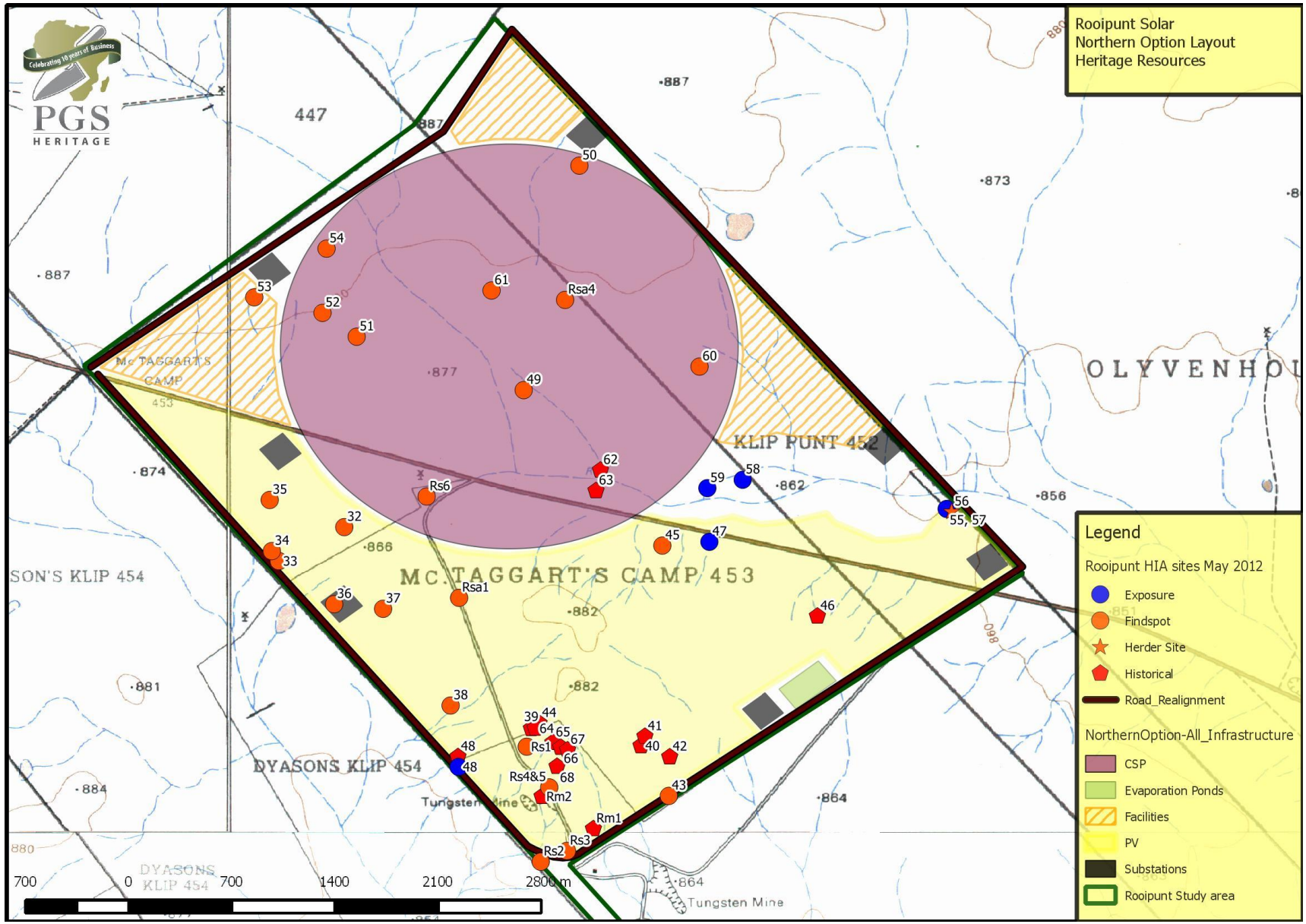
- Construction Phase before mitigation,
- Construction Phase after mitigation,
- Operational Phase before mitigation,
- Operational Phase after mitigation,
- Closure Phase before mitigation,
- Closure Phase after mitigation.

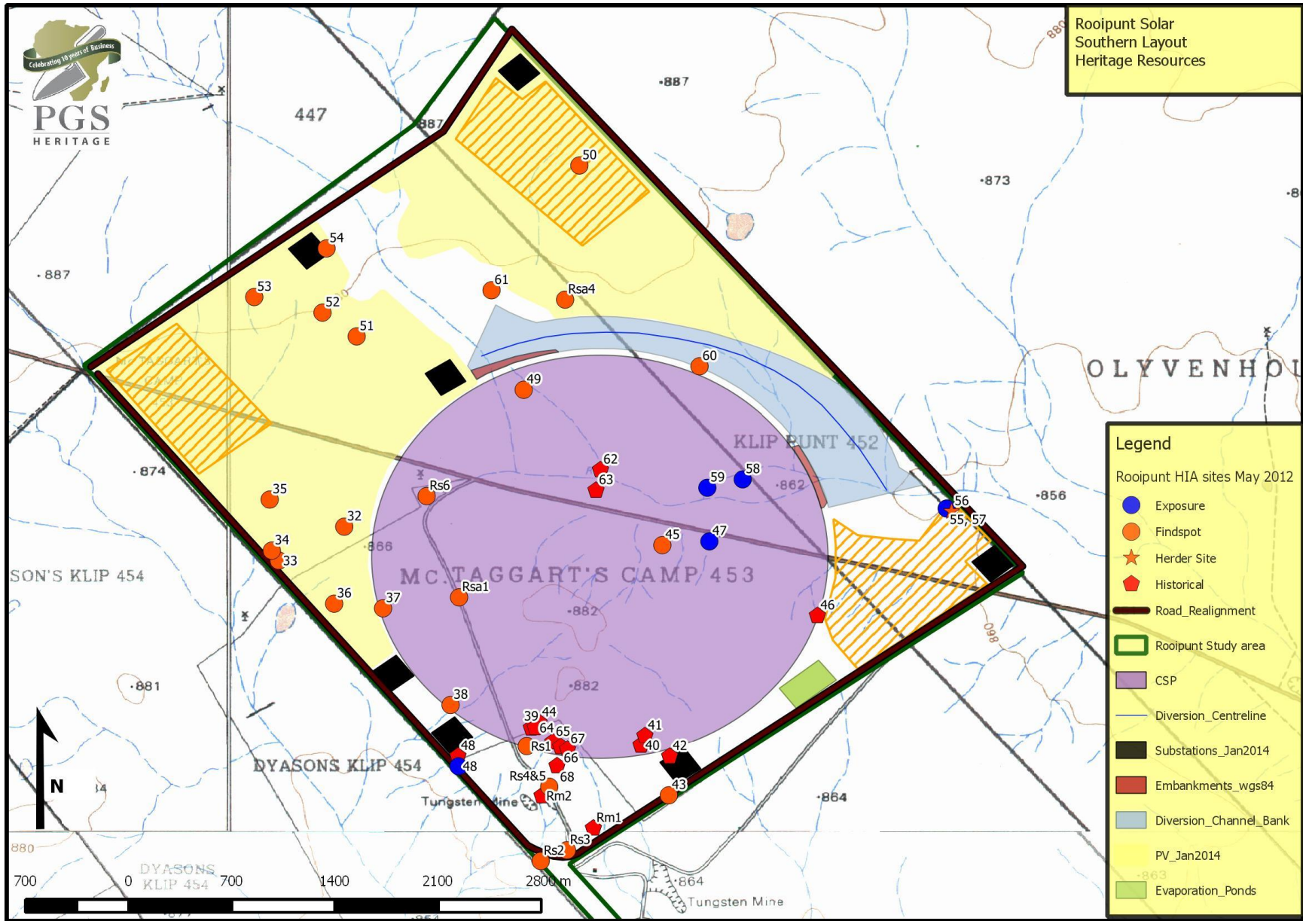
The Potential Environmental Impact Significance will be calculated using the following matrix:

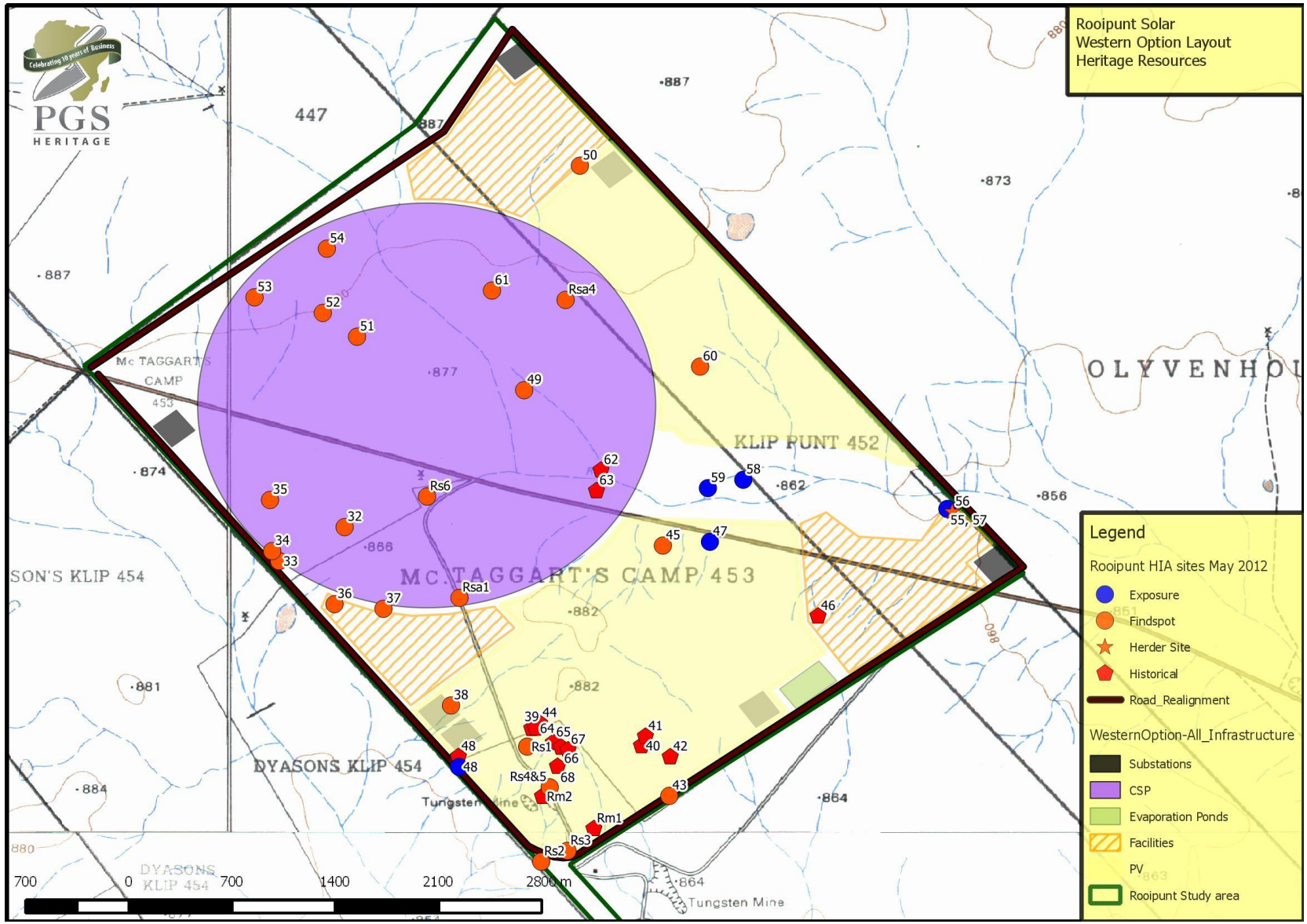
POTENTIAL ENVIRONMENTAL	CRITERIA					S	SIGNIFICANCE		
IMPACT	Nature	P	D	S	M	TOTAL	L	M	H
CONSTRUCTION	-	3	4	2	4	30		M	
CONSTRUCTION MITIGATION	+	3	1	1	2	12	L		
OPERATON	-	3	1	1	4	18	L		
OPERATION MITIGATION	-	3	1	1	2	12	L		
CLOSURE	+	2	1	1	2	8	L		
CLOSURE MITIGATION	+	2	1	1	2	8	L		

Appendix F

LAYOUT OPTIONS WITH HERITAGE SITES


Rooipunt Solar
Northern Option Layout
Heritage Resources
PGS HERITAGE
Celebrating 10 years of Business
MC TAGGART'S CAMP 453
KLIP PUNT 452
DYASONS KLIP 454
SON'S KLIP 454
OLYVENHOU
Tungsten Mine
Legend
Rooipunt HIA sites May 2012
Exposure
Findspot
Herder Site
Historical
Road_Realignment
NorthernOption-All_Infrastructure
CSP
Evaporation Ponds
Facilities
PV
Substations
Rooipunt Study area
700 0 700 1400 2100 2800 m


Rooipunt Solar
Southern Layout
Heritage Resources
PGS HERITAGE
Celebrating 10 years of Business
Legend
Rooipunt HIA sites May 2012
Exposure
Findspot
Herder Site
Historical
Road_Realignment
Rooipunt Study area
CSP
Diversion_Centreline
Substations_Jan2014
Embankments_wgs84
Diversion_Channel_Bank
PV_Jan2014
Evaporation_Ponds
KLIP PUNT 452
MC.TAGGART'S CAMP 453
DYASONS KLIP 454
SON'S KLIP 454
OLYVENHOL
Tungsten Mine
N
700 0 700 1400 2100 2800 m


Rooipunt Solar
Western Option Layout
Heritage Resources
PGS HERITAGE
Celebrating 10 years of Business
Mc TAGGARTS CAMP 453
KLIP RUNT 452
MC TAGGART'S CAMP 453
SON'S KLIP 454
DYASONS KLIP 454
OLYVENHOU
Tungsten Mine
Legend
Rooipunt HIA sites May 2012
Exposure
Findspot
Herder Site
Historical
Road_Realignment
WesternOption-All_Infrastructure
Substations
CSP
Evaporation Ponds
Facilities
PV
Rooipunt Study area
700 0 700 1400 2100 2800 m