MAINSTREAM RENEWABLE POWER

Eleven Solar PV Facilities and Supporting Electrical Infrastructure near Dealesville in the Free State Province Proposed by Mainstream Renewable Power Developments (Pty) Ltd.

HERITAGE IMPACT ASSESSMENT

CSIR Report No.:
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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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SPECIALIST CV

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Birth date and place:	22 June 1976, Cape Town, South Africa
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Languages spoken:	English and Afrikaans

EDUCATION

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

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

EMPLOYMENT HISTORY

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

MEMBERSHIPS

South African Archaeological Society Council member	2004 -
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 -
ASAPA Cultural Resources Management Section member	2007 -
UCT Department of Archaeology Research Associate	2013 -
Heritage Western Cape APM Committee member	2013 -

PROFESSIONAL ACCREDITATION

ASAPA membership number: 233, CRM Section member

Principal Investigator: Coastal shell middens (awarded 2007)
Stone Age archaeology (awarded 2007)
Grave relocation (awarded 2014)

Field Director: Rock art (awarded 2007)
Colonial period archaeology (awarded 2007)

FIELDWORK AND PROJECT EXPERIENCE

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

Phase 1 surveys and impact assessments:

- Project types
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies and impact assessments
  - Phase 1 test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

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

SPECIALIST DECLARATION

I, Jayson Orton, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Signature of the specialist: 

Name of company: ASHA CONSULTING (PTY) LTD

Professional Registration (including number): ASAPA CRM Section No. 233

Date: 18 DECEMBER 2014

EXECUTIVE SUMMARY

This study examines eleven proposed solar PV facilities and their associated electrical infrastructure. The study area is already strongly characterised by power lines and two large substations are present. The proposed land use is thus consistent and, in general, impacts are expected to be of low to very low significance for all types of heritage if mitigation is successfully implemented. The one exception is living heritage which will be difficult to mitigate and final decision-making in this regard needs to consider both the social impact assessment and the public participation process.

Braambosch Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on flat terrain with very few heritage resources. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase. It would be desirable to avoid the tree line, but this is not required.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Boschrand 2 Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on flat terrain with a low rocky ridge along the eastern edge of the site. Very few heritage resources occur. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase. Avoidance of the rocky ridge is preferable but not specifically required.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Eksteen Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on fairly flat terrain but a low rocky hill lies in the south-eastern corner of the site. Very few heritage resources occur, with most clustered on the rocky hill. The main concerns are palaeontology, which will require a pre-construction site inspection to locate any sensitive geological features that may require mitigation during the construction phase; a historical ruin that will require recording; and a possible grave that will require testing and, if positive, exhumation. Avoidance of the rocky hill is strongly advised, but not required. This measure would result in all mitigation except the palaeontological inspection falling away.

It should be noted that a historical structure and Stone Age rock engravings occur nearby and could be subjected to secondary impacts.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Grave	*Low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Irene Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on flat terrain with very few heritage resources. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Kentani Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on flat terrain with very few heritage resources. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Klipfontein Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on fairly flat terrain with several minor rock outcrops, especially in the higher-lying parts of the site. There are few physical heritage resources but living heritage is found across the site. The primary concerns are palaeontology which will require a pre-construction site inspection to locate any sensitive geological features that may require mitigation during the construction phase; archaeology which will require excavation/collection of artefact scatters; a possible grave in the southern part of the project area that will require testing and, if positive, exhumation; and living heritage that will require mitigation as guided by the social impact assessment. Authorisation of this project may not be appropriate because of the difficulty of mitigating the traditional land use (living heritage).

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Grave	*Low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*
Living heritage	*Low*	*Low*	*Very low*

Klipfontein 2 Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on fairly flat terrain but with several minor rock outcrops in the higher-lying part of the site. There are few physical heritage resources but living heritage is found across the site. The primary concerns are palaeontology, which will require a pre-construction site inspection to locate any sensitive geological features that may require mitigation during the construction phase; and living heritage that will require mitigation as guided by the social impact assessment. Authorisation of this project may not be appropriate because of the difficulty of mitigating the traditional land uses (living heritage).

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*
Living heritage	*Low*	*Low*	*Very low*

Meeding Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on flat terrain with very few heritage resources. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase. It would be desirable to avoid the tree line, but this is not required.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Sonoblomo Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on flat terrain with very few heritage resources. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Leliehoek Solar PV Facility and Supporting Electrical Infrastructure

This facility lies on flat terrain with very few heritage resources. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase.

It should be noted that a very significant late Holocene Stone Age site with rock engravings occurs nearby (although on a neighbouring farm), and could be subjected to indirect impacts.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

Transmission line corridor (including proposed locations of the collector substations)

The transmission line corridor and collector substations lie on generally flat terrain with very few heritage resources. The primary concern is palaeontology and a pre-construction site inspection will be required to locate any sensitive geological features that may require mitigation during the construction phase. It would be desirable to avoid tree lines, including the planted farm boundary located across the western substation site, although this is not required.

After the required mitigation the significance of impacts is expected to be as indicated below:

	Construction Phase	Operation Phase	Decommissioning Phase
Palaeontology	*Low*	*Very low*	*Very low*
Archaeology	*Very low*	*Very low*	*Very low*
Cultural landscape	*Low*	*Low*	*Very low*

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

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

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 20 000 years ago.

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

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

Hominin: a group consisting of modern humans, extinct species of humans and all their immediate ancestors.

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

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

Patina: the altered surface of an artefact which is due to chemical and physical weathering.

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

Werf: Afrikaans word commonly used to refer to a farm complex and all its related structural elements.

ABBREVIATIONS:

ASAPA: Association of Southern African Professional Archaeologists

CRM: Cultural Resources Management

CSIR: Council for Scientific and Industrial Research

EIA: Environmental Impact Assessment

ESA: Early Stone Age

GPS: global positioning system

HIA: Heritage Impact Assessment

LSA: Later Stone Age

MSA: Middle Stone Age

MW: mega-watt

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

PV: photo-voltaic

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

1 INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by the Council For Scientific and Industrial Research (CSIR) to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed development of six 100 MW and five 75 MW photo-voltaic (PV) solar energy facilities to the west of Dealesville in the Free State Province (Figure 1). Table 1 indicates the names and numbers of the farms on which development is proposed and the names of the solar energy facilities that have been proposed on those farms. Figure 2 shows the locations of the proposed facilities by name; they are labelled numerically in the order in which they are dealt with in this report.

Table 1: List of farms and solar energy facilities.

Map letter (from Fig. 1)	Farm name & number	Extent of farm / farm portion	Associated PV facilities and facility number (from Figure 2).
A	Walkerville 1031/1	158.5	(10) Sonoblomo
	Walkerville 1031/rem	438.8	(10) Sonoblomo
B	Overschot 31	340.3	(10) Sonoblomo
C	Oxford 1030/rem	383.1	(6) Kentani; (7) Klipfontein
D	Kentani 953	622.2	(7) Klipfontein
E	Constantia 751	856.5	(11) Leliehoek
F	Leliehoek 748	856.5	(11) Leliehoek
G	Klipfontein 305/rem	unknown	(7) Klipfontein; ((8) Klipfontein 2
H	Doornrandjes 546	856.5	(4) Eksteen
I	Braklaagte 149	815.7	(1) Braambosch
J	Boschrand 148	unknown	(2) Braklaagte; (3) Boschrand 2
K	Rosseau 1154	462.5	(9) Meeding
L	Klein Begin 1463	unknown	(5) Irene
M	Irene 1183	341.2	(5) Irene
N	Braambosch 198/rem	410.2	(1) Braambosch

1.1 Project description

Twelve different solar PV projects have been proposed on neighbouring farms. Each facility would have a maximum generating capacity of 100 MW or 75 MW and include the following infrastructure:

- Solar panels over an area of between 300 ha and 400 ha;
- Collector substation;
- 33 kV distribution power line; and
- 275 kV or 400 kV transmission power line.

The twelve projects would be operated together from a single control centre. Shared infrastructure includes the following:

- Transformer unit building;
- An operational control centre;
- An office;
- A warehouse/workshop for spares and maintenance equipment;
- Ablution and welfare facilities;
- Security enclosures; and possibly
- An on-site substation.

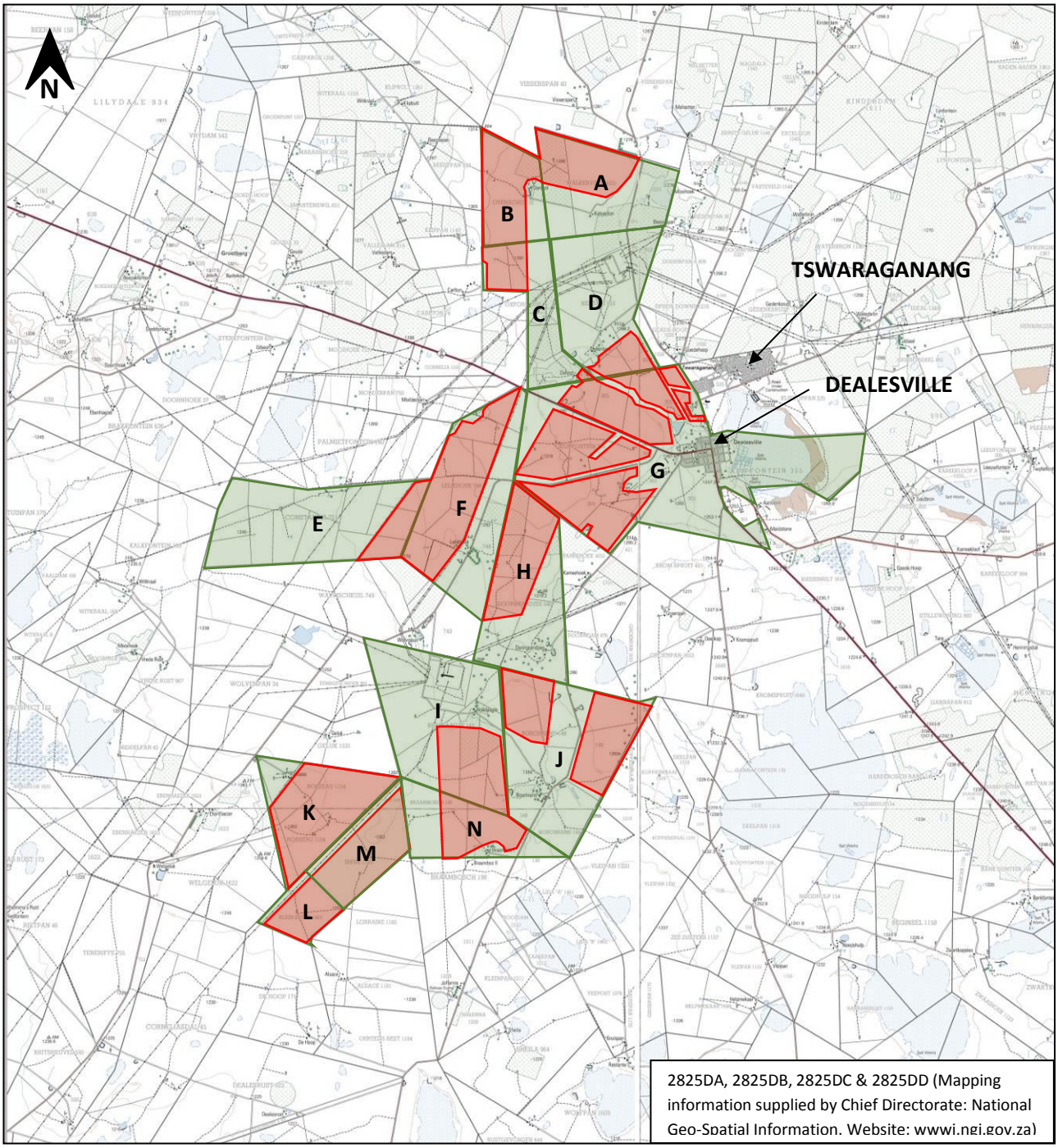

Figure 1: Location of the study area. The farms (numbered A to N in their approximate centres) are outlined in green, while the red polygons indicate the study area for development of the solar energy facilities.

The buildings are expected to be one storey high, although the workshop might be up to 5m high with a maximum footprint of about 2500 m^2.

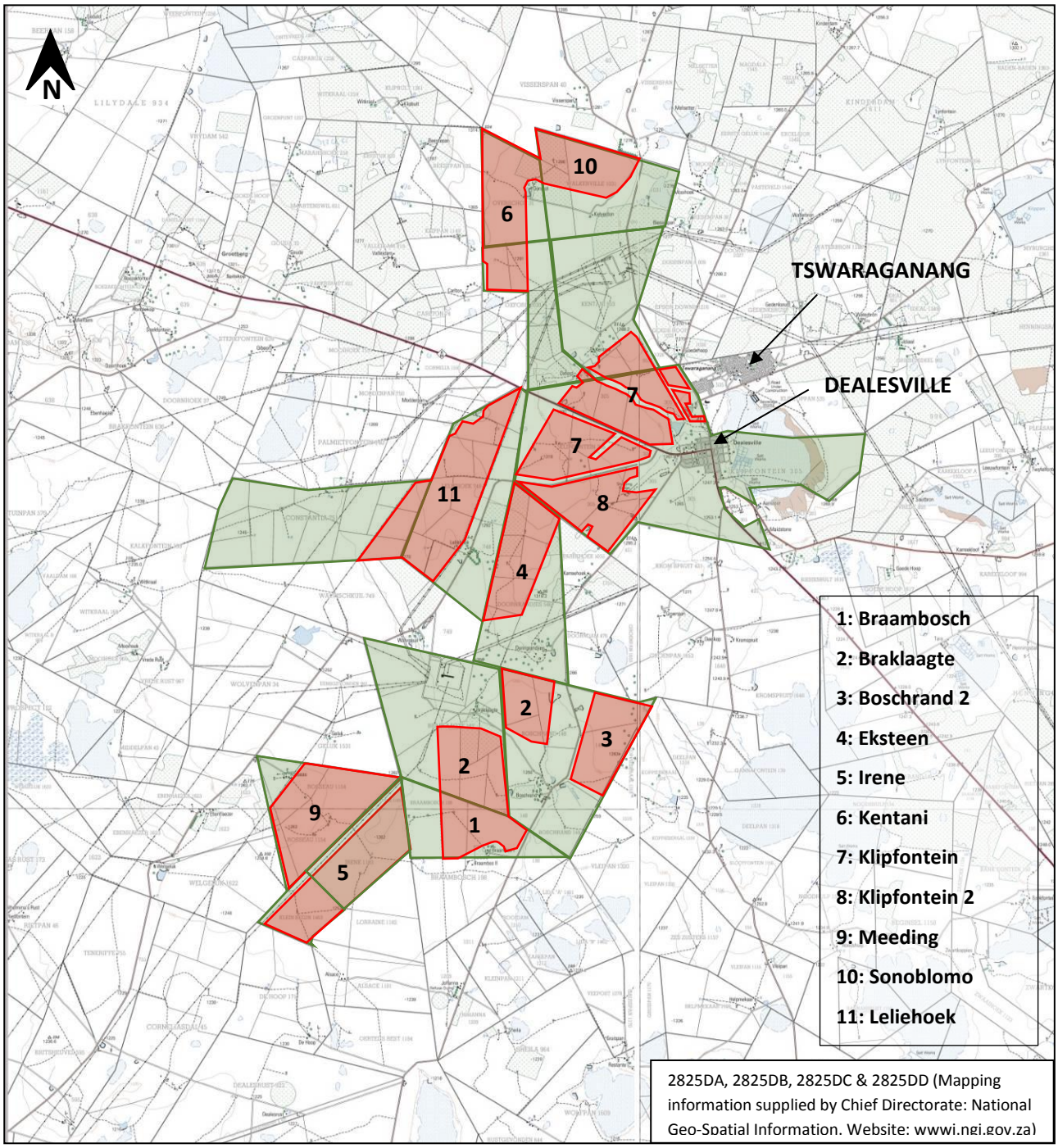

Figure 2: Location of the study area. The farms are outlined in green, while the red polygons indicate the study area for development of the solar energy facilities (numbered 1 to 11 in their approximate centres and in the order in which they are dealt with in this report). Note that projects 2 (Braklaagte) and 7 (Klipfontein) cover two or more proximate areas.

At present, two distribution and transmission options are being explored as follows:

- 33kV underground distribution lines connecting directly to either a northern or a southern collector substation (to be constructed), where the voltage will be stepped up to 275kV or 400kV and transmitted via an overhead transmission line to either the Perseus or Beta Substation; or

- 33kV underground distribution lines connecting to an on-site substation where the voltage will be stepped up to 132kV and transmitted via a 132kV overhead or underground line to a collector substation (to be constructed) located close to either the Perseus or Beta substation where the voltage will be stepped up to 275kV or 400kV and transmitted via a 275kV or 400kV overhead line to Perseus or Beta.

Note that no location alternatives are available and that, for impact assessment purposes, the above proposal reflects Alternative 1. Alternative 2 would be the No-Go alternative.

1.2 Terms of reference

ASHA Consulting (Pty) Ltd was requested to produce a Heritage Impact Assessment including archaeology, palaeontology, built environment, graves, cultural landscapes and scenic routes (but excluding a Visual Impact Assessment). The buildable areas, electrical servitudes and collector substation locations are all to be assessed.

It should also be noted that, following S.38(3) of the National Heritage Resources Act (No. 25 of 1999), all heritage resources should be identified and assessed.

1.3 Scope and purpose of the report

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

1.4 The author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in the Western Cape and Northern Cape provinces of South Africa since 2004. He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is accredited with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233).

1.5 Declaration of independence

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

2 HERITAGE LEGISLATION

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

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

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

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

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list "historical settlements and townscapes" and "landscapes and natural features of cultural significance" as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value.

Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted. This report fulfils that requirement.

Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to an Environmental Impact Assessment. The South African Heritage Resources Agency (SAHRA for archaeology and palaeontology) and Heritage Free State (for built environment and landscapes) are required to provide comment on the proposed project in order to facilitate final decision making by the DEA.

3 APPROACH AND METHODOLOGY

3.1 Objectives

The aim of this study was to identify any sensitive heritage features that might occur within and in close proximity to the proposed developments and which might thus be impacted by them. It also aims to identify any measures that can be taken to reduce or mitigate these impacts.

3.2 Methodology

3.2.1 Literature survey

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, particularly from the South African Heritage Resources Information System (SAHRIS).

3.2.2 Field survey

The eleven sites were subjected to a broad survey undertaken by vehicle and on foot as appropriate, while surrounding roads were driven to assess the cultural landscapes and views to and from the sites. The vehicle survey was aimed primarily at understanding the landscape, while the foot component aimed to understand the distribution of heritage resources within the landscape. This is essential for such a large study area because it is impossible to examine the entire area in detail. It should also be noted that although the survey focused on assessing the footprint areas, it was also necessary to visit obvious locations close by where any heritage sites present might be subjected to contextual (visual) impacts. The fieldwork took place over six days from 20th to 25th August 2014 with a seventh day on 11 December 2014 used to fill a gap in the survey. During the survey the positions of finds were recorded on hand-held GPS receivers set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed developments. Because of the very large size of the study area, all farms were examined at a superficial level at first with certain areas then returned to for a more detailed survey as appropriate.

Some land owners took us to heritage sites on their farms that they were aware of – these were generally outside of the foot print areas.

3.2.3 Impact assessment

For consistency, the impact assessment was conducted through application of a scale supplied by the CSIR and described within the EIA report.

3.3 Assumptions

It was assumed that archaeological resources are likely to be most common in rocky areas and, in particular, around pans.

3.4 Limitations

The study is carried out at the surface only and hence any completely buried archaeological sites will not be readily located. The extensive grass cover posed a severe limitation on the survey and it is deemed quite likely that isolated artefacts and perhaps even larger scatters could have gone unnoticed. Work in the surrounding landscape suggests that such material is unlikely to be of high significance though.

3.5 Project team

The survey was carried out by Dr Jayson Orton and Carol Orton, with assistance provided by various landowners who pointed out heritage resources they knew of on their properties. Wesley Flear provided assistance on the final day of survey.

4 PHYSICAL ENVIRONMENTAL CONTEXT

4.1 Site context

The area in which the twelve solar facilities have been proposed lies immediately to the northwest, west and southwest of the small town of Dealesville. Two large substations already exist in the area, Perseus to the northwest and Beta to the southwest of the town. A large number of power lines feed into and out of these substations and cross parts of the study area.

4.2 Site description

Features common to all or most of the farms are summarised, whereafter special features of each individual farm are provided. These are accompanied by photographs of the farms.

The general vicinity of Dealesville is very flat with extensive tracts of open grassland and numerous large pans. However, close to and southwest of the town there are a number of rocky koppies. The soil is orange, coloured by the dolerite that breaks the surface in many areas. Calcrete is also common just beneath the surface with exposures visible at times where the cover sands have eroded away. The landscape is quite strongly characterised by electrical infrastructure as noted above.

4.2.1 Overschot

This farm is very flat and has large areas of old agricultural lands in the northwest (Figure 3) and south (Figure 4).

Figure 3: View north on Overschot showing old agricultural lands in the northwest.

Figure 4: View southeast on Overschot towards the Perseus Substation.

4.2.2 Walkerville

This farm is very flat; the only feature is a cluster of trees around the old homestead (Figure 5). A pan occurs on the easternmost part of the farm but this falls outside of the study area.

Figure 5: View towards the south across Walkerville. The Perseus Substation lies beyond the trees on the left.

4.2.3 Oxford

This farm is again very flat (Figure 6), although the land rises gently towards the west. A number of power lines cross the farm.

Figure 6: View towards the east across the northern part of Oxford. The Perseus Substation is visible in the distance, although it lies on the neighbouring farm.

4.2.4 Kentani

The northern part of this farm where one of the substation options lies is old agricultural lands. Thi is just north of the existing Perseus Substation which lies on Kentani (Figures 7 & 8).

Figure 7: View towards the south on the northern part of Kentani showing old agricultural lands and the Perseus Substation.

Figure 8: View over the southern part of Kentani towards the Perseus Substation to the north.

4.2.5 Constantia

A particular feature of this farm is the presence of a perennial spring along the northern boundary of the farm (Figure 9). It is surrounded by trees and the original farm werf lies to its south. The study area, however, is just a thin strip of flat, open grassland along the eastern edge of the farm.

Figure 9: The spring on Constantia.

4.2.6 Leliehoek

This farm is largely flat, open grassland (Figure 10), but in one area a large number of dark-coloured dolerite boulders is present on the surface (Figure 11). Low outcrops of dolerite are present in other areas, while in the northern part of the farm the very eastern end of a low dolerite ridge just protrudes into the property.

Figure 10: View towards the north across the open grassland on Leliehoek.

Figure 11: View of the area in which many small dolerite boulders lie scattered on the surface on Leliehoek.

4.2.7 Klipfontein

The town of Dealesville was built on a portion of Klipfontein. The vast majority of the remaining portions of the farm lie to the west of the town. The land has the appearance of being town commonage and a number of huts and stock kraals are present scattered about the central and southern parts of the study area (Figures 12 & 13). A feature of this farm is the large but low dolerite hill that lies in the northern part of the Klipfontein 2 study area (Figure 14), while a number of small dolerite outcrops occur in the Klipfontein 1 (Figures 12 & 13), and to a lesser degree, Klipfontein, study areas. Some of these have very dark coloured boulders on them but in other areas the dolerite is well-weathered and orange-brown in colour. The northern half of the farm and its southern margins are far more typical of the surrounding countryside; they are flat and covered in dense grass (Figures 15 & 16).

Figure 12: View across the central part of Klipfontein with a stock post in the middle ground. This is in the Klipfontein 1 study area.

Figure 13: One of the small houses present in the Klipfontein 1 study area. The photograph is taken from one of the many rocky hills on the farm.

Figure 14: View towards the east across the rocky central part of Klipfontein (in the Klipfontein 2 study area). Dealesville is on the skyline in the left part of the photograph.

Figure 15: View towards the east across the northern part of Klipfontein (in the Klipfontein study area). The trees on the right surround a borrow pit.

Figure 16: View towards the east across the north-eastern part of Klipfontein (in the Klipfontein study area). The Tswaraganeng township is visible to the east.

4.2.8 Doornrandjes

This farm is topographically varied with the result that it presents a more visually stimulating landscape. The south-eastern part of the study area has a dolerite outcrop and is generally far more bushy than elsewhere (Figure 17), while further south and southeast several more such outcrops occur. To the north and west of the rocky areas, however, the farm is completely flat and coated in thick grass (Figures 18 & 19).

Figure 17: View towards the north from the largest dolerite koppie just to the south of the Eksteen study area at Doornrandjes.

Figure 18: View towards the northwest across the northern part of Doornrandjes.

Figure 19: View towards the east across the southern part of the Doornrandjes study area towards the low dolerite hill (partially visible at far left behind the bushes).

4.2.9 Walvischkuil

This flat, well-grassed farm lies just north of the Beta Substation and has many power lines crossing it (Figure 20).

Figure 20: View southwards towards the farm werf (in the trees) on Walvischkuil. The Beta substation is visible in the background on another farm.

4.2.10 Braklaagte

This farm appeared to be particularly flat and has very dense grass (Figure 20). The Beta Substation lies on the northern part of this farm and as a result any power lines cross it (Figure 21).

Figure 20: View across the dense grass in the Braklaagte study area.

Figure 21: View northwards showing power lines on Braklaagte feeding into Beta Substation.

4.2.11 Boschrand

This farm lies south of the Beta Substation. The vast majority is very flat and covered in thick grass and small bushes (Figure 22). However, its eastern boundary is formed by a long, low dolerite ridge that has many larger bushes and small trees growing on it (Figure 23).

Figure 22: View towards the northeast across the Boschrand.

Figure 23: View north from near the eastern western part of boundary of Boschrand showing the bushy ridge rising from the flat plains.

4.2.12 Rossouw

As with the other southern farms, this property is very flat and completely lacking in surface features. A line of trees (planted by the present owner's parents) is all the breaks the skyline (Figure 24).

Figure 24: View towards the east showing the tree line on Rossouw.

4.2.13 Klein Begin and Irene

These two smaller farms are treated together. Located in the far south of the study area, they are completely lacking in topography and coated only in grass (Figure 25).

Figure 25: View across the featureless landscape at Klein Begin and Irene.

4.2.14 Braambosch

Also lying in the south, this entire farm is completely flat and coated in thick grass, but one line of trees cuts the western part of the study area and, as on other farms, bare patches of sand are evident in areas where livestock have congregated (Figure 26). The eastern part of the study area had occasional calcrete outcrops and small bushes were present amongst the grass.

Figure 26: View towards the east across Braambosch showing the tree line that forms the only feature away from the farm werf.

5 CULTURAL HERITAGE CONTEXT

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

Not much heritage work has been carried out in the vicinity of Dealesville and some of the reports that were available for consultation are not very informative. However, the following review was compiled.

5.1 Palaeontological aspects

In terms of palaeontology, the study area is mapped on SAHRIS as being underlain by geological rock units with varying sensitivity. Although there are no areas of very high sensitivity, the area does include patches of high and moderate sensitivity. Some areas are known to be unfossiliferous and thus of no sensitivity at all. Figure 27 illustrates this.

Figure 27: Palaeontological sensitivity map from SAHRIS (Orange = high sensitivity, Green = moderate sensitivity, grey = zero sensitivity. Note that the dark grey/blue patches are pans showing through the sensitivity layer (these are generally within the orange areas).

There are some important fossil sites in the greater region and thus the chance of finding material of significance does exist. Florisbad is a very well-known fossil locality lying some 35 km to the east of the present study area. Here an early human cranium was recovered in 1932 (Dreyer 1935; Rightmire 1978) while mid-Pleistocene fauna and Middle Stone Age stone artefacts have also been recovered (Brink 1987; Dreyer 1938). Because of its importance in terms of both palaeontology and archaeology, Florisbad has been declared a Provincial Heritage Site (SAHRIS n.d.). Erfkroon is another important fossil site that lies along the Modder River some 15 km southwest of the southern end of the present study area. The fossils occur over a large area and are revealed in erosion gullies. Stone artefacts from the earlier part of the Middle Stone Age (MSA) and from the Later Stone Age (LSA) have also been found associated with the bones in places (Churchill *et al*. 2000).

5.2 Archaeological aspects

Stone Age material occurs widely across southern Africa, while the Iron Age, which only occurred within the last 2000 years, is present only in the eastern parts where summer rainfall allowed for the raising of summer crops. Stone-walled settlements dating to the Iron Age have been widely documented in parts of the Free State and adjacent Northern Cape (Maggs 1976a, 1976b) but the Iron Age appears to be absent from the immediate study area and its surrounds. Later Stone Age stone-built dwellings occur along the Riet River to the west (Humphreys 1972, 2009). With the exception of the rich MSA deposits of Florisbad (Kuman *et al*. 1999) and the MSA and LSA stone artefact assemblages from Erfkroon (Churchill *et al*. 2000), archaeological resources appear to be quite rare in this flat, open and well-grassed landscape. Archaeological material is, however, more common along the major rivers where artefacts are revealed in the river terrace gravels. Webley (2010) surveyed an area to the southeast of the present study area and reported a complete absence of any archaeological material of any sort. She further noted that stone suitable for the manufacture of flaked tools was not present and that the quantity of other rock available on the surface was insufficient to allow for the construction of stone dwellings. Hutten's (2011) survey of land to the north of Boshoff showed similar results but in that case a pan was present with a large scatter of MSA and LSA artefacts present alongside it. This demonstrates the preference to settle close to water sources that is prevalent across much of the relatively dry interior of southern Africa.

Rock engravings occur widely in the interior of South Africa where suitable rock exists. Many sites are located in the Free State with the National Museum, Bloemfontein (2014) listing numerous examples that may be visited by the public. However, neither that museum not the McGregor Museum in Kimberley has any records for the vicinity of Dealesville.

5.3 Historical aspects and the built environment

Historical resources will be primarily associated with farmsteads, although most are likely to be fairly recent, perhaps dating to the late 19th or early 20th centuries. The town of Dealesville is relatively recent, dating to 1899 (Raper n.d.). It was laid out on the farm Klipfontein belonging to John Henry Deale and was awarded municipal status in 1914. The second Anglo-Boer War (1899-1902) played a significant role in South African History, particularly in the interior of the country. Many battles were fought between the British and Boer forces. Significant battles in proximity to the present study area include the Battles of Modder River and Magersfontein 100 km to the southwest and west respectively, the Battle of Paardeberg 60 km to the southwest and the Battle of Driefontein just outside Bloemfontein, some 60 km to the southeast. Graves, graveyards and memorials across the central interior of South Africa serve as reminders of the war.

6 FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the study area during the course of the project. A full listing of all heritage resources encountered during the ground survey is contained in Appendix 1, while Appendix 2 maps their spatial locations. Note that only a brief summary of the palaeontological heritage is included here, and that a full palaeontological specialist desktop study, compiled by Lloyd Rossouw (2014), is available separately. Sections 6.1 to 6.6 discuss broadly the types of heritage found in the overall study area, while Section 6.7 summarises the resources that could potentially be impacted in the individual study areas for each of the twelve proposed facilities.

6.1 Palaeontology

The study area lies within the outcrop belt of the Middle Permian Tierberg Formation (Ecca Group) which is a generally poorly fossiliferous shale. It is thus only of moderate palaeontological sensitivity. The main fossils expected in the Tierberg Formation are trace fossils, fragmentary fish remains and, in the upper parts of the formation, plant remains that include petrified wood and leaves. The diversity of the assemblages is generally low. Dolerite dykes and sills occur throughout the area and are not palaeontologically significant (Rossouw 2014).

Quaternary alluvial deposits along major river courses and deposits related to springs and pan dunes are of high palaeontological sensitivity. Fossils found in these deposits include collections of mammalian teeth and bones, coprolites, freshwater molluscs and plant microfossils, as well as isolated specimens and even fossilised hyena burrows. Particularly notable are the banks of the Modder River. Fossil hyena lairs can also be found away from present river valleys and might be associated with pan dunes and spring deposits. In contrast, sediments related to ephemeral water courses or deposits accumulated through sheet wash have low sensitivity (Rossouw 2014).

6.2 Archaeology

6.2.1 Artefact scatters

A number of artefact scatters related to the MSA were noted in various parts of the study area, while even more widespread were individual MSA artefacts. These were all found in areas where the surface had become denuded and often eroded and this suggests that these artefacts are generally beneath the surface sands and could in fact be far more common than is expected. The context is essentially secondary, with the artefact accumulations having been the result of erosion, deflation and reburial; they could thus be referred to as background scatter. Despite this, some of the scatters are dense enough to merit mitigation because a large enough collection could be made to be informative about the local MSA. Figures 28 to 33 show various examples of scatters of MSA artefacts located across the study area with Figure 31 showing the context of one of them. The majority are in the central area, close to the rockier part of the landscape. The artefacts are all made on a rock type known as hornfels. This rock forms a very clear patina with the result that the original dark colour initially becomes lighter then gradually turns orange or brown. This allows a relative sequence to be created by assuming the darker, blacker artefacts to be younger and the browner ones to be older. Comparison of the artefacts in Figure 30 (which has older MSA material) and Figure 32 (which has younger MSA material) makes this clear. In Figure 33 the strong contrast in colour between MSA and LSA artefacts is also evident.

Figure 28: MSA hornfels artefacts from a lightly eroding area on Leliehoek (point 081). The scale bar is in 10 mm intervals.

Figure 29: MSA hornfels artefacts found associated with an outcrop of calcrete on Braklaagte (point 089). The scale bar is in 10 mm intervals.

Figure 30: A large collection of MSA hornfels artefacts found in an eroding context on Klipfontein (point 092). The scale bar is in 10 mm intervals.

Figure 31: The eroding area in which the artefacts shown in Figure 30 were found.

Figure 32: MSA hornfels artefacts found along an ephemeral stream where the banks are eroding and revealing buried artefacts. This location is on Klipfontein (point 164). The scale bar is in 10 mm intervals.

Figure 33: Collection of MSA (brown coloured) and LSA (darker coloured) artefacts from the crest of the hill in the western part of Klipfontein (point 094). The site has been disturbed by the construction of a cell phone tower on the hill. The scale bar is in 10 mm intervals.

Artefact scatters pertaining to the LSA were less common but nonetheless still present on the landscape. They tended far more strongly to be associated with features on the landscape. Examples of such features include the crest of the hill on Klipfontein (point 094; Figure 33), the spring on Constantia (point 069;

Figure 34), the hilltops on Doornrandjes (points 107 & 114) and the hilltop with its small pan on Modderfontein, just outside the western boundary of Leliehoek (point 146). These sites, because of their landscape features, are generally well out of the way of the potential development areas.

Figure 34: Scatter of LSA and historical artefacts associated with the spring on Constantia (point 069). The LSA artefacts are mostly in hornfels, but one large flake in another material (probably dolerite) was also present. The scale bar is in 10 mm intervals.

Scatters of historical artefacts were also noted. These were generally associated with sites that included some structural remains. The original farmstead on Constantia was located close to the spring there and a number of historical artefacts were found in the general area of the old werf and spring (Figure 34 & 35), although a comprehensive survey of this area was not carried out. Figure 36 shows artefacts found near small stone ruins at the foot of a rocky hill on Doornrandjes.

Figure 35: Historical artefacts found associated with an ash heap alongside a small stone foundation on Constantia (point 071). The scale bar is in 10 mm intervals.

Figure 36: Historical artefacts found in association with small ruined structures on Doornrandjes (points 137-8). The scale bar is in 10 mm intervals.

6.2.2 Rock engravings and graffiti

A number of rock engravings were found in the central, rocky portion of the study area. These relate to both the naturalistic and geometric rock art traditions said to have been made by the Bushmen and Khoekhoen respectively. On the summit of a hill on Doornrandjes there is a boulder with two antelope engraved on it. The lower of the two is clearly an eland, while the upper, less well preserved, one is most likely also an eland (Figure 37). On the same hill is another boulder with a single eland engraved on it (Figure 38). This hill is south of the study area and will not be directly impacted. On the farm Modderfontein, just west of the boundary fence of Leliehoek, there is a boulder with an engraving of an ostrich on it. The boulder is part of a long, low dolerite ridge but in its immediate context it is isolated from other rocks.

Figure 37: Engraved boulder on the north-eastern part of a hilltop on Doornrandjes (point 115). The inset shows the rock art with brightness and contrast altered to maximise visibility.

Figure 38: A engraving of an eland on the north-western part of a hilltop on Doornrandjes (point 119). The scale bar is in 10 mm intervals.

Perhaps the most significant archaeological site to have been found during the survey was located on Modderfontein, just outside the boundary of Leliehoek. This site appears to be a Khoekhoe occupation site

and has engraved geometric rock art (Figure 39 & 40), bedrock grinding hollows (Figure 41) and many flaked stone artefacts in hornfels. The archaeological remains are situated around a small, shallow hollow that accumulates water after rains.

Figure 39: View of one of the engraved boulders at point 146 on Modderfontein. The inset shows engraved geometric images with brightness and contrast adjusted to maximise visibility. The scale bar is in 10 mm intervals.

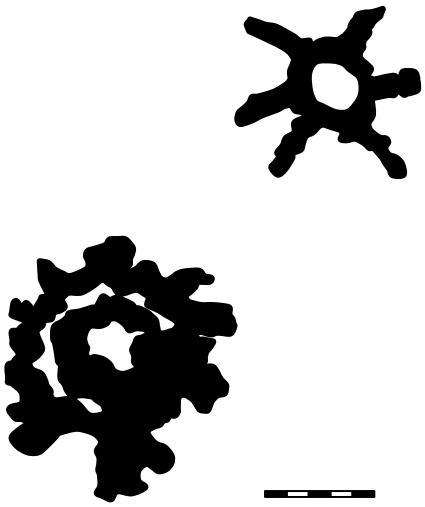

Figure 40: Two engraved geometric images from a second boulder at point 146 on Modderfontein.

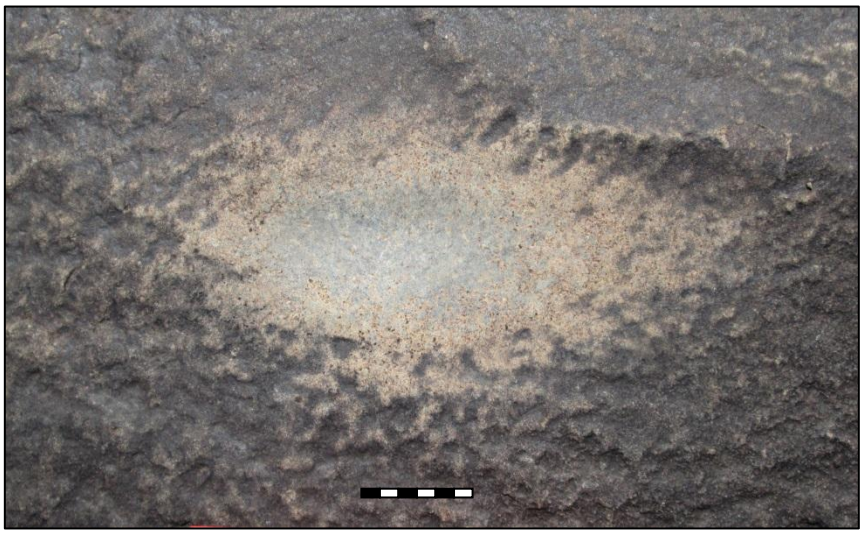

Figure 41: The clearest of the grinding hollows at point 146 on Modderfontein. The scale bar is in 10 mm intervals.

Historical and modern graffiti was found in a number of places. This was in the form of names, dates and other motifs engraved or scratched onto dolerite boulders. By far the majority of the graffiti was located on the farms Doornrandjes and Klipfontein. Besides names, initials, dates and other scratches (Figures 42 to 45), there were also recognisable modern symbols and items (Figures 46 & 47).

Figure 42: Grafitti inscriptions on Klipfontein showing the date 8-5-38 (point 096).

Figure 43: Scratched graffiti on Klipfontein (point 096).

Figure 44: Inscription on Klipfontein (point 096).

Figure 45: Inscription on Bosrand (point 124).

Figure 46: Snake, 'S' and yin-yang symbolism on Doornrandjes (point 135).

Figure 47: Machine gun graffiti on Doorn Randjes (point 118).

One very prominent piece of graffiti (Figure 48) occurs on Doornrandjes. The following suggestions as to its meaning have been made:

- Lindelani 'Matiiso Gill[1]: The text is Setswana and means something like "the saved ones of Bethsaida". The site could have been linked to ceremonies, perhaps to do with an Apostolic or Zionist Christian Church.
- Kobus de Villiers[2]: The text is Setswana and means something like "the living people of Bethsaida" referring to the people of the Holy Land, with the G-C apparently referring to God's Church. These would refer to a congregation and denomination respectively. High places are important both Biblically and, in the local culture, today for prayer and it is likely that this hill was/is used as a prayer site from where prayers can be said over the broader landscape.

Figure 48: Graffiti on Doornrandjes (point 117).

All the graffiti is likely fairly modern with visible dates including 1930 and 1938. Two others both had their final digit missing but indicated dates in the 1920s and 1940s. With one exception, the graffiti is not deemed significant. The exception is the religious marking at point 117 on Doornrandjes which reflects living heritage and will be assessed under that category in Section 7 below.

6.2.3 Ruined structures

A number of ruined dry stone-walled structures were encountered during the survey. The majority are obviously historical but one might date to the LSA. This was a small irregularly circular alignment of rocks on the side of a hill on Doornrandjes (Figure 49). Because of its irregular nature and its roughly piled construction technique, the structure may well be LSA, but no artefacts could be found associated with it. Historical structures included the complex kraal on Modderfontein (just beyond the western boundary of Leliehoek; Figures 50 & 51), the far more simple kraal on Palmietfontein (immediately alongside the

[1] Lindelani 'Matiiso Gill lived in Botswana for several years and is husband of Stephen Gill, curator of the Morija Museum & Archives in Lesotho.

[2] Kobus de Villiers is translator for the Dutch Reformed Church in Dealesville and is fluent in both Setsotho and Setswana.

Leliehoek boundary; Figure 52), a very large oval-shaped historical kraal on the southern section of Klipfontein (34 m by 42 m), a small structure that might once have been a shepherd's hut on Doornrandjes (Figure 53) and the old farm house on Walkerville (Figures 54 & 55). The latter is a fairly important heritage resource as it is an excellent example of the building style that pertained during the late 19th or early 20th century. The walls are generally of sun-dried mud bricks but with fired bricks around edges where extra strength was required. Barbed wire was inserted into the walls as reinforcement and beautiful cement rustication surrounds the window and door openings. Although the walls are largely still standing, both gables are damaged and the majority of the woodwork has been removed with the result that the walls are often damaged around the openings. There was also a ruined farm house (only remnants of sun-dried mud brick walls preserved) and a number of associated features on the farm Constantia and a ruined outbuilding made from dolerite blocks on Rossouw.

Figure 49: Piled stone structure on a hillside on Doornrandjes (point 132).

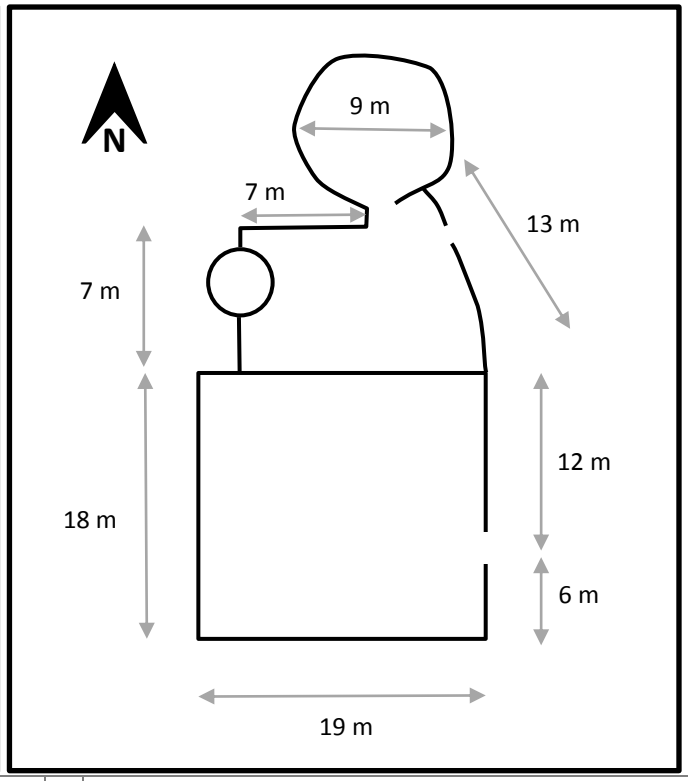

Figure 50: Floor plan of the historical stone-walled kraal on Modderfontein (point 145). The circle along the western edge is a large boulder (see Figure 51).

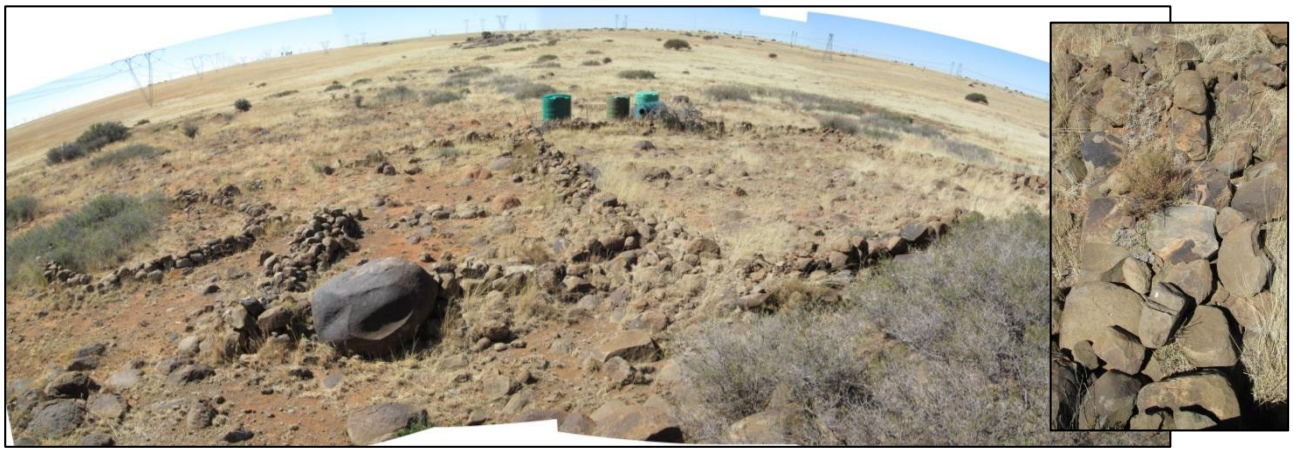

Figure 51: View towards the east of the historical kraal on Modderfontein (point 145). The inset photograph shows the historical building style of two skins with a rubble fill.

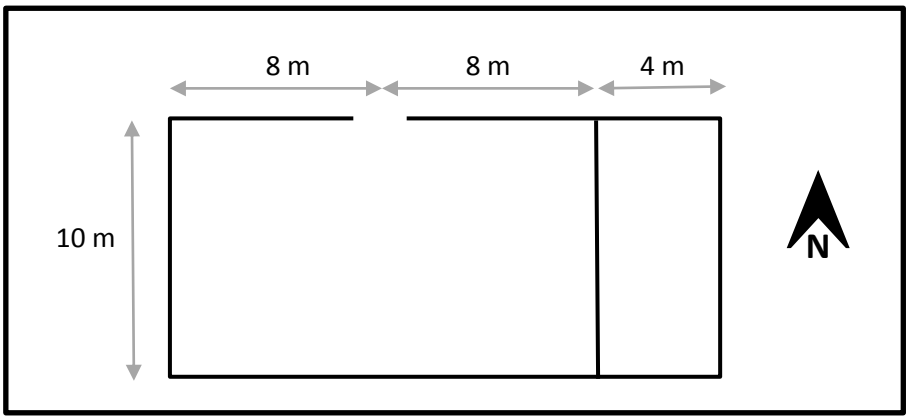

Figure 52: Floor plan of the historical kraal in the south-eastern corner of Palmietfontein (point 140).

Figure 53: The remains of a historical stone structure that might once have been a shepherd's hut.

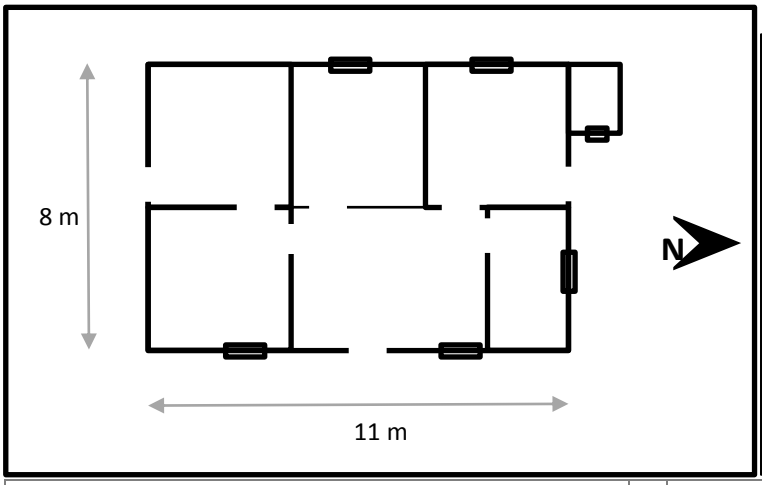

Figure 54: Floor plan of the historical farm house on Walkerville (point 126).

Figure 55: View towards the northwest of the old Walkerville farm house (point 126).

6.3 Built environment

Although no attempt was made to record the occupied houses on each farm (because these are excluded from the study areas with suitable buffers), any obviously historical structures were noted when see for the sake of adding to the overall understanding of the heritage environment. Two are significant in this regard.

The farm werf at Walviskuil seems to have once had much heritage character but, partly through a fire that destroyed part of the main house, this has become somewhat degraded. Figure 56 shows the now modified main house which has had a new roof added but which retains a Victorian-type veranda. Figure 57 shows an outbuilding constructed from calcrete rocks and mud. This outbuilding demonstrated very well the traditional building style in an area where proper building materials were either scarce or expensive to obtain.

Figure 56: The main farm house on Walviskuil (point 080).

Figure 57: An outbuilding on Walviskuil (point 080).

On Doornrandjes there was a very well preserved historical house that looked as though it might date to the early twentieth century. It is a plastered brick house placed over a dolerite block foundation and has a corrugated iron roof (Figure 58). Joinery is a mixture of wood and steel. The house is presently occupied. Sadly, its context has been eroded by the placement of large power lines immediately to the south of the house (Figure 59).

Figure 58: The west-facing façade of a historical house on Doornrandjes (point 099).

Figure 59: The northern end of a historical house on Doornrandjes (point 099).

6.4 Graves

Two graveyards were noted, one on Constantia and one on Walviskuil Both are Nel family graveyards. That on Constantia contains graves dating back into the late 19th century (Figures 60 & 61). Although graves are always of high significance, neither will be impacted and they are thus not of further concern. The Walviskuil graveyard (Figure 62) is located some 500 m from the north-western corner of the Beta Substation and 300 m west of the proposed transmission corridor.

Figure 60: Formal graves in the Constantia Graveyard (point 070).

Figure 61: An informal grave in the Constantia Graveyard (point 070).

Figure 62: Graves in the Walviskuil Graveyard (point 079).

6.5 Living heritage

6.5.1 Sotho initiation school

Although there was no trace of an initiation school on the ground, local informants noted that the southern part of the Klipfontein farm was used by Sotho initiates. This was reported to the social impact assessor who attempted to explore this issue some more but found it difficult to obtain information. What he was able to share through his enquiries and personal knowledge was the following:

- The person in charge of the initiation school had recently passed away and there was no current 'contact person' in this regard;
- Initiation is generally quite a secretive activity and information regarding this is not easily obtained; and
- Initiation sites are generally not 'sacred' in any way – loss of the site is unlikely to be a major issue, since a new site can be chosen.[3]

6.5.2 Dealesville town commonage

The Klipfontein farm gave the strong impression of having served as town commonage for some time. It certainly presently serves that purpose and a number of stock posts and a small reservoir and wind pump were seen scattered across the area (Figures 63 to 66). These were not individually mapped, although an abandoned post (not old enough to legally be counted as archaeological) did have its position recorded (Figures 67 & 68). In a number of other areas it was obvious that stock posts had been moved since the denuded nature of the surface indicated where livestock had congregated in the recent past. Another in the central part of Klipfontein yielded glass bottles in addition to metal and enamel items.

[3] This information was emailed to Surina Brink of CSIR who passed it to the present author on 4th December 2014.

Figure 63: Stock post in the northern part of the Klipfontein farm. The Tswaraganang Township lies in the background with grazing cattle off to the right hand side.

Figure 64: Cement reservoir, wind pump and fences on the central part of Klipfontein.

Figure 65: Small hut of corrugated iron andwood standing isolated from any other infrastructure in the central part of Klipfontein. The rocky outcrop in the foreground (point 096) contains much grafitti.

Figure 66: Two stock posts on the southern part of Klipfontein. One is visible at far left and one in the centre. A small herd of cattle is grazing at far right.

Figure 67: Denuded area with remains of an old stock post. Finds include metal items and enamel bowls and mugs (point 086).

Figure 68: Collection of old enamel mugs found at the old stock post at point 086.

6.5.3 Prayer site

The graffiti described in Section 6.2.2 above ("BATSHIDI BA BETHSAEDA G-C") appears to mark a site used for prayer and this site might thus also be considered to have cultural significance as living heritage. As graffiti alone it is not old enough to be considered heritage.

6.6 Cultural landscapes

The vicinity of Dealesville does not have a well-developed cultural landscape. Farmsteads are widely scattered and are not linked by any features such as tree lines. Tree lines, in fact, are very rare in the area. On Leliehoek there are a number of intersecting tree lines enclosing paddocks and creating spaces close to the farm werf (Figure 69), while remnant tree lines occur on Braambosch (Figure 26) and Rossouw in the south. The most common feature of the cultural landscape is fences which surround all the farms and divide each into a number of camps. Being small and barely visible at distance, they do not contribute strongly to the cultural landscape. Of more significance are the many power lines that cross the study area and the two large substations – these have transformed the landscape into an 'electrical landscape'

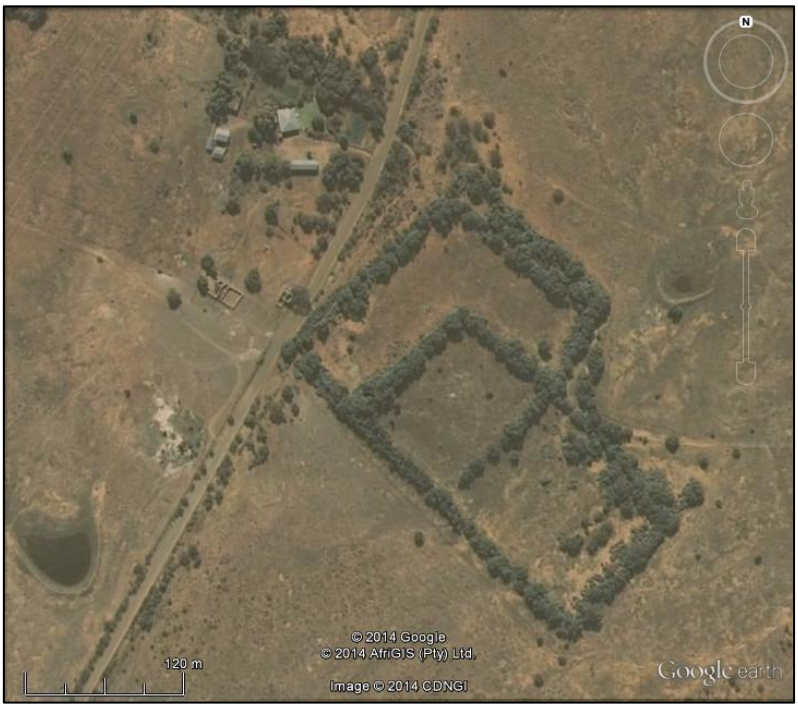

Figure 69: Aerial view of the farm werf at Leliehoek showing the spaces created by tree lines.

Figure 70: View towards the southeast showing the tree line. The trees on the right hand side are in fact a double row.

6.7 Summary of heritage indicators & identification of potential impacts

In this section of the report the heritage indicators affected by each of the twelve proposed developments are briefly summarised. Table 2 summarises the heritage significance of the expected impacts in each case with no mitigation applied and if the entire study area for each PV facility was developed. For the transmission corridor the summary indicates a worst case scenario with pylons placed over the most sensitive sites in the corridor.

6.7.1 Braambosch Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance are likely to be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.2 Braklaagte Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.3 Boschrand 2 Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- Historical grafitti of low heritage significance is likely to be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.4 Eksteen Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance are likely to be directly impacted.
- A Stone Age rock engraving of medium significance is likely to be directly impacted, while others may experience indirect impacts.
- Historical grafitti of low heritage significance is likely to be directly impacted.
- A historical ruin of low-medium significance is likely to be directly impacted.
- A building of medium-high significance may be indirectly impacted.
- A possible grave is likely to be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.5 Irene Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.6 Kentani Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.7 Klipfontein Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of medium archaeological significance are likely to be directly impacted.
- A possible grave is likely to be directly impacted.
- Living heritage, which is of low-medium significance is likely to be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.8 Klipfontein 2 Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- Living heritage, which is of medium significance is likely to be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.9 Meeding Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.10 Sonobolomo Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.11 Leliehoek Solar PV Facility and Supporting Electrical Infrastructure

- Stone Age archaeological resources of low archaeological significance may be directly impacted, while a site of high significance may be indirectly impacted.
- A Stone Age rock engraving site (with several engravings) of high significance is likely to be directly impacted, while other individual engravings may experience indirect impacts.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

6.7.12 Transmission line corridor (including proposed locations of the collector substations)

- Stone Age archaeological resources of low archaeological significance may be directly impacted.
- A building of medium-high significance may be indirectly impacted, while others of low significance may also be indirectly impacted.
- A graveyard of high significance may be indirectly impacted.
- The cultural landscape, which is of low significance, is likely to be directly impacted.

Table 2: Summary of the expected direct and indirect impacts to each type of heritage resource that might be impacted by the proposed PV facilities. Note that palaeontological resources are excluded from this table since those impacts could be of low significance if no sensitive geology is intersected or high if sensitive geological deposits are uncovered during the excavations. Historical graffiti is also excluded because none was deemed significant with one exception that falls under living heritage.

Heritage indicator		Stone Age & Historical archaeology (incl. ruins)			Stone Age engravings			Built environment			Cultural landscape			Living heritage			Graves		
Heritage significance		H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Braambosch	Direct Impacts																		
	Indirect Impacts																		
Braklaagte	Direct Impacts																		
	Indirect Impacts																		
Boschrand 2	Direct Impacts																		
	Indirect Impacts																		
Eksteen	Direct Impacts																???		
	Indirect Impacts																		
Irene	Direct Impacts																		
	Indirect Impacts																		
Kentani	Direct Impacts																		
	Indirect Impacts																		
Klipfontein	Direct Impacts																???		
	Indirect Impacts																		
Klipfontein 2	Direct Impacts																		
	Indirect Impacts																		
Meeding	Direct Impacts																		
	Indirect Impacts																		
Sonoblomo	Direct Impacts																		
	Indirect Impacts																		
Leliehoek	Direct Impacts																		
	Indirect Impacts																		
Transmission line corridor	Direct Impacts																		
	Indirect Impacts																		

7 ASSESSMENT OF IMPACTS & IDENTIFICATION OF MANAGEMENT ACTIONS

In this section of the report the potential impacts to heritage resources are formally assessed using an impact assessment rating scale supplied by the CSIR. Each proposed facility and the transmission corridors are discussed and assessed separately for impacts that might occur during the construction, operation and decommissioning phases – this is Alternative 1. The No-Go alternative is assessed as Alternative 2 and included under the construction phase only. Because the impacts are generally similar across the twelve proposed PV facilities, the impacts and mitigation measures have been discussed here and then referred to by their appropriate numbers in the impact assessment tables that follow.

Impacts

The impacts have been grouped into five types for assessment as follows:

- Impact 1: Destructive impacts to palaeontological resources (see attached specialist study for further details; please note that the ratings have been slightly altered from that report in order to align with the present report and author's interpretation of the ratings);
- Impact 2: Destructive impacts to specific heritage resources such as archaeological sites, rock engravings, historical graffiti and built structures;
- Impact 3: Destructive impacts to graves;
- Impact 4: Contextual impacts to the cultural landscape; and
- Impact 5: Impacts to living heritage which result in limitations being placed on the continued practicing of that heritage.

The first three impacts above include heritage resources that could experience direct, destructive, irreversible impacts, while the fourth and fifth impacts include those resources that would experience indirect (in this case contextual) impacts that could be reversed with decommissioning of the facilities and rehabilitation of the study area. It should be noted that none of the historical graffiti appeared to be more than 100 years old (1930s seemed to be the earliest) and because it was not considered important and is not technically covered by the NHRA (which requires archaeological and rock art heritage to be more than 100 years of age) it is not discussed or assessed further in this section. There is one exception (at Eksteen) which is part of a living heritage site and has been assessed under Impact 5.

Assessment of impacts at the construction phase includes impacts of variable significance, particularly within Impacts 1 and 2. In all cases, though, the worst impact is assessed. For example in palaeontological impacts (Impact 1) the significance will vary depend on the nature of the geological deposits being impacted but the assessment will consider the most sensitive deposit. Assessment of impacts in the operation and decommissioning phases could be variable depending on whether mitigation was successfully applied in earlier phases or not. In the tables that follow it is assumed that artefact scatters would have been mitigated during the construction phase (because those requiring mitigation occur in open areas well suited to development) and that areas in which living heritage is practised have been reduced in size by developments. It is assumed that other heritage sites would have been avoided and protected during earlier phases.

Mitigation

In the impact assessment tables in this section, mitigation and management measures are listed as follows:

- Mitigation 1: Pre-construction site inspection by a palaeontologist to pin-point any specific sensitive deposits (particularly pan dune and spring deposits) that might require construction phase monitoring.
- Mitigation 2: Monitoring of excavations into potentially fossiliferous deposits. Note that some of the proposed development sites are already known to require monitoring – this is indicated in the tables below for those sites where the Tierberg Formation of the Ecca Group will be impacted. Others may later be found to require monitoring after the site inspection. Should any fossils that require rescue be located during monitoring then the palaeontologist would recommend this as appropriate at the time.
- Mitigation 3: Excavation, collection, analysis and curation of Stone Age artefact scatters in order to preserve scientific data for further study. This involves laying out an excavation grid and excavating and sieving sand from the grid squares in order to recover all stone artefacts present. The grid allows for spatial control on the site and an estimation of the density of artefacts present.
- Mitigation 4: Detailed recording of rock engravings and possibly removal to a museum if possible/desirable. This would involve photography and tracing of engraved images in order to create a record of them. Those images that are on boulders that could be moved might be considered for permanent removal to a museum.
- Mitigation 5: Detailed recording of built environment resources and ruins prior to destruction or adaptive reuse. At this point there are no plans to reuse any buildings presently occurring in the study area. This mitigation therefor applies to a single small stone ruin. The site would need to be mapped and carefully examined for any other traces that might inform on its history. Collection of artefacts is not likely to be of use at this site and those few that are present should be recorded *in situ*.
- Mitigation 6: Test excavation of possible graves to confirm and, if confirmed, exhumation should follow. This would involve removal of covering rocks and careful excavation in order to determine firstly whether any grave shaft might be visible or, in the absence of any sign of a shaft, whether any bones might be present. If the test shows no grave to be present then the site may be destroyed as no heritage would be implicated. Should a grave be found then a call needs to be made as to whether the grave site can be protected or whether exhumation should take place. Historical/recent graves might require a full public consultation process to be carried out in order to determine the next of kin and what should be done with the remains afterwards.
- Mitigation 7: Avoid rocky areas that will require blasting and are difficult to rehabilitate so as to avoid landscape scarring. (This is more of a best practice measure as it will not affect the significance ratings.)
- Mitigation 8: Avoid tree lines in order to preserve what, in this area, is a significant component of the cultural landscape.
- Mitigation 9: Keep footprint as far from the urban area of Dealesville as possible and, as far as possible, avoid areas presently in use for initiation and livestock grazing.

Specific mitigation measures as outlined above would need to be applied at the construction phase, while best practise measures would need to be applied during other phases. It should, however, be noted that during the planning and implementation (construction phase) avoidance is always the best option, but where this is not possible the measures above should be applied. The following best practice management measures should also be considered over and above the specific mitigation measures outlined above:

- Disturbance footprints should be minimised and sensitive sites should be cordoned off and protected from incidental damage during construction.
- Personnel working on site during the operation phase should be informed as to the significance of heritage resources and that damaging them is illegal and cannot be allowed.
- During decommissioning, any known heritage resources still present close to the work area should be cordoned off and avoided by staff and machinery.

Monitoring

The above best practice measures can be implemented and monitored by the ECO during the construction and decommissioning phases. The objective of the monitoring would be simply to ensure that the status quo of all protected heritage sites is maintained. Monitoring is not really feasible during operation but impacts are generally very unlikely to occur during that phase.

7.1 Braambosch

7.1.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.1.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.1.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility, although one measure has been suggested for possible implementation. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. Although it should not be mandatory, avoidance of the tree line would be somewhat desirable (Mitigation 8). On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 3: Impact assessment summary table for the Construction Phase for the Braambosch PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	Medium	Low	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	Mitigation 8	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 4: Impact assessment summary table for the Operational Phase for the Braambosch PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 5: Impact assessment summary table for the Decommissioning Phase for the Braambosch PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.2 Braklaagte

7.2.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.2.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.2.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 6: Impact assessment summary table for the Construction Phase for the Braklaagte PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 7: Impact assessment summary table for the Operational Phase for the Braklaagte PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 8: Impact assessment summary table for the Decommissioning Phase for the BraklaagtePV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.3 Boschrand 2

7.3.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.3.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.3.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility, although it would be desirable to avoid the rocky ridge running along the eastern margin of the site (Mitigation 7) in order to reduce physical impacts to the landscape that might be difficult to rehabilitate. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 9: Impact assessment summary table for the Construction Phase for the Boschrand 2 PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	Medium Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	Mitigation 7	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 10: Impact assessment summary table for the Operational Phase for the Boschrand 2 PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 11: Impact assessment summary table for the Decommissioning Phase for the Boschrand 2 PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.4 Eksteen

7.4.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.4.2 Potential impact to Stone Age and historical archaeological resources

The resources identified have low and medium heritage significance with the latter requiring mitigation (Mitigation 3 and Mitigation 4) or avoidance. Should the small historical ruin be impacted then this will need a detailed recording prior to destruction (Mitigation 5). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.4.3 Potential impact to graves

A single potential grave was identified alongside an old ruined building. Graves always carry high significance. Direct impacts could occur during the construction phase with no further impacts likely during other phases, although the confidence of this latter statement is only medium because it can be difficult to control people working on site. It is desirable to avoid the rocky area (see 7.4.3 below) but should this not occur then the possible grave will need to be tested and (if it is a grave) exhumed (Mitigation 6). Alternative 2 would very likely not result in any impacts at all.

7.4.4 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility, although it would be desirable to avoid the rocky outcrop in the southern part of the site (Mitigation 7) in order to reduce physical impacts to the landscape that might be difficult to rehabilitate. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 12: Impact assessment summary table for the Construction Phase for the Eksteen PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	Mitigation 3 Mitigation 4 Mitigation 5	Site specific	Medium	Permanent	Irreversible	High	Highly probable	Medium Negative	Very low Negative	High
Impact 3	Mitigation 6	Site specific	High	Permanent	Irreversible	High	Highly probable	High Negative	Low Negative	Medium
Impact 4	Mitigation 7	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Low Negative	Low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 13: Impact assessment summary table for the Operational Phase for the Eksteen PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Very low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	Medium
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 14: Impact assessment summary table for the Decommissioning Phase for the Eksteen PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	Medium
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.5 Irene

7.5.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.5.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.5.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 15: Impact assessment summary table for the Construction Phase for the Irene PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 16: Impact assessment summary table for the Operational Phase for the Irene PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 17: Impact assessment summary table for the Decommissioning Phase for the Irene PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.6 Kentani

7.6.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1 & 2). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.6.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.6.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 18: Impact assessment summary table for the Construction Phase for the Kentani PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 19: Impact assessment summary table for the Operational Phase for the Kentani PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 20: Impact assessment summary table for the Decommissioning Phase for the Kentani PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.7 Klipfontein

7.7.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1 & 2). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.7.2 Potential impact to Stone Age archaeological resources

The resources identified have low and medium heritage significance with the latter requiring mitigation (Mitigation 3) or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases (although should the relevant sites be protected there is the chance of indirect impacts by construction workers if the sites are not properly protected. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock and possible defacing of Stone Age engravings by local people.

7.7.3 Potential impact to graves

A single potential grave was identified close to a hut. Graves always carry high significance. Direct impacts could occur during the construction phase with no further impacts likely during other phases, although the confidence of this latter statement is only medium because it can be difficult to control people working on site. The possible grave will need to be tested and (if it is a grave) exhumed (Mitigation 6). Alternative 2 would very likely not result in any impacts at all.

7.7.4 Potential impact to the cultural landscape

The cultural landscape of the town has low to medium heritage significance and only mitigation measure possible is to keep the development footprint as far away from Dealesville town as possible so as to reduce the visual impact on the town area. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. It is desirable to avoid the rockier areas which might be more difficult to rehabilitate (Mitigation 7). On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

7.7.5 Potential impact to living heritage

The Klipfontein study area is used for livestock grazing by local people. This is something they would have been doing for many generations (although not always at this peri-urban location) but would be disturbed by the presence of the PV facility. The only mitigation measure possible is to keep the development footprint as far away from Dealesville town as possible (Mitigation 9) which would help to preserve some of the more intensely used areas. Not using the Klipfontein site at all would be preferable. Alternative 2 would allow the traditional land use to continue uninterrupted.

Table 21: Impact assessment summary table for the Construction Phase for the Klipfontein PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	Mitigation 3	Site specific	Medium	Permanent	Irreversible	High	Definite	Medium Negative	Very low Negative	High
Impact 3	Mitigation 6	Site specific	High	Permanent	Irreversible	High	Highly probable	High Negative	Low Negative	Medium
Impact 4	Mitigation 7	Local	Medium	Long term	High	Low	Definite	Medium Negative	Low Negative	High
Impact 5	Mitigation 9	Local	Medium	Long term	High	Low	Definite	Medium Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Low Negative	Low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Temporary	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 22: Impact assessment summary table for the Operational Phase for the Klipfontein PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Very low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	Medium
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Impact 5	n/a	Local	Medium	Long term	High	Low	Definite	Medium Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 23: Impact assessment summary table for the Decommissioning Phase for the Klipfontein PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	Medium
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.8 Klipfontein 2

7.8.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.8.2 Potential impact to Stone Age and historical archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.8.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. Much of the site is high-lying with small rocky areas scattered widely. Avoiding the highest ground is preferable (Mitigation 7) so that some of the natural landscape will be visible from a distance to mitigate visual impacts. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

7.8.4 Potential impacts to living heritage

The Klipfontein 2 study area is used for livestock grazing by local people. This is something they would have been doing for many generations (although not always at this peri-urban location) but would be disturbed by the presence of the PV facility. The area is also used as the location for an initiation school. The only mitigation measure possible is to keep the development footprint as far away from Dealesville town as possible (Mitigation 9) which would help to preserve some of the more intensely used areas. The exact location of the initiation school could not be determined but this likely moves around. Not using the Klipfontein 2 site at all would be preferable. Alternative 2 would allow these traditional land uses to continue uninterrupted.

Table 24: Impact assessment summary table for the Construction Phase for the Klipfontein 2 PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	Mitigation 7	Local	Medium	Long term	High	Low	Definite	Medium Negative	Low Negative	High
Impact 5	Mitigation 9	Local	Medium	Long term	High	Low	Definite	Medium Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Temporary	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 25: Impact assessment summary table for the Operational Phase for the Klipfontein 2 PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Impact 5	n/a	Local	Medium	Long term	High	Low	Definite	Medium Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 26: Impact assessment summary table for the Decommissioning Phase for the Klipfontein 2 PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.9 Meeding

7.9.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1 & 2). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.9.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.9.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. Although it should not be mandatory, avoidance of the tree lines would be somewhat desirable (Mitigation 8). On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 27: Impact assessment summary table for the Construction Phase for the Meeding PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	Mitigation 8	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 28: Impact assessment summary table for the Operational Phase for the Meeding PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1										
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 29: Impact assessment summary table for the Decommissioning Phase for the Meeding PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.10 Sonoblomo

7.10.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1 & 2). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.10.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.10.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 30: Impact assessment summary table for the Construction Phase for the Sonoblomo PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 31: Impact assessment summary table for the Operational Phase for the Sonoblomo PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 32: Impact assessment summary table for the Decommissioning Phase for the Sonoblomo PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.11 Leliehoek

7.11.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.11.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.11.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for this facility. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

Table 33: Impact assessment summary table for the Construction Phase for the Leliehoek PV.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 34: Impact assessment summary table for the Operational Phase for the Leliehoek PV.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 35: Impact assessment summary table for the Decommissioning Phase for the Leliehoek PV.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.12 Transmission line corridor and collector substations

7.12.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required (Mitigation 1 & 2). Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.12.2 Potential impact to Stone Age archaeological resources

The resources identified have low heritage significance and thus do not require mitigation or avoidance. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock.

7.12.3 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and no mitigation is required for the transmission corridors, although it is strongly desirable that tree lines and farm complexes are avoided (Mitigation 6; it is expected that this will generally be the case, but the western alternative substation location is located across a planted boundary line). Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the power lines. Although the impacts are of medium intensity and will occur throughout the lifetime of the power line, the fact that they are easily reversible on decommissioning means that the significance of the impacts is low. It should also be noted here that a large number of power lines is already present in the vicinity and the new ones may be seen to 'fit in' with the present 'electrical landscape'. On decommissioning they would, with time for rehabilitation, revert to the status quo. With Alternative 2 the status quo would remain and no new impacts would be expected.

7.12.4 Potential impact to living heritage

It is noted that although power lines might cross land used for living heritage practices, this will not result in any impact on those practices. This aspect is thus not formally assessed here.

Table 36: Impact assessment summary table for the Construction Phase for the transmission line corridor and collector substations.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 37: Impact assessment summary table for the Operational Phase for the transmission line corridor and collector substations.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Medium	Long term	High	Low	Definite	Low Negative	Low Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 38: Impact assessment summary table for the Decommissioning Phase for the transmission line corridor and collector substations.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

7.13 Cumulative impacts

7.13.1 Potential impact to palaeontological resources

There is the potential for impacts of low to high significance depending on the geological deposits intersected during construction. A site inspection by a palaeontologist will be required prior to construction in order to pin-point any particular areas of concern so that these can be monitored during construction if required. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through natural erosion of the land surface that might expose fossils.

7.13.2 Potential impact to Stone Age and historical archaeological resources

Most of the resources identified have low heritage significance and thus do not require mitigation or avoidance. However, with mitigation successfully applied (Mitigation 3, 4 & 5) there are no significant cumulative impacts because similar resources can be found widely in the landscape. Direct impacts would occur during the construction phase with no further impacts likely during other phases. Impacts for Alternative 2 would be through trampling and breakage of artefacts by livestock, an unavoidable impact that no doubt occurs widely.

7.13.3 Potential impact to graves

Two potential graves might be adversely affected but with mitigation this is not seen as a cumulative impact of any significance.

7.13.4 Potential impact to the cultural landscape

The cultural landscape generally has low heritage significance and even with mitigation the impact significance will not be reduced. Impacts would be initiated at the construction phase and perpetuated throughout the lifetime of the facility. Although the impacts of the individual facilities are of medium intensity and will occur throughout the lifetime of the activity, the fact that they are easily reversible on decommissioning means that the significance of their impacts is low. However, with construction of all the proposed facilities and associated infrastructure the cumulative impact is considered to be of medium significance, since the wider landscape would be dramatically altered. On decommissioning the impacts would, with time for rehabilitation, revert to the status quo.

7.13.5 Potential impacts to living heritage

The three PV sites located on the Klipfontein farm will result in direct impacts to sites linked with living heritage (initiation and small-scale livestock rearing). Replacement locations can easily be sought for these activities but this might be difficult because at present they all occur on municipal land that effectively serves as town commonage. If all the proposed PV facilities are built then there will be a significant reduction in the amount of land available for these activities thus raising the significance of the cumulative impacts to a higher level than would be the case for the individual facilities.

Table 39: Impact assessment summary table for the Construction Phase for cumulative impacts.

Construction Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	Mitigation 1 Mitigation 2	Local	High	Permanent	Irreversible	High	Probable	High Negative	Low Negative	High
Impact 2	Mitigation 3 Mitigation 4 Mitigation 5	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 3	Mitigation 6	Site specific	High	Permanent	Irreversible	High	Highly probable	High Negative	Low Negative	Medium
Impact 4	Mitigation 8	Local	High	Long term	High	Low	Definite	Medium Negative	Medium Negative	High
Impact 5	Mitigation 9	Local	Medium	Long term	High	Low	Definite	High Negative	Medium Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Low Negative	Low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Temporary	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 40: Impact assessment summary table for the Operational Phase for the cumulative impacts.

Operational Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Highly probable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Very low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	Medium
Impact 4	n/a	Local	High	Long term	High	Low	Definite	Medium Negative	Medium Negative	High
Impact 5	n/a	Local	Medium	Long term	High	Low	Definite	High Negative	Medium Negative	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Probable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Temporary	High	Low	Improbable	Very low Neutral	Very low Neutral	High

Table 41: Impact assessment summary table for the Decommissioning Phase for the cumulative impacts.

Decommissioning Phase										
Direct Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 1										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	Medium
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Alternative 2										
Impact 1	n/a	Local	Low	Permanent	Irreversible	High	Improbable	Very low Neutral	Very low Neutral	High
Impact 2	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 3	n/a	Site specific	Low	Permanent	Irreversible	High	Improbable	Very low Negative	Very low Negative	High
Impact 4	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High
Impact 5	n/a	Local	Very low	Long term	High	Low	Improbable	Very low Neutral	Very low Neutral	High

8 PERMIT REQUIREMENTS

Once a final comment has been issued by the heritage authority (SAHRA), the recommendations should be included in the conditions of authorisation. This will essentially give 'permission' from the heritage authorities to proceed. If any archaeological mitigation is required then this would need to be conducted by an appropriate specialist under a permit issued to that specialist by SAHRA. This permit has no bearing on the developer or development but is purely a way in which the heritage authority can be sure that the mitigation work will be carried out satisfactorily.

On the present layouts, only the Eksteen and Klipfontein PV facilities require archaeological mitigation which would be subject to the above permit requirement. In all likelihood, however, the impacts on Eksteen would be avoided because the rocky hill with which the archaeological remains are associated might well be avoided during development.

9 CONCLUSIONS

The field survey for these projects revealed that heritage resources are generally very sparsely distributed on the landscape. Palaeontological resources may be present quite widely, although their overall density is likely to be low. Archaeological resources are also widespread, but significant resources, including LSA occupation sites and rock engravings, tend to be clustered on and around dolerite hills – the exceptions are some scatters of MSA artefacts revealed by erosion in open areas. Historical resources tend to be rare although a few were noted, again generally associated with dolerite outcrops. Living heritage is present in the form of small-scale livestock grazing and an initiation school occurring on the town commonage, while a prayer site lies atop one of the local hills. The cultural landscape is only very weakly developed.

There are no fatal flaws and all projects are deemed acceptable in heritage terms but subject to various mitigation measures, including in some cases the outcome of the social impact assessment and public participation process which may yet raise fatal flaws. The most important measures would be to avoid rocky outcrops as this would result in a significant reduction in the amount of other mitigation that would be required. The only aspect for which mitigation will be difficult is the living heritage practiced on the town commonage – finding replacement land will not be easy because the surrounding farms are privately owned. Final decision-making on this aspect will need to be made after consideration of the social impact assessment report.

Section 10 below lays out specific conditions related to the authorisation of each of the proposed projects.

10 REASONED OPINION AS TO WHETHER THE ACTIVTY SHOULD/SHOULD NOT BE AUTHORISED; AND CONDITIONS THAT SHOULD BE MADE IN RESPECT OF THAT AUTHORISATION

I, Jayson Orton am of the opinion that the following proposed solar PV facilities **should/should not** be authorised:

1. Braambosch Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined; and
- Any subsequent palaeontological monitoring required must be carried out during the construction phase.

2. Boschrand 2 Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined;
- Any subsequent palaeontological monitoring required must be carried out during the construction phase; and
- Rocky outcrops should be excluded from the final project layout as far as is possible.

3. Eksteen Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined;
- Any subsequent palaeontological monitoring required must be carried out during the construction phase;
- Rocky outcrops should be excluded from the final layout as far as is possible;
- The final layout should be shown to the project archaeologist to determine what mitigation is still required; and
- Depending on the layout, further mitigation might include excavation/collection of Stone Age artefact scatters, recording of a historical ruin and testing and possible exhumation of a suspected grave.

4. Irene Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined; and
- Any subsequent palaeontological monitoring required must be carried out during the construction phase.

5. Kentani Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined; and

- Any subsequent palaeontological monitoring required must be carried out during the construction phase.

6. Klipfontein Solar PV Facility and Supporting Electrical Infrastructure

This project **should not be** authorised **unless** this is deemed acceptable after the social impact assessment and public participation process. If then authorised it should be subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined;
- Any subsequent palaeontological monitoring required must be carried out during the construction phase;
- Rocky outcrops should be excluded from the final layout as far as is possible;
- The final layout should be shown to the project archaeologist to determine what mitigation is still required;
- Depending on the layout, further mitigation will include excavation/collection of Stone Age artefact scatters and possible exhumation of a suspected grave; and
- Any conditions related to traditional land uses (living heritage) as stipulated by the social impact assessor.

7. Klipfontein 2 Solar PV Facility and Supporting Electrical Infrastructure

This project **should not be** authorised **unless** this is deemed acceptable after the social impact assessment and public participation process. If then authorised it should be subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined;
- Any subsequent palaeontological monitoring required must be carried out during the construction phase;
- Rocky outcrops should be excluded from the final layout as far as is possible; and
- Any conditions related to traditional land uses (living heritage) as stipulated by the social impact assessor.

8. Meeding Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined; and
- Any subsequent palaeontological monitoring required must be carried out during the construction phase.

9. Sonobolomo Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined; and
- Any subsequent palaeontological monitoring required must be carried out during the construction phase.

10. Leliehoek Solar PV Facility and Supporting Electrical Infrastructure

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined; and

- Any subsequent palaeontological monitoring required must be carried out during the construction phase.

11. Transmission line corridor (including proposed locations of the collector substations)

This project **should be** authorised subject to the following conditions:

- Project area to be examined physically by a palaeontologist once final layouts have been determined; and
- Any subsequent palaeontological monitoring required must be carried out during the construction phase.

General Conditions that should be made in respect of these authorisations include:

- Development footprints should be kept as small as possible and all works to take place within the development footprints to avoid unnecessary landscape scarring and extra archaeological impacts;
- Rocky outcrops that are protected from development should be off limits during construction in order to reduce the chances of indirect impacts to archaeological sites, rock engravings and any other heritage resources located there; and
- If any archaeological or palaeontological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an appropriate specialist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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APPENDIX 1: LIST OF HERITAGE RESOURCES

List of heritage resources located across the study area. Note that because of the large number of finds on Klipfontein the farm has been divided into North, Centre and South. Finds 140 to 151 lie immediately outside of the Leliehoek study area on the farms Palmietfontein and Modderfontein but were recorded because of their proximity to the proposed development. Under "heritage significance" a brief mitigation requirement has been listed where this is necessary and includes all sites recorded, not just those within the proposed development footprints (this can assist with further planning in the event of the development footprints changing at a later stage); a number of hours refers to archaeological mitigation time thought to be required.

GPS point	location	Farm	Description	Heritage significance
019	S28 43 31.5 E25 44 20.7	Boschrand	Scatter of MSA hornfels artefacts in an eroded area with calcrete exposed.	Low
020	S28 43 42.8 E25 45 00.9	Boschrand	Historical engraved graffiti. "Philip X"	Low
021	S28 43 41.6 E25 44 59.5	Boschrand	Scatter of LSA hornfels artefacts including a broken scraper in a clearing on the koppie.	Low
022	S28 43 41.5 E25 44 58.8	Boschrand	Scatter of MSA and LSA hornfels artefacts including a broken scraper in a clearing on the koppie.	Low
023	S28 43 37.5 E25 44 58.0	Groenpan	Historical engraved graffiti. "DC 1930" and "DC 1.6.30".	Low
066	S28 41 06.0 E25 42 33.1	Leliehoek	Historical engraving. Word/name engraved on a dolerite boulder.	Low
067	S28 41 06.4 E25 42 32.5	Leliehoek	Dolerite boulder with pecked marks on it.	Low
068	S28 40 57.5 E25 40 35.4	Constantia	The spring on Constantia. There was also a *waterput* here which has been filled in.	Low
069	S28 40 59.0 E25 40 34.3	Constantia	Scatter of LSA hornfels artefacts close to the spring. There are likely to be more similar scatters around the spring but the rest of the area was not searched in detail.	Low-medium **Needs further survey.**
070	S28 41 06.3 E25 40 23.1	Constantia	Nel Family graveyard with fifteen graves. Dated headstones include 1882, 1884, 1896, 1905, 1914 and two other dated headstones with dates below soil level. Also eight graves with no headstones, some of which are small (babies). It is thought by the present owners that some of the graves without headstones may be those of British soldiers from the Anglo-Boer War but this cannot be confirmed.	High **AVOID**
071	S28 41 01.8 E25 40 32.0	Constantia	Dolerite block foundation and an ash heap.	Medium **AVOID**
072	S28 41 00.5 E25 40 34.0		The ruin of the original Constantia farm house. It was once the house of the brother of the present owner's grandfather.	
073	S28 41 01.8 E25 40 35.6		Small ruin of dolerite blocks of approximately 3 m by 3 m. Now has a tree growing in it.	
074	S28 41 02.9 E25 40 36.6		Stone kraal of dolerite blocks and calcrete rubble. Approximately 8 m by 24 m. According to the owner it is said that during the Anglo-Boer War the British killed all the sheep in this kraal in order to reduce the food supply of the local Boers.	
075	S28 41 32.2 E25 41 54.8	Leliehoek	Scatter of MSA hornfels artefacts exposed in a farm road.	Low
076	S28 40 50.9 E25 42 56.5	Leliehoek	Scatter of MSA hornfels artefacts along the edge of an excavation – they occur beneath the present ground surface. Includes one radial core that looks like a small hand-axe.	Low
077	S28 41 36.1 E25 42 26.3	Leliehoek	Small dam with walls lined with packed dolerite cobbles and boulders.	Low

GPS point	location	Farm	Description	Heritage significance
078	S28 41 45.9 E25 42 31.7	Leliehoek	Kraal and shed built of calcrete blocks with mud/dung. Part of the main farm werf which is not well concentrated.	Medium **AVOID**
079	S28 42 53.1 E25 41 54.4	Walviskuil	Nel Family graveyard on Walviskuil. It has four graves dated 1941, 1958, 1959 and 1963. Also a plaque commemorating scattered ashes – dated 2000and 2005.	High **AVOID**
080	S28 42 50.7 E25 41 55.9	Walviskuil	Farm werf. Shed built of calcrete blocks. It has been extended using brick and cement. House burnt down and was 'fixed up' afterwards; most of its internal walls have been removed.	Low-medium **AVOID**
081	S28 42 05.7 E25 42 29.3	Leliehoek	Scatter of hornfels artefacts over a wide area.	Low
082	S28 42 10.0 E25 42 28.8	Leliehoek	Scatter of hornfels artefacts over a wide area.	Low
083	S28 40 48.2 E25 44 21.6	Klipfontein (S)	Extensive MSA scatter of hornfels artefacts eroding out from the base of the cover sands. The artefacts are eroding out from the edge of a large excavation (old borrow pit). Although mostly MSA, there are probably some older and younger artefacts mixed in.	Low
084	S28 40 51.7 E25 44 19.6	Klipfontein (S)	Large kraal made from very big rocks. The walls are of the typical historical type – two skins with a rubble fill – but are badly collapsed. Natural outcrops of dolerite have been incorporated into the walls in places. About 34 m by 42 m.	Low
085	S28 40 53.4 E25 44 20.0	Klipfontein (S)	Scatter of hornfels MSA artefacts eroding out from the base of a hill.	Low
086	S28 40 58.8 E25 44 26.1	Klipfontein (S)	Old stockpost that is probably quite recent, perhaps mid-twentieth century. There are large numbers of enamel items, especially cups, but also some modern beer bottles, etc.	Low
087	S28 41 01.8 E25 44 26.0	Klipfontein (S)	Scatter of MSA hornfels artefacts exposed by erosion in a farm road.	Low
088	S28 40 49.4 E25 44 19.1	Klipfontein (S)	Dolerite boulder with some pecking on it, probably two letters but poorly executed.	Low
089	S28 45 04.3 E25 43 06.4	Klipfontein (S)	Scatter of MSA hornfels artefacts on an exposure of calcrete.	Low
n/a	n/a	Klipfontein (S)	The southern part of Klipfontein (where the Klipfontein 2 PV is proposed) is used as a Sotho initiation school or "Swart Skool" but no physical evidence of this use could be located. Questions asked of locals confirmed the fact that initiations happened in the area but brought forth no further information.	Medium **AVOID appropriate area if possible but not essential**
090	S28 40 45.7 E25 43 57.4	Klipfontein (C)	Scatter of MSA hornfels artefacts exposed in a farm track.	Low
091	S28 40 35.3 E25 43 51.8	Klipfontein (C)	Scatter of MSA hornfels artefacts exposed in an eroded area.	Low
092	S28 40 33.6 E25 43 52.9	Klipfontein (C)	Extensive scatter of MSA hornfels artefacts that includes a number of larger flakes and blades.	Low-medium **(8 hours)**
093	S28 40 30.7 E25 43 48.2	Klipfontein (C)	Old stockpost that is probably quite recent, perhaps mid-twentieth century. Artefacts include glass bottles, iron, enamel ware and ceramic fragments.	Low
094	S28 40 34.3 E25 43 36.6	Klipfontein (C)	Scatter of MSA and LSA hornfels artefacts in a deflated area on a hill top. A communications tower has been built on top of the site.	Low
095	S28 40 23.2 E25 43 43.4	Klipfontein (C)	Scatter of MSA hornfels artefacts exposed in an erosion gulley and associated with exposed calcrete.	Low
096	S28 40 29.7 E25 44 06.2	Klipfontein (C)	Dolerite outcrop with many names and initials scratched, engraved and pecked into the various boulders. Two inscriptions are dated 8-5-38 while another has 192… (the last numeral may be a 9).	Low-Medium
097	S28 40 31.0	Klipfontein (C)	Cluster of six dolerite rocks close to a hut. This could be a	Low or High

GPS point	location	Farm	Description	Heritage significance
	E25 44 06.2		grave.	**Avoid or test and follow exhumation process if required.**
098	S28 42 58.1 E25 43 07.7	Doornrandjes	Scatter of MSA hornfels artefacts exposed in a farm rod near the foot of a hill.	Low
099	S28 42 48.3 E25 42 59.4	Doornrandjes	Early twentieth century brick house on a dolerite block foundation. Walls are plastered, window frames are of steel and door frames are of wood. It has a corrugated iron roof. The house is presently occupied.	Medium-High **AVOID**
100	S28 42 23.0 E25 43 04.3	Doornrandjes	Area of hornfels pebbles and cobbles with artefacts located amongst them. The scatter is ephemeral and extends widely towards the east.	Low
101	S28 42 20.3 E25 43 10.0	Doornrandjes	15 m long line of stones. Possibly erosion control but seems unlikely.	---
102	S28 42 19.3 E25 43 10.3	Doornrandjes	3 m long line of stones. Possibly erosion control but seems unlikely.	---
103	S28 42 18.5 E25 43 11.2	Doornrandjes	17 m long line of stones. Possibly erosion control but seems unlikely.	---
104	S28 42 17.1 E25 43 11.7	Doornrandjes	8 m long line of stones. Possibly erosion control but seems unlikely.	---
105	S28 42 16.0 E25 43 11.8	Doornrandjes	Cluster of stones that seems like a disturbed alignment.	Low
106	S28 42 17.9 E25 43 16.7	Doornrandjes	Dolerite outcrop on a small hill. One boulder has some marks on it that are probably historical. A second boulder has what looks like the head and spine of an antelope that may be passing through the rock. It is poorly preserved, but appears to have taken advantage of the naturally variable surface of the rock.	Medium **(2 hours)**
107	S28 42 18.7 E25 43 17.8	Doornrandjes	Dolerite boulder on the crest of the hill that has graffiti on it. There is also a scatter of LSA artefacts over the top of the hill here.	Low
108	S28 42 18.3 E25 43 17.3	Doornrandjes	Rock with a rubbed patch on it.	---
109	S28 42 18.2 E25 43 19.8	Doornrandjes	The remaining walls of a small house of 13 m by 2.5 m. It is of dolerite boulders and is nowhere more than about 0.6 m high. There were also a number of artefacts in the vicinity including one ceramic sherd and some glass and metal. Nearby, 6 m southeast of the house, was a pile of stones that looks like a grave. This site is located on the eastern side of the low dolerite hill.	Low-medium or High **AVOID or test and follow exhumation process if required for grave. (2 hours for ruin)**
110	S28 42 18.9 E25 43 18.5	Doornrandjes	Circular piled stone feature of dolerite cobbles. It does not look like a grave.	Low
111	S28 42 26.1 E25 43 00.0	Doornrandjes	11 m long line of stones. Possibly erosion control but seems unlikely.	---
112	S28 42 09.9 E25 43 05.4	Doornrandjes	Patch of hornfels gravel with low density scatter of MSA hornfels artefacts in amongst it.	Low
113	S28 42 53.9 E25 43 08.7	Doornrandjes	Faint graffiti on a boulder on the crest of a prominent dolerite hill.	---
114	S28 42 54.0 E25 43 09.0	Doornrandjes	Scatter of LSA hornfels artefacts on the crest of the hill. Some MSA artefacts present as well.	Low
115	S28 42 53.6 E25 43 09.4	Doornrandjes	Pecked engraving of an antelope, almost certainly an eland, on a dolerite boulder. From nose to rump it is 35 cm long. A second but less well preserved antelope occurs immediately above the first.	Medium **(4 hours)**
116	S28 42 53.4	Doornrandjes	Scratched engraving of what appears to be an automatic	---

GPS point	location	Farm	Description	Heritage significance
	E25 43 09.0		rifle. The gun is 70 cm long.	
117	S28 42 53.2 E25 43 08.9	Doornrandjes	Graffiti "Batshidi ba Bethsaeda".	Low-medium
118	S28 42 53.1 E25 43 08.1	Doornrandjes	Two more instances of graffiti on doleriate boulders.	---
119	S28 42 53.4 E25 43 07.7	Doornrandjes	Scraped engraving of an antelope, almost certainly an eland. The eye has been left unscraped. Also some historical scratching on the same boulder. Located on the northern edge of the hill.	Medium **(2 hours)**
120	S28 42 53.5 E25 43 07.7	Doornrandjes	Boulder with graffiti on it. The boulder immediately above this one rings nicely but does not appear to have been used as a gong rock in the past.	---
121	S28 45 18.2 E25 42 56.8	Braambosch	Ephemeral MSA hornfels scatter associated with a calcrete outcrop. Also one flake in CCS.	Low
n/a	n/a	Braambosch	A tree line runs from west to east in the north-western part of the farm Part of it extends into the study area.	Low
122	S28 45 49.5 E25 41 02.4	Irene	Small dam with walls lined with packed dolerite cobbles and boulders.	Low
123	S28 43 56.7 E25 43 06.2	Boschrand	Small dam with walls lined with packed dolerite cobbles and boulders.	Low
124	S28 44 19.1 E25 44 44.9	Boschrand	Dolerite boulders with graffiti on a ridge. The initials H.S.M. are clearly visible.	Low
125	S28 44 36.9 E25 40 02.9	Rossouw	Ruined farm outbuilding made of two skins of dolerite blocks with dolerite and calcrete rubble fill. The top has had a few rows of bricks added, perhaps when the roof was replaced.	Low
126	S28 37 28.8 E25 44 20.5	Walkerville	Ruined farmhouse of 11 m by 8 m with an external hearth and chimney stack, looks like it was Victorian. The external walls and chimney (which was a later addition) were made of red clay bricks with frogs, while other walls were made from locally manufactured sun-baked bricks made from local soil and organic matter. The house had six rooms. There is plaster rustication around the openings. Barbed wire has been built into the walls for strengthening. The kitchen has a cement floor but the rest of the house would have had a wooden floor. The house has stone foundations under every wall.	Medium **AVOID**
127	S28 37 30.5 E25 44 20.5		Stone foundation with the remains of brick walls above. Structure was 6 m by 8 m. Floor is cement. There are frog bricks present.	
128	S28 37 24.4 E25 44 09.8	Walkerville	Old stock post, twentieth century artefacts present, but the site may have had its roots in the 19th century. Most artefacts lying about are glass and metal, including parts of an old cast iron single bed.	Low
129	S28 37 21.8 E25 44 08.9		Stone foundation located some 70- 80 m south of the stock post area but probably related to it. Also some Coronation bricks here.	
130	S28 37 41.9 E25 44 36.5	Walkerville	Road alignment with prickly pears and gum trees lining it. May have been a historic access route.	Low
131	S28 42 39.5 E25 42 50.9	Doornrandjes	The scattered remains of a small square hut foundation with dolerite and calcrete. Also some glass and iron fragments lying about.	Low
132	S28 42 50.1 E25 43 04.9	Doornrandjes	Piled stone feature/structure on the south side of a hill. Unknown age or function, could be historical or pre-colonial.	Low
133	S28 42 53.5 E25 43 07.9	Doornrandjes	Modern scratched image on a dolerite boulder.	---
134	S28 42 53.8 E25 43 07.8	Doornrandjes	Dolerite boulder with pecking on it. No discernible images. Probably recent.	---

GPS point	location	Farm	Description	Heritage significance
135	S28 42 54.0 E25 43 09.6	Doornrandjes	Dolerite boulder with scratched modern imagery on it. Snake in a circle with an "S" inside it and a yin-yang symbol.	---
136	S28 43 00.4 E25 43 33.0	Doornrandjes	Straight wall of dolerite boulders with a small circle at one end. Located on east side of a dolerite hill.	Low
137	S28 43 05.0 E25 43 38.8	Doornrandjes	Dolerite boulder foundation of a structure. Many glass and ceramic fragments scattered all through the area between this foundation and the next one to the southwest.	Low-medium **(8 hours)**
138	S28 43 06.6 E25 43 37.6		Dolerite boulder foundation of a structure. Lies 60 m southwest of the previous one.	
139	S28 43 01.8 E25 43 24.7	Doornrandjes	Scatter of MSA hornfels artefacts revealed in a farm road.	Low
140	S28 40 06.8 E25 42 21.0	Palmietfontein	Historical kraal on the north side of a dolerite hill. It is 20 m by 10 m with two rooms and a door in the larger room facing to the north. The rocks are very dispersed.	Low
141	S28 40 05.9 E25 42 18.2	Palmietfontein	Dolerite boulders with graffiti on them. "W.J.Coetzee" and others.	Low
142	S28 40 06.7 E25 42 17.6	Palmietfontein	Rock engravings on a dolerite boulders. One is a "sun" shape, probably Khoekhoe. Another is an antelope with a large hump (probably an eland) and another is a curved line of unknown meaning. Also the name "C.L. Coetzee 17.8.4…"	Medium-high **(4 hours)**
143	S28 40 06.4 E25 42 15.8	Palmietfontein	Isolated dolerite boulder off the hill with two or possibly three images engraved on it. A Khoekhoe "sun" shape and another geometric image are fairly clear but in general preservation is poor because of animals having rubbed themselves on the rock.	Medium-High **(4 hours)**
144	S28 40 07.3 E25 42 13.6	Modderfontein	Dolerite rock with a circle scratched onto it.	Low
145	S28 40 08.5 E25 42 04.5	Modderfontein	Historical kraal on the east side of a dolerite hill. It has a complex layout. Main square kraal has an opening to the east but to the north of the square section are other walls forming various enclosures.	Low-medium **(2 hours)**
146	S28 40 08.2 E25 42 03.2	Modderfontein	LSA Khoekhoe settlement on a dolerite hill. It includes geometric rock art, several bedrock grinding hollows and many stone artefacts (all on hornfels) scattered about a small muddy basin on the hill. The artefacts seem to be mostly quite fresh, but MSA also present. Two engraved rocks also appear to have been used as rock gongs.	High **AVOID**
147	S28 40 06.4 E25 42 06.2	Modderfontein	Historical stone foundation of 7 m by 4 m. Probably a small house related to the kraal system nearby. It is 75 m northwest of the kraal.	Low
148	S28 40 07.5 E25 42 07.6	Modderfontein	Dolerite boulder with smoothed and scratched areas (probably LSA).	Low
149	S28 40 07.7 E25 42 14.0	Modderfontein	Very faded probable geometric engraving on a dolerite boulder.	Low
150	S28 40 07.7 E25 42 14.9	Modderfontein	Isolated dolerite boulder with an engraving that looks like an ostrich.	Medium (2 hours)
151	S28 40 07.1 E25 42 13.9	Modderfontein	Dolerite boulder with probable geometric art that is very faded.	Low
152	S28 40 08.3 E25 42 20.7	Leliehoek	Scatter of MSA hornfels artefacts.	Low
153	S28 40 24.1 E25 42 24.5	Leliehoek	Dolerite boulder with some scratching on it. Unknown age, probably not old.	---
154	S28 40 42.3 E25 44 14.1	Klipfontein (C)	Dolerite boulder that has been rubbed.	---
155	S28 40 38.3 E25 44 16.7	Klipfontein (C)	Low structure built with two low stone walls 1.5 to 2.0 m apart and filled with earth and extending between points 155 and 156. From 156 to 157 it continues as a single line of	Low
156	S28 40 35.6			

GPS point	location	Farm	Description	Heritage significance
	E25 44 17.7		stones. It might have served to divert water from the stream near 155towards the north.	
157	S28 40 30.7 E25 44 17.5			
158	S28 40 30.7 E25 44 25.0	Klipfontein (C)	Scatter of hornfels MSA artefacts with some faceted platforms and many blades. The scatter seems better preserved than others in the area and there is a reasonable density.	Medium **(12 hours)**
159	S28 40 29.5 E25 44 26.4	Klipfontein (C)	Smaller patch of artefacts as above.	Medium **(4 hours)**
160	S28 40 47.4 E25 44 25.5	Klipfontein (S)	Scatter of MSA hornfels artefacts eroding out of the cover sands along the edge of an old borrow pit.	Low
161	S28 41 13.0 E25 44 44.3	Klipfontein (S)	Scatter of MSA hornfels artefacts in a farm road.	Low
162	S28 40 00.8 E25 44 20.2	Klipfontein (N)	Small quarry site. Looks quite recent. Many flakes have been removed from large rocks – not typical stone-dressing debris in that many “cores” are present.	Low
163	S28 39 55.0 E25 44 03.3	Klipfontein (N)	Scatter of MSA hornfels artefacts eroding out of the cover sands alongside an old borrow pit/quarry.	Low
164	S28 39 51.4 E25 44 56.5	Klipfontein (N)	Scatter of MSA hornfels artefacts eroding out of the cover sands along the banks of a stream.	Low
165	S28 39 49.8 E25 45 19.9	Klipfontein (N)	Scatter of MSA hornfels artefacts eroding out of the cover sands along the banks of a stream.	Low
166	S28 39 38.0 E25 45 10.6	Klipfontein (N)	Small quarry, perhaps for obtaining building stone. Probably not very old, likely twentieth century. Many large flakes lying on the ground. Many large holes in the ground with piles of dolerite cobbles around about.	Low
167	S28 39 29.4 E25 45 04.4	Klipfontein (N)	Scatter of MSA hornfels artefacts eroding out of the cover sands along the edge of a borrow pit.	Low
168	S28 39 39.0 E25 45 15.8	Klipfontein (N)	Small quarry, perhaps for obtaining building stone. Probably not very old, likely twentieth century. Many large flakes lying on the ground. Many large holes in the ground with piles of dolerite cobbles around about.	Low
169	S28 39 38.5 E25 45 22.6	Klipfontein (N)	Small quarry, perhaps for obtaining building stone. Probably not very old, likely twentieth century. Many large flakes lying on the ground. Many large holes in the ground with piles of dolerite cobbles around about.	Low
170	S28 39 44.9 E25 45 26.0	Klipfontein (N)	Small quarry, perhaps for obtaining building stone. Probably not very old, likely twentieth century. Many large flakes lying on the ground. Many large holes in the ground with piles of dolerite cobbles around about.	Low
171	S28 39 45.7 E25 45 27.8	Klipfontein (N)	Deflated area with MSA hornfels artefacts eroding out of the cover sands. It looks like this area has excavation potential to capture a sealed sample of artefacts from the area to the northwest of the exposed artefacts.	Medium **(16 hours)**
172	S28 39 44.6 E25 45 29.2			
173	S28 37 53.7 E25 43 05.3	Oxford	Small dam with walls lined with packed dolerite cobbles and boulders.	Low
174	S28 38 04.4 E25 43 00.9	Oxford	Scatter of MSA hornfels artefacts eroding out of a farm road.	Low
175	S28 38 01.8 E25 42 56.5	Oxford	Scatter of MSA hornfels artefacts in a deflated area that has gravel present in it as well.	Low

APPENDIX 2: MAPPING

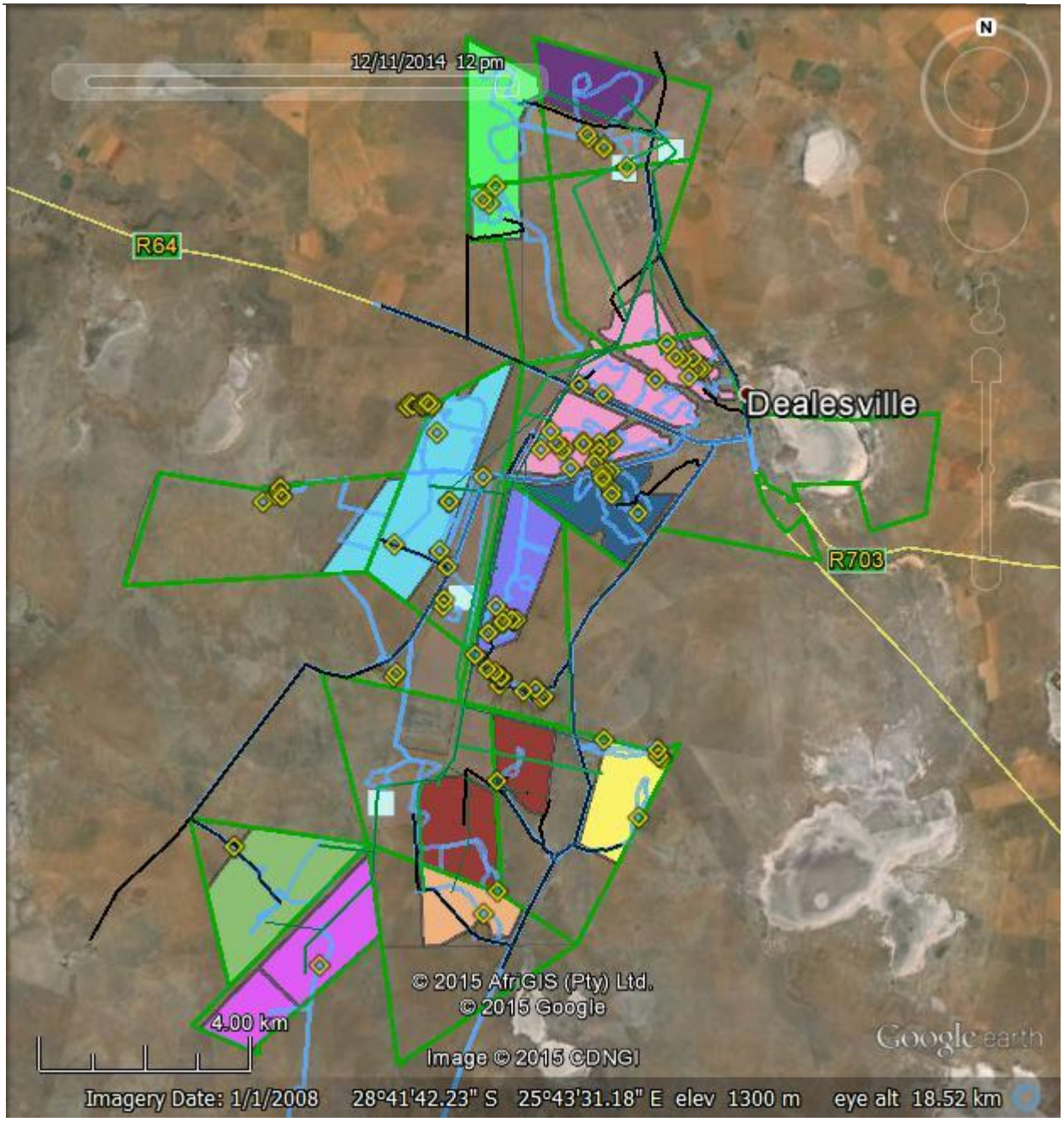

Figure A2.1: Aerial view of the study area showing all recorded heritage resources (yellow symbols).

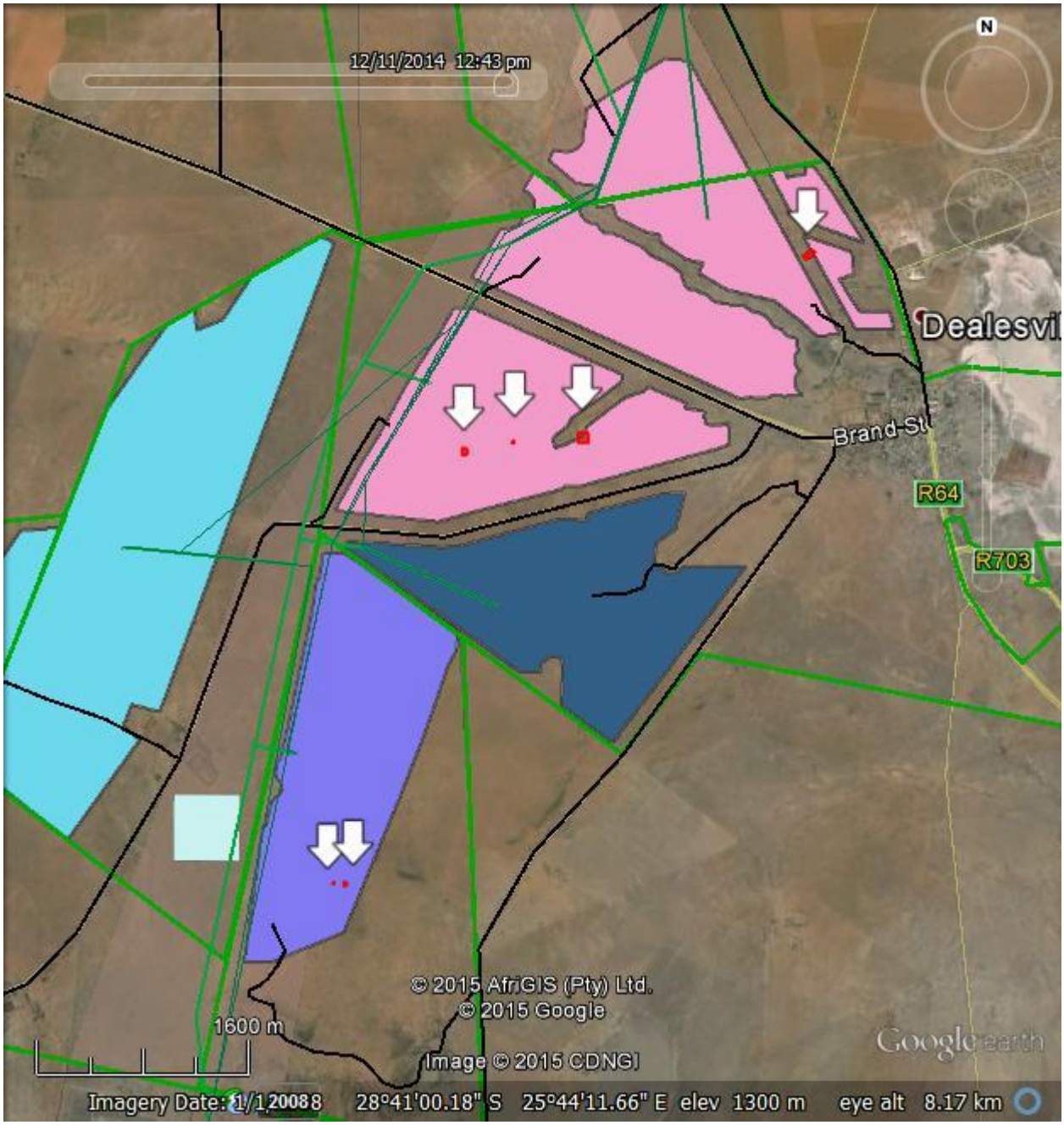

Figure A2.2: Aerial view of the central part of the study area showing the six locations where archaeological mitigation is required inside the development footprints (red polygons indicated by white arrows). Other mitigation-worthy sites not falling within the development footprints are not indicated as, on the present layout, they will not need mitigation.

Figure A2.3: Sites requiring mitigation at waypoints 092 and 097.

Figure A2.4: Sites requiring mitigation at waypoints 158 and 159.

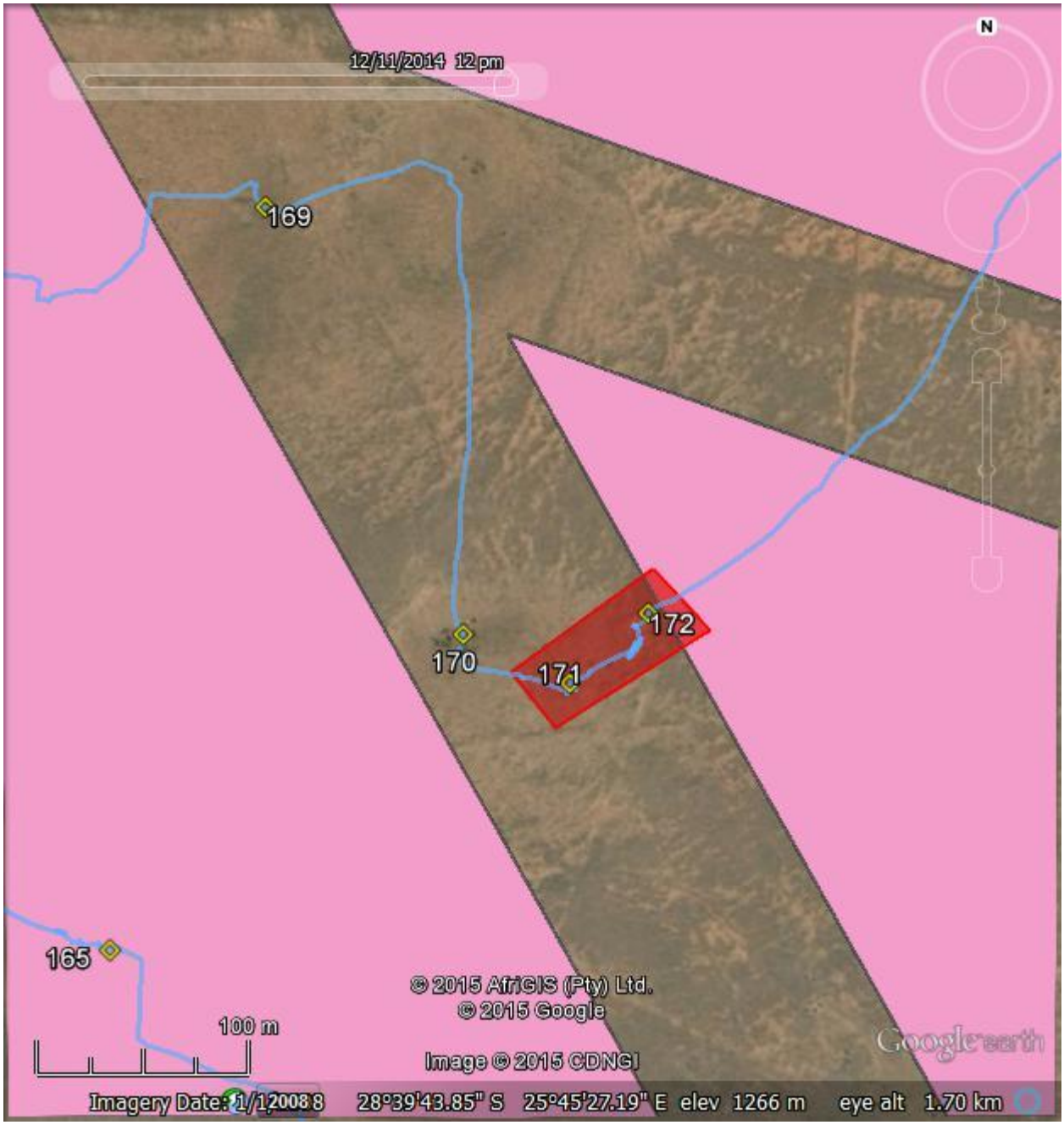

Figure A2.5: Sites requiring mitigation at waypoints 171 and 172.

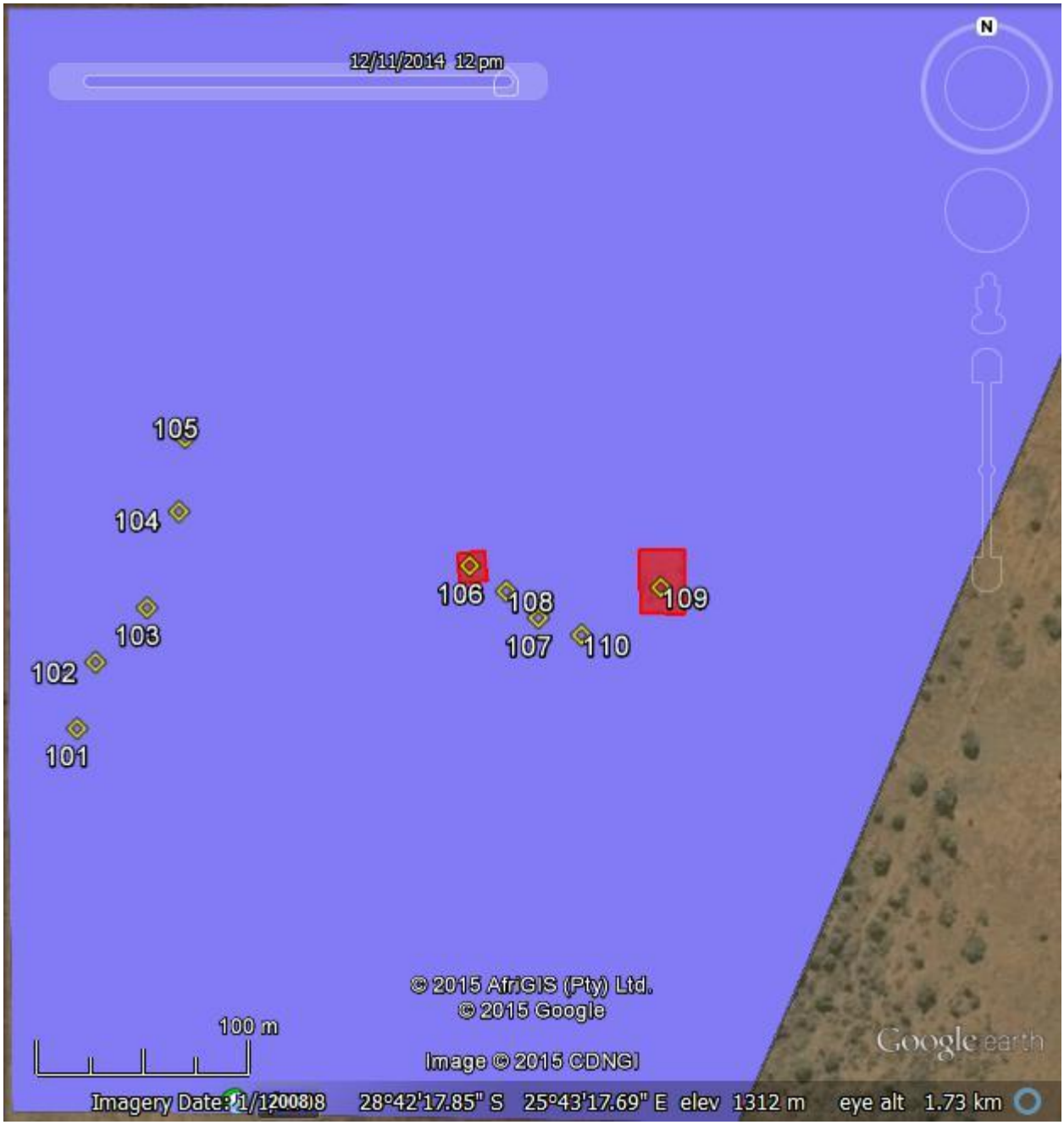

Figure A2.6: Sites requiring mitigation at waypoints 106 and 109.