environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

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Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

BOKPOORT II SOLAR

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SOUTH AFRICAN POLICE
COMMUNITY SERVICE CENTRE
16 APR 2020
HILLCREST
KWAZULU - NATAL

1. SPECIALIST INFORMATION

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2. DECLARATION BY THE SPECIALIST

I, LISA FROST RAMSAY, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

WSP

Name of Company:

16 April 2020

Date

SOUTH AFRICAN POLICE
COMMUNITY SERVICE CENTRE
16 APR 2020
HILLCREST
KWAZULU - NATAL

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, LISA FROST RAMSAY, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

NSP

Name of Company

16 APRIL 2020

Date

WO AP. MARTIN

Signature of the Commissioner of Oaths

20.04.16

Date

SOUTH AFRICAN POLICE
COMMUNITY SERVICE CENTRE
16 APR 2020
HILLCREST
KWAZULU - NATAL

ROYAL HASKONINGDHV

AIR QUALITY IMPACT ASSESSMENT FOR PROPOSED BOKPOORT 10 X PV SOLAR POWER FACILITIES

FARM BOKPOORT, NEAR GROBLERSHOOP, NORTHERN CAPE PROVINCE

16 APRIL 2020

AIR QUALITY IMPACT ASSESSMENT FOR PROPOSED BOKPOORT 10 X PV SOLAR POWER FACILITIES

FARM BOKPOORT, NEAR GROBLERSHOOP, NORTHERN CAPE PROVINCE

ROYAL HASKONINGDHV

PROJECT NO.: 41102263
DATE: APRIL 2020

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Signature				
Authorised by	Bradley Keiser	Bradley Keiser		
Signature				
Project number	41102263			

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EXECUTIVE SUMMARY

WSP Environmental was appointed by Royal HaskoningDHV to conduct an Air Quality Impact Assessment (AQIA) for the proposed Bokpoort photovoltaic (PV) solar power facilities in the Northern Cape. The site is within one of South Africa's eight renewable energy development zones, identified as most suitable for renewable energy developments in terms of environmental impact and economic and infrastructural factors.

An AQIA of the site was conducted by SSI Environmental in November 2010 for a then proposed concentrating solar plant (CSP) on the site. In 2016, Environmental Authorisations were received for two 75 MW PV plants and a 150 MW CSP plant on the site. ACWA Power Energy Africa now proposes 10 x 200 MW PV plants on the same footprint of the site. Each of the ten sites will comprise PV panels, a battery energy storage system (BESS), a substation, access routes and shared infrastructure consisting of buildings, including a workshop area for maintenance, storage, laydown area, parking, warehouse, and offices. A Basic Assessment is currently underway for the eight additional PV plants. The two already authorised for the site are being assessed for additional capacity and the inclusion of the BESS.

A regulatory assessment indicated that the PV facility does not trigger any of the regulated Listed Activities. As such, the facility does not require an Atmospheric Emission License (AEL). The closest sensitive receptor identified is a farmhouse, approximately 2 km south-west of the proposed site. Surrounding towns are at least 17 km from the site. Local existing air pollution sources include agricultural activities, domestic fuel burning and veld fires. The key pollutant from the proposed site during the construction and decommission phases would be particulate matter (PM). Various PM control measures for the construction phase are presented, the key being wet suppression. During the operational phase, there should be very limited air quality impacts, if any, beyond exhaust emissions and wheel entrainment of dust by traffic to and from the site. Strict BESS management and maintenance procedures will ensure containment and prevent any significant air quality impacts. On decommissioning, the BESS should be promptly removed offsite in line with manufacturer guidance and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

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1 INTRODUCTION

1.1 BACKGROUND

WSP Environmental (WSP) has been appointed by Royal HaskoningDHV to update an existing air quality impact assessment (AQIA) for the proposed Bokpoort photovoltaic (PV) solar power facilities in the Northern Cape. The site is within one of South Africa's eight renewable energy development zones, identified as most suitable for renewable energy developments in terms of environmental impact and economic and infrastructural factors.

An AQIA of the site was conducted by SSI Environmental in November 2010[1] for a then proposed concentrating solar plant (CSP) on the site. In 2016, Environmental Authorisations were received for two 75 MW PV plants and a 150 MW CSP plant on the site. ACWA Power Energy Africa (ACWA Power) now proposes 10 x 200 MW PV plants on the same footprint of the site (**Figure 1)**. Each of the ten sites will comprise PV panels, a battery energy storage system (BESS), a substation, access routes and shared infrastructure consisting of buildings, including a workshop area for maintenance, storage, laydown area, parking, warehouse, and offices. A Basic Assessment is currently underway for the eight additional PV plants. The two already authorised for the site are being assessed for additional capacity and the inclusion of the BESS. Terms of Reference

The Terms of Reference for the AQIA can be summarised as follows:

- A regulatory assessment;
- An overview of the dispersion potential of the region;
- Identification of sensitive receptors, such as local communities, in the vicinity of the proposed site;
- Identification of existing sources of emissions in the area;
- Identification of sources of emissions on the proposed site; and
- Recommendations for appropriate mitigation measures.

1.2 REGULATORY FRAMEWORK

Until 2004, South Africa's approach to air pollution control fell under the Atmospheric Pollution Prevention Act 45 of 1965 (APPA), which was repealed with the promulgation of the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA)[2]. NEM:AQA represented a shift in South Africa's approach to air quality management, from source-based control to a more integrated approach that includes ambient standards.

The objectives of NEM:AQA are to:

- Protect the environment by providing reasonable measures for:
  - The protection and enhancement of air quality;
  - The prevention of air pollution and ecological degradation; and
  - Securing ecologically sustainable development while promoting justifiable economic and social development.
- Give effect to the Constitutional right to an environment that is not harmful to their health and well-being[3]

Significant functions detailed in NEM:AQA include:

- The National Framework for Air Quality Management;
- Institutional planning matters, including:
  - The establishment of a National Air Quality Advisory Committee;

[1] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.
[2] National Environmental Management: Air Quality Act, Act 39 of 2004, Government Gazette 27318, 24 February 2005.
[3] Constitution of the Republic of South Africa *(No. 108 of 1996)*.

- The appointment of Air Quality Officers (AQOs) at each level of government;
- The development, implementation and reporting of Air Quality Management Plans at national, provincial and municipal levels;

— Air quality management measures including:

- The declaration of Priority Areas where ambient air quality standards are being, or may be, exceeded;
- The listing of activities that result in atmospheric emissions and which have the potential to impact negatively on the environment and the licensing thereof through an Atmospheric Emissions License (AEL);
- The declaration of Controlled Emitters;
- The declaration of Controlled Fuels;
- Procedures to enforce Pollution Prevention Plans or Atmospheric Impact Reporting for the control and inventory of atmospheric pollutants of concern; and
- Requirements for addressing dust and offensive odours.

Ambient air quality standards are defined as those "*targets for air quality management which establish the permissible concentration of a particular substance in, or property of, discharges to air, based on what a particular receiving environment can tolerate without significant deterioration*"[4]. South Africa's National Ambient Air Quality Standards (NAAQS) are based primarily on guidance offered by two standards set by the South African National Standards (SANS), namely:

— SANS 69:2004 Framework for implementing National ambient air quality standards; and

— SANS 1929:2005 Ambient air quality – Limits for common pollutants.

SANS 69:2004 makes provision for the establishment of air quality objectives for the protection of human health and the environment as a whole. Such air quality objectives include limit values, alert thresholds and target values.

SANS1929:2005 uses the provisions in SANS 69:2004 to establish air quality objectives for the protection of human health and the environment, and stipulates that limit values are initially set to protect human health. The setting of such limit values represents the first step in a process to manage air quality and initiate a process to ultimately achieve acceptable air quality nationally.

The NAAQS presented in **Table 1** became applicable for air quality management from their promulgation in 2009[5] and 2012[6]. The NAAQS have specific averaging periods, compliance timeframes, permissible frequencies of exceedance and reference methods.

Listed Activities and associated Minimum Emission Standards (MES) were published in Government Notice 248, Government Gazette 33064 (31 March 2010) in line with Section 21 of NEM:AQA. An amended list of activities was published in Government Notice 893, Government Gazette 37054 (22 November 2013)[7], with further amendments in June 2015 (Government Notice 551 of 2015) and 2018 (Government Notice 1207 of 2018). The proposed activities of the Bokpoort site do not trigger any of the Listed Activities. As such, the facility does not require an AEL.

[4] Department of Environmental Affairs (2000): Integrated Pollution and Waste Management Policy for South Africa. Government Gazette (No. R 227 of 2000), 17 March 2000 (No. 20978)

[5] Department of Environmental Affairs (2009): National Ambient Air Quality Standards. Government Gazette (No. R 1210 of 2009), 24 December 2009 (No. 32816)

[6] Department of Environmental Affairs (2012): National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Micro Metres ($PM_{2.5}$). Government Gazette (No. R 486 of 2012), 29 June 2012 (No. 35463)

[7] Department of Environmental Affairs (2013): List of Activities Which Result in Atmospheric Emissions Which Have or May Have A Significant Detrimental Effect on the Environment, Including Health, Social Conditions, Economic Conditions, Ecological Conditions Or Cultural Heritage. Government Gazette (No. 893 of 2013), 22 November 2013 (No. 37054)

Table 1: National ambient air quality standards

POLLUTANT	AVERAGING PERIOD	CONCENTRATION (µg/m^3)	PERMISSIBLE FREQUENCY OF EXCEEDANCE
Particulate Matter (PM_{10})	24 hours	75	4
	1 year	40	0
Particulate Matter ($PM_{2.5}$)	24 hour	40	4
		25[a]	4
	1 year	20	0
		15[a]	0
Benzene (C_6H_6)	1 year	5	0
Sulphur Dioxide (SO_2)	10 minutes	500	526
	1 hour	350	88
	24 hours	125	4
	1 year	50	0
Nitrogen Dioxide (NO_2)	1 hour	200	88
	1 year	40	0
Carbon Monoxide (CO)	1 hour	30000	88
	8 hour	10000	11
Ozone (O_3)	8 hour	120	11
Lead (Pb)	1 year	0.5	0

a: Effective date is 01 January 2030

1.3 STUDY SITE

The proposed site is on Farm Bokpoort 390, located approximately 80 km to the south-south-east of Upington (**Figure 1**). The region is semi-desert with cultivated crops along the floodplain of the Orange River. The chief activity on the site prior to development was sheep and cattle farming. A number of game farms are located to the north of the proposed site.

1.3.1 SENSITIVE RECEPTORS

A sensitive receptor is a person or place where involuntary exposure to pollutants released by the proposed project could take place (e.g. residences, schools, medical facilities, etc.). Receptors surrounding the proposed site were identified by SSI (2010)[8] from satellite images of the area. The closest sensitive receptor is a neighbouring farmhouse, approximately 2 km south-west of the proposed site. Residential areas identified include:

- Wegdraai (17 km south-west of the site);
- Groblershoop (18 km south of the site);
- Sutterheim (19 km south of the site);
- Brandboom (24 km south-south-east of the site);
- Boegoberg (34 km south-south-east of the site); and
- Upington (80 km west-north-west of the site).

[8] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.

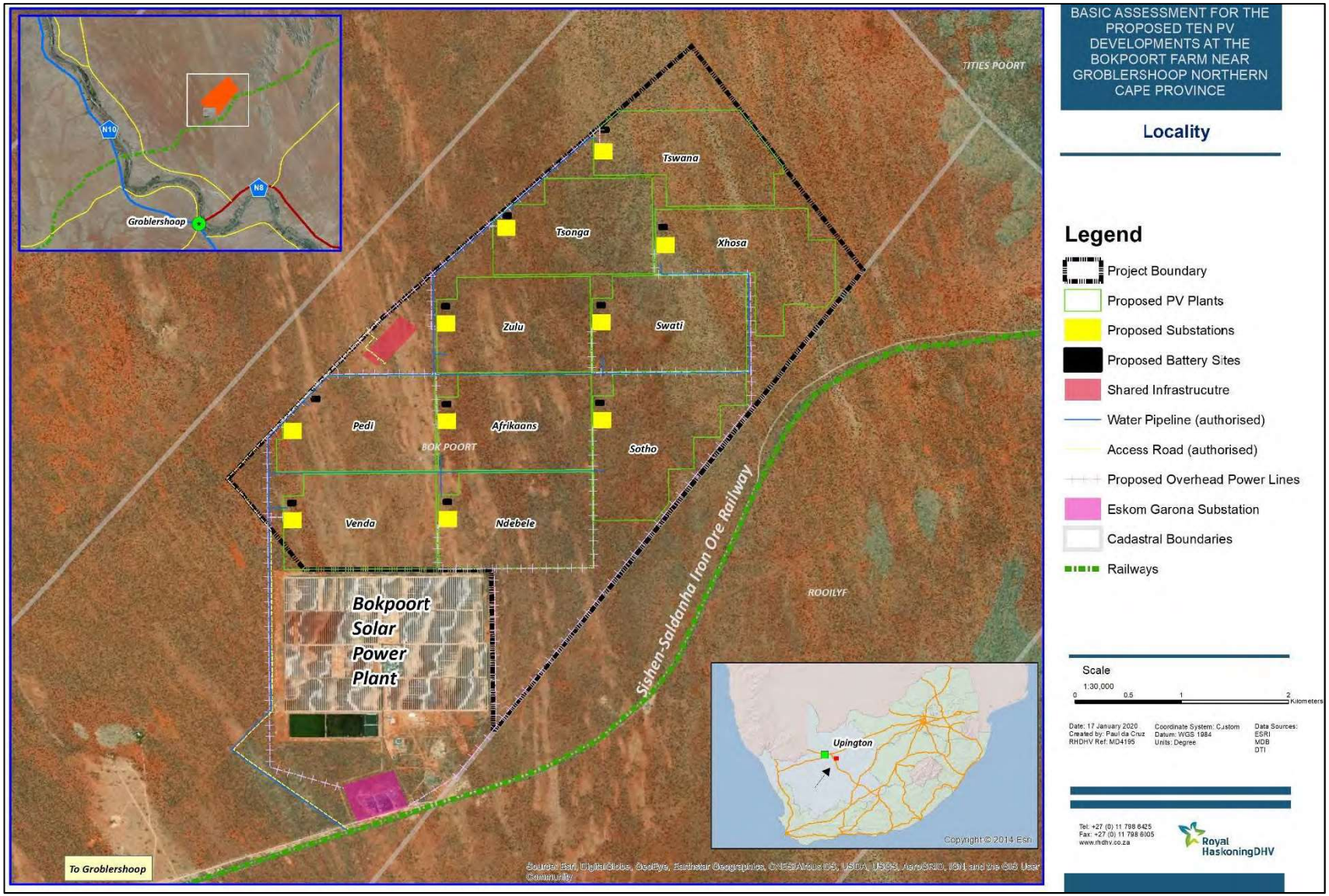


Figure 1: Site locality map

1.3.2 EXISTING SOURCES OF AIR POLLUTION

SSI (2010)[9] used satellite imagery to identify the following sources of air pollution in the area:

- Agriculture;
- Domestic fuel burning; and
- Veld fires.

The following sections, providing a qualitative description of the identified sources, were extracted from the SSI (2010)[10] AQIA report:

AGRICULTURE

Land-use along the Orange River is predominantly agricultural with crops such as grapes grown on the flood plains. The activities responsible for the release of particulate matter (PM) and gases to atmosphere include:

- Particulate emissions generated due to wind erosion from exposed areas;
- Particulate emissions generated due to the mechanical action of equipment used for tilling and harvesting operations
  - Tilling, harvesting and other activities associated with field preparation are seasonally based;
- Vehicle entrained dust on paved and unpaved road surfaces;
- Gaseous and particulate emissions due to fertilizer treatment; and
- Gaseous emissions due to the application of herbicides and pesticides.

DOMESTIC FUEL BURNING

It is anticipated that low income households in the area are likely to use coal and wood for space heating and cooking purpose. Biomass and coal smoke contain a large number of pollutants, including PM, carbon monoxide (CO), nitrogen oxides (NO_x), sulphur oxides (SO_3), formaldehyde, and polycyclic organic matter, including carcinogens such as benzo[a]pyrene[11].

Exposure to indoor air pollution (IAP) from the combustion of solid fuels has implications for acute respiratory infections (ARI) and otitis media (middle ear infection), chronic obstructive pulmonary disease (COPD), lung cancer (from coal smoke), asthma, cancer of the nasopharynx and larynx, tuberculosis, perinatal conditions and low birth weight, and diseases of the eye such as cataract and blindness[12].

Monitoring of pollution and personal exposures in biomass-burning households has shown concentrations are many times higher than those in industrialized countries. A typical 24-hr average concentration of PM_{10} in homes using biofuels may range from 200 to 5 000 µg/m^3, depending on the type of fuel, stove, and housing. Significant temporal and spatial variations may occur within a house. Field measurements, for example, recorded peak concentrations of > 50 000 µg/m^3 in the immediate vicinity of the fire, with concentrations falling significantly with increasing distance from the fire. Overall, it has been estimated that approximately 80% of total global exposure to airborne particulate matter occurs indoors in developing nations. Levels of CO and other pollutants also often exceed international guidelines[13].

[9] *Ibid.*
[10] *Ibid.*
[11] Ezzati, M. and D.M. Kammen, 2002. Environmental Health Perspective. The health impacts of exposure to indoor air pollution from solid fuels in developing countries: Knowledge, Gaps and data needs. Risk Resource and Environmental Management Divisions, Resources for the future, Washington DC, USA, Energy and Resources Group and Goldman School of Public Policy, University of California, Berkley California, USA.
[12] *Ibid.*
[13] *Ibid.*

VELD FIRES

A veld fire is a large-scale natural combustion process. The size and intensity of a veld fire depends variables such as meteorological conditions, vegetation variables, particularly moisture content, and the density of consumable fuel per hectare (available fuel loading).

The major pollutants from veld burning are PM, CO and volatile organics. NO_x is emitted at rates of from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of SO_x are negligible[14].

1.3.3 METEOROLOGY

The meteorological description below is extracted from the SSI (2010)[15] AQIA report:

MESO-SCALE METEOROLOGY

Local meteorology determines what happens to pollution when it is released into the atmosphere[16]. Pollution levels fluctuate daily and hourly, in response to changes in atmospheric stability and variations in mixing depth. Similarly, atmospheric circulation patterns will have an effect on the rate of transport and dispersion of pollution.

The release of atmospheric pollutants into a large volume of air results in the dilution of those pollutants. This is most effectively achieved during conditions of free convection and when the mixing layer is deep (unstable atmospheric conditions). These conditions occur most frequently in summer during the daytime. This dilution effect can however be inhibited under stable atmospheric conditions in the boundary layer (shallow mixing layer), particularly if pollution is trapped within a surface inversion. Surface inversions develop under conditions of clear, calm and dry conditions and often occur at night and during winter. Radiative loss during the night results in the development of a cold layer of air close to the earth's surface. These surface inversions dissipate once the sun rises and warms the earth's surface.

With the absence of surface inversions, the pollutants are able to diffuse freely upward; this upward motion may however be prevented by the presence of an elevated inversion. Elevated inversions occur commonly in high pressure areas. Sinking air warms adiabatically to temperatures in excess of those in the mixed boundary layer. The interface between the upper, gently subsiding air is marked by an absolutely stable layer or an elevated subsidence inversion. This type of elevated inversions is common over the interior Southern Africa. The continental high pressure present over the region in the winter months results in fine conditions with little rainfall and light winds with a northerly flow[17].

Seasonal variations in the positions of the high pressure cells have an effect on atmospheric conditions over the region. For most of the year the tropical easterlies cause an air flow with a north-easterly to north-westerly component. In the winter months the high pressure cells move northward, displacing the tropical easterlies northward resulting in disruptions to the westerly circulation. The disruptions result in a succession of cold fronts over the area in winter with pronounced variations in wind direction, wind speeds, temperature, humidity, and surface pressure. Airflow ahead of a cold front passing over the area has a strong north-north-westerly to north-easterly component, with stable and generally cloud-free conditions. Once the front has passed, the airflow is has a dominant southerly component[18].

Easterly and westerly wave disturbances cause a southerly wind flow and tend to hinder the persistence of inversions, either temporarily removing them or increasing their altitude, thereby facilitating the dilution and dispersion of pollutants. Pre-frontal conditions tend to reduce the mixing depth. The potential for the accumulation of pollutants during pre-frontal conditions is therefore enhanced over the plateau[19].

[14] U.S Environmental Protection Agency, (1996). Compilation of Air Pollution Emission Factors (AP-42), 6th Edition, Volume 1, Available at URL: http://www.epa.gov/ttn/chief/ap42/
[15] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.
[16] Tyson, P.D. and R.A. Preston-Whyte, 2000. The Weather and Climate of Southern Africa. Oxford University Press, Cape Town.
[17] *Ibid.*
[18] *Ibid.*
[19] *Ibid.*

SITE-SPECIFIC DISPERSION POTENTIAL

Given the remote location of the proposed site, local meteorological measurements were not available. SSI (2010)[20] made use of site-specific modelled MM5 meteorological data for the period January 2005 – December 2009 from Lakes Environmental.

Wind roses comprise of 16 spokes that represent the directions from which winds blew during the reference period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories.

Based on an evaluation of the meteorological data provided, winds originated predominantly from the north-north-east (10.5% of the time) and north (9% of the time) (**Figure 1**). Gentle to moderate breezes prevailed over the monitoring period. Calm wind speeds, which are designated as wind speeds less than 0.5 m/s, occur infrequently (<4 % of the time).

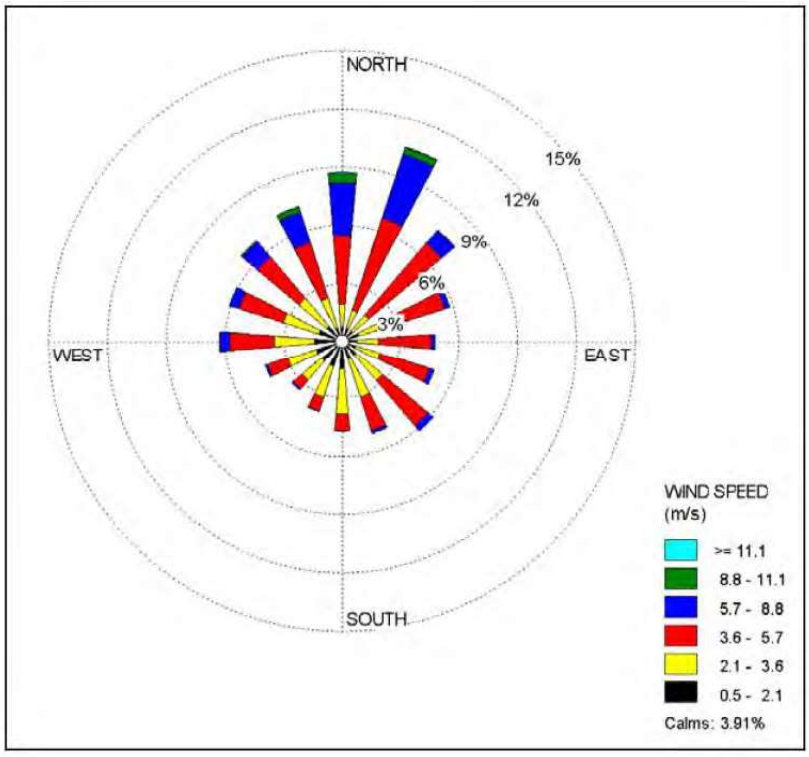


Figure 2: Period wind rose for study site, 2005 – 2009 MM5

A diurnal trend in the wind field is recorded at the proposed site (**Figure 3**). During the morning (06:00 – 12:00), moderate to fresh breezes prevail from the north-northeast to the north-north-west. During the afternoon (12:00 – 18:00), on average gentler breezes blow from the north-westerly sector. The evening (18:00 -00:00) shows a more varied wind rose, but with gentle westerlies prevailing. During the night-time (00:00 – 06:00), average wind speeds increase, with winds prevailing form the north-north-east to east-north-east.

The seasonal variability in the wind field at the proposed site is shown in **Figure 4**. During the summer months (Dec, Jan and Feb), winds originate predominantly from the west. During autumn (Mar, Apr and May), a shift is observed with winds originating predominantly from the north-north-east and north-east. A similar pattern to the autumn months is observed during the winter months (Jun, Jul and Aug) but with a northerly shift and higher average wind speeds. During spring (Sep, Oct and Nov), winds originate from all sectors, with the highest frequency recorded from the westerly sector. Lowest average wind speeds occur during spring.

[20] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.

Based on the prevailing meteorological conditions for the area, emissions released from the proposed site will be transported predominantly in a south-south-westerly and southerly direction from the proposed site.

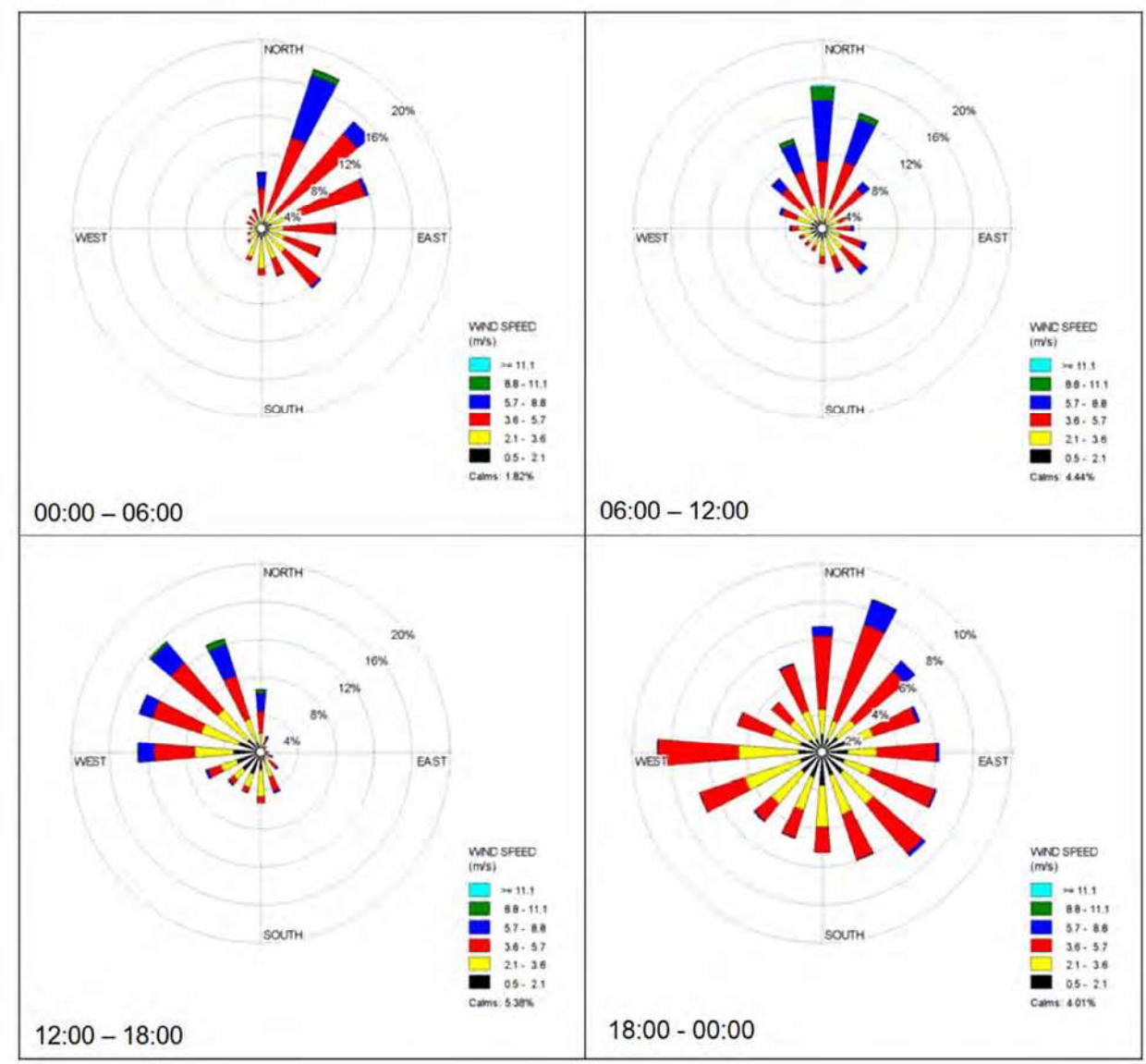


Figure 3: Diurnal wind rose for the study site, 2005 - 2009 MM5

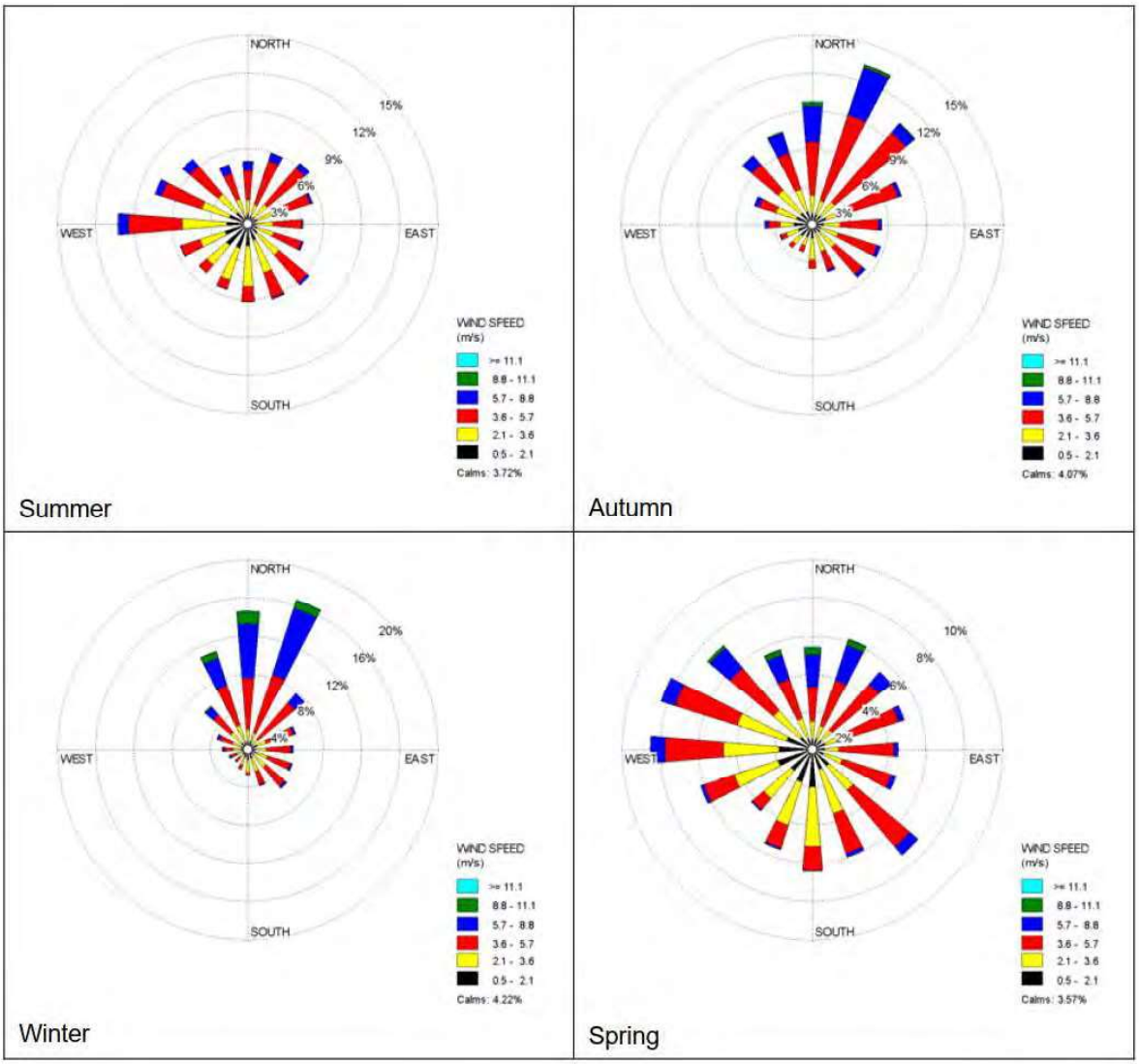


Figure 4: Seasonal wind rose, 2005 - 2009 MM5

ATMOSPHERIC STABILITY

Atmospheric stability is categorised into six classes (**Table 2**). The atmospheric boundary layer is generally most unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5 - 6 hours after sunrise, dependent on cloud cover. The degree of thermal turbulence is increased on clear warm days with light winds. During the night-time a stable layer, with limited vertical mixing, exists. During windy and cloudy conditions, the atmosphere is normally neutral.

Table 2: Atmospheric stability classes

A	Very unstable	calm wind, clear skies, hot daytime conditions
B	Moderately unstable	clear skies, daytime conditions
C	Unstable	moderate wind, slightly overcast daytime conditions
D	Neutral	high winds or cloudy days and nights
E	Stable	moderate wind, slightly overcast night-time conditions
F	Very stable	low winds, clear skies, cold night-time conditions

In general, the proposed site experiences neutral (Class D) to stable (Class E) atmospheric conditions (**Figure 5**). This is expected given the predominance of a high-pressure anticyclone over the interior of South Africa, which produces stable, clear conditions.

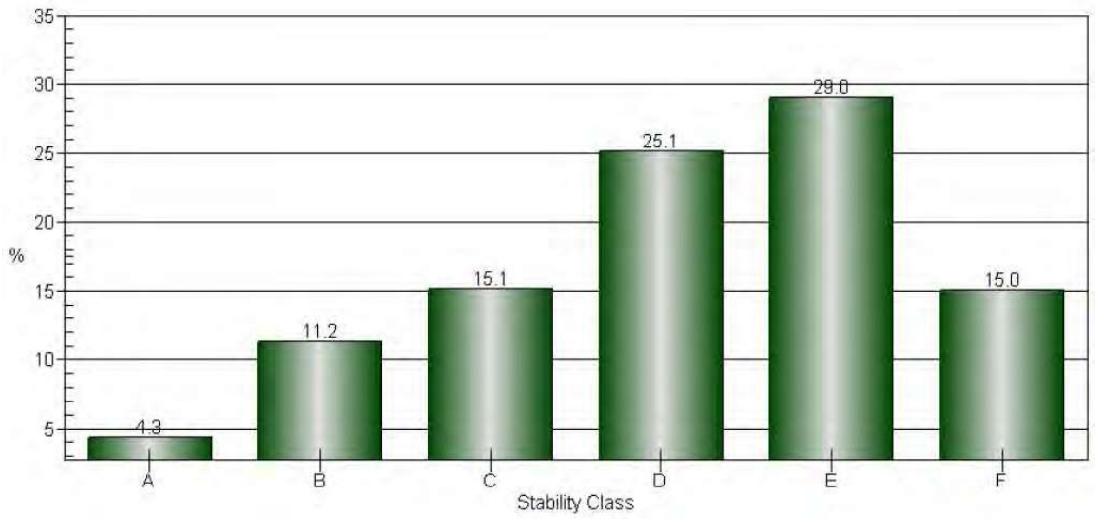


Figure 5: Stability class frequency distribution, 2005 – 2009 MM5

TEMPERATURE AND HUMIDITY

Temperature affects the formation, action, and interactions of pollutants in various ways. Chemical reaction rates tend to increase with temperature. Evaporation rates increase with temperature. When relative humidity exceeds 70%, light scattering by suspended particles can result in decreased visibility due to the resultant haze. Temperature also provides an indication of the rate of development and dissipation of the mixing layer[21].

Average monthly temperature and humidity at the proposed site for the period 2005 – 2009 is presented in **Figure 6**. Daily average summer temperatures range between ~24 °C and ~26 °C while winter temperatures range between ~11 °C and ~13 °C. Relative humidity peaks during the winter months.

[21] CEPA/FPAC Working Group, 1999. National Ambient Air Quality Objectives For Particulate Matter. Part 1: Science Assessment Document. Minister, Public Works and Government Services, Ontario. Available at URL: http://www.hc-sc.gc.ca/bch.

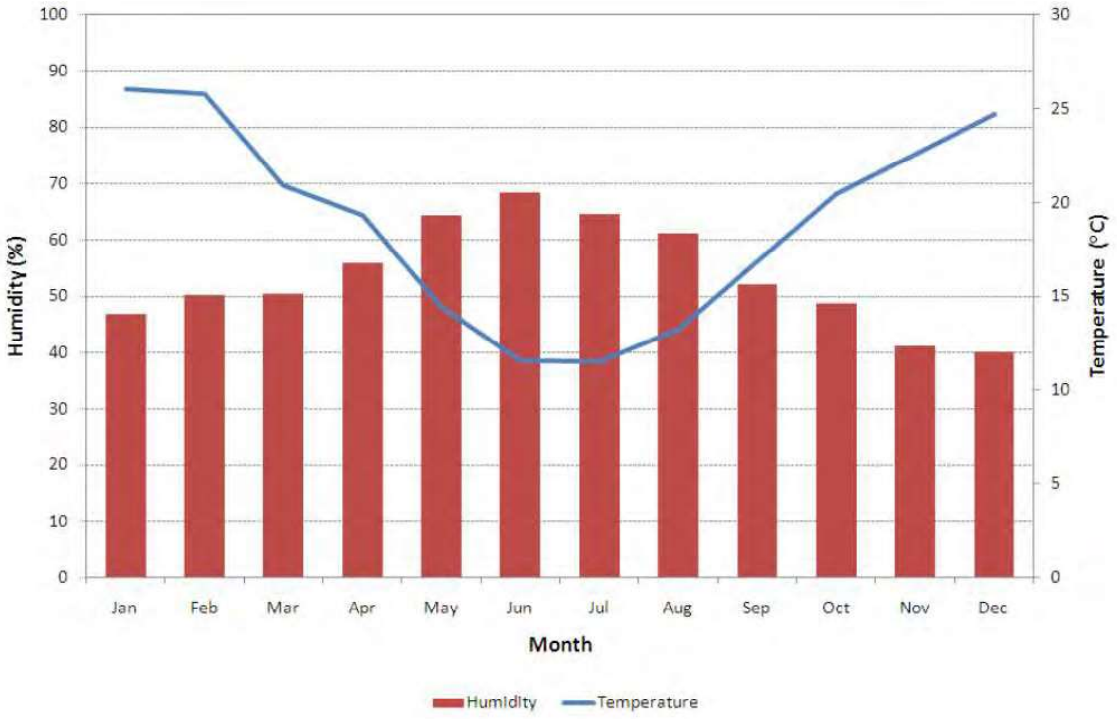


Figure 6: Monthly average temperature and relative humidity at the study site, 2005 - 2009 MM5

1.4 PROPOSED INFRASTRUCTURE

1.4.1 PHOTOVOLTAIC INFRASTRUCTURE

The solar PV development of up to 200 Megawatt (MW) that will consist of the following infrastructure:

- Solar PV modules that will be able to deliver up to 200 MW per PV plant to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
- A transformer that raises the system alternating current (AC) low voltage (LV) to medium voltage (MV):
  - The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
- Transformer substation;
- A BESS at each of the ten plants:
  - Battery power at point of connection: 150 MW
  - The BESS will store approximately 4500 m^3 of hazardous substance.
- Instrumentation and Control - hardware and software for remote plant monitoring and operation.

1.4.2 ENERGY STORAGE OPTIONS

ACWA Power favour a lithium ion BESS on each of the ten sites. Parsons (2017)[22] outline various advanced battery systems, including lead and advanced lead-acid batteries, ultracapacitators, lithium ion batteries, vanadium flow batteries, zinc bromine flow batteries, ion-chromium flow batteries, and sodium sulphur batteries. Ultracapacitators and lithium ion batteries generally are limited by high production costs, while vanadium flow batteries, zinc bromine flow batteries, and ion-chromium flow batteries remain developing technologies. Sodium sulphur batteries require high operating temperatures (250-300ºC).

Should ACWA Power not select the lithium ion option, we assume a lead-acid battery option will be selected. This is a mature battery technology with lower initial costs, albeit higher maintenance requirements than some of the alternatives. Our impact assessment thus consider both the lithium ion and lead-acid options.

1.4.3 ASSOCIATED INFRASTRUCTURE

Associated infrastructure includes:

- Mounting structures for the solar panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132 kV overhead powerline, which will connect the facility to the national grid via Eskom's existing Garona Substation:
  - The powerline will be approximately 5 km in length and will be located within a servitude spanning 15.5m on both sides;
  - The powerline towers will be 35 m high;
- Internal access roads (4 - 6 m wide roads will be constructed but existing roads will be used as far as possible);
- Shared infrastructure, consisting of buildings, including a workshop area for maintenance, storage, laydown area, parking, warehouse, and offices; and
- Fencing.

1.4.4 POLLUTANTS ASSOCIATED WITH THE PROPOSED FACILITY

PARTICULATE MATTER (PM)

Particulate matter (PM) is the key pollutant of concern during the construction phase of the project. PM refers to solid or liquid particles suspended in the air, varying in size from particles that are only visible under an electron microscope to soot or smoke particles that are visible to the human eye. PM contributes greatly to deteriorations in visibility, as well as posing major health risks, as small particles (PM_{10}) can penetrate deep into lungs (inhalable fraction), while even smaller particle sizes ($PM_{2.5}$) can enter the bloodstream via capillaries in the lungs (respirable fraction), with the potential to be laid down as plaques in the cardiovascular system or brain. Health effects include: respiratory disease, lung tissue damage, cardiovascular disease, cancer and premature death. Acidic particles may damage buildings, vegetation and acidify water sources.

Total suspended particulates (TSP) includes particles of aerodynamic diameter of 30 microns or less and is generally a nuisance as dust fallout. Dust fallout comprises of particulate matter with varying aerodynamic diameters and mass characteristics. Visible dust fallout typically has a high particle size and mass characteristic, and thus a localized impact due to the rapid gravity settling of the larger particles. Nuisance effects can be caused by particles of any size, though are generally associated with particles greater than 20 microns. Large dust particles fall out of the air relatively close to the source and form dust layers on furniture, motor vehicles, etc.

[22] Parsons (2017). South Africa Energy Storage Technology and Market Assessment, Job Number 640368, USTDA Activity Number 2015-11032A, Objective 4: Environmental Impact Assessment.

GASEOUS EMISSIONS FROM BATTERY ENERGY STORAGE SYSTEMS

BESS loss of containment due to corrosion or fires, or during maintenance procedures poses risks to ambient air quality.

In the case of lithium ion batteries, the following emissions are of concern[23]:

- When exposed to water (including humidity), lithium emits flammable gases;
- Most lithium-ion batteries contain organic electrolytes (e.g. lithium perchlorate, acetonitrile), that are combustible, with associated emissions; and
- Additional heavy metals (such a cobalt and manganese) within the battery can be emitted to atmosphere under upset conditions (a containment breach or thermal runaway fire conditions).

In the case of lead-acid batteries, the following emissions are of concern[24]:

- Overcharging of lead-acid batteries can result in the emissions of hydrogen (H_2) and hydrogen sulphide (H_2S). H_2 does not have health implications, but has explosion risks. H_2S has a rotten egg smell. Concentrations of H_2S high enough to cause health impacts are not expected in the offsite ambient environment.
- Containment loss is the greatest concern in relation to the storage of hazardous chemicals onsite, and is a particular concern with the lead-acid BESS since sulphuric acid is highly corrosive:
  - Acute exposure to sulphuric acid fumes can cause irritation to eyes and the mucus membranes of the respiratory system;
  - Toxic fumes of molten lead:
    - Ambient lead is regulated under the NAAQS (**Table 1**) due to well established health implications of chronic exposure;
  - Fugitive emissions of other gases (e.g. H_2S and SO_x) pose further risks; and
  - Depending on the metal alloy composition in lead-acid batteries, arsine (arsenic hydride, AsH_3) and stibine (antimony hydride, SbH_3) can also be emitted.

[23] *Ibid.*
[24] *Ibid.*

2 IMPACT ASSESSMENT

2.1 CONSTRUCTION PHASE

The PM emissions associated with the construction will be of a temporary nature. Emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions (USEPA, 1996).

The following possible sources of PM emissions have been identified for the construction phase:

- Vehicle activities associated with the transport of equipment to the site;
- Preparation of the surface area prior to development; and
- The removal of construction equipment from site after the set-up of new infrastructure.

Vehicles travelling to and from the site will emit PM and gases, such as NO_x. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of key transport routes.

2.2 OPERATIONAL PHASE

If areas exposed during the construction phases are promptly revegetated, emissions during the operational phase of the facility are expected to be insignificant. Two sources of potential emissions are presented below:

2.2.1 EXPOSED AREAS

Areas left exposed after construction can results in emissions of PM particularly during periods of high wind speeds, or due to wheel entrainment of PM if vehicles travel over these areas.

2.2.2 VEHICULAR TRAFFIC

Vehicles travelling to and from the site will emit PM and gases. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of the main access road and access gate.

2.2.3 BATTERY ENERGY STORAGE SYSTEMS

Loss of containment due to corrosion or fires, or during maintenance procedures poses risks to ambient air quality.

In the case of lithium ion batteries, the following emissions are of concern[25]:

- When exposed to water (including humidity) due to a containment breach, lithium emits flammable gases;
- Most lithium-ion batteries contain organic electrolytes (e.g. lithium perchlorate, acetonitrile), that are combustible, with associated emissions;
- Additional heavy metals (such a cobalt and manganese) within the battery can be emitted to atmosphere under upset conditions (e.g. thermal runaway fire conditions)

In the case of lead-iron batteries, the following considerations are relevant[26]:

- When overcharged the battery can produce H_2, which poses an explosion risk, and H_2S, which has an odour nuisance (rather than health risk) at expected ambient concentrations;

[25] *Ibid.*
[26] *Ibid.*

- Containment loss is the greatest concern in relation to the storage of hazardous chemicals onsite, and is a particular concern with the lead-acid BESS since sulphuric acid is highly corrosive:
  - Acute exposure to sulphuric acid fumes (an occupational rather than ambient air quality risk) can cause irritation to eyes and the mucus membranes of the respiratory system;
  - Toxic fumes of molten lead:
    - Ambient lead is regulated under the NAAQS (**Table 1**) due to well established health implications of chronic exposure;
  - Fugitive emissions of other gases (e.g. H_2S and SO_x) pose further risks; and
  - Depending on the metal alloy composition in lead-acid batteries, AsH_3 and SbH_3 can also be emitted.

2.3 DECOMMISSIONING PHASE

The following activities are associated with the decommissioning phase:

- Existing structures demolished, rubble removed and the area levelled;
- Remaining exposed excavated areas filled and levelled;
- Topsoil replaced; and
- Land and permanent waste piles prepared for revegetation.

Possible sources of particulate emissions during the closure and post-closure phase include:

- Smoothing of areas by bulldozer;
- Grading of sites;
- Transport and dumping of material for void filling;
- Infrastructure demolition;
- Infrastructure rubble piles;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil; and
- Preparation of soil for revegetation – ploughing and addition of fertiliser, compost etc.

Decommissioning of BESS can also result in emissions to atmosphere due to containment issues (refer to *2.2. Operational Phase).* As such, the decommissioned components should be removed from site as soon as possible and transferred to an appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

3 MITIGATION MEASURES

We highlight that the nearest identified receptor (a farmhouse) is 2 km away from the site. Identified towns are at least 17 km from the site. As such, it is not expected that there will be a significant number of complaints regarding activities on site. However, in line with good environmental practice, various air pollution mitigation measures are presented below. It is also recommended that a complaint receipt, recording and response procedure is developed. A record of complaints and the response thereto should be stored in hard and digital copy onsite.

3.1 CONSTRUCTION PHASE

Control techniques for fugitive PM sources during the construction phase include watering, chemical stabilisation or reduction of surface wind speed with windbreaks or source enclosures. Watering is the most common and least expensive method, although it only provides temporary dust control. Wet suppression of unpaved areas can achieve dust emission reductions of approximately 70% or more, which can be increased by up to 95% through the use of chemical stabilisation. The use of chemicals provides for longer dust suppression but is more costly and may have adverse environmental effects. It is unlikely that such methods will be required at the proposed site. Windbreaks and source enclosures are often impractical because of the size of the construction area, but key areas of current activity can be closed off to limit impacts. A summary of control measures for the proposed plant is provided in **Table 3**. Wet suppression is the recommended method for the proposed plant to control PM emissions during the construction phase[27].

Table 3: Potential sources of particulate matter during the construction phase and suggested control measures[28]

Source	Suggested Control Method
Debris handling	Wind speed reduction (e.g wind-breaks)
	Wet suppression
Truck transport	Wet suppression
	Paving of roads
Bulldozers	Wet suppression
Pan scrapers	Wet suppression
Cut/fill materials handling	Wind speed reduction
	Wet suppression
Cut/fill haulage	Wet suppression
	Paving of roads
General construction	Wind speed reduction
	Wet suppression
	Early paving of haul/access road

[27] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.
[28] *Ibid.*

3.2 OPERATIONAL PHASE

3.2.1 EXPOSED AREAS

Revegetation of areas exposed for long-term dust and water erosion control is the most cost effective option. Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings[29].

3.2.2 VEHICULAR TRAFFIC

While motor vehicles emit gaseous pollutants such as NO_x, the expected traffic levels to and from the site indicate that there will not be significant ambient air quality impacts beyond the access routes. Wheel entrained dust can supplement the PM load. Various measures are available to limit emissions by vehicles accessing and travelling onsite:

- Clear, signposted roads with no offroad driving permitted;
- Limits on unnecessary travel onsite:
  - Planned, efficient check and maintenance routines;
  - Controlled access; and
  - Clear signage.
- Signposted speed limits onsite and the use of speed humps if necessary to enforce onsite speed limit; and
- Prevent idling of vehicles at the access gate.

3.2.3 BATTERY ENERGY STORAGE SYSTEMS

The following are recommended to limit air quality impacts by the BESS:

- Strict BESS management and monitoring systems:
  - Temperature monitoring to ensure the system does not overheat;
  - Prevent overcharging as this poses an explosion risk[30]; and
  - Checks and maintenance in line with manufacturer specifications to prevent containment breaches; and
- Secondary containment areas to prevent ambient air quality impacts in the case of a breach[31].

3.3 DECOMMISSIONING PHASE

Windbreaks and source enclosures can be used during demolition, rubble removal, infilling, levelling and topsoil covering. Rubble piles can be covered and transported away from the site in covered trucks. It is key that all exposed areas are vegetated as soon as possible during the decommissioning process. Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings[32].

[29] *Ibid.*
[30] Parsons (2017). South Africa Energy Storage Technology and Market Assessment, Job Number 640368, USTDA Activity Number 2015-11032A, Objective 4: Environmental Impact Assessment.
[31] *Ibid.*
[32] SSI (2010). Air Quality Impact Assessment for a Proposed Concentration Solar Plant in the Norther Cape. Project Number: EO2.JNB.000674, 33 pp.

BESS must be decommissioned by trained personnel in line with manufacturer specifications. Decommissioned BESS must be removed offsite promptly and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

4 IMPACT RATING

The air quality impact ratings for the construction, operational and decommissioning phases are presented in **Tables 4** to **6** respectively. For all impacts, except *BESS: containment loss*, the rating is the same for mitigated and unmitigated impacts. This is because the magnitude of these impacts is 2 (minor) mitigated or unmitigated. For *BESS: containment loss,* an unmitigated scenario is not possible since the BESS is manufactured with containment.

Table 4: Impact rating for construction phase

IMPACT	Occurrence		Severity		Significance	
	Probability (P)	Duration (D)	Scale/Extent (S)	Magnitude (M)	(M+D+S) x P	Rating
Fugitive PM	5	2	2	2	30	Moderate

Table 5: Impact rating for operational phase

IMPACT	Occurrence		Severity		Significance	
	Probability (P)	Duration (D)	Scale/Extent (S)	Magnitude (M)	(M+D+S) x P	Rating
Fugitive PM	2	4	2	2	16	Low
Wheel entrained PM	5	4	2	2	40	Moderate
Vehicular Emissions	5	4	2	2	40	Moderate
BESS: Lead-iron overcharging	2	4	2	2	16	Low
BESS: Containment loss	1	4	3	10	17	Low

Table 6: Impact rating for decommissioning phase

IMPACT	Occurrence		Severity		Significance	
	Probability (P)	Duration (D)	Scale/Extent (S)	Magnitude (M)	(M+D+S) x P	Rating
Fugitive PM	5	2	2	2	30	Moderate
BESS: Containment loss	1	4	3	10	17	Low

5 CONCLUSION

This report provides an AQIA for the proposed Bokpoort 10 x PV solar power plants, each with an onsite BESS. A regulatory assessment indicated no triggers of the Listed Activities. As such, the facility does not require an AEL. The closest sensitive receptor identified is a farmhouse, approximately 2 km south-west of the proposed site. Surrounding towns are at least 17 km away from the site. Local existing air pollution sources include agricultural activities, domestic fuel burning and veld fires. The key pollutant from the proposed site during the construction and decommissions phases would be PM. Various PM control measures for the construction phase are presented, the key being wet suppression. During the operational phase, there should be very limited air quality impacts, if any, beyond exhaust emissions and wheel entrainment of dust by traffic to and from the site. Strict BESS management and maintenance procedures will ensure containment and prevent any significant air quality impacts. On decommissioning, the BESS should be promptly removed offsite in line with manufacturer guidance and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium ion batteries needs further investigation.

If the various mitigation recommendations are applied, air quality impacts during the various phases of the project will be low to moderate. It is recommended that the proposed Bokpoort 10 x PV solar power plants, each with an onsite BESS, are authorised subject to conditions contained within a comprehensive Environmental Management Programme (EMPr), including:

- Where feasible, windbreaks and enclosure of working areas during the construction and decommission phases.
  - Rubble piles should be covered and transported away from the site in covered trucks.
- Wet suppression of dust from unpaved and unvegetated areas during the construction and operational phases.
- Prompt revegetation of exposed areas.
- Paving of roads where feasible.
- Speed controls on upaved roads during the construction and operational phases.
  - Signposted speed limits onsite and the use of speed humps if necessary to enforce onsite speed limit.
- Clear, signposted roads with no offroad driving permitted;
- Limits on unnecessary travel onsite:
  - Planned, efficient check and maintenance routines;
  - Controlled access; and
  - Clear signage.
- Prevention of idling of vehicles at the access gate.
- Strict BESS management and monitoring systems:
  - Temperature monitoring to ensure the system does not overheat;
  - Prevent overcharging as this poses an explosion risk; and
  - Checks and maintenance in line with manufacturer specifications to prevent containment breaches; and
  - Secondary containment areas to prevent ambient air quality impacts in the case of a breach.
- BESS must be decommissioned by trained personnel in line with manufacturer specifications.
  - Decommissioned BESS must be removed offsite promptly and taken to the nearest appropriate recycling facility.

5.1 ASSUMPTIONS AND LIMITATIONS

- It was assumed that information supplied by the client was current and accurate, and that detail on all potentially pollutive activities was provided.
- A site visit was not conducted and it is assumed that the desktop analysis provided an accurate and comprehensive assessment of surrounding activities.

- The meteorological assessment was extracted from the SSI (2010)[33] report and is based on meteorological data from 2005 – 2009. It is assumed that there have not been significant climatic changes in the region since 2005.
- Water availability for wet suppression of dust was assumed. The alternative is chemical suppression.
- The BESS technology was not established at the time of compiling this report. It was assumed that the BESS would be lithium ion or lead-acid.

[33] *Ibid.*

6 DETAILS OF CONSULTANT

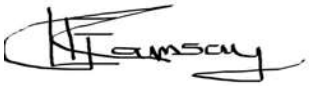
Dr Lisa Frost Ramsay is actively involved in various air quality management services, including atmospheric dispersion modelling; compilation of atmospheric emission inventories and licenses, odour monitoring, modelling and management; health impact assessments; liaising with stakeholders; and strategic air quality management plans. She has a thorough understanding of both the theoretical aspects and practical implementation of South African environmental legislation. With a background in meteorology, Lisa has experience using ground-based station, weather balloon, radar and satellite data for interpreting meteorological and atmospheric dispersion contexts. She is skilled in an array of emission inventory tools and dispersion modelling software packages, including TANKS, Water9, LandGEM, ADMS, AERMOD and CALPUFF. Lisa's PhD study at the University of Cambridge focused on air quality, environmental health and community engagement with science in South Durban. She maintains a broad research portfolio and supervises postgraduate students in the College of Health Sciences, University of KwaZulu-Natal, as an Honorary Research Fellow. A *Curriculum Vitae* is appended to this report.

6.1 DECLARATION

In terms of the National Environmental Management Act, Act No. 107 of 1998, as amended, and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations):

I, **Lisa Frost Ramsay**, declare that

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

WSP

Name of Company:

16 April 2020

Date

APPENDIX

CURRICULUM VITAE

LISA RAMSAY, Ph.D., M.Sc.

Air Quality Specialist, Environment & Energy

Years with the firm

7

Years of experience

10

Areas of expertise

Air Quality Impact Assessment

Odour Assessment

Health Impact Assessment

Atmospheric Emission Licensing

CAREER SUMMARY

After completing a PhD in the United Kingdom, Lisa worked at the University of KwaZulu-Natal as a researcher and lecturer of atmospheric sciences. She joined WSP as an Air Quality Specialist on a part time basis in July 2012.

EDUCATION

Doctorate, University of Cambridge, United Kingdom	2010
Master of Philosophy (First Class), University of Cambridge, United Kingdom	2006
Master of Science, University of KwaZulu-Natal, South Africa	2005
Bachelor of Science, Honours (Summa Cum Laude), University of Natal, South Africa	2003
Bachelor of Science (Summa Cum Laude), University of Natal, South Africa	2002

ADDITIONAL TRAINING

First Aid Level 1, The Emergency Network, Durban, South Africa	2017
Hazard Identification & Risk Assessment, Safety Risk Management (SRM), Durban, South Africa	2017
CALPUFF and AERMOD Air Dispersion Modelling, Lakes Environmental, Las Vegas, United States	2016

PROFESSIONAL MEMBERSHIPS

National Association for Clean Air	NACA

SELECTED PROFESSIONAL EXPERIENCE

Air Quality Impact Assessments

- Mondi Air Quality Impact Assessment and Minimum Emissions Standards (MES) Postponement Application, Richards Bay, KwaZulu-Natal, South Africa (2017 – 2019). Development of a comprehensive emissions inventory of the Richards Bay Mill for various emission scenarios (the then current scenario, EcoLean scenario and upgrade scenarios) for input to the Level 3 atmospheric dispersion model, CALPUFF. Dispersion model outputs were used to assess changes in air quality impact associated with proposed site developments. Furthermore, the outputs were used to compile an application for the postponement of compliance timeframes of the 2020 Minimum Emission Standards (MES). The MES postponement process includes public engagement, including presentations to community stakeholders and written responses to community comments. Client: Mondi Limited.
- Sappi Saiccor Projects Morris, Vulindlela and Stone and MES Postponement Application, Umkomaas, KwaZulu-Natal, South Africa (2015 – 2019). Development of a comprehensive emissions inventory of the Umkomaas Mill for various emission scenarios (the then current scenario, Project Morris scenario, Project Vulindlela scenario and Project Stone scenario) for input to the Level 3 atmospheric dispersion model, CALPUFF. Dispersion model outputs were used to assess changes in air quality impact associated with proposed site developments. Furthermore, the outputs were used to compile an application for

the postponement of compliance timeframes of the 2020 MES. The MES postponement process includes public engagement, including presentations to community stakeholders and written responses to community comments. Client: Sappi Southern Africa.

- Review of the Fadhili Combined Heat and Power Plant AQIA, Fadhili, Saudi Arabia (2016). Review of air quality impact assessment compiled by WSP Middle East to ensure the assessment was conducted in line with international best practice and International Finance Corporation (IFC) requirements. Client: WSP Parsons Brinckerhoff Middle East.
- Bulk Terminal Iron Ore Staining Assessment, Saldanha, Western Cape, South Africa (2015). Development of an emissions inventory for the iron ore bulk storage facility at Saldanha Bay. A Level 3 atmospheric dispersion model (CALPUFF) was applied to calculate ambient concentrations of particulate matter and levels of dust fallout. The study included an assessment of the red staining of surfaces in the nearby suburbs of Vredenburg, Langebaan and Bluewater Bay. Client: Transnet Port Terminals.
- Stellenbosch Landfill Decommissioning and Rehabilitation, Stellenbosch, Western Cape, South Africa (2014). Development of an emissions inventory for an existing landfill using United States Environmental Protection Agency AP42 emission factors. Emission inventories for three potential end use scenarios also were developed, including a gas-to-energy option. A Level 2 (AERMOD) dispersion model was applied to calculate ambient concentrations of key pollutants for a health impact assessment of nearby sensitive receptors under the various scenarios. Client: Aurecon South Africa.
- Proposed Power Plant, Ressano Garcia, Mozambique. (2014, 2016). Proposed facility for electricity generation from natural gas. A Level 2 dispersion model was run to assess the cumulative ambient impacts of both the Gigawatt facility and one neighbouring facility. The ambient concentrations were compared with local standards and international guidelines. Recommendations for emissions reduction and ambient air quality improvement were provided. In 2016, a 40 MW expansion scenario also was modelled and assessed. Client: Gigajoule Mozambique SA.
- Island View Storage Atmospheric Emission Licence, Durban, KwaZulu-Natal, South Africa (2013). Compilation of an Atmospheric Emission Licence for the largest chemical storage facility in South Africa. The study required emission estimation for more than 300 tanks (loading and breathing losses) and for the loading areas (ship and road) using the United States Environmental Protection Agency's AP42 emission factors. A legal compliance assessment was conducted. Client: Island View Storage.
- Cleaner Fuels 2 Air Quality Impact Assessment, Durban, KwaZulu-Natal, South Africa (2013). Assessment of the air quality impacts associated with process changes required to meet revised fuel specifications. Emissions from onsite stacks and tanks were calculated using a mass balance approach and use of the United States Environmental Protection Agency's TANKS model respectively. Ambient concentrations of various pollutants were calculated using a Level 2 dispersion model (ADMS). Study results were presented at contentious community meetings in the South Durban Basin. Client: Shell and BP South Africa Petroleum Refineries (SAPREF).
- Siguiri Mine Air Quality Impact Assessment, Siguiri, Guinea (2012). Development of an emissions inventory for mining processes and onsite electricity generation using United States Environmental Protection Agency AP42 and Australian National Pollution Inventory emission factors. A Level 2 dispersion model (ADMS) was used to calculate ambient concentrations of particulate matter and dust fallout in the region. A health impact and dust nuisance assessment was conducted for nearby sensitive receptors. Client: AngloGold Ashanti.

Air Quality Management Plans

- Msunduzi Local Municipality WSP was appointed to undertake Phase One of a two phased Air Quality Management Plan (AQMP) development process for the Msunduzi Local Municipality Air Quality Management Plan (2018- 2019). Phase One, comprised of the Baseline Assessment which included a geographic characterisation of the region, the status quo of air quality based on available ambient air quality monitoring data, an emissions inventory of identified emission sources and an institutional capacity assessment. The Baseline Assessment was used in Phase Two of the AQMP to input to a Level 3 CALPUFF dispersion model and to develop effective air quality management strategies for the Municipality. Client: Msunduzi Local Municipality.
- Capricorn District Municipality Air Quality Management Plan (2017). WSP was appointed to review the 2006 Air Quality Management Plan (AQMP) for the Capricorn District Municipality (a total of four Local Municipalities). The study comprised of an appraisal of the previous AQMP followed by the development of an updated AQMP. The baseline assessment included the quantification and simulation of atmospheric emissions within the District using a Level 3 CALPUFF dispersion model. The gap and problem analysis determined institutional capacity, identified information gaps and analysed air pollution problems. Based on these findings, the 2006 air quality goals were realigned and new intervention strategies designed. Client: Capricorn District Municipality.

Environmental Health Impact Assessments

- Compass Waste Proposed Medical Waste Thermal Desorption Unit, Olifantsfontein, Gauteng (2019). Environmental Health Impact Assessment for a proposed medical waste thermal desorption unit in Olifantsfontein, Midrand. The key potential health hazards associated with the proposed development are atmospheric emissions, biohazards and pests as well as impacts on wellbeing, such as odour and noise. This study assessed likely health impacts from the proposed facility via multiple exposure pathways using internationally recognised methodologies for establishing distribution, likelihood and significance of impact. Client: Compass Medical Waste Services.
- Interwaste Drakenstein Waste-to-Energy Project, Wellington, Western Cape, South Africa (2016). Environmental Health Impact Assessment (human, plant and animal health) for a proposed waste recovery, beneficiation and energy project comprising anaerobic digestion and direct combustion facilities. Potential health hazards associated with the proposed development included atmospheric emissions, water and soil contamination, biohazards and pests, as well as impacts on wellbeing, such as odour and noise. This study assessed likely health impacts from the proposed facility via multiple exposure pathways (including inhalation, dermal contact, and ingestion of locally produced crops and meat) using internationally recognised methodologies for establishing distribution, likelihood and significance of impact. Client: Resource Management Services.

Odour Impact Assessments

- Glen Arum Farms Nuisance Risk Assessment, Balgowan, KwaZulu-Natal (2019). WSP was appointed to undertake a nuisance risk assessment for an egg layer operation as part of a Section 24G rectification application. The study addressed odour, noise and vector nuisance. The odour assessment comprised odour emission estimation and dispersion modelling for comparison with relevant international guidance (in the absence of local standards). The noise assessment component included the measurement of day and night time noise levels both along the site boundary and at nearby sensitive receptors to assess compliance with national noise standards for rural areas. Vector risks for neighbouring sensitive receptors were assessed and recommendations for mitigation and control were made in line with international best practice. Client: SiVEST.

- Tongaat Hulett Shongweni Landholdings Air Quality and Odour Assessment, Shongweni, KwaZulu-Natal, South Africa (2017 – 2019). Investigation of nuisance odour at landholdings earmarked for development purposes. Investigations included ambient air quality measurements using both 'grab' and continuous monitoring methods. Odour levels were assessed using dynamic olfactometry and electronic nose technology. The study included a Level 3 (CALPUFF) dispersion modelling assessment of odour. Continuous ambient air quality monitoring continues at present. Client: Tongaat Hulett Developments.
- Upper Highway Community Odour Impact Assessment, Upper Highway, Kwazulu-Natal, South Africa (2017 - 2018). WSP was appointed by the Upper Highway Air non-profit organisation (NPO) to undertake an assessment of potential impacts of the EnviroServ Shongweni Landfill on the Upper Highway community. Field investigations included upwind, downwind and community comparative sampling of the odour plume for source appropriation and odorous compound identification. The study included an extensive literature review as well as statistical analysis of community complaints and wind direction data. A Level 3 (CALPUFF) dispersion modelling assessment of individual gases and cumulative odour was also undertaken. Client: Upper Highway Air (UHA).
- Mushroom Farm Odour Assessment, Hillcrest, KwaZulu-Natal, South Africa (2017). This study included the measurement of onsite and fenceline odour levels using an electronic nose (e-nose) and a Level 1 dispersion modelling assessment of point source emissions to delineate an odour footprint. Client: Denny Mushrooms.
- Pet Food Manufacturing Facility, Waterfall, KwaZulu-Natal, South Africa (2015). Odour investigation for pet food production facility comprising odour measurements using an electronic nose (e-nose) at the site boundary and at selected community points at various times of the day, focusing on areas from which odour complaints originated. The findings of the investigation were incorporated in a comprehensive odour management plan in line with international best practice and requirements stipulated by the local licensing authority. Reappointment in 2017 to audit the odour management plan. Client: AVI Products.
- Maggot Protein Production Facility Odour Management Plant, Philipi, Western Cape, South Africa (2014). Odour assessment and development of an odour management plan for a nutrient recycling plant in the City of Cape Town. The site is to process organic waste, producing maggots for drying and milling as protein feedstock. A legal compliance assessment was conducted and Atmospheric Emissions Licence application compiled. Client: AgriProtein Technologies.
- Galley Waste Compactor Odour Assessment, Richards Bay, KwaZulu-Natal, South Africa (2013). Assessment of the potential odour impact of a proposed galley waste compacting facility at the Port of Richards Bay. An odour emissions inventory was developed for atmospheric dispersion modelling facility in ADMS version 5 to calculate odour concentrations at distances away from the proposed waste compactor. Odour plumes were generated for impact interpretation Client: Transnet Port Authority (TNPA).

PUBLICATIONS AND PRESENTATIONS

Publications

- Muttoo, S.; **Ramsay, L.**; Brunekreef, B.; Beelen, R.; Meliefste, K. and Naidoo, R.N. "*Land use regression modelling estimating nitrogen oxides exposure in industrial south Durban, South Africa*". **Science of the Total Environment**, 610-611, 2018, pp. 1439-1477

- Pillay, K. and **Ramsay, L.F.** "Restructuring the Reduced Emissions from Deforestation and Forest Degradation (REDD+) mechanism for a Post Kyoto Agreement." *American Journal of Climate* Change 4(1), 2015, pp. 69-76
- Padayachee, Y.; Proches, S. and **Ramsay, L.F.**. "Beetle assemblages of indigenous and alien decomposing fruit in subtropical Durban, South Africa." *Arthropod Plant Interactions 8(2),* 2014, pp. 135-142
- Ndebele-Murisa, M.R.; Hill T. and **Ramsay, L.F.** "Validity of downscaled climate models and the implications of possible future climate change for Lake Kariba's Kapenta fishery." *Environmental Development, 5*, 2013, pp. 109-130.
- **Ramsay, L.F.** and Naidoo, R. "Carbon footprints, industrial, transparency and community engagement in a South Durban neighbourhood." *South African Geographical Journal, 94 (*2), 2012, pp. 174-190.
- **Ramsay, L.F.** "Severe Weather Bill Warning." *The Mercury, editorial, 1 February 2012*, 2012, pp. 6.
- Grenfell, S.E.; Ellery, W.N.; Grenfell, M.C.; **Ramsay, L.F**.; and Flugel, T.J. "Sedimentary facies and geomorphic evolution of a blocked-valley lake: Lake Futululu, Northern KwaZulu-Natal, South Africa." *Sedimentology 57*, 2010, pp. 1159-1174.
- **Ramsay, L.F**. "Climate Change for the People of South Durban." *Changing Tomorrow series,* SDCEA and Oxfam Great Britain, 2009, pp. 34
- Ellery, W.; Grenfell, M.; Grenfell, S.; Kotze, D.; McCarthy, T.; Tooth, S.; Grundling, P.-L.; Beckedahl, H.; Le Maitre, D. and **Ramsay, L.F.** "Controls on the distribution and dynamics of wetlands in South Africa." *Wetland Management Series: WET-Origins*, 2008.
- Diab, R.D., Thompson, A.M., Mari, K., **Ramsay, L.F.** and Coetzee, G.J.R. "Tropospheric ozone climatology over Irene, Johannesburg from 1990 - 1994 and 1998 – 2001." *Journal of Geophysical Research*, 2004, pp. 109.

Peer Reviewed Conference Papers

- Manqele, N.M. and **Ramsay, L.F.** "Evaluating the contribution of exhaust gas emissions to air pollution and the urban carbon footprint: A case study of the Port of Durban.", *National Association for Clean Air (NACA) Annual Conference, Durban, 9 - 10 October 2014.*
- Gumede, P. and **Ramsay, L.F.** "Community discernments of particulate matter emanating from a landfill site in Durban, KwaZulu-Natal," *16th International Union of Air Pollution Prevention and Environmental Protection Associations (IUAPPA) Clean Air Congress, Cape Town, South Africa, 29 September - 4 October 2013.*
- Simpson, A. and **Ramsay, L.F.** "Topographic control of wind field in the near-surface boundary layer." 16th International Union of Air Pollution Prevention and Environmental Protection Associations (IUAPPA) Clean Air Congress, Cape Town, 29 September - 4 October 2013.
- Tularam, H. and **Ramsay, L.F**. "Air quality in the Durban South Basin linked to synoptic events for the year 2009." *National Association for Clean Air (NACA) Annual Conference, East London, 12 - 14 October 2011.*
- **Ramsay, L.F.** "Asthma in the township communities of South Durban." Workshop on Chronic Disease and African Communities: Research, Practice and Policy, London School of Economics and Political Science, London, 23 - 24 June 2008.
- **Ramsay, L.F.** "Tropospheric ozone profiling for Irene, South Africa." Global Change and Regional Sustainability in South Africa, Kirstenbosch Gardens, 27 - 29 October 2003.

Selected Presentations

- **Ramsay, L.F.** "David vs Goliath: The social costs and scientific realities of MES non-compliance at Legacy Companion Animal Crematoria", IAIAsa 2016 National Conference, Port Elizabeth, 19 August 2017.
- **Ramsay, L.F.** "Atmospheric dispersion modelling in South Durban." EO2Heaven Conference, Leuven, Belgium, 14 May 2013.
- **Ramsay, L.F.** "Strengthening of the work of the Weather Service through the South African Weather Service Amendment Bill, 2011." Parliamentary Portfolio Committee, South African Parliament, Cape Town, 25 January 2012.
- **Ramsay, L.F.** "Air quality impacts in South Durban: A focus on Umlazi and Lamontville." Swedish Meteorological and Hydrological Institute (SMHI) workshop, Durban, 11 - 15 April 2011.
- **Ramsay, L.F.** "Climate change: risks and vulnerabilities in Africa." Faith Leaders Conference on Climate Change, Koinonia Centre, Durban, 20 - 24 September 2011.
- **Ramsay, L.F.** "Air pollution and health in South Durban." EO2H Workshop, University of KwaZulu-Natal, Durban, 10 November 2011.
- **Ramsay, L.F.** "Local Conceptualisations and articulations of environmental health: a South Durban case study.", Emerging New Research on Geographies of Health and Impairment (ENRGHI) conference, University of St Andrews, Scotland, 10 - 11 June 2008.
- **Ramsay, L.F.** "Accepting' poor environmental health." Royal Geographical Society Annual Conference, University College London, London, 27 - 29 August 2008.

Appendix B9: Heritage

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Development of the Bokpoort II PV Solar Power Facilities on the farm Bokpoort, Groblerhoop region, Northern Cape Province

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Heritage Consultant			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	
Specialist name:	J A van Schalkwyk			
Specialist Qualifications:	D Litt et Phil			
Professional affiliation/registration:	Association of Southern African Professional Archaeologists, No. 164			
Physical address:	62 Coetzer Avenue, Monument Park, Pretoria			
Postal address:	62 Coetzer Avenue, Monument Park, Pretoria			
Postal code:	0181	Cell:	076 790 6777	
Telephone:	012 347 7270	Fax:		
E-mail:	jvschalkwyk@mweb.co.za			

2. DECLARATION BY THE SPECIALIST

I, J A van Schalkwyk, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

n/a

Name of Company:

19 February 2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, J A van Schalkwyk, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

n/a

Name of Company

19 February 2020

Date

SUID-AFRIKAANSE POLISIEDIENS
SAPS LYTTELTON
2020 -02- 19
COMMUNITY SERVICES CENTRE
SOUTH AFRICAN POLICE SERVICE

Signature of the Commissioner of Oaths

2020-02-19

Date

Phase 1 Cultural Heritage Impact Assessment:

THE PROPOSED BOKPOORT II PV SOLAR POWER FACILITIES ON THE FARM BOKPOORT 390 NEAR GROBLERSHOOP, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

Prepared for:
Royal HaskoningDHV: Mr M Roods

- Address: P O Box 867, Gallo Manor, 2052, Gauteng, Tel: 087 352 1528; E-mail: Malcolm.Roods@rhdhv.com

Prepared by:
J A van Schalkwyk (D Litt et Phil),

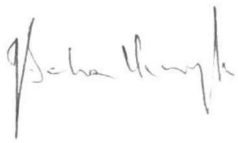
- Heritage Consultant: ASAPA Registration No.: 164 - Principal Investigator: Iron Age, Colonial Period, Industrial Heritage.
- Postal Address: 62 Coetzer Avenue, Monument Park, 0181; Tel: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

Report No: 2020/JvS/001

- Status: Final
- Date: January 2020
- Revision No: -
- Date: -

Specialist competency:

Johan A van Schalkwyk, D Litt et Phil, heritage consultant, has been working in the field of heritage management for more than 40 years. Originally based at the National Museum of Cultural History, Pretoria, he has actively done research in the fields of anthropology, archaeology, museology, tourism and impact assessment. This work was done in Limpopo Province, Gauteng, Mpumalanga, North West Province, Eastern Cape Province, Northern Cape Province, Botswana, Zimbabwe, Malawi, Lesotho and Swaziland. Based on this work, he has curated various exhibitions at different museums and has published more than 70 papers, most in scientifically accredited journals. During this period, he has done more than 2000 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.



J A van Schalkwyk
Heritage Consultant
January 2020





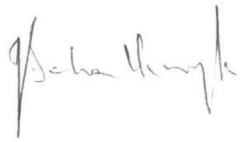


SPECIALIST DECLARATION

I, J A van Schalkwyk, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- 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, 2014 (as amended) and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I 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;
- I 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;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist



J A van Schalkwyk
January 2020

EXECUTIVE SUMMARY

Phase 1 Cultural Heritage Impact Assessment:
THE PROPOSED BOKPOORT II PV SOLAR POWER FACILITIES ON THE FARM BOKPOORT 390 NEAR GROBLERSHOOP, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

ACWA Power obtained 3 Environmental Authorisations in 2016 for 2 x 75MW PV facilities as well as a 150MW CSP facility. An EIA study was undertaken for the 75MW CSP plant in Bokpoort, Northern Cape and approved by Department of Environmental Affairs (DEA). In accordance with Section 38 of the National Heritage Resources Act, No. 25 of 1999, a heritage study (Dreyer 2015) was completed and submitted to SAHRA and was subsequently accepted by that authority.

However, ACWA Power Energy Africa (Pty) Ltd (formerly known as ACWA Power Africa Holdings) now proposes to, instead of the 150MW CSP facility, construct 8 x 200 MW PV plants in its place on the same footprint, which was assessed in 2016. Two PV Plants (Xhosa and Ndebele) have already been authorised but are undergoing another Basic Assessment (BA) study for the battery storage energy system (BESS) as well as the capacity increase from 75 to 200MW.

Royal HaskoningDHV (Pty) Ltd was contracted as independent environmental consultant to undertake the EIA process for the proposed construction of the 8 x 200 MW PV plants and the increased capacity and inclusion of BESS in the already authorised 2 PV projects.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Royal HaskoningDHV (Pty) Ltd* to conduct a cultural heritage assessment to determine if the construction of the PV plants and associated infrastructure would have an impact on any sites, features or objects of cultural heritage significance.

- As the total area was previously surveyed by Dreyer (2015), the purpose of the current survey was purely to verify his findings, as well as to assess the possible cumulative impact of the development as this was not done previously.

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's approval.

The cultural landscape qualities of the region are made up of a pre-colonial element consisting of Stone Age and a much later colonial (farmer) component, which eventually gave rise to an urban component which manifest in a number of small towns and an intensive farming industry.

<u>Identified sites</u>

Stone Age lithics dating to the MSA are found only as low-density surface scatters, which is confirmed by similar findings in the larger region by other researchers (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019). The density of artefacts is less than 1/50m^2.

- The low density of the lithic scatters is, on archaeological grounds, viewed to be of low significance and require no further action.

<u>Impact assessment and proposed mitigation measures</u>

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development.

Heritage sites	Significance of impact	Mitigation measures
Bokpoort II Solar Power Plant: Construction Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a
Bokpoort II Solar Power Plant: Operation Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a

Cumulative impact assessment

The cultural heritage profile of the larger region is very limited and consists of isolated findspots of Stone Age (MSA) tools, farmsteads and burial sites. Consequently, the cumulative impact of the proposed development is viewed to be **low**

Site type	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
Archaeological sites/material	Section 35	Generally protected: Low significance – Grade IV-C	Low (16)
			Low (16)
Burial sites and graves	Section 36	Generally protected: Low significance – Grade IV-A	Low (16)
			Low (16)

Legal requirements

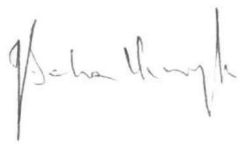
The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the study area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

Reasoned opinion as to whether the proposed activity should be authorised:

- From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed below.

Conditions for inclusion in the environmental authorisation:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological required.
- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.



J A van Schalkwyk
Heritage Consultant
January 2020

TECHNICAL SUMMARY

Project description	
Description	Development of 10 X 200MW Solar PV facilities
Project name	Bokpoort II Solar Power Plant (each individually identified as Afrikaans; Ndebele; Pedi; Sotho; Swati; Tsonga; Tswana; Venda; Xhosa; Zulu)

Applicant
ACWA Power Green Energy Africa (Pty) Ltd

Environmental assessors
Mr M Roods
Royal HaskoningDHV (Pty) Ltd

Property details						
Province	Northern Cape					
Magisterial district	Gordonia					
Local municipality	!Kheis					
Topo-cadastral map	2821DB, 2822CA					
Farm name	Bokpoort					
Closest town	Groblershoop					
Coordinates	Corner points (approximate)					
	No	Latitude	Longitude	No	Latitude	Longitude
	1	-28.73309	22.00469	2	-28.71962	22.00451
	3	-28.71952	21.98857	4	-28.71189	21.98206
	5	-28.67546	22.02122	6	-28.69420	22.03567

Development criteria in terms of Section 38(1) of the NHR Act	Yes/No
Construction of road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length	Yes
Construction of bridge or similar structure exceeding 50m in length	No
Development exceeding 5000 sq m	Yes
Development involving three or more existing erven or subdivisions	No
Development involving three or more erven or divisions that have been consolidated within past five years	No
Rezoning of site exceeding 10 000 sq m	No
Any other development category, public open space, squares, parks, recreation grounds	No

Land use	
Previous land use	Farming
Current land use	Farming

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GLOSSARY OF TERMS AND ABBREVIATIONS

TERMS

Bioturbation: The burrowing by small mammals, insects and termites that disturb archaeological deposits.

Cumulative impacts: "Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Debitage: Stone chips discarded during the manufacture of stone tools.

Factory site: A specialised archaeological site where a specific set of technological activities has taken place – usually used to describe a place where stone tools were made.

Historic Period: Since the arrival of the white settlers - c. AD 1830 - in this part of the country.

Holocene: The most recent time period, which commenced c. 10 000 years ago.

Iron Age (also referred to as **Early Farming Communities**)**:** Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. As they produced their own iron tools, archaeologists call this the Iron Age.

Early Iron Age	AD 200 - AD 900
Middle Iron Age	AD 900 - AD 1300
Later Iron Age	AD 1300 - AD 1830

Midden: The accumulated debris resulting from human occupation of a site.

Mitigation, means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

National Estate: The collective heritage assets of the Nation.

Pleistocene: Geological time period of 3 000 000 to 20 000 years ago.

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.

Early Stone Age	2 500 000 - 250 000 Before Present
Middle Stone Age	250 000 - 40-25 000 BP
Later Stone Age	40-25 000 - until c. AD 200

Tradition: As used in archaeology, it is a seriated sequence of artefact assemblages, particularly ceramics.

ACRONYMS and ABBREVIATIONS

AD	Anno Domini (the year 0)
ASAPA	Association of Southern African Professional Archaeologists
BC	Before the Birth of Christ (the year 0)
BCE	Before the Common Era (the year 0)
BP	Before Present (calculated from 1950 when radio-carbon dating was established)
CE	Common Era (the year 0)
CRM	Cultural Resources Management
EAP	Environmental Assessment Practitioner
EIA	Early Iron Age
ESA	Early Stone Age
HIA	Heritage Impact Assessment
I & AP's	Interested and Affected Parties
ICOMOS	International Council on Monuments and Sites
LIA	Late Iron Age
LSA	Later Stone Age
MIA	Middle Iron Age
MSA	Middle Stone Age
NASA	National Archives of South Africa
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

COMPLIANCE WITH APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	 Front page Page i Addendum Section 6
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 4
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7.3
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4.2.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Addendum Section 5; Figure 13
g) an identification of any areas to be avoided, including buffers;	Section 8
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 13 Addendum Section 5
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 7
k) any mitigation measures for inclusion in the EMPr;	Section 9 & 10
l) any conditions for inclusion in the environmental authorisation;	Section 10
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	 Section 10 Section 8, 9, 10
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Formed part of the original assessment
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Formed part of the original assessment
q) any other information requested by the competent authority.	Formed part of the original assessment
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	-

Phase 1 Cultural Heritage Impact Assessment:
THE PROPOSED BOKPOORT II PV SOLAR POWER FACILITIES ON THE FARM BOKPOORT 390 NEAR GROBLERSHOOP, !KHEIS LOCAL MUNICIPALITY, NORTHERN CAPE PROVINCE

1. INTRODUCTION

1.1 Background

ACWA Power obtained 3 Environmental Authorisations in 2016 for 2 x 75MW PV facilities as well as a 150MW CSP facility. An EIA study was undertaken for the 75MW CSP plant in Bokpoort, Northern Cape and approved by Department of Environmental Affairs (DEA). In accordance with Section 38 of the National Heritage Resources Act, No. 25 of 1999, a heritage study (Dreyer 2015) was completed and submitted to SAHRA and was subsequently accepted by that authority.

However, ACWA Power Energy Africa (Pty) Ltd (formerly ACWA Power Africa Holdings) now proposes to, instead of the 150MW CSP facility, construct 8 x 200 MW PV plants in its place on the same footprint, which was assessed in 2016. Two PV Plants (Xhosa and Ndebele) have already been authorised but are undergoing another Basic Assessment (BA) study for the battery storage energy system (BESS) as well as the capacity increase from 75 to 200MW.

Royal HaskoningDHV (Pty) Ltd was contracted as independent environmental consultant to undertake the EIA process for the proposed construction of the 8 x 200 MW PV plants, and the increased capacity and inclusion of BESS in the already authorised 2 PV projects.

South Africa's heritage resources, also described as the 'national estate', comprise a wide range of sites, features, objects and beliefs. However, according to Section 27(18) of the National Heritage Resources Act (NHRA), No. 25 of 1999, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site.

In accordance with Section 38 of the NHRA, an independent heritage consultant was appointed by *Royal HaskoningDHV (Pty) Ltd* to conduct a cultural heritage assessment to determine if the construction of the 10, 200 MW PV plants and associated infrastructure would have an impact on any sites, features or objects of cultural heritage significance.

- As the total area was previously surveyed by Dreyer (2015), the purpose of the current survey was purely to verify his findings, as well as to assess the possible cumulative impact of the development as this was not done previously.

This report forms part of the Environmental Impact Assessment (EIA) as required by the EIA Regulations in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended and is intended for submission to the South African Heritage Resources Agency (SAHRA).

1.2 Terms and references

The aim of a full HIA investigation is to provide an informed heritage-related opinion about the proposed development by an appropriate heritage specialist. The objectives are to identify heritage resources (involving site inspections, existing heritage data and additional heritage specialists if necessary); assess their significances; assess alternatives in order to promote heritage conservation issues; and to assess the acceptability of the proposed development from a heritage perspective.

The result of this investigation is a heritage impact assessment report indicating the presence/ absence of heritage resources and how to manage them in the context of the proposed development.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, on condition of successful implementation of proposed mitigation measures.

1.2.1 *Scope of work*

The aim of this study is to determine if any sites, features or objects of cultural heritage significance occur within the boundaries of the area where the 8 x 200 MW PV plants and the increased capacity and inclusion of BESS in the already authorised 2 PV projects is to take place. This included:

- Conducting a desk-top investigation of the area;
- A visit to the proposed development site.

The objectives were to:

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Identify any potential 'fatal flaws' related to the proposed development;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural or historical importance;
- Provide guideline measures to manage any impacts that might occur during the construction phase as well as the implementation phase.

1.2.2 *Assumptions and Limitations*

The investigation has been influenced by the following factors:

- It is assumed that the description of the proposed project, provided by the client, is accurate.
- The unpredictability of buried archaeological remains.
- No subsurface investigation (i.e. excavations or sampling) were undertaken, since a permit from SAHRA is required for such activities.
- It is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is sufficient and that it does not have to be repeated as part of the heritage impact assessment.

2. LEGISLATIVE FRAMEWORK

2.1 Background

Heritage Impact Assessments are governed by national legislation and standards and International Best Practise. These include:

- South African Legislation
  - National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA);
  - Mineral and Petroleum Resources Development Act, 2002 (Act No. 22 of 2002) (MPRDA);
  - National Environmental Management Act 1998 (Act No. 107 of 1998) (NEMA); and
  - National Water Act, 1998 (Act No. 36 of 1998) (NWA).
- Standards and Regulations
  - South African Heritage Resources Agency (SAHRA) Minimum Standards;
  - Association of Southern African Professional Archaeologists (ASAPA) Constitution and Code of Ethics;
  - Anthropological Association of Southern Africa Constitution and Code of Ethics.
- International Best Practise and Guidelines
  - ICOMOS Standards (Guidance on Heritage Impact Assessments for Cultural World Heritage Properties); and
  - The UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage (1972).

2.2 Heritage Impact Assessment Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, Section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority.

The National Heritage Resources Act (Act No. 25 of 1999, Section 38) provides guidelines for Cultural Resources Management and prospective developments:

"38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
(b) the construction of a bridge or similar structure exceeding 50m in length;
(c) any development or other activity which will change the character of a site:
(i) exceeding 5 000 m_2 in extent; or
(ii) involving three or more existing erven or subdivisions thereof; or
(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

And:

"38 (3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

(a) The identification and mapping of all heritage resources in the area affected;
(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;
(c) an assessment of the impact of the development on such heritage resources;
(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
(g) plans for mitigation of any adverse effects during and after the completion of the proposed development."

3. HERITAGE RESOURCES

3.1 The National Estate

The National Heritage Resources Act (No. 25 of 1999) defines the heritage resources of South Africa which are of cultural significance or other special value for the present community and for future generations that must be considered part of the national estate to include:

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;

- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, including-
    - ancestral graves;
    - royal graves and graves of traditional leaders;
    - graves of victims of conflict;
    - graves of individuals designated by the Minister by notice in the Gazette;
    - historical graves and cemeteries; and
    - other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
- sites of significance relating to the history of slavery in South Africa;
- movable objects, including-
    - objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
    - objects to which oral traditions are attached or which are associated with living heritage;
    - ethnographic art and objects;
    - military objects;
    - objects of decorative or fine art;
    - objects of scientific or technological interest; and
    - books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

3.2 Cultural significance

In the NHRA, Section 2 (vi), it is stated that ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. This is determined in relation to a site or feature’s uniqueness, condition of preservation and research potential.

According to Section 3(3) of the NHRA, a place or object is to be considered part of the national estate if it has cultural significance or other special value because of

- its importance in the community, or pattern of South Africa's history;
- its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
- sites of significance relating to the history of slavery in South Africa.

A matrix (see Section 2 of Addendum) was developed whereby the above criteria were applied for the determination of the significance of each identified site. This allowed some form of control over the application of similar values for similar identified sites.

4. PROJECT DESCRIPTION

4.1 Site location

The proposed development is located on the north-eastern portion of the Remaining Extent of the Farm Bokpoort 390, which is 20 km north-north-west of the town of Groblershoop within the !Kheis Local municipality in the ZF Mgcawu District Municipality, Northern Cape Province (Fig. 1). For more information, see the Technical Summary on p. V above.

The site is within one of South Africa's eight renewable energy development zones and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors.

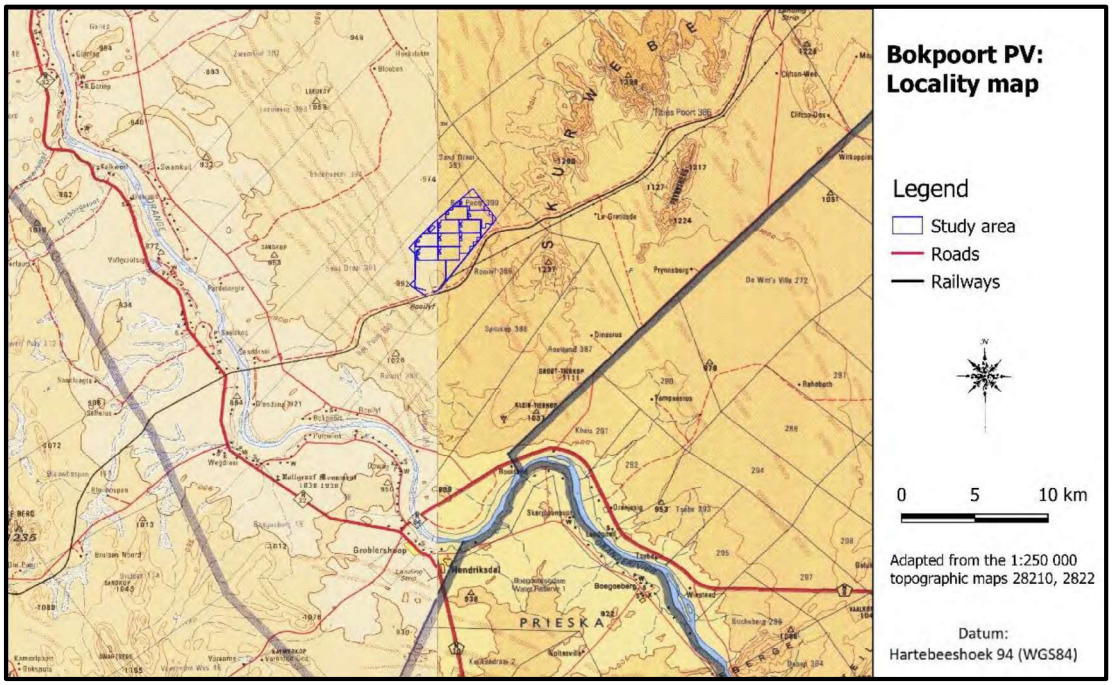


Figure 1. Location of the study area in regional context

4.2 Development proposal

The proposed development is 8 Photovoltaic (PV) Solar Developments of up to 200 Megawatt (MW) each, that will consist of the following infrastructure (Fig. 2):

- Solar PV modules that will be able to deliver up to 200 MW to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
- A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes:

- Mounting structures for the solar panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132 kV overhead power line which will connect the facility to the national grid via Eskom's existing Garona Substation;
- The powerline will be approximately 5 km in length and will be located within a servitude spanning 15.5m on both sides. The powerline towers will be 35 m high;
- Internal access roads (4 - 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing.
- Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

Battery energy storage system (applicable to the two authorised PV plants as well):

- Battery Power at Point of Connection: 150MW;
- Area Required: 16ha;
- The BESS will store approximately 4500m^3 of hazardous substance.

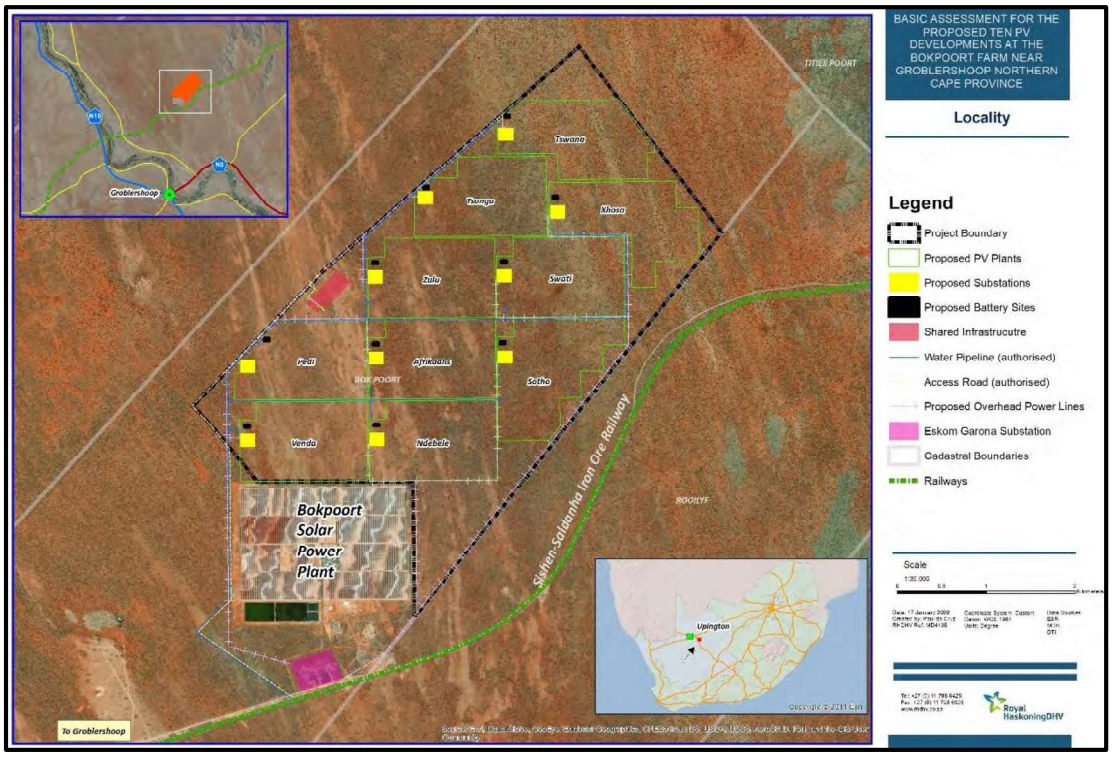


Figure 2. Layout of the project

5. STUDY APPROACH AND METHODOLOGY

5.1 Extent of the Study

This survey and impact assessment cover all facets of cultural heritage located in the study area as presented in Section 4 above and illustrated in Figure 2.

5.2 Methodology

5.2.1 *Pre-feasibility assessment*

5.2.1.1 Survey of the literature
A survey of the relevant literature was conducted with the aim of reviewing the previous research done and determining the potential of the area. In this regard, various anthropological, archaeological and historical sources were consulted – see list of references in Section 11.

- Information on events, sites and features in the larger region were obtained from these sources.

5.2.1.2 Survey of heritage impact assessments (HIAs)
A survey of HIAs done for projects in the region by various heritage consultants was conducted with the aim of determining the heritage potential of the area – see list of references in Section 11.

- Information on sites and features in the larger region were obtained from these sources.

5.2.1.3 Data bases
The *Heritage Atlas Database,* various SAHRA databases, the *Environmental Potential Atlas*, the *Chief Surveyor General* and the *National Archives of South Africa* were consulted.

- Database surveys produced a number of sites located in the larger region of the proposed development.

5.2.1.4 Other sources
Aerial photographs and topocadastral and other maps were also studied - see the list of references below.

- Information of a very general nature were obtained from these sources

The results of the above investigation are presented in Figure 3 below – see list of references in Section 11 – and can be summarised as follows:

- Stone tools, mostly dating to the Middle Stone Age (MSA), occur sporadically across the larger region and is mostly located on hills, outcrops and along drainage channels;
- Historic structures, inclusive of buildings and bridges, occur in a sporadic manner across the larger landscape as well as in urban centres;
- Formal and informal burial sites occur in a number of places in towns and across the countryside.

Based on the above assessment, the probability of cultural heritage sites, features and objects occurring in the study area is deemed to be **very low**.

Table 1: Pre-Feasibility Assessment

Category	Period	Probability	Reference
Natural			
Landscapes		None	
Early hominin	Pliocene – Lower Pleistocene		
	Early hominin	None	
Stone Age	Lower Pleistocene – Holocene		
	Early Stone Age	None	
	Middle Stone Age	Low	Dreyer (2014, 2015); Morris (2012, 2014); van der Walt (2015a, 2015b); van Ryneveld (2007); van Schalkwyk (2011, 2019)
	Later Stone Age	Low	

	Rock Art	None	
Iron age	Holocene		
	Early Iron Age	None	
	Middle Iron Age	None	
	Late Iron Age	None	
Colonial period	Holocene		
	Contact period/Early historic	Possible	Dreyer (2014)
	Recent history	Possible	Van der Walt (2015a); van Schalkwyk (2019)
	Industrial heritage	None	

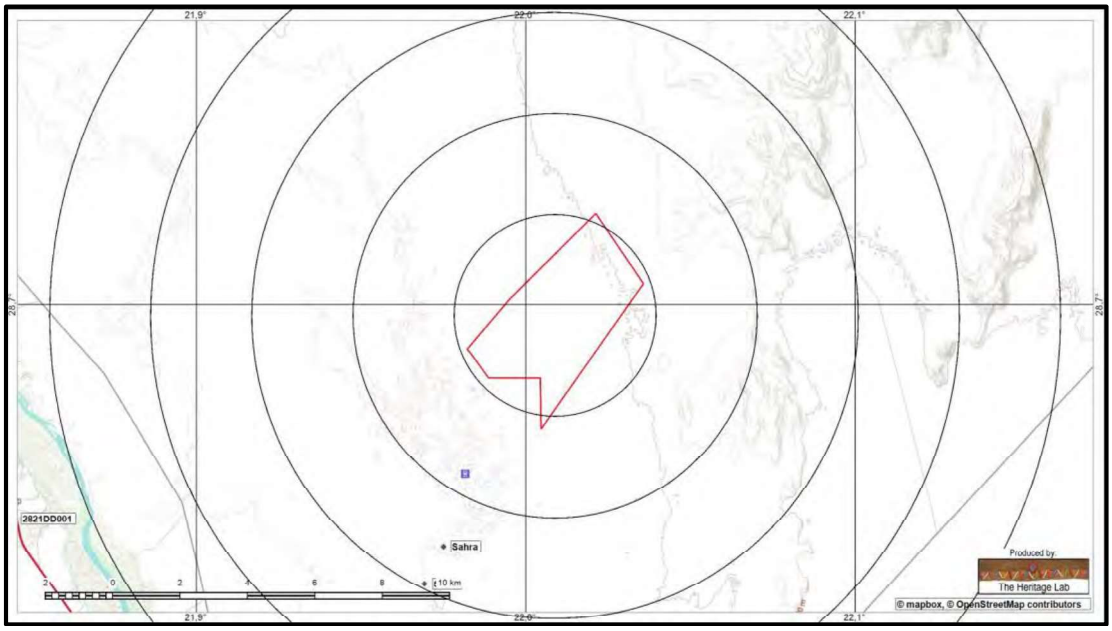


Figure 3. Location of known heritage sites and features in relation to the study area
(Circles spaced at a distance of 2km: heritage sites = coded green dots)

5.2.2 *Field survey*

The field survey was done according to generally accepted archaeological practices, and was aimed at locating all possible sites, objects and structures. The area that had to be investigated was identified by the *Royal HaskoningDHV (Pty) Ltd* by means of maps and .k*ml* files indicating the development area. This was loaded onto an ASUS digital device and used in Google Earth during the field survey to access the areas.

The site was visited on 4 December 2019 and was investigated by using internal tracks to access the sites and then walking a number of transects across it – see Fig. 4 below. During the site visit, archaeological visibility was good due to the prolonged period of drought in the region which prevented the vegetation cover from re-growing (see Fig. 5 below).

- As the total area was previously surveyed by Dreyer (2015), the purpose of this survey was just to confirm his findings. Therefore, only a cursory survey was done, stopping at places that seemed promising, especially to confirm the presence of stone tools.

5.2.3 *Documentation*

All sites, objects and structures that are identified are documented according to the general minimum standards accepted by the archaeological profession. Coordinates of individual localities are determined by means of the *Global Positioning System* (GPS) and plotted on a map. This information is

added to the description in order to facilitate the identification of each locality. Map datum used: Hartebeeshoek 94 (WGS84).

The track log and identified sites were recorded by means of a Garmin Oregon 550 handheld GPS device. Photographic recording was done by means of a Canon EOS 550D digital camera.

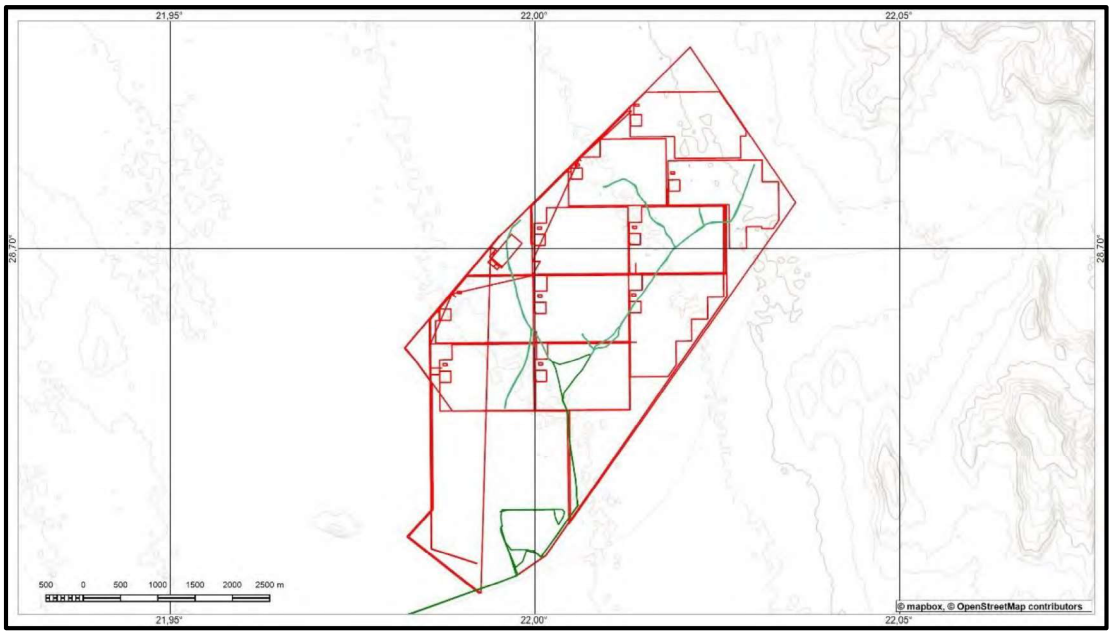


Figure 4. Map indicating the track log of the field survey.

6. DESCRIPTION OF THE AFFECTED ENVIRONMENT

6.1 Natural Environment

The geology of the study area is made up of superficial deposits comprising gravels, clays, sandstone, silcrete, calcrete and aeolian sand. The topography is described as plains and no rivers, outcrops or hills occur in the study area or its immediate vicinity (Fig. 5).

The original vegetation in the study area is classified as Kalahari Karroid Shrubland, part of the Nama-Karoo Biome, which is part of the Bushmanland Bioregion (Muncina & Rutherford 2006) (Fig. 6).

According to Dreyer (2015) the site is characterised by a repeated pattern of alternating red sand dunes, calcrete scatters and quartzite outcrops. The nature of the site varied from Aeolian (Kalahari) dune veld, visible spreads of calcrete and scatters of quartzite sills.

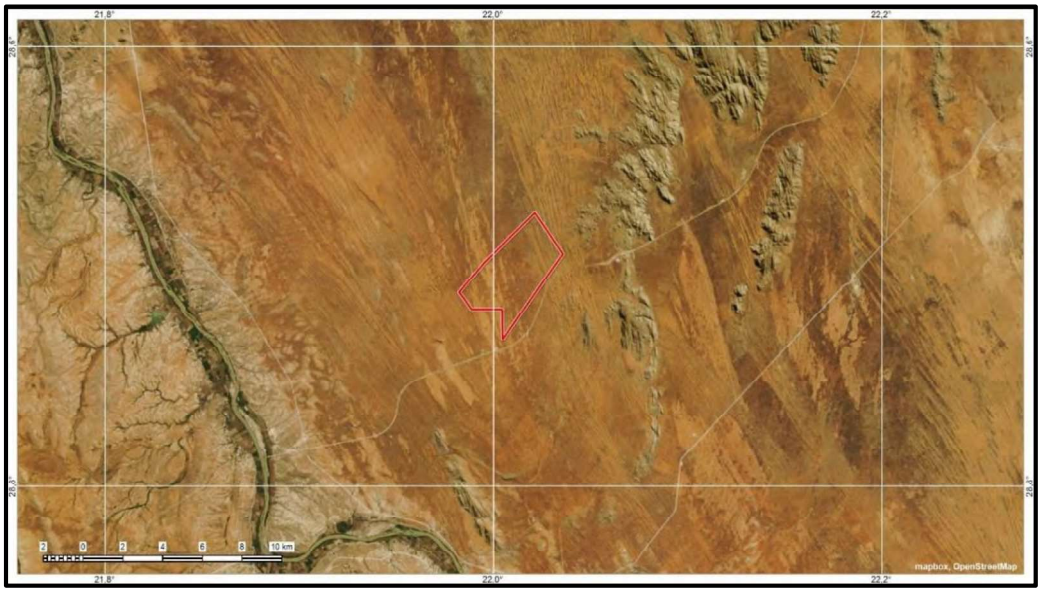


Figure 5. The topography of the larger region

Bushman grass

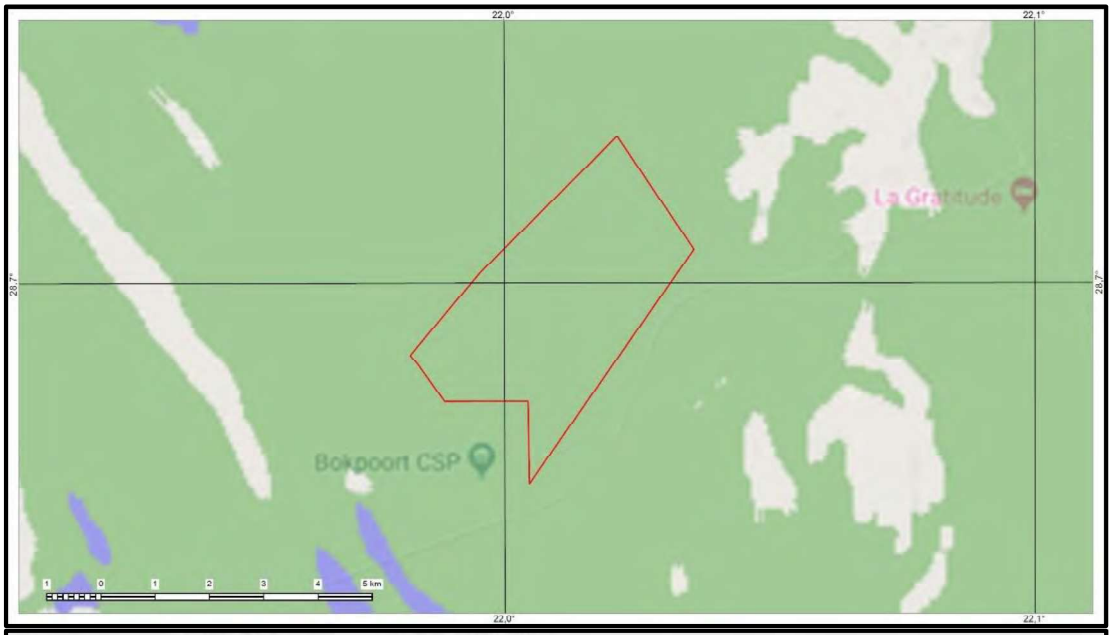
Scrub veldt

Calcrete scatters

Ruins of old dam

Figure 6. Views over the study area

The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area (Fig. 7) has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological study is required.



Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 7. The Palaeontological sensitivity of the study areas

6.2 Cultural Landscape

The aim of this section is to present an overview of the history of the larger region in order to eventually determine the significance of heritage sites identified in the study area, within the context of their historic, aesthetic, scientific and social value, rarity and representativity.

The cultural landscape qualities of the region are made up of a pre-colonial element consisting of Stone Age and a much later colonial (farmer) component, which eventually gave rise to an urban component which manifest in a number of small towns and an intensive farming industry.

6.2.1 *Stone Age*

Surveys in the area has revealed that the archaeological record in the larger region is temporarily confined to the Early and Middle Stone Age, with a smaller occurrence dating to the Later Stone Age. It is spatially concentrated around the rims of pans, the banks of stream and rivers (Morris 2005), but also in the vicinity of raw material resources.

Recently Parsons (2007, 2008) demonstrated that the so-called Swartkop and Doornfontein industries possibly relate to different socio-economies – those of hunter-gatherers and stock keepers. Based on an analysis of material recovered from five sites in the Northern Cape Province, all dating to the last two millennia, she compares variability between assemblages attributed to the Swartkop and Doornfontein industries and identify areas of overlap and difference.

6.2.2 *Iron Age*

Early Iron Age occupation did not take place in the region and seems as if the earliest Bantu-language speakers to have settled in the larger region were those of Tswana-speaking origin (Tlhaping and Tlharo) that settled mostly to the north and a bit to the west of Kuruman. However, they continued spreading westward and by the late 18th century some groups occupied the Langeberg region. With the annexation of the Tswana areas by the British in 1885, the area became known as British Betchuana Land. A number of reserves were set up for these people to stay in. In 1895 the Tswana-speakers rose up in resistance to the British authority as represented by the government of the Cape Colony. They were quickly subjected, and their land was taken away, divided up into farms and given out to white farmers to settle on (Snyman 1986).

In his study on the spread of the Iron Age into the Northern Cape, Humphreys (1976) used not only archaeological evidence, literary sources and eyewitness accounts, but also environmental factors such as rainfall data and vegetation cover. From this he concluded that it was not an environment conducive for keeping large herds of cattle, which was the mainstay of Iron Age communities' economy. He even indicates that the occupation of these people contracted from 1700 south of Postmasburg to just south of Kuruman by 1800, indicating a huge change in environmental factors.

Although some researchers would want to identify isolated, undecorated pieces of pottery found in the vicinity of Douglas as of Late Iron Age origin, this is doubtful as they also do not consider the possibility of it being of Khoi origin. Or, alternatively, of very recent origin, i.e. brought into the region by people working as labourers on the various diamond diggings in the larger region.

6.2.3 *Historic period*

It was only during the last part of the 19th century, early part of the 20th century when population numbers in the region increased. This was the result of intensive irrigation farming that developed along the Orange River.

The town of Upington, originally known as Olijvenhoutsdrift, was founded in 1871 as part of a mission station by the German missionary Rev Schröder. The town was renamed in 1884 after Sir Thomas Upington, who was the Prime Minister of the Cape Colony and who visited the town in 1884.

An irrigation canal was started by Rev Schröder in 1883. It was completed in 1885. By 1884 there were already 77 irrigation farms. Nowadays, it is disputed that Schröder was the original builder of the canal, and it is claimed that he only carried on with an idea that was started by a local inhabitant by the name of Abraham September.

Groblershoop developed as a result of development of the Boegoeberg Dam and water channels in 1929, which gave rise to grapes and wine production. During the Rebellion of 1914, a number of skirmishes were fought in the region.

6.3 Site specific review

Although landscapes with cultural significance are not explicitly described in the NHRA, they are protected under the broad 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.

The examination of historical maps and aerial photographs help us to reconstruct how the cultural landscape has changed over time as is show how humans have used the land.

As this used to be a very isolated region, little information exists about it. It was only recently when a number of development projects were initiated in the region, that the heritage potential of the region was investigated. Most of these studies focussed on the Stone Age presence in the region, which, by all accounts seems to be very limited (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019) as it presents a very low profile in the landscape.

From the Deed of Transfer no. 1294 (Fig. 8), it can be seen that the farm was first surveyed in December 1892 and then granted to F.W.C Loxton on 14 November 1894.

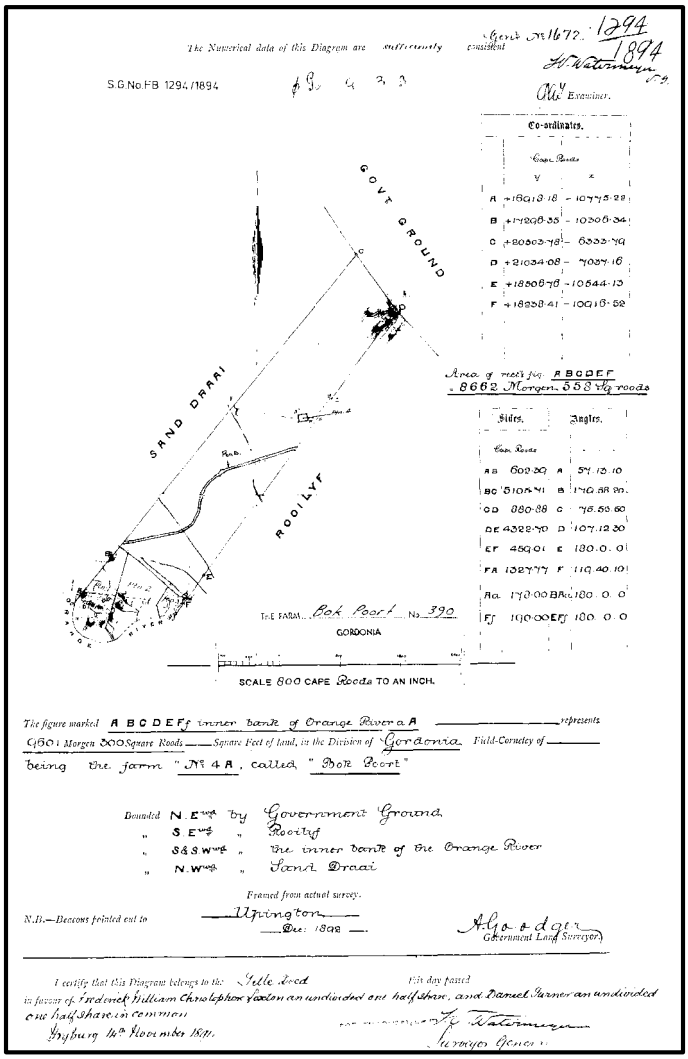


Figure 8. Copy of the original Deed of Transfer for the farm Bokpoort
(Chief Surveyor-General: 10026W01)

One of the older maps of the region (Fig. 9), dating to 1914, shows an area with little development in the interior where the isolated sheep post of vehicle tracks is indicated. Closer to the river and number of presumably farm names are indicated in the vicinity of the Orange River.

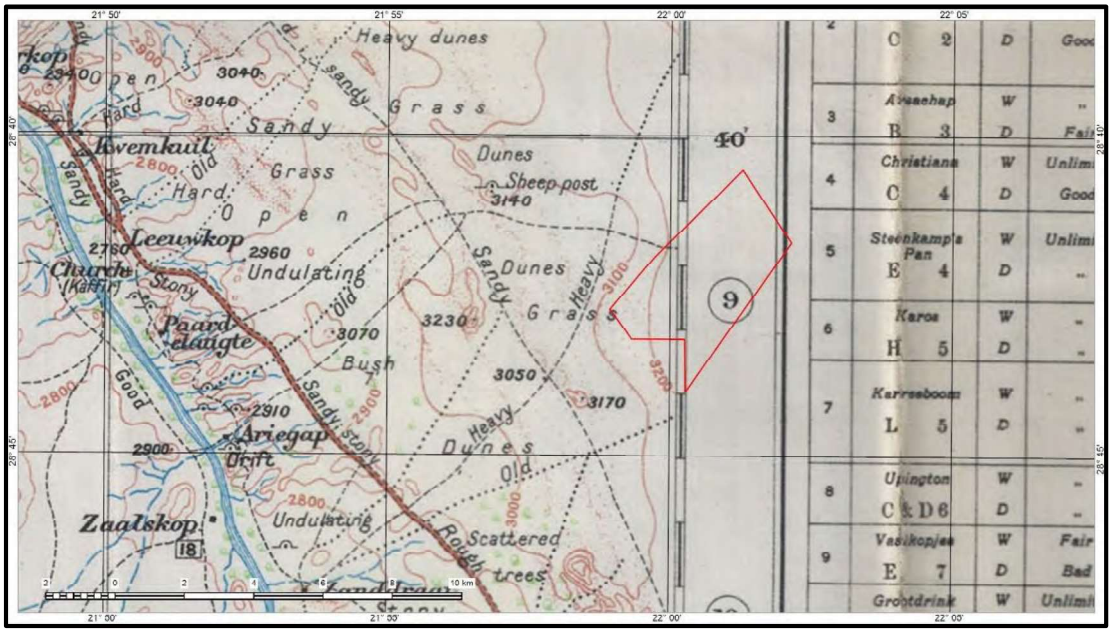


Figure 9. The study areas on the 1914 version of the 1:250 000 topographic map 'Upington'

The official aerial photograph dating to 1964 (Fig. 10) still shows, apart from fence boundaries, a landscape empty of any development. It was only by the middle of the 1970s when the Sishen-Saldanha railway line was opened (1976) and the associated powerlines were constructed, that any development can be seen. This presented on the 1981 version of the 1:50 000 topographic map (11).

However, this lack of development, i.e. built environment, seems to continue as can be seen on the various Google Image aerial photographs (Fig. 12) and it is only with the recent development of the Bokpoort Concentrated Solar Thermal that some built features were added to the region.

Figure 10. The study area on the 1964 version of the official aerial photograph (Photograph: 524_003_00863)

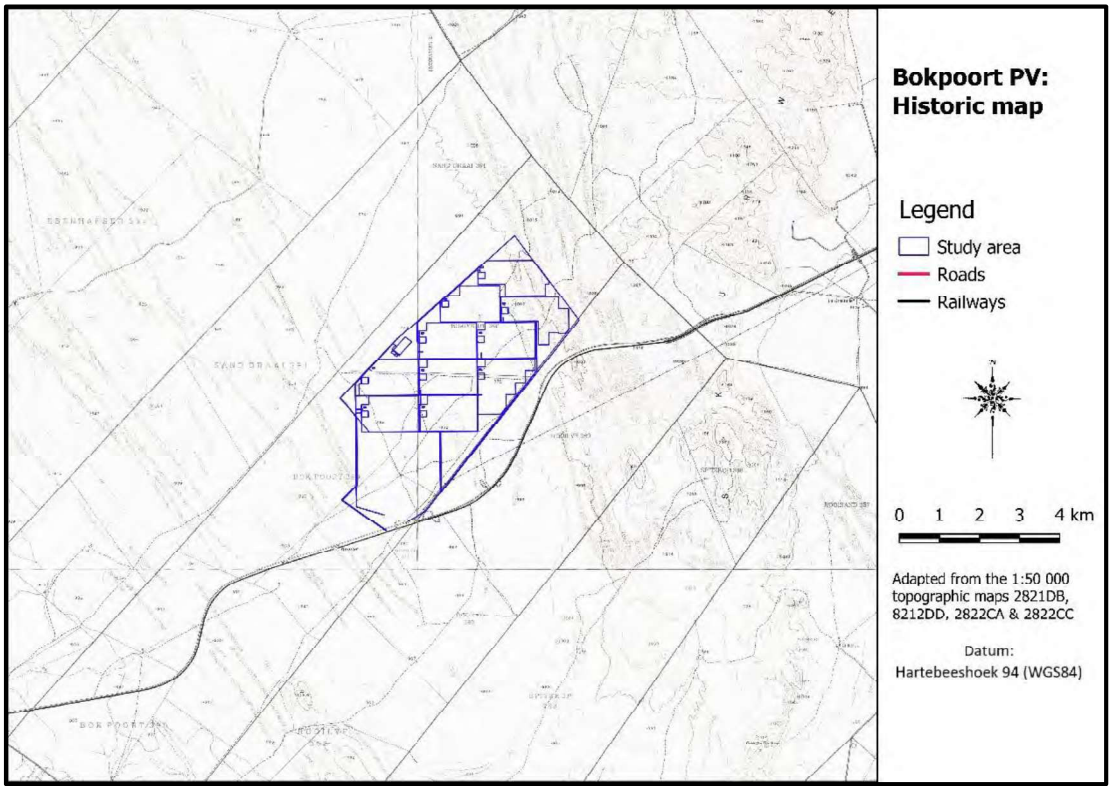


Figure 11. The study area on the 1982 version of the 1:50 000 topographic maps

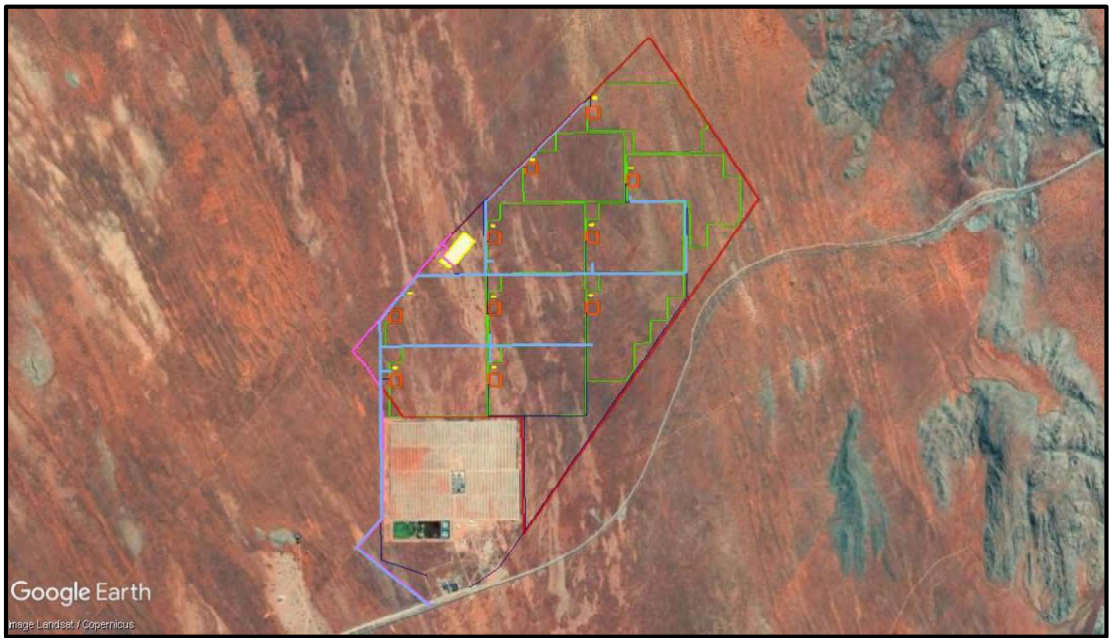


Figure 12. The study area on the 2019 aerial photograph
(Image: Google Earth)

7. SURVEY RESULTS

During the physical survey, the following sites, features and objects of cultural significance were identified in the study area (Fig. 13).

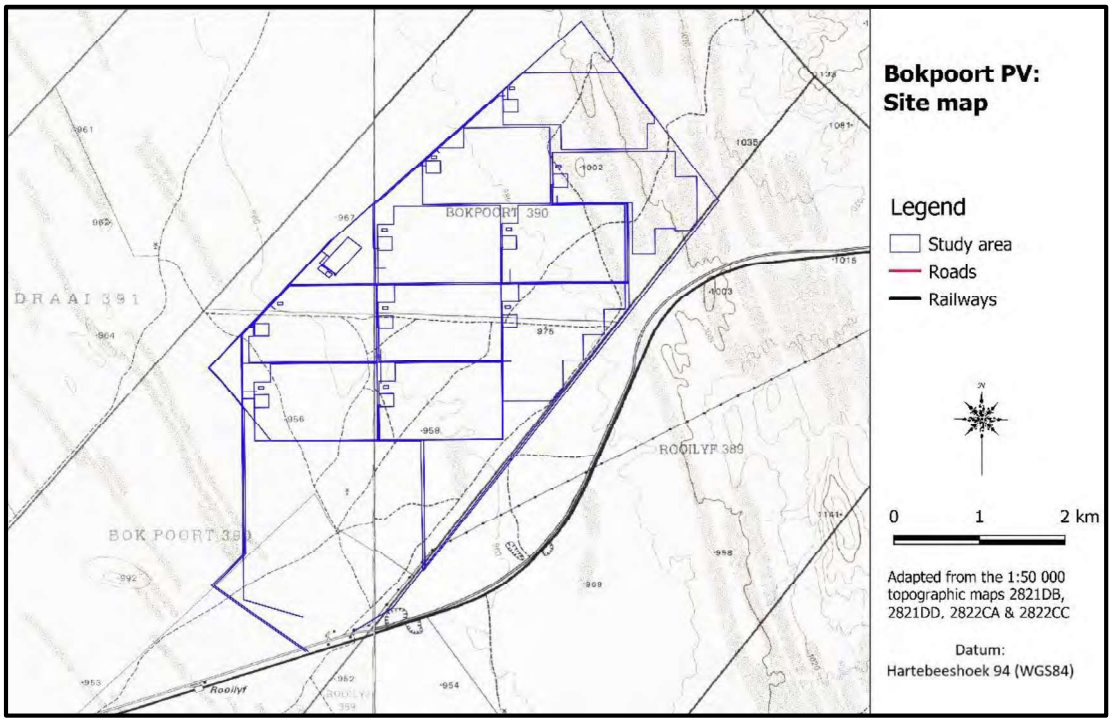


Figure 13. Location of heritage sites in the study area
(Please note that as nothing was found, nothing is indicated on the map)

7.1 Stone Age

Stone Age lithics dating to the MSA are found only as low-density surface scatters, which is confirmed by similar findings in the larger region by other researchers (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019). They are commonly found on the pebble plains where source material is readily available. The density of artefacts is less than 1/50m^2. The tools are mostly made from banded iron stone (jaspelite), although some quartzite and hardened shale flakes were also noted. Cores, flakes and tools are found. The tools are very rough and informal and only a few that can be described as typical, i.e. blades and scrapers, were identified.

- The low density of the lithic scatters is, on archaeological grounds, viewed to be of low significance and require no further action.

Figure 14. Some of the identified tools and flakes

7.2 Iron Age

- No sites, features or objects of cultural significance dating to the Iron Age were identified in the study area.

7.3 Historic period

- Apart from current farming related features such as water troughs, no sites, features or objects of cultural significance dating to the historic period were identified in the study area.

8. IMPACT ASSESSMENT RATINGS AND MITIGATION MEASURES

8.1 Impact assessment

Heritage impacts are categorised as:

- Direct or physical impacts, implying alteration or destruction of heritage features within the project boundaries;
- Indirect impacts, e.g. restriction of access or visual intrusion concerning the broader environment;
- Cumulative impacts that are combinations of the above.

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development and is summarised in Table 1 below:

Table 2: Calculation of the impact on the identified heritage features

Heritage sites	Significance of impact	Mitigation measures
Bokpoort II Solar Power Plant: Construction Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a
Bokpoort II Solar Power Plant: Operation Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a

8.2 Mitigation measures

Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

- For the current study, as no sites, features or objects of cultural significance were identified, no mitigation measures are proposed.

8.3 Cumulative assessment

The cumulative impact of the proposed Bokpoort project is assessed by adding impacts from this proposed development to existing and other proposed developments with similar impacts within a 60 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts include a total of six other plants and are listed in Table 3. From the map 'South African Generation Projects' (Fig. 13) below, it can be seen that the Bokpoort project is located in an area where little such development has taken place, with the implication that the cumulative impact would be very low.

Table 3: Existing and planned alternative energy generation facilities in the larger region

Name	Nearest town	Technology	Capacity	Status
Bokpoort	Groblershoop	Concentrated Solar Thermal	50MW	Fully operational
Eskom	Upington	Concentrated Solar Thermal	100MW	Awaiting construction
Grootdrink	Upington	Solar PV	?	Proposed
Karoshoek	Upington	Concentrated Solar Thermal	100MW	Awaiting construction
Tewa Isitha	Upington	Solar PV	?	Proposed
Upington	Upington	Solar PV	8.9MW	Fully operational

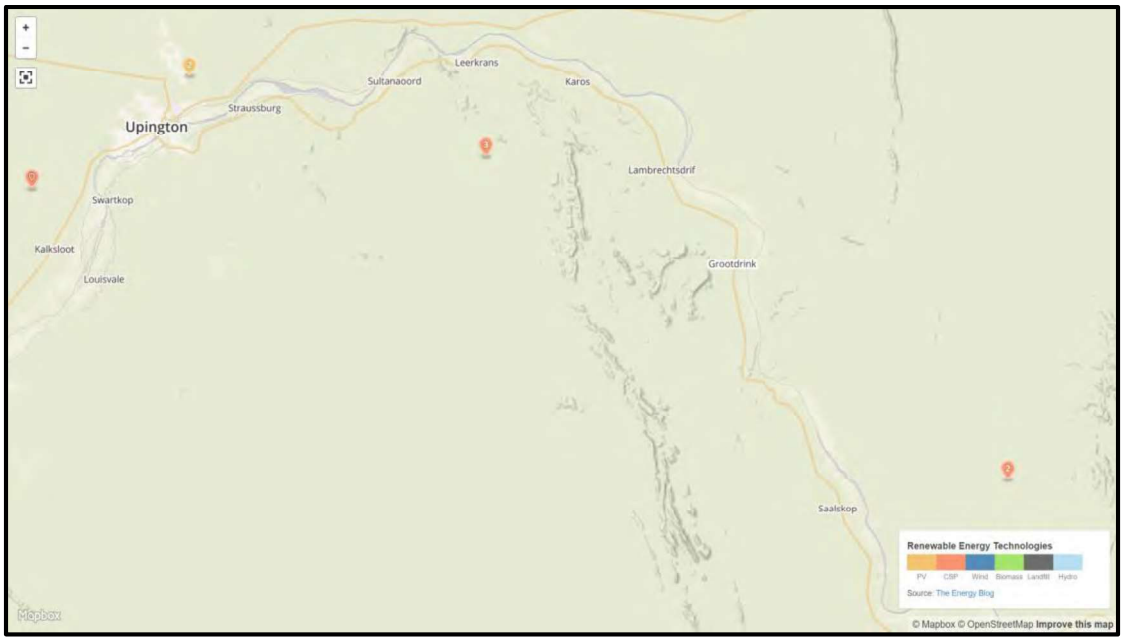


Figure 15. Map indicating the location of alternative energy generation facilities in the larger region (https://www.energy.org.za/map-south-african-generation-projects - accessed 27/01/2020)

The cultural heritage profile of the larger region is very limited. Most frequently found are stone artefacts, mostly dating to the Middle Stone Age. Sites containing such material are usually located along the margins of water features (pans, drainage lines), small hills and rocky outcrops. Such surface scatters or 'background scatter' is usually viewed to be of limited significance (Orton 2016). In addition to the Stone Age profile, there is also the colonial element. This manifests largely as individual farmsteads, in all its complexity, burial sites and infrastructure features such as roads, railways and power lines, which occurs only in limited numbers. This again has the implication that the cumulative impact would be very low.

Table 4: Cumulative impact assessment summary

Nature: Loss of or damage to sites, features or objects of cultural significance on the development site			
		Without mitigation	With mitigation
Extent		Local area (1)	Local area (1)
Duration		Permanent (5)	Permanent (5)
Intensity		Minor (2)	Minor (2)
Probability		Improbable (2)	Improbable (2)
Significance		Low (16)	Low (16)
Status (positive or negative)		Negative	Neutral
Reversibility		Non-reversible	Non-reversible
Irreplaceable loss of resources?		High	Low
Can impacts be mitigated		Yes	
Mitigation: Avoidance of site/excavation if required			
Cumulative impact: Limited loss of similar features in the larger landscape.			
Site type	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
Archaeological sites/material	Section 35	Generally protected: Low significance – Grade IV-C	Low (16)
			Low (16)
Burial sites and graves	Section 36	Generally protected: Medium significance – Grade IV-A	Low (16)
			Low (16)
Built environment	Section 34	Generally protected: Low significance – Grade IV-C	Low (16)
			Low (16)

9. MANAGEMENT MEASURES

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Those resources that cannot be avoided and that are directly impacted by the proposed development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future.

Sources of risk were considered with regards to development activities defined in Section 2(viii) of the NHRA that may be triggered and are summarised in Table 3A and 3B below. These issues formed the basis of the impact assessment described. The potential risks are discussed according to the various phases of the project below.

9.1 Objectives

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during construction activities.

The following shall apply:

- Known sites should be clearly marked in order that they can be avoided during construction activities.
- The contractors and workers should be notified that archaeological sites might be exposed during the construction activities.
- Should any heritage artefacts be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible;
- All discoveries shall be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the Environmental Control Officer will advise the necessary actions to be taken;

- Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site; and
- Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51. (1).

9.2 Control

In order to achieve this, the following should be in place:

- A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage sites and should be held accountable for any damage.
- Known sites should be located and isolated, e.g. by fencing them off. All construction workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer as identified above.
- In areas where the vegetation is threatening the heritage sites, e.g. growing trees pushing walls over, it should be removed, but only after permission for the methods proposed has been granted by SAHRA. A heritage official should be part of the team executing these measures.

Table 5A: Construction Phase: Environmental Management Programme for the project

Action required	Protection of heritage sites, features and objects		
Potential Impact	The identified risk is damage or changes to resources that are generally protected in terms of Sections 27, 28, 31, 32, 34, 35, 36 and 37 of the NHRA that may occur in the proposed project area.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer	During construction only
Monitoring	See discussion in Section 9.2 above		

Table 5B: Operation Phase: Environmental Management Programme for the project

Action required	Protection of heritage sites, features and objects		
Potential Impact	It is unlikely that the negative impacts identified for pre-mitigation will occur if the recommendations are followed.		
Risk if impact is not mitigated	Loss or damage to sites, features or objects of cultural heritage significance		
Activity / issue	**Mitigation: Action/control**	**Responsibility**	**Timeframe**
1. Removal of Vegetation 2. Construction of required infrastructure, e.g. access roads, water pipelines	See discussion in Section 9.1 above	Environmental Control Officer	During construction only
Monitoring	See discussion in Section 9.2 above		

10. CONCLUSIONS AND RECOMMENDATIONS

This report describes the methodology used, the limitations encountered, the heritage features that were identified and the recommendations and mitigation measures proposed relevant to this. It should be noted that the implementation of the mitigation measures is subject to SAHRA/PHRA's comments.

The cultural landscape qualities of the region are made up of a pre-colonial element consisting of Stone Age and a much later colonial (farmer) component, which eventually gave rise to an urban component which manifest in a number of small towns and an intensive farming industry.

Identified sites

Stone Age lithics dating to the MSA are found only as low-density surface scatters, which is confirmed by similar findings in the larger region by other researchers (Dreyer 2014, 2015; Morris 2014, 2018; van der Walt 2015; van Schalkwyk 2019). The density of artefacts is less than 1/50m^2.

- The low density of the lithic scatters is, on archaeological grounds, viewed to be of low significance and require no further action.

Impact assessment and proposed mitigation measures

Impact analysis of cultural heritage resources under threat of the proposed development, is based on the present understanding of the development:

- As no sites, features or objects of cultural significance are known to exist in the development area, there would be no impact as a result of the proposed development.

Heritage sites	Significance of impact	Mitigation measures
Bokpoort II Solar Power Plant: Construction Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a
Bokpoort II Solar Power Plant: Operation Phase		
Without mitigation	n/a	n/a
With mitigation	n/a	n/a

Cumulative impact assessment

The cultural heritage profile of the larger region is very limited and consists of isolated findspots of Stone Age (MSA) tools, farmsteads and burial sites. Consequently, the cumulative impact of the proposed development is viewed to be **low**

Site type	**NHRA category**	**Field rating**	**Impact rating: Before/After mitigation**
Archaeological sites/material	Section 35	Generally protected: Low significance – Grade IV-C	Low (16)
			Low (16)
Burial sites and graves	Section 36	Generally protected: Low significance – Grade IV-A	Low (16)
			Low (16)

Legal requirements

The legal requirements related to heritage specifically are specified in Section 3 of this report. For this proposed project, the assessment has determined that no sites, features or objects of heritage significance occur in the study area. If heritage features are identified during construction, as stated in the management recommendation, these finds would have to be assessed by a specialist, after which a decision will be made regarding the application for relevant permits.

Reasoned opinion as to whether the proposed activity should be authorised:

- From a heritage point of view, it is recommended that the proposed development be allowed to continue on acceptance of the proposed mitigation measures and the conditions proposed below.

Conditions for inclusion in the environmental authorisation:

- The Palaeontological Sensitivity Map (SAHRIS) indicate that the study area has a moderate sensitivity of fossil remains to be found and therefore a desktop palaeontological required.
- Should archaeological sites or graves be exposed in other areas during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

11. REFERENCES

11.1 Data bases

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Heritage Atlas Database, Pretoria
National Archives of South Africa
SAHRA Archaeology and Palaeontology Report Mapping Project (2009)
SAHRIS Database

11.2 Literature

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Wilson, M.G.C. & Anhaeusser, C.R. 1998. *The Mineral Resources of South Africa*. Sixth Edition. Handbook 16. Pretoria: Council for Geosciences.

11.3 Archival sources, maps and aerial photographs

1: 50 000 Topographic maps
Google Earth
Aerial Photographs: Chief Surveyor-General

12. ADDENDUM

1. Indemnity and terms of use of this report

The findings, results, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and the author reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although all possible care is taken to identify all sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the study. The author of this report will not be held liable for such oversights or for costs incurred as a result of such oversights.

Although the author exercises due care and diligence in rendering services and preparing documents, he accepts no liability and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

2. Assessing the significance of heritage resources and potential impacts

A system for site grading was established by the NHRA and further developed by the South African Heritage Resources Agency (SAHRA 2007) and has been approved by ASAPA for use in southern Africa and was utilised during this assessment.

2.1 *Significance of the identified heritage resources*

According to the NHRA, Section 2(vi) the **significance** of a heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

Matrix used for assessing the significance of each identified site/feature

1. SITE EVALUATION			
1.1 Historic value			
Is it important in the community, or pattern of history			
Does it have strong or special association with the life or work of a person, group or organisation of importance in history			
Does it have significance relating to the history of slavery			
1.2 Aesthetic value			
It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group			
1.3 Scientific value			
Does it have potential to yield information that will contribute to an understanding of natural or cultural heritage			
Is it important in demonstrating a high degree of creative or technical achievement at a particular period			
1.4 Social value			
Does it have strong or special association with a particular community or cultural group for social, cultural or spiritual reasons			
1.5 Rarity			
Does it possess uncommon, rare or endangered aspects of natural or cultural heritage			
1.6 Representivity			
Is it important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects			
Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class			
Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.			
2. Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Regional			
Local			
Specific community			
3. Field Register Rating			
1.	National/Grade 1: High significance - No alteration whatsoever without permit from SAHRA		
2.	Provincial/Grade 2: High significance - No alteration whatsoever without permit from provincial heritage authority.		
3.	Local/Grade 3A: High significance - Mitigation as part of development process not advised.		

4.	Local/Grade 3B: High significance - Could be mitigated and (part) retained as heritage register site	
5.	Generally protected 4A: High/medium significance - Should be mitigated before destruction	
6.	Generally protected 4B: Medium significance - Should be recorded before destruction	
7.	Generally protected 4C: Low significance - Requires no further recording before destruction	

2.2 *Significance of the anticipated impact on heritage resources*

All impacts identified during the HIA stage of the study will be classified in terms of their significance. Issues would be assessed in terms of the following criteria:

Nature of the impact
A description of what causes the effect, what will be affected and how it will be affected.

Extent
The physical **extent**, wherein it is indicated whether:
- 1 - The impact will be limited to the site;
- 2 - The impact will be limited to the local area;
- 3 - The impact will be limited to the region;
- 4 - The impact will be national; or
- 5 - The impact will be international.

Duration
Here it should be indicated whether the lifespan of the impact will be:
- 1 - Of a very short duration (0–1 years);
- 2 - Of a short duration (2-5 years);
- 3 - Medium-term (5–15 years);
- 4 - Long term (where the impact will persist possibly beyond the operational life of the activity); or
- 5 - Permanent (where the impact will persist indefinitely).

Magnitude (Intensity)
The magnitude of impact, quantified on a scale from 0-10, where a score is assigned:
- 0 - Small and will have no effect;
- 2 - Minor and will not result in an impact;
- 4 - Low and will cause a slight impact;
- 6 - Moderate and will result in processes continuing but in a modified way;
- 8 - High, (processes are altered to the extent that they temporarily cease); or
- 10 - Very high and results in complete destruction of patterns and permanent cessation of processes.

Probability
This describes the likelihood of the impact actually occurring and is estimated on a scale where:
- 1 - Very improbable (probably will not happen);
- 2 - Improbable (some possibility, but low likelihood);
- 3 - Probable (distinct possibility);
- 4 - Highly probable (most likely); or
- 5 - Definite (impact will occur regardless of any prevention measures).

Significance
The significance is determined through a synthesis of the characteristics described above (refer to the formula below) and can be assessed as low, medium or high:

S = (E+D+M) x P; where
S = Significance weighting

E = Extent
D = Duration
M = Magnitude
P = Probability

Significance of impact		
Points	Significant Weighting	Discussion
< 30 points	Low	Where this impact would not have a direct influence on the decision to develop in the area.
31-60 points	Medium	Where the impact could influence the decision to develop in the area unless it is effectively mitigated.
> 60 points	High	Where the impact must have an influence on the decision process to develop in the area.

Confidence
This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Status
- The status, which is described as either positive, negative or neutral.

Reversibility
- The degree to which the impact can be reversed.

Mitigation
- The degree to which the impact can be mitigated.

Nature:		
	Without mitigation	With mitigation
Construction Phase		
Probability		
Duration		
Extent		
Magnitude		
Significance		
Status (positive or negative)		
Operation Phase		
Probability		
Duration		
Extent		
Magnitude		
Significance		
Status (positive or negative)		
Reversibility		
Irreplaceable loss of resources?		
Can impacts be mitigated		

3. Mitigation measures

- *Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.*

Impacts can be managed through one or a combination of the following mitigation measures:

- Avoidance
- Investigation (archaeological)
- Rehabilitation
- Interpretation
- Memorialisation
- Enhancement (positive impacts)

For the current study, the following mitigation measures are proposed, to be implemented only if any of the identified sites or features are to be impacted on by the proposed development activities:

- (1) Avoidance/Preserve: This is viewed to be the primary form of mitigation and applies where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources. The site should be retained *in situ* and a buffer zone should be created around it, either temporary (by means of danger tape) or permanently (wire fence or built wall). Depending on the type of site, the buffer zone can vary from
    - 10 metres for a single grave, or a built structure, to
    - 50 metres where the boundaries are less obvious, e.g. a Late Iron Age site.

- (2) Archaeological investigation/Relocation of graves: This option can be implemented with additional design and construction inputs. This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated. Mitigation is to excavate the site by archaeological techniques, document the site (map and photograph) and analyse the recovered material to acceptable standards. This can only be done by a suitably qualified archaeologist.
    - This option should be implemented when it is impossible to avoid impacting on an identified site or feature.
    - This also applies for graves older than 60 years that are to be relocated. For graves younger than 60 years a permit from SAHRA is not required. However, all other legal requirements must be adhered to.
        - Impacts can be beneficial – e.g. mitigation contribute to knowledge

- (3) Rehabilitation: When features, e.g. buildings or other structures are to be re-used. Rehabilitation is considered in heritage management terms as an intervention typically involving the adding of a new heritage layer to enable a new sustainable use.
    - The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
    - Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
        - Conservation measures would be to record the buildings/structures as they are (at a particular point in time). The records and recordings would then become the 'artefacts' to be preserved and managed as heritage features or (movable) objects.
        - This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (4) Mitigation is also possible with additional design and construction inputs. Although linked to the previous measure (rehabilitation) a secondary though 'indirect' conservation measure would be to use the existing architectural 'vocabulary' of the structure as guideline for any new designs.
    - The following principle should be considered: **heritage informs design**.
        - This approach automatically also leads to the enhancement of the sites or features that are re-used.

- (5) No further action required: This is applicable only where sites or features have been rated to be of such low significance that it does not warrant further documentation, as it is viewed to be fully documented after inclusion in this report.
    - Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage/remains are destroyed.

4. Curriculum vitae

Johan Abraham van Schalkwyk

Personal particulars

Date of birth:	14 April 1952
Identity number:	520414 5099 08 4
Marital status:	Married; one daughter
Nationality:	South African

Current address: home

62 Coetzer Ave, Monument Park, Pretoria, 0181
Mobile: 076 790 6777; E-mail: jvschalkwyk@mweb.co.za

Qualifications

1995 DLitt et Phil (Anthropology), University of South Africa
1985 MA (Anthropology), University of Pretoria
1981 BA (Hons), Anthropology, University of Pretoria
1979 Post Graduate Diploma in Museology, University of Pretoria
1978 BA (Hons), Archaeology, University of Pretoria
1976 BA, University of Pretoria

Non-academic qualifications

12th HSRC-School in Research Methodology - July 1990
Dept. of Education and Training Management Course - June 1992
Social Assessment Professional Development Course - 1994
Integrated Environmental Management Course, UCT - 1994

Professional experience

Private Practice
2017 - current: Professional Heritage Consultant

National Museum of Cultural History
1992 - 2017: Senior researcher: Head of Department of Research. Manage an average of seven researchers in this department and supervise them in their research projects. Did various projects relating to Anthropology and Archaeology in Limpopo Province, Mpumalanga, North West Province and Gauteng. Headed the Museum's Section for Heritage Impact Assessments.
1978 - 1991: Curator of the Anthropological Department of the Museum. Carried out extensive fieldwork in both anthropology and archaeology

Department of Archaeology, University of Pretoria
1976 - 1977: Assistant researcher responsible for excavations at various sites in Limpopo Province and Mpumalanga.

Awards and grants

1. Hanisch Book Prize for the best final year Archaeology student, University of Pretoria - 1976.
2. Special merit award, National Cultural History Museum - 1986.
3. Special merit award, National Cultural History Museum - 1991.
4. Grant by the Department of Arts, Culture, Science and Technology, to visit the various African countries to study museums, sites and cultural programmes - 1993.
5. Grant by the USA National Parks Service, to visit the United States of America to study museums, sites, tourism development, cultural programmes and impact assessment programmes - 1998.
6. Grant by the USA embassy, Pretoria, under the Bi-national Commission Exchange Support Fund, to visit cultural institutions in the USA and to attend a conference in Charleston - 2000.
7. Grant by the National Research Foundation to develop a model for community-based tourism - 2001.

8. Grant by the National Research Foundation to develop a model for community-based tourism - 2013. In association with RARI, Wits University.

Publications
Published more than 70 papers, mostly in scientifically accredited journals, but also as chapters in books.

Conference Contributions
Regularly presented papers at conferences, locally as well as internationally, on various research topics, ranging in scope from archaeology, anthropological, historical, cultural historical and tourism development.

Heritage Impact Assessments
Since 1992, I have done more than 2000 Phase 1 and Phase 2 impact assessments (archaeological, anthropological, historical and social) for various government departments and developers. Projects include environmental management frameworks, roads, pipeline-, and power line developments, dams, mining, water purification works, historical landscapes, refuse dumps and urban developments.

Appendix B10: Palaeontology

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Proposed Bokpoort II Solar Power Facility on the Remaining Extent of Farm Bokpoort 390 near Groblershoop, Northern Cape Province

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	NATURA VIVA CC			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100
Specialist name:	Dr John Edward Almond			
Specialist Qualifications:	PhD (Palaeontology), University of Cambridge, UK			
Professional affiliation/registration:	Palaeontological Society of Southern Africa, Association of Professional Heritage Practitioners (W Cape)			
Physical address:	76 Breda Park, Breda St, Oranjezicjt, CAPE TOWN 8001, RSA			
Postal address:	PO Box 12410 Mill Street, CAPE TOWN			
Postal code:	8010	Cell:		
Telephone:	021 462 3622	Fax:		
E-mail:	naturaviva@universe.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Dr John Edward Almond**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

John E Almond

Signature of the Specialist

NATURA VIVA CC

Name of Company

1/31/2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Dr John Edward Almond**, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

John E Almond

Signature of the Specialist

NATURA VIVA CC

Name of Company

1/3/2020

Date

7288124.7 SAP

Signature of the Commissioner of Oaths

2020-03-01

Date

SOUTH AFRICAN POLICE SERVICE
STATION COMMANDER
CAPE TOWN
2020 -03- 01
CAPE TOWN
STATION COMMANDER
SOUTH AFRICAN POLICE SERVICE

PALAEONTOLOGICAL IMPACT ASSESSMENT: DESKTOP STUDY

Proposed Bokpoort II Solar Power Facility on the Remaining Extent of Farm Bokpoort 390 near Groblershoop, Northern Cape Province

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

February 2020

1. EXECUTIVE SUMMARY

ACWA Power Energy Africa (Pty) Ltd is proposing to develop the Bokpoort II Solar Power Facility on the Remaining Extent (RE) of the Farm Bokpoort 390 near Groblershoop, Northern Cape. An associated, authorised water pipeline to the Orange River running along an existing servitude will also traverse the adjoining Farm Sand Draai 391. The combined power generation capacity of the Bokpoort II solar development will be up to 2000 MW that will be generated by ten x 200 MW photovoltaic (PV) facilities, two of which have already been authorised but are undergoing another Basic Assessment (BA) study for the battery storage energy system as well as the capacity increase from 75 to 200MW. The total size of the Bokpoort II Solar Power Facility is approximately 1 500 ha.

The proposed alternative energy developments are underlain by highly metamorphosed Precambrian basement rocks (schists, quartzites, gneisses) of the Namaqua-Natal Province that are entirely unfossiliferous. These are largely mantled by Late Caenozoic superficial sediments including Quaternary aeolian sands of the Gordonia Formation (Kalahari Group), calcrete pedocretes (soil limestones) and alluvium of the Orange River and its tributaries. These younger superficial sediments are generally of low palaeontological sensitivity. Potentially fossiliferous older alluvial gravels are not mapped along the banks of the Orange River close to Groblershoop where these are intersected by the proposed water pipeline.

No significant fossil heritage resources have been recorded within the Bokpoort II Solar Power Facility study area. The area is inferred to be of low sensitivity in terms of palaeontological heritage and no sensitive or no-go areas have been identified within it during the present desktop assessment. The proposed solar power facility is of LOW (negative) impact significance with respect to palaeontological heritage resources. This assessment applies to all the planned infrastructure within the project area – *including* the water pipeline to the Orange River (already authorised) as well as the short 132 kV overhead line connection to the existing Eskom Garona Substation - and applies equally to all PV plants under consideration for the Bokpoort II Solar Power Facility. Cumulative impacts associated with the ten alternative energy developments are probably low and there are no fatal flaws in the development proposal as far as fossil heritage is concerned. The no-go alternative is of neutral significance for palaeontology. Providing that the recommendations outlined below for palaeontological monitoring and mitigation are fully implemented, there are no objections on palaeontological heritage grounds to authorisation of this alternative energy project. Pending the potential discovery of significant new fossil remains during development - notably fossil vertebrate bones & teeth - no further specialist palaeontological studies or mitigation are considered necessary for this project.

In the case of any significant chance fossil finds during construction (*e.g.* vertebrate teeth, bones, burrows, petrified wood, shells), these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to the South African Heritage Resources Agency, SAHRA (Contact

details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate mitigation by a professional palaeontologist can be considered. Such mitigation usually involves the judicious sampling, collection and recording of fossils as well as of relevant contextual data concerning the surrounding sedimentary matrix. The palaeontologist concerned would need to apply beforehand for a collection permit from SAHRA. A tabulated Chance Fossil Finds Procedure is appended to this report.

These recommendations should be incorporated into the Environmental Management Plan (EMP) for all the Bokpoort II alternative energy developments.

2. INTRODUCTION & BRIEF

The company ACWA Power Energy Africa (Pty) Ltd is proposing to develop a solar power facility – to be known as Bokpoort II - on the Remaining Extent (RE) of the Farm Bokpoort 390. An associated water pipeline to the Orange River running along an existing servitude will also traverse the adjoining Farm Sand Draai 391. The Bokpoort II project area is situated *c.* 20 km north of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province (Fig. 1). In 2016 ACWA Power obtained three Environmental Authorisations (EAs) for two 75 MW PV facilities as well as a 150 MW CSP facility on the property. The water main pipeline to the Orange has also already been authorised. However, it is now being proposed that, instead of the CSP facility, eight additional PV plants are developed within the same footprint. The two authorised PV facilities are undergoing another BA study for the battery storage energy system as well as the capacity increase from 75 to 200MW. The combined power generation capacity of the entire Bokpoort II solar development will be up to 2000 MW that will be generated by ten x 200 MW photovoltaic (PV) facilities.

Each of the eight proposed additional 200 Megawatt (MW) Photovoltaic (PV) Solar Developments will cover approximately 150 hectares and will comprise the following infrastructure:

- Solar PV modules that will be able to deliver up to 200 MW to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid;
- A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure (Figs. 2 & 3) includes:

- Mounting structures for the solar panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132kV overhead powerline which will connect the facility to the National Grid via Eskom's existing Garona Substation. The powerlines vary in length and will be located within a servitude spanning 15.5m meters on both sides. The powerline towers will be 35m high;
- Battery Energy Storage System (BESS) - battery Power at Point of Connection: 150MW, area required: 16ha; the BESS will store approximately 4500m^3 of hazardous substance.;
- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Shared infrastructure consisting of buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), laydown area, parking, warehouse, and offices (previously approved).

Since fossils preserved within the sedimentary rocks represented within the project area might be disturbed, damaged or destroyed during the construction phase of the proposed Bokpoort II development (*e.g.* during excavations or surface clearance) a desktop palaeontological heritage assessment was originally requested for this development by SAHRA (Case IDs 9659, 9699 and 9702; three letters of 27 June 2016). The present palaeontological heritage desktop study covering the entire Bokpoort II project area has accordingly been commissioned on the proponent's behalf by Royal HaskoningDHV (Pty) Ltd, Woodmead, Gauteng. The present palaeontological report contributes to a Basic Assessment process that covers:

- Eight additional 200 MW PV developments on the originally authorised CSP site.
- Two BESS sites to be included within the footprint of the approved PV 1 (Ndebele) and PV 2 (Xhosa) plants with a combined dangerous good storage volume of approximately 4500 m^3 for each additional BESS site as well as the capacity increase up to 200MW.

It is noted that:

(1) Two PV plants of 75 MW each (*i.e.* Ndebele and Xhosa) have already been authorised. These two PV plants will be subject to their own BA, for the proposed new BESS sites and capacity upgrade from 75 to 200MW. Basic Assessment processes for each of the proposed PV plants are being co-ordinated by Royal HaskoningDHV (Pty) Ltd. (Contact details: Ms Seshni Govender. Royal HaskoningDHV (Pty) Ltd. Address: Building No. 5 Country Club Estate, 21 Woodlands Drive, Woodmead, 2191. PO Box 867, Gallo Manor, 2052, Gauteng, South Africa. Tel: 087 352 1592. Mobile: 072 442 0086. E-mail: seshni.govender@rhdhv.com).

(2) The Bokpoort II site is within one of South Africa's eight Renewable Energy Development Zones (RED7 Upington area *cf* Heritage review by Fourie *et al.* 2014), and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors.

2.1. Legislative context for palaeontological assessment studies

The present desktop palaeontological heritage report falls under Sections 35 and 38 (Heritage Resources Management) of the South African Heritage Resources Act (Act No. 25 of 1999), and it will also inform the Environmental Management Programme for this project.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources Agency.

(2) All archaeological objects, palaeontological material and meteorites are the property of the State.

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

(4) No person may, without a permit issued by the responsible heritage resources Agency—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

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

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

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

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

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

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

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

Minimum standards for the palaeontological component of heritage impact assessment reports (PIAs) have been published by SAHRA (2013).

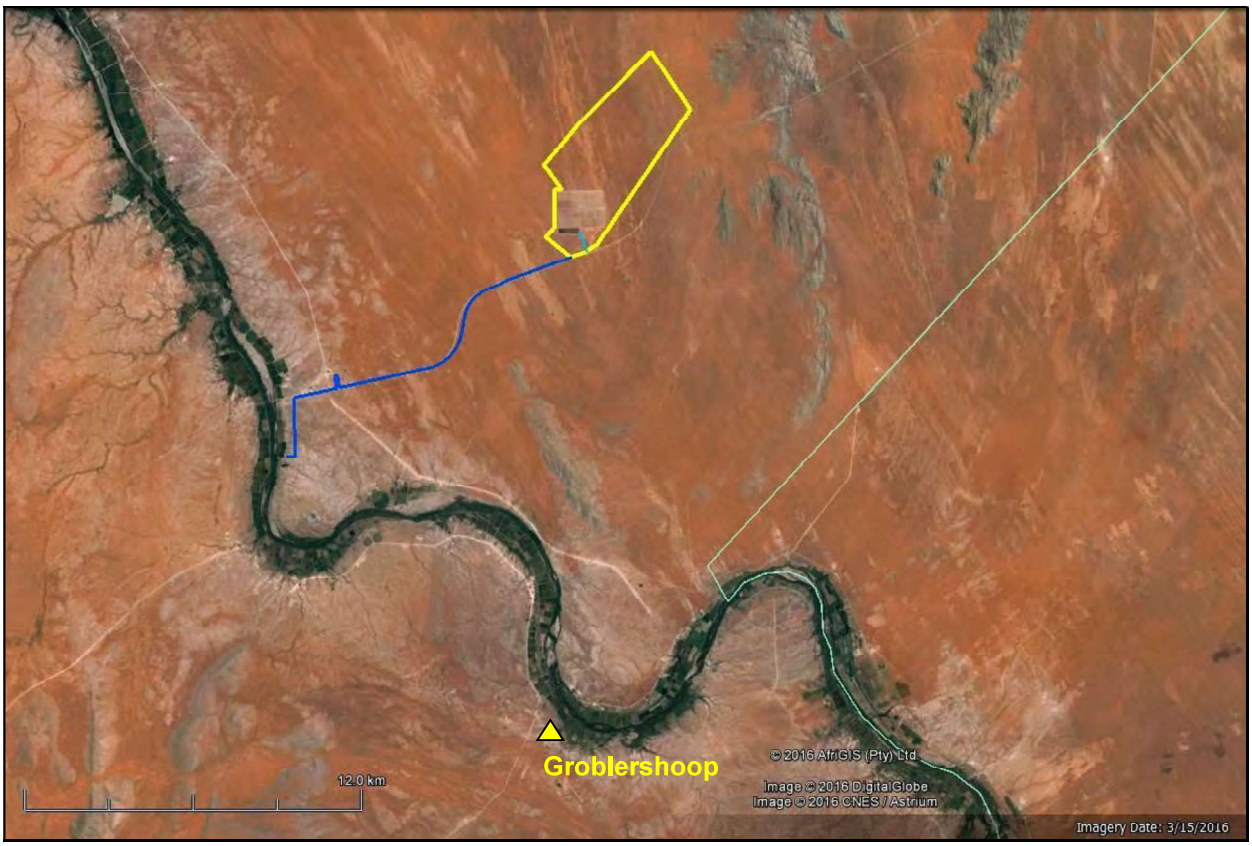

Figure 1: Google earth© satellite image showing the location of the Bokpoort II Solar Power Facility project area (yellow polygon) situated *c.* 20 km north of Groblershoop, Gordonia District, Northern Cape. The associated water pipeline to the Orange River (already authorised) is indicated by the blue line. N is towards the top of the image. Scale bar = 12 km.

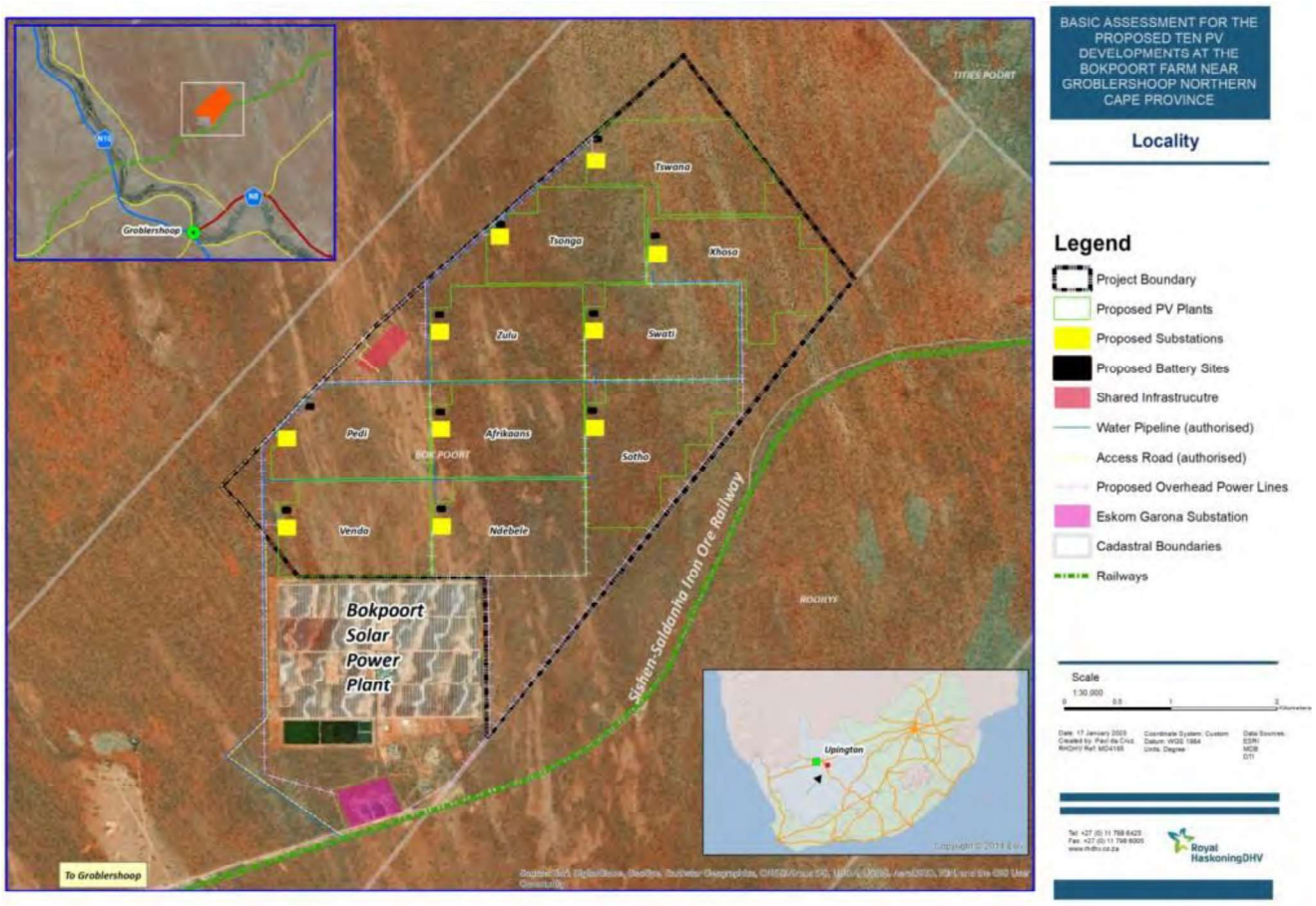

Figure 2: Google earth© satellite image of the Bokpoort II Solar Power Facility project area on the Remaining Extent (RE) of the Farm Bokpoort 390. Shown here are the project boundary (black dashed lines), 10 x PV plants (green) each with a battery site (black) and on-site substation (yellow), the existing Eskom Garona Substation (lilac), main access road (yellow) and shared infrastructure (red). The cleared area for the existing Bokpoort Solar Power Plant can be clearly seen.

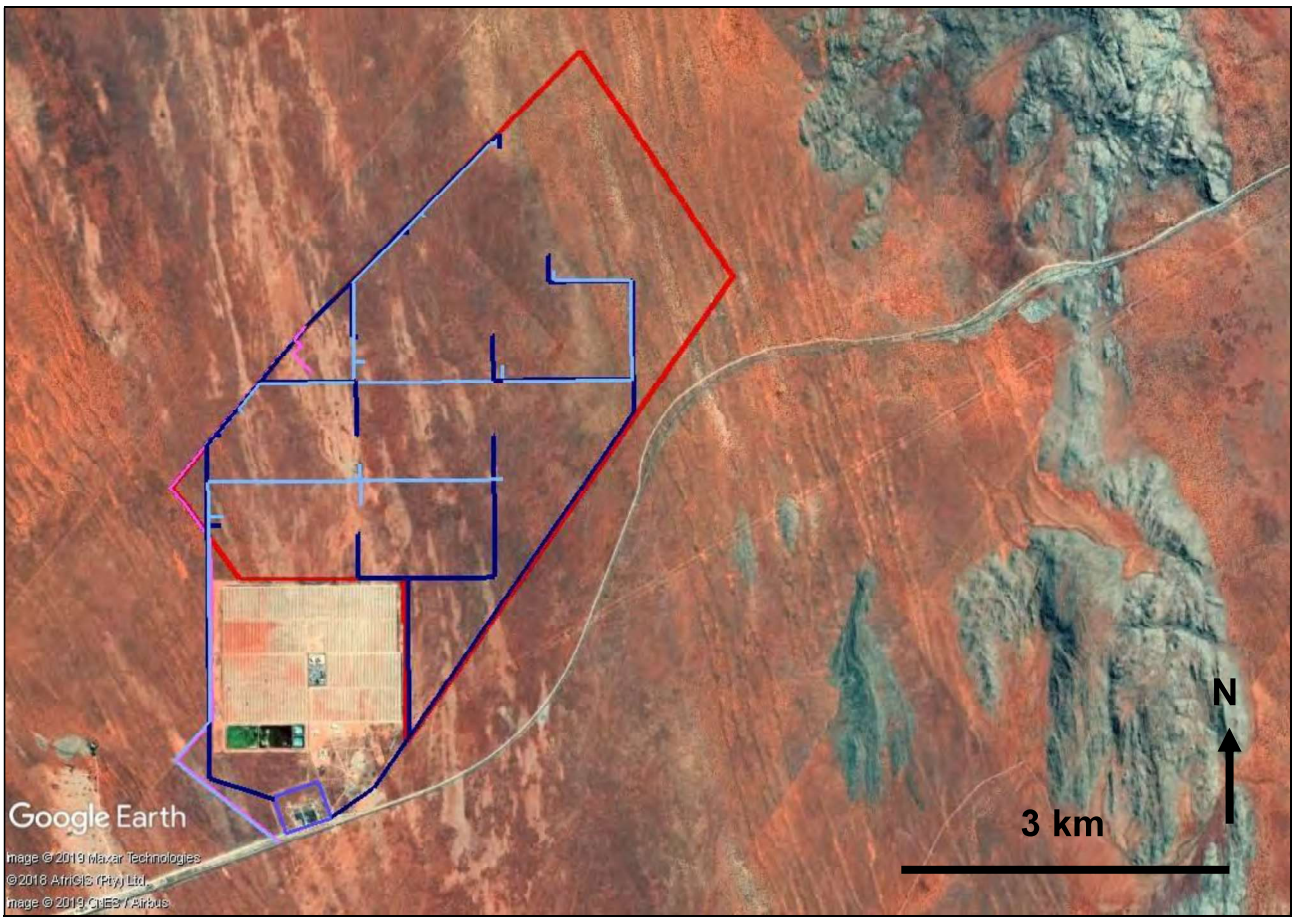

Figure 3: Google earth© satellite image of the Bokpoort II Solar Power Facility project area on the Remaining Extent (RE) of the Farm Bokpoort 390. Shown here are the project boundary (red), overhead powerlines (dark blue), water pipelines, main access road (pink) and the existing Eskom Garona Substation (lilac).

2.2. General approach used for this palaeontological impact study

This PIA report provides an assessment of the observed or inferred palaeontological heritage within the broader study area, with recommendations for specialist palaeontological mitigation where this is considered necessary. The report is based on (1) a review of the relevant scientific literature, including previous palaeontological impact assessments in the area (*e.g.* Almond 2012, 2013a, 2013b, Bamford 2016), (2) published geological maps and accompanying sheet explanations (*e.g.* Moen 2007), as well as (3) the author's extensive field experience with the formations concerned and their palaeontological heritage (*e.g.* Almond & Pether 2008).

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

are present within the development footprint, a field assessment study by a professional palaeontologist is usually warranted.

The focus of palaeontological field assessment is *not* simply to survey the development footprint or even the development area as a whole (*e.g.* farms or other parcels of land concerned in the development). Rather, the palaeontologist seeks to assess or predict the diversity, density and distribution of fossils within and beneath the study area, as well as their heritage or scientific interest. This is primarily achieved through a careful field examination of one or more representative exposures of all the sedimentary rock units present (*N.B.* Metamorphic and igneous rocks rarely contain fossils). The best rock exposures are generally those that are easily accessible, extensive, fresh (*i.e.* unweathered) and include a large fraction of the stratigraphic unit concerned (*e.g.* formation). These exposures may be natural or artificial and include, for example, rocky outcrops in stream or river banks, cliffs, quarries, dams, dongas, open building excavations or road and railway cuttings. Uncemented superficial deposits, such as alluvium, scree or wind-blown sands, may occasionally contain fossils and should also be included in the field study where they are well-represented in the study area. It is normal practice for impact palaeontologists to collect representative, well-localized (*e.g.* GPS and stratigraphic data) samples of fossil material during field assessment studies. In order to do so, a fossil collection permit from SAHRA is required and all fossil material collected must be properly curated within an approved repository (usually a museum or university collection).

Note that while fossil localities recorded during field work within the study area itself are obviously highly relevant, most fossil heritage here is embedded within rocks beneath the land surface or obscured by surface deposits (soil, alluvium *etc*) and by vegetation cover. In many cases where levels of fresh (*i.e.* unweathered) bedrock exposure are low, the hidden fossil resources have to be *inferred* from palaeontological observations made from better exposures of the same formations elsewhere in the region but outside the immediate study area. Therefore a palaeontologist might reasonably spend far *more* time examining road cuts and borrow pits close to, but outside, the study area than within the study area itself. Field data from localities even further afield (*e.g.* an adjacent province) may also be adduced to build up a realistic picture of the likely fossil heritage within the study area.

On the basis of the desktop and field studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological and taphonomic data) – is usually most effective during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management Agency, *i.e.* the South African Heritage Resources Agency, SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

2.3. Assumptions and limitations

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

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

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

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

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

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

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

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

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

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

In the case of the present study area near Groblershoop in the Northern Cape preservation of potentially fossiliferous bedrocks is favoured by the arid climate but bedrock exposure is very limited indeed due to cover by extensive superficial deposits (*e.g.* alluvium, sandy soils, surface gravels), especially in areas of low relief, as well as by Kalahari vegetation. Very few previous palaeontological heritage assessments have been carried out in the study region (*cf* SAHRIS website; Bamford 2016).

3. GEOLOGICAL CONTEXT

The Bokpoort II Solar Power Facility study area on the Remaining Extent (RE) of the Farm Bokpoort 390 comprises arid, low relief terrain in the Gordonia region on the north-eastern side of the Orange River some 20 km north of Groblershoop, Northern Cape (Fig. 1). The terrain within the solar facility study area slopes broadly southwards from *c.* 1010 m amsl in the north to c. 950 m amsl in the south. As clearly seen in satellite images (Figs. 1 to 3) bedrock exposure is good close to the river and along some sectors of the river bank, while away from the river the bedrocks are largely mantled with orange-brown Kalahari sands. NNW to SSE trending linear sand dunes here surround occasional emergent rocky Inselberge of basement rocks. Bedrock exposures in the vicinity are dissected by the dendritic drainage courses of small, intermittently-flowing streams.

The geology of the study area near Groblershoop is shown on the adjoining 1: 250 000 geological maps 2820 Upington and 2822 Postmasburg (Council for Geoscience, Pretoria; Fig. 4 herein). A comprehensive sheet explanation for the Upington map has been published by Moen (2007) while only a very brief explanation for the Postmasburg area is printed on the map itself. The entire study area is underlain at depth by ancient Precambrian igneous and metamorphic rocks that belong to the **Namaqua-Natal Province** of Mid Proterozoic (Mokolian) age (Cornell *et al.* 2006, Moen 2007). These metamorphosed basement rocks are approximately two to one billion years old and are entirely unfossiliferous (Almond & Pether 2008); they are only represented at surface by small bouldery outcrops (*cf* Dreyer 2015). They include a range of schistose and quartzitic units assigned to the **Brulpan Group** (*e.g.* **Groblershoop Formation** and **Prynnsburg Formation**), details of which are given by Moen (2007) as well as Cornell *et al.* (2006). Outside the present study area the Brulpan rocks are locally intruded by the **Kalkwerf Granite-gniess**, likewise unfossiliferous.

The Precambrian basement rocks within the study area are to a great extent mantled with a spectrum of coarse- to fine-grained **superficial deposits** such as rocky soils, downwasted surface gravels, colluvium (slope deposits), sheet wash, calcrete hardpans, aeolian sands and alluvium of intermittently-flowing streams. These younger deposits are generally young (Quaternary to Recent) and are largely unfossiliferous. Field photos of the study area (*e.g.* Dreyer 2015) show orange-brown Kalahari sands, exhumed calcrete hardpans and dispersed, surface gravels dominated by reworked or downwasted calcrete with minor basement quartzite and cherty clasts (these last probably derived from alluvial gravels of the Orange River).

Small patches of Late Tertiary to Quaternary **calcretes** or pedogenic limestones (T, darker yellow in Fig. 4) are mapped between the solar facility study area and the Orange River; some of these are traversed by the water pipeline servitude. Some of these calcretes may be correlated with the Pleistocene or Late Pliocene **Mokalanen Formation** of the **Kalahari Group**, while others may be of younger age (Partridge *et al.* 2006, Moen 2007). They include horizons of layered to structureless or nodular calcretes overlying basement rocks that are usually less than 3 m thick and often partially covered by wind-blown sands.

The great majority of the study area, including the water pipeline corridor, is covered by fine-grained aeolian (wind-blown) sands of the **Gordonia Formation** (**Qg**, pale yellow in Fig. 4), the youngest, Pleistocene to Recent, subunit of the Kalahari Group. Prominent NNW-SSE trending linear dunes of orange-hued sands are clearly visible on satellite images of the study area (Figs. 1 to 3). The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw 1991, Haddon (2000) and Partridge *et al.* (2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle *et al.*, 1983, p. 291). Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch.

According to Moen (2007) **older river terrace gravels** of possible Late Tertiary to Pleistocene age occur “all along the [Orange] river” within 2 km of the present banks and at elevations of up to 45 m (rarely as high as 85m) above the present flood plain. These older river gravels are frequently calcretised. Small patches of older terrace gravels are mapped along the eastern banks of the River Orange some 25 km north of Groblershoop but they are not indicated within the present study area. They may either be completely absent here or too small to map at 1: 250 000 scale. Field photos of the river bank where this is intersected by the existing pipeline show the presence here of disturbed, fine-grained younger alluvium.

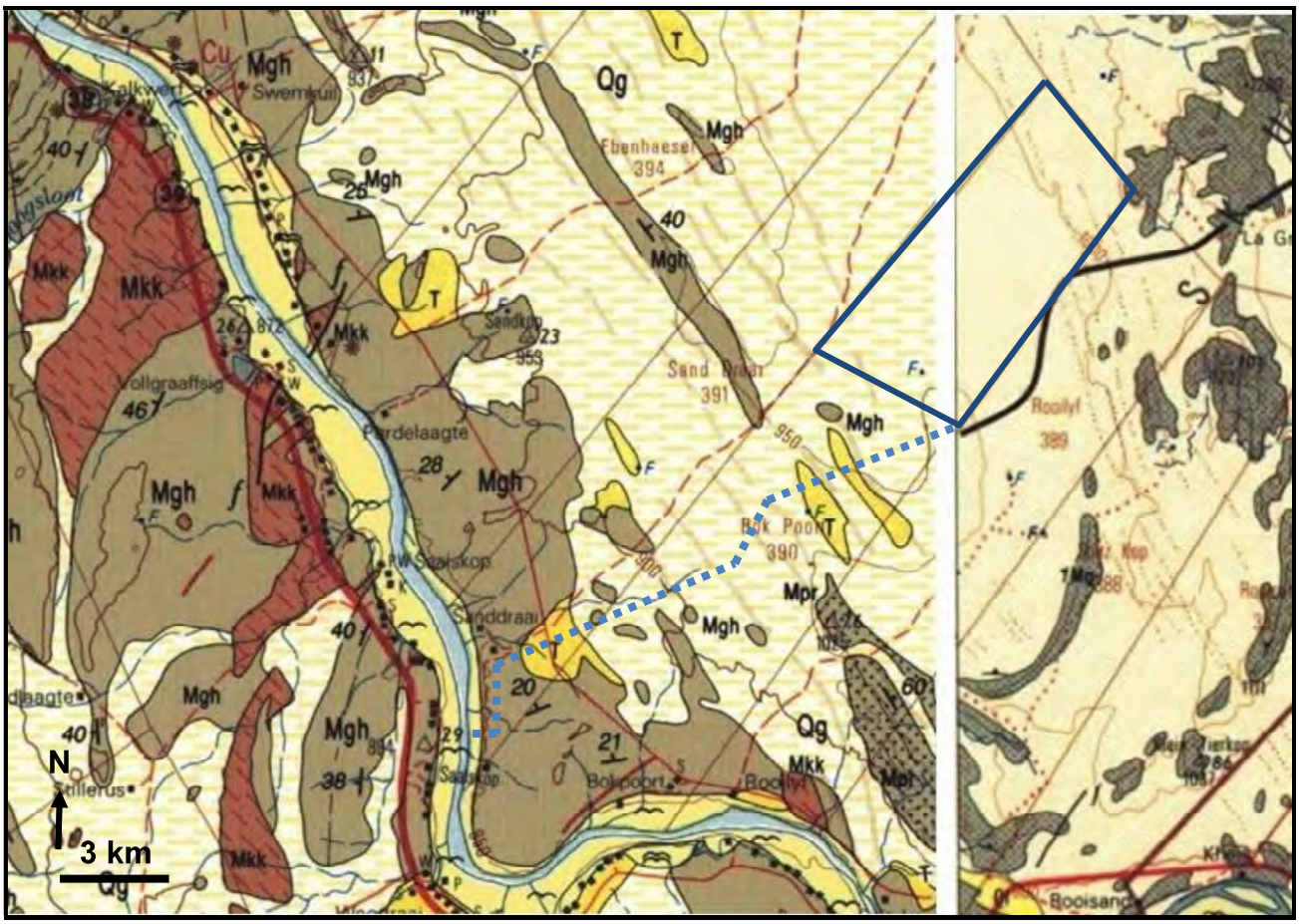

Figure 4: Extract from the adjoining 1: 250 000 geological maps 2820 Upington and 2822 Postmasburg (Council for Geoscience, Pretoria) showing the approximate location of the study area for the Bokpoort II Solar Power Facility on Farm Bokpoort 390 (dark blue polygon). The paler blue dotted line indicates the *approximate* course of the water pipeline to the Orange River.

The study area is underlain at depth by unfossiliferous Precambrian (Middle Proterozoic / Mokolian) basement rocks of the Namaqua-Natal Metamorphic Province (Mgh, Mg, Mpr *etc*, grey or grey-brown) that are assigned to the Brulpan Group and are intruded outside the study area by granite gneisses (Mkk, orange = Kalkwerf Gneiss). Superficial sediments of Late Caenozoic age include calcretes (T, bright yellow), reddish aeolian sands of the Gordonia Formation, Kalahari Group (Qg, pale yellow, with or without dashes), and alluvium of the Orange River (pale yellow with "flying bird" symbol). Small patches of older (Tertiary) terrace gravels are mapped on the eastern bank of the Orange River *c*. 25 km NW of Groblershoop, but *not* within the present study area.

4. PALAEONTOLOGICAL HERITAGE

The Precambrian metamorphic and igneous basement rocks of **the Namaqua-Natal Metamorphic Province** in the study area are entirely unfossiliferous (Almond & Pether 2008) and will therefore not be treated further here.

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

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

Alluvial gravels of the Orange River of Miocene and younger age are locally highly fossiliferous (*e.g.* Hendy 1984, Schneider & Marias 2004, Almond 2008a, 2009 and extensive references therein) but, as argued above, these are *not* mapped within the study area. Younger silty alluvial deposits may contain a range of terrestrial and freshwater fossils and subfossils. Freshwater snails are mentioned in particular by Moen (2007, p. 150). Stream gravels close to the west bank of the Orange River in the Groblershoop area were examined without success for palaeontological remains by Almond (2012).

5. PALAEONTOLOGICAL HERITAGE IMPACT ASSESSMENT

The Precambrian metamorphic bedrocks underling the study area at depth are unfossiliferous while the overlying Late Caenozoic superficial sediments are generally fossil-poor. As a consequence of the paucity of irreplaceable, unique or rare fossil remains within the development footprint the overall impact significance of the construction phase of the proposed solar energy project is assessed as LOW (negative) without mitigation, and VERY LOW (negative) after mitigation (See summary presented in Table 1). This assessment applies to all the planned infrastructure within the project area – *including* the water pipeline to the Orange River as well as the 132 kV overhead line connection to the Eskom Garona Substation - and applies equally to all PV plants under consideration for the Bokpoort II Solar Power Facility. There are no preferences on palaeontological heritage grounds for any particular infrastructure layout or technology alternative among the various options under consideration.

No significant further impacts on fossil heritage are anticipated during the planning, operational and decommissioning phases of the solar power facility. The no-go alternative (*i.e.* no development) would have a neutral impact on palaeontological heritage.

There are no fatal flaws in the present development proposal as far as fossil heritage is concerned. Providing that the proposed recommendations for palaeontological monitoring and mitigation outlined below are followed through, there are no objections on palaeontological heritage grounds to authorisation of this alternative energy project.

Confidence levels for this palaeontological heritage assessment are high. These conclusions are supported by previous palaeontological field assessments undertaken in the broader Kalahari study region (*e.g.* Almond 2012).

- **Cumulative impacts**

Given the low impact significance assessed for all solar energy developments concerned which are all underlain by very similar geology, it is likely that cumulative impacts associated with the Bokpoort II solar power facility are LOW. Very few palaeontological impact assessments for other developments in the wider project area near Groblershoop have been undertaken (SAHRIS website); one exception - for solar projects on the farm Sand Draai by Bamford (2016) - also concluded that the palaeontological sensitivity of the region is low.

Table 1: Assessment of impacts of the proposed Bokpoort II Solar Power Facility on fossil heritage resources within the development footprint during the construction phase of the development (*N.B.* Significant impacts are not anticipated during the operational and decommissioning phases).

Nature of impact: Disturbance, damage, destruction or sealing-in of *scientifically important* fossil remains preserved at or beneath the ground surface within the development area, most notably by surface clearance and bedrock excavations during the construction phase of the solar power facility.		
	Without mitigation	**With mitigation**
Scale	Site only (1)	Site only (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Low (2)	Improbable (1)
Significance	**Negative Low (16)**	**Negative Very Low (8)**
Status	Negative	Negative (loss of fossils) & positive (improved fossil database following mitigation)
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	No, since the limited fossil resources concerned are also represented outside the development area (*i.e.* not unique)	No, since the limited fossil resources concerned are also represented outside the development area (*i.e.* not unique)
Can impacts be mitigated?	Yes	Yes.
Mitigation: Monitoring of all substantial bedrock excavations for fossil remains by ECO on an ongoing basis during construction phase, with reporting of any substantial new palaeontological finds (notably fossil vertebrate bones & teeth) to SAHRA for possible specialist mitigation.		
Cumulative impacts: Low, given the very similar geology of the entire Bokpoort II study region.		
Residual impacts: Negative impacts due to loss of local fossil heritage will be partially offset by *positive* impacts resulting from mitigation (*i.e.* improved palaeontological database).		

6. SUMMARY & RECOMMENDATIONS

The project areas for the proposed Bokpoort II alternative energy developments on the Remaining Extent (RE) of the Farm Bokpoort 390 near Groblershoop are underlain, at or below the surface, by highly metamorphosed Precambrian basement rocks (schists, quartzites, gneisses) of the Namaqua-Natal Province that are entirely unfossiliferous. These are largely mantled by Late Caenozoic superficial sediments including Quaternary aeolian sands of the Gordonia Formation (Kalahari Group), calcrete pedocretes and alluvium of the Orange River and its tributaries. These younger superficial sediments are generally of low palaeontological sensitivity. Potentially fossiliferous older alluvial gravels are not mapped along the banks of the Orange River close to Groblershoop where these are intersected by the proposed water pipeline.

No significant fossil heritage resources have been recorded within the Bokpoort II solar power facility study area. The area is inferred to be of low sensitivity in terms of palaeontological heritage and no sensitive or no-go areas have been identified within it during the present desktop assessment. The proposed solar power facility is of LOW (negative) impact significance before mitigation with respect to palaeontological heritage resources. This assessment applies to all the planned infrastructure within the project area – *including* the water pipeline to the Orange River (already authorised) as well as the 132 kV overhead line connection to the Eskom Garona Substation - and applies equally to all PV plants under consideration for the Bokpoort II Solar Power Facility. Cumulative impacts associated with the ten PV solar energy developments are probably low, given the similar regional geology, and there are no fatal flaws in the development

proposal as far as fossil heritage is concerned. The no-go alternative is of neutral significance for palaeontology. Providing that the recommendations outlined below for palaeontological monitoring and mitigation are followed through, there are no objections on palaeontological heritage grounds to authorisation of this alternative energy project.

Pending the potential discovery of significant new fossil remains during development - notably fossil vertebrate bones & teeth - no further specialist palaeontological studies or mitigation are considered necessary for this project.

6.1. Recommended monitoring and mitigation

In the case of any significant chance fossil finds during construction (*e.g.* vertebrate teeth, bones, burrows, petrified wood, shells), these should be safeguarded - preferably *in situ* - and reported by the ECO as soon as possible to the South African Heritage Resources Agency, SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is so that appropriate mitigation by a professional palaeontologist can be considered. Such mitigation usually involves the judicious sampling, collection and recording of fossils as well as of relevant contextual data concerning the surrounding sedimentary matrix. The palaeontologist concerned would need to apply beforehand for a collection permit from SAHRA. A tabulated Chance Fossil Finds Procedure is provided in Appendix 1 to this report.

These recommendations should be incorporated into the Environmental Management Plan (EMP) for each alternative energy development.

7. ACKNOWLEDGEMENTS

I am grateful to Ms Seshni Govender of Royal HaskoningDHV, Woodmead, for commissioning this study as well as for providing the necessary background information. The original cultural heritage assessment for this project by Dreyer (2015) provided a very useful resource for evaluating surface geology in the study area.

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9. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

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

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

Declaration of Independence

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

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

<table>
<tr><th colspan="3">Appendix 1: CHANCE FOSSIL FINDS PROCEDURE: BOKPOORT II SOLAR POWER FACILITY ON THE REMAINING EXTENT OF FARM BOKPOORT 390 NEAR GROBLERSHOOP</th></tr>
<tr><td>Province & region:</td><td colspan="2">Northern Cape, ZF Mgcawu District Municipality.</td></tr>
<tr><td>Responsible Heritage Management Agency</td><td colspan="2">SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa.
Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Precambrian Namaqua-Natal basement rocks. Kalahari Group aeolian sands, calcretes, Late Caenozoic alluvium.</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Mammalian bones, teeth and horn cores, freshwater molluscs, trace fossils in older alluvial deposits, calcrete hardpans.</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
• Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
• Context – describe position of fossils within stratigraphy (rock layering), depth below surface
• Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation
• Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Agency for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
• Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
• Photograph fossils against a plain, level background, with scale
• Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
• Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
• Alert Heritage Resources Agency and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Agency, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Agency</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Agency. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Agency minimum standards.</td></tr>
</table>

Appendix B11: Traffic including Peer Review by SMEC

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Addendum to Bokpoort II PV Solar Farm: Concentrated Solar Power Tower Facility, Site Traffic Assessment
24 January 2020

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

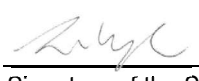
1. SPECIALIST INFORMATION

Specialist Company Name:	Royal HaskoningDHV			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	
Specialist name:	Leonie van Wyk			
Specialist Qualifications:	MSc Engineering			
Professional affiliation/registration:	Professional Engineer, ECSA			
Physical address:	Building No. 5 Country Club Estate, 21 Woodlands Drive, Woodmead, 2191			
Postal address:	PO Box 867, Gallo Manor, 2051, Gauteng.			
Postal code:	2052	Cell:	0835543399	
Telephone:	+27 87 352 1500	Fax:	-	
E-mail:	Leonie.vanwyk@rhdhv.com			

2. DECLARATION BY THE SPECIALIST

I, Leonie van Wyk, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

Royal Haskoning DHV

Name of Company:

20 May 2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Leonie van Wyk, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Royal HaskoningDHV

Name of Company

20 May 2020

Date

Signature of the Commissioner of Oaths

1/06/2020

Date

CERTIFIED TRUE COPY OF THE ORIGINAL

Malcolm Roods

Commissioner of Oaths
BA(Hons) LLB
(011) 798 6001
PO Box 867, Gallo Manor 2052
21 Woodlands Drive, Woodmead

REPORT

Addendum to Bokpoort II PV Solar Farm: Concentrated Solar Power Tower Facility, Site Traffic Assessment

Site Traffic Assessment

Client: ACWA Power (LTD) PTY

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1 INTRODUCTION

1.1 Purpose of Report

This report is an addendum to previously completed reports for the Bokpoort II Solar Farm Concentrated Solar Power Tower Facility, Bokpoort II Photovoltaic Facility 1 and Bokpoort II Photovoltaic Facility 2 (Site Traffic Assessment, May 2016). The previous reports detail the impact of the construction and operations of two 75 Mega Watt (MW) photovoltaic (PV) facilities and one 150MW Concentrated Solar Power (CSP) Tower facility. The project scope has been amended to ten 200MW PV solar facilities and no CSP tower facilities included in the development.
The proposed solar development site is located in the Northern Cape of South Africa. The site is located within one of South Africa's eight renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. This report will cover the impact of the 10 proposed PV facilities.

The report will address:

- Description of the Status Quo, including the existing traffic data and analysis at the surrounding road network and accesses to the site;
- Description of the construction process and methodology, including transport of materials and staff to site and site logistics during the construction and operational phases;
- Describe and quantify the traffic impact during construction period using intersection capacity analysis software;
- Address the access / egress at the site.

This traffic study will form part of the Environmental Basic Assessment specialist studies for the development of the proposed PV facilities.

1.2 Overview of Project

The proposed development will consist of ten 200MW PV facilities and the associated infrastructure. Also included in the development is a Battery Energy Storage System (BESS) on each of the 10 PV sites, with a storage capacity of 150MW. The combined power generation capacity of the entire development will be 2000 MW and the combined storage capacity of the BESSs will be 1500MW. Each PV facility will require 150ha of land, the combined area required for the ten proposed PV facilities is 1500 ha. The BESS site footprint is 16ha and the hazardous storage is 4500m^3 for each PV site. Previously, approval for 2 of the 10 PV facilities was obtained, PV 1 (Ndebele) and PV 2 (Xhosa), however the proposal for these two sites did not include the BESS for either of the sites as well as the capacity increase from 75 to 200MW.

1.3 Location of the Project

The PV facilities will be located within Farm Bokpoort 390 RE in the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province. The proposed site location is adjacent to Bokpoort I and in proximity of the Eskom's Garona Substation The development is also located adjacent to the Sanddraai solar power (CSP) and PV plant on the Farm Sanddraai 391, adjacent to Bokpoort to the north, for which Environmental Authorisation has been granted, however, construction has not yet started.

Figure 1.1: Locality Map

1.4 Consultant

Royal HaskoningDHV (RHDHV) was appointed by ACWA Power Energy Africa (Pty) Ltd to update the traffic specialist studies associated with the updated project scope.

1.5 Projects Impacting on this Study

The following projects in the study area should be noted:

- The proposed Sanddraai solar power (CSP) and PV plant on the farm Sanddraai 391, adjacent to Bokpoort I the proposed PV facilities;
- Bokpoort I solar plant for which construction was completed in March 2016 which is located on Farm Bokpoort 390; and
- At the time of completing the original investigation a request by farmers (grape farmers adjacent to the river) to upgrade the Gariep District Road which is currently a gravel road, due to dust generated by construction traffic which affects their grape production.

The expected programme for the construction period abovementioned projects as well as the 10 facilities being investigated are included in Table 1-1 below.

Table 1-1: Expected simultaneous construction program

	2020				2021												2022											
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Bokpoort I																												
Proposed PV solar facilities																												
PV 1																												
PV 2																												
PV 3																												
PV 4																												
PV 5																												
PV 6																												
PV 7																												
PV 8																												
PV 9																												
PV 10																												
Sanddraai																												

Note: This program is to be confirmed by ACWA Power Energy Africa (Pty) Ltd as details pertaining to the construction program are not yet finalized, and the program above is based on assumptions that were made regarding the construction activities. The construction program is dependent on the awarding of projects by the Department of Mineral Resources and Energy.

Planning and design phase
Construction phase
Operation phase

2 STATUS QUO

2.1 Land Use

The proposed site is on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, which has previously been used for animal grazing. It is currently zoned as a Special Zone and forms part of Renewable Energy Development Zone (REDZ) 7 Upington. The site is within one of South Africa's eight renewable energy development zones and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impacts, economic and infrastructural factors. The main farming activity in the area is vineyards with sultana farms on both sides of the Orange River close to (up to 500 to 1000m) the river bank and further away from the river is livestock farming and eco-tourism.

2.2 Access to Site

Access to the proposed site is via a private Transnet Service Road (gravel), running adjacent to the Sishen-Saldanha railway line. The Transnet Service Road is accessed via the Gariep Road, currently a gravel road, from either the N8 or N14. The road also provides access to farms located further north. This road was upgraded (widened to 8m and gravelled) during the construction of Bokpoort I and meet the requirements for the proposed PV facilities. Permission for use of the road was obtained during the application for construction for Bokpoort I, however, permission will have to obtained once again for the construction of the PV solar facilities.

2.3 Road Network and Intersections

The N14, N10 and N8 are the National roads in the region and are the main link between the economic centers of Gauteng and Namibia. Access to the site is via the Gariep Road the Transnet Service Road. Details of the road network are given in Table 1.

The intersections are currently all unsignalized intersections and operating at a good Level of Service (LOS) of LOS A with sufficient spare capacity (Bokpoort II Solar Farm Concentrated Solar Power Tower Facility, Site Traffic Assessment, May 2016).

Details of the LOS classifications are provided in Table 2-2

Table 2-1: LOS Classifications

LOS A	free flow
LOS B	reasonably free flow
LOS C	stable flow, at or near free flow
LOS D	approaching unstable flow.
LOS E	unstable flow, operating at capacity
LOS F	forced or breakdown flow