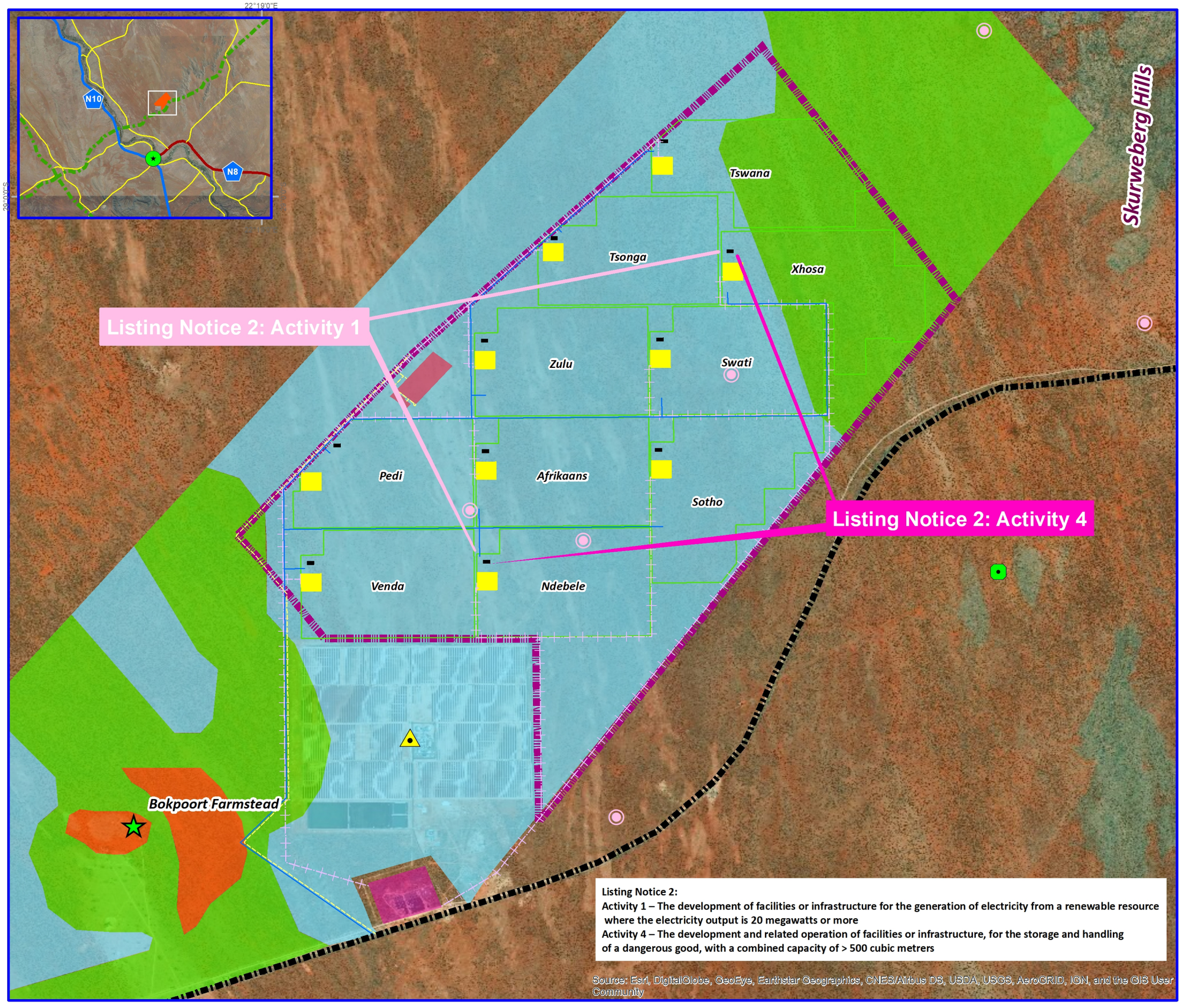
Appendix A: Maps

BASIC ASSESSMENT FOR THE PROPOSED TEN NEW PV DEVELOPMENTS AT THE BOKPOORT FARM NEAR GROBLERSHOOP NORTHERN CAPE PROVINCE

BASIC ASSESSMENT

Listing Notice Applicability - BESS Components



Legend

- Project Boundary
- Proposed PV Plants
- Proposed Substations
- Proposed Battery Sites
- Shared Infrastructure
- Water Pipeline (authorised)
- Access Road (authorised)
- Proposed Overhead Power Lines
- Eskom Garona Substation
- Railways
- Martial Eagle Nest
- Water Point

Receptor Type

- Farmstead

Sensitivity Zoning

Class

- Acceptable
- Not Preferred
- Preferred Area

N

Scale

1:30,000

0 0.5 1 2 Kilometers

Date: 24 February 2020
Created by: Paul da Cruz
RHDHV Ref: MD4195

Coordinate System: Custom
Datum: WGS 1984
Units: Degree

Data Sources:
ESRI
DTI
Golder Associates

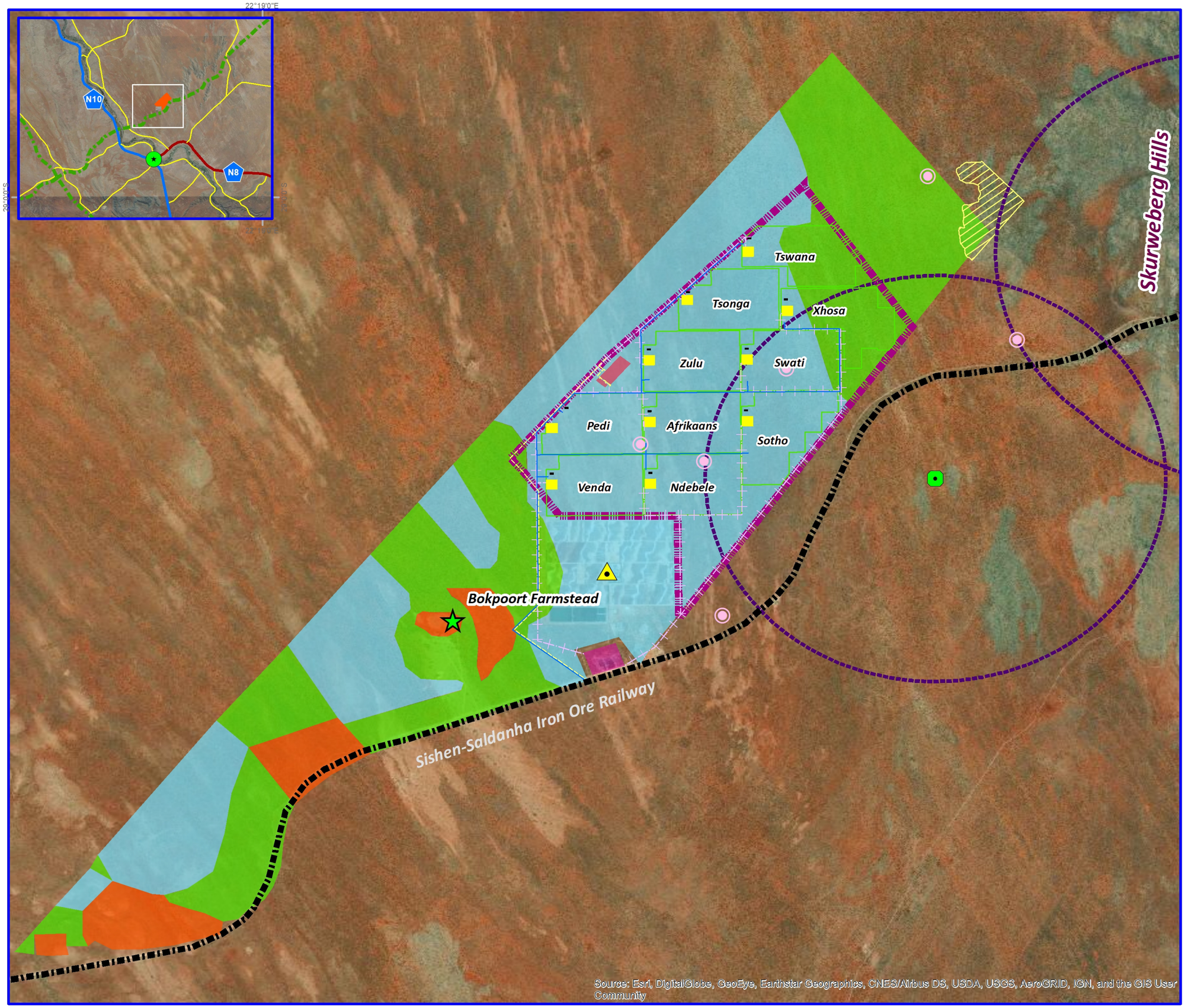
Tel: +27 (0) 11 798 6425
Fax: +27 (0) 11 798 6005
www.rhdhv.co.za

Royal HaskoningDHV

BASIC ASSESSMENT FOR THE PROPOSED TEN NEW PV DEVELOPMENTS AT THE BOKPOORT FARM NEAR GROBLERSHOOP NORTHERN CAPE PROVINCE

BASIC ASSESSMENT

Environmental Senstivity



Legend

- Project Boundary
- Proposed PV Plants
- Proposed Substations
- Proposed Battery Sites
- Shared Infrastructure
- Water Pipeline (authorised)
- Access Road (authorised)
- Proposed Overhead Power Lines
- Eskom Garona Substation
- Railways
- Eagle_Nest
- Water Point

Receptor Type

- Farmstead
- Eagle_NestBuffer3km
- High Bat Sensitivity Area

Sensitivity Zoning

Class

- Acceptable
- Not Preferred
- Preferred Area

N

Scale

1:53,900

0 0.5 1 2 3 Kilometers

Date: 24 February 2020
Created by: Paul da Cruz
RHDHV Ref: MD4195

Coordinate System: Custom
Datum: WGS 1984
Units: Degree

Data Sources:
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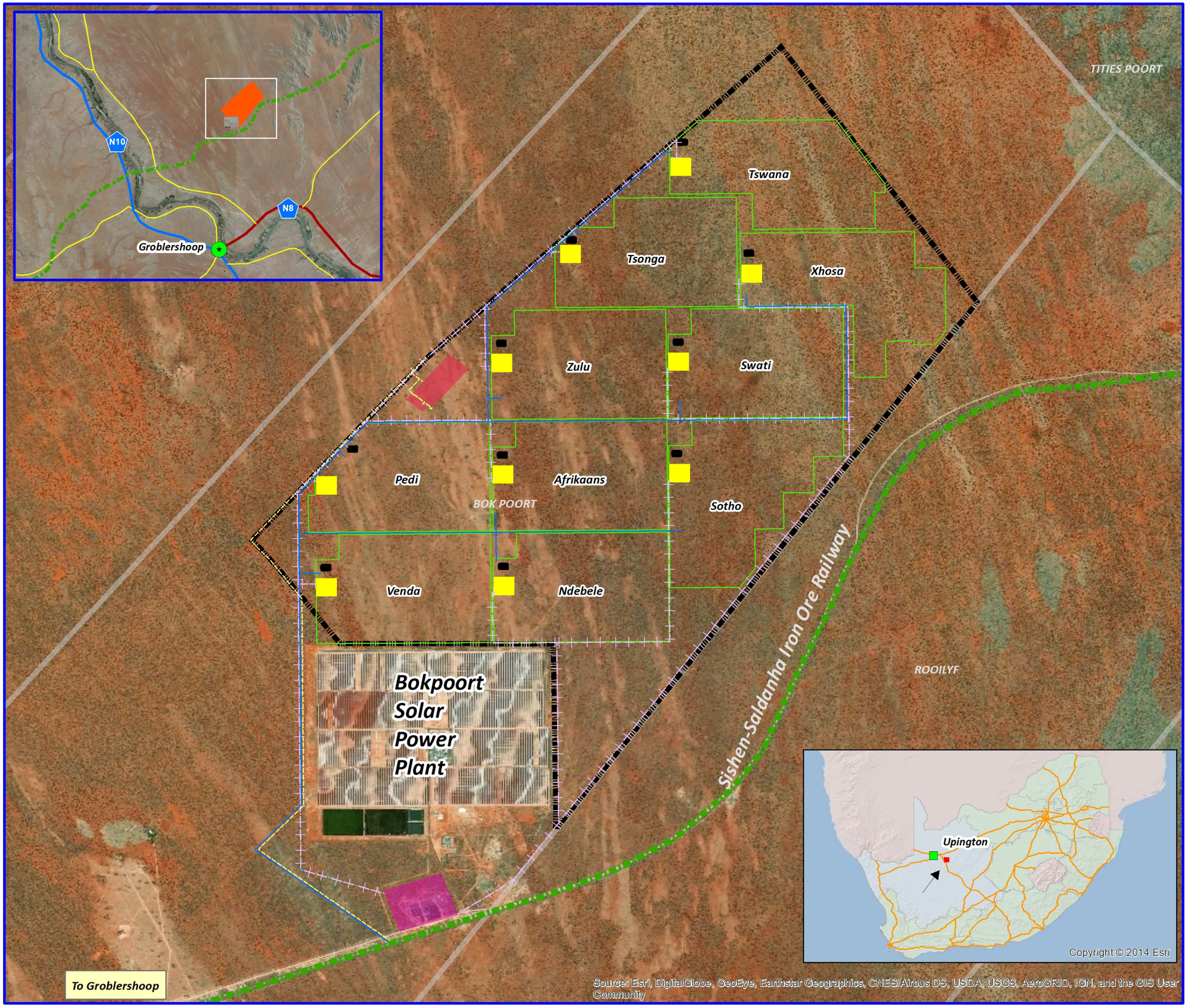
Royal HaskoningDHV

BASIC ASSESSMENT FOR THE PROPOSED TEN PV DEVELOPMENTS AT THE BOKPOORT FARM NEAR GROBLERSHOOP NORTHERN CAPE PROVINCE

Locality



Legend

- Project Boundary
- Proposed PV Plants
- Proposed Substations
- Proposed Battery Sites
- Shared Infrastrucutre
- Water Pipeline (authorised)
- Access Road (authorised)
- Proposed Overhead Power Lines
- Eskom Garona Substation
- Cadastral Boundaries
- Railways

Scale

1:30,000

0 0.5 1 2 Kilometers

Date: 17 January 2020
Created by: Paul da Cruz
RHDHV Ref: MD4195

Coordinate System: Custom
Datum: WGS 1984
Units: Degree

Data Sources:
ESRI
MDB
DTI

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Royal HaskoningDHV

Appendix B: Specialist Studies

Appendix B1: Soils and Agricultural Potential

Johann Lanz
Soil Scientist (Pri.Sci.Nat.)
Reg. no. 400268/12

Cell: 082 927 9018
Tel: 021 866 1518
e-mail: johann@johannlanz.co.za

PO Box 6209
Uniedal
7612
Stellenbosch
South Africa

AGRICULTURAL AND SOILS IMPACT ASSESSMENT FOR PROPOSED BOKPOORT 10 X PV SOLAR POWER FACILITIES ON THE FARM BOKPOORT NEAR GROBLERSHOOP NORTHERN CAPE PROVINCE

BA PHASE REPORT

Report by
Johann Lanz

December 2019

Johann Lanz
Professional profile

Education

• M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1997
• B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
• BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
• Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12, and am a member of the Soil Science Society of South Africa.

- **Soil Science Consultant Self employed 2002 - present**
  I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:

1. Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: CSIR; SRK Consulting; Aurecon; Mainstream Renewable Power; SiVEST; Savannah Environmental; Subsolar; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Sharples Environmental Services; Haw & Inglis; BioTherm Energy; Tiptrans.
2. Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Cederberg Wines; Unit for Technical Assistance - Western Cape Department of Agriculture; Wedderwill Estate; Goedgedacht Olives; Zewenwacht Wine Estate, Lourensford Fruit Company; Kaarsten Boerdery; Thelema Mountain Vineyards; Rudera Wines; Flagstone Wines; Solms Delta Wines; Dornier Wines.

3. **Soil Science Consultant Agricultural Consultors International (Tinie du Preez) 1998 - end 2001**
   Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

1. **Contracting Soil Scientist De Beers Namaqualand Mines July 1997 - Jan 1998**
   Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

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 DEVELOPMENT OF BOKPOORT 10 X 200 MW PV SOLAR POWER FACILITIES, NORTHERN CAPE PROVINCE

Kindly note the following:

- 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.
- 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.
- A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
- 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.
- 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:	Johann Lanz – Soil Scientist			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Johann Lanz			
Specialist Qualifications:	M.Sc. (Environmental Geochemistry)			
Professional affiliation/registration:	Registered Professional Natural Scientist Member of the Soil Science Society of South Africa			
Physical address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal address:	1a Wolfe Street, Wynberg, Cape Town, 7800			
Postal code:	7800	Cell:	082 927 9018	
Telephone:	082 927 9018	Fax:	Who still uses a fax?	
E-mail:	johann@johannlanz.co.za			

2. DECLARATION BY THE SPECIALIST

I, **Johann Lanz**, 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

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company:

30/10/2019

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, **Johann Lanz**, 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

Johann Lanz – Soil Scientist (sole proprietor)

Name of Company

30/10/2019

Date

Signature of the Commissioner of Oaths

2019 10:30.

Date

SUID-AFRIKAANSE POLISIEDIENS
STATION COMMANDER
WYNBERG KP
30 OCT 2019
STATION COMMANDER
WYNBERG CP
SOUTH AFRICAN POLICE SERVICE

Table of Contents

Executive Summary

The proposed development is on land zoned as 'Special'. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the proposed site is on land which is unsuitable for cultivation due to both climate and soil limitations.

The key findings of this study are:

- Soils on the site are shallow to moderately deep, red, sandy soils overlying hard pan carbonate and sometimes rock (Coega and Plooysburg soil forms).
- The major limitation to agriculture is the limited climatic moisture availability. The low water holding capacity of the soils is a further limitation.
- As a result, the site is unsuitable for cultivation and agricultural land use is limited to grazing.
- The project site is classified with a predominant land capability evaluation value of 5 (low). The site has a grazing capacity of 22 hectares per large stock unit.
- No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.
- The low agricultural potential of the site limits the significance of all on-site agricultural impacts.
- Two potential negative impacts of the development on agricultural resources and productivity were identified as:
    - Loss of agricultural land use caused by direct occupation of land by the energy facility footprint.
    - Soil degradation resulting from erosion, topsoil loss and contamination.
- All impacts were assessed as having low significance.
- Recommended mitigation measures include implementation of an effective system of storm water run-off control to mitigate erosion; and topsoil stripping and re-spreading to mitigate loss of topsoil.
- Because of the low agricultural potential of the site, and the consequent low agricultural impact, there are no restrictions relating to agriculture which would preclude authorisation of the proposed development. From an agricultural impact point of view, the development can be authorised.
- Despite any cumulative regional impact that may occur, it is preferable, in terms of the national mandate to conserve land for agricultural production, to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.

2 INTRODUCTION

This report is an update of an agricultural impact assessment that was completed in 2016.

ACWA Power obtained 3 Environmental Authorisations in 2016 for 2 x 75MW PV facilities as well as a 150MW CSP facility. However, ACWA Power now proposes to, instead of the 150MW CSP facility, construct (8), 200 MW PV plants in its place on the same footprint, which was assessed in 2016. The location is shown in Figure 1. Previously, approval for 2 PV facilities was obtained, PV 1 (Ndebele) and PV 2 (Xhosa), however the proposal for these two sites did not include the battery storage energy system for either of the sites as well as the capacity increase from 75 to 200MW.

Each of the PV plants has the following components: PV panels, battery storage site of 16 ha, access routes (the access roads will be in between the PV panels), substation, water pipeline connection to the main water pipeline (note: main water pipeline already authorised) and 132kV overhead line (31m servitude) 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). Each of the 10 PV plants will cover an area of 150 hectares. There is also a 132kv overhead line connection to the Garona substation.

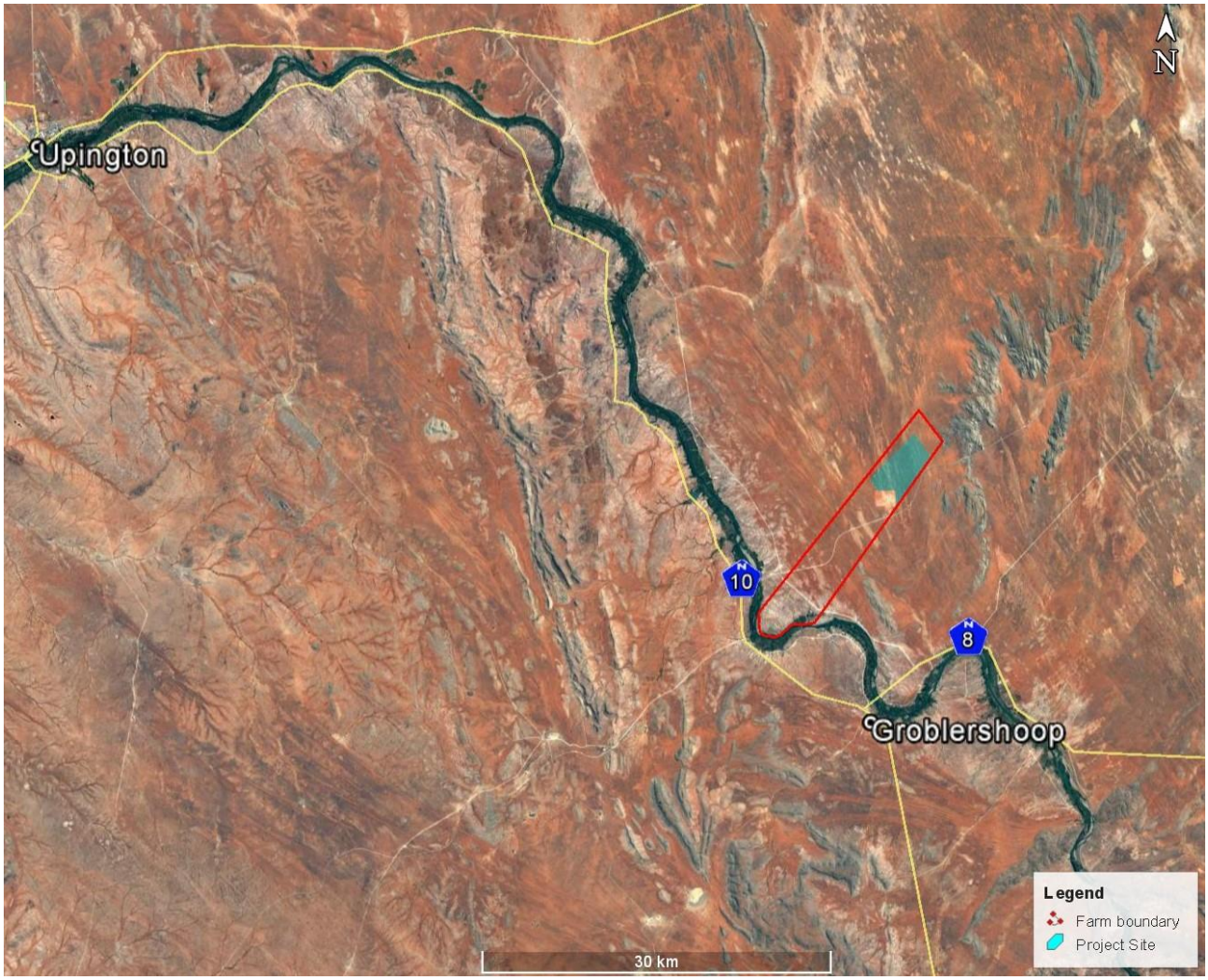

Figure 1. *Location map of the proposed site, north of the town of Groblershoop. The same site was assessed for the environmental authorisations obtained in 2016.*

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.

3 TERMS OF REFERENCE

The scope of work for this updated report is to update the existing specialist study which was undertaken in support of the 150MW CSP Environmental Impact Assessment in 2016.

1. to reflect the project changes which are:10 new PV developments on the already assessed CSP site
    1. Possible realignments of shared infrastructure (i.e. water pipeline, powerline, access road) on the same farm
2. to comply with the latest requirements for specialist reports according to the NEMA regulations
3. to comply with the latest Department of Agriculture protocol for agricultural assessments
4. to include updated baseline data on land capability

The terms of reference for the 2016 report were:

- Identify and assess all potential impacts (direct, indirect and cumulative) of the proposed development on soils and agricultural potential.
- Describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Describe the topography of the site.
- Describe the climate in terms of agricultural suitability.
- Summarise available water sources for agriculture.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Describe the erosion, vegetation and degradation status of the land.
- Determine the agricultural potential across the site.
- Determine the agricultural sensitivity to development across the site.
- Provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts.

Table 1. Compliance with the Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	**Addressed in the Specialist Report**
(1) A specialist report prepared in terms of these Regulations must contain- • 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;	 Following title page Following title page
• a declaration that the specialist is independent in a form as may be specified by the competent authority;	Following CV
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Sections 1 & 3
(cA)an indication of the quality and age of base data used for the specialist report;	Section 3
(cB)a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 6.6 & 7.4
(d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment;	Not applicable
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process <u>inclusive of equipment and modelling used</u>;	Section 3
(f) <u>details of an assessment of</u> the specific identified sensitivity of the site related to the <u>proposed</u> activity <u>or activities</u> and its associated structures and infrastructure, <u>inclusive of a site plan identifying site alternatives</u>;	Section 6.8 & 7 & Figure 3
(g) an identification of any areas to be avoided, including buffers;	Section 6.8
(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 3
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity <u>or activities;</u>	Section 7
(k) any mitigation measures for inclusion in the EMPr;	Section 7
(l) any conditions for inclusion in the environmental authorisation;	Section 8
(m)any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7
(n) a reasoned opinion- (i) whether the proposed activity, <u>activities</u> or portions thereof should be authorised; <u>(iA) regarding the acceptability of the proposed activity or activities and</u> (ii) if the opinion is that the proposed activity, <u>activities</u> 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 8 Section 8 Section 7
(o) a description of any consultation process that was undertaken	Not applicable

during the course of preparing the specialist report;	
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
(q) any other information requested by the competent authority.	Not applicable
(2) Where a government notice *gazetted* 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.	Not applicable

4 METHODOLOGY OF STUDY

The approach for this study was informed by the new protocol for the assessment and reporting of environmental impacts on agricultural resources which is linked to the national web-based environmental screening tool. The protocols have not been gazetted yet, but it is considered best practise to follow the assessment protocol because it represents the most recent thinking in this regard.

The tool identifies the entire project site as low agricultural sensitivity. The protocol therefore requires an Agricultural Compliance Statement and a field assessment is not required.

An Agricultural Compliance Statement must verify that:

1. The site is of "medium" or "low" sensitivity for agricultural resources; and
2. Whether or not the proposed development will have an unacceptable negative impact on the agricultural production capability of the site.

It must contain:

1. Details and relevant expertise as well as the SACNASP registration number of the soil scientist/agricultural specialist preparing the statement including a curriculum vita;
2. A signed statement of independence by the specialist;
3. A map showing the proposed development footprint (including supporting infrastructure) with a 50 m buffered development envelope, overlaid on the agricultural sensitivity map generated by the national environmental screening tool;
4. Calculations of the total development footprint area for each land parcel as well as the total footprint area of the development (including supporting infrastructure);
5. Confirmation as to whether the development footprint is in line with the development limits set in the assessment protocol
6. Confirmation as to whether the sensitivity of the agricultural resource coincides with that indicated on the web-based screening tool;
7. Confirmation from the specialist that all reasonable measures have been taken through micro-siting to minimize fragmentation and disturbance of agricultural activities;
8. A substantiated statement from the agricultural specialist on the acceptability of the

development and a recommendation on the approval or not of the development;

9. Any conditions to which the statement is subjected;
10. Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and
11. A description of the assumptions made and any uncertainties or gaps in knowledge.

Because of the low agricultural sensitivity of the site, the assessment was a desktop analysis of existing soil and agricultural potential data for the site. This is considered entirely adequate for a thorough assessment of all the agricultural impacts of the proposed development.

The following sources of information were used:

- Soil data was sourced from the land type data set, of the Department of Agriculture, Forestry and Fisheries. This data set originates from the land type survey that was conducted from the 1970's until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of hundreds of years.
- Land capability data was sourced from the 2017 National land capability evaluation raster data layer produced by the Department of Agriculture, Forestry and Fisheries, Pretoria.
- Field crop boundaries were sourced from the national web-based environmental screening tool.
- Rainfall and temperature data was sourced from The World Bank Climate Change Knowledge Portal.
- Grazing capacity data was sourced from the 2018 Department of Agriculture, Forestry and Fisheries long-term grazing capacity map for South Africa, available on Cape Farm Mapper.
- Satellite imagery of the site and surrounds was sourced from Google Earth.

Although a site visit is not required for low and medium agricultural sensitivity sites, this author has visited the site in 2015 for previous studies.

The potential impacts identified in this specialist study were assessed based on the criteria and methodology common to the whole impact assessment. The ratings of impacts were based on the specialist's knowledge and experience of the field conditions of the environment in which the proposed development is located, and of the impact of disturbances on that agricultural environment.

5 CONSTRAINTS AND LIMITATIONS OF STUDY

The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist but is done with due regard and as accurately as possible within these constraints.

The study makes the assumption that water for irrigation is not available across the site. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist, and none have been exploited in this area.

There are no other specific constraints, uncertainties and gaps in knowledge for this study.

6 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA), requires that an application for a renewable energy facility on agriculturally zoned land be approved by the Department of Agriculture, Forestry and Fisheries (DAFF) – now Department of Agriculture, Land Reform and Rural Development (DALR&RD). Despite the name of the Act, it does not apply only to subdivision, and its purpose is to ensure productive use of agriculturally zoned land. Therefore, even if land is not being subdivided or leased, SALA approval is required to develop agriculturally zoned land for non-agricultural purposes.

Power lines require the registration of a servitude for each farm portion crossed. In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA), the registration of a power line servitude requires written consent of the Minister if the following two conditions apply:

1. if the servitude width exceeds 15 metres; and
2. if Eskom is not the applicant for the servitude.

If one or both of these conditions do not apply, then no agricultural consent is required. Eskom is currently exempt from agricultural consent for power line servitudes.

The Act 70 of 1970 consent is separate from the EIA and needs to be applied for and obtained after the EIA.

Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). No application is required in terms of CARA. The EIA process covers the required aspects of this.

7 DESCRIPTION OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

7.1 Climate and water availability

Rainfall for the site is given as 265 mm per annum (The World Bank Climate Change Knowledge Portal, undated). The average monthly distribution of rainfall is shown in Figure 2. One of the most important climate parameters for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. Moisture availability is classified into 6 categories across the country (see Table 2). The site falls into the driest of

these six categories, which is labelled as a very severe limitation to agriculture.

Theoretically there is the possibility of water from the Orange River for the site, but the distance (13km) and the height of the site above the river (over 100 metres) makes irrigation from the river completely non-viable. Water for stock on the site is supplied from wind pumps.

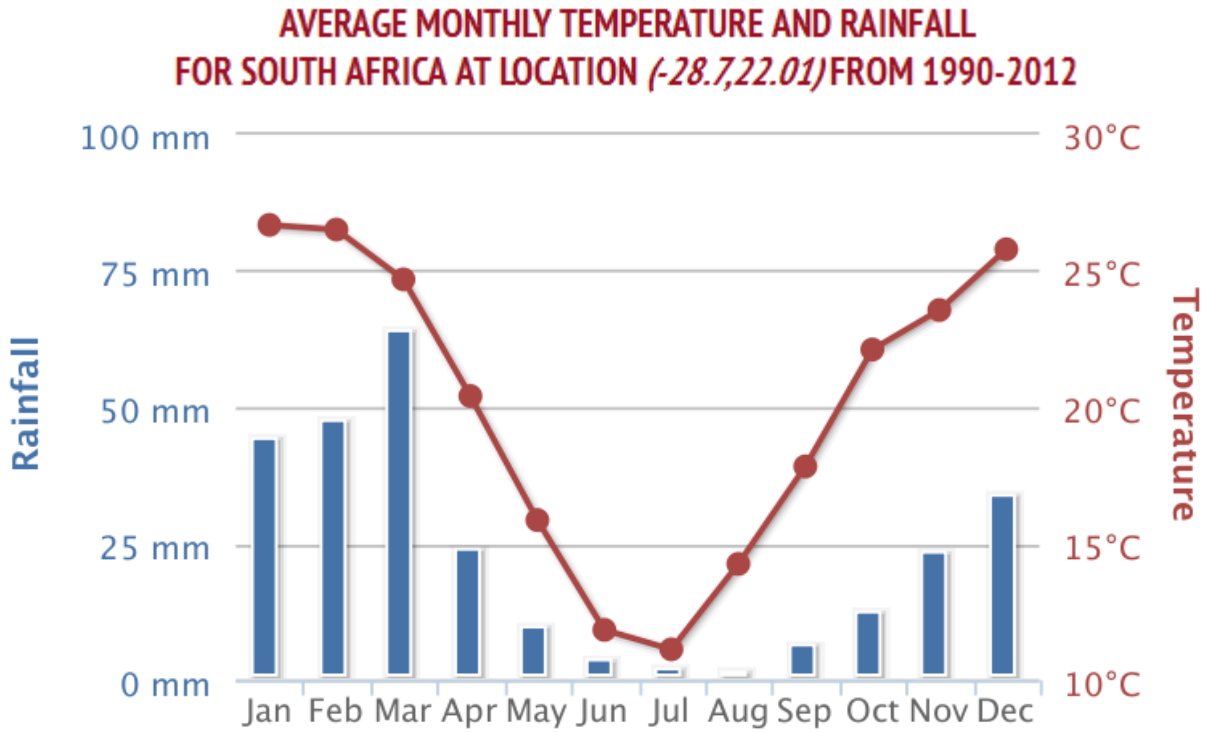

Figure 2. *Average monthly temperature and rainfall for the site (The World Bank Climate Change Knowledge Portal, undated).*

Table 2. The classification of moisture availability climate classes for summer rainfall areas across South Africa (Agricultural Research Council, Undated)

Climate class	Moisture availability (Rainfall/0.25 PET)	Description of agricultural limitation
C1	>34	None to slight
C2	27-34	Slight
C3	19-26	Moderate
C4	12-18	Moderate to severe
C5	6-12	Severe
C6	<6	Very severe

7.2 Terrain, topography and drainage

The proposed development is located on a terrain unit of plains with open low hills or ridges,

changing to rolling or irregular plains with low hills or ridges in the extreme north of the site. It is at an altitude of around 1,000 meters. Slope is less than 2% across the site. A satellite image map of the site is shown in Figure 3.

The geology is red to flesh-coloured wind-blown sand and surface limestone of Tertiary to Recent age. Occasional outcrops of quartz- sericite schist and quartzite of the Groblershoop Formation occur.

There are no water courses on or near the site.

7.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climate conditions into different land types. There is predominantly one land type across most of the site, namely Ae4. A small part of the site in the extreme north east is on land type Af7. The soils of Ae4 are shallow to moderately deep, red, sandy soils overlying hard pan carbonate and sometimes rock. These soils fall into the Calcic and Lithic soil groups according to the classification of Fey (2010). Land type Af7 comprises deeper red sands and includes dunes. A summary detailing soil data for the land type is provided in Appendix 1. Soils are predominantly of the Coega soil form, with lesser coverage of shallow Plooysburg form. It should be noted that the land type classification presented in Appendix 1 made use of the older South African soil classification system, which did not include the Coega and Plooysburg forms. These forms would have been classified, according to the older system, as Mispah and Hutton respectively.

The soils are classified as having low to moderate susceptibility to water erosion (class 5), and as highly susceptible to wind erosion (Ae4 = class 1b; Af7 = class 1a).

7.4 Agricultural capability

Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rainfed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability classes are suitable as arable land for the production of cultivated crops, while the lower suitability classes are only suitable as non-arable grazing land, or at the lowest extreme, not even suitable for grazing. In 2017, DAFF released updated and refined land capability mapping across the whole of South Africa. This has greatly improved the accuracy of the land capability rating for any particular piece of land anywhere in the country. The new land capability mapping divides land capability into 15 different categories with 1 being the lowest and 15 being the highest. Values below 8 are generally not suitable for production of any cultivated crop. Detail of this land capability scale is shown in Table 3.

The project area is classified with a predominant land capability evaluation value of 5, although it varies from 3 to 5 across the site. Agricultural limitations that result in the low land

capability classification are predominantly due to the very limited climatic moisture availability. The very sandy soils, with very limited water holding capacity are a further limitation. These factors render the site unsuitable for any kind of mainstream cultivation without irrigation, and limit it to low density grazing only.

The long-term grazing capacity of the site is fairly low at 22 hectares per large stock unit.

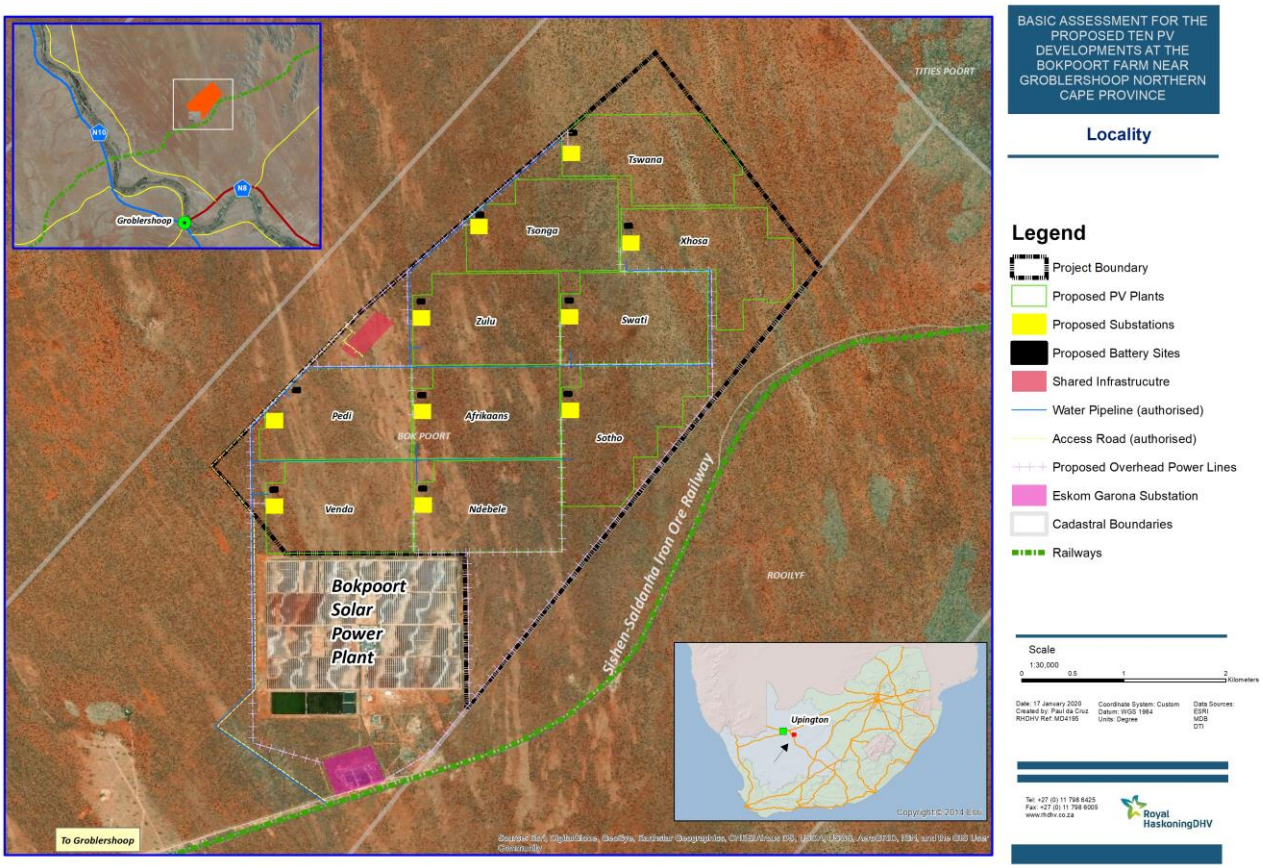

Figure 3. *Satellite image map of the proposed layout. The entire project site has low agricultural sensitivity.*

Table 3. Details of the 2017 Land Capability classification for South Africa.

Land capability evaluation value	Description
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High

10	
11	High
12	High to Very High
13	
14	Very High
15	

7.5 Land use and development on and surrounding the site

The site is located within a sheep farming agricultural region and currently used only for grazing. There has never been any cultivation on the site.

There are no buildings on the site. The only agricultural infrastructure on the site is fencing into grazing camps, wind pumps and stock watering points. There is an existing solar development on the farm adjacent to the proposed site, to its south.

Road access to the site is from the existing road access to the adjacent solar development.

7.6 Status of the land

The biome classification for the site is Kalahari Karroid Shrubland, with a small section of Gordonia Duneveld on land type Af7. The vegetation is grazed and sparse due to low rainfall, but there is no evidence of significant erosion or other land degradation on the site.

7.7 Possible land use options for the site

Because of predominantly the climate limitations, the site is totally unsuitable for cultivated crops, and viable agricultural land use is limited to grazing only.

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. These factors include an assessment of the significance of the loss of agricultural land. Renewable energy development is therefore a very suitable land use option for the site.

7.8 Agricultural sensitivity

Agricultural sensitivity is a direct function of the capability of the land for agricultural production. This is because a negative impact on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. A general assessment of agricultural sensitivity, in terms of loss of agricultural land in South Africa, considers arable land that can support viable production of cultivated crops, to have high sensitivity. This is because there is a scarcity of such land in South Africa, in terms of how much is required for food security. However, there is not a scarcity in the country of land that is only suitable as grazing land and such land is therefore not considered to have high agricultural sensitivity.

The national web-based environmental screening tool identifies the entire site as low agricultural sensitivity. This is confirmed by this assessment. Because no agricultural high sensitivity areas occur within the site, no parts of it need to be avoided by the development. There are no required buffers.

8 IDENTIFICATION AND ASSESSMENT OF IMPACTS ON AGRICULTURE

The change from the CSP, which had environmental authorisation, to the proposed 10 x PV facilities has no bearing on the significance of agricultural impacts, and there is therefore no change to the impact significance which received environmental authorisation.

This assessment has taken the previous EIA reports and their recommendations into account. The previous reports were done by the same specialist as this current report,

The impact assessment is also identical for all 10 PV facilities.

The focus and defining question of an agricultural impact assessment is to determine to what extent a proposed development will compromise (negative impacts) or enhance (positive impacts) current and/or future agricultural production. The significance of an impact is therefore a direct function of the degree to which that impact will affect current or future agricultural production. If there will be no impact on production, then there is no agricultural impact. Impacts that degrade the agricultural resource base pose a threat to production and therefore are within the scope of an agricultural impact assessment. Lifestyle impacts on the resident farming community, for example visual impacts, do not necessarily impact agricultural production and, if they do not, are not relevant to and within the scope of an agricultural impact assessment.

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the land by the total, direct, physical footprint of the proposed project including all roads.
- Construction (and decommissioning) activities that may disturb the soil profile and vegetation, for example for levelling, excavations, etc.

The significance of all potential agricultural impacts is kept low by the fact that the proposed site is on land of extremely limited agricultural potential that is only viable for low intensity grazing. The rating of an impact is based on the extent to which that impact can potentially affect agricultural production, in line with the discussion in paragraph 1 of this section.

The following two potential impacts of the developments on agricultural resources and productivity are identified and assessed in the table formats below.

Mitigation and monitoring recommendations are included in the table for each impact.

8.1 Impacts associated with the construction phase

8.1.1 Loss of agricultural land use

Agricultural grazing land directly occupied by the development infrastructure, which includes all associated infrastructure, will become unavailable for agricultural use.		
Status	Negative	
	Without mitigation	**With mitigation**
Probability	Definite (5)	Definite (5)
Duration	Long term (4)	Long term (4)
Scale / extent	Site only (1)	Site only (1)
Magnitude / severity	Minor (2)	Minor (2)
Significance	Moderate (35)	Moderate (35)
Comment on significance: The significance rating only comes out moderate because of the way the definite probability and the long - term duration influence the calculation. In my opinion the actual significance of this impact is low, and it has little real effect and does not need to have an influence on or require modification of the project design.		
Mitigation: None possible.		
Reversibility	The impact is reversible after the life of the project, with effective topsoiling of the land during rehabilitation, where necessary.	
Irreplaceable loss of resources?	Minor because of the low value of the agricultural resource, which is not scarce	
Confidence level of assessment	Medium - determination is based on common sense and general knowledge	

8.1.2 Soil degradation

Soil degradation can result from erosion, topsoil loss and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Hydrocarbon spillages from construction activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth.	
Comments: The water erosion risk is low due to the low slope gradients and low to moderate erodibility of the soils, but wind erosion risk is high.	
Status	Negative

	Without mitigation	**With mitigation**
Probability	Medium (3)	Low (2)
Duration	Medium term (3)	Medium term (3)
Scale / extent	Site only (1)	Site only (1)
Magnitude / severity	Minor (2)	Minor (2)
Significance	Low (18)	Low (12)

Mitigation:

Implement an effective system of storm water run-off control, where it is required - that is at all points of disturbance where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there.

If an activity will mechanically disturb the soil profile below surface, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation, which may be after construction or only at decommissioning. The depth of topsoil stripping is dependent on the specific field conditions. The maximum depth should be 30cm. If additional unconsolidated material exists below 30cm and needs to be removed for construction purposes, it must be stripped and stockpiled separately from the upper 30cm topsoil. Such material should only be used for fill below a topsoil layer, and not used for spreading on the surface. If there is less than 30cm of unconsolidated soil material above a limiting layer of rock or hardpan, then the entire depth must be stripped and stockpiled as topsoil, even if it contains a high proportion of course fragments.

Topsoil should be retained in the area below the panels (or mirrors). It is not desirable to strip and stockpile this topsoil for the whole of the operational phase. It will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase for the following reasons: conservation of topsoil, dust suppression and erosion control.

It is only in areas where topsoil cannot be retained on the surface during the operational phase, and where the area will be rehabilitated back to veld after decommissioning, that it should be stripped and stockpiled for the duration of the operational phase for re-spreading during de-commissioning.

Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.

Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land.

During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.
If there is compaction, either in re-spread topsoil or in areas where topsoil was retained during the operational phase, it must be loosened through an appropriate plough action.
If topsoil has been stockpiled for the duration of the operational phase, re-vegetation is likely to require seeding and / or planting.
Erosion must be carefully controlled where necessary on topsoiled areas.

Monitoring:
Establish an effective record keeping system for each area where soil is disturbed for constructional purposes. These records should be included in environmental performance reports, and should include all the records below.
Record the GPS coordinates of each area.
Record the date of topsoil stripping.
Record the GPS coordinates of where the topsoil is stockpiled.
Record the date of cessation of constructional (or operational) activities at the particular site.
Photograph the area on cessation of constructional activities.
Record date and depth of re-spreading of topsoil.
Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.

Include periodical site inspection in environmental performance reporting that inspects the effectiveness of the run-off control system and specifically records occurrence or not of any erosion on site or downstream.

Reversibility	The impact is reversible with effective rehabilitation.
Irreplaceable loss of resources?	Minor because of the low value of the agricultural resource, which is not scarce
Confidence level of assessment	Medium - determination is based on common sense and general knowledge

8.2 Impacts associated with the operational phase

Loss of agricultural land use and soil degradation occur at the start of the construction phase and are therefore not listed under operational phase impacts. There is no further loss of land that occurs in subsequent phases.

8.3 Impacts associated with the decommissioning phase

8.3.1 Soil degradation

Soil degradation can result from erosion, topsoil loss and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by

decommissioning related land surface disturbance. Loss of topsoil can result from poor topsoil management during decommissioning related excavations. Hydrocarbon spillages from decommissioning activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth.

Comments: The water erosion risk is low due to the low slope gradients and low to moderate erodibility of the soils, but wind erosion risk is high.

Status	Negative	
	Without mitigation	**With mitigation**
Probability	Medium (3)	Low (2)
Duration	Medium term (3)	Medium term (3)
Scale / extent	Site only (1)	Site only (1)
Magnitude / severity	Minor (2)	Minor (2)
Significance	Low (18)	Low (12)

Mitigation:

If an activity will mechanically disturb the soil profile below surface, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation, which may be after construction or only at decommissioning. The depth of topsoil stripping is dependent on the specific field conditions. The maximum depth should be 30cm. If additional unconsolidated material exists below 30cm and needs to be removed for construction purposes, it must be stripped and stockpiled separately from the upper 30cm topsoil. Such material should only be used for fill below a topsoil layer, and not used for spreading on the surface. If there is less than 30cm of unconsolidated soil material above a limiting layer of rock or hardpan, then the entire depth must be stripped and stockpiled as topsoil, even if it contains a high proportion of course fragments.

Topsoil should be retained in the area below the panels (or mirrors). It is not desirable to strip and stockpile this topsoil for the whole of the operational phase. It will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the panels are mounted. It will be advantageous to have topsoil and vegetation cover below the panels during the operational phase for the following reasons: conservation of topsoil, dust suppression and erosion control.

It is only in areas where topsoil cannot be retained on the surface during the operational phase, and where the area will be rehabilitated back to veld after decommissioning, that it should be stripped and stockpiled for the duration of the operational phase for re-spreading during de-commissioning.

Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them.

Dispose of all subsurface spoils from excavations where they will not impact on undisturbed land.

During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed

surface.
If there is compaction, either in re-spread topsoil or in areas where topsoil was retained during the operational phase, it must be loosened through an appropriate plough action.
If topsoil has been stockpiled for the duration of the operational phase, re-vegetation is likely to require seeding and / or planting.
Erosion must be carefully controlled where necessary on topsoiled areas.

Monitoring:
Establish an effective record keeping system for each area where soil is disturbed for constructional purposes. These records should be included in environmental performance reports, and should include all the records below.
Record the GPS coordinates of each area.
Record the date of topsoil stripping.
Record the GPS coordinates of where the topsoil is stockpiled.
Record the date of cessation of constructional (or operational) activities at the particular site.
Photograph the area on cessation of constructional activities.
Record date and depth of re-spreading of topsoil.
Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.

Include periodical site inspection in environmental performance reporting that inspects the effectiveness of the run-off control system and specifically records occurrence or not of any erosion on site or downstream.

Reversibility	The impact is reversible with effective rehabilitation.
Irreplaceable loss of resources?	Minor because of the low value of the agricultural resource, which is not scarce
Confidence level of assessment	Medium - determination is based on common sense and general knowledge

8.4 Cumulative impacts

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss or degradation of

agricultural land, with a consequent decrease in agricultural production. The defining question for assessing the cumulative agricultural impact is this:

> What level of loss of agricultural land is acceptable in the area, and will the loss associated with the proposed Bokpoort PV development, cause that level in the area to be exceeded?

The loss of agricultural land in the area is highly likely to be within an acceptable limit in terms of loss of low potential agricultural land, of which there is no scarcity in the country. This is particularly so when considered within the context of the following two points:

- In order for South Africa to achieve its renewable energy generation goals, agriculturally zoned land will need to be used for renewable energy generation. It is far more preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no cultivation potential, and low grazing capacity, than to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country. The limits of acceptable agricultural land loss are therefore far higher in this region than in regions with higher agricultural potential.
- It is also preferable, from an impact point of view as well as from practical considerations, to rather have a concentrated node of renewable energy development within one area, as is the case around this project, than to spread out the same number of developments over a larger area.

Acceptable levels of change in terms of other areas of impact such as visual impact would be exceeded long before agricultural levels of change came anywhere near to being exceeded.

It should also be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore low.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use is assessed as having low significance. In terms of cumulative impact, therefore, the development can be authorised.

8.5 Comparative assessment of alternatives

No proposed technology or grid connection alternatives will have any bearing on agricultural impacts.

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. The one identified potential such impact is that due to continued low rainfall in the area, in addition to other economic and market pressures on farming, the agricultural enterprises will come under increased pressure in terms of economic

viability, with resultant decrease in productivity.

There is not a big difference in the extent to which the development and the no-go alternative will impact agricultural production, which results in there being, from an agricultural impact perspective, no preferred alternative between the development and the no-go.

9 CONCLUSION AND RECOMMENDATIONS

The proposed development is on land zoned as 'Special'. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the investigated site is on land which is of low agricultural potential and is not suitable for cultivation.

It is preferable to incur a loss of agricultural land on such a site, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.

No agriculturally sensitive areas occur within the proposed site and no part of it is therefore required to be set aside from the development.

Because of the low agricultural potential of the site, and the consequent low agricultural impact, there are no restrictions relating to agriculture which would preclude authorisation of the proposed development. Therefore, from an agricultural impact point of view, the development should be authorised.

There are no conditions resulting from this assessment that need to be included in the environmental authorisation.

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APPENDIX 1: SOIL DATA

Table A1. Land type soil data for site.

Land type	Land capability class	Soil series (forms)	Depth (cm)	Clay % A horizon	Clay % B horizon	Depth limiting layer	% of land type
Ae4	7	Hutton	45-100	3-6	6-8	ka	42
		Mispah	10-25	6-10		ka	40
		Hutton	20-60	3-6	6-9	R, ka	10
		Hutton	60-120	2-4	3-6	ka	5
Af7	7	Hutton	60->120	2-4	4-8	ka	58
		Hutton	>120	1-2	2-4		40

Land capability classes: 7 = non-arable, low potential grazing land.

Depth limiting layers: R = hard rock; ka = hardpan carbonate.

Appendix B2: Hydrogeology

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Hydrogeological Baseline Assessment for Photovoltaic Solar Development

Report

Version – Final

7 February 2020

Royal HaskoningDHV

GCS Project Number: 19-0993

Client Reference: Bokpoort Groundwater Baseline Assessment


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1 INTRODUCTION

GCS (Pty) Ltd was appointed by Royal HaskoningDHV on behalf of ACWA Power Energy Africa (Pty) Ltd (ACWA Power) to conduct an updated hydrogeological assessment to convert the current site (which comprises of an authorised concentrated solar power (CSP) and two (2) Photovoltaic (PV) plants) into the development of ten (10) PV developments with shared infrastructure. The Bokpoort II: 2000MW PV Solar Power Development (the site) is located on the north-eastern portion of the remaining extent of the Farm Bokpoort 390, which is 20 km north-west of the town of Groblershoop within the Northern Cape Province. 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.

Previously, GCS conducted a hydrogeological assessment during April 2010. The previous hydrogeological assessment included a desk study, literature review, hydrocensus, collection of groundwater samples and reporting the findings and risk assessment. This report will include an updated hydrogeological investigation, hydrocensus (sensitive receptor survey) and will focus specifically on the risk assessment associated with the proposed ten (10) PV plants. This report will also include a review of the provisions of the specialist studies conducted by Golder Associates Africa (Pty) Ltd (Golder).

1.1 Terms of Reference

ACWA Power obtained three (3) Environmental Authorisations in 2016 for the 2 x 75MW PV facilities as well as a 150MW concentrated solar power (CSP) facility. However, a strategic decision was put forward to, instead of the CSP facility, ACWA Power is proposing to develop ten (10) PV plants (eight (8) new PV plants and two (2) authorised PV plants) within the same footprint. The MW capacity of each PV Plant will be 200MW per site. A Battery Energy Storage System (BESS) will be included on all ten (10) PV sites. To allow for this proposal, a basic assessment process will be undertaken to obtain the required authorisation for the PV plants. This report will focus on the groundwater risk assessment associated with the new PV plants and a review of the surface water risk assessments conducted by Golder.

1.1.1 The Solar Plant Design Specifications

The infrastructure and specifications to the solar plant design are listed below:

- A PV Solar 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 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; 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).
- Type of technology:
    - Photovoltaic Solar Power Plant.
- The proposed PV solar facility will have the following infrastructure that are important in terms of height:
    - The PV panels disposition over support structures will be approximately 4.5 m high; and

  - The substation will be approximately 10 m high.

- Surface area to be covered:
  - The proposed PV solar facility will cover 150 ha.
- Structure orientation:
  - The PV panels will be installed perpendicular to the sun's rays, which change continuously over the course of the day and season.
- Laydown area dimensions:
  - The construction laydown area will be 5 hectares.
- Generation capacity:
  - The proposed PV solar facility will generate up to 200 MW.
- Generation capacity of the facility as a whole at delivery points:
  - The proposed PV facility will generate up to 200 MW.
- Battery energy storage system (BESS):
  - BESS capacity on each PV site: 150 MW;
  - BESS site footprint on each PV site: 16ha; and
  - The BESS combined site storage within batteries on each PV site will be 4500 m^3 of hazardous substance.

2 SCOPE OF WORK

The following work were set out in the proposal and accepted by Royal HaskoningDHV:

- Site walk over and hydrocensus;
- Updated reporting and risk assessment; and
- A review of two (2) existing reports, compiled by Golder, which form part of the environmental impact assessment (EIA) reports for the proposed Bokpoort II solar developments. These reports included:
    - Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 1 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape; and
    - Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 2 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape.

3 METHODOLOGY

3.1 Site Investigation and Hydrocensus

The reconnaissance of the site was done to ensure an understanding of the topography and hydrology. A hydrocensus was conducted in and around the site boundaries, to:

- Obtain up to date hydrogeological and hydrological data, i.e. groundwater levels;
- Obtain groundwater samples to establish the background groundwater quality; and
- Identify groundwater and / or surface water stakeholders and quantify the groundwater and / or surface water use in the project area.

During the hydrocensus field program, the following information will be collected, but not limited to:

- Borehole locality (coordinates using a hand-held global positioning system – GPS);
- Borehole status (incl. equipped) and construction details;
- Static water level (using a depth to water level meter);
- Olfactory and visual conditions of the water; and
- Primary groundwater use (incl. abstraction rates).

3.2 Groundwater Sampling

The sampling procedure is undertaken in accordance to the following publications:

- ISO 5667-1: 2006 Part 1: Guidance on the design of sampling programs and sampling techniques.
- ISO 5667-3: 2003 Part 3: Guidance on preservation and handling of samples.

- ISO 5667-11: 2009 Part 11: Guidance on sampling of groundwater.
- DWAF Best Practice Guidelines Series G3: General Guidelines for Water Monitoring Systems.

The following information will be recorded during the field analysis for each sampling locality:

- Date and time of sampling;
- Coordinates of each borehole;
- General status of the borehole (locked, vandalised, etc.);
- Static water level for boreholes, using a dip meter;
- In-situ measurements for each sampling point, namely pH, electrical conductivity, total dissolved solids and temperature; and
- General characteristics of the water samples such as colour, turbidity (murky/clear) and smell, as well as visual observations of the sample site.

3.3 Water Quality Analysis

Aquatico Laboratory (a South African National Accreditation System (SANAS) accredited laboratory according to ISO / IEC 17025:2005 standards No: T0374) in Pretoria, South Africa, was commissioned to undertake the analytical testing for the collected groundwater samples.

3.4 Data Analysis and Reporting

The site assessment report will contain an updated description and evaluation of the existing groundwater quality and level based on the water analysis collected during the hydrocensus. An updated impact assessment and risk assessment was also conducted.

3.4.1 Impact Assessment

All results obtained during the hydrocensus and site investigation were compiled into a site-specific impact assessment and was utilised to conceptualise the site. This site conceptualisation was used to complete a source-pathway-receptor linkage to quantify areas of possible concern:

- Source – identification of on-site conditions and possible contaminant sources;
- Groundwater Pathway – evaluation of the geological environment, aquifer conditions and aquifer vulnerability; and
- Receptors – identification of all sensitive receptors (human and environment) within proximity of the site (including existing potable abstraction boreholes and sensitive areas).

3.4.2 Risk assessment

The identified impacts are assessed in accordance with the approach outlined below, extracted from the Golder EIR (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two (2) aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as shown in Table 3-1.

Table 3-1: Potential significance of impacts.

Occurrence		**Severity**	
Probability of occurrence	Duration of occurrence	Scale/ extent of impact	Magnitude (severity) of impact

To assess each of these factors of each impact listed in Table 3-1, the four ranking scales listed in Table 3-2 are used.

Table 3-2: Ranking scale

Probability	**Duration**
5- Definite/ don't know	5-Permanent
4- Highly probable	4-Long-term
3- Medium probability	3-Medium=term (8-15 years)
2- Low probability	2-Short-term (0-7 years) (impact ceases after the operational life of the activity)
1-Improbable	1-Immediate
0-None	0-None
Scale	**Magnitude**
5-International	10-Very high/don't know
4-Natinal	8-High
3-Regional	6-Moderate
2-Local	4-Low
1-Site only	2-Minor
0-None	0-None

Once these factors have been ranked for each impact, the significance of the two (2) aspects, occurrence and severity, must be assessed using the following formula:

$$\boldsymbol{SP = (Magnitude + Duration + Scale) \times Probability}$$

Where:

SP is the significance points.

The maximum value is 100 significance points (SP). The impact significance is then rated as shown in Table 3-3.

Table 3-3: Impact significance based on SP rating.

SP Rating		Comment
SP > 75	Indicates high environmental significance	An impact could influence the decision about whether or not to proceed with the project regardless of any possible mitigation
SP 30- 75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.

4 SITE DESCRIPTION

4.1 Site Locality

The site is located on the north-eastern portion of the remaining extent of the Farm Bokpoort 390, which is 20 km north-east of the town of Groblershoop within the Northern Cape Province. The locality map is shown in Figure 4-1 and the site layout with the current and proposed project expansion is shown in Figure 4-2.

4.2 Topography and Hydrology

From the 1:50 000 topographical map and observations on site, the site slopes in a western direction and drains towards the Orange River, as shown in Figure 4-3. The site is in the D73D quaternary catchment within the lower Orange Main Stem Catchment and is governed by the Orange Water Management Area (WMA).

4.3 Geological and Hydrogeological Setting

The general geology of the site mainly comprises red-brown, coarse-grained granite gneiss; and quartz-muscovite schists, quartzite, quartz-amphibole schists and greenstones of the Groblershoop formation, Brulpan group. Calcrete is also found especially on the south eastern part of the area. The geology map is shown Figure 4-4.

The aquifer vulnerability and classification maps of South Africa classifies this area as underlain by a least vulnerability, this means that this aquifer is only vulnerable to conservative pollutants in the long term when continuously discharged or leached (DWS, 2013). The metamorphic rocks represent fracted aquifer types with a moderately-yielding aquifer system of variable water quality.

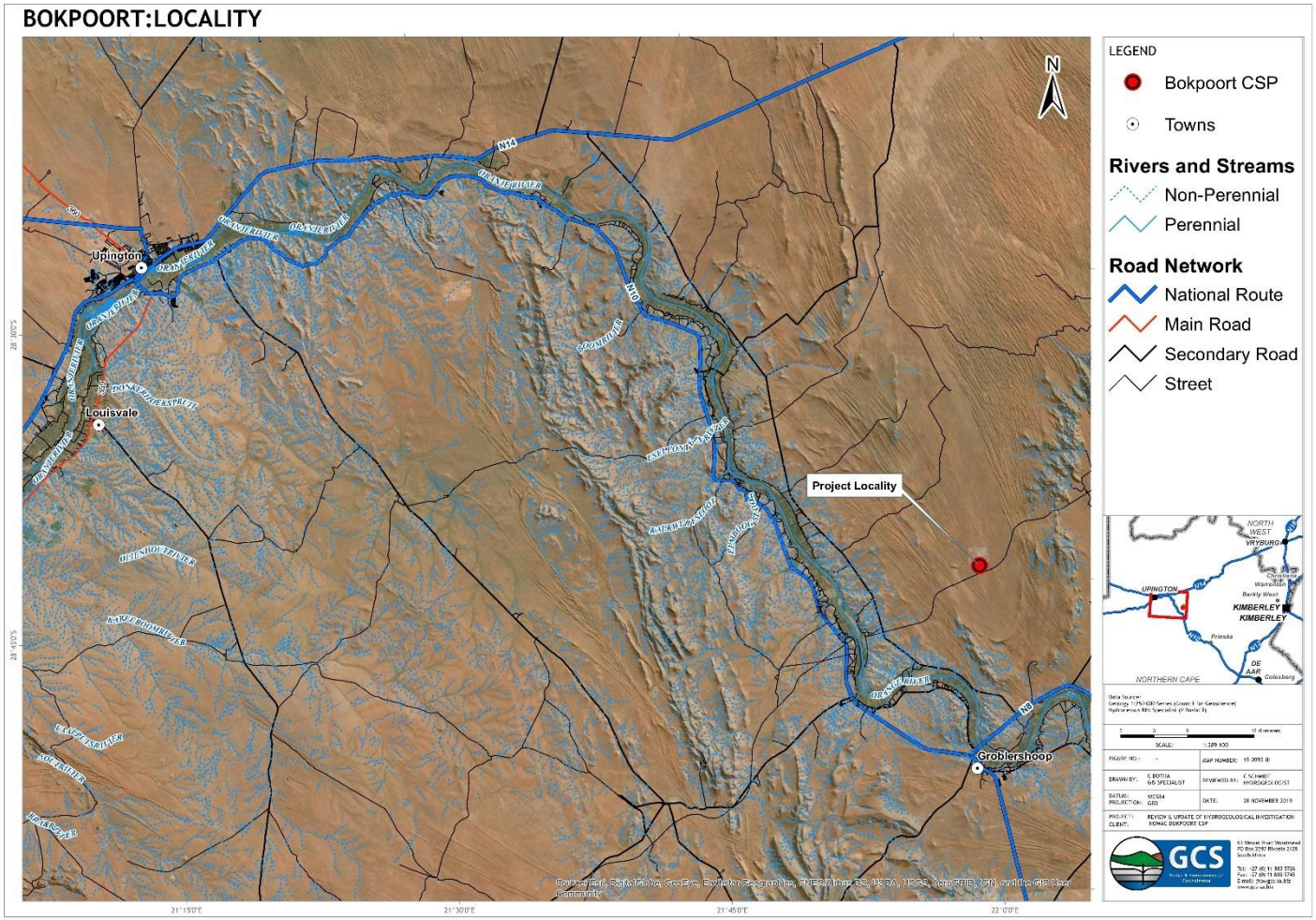

Figure 4-1: Locality map

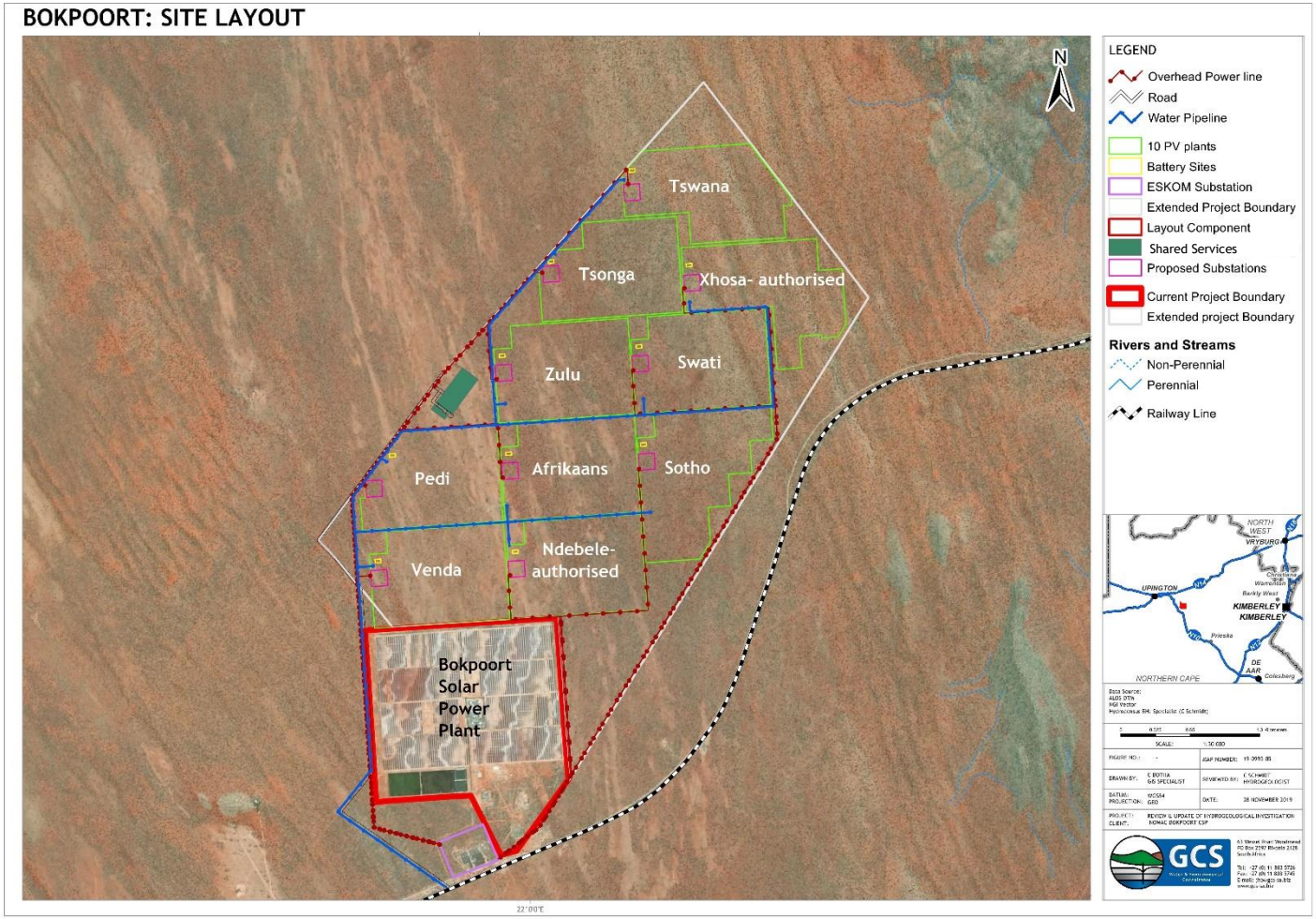

Figure 4-2: Site layout

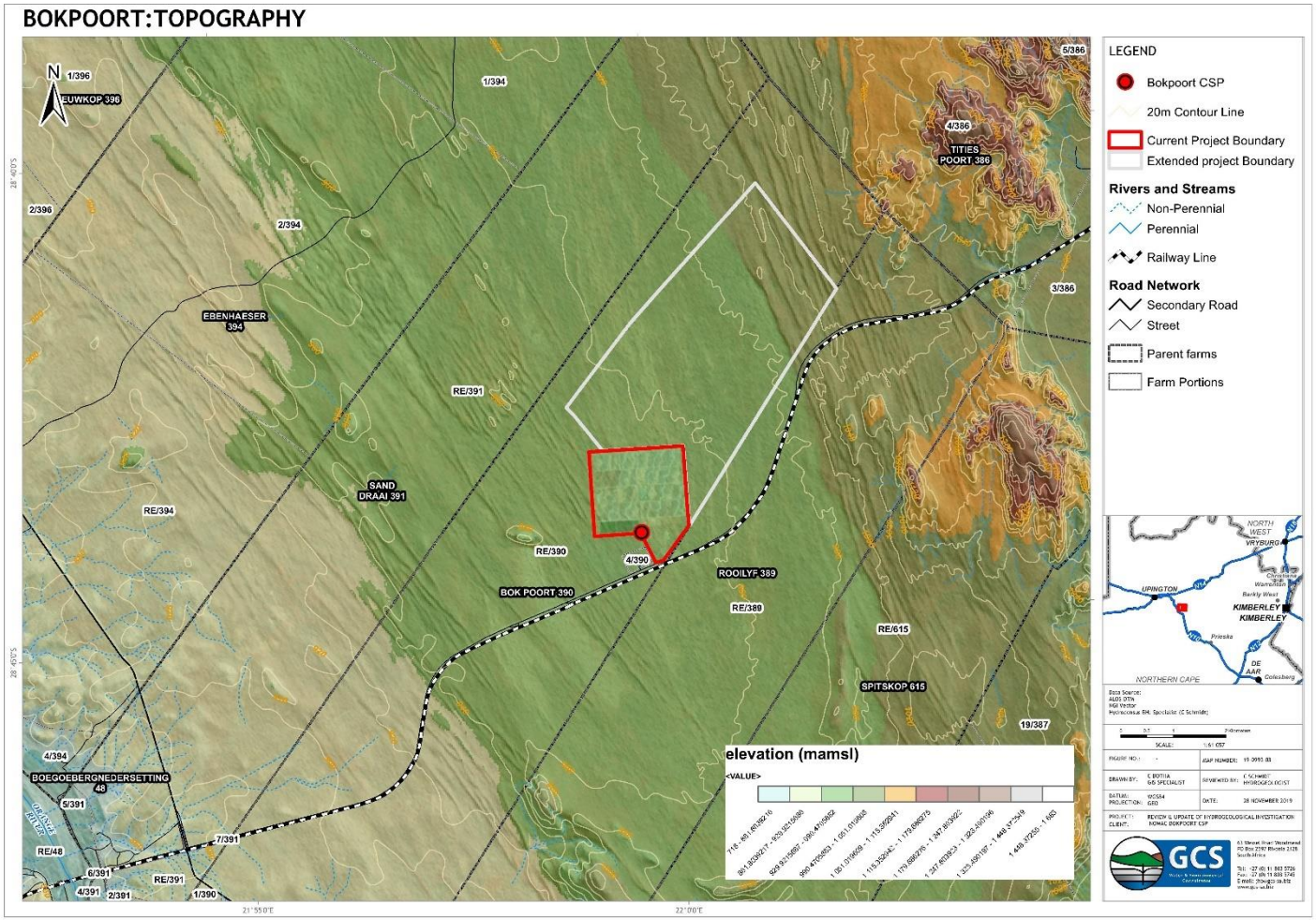

Figure 4-3: Topography map

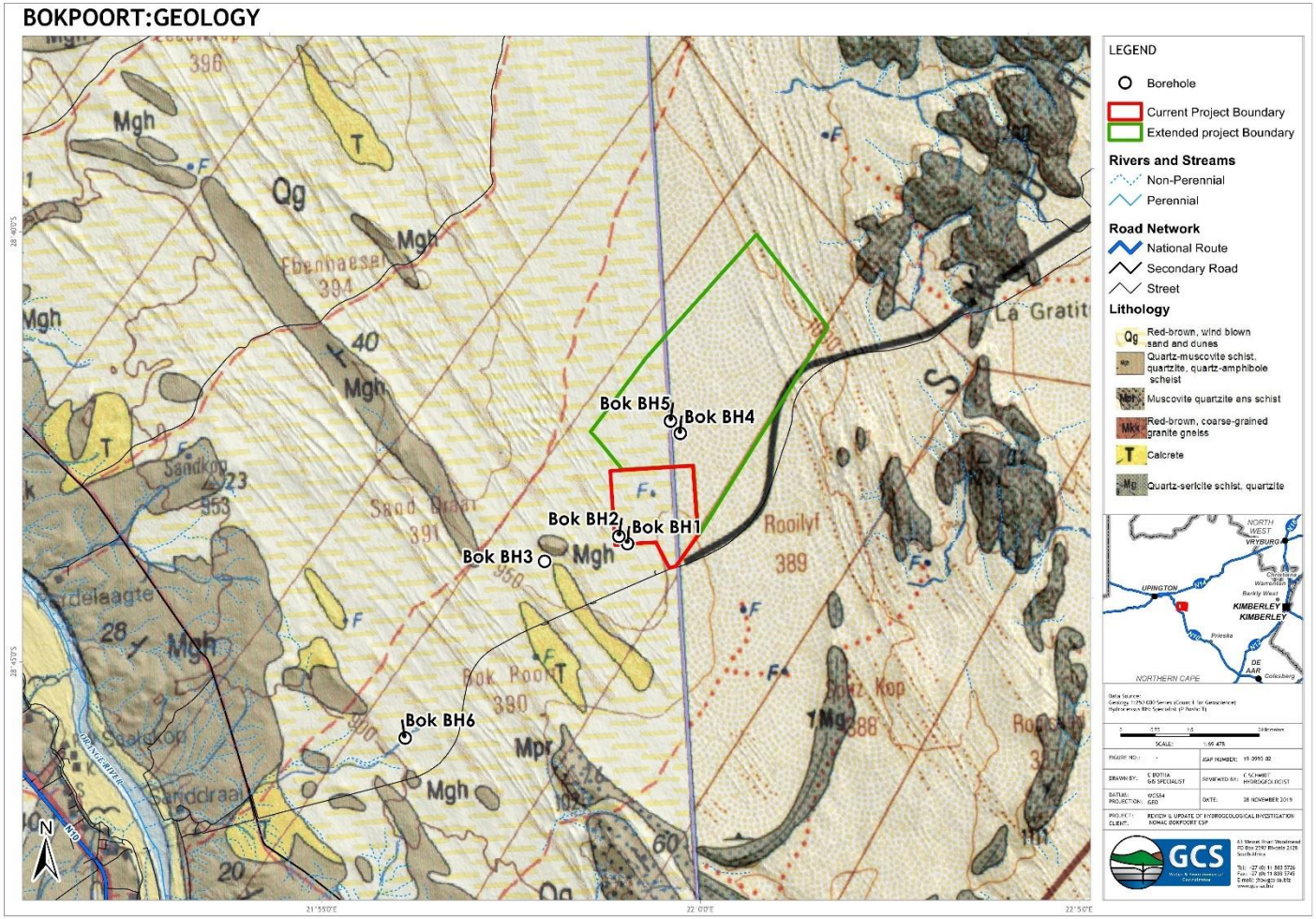

Figure 4-4: Geology map

5 HYDROCENSUS

Previously, during April 2010, GCS conducted a hydrocensus. The aim of this hydrocensus survey was to establish the extent of groundwater usage in the area. During this hydrocensus seven (7) boreholes were located. From the hydrocensus survey conducted in April 2010 it was established that the communities living on the farms rely on municipal water for domestic water supply and the farms located in proximity to the Orange River use water from the Orange River for water supply. Groundwater is utilised in farms located further away from the Orange River. Groundwater abstraction on the farms are mainly used for domestic purpose and animal (cattle and sheep) farming. Most of the boreholes were equipped with windmills and therefore no water level measurements could be taken. The water quality indicated pH ranging from 7.36 to 8.06; and the total dissolved solids (TDS) ranging from 420 to 490 mg/l.

During the hydrocensus conducted in November 2019, five (5) boreholes were identified within a ~4km radius of the study area and an additional borehole was located approximately 10 km from the study area and was included in the hydrocensus. Therefore, in total six (6) hydrocensus boreholes were identified, of which three (3) were accessible for groundwater level measurements. The results of the hydrocensus is summarised in Table 5-1. and the spatial distribution with respect to the study area is shown in Figure 5-1. Borehole Bok BH3 previously had a submersible pump installed and was utilized for domestic water supply for farm owner's house and farm village workers but this borehole is now dry. Similarly, borehole Bok BH6 previously had a windmill installed and was utilized for livestock watering but this borehole is now dry. Boreholes Bok BH1 and Bok BH2 are used for monitoring purposes around the evaporation ponds of the operational CSP. The hydrocensus field data sheets are provided in Appendix A.

Table 5-1: Hydrocensus data collected during November 2019.

Locality ID	Co-ordinate & Elevation Information			Borehole Status & Equipment Information					Water Use Application				Collar Height (m)	Groundwater Level (mbch)	Groundwater Elevation (m amsl)
					Pump Type										
	Latitude	Longitude	Surface Elevation (m amsl)	Status	Submersible	Windmill	Solar	Mono	Irrigation	Stock	Domestic	Other			
Bok BH1	-28.73413	21.98887	960	Monitoring Borehole								•	0.65	27.9	931.45
Bok BH2	-28.73262	21.98705	953	Monitoring Borehole								•	0	25.65	927.35
Bok BH3	-28.73661	21.97039	944	Not Operational									Dry		
Bok BH4	-28.71334	22.00186	953	Not Equipped									0.15	38.55	914.3
Bok BH5	-28.71084	21.99989	958	Operational		•				•			Not measured		
Bok BH6	-28.76924	21.93739	890	Not Operational									Dry		

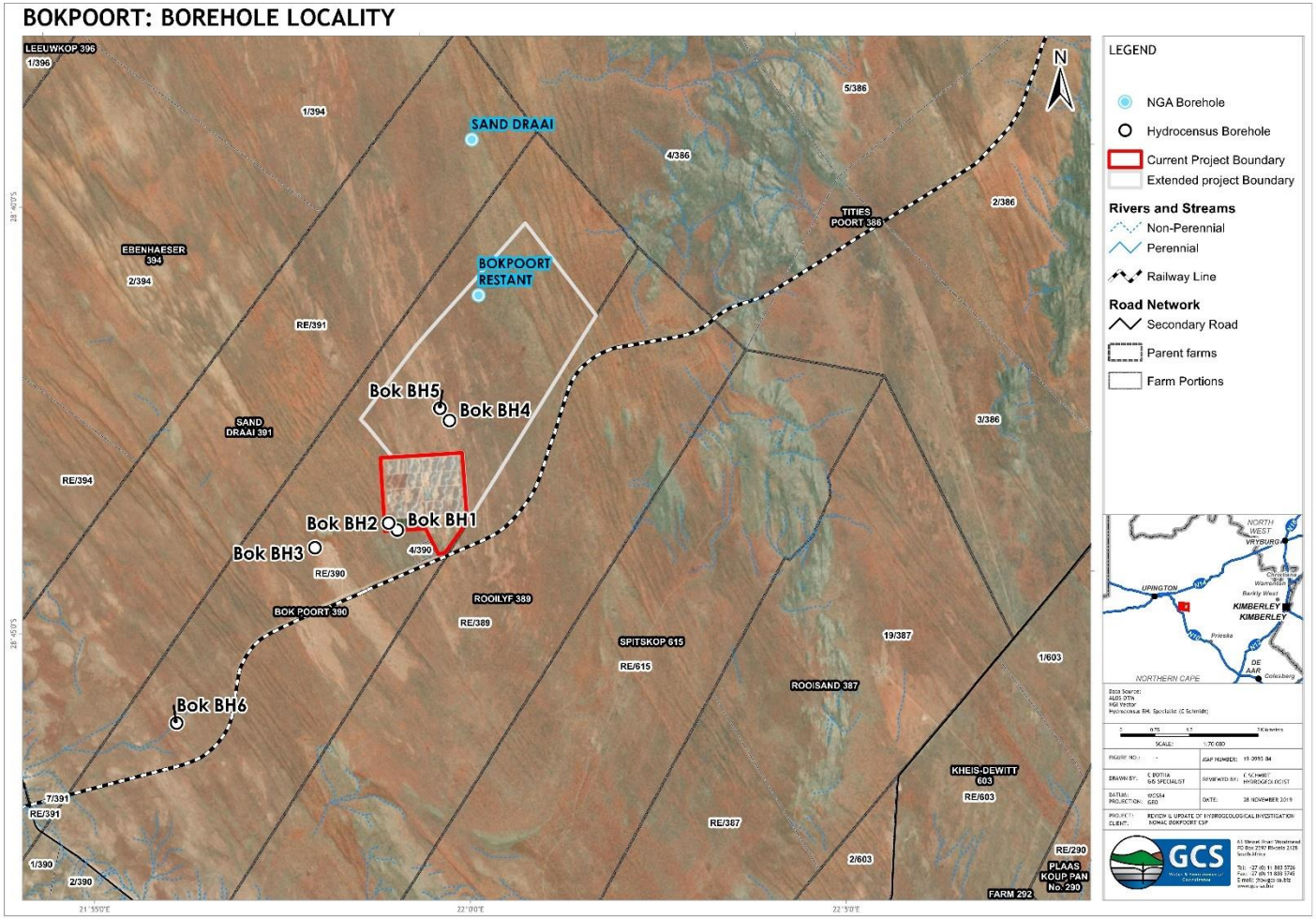

Figure 5-1: Borehole locality map

5.1 Groundwater Use

Similar to the hydrocensus conducted during April 2010, the November 2019 hydrocensus survey indicated that groundwater is mainly used for small-scale livestock watering purposes (goat and sheep farming). Table 5-2 summarises the status and use of the six (6) hydrocensus boreholes found during the 2019 hydrocensus.

Table 5-2: Borehole status and groundwater use, November 2019.

Description				Summary	
Number of Boreholes Identified			[No]	6	
Status	Operational		[No]	1	16.66%
	Equipped		[No]	1	16.66%
Primary Use	Stock Watering	small-scale	[No]	0	
		large-scale	[No]	2	33.33%
	Irrigation		[No]	0	
	Domestic		[No]	0	
	Other		[No]	2	33.33%

Notes

[No] Number

Other Monitoring borehole

5.2 Groundwater Level and Flow

Groundwater elevation recorded during the 2019 hydrocensus survey range between ~914 and ~931 metres above mean sea level (m amsl), with depth to water varying from ~25 metres below ground level (m bgl) and ~38 m bgl.

From the hydrocensus survey measured water level data, a correlation of ~ 68% exists between the topography and groundwater elevation (Figure 5-2). The relatively poor correlation is likely depictive of two (2) distinctive aquifer systems (the upper weathered aquifer and the deeper fractured aquifer).

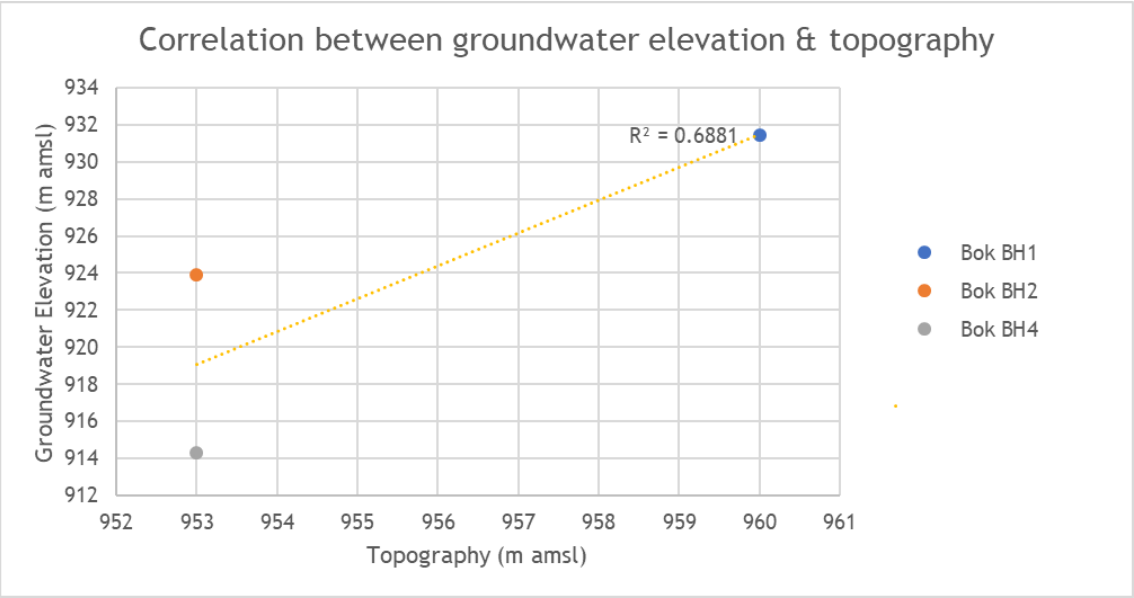

Figure 5-2: Topography and groundwater head correlation.

5.3 NGA and WARMS Databases

The National Groundwater Archive (NGA) and National Register of Water Use (WARMS) was accessed to obtain any existing groundwater data. Within a 5 km radius of the study area two (2) boreholes within the NGA were found, however, no registered boreholes on the WARMS database were found. Limited information for the two (2) NGA boreholes is available, Table 5-3. the spatial distribution of the NGA boreholes in relation to the study area is shown in Figure 5-1.

Table 5-3: Existing NGA data

Identifier	Latitude	Longitude	Farm Name	Province	Water Level	Depth
2822CA00012	-28.6892	22.00993	BOKPOORT RESTANT	Northern Cape	-	63
2822CA00042	-28.6587	22.01048	SAND DRAAI	Northern Cape	-	-

6 GROUNDWATER QUALITY

Aquatico Laboratory (a South African National Accreditation System (SANAS) accredited laboratory according to ISO / IEC 17025:2005 standards No: T0374) in Pretoria, South Africa, was commissioned to undertake the analytical testing for the collected groundwater samples.

Summary of the groundwater quality results are presented in Table 6-1; while the laboratory certificates of analyses are presented in Appendix B.

Boreholes Bok BH1 and Bok BH2 indicate water with neutral pH, electrical conductivity (EC) ranging from ~67 to ~105 mS/m, total hardness ranging from hard to very hard and low manganese concertation were recorded. Borehole Bok BH3 indicate very hard water with neutral pH, elevated EC and total dissolved solids (TDS), elevated nitrate concentration and low chromium concentration was recorded.

Table 6-1: Groundwater quality, November 2019.

Parameters	SAWQG Stock Watering	SAWQG Domestic Use	SANS 241-1:2015 Drinking Water Standard	Bok BH1	Bok BH2	Bok BH3
	Target Range	Target Values	Standard Limits	Nov-19	Nov-19	Nov-19
General Parameters						
pH at 22°C (pH units)	≤5 or ≥9	6-9	≤5 or ≥9.7 [O]	7.93	7.81	7.25
Conductivity mS/m @ 25°C	NL	NL	≥170 [A]	105	67.3	211
Total dissolved solids (TDS)	0-1000	0-450	≥1200 [A]	586	351	1373
Total suspended solids (TSS)	NL	NL	NS	17	34	890
Turbidity (NTU)	NL	0-1	≥5 [A]	28.6	59.1	1850
Total Alkalinity as $CaCO_3$	NL	NL	NS	321	244	440
Total Hardness as $CaCO_3$	NL	NL	NS	424	202	836
Anions						
Chloride, Cl	0-1500	0-100	≥300 [A]	98.8	82.6	342
Sulphate, SO_4	0-1000	0-200	≥500 [AH] ≥250 [A]	98.8	0.201	124
Fluoride, F	0-2	0-1.0	≥1.5 [CH]	0.737	0.389	0.786
Nitrogen Species						
Nitrate as N	NL	0-6	≥11 [AH]	0.261	<0.194	37
Nitrate as NO_3	0-100	NL	≥50 [AH]	1.16	<0.85	163.79
Nitrite as N	NL	0-6	≥0.9 [AH]	<0.065	<0.065	<0.065
Nitrite as NO_2	NL	NL	≥3 [AH]	<0.21	<0.21	<0.21
Ammonia (NH_3) as N	NL	0-1.0	≥1.5 [A]	0.115	0.111	<0.005
Ammonium (NH_4) as N	NL	NL	NS	3.75	4.55	0.018
Cations and Metals						
Calcium, Ca	0-1000	0-32	NS	45.9	16.8	144
Magnesium, Mg	0-500	0-30	NS	75	38.9	116
Sodium, Na	0-2000	0-100	≥200 [A]	50.9	46.7	106
Potassium, K	NL	0-50	NS	8.28	8.37	12.3
Iron, Fe	0-10	0-0.1	≥2 [CH] ≥0.3 [A]	<0.004	<0.004	<0.004
Aluminium, Al	0-5	0-0.15	≥0.3 [O]	<0.002	<0.002	<0.002
Manganese, Mn	0-10	0-0.05	≥0.4 [CH] ≥0.1 [A]	0.125	0.195	0.004
Total Chromium, Cr	NL	NL	≥0.05 [CH]	<0.01	<0.01	0.149
Lead, Pb	0-0.1	0-0.01	≥0.01 [CH]	<0.004	<0.004	<0.004
Boron, B	0-5	NL	≥2.4 [CH]	0.061	0.105	0.234
Cadmium, Cd	0-0.01	0-0.005	≥0.003 [CH]	<0.002	<0.002	<0.002
Mercury, Hg	0-0.001	0-0.006	≥0.006 [CH]	<0.004	<0.004	<0.004

Key:
All parameters in mg/l unless specified otherwise
Yellow Shading: Not meeting the target values as per SAWQG for Livestock Watering
Yellow Shading: Not meeting the target values as per SAWQG for Domestic Use
Blue Shading: Exceedance in terms of SANS 241-1:2015 Drinking Water Standard
[A] - SANS 241-1 Aesthetic Risk Limit
[CH] - SANS 241-1 Chronic Health Risk Limit
[AH] - SANS 241-1 Acute Health Risk Limit
[O] - SANS 241-1 Operational Risk Limit
NS- No Standard
NL- No Limit

6.1 Hydrogeological Characterisation

A Piper diagram, Figure 6-1, was created using the WISH software to characterize the water analysed. A Piper diagram is utilized to characterize water types in a graphical manner and to distinguish any specific water types in the area. The Piper diagram was quartered to simplify this process. The water samples can be grouped into the left, bottom, right, centre and upper quarters. The position of the water sample on the plot is based on the ratio of the various constituents measured in equivalence and is not an indication of the absolute water quality or the suitability thereof for domestic consumption. The following water types are observed in and surrounding Bokpoort II:

- Sample sites Bok BH1 and BH2 indicate predominantly Ca-Mg-HCO_3 type water; and
- Sample site Bok BH3 indicate predominantly Ca-Mg-Cl type water.

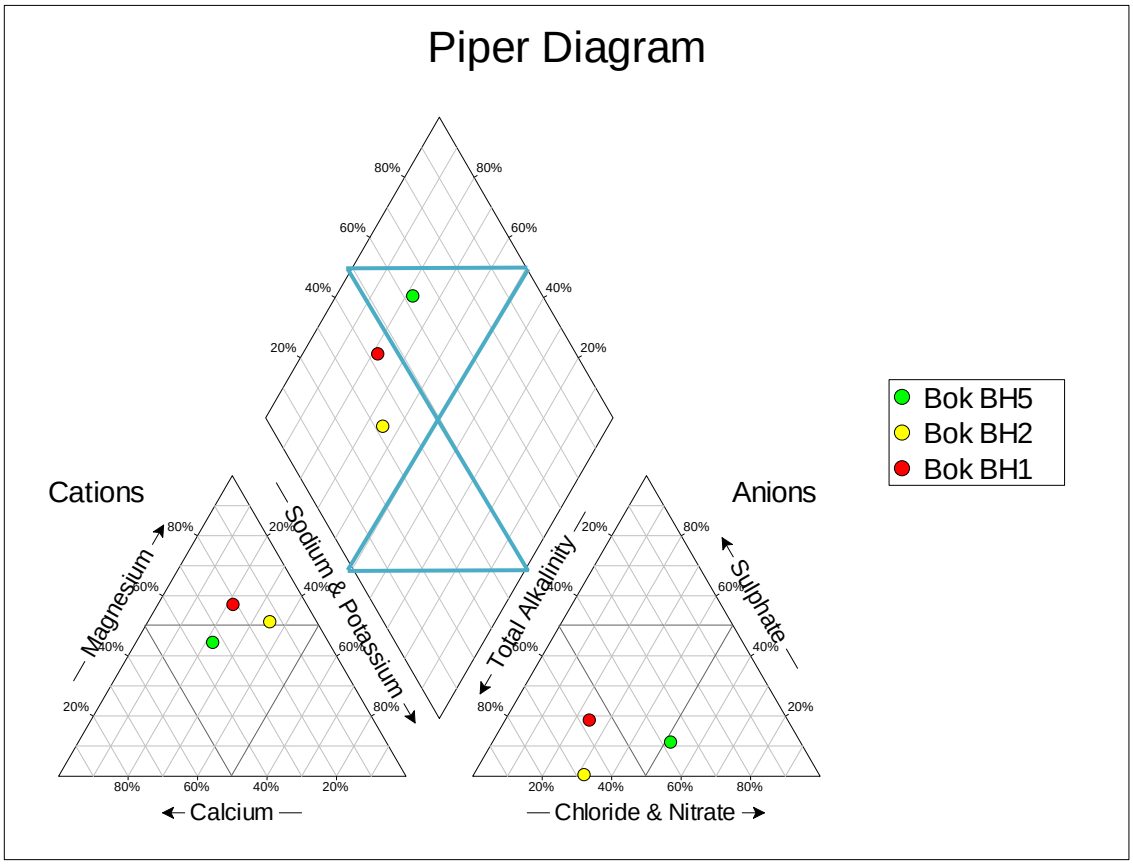

Figure 6-1: Piper diagram

6.2 Groundwater Quality Compared to Water Criteria Guidelines / Standards

Groundwater in the area is mostly used for livestock watering and is therefore compared to the Department of Water Affairs (DWA) South African Water Quality Guidelines Volume 5 for Livestock Watering Use (1996c). Additionally, the water quality will also be compared to the Department of Water Affairs (DWA) South African Water Quality Guidelines Volume 1 for Domestic Use (1996a) and South African Bureau of Standards (SABS) SANS 241-1:2011 Drinking Water Standards.

Comparison of the groundwater quality to the relevant guidelines is summarized in Table 6-2 (Livestock Watering Use) and Table 6-3 (Drinking / Domestic Use).

Table 6-2: Livestock watering use compliance and risk status

Sample ID	Compliance Status				Livestock Health Risk Status
	General Parameters	Anions	Nitrogen-Species	Cations and metals	
Bok BH1	Yes	Yes	Yes	Yes	None: based on all parameters analysed, the water adheres to SAWQG Target Values for Livestock watering.
Bok BH2	Yes	Yes	Yes	Yes	
Bok BH3	Yes	Yes	Yes	Yes	

Note/s:

Red indicates an exceedance of the DWA SAWQG Target Value for Livestock Watering Use

Table 6-3: Drinking / domestic use compliance and risk status

Sample ID	Compliance Status				Risk Status	
	General Parameters	Anions	Nitrogen-Species	Cations and metals	Health	Aesthetic
Bok BH1	No (TDS, turbidity)	Yes	Yes	No (Ca and Mn)	TDS, Ca and Mn: No health effects are likely. Turbidity: Water carries an associated risk of disease due to infectious disease agents and chemicals adsorbed onto particulate matter.	TDS: Water has a noticeable salty taste, but is well tolerated. No effects on plumbing or appliances. Turbidity: Severe aesthetic effects (appearance, taste and odour). Ca: No health effects. Increased scaling problems Lathering of soap impaired. Mn: Threshold for significant staining and taste problems.

Sample ID	Compliance Status				Risk Status	
	General Parameters	Anions	Nitrogen-Species	Cations and metals	Health	Aesthetic
Bok BH2	No (turbidity)	Yes	Yes	No (Mn)	Mn: No health effects are likely. Turbidity: Water carries an associated risk of disease due to infectious disease agents and chemicals adsorbed onto particulate matter.	Mn: Increasingly severe staining and taste problems. Turbidity: Severe aesthetic effects (appearance, taste and odour).
Bok BH3	No (EC, TDS and turbidity)	No (Cl)	No (Nitrate as N and as NO_3)	No (Ca and total Cr)	TDS/EC: Consumption of water does not appear to produce adverse health effects in the short term. Turbidity: Water carries an associated risk of disease due to infectious disease agents and chemicals adsorbed onto particulate matter. Cl and Ca: No health effects Nitrate as N: Methaemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults Cr: Danger of kidney damage with long-term exposure. Brief exposure, for less than one week should not cause any noticeable damage. Exposure should not exceed one week	TDS/EC: Water has a marked, salty taste and some effects on plumbing and appliances, such as increased corrosion or scaling, may be expected. Turbidity: Severe aesthetic effects (appearance, taste and odour). Cl: Water has a distinctly salty taste. Likelihood of noticeable increase in corrosion rates in domestic appliances Ca: Severe scaling problems Lathering of soap severely impaired

Note/s:
Red indicates an exceedance of the SANS 241:2011 and / or DWA SAWQG Target Value for Domestic Use

7 IMPACT ASSESMENT

The impact assessment applied the source-pathway-receptor approach to evaluate the risk associated with the proposed new PV plants. It is indicated on the Environmental Scoping Report (Jude Cobbing, 2006) that the proposed solar power facility will not use any groundwater. Water will be pumped from the Orange River to the station and used for washing of the solar cells and in the plant worker's change rooms. Therefore, overstressing of the aquifer due to over abstraction is not included as a possible impact as surface water will be utilised to meet the water demand on site.

The impact assessment is shown in Table 7-1. Sources are divided into possible impacts during the construction, operational and post closer phases. The pathway will consider factoring affecting the vulnerability of the underlying aquifer and the receptors will identify all surrounding groundwater users.

Table 7-1: Impact assessment

Aspect	Potential Impact	Notes
Source	***Construction Phase*** 1- Spillage of fuels, lubricants and other chemicals from construction equipment, vehicles and temporary workshop areas will be a likely source of pollution. 2- Increased runoff due to vegetation removal will cause a decrease in infiltration into soil and consequently decrease recharge to the underling aquifer.	1- If these hydrocarbons lubricants and other chemicals reach the groundwater, contamination can be expected. 2- Based on the Groundwater Resource Directed Measures (GRDM) the recharge within the D73D quaternary catchment is low (3.6 mm/a). The extended project area is relatively small (~1400 hectares) and increased runoff is expected to be low and sustainable drainage systems (SuDS) can also be implemented to manage the storm water thus lower the impact of increased runoff.
	Operational Phase 1- Leakage from BESS. The BESS combined site storage within batteries on each PV site will be 4500 m^3 of hazardous substance. 2- If unsatisfactory water quality (containing elevated counts of microbiological determinants or metal concentrations for example) is used to clean the solar cells this could infiltrate into the subsurface and possibly pollute the groundwater.	1- If leakage from the BESS reach the groundwater, contamination can be expected. 2- If infiltrating water with elevated counts of bacteria or metal concentrations can reach the groundwater, concentrations can be expected.
	Post Closure 1- No foreseen sources	1- The total disturbed area is relatively small, and it is likely that the impact will be minimal upon closure providing the site is properly decommissioned.

Aspect	Potential Impact	Notes
Pathway	***Infiltration potential/ aquifer vulnerability:*** 1- Depth to groundwater/ unsaturated zone characteristics	1- Following the hydrocensus and data obtained from the GRDM the groundwater level ranges from ~25 m bgl to ~ 45 m bgl. The deeper groundwater level allows for a large unsaturated zone above the groundwater level which can naturally attenuate any infiltering leakage or spills. Deeper groundwater conditions lower the risk of any potential impacts infiltrating from surface.
Receptor	***Users/receptors of groundwater:*** 1- Groundwater users 2- Distance to major water courses	1- Based on the hydrocensus the surrounding farmers (who are not in proximity to the Orange River) use groundwater for small-scale livestock watering purposes. There are few groundwater users within a ~5km radius of Bokpoort II. 2- Bokpoort II is located ~15km away from the Orange River. This large distance lowers the risk of the site having any impact on the down-gradient water course.

8 RISK ASSESSMENT

The risk ranking and Significance Point (SP) ranking is shown in Table 8-1. Based on the impact assessment there are three (3) main potential risks identified:

1. The groundwater quality can be impacted by spillage of fuels, lubricants, chemicals from construction equipment, vehicles and temporary workshop during the construction phase or from leakage from the BESS. Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur. With proper mitigations in place the significance of the impact is likely to be low.
2. Infiltration potential/ aquifer vulnerability is classified as having low environmental significance due to deeper groundwater level conditions which allow for a large unsaturated zone above the groundwater level which can naturally attenuate any infiltering leakage or spills. Unsaturated flow conditions within the upper weather zone/ unsaturated zone also involves slower movement of moisture allowing for longer periods of time for natural attenuation to occur.
3. Receptors surrounding the site are farmers who use groundwater for small-scale livestock watering purposes and the Orange River which is 15km away from the site. Most famers in the area use the Orange River for water supply and few groundwater users are within proximity to the site. The receptor is therefore classified as having low environmental significance.

Table 8-1: Ranking scale.

Potential Impact		Scale (S)	Duration (D)	Magnitude (M)	Probability (P)	Significance Point SP= (M +D+S) x P
1.Groundwater quality impact	Construction phase	1	1	6	3	24
	Operational phase	1	1	6	2	16
2.Infiltration potential/ aquifer vulnerability		1	2	2	2	10
3.Receptors		2	2	2	2	12

Note/s:

SP > 75	Indicates high environmental significance
SP 30- 75	Indicates moderate environmental significance
SP <30	Indicates low environmental significance

9 REVIEW OF PV EIA SPECIALIST REPORTS

Following the review of the two (2) reports mentioned in Section 2, it was found that the surface water impact assessment tables for the proposed 75 MW PV 1 Solar Facility and 75 MW PV 2 Solar Facility are identical. These surface water impact assessments were both corrected after an external review was performed by Mr Bruce Randell (Ilanda Water Services cc).

Following the strategic decision to develop ten (10) new PV plants each with a MW capacity of 200MW and BESS on each site the impact assessments needed to be reviewed and updated. At the time when the impact assessments were undertaken by Golder no provision was made for the inclusion of the BESS. Based on the inclusion of the BESS the following comments are made following the review of the two (2) above mentioned reports:

- The impact assessment (Table 9: Impact assessment during construction, operation and at closure each report mention in Section 2) needs to make specific mention of the BESS as an aspect and as a potential impact during the operational phase; and
- The impact/ risk assessment formula will also have to be updated as the BESS combined site storage within batteries on each PV site will be 4500 m^3 of hazardous substance.
- Table 9-1 is the recommended amendment to be included in the impact assessment table.

An additional alteration noted is the slight change in water demand which will be affected positively with the total demand changing to 0.22 million cubic metres per annum (Mm^3/a) (10 x 0.022 Mm^3/a) for the 10 PV solar facilities instead of the 0.3 Mm^3/a (0.25 + 2 x 0.025 Mm^3/a) for the CSP and two (2) PV solar facilities.

Table 9-1: Amendment to impact assessment during construction, operation and at closure (Golder, 2016a and Golder, 2016b)

Aspect	Potential Impact	Extent	Duration	Intensity	Probability	Impact	Notes
OPERATIONAL PHASE							
Water quality impacts due to chemical spills/ equipment use	Spillage of fuels, lubricants and other chemicals from the Battery Energy Storage System.	2	1	2	2	10- High Impact	It is expected that without mitigation a high negative impact can be expected. Mitigation will include: - Clean-up of spills as soon as they occur; - Maintenance of the abstraction pumps to prevent spills; -Maintenance of the Battery Energy Storage System to ensure optimal functionality and prevent fire risks; -Maintenance and quality control of firefighting equipment and systems; and - Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur. The significance of the impact after mitigation is likely to decrease to a medium negative impact.

10 CONCLUSION

GCS (Pty) Ltd was appointed by Royal HaskoningDHV on behalf of ACWA Power Energy Africa (Pty) Ltd (ACWA Power) to conduct a site walk over, hydrocensus and updated hydrogeological risk assessment to convert the current site (which comprises of an authorised concentrated solar power (CSP) and two (2) Photovoltaic (PV) plants) into the development of ten (10) PV developments with shared infrastructure.

The Bokpoort II: 2000MW PV Solar Power Development (the site) is located on the north-eastern portion of the remaining extent of the Farm Bokpoort 390, which is 20 km north-west of the town of Groblershoop within the Northern Cape Province. 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. The site slopes in a western direction and drains towards the Orange River and falls within the D73D quaternary catchment within the lower Orange Main Stem Catchment and is governed by the Orange WMA. The general geology of the site mainly comprises red-brown, coarse-grained granite gneiss; and quartz-muscovite schists, quartzite, quartz-amphibole schists and greenstones of the Groblershoop formation, Brulpan group. Two (2) distinctive aquifer systems (the upper weathered aquifer and the deeper fractured aquifer) underly the site.

During the hydrocensus conducted in November 2019, six (6) hydrocensus boreholes were identified, of which three (3) were accessible for groundwater level measurements. Groundwater is mainly used for small-scale livestock watering purposes (goat and sheep farming) and the groundwater elevation ranges between ~914 and ~931 m amsl, with depth to water varying from ~25 m bgl and ~38 m bgl. Based on all parameters analysed, the water adheres to SAWQG Target Values for Livestock watering. Boreholes Bok BH1 and Bok BH2 indicate water with neutral pH, electrical conductivity (EC) ranging from ~67 to ~105 mS/m, total hardness ranging from hard to very hard and low manganese concertation were recorded. Borehole Bok BH3 indicate very hard water with neutral pH, elevated EC and total dissolved solids (TDS), elevated nitrate concentration and low chromium concentration was recorded.

All results obtained during the hydrocensus and site investigation were compiled into a site-specific impact assessment and was utilised to conceptualise the site. This site conceptualisation was used to complete a source-pathway-receptor linkage to quantify areas of possible concern. The identified impacts are assessed in accordance with the approach extracted from the Golder EIR (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two (2) aspects for assessing the potential significance of impacts, namely:

- Occurrence: Probability of occurrence and duration of occurrence
- Severity: Scale/ extent of impact and magnitude (severity) of impact

A ranking scale, as shown in Table 3-2, is then used to rank the probability, duration, scale and magnitude. Once these factors have been ranked for each impact, the significance is assessed using the following formula:

$$\boldsymbol{SP = (Magnitude + Duration + Scale) \times Probability}$$

An SP ranking above 75 indicates high environmental significance, an SP between 30 to 75 indicates moderate environmental significance and an SP below 30 indicates low environmental significance.

The risk associated with Bokpoort II is of low environmental significance from a groundwater perspective. Bokpoort II will not use any groundwater as water will be pumped from the Orange River to meet the water demand on site. Overstressing of the aquifer due to over abstraction is not included as a possible impact as surface water will be utilised to meet the water demand on site. The risk identified are:

1. **Groundwater quality:** The groundwater quality can be impacted by spillage of fuels, lubricants, chemicals from construction equipment, vehicles and temporary workshop during the construction phase or from leakage from battery storage facility during the operational phase. Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur. With proper mitigations in place the significance of the impact is likely to be low.
2. **Infiltration potential/ aquifer vulnerability:** Due to deeper groundwater level conditions which allow for a large unsaturated zone above the groundwater level which can naturally attenuate any infiltering leakage or spills the Infiltration potential/ aquifer vulnerability is low. Unsaturated flow conditions within the upper weather zone/ unsaturated zone also involves slower movement of moisture allowing for longer periods of time for natural attenuation to occur.

3. **Receptors:** Few receptors surrounding Bokpoort II were identified during the 2019 hydrocensus. Receptors include farmers who use groundwater for small-scale livestock watering purposes and the nearest major water course is the Orange River which is 15km away from Bokpoort II. Most famers in the area use the Orange River for water supply and are not solely reliant on groundwater.

Overall the accumulative risk associated with both Bokpoort I and Bokpoort II (when operational) is of low environmental significance from a groundwater perspective. With proper mitigations in place the significance of the impact is likely to be low.

Following the strategic decision to develop ten (10) new PV plants each with a MW capacity of 200MW and BESS on each site the surface water impact assessments needed to be reviewed. At the time when the impact assessments were undertaken by Golder no provision was made for the inclusion of the BESS. Based on the inclusion of the BESS the following comments are made following the review of the two (2) above mentioned reports:

- The impact assessment (Table 9: Impact assessment during construction, operation and at closure each report mention in Section 2) needs to make specific mention of the BESS as an aspect and as a potential impact during the operational phase; and
- The impact/ risk assessment formula will also have to be updated as the BESS combined site storage within batteries on each PV site will be 4500 m^3 of hazardous substance.

Table 9-1 is the recommended update to be included in the impact assessment table.

An additional alteration noted is the slight change in water demand which will be affected positively with the total demand changing to 0.22 million cubic metres per annum (Mm^3/a) (10 x 0.022 Mm^3/a) for the 10 PV solar facilities instead of the 0.3 Mm^3/a (0.25+ 2 x 0.025 Mm^3/a) for the CSP and two (2) PV solar facilities.

Recommendations

The following recommendations are made:

- During the construction phase it is recommended to have bunded areas to store chemicals and/or fuel and clean-up of spills as soon as they occur. With proper mitigations in place the significance of the spillage and/or leakage is likely to be low;
- Once the construction phase has been completed it is recommended to do one monitoring routine of boreholes; and
- It is recommended to monitor the Orange River quality used on site during the operational phase.

11 REFERENCES

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- Department of Water and Sanitation (DWS) (2012). Aquifer Classification Map of South Africa.
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- Department of Water and Sanitation (DWS) (2013). Groundwater Resource Directed Measures (GRDM). Version 2.3.2.
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- Golder Associates (2016a). Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 1 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape. Report Number 1400951-300592-9
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- Parsons, R. and Conrad, J. 1998. Explanatory notes of the aquifer classification map of South Africa. Water Research Commission: Department of Water Affairs and Forestry. WRC Report No. KV 116/98. ISBN 1 8845 4568.
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- South African Bureau of Standards (SABS) (2015). South African National Standard: Drinking Water Part 1: Microbiological, physical, aesthetic and chemical determinants: SANS 241-1:2015 2nd Ed. ISBN 978-0-626-29841-8
- Aquifer Vulnerability of South Africa Map, Andiswa Matoti, Julian Conrad and Susan Jones, CSIR, 22 March 1999.

APPENDIX A: HYDROCENSUS FIELD DATA

HYDROCENSUS RECORD SHEET

Bore ID: Bok BH1

Date & Time Information:					
Hydrocensus Date:	**[dd-mmm-yyyy]**	20 November 2019	**Time:**	**[hh:mm]**	12:40

Coordinates Infromation:			Owner Infromation:	
Coordinates System:			**Owner:**	Bokpoort CSP
- Projection:		Geographic	**Contact Number/Email:**	+ 27 76 981 9202/ bmdodana@acwapower.com
- Datum:		WGS84	**Village/Farm Name:**	Farm Bokpoort 390
Coordinates:				
- Easting/Latitude:	**[m]/[DD]**	-28.734130	**Geological Information:**	
- Northing/Longitude:	**[m]/[DD]**	21.988870	Unknown (1)	
- Elevation:	**[m amsl]**	960		
Survey Method:		GPS-Handheld		

Bore/Spring Construction Information:			Bore/Spring Status & Equipment:		
Bore Installation Date	**[mmmm-yyyy]**	Unknown (1)	**Status:**		Monitoring Borehole
Bore Depth:	**[m]**	Not Applicable	**Water Application:**		
Collar Height:	**[m]**	0.65	**- Primary**		Monitoring
Reference Level Height:	**[m]**	Not Applicable	**- Other**		
Casing Diameter (ID)	**[m]**	Not Applicable	**- Domestic**		
Screen/Perforated Casinig Length:	**[m]**	Not Applicable	**- Stock Watering**		
Casing Type:		Not Applicable	**- Irrigation**		
			- Other		
			Equipment:		Not Applicable
			Equipment Status:		Not Applicable
			Abstraction Rate:	**[L/s]**	Not Applicable
			Pump Inlet:	**[m]**	Not Applicable

Hydrogeological Information:				Field Physio-Chemical Information:		
Static Water Level:	**[m brl]**	27.25		**pH:**	**[pH Unit]**	7.85
Aquifer Type:		Not Applicable		**Electrical Conductivity:**	**[µS/cm]**	1180
				Temperature:	**[°C]**	26.7
Water Strike Depth:	**[m bgl]**	Not Applicable	***(Strike 1)***			
			(Strike 2)	**Sample Information:**		
Accumulative Yield:	**[L/s]**	Not Applicable	***(Strike 1)***	**Sample Date:**	**[dd-mmm-yy]**	Wednesday, 20 November 2019
			(Strike 2)	**Sample Time:**	**[hh:mm]**	12:40
				Sample Method:		Grab sample
				Sample Depth:	**[m brl]**	Not Applicable

Comments

Note/s:

[1] Not measured / recorded
[2] Geological Map Series (1:250,000)
[3] Closed / damaged system
[4] No infromation available / made available to GCS
[5] Calculation (GCS)
[6] Borehole not sampled
[7] Dynamic Water Level

Additional Note/s:

Boreholes Bok BH1 and Bok BH2 are used for monitoring purposes around the evaporation ponds of the operational CSP.

Acronyms:

- m	-	metres
- m bgl	-	metres below ground level
- m amsl	-	metres above mean sea level
- m brl	-	metres below reference level
- L/s	-	Litres per second
- µS/m	-	micro Sieens per metre

Photo/s:

Source: GCS, 2019

Project Information:	
Project Number:	19-0993
Project:	Review and Update of Hydrogeological Investigation NOMAC- Bokpoort CSP
Hydrogeologist:	Miss C. Schmidt
Date:	November 2019

HYDROCENSUS RECORD SHEET

Bore ID: Bok BH2

Date & Time Information:					
Hydrocensus Date:	**[dd-mmm-yyyy]**	20 November 2019	**Time:**	**[hh:mm]**	13:04

Coordinates Infromation:			Owner Infromation:	
Coordinates System:			**Owner:**	Bokpoort CSP
- Projection:		Geographic	**Contact Number/Email:**	+ 27 76 981 9202/ bmdodana@acwapower.com
- Datum:		WGS85	**Village/Farm Name:**	Farm Bokpoort 390
Coordinates:				
- Easting/Latitude:	**[m]/[DD]**	-28.732620	**Geological Information:**	
- Northing/Longitude:	**[m]/[DD]**	21.987050	Unknown (1)	
- Elevation:	**[m amsl]**	953		
Survey Method:		GPS-Handheld		

Bore/Spring Construction Information:			Bore/Spring Status & Equipment:		
Bore Installation Date	**[mmmm-yyyy]**	Unknown (1)	**Status:**		Monitoring Borehole
Bore Depth:	**[m]**	Not Applicable	**Water Application:**		
Collar Height:	**[m]**	0.6	**- Primary**		Monitoring
Reference Level Height:	**[m]**	Not Applicable	**- Other**		
Casing Diameter (ID)	**[m]**	Not Applicable	**- Domestic**		
Screen/Perforated Casinig Length:	**[m]**	Not Applicable	**- Stock Watering**		
Casing Type:		Not Applicable	**- Irrigation**		
			- Other		
			Equipment:		Not Applicable
			Equipment Status:		Not Applicable
			Abstraction Rate:	**[L/s]**	Not Applicable
			Pump Inlet:	**[m]**	Not Applicable

Hydrogeological Information:				Field Physio-Chemical Information:		
Static Water Level:	**[m brl]**	27.9		**pH:**	**[pH Unit]**	7.73
Aquifer Type:		Not Applicable		**Electrical Conductivity:**	**[µS/cm]**	739
				Temperature:	**[°C]**	29.2
Water Strike Depth:	**[m bgl]**	Not Applicable	***(Strike 1)***			
			(Strike 2)	**Sample Information:**		
Accumulative Yield:	**[L/s]**	Not Applicable	***(Strike 1)***	**Sample Date:**	**[dd-mmm-yy]**	Wednesday, 20 November 2019
			(Strike 2)	**Sample Time:**	**[hh:mm]**	13:04
				Sample Method:		Grab sample
				Sample Depth:	**[m brl]**	Not Applicable

Comments

Note/s:

[1] Not measured / recorded
[2] Geological Map Series (1:250,000)
[3] Closed / damaged system
[4] No infromation available / made available to GCS
[5] Calculation (GCS)
[6] Borehole not sampled
[7] Dynamic Water Level

Additional Note/s:

Boreholes Bok BH1 and Bok BH2 are used for monitoring purposes around the evaporation ponds of the operational CSP.

Acronyms:

- m	-	metres
- m bgl	-	metres below ground level
- m amsl	-	metres above mean sea level
- m brl	-	metres below reference level
- L/s	-	Litres per second
- µS/m	-	micro Sieens per metre

Photo/s:

Source: GCS, 2019

Project Information:	
Project Number:	19-0993
Project:	Review and Update of Hydrogeological Investigation NOMAC- Bokpoort CSP
Hydrogeologist:	Miss C. Schmidt
Date:	November 2019

HYDROCENSUS RECORD SHEET

Bore ID: Bok BH3

Date & Time Information:					
Hydrocensus Date:	**[dd-mmm-yyyy]**	20 November 2019	**Time:**	**[hh:mm]**	14:59

Coordinates Infromation:			Owner Infromation:	
Coordinates System:			**Owner:**	Chris Honiball
- Projection:		Geographic	**Contact Number/Email:**	082 372 3467
- Datum:		WGS86	**Village/Farm Name:**	Farm Bokpoort 390
Coordinates:				
- Easting/Latitude:	**[m]/[DD]**	-28.736610	**Geological Information:**	
- Northing/Longitude:	**[m]/[DD]**	21.970390	Unknown (1)	
- Elevation:	**[m amsl]**	944		
Survey Method:		GPS-Handheld		

Bore/Spring Construction Information:			Bore/Spring Status & Equipment:		
Bore Installation Date	**[mmmm-yyyy]**	Unknown (1)	**Status:**		Not Operational
Bore Depth:	**[m]**	Not Applicable	**Water Application:**		
Collar Height:	**[m]**	Not Applicable	**- Primary**		-
Reference Level Height:	**[m]**	Not Applicable	**- Other**		
Casing Diameter (ID)	**[m]**	Not Applicable	**- Domestic**		
Screen/Perforated Casinig Length:	**[m]**	Not Applicable	**- Stock Watering**		
Casing Type:		Not Applicable	**- Irrigation**		
			- Other		
			Equipment:		Not Applicable
			Equipment Status:		Not Applicable
			Abstraction Rate:	**[L/s]**	Not Applicable
			Pump Inlet:	**[m]**	Not Applicable

Hydrogeological Information:				Field Physio-Chemical Information:		
Static Water Level:	**[m brl]**	DRY		**pH:**	**[pH Unit]**	Not Applicable
Aquifer Type:		Not Applicable		**Electrical Conductivity:**	**[µS/cm]**	Not Applicable
				Temperature:	**[°C]**	Not Applicable
Water Strike Depth:	**[m bgl]**	Not Applicable	***(Strike 1)***			
			(Strike 2)	**Sample Information:**		
Accumulative Yield:	**[L/s]**	Not Applicable	***(Strike 1)***	**Sample Date:**	**[dd-mmm-yy]**	Not Applicable
			(Strike 2)	**Sample Time:**	**[hh:mm]**	Not Applicable
				Sample Method:		Not Applicable
				Sample Depth:	**[m brl]**	Not Applicable

Comments

Note/s:

[1] Not measured / recorded
[2] Geological Map Series (1:250,000)
[3] Closed / damaged system
[4] No infromation available / made available to GCS
[5] Calculation (GCS)
[6] Borehole not sampled
[7] Dynamic Water Level

Additional Note/s:

Borehole Bok BH3 previously had a submersible pump installed and was utilized for domestic water supply for farm owner's house and farm village workers but this borehole is now dry.

Acronyms:

- m	-	metres
- m bgl	-	metres below ground level
- m amsl	-	metres above mean sea level
- m brl	-	metres below reference level
- L/s	-	Litres per second
- µS/m	-	micro Sieens per metre

Photo/s:

Source: GCS, 2019

Project Information:	
Project Number:	19-0993
Project:	Review and Update of Hydrogeological Investigation NOMAC- Bokpoort CSP
Hydrogeologist:	Miss C. Schmidt
Date:	November 2019

HYDROCENSUS RECORD SHEET

Bore ID: Bok BH4

Date & Time Information:					
Hydrocensus Date:	**[dd-mmm-yyyy]**	20 November 2019	**Time:**	**[hh:mm]**	14:21

Coordinates Infromation:			Owner Infromation:	
Coordinates System:			**Owner:**	Chris Honiball
- Projection:		Geographic	**Contact Number/Email:**	082 372 3467
- Datum:		WGS87	**Village/Farm Name:**	Farm Bokpoort 390
Coordinates:				
- Easting/Latitude:	**[m]/[DD]**	-28.713340	**Geological Information:**	
- Northing/Longitude:	**[m]/[DD]**	22.001860	Unknown (1)	
- Elevation:	**[m amsl]**	953		
Survey Method:		GPS-Handheld		

Bore/Spring Construction Information:			Bore/Spring Status & Equipment:		
Bore Installation Date	**[mmmm-yyyy]**	Unknown (1)	**Status:**		Not Equipped
Bore Depth:	**[m]**	Not Applicable	**Water Application:**		
Collar Height:	**[m]**	0.15	**- Primary**		None
Reference Level Height:	**[m]**	Not Applicable	**- Other**		
Casing Diameter (ID)	**[m]**	Not Applicable	**- Domestic**		
Screen/Perforated Casinig Length:	**[m]**	Not Applicable	**- Stock Watering**		
Casing Type:		Not Applicable	**- Irrigation**		
			- Other		
			Equipment:		Not Applicable
			Equipment Status:		Not Applicable
			Abstraction Rate:	**[L/s]**	Not Applicable
			Pump Inlet:	**[m]**	Not Applicable

Hydrogeological Information:				Field Physio-Chemical Information:		
Static Water Level:	**[m brl]**	38.4		**pH:**	**[pH Unit]**	Not Applicable
Aquifer Type:		Not Applicable		**Electrical Conductivity:**	**[µS/cm]**	Not Applicable
				Temperature:	**[°C]**	Not Applicable
Water Strike Depth:	**[m bgl]**	Not Applicable	***(Strike 1)***			
			(Strike 2)	**Sample Information:**		
Accumulative Yield:	**[L/s]**	Not Applicable	***(Strike 1)***	**Sample Date:**	**[dd-mmm-yy]**	Not Applicable
			(Strike 2)	**Sample Time:**	**[hh:mm]**	Not Applicable
				Sample Method:		Not Applicable
				Sample Depth:	**[m brl]**	Not Applicable

Comments

Note/s:

[1] Not measured / recorded
[2] Geological Map Series (1:250,000)
[3] Closed / damaged system
[4] No infromation available / made available to GCS
[5] Calculation (GCS)
[6] Borehole not sampled
[7] Dynamic Water Level

Additional Note/s:

Acronyms:

- m	-	metres
- m bgl	-	metres below ground level
- m amsl	-	metres above mean sea level
- m brl	-	metres below reference level
- L/s	-	Litres per second
- µS/m	-	micro Sieens per metre

Photo/s:

Source: GCS, 2019

Project Information:	
Project Number:	19-0993
Project:	Review and Update of Hydrogeological Investigation NOMAC- Bokpoort CSP
Hydrogeologist:	Miss C. Schmidt
Date:	November 2019

HYDROCENSUS RECORD SHEET

Bore ID: Bok BH5

Date & Time Information:					
Hydrocensus Date:	**[dd-mmm-yyyy]**	20 November 2019	**Time:**	**[hh:mm]**	14:29

Coordinates Infromation:			Owner Infromation:	
Coordinates System:			**Owner:**	Chris Honiball
- Projection:		Geographic	**Contact Number/Email:**	082 372 3467
- Datum:		WGS88	**Village/Farm Name:**	Farm Bokpoort 390
Coordinates:				
- Easting/Latitude:	**[m]/[DD]**	-28.710840	**Geological Information:**	
- Northing/Longitude:	**[m]/[DD]**	21.999890	Unknown (1)	
- Elevation:	**[m amsl]**	958		
Survey Method:		GPS-Handheld		

Bore/Spring Construction Information:			Bore/Spring Status & Equipment:		
Bore Installation Date	**[mmmm-yyyy]**	Unknown (1)	**Status:**		Operational
Bore Depth:	**[m]**	Not Applicable	**Water Application:**		
Collar Height:	**[m]**	Not Applicable	**- Primary**		Stock Watering (Small Scale)
Reference Level Height:	**[m]**	Not Applicable	**- Other**		
Casing Diameter (ID)	**[m]**	Not Applicable	**- Domestic**		
Screen/Perforated Casinig Length:	**[m]**	Not Applicable	**- Stock Watering**		Yes (Small Scale)
Casing Type:		Not Applicable	**- Irrigation**		
			- Other		
			Equipment:		Yes
			Equipment Status:		Windmill
			Abstraction Rate:	**[L/s]**	Unknown (1)
			Pump Inlet:	**[m]**	Unknown (1)

Hydrogeological Information:				Field Physio-Chemical Information:		
Static Water Level:	**[m brl]**	Unknown (1)		**pH:**	**[pH Unit]**	7.06
Aquifer Type:		Not Applicable		**Electrical Conductivity:**	**[µS/cm]**	2080
				Temperature:	**[°C]**	23.02
Water Strike Depth:	**[m bgl]**	Not Applicable	***(Strike 1)***			
			(Strike 2)	**Sample Information:**		
Accumulative Yield:	**[L/s]**	Not Applicable	***(Strike 1)***	**Sample Date:**	**[dd-mmm-yy]**	Wednesday, 20 November 2019
			(Strike 2)	**Sample Time:**	**[hh:mm]**	14:29
				Sample Method:		Grab sample
				Sample Depth:	**[m brl]**	Not Applicable

Comments

Note/s:

[1] Not measured / recorded
[2] Geological Map Series (1:250,000)
[3] Closed / damaged system
[4] No infromation available / made available to GCS
[5] Calculation (GCS)
[6] Borehole not sampled
[7] Dynamic Water Level

Additional Note/s:

Acronyms:

- m	-	metres
- m bgl	-	metres below ground level
- m amsl	-	metres above mean sea level
- m brl	-	metres below reference level
- L/s	-	Litres per second
- µS/m	-	micro Sieens per metre

Photo/s:

Source: GCS, 2019

Project Information:	
Project Number:	19-0993
Project:	Review and Update of Hydrogeological Investigation NOMAC- Bokpoort CSP
Hydrogeologist:	Miss C. Schmidt
Date:	November 2019

HYDROCENSUS RECORD SHEET

Bore ID: Bok BH6

Date & Time Information:					
Hydrocensus Date:	**[dd-mmm-yyyy]**	20 November 2019	**Time:**	**[hh:mm]**	15:35

Coordinates Infromation:			Owner Infromation:	
Coordinates System:			**Owner:**	Chris Honiball
- Projection:		Geographic	**Contact Number/Email:**	082 372 3467
- Datum:		WGS89	**Village/Farm Name:**	Farm Bokpoort 390
Coordinates:				
- Easting/Latitude:	**[m]/[DD]**	-28.769240	**Geological Information:**	
- Northing/Longitude:	**[m]/[DD]**	21.937390	Unknown (1)	
- Elevation:	**[m amsl]**	890		
Survey Method:		GPS-Handheld		

Bore/Spring Construction Information:			Bore/Spring Status & Equipment:		
Bore Installation Date	**[mmmm-yyyy]**	Unknown (1)	**Status:**		Not Operational
Bore Depth:	**[m]**	Not Applicable	**Water Application:**		
Collar Height:	**[m]**	Not Applicable	**- Primary**		-
Reference Level Height:	**[m]**	Not Applicable	**- Other**		
Casing Diameter (ID)	**[m]**	Not Applicable	**- Domestic**		
Screen/Perforated Casinig Length:	**[m]**	Not Applicable	**- Stock Watering**		
Casing Type:		Not Applicable	**- Irrigation**		
			- Other		
			Equipment:		Not Applicable
			Equipment Status:		Not Applicable
			Abstraction Rate:	**[L/s]**	Not Applicable
			Pump Inlet:	**[m]**	Not Applicable

Hydrogeological Information:				Field Physio-Chemical Information:		
Static Water Level:	**[m brl]**	DRY		**pH:**	**[pH Unit]**	Not Applicable
Aquifer Type:		Not Applicable		**Electrical Conductivity:**	**[µS/cm]**	Not Applicable
				Temperature:	**[°C]**	Not Applicable
Water Strike Depth:	**[m bgl]**	Not Applicable	***(Strike 1)***			
			(Strike 2)	**Sample Information:**		
Accumulative Yield:	**[L/s]**	Not Applicable	***(Strike 1)***	**Sample Date:**	**[dd-mmm-yy]**	Not Applicable
			(Strike 2)	**Sample Time:**	**[hh:mm]**	Not Applicable
				Sample Method:		Not Applicable
				Sample Depth:	**[m brl]**	Not Applicable

Comments

Note/s:

[1] Not measured / recorded
[2] Geological Map Series (1:250,000)
[3] Closed / damaged system
[4] No infromation available / made available to GCS
[5] Calculation (GCS)
[6] Borehole not sampled
[7] Dynamic Water Level

Additional Note/s:

Bok BH6 previously had a windmill installed and was utilized for livestock watering but this borehole is now dry.

Acronyms:

- m	-	metres
- m bgl	-	metres below ground level
- m amsl	-	metres above mean sea level
- m brl	-	metres below reference level
- L/s	-	Litres per second
- µS/m	-	micro Sieens per metre

Photo/s:

Source: GCS, 2019

Project Information:	
Project Number:	19-0993
Project:	Review and Update of Hydrogeological Investigation NOMAC- Bokpoort CSP
Hydrogeologist:	Miss C. Schmidt
Date:	November 2019

APPENDIX B: LABORATORY CERTIFICATES

aquatico Laboratories (Pty). Ltd.

ilac-MRA sanas Testing Laboratory T0685

Test Report

Client: Groundwater Consulting Services
Address: 63 Wessel Road, Woodmead, 2191
Report no: 78213
Project: GCS

Date of certificate: 27 November 2019
Date accepted: 22 November 2019
Date completed: 27 November 2019
Date received: 22 November 2019

Lab no:				63816	63817	63818
Date sampled:				20-Nov-19	20-Nov-19	20-Nov-19
Aquatico sampled:				No	No	No
Sample type:				Water	Water	Water
Locality description:				Bok BH1	Bok BH2	Bok BH5
Analyses		**Unit**	**Method**			
A	pH @ 25°C	pH	ALM 20	7.93	7.81	7.25
A	Electrical conductivity (EC) @ 25°C	mS/m	ALM 20	105	67.3	211
A	Total dissolved solids (TDS)	mg/l	ALM 26	586	351	1373
A	Total alkalinity	mg CaCO3/l	ALM 01	321	244	440
A	Chloride (Cl)	mg/l	ALM 02	98.8	82.6	342
A	Sulphate (SO_4)	mg/l	ALM 03	98.8	0.201	124
A	Nitrate (NO_3) as N	mg/l	ALM 06	0.261	<0.194	37.0
A	Nitrite (NO_2) as N	mg/l	ALM 07	<0.065	<0.065	<0.065
A	Ammonium (NH_4) as N	mg/l	ALM 05	3.75	4.55	0.018
N	Ammonia (NH_3) as N	mg/l	ALM 26	0.115	0.111	<0.005
A	Fluoride (F)	mg/l	ALM 08	0.737	0.389	0.786
A	Calcium (Ca)	mg/l	ALM 30	45.9	16.8	144
A	Magnesium (Mg)	mg/l	ALM 30	75.0	38.9	116
A	Sodium (Na)	mg/l	ALM 30	50.9	46.7	106
A	Potassium (K)	mg/l	ALM 30	8.28	8.37	12.3
A	Aluminium (Al)	mg/l	ALM 31	<0.002	<0.002	<0.002
A	Iron (Fe)	mg/l	ALM 31	<0.004	<0.004	<0.004
A	Manganese (Mn)	mg/l	ALM 31	0.125	0.195	0.004
A	Total Chromium (Cr)	mg/l	ALMT 31	<0.010	<0.010	0.149
A	Cadmium (Cd)	mg/l	ALM 31	<0.002	<0.002	<0.002
A	Lead (Pb)	mg/l	ALM 31	<0.004	<0.004	<0.004
A	Turbidity	NTU	ALM 21	28.6	59.1	1850
A	Total hardness	mg CaCO3/l	ALM 26	424	202	836
A	Total suspended solids (TSS)	mg/l	ALM 25	17	34	890
N	Mercury (Hg)	mg/l	ALM 34	<0.004	<0.004	<0.004
A	Boron (B)	mg/l	ALM 33	0.061	0.105	0.234
N	Temperature	°C	ALM 20	20.3	20.3	22.6
A	HNO3-Microwave digestion	mg/l	ALMT 30	Yes	Yes	Yes

A = Accredited N = Non accredited Out = Outsourced Sub = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; The results relates only to the test item tested; Results reported against the limit of detection; Results marked 'Non SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory; Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation; The report shall not be reproduced except in full without approval of the laboratory
The results apply to the sample received.

M. Swanepoel
Technical Signatory

Appendix B3: Surface Water (Hydrology)

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Our Reference 19-0993-Review of Surface Water Investigation- Bokpoort II

Your Reference GCS- Review of Surface Water Investigation- Bokpoort II

Memo

To:	Royal HaskoningDHV
Attention:	Malcolm Roods
CC:	Seshni Govender, Prashika Reddy & Bongi Mdodana
Subject:	Review of Surface Water Investigation- Bokpoort II
From:	Chantelle Schmidt & Robert Verger
Date:	07/02/2020

ATTENTION: MALCOLM ROODS

REVIEW OF SURFACE WATER INVESTIGATION- BOKPOORT CSP

GCS (Pty) Ltd was appointed by Royal HaskoningDHV on behalf of ACWA Power Energy Africa (Pty) Ltd (ACWA Power) to conduct an review of the three (3) reports, compiled by Golder Associates Africa (Pty) Ltd (Golder), which form part of the environmental impact assessment (EIA) reports for the proposed Bokpoort II solar developments. The Bokpoort II: 2000MW PV Solar Power Development (the site) is located on the north-eastern portion of the remaining extent of the Farm Bokpoort 390, which is 20 km north-west of the town of Groblershoop within the Northern Cape Province. 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.

A strategic decision was put forward to convert the current site (which comprises of an authorised concentrated solar power (CSP) and two (2) Photovoltaic (PV) plants) into the development of ten (10) PV developments (eight (8) new PV plants and two (2) authorised PV plants) with shared infrastructure. The MW capacity of each PV Plant will be 200MW per site. A Battery Energy Storage System (BESS) will be included on all ten (10) PV sites.

This memorandum report will include a review of the provisions of the specialist studies conducted by Golder.

Previous EIA Reports

GCS was provided with three (3) reports, compiled by Golder, which form part of the environmental impact assessment (EIA) reports for the proposed Bokpoort II solar developments. These reports included:

- Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 1 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape;
- Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 2 Solar Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape; and
- Surface Water Baseline and Impact Assessment Report for the Proposed 150 MW CSP Tower Facility (Proposed Bokpoort II Solar Development) near Groblershoop, Northern Cape.

Updated Surface Water Impact Assessment

Following the review of the three (3) above mentioned reports, it was found that the surface water impact assessment tables for the proposed 75 MW PV 1 Solar Facility, proposed 75 MW PV 2 Solar Facility and proposed 150 MW CSP Tower Facility are identical. These surface water impact assessments were also corrected after an external review was performed by Mr Bruce Randell (Ilanda Water Services cc).

Following the strategic decision to develop ten (10) PV plants each with a MW capacity of 200MW and BESS on each site the impact assessments needed to be reviewed and updated. At the time when the impact assessments were undertaken by Golder no provision was made for the inclusion of the BESS. Based on the inclusion of the BESS the following comments are made following the review of the two (2) above mentioned reports:

- The impact assessment (Table 9: Impact assessment during construction, operation and at closure) needs to make specific mention of the BESS as an aspect and as a potential impact during the operational phase; and
- The impact/ risk assessment formula will also have to be updated as the BESS combined site storage within batteries on each PV site will be 4500 m^3 of hazardous substance.
- Table 1 is the recommended amendment to be included in the impact assessment table.

Table 1: Amendment to impact assessment during construction, operation and at closure.

Aspect	Potential Impact	Extent	Duration	Intensity	Probability	Impact	Notes
OPERATIONAL PHASE							
Water quality impacts due to chemical spills/ equipment use	Spillage of fuels, lubricants and other chemicals from the BESS.	2	1	2	2	10- High Impact	It is expected that without mitigation a high negative impact can be expected. Mitigation will include: - Clean-up of spills as soon as they occur; - Maintenance of the abstraction pumps to prevent spills; -Maintenance of the BESS to ensure optimal functionality and prevent fire risks; -Maintenance and quality control of firefighting equipment and systems; and - Mitigations for spillage or leakages will include bunded areas to store chemicals and/or fuel, containerisation of the BESS and cleaning up spills as soon as they occur. The significance of the impact after mitigation is likely to decrease to a medium negative impact.

An additional alteration noted is the slight change in water demand which will be affected positively with the total demand changing to 0.22 million cubic metres per annum (Mm^3/a) (10 x 0.022 Mm^3/a) for the 10 PV solar facilities instead of the 0.3 Mm^3/a (0.25 + 2 x 0.025 Mm^3/a) for the CSP and two (2) PV solar facilities.

Please feel free to contact us if you have any questions or comments.

Yours sincerely,

Chantelle Schmidt
Hydrogeologist

Robert Verger
Senior Water Resource Specialist

Appendix B4: Surface Water (Wetlands)

Royal HaskoningDHV
Enhancing Society Together

REPORT

Surface Water Report for the Development of 8 New PV Plants and Amendment of 2 PV Developments on the Farm Bokpoort, Northern Cape

Client: ACWA Power

Reference: MD4195-RHD-RP-0001-RP-0001
Status: S0/P01.01
Date: 1/30/2020

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Document title:	Surface Water Report for the Development of 8 New PV Plants and Amendment of 2 PV Developments on the Farm Bokpoort, Northern Cape
Document short title:	Bokpoort 2 Surface Water
Reference:	MD4195-RHD-RP-0001-RP-0001
Status:	P01.01/S0
Date:	1/30/2020
Project name:	Basic Assessment for the Proposed Eight New PV Developments and Amendment of 2 PV Developments on the Farm Bokpoort, Northern Cape
Project number:	MD4195
Author(s):	Paul da Cruz

Drafted by:	Paul da Cruz
Checked by:	
Date / initials:	
Approved by:	
Date / initials:	

Classification
Project related

Disclaimer

Royal HaskoningDHV

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Executive Summary

Royal HaskoningDHV (RHDHV) has been appointed by ACWA Power to undertake Basic Assessment Studies for the development of eight (8) new Photovoltaic (PV) Solar Power Plants, on the Farm Bokpoort 390 located to the north of the town of Groblershoop in the Northern Cape Province. ACWA Power previously received Environmental Authorisation for the proposed development of PV and Concentrated Solar Power (CSP) Solar Plants on the Farm Bokpoort 390. ACWA Power wishes to change the CSP component of the proposed development to 8 PV facilities. Previously, approval for 2 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.

This study considers the surface water (freshwater) environment on the site of the proposed development, and whether the proposed development will exert an impact on surface water features. 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.

A 2000 Megawatt (MW) Photovoltaic (PV) Solar Development is proposed in total over the area. The proposed PV solar facility will cover 150 ha each. The proposed development will each consist of 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 includes:

- Mounting structures for the solar panels will be either rammed steel piles (preferred solution in terms of piles with pre-manufactured concrete footings to support the PV 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.;
- One water pipeline connection from the river (previously authorised) and different metering points at individual PV plants;
- 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).

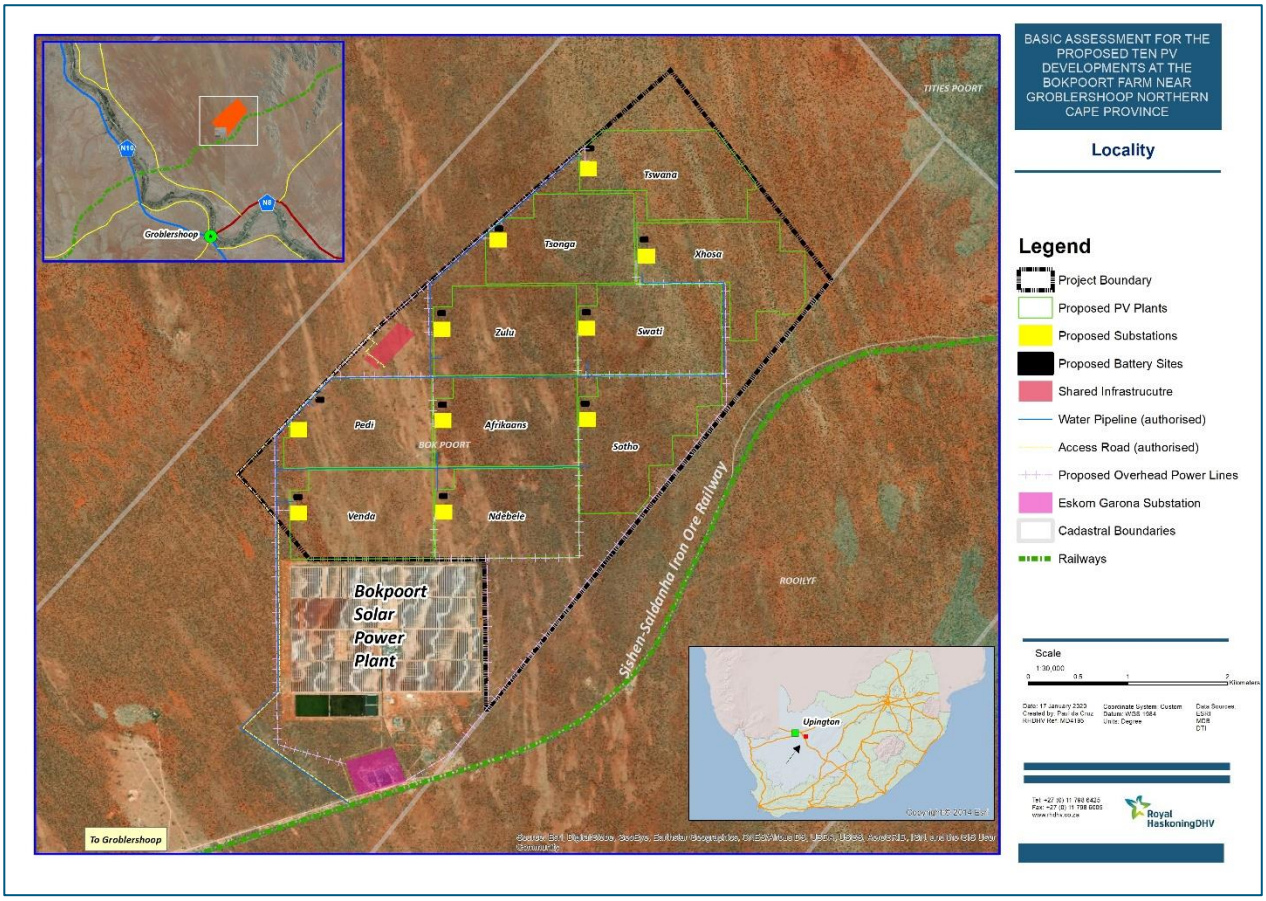

Figure i – Locality

The study area is located in a semi-arid climatic zone (semi-desert), being located on the boundary between the Great Karoo and the Kalahari semi-desert and receives a mean annual rainfall figure of approximately 215mm.

The entire development site is underlain by siliciclastic rocks of the Kalahari Group, with notable surface outcropping of calcrete. The terrain changes from the incised and more steeply-sloping terrain closer to the Orange River valley to much flatter terrain as one moves away from the river. Topographically the site can be divided into two main units – calcrete gravel plains that dominate the southern / south-western half of the site, and sandy flats that grade to Duneveld that characterise the northern-most part of the site. The Duneveld is comprised of sand of wind-blown (aeolian) origin. In the far north-eastern part of the site a number of parallel-running longitudinal dunes that are aligned in a north-south orientation are encountered. The site rises in altitude as one moves north-eastwards (i.e. away from the Orange River Valley).

Although not located near to the development site, areas characterised by a higher lying relief and rockier substrates occur to the south-west of the development site, as well as to the east and north-east. These areas are comprised of more resistant strata of the Brulpan Group, with the area to the south-west being comprised of schists, subordinate quartzite and metalava (greenstones) of the Groblershoop Formation and the areas to the east and north-east comprising of Muscovite quartzite and schist of the Prynsberg Formation. The absence of this geology on the site is very important from a surface water perspective as surface water features are largely absent from the Kalahari Group lithologies and associated landforms, whereas the more incised topography of the Brulpan Group typically contains surface drainage features.

The development site is located within the primary catchment of the Orange (Gariep) River, the largest river in a South African Context. The site is thus located in the Orange River Water Management Area (WMA).

The site is located within the D73D quarternary catchment. This catchment is comprised of a reach of the lower Orange River from Kheis (near Groblershoop) at its upstream end to Lambrechtsdrift (located between Groblershoop and Upington) at its downstream end, as well as a number of ephemeral / episodic watercourses that form tributaries of the Orange. The DHSWS WRiall500 rivers database shows no significant drainage in the vicinity of the development site, with only one watercourse to the east of the Orange River.

When the study area context drainage context is examined, a large-scale absence of drainage features in parts of the wider study area is present. Apart from the Orange which is a large regional river, drainage is largely limited to the wider Orange River valley, especially in the areas to the north and east of the river (in which the study area is located). Drainage only occurs within an area of about 4.5km of the river channel, an area which is largely characterised by rugged, incised topography, Beyond this corridor *no or very limited drainage occurs.* Limited surface water drainage occurs in areas characterised by higher-lying, rockier terrain, such as the mountainous terrain (Skurweberg Hills) located to the east and north-east of the site.

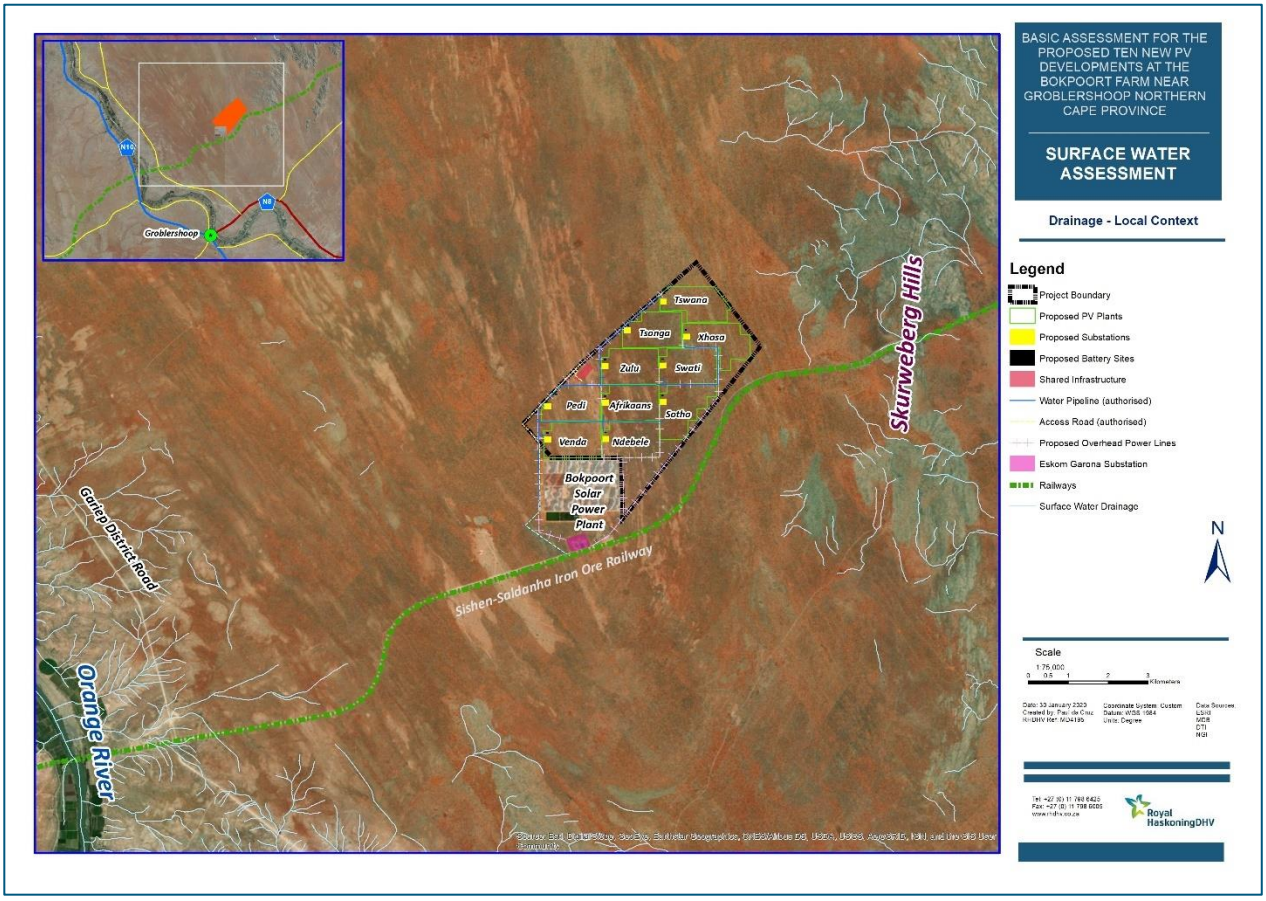

Figure ii – Local Drainage Context

The 1:50,000 scale topo-cadastral maps indicate that there are no drainage or surface water features on the development site. A site visit confirmed that no surface water features are located on the site of the proposed development. Of the two primary landforms located on the development site, the calcrete gravel

plains are extremely flat, with no linear surface water drainage features present. Pans can occur in such very flat terrain where no linear drainage occurs, but there are no pans that occur on the site.

The topography of most remainder of the site, in particular the central parts of the site is similarly very flat, but with a different substrate in the form of red aeolian sands. There is similarly no linear drainage in this part of the site and no pan occurrence.

The Duneveld that occurs in the far north-eastern quarter of the site is comprised of low, parallel-aligned dunes, with intervening flat areas of sandy substrate covered in a grassy vegetation cover. No surface water drainage was observed in this Duneveld, in spite of the site becoming more sloping, with an increase in altitude to the north-east. The combination of a highly permeable substrate (sandy material) and the presence of parallel-aligned dunes that run roughly perpendicular to the direction of the slope prevents the development of surface drainage features that would under other circumstances be aligned south-westwards in the direction of the slope.

The closest surface water features to the development site are located 900m-1km to the east and north-east of the development site's north-eastern boundary where the underlying geology changes and a concomitant change in topography from Duneveld to rocky hills is encountered. In this area, the presence of these watercourses is due to the sloping terrain of the ridge hillslopes which naturally promote surface water flows and accompanying incision. It is important to note that the courses of these watercourses are short, as they drain into the Duneveld and dissipate as they reach the Duneveld topography that lies adjacent to the hilly terrain.

To the south-west of the development site the closest surface water features are located just over 7km distant, being located where the rugged, incised topography that occurs closer to the Orange River valley is first encountered.

The absence of any surface water features on the development site entails that no surface water impacts will result due to the proposed development. The closest surface water features are located within a sufficient distance from the site that to ensure that the likelihood of the development impacting these features is very limited. In addition these features are not downstream or downslope of the site, thus making it even less likely that these could be impacted by the proposed development.

Accordingly no legislative process for the authorisation of the proposed development in terms of Section 21 c) & i) of the National Water Act will be required.

In spite of the absence of surface water features on the site, stormwater and pollution controls must be implemented on the development site, in order to ensure that uncontrolled stormwater flows do not cause erosion of the underlying substrate.

Acronyms

Acronym	Acronym description
CBA	Critical Biodiversity Area
CSP	Concentrated Solar Power
DHSWS	Department of Water and Sanitation
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
FSA	Fish Support Area
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act 36 of 1998
PV	Photovoltaic
RHDHV	Royal HaskoningDHV
WUA	Water Use Authorisation

Glossary

Glossary Term	Glossary Text
Aeolian	Wind-borne – i.e. referring to wind-borne and deposited materials, and erosion caused by wind
Alluvial Material / Deposits	Sedimentary deposits resulting from the action of rivers, including those deposited within river channels, floodplains, etc.
Calcrete	A type of rock cemented together by calcareous material, formed in soils in semi-arid conditions
Ephemeral	A river or watercourse that only flows at the surface periodically, especially those drainage systems that are only fed by overland flow (runoff).
Episodic	Relating to rivers and watercourses typically located within arid or semi-arid environments that only carry flow in response to isolated rainfall events
Semi-arid	A description of a climatic zone that is not sufficiently dry to be termed arid (arid climates are typically defined as having annual rainfall less than 250mm/year), but which is characterised by very low annual rainfall. Under the Köppen climate classification semi-arid climates are termed at steppe climates – being intermediate between desert climates and humid climates in ecological characteristics and agricultural potential.
Semi-desert	The transition zone between true desert and more mesic (moist) climatic areas, generally receiving annual rainfall in a range between 250 - 500mm/year. In terms of the Köppen climate classification, semi-desert climatic zones are intermediate between the desert climates and humid climates in ecological characteristics and agricultural potential.

Specialist Declaration

I, **Paul da Cruz**, declare that I –

- act as a specialist consultant in the field of Surface Water assessment
- 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 Environmental Impact Assessment Regulations, 2014 (as amended in 2017);
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2014 (as amended in 2017); and
- will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

PAUL DA CRUZ

1 Introduction

Royal HaskoningDHV (RHDHV) has been appointed by ACWA Power to undertake Basic Assessment Studies for the development of eight (8) new Photovoltaic (PV) Solar Power Plants on the Farm Bokpoort 390 located to the north of the town of Groblershoop in the Northern Cape Province. ACWA Power previously received Environmental Authorisation (EA) for the proposed development of PV and Concentrated Solar Power (CSP) Solar Plants on the Farm Bokpoort 390. As part of the suite of specialist studies associated with the original application, Golder compiled a Surface Water Baseline and Impact Assessment Report. This report characterised the surface water environment in the study area and this report is an update of that report. ACWA Power wishes to change the CSP component of the proposed development to PV. Previously, approval for 2 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.

This study considers the surface water (freshwater) environment on the site of the proposed development, and whether the proposed development will exert an impact on surface water features. 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.

A 2000 Megawatt (MW) Photovoltaic (PV) Solar Development is proposed. The proposed PV solar facility will cover 150 ha. The proposed development will consist of 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 includes:

- Mounting structures for the solar panels will be either rammed steel piles (preferred solution in terms of piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the structures, to be lain underground where practical;
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- One water pipeline connection from the river (previously authorised) and different metering points at individual PV plants;

- 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).

1.1 Aims of the Study

The aims of the study are to:

- Identify any surface water features on the development site and in its immediate vicinity;
- Map boundaries of such surface water (freshwater) features within the area of assessment, if such features are found to occur on the site; and
- Identify the likely impacts of the proposed development on surface water (freshwater) features.

1.1.1 Project (Study Area) Location and Description

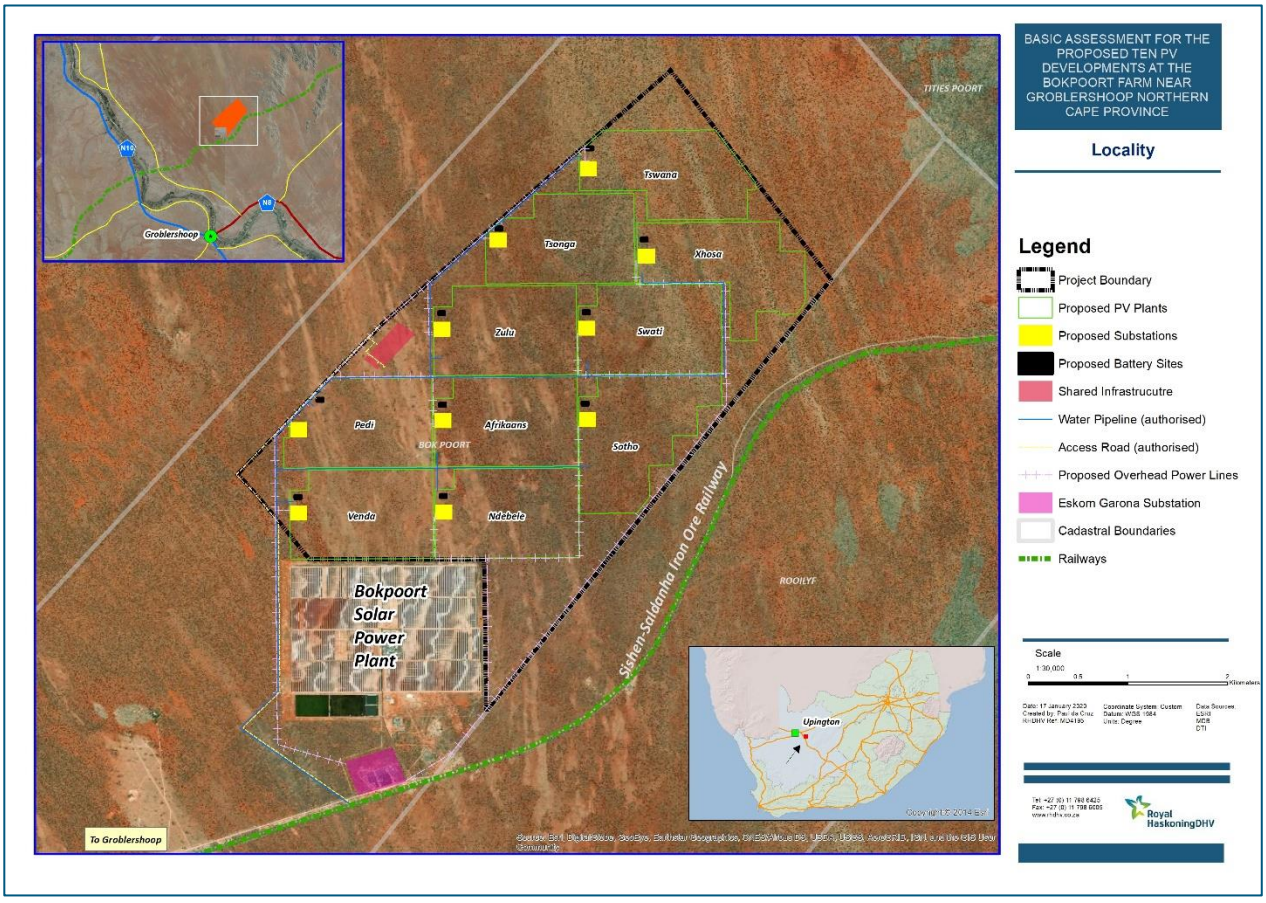

Figure 1 – Locality Map

1.2 Assumptions and Limitations

This report has not assessed the potential impact of abstraction on the Orange (Gariep) River, or the construction of a water pipeline from the Orange River to the proposed development as it is understood that that abstraction and development of a water pipeline were previously authorised. This aspect of the original environmental studies (conducted in 2016) was covered in the report undertaken by Golder (Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 1 Solar Facility, 2016). The report considered the water demand requirements of the proposed development in the context of the proposed abstraction of water from the Orange River.

This report does not consider stormwater generation and impacts. It is assumed that the Golder Surface Water Baseline and Impact Assessment Report for the Proposed 75 MW PV 1 Solar Facility, 2016 adequately covers this aspect of the proposed development.

1.3 Definition of Surface Water (Freshwater) Features

In the context of the identification, delineation and assessment of surface water features on the study site, it is important to detail the definition of surface water features to set the parameters for the investigation.

1.3.1 Surface Water / Freshwater Features

To set out a framework in which to assess surface water features, it is useful to set out what this report defines as surface water / freshwater resources. In this context, the National Water Act (Act 36 of 1998) (NWA) is used as a guideline. The NWA includes a number of features under the definition of water resources, i.e. watercourses, surface waters, estuaries and aquifers. The latter two features do not apply in the context of this study as this report does not consider groundwater (in the case of aquifers) and estuaries are coastal features, thus surface waters and water courses are applicable in this context. The Act defines a watercourse as (*inter alia*):

- a river or spring;
- a natural channel in which water flows regularly or intermittently;
- a wetland, lake or dam into which, or from which, water flows.

The definition of a water course as used in the Act is taken to describe surface water / freshwater features in this report.

It is important to note that the Act makes it clear that reference to a watercourse includes, where relevant, ***its bed and banks***.

It should be noted that due to the aridity of the study area which is located in a semi-desert, no wetlands or wetland habitat is likely to occur on the development site. Surface water features, if present on the development site, are likely to take the form of ephemeral or episodic water watercourses.

1.3.2 Riparian Habitat and Riparian Zones

The National Water Act defines riparian habitat as:

“the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a

frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas"

As detailed in the Department of Human Settlements, Water and Sanitation (DHSWS – formerly DWS, DWA and DWAF) 2005 guidelines for the delineation of wetlands and riparian areas, riparian areas typically perform important ecological and hydrological functions, some of which are the same as those performed by wetlands (DWAF, 2005).

Riparian areas include plant communities adjacent to and affected by surface and underground water features such as rivers, streams, lakes, or watercourses. It is important to note that these areas may be a few metres wide along smaller systems or more than a kilometre in floodplains. Both perennial and non-perennial streams support riparian vegetation (DWAF, 2005).

Because riparian areas represent the interface between aquatic and upland ecosystems, the vegetation in the riparian area may have characteristics of both aquatic and upland habitats. Many of the plants in the riparian area require large volumes of water (moisture) and are adapted to shallow water table conditions. Due to water availability and rich alluvial soils, riparian areas are usually very productive. Tree growth rate is high. This is certainly the case in riparian zones in the arid western interior of South Africa, as they typically contain trees and shrubs of a height, density and species diversity that is not present in the surrounding terrestrial habitats.

Riparian areas are important as they perform the following functions (DWAF, 2005):

- Storing water and thus assisting to reduce floods;
- Stabilising stream banks;
- Improving water quality by trapping sediment and nutrients;
- Maintaining natural water temperature for aquatic species;
- Providing shelter and food for birds and other animals;
- Providing corridors for movement and migration of different species;
- Acting as a buffer between aquatic ecosystems and adjacent land uses;
- Can be used as recreational sites; and
- Providing material for building, muti, crafts and curios.

These ecosystems may be considered 'critical transition zones' as they process substantial fluxes of materials from closely connected adjacent ecosystems (Ewel *et al*, 2001).

As discussed below riparian habitat is important from a legislative perspective – in terms of the National Water Act.

2 Legislative Context

The following section briefly examines the legislation that is relevant to the scope of the surface water assessment. The stipulations / contents of the legislation and policy that is relevant to the study are explored.

2.1 The National Water Act (Act 36 of 1998)

It is important to note that water resources are protected under the NWA. 'Protection' of a water resource, as defined in the Act entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource; and
- The rehabilitation of the water resource.

In the context of the current study and the identification of potential threats to the surface water features potentially posed by the proposed development, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia)-

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

The inclusion of physical properties of a water resource within the definition of pollution entails that any physical alterations to a water body, for example the excavation of a wetland or changes to the morphology of a water body can be considered as pollution. Activities which cause alteration of the biological properties of a watercourse, i.e. the fauna and flora contained within that watercourse are also considered pollution.

In terms of Section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include measures to (inter alia):

- cease, modify, or control any act or process causing the pollution;
- comply with any prescribed waste standard or management practice;
- contain or prevent the movement of pollutants;
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse.

These general stipulations of the Act have ramifications for the proposed development as impacts on freshwater features associated with the proposed development would be relevant in terms of the above stipulations of the NWA.

2.1.1 The National Water Act and Riparian Areas

Riparian habitat is afforded protection under the National Water Act in a number of ways. Firstly reference in the National Water Act to a watercourse includes its banks, on which riparian habitat is encountered. Riparian areas are thus afforded the same degree of protection as the rivers and channels alongside which they occur.

Riparian habitat is also important in the context of resource quality objectives that are a critical part of the Act. In terms of section 13(1) of the Act resource quality objectives must be determined for every significant water resource and are central part of data type specifications relating to national monitoring systems and national information systems as determined in section 137(2) and section 139(2) of the Act respectively. Under Section 27 of the Act resource quality objectives must be considered in the issuing of any licence or general authorisation and form a critical part of the duties of catchment management agencies. The purpose of resource quality objectives in the Act is to establish clear goals relating to the quality of the water resources. Resource quality is important in the context of riparian habitat as resource quality as defined in the Act means the quality of all aspects of a water resource and includes the character and condition of the riparian habitat. In terms of Section 26(4) of the Act, the need for the conservation and protection of riparian habitat must be considered in the determination and promulgation of regulations under the Act.

2.2 Water Use Authorisation Context – Section 21 c) & i) of the National Water Act

The General Authorisation Regulation in terms of Section 21 (c) and (i) water uses (GN509 of 2016, the General Authorisation in terms of Section 39 of the NWA for Water Uses as defined in Section 21 (c) or Section 21(i)) is applicable to a potential water use authorisation requirement for the proposed development.

Section 5 of GN509 states that the General Authorisation applies throughout the Republic of South Africa to the use of water in terms of section 21(c) or (i) of the Act ***within the regulated area of a watercourse***, as defined in the General Authorisation.

The Regulated Area of a watercourse as defined by of GN509 is:
(a) The outer edge of the 1 in 100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
(b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or
(c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

As there are no surface water features located on the site, or within 100m of the site (refer to Section 5), ***the site does not fall within the regulated area of a watercourse.*** Accordingly the development is not subject a Water Use Authorisation as ***no Section 21(c) and (i) water use would be triggered by the proposed development.***

3 Bioregional and National Conservation Planning Context

3.1 National Freshwater Ecosystem Priority Area (NFEPA) Database

The National Freshwater Ecosystem Priority Areas (NFEPA) Database has been analysed in order to determine whether any of the potentially-affected surface water resources on the development site have been classified as being nationally or regionally important.

The NFEPA database is a result of a process to develop cross-sector policy objectives for conserving South Africa's inland water biodiversity, which led to the definition of a national goal for freshwater conservation policy in South Africa: "to conserve a sample of the full diversity of species and the inland water ecosystems

in which they occur, as well as the processes which generate and maintain diversity" (Driver et al, 2011). The project provided strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs.

The NFEPA database has designated sub-quaternary catchments of importance, or priority catchments. This catchment approach is derived from a focus on sustainable development, given the current and future pressures on water resources. Protection and utilisation of natural resources need to work hand-in-hand to achieve sustainable development. In the context of water resources management, this means that catchments can be designed to support multiple levels of use, with natural rivers and wetlands that are minimally-used supporting the sustainability of hard-working rivers that often form the economic hub of the catchment. This concept is firmly embedded in the National Water Act and forms the foundation of the water resources classification system (Dollar et al. 2010). Keeping some rivers and wetlands in the catchment in a natural or good condition serves a dual purpose of conserving South Africa's freshwater biodiversity and promoting the sustainable use of water resources in the catchment.

FEPAs have been designated through the NFEPA analysis. These include River FEPAs and Wetland FEPAs. River FEPAs achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species and were identified in rivers that are currently in a good condition (A or B ecological category – i.e. in a condition / state that is natural or near-natural). Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources.

It is important to note that for River FEPAs, management of the catchment is also important; although FEPA status applies to the actual river reach within such a sub-quaternary catchment, surrounding land and smaller stream networks need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach. These are known as Phase 1 FEPA catchments.

Phase 2 River FEPAs and associated catchments have also been designated. Phase 2 FEPAs were identified in moderately modified rivers (C ecological category), only in cases where it was not possible to meet biodiversity targets for river ecosystems in rivers that were still in good condition (A or B ecological category). River condition of these Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once FEPAs in good condition (A or B ecological category) are considered fully rehabilitated and well managed.

FEPAs related to fish sanctuaries and fish support areas have also been created. These are rivers that are essential for protecting threatened and near-threatened freshwater fish species that are indigenous to South Africa and are mapped at the level of the quaternary catchment. Quaternary catchments are designated as Fish Sanctuaries or Fish Support Areas (FSAs).

No FEPA features are located on, or in the immediate vicinity of the development site. The closest surface water feature to the development site that appears on the NFEPA spatial dataset is the Orange River. The reach of the Orange River that is located to the south-west of the development site does not meet the river condition criteria for designation as a River FEPA, as it has been assigned a status of C – moderately modified. However it has been designated as a Fish Support Area and Fish Sanctuary based on the presence of the fish species *Barbus anoplus*. The river would not ordinarily be designated as a fish sanctuary due to its moderately modified condition, but it qualifies as an FSA as it has been identified as a translocation area identified for the threatened fish species. The distance of the development site from the Orange River, and the non-inclusion of any new abstraction of water from the river as part of the development entails that the Orange River would be unlikely to be affected by the proposed development.

3.2 Provincial Bioregional Context – The Northern Cape CBA Dataset

The identification of Critical Biodiversity Areas for the Northern Cape was undertaken using a Systematic Conservation Planning approach. Available data on biodiversity features (incorporating both pattern and process, and covering terrestrial and inland aquatic realms), their condition, current Protected Areas and Conservation Areas, and opportunities and constraints for effective conservation were collated. Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, national estuary priorities, and the NFEPA database were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes. Marxan analysis was used to ensure that the required representation of biodiversity features was achieved in a spatially efficient manner which avoided incompatible land uses and activities where possible. The assessment approach and map categories are designed to be compatible with the Guideline Regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans. Where possible, all targets are met in the identified set of CBAs (Holness and Oosthuysen, 2016).

The Northern Cape CBA Map identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of e landscape as a whole.

There are no CBAs or ESA designated on, or in the immediate vicinity of the development site. The closest designated CBAs are located approximately 10km to the south-west of the development site along the Orange River corridor. The closest designated ESAs are located approximately 1.4km to the east within the Skurweberg Hills.

4 Physical Environment of the Study Area

4.1 Climate

The study area is located in a semi-arid climatic zone (semi-desert), being located on the boundary between the Great Karoo and the Kalahari semi-desert and receives a mean annual rainfall figure of approximately 215mm (Source: SA Rainfall Atlas Database). There is a relatively strong seasonality in the rainfall figures, indicating that the area falls within the summer rainfall areas within the subcontinent; most of the rainfall occurs in the late summer / autumn between the months of January and April. The scarcity of rainfall and nature of precipitation also entails that rainfall events are episodic in nature, i.e. single rainfall events will contribute a relatively significant portion of rainfall.

4.2 Geology, Macro-geomorphology and Topography

The eastern bank of the Orange River located to the south-west of the development site is characterised by the presence of rocky terrain that rises from an alluvial terrace within the Orange River valley bottom that abuts the channel of the river (this terrace has been subject to intense cultivation). The Orange River corridor is underlain by alluvial sediments of recent geological origin. These sediments are only located in a narrow band along the river.

The entire development site is underlain by siliciclastic rocks of the Kalahari Group, with notable surface outcropping of calcrete. The terrain changes from the incised and more steeply-sloping terrain closer to the Orange River valley to much flatter terrain that is characterised by two prominent landforms – flat calcrete plains and sandy Duneveld. Topographically the site can be divided into two main units – calcrete gravel plains that dominate the southern / south-western half of the site, and sandy flats that grade to Duneveld that characterise the northern-most part od the site. The Duneveld occupies is comprised of sand of wind-blown (aeolian) origin. In the far north-eastern part of the site a number of parallel-running longitudinal dunes that are aligned in a north-south orientation are encountered. The site rises in altitude as one moves north-eastwards (i.e. away from the Orange River Valley).

Although not located near to the development site, areas characterised by a higher lying relief and rockier substrates occur to the south-west of the development site, as well as to the east and north-east (refer to Figure 3 – these are the 'greyer' colours on the aerial photos base as opposed to the red colours of the Kalahari sands). These areas are comprised of more resistant strata of the Brulpan Group, with the area to the south-west being comprised of schists, subordinate quartzite and metalava (greenstones) of the Groblershoop Formation and the areas to the east and north-east comprising of Muscovite quartzite and schist of the Prynsberg Formation. The absence of this geology on the site is very important from a surface water perspective as surface water features are largely absent from the Kalahari Group lithologies and associated landforms, whereas the more incised topography of the Brulpan Group typically contains surface drainage features.

As described above linear sand dunes occur in the north-eastern-most part of the development site. These dunes are comprised of aeolian material, having formed from material eroded from sedimentary deposits that was reworked into dunes during drier periods of the geological past. The dunes that occur widely over the Kalahari region that occupies much of the western interior of the sub-continent are comprised of the unconsolidated sands of the Kalahari Group that cover an area of over 2.5 million km2 (Haddon, 2005). The thickness of these unconsolidated sands varies across the basin, from a few centimetres to over 200m. The dominant landform associated with the sands is the dune fields. Sand dunes throughout the Kalahari Basin are largely stable and are generally classified as relict- or palaeo-forms as dune construction itself is not currently taking place (Haddon, 2005).

The dunes in the South African part of the Kalahari Basin are characterised by partly vegetated linear dunes of 2-15 m in height, dune widths of 150-250 m (Lancaster, 1988, 2000) and are characterised by broad, inter-dune areas which are commonly grassed (Haddon, 2005). These characteristics are present within the study area with a series of dunes aligned in parallel in a broadly northern-southern orientation located in the north-eastern part of the development site. The dunes on the site were typically observed to be relatively low in height, varying between 2-10m. The dunes are typically well-vegetated, with shrubs and grasses located on the dunes themselves and the flat intervening areas between dunes being well grassed. This Duneveld topography has important implications for the occurrence of surface water drainage on the development site as discussed in section 4.3 below.

4.3 Drainage Context

The development site is located within the primary catchment of the Orange (Gariep) River, the largest river in a South African Context. The site is thus located in the Orange River Water Management Area (WMA).

The site is located within the D73D quarternary catchment (refer to Figure 2). This catchment is comprised of a reach of the lower Orange River from Kheis (near Groblershoop) at its upstream end to Lambrechtsdrift (located between Groblershoop and Upington) at its downstream end, as well as a number of ephemeral / episodic watercourses that form tributaries of the Orange. The DHSWS WRiall500 rivers database shows

no significant drainage in the vicinity of the development site, with only one watercourse to the east of the Orange River.

When the study area context drainage context is examined, a large-scale absence of drainage features in parts of the wider study area is present (refer to Figure 2). Apart from the Orange which is a large regional river, drainage is largely limited to the wider Orange River valley, especially in the areas to the north and east of the river (in which the study area is located). Drainage only occurs within an area of about 4.5km of the river channel, an area which is largely characterised by rugged, incised topography, Beyond this corridor *no drainage occurs.* Limited surface water drainage occurs in areas characterised by higher-lying, rockier terrain, such as the mountainous terrain (Skurweberg Hills) located to the east and north-east of the site.

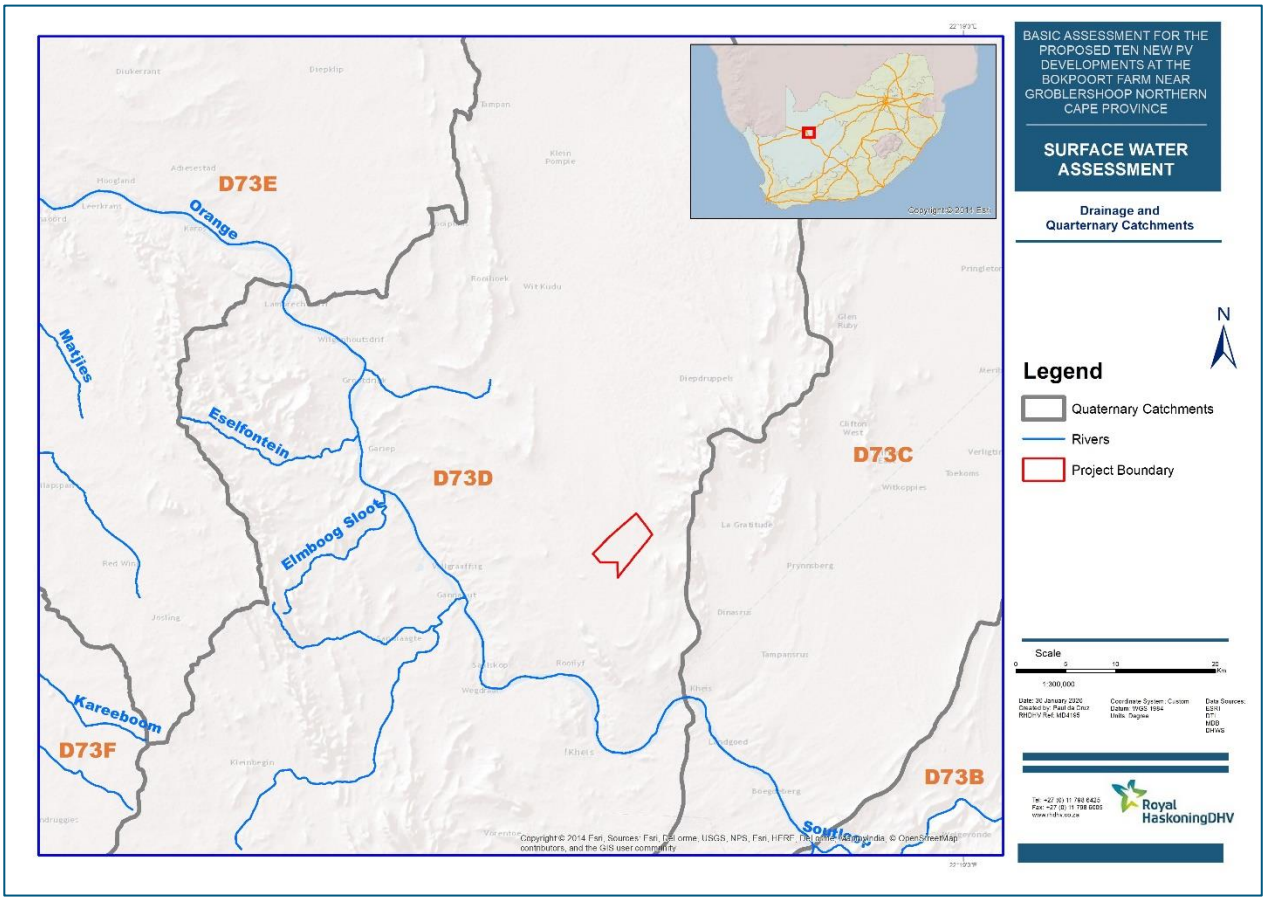

Figure 2 – Quarternary Catchment and Drainage Context

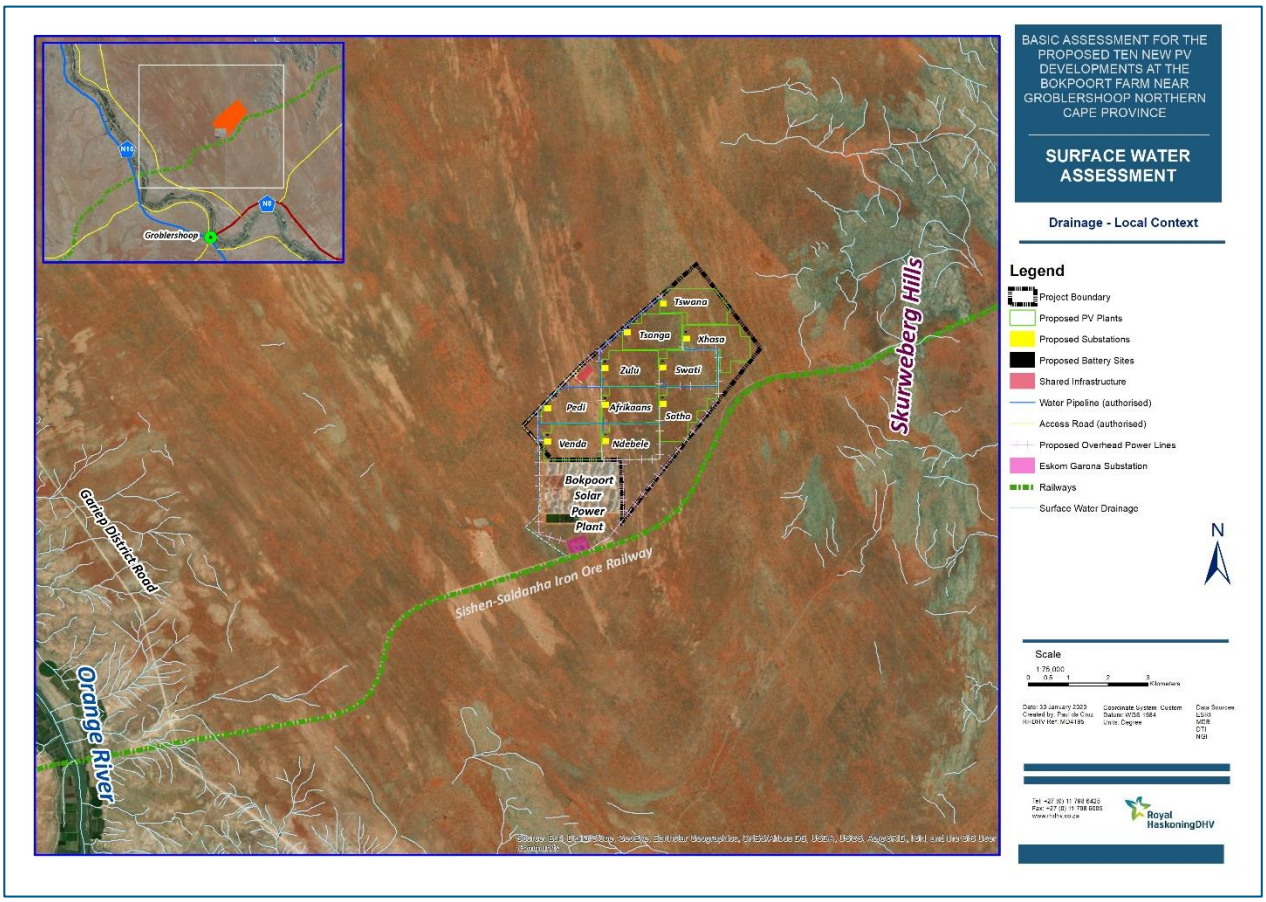

Figure 3 – Local Drainage Context

5 Surface Water Occurrence on the Development Site

The 1:50,000 scale topo-cadastral maps indicate that there are no drainage or surface water features on the development site (refer to Figure 3). A site visit was conducted to confirm this. The site was traversed as far as possible by vehicle.

The site visit confirmed that no surface water features are located on the site of the proposed development. Of the two primary landforms located on the development site, the calcrete gravel plains are extremely flat, with no linear surface water drainage features present. Pans can occur in such very flat terrain where no linear drainage occurs, but there are no pans that occur on the site.

The topography of most remainder of the site, in particular the central parts of the site is similarly very flat, but with a different substrate in the form of red aeolian sands. There is similarly no linear drainage in this part of the site and no pan (a type of wetland that can occur in flat terrain in arid settings) occurrence.

Figure 4 – An example of flat calcrete plains on the development site

The Duneveld that occurs in the far north-eastern quarter of the site is comprised of low, parallel-aligned dunes, with intervening flat areas of sandy substrate covered in a grassy vegetation cover. No surface water drainage was observed in this Duneveld, in spite of the site becoming more sloping, with an increase in altitude to the north-east. The combination of a highly permeable substrate (sandy material) and the presence of parallel-aligned dunes that run roughly perpendicular to the direction of the slope prevents the development of surface drainage features that would under other circumstances be aligned south-westwards.

Figure 5 – Duneveld terrain in the far north-eastern part of the site

The closest surface water features to the development site are located 900m-1km to the east and north-east of the development site's north-eastern boundary where the underlying geology changes and a concomitant change in topography from Duneveld to rocky hills is encountered. In this area, the presence of these watercourses is due to the sloping terrain of the ridge hillslopes which naturally promote surface water flows and accompanying incision. It is important to note that the courses of these watercourses are short, as they drain into the Duneveld and dissipate as they reach the Duneveld topography that lies adjacent to the hilly terrain.

To the south-west of the development site the closest surface water features are located just over 7km distant, being located where the rugged, incised topography that occurs closer to the Orange River valley is first encountered.

5.1 Implications for Development

The absence of any surface water features on the development site entails that no surface water impacts will result due to the proposed development. The closest surface water features are located within a sufficient distance from the site that to ensure that the likelihood of the development impacting these features is very limited. In addition these features are not downstream or downslope of the site, thus making it even less likely that these could be impacted by the proposed development.

Accordingly no legislative process for the authorisation of the proposed development in terms of Section 21 c) & i) of the National Water Act will be required.

In spite of the absence of surface water features on the site, stormwater and pollution controls must be implemented on the development site, in order to ensure that uncontrolled stormwater flows do not cause erosion of the underlying substrate.

6 Conclusion

This study has investigated the occurrence of surface water / freshwater features on the site of a proposed PV development. Due to a number of factors, primarily related to landform, terrain (topography) and underlying geology, there are no surface water features that occur on the site of the proposed development, or within its immediate vicinity. Accordingly the proposed development will not impact surface water features in any way and no legislative water use authorisation processes are required to be undertaken.

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Appendix B5: Ecology

Appendix B6: Avifauna

Appendix B7: Bats

Appendix B8: Air Quality

Appendix B9: Heritage

Appendix B10: Palaeontology

Appendix B11: Traffic

Appendix B12: Visual

Appendix B13: Socio-Economic

Appendix C: EAPs CV

Appendix D: Environmental Management Programme

Appendix E: Public Participation Report

Appendix F: EAP Oath