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ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR THE PROPOSED 1 GW UPINGTON SOLAR PARK WITHIN THE //KHARA HAIS MUNICIPALITY, NORTHERN CAPE PROVINCE

SCOPING SURFACE WATER IMPACT ASSESSMENT REPORT

Draft 1

DEA Reference Number:
14/12/16/3/3/2/588

Date:
May 2014

Report Version:
Draft

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CEF (SOC) Ltd

1 GW Upington Solar Park, Northen Cape Province, South Africa

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1 INTRODUCTION

CEF (SOC) Ltd. on behalf of the Department of Energy proposes the establishment of a 1 GW Solar Park in //Khara Hais Municipality (1 GW Upington Solar Park) in the Northern Cape Province. It is envisaged that the proposed Solar Park will make use of different Solar Technologies such as *Concentrated Solar Power (CSP)* which include; Parabolic Trough (PT) and Central Receiver (CR) and *Photovoltaic (PV)*; which include fixed and tracking crystalline PV, fixed thin film PV and Concentrated PV (CPV) with a total generating capacity of 1GW.

The proposed 1 GW Upington Solar Park will be located within farm Klipkraal 451, which falls within the //Khara Hais Local Municipality in the Northern Cape Province. The site can be accessed via the N10 (to the north of the farm) and N14 (to the south of the farm) and also can be accessed via other secondary roads. The portion of the farm where the Solar Park development is proposed covers an area of approximately 5011 hectares. The 1 GW Upington Solar Park will be developed on municipal owned land. The actual footprint for the Solar Park (will be confirmed during the EIA Phase) in terms of various technologies and applications and will actually be smaller than the total extent of the site. It is planned that the different solar technologies and the associated infrastructure will be within the boundaries of the Klipkraal site, and must avoid any impact on the environmental sensitive areas such as drainage lines.

The following persons gave input to this report:

- **Marinus Boon** – researcher of the surface water data, site verification and compilation of report; and
- **Frank van der Kooy** – verification process.

1.1 Terms of reference

A desktop investigation including site verification was conducted using spatial instruments (i.e. aerial photography, land use maps and topographical maps) to identify possible impacts related to the development of the Solar Park at the proposed Upington site. A literature survey was undertaken to assess the impact on the immediate catchment of the proposed site. After thorough assessment the following framework was proposed that need to be followed:

- Description of the affected drainage area and water resources;

- Identify the sources or possible sources or impacts on the water course (point sources or diffuse sources);
- Assessing the environment in terms of the proposed development and related impacts of the proposed development on the surface water systems;
- Compilation of a detailed report describing possible impacts on the surface water and impacts the proposed development will have on the surface water; and
- Providing recommendations and mitigation measures to remediate and minimise the identified impacts on surface water.

1.2 Study Approach, Limitations and Assumptions

For the purpose of this study, a study area of 10 km radius around the site has been defined to adequately cover quaternary catchments.

The scoping phase is defined as a procedure for determining the extent and approach to the EIA phase. The scoping study should provide a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community at large that might be affected by the proposed activity.

2 DESCRIPTION OF THE PROPOSED PROJECT

2.1 Location and Description

The farm Klipkraal 451 is owned by the //Khara Hais Local Municipality. The site is located approximately 10km west of Upington and was previously zoned as agricultural and undetermined land, the new rezoning to special zone was finalised last year by the municipality. The site boundaries are formed by a railway line to the south, the national road (N10) to the north, the farm Olyfenhoutsdrift to the west and Upington town to the east (**Figure 1**).

The proposed 1 GW Upington Solar Park development consists of the following infrastructure development but is not limited to:

- Construction of the Solar Park bulk infrastructure;
- Solar panels of different solar technologies;
- Workshop area for maintenance and storage of equipment ;
- Construction of pipelines for water supply;
- Subsoil stockpile area;
- Topsoil stockpile area – where possible foundations need to be constructed;
- Water treatment works and possible dam;

- Access/Haul road network.

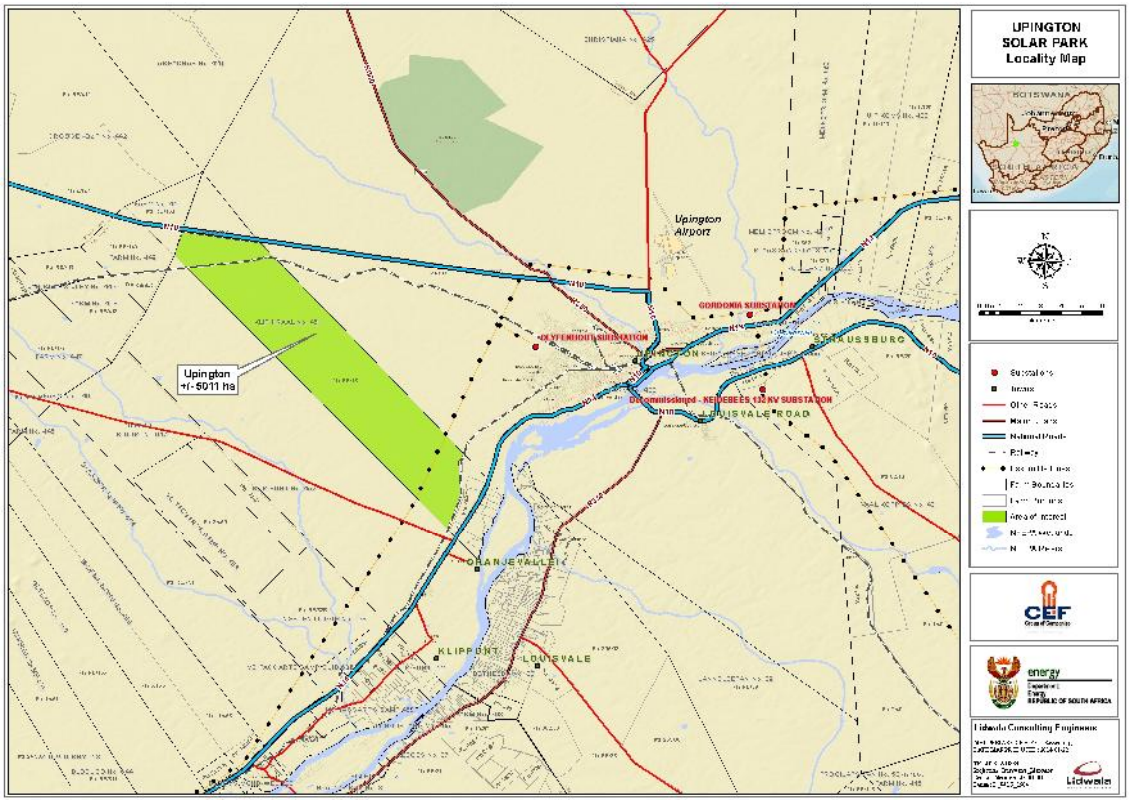

Figure 1: Illustrates the locality of the proposed 1 GW Upington Solar Park.

No site alternatives are proposed for this project as the placement strongly depends on the consistent solar radiation, flat and sparsely populated land, grid connection, water supply, good transport infrastructure and the availability of a large portion of municipal land.

Taking spatial considerations of the site, as well as the various objectives of the Solar Park into consideration, three preliminary layouts have been derived from the feasibility study.

2.2 Climate

The climate condition of the proposed study area can be regarded as warm to hot with rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 175 mm, of which 142 mm, or 81% rain falls between November to April. Rainfall is erratic and therefore cannot be relied on for agricultural practices. The average evaporation is 2 375 mm per year, peaking at 11.2 mm per day in December. Temperatures vary from an average monthly maximum and minimum of 35.0ºC and 18.7ºC for January to 20.8ºC and 3.3ºC for July respectively. The extreme high

temperature that has been recorded is 43ºC and the extreme low –7.9ºC. Frost occurs most years on 6 days on average between mid-June and mid-August.

2.3 Geology and Soil

The geology of the area comprises wind-blown sands with dunes of the Gordonia Formation, Kalahari Group (Geological Survey, 1988).

The area under investigation is covered by only two land types:

Ae10

(Deep, red, freely-drained soils, high base status)

Af8

(Deep, red, freely-drained soils, high base status, with dunes)

The red colour of the sand is derived from iron oxide. The dunes are predominantly located on the eastern portion of the area investigated. Outcrops are scarce in this sand-covered region (Aurecon, 2013).

2.4 Topography

The landscape of the site is generally flat to gently undulating slopes, sloping towards the south. The site is approximately 800-900 meters above sea level. The low slope of the study area is an indication of a uniform topography. The Gariep River (formerly known as Orange River) lies close to the south-eastern boundary of the area.

3 SURFACE WATER

3.1 Description of Aquatic Environment

3.1.1 Quaternary Catchment

The study area falls within the Lower Gariep River sub-basin, which comprises of the Gariep River from the confluence with the Vaal River and to the Gariep River Mouth. Major rivers that contribute to the flow in the Gariep include the Ongers and Sak rivers from the Northern Karoo; the Kuruman and Molopo rivers from the Northern part of the Northern Cape and the southern part of Botswana and the Fish River from Namibia. The proposed site is located within the quaternary catchment D37F. The area is dominated by ephemeral drainage lines. Ephemeral drainage lines is drainage lines or sometimes even large rivers that will carry water for only a brief period of time normally after a large rainfall event. Higher densities of vegetation may be supported by groundwater reserves below the drainage lines although the soil does not remain saturated for long enough to support

specially adapted flora. The potential runoff from the site flows in a westerly to a southerly direction to flow in the drainage lines which flow towards the Gariep River.

3.2 Surface Water Quality

3.2.1 Background Water Quality

From the numerous studies, investigations and monitoring information that is available on the subject, the following water quality issues are summarised for this quaternary catchment D37F:

- The aquatic resources within this quaternary catchment have been highly affected by the bed modification due to sedimentation and the Neusberg weir in the catchment.
- Significant flow modifications have taken place due to the effects of water abstraction and urban runoff from surrounding farming practices.
- High impacts have occurred as a result of introduced in-stream biota with special mention of the fish *Cyprinus carpio*.
- Impact due to inundation from the Neusberg weir is high.
- Riparian zones and stream bank conditions are considered to be moderately impacted due to alien vegetation encroachment.
- An impact on the aquatic community, due to altered water quality, is deemed to affect the catchment to a moderate degree due to the effects of general urban and rural runoff as well as agricultural effluent discharge (Scientific Aquatic Services CC, 2012).

Scientific Aquatic Services CC did an Aquatic Present Ecological State (PES) assessment in 2012 for proposed power line crossings in the area. A summary in terms of the water quality findings of this study indicated the following:

General water quality can be considered fair although some variation from the expected natural condition is deemed likely. The impact on water quality is deemed likely to come from both industrial and urban activities as far upstream as Mpumalanga and Gauteng as well as impacts form agricultural runoff into the Vaal River, a major tributary of the Orange River and the Orange River itself. There is also an indication of salts inflow, most likely due to erosion from agricultural lands entering the system. The aquatic communities of the system are however intact with more sensitive aquatic macro-invertebrate and fish populations still present and as such as much as the system is considered to be tolerant, it must also be considered to be sensitive to impacts that occur on the system (Scientific Aquatic Services CC, 2012). **Table 1** indicates specific water quality data along the main drainage feature.

Table 1: Specific water quality data along the main drainage feature (*Source: Scientific Aquatic Services CC, 2012*).

SITE	COND mS/m	D.O. mg/l	pH	TEMP °C
U/S	34.2	8.78	8.41	21.4
D/S	39.8	8.12	8.34	21.7

3.3 Surface Water Quantity

3.3.1 Mean Annual Runoff

The Orange River Integrated Water Resources Management Plan (2007) indicated that the Mean Annual Runoff (MAR) is 420 million m³/a for the lower orange catchment (**Table 2**). To provide an indication of the runoff volume that is expected to eventually reach the Orange River the "MAR adjusted" column was added (**Table 2**) which indicates that the MAR is 330 million m³/a.

Table 2: Summary of natural flow data (*Source: Mare, 2007)*.

Name	MAR (million m³/a)	MAR adjusted	Percentage of total runoff	Unit runoff (mm/a)
Orange River Catchment				
Lower Orange RSA	420	330	2.9	1.0

3.3.2 Drainage lines and Flood Volumes

There are no well-developed drainage lines on the site, which can be ascribed to the sandy substrate and low slope which allows for a high infiltration rate and very little runoff. Although some small drainage lines have been mapped within the study area by the Surveyor General these cannot be confirmed present based on the site visit. A single small drainage line running into one of the small pans can be confirmed present (**Figure 2**). Based on the site visit, the drainage lines mapped on the 1:50 000 topographic sheets for the area are not apparent in terms of riparian indicators and therefore are not considered sensitive and at least from a vegetation perspective (riparian zone) do not need to be avoided (Todd, 2014).

The Geotechnical study conducted by Aurecon as part of the feasibility study referred to that a 1:100 year floodline to be determined in the next phase of the geotechnical study.

3.4 Water Authority

The Department of Water Affairs act as the Regional Water Authority and their offices are located in Upington. The //Khara Hais Local Municipality is the appointed Water Service

Provider who is responsible to supply potable water to the Upington municipal area and they are also considered in terms of supply of water to the Solar Park.

3.5 Pans

Numerous pans have been observed on site during a site inspection in April 2014. These pans have a shallow soil depth with bedrock just underneath (**Figure 2**).

Figure 2: Illustrates the shallow soil depth with bedrock underneath

The ecology scoping study (Todd, 2014) confirmed the following about these pans: Although there are no pans mapped within the study area by the NFEPA (2011), satellite imagery and ground-truthing during the site visit and assessment had revealed that a number of relatively small pans are present within the site (**Figure 3**). It is likely that these have not been picked up by the NFEPA as these are rock pans which do not generate a characteristic signature as with clay pans. Most of these pans had water present during the site visit and had a variety of fauna associated with them. Karoo Toads as well as a number of different temporary water crustaceans such as Tadpole Shrimps, Fairy Shrimps and Clam Shrimps were observed breeding in the pans. The pans were also foci of animal activity and despite their distance from the Orange River a number of water-associated mammals including Cape Clawless Otter and Water Mongoose were observed to be using these areas. Due to their ecological significance, the pans are considered sensitive and as such rock pans are a rare feature in the landscape, their loss would be a significant potential impact associated with the Solar Park development. Not all of the pans are however considered equally significant and some of the larger pans or those which hold water on a more regular basis are identified as being priorities for conservation. The large pan which lies to the southeast of the Eskom Gordonia-Oasis 132kV line is identified as the most important pan within the proposed Soar Park site (**Figure 4**). This pan consists of several pools of water and each had different characteristics and faunal assemblages.

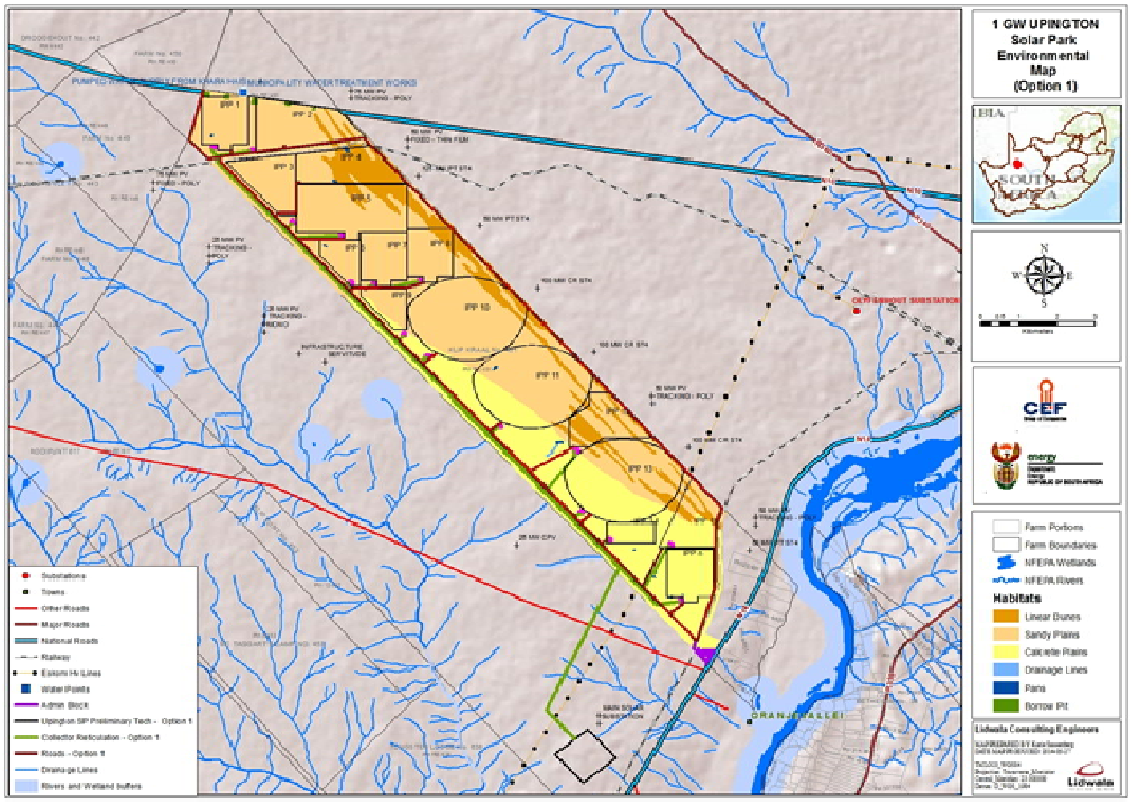

Figure 3: Illustrates the pans and the drainage lines including the hydrological features

Figure 4: The large pan which occurs near the Eskom 132kV line which traverses the site.

4 IDENTIFIED IMPACTS

4.1 Construction Phase

Large areas within the proposed Solar Park site will be cleared for construction activities and flat surfaces will be created for the storage and operation of heavy equipment. These construction activities have a possibility of affecting the storm water runoff characteristics within the proposed site. The flat surfaces will result in more point specific discharge points which in turn will concentrate the flow of water on site and increase the erosion potential. The absence of vegetation and the associated reduced infiltration will result in a higher runoff coefficient (higher percentage of water runoff from the site). Watercourses and man-made drainage structures will now carry more water which may result into flooding.

The following potentially negative impacts on the surface water associated with the construction phase have been identified:

- Clearance of the site to prepare for construction;
- Storage of hazardous chemical substances;
- Storage of fuel, oil and other hazardous substances;
- Cement and concrete batching;
- Transportation of material to site and the storage of material on site; and
- Dust as a result of construction activities.

The abovementioned impacts associated with the construction phase are generic and can be adequately managed through the implementation of a Construction Environmental Management Plan.

If construction activities will be undertaken in any watercourse or any of the surrounding areas it would lead to direct or indirect loss or damage of these areas or possible changes to the catchment of these areas and also to a decline in ecosystem functionality and can impact the lower lying Gariep River.

4.2 Operational Phase

The potentially negative impacts on the surface water that is associated with the operational phase have been identified and are as follows:

- Blocked surface water management systems as result of build-up of dust and silt.
- Surface water run off to wetlands, pans and drainage lines can be cut off as a result of the diversion of site storm water.
- Impact on the riparian systems including the riverine and in-stream habitats of the catchment and the surrounding environment.

- The watercourses are mostly seasonal and taking their locality within the bigger landscape in consideration they may also pose a flood risk to the Solar Park development.

The mitigation of the above mentioned impacts will be achieved via a comprehensive operational plan that specifies the maintenance of civil infrastructure and the natural flow of surface water into the pans and drainage lines by confining plant areas from those areas which drain into the watercourses (operational storm water management plan).

4.3 Decommissioning Phase

The scope of the decommissioning will be determined after the assessment of possible impacts that may be expected during decommissioning.

4.4 No-Go Alternative

The no-go option will result in having no impacts to surface water as there will be no construction, operational or decommissioning.

5 OVERVIEW OF IMPACT ASSESSMENT METHODOLOGY

In accordance to Regulation 31 of Government Notice R.543, which was promulgated in terms of section 24 of the National Environmental Management Act, 1998 (Act 107 of 1998), Lidwala EAP nedd to assess the significance of the potential environmental impacts in terms of the following criteria:

- Cumulative impacts;
- Nature of the impact;
- Extent and duration of the impact;
- Probability of the impact occurring;
- The degree to which the impact can be reversed;
- The degree to which the impact may cause irreplaceable loss of resources; and
- The degree to which the impact can be mitigated.

Issues will be assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected and how it will be affected;
- The physical **extent**, wherein it is indicated whether:
  - 1 - the impact will be limited to the site;
  - 2 - the impact will be limited to the local area;
  - 3 - the impact will be limited to the region;
  - 4 - the impact will be national; or
  - 5 - the impact will be international;
- The **duration**, wherein it is indicated whether the lifetime of the impact will be:
  - 1 - of a very short duration (0–1 years);
  - 2 - of a short duration (2-5 years);
  - 3 - medium-term (5–15 years);
  - 4 - long term (> 15 years); or
  - 5 - permanent;
- The **magnitude of impact on ecological processes**, quantified on a scale from 0-10, where a score is assigned:
  - 0 - small and will have no effect on the environment;
  - 2 - minor and will not result in an impact on processes;
  - 4 - low and will cause a slight impact on processes;
  - 6 - moderate and will result in processes continuing but in a modified way;
  - 8 - high (processes are altered to the extent that they temporarily cease); or
  - 10 - very high and results in complete destruction of patterns and permanent cessation of processes;

- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:
  - 1 - very improbable (probably will not happen;
  - 2 - improbable (some possibility, but low likelihood);
  - 3 - probable (distinct possibility);
  - 4 - highly probable (most likely); or
  - 5 - definite (impact will occur regardless of any prevention measures);
- the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- the **status**, which is described as either positive, negative or neutral;
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the degree to which the impact can be mitigated.

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

S = (E+D+M)*P; where

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

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

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- **30 - 60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

This EIA Report will assess the significance of impacts for all phases of the project i.e. construction, operation and decommissioning. The results of the above will be summarised in a tabular format. An example is provided below.

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
CONSTRUCTION PHASE									
BIODIVERSITY									
Impact 1: Loss or degradation of natural/ pristine habitat.	**nature of impact:**	Adverse Impact due to loss or degradation of natural habitat							
	with mitigation	1	4	2	3	**21**	**Low**	-	high
	without mitigation	2	5	2	4	**36**	**Medium**	-	high
	degree to which impact can be reversed:	None							high
	degree of impact on irreplaceable resources:	Low							high

5.1 Proposed activities for EIA phase

This will include the following studies and activities:

- Impacts on any watercourses depending on the final layout selected must be investigated;
- A basic draft storm water management plan will be compiled in consultation with the Design Engineer conducting storm water. If any of the watercourses (pans or drainage lines) identified on site (**Figure 4**) may possibly be impacted on by the proposed Solar Park development an aquatic specialist will then have to conduct a full aquatic study.
- Site-specific issues in terms of nature, extent, duration, severity and significance will be assessed in the EIA in terms of the final layout to be provided by the developer.

6 FINDINGS AND RECOMMENDATIONS

General findings and recommendations include:

- Drainage lines and other important water courses such as the numerous pans identified on site are normally regarded as NO-GO areas (vital natural corridors-wildlife habitat, providing resources for survival, reproduction and movement, home to important & threatened plant species, intact drainage lines reduce sediment loads and filter possible pollutants that may end up in the Orange River);
- Sensitive features such as wetlands, drainage lines and pans were collated and buffered where appropriate to comply with legislative requirements or ecological

considerations (**Figure 4**). The Department of Water Affairs (DWA) recommends a 100m buffer for drainage lines.

- Extent of the watercourse is the extent of the riparian habitat (as delineated according to DWAF, 2005a) or the 1:100 floodline, whichever is greater. The delineation of the watercourses will be undertaken by the ecologist including other relevant specialists (aquatic scientist when required) during EIA phase studies when the final layout is available. The delineation of the watercourses at the proposed Upington Solar Park site might need to rely on vegetation which indicates the riparian edge as described in the DWAF (2005) field procedure for identification and delineation of wetland and riparian areas.
- If any of the watercourses (pans or drainage lines) identified on site (**Figure 4**) may possibly be impacted by the proposed Solar Park development, it is then that an aquatic specialist will be required to conduct a full aquatic study. The study will have to include the determination of the present ecological status (PES) and the ecological importance and sensitivity (EIS) – this will determine the actual proximity of development allowed from the pans and also possible, avoidance, remediation, rehabilitation, mitigation to be applied/or the possible replacement thereof when the pans) cannot be avoided in terms of environmental offsets although the avoidance of these areas is the best practical environmental option.
- Development within the 500 radius of wetlands would require delineation including an appropriate buffer in terms of the NWA section 21 (c) and (i) water uses (*extent of the wetland is the outer edge of the temporary zone of the wetland as delineated according to DWAF, 2005).*

The following general recommendations will apply:

- Surface water impacts of all proposed technology options will largely be related to the way the local storm water system is managed and therefore an integrated approach will be encourage.
- No Solar Park development should be allowed within demarcated sensitive areas, and preferably areas of medium sensitivity that are surrounding wetlands and rivers.
- Construction must be planned to avoid any impact on the natural drainage of the site and the wetland functionality.
- Soil surfaces during construction devoid of all vegetation must not be left for open for lengthy periods of time to prevent erosion which in this case includes wind erosion and dust production.

- Proper and effective storm water management measures must be in place before construction and a storm water management plan should form part of the construction planning phase.
- Surface water generated during construction must not be discharged directly into any natural drainage system or wetland.

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environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/
NEAS Reference Number:	DEAT/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Environmental Impact Assessment for the Proposed 1 GW Upington Solar Park, Northern Cape Province

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4.2 The specialist appointed in terms of the Regulations_

I, Marinus Boon , declare that --

General declaration:

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 71 and is punishable in terms of section 24F of the Act.

MBoon

Signature of the specialist:

Lidwala CSA

Name of company (if applicable):

2014-06-25

Date: