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***SAND DRAAI CSP POWER PLANT (PTY) LTD:  
GROBLERSHOOP, NORTHERN CAPE.***

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**SCOPING PHASE  
AQUATIC ECOLOGICAL & IMPACT SURVEY.**

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Prepared for:

**Royal Haskoning DHV**

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## DECLARATION

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This report has been prepared according to the requirements of the Environmental Impact Assessments Regulations (GNR 543) in Government Gazette 33306 of 18 June 2010, as well as the Department of Water Affairs (DWA, 2005) *Guidelines for Delineating Wetland and Riparian Zones* and Department of Water Affairs (DWA, 2007) *River EcoClassification: Manual for EcoStatus Determination (vers 2)*. We (the undersigned) declare the findings of this report free from influence or prejudice.

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Date: 6 October 2014

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## EXECUTIVE SUMMARY

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*Solafrica Photovoltaic Energy Limited* has proposed the construction of a combined Concentrated Solar Power (CSP) and Photovoltaic (PV) project on the farm Sand Draai, near Groblershoop in the Northern Cape Province. The proposed construction will consist of:

- One 150 MW CSP plant, based on Parabolic Trough
- One 150 MW CSP Plant, based on Central Receiver technology; and
- One 125 MW Photovoltaic CSP plant.

EnviRoss CC was requested to undertake the aquatic ecological integrity and impact survey for the Scoping Phase of the Environmental Authorisation process for the proposed development, with emphasis on the potential impacts to the Orange River. A brief field survey was undertaken during September 2014.

### **Materials and Methods.**

A desktop study was undertaken utilising available literature, GIS databases and mapping resources, aerial imagery and data gathered from previous surveys within the same area. A brief field visit was undertaken to gain an understanding of the ecological processes associated with the proposed development area.

### **Results and Discussions**

The proposed development activities are thought to have limited impact significance to the overall ecological integrity of the Orange River, which already suffers a degree of transformation through infrastructure development along the riparian zones and largescale abstraction. The catchment supports two fish species of conservational concern, but it is thought that the proposed development will not impact the ongoing conservation of these species.

An assessment of the impact significance shows that all expected impacts can be mitigated to acceptable limits.

### **Conclusions and Recommendations**

*Recommendations and general mitigation measures are outlined below:*

- The river reach suffers a change from reference conditions in terms of biological integrity (macro-invertebrates and riparian vegetation) as well as instream and riparian habitat. A desktop review

and previous site surveys within the area show that the PES of the river falls within a C class (moderately modified). Even though there are transforming and degrading features present within the river reach, the overall Ecological Importance and Sensitivity (EIS) remains *High*. Mitigation measures should be in place to ensure that these ecological categories are not degraded;

- The proposed development, given the implementation of appropriate mitigation measures, is not thought to have overly significant impacts to the present ecological integrity of the system;
- It is recommended that any pump housing infrastructure be sited outside of the riparian zones of the Orange River;
- Sharing the pumping infrastructure with the adjacent Bokpoort CSP development is recommended to negate the need for further infrastructure development along the watercourse;
- The proposed development will not have any significant impacts to any further watercourses, other than the Orange River;
- The surface water quality throughout the survey area is considered good, with the aquatic system supporting a diversity of sensitive aquatic macro-invertebrate taxa. It is therefore imperative that the contamination of the surface waters through deleterious effluents and runoff water be avoided;
- Emergency procedures must be in place to timeously mitigate any accidental spillages and to isolate the impacting features as far as possible;
- Regular monitoring of water quality to enable early identification of contamination is recommended. The source of any contamination identified through the monitoring should be identified and managed according to best practice guidelines;
- Soil erosion emanating from disturbances within the riparian zones and other areas of steep gradients is thought to be the greatest impacting feature to potentially impact the overall ecological integrity of the aquatic system. Active storm water management should be implemented to stop silt and sediments from entering the aquatic system and smothering the habitat units. Disturbed soils and stockpiled soils should be protected from erosional features;
- The footprint of the actual development as well as the supporting structure and services during the construction phase should be retained as small as possible by construction vehicles being limited to designated roadways only. Destruction of the riparian habitat through the unnecessary clearing of vegetation should be avoided;
- Dumping of any excess rubble, building material or refuse must be prohibited within riparian and wetland habitat. Dumping of materials should only take place at designated and properly managed areas;

- Provided that erosion management, together with the implementation of mitigation measures to abate the negative ecological impacts of the features mentioned above, the overall ecological impact of the proposed development activities can be limited.

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## 1. INTRODUCTION & TERMS OF REFERENCE

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### 1.1. Background

*Solafrica Photovoltaic Energy Limited* has proposed the construction of a combined Concentrated Solar Power (CSP) and Photovoltaic (PV) project on the farm Sand Draai, near Groblershoop in the Northern Cape Province. The proposed construction will consist of:

- One 150 MW CSP plant, based on Parabolic Trough
- One 150 MW CSP Plant, based on Central Receiver technology; and
- One 125 MW Photovoltaic CSP plant.

EnviRoss CC was requested to undertake the aquatic ecological integrity and impact survey for the Scoping Phase of the Environmental Authorisation process for the proposed development, with emphasis on the potential impacts to the Orange River. A brief field survey was undertaken during September 2014.

### 1.2. Scope of Work

A brief site visit was undertaken during September 2014 to ground truth the information obtained and represents the Scoping Phase. Two field surveys were undertaken during January and February 2014 to address both terrestrial and aquatic aspects for these particular amendments, but five field surveys in total have been undertaken to the area to assess both the terrestrial and aquatic habitat units since June 2010.

The Scope of Work included the identification of the pertinent impacts associated with a development of this nature on the overall ecological integrity of the Orange River at the proposed development site. It was then to be determined if these impacts could be mitigated in order to abate the potential impacts.



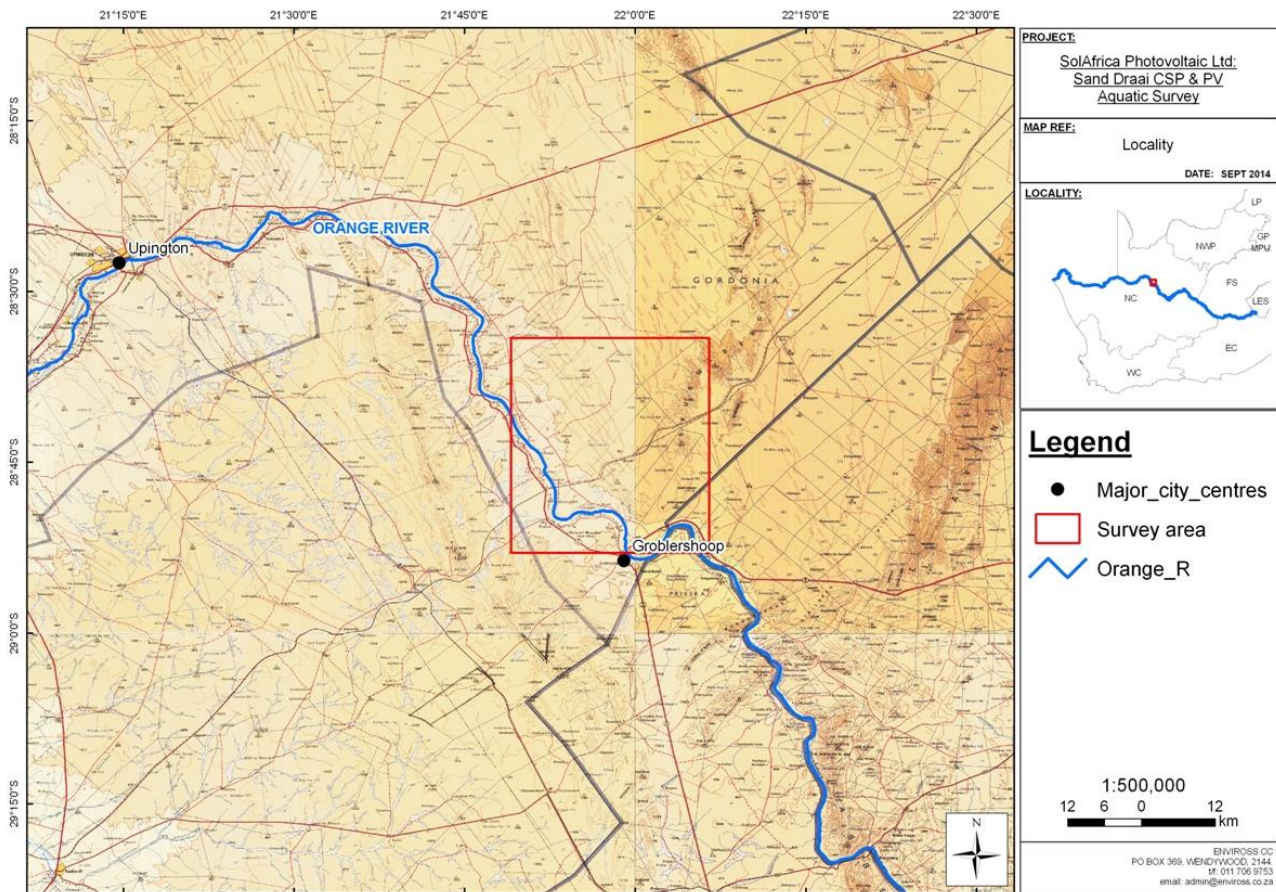


Figure 1: Locality of the study area.

### 1.3. Assumptions & Limitations

Reference is made in the report to engineering and design features and physical limitations on construction. These limitations and suggestions are based upon perception of an ecologist and are not meant to conflict those opinions of the engineers.

## 2. AIMS & OBJECTIVES

The objective of this report is to provide the relevant biological information pertaining to the surface water resources and the implications of the potential to the planning, management and construction teams of the proposed development activities, so as to manage and minimise the ecological impacts. It is also to provide baseline data that would serve as the benchmark for the specialist EIA phase reporting.

### 3. GENERAL STUDY AREA CHARACTERISTICS

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#### 3.1. Regional

The survey area is located on the northern banks of the Orange River near the town of Groblershoop (near the crossing). The area falls within the Mixed Karoo region with a rainfall of less than 200 mm per annum, with the majority of the precipitation falling within the late summer season (Esler, *et al.*, 2006). The Orange River forms a greenbelt through this predominantly otherwise desert/arid region and supports a riparian vegetation floral community as well as a thriving commercial agricultural sector. Further afield from the riparian zones, the surrounding area is largely open, natural veld, with the land use being dominated by livestock (low density) or game farming.

A formal irrigation scheme, supporting a large commercial agricultural sector, makes commercial agriculture the dominant land use within the areas adjacent to the river. The riparian zones are largely transformed to accommodate this land use. Agricultural fields are often protected from flood events by earth embankments, which have necessitated largescale transformation and landscaping of much of the riparian zones. Infrastructure along the river and within the riparian zones incorporates farm pumping equipment and buildings stations, surface water (stormwater) drains and access roadways.

The survey area falls within the Orange River (D) Primary Catchment, and within the DWA Lower Orange River Water Management Area (WMA14). It falls within the D73D Quaternary Catchment. The Orange River represents one of the very few perennial river systems within an otherwise arid region, with the vast majority of the rivers and streams being seasonal in nature.

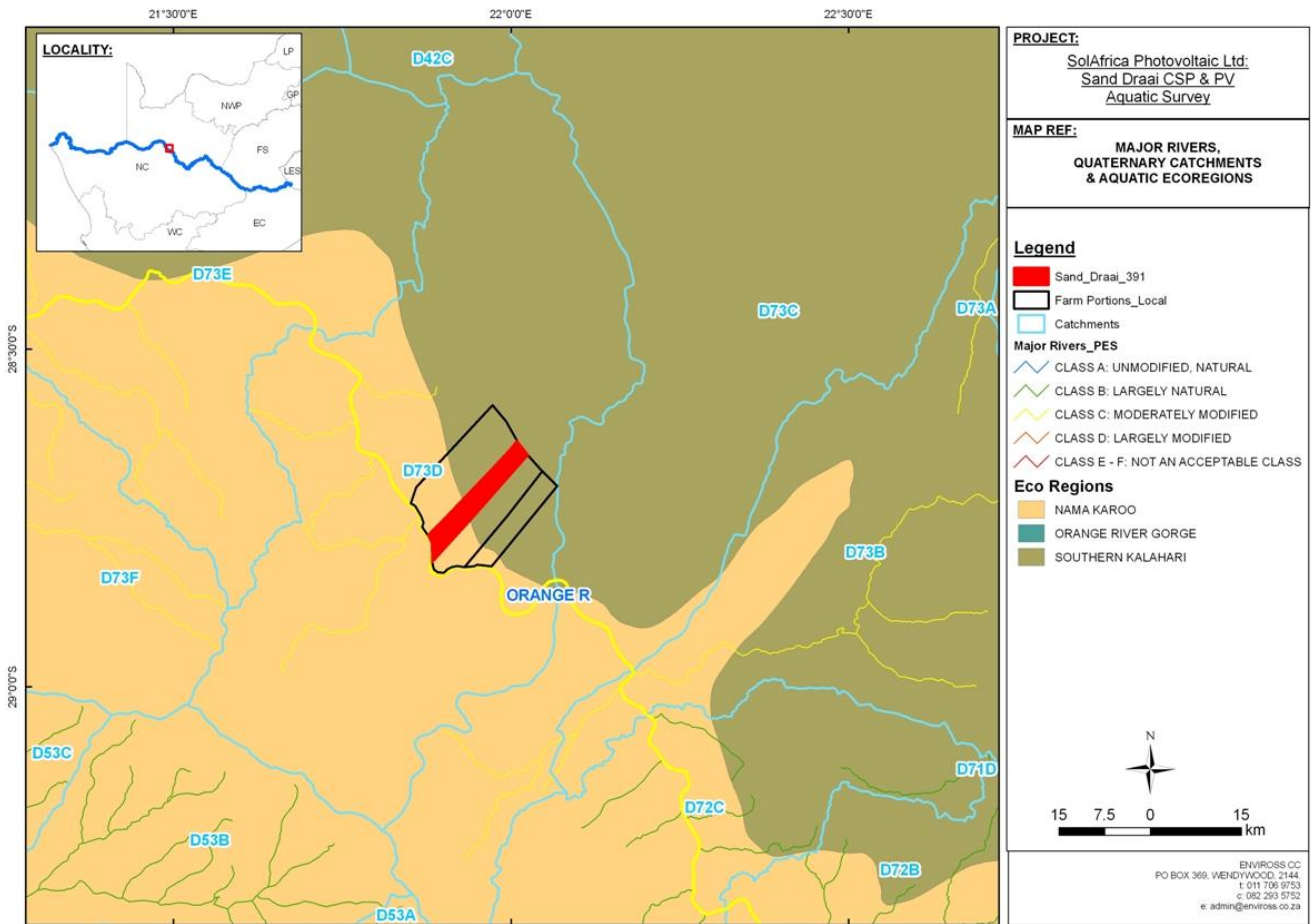


Figure 2: Regional catchment details, showing the PES of main rivers and streams, aquatic ecoregions and quaternary catchments.

### 3.2. Local

Much of the vegetation within this zonal area has been transformed to accommodate agricultural crops and the vast majority of the farm infrastructure is located within these areas. This means that the natural vegetation features have largely been lost.

The aquatic habitat is dominated by slow to medium velocity deep water with a substrate dominated by sand and mud at the site. Some rocky outcroppings do occur within the local area where the water is shallower and the velocity increases, and the formation of islands do occur with interlinking channels. This creates a diversity of aquatic habitat types. Some emergent aquatic vegetation occurring within hydraulically-sheltered areas, often associated with localised sandbanks, which is dominated by the reed *Phragmites australis*. The ecological processes associated with the proposed development area are presented in Figure 3.



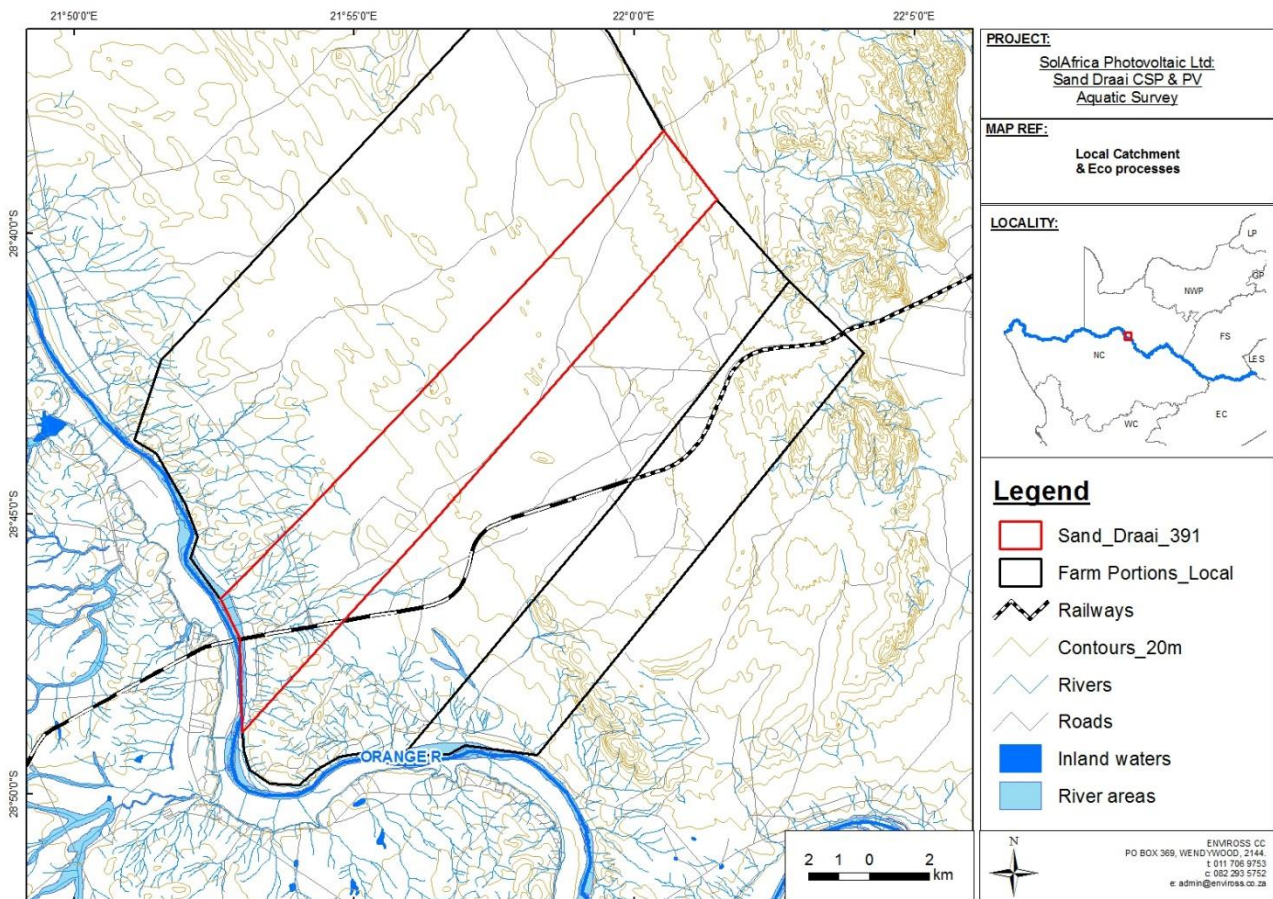


Figure 3: Local catchment details and ecological processes.

## 4. MATERIAL & METHODS

### 4.1. Desktop survey

Scrutiny of topographical maps, aerial photography and available GIS mapping databases (provincial and national) as well as the latest available literature were used to set the baseline data for the proposed development site. A large source of data was from the SANBI Biodiversity GIS website ([www.bgis.sanbi.org.za](http://www.bgis.sanbi.org.za)) with specific reference to the status of ecosystems and biodiversity within the Northern Cape Province. A large source of data is derived from the EnviRoss CC database from extensive aquatic surveys having been undertaken within the area for similar projects.

## 4.2. Field assessment

A field survey was then undertaken during September 2014 for ground-truthing, which then enabled the confirmation from on-site visual observations, allowing for habitat unit characterisation and assessment of ecological status. This aspect then further allowed for the identification of ecologically sensitive habitat, and the overall ecological integrity of the riparian vegetation structures.

## 5. RESULTS & DISCUSSIONS

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### 5.1. Description of watercourses within the survey area

The Orange River represents the only perennial watercourse and therefore the only permanent aquatic habitat within the region. The Orange River is regarded as a C-Class Present Ecological State (PES) river, which translates to a *moderately modified* system (Figure 2). This is due to modification of the hydrology of the system brought about by the occurrence of major impoundments located upstream of the site (Gariep Dam and Van Der Kloof Dam). These impoundments attenuate minor flooding events (therefore decrease the regular occurrences of floodwaters that would normally function for channel maintenance) and increase base flows (water is released from the impoundments for electricity generation and to satisfy demand for irrigation within the majority of the Orange River Valley area). The Orange River was historically classified as a non-perennial system, but remains as a perennial system since the construction of the dams and the inclusion of the watercourse within the Lesotho Highlands Scheme. Further factors that drive ecological transformation of the river include water quality impacts emanating mostly from agrochemicals. The Orange River provides the irrigation water for formal irrigation that is the dominant land use throughout the vast majority of the Orange River Valley, downstream of the impoundments. Riparian vegetation transformation to accommodate formal agriculture as well as exotic vegetation encroachment into the riparian zones are also major drivers of ecological change within the region.

The close proximity to the Orange River means the proposed development area incorporates relatively steeper gradients, which enhances the formation of drainage channels that directs surface water runoff toward the valley of the Orange River. Besides the Orange River, no other permanent watercourses occur and the channels that are present would allow for only brief persistence of surface waters. This may be enough within isolated areas to support some aquatic macro-invertebrates for a short period, but this would be under exceptional circumstances.

## 5.2. Riparian zones

The riparian zones of the Orange River are well-established and developed and form part of a unique vegetation unit known as Lower Gariep Alluvial Vegetation. This is an inland azonal vegetation unit of the freshwater wetlands biome. It is regarded as an endangered vegetation unit (Mucina & Rutherford, 2006) due to high levels of transformation. The riparian zones of the Orange River are also regarded as critical biodiversity areas (CBA's) (SANBI, 2009).



Figure 4: Examples of existing agricultural infrastructure that is common along the watercourse.

The riparian zones within the survey area are largely transformed to accommodate formal irrigated agriculture. As these areas are often naturally sloped and therefore were levelled to accommodate the agriculture. This levelling has created many earthen berms/embankments on the watercourse side of most of the agricultural fields. These embankments have a multitude of functions. They protect the croplands, orchards and vineyards from flooding events, decreases runoff from the fields and also protects the watercourse from the impacts of erosion. Much of the upper riparian zones within the survey area have therefore been transformed and the ecological functionality lost. The lower riparian zones still retain functionality as little of the lower edges have been allowed to remain. Landowners have recognised the fact that it is deleterious to establish agriculture too close to the water's edge for both safety and infrastructure protection reasons. Therefore, the lower zones of the riparian vegetation have largely been retained, and are largely dominated by reedbeds of mostly *Phragmites australis*. Exotic vegetation has

encroached within the riparian zones. Dominant species include *Eucalyptus camaldulensis*, *Prosopis glandulosa* and *Glauca nicotiniana*.

### 5.3. Ecological importance and Sensitivity (EIS)

The ecological importance of a river is an expression of its importance to the maintenance of biological diversity and ecological functioning on local and wider scales. Ecological sensitivity (or fragility) refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (resilience). Both abiotic and biotic components of the system are taken into consideration in the assessment of ecological importance and sensitivity (Kleynhans & Louw, 2007).

### 5.4. Aquatic biodiversity

#### 5.4.1. Fish

The DWA provides a reference list of fish species that would be expected to occur at the site (Kleynhans, 2008). There is a DWA reference site located upstream of the site near Boegoeberg Dam. There are 11 indigenous species expected to occur at the site, namely *Austroglanis sclateri*, *Barbus anoplus*, *Labeobarbus aeneus*, *Labeobarbus kimberleyensis*, *Barbus paludinosus*, *Barbus trimaculatus*, *Clarias gariepinus*, *Labeo capensis*, *Labeo umbratus*, *Pseudocrenilabrus philander* and *Tilapia sparrmanii*. It is assumed that these species would all occur within the river reach associated with the site.

Two of these species are regarded as being of conservational concern, namely *Labeobarbus kimberleyensis* and *Austroglanis sclateri*. Both of these species are known to occur within the river reach. It is assumed, however, that the proposed development activities will not pose a significant impact to the ongoing conservation of these species within the region.

#### 5.4.2. Aquatic macro-invertebrates

The aquatic macro-invertebrates recorded from the site are generally all commonly occurring and widely distributed within rivers of suitable water quality and habitat availability. No protected aquatic macro-invertebrate species have been recorded from the river reach.



### 5.4.3. Water quality

Expected water quality values associated with the proposed development site are presented in Table 1. These values represent the values that would be expected during a summer season.

**Table 1: Results of the laboratory general water quality analyses.**

Analyses in mg/ℓ (Unless specified otherwise)	Expected values
	pH – Value at 25°C
Electrical Conductivity in mS/m at 25°C	250-285
Total Dissolved Solids at 180°C	160-195
Suspended Solids at 105°C	10-16
Turbidity in N.T.U.	8-10
Total Alkalinity as CaCO <sub>3</sub>	100-120
Chloride as Cl	8-12
Sulphate as SO <sub>4</sub>	10-15
Fluoride as F	0.1-0.5
Nitrate as N	0.2-0.8
Total Coliform Bacteria / 100 mℓ	50-100
E. Coli / 100 mℓ	0
Free & Saline Ammonia as N	0.1-0.4

All remaining elements are expected to be within SA Water Quality Guideline (1996) values, but trace elements such as potassium and magnesium are thought to be expectedly high due to the use of agrochemicals within the system. Pesticides (agrochemicals) are also reported to be a limiting factor to aquatic macro-invertebrates within the river reach.

### 5.4.4. Ecological Importance and Sensitivity (EIS)

The use of biotic data in the assessment of the EIS considers the presence of rare and endangered species, unique species and species (including various life-history stages) with a particular sensitivity to flow (and flow-related water quality aspects) in combination with other ecological information on the study area. The EIS of a river is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Ecological Sensitivity refers to the ability of the system ability to tolerate disturbance and its resilience once an impact has taken place (Kleynhans, 1999b). The EIS of the system is regarded as being *High*. The most important and relevant points are summaries in Table 2.



**Table 2: Summary of the relevant points of the EIS determination (these are based on predicted survey data).**

Determinant	Score	Conf	Reason
<b>PRIMARY DETERMINANTS</b>			
Rare and endangered species	4	4	<i>Labeobarbus kimberleyensis; Austroglanis sclateri</i>
Populations of unique/isolated species	3	4	<i>Aridity of the surrounding region means that the riparian zones and river habitat would be utilised by many unique and isolated species.</i>
Species / taxon richness	3	4	<i>Moderate/High – it is assumed (from previous surveys and evaluation of the habitat quality) that at least 7 of the 11 expected fish species would occur within the river reach.</i>
Diversity of habitat types or features	3	4	<i>Moderate/High - instream biotopes diverse through interlinking channels, islands.</i>
Migration/breeding and foraging site for wetland/riparian species	2	4	<i>The riparian zones form a greenbelt through an arid area that is readily utilised for agriculture. It is therefore important to maintain this for maintenance of migrations and connectivity.</i>
Sensitivity to changes in natural hydrological regime	3	4	<i>Many fish species that occur at the site are regarded as being flow dependent, with flow being a primary trigger for stimulating migratory movements.</i>
Sensitivity to water quality changes	3	3	<i>Some sensitive biodiversity noted within the aquatic habitat that would be impacted by deterioration of water quality.</i>
Flood storage and energy dissipation	2	2	<i>The Orange River has a large catchment area. There is limited capacity for flood attenuation due to limited flood plain interaction.</i>
Base-flow augmentation and dilution	3	2	<i>Large catchment with significant mean annual runoff, with the Orange River representing the main watercourse for the region.</i>
<b>MODIFYING DETERMINANTS</b>			
Protected status	3	2	<i>Aquatic and riparian habitats are statutorily protected.</i>
Ecological importance (rarity of size/type/condition)	2	3	<i>The Orange River represents the main watercourse for the region and one of the very few perennial systems within an arid environment.</i>
<b>TOTAL</b>	<b>30</b>		
<b>MEDIAN</b>	<b>3</b>	<b>3</b>	
<b>EIS High</b>			

## 6. SCOPING PHASE IMPACT ASSESSMENTS.

The most prominent expected impacts to the aquatic habitat units are identified in Table 3. Predicted significance of the impacts as well as whether the impacts can be mitigated are also offered. It should be noted that the actual development footprint will be located far enough away from the Orange River to have any significant impact. The construction footprint also falls within an area that incorporates very few/no drainage lines or watercourses, which is a feature that becomes more prominent closer to the Orange River as the topography gets steeper. It is assumed that a pipeline will have to be constructed from the solar plant to the river, where a pump station will be established (as one alternative), or water requirements could be supplied from the existing Bokpoort CSP located adjacent to the site (as another alternative).

**Table 3: The major impacting features to the aquatic environment identified for the development.**

<b>Issue</b>	<b>Riparian habitat destruction – establishing a pump station on the banks of the Orange River</b>
Discussion	Riparian vegetation will be destroyed to accommodate a pump station, concrete causeway and pump facilities at the water edge.
Existing impact	Medium-High - Much of the riparian edges have been modified to accommodate formal agriculture. Pumping stations are also common along the watercourse for agricultural purposes.
Predicted impact	Low if mitigation measures implemented (e.g. siting the pump station housing outside of the riparian edges, or sharing existing pump housing facilities).
EIA investigation required	Yes
Cumulative impact	Low – the site already suffers transformation of much of the vegetation areas.
<b>Issue</b>	<b>Aquatic habitat destruction – construction of pumping infrastructure within the watercourse</b>
Discussion	Direct impacts due to formal construction within watercourse to facilitate pumping, protect pump inlets and to stabilise river banks.
Existing impact	Medium-High - Much of the riparian edges have been modified to accommodate formal agriculture. Pumping stations are also common along the watercourse for agricultural purposes.
Predicted impact	Low if mitigation measures are implemented.
EIA investigation required	Yes
Cumulative impact	Low – the spatial extent of the proposed infrastructure limits the overall impact.
<b>Issue</b>	<b>Long term impacts of reducing water volume within the Orange River in terms of satisfying the ecological reserve flow volume requirements</b>
Discussion	The ecological reserve flows refers to the amount of water that a system requires to allow for retention of overall ecological functionality. Removal of too much water will impair overall ecological functionality.
Existing impact	Medium to high. The Orange River provides water for an expansive formal agricultural sector within an arid environment and therefore a high volume is abstracted.
Predicted impact	Low - upstream impoundments release water to satisfy ecological reserve and irrigation demands. Water is also released for electricity generation. These releases have increased the base flow volume during low flow seasons. The impoundments have, however, abated medium flooding events. Large floods still do occur that cater for channel maintenance.
EIA investigation required	Yes
Cumulative impact	Medium. The Orange River provides water for an expansive formal agricultural sector within an arid environment and therefore a high volume is abstracted. Flow volumes are supplemented through releases from upstream impoundments.
<b>Issue</b>	<b>Impacts on aquatic biodiversity</b>
Discussion	Habitat destruction leading to loss habitat and, in turn, displacement of aquatic biodiversity, reduction in breeding habitat, etc. Increased disturbance factors that will displace sensitive faunal species.
Existing impact	Low-medium – instream infrastructure does already exist in many places along the watercourse within the river reach.
Predicted impact	Low – spatial extent of the proposed infrastructure is limited to a small footprint area that will have a very limited impact to the biodiversity within the river.
EIA investigation required	Yes
Cumulative impact	Low-medium – Infrastructure does already exist within the watercourse (pump stations, concrete causeways, bridges and jetties). In some cases, the infrastructure increases habitat diversity for opportunistic species
<b>Issue</b>	<b>Impacts on water quality</b>
Discussion	Water quality impacts will have a direct deleterious impact to aquatic habitat integrity and biodiversity.
Existing impact	Low – The Orange River has retained relatively good water quality. This tends to fluctuate seasonally with the seasonal use of agrochemicals.
Predicted impact	Spillages of fuels and oils near the watercourse by construction equipment. Fuel spillages of pumps should petrol/diesel pumps be utilised (pumps would most likely be electrical).

EIA investigation required	No, but mitigation should be outlined in EIA specialist report
Cumulative impact	Low
<b>Issue</b>	<b>Impacts on watercourses other than the Orange River</b>
Discussion	Pipeline excavations from the CSP site to the river will impact on the numerous watercourses that occur between the river and the CSP plant.
Existing impact	Low – the area is generally open and not subject to physical alterations other than a few roadways (mostly informal roadways).
Predicted impact	Low – provided mitigation measures are implemented (correct site reinstatement and landscaping to avoid erosion).
EIA investigation required	No, but mitigation measures to be outlined in specialist report during the EIA phase.
Cumulative impact	Low-medium – drainage lines and seasonal watercourses are often disregarded during the construction phase as it mostly occurs in the dry season. Follow up surveys during the wet season to monitor for emerging erosion impacts are very often not undertaken.

## 7. SENSITIVITY MAPPING

All watercourses, wetlands and riparian zones associated with the project should be considered sensitive habitat units and appropriate buffer zones should be designated to these units.

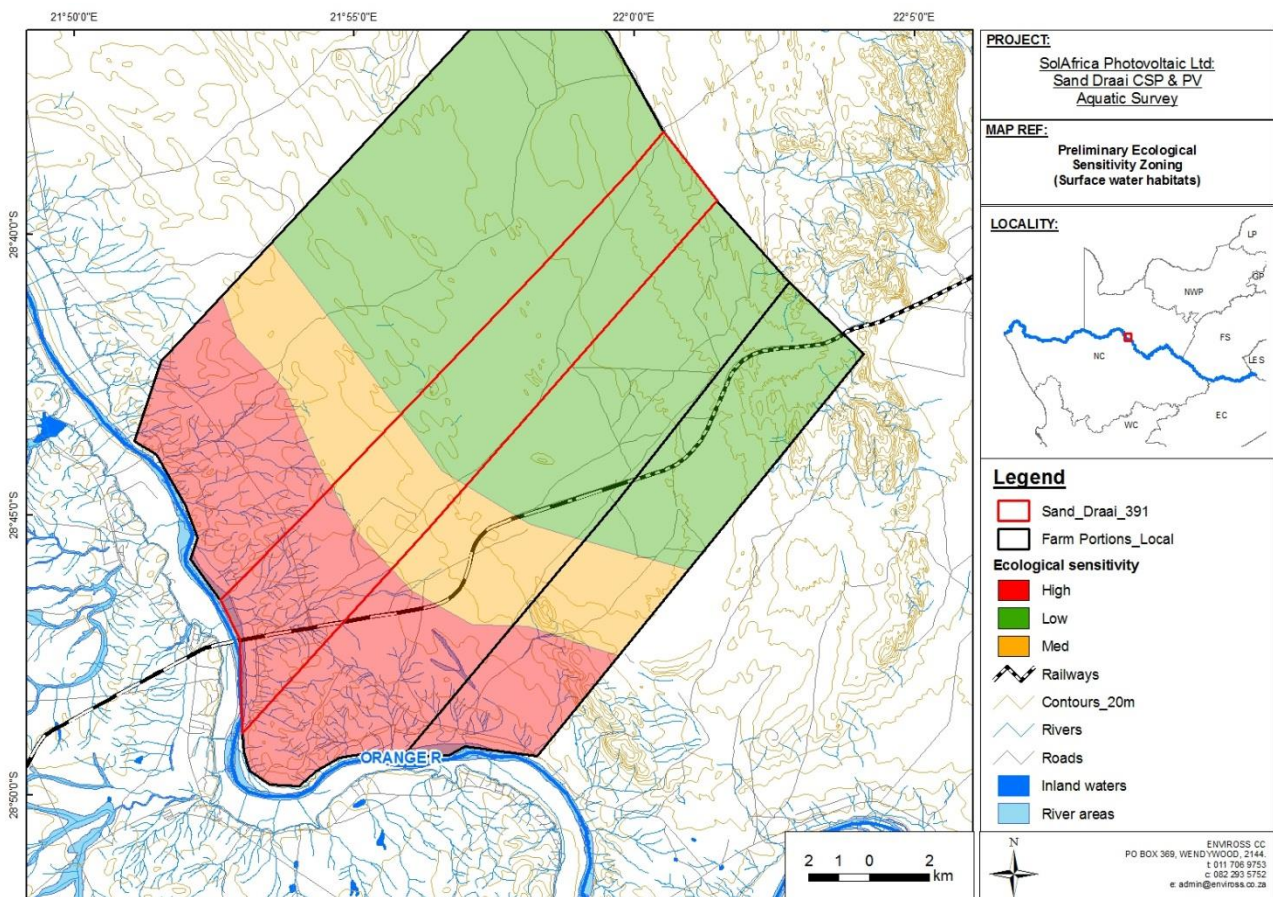


Figure 5: Preliminary ecological sensitivity zoning of the proposed development area and surroundings.

During the Scoping Phase, approximate ecological sensitivity zonation has been provided for the surface waters within the area (Figure 5). The watercourses and wetlands, together with the steep topographical areas associated with the riparian zones as one approaches the Orange River, have been zoned as areas of high ecological sensitivity. There is a zone between this area and the areas declared as low ecological sensitivity that is regarded as being of medium ecological sensitivity. This area acts as a buffer zone for the protection of the ecologically sensitive habitat features.

## 8. CONCLUSIONS & RECOMMENDATIONS

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A brief field survey was undertaken during September 2014 to the area where the proposed Sand Draai CSP and PV plants are proposed, and the Orange River within the reach associated with the proposed development. Upon completion of the survey the following general conclusions were drawn and some mitigation measures proposed:

- The river reach suffers a change from reference conditions in terms of biological integrity (macro-invertebrates and riparian vegetation) as well as instream and riparian habitat. A desktop review and previous site surveys within the area show that the PES of the river falls within a C class (moderately modified). Even though there are transforming and degrading features present within the river reach, the overall Ecological Importance and Sensitivity (EIS) remains *High*. Mitigation measures should be in place to ensure that these ecological categories are not degraded;
- The proposed development, given the implementation of appropriate mitigation measures, is not thought to have overly significant impacts to the present ecological integrity of the system;
- It is recommended that any pump housing infrastructure be sited outside of the riparian zones of the Orange River;
- Sharing the pumping infrastructure with the adjacent Bokpoort CSP development is recommended to negate the need for further infrastructure development along the watercourse;
- The proposed development will not have any significant impacts to any further watercourses, other than the Orange River;
- The surface water quality throughout the survey area is considered good, with the aquatic system supporting a diversity of sensitive aquatic macro-invertebrate taxa. It is therefore imperative that the contamination of the surface waters through deleterious effluents and runoff water be avoided;

- Emergency procedures must be in place to timeously mitigate any accidental spillages and to isolate the impacting features as far as possible;
- Regular monitoring of water quality to enable early identification of contamination is recommended. The source of any contamination identified through the monitoring should be identified and managed according to best practice guidelines;
- Soil erosion emanating from disturbances within the riparian zones and other areas of steep gradients is thought to be the greatest impacting feature to potentially impact the overall ecological integrity of the aquatic system. Active storm water management should be implemented to stop silt and sediments from entering the aquatic system and smothering the habitat units. Disturbed soils and stockpiled soils should be protected from erosional features;
- The footprint of the actual development as well as the supporting structure and services during the construction phase should be retained as small as possible by construction vehicles being limited to designated roadways only. Destruction of the riparian habitat through the unnecessary clearing of vegetation should be avoided;
- Dumping of any excess rubble, building material or refuse must be prohibited within riparian and wetland habitat. Dumping of materials should only take place at designated and properly managed areas;
- Provided that erosion management, together with the implementation of mitigation measures to abate the negative ecological impacts of the features mentioned above, the overall ecological impact of the proposed development activities can be limited.



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