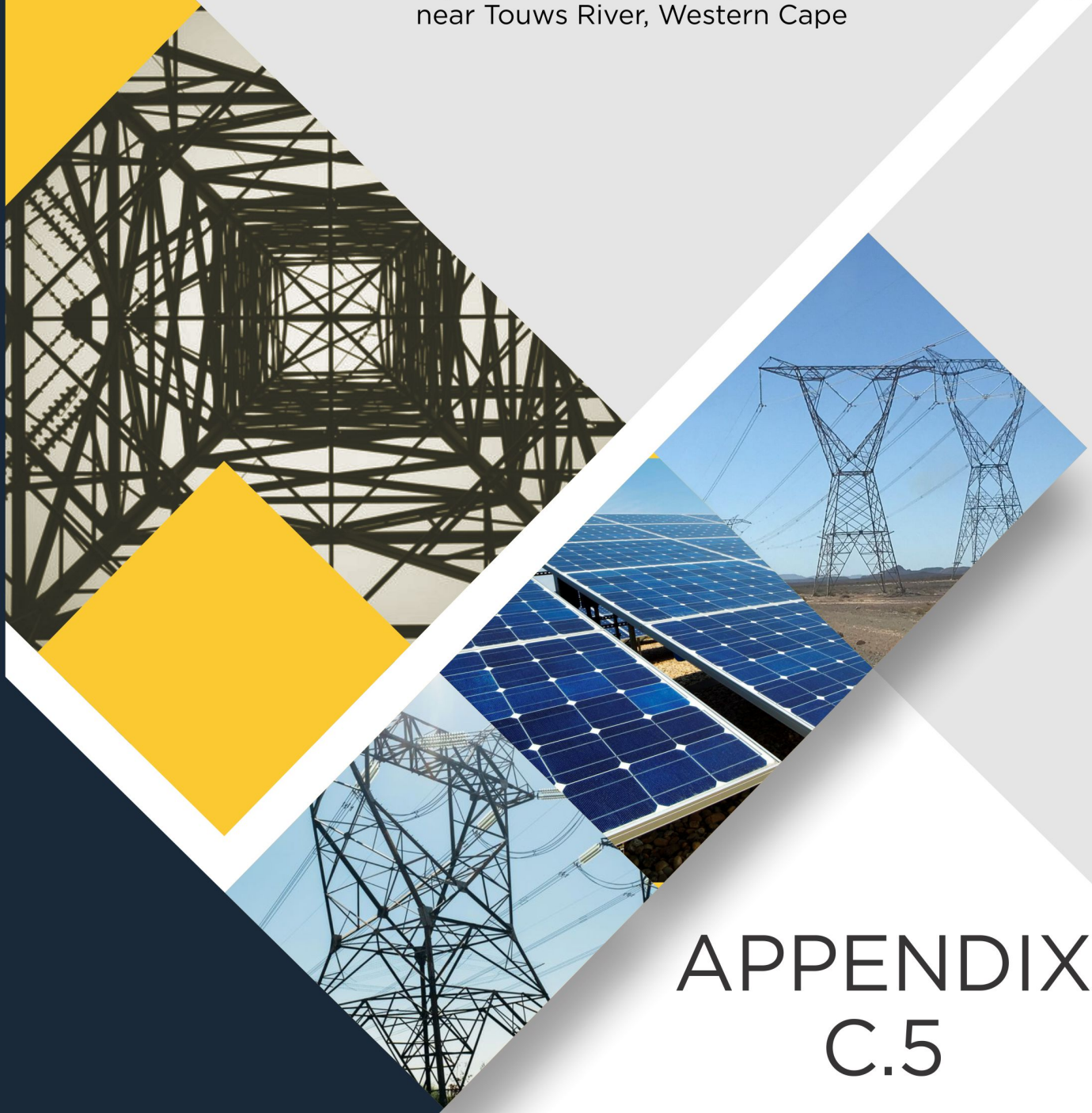
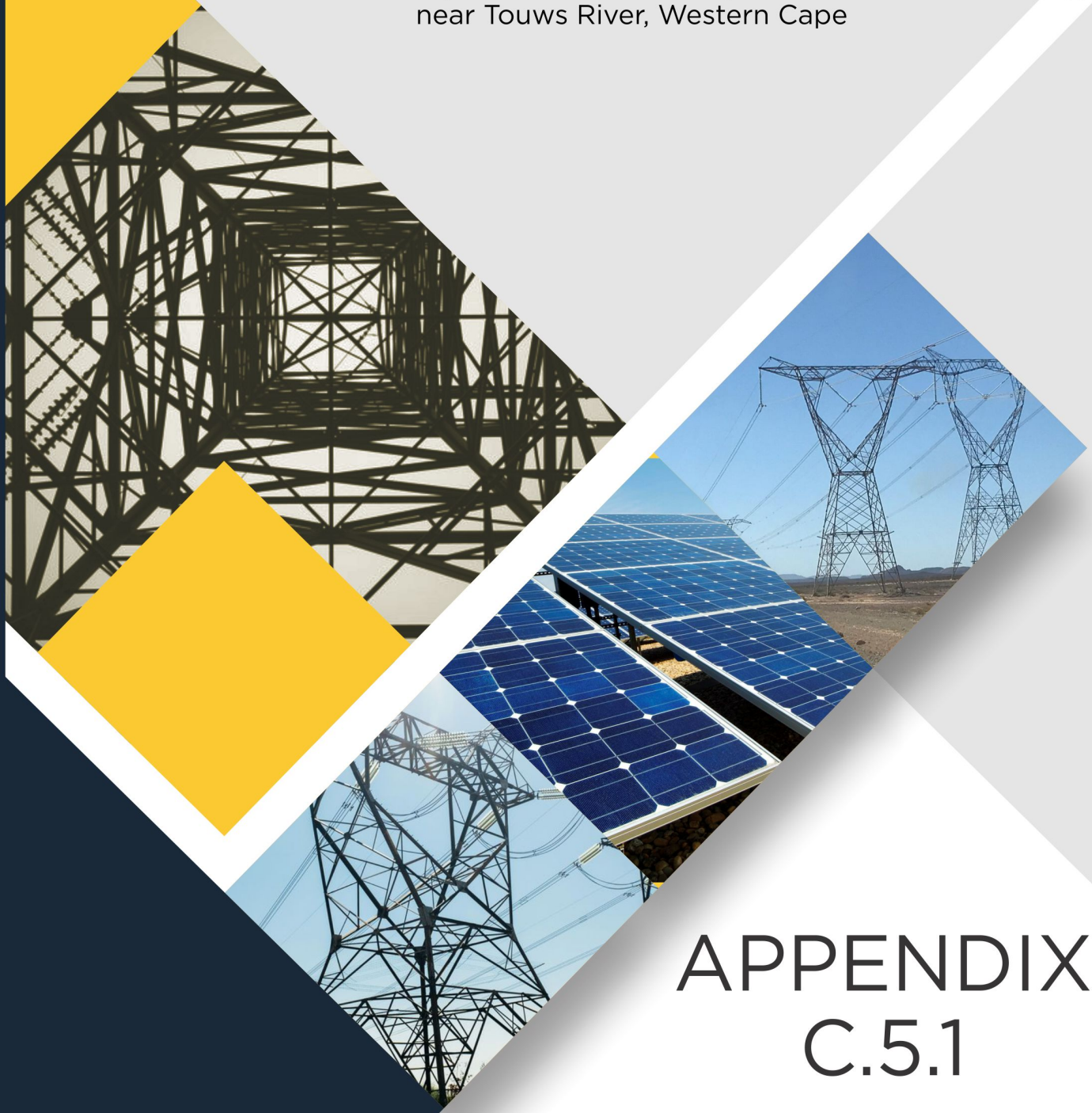
Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.5

Aquatic Biodiversity and Species

Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.5.1

Aquatic Biodiversity and Species for Witte Wall

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT:

Basic Assessment for the Proposed Development of two 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure on the Farm Witte Wall (i.e. Witte Wall PV 1 and Witte Wall PV 2), near Touws River, Western Cape

---

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	SDP Ecological & Environmental Services
P O Box 320	P O Box 1016
Stellenbosch	Ballito
7599	4420
South Africa	South Africa

October 2020

Executive Summary

Two 175 MW photovoltaic (PV) power generation plants (i.e. Witte Wall PV 1 and Witte Wall PV 2) have been proposed for establishment on the Farm Witte Wall 171. In addition, these plants, would provide power through 132kV overhead powerlines that would connect with the Kappa Sub-station, some 12km to the south of the site.

An evaluation of the aquatic aspects of the Farm Witte Wall was undertaken during September 2020 in order to consider the nature of the area in question and to evaluate the impacts of the proposed development.

The Farm Witte Wall lies within the Tanqua Succulent Karoo Biome and comprises of two veld types, namely Tanqua Karoo and Tanqua Wash Riviere. The former is associated with elevated terrestrial environments while the latter is associated with sandy, riparian habitats. Both veld types are considered "least threatened".

In evaluating the ecological significance of the subject site, it was determined that the importance of the Tanqua Wash Riviere habitat or lower riparian environments were high in terms of faunal diversity. These areas are considered important faunal habitat and are evidently also associated with extreme flood states, providing them with a high ecological sensitivity. These findings align with those of the Department of Environment, Forestry and Fisheries (DEFF) screening tool and the various data sets associated with the region.

Given the above, the proposed development of Witte Wall PV 1 and Witte Wall PV 2 is expected to elicit an overall moderate ecological impact that may be reduced to "low" significance if suitable mitigation measures are employed. The overhead powerlines are expected to elicit only a low significance impact, primarily associated with change that may arise in the riparian environments.

The proposed developments, if authorised should be approved with a number of conditions, in particular the placement of the development within the footprint identified and that a suitable game-permeable fence should be instituted. A number of related mitigation and management measures are proposed.

From the above, it is evident that subject to the conditions outlined in this report, the development of two 175 MW PV facilities at Witte Wall cannot be precluded on ecological grounds.

Contents

List of Figures

List of Tables

List of Abbreviations

AIP	Alien Invasive Plant
AMSL	above mean sea level
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Environmental importance and sensitivity
BA	Basic Assessment
CBA	Critical Biodiversity Areas
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
EGI	Electricity Grid Infrastructure
GPS	Global Positioning System
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
PV	Photovoltaic

Glossary

Definitions	
Arid	Areas which receive low levels of rainfall or there is a moisture deficit.
Aquifer	Underground layer of water-bearing permeable rock
Crepuscular	Fauna that is active at twilight
Dendrogram	A diagram showing relationships determined through a cluster analysis
Calcrete	A carbonate horizon formed in semi-arid regions. Also known as a caliche.
Dolerite	Form of igneous rock.
Drainage line	A geomorphological feature in which water may flow during periods of rainfall.
Dune	Landscape feature arising from the deposition of sediment, transported primarily by winds and resulting in a sandy feature that may or may not be stabilised by vegetation
EI	Environmental Importance
ES	Environmental Sensitivity
Eco morphology	Pertaining to the relationship between the geomorphology of an environment and the biotic components that are adapted to it.
Edaphic	Pertaining to soils.
Fossorial	Pertaining to burrowing animals or those which live underground
Geophyte	Plants with underground storage organs.
Graminoid	Grasses or grass-like. Also, monocotyledonous plants.
Gully	An erosion line exceeding 30cm in depth where water flow is concentrated and erosion resulting from flow is clearly evident.
Hydrogeomorphological	The interaction of geomorphic processes, landforms and /or weathered materials with surface and sub-surface waters.
Hygrophilous	Plants growing in damp or wet conditions
Multivariate analysis	A statistical method of evaluating nonlinear relationships between groups of data.
Non perennial	Flow is intermittent and irregular
Rill	Shallow erosion lines less than 30cm deep
Scarp	Physical feature determined by geology and comprises of a steep slope that differs from the slope of the prevailing landscape
Sheetwash	A mobile sheet of sediment deposited by water flow over a hill-slope or plain
Xeric	A dry, as opposed to wet (hydric) or mesic (intermediate) environment.

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT

This report serves as the Aquatic Biodiversity and Species Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed development of two 175 MW Solar Photovoltaic (PV) Facilities and associated Electrical Grid Infrastructure (EGI) on the Farm Witte Wall 171, near Touws River in the Western Cape. These projects are referred to as Witte Wall PV 1 and Witte Wall PV 2.

1 Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The Project Applicant is undertaking an Application for Environmental Authorisation (EA) to be submitted to the National Department of Environment, Forestry and Fisheries (DEFF), which entails significant planning, as well as the undertaking of BA processes. The Project Applicant is proposing to develop nine solar PV facilities, nine powerlines and associated infrastructure to link the proposed PV facilities to the Eskom Kappa Substation. There are nine separate Project Applicants. Two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172. This Aquatic Biodiversity and Species Specialist Assessment specifically deals with the Witte Wall PV 1 and Witte Wall PV 2 projects, as well as the associated EGI (Figure 1). This specialist study, is being undertaken as part of said BA process, in order to evaluate the aquatic habitats of the receiving environment in relation to the proposed development.

The bio physical reconnaissance and evaluation of a portion of the farm Witte Wall was undertaken during the period September 2020 and entailed both a literature review of the region, as well as on site evaluations, during which specific primary data was collected and evaluated. In addition, the identification of key hydrological features on site and an interpretation of the prevailing flora and fauna, as well as other features was undertaken.

All data collected in the field and during the literature review was evaluated and interpreted in order to provide an understanding of the nature of the prevailing environment at a landscape and habitat level, together with specific evaluation of data relating to habitat form and structure. The evaluation also sought to identify any anomalies within the prevailing environment. Such variance may be considered to be indicative of differing habitat forms, which under consideration, may be of higher order ecological value in relation of the prevailing environment.

1.2 Details of Specialist

This specialist assessment has been undertaken by Messrs S C Bundy, L P Maingard and AM Whitehead of SDP Ecological and Environmental Services. The following information is provided in respect of the above:

S C Bundy	Ecologist	SACNASP No. 400093/06
LP Maingard	Ecologist	SACNASP No. 116639/16
AM Whitehead	Ecologist	SACNASP No. 400176/10

Curriculae vitae of the individuals above are included in Appendix A of this specialist assessment, as well as specialist statements of independence in Appendix B.

1.3 Terms of Reference

The overall objectives of the Aquatic Biodiversity and Species Specialist Assessment are:

- To identify and establish an understanding of the site under consideration at a landscape scale of evaluation with particular consideration being given to important aquatic or riverine habitats, as they may be identified.

- To provide an evaluation and status of habitat composition and significance within the site in order to evaluate the potential impact of the proposed development on the ecological function of the site.

- To assess the actual and potential impacts arising from the proposed development on the hydrological features within the study site. Such impacts may be directly applicable to the site and contained within the site boundaries, or may be indirect impacts, which may have ramifications outside of the site boundary; or may be of a cumulative nature, in terms of impacts arising from similar developments or activities within the region.

- To provide guidance on the implementation of mitigation measures that may serve to moderate any negative impacts that may arise on site, as a consequence of the proposed development.

The Scope of Work is based on the following broad Terms of Reference, which have been specified for this specialist study:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320; as well as all relevant legislation. Identify any additional protocols, legal and permit requirements that are relevant to this project and the implications thereof.

- Review detailed information relating to the project description and precisely define the environmental risks to the aquatic environment and consequences for prevailing ecology.

- Compile a baseline description of the aquatic ecology of the study area, and provide an overview of the entire study area in terms of ecological significance and sensitivity.

- Provide specific ecological data in respect of the aquatic components of the site using ground-truthing methods, with an emphasis on those areas considered to be of “high” and possibly, “moderate” sensitivity.

- Based on the desktop study, undertake field work and sampling across the site to record relevant data and to compile an overview of the habitat under review. The site visit must also identify the level of sensitivity assigned to the project area on the National Web-based Environmental Screening Tool (Screening Tool), and to verify and confirm this sensitivity and land-use. A Site Sensitivity Verification Report must also be compiled based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.

- Collate all data collected during the field work and undertake a review using methodologies that allows for comparison or consideration of biological data.

- Provide a detailed hydrological and aquatic biodiversity sensitivity map of the site, including mapping of disturbance and transformation on site, as well as set-backs or buffers.

- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.

- Identify any species of special concern or protected species on site.

- Identify and delineate wetlands that may occur on the site, using the relevant protocols established.

- Determine if a Water Use License (WUL) is required and if so, determine the requirements thereof.

- Identify and rate potential direct, indirect and cumulative impacts on the aquatic ecology, species and ecological processes within the site during the construction, operation and decommissioning phases of the project.

- Provide input to the EMPr, including mitigation and monitoring requirements to ensure that the impacts on the aquatic ecology are limited.

- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.

- Compile an assessment report qualifying the risks and potential impacts on aquatic ecology in the study area and impact evaluations.

- Incorporate and address issues and concerns raised by Stakeholders, Competent Authority, I&APs and the public during the Public Participation Process (where relevant and applicable).

2 Approach and Methodology

A literature review and desktop analysis were undertaken prior to the field investigation, utilizing various sources including the National Fresh Water Priority Areas (NFEPA) data and other relevant sources. Recent and historical aerial imagery of the site was reviewed in order to identify points for investigation during the field survey.

Utilising the above information, a field investigation was undertaken from the 14th to 18th September 2020, whereby:

- Key features, such as rivers and scarps were evaluated in order to determine the key, geophysical features on the site;
- Sites of geomorphological or topographic variance were identified and subjected to an evaluation of species present within a 40 m linear extent across the selected site. Species were identified and collated according to a “presence – absence” method of evaluation;
- Additional random sample points were selected from across the site for comparative purposes; and
- Any additional species of significance not identified within the sample sites were also noted.

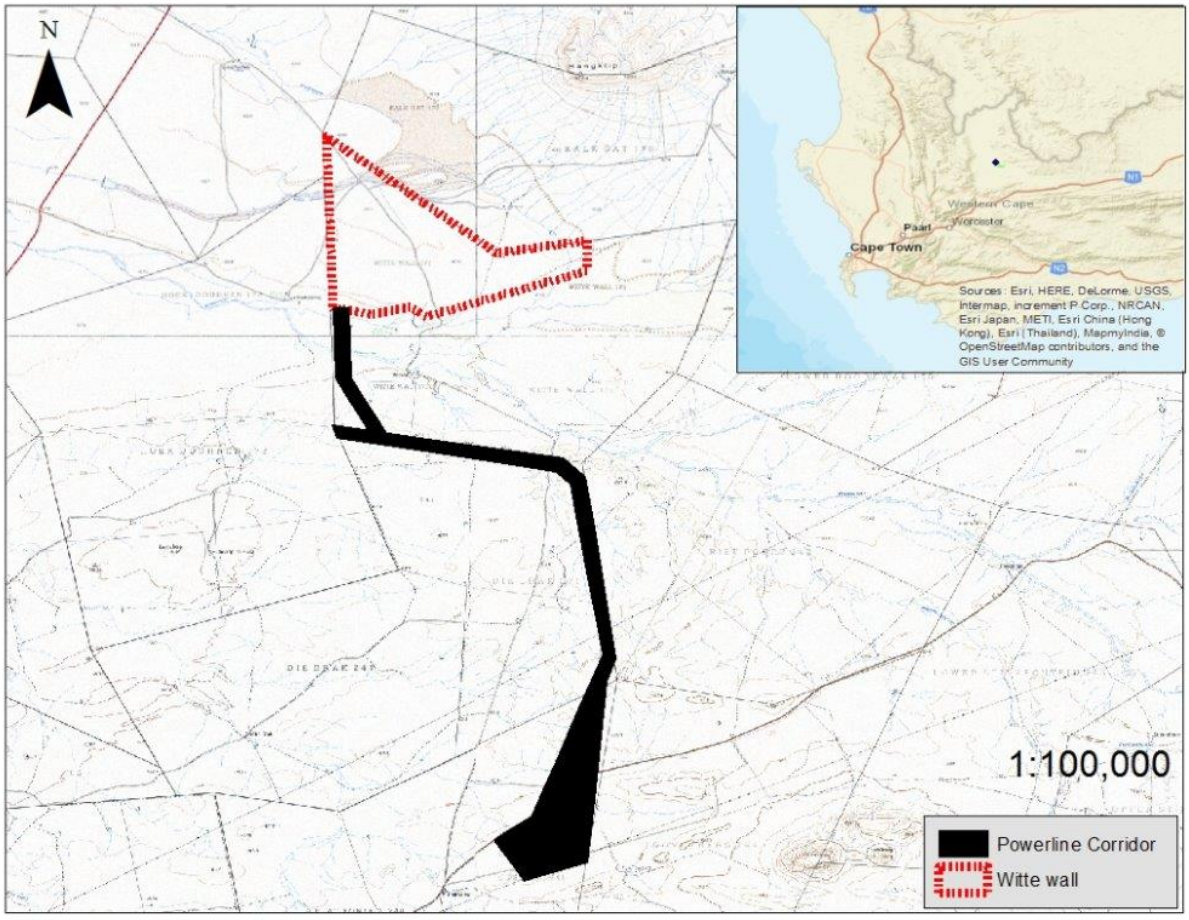


Figure 1. Topographic map indicating the Farm Witte Wall, as well as the study area (outlined in red) and the adjoining powerline corridor.

All data was collated and subject to evaluation in order to:

- Place the data into a hierarchy of similarities according to species composition and sample sites.
- Give consideration to the overall structure of habitat within the subject site.
- Identify any habitat anomalies that may be identified in such analysis.
- Allow for the interpretation of such data in order to prioritise and evaluate habitat form and structure within the study area.

In addition, using methods identified in the Department of Water Affairs' "A Practical Field Procedure for Identification of Wetlands and Riparian Areas" (2005), such features were identified and defined. Such evaluations utilised both geomorphological, geohydromorphic edaphic conditions and botanical indicators in order to identify such components. Where riparian and wetland systems were identified these areas were subject to specific evaluation within this assessment report.

Riparian delineation methods

As noted above, the delineation of riparian edge and ephemeral wetland environments was undertaken utilizing accepted delineation techniques contained within "*A Practical Field Procedure for Identification of Wetlands and Riparian Areas"* (DWAF 2005) and the updated guidelines (DWAF 2008). A description of the rationale is provided below.

Riparian indicators - Indicators of a riparian system include the following (as per DWAF 2005):

1. An “obvious” floodplain and active channel.

2. Evidence of active erosion indicating a high energy system.

3. The absence of “classic” hydromorphic vegetation, with species associated with riparian areas dominating, or simply a change in vegetation density and structure.

As such, the approach to defining the riparian zone is not strictly defined (DWAF 2005) and a number of methods can be used. Accepted riparian indicators include:

1) **Topography**: identification of flood terraces and macro-channels.

2) **Vegetation**: identification of a distinct area of vegetation change, often in close association with the macro-channel. Changes can be in relation to species diversity or physical nature (density or health).

3) **Alluvial soils** and deposited material: identification of recent deposits of sand or mud, serves as a confirmatory indicator.

A number of methods exist for identifying riparian indicators. Acceptable methods include (DWAF 2005):

1) The use of topographical maps.

2) Aerial photographs and aerial videos.

3) Ecoregions (e.g. using climatic, geological or vegetative community indicators can be useful as a predictive method).

4) Field work (i.e. confirming desktop observations by locating indicators on site).

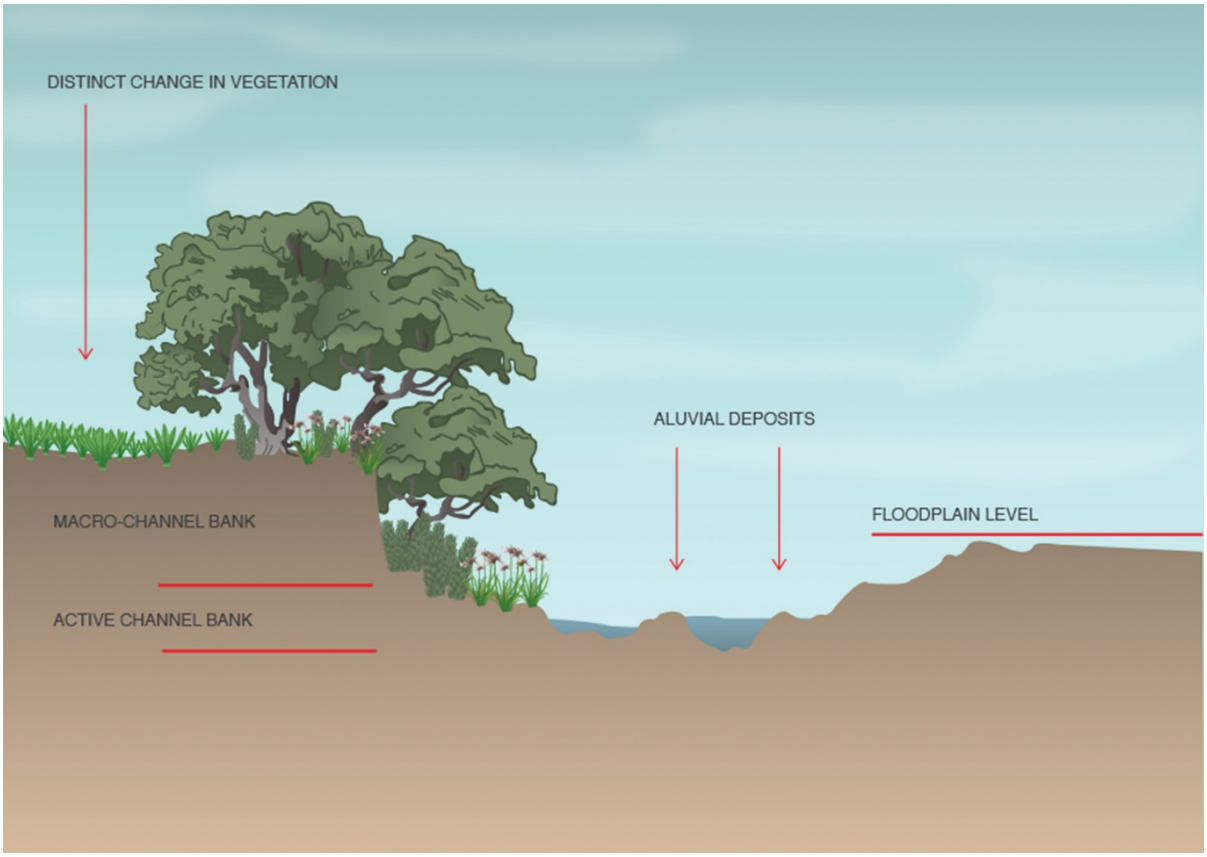


Figure 2. Illustration of a typical riparian cross section (Adapted from DWAF 2005), indicating riparian edge (arrow (distinct change in vegetation)).

Wetland Habitat

Due to the continuous or regular saturation experienced within wetland environments, soil chemistry differs from mesic or dry environments, giving rise to specific plant associations or groupings (hydrophytes) within wetland environments (Figure 2). The dependence of hydrophytes on wetland conditions varies from species to species and as a result, these species can be classified according to their occurrence within wetland areas. Such groups include obligate wetland species and facultative wetland species (as set out in DWAF 2005 and 2008).

A dominance of obligate species, indicates wetland conditions. In addition, the species present can be used to determine the three wetland zones, permanent, seasonal and temporary, however the difference between seasonal and temporary wetland areas is often ambiguous, resulting in the two categories being combined occasionally.

Soil characteristics are also utilized in the delineation process. Under fluctuating periods of water inundation, as well as the permanent presence of water within the upper soil horizons, minerals in the soil are either leeched from the horizon or are subject to chemical reactions, leading to changes in soil colouration and the presence of "mottling". The frequency of mottling indicates the degree of saturation and hence the wetland zone.

During the delineation exercise, the riparian and wetland areas associated with the site were delineated using aerial photography and field observations, which focus primarily on changes in vegetation, topography and the presence of alluvial deposits. Specific points were marked using a Garmin VI Montana Global Positioning System (GPS) device, where necessary.

Wetland functionality and health (PES)

Utilization was made of the Wet-Eco services tool (Kotze et. al. 2007) to determine the significance of the three identified wetland environments. Being an arid environment, with little or intermittent flow arising only on occasion, a "desktop" environmental importance and sensitivity (EIS) and Present Ecological State (PES) was undertaken (i.e. it was not possible to evaluate aquatic biota or undertake water chemistry analysis). This exercise involved the identification of the appropriate riverine section. The results of the PES or ecological status of the system provide an indication of the level of importance of the river, according to a ranking. The various classes or ratings are presented in Table 1.

Table 1. PES/Ecological status ratings for riverine system (Kleynhans et al 2005)

Rating	Description
A	Unmodified, natural.
B	Largely natural. A slight change in ecological processes is discernible but the system remains largely intact.
C	Moderately modified. A moderate change in ecological processes has taken place but the system remains predominantly intact.
D	Largely modified. A large change in ecological processes has occurred and the system is appreciably altered.
E	Greatly modified. The change in ecological processes is great but some features are still recognizable.

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS category as listed in Table 2 below:

Table 2. EIS category, score and interpretation.

EIS Category	Range of Mean	Recommended Ecological Management Class[3]
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

2.1 Information Sources

The following data sources were consulted during this investigation.

Table 3. Data sources utilised during assessment

Data / Information	Source	Date	Type	Description
South African National Protected Areas Database (SAPAD)	Department of Environmental Affairs	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Western Cape Biodiversity Spatial Plan (WCBSP)	CapeNature. 2017. Western Cape Biodiversity Spatial Plan 2017. http://bgis.sanbi.org/	2017	Report & Spatial	Spatial conservation planning units and associated management recommendations for the Western Cape province
National Biodiversity Assessment	South African National Biodiversity Institute	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including, vegetation types, wetlands and rivers.
http://posa.sanbi.org/sanbi South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA) [dataset]	SANBI Plants of Southern Africa	2016	Data	Plant list for Tankwa region.
www.vmus.adu.org.za Animal Demography Unit	ADU: University of Cape town	2020	Data	Specific data on geographic occurrence

Data / Information	Source	Date	Type	Description
(ADU).				and record for various taxa.
Tankwa Weather http://tankwaweather.co.za	Private weather station	2020	Data	A private Davis Vantage Pro 2 mounted 1.6m above the ground. And anemometer at 10m angle Operation since: Jan 2015

2.2 Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations are presented in respect of this evaluation:

- Site reconnaissance was undertaken over a consecutive 5 day period during the early summer. Such field reconnaissance does not account for seasonal variations that may arise and reliance on collated and historical data from the region is required.
- During the period of reconnaissance, seasonality and weather conditions may have affected findings, in particular, colder temperatures.
- The area in general has been subject to an extended and significant drought, which is likely to have influenced habitat form at a limited level, as well as faunal populations.
- Cumulative impacts have been considered on a regional basis over a 30km radius.

2.3 Consultation Processes Undertaken

Interaction was undertaken with local residents and interested parties who were considered to have specific knowledge of the area, these included:

- Mr Philip van Heerden
- Mr Andre Vermeulen.

The above persons provided anecdotal information which was verified and considered during the site evaluation, as well as by further interrogation of the literature and data.

3 Description of Project Aspects relevant to Aquatic Biodiversity

The development of a PV facility, associated infrastructure and EGI on the subject properties will by necessity, be undertaken on land that meets a number of criteria including, *inter-alia*, level or gradual falls, generally suitable founding conditions and avoidance of areas that may be inundated by flooding. As a consequence, the proposed PV facilities will avoid all riverine and wetland environments.

Howsoever, the proposed development will alter the nature of the immediate catchment associated with such riverine environments through both the construction of the facility as well as its operations. Such change will arise primarily from changes in the rate of flow of surface water and possible alteration of the edaphics or soils within the facility, as well as, to a minor extent, water chemistry and perhaps, more indirectly, the biotic components of the riverine system.

The proposed Witte Wall PV projects will see a land use change that differs significantly from the prevailing land use. The implementation of the proposed development will result in notable change to

the prevailing catchment associated with the river systems in the area, primarily on account of the construction stage of the project, as well as the long-term operational stage. Indirect impacts may therefore arise on riverine systems as a consequence of changes in the catchment. The development of the site for the PV facilities, associated infrastructure and EGI will see the following activities arise:

- Cordoning and fencing of the sites during both the construction and operational phases. This component of the project usually entails the establishment of an electrified fence (or palisade or mesh type) of about 2 – 3 m high which remains in situ for the lifetime of the project (i.e. for the operational phase). For the construction phase, the construction area and construction site camp may also be cordoned off with temporary fencing. Game fences will also be constructed around each PV facility on the farm Witte Wall. Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm.

- Clearance or partial clearance of minor topographic features and vegetation, where applicable, during the construction phase.

- Establishment of roadways (i.e. access roads leading to the site and internal gravel access roads) and hard panning of surfaces, with minor stormwater management aspects being introduced during the construction and operational phases.

- Establishment of modular arrays with concomitant cabling and provision of invertors within the arrays. The footing of the module framework is founded into the ground using an earth screw or similar methods. Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m

- Establishment of step up transformers and two on-site substations (one for Witte Wall PV 1 and one for Witte Wall PV 2). This facility is expected to occupy an area of approximately 2 ha each. It will be fenced and isolated from the balance of the site.

- A Lithium Ion Battery Energy Storage System (BESS) will be established at each PV Facility. The proposed BESS will cover an area of up to 8 hectares within the laydown area and a height of up to 5 – 10 m.

- A laydown area of approximately 13 ha in extent.

- Establishment of offices and related infrastructure.

- A yard for storage and general operations will be set aside, adjacent to the built offices.

- An overhead powerline (132kV) will be established per PV Facility from the on-site substation to the Kappa substation. The powerlines will traverse the Groot River and adjacent lands to the south, aligning with existing powerlines associated with adjacent renewable energy projects.

The commencement of construction on site will entail low to significant alteration of the prevailing habitat, depending upon the final design and layout of the PV facilities. A general sequestering of the subject area, through the fencing of the site from the surrounding habitat forms will thus arise.

While the construction phase will see temporary disturbances and transformation to the environment, these impacts on the prevailing ecology are likely to be significant in terms of impact, but of short

temporal extent, as the construction project rolls out and a stability, albeit within a differing environment, arises on the subject site. It therefore follows that impacts on the ecology arising from this project can be divided into two aspects, namely: construction phase impacts and operational impacts.

4 Baseline Environmental Description

The Witte Wall farm lies within the southern extent of the Tankwa Karoo, part of the Succulent Karoo Biome. The Tankwa Karoo is associated with a comparatively low altitude and generally flat to undulating landscape, not exceeding 1500m amsl. According to the Koppen-Geiger climate classification method (www.koeppen-geiger.vu-wien.ac.at), the area is classified "BSh", which is indicative of an arid, hot environment. Such extremes have given rise to a regionally unique environment, both from an aquatic and terrestrial perspective.

In an arid region such as the Tankwa, riverine environments are primarily seasonal systems, flowing intermittently during high precipitation events. These episodes of flow can be significant flood events as deep frontal rains, as well as orographic rainfall arises within the catchment and on the Hangklip mountain to the north east. Rainfall events are also seasonal (mainly a winter period phenomenon) and during the periods between such precipitation events, little or no flow arises in these systems. Given the alluvial nature of these systems, little in the way of wetland environment is encountered in the river channels.

Some consideration of the broader ecological features of the site are presented below.

4.1 General Description

Witte Wall can be described as a series of undulating plains and plateaux, interspersed with occasional dolerite ridges. The lower elevations of the site are associated with sheet wash plains and larger ephemeral rivers that are dominated by alluvial sands.

Given this topography, two habitat forms or veld types are evident within the PV sites, these being SKv 5 Tanqua Karoo (Mucina and Rutherford 2006), a form of the Succulent Karoo Biome, and Tanqua Wash Riviere (AZi 7) a riparian habitat form (Figure 3). Both these veld types are considered "least threatened" from a conservation perspective. The same status applies to the EGI corridor running along Die Brak and Platfontein Farms.

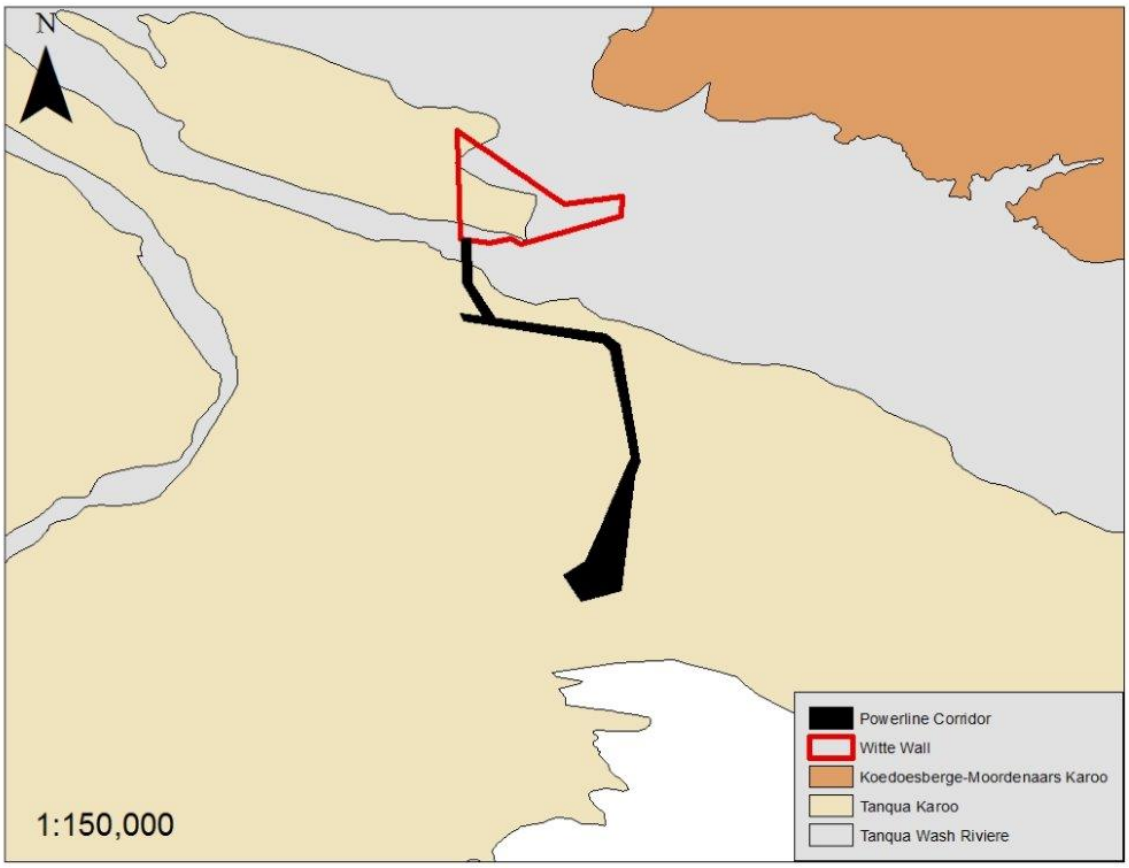


Figure 3. Map indicating veld types in relation to study area

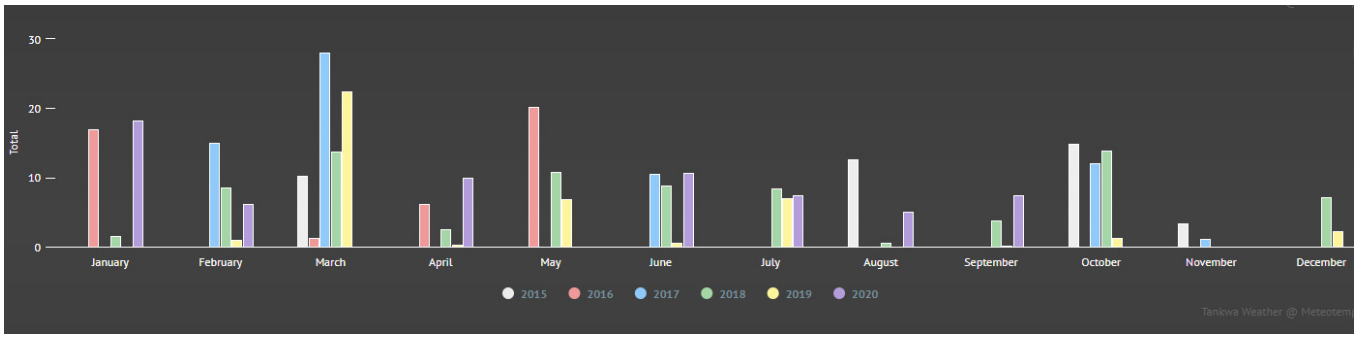


Figure 4. Graph showing monthly rainfall in Tankwa 2015 – date.

4.1.1 Ecological Processes, Functioning and Drivers

Two principle factors are considered to be the master elements driving the localised ecology. These can be considered to be broadly meteorological factors, namely wind, rainfall and temperature, while edaphics, particularly giving rise to lithic or sandy environments may be considered a geophysical driver. Notably, anthropogenic factors have over the previous century proven to be a key driver in contemporary habitat form and structure.

From a meteorological perspective the study area is a “xeric habitat”, with an average annual rainfall recorded over the last 5 years of between just over 40mm to 66mm in 2017 (2020 may exceed this record). There is however, high spatial and inter annual variability in rainfall patterns across the

region (Figure 4). According to Mucina and Rutherford (2006), the region may be considered to be a "rain shadow desert", where topography influences rainfall patterns.

In addition to the above, wind is a key issue within the region, driving sediment movement and promoting aeolian, sediment transport in areas exposed to high winds and with little vegetative cover. Where vegetation cover has been compromised, aeolian transport generally prevents the natural re-establishment of vegetation, or at least retards such emergence. The dominant winds within the subject site are the north westerly and southerly wind, which are seasonally prevalent (Figure 5). Sheetwash is also conspicuous to the east of the site, where sediments transported from up-slope have been deposited, proximal to the riverine areas.

Temperatures in the region can be considered to be extreme, with the greatest range recorded in the area lying at 53 °C. The lowest recorded minimum temperature is -3. °C and the highest maxima being 50.2°C (http://tankwaweather.co.za/pages/station/climate.php). A mean maximum temperature of 35°C is recorded by the SA Weather Service. Such extremes are indicative of the requirement for floral and faunal species to be tolerant of the effects of frosting, as well as high insolation and transpiration states. As a consequence, plant communities and faunal populations in the region generally show high levels of adaptation, occurring in specific areas or zones and the utilisation of specific, niche environments, e.g. scarp slopes and riverine environments by both floral and faunal communities.

4.1.2 Aquatic Biodiversity and Ecosystems

4.1.2.1 Aquatic Ecosystems

At a landscape level, riverine and riparian areas in the southern Tankwa region generally show improved vegetation cover and faunal presence on account of access to water and increased availability. The vegetation cover is however, primarily not hygrophilous in nature and is generally a *Vachellia* karoo dominated environment with *Lyceum cinereum* and *Salsola ceresica* being the dominant species within vegetation associes in these areas. Such species align with the Tankwa Wash Riviere habitat and as such, do not conform with the strict definition of "riparian vegetation". Mucina and Rutherford (2006) refer to this habitat as either "alluvial shrublands and herb lands", and "sheetwashes".

These areas are however subject to intermittent but significant flooding and as such there can be significant transport of material within these riverine environments. As such these areas show a natural disturbance regime that results in scour and erosion, as well as significant deposition. Lighter falls may result in generally low-level inundation of pools and ponds within the riverine environments, and these may support small associes and consocies of *Spiloxene aquatica* and *Scirpoides dioecus.* Given the generally dry and erratic flows experienced within aquatic environments within the southern Tankwa region, aquatic biota is generally limited and cannot be utilised in the determination of the ecological state of these systems. Howsoever, terrestrial fauna is notably more prevalent in the Tankwa Wash Riviere habitat, primarily because of improved cover and access to water.

Given the above, anthropogenic factors have been a key determinant in the contemporary nature of the aquatic or riverine environments within the site. While the current land use on the site is game ranching, previous agricultural land uses have specifically focussed on sheep and goat farming, which has been undertaken since the 1700s.The overgrazing of the land has given rise to poor vegetation cover and has contributed significantly to sediment deposition and alluvial conditions that presently prevail in the riparian environments. In addition, owing to the poor soils found in the terrestrial environments of the Tankwa, almost all cultivation practices, including the laying down of pasture, has

been and continues to be undertaken in the riverine environments. There is thus regular and sustained disturbance in these areas. In addition, the scarcity of water in the region has resulted in the establishment of dams and other features to attenuate and capture water in the rivers. Some dams are successful, while others are less so, having been breached by the torrential flooding that arises from time to time.
In addition to the above, a point of some interest is the significant use of subterranean water through abstraction for the tending of livestock and other activities. Notably this water has a high salinity and as the subterranean water enters the riparian environment, such salts may have a small but pervasive effected on this habitat (*pers obs*).

The above natural and anthropogenic factors have given rise to a generally altered environment and concomitantly changed habitat within and adjacent to the river systems of the locale. It follows that further land use change in the region, where livestock are excluded, may allow for the seral succession processes of habitats previously affected by farming activities to emerge. Such change may alter the nature of the catchment and indirectly affect the evident aquatic and riverine systems. In addition, this change may not necessarily be adverse and improvements in the local aquatic ecology may arise. A prudent approach to the implementation of such development is however required in order to ensure beneficiation.

4.1.2.2 Aquatic Species

No aquatic biota was identified within either the Klein Droelaagte River or the Groot River (Figure 5).

Given the ostensibly dry state of the river bed, as well as the intermittently extreme flow experienced in these systems, there is little likelihood of fish species being present within either of the two river systems at any given time. The nearest data relating to ichthyofauna within the catchment of these two rivers arises from the confluence of the Doering River and Grootr River, some 60 kilometres downstream. This data indicates the presence *Barbus capensis*, (Clanwilliam yellowfish), *B serra* (Clanwilliam sawfin) endangered, *Galaxias zebratus* and the endangered Clanwilliam sandfish, *Labeo seeberi*. *Micropterus salmoides*, the exotic largemouth bass, has also been recorded from these areas (Department of Water and Sanitation[1] (DWS), 2014). Recent attempts to locate *L seeberi* in the lower Tankwa River have not been successful.

The Animal Demography Unit (ADU) data base identifies only two anurans (frogs) from the Tankwa region, these being *Vandijkophrynus gariepensis gardenias* (Karoo toad) and the common *Amietia fuscigula* (the Cape river frog). *A fuscigula* is rapidly expanding its range, utilising farm dams and open water, while *V gariepinus* is an abundant species in the region. Both species are considered to be of least concern from a conservation perspective.

Data derived from the ADU identified three families of Odonata (dragonflies) within the region, these being the Libellulidae, Gomphidae and Coenagrionidae (FitzPatrick Institute of African Ornithology, 2020). All species are of *least concern* from a conservation perspective. Notably Libellulids are commonly associated with stagnant or still waters, rather than streams and regular flow which would account for their representation in this region.

In general, much of the riparian areas within the region are subject to regular disturbance primarily on account of farming activities, where cultivation and pastural activities are compelled to be undertaken within these areas. More terrestrial environments are not easy to till and are generally water deficient and thus production is poor.

[1] DWS is now operating as the Department of Water, Sanitation and Human Settlements

4.1.2.3 Conservation Planning

Critical Biodiversity Areas and Ecological Support Areas

Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) are indicated in terms of the Western Cape Biodiversity Spatial Plan (WCBSP) (2017). The assessed area for the PV arrays and associated infrastructure, specifically the power lines, traverse a number of Terrestrial and Aquatic CBA and ESA delineated areas. However, the actual footprint of the Witte Wall PV facilities only traverses extremely minor areas of Terrestrial CBA 1 and CBA 2; and a few minor areas of Aquatic ESA 1, mostly associated with drainage line watercourses, and extremely small areas of ESA 2. This preliminary data provided by the WCBSP is the product of a systematic biodiversity planning assessment which identifies portions of land that require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and aquatic realms (CapeNature 2017). These spatial priorities are used to inform sustainable development in the Western Cape Province.

In addition to the above, CBAs and ESAs are separated further into CBA 1 and 2 as well as ESA 1 and 2 respectively. It is important to note that CBA 1 show areas in a natural condition and those that are potentially degraded or represent secondary vegetation are considered to be CBA 2. Similarly, a distinction is made between ESAs that are likely to be functional (i.e., in a natural, near-natural or moderately degraded condition; ESA 1), and ESAs that are likely severely degraded or have no natural cover remaining and therefore require restoration where feasible (ESA 2). The ESAs are not considered essential from a conservation perspective for meeting biodiversity targets; however, they may offer some ecological services.

As much of the floral and faunal diversity within the subject region is related to riparian environments, it is clear that by excluding the proposed development from these areas, impacts on areas or corridors that have significant ecological support functions are unlikely to be affected by the proposed development.

Critically Endangered and Threatened Ecosystems

According to the Biodiversity Geographic Information System (BGIS) developed by SANBI, there are no Critically Endangered and Threatened Ecosystems on the subject sites. The ‘endangered’ and ‘threatened’ eco-systems identified within the Cape Winelands District Municipal region are not located within the study areas. Such areas are located some 40 kilometres to the east and the west of the site, but do not extend into the subject area.

Protected Areas (PAs)

The project area does not fall within or adjacent to a Protected Area.

4.2 Project-specific Environmental Description

As indicated above, the riverine and riparian habitat of such an arid region does not display the classic characteristics of hygrophilous habitats. As such, the PES of these environments cannot be determined using the recommended methods of the DWS from primary data collection. Consideration is therefore given to the general nature of the site and the use of a desktop PES.

The Farm Witte Wall incorporates portions of two river systems, namely the Klein Droelaagte, in the north and the Groot River in the south (Figure 5). A small unnamed river system also flows through the farm and has its confluence with the Groot River on the Farm Witte Wall.

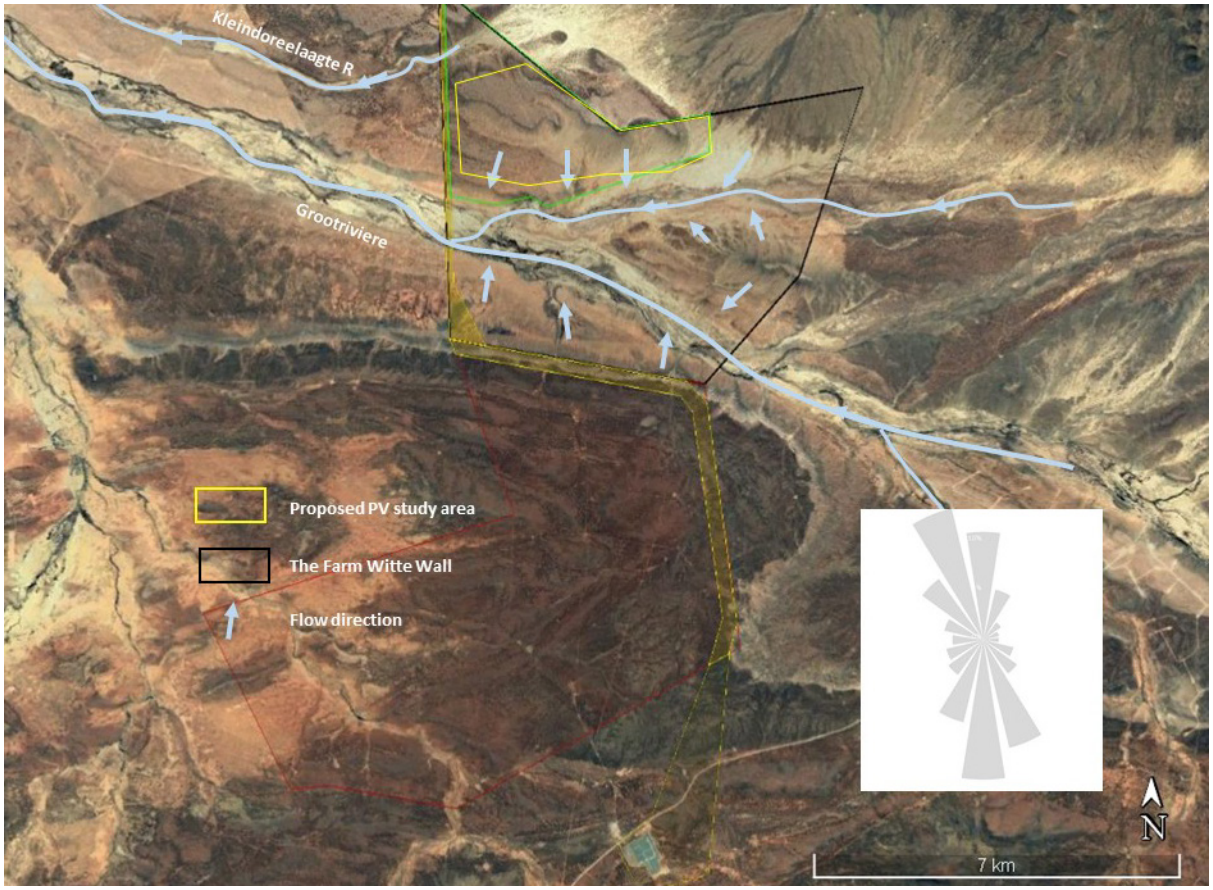


Figure 5. Map image showing two major river systems associated with the farm Witte Wall and drainage patterns, as well as prevailing winds. A schematic area of the proposed PV facilities is also indicated (Google Earth, 2020).

These rivers all ultimately flow into the Doring River and this in turn, serves the Olifants River, with its confluence some 60 kilometres north of the site. Most surface drainage from the farm Witte Wall flows into the Groot River on account of the prevailing topography.

According to the DWS (2014) data for reach 8160 of the Groot River, this system has been classed using a desktop PES as "D" with an environmental importance (EI) of "*moderate*" and a "*very high*", environmental sensitivity (ES). The Klein Droelaagte has not been assessed, however the Droelaagte, from the same data set and located downstream of the site is considered to have a PES of "D", an EI ranked as "*moderate*" and an environmental sensitivity of "*very high*".

The Groot River is, as stated above, part of a network of ephemeral river systems with intermittent flows primarily associated with the winter rainfall period. The wider riparian environment comprises of a network of minor channels that are active under low flow conditions, while under high flow conditions and flooding events, the entire riparian area can be subject to inundation (Figure 6).

Figure 6. Image of the dam wall within the Witte Wall farm area – note breach within the centre of the wall. Also to be noted is the width of the wall indicating the extent of flood.

On account of the general lack of flow within the channel, a number of dam and attenuation initiatives have been employed along the Groot River within Witte Wall and neighbouring farms in order to arrest flow and contain water for farming purposes. Larger dams on site are noted to have failed during the Laingsburg floods (Figure 6), having been breached by the flood waters. Smaller initiatives are also evident within the riparian environment, however most water used for stock and game farming is subterranean. The morphology of the river system varies either from a shale scarp, with vertically incised embankments with stony bed to alluvial deposits which can be several metres in depth (Figures 7 and 8). As a consequence, differing eco-morphologies can be identified within the river channel. The more lithic embankments favour refugia for a number of reptile and invertebrate species, while the talus associated with ablation and scour that is found at points within the river bed may favour some geophytes. The alluvial deposits offer a differing form of refugia, in particular, nesting areas for a number of bird species such as the kingfishers (Alcedinidae) (Figure 8).

Vegetation comprises primarily of xeric shrubs associated with the Tanqua Wash Riviere habitat form, with *Lyceum cinereum* and *V karoo* forming the dominant species in these areas. In isolated portions of the riparian environment, small outliers of *Scirpoides dioecus* may be evident within the primary channels, particularly where soils show an improved clay content and are able to retain moisture. As discussed above, the riverine environments show improved faunal populations on account of the increased availability of water near the surface, improved vegetation cover and related factors. It is clear that within Witte Wall, this state prevails within the Groot River. Species identified within the riverine areas include *Pedioplanis laticeps*, the Karoo sand lizard, small mammals including the Cape hare (*Lepus capensis*) and the common mole rat (*Cryptomys hottentotus*). The latter, a fossorial species is evidently prevalent in these areas.

Figure 7. Image of channel at Witte Wall showing shale scarp and stony river bed environment.

Figure 8. Image of deep, sandy alluvial deposit with nesting holes.

Using the above information, a desktop PES can be compiled for the subject section of the Groot River. This PES is presented in Table 4. The ecological importance of the system is presented in Table 5.

Table 4. PES rating of the section of the Groot River at Witte Wall.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	2	3
Water Quality	3	2
Stream Bed Condition	2	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	2	3
PES	2.5 (C)	

Table 5. EIS rating of the Groot River

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The above PES and EIS differ somewhat from the DWS classification with a slightly higher PES and somewhat lower EIS. This differentiation is attributed primarily to the more recent drought conditions that prevail across the site and the very low level of instream biota evident within the system at this point. All drainage from the sites proposed for the development of the PV facilities will be into the Groot River. The catchment of the Klein Droelaagte will not be affected by development within Witte Wall. Howsoever, this system is similar in nature to that of the Groot River. The dominant vegetation forms being *V karoo*, with a primarily alluvium dominated bed form (Figure 9). A PES and EIS for this system are presented in Tables 6 and 7.

Figure 9. Image of typical section of the Klein Droelaagte.

Table 6. PES rating of the section of the Klein Droelaagte River at Witte Wall.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	3	3
Water Quality	3	2
Stream Bed Condition	1	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	1	3
PES	2.3 (C)	

Table 7. EIS rating of the Klein Droelaagte section at Witte Wall

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The EIS records a moderate level of ecological importance, whilst PES shows a score of C - "Moderately *modified. A moderate change in ecological processes has taken place but the system remains predominantly intact*". In respect of the subject system, however change to the system arising from the proposed Witte Wall PV 1 and PV 2 projects, including all associated infrastructure and EGI, is unlikely to be evident as most, if not all of the development footprint lies outside of the catchment of this system.

4.3 Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

Figure 10 below presents the information relating to the Screening Tool for the Aquatic Biodiversity Combined Sensitivity as it relates to the Farm Witte Wall for the proposed PV Facilities, and Figure 11 shows the extent of the EGI Corridor. Evident from this data is that much of the area under consideration is considered to be of *low sensitivity* in terms of the aquatic biodiversity prevalent in the region. The data does however indicate "very high" sensitivity in respect of the Groot River which bisects the site, as shown in Figure 10. The Klein Droelaagte river is not represented in this data set. The ecological sensitivity is however believed to approximate that of the Groot River. The Screening Tool identifies the very high sensitivity areas as aquatic CBAs, Rivers, Wetlands and Freshwater ecosystem priority area quinary catchments. However, it must be noted that the actual footprint of the PV Facilities is only earmarked as low sensitivity on the Screening Tool from an aquatic biodiversity sensitivity perspective.

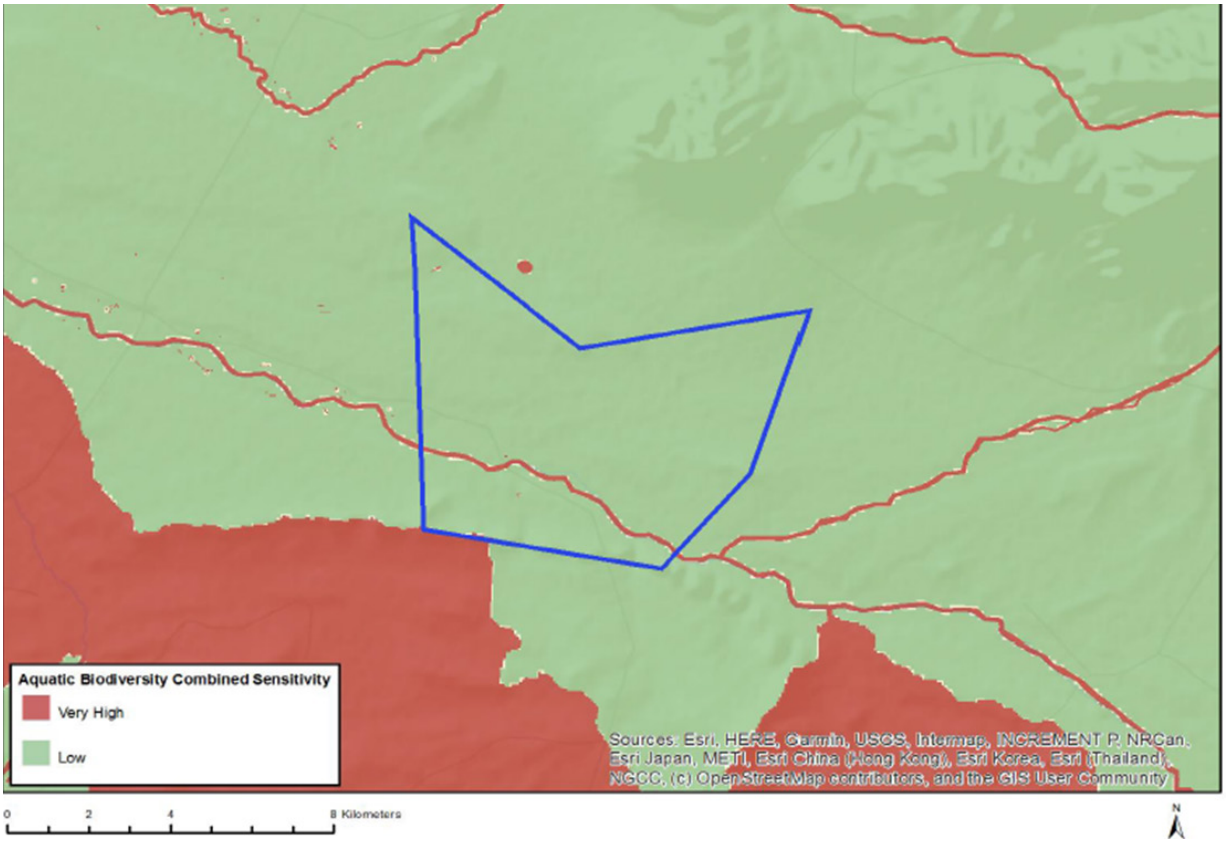


Figure 10. Map depicting aquatic biodiversity combined sensitivity in and around the Witte Wall farm (Source DEFF Screening Tool, 2020).

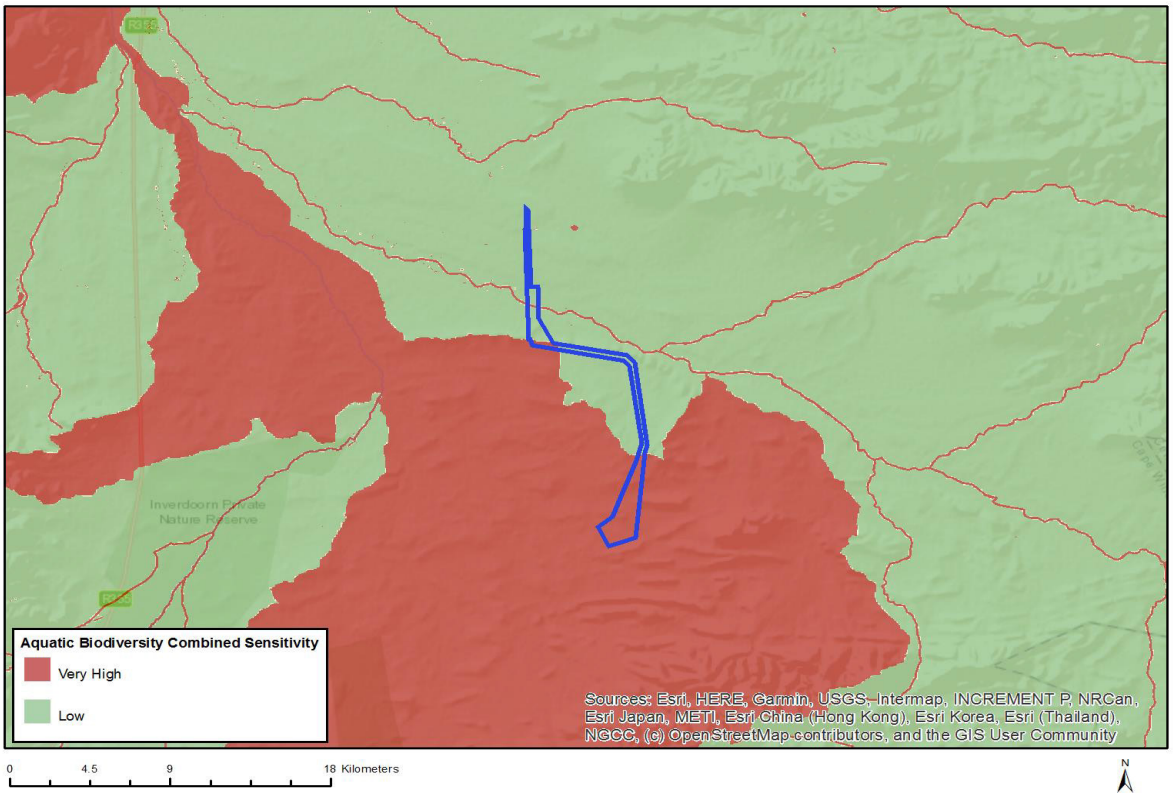


Figure 11. Map depicting aquatic biodiversity combined sensitivity in and around the EGI corridor (Source DEFF Screening Tool, 2020).

In terms of the EGI Corridor, the Screening Tool shows Very High sensitivity due to Aquatic CBAs, Rivers and freshwater ecosystem priority area quinary catchments. The river showing Very High sensitivity is the Groot River, which bisects the Witte Wall farm. The high sensitivity attributed to the Groot River is perhaps related to the presence of certain critically endangered species, such as Clanwilliam sandfish (*L seeberi*). While the riverine rabbit (*Bunolagus monticularis*), the subject of a particular investigation may also be present in the riparian environments, it must be considered a terrestrial species in respect of the aquatic assessment and its presence or absence would not alter the findings of Tables 6 and 7 above. Howsoever, *B monticularis'* preferred habitat range being within these areas, as well as the general use of the systems by terrestrial fauna does render the drainage features with a high ecological sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

Using the above information, as well as the findings of the aquatic assessment a sensitivity map of the site can be compiled. This is presented in Figure 12 below. This map indicates the following for the Witte Wall PV 1 and Witte Wall PV 2 sites:

- The terrestrial environments which are deemed to have "low sensitivity" from an ecological perspective.
- The riparian environments, which are deemed to have "high sensitivity".
- Areas of terrestrial importance and a "buffer" at the interface of the terrestrial and riparian areas, which approximates 100m and includes areas of sheet wash and flood extremes.

Figure 13 presents the proposed Witte Wall PV 1 and PV 2 development footprints in relation to the low, moderate and high sensitivity mapping information. Notably, the two project areas fall outside of areas of moderate and high sensitivity.

Figure 14 shows the position of the Witte Wall PV facilities in relation to the Kappa Substation. Overhead powerlines will connect the Witte Wall PV Facilities to the Kappa Substation. Figure 14 shows that the overhead powerlines will traverse the Groot River, however the servitude will not affect any other wetland or riparian environments and is acceptable to cross.

Figure 12. Map showing areas of ecological sensitivity in subject site

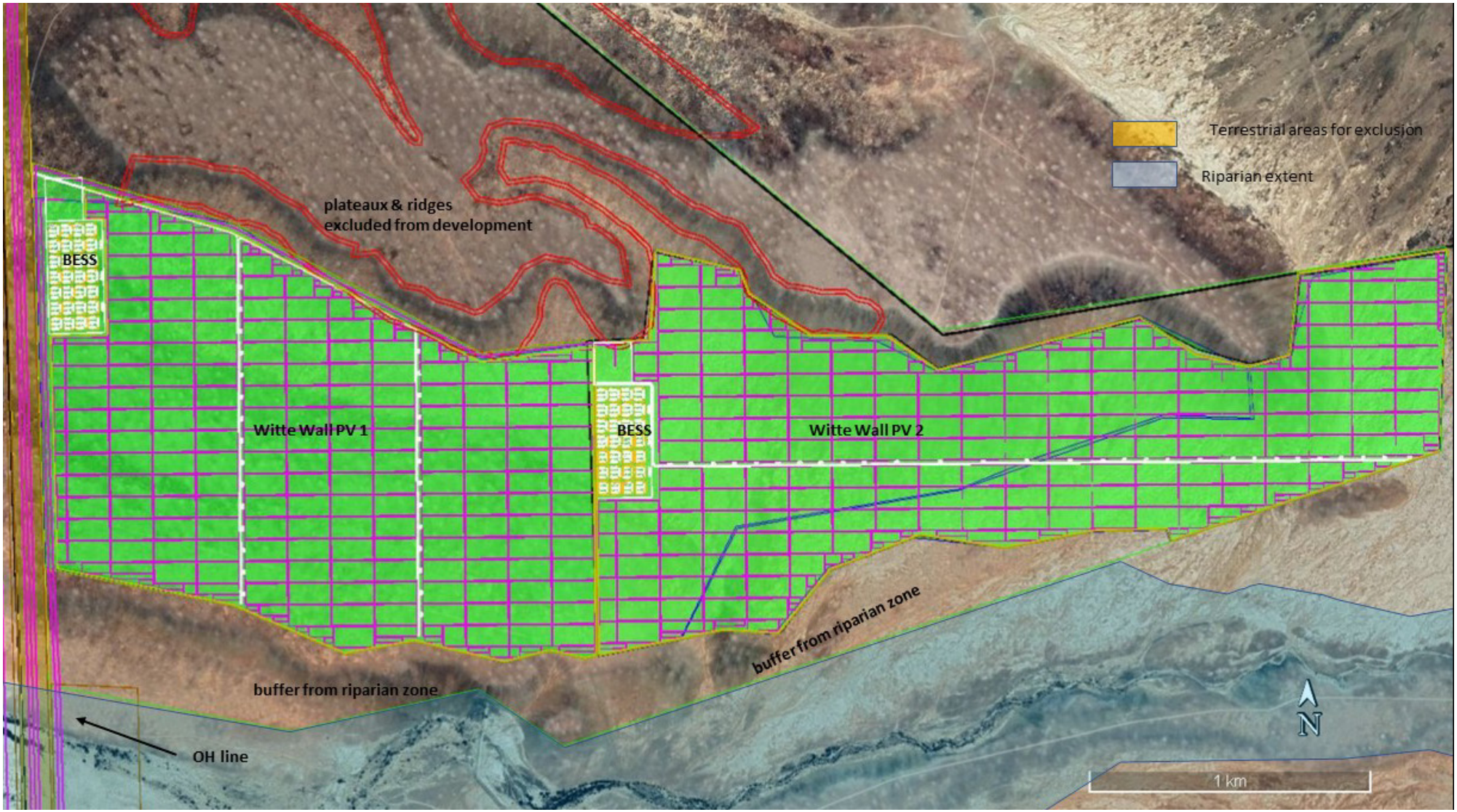


Figure 13. Map showing detail of Witte Wall PV 1 and Witte Wall PV 2 layout and development footprint at Witte Wall

Figure 14. Map showing Witte Wall PV 1 and 2 and overhead powerline route to Kappa Substation, highlighting riparian areas of ecological sensitivity

Given the above, the following Environmental Sensitivities can be attributed to the two PV sites and the EGI. Refer to Appendix C of this report for the Site Sensitivity Verification Report.

4.3.2.1 Witte Wall 1 – PV Facility and Associated Infrastructure

The proposed extent of Witte Wall PV 1 encompasses areas within the terrestrial environment, generally classified as being of "low" ecological sensitivity. An extensive buffer (100 m) has been applied between the "high ecological sensitivity areas" of the Groot River and the development footprint of the PV facility. It follows that engineering interventions to curb surface run off and other factors that may affect the riverine system of the Groot River will have to be implemented.

4.3.2.2 Witte Wall 2 – PV Facility and Associated Infrastructure

The proposed extent of Witte Wall PV 2, encompasses a similar area to that of PV 1 and is within the terrestrial environment, which is considered to be of "low" ecological sensitivity. As with PV 1, an extensive buffer (100 m) has been applied between the "high ecological sensitivity areas" of the Groot River, as well as an unnamed tributary, and the development footprint of the PV facility. As with PV 1, it follows that engineering interventions to curb surface run off and other factors that may affect the riverine system of the Groot River will have to be implemented.

4.3.2.3 EGI and Associated Infrastructure

PV 1 and PV 2 would serve the Kappa substation to the south of the farm. Two 132kV powerlines with associated towers would cross the Groot River to the south of the PV facilities at a point located to the west of the farm (Figure 15). This crossing aligns with an existing fenced boundary on the farm and would require the establishment of one or two towers within the riparian environment. The position of the footings of the towers should evidently avoid the main channels within the riparian edge and be built to accommodate significant flooding and high-level flows. However once established, the towers should not be considered a significant impact of ecological significance.

Figure 15. Image showing fence line across Groot River, where the overhead power line servitude has been proposed.

Other portions of the powerline effectively avoid any significant watercourse or drainage feature and align with a wholly terrestrial environment.

4.3.3 Sensitivity Analysis Summary Statement

Two riverine environments (i.e. Groot River and the Klein Droelaagte) fall within the Farm Witte Wall and these systems are considered to be of moderate aquatic ecological importance and overall high sensitivity. The Klein Droelaagte system is not depticed on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figure 17). The proposed Witte Wall PV 1 and PV 2 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. No wetland environments are associated with the PV and associated infrastructure development footprints (including the powerlines). The balance of the area on Witte Wall PV 1 and Witte Wall PV 2 are assigned low sensitivity, which corroborates with the Screening Tool. Whilst the PV development and associated infrastructure traverse through areas designated as CBA and ESA at particular points, such infringement is considered to be relatively minor as much of these sensitive areas have been largely avoided by the proposed development – as shown by Figure 16 below. The electrical overhead powerline that traverses the Groot River, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system. The above sensitivity analysis largely corroborates the findings of the Screening Tool, the sensitivities of which have been verified and utilized in the planning of the PV facilities at Witte Wall and for the EGI corridor along the farms Platfontein and Die Brak. Where the line traverses' portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

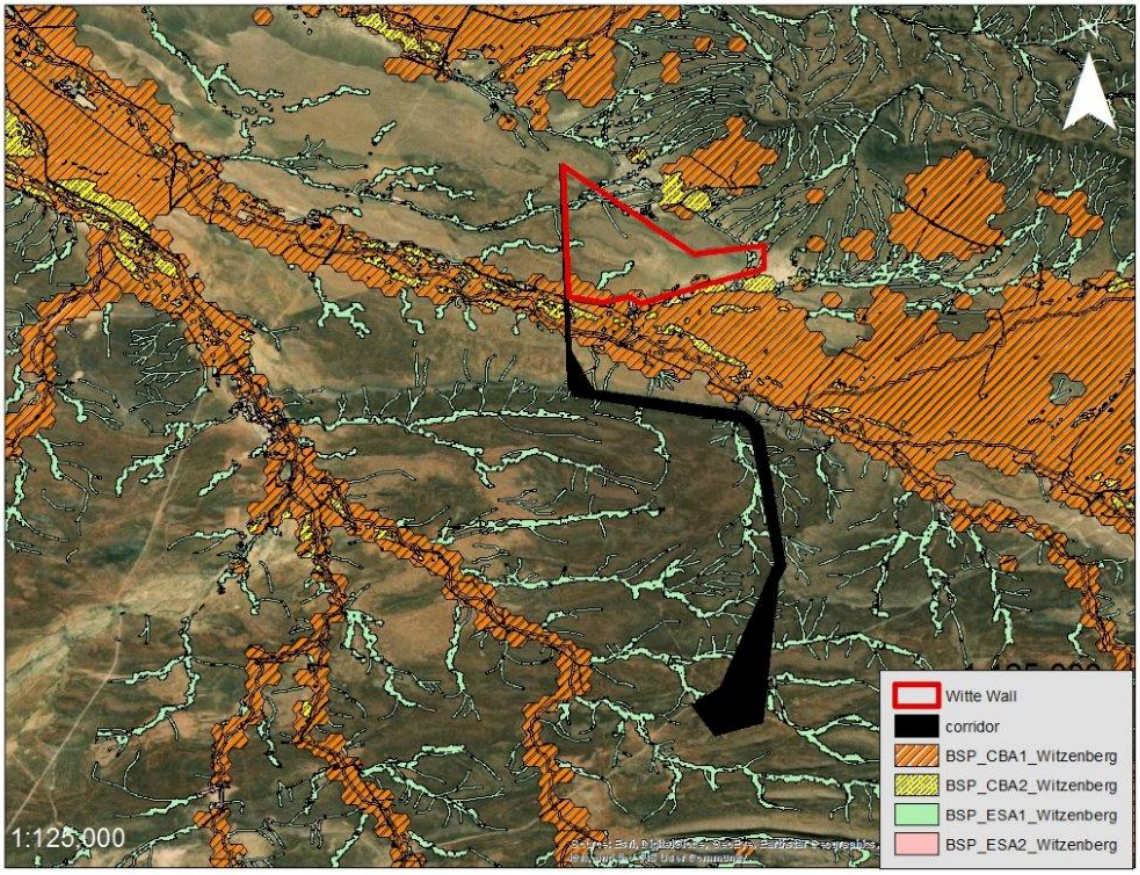


Figure 16. Map image detailing the Witte Wall PV site and associated infrastructure in relation to CBA and ESA defined by Cape Nature.

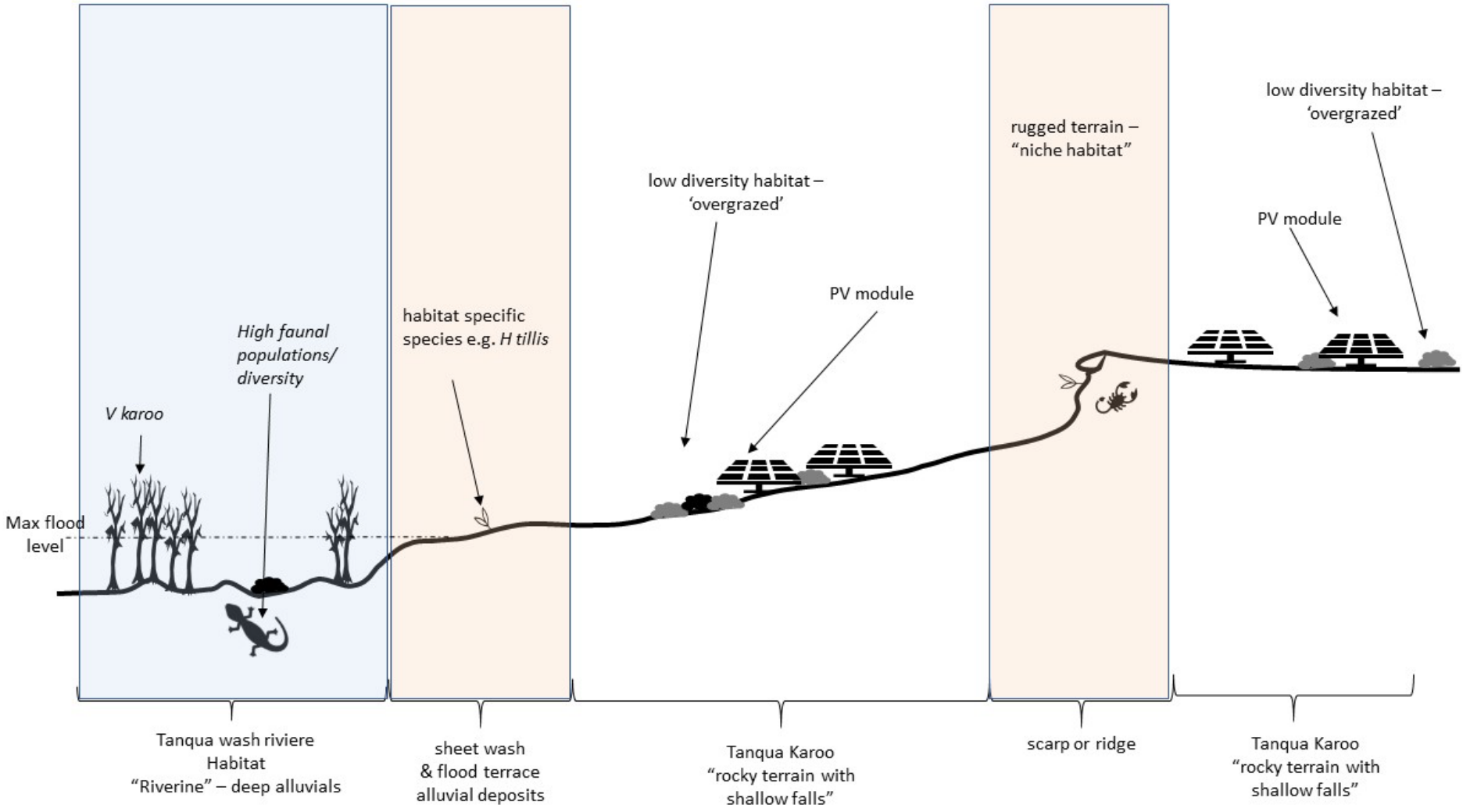


Figure 17. Schematic diagram indicating areas of high sensitivity (blue), moderate sensitivity (beige), and areas suitable for establishment of solar modules

5 Alternative Development Footprints

No site alternatives are being considered. However, the layout was designed after provision of sensitivity data by the specialists to ensure that it would have the least possible overall impact. One EGI corridor has been proposed but this is wide enough to allow some specific siting of the alignment to reduce impacts.

6 Issues, Risks and Impacts

6.1 Identification of Potential Impacts/Risks

A number of direct, indirect and cumulative impacts on the localized and broader ecology of the region can be identified as a consequence of the proposed PV and EGI developments being implemented. Direct impacts are those that are directly attributable to the implementation and operation of the project, while indirect impacts are consequential effects of the proposed project that may not be directly attributable to the development. Cumulative impacts are those externalities that arise from the proposed development and compound existing effects or influences on the ecology of the region. These impacts are also defined as originating from the construction phase or the operational phase and may include the 'decommissioning phase".

6.1.1 Construction Phase

The following potential impacts during the Construction Phase of the PV Facilities, EGI and associated infrastructure.

- **Potential Impact 1**: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it.

- **Potential Impact 2**: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna.

- **Potential Impact 3**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities.

6.1.2 Operational Phase:

The following potential impacts during the Operational Phase of the PV Facilities, EGI and associated infrastructure can be summarized:

- **Potential Impact 4**: Changes in the geomorphological state of drainage lines on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change.

- **Potential Impact 5**: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long-term activities on site, but are likely to be negligible.

6.1.3 Decommissioning Phase

Such alterations and changes will be dependent upon the expectant post-decommissioning land use.However, abandonment of the site and cessation of the PV Facilities, EGI and associated infrastructure would probably result in:

- **Potential Impact 6**: A reversion of present faunal population states within the study area, with some variation to these populations being possible.

- **Potential Impact 7**: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment.

6.1.4 Indirect Impacts of the PV Facilities, EGI and associated infrastructure.

The following indirect impacts on the PV Facilities, EGI and associated infrastructure have also been identified:

- **Potential Impact 8**: Changes in the broader landscape ecology through alteration of eco-morphological drivers.

- **Potential Impact 9**: Changes in faunal ethos as a result of the establishment of the PV facilities on Witte Wall.

6.1.5 Cumulative Impacts of the PV Facilities, EGI and associated infrastructure.

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) (i.e. two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172). Notably there are 11 other renewable energy projects that have received EA within 30 km of the subject site. The majority of these projects employ wind turbines, which present fundamentally different impacts and externalities that may affect the broader ecology of the region, although three smaller sites located some 30 km south of Witte Wall will employ PV technology for power generation. The cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of this project and other land use changes in the region are likely to exhibit the following:

- **Potential Impact 10:** Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.

- **Potential Impact 11**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

6.2 Summary of Issues identified during the Public Consultation Phase

Interaction with local residents in the region indicated that:

- Historically, farming activities over the preceding 150 years was seen to have altered the prevailing habitat.

- Fauna were confined to the riverine areas in general.

- Flood events could be severe, with a rapid rise in the water levels within rivers being noted following rain in the upper catchments.

Additional points raised by the local residents are captured in Table 8 below.

Table 8: Comments Received from Stakeholders / Local Residents during the Field Work component of this Aquatic Biodiversity and Species Assessment

Comment	Commenter	Response from the Specialist
The removal of natural vegetation containing threatened, protected and endemic species as a result of the proposed project	Mr Andre Vermeulen	The general approach to construction of the proposed facilities, associated infrastructure and EGI is to maintain vegetation on site. No "blading" of areas, other than within the laydown area, the site of the substation and along roads is to be undertaken.
Increased dust deposition during construction activities	Mr Andre Vermeulen	This is a likely scenario. Mitigation measures will have to be employed including "damping", traffic speed limitations and other management measures

Additional comments will be received from stakeholders and Interested and Affected Parties during the 30-day comment period on the Draft BA Report.

7 Impact Assessment of the PV Facilities, EGI and associated infrastructure.

The nature of impact / risk is discussed below. The impacts described below apply to both the Witte Wall PV 1 and Witte Wall PV 2 projects, including the EGI and associated infrastructure (i.e. they are the same and have not been repeated).

7.1 Potential Impacts during the Construction Phase

Potential Impact 1: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it

As construction proceeds the natural drainage patterns, sediment transport mechanisms and other related factors will alter, with concomitant change in the ecology associated with these factors. This is rated as a direct, negative impact. Implementation of management principles will reduce these impacts from "high" to "moderate" significance and possibly "low", during the closing of the construction phase.

Potential Impact 2: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna

ELP will alter faunal ethos of some species, particularly during construction, primarily associated with work at night. ELP can be addressed through initially, interventions in respect of lighting during the

construction phase such as reduced security lighting, downward lighting and restriction on lumens employed. This is generally a low significance impact before and after implementation of mitigation measures

Potential Impact 3: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities

During the construction phase, increased mobilization of sediments, minor spills of materials and other factors may alter surface water chemistry. This impact would however be low significance, with the employment of suitable management measures during the construction stage. Mitigation measures include providing adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.

7.1.1 Impact Summary Table: Construction Phase

The impact ratings are described in this section for the construction phase.

Table 9: Impact Summary Table for the Construction Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE – Direct Impacts						
Impact 1: Changes in the geomorphological state of drainage patterns	*Status*	*Negative*	*High (2)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Moderate (3)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 2: Increased ELP	*Status*	*Negative*	*Low (4)*	• *Ensure reduced security lighting, downward lighting and restriction on lumens employed*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 3: Changes in water resources and surface water in terms of water quality	*Status*	*Negative*	*Moderate (3)*	• *Provide adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.2 Potential Impacts during the Operations Phase

Potential Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change

As climatic factors change within the region, natural bio-physical responses, including changes in habitat or faunal population shifts may be affected on account of the presence of the PV facilities, EGI and associated infrastructure. This impact is considered "low" significance on account of the generally limited extent of the site in relation to surrounding habitats.

Potential Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities

Such changes will be related to the long-term activities on site, but are likely to be negligible. Alteration in water quality are surmised to stem primarily from unintended hydrocarbon leaks from operating vehicles and other machinery on site. However, impacts of this nature during the operational phase are considered to be of "low" significance with mitigation measures including to retain spill kits on site.

7.2.1 Impact Summary Table: Operational Phase

The impact ratings are described in this section for the operational phase.

Table 10: Impact Summary Table for the Operational Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE – Direct Impacts						
Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change	*Status*	*Negative*	*Low (4)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities	*Status*	*Negative*	*Low (4)*	• *Provide adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.* • *Implement proper spill control and management, such as the retention of emergency spill kits on site*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.3 Decommissioning of Site

Potential Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible

On account of both the abovementioned seral state of the land as well as other factors, decommissioning and reversion to a land use, akin to the present, should see some alteration of faunal populations and a reversion to present populations with some ousting and recruitment of species. This impact is rated as "low" significance before and after the implementation of management actions.

Potential Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment

This impact is rated with a low significance and possibly, "positive". This impact will be a long-term impact which may be considered "negative" but of low significance. Additional hard panning as a result of the establishment of the PV facilities and associated infrastructure contributes to the change in the geomorphological state of the drainage lines. Stormwater controls are to be incorporated into the development to ensure attenuation of flow.

7.3.1 Impact Summary Table: Decommissioning Phase

The impact ratings are described in this section for the decommissioning phase.

Table 11: Impact Summary Table for the Decommissioning Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE – Direct Impacts						
Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible	*Status*	*Neutral*	*Low (4)*	• *Ensure that there is appropriate disposal of materials and waste during decommissioning activities* • *Manage stabilisation and reinstatement of the land*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment	*Status*	*Neutral*	*Low (4)*	• *Provide adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.4 Indirect Impacts

The following indirect impacts are anticipated to be associated with the establishment of the PV facilities, EGI and associated infrastructure on the farm Witte Wall. Indirect impacts arising from the establishment of the site are likely to be of low significance, and generally latent in nature.

Potential Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers

The development of the two proposed PV facilities on Witte Wall may alter habitat form and structure beyond the boundaries of the PV facilities as support infrastructure (e.g. roads) are established, or as physical or biological factors change (e.g. drainage patterns change or grazing pressures increase at other points). The impacts may however prove to be of low impact significance.

The site and reversion to the present land use, may see some alteration of drainage patterns and general surface hydraulics. This impact is considered to be "low" significance.

Potential Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities.

Changes in faunal ethos on account of the establishment of the PV facilities on Witte Wall, some faunal populations may emigrate from the area, while others may favour other factors around the site. Behavioral change in faunal populations will drive ecological change beyond the boundaries of the PV Facilities. This impact is rated as "low" significance without and with the implementation of mitigation measures.

7.4.1 Impact Summary Table: Indirect Impacts

The impact ratings are described in this section for the indirect impacts during both the construction and operation phase.

Table 12: Impact Summary Table for Indirect Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Indirect Impacts						
Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers	*Status*	*Negative*	*Low (4)*	• *Appropriate management of the site must be undertaken along ecological integration approaches*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities	*Status*	*Negative*	*Low (4)*	Exclusion areas should be maintained. Maintain scarp slopes and ensure that they are unimpeded by the proposed development. Mitigation of this impact would result in a low rating.	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

7.5 Cumulative Impacts

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) and 11 authorised renewable energy projects on some 50 000 ha of land within 30 km of the subject site (Figure 18). The cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of the proposed projects and other land use changes in the region are likely to exhibit the following:

Potential Impact 10: Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.

This impact deals with increased an increased change in the geomorphological state of drainage lines and water courses due to long term and extensive change in the nature of the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are rated as moderate and likely, respectively, rendering the significance as low without the implementation of management measures. Mitigation measures include cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.

Potential Impact 11: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

This impact deals with changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are respectively rated as moderate and likely, rendering the significance as low without the implementation of management measures. Mitigation measures include coordinated and sustained management of all nine PV and EGI Projects associated with this BA.

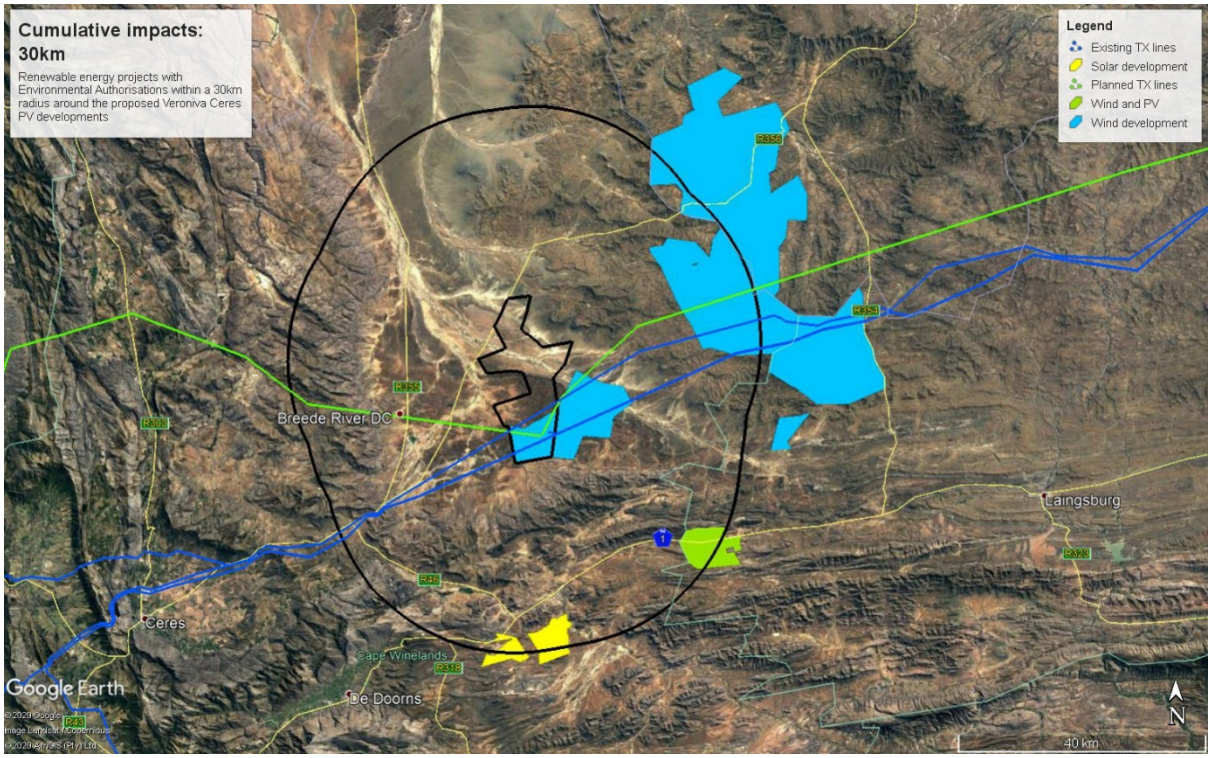


Figure 18. Map indicating renewable energy and EGI projects within 30 km of project site (van Rooyen, 2020).

7.5.1 Impact Summary Table: Cumulative Impacts

The impact ratings are described in this section for the cumulative impacts during the construction and operational phase.

Table 13: Impact Summary Table for the Cumulative Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Cumulative Impacts						
Impact 10: *Increased change in the geomorphological state of drainage lines and watercourses, on account of long term and extensive change in the nature of the catchment*	*Status*	*Negative*	*Low (4)*	Cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Impact 11: *Changes in water resources and surface water in terms of water quality on account of extensive changes in the catchment.*	*Status*	*Negative*	*Low (4)*	*Co-ordinated and sustained management of all nine PV and EGI Projects associated with this BA.*	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

8 Impact Assessment Summary

Table 14 and Table 15 provides a summary of the expected impacts after mitigation for the PV Facilities and EGI, respectively.

Table 14: Overall Impact Significance (Post Mitigation) of the proposed PV facilities and associated infrastructure

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

Table 15: Overall Impact Significance (Post Mitigation) of the proposed EGI to support the PV facilities

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

9 Legislative and Permit Requirements

The proposed establishment of the Witte Wall PV 1 and Witte Wall PV 2 facilities, associated infrastructure and EGI on the subject sites are considered to elicit a requirement for compliance with the following legislation as this may apply to the riverine and aquatic environments.

- **The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended)**

The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) (NEMBA) may be applicable to the site, particularly in respect of matters pertaining to threatened or protected species encountered on or around the sites or the matter of redress of AIPs. This may apply in respect of the establishment of the powerline across the Groot River.

- **The National Water Act (Act 36 of 1998, as amended)**

The proposed Witte Wall PV 1 and PV 2 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The sensitivity map in Figure 12 indicates that for the Witte Wall PV 1 and Witte Wall PV 2 projects, areas of terrestrial importance and a “buffer” at the interface of the terrestrial and riparian areas have been demarcated, which approximates 100 m and includes areas of sheet wash and flood extremes. In addition, no wetland environments are associated with the PV and associated infrastructure development footprints (including the powerlines).

The powerlines will, however, cross the Groot River and would require the establishment of one or two towers within the riparian environment. In addition, the access road leading to the Witte Wall PV 1 and PV 2 sites would need to be upgraded as part of the proposed projects. Sections of the access road upgrade will take place within 100 m of the Groot River and the unnamed river system that flows across Witte Wall and into the Groot River. The requirement for a General Authorisation or Water Use License in terms of Section 21 (c) and 21 (i) of the National Water Act may be required where activities arise within the bed of the river in respect of the establishment of towers for the overhead powerlines and the road upgrading. Therefore, the following projects likely require a Water Use License or similarly a General Authorisation:

- Witte Wall PV 1 – for the access road upgrade and power line specifically; and
- Witte Wall PV 2 - for the access road upgrade and power line specifically;

The Department of Human Settlements, Water and Sanitation are to confirm such prerequisite legal requirements.

- **The National Forest Act (Act 84 of 1998)**

The clearance of “natural forest” may be applicable, where, particularly in the establishment of the power line that traverses the Groot River, there may be the requirement to remove associations of *V karoo*. Although not strictly “forest” in ecological terms, the *contiguous canopy* definition of forest would apply under Section 7 of the National Forest Act (Act 84 of 1998).

- **The Cape Nature and Environmental Conservation Ordinance 19 of 1974 (also the Western Cape Nature Conservation Laws Amendment Act (2000))**

This act should be given consideration following EA with particular respect to Chapters IV, (The protection of wild animals other than fish) and Chapter VI, (The protection of flora). The requirement for permits when removing and relocating specific flora that may be encountered or alternatively addressing fauna that may be encountered around the sites would require due consideration.

- **Draft Western Cape Biodiversity Bill, 2019.**

This law has not been promulgated however some aspects of Chapter 7, in particular may apply to the sites, once promulgated.

In consideration of the applicable legislation listed above, it is important to note that the requirement for approval is to be confirmed by the competent authority on the matter.

10 Environmental Management Programme Inputs

The proposed PV facilities on Witte Wall and the associated infrastructure and EGI, will not effectively enter into the riparian environments located on the affected farms. However, the BA process has identified a number impacts that are expected to arise during the planning and construction components of this project. The prevailing impacts to the aquatic biodiversity are:

- Increased surface run off of storm water under high precipitation events with concentration at specific points; and
- Minor changes in water quality through suspended and dissolved materials arising from activities on site (e.g. fats, soaps and oils).

The riverine environments are effectively ephemeral rivers and not subject to regular flow. It is anticipated that impacts from the PV facilities and their associated infrastructure and EGI will be primarily indirect in nature. The EMPr focuses on the mitigation and management of the prevailing (direct, indirect, cumulative) impacts, the subsequent mitigation actions as well as the methodology, frequency and responsibility of the monitoring regime. From the above the EMPr has been compiled in alignment with Appendix 4 of the 2014 NEMA EIA Regulations which aims to detail measures that are to be carried out in order to:

- Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- Comply with any prescribed environmental management standards or practices;
- Comply with any applicable provisions regarding closure; and
- Comply with any provisions regarding financial provision for rehabilitation.

11 Final Specialist Statement and Authorisation Recommendation

11.1 Statement and Reasoned Opinion

Given the information presented above it is evident that should the Applicants establish the proposed development within the identified footprint on Witte Wall that both Witte Wall PV 1 and Witte Wall PV 2 may proceed with limited impact on the broader ecological processes and those areas deemed to be of ecological significance (namely the lower riparian environments and sand wash environments).

It therefore follows that Witte Wall PV 1 and Witte Wall PV 2 show a low-level aquatic ecological impact on adjacent riparian environments identified and subject to the implementation of the prescribed management recommendations and conditions, should not be precluded from development on ecological grounds.

11.2 EA Condition Recommendations

Should the mandated authorities approve the proposed development, the following broad management recommendations are proposed for incorporation into the EA:

- Maintenance and establishment of an ambulatory set back of >100m from the identified riparian areas and points of sheet wash as per the layout plan presented.

- That construction and establishment of modules and arrays be undertaken without the clearance of vegetation. Where vegetation proves excessively tall and affects either construction or operation, pruning may be effected.

- A detailed stormwater management and drainage plan be developed that considers *inter alia*, surface flows arising from elevated areas above the PV facilities and its discharge from the facilities. This philosophy must include attenuation and energy dissipation mechanisms and redress of erosion and sheet flow across site.

- The laydown area for the PV facilities should be subject to compaction and the use of dust suppressants when in operation, to prevent excessive particulate matter becoming airborne.

- Management of fauna within the site and surrounds, as well as the incorporation of “wildlife” porosity into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife.

- Maintain the riparian areas as general “exclusion areas” for all operations, with the exception of the establishment of the overhead powerlines.

- Management of exotic weed invasion that may arise within riparian areas as a consequence of disturbance.

- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

It is our opinion that with the implementation of the above, the project proposal, subject to final design and adherence to the above recommendations, should be authorised.

12 References

Chris van Rooyen Consulting. 2020. Avifauna Assessment for the Proposed Development of two 175 MW Solar Photovoltaic Facilities (Witte Wall PV 1 and Witte Wall PV 2), and associated Electrical Grid Infrastructure near Touws River, Western Cape. Unpublished report prepared for Veroniva (Pty) Ltd, Cape Town: Chris van Rooyen Consulting.

CSIR. 2000. Cape Action Plan for the Environment: Strategy. CSIR Report No.: ENV-S-C 99130B. Prepared for WWF-SA, Stellenbosch.

Department of Environmental Affairs and Tourism. 2000. Guideline Document: Strategic Environmental Assessment in South Africa. Pretoria.

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS-RDM: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed on [date].

FitzPatrick Institute of African Ornithology (2020). OdonataMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=OdonataMAP on 2020-10-08

Kleynhans, C.J. and Louw, M.D., 2007. Module A: EcoClassification and EcoStatus determination. *River EcoClassification: Manual for EcoStatus Determination (version 2) Water Research Commission Report No. TT*, *333*(08).

Kotze, D., Marneweck, G., Batchelor, A., Lindley, D. and Collins, N., 2009. WET-EcoServices: a technique for rapidly assessing ecosystem services supplied by wetlands.

Kottek, M., J. Grieser, C. Beck, B. Rudolf, and F. Rubel, 2006: World Map of the Köppen-Geiger climate classification updated. *Meteorol. Z.*, 15, 259-263. DOI: 10.1127/0941-2948/2006/0130.

Mucina, L., Rutherford, M.C. and Powrie, L.W., 2006. Vegetation Atlas of South Africa, Lesotho and Swaziland. *The Vegetation of South Africa, Lesotho and Swaziland'. (Eds L. Mucina and MC Rutherford.) pp*, pp.748-789.

Tankwa Weather. 2020. Available at http://tankwaweather.co.za/pages/station/climate.php. Accessed on 21 September 2020.

APPENDICES

APPENDIX A - SPECIALIST EXPERTISE

NAME Simon Colin Bundy
PROFESSION Ecologist / Environmental Assessment Practitioner
DATE OF BIRTH 7 September 1966
MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist
EDUCATION
BSc Biological Science (1990) University of Natal
Diploma Project Management (1997) Executive Education
MSc (2004) University of KwaZulu Natal
PhD. Candidate: Department of Engineering, University of Kwa Zulu Natal
1998: Guest of Konrad Adenhauer Foundation to Berlin to consider "sustainable development initiatives" in Europe
2000: Training course: "Environmental Economics and Development". University of Colorado (Boulder) USA.
2008: Certificate in Coastal Engineering: Stellenbosch University

KEY COMPETENCIES AND EXPERIENCE

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. With a core competency in coastal ecological systems and coastal management, Bundy has worked on coastal projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as South Africa, providing ecological and general environmental advice and support. In addition, Bundy has worked in Rwanda, Lesotho and Zambia. Within South Africa, Bundy has been involved in a number of large-scale mega power projects as well as the development of residential estates, infrastructure and linear developments in KwaZulu Natal, Eastern Cape and Western Cape. In such projects Bundy has provided both technical support, as well as the undertaking of rehabilitation programmes.

From a technical specialist perspective, Bundy focusses on coastal ecological systems in the near shore environment and is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and for the Department of Economic Development Tourism and Environmental Affairs in conjunction with the Oceanographic Research Institute. In 2015, Bundy formulated the coastal set back line method for the iSimangaliso Wetland Park, funded by the Global Environment Fund of the United Nations. Bundy acts as botanical

and environmental specialist for Eskom Eastern Region and provides technical support to the IEM division of the Council for Scientific and Industrial Research, Stellenbosch.

SELECTED RELEVANT PROJECT EXPERIENCE

Aquatic and Ecological evaluation of the impacts of Scatec Kenhardt Solar Facilities 1 – 6 in Northern Cape – CSIR (2016 to 2019)

Investigations and review of the aquatic and terrestrial ecology associated with 6 solar facilities at Kenhardt in Northern Cape

Aquatic and Ecological evaluation of the impacts of Maintstream wind Projects in Sutherland Northern Cape & Western Cape – CSIR (2015 to 2016)

Investigations and review of the terrestrial ecology associated with wind power facilities near Sutherland in Northern Cape

Ecological investigations Tongaat and Illovo Desalination Plants: CSIR – (2013 - 2016)

Review of eco-physiological state of the coastal environments in and around the proposed Illovo and Tongaat desalination plants for associated EIA process.

Ecological Review and Rehabilitation Planning: Sodwana Bay: iSimangaliso Wetland Park Authority – (2014 - 2015)

Analysis and review of state of dune cordon in and around Sodwana Bay with modelling of the impacts of removing exotic trees from site to rejuvenate dune and beach dynamics

Review of Project Leader and Coastal Specialist: Addington Farm Strategic Environmental Assessment (2016)

Evaluation of coastal habitat and beach-dune interface for the generation of setback lines for the proposed Addington Farm residential development.

Aquatic and Ecological evaluation of the impacts of in-water hull cleaning, Port Louis, Mauritius and Port of Durban – Aquatech / Divetech Solutions (2014 to date)

Investigations and review of the chemo-physical impact of in-water hull cleaning in the Durban and Port Louis Ports for accreditation with the International Maritime Organisation.

Coastal ecological evaluation of the Van Riebeeckstrand coastline, Cape Town for the establishment of inter-continental telecommunication cables. Acer Africa (2016)

Specialist investigation into the impact of establishing marine cables at Van Riebeeckstrand Cape Town for MTN. Client: Acer Africa.

Review and report on impact of the Fairbreeze Mine at Mtunzini on aquaculture operations at Mtunzini Aquaculture – Supporting document for legal argument presented on behalf of Mtunzini Aquaculture. (2017)

Specialist review and investigation of groundwater discharge and dune mobility at Siyaya, Mtunzini and its effect on the marine intake supplying the Mtunzini Fish Farm. Client: Mtunzini Fish Farm / Eversheds

Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event: West of England Insurance, United Kingdom (2018 - 2019)

Location, evaluation and monitoring of plastic pellets within the coastal habitats between Durban and Richards Bay with Resolve Marine, AR Brink and Assoc's and Drizit Environmental. Objective is to maintain a defendable but efficient level of pellet contamination across coastline.

Rehabilitation Projects: (2010 - 2015)

- Dune rehabilitation of Durban Harbour southern breakwater 2009 – 2010 for Group 5. Sculpt, establish and maintain.
- Mangrove forest rehabilitation of Hugh Dent pump station 2015 for Sembcorp Siza Water.
- Dune rehabilitation of Ballito beachfront 2009 for KwaDukuza Municipality, following 2007 storm surge event
- Ulundi TSC rehabilitation for Eskom Eastern Region, 2016
- Mangethe substation rehabilitation of area for Eskom Eastern region, 2016.

PUBLICATIONS

Bundy S C. 2018 "The great coastal conservation conundrum". EKZN Wildlife Conservation Symposium

Smith AM, Bundy SC, Cooper (2016) "Apparent dynamic stability of the south east African coastline, despite sea level rise" Earth Surface Processes and Landforms DOI 10. 1002

Bundy, S. C. and Forbes, N. T., 2015. *"Coastal dune mobility and their use in establishing a setback line*" 9th West Indian Ocean Marine Science Conference 2015

Smith AM, SC Bundy 2012 "Review of Coastal Defence Systems in Southern Africa" Article for Springer Scientific Publications through Ulster University, Pilkey and Cooper

Bundy, S. C., Smith, A. M., Mather, A. A. 2010. "Dune retreat and stability on the Northern Amanzimtoti Dune Cordon", EKZN Wildlife Conservation Symposium 2010

Smith, A Mather AM Bundy SC, Cooper AS Guastella L, Ramsay PJ and Theron A; 2010 "*Contrasting styles of swell-driven coastal erosion: examples from KwaZulu-Natal, South Africa*" Geology Journal", Cambridge University Press

Bundy SC AM Smith, (2009) "*A Review of Select Dune Rehabilitation Initiatives and a Proposed Methodology towards Ensuring a Prudent Approach towards the "Greening of Dunes*" VI International Sandy Beaches Symposium Emphakweni Port Alfred

Bundy, S. C. and Smith, A. M. 2009 *"Analysis of the Recovery of Two Separate Coastal Dune Systems Following the 2006 – 2007 Marine Erosion Event and Assessment of the Artificial Dune System in Coastal Management*" KZN Marine and Coastal Management Symposium, Durban South Africa.

Smith A and Bundy S 2009 "*Coastal erosion: reparative work on the Ballito coastline, KwaZulu-Natal, South Africa, was it enough?*" 2009 International Multi-Purpose Reef and Coastal Conference, Jeffrey's Bay South Africa

Smith A, Mather A, Theron A, S Bundy 2008 **"***The 2006-2007 KwaZulu – Natal Coastal Erosion Event in Perspective*" 2009 Contribution to the South African Environmental Observation Network publication "Climate Change in Southern Africa"

Name:	Alexander Michael Whitehead
Profession:	Environmental Consultant/Ecologist
Date of Birth:	30/08/1983
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	14
Nationality:	South African
Email address:	alex@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Ichthyology and Fisheries Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – Reg. No. 400176/10 (Ecological Science)

Key Skills and experience:

- Computer skills – (MS Word, STATISTICA, Excel, MS Access, PRIMER 5 (multivariate statistical program), CAP 4 (multivariate statistical program));
- Bioassessment - Experience in sampling aquatic invertebrates (SASS 5) and ichthyofauna (Electrofishing and estuarine sampling techniques);
- Water quality - Experience in carrying out water samples and interpreting results in both freshwater and estuarine environments;
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Wetland functionality assessments – Assessment of wetland functionality using ecological indicators and standard methods such as Wet-Ecoservices and Wet-Health.
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Rehabilitation – Compilation of wetland and terrestrial rehabilitation plans as well as practical experience in planning and conducting weed eradication and re-vegetation programs.
- Environmental monitoring and auditing –
- Open space and conservation planning – Identification of areas of open space or conservation importance.
- Botanical/protected species permits and Risk Assessments – Permit applications under the National Forest Act (84 of 1998), Natal Nature Conservation Ordinance (15 of 1973) and National Environmental Management: Biodiversity Act (10 of 2004).

Name:	Luke Patrick Maingard
Profession:	Environmental Consultant/Ecologist
Date of Birth:	15/09/1993
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	5
Nationality:	South African
Email address:	Luke@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Environmental Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – (Ecological Science)

Key Skills and experience:

- Geographic Information Systems
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental legislation
- Storm water control and management design and implementation
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Environmental Control Officer to numerous construction sites
- Data management and analysis
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.

Appendix B - Specialist Statement of Independence

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

Basic Assessments for the Proposed Development of two 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Witte Wall 1 and Witte Wall 2), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	SDP Ecological & Environmental Services			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	ex	Percentage Procurement recognition	
Specialist name:	Simon C Bundy			
Specialist Qualifications:	BSc MSC Dip Proj Man			
Professional affiliation/registration:	SACNASP			
Physical address:	6 Salisbury Road, Ballito			
Postal address:	P O Box 1016, Ballito			
Postal code:	4420	Cell:	082 446 4847	
Telephone:	032-586 1218	Fax:		
E-mail:	simon@ecocoast.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Simon C Bundy_____, 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

S. D. P CC
P.O. BOX 1016, BALLITO 4420
TEL: 032 946 0886
FAX: 032 946 0886
WEB: www.sdpecology.co.za

Name of Company:

17 | 11 | 20

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Susan C Bunce, 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

SDP Ecological

Name of Company

17/11/20

Date

Signature of the Commissioner of Oaths

Date

COMMISSIONER OF OATHS
ASHLEY PILAY
BRANCH MANAGER: ZIMBALI
SHOP 28, LIFESTYLE CTR
BALLITO 4420
DATE: 18/11/2020

Appendix C: Site Sensitivity Verification

Prior to commencing with the Aquatic Biodiversity and Species Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	14/09/2020 – 18/09/2020
Specialist Name	Simon Bundy and Luke Maingard
Professional Registration Number	S C Bundy SACNASP No.400093/06 L P Maingard SACNASP No. 116639/16
Specialist Affiliation / Company	SDP Ecological and Environmental Services

The Site sensitivity verification was undertaken using the following means:

1. Preliminary desktop analysis achieved by overlaying a variety of geospatial data features – namely NFEPA data and other sensitivity data obtained from the SANBI BGIS as well as the DEFF Screening Tool. Further to this, the Present Ecological State (PES) and Environmental importance and sensitivity (EIS) data had been derived from the DWS Present Ecological State and Ecological Importance model.

2. Literary review of the site, obtaining baseline knowledge of the ecological history of the site as well as the PES of the site. To this end a review of historical images of the site had also been undertaken.

3. Onsite investigation of the subject area from the 14/09/2020 to the 18/09/2020.

Two riverine environments (i.e. Groot River and the Klein Droelaagte) fall within the Farm Witte Wall and these systems are considered to be of moderate aquatic ecological importance. The Klein Droelaagte system is not depicted on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figures 11, 12 and 13 in the main report). The proposed Witte Wall PV 1 and Witte Wall PV 2 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The rest of the area on Witte Wall PV 1 and Witte Wall PV 2 are assigned low sensitivity, which corroborates with the Screening Tool.

The electrical overhead powerlines that traverse the Groot River, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system.

The above sensitivity analysis corroborates the findings of the screening tool and has been utilized in the planning of the PV facilities at Witte Wall, and for the EGI corridor along the farms Platfontein and Die Brak. Where the line traverses portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

Appendix D: Impact Assessment Methodology

The following impact assessment was adopted, which includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

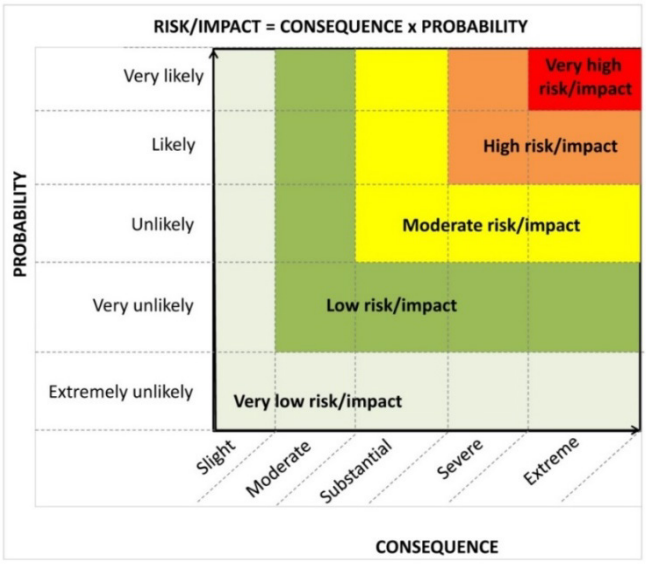


Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

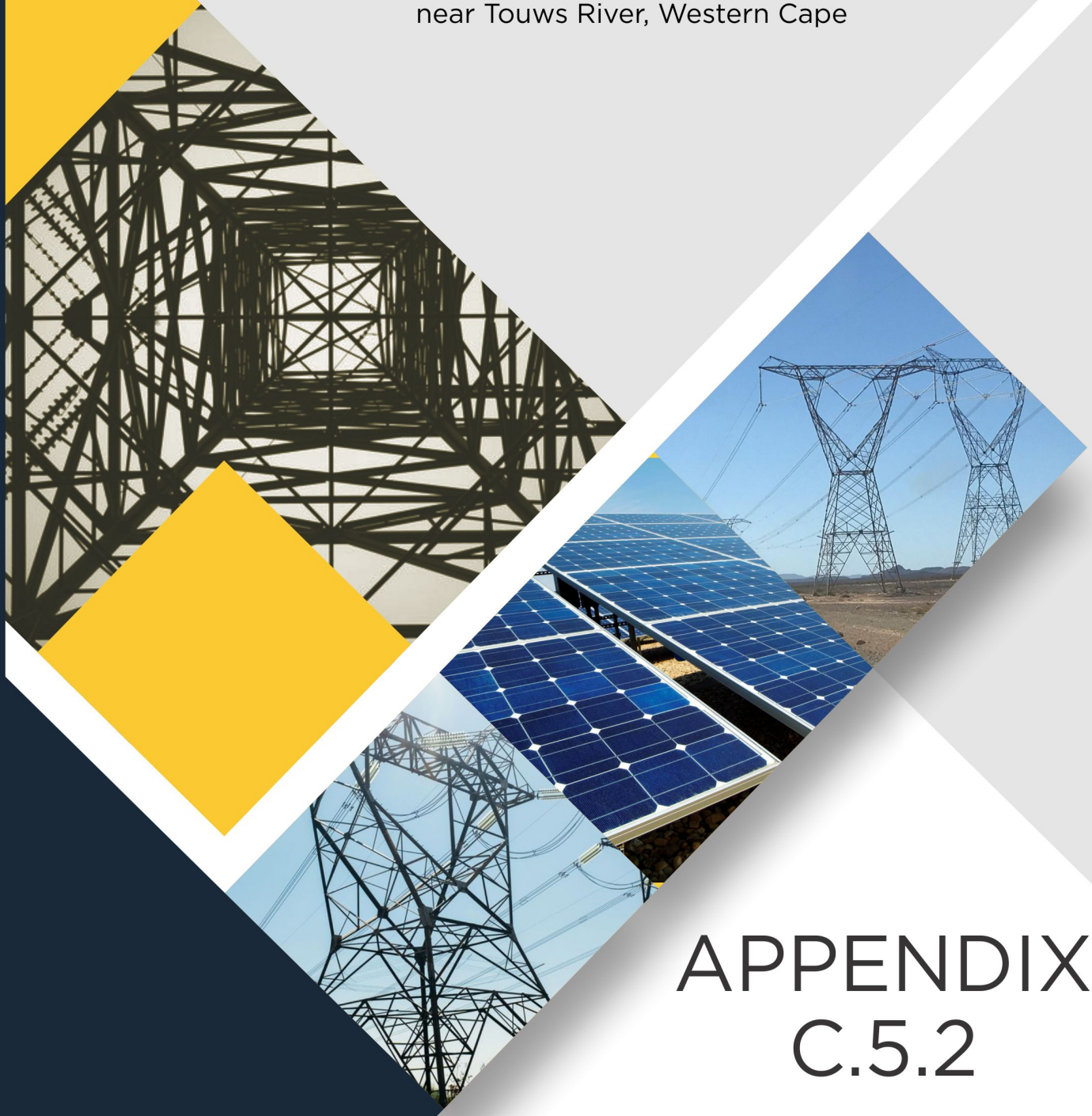
Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: *2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;* *a) aquatic ecosystem types; and* *b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;*	*Section 4*
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	*Figure 11, Figure 12 and Figure 13*
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	*Section 4*
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including: *a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and* *b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).*	*Section 4 and Tables 4, 5, 6 and 7*
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	*Not Applicable – see Section 5*
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: *2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?* *2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?* *2.5.3. How will the proposed development impact on fixed and*	*Sections 6 and 7* *In particular planning, operation and decommissioning impacts:* *1. No change in state anticipated* *2. No change in resource quality anticipated* *3. Riparian areas are excluded – no change in ecological processes of significance*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity		Section where this has been addressed in the Specialist Report
	dynamic ecological processes that operate within or across the site? This must include: *a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);* *b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub - catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);* *c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and* *d) to what extent will the risks associated with water uses and related activities change;*	*anticipated.* *a. As significant buffering of riparian areas, limited hardpanning is anticipated – impacts of hydrological importance are not anticipated* *b. Sediment transport change will be negligible* *c. Minor change in lower catchment with minimal change that is negligible, to the watercourse* *d. No changes to water use or any related activities are anticipated.*
2.5.4.	*how will the proposed development impact on the functioning of the aquatic feature? This must include:* *a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system);* *b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river);* *c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley -bottom wetland);* *d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);* *e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and* *f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);*	*Section 7* *In summary* *a. Baseflow does not arise as the systems are ephemeral* *b. Flow is intermittent. No change is expected in volumes* *c. Hydrogeomorphic state will remain intact and no change is anticipated* *d. Water quality is unlikely to have any significant alteration particularly during operations and decommissioning* *e. No fragmentation is anticipated as riparian environments have been avoided* *f. No change in important features anticipated.*
2.5.5.	*how will the proposed development impact on key ecosystems regulating and supporting services especially:* *a) flood attenuation;* *b) streamflow regulation;* *c) sediment trapping;* *d) phosphate assimilation;*	*As the systems are ephemeral, set back and out of maximum flood extents and there is a distinct lack of aquatic habitat and eco-morphology, no variation in ecological drivers*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
e) nitrate assimilation; *f) toxicant assimilation;* *g) erosion control; and* *h) carbon storage?*	*of aquatic systems is anticipated.*
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	*Sections 4 and 7* *Aquatic biota are transitory in the affected systems and no change is anticipated with the proposed development.*
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: *a) size of the estuary;* *b) availability of sediment;* *c) wave action in the mouth;* *d) protection of the mouth;* *e) beach slope;* *f) volume of mean annual runoff; and* *g) extent of saline intrusion (especially relevant to permanently open systems).*	*Not Applicable – the site does not include any estuaries.*
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	*Appendix A*
2.7.2. a signed statement of independence by the specialist;	*Appendix B*
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 2 and Appendix C*
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	*Section 2*
2.7.5. a description of the assumptions made, any uncertainties or gaps in knowledge or data;	*Section 2.2*
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	*Sections 4 and 11.2*
2.7.7. additional environmental impacts expected from the proposed development;	*Sections 4, 6 and 7*
2.7.8. any direct, indirect and cumulative impacts of the proposed development on site;	*Sections 6 and 7*
2.7.9. the degree to which impacts and risks can be mitigated;	*Section 7*
2.7.10. the degree to which the impacts and risks can be reversed;	*Section 7*
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	*Section 7*
2.7.12. a suitable construction and operational buffer for the	*Sections 4.3.2 and 11.2*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
aquatic ecosystem, using the accepted methodologies;	
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	*Sections 7 and 10*
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	*Not Applicable – the PV sites fall outside of the sensitive areas.*
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	*Section 11.1*
2.7.16. any conditions to which this statement is subjected.	*Section 11.2*
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, that are to be included in the EMPr.	*Sections 7 and 10 of this report include mitigation and monitoring measures. These are to be included and incorporated into the BA Report.*
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*Appendix B of this report. This report is included as an appendix to the BA Report.*

Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.5.2

Aquatic Biodiversity and Species for Grootfontein

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT:

Basic Assessment for the Proposed Development of three 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure on the Farm Grootfontein (i.e. Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3), near Touws River, Western Cape

---

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	SDP Ecological & Environmental Services
P O Box 320	P O Box 1016
Stellenbosch	Ballito
7599	4420
South Africa	South Africa

October 2020

Executive Summary

Three 175 MW photovoltaic (PV) power generation plants (i.e. Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3) have been proposed for establishment on the Farm Grootfontein 149. In addition, these plants, would provide power through 132kV overhead powerlines that would connect with the Kappa Sub-station, some 13km to the south of the site.

An evaluation of the aquatic aspects of the Farm Grootfontein was undertaken during September 2020 in order to consider the nature of the area in question and to evaluate the impacts of the proposed development.

The Farm Grootfontein lies within the Tanqua Succulent Karoo Biome and comprises of two veld types, namely Tanqua Karoo and Tanqua Wash Riviere. The former is associated with elevated terrestrial environments while the latter is associated with sandy, riparian habitats. Both veld types are considered "least threatened".

In evaluating the ecological significance of the subject site, it was determined that the importance of the Tanqua Wash Riviere habitat or lower riparian environments were high in terms of faunal diversity. These areas are considered important faunal habitat and are evidently also associated with extreme flood states, providing them with a high ecological sensitivity. These findings align with those of the Department of Environment, Forestry and Fisheries (DEFF) Screening Tool and the various data sets associated with the region.

Given the above, the proposed development of Grootfontein PV 1, Grootfontein PV2 and Grootfontein PV 3 is expected to elicit an overall, moderate ecological impact that may be reduced to "low" significance if suitable mitigation measures are employed. The overhead powerlines are also expected to elicit only a low significance impact, primarily associated with change that may arise in the riparian environments.

The proposed developments, if authorised, should be approved with a number of conditions, in particular the placement of the development within the footprint identified and that a suitable game-permeable fence should be instituted. A number of related mitigation and management measures are proposed.

From the above, it is evident that subject to the conditions outlined in this report, the development of three 175 MW PV facilities at Grootfontein cannot be precluded on ecological grounds.

Contents

List of Figures

List of Tables

List of Abbreviations

AIP	Alien Invasive Plant
AMSL	above mean sea level
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Environmental importance and sensitivity
BA	Basic Assessment
CBA	Critical Biodiversity Areas
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
EGI	Electricity Grid Infrastructure
GPS	Global Positioning System
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
PV	Photovoltaic

Glossary

Definitions	
Arid	Areas which receive low levels of rainfall or there is a moisture deficit.
Aquifer	Underground layer of water-bearing permeable rock
Crepuscular	Fauna that is active at twilight
Dendrogram	A diagram showing relationships determined through a cluster analysis
Calcrete	A carbonate horizon formed in semi-arid regions. Also known as a caliche.
Dolerite	Form of igneous rock.
Drainage line	A geomorphological feature in which water may flow during periods of rainfall.
Dune	Landscape feature arising from the deposition of sediment, transported primarily by winds and resulting in a sandy feature that may or may not be stabilised by vegetation
EI	Environmental Importance
ES	Environmental Sensitivity
Eco morphology	Pertaining to the relationship between the geomorphology of an environment and the biotic components that are adapted to it.
Edaphic	Pertaining to soils.
Fossorial	Pertaining to burrowing animals or those which live underground
Geophyte	Plants with underground storage organs.
Graminoid	Grasses or grass-like. Also, monocotyledonous plants.
Gully	An erosion line exceeding 30cm in depth where water flow is concentrated and erosion resulting from flow is clearly evident.
Hydrogeomorphological	The interaction of geomorphic processes, landforms and /or weathered materials with surface and sub-surface waters.
Hygrophilous	Plants growing in damp or wet conditions
Multivariate analysis	A statistical method of evaluating nonlinear relationships between groups of data.
Non perennial	Flow is intermittent and irregular
Rill	Shallow erosion lines less than 30cm deep
Scarp	Physical feature determined by geology and comprises of a steep slope that differs from the slope of the prevailing landscape
Sheetwash	A mobile sheet of sediment deposited by water flow over a hill-slope or plain
Xeric	A dry, as opposed to wet (hydric) or mesic (intermediate) environment.

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT

This report serves as the Aquatic Biodiversity and Species Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed development of three 175 MW Solar Photovoltaic (PV) Facilities and associated Electrical Grid Infrastructure (EGI) on the Farm Grootfontein 149, near Touws River in the Western Cape. These projects are referred to as Grootfontein PV 1 Grootfontein PV 2and Grootfontein PV 3.

1 Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The Project Applicant is undertaking an Application for Environmental Authorisation (EA) to be submitted to the National Department of Environment, Forestry and Fisheries (DEFF), which entails significant planning, as well as the undertaking of BA processes. The Project Applicant is proposing to develop nine solar PV facilities, nine powerlines and associated infrastructure to link the proposed PV facilities to the Eskom Kappa Substation. There are nine separate Project Applicants. Two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172. This Aquatic Biodiversity and Species Specialist Assessment specifically deals with the Grootfontein PV 1 Grootfontein PV 2 and Grootfontein PV 3 projects, as well as the associated EGI (Figure 1). This specialist study, is being undertaken as part of said BA process, in order to evaluate the aquatic habitats of the receiving environment in relation to the proposed development.

The biophysical reconnaissance and evaluation of a portion of the farm Grootfontein was undertaken during the period September 2020 and entailed both a literature review of the region, as well as on site evaluations, during which specific primary data was collected and evaluated. In addition, the identification of key hydrological features on site and an interpretation of the prevailing flora and fauna, as well as other features was undertaken.

All data collected in the field and during the literature review was evaluated and interpreted in order to provide an understanding of the nature of the prevailing environment at a landscape and habitat level, together with specific evaluation of data relating to habitat form and structure. The evaluation also sought to identify any anomalies within the prevailing environment. Such variance may be considered to be indicative of differing habitat forms, which under consideration, may be of higher order ecological value in relation of the prevailing environment.

1.2 Details of Specialist

This specialist assessment has been undertaken by Messrs S C Bundy, L P Maingard and AM Whitehead of SDP Ecological and Environmental Services. The following information is provided in respect of the above:

S C Bundy	Ecologist	SACNASP No. 400093/06
LP Maingard	Ecologist	SACNASP No. 116639/16
AM Whitehead	Ecologist	SACNASP No. 400176/10

Curriculae vitae of the individuals above are included in Appendix A of this specialist assessment, as well as specialist statements of independence in Appendix B.

1.3 Terms of Reference

The overall objectives of the Aquatic Biodiversity and Species Specialist Assessment are:

- To identify and establish an understanding of the site under consideration at a landscape scale of evaluation with particular consideration being given to important aquatic or riverine habitats, as they may be identified.

- To provide an evaluation and status of habitat composition and significance within the site in order to evaluate the potential impact of the proposed development on the ecological function of the site.

- To assess the actual and potential impacts arising from the proposed development on the hydrological features within the study site. Such impacts may be directly applicable to the site and contained within the site boundaries, or may be indirect impacts, which may have ramifications outside of the site boundary; or may be of a cumulative nature, in terms of impacts arising from similar developments or activities within the region.

- To provide guidance on the implementation of mitigation measures that may serve to moderate any negative impacts that may arise on site, as a consequence of the proposed development.

The Scope of Work is based on the following broad Terms of Reference, which have been specified for this specialist study:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320; as well as all relevant legislation. Identify any additional protocols, legal and permit requirements that are relevant to this project and the implications thereof.

- Review detailed information relating to the project description and precisely define the environmental risks to the aquatic environment and consequences for prevailing ecology.

- Compile a baseline description of the aquatic ecology of the study area, and provide an overview of the entire study area in terms of ecological significance and sensitivity.

- Provide specific ecological data in respect of the aquatic components of the site using ground-truthing methods, with an emphasis on those areas considered to be of “high” and possibly, “moderate” sensitivity.

- Based on the desktop study, undertake field work and sampling across the site to record relevant data and to compile an overview of the habitat under review. The site visit must also identify the level of sensitivity assigned to the project area on the National Web-based Environmental Screening Tool (Screening Tool), and to verify and confirm this sensitivity and land-use. A Site Sensitivity Verification Report must also be compiled based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.

- Collate all data collected during the field work and undertake a review using methodologies that allows for comparison or consideration of biological data.

- Provide a detailed hydrological and aquatic biodiversity sensitivity map of the site, including mapping of disturbance and transformation on site, as well as set-backs or buffers.

- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.
- Identify any species of special concern or protected species on site.

- Identify and delineate wetlands that may occur on the site, using the relevant protocols established.

- Determine if a Water Use License (WUL) is required and if so, determine the requirements thereof.

- Identify and rate potential direct, indirect and cumulative impacts on the aquatic ecology, species and ecological processes within the site during the construction, operation and decommissioning phases of the project.

- Provide input to the EMPr, including mitigation and monitoring requirements to ensure that the impacts on the aquatic ecology are limited.

- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.

- Compile an assessment report qualifying the risks and potential impacts on aquatic ecology in the study area and impact evaluations.

- Incorporate and address issues and concerns raised by Stakeholders, Competent Authority, I&APs and the public during the Public Participation Process (where relevant and applicable).

2 Approach and Methodology

A literature review and desktop analysis were undertaken prior to the field investigation, utilizing various sources including the National Fresh Water Priority Areas (NFEPA) data and other relevant sources. Recent and historical aerial imagery of the site was reviewed in order to identify points for investigation during the field survey.

Utilising the above information, a field investigation was undertaken from the 14th to 18th September 2020, whereby:

- Key features, such as rivers and scarps were evaluated in order to determine the key, geophysical features on the site;

- Sites of geomorphological or topographic variance were identified and subjected to an evaluation of species present within a 40 m linear extent across the selected site. Species were identified and collated according to a “presence – absence” method of evaluation;

- Additional random sample points were selected from across the site for comparative purposes; and

- Any additional species of significance not identified within the sample sites were also noted.

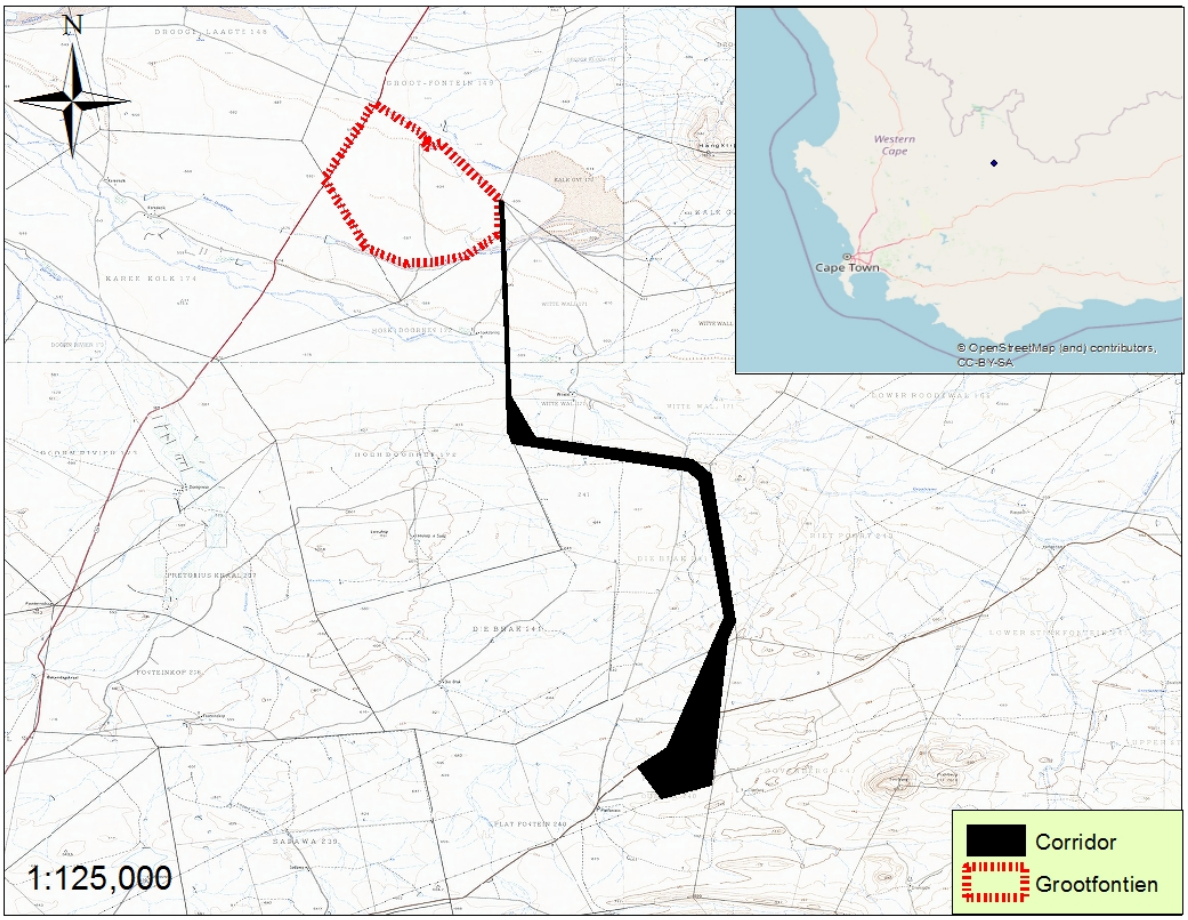


Figure 1. Topographic map indicating the study area (outlined in red) on the Farm Grootfontein, and the adjoining powerline corridor.

All data was collated and subject to evaluation in order to:

- Place the data into a hierarchy of similarities according to species composition and sample sites.
- Give consideration to the overall structure of habitat within the subject site.
- Identify any habitat anomalies that may be identified in such analysis.
- Allow for the interpretation of such data in order to prioritise and evaluate habitat form and structure within the study area.

In addition, using methods identified in the Department of Water Affairs' "A Practical Field Procedure for Identification of Wetlands and Riparian Areas" (2005), such features were identified and defined. Such evaluations utilised both geomorphological, geohydromorphic edaphic conditions and botanical indicators in order to identify such components. Where riparian and wetland systems were identified these areas were subject to specific evaluation within this assessment report.

Riparian delineation methods

As noted above, the delineation of riparian edge and ephemeral wetland environments was undertaken utilizing accepted delineation techniques contained within "*A Practical Field Procedure for Identification of Wetlands and Riparian Areas"* (DWAF 2005) and the updated guidelines (DWAF 2008). A description of the rationale is provided below.

Riparian indicators - Indicators of a riparian system include the following (as per DWAF 2005):

1. An "obvious" floodplain and active channel.

2. Evidence of active erosion indicating a high energy system.

3. The absence of "classic" hydromorphic vegetation, with species associated with riparian areas dominating, or simply a change in vegetation density and structure.

As such, the approach to defining the riparian zone is not strictly defined (DWAF 2005) and a number of methods can be used. Accepted riparian indicators include:

1) **Topography**: identification of flood terraces and macro-channels.

2) **Vegetation**: identification of a distinct area of vegetation change, often in close association with the macro-channel. Changes can be in relation to species diversity or physical nature (density or health).

3) **Alluvial soils** and deposited material: identification of recent deposits of sand or mud, serves as a confirmatory indicator.

A number of methods exist for identifying riparian indicators. Acceptable methods include (DWAF 2005):

1) The use of topographical maps.

2) Aerial photographs and aerial videos.

3) Ecoregions (e.g. using climatic, geological or vegetative community indicators can be useful as a predictive method).

4) Field work (i.e. confirming desktop observations by locating indicators on site).

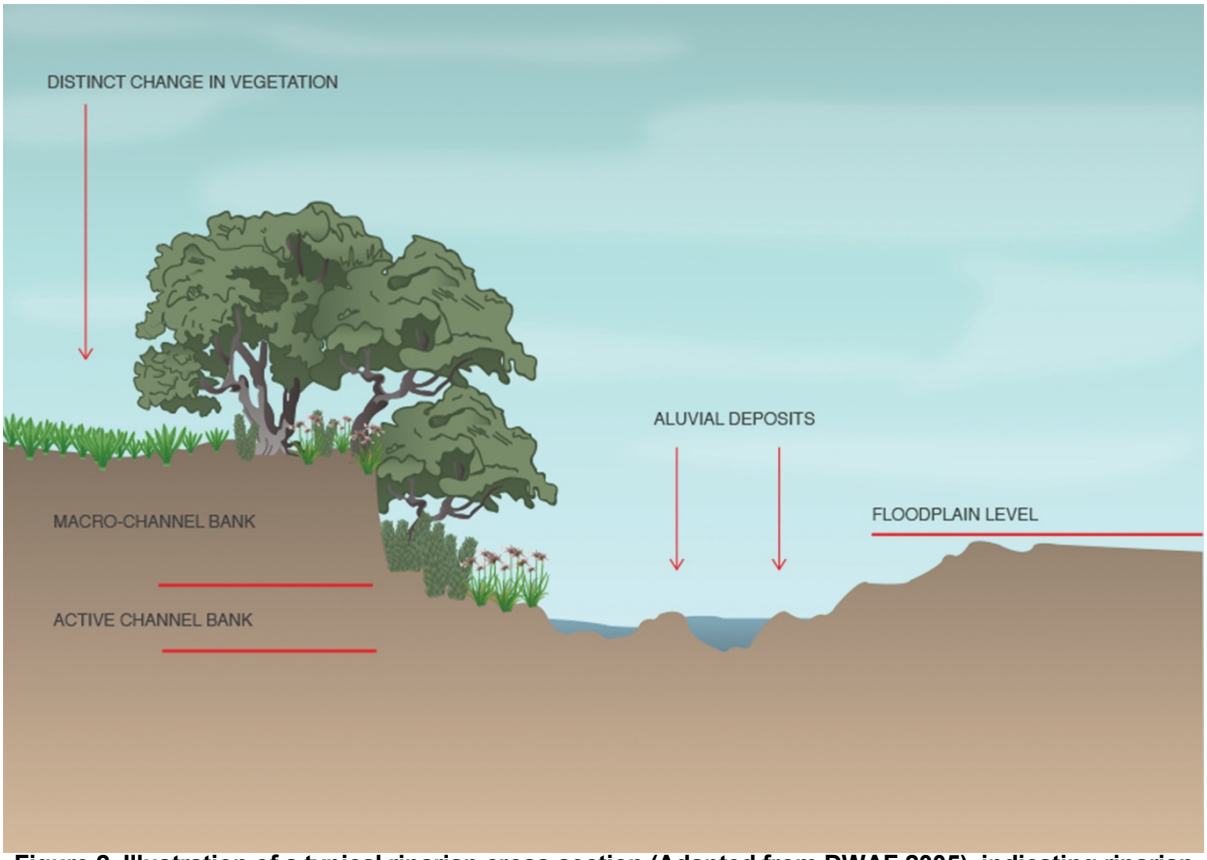


Figure 2. Illustration of a typical riparian cross section (Adapted from DWAF 2005), indicating riparian edge (arrow (distinct change in vegetation)).

Wetland Habitat

Due to the continuous or regular saturation experienced within wetland environments, soil chemistry differs from mesic or dry environments (Figure 2), giving rise to specific plant associations or groupings (hydrophytes) within wetland environments. The dependence of hydrophytes on wetland conditions varies from species to species and as a result, these species can be classified according to their occurrence within wetland areas. Such groups include obligate wetland species and facultative wetland species (as set out in DWAF 2005 and 2008).

A dominance of obligate species, indicates wetland conditions. In addition, the species present can be used to determine the three wetland zones, permanent, seasonal and temporary, however the difference between seasonal and temporary wetland areas is often ambiguous, resulting in the two categories being combined occasionally.

Soil characteristics are also utilized in the delineation process. Under fluctuating periods of water inundation, as well as the permanent presence of water within the upper soil horizons, minerals in the soil are either leeched from the horizon or are subject to chemical reactions, leading to changes in soil colouration and the presence of "mottling". The frequency of mottling indicates the degree of saturation and hence the wetland zone.

During the delineation exercise, the riparian and wetland areas associated with the site were delineated using aerial photography and field observations, which focus primarily on changes in vegetation, topography and the presence of alluvial deposits. Specific points were marked using a Garmin VI Montana Global Positioning System (GPS) device, where necessary.

Wetland functionality and health (PES)

Utilization was made of the Wet-Eco services tool (Kotze et. al. 2007) to determine the significance of the three identified wetland environments. Being an arid environment, with little or intermittent flow arising only on occasion, a "desktop" environmental importance and sensitivity (EIS) and Present Ecological State (PES) was undertaken (i.e. it was not possible to evaluate aquatic biota or undertake water chemistry analysis). This exercise involved the identification of the appropriate riverine section. The results of the PES or ecological status of the system provide an indication of the level of importance of the river, according to a ranking. The various classes or ratings are presented in Table 1.

Table 1. PES/Ecological status ratings for riverine system (Kleynhans et al 2005)

Rating	Description
A	Unmodified, natural.
B	Largely natural. A slight change in ecological processes is discernible but the system remains largely intact.
C	Moderately modified. A moderate change in ecological processes has taken place but the system remains predominantly intact.
D	Largely modified. A large change in ecological processes has occurred and the system is appreciably altered.
E	Greatly modified. The change in ecological processes is great but some features are still recognizable.

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS category as listed in Table 2 below:

Table 2. EIS category, score and interpretation.

EIS Category	Range of Mean	Recommended Ecological Management Class[3]
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

2.1 Information Sources

The following data sources were consulted during this investigation.

Table 3. Data sources utilised during assessment

Data / Information	Source	Date	Type	Description
South African National Protected Areas Database (SAPAD)	Department of Environmental Affairs	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Western Cape Biodiversity Spatial Plan (WCBSP)	CapeNature. 2017. Western Cape Biodiversity Spatial Plan 2017. http://bgis.sanbi.org/	2017	Report & Spatial	Spatial conservation planning units and associated management recommendations for the Western Cape province
National Biodiversity Assessment	South African National Biodiversity Institute	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including, vegetation types, wetlands and rivers.
http://posa.sanbi.org/sanbi South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA) [dataset]	SANBI Plants of Southern Africa	2016	Data	Plant list for Tankwa region.
www.vmus.adu.org.za Animal Demography Unit	ADU: University of Cape town	2020	Data	Specific data on geographic occurrence

Data / Information	Source	Date	Type	Description
(ADU).				and record for various taxa.
Tankwa Weather http://tankwaweather.co.za	Private weather station	2020	Data	A private Davis Vantage Pro 2 mounted 1.6m above the ground. And anemometer at 10m angle Operation since: Jan 2015

2.2 Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations are presented in respect of this evaluation:

- Site reconnaissance was undertaken over a consecutive 5 day period during the early summer. Such field reconnaissance does not account for seasonal variations that may arise and reliance on collated and historical data from the region is required.
- During the period of reconnaissance, seasonality and weather conditions may have affected findings, in particular, colder temperatures.
- The area in general has been subject to an extended and significant drought, which is likely to have influenced habitat form at a limited level, as well as faunal populations.
- Cumulative impacts have been considered on a regional basis over a 30km radius.

2.3 Consultation Processes Undertaken

Interaction was undertaken with local residents and interested parties who were considered to have specific knowledge of the area, these included:

- Mr Philip van Heerden
- Mr Andre Vermeulen.

The above persons provided anecdotal information which was verified and considered during the site evaluation, as well as by further interrogation of the literature and data.

3 Description of Project Aspects relevant to Aquatic Biodiversity

The development of a PV facility, associated infrastructure and EGI on the subject properties will by necessity, be undertaken on land that meets a number of criteria including, *inter-alia*, level or gradual falls, generally suitable founding conditions and avoidance of areas that may be inundated by flooding. As a consequence, the proposed PV facilities will avoid all riverine and wetland environments.

Howsoever, the proposed development will alter the nature of the immediate catchment associated with such riverine environments through both the construction of the facility as well as its operations. Such change will arise primarily from changes in the rate of flow of surface water and possible alteration of the edaphics or soils within the facility, as well as, to a minor extent, water chemistry and perhaps, more indirectly, the biotic components of the riverine system.
The proposed Grootfontein PV projects will see a land use change that differs significantly from the prevailing land use. The implementation of the proposed development will result in notable change to the prevailing catchment associated with the river systems in the area, primarily on account of the

construction stage of the project, as well as the long-term operational stage. Indirect impacts may therefore arise on riverine systems as a consequence of changes in the catchment. The development of the site for the PV facilities, associated infrastructure and EGI will see the following activities arise:

- Cordoning and fencing of the sites during both the construction and operational phases. This component of the project usually entails the establishment of an electrified fence (or palisade or mesh type) of about 2 – 3 m high which remains in situ for the lifetime of the project (i.e. for the operational phase). For the construction phase, the construction area and construction site camp may also be cordoned off with temporary fencing. Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm.

- Clearance or partial clearance of minor topographic features and vegetation, where applicable, during the construction phase.

- Establishment of roadways (i.e. access roads leading to the site and internal gravel access roads) and hard panning of surfaces, with minor stormwater management aspects being introduced during the construction and operational phases.

- Establishment of modular arrays with concomitant cabling and provision of invertors within the arrays. The footing of the module framework is founded into the ground using an earth screw or similar methods. Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m

- Establishment of step up transformers and three on-site substations (one for Grootfontein PV 1, one for Grootfontein PV 2 and one for Grootfontein PV 3). This facility is expected to occupy an area of approximately 2 ha each. It will be fenced and isolated from the balance of the site.

A Lithium Ion Battery Energy Storage System (BESS) will be established at each PV Facility. The proposed BESS will cover an area of up to 8 hectares within the laydown area, and a height of up to 5 – 10 m.

A laydown area of approximately 13 ha in extent.

- Establishment of offices and related infrastructure.

- A yard for storage and general operations will be set aside, adjacent to the built offices.

- An overhead powerline (132kV) will be established per PV Facility from the on-site substation to the Kappa substation. The powerlines will traverse the Klein Droelaagte and the Groot River and adjacent lands to the south, aligning with existing powerlines associated with adjacent renewable energy projects.

The commencement of construction on site, will entail low to significant alteration of the prevailing habitat, depending upon the final design and layout of the PV facilities. A general sequestering of the subject area, through the fencing of the site from the surrounding habitat forms will thus arise.

While the construction phase will see temporary disturbances and transformation to the environment, these impacts on the prevailing ecology are likely to be significant in terms of impact, but of short temporal extent, as the construction project rolls out and a stability, albeit within a differing

environment, arises on the subject site. It therefore follows that impacts on the ecology arising from this project can be divided into two aspects, namely: construction phase impacts and operational impacts.

4 Baseline Environmental Description

The Grootfontein farm lies within the southern extent of the Tankwa Karoo, part of the Succulent Karoo Biome. The Tankwa Karoo is associated with a comparatively low altitude and generally flat to undulating landscape, not exceeding 1500m amsl. According to the Koppen-Geiger climate classification method (www.koeppen-geiger.vu-wien.ac.at), the area is classified "BSh", which is indicative of an arid, hot environment. Such extremes have given rise to a regionally unique environment, both from an aquatic and terrestrial perspective.

In an arid region such as the Tankwa, riverine environments are primarily seasonal systems, flowing intermittently during high precipitation events. These episodes of flow can be significant flood events as deep frontal rains, as well as orographic rainfall arises within the catchment and on the Hangklip mountain to the north east. Rainfall events are also seasonal (mainly a winter period phenomenon) and during the periods between such precipitation events, little or no flow arises in these systems. Given the alluvial nature of these systems, little in the way of wetland environment is encountered in the river channels.

Some consideration of the broader ecological features of the site are presented below.

4.1 General Description

Grootfontein can be described as a series of undulating plains and plateaux, interspersed with occasional dolerite ridges. The lower elevations of the site are associated with sheet wash plains and larger ephemeral rivers that are dominated by alluvial sands.

Given this topography, two habitat forms or veld types are evident within the PV sites, these being SKv 5 Tanqua Karoo (Mucina and Rutherford 2006), a form of the Succulent Karoo Biome, and Tanqua Wash Riviere (AZi 7) a riparian habitat form (Figure 3). Both these veld types are considered "least threatened" from a conservation perspective. The same status applies to the EGI corridor running along Die Brak and Platfontein Farms.

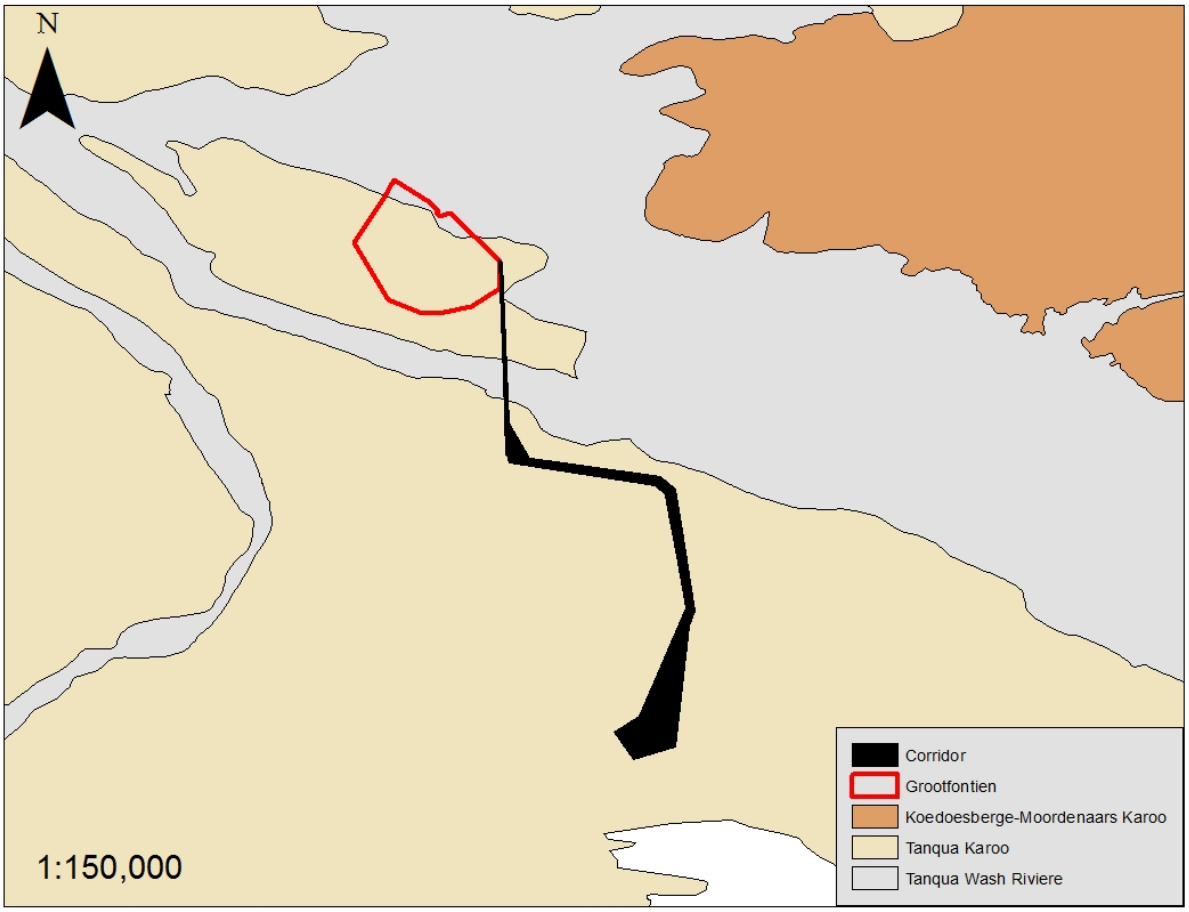


Figure 3. Map indicating veld types in relation to study area

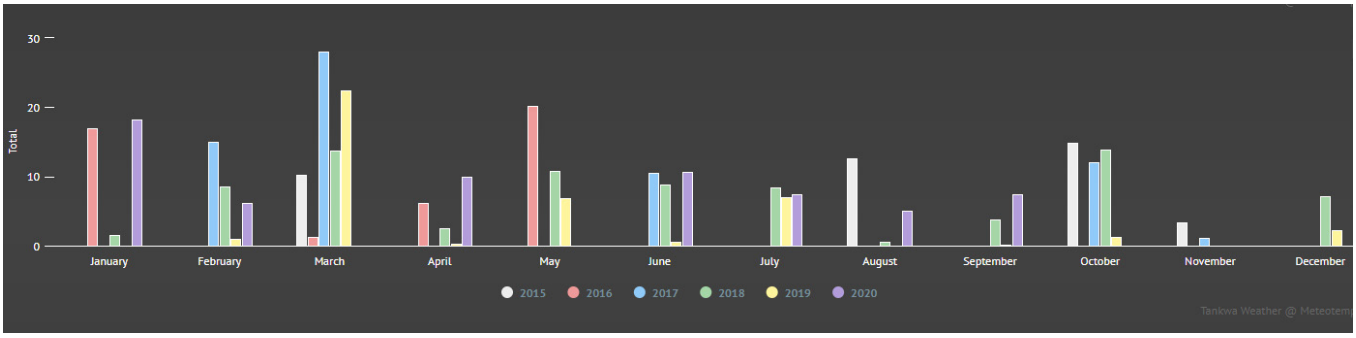


Figure 4. Graph showing monthly rainfall in Tankwa 2015 – date.

4.1.1 Ecological Processes, Functioning and Drivers

Two principle factors are considered to be the master elements driving the localised ecology. These can be considered to be broadly meteorological factors, namely wind, rainfall and temperature, while edaphics, particularly giving rise to lithic or sandy environments may be considered a geophysical driver. Notably, anthropogenic factors have over the previous century proven to be a key driver in contemporary habitat form and structure.

From a meteorological perspective the study area is a “xeric habitat”, with an average annual rainfall recorded over the last 5 years of between just over 40mm to 66mm in 2017 (2020 may exceed this record). There is however, high spatial and inter annual variability in rainfall patterns across the

region (Figure 4). According to Mucina and Rutherford (2006), the region may be considered to be a "rain shadow desert", where topography influences rainfall patterns.

In addition to the above, wind is a key issue within the region, driving sediment movement and promoting aeolian, sediment transport in areas exposed to high winds and with little vegetative cover. Where vegetation cover has been compromised, aeolian transport generally prevents the natural re-establishment of vegetation, or at least retards such emergence. The dominant winds within the subject site are the north westerly and southerly wind, which are seasonally prevalent (Figure 5). Sheetwash is also conspicuous to the east of the site, where sediments transported from up-slope have been deposited, proximal to the riverine areas.

Temperatures in the region can be considered to be extreme, with the greatest range recorded in the area lying at 53 °C. The lowest recorded minimum temperature is -3. °C and the highest maxima being 50.2°C (http://tankwaweather.co.za/pages/station/climate.php). A mean maximum temperature of 35°C is recorded by the SA Weather Service. Such extremes are indicative of the requirement for floral and faunal species to be tolerant of the effects of frosting, as well as high insolation and transpiration states. As a consequence, plant communities and faunal populations in the region generally show high levels of adaptation, occurring in specific areas or zones and the utilisation of specific, niche environments, e.g. scarp slopes and riverine environments by both floral and faunal communities.

4.1.2 Aquatic Biodiversity and Ecosystems

4.1.2.1 Aquatic Ecosystems

At a landscape level, riverine and riparian areas in the southern Tankwa region generally show improved vegetation cover and faunal presence on account of access to water and increased availability. The vegetation cover is however, primarily not hygrophilous in nature and is generally a *Vachellia* karoo dominated environment with *Lyceum cinereum* and *Salsola ceresica* being the dominant species within vegetation associes in these areas. Such species align with the Tankwa Wash Riviere habitat and as such, do not conform with the strict definition of "riparian vegetation". Mucina and Rutherford (2006) refer to this habitat as either "alluvial shrublands and herb lands", and "sheetwashes".

These areas are however subject to intermittent but significant flooding and as such there can be significant transport of material within these riverine environments. As such these areas show a natural disturbance regime that results in scour and erosion, as well as significant deposition. Lighter falls may result in generally low-level inundation of pools and ponds within the riverine environments, and these may support small associes and consocies of *Spiloxene aquatica* and *Scirpoides dioecus.* Given the generally dry and erratic flows experienced within aquatic environments within the southern Tankwa region, aquatic biota is generally limited and cannot be utilised in the determination of the ecological state of these systems. Howsoever, terrestrial fauna is notably more prevalent in the Tankwa Wash Riviere habitat, primarily because of improved cover and access to water.

Given the above, anthropogenic factors have been a key determinant in the contemporary nature of the aquatic or riverine environments within the site. The current land use on the site is livestock ranching, specifically focussed on sheep and goat farming, which has been undertaken since the 1700s. The overgrazing of the land has given rise to poor vegetation cover and has contributed significantly to sediment deposition and alluvial conditions that presently prevail in the riparian environments. In addition, owing to the poor soils found in the terrestrial environments of the Tankwa, almost all cultivation practices, including the laying down of pasture, has been and continues to be

undertaken in the riverine environments. There is thus regular and sustained disturbance in these areas. In addition, the scarcity of water in the region has resulted in the establishment of dams and other features to attenuate and capture water in the rivers. Some dams are successful, while others are less so, having been breached by the torrential flooding that arises from time to time.

In addition to the above, a point of some interest is the significant use of subterranean water through abstraction for the tending of livestock and other activities. Notably this water has a high salinity and as the subterranean water enters the riparian environment, such salts may have a small but pervasive effected on this habitat (*pers obs*).

The above natural and anthropogenic factors have given rise to a generally altered environment and concomitantly changed habitat within and adjacent to the river systems of the locale. It follows that further land use change in the region, where livestock are excluded, may allow for the seral succession processes of habitats previously affected by farming activities to emerge. Such change may alter the nature of the catchment and indirectly affect the evident aquatic and riverine systems. In addition, this change may not necessarily be adverse and improvements in the local aquatic ecology may arise. A prudent approach to the implementation of such development is however required in order to ensure beneficiation.

4.1.2.2 Aquatic Species

No aquatic biota was identified within either the Klein Droelaagte River or the Groot River (Figure 5).

Given the ostensibly dry state of the river bed, as well as the intermittently extreme flow experienced in these systems, there is little likelihood of fish species being present within either of the two river systems at any given time. The nearest data relating to ichthyofauna within the catchment of these two rivers arises from the confluence of the Doering River and Groot River, some 60 kilometres downstream. This data indicates the presence *Barbus capensis*, (Clanwilliam yellowfish), *B serra* (Clanwilliam sawfin) endangered, *Galaxias zebratus* and the endangered Clanwilliam sandfish, *Labeo seeberi*. *Micropterus salmoides*, the exotic largemouth bass, has also been recorded from these areas (Department of Water and Sanitation[1] (DWS), 2014). Recent attempts to locate *L seeberi* in the lower Tankwa River have not been successful.

The Animal Demography Unit (ADU) data base identifies only two anurans (frogs) from the Tankwa region, these being *Vandijkophrynus gariepensis gardenias* (Karoo toad) and the common *Amietia fuscigula* (the Cape river frog). *A fuscigula* is rapidly expanding its range, utilising farm dams and open water, while *V gariepinus* is an abundant species in the region. Both species are considered to be of least concern from a conservation perspective.

Data derived from the ADU identified three families of Odonata (dragonflies) within the region, these being the Libellulidae, Gomphidae and Coenagrionidae (FitzPatrick Institute of African Ornithology, 2020). All species are of *least concern* from a conservation perspective. Notably Libellulids are commonly associated with stagnant or still waters, rather than streams and regular flow which would account for their representation in this region.

In general, much of the riparian areas within the region are subject to regular disturbance primarily on account of farming activities, where cultivation and pastural activities are compelled to be undertaken within these areas. More terrestrial environments are not easy to till and are generally water deficient and thus production is poor.

[1] DWS is now operating as the Department of Water, Sanitation and Human Settlements

4.1.2.3 Conservation Planning

Critical Biodiversity Areas and Ecological Support Areas

Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) are defined in terms of the Western Cape Biodiversity Spatial Plan (WCBSP) (2017). The assessed area for the PV arrays and associated infrastructure, mainly the power lines, traverse a number of Terrestrial and Aquatic CBA and ESA delineated areas. However, the actual footprint of the Grootfontein PV facilities does not traverse any CBAs; however covers a few minor areas of Aquatic ESA 1, mostly associated with drainage line watercourses, as well as extremely small portions of ESA 2. This preliminary data provided by the WCBSP is the product of a systematic biodiversity planning assessment which identifies portions of land that require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and aquatic realms (CapeNature 2017). These spatial priorities are used to inform sustainable development in the Western Cape Province.

In addition to the above, CBAs and ESAs are separated further into CBA 1 and 2 as well as ESA 1 and 2 respectively. It is important to note that CBA 1 show areas in a natural condition and those that are potentially degraded or represent secondary vegetation are considered to be CBA 2. Similarly, a distinction is made between ESAs that are likely to be functional (i.e., in a natural, near-natural or moderately degraded condition; ESA 1), and ESAs that are likely severely degraded or have no natural cover remaining and therefore require restoration where feasible (ESA 2). The ESAs are not considered essential from a conservation perspective for meeting biodiversity targets; however, they may offer some ecological services.

As much of the floral and faunal diversity within the subject region is related to riparian environments, it is clear that by excluding the proposed development from these areas, impacts on areas or corridors that have significant ecological support functions are unlikely to be affected by the proposed development.

Critically Endangered and Threatened Ecosystems

According to the Biodiversity Geographic Information System (BGIS) developed by SANBI, there are no Critically Endangered and Threatened Ecosystems on the subject sites. The ‘endangered’ and ‘threatened’ eco-systems identified within the Cape Winelands District Municipal region are not located within the study areas. Such areas are located some 40 kilometres to the east and the west of the site, but do not extend into the subject area.

Protected Areas (PAs)

The project area does not fall within or adjacent to a Protected Area.

4.2 Project-specific Environmental Description

As indicated above, the riverine and riparian habitat of such an arid region does not display the classic characteristics of hygrophilous habitats. As such, the PES of these environments cannot be determined using the recommended methods of the DWS from primary data collection. Consideration is therefore given to the general nature of the site and the use of a desktop PES. The Farm Grootfontein incorporates portions of two river systems, namely the Droelaagte, in the north and the Klein Droelaagte in the south (Figure 5).

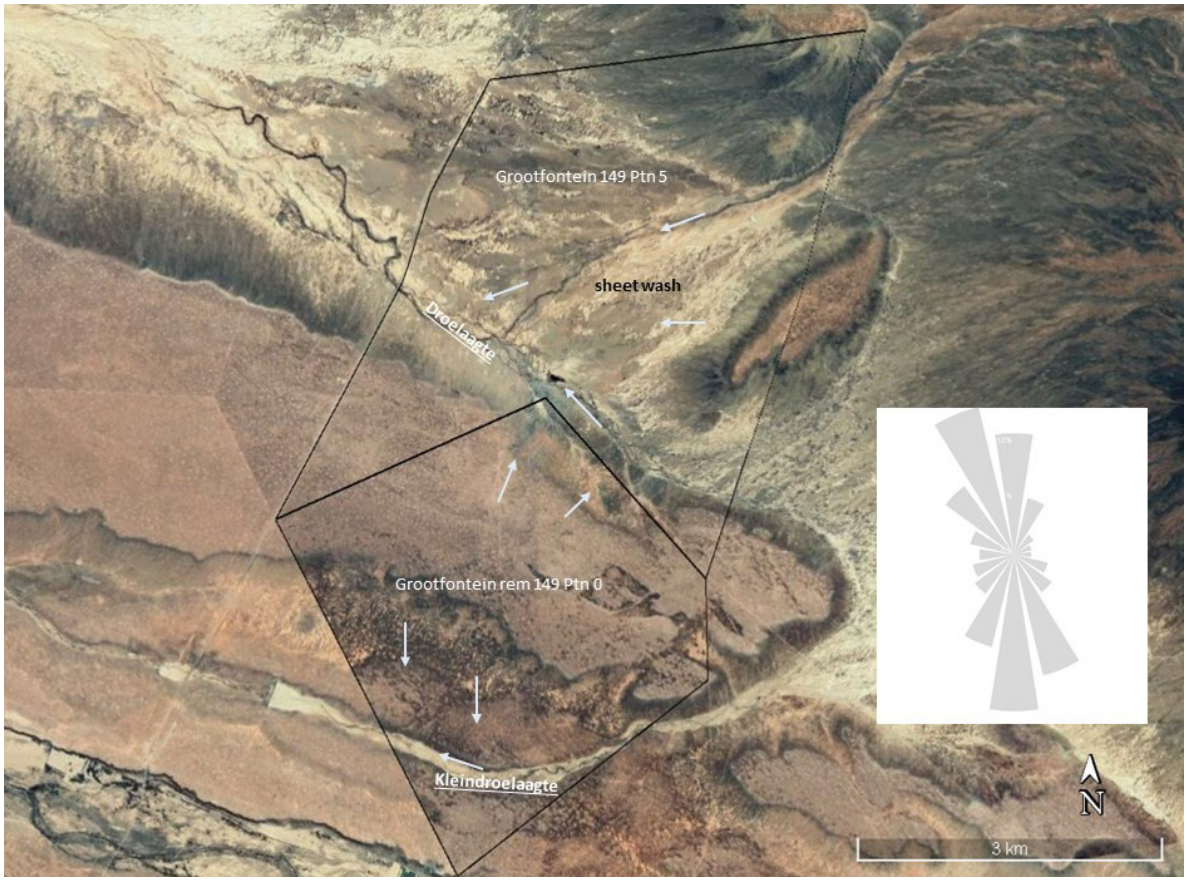


Figure 5. Map image showing two major river systems associated with the farm Grootfontein and drainage patterns, as well as prevailing winds (Google Earth, 2020).

These rivers all ultimately flow into the Doring River and this in turn, serves the Olifants River, with its confluence some 60 kilometres north of the site. Most surface drainage from the farm Grootfontein flows into the Klein Droelaagte on account of the prevailing topography.

The Klein Droelaagte has not been assessed in the DWS primary data collection, however the Droelaagte, from the same data set and located downstream of the site is considered to have a PES of "D", an EI ranked as "*moderate*" and an environmental sensitivity of "*very high*".

The Droelaagte, and Klein Droelaagte are part of a network of ephemeral river systems with intermittent flows primarily associated with the winter rainfall period. The wider riparian environment comprises of a network of minor channels that are active under low flow conditions, while under high flow conditions and flooding events, the entire riparian area can be subject to inundation.

On account of the general lack of flow within the channel, a number of dam and attenuation initiatives have been employed along the Droelaagte within Grootfontein and neighbouring farms in order to arrest flow and contain water for farming purposes. Larger dams on site are noted to have failed during the Laingsburg floods, having been breached by the flood waters. Smaller initiatives are also evident within the riparian environment (Figure 6), however most water used for stock and game farming is subterranean. The morphology of the river system varies either from a shale scarp, with vertically incised embankments with stony bed to alluvial deposits which can be several metres in depth (Figure 7). As a consequence, differing eco-morphologies can be identified within the river channel. The more lithic embankments favour refugia for a number of reptile and invertebrate species, while the talus associated with ablation and scour that is found at points within the river bed

may favour some geophytes. The alluvial deposits offer a differing form of refugia, in particular, nesting areas for a number of bird species such as the kingfishers (Alcedinidae).

Vegetation comprises primarily of xeric shrubs associated with the Tanqua Wash Riviere habitat form, with *Lyceum cinereum* and *V karoo* forming the dominant species in these areas. In isolated portions of the riparian environment, small outliers of *Scirpoides dioecus* may be evident within the primary channels, particularly where soils show an improved clay content and are able to retain moisture. As discussed above, the riverine environments show improved faunal populations on account of the increased availability of water near the surface, improved vegetation cover and related factors. It is clear that within Grootfintein, this state prevails within the Dreolaagte. Species identified within the riverine areas include *Pedioplanis laticeps*, the Karoo sand lizard, small mammals including the Cape hare (*Lepus capensis*) and the common mole rat (*Cryptomys hottentotus*). The latter, a fossorial species is evidently prevalent in these areas.

Figure 6. Image of dam at Grootfontein that lies on the Droelaagte.

Figure 7. Image of deep, sandy alluvial deposit within Droelaagte

Using the above information, a desktop PES can be compiled for the subject section of the Droelaagte. This PES is presented in Table 4. The ecological importance of the system is presented in Table 5.

Table 4. PES rating of the section of the Droelaagte River at Grootfontein.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	2	3
Water Quality	3	2
Stream Bed Condition	2	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	2	3
PES	2.5 (C)	

Table 5. EIS rating of the Droelaagte River

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The above PES and EIS differ slightly from the DWS classification with a slightly higher PES and somewhat lower EIS. This differentiation is attributed primarily to the more recent drought conditions that prevail across the site and the very low level of instream biota evident within the system at this point. Drainage from the sites proposed for the development of the PV facilities will be primarily into the more southerly Klein Droelaagte.

The Klein Droelaagte is however a smaller system. Howsoever, this system is similar in nature to that of the Droelaagte. The dominant vegetation forms being *V karoo*, with a primarily alluvium dominated bedform (Figure 8). A PES and EIS for this system are presented in Tables 6 and 7.

Figure 8. Image of typical section of the Klein Droelaagte.

Table 6. PES rating of the section of the Klein Droelaagte River at Grootfontein.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	3	3
Water Quality	3	2
Stream Bed Condition	1	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	1	3
PES	2.3 (C)	

Table 7. EIS rating of the Klein Droelaagte section at Grootfontein

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The EIS records a moderate level of ecological importance, whilst PES shows a score of C – "Moderately *modified. A moderate change in ecological processes has taken place but the system remains predominantly intact*". In respect of the subject system, however change to the system arising from the proposed Grootfontein projects, including all associated infrastructure and EGI, is unlikely to be evident as most, if not all of the development footprint lies outside of the catchment of this system.

4.3 Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

Figure 9 below presents the information relating to the Screening Tool for the Aquatic Biodiversity Combined Sensitivity as it relates to the Farm Grootfontein for the proposed PV Facilities, and Figure 10 shows the extent of the EGI Corridor. Evident from this data is that much of the area under consideration is considered to be of *low sensitivity* in terms of the aquatic biodiversity prevalent in the region. The data does however indicate "very high" sensitivity in respect of the Groot River, which lies to the south of the site, as shown in Figure 9 (for the PV Facilities) and Figure 10 (for the EGI corridor) below. The Klein Droelaagte river is not represented in this data set. The ecological sensitivity is however believed to approximate that of the Droelaagte. The Screening Tool identifies the very high sensitivity areas as aquatic CBAs, Rivers and Wetlands. However, it must be noted that the actual footprint of the PV Facilities is only earmarked as low sensitivity on the Screening Tool from an aquatic biodiversity sensitivity perspective.

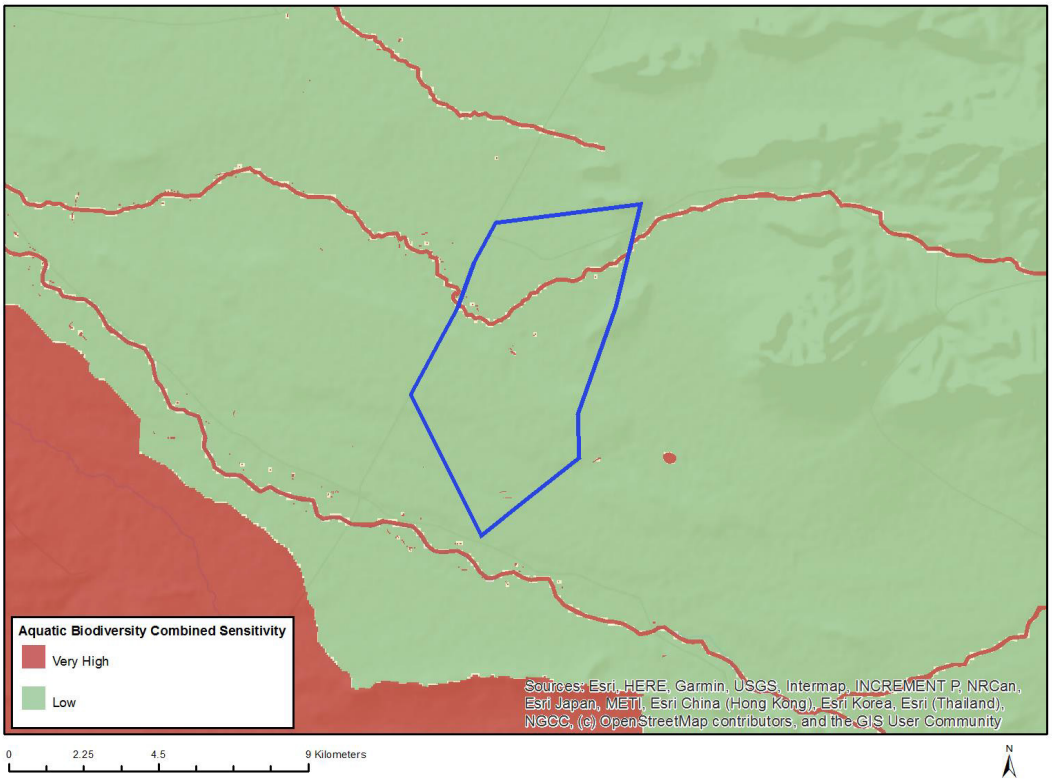


Figure 9. Map depicting aquatic biodiversity combined sensitivity in and around the Grootfontein farm (Source DEFF Screening Tool, 2020).

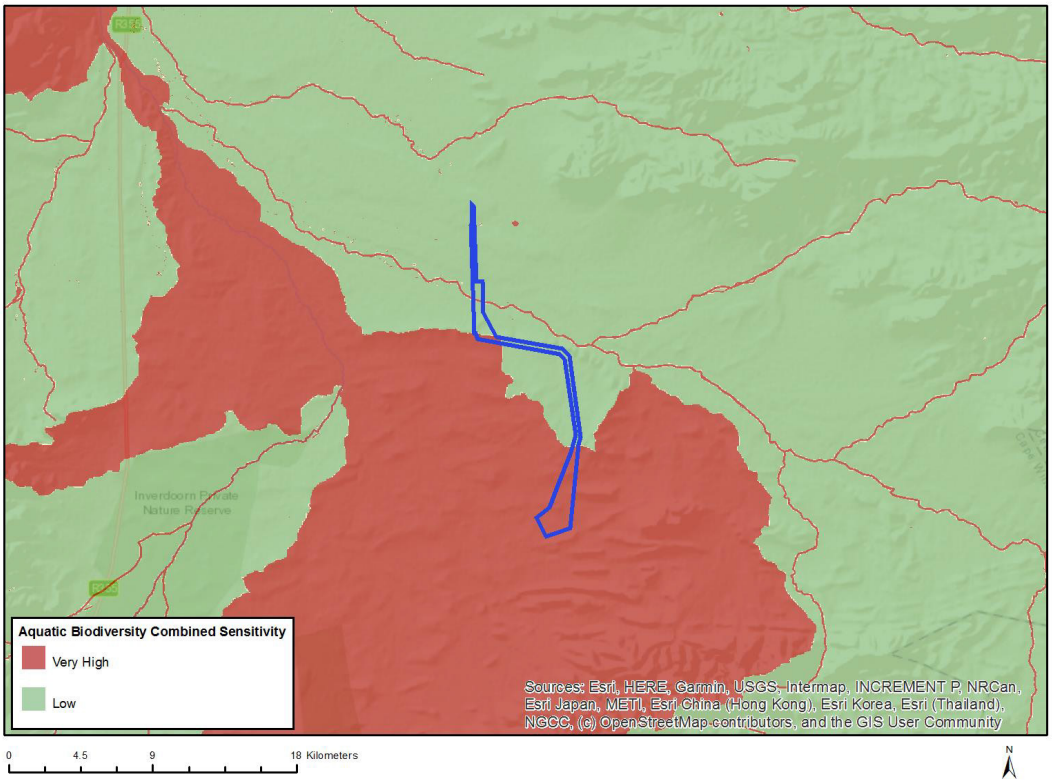


Figure 10. Map depicting aquatic biodiversity combined sensitivity in and around the EGI corridor (Source DEFF Screening Tool, 2020).

In terms of the EGI Corridor, the Screening Tool shows Very High sensitivity due to Aquatic CBAs, Rivers and freshwater ecosystem priority area quinary catchments. The river showing Very High sensitivity is the Groot River which bisects the Witte Wall farm.

The high sensitivity attributed to the Groot River is perhaps related to the presence of certain critically endangered species, such as Clanwilliam sandfish (*L seeberi*). While the riverine rabbit (*Bunolagus monticularis*), the subject of a particular investigation may also be present in the riparian environments, it must be considered a terrestrial species in respect of the aquatic assessment and its presence or absence would not alter the findings of Tables 4, 5, 6 and 7 above. Howsoever, *B monticularis'* preferred habitat range being within these areas, as well as the general use of the systems by terrestrial fauna does render the drainage features with a high ecological sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

Using the above information, as well as the findings of the aquatic assessment a sensitivity map of the site can be compiled. This is presented in Figure 10 below. This map indicates the following for the Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 sites:

- The terrestrial environments which are deemed to have "low sensitivity" from an ecological perspective.
- The riparian environments, which are deemed to have "high sensitivity".
- Areas of terrestrial importance and a "buffer" at the interface of the terrestrial and riparian areas, which approximates 100m and includes areas of sheet wash and flood extremes.

Figures 11 and 12 present the proposed Grootfontein PV 1, PV 2 and PV 3 development footprints in relation to the low, moderate and high sensitivity mapping information. Notably, the three project areas fall outside of areas of moderate and high sensitivity.

Figure 13 shows the position of the Grootfontein PV facilities in relation to the Kappa Substation. Overhead powerlines will connect the Grootfontein PV Facilities to the Kappa Substation. Figure 13 shows that the overhead powerlines will traverse the Groot River, however the servitude will not affect any other wetland or riparian environments and is acceptable to cross.

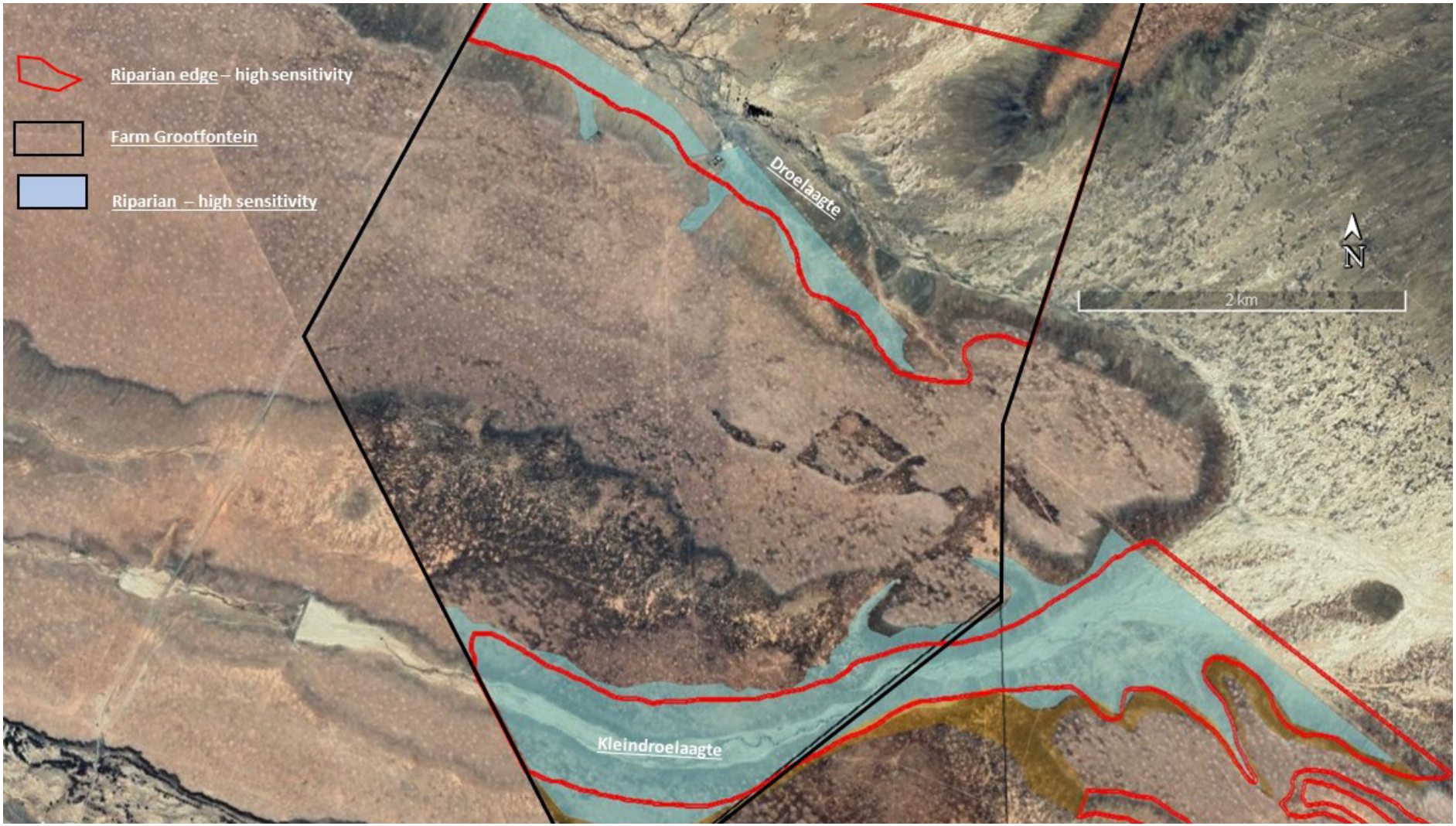


Figure 11. Map showing areas of ecological sensitivity in subject site

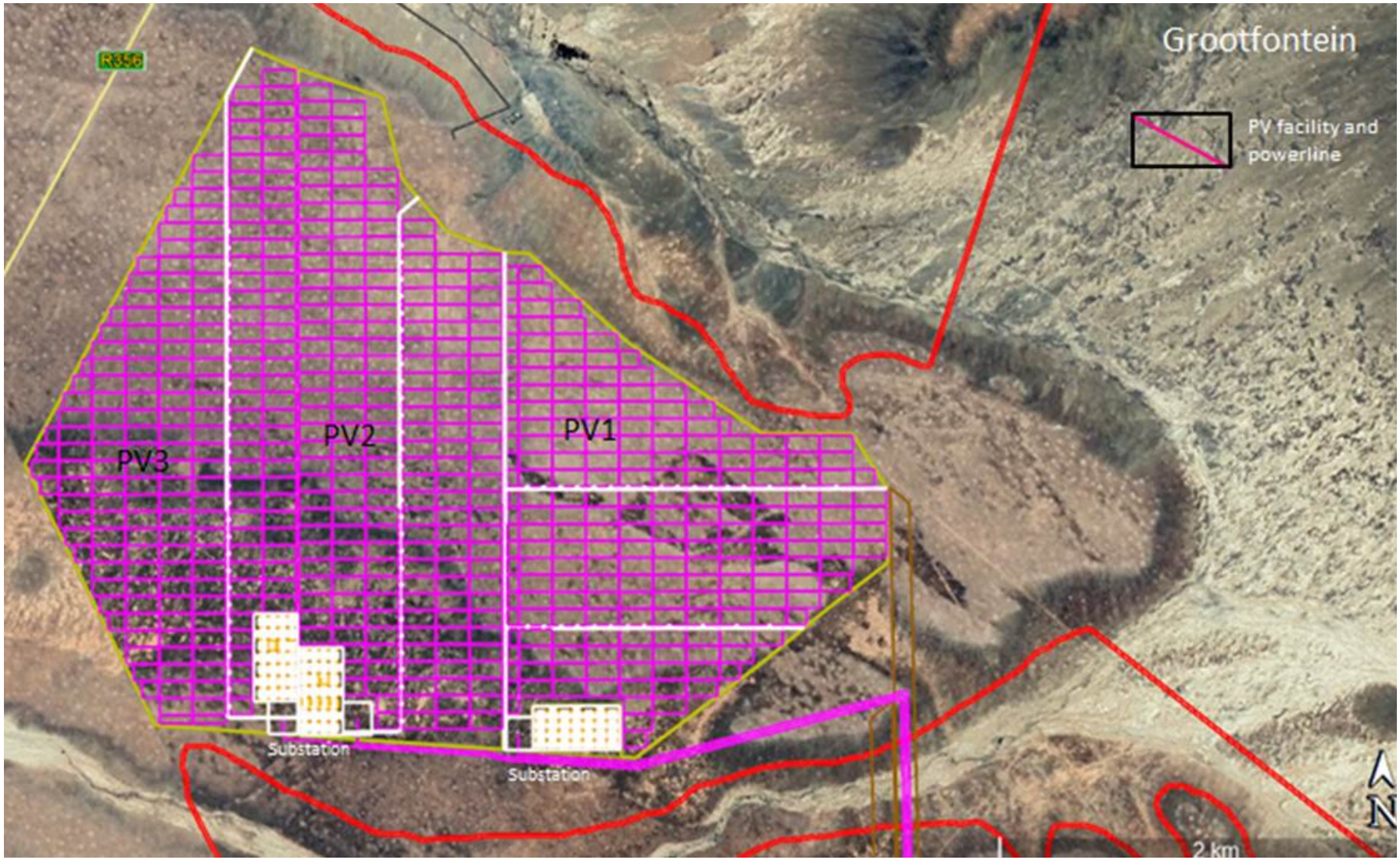


Figure 12. Map showing detail of Grootfontein PV 1, PV 2 and PV 3 layout and development footprint.

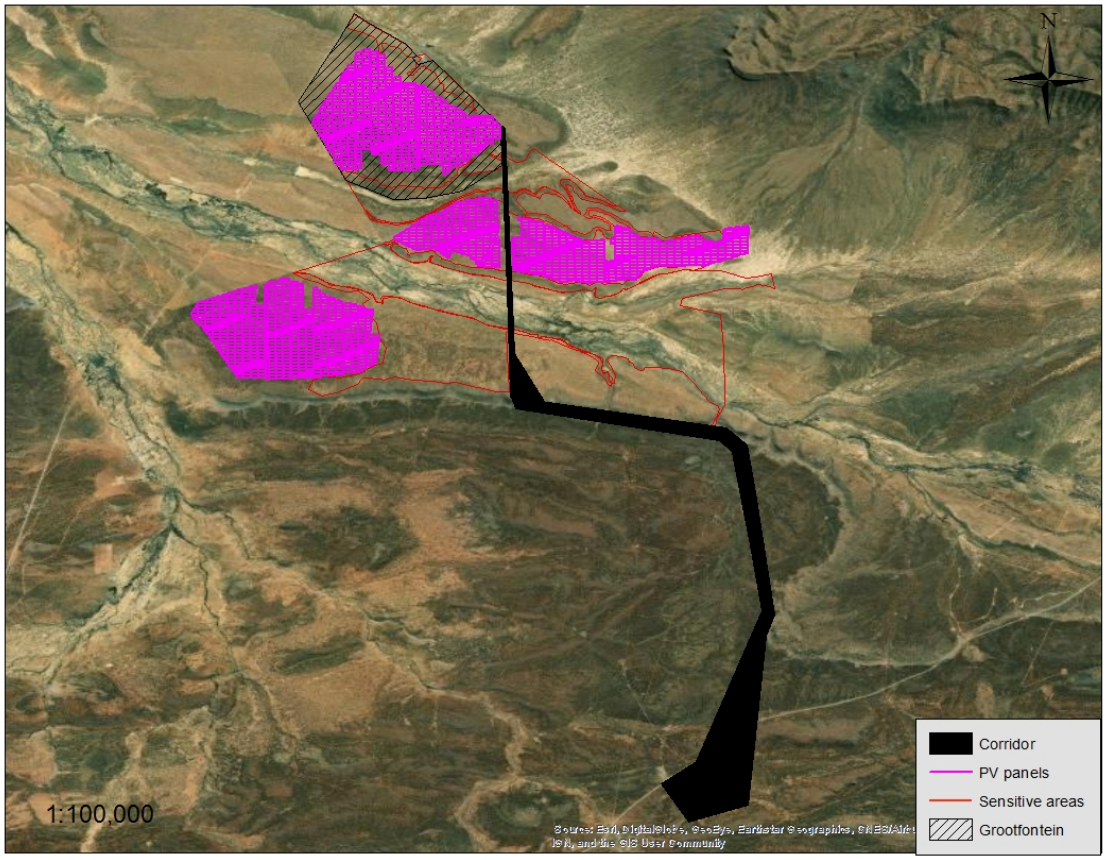


Figure 13. Map showing Grootfontein PV 1, PV 2 and PV 3 and overhead powerline route corridor to the Kappa Substation, highlighting riparian areas of ecological sensitivity. Note that this figure also shows the Witte Wall and Hoek Doornen PV Facilities (which are subjected to separate Biodiversity Assessments).

Given the above, the following Environmental Sensitivities can be attributed to the three PV sites and the EGI. Refer to Appendix C of this report for the Site Sensitivity Verification Report.

4.3.2.1 Grootfontein PV 1 – PV Facility and Associated Infrastructure

The proposed extent of Grootfontein PV 1 encompasses areas within the terrestrial environment, generally classified as being of "low" ecological sensitivity. An extensive buffer (100 m) has been applied between the "high ecological sensitivity areas" of the Droelaagterivier and Klein Droelaagte and the development footprint of the PV facility. It follows that engineering interventions to curb surface run off and other factors that may affect the riverine system of the Droelaagte and Klein Droelaagte will have to be implemented.

4.3.2.2 Grootfontein PV 2 – PV Facility and Associated Infrastructure

The proposed extent of Grootfontein PV 2, encompasses a similar area to that of PV 1 and is within the terrestrial environment, which is considered to be of "low" ecological sensitivity. As with PV 1, an extensive buffer (100 m) has been applied between the "high ecological sensitivity areas" of the Droelaagte, as well as the Klein Droelaagte, and the development footprint of the PV facility. As with PV 1, it follows that engineering interventions to curb surface run off and other factors that may affect the riverine system of the Droelaagte and Klein Droelaagte will have to be implemented.

4.3.2.3 Grootfontein PV 3 – PV Facility and Associated Infrastructure

The proposed extent of Grootfontein PV 3, encompasses a similar area to that of PV 1 and PV 2 and is within the terrestrial environment, which is considered to be of "low" ecological sensitivity. As with PV 1 and 2, an extensive buffer (100 m) has been applied between the "high ecological sensitivity areas" of the Droelaagte, as well as the Klein Droelaagte, and the development footprint of the PV facility. As with PV 1 and PV 2, it follows that engineering interventions to curb surface run off and other factors that may affect the riverine system of the Droelaagte and Klein Droelaagte will have to be implemented.

4.3.2.4 EGI and Associated Infrastructure

PV 1, PV 2 and PV 3 would serve the Kappa substation to the south of the farm. Three 132kV powerlines with associated towers would cross the Kleindroelaagte and the Groot River to the south of the PV facilities (Figure 13). The Klein Droelaagte can be easily traversed by the powerlines, while the traverse over the Groot River aligns with an existing fenced boundary on the farm Witte Wall (Figure 14).

The position of the footings of the towers should evidently avoid the main channels within the riparian edge and be built to accommodate significant flooding and high-level flows. However once established, the towers should not be considered a significant impact of ecological significance.

Figure 14. Image showing fence line across Groot River, where the overhead power line servitude has been proposed

Other portions of the powerlines effectively avoid any significant watercourse or drainage feature and align with a wholly terrestrial environment.

4.3.3 Sensitivity Analysis Summary Statement

Two riverine environments (i.e. Droelaagte and the Klein Droelaagte) fall within the Farm Grootfontein and these systems are considered to be of moderate aquatic ecological importance and overall high

sensitivity. The Klein Droelaagte system is not depicted on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figure 15).

The proposed Grootfontein PV 1, Grootfontein PV 2 and PV 3 facilities are considered to be suitably set back from the riparian environments associated with both the Droelaagte and the Klein Droelaagte Rivers and as such, maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor, as well as offering improved refugia for fauna. No wetland environments are associated with the PV development footprints and associated infrastructure (including the powerlines).

The balance of the area on Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 are assigned low sensitivity, which corroborates with the Screening Tool. Whilst the PV development and associated infrastructure traverse through areas designated as CBA and ESA at particular points, such infringement is considered to be relatively minor as much of these sensitive areas have been largely avoided by the proposed development – as shown by Figure 15 below.

The electrical overhead powerlines that traverse the Groot River, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system. The above sensitivity analysis largely corroborates the findings of the Screening Tool, the sensitivities of which have been verified and utilized in the planning of the PV facilities at Grootfontein and for the EGI corridor along the farms Platfontein and Die Brak. Where the lines traverse portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

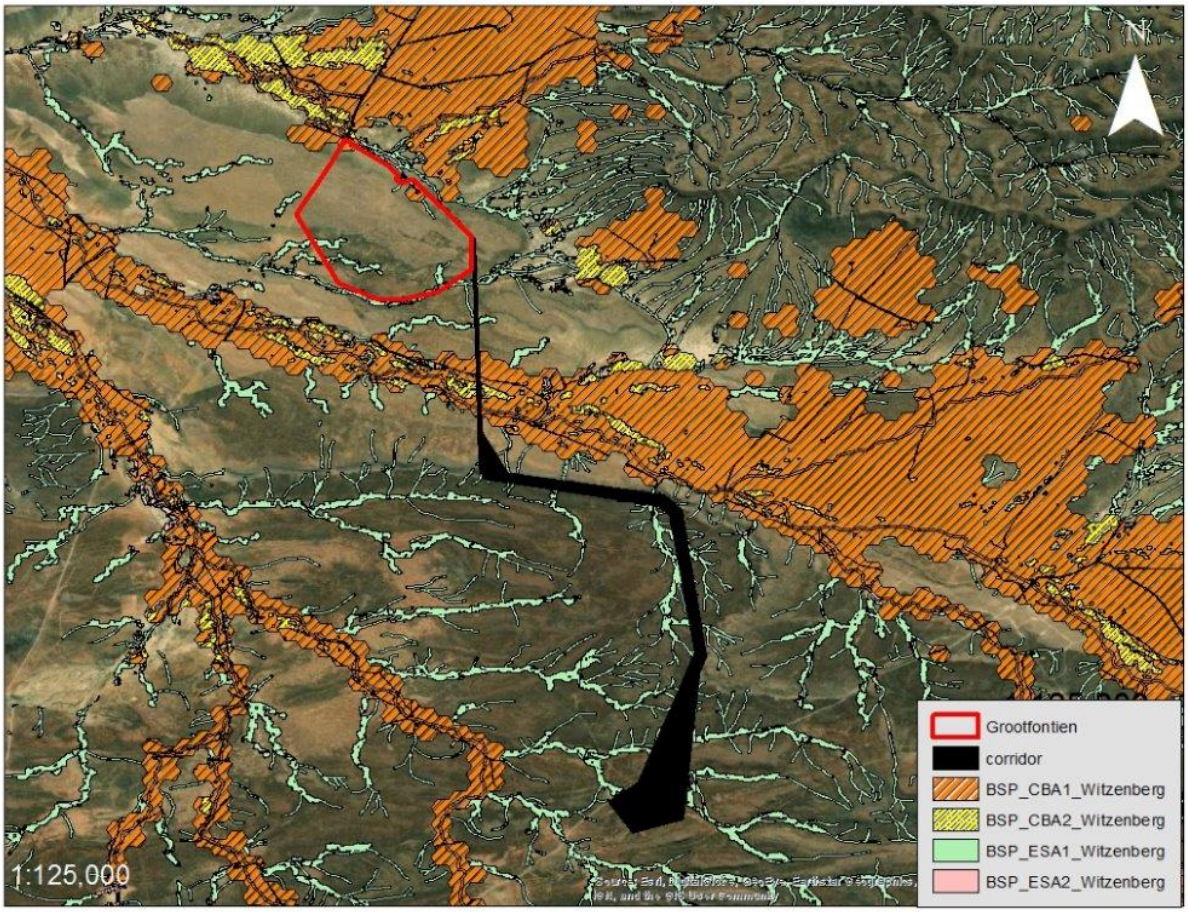


Figure 15. Map image detailing the Grootfontein PV site and associated infrastructure in relation to CBA and ESA areas as per the Western Cape Biodiversity Spatial Plan framework (Cape Nature, 2017).

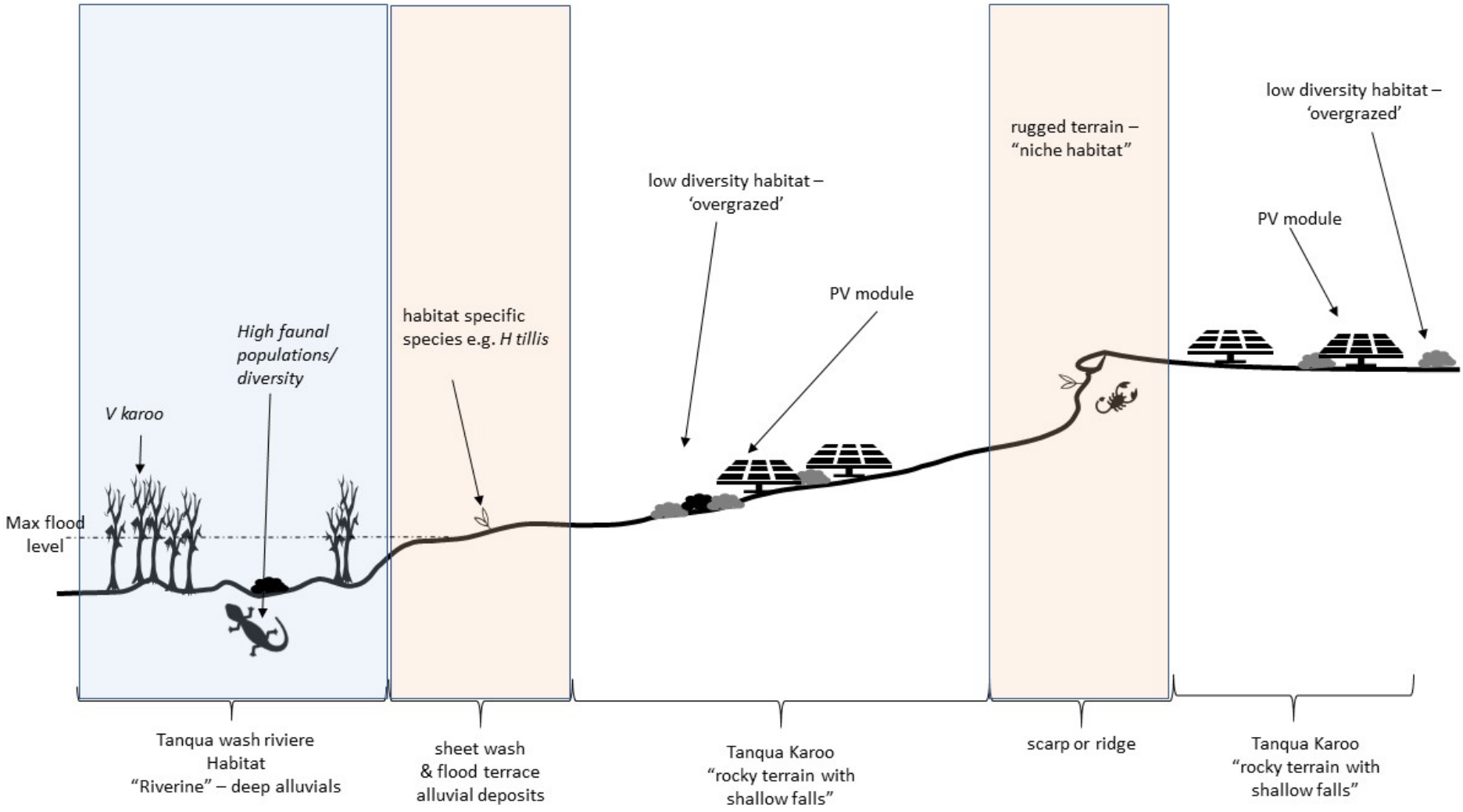


Figure 16. Schematic diagram indicating areas of high sensitivity (blue), moderate sensitivity (beige), and areas suitable for establishment of solar modules

5 Alternative Development Footprints

No site alternatives are being considered. However, the layout was designed after provision of sensitivity data by the specialists to ensure that it would have the least possible overall impact. One EGI corridor has been proposed but this is wide enough to allow some specific siting of the alignment to reduce impacts.

6 Issues, Risks and Impacts

6.1 Identification of Potential Impacts/Risks

A number of direct, indirect and cumulative impacts on the localized and broader ecology of the region can be identified as a consequence of the proposed PV and EGI developments being implemented. Direct impacts are those that are directly attributable to the implementation and operation of the project, while indirect impacts are consequential effects of the proposed project that may not be directly attributable to the development. Cumulative impacts are those externalities that arise from the proposed development and compound existing effects or influences on the ecology of the region. These impacts are also defined as originating from the construction phase or the operational phase and may include the 'decommissioning phase".

6.1.1 Construction Phase

The following potential impacts during the Construction Phase of the PV Facilities, EGI and associated infrastructure.

- **Potential Impact 1**: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it.

- **Potential Impact 2**: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna.

- **Potential Impact 3**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities.

6.1.2 Operational Phase:

The following potential impacts during the Operational Phase of the PV Facilities, EGI and associated infrastructure can be summarized:

- **Potential Impact 4**: Changes in the geomorphological state of drainage lines on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change.

- **Potential Impact 5**: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long-term activities on site, but are likely to be negligible.

6.1.3 Decommissioning Phase

Such alterations and changes will be dependent upon the expectant post-decommissioning land use. However, abandonment of the site and cessation of the PV Facilities, EGI and associated infrastructure would probably result in:

- **Potential Impact 6**: A reversion of present faunal population states within the study area, with some variation to these populations being possible.

- **Potential Impact 7**: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment.

6.1.4 Indirect Impacts of the PV Facilities, EGI and associated infrastructure.

The following indirect impacts on the PV Facilities, EGI and associated infrastructure have also been identified:

- **Potential Impact 8**: Changes in the broader landscape ecology through alteration of eco-morphological drivers.

- **Potential Impact 9**: Changes in faunal ethos as a result of the establishment of the PV facilities on Grootfontein.

6.1.5 Cumulative Impacts of the PV Facilities, EGI and associated infrastructure.

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) (i.e. two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172). Notably there are 11 other renewable energy projects that have received EA within 30 km of the subject site. The majority of these projects employ wind turbines, which present fundamentally different impacts and externalities that may affect the broader ecology of the region, although three smaller sites located some 30 km south of Grootfontein will employ PV technology for power generation. The cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of this project and other land use changes in the region are likely to exhibit the following:

- **Potential Impact 10:** Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.

- **Potential Impact 11**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

6.2 Summary of Issues identified during the Public Consultation Phase

Interaction with local residents in the region indicated that:

- Historically, farming activities over the preceding 150 years was seen to have altered the prevailing habitat.
- Fauna were confined to the riverine areas in general.
- Flood events could be severe, with a rapid rise in the water levels within rivers being noted following rain in the upper catchments.

Additional points raised by the local residents are captured in Table 8 below.

Table 8: Comments Received from Stakeholders / Local Residents during the Field Work component of this Aquatic Biodiversity and Species Assessment

Comment	Commenter	Response from the Specialist
The removal of natural vegetation containing threatened, protected and endemic species as a result of the proposed project	Mr Andre Vermeulen	The general approach to construction of the proposed facilities, associated infrastructure and EGI is to maintain vegetation on site. No “blading” of areas, other than within the laydown area, the site of the substation and along roads is to be undertaken.
Increased dust deposition during construction activities	Mr Andre Vermeulen	This is a likely scenario. Mitigation measures will have to be employed including “damping”, traffic speed limitations and other management measures

Additional comments will be received from stakeholders and Interested and Affected Parties during the 30-day comment period on the Draft BA Report.

7 Impact Assessment of the PV Facilities, EGI and associated infrastructure.

The nature of impact / risk is discussed below. The impacts described below apply to both the Grootfontein PV 1 Grootfontein PV 2 and Grootfontein PV 3 projects (i.e. they are the same and have not been repeated).

7.1 Potential Impacts during the Construction Phase

Potential Impact 1: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it

As construction proceeds the natural drainage patterns, sediment transport mechanisms and other related factors will alter, with concomitant change in the ecology associated with these factors. This is rated as a direct, negative impact. Implementation of management principles will reduce these impacts from “high” to “moderate” significance and possibly “low”, during the closing of the construction phase.

Potential Impact 2: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna

ELP will alter faunal ethos of some species, particularly during construction, primarily associated with work at night. ELP can be addressed through initially, interventions in respect of lighting during the construction phase such as reduced security lighting, downward lighting and restriction on lumens employed. This is generally a low significance impact before and after implementation of mitigation measures.

Potential Impact 3: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities

During the construction phase, increased mobilization of sediments, minor spills of materials and other factors may alter surface water chemistry. This impact would however be low significance, with the employment of suitable management measures during the construction stage. Mitigation measures include providing adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.

7.1.1 Impact Summary Table: Construction Phase

The impact ratings are described in this section for the construction phase.

Table 9: Impact Summary Table for the Construction Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE – Direct Impacts						
Impact 1: Changes in the geomorphological state of drainage patterns	*Status*	*Negative*	*High (2)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Moderate (3)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 2: Increased ELP	*Status*	*Negative*	*Low (4)*	• *Ensure reduced security lighting, downward lighting and restriction on lumens employed*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 3: Changes in water resources and surface water in terms of water quality	*Status*	*Negative*	*Moderate (3)*	• *Provide adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.2 Potential Impacts during the Operations Phase

Potential Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change

As climatic factors change within the region, natural bio-physical responses, including changes in habitat or faunal population shifts may be affected on account of the presence of the PV facilities, EGI and associated infrastructure. This impact is considered "low" significance on account of the generally limited extent of the site in relation to surrounding habitats.

Potential Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities

Such changes will be related to the long-term activities on site, but are likely to be negligible. Alteration in water quality are surmised to stem primarily from unintended hydrocarbon leaks from operating vehicles and other machinery on site. However, impacts of this nature during the operational phase are considered to be of "low" significance with mitigation measures including to retain spill kits on site.

7.2.1 Impact Summary Table: Operational Phase

The impact ratings are described in this section for the operational phase.

Table 10: Impact Summary Table for the Operational Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE – Direct Impacts						
Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change	*Status*	*Negative*	*Low (4)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities	*Status*	*Negative*	*Low (4)*	• *Provide adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces* • *Implement proper spill control and management, such as the retention of emergency spill kits on site*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.3 Decommissioning of Site

Potential Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible

On account of both the abovementioned seral state of the land as well as other factors, decommissioning and reversion to a land use, akin to the present, should see some alteration of faunal populations and a reversion to present populations with some ousting and recruitment of species. This impact is rated as "low" significance before and after the implementation of management actions.

Potential Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment

This impact is rated with a low significance and possibly, "positive". This impact will be a long-term impact which may be considered "negative" but of low significance. Additional hard panning as a result of the establishment of the PV facilities and associated infrastructure contributes to the change in the geomorphological state of the drainage lines. Stormwater controls are to be incorporated into the development to ensure attenuation of flow.

7.3.1 Impact Summary Table: Decommissioning Phase

The impact ratings are described in this section for the decommissioning phase.

Table 11: Impact Summary Table for the Decommissioning Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE – Direct Impacts						
Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible	*Status*	*Neutral*	*Low (4)*	• *Ensure that there is appropriate disposal of materials and waste during decommissioning activities* • *Manage stabilisation and reinstatement of the land*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment	*Status*	*Neutral*	*Low (4)*	• *Provide adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.4 Indirect Impacts

The following indirect impacts are anticipated to be associated with the establishment of the PV facilities, EGI and associated infrastructure on the farm Grootfontein. Indirect impacts arising from the establishment of the site are likely to be of low significance, and generally latent in nature.

Potential Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers

The development of the three proposed PV facilities on Grootfontein may alter habitat form and structure beyond the boundaries of the PV facilities as support infrastructure (e.g. roads) are established, or as physical or biological factors change (e.g. drainage patterns change or grazing pressures increase at other points). The impacts may however prove to be of low impact significance.

As per impact 7, the decommissioning of the site and reversion to the present land use, may see some alteration of drainage patterns and general surface hydraulics. This impact is considered to be "low" significance.

Potential Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities.

Changes in faunal ethos on account of the establishment of the PV facilities on Grootfontein, some faunal populations may emigrate from the area, while others may favour other factors around the site. Behavioral change in faunal populations will drive ecological change beyond the boundaries of the PV Facilities. This impact is rated as "low" significance without and with the implementation of mitigation measures.

7.4.1 Impact Summary Table: Indirect Impacts

The impact ratings are described in this section for the indirect impacts during both the construction and operation phase.

Table 12: Impact Summary Table for Indirect Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Indirect Impacts						
Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers	*Status*	*Negative*	*Low (4)*	• *Appropriate management of the site must be undertaken along ecological integration approaches*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities	*Status*	*Negative*	*Low (4)*	• *Exclusion areas should be maintained. Maintain scarp slopes and ensure that they are unimpeded by the proposed development. Mitigation of this impact would result in a low rating.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

7.5 Cumulative Impacts

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) and there are 11 authorised renewable energy projects on some 50 000 ha of land within 30 km of the subject site (Figure 17). The

cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of the proposed projects and other land use changes in the region are likely to exhibit the following:

Potential Impact 10: Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.

This impact deals with increased an increased change in the geomorphological state of drainage lines and water courses due to long term and extensive change in the nature of the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are rated as moderate and likely, respectively, rendering the significance as low without the implementation of management measures. Mitigation measures include cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.

Potential Impact 11: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

This impact deals with changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are respectively rated as moderate and likely, rendering the significance as low without the implementation of management measures. Mitigation measures include coordinated and sustained management of all nine PV and EGI Projects associated with this BA.

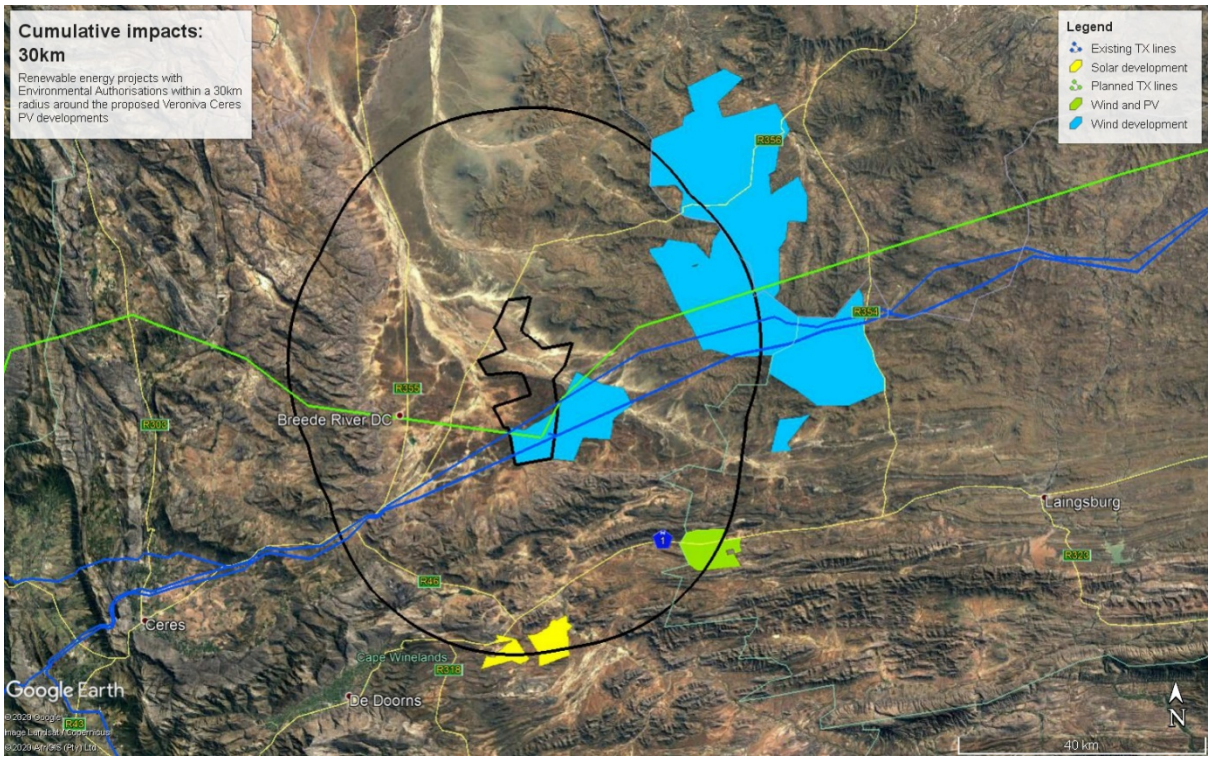


Figure 17. Map indicating renewable energy and EGI projects within 30 km of project site (van Rooyen, 2020).

7.5.1 Impact Summary Table: Cumulative Impacts

The impact ratings are described in this section for the cumulative impacts during the construction and operational phase.

Table 13: Impact Summary Table for the Cumulative Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Cumulative Impacts						
Impact 10: *Increased change in the geomorphological state of drainage lines and watercourses, on account of long term and extensive change in the nature of the catchment*	*Status*	*Negative*	*Low (4)*	• *Cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.*	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				
Impact 11: *Changes in water resources and surface water in terms of water quality on account of extensive changes in the catchment.*	*Status*	*Negative*	*Low (4)*	• *Co-ordinated and sustained management of all nine PV and EGI Projects associated with this BA.*	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

8 Impact Assessment Summary

Table 14 and Table 15 provides a summary of the expected impacts after mitigation for the PV Facilities and EGI, respectively.

Table 14: Overall Impact Significance (Post Mitigation) of the proposed PV facilities and associated infrastructure

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

Table 15: Overall Impact Significance (Post Mitigation) of the proposed EGI to support the PV facilities

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

9 Legislative and Permit Requirements

The proposed establishment of the Grootfontein PV 1 Grootfontein PV 2 and Grootfontein PV 3 facilities, associated infrastructure and EGI on the subject sites are considered to elicit a requirement for compliance with the following legislation as this may apply to the riverine and aquatic environments.

- **The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended)**

The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) (NEMBA) may be applicable to the site, particularly in respect of matters pertaining to threatened or protected species encountered on or around the sites or the matter of redress of AIPs. This may apply in respect of the establishment of the powerline across riverine habitats.

- **The National Water Act (Act 36 of 1998, as amended)**

The proposed Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such, maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The sensitivity map in Figures 11 and 12 indicates that for the Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 projects, areas of terrestrial importance and a “buffer” at the interface of the terrestrial and riparian areas have been demarcated, which approximates 100 m and includes areas of sheet wash and flood extremes.

In addition, no wetland environments are associated with the PV and associated infrastructure development footprints (including the powerlines). The powerlines will, however, cross the Klein Droelaagte River and Groot River and would require the establishment of one or two towers within the riparian environment of the Groot River. The Klein Droelaagte can be easily traversed by the powerlines. In addition, one of the options of the access road leading to the Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 sites (i.e. Option 1) would need to be upgraded as part of the proposed projects. Sections of the access road upgrade will take place within 100 m of the Droelaagte River. However, if the alternative option to access the Grootfontein PV sites is used, then this will be greater than 100 m away from the Klein Droelaagte River and Groot River.

The requirement for a General Authorisation or Water Use License in terms of Section 21 (c) and 21 (i) of the National Water Act may be required where activities arise within the bed of the river in respect of the establishment of towers for the overhead powerlines and the road upgrading. Therefore, the following projects likely require a Water Use License or similarly a General Authorisation:

- Grootfontein PV 1 – for the access road upgrade using Road Access 1 and power line specifically;
- Grootfontein PV 2 – for the access road upgrade using Road Access 1 and power line specifically; and
- Grootfontein PV 3 – for the access road upgrade using Road Access 1 and power line specifically.

The Department of Human Settlements, Water and Sanitation are to confirm such prerequisite legal requirements.

- **The National Forest Act (Act 84 of 1998)**

The clearance of "natural forest" may be applicable, where, particularly in the establishment of the power line that traverses the Groot River, there may be the requirement to remove associations of *V karoo*. Although not strictly "forest" in ecological terms, the *contiguous canopy* definition of forest would apply under Section 7 of the National Forest Act (Act 84 of 1998).

- **The Cape Nature and Environmental Conservation Ordinance 19 of 1974 (also the Western Cape Nature Conservation Laws Amendment Act (2000))**

This act should be given consideration following EA with particular respect to Chapters IV, (The protection of wild animals other than fish) and Chapter VI, (The protection of flora). The requirement for permits when removing and relocating specific flora that may be encountered or alternatively addressing fauna that may be encountered around the sites would require due consideration.

- **Draft Western Cape Biodiversity Bill, 2019.**

This law has not been promulgated however some aspects of Chapter 7, in particular may apply to the sites, once promulgated.

In consideration of the applicable legislation listed above, it is important to note that the requirement for approval is to be confirmed by the competent authority on the matter.

10 Environmental Management Programme Inputs

The proposed PV facilities on Grootfontein and the associated infrastructure and EGI, will not effectively enter into the riparian environments located on the affected farms. However, the BA process has identified a number impacts that are expected to arise during the planning and construction components of this project. The prevailing impacts to the aquatic biodiversity are:

- Increased surface run off of storm water under high precipitation events with concentration at specific points; and
- Minor changes in water quality through suspended and dissolved materials arising from activities on site (e.g. fats, soaps and oils).

The riverine environments are effectively ephemeral rivers and not subject to regular flow. It is anticipated that impacts from the PV facilities and their associated infrastructure and EGI will be primarily indirect in nature. The EMPr focuses on the mitigation and management of the prevailing (direct, indirect, cumulative) impacts, the subsequent mitigation actions as well as the methodology, frequency and responsibility of the monitoring regime. From the above the EMPr has been compiled in alignment with Appendix 4 of the 2014 NEMA EIA Regulations which aims to detail measures that are to be carried out in order to:

- Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- Comply with any prescribed environmental management standards or practices;
- Comply with any applicable provisions regarding closure; and
- Comply with any provisions regarding financial provision for rehabilitation.

11 Final Specialist Statement and Authorisation Recommendation

11.1 Statement and Reasoned Opinion

Given the information presented above it is evident that should the Applicants establish the proposed development within the identified footprint on Grootfontein that Grootfontein PV 1 – PV 3 may proceed with limited impact on the broader ecological processes and those areas deemed to be of ecological significance (namely the lower riparian environments and sand wash environments).

It therefore follows that:

- Grootfontein PV 1;
- Grootfontein PV 2 and
- Grootfontein PV 3

show a low-level aquatic ecological impact on adjacent riparian environments identified and subject to the implementation of the prescribed management recommendations and conditions, should not be precluded from development on ecological grounds.

11.2 EA Condition Recommendations

Should the mandated authorities approve the proposed development, the following broad management recommendations are proposed for incorporation into the EA:

- Maintenance and establishment of an ambulatory set back of >100m from the identified riparian areas and points of sheet wash as per the layout plan presented.

- That construction and establishment of modules and arrays be undertaken without the clearance of vegetation. Where vegetation proves excessively tall and affects either construction or operation, pruning may be effected.

- A detailed stormwater management and drainage plan be developed that considers *inter alia*, surface flows arising from elevated areas above the PV facilities and its discharge from the facilities. This philosophy must include attenuation and energy dissipation mechanisms and redress of erosion and sheet flow across site.

- The laydown area for the PV facilities should be subject to compaction and the use of dust suppressants when in operation, to prevent excessive particulate matter becoming airborne.

- Management of fauna within the site and surrounds, as well as the incorporation of “wildlife” porosity into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife.

- Maintain the riparian areas as general “exclusion areas” for all operations, with the exception of the establishment of the overhead powerlines.

- Management of exotic weed invasion that may arise within riparian areas as a consequence of disturbance.

- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

It is our opinion that with the implementation of the above, the project proposal, subject to final design and adherence to the above recommendations, should be authorised.

12 References

Chris van Rooyen Consulting. 2020. Avifauna Assessment for the Proposed Development of two 175 MW Solar Photovoltaic Facilities (Witte Wall PV 1 and Witte Wall PV 2), and associated Electrical Grid Infrastructure near Touws River, Western Cape. Unpublished report prepared for Veroniva (Pty) Ltd, Cape Town: Chris van Rooyen Consulting.

CSIR. 2000. Cape Action Plan for the Environment: Strategy. CSIR Report No.: ENV-S-C 99130B. Prepared for WWF-SA, Stellenbosch.

Department of Environmental Affairs and Tourism. 2000. Guideline Document: Strategic Environmental Assessment in South Africa. Pretoria.

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS-RDM: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed on [date].

FitzPatrick Institute of African Ornithology (2020). OdonataMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=OdonataMAP on 2020-10-08

Kleynhans, C.J. and Louw, M.D., 2007. Module A: EcoClassification and EcoStatus determination. *River EcoClassification: Manual for EcoStatus Determination (version 2) Water Research Commission Report No. TT*, *333*(08).

Kotze, D., Marneweck, G., Batchelor, A., Lindley, D. and Collins, N., 2009. WET-EcoServices: a technique for rapidly assessing ecosystem services supplied by wetlands.

Kottek, M., J. Grieser, C. Beck, B. Rudolf, and F. Rubel, 2006: World Map of the Köppen-Geiger climate classification updated. *Meteorol. Z.*, 15, 259-263. DOI: 10.1127/0941-2948/2006/0130.

Mucina, L., Rutherford, M.C. and Powrie, L.W., 2006. Vegetation Atlas of South Africa, Lesotho and Swaziland. *The Vegetation of South Africa, Lesotho and Swaziland'. (Eds L. Mucina and MC Rutherford.) pp*, pp.748-789.

Tankwa weather. 2020. Available at http://tankwaweather.co.za/pages/station/climate.php. Accessed on 21 September 2020.

APPENDICES

Appendix A - Specialist Expertise

NAME Simon Colin Bundy

PROFESSION Ecologist / Environmental Assessment Practitioner

DATE OF BIRTH 7 September 1966

MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist

EDUCATION

BSc Biological Science (1990) University of Natal

Diploma Project Management (1997) Executive Education

MSc (2004) University of KwaZulu Natal

PhD. Candidate: Department of Engineering, University of Kwa Zulu Natal

1998: Guest of Konrad Adenhauer Foundation to Berlin to consider “sustainable development initiatives” in Europe

2000: Training course: “Environmental Economics and Development”. University of Colorado (Boulder) USA.

2008: Certificate in Coastal Engineering: Stellenbosch University

KEY COMPETENCIES AND EXPERIENCE

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. With a core competency in coastal ecological systems and coastal management, Bundy has worked on coastal projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as South Africa, providing ecological and general environmental advice and support. In addition, Bundy has worked in Rwanda, Lesotho and Zambia. Within South Africa, Bundy has been involved in a number of large-scale mega power projects as well as the development of residential estates, infrastructure and linear developments in KwaZulu Natal, Eastern Cape and Western Cape. In such projects Bundy has provided both technical support, as well as the undertaking of rehabilitation programmes.

From a technical specialist perspective, Bundy focusses on coastal ecological systems in the near shore environment and is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and for the Department of Economic Development Tourism and Environmental Affairs in conjunction with the Oceanographic Research Institute. In 2015, Bundy formulated the coastal set back line method for the iSimangaliso Wetland Park, funded by the Global Environment Fund of the United Nations. Bundy acts as botanical

and environmental specialist for Eskom Eastern Region and provides technical support to the IEM division of the Council for Scientific and Industrial Research, Stellenbosch.

SELECTED RELEVANT PROJECT EXPERIENCE

Aquatic and Ecological evaluation of the impacts of Scatec Kenhardt Solar Facilities 1 – 6 in Northern Cape – CSIR (2016 to 2019)

Investigations and review of the aquatic and terrestrial ecology associated with 6 solar facilities at Kenhardt in Northern Cape

Aquatic and Ecological evaluation of the impacts of Maintstream wind Projects in Sutherland Northern Cape & Western Cape – CSIR (2015 to 2016)

Investigations and review of the terrestrial ecology associated with wind power facilities near Sutherland in Northern Cape

Ecological investigations Tongaat and Illovo Desalination Plants: CSIR – (2013 - 2016)

Review of eco-physiological state of the coastal environments in and around the proposed Illovo and Tongaat desalination plants for associated EIA process.

Ecological Review and Rehabilitation Planning: Sodwana Bay: iSimangaliso Wetland Park Authority – (2014 - 2015)

Analysis and review of state of dune cordon in and around Sodwana Bay with modelling of the impacts of removing exotic trees from site to rejuvenate dune and beach dynamics

Review of Project Leader and Coastal Specialist: Addington Farm Strategic Environmental Assessment (2016)

Evaluation of coastal habitat and beach-dune interface for the generation of setback lines for the proposed Addington Farm residential development.

Aquatic and Ecological evaluation of the impacts of in-water hull cleaning, Port Louis, Mauritius and Port of Durban – Aquatech / Divetech Solutions (2014 to date)

Investigations and review of the chemo-physical impact of in-water hull cleaning in the Durban and Port Louis Ports for accreditation with the International Maritime Organisation.

Coastal ecological evaluation of the Van Riebeeckstrand coastline, Cape Town for the establishment of inter-continental telecommunication cables. Acer Africa (2016)

Specialist investigation into the impact of establishing marine cables at Van Riebeeckstrand Cape Town for MTN. Client: Acer Africa.

Review and report on impact of the Fairbreeze Mine at Mtunzini on aquaculture operations at Mtunzini Aquaculture – Supporting document for legal argument presented on behalf of Mtunzini Aquaculture. (2017)

Specialist review and investigation of groundwater discharge and dune mobility at Siyaya, Mtunzini and its effect on the marine intake supplying the Mtunzini Fish Farm. Client: Mtunzini Fish Farm / Eversheds

Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event: West of England Insurance, United Kingdom (2018 - 2019)

Location, evaluation and monitoring of plastic pellets within the coastal habitats between Durban and Richards Bay with Resolve Marine, AR Brink and Assoc's and Drizit Environmental. Objective is to maintain a defendable but efficient level of pellet contamination across coastline.

Rehabilitation Projects: (2010 - 2015)

- Dune rehabilitation of Durban Harbour southern breakwater 2009 – 2010 for Group 5. Sculpt, establish and maintain.
- Mangrove forest rehabilitation of Hugh Dent pump station 2015 for Sembcorp Siza Water.
- Dune rehabilitation of Ballito beachfront 2009 for KwaDukuza Municipality, following 2007 storm surge event
- Ulundi TSC rehabilitation for Eskom Eastern Region, 2016
- Mangethe substation rehabilitation of area for Eskom Eastern region, 2016.

PUBLICATIONS

Bundy S C. 2018 "The great coastal conservation conundrum". EKZN Wildlife Conservation Symposium

Smith AM, Bundy SC, Cooper (2016) "Apparent dynamic stability of the south east African coastline, despite sea level rise" Earth Surface Processes and Landforms DOI 10. 1002

Bundy, S. C. and Forbes, N. T., 2015. *"Coastal dune mobility and their use in establishing a setback line*" 9th West Indian Ocean Marine Science Conference 2015

Smith AM, SC Bundy 2012 "Review of Coastal Defence Systems in Southern Africa" Article for Springer Scientific Publications through Ulster University, Pilkey and Cooper

Bundy, S. C., Smith, A. M., Mather, A. A. 2010. "Dune retreat and stability on the Northern Amanzimtoti Dune Cordon", EKZN Wildlife Conservation Symposium 2010

Smith, A Mather AM Bundy SC, Cooper AS Guastella L, Ramsay PJ and Theron A; 2010 "*Contrasting styles of swell-driven coastal erosion: examples from KwaZulu-Natal, South Africa*" Geology Journal", Cambridge University Press

Bundy SC AM Smith, (2009) "*A Review of Select Dune Rehabilitation Initiatives and a Proposed Methodology towards Ensuring a Prudent Approach towards the "Greening of Dunes*" VI International Sandy Beaches Symposium Emphakweni Port Alfred

Bundy, S. C. and Smith, A. M. 2009 *"Analysis of the Recovery of Two Separate Coastal Dune Systems Following the 2006 – 2007 Marine Erosion Event and Assessment of the Artificial Dune System in Coastal Management*" KZN Marine and Coastal Management Symposium, Durban South Africa.

Smith A and Bundy S 2009 "*Coastal erosion: reparative work on the Ballito coastline, KwaZulu-Natal, South Africa, was it enough?*" 2009 International Multi-Purpose Reef and Coastal Conference, Jeffrey's Bay South Africa

Smith A, Mather A, Theron A, S Bundy 2008 **"***The 2006-2007 KwaZulu – Natal Coastal Erosion Event in Perspective*" 2009 Contribution to the South African Environmental Observation Network publication "Climate Change in Southern Africa"

Name:	Alexander Michael Whitehead
Profession:	Environmental Consultant/Ecologist
Date of Birth:	30/08/1983
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	14
Nationality:	South African
Email address:	alex@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Ichthyology and Fisheries Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – Reg. No. 400176/10 (Ecological Science)

Key Skills and experience:

- Computer skills – (MS Word, STATISTICA, Excel, MS Access, PRIMER 5 (multivariate statistical program), CAP 4 (multivariate statistical program));
- Bioassessment - Experience in sampling aquatic invertebrates (SASS 5) and ichthyofauna (Electrofishing and estuarine sampling techniques);
- Water quality - Experience in carrying out water samples and interpreting results in both freshwater and estuarine environments;
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Wetland functionality assessments – Assessment of wetland functionality using ecological indicators and standard methods such as Wet-Ecoservices and Wet-Health.
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Rehabilitation – Compilation of wetland and terrestrial rehabilitation plans as well as practical experience in planning and conducting weed eradication and re-vegetation programs.
- Environmental monitoring and auditing –
- Open space and conservation planning – Identification of areas of open space or conservation importance.
- Botanical/protected species permits and Risk Assessments – Permit applications under the National Forest Act (84 of 1998), Natal Nature Conservation Ordinance (15 of 1973) and National Environmental Management: Biodiversity Act (10 of 2004).

Name:	Luke Patrick Maingard
Profession:	Environmental Consultant/Ecologist
Date of Birth:	15/09/1993
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	5
Nationality:	South African
Email address:	Luke@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Environmental Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – (Ecological Science)

Key Skills and experience:

- Geographic Information Systems
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental legislation
- Storm water control and management design and implementation
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Environmental Control Officer to numerous construction sites
- Data management and analysis
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.

Appendix B - Specialist Statement of Independence

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

Basic Assessments for the Proposed Development of three 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Grootfontein 1; Grootfontein 2; and Grootfontein 3), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	SDP Ecological & Environmental Services			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	ex	Percentage Procurement recognition	
Specialist name:	Simon C Bundy			
Specialist Qualifications:	BSc MSC Dip Proj Man			
Professional affiliation/registration:	SACNASP			
Physical address:	6 Salisbury Road, Ballito			
Postal address:	P O Box 1016, Ballito			
Postal code:	4420	Cell:	082 446 4847	
Telephone:	032-586 1218	Fax:		
E-mail:	simon@ecocoast.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Simon C Bundy_____, 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

S D [illegible]
P.O. BOX 1016, BALLITO
TEL: 032 946 [illegible]

Name of Company:

17/11/20

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Susan C. Bundy, 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

SDP Ecological

Name of Company

17/11/20

Date

Signature of the Commissioner of Oaths

Date

COMMISSIONER OF OATHS
ASHLEY PUCAY
BRANCH MANAGER: ZAMBALI
SHOP 28, LIFESTYLE CTR
BALLITO 4420
DATE: 18/11/2020

Appendix C: Site Sensitivity Verification

Prior to commencing with the Aquatic Biodiversity and Species Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	14/09/2020 – 18/09/2020
Specialist Name	Simon Bundy and Luke Maingard
Professional Registration Number	S C Bundy SACNASP No.400093/06 L P Maingard SACNASP No. 116639/16
Specialist Affiliation / Company	SDP Ecological and Environmental Services

The Site sensitivity verification was undertaken using the following means:

1. Preliminary desktop analysis achieved by overlaying a variety of geospatial data features – namely NFEPA data and other sensitivity data obtained from the SANBI BGIS as well as the DEFF Screening Tool. Further to this, the Present Ecological State (PES) and Environmental importance and sensitivity (EIS) data had been derived from the DWS Present Ecological State and Ecological Importance model.
2. Literary review of the site, obtaining baseline knowledge of the ecological history of the site as well as the PES of the site. To this end a review of historical images of the site had also been undertaken.
3. Onsite investigation of the subject area from the 14/09/2020 to the 18/09/2020.

Two riverine environments (i.e. Droelaagte and the Klein Droelaagte) fall within the Farm Grootfontein and these systems are considered to be of moderate aquatic ecological importance. The Klein Droelaagte system is not depicted on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figures 11, 12 and 13 in the main report). The proposed Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 facilities are considered to be suitably set back from the riparian environments associated with both the Droelaagte and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The rest of the area on Grootfontein PV 1, PV 2 and PV 3 are assigned low sensitivity, which corroborates with the Screening Tool.

The electrical overhead powerlines that traverse the Groot River, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system.

The above sensitivity analysis corroborates the findings of the screening tool and has been utilized in the planning of the PV facilities at Grootfontein and for the EGI corridor along the farms Platfontein and Die Brak. Where the lines traverse portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

Appendix D: Impact Assessment Methodology

The following impact assessment was adopted, which includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFFT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

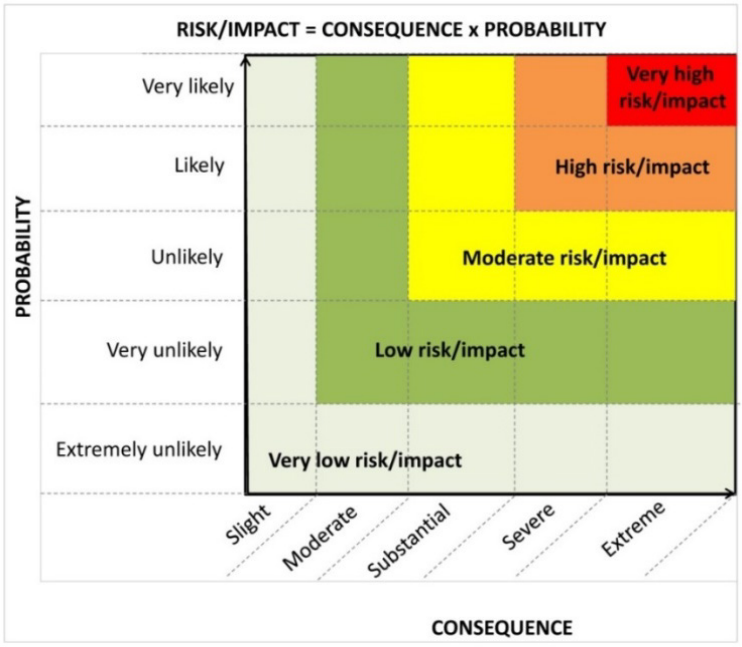


Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

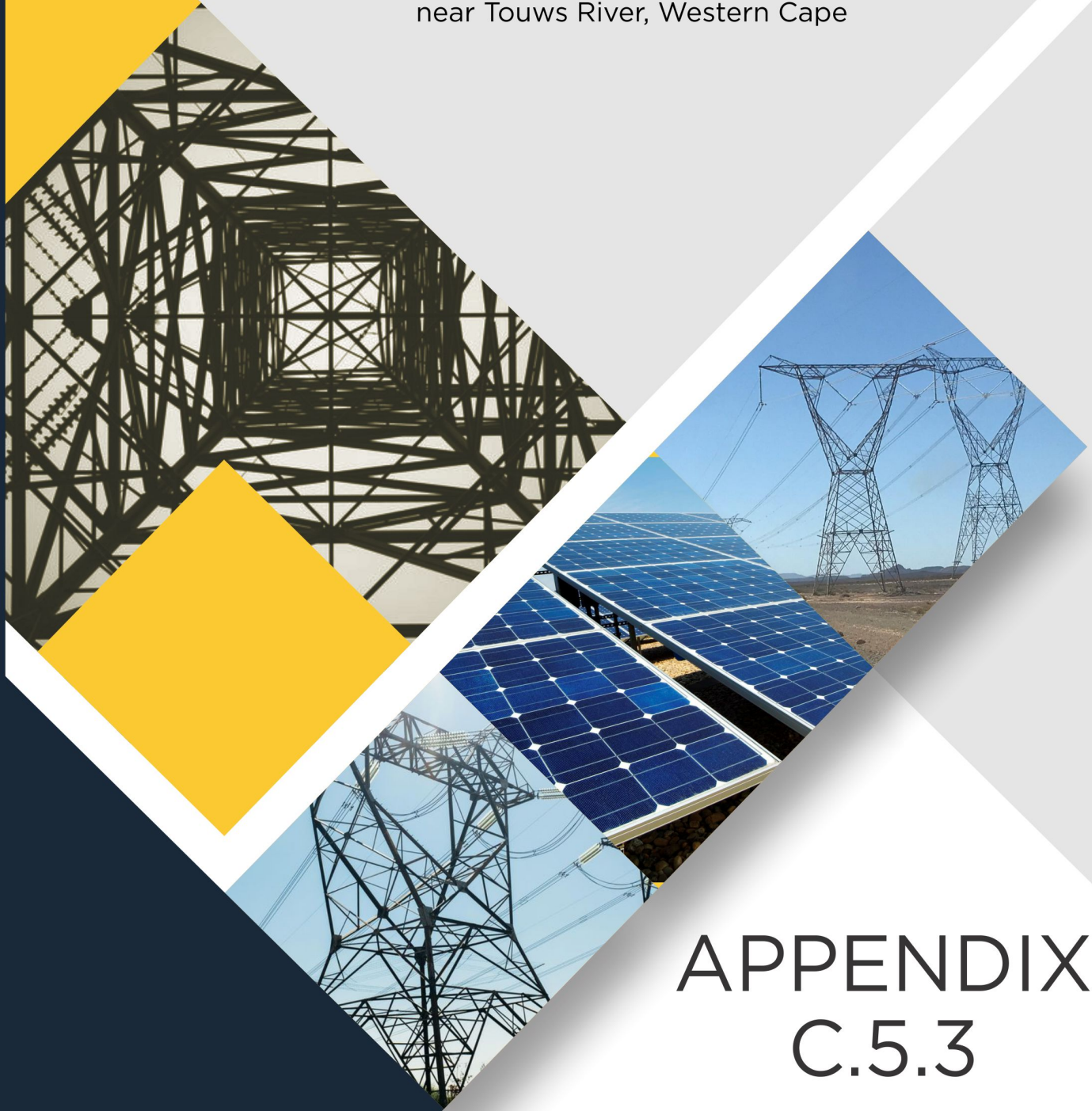
Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: *2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;* *a) aquatic ecosystem types; and* *b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;*	*Section 4*
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	*Figure 11, Figure 12 and Figure 13*
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	*Section 4*
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including: *a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and* *b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).*	*Section 4 and Tables4, 5, 6 and 7*
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	*Not Applicable – see Section 5*
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: *2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?* *2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?* *2.5.3. How will the proposed development impact on fixed and*	*Section 6 and 7* *In particular planning, operation and decommissioning impacts* *1. No change in state anticipated* *2. No change in resource quality anticipated* *3. Riparian areas are excluded – no change in ecological processes of significance*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity		Section where this has been addressed in the Specialist Report
	dynamic ecological processes that operate within or across the site? This must include: a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub - catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns); c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and d) to what extent will the risks associated with water uses and related activities change;	anticipated. a. As significant buffering of riparian areas, limited hardpanning is anticipated – impacts of a hydrological importance are not anticipated b. Sediment transport change will be negligible c. Minor change in lower catchment with minimal change that is negligible, to the watercourse d. No changes to water use or any related activities are anticipated.
2.5.4.	how will the proposed development impact on the functioning of the aquatic feature? This must include: a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system); b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river); c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley -bottom wetland); d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);	Section 7 In summary a. Baseflow does not arise as the systems are ephemeral b. Flow is intermittent. No change is expected in volumes c. Hydrogeomorphic state will remain intact and no change is anticipated d. Water quality is unlikely to have any significant alteration particularly during operations and decommissioning e. No fragmentation is anticipated as riparian environments have been avoided f. No change in important features anticipated.
2.5.5.	how will the proposed development impact on key ecosystems regulating and supporting services especially: a) flood attenuation; b) streamflow regulation; c) sediment trapping; d) phosphate assimilation;	As the systems are ephemeral, set back and out of maximum flood extents and there is a distinct lack of aquatic habitat and eco-morphology, no variation in ecological drivers

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
e) nitrate assimilation; *f) toxicant assimilation;* *g) erosion control; and* *h) carbon storage?*	*of aquatic systems is anticipated.*
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	*Sections 4 and 7* *Aquatic biota are transitory in the affected systems and no change is anticipated with the proposed development.*
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: *a) size of the estuary;* *b) availability of sediment;* *c) wave action in the mouth;* *d) protection of the mouth;* *e) beach slope;* *f) volume of mean annual runoff; and* *g) extent of saline intrusion (especially relevant to permanently open systems).*	*Not Applicable – the site does not include any estuaries.*
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	*Appendix A*
2.7.2. a signed statement of independence by the specialist;	*Appendix B*
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 2 and Appendix C*
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	*Section 2*
2.7.5. a description of the assumptions made, any uncertainties or gaps in knowledge or data;	*Section 2.2*
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	*Sections 4 and 11.2*
2.7.7. additional environmental impacts expected from the proposed development;	*Sections 4, 6 and 7*
2.7.8. any direct, indirect and cumulative impacts of the proposed development on site;	*Sections 6 and 7*
2.7.9. the degree to which impacts and risks can be mitigated;	*Section 7*
2.7.10. the degree to which the impacts and risks can be reversed;	*Section 7*
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	*Section 7*
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	*Sections 4.3.2 and 11.2*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	*Sections 7 and 10*
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	*Not Applicable – the PV sites fall outside of the sensitive areas.*
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	*Section 11.1*
2.7.16. any conditions to which this statement is subjected.	*Section 11.2*
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, that are to be included in the EMPr.	*Sections 7 and 10 of this report include mitigation and monitoring measures. These are to be included and incorporated into the BA Report.*
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*Appendix B of this report. This report is included as an appendix to the BA Report.*

Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.5.3

Aquatic Biodiversity and Species for Hoek Doornen

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT:

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure on the Farm Hoek Doornen (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape

---

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	SDP Ecological & Environmental Services
P O Box 320	P O Box 1016
Stellenbosch	Ballito
7599	4420
South Africa	South Africa

October 2020

Executive Summary

Four 175 MW photovoltaic (PV) power generation plants (i.e. Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4) have been proposed for establishment on the Farm Hoek Doornen 172. In addition, these plants, would provide power through 132kV overhead powerlines that would connect with the Kappa Sub-station, some 12km to the south of the site.

An evaluation of the aquatic aspects of the Farm Hoek Doornen was undertaken during September 2020 in order to consider the nature of the area in question and to evaluate the impacts of the proposed development.

The Farm Hoek Doornen lies within the Tanqua Succulent Karoo Biome and comprises of two veld types, namely Tanqua Karoo and Tanqua Wash Riviere. The former is associated with elevated terrestrial environments while the latter is associated with sandy, riparian habitats. Both veld types are considered "least threatened".

In evaluating the ecological significance of the subject site, it was determined that the importance of the Tanqua Wash Riviere habitat or lower riparian environments were high in terms of faunal diversity. These areas are considered important faunal habitat and are evidently also associated with extreme flood states, providing them with a high ecological sensitivity. These findings align with those of the Department of Environment, Forestry and Fisheries (DEFF) screening tool and the various data sets associated with the region.

Given the above, the proposed development of Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 is expected to elicit an overall moderate ecological impact that may be reduced to "low" significance if suitable mitigation measures are employed. The overhead powerlines are expected to elicit only a low significance impact, primarily associated with change that may arise in the riparian environments.

The proposed developments, if authorised should be approved with a number of conditions, in particular the placement of the development within the footprint identified and that a suitable game-permeable fence should be instituted. A number of related mitigation and management measures are proposed.

From the above, it is evident that subject to the conditions outlined in this report, the development of four 175 MW PV facilities at Hoek Doornen cannot be precluded on ecological grounds.

Contents

List of Figures

List of Tables

List of Abbreviations

AIP	Alien Invasive Plant
AMSL	above mean sea level
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIS	Environmental importance and sensitivity
BA	Basic Assessment
CBA	Critical Biodiversity Areas
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
EGI	Electricity Grid Infrastructure
GPS	Global Positioning System
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NEMBA	National Environmental Management Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
PES	Present Ecological State
PV	Photovoltaic

Glossary

Definitions	
Arid	Areas which receive low levels of rainfall or there is a moisture deficit.
Aquifer	Underground layer of water-bearing permeable rock
Crepuscular	Fauna that is active at twilight
Dendrogram	A diagram showing relationships determined through a cluster analysis
Calcrete	A carbonate horizon formed in semi-arid regions. Also known as a caliche.
Dolerite	Form of igneous rock.
Drainage line	A geomorphological feature in which water may flow during periods of rainfall.
Dune	Landscape feature arising from the deposition of sediment, transported primarily by winds and resulting in a sandy feature that may or may not be stabilised by vegetation
EI	Environmental Importance
ES	Environmental Sensitivity
Eco morphology	Pertaining to the relationship between the geomorphology of an environment and the biotic components that are adapted to it.
Edaphic	Pertaining to soils.
Fossorial	Pertaining to burrowing animals or those which live underground
Geophyte	Plants with underground storage organs.
Graminoid	Grasses or grass-like. Also, monocotyledonous plants.
Gully	An erosion line exceeding 30cm in depth where water flow is concentrated and erosion resulting from flow is clearly evident.
Hydrogeomorphological	The interaction of geomorphic processes, landforms and /or weathered materials with surface and sub-surface waters.
Hygrophilous	Plants growing in damp or wet conditions
Multivariate analysis	A statistical method of evaluating nonlinear relationships between groups of data.
Non perennial	Flow is intermittent and irregular
Rill	Shallow erosion lines less than 30cm deep
Scarp	Physical feature determined by geology and comprises of a steep slope that differs from the slope of the prevailing landscape
Sheetwash	A mobile sheet of sediment deposited by water flow over a hill-slope or plain
Xeric	A dry, as opposed to wet (hydric) or mesic (intermediate) environment.

AQUATIC BIODIVERSITY AND SPECIES SPECIALIST ASSESSMENT

This report serves as the Aquatic Biodiversity and Species Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed development of four 175 MW Solar Photovoltaic (PV) Facilities and associated Electrical Grid Infrastructure (EGI) on the Farm Hoek Doornen 172, near Touws River in the Western Cape. These projects are referred to as Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4.

1 Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The Project Applicants are undertaking an Application for Environmental Authorisation (EA) to be submitted to the National Department of Environment, Forestry and Fisheries (DEFF), which entails significant planning, as well as the undertaking of BA processes. The Project Applicants are proposing to develop nine solar PV facilities, nine powerlines and associated infrastructure to link the proposed PV facilities to the Eskom Kappa Substation. There are nine separate Project Applicants. Four PV facilities are being proposed on the Farm Hoek Doornen 172; three PV Facilities are being proposed on the farm Grootfontein 149; and two PV Facilities will be constructed on the Farm Hoek Witte Wall 171. This Aquatic Biodiversity and Species Specialist Assessment specifically deals with the Hoek Doornen PV 1 – 4 projects, as well as the associated EGI (Figure 1). This specialist study, is being undertaken as part of said BA process, in order to evaluate the aquatic habitats of the receiving environment in relation to the proposed development.

The bio physical reconnaissance and evaluation of a portion of the farm Hoek Doornen was undertaken during the period September 2020 and entailed both a literature review of the region, as well as on site evaluations, during which specific primary data was collected and evaluated. In addition, the identification of key hydrological features on site and an interpretation of the prevailing flora and fauna as well as other features were undertaken.

All data collected in the field and during the literature review was evaluated and interpreted in order to provide an understanding of the nature of the prevailing environment at a landscape and habitat level, together with specific evaluation of data relating to habitat form and structure. The evaluation also sought to identify any anomalies within the prevailing environment. Such variance may be considered to be indicative of differing habitat forms, which under consideration, may be of higher order ecological value in relation of the prevailing environment.

1.2 Details of Specialist

This specialist assessment has been undertaken by Messrs S C Bundy, L P Maingard and AM Whitehead of SDP Ecological and Environmental Services. The following information is provided in respect of the above:

S C Bundy	Ecologist	SACNASP No. 400093/06
LP Maingard	Ecologist	SACNASP No. 116639/16
AM Whitehead	Ecologist	SACNASP No. 400176/10

Curriculae vitae of the individuals above are included in Appendix A of this specialist assessment, as well as specialist statements of independence in Appendix B.

1.3 Terms of Reference

The overall objectives of the Aquatic Biodiversity and Species Specialist Assessment are:

- To identify and establish an understanding of the site under consideration at a landscape scale of evaluation with particular consideration being given to important aquatic or riverine habitats, as they may be identified.

- To provide an evaluation and status of habitat composition and significance within the site in order to evaluate the potential impact of the proposed development on the ecological function of the site.

- To assess the actual and potential impacts arising from the proposed development on the hydrological features within the study site. Such impacts may be directly applicable to the site and contained within the site boundaries, or may be indirect impacts, which may have ramifications outside of the site boundary; or may be of a cumulative nature, in terms of impacts arising from similar developments or activities within the region.

- To provide guidance on the implementation of mitigation measures that may serve to moderate any negative impacts that may arise on site, as a consequence of the proposed development.

The Scope of Work is based on the following broad Terms of Reference, which have been specified for this specialist study:

- Comply with the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320; as well as all relevant legislation. Identify any additional protocols, legal and permit requirements that are relevant to this project and the implications thereof.

- Review detailed information relating to the project description and precisely define the environmental risks to the aquatic environment and consequences for prevailing ecology.

- Compile a baseline description of the aquatic ecology of the study area, and provide an overview of the entire study area in terms of ecological significance and sensitivity.

- Provide specific ecological data in respect of the aquatic components of the site using ground-truthing methods, with an emphasis on those areas considered to be of “high” and possibly, “moderate” sensitivity.

- Based on the desktop study, undertake field work and sampling across the site to record relevant data and to compile an overview of the habitat under review. The site visit must also identify the level of sensitivity assigned to the project area on the National Web-based Environmental Screening Tool (Screening Tool), and to verify and confirm this sensitivity and land-use. A Site Sensitivity Verification Report must also be compiled based on the requirements documented in the Assessment Protocols published on 20 March 2020, in Government Gazette 43110, GN 320.

- Collate all data collected during the field work and undertake a review using methodologies that allows for comparison or consideration of biological data.

- Provide a detailed hydrological and aquatic biodiversity sensitivity map of the site, including mapping of disturbance and transformation on site, as well as set-backs or buffers.
- Provide review input on the preferred infrastructure layout following the sensitivity analysis and layout identification.

- Identify any species of special concern or protected species on site.

- Identify and delineate wetlands that may occur on the site, using the relevant protocols established.

- Determine if a Water Use License (WUL) is required and if so, determine the requirements thereof.

- Identify and rate potential direct, indirect and cumulative impacts on the aquatic ecology, species and ecological processes within the site during the construction, operation and decommissioning phases of the project.

- Provide input to the EMPr, including mitigation and monitoring requirements to ensure that the impacts on the aquatic ecology are limited.

- Review the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.

- Compile an assessment report qualifying the risks and potential impacts on aquatic ecology in the study area and impact evaluations.

- Incorporate and address issues and concerns raised by Stakeholders, Competent Authority, I&APs and the public during the Public Participation Process (where relevant and applicable).

2 Approach and Methodology

A literature review and desktop analysis were undertaken prior to the field investigation, utilizing various sources including the National Fresh Water Priority Areas (NFEPA) data and other relevant sources. Recent and historical aerial imagery of the site was reviewed in order to identify points for investigation during the field survey.

Utilising the above information, a field investigation was undertaken from the 12th to 18th September 2020, whereby:

- Key features, such as rivers and scarps were evaluated in order to determine the key, geophysical features on the site;

- Sites of geomorphological or topographic variance were identified and subjected to an evaluation of species present within a 40 m linear extent across the selected site. Species were identified and collated according to a “presence – absence” method of evaluation;

- Additional random sample points were selected from across the site for comparative purposes; and

- Any additional species of significance not identified within the sample sites were also noted.

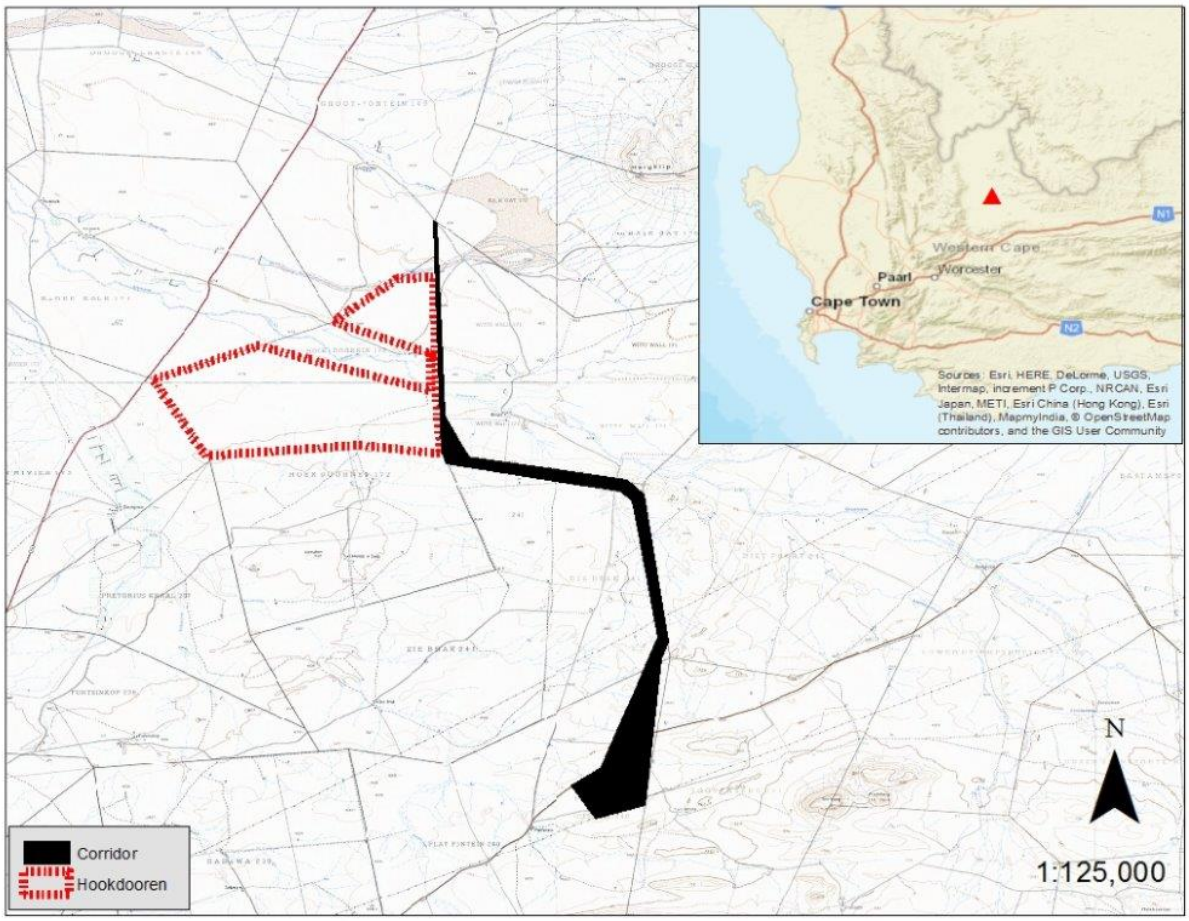


Figure 1. Topographic map indicating the study area (outlined in red) on the Farm Hoek Doornen and the adjoining powerline corridor.

All data was collated and subject to evaluation in order to:

- Place the data into a hierarchy of similarities according to species composition and sample sites.
- Give consideration to the overall structure of habitat within the subject site.
- Identify any habitat anomalies that may be identified in such analysis.
- Allow for the interpretation of such data in order to prioritise and evaluate habitat form and structure within the study area.

In addition, using methods identified in the Department of Water Affairs' "A Practical Field Procedure for Identification of Wetlands and Riparian Areas" (2005), such features were identified and defined. Such evaluations utilised both geomorphological, geohydromorphic edaphic conditions and botanical indicators in order to identify such components. Where riparian and wetland systems were identified these areas were subject to specific evaluation within this assessment report.

Riparian delineation methods

As noted above, the delineation of riparian edge and ephemeral wetland environments was undertaken utilizing accepted delineation techniques contained within "*A Practical Field Procedure for Identification of Wetlands and Riparian Areas"* (DWAF 2005) and the updated guidelines (DWAF 2008). A description of the rationale is provided below.

Riparian indicators - Indicators of a riparian system include the following (as per DWAF 2005):

1. An "obvious" floodplain and active channel.
2. Evidence of active erosion indicating a high energy system.
3. The absence of "classic" hydromorphic vegetation, with species associated with riparian areas dominating, or simply a change in vegetation density and structure.

As such, the approach to defining the riparian zone is not strictly defined (DWAF 2005) and a number of methods can be used. Accepted riparian indicators include:

1) **Topography**: identification of flood terraces and macro-channels.

2) **Vegetation**: identification of a distinct area of vegetation change, often in close association with the macro-channel. Changes can be in relation to species diversity or physical nature (density or health).

3) **Alluvial soils** and deposited material: identification of recent deposits of sand or mud, serves as a confirmatory indicator.

A number of methods exist for identifying riparian indicators. Acceptable methods include (DWAF 2005):

1) The use of topographical maps.

2) Aerial photographs and aerial videos.

3) Ecoregions (e.g. using climatic, geological or vegetative community indicators can be useful as a predictive method).

4) Field work (i.e. confirming desktop observations by locating indicators on site).

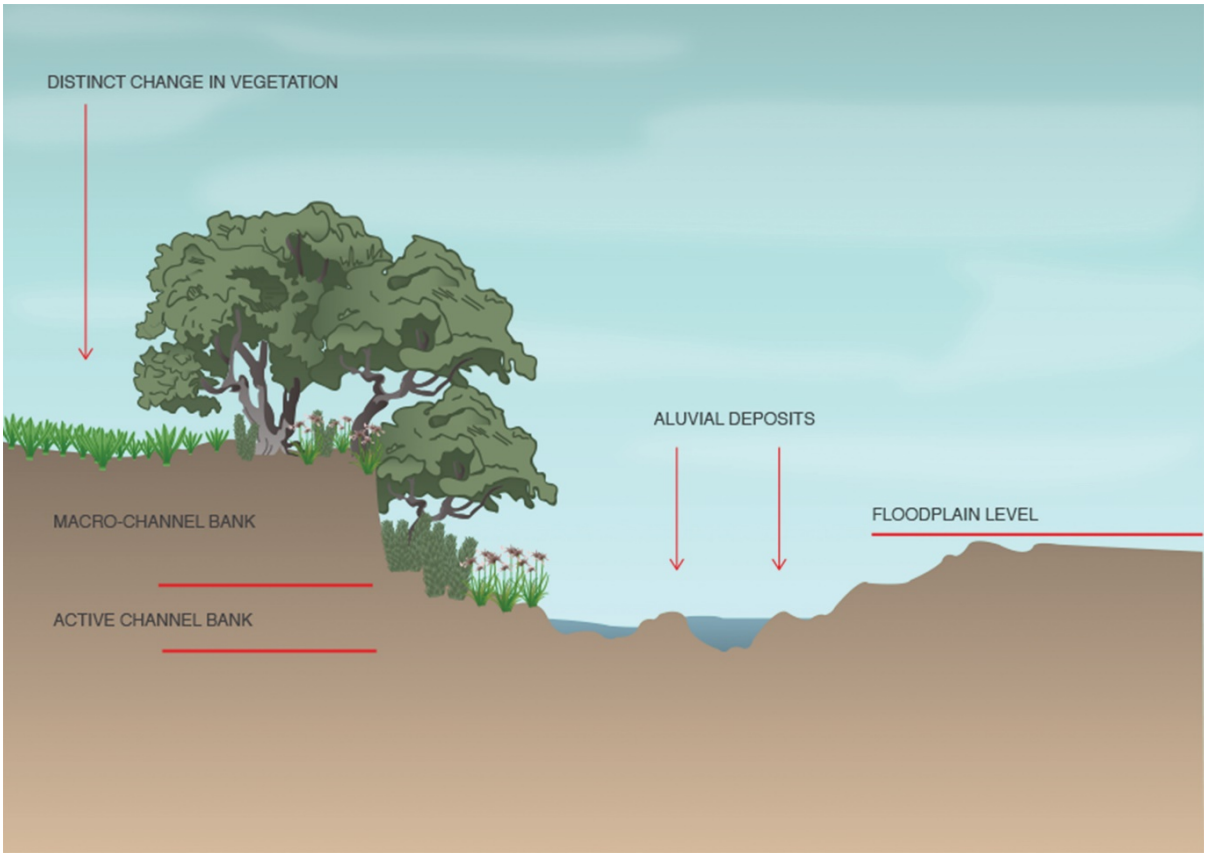


Figure 2. Illustration of a typical riparian cross section (Adapted from DWAF 2005), indicating riparian edge (arrow (distinct change in vegetation)).

Wetland Habitat

Due to the continuous or regular saturation experienced within wetland environments, soil chemistry differs from mesic or dry environments, giving rise to specific plant associations or groupings (hydrophytes) within wetland environments (Figure 2). The dependence of hydrophytes on wetland conditions varies from species to species and as a result, these species can be classified according to their occurrence within wetland areas. Such groups include obligate wetland species and facultative wetland species (as set out in DWAF 2005 and 2008).

A dominance of obligate species, indicates wetland conditions. In addition, the species present can be used to determine the three wetland zones, permanent, seasonal and temporary, however the difference between seasonal and temporary wetland areas is often ambiguous, resulting in the two categories being combined occasionally.

Soil characteristics are also utilized in the delineation process. Under fluctuating periods of water inundation, as well as the permanent presence of water within the upper soil horizons, minerals in the soil are either leeched from the horizon or are subject to chemical reactions, leading to changes in soil colouration and the presence of "mottling". The frequency of mottling indicates the degree of saturation and hence the wetland zone.

During the delineation exercise, the riparian and wetland areas associated with the site were delineated using aerial photography and field observations, which focus primarily on changes in vegetation, topography and the presence of alluvial deposits. Specific points were marked using a Garmin VI Montana Global Positioning System (GPS) device, where necessary.

Wetland functionality and health (PES)

Utilization was made of the Wet-Eco services tool (Kotze et. al. 2007) to determine the significance of the three identified wetland environments. Being an arid environment, with little or intermittent flow arising only on occasion, a "desktop" environmental importance and sensitivity (EIS) and Present Ecological State (PES) was undertaken (i.e. it was not possible to evaluate aquatic biota or undertake water chemistry analysis). This exercise involved the identification of the appropriate riverine section. The results of the PES or ecological status of the system provide an indication of the level of importance of the river, according to a ranking. The various classes or ratings are presented in Table 1.

Table 1. PES/Ecological status ratings for riverine system (Kleynhans et al 2005)

Rating	Description
A	Unmodified, natural.
B	Largely natural. A slight change in ecological processes is discernible but the system remains largely intact.
C	Moderately modified. A moderate change in ecological processes has taken place but the system remains predominantly intact.
D	Largely modified. A large change in ecological processes has occurred and the system is appreciably altered.
E	Greatly modified. The change in ecological processes is great but some features are still recognizable.

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The median of the determinants is used to assign the EIS category as listed in Table 2 below:

Table 2. EIS category, score and interpretation.

EIS Category	Range of Mean	Recommended Ecological Management Class[3]
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

2.1 Information Sources

The following data sources were consulted during this investigation.

Table 3. Data sources utilised during assessment

Data / Information	Source	Date	Type	Description
South African National Protected Areas Database (SAPAD)	Department of Environmental Affairs	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Western Cape Biodiversity Spatial Plan (WCBSP)	CapeNature. 2017. Western Cape Biodiversity Spatial Plan 2017. http://bgis.sanbi.org/	2017	Report & Spatial	Spatial conservation planning units and associated management recommendations for the Western Cape province
National Biodiversity Assessment	South African National Biodiversity Institute	2018	Report and Spatial	Latest assessment of South African biodiversity and ecosystems, including, vegetation types, wetlands and rivers.
http://posa.sanbi.org/sanbi South African National Biodiversity Institute. 2016. Botanical Database of Southern Africa (BODATSA) [dataset]	SANBI Plants of Southern Africa	2016	Data	Plant list for Tankwa region.
www.vmus.adu.org.za Animal Demography Unit	ADU: University of Cape town	2020	Data	Specific data on geographic occurrence

Data / Information	Source	Date	Type	Description
(ADU).				and record for various taxa.
Tankwa Weather http://tankwaweather.co.za	Private weather station	2020	Data	A private Davis Vantage Pro 2 mounted 1.6m above the ground. And anemometer at 10m angle Operation since: Jan 2015

2.2 Assumptions, Knowledge Gaps and Limitations

The following assumptions and limitations are presented in respect of this evaluation:

- Site reconnaissance was undertaken over a consecutive 5 day period during the early summer. Such field reconnaissance does not account for seasonal variations that may arise and reliance on collated and historical data from the region is required.
- During the period of reconnaissance, seasonality and weather conditions may have affected findings, in particular, colder temperatures.
- The area in general has been subject to an extended and significant drought, which is likely to have influenced habitat form at a limited level, as well as faunal populations.
- Cumulative impacts have been considered on a regional basis over a 30km radius.

2.3 Consultation Processes Undertaken

Interaction was undertaken with local residents and interested parties who were considered to have specific knowledge of the area, these included:

- Mr Philip van Heerden
- Mr Andre Vermeulen.

The above persons provided anecdotal information which was verified and considered during the site evaluation, as well as by further interrogation of the literature and data.

3 Description of Project Aspects relevant to Aquatic Biodiversity

The development of a PV facility, associated infrastructure and EGI on the subject properties will by necessity, be undertaken on land that meets a number of criteria including, *inter-alia*, level or gradual falls, generally suitable founding conditions and avoidance of areas that may be inundated by flooding. As a consequence, the proposed PV facilities will avoid all riverine and wetland environments.

Howsoever, the proposed development will alter the nature of the immediate catchment associated with such riverine environments through both the construction of the facility as well as its operations. Such change will arise primarily from changes in the rate of flow of surface water and possible alteration of the edaphics or soils within the facility, as well as, to a minor extent, water chemistry and perhaps, more indirectly, the biotic components of the riverine system.

The proposed Hoek Doornen PV projects will see a land use change that differs significantly from the prevailing land use. The implementation of the proposed development will result in notable change to the prevailing catchment associated with the river systems in the area, primarily on account of the construction stage of the project, as well as the long-term operational stage. Indirect impacts may therefore arise on riverine systems as a consequence of changes in the catchment. The development of the site for the PV facilities, associated infrastructure and EGI will see the following activities arise:

- Cordoning and fencing of the sites during both the construction and operational phases. This component of the project usually entails the establishment of an electrified fence (or palisade or mesh type) of about 2 – 3 m high which remains in situ for the lifetime of the project (i.e. for the operational phase). For the construction phase, the construction area and construction site camp may also be cordoned off with temporary fencing. Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm.

- Clearance or partial clearance of minor topographic features and vegetation, where applicable, during the construction phase.

- Establishment of roadways (i.e. access roads leading to the site and internal gravel access roads) and hard panning of surfaces, with minor stormwater management aspects being introduced during the construction and operational phases.

- Establishment of modular arrays with concomitant cabling and provision of invertors within the arrays. The footing of the module framework is founded into the ground using an earth screw or similar methods. Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m

- Establishment of step up transformers and 4 substations (one for each PV facility). This facility is expected to occupy an area of approximately 2 ha each. It will be fenced and isolated from the balance of the site.

A Lithium Ion Battery Energy Storage System (BESS) will be established at each PV Facility. The proposed BESS will cover an area of up to 8 hectares within the laydown area and a height of up to 5 – 10 m.

A laydown area of approximately 13 ha in extent.

- Establishment of offices and related infrastructure.

- A yard for storage and general operations will be set aside, adjacent to the built offices.

- An overhead powerline (132kV) will be established per PV Facility from the on-site substation to the Kappa substation. The powerline for Hoek Doornen PV 4 will traverse the Groot River and adjacent lands to the south, aligning with existing powerlines associated with adjacent renewable energy projects.

The commencement of construction on site will entail low to significant alteration of the prevailing habitat, depending upon the final design and layout of the PV facilities. A general sequestering of the subject area, through the fencing of the site from the surrounding habitat forms will thus arise.

While the construction phase will see temporary disturbances and transformation to the environment, these impacts on the prevailing ecology are likely to be significant in terms of impact, but of short temporal extent, as the construction project rolls out and a stability, albeit within a differing environment, arises on the subject site. It therefore follows that impacts on the ecology arising from this project can be divided into two aspects, namely: construction phase impacts and operational impacts.

4 Baseline Environmental Description

The Hoek Doornen farm lies within the southern extent of the Tankwa Karoo, part of the Succulent Karoo Biome. The Tankwa Karoo is associated with a comparatively low altitude and generally flat to undulating landscape, not exceeding 1500m amsl. According to the Koppen-Geiger climate classification method (www.koeppen-geiger.vu-wien.ac.at), the area is classified "BSh", which is indicative of an arid, hot environment. Such extremes have given rise to a regionally unique environment, both from an aquatic and terrestrial perspective.

In an arid region such as the Tankwa, riverine environments are primarily seasonal systems, flowing intermittently during high precipitation events. These episodes of flow can be significant flood events as deep frontal rains, as well as orographic rainfall arises within the catchment and on the Hangklip mountain to the north east. Rainfall events are also seasonal (mainly a winter period phenomenon) and during the periods between such precipitation events, little or no flow arises in these systems. Given the alluvial nature of these systems, little in the way of wetland environment is encountered in the river channels.

Some consideration of the broader ecological features of the site are presented below.

4.1 General Description

Hoek Doornen can be described as a series of undulating plains and plateaux, interspersed with occasional dolerite ridges. The lower elevations of the site are associated with sheet wash plains and larger ephemeral rivers that are dominated by alluvial sands.

Given this topography, two habitat forms or veld types are evident within the PV sites, these being SKv 5 Tanqua Karoo (Mucina and Rutherford 2006), a form of the Succulent Karoo Biome, and Tanqua Wash Riviere (AZi 7) a riparian habitat form (Figure 3). Both these veld types are considered "least threatened" from a conservation perspective (Figure 3). The same applies to the EGI corridor running along Die Brak and Platfontein Farms.

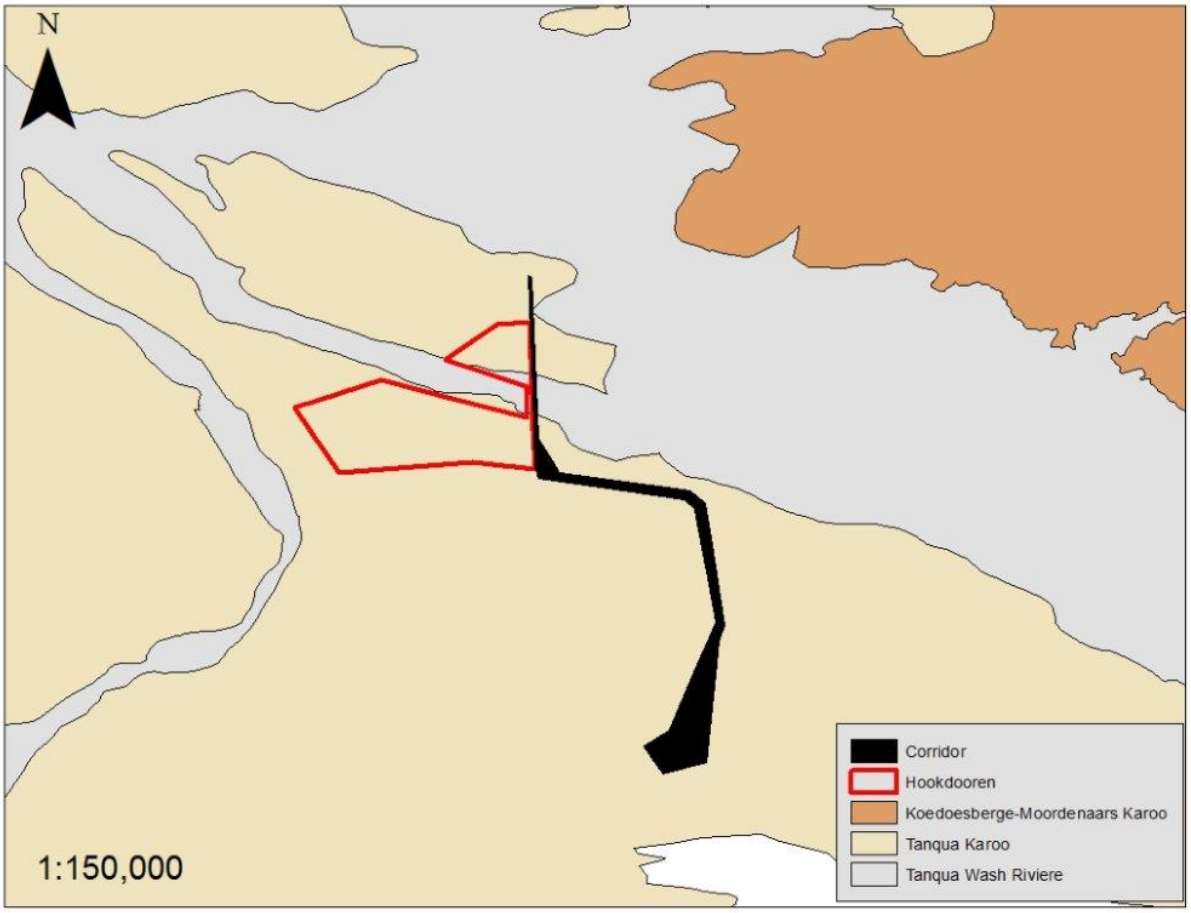


Figure 3. Map indicating veld types in relation to study area

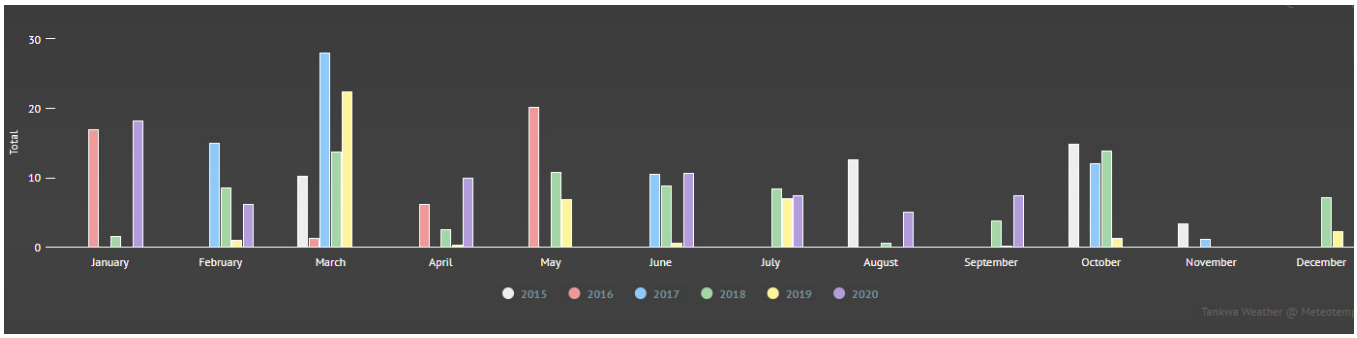


Figure 4. Graph showing monthly rainfall in Tankwa 2015 – date.

4.1.1 Ecological Processes, Functioning and Drivers

Two principle factors are considered to be the master elements driving the localised ecology. These can be considered to be broadly meteorological factors, namely wind, rainfall and temperature, while edaphics, particularly giving rise to lithic or sandy environments may be considered a geophysical driver. Notably, anthropogenic factors have over the previous century proven to be a key driver in contemporary habitat form and structure.

From a meteorological perspective the study area is a “xeric habitat”, with an average annual rainfall recorded over the last 5 years of between just over 40mm to 66mm in 2017 (2020 may exceed this record). There is however, high spatial and inter annual variability in rainfall patterns across the

region (Figure 4). According to Mucina and Rutherford (2006), the region may be considered to be a "rain shadow desert", where topography influences rainfall patterns.

In addition to the above, wind is a key issue within the region, driving sediment movement and promoting aeolian, sediment transport in areas exposed to high winds and with little vegetative cover. Where vegetation cover has been compromised, aeolian transport generally prevents the natural re-establishment of vegetation, or at least retards such emergence. The dominant winds within the subject site are the north westerly and southerly wind, which are seasonally prevalent (Figure 5). Sheetwash is also conspicuous to the east of the site, where sediments transported from up-slope have been deposited, proximal to the riverine areas.

Temperatures in the region can be considered to be extreme, with the greatest range recorded in the area lying at 53 °C. The lowest recorded minimum temperature is -3. °C and the highest maxima being 50.2°C (http://tankwaweather.co.za/pages/station/climate.php). A mean maximum temperature of 35°C is recorded by the SA Weather Service. Such extremes are indicative of the requirement for floral and faunal species to be tolerant of the effects of frosting, as well as high insolation and transpiration states. As a consequence, plant communities and faunal populations in the region generally show high levels of adaptation, occurring in specific areas or zones and the utilisation of specific, niche environments, e.g. scarp slopes and riverine environments by both floral and faunal communities.

4.1.2 Aquatic Biodiversity and Ecosystems

4.1.2.1 Aquatic Ecosystems

At a landscape level, riverine and riparian areas in the southern Tankwa region generally show improved vegetation cover and faunal presence on account of access to water and increased availability. The vegetation cover is however, primarily not hygrophilous in nature and is generally a *Vachellia* karoo dominated environment with *Lyceum cinereum* and *Salsola ceresica* being the dominant species within vegetation associes in these areas. Such species align with the Tankwa Wash Riviere habitat and as such, do not conform with the strict definition of "riparian vegetation". Mucina and Rutherford (2006) refer to this habitat as either "alluvial shrublands and herb lands", and "sheetwashes".

These areas are however subject to intermittent but significant flooding and as such there can be significant transport of material within these riverine environments. As such these areas show a natural disturbance regime that results in scour and erosion, as well as significant deposition. Lighter falls may result in generally low-level inundation of pools and ponds within the riverine environments, and these may support small associes and consocies of *Spiloxene aquatica* and *Scirpoides dioecus.* Given the generally dry and erratic flows experienced within aquatic environments within the southern Tankwa region, aquatic biota is generally limited and cannot be utilised in the determination of the ecological state of these systems. Howsoever, terrestrial fauna is notably more prevalent in the Tankwa Wash Riviere habitat, primarily because of improved cover and access to water.

Given the above, anthropogenic factors have been a key determinant in the contemporary nature of the aquatic or riverine environments within the site. While the current land use on the site is game ranching on adjacent sites (the current site does not have any current agricultural practices), previous agricultural land uses have specifically focussed on sheep and goat farming, which has been undertaken since the 1700s. The overgrazing of the land has given rise to poor vegetation cover and has contributed significantly to sediment deposition and alluvial conditions that presently prevail in the riparian environments. In addition, owing to the poor soils found in the terrestrial environments of the

Tankwa, almost all cultivation practices, including the laying down of pasture, has been and continues to be undertaken in the riverine environments. There is thus regular and sustained disturbance in these areas. In addition, the scarcity of water in the region has resulted in the establishment of dams and other features to attenuate and capture water in the rivers. Some dams are successful, while others are less so, having been breached by the torrential flooding that arises from time to time.

In addition to the above, a point of some interest is the significant use of subterranean water through abstraction for the tending of livestock and other activities. Notably this water has a high salinity and as the subterranean water enters the riparian environment, such salts may have a small but pervasive effected on this habitat (*pers obs*).

The above natural and anthropogenic factors have given rise to a generally altered environment and concomitantly changed habitat within and adjacent to the river systems of the locale. It follows that further land use change in the region, where livestock are excluded, may allow for the seral succession processes of habitats previously affected by farming activities to emerge. Such change may alter the nature of the catchment and indirectly affect the evident aquatic and riverine systems. Such change may not necessarily be adverse and improvements in the local aquatic ecology may arise. A prudent approach to the implementation of such development is however required in order to ensure beneficiation.

4.1.2.2 Aquatic Species

No aquatic biota was identified within either the Klein Droelaagte River or the Groot River (Figure 5).

Given the ostensibly dry state of the river bed, as well as the intermittently extreme flow experienced in these systems, there is little likelihood of fish species being present within either of the two river systems at any given time. The nearest data relating to ichthyofauna within the catchment of these two rivers arises from the confluence of the Doering River and Groot River, some 60 kilometres downstream. This data indicates the presence *Barbus capensis*, (Clanwilliam yellowfish), *B serra* (Clanwilliam sawfin) endangered, *Galaxias zebratus* and the endangered Clanwilliam sandfish, *Labeo seeberi*. *Micropterus salmoides*, the exotic largemouth bass, has also been recorded from these areas (Department of Water and Sanitation[1] (DWS), 2014). Recent attempts to locate *L seeberi* in the lower Tankwa River have not been successful.

The Animal Demography Unit (ADU) data base identifies only two anurans (frogs) from the Tankwa region, these being *Vandijkophrynus gariepensis gardenias* (Karoo toad) and the common *Amietia fuscigula* (the Cape river frog). *A fuscigula* is rapidly expanding its range, utilising farm dams and open water, while *V gariepinus* is an abundant species in the region. Both species are considered to be of least concern from a conservation perspective.

Data derived from the ADU identified three families of Odonata (dragonflies) within the region, these being the Libellulidae, Gomphidae and Coenagrionidae (FitzPatrick Institute of African Ornithology, 2020). All species are of least concern from a conservation perspective. Notably Libellulids are commonly associated with stagnant or still waters, rather than streams and regular flow which would account for their representation in this region.

In general, much of the riparian areas within the region are subject to regular disturbance primarily on account of farming activities, where cultivation and pastural activities are compelled to be undertaken within these areas. More terrestrial environments are not easy to till and are generally water deficient and thus production is poor.

[1] DWS is now operating as the Department of Water, Sanitation and Human Settlements

4.1.2.3 Conservation Planning

Critical Biodiversity Areas and Ecological Support Areas

Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) are categorised in terms of the Western Cape Biodiversity Spatial Plan (WCBSP) (2017). The assessed area for the PV arrays and associated infrastructure, specifically the power lines, traverse a number of Terrestrial and Aquatic CBA and ESA delineated areas. However, the actual footprint of the Hoek Doornen PV 1 and Hoek Doornen PV 3 facilities do not traverse any CBAs; however covers a few minor areas of Aquatic ESA 1, mostly associated with drainage line watercourses. The actual footprint of the Hoek Doornen PV 2 and Hoek Doornen PV 4 facilities covers a few extremely minor areas of CBA 1 (Terrestrial) and Aquatic ESA 1, mostly associated with drainage line watercourses. This preliminary data provided by the WCBSP is the product of a systematic biodiversity planning assessment which identifies portions of land that require safeguarding to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services, across terrestrial and aquatic realms (CapeNature 2017) These spatial priorities are used to inform sustainable development in the Western Cape Province.

In addition to the above, CBAs and ESAs are separated further into CBA 1 and 2 as well as ESA 1 and 2 respectively. It is important to note that CBA 1 show areas in a natural condition and those that are potentially degraded or represent secondary vegetation are considered to be CBA 2. Similarly, a distinction is made between ESAs that are likely to be functional (i.e., in a natural, near-natural or moderately degraded condition; ESA 1), and ESAs that are likely severely degraded or have no natural cover remaining and therefore require restoration where feasible (ESA 2). The ESAs are not considered essential from a conservation perspective for meeting biodiversity targets; however, they may offer some ecological services.

As much of the floral and faunal diversity within the subject region is related to riparian environments, it is clear that by excluding the proposed development from these areas, impacts on areas or corridors that have significant ecological support functions are unlikely to be affected by the proposed development.

Critically Endangered and Threatened Ecosystems

According to the Biodiversity Geographic Information System (BGIS) developed by SANBI, there are no Critically Endangered and Threatened Ecosystems on the subject sites. The ‘endangered’ and ‘threatened’ eco-systems identified within the Cape Winelands District Municipal region are not located within the study areas. Such areas are located some 40 kilometres to the east and the west of the site, but do not extend into the subject area.

Protected Areas (PAs)

The project area does not fall within or adjacent to a Protected Area.

4.2 Project-specific Environmental Description

As indicated above, the riverine and riparian habitat of such an arid region does not display the classic characteristics of hygrophilous habitats. As such, the PES of these environments cannot be determined using the recommended methods of the DWS from primary data collection. Consideration is therefore given to the general nature of the site and the use of a desktop PES.

The Farm Hoek Doornen incorporates portions of two river systems, namely the Klein Droelaagte, in the north and the Groot River in the south (Figure 5).

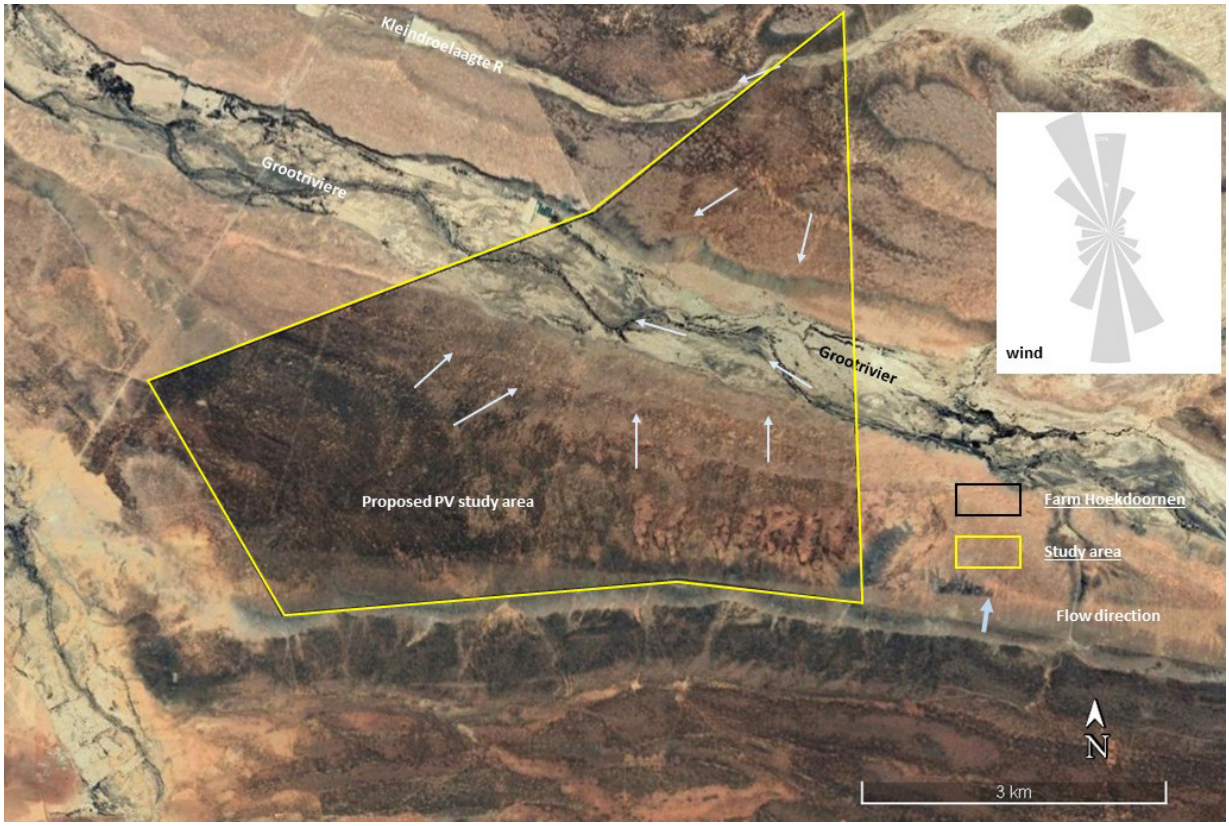


Figure 5. Map image showing two major river systems associated with the farm Hoek Doornen and drainage patterns (Google Earth, 2020).

These rivers all ultimately flow into the Doring River and this in turn, serves the Olifants River, with its confluence some 60 kilometres north of the site. Most surface drainage from the farm Hoek Doornen flows into the Groot River on account of the prevailing topography.

According to the DWS (2014) data for reach 8160 of the Groot River, this system has been classed using a desktop PES as "D" with an environmental importance (EI) of "*moderate*" and a "*very high*", environmental sensitivity (ES). The Klein Droelaagte has not been assessed, however the Droelaagte, from the same data set and located downstream of the site is considered to have a PES of "D", an EI ranked as "*moderate*" and an environmental sensitivity of "*very high*".

The Groot River is, as stated above, part of a network of ephemeral river systems with intermittent flows primarily associated with the winter rainfall period. The wider riparian environment comprises of a network of minor channels that are active under low flow conditions, while under high flow conditions and flooding events, the entire riparian area can be subject to inundation (Figure 6).

Figure 6. Image of the dam wall within the Hoek Doornen farm area – note breach within the centre of the wall.

On account of the general lack of flow within the channel, a number of dam and attenuation initiatives have been employed along the Groot River within Hoek Doornen and neighbouring farms in order to arrest flow and contain water for farming purposes. Larger dams on site are noted to have failed during the Laingsburg floods (Figure 6), having been breached by the flood waters. Smaller initiatives are also evident within the riparian environment, however most water used for stock and game farming is subterranean. The morphology of the river system varies either from a shale scarp, with vertically incised embankments with stony bed to alluvial deposits which can be several metres in depth (Figures 7 and 8). As a consequence, differing eco-morphologies can be identified within the river channel. The more lithic embankments favour refugia for a number of reptile and invertebrate species, while the talus associated with ablation and scour that is found at points within the river bed may favour some geophytes. The alluvial deposits offer a differing form of refugia, in particular nesting areas for a number of bird species such as the kingfishers (Alcedinidae) (Figure 8).

Vegetation comprises primarily of xeric shrubs associated with the Tanqua Wash Riviere habitat form, with *Lyceum cinereum* and *V karoo* forming the dominant species in these areas. In isolated portions of the riparian environment, small outliers of *Scirpoides dioecus* may be evident within the primary channels, particularly where soils show an improved clay content and are able to retain moisture. As discussed above, the riverine environments show improved faunal populations on account of the increased availability of water near the surface, improved vegetation cover and related factors. It is clear that within Hoek Doornen, this state prevails within the Groot River. Species identified within the riverine areas include *Pedioplanis laticeps*, the Karoo sand lizard, small mammals including the Cape hare (*Lepus capensis*) and the common mole rat (*Cryptomys hottentotus*). The latter, a fossorial species is evidently prevalent in these areas.

Figure 7. Image of channel of Groot River at Hoek Doornen showing shallow river bed environment.

Figure 8. Image of deep, sandy alluvial deposit with nesting holes.

Using the above information, a desktop PES can be compiled for the subject section of the Groot River. This PES is presented in Table 4. The ecological importance of the system is presented in Table 5.

Table 4. PES rating of the section of the Groot River at Hoek Doornen.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	2	3
Water Quality	3	2
Stream Bed Condition	2	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	2	3
PES	2.5 (C)	

Table 5. EIS rating of the Groot River

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The above PES and EIS differ somewhat from the DWS classification with a slightly higher PES and somewhat lower EIS. This differentiation is attributed primarily to the more recent drought conditions that prevail across the site and the very low level of instream biota evident within the system at this point. All drainage from the sites proposed for the development of the PV facilities will be into the Groot River. The Klein Droelaagte within Hoek Doornen is similar in nature to that of the Groot River whereas the dominant vegetation forms being *V karoo*, with a primarily alluvium dominated bed form (Figure 9). A PES and EIS for this system are presented in Tables 6 and 7.

Figure 9. Image of typical section of the Klein Droelaagte.

Table 6. PES rating of the section of the Klein Droelaagte River at Hoek Doornen.

Assessment Attribute	Score (1-5)	Confidence
Flow	1	3
Inundation	3	3
Water Quality	3	2
Stream Bed Condition	1	3
Introduced Instream Biota	5	3
Riparian or Stream Bank Condition	1	3
PES	2.3 (C)	

Table 7. EIS rating of the Klein Droelaagte section at Hoek Doornen

Determinant	Score	Confidence
Biotic		
Rare and endangered biota (0-4)	1	2
Unique biota (0-4)	1	2
Intolerant biota (0-4)	0	2
Species/taxon richness (1-4)	1	2
Abiotic		
Diversity of aquatic habitat types or features (1-4)	1	3
Refuge value of habitat types (1-4)	0	3
Sensitivity of habitat to flow changes (1-4)	4	3
Sensitivity to flow related water quality changes (1-4)	2	3
Migration route/corridor for instream and riparian biota (0-4)	0	3
National Parks, wilderness areas, nature reserves, natural heritage sites, natural areas. (0-4)	3	4
EIS	1.3 (Moderate)	

The EIS records a moderate level of ecological importance, whilst PES shows a score of C - "Moderately *modified. A moderate change in ecological processes has taken place but the system remains predominantly intact*". In respect of the subject system, however change to the system arising from the proposed Hoek Doornen PV 1 - 4 projects, including all associated infrastructure and EGI, is unlikely to be evident as most, if not all of the development footprint lies outside of the catchment of this system.

4.3 Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

Figure 10 below presents the information relating to the Screening Tool for the Aquatic Biodiversity Combined Sensitivity as it relates to the Farm Hoek Doornen for the proposed PV Facilities, and Figure 11 shows the extent of the EGI Corridor. Evident from this data is that much of the area under consideration is considered to be of *low sensitivity* in terms of the aquatic biodiversity prevalent in the region. The data does however indicate "very high" sensitivity in respect of the Groot River which bisects the site, as shown in Figure 10 (for the PV Facilities) and Figure 11 (for the EGI corridor) below. The Klein Droelaagte river is not represented in this data set. The ecological sensitivity is however believed to approximate that of the Groot River. The Screening Tool identifies the very high sensitivity areas as aquatic CBAs, Rivers, and Freshwater ecosystem priority area quinary catchments. However, it must be noted that the actual footprint of the PV Facilities is only earmarked as low sensitivity on the Screening Tool from an aquatic biodiversity sensitivity perspective.

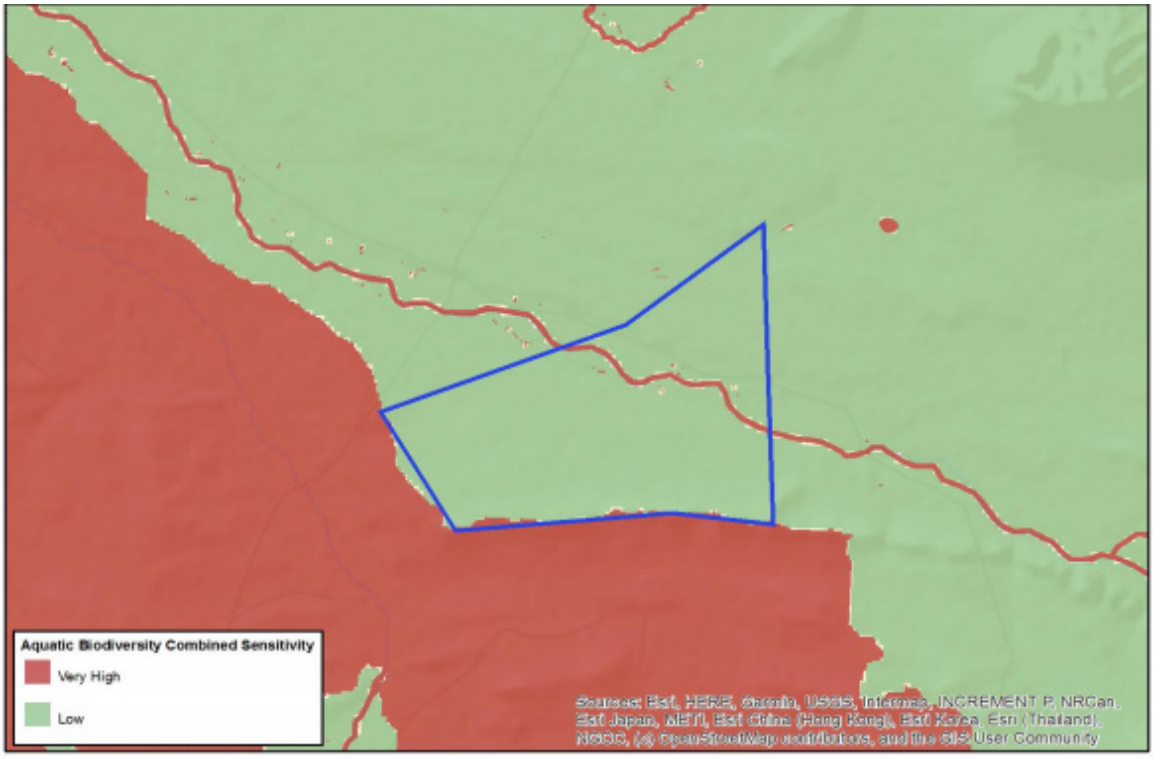


Figure 10. Map depicting aquatic biodiversity combined sensitivity in and around the Hoek Doornen farm (Source DEFF Screening Tool, 2020).

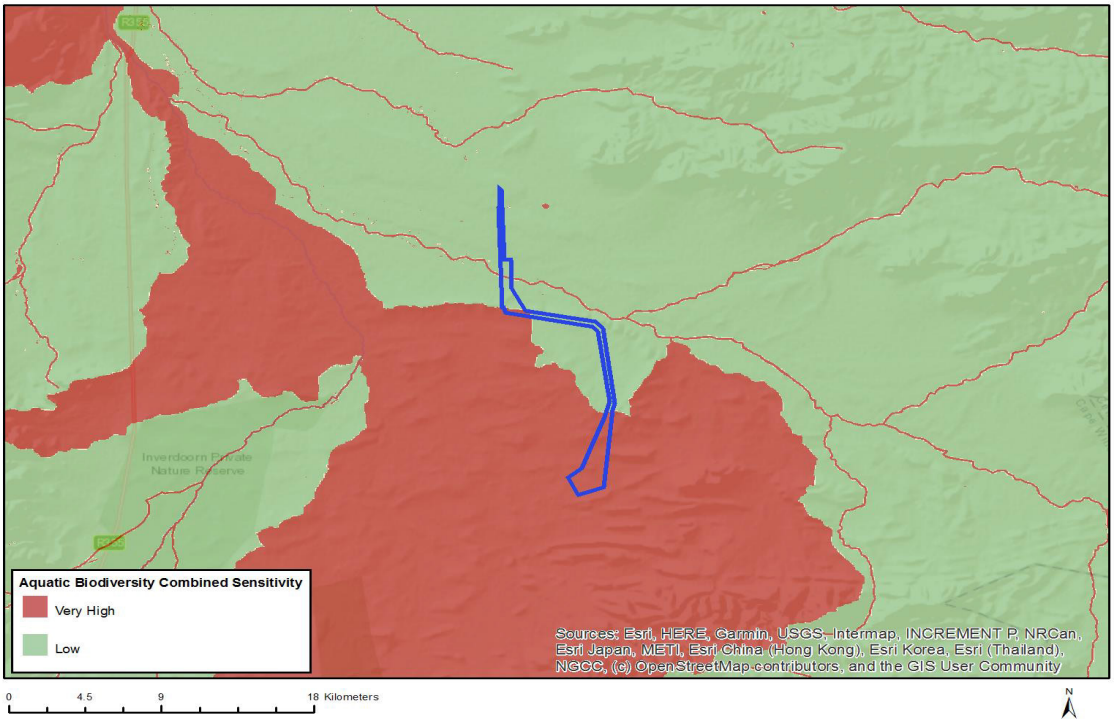


Figure 11. Map depicting aquatic biodiversity combined sensitivity in and around the EGI corridor (Source DEFF Screening Tool, 2020).

In terms of the EGI Corridor, the Screening Tool shows Very High sensitivity due to Aquatic CBAs, Rivers and freshwater ecosystem priority area quinary catchments. The river showing Very High sensitivity is the Groot River which bisects the Witte Wall farm.

The very high sensitivity attributed to the Groot River is perhaps related to the presence of certain critically endangered species, such as Clanwilliam sandfish (*L seeberi*). While the riverine rabbit (*Bunolagus monticularis*), the subject of a particular investigation may also be present in the riparian environments, it must be considered a terrestrial species in respect of the aquatic assessment and its presence or absence would not alter the findings of Tables 4, 5, 6 and 7 above. Howsoever, *B monticularis'* preferred habitat range being within these areas, as well as the general use of the systems by terrestrial fauna does render the drainage features with a high ecological sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

Using the above information, as well as the findings of the aquatic assessment a sensitivity map of the site can be compiled. This is presented in Figure 12 below. This map indicates the following for the Hoek Doornen PV 1 – PV 4 sites:

- The terrestrial environments which are deemed to have "low sensitivity" from an ecological perspective.
- The riparian environments, which are deemed to have "high sensitivity".
- Areas of terrestrial importance and a "buffer" at the interface of the terrestrial and riparian areas, which approximates 100m and includes areas of sheet wash and flood extremes.

Figures 12 and 13 presents the proposed Hoek Doornen PV 1 – PV 4 development footprints in relation to the low, moderate and high sensitivity mapping information. Notably, the four project areas fall outside of areas of moderate and high sensitivity.

Figure 14 shows the position of the Hoek Doornen PV facilities in relation to the Kappa Substation. Overhead powerlines will connect Hoek Doornen PV Facilities to the Kappa Substation. Figure 14 shows that the overhead powerline for Hoek Doornen PV 4 will traverse the Groot River, however the servitude will not affect any other wetland or riparian environments, and is acceptable to cross.

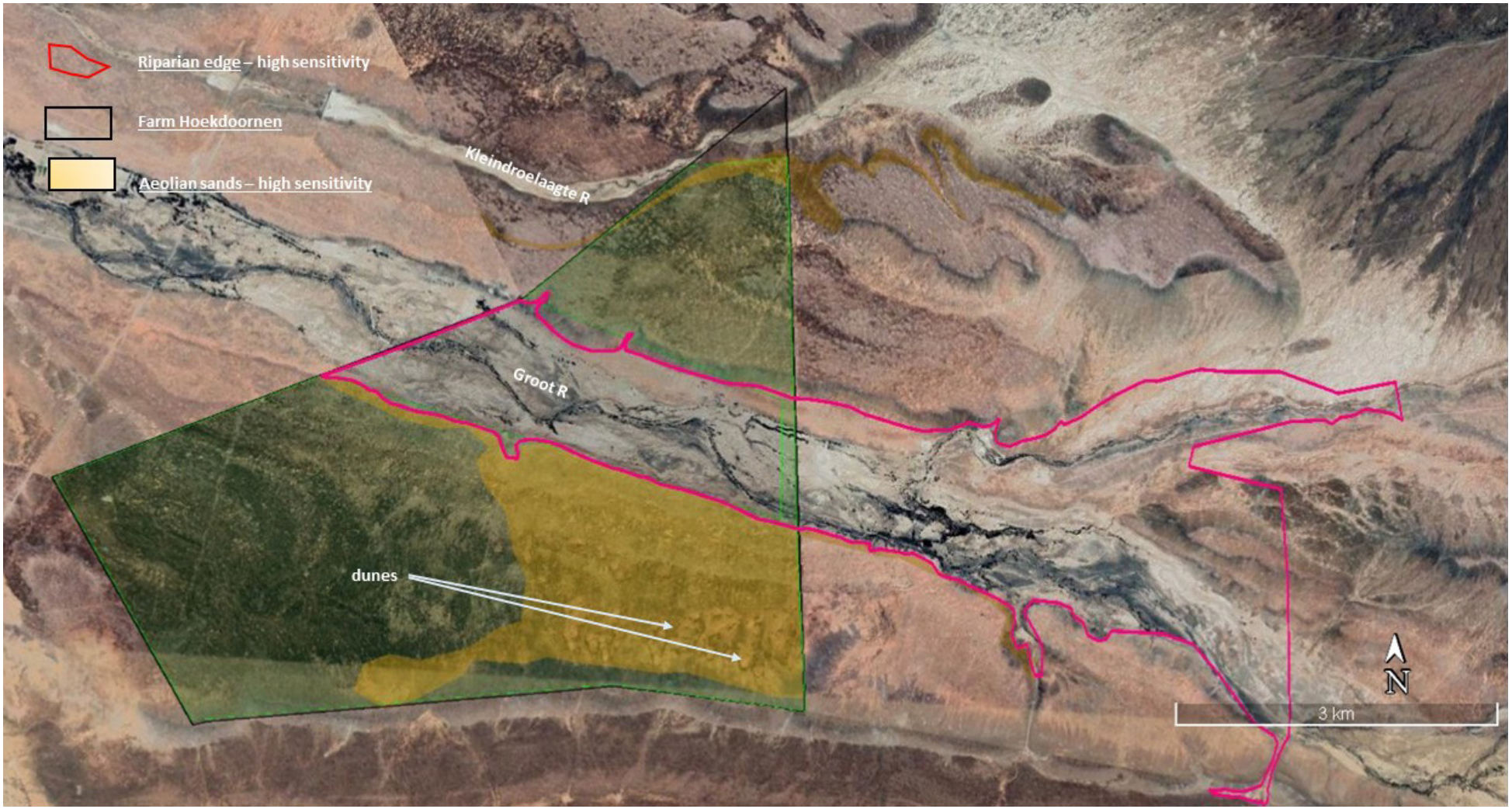


Figure 12. Map showing areas of ecological sensitivity in subject site.

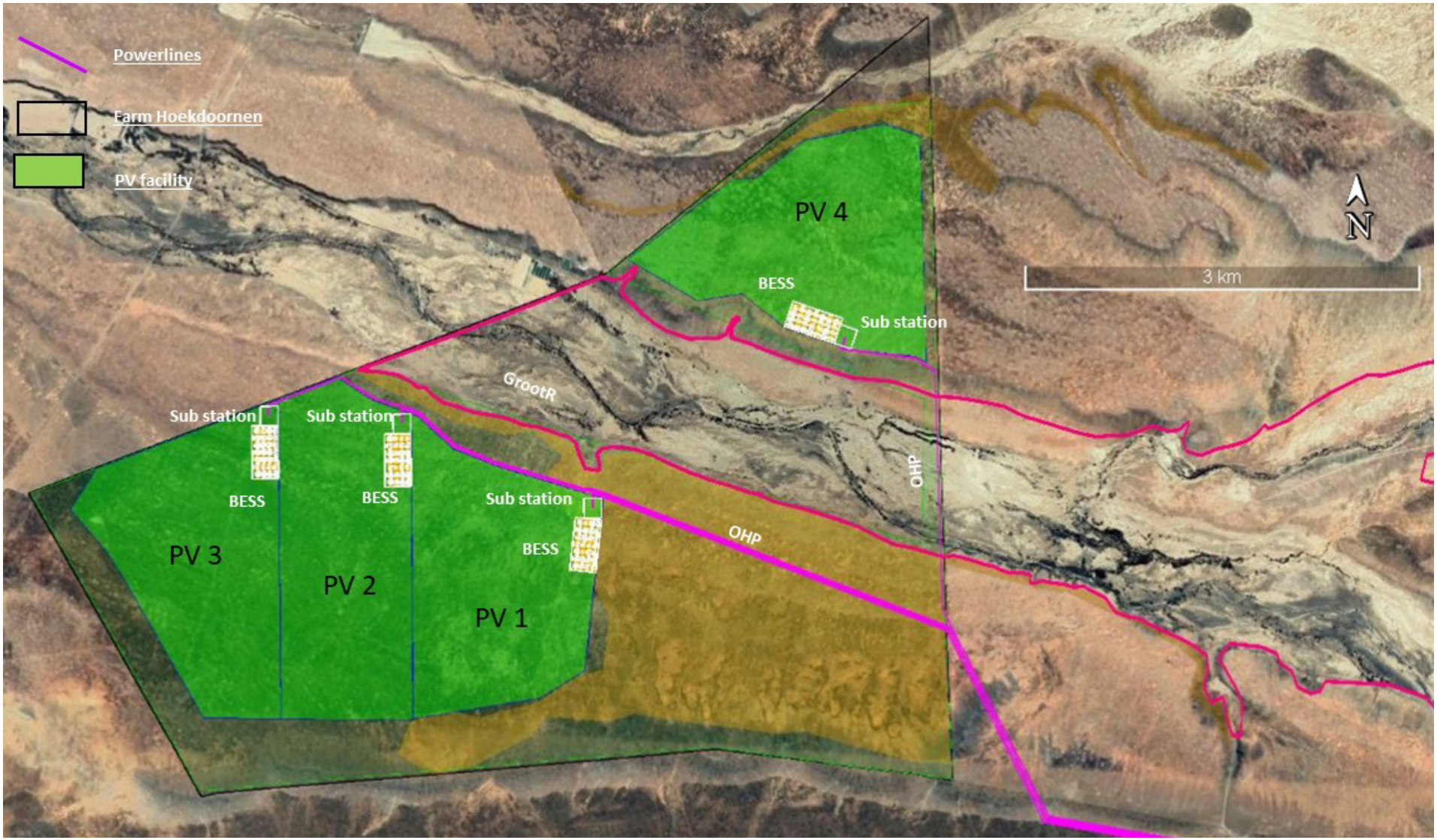


Figure 13. Map showing detail of Hoek Doornen PV 1 – PV 4 layout and development footprint at Hoek Doornen.

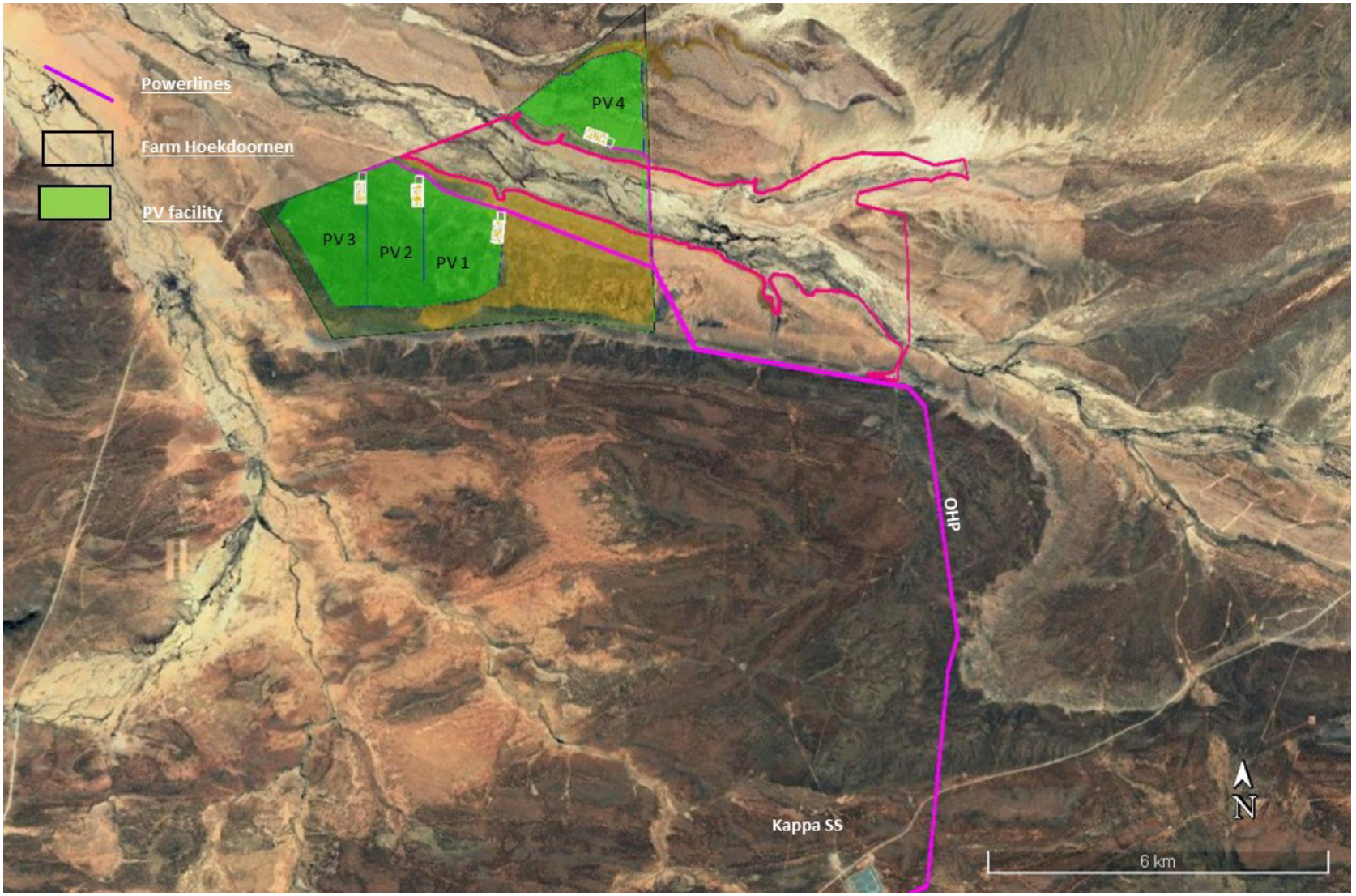


Figure 14. Map showing Hoek Doornen PV 1 - PV 4 and overhead powerline route to Kappa Substation, highlighting riparian areas of ecological sensitivity

Given the above, the following Environmental Sensitivities can be attributed to the four PV sites and the EGI. Refer to Appendix C of this report for the Site Sensitivity Verification Report.

4.3.2.1 Hoek Doornen – PV Facility 1 – PV 4 and Associated Infrastructure

The proposed extent of Hoek Doornen PV facilities encompasses areas within the terrestrial environment, generally classified as being of “low” ecological sensitivity. An extensive buffer (100 m) has been applied between the “high ecological sensitivity areas” of the Groot River and the development footprint of the PV facility. It follows that engineering interventions to curb surface run off and other factors that may affect the riverine system of the Groot River and Klein Droelaagte will have to be implemented.

4.3.2.2 EGI and Associated Infrastructure

The PV facilities would serve the Kappa substation to the south of the farm. One 132kV powerline for the Hoek Doornen PV 4 facility with associated towers would cross the Groot River to the south of the PV facilities in the vicinity of a point located to the west of the Witte Wall Farm (Figure 15). This crossing will be downstream of an existing fenced boundary on the Witte Wall Farm and would require the establishment of one or two towers within the riparian environment.

The position of the footings of the towers should evidently avoid the main channels within the riparian edge and be built to accommodate significant flooding and high-level flows. However once established, the towers should not be considered a significant impact of ecological significance. The powerlines for the Hoek Doornen PV 1, PV 2 and PV 3 facilities will not cross the Groot River, as these facilities lie to the south of the Groot River.

Figure 15. Image showing fence line across Groot River, where the overhead power line servitude has been proposed for the proposed power lines. The powerline for Hoek Doornen PV 4 would cross the Groot River downstream of this fence line.

Other portions of the powerline effectively avoid any significant watercourse or drainage feature and align with a wholly terrestrial environment.

4.3.3 Sensitivity Analysis Summary Statement

Two riverine environments (i.e. Groot River and the Klein Droelaagte) fall within the Farm Hoek Doornen and these systems are considered to be of moderate aquatic ecological importance and overall high sensitivity that which have been catagorised as ESA and CBA respectively as shown by Figure 16 below. The Klein Droelaagte system is not depticed on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figure 17). The proposed Hoek Doornen PV facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. No wetland environments are associated with the PV and associated development footprints (including the power lines).

The balance of the area on Hoek Doornen PV facilities are assigned low sensitivity, which corroborates with the Screening Tool. The electrical overhead powerline that traverses the Groot River for Hoek Doornen PV 4, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system. The above sensitivity analysis largely corroborates the findings of the Screening Tool, the sensitivities of which have been verified and utilized in the planning of the PV facilities at Hoek Doornen and for the EGI corridor along the farms Platfontein and Die Brak. Where the powerlines traverse portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

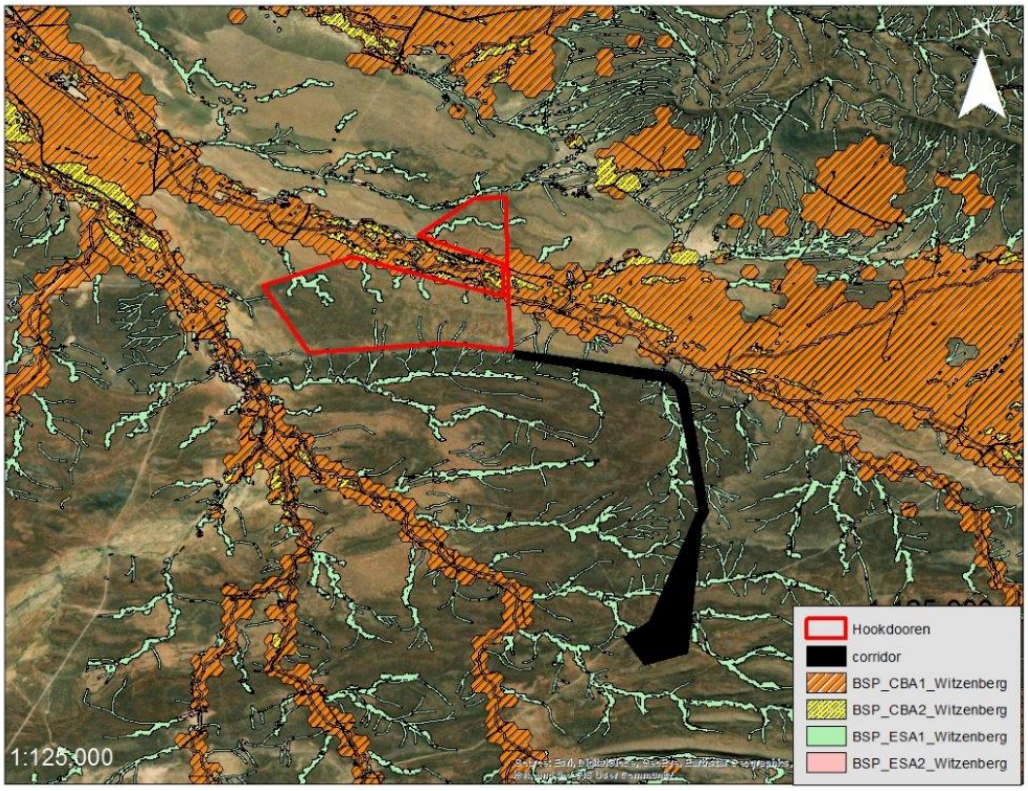


Figure 16. Map image detailing the Hoek Doornen PV site and associated infrastructure in relation to CBA and ESA portion of lands identified through the Western Cape Biodiversity Spatial Plan framework (Cape Nature, 2017).

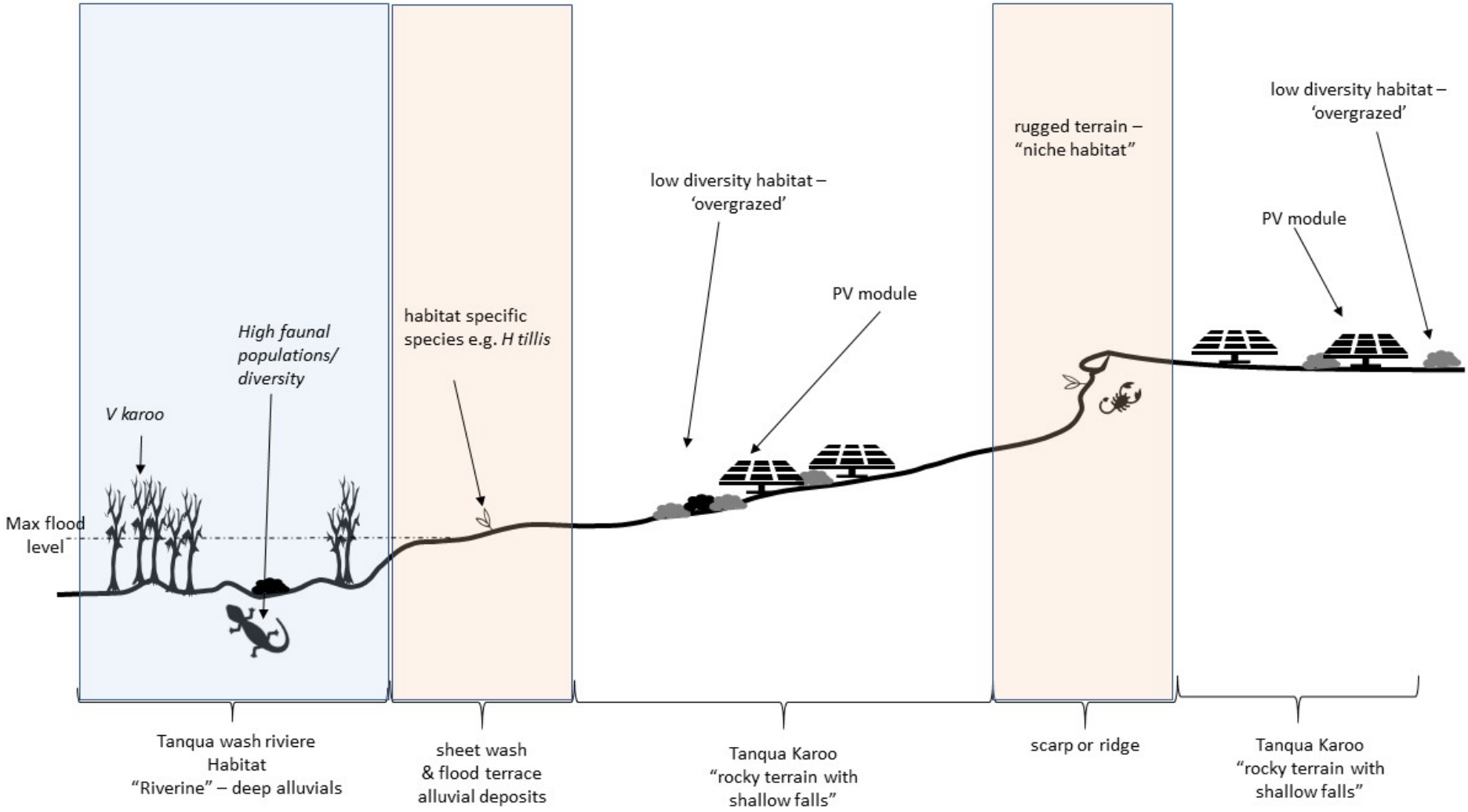


Figure 17. Schematic diagram indicating areas of high sensitivity (blue), moderate sensitivity (beige), and areas suitable for establishment of solar modules.

5 Alternative Development Footprints

No site alternatives are being considered. However, the layout was designed after provision of sensitivity data by the specialists to ensure that it would have the least possible overall impact. One EGI corridor has been proposed but this is wide enough to allow some micrositing of the alignment to reduce impacts.

6 Issues, Risks and Impacts

6.1 Identification of Potential Impacts/Risks

A number of direct, indirect and cumulative impacts on the localized and broader ecology of the region can be identified as a consequence of the proposed PV and EGI developments being implemented. Direct impacts are those that are directly attributable to the implementation and operation of the project, while indirect impacts are consequential effects of the proposed project that may not be directly attributable to the development. Cumulative impacts are those externalities that arise from the proposed development and compound existing effects or influences on the ecology of the region. These impacts are also defined as originating from the construction phase or the operational phase and may include the 'decommissioning phase".

6.1.1 Construction Phase

The following potential impacts during the Construction Phase of the PV Facilities, EGI and associated infrastructure.

- **Potential Impact 1**: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it.
- **Potential Impact 2**: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna.
- **Potential Impact 3**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities.

6.1.2 Operational Phase:

The following potential impacts during the Operational Phase of the PV Facilities, EGI and associated infrastructure can be summarized:

- **Potential Impact 4**: Changes in the geomorphological state of drainage lines on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change.
- **Potential Impact 5**: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities. Such changes will be related to the long-term activities on site, but are likely to be negligible.

6.1.3 Decommissioning Phase

Such alterations and changes will be dependent upon the expectant post-decommissioning land use.However, abandonment of the site and cessation of the PV Facilities, EGI and associated infrastructure
would probably result in:

- **Potential Impact 6**: A reversion of present faunal population states within the study area, with some variation to these populations being possible.
- **Potential Impact 7**: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment.

6.1.4 Indirect Impacts of the PV Facilities, EGI and associated infrastructure.

The following indirect impacts on the PV Facilities, EGI and associated infrastructure have also been identified:

- **Potential Impact 8**: Changes in the broader landscape ecology through alteration of eco-morphological drivers.
- **Potential Impact 9**: Changes in faunal ethos as a result of the establishment of the PV facilities on Hoek Doornen.

6.1.5 Cumulative Impacts of the PV Facilities, EGI and associated infrastructure.

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) (i.e. two PV facilities are being proposed on the farm Witte Wall 171; three PV Facilities are being proposed on the farm Grootfontein 149; and four PV Facilities will be constructed on the Farm Hoek Doornen 172). Notably there are 11 other renewable energy projects that have received EA within 30 km of the subject site. The majority of these projects employ wind turbines, which present fundamentally different impacts and externalities that may affect the broader ecology of the region, although three smaller sites located some 30 km south of Hoek Doornen will employ PV technology for power generation. The cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of this project and other land use changes in the region are likely to exhibit the following:

- **Potential Impact 10:** Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.
- **Potential Impact 11**: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

6.2 Summary of Issues identified during the Public Consultation Phase

Interaction with local residents in the region indicated that:

- Historically, farming activities over the preceding 150 years was seen to have altered the prevailing habitat.

- Fauna were confined to the riverine areas in general.
- Flood events could be severe, with a rapid rise in the water levels within rivers being noted following rain in the upper catchments.

Additional points raised by the local residents are captured in Table 8 below.

Table 8: Comments Received from Stakeholders / Local Residents during the Field Work component of this Aquatic Biodiversity and Species Assessment

Comment	Commenter	Response from the Specialist
The removal of natural vegetation containing threatened, protected and endemic species as a result of the proposed project	Mr Andre Vermeulen	The general approach to construction of the proposed facilities, associated infrastructure and EGI is to maintain vegetation on site. No "blading" of areas, other than within the laydown area, the site of the substation and along roads is to be undertaken.
Increased dust deposition during construction activities	Mr Andre Vermeulen	This is a likely scenario. Mitigation measures will have to be employed including "damping", traffic speed limitations and other management measures.

Additional comments will be received from stakeholders and Interested and Affected Parties during the 30-day comment period on the Draft BA Report.

7 Impact Assessment of the PV Facilities, EGI and associated infrastructure.

The nature of impact / risk is discussed below. The impacts described below apply to both the Hoek Doornen PV 1, PV 2, PV 3 and PV 4 projects, including the EGI and associated infrastructure (i.e. they are the same and have not been repeated).

7.1 Potential Impacts during the Construction Phase

Potential Impact 1: Changes in the geomorphological state of drainage patterns due to construction activities leading to change in the eco-morphology of lower lying areas and those immediately adjacent to it

As construction proceeds the natural drainage patterns, sediment transport mechanisms and other related factors will alter, with concomitant change in the ecology associated with these factors. This is rated as a direct, negative impact. Implementation of management principles will reduce these impacts from "high" to "moderate" significance and possibly "low", during the closing of the construction phase.

Potential Impact 2: Increased electrical light pollution, leading to changes in nocturnal behavioral patterns of fauna

ELP will alter faunal ethos of some species, particularly during construction, primarily associated with work at night. ELP can be addressed through initially, interventions in respect of lighting during the construction phase such as reduced security lighting, downward lighting and restriction on lumens employed. This is generally a low significance impact before and after implementation of mitigation measures.

Potential Impact 3: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) as a result of construction activities

During the construction phase, increased mobilization of sediments, minor spills of materials and other factors may alter surface water chemistry. This impact would however be low significance, with the employment of suitable management measures during the construction stage. Mitigation measures include providing adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.

7.1.1 Impact Summary Table: Construction Phase

The impact ratings are described in this section for the construction phase.

Table 9: Impact Summary Table for the Construction Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE – Direct Impacts						
Impact 1: Changes in the geomorphological state of drainage patterns	*Status*	*Negative*	*High (2)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Moderate (3)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 2: Increased ELP	*Status*	*Negative*	*Low (4)*	• *Ensure reduced security lighting, downward lighting and restriction on lumens employed*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 3: Changes in water resources and surface water in terms of water quality	*Status*	*Negative*	*Moderate (3)*	• *Provide adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.2 Potential Impacts during the Operations Phase

Potential Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change

As climatic factors change within the region, natural bio-physical responses, including changes in habitat or faunal population shifts may be affected on account of the presence of the PV facilities, EGI and associated infrastructure. This impact is considered "low" significance on account of the generally limited extent of the site in relation to surrounding habitats.

Potential Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities

Such changes will be related to the long-term activities on site, but are likely to be negligible. Alteration in water quality are surmised to stem primarily from unintended hydrocarbon leaks from operating vehicles and other machinery on site. However, impacts of this nature during the operational phase are considered to be of "low" significance with mitigation measures including to retain spill kits on site.

7.2.1 Impact Summary Table: Operational Phase

The impact ratings are described in this section for the operational phase.

Table 10: Impact Summary Table for the Operational Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE – Direct Impacts						
Impact 4: Changes in the geomorphological state of the subject site on account of long-term climatic changes and the concomitant change in the nature of the catchment arising from the land use change	*Status*	*Negative*	*Low (4)*	• *Exclusion areas should be maintained. Maintain scarp slopes unimpeded by development. Avoid extensive alteration of sheet wash areas.* • *Cordon off the sites to prevent inward migration of fauna* • *Implement other general management principles as per the EMPr*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 5: Changes in water resources and water quality (i.e. impact on water chemistry) as a result of operational activities	*Status*	*Negative*	*Low (4)*	• *Provide adequate storm water controls to ensure that attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces* • *Implement proper spill control and management, such as the retention of emergency spill kits on site*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Medium*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.3 Decommissioning of Site

Potential Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible

On account of both the abovementioned seral state of the land as well as other factors, decommissioning and reversion to a land use, akin to the present, should see some alteration of faunal populations and a reversion to present populations with some ousting and recruitment of species. This impact is rated as "low" significance before and after the implementation of management actions.

Potential Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment

This impact is rated with a low significance and possibly, "positive". This impact will be a long-term impact which may be considered "negative" but of low significance. Additional hard panning as a result of the establishment of the PV facilities and associated infrastructure contributes to the change in the geomorphological state of the drainage lines. Stormwater controls are to be incorporated into the development to ensure attenuation of flow.

7.3.1 Impact Summary Table: Decommissioning Phase

The impact ratings are described in this section for the decommissioning phase.

Table 11: Impact Summary Table for the Decommissioning Phase

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE – Direct Impacts						
Impact 6: A reversion to present faunal population states within the study area, with some variation to these populations being possible	*Status*	*Neutral*	*Low (4)*	• *Ensure that there is appropriate disposal of materials and waste during decommissioning activities* • *Manage stabilisation and reinstatement of the land*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				
Impact 7: Changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment	*Status*	*Neutral*	*Low (4)*	• *Provide adequate storm water controls to ensure attenuation of storm water runoff emanating from the PV panels and other hard panned surfaces.*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Low*				
	Irreplaceability	*Low*				

7.4 Indirect Impacts

The following indirect impacts are anticipated to be associated with the establishment of the PV facilities, EGI and associated infrastructure on the farm Hoek Doornen. Indirect impacts arising from the establishment of the site are likely to be of low significance, and generally latent in nature.

Potential Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers

The development of the four proposed PV facilities on Hoek Doornen may alter habitat form and structure beyond the boundaries of the PV facilities as support infrastructure (e.g. roads) are established, or as physical or biological factors change (e.g. drainage patterns change or grazing pressures increase at other points). The impacts may however prove to be of low impact significance.

The decommissioning of the site and reversion to the present land use, may see some alteration of drainage patterns and general surface hydraulics. This impact is considered to be "low" significance.

Potential Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities.

Changes in faunal ethos on account of the establishment of the PV facilities on Hoek Doornen, some faunal populations may emigrate from the area, while others may favour other factors around the site. Behavioral change in faunal populations will drive ecological change beyond the boundaries of the PV Facilities. This impact is rated as "low" significance without and with the implementation of mitigation measures.

7.4.1 Impact Summary Table: Indirect Impacts

The impact ratings are described in this section for the indirect impacts during both the construction and operation phase.

Table 12: Impact Summary Table for Indirect Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Indirect Impacts						
Impact 8: Changes in the broader landscape ecology through alteration of eco-morphological drivers	*Status*	*Negative*	*Low (4)*	• *Appropriate management of the site must be undertaken along ecological integration approaches*	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
Impact 9: Changes in faunal ethos due to the establishment of the PV Facilities	*Status*	*Negative*	*Low (4)*	Exclusion areas should be maintained. Maintain scarp slopes and ensure that they are unimpeded by the proposed development. Mitigation of this impact would result in a low rating.	*Low (4)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

7.5 Cumulative Impacts

The cumulative assessment also considers all nine proposed PV plants and nine power lines as part of this suite of developments (referred to as the Ceres PV Development) and there are 11 authorised renewable energy projects on some 50 000 ha of land within 30 km of the subject site (Figure 18). The

cumulative impact assessment also considers other proposed, approved and existing power lines within the 30 km radius.

Given the above, cumulative impacts arising from the implementation of the proposed projects and other land use changes in the region are likely to exhibit the following:

Potential Impact 10: Increased change in the geomorphological state of drainage lines and watercourses on account of long term and extensive change in the nature of the catchment.

This impact deals with increased an increased change in the geomorphological state of drainage lines and water courses due to long term and extensive change in the nature of the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are rated as moderate and likely, respectively, rendering the significance as low without the implementation of management measures. Mitigation measures include cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.

Potential Impact 11: Changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment.

This impact deals with changes in water resources and surface water in terms of water quality (i.e. impact on water chemistry) on account of extensive changes in the catchment. This impact is rated as negative with a regional spatial extent and long term duration. The impact consequence and probability are respectively rated as moderate and likely, rendering the significance as low without the implementation of management measures. Mitigation measures include coordinated and sustained management of all nine PV and EGI Projects associated with this BA.

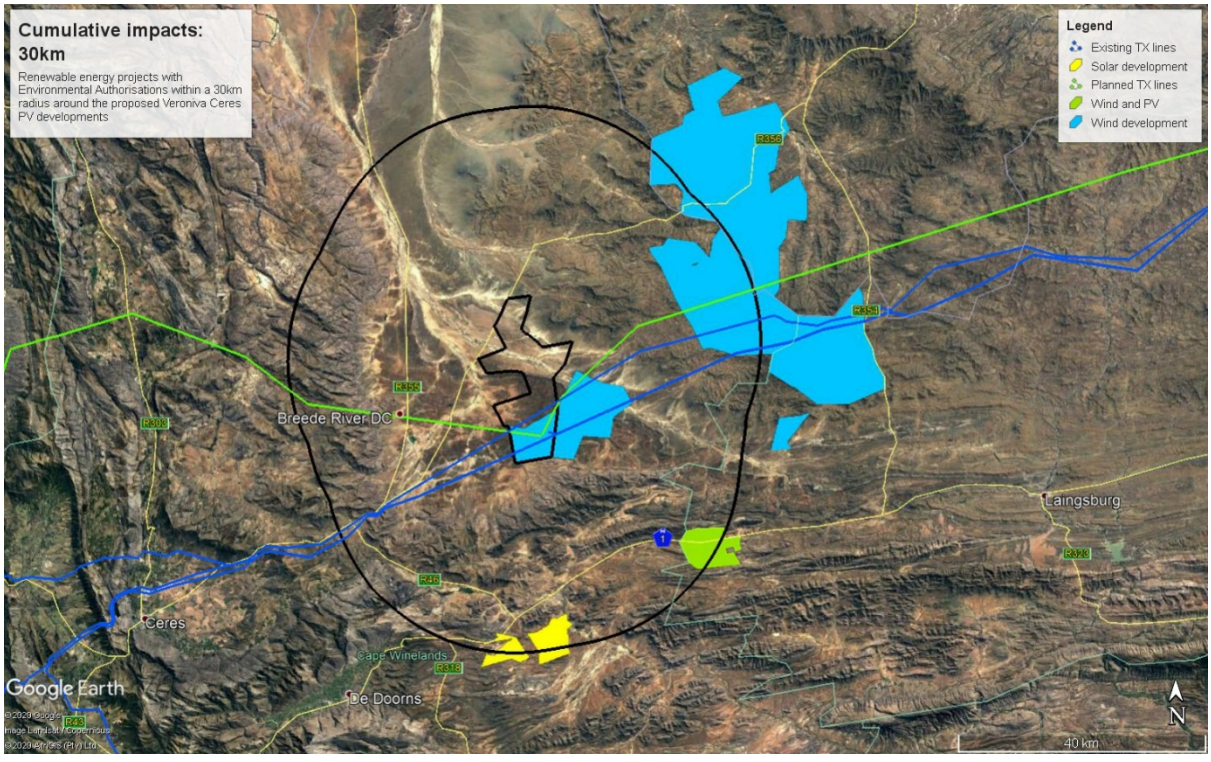


Figure 18. Map indicating renewable energy and EGI projects within 30 km of project site (van Rooyen, 2020).

7.5.1 Impact Summary Table: Cumulative Impacts

The impact ratings are described in this section for the cumulative impacts during the construction and operational phase.

Table 13: Impact Summary Table for the Cumulative Impacts

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
Construction and operational phase – Cumulative Impacts						
Impact 10: *Increased change in the geomorphological state of drainage lines and watercourses, on account of long term and extensive change in the nature of the catchment*	*Status*	*Negative*	*Low (4)*	Cordoning off the sites to prevent inward migration of fauna as well the implementation of other general management principles as per the EMPr.	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				
Impact 11: *Changes in water resources and surface water in terms of water quality on account of extensive changes in the catchment.*	*Status*	*Negative*	*Low (4)*	*Co-ordinated and sustained management of all nine PV and EGI Projects associated with this BA.*	*Low (4)*	*High*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*Moderate*				
	Irreplaceability	*Low*				

8 Impact Assessment Summary

Table 14 and Table 15 provides a summary of the expected impacts after mitigation for the PV Facilities and EGI, respectively.

Table 14: Overall Impact Significance (Post Mitigation) of the proposed PV facilities and associated infrastructure

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

Table 15: Overall Impact Significance (Post Mitigation) of the proposed EGI to support the PV facilities

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	Low
Cumulative - Decommissioning	NA

9 Legislative and Permit Requirements

The proposed establishment of the Hoek Doornen PV facilities, associated infrastructure and EGI on the subject sites are considered to elicit a requirement for compliance with the following legislation as this may apply to the riverine and aquatic environments.

- **The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended)**

The National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) (NEMBA) may be applicable to the site, particularly in respect of matters pertaining to threatened or protected species encountered on or around the sites or the matter of redress of AIPs. This may apply in respect of the establishment of the powerline across the Groot River.

- **The National Water Act (Act 36 of 1998, as amended)**

As noted above, the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such, maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The sensitivity map in Figure 12 indicates that for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 projects, areas of terrestrial importance and a “buffer” at the interface of the terrestrial and riparian areas have been demarcated, which approximates 100 m and includes areas of sheet wash and flood extremes. In addition, no wetland environments are associated with the PV and associated infrastructure development footprints (including the powerlines).

The powerline for Hoek Doornen PV 4 will, however, cross the Groot River and would require the establishment of one or two towers within the riparian environment of the Groot River. The powerlines for the Hoek Doornen PV 1, PV 2 and PV 3 facilities will not cross the Groot River, as these facilities lie to the south of the Groot River. In addition, the access road leading to the Hoek Doornen PV 4 site would need to be upgraded as part of the proposed projects. Sections of the access road upgrade will take place within 100 m of the Groot River.

The requirement for a General Authorisation or Water Use License in terms of Section 21 (c) and 21 (i) of the National Water Act may be required where activities arise within the bed of the river in respect of the establishment of towers for the overhead powerlines and the road upgrading. Therefore, the following project likely requires a Water Use License or similarly a General Authorisation:

- Hoek Doornen PV 4 – for the access road upgrade and power line specifically.

However, if the towers are needed to be placed within 100 m of the bank of the Groot River, for the Hoek Doornen PV 1, PV 2 and PV 3 facilities, then a Water Use License or similarly a General Authorisation may be required. The Department of Human Settlements, Water and Sanitation are to confirm such prerequisite legal requirements.

- **The National Forest Act (Act 84 of 1998)**

The clearance of "natural forest" may be applicable, where, particularly in the establishment of the power line that traverses the Groot River for Hoek Doornen PV 4, there may be the requirement to remove associations of *V karoo*. Although not strictly "forest" in ecological terms, the *contiguous canopy* definition of forest would apply under Section 7 of the National Forest Act (Act 84 of 1998).

- **The Cape Nature and Environmental Conservation Ordinance 19 of 1974 (also the Western Cape Nature Conservation Laws Amendment Act (2000))**

This act should be given consideration following EA with particular respect to Chapters IV, (The protection of wild animals other than fish) and Chapter VI, (The protection of flora). The requirement for permits when removing and relocating specific flora that may be encountered or alternatively addressing fauna that may be encountered around the sites would require due consideration.

- **Draft Western Cape Biodiversity Bill, 2019.**

This law has not been promulgated however some aspects of Chapter 7, in particular may apply to the sites, once promulgated.

In consideration of the applicable legislation listed above, it is important to note that the requirement for approval is to be confirmed by the competent authority on the matter.

10 Environmental Management Programme Inputs

The proposed PV facilities on Hoek Doornen and the associated infrastructure and EGI, will not effectively enter into the riparian environments located on the affected farms. However, the BA process has identified a number impacts that are expected to arise during the planning and construction components of this project. The prevailing impacts to the aquatic biodiversity are:

- Increased surface run off of storm water under high precipitation events with concentration at specific points; and
- Minor changes in water quality through suspended and dissolved materials arising from activities on site (e.g. fats, soaps and oils).

The riverine environments are effectively ephemeral rivers and not subject to regular flow. It is anticipated that impacts from the PV facilities and their associated infrastructure and EGI will be primarily indirect in nature. The EMPr focuses on the mitigation and management of the prevailing (direct, indirect, cumulative) impacts, the subsequent mitigation actions as well as the methodology, frequency and responsibility of the monitoring regime. From the above the EMPr has been compiled in alignment with Appendix 4 of the 2014 NEMA EIA Regulations which aims to detail measures that are to be carried out in order to:

- Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- Comply with any prescribed environmental management standards or practices;

- Comply with any applicable provisions regarding closure; and
- Comply with any provisions regarding financial provision for rehabilitation.

11 Final Specialist Statement and Authorisation Recommendation

11.1 Statement and Reasoned Opinion

Given the information presented above it is evident that should the Applicants establish the proposed development within the identified footprint on Hoek Doornen that the Hoek Doornen PV facilities may proceed with limited impact on the broader ecological processes and those areas deemed to be of ecological significance (namely the lower riparian environments and sand wash environments).

It therefore follows that: Hoek Doornen PV facilities and associated infrastructure show a low-level aquatic ecological impact on adjacent riparian environments identified and subject to the implementation of the prescribed management recommendations and conditions, should not be precluded from development on ecological grounds.

11.2 EA Condition Recommendations

Should the mandated authorities approve the proposed development, the following broad management recommendations are proposed for incorporation into the EA:

- Maintenance and establishment of an ambulatory set back of >100m from the identified riparian areas and points of sheet wash as per the layout plan presented.

- That construction and establishment of modules and arrays be undertaken without the clearance of vegetation. Where vegetation proves excessively tall and affects either construction or operation, pruning may be effected.

- A detailed stormwater management and drainage plan be developed that considers *inter alia*, surface flows arising from elevated areas above the PV facilities and its discharge from the facilities. This philosophy must include attenuation and energy dissipation mechanisms and redress of erosion and sheet flow across site.

- The laydown area for the PV facilities should be subject to compaction and the use of dust suppressants when in operation, to prevent excessive particulate matter becoming airborne.

- Management of fauna within the site and surrounds, as well as the incorporation of “wildlife” porosity into fence lines and the implementation of measures on the energised fence line to avoid mortalities to wildlife.

- Maintain the riparian areas as general “exclusion areas” for all operations, with the exception of the establishment of the overhead powerlines.

- Management of exotic weed invasion that may arise within riparian areas as a consequence of disturbance.

- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

It is our opinion that with the implementation of the above, the project proposal, subject to final design and adherence to the above recommendations, should be authorised.

12 References

Chris van Rooyen Consulting. 2020. Avifauna Assessment for the Proposed Development of two 175 MW Solar Photovoltaic Facilities (Witte Wall PV 1 and Witte Wall PV 2), and associated Electrical Grid Infrastructure near Touws River, Western Cape. Unpublished report prepared for Veroniva (Pty) Ltd, Cape Town: Chris van Rooyen Consulting.

CSIR. 2000. Cape Action Plan for the Environment: Strategy. CSIR Report No.: ENV-S-C 99130B. Prepared for WWF-SA, Stellenbosch.

Department of Environmental Affairs and Tourism. 2000. Guideline Document: Strategic Environmental Assessment in South Africa. Pretoria.

Department of Water and Sanitation. 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: [W5 (for example)]. Compiled by RQIS-RDM: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx accessed on [date].

FitzPatrick Institute of African Ornithology (2020). OdonataMAP Virtual Museum. Accessed at http://vmus.adu.org.za/?vm=OdonataMAP on 2020-10-08

Kleynhans, C.J. and Louw, M.D., 2007. Module A: EcoClassification and EcoStatus determination. *River EcoClassification: Manual for EcoStatus Determination (version 2) Water Research Commission Report No. TT*, *333*(08).

Kotze, D., Marneweck, G., Batchelor, A., Lindley, D. and Collins, N., 2009. WET-EcoServices: a technique for rapidly assessing ecosystem services supplied by wetlands.

Kottek, M., J. Grieser, C. Beck, B. Rudolf, and F. Rubel, 2006: World Map of the Köppen-Geiger climate classification updated. *Meteorol. Z.*, 15, 259-263. DOI: 10.1127/0941-2948/2006/0130.

Mucina, L., Rutherford, M.C. and Powrie, L.W., 2006. Vegetation Atlas of South Africa, Lesotho and Swaziland. *The Vegetation of South Africa, Lesotho and Swaziland'. (Eds L. Mucina and MC Rutherford.) pp*, pp.748-789.

Tankwa Weather. 2020. Available at http://tankwaweather.co.za/pages/station/climate.php. Accessed on 21 September 2020.

APPENDICES

Appendix A - Specialist Expertise

NAME Simon Colin Bundy

PROFESSION Ecologist / Environmental Assessment Practitioner

DATE OF BIRTH 7 September 1966

MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist

EDUCATION

BSc Biological Science (1990) University of Natal

Diploma Project Management (1997) Executive Education

MSc (2004) University of KwaZulu Natal

PhD. Candidate: Department of Engineering, University of Kwa Zulu Natal

1998: Guest of Konrad Adenhauer Foundation to Berlin to consider "sustainable development initiatives" in Europe

2000: Training course: "Environmental Economics and Development". University of Colorado (Boulder) USA.

2008: Certificate in Coastal Engineering: Stellenbosch University

KEY COMPETENCIES AND EXPERIENCE

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. With a core competency in coastal ecological systems and coastal management, Bundy has worked on coastal projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as South Africa, providing ecological and general environmental advice and support. In addition, Bundy has worked in Rwanda, Lesotho and Zambia. Within South Africa, Bundy has been involved in a number of large-scale mega power projects as well as the development of residential estates, infrastructure and linear developments in KwaZulu Natal, Eastern Cape and Western Cape. In such projects Bundy has provided both technical support, as well as the undertaking of rehabilitation programmes.

From a technical specialist perspective, Bundy focusses on coastal ecological systems in the near shore environment and is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and for the Department of Economic Development Tourism and Environmental Affairs in conjunction with the Oceanographic Research Institute. In 2015, Bundy formulated the coastal set back line method for the iSimangaliso Wetland Park, funded by the Global Environment Fund of the United Nations. Bundy acts as botanical

and environmental specialist for Eskom Eastern Region and provides technical support to the IEM division of the Council for Scientific and Industrial Research, Stellenbosch.

SELECTED RELEVANT PROJECT EXPERIENCE

Aquatic and Ecological evaluation of the impacts of Scatec Kenhardt Solar Facilities 1 – 6 in Northern Cape – CSIR (2016 to 2019)

Investigations and review of the aquatic and terrestrial ecology associated with 6 solar facilities at Kenhardt in Northern Cape

Aquatic and Ecological evaluation of the impacts of Maintstream wind Projects in Sutherland Northern Cape & Western Cape – CSIR (2015 to 2016)

Investigations and review of the terrestrial ecology associated with wind power facilities near Sutherland in Northern Cape

Ecological investigations Tongaat and Illovo Desalination Plants: CSIR – (2013 - 2016)

Review of eco-physiological state of the coastal environments in and around the proposed Illovo and Tongaat desalination plants for associated EIA process.

Ecological Review and Rehabilitation Planning: Sodwana Bay: iSimangaliso Wetland Park Authority – (2014 - 2015)

Analysis and review of state of dune cordon in and around Sodwana Bay with modelling of the impacts of removing exotic trees from site to rejuvenate dune and beach dynamics

Review of Project Leader and Coastal Specialist: Addington Farm Strategic Environmental Assessment (2016)

Evaluation of coastal habitat and beach-dune interface for the generation of setback lines for the proposed Addington Farm residential development.

Aquatic and Ecological evaluation of the impacts of in-water hull cleaning, Port Louis, Mauritius and Port of Durban – Aquatech / Divetech Solutions (2014 to date)

Investigations and review of the chemo-physical impact of in-water hull cleaning in the Durban and Port Louis Ports for accreditation with the International Maritime Organisation.

Coastal ecological evaluation of the Van Riebeeckstrand coastline, Cape Town for the establishment of inter-continental telecommunication cables. Acer Africa (2016)

Specialist investigation into the impact of establishing marine cables at Van Riebeeckstrand Cape Town for MTN. Client: Acer Africa.

Review and report on impact of the Fairbreeze Mine at Mtunzini on aquaculture operations at Mtunzini Aquaculture – Supporting document for legal argument presented on behalf of Mtunzini Aquaculture. (2017)

Specialist review and investigation of groundwater discharge and dune mobility at Siyaya, Mtunzini and its effect on the marine intake supplying the Mtunzini Fish Farm. Client: Mtunzini Fish Farm / Eversheds

Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event: West of England Insurance, United Kingdom (2018 - 2019)

Location, evaluation and monitoring of plastic pellets within the coastal habitats between Durban and Richards Bay with Resolve Marine, AR Brink and Assoc's and Drizit Environmental. Objective is to maintain a defendable but efficient level of pellet contamination across coastline.

Rehabilitation Projects: (2010 - 2015)

- Dune rehabilitation of Durban Harbour southern breakwater 2009 – 2010 for Group 5. Sculpt, establish and maintain.
- Mangrove forest rehabilitation of Hugh Dent pump station 2015 for Sembcorp Siza Water.
- Dune rehabilitation of Ballito beachfront 2009 for KwaDukuza Municipality, following 2007 storm surge event
- Ulundi TSC rehabilitation for Eskom Eastern Region, 2016
- Mangethe substation rehabilitation of area for Eskom Eastern region, 2016.

PUBLICATIONS

Bundy S C. 2018 "The great coastal conservation conundrum". EKZN Wildlife Conservation Symposium

Smith AM, Bundy SC, Cooper (2016) "Apparent dynamic stability of the south east African coastline, despite sea level rise" Earth Surface Processes and Landforms DOI 10. 1002

Bundy, S. C. and Forbes, N. T., 2015. *"Coastal dune mobility and their use in establishing a setback line*" 9th West Indian Ocean Marine Science Conference 2015

Smith AM, SC Bundy 2012 "Review of Coastal Defence Systems in Southern Africa" Article for Springer Scientific Publications through Ulster University, Pilkey and Cooper

Bundy, S. C., Smith, A. M., Mather, A. A. 2010. "Dune retreat and stability on the Northern Amanzimtoti Dune Cordon", EKZN Wildlife Conservation Symposium 2010

Smith, A Mather AM Bundy SC, Cooper AS Guastella L, Ramsay PJ and Theron A; 2010 "*Contrasting styles of swell-driven coastal erosion: examples from KwaZulu-Natal, South Africa*" Geology Journal", Cambridge University Press

Bundy SC AM Smith, (2009) "*A Review of Select Dune Rehabilitation Initiatives and a Proposed Methodology towards Ensuring a Prudent Approach towards the "Greening of Dunes*" VI International Sandy Beaches Symposium Emphakweni Port Alfred

Bundy, S. C. and Smith, A. M. 2009 *"Analysis of the Recovery of Two Separate Coastal Dune Systems Following the 2006 – 2007 Marine Erosion Event and Assessment of the Artificial Dune System in Coastal Management*" KZN Marine and Coastal Management Symposium, Durban South Africa.

Smith A and Bundy S 2009 "*Coastal erosion: reparative work on the Ballito coastline, KwaZulu-Natal, South Africa, was it enough?*" 2009 International Multi-Purpose Reef and Coastal Conference, Jeffrey's Bay South Africa

Smith A, Mather A, Theron A, S Bundy 2008 **"***The 2006-2007 KwaZulu – Natal Coastal Erosion Event in Perspective*" 2009 Contribution to the South African Environmental Observation Network publication "Climate Change in Southern Africa"

Name:	Alexander Michael Whitehead
Profession:	Environmental Consultant/Ecologist
Date of Birth:	30/08/1983
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	14
Nationality:	South African
Email address:	alex@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Ichthyology and Fisheries Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – Reg. No. 400176/10 (Ecological Science)

Key Skills and experience:

- Computer skills – (MS Word, STATISTICA, Excel, MS Access, PRIMER 5 (multivariate statistical program), CAP 4 (multivariate statistical program));
- Bioassessment - Experience in sampling aquatic invertebrates (SASS 5) and ichthyofauna (Electrofishing and estuarine sampling techniques);
- Water quality - Experience in carrying out water samples and interpreting results in both freshwater and estuarine environments;
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Wetland functionality assessments – Assessment of wetland functionality using ecological indicators and standard methods such as Wet-Ecoservices and Wet-Health.
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Rehabilitation – Compilation of wetland and terrestrial rehabilitation plans as well as practical experience in planning and conducting weed eradication and re-vegetation programs.
- Environmental monitoring and auditing –
- Open space and conservation planning – Identification of areas of open space or conservation importance.
- Botanical/protected species permits and Risk Assessments – Permit applications under the National Forest Act (84 of 1998), Natal Nature Conservation Ordinance (15 of 1973) and National Environmental Management: Biodiversity Act (10 of 2004).

Name:	Luke Patrick Maingard
Profession:	Environmental Consultant/Ecologist
Date of Birth:	15/09/1993
Current Employment:	SDP Ecological and Environmental Services cc
Position:	Ecologist/Environmental Consultant
Years of experience:	5
Nationality:	South African
Email address:	Luke@ecocoast.co.za
Tertiary Qualifications:	BSc (Hons.) Environmental Science (Rhodes University)

Professional Affiliations:

South African Council for Natural Scientific Professions – (Ecological Science)

Key Skills and experience:

- Geographic Information Systems
- Wetland and riparian habitat delineation – Delineation of wetland and riparian areas using accepted methods (DWAF 2005, 2008);
- Terrestrial ecological assessments – General biodiversity assessments and identification of sensitive habitats.
- Alien invasive plant management
- Environmental legislation
- Storm water control and management design and implementation
- Environmental Impact Assessment (EIA) and Basic Assessment (BA) Processes –
- Environmental management – Compilation of practical EMPr documents and environmental management processes.
- Environmental Control Officer to numerous construction sites
- Data management and analysis
- Aquatic assessments – Assessment of freshwater ecosystems using bioassessment/sampling protocols, water quality data and ecological indicators.

Appendix B - Specialist Statement of Independence

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

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

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

Departmental Details

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

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

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

Specialist Company Name:	SDP Ecological & Environmental Services			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	ex	Percentage Procurement recognition	
Specialist name:	Simon C Bundy			
Specialist Qualifications:	BSc MSC Dip Proj Man			
Professional affiliation/registration:	SACNASP			
Physical address:	6 Salisbury Road, Ballito			
Postal address:	P O Box 1016, Ballito			
Postal code:	4420	Cell:	082 446 4847	
Telephone:	032-586 1218	Fax:		
E-mail:	simon@ecocoast.co.za			

2. DECLARATION BY THE SPECIALIST

I, ___Simon C Bundy_____, 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

S. D. P CC
P.O. BOX 1016, BALLITO 4420
TEL: 032 946 1685
FAX: 086 [illegible] ZA
WWW.SDPECOLOGY.CO.ZA

Name of Company:

17/11/20

Date

Appendix C: Site Sensitivity Verification

Prior to commencing with the Aquatic Biodiversity and Species Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

The details of the site sensitivity verification are noted below:

Date of Site Visit	14/09/2020 – 18/09/2020
Specialist Name	Simon Bundy and Luke Maingard
Professional Registration Number	S C Bundy SACNASP No.400093/06 L P Maingard SACNASP No. 116639/16
Specialist Affiliation / Company	SDP Ecological and Environmental Services

The Site sensitivity verification was undertaken using the following means:

1. Preliminary desktop analysis achieved by overlaying a variety of geospatial data features – namely NFEPA data and other sensitivity data obtained from the SANBI BGIS as well as the DEFF Screening Tool. Further to this, the Present Ecological State (PES) and Environmental importance and sensitivity (EIS) data had been derived from the DWS Present Ecological State and Ecological Importance model.
2. Literary review of the site, obtaining baseline knowledge of the ecological history of the site as well as the PES of the site. To this end a review of historical images of the site had also been undertaken.
3. Onsite investigation of the subject area from the 14/09/2020 to the 18/09/2020.

Two riverine environments (i.e. Groot River and the Klein Droelaagte) fall within the Farm Hoek Doornen and these systems are considered to be of moderate aquatic ecological importance. The Klein Droelaagte system is not depicted on the Screening Tool, however it has been identified as part of this study. However, from a more regional perspective, these ephemeral systems are perhaps of greater significance in that they offer improved habitat for terrestrial fauna (Figures 11, 12 and 13 in the main report). The proposed Hoek Doornen PV 1 and Hoek Doornen PV 2 facilities are considered to be suitably set back from the riparian environments associated with both the Groot River and the Klein Droelaagte Rivers and as such maintain these riverine environments as both a faunal and intermittent hydrological pathway and corridor as well as offering improved refugia for fauna. The rest of the area on Hoek Doornen PV 1 and Hoek Doornen PV 2 are assigned low sensitivity, which corroborates with the Screening Tool.

The electrical overhead powerline that traverses the Groot River for Hoek Doornen PV 4, subject to the suitable positioning of the towers, are unlikely to elicit significant negative ecological impacts on the system.

The above sensitivity analysis corroborates the findings of the screening tool and has been utilized in the planning of the PV facilities at Hoek Doornen and for the EGI corridor along the farms Platfontein and Die Brak. Where the powerlines traverse portions of the Farm Die Brak and Platfontein, the corridor traverses a wholly terrestrial environment.

Appendix D: Impact Assessment Methodology

The following impact assessment was adopted, which includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

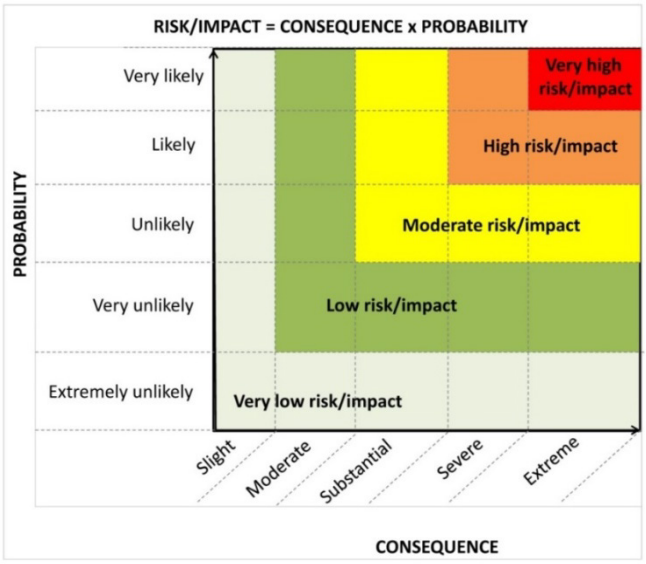


Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Aquatic Biodiversity Protocol (GN 320, 20 March 2020)

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: *2.3.1. a description of the aquatic biodiversity and ecosystems on the site, including;* *a) aquatic ecosystem types; and* *b) presence of aquatic species, and composition of aquatic species communities, their habitat, distribution and movement patterns;*	*Section 4*
2.3.2. the threat status of the ecosystem and species as identified by the screening tool;	*Figure 11, Figure 12 and Figure 13*
2.3.3. an indication of the national and provincial priority status of the aquatic ecosystem, including a description of the criteria for the given status (i.e. if the site includes a wetland or a river freshwater ecosystem priority area or sub catchment, a strategic water source area, a priority estuary, whether or not they are free -flowing rivers, wetland clusters, a critical biodiversity or ecologically sensitivity area); and	*Section 4*
2.3.4. a description of the ecological importance and sensitivity of the aquatic ecosystem including: *a) the description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); and* *b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel and flow regime (surface and groundwater).*	*Section 4 and Tables 4, 5, 6 and 7*
2.4. The assessment must identify alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification and which were not considered appropriate.	*Not Applicable – see Section 5*
2.5. Related to impacts, a detailed assessment of the potential impacts of the proposed development on the following aspects must be undertaken to answer the following questions: *2.5.1. Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?* *2.5.2. Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?* *2.5.3. How will the proposed development impact on fixed and*	*Sections 6 and 7* *In particular planning, operation and decommissioning impacts* *1. No change in state anticipated* *2. No change in resource quality anticipated* *3. Riparian areas are excluded – no change in ecological processes of significance*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity		Section where this has been addressed in the Specialist Report
	dynamic ecological processes that operate within or across the site? This must include: *a) impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes);* *b) will the proposed development change the sediment regime of the aquatic ecosystem and its sub - catchment (e.g. sand movement, meandering river mouth or estuary, flooding or sedimentation patterns);* *c) what will the extent of the modification in relation to the overall aquatic ecosystem be (e.g. at the source, upstream or downstream portion, in the temporary I seasonal I permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); and* *d) to what extent will the risks associated with water uses and related activities change;*	*anticipated.* *a. As significant buffering of riparian areas, limited hardpanning is anticipated – impacts of a hydrological importance are not anticipated* *b. Sediment transport change will be negligible* *c. Minor change in lower catchment with minimal change that is negligible, to the watercourse* *d. No changes to water use or any related activities are anticipated.*
2.5.4.	*how will the proposed development impact on the functioning of the aquatic feature? This must include:* *a) base flows (e.g. too little or too much water in terms of characteristics and requirements of the system);* *b) quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over - abstraction or instream or off stream impoundment of a wetland or river);* *c) change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley -bottom wetland);* *d) quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);* *e) fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and* *f) the loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.);*	*Section 7* *In summary* *a. Baseflow does not arise as the systems are ephemeral* *b. Flow is intermittent. No change is expected in volumes* *c. Hydrogeomorphic state will remain intact and no change is anticipated* *d. Water quality is unlikely to have any significant alteration particularly during operations and decommissioning* *e. No fragmentation is anticipated as riparian environments have been avoided* *f. No change in important features anticipated.*
2.5.5.	*how will the proposed development impact on key ecosystems regulating and supporting services especially:* *a) flood attenuation;* *b) streamflow regulation;* *c) sediment trapping;* *d) phosphate assimilation;*	*As the systems are ephemeral, set back and out of maximum flood extents and there is a distinct lack of aquatic habitat and eco-morphology, no variation in ecological drivers*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
e) nitrate assimilation; *f) toxicant assimilation;* *g) erosion control; and* *h) carbon storage?*	*of aquatic systems is anticipated.*
2.5.6. how will the proposed development impact community composition (numbers and density of species) and integrity (condition, viability, predator - prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	*Sections 4 and 7* *Aquatic biota are transitory in the affected systems and no change is anticipated with the proposed development.*
2.6. In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: *a) size of the estuary;* *b) availability of sediment;* *c) wave action in the mouth;* *d) protection of the mouth;* *e) beach slope;* *f) volume of mean annual runoff; and* *g) extent of saline intrusion (especially relevant to permanently open systems).*	*Not Applicable – the site does not include any estuaries.*
2.7. The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the following information:	
2.7.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	*Appendix A*
2.7.2. a signed statement of independence by the specialist;	*Appendix B*
2.7.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	*Section 2 and Appendix C*
2.7.4. the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;	*Section 2*
2.7.5. a description of the assumptions made, any uncertainties or gaps in knowledge or data;	*Section 2.2*
2.7.6. the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;	*Sections 4 and 11.2*
2.7.7. additional environmental impacts expected from the proposed development;	*Sections 4, 6 and 7*
2.7.8. any direct, indirect and cumulative impacts of the proposed development on site;	*Sections 6 and 7*
2.7.9. the degree to which impacts and risks can be mitigated;	*Section 7*
2.7.10. the degree to which the impacts and risks can be reversed;	*Section 7*
2.7.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	*Section 7*
2.7.12. a suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies;	*Sections 4.3.2 and 11.2*

Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity	***Section where this has been addressed in the Specialist Report***
2.7.13. proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr);	*Sections 7 and 10*
2.7.14. a motivation must be provided if there were development footprints identified as per paragraph 2.4 above that were identified as having a "low" aquatic biodiversity sensitivity and that were not considered appropriate;	*Not Applicable – the PV sites fall outside of the sensitive areas.*
2.7.15. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not; and	*Section 11.1*
2.7.16. any conditions to which this statement is subjected.	*Section 11.2*
2.8. The findings of the Aquatic Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, that are to be included in the EMPr.	*Sections 7 and 10 of this report include mitigation and monitoring measures. These are to be included and incorporated into the BA Report.*
2.9. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	*Appendix B of this report. This report is included as an appendix to the BA Report.*