Scoping and Environmental Impact Assessment: Third phase 400MW solar Photo-Voltaic (PV) plant, Northern Cape.

Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification

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De Aar Solar PV Plant Phase 3: Environmental Impact Assessment (S&EIA) for a 400 MW Solar PV facility in the Northern Cape.

Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report

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Executive Summary

The project is undertaking a Scoping and Environmental Impact Assessment (S&EIA) for a 400 MW Solar PV facility in the Northern Cape.

This Specialist Study will be focused on the Aquatic and Riparian Ecology and an Environmental Evaluation at the Solar PV Facility. The assessment objectives for the Specialist Study will address the following services/specialist components:

(1) identifying, describing (assessing) and delineating any wetlands, pans and/or watercourses in the study area,
(2) demarcating appropriate ecological buffers along adjacent wetlands, pans and/or watercourses, and
(3) undertaking a Risk Assessment of certain activities associated with the development (to determine if S21(c) and (i) water uses can be authorised under a General Authorisation), specifically:

- A total of six (6) road crossings will be required to access the different PV Blocks of the Solar PV facility, which is fragmented by the watercourse. (Figure 30),
- Erecting a perimeter fence (and creating a fire-break road) that may cross a watercourse in two potential locations,
- Developing a solar PV system within 100m of a watercourse and/or 500 m from a wetland or pan (including the possible wetland system near Corner C),
- Installing underground water pipes, aboveground storage tanks and a deionization plant in proximity to both boreholes (with pans), and
- Three potential watercourse crossings for underground cables (used to take electricity from the field transformers to the on-site substation).

Prior to commencing with a specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration were identified by the screening tool and have been confirmed by undertaking a site sensitivity verification (Protocol 2). The outcome of the site sensitivity verification relating to the level and/or need for specialist assessments identified in the screening tool with regards to Aquatic Biodiversity: Environmental Sensitivity - Very High.

The De Aar 400 MW Solar PV drainage systems are predominantly classified as ephemeral, which means that the stream flows briefly in direct response to precipitation in the immediate vicinity, and the channel is at all times above the ground-water reservoir. These ephemeral tributaries are tributaries of the Brak River and considered to be in a largely natural ecological state.

All the small tributaries in the area are ephemeral or intermittent and with no clear associated vegetation. These systems have a far less predictable flow regime compared to perennial or seasonal rivers, and are frequently dry for long periods in arid regions.

The ephemeral drainage system of the De Aar Phase 3 Solar PV facility project area consists of one major ephemeral drainage channel which are fed by upstream catchment areas beyond the project area fence line. Three smaller tributaries are feeding into the main drainage line in the project area.

The overall Ecostatus of the Solar PV Facility (Phase 3) drainage line matches a Category B (Largely natural with few modifications). The table below provides the available parameters that were instrumental to establish the Ecostatus of the Solar PV Facility (Phase 3) drainage line.

Parameter	Score %	Category	Description
VEGRAI SASS Habitat	93.9 3.2 55.0	A C B	Natural Fair Poor
Ecostatus		B	Largely natural with few modifications

According to the initial buffer requirement, it becomes apparent that, to protect the main drainage line of the Phase 3 project area in its current condition from any degradation, a buffer of 20 m wide on both sides of the drainage line delineation is required during the construction and operational phases. This buffer width is obtained whenever the following mitigation measures are applied to the model:

- the management of surface water runoff,
- erosion monitoring,

as well as constraints regarding the clearing of vegetation within these areas.

The delineated ephemeral drainage line in the project area has been identified as having the conservation importance relating to the Freshwater Ecosystem Protected Areas (FEPA) category. The entire sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach.

Due to the gentle slope of the terrain where headwater drainage systems originate, downpours will dissipate downhill without forming any discernible wetland habitats. Thus, the very short-lived nature of the headwater drainage systems, the EISC of this biotope is classified as “Low”.

Biotopes with “Moderate**”** and “Low” ecological and sensitivity classes were not considered as no-go areas. These biotopes included the headwater drainage systems which transport surface flows during high rainfall events and present short-lived aquatic systems.

Even that they are not considered as no-go areas, development within these areas, such as placement of solar panels, power line pylons and other linear infrastructure, shall be subjected to strict mitigation measures. This will include the management of surface water runoff, erosion monitoring, as well as constraints regarding the clearing of vegetation within these areas.

The ecological importance and sensitivity of the large ephemeral drainage systems and associated alluvial floodplains, are being classified as “High”. Water resource types with a “High” EISC will be considered as no go areas for development, except linear infrastructure crossings, specifically access roads, underground cables and pipelines, and overhead powerlines. The no-go areas will include the buffers of the drainage areas in the project footprint.

According to the Specialist TOR, a GN509 Risk Assessment was completed for the study. Infrastructural components of the Solar PV Facility (Phase 3) project were described and assessed. Special mitigation and management measures were determined and the current existing best practice management described by the risk assessment report. The following main activities were identified and assessed:

The impacts of activities and infrastructure relating to the following:

- Linear structures
    - Transmission pylons (overhead powerline)
    - Road crossings
    - Cabling routes
    - Pipe crossings
    - Perimeter fence (with fire-break road).

- Boreholes
- PV system (solar panel arrays, inverters, and field transformers)
- Pollution potential at storing and disposal facilities.
- Alien invasive plants.

During the risk assessment, 16 potential impacts were identified. For these potential impacts identified during the risk assessment, all were assigned mitigation measures that reversed potential impacts to “Low” risk rating posed to the resource quality of the watercourse. No impact was identified to cause loss of irreplaceable resources.

Apart from farms practicing agriculture, there are no other PV developments present in the small catchment further upstream. The isolation of the Phase 3 Solar PV facility project catchment protects the project drainage lines from any significant development further upstream.

If any cumulative impacts on the receiving drainage systems have been identified from other PV developments within 30 km radius of the Phase 3 Solar PV development, this will not impact on the Phase 3 Solar PV facility and the proposed project is not expected to add to any cumulative impacts further downstream.

By implementing all the mitigation measures and managing the system on a continuous basis as prescribed by the Risk Assessment, all the impacts will be addressed to a satisfactory level. Therefore, it is proposed that the project should be authorised with the provision that the mitigation measures prescribed in this document, where applicable, are included in the EMPr

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d. Risks associated with water uses.

2.5.3.4 Impact on the functioning of the aquatic feature stated

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c. Change in the hydrogeomorphic typing.
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(b) Streamflow regulation:
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2.5.4 How will the proposed development impact community composition.

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2.8.1 Details of the Specialist

2.8.1.1 Contact details of the specialist
2.8.1.2 Field of expertise
2.8.1.3 Curriculum vitae

2.8.2 A signed statement of independence by the specialist

2.8.3 A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment

2.8.4 Methodology

2.8.5 A description of the assumptions made and any uncertainties or gaps in knowledge or data

2.8.6 The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.

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2.7.8 Any direct, indirect and cumulative impacts of the proposed development on site.

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2.8.13 The proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).

2.8.14 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.

2.8.15 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.

2.8.16 Any conditions to which this statement is subjected.

References and Appendices

Abbreviations

°C	Degrees Celsius
AQV	Aquatic vegetation
Approx	Approximately
ASPT	Average Score per Taxon
BGIS	Biodiversity Geographic Information System
CAD	Computer-aided design
CBA	Critical Biodiversity Areas
Cell	Cell phone
DEA	Department of Environmental Affairs (National)
DFFE	Department of Forestry, Fisheries and the Environment
Dr	Doctor
DWA	Department of Water Affairs (post-2010)
DWAF	Department of Water Affairs and Forestry (pre-2010)
DWS	Department of Water and Sanitation (since May 2014))
E	East
e.g.	For example
EC	Ecological Category
ECO	Environmental Control Officer
Ecoclassification	Ecological classification
EcoStatus	Ecological Status
EEC	Ecoleges Environmental Consultants
EFR	Environmental Flow Requirements
EI	Ecological Importance
EIA	Environmental Impact Assessment
EISC	Ecological Importance and Sensitivity Category
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESKOM	Electricity Supply Commission
EWR	Environmental Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
FRAI	Fish Response Assessment Index
GIS	Geographic Information System
Gov	Government
GPS	Global Positioning System
GSM	Gravel, sand and mud
GW	Gigawatt
ha	Hectares
HCR	Habitat Cover Ratings
HGM	Hydro-Geomorphic
HQI	Habitat Quality Index
IHAS	Integrated Habitat Assessment System
KML	Keyhole Markup Language
KMZ	Keyhole Markup language Zipped
KNP	Kruger National Park
kWh/m^2	Kilowatt-hour per square meter
kV	Kilovolt
LDV	Light delivery vehicle
LUDS	Land-Use Decision Support Tool
m	Meter
MCDA	Multi Criteria Decision Analysis
MIRAI	Macro-invertebrate Response Assessment Index

mm	Millimetre
MV	Marginal vegetation
MW	Megawatt
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
No	Number
NP	National Park
NWA	National Water Act
PES	Present Ecological State
PESEIS	Present Ecological State, Ecological Importance and Ecological Sensitivity
PhD	Doctor of Philosophy
PO Box	Post office box
Pr. Sci. Nat	Natural Scientific Professionals
Pty (Ltd)	Proprietary limited company
PV	Photovoltaic
REC	Recommended Ecological Category
Reg. no.	Registration number
REIPPP	Renewable Energy Independent Power Producers Procurement
RHP	River Health Programme
RMIPPP	Risk Mitigation IPP Procurement Programme
RQO	Resource Quality Objectives
S	South
SA	South Africa
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SASS5	South African Scoring System version 5
S&EIA	Scoping and Environmental Impact Assessment
SHI	Site Fish Habitat Integrity Index
SIC	Stones in current
SIP	Strategic Infrastructure Project
SOOC	Stones out of current
SQR	Sub-quaternary reach
SSV	Site Sensitivity Verification
VEGRAI	Riparian Vegetation Response Assessment Index
WRC	Water Research Commission

1. Introduction

1.1 Background to the project

In 2016 Ecoleges undertook a S&EIA for the development of a 225 MW Solar PV facility between Hanover and De Aar in the Northern Cape. Three alternative footprints (PV01, PV02, PV03) were investigated during the assessment process. The central footprint (PV02) was identified as the preferred option because of its lower environmental impact and proximity to an existing 400kV Eskom powerline when compared with PV01 and PV03. The National Department of Environmental Affairs granted an environmental authorisation (DEA Reference: 14/12/16/3/3/2/998) on 16th April 2018. The activity must commence on the PV02 footprint within a period of five years from the date of issue.

An amendment to increase the capacity (not the footprint) of the facility to 300 MW due to technological advancements in solar photovoltaic efficiency and electrical output was granted on 24th November 2020.

A second amendment was granted in 2021 for the inclusion of containerised lithium-ion battery Storage and dual-fuel backup generators with associated fuel storage.

The competent authority was the National Department of Environmental Affairs because the application was part of the REIPPP or RMIPPP BID rounds, which formed part of a Strategic Infrastructure Project (SIP) as described in the National Development Plan, 2011. Soventix SA (Pty) Ltd was an unsuccessful bidder. However, the applicant has since partnered with another company, Solar Africa, with 1.5 GW in private renewable energy offtake agreements, making it economically feasible to develop two more 300 and 400 MW facilities (Phases 2 and 3, respectively).

Soventix will therefore apply for an environmental authorisation to develop an additional 300MW on the PV03 footprint (Phase 2) that was considered during the initial S&EIA. It is proposed to connect this second phase to the substation that forms part of the authorised facility on PV02.

Unlike footprints PV02 and PV03, Phase 3 was not assessed during the S&EIA for Phase 1. Phase 3 involves the development of a third 400 MW Solar Photovoltaic (PV) facility on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C.

The two additional Solar PV facilities (Phase 2 and 3) will feed into the authorised sub-station on the PV02 footprint (Phase 1). Consequently, the expansion of the substation footprint will require a third (Part 2) amendment to the existing environmental authorisation (DEA Reference: 14/12/16/3/3/2/998).

Phase 3 Solar PV facilities need to be connected to an on-site substation on Phase 2 using overhead powerlines (and an existing road network). Depending on the width of the watercourse, pylons may need to be placed inside a watercourse, and some existing road crossings may need to be widened.

The principal aims of an aquatic assessment will be to determine how this development (and its separate elements, e.g., solar PV panels, pylons and road crossings) will impact on the aquatic ecological integrity of the area, demarcate appropriate ecological buffers along adjacent watercourses, and undertake a Risk Assessment of existing road crossings and potential transmission corridors (to determine if S21(c) and (i) water uses can be authorised under a General Authorisation).

1.2 Specialist Terms of Reference

This project proposal is prepared for a Specialist Study: Scoping and Environmental Impact Assessment (S&EIA) "The development of a 400 MW Solar Photovoltaic (PV) facility and associated infrastructure on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C, between De Aar and Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa".

The principal aims of an aquatic assessment will be to determine how this development (and its separate elements, e.g., solar PV panels, pylons and road crossings) will impact on the aquatic ecological integrity of the area (particularly any important/sensitive aquatic invertebrate populations) demarcate appropriate ecological buffers along adjacent watercourses, and undertake a Risk Assessment of existing road crossings and potential transmission corridors (to determine if S21(c) and (i) water uses can be authorised under a General Authorisation).

Specialist Assessment and Minimum Report Content Requirements

Perform the Specialist Assessment according to the criteria provided by the "Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity" (Appendix D: Aquatic Biodiversity Protocol (GN No. 320 dated 20th March 2020)).

Write up the findings of the specialist assessment in an Aquatic Biodiversity Specialist Assessment Report or Aquatic Biodiversity Compliance Statement that contains the minimum report content requirements prescribed in the same protocol. Ensure the assessment and reporting meets all the requirements of the relevant protocol.

Water Use Authorisations for Section 21 (a), (b), (c), (i) and (g) water uses are also required, include the following technical information in your Aquatic Assessment as per the Water Use License & Appeals Regulations (2017):

- Perform a Present Ecological Study (PES) according to the "Supplementary Water Use Information Section 21(c) and (i) Water Uses (DW781suppl, DW775suppl, Edition 14 August 2009)").

- Undertake a Risk Assessment for S21(c) and (i) water uses associated with the potential transmission corridors and existing road crossings that may need to be widened.

- Generate a Wetland Delineation Report.

Objectives

- Determine how the solar PV panels will impact on the aquatic ecological integrity of the area, particularly any important/sensitive aquatic invertebrate populations.
- Determine how the construction of pylons within a watercourse will impact on the aquatic ecological integrity of the area.

- Determine how the widening of existing road crossings will impact on the aquatic ecological integrity of the area.
- Delineate the extent of adjacent watercourses, that is the edge of the riparian zone (or macro channel bank) or in the case of wetlands or pans, the outer edge of the temporary zone.
- Demarcate appropriate ecological buffers along adjacent watercourses.
- Undertake a Risk Assessment for S21(c) and (i) water uses associated with the potential transmission corridors.
- Undertake a Risk Assessment for S21(c) and (i) water uses associated with the existing road crossings that may need to be widened.
- Identify and quantify the perceived impacts and propose mitigations to be included in the EMPr. The potential impacts and recommended mitigations must be identified for the planning and design, pre-construction, construction, and post-construction (e.g., monitoring rehabilitation of the construction site) only.
- The impacts must be assessed and evaluated according to the EIA Regulations, 2014 as amended (https://cer.org.za/wp-content/ uploads/1999/01/ EIA-Regulations.pdf) or the Impact Assessment Criteria and Matrix to be supplied upon appointment.
- Undertake a cumulative impact assessment of the Solar PV facility if there are other similar facilities within a 30km radius of the proposed development site. Information on the location of renewable energy developments.

Screening Assessment

PHASE 1: Site Sensitivity Verification and Minimum Report Content Requirements

- Perform the **Site Sensitivity Verification** according to the criteria provided by the "Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity" (Appendix D: Aquatic Biodiversity Protocol (GN No. 320 dated 20th March 2020)).
- Record the outcome of the Site Sensitivity Verification in the form of a report according to the minimum report content requirements in the same protocol.
- Ensure the assessment and reporting meets all the requirements of the relevant protocol.

Aquatic Biodiversity Specialist Assessment

PHASE 2: Specialist Assessment and Minimum Report Content Requirements

- Perform the Specialist Assessment according to the criteria provided by the "Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity" (Appendix D: Aquatic Biodiversity Protocol (GN No. 320 dated 20th March 2020)).
- Write up the findings of the specialist assessment in an Aquatic Biodiversity Specialist Assessment Report or Aquatic Biodiversity Compliance Statement that contains the minimum report content requirements prescribed in the same protocol.
- Ensure your assessment and reporting meets all the requirements of the relevant protocol.
- Perform a Present Ecological Study (PES) according to the "Supplementary Water Use Information Section 21(c) and (i) Water Uses (DW781suppl, DW775suppl, Edition 14 August 2009)").
- Prepare a Wetland Delineation Report for S21(c) and (i) water uses.

- Undertake a Risk Assessment.

Special note: The status quo of the wetland/watercourse is to be determined using established and accepted survey methods including the South African Scoring System version 5 (SASS5) and the Fish Response Assessment Index (FRAI) (Kleynhans 1999; Kleynhans et al. 2005) for aquatic invertebrates and fish communities, respectively).

Impact Assessment

- Assess the impacts for each of the proposed development alternatives including the no-go option, which will be identified throughout the process.
- Consider the potential negative and positive impacts that would result from the proposed alternatives and include mitigation measures to reduce those negative impacts that cannot be avoided, as well as measures to enhance the positive impacts.
- The potential impacts and recommended mitigations must be identified for the planning and design, pre-construction and construction.

Mapping

All sensitivity maps indicating, for example a delineated edge, no-go area or buffer zone, will be provided as KMZ, KML or geo-referenced CAD files

1.3 Legal considerations

Activities that require basic assessment

South Africa experiences some of the highest levels of solar radiation in the world (between 4.5 and 6.5kWh/m^2) and therefore, possesses considerable solar resource potential for solar photovoltaic generation. The following is an abstract from a document of the Department of National Environmental Management Act (107/1998), Environmental Affairs: Environmental Impact Assessment Guideline for Renewable Projects.

"Photovoltaic (PV) systems are widely applied in South Africa for powering professional niche applications and where PV is well established as the best practical option. The potential use and applications include electricity (photovoltaic and solar thermal) generation relating to large-scale grid-connected applications.

The potential environmental impacts associated with solar power (land use and habitat loss, water use, and the use of hazardous materials in manufacturing) vary greatly depending on the technology to be used. In broad terms the range of potential impacts could include:

Land use: Depending on their location, larger utility-scale solar facilities can raise concerns about land degradation and habitat loss. Total land area requirements estimated for utility-scale PV systems range from 1.5 to 4 ha per megawatt.

Potential mitigation measures for solar energy projects include but are not limited to:

Conduct pre-disturbance surveys as appropriate to assess the presence of sensitive areas, fauna, flora and sensitive habitats;

- Utilise existing roads and servitudes as much as possible to minimise project footprint;
- Site projects to avoid construction too near pristine natural areas and communities;
- Develop and implement a storm water management plan;
- Develop and implement waste management plan; and
- Re-vegetation with appropriate indigenous species to prevent dust and erosion, as well as establishment of alien species

Activities that require basic assessment

Technologies of Solar

(xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs – (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; -

The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for – (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan

The expansion of facilities or structures for the generation of electricity from a renewable resource where–

(i) the electricity output will be increased by 10 megawatts or more, excluding where such expansion takes place on the original development footprint; or
(ii) regardless the increased output of the facility, the development footprint will be expanded by 1 hectare or more; excluding where such expansion of facilities or structures is for photovoltaic installations and occurs within an urban area.

The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within an urban area.”

Environmental authorisation

The proposed development requires an environmental authorisation for the following listed (or specified) activities:

LN 1, Listed Activity 11 The development of facilities or infrastructure for the transmission and distribution of electricity - (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts;

LN 1, Listed Activity 12 The development of - (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs - (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;

LN 1, Listed Activity 19 The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;

LN 1, Listed Activity 27 The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation,

LN 1, Listed Activity 28 Residential, mixed, retail, commercial, industrial, or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;

LN 2, Listed Activity 2 The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more,

LN 3, Listed Activity 4 The development of a road wider than 4 metres with a reserve less than 13,5 metres.

LN3, Listed Activity 12 (replaces LA27 of LN1) The clearance of an area of 300 square metres or more of indigenous vegetation LN3, Listed Activity 14 (replaces LA12 of LN1) The development of – (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs - (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;

LN3, Listed Activity 18 (in combination with or replaces LA4 of LN3) The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.

Kindly note that the scope of the application, assessment, and authorisation as per the wording of the listed (or specified) activity(ies) does not include operational aspects. As such, operational aspects must not be assessed and mitigated. None the less a person can still make recommendations to the design that will effectively mitigate any perceived operational impacts

1.4 Plan of study

Project Brief

The project is undertaking a Scoping and Environmental Impact Assessment (S&EIA) for a 400 MW Solar PV facility in the Northern Cape.

The plan of study is to undertake a desktop analysis and compile a high level Scoping Report describing the study area, assessment objectives, proposed methodologies to achieve those objectives, and where applicable, the anticipated timeframe to complete the entire assessment, a breakdown of the times required to complete the different phases of the assessment, identification of critical milestones (required for continuation to the next phase in the assessment) and the optimum times (of the day and of the year) to undertake your assessment.

Study area

The development of a 400 MW Solar Photovoltaic (PV) facility is proposed on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C.

The size of the proposed development footprint for the 400 MW solar PV facility is approximately 600 ha. This area includes four interconnected 100 MW solar PV plants (150ha each), with associated infrastructure. The PV system will be connected via distribution lines to the authorised substation on Phase 1. The substation ties into the existing ESKOM 400KV overhead powerlines. Existing roads will be used for main access, which may need to be enlarged to allow large equipment to access the site during construction.

The study area lies near the eastern edge of the Nama Karoo biome and is mapped according to the national vegetation types (Mucina and Rutherford, 2006) as being of the vegetation type Northern Upper Karoo which is considered to be least threatened.

The Aquatic Biodiversity Sensitivity of the study area is “Very High” owing to the presence of a “Strategic Water Source Area” as well as “Wetlands and Estuaries” (Screening Report compiled by Ecoleges Environmental Consultants and dated 02 February 2022).

The main water feature in the area is tributaries to the Brak River, a seasonal tributary within the Orange River System which flows in an arc from south-east to north-west, eventually feeding into the Orange River basin. The ephemeral drainage line running through the project area is an unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the Project Area.

The river flows to the north of the study area with a number of its tributaries crossing the area as it flows in a northerly direction. All the small tributaries in the area are ephemeral or intermittent and are discernible only as slightly shallow depressions with no clear associated vegetation and slightly clayey soils.

Assessment objectives

The principal aims of an aquatic assessment will be to determine how the development (and its separate elements, e.g., solar PV panels, pylons and road crossings) will impact on the aquatic ecological integrity of the area (particularly any important/sensitive aquatic invertebrate populations) by:

(1) identifying, describing (assessing) and delineating any wetlands, pans and/or watercourses in the study area,

(2) demarcating appropriate ecological buffers along adjacent wetlands, pans and/or watercourses, and

(3) undertaking a Risk Assessment of certain activities associated with the development (to determine if S21(c) and (i) water uses can be authorised under a General Authorisation), specifically:

- A total of six (6) road crossings will be required to access the different PV Blocks of the Solar PV facility, which is fragmented by the watercourse. (Figure 30),
- Erecting a perimeter fence (and creating a fire-break road) that may cross a watercourse in two potential locations,
- Developing a solar PV system within 100m of a watercourse and/or 500 m from a wetland or pan (including the possible wetland system near Corner C),
- Installing underground water pipes, aboveground storage tanks and a deionization plant in proximity to both boreholes (with pans), and
- Three potential watercourse crossings for underground cables (used to take electricity from the field transformers to the on-site substation).

Proposed methodologies

Riparian Delineation & Scientific Buffer determination**:** Riparian delineation and habitat evaluation was done according to the DWAF Guidelines (2005) and DWAF updated manual (2008).

Scientific Buffer determination**:** Determination of Buffer zone requirements for the drainage system: Excel based Buffer Zone Tools (Macfarlane and Bredin, 2017).

Site Specific historic and current PES & EIS relating to the following characteristics:

Assess the ecological status, importance and sensitivity of the site as required for section 21 (c) and (i) water uses by the Department of Water and Sanitation (DWS):

- EcoClassification and EcoStatus Determination are used to define Ecological importance and sensitivity (WRC Report No. TT 377-08).
- Present Ecological State (PES): The PESEIS data from the Department of Water and Sanitation Desktop PESEIS assessment (DWS, 2014), supplies most of the current status information of the relevant sub-quaternary river reaches (SQRs) for South Africa.
- Assessment of ecological importance and sensitivity (Kleynhans et al - DWAF, 1999).

Flow and sediment regimes: Flow and sediment regimes at appropriate flows will be obtained from existing DWS data base and other relevant studies (DWA, 2010),

Vegetation: Riparian habitat surveys (Riparian Vegetation Index — VEGRAI): The index is based on the interpretation of the influence of riparian vegetation structure and function on in-stream habitat.

Riparian and in-stream Habitat: The habitat indices to be used in this survey are the Invertebrate Habitat Assessment System (IHAS) and the Habitat Quality Index (HQI). Sites will be evaluated according to the Index of Habitat Integrity (IHI) model. For the fish section the Habitat Cover Ratings (HCR) and Site Fish Habitat Integrity Index (SHI) were also applied.

Biota - Aquatic surveys:

- Aquatic habitat assessments
- Macro-invertebrates - SASS5 for invertebrates
- Fish - FRAI-based surveys

Water quality in relation to the flow regime, including the following characteristics of the water:

- Biological: Macro Invertebrate Response Assessment Index (MIRAI)

Impact/Risk Assessment: The Risk Assessment will be done in accordance with the Risk Matrix (Based on DWS 2014 publication: Section 21 (c) and (i) water use Risk Assessment Protocol and as contained as Appendix A in GN509 of 26 August 2016) and is to be carried out by considering the risk rating of the proposed project activities after implementing mitigation measures.

A cumulative impact assessment of the proposed development shall also be performed, by comparing the Department's Renewable Energy EIA Application Data (https://egis.environment.gov.za/renewable_energy) with the latest Google Earth satellite imagery to identify and assess only those Solar PV facilities that have been developed within 30km of this development (Phase 3).

Mitigation and/or management measures: A proactive approach to risk-based water use authorisation requires that, wherever possible, impacts should be addressed with suitable mitigation measures that should aim to render such impacts negligible.

Anticipated timeframe to complete the entire assessment

The assessment of the following activities will determine the anticipated timeframe to complete the entire assessment:

- Assessing the presence and sensitivity of the local aquatic ecology of:
  - Wetlands/pans
  - Drainage lines
- Assessing the impacts of activities and infrastructure relating to the following:
  - PV system (solar panel arrays, inverters, and field transformers)
  - On-site substation
  - Transmission pylons (overhead powerline)
  - Road crossings
  - Boreholes
  - Pipeline and cable routes
  - Construction camp (to be converted into operational area)
  - Borrow pit, and
  - Perimeter fence (with fire-break road).

Assessing these aspects in a project area of approximately 600 ha will be completed in a period of 7 days. All of these aspects will be considered in the Risk Assessment and form part of the Impact Study.

Identification of critical milestones

As mentioned in the following section (optimum times), the best time to do the study will be when there is surface water in the system. Since the wet season is approaching, the sooner the better. After the surveys the report will be completed in at least a 2 months period.

Optimum times (of the day and of the year) to undertake your assessment

The best time to do the study will be when there is surface water in the system. However, this is an ephemeral system with erratic flows and presence of surface water is very seldom present. Therefore, surveys can be done whenever vegetation is still with leaves, thus from late spring to early fall.

Figure 1: The layout of the De Aar Phase 3 project road crossings between the solar PV panel arrays.

1a. Corridor to Road Crossing No. 1
1b. Corridor to Road Crossing No. 2
1c. Corridor to Road Crossing No. 3
1d. Corridor to Road Crossing No. 4
1e. Corridor to Road Crossing No. 5
1f. Corridor to Road Crossing No. 6

Figure 2: The layout of the De Aar Phase 3 project linear structures corridors.

2a. Corridor for Underground Cable Crossing No. 1
2b. Corridor for Underground Cable Crossing No. 2
2c. Corridor for Underground Cable Crossing No. 3
2d. Pipeline corridor to borehole No. 4
2e. Pipeline corridor to borehole No. 5
2f. Pipeline corridor to borehole No. T1 and T2

Figure 3: The layout of the De Aar Phase 3 proposed project activities.

3a. Distribution Line Crossing.
3b. Construction Camp (Laydown Area).
3c. Eskom 132kV Powerline near Corner A.
3d. Proposed Area for a Borrow Pits.

1.5 Aquatic Biodiversity Protocol

This section concerns the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity (hereafter referred to as: Aquatic Biodiversity Protocol).

This protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on aquatic1 biodiversity for activities requiring environmental authorisation (Gov Gazette). In this Special Assessment Report, the corresponding numbering in the protocol will be added wherever it is relevant, for an example, this paragraph was obtained from Protocol 1 (1. Scope).

The assessment and reporting requirements of this protocol are associated with a level of environmental sensitivity identified by the national web based environmental screening tool (screening tool) (Protocol 1).

1.5.1 Screening Report for an Environmental Authorization as required by the 2014 EIA regulations – proposed site environmental sensitivity.

The National Web based Environmental Screening Tool allows for the generating of a Screening Report referred to in Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended whereby a Screening Report is required to accompany any application for Environmental Authorisation.

During the environmental authorisation process for Phase 3 of the De Aar Solar PV project, Ecoleges Environmental Consultants (EEC) undertook a Screening Assessment of the project. By using the National web-based Environmental Screening Tool hosted by the Department (DFFE) on their website (www.environment.gov.za), the Screening Report (Ecoleges Environmental Consultants, 2022) identified certain specialist assessments based on the selected ‘application classification’.

A Screening Assessment was undertaken, and the Screening Report was generated on the 2 February 2022, using the application classification “Utilities Infrastructure| Electricity| Generation| Renewable| Solar| PV.”

Application classification “Utilities Infrastructure.”

EIA Reference number: S&EIA
Project name: De Aar Phase 3
Project title: Solar PV plant
Applicant: Soventix SA Pty Ltd
Compiler: Ecoleges Environmental Consultants

An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of “very high sensitivity” for aquatic biodiversity, must submit an Aquatic Biodiversity Specialist Assessment (**Table 1**).

Figure 4: The proposed De Aar Phase 3 project area in the Brak River catchment and which is rated as "Very High" sensitivity (Environmental Screening Tool, 2022).

Table 1: The Aquatic Biodiversity Impact Assessment identified in the Screening Report (Figure 4).

Theme	Sensitivity Rating	Reason for Sensitivity Rating		Type of Assessment	TOR
		Sensitivity	Features		
Aquatic Biodiversity	Very High	Very high	Strategic water source area	Aquatic Biodiversity Specialist Assessment	Gazetted Protocol (GN No.320)
			Wetlands and Estuaries		

EEC subsequently undertook a Site Sensitivity Verification (Ecoleges Environmental Consultants, 2022), which involved a desktop analysis and site inspection, to verify the land use and environmental sensitivity (rating) designated by the Screening Tool.

1.5.2 Site Sensitivity Verification and Minimum Report Content Requirements

Prior to commencing with a specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration identified by the screening tool must be confirmed by undertaking a **site sensitivity verification** (Protocol 2)**.**

The Site Sensitivity Verification was undertaken by Ecoleges Environmental Consultants (EEC) during February 2022 and written up as: “Site Assessment SSV Form_De Aar Phase 3” The report will be made available as required by this protocol (Ecoleges Environmental Consultants (EEC), 2022).

They motivated for a Very High sensitivity at both sites and support the need for an Aquatic Biodiversity Specialist Assessment.

Table 2: The outcome of the site sensitivity verification relating to the level and/or need for specialist assessments identified in the screening tool with regards to Aquatic Biodiversity.

Environmental Theme	Environmental Sensitivity	Feature	Identified Specialist Assessments	Outcome
Aquatic Biodiversity	Very High	Strategic water source area	Aquatic Biodiversity Impact Assessment	Confirmed: Aquatic Biodiversity Specialist Assessment

Motivation for Sensitivity Rating (EEC, 2022).

A Very High sensitivity is supported with the requisite Aquatic Biodiversity Impact Assessment including assessing the impacts to the watercourse crossing of the overhead connecting powerlines, additionally the associated Aquatic Risk Assessment will support the registration of Section 21(c) & (i) water uses under General Authorisation of the National Water Act (Act 36 of 1998).

2. Specialist Assessment and minimum report content requirements

Assessment and reporting of impacts on aquatic biodiversity

An applicant intending to undertake an activity identified in the scope of this protocol on a site identified on the screening tool as being of “very high sensitivity” for aquatic biodiversity, must submit an **Aquatic Biodiversity Specialist Assessment** (Screening Report).

The “Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Aquatic Biodiversity” (Appendix D: Aquatic Biodiversity Protocol (GN No. 320 dated 20th March 2020)) will be the proforma used throughout this report (see Table of Contents). Tables 3 and 22 summarises the main minimum report contents requirements.

Table 3:	Specialist assessment Checklist
	Requirements for Specialist Reports: Published in Government Notice No. 320; Government Gazette 43110**;** 20 March 2020
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP), with expertise in the field of aquatic sciences.
2.2	The preferred site within the proposed development footprint.
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.
2.3.2	The threat status of the ecosystem and species as identified by the screening tool
2.3.3	An indication of the national and provincial priority status of the aquatic ecosystem.
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.
	(b) the historic ecological condition (reference) as well as present ecological state of rivers (in-stream, riparian and floodplain habitat).
2.4	Identify alternative development footprints.
2.5	Assessment of the potential impacts of the proposed development:
2.5.1	Maintaining the priority aquatic ecosystem.
2.5.2	Maintaining the resource quality objectives.
2.5.3	Impact on fixed and dynamic ecological processes.
	a. Impacts on hydrological functioning.
	b. Sediment regime.
	c. Modification in relation to the overall aquatic ecosystem.
	d. Risks associated with water uses.
2.5.4	Impact on the functioning of the aquatic feature:
	a. Base flows.
	b. Quantity of water.
	c. Change in the hydrogeomorphic typing.
	d. Quality of water.

Table 3:	Specialist assessment Checklist
	e. Ecological connectivity.
	f. Loss or degradation of all or part of any unique or important features.
2.5.5	Impact on key ecosystems regulating and supporting services especially:
	(a) flood attenuation;
	(b) streamflow regulation;
	(c) sediment trapping;
	(d) phosphate assimilation;
	(e) nitrate assimilation;
	(f) toxicant assimilation;
	(g) erosion control;
	(h) carbon storage.
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?
2.6	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered?

2.1 Registered Specialist

The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP), with expertise in the field of aquatic sciences.

Dr Andrew Deacon is registered with the South African Council for Natural Scientific Professions (SACNASP). Registration number: 116951.

2.2 The preferred site within the proposed development footprint.

No alternatives were considered.

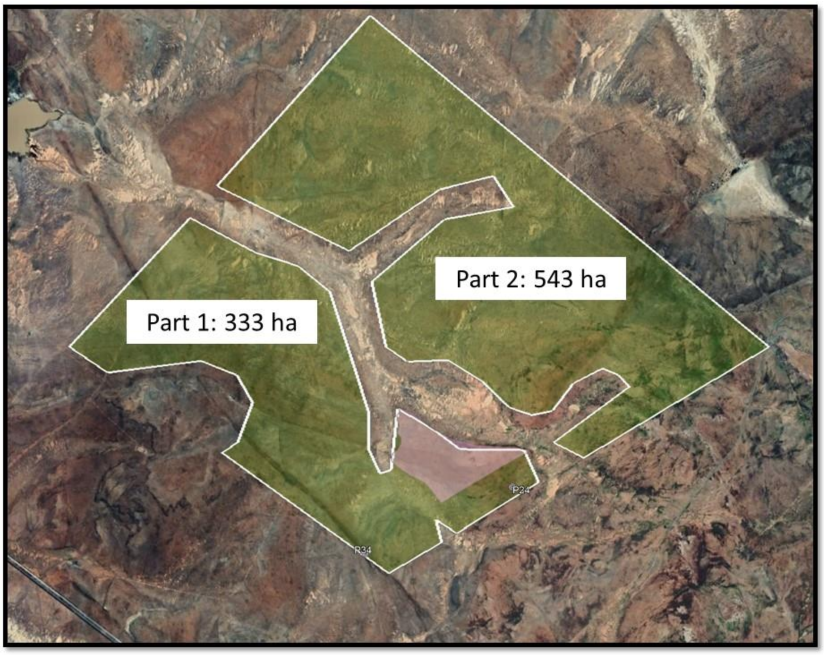

Figure 5: Locations of the Phase 3 Solar preferred sites illustrated.

2.3 Baseline description

According to the Aquatic Biodiversity Protocol, the assessment must provide a baseline description of the site which includes, as a minimum, the following aspects: 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.

Landscape Features of the project area:

The study area lies near the eastern edge of the Nama Karoo biome, and is mapped according to the national vegetation types (Mucina and Rutherford, 2006) as being of the vegetation type Northern Upper Karoo (NKu 3) (Figure 6) which is considered to be least threatened.

The area is characterised by wide open plains with relatively flat topography typical of the Central Karoo. The site is relatively flat (average slope gradient is less than 10% from the east to the west) with some isolated hills and low rocky ridges in the east and north-east of the site. There are a few shallow drainage lines present on site.

The vegetation cover is generally dominated by sparse dwarf karroid scrub and tufted grass with bare patches of sand in between. Portions of the area are in a disturbed condition, most likely as a result of livestock grazing.

The shrubland is dominated by dwarf karoo shrubs, grasses and low trees. The topography of the region is generally flat, characterised by wide plains and open spaces. It is evident that the Vegetation Map (Figure 6) provides an oversimplification of the vegetation of the site and there are at least three distinct vegetation types present on the site.

The open plains of the site correspond with the Northern Upper Karoo vegetation type, but the dolerite hills and koppies present have vegetation more closely allied with Upper Karoo Hardeveld, while the floodplain of the Brak River is clearly characterised by an azonal vegetation type, allied with Upper Gariep Alluvial Vegetation (Ecoleges Environmental Consultants, 2017). The floodplain has however been heavily modified by human activity with a lot of diversion walls and historical disturbance present.

Along the Brak River the common reed *Phragmites australis* dominates the instream habitat, while there is very little discernible riparian vegetation. The ephemeral streams have no visible aquatic vegetation. *Phragmites australis* reeds grow in the beds of several of the ephemeral rivers.

Geology & Soils

Shales form the underlying geology while Jurassic Karoo Dolerite silts and sheets support this vegetation complex in places. Soils are variable from shallow to deep, red-yellow apedal, freely drained soils to very shallow Glenrosa and Mispah forms.

The dolerite intrusions (dykes and sills) are more resistant to weathering than the sandstones and shales, thus causing the formation of the characteristic Karoo koppies.

Climate:

The climate of the study area can be regarded as warm to hot with a summer rainfall and dry, cold winters. Temperatures vary from an average monthly maximum and minimum of 32.6ºC and 15.4ºC for January to 16.8ºC and 0.3ºC for July, respectively. Temperature ranges are large with lows of -10°C in winter to mid 40°C in summer. The long-term average annual rainfall in this region of the Northern Cape is only 289mm, of which 201 mm (70%) falls from November to April. Frost occurs most years, 30 days on average, between late May and early September.

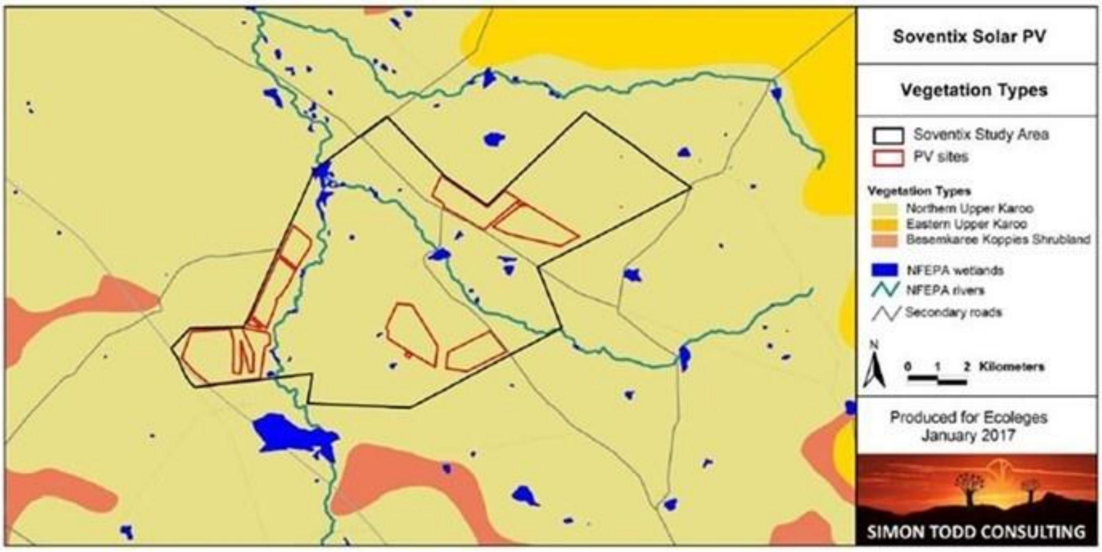

Figure 6. Broad-scale overview of the vegetation in and around the De Aar Solar PV facility project site (Mucina & Rutherford, 2006) (Nel et al. 2011).

Conservation

This is a least threatened unit with a conservation target of 21%. None conserved in statutory conservation areas. About 4% has been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by building of dams. Erosion is moderate (46.2%), very low (32%) and low (20%).

2.3.1 Aquatic ecosystem types

Aquatic surveys and biomonitoring are essential components of ecological risk assessment and aim to measure present biological conditions and trends in the aquatic ecosystem. It attempts to relate the observed variation to changes in available habitat, as dictated by physical system drivers of the system such as water quality, geomorphology, and hydrology (Kleynhans & Louw, 2008).

2.3.1.1 Ecoregion and River Characteristics

The main water feature in the area is the Brak River, a seasonal tributary within the Orange River System. The ephemeral Brak River flows in an arc from south-east to north-west, eventually feeding into the Orange River basin. The Nama Karoo is regarded as a semi-desert and precipitation, which occurs predominantly in the summer months, is unpredictable and sporadic.

The preferred De Aar phase 3 Solar PV facility project site is situated in the catchment of an unnamed tributary of the Brak River, a seasonal tributary within the Orange River System in the Northern Cape Province. The drainage of the site is in a north westerly direction towards the Brak River, and the site is located at an altitude of approximately 1 300 m to 1 340 m above sea level.

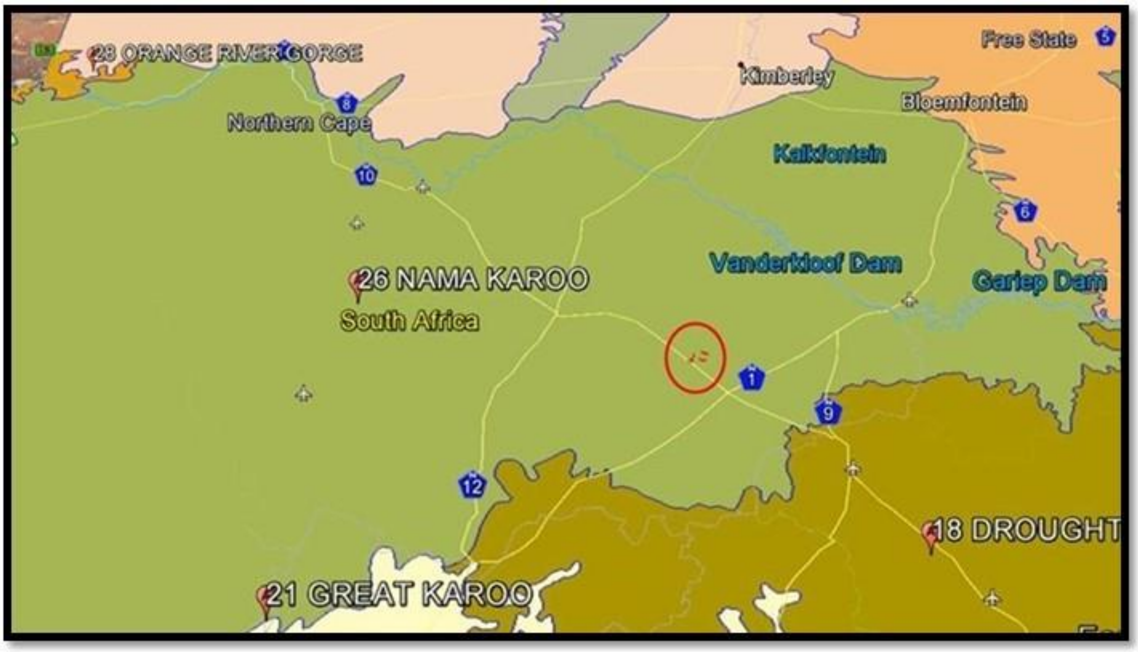

Figure 7: The position of the Project Area (red circle) in the Nama Karoo ecoregion according to the Water Resource Classification System (DWS, 2014).

The Brak River confluence with the Orange River is downstream of the Orange-Vaal confluence, and is a river which flows non-perennially from the south and is in turn fed by the Ongers River, rising in the vicinities of Hanover and Richmond respectively.
The Brak River drains shrubland vegetation in an area with a very low rainfall. As a result, the water within the river system is saline and turbid and seasonally flowing. All the ephemera drainage lines from the Phase 3 Solar PV Facility drains into the Brak River system.

The fauna of the more seasonal and ephemeral ecosystems is not well known, but they have been found to provide aquatic habitat to a diverse array of faunal species that depend on brief periods of inundation for hatching, mating, feeding and refuge. For instance, many frogs of the Karoo region breed in temporary pools associated with watercourses and wetlands, this includes the Karoo Toad *Vandijkophrynus gariepensis* and Karoo Dainty Frog *Cacosternum Karooicum*.

A great number of other organisms are not confined to these temporary systems, but derive crucial benefits from them, like migratory birds and many invertebrates that migrate from permanent to temporary habitats on a regular basis.

Non-perennial (seasonal, intermittent, ephemeral and episodic) rivers are systems which place extreme stress on biota occupying them by exhibiting highly variable chemical and physical attributes. The most important of these are the unpredictable and highly variable flow patterns. These flow patterns determine the habitat available for biota such as aquatic invertebrates.

Habitat available can be diverse during flow but a very low diversity could be available during dry periods. The reduction in flow causes major habitat types (e.g., stones-in-current, marginal vegetation) to dry out and become unavailable to biota. The habitat type mostly available in temporary rivers is pools, in which invertebrates can survive the dry period and from where they can recolonise the stream as flow returns.

2.3.1.2 The ecology of the drainage lines in the De Aar Phase 3 Solar PV facility project area.

During the field surveys on the De Aar Phase 3 Solar PV facility project area, the entire area was explored by vehicle or on foot in order to locate and identify all natural water resources which form part of the regional ecology.

The De Aar Phase 3 Solar PV facility water course

According to the National Water Act (Act No. 36 of 1998), a water resource is defined as “a watercourse, surface water, estuary, or aquifer’. A watercourse in turn refers to:

a) a river or spring;
b) a natural channel in which water flows regularly or intermittently;
c) a wetland, lake or dam into which, or from which, water flows; and
d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse. Reference to a watercourse includes, where relevant, its bed and banks.”

Watercourse classification: Rivers and streams with a Riparian zone

Classifying the De Aar Phase 3 Solar PV facility project watercourses, most of these are with the Rivers and Streams category. According to Ollis et al (2013), a river is a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit.

Using the Classification System for Wetlands and other aquatic Ecosystems in South Africa (Ollis et al, 2013) as reference, the riverine environment of the De Aar Phase 3 Solar PV facility project area drainage lines can be classified as follows: Rivers and streams with a Riparian zone.

The proposed De Aar Phase 3 Solar PV facility project site occurs within the D62D quaternary catchment of the Brak River, in the Nama Karoo Ecoregion of the Orange Water Management Area. The catchment of the study area is drained by a number of its tributaries crossing the area as it flows in a north-westerly direction towards the Brak River.

The regional geomorphology is dominated by flat pediplain areas overlying Dwyka / Ecca shales. Soils are shallow sandy soils that drain well, allowing for the development of broad alluvial floodplains, interspersed by the rocky inselbergs and small mountain ranges observed. Hydrological flow in the region is concentrated into the lower portions of the catchment. Drainage down the slopes is thus in a westerly direction towards the Brak River.

All the small tributaries in the area are ephemeral or intermittent and with no clear associated vegetation (Figure 14). According to Figure 8, permanent rivers and wetlands are limited mostly to mainstem rivers and secondary drain lines such as those observed outside the current study area (Brak River). Thus, these natural temporary systems are the principal drainage system of the Solar PV Facility (Phase 3) project area.

These systems have a far less predictable flow regime compared to perennial or seasonal rivers, and are frequently dry for long periods in arid regions. The ephemeral tributaries of the Brak River are considered to be in a largely natural ecological state.

A generally accepted classification scheme distinguishes four main categories of streams (Boulton et al., 2000):

- Ephemeral streams – flow briefly (<1month) with irregular timing and usually only after unpredictable rain has fallen;
- Intermittent or temporary streams – flows for longer periods (>1 – 3 months), regularly have an annual dry period coinciding with prolonged dry weather;
- Semi-permanent streams – flow most of the year but cease flowing during dry weather (<3 months), drying to pools. During wetter years, flow may continue all year round;
- Permanent streams perennial flow. May cease to flow during rare extreme droughts.

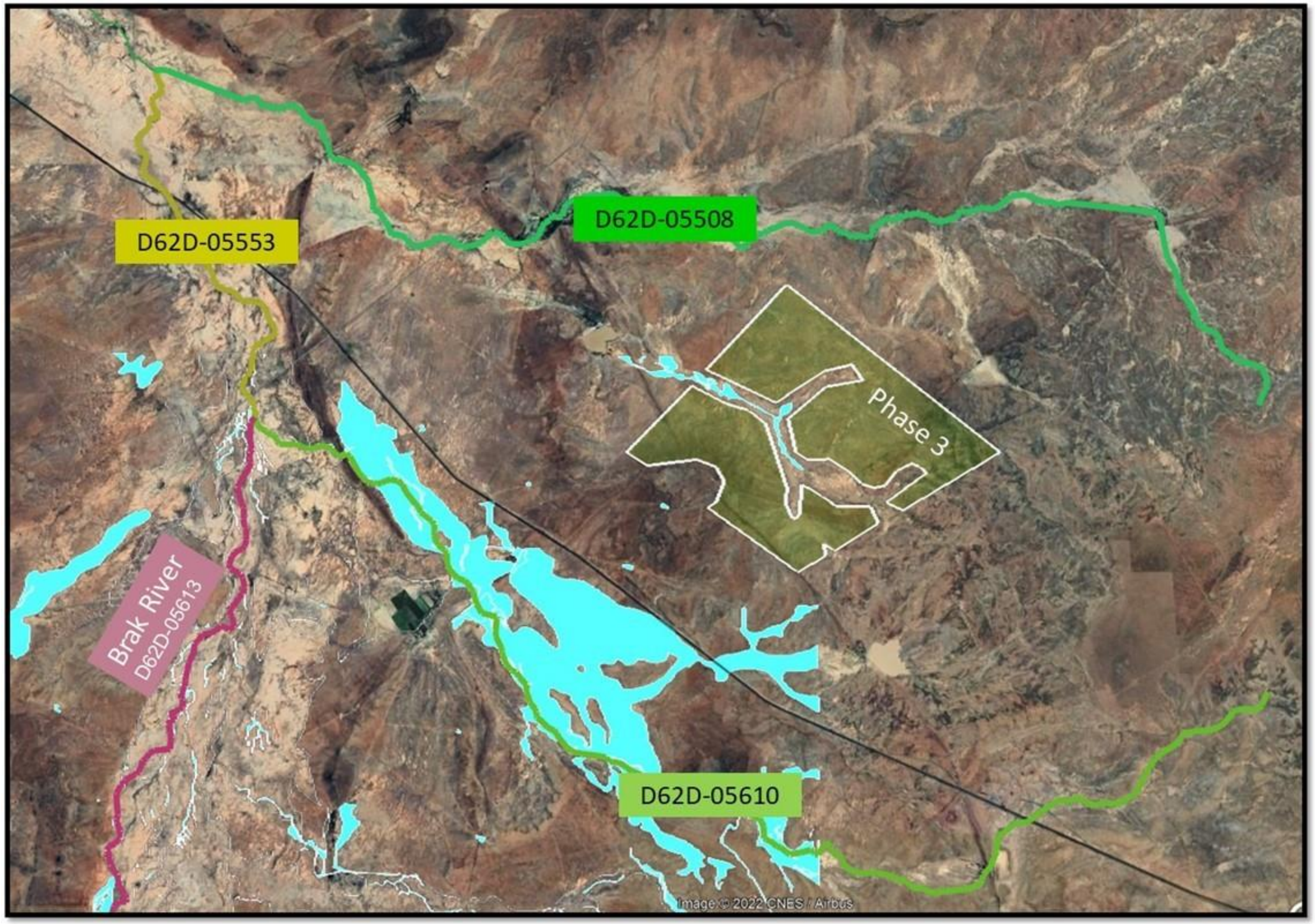

Figure 8. The ephemeral flows from the De Aar Phase 3 Solar PV facility project area are draining towards the Brak River tributary.

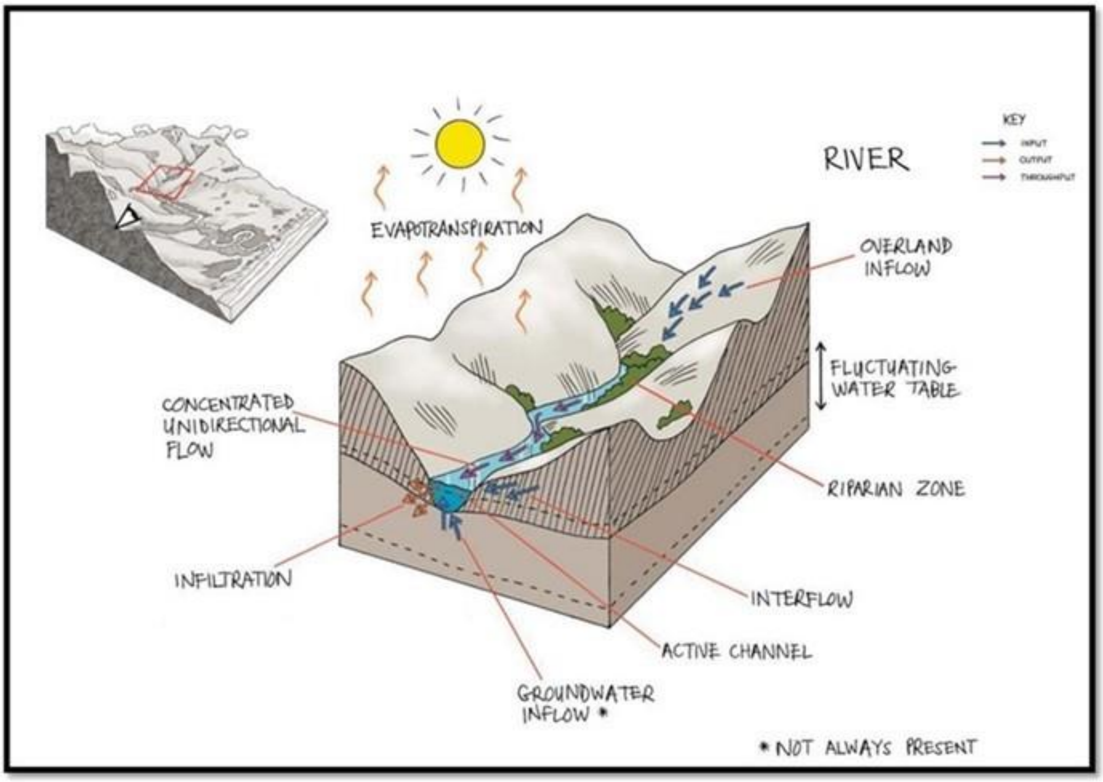

Figure 9: A diagram of a typical “Rivers and streams with Riparian zone” system (Ollis et al, 2013).

Ephemeral drainage system: Intermittent Aseasonal.

The De Aar Phase 3 Solar PV facility project area drainage systems are predominantly classified as ephemeral, which means that the stream flows briefly in direct response to precipitation in the immediate vicinity, and the channel is at all times above the ground-water reservoir.

According the Rossouw, et al (2005), the ephemeral drainage system dominating the project area, can be classified as “Intermittent aseasonal”. These rivers exhibit intermittent, unpredictable and highly variable flow within and between years in a five-year period. Usually occur in climatic transition zones, semiarid areas, and marginal areas, e.g., southern African drought corridor. Although major rainfall and discharge events may be broadly seasonal, flow follows no distinct pattern and drying may occur in any season. Duration of flow, no flow, and drying events are highly variable within and between years, depending on antecedent climatic conditions.

The ephemeral drainage system of the De Aar Phase 3 Solar PV facility project area consists of one major ephemeral drainage channel which are fed by upstream catchment areas beyond the project area fence line. Three smaller tributaries are feeding into the main drainage line in the project area (Figure 10).

Figure 10: A diagram to identify the different drainage types encountered in the ephemeral drainage system during the aquatic surveys in the project area:

a. Headwater drainage lines (Green delineation)
b. Ephemeral drainage channel (Blue delineation)

Seasonal, intermittent and ephemeral rivers are included in the National Wetland Classification System (SANBI, 2009) with the Rivers and Streams category:

"Rivers and streams: This type of water resource is described as a channel (river, including the banks) in the National Wetland Classification System (SANBI, 2009). This is defined as *"an open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterizes the hydrodynamic nature of these units."* According to the classification system, channels generally refer to rivers or streams (including those that have been canalized) that are subject to concentrated flow on a continuous basis **or periodically during flooding**. This definition is consistent with the NWA (Act No. 36 of 1998) which makes reference to (i) a river or spring and (ii) a **natural channel** in which water **flows** regularly or **intermittently**

within the definition of a water resource. As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel banks which can be identified and delineated."

River continuum: 1.1 Headwater drainage lines

The arid drainage lines adjacent to the project area consist mostly of ephemeral channels and drainage lines. Ephemeral channels and drainage lines represent linear and narrow watercourses in the form of headwater drainage lines (second order drainage lines and channels). Headwater drainage lines that only carry storm flow are located at the source of drainage line networks.

These features were captured as lines during the delineation process and are expected to be consistent with the NWA watercourse definition of 'natural channels that flow regularly or intermittently'.

Headwater drainage lines, which include first and second order drainage lines and ephemeral channels, are also regarded as watercourses, even though they may have discontinuous or swale-like channels.

Headwater drainage lines that only carry storm flow are located at the source of drainage line networks. They differ from downstream reaches due to a closer linkage with hillslope processes, higher temporal and spatial variation (Gomi et al. 2002).

Headwater systems form part of a continuum between hillslopes and stream channels (Gomi et al. 2002). Transitional channels (temporary or ephemeral channels) can have defined channel banks, as well as discontinuous channel segments along their length, and emerge out of zero-order basin. They form the headmost definable portion of the drainage line network (first-order channels) and can have either ephemeral or intermittent flow.

In certain situations, it might be challenging to know whether a particular wetland is a headwater drainage line or a seep, as some seeps are found in foot- or toe-slope locations with extremely shallow gradients. One of the key differences between these two wetland types, is that seeps are often fed primarily by the expression of groundwater at the ground surface whereas headwater drainage lines are typically fed by precipitation alone. It should also be noted that systems that are not permanently or periodically inundated are not considered true wetlands, i.e., those associated with the drainage lines.

Headwater drainage lines riparian vegetation consists of a relatively sparse low shrub layer. In between the sparse low shrub layer, a small sedge appears during very wet periods as part of the riparian zone, indicating the area of increased wetness.

Figure 11: Headwater drainage lines

11a. This headwater drainage line shows up clearly as a dark shrub layer in the grassy surroundings.
11b. The riparian vegetation of the drainage line consists of a relatively sparse low shrub layer.
11c. Bare areas or cleared patches appear when rainwater washes down the slope.

Figure 12: Headwater drainage lines

12a and 12b. On hilly slopes and even on relative flat surfaces, swale-like channels transport rainwater through interflow towards the main drainage line.
12c. Most of the riparian vegetation of the headwater drainage line consists of a relatively sparse low shrub layer.
12d and 12e. In between the sparse low shrub layer, a small sedge appears during very wet periods as part of the riparian zone, indicating the area of increased wetness.

River continuum: 1.2 Ephemeral drainage system

Larger ephemeral washes are generally old, well-established and stable floodplains. The smaller washes are typically found within smaller valley floor areas, indicating that these smaller valley floors do not have the same flood buffering capacities as the larger ephemeral washes.

Apart from the basic channel that delineates the ephemeral drainage line, different geomorphological and vegetation features are present in the drainage line configuration.

Figure 13: Ephemeral drainage system

13a and 13b. An ephemeral drainage line with some pools resulting from recent rains.
13c. The presence of moisture in the ephemeral systems results in this lush, sedge-filled drainage line.

Feature: 1.2.1 Associated Riparian zone

Rivers can be divided into the ‘active channel’ and ‘riparian zone’ components. It is important to note that ‘Riparian habitat’ may be associated with either of these systems and is regarded by DWS as part of the water resource and ‘regulated area’. **Riparian habitat** is defined in the NWA (Act No. 36 of 1998) as *“the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.”*

Riparian habitat (or zone): includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods would be considered riparian wetlands, opposed to non-wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many metres below the surface. Thus, it should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e., those associated with the drainage lines.

In terms of the regional vegetation and aquatic habitat composition, there is very little discernible riparian vegetation Solar PV Facility (Phase 3) project area. The riparian vegetation consists of a relatively dense low shrub. These shrubby systems are often visible by the formation of smaller washes and dense encroachment by spiny shrubs.

No hydromorphic (wetland soil) or hydrophyte (wetland plant) indicators are expected in these watercourses.

Feature: 1.2.2 Braided channel: bar and swale topography

Washes that lack distinct channel features do often display channel configuration referred to as bar and swale topography (Botha, 2021).

Arid ephemeral streams (washes) are typically discontinuous channels on a flat topography in dry environments (Figure 14a to 14c). Washes that lack distinct channel features do often display braided channel configuration referred to as bar and swale topography (Lichvar & Wakeley, 2004).

Washes that lack distinct channel features do often display braided channel configuration referred to as bar and swale topography. Discontinuous streams can also display a stream pattern characterized by alternating erosional and depositional reaches.

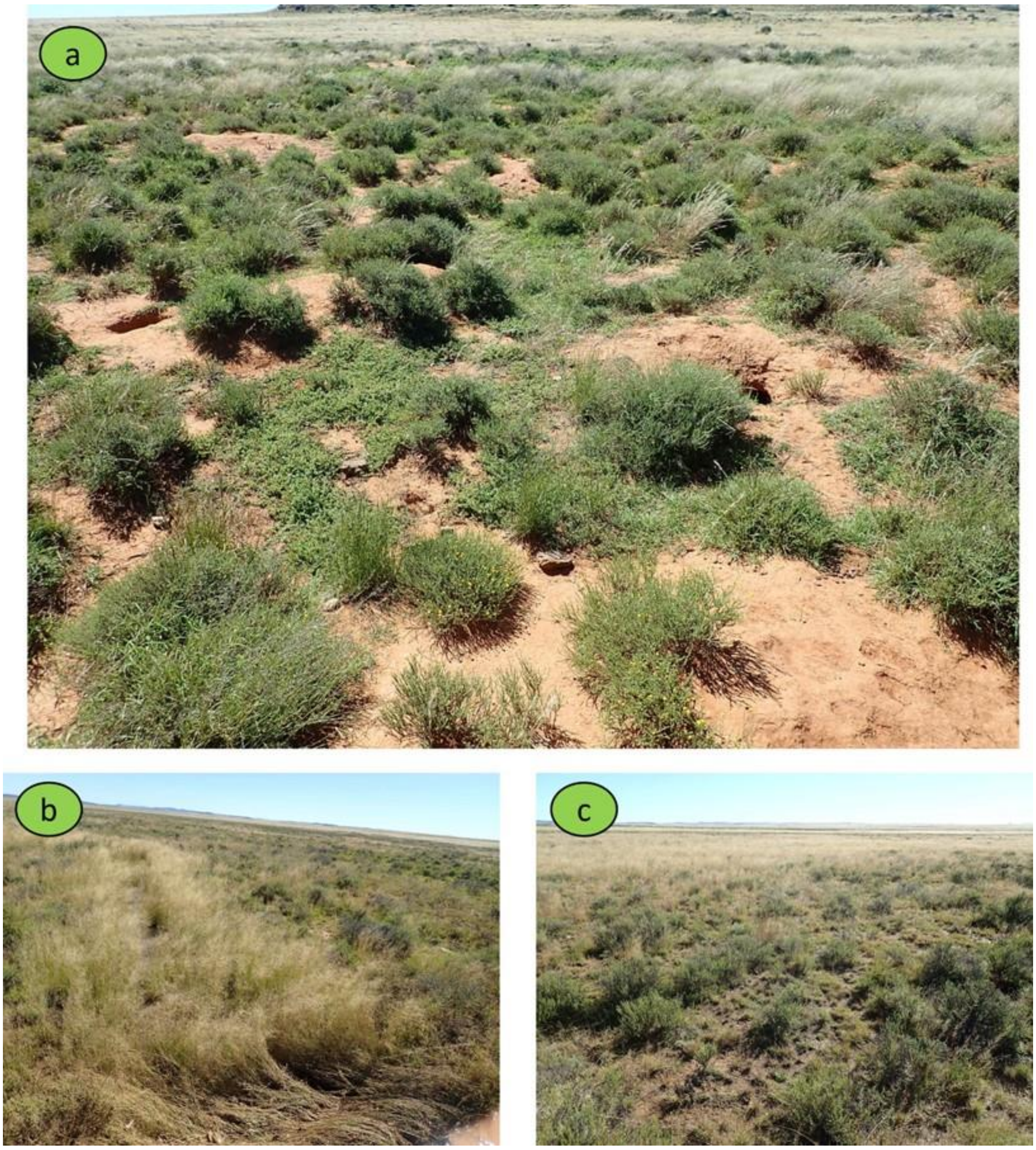

Figure 14: Associated Riparian zone

14a to 14c. The riparian vegetation consists of a relatively dense low shrub (a), often visible by the formation of smaller washes (b) and dense encroachment by spiny shrubs (c).

Figure 15: Braided channel: bar and swale topography

15a. Google Earth screen grab (244m) of the braided channel configuration referred to as bar and swale topography.
15b. Bar and swale topography on the middle section of the main drainage line.
15c. A typical bar and swale setup in the main drainage line.

Feature: 1.2.3 Alluvial floodplains

Alluvial floodplains are characterised by numerous channels that traverse a floodplain, valley floor or alluvial fan. They tend to be classified as watercourses rather than as wetlands as they show very few wetland characteristics in the strictest sense.

Feature: 1.2.3.1 Alluvial fans

A dominant feature of the Karoo landscape is the alluvial floodplains or washes. They are characterised by numerous channels that traverse a floodplain, valley floor or alluvial fan. Surface water may flow along a particular channel in one year, but due to their being little topographic definition or gradient across the landscape, a parallel channel may be eroded the following year, leading to a network of channels.

Some ecologists call these features “dendritic drainage systems”, while others refer to them as washes or floodplains. They tend to be classified as watercourses rather than as wetlands as they show very few wetland characteristics in the strictest sense.

Alluvial fans are also tricky to classify as they do not sit neatly in any of the hydrogeomorphic units used by the National Classification System for Wetlands and other Inland Aquatic Ecosystems (Ollis et al., 2013). Alluvial fans are typically created when valleys widen suddenly or stream flows from a narrow, relatively steep valley onto a wider, gradually sloping valley floor or flatter plain.

Extensive alluvial fans are present in the drainage line and it became evident that the rapid deposition of the sediment load carried by surface water, gave rise to these alluvial fans. Some alluvial fans (or portions of alluvial fans) have distinct channels, while others may lose this distinction as water and sediment disperse and settle relatively evenly across the fan.

Feature: 1.2.3.2 Floodplain flat

Floodplain flat is described as a non-depressional, near-level wetland area forming part of a floodplain. It is important to recognise that a floodplain flat is connected to a drainage network, as part of a broader wetland complex associated with a river channel, while a wetland flat is not in any way connected to a drainage network. Floodplain flats are connected to and fed by a river, while the ‘wetland flats’ are fed only by precipitation and/or groundwater.

Sand washes are the seasonal watercourses that traverse the other types of washes. Here the soils have been washed clean of silt, with sand of medium to fine grain remaining. These watercourses tend to have mostly bare beds, with vegetation occurring in clumps along the bed and more densely along the banks.

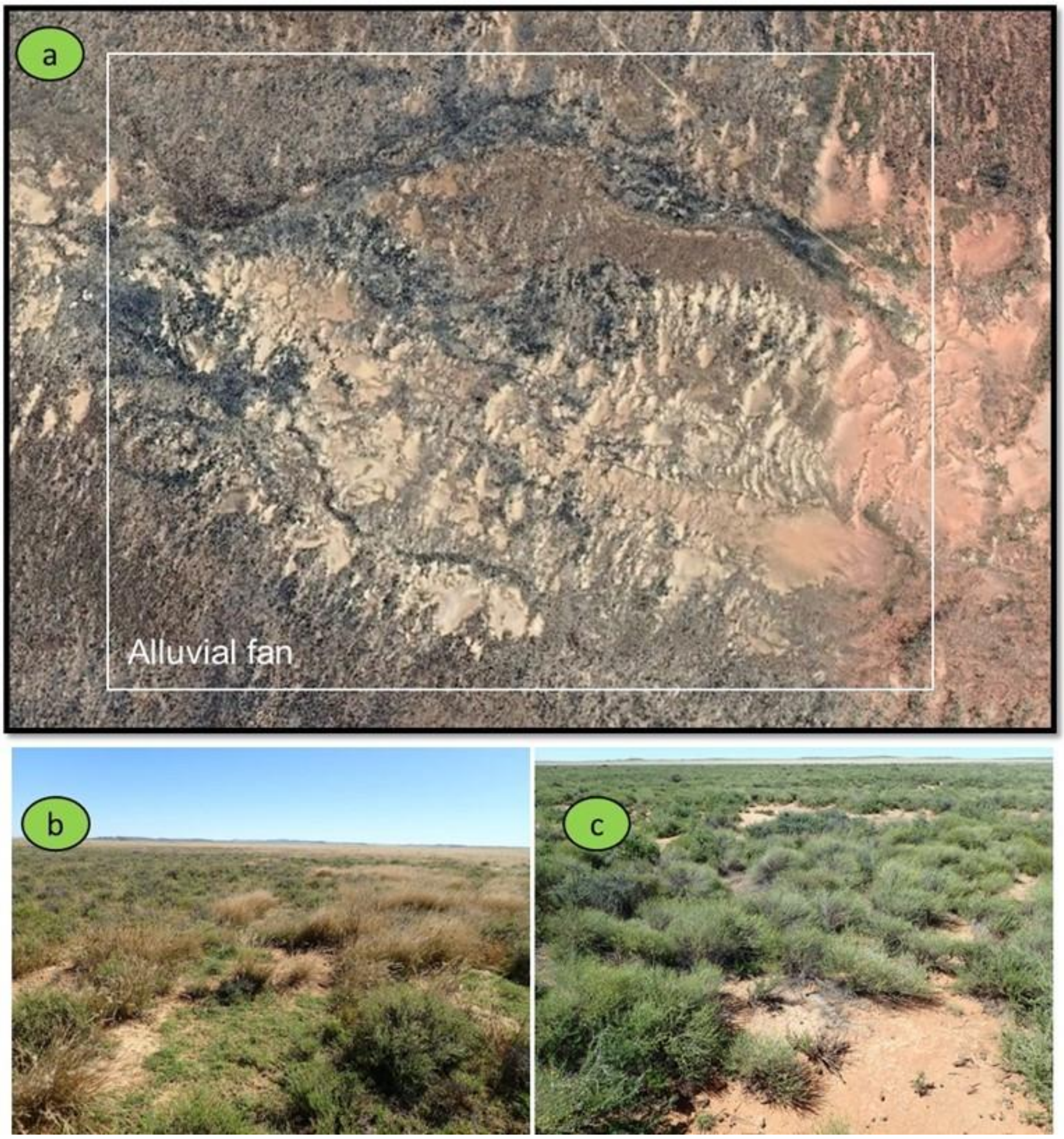

Figure 16: Alluvial fans

16a. Google Earth screen grab of an alluvial fan developed between the ephemeral channel upstream and the braided channel configuration further downstream (white block).

16b - 16d. Some alluvial fans (or portions of alluvial fans) have distinct channels, while others may lose this distinction as water and sediment disperse and settle relatively evenly across the fan.

Figure 17: Floodplain flats

17a. A floodplain flat is described as a non-depressional, near-level wetland area forming part of a floodplain.
17b. Sand washes are the seasonal watercourses that traverse the other types of washes.
17c. These watercourses tend to have mostly bare beds, with vegetation occurring in clumps along the bed and more densely along the banks.

River continuum: 1.3 Artificial wetlands - dams

Artificial wetlands associated with dammed drainage lines form part of the system, but due to the interference with natural flows, these structures are not considered as beneficial to the natural functioning of a stream system. The small farm dams which is present in the drainage line intercept flows and store it for agricultural uses. It thus prevents the flow in the early rainy season to reach downstream habitats, and it is only when the dams have filled that they overflow and release the disrupted flows to the downstream habitats.

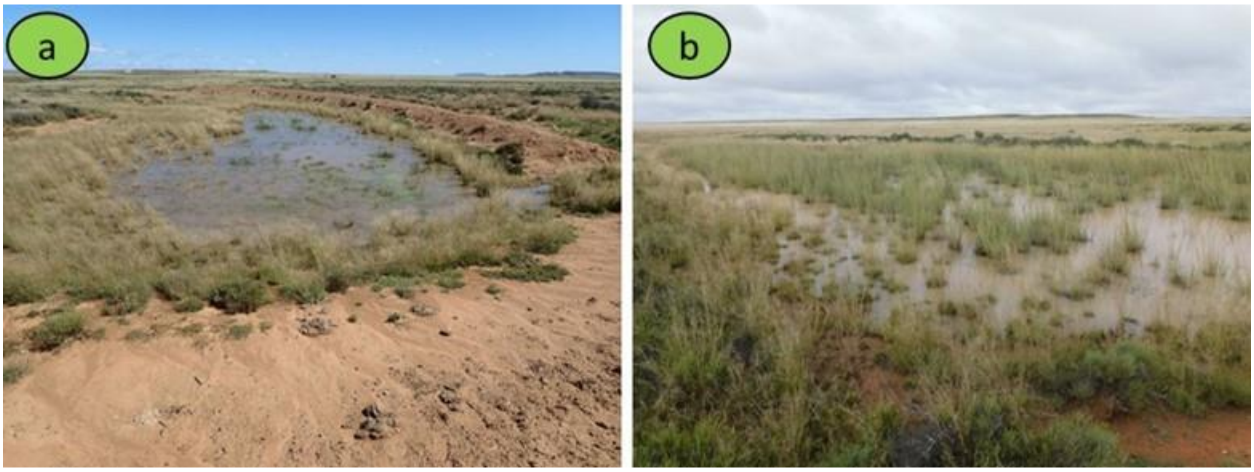

Figure 18: Artificial wetlands - dams

18a - 18c. The prolonged inundation of the farm dam surrounding creates a favourable condition for shrubby riparian vegetation to establish.

2.3.1.3 Ecological survey transects in the De Aar Phase 3 Solar PV facility project area**.**

A major component of this study is the characterisation of wetland types of the project area landscape. Representative survey sites were selected in all prominent vegetation types of the study area. Extensive transects (100-200m) were then surveyed for potential wetland habitat. GPS readings provide fixed locations of these transects for future monitoring (Table 4; Figure 19). During the survey of the De Aar Phase 3 Solar PV facility project, the drainage line environment was surveyed by doing 6 transects.

The surveys assessed the sites for the presence of all wetland aspects which could potentially be influenced by the project activities. Apart from establishing the extent of the riparian zone, it also supplied information to assess the Present Ecological State of the areas, as well as identifying issues relating to possible impacts (current and future) in the study area. The coordinates of the transects are summarised in Table 4.

Table 4: Description of transects conducted for wetland assessments in the De Aar Phase 3 Solar PV facility project area.

Survey transects in the De Aar Phase 3 Solar PV project area.	Coordinates		Length (m)
	Start	End	
Drainage transects			
Transect 1	30°49'30.09"S 24°22'6.59"E	30°49'55.34"S 24°21'22.90"E	1470
Transect 2	30°49'33.92"S 24°21'43.15"E	30°49'50.51"S 24°21'0.45"E	1283
Transect 3	30°50'0.11"S 24°21'25.01"E	30°50'12.52"S 24°21'14.89"E	461
Transect 4	30°50'32.57"S 24°21'17.82"E	30°51'0.53"S 24°21'43.08"E	1164
Transect 5	30°50'59.82"S 24°21'45.87"E	30°50'23.73"S 24°21'16.88"E	1870
Transect 6	30°50'40.90"S 24°22'23.19"E	30°50'30.56"S 24°21'58.34"E	748
Total			6996

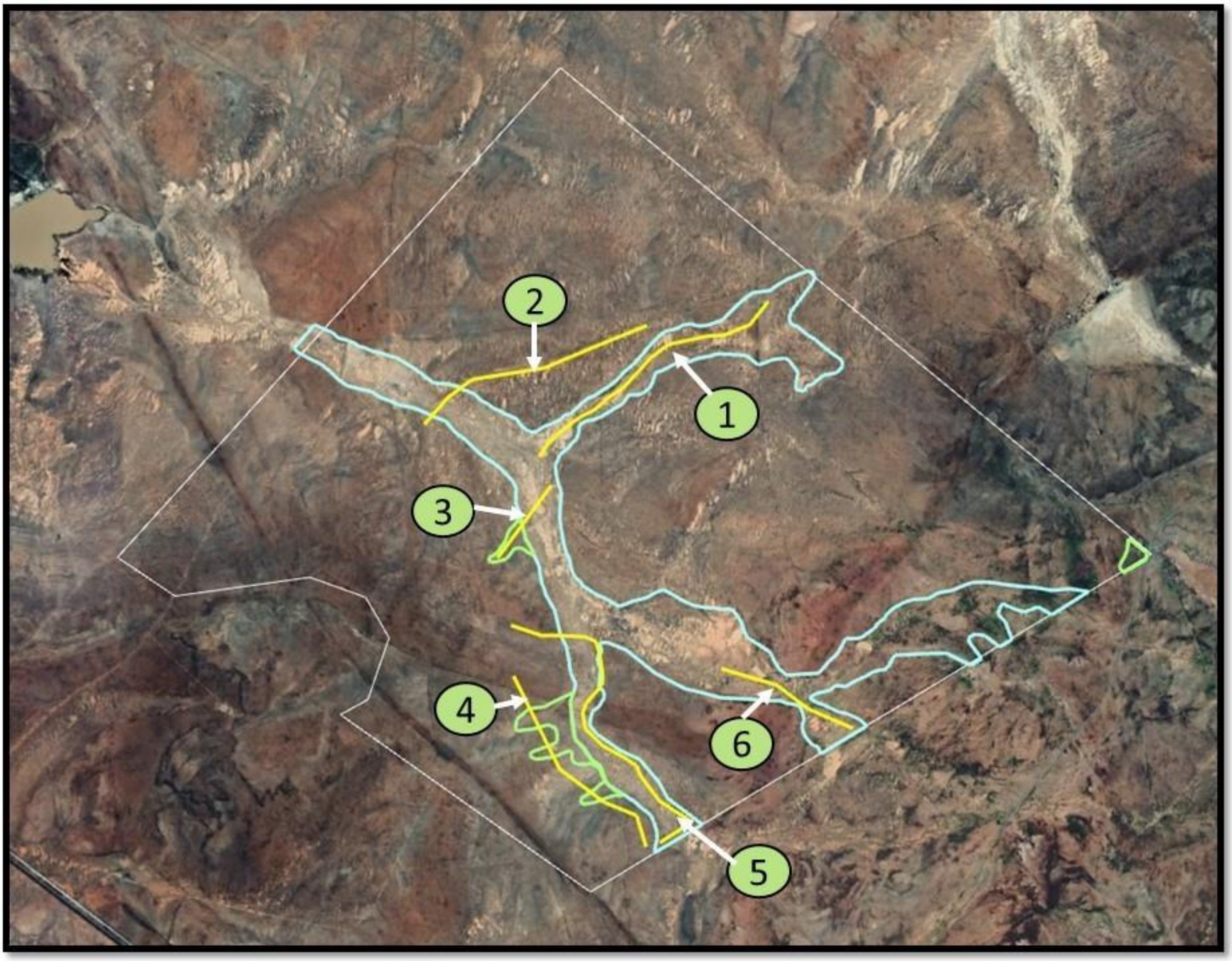

Figure 19: The transects conducted during wetland assessments (Table 4).

2.3.1.4 Vegetation communities

In terms of the regional vegetation and aquatic habitat composition, there is very little discernible riparian vegetation Solar PV Facility (Phase 3) project area. The riparian vegetation consists of a relatively dense low shrub. These shrubby systems are often visible by the formation of smaller washes and dense encroachment by spiny shrubs.

Figure 20: The riparian vegetation consists of a dense encroachment by spiny shrubs (darker vegetation in the middle of the figure).

VEGRAI model

The VEGRAI process has a spread sheet model component that is composed of a series of metrics and metric groups each of which is rated in the field with the guidance of data collection sheets (referred to as field forms).

The purpose is to evaluate and interpret the observed impacts at a site in terms of its relative influence on the riparian vegetation according to vegetation removal, alien vegetation invasion, water quantity and quality. The approach followed is that each of these four broad causes of modification relates to and is associated with particular human-related activities that would change the riparian vegetation characteristics directly or indirectly. Some of these changes may occur rapidly while others will occur gradually and only become evident through time.

Table 5: A comparative description related to reference and present state of the riparian zone in the project area.

Zones	Impacts	Response Metrics	Description of PRESENT STATE	Description of REFERENCE STATE
Marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition	The marginal vegetation consists of vegetation occurring in clumps more densely along the banks, and there is evidence of grazing by goats in areas.	The marginal vegetation consisted of vegetation occurring in clumps more densely along the banks.
Non-marginal	Vegetation Removal Exotic Vegetation Water Quantity Water Quality	Cover Abundance Species Composition	The riparian vegetation consisted of relatively dense low spiny shrub in the river channel. There are dams in a few places which interrupt the natural drainage line continuum.	The riparian vegetation consisted of relatively dense low spiny shrub.

Table 6: Evaluation of the marginal zone integrity (VEGRAI model) in the project area**.**

	MODIFICATION RATINGS			
CAUSES OF MODIFICATION	**INTENSITY**	**EXTENT**	**CONFIDENCE**	**NOTES: (give reasons for each assessment)**
REMOVAL	0,5	1.5	2,0	Grazing by goats.
EXOTIC INVASION	0,0		4,0	None
WATER QUANTITY	0,5	0,5	3,0	Dams
WATER QUALITY	0,0	0,0	3,0	None
AVERAGE			3,0	

		RESPONSE METRIC RATINGS			
VEGETATION COMPONENTS	**RESPONSE METRIC**	**CONSIDER? (Y/N)**	**RATING**	**CONFIDENCE**	**NOTES: (give reasons for each assessment)**
WOODY	COVER	Y	0,0	4,0	No change.
	ABUNDANCE	Y	0,0	4,0	No change.
	SPECIES COMPOSITION	Y	0,0	3,0	No change.
			0,0	3,7	
NON-WOODY	COVER	Y	0,5	4,0	Grazing by goats.
	ABUNDANCE	Y	0,5	4,0	Grazing by goats.
	SPECIES COMPOSITION	Y	0,0	3,0	Little change.
			0,3	2,7	

VEGETATION COMPONENTS	**CONSIDER? (Y/N)**	**RANK**	**WEIGHT**	**RATING**	**WEIGHTED RATING**	**MEAN CONFIDENCE**	**NOTES: (give reasons for each assessment)**
WOODY	Y	2,0	10,0	0,0	0,00	3,7	None present
NON-WOODY	Y	1,0	100,0	0,3	0,33	2,7	Present
CHANGE (%) IN MARGINAL ZONE CONDITION				**6,1**	0,33	3,2	

Table 7: Evaluation of the non-marginal zone integrity (VEGRAI model) in the project area.

	MODIFICATION RATINGS						
CAUSES OF MODIFICATION	**INTENSITY**	**EXTENT**	**CONFIDENCE**	**NOTES: (give reasons for each assessment)**			
REMOVAL	0,5	1.5	2,0	Grazing by goats.			
EXOTIC INVASION	0,0		4,0	None			
WATER QUANTITY	0,5	0,5	3,0	Dams			
WATER QUALITY	0,0	0,0	3,0	None			
AVERAGE			3,0				
		RESPONSE METRIC RATINGS					
VEGETATION COMPONENTS	**RESPONSE METRIC**	**CONSIDER? (Y/N)**	**RATING**	**CONFIDENCE**	**NOTES: (give reasons for each assessment)**		
WOODY	COVER	Y	0,0	4,0	No change.		
	ABUNDANCE	Y	0,0	4,0	No change.		
	SPECIES COMPOSITION	Y	0,0	3,0	No change.		
			0,0	3,7			
NON-WOODY	COVER	Y	0,5	4,0	Grazing by goats.		
	ABUNDANCE	Y	0,5	4,0	Grazing by goats.		
	SPECIES COMPOSITION	Y	0,0	3,0	Little change.		
			0,3	2,7			
VEGETATION COMPONENTS	**CONSIDER? (Y/N)**	**RANK**	**WEIGHT**	**RATING**	**WEIGHTED RATING**	**MEAN CONFIDENCE**	**NOTES: (give reasons for each assessment)**
WOODY	Y	2,0	10,0	0,0	0,00	3,7	None present
NON-WOODY	Y	1,0	100,0	0,3	0,33	2,7	Present
	CHANGE (%) IN MARGINAL ZONE CONDITION		**6.1**		0,33	3,2	

Table 8: The vegetation integrity evaluation of the riparian zone in the project area.

LEVEL 3 ASSESSMENT						
METRIC GROUP	CALCULATED RATING	WEIGHTED RATING	CONFIDENCE	RANK	% WEIGHT	NOTES: (give reasons for each assessment)
MARGINAL	93,9	52,2	3,2	1,0	100,0	None present
NON-MARGINAL	93,9	41,8	3,2	2,0	80,0	Present
	2.0				180.0	
LEVEL 3 VEGRAI (%)				93,9		
VEGRAI EC				A		
AVERAGE CONFIDENCE				3,2		

According to the VEGRAI assessment (Table 8) for the Solar PV Facility (Phase 3) drainage line, the Ecological Class is an A (93,9%).

The final scores of the VEGRAI assessment regarding the riparian and marginal zone integrity of the Solar PV Facility (Phase 3) project drainage line are presented in Table 9.

Table 9: A summary of the VEGRAI scores of the Solar PV Facility in the project area.

Drainage lines	Non-marginal zone condition	Marginal zone condition	Level 3 VEGRAI	VEGRAI EC
Solar PV Facility	93.9%	93.9%	93.9%	A

The vegetation integrity score is 93.9% which represents an Ecological Class A (90-100). This score reflects an "Unmodified, natural." status (Table 10).

Table 10: Generic ecological categories for EcoStatus components (modified from Kleynhans 1999).

ECOLOGICAL CATEGORY	**DESCRIPTION**	**SCORE (% OF TOTAL)**
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

2.3.1.5 Aquatic habitat assessment

During the monitoring survey in April 2022 the following parameters were measured - IHAS (Integrated Habitat Assessment System) and HQI (Habitat Quality Index) with the results summarized in Table 11. The only aquatic habitat present to sample, was a series of isolated pools in the system, filled with rainwater but not flowing (Figure 21). These pools are certainly very temporary and the habitats available were overhanging grass and a sandy pool bottom with loose pebbles and stones.

Figure 21: Isolated pools were present in the project area and aquatic surveys were done in these aquatic habitats.

Table 11: The combined habitat parameters as measured in the project pools.

SITE	IHAS%	CATEGORY	HQI%	CATEGORY
SITE 1	54	Poor	55	Poor

During the April 2022 survey, the IHAS and HQI scores were mostly “Poor” (Table 11) due to the shallow water level, brief presence of surface water and the lack of flow.

2.3.1.6 Presence of aquatic species

Aquatic invertebrate assessment

The aquatic macro-invertebrates were sampled according to the SASS5 method at the project pools, and Table 12 lists the macro-invertebrates sampled at the site and reflects the SASS5 scores for the survey.

The shallow water level, brief presence of surface water and the lack of flows, reflected in the macro-invertebrate scores (Table 12), resulting in "Fair" SASS scores and low number of families (Table 13). Most of the taxa recorded had low sensitivity scores, with the highest scores of 5, indicating the low sensitivity of the assemblage, mostly air-breathers.

Table 12: SASS5 scores of the different habitat types at the sampling pool site (a complete table of this summarized version can be viewed in Appendix 1).

TAXON	Stones	Vegetation	GSM	Total
Baetidae 1 spp 4	A	A	A	B
Corixidae 3			B	B
Notonectidae 3		A		A
Dytiscidae 5	1	A	1	A
Culicidae 1		A	A	A
SASS Score	9	13	13	16
No of families	2	4	4	5
ASPT	4.5	3.2	3.2	3.2

Estimated abundance: 1=1; A=2-10; B=11-100; C=101-1000; D=>1000

Table 13: Categories used to classify Habitat, SASS and ASPT values:

HABITAT	SASS4	ASPT	CONDITION
>100	>140	>7	Excellent
80-100	100-140	5-7	Good
60-80	60-100	3-5	Fair
40-60	30-60	2-3	Poor
<40	<30	<2	Very poor

Fish Response Assessment Index (FRAI)

The purpose of the Fish Response Assessment Index (FRAI) is to provide a habitat-based cause-and-effect interpretation underpinning the deviation of the fish assemblage from the reference condition.

Due to the ephemeral nature of the system, the lack of flows and absence of surface water, are the reasons why no fish species are able to inhabit and survive in the system. Even during the short-lived surface flows, the distance from permanent water and brief inundation of the system, rules out the presence of these assemblages.

2.3.1.7 Ecological Category (EC)

EcoStatus Definition: "The totality of the features and characteristics of the river and its riparian areas that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services". This ability relates directly to the capacity of the system to provide a variety of goods and services.

The driver components are assessed separately (i.e., an EC for each driver) and not integrated at a driver level to provide a driver-based indication of the EcoStatus. However, the individual metrics of all the driver components are assessed in a combined fashion that allows some comparison between metrics of all drivers. This facilitates deriving the cause-and-effect relationship that is required in the interpretation and assessment of a particular biological responses.

The biological responses are assessed separately, but the resulting fish and macro-invertebrate ECs are integrated to provide an indication of the in-stream EC (Table 14). Logically, the integration of the riparian vegetation EC and the in-stream EC would provide the EcoStatus. The influence of the riparian vegetation on the in-stream habitat is used to interpret the biological responses and endpoints. This means that in some cases, the integrated in-stream biological responses are deemed to provide a reasonable indication of the EcoStatus.

Table 14: The table below provides the available parameters that were instrumental to establish the Ecostatus of the Solar PV Facility (Phase 3) drainage line.

Parameter	Score %	Category	Description
VEGRAI	93.9	A	Natural
SASS	3.2	C	Fair
Habitat	55.0	B	Poor
Ecostatus		B	Largely natural with few modifications

EcoClassification - the term used for the Ecological Classification process - refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of rivers relative to the natural or close to the natural reference condition.

The overall Ecostatus of the Solar PV Facility (Phase 3) drainage line matches a Category B (Largely natural with few modifications) (Table 15).

Table 15: Generic ecological categories for EcoStatus.

ECOLOGICAL CATEGORY	DESCRIPTION	SCORE (% OF TOTAL)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions have occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions are extensive.	20-39
F	Critical/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

2.3.1.8 Corridors for Connectivity

The guidelines for land-use practices or activities that impact on water quantity in freshwater CBAs includes the following: Generic buffers should be established around streams within these catchments. These buffers can be refined based on a site visit and applying the DWS's wetland delineation tool.

Due to their positioning adjacent to water bodies, buffer zones associated with streams and rivers will typically incorporate riparian habitat. Riparian habitat, as defined by the NWA, includes the physical structure and associated vegetation of the areas associated with a watercourse (Macfarlane et al, 2015). However, the riparian zone is not the only habitat type that is present in the buffer as the zone may also incorporate stream banks and terrestrial habitat, depending on the width of the aquatic impact buffer zone applied. Therefore, the riparian zone must be delineated before the buffer zone is established.

2.3.1.8.a Riparian delineation

Riparian delineation and habitat evaluation was undertaken according to the DWAF Guidelines (2005) and DWAF updated manual (2008) (see Methods Section 2.8.4 Aquatic biota surveys). Figure 22 illustrates the project drainage line with the riparian zone delineated. The delineation shapefiles are available as Appendices 2 to 6.

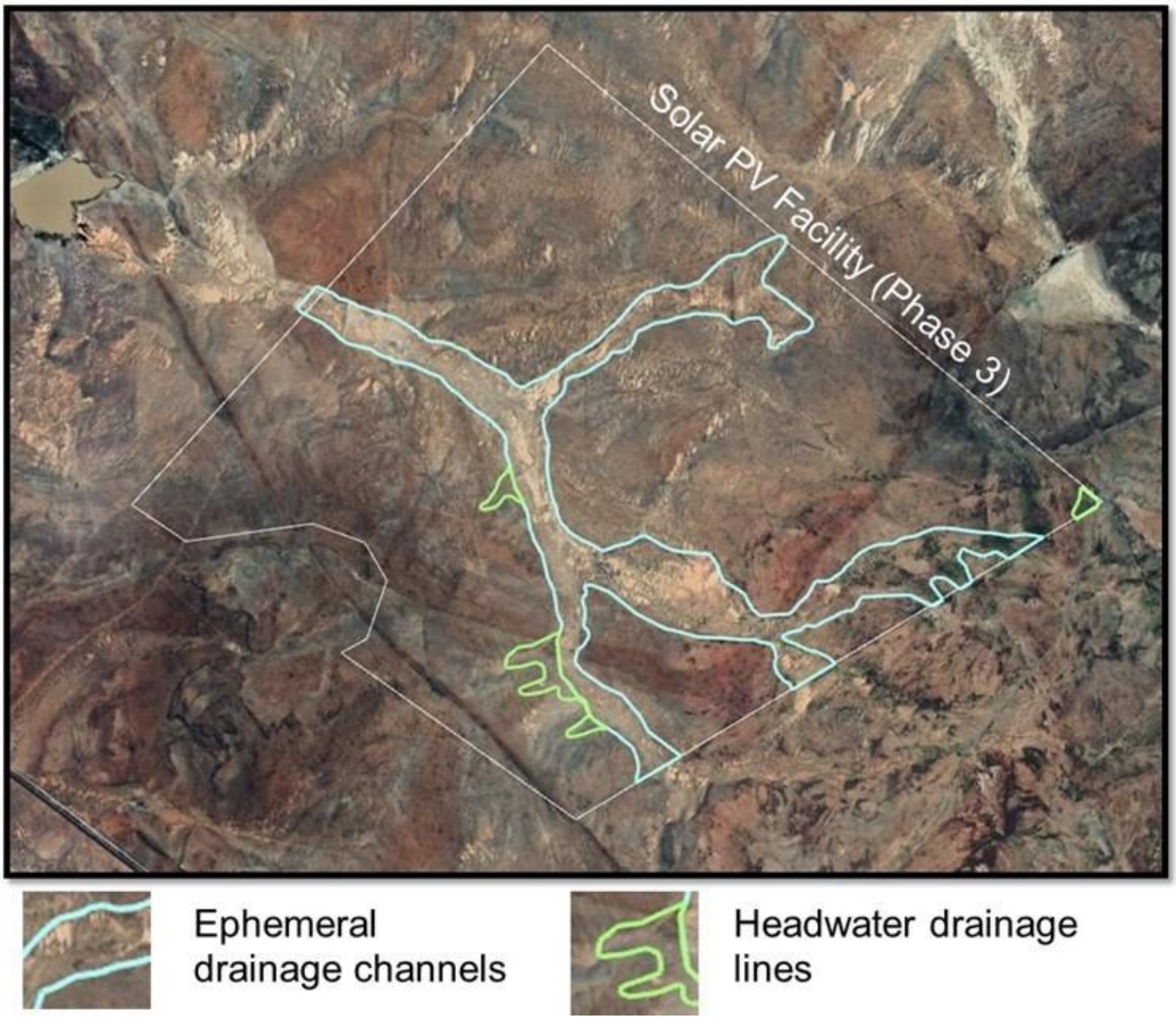

Figure 22: The delineated riparian zone of the Phase 3 PV facility: Green lines - Headwater drainage lines; Blue lines – Ephemeral drainage channels.

2.3.1.8.b Buffer zones

Buffer zones have been used in land-use planning to protect natural resources and limit the impact of one land-use on another. Buffer zones will serve as a mitigating measure for impacts created by the construction and operational phases of the Phase 3 PV facility project area, and the implemetation will be recapitulated in the mitigation section (2.5.2).

Buffer zones associated with water resources have been shown to perform a wide range of functions, and on this basis, have been proposed as a standard measure to protect water resources and associated biodiversity. These functions include:

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

Determining the required buffer width is largely an exercise of assessing the situation and linking it to an acceptable level of risk. Determining appropriate management measures for aquatic impact buffer zones is largely dependent on the threats associated with the proposed activity adjacent to the water resource. These threats include:

- Increases in sedimentation and turbidity;
- Increased nutrient inputs;
- Increased inputs of toxic organic and heavy metal contaminants; and
- Pathogen inputs.

Any potential risks must be managed and mitigated to ensure that no deterioration to the water resource takes place. Standard management measures should be implemented to ensure that any on-going activities do not result in a decline in water resource quality. The protected riparian zone will serve as a mitigating measure for impacts created by the construction and operational phases of the proposed project.

In determining the buffer zone requirements for river ecosystems, the process involves a number of steps in order to establish the buffer around the proposed riverine site. The following aspects were addressed specifically for the Phase 3 PV facility project (according to the steps suggested in Macfarlane, 2017):

Step 1: Define objectives and scope to determine the most appropriate level of the assessment.

The motivations for assessing potential impacts and establishing buffer zone requirements may be diverse. It is therefore important that the specific objective for the assessment is clearly understood before starting.

Determine the Most Appropriate Level of Assessment

Site-based assessment: This assessment is designed for detailed planning and includes a more rigorous assessment of risks as well as incorporating site-specific factors that can affect buffer requirements.

Step 2: Map and categorise water resources in the study area

After establishing the scope and appropriate level of the assessment (site-based delineation), the assessor must generate a map delineating the boundaries of the water resources potentially affected by proposed developments within the study area. The guidelines on delineating ephemeral and seasonal systems as suggested in Macfarlane (2017), were employed in the delineation exercise of the crossing drainage system.

Identify Water Resource Type: The Hydro-geomorphological (HGM) classification systems have been used to categorise the river system into the appropriate type (SANBI, 2009; Ollis et al., 2013), which is an ephemeral river type with headwaters and associated riparian zone.

Step 3: Refer to the DWS management objectives for mapped waterresources or develop surrogate objectives.

Understanding the rationale and objective for resource protection is a key step in informing management and protection requirements for water resources. Where impacts are likely to be low, it may be appropriate to simply set a management objective to “maintain” the status quo. This ensures that existing impacts are managed to a certain level without forcing applicants to undertake extensive surveys to establish whether improvement in water resource quality is required.

Determine the PES and Anticipated Trajectory of Water Resource Change

In Section 2.3.1.7 the PES for the Phase 3 PV facility draqinage line in the study area was established as a “B” (Largely natural) (Table 14) and the Ecological Importance and Sensitivity is rated as “Low”.

Step 4: Assess the risks from proposed developments and define mitigation measures necessary to protect mapped water resources in the study area

Do a Risk Assessment for Potential Impacts of Planned Activities on Water Resources:

Apart of the Risk Assessment that was done with the Risk Matrix, the desktop buffer zone tool has also a built-in risk assessment per site.

Site-based assessment: Desktop threat ratings are used as a starting point for buffer zone determination. While desktop threat ratings provide an indication of the level of threat posed by different land uses/activities, there is likely to be some level of variability between activities occurring within a sub-sector. It is therefore important that these threat ratings be reviewed based on specialist input and that a justification for any changes is documented in the Buffer Zone Tools.

Assess the Sensitivity of Water Resources to Threats Posed by Lateral Land Use Impacts.

The sensitivity of water resources to lateral impacts is another factor affecting the level of risk posed by a development. A more risk-averse approach is therefore required when proposed developments take place adjacent to water resources that are sensitive to lateral impacts, as opposed to the same development taking place adjacent to a water resource which is inherently less sensitive to the impacts under consideration.

The aspects utilised to establish the Phase 3 PV facility buffer zone, are listed in Table 16 and the buffers obtained from these features are displayed at the end of the table as: 20 m during the construction phase, and 20 m for the operational phase.

Table 16: Site-based tool: Determination of buffer zone requirements for river systems.

Site-based tool: Determination of buffer zone requirements for river systems.	
Name of Assessor	Dr AR Deacon
Project details	Phase 3 PV facility project
Date of Assessment	2022/06/22
Level of Assessment	Site-based
Approach used to delineate the riparian zone & active channel?	Site-based delineation
River type	Transitional
Present Ecological State	B (Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged).
Ecological importance & sensitivity (Current status)	Low: Features regarded as somewhat ecologically important and sensitive at a local scale. The functioning and/or biodiversity features have a low-medium sensitivity to anthropogenic disturbances. They typically play a very small role in providing ecological services at the local scale.
Management Objective	Maintain
Sector	Service infrastructure: Land use relating to the provision of all necessary utility services such as communication, municipal waste handling facilities and associated transfer pipeline infrastructure for fuels and water.
Sub-sector	Above-ground communication/power (electricity) infrastructure: Above-ground infrastructure designed for the transfer of power (electricity cables) or data (telephone lines).
MAP Class	0 - 400mm
Rainfall intensity	Zone 1
Stream order	2nd order
Channel width	5 - 10m
Perenniality	Intermittent systems (<3 months)
Average slope of rivers catchment	3-5%
Inherent runoff potential of the soil in the river's catchment	Moderate (B/C)
Longitudinal river zonation	Transitional river
Inherent erosion potential (K factor) of catchment soils	0.25 - 0.50
Retention time	Generally slow moving
Inherent level of nutrients in the landscape	Moderate base status
Inherent buffering capacity	"Hard" water rich in bicarbonate and carbonate ions or naturally acid waters high in organic acids
Natural salinity levels	Slightly Saline (200-400 mS/m)
River depth to width ratio	> 0.25
Mean annual temperature	Zone 2 (15.5 - 16.9 Degrees C)
Level of domestic, livestock and contact recreational use	Low

Buffer attributes (Current status)	
Slope of the buffer	Gentle (2.1 - 10%)
Vegetation characteristics (Construction phase)	Poor: Vegetation either short (<5cm) or robust but widely spaced plants with poor interception (e.g., trees or shrubs with poorly vegetated understory).
Vegetation characteristics (Rehabilitation phase)	Poor: Vegetation either short (<5cm) or robust but widely spaced plants with poor interception (e.g., trees or shrubs with poorly vegetated understory).
Soil permeability	Moderately low: Deep moderately fine textured soils (e.g., loam & sandy clay loam) OR shallow (<30cm) moderately drained soils.
Micro-topography of the buffer zone	Dominantly uniform topography: Dominantly smooth topography with few/minor concentrated flow paths to reduce interception.
Aquatic impact buffer requirement	
Construction Phase	**20m**
Operational Phase	**20m**

According to the initial buffer requirement, it becomes apparent that, to protect the Phase 3 PV facility in its current condition from any degradation, a buffer of 20 m wide on both sides of the drainage line delineation is required during the construction and operational phases. This buffer width is obtained whenever the following mitigation measures are applied to the model:

- the management of surface water runoff,
- erosion monitoring,
- as well as constraints regarding the clearing of vegetation within these areas.

Step 5: Assess risks posed by proposed development on biodiversity and identify management zones for biodiversity protection.

Step 6: Delineate and demarcate final buffer zone requirements.

Once protection requirements for water resources and associated biodiversity have been established, the buffer zone requirements have to be finalised and delineated on a layout plan and in-field.

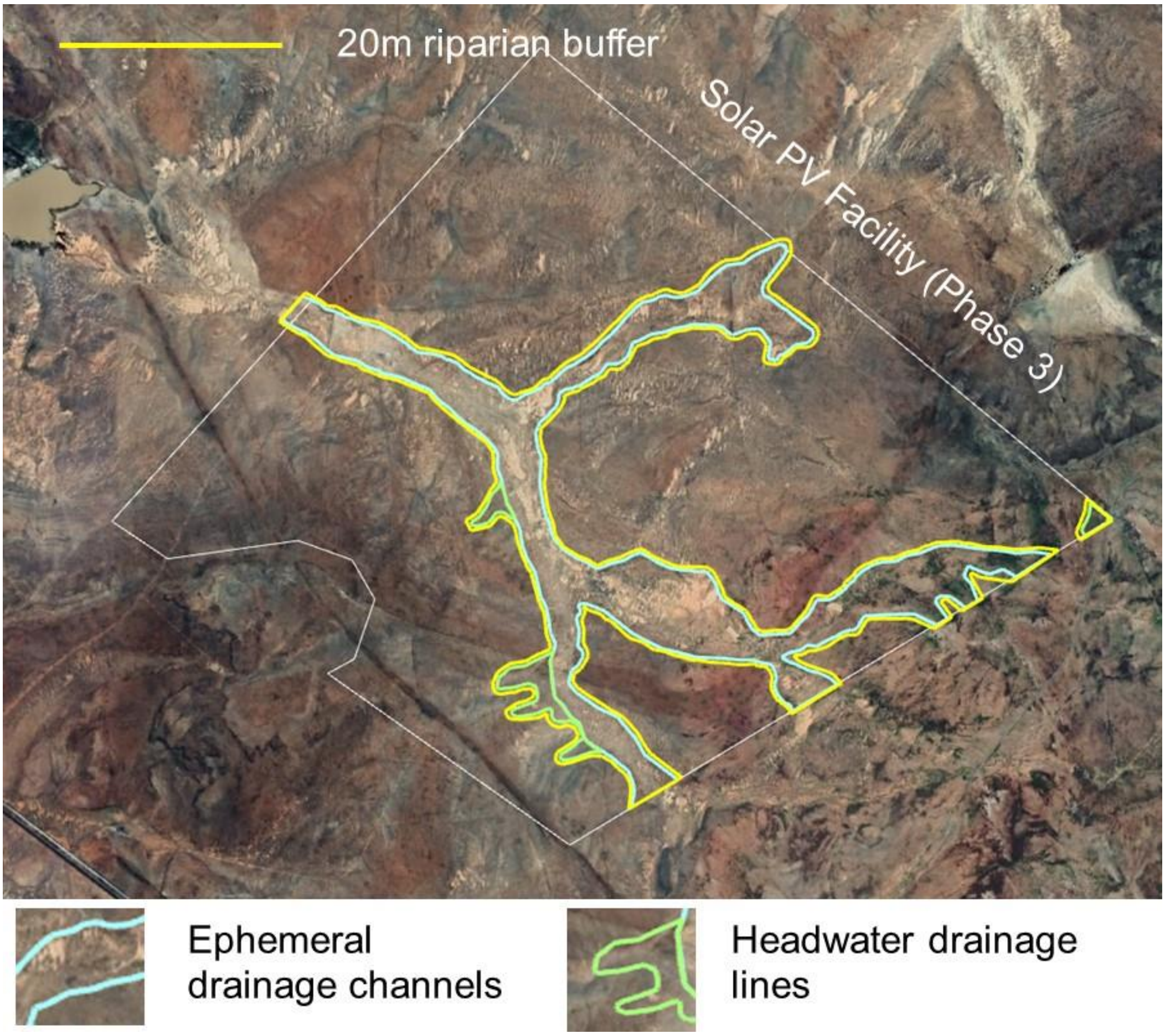

Figure 23: This figure outlines the proposed buffer of 20m (yellow line) in order to protect the riparian corridor (green and blue lines) (Shape file of buffer – Appendix 2 to 6).

Step 7: Document management measures necessary to maintain the effectiveness of the final buffer zone areas.

Once a final buffer zone area has been determined, appropriate management measures need to be documented to ensure that the water quality enhancement and other buffer zone functions, including biodiversity protection, are maintained or enhanced. These measures should ideally be integrated in the environmental management plan (EMP) for the proposed development, as it includes a requirement to assign clear responsibilities for buffer zone management at both the construction and operation phases. Although management measures will be specific to each site, some guidance is provided to ensure that management measures cater adequately for key buffer zone functions.

The KML shapefile for the final buffer zone of the Phase 3 PV facility drainage (Figure 23) is present in Appendix 2 to 6.

2.3.2 The threat status of the ecosystem and species as identified by the screening tool

Proposed Development Area Environmental Sensitivity

The following summary of the development footprint environmental sensitivities or threat status of the ecosystem and species is identified. Only the highest environmental sensitivity is indicated. The footprint environmental sensitivities for the proposed development footprint as identified, are indicative only and must be verified on site by a suitably qualified person before the specialist assessments identified below can be confirmed.

Table 17: The development footprint environmental sensitivities of the aquatic ecosystem identified by the screening tool (Figure 24).

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Animal species		**X**		
Aquatic Biodiversity Theme	**X**			
Plant Species Theme				**X**

The following section with maps represents the results of the screening for environmental sensitivity in the proposed site for the aquatic ecosystem themes associated with the project classification.

Table 18: Sensitivity features of the project area.

Theme	Sensitivity	Feature
Aquatic biodiversity	Very High	Wetlands Strategic water source area

Figure 24: A map obtained from the Screening Tool, indicating the relative aquatic biodiversity theme sensitivity.

2.3.3 An indication of the national and provincial priority status of the aquatic ecosystem.

List and map sensitive environments in proximity of the project locality-sensitive environments include wetlands, nature reserves, protected areas, etc.

Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact. It is classified as Least Threatened (Mucina & Rutherford 2006). The Soventix Project Site falls within the planning domain of the Northern Cape Provincial Biodiversity Plan, developed by the Department of Environment and Nature Conservation, Northern Cape. The potential impact of the development on Critical Biodiversity Areas should be considered in detail as these areas have been identified through systematic conservation planning exercises and represent biodiversity priority areas which should be maintained in a natural to near natural state in order to safeguard biodiversity pattern and ecological processes. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives.

Ecological importance of the site

To establish how important the site is for meeting biodiversity targets, the Land-Use Decision Support Tool (LUDS) was used to compile the LUDS Report (BGIS, 2016). LUDS was developed to facilitate and support biodiversity planning and land-use decision-making at a national and provincial level. Its primary objective is to serve as a guide for biodiversity planning but should not replace specialist ecological assessments.

Critical Biodiversity Areas (CBAs) are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. If these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

Before the field study, the team will establish how important the site is for meeting biodiversity targets. To do this, it is necessary to answer the following three simple but fundamentally important questions:

- How important is the site for meeting biodiversity objectives (e.g., is it in a CBA or Ecological Support Area (ESA)?
- Is the proposed land-use consistent with these objectives or not (to be checked against the land-use guidelines)?
- Does the sensitivity of this area trigger the Department of Environment and Nature Conservation, Northern Cape's requirements for assessing and mitigating environmental impacts of developments, or in terms of the listed activities in the EIA regulations?

The key results of the BGIS Maps are illustrated in Figure 25 and the LUDS Report are summarized in Table 19. The information is extracted for the area from national datasets available on the Biodiversity Geographic Information System (BGIS).

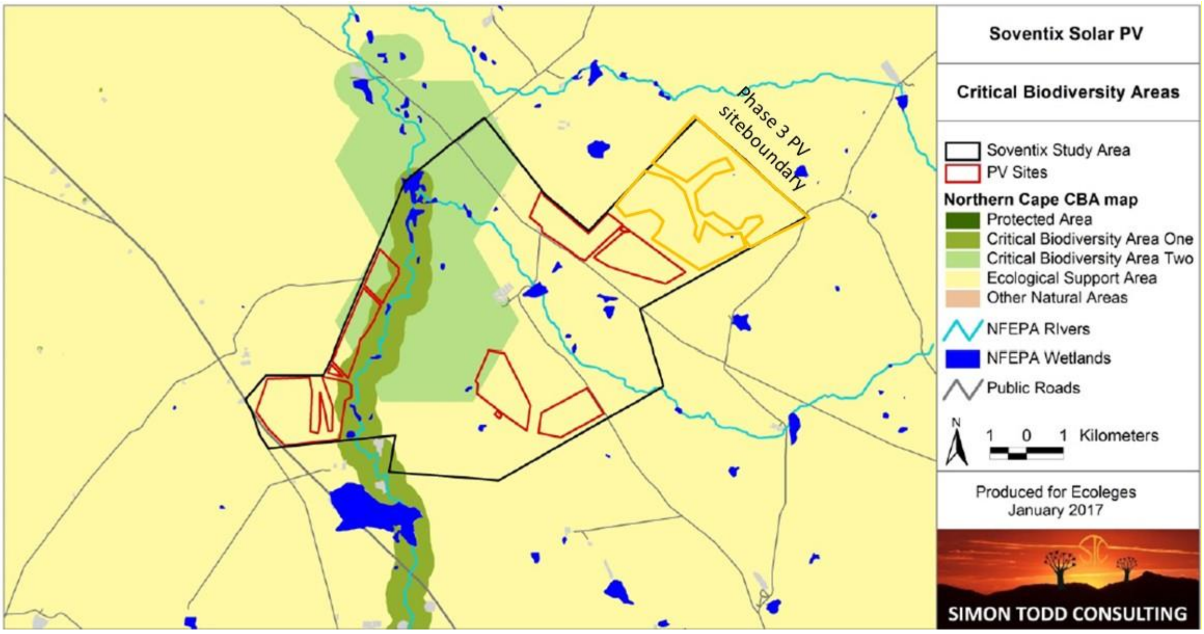

Figure 25: Critical Biodiversity Areas map of the proposed Soventix PV project, indicating Phase 3 site boundary (dark yellow polygons), and the surrounding area.

Critical Biodiversity Areas (CBAs)

Ecological Support Areas (ESAs): Those areas that play a significant role in supporting ecological functioning of Critical Biodiversity Areas (CBAs) and/or delivering ecosystem services, as determined in a systematic biodiversity plan. A Critical Biodiversity Area map is a map of Critical Biodiversity Areas and Ecological Support Areas based on a systematic biodiversity plan. Critical Biodiversity Areas and Ecological Support Areas are areas that require safeguarding to ensure the continued existence of biodiversity, ecological processes and ecosystem services. A Critical Biodiversity Area map, often developed at provincial level, provides the basis for a biodiversity sector plan.

Freshwater Ecosystem Priority Areas (FEPAs)

Freshwater Ecosystem Priority Areas (FEPAs) were identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries FEPA maps show various different categories, each with different management implications. The categories include river FEPAs and associated sub-quaternary catchments, wetland FEPAs, wetland clusters, Fish Support Areas and associated sub-quaternary catchments, fish sanctuaries, phase 3 FEPAs and associated sub-quaternary catchments, and Upstream Management Areas. NFEPA map products provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs.

Table 19: The key results of the LUDS Report as extracted for the Soventix project area from national datasets available from BGIS.

National Data Set	Aspect	Presence
National terrestrial information: Northern Cape		
South African municipal boundaries	**Municipality name:** Local - Emthanjeni (NC073) District – Pixley ka Seme	NC073
Critical Biodiversity Areas		
Ecological support Area	Nama Karoo	Ephemeral - - Lower foothill
National aquatic information: Lower Orange, Orange tributaries		
FEPA River ecosystem type	D62D-05613	Ephemeral - Nama Karoo - Lower foothill Ephemeral - Nama Karoo - Upper foothill

In the study area, the ephemeral drainage line has been identified as having conservation importance. Figure 26 represents the Freshwater Ecosystem Protected Areas (FEPA) map for the area. For river FEPAs the whole sub-quaternary catchment is shown in dark green (Figure 26), although FEPA status applies to the actual river reach within such a sub-quaternary catchment. The shading of the whole sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach.

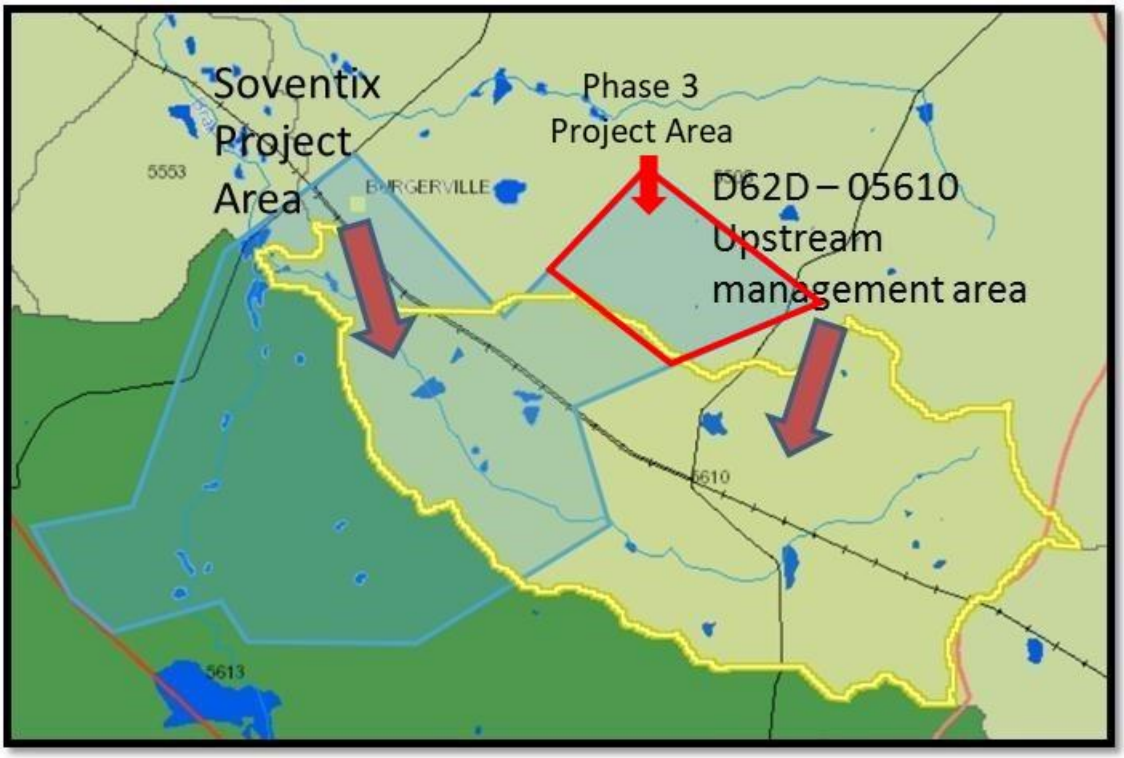

Figure 26: The position of the D62D-05610 FEPA Upstream Management Area in relation to the project site. Note that this nearby NFEPA aspect will not be impacted by Phase 3 activities since it is outside the delineation.

A tiny portion of the Phase 3 project area is situated in an Upstream Management Area. The nearby NFEPA aspect will not be impacted by Phase 3 activities since most of it is outside the Management Area. Upstream Management Areas (Figure 26) are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas. Upstream Management Areas do not include management areas for wetland FEPAs, which need to be determined at a finer scale.

The areas surrounding the drainage lines in the project area (light yellow in Figure 25), is classified as an Ecological Support Area (ESA). The desired management objective for an ESA is to be maintained in a natural, functional state. Limited loss of ecosystems or functionality is acceptable, as long as the present ecological state is not lowered.

- All wetlands are protected under the National Water Act (Act 36 of 1998).
- In terms of the National Water Act, freshwater ecosystems (all wetlands included) should not be allowed to degrade to an unacceptably modified condition (E or F ecological category).
- Conduct a buffer determination assessment around all wetlands, regardless of ecological condition or ecosystem threat status.
- Any further loss of area or ecological condition must be avoided, including if needed, a 100 m generic buffer around the wetland.

2.3.4 A description of the ecological importance and sensitivity of the aquatic ecosystem.

The Ecological Importance and Sensitivity (EIS) of a wetland is an expression of the importance of the aquatic resource for the maintenance of biological diversity and ecological functioning on local and wider scales; whilst Ecological Sensitivity (or fragility) refers to a system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Kleynhans and Louw, 2007)

The distinct water resource types that have been recognised in the project- and surrounding area are listed as:

- Headwater drainage lines (Figure 27)
- Large ephemeral drainage systems (Figure 27a).
- Associated riparian zones (Figure 27b).
- Alluvial floodplains (Figure 27c).
    - Alluvial fans (Figure 27d).
    - Floodplain flats (Figure 27d).

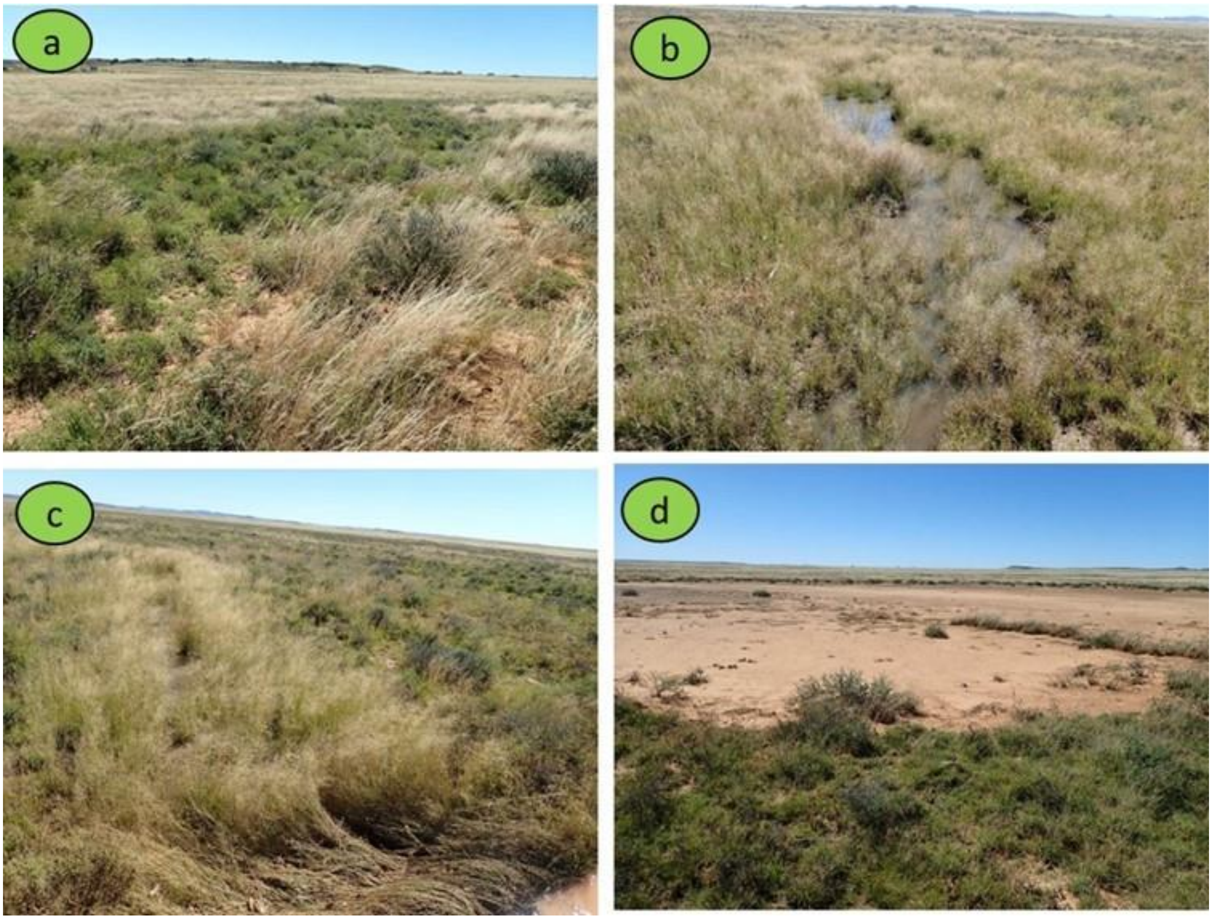

Figure 27: Water resource types.

27a. A headwater drainage line.
27b. A large ephemeral drainage system.
27c. Associated riparian zones.
27d. A floodplain flat.

Table 20: The ecological importance and sensitivity classes (EISC) of the different water resource types identified in the project area.

DETERMINANTS	Large ephemeral drainage systems	Smaller ephemeral drainage systems	Headwater drainage lines	Alluvial floodplains
BIOTA (RIPARIAN & INSTREAM)	(0-4)	(0-4)	(0-4)	(0-4)
Rare & endangered (range: 4=very high - 0 = none)	2,00	2,00	1,00	2,00
Unique (endemic, isolated, etc.) (range: 4=very high - 0 = none)	2,00	2,00	1,00	2,00
Intolerant (flow & flow related water quality) (range: 4=very high - 0 = none)	2,00	1,00	0,00	2,00
Species/taxon richness (range: 4=very high - 1=low/marginal)	2,00	2,00	2,00	2,00
RIPARIAN & INSTREAM HABITATS	(0-4)	(0-4)	(0-4)	(0-4)
Diversity of types (4=Very high - 1=marginal/low)	4,00	4,00	2,00	4,00
Refugia (4=Very high - 1=marginal/low)	3,00	2,00	1,00	3,00
Sensitivity to flow changes (4=Very high - 1=marginal/low)	3,00	2,00	1,00	3,00
Sensitivity to flow related water quality changes (4=Very high - 1=marginal/low)	2,00	1,00	1,00	2,00
Migration route/corridor (instream & riparian, range: 4=very high - 0 = none)	3,00	3,00	2,00	3,00
Importance of conservation & natural areas (range, 4=very high - 0=very low)	4,00	3,00	2,00	4,00
MEDIAN OF DETERMINANTS	**2,50**	**2,00**	**1,00**	**2,50**
ECOLOGICAL IMPORTANCE AND SENSITIVITY CLASS (EISC)	**HIGH**	**MODERATE**	**LOW**	**HIGH**

The only water resource system found in the Solar PV Facility (Phase 3) project area, is the large ephemeral drainage channel in the centre of the project area, which is classified as an intermittent aseasonal system with headwaters and alluvial floodplains.

If all these water resource types were present in the Phase 3 project area, the status allocated to them and the different classes, would be grouped as follow (Botha, 2021):

- "High" ecological and sensitivity classes: These areas, including their buffers, will be considered as no-go areas for development, apart from linear infrastructure crossings, including underground cables and pipelines, road crossings and an overhead power line..

- "Moderate**"** and "Low" ecological and sensitivity classes: These areas, are not considered as no-go areas, however, development within these areas shall be subjected to strict mitigation measures. This will include the management of surface water runoff, erosion monitoring, as well as constraints regarding the clearing of vegetation within these areas.

Due to the gentle slope of the terrain where headwater drainage systems originate, downpours will dissipate downhill without forming any discernible wetland habitats. Thus, the very short-lived nature of the headwater drainage systems, the EISC of this biotope is classified as “Low”. These areas, are not considered as no-go areas, however, development within these areas, such as placement of solar panels, power line pylons and other linear infrastructure, shall be subjected to strict mitigation measures.

The ecological importance and sensitivity of the large ephemeral drainage systems and associated alluvial floodplains, are being classified as “High” (Table 20). Water resource types with a “High” EISC will be considered as no-go areas for all infrastructure apart access roads, pipelines and cables. The no-go areas will include the buffers of the drainage areas in the project footprint.

2.3.4.1 Present Ecological State of the study area

Background to the Present Ecological State and potential impacts related to the project

Water flow patterns

The land use is currently agriculture, and will retain in part its agricultural use for livestock grazing, but will convert significant sections for commercial Solar PV for a fixed-term. The size of the proposed Solar development footprint is approximately 600ha.

Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows (large areas of solar panels directing rainwater), which leads to erosion, altered flow regimes and changes in water availability.

Storm water run-off from vehicle service tracks between the panel arrays, un-surfaced roads, buildings, borrow pits and excavation sites may cause erosion and channelling of flow, changes in flow patterns, head-cut and gully erosion, and sedimentation in wetlands and watercourses.

Inadequate storm water management and soil stabilisation measures in cleared areas could lead to erosion that could cause the loss of riparian vegetation and which would lead to siltation of nearby watercourses.

Off-road driving (even once-off) can cause long-term structural change in habitat. Driving of heavy vehicles even once over flat clay flood plain areas will have major impact, these areas are highly sensitive to change and the whole ecology of the system is dependent on spreading out of water over vast flat areas during rainfall events.

Indentations caused from vehicles driving over the soil surface will cause significant changes in water run off patterns and will remain in the landscape for hundreds of years.

Erosion

Erosion and sedimentation are important ecological processes in the Karoo. Loss and fragmentation of habitat disrupt these processes. Erosion is a particularly high risk on steep slopes, and in drainage lines that lack channel features and are naturally adapted to lower energy runoff with dispersed surface flows (such as unchannelled valley-bottom wetlands), and naturally less turbid freshwater systems.

Damming or diverting water

No additional or new damming of water or diverting water as part of the project construction or long-term operations is envisaged. However, the construction of a sub-station will not be feasible within one dry season, so improvements to the road surface may impede instream flow during the wet season.

Extraction of groundwater

Any extraction of water (surface or groundwater) in the arid Karoo environment will result in impacts on inundation/saturation regimes in wetlands, and flow regimes in watercourses. Extraction of groundwater will also result in drawdown of the water table. Ephemeral and seasonal pools lower down in catchments are more vulnerable as they are more dependent on groundwater.

Extraction of water will cause a decline on species dependent on water availability, including amphibians and fish, and may impact availability of breeding habitats for aquatic species. Riparian plant species and communities dependant on perched water tables (such as *Valchelia karroo, Searsia lancea, Phragmites australis*) will be impacted.

Roads and stream crossings

Driving on wet clay forms ruts that later develop into dongas or holes too deep for vegetation establishment. The disruption of surface drainage patterns where roads are raised above the base level of natural drainage channels or wetlands can cause fragmentation of aquatic ecosystems, and loss of connectivity, and can hamper the movement of aquatic or semi-aquatic fauna along riverine corridors or within and between wetlands.

Once permanent roads are built and regularly maintained and graded, there will be erosion that results from the formation of rills. This will change hydrological flows and have a detrimental effect on vegetation surrounding the roads.

Pollution of the water sources

Construction and maintenance of roads and other infrastructure can be associated with spills of fuel and other chemicals. Water pollution/contamination from accidental releases associated with natural flood events; leaking infrastructure (e.g., ponds, closed water treatment units); and spills of waste water.

In addition to pollution effects, any release of waste water into surface water ecosystems will impact on flow and temperature regimes. This is especially disruptive for the ephemeral and seasonal ecosystems of the arid Karoo environment, including affecting hatching/mating cues and growth of freshwater species.

The uncontrolled interaction of construction workers with watercourses that could lead to the pollution of these watercourses, e.g., dumping of construction material into the drainage system, washing of equipment The lack of provision of adequate sanitary facilities and ablutions on the servitude may lead to direct or indirect faecal pollution of surface water resources.

Invasive alien plant species

Construction can introduce invasive alien species, and lead to the spread of those that are already present. This will negatively compete with indigenous species and disrupt ecological processes.

Overhead power lines

Power lines can be associated with impacts on surface water resources if the towers are placed within a river or watercourse, or if the riparian vegetation within the power line servitude is felled. The process of constructing the power lines can also cause impacts on surface water resources, especially if certain mitigation measures and procedures are not followed.

Apart from habitat loss within the development footprint, another major potential source of impact of the development on birds would be from any power lines needed for the grid connection which could cause mortalities through electrocution and collisions of susceptible wetland bird species such as cranes and flamingos. Given the proximity of the Eskom lines to the site, any required overhead lines would be short, which would be important in mitigating this impact to a low level. Bird flappers could be incorporated in areas of increased bird activity.

2.3.4.2 Resource quality objectives.

No RQO was set by DWS for this ephemeral system.

2.4 Identify alternative development footprints.

No alternative footprints were investigated.

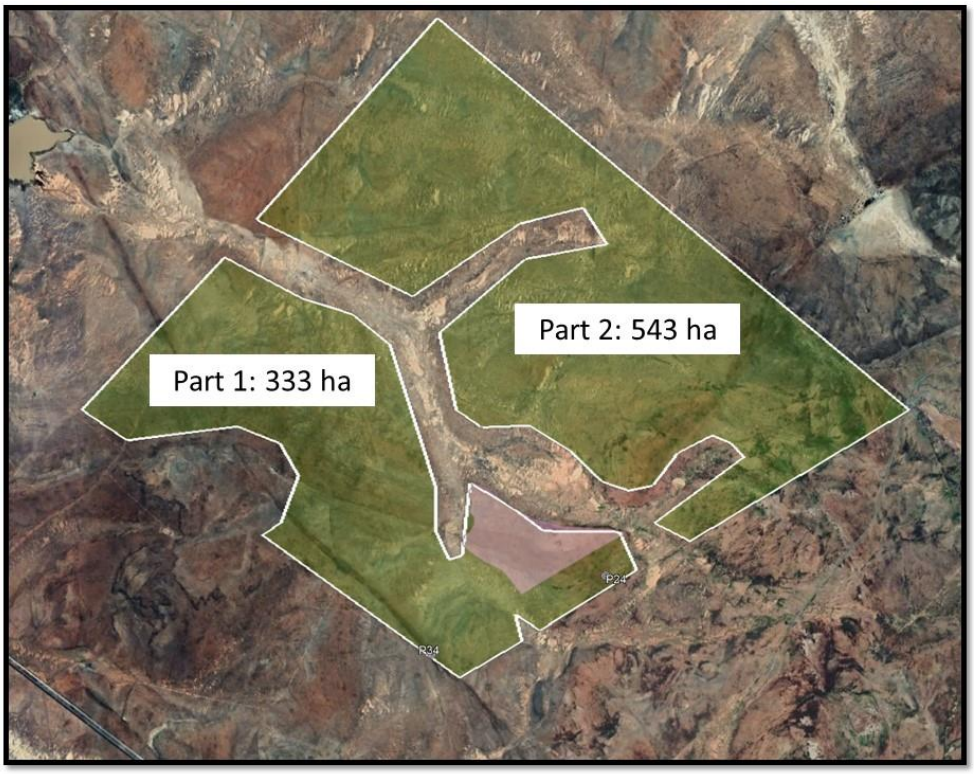

Figure 28: Locations of the Phase 3 Solar preferred sites illustrated.

2.5 Assessment of the potential impacts of the proposed development.

NEMA defines "evaluation" as "the process of ascertaining the relative importance or significance of information, in the light of people's values, preferences and judgements, to make a decision." NEMA and the EIA Regulations call for a hierarchical approach to impact management.

According to the Specialist TOR (Section 1.2), in addition to the Impact Assessment required for the Aquatic Biodiversity Specialist Assessment, a GN509 Risk Assessment should also be completed for the study.

2.5.1 Infrastructural components to be evaluated for the impact assessment

Infrastructural components of the Solar PV Facility (Phase 3) project need to be described and assessed according to the GN509 Risk Assessment. They need special mitigation and management measures to be determined and/or the current existing best practice management need to be described by the risk assessment report. The assessment needs to indicate if these components fall inside or outside of the regulated area (riparian habitat) and buffer zone.

Infrastructural components

Assessing the impacts of activities and infrastructure relating to the following:

- Linear structures
  - Distribution pylons (overhead powerline)
  - Road crossings
  - Cabling routes
  - Pipe crossings
  - Perimeter fence (with fire-break road).
- Boreholes
- PV system (solar panel arrays, inverters, and field transformers)
- Pollution potential at storing and disposal facilities.
- Alien invasive plants.

Linear structures

During the project development, the following linear structures will be constructed in close proximity of the drainage lines and will be crossing these watercourses in certain areas.

- Distribution pylons (overhead powerline)
- Road crossings
- Cabling routes
- Pipe crossings
- Perimeter fence (with fire-break road).

Establishment of distribution pylons and overhead powerlines

The planned 66 kV to 132 kV distribution line will be approximately 20 m high, and the servitude width is approximately 32 m. Construction of the powerline surface infrastructure will include the following activities:

- Establishment of pylons within / in close proximity to watercourses.
- Stockpiling of material excavated in close proximity to the excavation.
- Barricading excavated hole.
- Carting and assembling of pylons, including transport and offloading of pylon sections in the vicinity of the pylon location.
- Erection of pylons.
- Backfill of pylon excavation.
- Spoiling of excess excavated material around the pylon. Where a pylon is situated in close proximity to a wetland care must be taken to minimise disturbance as far as possible.
- Using cranes trucks, LDVs and string machines to assemble cables into position.

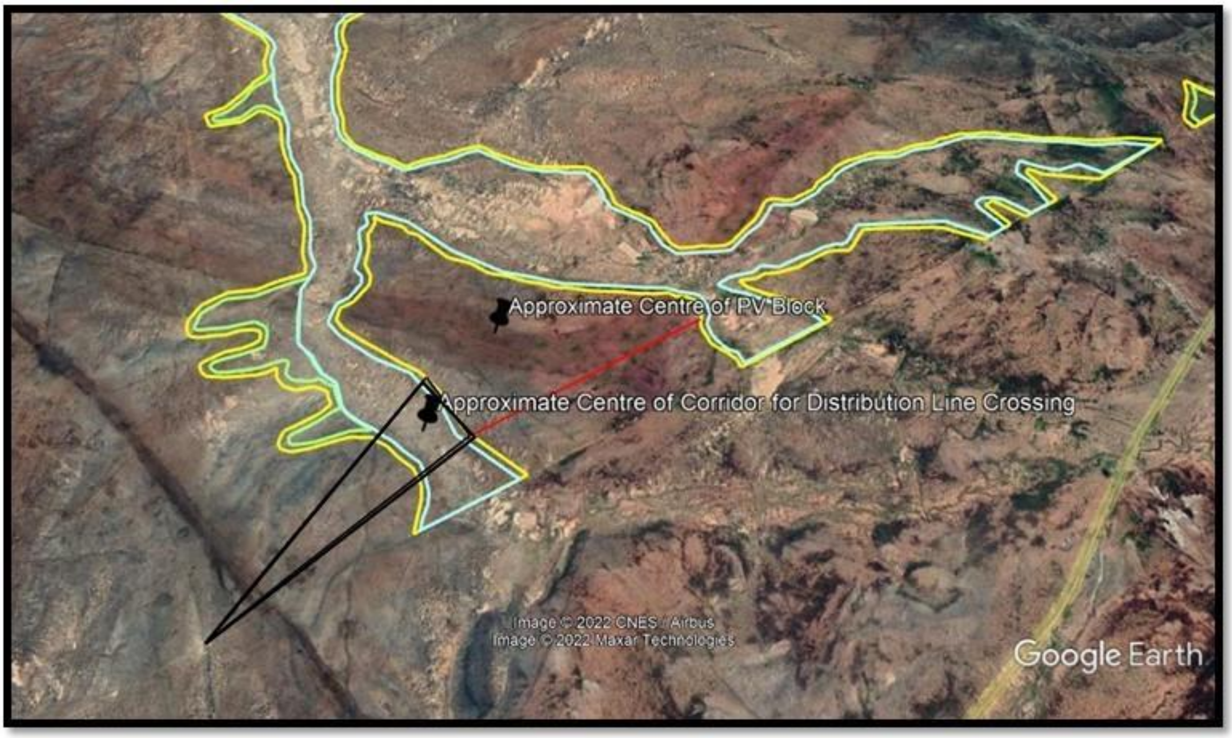

Figure 29: 'Corridors' indicating the permissible area (black polygon) for the alignment of the planned distribution line (66 kV to 132 kV) crossing (MacGregor, 2022)

Roads

Two-track roads

Two-track access roads will be placed between the parallel arrays during the construction phase, and a fire break, comprising a two-track dirt road with mowed vegetation will be created inside the perimeter fence.

Graded Roads

Existing roads will be upgraded (graded 5 to 6 m wide, imported material, shaped for runoff, and compacted).

Servitude road under the Eskom 132 kV powerline.

New roads, 5 to 6 m wide, will be built (graded, imported material, shaped for runoff, and compacted) to access the construction camp and laydown area to access components of the PV system, specifically field transformers and the on-site substation.

Passing lanes: Passing lanes up to ± 8 m wide and ± 30 m long will be placed at strategic areas on new roads.

Drainage line Crossings

Distribution pylons (overhead powerline)

Powerline infrastructure intersecting a watercourse - The planned 66 kV to 132 kV powerline will have a 32 m wide servitude.

Road crossings

- A total of six (6) road crossings will be required to access the different PV Blocks of the Solar PV facility, which is fragmented by the watercourse.
    - **Existing road crossings -** Upgrading three existing road crossings (including installing culverts).
    - **Three road crossings** that will link the two areas separated by a watercourse. Precast box culverts or pipes will also be required for the three road crossings.

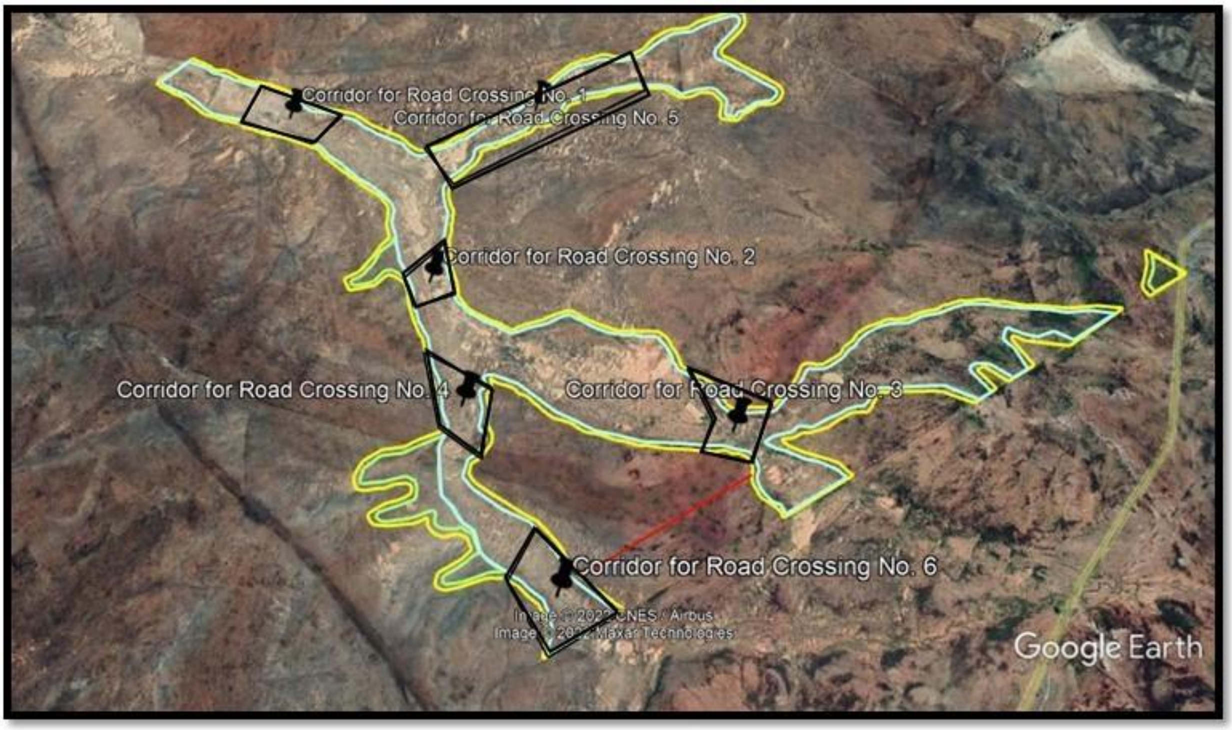

Figure 30: 'Corridors' indicating the permissible area (black polygons) for the alignment of the road crossings (MacGregor, 2022)

Cabling routes: Underground Cable crossings

Approximately 2000 inverters will be cabled to 80 field transformers (twenty-five inverters are connected to a field transformer). Placement of underground cables linking Area 1 to Area 2 with three potential watercourse crossings for these cables (used to take electricity from the field transformers to the on-site substation).

Underground cables from the field transformers to the on-site substation will cross the watercourse at three different locations. It is advised that the Engineers use the same crossings for the underground cables and roads.

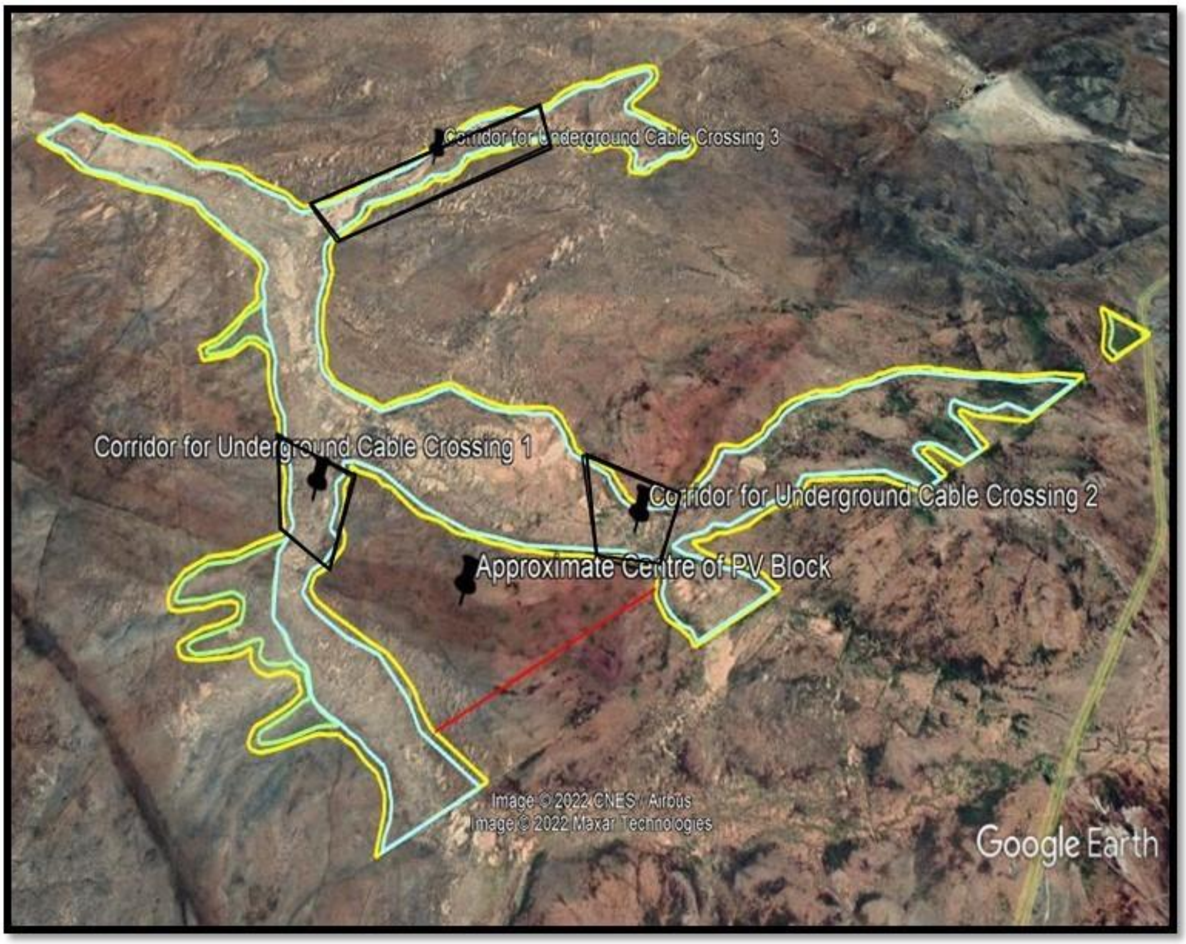

Figure 31: 'Corridors' indicating the permissible area (black polygons) for the alignment of the underground cable crossings (MacGregor, 2022).

Pipe crossings

Installing underground water pipes, aboveground storage tanks and a deionization plant in proximity to both boreholes. Pipes will need to transfer the water from the wind pumps at Borehole No. 4 and Borehole No. 5 (inside the delineated watercourse) to their respective deionization plants and storage tanks.

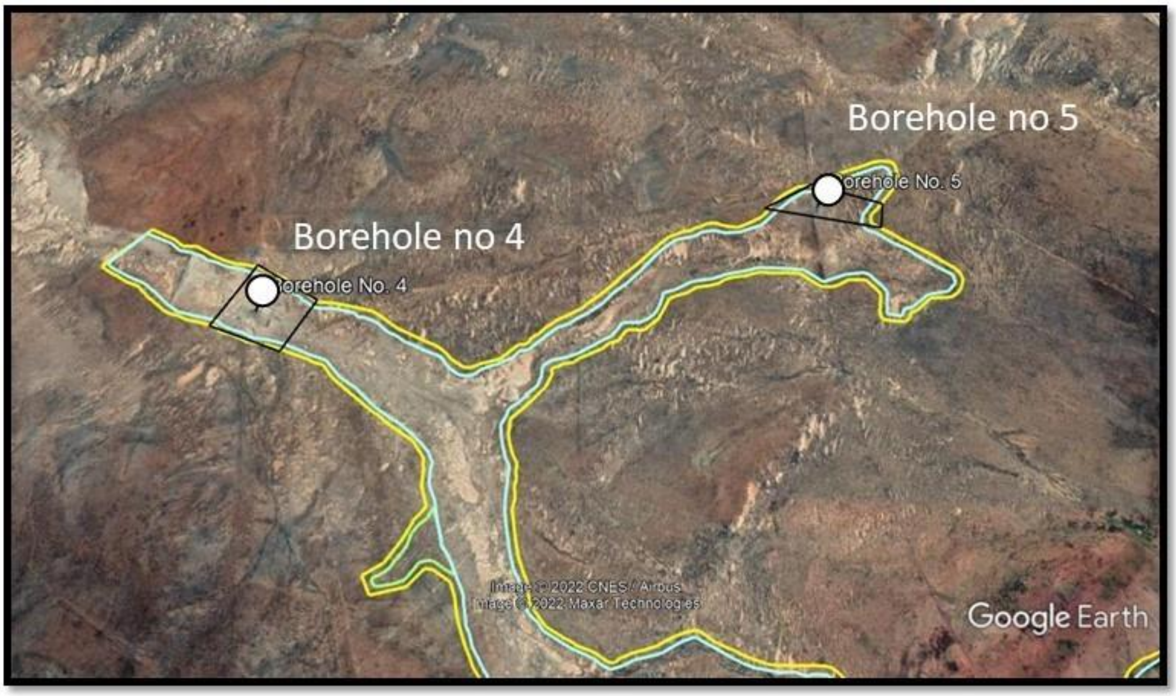

Figure 32: 'Corridors' indicating the permissible area (black polygons) for the alignment of the underground pipelines (MacGregor, 2022).

If a third borehole is drilled at sites T1 or T2, it will, unlike Boreholes No. 4 and 5, be located outside a watercourse. However, a pipeline will need to transport the water from the borehole pump to the PV block containing the operational area including the deionisation plant with water tanks. The pipeline will cross a watercourse whereas the deionisation plant and water tanks may be within 100 m from the edge of the watercourse or 500 m from the edge of a wetland/pan.

Underground cables from the field transformers to the on-site substation will cross the watercourse at three different locations. It is advised that the Engineers use the same crossings for the underground cables and roads.

Perimeter fence (with fire-break road).

Constructing a perimeter fence (and fire-break road) through the watercourse. Erecting a perimeter fence (and creating a fire-break road) that may cross a watercourse in two potential locations It is planned to maintain continuity throughout the watercourse by keeping the perimeter fence around each PV block outside the demarcated 10 m ecological buffer.

Fencing

- A 4 to 5 m-wide fire break road, comprising a two-track dirt road with mowed vegetation will be created inside the perimeter fence.
- Parts of the perimeter fence (and fire-break road) will cross a watercourse.

PV system (solar panel arrays, inverters, and field transformers)

Developing a solar PV system within 100m of a watercourse. There are four PV Blocks in the project area which will wrap around the ephemeral drainage line; some will be within 100m from the edge of the watercourse.

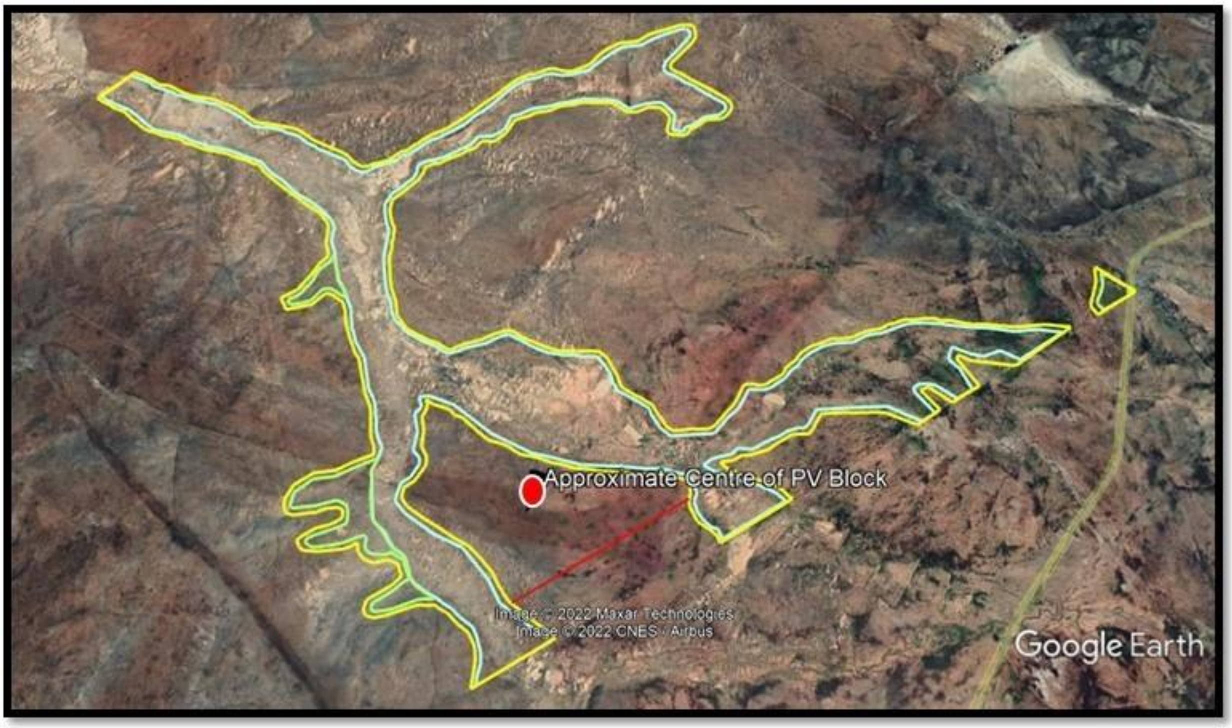

Figure 33: Approximate Centre of PV Block (red dot) where the on-site substation, operational area and construction camp will be located (MacGregor, 2022).

Solar photovoltaic (PV) panels

The development of the proposed solar PV plant involves placement of several photovoltaic panels in a designated area earmarked for the development. The arrays are mounted onto a single-axis tracker and supported by steel or aluminium racks. Although the axis is fixed, the panels themselves will "track" the sun. They stow overnight horizontally, that is at zero tilt to reduce wind loading. The height of the array above the ground in the stow position is ± 2 m. The solar panels cannot move to a vertical (90º) position. The maximum tilt at sunrise (east-facing) and sunset (west-facing) is 50º, so the ground clearance and maximum height during these brief periods will be 0.3 m and 3,822 m, respectively.

During a rain fall event, rain runs across the panel to the dripline and falls to the underlying surface, where it can either infiltrate or run off. Surface runoff beneath solar panels has the opportunity to infiltrate, meaning that there is no significant net loss in pervious area (Jones and Wagener, 2017).

Cook & McCuen (2013) indicate that the PV panels themselves do not have a significant effect on storm water runoff volumes, peak flows, or times to peak, provided that the ground cover (vegetation) beneath the panels is well maintained and is not allowed to deteriorate to a gravel or bare earth surface. Such lack of maintenance would result in significant increases in peak discharge rates, with a consequent risk of erosion at the base of the panels.

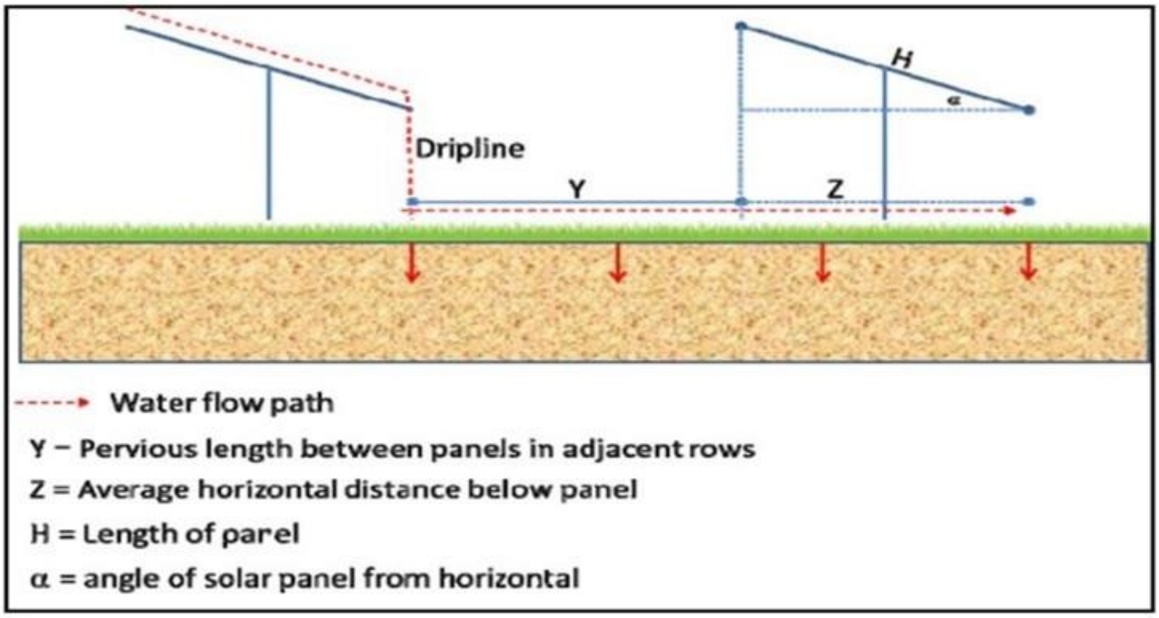

Figure 34: A schematic illustration of the hydrologic process for solar panels (Minnesota Stormwater Manual, 2017).

<u>Boreholes</u>

- Water shall be abstracted from two existing boreholes and a third borehole is proposed at the operational area.
- Water treatment (deionisation) plant to be located outside ecological buffer).
- 10 m^3-tanks (100 m^3 in total) will be located outside the 20 m ecological buffer.

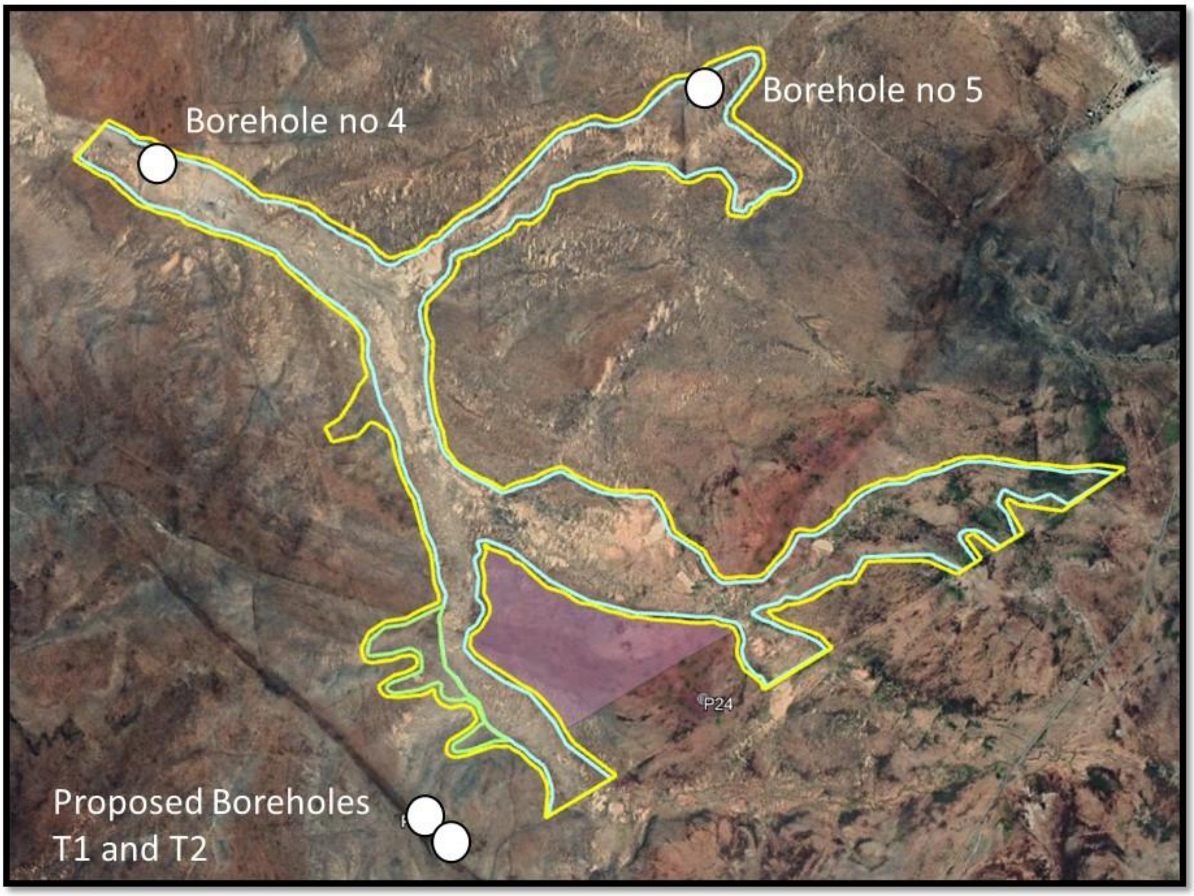

Figure 35: The two existing boreholes inside the delineated watercourse (MacGregor, 2022), and two sites, T1 and T2 are proposed borehole options.

Water required

- Groundwater will be required during construction for dust control (suppression) along principal access roads, mixing concrete and potable usage.
- Groundwater will be required during operation for potable usage, washing the modules, and livestock watering for the sheep.

Excluding dust control, it is estimated that approximately **22,05 m^3/day** of groundwater shall be required during construction for mixing concrete (**5,8 m^3/day**) and potable usage (**16,25 m^3/day**) but dust control (suppression) along principal access roads would require an additional **674,4 m^3 per spraying**. The use of certain environmentally friendly soil binders can, however, reduce water consumption per spraying to **168,6 m^3**.

It is estimated that approximately **13,4 m^3/day** of groundwater shall be required during operation for potable usage (**5,5 m^3/day**), washing the modules (**4,5 m^3 per day**), and livestock watering for the sheep (**3,4 m^3/day**).

Pollution potential at storing and disposal facilities.

Wastewater *d*isposal

Construction

The principal sanitation system during **construction** shall be a sewerage treatment package plant, specifically the NEWGen100. The NewGen100 sanitation system will be supplemented by portable chemical toilets for use by the work front further away from the construction camp.

Operation

The principal sanitation system during **operation** shall be a sewerage treatment package plant, specifically the Biorock package plant. Treated effluent may be reused during construction and operation for toilet flushing and/or dust suppression on gravel roads.

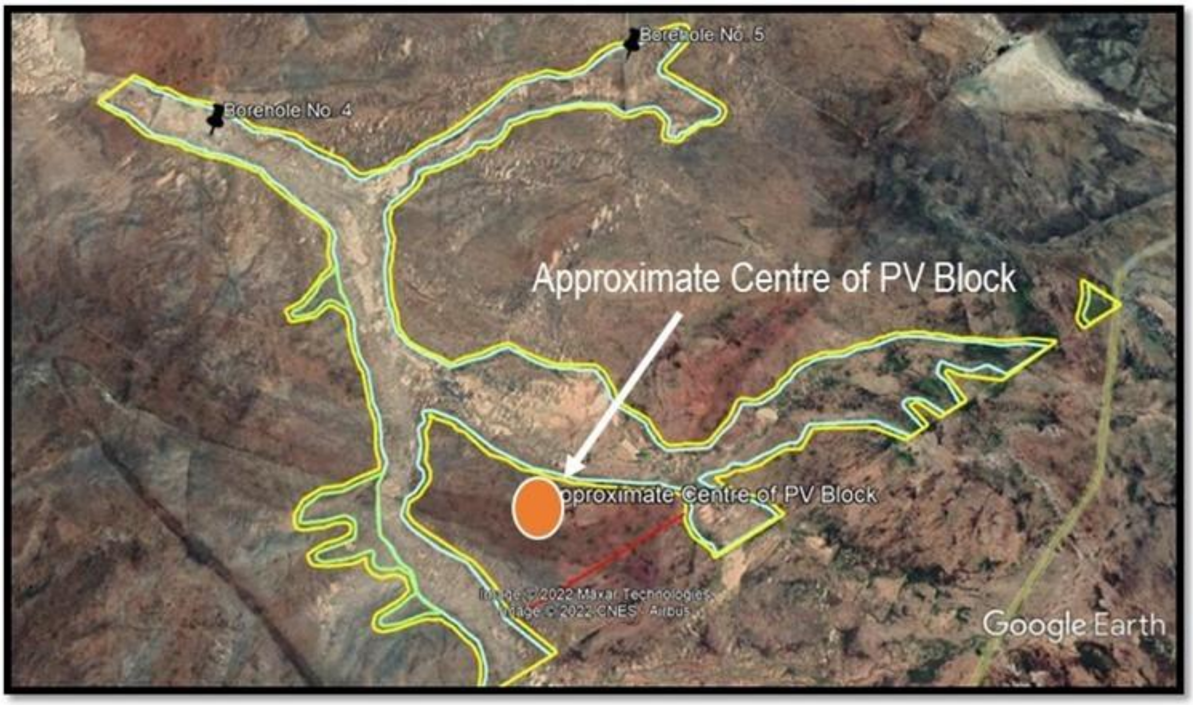

Figure 36: The approximate Centre of PV Block where the on-site substation and operational area will be located where tanks will be used for storing potable groundwater and wastewater (MacGregor, 2022).

Storage

Approximate Centre of PV Block where the on-site substation, operational area and construction camp will be located, will manage aspects relating to disposal and storage of wastewater. Up to 300m^3 of water storage tanks may be installed for the storage of groundwater.

Construction - It is assumed that the two-track roads in between the solar panel arrays and the firebreak road will not contribute significantly to dust by maintaining the native vegetation in the middle of the two-tracks. The principal sources of dust have been identified as those graded/cleared roads that will be used regularly to access key areas during construction.

Operation - the only remaining principal source of dust that will be used regularly by 55 staff to access the operational area is the access road from the N10 to the main entrance of the operational area, including the servitude road under the Eskom 132 kV powerline (18,5 km).

2.5.2 Assessment of impacts – Risk Matrix (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

The risks associated with the water use/s and related activities.

The Risk Assessment was done in accordance with the Risk Matrix (Based on DWS 2015 publication: Section 21 (c) and (I) water use Risk Assessment Protocol and as contained in Appendix A in GN509 of 26 August 2016) and was carried out considering the risk rating of the project. Following is an abstract from the completed Risk Matrix to indicate the significance of the project activities in the De Aar Phase 3 Solar PV facility project area:

NEMA and the EIA Regulations call for a hierarchical approach to impact management. The Impact Mitigation Hierarchy:

• Firstly, alternatives must be investigated to avoid negative impacts altogether.

• Secondly, after it has been found that the negative impacts cannot be avoided, alternatives must be investigated to reduce (mitigate and manage) unavoidable negative impacts to acceptable limits.

• Thirdly, alternatives must be investigated to remediate (rehabilitate and restore).

• Fourthly, unavoidable impact that remain after mitigation and remediation must be compensated for through investigating options to offset the negative impacts.

• While throughout, alternatives must be investigated to optimise positive impact.

Undertaking a Risk Assessment of certain activities associated with the development (to determine if S21(c) and (i) water uses can be authorised under a General Authorisation), specifically:

- Upgrading three existing road crossings (including installing culverts),
- Erecting a perimeter fence (and creating a fire-break road) that may cross a watercourse in two potential locations,
- Developing a solar PV system within 100m of a watercourse and/or 500 m from a wetland or pan (including the possible wetland system near Corner C),
- Installing underground water pipes, aboveground storage tanks and a deionization plant in proximity to both boreholes (with pans), and
- Three potential watercourse crossings for underground cables (used to take electricity from the field transformers to the on-site substation).

Table 21: Following is an abstract from the Risk Assessment Matrix for the De Aar Phase 3 Solar PV facility project area: relating to all current and expected impacts that the project had on the system, the significance of these impacts, and mitigation through control measures (original Risk Assessment Matrix attached as Appendix 7).

No.	Phases	Activity	Aspect	Potential Impact	Significance	Risk Rating	Confidence level
1	Construction	Construction of linear structures: General	Vegetation clearing: Vegetation will be cleared from the physical footprint of pylon footings (linear), cabling routes and underground cables and water pipes (linear), roads (linear), a fire-break road and fencing posts (linear).	Impact 1. Loss of riparian systems and disturbance of the alluvial water courses.	**38,25**	**Low**	**3**
				Impact 2. Areas cleared or disturbed around site might be affected by erosion of topsoil.	**38,25**	**Low**	**4**
				Impact 3. Disturbing topsoil might result in increased turbidity, as well as siltation in watercourses.	**45**	**Low**	**3**
			Spreading invasive non-native plants into degraded areas.	Impact 4. Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas. Competing with indigenous plant species.	**42,5**	**Low**	**3**
2	Construction	Construction of linear structures: Specific to overhead powerlines, road crossings, underground pipes crossing, underground cables crossing, a fire-break road and fencing posts.	Establishment of transmission pylons and overhead powerlines within / in close proximity to watercourses; Connecting overhead powerline - Impacts on water quality.	Impact 5. Areas cleared or disturbed around the pylon site might be affected by erosion of topsoil.	**26**	**Low**	4
				Impact 6. Disturbing topsoil around the pylon site might result in increased suspended solids, as well as siltation in watercourses.	**24**	**Low**	4
			Road watercourse crossings: Access through drainage lines and riparian zones, disturbing topsoil.	Impact 7. Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	**40,5**	**Low**	3
				Impact 8. Inadequate storm water management and soil stabilisation measures might result in increased suspended solids and thus the siltation of watercourses.	**40,5**	**Low**	3
				Impact 9. Road crossings interfering with surface- or sub-surface flows.	**24**	**Low**	4
			Watercourse crossings - Underground pipes crossing through drainage lines and riparian zones.	Impact 10. Removal of vegetation and disturbing topsoil by laying underground pipelines at watercourse crossings might result in increased erosion, which leads to siltation of watercourses.	**29,25**	**Low**	4
			Watercourse crossings: Underground cables crossing through drainage lines and riparian zones.	Impact 11. Disturbing topsoil by laying underground cables at watercourse crossings might result in increased erosion, which leads to siltation of watercourses.	**29,25**	**Low**	4

			Watercourse crossings – Perimeter fence crossing: Fences crossing through drainage lines and riparian zones.	Impact 12. Disturbing topsoil by installing the perimeter fence at watercourse crossings might result in increased erosion, which leads to siltation of watercourses.	**24**	**Low**	4
3	Construction	Photovoltaic panels.	The primary concern with such a development would be the impact that it has on the storm water runoff patterns – the hydrologic response – of the land.	Impact 13. Risk of erosion at the base of the panels.	**47,25**	**Low**	**3**
				Impact 14. Sedimentation in wetlands and watercourses.	**42,75**	**Low**	3
4	Construction	Pollution potential.	Servicing of construction vehicles and equipment in a drainage line catchment.	Impact 15. Chemical pollution of the water resources.	**29,25**	**Low**	**4**
			Storing and disposal facilities.	Impact 16. Pollution due to accidental releases of contaminated liquids.	**38,25**	**Low**	

Control measures of these impact are described below.

Table 22: The rating classes for the Risk Assessment Matrix.

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

Following are the control measures applied to mitigate for impacts listed during the Risk Assessment process in Table 21.

Construction of linear structures: General

Impact 1. Loss of riparian systems and disturbance of the alluvial water courses.

Control Measures

- A construction method statement should be compiled and approved prior to the commencement of construction activities.
- The method statement should take cognisance of:
    - The mitigation measures outlined below, as well as mitigation measures specified by each of the environmental specialists.
    - The conditions of the Environmental Authorisation and Integrated Water Use License.
    - The Environmental Management Program (EMPr) for the project submitted as part of the Environmental Impact Assessment Report.
    - The Environmental Control Officer (ECO) must ensure that the contractor adheres to the above-mentioned documents.
- The highly sensitive major ephemeral washes and their associated buffer areas should be regarded as No-Go areas for all construction activities apart from road construction/upgrading and lying pipes and distribution line, and only where the use of existing access roads is not an option.
- The recommended buffer areas between the delineated freshwater resource features and proposed project should be maintained.
- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
- A vegetation rehabilitation plan should be implemented. Vegetation cover can be removed as sods and stored within transformed vegetation. Alien invasive vegetation must be removed prior to storing the grassland sods.
- The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other.
- Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.
- Vegetation clearing should occur in a phased manner to minimise erosion and/or run off.
- Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and where deemed necessary by the ECO.
- Road infrastructure and other linear development (pipes, cables and fences) should coincide as far as possible to minimise the impact.

Impact 2. Areas cleared or disturbed around site might be affected by erosion of topsoil.

Control Measures

- Conduct pre-disturbance surveys as appropriate to assess the presence of sensitive areas, fauna, flora and sensitive habitats.
- Formal infrastructure, in the form of access roads, pipes, culverts, etc. should be kept to a minimum.
- Site projects to avoid construction too near pristine natural areas and communities.
- Vegetation and soil should be retained in position for as long as possible, and should only be removed immediately ahead of construction / earthworks in any specific area.
- In areas where construction activities have been completed and no further disturbance is anticipated, rehabilitation and re-vegetation should commence as soon as possible.
- The Swartland and Valsrivier soils may have an influence on any foundations.
- Where the original vegetation was cleared or severely disturbed, rehabilitation measures should be put in place.
- Replanting activities should be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment.
- The sowing of grass seeds in combination with the chemical and mechanical water infiltration improvement measures should also be considered for highly degraded areas.
- Should plants not successfully establish within two growing seasons after the first planting, new plant material should be provided.
- It is important that a good long-term grazing strategy (with small stock). Maintaining the natural vegetation in an optimal state is seen as the best and most cost-effective method to limit soil erosion to the minimum.
- Any erosion channels developing during or after the construction period should be appropriately backfilled (and compacted where relevant) and the areas restored to a condition similar to the condition before the erosion occurred.
- Site rehabilitation should aim to restore surface draining patterns, natural soil and vegetation as far as feasible.

Impact 3. Disturbing topsoil might result in increased turbidity, as well as siltation in watercourses.

Control Measures

- Storm water management and erosion control measures should be implemented. These should include the following:

  - The excavated soil should be placed on the upstream side of construction activities in order to act as a storm water diversion berm.

  - Where such diversion berms create concentrated flows, as well as in steep and/or sensitive areas (such as wetlands) the use of swales, silt fences or other effective erosion control measures is recommended to attenuate runoff.

  - All storm water management measures should be regularly maintained.

- The project areas are situated on Karoo sediments that are known for high sodium and magnesium content in the soil. Water infiltration can be improved by means of mechanical intervention and the application of gypsum or similar ameliorants.

Impact 4. Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas. Competing with indigenous plant species.

Control Measures

- A weed and alien invasive species control plan should be implemented during the contract period.

- Re-vegetation with appropriate indigenous species to prevent dust and erosion, as well as establishment of alien species.

- Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion.

- Any materials brought in to construction sites should be from sources free of invasive alien species.

- Clearing of invasive alien plants must take place coupled with the sowing of seeds of indigenous species to stabilise disturbed habitats.

- Compacted bare ground should be loosened and pitted, and covered with branches or stones. This will improve the ability of the surfaces to trap seeds and to absorb rainwater, thereby hastening vegetation recovery.

Construction of linear structures: Specific to overhead powerlines, road crossings, underground pipes crossing, underground cables crossing, a fire-break road and fencing posts.

Impact 5. Areas cleared or disturbed around the pylon site might be affected by erosion of topsoil.

and

Impact 6. Disturbing topsoil around the pylon site might result in increased suspended solids, as well as siltation in watercourses.

Control Measures (Specific to transmission pylons and overhead powerlines**)**

- No pylons should be located within an area that would be expected to become inundated during a 1:100 flood event.
- Vegetation should be removed only where essential for the continuation of the powerline. Any disturbance to the adjoining natural vegetation cover or soils should not be allowed.
- The duration of construction activities at each pylon site should be minimised as far as is practical.
- The shallow soils may present a challenge for some construction items like poles that need to be planted.
- Once construction at a pylon site is complete, the site should be rehabilitated immediately by removing all waste material. The rehabilitation specification should be determined by the soils and vegetation specialists.

Also refer to Control Measures of Impact 1 and 2.

Impact 7. Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.

Control Measures

- It is not envisaged that the proposed development will result in major soil erosion or any other degradation of the soils of the focus areas if there is proper runoff management from roads and other bare areas.
- Where new water course crossings are required, the engineering team must provide an effective means to minimise the potential up- and downstream effect of erosion and sedimentation (erosion protection) as well as minimise the loss of riparian vegetation (reduce footprint as much as possible).
- The area of disturbance should be kept to a minimum to allow clearing of the construction right of way. Especially the roads that cross the large flood plains and severe gulley erosion (observed outside the three project areas) should be planned well to reduce soil erosion. This is also true for temporary access roads to install the solar panels.
- Ensure dust abatement measures are in place during and post construction.

- Ensure erosion control along roads. Existing roads should be used for access as far as possible.

- Avoid routes through drainage lines and riparian zones wherever possible. Where access through drainage lines and riparian zones is unavoidable, only one road is permitted, constructed perpendicular to the drainage line.

- Avoid roads that follow drainage lines within the floodplain.

- Build water diversion structures at 20 to 50 m intervals (depending on the steepness of the slope) along veld tracks.

- Berm ends should be extended on the downslope side of the road with rocks to prevent diverted water eroding the soil. These will prevent veld roads acting as water channels, causing donga erosion. It will also facilitate vegetation recovery on closed roads.

- Storm water runoff off all roads must be spread as much as possible, to avoid concentration of flows off compacted or hardened surfaces.

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed (Figure 37). However, it is important to note that rainfall is highly unpredictable with frequent droughts for the project areas.

- The clayey soils and most noticeably the Swartland and Valsrivier soils may restrict vehicle movement during the wet season.

- There should be reduced activity at the site after rainfall events when the soils are wet. No driving off from hardened roads should occur immediately following large rainfall events until soils had dried out and the risk of bogging down has decreased.

- Slight deviations of alignment are permitted, so as to avoid significant vegetation specimens and communities, natural features and sites of cultural and historical significance. These deviations must be approved by the ECO.

- Maintain all access routes and roads adequately in order to minimise erosion and undue surface damage. Repair rutting and potholing and maintain stormwater control mechanisms.

- Ensure that all access roads utilised during construction (which are not earmarked for closure and rehabilitation) are returned to a usable state and / or a state no worse than prior to construction.

- The width of the construction corridor should be kept to a minimum.

- Existing two-track road crossings occur within the corridors demarcated for Road Crossing Numbers 1, 2, 3 and 6 but (except for No. 6) they are at oblique angles to the principal direction of flow within the watercourse, making them longer than necessary. Consequently, it is advised that the Engineers realign those crossings, effectively designing new (shorter) crossings (as opposed to upgrading existing two-track roads) to reduce the physical footprint and scale of the ecological impact.

- Slight deviations of roads and route alignments must be permitted in order to avoid plants of conservation concern that are located within the pipeline route.

- Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area in the river beds.

- Storm water crossings at access roads should be provided in the form of drifts, rather than pipes or culverts. Drifts should be constructed from concrete or grouted stone pitching. Drifts should be provided at frequent spacings, again to minimise the concentration of flows.

- Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that it does not re-occur.

Figure 37: The clayey soils and most noticeably the Swartland and Valsrivier soils may restrict vehicle movement during the wet season.

> **Impact 8.** Inadequate storm water management and soil stabilisation measures might result in increased suspended solids and thus the siltation of watercourses.

Control Measures

- All storm water drainage discharge points should be provided with outlet structures, designed with adequate erosion protection, to ensure that storm water is discharged from formal structures onto the natural ground at a safe and acceptable velocity.

- No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.

- The size and lining of the drain would be dependent on the peak flow rates and velocities, which should be determined through hydrological modelling.

- Storm water crossings at access roads should be provided in the form of drifts, rather than pipes or culverts.

- No off-road driving in wet conditions, and for two weeks afterwards. In particular, no driving in veld should take place on clay or fine-textured soils following rain.

- Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas.

Impact 9. Road crossings interfering with surface- or sub-surface flows.

Control Measures

- Minimise new crossings over wetlands and watercourses. If wetlands or watercourses cannot be avoided, ensure that road crossings are constructed using riprap, gabion mattresses, and/or other permeable material to minimise the alteration of surface and sub-surface flow.
- All crossings over watercourses should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river channel.

- Flow of water under roads must be allowed to occur without leading to concentration of surface flow. This can be achieved through designing bridges that span the entire width of aquatic ecosystems where possible, or laying down pipes or culverts to ensure connectivity and avoid fragmentation of surface aquatic ecosystems.

Impact 10. Removal of vegetation and disturbing topsoil by laying underground pipelines at watercourse crossings might result in increased erosion, which leads to siltation of watercourses.

Control Measures

Road infrastructure and other linear development such as underground pipes, should coincide as far as possible to minimise the impact.

Implement best management practices for underground linear structures (underground pipelines and underground cables): The following mitigation is aimed at both these underground linear structures:

- Suitable demarcation must be erected around the construction area, including the servitude, areas where material is stored and the actual footprint of the development to prevent access to sensitive areas.

- Site demarcations should be maintained until the cessation of all construction activities.

- Vehicular or pedestrian access must be prohibited in natural areas beyond the demarcated boundary of the construction site.

- A vegetation rehabilitation plan should be implemented.

- A rehabilitation plan must be implemented that will restore the natural vegetation to what it was prior to the construction of the pipeline, so that the long-term impact could be negligible.

- Construction activities must be restricted to previously disturbed areas, as far as possible.

- Sensitive vegetation containing protected plant species and plants of conservation concern must be cordoned off and protected from construction activities and vehicles.

- Construction in and around watercourses must be restricted to the dryer winter months.

- Cordon off areas under rehabilitation as “no-go areas” to prevent vehicular, pedestrian and livestock access.

- Implement source-directed controls.

- Maintain buffer zones to trap sediments.

- Conduct active rehabilitation during the construction activities.

- Implement appropriate stormwater management around the excavation areas to prevent the ingress of run-off into the excavation trenches.

Impact 11. Disturbing topsoil by laying underground cables at watercourse crossings might result in increased erosion, which leads to siltation of watercourses.

Control Measures

- Underground cables from the field transformers to the on-site substation will cross the watercourse at three different locations. It is advised that the Engineers use the same crossings for the underground cables and roads.

- Road infrastructure and other linear development such as underground cables, should coincide as far as possible to minimise the impact.

Implement best management practices for underground linear structures (underground pipelines and underground cables): See best management practices above (mitigation: Pipelines) for mitigation aimed at both these underground linear structures.

Impact 12. Disturbing topsoil by installing the perimeter fence at watercourse crossings might result in increased erosion, which leads to siltation of watercourses.

Control Measures

- Fence sites as appropriate to ensure safe restricted access.

- The shallow soils may present a challenge for some construction items like poles that need to be planted.

- A rehabilitation plan must be implemented that will restore the natural vegetation to what it was prior to the construction of the pipeline, so that the long-term impact could be negligible.

Photovoltaic panels.

Impact 13. Risk of erosion at the base of the panels.

Control Measures

- Disturbance of the natural topography and vegetation cover should be minimised. The natural contours should be preserved as far as is practical in order to preserve the existing site drainage patterns as far as possible.
- Clearing of vegetation for the construction of substations and other infrastructure that will be covered with weather proof surfaces should preferably be done outside the main rainfall periods. This will ensure there will not be unnecessary sediment load in the water courses before the cleared areas can be stabilized.
- Correct panel level and aspect should be provided in the design of the support structures and not through earthworks.
- Utilisation of low impact construction techniques should be encouraged, with the footprint of disturbed areas being minimised.
- Allows growth of vegetation beneath and between panels.
- Good rangeland management for the areas underneath the solar panels will be essential to maintain a good vegetation cover and to reduce soil erosion and runoff.
- It is possible that the shading effect of the proposed solar panels will increase soil moisture content and therefore improve the general grazing capacity of the study areas.
- The mounting foundations of the panels should occupy minimal space.
- Natural, dispersed, drainage should be encouraged, by maintaining the natural drainage characteristics of the land as far as possible, thereby minimising the concentration of flows and consequently the risk of erosion.
- Formal infrastructure, in the form of access roads, pipes, culverts, etc. should be kept to a minimum.
- A vegetation cover that at least matches the natural, pre-development cover, should be maintained at all times between and beneath the solar panels.
- Grass cover at base of panels, particularly on drip line, should be actively maintained.
- Regular visual inspections are required to identify problems as they occur.
- Reseed bare areas.
- Inspection of the area frequently especially after intense rainfall and runoff events, with particular emphasis on the dripline areas and at access roads.
- Repair of erosion channels as soon as they develop.
- Monitoring in the form of visual inspections of the vegetation cover and erosion and sediment control features.

Impact 14. Sedimentation in wetlands and watercourses.

Control Measures

- Allows runoff to flow easily between each panel set and decrease the event of concentrated runoff from taking place.
- Guidelines for the arrangement of panels (spacing between arrays) in order to minimise the impact on storm water runoff characteristics are provided by the Minnesota Pollution Control Agency (2017).
- Diversion of upslope surface runoff around the solar PV area should be considered. Berms and/or open drains can be provided for this purpose. The size and lining of the drain would be dependent on the peak flow rates and velocities, which should be determined through hydrological modelling.
- All storm water drainage discharge points should be provided with outlet structures, designed with adequate erosion protection, to ensure that storm water is discharged from formal structures onto the natural ground at a safe and acceptable velocity.
- Any sediment build-up should be removed immediately.
- Develop and implement a storm water management plan.
- The objective of a Storm Water Management Plan (SWMP) is to control storm water runoff from the site. It should be designed to improve the storm water quality (i.e., sediment removal) and control runoff directly being discharged from the designated site.
- Disturbance of the natural topography and vegetation cover should be minimised. The natural contours should be preserved as far as is practical in order to preserve the existing site drainage patterns as far as possible.
- Natural, dispersed, drainage should be encouraged, by maintaining the natural drainage characteristics of the land as far as possible, thereby minimising the concentration of flows and consequently the risk of erosion.
- Diversion of upslope surface runoff around the solar PV area should be considered. Berms and/or open drains can be provided for this purpose.
- The size and lining of the drain would be dependent on the peak flow rates and velocities, which should be determined through hydrological modelling.
- A storm water drain should be provided along all access roads. The size and lining of the drain would be dependent on the peak flow rates and velocities, which should be determined through hydrological modelling.

Pollution potential.

Impact 15. Chemical pollution of the water resources.

Control Measures

- Sites of oiling and refuelling points to be located away from rivers, surface water sewers or other watercourses.

- Prevent the spillage of oil, grease and diesel from construction plant (increased hydrocarbon concentrations in surface waters) which will Impact on the quality of storm water runoff from the project area.

- Drip trays should be placed under any activity requiring active lubrication or oiling at the pylon sites.

- Spill clean-up kits should be available on site for immediate remediation of any spills and removal of contaminated soils.

- No fuel should be stored at the pylon sites and no refuelling or servicing of construction plant should take place at the construction sites.

- No construction materials should be disposed of within the delineated riparian zone or within the 20 m buffer zone on the watercourse.

- No concrete batching should take place within the delineated riparian zone or within the 20 m buffer zone on the watercourse.

- All surplus spoil material from the foundation excavations (i.e., not used as backfill) should be removed from the site as soon as is practically possible.

- Waste material should be removed to a licensed waste disposal facility, if it cannot be re-used or recycled.

Impact 16. Pollution due to accidental releases of contaminated liquids.

Control Measures

- Develop and implement waste management plan.

- Black water (flush toilet sewerage) and grey water (kitchen, change rooms, medical room, and workshop) shall be treated to general or special limits with a bio-box package plant
- The treated effluent will need to be treated further if it is to be used for cleaning the modules (or panels).

- Storing treated effluent (and rainwater) during operation for reuse and/or disposal in tanks will be used for storing treated wastewater (and rainwater) for reuse (toilet flushing and/or dust suppression) and/or disposal.
- Storing untreated effluent (concrete slurry from e.g., concrete mixer trucks) will be used to store concrete slurry for reuse or disposal.
- Storing contaminated soil for reuse (bioremediation and rehabilitation) for storage and bioremediation of soil contaminated with hydrocarbon spills or storage and collection for disposal at the De Aar licensed landfill site.
- The high concentration of ions in the borehole water will be removed by means of a deionization plant. The demineralised water will be stored in aboveground JoJo type storage tanks. The deionization plants and storage tanks will be located outside the 1:100-yr flood line. Water shall not be piped to any other area. Instead, it will be pumped into water bowsers and driven to those areas where it will be utilised, including additional storage tanks at the operational area.

2.5.3 The Impact Mitigation Hierarchy

- Firstly, alternatives must be investigated to avoid negative impacts altogether.
- Secondly, after it has been found that the negative impacts cannot be avoided, alternatives must be investigated to reduce (mitigate and manage) unavoidable negative impacts to acceptable limits.
- Thirdly, alternatives must be investigated to remediate (rehabilitate and restore).
- Fourthly, unavoidable impact that remain after mitigation and remediation must be compensated for through investigating options to offset the negative impacts.
- While throughout, alternatives must be investigated to optimise positive impact.

2.5.3.1 to 2.5.6 Impact Assessment Aspects

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 to 2.5.6 below):

2.5.3.1 Maintaining the priority aquatic ecosystem.

Question: Is the proposed development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?

A: Yes, no significant adverse impact has been predicted during the study and impact assessment that could jeopardise the surrounding environment. Aspects of mitigation prescribed, should maintain the integrity of the system.

2.5.3.2 Maintaining the resource quality objectives.

Question: Is the proposed development consistent with maintaining the resource quality objectives for the aquatic ecosystems present?

A: No RQO was set by DWS for this ephemeral system. Water quality and flows will remain unchanged by the construction and operational phases as the system drains towards the Brak River and it will not change the PES of the mainstem.

2.5.3.3 Impact on fixed and dynamic ecological processes.

Question: How will the proposed development impact on fixed and dynamic ecological processes that operate within or across the site? This must include:

a. Impacts on hydrological functioning.

Impact: 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);

A: It is an ephemeral system and it only flows rarely during seasonal downpours. No further damming is envisaged thus flows can proceed towards the Brak River mainstem.

b. Sediment regime.

Impact: 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);

A: Should the mitigation regarding sedimentation in the project area be adhered to, no significant changes in the sediment regime is expected.

c. Modification in relation to the overall aquatic ecosystem.

Impact: 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 / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.)?

A: No modification is expected. The ephemeral system flows rarely and during these events no interference of flows is foreseen.

d. Risks associated with water uses.

Impact: To what extent will the risks associated with water uses and related activities change?

A: It has already been established that the development will not impact on any of the drainage users due to the project. As such the activity will not affect or impact any broader societal needs, communities or economies.

2.5.3.4 Impact on the functioning of the aquatic feature stated

Question: How will the proposed development impact on the functioning of the aquatic feature? This must include:

a. Base flows.

Impact: On base flows (e.g., too little or too much water in terms of characteristics and requirements of the system).

A: The ephemeral system flows rarely and during these events no interference or manipulation of flows is foreseen.

b. Quantity of water.

Impact: The 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).

A: The ephemeral system flows rarely and during these events no interference or manipulation of flows is foreseen.

c. Change in the hydrogeomorphic typing.

Impact: The change in the hydrogeomorphic typing of the aquatic ecosystem (e.g., change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland).

A: The presence of pylons or solar panels will have no impact on flow or associated habitat.

d. Quality of water.

Impact: The quality of water (e.g., due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication);

A: A solar PV development does not entail chemical processes, so chemical contamination of storm water generated on the site would typically not be a concern.

e. Ecological connectivity.

Impact: The fragmentation (e.g., road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).

A: All probable adverse impacts on the drainage line are well mitigated according to the risk assessment, which will be incorporating all linear developments.

f. Loss or degradation of all or part of any unique or important features.

Impact: 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.);

A: There will be no loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem since.

2.5.3.5 Impact on key ecosystems regulating and supporting services especially:

Question: How will the proposed development impact on key ecosystems regulating and supporting services especially:

(a) Flood attenuation: There are some existing small dams in the system, but no structure is planned in the project area that will change the current aquatic ecosystem.

(b) Streamflow regulation: No streamflow regulation will take place when the structure is in place. There are currently some existing small dams in the system, but no structure is planned in the system that will impact streamflow.

(c) Sediment trapping: It will remain a free-flow system.

(d) Phosphate assimilation: There is no reason to believe that the construction or operation of the solar system will have an impact on any water quality parameter in the drainage reach.

(e) Nitrate assimilation: There is no reason to believe that the construction or operation of the solar system will have an impact on any water quality parameter in the drainage reach.

(f) Toxicant assimilation: A solar PV development does not entail chemical processes, so chemical contamination of storm water generated on the site would typically not be a concern.

(g) Erosion control: In areas where construction activities have been completed and no further disturbance is anticipated, rehabilitation and re-vegetation should commence as soon as possible.

(h) Carbon storage: By not interfering with any plant cover and not impacting on the extensive shrubby areas around the project area, will keep the carbon levels similar to before the construction.

2.5.4 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?

A: There is no reason to believe that the proposed development will 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.

2.5.5 In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered.

A: Not applicable to this project.

2.6 Need & Desirability (not listed as part of the Aquatic Biodiversity Protocol)

According to Regulation 13(1)(b) and 13(1)(e) read together with Regulation 18 of the amended EIA Regulations, 2014, Specialists must have knowledge of any guidelines that have relevance to the proposed activity and have regard to the need for and desirability of the undertaking of the proposed activity.

2.7 Minimum Requirements for Specialist Assessments (see below)

The protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity.

This protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on aquatic biodiversity for activities requiring environmental authorisation.

Table 22:	Specialist reports Checklist
	Requirements for Specialist Reports: Published in Government Notice No. 320; Government Gazette 43110**;** 20 March 2020
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;
2.7.2.	a signed statement of independence by the specialist;
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;
2.7.4.	the methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant;
2.7.5.	a description of the assumptions made any uncertainties or gaps in knowledge or data;
2.7.6.	the location of areas not suitable for development, which are to be avoided during construction and operation, where relevant;
2.7.7.	additional environmental impacts expected from the proposed development;
2.7.8.	any direct, indirect and cumulative impacts of the proposed development on site;
2.7.9.	the degree to which impacts and risks can be mitigated;
2.7.10.	the degree to which the impacts and risks can be reversed;
2.7.11.	the degree to which the impacts and risks can cause loss of irreplaceable resources;
2.7.12.	a suitable construction and operational buffer for the 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);
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;
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
2.7.16.	any conditions to which this statement is subjected.

2.8 Aquatic Biodiversity Specialist Assessment Report

The findings of the specialist assessment must be written up in an Aquatic Biodiversity Specialist Assessment Report that contains, as a minimum, the information summarised in Table 22.

The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP), with expertise in the field of aquatic sciences.

For detail of the Registered Specialist, see Section 2.1.

2.8.1 Details of the Specialist

2.8.1.1 Contact details of the specialist:

Dr Andrew Deacon
Cell: 082 325 5583
Email: andrew@nethog.co.za
PO Box 784, Malalane, 1320

Registered with the South African Council for Natural Scientific Professions (SACNASP). Registration number: 116951

2.8.1.2 Field of expertise: Freshwater Ecologist

2.8.1.3 Curriculum vitae

Dr Andrew Deacon (PhD Zoology) worked as a researcher at Scientific Services, South African National Parks (SANParks, 1989 - 2012). He was initially employed as an Aquatic ecologist to coordinate the multidisciplinary KNP Rivers Research Programme, but later was tasked to manage the monitoring and research programmes for small vertebrate ecology in 15 South African National Parks (including Addo-, Kalahari- and Kruger NP).

As a recognised scientist in the fields of Ichthyology and Terrestrial Ecology, he is currently engaged as a specialist consultant regarding ecological studies. He was involved in numerous research programmes and projects and produced EIA specialist reports (aquatic or terrestrial ecology) for 82 projects. Additionally, he also participated in Aquatic ecosystem projects, Environmental Water Requirement Studies and Faunal and ecosystems monitoring projects.

Apart from multiple environmental projects in South Africa, he has worked on assignments in the Democratic Republic of the Congo, Zambia, Mozambique, Zimbabwe, Namibia and Swaziland. He completed: Wetland Introduction and Delineation Course – Centre for Environmental Management: University of the Free State. He is a registered Professional Natural Scientist (Pr. Sci. Nat.) in the fields of Ecological Science (Reg. no. 116951).

2.8.2 A signed statement of independence by the specialist (corresponding with Item 2.7.2 in the protocol for the specialist assessment and minimum report content requirements – see Table 22)

DECLARATION

I, Andrew Richard Deacon, declare that I –

- act as an independent specialist consultant in the field of ecological science;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report; and
- will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

ANDREW RICHARD DEACON

2.8.3 A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.

This section corresponds with Item 2.8.3 in the protocol for the specialist assessment and minimum report content requirements (see Table 22)

The field work has taken place over a period of eight days from 1 to 7 April 2022 in the De Aar Phase 3 Solar PV facility project area. The season corresponds with late summer when the riparian zone vegetation starts to lose leaves, however the shrubby layer in the project area is very hardy and some still bears flowers.

Since seasonal changes do not influence the presence of aquatic fauna (fish and macro-invertebrates) significantly, aquatic surveys are not directed by seasonality. However, flows occur only during the rainy season. During the current survey the place had exceptional rains and surface water was present in abundance.

2.8.4 Methodology

The methodology used to undertake the site inspection and the specialist assessment, (including equipment and modelling used, where relevant), are described in the following section.

2.8.4.1 Screening Report

The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.

The Screening Tool also provides site specific EIA process and review information, for example, the Screening Tool may identify if an industrial development zone, minimum information requirement, Environmental Management Framework or bio-regional plan applies to a specific area.

Finally, the Screening Tool allows for the generating of a Screening Report referred to in Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended whereby a Screening Report is required to accompany any application for Environmental Authorisation and as such the tool has been developed in a manner that is user friendly and no specific software or specialised GIS skills are required to operate this system.

A screening report was done for an environmental authorization or for a part two amendment of an environmental authorisation as required by the 2014 EIA regulations, evaluating the proposed development footprint for environmental sensitivity.

2.8.4.2 Site Sensitivity Verification Report

2.7.4.2.1 The site sensitivity verification must be undertaken by an environmental assessment practitioner or a specialist (Protocol 2.1).

2.7.4.2.2 The site sensitivity verification must be undertaken through the use of (Protocol 2.2):

(a) a desk top analysis, using satellite imagery;
(b) a preliminary on-site inspection; and
(c) any other available and relevant information.

2.7.4.2.3 The outcome of the site sensitivity verification must be recorded in the form of a report that (Protocol 2.3):

(a) confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;

(b) contains a motivation and evidence (e.g., photographs) of either the verified or different use of the land and environmental sensitivity; and

(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

2.8.4.3 Aquatic biodiversity and ecosystems

2.8.4.3.1 Aquatic ecosystem types

Aquatic Ecosystem Classification

Aquatic ecosystems were classified according to a hierarchical system described by Ollis *et al*. (2013).

Aquatic Habitat Assessments

Habitat assessments, according to the habitats sampled, were performed because changes in habitat can be responsible for changes in SASS5 scores. This was achieved by applying the SASS orientated habitat assessment indices. The indices used are the Integrated Habitat Assessment System (IHAS) score sheet and the Habitat Quality Index (HQI).

Applicable fish habitat assessments such as the Habitat Cover Ratings (HCR) and Site Fish Habitat Integrity Index (SHI) will be used to assess the habitat potential and condition for fish assemblages

2.8.4.3.2 Aquatic biota surveys

Macro-invertebrates and fish are good indicators of river health. By making use of established and accepted survey methods (SASS5 for invertebrates and FRAI-based surveys for fish) and incorporating the habitat aspects, a proper basis for biological diversity can be obtained.

The different components of the proposed development and its impact on the aquatic environment will be assessed for the river in the project area. The following recognised bio-parameters and methods will be used:

- Aquatic invertebrates: South African Scoring System version 5 (SASS5).
- Fish communities: Fish Response Assessment Index (FRAI).

Aquatic invertebrate assessment

Benthic macro-invertebrate communities of the selected sites were investigated according to the South African Scoring System, version 5 (SASS5) approach. An invertebrate net (30cm x 30cm square with 0.5mm mesh netting) was used for the collection of the organisms. The available biotopes at each site will be identified on arrival. Each of the biotopes was then sampled separately and by different methods. Sampling of the biotopes was done as follows:

Stones in current (SIC): Movable stones of at least cobble size (3 cm diameter) to approximately 20 cm in diameter, within the fast and slow flowing sections of the river. Kick-sampling is used to collect organisms in this biotope. This is done by placing the net on the bottom of the river, just downstream of the stones to be kicked, in a position where the current will carry the dislodged organisms into the net. The stones are then kicked over and against each other to dislodge the invertebrates (kick-sampling) for ± 2 minutes.

Stones out of current (SOOC): *Where the river is calm, such as behind a sandbank or ridge of stones or in backwaters.* Collection is again undertaken using the kick-sampling method, except in this case the net is swept across the area sampled to catch the dislodged biota. Approximately 1 m^2 is sampled in this way.

Sand: These include sandbanks within the river, small patches of sand in hollows at the side of the river or sand between the stones at the side of the river where flow was slow or no flow was recorded. This biotope is sampled by stirring the substrate, shuffling or scraping of the feet is done for half a minute, whilst the net is continuously swept over the disturbed area.

Gravel: Gravel typically consists of smaller stones (2-3 mm up to 3 cm). Sampling similar to that of sand.

Mud: *It consists of very fine particles, usually as dark-coloured sediment.* Mud usually settles to the bottom in still or slow flowing areas of the river. Sampling like that of sand.

Marginal vegetation (MV): *This represents the overhanging grasses, bushes, twigs and reeds from the riverbank.* Sampling is undertaken by holding the net perpendicular to the vegetation (half in and half out of the water) and sweeping back and forth in the vegetation (± 2m of vegetation).

Aquatic vegetation (AQV): *Rooted, submerged or floating waterweeds such as Potamogeton, Aponogeton and Nymphaea.* Sampled by pushing the net (under the water) against and amongst the vegetation in an area of approximately one square meter.

The organisms sampled in each biotope were identified and their relative abundance is also noted on the SASS5 datasheet. Habitat assessments, according to the habitats sampled, were performed due to the fact that changes in habitat can be responsible for changes in SASS5 scores. This was achieved by applying the SASS orientated habitat assessment indices. The indices used are the Integrated Habitat Assessment System (IHAS) score sheet and the Habitat Quality Index (HQI).

The SASS5 method was used to establish the macro-invertebrate integrity in all three of the main habitat assemblages: stones, vegetation and sand/mud/gravel. The associated habitats were determined with the Invertebrate Habitat Assessment System (IHAS) and the Habitat Quality Index (HQI).

Although the SASS5 method was used as prescribed by DWS, it must be kept in mind that this method was designed for water quality purposes. Therefore, the macro-invertebrate integrity scores may vary throughout the year as water quality changes, due to flow variation, as should be the case in the pre- and post-construction phases of the monitoring project.

Aquatic invertebrates were sampled using a standard SASS net and identified to at least family level according to the SASS5 sampling technique (Dickens and Graham 2002). The SASS5 results were classified into one of six Present Ecological State categories, ranging from Natural (Category A), to very Critically Modified (Category F).

Fish communities - Fish Response Assessment Index (FRAI)

The biotic assessment method uses a series of fish community attributes related to species composition and ecological structure to evaluate the quality of an aquatic biota. Data on distribution, richness, length frequency and abundance will be collected. The sampling methods include fish traps, seine nets, mosquito nets and electro-fishing.

Due to the ephemeral nature of the system, the lack of flows and absence of surface water, are the reasons why no fish species are able to inhabit and survive in the system. Even during the short-lived surface flows, the distance from permanent water and brief inundation of the system, rules out the presence of these assemblages

a) Riparian habitat surveys (Riparian Vegetation Index — VEGRAI)

The general components of the VEGRAI are specified as following:

- It is a practical and rapid approach to assess changes in riparian vegetation condition.
- It considers the condition of the different vegetation zones separately but allows the integration of zone scores to provide an overall index value for the riparian vegetation zone as a unit.
- The vegetation is assessed based on woody and non-woody components in the respective zones and according to the different vegetation characteristics which include, inter alia:

  - Cover
  - Abundance
  - Recruitment
  - Population structure
  - Species composition

- It provides an indication of the causes for riparian vegetation degradation.
- It is impact based. This means that the reference condition will only be broadly defined and based on the natural situation in the absence of impacts. Where possible, however, reference conditions should be derived based on reference sites or sections.

The index is based on the interpretation of the influence of riparian vegetation structure and function on in-stream habitat.

Although biodiversity characteristics are used in assessing the riparian vegetation condition, it is not a biodiversity assessment index *per se.*

For this study the Level 3 VEGRAI will be used as Level 3 is applied by the River Health Programme (RHP) and for rapid Ecological Reserve purposes. This level will be aimed at general aquatic ecologists.

Ecological State of the Water Course

The determination and categorisation of the Present Ecological State (PES) takes place during the process of the Ecological Classification process. The purpose of the EcoClassification process is to gain insights and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the river.

During the EcoClassification process, the EcoStatus is also determined. EcoStatus represents an ecologically integrated state representing the **drivers** (hydrology, geomorphology, physico-chemical) and **responses** (fish, aquatic invertebrates and riparian vegetation). The EcoStatus refers to the integration of physical changes by the biota and as reflected by biological responses.

The development of methods to achieve the objectives of this study, focused on a two-step process –

- Devising consistent indices for the assessment of the Ecological Categories of individual biophysical components.
- Devising a consistent process whereby the Ecological Categories of individual components can be integrated at various levels to derive the EcoStatus of the river.

The following index models were developed following a Multi Criteria Decision Making Approach (MCDA):

- Fish Response Assessment Index (FRAI)
- Macro Invertebrate Response Assessment Index (MIRAI)
- Riparian Vegetation Response Assessment Index (VEGRAI)

Riparian delineation

It is important to differentiate between wetlands and riparian habitats. Riparian zones are not wetlands, however, depending on the ecosystem structure, wetlands can be also be classified as riparian zones if they are located in this zone (e.g., valley bottom wetlands). Although these distinct ecosystems will be interactive where they occur in close proximity it is important not to confuse their hydrology and eco-functions.

Riparian delineations are performed according to *"A practical field procedure for identification and delineation of wetlands and riparian areas"* as amended and published by the Department of Water Affairs and Forestry (2005); (Henceforth referred to as DWAF Guidelines (2005).

Aerial photographs and land surveys were used to determine the different features and riparian areas of the study area. Vegetation diversity and assemblages were determined by completing survey transects along all the different vegetation communities identified in the riparian areas.

Riparian areas are protected by the National Water Act (Act 36 of 1998), which defines a riparian habitat as follows:

> *"Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."*

Riparian areas include plant communities adjacent to and affected by surface and subsurface hydrologic features, such as rivers, streams, lakes, or drainage ways. Due to water availability and rich alluvial soils, riparian areas are usually very productive.

Tree growth rate is high and the vegetation is lush and includes a diverse assemblage of species. The delineation process requires that the following be taken into account:

- Topography associated with the watercourse;
- Vegetation;
- Alluvial soils and deposited material.

A typical riparian area according to the DWAF Guidelines (2005) is illustrated in Figure 38.

In addition to the DWAF Guidelines (2005) and DWAF updated manual (2008), the unpublished notes: *Draft riparian delineation methods prepared for the Department of Water Affairs and Forestry, Version 1* (Mackenzie & Rountree, 2007) were used for classifying riparian zones encountered on the property according to the occurrence of nominated riparian vegetation species.

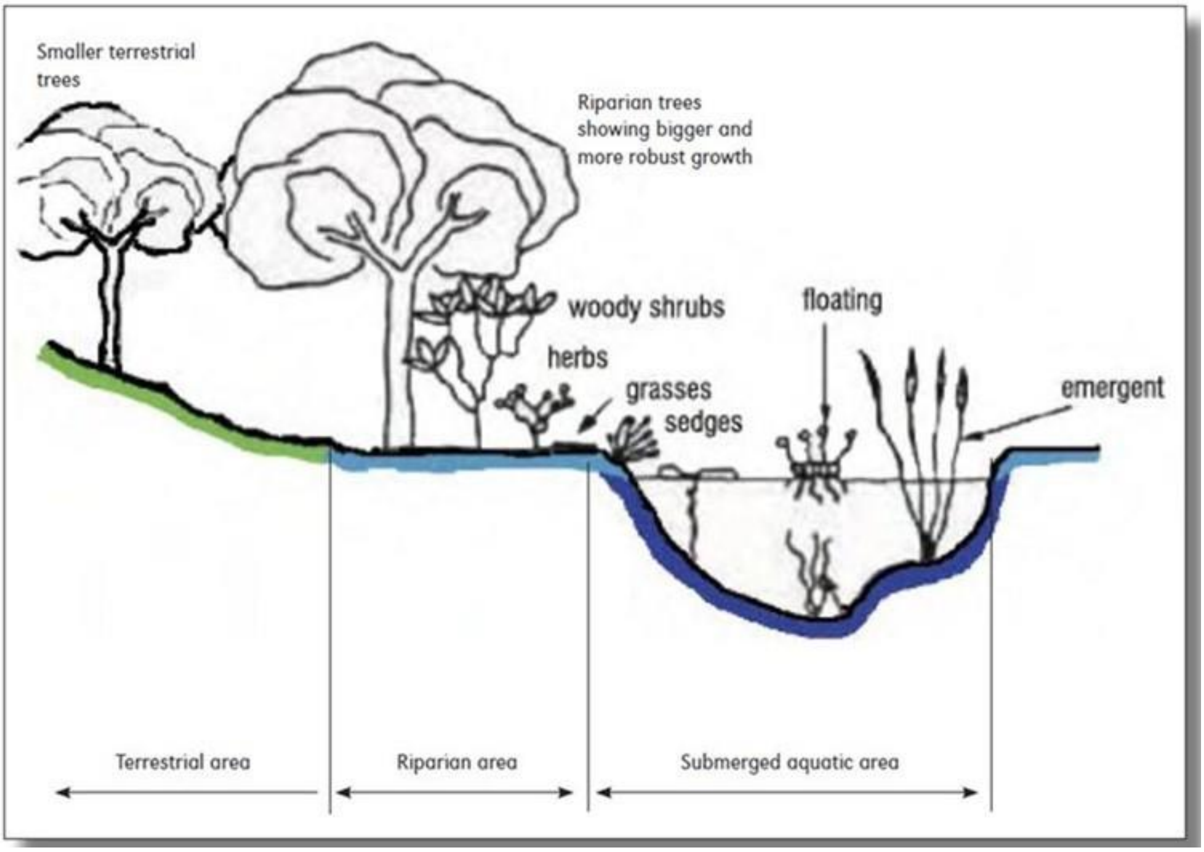

Figure 38: A cross section through a typical riparian area (DWAF Manual, 2008).

Buffers

Aquatic buffer zones are typically designed to act as a barrier between human activities and sensitive water resources thereby protecting them from adverse negative impacts. Buffer zones associated with water resources have been shown to perform a wide range of functions, and on this basis, have been proposed as a standard measure to protect water resources and associated biodiversity (Macfarlane et al, 2015). These functions include:

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic- and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

Due to their positioning adjacent to water bodies, buffer zones associated with streams and rivers will typically incorporate riparian habitat. Riparian habitat, as defined by the NWA, includes the physical structure and associated vegetation of the areas associated with a watercourse. These areas are commonly characterised by alluvial soils (deposited by the current river system) and are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas (Macfarlane et al, 2015).

However, the riparian zone is not the only vegetation type that lies in the buffer zone as the zone may also incorporate stream banks and terrestrial habitats depending on the width of the aquatic impact buffer zone applied. A diagram indicating how riparian habitat typically relates to aquatic buffer zones defined in this guideline is provided in Figure 39.

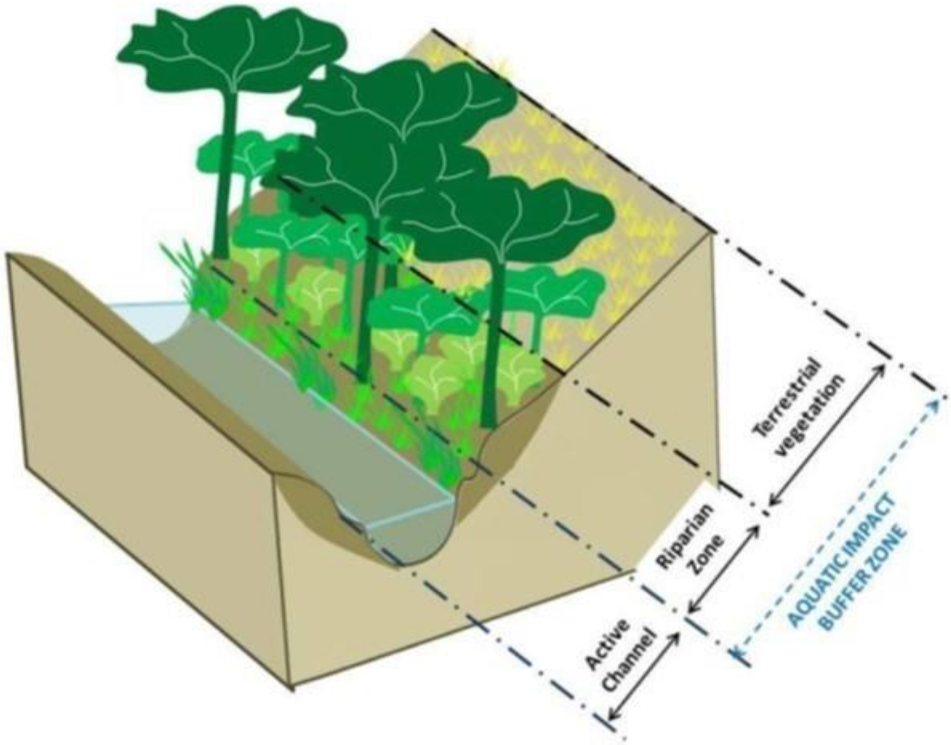

Figure 39: Schematic diagram indicating the boundary of the active channel and riparian habitat, and the areas potentially included in an aquatic impact buffer zone (Macfarlane et al, 2015).

Once an aquatic impact buffer zone has been determined, management measures need to be tailored to ensure buffer zone functions are maintained for effective mitigation of relevant threat/s. Management measures must therefore be tailored to ensure that buffer zone functions are not undermined. Aspects to consider include:

- Aquatic impact buffer zone management requirements;
- Management objectives for the aquatic impact buffer zone; and
- Management actions required to maintain or enhance the aquatic impact buffer zone in line with the management objectives. Activities that should not be permitted in the aquatic impact buffer zone should also be stipulated.

Determining appropriate management and monitoring of buffer zones

A series of Excel based Buffer Zone Tools have been developed to help users determine suitable buffer zone requirements (Macfarlane and Bredin, 2017). These include a rapid desktop tool for determining potential aquatic impact buffer zone requirements together with three site-based tools for determining buffer zone requirements for rivers, wetlands and estuaries. Central to these tools is a buffer model, which is populated automatically from the data capture sheets provided. This is based on best available science and is used to generate buffer zone recommendations as part of the assessment process. The Overview of the stepwise assessment process for buffer zone determination (Macfarlane and Bredin, 2017) is illustrated if Figure 40.

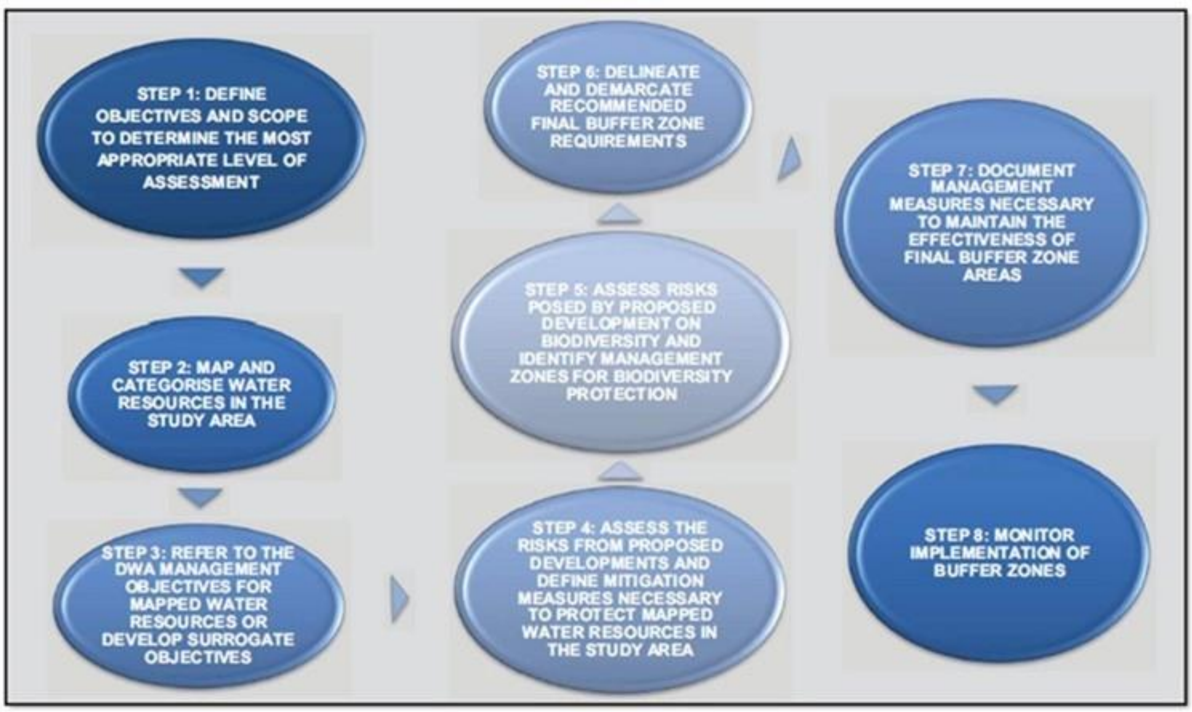

Figure 40: Overview of the step-wise assessment process for buffer zone determination (Macfarlane and Bredin, 2017).

Once a final buffer zone area has been determined, appropriate management measures should be documented to ensure that the water quality enhancement and other buffer zone functions, including biodiversity protection, are maintained or enhanced. Key aspects addressed include:

- Demarcating buffer zones.
- Defining suitable management measures to maintain buffer functions.
- Reviewing the need to integrate protection requirements with social and development imperatives.
  Monitoring to ensure that buffer zones are implemented and maintained effectively.

2.8.4.3 Spatial data sets that indicate Critical Biodiversity Areas

Critical Biodiversity Areas (CBAs) are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. If these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.

Land-Use Decision Support Tool (LUDS)

To establish how important the site is for meeting biodiversity targets, it is necessary to answer the following three simple but fundamentally important questions:

- How important is the site for meeting biodiversity objectives (e.g., is it in a **Critical Biodiversity Areas** (CBA) or Ecological Support Area (ESA)?
- Is the proposed land-use consistent with these objectives or not (to be checked against the land-use guidelines)?
- Does the sensitivity of this area trigger the requirements for assessing and mitigating environmental impacts of developments, or in terms of the listed activities in the EIA regulations?

PES & EIS assessment brief

Following is a summary of all the important aspects and processes that play a role in the determination of the Present Ecological State (PES) and Ecological Importance & Sensitivity (EIS), as part of the Environmental Water Requirement (EWR) process in determining the Ecological Reserve.

The **Ecological Reserve** refers to the quantity and quality of water required to (i) supply basic human needs and (ii) protect aquatic ecosystems and the detail of the Reserve is derived from the **Ecological Reserve determination**. The **EcoClassification** process is an integral part of the Ecological Reserve determination method and of any **Environmental Flow Requirement (EFR)** or **Environmental Water Requirement (EWR)** method. Reserve determination methods identify **EWRs** as continuous flows and periodic 'events' of defined magnitudes which are combined as volumes or mean monthly flows.

The term **EcoClassification** is used for the **Ecological Classification (EC)** process and refers to the determination and categorisation of the **Present Ecological State** (**PES**). The PES of the river is expressed in terms of various components i.e., drivers (physico-chemical, geomorphology, hydrology) and biological responses (fish, riparian vegetation and aquatic invertebrates) as well as an integrated state, the **Ecological Status** or **EcoStatus** of a river. The EcoStatus refers to the integration of physical changes by the biota and as reflected by biological responses. The individual drivers and biological responses are referred to as **components** while the individual attributes within each component that are assessed, to determine deviation from the expected natural reference condition, are referred to as ***metrics***.

Ecological Categories (A→F; A = Natural, and F = critically modified) are determined as part of the **EcoClassification** process form an essential part of most of the **Reserve** steps. The **Recommended Ecological Category (REC)** can be recommended as future states depending on the **EIS** and **PES** of the river reach.

Resource Quality Objectives (**RQOs**) are defined as clear goals (numerical or descriptive statements) relating to the quality of a water resource and are set in accordance to the management class (preliminary class in the absence of the classification system) specified for the resource to ensure the water resource is protected.

Risk Assessment using the Risk Matrix

In terms of the new Government Gazette Notice, GN 509 in GG 40229 of 26 August 2016 (*General Authorisations for impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse), Regulation 7*:

Assessment of risk and mitigation factors

It is required that the following documents and associated spread sheets be used during the assessment of risk and mitigation of risks:

(a) A Practical Field Procedure for Delineation of Wetlands and Riparian Area (2005) which is available on the Department's website http:/ /www.dws.gov.za, under water use authorization in terms of section 21 (c) or (i) of the Act;

(b) Appendix A (Excel Spreadsheet) and information regarding the method used in Appendix A is contained in the Department of Water and Sanitation 2015 publication: Section 21(c) and (i) water use Risk Assessment Protocol, which is available on the Department's website http: / /www.dws.gov.za, under section 21(c) and (i) water use authorization.

(c) Guideline: Assessment of activities /developments affecting wetlands, which is available on the Department's website http: / /www.dws.gov.za, under section 21 (c) and (i) water use authorization.

(d) Guideline for the determination of buffer zones for rivers, wetlands and estuaries, which is available on the Department's website http: / /www.dws.gov.za, under water use authorization in terms of section 21 (c) and (i) of the Act.

The DWS Risk assessment protocol was obtained from GN 509. Risk posed to "resource quality", as defined in the NWA, must be scored according to the Risk Rating Table for Severity (Table 23). A Severity score is then generated. Consequence, Likelihood and finally Significance scores are automatically calculated with the rest of parameters according to respective Risk Rating Tables (Tables 23 - 27).

Risk is determined after considering all listed control/mitigation measures. Borderline LOW /MODERATE risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to a listing of additional mitigation measures considered and listed in RED font. ONLY LOW RISK ACTIVITIES located within the regulated area of the watercourse will qualify for a General Authorisation (GA) according to GN 509. Medium and High-risk activities will require a Section 21 (c) and (i) water use license. The risk rating is determined by combined scores from the following matrix components (Tables 23 - 27):

Consequence= Severity + Spatial Scale + Duration
Likelihood = Frequency of the Activity+ Frequency of the Impact + Legal Issues + Detection
Risk = Consequence x Likelihood

Table 23: Severity - How severe do the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, and habitat)? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table 24: Spatial scale - How large is the area that the aspect is impacting on? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional/neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

Table 25: Duration -How long does the aspect impact on the resource quality? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

Table 26: Frequency of the activity - How often do you do the specific activity? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table 27: Frequency of the incident/impact - How often does the activity impact on the resource quality? Derived from the DWS Risk Matrix Impact Assessment method (GN 509).

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

2.8.5 A description of the assumptions made and any uncertainties or gaps in knowledge or data.

- Whilst the author has made every effort to verify that information provided in this report is reliable, accurate and relevant, this report is based on information that could reasonably have been sourced within the time period allocated to the report and is dependent on the information provided by management and/or its representatives.

- Project proponents will always strive to avoid and mitigate potentially negative project related impacts on the environment, with impact avoidance being considered the most successful approach, followed by mitigation. It further assumes that the project proponents will seek to enhance potential positive impacts on the environment.

- Due to the fact that detail mitigation procedures have been presented, it is trusted that the construction team management with the help of the ECO will ensure that these mitigatory measures be implemented where applicable.

<u>2.8.6 to 2.8.16 Minimum information regarding:</u>

2.8.6 The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.

Synopsis: "No-go" zones have already been demarcated. A 20 m buffer around the drainage line should be respected as an area of higher sensitivity than the rest of the surrounding environment (Figure 23).

2.8.7 Additional environmental impacts expected from the proposed development.

Synopsis: All identified impacts have been addressed in detail in the impact assessment section (Section 2.5), and no additional impacts is anticipated.

2.8.8 Any direct, indirect and cumulative impacts of the proposed development on site.

The entire Phase 3 Solar PV facility project area is situated in a small catchment (1 332 ha) of the D62D-05508 sub-quaternary catchment, which is a tributary to the Brak River (Figure 41). All the impacts originating in the project catchment due to proposed activities, can be mitigated to "Low", and therefore, it is expected that the impacts on downstream reaches will be minimal. Existing dams and weirs in the downstream reaches will further buffer any possible impacts (low levels of sedimentation) originating from the project area. Thus, no influence deriving from the project will have any significant effect on the downstream ecology.

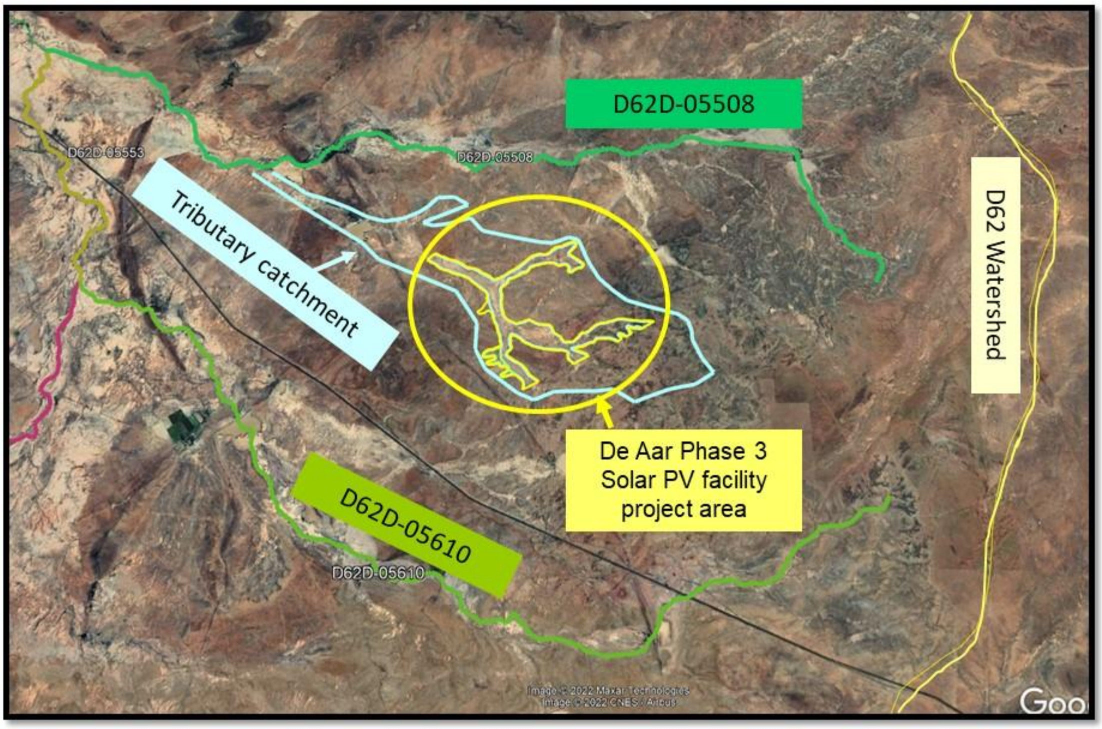

Figure 41: The Phase 3 Solar PV facility catchment (1 332 ha) is a tributary of the D62D-05508 sub-quaternary catchment and isolated from adjacent drainage lines, except for its confluence with D62D-05508.

Apart from farms practicing agriculture, there are no other PV developments present in the small catchment further upstream. The isolation of the Phase 3 Solar PV facility project catchment protects the project drainage lines from any significant development further upstream (see Figure 41).

If any cumulative impacts on the receiving drainage systems have been identified from other PV developments within 30 km radius of the Phase 3 Solar PV development, this will not impact on the Phase 3 Solar PV facility and the proposed project is not expected to add to any cumulative impacts further downstream.

Synopsis: The main issues relating to construction and operation have been addressed and no further direct, indirect and cumulative impacts are anticipated.

2.8.9 The degree to which impacts and risks can be mitigated.

Synopsis: During the risk assessment, 16 potential impacts were identified. All were successfully mitigated to a "Low" risk rating (Table 21).

2.8.10 The degree to which the impacts and risks can be reversed.

Synopsis: For 16 potential impacts identified during the risk assessment, all were assigned mitigation measures that reversed potential impacts to "Low" risk rating posed to the resource quality of the watercourse (Table 21).

2.8.11 The degree to which the impacts and risks can cause loss of irreplaceable resources.

Synopsis: No impact was identified to cause loss of irreplaceable resources during the risk assessment. All the risk assessed were mitigated to a "Low" risk rating (Table 21).

2.8.12 A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.

Synopsis: By making use of the DWS Buffer Tool Kit, a final aquatic impact buffer of 20 m on both sides of the De Aar Phase 3 Solar PV facility project area were establish. The 20 m buffer is situated directly outside the riparian zone on the outer bank (Figure 23).

2.8.13 The proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).

Synopsis: All the proposed impact management actions listed in the Risk Matrix (Table 21) in the Environmental Management Programme will be considered and, if applicable, they will be included in the EMPr.

2.8.14 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.

Synopsis: Biotopes with "Moderate" and "Low" ecological and sensitivity classes were not considered as no-go areas. These biotopes included the headwater drainage systems which transport surface flows during high rainfall events and present short-lived aquatic systems. On the other hand, development within these areas shall be subjected to strict mitigation measures. This will include the management of surface water runoff, erosion monitoring, as well as constraints regarding the clearing of vegetation within these areas.

2.8.15 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.

Synopsis: By implementing all the suggested mitigation measures and managing the system as prescribed, on a continuous basis, all the impacts will be addressed to a satisfactory level. It is the reasoned opinion that the overall project outcome mitigates all listed impacts satisfactory to a "Low" impact level.

2.8.16 Any conditions to which this statement is subjected.

Synopsis: It is proposed that the project should be authorised with the provision that the mitigation measures prescribed in this document are, where applicable, included in the EMPr.

Summary: A reasoned opinion

According to the Specialist TOR, a GN509 Risk Assessment was completed for the study. Infrastructural components of the Solar PV Facility (Phase 3) project were described and assessed. Special mitigation and management measures were determined and the current existing best practice procedures described by the risk assessment report. The following main activities were identified and assessed:

Construction and operational phases

- Linear structures
  - Transmission pylons (overhead powerline)
  - Road crossings
  - Cabling routes
  - Pipe crossings
  - Perimeter fence (with fire-break road).
- Boreholes
- PV system (solar panel arrays, inverters, and field transformers)
- Pollution potential at storing and disposal facilities.
- Alien invasive plants.

During the risk assessment, 16 potential impacts were identified. For these potential impacts identified during the risk assessment, all were assigned mitigation measures that reversed potential impacts to "Low" risk rating posed to the resource quality of the watercourse. No impact was identified to cause loss of irreplaceable resources.

By implementing all the mitigation measures and managing the system on a continuous basis as prescribed by the Risk Assessment, all the impacts will be addressed to a satisfactory level. Therefore, it is proposed that the project should be authorised with the provision that the mitigation measures prescribed in this document, where applicable, are included in the EMPr

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Appendices

Appendix 1: The complete SASS 5 form.

TAXON	Stones	Vegetation	GSM	Total
Porifera 5				
Coelenterata 3				
Turbellaria 3				
Oligochaeta 1				
Leeches 3				
Amphipoda 15				
Potamonautidae 3				
Atyidae (Shrimp) 8				
Palaemonidae 10				
Hydracarinae 8				
Notonemouridae 14				
Perlidae 12				
Baetidae 1 spp 4				
2 spp 6				
>2 spp 12				
Caenidae 6				
Ephemeridae 15				
Heptageniidae 10				
Leptophlebiidae 13				
Oligoneuridae 15				
Polymitarcyidae 10				
Prosopistomatidae 15				
Teloganodidae 12				
Tricorythidae 9				
Calopterydidae 10				
Chlorocyphidae 10				
Chlorolestidae 8				
Coenagrionidae 4				
Lestidae 8				
Platycnemidae 10				
Protoneuridae 8				
Zygoptera 6				
Aeshnidae 8				
Cordulidae 8				
Gomphidae 6				
Libellulidae 4				
Belostomatidae 3				
Corixidae 3				
Gerridae 5				
Hydrometridae 6				
Naucoridae 7				
Nepidae 3				
Notonectidae 3				
Pleidae 4				
Veliidae 5				
Corydalidae 8				
Sialidae 6				
Dipseudopsidae 10				
Ecnomidae 8				

Hydropsychidae 1= 4				
2spp = 6				
>2spp =12				
Philopotamidae 10				
Polycentropodidae 12				
Psychomyiidae/Xip. 8				
Barbarochthonidae 13				
Calamoceratidae 11				
Glossosomatidae 11				
Hydroptilidae 6				
Hydrosalpingidae 15				
Lepidostomatidae 10				
Leptoceridae 6				
Petrothrincidae 11				
Pisuliidae 10				
Sericostomatidae 13				
Dytiscidae 5				
Elmidae/Dryopidae 8				
Gyrinidae 5				
Haliplidae 5				
Helodidae 12				
Hydraenidae 8				
Hydrophilidae 5				
Limnichidae 8				
Psephenidae 10				
Athericidae 13				
Blepharoceridae 15				
Ceratopogonidae 5				
Chironomidae 2				
Culicidae 1				
Dixidae 13				
Emphididae 6				
Ephydridae 3				
Muscidae 1				
Psychodidae 1				
Simuliidae 5				
Syrphidae 1				
Tabanidae 5				
Tipulidae 5				
Ancylidae 6				
Bulininae 3				
Hydrobidae 3				
Lymnaeidae 3				
Physidae 3				
Planorbidae 3				
Thiaridae 3				
Viviparidae 5				
Corbiculidae 5				
Spaeridae 3				
Uniondae 6				
SASS Score				
No of families				
ASPT				

Estimated abundance: 1=1; A=2-10; B=11-100; C=101-1000; D=>1000