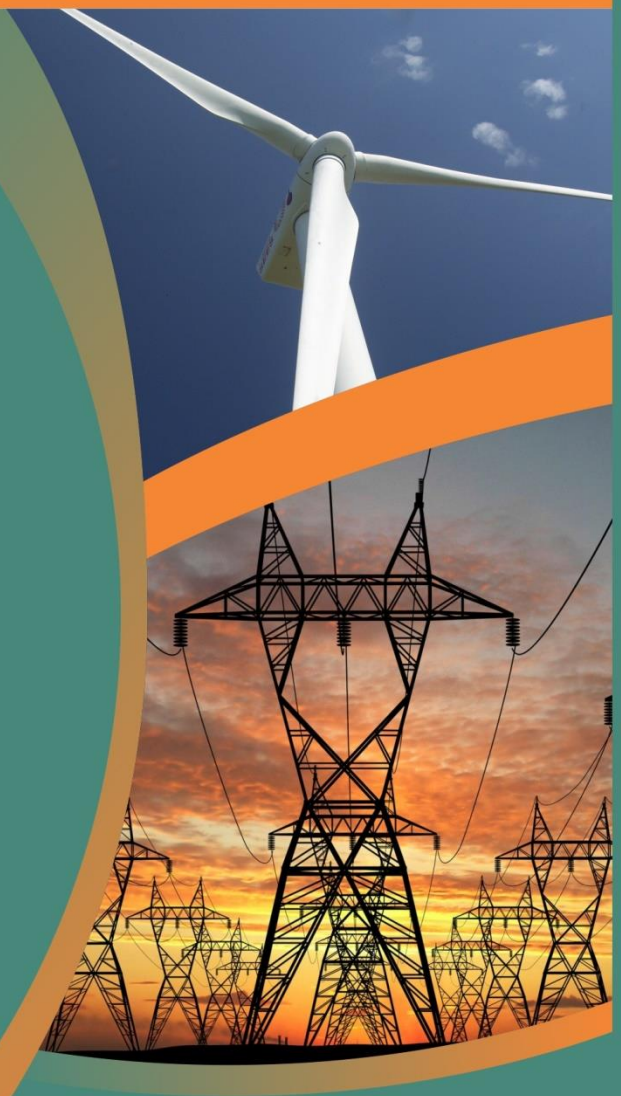
BASIC ASSESSMENT REPORT

Basic Assessment for the Proposed Construction and Operation of Electrical Grid Infrastructure to support the Sutherland, Sutherland 2 and Rietrug Wind Energy Facilities (WEFs), Northern and Western Cape Provinces



APPENDIX D.2: Aquatic Ecology (Freshwater) Impact Assessment

FRESHWATER SPECIALIST STUDY:

Basic Assessment for the proposed development of a 132 kV transmission line, a major transmission substation and 400 kV line within the Renewable Energy Development Zone (REDZ): 2 Komsberg in the Northern and Western Cape

Report prepared for:
CSIR – Environmental Management Services
P O Box 17001
Congella, Durban, 4013
South Africa

Report prepared by:
BlueScience (Pty) Ltd
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Version 1: June 2019
Version 2: September 2019

SPECIALIST CV

ANTONIA BELCHER

NAME:	Antonia (Toni) Belcher (Pr. Sci. Nat)
PROFESSION:	Aquatic scientist
NATIONALITY:	South African
YEARS OF EXPERIENCE:	28 years
PROFESSIONAL REGISTRATION:	Professional Environmental Scientist (Pr. Sci. Nat 400040/10) Professional Ecological Science (Pr. Sci. Nat 400040/10)
ACADEMIC QUALIFICATIONS:	1998 - M.Sc. in Environmental Management, Potchefstroom University (cum laude) 1989 - B.Sc. (Hons) in Oceanography, University of Port Elizabeth 1987 - B.Sc. – Mathematics, Applied Mathematics, University of Port Elizabeth 1984 – Matriculation, Lawson Brown High School, Port Elizabeth

AREAS OF SPECIALISATION:

- Environmental water requirement studies
- River maintenance and management plans (MMP)
- Aquatic ecosystem monitoring and assessments
- Design of water quality and monitoring programmes for aquatic ecosystems
- Compilation of State of River reports (aquatic data collection, interpretation, presentation, graphic layout and design and preparation of technical and glossy print ready copies)
- Environmental Impact Assessments
- River classification and environmental water requirements (Ecological Reserve determinations)
- Integrated Water Resource Management
- River, Wetlands and Estuary management
- Water quality assessment and management reporting
- Water resource legislation
- Water resource institutions
- Water education
- South Africa, Namibia, Swaziland, Lesotho, Rwanda

COUNTRIES WORKED IN:

South Africa, Namibia, Swaziland, Lesotho, Rwanda

EMPLOYMENT RECORD:

2013 -	BlueScience (Pty) Ltd (Principal Specialist Scientist)
2007 – 2012	Self-employed

1999 – 2007	Assistant and Deputy Director, Water Resource Protection, Western Cape Regional Office, Department of Water Affairs, Cape Town
1995 – 1999	Institute for Water Quality Studies, Department of Water Affairs
1991 – 1995	Water Pollution Control Officer, Water Quality Management, Department of Water Affairs, Pretoria
1989 – 1990	Mathematics tutor and administrator, Master maths, Randburg and Braamfontein Colleges, Johannesburg
1987 – 1988	Part-time field researcher, Department of Oceanography, University of Port Elizabeth

AWARDS AND ACHIEVEMENTS:

- Woman in Water award for Environmental Education (2006)
- Runner up for the Woman in Water prize for Water Research (2006)

SUMMARY OF RECENT EXPERIENCE:

2008 –

Environmental water requirement studies for various rivers in South Africa and Lesotho;

Berg (Zones 1-3), Kingna, Baden, Konings and Poesjesnel **rivers maintenance and management plans**;

Water quality impact assessment for the upgrade of more than 15 wastewater treatment works in the Western Cape and consideration of reuse of the treated wastewater from many of these works for potable water supply;

More than **350 freshwater impact assessments studies** as input into EIA decision making processes. Toni has conducted more than **150 water use authorisation applications**. This included more than 40 freshwater impact assessments for roads, power line and substation and renewable energy projects.

Development of RDM (**Resource Directed Measures**) curriculum for a Master degree programme at University of science institutions in South Africa.

Free State **river health monitoring** programme (monitoring for 3 year period).

Classification of the water resources of the Olifants Doorn Water Management Area.

Graphic design, layout, technical compilation and preparation of print ready glossy publications for the **State-of-River reports** for the Gouritz and Breede Water Management Areas

Development and piloting of a National Strategy to **Improve Gender Representation in Water Management Institution**s, where the focus is on improving the capacity (specifically amongst women) to participate in water related decision making in Limpopo, Eastern Cape and KZN.

Compilation of a background document as well as a framework management plan towards the development of an **integrated water resources management plan for the Sandveld**;

Aquatic specialist to the City of Cape Town project: Determination of additional resources to **manage pollution in stormwater and river systems**;

Framework for Education and Training in Water (FETWATER), Resource Directed Measures Network partner which has undertaken **training initiatives on environmental water requirements** in the SADC region;

Resource Directed Management of Water Quality: **Development of training materials**,

Department of Water Affairs and Forestry; and

2000 –2007:

Manager responsible for the implementation of the Reserve Directed Measures component of the National Water Act Western Cape Regional Office; and

Provincial Champion for the River Health Programme in the Western Cape and designed, implemented and compiled State-of-River reports for 7 catchment areas in the Western Cape.

1995 - 2000:

Project manager and coordinator for the freshwater and marine water quality guidelines for South Africa; and

Provided specialist input into various aspects of the new National Water Act and its implementation

1991 –1995:

Water quality catchment studies

Development and implementation of marine water quality policy for South Africa.

SPECIALIST DECLARATION

I, Antonia Belcher, as the appointed independent specialist hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and 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 NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: S C Bundy

Signature of the specialist

Date: 13 June 2019

EXECUTIVE SUMMARY

It is proposed to construct a 132 kV transmission line, a major transmission substation and 400 kV line near Sutherland. The western portion of the proposed project is located largely along the border between the Northern and Western Cape provinces on the higher-lying Komsberg Mountains that is the watershed between the northerly flowing Riet River tributary of the Orange River and the southerly flowing Dwars River tributaries of the Gouritz River. The eastern portion of the project is located within the Western Cape, within the upper reaches of the Vanwyks, Juk and Ouberg Tributaries of the Dwyka River, a tributary of the Gouritz River. This section of the transmission lines and the proposed substation are located within lower lying valleys and floodplain areas. Associated with the very upper reaches of the rivers on the hill tops are seep areas and vernal ponds while valley bottom and floodplain wetlands occur in the lower foothills and floodplain zones within the deeper valleys.

The study area is located largely within Upstream Freshwater Ecosystem Priority Areas (FEPA) Rivers that should not be impacted such that they would result in degradation of more ecologically important downstream FEPA Rivers. There are several instream wetland areas within the channels of the larger watercourses that have been mapped as artificial FEPA Wetlands of which only two are located near the proposed works. A natural depression is the only mapped natural FEPA Wetland located in the wider study area but is at least 500m south of the proposed line in the upper Riet River.

The only aquatic Critical Biodiversity Area (CBA) crossed by the proposed transmission line is on the Vanwyks River downstream of the Western Cape Border. This river reach is considered of high ecological importance in terms its unique habitat and linked to terrestrial habitat and vegetation. The remainder of the watercourses are mapped as aquatic Ecological Support Areas (ESAs). Most of the terrestrial areas adjacent to the watercourses in the area are mapped as Other Natural Areas. Within the Northern Cape CBA, most of the study area is mapped as a CBA, becoming an ESA within the eastern portion of the study area in the Northern Cape.

The rivers within the study area is still in a natural condition in their upper reaches with few modifications (some roads and very small dams). Downstream, in the middle reaches of the Vanwyks, Juk and Oubergs Rivers, the rivers become largely natural to moderately modified. The riparian habitat is slightly more degraded as a result of direct habitat modification from the surrounding farming activities.

The larger watercourses in the study area, the Riet, Vanwyks, Juk and Oubergs Rivers, have a high ecological importance and sensitivity while the smaller tributaries/drainage features are of a moderate ecological importance and sensitivity. The larger watercourses tend to be more ecologically important but less sensitive to impacts while the smaller tributaries are less ecologically important but more sensitive to flow, water quality and habitat modification.

The hillslope seeps and the vernal pools are in a natural ecological condition while the valley bottom wetlands have been slightly modified but are still in a largely natural ecological condition. The floodplains although still largely natural, are the most impacted by the activities within the valley floor. The wetland features are considered of high ecological importance and sensitivity.

The recommended ecological condition of the aquatic features within the study area are that they should be maintained in their current ecological condition and should not be allowed to degrade

further. The recommended buffer areas as a development setback from the aquatic features to ensure these aquatic ecosystems are not impacted by the proposed activities, are as follows:

- *Smaller streams and drainage lines, together with their seeps: at least 50m from the centre of these streams or the delineated wetland edge (whichever is the furthest);*
- *The larger rivers within the valley floor, together with their valley bottom wetlands: at least 100m, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest); and*
- *The vernal pool and other wetland areas: at least 50m, measured from the top of bank of the river channels or the delineated wetland edge.*

Activities during the construction phase of the project could be expected to result in some disturbance of soil and vegetation cover for clearing and preparation of the project elements. There is also the potential for some water quality impacts associated with the construction activities. A localised impact could be expected that has a low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

During the operation phase the potential impacts relate to increased potential for erosion and invasive alien plant growth within the disturbed watercourses. A localised long-term impact of very low overall significance would be expected, provided the recommended mitigation measures are undertaken. The following mitigation measures are recommended:

- *Ensure final layout of transmission line and substation avoids watercourses and recommended buffers as far as possible; utilisation should be made of existing disturbed areas and access roads;*
- *A stormwater management plan should be compiled for the compacted surfaces within the site by the project engineer with input from the freshwater specialist. The plan should aim to reduce the intensity of runoff particularly on the steeper slopes and reduce the intensity of the discharge into the adjacent drainage lines. Where necessary measures to dissipate flow intensity or protect erosion should be included in the plan. Adjacent to wetland areas, the plan should encourage infiltration rather than runoff and should prevent the impedance of surface or sub-surface flows. The plan should also mitigate any contaminated runoff from the construction and operation activities from being discharged into any of the aquatic features within the site;*
- *Adequate and erosion mitigation measures should be incorporated into designs;*
- *For any new infrastructure placed within the watercourses:*
    - *The structure should not impede or concentrate the flow in the watercourse;*
    - *The structure should be placed at the base level of the channel and be orientated in line with the channel so as to not cause erosion of the channel;*
    - *Any rubble or waste associated with the construction works within the aquatic features should be removed from the watercourse channel and banks once construction is complete; and*
    - *Water consumption requirements for the site for the construction must be via an authorised water supply.*
- *For all project related components within the site, any aquatic features of high sensitivity (wetland areas and vernal pools) within the immediate area should be demarcated by the*

appointed ECO prior to commencement of the construction activities and treated as no-go areas during the construction phase.

- *Any activities that require construction within the delineated aquatic features and the recommended buffers should be described in method statements that are approved by the ECO.*
- *Rehabilitation of any the disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately following completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity as described above;*
- *Ablution facilities should not be placed within 50m of any of the aquatic features delineated within the site;*
- *Liquid dispensing receptacles (e.g. lubricants, diesel, shutter oil etc.) must have drip trays beneath them/beneath the nozzle fixtures. Material safety data sheets (MSDS) must be available on site (if required) where products are stored, so that in the event of an incident, the correct action can be taken. Depending on the types of materials stored on site during the maintenance activities, suitable product recovery materials (such as Spillsorb or Drizit products) must be readily available. Vehicles should ideally be washed at their storage yard as opposed to on site.*
- *Proper waste management should be undertaken within the site with facilities provided for the on-site disposal of waste and the removal of stored waste to the nearest registered solid waste disposal facility*
- *Ongoing control of invasive alien plants within the site should be undertaken according to an approved plan. The plan should make use of alien clearing methods as provided by the Working for Water Programme. Monitoring and control measures should take place at least biannually for the first 3 years of the project*
- *Invasive alien plant material that has been cleared should be removed from the riparian zones and not left on the riverbanks or burnt within the riparian zone and buffer area;*
- *Ongoing monitoring of the structures, in particular prior to the rainfall period, should be undertaken to ensure that the integrity of the structures is intact and that they are not block with sediment or debris. Ongoing monitoring post large rainfall events should also be undertaken to identify and address any erosion occurring within the watercourses*

The risk assessment for the project determined that the proposed transmission line and substation poses a low risk of impacting aquatic habitat, water flow and water quality. With these findings of the risk assessment, the water use activities associated with the proposed project could potentially be authorised by means of the general authorisations for the Section 21(c) and (i) water uses.

Based on the above findings, there is no reason from a freshwater perspective, why the proposed activity (with implementation of the above-mentioned mitigation measures) should not be authorized.

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LIST OF ABBREVIATIONS

BA	Basic Assessment
BGCMA	Breede Gouritz Catchment Management Agency
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DWA(F)	Department of Water Affairs (and Forestry)
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EI&ES	Ecological Importance and Ecological Sensitivity
EMPr	Environmental Management Programme
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
GA	General Authorisation
GIS	Global Information System
GN	Government Notice
ha	hectare
HI	Habitat Integrity
IUCN	International Union for Conservation of Nature
kW	kilowatt
MMP	Maintenance Management Plan
MW	megawatt
ONA	Other Natural Areas
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Area
NWA	National Water Act
PA	Protected Area
PES	Present Ecological Status
REC	Recommended Ecological Condition
REDZ	Renewable Energy Development Zone
SANBI	South African National Biodiversity Institute
SEA	Strategic Environmental Assessment
WCBSP	Western Cape Biodiversity Spatial Plan
WEF	Wind Energy Facility
WMA	Water Management Area
WUL	Water Use License
WULA	Water Use License Application

GLOSSARY

Definitions	
Catchment	The area from which any rainfall will drain into the watercourse or watercourses or part of a watercourse, through surface flow to a common point or common points
Critical Biodiversity Areas	Areas that are required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure.
Ecological Importance and Sensitivity	The rating of any given wetland or river reach that provides an indication of the ecological importance of the aquatic system using criteria such as conservation needy habitat or species, protected ecosystems or unique habitat observed. The sensitivity is then derived by assessing the resilience the habitat exhibits under stress as a result of changes in flow or water quality.
Ecological Support Areas	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of Protected Areas or Critical Biodiversity Areas and are often vital for delivering ecosystem services.
Other Natural Areas	Areas that have not been identified as a priority in the biodiversity spatial plans but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for meeting biodiversity targets, they are still an important part of the natural ecosystem.
Present Ecological State	The current ecological condition of a watercourse as measured against the deviation from the natural or pre-impacted condition of the system
Protected Areas	Areas that are formally protected by law and recognised in terms of the National Environmental Management: Protected Areas Act. This includes gazetted private Nature Reserves and Protected Environments concluded via a stewardship programme.
Riparian habitat	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
River FEPA	Rivers currently in a good condition (A or B ecological category) that have been identified to achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species. They should remain in a good condition to contribute to the biodiversity goals of the country.
Seeps	Occur on the hillslopes and valley heads and are often seasonal, mostly fed by groundwater, hillslope interflow and to a lesser degree precipitation. They are most numerous in the mountainous areas of the Western Cape.
Upstream Management Areas	Sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream River FEPAs
Valley-bottom wetlands	Wetlands located on the valley floors that are mostly fed by overland inflow, hillslope interflow and groundwater. They may be channelled or un-channelled.

Vernal pools	Also called vernal ponds or ephemeral pools, are temporary pools of water that provide habitat for distinctive aquatic plants and animals that are adapted to the very short inundation periods of these pools.
Watercourse	(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 of DWS may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks;
Water management area	An area established as a management unit in the national water resource strategy within which a catchment management agency will conduct the protection, use, development, conservation, management and control of water resources
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.
Wetland FEPA	Wetlands currently in a good condition (A or B ecological category) that have been identified to achieve biodiversity targets for river ecosystems and threatened/near-threatened fish species. They should remain in a good condition in order to contribute to the biodiversity goals of the country.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Specialist Report Section
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Included following the cover page
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Included following the Curriculum Vitae
c) an indication of the scope of, and the purpose for which, the report was prepared;	Sections 1.1, 1.2 and 1.3
(cA) an indication of the quality and age of base data used for the specialist report;	Sections 1.4 and 1.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 2, 3 and Appendix A
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3
g) an identification of any areas to be avoided, including buffers;	Section 3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 5
k) any mitigation measures for inclusion in the EMPr;	Section 6
l) any conditions for inclusion in the environmental authorisation;	Sections 6 and 7
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 7
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 5.1
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A at this stage
q) any other information requested by the competent authority.	N/A at this stage-
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

FRESHWATER SPECIALIST STUDY: BASIC ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF A TRANSMISSION LINE AND SUBSTATION WITHIN THE REDZ: 2 KOMSBERG IN THE NORTHERN AND WESTERN CAPE

1 INTRODUCTION AND METHODOLOGY

1.1 Scope and Objectives of this Specialist Report

This Aquatic Ecological (including wetlands) Impact Assessment is intended to inform the Basic Assessment (BA) process for the proposed development of a 132 kV transmission line, a major transmission substation and 400 kV line near Sutherland in the Northern Cape and Western Cape provinces. The proposed transmission lines and substation will be located within the Renewable Energy Development Zone 2 (REDZ 2) known as Komsberg, published in terms of Section 24(3) of the National Environmental Management Act, 1998 (NEMA) in Government Notice (GN) R114 of 16 February 2018.

1.2 Terms of Reference

Aquatic Ecology (including wetlands) Impact Assessment should include the following:

- A single site visit including field surveys for the proposed works;
- Screening of environmental sensitivities on the site based on the site visit and other sources, to identify no-go areas. Based on the screening, an environmental sensitivity map must be compiled by the specialist to identify the sensitive areas on site (low, medium and high or no-go areas;
- A draft specialist assessment report (the input complying with content requirements of Appendix 6 of the EIA Regulations, 2014, as amended) to be included in the Draft BA Report; and
- A final specialist assessment report (the input complying with content requirements of Appendix 6 of the EIA Regulations, 2014, as amended) to be included in the Final BA Report. The final specialist report must address the review comments by the CSIR, the applicant and any relevant comments which may arise from the public participation process.

Specific issues to be addressed in the Aquatic Ecological Study:

- Describe the aquatic ecology features of the project area, with focus on features that are potentially impacted by the proposed project. The description should include the major habitat forms within the study site, giving due consideration to freshwater ecosystems, drainage lines and wetlands;
- Consider seasonal changes and long-term trends, such as due to climate change;
- Identify any Species of Special Concern or protected species on site relevant to the aquatic environment;

- Map the sensitive ecological features within the proposed project area, showing any "no-go" areas (i.e. "very high" sensitivity). Specify set-backs or buffers, and provide clear reasons for these recommendations. Also map the extent of disturbance and transformation of the site;

- Identify and delineate wetlands that may occur on the site, using the relevant protocols established by DWAF (2005);

- Determine if a Water Use License (WUL) or General Authorisation (GA) is required and if so, determine the requirements thereof;

- Identify and assess the potential impacts of the project (including all access roads) on the aquatic environment;

- Provide mitigation measures to include in the environmental management plan; and

- The assessment should be based on existing information, national and provincial databases, SANBI mapping, professional experience and field work conducted.

1.3 Approach and Methodology

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and surrounding catchments, as well as by a more detailed assessment of the freshwater features on the various farm portions that comprise the study area.

The site was visited in the rainy season for one day in May 2019. No additional site visits were deemed necessary. During the field visits, the characterisation and integrity assessments of the freshwater features were undertaken. Mapping of the freshwater features was undertaken using a GPS Tracker and mapped in PlanetGIS and Google Earth Professional.

The following techniques and methodologies were utilised to undertake this study:

1. The guideline document, "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as published by DWAF (2005) was followed for the delineation of the wetland areas. According to the delineation procedure, the wetlands were delineated by considering the following wetland indicators: terrain unit indicator; soil form indicator; soil wetness indicator; and vegetation indicator;

2. The wetlands were subsequently classified according to their hydro-geomorphic determinants based on a classification system devised by Kotze *et al* (2004) and SANBI (2009). Notes were made on the levels of degradation in the wetlands based on field experience and a general understanding of the types of systems present;

3. A Present Ecological State (PES) assessment was conducted for each hydro-geomorphic wetland unit identified and delineated within the study area;

4. The functional wetland assessment technique, WET-EcoServices, developed by Kotze *et al* (2009) was used to provide an indication of the ecological benefits and services provided by delineated wetland habitat. This technique consists of assessing a combination of desktop and infield criteria to identify the importance and level of functioning of the wetland units within the landscape;

5. The present ecological condition of the watercourses was determined using national River Health Programme methodologies as described in this report;

6. The ecological importance and ecological sensitivity (EI&ES) assessment of the wetlands and watercourses were conducted according to the guidelines as developed by DWAF (1999); and

7. Recommendations are made with respect to the adoption of buffer zones within the development site, based on the wetlands functioning and site characteristics.

1.4 Assumptions and Limitations

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The methodologies and techniques used in this assessment have been developed nationally and are typically of a rapid nature as is required for this freshwater impact assessment.

No baseline long-term monitoring was undertaken as part of this assessment. In addition, there is very little existing information available for the aquatic features within the study area. Data was utilised for adjacent aquatic ecosystems and where available more detailed assessments were used for the aquatic features within the area. The nature of the proposed activities however also allows them to be placed some distance from any mapped aquatic features such that the likely impacts would be very low. The impacts of roads and powerlines on the aquatic features are however well understood and can be effectively mitigated to ensure the impacts remain low. The preferred mitigation measure is to limit the disturbance to aquatic features as far as possible by avoiding and minimising the number of crossings and providing adequate buffer areas. This will also ensure that the cumulative impacts will remain low.

The ground-truthing of aquatic features was undertaken during winter when the use of vegetation as an indicator was possible. However, given the topography at the site, it was not possible to cover the site in a high level of detail. Extrapolation of the areas ground-truthed to those not covered was thus done using the latest available aerial imagery for the site.

The level of aquatic assessment undertaken was considered to be adequate for this study. No further fieldwork will be required, if the proposed project activities remain outside of the delineated aquatic features and the recommended buffers.

1.5 Source of Information

Information used in this freshwater impact assessment includes:

- The satellite image used as a background to all maps was obtained from PlanetGIS and Google Earth Professional, 2019;

- The SANBI Biodiversity GIS and CapeFarmMapper websites were consulted to identify any constraints in terms of geology, soils, natural vegetation cover, fine-scale biodiversity conservation mapping as well as possible freshwater features mapped in the Freshwater Ecosystem Priority Areas maps;

- Available PES and EI&ES data from the watercourses in the area was obtained from the national Desktop PES EI ES Assessment undertaken by DWA in 2012;

- The State of Rivers Report for the Gouritz Water Management Area (WMA) that was undertaken in 2007 and the draft Resource Quality Objectives gazetted in 2018 were utilised to inform the

PES and EI&ES, as well as the Recommended Ecological Condition (REC) of the aquatic features in the area;

- Water Resources 2012 and climate data from the South African Atlas of Climatology and Agrohydrology (2009, RE Schulze) was utilised to determine the runoff; and
- Project information sourced from the client, that is the previous aquatic impact assessment undertaken by SASS in 2017.

2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE AQUATIC ECOSYSTEM IMPACTS

The proposed development of a 132 kV transmission line, a major transmission substation and 400 kV line within the Renewable Energy Development Zone (REDZ): 2 Komsberg is located primarily in the upper reaches of the Dwyka River, a tributary in the Gouritz River System in the Southern Coast of South Africa. The Gouritz Water Management Area lies within the management area of the Breede Gouritz Catchment Management Agency (BGCMA). The western extent of the 132 kV transmission line is located in the upper reaches of the Riet River, a smaller tributary of the lower Orange River System that lies within the management area of the Northern Cape Regional office of the Department of Water and Sanitation (DWS).

Activities and infrastructure associated with the proposed development of a 132 kV transmission line, a major transmission substation and 400 kV line include (Figure 1):

- Construction of a major transmission substation (400 m x 400 m) that will be placed within some smaller ephemeral tributaries of the Juk River, a tributary of the Dwyka River;
- Construction of an overhead 132 kV transmission line over a distance of approximately 41 km that will need to span the upper reaches of the Dwyka and Riet Rivers;
- Construction of an overhead 400 kV transmission line for approximately 4 km that will span the upper reaches of the Juk River; and
- Construction of service roads (jeep track) below the lines that will need to cross the watercourses associated with the upper reaches of the Dwyka and Riet Rivers.

The above-mentioned structures would be in place for the operational phase of the project and could potentially impact on aquatic features over the longer term. An alternative section of service road is proposed for the 132 kV line.

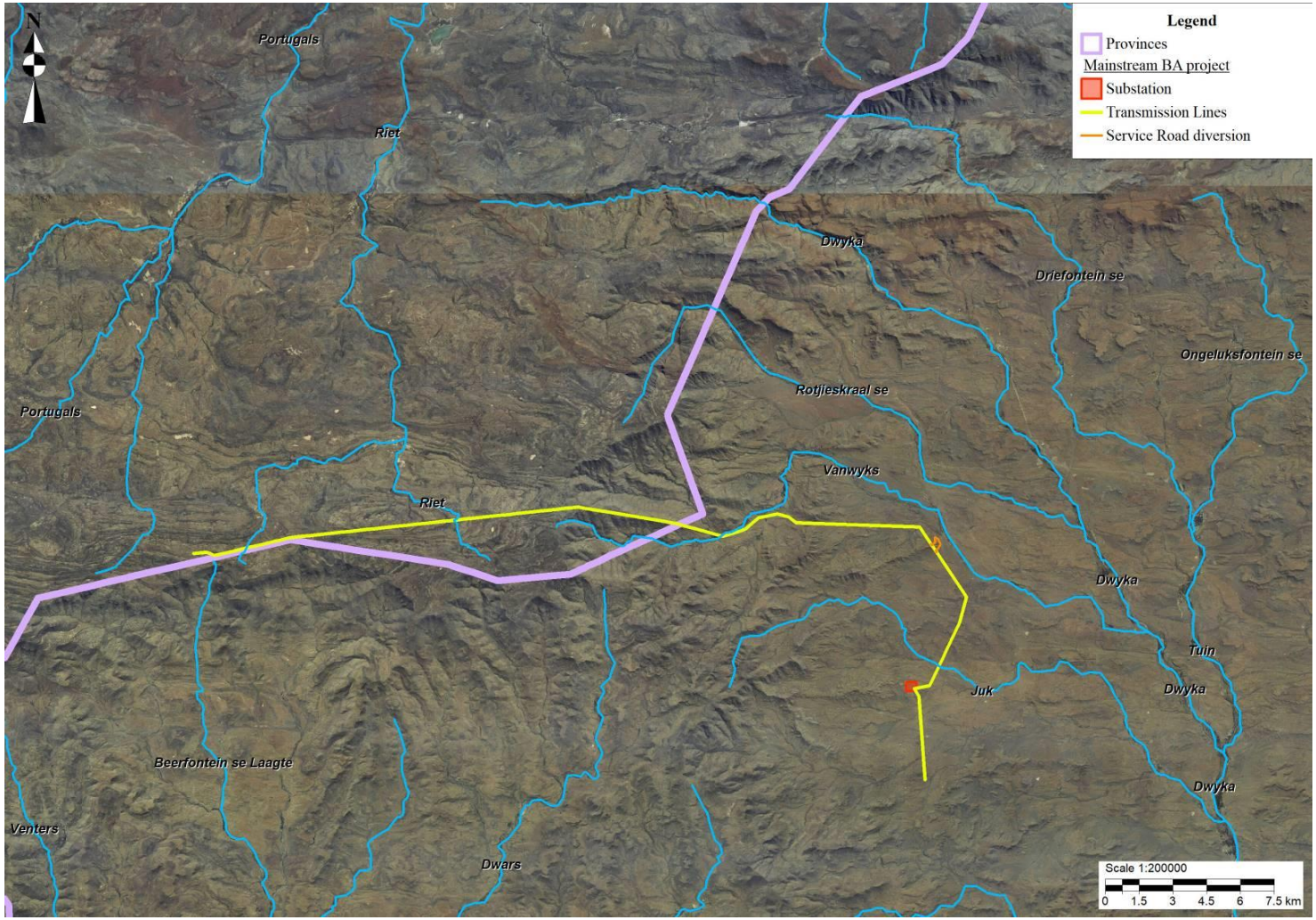


Figure 1. Locality map of the proposed substation and transmission lines relative to freshwater features present

DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 Topography

The western portion of the proposed project is located largely along the border between the Northern and Western Cape provinces. This boundary is on the higher-lying Komsberg Mountains that is the watershed between the northerly flowing Riet River tributary of the Orange River and the southerly flowing Dwars River tributaries of the Gouritz River. The eastern portion of the project is located within the Western Cape province and within the upper reaches of the Vanwyks, Juk and Ouberg Tributaries of the Dwyka River, a tributary of the Gouritz River. While the western half of the transmission lines is located on higher lying areas, the eastern half of the transmission lines and the proposed substation are located within lower lying valleys and floodplain areas.

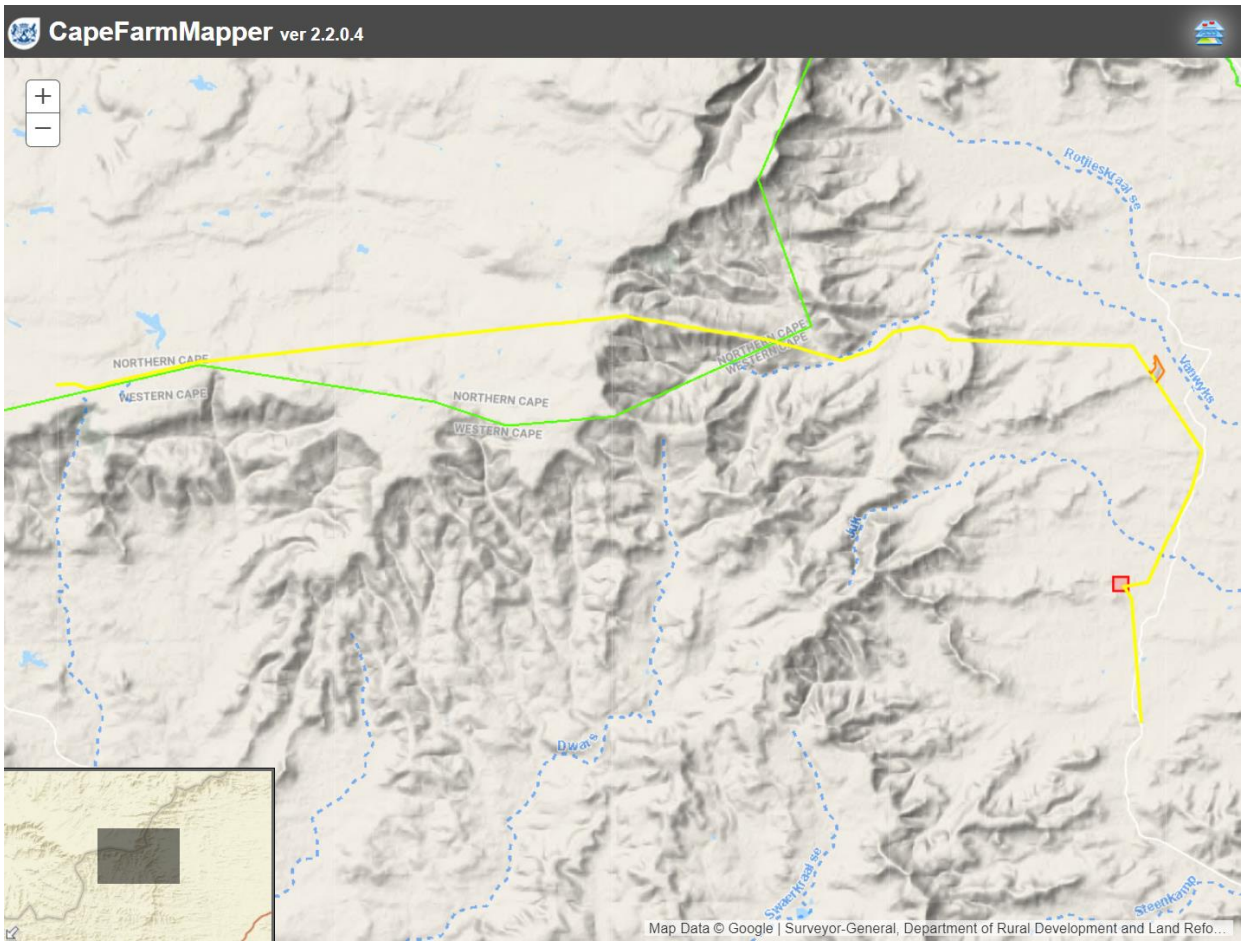


Figure 2. Relief map for the area, showing the main watercourses and the location of the proposed project activities (CapeFarmMapper, 2019)

Table 1 provides an overview and summary of the water resource information for the area in which the project activities are proposed.

Table 1: Key water resources information for the proposed project activities

Descriptor	Name / details	Notes
Water Management Area	Berg Olifants WMA and Lower Orange WMA	
Catchment Area	Riet River and its tributary the Portugals River, Vanwyks and Juk, tributaries of the Dwyka River	Riet River is a tributary in the Orange River System Dwyka River is a tributary in the Gouritz River System
Quaternary Catchment	D56A (Portugals River) D56B (Riet River) J24A (Dwyka River)	
Present Ecological state	Dwyka Rivers – Natural Portugals River- Largely Natural Riet River – Moderately modified	DWS (2012)
Ecological Importance (EI) and Ecological Sensitivity (ES)	Dwyka Rivers- High EI and high ES; Portugals – Moderate EI and Very Low ES Riet Rivers– Low EI and Low/Very Low ES	
Type of water resources	Rivers, ephemeral streams	
Latitude	32°38'41.45"S	Western extent of transmission line
Longitude	20°55'2.77"E	
Latitude	32°44'6.72"S	Eastern extent of transmission line
Longitude	21°15'41.32"E	
Latitude	32°41'51.57"S	Centre of proposed substation site
Longitude	21°15'18.00"E	

2.2 Climate and Hydrology

The study area experiences a low rainfall of only 126mm per annum in the eastern extent to 206 mm in the west. Rainfall varies somewhat between the two extents with rainfall in the east falling mostly in summer (February) while in the west rain falls throughout the year with slightly higher rainfall in winter with June being the highest rainfall month on average (Figure 3).

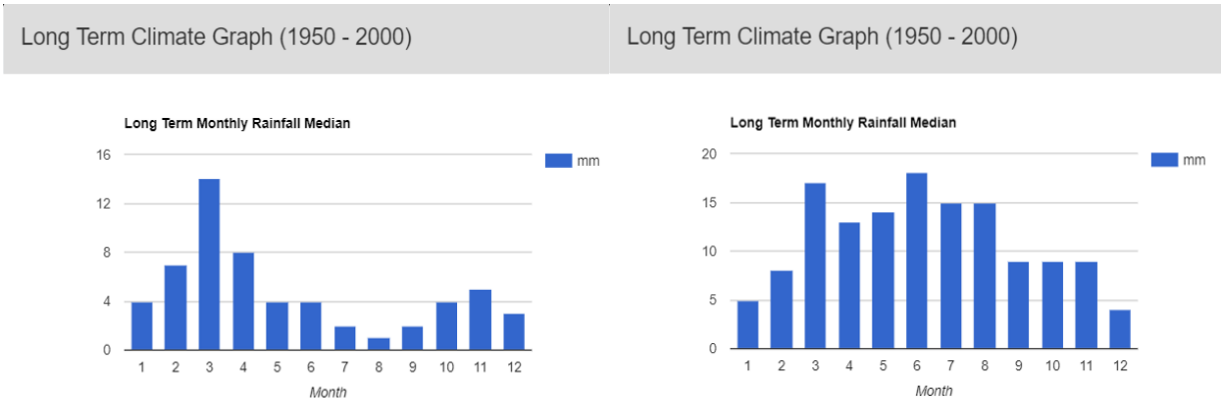


Figure 3. Average monthly rainfall in the eastern (left) and the western (right) extents for the study area, collected between 1950 and 2000 (Schulze, 2009)

The flow pattern (Figure 4) is similar to the rainfall pattern. Flow in the rivers however tends to be episodic (Figure 4) with very little to no flow in the rivers for much of the river. Water flow typically only occurs for a short period of time following localised rainfall. When flow occurs in the

watercourses it occurs as a high flow event. The flow nature does however make erosion control measures in the watercourses, particularly on the slopes, an essential mitigation.

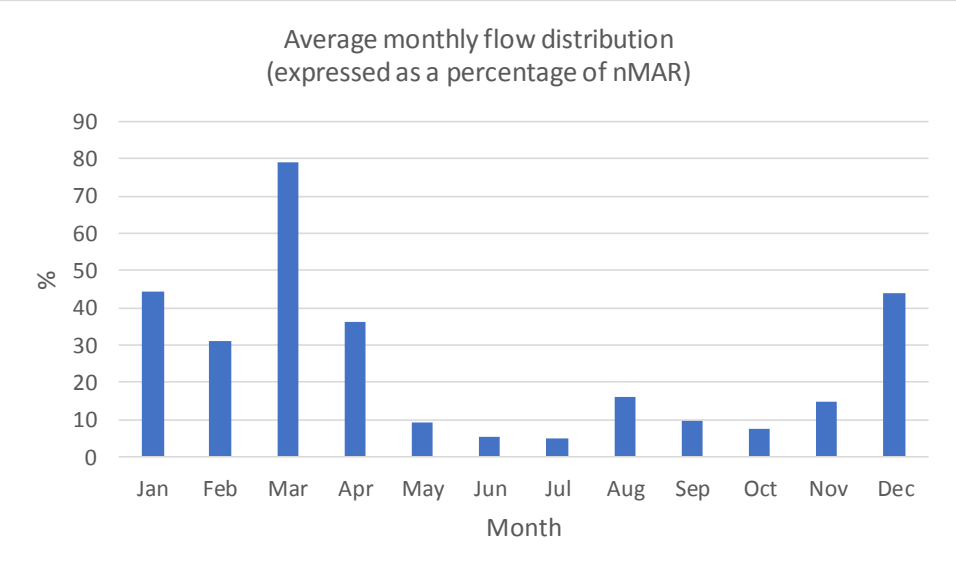


Figure 4. Monthly flow distribution within the Dwyka River Catchment as the catchment where infrastructure would be placed within the valley and floodplain. The monthly flow is shown as a percentage of the natural mean annual runoff (nMAR) for the catchment.

2.3 Geology and Soils

Mudstone, siltstone and sandstone of the Beaufort Group as well as sandstone, siltstone and shale of the Ecca Group; Karoo Sequence occur within the area.

The ridges are generally sandstone with very shallow, rocky soils. The lower-slopes and valley bottoms are largely underlain by shale, which may form loose gravel on the slopes or give rise to a heavier clay soil on the flat areas. Some of the lower slopes and plains contain coarse sands and gravels of a quartzitic nature. The soils are typically Glenrosa and / or Mispah forms and lime is generally present. Glenrosa has a low erodibility when occurring on flat or gentle slopes but increases on steeper slopes of ridges, hills and mountains. This is often ameliorated by stony deposits that reduce runoff intensity. Mispah soil is often found in association with Glenrosa and has a low erodibility.

2.4 Vegetation

Under unmodified conditions, the vegetation type comprises of Roggeveld Shale Renosterveld for the western extent of the study area, Central Mountain Shale Renosterveld in the central area and Gamka Karoo in the eastern extent (Figure 5). The vegetation reflects the varied topography and associated geology of the area with Central Mountain Shale Renosterveld occurring predominantly on the ridges, Roggeveld Shale Renosterveld on the low hills and broad shallow valleys, while Gamka Karoo dominates the lowlands.

Roggeveld Shale Renosterveld consists of moderately tall shrublands dominated by renosterbos *Elytropappus rhinocerotis*, with many geophytes such as *Geissorhiza heterostyla* and *Spiloxene capensis* occurring in the wetter and more rocky habitats. Central Mountain Shale Renosterveld comprises of a low, open to medium density shrubland with a medium dense matrix of short, divaricate shrubs, dominated by renosterbos. All of these vegetation types are regarded as "least threatened".

The vegetation associated with the ephemeral tributaries is not clearing defined from the of the surrounding terrestrial vegetation. The vegetation along the larger watercourses within the study area such as the Juk and Vanwyks Rivers comprises largely of *Vachellia karroo* dominated thickets with *Searsia burchellii*, *S. lancea, Carissa bispinosa* and *Euclea undulata* fringed by *Stipagrostis* spp. grass within the sandy floodplains.

Most of the vegetation associated with the aquatic features within the valley floors in the study area is still largely natural and contains little to no of invasive alien plants.

2.5 Biodiversity Conservation Value

There are three freshwater biodiversity conservation mapping initiatives of relevance to the study area due to the fact that the site is split over two provinces: the national Freshwater Ecosystem Priority Areas (FEPAs) and the 2017 Western Cape Biodiversity Spatial Plan (WCBSP) for the Laingsberg Local Municipality (for the extern extent) and the 2016 Northern Cape Critical Biodiversity Area (for the western extent).

FEPAs are intended to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. FEPAs were determined through a process of systematic biodiversity planning and were identified using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries. The study area is located largely outside of any FEPA River (green areas in Figure 6) with the only FEPA River sub-catchment along the proposed transmission line, is on the western extent, associated with the Beerfontein se Laagte River, a tributary in the upper Buffels River. The river is considered of high ecological importance in terms its unique habitat and is linked to unique terrestrial habitat and vegetation. The goal for FEPA Rivers is that they should not be allowed to degrade. The remainder of river sub-catchments are mapped as Upstream FEPA Rivers that should not be impacted such that they would result in degradation of more ecologically important downstream FEPA Rivers.

There are several instream wetland areas within the channels of the larger watercourses that have been mapped as artificial FEPA Wetlands (Karoo Shale Renosterveld Seeps in the upper Riet River and Lower Nama Karoo channelled valley bottom wetlands in the Vanwyks and Juk Rivers). Only two Lower Nama Karoo channelled valley bottom wetlands in the Juk River are located near the proposed works. A natural Karoo Shale Renosterveld depression is the only mapped natural FEPA Wetland located in the wider study area but is at least 500m south of the proposed line in the upper Riet River.

The 2017 WCBSP used available land cover data to identify areas of potential biodiversity importance. The use of land cover data means that data collected by a site visit is still required to confirm the ecological condition of the area.

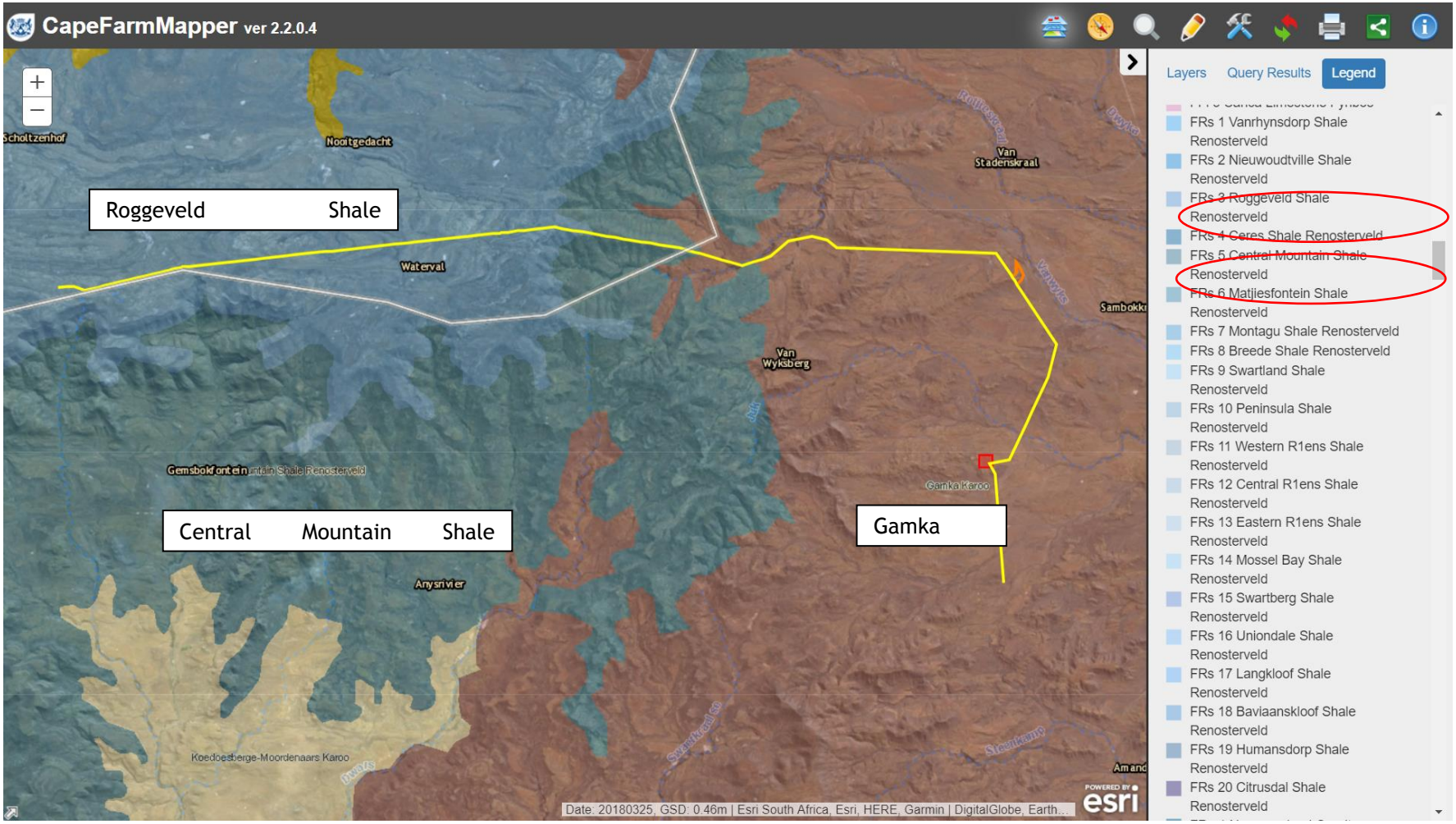


Figure 5. National Vegetation Map (SANBI, 2012) for the study area (yellow line) (CapeFarmMapper, 2019)

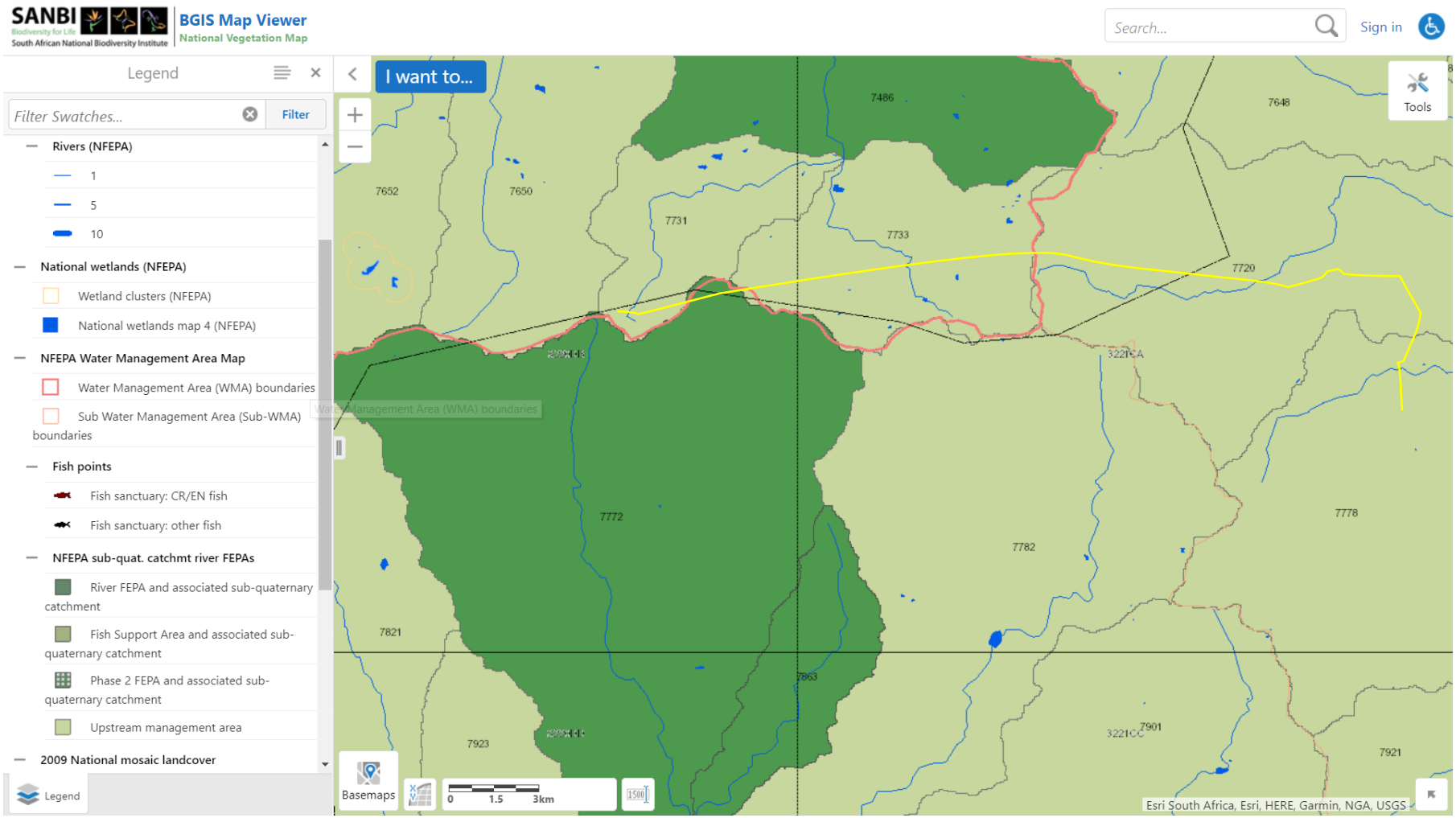


Figure 6. National Freshwater Ecosystem Priority Areas for the study area (yellow line) (SANBI Biodiversity GIS, 2019)

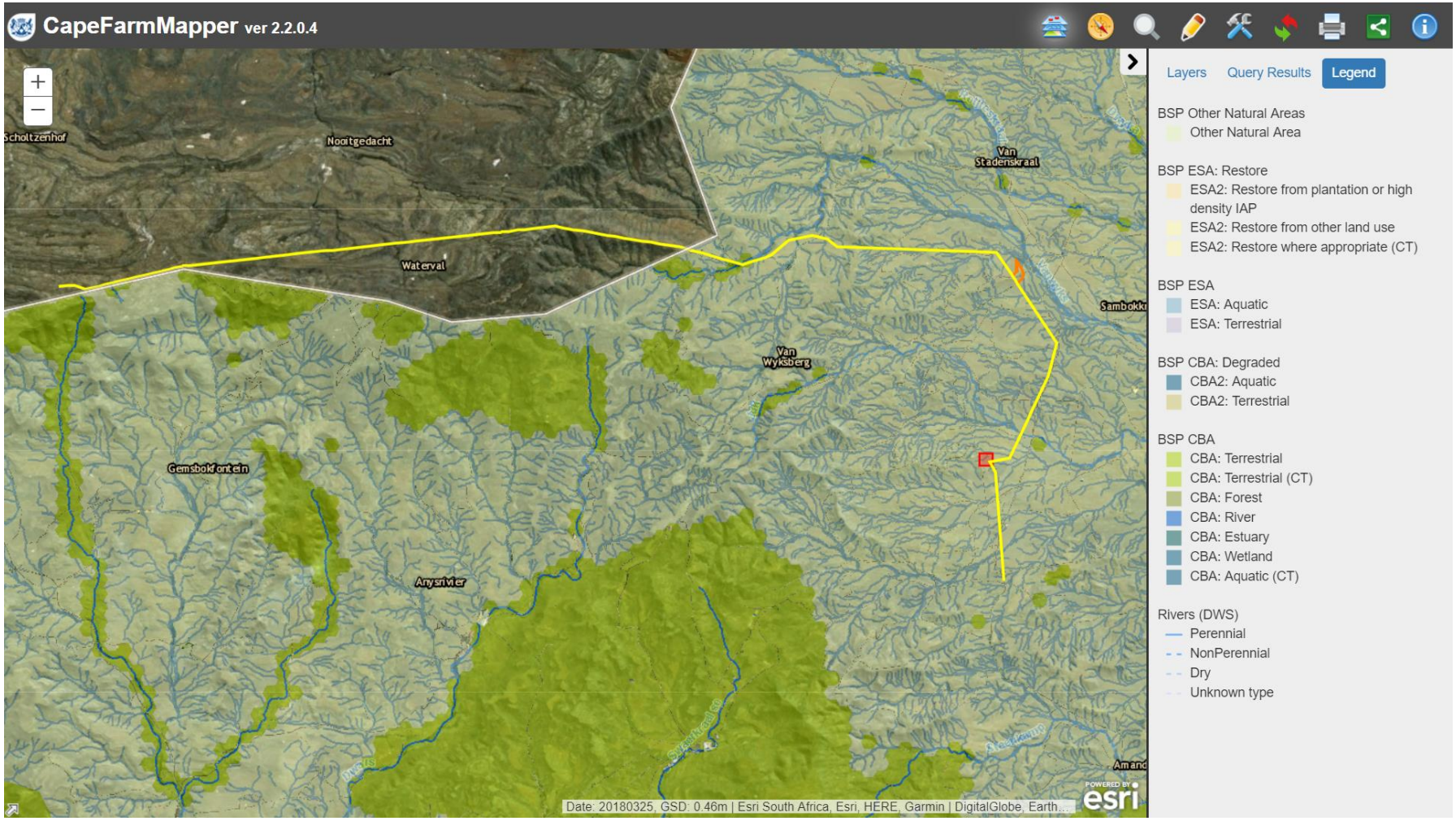


Figure 7. The 2017 Western Cape Biodiversity Spatial Plan for Witzenberg Municipality (CapeFarmMapper, 2019)

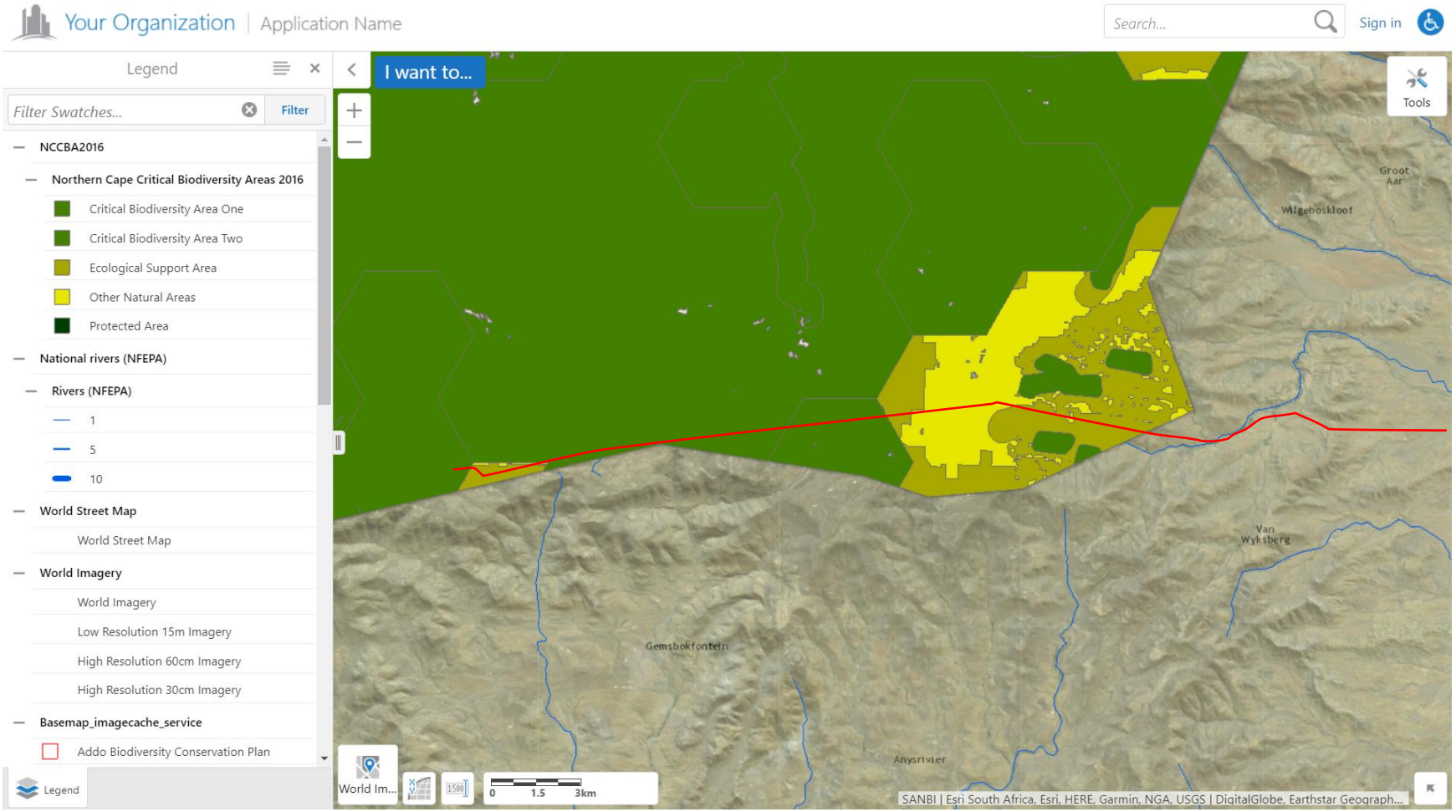


Figure 8. The 2016 Northern Cape Critical Biodiversity Areas for the western portion of the study area where it passes through the Northern Cape (SANBI Biodiversity GIS, 2019)

The Laingsberg WCBSP mapping comprises the following categories:

- CBA1- Critical Biodiversity Areas likely to be in a natural condition (terrestrial, forest, river, estuary and wetland);
- CBA2 – Potentially degraded Critical Biodiversity Areas or those that contain secondary vegetation (terrestrial and aquatic);
- ESA1 – Natural or near natural Ecological Support Areas (terrestrial and aquatic);
- ESA2 – Ecological Support Areas degraded and require restoration where feasible; and
- ONA – Other Natural Areas have not been identified as a priority to meet biodiversity targets.

The only aquatic CBAs within the study area are sections of river where they occur within terrestrial CBAs (CBA1). The only aquatic CBA crossed by the proposed transmission line is on the Vanwyks River approximately 4 km downstream of the Western Cape Border. As for the FEPA River status, the river is considered of high ecological importance in terms its unique habitat and linked to terrestrial habitat and vegetation, The remainder of the watercourses are mapped as aquatic ESAs (ESA1). Most of the terrestrial areas adjacent to the watercourses in the area are mapped as ONAs.

Within the Northern Cape CBA mapping of 2016, most of the area is mapped as a CBA, becoming an ESA to the east of the study area within the eastern portion of the study area in the Northern Cape. This would imply that for the watercourses within this area, the ecological integrity of these features within the CBAs should be preserved while the ecological functionality of the watercourses within the ESAs needs to be retained.

Aquatic Habitat and Species of Concern

The watercourses in the study area are non-perennial, however some rock pools and dams are likely to contain water for most of the year. As a result, no indigenous fishes occur within the rivers and the amphibian diversity within the study area is likely to be relatively low. No species of conservation concern are known to occur in the study area from an aquatic perspective. The species likely to be present are quite widespread and of low conservation concern. These include the Karoo Dainty Frog, *Cacosternum karooicum* (Data Deficient), the Cape Sand Frog, *Tomopterna delalandii* and the Raucous Toad, *Amietophrynus rangeri*. The latter two amphibian species are listed as “Not Threatened”. The endangered riverine rabbit, *Bunolagus monticularis*, is also indicated to occur in the area.

One plant species of conservation concern, the candelabra lily, *Brunsvigia josephinae*, which is listed as “Vulnerable”, is known to occur along the watercourses throughout the study area.

3 AQUATIC SENSITIVITY MAP

The proposed activities (substation, transmission lines and access roads) have the potential to impact on the freshwater features if located within or immediately adjacent to the aquatic features. As there is some flexibility relating to the exact location of the various project elements, it is usually easy to mitigate the impact of these activities on the freshwater features within the site by locating them sufficiently far enough away from the freshwater features. The substation and access roads will have the most potential impacts on the freshwater features, due to the fact that these elements may need to be placed in or adjacent to the freshwater features. Such disturbances of the freshwater features need to be minimised and mitigated as far as possible.

3.1 Ecological Assessment of the Aquatic Features within the Study area

This section comprises of a description of the aquatic ecosystems within the study area as well as an assessment of their present ecological condition and their ecological importance and ecological sensitivity. The aquatic features within the study area consist of the upper reaches of the Riet River (Portugals Tributary, Salmonsloop Tributary and the Riet River) that flows northwards towards the Orange River; the upper reaches of the Buffels River (Beerfontein se Laagte Tributary) that flows southwards towards the Gouritz River; and the upper reaches of Dwyka River (Vanwyks and Juk Rivers) and the lesser, unnamed tributaries. The Present Ecological Status (PES) of the rivers and tributaries was determined using Habitat Integrity (HI) Assessments and the Site Characterisation information. The ecological importance and sensitivity of the rivers were also assessed. Associated with the very upper reaches of the rivers on the hill tops are seep areas and vernal ponds while valley bottom and floodplain wetlands occur in the lower foothills and floodplain zones within the deeper valleys.

3.1.1 Description of Aquatic Features

Riet River

The upper reaches of the Riet River rise near the western extent of the proposed transmission line and flows northwards to eventually drain into the lower Orange River. The river and a number of smaller tributaries of the river, of which the Portugals and Salmonsloop Tributaries are the largest, originate on the northern slopes of the Komsberg Mountains. The watercourses are still in a largely natural to moderately modified ecological condition with little disturbance except for roads in its upper catchment. Minor modification to the rivers as a result of surrounding farming activities include some abstraction and storage of water, localised erosion and low numbers of alien invasive plants. The rivers are mapped as aquatic CBAs and are located in an Upstream FEPA River Sub-catchment. The proposed transmission line will only cross the upper reaches of these tributaries.

Buffels River (Beerfontein se Laagte Tributary)

The Beerfontein se Laagte Tributary of the Buffels River rises on the southern ridge of the Komsberg Mountain where the transmission line is proposed. The river flows southward to confluence with several other tributaries before draining into the Buffels River a tributary in the Gourtiz River System. The river and its tributaries flow within relatively steep-sided valleys as a result is still in a largely natural ecological condition, surrounded by natural terrestrial vegetation. As a result, the river is mapped as an aquatic CBA and a FEPA River. Although the line is located slightly north of this river and away from this river, it is important that the proposed activities do not impact on this river.

Vanwyks River

The Vanwyks River is a tributary of the Dwyka Rivers that flows from the Komsberg Mountains eastwards from the mountains. The river lies largely to the north-east of the study area. The river is been slightly modified by the surrounding farming activities, with grazing of the surrounding terrestrial vegetation, fences and access roads, and some farm dams occurring in the catchment. Sections of the river is mapped as an aquatic CBA where valley bottom wetland areas occur, and the remainder of the watercourses mapped as aquatic ESAs. The sub-catchment is mapped as an Upstream FEPA River. The transmission line passes over the upper reaches where the river is mapped as an aquatic CBA and then is located largely south and east of the river, crossing some of the smaller tributaries and secondary channels of the river within the valley floor.

Juk River

The Juk River also originates on the eastern slope of the Komsberg Mountains and flows in an easterly direction and then southwards to join the Dwyka River. The watercourse and its tributaries lie south of the Vanwyks River. The river has been modified by farming activities similarly to the Vanwyks River and is in a moderately modified ecological condition. The river is mapped as an aquatic CBA a short distance downstream of where the proposed transmission line is proposed to cross the mainstem of the river. The remaining reaches of the river and its tributaries are all mapped as aquatic ESAs. The sub-catchment is mapped as an Upstream FEPA River. The transmission line and the proposed substation are located in the middle reaches of the river.

Oubergs River (Koolgat se Rivier and Vaalrants Tributaries)

The Koolgat se Rivier and Vaalrants Tributaries of the Oubergs River originate to the east slope of the Komsberg Mountains and flow eastwards to join the Juk River. The south-eastern extent of the transmission line is located within the floodplain of these rivers, ending between the Koolgat se River and the Oubergs River. As for the Vanwyks and Juk Rivers, these rivers have been moderately modified by the surrounding farming activities. The rivers and their tributaries are mapped as an aquatic ESAs. The watercourses are located within an Upstream FEPA River sub-catchment.

Only the Riet, Vanwyks, Juk and Oubergs Rivers and their associated smaller tributaries and wetland areas are assessed in the following section, where they may be impacted by the proposed activities.

Figure 9. Map showing the location of the main aquatic features within the area

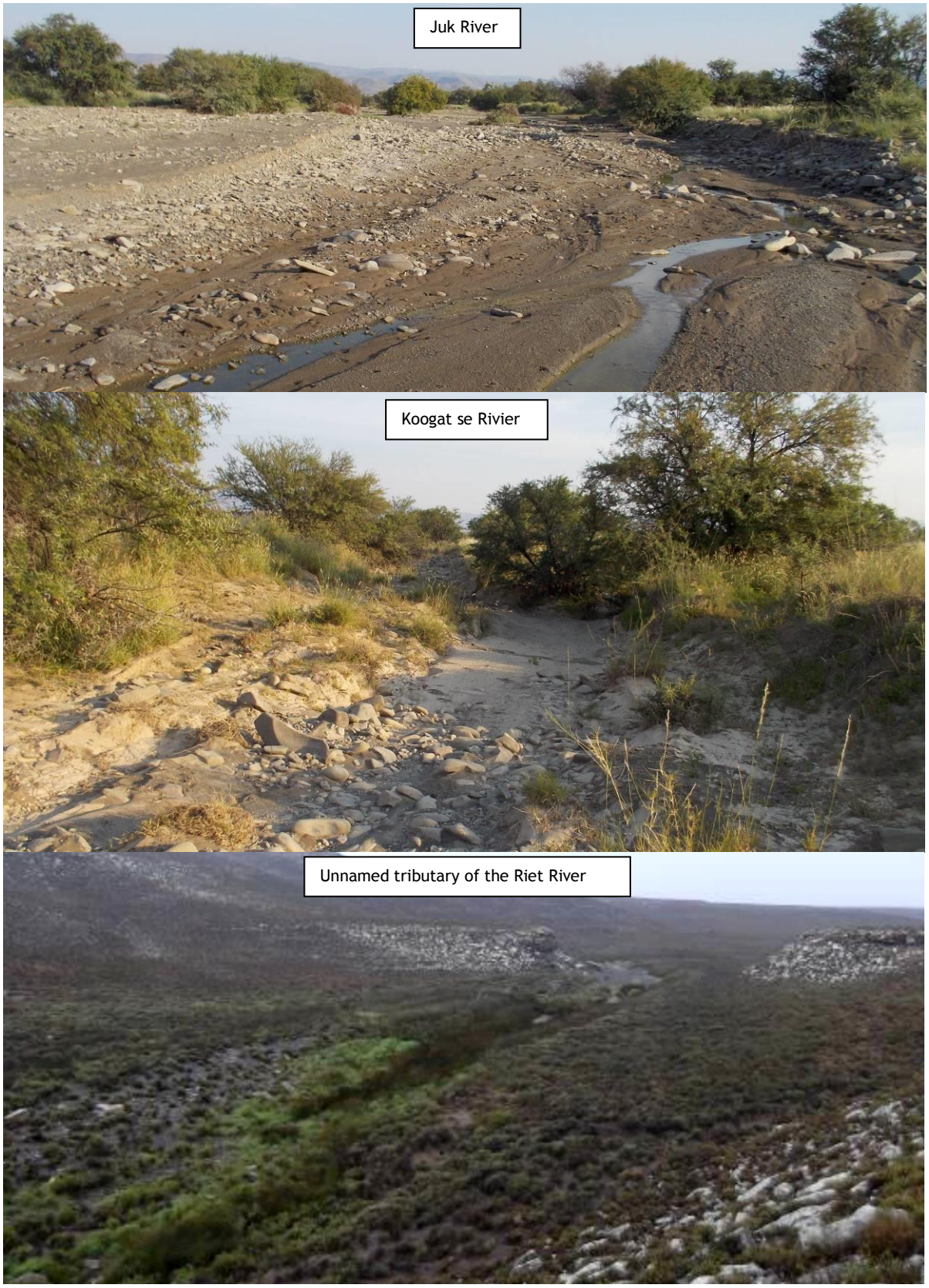


Figure 10. View of the larger rivers and smaller tributaries within the study area

3.1.2 Classification of aquatic features

Classification of the watercourses within the study area

To assess the condition and ecological importance and sensitivity of the watercourses, it is necessary to understand how they might have appeared under unimpacted conditions. This is achieved through classifying the rivers according to their ecological characteristics, in order that they can be compared to ecologically similar rivers.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river condition should only be done between rivers that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers provides the basis for assessing river condition to allow comparison between similar river types. The primary classification of rivers is a division into Ecoregions. Rivers within an ecoregion are further divided into sub-regions.

Ecoregions: groups of rivers within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation. For the purposes of this study, the ecoregional classification presented in DWAF (1999), which divides the country's rivers into ecoregions, was used. The western portion to the transmission line falls within the Nama Karoo Ecoregion while the eastern portion falls within the Great Karoo Ecoregion (Table 2).

Table 2. Characteristics of the Ecoregion

Main Attributes	Great Karoo	Nama Karoo
Terrain Morphology:	**Plains; Low Relief**; Plains Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills, Lowlands; Mountains; Moderate to High Relief; **Closed Hills; Mountains; Moderate and High Relief;** Table-Lands: Moderate and High Relief	Plains; Low Relief**;** **Plains Moderate Relief;** **Lowlands; Hills and Mountains; Moderate and High Relief;** Open Hills, Lowlands; Mountains; Moderate to High Relief; Closed Hills; Mountains; Moderate and High Relief
Vegetation types	**Central Nama Karoo**; Eastern Mixed Nama Karoo; **Great Nama Karoo**; Upper Nama Karoo; Lowland Succulent Karoo; Upland Succulent Karoo; Escarpment Mountain Renosterveld	Eastern Mixed Nama Karoo; Upper Nama Karoo; **Bushmanland Nama Karoo;** Orange River Nama Karoo
Altitude	300-1700m; 1700-1900m limited	300-1700m
MAP	0 to 500m	0 to 500m
Rainfall seasonality	Very late summer to winter	Late to very late summer to winter
Mean annual temp.	10 to 20 °C	12 to 20°C
Median annual simulated runoff	<5 to 60 mm for quaternary catchment	<5 to 60 mm for quaternary catchment

Sub-regions: sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that this a major factor in the determination of the distribution of the biota. Table 3 provides the geomorphological and physical features of the rivers within the study area.

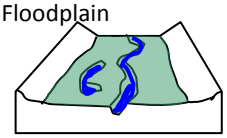
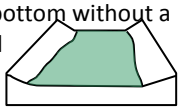
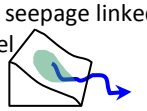
Table 3. Geomorphological and Physical features of the watercourses crossed by the proposed transmission line

River	Lower Vanwyks, Juk and Oubergs Rivers	Upper Riet and Vanwyks Rivers
Geomorphological Zone	Lowland and floodplain zones	Mountain streams and foothill zones
Lateral mobility	Unconfined	Largely confined
Channel form	Single to multiple channels	Simple single channel
Channel pattern	Braided channel with moderate sinuosity	Single channel, moderate to low sinuosity
Channel type	Boulders, gravel and alluvium	Bedrock, boulders and gravel
Channel modification	Channel is fairly natural with limited direct habitat modification	Natural with some very small instream dams
Hydrological type	Seasonal to episodic	Seasonal to episodic
Ecoregion	Great Karoo	Nama Karoo
DWA catchment	J24A	D56B and J24A
Vegetation type	Gamka Karoo,	Roggeveld and Central Mountain Shale Renosterveld

Classification of the watercourses within the study area

Wetlands can be broadly classified according to their flow and geomorphic characteristics. According to Table 4 the wetland features within the study area can be classified into groups as described in Table 5.

Table 4. Wetland hydro-geomorphic types typically supporting inland wetlands in South Africa

Hydro-geomorphic types	Description	Source of water[1]	
		Surface	Sub-surface
Floodplain 	Valley bottom areas with a well-defined stream channel, gently sloped and characterised by floodplain features (oxbow depressions & natural levees) and alluvial transport and deposition of sediment, leads to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel 	Valley bottom areas with well-defined stream channel but lacking characteristic floodplain features. May be gently sloped, characterised by net accumulation of alluvial deposits or may have steeper slopes, characterised by net loss of sediment. Water inputs from main channel (overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterised by alluvial sediment deposition, generally leading to net accumulation of sediment. Water inputs mainly from channel entering wetland and from adjacent slopes.	***	*/ ***
Hill slope seepage linked to channel 	Slopes on hillsides, which are characterised by the colluvial movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hill slope seepage 	Slopes on hillsides, which are characterised by colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface connection.	*	***
Depression (includes Pans) 	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water. It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important output

Water source: * Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on local circumstances

Wetland

Table 5: Classification of wetland areas within study area

Name	Hillslope seeps	Vernal pools	Valley bottom wetlands and wider floodplain
System	Inland		
Ecoregion	Nama Karoo		Great Karoo
Landscape setting	Upper Hill slope	Bench (hilltop)	Channeled Valley bottom
Longitudinal zonation	Headwaters	Depression	Lower foothill
Drainage	With channel outflow	Without channel in- and outflow	With channel in- and outflow
Seasonality	Seasonally inundated		
Modification	Largely natural		Moderately modified
Geology	Sandstone of the Beaufort Group		Shale and siltstone of the Ecca Group; Karoo Sequence
Vegetation	Central Mountain and Roggeveld Shale Renosterveld		Gamka Karoo
Substrate	Rock with limited fine sediment		Gravel/sand
Salinity	Fresh		Slightly brackish

The wetlands associated with the foothill reaches of the rivers within the steeper valleys can be classified as valley bottom wetlands. There areas open out into the wider floodplain areas of the Vanwyks, Juk and Ouberg Rivers. In addition, on the hilltops in the upper reaches of the Riet River, there are some seeps associated with the river systems and some vernal pools. Artificial wetlands associated with the dams along the watercourses are classified as depression wetland based on the wetland types described in Table 4. Flow into and out of the wetland areas is largely associated with the watercourses within the study area. The dams have not been assessed further due to their artificial nature.

3.1.3 Present Ecological Condition

Habitat Integrity of the Watercourses

The evaluation of Habitat Integrity provides a measure of the degree to which a river has been modified from its natural state. The methodology (DWAF, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of degradation of a river. The severity of each impact is ranked using a six-point scale from 0 (no impact) to 25 (critical impact). The Habitat Integrity Assessment is based on assessment of the impacts of two components of the river, the riparian zone and the instream habitat. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category (Table 8).

Due to the fact that the aquatic features and the surrounding land and water use impacts were very similar, the habitat integrity assessment could be divided into the following two groups: the upper reaches of the watercourses that have few modifications; and the lower, more modified middle reaches of the larger watercourses within the study area.

The rivers within the study area is still in a natural condition in their upper reaches with few modifications (some roads and very small dams). Downstream, in the middle reaches of the Vanwyks, Juk and Oubergs Rivers, the rivers become largely natural to moderately modified. The riparian habitat is slightly more degraded as a result of direct habitat modification from the surrounding farming activities.

Table 6. Instream Habitat Integrity assessment for the watercourses within the study area

Instream Criteria	Upper Riet and Vanwyks Rivers	Lower Vanwyks, Juk and Oubergs Rivers
Water Abstraction	2	6
Flow Modification	4	6
Bed Modification	4	8
Channel Modification	3	4
Water Quality	3	6
Inundation	3	4
Exotic Macrophytes	0	0
Exotic Fauna	0	0
Rubbish Dumping	0	2
Instream Integrity Class	A/B	B/C

Table 7. Riparian Habitat Integrity assessment for the watercourses within the study area

Riparian Category	Upper Riet and Vanwyks Rivers	Lower Vanwyks, Juk and Oubergs Rivers
Vegetation Removal	3	6
Exotic Vegetation	3	5
Bank Erosion	4	5
Channel Modification	3	4
Water Abstraction	2	6
Inundation	3	4
Flow Modification	3	6
Water Quality	3	5
Riparian Integrity Category	B	B/C

Table 8. Habitat Integrity categories (From DWAF, 1999)

Category	Description	Score (%)
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.	80-90
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. Large loss of natural habitat, biota and ecosystem function has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	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 worst instances, basic ecosystem functions have been destroyed and changes are irreversible.	0

Wetland Habitat Integrity

The Wetland PES Method (DWAF 2005) was used to establish the integrity of the wetlands in the study area and was based on the modified HI approach developed by Kleynhans (DWAF, 1999; Dickens *et al*, 2003). Table 9 displays the criteria and results from the assessment of the habitat integrity of the wetlands within the study area. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 9. Habitat integrity assessment criteria for palustrine wetlands (Dickens *et al*, 2003)

Criteria	Relevance
Hydrologic	
Flow Modification	Abstraction, impoundments or increased runoff from developed areas. Change in flow regime, volume, velocity & inundation of habitats resulting in floralistic changes or incorrect cues.
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water Quality	
Water Quality Modification	From point or diffuse sources such as upstream agriculture, human settlements and industry. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rate of erosion, accretion, infilling of wetlands &habitat change.
Hydraulic/Geomorphic	
Canalisation	Desiccation or change to inundation of wetland and change in habitat
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities that reduce or change wetland habitat
Biota	
Terrestrial Encroachment	Desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat
Indig Vegetation Removal	Direct destruction of habitat through farming, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plants	Affects habitat characteristics through changes in community structure and water quality
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Overuse of Biota	Overgrazing, overfishing, etc.

Table 10. Wetland habitat integrity assessment (score of 0=critically modified to 5=unmodified)

Criteria & Attributes	Hillslope seeps	Valley bottom wetlands and floodplains	Vernal pools
Hydrological			
Flow Modification	4.9	4.1	4.9
Permanent Inundation	5	4.2	5
Water Quality			
Water Quality Modification	5	4.2	5
Sediment Load Modification	4.9	4.1	4.8
Hydraulic/Geomorphic			
Canalisation	5	4.0	5
Topographic Alteration	5	4.1	5
Biota			
Terrestrial Encroachment	4.9	4.0	4.9
Indigenous Vegetation Removal	5	4.0	4.9

Criteria & Attributes	Hillslope seeps	Valley bottom wetlands and floodplains	Vernal pools
Invasive Plant Encroachment	5	4.3	5
Alien Fauna	5	3.9	5
Over utilization of Biota	5	4.0	5
Category	A	B	A

Table 11. Relation between scores given and ecological categories

Scoring Guidelines	Interpretation of Scores: Rating of Present Ecological Status Category (PESC)
Natural, unmodified – score=5.	CATEGORY A >4; Unmodified, or approximates natural condition.
Largely natural – score=4.	CATEGORY B >3 and ≤4; Largely natural with few modifications, with some loss of natural habitat.
Moderately modified-score=3.	CATEGORY C >2 and ≤3; moderately modified, but with some loss of natural habitats.
Largely modified – score=2.	CATEGORY D ≤2; largely modified. Large loss of natural habitat & basic ecosystem function
Seriously modified – rating=1.	CATEGORY E >0 and <2; seriously modified. Extensive loss of natural habitat & basic ecosystem function.
Critically modified – rating=0.	CLASS F 0; critically modified. Modification reached critical levels with system completely modified.

The hillslope seeps and the vernal pools are in a natural ecological condition while the valley bottom wetlands have been slightly modified but are still in a largely natural ecological condition. The floodplains although still largely natural are the most impacted by the activities within the valley floor.

3.1.4 Ecological Importance and Sensitivity

The Ecological Importance and Ecological Sensitivity (EI&ES) assessment for both watercourses and wetlands considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (Table 12). The median of the resultant score is calculated to derive the EI&ES category (Table 13). The results of the EIS assessment are shown in Table 14. The EI&ES have been determined for the larger water courses and for the smaller unnamed tributaries separately.

Table 12. Scale used to indicate either ecological importance or sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale

Table 13. Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	Range of median
Very high	Quaternaries/delineations unique on a national and international level based on unique biodiversity. These rivers are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations unique on a national scale based on biodiversity. These rivers may be sensitive to flow modifications and may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations unique on a provincial/ local scale due to biodiversity. These rivers are not very sensitive to flow modification and have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations not unique on any scale. These rivers are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Ecological Importance and Sensitivity of the Watercourses

Table 14. Results of the EI&ES assessment of the watercourses in the study area

Biotic and Aquatic Habitat Determinants	Riet River	Vanwyks, Juk and Oubergs Rivers	Smaller tributaries
Rare and endangered biota	2.5	1.5	1
Unique biota	2	2	1
Intolerant biota	2	2	2
Species/taxon richness	2	1.5	1.5
Diversity of aquatic habitat types or features	2	2.5	1
Refuge value of habitat type	2.5	2.5	1
Sensitivity of habitat to flow changes	2.5	2.5	2
Sensitivity of flow related water quality changes	2	2	2.5
Migration route/corridor for instream & riparian biota	2.5	2.5	1
National parks, wilderness areas, Nature Reserves, Natural Heritage sites, Natural areas, PNEs	1.5	1.5	1.5
EIS CATEGORY	High	High	Moderate

The larger watercourses in the study area, Riet, Vanwyks, Juk and Oubergs Rivers have a high ecological importance and sensitivity while the smaller tributaries/drainage features are of a moderate ecological importance and sensitivity. The larger watercourses tend to be more ecologically important but less sensitive to impacts while the smaller tributaries are less ecologically important but more sensitive to flow, water quality and habitat modification.

Ecological Importance and Sensitivity of the Wetlands

The EIS Assessment for the wetland areas utilise a similar methodology to that for rivers. The results from the wetland EIS assessment are provided in Table 15 below. The assessment of the ecosystem services supplied by the wetland areas (divided into Hydrological Functional Importance and Direct Human Benefits) was conducted according to the guidelines as described by Kotze *et al* (2005).

Table 15: Results of the EIS assessment for the wetland areas

Ecological Importance	Vernal pools	Hillslope seeps	Valley bottom wetlands	Floodplain
Biodiversity support	2.33	1.83	2.17	2.83
Presence of Red Data species	3	2	1	3
Populations of unique species	3	2	2	2
Migration/breeding/feeding sites	1	1.5	3.5	3.5
Landscape scale	1.60	2.10	1.40	1.60
Protection status of the wetland	1	3	1	1
Protection status of the vegetation type	1	1	1	1
Regional context of the ecological integrity	2	2	2	2
Size and rarity of the wetland type/s present	2	2	1	2
Diversity of habitat types	2	2.5	2	2
Sensitivity of the wetland	1.67	1.33	1.93	2.00
Sensitivity to changes in floods	1	1	2.8	3
Sensitivity to changes in low flows/dry season	1	1	2	2
Sensitivity to changes in water quality	3	2	1	1
ECOLOGICAL IMPORTANCE & SENSITIVITY	2.33	2.10	2.17	2.83
Flood attenuation	0	1	3	3.5
Streamflow regulation	0	2	1	2
Sediment trapping	0.5	1.5	2.5	2
Phosphate assimilation	1	1	1	1
Nitrate assimilation	0	1	1.5	1.5
Toxicant assimilation	0	0	1	1
Erosion control	0	2.5	2	2
Carbon storage	0.5	1.5	1	1
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	0.25	1.31	1.63	**1.75**
Water for human use	0	1	1.5	1.5
Harvestable resources	0	1	1.5	1
Cultivated foods	0	1	0	0
Cultural heritage	0	1	0	0
Tourism and recreation	0	1	2	1
Education and research	1	1	1	1
IMPORTANCE OF DIRECT HUMAN BENEFITS	0.17	1.00	1.00	0.75
OVERALL IMPORTANCE (highest score)	2.33	2.10	2.17	2.83

The wetland features within the study area are considered of high ecological importance and sensitivity. The hillslope seeps, valley bottom wetlands and floodplains are closely associated with the rivers in the area and the importance of the habitat in providing ecological corridors for the movement of biota. The valley bottom wetlands and floodplains also play an important role in mitigating flow and water quality impacts in the watercourses and provide important habitat. The vernal pools are small but contain a unique aquatic habitat and specific associated biota.

3.1.5 Recommended Ecological Condition of Aquatic Ecosystems

Considering the natural to largely natural ecological condition of the aquatic ecosystems within the higher lying areas of the area assessed and their moderate to high ecological importance and ecological sensitivities, the recommended ecological condition (REC) of these features would be that they remain in a natural ecological condition. The middle reaches of the Riet, Vanwyks, Juk

and Oubergs Rivers that are in a largely natural to moderately modified as a result of direct habitat modification from the surrounding activities. These rivers should be maintained in their current ecological condition and should not be allowed to degrade further.

3.1.6 Aquatic Ecosystem Constraints Mapping

This section provides an assessment of the proposed project components in relation to the mapped and assessed aquatic ecosystems. Based on the PES, and EI&ES and REC, buffers have been recommended to protect these ecosystems.

The recommended buffer area as a development setback from the aquatic features to ensure these aquatic ecosystems are not impacted by the proposed activities, is as follows:

- Smaller streams and drainage lines, together with their seeps: at least 50m from the centre of these streams or the delineated wetland edge (whichever is the furthest);

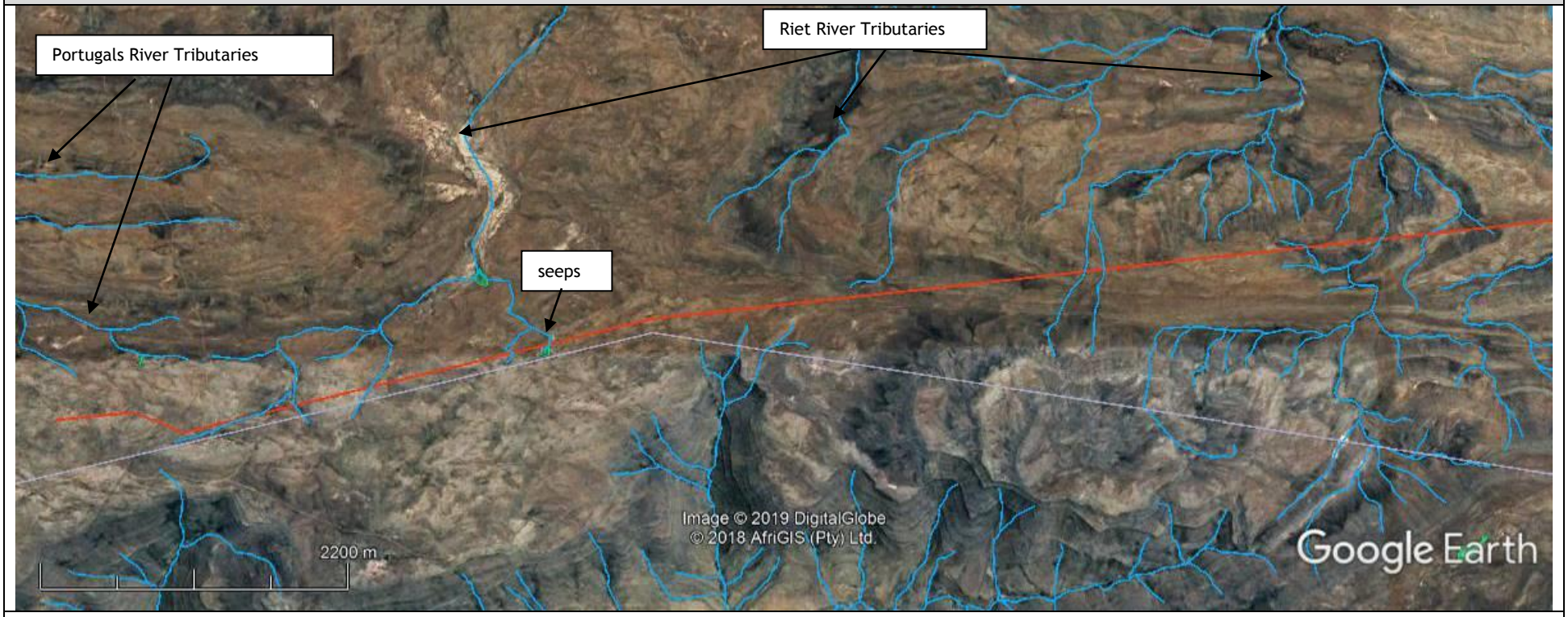
- The larger rivers within the valley floor, together with their valley bottom wetlands: at least 100m, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest); and

- The vernal pool and other wetland areas: at least 50m, measured from the top of bank of the river channels or the delineated wetland edge.

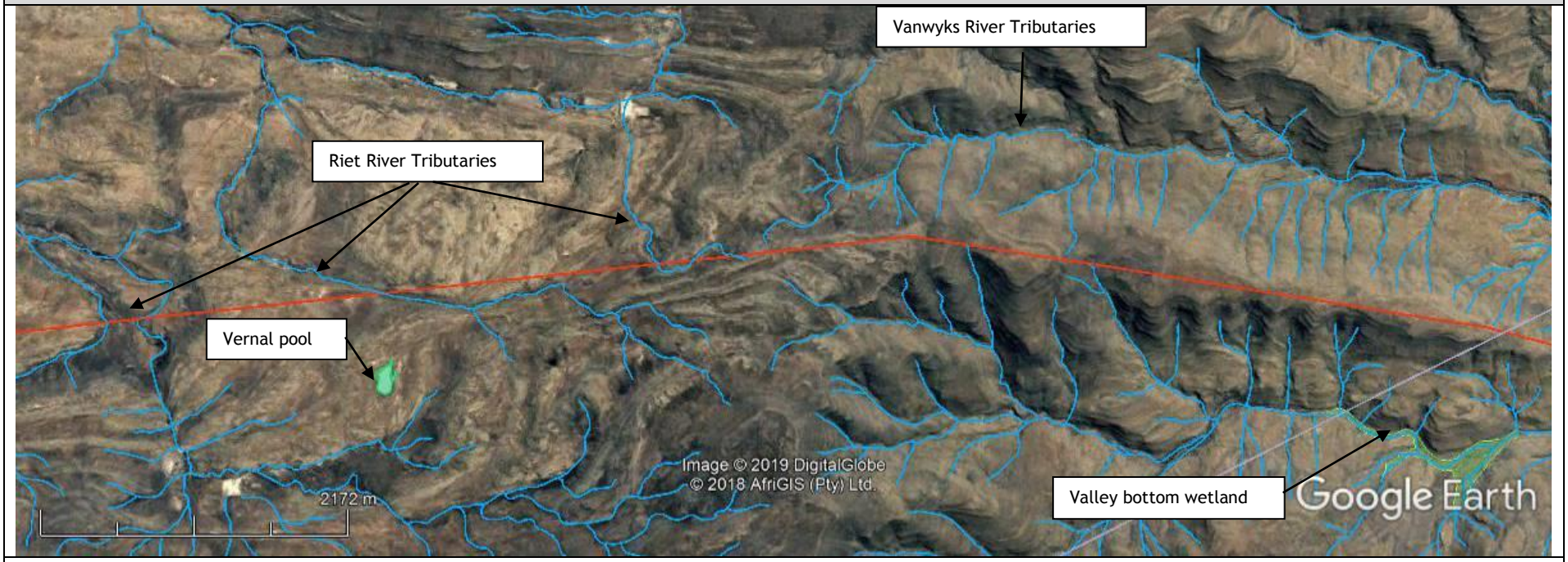
These recommended buffers are in line with the watercourse and wetland buffers that have been recommended in the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (CSIR, 2015) and are deemed appropriate to the aquatic features and the proposed activities within the study area.

The placing of the access roads within the recommended buffers and through the watercourses, and the mitigation thereof, is discussed separately in the following table that further assesses the potential freshwater constraints.

Table 16. Freshwater constraints associated with the project components

Western Extent of transmission line: Portugals and Riet Rivers

Comments and Recommendations While the western extent of the transmission line starts within the Portugals River Catchment, it does not cross any of the associated watercourses. Within this section, the line only crosses the Riet River tributaries along the high lying areas at the very upper reaches of the watercourses. The Riet River at the line is mapped as an aquatic CBA and is within an Upstream FEPA sub-catchment. The PES of the rivers is largely natural and the EIS is high. The rivers should remain in a largely natural ecological condition. The recommended buffer to protect these aquatic features is 50m and it is recommended that the pylons of the proposed transmission line be placed outside of these areas. Given that an access road for the line will be placed under the line, it is recommended that the line and access road be located slightly south of the seeps shown in the Google Earth image above (approx. 125 m south of the indicated route). Further east, the routing should try to minimise the number of watercourses crossed or placing the road directly along the watercourses by placing the route slightly south of the current alignment. Any potential erosion along the constructed road should be mitigated.

Western Extent of transmission line: Riet and Vanwyks River

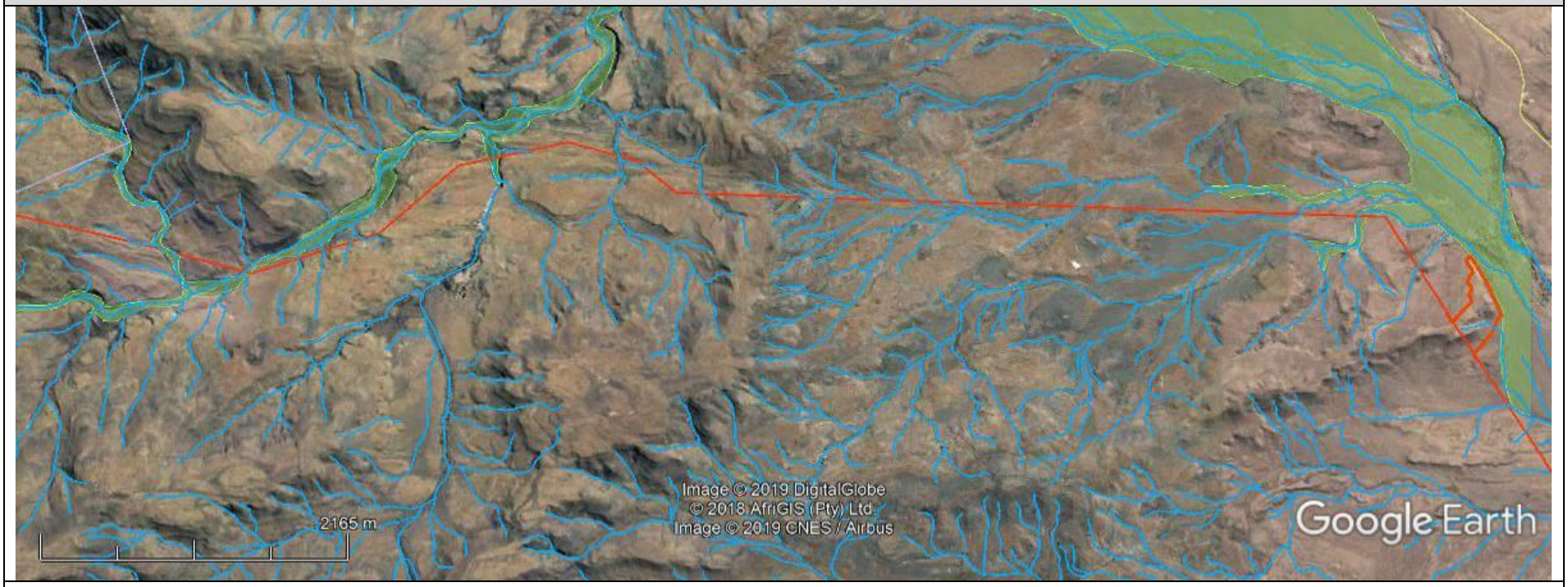


Comments and Recommendations

Within this section, the line crosses the upper Riet River and its tributaries and then passes eastwards along a ridge between two tributaries of the Vanwyks River. The Riet River at the line is mapped as an aquatic CBA in the west and then ESAs further east. As stated for the previous section, the watercourses are within an Upstream FEPA sub-catchment. The middle reaches of the Vanwyks River, where valley bottom wetland areas occur, the river is mapped as an aquatic CBA, while the remainder of the watercourses are aquatic ESAs. Within this section, the PES of the rivers becomes slightly more modified, becoming largely natural to moderately modified and the EIS of the watercourses remains high. The rivers should remain at least in a largely natural to moderately modified ecological condition.

The recommended buffer to protect these aquatic features is 50m and it is recommended that the pylons of the proposed transmission line be placed outside of these areas. Given that an access road for the line will be placed under the line, the routing should try to minimise the number of watercourses crossed or placing the road directly along the watercourses. Any potential erosion along the constructed road should be mitigated.

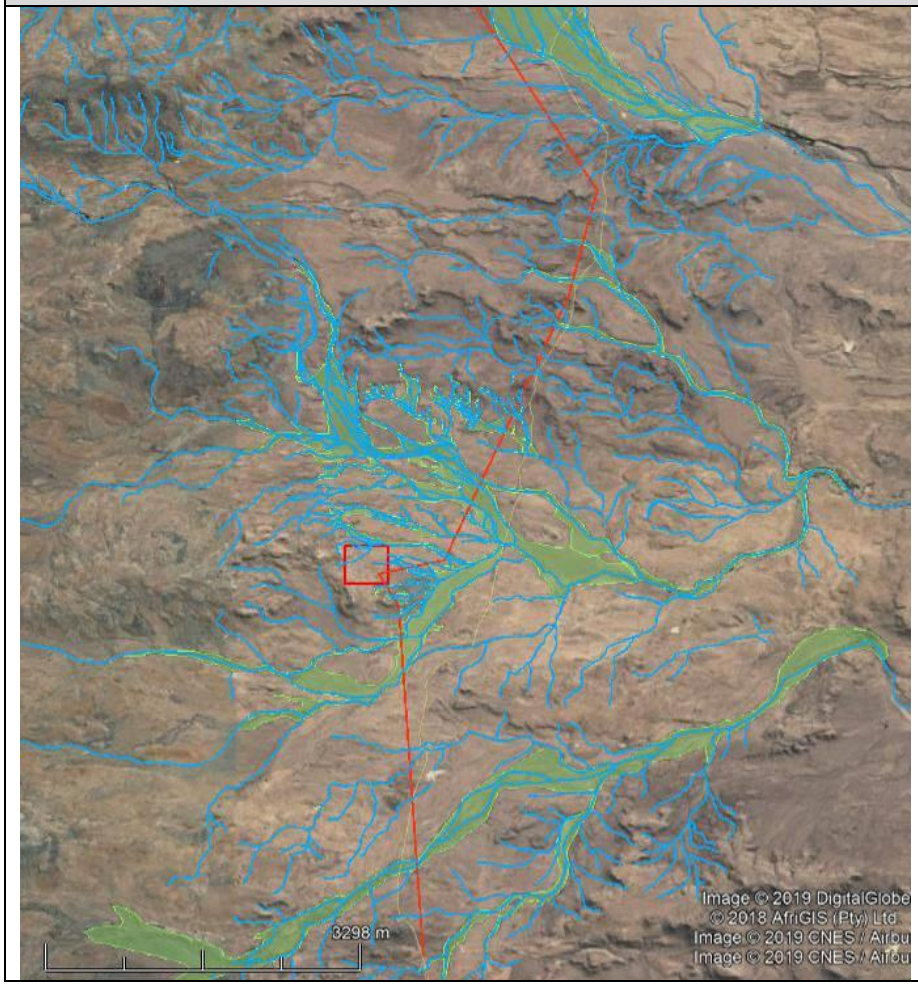
Western Extent of transmission line: Vanwyks River

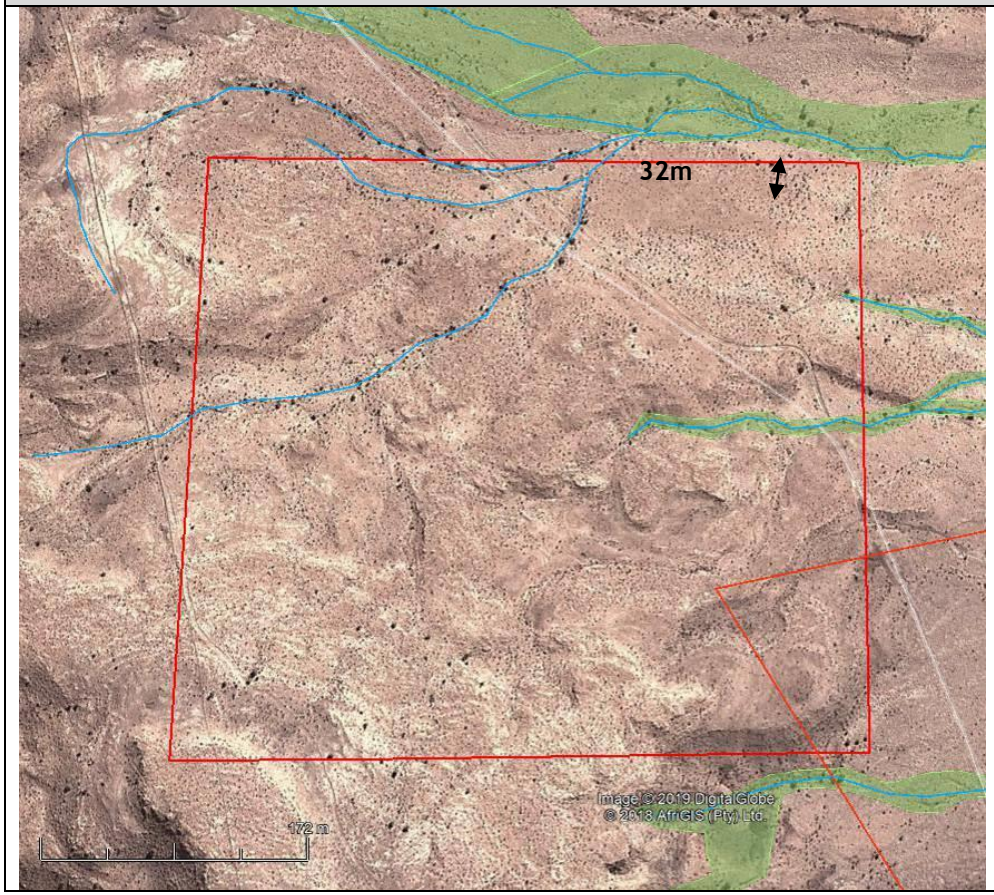


Comments and Recommendations

Within this section, the line crosses the middle reaches of the Vanwyks River, its tributaries and the associated valley bottom and floodplain wetlands. The alternative service road is also located within this section, directly adjacent to the floodplain of the Vanwyks River. As stated for the previous section, the middle reaches of the Vanwyks River, where valley bottom wetland areas occur, the river is mapped as an aquatic CBA, while the remainder of the watercourses are aquatic ESAs. Within this section, the PES of the watercourses is largely natural to moderately modified and the EIS of the watercourses remains high. The rivers should remain at least in a largely natural to moderately modified ecological condition.

The recommended buffer to protect the smaller tributaries is 50m while there should be at least a 100m buffer, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest), for the larger rivers. It is still possible to place the pylons of the proposed transmission line outside of the aquatic features and the recommended buffers however the access roads will need to pass through there areas. Where possible existing access roads should be used, the routing should try to minimise the number of watercourses crossed or placing the road directly along the watercourses. Any potential erosion along the constructed road should be mitigated.

Western Extent of transmission line: Juk and Ouberg Rivers	Comments and Recommendations
	Within this section, the line crosses the middle reaches of the Vanwyks, Juks and Oubergs Rivers, its tributaries and the associated valley bottom and floodplain wetlands. The middle reaches of these rivers are mapped as aquatic ESAs and they are within an Upstream FEPA sub-catchment. The PES of the watercourses is largely natural to moderately modified and the EIS of the watercourses is high. The rivers should remain at least in a largely natural to moderately modified ecological condition. The recommended buffer to protect the smaller tributaries is 50m while there should be at least a 100m buffer, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest), for the larger rivers. It is still possible to place the pylons of the proposed transmission line outside of the aquatic features and the recommended buffers however the access roads will need to pass through there areas. Where possible existing access roads should be used, the routing should try to minimise the number of watercourses crossed or placing the road directly along the watercourses. Any potential erosion along the constructed road should be mitigated.

Proposed substation	Comments and Recommendations
	The proposed location of the substation is within the upper to middle reaches of Juks River. It has been located to try and avoid the watercourses as far as possible and only a few minor watercourses occur within the footprint. The loss of the watercourses within the footprint is not seen as a significant impact and if properly mitigated, particularly in terms of stormwater runoff from the developed area, will not result in any degradation of the watercourses downstream of the site. The footprint should be located within this footprint such that it avoids loss of the watercourses as far as possible. Allowance for a buffer of at least 32m should be sought from the watercourse to the north of the site. The existing access road to the site should preferably be utilised.

4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The proposed activity needs to take cognizance of the legislative requirements, policies, strategies, guidelines and principles of the relevant regulatory documents of the Eden District, as well as the National Water Act (NWA) and the National Environmental Management Act (NEMA).

4.1 The National Environmental Management Act (Act No. 107 of 1998)

NEMA is the overarching piece of legislation for environmental management in South Africa and includes provisions that must be considered in order to give effect to the general objectives of integrated environmental management.

Chapter Seven of the NEMA states that:

"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".

The Act also clearly states that the landowner, or the person using or controlling the land, is responsible for taking measures to control and rectify any degradation. These may include measures to:

"(a) investigate, assess and evaluate the impact on the environment;

(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment:

(c) cease, modify or control any act, activity or process causing the pollution or degradation:

(d) contain or prevent the movement of pollutants or degradation: or

(e) eliminate any source of pollution or degradation: or

(f) remedy the effects of the pollution or degradation."

4.2 NEMA Environmental Impact Assessment Regulations, 2014, as amended

NEMA provides for the identification of activities which will impact the environment, in terms of Section 24. These activities were promulgated in terms of Government Notice No. R. 324, 325 and 327, dated 4 December 2014, as amended, and requires environmental authorisation. The impacts of the listed activities must be investigated in April 2017, assessed and reported to the competent authority before authorisation to commence with such listed activities can be granted.

4.2.1 National Water Act, 1998 (Act No. 36 of 1998)

The purpose of the National Water Act, 1998 (NWA) is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorisation and register as users. The NWA also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources.

The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21 of the NWA), which may impact on water resources through the categorisation of 'listed water uses' encompassing water abstraction and flow attenuation within catchments as well as the potential contamination of water resources, where the DWS is the administering body in this regard. Defined water use activities require the approval of DWS in the form of a General Authorisation (GA) or WUL. There are restrictions on the extent and scale of listed activities for which General Authorisations apply.

Section 22(3) of the NWA allows for a responsible authority (DWS) to dispense with the requirement for a WUL if it is satisfied that the purpose of the Act will be met by the grant of a licence, permit or authorisation under any other law.

Regulations requiring that a water user be registered, GN R.1352 (1999)

Regulations requiring the registration of water users were promulgated by the Minister of Water Affairs in terms of provision made in Section 26(1)(c), read together with Section 69 of the National Water Act, 1998. Section 26(1)(c) of the Act allows for registration of all water uses including existing lawful water use in terms of Section 34(2). Section 29(1)(b)(vi) also states that in the case of a GA, the responsible authority may attach a condition requiring the registration of such water use. The Regulations (Art. 3) oblige any water user as defined under Section 21 of the Act to register such use with the responsible authority and effectively to apply for a Registration Certificate as contemplated under Art.7(1) of the Regulations.

GA in terms of Section. 39 of the NWA

According to the preamble to Part 6 of the NWA, 1998, "*This Part established a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette…*" and further states that "*The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary…*"

The GAs for Section 21 (c) and (i) water uses (impeding or diverting flow or changing the bed, banks or characteristics of a watercourse) as defined under the NWA have recently been revised (Government Notice R509 of 2016). The proposed works within or adjacent to the wetland areas and river channels are likely to change the characteristics of the associated freshwater ecosystems and may therefore require authorization. Determining if a water use licence is required for these water uses is now associated with the risk of degrading the ecological status of a watercourse. A low risk of impact could be authorised in terms of a GA. A risk assessment has been undertaken for the proposed project and is discussed in this report, under Section 5.7.

5 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

5.1 Key Issues Identified

Most of the potential aquatic ecosystem impacts of the proposed transmission line and substation are likely to mostly take place during the construction phase. The potential impacts of all the proposed activities and the associated issues identified include:

- Disturbance of aquatic habitats within the watercourses with the associated impacts to sensitive aquatic biota;

- The removal of indigenous riparian and instream vegetation that has the potential to reduce the ecological integrity and functionality of the watercourses;
- Demand for water for construction could place a stress on the existing available water resources;
- Alien vegetation infestation within the aquatic features due to disturbance; and
- Increased sedimentation and risks of contamination of surface water runoff during construction.

During the operational phase for all the proposed works, the potential impacts would include:

- Ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to the substation that needs to be maintained; and
- Modified runoff characteristics from hardened surfaces at the substation and along the roads that has the potential to result in erosion of hillslopes and watercourses.

No consultation process was deemed to be required during the course of preparing this baseline freshwater specialist report. However, consultation will be undertaken if deemed necessary, to respond to relevant comments be received following the release of the Draft Basic Assessment Report.

5.2 Potential Impacts

The potential impacts identified for all the proposed activities assessed in this basic freshwater assessment are as follows:

Construction Phase:

- Modification or loss of aquatic habitat and water quality impacts;

Operational Phase

- Degradation of ecological condition of aquatic ecosystems; modification of runoff, erosion; and alien vegetation invasion in aquatic features

Decommissioning Phase

- Disturbance of aquatic habitats and water quality impacts.

Cumulative impacts

- Degradation of ecological condition of aquatic ecosystems.

The assessment of the potential aquatic ecosystem impacts for all of the proposed works and the recommendation of mitigation measures are discussed below and collated in Table 19, Table 20 and Table 21 for the Construction, Operation and Decommissioning Phases of the project. These tables are included in Appendix A of this report. The methodology adopted for the impact assessment, including the definitions of the impact assessment criteria and significance allocation (as a product of probability and consequence), has been described in detail in the Basic Assessment Report (Section D).

5.3 Impact of proposed Substation: Degradation of ecological condition of aquatic ecosystems; modification of runoff; erosion; and alien vegetation invasion in aquatic features

Construction Phase: Construction of the substation will require a relatively high intensity disturbance of a limited surface area at the site as a foundation will need to be constructed for the site. A construction camp with a temporary laydown area and concrete batching plant is likely to be placed within the site for the construction works. According to the layout plan for the proposed substation it will largely be located away from the aquatic features.

Activities during the construction phase of the project could thus be expected to result in some disturbance of soil and vegetation cover for clearing and preparation of the substation footprint. There is also the potential for some water quality impacts associated with the batching of concrete should it be required, from hydrocarbon spills or associated with the other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of cement.

A localised short-term impact could be expected that has a moderate to low overall significance (without the implementation of mitigation measures) in terms of its impact on the identified aquatic ecosystems in the area.

Operation Phase: During the operation phase the substation is likely to operate unattended and with low maintenance required. The hard surfaces created by the substation may lead to increased runoff, in particular on surfaces with a steeper gradient. This may lead to increased erosion and sedimentation of the downslope areas. A localised long-term impact could be expected that would have a low overall significance post-mitigation in terms of its impact on the identified aquatic ecosystems in the area. The only potentially toxic or hazardous materials which would be present in relatively small amounts would be of lubricating oils and hydraulic and insulating fluids. Therefore, contamination of surface or ground water or soils is highly unlikely. There is no water consumption impact associated with the operation of the substation.

Decommissioning Phase: During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

Therefore, during the following potential impacts may occur:

- Construction and Decommissioning Phase Direct Impacts:
    - Disturbance and loss of aquatic habitat.
- Construction and Decommissioning Phase Indirect Impacts:
    - Modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.
- Operational Phase Direct Impacts:
    - Disturbance and loss of aquatic habitat and modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.

- Operational Phase Indirect Impacts:
    - Invasive alien plant growth in riparian zones and potential for erosion of watercourses due to the disturbance of aquatic habitat and modification of runoff characteristics.
- Decommissioning Phase Indirect Impacts:
    - Invasive alien plant growth and potential for erosion of watercourses due to the disturbance of aquatic vegetation.

Proposed mitigation:

Construction Phase: A buffer of at least 32 m between the delineated aquatic ecosystems to the north of the substation footprint and the substation should be maintained. The final location of the substation should be orientated such that it minimises the loss of aquatic habitat as far as possible. Runoff associated with the minor watercourses within the site will need to be diverted around the substation.

Any indigenous vegetation clearing within or adjacent to the watercourses should prevented as far as possible to minimise erosion within the watercourses. The cleared and disturbed areas surrounding the substation should be rehabilitated as far as possible with revegetation of cleared areas with local indigenous vegetation if necessary. An Environmental Control Officer (ECO) or an appropriate specialist with knowledge and experience of the local flora be appointed during the construction phase to be able to make clear recommendations with regards to the revegetation of disturbed areas.

During the construction phase, site management must be undertaken at the laydown and construction areas. This should specifically address on-site stormwater management and prevention of pollution measures from any potential pollution sources during the construction activities such as hydrocarbon spills. Any stormwater that does arise within the construction site must be handled in a suitable manner to trap sediments and reduce flow velocities.

Operation Phase: Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants.

Storm water run-off from the footprint of the substation should be mitigated, both in terms of the flow and water quality leaving the hardened areas within the substation. No stormwater runoff must be allowed to discharge directly into the watercourses. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales. Should any erosion features develop, they should be stabilised as soon as possible.

Decommissioning Phase: During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. Disturbed areas may need to be rehabilitated and revegetated. Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.

Significance of impacts after mitigation: A localised, short- and longer term impact will still occur as a result of construction and operation of the substation within and adjacent to watercourses. The overall significance of the impact on the aquatic ecosystems is however expected to be low to very low.

Residual Risks: Residual risks are associated with the loss of aquatic habitat what would result from the construction of the substation. There is also the potential for erosion of the watercourses and invasion of the aquatic habitats with alien plant species. It is important that these aspects be monitored and management on an ongoing and long-term basis.

5.4 Impact of the transmission lines and associated access road: Degradation of ecological condition of aquatic ecosystems; erosion and alien vegetation invasion in aquatic features

Construction and Operation Phase: The access road and transmission lines will need to cross some watercourses. The major impacts associated with the roads relate to loss of habitat within the watercourses at the crossings, potential invasive alien plant growth as well as the potential for flow and water quality impacts and the associated impacts on the soil (erosion of watercourse channels).

A localised short- and longer-term impact of low significance is expected on the identified aquatic ecosystems in the area at the points at which the infrastructure will need to cross the watercourses, during and after the construction phase. The disturbance would largely take place during the construction phase. However, a long-term disturbance of the aquatic habitat at the road crossings could also be expected during the operational phase.

Decommissioning Phase: During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

Therefore, during the following potential impacts may occur:

- Construction and Decommissioning Phase Direct Impacts:
    - Disturbance and loss of aquatic habitat.
- Construction and Decommissioning Phase Indirect Impacts:
    - Modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.
- Operational Phase Direct Impacts:
    - Disturbance and loss of aquatic habitat and modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.
- Operational Phase Indirect Impacts:
    - Invasive alien plant growth in riparian zones and potential for erosion of watercourses due to the disturbance of aquatic habitat and modification of runoff characteristics.
- Decommissioning Phase Indirect Impacts:
    - Invasive alien plant growth and potential for erosion of watercourses due to the disturbance of aquatic vegetation.

Proposed mitigation: The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance created by the proposed works. Where access routes need to be constructed through the watercourses, the disturbance of the channels should be limited. Wetland

areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 50m buffer zone.

All crossings over watercourses should be such that the flow within the drainage channel is not impeded and should be constructed perpendicular to the river channel. Road infrastructure and location of the transmission line pylons should coincide as far as possible to minimise the impact. Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. Disturbed areas may need to be rehabilitated and revegetated. Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.

Significance of impacts after mitigation: A localised, short-term impact will still occur during the construction phase; however, the overall significance of the impact on the aquatic ecosystems is expected to be low to very low.

Residual risks: Residual risks are associated with the indirect impacts of the proposed activities, that is, the potential for erosion of the watercourses and invasion of the aquatic habitats with alien plant species. It is important that these aspects be monitored and managed on an ongoing and long-term basis.

5.5 Cumulative impact of the Proposed projects on freshwater ecosystems

Land use in the area currently consists of low-density livestock farming due to the limited water supply and poor carrying capacity of the cover vegetation. Current land and water use impacts on the watercourses within the larger study area is therefore very low. A number of renewable energy projects have been approved are being considered in the area that were considered in the potential cumulative freshwater impacts on the watercourses in the area. Only those in the immediate area are likely to have cumulative impacts on the watercourses. These are Mainstream Power Sutherland Wind Farms, Komsberg Wind Farm (Pty) Ltd and the Suurplaat Renewable Energy Projects (Figure 11).

Freshwater impact assessments were undertaken for these projects. The nature of the proposed WEF projects allows them to have minimal impact on the surface water features, since the proposed project elements can be placed far enough away from the freshwater features so as to not impact on them. Typically, the recommended river buffers are 50 m for the upper reaches of the rivers, 100 m for the lower reaches and 32 m for all other drainage channels.

The largest potential impact of these projects is as a result of the associated infrastructure which can be mitigated such that its impact on the aquatic ecosystems will be of a low significance. For the projects concerned, the road layouts have been revised in such a manner that all of the important wetland areas / rivers were avoided and where possible existing roads have been used. This further reduced the impacts on the aquatic ecosystems, but also provided an opportunity to improve the current road crossings, by providing better erosion protection measures and through the construction of low water crossings or properly sized box culverts instead of pipe culverts that are prone to blocking.

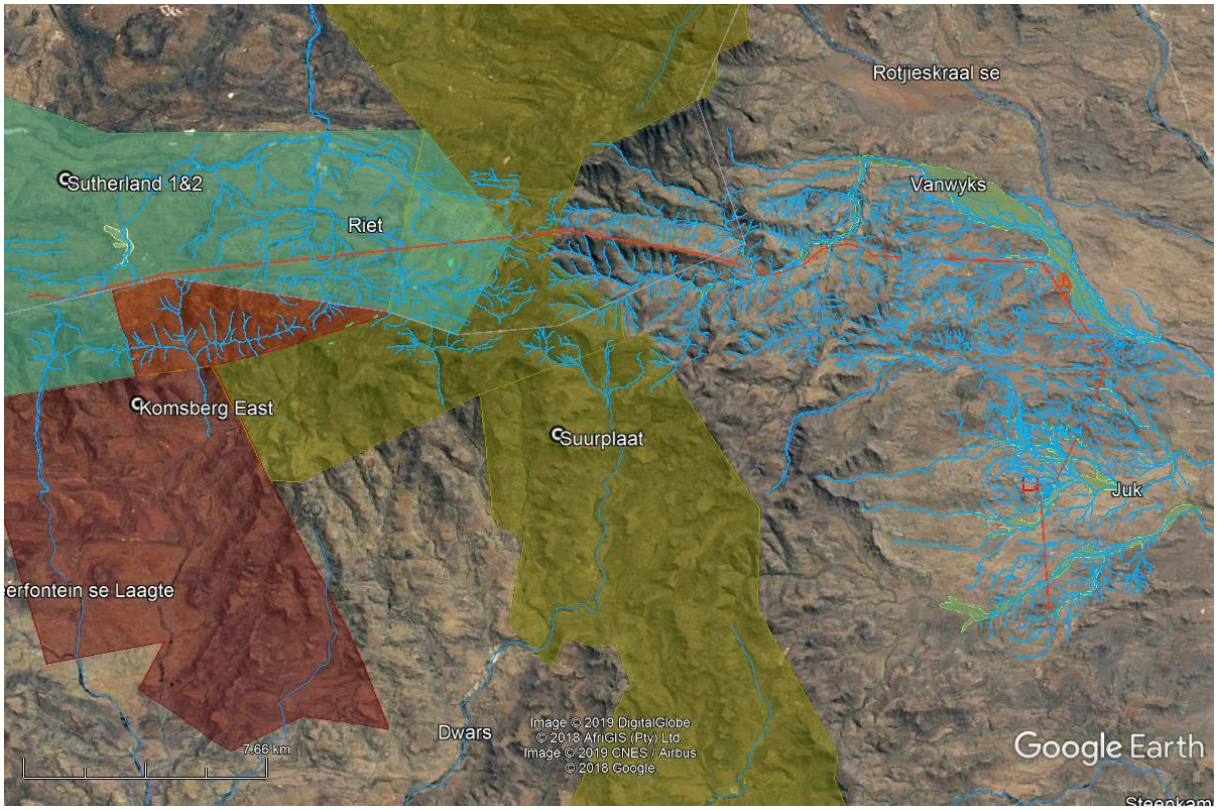


Figure 11. Map indicating the projects approved or proposed within the catchments of the proposed transmission lines

One could thus expect that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.

The following mitigation measures have been recommended:

- Placement of the project elements to minimise disturbance of aquatic features within the site and allow for adequate buffers to ensure protection of the aquatic features. The potential stormwater impacts of the proposed developments areas should be mitigated on-site to address any erosion or water quality impacts. Good housekeeping measures as stipulated in the EMPr for the project should be in place where construction activities take place to prevent contamination of any freshwater features. Where possible, the access roads should coincide with existing roads or areas of disturbance. Disturbed areas should be rehabilitated through reshaping of the surface to resemble that prior to the disturbance and vegetated with suitable local indigenous vegetation. Any new road crossings through the watercourses should preferably cross perpendicular to the channels and should not impede or concentrate flow in the channels. Undertake ongoing and long-term monitoring and management of aquatic features to prevent the impacts of erosion and invasive alien vegetation growth.

5.6 Consideration of the No-Go Alternative

The No-go Alternative implies that transmission line and substation would not be established within the area and that low-level agricultural practices would continue. The existing agricultural practices within the study area have had a very low impact on the freshwater features in the area. Should the transmission line not be developed, it is likely that the aquatic features would remain in

a natural to largely natural ecological condition. Water is however a limiting factor on the future development of the area. Invasive alien plant growth within the riparian areas of the rivers, as well as erosion of the watercourses within the area should be continually managed to reduce any impacts on the freshwater features.

5.7 Risk Assessment

A preliminary risk assessment was carried out for the proposed transmission line and substation to inform the water use authorisation process. The assessment indicates the level of risk certain activities pose to freshwater resources where the outcomes are used to guide decisions regarding water use authorisation of the proposed activity. A summary of the potential risks can be seen in Table 17. These risk rating classes can be seen in Table 18 and Appendix C of this report.

Table 17: Summary risk assessment for the proposed project

Phases	Activity	Impact	Likelihood	Significance	Risk Rating
Construction	Construction works associated with Transmission Line and Substation	Soil and vegetation disturbance; potential for some water quality and flow impacts associated with construction activities	12	55.5	L
Operation	Operational activities associated with Transmission Line and Substation	Disturbance related to infrastructure maintenance; stormwater along roads and developed area; resulting erosion and alien vegetation growth	12	48	L
Decommission	Removal of Transmission Line and Substation	Disturbance related to aquatic habitat disturbance onsite when removing infrastructure	12	48	L

Table 18: Risk rating classes for the Risk Assessment

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. Wetlands may be excluded.
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. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

The risk assessment determined that the proposed transmission line and substation poses a **low** risk of impacting aquatic habitat, water flow and water quality. With these findings of the risk assessment, the water use activities associated with the proposed project could potentially be authorised by means of the general authorisations for the Section 21(c) and (i) water uses.

6 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

The following mitigation measures are recommended to minimise the potential impacts of the proposed activities on the aquatic features within the site. These measures should be addressed in the EMPr for the Construction and Operation Phases of the Project. It is also recommended that a Maintenance Management Plan be drawn up for the project to guide the longer-term activities that would need to take place within the aquatic features in the site.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
DESIGN PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the proposed transmission line and substation.	Limit the disturbance of aquatic habitat. Minimise potential to modify runoff / hydraulics related impacts and increase the potential for erosion	▪ Ensure final layout of transmission line and substation avoids watercourses and recommended buffers as far as possible; utilisation should be made of existing disturbed areas and access roads; ▪ A stormwater management plan should be compiled for the compacted surfaces within the site by the project engineer with input from the freshwater specialist. The plan should aim to reduce the intensity of runoff particularly on the steeper slopes and reduce the intensity of the discharge into the adjacent drainage lines. Where necessary measures to dissipate flow intensity or protect erosion should be included in the plan. Adjacent to wetland areas, the plan should encourage infiltration rather than runoff and should prevent the impedance of surface or sub-surface flows. The plan should also mitigate any contaminated runoff from the construction and operation activities from being discharged into any of the aquatic	Ensure that this is taken into consideration during the planning and design phase.	During design cycle and before construction commences.	Holder of the EA

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		features within the site; ▪ Adequate and erosion mitigation measures should be incorporated into designs; ▪ For any new infrastructure placed within the watercourses: o The structure should not impede or concentrate the flow in the watercourse. o The structure should also be placed at the base level of the channel and be orientated in line with the channel. and o Any rubble or waste associated with the construction works within the aquatic features should be removed once construction is complete; and ▪ Water consumption requirements for the site for the construction must be via an authorised water supply.			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
CONSTRUCTION PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the proposed transmission line and substation.	Limit the disturbance of aquatic habitat. Limit potential for contamination/pollution of aquatic ecosystems	▪ For all project related components within the site, any aquatic features of high sensitivity (wetland areas and vernal pools) within the immediate area should be demarcated by the appointed ECO prior to commencement of the construction activities and treated as no-go areas during the construction phase. ▪ Any activities that require construction within the delineated aquatic features and the recommended buffers should be described in method statements that are approved by the ECO. ▪ Rehabilitation of any the disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately following completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity as described above; ▪ Ablution facilities should not be placed within 50m of any of the aquatic features delineated within the site; ▪ Liquid dispensing receptacles (e.g. lubricants, diesel, shutter oil etc.) must have drip trays beneath them/beneath the nozzle fixtures. Material safety data sheets (MSDS) must be available on site (if	Monitoring that no-go areas are adhered to should be undertaken on an ongoing basis for the duration of the construction phase. Ongoing monitoring of implementation of method statements and rehabilitation measures should be undertaken in the construction phase. Weekly monitoring of basic water quality constituents (Dissolved oxygen, electrical conductivity, suspended solids, and pH) should be undertaken upstream and downstream of sites where construction activities will need to take place within aquatic features. This should be accompanied with ongoing visual inspections.	Ongoing during construction	Proponent/contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		required) where products are stored, so that in the event of an incident, the correct action can be taken. Depending on the types of materials stored on site during the maintenance activities, suitable product recovery materials (such as Spillsorb or Drizit products) must be readily available. Vehicles should ideally be washed at their storage yard as opposed to on site. ▪ Proper waste management should be undertaken within the site with facilities provided for the on-site disposal of waste and the removal of stored waste to the nearest registered solid waste disposal facility			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
OPERATION PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the proposed transmission line and	Limit the disturbance of aquatic habitat; Minimise potential to modify runoff / hydraulics related impacts and increase the potential for erosion;	▪ Ongoing control of invasive alien plants within the site should be undertaken according to an approved plan. The plan should make use of alien clearing methods as provided by the Working for Water Programme. Monitoring and control measures should take place at least	Ongoing monitoring of invasive alien plants within the site should be undertaken according to an approved plan Once the construction activities have ceased, the frequency of the monitoring can be reduced.	Ongoing during operation	Proponent/contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
substation.	Control of invasive alien plants in riparian zones and wetland areas; Limit potential for contamination/pollution of aquatic ecosystems	biannually for the first 3 years of the project ▪ Invasive alien plant material that has been cleared should be removed from the riparian zones and not left on the riverbanks or burnt within the riparian zone and buffer area; ▪ Ongoing monitoring of the structures, in particular prior to the rainfall period, should be undertaken to ensure that the integrity of the structures is intact and that they are not block with sediment or debris. Ongoing monitoring post large rainfall events should also be undertaken to identify and address any erosion occurring within the watercourses			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
DECOMMISSION PHASE					
FRESHWATER ECOLOGY IMPACTS					
Potential impact on freshwater ecology as a result of the proposed transmission line and substation.	Limit the disturbance of aquatic habitat.	▪ For all project related components within the site, the aquatic features of high sensitivity within the immediate area should be demarcated by the appointed ECO prior to commencement of the decommission activities and treated as no-go areas during the decommission phase.	Monitoring that no-go areas are adhered to should be undertaken on an ongoing basis for the duration of the decommission phase. Ongoing monitoring of implementation of method statements and rehabilitation	Ongoing during decommission	Proponent/contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		▪ Any activities that require decommission activities within the delineated aquatic features and the recommended buffers should be described in method statements that are approved by the ECO ▪ Rehabilitation of any the disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately following completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity as described above ▪ Control of invasive alien plants within the site should be undertaken according to the approved plan	measures should be undertaken in the decommission phase. Ongoing monitoring of invasive alien plants within the site should be undertaken according to an approved plan		

Monitoring Requirements:

Daily compliance monitoring of the implementation of the measures as laid out in the EMPr and associated method statements should be undertaken by the Site Manager in conjunction with the ECO. A record of the monitoring undertaken during the maintenance management activities should be kept.

Visual inspections and Photographs should be taken weekly upstream and downstream of sites where construction activities will need to take place within aquatic features. Once the construction activities have ceased, the frequency of the monitoring can be reduced to monthly until DWS is satisfied that the site is adequately rehabilitated.

As mentioned above, ongoing monitoring of invasive alien plant growth and erosion within the aquatic features and the recommended buffers on biannually (every six months) for the construction phase and the first three operational years of the project. That monitoring should preferably take place prior to the winter rainfall period and following high rainfall events.

7 CONCLUSION AND RECOMMENDATIONS

The western portion of the proposed project is located largely along the border between the Northern and Western Cape provinces on the higher-lying Komsberg Mountains that is the watershed between the northerly flowing Riet River tributary of the Orange River and the southerly flowing Dwars River tributaries of the Gouritz River. The eastern portion of the project is located within the Western Cape, within the upper reaches of the Vanwyks, Juk and Ouberg Tributaries of the Dwyka River, a tributary of the Gouritz River. This section of the transmission lines and the proposed substation are located within lower lying valleys and floodplain areas. Associated with the very upper reaches of the rivers on the hill tops are seep areas and vernal ponds while valley bottom and floodplain wetlands occur in the lower foothills and floodplain zones within the deeper valleys.

The study area is located largely within Upstream FEPA Rivers that should not be impacted such that they would result in degradation of more ecologically important downstream FEPA Rivers. There are several instream wetland areas within the channels of the larger watercourses that have been mapped as artificial FEPA Wetlands of which only two are located near the proposed works. A natural depression is the only mapped natural FEPA Wetland located in the wider study area but is at least 500m south of the proposed line in the upper Riet River.

The only aquatic CBA crossed by the proposed transmission line is on the Vanwyks River downstream of the Western Cape Border. This river reach is considered of high ecological importance in terms its unique habitat and linked to terrestrial habitat and vegetation. The remainder of the watercourses are mapped as aquatic ESAs. Most of the terrestrial areas adjacent to the watercourses in the area are mapped as ONAs. Within the Northern Cape CBA, most of the study area is mapped as a CBA, becoming an ESA within the eastern portion of the study area in the Northern Cape.

The rivers within the study area is still in a natural condition in their upper reaches with few modifications (some roads and very small dams). Downstream, in the middle reaches of the Vanwyks, Juk and Oubergs Rivers, the rivers become largely natural to moderately modified. The riparian habitat is slightly more degraded as a result of direct habitat modification from the surrounding farming activities.

The larger watercourses in the study area, the Riet, Vanwyks, Juk and Oubergs Rivers, have a high ecological importance and sensitivity while the smaller tributaries/drainage features are of a

moderate ecological importance and sensitivity. The larger watercourses tend to be more ecologically important but less sensitive to impacts while the smaller tributaries are less ecologically important but more sensitive to flow, water quality and habitat modification.

The hillslope seeps and the vernal pools are in a natural ecological condition while the valley bottom wetlands have been slightly modified but are still in a largely natural ecological condition. The floodplains although still largely natural, are the most impacted by the activities within the valley floor. The wetland features are considered of high ecological importance and sensitivity.

The recommended ecological condition of the aquatic features within the study area are that they should be maintained in their current ecological condition and should not be allowed to degrade further. The recommended buffer areas as a development setback from the aquatic features to ensure these aquatic ecosystems are not impacted by the proposed activities, are as follows:

- Smaller streams and drainage lines, together with their seeps: at least 50m from the centre of these streams or the delineated wetland edge (whichever is the furthest);

- The larger rivers within the valley floor, together with their valley bottom wetlands: at least 100m, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest); and

- The vernal pool and other wetland areas: at least 50m, measured from the top of bank of the river channels or the delineated wetland edge.

Activities during the construction phase of the project could be expected to result in some disturbance of soil and vegetation cover for clearing and preparation of the project elements. There is also the potential for some water quality impacts associated with the construction activities. A localised impact could be expected that has a low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

During the operation phase the potential impacts relate to increased potential for erosion and invasive alien plant growth within the disturbed watercourses. A localised long-term impact of very low overall significance would be expected, provided the recommended mitigation measures are undertaken. The following mitigation measures are recommended:

- Ensure final layout of transmission line and substation avoids watercourses and recommended buffers as far as possible; utilisation should be made of existing disturbed areas and access roads;

- A stormwater management plan should be compiled for the compacted surfaces within the site by the project engineer with input from the freshwater specialist. The plan should aim to reduce the intensity of runoff particularly on the steeper slopes and reduce the intensity of the discharge into the adjacent drainage lines. Where necessary measures to dissipate flow intensity or protect erosion should be included in the plan. Adjacent to wetland areas, the plan should encourage infiltration rather than runoff and should prevent the impedance of surface or sub-surface flows. The plan should also mitigate any contaminated runoff from the construction and operation activities from being discharged into any of the aquatic features within the site;

- Adequate and erosion mitigation measures should be incorporated into designs;

- For any new infrastructure placed within the watercourses:
    - The structure should not impede or concentrate the flow in the watercourse;
    - The structure should also be placed at the base level of the channel and be orientated in line with the channel;
    - Any rubble or waste associated with the construction works within the aquatic features should be removed once construction is complete; and
    - Water consumption requirements for the site for the construction must be via an authorised water supply;
- For all project related components within the site, any aquatic features of high sensitivity (wetland areas and vernal pools) within the immediate area should be demarcated by the appointed ECO prior to commencement of the construction activities and treated as no-go areas during the construction phase;
- Any activities that require construction within the delineated aquatic features and the recommended buffers should be described in method statements that are approved by the ECO;
- Rehabilitation of any the disturbed areas within the aquatic features and the recommended buffer areas should be undertaken immediately following completion of the disturbance activity according to rehabilitation measures as included in a method statement for that specific activity as described above;
- Ablution facilities should not be placed within 50m of any of the aquatic features delineated within the site;
- Liquid dispensing receptacles (e.g. lubricants, diesel, shutter oil etc.) must have drip trays beneath them/beneath the nozzle fixtures. Material safety data sheets (MSDS) must be available on site (if required) where products are stored, so that in the event of an incident, the correct action can be taken. Depending on the types of materials stored on site during the maintenance activities, suitable product recovery materials (such as Spillsorb or Drizit products) must be readily available. Vehicles should ideally be washed at their storage yard as opposed to on site;
- Proper waste management should be undertaken within the site with facilities provided for the on-site disposal of waste and the removal of stored waste to the nearest registered solid waste disposal facility;
- Ongoing control of invasive alien plants within the site should be undertaken according to an approved plan. The plan should make use of alien clearing methods as provided by the Working for Water Programme. Monitoring and control measures should take place at least biannually for the first 3 years of the project;
- Invasive alien plant material that has been cleared should be removed from the riparian zones and not left on the riverbanks or burnt within the riparian zone and buffer area; and
- Ongoing monitoring of the structures, in particular prior to the rainfall period, should be undertaken to ensure that the integrity of the structures is intact and that they are not block with sediment or debris. Ongoing monitoring post large rainfall events should also be undertaken to identify and address any erosion occurring within the watercourses.

The risk assessment for the project determined that the proposed transmission line and substation poses a low risk of impacting aquatic habitat, water flow and water quality. With these findings of the risk assessment, the water use activities associated with the proposed project could potentially be authorised by means of the general authorisations for the Section 21(c) and (i) water uses.

Based on the above findings, there is no reason from a freshwater perspective, why the proposed activity (with implementation of the above-mentioned mitigation measures) should not be authorized. The revised layout has further reduced any potential impacts to the aquatic ecosystems in the area and thereby has improved the acceptability of the proposed transmission line and substation from an aquatic ecosystem point of view.

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9 APPENDICES

Appendix A: Impact Assessment Tables

Table 19. Impact assessment summary table for the Construction Phase: Freshwater Ecosystems

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
CONSTRUCTION PHASE															
Direct Impacts															
Construction activities in or adjacent to aquatic features for the substation, transmission line and service road construction	Disturbance of aquatic habitat	Negative	Local	Long term	Substantial	Likely	Moderate to low	Low	Moderate	Yes	Yes	Limit disturbance of watercourses through avoiding recommended buffers and utilising existing disturbed areas	Low	4	High
Indirect Impacts															
Altered runoff characteristics as a result of construction activities for the substation, transmission line and service road construction	Modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems	Negative	Local	Short-term	Substantial - Moderate	Likely	High	Moderate	Moderate to low	Yes	Yes	Stormwater planning and management; design of crossings	Low to very low	4 to 5	High

[1] Status: Positive (+) ; Negative (-)
[2] Site; Local (<10 km); Regional (<100); National; International
[3] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Table 20. Impact assessment summary table for the Operational Phase: Freshwater Ecosystems

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
OPERATIONAL PHASE															
Direct Impacts															
Operation activities in or adjacent to aquatic features due to the development of the substation, transmission line and service road	Disturbance of aquatic habitat; modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.	Negative	Local	Long-term	Substantial	Likely	Medium to low	Moderate	Moderate	Yes	Yes	Limit disturbance to project areas that are outside of watercourses and buffers	Low	4	High
Indirect Impacts															
Secondary impacts as a result of disturbance and removal of riparian vegetation due to the operation of the substation, transmission line and service road	Invasive alien plant growth in riparian zones and wetland areas and potential for erosion of watercourses due to the disturbance of aquatic habitat and modification of runoff characteristics.	Negative	Local	Long-term	Substantial	Likely	Medium to low	Moderate	Moderate	Yes	Yes	Monitoring and clearing alien vegetation; mitigation of erosion on steeper slopes	Low	4	High

Table 21. Impact assessment summary table for the Decommissioning Phase: Freshwater Ecosystems

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
DECOMMISSIONING PHASE															
Direct Impacts															
Decommissioning activities in or adjacent to aquatic features as a result of the substation, transmission line and service road	Disturbance of aquatic habitat	Negative	Local	Short term	Substantial to moderate	Likely to unlikely	Moderate	Moderate	Moderate to low	Yes	Yes	Limit disturbance of watercourses through avoiding recommended buffers and utilising existing disturbed areas	Low to very low	4 to 5	High
Indirect Impacts															
Altered runoff characteristics as a result of decommissioning activities linked to infrastructure, such as the substation, transmission line and service road	Modification to flow and water quality due to the disturbance activities in or adjacent to aquatic ecosystems	Negative	Local	Short-term	Substantial to moderate	Likely to unlikely	High	Moderate	Moderate to low	Yes	Yes	Stormwater planning and management; design of crossings	Low to very low	4 to 5	High
Secondary impacts as a result of disturbance and removal of riparian vegetation during the decommissioning of infrastructure (, such as the substation, transmission line and service road)	Invasive alien plant growth and potential for erosion of watercourses due to the disturbance of aquatic vegetation.	Negative	Local	Medium-term	Substantial to Moderate	Likely to unlikely	Moderate to low	Moderate	Moderate to low	Yes	Yes	Monitoring and clearing alien vegetation; mitigation of erosion on steeper slopes	Low to very low	4 to 5	High

[4] Status: Positive (+) ; Negative (-)
[5] Site; Local (<10 km); Regional (<100); National; International
[6] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Table 22. Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
CUMULATIVE IMPACTS															
Cumulative disturbance activities within watercourses of the area; use of water and possible modification and contamination of runoff	Disturbance of aquatic habitat; modification to flow and water quality as a result of proposed activities in or adjacent to aquatic ecosystems. Invasive alien plant growth in riparian zones and wetland areas and potential for erosion of watercourses as a result of disturbance of aquatic habitat and modification of runoff characteristics	Negative	Local	Short and longer term	Moderate	Likely	Moderate	Moderate	Low	Yes	Yes	Allow for adequate buffers; mitigate stormwater impacts on-site; Good housekeeping measures as stipulated in the EMPr; infrastructure should coincide with existing infrastructure as far as possible; disturbed areas should be rehabilitated and vegetated with suitable local indigenous vegetation; new road crossings through the watercourses should cross perpendicular to the channels and should not impede or concentrate flow in the channels; Undertake ongoing and long term monitoring and management of aquatic features to prevent the impacts of erosion and invasive alien vegetation growth	Low	4	High

Appendix B: PES, EI and ES for the major watercourses in the Study Area (DWS, 2012)

Juks River:

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF
J24A-07871	Dwyka	3.42	3	Y		NATURAL/CLOSE TO NATURAL	A
MEAN EI CLASS	MEAN ES CLASS	DEFAULT ECOLOGICAL CATEGORY (EC)	RECOMMENDED ECOLOGICAL CATEGORY (REC)				
HIGH	HIGH	B	#NUM!				

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	NONE	FISH SPP/SQ		INVERT TAXA/SQ	15.00	FISH PHYS-CHEM SENS DESCRIPTION	
RIP/WETLAND ZONE CONTINUITY MOD	NONE	FISH: AVERAGE CONFIDENCE		INVERT AVERAGE CONFIDENCE	1.00	FISH NO-FLOW SENSITIVITY DESCRIPTION	
POTENTIAL INSTREAM HABITAT MOD ACT.	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT REPRESENTIVITY PER SECONDARY, CLASS	MODERATE	INVERT PHYS-CHEM SENS DESCRIPTION	MODERATE
RIPARIAN-WETLAND ZONE MOD	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT RARITY PER SECONDARY: CLASS	HIGH	INVERTS VELOCITY SENSITIVITY	HIGH
POTENTIAL FLOW MOD ACT.	SMALL	FISH RARITY PER SECONDARY: CLASS		ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	VERY HIGH	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	HIGH
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	NONE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH)	VERY HIGH	HABITAT DIVERSITY CLASS	LOW	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	VERY LOW	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	VERY HIGH
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON	HIGH	INSTREAM MIGRATION LINK CLASS	VERY HIGH		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	VERY HIGH		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY	VERY HIGH		
				INSTREAM HABITAT INTEGRITY CLASS	VERY HIGH		

Vanwyks River:

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF
J24A-07720	Vanwyks	34.14	1	Y		NATURAL/CLOSE TO NATURAL	A
MEAN EI CLASS	MEAN ES CLASS	DEFAULT ECOLOGICAL CATEGORY (EC)	RECOMMENDED ECOLOGICAL CATEGORY (REC)				
VERY HIGH	LOW	A	#NUM!				

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	NONE	FISH SPP/SQ		INVERT TAXA/SQ	15.00	FISH PHYS-CHEM SENS DESCRIPTION	
RIP/WETLAND ZONE CONTINUITY MOD	NONE	FISH: AVERAGE CONFIDENCE		INVERT AVERAGE CONFIDENCE	1.00	FISH NO-FLOW SENSITIVITY DESCRIPTION	
POTENTIAL INSTREAM HABITAT MOD ACT.	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT REPRESENTIVITY PER SECONDARY, CLASS	MODERATE	INVERT PHYS-CHEM SENS DESCRIPTION	MODERATE
RIPARIAN-WETLAND ZONE MOD	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT RARITY PER SECONDARY: CLASS	HIGH	INVERTS VELOCITY SENSITIVITY	HIGH
POTENTIAL FLOW MOD ACT.	SMALL	FISH RARITY PER SECONDARY: CLASS		ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	VERY HIGH	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	LOW
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	NONE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH)	VERY HIGH	HABITAT DIVERSITY CLASS	HIGH	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	LOW
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	HIGH	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	LOW
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON	HIGH	INSTREAM MIGRATION LINK CLASS	VERY HIGH		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	VERY HIGH		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY	VERY HIGH		
				INSTREAM HABITAT INTEGRITY CLASS	VERY HIGH		

Portugals River:

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
D56A-07650	0.00	18.52	1	Y		LARGELY NATURAL	B
MEAN EI CLASS	**MEAN ES CLASS**	**DEFAULT ECOLOGICAL CATEGORY (EC)**	**RECOMMENDED ECOLOGICAL CATEGORY (REC)**				
MODERATE	VERY LOW	C	#NUM!				

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	MODERATE	FISH SPP/SQ	1.00	INVERT TAXA/SQ	4.00	FISH PHYS-CHEM SENS DESCRIPTION	VERY LOW
RIP/WETLAND ZONE CONTINUITY MOD	SMALL	FISH: AVERAGE CONFIDENCE	1.00	INVERT AVERAGE CONFIDENCE	1.00	FISH NO-FLOW SENSITIVITY DESCRIPTION	VERY LOW
POTENTIAL INSTREAM HABITAT MOD ACT.	SMALL	FISH REPRESENTIVITY PER SECONDARY: CLASS	LOW	INVERT REPRESENTIVITY PER SECONDARY, CLASS	LOW	INVERT PHYS-CHEM SENS DESCRIPTION	VERY LOW
RIPARIAN-WETLAND ZONE MOD	SMALL	FISH REPRESENTIVITY PER SECONDARY: CLASS	LOW	INVERT RARITY PER SECONDARY: CLASS	VERY LOW	INVERTS VELOCITY SENSITIVITY	FALSE
POTENTIAL FLOW MOD ACT.	SMALL	FISH RARITY PER SECONDARY: CLASS	VERY LOW	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	LOW	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	VERY LOW
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	NONE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	LOW	HABITAT DIVERSITY CLASS	MODERATE	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	VERY LOW	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	MODERATE
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	LOW	INSTREAM MIGRATION LINK CLASS	HIGH		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	VERY HIGH		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS	VERY HIGH		
				INSTREAM HABITAT INTEGRITY CLASS	VERY HIGH		

Riet River (western tributary):

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
D56B-07731	0.00	12.34	1	0.00	Ephemeral		
MEAN EI CLASS	**MEAN ES CLASS**	**DEFAULT ECOLOGICAL CATEGORY (EC)**	**RECOMMENDED ECOLOGICAL CATEGORY (REC)**				
LOW	LOW						

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	NONE	FISH SPP/SQ		INVERT TAXA/SQ		FISH PHYS-CHEM SENS DESCRIPTION	
RIP/WETLAND ZONE CONTINUITY MOD	NONE	FISH: AVERAGE CONFIDENCE		INVERT AVERAGE CONFIDENCE		FISH NO-FLOW SENSITIVITY DESCRIPTION	
POTENTIAL INSTREAM HABITAT MOD ACT.	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT REPRESENTIVITY PER SECONDARY, CLASS		INVERT PHYS-CHEM SENS DESCRIPTION	
RIPARIAN-WETLAND ZONE MOD	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT RARITY PER SECONDARY: CLASS		INVERTS VELOCITY SENSITIVITY	
POTENTIAL FLOW MOD ACT.	NONE	FISH RARITY PER SECONDARY: CLASS		ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	VERY LOW	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	VERY LOW
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	NONE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	VERY LOW	HABITAT DIVERSITY CLASS	MODERATE	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	VERY LOW	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	MODERATE
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	LOW	INSTREAM MIGRATION LINK CLASS			
				RIPARIAN-WETLAND ZONE MIGRATION LINK			
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS			
				INSTREAM HABITAT INTEGRITY CLASS			

Riet River (eastern tributary):

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
D56B-07733	Riet	8.89	1	Y		MODERATELY MODIFIED	C
MEAN EI CLASS	**MEAN ES CLASS**	**DEFAULT ECOLOGICAL CATEGORY (EC)**	**RECOMMENDED ECOLOGICAL CATEGORY (REC)**				
LOW	VERY LOW	D	#NUM!				

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	LARGE	FISH SPP/SQ	1.00	INVERT TAXA/SQ	4.00	FISH PHYS-CHEM SENS DESCRIPTION	VERY LOW
RIP/WETLAND ZONE CONTINUITY MOD	MODERATE	FISH: AVERAGE CONFIDENCE	1.00	INVERT AVERAGE CONFIDENCE	1.00	FISH NO-FLOW SENSITIVITY DESCRIPTION	VERY LOW
POTENTIAL INSTREAM HABITAT MOD ACT.	MODERATE	FISH REPRESENTIVITY PER SECONDARY: CLASS	LOW	INVERT REPRESENTIVITY PER SECONDARY, CLASS	LOW	INVERT PHYS-CHEM SENS DESCRIPTION	VERY LOW
RIPARIAN-WETLAND ZONE MOD	LARGE	FISH REPRESENTIVITY PER SECONDARY: CLASS	LOW	INVERT RARITY PER SECONDARY: CLASS	VERY LOW	INVERTS VELOCITY SENSITIVITY	FALSE
POTENTIAL FLOW MOD ACT.	MODERATE	FISH RARITY PER SECONDARY: CLASS	VERY LOW	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	LOW	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	VERY LOW
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	NONE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	LOW	HABITAT DIVERSITY CLASS	LOW	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	VERY LOW	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING		INSTREAM MIGRATION LINK CLASS	MODERATE		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	HIGH		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS	MODERATE		
				INSTREAM HABITAT INTEGRITY CLASS	HIGH		

Beerfontein se Laagte River:

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPERTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
J11B-07772	Beerfontein se	20.03	1	Y		LARGELY NATURAL	B
MEAN EI CLASS	MEAN ES CLASS	DEFAULT ECOLOGICAL CATEGORY (EC)	RECOMMENDED ECOLOGICAL CATEGORY (REC)				
HIGH	MODERATE	B	#NUM!				

PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE				ECOLOGICAL SENSITIVITY	
INSTREAM HABITAT CONTINUITY MOD	SMALL	FISH SPP/SQ		INVERT TAXA/SQ	19.00	FISH PHYS-CHEM SENS DESCRIPTION	
RIP/WETLAND ZONE CONTINUITY MOD	SMALL	FISH: AVERAGE CONFIDENCE		INVERT AVERAGE CONFIDENCE	3.00	FISH NO-FLOW SENSITIVITY DESCRIPTION	
POTENTIAL INSTREAM HABITAT MOD ACT.	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT REPRESENTIVITY PER SECONDARY, CLASS	MODERATE	INVERT PHYS-CHEM SENS DESCRIPTION	MODERATE
RIPARIAN-WETLAND ZONE MOD	NONE	FISH REPRESENTIVITY PER SECONDARY: CLASS		INVERT RARITY PER SECONDARY: CLASS	VERY HIGH	INVERTS VELOCITY SENSITIVITY	HIGH
POTENTIAL FLOW MOD ACT.	SMALL	FISH RARITY PER SECONDARY: CLASS		ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	VERY HIGH	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	VERY HIGH
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	SMALL	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	VERY HIGH	HABITAT DIVERSITY CLASS	MODERATE	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY HIGH	HABITAT SIZE (LENGTH) CLASS	MODERATE	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	LOW
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	LOW	INSTREAM MIGRATION LINK CLASS	VERY HIGH		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	VERY HIGH		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS	VERY HIGH		
				INSTREAM HABITAT INTEGRITY CLASS	VERY HIGH		

Appendix C: Risk Matrix for the Proposed Project

ASPECTS AND IMPACT REGISTER/RISK ASSSESSMENT FOR WATERCOURSES INCLUDING RIVERS, PANS, WETLANDS, SPRINGS,DRAINAGE LINES:Sutherland Transmission Line and Substation
COMPILED BY: Toni Belcher, BlueScience
Date:June 2019

					Severity																
Nr.	**Phases**	**Activity**	**Aspect**	**Impact**	**Flow Regime**	**Physico & Chemical (Water Quality)**	**Habitat (Geomorph+Vegetation)**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**	**Frequency of activity**	**Frequency of impact**	**Legal Issues**	**Detection**	**Likelihood**	**Significance**	**Risk Rating**	**Control Measures**	**Confidence**	**Type Watercourse**
1	Construction	Construction works associated with Transmission Line and Substation	Soil and vegetation disturbance; potential for some water quality and flow impacts associated with construction activities	Loss of biodiversity & habitat, impeding flow & water quality impact	1	1.5	2	2	1.625	1	2	**4.625**	1	2	5	4	**12**	**55.5**	**L**	See freshwater report	High	Upper and middle reaches of the Riet, Vanwyks, Juk and Ouberg Rivers and their lesser, unnamed tributaries, as well as wetlands associated with the larger watercourses and some small dams, vernal ponds and seeps on the hill tops (PES=A/B to B/C; EIS=Moderate to High)
2	Operation	Operational activities associated with Transmission Line and Substation	Disturbance related to infrastructure maintenance; stormwater along roads and developed area; resulting erosion and alien vegetation growth	Disturbance to aquatic habitat - Facilitation of erosion and invasion by alien plants	1	1	1	1	1	1	2	**4**	1	2	5	4	**12**	**48**	**L**			
3	Decommission	Removal of Transmission Line and Substation	Disturbance related to aquatic habitat disturbance onsite when removing infrastructure	Habitat disturbance and some flow and water quality impacts	1	1	1	1	1	1	2	**4**	1	2	5	4	**12**	**48**	**L**			