Oya Energy (Pty) Ltd

Project Description
Oya Energy (Pty) Ltd (hereafter referred to as “Oya Energy”) is proposing to construct a 132kV overhead power line and 33/132kV substations near Matjiesfontein in the Western and Northern Cape Provinces (hereafter referred to as the “proposed development”). The overall objective of the proposed development is to feed the electricity generated by the proposed Oya Energy Facility (part of separate on-going EIA process with DEFF Ref No: 14/12/16/3/3/2/2009) as well as any future nearby developments into the national grid. The grid connection and substations (this application) requires a separate EA, in order to allow the EA to be handed over to Eskom.

Report Type: Specialist Freshwater Ecological Assessment

DEA Reference: To be Allocated
Report Prepared by: FEN Consulting (Pty) Ltd (FEN 21-0054)
Issue Date: 3 November 2020
Version No.: Version 1

OYA ENERGY (PTY) LTD

DESCRIPTION: FRESHWATER ECOLOGICAL ASSESSMENT REPORT FOR THE PROPOSED 132KV OYA POWER LINE NEAR MATJIESFONTEIN, WESTERN AND NORTHERN CAPE PROVINCES

FRESHWATER ECOLOGICAL ASSESSMENT

EXECUTIVE SUMMARY

FEN Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the Basic Assessment (BA) processes for the proposed 132kV overhead power line and substation development (referred to as the 'proposed development') between the Oya Energy Facility and the Kappa substation. Five (5) power line route alternatives are proposed for the section of the proposed overhead power line which connects the Oya on-site substation to the Kappa substation (i.e. Oya to Kappa). Additionally, this report also assessed the freshwater ecological aspects associated with the power line route from the Kudusberg on-site substation to the Oya on-site substation (i.e. Kudusberg to Oya). Only one (1) alternative was proposed for the Oya to Kappa route.

The purpose of this report is to define the ecology of the proposed development in terms of the watercourse characteristics, including mapping of the natural watercourse, defining areas of increased Ecological Importance and Sensitivity (EIS), and defining the Present Ecological State (PES) of the watercourses associated with the proposed development. The Department of Water and Sanitation (DWS) Risk Assessment Matrix as promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA) and an Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) was applied to determine the significance of the impacts associated with the proposed development and mitigatory measures were identified which aim to minimise the potential impacts.

During the site visit undertaken on the 22nd to 24th of October 2020, several ephemeral tributaries with riparian vegetation, ephemeral rivers and episodic drainage lines (EDLs) without riparian vegetation were identified in the investigation area. Although these episodic drainage lines cannot be classified as rivers or streams in the traditional sense thereof due to the lack of saturated soils and riparian vegetation, they do still function as waterways, through episodic conveying of water. Based on the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998), water does flow regularly or intermittently within these drainage lines, conveying water from the upgradient catchment area into the downgradient tributaries and the ephemeral rivers. As such, they can be considered as watercourses due to their importance for hydrological functioning and therefore enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998). Several areas hosting episodic preferential flow paths (PFP) were also identified. As with the EDLs, these preferential flow paths also lack riparian and wetland characteristics and may potentially only convey surface water for a short period of time after rainfall events. Thus, these features are not considered of ecological importance but contributes to the hydrological functioning of the drainage systems at large. The PFP cannot be considered as watercourses (thus no ecological assessment undertaken) and may potentially only enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998) should a floodline be applicable to these features. The results of the ecological assessment of the watercourses are discussed in Section 6.1 of this report is summarised in the table below:

Table A: Summary of results of the ecological assessment as discussed in Section 6.1

Watercourse	Present Ecological State (PES)	Ecoservices	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS)
Ephemeral Rivers (Adamskraal, Groot, Muishonds and Ongeluk River)	B (Largely natural with few modifications)	Intermediate (1,5)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: A/B (Improve)
Ephemeral tributaries with riparian vegetation	B (Largely natural with few modifications)	Intermediate (1,5)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: A/B (Improve)
Episodic drainage lines	B/C (Largely natural with few modifications)	Intermediate (1,4)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: A/B (Improve)

The activities associated with the construction and operational phases of the proposed power line and substation development based on the alignment provided by the proponent, includes site preparation, excavation of pits installation of the pylons. Table B below provides a summary of the outcome of the impact assessment as provided in Section 6.4 in this report.

Table B: Summary of results of the impact assessment as discussed in Section 6.4.

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION
Construction Phase				
Direct	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present), geomorphology, habitat and biota.	Potential direct impacts caused by site preparation activities such as the removal of vegetation and associated disturbances to soils, and access to the site, including grading of new and existing informal farm roads through watercourses. These activities result in the disturbance to habitat and loss of ecoservices.	Negative Medium impact	Negative Low impact
Indirect	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present) and geomorphology	Potential indirect impacts caused by site preparation activities (clearing areas for the installation of pylons outside the watercourses and its associated 32m NEMA ZoR) includes the disturbance of the natural buffer area surrounding the watercourses, potentially resulting dust creation, and decrease of surface roughness .	Negative Low impact	Negative Low impact
Indirect	Watercourse drivers and receptors such as vegetation, geomorphology and sediment balance.	The installation of the pylons (including mixing and casting of concrete for foundations) and spanning of the proposed power line entails: *Excavation of pits for the pylons leading to stockpiling of soil; and *Potential movement of construction equipment and personnel in the areas surrounding watercourses. This may result in indirect impacts (since no pylons will be located directly within watercourses) such as: *Disturbances of soils leading to potential impacts to the watercourse vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered watercourse habitat; *Altered runoff patterns, leading to increased erosion and sedimentation of the watercourses.	Negative Low impact	Negative Low impact

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION
Operational Phase				
Indirect	Watercourse drivers and receptors such as vegetation, geomorphology and sediment balance.	Operation and maintenance of the power line and substations may result in: *Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses *Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the access roads. The expected impacts may potentially be: *Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; *Altered water quality (if surface water is present) as a result of increased availability of pollutants	Negative Low impact	Negative Low impact
Decommissioning Phase				
Direct	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present), geomorphology, habitat and biota.	Potential impacts that may result due to the decommissioning activities: • Clearing of habitat that has established in previous phases, resulting in a disturbed ecological structure; • Compaction and disturbance of soils due to decommissioning activities, making the impacted areas unfavourable for the establishment of vegetation and may allow opportunistic alien and invasive species to establish in the nearby watercourses; and • Movement of construction vehicles within the watercourses, disturbing established biota therein.	Negative Medium impact	Negative Low impact
Cumulative Impact				
Direct	Drainage system habitat integrity and hydrological functioning	• Loss of watercourse vegetation and subsequent habitat, due to watercourse road crossings and regular movement of vehicles within the surrounding area of the watercourses • Changes to flow, pattern and timing of surface water in the drainage system due to land use changes in the catchment (albeit limited due to the limited footprint of a power line), potentially resulting in changes to the hydrological regime of the larger downstream watercourses.	Negative Medium impact	Negative Low impact
No -Go Impact				
NA	No-Go Alternative (the option of not fulfilling the proposed project)	This option would result in no environmental impacts and thus no impacts to the watercourses in the investigation area from the proposed power line and substation development on the site or surrounding local area. Implementing the no-go option would entail no development.	Positive Low Impact	Positive Low Impact

Direct negative medium impacts associated with creating new access roads to service the power line and substation development are expected to occur to the watercourse drivers and receptors during the construction phase. Should the recommended mitigation measures be implemented with specific mention of only installing pylons outside the delineated extent of the watercourses and its associated 32m NEMA Zone of Regulation, a negative low impact significance is expected to occur. It is therefore recommended that the mitigation measures as stipulated in Table 10 and 11 and the good housekeeping measures as per **Appendix F** be implemented to prevent and direct/indirect impacts from occurring on the watercourses. None of the proposed power line development alternatives are considered fatally flawed, however preference is given to power line alternative 3 and 4 since these power line routes are routed along existing power line infrastructure which has already incurred environmental disturbances and have existing access roads which may be utilised during the current proposed construction and operational phases of the power line between the Oya Energy Facility and the Kappa substation, and these power line alternatives are considered to have the least amount of watercourse crossings. As such, it is the opinion of the freshwater specialist that EA may be granted for the proposed development. Should the construction of the road crossings in the watercourses be

undertaken in the driest period of the year when no surface flow is present and the recommended mitigation measures are applied, the risk significance of the proposed development can be reduced and Water Use Authorisation by means of General Authorisation (GA) in terms of Section 21(c) and (i) water uses may potentially be obtained in consultation with the Department of Water and Sanitation (DWS). However, the DWS, the custodian of water resources in South Africa, must be consulted with regards to the outcome of this assessment.

Based on the findings of the freshwater ecological assessment and the results of the impact and risk assessments, it is the opinion of the ecologist that the proposed development poses a negative low risk to the integrity of the watercourses in the investigation area provided that adherence to cogent, well-conceived and ecologically sensitive construction plans are implemented and the mitigation measures provided in this report as well as general good construction practice are adhered to, the proposed development layout is deemed acceptable and should be approved as part of the EA.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA) AND ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environment, Forestry and Fisheries (DEFF) screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as well as for the Environmental Impact Assessment (EIA) Regulations 2014 (as amended) requirements for Specialist Reports.

No.	Requirements	
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Section 1.3
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 5
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 5
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 5
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 5 and Section 6.1
2.3	Identify any alternative development footprints within the preferred development site which would be of a "low" sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	NA – proposed development will be routed in a very high aquatic sensitivity
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Yes, with implementation of proposed mitigation measures
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.); d. Assessment of the risks associated with water use/s and related activities.	Section 6
2.4.4	How will the development impact on the functionality of the aquatic feature including:	Section 6.3 and 6.4

	a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system); b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchanneled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); and f. Loss or degradation of all or part of any unique or important features associated with or within the aquatic ecosystem (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soils, etc.).	
2.4.5	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 6.1
2.4.6	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 6.1
2.4.7	In addition to the above, where applicable, impacts to the frequency of estuary mouth closure should be considered, in relation to: size of the estuary; availability of sediment; wave action in the mouth; protection of the mouth; beach slope; volume of mean annual runoff; and extent of saline intrusion (especially relevant to permanently open systems).	NA – Closest estuary is approximately 180 km south of the proposed development
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Section 1.3
3.2	A signed statement of independence by the specialist.	Page 9
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 1.4 and 6.1
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Section 1.4, Appendix C and Appendix D
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 2
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 6.2
3.7	Additional environmental impacts expected from the proposed development.	Section 6.3 and 6.4
3.8	Any direct, indirect and cumulative impacts of the proposed development on site.	Section 6.4
3.9	The degree to which impacts, and risks can be mitigated.	Section 6.3 and 6.4
3.10	The degree to which impacts, and risks can be reversed.	Section 6.3 and 6.4
3.11	The degree to which the impacts and risks can cause loss of irreplaceable resources.	Section 6.3 and 6.4
3.12	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.	Section 6.2
3.13	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 6.5
3.14	A motivation must be provided if there were development footprints identified as per paragraph 2.3 for reporting in terms of Section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) that were identified as having a “low” aquatic biodiversity and sensitivity and that were not considered appropriate.	NA – proposed development will be routed in an area considered of very high aquatic sensitivity
3.15	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability or not of the proposed development and if the proposed development should receive approval or not.	Section 8
3.16	Any conditions to which this statement is subjected.	Section 8

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Freshwater ecological assessment report for the proposed 132kv OYA power line near Matjiesfontein, Western and Northern Cape Province

Kindly note the following:

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

Departmental Details

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

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

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

SPECIALIST INFORMATION

Specialist Company Name:	FEN Consulting (Pty) Ltd.			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	
Specialist name:	Christel du Preez			
Specialist Qualifications:	MSc Environmental Science			
Professional affiliation/registration:	(Pr. Sci. Nat) Freshwater Ecologist			
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Telephone:	+27 11 616 7893	Fax:	+27 86 724 3132	
E-mail:	christel@sasenvgroup.co.za			

DECLARATION BY THE SPECIALIST

I, ____Christel du Preez_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

C du Preez

Signature of the Specialist

FEN Consulting (Pty) Ltd.

Name of Company:

9 November 2020

Date:

UNDERTAKING UNDER OATH/ AFFIRMATION

I, Christel du Preez, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

FEN Consulting (Pty) Ltd.

Name of Company

9 November 2020

Date

Signature of the Commissioner of Oaths

2020/11/09

Date

MELISSA COLYN
Commissioner of Oaths
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OYA ENERGY (PTY) LTD

DESCRIPTION: FRESHWATER ECOLOGICAL ASSESSMENT REPORT FOR THE PROPOSED 132KV OYA POWER LINE NEAR MATJIESFONTEIN, WESTERN AND NORTHERN CAPE PROVINCES

FRESHWATER ECOLOGICAL ASSESSMENT

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flow into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Episodic drainage lines	Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years.
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perennial:	Flows all year round.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	The outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.
Watercourse:	In terms of the definition contained within the National Water Act, 1998 (Act No. 36 of 1998) a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks.
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ABBREVIATIONS & ACRONYMS

°C	Degrees Celsius
AC	Alternating Current
BA	Basic Assessment
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DC	Direct Current
DEFF	Department of Environment, Forestry and Fisheries
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEN	Freshwater Ecologist Network
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IHI	Index of Habitat Integrity
kV	Kilovolt
m	Meter
MAP	Mean Annual Precipitation
MC	Management Classes
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NBA	National Biodiversity Assessment
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NWCS	National Wetland Classification System
OHL	Overhead power line
O&M	Operation and Maintenance
PEMC	Present Ecological Management Class
PES	Present Ecological State
REC	Recommended Ecological Category
REDZ	Renewable Energy Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Program (REIPPPP)
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SARERD	South African Renewable Energy Resource Database
SQR	Sub-quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WULA	Water Use Licence Application
WRC	Water Research Commission
ZOR	Zone of Regulation

OYA ENERGY (PTY) LTD

DESCRIPTION: FRESHWATER ECOLOGICAL ASSESSMENT REPORT FOR THE PROPOSED 132KV OYA POWER LINE NEAR MATJIESFONTEIN, WESTERN AND NORTHERN CAPE PROVINCES

FRESHWATER ECOLOGICAL ASSESSMENT

1. INTRODUCTION

Freshwater Ecologist Network (FEN) Consulting (Pty) Ltd has been appointed by SiVEST (Pty) Ltd, on behalf of Oya Energy (Pty) Ltd to undertake the assessment of the proposed 132 kilovolt (kV) overhead power line, for which several alternatives are proposed, and 33/132kV substations (hereafter referred to as the proposed development) which is located within one (1) of the Strategic Transmission Corridors as defined and in terms of the procedures laid out in Government Notice (GN) No. 113[1], namely the Central Corridor, near Matjiesfontein in the Western and Northern Cape Provinces of South Africa.

The proposed overhead power line (OHL) project will irrespective of its location within the Central Corrido be subject to a Basic Assessment (BA) process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority for this BA is the National Department of Environment, Forestry and Fisheries (DEFF). A freshwater ecological assessment has been commissioned to assess and verify the OHL under the new Gazetted specialist protocols[2].

1.1 Scope and Objectives

The objective of this report is to conduct a specialist freshwater ecological assessment as part of the BA and Water Use Licence Application (WULA) processes for the proposed 132kV overhead power line and 33/132kV substations (Please refer to Section 3 for the project description). In order to identify all watercourses that may potentially be impacted by the proposed development, a 500 m "zone of investigation" around the power line alternative routes and substations, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving freshwater environment. This area – i.e. the 500 m zone of investigation around the power line alternative routes and substations - will henceforth be referred to as the "investigation area".

The scope and specific outcomes in terms of this report are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA] 2011 database; the Department of Water and Sanitation Research Quality Information Services [DWS RQIS PES/EIS], (2014) database, National Biodiversity Assessment (NBA) (2018) were undertaken to aid in defining the PES and EIS of the watercourses;
- All watercourses associated with the proposed development and investigation areas were delineated using desktop methods in accordance with GN 509 of 2016 as it relates to activities as stipulated in the National Water Act, 1998 (Act No. 36 of 1998) and subsequently verified infield according to the

[1] Formally gazetted on 16 February 2018 (GN No. 113)
[2] Formally gazetted on 20 March 2020 (GN No. 320)

"Department of Water Affairs and Forestry (DWAF)[3] (2008)[4]: A practical field procedure for identification of wetlands and riparian areas". Aspects such as soil morphological characteristics and wetness along with vegetation types were used to verify the watercourses;

- The watercourse classification assessment was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013);
- The EIS of the watercourses were determined according to the method described by Rountree & Kotze (2013);
- The PES of the watercourses was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.* (2008) and the River EcoClassification: Index of Habitat Integrity (IHI) as advocated by the Water Research Commission (WRC) and DWAF (2008), as applicable;
- The watercourses were mapped according to the ecological sensitivity of each hydrogeomorphic unit in relation to the proposed development. In addition to the watercourse boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Allocation of a suitable RMO, REC and Best Attainable State (BAS) to the watercourses based on the results obtained from the PES and EIS assessments;
- The DWS Risk Assessment Matrix (2016) was applied to identify potential impacts that may affect the watercourses as a result of the proposed development, and to aim to quantify the significance thereof; and
- To present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact of the proposed development on the receiving environment.

1.2 Terms of Reference

The purpose of this report is to define the ecology of the area in terms of watercourse characteristics, including mapping of the watercourses, discuss key ecological drivers and to define the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS), as well as the socio-cultural and ecological service provision of the watercourses utilising current industry "best practice" assessment methods. Additionally, this report aims to define the Recommended Management Objectives (RMO) and Recommended Ecological Category (REC) for the watercourses (please refer to the specific outcomes as listed in Section 1.1). It is a further objective of this study to provide detailed information pertaining to the impacts anticipated to the watercourses as a result of the proposed development to allow for informed decision-making by all stakeholders, including the relevant competent authorities.

[3] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA) and subsequently as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

[4] Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

1.3 Specialist Credentials

Curriculum vitae of Christel du Preez

Personal details

Position in Company	Senior Scientist (Watercourse ecology)
Joined SAS Environmental Group of Companies	2016

Membership in professional societies

Professional member of the South African Council for Natural Scientific Professions (SACNASP) (SACNASP – Reg No. 120240/19)
Member of the Western Cape Wetland Forum (WCF)
Member of the Gauteng Wetland Forum (GWF)

Education

Qualifications

MSc Environmental Sciences (North West University)	2017
BSc Hons Environmental Sciences (North West University)	2012
BSc Environmental and Biological Sciences (North West University)	2011

Short Courses

Wetland and Aquatic plant Identification presented by Carin van Ginkel (Crispis Environmental)	2019
Wetland Management: Introduction and Delineation presented by the Centre of Environmental Management University of the Free State	2018
Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2017
Basic Principles of ecological rehabilitation and mine closure presented by the Centre for Environmental Management North West University	2015

Areas of work experience

South Africa – Gauteng, Mpumalanga, Limpopo, Western Cape, Northern Cape, Eastern Cape

Key specialist disciplines

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plan
- Freshwater Offset Plan

Curriculum vitae of Kim Marais

Personal details

Position in Company	Senior Scientist (Water Resource Manager)
Joined SAS Environmental Group of Companies	2015

Membership in professional societies

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

Education

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

Areas of work experience

South Africa – Gauteng, Mpumalanga, Limpopo, Western Cape, Northern Cape, Eastern Cape

Key specialist disciplines

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plan

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes

1.4 Assessment Methodology

As part of this assessment, the following definitions, as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

Watercourse means-

(a) A river or spring;
(b) A natural channel in which water flows regularly or intermittently;
(c) A wetland, lake or dam into which, or from which water flows; and
(d) Any collection of water, which the Minister may, by notice of the Gazette, declare a watercourse.

Wetland habitat is "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."

Riparian habitat includes the physical structure and associated vegetation of 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.

A field verification was undertaken on the 22nd to the 24th of October 2020 (Western Cape late spring season[5]), during which the presence of any watercourse characteristics as defined by DWAF (2008) or wetlands as defined by the National Water Act, 1998 (Act No. 36 of 1998) were noted (please refer to Sections 5 and 6 of this report). In addition to the delineation process, detailed assessment of the delineated watercourses was undertaken, at which time factors affecting the integrity of the watercourses were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourses. A detailed explanation of the methods of assessment undertaken as listed in Section 1.1 is provided in **Appendix C** of this report.

The watercourse delineation took place according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

Following the completion of the assessment, a risk assessment (DWS Risk Assessment) and an impact assessment (as provided by SiVEST) was undertaken (please refer to **Appendix D** for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures, which apply to the proposed construction and operational/maintenance activities. The detailed mitigation measures are outlined in Section 6.3 and 6.4 of this report, while the general management measures which are considered best practice mitigation applicable to this project, are outlined in **Appendix F**.

[5] Site surveys are recommended to take place during a seasonal period where the probability of detecting an identifiable life history stage of vegetation species (such as facultative vegetation species) is highest and in the rainy period to ensure optimised conditions for the identification of seasonal watercourses, which may otherwise be overlooked. Thus, the site conditions at the time of the field assessment are considered optimal as rainfall had occurred (end of July) in the local area prior to the site assessment undertaken October 2020.

2. ASSUMPTIONS AND LIMITATIONS

- The ground-truthing and delineation of the watercourse boundaries and the assessment thereof are confined to a single site visit undertaken on the 22nd to the 24th of October 2020 (Western Cape late spring season) of the proposed development. All watercourses identified within the investigation area were delineated in fulfilment of Government Notice 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) using various desktop methods including the use of topographic maps, historical and current digital satellite imagery and aerial photographs;
- This scope of work is limited to assessing the watercourses associated with the proposed development only, and does not include assessing watercourses potentially impacted by the construction and development of substations or any other surface infrastructure associated with the Oya Energy development;
- At the time of this assessment, the positions for the pylons supporting the proposed development was not available as the outcome of this assessment will guide the placement of these structures. It is also assumed that maintenance roads will be required as part of the proposed development, however, no details pertaining to new roads were provided by the proponent as part of this assessment;
- Due to the landscape in some areas being rugged and very undeveloped, some reaches of the identified watercourses were inaccessible. Therefore, verification points for watercourses were located at points as close to the watercourse to be verified as possible and where necessary the conditions at the exact point required were inferred or extrapolated;
- Due to the majority of watercourses being ephemeral within the region, very few areas were encountered that displayed more than one watercourse characteristic as defined by the DWAF (2008) method (such as containing alluvial or inundated soils, or hosts riparian vegetation adapted to saturated conditions). As a result, identification of the outer boundary of the temporary watercourse zones and marginal riparian zones proved difficult in some areas and, in particular, in the areas where watercourse conditions and riparian zones are marginal, and therefore delineations were augmented with the use of digital satellite imagery. Nevertheless, the watercourse delineations as presented in this report are regarded as a best estimate of the watercourse boundaries based on the site conditions present at the time of assessment and the results obtained are, however, considered sufficiently accurate to allow informed planning and decision making to take place;
- Global Positioning System (GPS) technology is inherently somewhat inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. However, the delineations as provided in this report are deemed accurate enough to fulfil the environmental authorisation requirements as well as the implementation of the mitigation measures provided;
- Watercourses and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the watercourses have been accurately assessed and considered, based on the field observations and the consideration of existing studies and monitoring data in terms of riparian and wetland ecology.

3. TECHNICAL DESCRIPTION

3.1 Project Location

Oya Energy (Pty) Ltd (hereafter referred to as “Oya Energy”) is proposing to construct a 132kV overhead power line and 33/132kV substations near Matjiesfontein in the Western and Northern Cape Provinces (hereafter referred to as the “proposed development”) (Figure 1). The overall objective of the proposed development is to feed the electricity generated by the proposed Oya Energy Facility (part of separate on-going EIA process with DEFF Ref No.: 14/12/16/3/3/2/2009) as well as any future nearby developments into the national grid. The grid connection and substations (this application) requires a separate EA, in order to allow the EA to be handed over to Eskom.

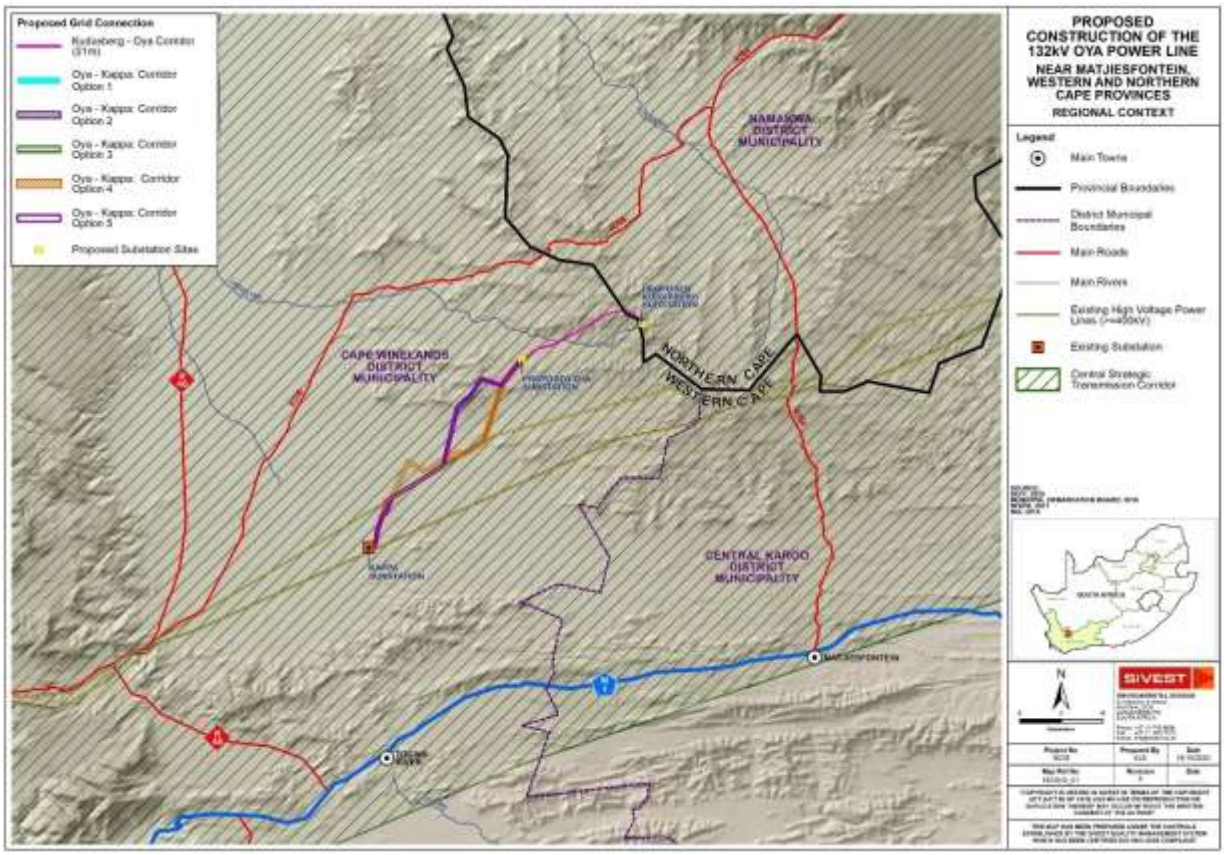


Figure 1: Oya 132kV overhead power line and substation Regional context map.

The proposed overhead power line corridors and substations will affect the following properties[6]:

- Portion 2 of the Farm Bakovens Kloof No 152 (2/152): C01900000000015200002
- Remainder of the Farm Bakovens Kloof No 152 (RE/152): C01900000000015200000
- Portion 3 of the Farm Baakens Rivier No 155 (3/155): C01900000000015500003
- Remainder of the Farm Baakens Rivier No 155 (RE/155): C01900000000015500000
- Portion 1 of the Farm Gats Rivier No 156 (1/156): C01900000000015600001
- Remainder of the Farm Gats Rivier No 156 (RE/156): C01900000000015600000
- Portion 1 of the Farm Amandelboom No 158 (1/158): C01900000000015800001
- Remainder of the Farm Oliviers Berg No 159 (RE/159): C01900000000015900000

[6] 21-digit surveyor general (SG) codes also provided

- Portion 2 of the Farm Bantamsfontein No 168 (2/168): C01900000000016800002
- Portion 4 of the Farm Bantamsfontein No 168 (4/168): C01900000000016800004
- Portion 5 of the Farm Bantamsfontein No 168 (5/168): C01900000000016800005
- Portion 7 of the Farm Bantamsfontein No 168 (7/168): C01900000000016800007
- Portion 13 of the Farm Bantamsfontein No 168 (13/168): C01900000000016800013
- Remainder of the Farm Bantamsfontein No 168 (RE/168): C01900000000016800000
- Remainder of the Farm Lower Roodewal No 169 (RE/169): C01900000000016900000
- Remainder of the Farm Matjes Fontein No 194 (RE/194): C07200000000019400000
- The Farm Platfontein No 240 (240): C01900000000024000000
- The Farm Die Brak No 241 (241): C01900000000024100000
- Portion 1 of the Farm Rietpoort No 243 (1/243): C01900000000024300001
- Remainder of the Farm Rietpoort No 243 (RE/243): C01900000000024300000
- Remainder of the Farm Toover berg No 244 (RE/244): C01900000000024400000

The proposed development is located in the Witzenberg and Karoo Hoogland Local Municipalities respectively, which fall within the Cape Winelands and Namakwa District Municipalities.

The entire extent of the proposed development is located within one (1) of the Strategic Transmission Corridors as defined and in terms of the procedures laid out in GN No. 113, namely the Central Corridor. The proposed overhead power line and substation project will irrespective of this be subject to a BA process in terms of the NEMA (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority for this BA is the DEFF.

At this stage, it is anticipated that the proposed development will include a 132kV power line and 33/132kV substations to feed electricity generated by the renewable energy facilities owned by the applicant into the national gird at the Kappa substation.

The type of power line towers being considered at this stage include both lattice and monopole towers and it is assumed that these towers will be located approximately 200 m to 250 m apart. The towers will be up to 45 m in height, depending on the terrain, but will ensure minimum overhead line clearances from buildings and surrounding infrastructure. 300 m wide power line corridors (i.e. 150 m on either side) are being assessed to allow flexibility when determining the final route alignment. The proposed power line however only requires a 31 m wide servitude and as such, this servitude would be positioned within the assessed corridor. It should be noted that this freshwater ecological assessment considered a 500 m investigation area surrounding the proposed power lines, in line with GN 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

The size of the proposed Oya and Kudusberg on-site Eskom substation and Operations and Maintenance (O&M) building sites will be approximately 4 hectare (ha)] each.

3.1.1 Alternatives

It should be noted that only one (1) route is possible for the section of the proposed power line which connects the Kudusberg on-site substation to the Oya on-site substation (i.e. Kudusberg to Oya). No alternatives can therefore be provided for this section of the power line. The Kudusberg to Oya power line corridor route is approximately 16.6 km in length and runs from the Kudusberg on-site substation along the RE/194, 1/158, RE/159, RE/156, 1/156 and RE/155 properties to the Oya on-site substation.

Five (5) power line corridor route alternatives have been provided for the section of the proposed overhead power line which connects the Oya on-site substation to the Kappa substation (i.e. Oya to Kappa). The above-mentioned alternatives are described below:

- **Power Line Corridor Alternative 1 (Oya to Kappa):** Approximately 34.14 km in length and runs along the RE/155, RE/152, 2/152, RE/169, RE/243, 241, 240 and RE/244 properties to the Kappa substation
- **Power Line Corridor Alternative 2 (Oya to Kappa)**: Approximately 32.43 km in length and runs along the RE/155, 3/155, RE/152, 2/152, RE/169, 13/168, 5/168, 1/243, RE/243, 241 and 240 properties to the Kappa substation
- **Power Line Corridor Alternative 3 (Oya to Kappa):** Approximately 30.56 km in length and runs along the RE/155, 4/168, 13/168, 5/168, 1/243, 240 and RE/244 properties to the Kappa substation
- **Power Line Corridor Alternative 4 (Oya to Kappa):** Approximately 32.94 km in length and runs along the RE/155, 4/168, 13/168, RE/169, RE/243, 241 and 240 properties to the Kappa substation
- **Power Line Corridor Alternative 5 (Oya to Kappa):** Approximately 32.26 km in length and runs along the RE/155, RE/152, 2/152, RE/169, 5/168, 1/243 and 240 properties to the Kappa substation

The power line corridor routes mentioned above provide different route alignments contained within an assessment corridor of up to 300 m wide. This is to allow for flexibility to route the power line within the authorised corridors.

'No-go' alternative

The 'no-go' alternative is the option of not fulfilling the proposed project as well as preventing the connection of the energy development in the area to feed electricity into the national grid. This alternative would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. Implementing the 'no-go' option would entail no development. The affected properties are currently not used for agricultural activities, although they are suitable for very low-level grazing.

The 'no-go' option is a feasible option, however, this would prevent the proposed development from contributing to the environmental, social and economic benefits associated with the development of the renewables sector.

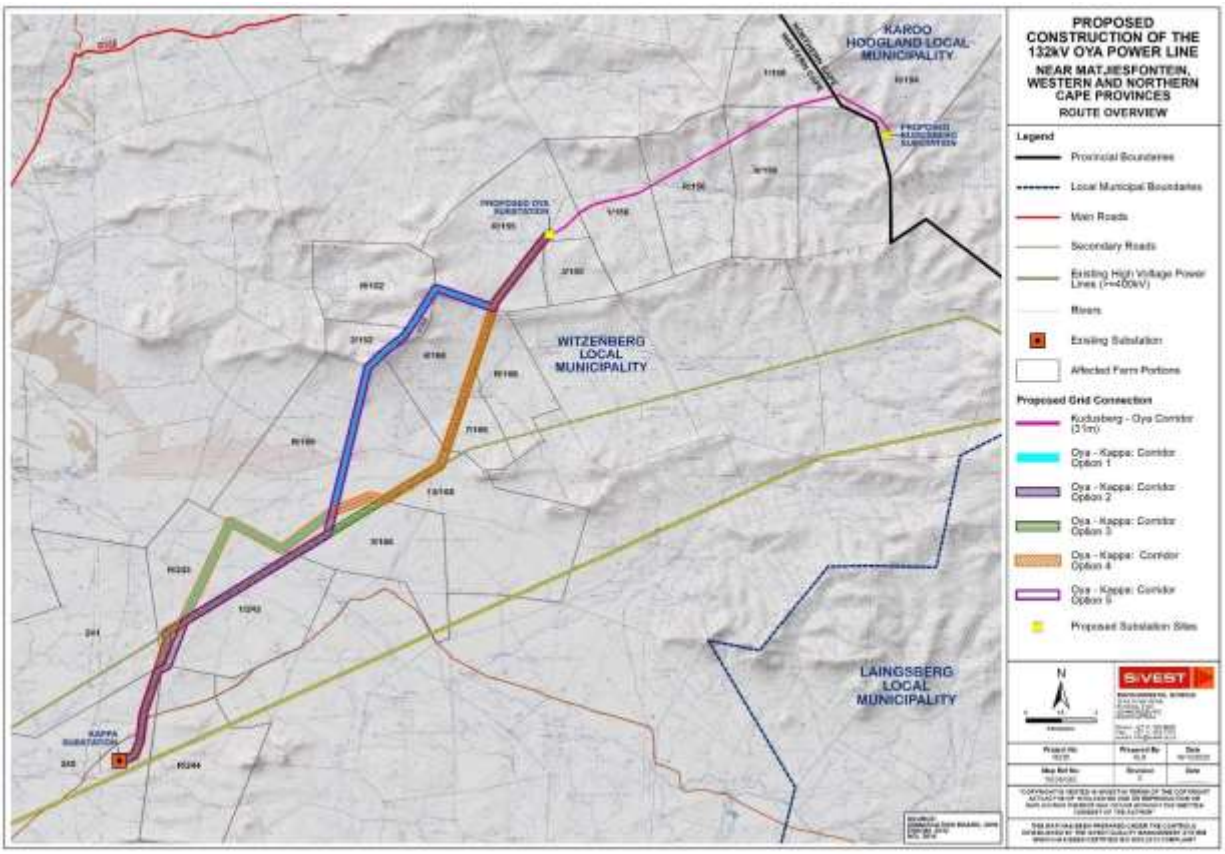


Figure 2: Oya 132kV overhead power line alternatives and substations located near Matjiesfontein in the Western and Northern Cape Provinces.

4. LEGAL REQUIREMENT AND GUIDELINES

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in **Appendix B**:

- Constitution of the Republic of South Africa, 1996[7];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA); and
- The National Environmental Management: Biodiversity Act, 2014 (Alien and Invasive Species Regulations, 2014).

It is important to note that in terms of the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998) (See **Appendix B**), all of the natural watercourses associated with the proposed development (including the ephemeral rivers and tributaries with riparian vegetation and the episodic drainage lines with no riparian vegetation) will be regulated in terms of Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) as well as the applicable zones of regulation. All the natural watercourses will thus require further authorisation from the Department of Environment, Forest and Fisheries (DEFF)) and the Department of Water and Sanitation (DWS). This report aids in providing relevant information for these authorisation processes.

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 National and Provincial Datasets

The following section contains data accessed as part of the desktop assessment and presented as a "dashboard-style" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible in order to allow for integration of results by the reader to take place. Where required, further discussion and interpretation are provided.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics associated with the proposed development at the scale required to inform the environmental authorisation and/or water use authorisation processes. Given these limitations, this information is considered useful as background information to the study, is important in legislative contextualisation of the risks and impacts, and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. It must, however, be noted that field verification of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision-making process.

Table 1: Desktop data relating to the characteristics of watercourses associated with the investigation area.

Aquatic ecoregion and sub-regions in which the investigation area are located			**Detail of the investigation area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database**	
Ecoregion	Great Karoo		FEPACODE (Figure 4)	The south western portion of the investigation area (proximity of alternative 1 and 5 of the Oya to Kappa power line alternatives) falls within a sub quaternary catchment indicated to be a FEPA. The southern portion of the investigation area is situated with an Upstream Management Catchment, required to prevent the downstream degradation of FEPAS and Fish Support Areas.
Catchment	Olifants - Cape			
Quaternary Catchment (Figure 3)	E22D, E22E, E23G, E23H, E22B, E23A			
WMA	Olifants/ Doorn			
subWMA	Doring			
Dominant characteristics of the Great Karoo Ecoregion Level II (21.03) (Kleynhans *et al*., 2007)				
Level II Code	21.03	21.02		
Dominant primary terrain morphology	Low Mountains, Parallel Hills and Lowlands, Mountains and Lowlands.	Plains.	NFEPA Wetlands	According to the NFEPA (2011) database, four artificial wetlands are situated within the investigation area. These range from channelled valley bottoms, unchannelled valley bottoms, wetland flats and valley head seeps. The majority of these wetlands were artificial and considered to be in a heavily to critically modified (Class DEF) ecological condition. During the field investigation, these features were identified as artificial impoundments.
Dominant primary vegetation types	Great Nama Karoo, Escarpment Mountains Renosterveld, Upland Succulent Karoo, Upper Nama Karoo.	Lowland Succulent Karoo, Upland Succulent Karoo, Central Mountain Renosterveld.		
Altitude (m a.m.s.l)	500-1700 (limited)	500 - 1100	Wetland Vegetation Type	The investigation area is indicated to fall within the Rainshadow valley Karoo (Critically Endangered) and Karoo Shale Renosterveld (Least Threatened) Wetland Vegetation Type, Mbona *et al*. (2015).
MAP (mm)	100 to 300	100 - 400		
The coefficient of Variation (% of MAP)	30 to 40	30 - 40		
Rainfall concentration index	30 to 55	45 - >65		
Rainfall seasonality	Very late summer, Winter	Winter	NFEPA Rivers (Figure 5)	According to the NFEPA database, the proposed development crosses the Brak, Muishonds, Groot and Ongeluks River. According to the NFEPA dataset and the PES (1999) Classification, the Brak, and Ongeluks Rivers are indicated to be in a moderately modified (Class C) ecological condition whilst the Muishond River is indicated to be in a Largely natural (Class AB) and moderately modified ecological condition according to both databases respectively.
Mean annual temp. (°C)	14 - 18	16 - 20		
Winter temperature (July)	0 - 18	2 - 20		
Summer temperature (Feb)	10 - 30	12 - > 32		
Median annual simulated runoff (mm)	<5 - 20	<5 - 80		
Importance of the investigation area according to the Western Cape Biodiversity Spatial Plan (2017) (Figure 6)				
According to the Western Cape Biodiversity Spatial Plan (2017), several areas within the investigation area are classified as Critical Biodiversity Areas (CBA) 1, of terrestrial ecological importance. CBA 1 areas are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure, in this case specifically for riverine environments. CBA 1 are areas likely to be in a natural condition. In addition, several areas associated with the southern portion of the investigation area (alternatives 1, 2 and 5) are classified as CBA 2. CBA 2 areas are areas in a degraded of secondary condition that are required to meet biodiversity targets for species, ecosystems or ecological processes and infrastructure. In addition, several areas within the investigation area are considered to be Ecological Support Areas (ESAs) 1 (of aquatic importance). ESAs are important in supporting the functioning of CBAs and are often vital for delivering ecosystem services. ESA 1 are areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. In addition, several areas within the investigation area of the Oya to Kappa substation power line alternatives were classified as ESA 2. ESA 2 are areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas (PAs) or CBAs and are often vital for delivering ecosystem services. Large areas that are to be traversed by			

the Oya to Kappa substation power line alternatives are also considered to be Other Natural Areas (ONAs). These are areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.
Importance of the investigation area according to the Critical Biodiversity Areas of the Northern Cape (2016) (Figure 7)
According to the Critical Biodiversity Areas of the Northern Cape (2016), the northern portion of the investigation area falls within areas classified as Ecological Support Areas (ESAs) and Other Natural Areas (ONAs). ESAs are areas that are not essential for meeting biodiversity targets but, play an important role in supporting the ecological functioning in Critical Biodiversity Areas (CBAs). ONAs are areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.
National Web Based Environmental Screening Tool (2020): Aquatic Biodiversity sensitivity
A portion within the south of the investigation area is located within areas considered of high aquatic biodiversity sensitivity as a result of potential aquatic CBAs and rivers that may be traversed by the proposed development.
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (National Wetland Map 5 is included in the NBA)
According to the NBA 2018: SAIIAE Wetland Map 5, there are no wetlands situated within the investigation area or traversed by the proposed development. The rivers as per the NFEPA Rivers (as per Figure 5) are proposed to be traversed by the proposed development. The Groot River is considered to be in a largely modified (Class D) ecological condition and the EPL and ETS is poorly protected and least threatened. The Adamskraal River is considered to be unmodified (Class A) and the EPL and ETS is poorly protected and least threatened. The Muishond River traverses the central portions of the investigation area surrounding the Oya to Kappa power line substation alternatives and is considered to be unmodified with an EPL and ETS of poorly protected and least threatened, respectively. The Kudusberg to Oya power line crosses the Ongeluks and Brak Rivers. The Ongeluks River exhibited a largely natural ecological condition (Class B), whilst the Brak River was considered to be unmodified (Class A) with both rivers displaying a EPL and ETS of poorly protected and least threatened.

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA = National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area

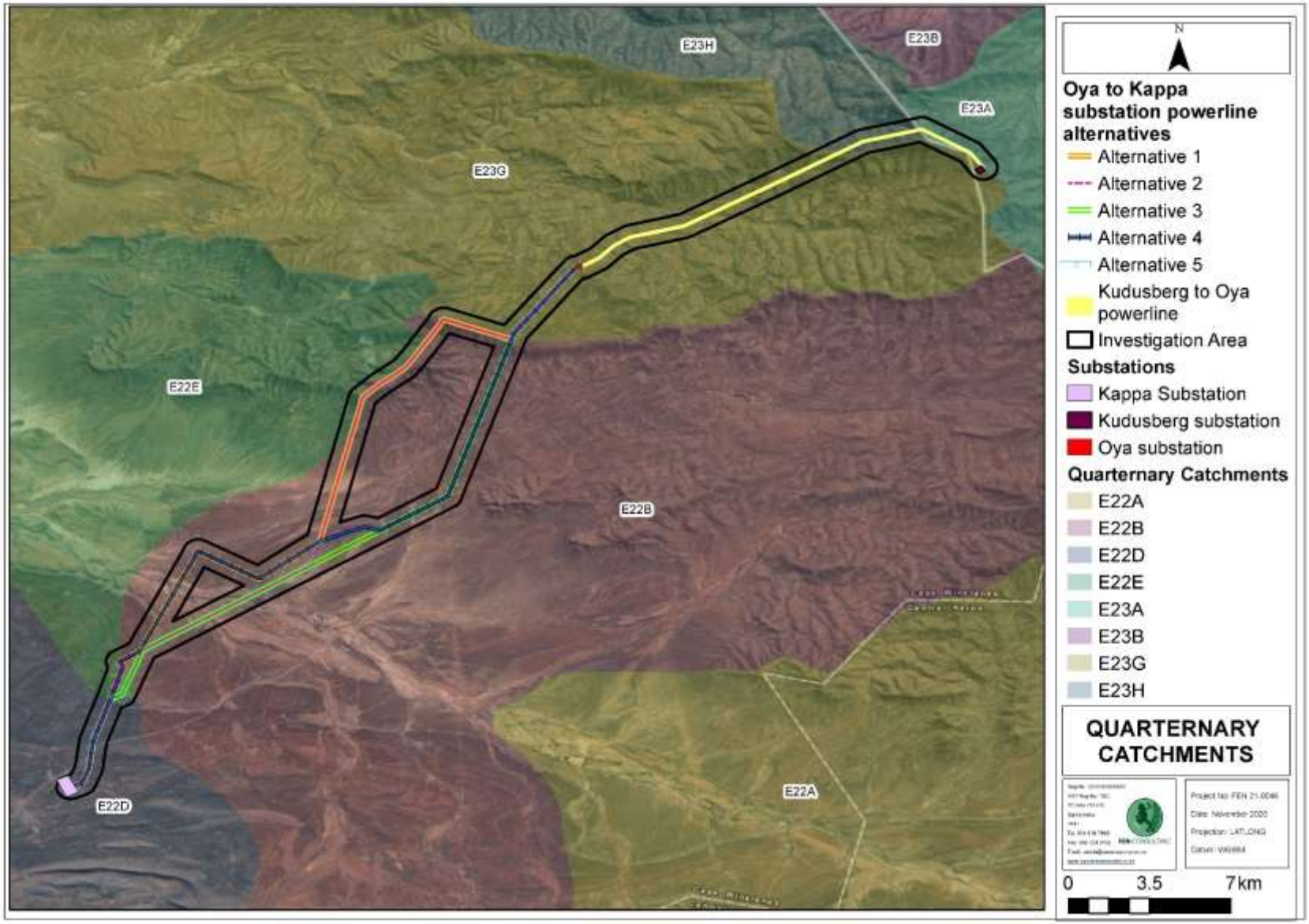


Figure 3: Quaternary catchments associated with the proposed development and associated investigation area.

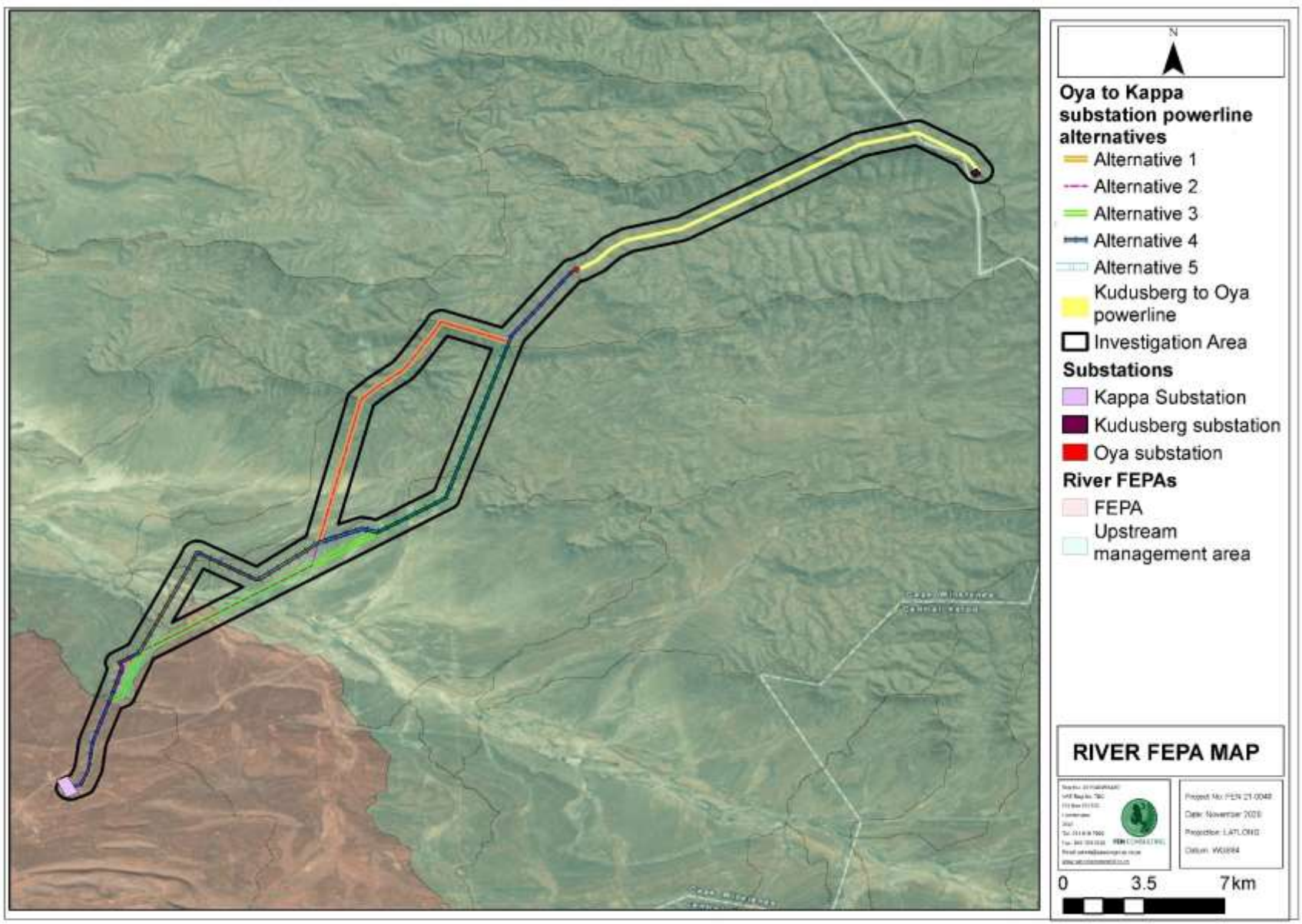


Figure 4: River FEPAs associated with the proposed development and associated investigation area according to the NFEPA (2011) database.

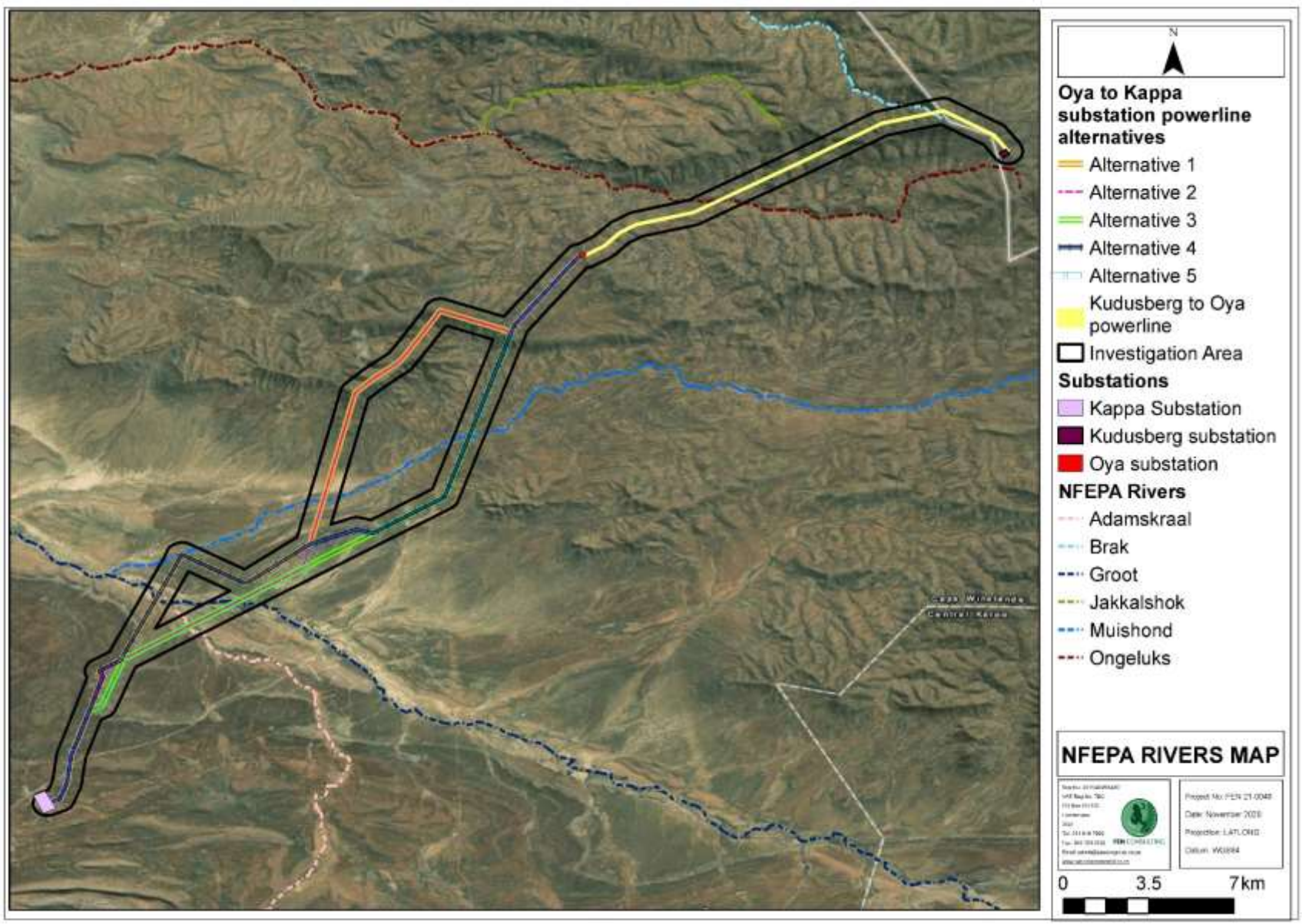


Figure 5: Rivers associated with the proposed development and associated investigation area according to the NFEPA (2011) database.

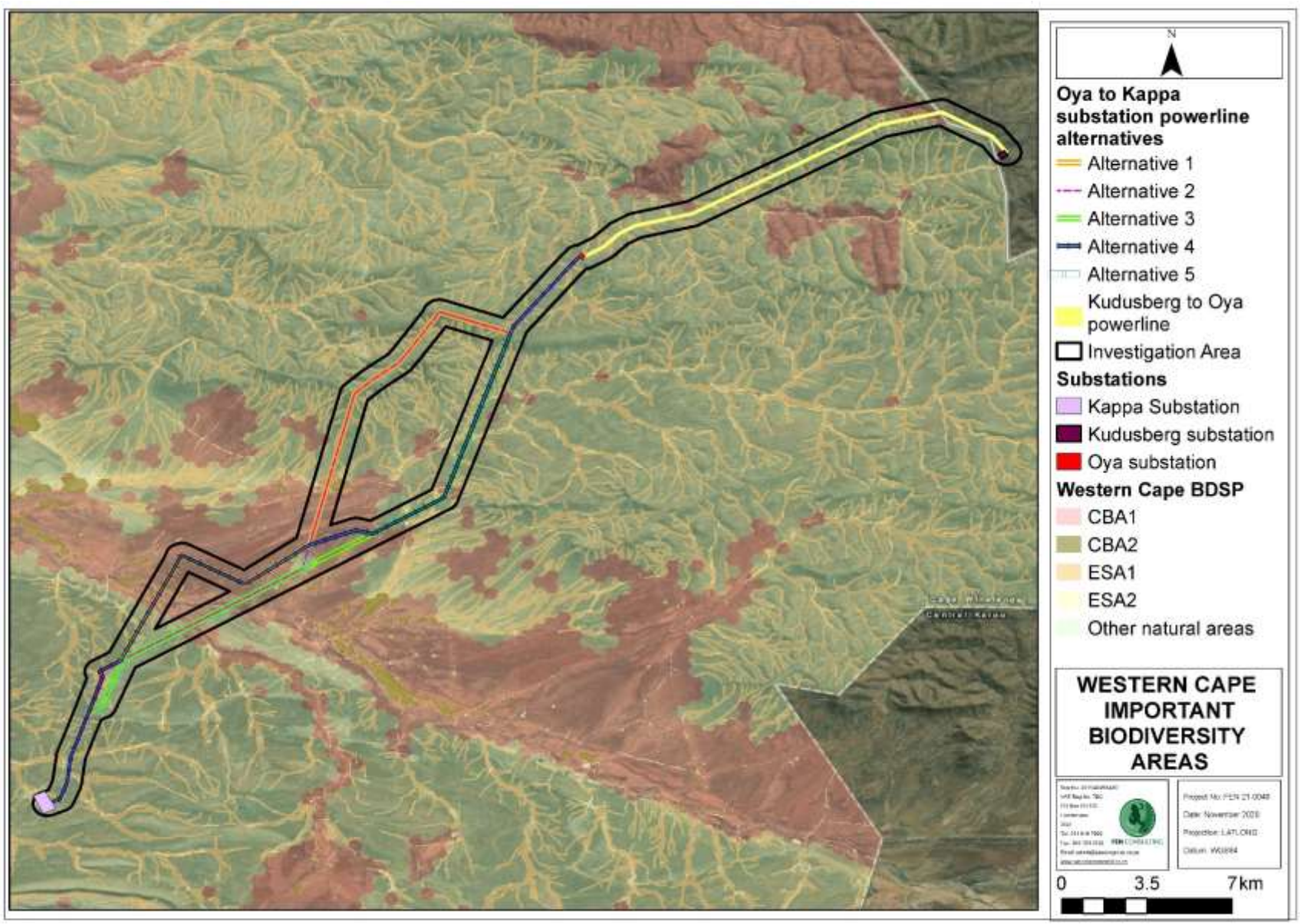


Figure 6: The areas of biodiversity importance associated with the proposed development and investigation area, according to the Western Cape Biodiversity Spatial Plan (2017).

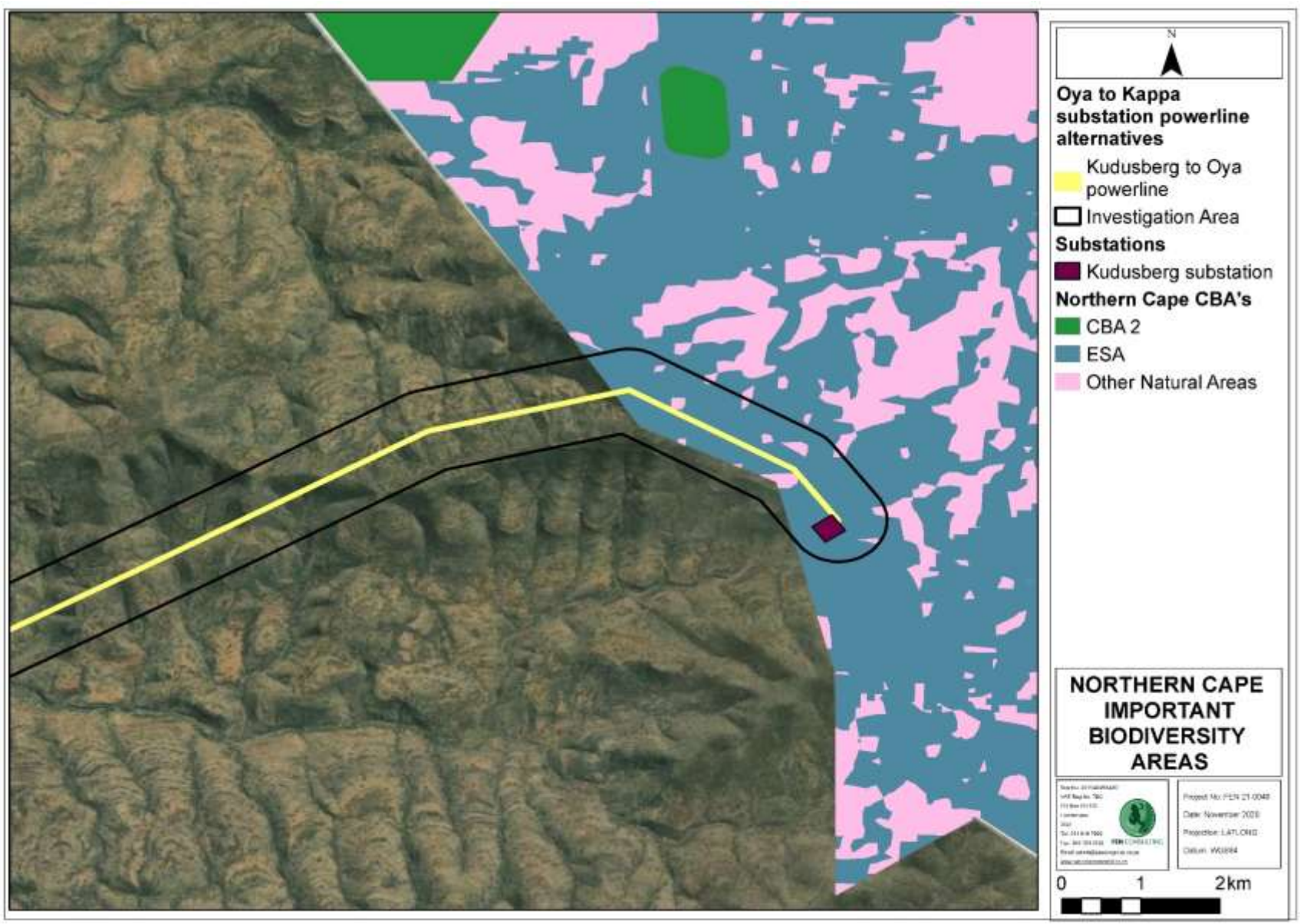


Figure 7: The areas of biodiversity importance associated with the proposed development according to the Critical Biodiversity Areas of the Northern Cape (2016) database.

5.2 Ecological Status of Sub-Quaternary Catchments [Department of Water and Sanitation (DWS) Resource Quality Services (RQS) PES/EIS Database].

The PES/EIS database, as developed by the DWS RQIS department was utilised to obtain additional background information on the project area. The information from this database is based on information at a sub-quaternary catchment reach (SQR) level. Descriptions of the aquatic ecology is based on information collated by the DWS RQIS department from available sources of reliable information, such as the South Africa River Health Programme (SA RHP) sites, Ecological Water Requirements (EWR) sites and Hydro Water Management System (WMS) sites.

Key information on invertebrates and background conditions associated with the SQRs E23H-07869 (Brak River), E23G-08076 (Ongeluks River), E22B – 08293 (Adamskraal River); E22B–08237 and E22B-8274 (Groot River) and E22B-08134 (Muishond River) as contained in this database and pertaining to the PES and EIS are tabulated in Tables 2 and 3 and visually represented in Figure 1 that follows.

Table 2: Invertebrates previously collected from or expected at the SQR monitoring points.

Macro-Invertebrates	E23H-07869 (Brak River)	E23G-08076 (Ongeluks River)	E22B – 08293 (Adamskraal River); E22B - 08237 and E22B-8274 (Groot River) and E22B-08134 (Muishond River)
Aeshnidae	X	X	X
Ancylidae	X		
Baetidae 1 Sp	X	X	
Baetidae 2 Sp			X
Belostomatidae	X	X	
Ceratopogonidae	X		X
Caenidae	X	X	
Chironomidae	X		X
Coenagrionidae	X	X	X
Corduliidae	X	X	X
Corixidae	X	X	X
Culicidae	X		X
Dytiscidae	X		X
Elmidae			X
Gerridae	X	X	X
Gomphidae			X
Gyrinidae	X		X
Hydracarina	X	X	X
Hirudinea			X
Hydrometridae			
Hydrophilidae			
Hydropsychidae 2 sp.			X
Leptoceridae			X
Lestidae	X	X	
Libellulidae	X	X	X
Lymnaeidae	X		X
Muscidae	X		
Naucoridae			X
Notonectidae	X	X	X
Oligochaeta	X	X	X
Physidae	X		
Pleidae	X	X	X
Simuliidae	X		X
Turbellaria			X
Veliidae/Mesoveliidae	X	X	X

Table 3: Summary of the ecological status of the sub-quaternary catchment (SQ) reaches associated with the proposed development based on the DWS RQS PES/EIS database.

	E22B- 08293 (Adamskraal River)	E23H-07869 (Brak River)	E22B-8274 and E22B – 08237 (Groot River)	E23G-08076 (Ongeluks River)	E22B-08134 (Muishond River)
Synopsis					
PES Category Median	Natural/Close to natural	Natural/Close to natural	Natural/Close to natural	Unmodified, natural	Natural/Close to natural
Mean EI class	High	High	High	High	High
Mean ES class	High	Very High	High	Very High	Very High
Length	23.58	39.38	10.07	22,3	44.03
Stream order	1	1	2	1	1
Default EC[4]	B (High)	A (Very High)	B (High)	A	A (Very High)
PES Details					
Instream habitat continuity MOD	None	None	None	None	None
RIP/wetland zone continuity MOD	Small	Small	Small	Small	Small
Potential instream habitat MOD activities	None	None	None	None	None
Riparian/wetland zone MOD	None	None	None	None	None
Potential flow MOD activities	Small	Small	Small	Small	Small
Potential physico-chemical MOD activities	None	None	None	None	None
EI Details					
Fish spp/SQ	-	-	-	-	-
Fish average confidence	-	-	-	-	-
Fish representivity per secondary class	-	-	-	-	-
Fish rarity per secondary class	-	-	-	-	-
Invertebrate taxa/SQ	28	25	28	25	28
Invertebrate average confidence	1	3	1	3	1
Invertebrate representivity per secondary class	Moderate	Moderate	Moderate	Moderate	Moderate
Invertebrate rarity per secondary class	High	High	High	High	High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	Very Low	Moderate	Very Low	Very Low	Very Low
Habitat diversity class	Moderate	Moderate	Very Low	Low	Moderate
Habitat size (length) class	Moderate	High	Very Low	Moderate	Very High
Instream migration link class	Very High	Very High	Very High	Very High	Very High
Riparian-wetland zone migration link	Very High	Very High	Very High	Very High	Very High
Riparian-wetland zone habitat integrity class	Very High	Very High	Very High	Very High	Very High
Instream habitat integrity class	Very High	Very High	Very High	Very High	Very High
Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	Very High	Very High	Very High	Very High	Very High
Riparian-wetland natural vegetation rating based on expert rating	Very High	Very High	Very High	Very High	Very High

	E22B- 08293 (Adamskraal River)	E23H-07869 (Brak River)	E22B-8274 and E22B – 08237 (Groot River)	E23G-08076 (Ongeluks River)	E22B-08134 (Muishond River)
ES Details					
Fish physical-chemical sensitivity description	-	-	-	-	-
Fish no-flow sensitivity	-	-	-	-	-
Invertebrates physical-chemical sensitivity description	Moderate	Moderate	Moderate	Moderate	Moderate
Invertebrates velocity sensitivity	Very High	High	Very High	High	Very High
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description	Very Low	Very High	Very Low	Very High	Very High
Stream size sensitivity to modified flow/water level changes description	Very High	Very High	Very High	High	Very High
Riparian-wetland vegetation intolerance to water level changes description	Very High	Very High	Very High	Marginal and non-marginal species require seasonal flows	Very High

[1] PES = Present Ecological State; confirmed in database that assessments were performed by expert assessors;
[2] EI = Ecological Importance;
[3] ES = Ecological Sensitivity
[4] EC = Ecological Category; default based on median PES and highest of EI or ES means.

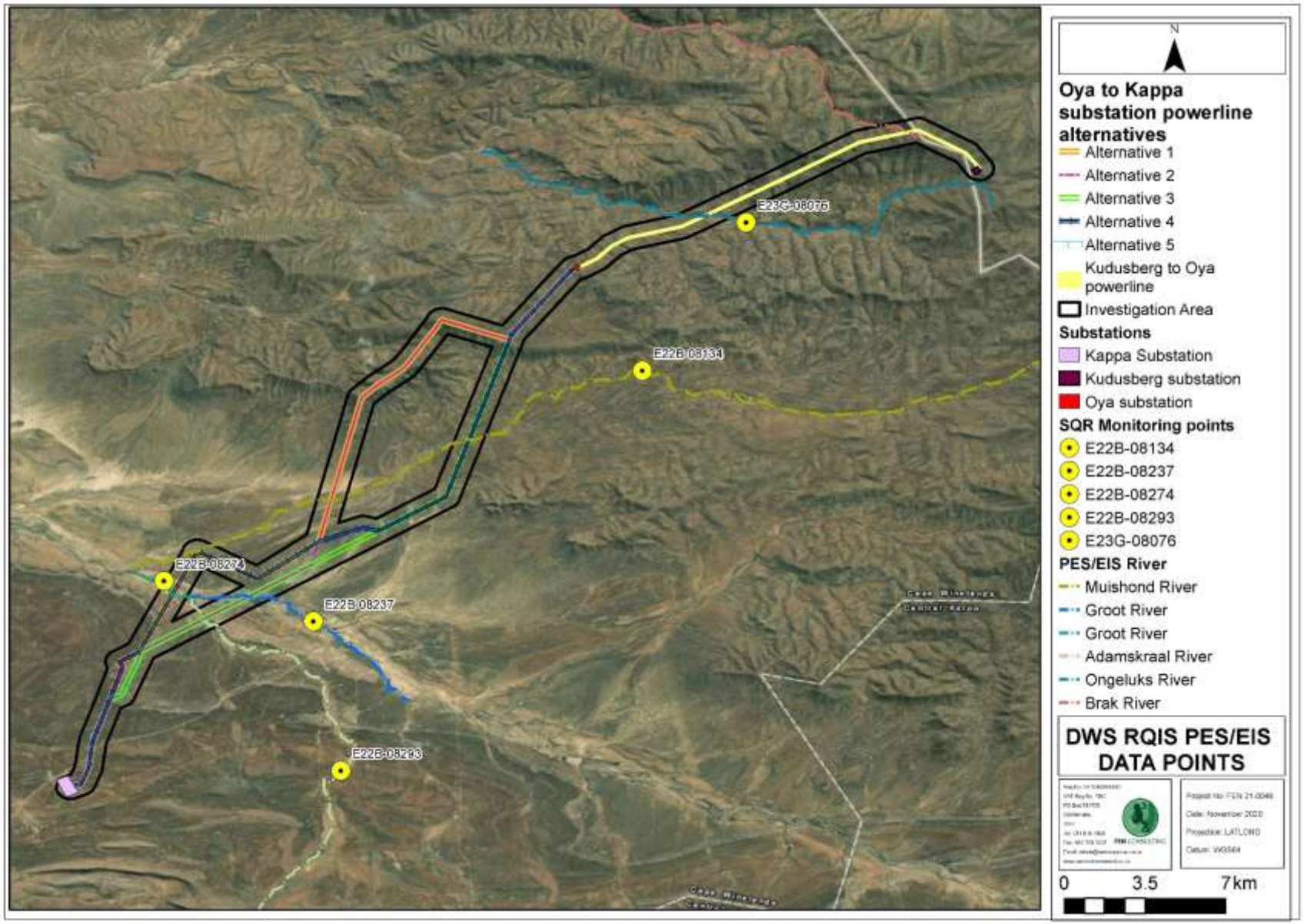


Figure 8: DWS RQIS PES/EIS sub-quaternary catchment reaches (SQRs) indicated relative to the proposed development and investigation area.

6. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

6.1 RESULTS: WATERCOURSE ASSESSMENT

6.1.1 Field verification and delineation

In preparation for the field assessment, aerial photographs, digital satellite imagery and provincial and national watercourse databases (as outlined in Section 5.1 of this report) were used to identify points of interest associated with the proposed development at a desktop level. In this regard, specific mention is made of the following:

- Linear features: since water flows/moves through the landscape, watercourses often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: with water flow paths often showing as white/grey or black and outcrops or bare soils displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and
- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

These points of interest were verified during the site assessment undertaken on the 22nd to 24th of October 2020. The proposed development is located in the east largely on the higher-lying Oliviersberg and Koedoesberg Mountains, routed in the west through the topographical flat valley of the Groot River to where the Kappa substation is located. The proposed development crosses watercourses associated with the Brak, Ongeluks, Muishonds, Groot, Adamskraal, Karee and Kleinpoorts river systems.

The majority of watercourses identified within the investigation area can best be described as headwater episodic[8] drainage lines (EDLs) without riparian vegetation which flow into larger ephemeral tributaries (with riparian vegetation) connected to larger ephemeral rivers. Although these EDLs cannot be classified as riparian resources in the traditional sense thereof due to the lack of saturated soils and riparian vegetation, they do still function as waterways, through episodic conveyance of water. However, based on the definition of a watercourse (see Section 1.4) water flows regularly or intermittently within these drainage lines, conveying water from the upgradient catchment area into the downgradient tributaries and eventually into the larger river systems. As such, they can be considered as watercourses due to their importance for hydrological functioning as they do function as waterways and therefore enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998).

Several areas hosting episodic preferential flow paths (PFP) were also identified (Figure 9). As with the EDLs, these preferential flow paths also lack riparian and wetland characteristics and may potentially only convey surface water for a short period of time after rainfall events. Thus, these features are not considered of ecological importance but contributes to the hydrological functioning of the drainage systems at large. The PFP cannot be considered as watercourses (thus no ecological assessment undertaken) and may potentially

[8] "Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years." (Uys and O'Keeffe, 1997, in Rossouw *et. al*, 2006).

only enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998) should a floodline be applicable to these features. Due to the extent of these small PFPs, they were not mapped or delineated – however specific areas where extensive PFP were noted are indicated on the delineation maps (Figure 11).

Figure 9: Photographs of preferential surface flow paths associated with the Groot River drainage system.

The seven (7) separate drainage systems identified within the investigation area relative to the proposed development is provided in the Table 4 and visually depicted in Figures 10 to 12.

Table 4: Summary of the drainage systems identified relative to the proposed development.

Drainage System	Locality	General description
Kleinpoorts River system (Figure 10).	Drainage system associated with the north eastern portion of the investigation area. The power line between the Kudusberg substation to Oya substation facility will traverse this drainage system.	Several small headwater EDLs are located within the investigation area to be traversed by the proposed development. These EDLs are considered to be in a largely natural ecological condition due to their remote locality.
Brak River system (Figure 10).	Drainage system associated with the north eastern portion of the investigation. The power line between the Kudusberg substation to Oya substation will traverse this drainage system.	Several small headwater EDLs are located within the investigation area to be traversed by the proposed development. These EDLs are considered to be in a largely natural ecological condition due to their remote locality.
Ongeluks River system (Figure 10).	Drainage system associated with the northern portion of the investigation area. The central to southern portion of the power line between the Kudusberg substation to Oya substation will traverse this drainage system. Power line alternative 5 proposed between the Oya energy facility substation to the Kappa substation will traverse this system.	This is the largest drainage system associated with the power line between the Kudusberg Substation to Oya Substation. The headwaters of this river system is located at the proposed substation locality (in the most far eastern portion of the investigation area). The proposed power line will subsequently cross EDLs, ephemeral tributaries and the Ongeluk River. The watercourses of this system located in the investigation area is predominantly largely natural with a few modifications specifically to some of the watercourses proposed to be crossed by the southern portion of the power line.
Muishonds River system (Figure 11)	Drainage system associated with the central portion of the investigation area. All proposed power line alternatives from the Oya substation to the Kappa substation will traverse this system.	This is the largest drainage system associated with the power line between the Oya energy facility substation to the Kappa substation. All proposed power line alternatives routes will traverse this drainage system. The headwaters of this river system, predominantly the EDLs, is located in the investigation area associated with power line alternatives 1, 2 and 5. Proposed power line alternatives 3 and 4 traverse the EDLs, tributaries and the Muishonds River. The central portion of the investigation area (associated with all power line alternatives) traverse large areas consisting of episodic preferential flow paths (PFP).
Groot River system	Drainage system associated with the southern portion of the investigation area. All proposed	All proposed power line alternatives crosses this drainage system, which consist of the Groot River and several EDLs. Due to the locality of this

Drainage System	Locality	General description
(Figure 11 and 12)	power line alternatives from the Oya energy facility substation to the Kappa substation traverse this system.	drainage system, being subjected to long term grazing, the watercourses has been modified to some extent.
Adamskraal River (Figure 11 and 12)	Drainage system associated with the southern portion of the investigation area. Proposed power line alternatives 2, 3 and 5 from the Oya energy facility substation to the Kappa substation traverse this system.	An EDL and the Adamskraal River is traversed by the proposed power line alternatives 2, 3, and 5. The reaches of the watercourses located in the investigation area are considered to be in a largely natural ecological condition due to their remote locality.
Karee River (Figure 12)	Drainage system associated with the southern portion of the investigation area. All proposed power line alternatives from the Oya energy facility substation to the Kappa substation traverse this system.	Several EDLs and PFPs are traversed by the power line alternatives between the Oya energy facility substation to the Kappa substation. The reaches of the watercourses located within the investigation area are considered to be in a largely natural ecological condition due to their remote locality.

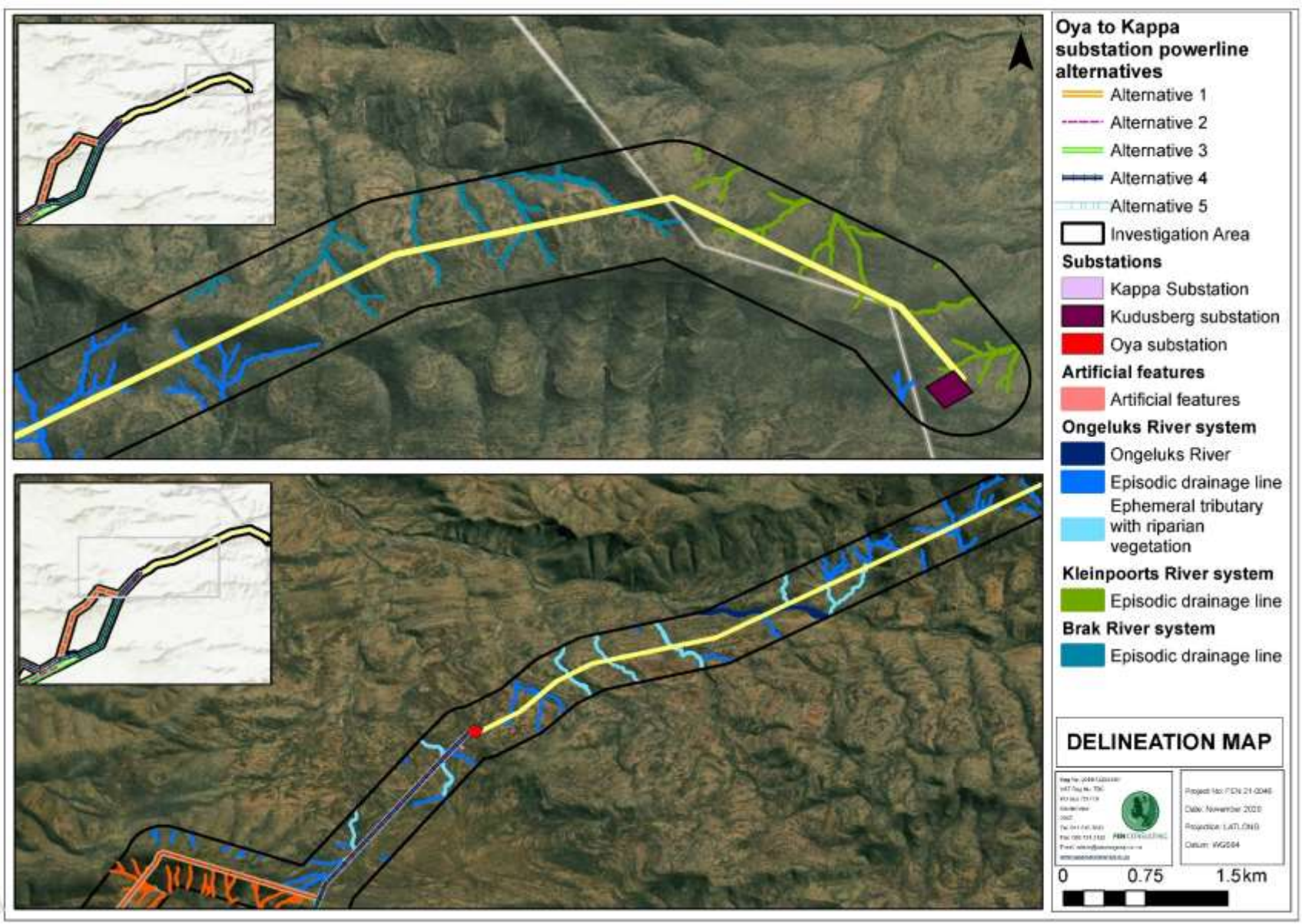


Figure 10: The locality of the delineated watercourses of the Kleinpoorts, Brak and Ongeluk River systems associated with the proposed development. Although the power line traverses watercourses, pylons will not be located within its delineated extent. Although the power line alternatives traverses watercourses, pylons will not be located within the watercourse delineated extent.

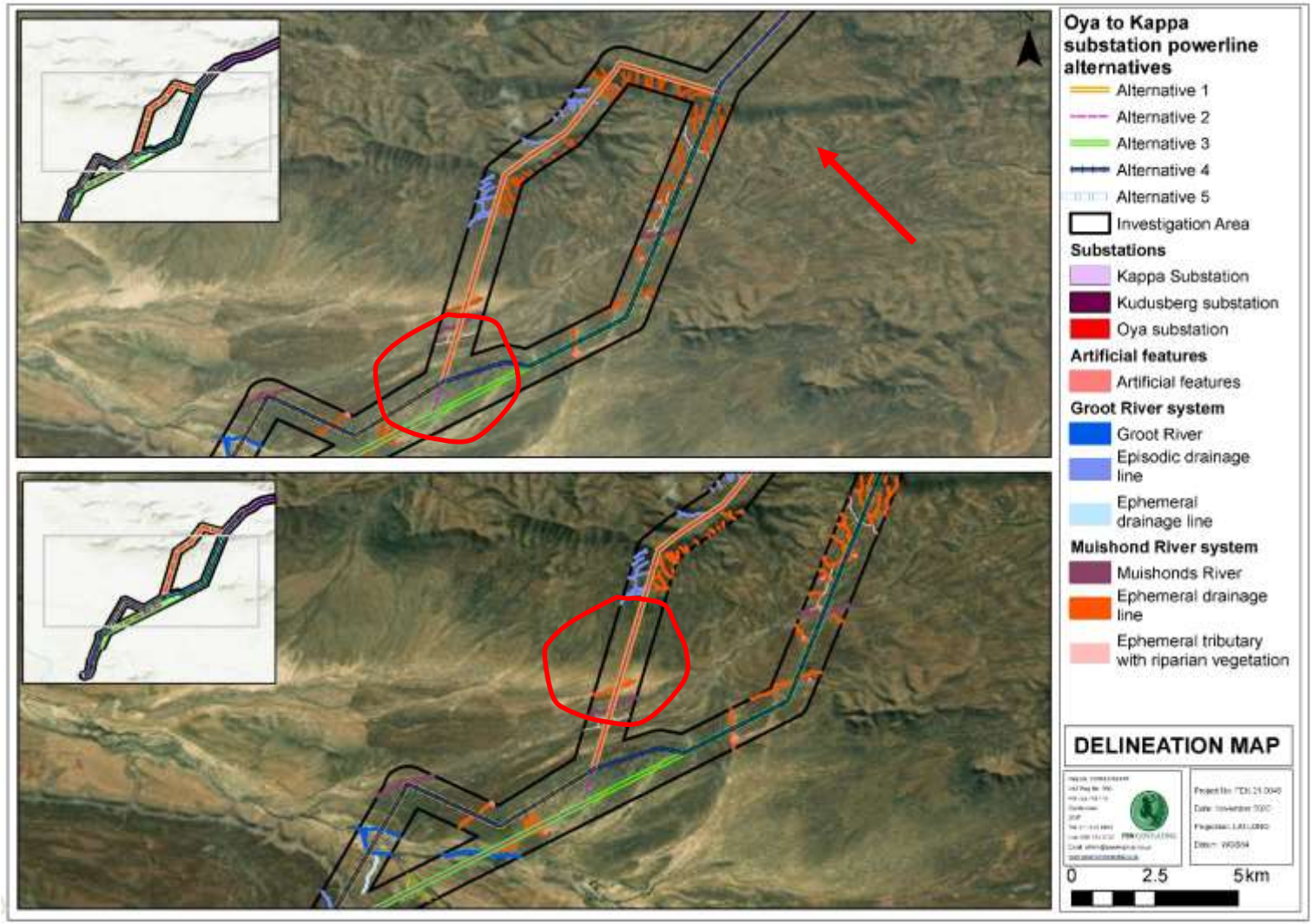


Figure 11: The locality of the delineated watercourses of the Adamskraal, Groot, and Muishond River systems associated with the proposed development. The red polygon indicates areas with preferential flow paths[9]. Although the power line alternatives traverses watercourses, pylons will not be located within the watercourse delineated extent.

[9] Preferential flow paths also lack riparian and wetland characteristics and may potentially only convey surface water for a short period of time after rainfall events. Thus, these features are not considered of ecological importance but contributes to the hydrological functioning of the drainage systems at large. The PFP cannot be considered as watercourses and may potentially only enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998) should a floodline be applicable to these features.

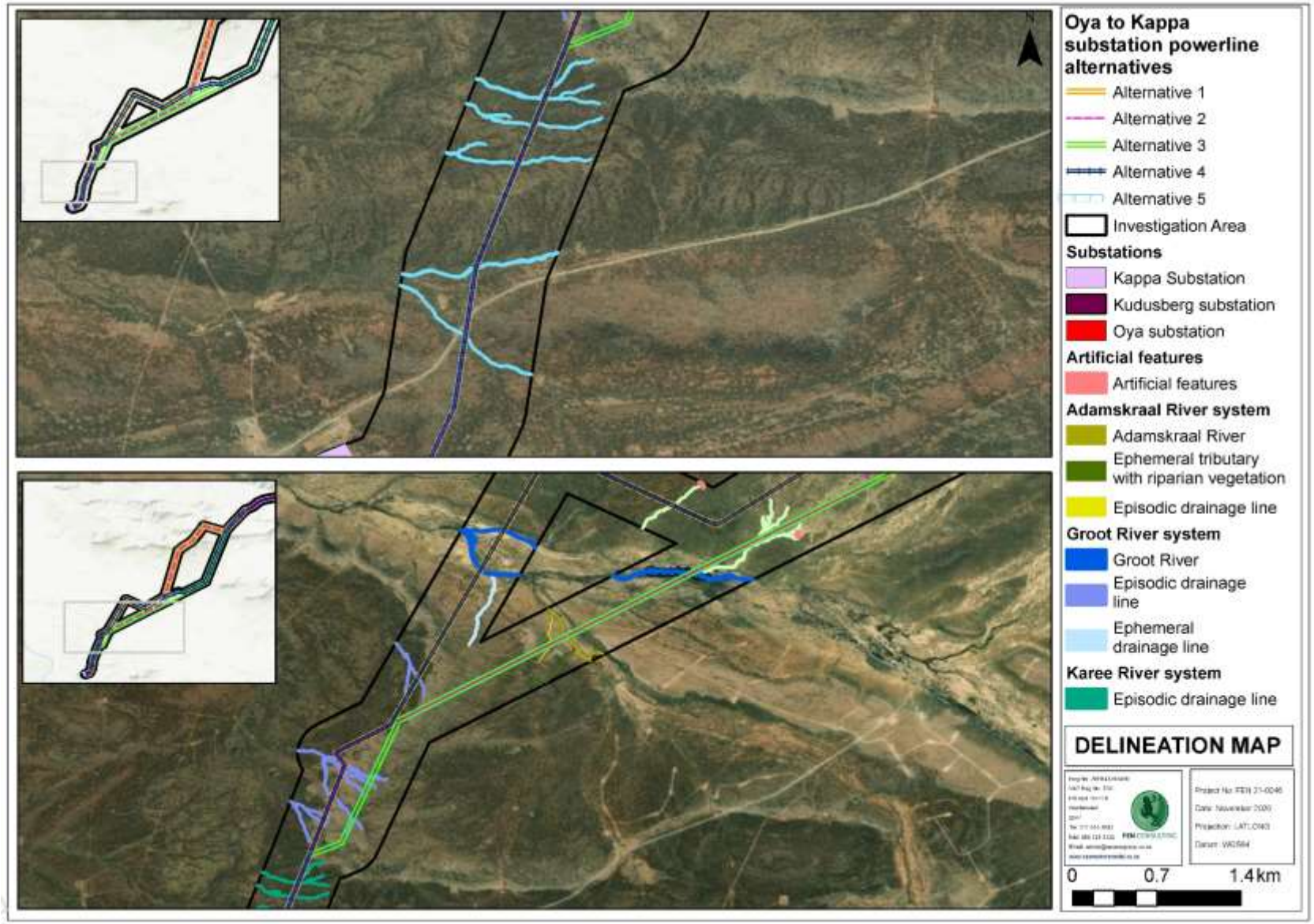


Figure 12: The locality of the delineated watercourses of the Groot and Karee River systems associated with the proposed development. Although the power line alternatives traverses watercourses, pylons will not be located within the watercourse delineated extent.

6.1.2 Watercourse delineation

The outer boundary of the identified watercourses were delineated according to the guidelines advocated by DWAF (2008) taking into consideration soil characteristics as defined by Job (2009). The delineations as presented in this report are regarded as a best estimate based on the site conditions present at the time of the assessment. During the field assessment, the following indicators were used in order to determine the boundary of the riparian watercourses identified to be associated with the proposed power line and substations development and associated investigation area:

- **Topography/elevation** was used to determine which parts of the landscape watercourses are most likely to occur. Since watercourses occur where there is a prolonged presence of water in the landscape, the most common place one could expect to find watercourses is in the valley bottom position (DWAF, 2008). The main tributaries and rivers of the identified drainage systems are all located in the valley bottom position (Figure 13). Most other watercourses (like the smaller episodic drainage lines) are also located in valleys between undulating hills within the upslope that slopes towards the larger downstream system where concentration of flow leads to drainage towards the larger tributaries and rivers.

Figure 13: A photograph depicting the topographical setting of the smaller episodic drainage lines in the higher slope position (yellow dashed line) relative to the larger ephemeral tributaries or river in the valley bottom position (blue line).

- **Vegetation associated with riparian areas:** the identification of riparian areas relies heavily on vegetative indicators. Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs:
    - in species composition relative to the adjacent terrestrial area; and

- in the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the health, density, crowding, size, structure and/or numbers of individual plants.

Only in the larger downstream ephemeral rivers and tributaries was a change in riparian vegetation identified from that of the terrestrial vegetation (Figure 14), where a mix of low tree and shrub species such as *Vahellia karroo, Searsia lancea, Lycium cinereum, Diospyros ausro-africana* and *Buddleja saligna* are prevalent. Trees and shrubs are less prominent along the rocky episodic drainage lines located in the upper reaches of the drainage systems (Figure 14).

Figure 14: Photographs depicting the vegetation component of the watercourses associated with the proposed development. (Left) the lower reaches of the ephemeral rivers host tree species (indicated by the yellow arrows) in its marginal zones, which can be easily distinguished from the surrounding terrestrial vegetation. (Right) the vegetation of the smaller episodic drainage line type watercourses is similar to that of the surrounding terrestrial areas.

- ***The presence of alluvial soils:*** The presence of alluvial soils was used as an indicator of riparian zones, as defined by the National Water Act, 1998 (Act No. 36 of 1998). The occurrence of alluvial deposited material adjacent to the active channel is a good indicator of the riparian zone of a riparian watercourse (such as that of the identified river, tributaries and ephemeral drainage lines). Alluvial soils are soils derived from materials deposited by flowing water, especially in the valley bottom position. Riparian areas often, but not always, have alluvial soils (Figure 15). While the presence of alluvial soils cannot always be used as a primary indicator to delineate riparian watercourses accurately, it can be used in conjunction with the topographical and vegetative indicators. Unlike wetland areas, riparian zones are usually not saturated for a long enough period of time for redoximorphic features to develop. This is because riparian watercourses are mainly driven by flow, originating from its local catchment which flows through the watercourse and does not reside in the riparian watercourse as with wetlands. This is specifically true for ephemeral and episodic systems that experience flash flooding in response to rainfall events.

Figure 15: (Left) a shallow layer of alluvial soil is present in the active channel of this ephemeral tributary. (Right) the upper reaches of the tributaries and smaller episodic drainage lines have exposed bedrock, and only present with small isolated areas where alluvial soil is deposited.

6.1.3 Watercourse classification and assessment

The watercourses listed in Table 4 above were classified according to the Classification System outlined in **Appendix C** of this report as Inland Systems, located within the Great Karoo Ecoregion. Table 5 below presents the classification from level 3 to 4 of the Wetland Classification System (Ollis *et al.* 2013).

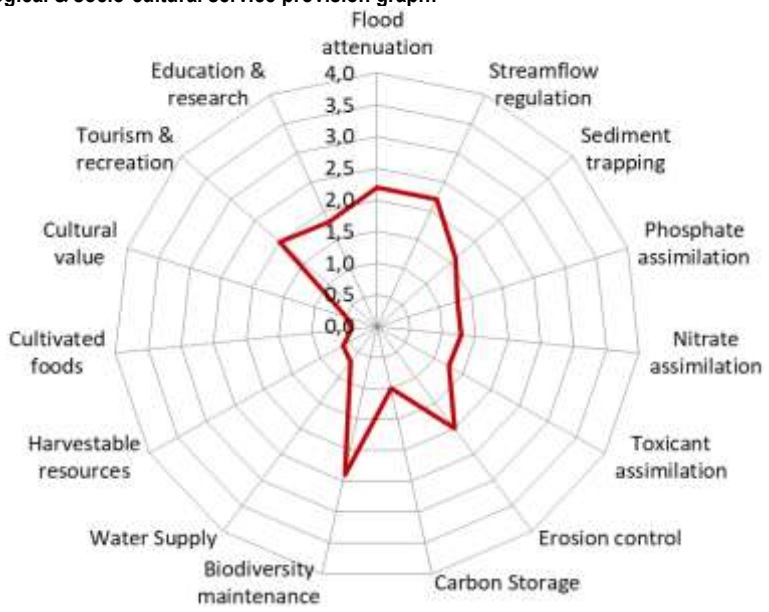
Table 5: Classification of the watercourses associated with the proposed development.

Watercourse	Level 3: Landscape Unit	Level 4: Hydrogeomorphic (HGM) Type
Rivers	Valley Floor: the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	A linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.
Ephemeral tributaries with riparian vegetation	Slope—an inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	
Episodic Drainage lines		

Tables 6, 7 and 8 provides a summary of the field verification findings in terms of relevant aspects (hydrology, geomorphology and vegetation components) associated with the watercourses. Due to the similar watercourse characteristics of the rivers, ephemeral tributaries and that of the episodic drainage lines, and each of these watercourse types having been subjected to the same anthropogenic impacts, the ecoservice provision, hydrological regime, geomorphological characteristics, water quality and habitat of these watercourses, all of the ephemeral tributaries and all of the rivers, episodic drainage lines were assessed in a combined fashion. The details pertaining to the methodology used to assess the river is contained in **Appendix C**.

Table 6: Summary of results of the assessment of the ephemeral rivers (Adamskraal, Groot, Muishonds and Ongeluk River) associated with the proposed development.

Ecological & socio-cultural service provision graph:



Aquatic IHI discussion

IHI Riparian PES Category: B (Largely natural with few modifications)

The ephemeral rivers proposed to be traversed by the proposed development has remained largely intact, with limited changes to the cover, abundance and species composition when compared to the reference conditions in both the marginal as well as non-marginal zones. Some disturbance from anthropogenic activity (such as historical grazing, informal road crossings and artificial instream impoundments) in the immediate surroundings of the rivers were noted, which has resulted in some bank erosion, an increase in the presence of alien vegetation species and some loss of tree diversity within the riparian zone. Overall, these rivers are considered natural with few modifications.

Figure 16: Representative photographs of the ephemeral rivers. (Top Left) Adamskraal River; (Top Right) Groot River; (Bottom Left) Muishonds River); Bottom Right) Ongeluks River. Note that these river s hosts trees along its marginal zones (primarily Vachellia karoo), with shallow alluvial soils deposited on a rock bed base.

Ecoservice provision

Ecoservice Provisioning: 1,5 (Intermediate)

Due to the ephemeral nature of these rivers, their capacity to provide certain ecological services is considered seasonal, although this is counteracted by the relative natural ecological integrity of the rivers, which increases the overall functionality (specifically for streamflow regulation and flood attenuation). These rivers are considered important for biodiversity maintenance and act as migratory corridors in a semi-arid region. As these are ephemeral rivers, they are not considered important for water supply, harvestable resources or cultivated foods.

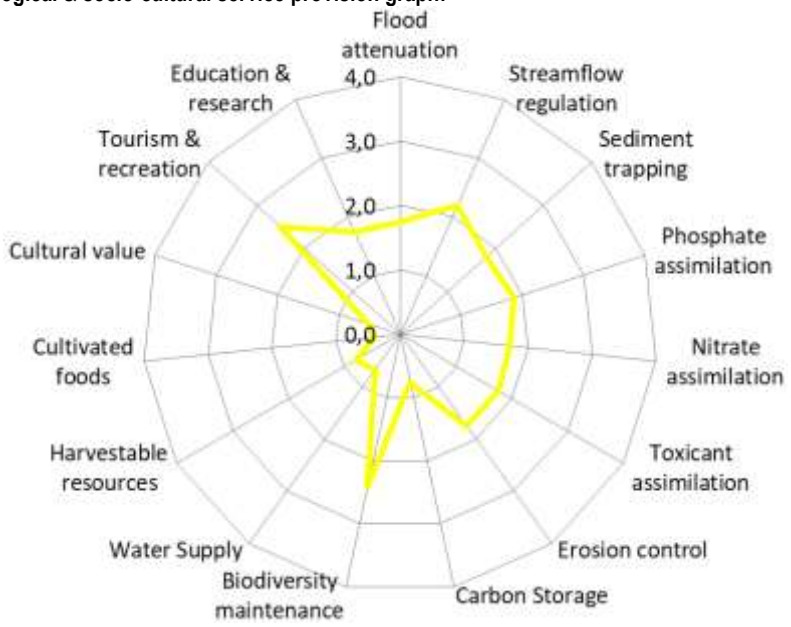
EIS discussion
EIS Category: High These rivers are considered of high ecological importance due to its hydrofunctional importance with specific mention of the streamflow and flood attenuation it provides. The large ephemeral rivers (such as the Groot River and partially the Ongeluks and Muishonds river) area also considered to be a Critical Biodiversity Area (CBA) 1 (WCBSP, 2017), which are areas that must remain in good ecological condition for meeting biodiversity targets for ecosystem types, species of special concern or ecological processes. CBA 1 are areas that are irreplaceable or near irreplaceable for meeting biodiversity targets. Due To the connectedness of all these rivers to both vast terrestrial areas and smaller drainage systems, they are considered important for biodiversity maintenance on a landscape scale.
REC Category and RMO
REC: Category B (Largely natural with few modifications) **BAS: Category B** **RMO: A/B (Improve)** The assessed reaches of the rivers within the investigation area remains in relatively good condition despite some modification due to livestock grazing (which is not considered substantial). Since it is considered to have a high ecological importance, all efforts should be made to retain current levels of ecological functioning and prevent degradation of these rivers. Since most of these rivers are classified as either CBAs or ESAs and are considered of high Ecological Importance and Sensitivity (EIS), the Recommended Management Objective (RMO) is to, at minimum, maintain the rivers in their current ecological state, but it is recommended that small scale rehabilitation of areas which may potentially be impacted by the proposed development (such as road crossings) be undertaken. Additionally, it must be ensured that no edge effects from any surface infrastructure proposed as part of the proposed development (such as the pylons or service roads) that may be located within close proximity to the rivers, enter these systems.

Watercourse characteristics:	
a) Hydraulic regime Despite a relatively large drainage networks associated with these rivers, surface water is only present during the wet season. When surface flow is present, it occurs as a high flow event, which can result in erosion of the stream banks and may only last a couple of days to weeks. Despite some formal and informal road crossings over these rivers, their hydrological functionality and connectivity is considered intact.	**a) Water quality** No surface water was present within the rivers during the site assessment; thus, no water quality parameters could be measured. Nevertheless, due to the relatively remote locality the rivers and the low degree of catchment transformation, it can be concluded that if surface water is present, the water quality is likely to be good, with limited impacts from pollutants.
b) Geomorphology and sediment balance As these larger river reaches are located in the valley bottom position alluvial soils has been deposited along with large and small rocks that have been transported and subsequently deposited by the upstream flows. The Muishonds, Adamskraal and Groot River can be classified as anabranching rivers. Once these rivers become anabranching, sediment will be collected (during flow conditions) and deposited downstream when the sediment load becomes oversaturated, thereby creating 'islands' within the river channel, which is evident within the downstream reaches of the Groot River and Adamskraal River assessed. Also, the high surface roughness of the in-stream area of the rivers slows down flows and allows for sediment deposition to occur more rapidly. Erosion does occur, however not to a significant degree, mainly as a result of overbank flows (during flow periods) that scour these island surfaces. The high flow variability (due to the seasonal characteristics of the rivers and infrequent rainfall events), coupled with the variable elevation of deposited islands, promotes regular overbank flows. The presence of riparian vegetation which has become established on such islands may provide a trigger and/or determine the location of overbank flow, especially where channels are densely obstructed.	**c) Habitat and biota** Sparse vegetation (consisting of low growing shrubs) is located in the active channels of the rivers, which have established either in the alluvial soils or rock creases. The anabranching river networks provides a wide strip of substrate in which riparian vegetation has established. The colonisation of the riparian vegetation within the anabranching network plays a critical role in maintaining the stability of these islands (and delaying erosion, thus sedimentation) by increasing sediment cohesion and decreasing flow erosivity. Overall, these rivers are considered important in providing habitat for a variety of species (floral and faunal) as it has a variety of habitat types.

Extent of modification anticipated	**Minimal** Some modification is anticipated to the extent of the rivers. This is attributed to the construction of potential new roads through the watercourses and upgrading of the existing road crossings (if and where applicable), changes to flow pattern and timing in the rivers will need to be monitored to ensure that the hydrological connectivity of rivers are not adversely affected. It is assumed that no power line pylons will be constructed within the delineated extent of the rivers. Nevertheless, the recommend mitigation measures must still be implemented to mitigate any potential indirect impacts.	
Impact Significance:	**Low** (with the implementation of mitigation measures)	No proposed surface infrastructure will be located in the rivers or its 32m NEMA Zone of Regulation, however, existing roads traversing some of the river reaches may be upgraded or new roads may traverse these rivers. Such activities were identified to pose a negative medium impact to the rivers without the implementation of mitigation measures. Should road grading/upgrading activities only occur within the dry period (that will not require any kind of diversion of flow) that would traverse the ephemeral rivers and the recommended mitigation measures be applied, the impact significance can be reduced to a low negative impact.

Table 7: Summary of results of the assessment of the ephemeral tributaries with riparian vegetation associated with the proposed development.

Ecological & socio-cultural service provision graph:



Aquatic IHI discussion

IHI Riparian PES Category: B (Largely natural with few modifications)

The ephemeral tributaries identified within the investigation area have remained largely intact, with limited change to the cover, abundance and species composition when compared to the reference conditions in both the marginal as well as non-marginal zones. Some disturbance from anthropogenic activity (informal road crossings and artificial instream impoundments) in the immediate surroundings of the tributaries are noted, which have resulted in some bank erosion, an increase in the presence of alien vegetation species and some loss of tree diversity within the riparian zone.

Figure 17: Representative photographs of the ephemeral tributaries. (Top left and right) the active channel of these tributaries consists of a shallow layer of alluvial soil; (Bottom left) the ephemeral tributary can be distinguished in the landscape from the surrounding terrestrial area based on the presence of tree species. (Bottom right) the ephemeral tributaries are confined in some areas by a rocky ridge.

Ecoservice provision

Ecoservice Provisioning: 1,5 (Intermediate)

Due to the ephemeral nature of these tributaries, their capacity to provide certain ecological services is reduced, although this is counteracted by the relatively intact ecological integrity of the tributaries, which increases its overall functionality. These tributaries are considered important for biodiversity maintenance and hydrological connectivity as they predominantly connect the smaller EDLs to the larger ephemeral rivers. As these are ephemeral watercourses, they are of seasonal importance for the supply of water for a variety of faunal species.

EIS discussion

EIS Category: High

The ephemeral tributaries are considered to be ecologically important and sensitive on a landscape scale, due to the protection status of the tributaries and size and rarity thereof in the local setting. Furthermore, the wetland vegetation type associated with the investigation area (according to NFEPA, 2011) is considered to be critically endangered and the entire drainage network in the investigation area is classified as an ESA 1 (WCBSP, 2017). Due to the locality of the tributaries within private fenced of farm properties, consequently, the tributaries system has remained largely undisturbed (with the exception of isolated areas being grazed by livestock) and is therefore important in terms of biodiversity value. The hydro-functional importance of the tributaries are considered moderate, through the recharge of the downstream ephemeral rivers, while the direct human benefits are considered to be low.

REC Category and RMO

REC: Category B (Largely natural with few modifications)
BAS: Category B
RMO: A/B (Improve)

Since these tributaries are classified as ESA 1 and are considered of high Ecological Importance and Sensitivity (EIS), the Recommended Management Objective (RMO) is to, at minimum, maintain these tributaries in their current ecological state, but it is recommended that small scale rehabilitation of areas which may potentially be impacted by the proposed development (such as road crossings) be undertaken. Additionally, it must be ensured that no edge effects from surface infrastructure proposed as part of the proposed development (such as the pylons or service roads) that may be located within close proximity to the tributaries, enter these systems.

Watercourse characteristics:

b) Hydraulic regime

Despite a relatively large drainage network (consisting of upstream episodic drainage lines) associated with these tributaries, most of these tributaries only convey water during the wet season and do not consist of water bearing strata with the capacity to store and then to convey water to the downstream ephemeral rivers. As such, discharge into the larger tributaries from the episodic drainage lines are highly variable due to the seasonal nature of the rainfall of the area. When flow occurs within the tributaries, it occurs as a high flow event, which can result in erosion of the stream banks.

Notwithstanding several informal road crossings, the hydrological connectivity and functionality of the tributaries are considered intact.

d) Water quality

No surface water was present within the tributaries during the site assessment; thus, no water quality parameters could be measured. Nevertheless, due to the relatively remote locality the tributaries and the low degree of catchment transformation, it can be concluded that if surface water is present, the water quality is likely to be good, with limited impacts from pollutants.

e) Habitat and biota

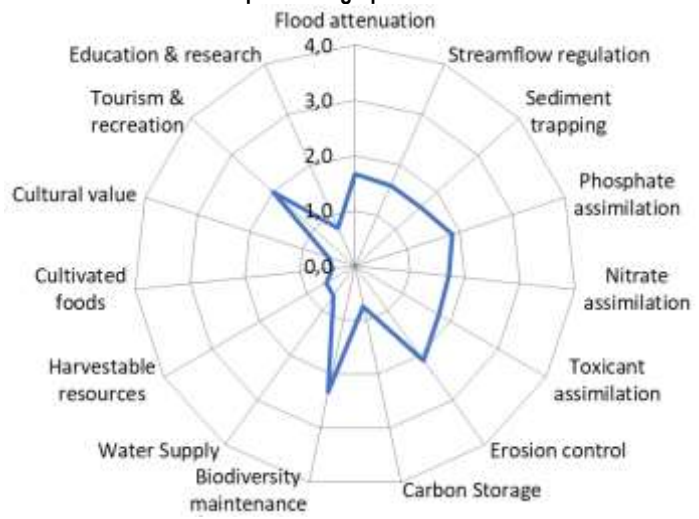
The ephemeral tributaries are characterised by riverine terraces and ridges supporting a variety of macrophytic vegetation, marginal reed belts as well as riverine thickets (comprising low growing trees and shrubs). The vegetation component of the tributaries is considered intact. Due to the seasonal nature of the tributaries, they do not retain water for long enough periods of time to provide breeding and foraging habitat for aquatic macro-invertebrates or avifaunal species. However, it does provide migratory connectivity as well as sheltered nesting habitat for terrestrial avifaunal species. The presence of the existing roads crossing several of the ephemeral tributaries has resulted in the loss of riparian vegetation and invasion of alien and invasive species in the immediate upstream and downstream area of the crossings. Very few alien or invasive vegetation species were noted within the reaches of the tributaries investigated during the site assessment, however within the footprint area of the crossings, alien vegetation species were noted where disturbances (such as the road crossings) occurred.

f) Geomorphology and sediment balance

These tributaries are characterised by rocky embankments and a shallow layer of alluvial soils over a solid rock bed. Erosion was noted in areas where a high drop has formed, where water drops into a section of the active channel not underlain by bedrock. Where roads traverse some of these tributaries, erosion was noted, however this is not considered significant. As surface water is only present during and after rainfall events, sand and sediment are transported downstream during high flood periods. Thus, the sediment load of the tributaries is deemed to be high (albeit natural) during flood events.

Extent of modification anticipated	**Minimal** Some modification is anticipated to the extent of the tributaries. This is attributed to the construction of the grading/upgrading of existing road crossings through the watercourses, changes to flow pattern and timing in the tributaries will need to be monitored to ensure that the hydrological connectivity of the tributaries are not adversely affected. It is assumed that no power line pylons will be constructed within the delineated extent of the tributaries. Nevertheless, the recommend mitigation measures must still be implemented to mitigate any potential indirect impacts.	
Impact Significance:	**Low** (with the implementation of mitigation measures)	No power line pylons may be constructed within the delineated extent of the ephemeral tributaries, however, existing roads traversing some tributaries may be upgraded that will traverse these tributaries. Such activities were identified to pose a negative medium impact to the tributaries without the implementation of mitigation measures. Should road grading/upgrading only occur within the dry period (that will not require any kind of diversion of flow) and the recommended mitigation measures be applied, the impact significance can be reduced to a low negative impact.

Table 8: Summary of results of the assessment of the episodic drainage lines associated with the proposed development.

<table>
<tr><td>Ecological & socio-cultural service provision graph:
 
</td><td> 
Figure 18: Representative photographs of the episodic drainage lines. These drainage lines are clearly defined by an unvegetated channel of exposed bedrock. No significant change between the vegetation associated with the edge of the drainage line channel to that of the surrounding terrestrial area is evident.</td></tr>
<tr><td>VEGRAI discussion</td><td>Ecoservice provision</td></tr>
<tr><td>VEGRAI Category: B/C (Largely natural with few modifications)
These EDLs are located in the landscape where runoff flows as surface water over impermeable bedrock at the point of outcropping. The vegetation cover within the immediate vicinity of the EDLs (along its active channel) remains fairly intact and indicative of the natural species composition expected of the vegetation type, however some invasive species were present in areas where disturbance has occurred (i.e. road crossings, instream impoundments). The informal road crossings which traverse some of the EDLs have resulted in localised incidences of increased sediment inputs and altered flow patterns during rainfall events, which has altered the overall ecological integrity of these features, albeit limited in extent.</td><td>Ecoservice Provisioning: 1,4 (Intermediate)
Due to the episodic nature of these EDLs, their capacity to provide certain ecological services is considered reduced, although this is counteracted by the relative ecological integrity of the EDLs which increases its overall functionality. Due to their high degree of connectivity to other natural areas, these EDLs are ecologically important in terms of providing mitigatory corridors and habitat for a variety of biota. The EDLs are not considered important for harvestable resources or cultivated foods, mainly due to it being located in a natural water scarce region and within an area utilised for recreational purposes.</td></tr>
<tr><td colspan="2">EIS discussion</td></tr>
<tr><td colspan="2">EIS Category: High
The EDLs are considered of ecological importance on a landscape scale, primarily due to the wetland vegetation type associated with the investigation area (according to NFEPA, 2011) which is considered to be critically endangered and the entire drainage network in the investigation areas is classified as an ESA 1 (WCBSP, 2017). Even though modifications to these EDLs have occurred, it still provides habitat to a variety of biota, given the high degree of connectivity of these features with the surrounding landscape.</td></tr>
</table>

<table>
<tr><th colspan="4">REC Category and RMO</th></tr>
<tr><td colspan="4">REC: Category B (Largely natural with few modifications)
BAS: Category B
RMO: A/B (Improve)

Since these EDLs are classified as ESA 1 and are considered of high Ecological Importance and Sensitivity, the Recommended Management Objective (RMO) is to, at minimum, maintain these EDLs in its current ecological state, as any potential impacts my also impact cumulatively on the downstream tributaries and ephemeral rivers. Whilst some modifications to the overall drainage system have occurred as a result of historical livestock grazing, road crossings or instream impoundments, further degradation of these drainage lines should not be permitted. It is recommended that small scale rehabilitation of areas which may potentially be impacted by the proposed development (such as road crossings or pylons within close proximity to the EDLs) be undertaken. Additionally, it must be ensured no edge effects (such as sediment laden stormwater runoff) from surface infrastructure (such as the pylons or service roads) as part of the proposed development that may be located within close proximity to the EDLs, enters these systems.</td></tr>
<tr><th colspan="4">Watercourse characteristics:</th></tr>
<tr><td colspan="2">a) Hydraulic regime

These EDLs arise from the mountainous areas located south of the investigation area. Most of the assessed EDLs are considered part of the headwaters of the overall drainage systems in the local area. Road crossings and small instream impoundments within the EDLs have resulted in small changes to existing flow patterns. However, overall, changes to the hydrological functioning of the EDLs are not pronounced and allow for uninterrupted hydrological functionality of the downstream systems.</td><td colspan="2">b) Water quality

No surface water was present in the EDLs during the site assessment; thus, no water quality parameters could be measured. Nevertheless, due to the relatively remote locality the drainage lines and the low degree of catchment transformation, it can be concluded that if surface water is present, the water quality is likely to be good, with limited impacts from pollutants.</td></tr>
<tr><td colspan="2">c) Geomorphology and sediment balance
The geomorphology of the upstream reaches of the EDLs are largely intact. Some erosion of the downstream reaches of the EDLs just below the instream impoundments and at road crossings were noted, however, it is not considered significant. Despite erosion noted within isolated areas of the EDLs, no significant deposition of sediment was observed.</td><td colspan="2">d) Habitat and biota
Although not necessarily large enough by themselves to support significant populations of fauna, habitat along the EDLs remains largely intact and representative of the natural vegetation type. The vegetation associated with the EDLs are predominantly short growing shrubs, but no facultative vegetation species were identified within these EDLs. It is thus deemed likely that the EDLs do provide important refuge and migratory corridors for smaller mammals and avifauna, but lack in adequate provision for aquatic habitat and thus biota.</td></tr>
<tr><td>Extent of modification anticipated</td><td colspan="3">Minimal
Some modification is anticipated to the extent of the EDLs. This is attributed to the grading/upgrading of existing road crossings through the watercourses, upgrading of the existing road crossings, changes to flow pattern and timing in the EDLs will need to be monitored to ensure that the hydrological connectivity of the EDLs are not adversely affected. Should road grading/upgrading only occur within the dry period (that does not require diversion of flow) that would cross the EDLs and the recommended mitigation measures be applied, the impact significance can be reduced to a low negative impact.</td></tr>
<tr><td>Impact Significance:</td><td>Low
(with the implementation of mitigation measures)</td><td colspan="2">No power line pylons may be constructed within the delineated extent of the EDLs, however, existing roads traversing some EDLs may be upgraded. Such activities were identified to pose a negative medium impact to the EDLs without the implementation of mitigation measures. Should road upgrading/grading activities be constructed only within the dry period (that will not require any kind of diversion of flow) that would cross the EDLs and the recommended mitigation measures be applied, the impact significance can be reduced to a low negative impact.</td></tr>
</table>

All comprehensive results calculated are available in **Appendix D.**

6.2 LEGISLATIVE REQUIREMENTS & SENSITIVITY MAPPING

The following legislative requirements were considered during the assessment. A detailed description of these legislative requirements is presented in **Appendix B** of this report:

- The Constitution of the Republic of South Africa, 1996[10];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

It is important to note that in terms of the definition of a watercourse as per the NWA (See **Appendix B**), all of the natural watercourses associated with the proposed development (including the ephemeral rivers and tributaries with riparian vegetation and the episodic drainage lines with no riparian vegetation) will be regulated in terms of Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) as well as the applicable zones of regulation. All the natural watercourses will thus require further authorisation from the Department of Environment, Forest and Fisheries (DEFF)) and the Department of Water and Sanitation (DWS). This report aids in providing relevant information for these authorisation processes.

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on watercourses arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted, however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

The definition and motivation for a regulated zone of activity for the protection of the assessed watercourses can be summarised in Table 9 that follows.

[10] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

Table 9: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998). **Department of Water and Sanitation (DWS)**	**Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), a regulated area of a watercourse in terms of water uses as listed in Section 21c and 21i is defined as: • the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the **absence of a determined 1 in 100-year flood line or riparian area the area within 100 m from the edge of a watercourse** where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a 500m radius from the delineated boundary (extent) of any wetland or pan in terms of this regulation.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended. **Department of Environment, Forestry and Fisheries**	Activities of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) **Activity 12**: *The development of:* *(xii) Infrastructure or structures with a physical footprint of 100 square meters or more;* *Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse.* **Activity 19:** *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from –* *(a) a watercourse* **Activity 48**: *The expansion of-* *(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs—* *(a) within a watercourse; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* Activities of Listing Notice 3 (GN 324) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) **Activity 14:** *The development of –* *(ii) infrastructure or structures with a physical footprint of 10 square metres or more;* *Where such development occurs-* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse* *Associated with the Northern and Western Cape:* Outside urban areas:

Regulatory authorisation required	Zone of applicability
	(aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) World Heritage Sites; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Sites or areas identified in terms of an international convention; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Core areas in biosphere reserves; (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; **Activity 18:** *The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometer-* *Associated with the Northern Cape* *Outside urban areas:* *(ii) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.*

A 32 m Zone of Regulation (ZoR) in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) and in the absence of a defined 1 in 100 year flood line, a 100 m Zone of Regulation in accordance with Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) were applied to the ephemeral rivers and tributaries with riparian vegetation and the episodic drainage lines with no riparian vegetation associated with the proposed development (Figures 19 to 21). The proposed power lines will be routed over several watercourses. Should pylons be located within the 100 m GN509 regulated area, a Water Use Authorisation (WUA) from the DWS is required prior to commencement of any construction. As access roads will be constructed as part of the power line development (although no layout provided as part of this assessment), based on the outcome of the assessment for access roads for the Oya/Kudusberg WEF (FEN Consulting, 2020[11]), should these road be developed during the direst period of the year and the recommended mitigation measures be implemented, development of new roads is expected to pose Low risk significance and a Water Use Authorisation by means of a General Authorisation in terms of Section 21(c) and (i) water uses may potentially be obtained in consultation with the DWS.

[11] FEN Consulting. 2020. Freshwater ecological assessment as part of the water use authorisation process for the proposed 325 Mw Kudusberg Wind Energy Facility (WEF) and associated infrastructure between Sutherland and Matjiesfontein in the Western and Northern Cape Provinces. October 2020. Report Reference nr. FEN 21-0056

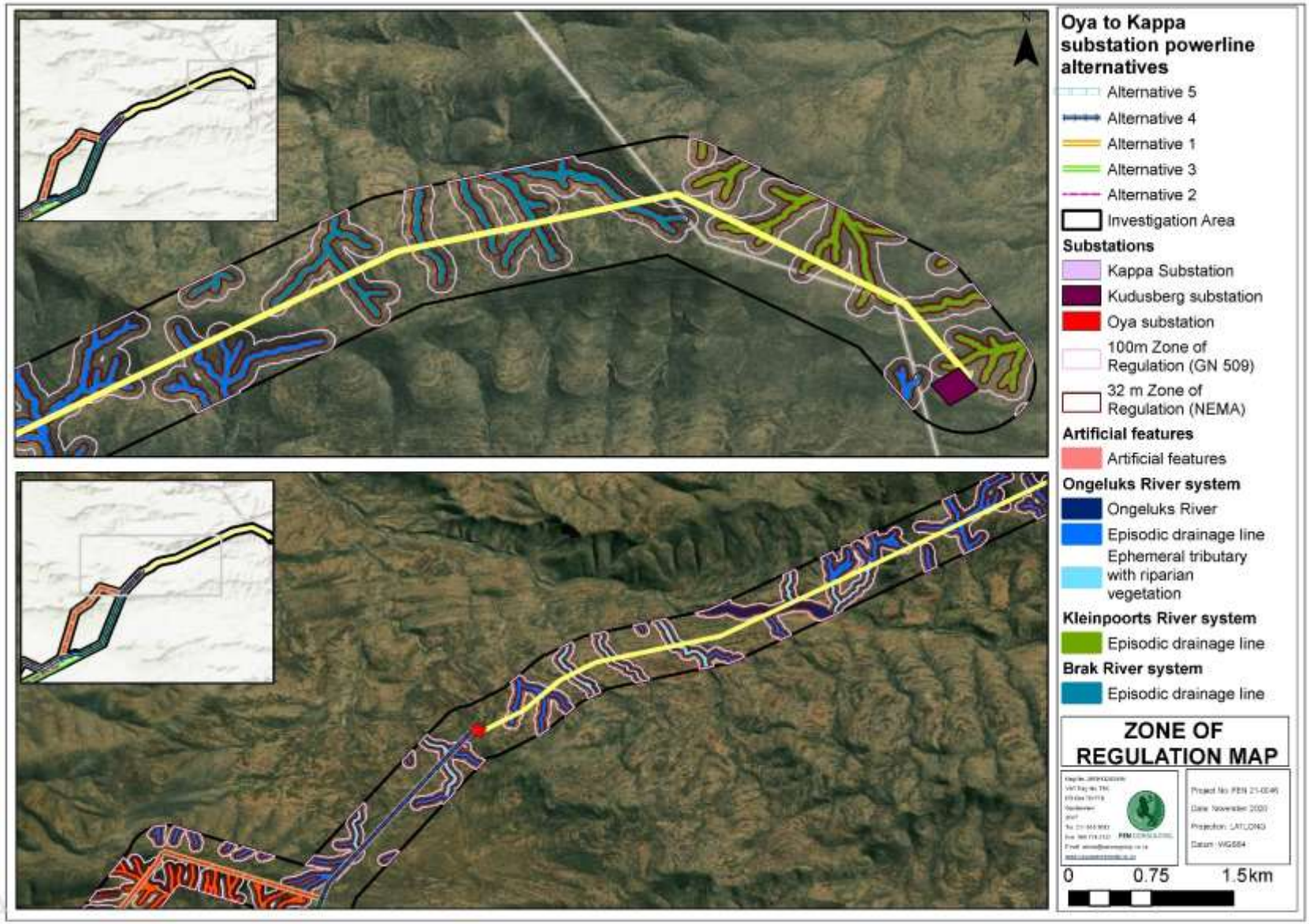


Figure 19: The conceptual presentation of the zones of regulation in terms of GN509 of 2016 as it relates to the NWA and the NEMA in relation to the delineated watercourses associated with the northern portion of the investigation area.

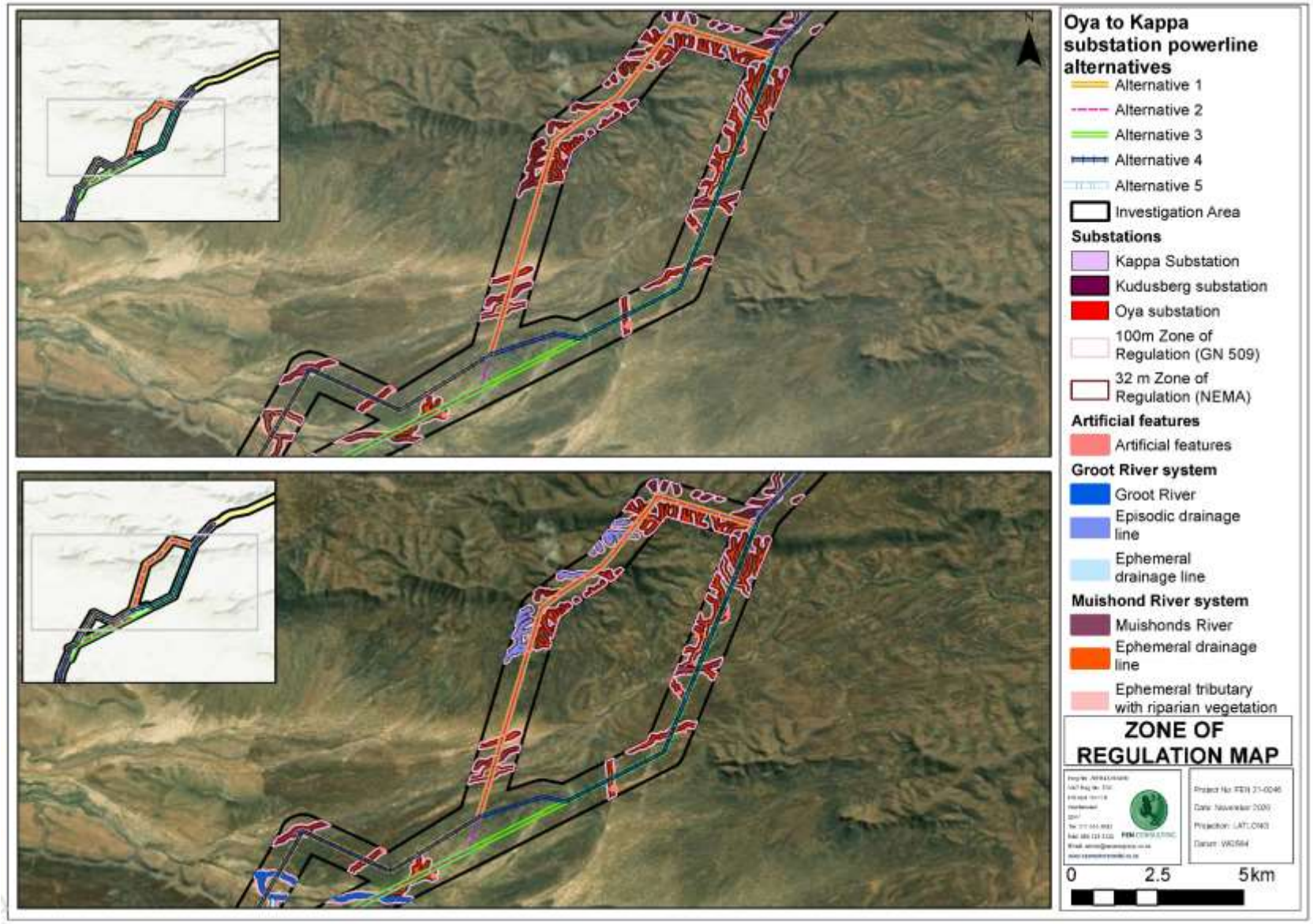


Figure 20: The conceptual presentation of the zones of regulation in terms of GN509 of 2016 as it relates to the NWA and the NEMA in relation to the delineated watercourses associated with the central portion of the investigation area.

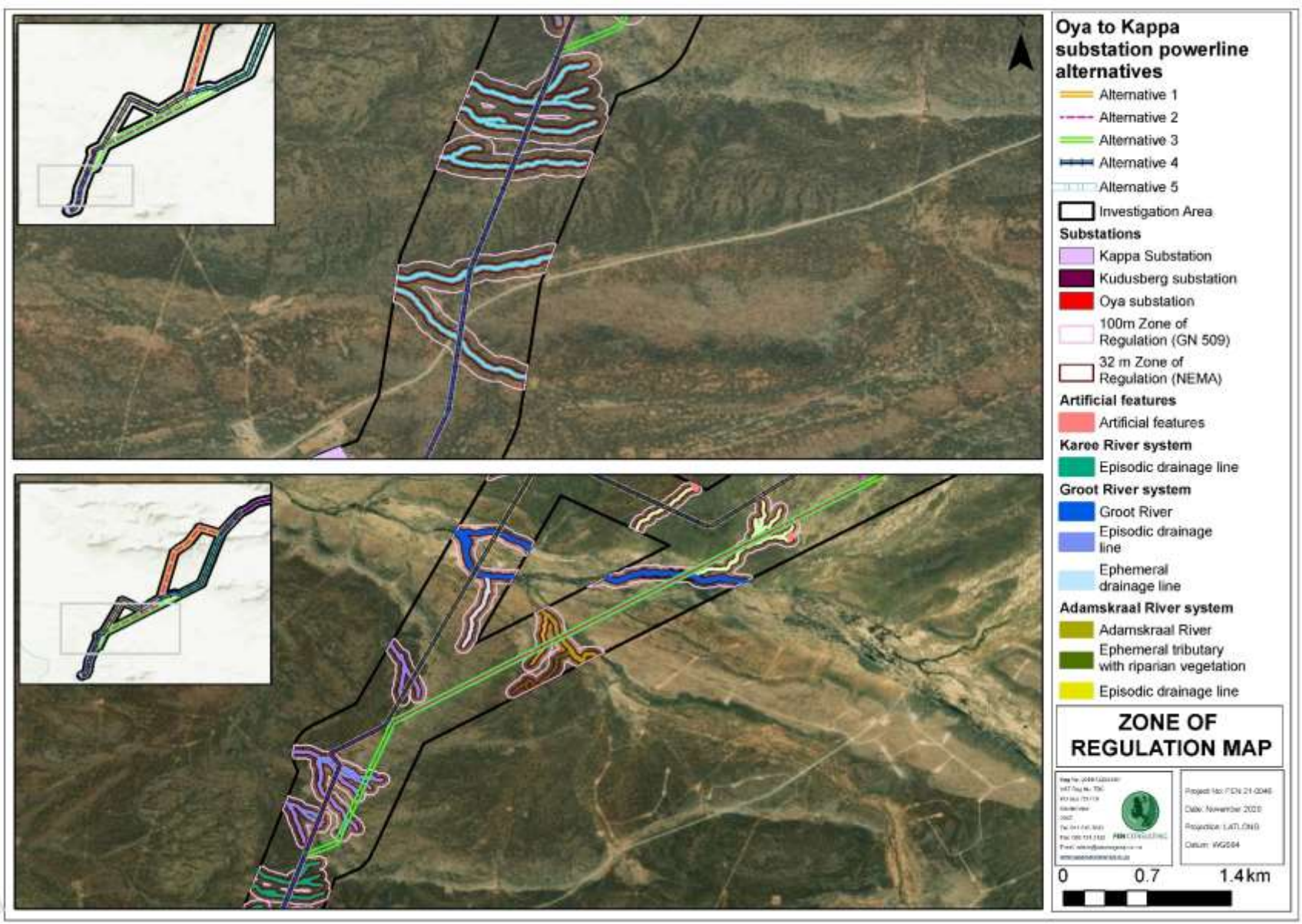


Figure 21: The conceptual presentation of the zones of regulation in terms of GN509 of 2016 as it relates to the NWA and the NEMA in relation to the delineated watercourses associated with the southern portion of the investigation area.

6.3 DWS Risk Assessment

This section presents the significance of potential impacts on the ecology of the identified watercourses associated with the proposed development. In addition, it also indicates the recommended mitigatory measures needed to minimise the perceived impacts of the proposed development and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures.

6.3.1 Risk Assessment considerations and outcome

Following the assessment of the watercourses associated with the proposed development, the impact assessment was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the identified watercourses. The impact assessment was undertaken for the proposed layout as provided by the proponent and as described in Section 3 of this report and presented in Figure 1. The points below summarise the considerations made when applying the impact assessment:

- The risk assessment was applied considering the risk significance of the proposed surface infrastructure components, as described in Section 3 and depicted in Figure 1. Due to the similar areas the proposed power line alternative routes will be routed through (i.e. all power line alternative routed will be routed through mountainous areas traversing headwater EDLs and traversing tributaries and rivers within the lower laying southern area towards the Kappa Substation), the risk assessment was applied once for all the proposed alternatives. A comparative assessment of the proposed power line alternatives is provided in Section 7 which considered the outcome of the risk assessment;
- At the time of this assessment the layout for any access roads to the proposed power line and substations (potential new and those requiring upgrading) was not available. As such, it is assumed that the existing informal farm roads will be used as access roads. It is assumed that these roads will be used as is or will be graded (but the width of the roads will remain the same) to accommodate construction vehicles. No formal construction of roads, widening of roads, use of tar or concrete, was considered as part of this risk assessment;
- Although the preferential flow paths are not considered true watercourses, the potential risk significance of the proposed development was nevertheless included in the DWS Risk Assessment as these features are linked to natural watercourses;
- The risk assessment was applied assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report present the perceived impact significance post-mitigation;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the Department of Environment, Forestry and Fisheries (DEFF) *et a*l (2013) would be followed, i.e. the impacts would first be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required. In this regard, the risk assessment was undertaken assuming that the location of the proposed power line pylons and substation sites will be located at least 32 m (outside the 32 m regulated zone in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998)) from the delineated extent of a watercourse. This will conform to the mitigation hierarchy of the DEFF *et a*l (2013), to avoid significant impacts to the watercourses;
- Since it is expected that the 100 m GN509 ZoR cannot be avoided for the placement of pylons, the legal issues for the construction of pylons were scored a maximum value of “5”;
- The activities relating to the proposed development are all highly site specific, not of a significant extent relative to the area of the watercourses assessed, and therefore have a limited spatial extent;
- While the operation of the proposed power line and substations will be a permanent activity, the installation thereof is envisioned to take no more than a few months. However, the frequency of the construction impacts may be daily during this time;
- Most impacts are considered to be easily detectable; and

- The considered mitigation measures are easily practicable.

Table 10 below provides a summary of the outcome of the DWS Risk Assessment for the above-listed activities, based on the method presented in **Appendix D**. All general good housekeeping mitigation measures and the full risk assessment scoring is provided in **Appendix F**.

Table 10: Summary of the results of the DWS risk assessment applied to the watercourses which may potentially be impacted by the proposed development.

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
1	Construction Phase	Site preparation prior to construction activities.	Vehicular movement (transportation of construction materials)	*Loss of watercourse vegetation, associated habitat and ecosystem services; *Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and *Soil and stormwater contamination from potentially spilled oils and hydrocarbons originating from construction vehicles.	1,25	3,25	3	42,25	L	It is assumed that the proposed power line pylons and substations will be located outside of the watercourses and at least 32m from the delineated edge of a watercourses – this in itself is considered a mitigation measure, which entails no direct negative impacts from occurring on the watercourses. Nevertheless, the following mitigation measure must be implemented: *It is imperative that all construction works (with specific mention of creating new watercourse crossings) be undertaken during the driest period of the year when the flow is very low in the watercourses and use of informal road crossings will have a limited impact; *Due to the accessibility of the sites, no unnecessary crossing of the watercourses by machinery or construction vehicles may be permitted. Use must be made of existing watercourse crossing to access the project sites. This will limit edge effects, erosion and sedimentation of the watercourses during the construction phase; *The reaches of the watercourses where no activities are planned (i.e. no pylons and no spanning of the power line over the watercourse) must be considered no-go areas; *Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the watercourses and their associated 32 m NEMA Zone of Regulation (ZoR); *Removed vegetation must be stockpiled outside of the delineated boundary of the watercourse, if possible. Should it not be possible, the removed vegetation may be stockpiled in the watercourse, for the duration of the construction period. The footprint areas and height of these stockpiles should be kept to a minimum. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.
2			Removal of vegetation and associated disturbances to soils, and access to the site, including grading of existing informal farm roads.	*Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream watercourse areas; *Exposure of soils, leading to increased runoff, and erosion, and thus increased sedimentation of the watercourses; *Increased sedimentation of the watercourses, leading to smothering of vegetation associated in the watercourses; and *Proliferation of alien and/or invasive vegetation as a result of disturbances.	1,25	3,25	14	45,5	L	

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
3		Installation of the pylons (further than 32m but within 100 m of the delineated watercourses) and spanning of the proposed power line.	*Excavation of pits for the pylons leading to stockpiling of soil; *Potential movement of construction equipment and personnel in the areas surrounding watercourses.	*Disturbances of soils leading to potential impacts to the watercourse vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered watercourse habitat; *Altered runoff patterns, leading to increased erosion and sedimentation of the watercourses.	1,25	3,25	14	45,5	L	*Excavation of pits for the pylon foundation may result in loose sediments within the landscape, specifically if works are taken during a period of rainfall (if applicable). As such, sediment traps should also be installed downstream/downgradient of the construction area. Sediment traps can be created by pegging an appropriate geotextile across the entire width of the work area at the specified pylon, held down by cobbles/boulders or by geotextile wrapped hay bales spanning the width of the work area and staked into position; *During excavation of the pits, soils must be stockpiled upgradient of the excavated pit. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum. These soils must be used to close off the pits, immediately after installation of the pylon; *Material used as bedding material (at the bottom of the excavated pit) should be stockpiled outside of the 32m NEMA ZoR and as close as possible to the pylon footprint area. Once the pit has been excavated, the bedding material should directly be placed within the pit, rather than stockpiling it alongside the pit; *When the power line is strung between the pylons, no vehicles my indiscriminately drive through the watercourses, use must be made of the dedicated access roads. <u>Control measures for concrete mixing on site:</u> *No mixed concrete may be deposited outside of the designated construction footprint; *As far as possible, concrete mixing should be restricted to the contractor laydown area. Additionally, batter / dagga board mixing trays and impermeable sumps should be provided, onto which any mixed concrete can be deposited while it awaits placing; and

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
4			Mixing and casting of concrete for foundations.	*Potential contamination of surface water (if present).	1,25	3,25	14	45,5	L	*Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site. <u>With regards to backfilling of the concrete encasing:</u> *Soils removed for excavating the pit should be used as backfill material; All excavated pits must be compacted to natural soil compaction levels to prevent the formation of preferential surface flow paths and subsequent erosion. Conversely, areas compacted as a result of construction activities (within the 5 m buffer zone) must be loosened to natural soil compaction levels; *Any remaining soils following the completion of backfilling of the pits are to be spread out thinly surrounding the installed pylon (outside watercourses) to aid in the natural reclamation process; and *The construction footprint must be limited to the pit area and an additional 5 m buffer (to allow for the stockpiling and movement of personnel). The area must be rehabilitated after the completion of the construction phase, including revegetation thereof with indigenous vegetation. In addition, alien vegetation eradication of the footprint area must be undertaken. <u>Pylons located within preferential flow paths (PFPs) (it must be noted that PFPs are not considered true watercourses):</u> *Should pylons be located in or near preferential flow paths[12], all mitigation measures as listed in this table is applicable; *It is recommended that gabions be installed around the pylon footprint, as depicted in Figure 22 below. Figure 22 depicts an existing power line (power line alternative 2/3/5 proposed to be constructed along this existing power line alignment) within an area hosting PFPs. This allows for surface water to freely drain through the landscape but also protects the base of the pylon from potential erosion.

[12] Preferential flow paths also lack riparian and wetland characteristics and may potentially only convey surface water for a short period of time after rainfall events. Thus, these features are not considered of ecological importance but contributes to the hydrological functioning of the drainage systems at large. The PFP cannot be considered as watercourses and may potentially only enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998) should a floodline be applicable to these features.

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
										 **Figure 22: Photograph depicting a pylon located within an area hosting preferential flow paths. The gabion structures around the base of the pylon prevents erosion.**
5	**OPERATIONAL PHASE**	Operation and maintenance of the power line and substations	*Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses; *Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff	*Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; *Altered water quality (if surface water is present) as a result of increased availability of pollutants	1	3	12	36	L	*Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the watercourses may be permitted; *During periodic maintenance activities of the power line and substations =, monitoring for erosion should be undertaken with specific mention investigating the pylons located near areas hosting preferential flow paths; *Should erosion be noted at the base of the pylon that may potentially impact on a watercourse in the surrounding area, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation; *Monitoring for the establishment for alien and invasive vegetation species must be undertaken, specifically for access roads through or along the watercourses used to service the power line and substations. Should alien and invasive plan species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation.

	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
			from the access roads							

The activities associated with the construction and operational phases of the proposed development based on the alignment provided by the proponent, includes site preparation, excavation of pits installation of the pylons at least 32 m from the delineated extent of watercourses, poses a Low risk significance to the watercourses, with the implementation of the recommended mitigation measures. As such, all mitigation measures as stipulated in Table 10 above must be implemented to prevent any negative edge effects from occurring on the watercourses. Due to the similar areas the proposed power line alternative routes will be routed through (i.e. all power line alternative routed will be routed through mountainous areas traversing headwater EDLs and traversing tributaries and rivers within the lower laying southern area towards the Kappa Substation), all the proposed power line alternative routes are considered to pose a Low risk significance to the identified watercourses. A comparative assessment of the proposed power line alternatives is provided in Section 7 which considered the outcome of the risk assessment;

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, the significance of impacts arising from the proposed power line and substation development are likely to be reduced during the construction and operational phases assuming that a high level of mitigation takes place. Additional “good practice” mitigation measures applicable to a project of this nature are provided in **Appendix F** of this report.

6.4 Impact Assessment

The section presents the outcome of the impact assessment as provided by the proponent. Table 11 presents a summary of the expected impacts (direct and indirect) as part of the construction, operational and decommissioning phases, and includes the impact assessment summary for the ‘no-go’ impacts and cumulative impacts. All general good housekeeping mitigation measures and the full impact assessment scoring is provided in **Appendix F**.

Table 11: Summary of the outcome of the impact assessment considering the proposed development.

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION			RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION		
			TOTAL	STATUS	Significance		TOTAL	STATUS	Significance
Construction Phase									
Direct	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present), geomorphology, habitat and biota.	Potential direct impacts caused by site preparation activities such as the removal of vegetation and associated disturbances to soils, and access to the site, including grading of new and existing informal farm roads through watercourses. These activities result in the disturbance to habitat and loss of ecoservices.	27	Negative	Negative Medium impact	It is assumed that the proposed power line pylons and substations will be located outside of the watercourses and at least 32m from the delineated edge of a watercourses (thus outside the 32m NEMA ZoR) – this in itself is considered a mitigation measure, which entails no direct negative impacts from occurring on the watercourses. Nevertheless the following mitigation measure must be implemented: *It is imperative that all construction works be undertaken during the driest period of the year when the flow is very low in the watercourses and use of informal road crossings will have a limited impact; *Due to the accessibility of the sites, no unnecessary crossing of the watercourses may be permitted. This will limit edge effects, erosion and sedimentation of the watercourses during the construction phase; *New watercourse road crossings must be kept to a minimum, and may only be developed should existing road crossings not be feasible to use or to circumnavigate the watercourse. The road crossing must be kept as small as possible, only removing the required vegetation and preferably in an area where the channel is lined with solid bed rock (which will not erode); *The reaches of the watercourses where no activities are planned (i.e. no pylons and no spanning of the power line over the watercourse) must be considered no-go areas; *Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the watercourses and their associated 32 m NEMA Zone of Regulation (ZoR); *Removed vegetation must be stockpiled outside of the delineated boundary of the watercourse. The footprint areas and height of these stockpiles should be kept to a minimum. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.	16	Negative	Negative Low impact

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION			RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION		
			TOTAL	STATUS	Significance		TOTAL	STATUS	Significance
Indirect	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present) and geomorphology	Potential indirect impacts caused by site preparation activities (clearing areas for the installation of pylons outside the watercourses and its associated 32m NEMA ZoR) includes the disturbance of the natural buffer area surrounding the watercourses, potentially resulting dust creation, and decrease of surface roughness .	18	Negative	Negative Low impact	• It should be feasible to utilise existing roads to gain access to the proposed construction area. No indiscriminate crossing of the watercourses outside of the proposed crossing point or driving in unmarked areas through the buffer zones of the watercourses may be permitted. This will avoid any disturbance to the terrestrial vegetation; • No other terrestrial vegetation areas may be disturbed by the proposed construction activities for the surface infrastructure, other than the approved proposed footprint areas; and • After construction of the surface infrastructure, the area surrounding the surface infrastructure must be revegetated with suitable indigenous vegetation (terrestrial vegetation) to prevent the establishment of alien vegetation species and their potential spread into the watercourses.	8	Negative	Negative Low impact
Indirect	Watercourse drivers and receptors such as vegetation, geomorphology and sediment balance.	The installation of the pylons (including mixing and casting of concrete for foundations) and spanning of the proposed power line entails: *Excavation of pits for the pylons leading to stockpiling of soil; and *Potential movement of construction equipment and personnel in the areas surrounding watercourses. This may result in indirect impacts (since no pylons will be located directly within watercourses) such as: *Disturbances of soils leading to potential impacts to the watercourse vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered watercourse habitat; *Altered runoff patterns, leading to increased erosion and sedimentation of the watercourses.	18	Negative	Negative Low impact	*Excavation of pits for the pylon foundation may result in loose sediments within the landscape, specifically if works are taken during a period of rainfall (if applicable). As such, for activities specifically within close proximity to PFPs and upon recommendation of the ECO sediment traps should also be installed downstream/downgradient of the construction area. Sediment traps can be created by pegging an appropriate geotextile across the entire width of the work area at the specified pylon, held down by cobbles/boulders or by geotextile wrapped hay bales spanning the width of the work area and staked into position; *During excavation of the pits, soils must be stockpiled upgradient of the excavated pit. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum. These soils must be used to close off the pits, immediately after installation of the pylon. The stockpiles must remain as small; *; *Material used as bedding material (at the bottom of the excavated pit) should be stockpiled outside of the 32m NEMA ZoR and as close as possible to the pylon footprint area. Once the pit has been excavated, the bedding material should directly be placed within the pit, rather than stockpiling it alongside the pit; *When the power line is strung between the pylons, no vehicles my indiscriminately drive through the watercourses, use must be made of the dedicated access roads. <u>Control measures for concrete mixing on site:</u> *No mixed concrete may be deposited outside of the designated construction footprint; *As far as possible, concrete mixing should be restricted to the contractor laydown area. Additionally, batter / dagga board mixing trays and impermeable sumps should be provided, onto which any mixed concrete can be deposited while it awaits placing; and *Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site.	9	Negative	Negative Low impact

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION			RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION		
			TOTAL	STATUS	Significance		TOTAL	STATUS	Significance
						With regards to backfilling of the concrete encasing: *Soils removed for excavating the pit should be used as backfill material; All excavated pits must be compacted to natural soil compaction levels to prevent the formation of preferential surface flow paths and subsequent erosion. Conversely, areas compacted as a result of construction activities (within the 5 m buffer zone) must be loosened to natural soil compaction levels; *Any remaining soils following the completion of backfilling of the pits are to be spread out thinly surrounding the installed pylon (outside watercourses) to aid in the natural reclamation process; and *The construction footprint must be limited to the pit area and an additional 5 m buffer (to allow for the stockpiling and movement of personnel). The area must be rehabilitated after the completion of the construction phase, including revegetation thereof with indigenous vegetation. In addition, alien vegetation eradication of the footprint area must be undertaken. Pylons located within preferential flow paths (PFPs): *Should pylons be located in or near preferential flow paths, all mitigation measures as listed in this table is applicable; *It is recommended that gabions be installed around the pylon footprint, as depicted in Figure 23 in Table 10 above. Figure 23 depicts an existing power line (power line alternative 2/3/5 proposed to be constructed along this existing power line alignment) within an area hosting PFPs. This allows for surface water to freely drain through the landscape but also protects the base of the pylon from potential erosion.			
Operational Phase									

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION			RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION		
			TOTAL	STATUS	Significance		TOTAL	STATUS	Significance
Indirect	Watercourse drivers and receptors such as vegetation, geomorphology and sediment balance.	Operation and maintenance of the power line and substation may result in: *Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses; *Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the access roads. The expected impacts may potentially be: *Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; *Altered water quality (if surface water is present) as a result of increased availability of pollutants	18	Negative	Negative Low impact	*Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the watercourses may be permitted; *During periodic maintenance activities of the power line and substation, monitoring for erosion should be undertaken with specific mention investigating the pylons located near areas hosting preferential flow paths; *Should erosion be noted at the base of the pylon that may potentially impact on a watercourse in the surrounding area, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation; *Monitoring for the establishment for alien and invasive vegetation species must be undertaken, specifically for access roads through or along the watercourses used to service the power line and substation. Should alien and invasive plan species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation.	9	Negative	Negative Low impact
Decommissioning Phase									

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION			RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION		
			TOTAL	STATUS	Significance		TOTAL	STATUS	Significance
Direct	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present), geomorphology, habitat and biota.	Potential impacts that may result due to the decommissioning activities: • Clearing of habitat that has established in previous phases, resulting in a disturbed ecological structure; • Compaction and disturbance of soils due to decommissioning activities, making the impacted areas unfavourable for the establishment of vegetation and may allow opportunistic alien and invasive species to establish in the nearby watercourses; and • Movement of construction vehicles within the watercourses, disturbing established biota therein.	27	Negative	Negative Medium impact	• No indiscriminate movement of construction equipment in the watercourses and buffer zones surrounding the watercourses may be permitted. Use must be made of the existing roads during the decommissioning phase; • All surface infrastructure must be decommissioned. All materials must be removed and may temporarily be stockpiled outside the watercourses and its 32 m NEMA ZoR, where after is must be removed from site and disposed of at a registered disposal facility; • Should road crossings be decommissioned, road footprint areas within the watercourse must be levelled to the same level and shape as that of the upstream and downstream reaches. This will ensure a continuous bed level and prevent any concentration of surface flow from occurring; • Watercourse embankments must be suitably rehabilitated (shaped and revegetated) to prevent any erosion from occurring; • All infrastructure footprint areas must be ripped and be revegetated within suitable indigenous vegetation species; All areas revegetated must be monitored until suitable basal cover has been re-established. Follow up revegetation should take place in areas where initial revegetation is not successful; • It is recommended that a Watercourse Rehabilitation and Management Plan be compiled and implemented once the layout plan has been finalised. Implementation must be overseen by a suitably qualified Environmental Control Officer (ECO) and the ECO must sign off the rehabilitation before the relevant contractors leave site; and • Post-closure monitoring of the watercourses (for a period of 3 years), with specific mention of the invasion of alien vegetation species) is recommended to be undertaken.	16	Negative	Negative Low impact
Cumulative Impact Assessment									
Direct	Drainage system habitat integrity and hydrological functioning	• Loss of watercourse vegetation and subsequent habitat, due to watercourse road crossings and regular movement of vehicles within the surrounding area of the watercourses • Changes to flow, pattern and timing of surface water in the drainage system due to land use changes in the catchment (albeit limited due to the limited footprint of a power line and substation), potentially resulting in changes to the hydrological regime of the larger downstream watercourses.	36	Negative	Negative Medium impact	• The mitigation measures pertaining to the grading roads or upgrading of existing informal roads must be adhered to, specifically to avoid erosion and only allow road crossings where authorised; • Continuous and more frequent use of the roads and movement within the watercourses and surrounding buffer areas during the life of the proposed development may compromise the integrity of the watercourses. As such it is highly recommended that a Watercourse Maintenance and Management Plan (WMMP) be implemented, to avoid any unnecessary impacts and to ensure adequate mitigation of activities that may directly impact on the watercourses, in order to avoid extensive cumulative impacts from occurring. This WMMP must detail: o Alien and invasive plant species control; o Sediment and erosion control; and o Hydrological connectivity.	20	Negative	Negative Low impact

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION			RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION		
			TOTAL	STATUS	Significance		TOTAL	STATUS	Significance
"No-Go Impact"									
NA	No-Go Alternative (the option of not fulfilling the proposed project)	This option would result in no environmental impacts and thus no impacts to the watercourses in the investigation area from the proposed power line and substation development on the site or surrounding local area. Implementing the no-go option would entail no development.	5	Positive	Positive Low Impact	Since no activities will be constructed or operated, no mitigation measures can be applied.	5	Positive	Positive Low Impact

6.4.1 Cumulative Impact Assessment

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Section 6.4 above. Watercourses within the region are under continued threat due to rapid land use transformation in the surrounding landscape.

The outcome of the Cumulative Impact Assessment is presented in Table 11 above. Direct and indirect impacts to the watercourses resulting from future existing and proposed renewable energy facilities (REF) and associated grid connection infrastructure (Table 12 and Figure 23) include an increase in alien and invasive species entering the watercourses due to regular disturbance of soils and removal of indigenous vegetation. This results in greater inputs of sediment, and nutrients from runoff that are of higher concentrations in surface runoff which enters the larger drainage systems. The impacts on the watercourses associated with the proposed development are likely to add to the cumulative impact on the loss of freshwater habitat within the region, specifically given the proposed REFs (including associated power lines) within a 35 km radius of the proposed development (Table 12). Since no pylons and substation sites as part of the proposed development are likely to encroach on the watercourses (as it is assumed that the pylons and substations will be located outside the delineated extent of watercourses and its 32m NEMA ZoR) and the grading of existing road crossings will result in direct impact, the contribution to the cumulative impacts are deemed Negative Low with the implementation of the recommended mitigation measures (refer to Table 11).

Most anticipated impacts to the watercourses associated with the proposed development are indirect, with the exception of the road upgrading/new road development activities for watercourse road crossings. With management and mitigation measures implemented during the construction phase and monitoring of alien and invasive plant species in the watercourses the impacts from the proposed development can further be reduced, thus no significant cumulative contribution to the above mentioned impacts is considered likely.

It is important to note however that the study area is located within the REDZ 2, known as Komsberg REDZ, and also within a Strategic Transmission Corridor and thus the relevant authorities support the concentration of renewable energy developments and associated power line infrastructure in this area.

Table 12: Renewable energy developments and associated grid connection infrastructure (where applicable) identified within a 35km radius of the proposed development

Applicant	Project	Technology	Capacity	Status of Application / Development
Oya Energy (Pty) Ltd	Oya Energy Facility	Hybrid	305MW	EIA Process underway
Brandvalley Wind Farm (Pty) Ltd	Brandvalley WEF	Wind	140MW	Approved
Biotherm Energy (Pty) Ltd	Esizayo WEF	Wind	140MW	Approved
African Clean Energy Developments Renewables	Hidden Valley (Karusa & Soetwater) WEF	Wind	140MW	Under Construction
Karreebosch Wind Farm (Pty) Ltd	Kareebosch WEF	Wind	140W	Approved
Rondekop Wind Farm (Pty) Ltd	Rondekop WEF	Wind	325MW	Approved
Kudusberg Wind Farm (Pty) Ltd	Kudusberg WEF	Wind	325W	Approved
South Africa Mainstream Renewable Power Perdekraal West (Pty) Ltd	Perdekraal West WEF & Associated Grid Connection Infrastructure	Wind	150M	Approved
South Africa Mainstream Renewable Power Perdekraal East (Pty) Ltd	Perdekraal East WEF & Associated Grid Connection Infrastructure	Wind	110MW	Operational
Rietkloof Wind Farm (Pty) Ltd	Rietkloof WEF	Wind	186MW	Approved

Applicant	Project	Technology	Capacity	Status of Application / Development
Roggeveld Wind Power (Pty) Ltd	Roggeveld WEF	Wind	140MW	Under Construction
ENERTRAG SA (Pty) Ltd	Tooverberg WEF & Associated Grid Connection Infrastructure	Wind	140MW	Approved

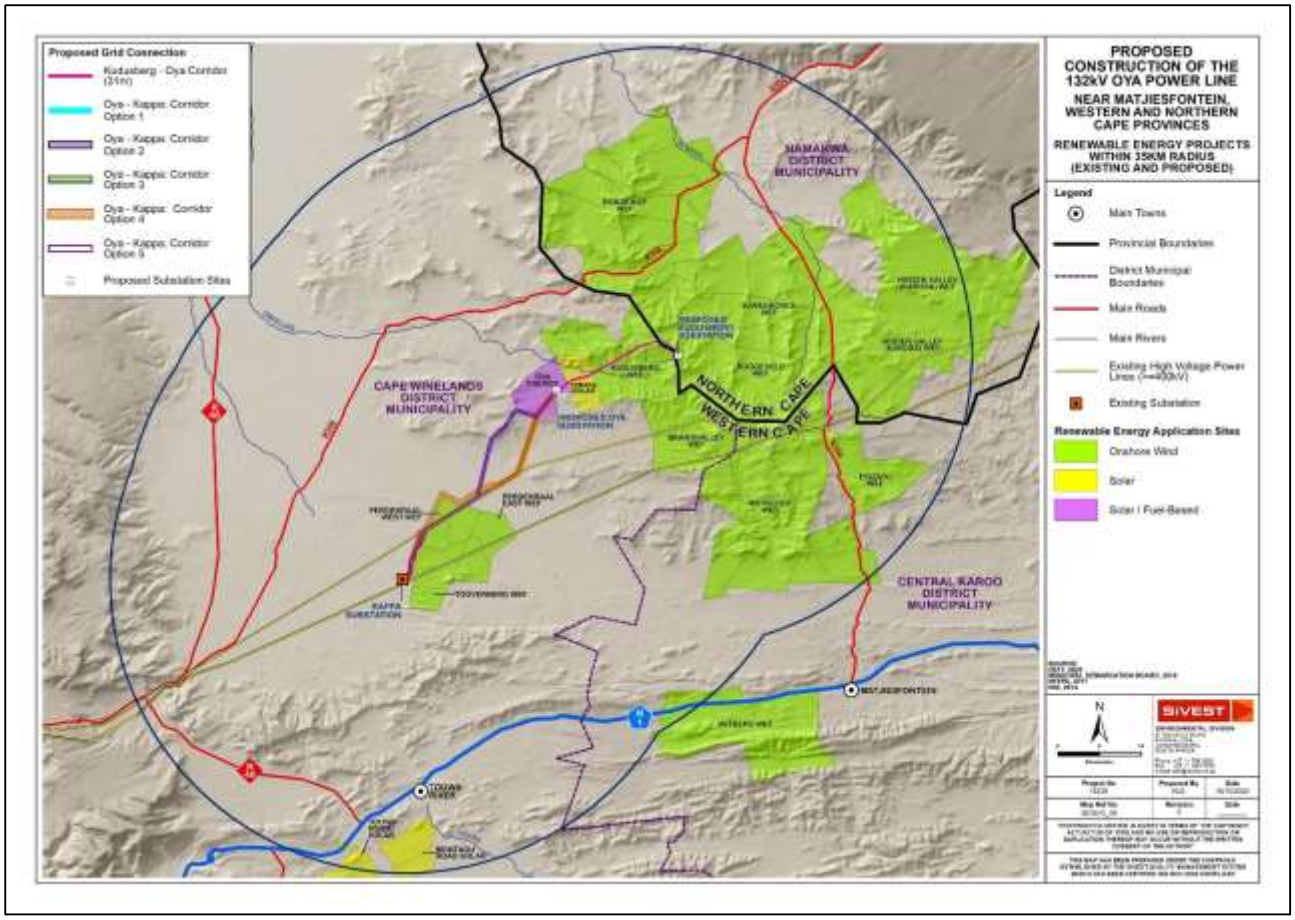


Figure 23: Renewable energy developments identified within a 35 km radius of the proposed development.

6.5 Recommendations / Conditions / Measures to be included in EMPr / EA

Based on the outcome of the risk and impact assessments as per Section 6.3 and 6.4 above, a list of key mitigation measures is provided below which must be implemented to prevent any direct or indirect negative impacts from occurring on the watercourses associated with the proposed development. Required monitoring actions are presented in Table 13 that follows.

- It is recommended that the power line pylons and substation infrastructure will be located outside of the watercourses and at least 32 m from the delineated edge of a watercourses, this would avoid direct negative impact to the watercourses;
- Use must be made of existing informal roads to access the construction site and for use during the operational phase. Only where it's not possible to circumnavigate watercourses, new watercourses crossings may be made. These watercourses crossings must be kept as small as possible;

Construction phase:

- It is imperative that all construction works (with specific mention of creating new watercourse crossings) be undertaken during the driest period of the year when the flow is very low in the watercourses and use of informal road crossings will have a limited impact;
- Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the watercourses and their associated 32 m NEMA Zone of Regulation (ZoR);
- Removed vegetation must be stockpiled outside of the delineated boundary of the watercourse, if possible. Should it not be possible, the removed vegetation may be stockpiled in the watercourse, for the duration of the construction period. The footprint areas and height of these stockpiles should be kept to a minimum. Should the vegetation not be suitable for reinstatement after the construction phase or be alien/invasive vegetation species, all material must be disposed of at a registered garden refuse site and may not be burned or mulched on site.
- Excavation of pits for the pylon foundation may result in loose sediments within the landscape, specifically if works are taken during a period of rainfall (if applicable). As such, sediment traps should also be installed downstream/downgradient of the construction area should it be recommended by the ECO in that period; and
- During excavation of the pits, soils must be stockpiled upgradient of the excavated pit. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum. These soils must be used to close off the pits, immediately after installation of the pylon.

Operational Phase:

- Maintenance vehicles must make use of dedicated access roads and no indiscriminate movement in the watercourses may be permitted;
- During periodic maintenance activities of the power line and substation, monitoring for erosion should be undertaken with specific mention investigating the pylons located near areas hosting preferential flow paths;
- Should erosion be noted at the base of the pylon that may potentially impact on a watercourse in the surrounding area, the area must be rehabilitated by infilling the erosion gully and revegetation thereof with suitable indigenous vegetation;
- Monitoring for the establishment for alien and invasive vegetation species must be undertaken, specifically for access roads through or along the watercourses used to service the power line and substation. Should alien and invasive plan species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation.

Table 13: Monitoring actions to be implemented with the activities associated with the proposed development.

Aspect	Phase	Monitoring Location	Frequency of sampling	Performance Indicator	Reporting Requirement
Erosion and sedimentation	Construction phase	1. Watercourse road crossings 2. At the base of each pylon	Visual inspections must take place every month during the construction phase and after rainfall events.	To monitor the extent of erosion and sedimentation of the watercourses. Provide a report addressing the following: 1. Brief indication of the method of assessment; 2. Assumptions and Limitations must be listed; 3. Photographs and GPS point locations taken of existing erosion prior to and post rehabilitation activities must be incorporated into the report; 4. Any erosion observed must be discussed in detail; 5. Map indicating where erosion is present; and 6. Recommended mitigation and remediation actions should be presented and dates when remediation actions were undertaken.	Reporting to be included as part of the annual ECO monitoring report and submitted to the competent authority.
	Operational phase		Visual inspections must take place monthly during the winter rainy season for three years after the completion of construction to monitor and remove debris, sediment deposits and erosion along the watercourse crossings.		
Alien Invasive Species Plant Control.	All phases	1. Watercourse road crossings 2. At the base of each pylon Area directly adjacent to the pylons	Monitoring must be undertaken as per an Alien and Invasive plant species plan. This must include: 1. Visual inspection of construction footprint areas once a month during the construction phase; 2. Visual inspections must take place monthly during the winter rainy season for three years after the completion of construction to monitor the establishment of alien or invasive plant species specifically at the watercourses crossings or in the surrounding areas to the pylons.	To monitor the germination of AIPs at watercourse road crossings and pylon base areas: The report needs to address the following: 1. A list of species identified within the focus areas; 2. Discuss the density of species; 4. Fixed point photo (Taking photo at specific point within focus area where AIPs was identified); and 5. Focus areas requiring AIP control and proposed AIP control measures.	Reporting to be included as part of the annual ECO monitoring report and submitted to the competent authority.
Revegetation	All phases	1. Watercourse road crossings (those that will not be retained as maintenance roads) 2. surrounding the base of each pylon	A vegetation assessment to be undertaken one year post rehabilitation (during the growing season) to ensure plant survival and to ensure that no AIPs are outcompeting indigenous species.	To monitor the reinstatement of vegetation. The report needs to address the following: 1. A list of species occurring within the focus areas; 2. Discuss the density of species; 4. Fixed point photo (Taking photo at specific point within focus area to identify the success of revegetation; and 5. Focus areas requiring remedial action and proposed corrective actions.	Reporting to be included as part of the annual ECO monitoring report and submitted to the competent authority.

7. COMPARATIVE ASSESSMENT OF ALTERNATIVES

This section provides a comparative assessment of the proposed development alternatives as described in Section 3. Table 14 provides the key to describe the preference classes. The proposed project alternatives are described according to the preference classes (Table 15). None of the alternatives are fatally flawed when mitigation is implemented. Due to the similar areas the proposed power line alternative routes will be routed through (i.e. all power line alternative routed will be routed through mountainous areas traversing headwater EDLs and traversing tributaries and rivers within the lower laying southern area towards the Kappa Substation), all the proposed power line alternative routes are considered to pose a Low risk significance/Low negative impact significance to the identified watercourses. The southern portion of the proposed development is located within an area considered of very high aquatic biodiversity sensitivity [by the National Web Based Environmental Screening Tool (2020)], however, any watercourses located in this specific area and any other areas considered to be of very high aquatic biodiversity sensitivity associated with the remaining extent of the investigation area (such as the drainage networks) can be avoided by constructing pylons outside the delineated extent of the watercourses.

Table 14: Key for the preference classes to the proposed project alternatives

PREFERRED	The alternative will result in a low impact / reduce the impact / result in a positive impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 15: Comparative assessment of the proposed surface infrastructure components for the proposed development.

Alternative	Preference	Reasons (incl. potential issues)
POWER LINE CORRIDOR ROUTE ALTERNATIVES		
Power Line Corridor Alternative 1 (Oya to Kappa)	No preference	This power line alternative will traverse several watercourses, including a tributaries of the Ongeluks River system, the Muishonds River, headwater EDLs from the Muishond River, the Groot River and EDLs from the Karree River system. The northern portion of this power line alternative will be routed through a mountainous area which will potentially require the grading of roads which will be in the vicinity of several headwater EDLs of the Ongeluks and Muishond River system. The southern portion of this power line alternative will be routed along areas where small farm roads exist, including road crossings through watercourses. Overall, this power line alternative route will travers 35 watercourses. Despite this power line alternative crossing 35 watercourses, it is expected that no pylons will be directly located in watercourses, as such no significant direct impacts are expected to be associated with this development alternative.
Power Line Corridor Alternative 2 (Oya to Kappa)	No preference	This power line alternative will traverse several watercourses, including a tributaries of the Ongeluks River system, the Muishonds River, headwater EDLs from the Muishond River, the Groot River and EDLs from the Karree River system. The northern portion of this power line alternative will be routed through a mountainous area which will require the grading of roads which will be in the vicinity of several headwater EDLs of the Ongeluks and Muishond River system. The southern portion of this power line alternative will be routed along areas where small farm roads exist, including road crossings through watercourses. Overall, this power line alternative route will travers 31 watercourses.

Alternative	Preference	Reasons (incl. potential issues)
		Despite this power line alternative crossing 35 watercourses, it is expected that no pylons will be directly located in watercourses, as such no significant direct impacts are expected to be associated with this development alternative.
Power Line Corridor Alternative 3 (Oya to Kappa)	Preferred	This power line alternative will primarily be routed along existing farm roads and existing public access road (with the expectation of the most northern portion). It is recognized that the majority of the southern portion of this power line alternative will be routed along the public access road and an existing power line route. Overall, this power line alternative route will travers 25 watercourses, of which some of these watercourses has been disturbed by anthropogenic activities (such as linear crossings), however not considered extensive. Thus, should this alternative be considered an option, use can be more readily be made of the existing power line route roads to access the proposed new power line alignment, which will minimize the environmental impacts. As it is expected that no pylons will be directly located in watercourses, no significant direct impacts are expected to be associated with this development alternative.
Power Line Corridor Alternative 4 (Oya to Kappa)	Preferred	As with power line alternative 3, this power line alternative will primarily be routed along existing farm roads and existing public access road (with the expectation of the most northern portion). It is recognized that the majority of the southern portion of this power line alternative will be routed along the public access road and an existing power line route, and a short southern portion along farm boundary fences. Overall, this power line alternative route will travers 30 watercourses, some of which has been disturbed by anthropogenic activities (such as linear crossings), however not considered extensive. Thus, should this alternative be considered an option, use can be more readily be made of the existing power line route roads to access the proposed new power line alignment, which will minimize the environmental impacts. As it is expected that no pylons will be directly located in watercourses, no significant direct impacts are expected to be associated with this development alternative.
Power Line Corridor Alternative 5 (Oya to Kappa)	No preference	As with power line alternative 2, this power line alternative will traverse several watercourses, including a tributaries of the Ongeluks River system, the Muishonds River, headwater EDLs from the Muishond River, the Groot River and EDLs from the Karree River system. The northern portion of this power line alternative will be routed through a mountainous area which will require the grading of roads which will be in the vicinity of several headwater EDLs of the Ongeluks and Muishond River system. The southern portion of this power line alternative will be routed along areas where small farm roads exist, including road crossings through watercourses. Overall, this power line alternative route will travers 35 watercourses. Despite this power line alternative crossing 35 watercourses, it is expected that no pylons will be directly located in watercourses, as such no significant direct impacts are expected to be associated with this development alternative.

8. CONCLUSION AND SUMMARY

8.1 Summary of Findings

FEN Consulting (Pty) Ltd was appointed to conduct a specialist freshwater ecological assessment as part of the BA processes for the proposed 132 kV overhead power line and 33/132kV substation development.

During the site visit undertaken on the 22nd to 24th of October 2020, several ephemeral tributaries with riparian vegetation, ephemeral rivers and episodic drainage lines (EDLs) without riparian vegetation were identified to be associated with the proposed development and the associated investigation area. Although these episodic drainage lines cannot be classified as rivers or streams in the traditional sense thereof due to the lack of saturated soils and riparian vegetation, they do still function as waterways, through episodic conveying of

water. Based on the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998), water does flow regularly or intermittently within these drainage lines, conveying water from the upgradient catchment area into the downgradient tributaries and the ephemeral rivers. As such, they can be considered as watercourses due to their importance for hydrological functioning and therefore enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998). Several areas hosting episodic preferential flow paths (PFP) were also identified. As with the EDLs, these preferential flow paths also lack riparian and wetland characteristics and may potentially only convey surface water for a short period of time after rainfall events. Thus, these features are not considered of ecological importance but contributes to the hydrological functioning of the drainage systems at large. The PFP cannot be considered as watercourses (thus no ecological assessment undertaken) and may potentially only enjoy protection in terms of the National Water Act, 1998 (Act No. 36 of 1998) should a floodline be applicable to these features. The results of the ecological assessment of the watercourses are discussed in Section 6.1 of this report is summarised in the table below:

Table 16: Summary of results of the ecological assessment as discussed in Section 6.1

Watercourse	PES	Ecoservices	EIS	REC
Ephemeral Rivers (Adamskraal, Groot, Muishonds and Ongeluk River)	B (Largely natural with few modifications)	Intermediate (1,5)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: A/B (Improve)
Ephemeral tributaries with riparian vegetation	B (Largely natural with few modifications)	Intermediate (1,5)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: A/B (Improve)
Episodic drainage lines	B/C (Largely natural with few modifications)	Intermediate (1,4)	High	REC: Category B (Largely natural with few modifications) BAS: Category B RMO: A/B (Improve)

8.2 Impact Statement

The activities associated with the construction and operational phases of the proposed power line and substation development based on the alignment provided by the proponent, includes site preparation, excavation of pits installation of the pylons. Direct negative medium impacts associated with creating new access roads to service the power line and substation development are expected to occur to the watercourse drivers and receptors during the construction phase. Should the recommended mitigation measures be implemented with specific mention of only installing pylons outside the delineated extent of the watercourses and its associated 32m NEMA ZoR, a negative low impact significance is expected to occur. It is therefore recommended that the mitigation measures as stipulated in Table 11 and the good housekeeping measures as per **Appendix F** be implemented to prevent and direct/indirect impacts from occurring on the watercourses. None of the proposed power line development alternatives are considered fatally flawed, however preference is given to power line alternative 3 and 4 since these power line routes are routed along existing power line infrastructure which has already incurred environmental disturbances and have existing access roads which may be utilised during the current proposed construction and operational phases of the power line between the Oya Energy Facility and the Kappa substation, and these power line alternatives are considered to have the least amount of watercourse crossings.

As such, it is the opinion of the freshwater specialist that the EA may be granted for the proposed development. Should the construction of the road crossings in the watercourses be undertaken in the driest period of the year when no surface flow is present and the recommended mitigation measures are applied, the risk significance of the proposed development can be reduced to a low risk and a Water Use Authorisation by means of a General Authorisation in terms of Section 21(c) and (i) water uses may potentially be obtained in consultation with the DWS. However, the DWS, the custodian of water resources in South Africa, must be consulted with regards to the outcome of this assessment.

8.3 Conclusion

Based on the findings of the freshwater ecological assessment and the results of the impact and risk assessments, it is the opinion of the ecologist that the proposed development poses a negative low risk to the integrity of the watercourses in the investigation area provided that adherence to cogent, well-conceived and ecologically sensitive construction plans are implemented and the mitigation measures provided in this report as well as general good construction practice are adhered to, the proposed development layout is deemed acceptable and should be approved as part of the EA.

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APPENDIX A: Indemnity and Terms of Use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and FEN CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

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This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX B: Legislative Requirements

The Constitution of the Republic of South Africa, 1996[13]	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive normalization of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act, 1998 (Act No. 107 of 1998)	The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The objectives of this act are (within the framework of the National Environmental Management Act) to provide for: ➢ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➢ the use of indigenous biological resources in a sustainable manner; ➢ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➢ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➢ to provide for co-operative governance in biodiversity management and conservation; and ➢ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources. Furthermore, a person may not carry out a restricted activity involving either: a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit. Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof. ***National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (Alien and Invasive Species Regulations, 2014)*** NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aim to: ➢ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➢ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➢ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as: (a) a species that is not an indigenous species; or

[13] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

	(b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. Categories according to NEMBA (Alien and Invasive Species Regulations, 2014): ➢ **Category 1a**: Invasive species that require compulsory control. ➢ **Category 1b**: Invasive species that require control by means of an invasive species management programme. ➢ **Category 2**: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread. ➢ **Category 3**: Ornamentally used plants that may no longer be planted.
National Environmental Management: Biodiversity Act, 2004(Act No.10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. (b) An MEC for environmental affairs in a province may, by notice in the Gazette, publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): (a) critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; (b) endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and (d) protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs (a), (b) or (c).
National Water Act , 1998 (Act No. 36 of 1998)	The National Water Act, 1998 (Act No. 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i). A watercourse is defined as: a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act , 1998 (Act No. 36 of 1998)	In accordance with Government Notice (GN)509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: ➢ The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; ➢ In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or ➢ A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix; iii) Do maintenance with their existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; iv) Conduct river and storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.

APPENDIX C: Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the watercourses and drainage line features present in close proximity of the development are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland feature present in the vicinity of the development.

1.2 *Department of Water and Sanitation (DWS) Resource Quality Information Services Present Ecological State / Ecological Importance and Sensitivity (PES/EIS) Database (2014)*

The PES/EIS database as developed by the DWS RQIS department was utilised to obtain background information on the project area. The PES/EIS database has been made available to consultants since mid-August 2014. The information from this database is based on information at a sub-quaternary catchment reach (subquat reach) level with the descriptions of the aquatic ecology based on the information collated by the DWS RQIS department from all reliable sources of reliable information such as SA RHP sites, EWR sites and Hydro WMS sites. The results obtained serve to summarise this information as a background to the conditions of the watercourse traversed by the proposed linear development.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian features encountered within the study area was assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis et. al., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	**LEVEL 2: REGIONAL SETTING**	**LEVEL 3:LANDSCAPE UNIT**
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Units for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4:HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems
From the classification system, Inland Systems are defined as **aquatic ecosystems that have no existing connection to the ocean**[14] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups
For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et. al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) groups' vegetation types across the country, according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting
At Level 3 of the classification system for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et. al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units
Seven primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table C2), on the basis of hydrology and geomorphology (Ollis *et. al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates;
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and

[14] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley, but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for "channel", "flat" and "valleyhead seep") is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et. al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et. al*., 2009).

3. Wet-Ecoservices (2009)

"The importance of a water resource, in ecological, social or economic terms, acts as a modifying or motivating determinant in the selection of the management class" (DWA, 1999). The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table C3: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Index of Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in the table below.

Table C4: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans et al. 2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19

5. Riparian Vegetation Response Index (VEGRAI)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

The Riparian Vegetation Response Assessment Index (VEGRAI) is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results15. Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

6. Ecological Importance and Sensitivity (EIS) (Rountree & Kotze, 2013)

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (see table below) of the wetland system being assessed.

[15] Kleynhans *et al*, 2007

Table C5: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

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

7. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

"A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure" (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C6: Recommended management objectives (RMO) for watercourses based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, a REC class D is allocated by default, as the minimum acceptable PES category.**

A watercourse may receive the same class for the REC as the PES if the watercourse is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C7: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

8. Watercourse Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act, 1998 (Act No. 36 of 1998) as "land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".
The wetland zone delineation took place according to the method presented in the DWAF (2005) document "A practical field procedure for identification and delineation of wetlands and riparian areas.

An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The position in the landscape, which will help identify those parts of the landscape where wetlands are more likely to occur;
- The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
- The presence of wetland vegetation species; and
- The presence of redoximorphic soil feature, which are morphological signatures that appear in soils with prolonged periods of saturation.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008).
Riparian and wetland zones can be divided into three zones (DWAF, 2005). The permanent zone of wetness is nearly always saturated. The seasonal zone is saturated for a significant period of wetness (at least three months of saturation per annum) and the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation. The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland area.

APPENDIX D: RISK AND IMPACT ASSESSMENT METHODOLOGY

1. DWS RISK ASSESSMENT

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation;
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[16]. The interaction of an aspect with the environment may result in an impact;
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Frequency of activity** refers to how often the proposed activity will take place;
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor;
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial extent** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[17].

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

[16] The definition has been aligned with that used in the ISO 14001 Standard.
[17] Some risks/impacts that have low significance will however still require mitigation

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

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

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

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

Table D3: Duration (How long does the aspect impact on the resource quality)

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

Table D4: Frequency of the activity (How often do you do the specific activity)

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

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

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

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION

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

A low risk class must be obtained for all activities to be considered for a GA (after the application of mitigation measures)

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develop or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[18] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

2. SIVEST IMPACT ASSESSMENT

[18] Mitigation measures should address both positive and negative impacts

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 3.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used:

Table D10: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).

3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE (S)

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Impact Summary

The impacts will then be summarized, and a comparison made between pre and post mitigation phases as shown in the table below. The rating of environmental issues associated with different parameters prior to and post mitigation of a proposed activity will be averaged. A comparison will then be made to determine the effectiveness of the proposed mitigation measures. The comparison will identify critical issues related to the environmental parameters.

Table D11: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Surface water	Erosion	43		16	
	Oil spills	22		22	
	Alteration of aquatic biota	16		3	
			- 27		**-13.67**
			Low Negative Impact		Low Negative Impact

Comparative assessment of proposed project alternatives

Table D12: Key for the preference classes to the proposed project alternatives

PREFERRED	The alternative will result in a low impact / reduce the impact / result in a positive impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

APPENDIX E: Results of Field Investigation

PRESENT ECOLOGICAL STATE (PES), ECOSERVICES AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table E1: Presentation of the results of the IHI assessment applied to the ephemeral tributaries with riparian vegetation.

RIPARIAN IHI	
Base Flows	0,0
Zero Flows	0,0
Moderate Floods	1,0
Large Floods	1,0
HYDROLOGY RATING	**0,6**
Substrate Exposure (marginal)	1,5
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,5
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	1,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	1,0
Physico-Chemical (non-marginal)	1,0
Marginal	1,5
Non-marginal	1,0
BANK STRUCTURE RATING	**1,3**
Longitudinal Connectivity	0,0
Lateral Connectivity	0,0
CONNECTIVITY RATING	**0,0**
RIPARIAN IHI %	**84,6**
RIPARIAN IHI EC	**B**
RIPARIAN CONFIDENCE	**2,9**

Table E2: Presentation of the results of the outcome of the VEGRAI assessment for the episodic drainage lines.

LEVEL 3 ASSESSMENT					
METRIC GROUP	**CALCULATED RATING**	**WEIGHTED RATING**	**CONFIDENCE**	**RANK**	**% WEIGHT**
MARGINAL	80,0	53,3	2,5	1,0	100,0
NON MARGINAL	80,0	26,7	2,5	2,0	50,0
2,0					150,0
LEVEL 3 VEGRAI (%)				80,0	
VEGRAI EC				**B/C**	
AVERAGE CONFIDENCE				2,5	

Table E3: Presentation of the results of the Socio-cultural and Ecoservice provision provided by the assessed watercourses

Ecosystem service	Ephemeral rivers	Episodic drainage lines	Ephemeral tributaries
Flood attenuation	2,2	1,7	1,8
Streamflow regulation	2,2	1,6	2,2
Sediment trapping	1,6	1,6	1,8
Phosphate assimilation	1,3	1,9	1,9
Nitrate assimilation	1,3	1,7	1,7
Toxicant assimilation	1,3	1,8	1,8
Erosion control	2,0	2,1	1,8
Carbon Storage	1,0	0,8	0,8
Biodiversity maintenance	2,4	2,3	2,4
Water Supply	0,7	0,7	0,7
Harvestable resources	0,6	0,6	0,8
Cultivated foods	0,4	0,4	0,4
Cultural value	0,5	0,5	0,5
Tourism & recreation	2,0	2,0	2,5
Education & research	1,8	0,8	1,8
SUM	**21,2**	**20,3**	**22,6**
Average score	**1,4**	**1,4**	**1,5**

Table E4: Presentation of the EIS assessment applied to the assessed watercourses.

FRESHWATER FEATURE:			Episodic drainage lines	Ephemeral tributaries
Ecological Importance and Sensitivity			Score (0-4)	
Biodiversity support			**A (average)**	
			0,67	1,00
Presence of Red Data species			0	0
Populations of unique species			0	1
Migration/breeding/feeding sites			2	2
Landscape scale			**B (average)**	
			2,00	2,20
Protection status of the wetland			2	2
Protection status of the vegetation type			2	2
Regional context of the ecological integrity			2	2
Size and rarity of the wetland type/s present			2	3
Diversity of habitat types			2	2
Sensitivity of the wetland			**C (average)**	
			1,67	2,00
Sensitivity to changes in floods			2	3
Sensitivity to changes in low flows/dry season			1	1
Sensitivity to changes in water quality			2	2
ECOLOGICAL IMPORTANCE & SENSITIVITY (max of A,B or C)			**B**	**B**
Hydro-Functional Importance			**Score (0-4)**	
Regulating & supporting benefits	**Flood attenuation**		1,7	1,8
	Streamflow regulation		1,6	2,2
	Water Quality Enhancement	***Sediment trapping***	1,6	1,8
		Phosphate assimilation	1,9	1,9
		Nitrate assimilation	1,7	1,7
		Toxicant assimilation	1,8	1,8
		Erosion control	2,1	1,8
	Carbon storage		0,8	0,8
HYDRO-FUNCTIONAL IMPORTANCE (average score)			2	2
Direct Human Benefits			**Score (0-4)**	
Subsistence benefits	***Water for human use***		0,7	0,7
	Harvestable resources		0,6	0,8
	Cultivated foods		0,4	0,4
Cultural benefits	***Cultural heritage***		0,5	0,5
	Tourism and recreation		2	2,5
	Education and research		0,8	1,8
DIRECT HUMAN BENEFITS (average score)			0,83	1,12

APPENDIX F: RISK ANALYSIS AND MITIGATION MEASURES

General construction management and good housekeeping practices
Latent and general impacts which may affect the watercourse ecology and biodiversity, will include any activities which take place in close proximity to the proposed activities that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the watercourse identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into watercourses unless absolutely essential and where project activities are located in the watercourses. It must be ensured that the watercourse habitat is off-limits to construction vehicles and non-essential personnel;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes (if applicable) should avoid watercourses and be restricted to existing roads where possible;
- Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)) Removal of species should take place throughout the construction, operational, and maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species*;* and
  - No vehicles should be allowed to drive through designated sensitive wetland areas during the eradication of alien and weed species.

Soils

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soils;

- No stockpiling of topsoil is to take place within the recommended buffer zone around the watercourses (unless specified otherwise), and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the watercourses;
- All soils compacted as a result of construction activities as well as ongoing operational activities falling outside of project footprint areas should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble/silt removed from the construction area must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the development should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

Risk significance on the watercourse ecology of the study area

The table below serves to summarise the anticipated impacts that might occur during the construction and operational phases as well as the mitigation measures that must be implemented in order to maintain and enhance the ecological integrity of the resource.

DWS Risk Assessment Outcome

	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
1	Construction Phase	Site preparation prior to construction activities.	Vehicular movement (transportation of construction materials)	*Loss of watercourse vegetation, associated habitat and ecosystem services; *Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and *Soil and stormwater contamination from potentially spilled oils and hydrocarbons originating from construction vehicles.	2	1	1	1	1,25	1	1	3,25	5	2	5	1	13	42,25	L
2			Removal of vegetation and associated disturbances to soils, and access to the site, including grading of existing informal farm roads.	*Earthworks could be potential sources of sediment, which may be transported as runoff into the downstream watercourse areas; *Exposure of soils, leading to increased runoff, and erosion, and thus increased sedimentation of the watercourses; *Increased sedimentation of the watercourses, leading to smothering of vegetation associated in the watercourses; and *Proliferation of alien and/or invasive vegetation as a result of disturbances.	2	1	1	1	1,25	1	1	3,25	5	3	5	1	14	45,5	L
3		Installation of the pylons and spanning of the proposed power line.	*Excavation of pits for the pylons leading to stockpiling of soil; *Potential movement of construction equipment and personnel within the watercourses.	*Disturbances of soils leading to potential impacts to the watercourse vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered watercourse habitat; *Altered runoff patterns, leading to increased erosion and sedimentation of the watercourses.	2	1	1	1	1,25	1	1	3,25	5	3	5	1	14	45,5	L
4			Mixing and casting of concrete for foundations.	*Potential contamination of surface water (if present).	1	2	1	1	1,25	1	1	3,25	5	3	5	1	14	45,5	L

	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
5	**OPERATIONAL PHASE**	Operation and maintenance of the power line	*Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses; *Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the access roads	*Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; *Altered water quality (if surface water is present) as a result of increased availability of pollutants	1	1	1	1	1	1	1	3	3	3	5	1	12	36	L

Impact Assessment Outcome

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
			Extent	Probability	Reversibility	Irreplaceable loss of	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity	Extent	Probability	Reversibility	Irreplaceable loss of resources	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity
Direct	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present), geomorphology, habitat and biota.	Potential direct impacts caused by site preparation activities such as the removal of vegetation and associated disturbances to soils, and access to the site, including grading of new and existing informal farm roads through watercourses. These activities result in the disturbance to habitat and loss of ecoservices.	1	3	2	2	1	3	27	Negative	Negative Medium impact	1	2	2	2	1	2	16	Negative	Negative Low impact
Indirect	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present) and geomorphology	Potential indirect impacts caused by site preparation activities (clearing areas for the installation of pylons outside the watercourses and its associated 32m NEMA ZoR) includes the disturbance of the natural buffer area surrounding the watercourses, potentially resulting dust creation, and decrease of surface roughness .	1	2	2	2	2	2	18	Negative	Negative Low impact	1	1	2	2	2	1	8	Negative	Negative Low impact

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
			Extent	Probability	Reversibility	Irreplaceable loss of	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity	Extent	Probability	Reversibility	Irreplaceable loss of resources	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity
Indirect	Watercourse drivers and receptors such as vegetation, geomorphology and sediment balance.	The installation of the pylons (including mixing and casting of concrete for foundations) and spanning of the proposed power line entails: *Excavation of pits for the pylons leading to stockpiling of soil; and *Potential movement of construction equipment and personnel in the areas surrounding watercourses. This may result in indirect impacts (since no pylons will be located directly within watercourses) such as: *Disturbances of soils leading to potential impacts to the watercourse vegetation, increased alien vegetation proliferation in the footprint areas, and in turn to altered watercourse habitat; *Altered runoff patterns, leading to increased erosion and sedimentation of the watercourses.	1	2	2	2	2	2	18	Negative	Negative Low impact	1	2	2	2	2	1	9	Negative	Negative Low impact
Indirect	Watercourse drivers and receptors such as vegetation, geomorphology and sediment balance.	Operation and maintenance of the power line and substation may result in: *Potential indiscriminate movement of maintenance vehicles within the watercourses or within close proximity to the watercourses; *Increased risk of sedimentation and/or hydrocarbons entering the watercourses via stormwater runoff from the access roads. The expected impacts may potentially be: *Disturbance to soils and ongoing erosion as a result of periodic maintenance activities; *Altered water quality (if surface water is present) as a result of increased availability of pollutants	1	2	2	2	2	2	18	Negative	Negative Low impact	1	2	2	2	2	1	9	Negative	Negative Low impact

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
			Extent	Probability	Reversibility	Irreplaceable loss of	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity	Extent	Probability	Reversibility	Irreplaceable loss of resources	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity
Direct	Watercourse drivers and receptors such as hydrology, water quality (when surface water is present), geomorphology, habitat and biota.	Potential impacts that may result due to the decommissioning activities: • Clearing of habitat that has established in previous phases, resulting in a disturbed ecological structure; • Compaction and disturbance of soils due to decommissioning activities, making the impacted areas unfavourable for the establishment of vegetation and may allow opportunistic alien and invasive species to establish in the nearby watercourses; and • Movement of construction vehicles within the watercourses, disturbing established biota therein.	1	3	2	2	1	3	27	Negative	Negative Medium impact	1	2	2	2	1	2	16	Negative	Negative Low impact
Direct	**CUMULATIVE IMPACT** Drainage system habitat integrity and hydrological functioning	• Loss of watercourse vegetation and subsequent habitat, due to watercourse road crossings and regular movement of vehicles within the surrounding area of the watercourses • Changes to flow, pattern and timing of surface water in the drainage system due to land use changes in the catchment (albeit limited due to the limited footprint of a power line and substation), potentially resulting in changes to the hydrological regime of the larger downstream watercourses.	2	3	2	2	3	3	36	Negative	Negative Medium impact	2	2	2	2	2	2	20	Negative	Negative Low impact

	ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
			Extent	Probability	Reversibility	Irreplaceable loss of	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity	Extent	Probability	Reversibility	Irreplaceable loss of resources	Duration	Intensity / Magnitude	TOTAL	STATUS (+ OR -)	Severity
NA	**No-Go Alternative** (the option of not fulfilling the proposed project)	This option would result in no environmental impacts and thus no impacts to the watercourses in the investigation area from the proposed power line and substation development on the site or surrounding local area. Implementing the no-go option would entail no development.	1	1	1	1	1	1	5	Positive	Positive Low Impact	1	1	1	1	1	1	5	Positive	Positive Low Impact