WETLAND ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED BORUTHO – SILIMELA 400kV POWERLINE, LIMPOPO PROVINCE

JULY 2024

PROFESSIONAL DECLARATION

The specialist investigator responsible for conducting this particular specialist surface water study declares that:

- At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in professional capacity.
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being a member of the general public.
- I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data.
- I do not have any influence over decisions made by the governing authorities.
- Should I, at any point, consider myself to be in conflict with any of the above declarations, I shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.
- I undertake to disclose 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 a competent authority to such a relevant authority and the applicant.
- I have expertise and experience in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity.
- This document and all information contained herein is and will remain the intellectual property Ecosolve Consulting and the specialist investigator responsible for conducting the study. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigator.
- I will comply with the Act, regulations and all other applicable legislation.
- All the particulars furnished by me in this document are true and correct.
- I realize that a false declaration is an offence in terms of Regulation 71 of NEMA and is punishable in terms of section 24F of the Act.

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EXECUTIVE SUMMARY

The majority of the watercourses in the study area are likely to have been impacted by agriculture and cattle farming to varying degrees, as well as mining in some areas. However, most of the proposed line is located on parts of the country that is very sparsely inhabited. Consequently, impacts to watercourses are relatively less significant compared to denser populated areas. Numerous waterbodies occur within the 1 km corridor discussed in this report. The watercourses (including the buffer zones) directly crossed by the proposed development are the ones likely to be potentially impacted and form the main focus of this report.

The risk scores fall in the Low category. Authorisation may proceed through a General Authorisation given that mitigation measures are effectively implemented. The risk scores fall in the Low category. Authorisation may proceed through a General Authorisation given that mitigation measures are effectively implemented.

From the impact assessment undertaken it is evident that during construction phase, prior to mitigation impacts on loss of habitat and ecological structure, as well as impacts on hydrological function and sediment balance are medium-high level impacts. However, should mitigation be implemented, the impacts will be reduced to medium-low level impacts. The impacts on ecological and sociocultural service provision, impacts on floral species as well as impacts on floral species are medium-low level impacts prior to mitigation. However, should mitigation be implemented, the impacts will be reduced to low level impacts. The impacts on faunal species will be low prior to mitigation and very-low should mitigation be implemented. During operational phase, prior to mitigation impacts on habitat and ecological structure, ecological and sociocultural service provision as well as hydrological function and sediment balance are low level impacts. Furthermore, the impacts on floral species and faunal species are very low significance impacts. However, should mitigation be implemented all impacts will be reduced to very-low significance impacts.

Several recommended mitigation measures are made to minimise the impact on the watercourses. Key mitigation measures include (but are not limited to):

- No construction may take place within the wetlands or 100m GN704 Zone of Regulation. Additionally, the wetlands and 100m GN704 Zone of Regulation must be demarcated as a no-go area;
- No stockpiles are to be permitted within the 100m GN704 Zone of Regulation;
- Exposed soil and stockpiles must be protected from wind by covering with a suitable geotextile such as hessian sheeting and ensure no stockpiles are higher than 2m;
- Dust suppression measures must be implemented throughout construction to prevent excessive dust which may smother wetland vegetation; and
- A site-specific rehabilitation plan, including an alien invasive plant (AIP) management plan, must be compiled and implemented. AIPs should be removed by hand and no machinery should be allowed in the wetlands.

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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 flows 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".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non- wetland areas.
Fluvial:	Resulting from water movement.
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
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).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Intermittent flow:	Flows only for short periods.
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).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater.
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.
Species of Conservational Concern (SCC)	The term SCC in the context of this report refers to all RD (Red Data) and IUCN (International Union for the Conservation of Nature) listed species as well as protected species of relevance to the project.
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, 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.

ACRONYMS

BAR	Basic Assessment Report
BAS	Best Attainable State
BGIS	Biodiversity Geographic Information Systems
°C	Degrees Celsius.
CBA	Critical Biodiversity Area
C-Plan	Conservation Plan
CVB	Channelled Valley Bottom
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
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
EMP	Environmental Management Program
ESA	Ecological Support Area
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
HSS	Hillslope Seep
m	Meter
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PCD	Pollution Control Dam
PES	Present Ecological State
REC	Recommended Ecological Category
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute

SANParks	South African National Parks
SA RHP	South Africa River Health Programme
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WRD	Waste Rock Dump
WULA	Water Use License Application

1. INTRODUCTION

1.1 Background

Ecosolve Consulting (Ecosolve) was appointed to conduct a freshwater ecological assessment as part of the Basic Assessment Process for construction of 400kV power line between the existing Borutho and Silimela substations, approximately 150km, Limpopo Province, as depicted in Figures 2-1 and 2-2 (please refer to Section 2 for the project description).

In order to identify all watercourses that may potentially be impacted by the proposed project, a 500m "zone of investigation" around the proposed project, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998), was used as a guide in which to assess possible sensitivities of the receiving freshwater environment. This area – i.e. the 500m zone of investigation around the proposed 400kV Power Line – will henceforth be referred to as the "investigation area".

The purpose of this report is to define the ecology of the area in terms of watercourse characteristics, including mapping of the watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and to define the Present Ecological State (PES) of the watercourses associated with the proposed project. Additionally, this report aims to define the socio-cultural and ecological service provision of the watercourses and the Recommended Management Objectives (RMO) and Recommended Ecological Category (REC) for the watercourses. It is a further objective of this study to provide detailed information when considering the proposed project in the vicinity of the watercourses, to ensure the ongoing functioning of the ecosystem, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

The Department of Water and Sanitation (DWS) Risk Assessment Matrix (2016) as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the perceived impacts associated with the proposed project, and the operational activities impact on the receiving freshwater environment. In addition, mitigatory measures were developed which aim to minimise the perceived impacts associated with the proposed project, followed by an assessment of the significance of the impacts after mitigation, assuming that they are fully implemented.

This report, after consideration and a description of the ecological integrity of any watercourses associated with the proposed project, must guide the relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the project from a watercourse management point of view.

1.2 Scope of Work

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]
- All watercourses within the investigation area were delineated using desktop methods in accordance with GN509 of 2016 as it relates to activities as stipulated in Section 21 (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) and verified according to the "Department of Water Affairs and Forestry (DWAF)1 (2005)2: A practical field procedure for identification of wetlands and riparian areas". Aspects such as soil morphological characteristics, vegetation types and wetness 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 was determined according to the method described by Rountree & Kotze (2013);
- The PES of the watercourses was determined according to the resource-directed measures guideline of Macfarlane et al. (2008);
- The watercourses were mapped according to the ecological sensitivity of each hydrogeomorphic unit in relation to the proposed 400kV Power Line project. 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 400kV Power Line project, 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 on the receiving freshwater environment.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- All watercourses identified within 500m of the proposed project were delineated in fulfilment of GN509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) using desktop methods and verification thereof undertaken according to “Department of Water Affairs and Forestry (DWAF) (2008): Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas”. The general surroundings were considered in the desktop assessment of the study area;
- Due to the degree to which the site has been disturbed, 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. Global Positioning System (GPS) technology is inherently 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 authorisation requirements as well as implementation of the mitigation measures provided. If more accurate assessments are required, the watercourses will need to be surveyed and pegged according to surveying principles;
- Freshwater 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 boundary 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 proposed project activities have been accurately assessed and considered, based on the field observations in terms of freshwater ecology.

1.4 Legislative Requirements and Provincial 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:

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996);
- 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); and,
- Government Notice 704 as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) regarding the use of water for mining and related activities aimed at the protection of water resources.

SPECIALIST INFORMATION AND LEGAL REQUIREMENTS

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6):

Legislated Content	Section in this Report
Details of Specialist who Prepared the Report	Appendix F
Expertise of the Specialist	Appendix F
CV of Specialist	Appendix F
Declaration of Independence	Page 2
Scope and Purpose of the Report	Section 1.2
Date and Season of the Assessment	Section 5.2
Methodology	Chapter 3
Site Sensitivity	Section 5.3
“No-Go Areas” and Buffers	Section 5.3
Sensitivity Maps	Figure 5.1
Assumptions and Limitations	Section 1.3
Results and Alternatives	Chapter 4
Mitigation Measures	Appendix E
Conditions	Appendix E
Monitoring Requirements	Appendix E

Conclusions	Chapter 8
Consultations	N/A
Comments Received	
Other Information	N/A

2. PROJECT DESCRIPTION

Eskom Holdings SOC Limited (herein referred to as Eskom) has appointed NTC Environmental (Pty) Ltd as an independent Environmental Assessment Practitioner (EAP) to undertake a Basic Assessment (BA) Process for the proposed construction of the Borutho-Silimela 400kV powerline and its associated infrastructure. The length of the powerline is approximately 150km. The proposed power line is located between the Borutho Substation on farm Gillimberg 861 in Mokopane and runs south to the Silimela Substation on farm Loskop Noord 12, near Marble Hall within the Lepelle-Nkumpi, Mogalakwena, Modimolle-Mookgophong and Ephriam Mogale Local Municipalities, Limpopo Province.

The construction of the power line will aid Eskom in strengthening the power supply wiTransmission scope of work:

- Extend Borutho Substation to accommodate 1 x 400kV feeder bay for Silimela Line 1
- Extend Silimela Substation to accommodate 1 x 400kV feeder bay for Borutho Line 1
- Build approximately 150km 400kV line from Borutho Substation to Silimela Substation, with associated extensions at the terminal substations.

The powerline corridor to be studied is 1km within the Limpopo Province.

Borutho subtation falls under the Waterberg District Municipality, in the Limpopo Province, South Africa. It is ensconced between the towns of: Steenbokpan (i.e., a village town) located west of Lephalale (former Elisras – Medupi located approximately 17.9km west of the town), Marken (i.e., a village town), Mokopane in the south-east (i.e., approximately 31km from Borutho substation) and the town of Polokwane in the east (i.e., the capital town of Limpopo - Borutho is approximately 48km).

The proposed development falls within three Local Municipalities, namely, Ephraim Mogale, Modimolle-Mookgophong and Mogalakwena, Limpopo Province. The Local Municipalities fall within the jurisdiction of the Sekhukhune and Waterberg District Municipalities.

The geographic coordinates are as follows:

- Start: 23° 54’24.97 S; 28° 58’41.96 E;
- Middle 24° 31’21.81 S; 28° 57’45.01 E .
- End: 25° 05’13.31 S; 29° 17’57.47 E.

The powerline will transverse the following properties:

• Portion 0 of Farm Ga Puka	• Portion 73 of Farm Piet Potgietersrust KS
• Portion 0 of Farm Gillimberg 861 LR	• Portion 47 of Farm Piet Potgietersrust KS
• Portion 7 of Farm Gillimberg 861 LR	• Portion 49 of Farm Piet Potgietersrust KS
• Portion 9 of Farm Gillimberg 861 LR	• Portion 2 of Farm Weltevrede
• Portion 17 of Farm Gillimberg 861 LR	• Portion 9 of Farm De Hoop
• Portion 8 of Farm Gillimberg 861 LR	• Portion 1 of Farm De Hoop
• Portion 6 of Farm Gillimberg 861 LR	• Portion 6 of Farm Klavervalley
• Portion 30 of Farm Gillimberg 861 LR	• Portion 2 of Farm Ceres
• Portion 10 of Farm Gillimberg 861 LR	• Portion 7 of Farm Geluksfontein
• Portion 29 of Farm Gillimberg 861 LR	• Portion 5 of Farm Springhaan Slaagte
• Portion 47 of Farm Gillimberg 861 LR	• Portion 0 of Farm Rondeberg
• Portion 1521 of Farm Piet Potgietersrust KS	• Portion 7 of Farm Conterberg
• Portion 1489 of Farm Piet Potgietersrust KS	• Portion 17 of Farm Conterberg
• Portion 1567 of Farm Piet Potgietersrust KS	• Portion 1 of Farm Weltevrede

- Portion 1435 of Farm Piet Potgietersrust KS
- Portion 1566 of Farm Piet Potgietersrust KS
- Portion 1486 of Farm Piet Potgietersrust KS
- Portion 1443 of Farm Piet Potgietersrust KS
- Portion 1446 of Farm Piet Potgietersrust KS
- Portion 1533 of Farm Piet Potgietersrust KS
- Portion 1491 of Farm Piet Potgietersrust KS
- Portion 1517 of Farm Piet Potgietersrust KS
- Portion 1481 of Farm Piet Potgietersrust KS
- Portion 1482 of Farm Piet Potgietersrust KS
- Portion 1539 of Farm Piet Potgietersrust KS
- Portion 1529 of Farm Piet Potgietersrust KS
- Portion 1474 of Farm Piet Potgietersrust KS
- Portion 1568 of Farm Piet Potgietersrust KS
- Portion 1438 of Farm Piet Potgietersrust KS
- Portion 1432 of Farm Piet Potgietersrust KS
- Portion 1427 of Farm Piet Potgietersrust KS
- Portion 1426 of Farm Piet Potgietersrust KS
- Portion 1520 of Farm Piet Potgietersrust KS
- Portion 1537 of Farm Piet Potgietersrust KS
- Portion 1483 of Farm Piet Potgietersrust KS
- Portion 1440 of Farm Piet Potgietersrust KS
- Portion 1439 of Farm Piet Potgietersrust KS
- Portion 48 of Farm Piet Potgietersrust KS
- Portion 52 of Farm Piet Potgietersrust KS
- Portion 17 of Farm Piet Potgietersrust KS
- Portion 98 of Farm Piet Potgietersrust KS
- Portion 100 of Farm Piet Potgietersrust KS
- Portion 144 of Farm Piet Potgietersrust KS
- Portion 41 of Farm Piet Potgietersrust KS
- Portion 40 of Farm Piet Potgietersrust KS
- Portion 58 of Farm Uitloop 3
- Portion 46 of Farm Gillimberg 861 LR
- Portion 59 of Farm Uitloop 3
- Portion 55 of Farm Uitloop 3
- Portion 62 of Farm Piet Potgietersrust KS
- Portion 35 of Farm Piet Potgietersrust KS
- Portion 175 of Farm Uitloop 3
- Portion 57 of Farm Piet Potgietersrust KS
- Portion 140 of Farm Piet Potgietersrust KS
- Portion 80 of Farm Piet Potgietersrust KS
- Portion 75 of Farm Piet Potgietersrust KS
- Portion 9 of Farm Conterberg
- Portion 11 of Farm Haarde Kraal
- Portion 5 of Farm Klavervalley
- Portion 1 of Farm Doornlaagte
- Portion 2 of Farm Rondeberg
- Portion 2 of Farm Mooigelegen
- Portion 3 of Farm De Hoop
- Portion 3 of Farm Doornstock
- Portion 1 of Farm Rondeberg
- Portion 23 of Farm Conterberg
- Portion 3 of Farm De Bults Punt
- Portion 4 of Farm De Bults Punt
- Portion 3 of Farm Springhaa Nslaagte
- Portion 8 of Farm De Hoop
- Portion 0 of Farm Springhaa Nslaagte
- Portion 2 of Farm Oranjefon Tein
- Portion 3 of Farm Oranjefon Tein
- Portion 5 of Farm Conterberg
- Portion 12 of Farm Springhaa Nslaagte
- Portion 7 of Farm Klavervalley
- Portion 1 of Farm Doornstock
- Portion 10 of Farm Conterberg
- Portion 3 of Farm Ceres
- Portion 4 of Farm Hartebeest Fontein
- Portion 1 of Farm Haakdoorn Kuil
- Portion 0 of Farm Rondom
- Portion 3 of Farm Klipgat
- Portion 0 of Farm Knoppiesdo Ornboom
- Portion 0 of Farm Zoetfontein
- Portion 0 of Farm Haardekraal
- Portion 4 of Farm Klavervalley
- Portion 0 of Farm Doornlaagte
- Portion 8 of Farm Geluksfontein
- Portion 16 of Farm Conterberg
- Portion 1 of Farm Mooigelegen
- Portion 1 of Farm Rondom
- Portion 0 of Farm Gegund

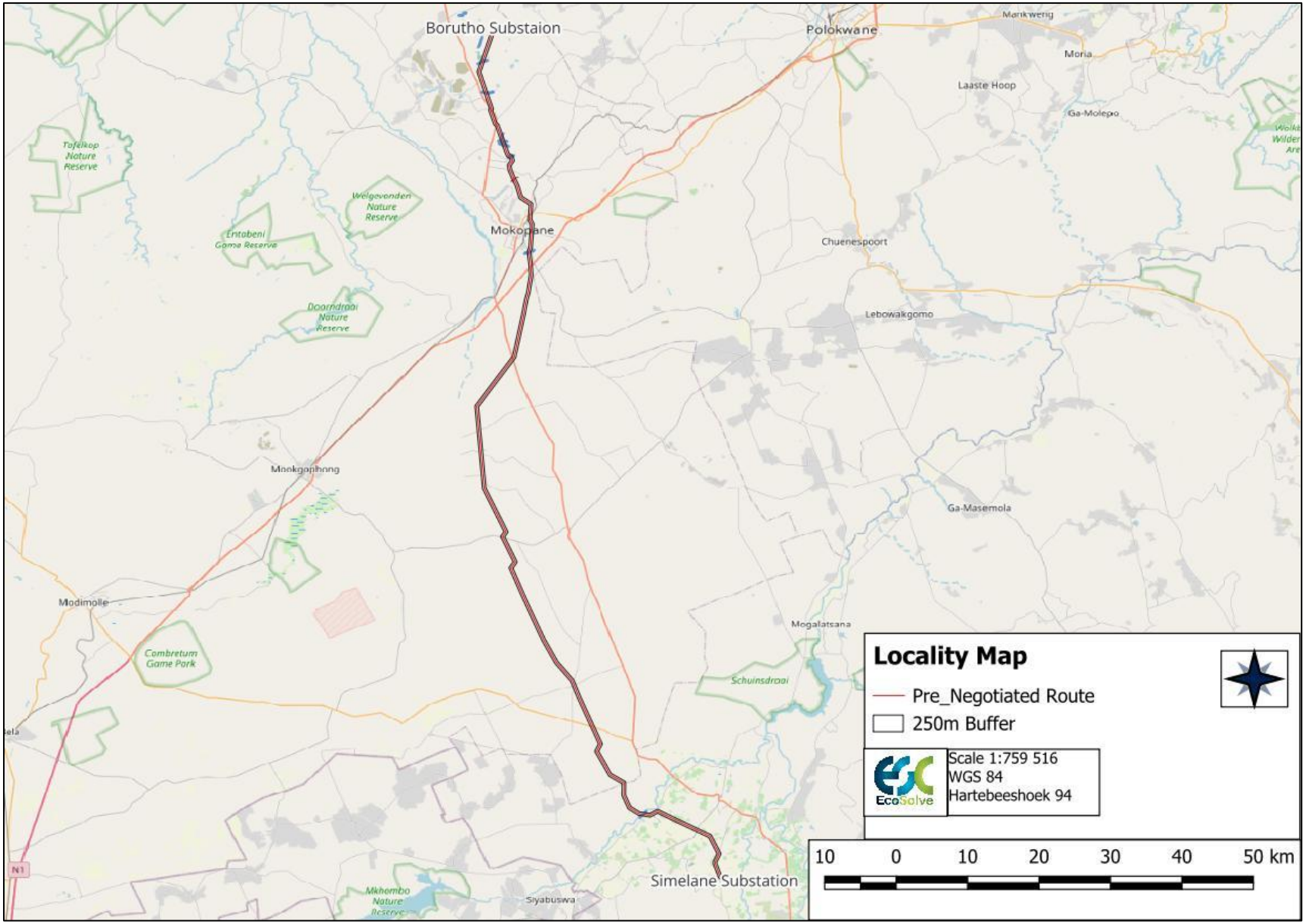


Figure 2-1: 400kV Power Line Project Area – Overview

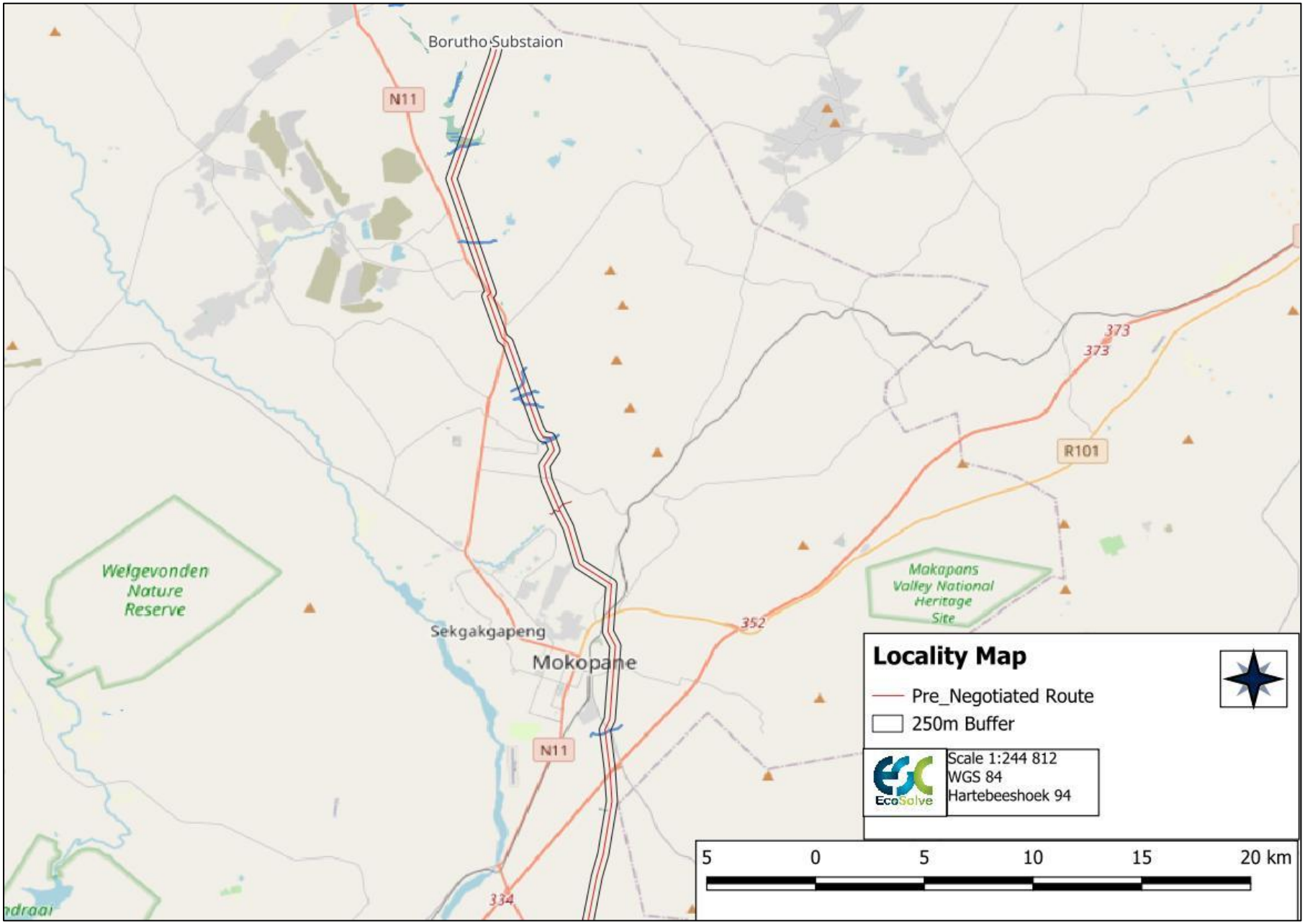


Figure 2-2: 400kV Power Line Project Area – Northern Section

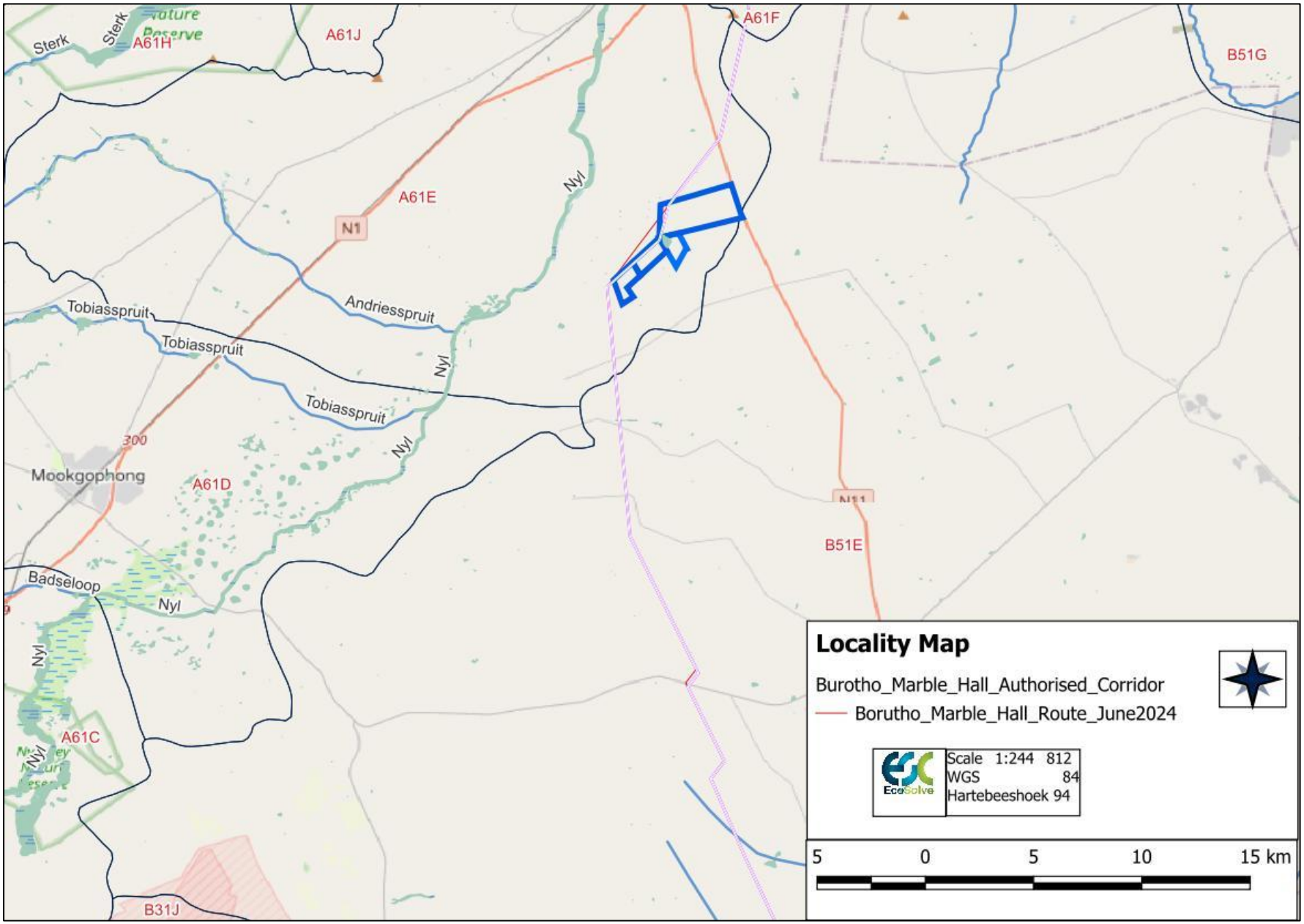


Figure 2-3: 400kV Power Line Project Area – Middle Section

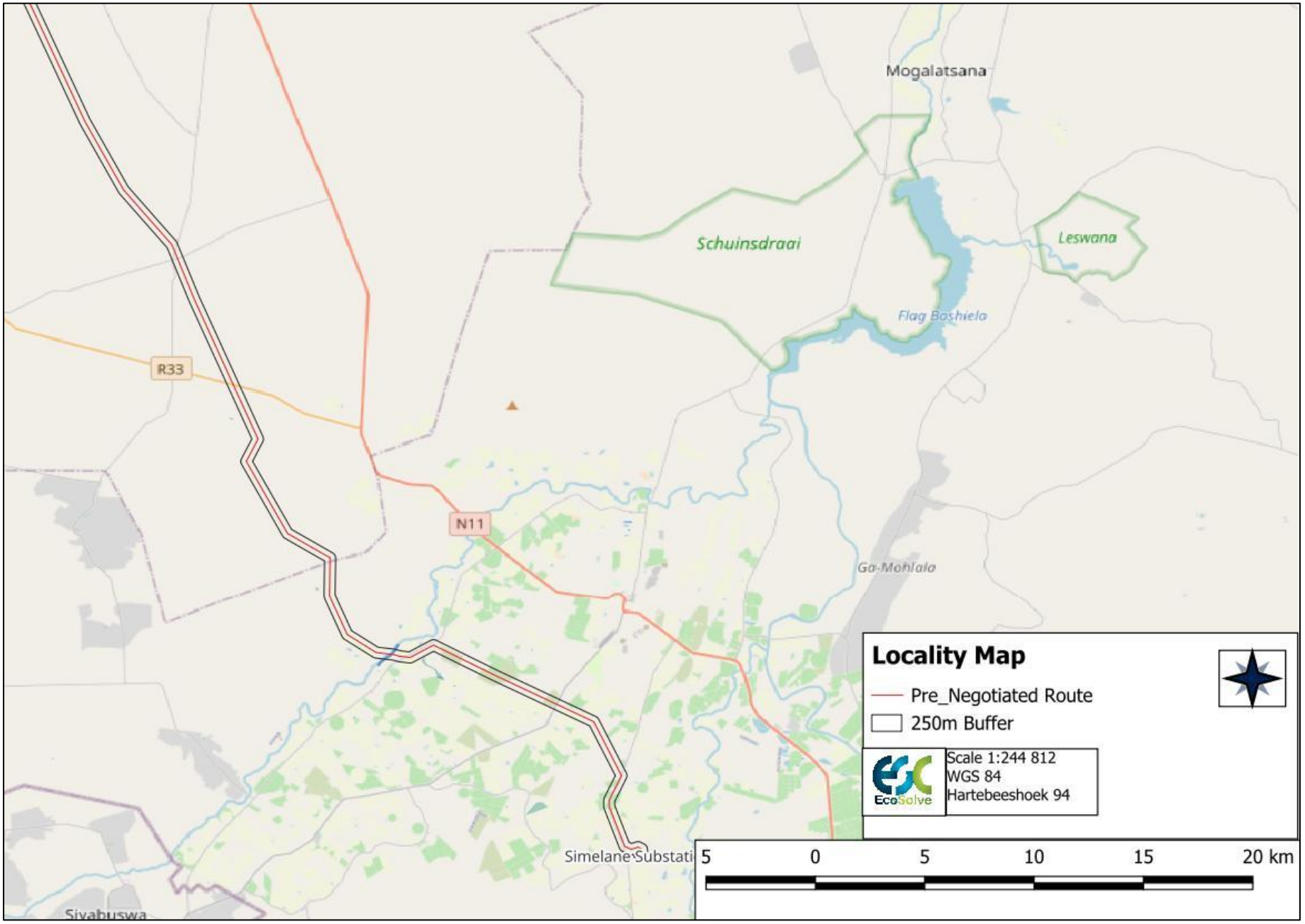


Figure 2-4: 400kV Power Line Project Area – Southern Section

3. ASSESSMENT APPROACH

3.1 Watercourse Field Verification

For the purposes of this investigation, the definition of a watercourse and a wetland were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998). The definitions are as follows:

A **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 in the *Gazette,* declare to be a watercourse,

and a reference to a watercourse includes where relevant, its bed and banks.

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."

A field assessment was undertaken in May 2019, during which the presence of any freshwater characteristics as defined by DWAF (2008) and by the National Water Act, 1998 (Act No. 36 of 1998), were noted (please refer to Section 4 of this report). The watercourse delineation took place, as far as possible, according to the method presented in "A practical field procedure for identification and delineation of wetlands and riparian areas" published by DWAF in 2005. 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; and
- Vegetation adapted to saturated soils.

In addition to the delineation process, a detailed assessment of the watercourses associated with the proposed project was undertaken, whereby factors affecting the integrity of the watercourses were taken into consideration and aided in the determination of the functioning as well as the provision of ecological and socio-cultural services by the watercourses. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

3.2 Sensitivity Mapping

The watercourses associated with the proposed project were delineated with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project the features onto digital satellite imagery and topographic maps. The sensitivity maps presented in Section 5.3 should guide the design and layout of the proposed project.

3.3 Risk Assessment and Recommendations

Following the completion of the assessment, the DWS risk assessment was conducted and recommendations were developed to address and mitigate impacts associated with the proposed project. These recommendations also include general ‘best practice’ management measures, which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation.

4. RESULTS OF THE DESKTOP ANALYSIS

4.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard style” report below (Table 4-1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for integration of results by the reader to take place.

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 development area’s actual site characteristics at the scale required to inform the environmental authorisation and/or water use licencing processes. However, this information is considered to be useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance.

Table 4-1: Desktop data relating to the character of the watercourses associated with the proposed Borutho – Silimela Power Line project.

Aquatic ecoregion and sub-regions in which the proposed 400kV Power Line		Detail of the proposed Aquatic ecoregion and sub-regions in which the proposed area	
Ecoregion	Central Bushveld	Critical Biodiversity Area (CBA)	The proposed 150 km 400kV Borutho to Silimela Powerline, the relative terrestrial biodiversity theme sensitivity is classified as VERY HIGH due to portions of the site occurring within a Critical Biodiversity Area (CBA) 1 and 2. Protected Area (PA), Witvinger Nature and Reserve Occurs within the approved corridor.
Catchment	Olifants		
Quaternary Catchment	B32H; B31J; B51E; A61E; B51E; A61F and A61G		
WMA	Olifants		
Major Rivers	Elands; Dorps; Rooisloot and Groot-Sandsloot		
Detail of the proposed project area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database		Ecological Support Area (ESA)	Terrestrial biodiversity theme sensitivity is classified as VERY HIGH due to portions of the site occurring within an Ecological Support Area (ESA) 1 and 2
FEPACODE	Elands = 0 Dorps = 4 Rooisloot = 4 Groot-Sandsloot = 4		
NFEPA Wetlands	According to the NFEPA database, Unchanneled valley-bottom wetlands, Channelled valley-bottom wetlands and Seeps are associated with the project area.		
Wetland Vegetation Type	Central Bushveld was identified within the study area.		
NFEPA Rivers	According to the NFEPA Database, the following NFEPA rivers were identified: • Elands • Dorps • Rooisloot • Groot-Sandsloot		
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)			
Proximity to Detail of the proposed Aquatic ecoregion and sub-regions in the proposed project area.	Within		
Assessed by expert?	Yes		
PES Category Median	Elands = Class C: Moderately Modified Dorps = Class C: Moderately Modified Rooisloot = Class C: Moderately Modified Groot-Sandsloot = Class D: Largely Modified		

CBA = Critical Biodiversity Areas; DWS = Department of Water and Sanitation; EI = Ecological Importance; EMF = Environmental Management Framework; ES = Ecological Sensitivity; ESA = Ecological Support Area; FEPA = Freshwater Ecosystem Priority Area; m.a.m.s.l = Meters Above Mean Sea Level; MAP = Mean Annual Precipitation; NFEPA = National Freshwater Ecosystem Priority Areas; WMA = Water Management Area.

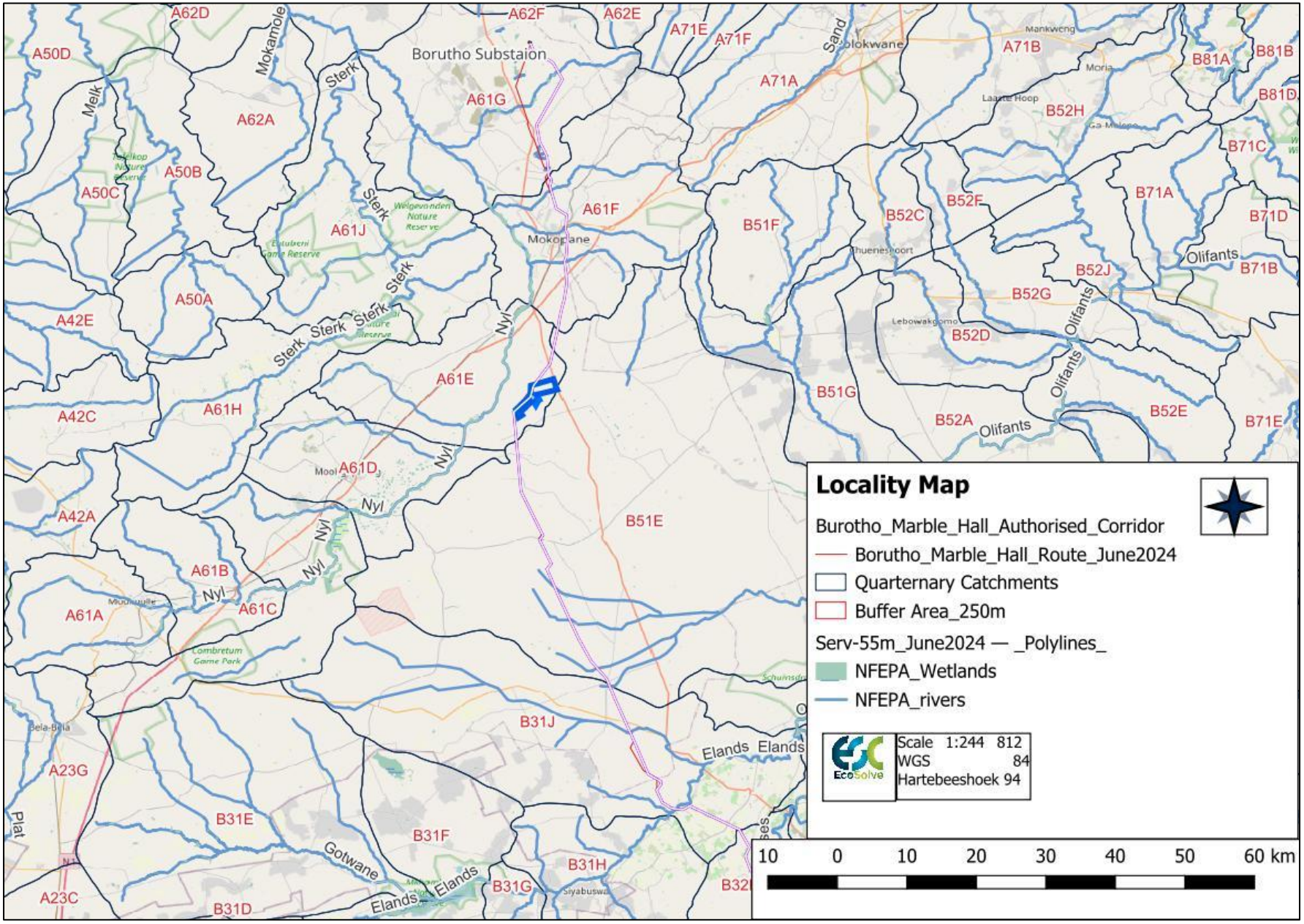
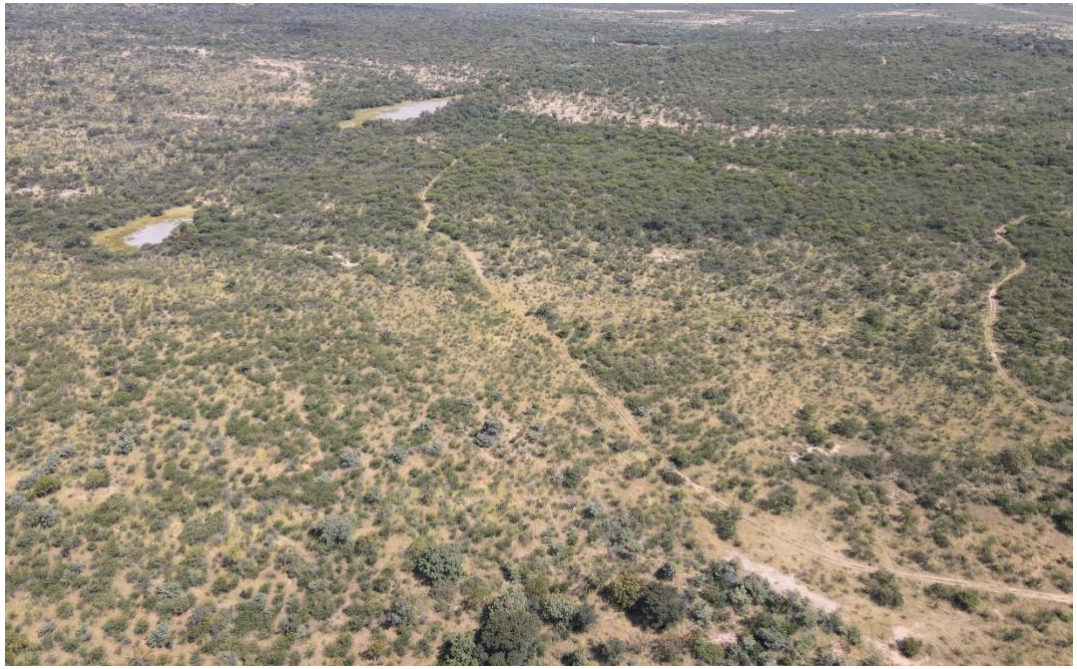


Figure 4-1: The wetlands and rivers associated with the proposed 400kV Power Line project according to the NFEPA Database (NFEPA, 2011)

Non-Perineal Stream



Typical landscape showing Pans

5. RESULTS: WATERCOURSE ASSESSMENT

5.1 Watercourse Delineation

Due to the degree to which the site has been disturbed, 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.

During the assessment, the following indicators were used to delineate the boundary of the temporary wetland zone:

- Topography/elevation was used to determine in which parts of the landscape the watercourses were most likely to occur;
- Obligate and facultative wetland species were used in conjunction with terrain units as well as the point where a distinct change in the vegetation composition was observed to determine the wetland zone boundary; and
- The soil form indicator was used to determine whether wetland characteristics were present within the project site and investigation area. In order to confirm the presence of a wetland, the soil needs to present redoxymorphic soil features, which are morphological signatures that appear in soils with prolonged periods of saturation and water level fluctuation (due to the resultant anaerobic conditions). These redoxymorphic soil features would be dentifiable in the soil irrespective of the season in which the soil sample is taken, as they are not determined by how 'wet' the soil is, but rather by the mottling or signs of gleying that has occurred over a period of time within the soil.

5.2 Watercourse System Characterisation

In preparation for the field assessment, digital satellite imagery and provincial and national watercourse databases (as outlined in Section 4 of this report) were used to identify areas of interest at a desktop level. During the site assessment undertaken on the 18th of November 2023, several wetlands, rivers and estuaries were identified within the investigation area.

The identified wetlands were characterised according to the classification system (Ollis, *et al*., 2013) as inland systems (i.e. a system having no existing connection to the ocean, but which is inundated or saturated with water, either permanently or periodically), as summarised in the Table 5-1 and 5-2 below.

Table 5-1: Characterisation of the watercourses associated with the proposed 400kV Power Line project according to the Classification System (Ollis et. al., 2013).

Catchment	Coordinates		Watercourse and HGM Unit	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008)	EIS (DWAF, 1999)/QHI (Seaman et al, 2010)	REC
	Start	End				
B32H	25° 3'54.33"S; 29°17'2.66"E	25° 2'57.12"S; 29°17'21.11"E	Depression	D	Low	D
B31J	24°59'51.74"S; 29°10'55.20"E	24°59'51.18"S; 29°10'54.55"E	Perennial River (Elands River)	D	Low	D
B31J	24°56'55.67"S; 29° 8'30.46"E	24°56'53.73"S; 29° 8'29.74"E	Valley head Seep	D	Low	D
B31J	24°53'19.86"S; 29° 6'46.95"E	24°53'16.42"S; 29° 6'45.55"E	Depression	D	Low	D
B31J	24°49'22.22"S; 29° 5'24.89"E	24°49'19.68"S; 29° 5'24.07"E	Valleyhead seep	D	Low	D
B51E	24°43'55.72"S; 29° 2'38.92"E	24°43'46.83"S; 29° 2'36.00"E	Valleyhead seep	D	Low	D
B51E	29° 2'36.00"E; 29° 1'50.04"E	24°41'11.36"S; 29° 1'55.22"E	Unchannelled valley-bottom wetland	D	Low	D
B51E	24°33'3.96"S; 28°58'4.80"E	24°33'1.89"S; 28°58'3.89"E	Riparian Area	D	Low	D
B51E	24°31'37.25"S; 28°57'44.75"E	24°31'32.53"S; 28°57'44.26"E	Depression	D	Low	D
B51E	24°29'24.60"S; 28°57'30.76"E	24°29'21.62"S; 28°57'30.89"E	Channelled valley-bottom wetland	D	Low	D
B51E	24°31'37.26"S; 28°57'44.39"E	24°31'32.52"S; 28°57'43.98"E	Depression	D	Low	D
B51E	24°29'25.00"S; 28°57'29.06"E	24°29'21.02"S; 28°57'29.54"E	Channelled valley-bottom wetland	D	Low	D
B51E	24°28'16.30"S; 28°57'25.60"E	24°28'13.67"S; 28°57'25.92"E	Flat Wetland	D	Low	D
A61E	24°25'24.67"S; 28°57'8.03"E	24°25'20.47"S; 28°57'11.40"E	Valleyhead seep	D	Low	D
A61E	24°24'41.04"S; 28°58'51.21"E	24°24'17.50"S; 28°58'44.55"E	Depression	D	Low	D
A61E	24°23'50.39"S; 28°58'18.65"E	24°23'48.99"S; 28°58'19.86"E	Unchannelled valley-bottom wetland	D	Low	D
A61E	24°23'48.24"S; 28°58'36.89"E	24°23'45.66"S; 28°58'38.60"E	Unchanneled valley-bottom wetland	D	Low	D
A61E	24°23'23.65"S; 28°59'3.47"E	24°23'22.44"S; 28°59'4.13"E	Unchanneled valley-bottom wetland	D	Low	D
A61E	24°23'19.49"S; 28°59'10.73"E	24°23'18.00"S; 28°59'10.77"E	Unchanneled valley-bottom wetland	D	Low	D

Catchment	Coordinates		Watercourse and HGM Unit	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008)	EIS (DWAF, 1999)/QHI (Seaman et al, 2010)	REC
	Start	End				
A61E	24°22'38.70"S; 28°59'35.27"E	24°22'37.00"S; 28°59'36.15"E	Unchanneled valley-bottom wetland	D	Low	D
A61E	24°22'36.84"S; 28°59'38.94"E	24°22'35.00"S; 28°59'40.18"E	Unchanneled valley-bottom wetland	D	Low	D
B51E	24°22'16.56"S; 29° 0'0.10"E	24°22'16.00"S; 28°59'58.52"E	Riparian Area	D	Low	D
B51E	24°22'8.04"S; 29° 0'6.09"E	29° 0'6.09"E; 29° 0'6.38"E	Riparian Area	D	Low	D
A61F	24°15'14.99"S; 29° 1'43.76"E	24°15'2.49"S; 29° 1'51.41"E	Channeled valley-bottom wetland	D	Low	D
A61E	24°15'1.90"S; 29° 1'25.18"E	24°14'57.43"S; 29° 1'26.95"E	Channeled valley-bottom wetland	D	Low	D
A61E	24°12'59.53"S; 29° 1'28.12"E	24°12'54.11"S; 29° 1'27.56"E	Unchanneled valley - bottom	D	Low	D
A61E	24°12'51.50"S; 29° 1'37.80"E	24°12'55.45"S; 29° 1'38.59"E	Riparian Area	D	Low	D
A61E	24°10'10.11"S; 29° 1'25.64"E	24°10'9.57"S'; 29° 1'24.63"E	Perennial River (Dorps)	C	Moderate	C
A61F	24° 8'2.75"S; 29° 0'28.56"E	24° 8'2.91"S; 29° 0'28.26"E	Perennial River (Rooisloot)	C	Moderate	C
A61G	24° 6'54.42"S; 29° 0'17.83"E	24° 6'53.06"S; 29° 0'16.94"E	Riparian Area	C	Moderate	C
A61G	24° 5'0.70"S'; 28°59'59.49"E	24° 4'55.09"S; 29° 0'1.67"E	Riparian Area	C	Moderate	C
A61G	24° 5'1.16"S; 28°59'58.90"E	24° 4'59.21"S; 28°59'59.14"E	Riparian Area	C	Moderate	C
A61G	24° 4'55.13"S; 29° 0'2.94"E	24° 4'54.42"S; 29° 0'2.86"E	Riparian Area	C	Moderate	C
A61G	24° 3'59.63"S; 28°59'28.62"E	24° 3'59.52"S; 28°59'27.60"E	Riparian Area	C	Moderate	C
A61G	24° 3'45.16"S; 28°59'24.20"E	24° 3'44.38"S; 28°59'23.92"E	Riparian Area	D	Low	D
A61G	24° 3'53.63"S; 28°59'8.29"E	24° 3'49.04"S; 28°59'6.64"E	Channeled valley-bottom wetland	C	Moderate	C
A61G	24° 3'35.25"S; 28°59'9.31"E	24° 3'34.65"S; 28°59'8.68"E	Perennial River	C	Moderate	C
A61G	24° 2'23.56"S; 28°59'11.77"E	24° 2'20.97"S; 28°59'11.81"E	Seep	C	Moderate	C
A61G	24° 1'18.25"S; 28°58'46.56"E	24° 1'12.61"S; 28°58'44.38"E	Channeled valley-bottom wetland	C	Moderate	C
A61G	23°59'37.50"S; 28°58'14.36"E	23°59'36.54"S; 28°58'13.96"E	Perennial River (Groot-Sandsloot)	C	Moderate	C

Catchment	Coordinates		Watercourse and HGM Unit	PES (Macfarlane et al, 2009)/ VEGRAI (Kleynhans et al, 2008)	EIS (DWAF, 1999)/QHI (Seaman et al, 2010)	REC
	Start	End				
A61G	23°59'13.60"S; 28°57'50.10"E	23°59'10.06"S; 28Perennial5"E	Channeled valley-bottom wetland	C	Moderate	C
A61G	23°58'36.20"S; 28°57'47.93"E	23°58'34.27"S; 28°57'48.16"E	Flat Wetland	C	Moderate	C
A61G	23°56'58.85"S; 28°57'38.78"E	23°56'58.11"S; 28°57'38.72"E	Non-Perennial River	C	Moderate	C
A61G	23°55'24.24"S; 28°57'31.45"E	23°55'24.03"S; 28°57'31.12"E	Non-Perennial River	C	Moderate	C
A61G	23°54'10.79"S; 28°56'31.13"E	23°54'6.98"S; 28°56'31.06"E	Non-Perennial River	C	Moderate	C
A61G	23°53'43.88"S; 28°56'16.17"E	23°53'40.89"S; 28°56'13.55"E	Channeled valley-bottom wetland	C	Moderate	C
A61G	23°53'7.42"S; 28°56'3.22"E	23°53'6.54"S; 28°56'2.92"E	Non-Perennial River	C	Moderate	C

5.3 Sensitivity Mapping

5.3.1 Legislative Requirements, National and Provincial guidelines pertaining to the application of buffer zones

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 to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources 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).

Legislative requirements were taken into consideration when determining a suitable buffer zone for the wetlands. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the wetlands can be summarised on Table 5-4 as follows:

Table 5-2: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	**Applicability**
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 (as amended). **The Department of Forestry, Fisheries and the Environment (DFFE).**	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment (EIA) regulations, 2014 (as amended) states that: *The development of:* *(xii) infrastructure or structures with a physical footprint of 100 square metres or more;* *Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* c) *If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.*
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). **The Department of Water and Sanitation (DWS)**	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 for Section 21 (c) and 21 (i) of the National Water Act, 1998 (Act No, 36 of 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 100m 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

A buffer was also calculated using the “Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries” as developed by Macfarlane *et al.* (2015). Given that the proposed development and associated activities remains strictly within the study, a 32m construction and operational buffer was applied to mitigate against edge effects and impacts that may occur from the proposed development.

These zones of regulation must be taken into consideration during any future planning processes, in line with the mitigation hierarchy as advocated by the Department of Forestry, Fisheries and the Environment (DFFE) et. al, 2013, and should they be encroached upon then the relevant authorisations will need to be obtained prior to the commencement of any activities. The delineated HGM units and their applicable buffer zones in terms of a calculated construction and operation buffer using the using the method of Macfarlane et al. (2015) and the zones of regulation in terms of the National Water Act, 1998 (Act No.36 of 1998) (GN 509) are conceptually depicted in Figure 6, as well as the zones of regulation in terms National Environmental Management Act, 1998Act No. 107 of 1998 (NEMA) and GDARD (2014) setback.

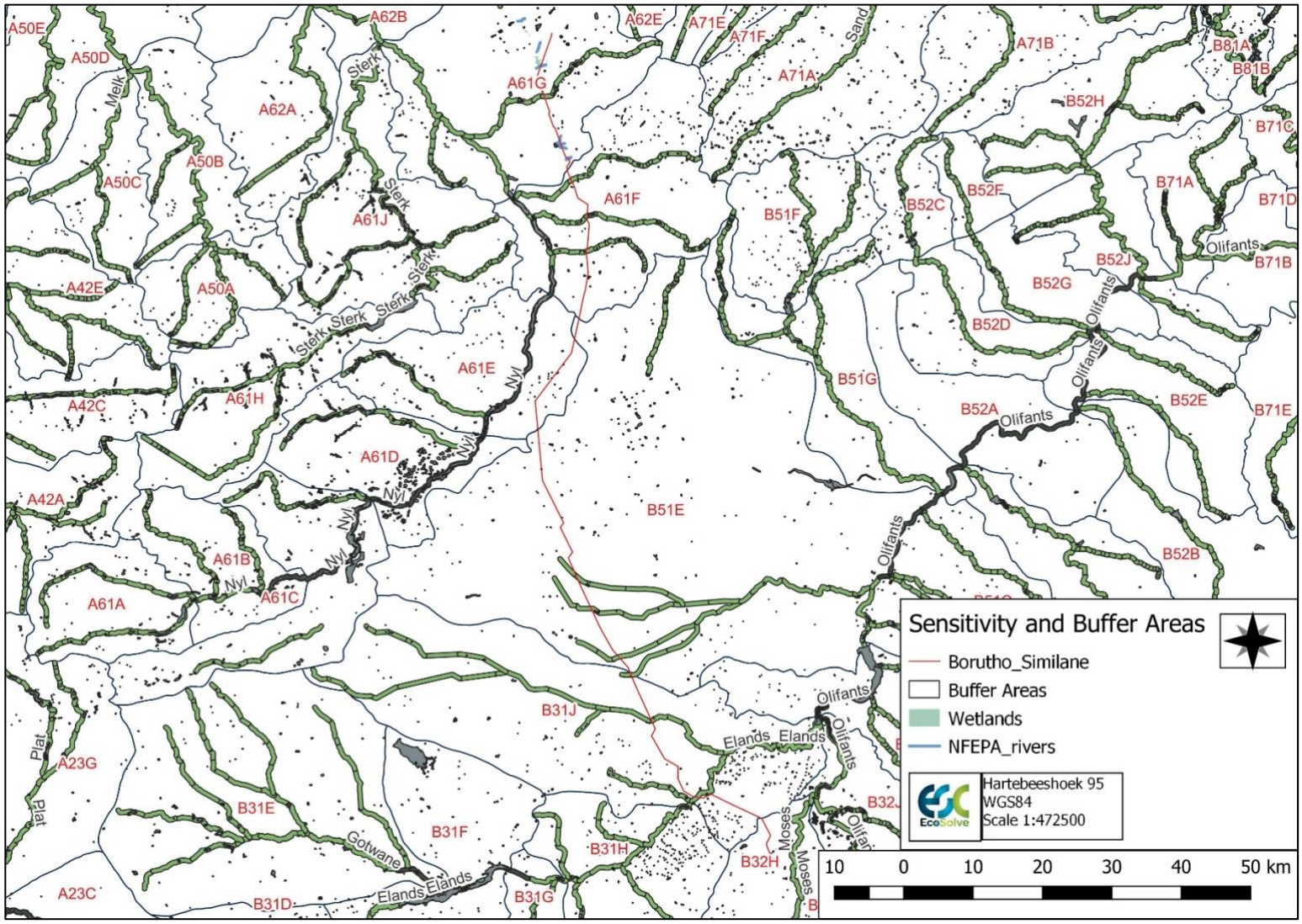


Figure 5-1: Buffers associated with the proposed 400kV Power Line project

6. RISK ASSESSMENT

This section presents the significance of potential impacts on the freshwater ecology of the identified wetlands associated with the of the project (all details are provided in Section 2: Project Description). In addition, it also indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed project and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

6.1 Risk Analyses

6.1.1 Consideration of impacts and application of mitigation measures

Following the assessment of the wetlands, the DWS approved Risk Assessment Matrix (2016) was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of the wetlands associated with the proposed project. These results are summarised in Table 6-1 presented in Section 6.1.2 of this report.

Following the risk assessment, mitigation measures were compiled to serve as guidance throughout the construction and operational phases. The points below summarise the considerations undertaken:

- 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 presents the perceived impact significance post-mitigation;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DFFE *et al* (2013) would be followed, i.e., the impacts would be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;

At the time of this assessment, the assessed reaches of the wetlands associated with the proposed project were considered to be in a moderately to largely modified ecological state, and of low/marginal to moderate importance and sensitivity;

- The activities are all highly site specific, not of a significant extent relative to the area of the wetlands assessed, and therefore have a limited spatial extent;
- While the operation of the of the project will be a permanent activity, the construction 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;
- The considered mitigation measures are easily practicable;
- It is highly recommended that the proponent make provision for small-scale rehabilitation of the reaches of the wetland which may be directly impacted upon by the proposed of the 400kV Power Line project. The area must preferably be rehabilitated to conditions as close as possible to the “natural” state, not the pre-construction state since the state of the wetlands is deemed to be altered from a reference condition. This will ensure that the current levels of ecological service provision of the wetlands are maintained and where feasible, improved; and

- Since no geohydrological data specifically pertaining to the proposed project were available at the time of the compilation of this report, the risk significance of decant was not assessed in detail as part of this study.

6.1.2 Impact discussion and essential mitigation measures

There are four key ecological impacts on the wetlands that are anticipated to occur, namely:

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, these impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation of and strict adherence to these measures will assist in minimising the significance of impacts on the receiving freshwater environment. A summary of the risk assessment is provided in the Table 6-1 below, followed by a discussion of the outcome thereof.

Table 6-1: The severity score derived from the DWS (2015b) risk assessment matrix for the construction and operation of the proposed power line

Impact	Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial Scale	Duration	Consequence
Construction Phase									
Increase in sediment	Construction of new Infrastructure	2	2	2	2	2	1	2	5
Altered hydrology	Installation of pylons and associated infrastructure	2	2	2	2	2	1	2	5
Input of toxic heavy metal contaminants	Construction machinery could leak hydrocarbons/Diesel	1	4	3	4	3	1	2	6
Operational Phase									
Inputs of toxic contaminants	Inputs from stormwater	2	2	2	2	2	1	2	5
	Groundwater Contamination	1	4	3	4	3	1	2	6

Table 6-2: The significance score derived from the DWS (2015b) risk assessment matrix for the proposed activities

Impact	Aspect	Frequency of activity	Frequency of impact	Legal issues	Detection	Likelihood	Significance	Without Mitigation	With Mitigation	Impacts
Construction Phase										
Increase in sediment	Construction of new Infrastructure	5	2	1	2	10	50	Low	Low	Negative
Altered hydrology	Installation of pylons and associated infrastructure	5	2	1	2	10	50	Low	Low	Negative
Input of toxic heavy metal contaminants	Construction machinery could leak hydrocarbons/Diesel	5	1	1	1	8	48	Low	Low	Negative
Operational Phase										
Inputs of toxic contaminants	Inputs from stormwater	1	1	5	2	9	45	Low	Low	Negative
	Groundwater Contamination	1	1	5	2	9	54	Low	Low	Negative

(*) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

The outcome of the Risk Assessment indicated that the proposed development fall in the Low risk category and authorisation may proceed through a General Authorisation.

The site clearing activities, excavation activities and in particular the activities associated with the construction of the stormwater infrastructure within the riparian poses the highest risk to the freshwater system during the construction phase. This is mainly due to the potential diversion of flow and the associated trampling/soil compaction associated with the construction activities by personnel and construction vehicles. This would also require the removal of riparian vegetation, which have an impact on the habitat provisioning of the system. The duration of impacts within the system should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. Therefore, the construction period should be kept as short as possible.

The use of Sustainable Drainage Systems (SuDS) to manage stormwater is considered important for the proposed development as there will be an increase in hardened surfaces within close proximity to the drainage lines, to prevent significant impacts on the hydrological functioning of the systems, reduce the risk of flooding during high flow periods and reduce the risk of increased erosion. Furthermore, any discharge of runoff into the drainage lines must be done in such a way as to prevent erosion. In this regard, it is highly recommended that a suitably qualified engineer be consulted with regards to the use of SuDS.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, the impacts arising from the proposed Borutho – Silimela 400kV Power Line project are likely to be of low to moderate significance during the construction and operational phases.. It is also recommended that ongoing alien vegetation control is implemented during the operational phase to enhance the ecological state of the wetlands associated within the proposed project.

Additional “good practice” mitigation measures applicable to a project of this nature are provided in Appendix E of this report.

7. IMPACT ASSESSMENT

7.1 Impact Identification and Assessment

The tables below serve to summarise the significance of perceived impacts of the construction of the stormwater channel and berm on the ecology and biodiversity of the riparian feature as well as the ephemeral drainage line described in Appendix G. Each individual impact identified is presented in this report. A summary of all potential pre-construction, construction and operational impacts is provided in Section 7.2.1. Sections described in Appendix E also indicate the required mitigatory measures needed to minimise the impact and present an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented at acceptable cost. Both essential and recommended mitigatory measures have been presented for both construction and operational phase impacts.

7.1.1 General House Keeping Rules

Latent and general everyday impacts, which may impact on the riparian ecology and biodiversity of the area, will include any activity which takes place within close proximity of the proposed stormwater channel and berm development that may impact on the receiving environment. These mitigation measures are highlighted below and are relevant for all sensitive areas identified in this report:

- Edge effects (impacts on areas beyond the construction footprint due to less than desirable care and management) during construction and operation, need to be strictly controlled through ensuring good housekeeping and strict management of activities within riparian/drainage areas and the associated buffer zones:
    - Implement waste management as stipulated in the Environmental Management Programme in order to prevent construction related waste from entering the riparian environment;
    - Do not allow dumping of waste material within riparian/drainage areas and do not allow any temporary storage of building material within these areas; and
    - All waste, with special mention of waste rock and spoils and remaining construction material should be removed from the site on completion of the construction phase.
- Remove alien and weed species within the riparian zone in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Species specific and area specific eradication recommendations:
    - Take care with the choice of herbicide to ensure that no additional impacts on the riparian habitat occurs due to the herbicide used;
    - Keep footprint areas as small as possible when removing alien plant species;
    - Do not allow vehicles to drive through the riparian areas during the eradication of alien and weed species; and
    - Dispose of removed alien plant material at a registered waste disposal site. ¬ Keep vegetation clearing and excavations to a minimum extent;
- Restrict all vehicles to designated roadways. The indiscriminate movement of vehicles through riparian/drainage areas must be strictly prohibited;
- Ensure that on-site camp fires are forbidden;

- Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakages;
- Should any spills occur, they must be immediately cleaned up and treated accordingly and the soil must be ripped and disposed of at a safe authorised waste facility;
- An emergency spill kit must be available on site at all times and an Emergency Response Plan must be developed and implemented;
- Regularly inspect all construction vehicles for leaks. Re-fueling must take place on a sealed surface area to prevent hydrocarbons reaching surface/subsurface water that could potentially flow to the riparian/drainage areas;
- Sanitation facilities must be provided for the duration of the construction phase and all waste must be removed to an appropriate facility. These facilities must be located outside of the riparian/drainage area and must be regularly serviced;
- Access to the site should be limited to a single access entry point and access to the remainder of the riparian areas should be limited to minimise compaction of soils, loss of vegetation and increased erosion;
- The proposed stormwater channel and berm should be constructed in such a manner as to avoid upstream ponding and downstream erosion; and
- The duration of impacts on the feature should be minimised as far as possible by ensuring that the duration in which flow alteration and sedimentation will take place is minimised.

7.2 Impact Analyses

Impact 1: Loss of habitat and ecological structure

Loss of habitat and ecological structure may be caused by construction waste materials spilling into the system that will in turn affect the integrity of the area. Construction related activities that might be undertaken prior to mitigation, such as the removal of the topsoil and vegetation clearing, will lead to destruction of habitat and overall loss of biodiversity within the system. Disturbance within the system may lead to loss of migratory routes for more mobile species. Furthermore, the removal of vegetation and the disturbance of soils will result in the alteration of the vegetation community.

Table 7-1: Aspects and activities register

Pre-Construction	Construction	Operational
Possible inappropriate design and placement of infrastructure leading to habitat modifications.	Site clearing and the removal of vegetation leading to increased runoff and erosion	Soil disturbance due to movement of maintenance vehicles
	Earthworks and the disturbance of soils leading to altered habitat	Proliferation of alien vegetation species as a result of poor rehabilitation post construction activities
	Spillage from construction vehicles leading to contamination of soils	Vegetation trampling and littering during maintenance activities
	Changes to vegetation communities due to alien invasion resulting in altered habitat integrity	

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**5**	**3**	**4**	**3**	**4**	**8**	**11**	**88 (Medium – High)**
Operational Phase	**2**	**3**	**2**	**2**	**2**	**5**	**6**	**30 (Low)**

Essential mitigation measures for construction phase:

- Demarcate areas and ensure that vegetation clearing and indiscriminate vehicle driving occurs within demarcated areas;
- Use a coffer dam to temporarily divert stream flow;
- Minimize construction footprints prior to commencement of the construction and control the edge effects from construction activities; and
- Implement alien vegetation control program and ensure establishment of indigenous species within areas previously dominated by alien vegetation.

Recommended mitigation measures for construction phase:

- Ensure that all activities impacting on the Sand River are managed according to the relevant DWS Licensing regulations;
- As far as possible, all construction activities should occur in the low flow season, during the drier winter months; and
- Reinforce banks where necessary with hessian sheets.

Essential mitigation measures for operational phase:

- Any area where active erosion is observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible.

Recommended mitigation measures for operational phase:

- N/A

Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**5**	**3**	**3**	**2**	**2**	**8**	**7**	**56 (Medium – Low)**
Operational Phase	**2**	**3**	**1**	**1**	**1**	**5**	**3**	**15 (Very Low)**

Probable latent impacts:

- Erosion and incision of the river may occur if not effectively rehabilitated and managed.

Impact 2: Changes to ecological and sociocultural service provision

Construction related activities might result in the loss of ecosystem services and function such as streamflow regulation and sediment trapping. Furthermore, impacts may result in the decrease in the ability of the river to support biodiversity as a result of vegetation clearing and general edge effects.

Aspects and activities register

Pre-Construction	Construction	Operational
Possible inappropriate planning and design of the stormwater structures leading to increased impact on the biological structure of the Sand River and the associated effects that this will have on service provision	Loss of ability to assimilate phosphate and toxicants due to vegetation clearing	Vegetation trampling during maintenance activities
	Inability to support biodiversity due to vegetation clearing and contamination of the soil and water	Inability to support biodiversity as a result of limited vegetation extent and introduction of alien vegetation species as a result of poor rehabilitation management and mitigation
	Earthworks within riparian areas leading to loss of ability to attenuate floods	Soil compaction due to indiscriminate driving of construction vehicles which alters infiltration abilities of the soil, thus resulting in increased runoff volumes
	Pollution and contamination of soils and water as a result of waste dumping	
	Unmanaged oil leaks from	

	Construction vehicles leading to water quality deterioration	

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**5**	**3**	**3**	**3**	**3**	**8**	**9**	**72 (Medium – Low)**
Operational Phase	**2**	**3**	**3**	**2**	**2**	**5**	**7**	**35 (Low)**

Essential mitigation measures for construction phase:

- During construction use techniques which support the hydrology and sediment control functions of the riparian areas; and
- Limit excavations to a minimum extent to ensure that drainage patterns within the river returns to normal as soon as possible after construction

Recommended mitigation measures for construction phase:

- Restrict construction to the drier winter months, if possible, to avoid sedimentation of the river and to minimize the severity of disturbance of the river and hydraulic function

Essential mitigation measures for operational phase:

- Monitor the river for erosion and incision; and
- Implement an alien vegetation control program and ensure establishment of indigenous species within areas previously
- dominated by alien vegetation.

Recommended mitigation measures for operational phase:

- N/A

Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**5**	**3**	**2**	**2**	**2**	**8**	**6**	**48 (Low)**
Operational Phase	**1**	**3**	**2**	**1**	**1**	**4**	**4**	**16 (Very Low)**

Probable latent impacts:

- Reduced biodiversity support; and
- Reduced functioning of nutrient cycling.

Impact 3: impacts on hydrological function and sediment balance

During the construction phase of the proposed stormwater channel and berm, activities such as excavations will lead to flow disturbance within the river and riparian areas. Stream flow will have to be temporarily diverted, thus impacting on the hydrology of the system. Furthermore, sediment deposition as a result of soil disturbance and increased sediment runoff during the construction may result in an impact on the sediment balance of the system.

Aspects and activities register

Pre-Construction	Construction	Operational
Potential inappropriate planning leading to the placement of infrastructure within the riparian area.	Disturbance of soils resulting in sediment deposition into the river during runoff.	Proliferation of alien vegetation as a result of poor rehabilitation post construction activities
	Streamflow diversion resulting in inundation of upstream areas	Incision and erosion of the river due to increased water velocity.
	Increased runoff and erosion due to earthworks in the river resulting in altered runoff patterns.	

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**5**	**3**	**3**	**2**	**2**	**8**	**7**	**56 (Medium – Low)**
Operational Phase	**1**	**3**	**1**	**1**	**1**	**4**	**4**	**16 (Low)**

Essential mitigation measures for construction phase:

- Stream diversions must at no time lead to upstream ponding and inundation or lead to downstream erosion;
- Any construction-related waste must not be placed in the vicinity of the riparian areas;

- Limit the footprint area of the construction activity to what is absolutely essential in order to minimize environmental damage; and
- Upon completion of the construction phase the disturbed area should be rehabilitated through reprofiling and revegetation.

Recommended mitigation measures for construction phase:

- Desilt all areas affected by construction activities; and
- As far as possible, all construction activities should occur in the low flow season, during the drier summer months.

Essential mitigation measures for operational phase:

- Reinforce banks where necessary with hessian sheets.

Recommended mitigation measures for operational phase:

- Ongoing aquatic biomonitoring on a minimum of a quarterly basis must take place from 6 months till 1 year after construction to determine any impacts requiring mitigation; and
- During the operational phase an annual assessment should be undertaken to determine if any excessive erosion along the structure. Photographic records should be maintained and any necessary maintenance and rehabilitation implemented.

Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**5**	**3**	**2**	**2**	**2**	**8**	**6**	**48 (Low)**
Operational Phase	**1**	**3**	**2**	**1**	**1**	**4**	**4**	**16 (Very Low)**

Probable latent impacts:

- Reduced biodiversity support; and
- Reduced functioning of nutrient cycling.

Impact 4: Impacts on floral Species of Conservational Concern (SCC)

Construction related activities such as vegetation clearing and top soil removal might result in the loss of vegetation communities as well as proliferation of alien vegetation species. In addition, excavations will lead to bank destabilization, thus resulting in the removal of woody vegetation species along the banks. SCC such as *Boophane disticha* and *Hypoxis hemerocallidae* may occur within the project area. Although these species were not located within the direct footpath of the construction activities, their presence should be noted to ensure that no edge effects and removal thereof takes place. Should these above-mentioned species be noted during the construction of the stormwater channel and berm, these species should be rescued and relocated to suitable habitat, outside of the construction footprint area. These species must be relocated to suitable sites by a qualified specialist.

Aspects and activities register

Pre-Construction	Construction	Operational
Potential inadequate planning and inappropriate design of the stormwater channel and berm leading to increased impact on the floral species	Site clearing and removal of indigenous vegetation	Waste dumping leading to pollution of soils
	Collection of protected vegetation species for medicinal purposes	Proliferation of alien vegetation as a result of poor rehabilitation post construction activities
	Movement of construction vehicles leading to trampling and loss of indigenous vegetation	

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**4**	**3**	**3**	**2**	**3**	**7**	**8**	**56 (Medium – Low)**
Operational Phase	**2**	**3**	**2**	**1**	**1**	**5**	**4**	**20 (Very Low)**

Essential mitigation measures for construction phase:

- Limit excavations to a minimum extent to minimize loss of vegetation and the proliferation of alien vegetation species; and
- Prohibit the collection of vegetation species for medicinal purposes and/or firewood.

Recommended mitigation measures for construction phase:

- Should any SCC be encountered in the footprint area during construction phase, the species must be relocated to a suitable site by an authorized specialist; and
- Upon completion of the construction phase the disturbed area should be rehabilitated through reprofiling and revegetation.

Essential mitigation measures for operational phase:

- Implement an alien vegetation control program within riparian/drainage areas and ensure establishment of indigenous species within areas previously dominated by alien vegetation.

Recommended mitigation measures for operational phase:

- N/A

Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**4**	**3**	**2**	**2**	**2**	**7**	**6**	**42 (Low)**
Operational Phase	**1**	**3**	**1**	**1**	**1**	**4**	**3**	**12 (Very Low)**

Probable latent impacts:

- Proliferation of alien vegetation species; and
- Altered vegetation species composition.

Impact 5: Impacts on faunal species

During construction phase of the proposed stormwater channel and berm, excavations will lead to sedimentation within the riparian areas. Furthermore, sedimentation can lead to habitat alteration within deeper pools, which will affect fish species that require refuge pools during the dry season. Stream flow will have to be temporarily diverted, thus impacting on the survival of the aquatic species within the system. No important faunal species were encountered during site assessment.

Aspects and activities register

Pre-Construction	Construction	Operational
Potential inappropriate planning leading to loss of faunal species	Site clearing and the removal of vegetation leading to increased sedimentation	Contamination of water during maintenance activities
	Stream flow diversion creating a migration barrier	Collision of vehicles with potential important faunal species during maintenance activities
	Streamflow diversion resulting in inundation of upstream areas and drying-up of downstream areas, thus resulting in loss of habitat for aquatic and faunal species downstream	
	Soil and water contamination, leading to loss of aquatic and faunal species	
	Loss of faunal species as a result of habitat disturbance and reduction of food supply	
	Loss of potential SCC species due to collision with construction vehicles	

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction Phase	**3**	**3**	**3**	**2**	**3**	**6**	**8**	**48 (Low)**

Operational Phase	**2**	**3**	**2**	**2**	**2**	**5**	**6**	**25 (Very Low)**

Essential mitigation measures for construction phase:

- No trapping or hunting of fauna is to take place. Access control must be implemented to ensure that no illegal trapping or poaching takes place; and
- Limit the footprint area of the construction activity to what is absolutely essential in order to minimize environmental damage.

Recommended mitigation measures for construction phase:

- All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction vehicles.

Essential mitigation measures for operational phase:

- No trapping or hunting of fauna is to take place; and
- Ensure that migratory connectivity is maintained where appropriate, especially in the sensitive faunal habitat unit areas.

Recommended mitigation measures for operational phase:

- N/A

Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction Phase	**2**	**3**	**2**	**1**	**2**	**5**	**5**	**25 (Very Low)**
Operational Phase	**1**	**3**	**1**	**1**	**1**	**4**	**3**	**12 (Very Low)**

Probable latent impacts:

- Decrease in potential important faunal species diversity may lead to loss of species richness overtime in the area.

7.2.1 Impact Assessment Conclusion

Based on the above assessment it is evident that there are five possible impacts that may affect the ecology of the resources in close proximity of the proposed stormwater channel and berm. The table below summarises the findings indicating the significance of the impacts before mitigation takes place and the likely impacts if management and mitigation takes place. In the consideration of mitigation, it is assumed that a high level of mitigation takes place but which does not lead to prohibitive costs.

Table 7-2: A summary of the results obtained from the ecological impact assessment.

Construction Phase		
Impact	**Unmanaged**	**Managed**
1: Loss of habitat and ecological structure	Medium-high	Medium-low
2: Changes to ecological and sociocultural service provision	Medium-low	Low
3: Impacts on hydrological function and sediment balance	Medium-high	Medium-low
4: Impacts on the floral species	Medium-low	Low
5: Impacts on faunal species	Low	Very-low
Operational Phase		
1: Loss of habitat and ecological structure	Low	Very-low
2: Changes to ecological and sociocultural service provision	Low	Very-low
3: Impacts on hydrological function and sediment balance	Low	Very-low
4: Impacts on the floral species	Very-low	Very-low
5: Impacts on faunal species	Very-low	Very-low

From the impact assessment undertaken it is evident that during construction phase, prior to mitigation impacts on loss of habitat and ecological structure, as well as impacts on hydrological function and sediment balance are medium-high level impacts. However, should mitigation be implemented, the impacts will be reduced to medium-low level impacts. The impacts on ecological and sociocultural service provision, impacts on floral species as well as impacts on floral species are medium-low level impacts prior to mitigation. However, should

mitigation be implemented, the impacts will be reduced to low level impacts. The impacts on faunal species will be low prior to mitigation and very-low should mitigation be implemented. During operational phase, prior to mitigation impacts on habitat and ecological structure, ecological and sociocultural service provision as well as hydrological function and sediment balance are low level impacts. Furthermore, the impacts on floral species and faunal species are very low significance impacts. However, should mitigation be implemented all impacts will be reduced to very-low significance impacts.

7.3 Assessment Of Cumulative Impacts

In terms of the NEMA EIA Regulations (2014), a cumulative impact is defined as:

"The past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities".

Project induced cumulative impacts should be considered, along with direct and indirect impacts, in order to better inform the developer's decision making and project development process. Cumulative impacts may be categorised into one or more of the following types:

- **Additive:** the simple sum of all the effects (e.g. the accumulation of ground water pollution from various developments over time leading to a decrease in the economic potential of the resource);
- **Synergistic:** effects interact to produce a total effect greater than the sum of individual effects. These effects often happen as habitats or resources approach capacity (e.g. the accumulation of water, air and land degradation over time leading to a decrease in the economic potential of an area);
- **Time crowding:** frequent, repetitive impacts on a particular resource at the same time (e.g. multiple boreholes decreasing the value of water resources);
- **Neutralizing:** where effects may counteract each other to reduce the overall effect (e.g. infilling of a wetland for road construction, and creation of new wetlands for water treatment); and,
- **Space crowding:** high spatial density of impacts on an ecosystem (e.g. rapid informal residential settlement)."

Cumulative impacts are, however, difficult to accurately and confidently assess, owing to the high degree of uncertainty, as well as they're often being based on assumptions.

However, the cumulative impact of the construction of the electricity infrastructure is considered to be low to moderate (at district level) and moderate to high (on individual farms), as the study area already comprises of a number of existing linear infrastructure including power lines and roads.

Cumulative impacts of linear projects need to be seen both from a site perspective (e.g. at individual farm level) and from a municipal, district or area perspective. Previous studies have shown that combining similar infrastructure results in high impacts on individual properties, and even on the neighbours, but that the cumulative impact on the district is less than if the infrastructure is spread out over a wider area. Also, there is generally more opportunity for mitigation of this impact at farm level (e.g. through adequate financial compensation), while there is limited opportunity for mitigation at municipal or district level. Hence, from the perspective of addressing cumulative impact, it is the view of the EAP that new power line should generally be placed in corridors where technically possible.

The impacts are seen to be similar between these two options and will arise from:

- Increased visual impact
- Increasing limitations on land-use
- Further potential reductions of property value
- Additional disruption and invasion of privacy due to the construction and maintenance of the additional power line.

The Similane-Burutho power line was reviewed in conjunction with the Integrated Development Plans (IDPs) and Spatial Development Frameworks (SDFs) for the area. These are seen to provide detail for planned development and land use management but the alternatives are all located in “agricultural areas”. The main cumulative impact is therefore seen to be further limitations on agricultural production.

It is difficult to provide as detailed an assessment of cumulative impacts as is the case for direct and indirect project induced impacts. This is usually because of the absence of specific details and information related to cumulative impacts. In these situations, the EAP will need to ensure that any assumptions made as part of the assessment are made clear. Accordingly, this includes an overview and analysis of cumulative impacts related to a variety of project actions and does not provide a significance rating for these impacts. The objective is to identify and focus on potentially significant cumulative impacts so these may be taken into consideration in the decision-making process. It is important to realise these constraints, and to recognise that the assessment will not, and indeed cannot, be perfect. The potential for cumulative impacts will, however, be considered, rather than omitted from the decision making-process and is therefore of value to the project and the environment.

8. CONCLUSION AND RECCOMENDATIONS

The majority of the watercourses in the study area are likely to have been impacted by agriculture and cattle farming to varying degrees, as well as mining in some areas. However, most of the proposed line is located on parts of the country that is very sparsely inhabited. Consequently, impacts to watercourses are relatively less significant compared to denser populated areas. Numerous waterbodies occur within the 1 km corridor discussed in this report. The watercourses (including the buffer zones) directly crossed by the proposed development are the ones likely to be potentially impacted and form the main focus of this report.

The proposed 180 km 400kV Borutho to Silimela Powerline, the relative terrestrial biodiversity theme sensitivity is classified as VERY HIGH due to portions of the site occurring within a Critical Biodiversity Area (CBA) 1 and 2. Protected Area (PA), Witvinger Nature and Reserve Occurs within the approved corridor.

Terrestrial biodiversity theme sensitivity is classified as VERY HIGH due to portions of the site occurring within an Ecological Support Area (ESA) 1 and 2

According to the NFEPA database, Unchanneled valley-bottom wetlands, Channelled valley-bottom wetlands and Seeps are associated with the project area.

The following PES Categories were noted:

- Elands = Class C: Moderately Modified
- Dorps = Class C: Moderately Modified
- Rooisloot = Class C: Moderately Modified
- Groot-Sandsloot = Class D: Largely Modified

The risk scores fall in the Low category. Authorisation may proceed through a General Authorisation given that mitigation measures are effectively implemented. The risk scores fall in the Low category. Authorisation may proceed through a General Authorisation given that mitigation measures are effectively implemented. It should be noted that Appendix D2 of GN 509 states that the construction of new transmission or distribution powerlines, minor maintenance on roads, river crossings, towers and substations, where the footprint remains the same, are exempt from a WUL.

From the impact assessment undertaken it is evident that the impacts on hydrological function and sediment balance are medium-high level impacts. However, should mitigation be implemented, the impacts will be reduced to medium-low level impacts. The impacts on ecological and sociocultural service provision, impacts on floral species as well as impacts on floral species are medium-low level impacts prior to mitigation. However, should mitigation be implemented, the impacts will be reduced to low level impacts. The impacts on faunal species will be low prior to mitigation and very-low should mitigation be implemented. During operational phase, prior to mitigation impacts on habitat and ecological structure, ecological and sociocultural service provision as well as hydrological function and sediment balance are low level impacts. Furthermore, the impacts on floral species and faunal species are very low significance impacts. However, should mitigation be implemented all impacts will be reduced to very-low significance impacts.

Several recommended mitigation measures are made to minimise the impact on the watercourses. Key mitigation measures include (but are not limited to):

- No construction may take place within the wetlands or 100m GN704 Zone of Regulation. Additionally, the wetlands and 100m GN704 Zone of Regulation must be demarcated as a no-go area;

- No stockpiles are to be permitted within the 100m GN704 Zone of Regulation;
- Exposed soil and stockpiles must be protected from wind by covering with a suitable geotextile such as hessian sheeting and ensure no stockpiles are higher than 2m;
- A site-specific rehabilitation plan, including an alien invasive plant (AIP) management plan, must be compiled and implemented. AIPs should be removed by hand and no machinery should be allowed in the wetlands.
- The use of Sustainable Drainage Systems (SuDS) to manage stormwater is considered important for the proposed development as there will be an increase in hardened surfaces within close proximity to the drainage lines, to prevent significant impacts on the hydrological functioning of the systems, reduce the risk of flooding during high flow periods and reduce the risk of increased erosion. Furthermore, any discharge of runoff into the drainage lines must be done in such a way as to prevent erosion. In this regard, it is highly recommended that a suitably qualified engineer be consulted with regards to the use of SuDS.

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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 Ecosolve 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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APPENDIX B – LEGISLATION

LEGISLATIVE REQUIREMENTS

The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 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 44ormalizati 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.
The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	The National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and the associated EIA Regulations, 2014 (as amended), 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 Water Act 1998 (Act No. 36 of 1998) (NWA)	The NWA 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 I & (i).
Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA	In accordance with Regulation GN509 of 2016, a regulated area of a watercourse for section 21c and 21i of the NWA 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: • Exercise the water use activities in terms of Section 21I and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; • Use water in terms of section 21I or (i) of the Act if it has a low risk class as determines through the Risk Matrix; • Do maintenance with their existing lawful water use in terms of section 21I or (i) of the Act that has a LOW risk class as determined through the Risk Matrix; • Conduct river and stormwater management activities as contained in a river management plan; • Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have a LOW risk class as determined through the Risk Matrix; and • 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.
Government Notice 704 – Regulations on the use of water for mining and related activities aimed at the protection of water resources, 1999	These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed project complies with Regulation GN 704 of the NWA which contains regulations on the use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;* • According to the above, the activity footprint must fall outside of the 1:100 year floodline of the watercourse or 100m from the edge of the watercourse, whichever distance is the greatest.
GDARD Requirements for Biodiversity Assessments Version 3 (GDARD, 2014).	The biodiversity assessment must comply with the minimum requirements as stipulated by GDARD Version 3 of 2014 and must contain the following information: • The wetland delineation procedure must identify the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas; • The delineation must be undertaken according to the DWAF guidelines; • The wetland and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive in a sensitivity map. Rules for buffer zone widths are as follows: • 30m for wetlands occurring inside urban areas; • 50m for wetlands occurring outside urban areas; and 50m for priority pans.

APPENDIX C – WATERCOURSE 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 freshwater features present or in close proximity of the proposed study area 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 features present in the vicinity of or within the proposed study area.

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

The freshwater features encountered within the proposed study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Proposed classification structure for Inland Systems, up to Level 3

WETLAND/AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONALSETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups Other special framework	Valley Floor
		Slope
		Plain
		Other special framework

Hydrogeomorphic (HGM) Unit 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[1] (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 at Level 2 of the classification system is that of 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) group's 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 National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through

[1] 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.

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
- **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-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation

Two levels of assessment are provided by WET-Health:

- **Level 1**: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- **Level 2:** On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment

Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial extent of the impact of individual activities and then separately assessing the intensity of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The impact scores, and Present State categories are provided in the table below.

Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D

Impact category	Description	Impact score range	Present State category
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-6.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota	8-10	F

Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

Overall health of the wetland

Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

4. Wetland Function Assessment

"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". [2] The assessment of the ecosystem services supplied by the identified freshwater features 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;

[2] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

- 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 freshwater features. 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 freshwater features.

Table C5: 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

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

The purposed 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 (Table C8) of the wetland system being assessed.

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

6. 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.

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: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

PES			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
	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 unnacceptable (Malan and Day, 2012) and therefore, should a watercourse fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

Table C8: Description of Recommended Ecological Category (REC) classes.

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

7. Wetland Delineation

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

- 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.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators, and can accordingly be classified as both. If you are adjacent to a watercourse, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

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 (DWA, 2005).

APPENDIX D – RISK ASSESSMENT METHODOLOGY

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'[3]. 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 freshwater features, 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.
- **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

[3] The definition has been aligned with that used in the ISO 14001 Standard

are then read off a significance rating matrix and are used to determine whether mitigation is necessary[4].

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 (No. 108 of 1997) 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.

"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, a 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)

[4] Some risks/impacts that have low significance will however still require mitigation

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)

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

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.

i) 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[5] 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

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

- 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.

APPENDIX E – RISK ASSESSMENT AND MITIGATION MEASURES

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecology and biodiversity, will include any activities which take place in close proximity to the project that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater system identified in this report:

Proposed construction footprint

- All development footprint areas should remain as small as possible and should not encroach into the freshwater areas unless absolutely essential and part of the proposed project. It must be ensured that the freshwater 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 should avoid freshwater areas 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 and equipment must be regularly inspected for leaks. Re-fuelling must take place outside of the stipulated setback area, 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

- Proliferation of alien and invasive species is expected within any disturbed areas. Alien invasive species are opportunistic, and where disturbances do occur, they will propagate; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;

- Removal of the alien and weed species encountered within the study area and particularly any identified within the watercourse 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 impermeable surfaces such as access roads and the walkways within close proximity to the watercourse 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 winter 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 close proximity to the watercourse, and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the watercourse;
- 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 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 proposed project should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

Monitoring Plan

The main objective of the wetland monitoring plan is to identify and assess changes in wetland habitat integrity over time as a consequence of coal washing and associated surface infrastructures and activities.

The proposed monitoring plan must thus focus on an approach that will allow for the detection and evaluation of the above impacts, summarised as follows:

- Habitat integrity
- Flow quantity in wetlands;
- Water quality

A challenge to the wetland monitoring plan is the fact that Eskom activities will take place within an environment with already impacted and degraded wetland systems that have undergone change and are undergoing further change due to existing land use activities within the catchment of these wetlands and sometimes within the wetlands themselves. Compiling a monitoring strategy able to discern the root cause of any identified changes to the wetlands can be a significant challenge.

Wetland monitoring should include the following:

WET-Health (Version 2) Level 2

The WET-Health (Version 2) Level 2 Macfarlane *et al*. (2020) assessment methodology should be applied to each of the selected wetland assessment units. This must include detailed field verified mapping of within wetland disturbance units at a fine scale. Regional land use datasets can be used for the Catchment, 200m Buffer and Inflowing Stream Buffers components of the assessment, but should be subjected to a rapid desktop review to ensure accuracy. Such a desktop review should focus on high intensity land uses such as mining and urbanisation to ensure these are accurately captured. Significant point source discharges should also be identified through a literature review and/or desktop review of aerial imagery.

Wetland Vegetation Monitoring

A vegetation-based “bottom-up” classification of wetland habitat types as detailed in Sieben *et al*. (2017) should be undertaken. As a minimum zones of similar hydroperiod (e.g. permanently wet areas, seasonally wet areas, temporary wet areas) should be identified and mapped within each wetland assessment unit and dominant plant species of each zone/habitat type recorded.

A statistically relevant quadrant- or transect-based vegetation sampling approach should then be developed based on site specific conditions and wetland type. The size and number of quadrants/transects should be determined for each individual wetland assessment unit to ensure a statistically relevant sampling procedure (the number of quandrants/transects required per wetland as well as the size of quandrants/transects are likely to vary between different wetland types, and as such need to be determined at a site-specific level). Emphasis must be placed on a repeatable sampling approach to allow for the interpretation of trends over time. Stratified sampling is recommended and should focus on habitat types most likely to reflect changes

1.5 Relevant Standards for Monitoring

Wetland monitoring must be undertaken by an experienced wetland ecologist registered with SACNASP as a Professional Natural Scientist (*Pr. Sci. Nat*.) in an appropriate field of practice. Ideally the wetland monitoring must be undertaken as a standalone report.

1.6 Monitoring Frequencies

Wetland monitoring should be undertaken once a year during the summer season, i.e. annually.

1.7 Data Capture Protocols

Data should be captured as per the WET-Health Version 2 Level 2 spreadsheets (Macfarlane, Ollis and Kotze, 2020) and in associated shapefiles.

A suitable data capture template should be developed in MS Excel for capturing vegetation monitoring data.

1.8 Monitoring/ Sampling Technique

The method detailed in the Level 2 assessment of the WET-Health Version 2 document (Macfarlane, Ollis and Kotze, 2020) should be applied.

1.9 Variables to be Analysed/Recorded

In addition to the data collection required in terms of the WET-Health Version 2 Level 2 assessment, the following should be recorded at each of the sampling wetlands:

- Fixed point photographs (at least 2 suitable locations should be identified in each wetland unit where habitat changes due to flow changes could be expected);
- On-site water quality (pH, EC, Temperature);
- Water level and approximate flow (e.g. using a Transparent Velocity Head Rod or similar/better);
- Erosion features (e.g. head-cuts, gullies, incised channels) should be recorded (co-ordinates) and dimensions noted. In the case of gullies or incised channels, specific points for such measurements should be selected; and
- At least 1 vegetation transect should be monitored per wetland. Transects should be placed to intersect areas where habitat changes due to flow changes could be expected. Vegetation zones must be recorded, as well as species per zone, and must include a measure of cover/abundance.

Reporting

Monitoring reports must be produced after each monitoring event and should include, but not be restricted to, the following:

- Observed trends between monitoring events;
- Recommendations on corrective actions that need to be implemented by Eskom and its contractors where non-compliance has been recorded; and
- Suggested updates to the WM&RP.

APPENDIX F – DETAILS OF SPECIALIST

Name: Tšepo Lepono

Company Represented: Ecosolve Consulting

Professional Registration: (Pr.Sci.Nat, Environmental Science – 119000)

Tšepo is by formal training an Environmental Scientist whose key qualification stems from a BSc (Biology and Chemistry) and BSc Honours Degree in Applied Environmental Management. He also holds a Post Graduate Diploma in Land and Agrarian. Mr Lepono has 18 years of experience in environmental management.

His experience spans both the public and private sector. Tšepo has successfully undertaken several EIA, WULAs. Many of these projects are considered landmark projects in South Africa's environmental mining sector and included several hazardous waste facilities. He is ideally skilled and experienced to manage this project to its conclusion. His CV is attached hereto.

PERSONAL DETAILS

Current Position: Director

Name of Firm: Ecosolve Consulting

Profession: Environmental Management and Ecologist

Contact Number: +27 (0) 83 339 9103

Email Address: tsepo@ecosolve.co.za

KEY COMPETENCY

Mr T Lepono is by formal training an Environmental Scientist whose key qualification stems from a BSc (Biology and Chemistry) from the National University of Lesotho (NUL) and BSc Honours Degree in Applied Environmental Management from University of North West (UNW) formerly Potchefstroom University (UP for CHE). He also holds a Post Graduate Diploma in Land and Agrarian Studies from University of Western Cape (UWC) and is currently studying towards obtaining an MPhil in the same discipline. Mr Lepono has 18 years of experience in environmental management. His roles and responsibilities in his career required him to apply skills and competencies in the following areas; Integrated Environmental Management (IEM), Conservation Planning, Project Management, Rural Development and Natural Resources Management. Mr Lepono is currently a Director at Ecosolve Consulting (Ecosolve). Ecosolve is an environmental consultancy providing services to public and the private sectors in the field of Environmental Management.

EDUCATIONAL QUALIFICATIONS

Date	Institution	Qualification
2007	University of Western Cape	Post Graduate Diploma in Land and Agrarian Studies
2002	Potchefstroom University	BSc Honours in Applied Environmental Management

1995 National University of Lesotho BSc (Biology and Chemistry)

Relevant Short Courses

Date	Institution	Course
2007	Potchefstroom University	Environmental Law for Environmental Managers
2006	Montana State University (USA)	Protected Area Management and Planning
2006	Potchefstroom University	NEMA Regulations
2005	University of Pretoria	Project Management
2003	Potchefstroom University	Environmental Law
2003	Potchefstroom University	Implementing Environment Management Systems
2002	Rand Afrikaans University	Water Quality Management for Environmental Managers
2002	Potchefstroom University	Environmental Impact Assessment
1999	Rhodes University	Aquatic Biomonitoring for Water Resource Managers and Personnel

November 2012 to date Ecosolve Consulting

Position: Director

Location: Johannesburg, South Africa

Responsibilities:

- Ensure that the senior management team gives appropriate priority to providing reports;
- Lead the communication program with other directors and senior staff members;
- Ensure that the development needs of the executive directors and other members of senior management reporting to him are identified and met;
- Responsible for proposing and developing the Company's strategy and overall commercial objectives, which he does in close consultation with the senior staff
- Responsible for conducting the affairs of the Company with the highest standards of integrity and probity and in compliance with all applicable laws, principles and rules of corporate governance, including the King III, Company's Articles of Association and its Corporate Governance Manual.
- Responsible for ensuring that the Company has in place all necessary financial, operational and compliance controls and risk management systems.

May 2008 to November 2012 Peter Brett Environmental

Position: Environment Director

Location: Johannesburg, South Africa

Responsibilities:

- Develop new markets nationally and internationally
- Accountable for the direction, performance management and development of the environmental department, ensuring quality, profitability and efficiency
- Marketing, including market research, securing new clients and maintenance of existing clients
- Manage all environmental projects
- Appoint and Manage of Specialists
- Evaluate and review of reports before submission to environmental authorities for approval – quality assurance.

July 2003 to April 2008 **Maloti-Drakensberg Project (World Bank Funded)**

Position: **Biodiversity Project Manager**

Location: **Maseru, Lesotho**

Responsibilities:

- The overall responsibilities include fulfilling the role of head of the conservation department of the project as part of a multi-disciplinary team working towards a broad vision of promoting conservation and sustainable use of biological diversity and economic development within the Maloti-Drakensberg bioregion.
- Formulation of an Integrated National Development Planning Framework linking plans with the resource base
- Sectoral and resource integration at community, district and national levels including the integration of data and adoption of uniform enumeration and planning areas
- Harmonisation of planning legislation including development of natural resources by-laws for the newly formulated local government structures in Lesotho
- Facilitate execution of conservation assessments and development of monitoring programmes in collaboration with stakeholders
- Develop a 20 year conservation and development strategy for the Maloti-Drakensberg bioregion and a 5 year action plan including a spatial land use plan
- Facilitate development of a country specific (Lesotho) bioregional conservation and development plan
- Facilitate development of Lesotho conservation and development 5-year action plan and financing plan
- Provide technical support to environmental management of the MDTP
- With the Department of Environment (DoE) and other stakeholders, ensure development of legislation and policies pertaining to conservation and management of biodiversity and its components.

1998 to 2003 **Rand Water**

Position: **Scientist**

Location: **Vereeniging, Gauteng, South Africa**

Responsibilities:

- Accreditation of SASS5 Index as a tool for monitoring of Upper Vaal Catchment water quality.
- Routine SASS5 assessment for Upper Vaal Catchment from 1999 – 2003.
- Overall management of the Aquatic Biomonitoring Unit within the Hydrobiology Section.
- Development and maintenance of methods that comply with national and international standards and fulfils Rand Water's and clients' requirements in terms of source water protection
- Supervision of contractors and consultants assisting with source water protection
- The activities related to the laboratory working area designated to aquatic biomonitoring and field studies are co-ordinated and managed
- Routine and special research investigations related to source water protection are co-ordinated and managed.
- Aquatic biomonitoring techniques that are internationally accepted are identified, developed, validated, and verified for possible use by Rand Water.
- Undertake ecological research in the Vaal Dam catchment that will provide information and assist with the protection of source water as well as all aspects related to aquatic biomonitoring.
- Aquatic biomonitoring methods are maintained and performed in accordance with internationally accepted protocols like Standard ISO 14001.
- Development of water quality objectives in the Wilge, Liebengersvlei, Grootdraai Dam, Waterval and the Vaal Dam catchments
- Water quality monitoring in the Vaal Dam and Vaal Barrage catchments
- Collate and integrate specialists' reports for compilation of research projects for Rand Waters' Catchment Management section and other clients

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1996 to 1998 **CSIR – Environmentek**

Position: **Scientific Technician**

Location: **Maseru, Lesotho**

Responsibilities:

- The overall responsibilities included performing, on a monthly basis, SASS4 index, water sampling from the rivers on the Mohale and Katse Dam catchments for chemical analysis and undertaking full benthic invertebrate sampling and analysis
- Planning and organising field trips
- Data Management
- River mapping for the purpose of measuring habitat degradation over time.

- Working with international and local firms on the Instream Flow Requirements (IFR) for river courses downstream of LHWP dams.
- Water quality monitoring of Phase 1B of the rivers within LHWP dams.
- Baseline water quality and aquatic communities' studies on the rivers within the LHWP dams.

Miscellaneous

- Worked with a multi disciplinary team in developing SADC Regional Biodiversity Strategy;
- National coordinator for the Biodiversity Working Group from 2003 to 2008. This forum gives strategic direction for conservation planning and management within Lesotho;
- Member of joint technical Bearded Vulture Study Group. A joint initiative between Lesotho and South Africa for management of Vultures and other birds of prey;
- Presented a paper for International Water Association (IWA) Conference in Edinburg on "Ecological Effects of the Release of Water from Katse Dam into Ash/Liebenbergsvlei System – Rand Water's Perspective"
- Public Lecture on "The Role of Public Participation on Linear Projects in Developing Countries" at Oxford Brookes University in London;
- Presented a Paper at the International Water Association in Scotland on Water Quality Impacts of Transfer of Water from Lesotho Highlands Water Project (LHWP) into Vaal System
- Presented a paper at UNESCO in Zambia on Challenges in Establishing Protected Areas in Communal System of Lesotho

RELEVANT ASSIGNMENTS

PERIOD	ROLE	CLIENT	PROJECT TITLE
2020 - Current	Water Quality Monitoring for 2019/2020 High Flows	Lepelle Northern Water	Biomonitoring (Fish, Macroinvertebrates, Diatoms, Bioaccumulation and Toxicity) Assessments for LNW Catchment, Limpopo
2019 - Current	Water Quality Monitoring	NTC Group	Klipspruit Biomonitoring (Fish, Macroinvertebrates and Toxicity) Assessments for South32 Mine, Ogies.
2019 - Current	Water Quality Monitoring	NTC Group	Khuthala Biomonitoring (Fish, Macroinvertebrates and Toxicity) Assessments for South32 Mine, Ogies.
2019 - Current	Water Quality Monitoring	Vametco	Biomonitoring (Fish, Macroinvertebrates and Toxicity) Assessments for Vametco Alloys, North West.
2019 - Current	Environmental Assessment Practitioner	Eskom	EA Amendment for Amendments of Environmental Authorisations, Construction EMPrs and General

PERIOD	ROLE	CLIENT	PROJECT TITLE
			Authorisations for Transnet Coal Link Upgrade Project
2019 - Current	Environmental Control Officer	ROMH	Upgrade of Gravel Road to Surface Standard in Thulani, Soweto
2018 - Current	Water Quality Monitoring for 2018/2019 High Flows	Lepelle Northern Water	Biomonitoring (Fish, Macroinvertebrates, Diatoms, Bioaccumulation and Toxicity) Assessments for LNW Catchment, Limpopo
2018 - Current	Water Quality Monitoring	NTC Group	Biomonitoring (Fish, Macroinvertebrates and Toxicity) Assessments for South32 Mine, Ogies.
2016 – Current	Environmental Control Officer	SANRAL	N2 Wildcoast Toll Road Highway, OR Tambo Disrict Municipality. Eastern Cape.
2018 – Current	Environmental Assessment Practitioner	VMQ Property Services	Environmental Fatal Flaw Analysis for Medunsa and Arcadia Properties.
2016 – 2017	Environmental Control Officer and OHSE Consultant	PRASA	Construction of PRASA's Depot Modernisation Programme in Wolmerton.
2016 - 2016	Open Space Development and Management Framework	Gudani Environmental	Strategic Assessment Framework for Western Mining Belt – City of Johannesburg
2015 - Current	Environmental Control Officer	PRASA	Provision Of Environmental Control Officer (ECO) for Proposed Development of PRASA Nigel Rolling Stock Manufacturing Plant in Nigel – Civil Works
2015 - Current	Environmental Management	SANRAL	Mine Closure Application for Rehabilitation of N17 from Bethal to Ermelo
2015 - Current	Environmental Management	SANRAL	Mine Closure Application for Rehabilitation of N17 from Springs to Leandra
2014 - Current	Environmental Control Officer	Loliwe Rail	Provision Of Environmental Control Officer (ECO) for Duffs Road Station Modernisation Project
2013 - Current	Waste Management and Biodiversity Chapters	United nations Environmental Programme (UNEP)	State of Environment Outlook Report (SEOR) for Lesotho 2012 – 2030.
2013 – 2014	Environmental Assessment Practitioner	Nkambule and Associates	Environmental Management for Limindlela Station in Gauteng Province – PRASAs Mordenisation Programme
2013 – 2014	Environmental Assessment Practitioner	PRASA	Environmental Management for Braamfontein Depot in Gauteng

PERIOD	ROLE	CLIENT	PROJECT TITLE
			Province – PRASAs Mordenisation Programme
2013 – Current	Environmental Assessment Practitioner	PRASA	Environmental Management for Wolmerton Depot in Gauteng Province – PRASAs Mordenisation Programme
2013 – Current	Environmental Assessment Practitioner	PRASA	Environmental Management for Springfield Depot Kwazulu Natal – PRASAs Mordenisation Programme
2013 – 2014	Environmental Assessment Practitioner	PRASA	Environmental Management for Durban Yard Depot in Kwazulu Natal – PRASAs Mordenisation Programme
1999 – 2002	Project Manager	Rand Water	Ecological impacts of the release of water from Katse Dam into Ash/Liebenbergsvlei system.
2002 – 2002	Biodiversity Specialist	Government of Lesotho (NES)	State of Environment Report (SoER) 2002 for Lesotho.
2002 – 2002	Ecologist	NUL Consuls	Environmental Impact Assessment (EIA) for Letšeng la Letsie in Lesotho.
2002 – 2002	Ecologist	NUL Consuls	Environmental Impact Assessment (EIA) for Letšeng la Terai Diamond Mine in Lesotho.
2002 – 2003	Programme Manager	Rand Water	Monitoring of Water from Katse Dam into the Upper Vaal System.
2002 – 2005	Ecologist	Sechaba Consultants	Feasibility Study for the Augmentation of Water in the Lowlands of Lesotho (Lesotho Lowlands Water Supply Scheme).
2003 – 2003	Project Director	NUL Consuls	LHDA Contract 1053. Biological Resources Monitoring on the LHWP Phase 1B catchment.

LANGUAGE PROFICIENCY

Language	Reading	Speaking	Writing
English	Excellent	Excellent	Excellent
Sesotho	Excellent	Excellent	Excellent
iSizulu	Good	Good	Good
Tswana	Good	Good	Good

SCIENTIFIC PUBLICATIONS

- Lepono,T. Du Preez,H. Thokoa, M. 2003. Monitoring of Water Transfer from Katse Dam into the Upper Vaal River System: Water Utility's Perspective Water Science & Technology. IWA Publishing.
- Roy, D. P.; Trigg, S. N.; Bhima, R.; Brockett, B.; Dube, O.; Frost, P.; Govender, N.; Landmann, T.; Roux, J. L. & Lepono, T. 2006. The utility of satellite fire product

accuracy information -perspectives and recommendations from the southern Africa fire network. IEEE Transactions on Geoscience and Remote Sensing.

PROFESSIONAL REGISTRATION

SACNASP – Pri.Sci.Nat 119000

AWARDS

Best Paper Presentation – 35th Annual Conference, Namibia: Southern African Society of Aquatic Scientists (SASAqS). 1999.

APPENDIX G – IMPACT 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[6]. 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. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and

[6] The definition has been aligned with that used in the ISO 14001 Standard.

duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The probability of the impact and the sensitivity of the receiving environment together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. 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[7]. The assessment of significance is undertaken twice. Initially, significance is based only on natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation. 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 (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes as shown below. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

The significance of project related environmental impacts was determined through a criterion that relies on the application of scientific measurements and on professional judgement. Environmental significance was determined for before and after the implementation of recommended mitigation measures. Environmental significance depends on the nature of the impact, which is dependent on the impact characteristics that are namely the extent, intensity, duration, frequency and probability.

In summary, the process endeavours to identify what is important or acceptable, activities that will require environmental management actions and it will also assist with the schedule for the implementation of the management measures.

The significance of the project impacts was calculated based on the following formulae:

Impact Significance = consequence (extent + duration + intensity) x probability

The Impact Assessment Framework is as follows:

Impact Assessment Framework

Consequence (C)	Extent (E)	Rating	Duration (D)	Rating	Intensity (I)	Rating
	Site Local Regional National International	1 2 3 4 5	Immediate Short-term Medium-term Long term Permanent	1 2 3 4 5	Negligible Low Moderate High Very High	1 2 3 4 5
Probability (P)	Frequency of Occurrence			Rating		
	None Improbable Low Probability Medium Probability High Probability Definite			0 1 2 3 4 5		
Significance (S)	Negligible	Low	Low-Medium	Medium	Medium-High	High

[7] Some risks/impacts that have low significance will however still require mitigation

	0	1-15	16- 30	31 -45	46-60	> 60

Significance Rating Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (Frequency of Activity + Frequency of Impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Positive/Negative Mitigation Ratings.

Significance	Rating Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126 – 150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101 – 125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium – High	76 – 100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium – Low	51 – 75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26 – 50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very Low	1 – 25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

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 develops 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 all stages of the project cycle including:
  - Pre-construction;
  - Construction; and
  - Operational.
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed; and
- Particular attention was paid to describing any residual impacts that may occur.

Mitigation Measure Development

- The following points present 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[8] are identified and described in as much detail as possible;
- Measures and actions to address negative impacts will favour avoidance and prevention over minimization, mitigation or compensation;
- 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, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation.

Recommendations

- 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 development as a whole. Mitigation measures have been developed to address issues from planning, through construction and rehabilitation to after care and maintenance.

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