38 Jacaranda Street, Arboretum, Richards Bay
P.O. Box 101672, Meerensee, 3901
Telephone: 035 789 0632 / 078 284 9332 Fax: 086 535 8846
Website: www.emveloconsultants.co.za E-mail: info@emveloconsultants.co.za

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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

EIA REF: 14/12/16/3/3/2/2145

The proposed upgrading of Olifantspoort and Ebenezer Water Supply Schemes, Phase 1 within the Jurisdiction of Capricorn and Mopani District Municipalities, Limpopo Province.

23 AUGUST 2022

Prepared by:

Emvelo Quality and Environmental Consultant (PTY) Ltd.

Prepared for:

Sigodi Marah Martin Management Support (Pty) Ltd.

On Behalf of:

Lepelle Northen Water (SOC)

Applicant Details:

The Applicant	**Lepelle Northen Water (SOC)**
Contact Person	**Gundo Motsoare** **Project Engineer**
Address	**1 Landros Mare Street, Polokwane, 0700**
Contact Details	**(015) 295 1800** **gundom@lepelle.co.za**

Environmental Assessment Practitioner (EAP) Details

Name of Consultancy	**Emvelo Quality and Environmental Consultant (PTY)Ltd**
Name of EAP	**Phumzile Lembede (B.Sc. Honours in Environmental Management) Registered Pr. Sci. Nat. and EAP** **Dumisani Myeni (B.Sc. Honours in Environmental Management); Registered Cand. Sci. Nat.**
Peer Reviewer	**Dr Troy Govender, PhD (Environmental Science), Masters (Environmental Management), B. Sc. B. Tech (PR Management), Pr. Sci. Nat.** **Independent Sustainability and Environmental Scientist**
Address	**P.O. Box 101672, Meerensee, 3901** **38 Jacaranda Street, Arboretum, Richards Bay 3900.**
Contact Details	**Tel: 035 789 0632/ Fax: 086 577 5220** **info@emveloconsultants.co.za**

PROJECT TEAM	CLIENT CONTACT PERSON
Phumzile Lembede Dumisani Myeni	Gundo Motsoare (Project Engineer)

Overview: Assessment of impacts related to the proposed upgrading of Olifantspoort and Ebenezer Water Supply Schemes, Phase 1, in order to ensure the Client's compliance with all relevant environmental legislation.

Project Team Details	
Principal EAP	***Phumzile Lembede*** (BSc. Honours in Environmental Management) Registered: Pr. Sci. Nat. (SACNASP) & EAP (EAPASA) Field: Environmental Management & Water Resource 10 Years' Experience phumizle@emveloconsultants.co.za
Study Lead	***Dumisani Myeni*** (BSc. Honours in Environmental Management) Registered: Cand. Sci. Nat (SACNASP) Field: Environmental Management, Water Resource & Waste Management. 8 Years' Experience dumisani@emveloconsultants.co.za

QMS – INFORMATION

PRINCIPAL EAP	STUDY LEAD	PEER REVIEWER
Phumzile Lembede	Dumisani Myeni	Troy Govender
ENV. CONSULTANT	ENV.SCIENTIST	ENV.SCIENTIST

QMS-REVISION HISTORY

Revision	Revision Date	Details	Authorized	Name	Position
1	08-08-2022	DRAFT EIR	Y	Dumisani Myeni	Study Lead Env. Scientist

2	12-08-2022	DARFT EIR	Y	Dr. Troy Govender	Peer Review Env. Scientist
3	22-08-2022	DRAFT EIR	Y	Phumzile Lembede	Principal EAP Env. Scientist

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LIST OF ACRONYMS

CA	Competent Authority
CBA	Critical Biodiversity Area
CFP	Chance Finds Procedure
DEIR	Draft Environmental Impact Assessment Report
DFFE	Department of Forestry, Fisheries and Environment
DOT	Department of Transport
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ERA	Environmental Risk Assessment
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
HCW	Health care (medical) waste
HGM	Hydrogeomorphic
I&APs	Interested and Affected Parties
mASL	Meters Above Sea Level
MSDS	Material Safety Data Sheet
NEMA	National Environmental Management Act 107 (Act 107 of 1998)
NEM:PAA	National Environmental Management: Protected Areas, 2003 (Act 57 of 2003)
NFEPA	National Freshwater Ecosystem Priority Areas
NWBEST	National Web-Based Environmental Screening Tool
PAOI	Project Area of Influence
SCC	Species of Conservation Concern
SP	Significance Point/score

GLOSSARY OF TERMS

ACTIVITY: An action either planned or existing that may result in environmental impacts through resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.

ALTERNATIVES: Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.

APPLICANT: The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.

ARCHAEOLOGICAL RESOURCES: includes (a) material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artifacts, human and hominid remains and artificial features and structures; (b) rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation; wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, 1994 (Act 15 of 1994), and any cargo, debris or artifacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation; features, structures and artifacts associated with military history which are older than 75 years and the site on which they are found.

BIODIVERSITY: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

CONTRACTOR: companies and or individual persons appointed on behalf of the client to undertake activities, as well as their sub-contractors and suppliers.

DEVELOPMENT: the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity, but excludes any modification,

alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.

DEVELOPMENT FOOTPRINT: any evidence of physical alteration because of the undertaking of an activity.

ENVIRONMENT: in terms of the NEMA (as amended), the "environment" means the surroundings within which humans exist and that are made up of: (i) the land, water, and atmosphere of the earth; (ii) micro-organisms, plant and animal life; any part or combination of (i) of (ii) and the interrelationships among and between them; the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

ENVIRONMENTAL AUTHORISATION: An authorisation issued by the competent authority in respect of a listed activity, or an activity which takes place within a sensitive environment.

ENVIRONMENTAL CONTROL OFFICER (ECO): an individual nominated through the client to be present on-site to act on behalf of the client in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities as prescribed in NEMA.

ENVIRONMENTAL IMPACT: the change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr): a detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive environmental impacts and limiting or preventing negative environmental impacts are implemented during the lifecycle of the project. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.

GENERAL WASTE: waste that does not pose an immediate hazard or threat to health or the environment, and includes domestic waste; building and demolition waste; business waste; and inert waste.

HAZARDOUS WASTE: hazardous waste means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

HYDROLOGICAL SYSTEM: water bodies and their connectivity to the welfare of an ecosystem.

INDIGENOUS VEGETATION: refers to vegetation consisting of native plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

INTERESTED AND AFFECTED PARTY (I&AP): for the purposes of Chapter 5 of the NEMA and in relation to the assessment of the environmental impact of a listed activity or related activity, an interested and affected party contemplated in Section 24(4) (a) (v), and which includes (a) any person, group of persons or organization interested in or affected by such operation or activity; and (b) any organ of state that may have jurisdiction over any aspect of the operation or activity.

MITIGATION: the measures designed to avoid, reduce or remedy adverse impacts.

POLLUTION: NEMA defines pollution to mean any change in the environment caused by the substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people or will have such an effect in the future.

REHABILITATION: rehabilitation is defined as the return of a disturbed area to a state which approximates the state (wherever possible) which it was before the disruption.

WATER POLLUTION: the National Water Act, 1998 (Act 36 of 1998) defines water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (a) to the welfare, health or safety of human beings; (b) to any aquatic or non-aquatic organisms; (c) to the resource quality, or (d) to property.

WATERCOURSE: can be a) a river or spring; b) a natural channel or depression in which water flows regularly or intermittently; c) a wetland, lake or dam into which, or from which, water flows; and/or d) any collection of water which the Minister may, by notice in the Gazette, declare to be a

watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.

WETLAND: the 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.

ASSUMPTIONS AND LIMITATIONS

Certain assumptions, limitations, and uncertainties are associated with this report. This report is based on information that is currently available and, as a result, the following assumptions and limitations should be noted:

- This report is based on project information provided by the client;
- The description of the baseline environment has been obtained from environmental desktop study, site/field visits and specialist studies;
- The results are based on the outcomes of a single assessment. The risk assessment only included the proposed development and the anticipated activities, no ancillary activities were considered; and
- In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project.

EXECUTIVE SUMMARY

Emvelo Quality and Environmental Consultant (PTY) Ltd has been appointed by Sigodi Marah Martin Management Support (Pty) Ltd (the Project Principal Agent) on behalf of Lepelle Northern Water (SOC) Ltd (the Applicant), as the independent Environmental Assessment Practitioner (EAP), to facilitate the Scoping and Environmental Impact Assessment Process required in terms of the National Environmental Management Act1998 (Act. No. 107 of 1998) (NEMA) for this application.

The Lepelle Northern Water (SOC) (LNW) is a water service board supplying three regions in Limpopo Province, namely: Capricorn, Mopani, and Sekhukhune Region. The upgrades will only affect the water schemes within Capricorn and Mopani Regions, namely: Olifantspoort and Ebenezer Water Supply Schemes (WSS). The Olifantspoort and Ebenezer WSS have become an integrated scheme, as they both supply similar regions and also supply the Greater Polokwane Municipal which is highly populated and is a strategic economic hub for Limpopo Province. The proposed upgrading components form phase 1 for this broader schemes upgrade. These schemes supply potable water to the Polokwane Municipal area, and surrounding communities. Therefore, LNW has identified components of the project for advance implementation to secure Polokwane's current water needs. Consequently, the Environmental Impact Assessment (Scoping and full EIA) process has commenced, as a result of the proposed upgrades.

The NEMA Environmental Impact Assessment (EIA) Regulations (2014) as amended in 2017, govern the process of applying for environmental authorization for certain developments. A provision in the EIA Regulations is made for two forms of assessment: Basic Assessment and Scoping & EIA, depending on the scope of the activity. The EIA regulations specify that: Activities identified in Listing Notice 1 and 3 (GNR 327 and 324 of 2017) require a Basic Assessment while activities identified in Listing Notice 2 (GNR 325 of 2017) are subject to a Scoping and EIA. The listed activities associated with the proposed development are: ***Listing Notice 1***, Activity 9,12, 19, and 45; ***Listing Notice 3***, Activity12 and 14; ***Listing Notice 2***, Activity 11, 15 and 16. Therefore, this application will follow a Scoping/EIA (S&EIR) process, as activities in Listing Notice 2 has been triggered.

The Public Participation Process (PPP) for both the Scoping and Environmental Impact Assessment was undertaken in accordance with chapter 6 of GN No. 326 (7 April 2017), as well

as the EIA regulations and the Disaster Management Act, 2002 (Act No. 57 of 2002) as published on 29 April 2020 (***Refer to Appendix E***).

The study area within Olifantspoort WSS has the following environmental sensitivities: The Olifantspoort Off-Channel Storage Dam will be constructed within Critical Biodiversity Area 1 (CBA1); The Olifantspoort abstraction works (weir and upgrade abstraction pipeline) will take place within Olifants River (NFEPA) and within CBA1. The pipeline route from PS1 to Specon reservoirs has some of its sections traversing along sensitive environment namely CBA1, CBA2, Chunies River (NFEPA), and one hydrological body (wetland). The pipeline route from PS2 to Witkos and Palmietfontein Reservoirs has some of its sections traversing the CBA1, CBA2 Chunies River (NFEPA), and three hydrological bodies (wetlands). The pipeline route from Palmietfontein Reservoirs to OSA164 has some of its section traversing along CBA1, three (3) hydrological bodies, and also traverse adjacent the Protected Area. The pipeline route from OSA 164 to Krugersburg reservoirs has other parts of the pipeline traversing adjacent the boundary of Protected Area (Polokwane Nature Reserve), CBA1 and one (1) hydrological body (wetland).

Whereas the study area within Ebenezer WSS has the following environmental sensitivities: The pipeline route from Ebenezer pumpstation to the Rustfontein reservoirs complex has portions traversing the Great Letaba River (NFEPA), one (1) hydrological body (wetland system), and a vast track of CBA1. The section adjacent Haenertsburg village overlain by Woodbush Granite Grassland which is considered 'Critically Endangered'.

The potential impact as a result of upgrading the Olifantspoort and Ebenezer WSS, will be mitigated by carefully employing the following preferred alternatives: *'Alternative A: Routing Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Location Alternative'* that will meet the stated need for and purpose of the project, by providing proper mitigation measures. The summary of the significant impacts for the construction and operation/maintenance phase are outlined by ***Table 1*** below.

The preferred '*Alternative A: Routing Alternatives'* for the proposed project will have minimal environmental impact as this alternative proposes that, the proposed conveyance infrastructure run parallel to the existing pipeline. This 'Routing Alternative' also proposes few deviations where the pipeline will intercept with sensitive biophysical environment, existing infrastructure, and heritage resources, which will be consolidated with the '*Alternative B: Design Alternative'*. The '*Alternative C: Technology Alternative'*, describe the excavatability and rippability to determine

the use of machinery. Due to persisting bedrocks, the preferred technology to be used will be heavy mechanical excavator, bulldozer of mass approximately 35t, fitted with a single-tine ripper suitable for heavy ripping, and of flywheel power of approximately 220kW. The wedging will be undertaken where the bedrock outcrop is intercepted. The blasting must be discouraged and be used as last resort where all means and mentioned methods mentioned above show some significant failures. The '*Alternative D: Location Alternative*' considers the proposed site for Off-Channel Storage Dam (OCSD) is the most preferred due to the following reasons: the topographic and geological formation for the proposed OCSD site highly favours the design for the dam; OCSD will be highly dependent on its close proximity to the Olifantspoort abstraction and water treatment works (WTW) as it forms a component of water treatment storage (impounding). The location of new proposed Olifantspoort weir favours the current abstraction works as alternative location will require construction abstraction works at different location, Therefore, the location of new proposed weir reduces the construction footprint of raw water conveyance infrastructure between the OCSD and the existing WTW. Furthermore, the '*Site Layout Alternative'* proposes the construction of new weir, by considering the operational and environmental aspect associated with upgrading of existing weir.

In order to ensure that the potential identified alternatives are assessed in the most objective manner possible, an environmental sensitivity exercise, and preliminary desktop studies were undertaken for the study area, against the development areas (locality of water supply schemes). A screening study was also initiated in order to assess where identified potential alternatives would be suitable. Therefore, the direct and indirect impacts, as a result of construction, operations and maintenance were assessed during the scoping phase, include biophysical impacts and socio-economic impacts.

The key environmental issues that were identified during the scoping phase are: impacts on aquatic features, terrestrial biodiversity (habitat fragmentation), terrestrial aquatic ecosystem functions and services, geology and soils, pollution, heritage and paleontological resources, and traffic. These impacts were further assessed during EIA phase and mitigation measures discussed in this report. The (***table 1***) below outlines the and overall summarised impacts significance.

Table 1: Summarised Impacts Significance

Impact	Construction Phase		Operational Phase	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Erosion due to uncontrolled construction activities such as, clearing of vegetation, topsoil removal, degradation of indigenous vegetation and sensitive plant communities and associated habitats due to excavation for bulk water pipeline upgrades or replacement.	High	Very low	Medium-High	Negligible
Uncontrolled construction activities for clearance along riparian zone, wetlands and CBAs (i.e. inappropriate utilization of sensitive systems).	High	Negligible	Medium-High	Negligible
Potential loss of wetland and riparian zone habitat	High	Negligible	Medium-High	Negligible
Alteration of flow regimes and fluvial systems due to pipeline route construction within the wetlands and riparian zones.	Very high	Very low	Medium-High	Negligible
Uncontrolled construction activities within an instream habitat, such as excavations within and the removal of substrate within the Olifants River for abstraction work, Chunies River, Greater Letaba River and streams for pipeline crossing, leading to altered flows, poor water quality, and modified geomorphology.	High	Very Low	Medium-High	Negligible
Destruction of heritage resources	Medium	Negligible	Negligible	Negligible
Uncontrolled construction activities may result in oil/chemical spills such as - portable toilets, petrol, diesel and other hydrocarbons spills.	Medium high	Negligible	Medium-High	Negligible
Alien invasive plant encroachments through construction activities	Medium	Negligible	Medium	Negligible

The EAP submits that the environmental process undertaken thus far complies with the requirements as prescribed by Appendix 3 of GNR 326 (EIA Regulation 2014 as amended on 07 April 2017) and that this report covers the full suite of potential environmental issues related to the activities of upgrading of Olifantspoort and Ebenezer WSS phase 1. All potential impacts have been evaluated and responded to by either complete avoidance where possible, or by recommendation of the most appropriate and feasible mitigation measures. The preferred/mitigated development proposal presented in this Draft Environmental Impact Report (DIER) is responsive to the integrated results of inputs from I&APs during the Scoping Phase and the assessment of potential impacts made by the various specialists on the project team.

1 INTRODUCTION AND BACKGROUND

Emvelo Quality and Environmental Consultant (PTY) Ltd. has been appointed by Sigodi Marah Martin Management Support (Pty) Ltd (the Project Principal Agent) on behalf of Lepelle Northern Water (SOC) Ltd (the Applicant), as an independent Environmental Assessment Practitioner (EAP) to undertake an Environmental Impact Assessment (EIA) for the proposed upgrading of Olifantspoort and Ebenezer Water Supply Schemes, Phase 1 within the Jurisdiction of Capricorn and Mopani District Municipalities, Limpopo Province, as required in terms of the National Environmental Management Act ,1998 (Act. No. 107 of 1998) (NEMA) for this application.

The LNW is a water service board supplying three regions in Limpopo Province, namely: Capricorn, Mopani, and Sekhukhune Region. The upgrades will only affect the water schemes within Capricorn and Mopani Regions, namely: Olifantspoort and Ebenezer WSS. The Olifantspoort and Ebenezer WSS have become an integrated scheme, as they both supply similar regions and also supply the Greater Polokwane Municipal which is highly populated and which is also a strategic economic hub for Limpopo Province. The proposed upgrading components form phase 1 for these broader schemes upgrade. These schemes supply potable water to the Polokwane Municipal area, and surrounding communities. Therefore, LNW has identified components of the project for advance implementation to secure Polokwane's current water needs. Consequently, the Environmental Impact Assessment (Scoping and full EIA) process has commenced, as a result of the proposed upgrades, assisting the LNW (applicant) in identifying all potential adverse environmental consequences of the project, their extent and significance, and to ensure that the environmental management requirements are adequately implemented.

1.1 Details of the EAP

The contact details of the Emvelo Quality and Environmental Consultant (Pty) Ltd. (the EAP) is detailed on the cover page with project details. Below the details of the project team that conducted the EIA. The CVs are attached as (***Appendix F***).

Table 2: Project Team

Name	Qualification	Professional Registration	Experience (Years)	Duties
Phumzile Lembede	B.Sc. Honours in Environmental Management.	Pr. Sci. Nat. (Environmental Science, SACNASP) EAP (EAPASA)	10	Principal EAP (Project Manager & Environmental Scientist
Dumisani Myeni	B.Sc. Honours in Environmental Management.	Cand. Sci. Nat. (Environmental Science, SACNASP)	8	Study Lead Environmental Scientist

1.2 Specialists

The (***Table 3***) provides a list of the specialist studies that have been undertaken to address the key impacts that was relevant to this EIA. The specialist reports are included in (***Appendix G***).

Table 3: Team of Environmental Specialists

Name	Qualification	Professional Registration	Experience (Years)	Duties
Andrew Husted	MSc. (Aquatic Health) BSc. (Natural Science)	Pr. Sci. Nat. (Aquatic, Ecological and Environmental Science), SACNASP	13 years	Terrestrial Biodiversity Impact Assessment
Avhafarei Phamphe	MSc. (Botany)	Pr. Sci. Nat (Ecological Science), SACNASP	18 years	

Name	Qualification	Professional Registration	Experience (Years)	Duties
Andrew Husted	MSc.(Aquatic Health) BSc. (Natural Science)	Pr. Sci. Nat. (Aquatic, Ecological and Environmental Science), SACNASP	13 years	Aquatic Ecological Impact Assessment Wetland Delineation Impact Assessment
Ryan Edwards	MSc. (Environmental Science)	Pr. Sci. Nat., SACNASP	14 Years	
Caleena De Carvalho	BSc. (Hons) Environmental Water Management	Pr. Sci. Nat., SACNASP	5 Years	
Bryan Paul	BSc. (Hons) Environmental Management	Pr. Sci. Nat., SACNASP	8	
Paulo Kagoda	MS. (Engineering)	International Association of Hydrological Sciences (IAHS), Water Institute of Southern Africa (WISA)]	12 Years	Hydrology Impact Assessment
John Phipson	Diploma in Agriculture (1960).	Pr. Sci. Nat., SACNASP	58 Years	Agricultural Impact Assessment
Roy Muroy	Masters in Archaeology Cultural Heritage and Museum Studies	Professional Member of Association of Professional Heritage	9 Years	Paleontological, Archaeological and Cultural Heritage Impact Assessment

Name	Qualification	Professional Registration	Experience (Years)	Duties
Marion Bamford	PhD in Palaeobotany	Practitioners; Professional Member of Association of Southern African Professional Archaeologists Palaeontological Society of Southern Africa	25 years	

1.3 Report Structure

This report has been prepared in compliance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ["NEMA"] and the EIA Regulations contained in Government Notice (GN) No. R982 of 2014 as promulgated in terms of the NEMA ["EIA Regulations"] as amended up to and including GNR 326 in GN 40772 of 07 April 2017. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in ***Table 4*** below.

Table 4: Environmental Impact Assessment Report Structure

EIA Regulation	Description – EIA Regulation (2014) as amended on 07 April 2017	Content in Report
Appendix 3(a):	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	• Section 1.1 • Appendix F
Appendix 3(b):	The location of the activity. Including – i. The 21-digit Surveyor General code of each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in items (i) and (ii) is not available, the co-ordinates of the boundary of the property or properties;	• Section 3
Appendix 3(c):	A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and co-ordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On a land where the property has not been defined, the co-ordinates within which the activity is to be undertaken;	• Section 3
Appendix 3(d):	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered; ii. A description of the activities to be undertaken, including associated structures and infrastructure;	• Section 4 • Section 6
Appendix 3(e):	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	• Section 9
Appendix 3(f):	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report;	• Section 7
Appendix 3(g):	A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	• Section 7

EIA Regulation	Description – EIA Regulation (2014) as amended on 07 April 2017	Content in Report
Appendix 3(h):	A full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: – (i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and (x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	• Section 4 • Section 8 • Section 11 • Section 12 • Section 14 • Appendix E
Appendix 3(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the EIA process; and	• Section 12 • Section 14

EIA Regulation	Description – EIA Regulation (2014) as amended on 07 April 2017	Content in Report
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	
Appendix 3(j)	An assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	• Section 14 • Section 15
Appendix 3(k):	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	• Section 17
Appendix 3(l):	An environmental impact statement which contains- (i) a summary of the key findings of the EIA: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives	• Section 3 • Section 20 • Appendix C
Appendix 3(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	• Section 17 • Appendix B
Appendix 3(n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	• Section 8.6 • Section 14 • Section 15

EIA Regulation	Description – EIA Regulation (2014) as amended on 07 April 2017	Content in Report
Appendix 3(o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	• Section 18
Appendix 3(p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	• Assumption and limitation
Appendix 3(q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	• Section 7 & Section 21
Appendix 3(r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	N/A
Appendix 3(s)	An undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by I&APs;	• Appendix A
Appendix 3(t)	Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
Appendix 3(u)	An indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	N/A
Appendix 3(v)	Any specific information that may be required by the competent authority; and	N/A
Appendix 3(w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

2 PROJECT TITTLE

The proposed upgrading of Olifantspoort and Ebenezer Water Supply Schemes, Phase 1 within the Jurisdiction of the Capricorn and Mopani District Municipalities, Limpopo Province.

3 PROJECT LOCALITY

The project locality is described in terms of geographic locational context and site context, as explained in (***Section 3.1 & 3.2***) below.

3.1 Geographical Locational Context

The study area represents the regions where the upgrades for Olifantspoort and Ebenezer WSS phase 1 will take place, namely Haenertsburg within Greater Tzaneen Local Municipality; Sekhukhune and Lebowakgomo within Lepelle-Nkumpi Local Municipality; Polokwane, Krugersburg and Mankweng within Polokwane Local Municipality, in Limpopo Province (***Figure 1***).

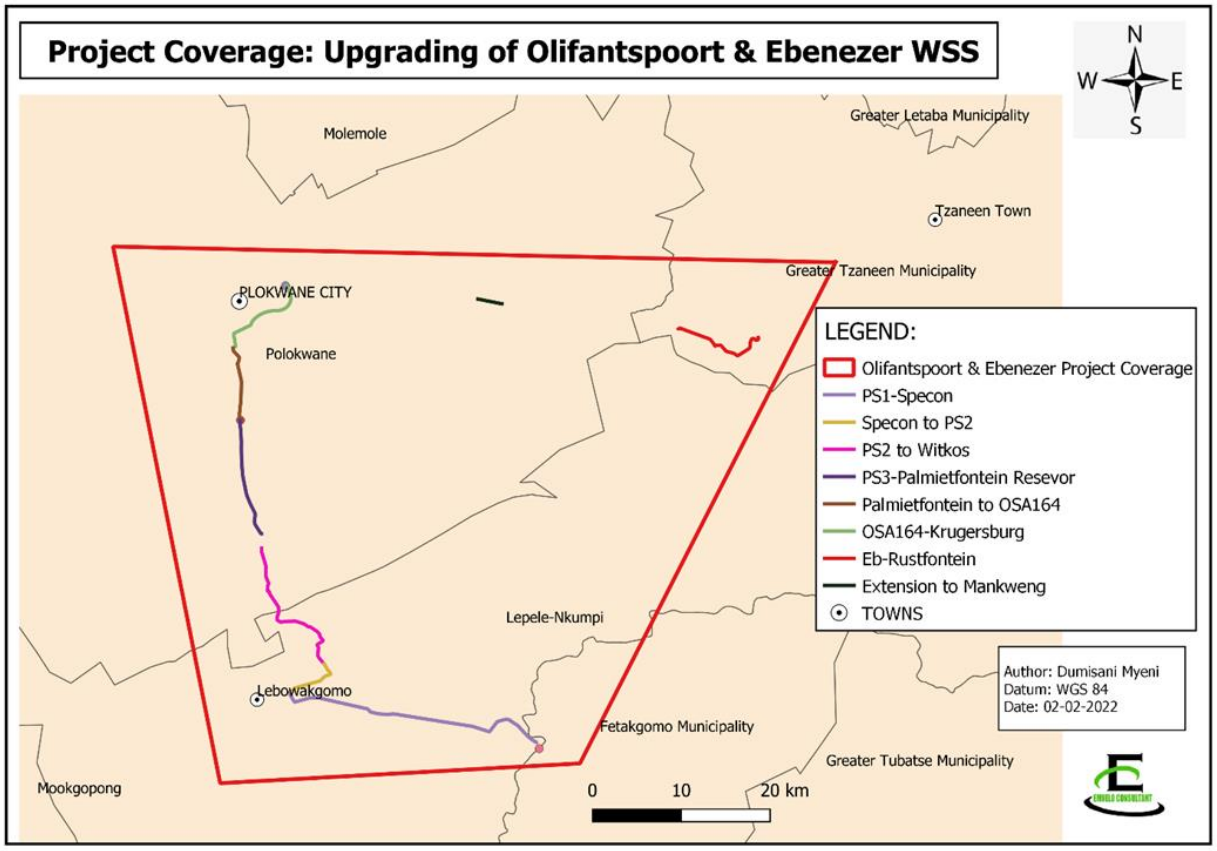

Figure 1: Geographic locational context (Olifantspoort &Ebenezer Project Coverage)

3.2 Site Locality Context (Site Description)

The upgrades for Olifantspoort and Ebenezer WSS phase 1 will take place and traverse along the following localities, namely: Dal Josaphat Farm, Mphahlele, Lebowakgomo Q, Lebowakgomo S, Syferkuil Farm, Driefontein Farm, Bezuidenhout Lust Farm, Patent Farm, Majebas Kraal, Rustfontein Farm, Bochum Farm, Driekuil Farm, Eindelik Farm, Hove Farm, Troutwaters AH, Haenertsburg Town and Townlands, Mankweng, Polokwane Game Reserve, and Krugersburg.

The ***Tables 5, 6 & 7*** below, provides the Global Positioning System (GPS) co-ordinates for the outlined water packages for the proposed upgrades for Olifantspoort and Ebenezer WSS phase 1.

Table 5: Co-ordinates (Olifantspoort WSS Coverage)

Olifants Abstraction	
Co-ordinates	24°21'40.14"S, 29°45'39.60"E
Proposed Olifants Weir Co-ordinates	
East Bank (East Flank End)	24°21'37.03"S, 29°45'42.24"E
Central	24°21'38.30"S, 29°45'43.95"E
West Bank (West Flank End)	24°21'39.97"S, 29°45'46.26"E
Raw Water main to Off-stream storage Dam	
Start Co-ordinates	24°21’40.11”S, 29°45’41.60”E
Bend 1	24°21'38.90"S, 29°45'37.34"E
Bend 2	24°21'39.86"S, 29°45'31.02"E
End Co-ordinates	24°21’39.18”S, 29°45’28.72”E
Off- Channel Storage Dam	
Co-ordinates	24°21’38.30”S, 29°45’25.88”E
Corner 1	24°21'37.91"S, 29°45'29.83"E
Corner 2	24°21'35.25"S, 29°45'29.15"E
Corner 3	24°21'27.02"S, 29°45'26.86"E
Corner 4	24°21'23.27"S, 29°45'22.87"E
Corner 5	24°21'27.07"S, 29°45'14.08"E
Corner 6	24°21'34.34"S, 29°45'11.67"E
Corner 7	24°21'36.38"S, 29°45'13.84"E
Corner 8	24°21'34.70"S, 29°45'15.48"E
Corner 9	24°21'41.24"S, 29°45'18.97"E
Corner 10	24°21'44.48"S, 29°45'26.90"E
Raw Water main from OCSD to Olifantspoort WTW	
Start Co-ordinates	24°21'31.00"S, 29°45'25.65"E
Bend 1	24°21'30.49"S, 29°45'28.96"E
Bend 2	24°21'24.72"S, 29°45'28.80"E
Bend 3	24°21'24.72"S, 29°45'28.80"E
Bend 4	29°45'30.63"E, 29°45'32.47"E
End Co-ordinates	24°21'22.15"S, 29°45'32.60"E

PS1 to Specon	
Start Co-ordinates	24°21’17.29”S, 29°45’32.10”E
Bend 1	24°19'59.62"S, 29°43'58.28"E
Bend 2	24°19'56.94"S, 29°43'56.91"E
Bend 3	24°19'52.93"S, 29°43'42.02"E
Bend 4	24°20'1.88"S, 29°43'9.43"E
Bend 5	24°20'38.92"S, 29°42'40.90"E
Bend 6	24°19'36.41"S, 29°36'30.50"E
Bend 7	24°19'26.85"S, 29°35'27.92"E
Bend 8	24°19'16.01"S, 29°35'17.56"E
Bend 9	24°18'35.35"S, 29°32'17.67"E
Bend 10	24°18'35.69"S, 29°31'47.10"E
Bend 11	24°18'51.12"S, 29°30'51.46"E
Bend 12	24°18'23.32"S, 29°30'34.35"E
End Co-ordinates	24°18’16.70”S, 29°30’32.31”E
Specon to PS2	
Start Co-ordinates	24°18’15.17”S, 29°30’37.49”E
Bend 1	24°18'15.39"S, 29°30'37.51"E
Bend 2	24°18'16.18"S, 29°30'38.60"E
Bend 3	24°18'15.64"S, 29°30'40.66"E
Bend 4	24°18'11.65"S, 29°30'41.80"E
Bend 5	24°18'9.71"S, 29°30'45.37"E
Bend 6	24°18'2.78"S, 29°30'50.16"E
Bend 7	24°18'0.35"S, 29°30'49.42"E
Bend 8	24°17'32.66"S, 29°32'26.12"E
Bend 9	24°17'16.74"S, 29°32'43.42"E
Bend 10	24°17'10.27"S, 29°33'2.06"E
Bend 11	24°17'8.95"S, 29°33'2.86"E
Bend 12	24°16'59.95"S, 29°32'57.70"E
Bend 13	24°16'53.08"S, 29°32'51.21"E
Bend 14	24°16'34.99"S, 29°32'41.34"E
End Co-ordinates	24°16’32.52”S 29°32’39.35”E
PS2 to Witkos	
Start Co-ordinates	24°16’30.64”S, 29°32’37.59”E
Bend 1	24°16'2.58"S, 29°32'15.99"E
Bend 2	24°15'32.34"S, 29°32'18.51"E
Bend 3	24°15'25.16"S, 29°32'14.24"E
Bend 4	24°15'21.70"S, 29°32'13.77"E
Bend 5	24°15'8.97"S, 29°32'34.93"E
Bend 6	24°15'5.02"S, 29°32'33.82"E
Bend 7	24°14'53.95"S, 29°32'24.39"E
Bend 8	24°14'47.40"S, 29°32'23.48"E
Bend 9	24°14'35.33"S, 29°32'14.76"E
Bend 10	24°14'17.92"S, 29°31'49.14"E
Bend 11	24°14'17.02"S, 29°31'41.30"E
Bend 12	24°14'6.45"S, 29°31'25.00"E
Bend 13	24°13'56.75"S, 29°30'53.53"E
Bend 14	24°13'58.04"S, 29°30'15.58"E
Bend 15	24°14'0.97"S, 29°30'1.01"E
Bend 16	24°13'52.23"S, 29°29'47.03"E
Bend 17	24°13'40.49"S, 29°29'49.46"E
Bend 18	24°13'37.42"S, 29°29'48.94"E
Bend 19	24°13'26.69"S, 29°29'53.20"E

Bend 20	24°13'21.23"S, 29°29'53.21"E
Bend 21	24°13'20.77"S, 29°29'53.47"E
Bend 22	24°13'6.06"S, 29°29'52.99"E
Bend 23	24°12'17.42"S, 29°29'21.01"E
Bend 24	24°12'9.09"S, 29°29'20.29"E
Bend 25	24°12'8.20"S, 29°29'13.71"E
Bend 26	24°12'5.03"S, 29°29'12.05"E
Bend 27	24°11'44.28"S, 29°29'14.49"E
Bend 28	24°11'42.57"S, 29°29'17.47"E
Bend 29	24°11'7.41"S, 29°29'6.17"E
Bend 30	24°10'40.50"S, 29°29'8.14"E
Bend 31	24° 9'45.67"S, 29°28'51.81"E
End Co-ordinates	24°09'32.02"S, 29°28'51.09"E
Witkos Reservoir	
Co-ordinates	24°09'33.01"S, 29°28'52.71"E
Witkos-PS3 Pumping Main	
Start Co-ordinates	24°09'29.75"S, 29°28'50.06"E
Bend 1	24° 9'25.89"S, 29°28'48.70"E
Bend 2	24° 9'23.43"S, 29°28'48.85"E
Bend 3	24° 8'54.64"S, 29°28'49.67"E
End Co-ordinates	24°08'39.35"S, 29°28'51.70"E
PS3-Palmietfontein Reservoir Main	
Start Co-ordinates	24°08'39.02"S, 29°28'50.56"E
Bend 1	24° 8'38.80"S, 29°28'49.66"E
Bend 2	24° 8'38.20"S, 29°28'48.65"E
Bend 3	24° 8'5.80"S, 29°28'27.99"E
Bend 4	24° 7'53.06"S, 29°28'24.78"E
Bend 5	24° 7'27.94"S, 29°28'28.33"E
Bend 6	24° 6'18.77"S, 29°27'57.16"E
End Co-ordinates	24°01'47.07"S, 29°27'33.71"E
Palmietfontein Reservoir	
Co-ordinates	24° 1'46.35"S, 29°27'34.32"E
Palmietfontein to OSA164	
Start Co-ordinates	24°01'46.12"S, 29°27'32.14"E
Bend 1	24° 1'21.29"S, 29°27'30.28"E
Bend 2	24° 1'15.05"S, 29°27'31.96"E
Bend 3	23°59'26.30"S, 29°27'38.16"E
Bend 4	23°58'20.13"S, 29°27'23.10"E
Bend 5	23°58'16.76"S, 29°27'26.52"E
Bend 6	23°57'58.28"S, 29°27'30.67"E
Bend 7	23°57'34.92"S, 29°27'8.97"E
End Co-ordinates	23°57'24.12"S, 29°27'07.00"E
OSA164 to Krugersburg	
Start Co-ordinates	23°57'22.86"S, 29°27'09.34"E
Bend 1	23°57'23.09"S, 29°27'9.51"E
Bend 2	23°57'18.85"S, 29°27'16.99"E
Bend 3	23°56'30.88"S, 29°27'9.59"E
Bend 4	23°56'0.82"S, 29°28'11.63"E
Bend 5	23°55'46.67"S, 29°28'17.69"E
Bend 6	23°55'35.20"S, 29°28'28.42"E
Bend 7	23°55'24.91"S, 29°28'42.30"E
Bend 8	23°55'16.98"S, 29°28'57.46"E
Bend 9	23°55'9.03"S, 29°29'31.91"E

Bend 10	23°55'2.50"S, 29°30'12.69"E
Bend 11	23°54'52.68"S, 29°30'25.67"E
Bend 12	23°54'32.29"S, 29°30'37.22"E
Bend 13	23°54'9.27"S, 29°30'37.23"E
Bend 14	23°54'9.19"S, 29°30'33.96"E
Bend 15	23°53'59.88"S, 29°30'31.97"E
Bend 16	23°53'57.18"S, 29°30'29.98"E
Bend 17	23°53'46.91"S, 29°30'29.16"E
End Co-ordinates	23°53’36.82”S, 29°30’24.49”E

Table 6: Co-ordinates (Ebenezer WSS Coverage)

Ebenezer Pumpstation- Rustfontein	
Start Co-ordinates	23°56’45.94”S, 29°58’59.78”E
Bend 1	23°56'52.01"S, 29°59'0.57"E
Bend 2	23°56'54.24"S, 29°58'57.73"E
Bend 3	23°56'54.85"S, 29°58'55.77"E
Bend 4	23°56'55.84"S, 29°58'52.49"E
Bend 5	23°56'55.19"S, 29°58'50.26"E
Bend 6	23°56'50.25"S, 29°58'44.34"E
Bend 7	23°56'50.61"S, 29°58'36.74"E
Bend 8	23°57'4.49"S, 29°58'30.09"E
Bend 9	23°57'16.26"S, 29°58'29.62"E
Bend 10	23°57'17.76"S, 29°58'29.84"E
Bend 11	23°57'20.64"S, 29°58'29.72"E
Bend 12	23°57'25.36"S, 29°58'26.92"E
Bend 13	23°57'52.27"S, 29°57'44.49"E
Bend 14	23°57'43.43"S, 29°57'30.56"E
Bend 15	23°57'37.05"S, 29°57'4.93"E
Bend 16	23°57'15.01"S, 29°56'44.58"E
Bend 17	23°57'13.95"S, 29°56'27.21"E
Bend 18	23°57'17.39"S, 29°56'24.83"E
Bend 19	23°57'15.41"S, 29°56'20.69"E
Bend 20	23°57'9.17"S, 29°56'18.20"E
Bend 21	23°56'51.93"S, 29°56'3.51"E
Bend 22	23°56'44.43"S, 29°55'43.01"E

Bend 23	23°56'11.67"S, 29°54'15.53"E
Bend 24	23°56'15.60"S, 29°54'9.59"E
End Co-ordinates	23°56’14.78”S, 29°54’08.87”E
Extension to Mankweng	
Start Co-ordinates	23°54’48.91”S, 29°42’24.10”E
End Co-ordinates	23°54’25.96”S, 29°41’58.89”E.

Table 7: Pipeline River Crossings

PS1 to Specon	
River crossing 1 (Chunies River)	24°19'58.66"S, 29°43'57.78"E
River crossing 2 (Chunies River)	24°18'58.20"S, 29°33'59.11"E
PS2 to Witkos	
River crossing 1 (Chunies river)	24°15'10.87"S, 29°32'31.84"E
River crossing 2 (Chunies river)	24°13'56.77"S, 29°29'54.46"E
River crossing 3 (Chunies river)	24°13'48.39"S, 29°29'47.78"E
River crossing 4 (Chunies river)	24°13'38.20"S, 29°29'49.08"E
Wetland crossing 1	24°12'6.26"S, 29°29'12.70"E
Wetland crossing 2	24°11'52.08"S, 29°29'13.52"E
River crossing 5 (Chunies river)	24°10'57.46"S, 29°29'6.92"E
River crossing 6 (Chunies river)	24°10'52.15"S, 29°29'7.30"E
Ebenezer pump station-Rustfontein reservoirs	
River Crossing 1 (Greater Letaba)	23°56'48.73"S, 29°59'0.30"E
River Crossing 2 (Greater Letaba)	23°56'31.62"S, 29°55'8.12"E

Table 8: Proposed Diversions

PS1 to Specon	
Diversion 1 Start Coordinates	24°21'13.50"S, 29°45'23.23"E
Diversion bend 1	24°19'59.61"S, 29°43'58.32"E
Diversion bend 2	24°19'56.98"S, 29°43'56.92"E
Diversion bend 3	24°19'52.92"S, 29°43'42.02"E
Diversion bend 4	24°20'2.03"S, 29°43'9.65"E
Diversion 1 End Co-ordinates	24°20'38.89"S, 29°42'41.04"E
Diversion 2 Start Co-ordinates	24°18'35.36"S, 29°32'17.77"E
Diversion bend 1	24°18'35.67"S, 29°31'47.10"E

Diversion bend 2	24°18'51.13"S, 29°30'51.46"E
Diversion bend 3	24°18'23.33"S, 29°30'34.36"E
Diversion 2 End Coordinates	24°18'16.78"S, 29°30'32.75"E
Ebenezer pump station to Rustfontein reservoirs	
Diversion 1 Start Co-ordinates	23°56'46.01"S, 29°58'59.71"E
Diversion Bend 1	23°56'52.04"S, 29°59'0.55"E
Diversion Bend 2	23°56'54.23"S, 29°58'57.77"E
Diversion Bend 3	23°56'55.87"S, 29°58'52.49"E
Diversion Bend 4	23°56'55.18"S, 29°58'50.23"E
Diversion Bend 5	23°56'50.22"S, 29°58'44.35"E
Diversion Bend 6	23°56'50.59"S, 29°58'36.86"E
Diversion Bend 7	23°57'4.57"S, 29°58'30.08"E
Diversion 1 End Co-ordinates	23°57'17.78"S, 29°58'29.86"E

The (***Table 9***) below, provides the 21-digit Surveyor General Code (SGC).

Table 9: The 21-digit Surveyor General Code

T	O	K	S	0	0	5	4	0	0	0	0	0	4	6	1	0	0	0	0	0
T	O	K	S	0	1	8	0	0	0	0	0	0	0	6	4	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	0	2	2	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	1	1	2	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	1	1	4	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	0	8	3	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	0	1	5	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	1	4	7	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	6	4	2	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	3	6	9	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	3	6	5	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	3	6	2	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	3	6	6	0	0	0	0	0
T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	1	5
T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	2	3

T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	2	5
T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	2	4
T	O	K	S	0	0	1	8	0	0	0	0	0	2	2	4	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	6	4	5	0	0	0	0	3
T	O	K	S	0	0	1	8	0	0	0	0	0	2	2	2	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	2	2	6	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	0	1	8	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	2	1	9	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	1	0	8	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	1	1	1	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	2	2	3	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	0	9	5	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	1	0	9	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	2	2	5	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	6	8	0	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	0	9	6	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	0	1	1	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	1	7	9	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	2	2	1	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	6	4	5	0	0	0	0	4
T	O	K	S	0	0	1	8	0	0	0	0	0	6	4	5	0	0	0	0	0
T	O	K	S	0	0	1	8	0	0	0	0	0	6	4	5	0	0	0	0	2
T	O	K	S	0	0	1	8	0	0	0	0	0	1	6	9	0	0	0	0	0
T	O	K	S	0	0	1	0	0	0	0	0	1	0	3	9	0	0	0	0	0
T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	0	7
T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	0	9
T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	1	7

T	O	K	S	0	0	0	0	0	0	0	0	0	4	5	8	0	0	0	0	0
T	O	K	S	0	0	0	0	0	0	0	0	0	0	9	7	0	0	0	0	0
T	O	K	S	0	0	0	0	0	0	0	0	0	0	9	7	0	0	0	0	1
T	O	K	S	0	0	0	0	0	0	0	0	0	2	6	2	0	0	0	0	0
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T	O	K	S	0	0	0	0	0	0	0	0	0	2	6	3	0	0	0	0	1
T	O	K	S	0	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0
T	O	K	S	0	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	3
T	O	K	S	0	0	0	0	0	0	0	0	0	0	7	4	0	0	0	0	0
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T	O	K	S	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	9
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T	O	K	S	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0
T	O	K	S	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0
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T	O	K	S	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	5
T	O	K	S	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	5
T	O	K	S	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	1
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T	O	L	S	0	0	0	0	0	0	0	0	0	7	4	6	0	0	0	0	0

T	O	L	S	0	0	0	0	0	0	0	0	0	6	8	8	0	0	0	0	0
T	O	L	S	0	0	0	0	0	0	0	0	0	9	9	3	0	0	0	0	0
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T	O	L	S	0	1	0	2	0	0	0	4	3	1	3	5	0	0	0	0	0
T	O	L	S	0	1	0	2	0	0	0	4	3	2	5	5	0	0	0	0	0

The Olifantspoort OCSD and weir represented in ***figure 2*** are situated within Koppieskraal, Portion 0. Farm No. 475, and Dal Josaphat Farm No. 461.

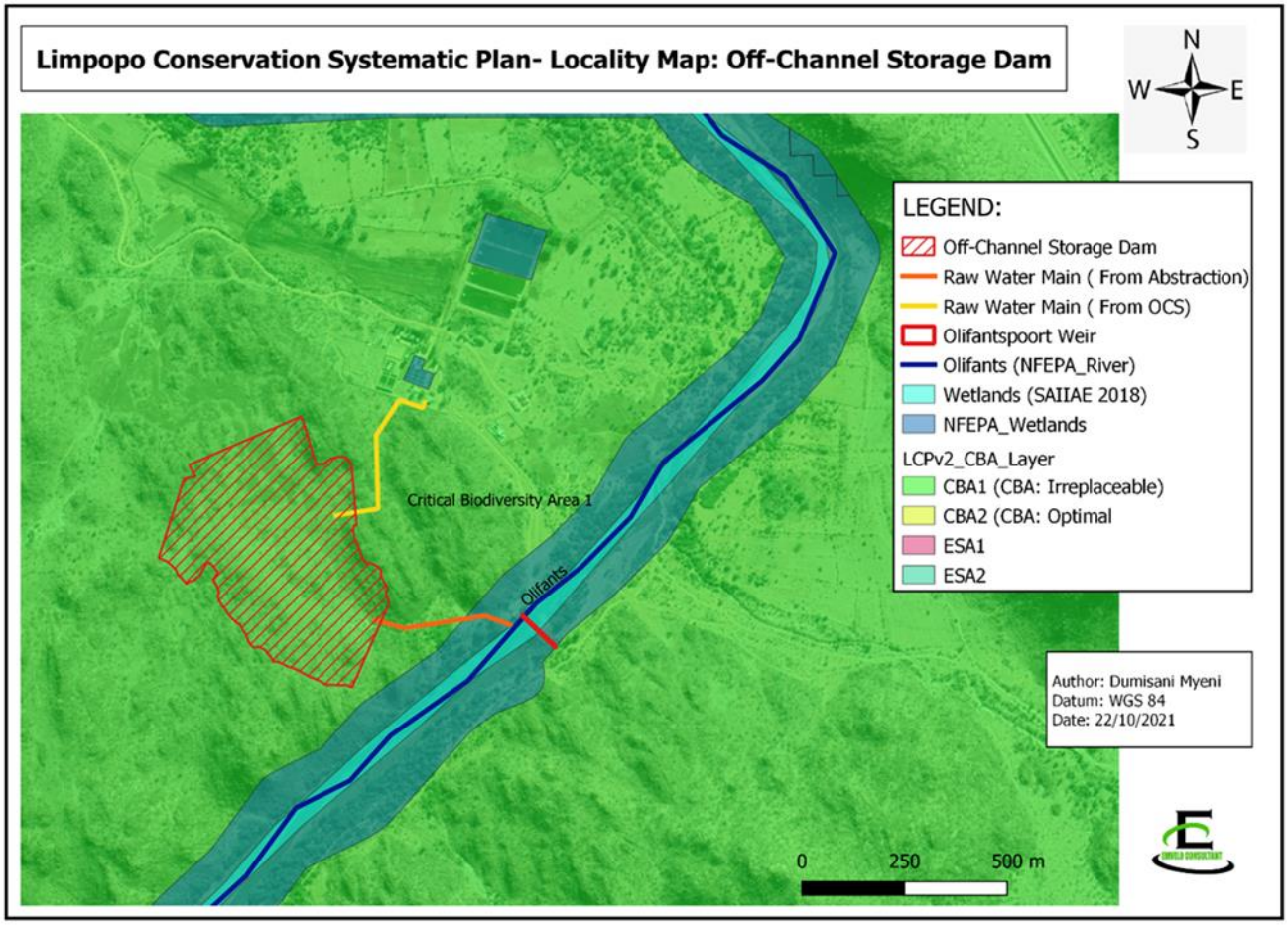

Figure 2: Olifantspoort Off-Channel Storage Dam and Olifantspoort Weir

Approximately 86km of upgrades for Olifantspoort WSS' water conveyance and storage infrastructure from Olifants River (abstraction) to Krugersburg Reservoirs (***figure 3***), traverse the following localities: Koppieskraal, Voorspoed, Locatie Van M`Phatlele, Lebowakgomo-S, Lebowakgomo-Q, Uitloop, Schoonheid, Tsjuenispoort Oost, Staanplaats, Langkrans, Morgenzon, Block A, Tsjuenispoort West, Polokwane Metallurgical Complex, Beestekraal, Rietkolk, Palmietfontein, Du Preez Rust, Beestekraal, Weltevreden, Wildebeestkuil, Polokwane Town, Polokwane Game Reserve, Sterkloop, and Krugersburg.

Approximately 13.5km of upgrades for Ebenezer WSS' water conveyance from Ebenezer high lift pumpstation to Rustfontein reservoir complex, and extension from chamber GB73 to the Mankweng reservoir off-take (***figure 4***), traverse the following localities: Misty Crown, Driekuil, Hove, Bali-Will-Will, Rustfontein, Bochum, Eindelik, Rooiwal, Weighton, Stylbult, Haenertsburg Town and Townlands, Westwood, Allandale, Danallan, Nooitgedacht, Troutwaters AH, Driefontein, Syferkuil, and Bezuidenhout Lust.

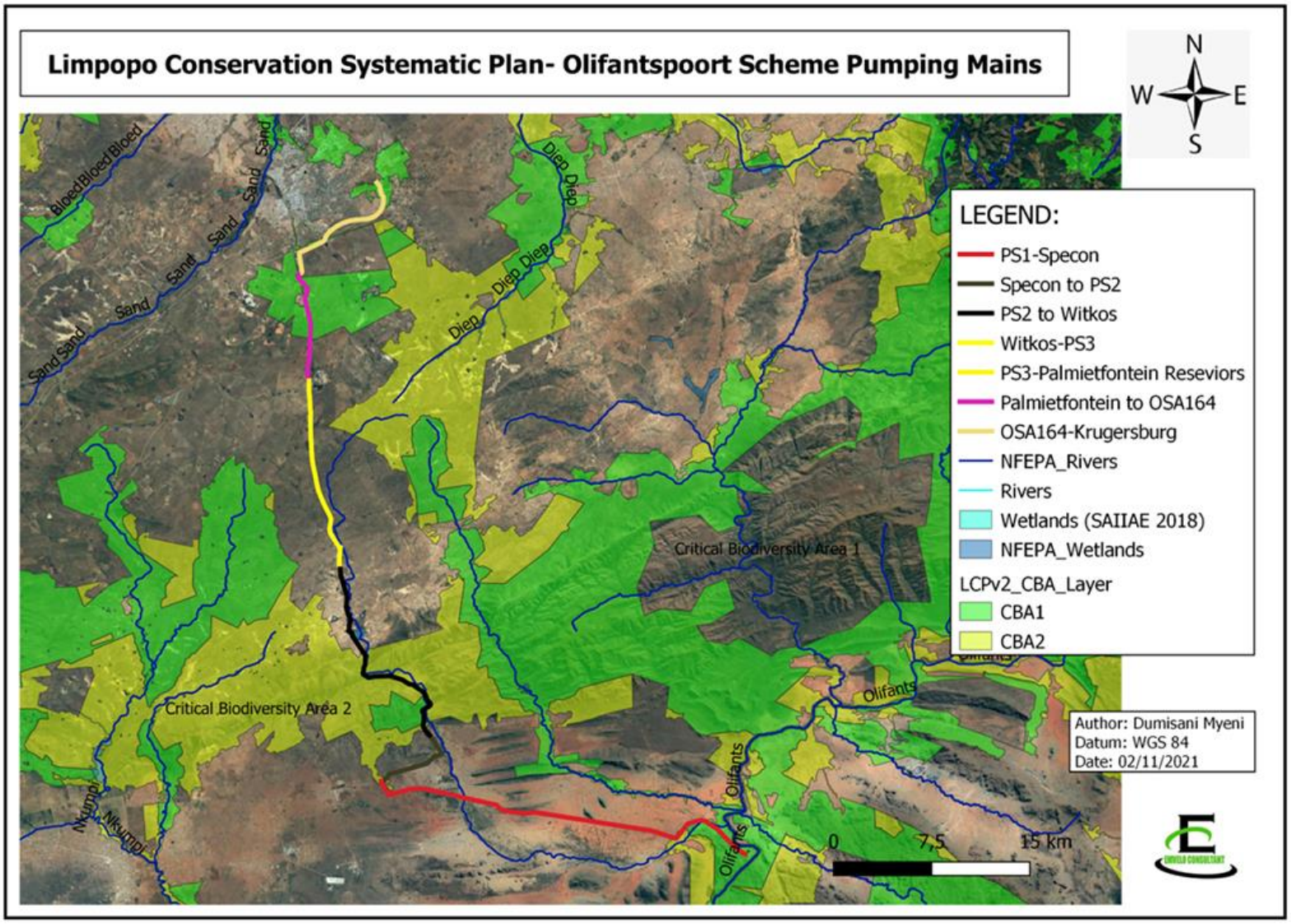

Figure 3: Map Showing Locality of Olifantspoort Supply Scheme Pumping Mains

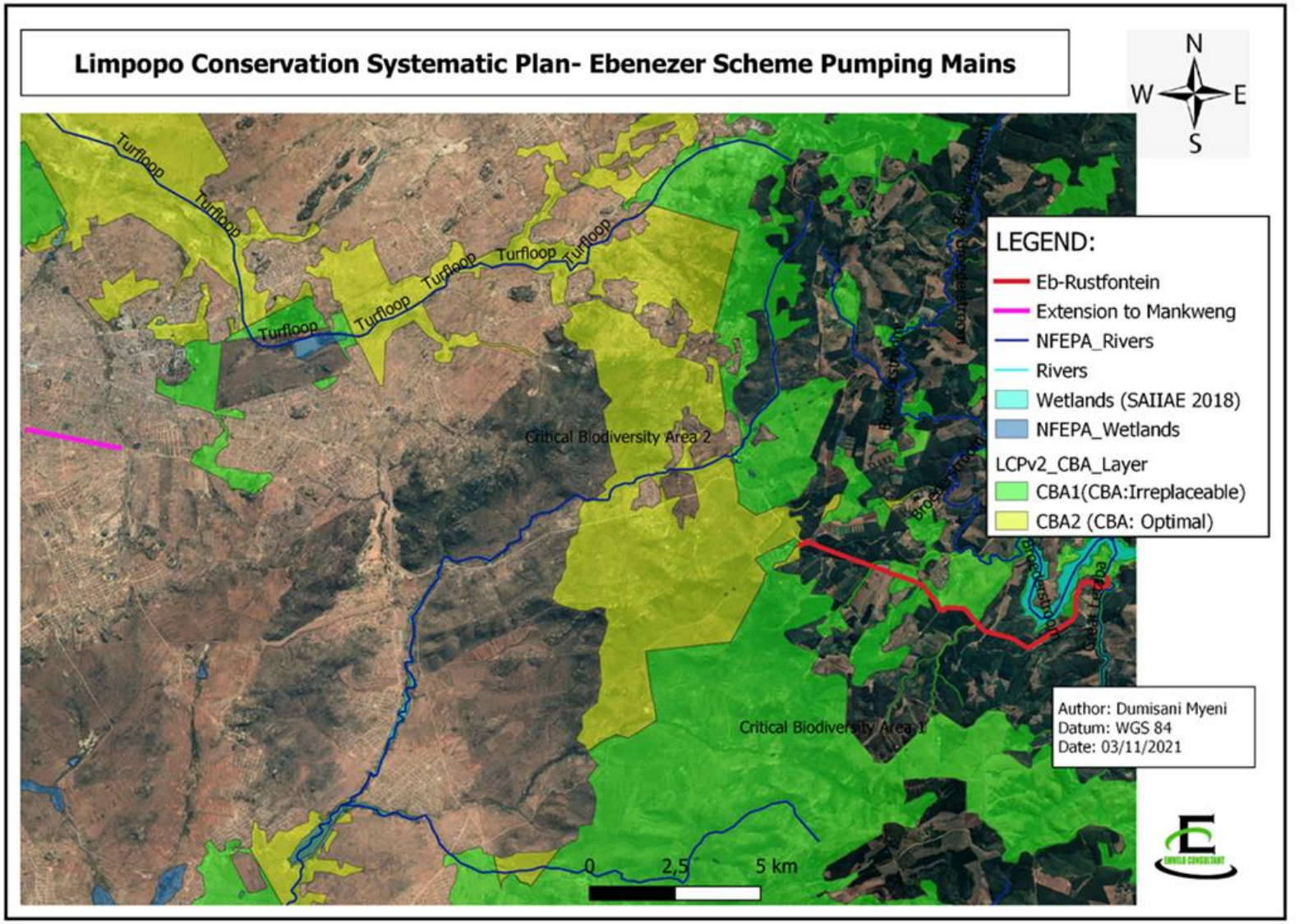

Figure 4: Map Showing Locality of Ebenezer Supply Scheme Pumping Mains

3.3 Site Access

The site directions given below begin from the starting point of the Olifantspoort WSS and Ebenezer WSS, assuming that all sites can be accessed from the starting point and moving towards the project ending point, along the pipeline route, as discussed below. However, this does not imply to site access for construction activities and hauling of material to the rest of project pipeline routes.

As the routes lie parallel to the main and provincial roads or next to built-up areas, there are multiple access points to the pipeline routes. In many instances the pipeline route runs parallel to Eskom power lines which usually have medium to good quality gravel maintenance service roads.

It is recommended that where there are no existing access roads, or access road passes through residential areas, the construction access must follow the servitude of the existing pipeline route. Progressive site clearance for the pipeline and access route will be achieved through the following:

- This will be along the existing pipeline route servitude and will require an increase in the existing servitude width to accommodate the new pipeline. The tractor excavator/bulldozer will strip the topsoil and set it aside for later reinstatement or soiling of batters as required. The cleared area will form an area for a pipeline route and for access to reach further working area of pipeline route and making provision for maintenance road within the pipeline servitude.
- A pipeline construction corridor will be not more than 15m width. The construction servitude will include the trench, one-way running track, topsoil stockpile corridor and subsoil stockpile corridor. All areas of watercourses outside this servitude must be considered no-go areas.
- In order to construct a pipeline, staging areas and storage yards are cleared and strategically located along the planned right-of-way.

The sub-sections (***3.3.1 & 3.3.***2) below detail direction to site locality with the reference from Polokwane City.

3.3.1 Access to Olifantspoort WSS

The Olifantspoort abstractions works are approximately 60km southeast of Polokwane City (24° 21’ 40.10” S, 29°45’41,58”E). The sites can be accessed via the R37 from Polokwane City toward Lebowakgomo. Along R37 at Lebowakgomo take R518 toward the Lebowakgomo Build It Store and heads past Mamaolo. Just after passing Lebowakgomo Traffic Department, the route veers left along the gravel road toward Mphahlele village and passes through Seleteng Taxi Rank, continues towards Maijane Primary School, and turns sharp right about 400m, following the main road toward Olifantspoort Water Treatment Works (WTW). The Olifantspoort abstraction works is approximately 1km from Olifantspoort WTW. The OCSD site (24°21’38.30”S, 29°45’25.88”E) is adjacent the Olifantspoort abstraction works, and behind Olifantspoort WTW. To access the remainder of the project’s water convenience and storage infrastructure, travel backwards toward Lebowakgomo S and Lebowakgomo Q, then from Specon reservoirs travel back to Polokwane City to access Krugersburg reservoirs (23°53'37.91"S, 29°30'18.16") at Krugersburg (end of project).

3.3.2 Access to Ebenezer WSS

The Ebenezer WSS starts at Ebenezer pumpstation adjacent to Ebenezer Dam. The sites can be accessed via the R71 from Polokwane City towards Haenertsburg which passes through Haenertsburg and on the R528 towards Tzaneen. Thereafter left towards Mist Crown (Ebenezer Dam) to reach to Ebenezer pumpstation. To access the remainder of project’s water conveyance infrastructure sites, travel back to Haenertsburg and Rustfontein reservoirs, following the accessible pipeline route. For the Mokweng pipeline extension, travel toward Turfloop Nature Reserve and turn left at Paledi Mall to Mokweng reservoirs which is across the street.

4 DESCRIPTION OF PROPOSED ACTIVITIES

The proposed upgrading of Olifantspoort Water Supply Scheme, Phase 1 from Olifantspoort WTW to Krugersburg Reservoirs, and Upgrading of Ebenezer Water Supply Scheme, Phase 1 from Ebenezer Pumpstation to Rustfontein, and Mankweng reservoir off-take, will include the following components of the water conveyance and storage infrastructure.

Both of the proposed pipeline upgrades and refurbishment between Olifantspoort and Ebenezer Schemes’ water conveyance and storage infrastructure merge to supply the

Polokwane Municipal Area. The total length of pipeline upgrade for these two schemes is approximately 99.5km.

4.1 Description of Activities for Upgrading of Olifantspoort WSS Phase 1

The proposed upgrades Olifantspoort WSS water conveyance from Olifantspoort abstraction work to Krugersburg reservoirs is approximately ***86km***. The components of water conveyance and storage infrastructure are outlined below:

- The construction of the new weir 100m downstream of the existing Olifantspoort weir/ or alternatively upgrading of existing Olifantspoort weir;
- Upgrading of and raw water abstraction works;
- Construction of 200 000m^2 Olifantspoort off-channel storage dam with 5m embarkment height; The dam will form the off-channel storage from Olifants River with a capacity of 1750 000 m^3 at the full supply level.
- Construction of 350m (1600mmø) raw water main from Olifantspoort abstraction to the off-stream storage dam, and 450m (1600mmø) raw water main from the off-channel storage dam to the Olifantspoort WTW;
- Refurbishment of the Olifantspoort WTW by constructing a new 60 Mℓ/d module, within the Olifantspoort WTW facility;
- Refurbishment of the Pump Stations (PS): PS1, PS2 and PS3, by construction of new pumpstations within the pumpstation facilities.
- Upgrading of Specon Storage Reservoirs and construction of an additional 12Mℓ reservoir;
- Duplicate/dualisation of approximately ***28.3km*** (800mmø) existing main by adding another (1500mmø) rising main from the Olifantspoort WTW (PS1) to Specon;
- Duplicate/dualisation of approximately ***23.6km*** (790mmø) existing main by adding another (1500mmø) main from Specon to PS2, and from the PS2 Witkos Reservoir;
- Duplicate/dualisation of approximately ***14.6km*** (740mmø) of existing main by adding another (1200mmø) main from Witkos Reservoir to PS3 and the Palmietfontein Reservoir;
- Construction of new reservoirs at Witkos (30Mℓ) and Palmietfontein (50Mℓ);

- Construction of approximately ***8.5km*** (1200mmø) pumping main with pumping rate of (1900 ℓ/s) from Palmietfontein Reservoirs to OSA164;
- Construction of approximately ***11km*** (1200mmø) pumping main with pumping rate of (1900 ℓ/s) from OSA 164 to the Krugersburg reservoirs.

4.2 Description of Activities for upgrading of Ebenezer WSS phase 1

The proposed upgrades to Olifantspoort WSS water conveyance for Ebenezer WSS is approximately ***13.5km***. The components of water conveyance comprise the following:

- The refurbishment of the Ebenezer WTW;
- Refurbishment and modifications to Ebenezer high-lift pump station;
- Construction of approximately11km (900mmø) new pumping main with a pumping rate of (1250ℓ/s), corresponding to 89 Mℓ /day from Ebenezer high-lift pump station to the Rustfontein reservoirs complex;
- Extension of approximately 2.5km (600mmø) pumping main (Pipeline B) from Chamber GB73 to the Mankweng reservoir off-take.

4.3 Design Criteria

The design criteria discussed in this report reflect the main project activities that triggers the EIA as listed below:

- Construction of the new Olifantspoort weir or upgrading of Olifantspoort weir;
- Upgrading of the raw water abstraction works;
- Construction of 200 000m^2 (1750 000 m^3) Olifantspoort off-channel storage dam (OCSD); and
- Water conveyance infrastructure (bulk pipeline) from Olifantspoort WTW (PS1) to the Krugersburg reservoirs, and Ebenezer high-lift pump station to Rustfontein reservoirs complex; and Extension from Chamber GB73 to the Mankweng reservoir off-take.

4.3.1 Construction of New Olifantspoort Weir or Upgrading Existing Weir

The upgrading of the Olifantspoort WSS proposes two alternatives namely, construction of the new Olifantspoort weir, 100m downstream of existing weir or upgrading of the existing weir. However, the alternatives are weighed through alternatives described in ***Section 6***.

Option A: Construction of New Weir

The design has also provided a preferred option which involve the construction of a new weir downstream of existing weir, which will be 100m apart. The proposed new abstraction works has to be placed within 100m downstream of the existing weir because of the following reasons, *inter alia*: The floodplain opens up wider further downstream, and flood-related risks are relatively high near the left bank at the existing abstraction works and downstream, which is necessary for self-scour of the intake during floods; The width of flooded floodplain is relatively narrow over the first 100m downstream of the existing weir which will limit the required length of the new weir.

The construction of a new weir will involve six (6) steps in the construction sequence to be discussed in option B (the upgrading of existing weir).

The new weir design requires that the upgrade of the abstraction works, to have:

a) Gravel trap

- A gravel trap of 5m wide by 13.67m long to be added at the river intakes, with radial gate (5m wide x 3m high opening) downstream of the gravel trap for flushing sediment at the intake.
- During floods exceeding the 2-year flood when the weir is submerged, the gate remains closed, and the intake becomes self-scouring due to secondary currents.
- The gravel trap can be flushed effectively for river discharges smaller than 200 m^3/s, by opening the radial gate.

b) Weir concrete structure

- The weir has to be raised by 1.3m to elevation 740 mASL at the low notch (weir height above the riverbed 3.5m), to increase the submergence at the river intakes and trash racks.
- To prevent floating debris from blocking the trash racks and entering the abstraction works the soffit level of the river intakes is 0.3m below the low notch level of the weir.
- The horizontal floor between the river intakes and the hopper canal is removed and the hopper is made deeper by 1.48m to make the hopper sides steeper to a gradient of 2:1 (V:H) for coarse and cohesive sediment removal in the hoppers.
- Upstream of the abstraction works a high curved wall is added to streamline the flood flow patterns.

c) Abstraction works

- New submersible pumps should be installed with 4 duty and 2 standby pumps.

The upgrading of Olifantspoort abstraction works require that the new Olifantspoort weir be constructed within 100m downstream of the existing weir, thereafter the existing weir be abandoned. The ***table 10*** below outlines the design criteria for construction of the new Olifantspoort weir.

Table 10: New Weir Design Criteria

Weir Component	Description and Units	Measurement
Weir	Weir low notch length (m)	30.00
	Weir low notch elevation (mASL)	741.20
	Lowest riverbed level immediately downstream of the weir (mASL)	736.50
	Weir height at low notch (m)	4.70
	Minimum Operating Level (MOL) (mASL)	741.20
	Weir second notch length (m)	80.00
	Weir second notch elevation (mASL)	741.50

Weir Component	Description and Units	Measurement
Boulder Trap	Boulder trap invert level of upstream low weir crest (mASL)	738.562
	Boulder trap width at gate (m)	4.0
	Boulder trap slope (V:H)	1:12
	Boulder trap (BT) invert level downstream (mASL)	736.500
	Radial gate width at boulder trap (m)	4.0
	Radial gate height at boulder trap (m)	4.0
Submerged opening between BT and GT	BT-Gravel trap intake opening invert level (mASL)	740.100
	BT-Gravel trap intake opening soffit level (mASL)	740.600
	BT-Gravel trap (GT) submerged intake opening height (m)	0.500
	BT-Gravel trap (GT) submerged intake opening length (m)	10.165
Gravel Trap	Bed slopes of gravel traps (V:H)	1:6.9 &1:30; 1:15
	Radial gate width at gravel trap (x2) (m)	3.0
	Radial gate height at gravel trap (m)	3.0
Intake opening and trash racks	GT-Pump canal Intake with trash racks: length (m)	full length = 14.849m (length – vertical walls = 10.182m)
	GT-Pump canal Intake with trash racks: height (m)	1.050
	GT-Pump canal Intake with trash racks: invert level (mASL)	739.850
	Trash racks: 10mm x 50mm flat bars with vertical openings (mm)	40
	Design flow velocity through trash racks (m/s)	0.3
Pump canals	Pump canal width (m)	1.20
	Pump canal flushing gate width (m)	1.20
	Pump canal flushing gate height (m)	2.00
	Bed slope of pump canals (V:H)	1:40

A fishway will probably be required at the weir due to the required height of the weir of 4.7m above the riverbed. The need for a fishway, the type of fishway and the design should be carried out by a fishway or aquatic life specialist, with hydraulic design support to analyse the river flow exceedance statistics from observed data, flow velocities and flow depths along the fishway for different river flows, tailwater levels and resting pool hydraulics.

Option B: Upgrading of Olifantspoort Weir and Raw Water Abstraction Works

The existing abstraction works has the following main components:

- Weir 108m long and low notch height 2.2m above the riverbed. The weir was raised in the past with a brick wall, but the brick wall was washed away during a flood.
- 6 intakes at the river with trash racks which can be raised for cleaning. The river intakes are perpendicular to the weir.
- Hopper canal with 6 jet pumps with motive pump at the switchgear elevation above the 500-year flood level;
- 6 submersible pumps (4 duty and 2 standby)
- Debris wall at the hopper canal to prevent floating debris from entering the pump pit;
- Switchgear above the 500-year flood level based on the flood hydrology of the original design.

The flood peaks are higher than in the original design and therefore the switchgear should be raised in the upgrade design to at least above the 100-year flood level with freeboard. In order to increase the water capacity for the Olifantspoort (WTW, amongst other interventions), the weir situated at the abstraction works on the Olifants River is to be raised by 2.8m.

The upgrading of Olifantspoort weir will undergo six (6) steps in the construction sequence:

1) *Construction of sump and temporary delivery pipelines:*
    - A cut-off earth berm will be constructed on the right bank of the river, upstream of the existing side channel, to protect the area in which the temporary pumping

sump will be constructed. This will protect the construction area from any floods that may occur during construction of the sump;

- The temporary pumping sump will be constructed within the existing side channel;
- The pumping sump will contain four submersible pumps, two duty and two standby which will deliver water through two pipes;
- Temporary delivery pipes will run over the existing weir wall while being supported on a steel pipe rack.

2) *Divert water over sump and establish flow through temporary system:*

- The construction of additional earth berms which will direct a portion of the flow over the submersible pumps;
- A portion of the flow is to be diverted, in order to ensure sufficient water reaches the existing abstraction works to continue supplying the WTW, until the change-over to the temporary system occurs;
- An area within the diversion channel will likely require excavation work in order to achieve levels that will allow sufficient flow into the channel.

3) *Construction coffer dams, and draining of the construction area:*

- Construction of the earth coffer dams, one upstream of the new abstraction works and one downstream of the weir;
- The areas immediately upstream and downstream of the weir will be drained and construction work can commence.

4) *Raising the weir between the existing abstraction works, and channelling berm and construct weir extension:*

- The weir area between the two coffer dams will be raised and the weir extension on the right bank will be constructed;
- The weir extension will have a dogleg, in order to limit the length of the weir extension, as a result of a slight valley within the vicinity of the weir;

- The new abstraction works along with the new (1600mmø) rising main will also be constructed.

5) *Initiate flow from new abstraction works:*

- Demolish the downstream coffer dam and a portion of the upstream coffer dam, to allow some of the flow to reach the new abstraction works;
- Demolish entire downstream and a portion of the upstream coffer dams. Flow through diversion channel to be sufficient to supply required volumes to the WTW.

6) *Demolish temporary pumping system and raise the final portion of the weir:*

- The temporary pumping sump and delivery pipes can be demolished to allow for work to be done on the final portion of the weir;
- A protective berm (coffer dam wall) will be constructed upstream of the diversion channel, to protect the final construction area from minor and major floods that might occur during this portion of the construction work.

The existing abstraction works has the following key hydraulic design characteristics (***Table 11***).

Table 11: Hydraulic design of the existing river abstraction works

Weir Component Description and Units	Measurement
Weir elevation at low notch (mASL)	738.70
Weir elevation at high notch (mASL)	738.85
Weir total length (m)	108
Weir low notch length (m)	8
Riverbed level downstream of the weir (mASL)	736.5
Weir height at low notch (m)	2.2
River intake invert level (mASL)	738.2
River intake soffit level (mASL)	740.8
Intake trash rack flow velocity with MOL = low notch level and no blockage of trash rack (m/s)	

Weir Component Description and Units	Measurement
Number of river intakes	8
Width of each intake opening (m)	1.0
Trash rack opening dimensions (mm x mm)	100 x 100
Fine screen opening dimensions (mm x mm)	30 x 30
Duty pump submergence below weir low notch (m)	5
Switchgear floor level for 500-year flood (mASL)	746.75

4.3.2 **Construction of OCSD**

The OCSD form the Olifantspoort impoundments, will form off channel storage from Olifants River (abstraction) with a capacity of 1750 000 m³ at the full supply level, as an additional measure to mitigate against issues with sediment around the abstraction works. The OCSD will act as a sedimentation basin and aim to limit the amount of sediment transported to the WTW in future.

The design criteria for OCSD are described below:

1) *Dam type:*

- Vaal Augmentation Planning Study (VAPS) (DWAF, 1996) was used for selection of dam type.
- The criteria for selection of Olifantspoort OCSD site are the required capacity, topography, geology, and the need to pass the maximum flood peak. Contours were used to create a stage capacity curve.
- Four dam types discussed hereunder were considered as appropriate at the identified Olifantspoort site, namely: hardfill dam, concrete faced rockfill dam, rockfill dam with geomembrane, and rubble masonry concrete dam.

2) Required storage capacity

- The capacity varies marginally according to dam type.

Table 12: Dam types of storage capacity

Level	Total Storage
RL 755.00 m	227 711 m^3
RL 765.00 m	1 663 785 m^3
RL 767.00 m	2 064 860 m^3

3) Desilting

- The dam will be completely silted in 82 years if no dredging is done during its lifetime. Therefore, using parameters as indicated in ***Table 13*** below, and assuming a horizontal silt level, the following is applicable:

Table 13: Year pumped and horizontal silt level at OCSD

Years	Pumped Sediment
11.5	RL 755.00 m
20	RL 757.00 m
50	RL 761.25 m
82	RL 765.00 m

- With the proposed configuration and LDDL at RL 755.0 m, 11.5-year sediment level, 8.0 days of storage will be available, at 20-year sediment level 5.7 days of storage will be available, and at 50-year sediment level, 2.3 days of storage will be available.
- The proposed dam arrangement will include a ramp for the removal of sediment. Furthermore, the proximity of the abstraction works and the water treatment plant to the OCSD is expected to ensure that operations and maintenance personnel will be able to monitor the silt level in the OCSD closely and ensure timeous sediment removal.

4) *Spillway:*

- The spillway for the Olifantspoort OCSD will comprise a 70m long uncontrolled crest structure located on the saddle of the western closure wall. The closure wall on this saddle will only be some 2m high above the natural ground line.
- The spillway structure will take the form of a simple broad crested weir founded at appropriate levels according to the geology on the saddle.
- The spillway structure will be a simple rubble masonry gravity section;
- The spillway will be designed for the maximum discharge associated with the 100-year recurrence interval flood (RDF = Q100), while the absolute spillway capacity must be adequate to carry the Safety Evaluation Flood (SEF). Allowance to accommodate applicable concurrent over-pumping from the abstraction works was included in the total capacity of the spillway.
- Energy dissipation will be designed in accordance with the applicable dam safety legislation for the spillway discharge associated with the rapid drawdown (RDD).

5) *Freeboard:*

- Fetch calculations were undertaken for the Eastern 1, Northern and Southern embankments. The same freeboard was accepted for the Eastern 2 wall.

6) *Intake and outlet works:*

- An inlet structure near the southern closure wall will facilitate inflows from the abstraction works, and the offtake structure will be required near the eastern closure wall. This will comprise a multi-level off-take structure to facilitate draw off of the best quality water.
- The intake structure will comprise two separate wet wells, containing fixed trash racks, guides for removable fines screens and the stoplog gate, sealing frames and intake pipe bell mouths. The intake pipes will be staggered on the adjacent pipe stacks to provide abstraction at 3.8m vertical intervals. This will allow for a 100% redundancy in accordance with common national primary water supply practice.

- Two outlet pipes will be taken underneath the Eastern 1 wall encased in a concrete block, constructed directly in the foundation.
- An outlet to ensure the dam can be emptied in an emergency situation is required.
- Water for domestic and industrial use is to be delivered directly from the OCSD to the Olifantspoort WTW through a dedicated pipeline over the eastern saddle. The design will make provision to abstract water to the toe of the eastern closure wall structure.

7) Drawdown:

- To facilitate emergency draw-down, a T-piece will be provided off one of the outlet conduits to utilise the area located between the two ridges on the north-eastern perimeter of the OCSD but discharging into the Olifants River upstream of the abstraction works.
- The dam can be emptied to RL 745m as opposed to RL 755m if integrated into the main outlet works.

8) Capacity:

- The full demand could be supplied when one pipe stack is out of order. The capacity of the outlet is 3.6 m^3/s at the LDDL of RL 755.0m using a 1.4m diameter pipe.

9) Submergence:

- Will have the lowest drawdown level (LDDL) of RL 755.0m, and the offtake at just below this level will be provided through both stacks.

4.3.3 Construction of Water Pipeline

The Technical Guidelines for the Development of Water and Sanitation Infrastructure –Second Edition (2004): DWS; Steel Pipe- A guide for Design and Installation: AWWA Manual M11; Report MS1429-STY-GEN-003-00 Design Guidelines (2017) MSW; and CWCD

(Supplementary Steel Design) Program by the University of Pretoria, has been adopted as design criteria and formed the basis for pipeline strength analysis.

The pumping mains from PS1 to the Krugersburg reservoirs and Ebenezer pumpstation to Rustfontein reservoirs including Mankweng reservoir off-take are to meet the projected demands for 20-year lifespan considering capacity of the existing pipeline, which will be refurbished at a later stage of the project.

Table 14: Water Pipeline Design Criteria

Design parameter	Measurement
AADD (2042)	20 years
Design Capacity	1.5 x 1.1 x AADD
Peak Summer Flows	1.5 x AADD
Losses percentage based on 2042 AADD	10%
Design Capacity PS1, Specon and PS2 (Olifantspoort WSS)	190 Mℓ/d
Design Capacity PS2 to Palmietfontein (Olifantspoort WSS)	150 Mℓ/d
Conveyance system capacity Ebenezer to Rustfontein	90 Mℓ/d
Water Abstraction - Olifantspoort Scheme	120 Mℓ/d
Pumping Cycle - Olifantspoort	20 hr/day
Water Abstraction - Ebenezer Scheme	44.4 Mℓ/d
Pumping cycle - Ebenezer	18hr/day

1) Pipeline Specifications

- Pipe material: Helical Submerged Arc-Welded (HSAW) steel pipes manufactured in accordance with SANS719 and API 5L.
- Pipe Joints: Butt welded joints for bevelled ended pipes or spherical slip joints as alternatives.
- Flanged joints at valve chambers, offtakes, meters, etc. all flanges drilled to SANS 1123. Self-healing corrosion preventive pipe wrapping.
- Corrosion protection: Cement Mortar Lining / Epoxy lining (internal), and rigid polyurethane (external). Cathodic protection system.
- Bends: 0 to 5º mitred bends; 5º to 30º medium radius two segments; 30º to 90º long radius 3 to 4 segments.

- The isolating valves shall be 1200mmø double offset butterfly valves. These isolating valves will be positioned to facilitate maintenance and repairs to limit the time necessary to drain sections of the pipeline without wasting large volumes of water in the process.
- The air valves for the project were specified as double orifice dual action air release / vacuum break valves with mechanism to prevent slamming and to mitigate hydraulic surge.
- The location of the scour valves shall be governed by the longitudinal pipeline profile to ensure effective drainage of the pipeline. The valves shall be 350mmø wedge gate valves sized to allow for the draining time for the isolated pipeline section to be maximum of 2 hours.

2) *Connection to existing infrastructure:*

- The connection to existing infrastructure will be at PS1, PS2 and PS3; Specon reservoirs, Witkos reservoirs, OSA164, Krugersburg reservoirs and Ebenezer pumpstation,
- Offtakes: The new connection points will incorporate isolating valves, flow meters, check valves and pressure reducing valves required to reduce the pressure delivered to the water supply system.

3) *Alignment and profiles:*

- Pumping main to run parallel to the existing pipeline.
- The proposed diversions will bypasses two offtakes from the existing pipeline supplying Mphahlele RWS, which will need to be replaced by providing new offtakes and supply pipelines linking to the existing water lines. A 7.1km long diversion before terminating at the Specon reservoir site to avoid intrusion into residential development in Lebowakgomo S, which encroaches over the existing pipeline servitude.

4) *Earthworks and construction:*

- Deep pipeline excavations for securing slope stability, battering and support.
- Minimum cover of 900mm or 1200 mm under roadways or pipe jacking subject to wayleave conditions of relevant roads authorities.
- Blasting to be avoided or use of alternative method to protect existing services when excavating in close proximity to existing services.

5) *Connection to existing infrastructure:*

- The connection to existing infrastructure will be at PS1, PS2 and PS3; Specon reservoirs, Witkos reservoirs, Palmietfontein reservoirs, Rustfontein reservoirs, Chamber GB73, and Mankweng reservoir off-take.
- Offtakes: The new connection points will incorporate isolating valves, flow meters, check valves and pressure reducing valves required to reduce the pressure delivered to the water supply system.
- Reservoirs and pumpstation outlet specifications: Helical Submerged Arc-welded (HSAW) steel pipes manufactured in accordance with SANS719 and API 5L; Steel Grade external pipework: X42 (290 MPa) and internal reservoir pipework cast in Grade 304 stainless steel.
- Pipe Joints: Butt welded joints for bevelled ended pipes or spherical slip joints as alternatives; Flanged joints at valve chambers, offtakes, meters, etc. all flanges drilled to SANS 1123.
- Corrosion protection: Epoxy lining (internal) and epoxy eternal coating.
- All buried pipes, flanges and specials shall be wrapped with self-healing corrosion preventive pipe wrapping.

6) *Concrete works:*

- Minimum cover to reinforcement 50 mm.
- Valve chambers: Grade 25/19.
- Mass concrete for pipe encasement: Grade 20/19.
- Blinding layer: Grade 15/19.

4.3.4 Construction of Reservoirs

The Construction of new reservoirs at Specon (12Mℓ), Witkos (30Mℓ) and Palmietfontein (50Mℓ), will involve the following concrete specifications:

- Minimum cover to reinforcement 50 mm.
- Reservoir structure Grade 35/19.
- Valve chambers: Grade 25/19.

5 SUPPORTING SERVICES

The supporting services are the services which are linked to the operation of the ADF. These involve:

- Water and sanitation;
- Access roads (traffic).

5.1 Water and Sanitation

a) Water supply

The water to be used during construction will use metered water supplied by the Lepelle Northern Water utility, with the provision of existing water within the project locality. The water use will include water for construction, consumption, equipment cleaning and hygiene as well as dust suppression where required.

b) Sanitation

Sanitation facilities will be need for approximately 200 workers on a daily basis. There are current no existing sanitation facilities at the site, or in close proximity.

Raw sewage discharge into the ground or watercourses will contribute to significant environmental, social and health impacts.

All construction sites will have portable chemical toilets located conveniently along the working areas, and all effluent waste will be disposed of at the Polokwane Wastewater Treatment Works.

5.2 Access Roads (Traffic)

The access road to the construction sites is linked to existing roads. The traffic to and from the site is limited to the delivery of materials as well as the collection and removal of materials from the sites.

It is anticipated that large high volume of traffic comprising construction vehicle from small to large plants which will be hauling material to and from different work areas within the project footprint. As well as transporting workers to sites, including technical teams and professional who will be frequenting the project work areas.

Local communities, road users including school children will be impacted during construction activities in the area. Safety risks, and domestic and wildlife collisions, related to the movement of heavy equipment, materials and vehicles will likely increase during the course of the project.

For Ebenezer WSS the construction will start from the Rustfontein Reservoirs and continue

progressively towards Haenertsburg, the construction access must follow the servitude of existing pipeline route. Progressive site clearance for pipeline and access route will be achieved through the cleared area forming an area for a pipeline route and for access road to reach further working areas of the pipeline route and making provision for maintenance road within the pipeline servitude.

For Olifantspoort WSS, the construction will start of Olifantspoort abstraction work and progress further along the pipeline route. Progressive site clearance for pipeline and access route will be achieved through the cleared area forming an area for a pipeline route and for access road to reach further working area of pipeline route and making provision for maintenance road within the pipeline servitude.

6 LISTED AND SPECIFIED ACTIVITIES TRIGGERED

LNW will require an Environmental Authorisation (EA) prior to undertaking the Upgrading of Olifantspoort and Ebenezer WSS. ***Table 15*** below indicates the Listed activities in terms of the EIA 2014 Regulations (as amended on 07 April 2017) that are applicable to the proposed project.

Table 15: Listed and Specified Activities Triggered

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
GNR No. 327 (7 April 2017) Listing Notice 1.	Listed Activity 9	The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more;	The proposed upgrading of Olifantspoort and Ebenezer Schemes pipelines with a diameter of (1200mmø) and pumping rate of more than (120 ℓ/s). ***Olifantspoort Scheme***: Construction of approximately 86km between Olifants River/Olifantspoort abstraction and Krugersburg, will require- ○ The construction of approximately 8.5km (1 200mmø) main pipeline with pumping rate of (1 900 ℓ/s) from Palmietfontein Reservoirs to OSA164; ○ Construction of approximately 11km (1200mmø) gravity main with pumping rate of (1 900 ℓ/s) from OSA 164 to Krugersburg reservoirs. ***Ebenezer Scheme***: Construction of approximately 13.5km of pipeline between Ebenezer Dam/ Pumpstation to Mokweng/ Mokweng Reservoirs, will require- ○ The construction of approximately 11km(900mmø) new pumping main pipeline with a pumping rate of (1 250ℓ/s) from Ebenezer high-lift pump station to Rustfontein reservoirs complex; ○ The construction of approximately 2.5km (600mmø) pumping main Pipeline (B) from Chamber GB73 to the Mankweng reservoir off-take.

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
GNR No. 327 (7 April 2017) Listing Notice 1.	Listed Activity 12	The development of— (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs— (a) within a watercourse; excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; [or] (ee) where such development occurs within existing roads, [or] road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within	***Olifantspoort Scheme***: ○ The Construction of 350m (1600mmø) raw water main from Olifantspoort abstraction to the off-stream storage dam. The construction takes place within Olifants River and portion of this pipeline is within a riparian zone of Olifants River. This will result in clearance of an area of 100m with a width of 10m (100m^2) for construction corridor and installation of water bulk infrastructure within a water surface area. ○ The section of bulk pipeline from PS1 to Specon has two interceptions with the Chunies River , which is a NFEPA River. The proposed upgrade will have two river crossings at this section of pipeline, as a result the concrete encase will be constructed at Chunies River crossings. ○ The section of bulk pipeline from PS2 to Witkos has four interceptions with the Chunies River , which is a NFEPA River. The proposed upgrade will have four river crossings at this section of pipeline, as a result the concrete encase will be constructed at Chunies River crossings.

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
		6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	
GNR No. 327 (7 April 2017) Listing Notice 1.	Listed Activity 19	The infilling of depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from ─ (i) a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; [or] (c)falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d)occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e)where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	**Olifantspoort Scheme**: ○ The upgrading of raw water abstraction works at Olifantspoort entails the construction of a new weir and other abstractions works. These will result in excavation, infilling and deposition within watercourses. Thus excavation and infilling of more than $10m^3$ of material within watercourse. ○ The Construction of 350m (1600mmø) raw water main from Olifantspoort abstraction to the off-stream storage dam. The construction takes place within Olifants River and portion of this pipeline is within a riparian zone of Olifants River. This will result in clearance of an area of 100m with a width of 10m ($100m^2$) for construction corridor and installation of water bulk infrastructure within a water surface area. Thus excavation and infilling of more than $10m^3$ of material within watercourse. ○ The section of bulk pipeline from PS1 to Specon has two interceptions with the Chunies River , which is a NFEPA River. The proposed upgrade will have two river crossings at this section of pipeline. This section also traves traverse the wetlands . The construction for pipeline route will result in

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
			excavation and infilling of more than 10m^3 of material within watercourse. ○ The section of bulk pipeline from PS2 to Witkos has four interceptions with the Chunies River , which is a NFEPA River. The proposed upgrade will have four river crossings at this section of pipeline There are also wetlands intercepted within and adjacent pipeline route. The construction for pipeline route will result in excavation and infilling of more than 10m^3 of material within watercourse. ○ The pipeline from PS3 to Palmietfontein reservoirs traverse the area with a number of wetlands systems forming a hydrological body with the Chunies River. The construction for pipeline route will result in excavation and infilling of more than 10m^3 of material within watercourse. ***Ebenezer Scheme***: ○ The construction of approximately 11km(900mmø) new pumping main from Ebenezer high-lift pump station to Rustfontein reservoirs complex, will involve in river crossings at Greater Letaba River next to Ebenezer pumpstation. The pipeline also traverse a number of wetlands. The construction for pipeline route will result in excavation and

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
			infilling of more than 10m^3 of material within watercourse.
GNR No. 327 (7 April 2017) Listing Notice 1.	Listed Activity 45	The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure- (i)has an internal diameter of 0.36 metres or more; or (ii)has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length;	***Olifantspoort Scheme***: Construction of approximately 86km of pipeline between the Olifants River and Krugersburg, will require: ○ Duplicate/dualisation of approximately 28.3km (800mmø) existing main pipeline by adding another (1500mmø) rising main pipeline from Olifantspoort WTW (PS1) to Specon; ○ Duplicate/dualisation of approximately 23.6km (790mmø) existing main pipeline by adding another (1 500mmø) main pipeline from Specon to PS2, and from PS2 Witkos Reservoir; ○ Duplicate/dualisation of approximately 14.6km (740mmø) existing main pipeline by adding another (1 200mmø) main pipeline from Witkos Reservoir to PS3 and the Palmietfontein Reservoir.
GNR No. 325 (7 April 2017) Listing Notice 2	Listed Activity 11	The development of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following — (i) water catchments; (ii) water treatment works; or (iii) impoundments;	***Olifantspoort Scheme***: Construction of 350m (1 500mmø) raw water main pipeline from the Olifants River abstraction to off-stream storage dam to transfer more than 50 000m^3 /day of raw water from the Olifantspoort River to an off-channel storage dam for impoundments. Where the dam will form off-channel storage from Olifants River with a capacity of 1750 000 m^3 at the full

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
		excluding treatment works where water is to be treated for drinking purposes.	supply level. and later transferred to the Olifantspoort WTW within Koppieskraal, Portion 0. Farm No. 475.
GNR No. 325 (7 April 2017) Listing Notice 2	Listed Activity 15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii)maintenance purposes undertaken in accordance with a maintenance management plan'	***Olifantspoort Scheme***: The construction of 200 000m^2 Olifantspoort off-channel storage dam, will result in the clearance of 20ha of indigenous vegetation, within Koppieskraal, Portion 0. Farm No. 475.
GNR No. 325 (7 April 2017) Listing Notice 2	Listed Activity 16	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the highwater mark of the dam covers an area of 10 hectares or more.	***Olifantspoort Scheme***: Construction of off-channel storage dam will involve four earth embankment walls with the highest at 20m above NGL, which therefore exceeds 5m in height, and the highwater mark of the dam will cover an area of approximately 200 000m^2, which is more than 10 hectares, within Koppieskraal, Portion 0. Farm No. 475.
GNR No. 324 (7 April 2017) Listing Notice 3	Listed Activity 12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. **e. Limpopo** i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been	***Olifantspoort Scheme***: The Construction of 200 000m^2 Olifantspoort off-channel storage dam, will result in the clearance of more than 1ha of indigenous vegetation within CBA1 at Koppieskraal, Portion 0. Farm No. 475. The Olifantspoort Scheme has a total of approximately 25.1km of pipeline route which traverses the CBA. For this scheme, the construction of the pipeline will involve clearance of 10-15m wide construction corridors along the

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
		identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans; or iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.	entire pipeline route. Resulting in the clearance of approximately 251 000m^2 of vegetation within the CBAs, as described below: o The first 3.8km portion of 28.3km of (1 500mmø) rising main pipeline from Olifantspoort WTW (PS1) to Specon traverses CAB1; o The first 1.6km portion, of 23.6km (1 500mmø) main pipeline from Specon to Witkos Reservoir traverse CBA1. Whilst the middle portion of 8.2km pipeline traverses the CBA2; o The last 5.2km portion of 8.5km (1 200mmø) pumping main pipeline from Palmietfontein Reservoirs to OSA164 traverses CBA1; o The first 4km portion, and last 2.3km portion of 11km (1 200mmø) gravity main pipeline from OSA 164 to Krugersburg reservoirs traverses CBA1. Then first 4km portion of 11km (1 200mmø) gravity main pipeline from OSA 164 to Krugersburg reservoirs traverses a boundary of a ***Protected Area (Polokwane Nature Reserve).*** ***Ebenezer Scheme***: The section adjacent Haenertsburg village overlain by Woodbush Granite Grassland which is considered ***'Critically***

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
			Endangered'. In this section the pipeline will be re-routed along the fire break and boundary of timber plantation. The first 200m and further 500m portion, and middle 3.4km portion of 11km of (900mmø) pumping main pipeline from Ebenezer high-lift pump station to Rustfontein reservoirs complex traverses CBA1. The Ebenezer Scheme has a total of approximately 5.4km of pipeline which traverses the CBAs. For this scheme, the construction of the pipeline will involve clearance of 10-15m wide construction corridors for the entire length of the pipeline route. This will result in clearance of approximately 54 000m^2 vegetation within the CBAs.
GNR No. 324 (7 April 2017) Listing Notice 3	Listed Activity 14:	The development of— **[(v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square metres in size;** **(xii) infrastructure or structures with a physical footprint of 10 square metres or more;]** The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or	***Olifantspoort Scheme***: The upgrading of raw water abstraction works at Olifantspoort entails the construction **of a new weir** and other abstractions works. This will result in development infrastructure and water surface area of more than 10m^2. The upgrading of Olifantspoort weir and raw water abstraction works, will take place within the Olifants River which is in CBA1 at Olifantspoort abstraction.

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Applicability
		(ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a)within a watercourse; **e. Limpopo** i. Outside urban areas: (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;'	***Ebenezer Scheme***: The pipeline from Ebenezer pumpstation to Rustfontein reservoirs will have a river crossing next to Ebenezer pumpstation at the Greater Letaba River. The pipeline at this river section will be suspended by means of gantry. This will result of clearance of surface area of more than 100m^2 and construction of concrete plights at bas of the river to support a gantry. This section is within CBA1. These development takes place outside urban areas.

7 ACTIVITY MOTIVATION

The LNW is a water service board supplying three regions in the Limpopo Province, namely: Capricorn, Mopani, and Sekhukhune Region. The upgrades will only affect the water schemes within Capricorn and Mopani Regions, namely: Olifantspoort and Ebenezer Water Supply Schemes (WSS). The Olifantspoort and Ebenezer WSS have become an integrated scheme, as they both supply similar regions and also supply the Greater Polokwane Municipality which is highly populated and a strategic economic hub for the Limpopo Province. Therefore, LNW has identified components of the project for advance implementation to secure Polokwane's current water needs. The proposed upgrading components form phase 1 for these broader schemes upgrade.

7.1 The need

The City of Polokwane and its surrounding towns and neighbouring communities are in the midst of a severe water crisis. Water supplies to Polokwane have been severely constrained for over a decade, affecting the reliability of water services for human consumption and economic development of the area. The water crisis is exacerbated by an apparent aging infrastructure, which requires upgrades at the Olifantspoort and Ebenezer WSS to meet the growing water demand. The damage to infrastructure due to the aging and lack of maintenance has caused less water availability at the major water reservoirs, which have been at 0% for several days, leaving the residents of the Polokwane Local Municipality and neighbouring communities dependent on water tankers. Such a situation brings much inconvenience and hardships especially for the elderly, infirm, those with disabilities and those who are ill.

7.2 Desirability

As discussed from the previous section, in response to the growing urgency to secure adequate and sustainable bulk water supplies that is required to address the current water shortages and long-term demands, Lepelle Northern Water's implementation of phase 1 upgrades, will replenishment of reservoirs, which will then provide the City of Polokwane and surrounding communities with adequate water supply designed for 20-year plan projection, at least up to 2042.

Apart from improved water supply, one of the deliverables for water infrastructure projects are job creation and stimulation of the local economy. The inclusion of local labour during the construction phase will create much-needed temporary employment opportunities and transfer of skills to local community, as well as support local supply chains and businesses.

8 SITE ALTERNATIVES

The DFFE provides guidelines on the assessment of alternatives, to which the impact assessment must be considered. Regulations indicate that any alternatives considered in an assessment process must be reasonable and feasible. Additionally, I&APs must be afforded an opportunity to provide inputs into the process of formulating alternatives. Once a full range of potential alternatives have been identified, the reasonable and feasible alternatives should be formulated as activity alternatives for further consideration during the basic assessment or scoping and EIA process (DEAT,2004a; DEAT, 2006). These alternatives are: location (site), activity (project), site layout, design, scale, routing, scheduling, process, demand, input, technology, and no-go options.

It is, however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the applicant and the appointed EAP, which in some instances culminates in a single preferred project proposal (DEAT, 2006).

After weighing all project alternatives for this project (Discrete Alternative Approach), the preferred '*Alternative A: Routing Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Location Alternative'* were adopted as alternatives that will meet the stated need for and purpose of the project, by providing proper mitigation measures, as discussed below.

8.1 Alternative A (Routing Alternative)

In the linear project activities, the '*Routing Alternatives*' are employed through route investigations, and various corridors are investigated and compared in terms of their impacts (DEAT,2004a). The '*Routing alternative*' for this project, involve looking at the impact likelihood and providing suitable engineering design and suitable routes to mitigate those impacts.

The '*Routing Alternative*' proposes that the new pipeline upgrades run parallel to the existing pipeline. This '*Routing Alternative*' also proposes a few deviations where the pipeline will intercept with sensitive biophysical environment, existing infrastructure, and heritage resources.

As a result, the proposed diversions for the Olifantspoort Scheme pumping mains will have two diversions:

- Bypassing the two offtakes from the existing pipeline supplying Mphahlele Raw Water Supply (RWS). In this 0.0 to 7.0 km section of pipeline, about 200m downstream of PS1, the new 1 500mmø pipeline will branch off from the existing 800mmø pumping main pipeline for about 7km, as the existing pipeline crosses through a hilly and rocky terrain. This will necessitate the establishment of an access road for maintenance. To facilitate pipeline maintenance and repairs, this section of the new pipeline will be diverted to enable construction of a service road along the pipeline servitude.

  The assessment further observed that, the re-routed area adjacent Olifantspoort WTW within PS1 to Specon bypass by the sludge lagoon will now result in direct intrusion into the wetland for approximately 317 m. This wetland is densely vegetated with *Typha capensis* and the preferred route will result in direct wetland habitat destruction and may alter the functionality of this system. The route can be redirected along the existing gravel road to avoid intrusion into this system.

- A 7.1km bypass pipeline forming a diversion at 22.0 to 28.1 km section between PS1 and before terminating at the Specon reservoir. This diversion is meant to avoid intrusion into residential development in Lebowakgomo S, which will encroach over the existing pipeline servitude.

The assessment further observed that the PS1 to Specon bypass will directly intrude into a large hillslope seepage wetland that comprises of seasonable saturation. The pipeline will expand for approximately 420 m of wetland and caution must be taken to not impede subsurface flows feeding downstream. There is poor stormwater management along this section of the residential development with stormwater concentrating towards and being directed to the wetland. This system is currently regulating flows that would otherwise run downslope at high velocities and in high volumes. When working in this wetland, specific mitigative measures should be considered by the engineer to allow for natural flows through the system.

- There will also be another diversion along the Chuniespoort Dam, as the existing pumping main pipeline crosses through the dam's basin. The new pipeline will be placed further to the dam's basin along the R37 road reserve.

The following diversions, as illustrated below in ***Figures 5 & 6*** will take place on the pipeline sections between PS1 to Specon reservoirs.

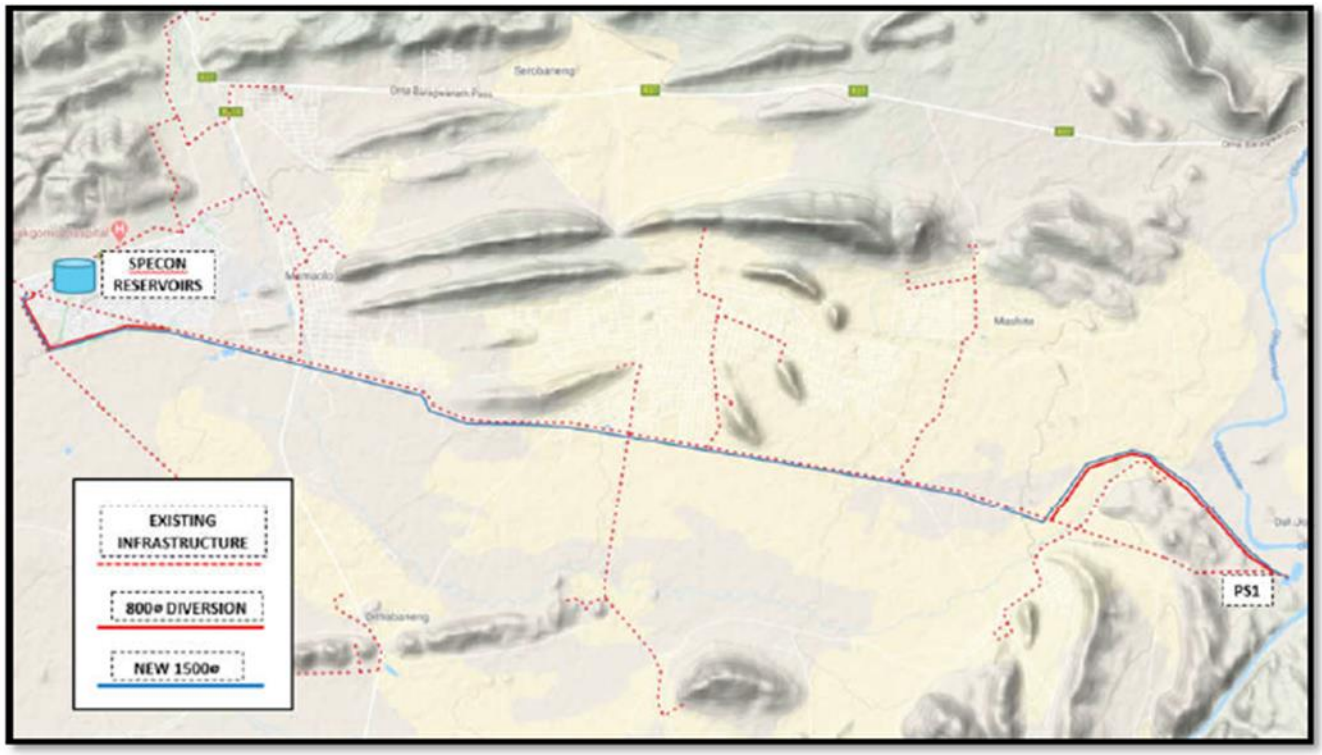

Figure 5: Diversion between PS1 and Specon (Routing Alternative)

Figure 6: Diversion along Lebowakgomo S (settlements encroached pipeline route)

The proposed diversions for Ebenezer Scheme pumping main pipeline will include construction of three new diversions of the existing pipeline:

- The 2.3 km long diversion to bypass the 2.0 to 4.0 km pipeline from Ebenezer pumpstation section of the pipeline running in close proximity to the water edge along the dam's basin, whereas the new pipeline will be constructed along the existing road reserve.
- The 2km of existing pipeline, between 4.0 to 6.0 km from Ebenezer pumpstation section of pipeline crosses through the middle of the farmland and near a farm dam, and rugged terrain. Therefore, the diversion for this section of the new pipeline will follow the existing road reserve.
- The 1.3 km long diversion between 6.0 to 8.0 km section of pipeline, will be necessary to avoid the environmentally sensitive endangered grassland area (Woodbush Granite Grassland), and Haenertsburg Cemetery. In this section the new pipeline will run along the road reserve of the timber forest servitude.

The following diversions as illustrated below in ***Figures 7 & 8*** will be in sections of pumping main between Ebenezer Pumpstation and Rustfontein Reservoirs.

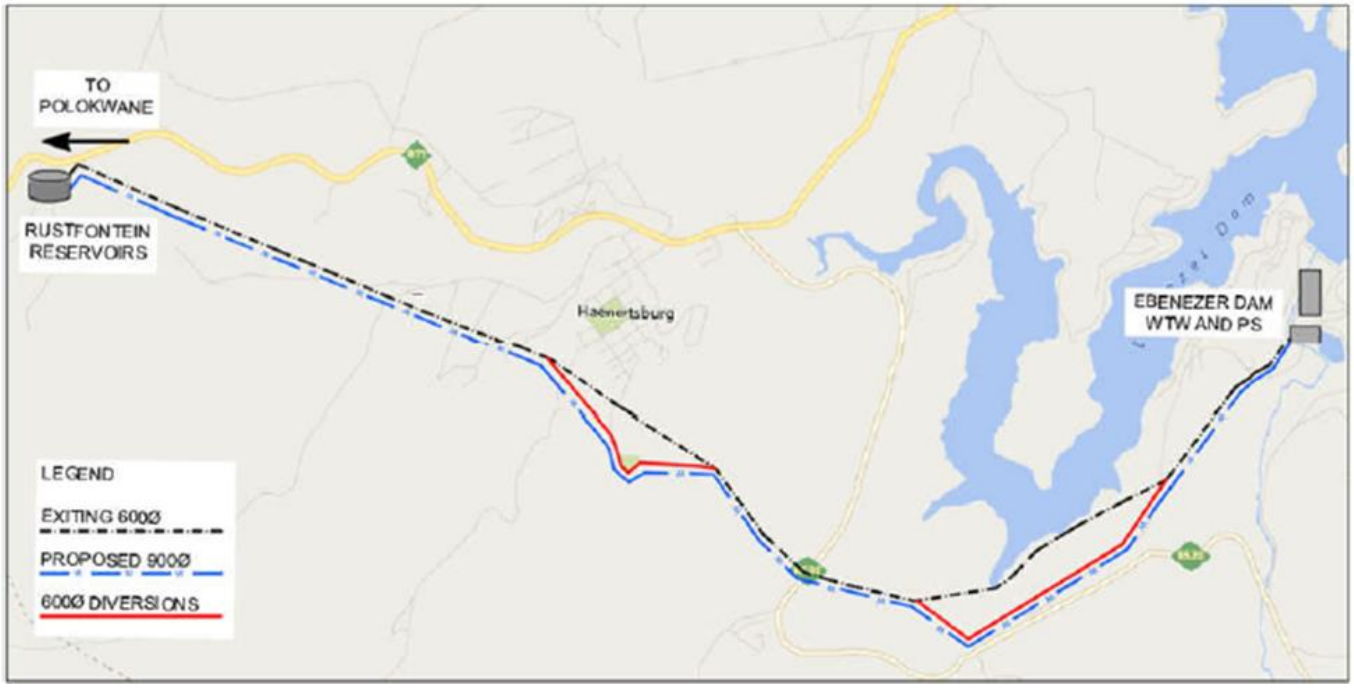

Figure 7: Ebenezer WSS Diversion (Routing Alternative)

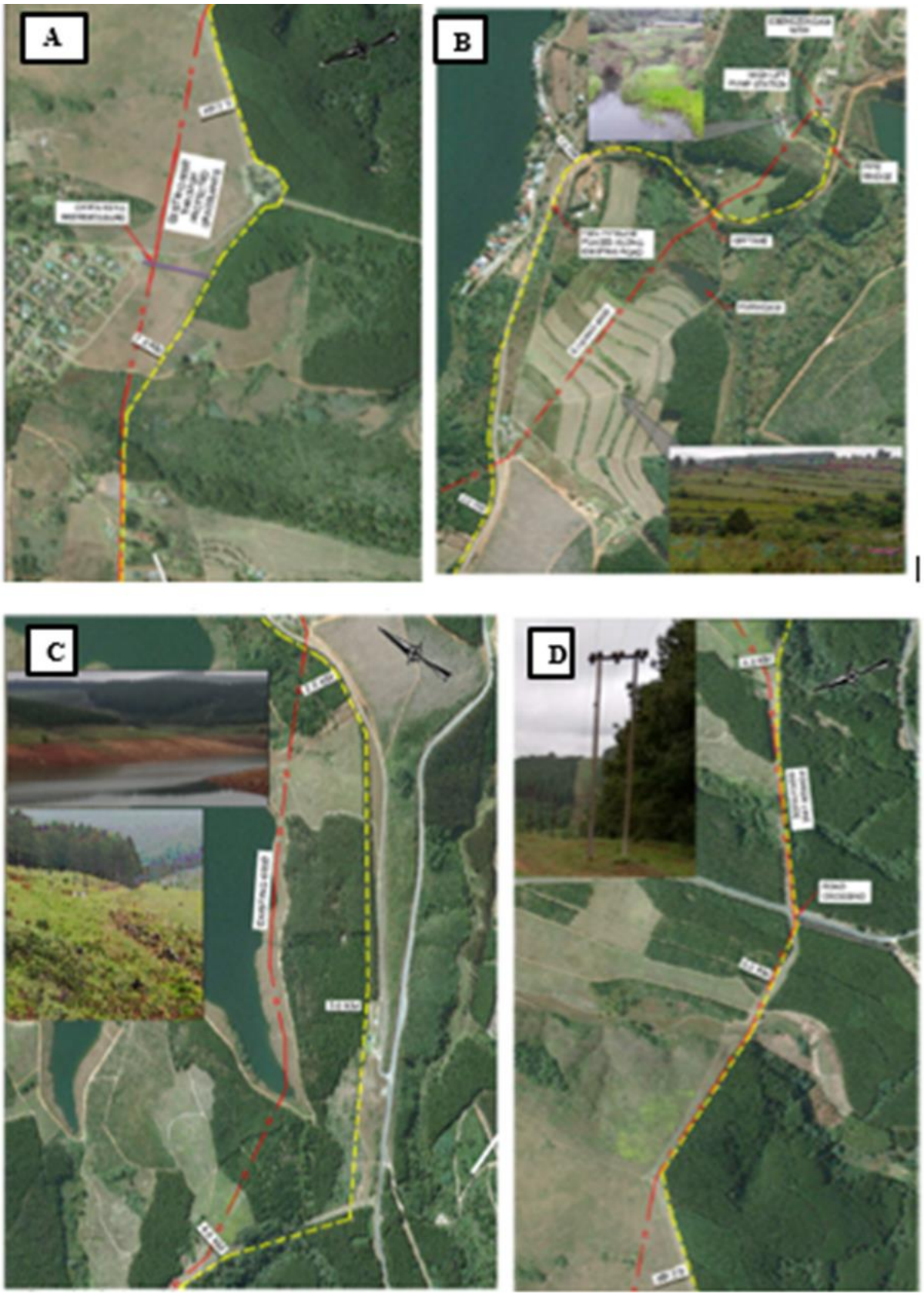

Figure 8: Ebenezer WSS Diversion Sections

Notes: *A & D = Deviation at endangered grassland area, and Haenertsburg Cemetery; B = Deviation at farmland and near a farm dam; C = Deviation along the dam's basin.*

The routing also propose that where possible the pipeline must be re-aligned along the road reserve or gravel roads to prevent intrusion into wetlands. This could be done by re-routing the pipeline adjacent to wetlands by remaining within development footprint outside of wetlands. Install a 28m buffer for CVB wetlands; a 26m buffer for UVB wetlands; a 25m buffer for seepage wetlands; and 20m buffer for dams to restrict development from encroaching into the wetland systems.

The '*Routing Alternative'* cannot be taken in isolation but will require strict adherence to integration of the '*Design Alternative'* which is discussed below.

8.2 Alternative B (Design Alternative)

The design alternatives form an integral part of the project proposal and becomes a part of the project description and need not be evaluated as separate alternatives (DEAT, 2004a). This 'Design Alternative' is in line with project design criteria described in ***Section 4.3***. Therefore, this section provides for a project design for conveyance and storage infrastructure as previously described.

8.2.1 Design for conveyance infrastructure

In order to mitigate environmental impacts associated with the proposed bulk conveyance infrastructure for this project, the majority of the pipeline will be constructed along the road reserves and parallel to existing pipelines.

The project design for conveyance infrastructure also provides for consideration for offtakes from PS1, Specon reservoirs, PS2, PS3 ,Witkos reservoirs, Palmietfontein reservoirs and Krugersburg reservoirs, including the deviations as discussed in ***Section 8.1*** above.

The water conveyance will have seven river crossings. The design for river crossings differs based on in-sutu conditions. At the Great Letaba River from the pipeline section of Ebenezer Pumpstation to Rustfontein reservoirs, the river crossing the gantry to hook the pipe over the

Groot Letaba River is proposed as an alternative of crossing under the river to limit environmental impact and potential risks associated with flooding during the construction phase. Whereas the other remaining six river crossings at Chunies River with be underlaid in the riverbed and overlain by the plum concrete to prevent the in-sutu eroding and damage to infrastructure as a result of exposed pipeline.

In order to mitigate identified environmental impacts on the pipeline around the Chuniespoort Passage, up 8.3 km from Specon, the new pipeline will be joined to the existing 1 200mmø pipeline which is suspended by concrete plights along 1.5 km section of the pumping main pipeline, which was originally designed to accommodate the future upgrading of the conveyance capacity along the pipeline route crossing through Chuniespoort Passage. This will be done to avoid tunnelling or pipe jacking through the steep topography and rocky ground terrain, combined with the restricted area available for the construction of a new parallel pipeline, at this section of pipeline route.

The design along the road reserve and for road crossing will be done in accordance with Department of Transport (DoT) standards. These designs will be requirements to secure the wayleave with regards to the pipeline situated within the road reserve; specifications and requirements for pipe crossings underneath the roads, which will be constructed by means of pipe jacking; specification, requirements, and preferences with regards to access to the respective roads.

8.2.2 Design for Abstraction Works and OCSD

a) Design for upgrading of weir

The weir will be raised by 2.8m, to an elevation of 741.8 mASL, and will therefore also need to be extended on the right bank of the river. The left end of the weir will be raised up against the existing abstraction works and will therefore not need to be extended as required for the right side. The weir will be raised through the use of mass concrete which will be dowelled into the existing wall in order to achieve the required wall level.

In order to limit the length of the weir extension, the weir extension will form a bend of 130° from the existing weir structure and will be aimed at a rock outcrop towards the south of the

right end of the weir wall. This will also help to ensure that no water reaches the valley situated on the right of the river during floods which could result in inundation of the upstream weir (see figure below). Therefore, an investigation between the end of the exposed weir wall and the valve chamber will inform the design.

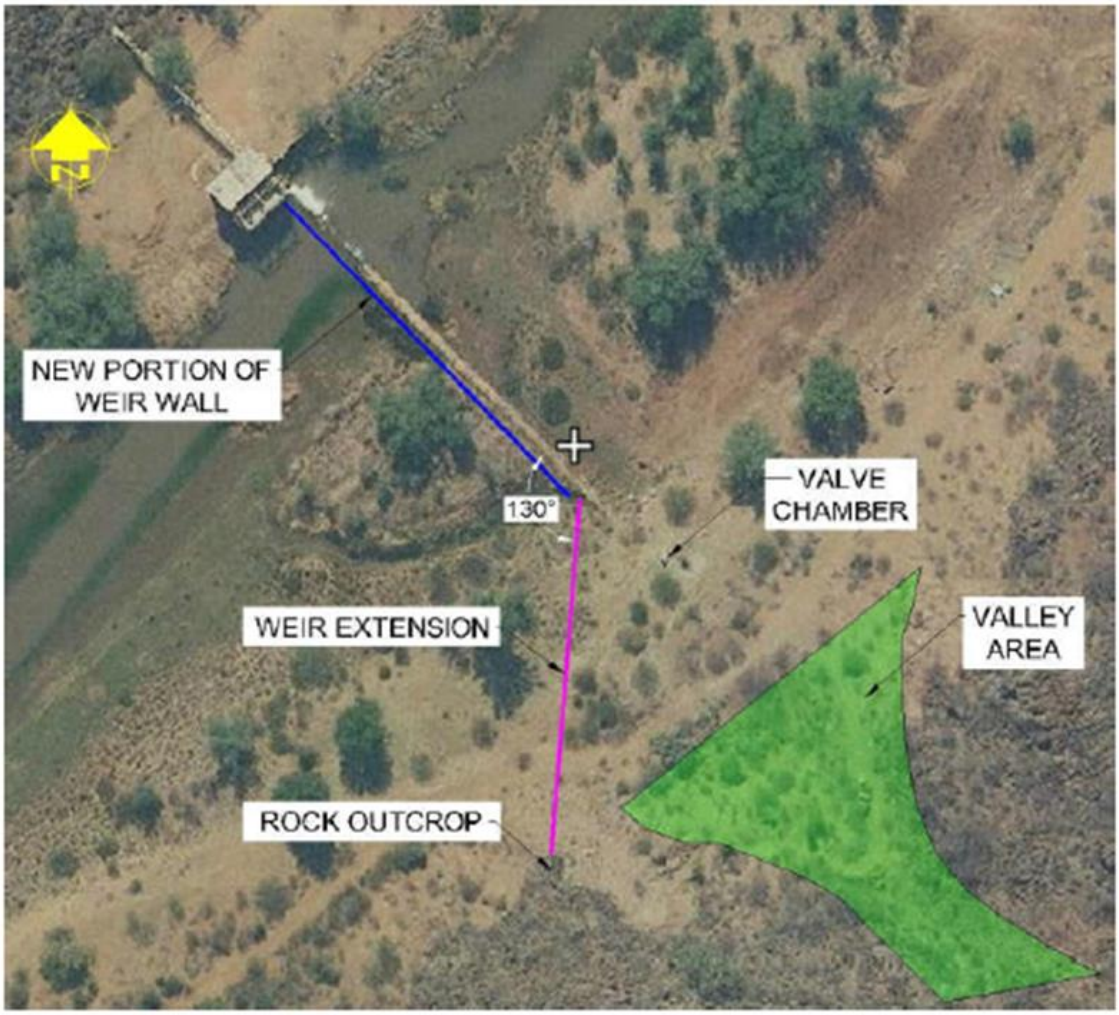

Figure 9: Upgrading of Weir Design

b) Off-Channel Storage Dam

The dam will form off channel storage from the Olifants River with a capacity of 1750 000 m^3 at the full supply level.

The design for OCSD will premise on the following four options:

- ***Option 1:*** *Rubble Masonry Concrete Dam* - The possible design for the multiple arch buttress structure proposed for the Olifantspoort OCSD will be based loosely on various structures previously constructed in South Africa and all proposed construction will be align with similar applications previously applied elsewhere.

  The general layout of the dam structure has been proportioned and aligned to best fit the site topography while ensuring an economical solution with adequate and efficient structural performance. The arches are designed with an intrados radius of 14m, an arch aperture of 140^0 and a structural thickness of 1.8m. The buttresses will be 3m in width, with a flaring towards the upstream end to provide increased hydraulic discharge capacity over the arches, and will indicate a downstream slope with gradient of 0.8 H:1 V. The arches and buttresses will be provided with 2.5m high footings, protruding 0.3m downstream and 1.5m upstream. Simple gravity structures will be utilised at the abutments.

- ***Option 2:*** *Concrete Faced Rockfill Dam* - Has advantages such as use of local materials, simple construction methods, shorter construction periods and lower cost. A concrete facing dam will be placed on the upstream face of the CFRD. This will be supported by a reinforced concrete plinth to be constructed on groutable bedrock along the upstream toe of the dam. The crest width will be 6m. The upstream and downstream slopes were accepted to be with a gradient of 1.4 H: 1 V. Extruded kerbs from low-grade concrete will be used to ensure a smooth surface for the reinforced concrete slab.

- ***Option 3:*** *Hardfill Dam* – Hardfill will comprise of rock material obtained from a quarry and river sand, and cement. This will require concrete batching from site or using a recycler/soil stabiliser. The main portion of the dam will be configured as a symmetrical faced hardfill dam, with an integral spillway. The non-overspill crest will be configured as a vertically faced structure 6m wide and 4m high.

- ***Option 4****: Rockfill Dam with Geomembrane* - PVC geomembranes are used to provide the water barrier in embankment dams, and as external water stop for peripheral and vertical joints in Geomembrane Facing Rockfill Dam (GFRD). The GFRD utilizes a PVC membrane as impervious membrane as opposed to the reinforced concrete face.

8.3 Alternative C (Technology Alternative)

The technology to be used in the activity, refers to a consideration of the method of operation, such that an alternative includes the option of achieving the same goal by using a different method or process (DEA&DP, 2007). The project involves bulk excavation for conveyance and storage infrastructure, such as excavation for laying of bulk pipeline, excavation for upgrading and extension of water and abstraction work, as well as major excavation for founding of the OCSD basin.

The technology used will vary in line with in-sutu geological conditions along the conveyance sections, and at the OCSD location, as outlined by ***Table 16*** below.

Table 16: SANS1200D Excitability Classes (Geology and Excavation Technologies)

***In-sutu* Geological Conditions at different depth**	**Description of material properties/Excavatability and Rippability**
Soft	Material that can be efficiently removed or loaded without prior ripping, by means of bulldozer, tractor-scraper, track type front end loader, back acting excavator, without the use of pneumatic tools such as paving breaker.
Intermediate	Material that can efficiently be ripped by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width and adequately ripped by a bulldozer of mass approximately 35t, fitted with a single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW. Or use of pneumatic tools before removal by equipment to one specified above.
Hard rock	Excavation in material that cannot before removal, be efficiently ripped by a bulldozer. This type of bedrock that cannot be removed without blasting or without wedging and splitting
Boulder (Class A)	Excavation in material containing more than 40% volume boulders of size in the range of 0.03-20m^3, in matrix of soft material or smaller boulder.
Boulder (Class B)	Excavation in material containing more than 40% volume boulders of size in the range of 0.03-20m^3, in matrix of soft material or smaller boulder, and which require individual drilling

	and blasting in order to be loaded by a tractor type front-end loader or by a TLB/back acting excavator

The soil conditions described below provide an indication of the type of the technology that needs to be employed in this proposed project.

8.3.1 Prominent Geological Formation for Conveyance Route

The Prominent geological formation along the Ebenezer WSS route, comprises roughly northeast - and northwest striking *diabase dyke* intrusions which cut through most of the strata underlying the pipeline routes. These may give rise to the occurrence of fractured bedrock exhibiting hard rock consistency at relatively shallow depth and discontinuous lines of rounded boulders at the surface. It is possible that several other even less prominent intrusions may also be encountered in other locations along the routes.

Prominent geological formations along the Olifantspoort WSS route comprise of fractured bedrock exhibiting hard rock consistency at relatively shallow depth and discontinuous lines of rounded boulders at the surface.

Given the above mentioned prominent geological formation on conveyance route, it is inferred that the *In-sutu* geological conditions at different depth range from Intermediate to Boulder (Class A). Therefore, the technology to be employed for excavation of the pipeline will be excavators such by a TLB of flywheel power approximately 0.10kW per millimetre of tined bucket width; a heavy excavator or bulldozer of mass approximately 35t, fitted with a single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW. On some occasions, there will be blasting or wedging where the bedrock outcrop is intercepted.

8.3.2 Abstraction works and OCSD

The prominent geological formation on the OCSD section is characterised by the rock *Gabbronorite* bedrock outcrops, which consist of large *Gabbronorite* boulders, with the most extensive outcropping occurring within the central and North-Eastern portions of the site. Whereas the weir and abstraction section are characterised by intermediate but stable

geological linear features along the Olifants River emanating from the weathered Gabbronorite bedrock within the riparian zone.

Based on the above summary of prominent geological formation at abstraction and the OCSD section, it is inferred that the dam basin excavations is considered to be highly variable due to the presence of frequent bedrock outcrop. Hence the hard rock excavation from the surface, and to the intermediate excavatability to a depth will be necessary. Therefore, technology use for excavation will vary based on in-sutu material at varying depth, such as heavy mechanical excavator, bulldozer of mass not exceeding 35t, fitted with a single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW. Within some areas there may be a need for wedging where the bedrock outcrop is intercepted.

8.4 Alternative D (Site Layout Alternatives)

The site layout alternatives permit consideration of different spatial configurations of an activity on a particular site. This may include particular components of a proposed development or may include the entire activity (DEAT, 2004a). The '*Site Layout Alternative*' recommends that the proposed conveyance infrastructure be streamlined and be parallel to the existing pipeline route, except where diversions are required. The 'Site Layout Alternative' also considered development of the conveyance infrastructure servitude along the road reserve and in areas which will provide easier maintenance access. This alternative is desirable as it will minimise the impact of the pipeline construction on environmental sensitive areas and the development of conveyance infrastructure within virgin lands.

8.4.1 Site Layout-Construction of New Weir

The '*Site Layout Alternative*' recommends that the construction of a new weir, taking into consideration the operational and environmental aspect associated with upgrading of the existing weir as described in (***Section 4.3.1***).

The proposed new abstraction works has to be placed within 100m downstream of the existing weir. This could be considered as the preferred alternative as opposed to upgrading of the existing weir as illustrated by ***Figure 10 & 11*** below, due to following reasons:

- The floodplain opens up wider further downstream;

- The flood risks are relatively higher near the left bank at the existing abstraction works and downstream, which is required for self-scour of the intake during flood events;
- The width of the flooded floodplain is relatively narrow over the first 100m downstream of the existing weir which limits the required new weir length;
- The river upstream of the existing abstraction works is relatively straight and there is no distinct meanders with potential secondary currents that will help the self-scour of the intake if the new abstraction works is placed upstream of the existing one at a location of 200m upstream;
- The upstream location could also affect the flows to the existing abstraction works during construction and the site is affected by the backwater effect of the existing weir.

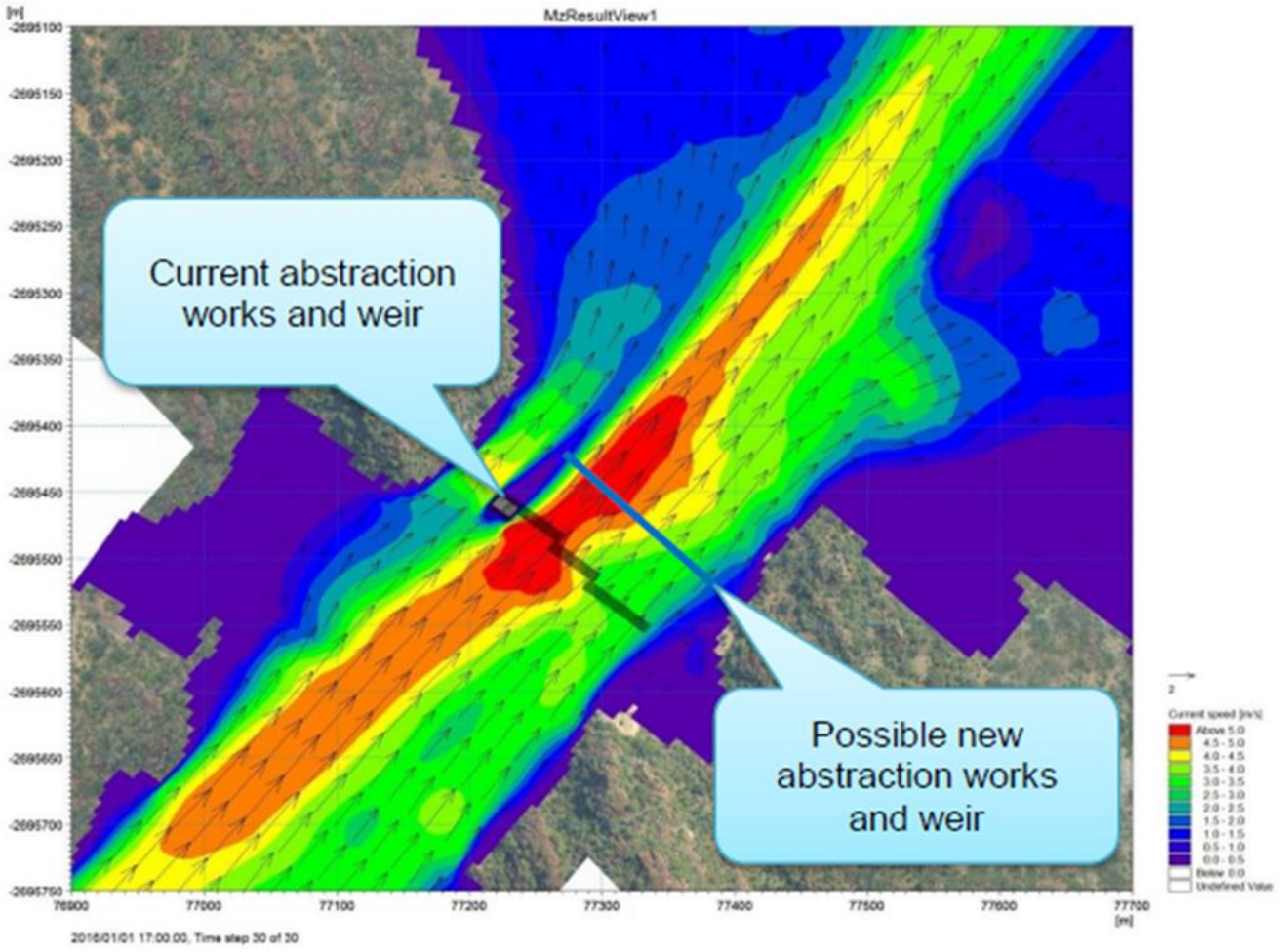

Figure 10: Abstraction Work-Simulated low velocities at the peak of the 100-year flood

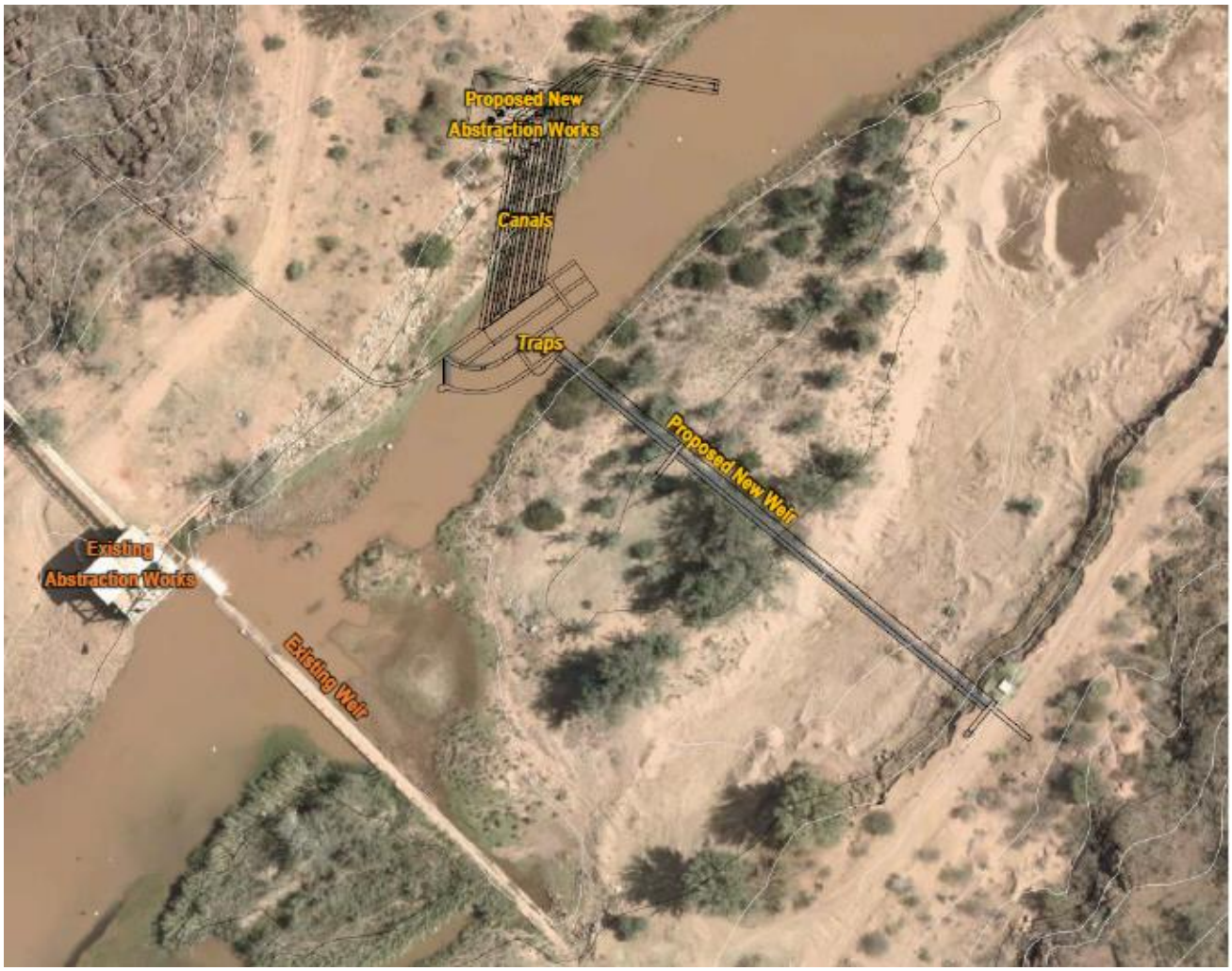

Figure 11: Site Location and Layout of Proposed New Weir

8.4.2 Site Layout OCSD

The proposed OCSD is to be adjacent to the Olifantspoort abstraction and WTW (***Figure 11***). This will minimise environmental impact and will limit the construction footprint for raw water conveyance infrastructure from Olifantspoort abstraction to the OCSD and further to Olifantspoort WTW.

8.5 Alternative E (Location Alternative)

The '*Location Alternative*' could be considered part of site layout alternatives. The '*Location Alternative*' provides for the entire proposal or for a component of a proposal, locations that are geographically quite separate, and alternative locations that are in close proximity (DEAT, 2004a).

8.5.1 OCSD Preferred Location

In this case as discussed above, the OCSD will be highly dependent on its close proximity to the Olifantspoort abstraction and the WTW to reduce the construction footprint of raw water conveyance infrastructure between the OCSD and the above-mentioned two sites. Additionally, the OCSD in its proposed location, is highly dependent on the infrastructure and utility services developed for Olifantspoort WSS (***Figure 11***).

Lastly, the topographic and geological formation for the proposed OCSD site, highly favour the design for the dam, as discussed in ***Section 4.3.1 and 4.3.2*** design criteria.

8.5.2 New Weir Preferred Location

This 'Location Alternative' recommended that the new weir location be based on river conditions described ***in Section 8.5.1*** above. Apart from that, the weir will be aligned to abstraction works with only configuration to site layout but within the similar geographical location, as the abstraction works will be placed within 100m downstream of the existing weir (***Figure12***). This will mitigate the impacts, as the project footprint for raw water mains from the abstraction to the OCSD and Olifantspoort WTW will remain unchanged.

It is important to note that, a re-location of the OCSD and new proposed weir from the proposed site will have major financial and logistical implications in terms of cost benefit analysis when evaluated or ranked in terms of the feasibility of projects outside the proposed site, as well as creating undesirable impacts at another site (DEAT, 2004c).

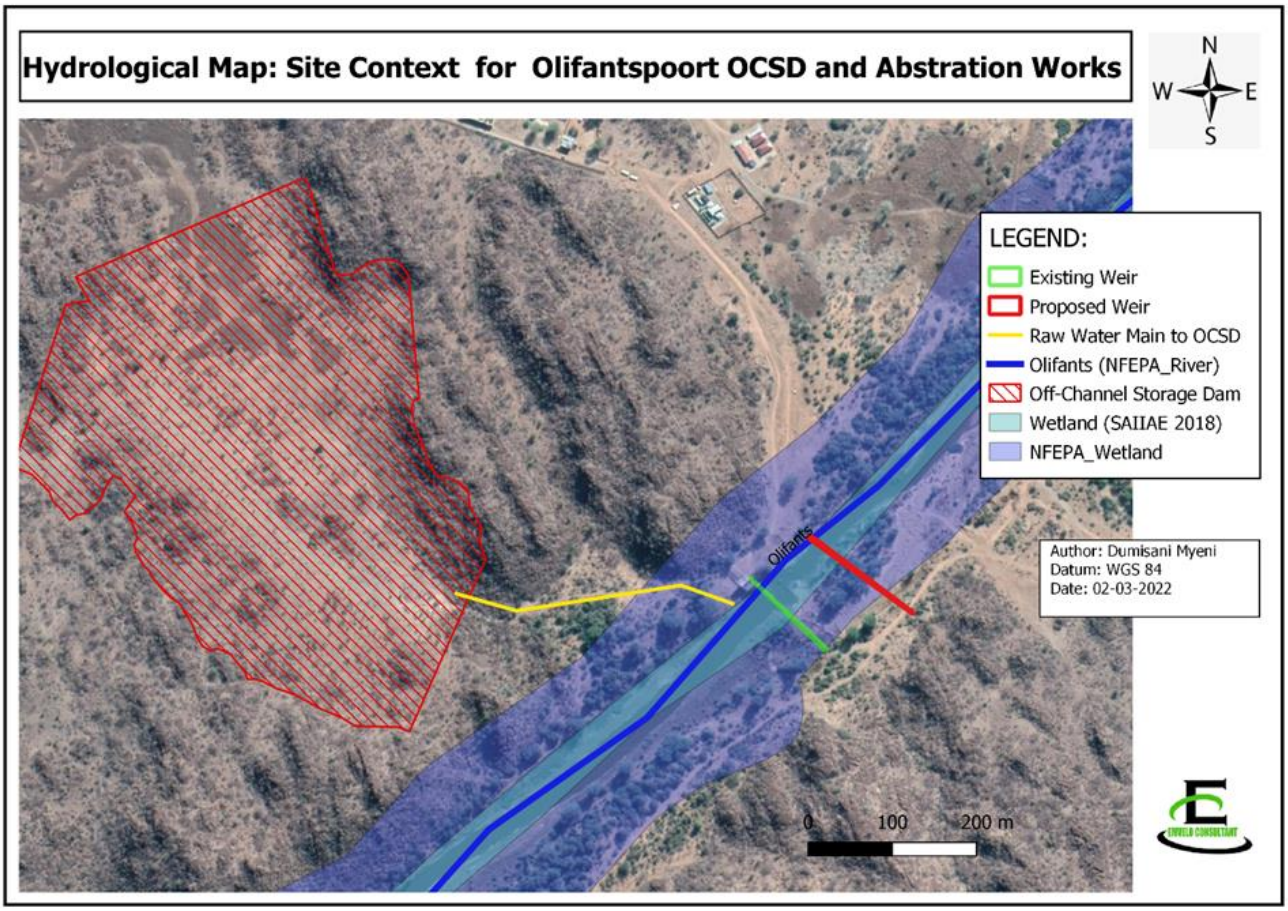

Figure 12: The OCSD and Abstraction Works Site Layout

8.6 Alternative E (No-Go Alternative)

In the absence of the proposed development, the residents of Polokwane City and surrounding communities will continue to experience major disruptions, inconveniences and hardships, with regards to adequate water supply. It is important to note that the existing water infrastructure is ageing and no longer able to deliver adequate water supply to meet the current water demand (Refer to Section 7.1& 7.2). It is also important to note that this infrastructure project serves to provide public good (water supply) to the affected communities mentioned. Therefore, projects that are proposed on public land and/or for the public good should consider the major development alternatives that would meet the stated need for and purpose of the project (DEAT, 2004a).

Provision of clean drinking water is a national priority and one of the key elements of a decent standard of living for all South Africans (NPC, 2012).

The EAP is therefore of the view that the NO-GO option is undesirable in the face of social and economic needs of the residents of Polokwane Municipality, Lepelle-Nkumpi Municipality, and Tzaneen Municipality as well as other nearby communities and South Africa's National Development Plan 2030 objectives.

8.7 Preferred Alternative

The role of alternatives is to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, and or through reducing or avoiding potentially significant negative impacts (DEAT, 2004a).

With 'Alternative A: Routing Alternatives', the proposed project will have minimal environmental impact as this alternative proposes that, the proposed conveyance infrastructure run parallel to the existing pipeline. This 'Routing Alternative' also proposes few deviations where the pipeline will intercept with sensitive biophysical environment, existing infrastructure, and heritage resources, which will be consolidated with the 'Alternative B: Design Alternative'. The routing also proposes that where possible the pipeline must be re-aligned along the road reserve or gravel roads to prevent intrusion into wetlands. This could be done by re-routing the pipeline adjacent to wetlands by remaining within development footprint outside of wetlands. Install a 28m buffer for CVB wetlands; a 26m buffer for UVB wetlands; a 25m buffer for seepage wetlands; and 20m buffer for dams to restrict development from encroaching into the wetland systems.

With 'Alternative C: Technology Alternative', the excavatability and rippability determine the use of machinery, and due to persisting bedrocks, the preferred technology to be used will be heavy mechanical excavator, bulldozer of mass not exceeding 35t, fitted with a single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW. On some sections of the pipeline, there may be blasting or wedging where the bedrock outcrop is intercepted.

With 'Alternative D: Location Alternatives' the proposed site for the OCSD is the most preferred due to the following reasons: the topographic and geological formation for the proposed OCSD

site, highly favour the design of the dam; the OCSD will be highly dependent on its close proximity to the Olifantspoort abstraction and WTW to reduce the construction footprint of raw water conveyance infrastructure between the OCSD and the above-mentioned two sites.

The above four alternatives cannot be evaluated in isolation as these are interlinked to one another. However, mitigation measures to address the identified impacts are presented in this report by the various specialists on the project team. The adherence to mitigation measures will render the impacts to be minimal and/or negligible. The mitigation measures are discussed under ***Section 14*** and the EMPr.

9 APPLICABLE LEGISLATION, POLICIES AND/OR GUIDELINES

In terms of the Environmental Regulations promulgated under the NEMA, an EIA must be conducted for any development or activity that requires an EA. In addition to the listed activities in the NEMA, relevant to this project, that triggers the need for an EA, the following legislation requirements are also relevant to this proposed project:

Table 17: Environmental Statutory Framework

Legislation	Relevance
Constitution of the Republic of South Africa, (No. 108 of 1996)	➢ Chapter 2 – Bill of Rights ➢ Section 7: The right to progressive realisation of basic human rights ➢ Section 9: The right to equality and special measures to overcome unfair discrimination and disadvantage ➢ Section 24 – Environmental Rights/ Health or Well-Being / Depletion Of Natural Resources ➢ Section 32: Access to Information ➢ Section 33: The right to just administrative justice ➢ Section 38: Enforcement of rights ➢ Section 68: Authority for Provincial Legislation ➢ Section 231: International agreements
National Environmental Management Act (NEMA) (No. 107 of	➢ Section 2: Principles in Environmental Management ➢ Section 24: Environmental Authorisations and/or Norms and Standards (EA) (➢ Section 24G: Rectification Application ➢ Section 24J: Implementation Guidelines ➢ Section 24L: Alignment of Environmental Authorisations, including Integrated Environmental Authorisations)

Legislation	Relevance
1998)	➢ Section 24N: Environmental Management Programmes, Rehabilitation of Disturbed Areas and Closure Plan ➢ Section 24P: Financial Provision for Remediation of environmental damage ➢ Section 24Q: Monitoring and Performance Assessment (Environmental Audit) on EMPr's ➢ Section 24S: Management of Residue Stockpiles and Residue Deposits ➢ Section 24M: Exemption from Application of Certain Provisions of The Act ➢ Section 28: Duty of Care and Remediation of Environmental Damage ➢ Section 28: Soil Pollution ➢ Section 29: Protection of Workers on Refusal to Undertake Work ➢ Section 30: Emergency Incident Causing Danger to Public or Environment ➢ Section 30A: Emergency Situation - Request for Directive to undertake listed activity without EA ➢ Section 31: Access to Environmental Information and Protection of Workers ➢ Section 32: Enforcement of Environmental Laws ➢ Section 34: Liabilities in Criminal Offences Under Environmental Laws ➢ Section 39: Control over products which could harm the environment ➢ Section 43: Appeals (Ch 9, Sec 43) ➢ Section 44 and 47: Regulations ➢ Section 47A: Regulations, Legal Documents and Steps Not in Compliance With Procedural Requirements ➢ Section 47B: Consultation with other Departments ➢ Section 47C: Extension of Time Periods ➢ Section 47D: Delivery of Documents ➢ Section 49A and 49B: Offences and Penalties
GN No. 326 (7 April 2017)	➢ Purpose - regulate the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing, and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to and EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.
➢ Purpose – to identify activities that would require environmental authorizations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24C of NEMA. ➢ The investigation, assessment, and communication of the potential impact of activities must follow the procedure as prescribed in regulations 19 and 20 of the EIA Regulations published in terms of section 24(5) of the Act. However, according to Regulation 15(3) of GN No. 327, Scoping and an Environmental Impact Report (S&EIR) must be applied to an application, if the application is for two or more activities as part of the same development for which S&EIR must already be applied in respect of any of the activities.	

Legislation	Relevance
➢ Listed Activities that are relevant to this project are: **Listing Notice 1 Activity 9, 12, 19 & 45; Listing Notice 2 Activity 11, 15 & 16; Listing Notice 3 Activity 12 & 14.**	
National Water Act (Act No. 36 of 1998)	➢ Chapter 3 – Protection of water resources. ➢ Section 19 – Prevention and remedying effects of pollution. ➢ Section 20 – Control of emergency incidents. ➢ Chapter 4 – Use of Water ➢ Section 21 -Water Use ➢ Authority – Department of Water and Sanitation (DWS).
NEMA 1998 - GN R982 of 4 December 2014 - Environmental Impact Assessment Regulations, 2014	➢ Regulation 1 and 2: Interpretation, Purpose and Commencement of Regulations) ➢ Regulation 3: Timeframes) ➢ Regulation 4: Decision on Applicant and Notification to I&AP's ➢ Regulation 5 and 6: General Requirements for Applications ➢ Regulation 7, 8 and 9: Consultations between Competent Authority and other relevant State Departments ➢ Regulation 10 and 11: Competent Authority - Right of access to information ➢ Regulation 12, 13 and 14: EAP's and Specialists' Appointments and Conditions ➢ Regulation 15: Assessment Process to be followed ➢ Regulation 16, 17 and 18: Requirements applicable to the EA Application ➢ Regulation 19 and 20: Basic Assessment Report submitted to Competent Authority ➢ Regulation 21, 22, 23 and 24: S&EIR submission to Competent Authority ➢ Regulation 25 and 26: Issue and Content of an Environmental Authorisation ➢ Regulation 31, 32 and 33: Amendment of Environmental Authorisation ➢ Regulation 34: Audits on EA's, EMPr's and Closure Plans ➢ Regulation 36 and 37: Amendments to an EMPr and Closure Plan ➢ Regulation 38: Suspension and Withdrawal of Environmental Authorisation ➢ Regulation 39, 40, 41, 42, 43 and 44: Public Participation ➢ Regulation 45, 46 and 47: General Matters ➢ Regulation 48: Offences
National Environmental Management Air Quality Act (Act No. 39 of 2004)	➢ NEM: AQA (Act No.39 of 2004). ➢ Air quality management ➢ Section 32 – Dust control. ➢ Section 34 – Noise control. ➢ Authority – DFFE
National Environmental Management:	➢ Section 43-48: Biodiversity Management Plans (Ecosystems, Indigenous Species or Migratory Species) ➢ Section 51-55: Threatened or Protected Ecosystems and Threatening Processes ➢ Section 56-58: Threatened or Protected Species ➢ Section 64-67 and 69: Alien Species Posing a potential threat to Biodiversity ➢ Section 70 and 77: Invasive Species posing a potential threat to Biodiversity

Legislation	Relevance
Biodiversity Act, 2004 (Act No. 10 of 2004)	➢ Section 101 and 102: Offences and Penalties Authority – DFFE.
Occupational Health & Safety Act (Act No. 85 of 1993)	➢ Provisions for Occupational Health & Safety Regulation 9A and 14: Hazardous Chemicals Substances ➢ Regulation 10 and 15: Disposal of HCS Waste ➢ Authority – Department of Labour.
National Heritage Resources Act (Act No. 25 of 1999)	➢ Section 34 – protection of structures older than 60 years. ➢ Section 35 – protection of heritage resources. ➢ Section 36 – protection of graves and burial grounds. ➢ Section 51: Offences and Penalties ➢ Authority – Provincial Heritage Agency: Limpopo
National Road Traffic Act 1996 (Act No. 96 of 1996)	➢ Section 51: Waste on or Near National Road ➢ Authority – Limpopo Department of Transport and community safety
Environment Conservation Act (Act 73 Of 1989)	➢ Section 19: Prohibition of littering ➢ Section 20: Waste management (establishment of waste disposal site) ➢ Section 29: Offences and Penalties ➢ Section 31A: Damage to Environment
Promotion of Access to Information Act, 2000 (Act No 2 of 2000)	➢ Section 11 and 12: Access to Records of Public Bodies ➢ Section 50: Access to Record of Private Bodies ➢ Section 51: Publication and Availability of Certain Records ➢ Section 70: Mandatory Disclosure by Public/Private Bodies
Water Services Act, 1997 (Act No. 108 of 1997)	➢ Section 3: Right of Access to Basic Water Supply and Sanitation ➢ Section 9: National Standards on Provision of Water Services ➢ Section 11: Duty to Provide Access to Water Services ➢ Section 12-18: Water Services Development Plans ➢ Section 27: Monitoring of Water Services Provided ➢ Section 77: Transferability of Servitudes
Hazardous Substances Act, 1973 (Act No. 15 of 1973)	➢ Section 2-3: Grouped Hazardous Substances ➢ Group I – Hazardous Substances (GN R 452 Of 25 March 1977 and GN 801 Of 31 July 2009) ➢ Group II Hazardous Substances (GN R1382 Of 12 August 1994) ➢ Group III Hazardous Substances (GN R1302 Of 14 June 1991)

Legislation	Relevance
	➢ Group IV Hazardous Substances (GN R247 of 26 February 1993) ➢ Section 18 and 19: Offences and Penalties
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947)	➢ Section 3 and 7: Pest Control Operators, and use of fertilizers, farm feeds, agricultural, stock remedies and sterilising plants ➢ Section 7: Sale of fertilizers, farm feeds, agricultural remedies, and stock remedies ➢ Section 7BIS: Prohibition on acquisition, disposal, sale or use of certain fertilizers, farm feeds, agricultural remedies, and stock remedies ➢ GN R181 of 7 February 2003 - Regulation Relating to the Prohibition of the Sale, Acquisition, Disposal or Use of Agricultural Remedies ➢ Containers And Labels of Agricultural and Stock Remedies
	➢ GN 98 of 11 February 2011 - Pest Control Operator Regulations
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	➢ Section 7-9: National Norms and Standards, Provincial Norms and Standards and Waste Service Standards ➢ Section 14 and 15: Priority Waste ➢ Section 16: Duty on Waste Holder to Implement Reasonable Measures ➢ Section 17: Reduction, Re-Use, Recycling and Recovery of Waste ➢ Section 21 and 22: Storage of Waste ➢ Section 23 and 24: Waste Collection needs to be Authorised by the Municipality ➢ Section 25: Waste Transportation ➢ Section 26: Unauthorised Disposal of Waste and Protection of Environment ➢ Section 25: Protection of Environment at Private Land ➢ Section 35-41: Contaminated Land ➢ Section 43-59: Waste Management Licences for Listed Waste Activities or Compliance to Norms and Standards ➢ Section 67 and 68: Offences and Penalties ➢ Regulation 4: Waste Classification ➢ Regulation 5: Safety Data Sheets for Hazardous Waste ➢ Regulation 6: General Obligations on Waste Generators, Transporters And Managers ➢ Regulation 7: Waste Treatment ➢ Regulations 8: Waste Assessment - Waste Disposal to Landfill - Obligations on Generators and Managers ➢ Regulation 9: Waste Management Activities that do not require a Waste Management Licence ➢ Regulation 10: Records on Waste Generation and Management
Advertising on Roads and Ribbon	➢ Section 8: Articles or Materials on or Near Public Roads

Legislation	Relevance
Development Act, 1940 (Act No. 21 of 1940)	
Health Act, 1977 (Act No. 63 of 1977)	➢ Section 20: Waste Being a Threat to Human Health
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	➢ Section 5: Prohibition on the Spreading of Weeds ➢ Section 8 and 9: Soil Conservation Schemes ➢ Regulation 8: Managing the Flow Pattern of Run-off Water ➢ Regulation 12: Burning of Veld, Prevention and Control of Veld Fires ➢ Regulation 15: Weeds and Invader Plants
National Forests Act, 1998 (Act No. 84 of 1998)	➢ Section 7: Indigenous trees ➢ Section 12-15: Protected Trees (All Areas) ➢ Section 16: Registration in Title Deeds ➢ Section 61-64: Offences and Penalties
National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)	➢ Section 9 and 10: Fire Danger Rating ➢ Section 17-19 and 34: Firebreaks ➢ Section 24 and 25: Offences and Penalties
National Environmental Management: Protected Areas Act, 2003 (Act No 57 of 2003)	➢ Section 18 and 19: Special Nature Reserves ➢ Section 23-26: Nature Reserves ➢ Section 28 and 29: Protected Environments ➢ Section 37: Management of Protected Areas ➢ Section 38-42: Management Plans in Protected Areas ➢ Section 43: Monitoring performance of Protected Areas ➢ Section 45-47: Access to Protected Areas ➢ Section 48: Restricted activities in Protected Areas ➢ Regulation 49: Regulation or Restriction of Activities in Protected Areas ➢ Section 89: Offences and Penalties

10 EIA PROCESS AND METHODOLOGY

The EIA for the upgrading of the Olifantspoort and Ebenezer WSS Phase 1, comprises two main phases, namely the Scoping phase and the EIA phase. In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIA's in order to apply for, and be considered for, the issuing of an EA. These EIA Regulations provide a

detailed description of the EIA process to be followed when applying for EA for any listed activity and is illustrated in ***Figure 12*** below.

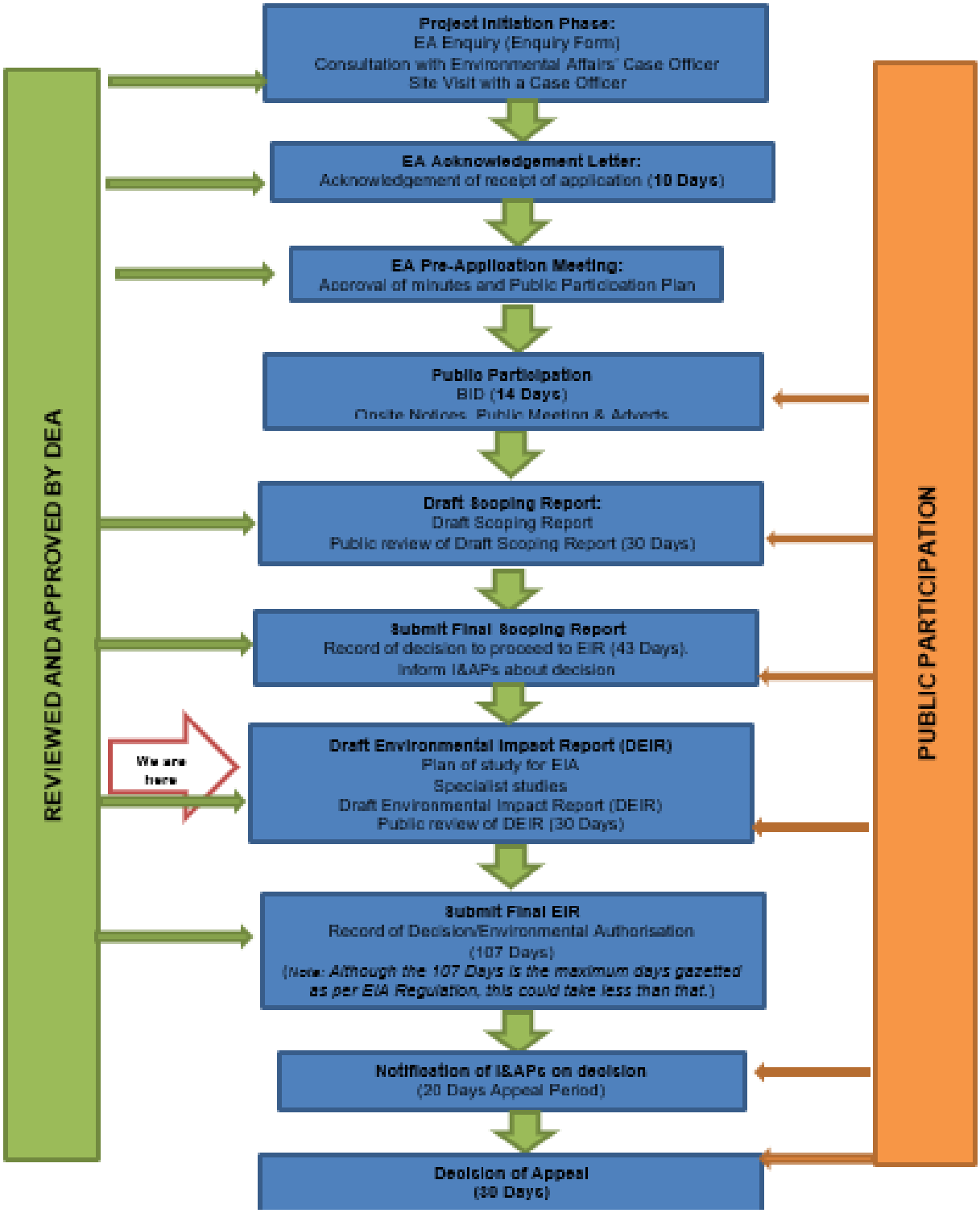

Figure 13: EIA process flow

11 STAKEHOLDER ENGEGEMENT

Section 24 (4) (a) (v) of NEMA, provides that the procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment, must ensure, with respect to every application for an EA, the public information and participation procedures which provide all I&APs, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures.

The purpose of the Public Participation Process (PPP) and stakeholder engagement process is to:

- Provide an opportunity for I&APs to obtain clear, accurate and comprehensible information about the proposed activity, its alternatives or the decision and the environmental impacts thereof;
- Provide I&APs with an opportunity to indicate their viewpoints, issues and concerns regarding the activity, alternatives and / or the decision;
- Provide I&APs with the opportunity to suggest ways of avoiding, reducing or mitigating negative impacts of an activity and enhancing positive impacts;
- Enable the applicant to incorporate the needs, preferences and values of I&APs into the activity;
- Provide opportunities to avoid and resolve disputes and reconcile conflicting interests;
- Enhance transparency and accountability in decision-making;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximize and/or promote positive environmental impacts associated with the project.

11.1 Legal Compliance

The PPP must comply with several important sets of legislation that require public participation as part of an application for authorisation or approval, namely but not limited to:

- The National Environmental Management Act (Act No. 107 of 1998 – NEMA);

- The National Water Act (Act No. 36 of 1998-NWA)

11.2 Identification of Interested and Affected Parties

Adherence to the requirements of the above-mentioned Acts will allow for an integrated PPP to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts. The details of the integrated PPP followed are provided below.

11.3 Initial Notification of I&APs

The I&AP databases compiled for various past environmental authorisation processes within the jurisdiction of Capricorn District and Mopani District have been utilised towards compiling a pre-notification register of key I&APs to be notified of the EA Application. The I&AP database includes amongst others: landowners, communities, regulatory authorities and other specialist interest groups. Additional I&APs have been registered during the initial notification and call to register period. The I&APs database will continue to be updated throughout the duration of the EIA process. A full list of I&APs is attached in ***Appendix E***.

11.3.1 Consultation with Authorities

The relevant authorities required to review the proposed project and provide an EA were consulted from the outset of this study and have been engaged throughout the project process. In terms of NEMA Section 24 (C), the lead decision-making authority for this application for EA is the National Department of Forestry, Fisheries and Environmental (DFFE).

However, other authorities with jurisdiction over elements of the receiving environment or project activities will also be consulted and listed as I&APs. Therefore, the following are also noted as key commenting authorities:

- DFFE Biodiversity Conservation
- Limpopo Province: Dept. of Economic Development, Environmental and Tourism
- Department of Water and Sanitation (DWS);
- Limpopo Province: Dept. of Transport and Community Safety;
- Kruger to Canyons Biosphere Region

Authority consultation included the following activities:

- Submission of EA Enquiry to DFFE
- The EA Pre-Application Meeting was convened with DFFE on 13th of October 2021 (***Refer to Appendix E*** for a copy of the minutes).
- An application for authorisation in terms of NEMA (Act 107 of 1998), was submitted to DFFE, has been registered and given the following reference number: ***REF: 14/12/16/3/3/2/2145.***

11.3.2 Consultation with other relevant authorities

The Background Information Document (BID) and Draft Scoping Report regarding the project was provided to all relevant authorities and agencies, together with a registration and comment form formally requesting their input into the EIA process. The authorities include *inter alia* as attached in ***Appendix E***:

- DFFE Biodiversity Conservation
- Limpopo Province: Dept. of Economic Development, Environmental and Tourism
- Department of Water and Sanitation (DWS);
- Limpopo Province: Dept. of Transport and Community Safety;
- Kruger to Canyons Biosphere Region
- South African Heritage Resource Agency;
- Limpopo Province: Dept. of Agriculture and Rural Development;
- Limpopo Provincial Heritage Agency;
- Great Tzaneen Local Municipality;
- Polokwane Local Municipality;
- Polokwane Game Reserve.
- Lepelle-Nkumpi Local Municipality;
- Capricorn District Municipality;
- Mopani District Municipality.

11.3.3 Notification of Public Stakeholders

Section 41 of Chapter 6 of the EIA regulations have listed the different options, to be used when notifying the I&APs. The PP process for this project was conducted, as detailed in ***Table 18*** and indicated by the green blocks.

Table 18: Notification of I&APs

All the Interested and Affected parties were notified of the application by-		
Fixing a notice board at the place conspicuous to and accessible by the public at the boundary, on the fence, or along the corridor of any alternative sites. *See Appendix E: Onsite notices positions.*	**YES**	~~**NO/NA**~~
Any alternative site also mentioned in the application	~~**YES**~~	**NO/NA**
Has a written notice been given to-		
Landowner or person in control if the applicant is not in control of the land. This is a linear activity. Therefore, in terms of EIA Regulations, 2014 as amended on 07 April 2017, the Section 39 (2) (a) the land consent does not apply in respect to linear activity. *The notification was sent communities and municipalities within jurisdiction of the proposed water conveyance upgrade.*	~~**YES**~~	**NO/NA**
The municipal councillor of the Ward in which the site and alternative site of the proposed activity. *Polokwane Municipality, Lepelle-Nkumpi Municipality, and Tzaneen Municipality received BIDs and BIDs were also hand delivered to ward councillor by a project social facilitator.*	**YES**	~~**NO**~~
The municipality which has jurisdiction in the area and other organs of state:	**YES**	~~**NO**~~
Placing an advertisement in-		
Regional newspaper (***Daily Sun Newspaper, 21/02/2022***)	**YES**	~~**NO**~~
Any official Gazette that is published specifically for providing public notice of applications	~~**YES**~~	**NO**
One provincial newspaper, any official Gazette that is published with the purpose of providing public notice of applications.	~~**YES**~~	**NO**

11.4 Availability of the Draft Scoping Report

Notification regarding the availability of the Scoping Report for public review was given in the following manner to all registered I&APs to ensure that a fair and inclusive public participation process was adopted, in accordance with both, the EIA regulations of 2014 as amended in

2017, as well as the Covid 19 protocol as stipulated in the Disaster Management Act, 2002 (Act No. 57 of 2002) and published on 29 April 2020.

The Draft Scoping Report was made available for public review through the following interventions as described in ***Table 19*** and was re-circulated for 30 days for comment from ***11th of March 2022 to the 11th of April 2022***.

Table 19: Availability of Draft Scoping Report

Task	Action
Draft Scoping Report.	The DFFE will receive the Draft Scoping report, Daft EIR and EIR through the online system, via uploading at online system: https://sfiler.environment.gov.za:8443 Other stakeholders identified and listed on the I&APs register received an electronic copy of the Draft Scoping Report through e-mails, or CD and hard copies were delivered, based on their request. Comments were received through the same lines of communications or depending on the preferred method of the stakeholders. As for the general community, the Draft Scoping Report, was forwarded to the Ward Councillor and the focus group as an electronic (CD & email) version, as well as hardcopy documents based on their specific request. The Ward Councillor and focus group was required to forward the electronic copies of the Draft Scoping Report to the executive members of the community (including ward committee members, community and organizational leaders). The executive members were then tasked to further forward the Draft Scoping Report to individual community members, based on the request. This was conducted in compliance to Covid-19 protocols as stipulated in Disaster Management Act, 2002 (Act No. 57 of 2002) and published on 29 April 2020. The community were also given the opportunity to have their comments on the scope of the project through the communication snowball effect in a reverse approach, until the information reached the EAP, or direct contact with the EAP for comments for considerations on the Final Scoping Report and Draft EIR.

11.5 Availability of EIA/EMPr

Notification regarding the availability of the EIA and the EMPr Report for public review was conducted in the same manner as for the Scoping Report above and the report made available for public review and comment for a period of 30 days from ***23 August 2022*** to ***22 September 2022***.

11.6 Comments and Responses

Section 43 of Chapter 6 of NEMA (EIA Regulations 2014 as amended on 07 April 2017) indicates that all I&APs are entitled to comment in writing on all reports produced by the applicant during the EIA process. This will bring the concerns raised to the attention of the applicant. The comments in this EIA report are carried over from the initial Scoping Report. All comments are integrated and the EIA is set to address the previous comments raised. The comments response report is attached as ***Appendix E***.

The proof of document circulation to I&APs is attached as ***Appendix E***.

12 DESCRIPTION OF BASELINE ENVIRONMENT

This section provides a general description of the status quo of the receiving environment in the project area. This serves to provide the context within which the EIA exercise was conducted. It also allows for an appreciation and identification of sensitive environmental features and possible receptors of the effects of the project.

12.1 Climate

The Southern African region is divided into three climatic regions: Wet, dry, and moderate regions. Limpopo Province encompasses: the Hot semi-arid climate (*BSh*); Humid subtropical climate (Cfa); Humid subtropical climate (*Cwa*); Oceanic climate (*Cfb*); Hot desert climates (*BWh*); and Cold semi-arid climates (BSk), with categories classified by the Köppen-Geiger system (Climate-Data.org).

The climate region of this study is referenced to Polokwane and Tzaneen climatic region. The climate of the project site as classified by the Köppen-Geiger system is categorised as follows:

Polokwane *(Cwb),* and Tzaneen (*Cwa*). Except for the Haenertsburg area which is in the Mistbelt and has good rains and good soils, the majority of the pipeline corridor are served by poor and often erratic rainfall.

The Tzaneen region has a warm and temperate climate with an average annual temperature of 18.0 °C and the annual precipitation of 661mm. Most rain is experienced during the summer months between November-March. The period between April to October is considered a dry season with limited precipitation (***Figure 14***).

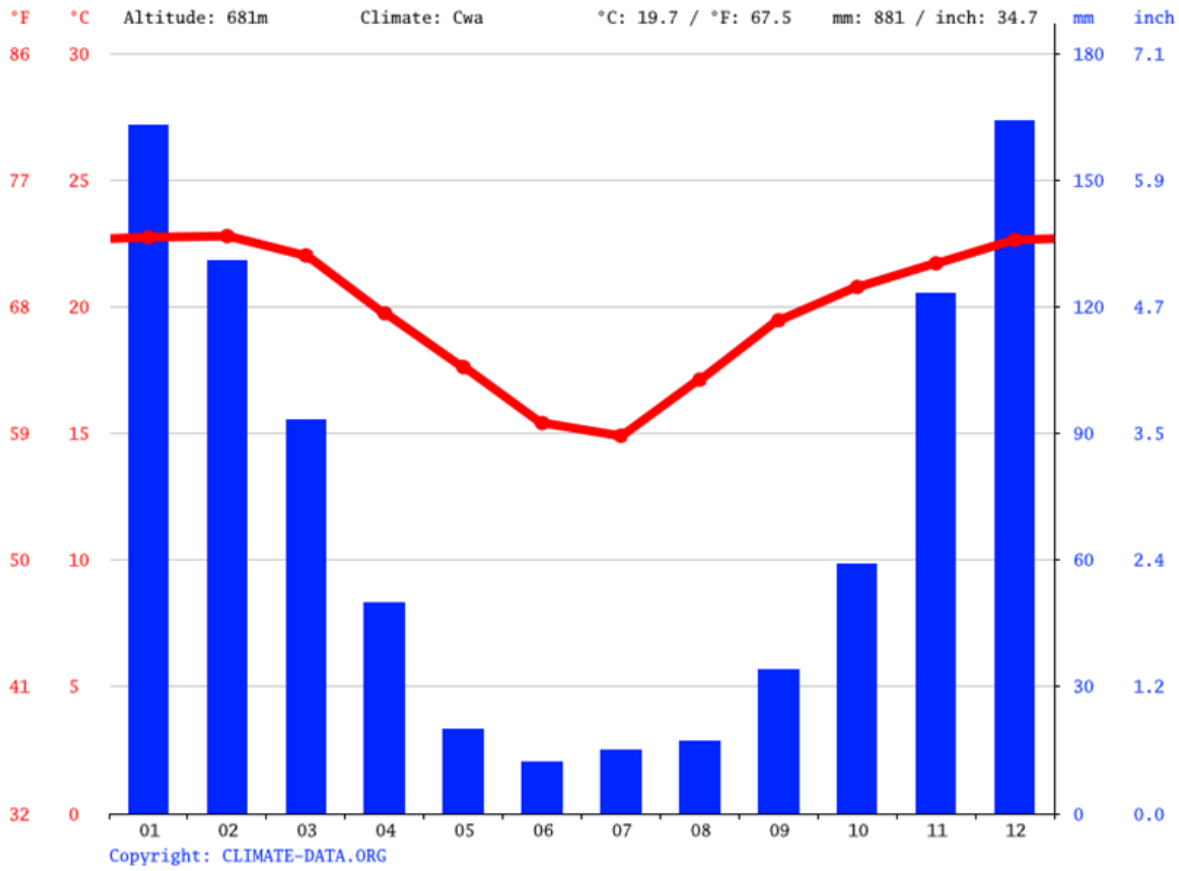

Figure 14: Tzaneen climate graph over a 12-month period [Source: Climate-Data.Org]

Polokwane region has a warm and temperate climate, with an average annual temperature of 19.7°C and annual precipitation of 881 mm, mostly received during the summer months between November to March. The period between April to October is considered a dry season with limited precipitation (***Figure 15***).

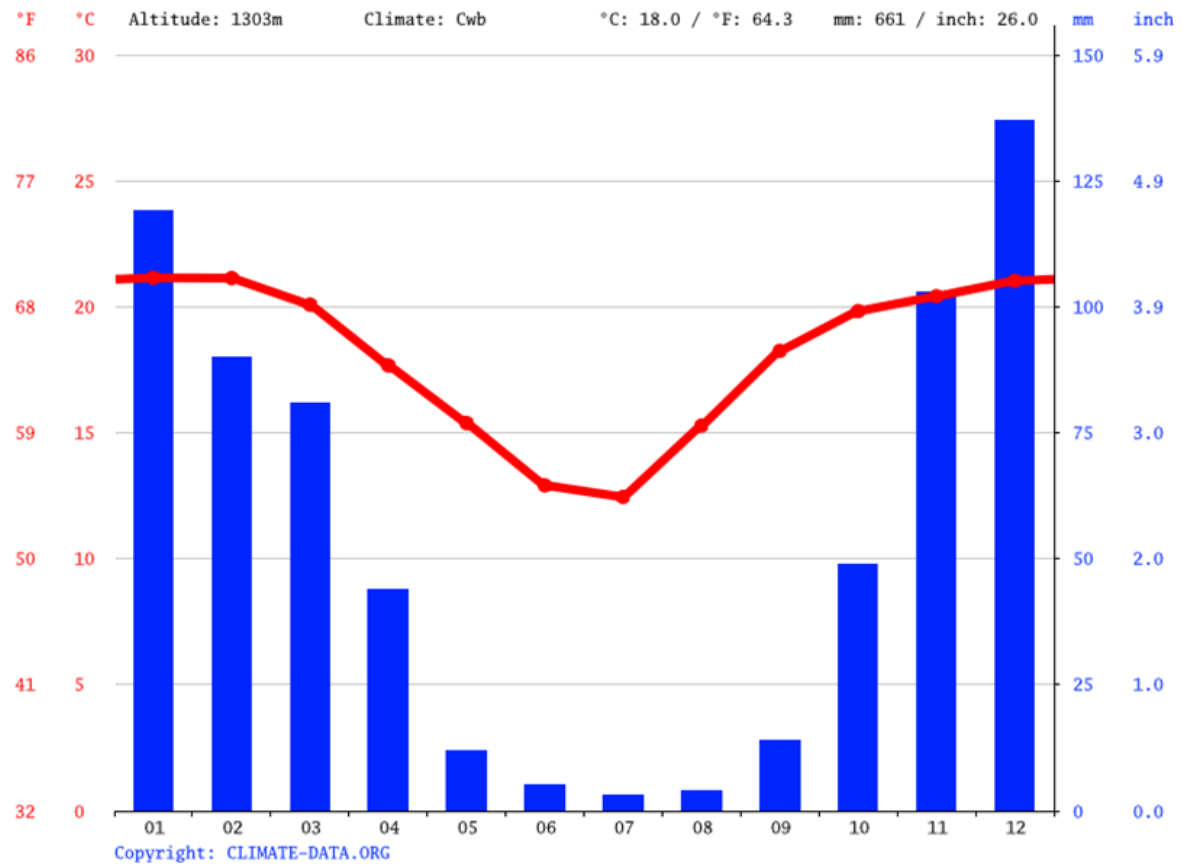

Figure 15: Polokwane climate graph over a 12-month period [Source: Climate-Data.Org]

The environmental factors to be taken into consideration with regard to the region's climatic trends, is that the construction of a weir within the Olifants River and a pipeline river crossing need to be undertaken during the low-flow condition. Given the above-mentioned climatic trajectory (***Figure 14 & 15***), it is inferred that construction within the watercourse and the riparian zone, will have minimal impact on the hydrological and geological elements when undertaken during the period between April to November. The risk of soil erosion on the section of PS1 to Specon where there are Hutton soils can be mitigated by excavation and backfill during the dry period when the risk of storm water runoff is virtually nil. This step could be mitigated further by mechanically compacting the backfill soil (***Refer to Section 12.9***).

12.1.1 Potential impact

The projects itself has no direct impact with regard to climate but will be influenced by the regional climatic conditions, as discussed above. Additionally, the impact during construction will be influenced by the climatic conditions. It is therefore imperative that measures to regulate the impact during construction, be detailed in an EMPr, Hydrological Impact Assessment, and Aquatic Ecological Impact Assessment. It must also be noted that extreme weather events, caused by climate change, would impact the construction activities, work progress and the resilience of the engineering designs. It is desirable that the developer also consider undertaking a Climate Impact Assessment (CIA) to ensure that reasonable mitigation and adaptation measures are in place for the duration of this project.

12.2 Hydrology

The hydrological system comprises an interlinked system of ecosystems such as the headwaters of a river catchment, rivers and wetlands downstream, lakes, groundwater, estuaries, and the marine environment.

The freshwater ecosystem within the Capricorn District, and Mopani District comprise diverse rivers and wetlands (***Figure 16***), as discussed below.

The project footprint is located along the A71A, B52A, B52C, B52D, B52E, and B81A Quaternary Catchments under the Olifants and Limpopo Water Management Area.

The site contained three (3) National Freshwater Ecosystem Priority Area (NFEPA) rivers, namely Olifants River, Chunies River, and Greater Letaba River all featured within the project areas, however the Chunies River occurred throughout most of the study area from the PS1 and rising main to the Palmietfontein reservoir.

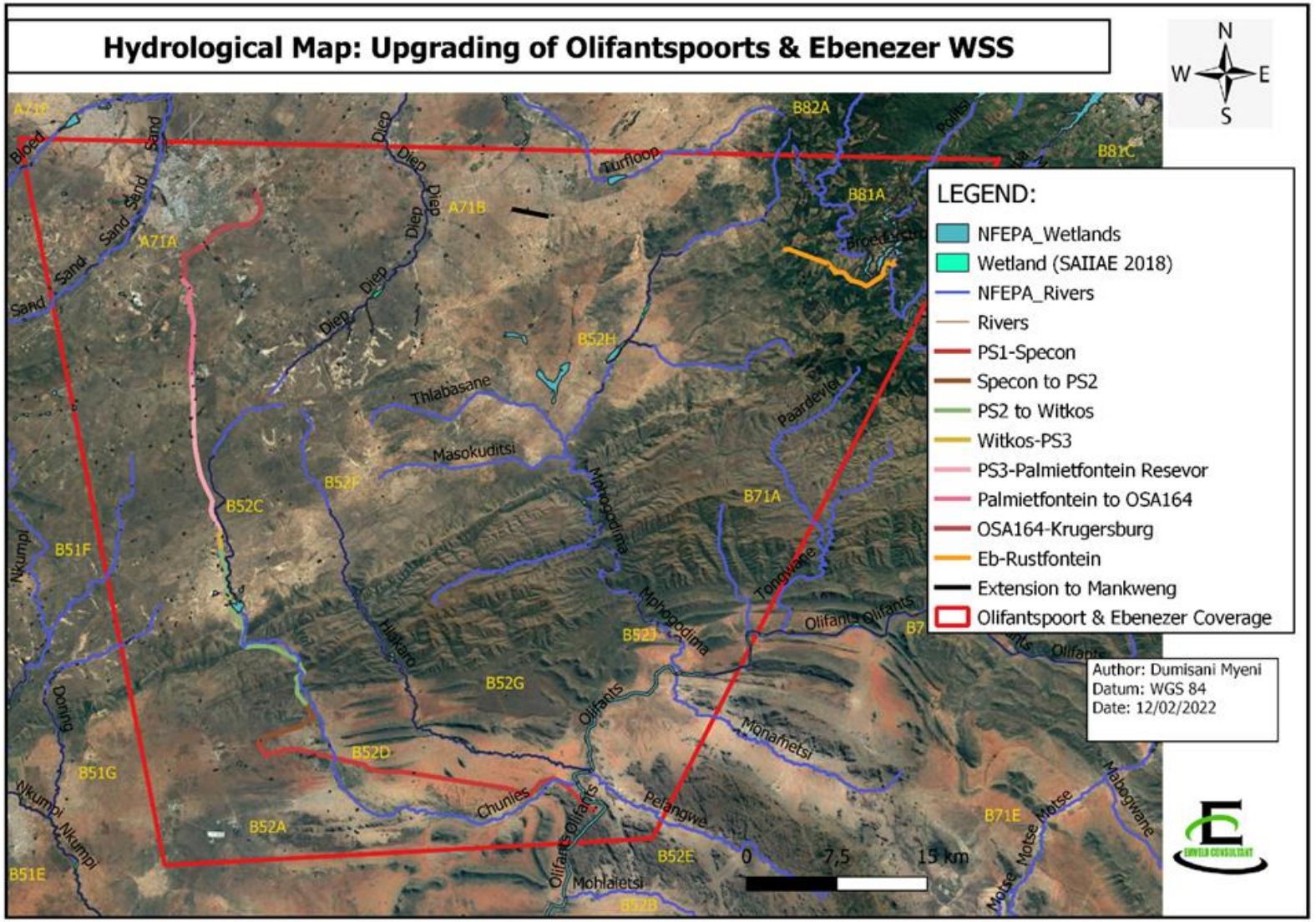

Figure 16: Hydrological Map (Upgrading of Olifantspoort & Ebenezer WSS)

12.2.1 **Rivers and Dams (Olifantspoort Scheme)**

The Olifantspoort WSS falls under the Capricorn District which has a distribution of the National Freshwater Ecosystem Priority Areas (NFEPA) catchments including River FEPAs (LEDET, 2019). The study area for the Olifantspoort Scheme, includes the Olifants River forming a boundary and abstraction point, as well as traverses the Chunies River. All these watercourses are free flowing rivers except for Chunies River. However, all of these rivers are classified as NFEPA rivers (***Figure 16***). Olifants River system hold high value of Ecological Importance and Sensitivity (EIS) in terms of the maintenance of biological diversity and ecological functioning at a local and landscape level.

The locality riverine habitats identified fall into the following geomorphological classification:

- Olifants River – Perennial, Lowland River.
- Chunies River – Non-perennial, Lowland River.
- Ephemeral Lower Foothill Rivers.
- Ephemeral Mountain Streams.

The lower foothills rivers were characterised by narrow, sandy alluvial banks with a very gentle gradient. Some areas had small patches of medium to large stones within the channel. Generally, the bed of these streams were vegetated with overgrazed, short grass species which could not be identified. The riparian areas were predominantly invaded by *Acacia mearnsii*.

The mountain streams occurred in steeply sloping valleys and presented steep embankments with V-shaped channel characteristics. The available habitat was dominated by bedrock, sand/alluvium and marginal vegetation with low presence of stones and gravel.

The locality of pipeline route and abstraction also traversed by several un-channelled and non-wetland watercourses were also encountered and were classified as ‘drainage lines’.

The site hydrological context of the Olifantspoort WSS (***Figure 17***) indicate that the existing weir and proposed new weir falls within a NFEPA river, namely the Olifants River.

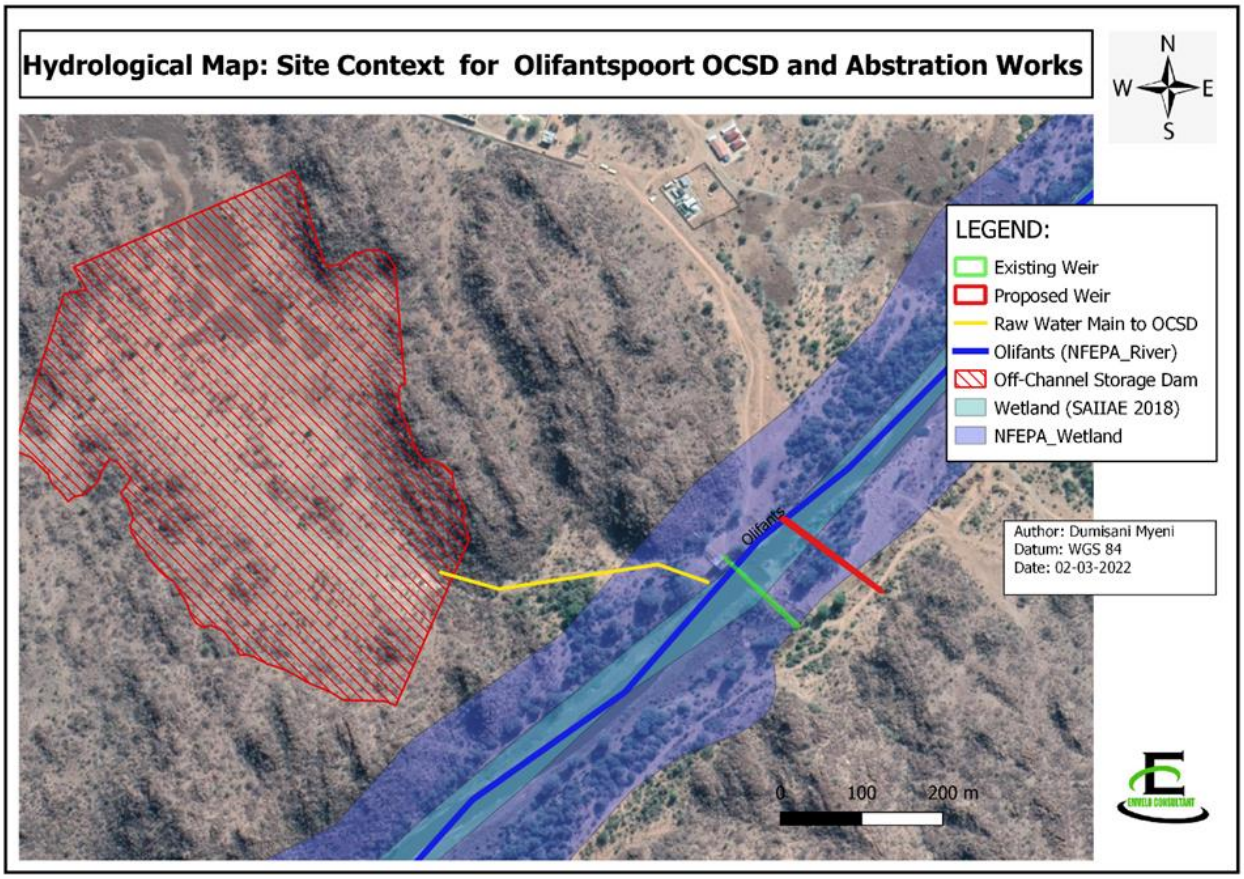

Figure 17: Site Hydrological Context at the Olifantspoort OCSD and Abstraction Works

The field investigation indicates that the Olifants River presented a wide and deep channel with generally slow flowing deep waters. Flow velocity was relatively higher immediately downstream of the weir. The biotopes were dominated by gravel and sand with moderate muddy areas. Marginal vegetation was also fairly dominant and comprised almost exclusively of *Phragmites australis*.

The habitat upstream to the weir is characterised predominantly by slow-deep conditions. The riverbanks are vegetated by reeds which offer good cover/refuge for aquatic species, as well as undercut banks were also present which provides refuge during high flow periods. The riparian area downstream of the weir has been cleared thus limiting the availability of marginal

vegetation. Fast-deep conditions were prevalent below the weir with scattered zones of slow-shallow environments. Habitat is more variable downstream with the occurrence of scattered islands, sections of riffles associated with the gravel and sand biotopes and slower flowing sections providing refuge for weaker swimming fish species. Generally, the reach downstream promotes the occurrence of fish species preferring faster flowing water (rheophilic species), whereas the island sections and surrounding banks promotes the occurrence of weaker swimming or more benthic species. Upstream benthic species are likely to be dominant, however the stronger swimming rheophilic species may be able to traverse the established weir.

The abstraction works will take place within Olifants River system, which has a combined ***PES classified as C*** due to Water abstraction for residential and agricultural purposes. Bed, channel and flow modifications due to road crossings/culverts and weir, as well as proliferation of alien plants.

The majority of river crossings will take place within Chunies River system, which has a combined ***PES classified as D*** due to significant instream and bank erosion, proliferation of alien plant species, water quality impacts due to the surrounding semi-formal residential housing, bed modifications due to cattle trampling, vegetation removal to cater for housing as well significant litter due to illegal dumping within the streams.

The section of bulk pipeline from PS1 to Specon has two interceptions with the Chunies River, which is a NFEPA river (***Figure 18***). Therefore, the proposed upgrade will have two river crossings for this section of pipeline.

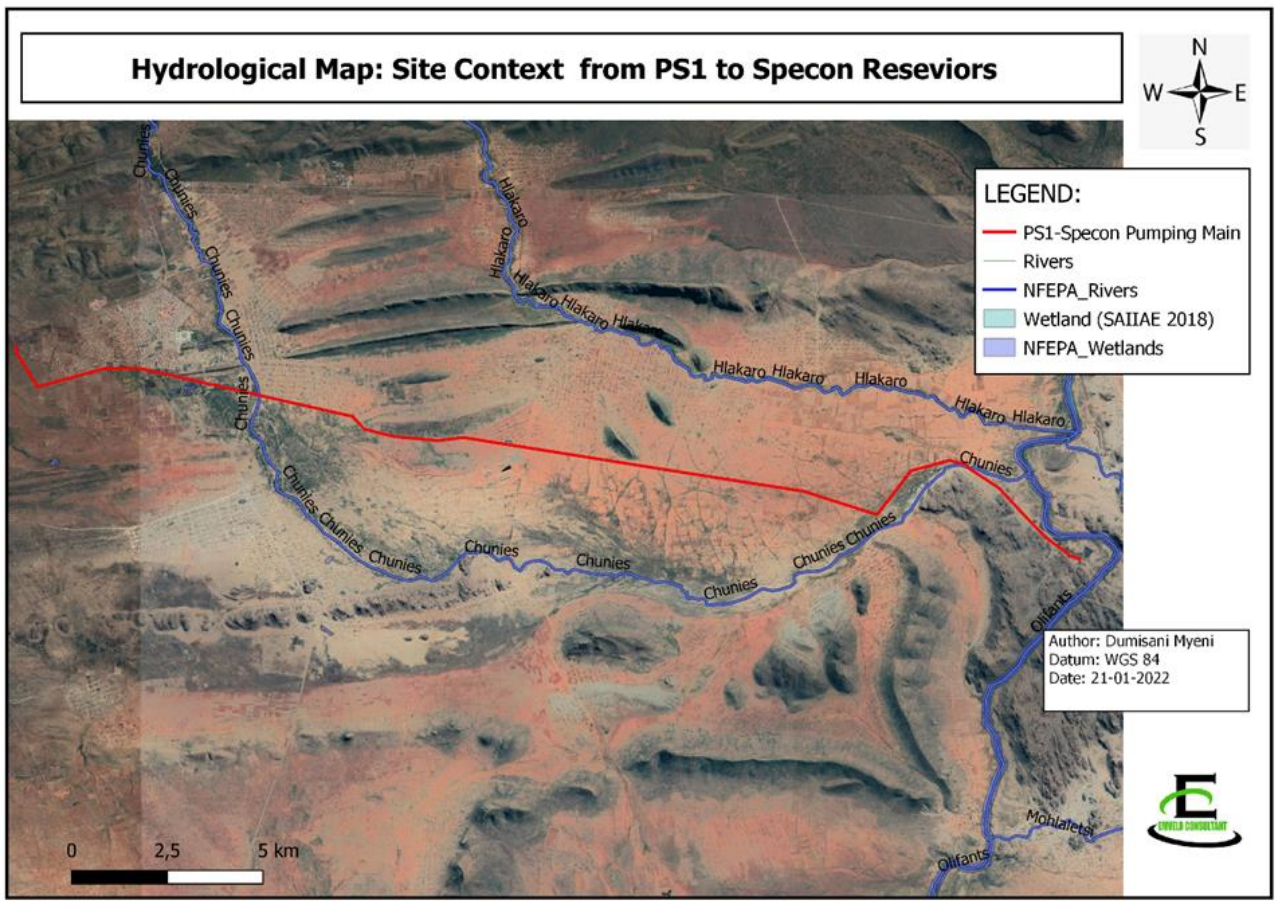

Figure 18: Site Hydrological Context Between Section of PS1 and Specon Reservoirs

The section of bulk pipeline from PS2 to Witkos has four interceptions with the Chunies River, which is a NFEPA river (***Figure 19***). The proposed upgrade will have four river crossings for this section of pipeline. The pipeline has riparian zones and seep wetland habitats, within the pipeline river crossings. These are also comprised of watercourse units, which have not been identified as Wetland FEPAs, but rather the riparian zone. In this section, the Chunies River drains into the foothills and into a flat forming a natural dam (Chuniespoort Dam) and within a wetland pan, the pipeline runs parallel to the Chuniespoort Dam.

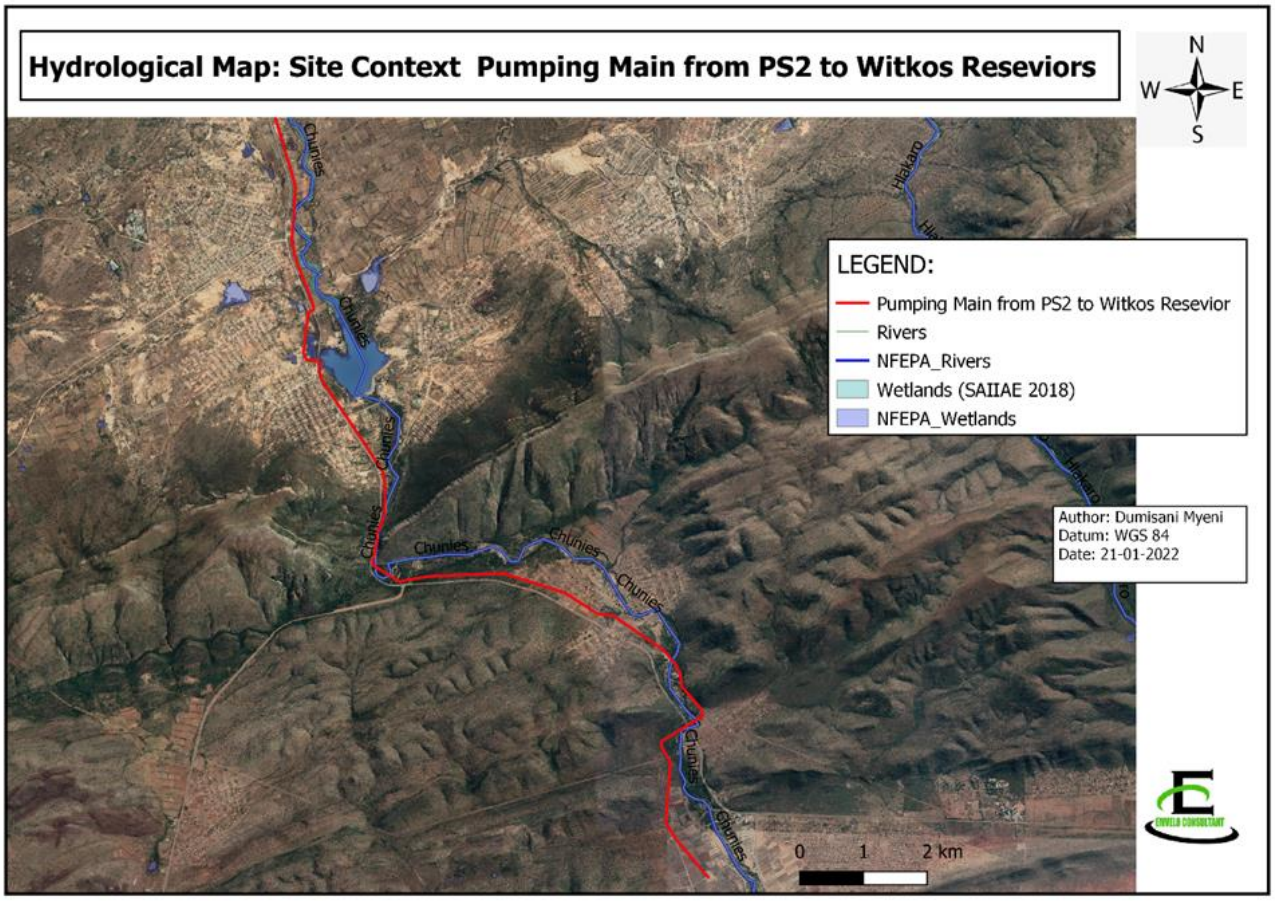

Figure 19: Site Hydrological Context on Section of PS2 and Witkos Reservoir

The field investigation indicates that the PS1 to Specon pipeline has riparian zones and seep wetland habitats, within the pipeline river crossings. These are comprised of watercourse units, which have not been identified as Wetland FEPAs, but rather the riparian zone. The Chunies River provided a variety of habitat throughout its profile. The most dominant habitat was the GSM and stones in current biotopes with scattered areas of bedrock. Generally, no water was present at majority of the assessed reaches. Scattered pools of stagnant water were present. The bad and banks of the channel were impacted by cattle trampling and litter disposal. The riparian zone was significantly invaded by *Acacia mearnsii*. Some instream vegetation was observed which was dominated by *Juncus effusus*.

Substantial in-stream wetlands are also present along reaches of the system.

12.2.2 **Rivers and Dams (Ebenezer Scheme)**

The Ebenezer WSS falls under the Mopani District, which has two secondary catchments, namely: the Great Letaba Catchment in the north; and the Lower Olifants Catchment in the south. The Wolkberg in the southwest of the district, within the northern escarpment of the Drakensberg Mountains, forms the headwater for the Great Letaba River. This district shares the Olifants River with the Capricorn District as this river forms a boundary between three districts, namely Capricorn, Sekhukhune, and Mopani Districts, and the largest tributary of the Limpopo River. All the afore-mentioned river systems are classified as NFEPA rivers, and have numerous tributaries traversing the region, forming several dams, and plains across the region (LEDET, 2016).

The study area is located in the Wolkberg Strategic Water Source Area (SWSA). Key water resources within the DWS regulated area include the Ebenezer Dam which is an earth-filled type dam on the Great Letaba River. It was established in 1959 and its primary purpose is for municipal and industrial water supply. The dam has a surface area of 386ha, supplying up to 70 million cubic meters to Tzaneen and the surrounding area.

The study area from Ebenezer pumpstation has water conveyance intercepting the Great Letaba River (***Figure 20***). This river system hold high value of Ecological Importance and Sensitivity (EIS) in terms of the maintenance of biological diversity and ecological functioning at a local and landscape level. Within locality the Ebenezer WSS will have one river crossing at the Great Letaba River adjacent to Ebenezer pumpstation. The main drainage features in the study are the perennial Groot-Letaba River and Broederstroom River located in the most eastern and northern portions of the study area, respectively. More locally, the Ebenezer to Rustfontein pipeline crosses several non-perennial streams and rivers that drain into the Broederstroom River. The study area extends across three (3) quaternary catchments. The Groot-Letaba River is located in quaternary catchment B81B and Broederstroom River in B81A while the remaining portions of the study area is within B52H.

The Ebenezer Pipeline Extension pipeline crosses a single non-perennial drainage line that drains into a tributary river of the Turfloop River, in quaternary catchment A71B, this drainage line has been transformed.

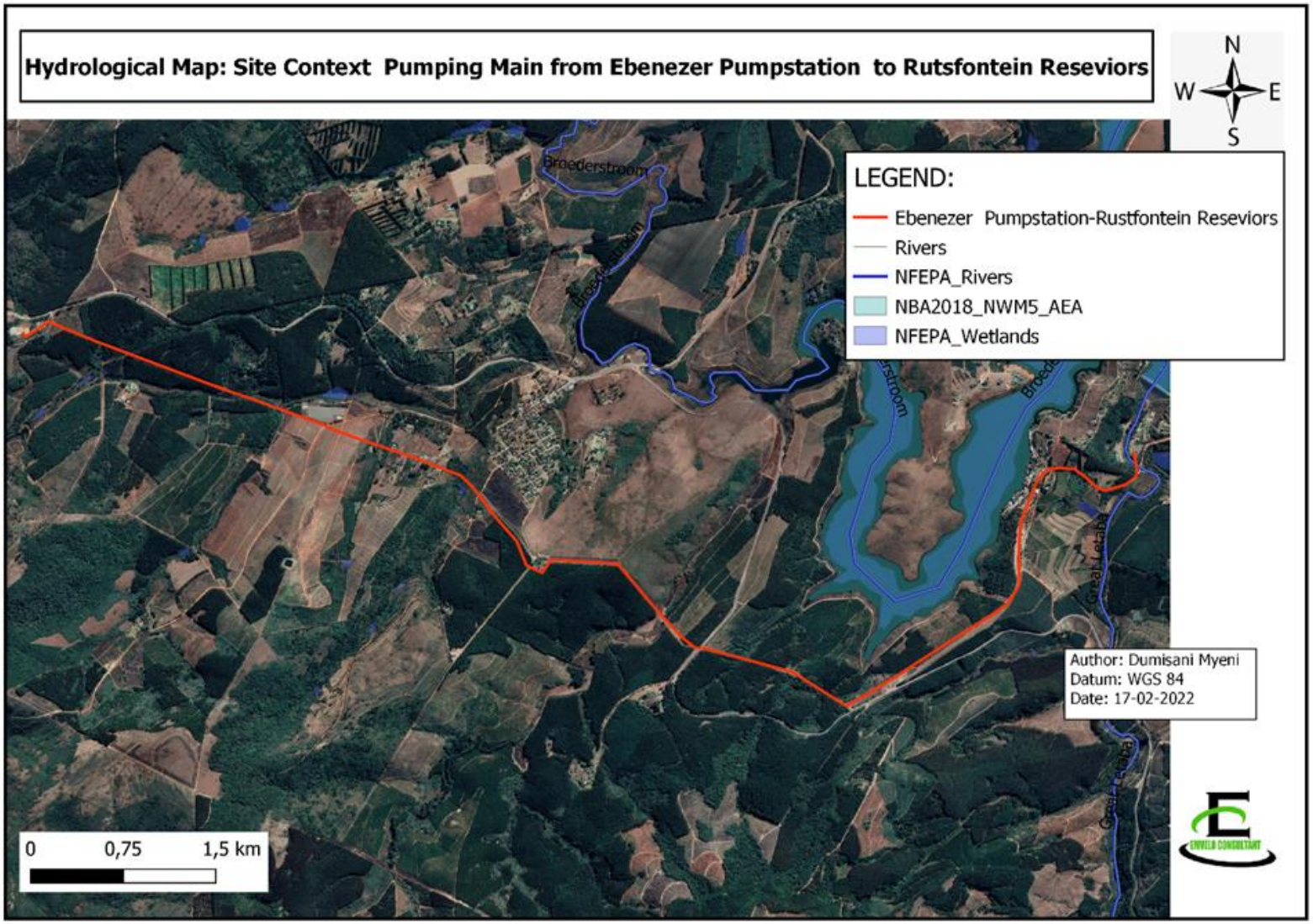

Figure 20: Site hydrological context from Ebenezer to Rustfontein reservoirs.

12.2.3 **Wetlands (Olifantspoort Scheme)**

The Capricorn District has a number of isolated wetlands dispersed across the region. However, the are no known RAMSAR sites located within the district (LEDET, 2019).

The site contained two (2) National Freshwater Ecosystem Priority Area (NFEPA) rivers, namely Olifants River (abstraction works) and Chunies River (conveyance infrastructure) all featured within the project areas. Some portion of these rivers contained NFEPA wetlands in the form of Channelled Valley Bottom (CVB) wetlands, whereas the remainder of the study area contained scattered NFEPA wetlands.

The study area at Olifantspoort abstraction works comprise valley bottom wetland (NFEPA wetland) which is formed within the riparian zone of the Olifants River. As a result, the construction activities at the abstraction works will take place in the NFEPA wetland, forming riparian zone (***Figure 21***).

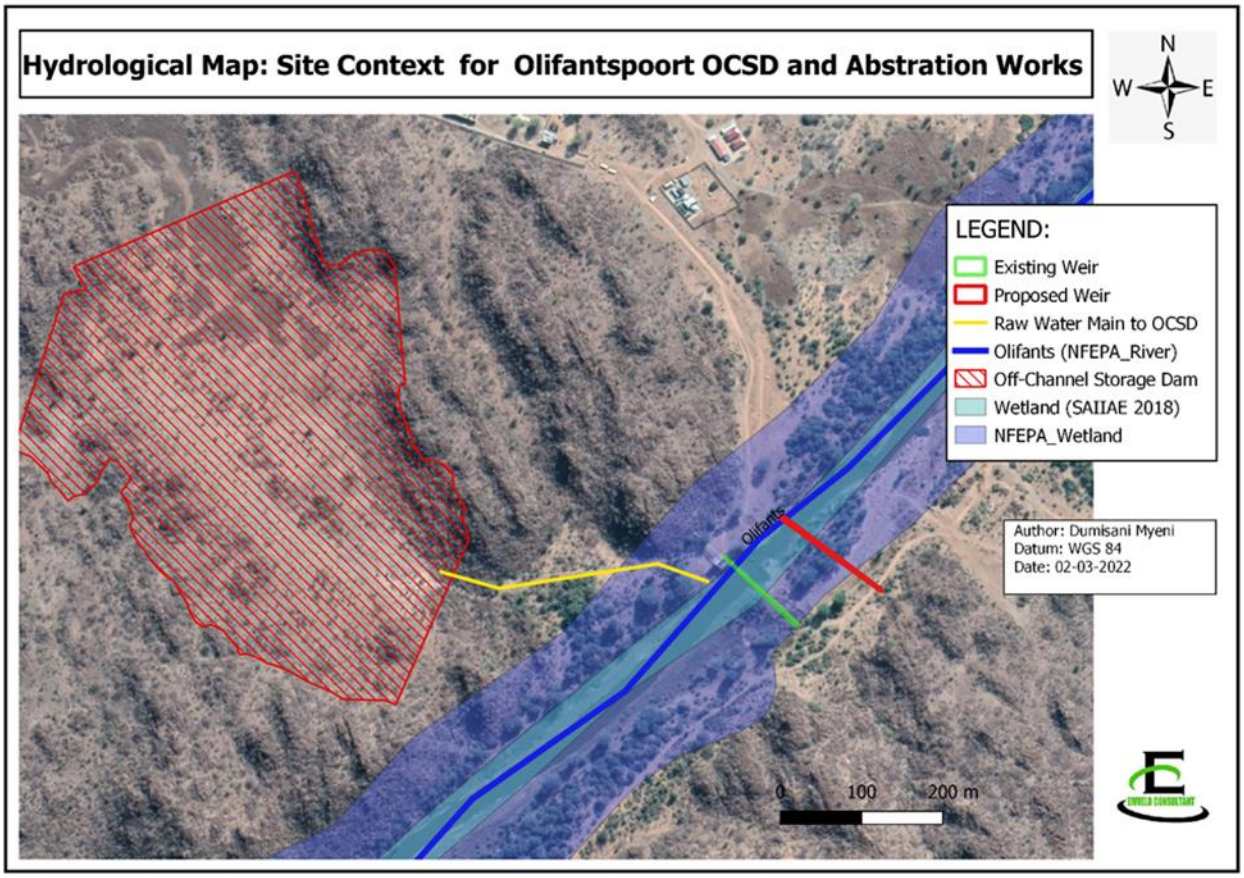

Figure 21: NFEPA Wetland at Olifantspoort Abstraction Works

The construction of water conveyance from PS1 to Specon reservoirs will intercept the NFEPA wetland along the Olifantspoort WTW (PS1) (***Figure 22***).

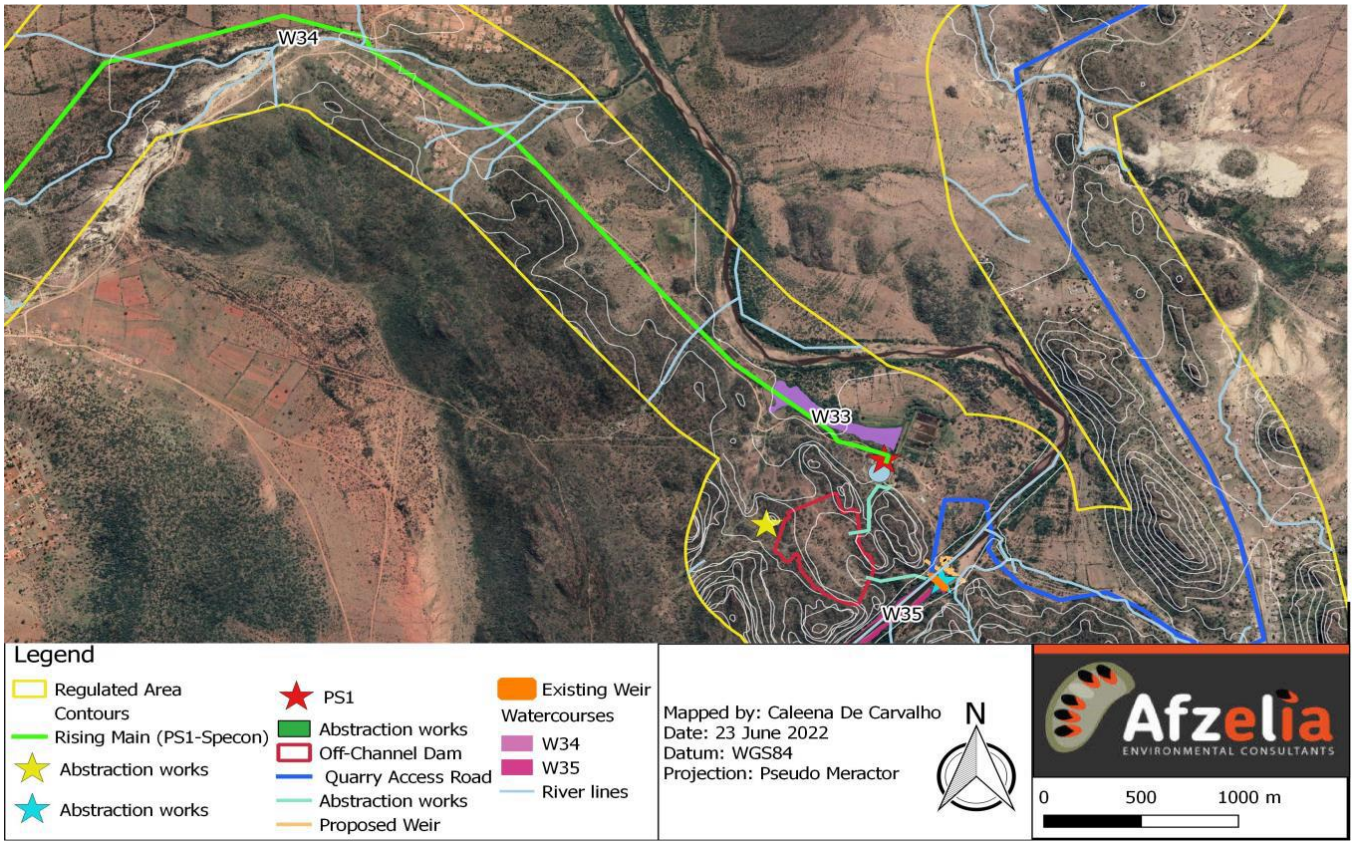

Figure 22: Wetland Adjacent PS1 from section of PS1 to Specon pumping main

The construction of water conveyance from PS1 to Specon reservoirs will intercept the wetland hydrological body within the last portion towards Specon reservoirs , and also traverse the drainage lines (***Figure 23***).

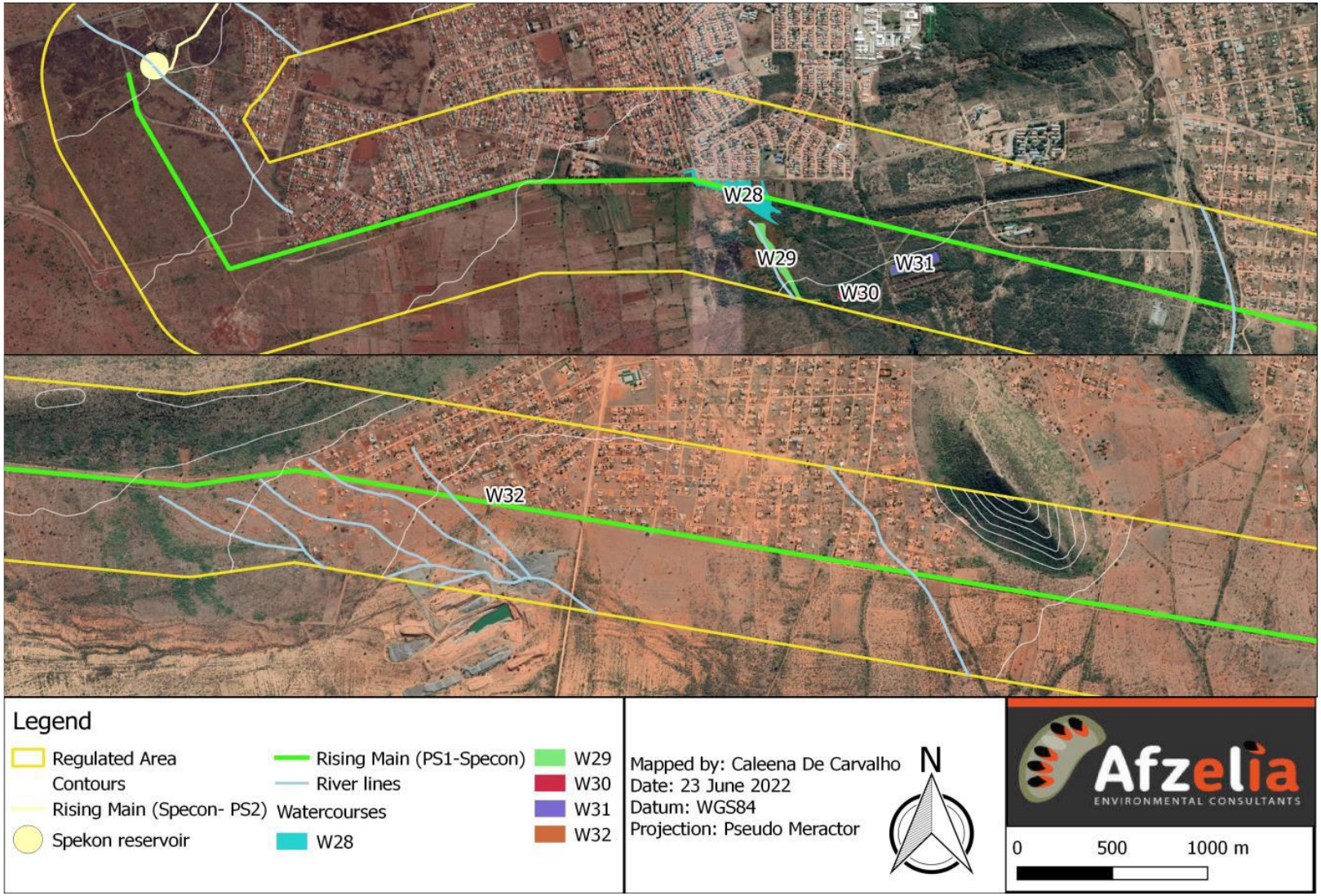

Figure 23: Delineated wetlands that fell within the PS1 to Specon pumping main

The pipeline from Sepcone to PS2 traverses the drainage lines. No wetlands identified within this section of pumping main (***Figure 24***).

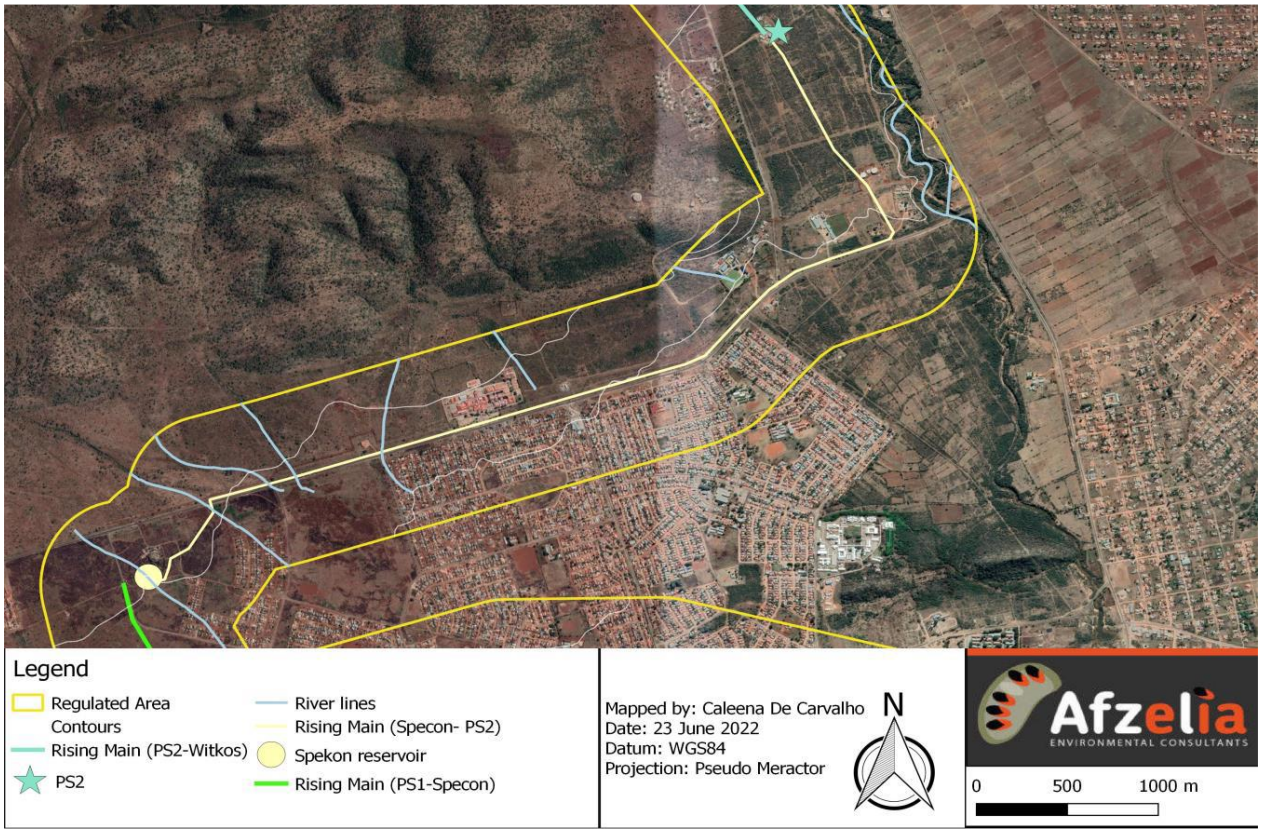

Figure 24: Delineated wetlands that fell within the Specon to PS2 pumping main.

The portion PS2 to Witkos reservoir transcends along Chuniespoort Dam which forms part of the NFEPA valley bottom wetland along the flood plain of Chunies River. This portion of water conveyance is also within an area of small wetlands forming a wetlands system (**Figure 25**).

Lastly, the conveyance along Witkos to PS3, the PS3 to Palmietfontein, the Palmietfontein to to OSA164 pumping main, and OSA164 to Krugersburg pumping main traverse the area with a number of wetlands and drainage lines (***Figures 26,27 & 28***).

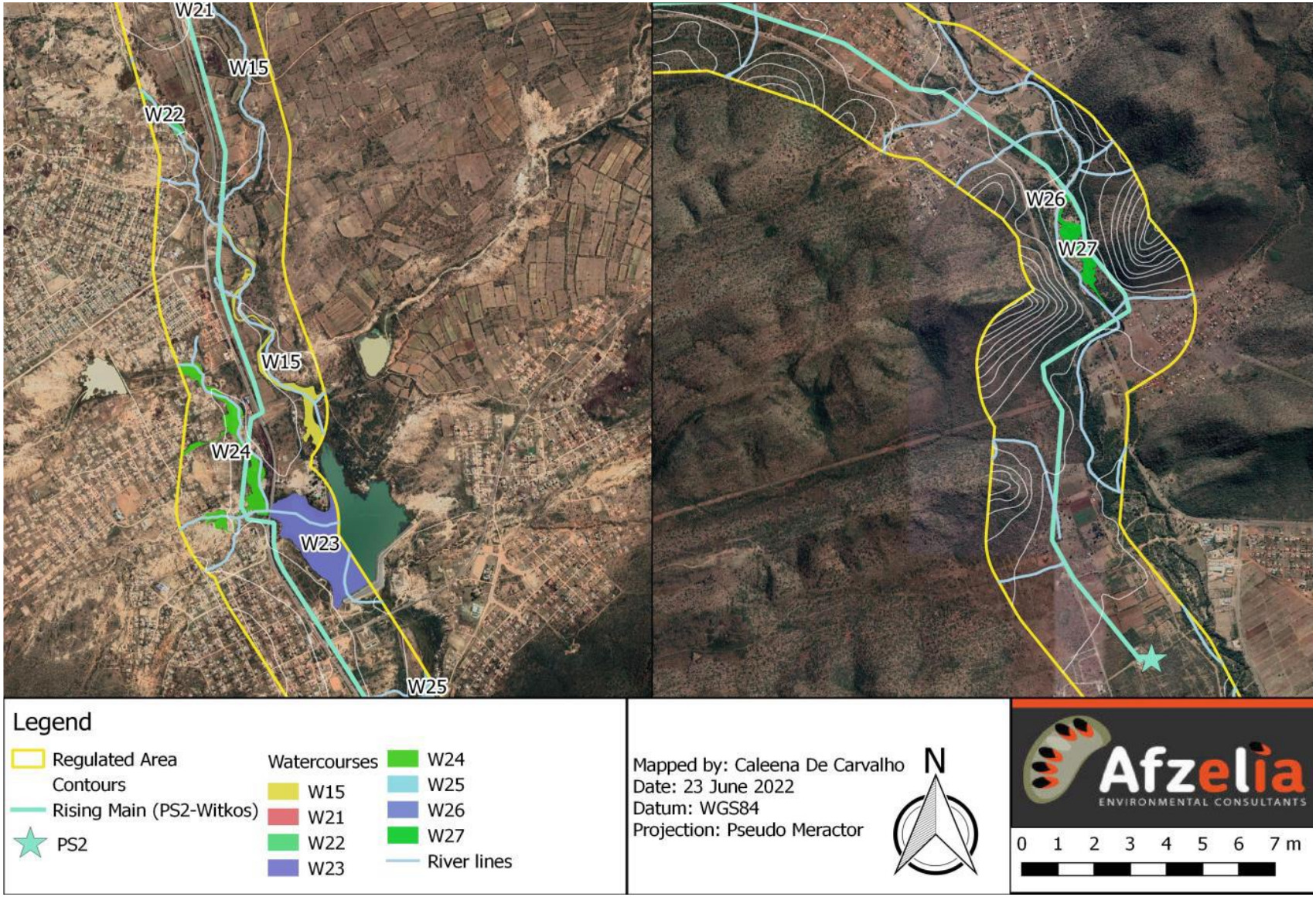

Figure 25: Delineated wetlands that fell within the PS2 to Witkos rising main.

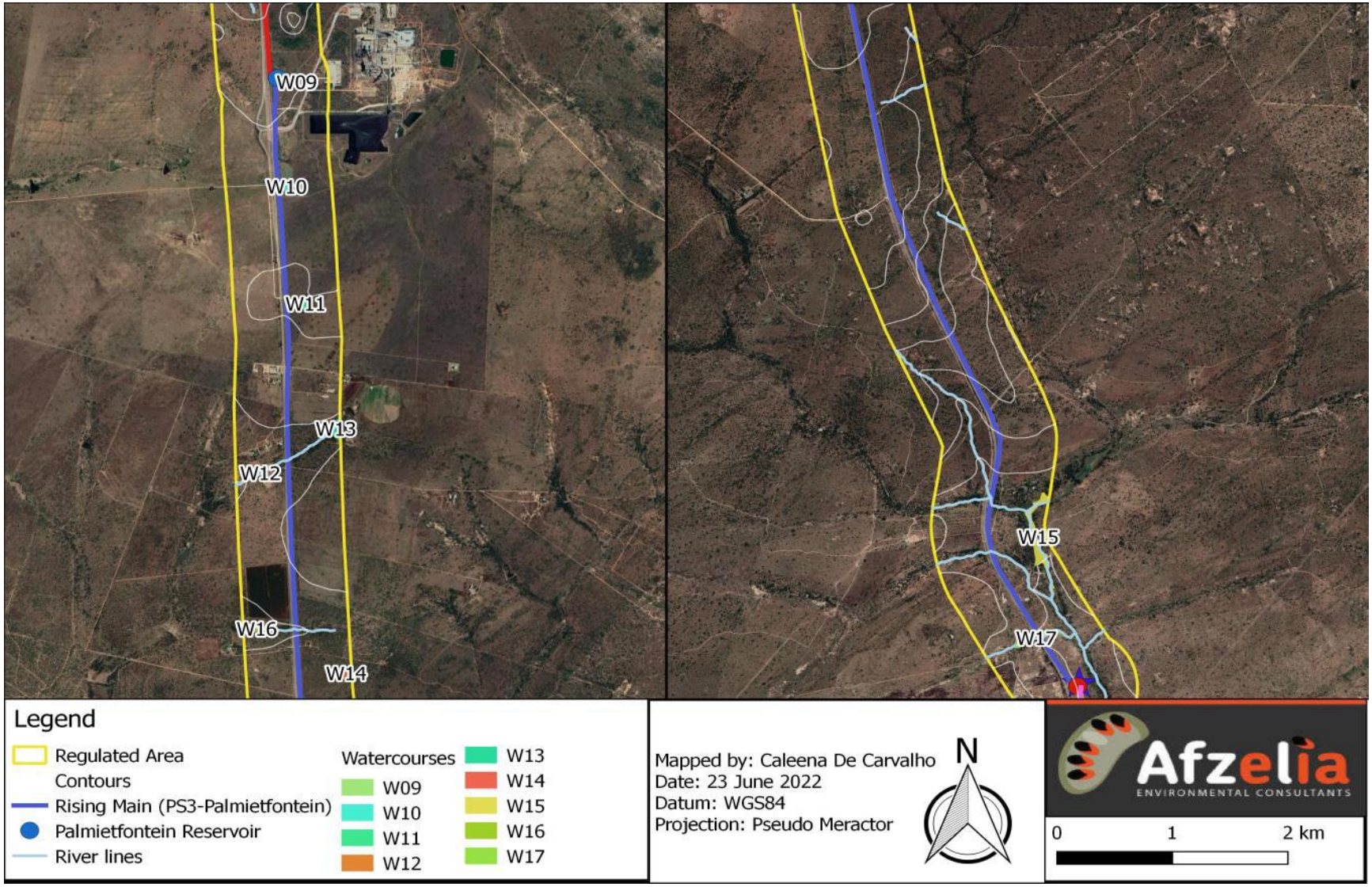

Figure 26: Delineated wetlands that fell within the PS3 to Palmietfontein rising main.

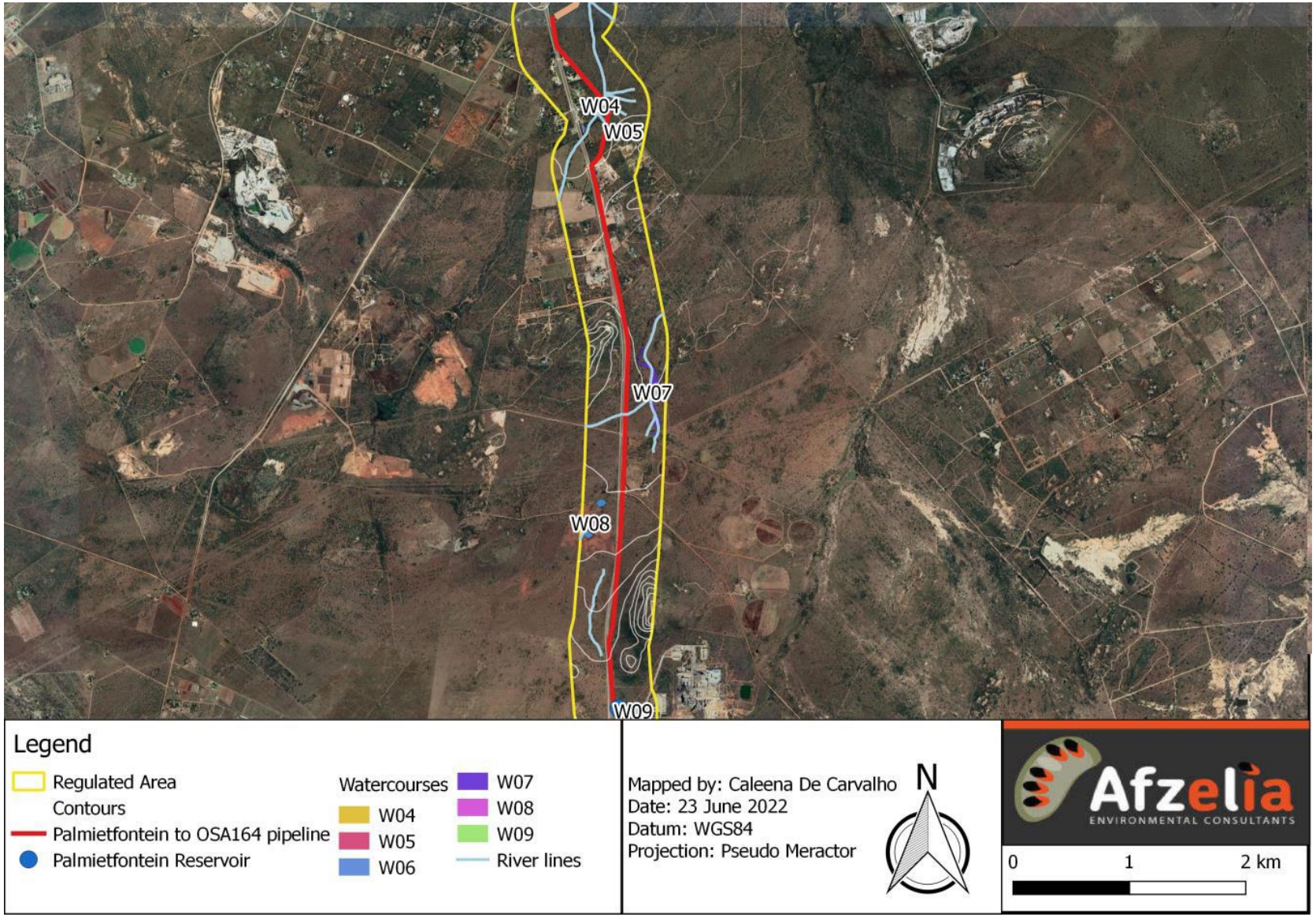

Figure 27: Delineated wetlands that fell within the Palmietfontein to OSA164 pumping main.

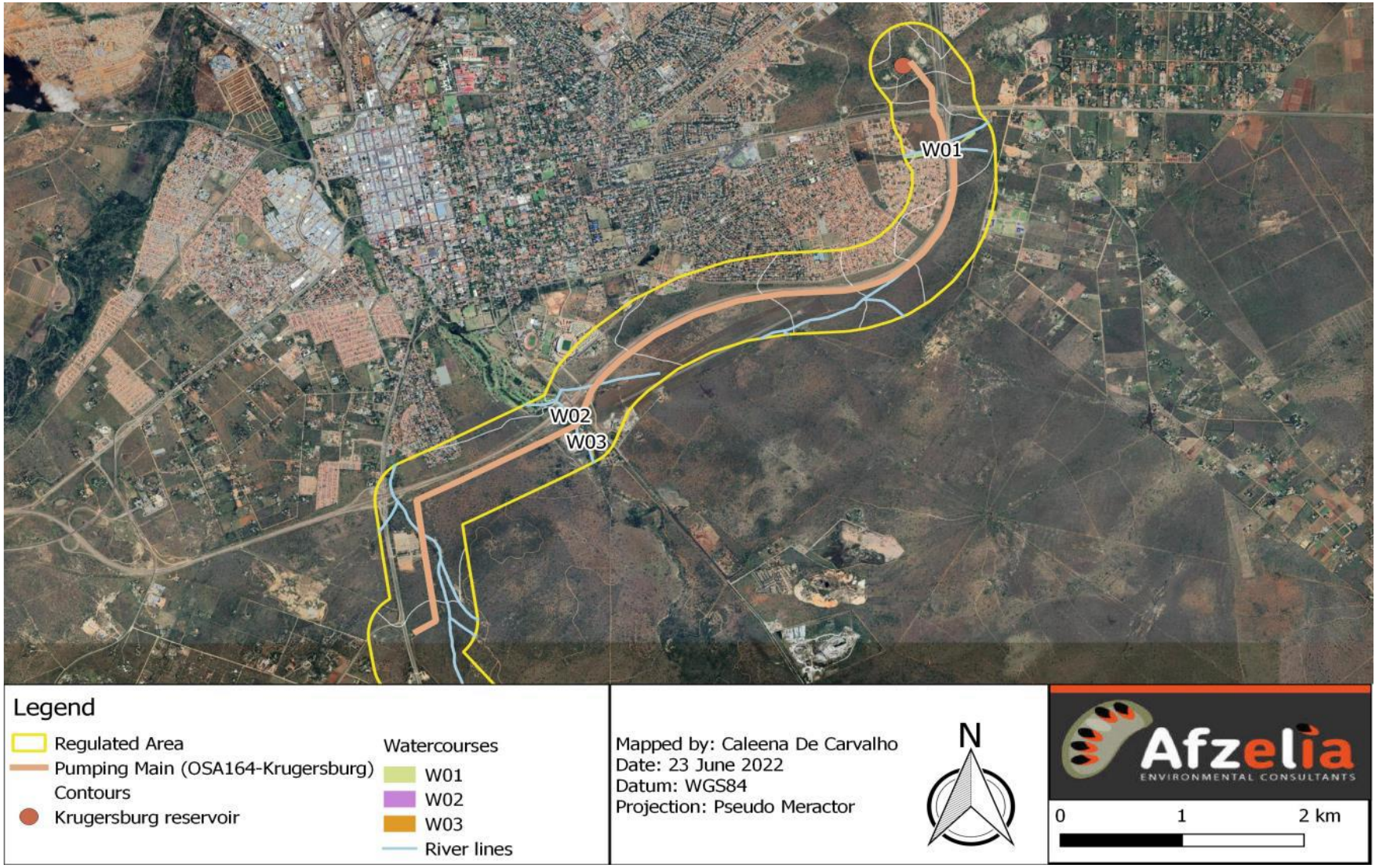

Figure 28: Delineated wetlands that fell within the OSA164 to Krugersburg pumping main.

The field assessment confirmed the presence of several wetland systems within Olifantspoort Scheme conveyance route, mainly the Channelled Valley Bottom (CVB) wetlands, Unchanneled Valley Bottom (UVB), the seep wetlands, and drainage lines. The hillslope seepage wetland will be traversed by the PS3 to Palmietfontein rising main, OSA to Krugersdorp, PS2 to Witkos pumping main. Seepage dam will not be traversed by the OSA to Krugersdorp whereas the UVB will be affected. The UVB wetland will be at risk of impact by the PS2 to Witkos pumping main construction activities. The CVB wetland will be traversed in two sections by the PS2 to Witkos rising main. It has undergone modifications as a result of the Chuniespoort Dam.

12.2.4 **Wetlands (Ebenezer Scheme)**

The Mopani District which hosts the Ebenezer WSS is characterised by undulating plains forming wetlands along differing altitudinal zones with seeps, dams, vleis, etc. (LEDET, 2016). Wetlands are largely known for providing species habitat and ecosystem services.

The study area has wetlands dispersed across and along the altitudinal zones, with highest concentration along the plain of the Broederstroom River linking to Ebenezer Dam, and isolated wetlands dispersed along the Rustfontein area.

The field assessment confirmed the presence of several wetland systems on the section of Ebenezer to Rustfontein reservoirs, mainly the CVB wetlands that were connected to riverine systems. Only three (3) wetland systems in the form of two (2) CVB wetlands and one (1) UVB wetland were identified to be at risk of impact as a result of the proposed pipeline route traversing these systems (***Figure 29***). The watercourses within the section of Ebenezer pumpstation to Rustfontein reservoirs have already undergone large modifications as a result of surrounding monoculture, mainly blue gum (*Eucalyptus globulus*) and Pine plantations and several vegetable farms. Most of the wetland systems were identified as CVB wetlands connected to drainage lines and had been diverted and dammed to be utilised for agricultural practices and a majority of them have been confined to corridors. The wetland delineated on Ebenezer extension to Mankweng pipeline route were the seepage wetland and is located approximately 175m away from the proposed activities (***Figure 30***).

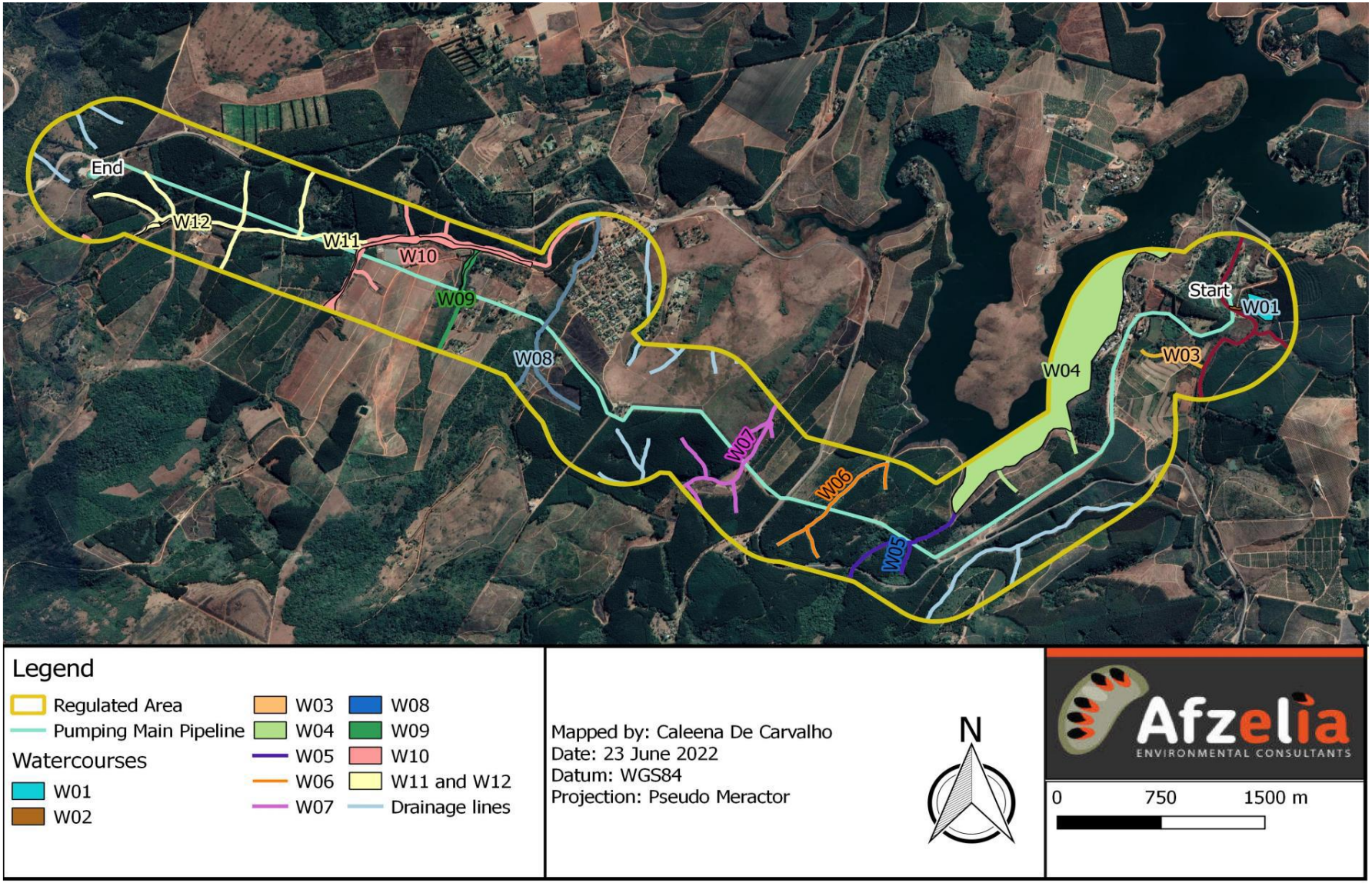

Figure 29: Watercourse Delineation and Classification Map- Ebenezer to Rustfontein Reservoirs

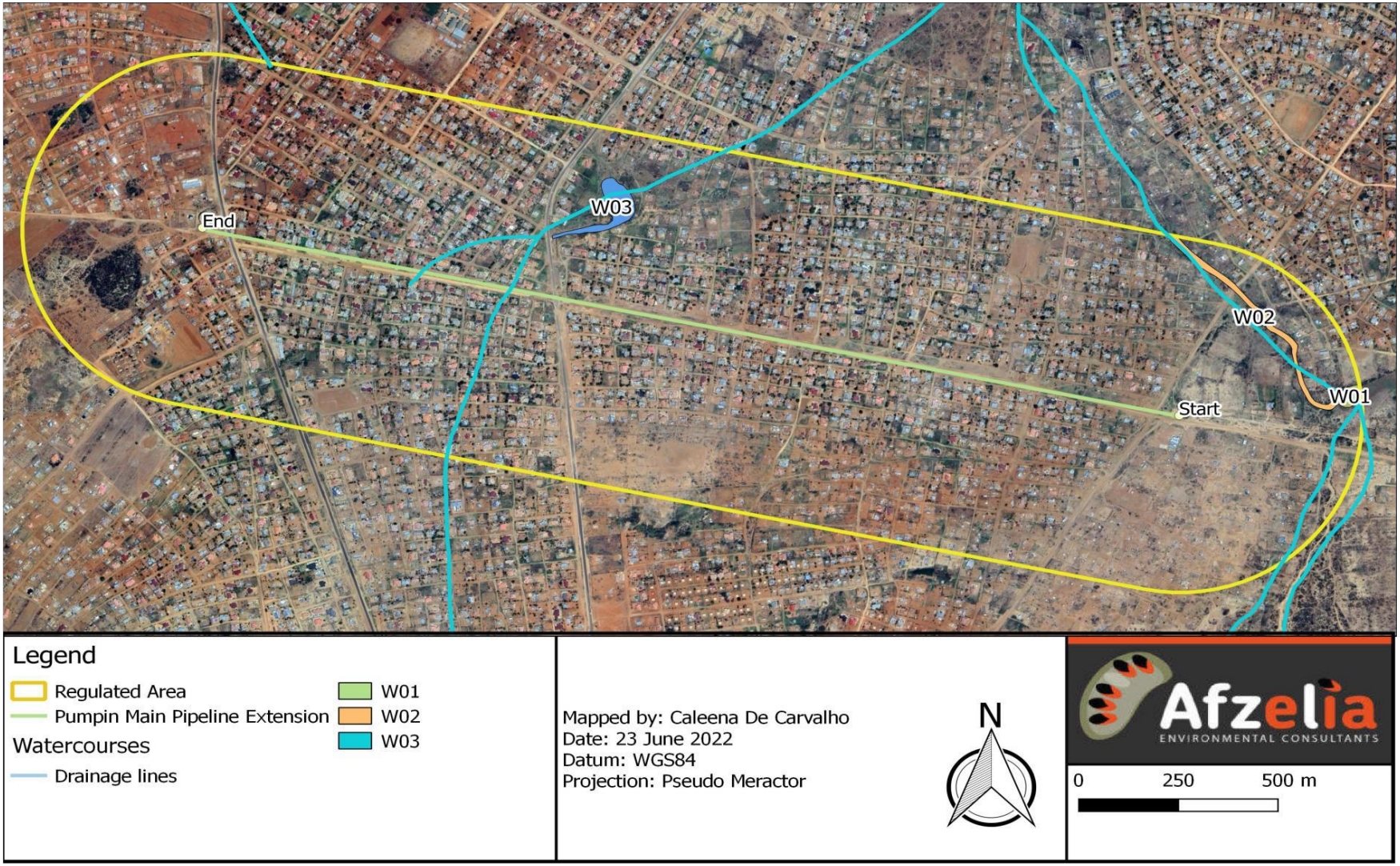

Figure 30: Watercourse Delineation and Classification Map - Extension to Mankweng

12.2.5 Potential impacts of the project hydrological features

The construction at Olifantspoort abstraction works and the water conveyance upgrades will have seven river crossings. The pipeline for Olifantspoort will have six interceptions at the Chunies River, and Ebenezer will have one interception at the Great Letaba River. As a result, the pipeline river crossings will have negative impacts on the river's hydrology from the *in-sutu* riparian zone and downstream watercourse. This will result in riparian incision, banks inundation, stream flow reduction, and downstream pollution, if proper mitigation measures and good construction practice are not adhered to. The construction of the pipeline will have direct disturbance and destruction of wetland habitat along the preferred pipeline route. Therefore, measures to regulate the impact that result during construction is described in the EMPr, Wetland Impact Assessment, Aquatic Ecological Impact Assessment, and Surface Water Hydrology Assessment.

12.3 Ground Water Quality

The study area comprises the varying types of terrain and mainly shallow soils, with localized pockets of soils of variable thickness. These give rise to varying Existing Groundwater Level (EGL) in the study area. However, there is very little possibility that groundwater will be encountered during construction, with exception of valley bottom wetlands. The Geotechnical Assessment is undertaken to describe the excitability and EGL conditions within the water conveyance portions. Notwithstanding the field investigation depicted the occurrence of groundwater seepage from a depth of 0.90 m below EGL and perching of infiltrating groundwater on bedrock in some section of pipeline route, and the groundwater predicted to perch on bedrock and/or hardpan Calcrete (**Refer to Section 12.9**).

12.3.1 Potential Impacts

Potential impacts on groundwater may arise if hazardous substances are allowed to leak onto bare soil and potentially leach into the ground. Therefore, measures to regulate such impacts during construction are described in EMPr.

12.4 Biomes

The study is conducted within Capricorn, and Mopani regions, which host the Olifantspoort and Ebenezer WSS, respectively. These regions are predominantly covered by Savanna biome, as 65% of the Capricorn District is overlain by this biome, with the remainder being made up of Forest (4%), Grassland (19%) and Azonal (11%) biomes. The Capricorn District has three centres of endemism, namely the Soutpansberg, Wolkberg and Sekhukhune land Centres of Endemism. Furthermore, 68% of Mopani District is overlain by Savanna biome with the remainder being made up of Grassland (16%) and Forest (10%) biomes (LEDET, 2016; LEDET, 2019).

12.4.1 Olifantspoort Scheme Biomes

The ***Figure 31*** below shows the study area of Olifantspoort WSS from the Olifantspoort abstraction works to the Krugersburg reservoirs falls within the Savanna biome that also contain isolated Grassland biome intrusions.

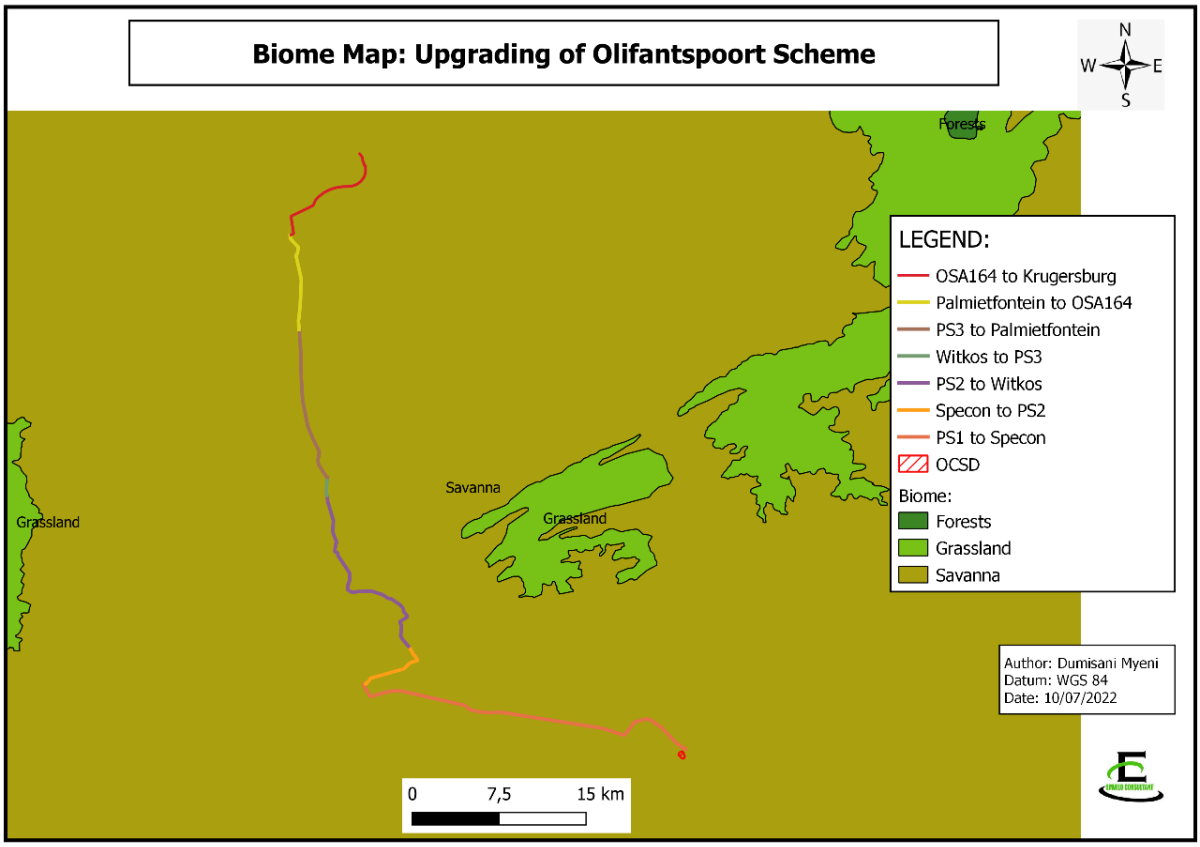

Figure 31: Map Showing the biome within Olifantspoort Scheme

12.4.2 Ebenezer Scheme Biomes

As depicted in ***Figure 32*** below, the study area for the Ebenezer WSS, from the Ebenezer pumpstation to the Rustfontein reservoirs, falls within the grassland biome, with an intrusion of forest biome. While the extension Mankweng falls within the Savanna biome.

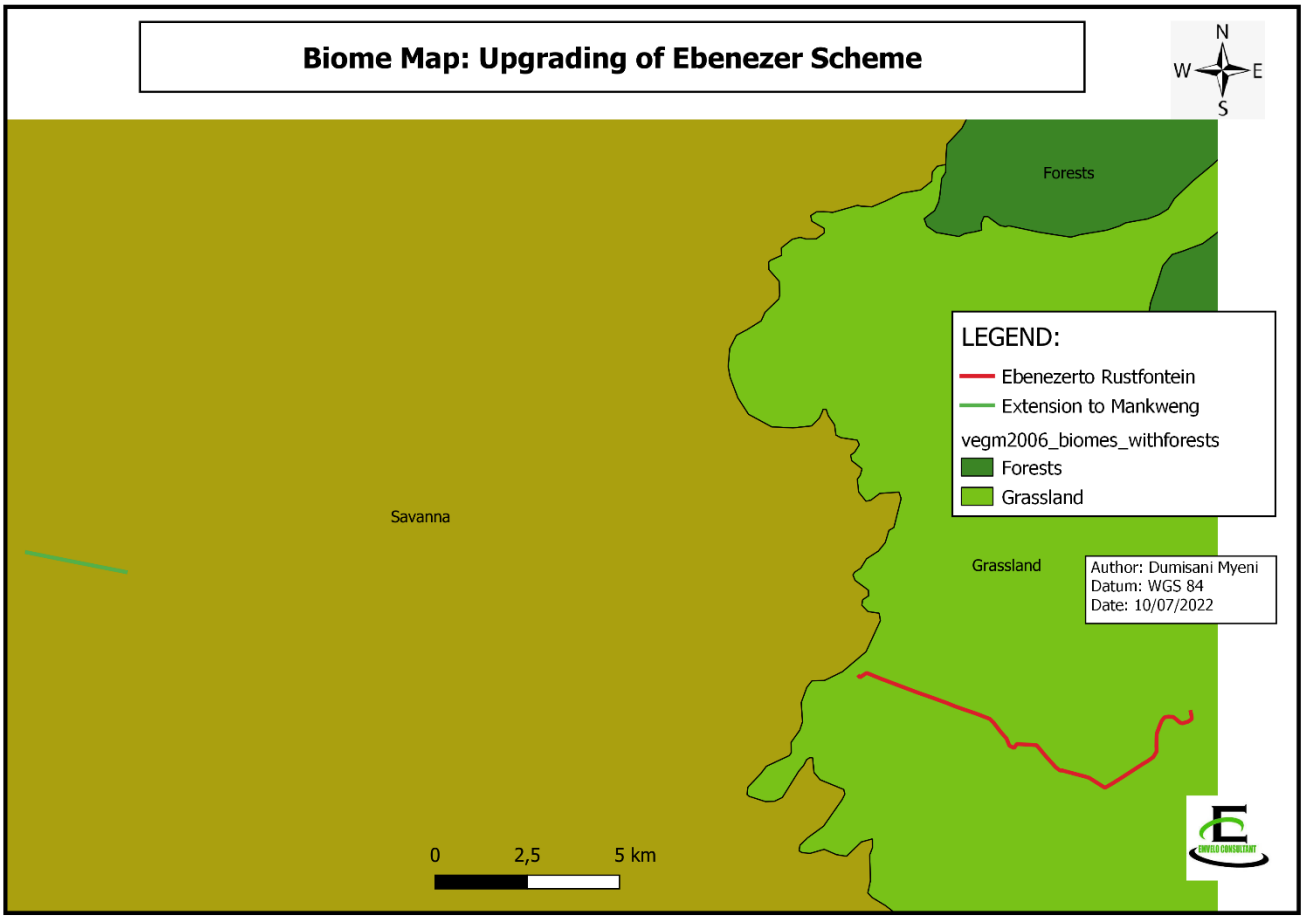

Figure 32: Map Showing Biomes within Ebenezer WSS Study Areas

12.5 Flora

As discussed in ***Section 12.4***, the Capricorn and Mopani Districts are dominated by Savana biome, with the remainder made up of Grassland, Forest and Azonal biomes. Therefore, the vegetation types within Capricorn corresponds to dominant biome, as the Capricorn District has 26 different vegetation types, to which six of the 26 vegetation types has a high conservation status, namely:

(a) Vulnerable: Sekhukhune Plains Bushveld, Polokwane Plateau Bushveld and Spingbokvlakte Thornveld

(b) Endangered: Tzaneen Sour Lowveld and Sekhukhune Norite Bushveld ;

(c) Critically Endangered: Woodbush Granite Grassland .

The Capricorn District has a high level of endemism as fifteen of the vegetation types occurring within the district are classified as endemic and two as near-endemic (LEDET, 2019).

The Mopani District has 25 different vegetation types, of which nine of the 25 vegetation types have a high conservation status, with 5 of these are classified as '*Vulnerable*', two as *'Endangered'* and two as '*Critically Endangered'*. The district has a high level of species endemism as nine of the vegetation types occurring within the district are classified as endemic and five as near-endemic (LEDET, 2016).

12.5.1 Flora within the Olifantspoort Scheme Study Area

The vegetation type with the study area Olifantspoort WSS (***Figure 33***) is predominantly: Sekhukhune Plains Bushveld (SVcb27) '*Vulnerable*' with (19%) conservation target; Polokwane Plateau Bushveld (SVcb23) ' *Least Threatened'* with (19%) conservation target; Ohriigstad Mountain Bushveld (SVcb26) '*Least Threatened'* with (24%) conservation target; Mamabolo Mountain Bushveld(SVcb24) '*Least Threatened'* with (24%) conservation target; and an intrusion of Northern Mistbelt Forest, and a Spingbokvlakte Thornveld (Mucina & Rutherford, 2006).

A 500m Project Area of Influence (PAOI) was considered applicable to the nature and scale of the activities taking place for upgrading of the Olifantspoort Scheme, which include abstraction works the OCSD, conveyance and storage infrastructure. There were six distinct habitats that were delineated during the site visit within the study area, namely bushveld, forest, thornveld, watercourse (instream, riparian, wetlands), and secondary vegetation, and settlement (rural and urban).

The Olifantspoort Scheme (pipelines) is aligned mostly along the main R37 road which is mostly degraded due to the initial pipeline construction activities and human settlements. However, there are also sections of the pipeline route which fall within areas which are less disturbed but in their secondary succession. Sections of the OSA164-Krugersburg and the Palmietfontein to OSA164 pipeline routes traverse through the Polokwane Nature Reserve. Most of the big trees have coppice branches after being cut for firewood and other uses by

local inhabitants. This route also passes through sections which are highly sensitive, like Chuniespoort Mountains, listed as CBA 1 and CBA 2 regions. Plant species such as the protected Marula and Shepard trees were recorded in abundance along this route. Some sections of the project site are dominated by anthropogenic activities such as illegal dumping of materials. The ***Table 20*** below outlined the plant species identified within PAOI of Olifantspoort Scheme

Table 20: Plant Species Recorded within Olifantspoort Scheme PAOI

Scientific name	Common name	Ecological status	Growth Form
Acacia melanoxylon	Australian blackwood	Category 2 AIS	Tree
Acacia mearnsii	Black Wattle	Category 2 AIS	Tree
Abutilon angulatum	Elephant's Ear	Indigenous	Shrub
Agave sisalana	Sisal	Category 2 AIS	Succulent
Aloe chabaudii var. chabaudii	Inhlaba	Indigenous/Least concern	Succulent
Aloe cryptopoda (= *A. wickensii*)	Geelaalwee	Data Deficient - Taxonomically Problematic	Succulent
Aloe maculata	Soap aloe	Indigenous/Least concern	Succulent
Aloe globuligemma	Knoppiesaalwyn	Indigenous/Least Indigenous/Medicinal	Succulent
Aloe cf. marlothii	Mountain aloe	Indigenous/Medicinal /Least concern	Succulent
Aloe mutabilis (Aloe arborescens)	Blue krantz aloe	Indigenous/Least concern	Succulent
Aloe immaculata	Spotles Aloe	Indigenous/Medicinal	Succulent
Alternanthera pungens	Khakhiweed	Weed	Herb
Amaranthus hybridus	Pigweed	Weed	Herb
Antidesma venosum	Tassel-berry	Indigenous/Least concern	Tree
Argemone ochroleuca	White-flowered Mexican poppy	Category1b AIS	Herb
Aristida congesta subsp. *congesta*	Buffalo Grass	Indigenous	Grass
Asparagus laricinus	Bergkatbos	Least concern	Shrublet
Asparagus virgatus	Broom Asparagus	Indigenous/Medicinal	Shrub
Asparagus laricinus	Bergkatbos	Least concern	Shrublet
Bauhinia galpinii	Pride-of-de-Kaap	Indigenous/Least concern	Shrub
Berkheya setifera	Buffalo-tongue	Least concern	Herb
Berchemia zeyheri	Red ivorywood	Indigenous/Least concern	Tree
Bidens pilosa	Common Black-jack	Weed	Herb
Blepharis subvolubilis	Eyelash Flower	Least concern	Herb
Bolusanthus speciosus	Tree wisteria	Indigenous/Least concern	Tree
Boscia albitrunca	Shepherd's tree	Protected tree	Tree
Celtis africana	White stinkwood	Least concern	Tree
Chromolaena odorata	Triffid weed	Category 1b AIS	Shrub
Chloris gayana	Rhode's Grass	Indigenous/Least concern	Grass
Combretum hereroense	Russet bushwillow	Indigenous/Least concern	Tree
Combretum cf. molle	Velvet bush willow	Indigenous/Least concern	Tree
Commiphora mollis	Velvet-leaved Corkwood	Indigenous/Least concern	Tree
Conyza sumatrensis	Tall fleabane	Weed	Herb
Croton megalobotrys	Fever-berry	Indigenous/Least concern	Tree
Cynodon dactylon	Couch Grass	Indigenous	Grass

Scientific name	Common name	Ecological status	Growth Form
Cynanchum viminale	Caustic Bush	Indigenous/Least concern	Herb
Cyperus fulgens		Indigenous/Least concern	Sedge
Cyperus rupestris var. rupestris.	Red Rock Sedge	Indigenous/Least concern	Sedge
Datura ferox	Long spined thorn apple	Category 1b AIS	Herb
Datura stramonium	Jimson weed	Category 1b AIS	Herb
Digitaria eriantha	Smuts finger grass	Indigenous	Grass
Dichrostachys cinerea	Sicklebush	Indigenous	Shrub
Dombeya rotundifolia	Wild Pear	Indigenous/Least concern	Tree
Ehretia rigida subsp*. nervifolia*	Puzzlebush	Indigenous/Least concern	Tree
Euphorbia ingens	Giant euphorbia	Least concern/Medicinal	Tree
Erythrina lysistemon	Coral tree	Indigenous/Least concern	Tree
Eragrostis curvula	Weeping love grass	Least concern	Grass
Eragrostis plana	Fan Love Grass	Least concern	Grass
Ficus sur	Broom cluster fig	Indigenous/Least concern	Tree
Flaveria bidentis	Smelter's-bush	Category1b AIS	Shrub
Gardenia volkensii	Bushveldt gardenia	Indigenous/Least concern	Tree
Grewia bicolor	White raisin	Indigenous	Shrub
Grewia flavescens	Donkey Berry	Indigenous/Least concern	Shrub
Gymnosporia buxifolia	Common Spike-thorn	Indigenous	Tree
Gymnosporia senegalensis	Red spikethorn	Indigenous/Least concern	Shrub
Gomphocarpus physocarpus	Balloon milkweed	Least concern/Medicinal	Shrub
Gymnanthemum myrianthum	Eared Vernonia	Indigenous/Least concern	Herb
Helichrysum sp			Herb
Hemarthria altissima	Limpopo Grass	Indigenous/Least concern	Grass
Hypoxis hemerocallidea	African potato	Least concern/Medicinal	Herb
Kalanchoe cf. brachyloba	Short-lobed kalanchoe	Indigenous/Least concern	Succulent
Kirkia wilmsii	Bastard Pepper Tree	Indigenous/Least concern	Tree
Imperata cylindrica	Cogon grass	Indigenous/Least concern	Grass
Laggera decurrens	Silky Sage	Indigenous/Least concern	Herb
Lantana camara	Common Lantana	Category1b AIS	Shrub
Leucaena leucocephala	Leucaena	Category 2 AIS	Tree
Ledebouria sp			Herb
Ledebouria marginata	Tough-Leaved African Hyacinth	Indigenous/Least concern	Herb
Leonotis leonurus	Lion's ear	Least concern	Shrub
Lilium formosanum	Formosa lily	Category 1b AIS	Herb
Lippia javanica	Lemon Bush	Least concern/Medicinal	Herb
Lopholaena coriifolia	Leather-leaved Fluff-bush	Indigenous/Least concern	Shrub
Melia azedarach	Persian Lilac/Syringa	Category1b AIS	Tree
Melinis repens	Natal Red Top	Least concern	Grass
Melhania prostrata	Geelblom	Least concern	Herb
Morus alba	White mulberry	Invader 2	Tree
Nicotiana glauca	Wild tobacco	Category1b AIS	Shrub
Opuntia ficus-indica	Sweet prickly pear	Category 1b AIS	Succulent
Otholobium wilmsii	Grassland Hook-leaved Pea	Least concern	Herb
Panicum maximum	Guinea grass	Indigenous	Grass
Persicaria lapathifolia	Pale persicaria	Weed	Herb
Pellaea calomelanos	Hard fern	Indigenous/Least concern	Fern
Pennisetum clandestinum	Kikuyu	Exotic	Grass
Peltophorum africanum	African Black Wattle	Indigenous/Least concern	Tree

Scientific name	Common name	Ecological status	Growth Form
Plantago major	Broadleaved Ribwort	Least concern/Medicinal	Herb
Phragmites australis	Common reed Thatching	Least concern	Reed
Pogonarthria squarrosa	Sickle grass	Indigenous	Grass
Prosopis glandulosa	Honey mesquite	Category 2 AIS	Tree
Pseudognaphalium luteo-album	Jersey Cudweed	Least concern	Herb
Psidium guajava	Guava	Invader 3	Tree
Pyracantha angustifolia	Yellow firethorn	Category 1b AIS	Shrub
Ricinus communis	Castor Oil Bush	Category 2	Shrub
Sansevieria hyacinthoides	Mother-in-law's tongue	Least concern	Herb
Searsia lancea	Karee	Least concern	Tree
Schotia brachypetala	Weeping boer-bean	Indigenous/Least concern	Tree
Sclerocarya birrea subsp. *caffra*	Marula	Protected Tree	Tree
Searsia leptodictya	Mountain karee	Indigenous/Least concern	Tree
Senegalia nigrescens	Knob Thorn	Indigenous	Tree
Senegalia cf. caffra	Hook-thorn	Indigenous/Least concern	Tree
Senna didymobotrya	Peanus butter cassia	Category 1b AIS	Shrub
Senna petersiana	Eared Senna	Indigenous/Least concern	Shrub
Senegalia mellifera	Black thorn	Indigenous/Least concern	Tree
Searsia pyroides	Common wild currant	Indigenous/Least concern	Tree
Senecio linifolius	Thread Ragwort	Indigenous/Least concern	Herb
Solanum mauritianum	Bugweed	Category 1b AIS	Shrub
Solanum panduriforme	Bitter Apple	Weed	Shrub
Sporobolus africanus	Ratstail Dropseed	Least concern	Grass
Sporobolus pyramidalis	Giant rat's tail grass	Thread Ragwort	Indigenous/Least concern
Spirostachys africana	Tamboti	Protected Tree-LEDET	Shrub
Strychnos spinosa	Natal orange	Indigenous/Least concern	Tree
Tagetes minuta	Khaki weed	Weeds	Herb
Tecoma stans	Yellow bells	Category 1b AIS	Tree
Terminalia sericea	Silver cluster-leaf	Indigenous/Least concern	Tree
Themeda triandra	Red grass	Indigenous/Least concern	Grass
Tricliceras longepedunculatum	Lion's eye	Least concern	Herb
Typha capensis	Bulrush	Least concern	Aquatic Herb
Vachellia karroo	Sweet thorn	Indigenous/Least concern	Tree
Vachellia nilotica subsp *kraussiana*	Scented-pod Acacia	Indigenous/Least concern	Tree
Vachellia rehmanniana	Silky Thorn	Indigenous/Least concern	Tree
Vachellia xanthophloea	Fever tree	Medicinal/Least concern	Tree
Vangueria infausta	African medlar	Indigenous	Tree
Vepris reflexa	Bushveld White Ironwood	Indigenous/Least concern	Tree
Volkameria glabra	Stinkboom	Indigenous/Least concern	Tree
Xanthium strumarium	Large Cocklebur	Category 1b AIS	Herb
Xerophyta retinervis	Monkey's Tail	Indigenous/Least concern	Herb
Ximenia americana var. microphylla	Blue Sour Plum	Indigenous/Least concern	Shrub
Ximenia caffra	Sour plum	Indigenous/Least concern	Shrub
Zinnia peruviana	Redstar zinnia	Weed	Herb
Ziziphus mucronata	Buffalo thorn	Indigenous/Least concern	Tree

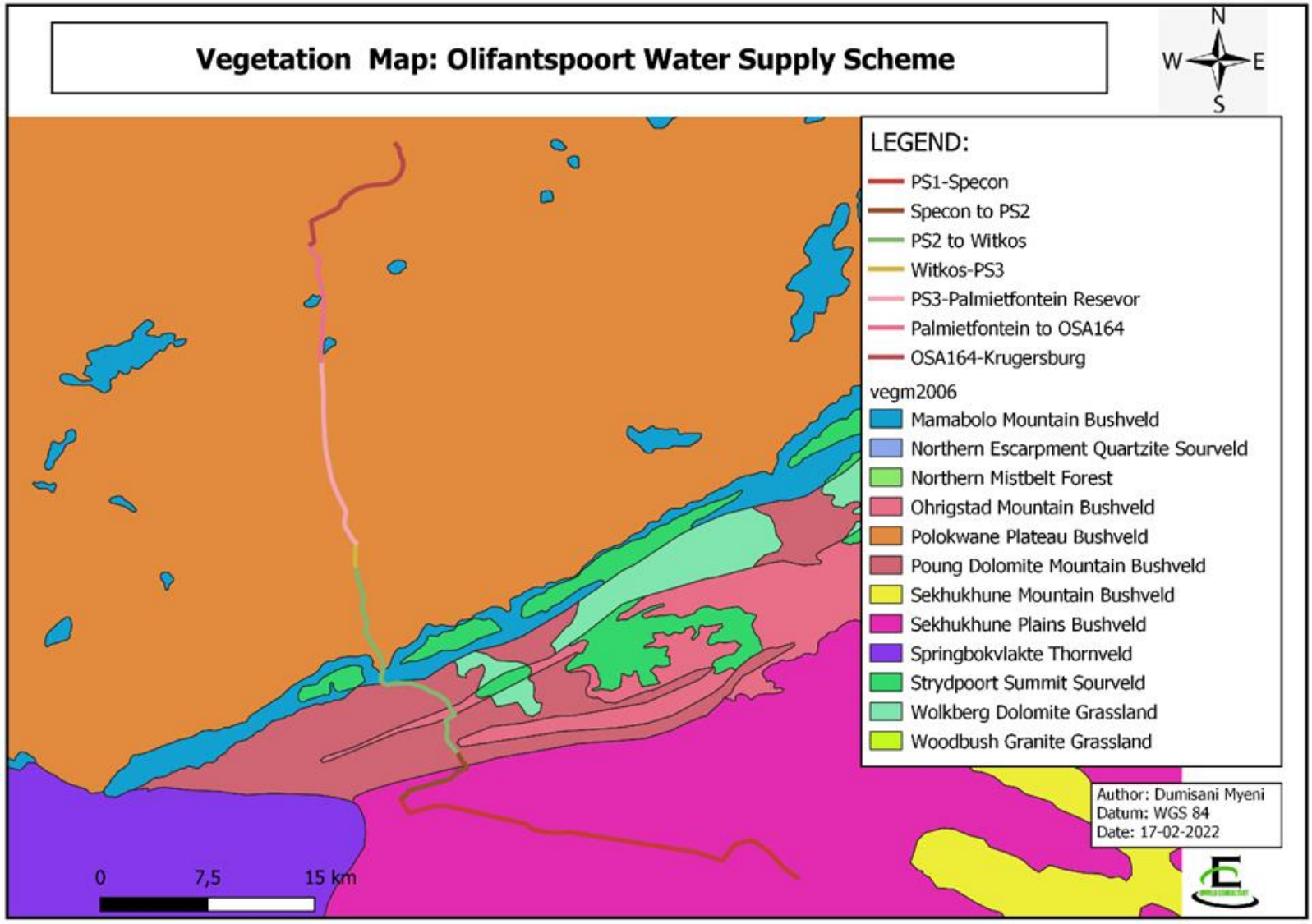

Figure 33: Map showing the vegetation types within Olifantspoort WSS Study Area

12.5.2 **Flora Within Ebenezer Scheme Study Area**

The vegetation type within the study area of the Olifantspoort WSS (***Figure 34***) is predominantly: Woodbush Granite Grassland (*Gm25*) '*Critically Endangered'* with a 27% conservation target; Polokwane Plateau Bushveld (*SVcb23*)' *Least Threatened'* with a 19% conservation target; with an intrusion of Mamabolo Mountain Bushveld (Mucina & Rutherford, 2006).

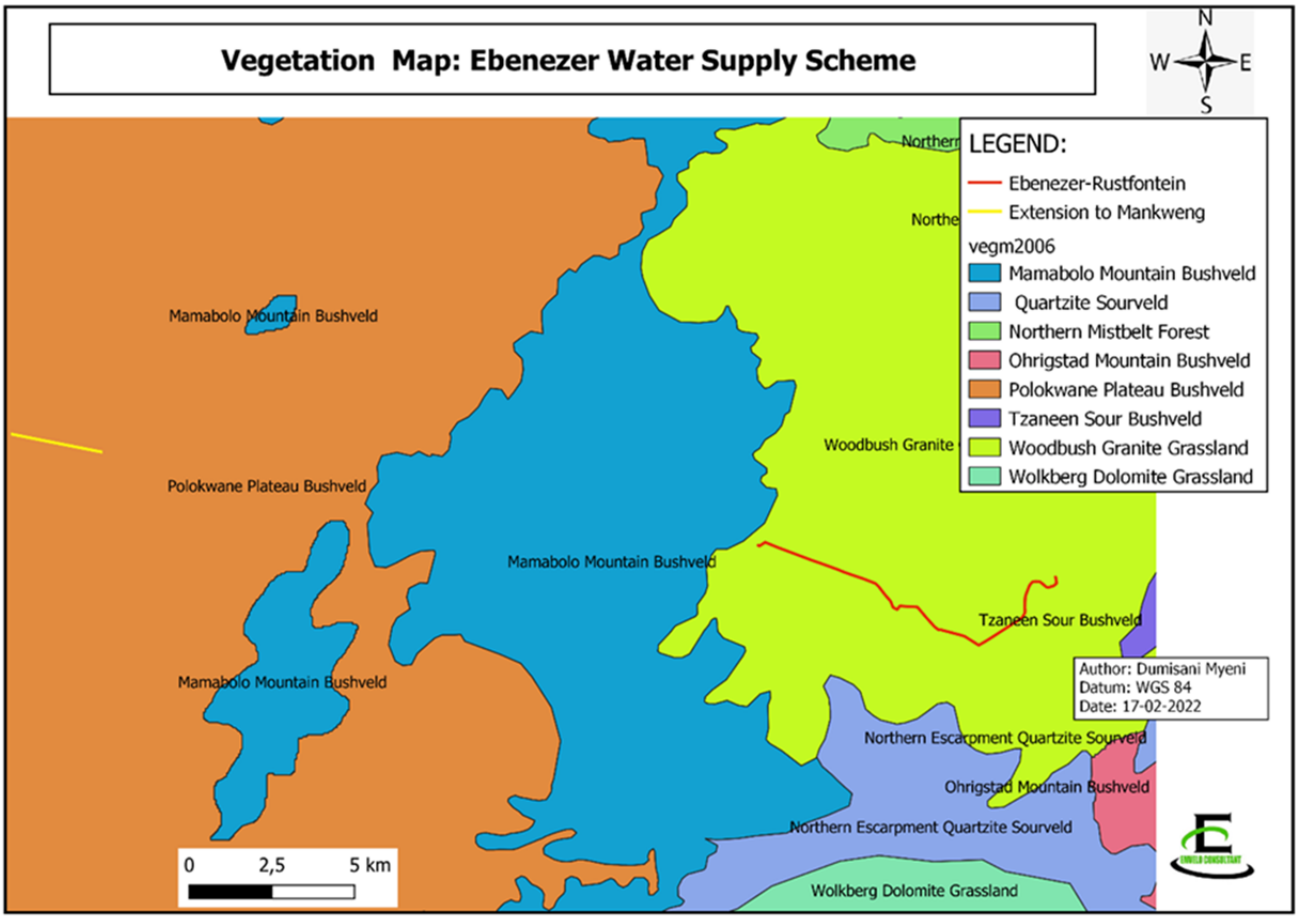

Figure 34: Map showing the vegetation types within the Ebenezer WSS Study Area

A 500m Project Area of Influence (PAOI) was considered applicable to the nature and scale of the activities for the upgrading of the Ebenezer Scheme, which include conveyance infrastructure. There were four distinct habitats that were delineated during the site visit within the study area, namely grassland (natural habitat), bushveld (natural), farmlands (transformed), urban and settlement (transformed).

According to Mucina *et al*. (2006), Woodbush Granite Grassland threatened ecosystem occurs on the Woodbush Plateau and its outliers, to the north of the Wolkberg, on the Groot Letaba watershed west of Duiwelskloof, Tzaneen and Lenyenye. It occurs in mountainous plateau covered by grassland, showing increased low-shrub density on steep south- and east-facing slopes. At least four endemic plant species occur in the ecosystem. The ecosystem is not protected.

The extension to the Mankweng Pipeline falls within a peri-urban environment and along the road servitude. The area is largely transformed, with only the Marula trees found along this route and the habitat is dominated by alien invasive plant species.

The section of pipeline from the Ebenezer to Rustfontein reservoirs traverses area overlain by Woodbush Granite Grassland (*Gm25*) '*Critically Endangered'*. According to the South African National Biodiversity Institute (2011) Threatened Ecosystems, the Woodbush Granite Grassland threatened ecosystem, which is listed as '*Critically Endangered* (CR)' is also listed as Poorly Protected (PP) on a national scale, as these ecosystems are of 5% to 49% conservation target in protected areas. This fragment of grassland within Haenertsburg is formally protected within the Haenertsburg Nature Reserve, managed by a community group called Friends of the Haenertsburg Grassland (FroHG). In order to conserve this vegetation and avoid further habitat degradation and fragmentation within this ecosystem, the pipeline will be re-routed along areas that have been previously disturbed such as along the timber plantation boundary and behind the Haenertsburg Cemetery (***Figure 35***).

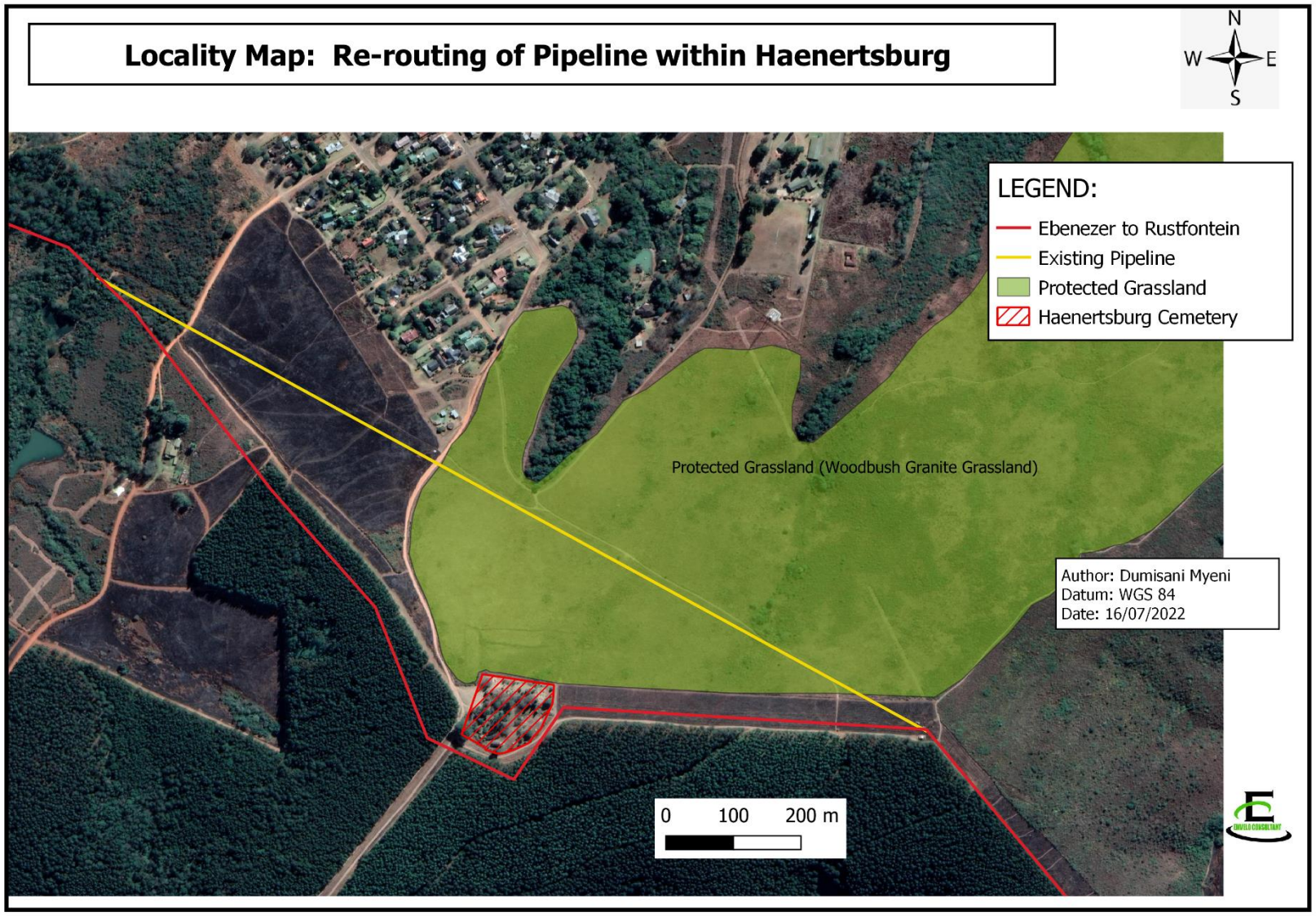

Figure 35: Re-routing of Pipeline from Woodbush Granite Grassland Protected Area

The field assessment within the PAOI observed that vegetation communities with this area of Ebenezer consist of the following plant species, as listed in ***Table 21*** below.

Table 21: Plant Species Recorded within Ebenezer Scheme PAOI

Scientific name	Common name	Ecological status	Growth Form
Acacia melanoxylon	Australian blackwood	Category 2 AIS	Tree
Acacia mearnsii	Black Wattle	Category 2 AIS	Tree
Alternanthera pungens	Khakhiweed	Weed	Herb
Asparagus virgatus	Broom Asparagus	Indigenous/Medicinal	Shrub
Asparagus laricinus	Bergkatbos	Least concern	Shrublet
Athrixia phylicoides	Bush tea	Indigenous/Medicinal	Shrub
Bidens pilosa	Common Black-jack	Weed	Herb
Buddleja salviifolia	Butterfly bush	Indigenous/Least concern	Shrub
Celtis africana	White stinkwood	Least concern	Tree
Chromolaena odorata	Triffid weed	Category 1b AIS	Shrub
Croton megalobotrys	Fever-berry	Indigenous/Least concern	Tree
Cynodon dactylon	Couch Grass	Indigenous	Grass
Cynanchum viminale	Caustic Bush	Indigenous/Least concern	Herb
Cyperus rupestris var. rupestris.	Red Rock Sedge	Indigenous/Least concern	Sedge
Digitaria eriantha	Smuts finger grass	Indigenous	Grass
Dichrostachys cinerea	Sicklebush	Indigenous	Shrub
Hemarthria altissima	Limpopo Grass	Indigenous/Least concern	Grass
Hypericum revolutum	Curry Bush	Indigenous/Least concern	Shrub
Lantana camara	Common Lantana	Category1b AIS	Shrub
Lilium formosanum	Formosa lily	Category 1b AIS	Herb
Panicum maximum	Guinea grass	Indigenous	Grass
Pennisetum clandestinum	Kikuyu	Exotic	Grass
Pinus patula	Patula pine	Category 2	Tree
Phragmites australis	Common reed Thatching	Least concern	Reed
Pogonarthria squarrosa	Sickle grass	Indigenous	Grass
Pyracantha angustifolia	Yellow firethorn	Category 1b AIS	Shrub
Ricinus communis	Castor Oil Bush	Category 2	Shrub
Rhamnus prinoides	Dogwood	Indigenous/Least concern	Shrub
Rubus cuneifolius	American bramble	Category 1b AIS	Shrub
Senna didymobotrya	Peanus butter cassia	Category 1b AIS	Shrub
Solanum mauritianum	Bugweed	Category 1b AIS	Shrub
Solanum panduriforme	Bitter Apple	Weed	Shrub
Sporobolus africanus	Ratstail Dropseed	Least concern	Grass
Sporobolus pyramidalis	Giant rat's tail grass	Indigenous/Least concern	Grass
Tagetes minuta	Khaki weed	Weeds	Herb
Themeda triandra	Red grass	Indigenous/Least concern	Grass
Typha capensis	Bulrush	Least concern	Aquatic Herb
Xerophyta retinervis	Monkey's Tail	Indigenous/Least concern	Herb

12.5.3 Potential Impacts Associated with Vegetation Clearance

The potential impacts to vegetation could result from the vegetation clearance for construction of the pipeline, the OCSD and the abstraction works, which will involve the clearance of vegetation along the riverbanks and the CBAs. However, proper mitigation can be achieved through diligent implementation of the recommendations contained in the EMPr, Terrestrial Biodiversity Impact Assessment, and the Wetland Habitat Impact Assessment.

12.6 Protected Areas

Protected areas in South Africa are defined as parts of the landscape that are formally protected by law in terms of the NEM: PAA and managed primarily for the purpose of biodiversity conservation. This study area falls within the Kruger to Canyons (K2C) Biosphere Region (LEDET, 2016). There are specifically four Protected Areas within the study area (***Figure 36***), namely the Polokwane Game Reserve, the Haenertsburg Nature Reserve, Woodbush Forest Reserve, and Turfloop Nature Reserve.

The OSA164-Krugersburg and Palmietfontein to OSA164 pipelines traverse along the boundary of the Polokwane Nature Reserve. This reserve is considered as one of the biggest municipal-owned game reserves in South Africa. It is a home to more than 21 species of wildlife, including the white rhinoceros, sable antelope, giraffe, impala and many more. The Ebenezer-Rustfontein pipeline is re-routed to traverse along the boundary of the Haenertsburg Nature Reserve, which is known to conserve large remaining fragments of Woodbush Granite Grasslands (WGG). About 190ha and 661 species of the WGG is situated next to the small town of Haenertsburg, to the south and west of the village, where the bulk of it is formally protected in the Haenertsburg Nature Reserve.

It must also be noted that Wolkberg Forest Belt Important Bird and Biodiversity Areas (IBA) is found less than ten kilometres from the PS1 to Specon, Specon to PS2, and PS2 to Witkos pipeline.

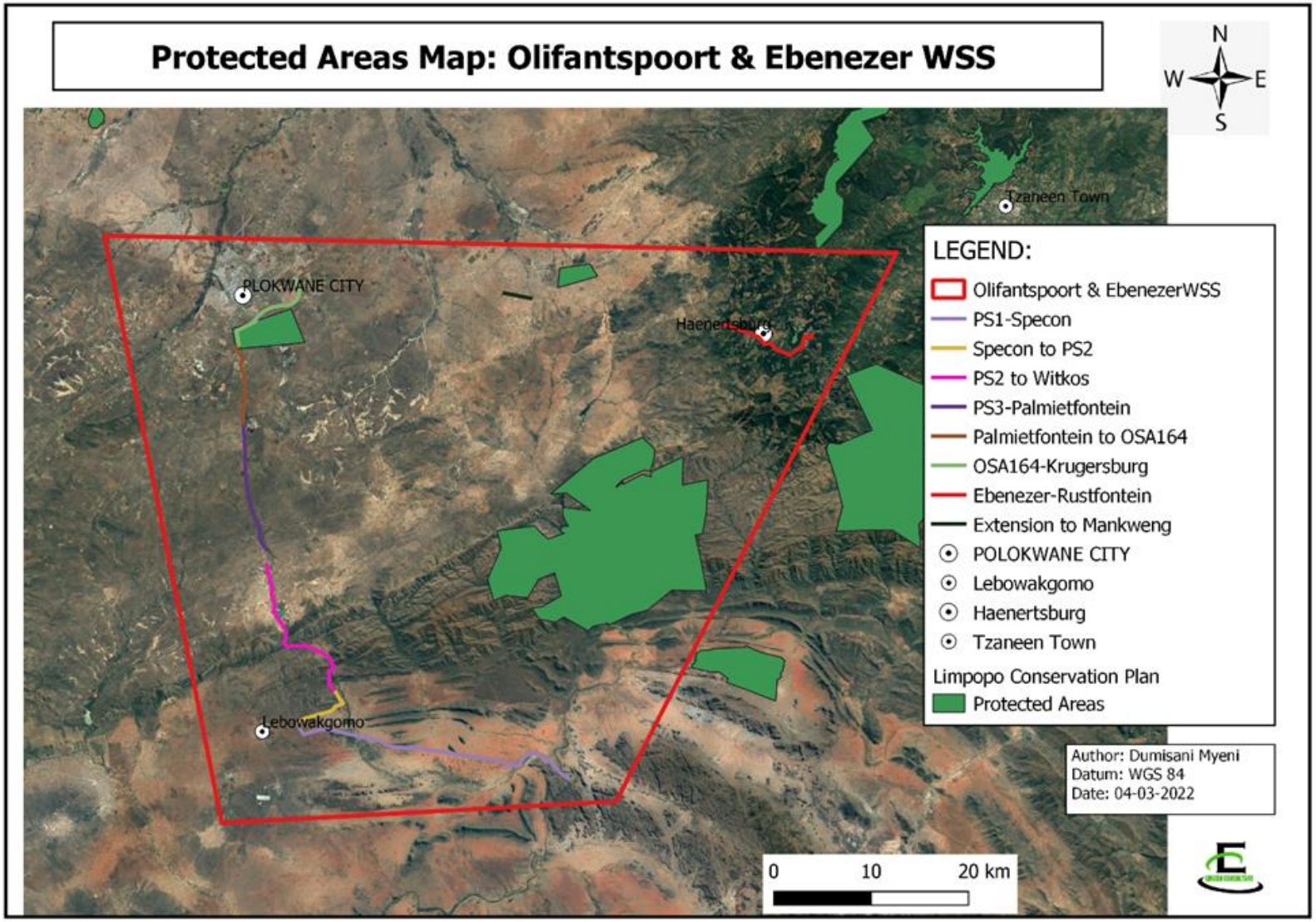

Figure 36: Map showing the protected areas within a study area

The LEDET Bioregional Plans (2016; 2019) described two main categories of areas that are required to meet conservation targets which are the Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). The CBAs are crucial for supporting biodiversity features and ecosystem functioning and are required to meet or process biodiversity targets, including corridors. The ESAs represent the functionality and not necessarily the entire natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within a CBA (***Refer to Table 22***).

Table 22: Subcategories of CBAs and ESAs [Source: LEDET,2016;2019]

Critical Biodiversity Areas (CBAs) **– Crucial for supporting biodiversity features and ecosystem functioning and are required to meet biodiversity and/or process targets**	
Critical Biodiversity Areas: Irreplaceable (CBA1)	Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems.
Critical Biodiversity Areas: Optimal (CBA2)	Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high-cost areas as much as possible (Category driven primarily by process but is informed by expert input).
Ecological Support Areas (ESAs) – **Functional but not necessarily entirely natural areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within CBAs.**	
Ecological Support Areas	Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs. The area also contributes significantly to the maintenance of Ecosystem Services.
Ecological Support Areas: Species Specific	Terrestrial modified areas that provide a critical support function to a threatened or protected species, for example agricultural land or dams associated with nesting/roosting sites.
Ecological Support Areas: Buffers	Terrestrial areas identified as requiring land-use management guidance not necessarily due to biodiversity prioritisation, but in order to address other legislation/agreements which the biodiversity sector is mandated to address, e.g., WHS Convention, triggers Listing Notice criteria, etc.

12.6.1 CBAs along the Olifantspoort WSS

There are a number of CBAs and ESAs falling within the PAOI of the Olifantspoort Scheme. Hence, the Olifantspoort abstraction works and the OCSD will be constructed within Critical Biodiversity Area 1 (CBA1) (***Figure 37***).

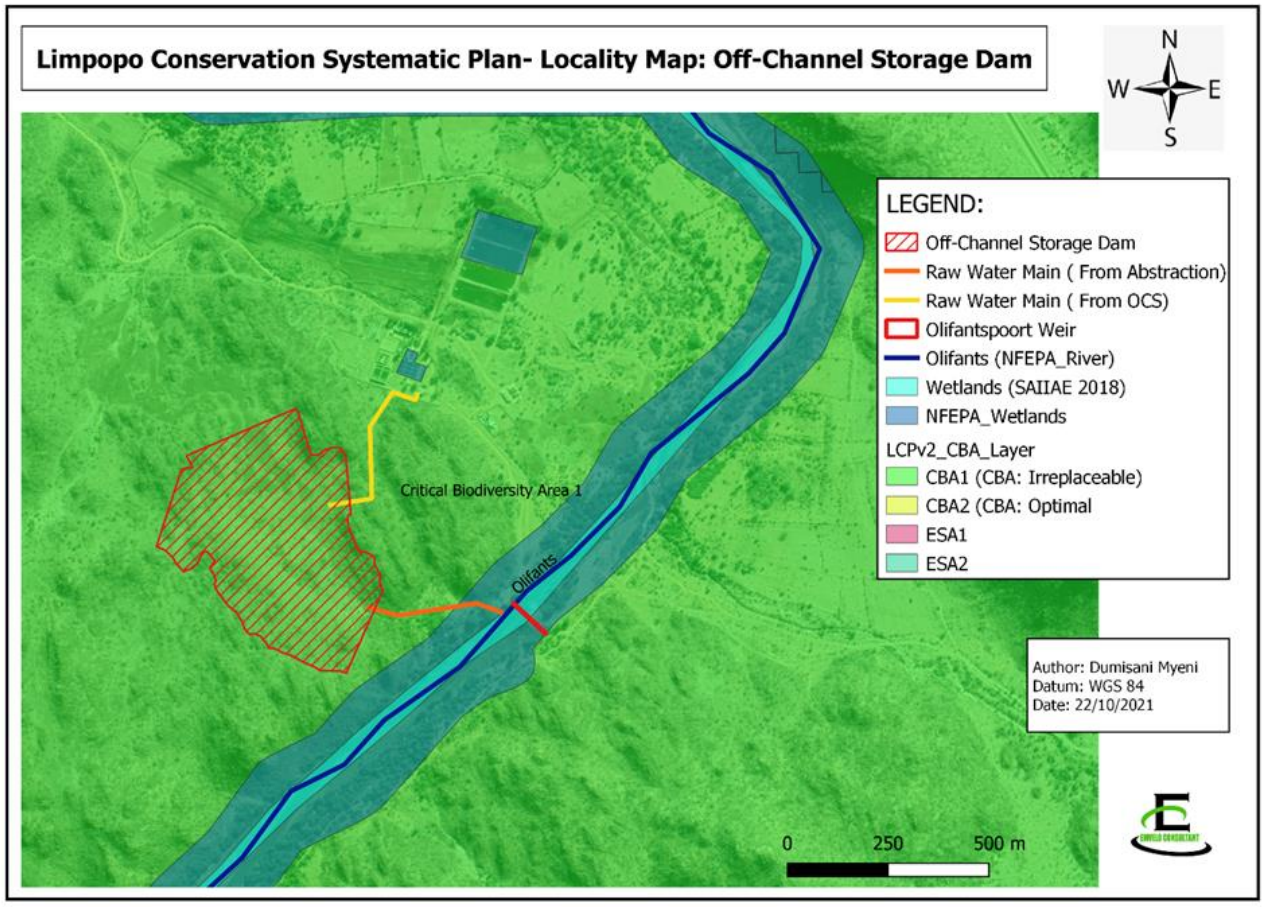

Figure 37: Map showing CBAs within Abstraction Works and OCSD

The Pipeline from PS1 to Specon main traverses CBA1, CBA2 (CBA: Optimal); PS2 to Witkos and Palmietfontein Reservoirs traverses CBA1, CBA2; Palmietfontein Reservoirs to OSA164 traverse CBA1 and Protected Area. OSA 164 to Krugersburg Reservoirs traverse the Protected Area and CBA1 (***Figure 38***).

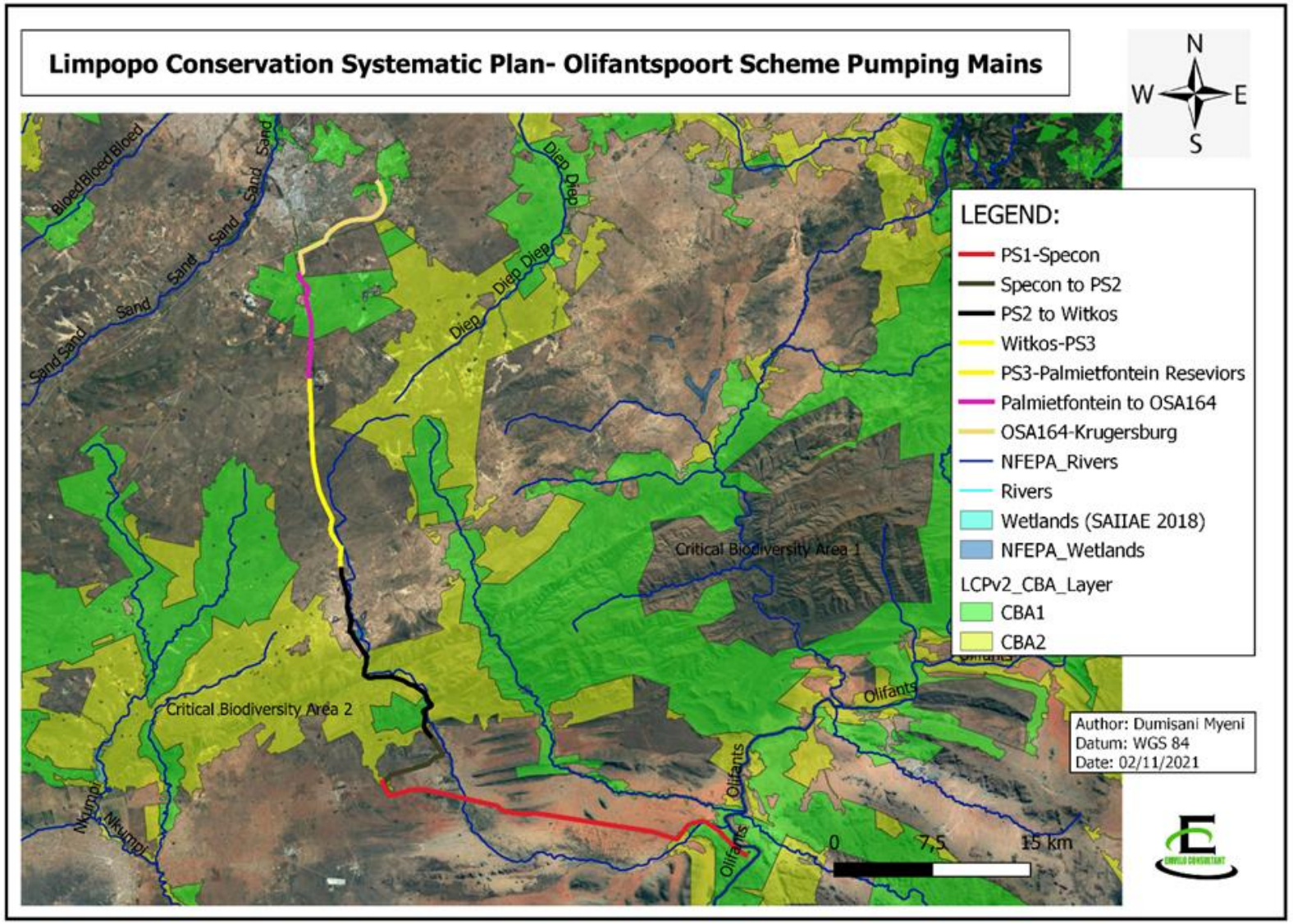

Figure 38: Map showing CBAs from PS1 to Krugersburg Reservoirs

The Species of Conservation Concern (SCC) are underpinned by ecological, economic, or cultural importance and include: those that are rare, endemic, or threatened; species with unusual distributions; and medicinal and other indigenous species that are exploited commercially or for traditional use. The CBAs and ESAs support the species diversity and SCC. Therefore, there is a likelihood that SCC will be encountered during the construction within the PAOI.

12.6.2 **CBAs along Ebenezer Scheme**

The water conveyance along the Ebenezer pumpstation to Rustfontein reservoir traverses vast tracks of CBA1. However, the conveyance is re-routed at Haenertsburg to prevent interception of conserved Woodbush Granite Grassland. The Ebenezer to Rustfontein pipeline will be re-routed to traverse along the boundary of the Haenertsburg Nature Reserve, which is known to conserve large remaining fragments of Woodbush Granite Grasslands. About 190ha and 661 species of the Woodbush Granite Grassland is situated next to the small town of Haenertsburg, to the south and west of the village, where the bulk of it is formally protected in the Haenertsburg Nature Reserve (***Figure 39***).

The CBAs and ESAs support the species diversity and SCC. Therefore, there is a likelihood that SCC will be encountered during construction within the PAOI of Ebenezer to Rustfontein pipeline.

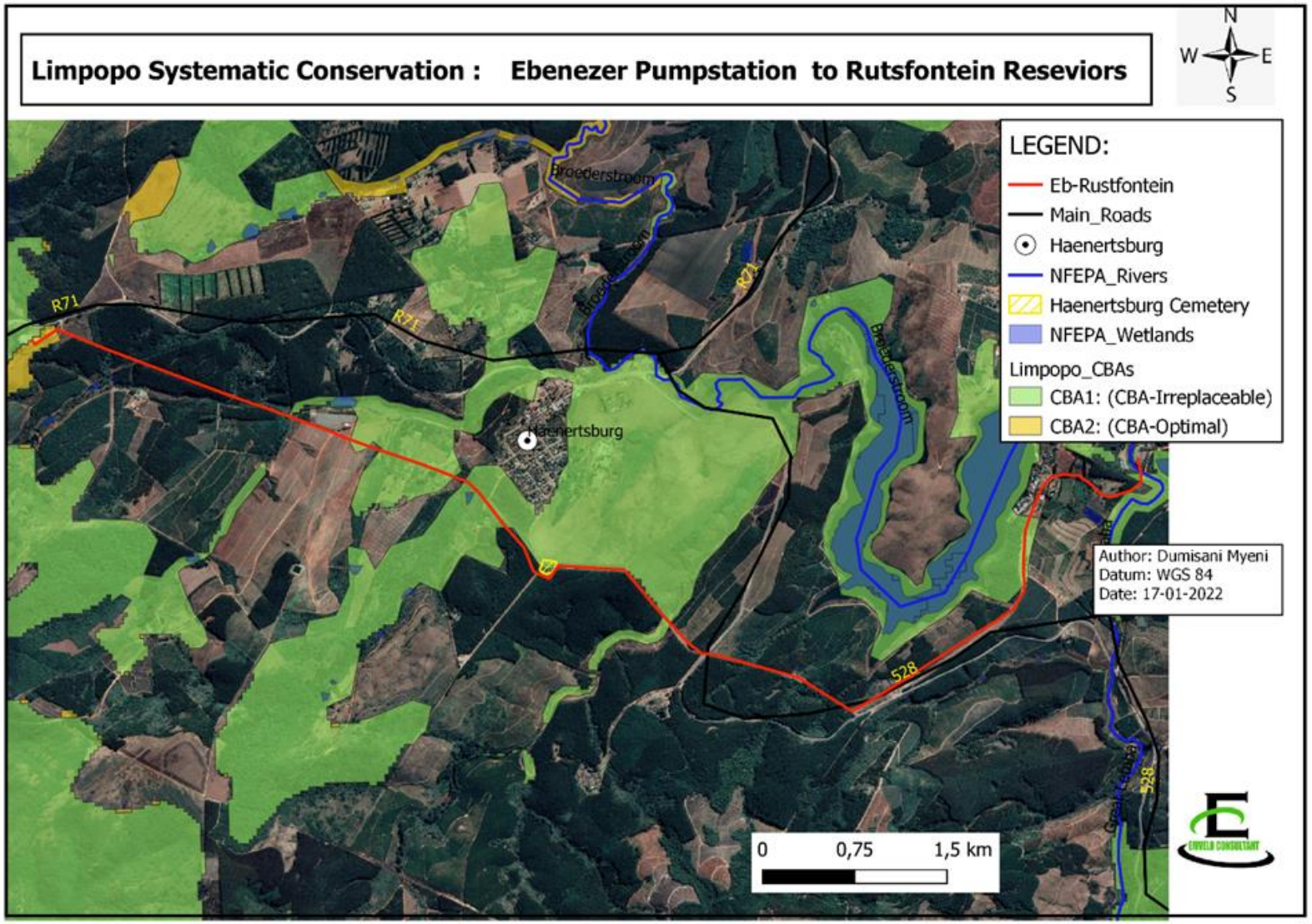

Figure 39: Map showing CBAs along Ebenezer WSS

12.6.3 **Potential Impacts**

Intensive vegetation clearance at project site can lead to fragmentation, reduction and loss of habitat as well as loss of plant species such as SCC. Such habitat loss is likely to lead to the migration of wildlife away from the area. However, proper mitigation can be achieved through careful implementation of the recommendations in the EMPr, and in the Terrestrial Biodiversity Impact Assessment.

12.7 Fauna

The Mopani and Capricorn Districts have endemic faunal species which is found in Limpopo and other parts of South Africa: Mammals such as Gunning's Golden Mole (*Amblysomus gunning*) *'Endangered'*, Samango Monkey (*Cercopithecus albogularis*), Ground Pangolin (*Manis temminckii*) and Leopard (*Panthera pardus*) '*Threatened*'. Yellow Golden mole (*Calcochloris obtusirostris*) '*Near Threatened'*, Four-toed Elephant-shrew (*Petrodromus tetradactylus*) '*Near Threatened'*, Water Rat (*Dasymys robertsii*) '*Vulnerable*', Schwarz's White-collared Money (*Cercopithecus albogularis schwarzi*), African Wild Dog (*Lycaon pictus*), and Thin Mouse Shrew (*Myosorex cf. tenuis*) '*Endangered*'. Reptiles such as Methuens Dwarf Gecko (*Lygodactylus methueni*), '*Vulnerable*'. Bird species such as the Blue Swallow (*Hirundo atrocaerulea*) '*Vulnerable*' and Cape Parrot (*Poicephalus robustus*) '*Critically Endangered'*. Amphibian species such as the Forest Rain Frog, (*Breviceps sylvestris*) '*Endangered*'. Insects such as Wolkberg Zulu Butterfly (*Alaena margaritacea*) '*Critically Endangered'* (LEDET, 2016; LEDET, 2019).

The Mopani and Capricorn Districts was interrogated against Quarter Degree Square 2329DD, 2329CD, 2329 DC and 2429BC within the Olifantspoort and Ebenezer Schemes (***Figure 40***) obtained from the Fitzpatrick Institute of African Ornithology Virtual Museum (2019). The assessment indicates the presence of *Pyxicephalus adspersus* (Giant Bull Frog) , *Rhinolophus smithersi* (Smithers' Horseshoe Bat), and *Platysaurus orientalis fitzsimonsi* (FitzSimons' Flat Lizard), *Pseudocordylus transvaalensis* (Northern Crag Lizard), *Homoroselaps dorsalis* (Striped Harlequin Snake), *Afroedura multiporis* (Afroedura multiporis), *Breviceps sylvestris sylvestris* (Transvaal Rain Frog) *'Near Threatened*'. The Afroedura multiporis (Methuen's Dwarf Gecko), *Lygodactylus methueni* (Methuen's Dwarf Gecko), *Sagittarius serpentarius* (Secretarybird) 'Vulnerable'. The *Acontias rieppeli* (Woodbush Legless Skink), *Aloeides stevensoni* (Wolkberg russet), *Dingana clara* (Wolkberg

widow), *Pseudonympha swanepoeli* (Swanepoel's Brown) 'Endangered'. The *Alaena margaritacea* (Wolkberg zulu), *Gyps coprotheres* (Cape Vulture) 'Critically Endangered'.

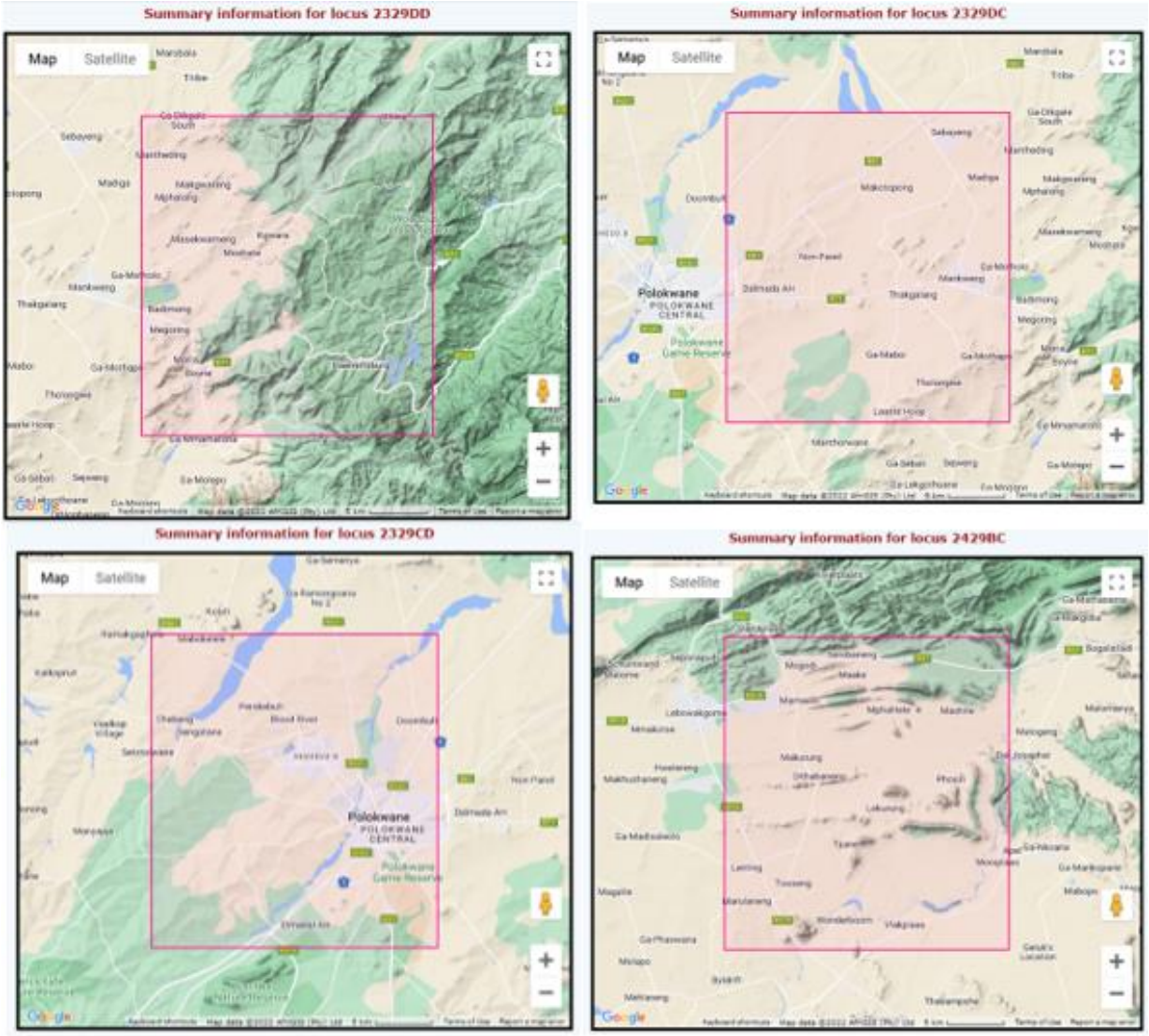

Figure 40: Quarter Degree Square Coverage [Source: DDI Virtual Museum (2019)

The field assessment observed that hunting by locals was prevalent in some sections of the Olifantspoort scheme route. However, the following mammal species were identified: Vervet Monkey and Cape Porcupine. The were 54 bird species recorded during the field surveys. Species recorded were common and widespread and typical of savanna, grasslands and forest biomes. No Red Data bird species associated with the study area were recorded. No reptile SCC were recorded along the project development routes.

The aquatic species likely to occur within the Olifants River are: *Oreochromis mossambicus* (Mozambique Tilapia) '*Vulnerable*'; as well as *Chiloglanis paratus* (Sawfin Suckermouth), *Chiloglanis pretoriae* (Shortspine Suckermouth), *Clarias gariepinus* (Sharptooth Catfish), *Coptodon rendalli* (Red Tilapia), *Enteromius paludinosus* (Straightfin Barb), *Enteromius trimaculatus* (Threespot Barb), *Enteromius unitaeniatus* (Longbeard Barb), *Enteromius viviparus* (Bowstripe Barb), Labeo cylindricus (African Carp), *Labeo molybdinus* (Leaden Labeo), *Labeobarbus marequensis* (Lowveld Largescale Yellowfish), *Mesobola brevianalis* (Hyphen Barb), *Micralestes acutidens* (Sharptooth Tetra), *Pseodocrenilabrus philander* (Southern Mouthbrooder), *Schilbe intermedius* (Butter Catfish), *Synodontis zambiensis* (Brown Squeaker), and *Tilapia sparrmanii* (Banded Tilapia) all '*Least Concern'*. The Threespot Barb, Lowveld Largescale Yellowfish, and Banded tilapia were recorded during infield survey.

12.7.1 Potential Impacts

It is important to note that the ESA and CBA areas along the pipeline route, the OCSD and abstraction works support species habitat. Vegetation clearance within the riparian, wetlands, grassland, bushveld, and forest habitat for the purpose of construction of water pipeline could modify the natural habitat integrity, locality fauna disturbance might occur and could led to fragmentation, reduction, and loss of habitat as well as the ecological corridors and connectivity. As well as disturbance to aquatic species a result of modifications to instream habitat continuity due to upgrading of abstraction works and construction of new weir, and pipeline river crossings. However, proper mitigation can be achieved through carefully implementation of recommendations contained in the EMPr, Terrestrial Ecological Assessment, Aquatic Ecological Impact Assessment, and the Wetland Habitat Impact Assessment.

12.8 Topography

The Capricorn District is overlain by flat, gentle, and undulating terrain, with the majority of flat terrain (LEDET, 2019). Given that the large proportion of the Capricorn District is characterised by flat terrain, it is therefore inferred that the large portion of water conveyance upgrades for the Olifantspoort WSS will traverse across the flat terrain with few exceptions of undulating terrain.

The locality at the Olifantspoort abstraction works is characterised by a gentle terrain and incised valley which ranges between approximately 739m and 771 mASL within a space of approximately 300m. PS1 to Specon portion is characterised by a gentle terrain with an elevation ranging from 744m and 1010 mAMSL. The portion between PS2 to Witkos is characterised by gentle to undulating terrain which ranges between 1020m and 1228 mASL. The undulating terrain is only experienced along the Chuniespoort Pass. Witkos to the Krugersburg reservoirs is characterised by gentle terrain.

Mopani District is predominately characterized by flat and undulating terrain, with the presence of an escarpment. This renders the region having varying terrain with an elevation that ranges between 200m and 2 200 mASL (LEDET, 2019). The study area of Ebenezer WSS is characterised by undulating terrain ranging between 1305m and 1538 mASL.

12.8.1 Potential impacts

The topography characteristic of the study area comprises of a gentle and undulating terrain. The undulating terrain affects the water conveyance performance, thus requiring special engineering designs principles, which is likely to result in deep excavations, thus having an impact on geological features. The steep terrain, at incised valleys, can have surface run-off propensity at the riverbanks. This will be addressed in accordance with in-sutu material erodibility, excavatability, rippability, and run-off propensity. However, proper mitigation can be achieved through careful implementation of the recommendations in the Geotechnical Assessment and EMPr.

12.9 Geology Underlain Olifantspoort Scheme

The geological composition underlain the Olifantspoort Scheme comprise of stratified geological group formation, namely Dsjate, Magaliesburg, Roossenekal, Dwars River, Duitschland, Silverton, Lakenvalei, Pretoria, Malmani, Penge, Turfloop granite, Black Reef, Wolkberg, Pietersburg, and Goud Plaats-Hout River Gneiss geological group formations.

The dominant geological group formations that underlie the portion between the Abstraction, OCSD, PS1 to Specon and PS2 pipeline are: Dsjate geological group formation (dominating

the abstraction work); Roossenekal, Magaliesburg, Dwars River, Silverton, Pretoria and Duitschland (***Figure 41***).

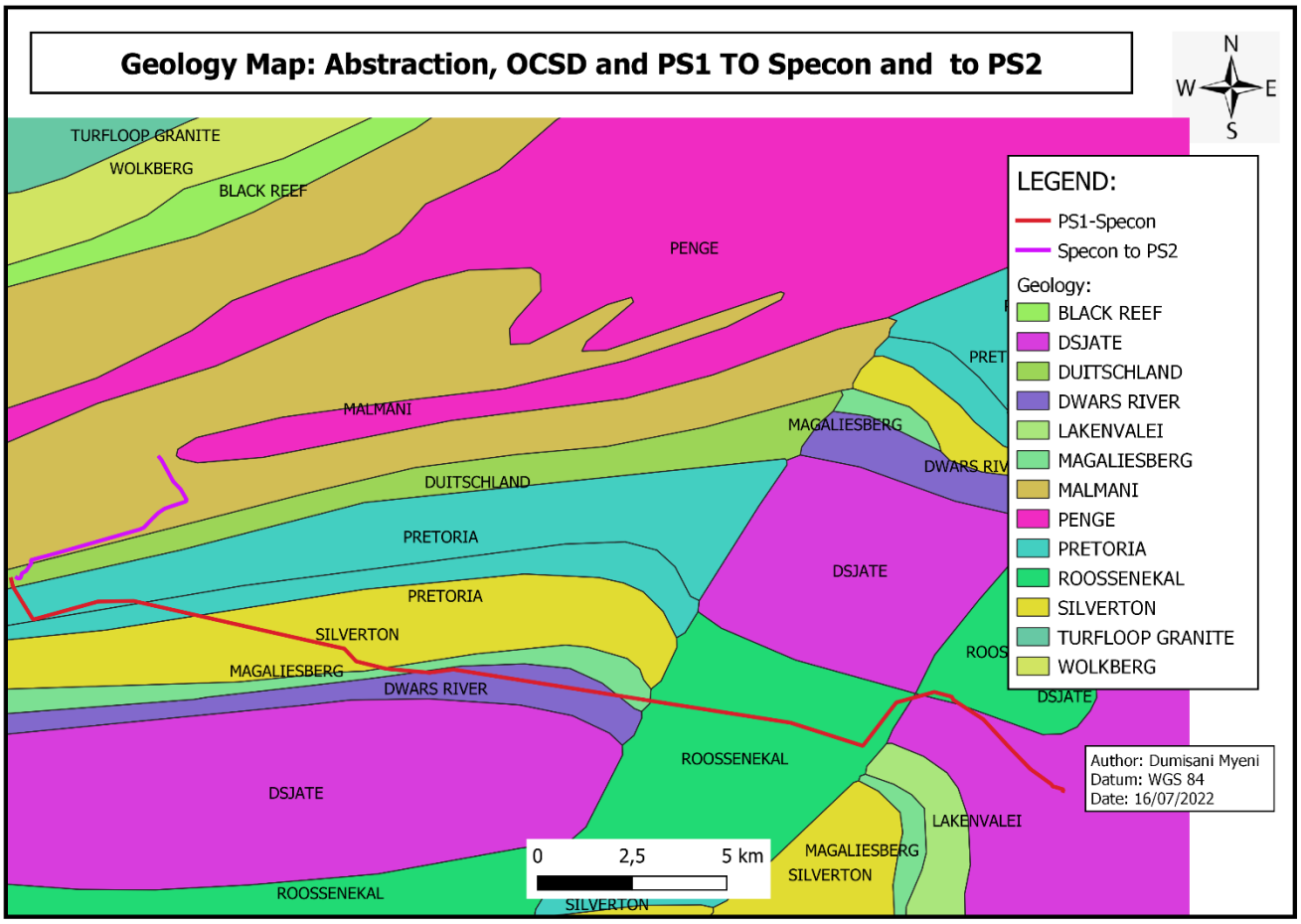

Figure 41: Dominance Geological Formation (Abstraction, PS1 to PS2)

The field investigation indicates that the vicinity of the OCSD is characterised by a combination of soil and boulders or highly fractured/jointed rock-mass with a relatively thin sequence of transported soils of clayey sand deposit, highly decomposed rock fragments underlain by Gabbronorite rock-mass. The OCSD is also attributed to the occurrence of deeply weathered and/or deeply jointed/fractured zones rendering the material to have poor excavatability of 1.40m below EGL. However, the bedrock outcrops were transitional within the underlying less jointed rock-mass and interlocking nature of the rock-mass, particularly at depth, rendering the excavatability to improve slightly for more open excavations.

The field investigation at the abstraction work (Olifants River) indicates that the channel bank hosts a thick succession of fine sand, displaying an increase in clay content with an increase in depth (likely attributed to illuviation). The instream material is said to have a sequence of deposits, comprised of an upper fine sand (akin to the uppermost bank deposits), followed by a clay deposit, further underlain by a coarse sand. The riverbank material showed a high rate of collapse. The vicinity is deemed to have soft excavation conditions, with Gabbro rock encountered at a depth of 2.7m below EGL, with the blanketing material is deemed to be backfill.

The field investigation also indicates that the PS1 to Specon is underlain by conglomerate of Hutton soils. Although Hutton soils have a very low erosion hazard, there was in this instance severe erosion even though the land was absolutely level. This portion of pipeline is also characterised by weathered Alluvium Gabbro bedrock, Residual Gabbro, Hillwash with localised alluvium, Residual Quartzite, Calcified and/or ferruginised residual Quartzite, Sporadic bedrock, and hardpan Calcrete. The sections of this pipeline demonstrated varying excavatability due to varying in-sutu characteristics, with other portions demonstrating good excavatability to 2.5m while some portions demonstrated poor excavatability at varying depth up to 2.5m, as a result of very dense soils, bedrock and/or hardpan Calcrete. Localised sidewall instabilities were encountered within the vicinity of the Chunies River crossings. The occurrence of groundwater seepage from a depth of 0.90 m below EGL and perching of infiltrating groundwater on bedrock was observed in some sections, and the groundwater predicted to perch on bedrock and/or hardpan Calcrete.

The dominant geological group formations that underlie the portion between Specon to PS2, and PS2 to Witkos are: Duitschland, Malmani, Penge, black reef, and Turfloop Granite (***Figure 42***).

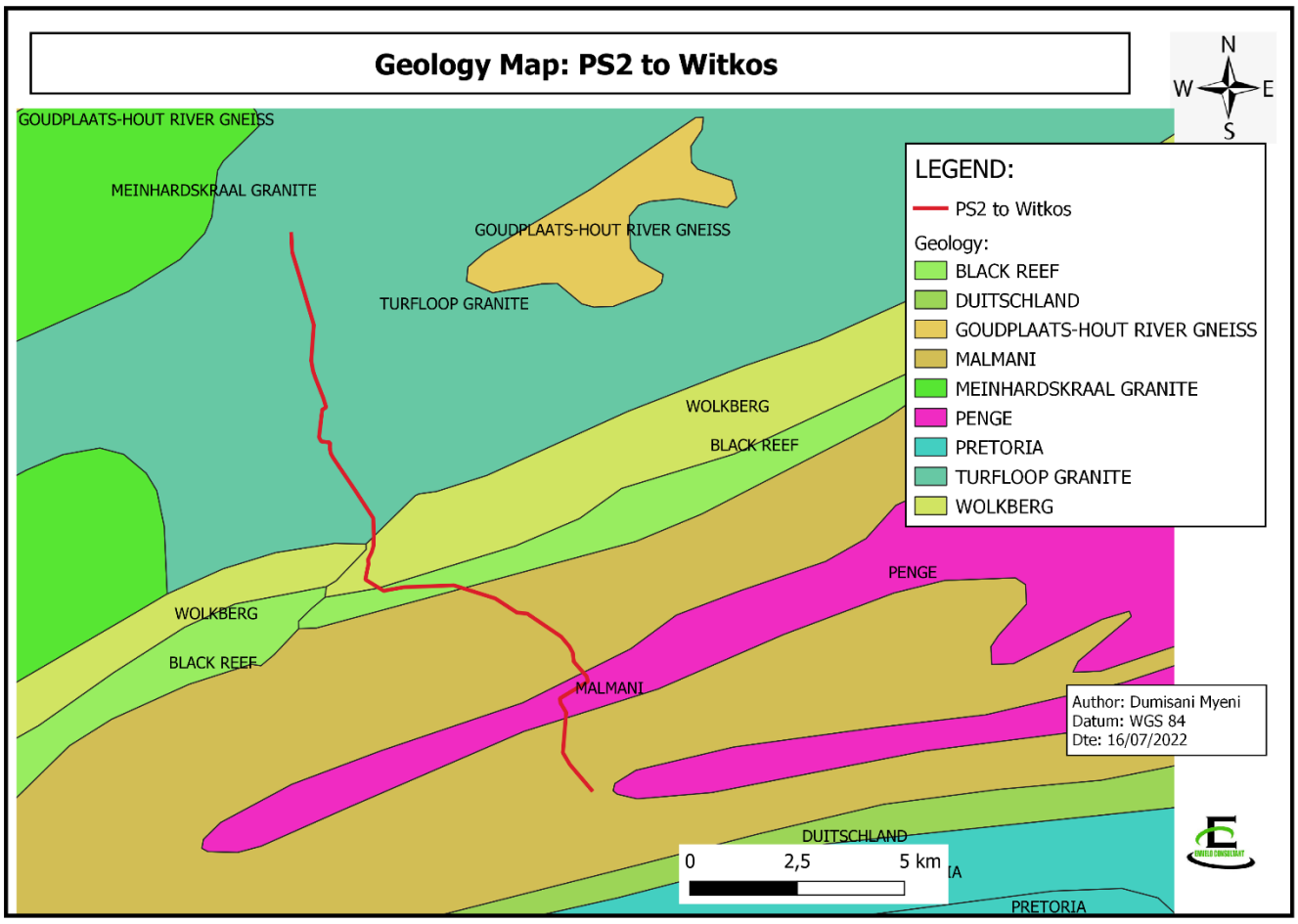

Figure 42: Dominance Geological Formation (Specon to PS2, and PS2 to Witkos)

The field investigation indicates that the section of pipeline route from Specon to PS2, and PS2 to Witkos is underlain by predominantly apedal soils. Occasional bedrock outcrops also occur with an average soil thickness that of 0.2m. The topsoil predominantly underlain by weathered bedrock, with very occasional occurrences of hardpan Calcrete. This section demonstrated good excavatability at varying depth level. The section from PS2 to Witkos passes through ridge crests and upper side slopes (including the Chuniespoort passage). No excavation will take place within the vicinity of the Chuniespoort Passage as the pipeline will align with the existing pipeline. In this section of Chuniespoort Passage the new pipeline will be joined to the existing 1 200mmø which is suspended by concrete plights along 1.5km section of pumping main, which was originally designed to accommodate the future upgrading of the conveyance capacity along the pipeline route crossing through the Chuniespoort Passage. This will be done to avoid tunnelling or pipe jacking through the steep topography

and rocky ground terrain, combined with the restricted area available for the construction of a new parallel pipeline, at this section of pipeline route.

The dominant geological group formations that underlie the portion between Witkos to Krugersburg Reservoirs are: Turfloop Granite, Goud Plaats-Hout River Gneiss, and Pietersburg (***Figure 33***).

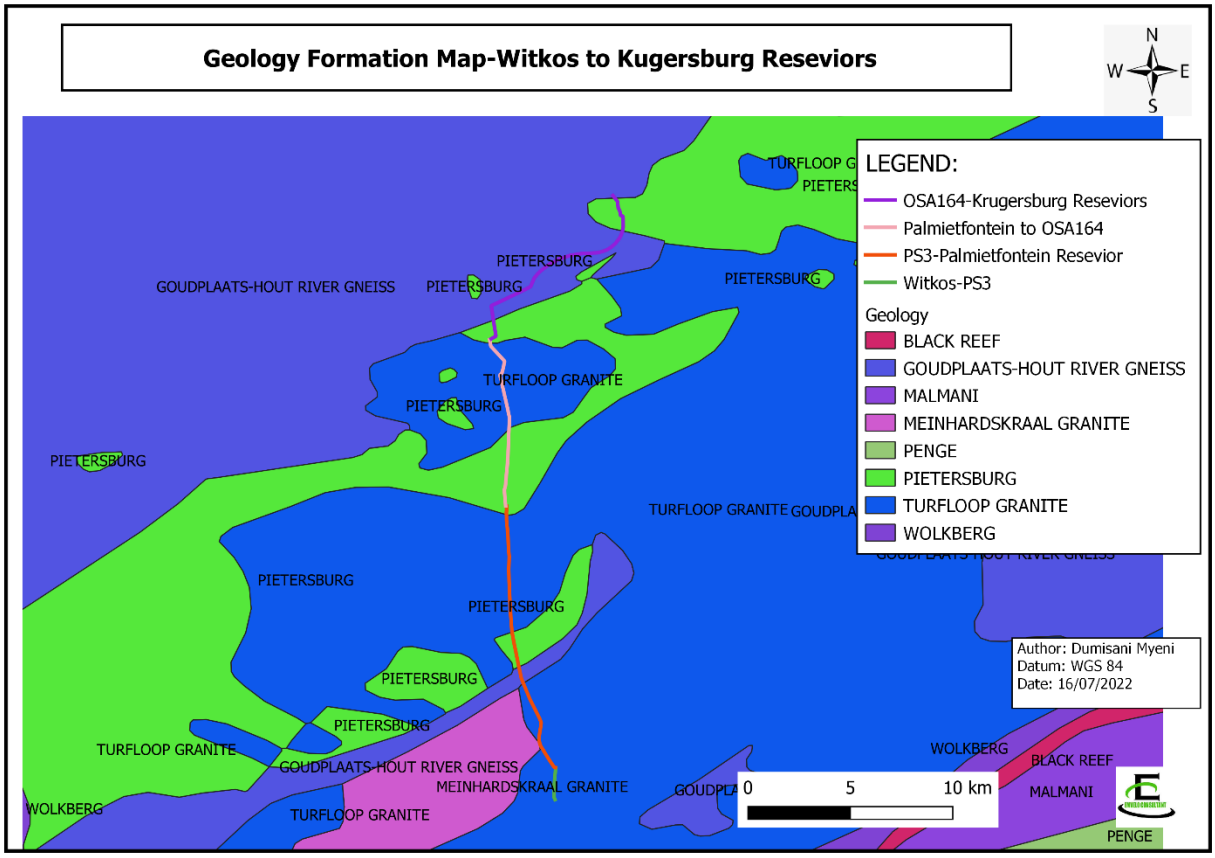

Figure 43: Dominance Geological Formation (Witkos to Krugersburg Reservoirs)

The field investigation observed the transition from Mispah to Glenrosa Soil Form on the section between OSA164 to Krugersburg Reservoirs. This portion of pipeline between Witkos to Palmietfontein reservoir is also characterised by alluvium or colluvial deposits deemed to be hill wash and/or a pebble marker, residual Gneiss and/or completely weathered Gneiss, residual Schist and/or completely weathered Schist and/or Schist rock-mass, and dykes traversing this section of the route, with overall moderate to poor excavatability at varying depth to 2.5m due to very dense soils or localised bedrock. Infiltrating groundwater predicted to perch temporarily on bedrock or very dense soils. The section from Palmietfontein reservoirs

to Krugersburg reservoirs is characterised by shallow rocky soils / hardpan *pedocretes* underlain mainly by saprolite, with localized occurrences of weathered bedrock at depth, occasional bedrock outcrops also occur with occasional occurrences of deep soils, unconsolidated material and signs of gleying.

12.10 Geology Underlain Ebenezer Scheme

The geological composition that underlies the Ebenezer Scheme comprise of stratified geological group formation, namely Goud Plaats-Hout River Gneiss, and Turfloop Granite (***Figure 44***).

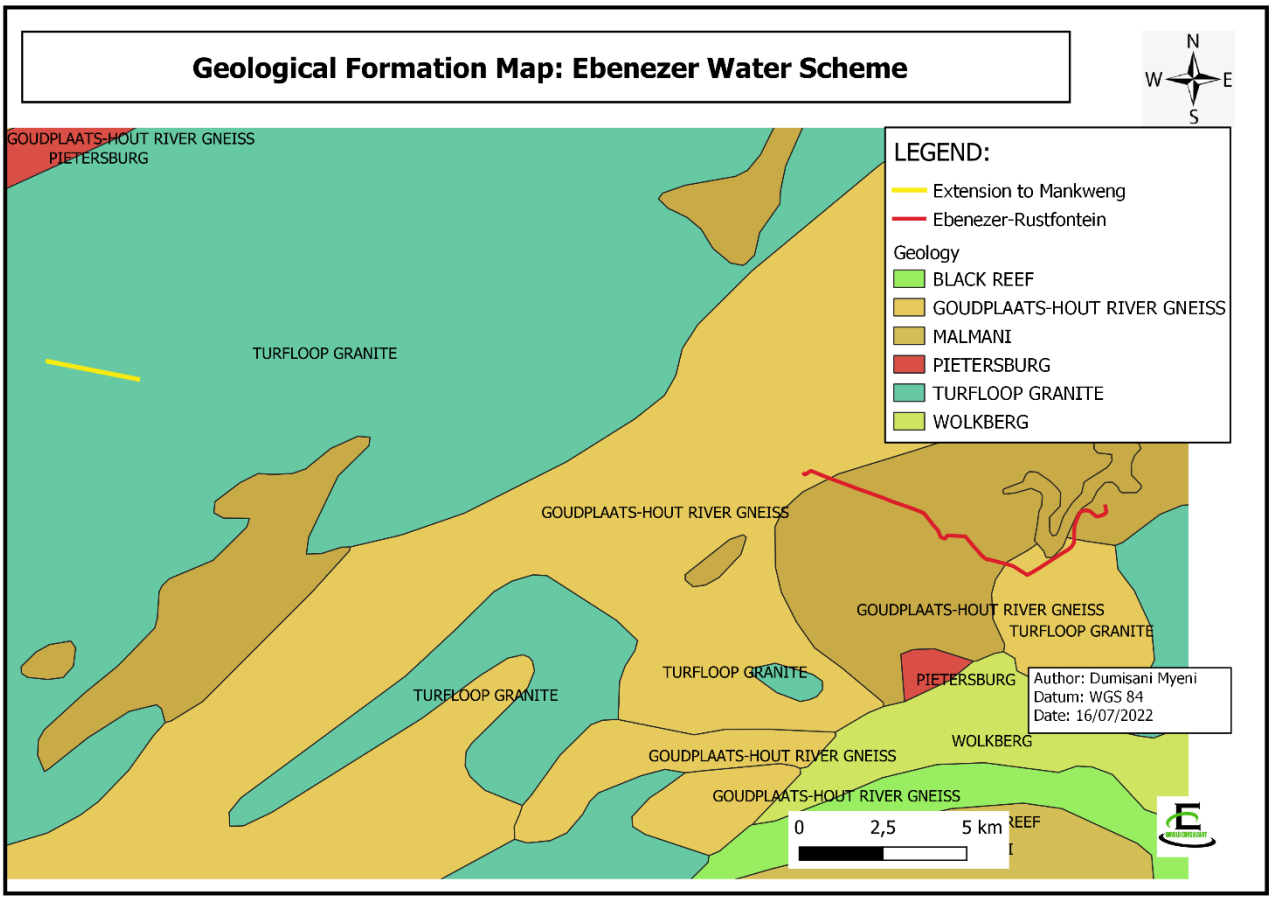

Figure 44: Dominance Geological Formation (Ebenezer Water Scheme)

The field investigation observed the Glenrosa Soil Form within Mistbelt ecosystems favoured by the timber industry on the section between Ebenezer to Rustfontein reservoirs. The section within Ebenezer is characterised by ridge crests, mid slopes freely drained, *apedal* soils that have undergone leaching, mainly associated with the Goudplaats Gneiss strata, with restricted

depth of excavation due to slopes and predicted good excavatability to 5 m, with sidewall instabilities. Some portion in furthest areas will experience localised difficult excavation due to shallow bedrock or very dense soils but dominantly good excavation up to 2.5m depth.

The Mankweng extension demonstrated mainly shallow soils and hillwash occurrence across the vast majority of the site, with localized pockets of soils of variable thickness, however with good excavatability.

12.10.1 Potential impacts

The construction activities for the purpose of upgrading the water conveyance and storage infrastructure for Olifantspoort and Ebenezer WSS will involve deep excavation and ripping of boulders where necessary. This also includes the excavation within the riparian habitat at river crossings. This activity may have impacts on geological stability of the riverbanks within the vicinity of conveyance, thus resulting in riverbank incision and run-off erosion. This will be addressed in accordance with in-sutu material erodibility, excavatability, rippability, and run-off propensity. However, proper mitigation can be achieved through diligent implementation of the recommendations contained in the Geotechnical Assessment and EMPr.

12.11 Visual environment and land use character

Subject to the direct visual influence of the upgrading of the Olifantspoort and Ebenezer Water Supply Schemes and associated infrastructure, the zone of visual influence can be experienced at different scales by receptors located at various distances from the site. The viewshed area and zone of visual influence for new developments is classified as follows:

- High visibility - Visible from a large area (several square kilometres, >5km radius)
- Moderate visibility - Visible from an intermediate area (several hectares, 2.5 – 5 km radius).
- Low visibility - Visible from a small area around the project site (<1km radius).

Most portions of pipeline traverse seven distinct habitats that were delineated within the PAOI, namely grassland bushveld, forest, thornveld, watercourse (instream, riparian, wetlands), and secondary vegetation (commercial forestry and subsistence agriculture), and settlement (rural

and urban). Some of these are rural areas within bushveld and grassland. This portion of the route has a livestock carrying capacity of less than 6-8 ha per livestock unit. There was a good blend of cattle as grazers and goats as browsers.

The bulk water pipeline runs parallel to the existing pipeline, with one small exception of rerouting to prevent interception of the sensitive environment. Where the pipeline is through or immediately adjacent to built-up areas, the proposed new pipeline will travel through existing servitudes and will have no impact on adjacent land.

The proposed development is the construction and upgrading of water conveyance and infrastructure which is considered to have no negative visual impacts, as the proposed infrastructure will be concentrated within existing footprints and are not elevated structures. During construction activities it is likely that the project could be considered 'low visibility' or negligible as it can be visible within a small area around the project site (<1km radius).

12.11.1 Potential Impacts

The proposed water infrastructure project consists of mainly water pipeline which will be sub surface, and storage infrastructure which will be conveniently constructed in close proximity to existing storage infrastructure. Therefore, the project will have minor visual and land use change. The visual impacts could only be experienced during construction through movement of construction machinery, storage of materials/equipment and excavated spoil materials along the trenches, which can only be viewed at the local scale. Also, the dust and other visibility aspects will be managed through proper implementation of recommendations contained in EMPr.

12.12 Heritage and cultural aspects

The Capricorn District inherited the Capricorn name from the Tropic of Capricorn which runs directly through the region. This is considered as regional heritage aspect of the area. The Capricorn District also hosts the Bakone Malapa Northern Sotho Museum (an open-air 'living' museum demonstrating Sotho culture), the Hugh Exton Photographic Museum, Zion Christian Church Headquarters, which is located at Zion City Moria, the Zebediela Citrus Estate, the Polokwane Museum, the Polokwane Smelter, and the towns of Alldays, and Houtbosdorp

(LEDET, 2019). The Mopani District hosts the Westfalia Estates, Manotsa and Madrid and Shiluvane (LEDET, 2016; LEDET, 2019).

A preliminary desktop study for palaeontological sensitivity within the region of the Olifantspoort Scheme, reveals that the site falls within 'Low-High sensitivity' (***Figure 45***). The environmental screening tool also describe that the other portions of the Olifantspoort Scheme has a high palaeontology sensitivity and low-medium archaeological and cultural heritage sensitivity.

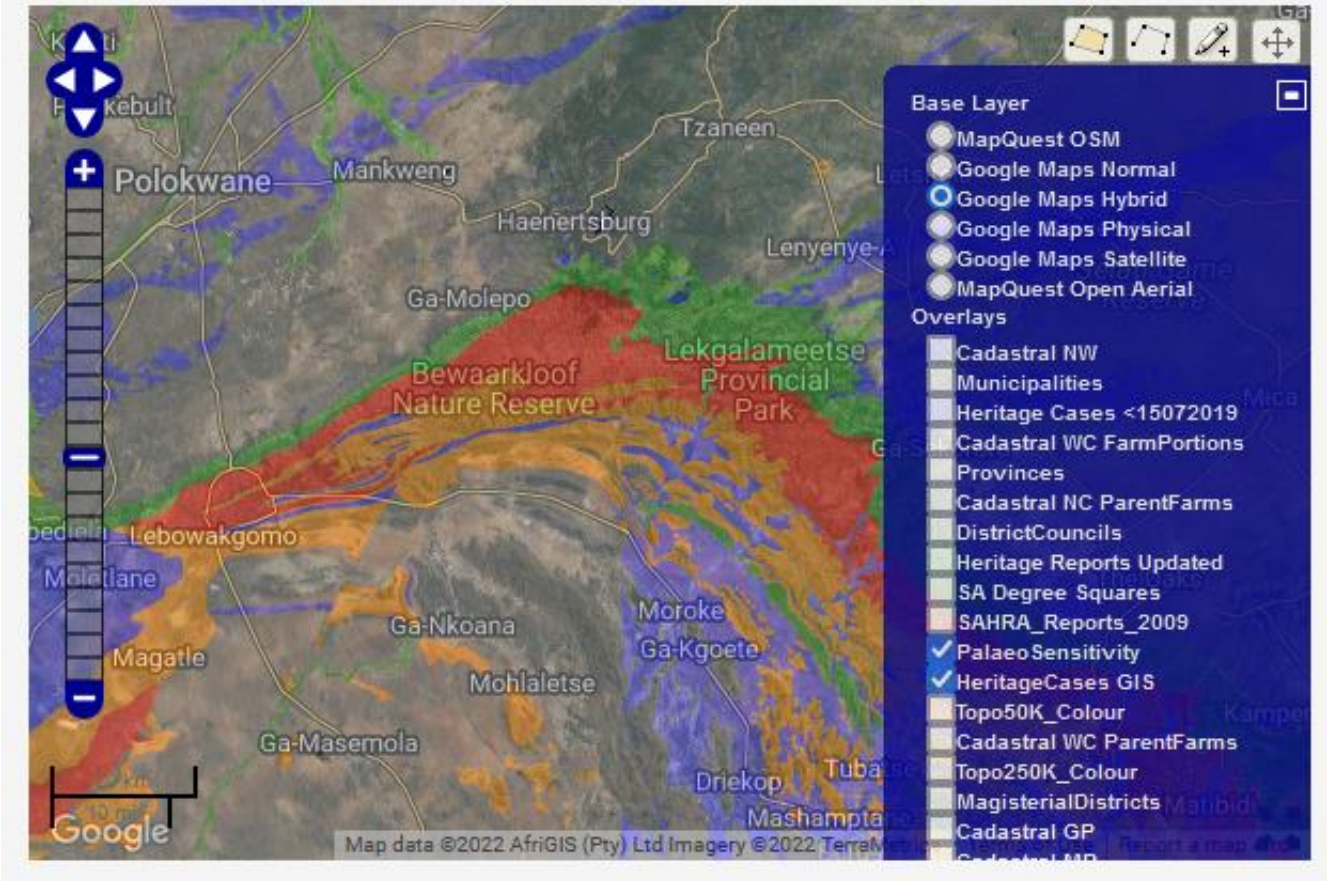

Figure 45: Olifantspoort & Ebenezer WSS Palaeontological Sensitivity
[Source: SAHRIS https://sahris.sahra.org.za/node/add/heritage-cases]

Although the general project area has a number of archaeological sites recorded, from a contextual studies perspective, no medium to high significance archaeological, heritage landmark or monument was recorded within the direct path of the proposed pipeline corridors.

The Olifantspoort Scheme study area is characterised of urban setting and several scattered rural villages which are linked with gravel roads. The outskirts of some of these villages have informal graveyards and private graves. Abandoned homesteads between these villages are sometimes associated with single, isolated graves. Some of these informal graves are unmarked (visible tombstones) and therefore are inconspicuous. Formal graveyards were easily recognisable. Moreover, the survey noted the existence of an Iron Age Farming Community. The site is characterized by round hut foundations marked with stones and a number of Iron Age farming community cattle kraals present represent the 'Central Cattle Pattern' (CCP). Furthermore, the area hosts the Bakone Open Air Museum.

It is also important to note that the Ebenezer pipeline will traverse along the boundary of the Haenertsburg Cemetery.

Based on the nature of the project, surface activities may impact upon the fossil heritage preserved in the development footprint.

12.12.1 Potential Impacts

During the clearing of vegetation, excavation and construction activities, heritage resources/artefacts/places that might be buried underground may be affected. Moreover, excavations (pre-construction and construction phase) could uncover the following: stone foundations, ash middens associated with the farmsteads and homesteads that can contain bone, glass and clay ceramics, ash, metal objects such as spoons, knives, and possible adult and infant burials (especially unmarked). However, proper mitigation can be achieved through diligent implementation of the recommendations contained in the EMPr and Palaeontological, Archaeological and Cultural Heritage Impact Assessments.

12.13 Social and economic aspects

The project will have positive impacts in terms of improving livelihoods. It is also expected that the local community will benefit through jobs during the construction, operation, and maintenance phases, which will enable the transfer of skills and boost the local economy. Additionally, local businesses will benefit from the supply chain processes. This will contribute

to alleviating poverty and decrease the dependency ratio of the area. Most importantly, the upgrading of the Olifantspoort and Ebenezer WSS scheme will provide sustainable water supply within Polokwane and the surrounding communities to improve standards of living and support farming and other water-based small businesses.

The proposed pipeline will run parallel to the existing pipeline. Therefore, there will not be any displacement of households. The pipeline upgrades have also made provision for necessary deviations where settlements have encroached within the existing route.

12.13.1 Potential Impacts

Minimal to no negative impact on the social and economic aspects associated with the proposed upgrade are envisaged, as the pipeline will run parallel to the existing pipeline. Additionally, the upgrades have made provision for deviations where necessary so as not to disturb existing dwellings that have encroached within the existing corridor. Therefore, there will be no need for any displacement of households.

12.14 Traffic

Local communities and road users including school children will be impacted during construction activities in the area. Safety risks, and domestic and wildlife collisions, related to the movement of heavy equipment, materials and vehicles will likely increase during the course of the project.

The hauling of material and equipment to site will utilise existing local roads. Access roads will be aligned with the pipeline servitude. A basic traffic management plan will be included during construction phase. Mitigation of potential traffic related impacts will be addressed by proper implementation of safety management systems during the construction.

13 WASTE AND AIR POLLUTION

The construction activities of the upgrading of the Olifantspoort and Ebenezer WSS will lead to air pollution and waste generation, and such pollution and waste has detrimental effects on the receiving environment.

13.1 Waste Management

Some of the possible solid and liquid waste generated during the construction and assembling of the pipelines and associated infrastructure include general waste (plastic, paper, food scraps, etc.), hazardous waste (chemicals, oil, diesel, resins, drilling fluids, sewage, etc.), medical waste from onsite injuries (bandages, swabs, medication, needles, etc.) and building rubble (cement, steel, wood, etc.). The general waste will be disposed of at a registered Polokwane landfill site, while the disposal of hazardous and health care (medical) waste will be handled by a certified waste disposal service provider. Proper measures will be put in place to manage all waste generated during construction, as prescribed in EMPr.

13.1.1 Potential Impacts

The incorrect handling and disposal of hazardous waste (lubricants, fuel, chemicals, agricultural remedies, *inter alia*) could have contaminate nearby watercourses.

Potential impacts on groundwater may arise if hazardous substances are allowed to leak onto bare soil and potentially leach into the ground or disposed of incorrectly or enter the water bodies. Hazardous waste (eg. chemical) contamination of water bodies by runoff water that contain contaminants from onsite waste storage areas and/or chemical storage areas can have significant impacts. Management plants will be implemented to contain any spillages (hazardous substances),handling of waste emanating from the site, and clean-up of spillages, as prescribed in the EMPr.

13.2 Air pollution

The proposed development itself will not have direct impact on air pollution and atmospheric emission, as the operating of a water pipeline does not have emissions. However, certain activities during construction could have impacts on the ambient air as a result of emissions from the onsite equipment, machinery, and vehicles. These include dust emanating from construction activities and fumes (carbon monoxide) released by construction vehicles and machinery.

13.2.1 Potential Impacts

The proposed development itself will not have direct impact on air pollution and atmospheric emission. However, proper measures will be put in place to contain any dust and emissions occurring during construction, as prescribed by EMPr.

13.3 Wastewater

Wastewater will discharged mainly during construction activities especially with the large number of workers on site. Some of the sources of wastewater include:

(a) surface runoff from construction activities

(b) washing of vehicles, equipment, implements, etc.

(c) site toilets, food preparation, personal hygiene

13.3.1 Potential Impacts

The incorrect handling and disposal of wastewater (chemicals toilet and grey water) from site could have detrimental impacts on nearby watercourses.

Potential impacts on groundwater may arise if hazardous substances are allowed to leak onto bare soil and potentially leach into the ground or disposed of incorrectly or enter the surface water bodies. Water contaminated with silt and mud will contribute to flooding due to blockage of drainage systems. Additionally, ecosystems will be negatively impacted from all the silt and mud entering water bodies.

Proper measures will be put in place to contain any spillages (wastewater) and handling of waste emanating from the site, as prescribed in the EMPr including chemical toilets located conveniently along the working areas, managed by a competent portable toilet service provider and all effluent waste will be disposed off at the Polokwane Wastewater Treatment Works.

13.4 Noise management

The project sites will emit different levels of noise due the various construction activities, rock blasting, use of heavy machinery, movement of heavy construction vehicles, as well as from the large number of workers on site.

13.4.1 Potential Impacts

The noise generated by the construction activities will mainly come from rock blasting, construction machinery and construction vehicles. However, noise impacts are expected to be of short duration and only during certain days and times of the construction phase, which is likely to only have impacts to the immediate environment. Proper measures will be detailed in the EMPr to manage and minimise all noise pollution impacts.

14 IMPACT ASSESSMENT AND MITIGATION MEASURES

The EIA conducted for the construction of the pipelines, are discussed in ***Section 14.1*** below.

Each impact identified is assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To effectively implement the adopted scientific approach in determining the significance of the environmental impact, a numerical value was linked to each rating scale.

The following criteria will be applied to the impact assessment for the construction and the operational/maintenance phases of the Olifantspoort and Ebenezer WSS.

Occurrence

- Probability - the probability of the impact describes the likelihood of the impact actually occurring.
- Impact duration - the duration of the impact describes the period of time during which an environmental system or component is changed by the impact.

Severity

- Magnitude – refers to the ‘degree of disturbance’ to biophysical systems and components which expresses the change in the health, functioning and/or role of the system or component as a result of an activity.
- Scale/extent - the extent of the impact generally expresses the spatial influence of the effects produced by a disturbance to an environmental system or component.

The following ranking scales were used:

Probability = P 5 – Definite (More than 80 % chance of occurrence) 4 – Probable (Between 60-80% chance of occurrence) 3 – Possible (Between 40-60% chance of occurrence) 2 – Fairly Unlikely (Between 20-40% chance of occurrence 1 – Unlikely (Less than 20% chance of occurrence)	*Duration = D* 5 – Permanent - The only class of impact that will be non-transitory (indefinite) 4 - Long-term - The impact and its effects will continue or last for the entire operational life of the development (15 - 50years) 3 - Medium-term - The impact and its effects will continue or last for some time after the construction phase (5 - 15 years) 2 – Medium-short - The impact and its effects will continue or last for the period of a relatively long construction period and/or limited recovery time after this construction period (2 - 5 years) 1 – Short Term - Likely to disappear with mitigation measures or through natural processes which span shorter than the construction phase (0-2 years)
Scale = S 5 – International (beyond 200km) 4 – Regional (50-200km radius) 3 – Local (2-50km radius) 2 – Surrounding area (within 2km) 1 – Site (within100m)	*Magnitude = M* 5 - High 4– Medium High 3 – Medium 2 – Medium Low 1 – Low
Status of Impact *+ Positive / -Negative or 0-Neutral*	

The overall impact significance score/points (SP) for each identified impact are calculated by multiplying magnitude, duration, and scale by the probability of all this happening.

The range of possible significance scores is classified into seven rating classes (***Refer to section 14.1***).

SP = (Magnitude +Duration +Scale) x Probability

The impact status can either be positive, negative or neutral as depicted in table below.

Significance	Environmental Significance Points	Colour Code
Negligible	0-10	N
Very low	11-20	VL
Low	21-30	L
Medium	31-40	M
Medium-High	41-50	MH
High	51-60	H
Very high	61-75	VH

The impact assessment and mitigation measures outlined (in ***Section 14.1***) below are based on preferred alternatives, namely: The *'Alternative A: Routing Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Location Alternative'* that will meet the stated need for and purpose of the project, by providing proper mitigation measures.

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14.1 Impact Analysis (Routing, Design, Technology, Location Alternatives)

Table 23: Project Panning (Inception) Impact Mitigation

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
Poor project panning will result in unnecessary damage and disturbance to natural vegetation: Extensive vegetation clearance due to poor site layout design, and planning which will result in extensive vegetation clearance, large scale top soil removal and excavation for site site-up clearing and degradation of indigenous vegetation and sensitive plant communities such as 'Critically Endangered' grassland (Woodbush Granite Grassland) including wetlands habitat. Moreover, that pipeline construction will also take place within Sekhukhune Plains Bushveld '*Vulnerable*'	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 5** **SP = 60**	➢ The site layout plan must clearly delineate the servitude for pipeline construction corridor. ➢ The route design must incorporate a pipeline construction corridor of not more than 10m width for construction corridor within the vicinity of Woodbush Granite Grassland, river crossings and wetlands, and of not more than 15m width on the remainder sections of pipeline. ➢ The site layout plan must indicate areas that are no-go zones, to limit large scale and unnecessary vegetation clearance. ➢ Develop a site layout design for re-routing 1.3 km of pipeline between the 6.0 to 8.0 km section of Ebenezer to Rustfontein Reservoir pipeline and within the Haenertsburg Village pipeline, to avoid the environmentally sensitive '*Critically Endangered'* grassland (Woodbush Granite Grassland) within Haenertsburg Nature Reserve. The pipeline	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		will be re-routed along areas that have been previously disturbed along the timber plantation boundary and behind Haenertsburg Cemetery. ➢ The proposed pipeline must be constructed outside of any other remnant of Woodbush Granite Grassland so as not to disturb this vegetation. ➢ Site offices, workers' toilets and holding areas for equipment, vehicles and materials, must not be located on grassland, Nature Reserves or forest fragments. ➢ A plan to actively rehabilitate and clean-up the construction areas during construction and post-construction must be developed and implemented. ➢ An ECO must be appointed to enforce environmental compliance during construction. ➢ Pre-construction environmental induction must be conducted for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to conservation and	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		importance of protected plants/trees and medicinal plants, as well as to conditions of the EA and the various permits/licenses.	
Poor project planning will result in loss of plants SCC: Poor design and construction planning may result in the permanent loss of various plant SCC as the abstraction works will take place within a NFEPA river, and other portions of the pipeline will be constructed along the sensitive environment such as Woodbush Granite Grassland habitat, Sekhukhune Bushveld habitat, riparian, wetland habitat, CBA1, CBA2 and adjacent protected areas. The CBAs and ESAs support the species diversity and SCC. Therefore, there is a likelihood that plant SCC will be encountered during construction.	**High** **(60)** **SP = (M + D + S) × P** **S P= (5 + 5 + 2) × 5** **SP = 60**	➢ The site layout for abstraction works (proposed new weir and activation works) must clearly illustrate the proposed construction footprint within the vicinity of abstraction works and clearly delineate the servitude for the construction corridor. ➢ Schedule the work at the abstraction site to take place during low peak conditions and dry period. ➢ Develop a site layout design for re-routing 1.3 km of pipeline between the 6.0 to 8.0 km section of Ebenezer to Rustfontein Reservoir pipeline within the Haenertsburg Village pipeline, to avoid the environmentally sensitive 'Critically Endangered' grassland area (Woodbush Granite Grassland) within Haenertsburg Nature Reserve. The pipeline will be re-routed along areas that have been previously disturbed along the timber	**Negligible** **(10)** **SP = (M + D + S) × P** **SP = (2 + 2 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		plantation boundary and behind Haenertsburg Cemetery. ➢ The site layout plan must clearly delineate the servitude for the pipeline construction corridor. ➢ The site layout plan must indicate no-go areas to limit large scale and unnecessary vegetation clearance. ➢ Location for the site camp must be identified with the approval of the ECO. The site camp must be established at an already disturbed site and be clearly demarcated with appropriate signage. ➢ An ECO must be appointed to oversee construction activities, and establishment of construction site camp, as well as to ensure compliance to all environmental legal requirements. ➢ A plan to actively rehabilitate the site during construction and post-construction needs to be developed and implemented.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
Poor project planning will result in loss of fauna SCC: Poor design and construction planning may result in the permanent loss of various animal SCC as the abstraction works will take place within the NFEPA river, while other portions of the pipeline will be constructed along the sensitive environment such as the Woodbush Granite Grassland habitat, Sekhukhune Bushveld habitat, riparian, wetland habitat, CBA1, CBA2 and adjacent protected areas. There is a likelihood that animal SCC will be encountered during construction. Local fauna disturbance might occur and could led to fragmentation, reduction, and loss of habitat as well as destruction of ecological corridors and connectivity. Some animal SCC could be prone to injury and mortality from construction activities or poaching by workers.	**High** **(60)** **SP = (M + D + S) × P** **SP = (5 + 5 + 2) × 5** **SP = 60**	➢ A design for a weir must incorporate a fish ladder to provide a fishway and aquatic species migration from either side of the weir wall. ➢ The site layout plan for abstraction works (proposed new weir and activation works), and all wetlands and river crossings must clearly illustrate the proposed construction footprint within the vicinity of abstraction works and clearly delineate the servitude for construction corridor. ➢ Schedule the work at abstraction to take place during low peak conditions and dry period. ➢ Develop a site layout design for re-routing 1.3 km of pipeline between the 6.0 to 8.0 km section of the Ebenezer to Rustfontein Reservoir pipeline within the Haenertsburg Village pipeline, to avoid the environmentally sensitive 'Critically Endangered' grassland area (Woodbush Granite Grassland) within the Haenertsburg Nature Reserve. The pipeline will be re-routed along areas that have been previously disturbed along the	**Very Low** **(12)** **SP = (M + D + S) × P** **SP = (2 + 2 + 2) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		timber plantation boundary and behind Haenertsburg Cemetery. ➢ The site layout plan must clearly delineate the servitude for the pipeline construction corridor. ➢ The site layout plan must make indicate no-go areas/zone, to limit large scale vegetation clearance. ➢ Locations for the site camp must be identified with the approval of the ECO. The site camp must be established at an already disturbed site and be clearly demarcated with appropriate signage. ➢ An ECO must be appointed to oversee construction activities, establishment of construction site camp and compliance to all environmental legal requirements. ➢ A plan to actively rehabilitate the site during construction and post-construction needs to be developed and implemented.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
Poor project planning will result in degradation of freshwater habitat. Poor design and / or implementation of the planned infrastructure associated with the construction of abstraction works (weir and abstraction works), and pipeline river crossings will result in degradation of watercourse habitat, as these activities will lead to removal of instream and riparian vegetation, flow regime alteration as well as the alteration of the natural topography of the watercourse.	**High** **(60)** **SP = (M + D + S) × P** **SP = (5 + 4 + 3) × 5** **SP = 60**	➢ Develop the engineering designs to prevent or minimise alteration of flow regime within the vicinity of the weir and the river crossings. ➢ The site layout for abstraction works (proposed new weir and activation works), and all wetland and river crossings must clearly indicate the proposed construction footprint within the vicinity of abstraction works and clearly delineate the servitude for the construction corridor. ➢ The design must incorporate a pipeline construction corridor of not more than 10m wide for construction corridor within the vicinity of river crossings and wetlands. ➢ The pipeline along the wetlands must include buffer determination to design a layout to buffer at least 12m from seep and channel valley bottom wetlands to protect wetland habitat and ecological corridor, and mark no-go areas. ➢ Design must re-route the pipeline and divert the pipeline not to cross directly into the wetland habitat provided that no limitation	**Very-Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		due to certain developments adjacent to the pipeline route within a watercourse. ➢ Re-route the 2.3 km pipeline to bypass from the 2.0 to 4.0 km pipeline from Ebenezer pumpstation section which runs in close proximity to the water edge along the dam basin, whereas the new pipeline will be constructed along the existing road reserve. ➢ Re-route the pipeline along Chuniespoort Dam, as the existing pumping main pipeline crosses through the dam's basin. The new pipeline will be placed further to the dam's basin along the R37 road reserve. ➢ A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic ecologist or ECO. ➢ Conceptual riparian zone rehabilitation and monitoring plan with a focus on erosion and alien vegetation management, be compiled prior construction and implemented.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		➢ An ECO must be appointed to oversee construction activities and ensure compliance to all EA and permit conditions.	
Poor project planning will result in deterioration of surface water quality and streamflow reduction. Construction of the Olifantspoort abstraction works within the Olifants River; the section of bulk pipeline from PS1 to Specon has two river crossings within the vicinity of the Chunies River; the section of bulk pipeline from PS2 to Witkos has four river crossings within the vicinity of the Chunies River; the section of bulk pipeline from Ebenezer to Rustfontein has a river crossing within the vicinity of the Greater Letaba River. The Construction of new off channel storage dam. These will result in Increased sediment laden runoff; Diversion of drainage; Increased volumes entering aquatic habitat. Poor design and / or implementation of the planned infrastructure associated with the pipeline river crossing, abstraction works likely to result in degradation of watercourse habitat include (i) undertaking bulk earthworks along the banks and	**High** **(60)** **SP = (M + D + S) × P** **SP = (5 + 4 + 3) × 5** **SP = 60**	➢ The project plan must schedule the construction activities within the instream and riparian habitat to take place during the low flow condition and dry period. ➢ All pipeline crossings must be aligned and designed to minimise the extent of river habitat directly impacted by construction activities. In this regard the pipeline crossings should be aligned at right angles to flow and along existing or planned areas / corridors of disturbance. ➢ Pipeline crossings should be established underground. However, where there are opportunities to attach to / include pipelines in the existing crossing structures, these must be investigated. Pipe bridges must be designed such that pipes are suspended sufficiently high above the channel bed and above the high-water mark so as not to interfere with natural flow regimes and such that pipes do not act as traps for debris and	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
riverbed (ii) placing infrastructure within watercourses, and (iii) de-watering of the construction area. These activities will lead to removal of instream and riparian vegetation, flow regime alteration as well as the alteration of the natural topography of the watercourse, and concrete encase at river crossing.		sediment transported through the channel. Pipe bridge piers should be placed on either side of the watercourse for smaller rivers/streams and not to be placed within the channel bed. Piers should be placed with enough distance up the bank (preferably on the top of the upper bank) and not below the water mark/bank full level. The viability of this should be further investigated by the project engineer. ➢ Ensure that the timing of the topsoil stripping is optimised to limit the time between stripping and construction/deposition. ➢ A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic ecologist or ECO. ➢ The pipelines and associated embedment material must be established below the base level and suitably secured in place to ensure that it does not act as barrier or impediment to flow (in the case of the pipeline). Concrete encase design at river crossings must allow	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		for adequate flow of water, and be subject to change as determined by *in-sutu* conditions. ➢ Ideally, pipelines should be placed above the watercourse via a pipe bridge where it does not impede the flow or characteristics of the stream bed and channel. Pipe bridges must be designed such that pipes are suspended sufficiently high above the channel bed and above the high-water mark so as not to interfere with natural flow regimes and such that pipes do not act as traps for debris and sediment transported through the channel. ➢ Pipe bridge piers must be placed on either side of the watercourse for smaller rivers/streams and not to be placed within the channel bed. Piers should be placed with enough distance up the bank (preferably on the top of the upper bank) and not below the water mark/bank full level. The viability of this should be further investigated by the project engineer. ➢ Engineering design to mitigate extreme events from inundation upstream of the weir.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		➢ The design alternative that was chosen for this project, caters for such events - hence the hydraulic model confirmed the slight changes on existing river condition at the weir locality with regard to extreme events of 1:50 year and 1:00 year flood events, with a low-notch crest elevation of 741.20 mASL. A 4.700 m high weir (i.e. low notch height above the local bed level downstream of the low notch) has been designed with a 30 m long low notch next to the gravel trap, and a 0.3 m higher second notch with a 80 m length. ➢ The OCSD spillway will be designed for the maximum discharge associated with 100-year recurrence interval flood. Spillway capacity must be adequate to carry the Safety Evaluation Flood (SEF). ➢ Energy dissipation will be designed in accordance with dam safety legislation associated with the rapid drawdown (RDD) which discharges into the upper reaches of the abstraction works.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		➢ Drawdown must be released in a controlled manner to resemble natural flows. Drainage must be diverted to allow for natural drainage through the landscape. ➢ Monitor the silt level in the dam closely and ensure timeous sediment removal. Implement energy dissipators for the spillway	
Poor project planning will result in site geological instability (soil erosion, banks incision and seepage): The riverbank material at abstraction works indicate the potential of a high rate of collapse. The vicinity is deemed to have soft excavation conditions. The river crossings demonstrated the localized sidewall instabilities. The sections pipeline demonstrated varying excavatability due to varying in-sutu characteristics, with other portions demonstrating good excavatability to 2.5m and some portions demonstrated poor excavatability at varying depth		➢ Design geosynthetics for all river crossings and abstraction works to prevent bank incision and erosion. ➢ A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic ecologist or ECO. ➢ All excavation works which require ripping must be determined by Seismic Evaluation ➢ Blasting of rock outcrops must be considered as a last resort. A detail report must be submitted by the contractor prior to construction detailing the conditions which will resort in blasting. This report must be accompanied by blasting method statement.	**Very Low (12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
up to 2.5m, as a result of very dense soils, bedrock outcrops and/or hardpan. Due to the geological conditions, the construction will require heavy excavator and ripper machinery. Moreover, geological conditions of some sections of pipeline route presents excavation challenges. The section from PS2 to Witkos passes through a ridge crest and upper side slopes (including the Chuniespoort passage).		➢ Design to cater for the tie-in of new pipeline to the existing 1 200mmø pipeline which is suspended by concrete plights along 1.5 km section of pumping main pipeline, which was originally designed to accommodate the future upgrading of the conveyance capacity along the pipeline route crossing through the Chuniespoort Passage. This will be done to avoid tunnelling or pipe jacking through the steep topography and rocky ground terrain, combined with the restricted area available for the construction of a new parallel pipeline, at this section of pipeline route. ➢ Conceptual riparian zone rehabilitation and monitoring plan with a focus on erosion and alien vegetation management, be compiled prior to construction. ➢ Design an adequate stormwater management system to include surface drainage for continual drainage within the pipeline route and vicinity of the river crossings including abstraction works to prevent bank incision, seepage and geological instability as a result of ponding.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
Poor project planning will result in social distress: Social impacts related to bulk water infrastructure emanate from: • Movement of heavy machinery within residential areas; • Possible disturbance of settlements located within the construction corridors; • Disturbance of existing services (water, powerline, roads); • Destruction of services (water infrastructure, electricity, telecommunication infrastructure, and residential access roads). • Disturbance of graves and heritage resources	**High** **(60)** **SP = (M + D + S) × P** **SP = (5 + 4 + 3) × 5** **SP = 60**	➢ Appoint a Social Facilitator to manage project social aspects. ➢ A basic traffic management plan must be included during the construction phase. The mitigation of this will be addressed by diligent implementation of Safety Management Systems during the construction phase. ➢ Identify and delineate the existing multiple access points to the pipeline routes. These access route must form an integral part of site layouts which must be communicated to project team including delivery crew. ➢ The material hauling route must be demarcated. No construction trucks, or vehicles transporting material and equipment will be allowed to pass through the residential areas where there are restrictions in terms of the axle load permitted on the road. ➢ Identify all existing underneath and surface infrastructure, such as water pipeline, telecommunication lines, and powerlines which will be in the corridor, and submit the wayleaves to relevant authorities to approve	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		the design and construction method. These designs will be required to secure wayleaves. ➢ The design makes a provision to bypass the two offtakes from the existing pipeline supplying Mphahlele Raw Water Supply (RWS). In this 0.0 to 7.0 km section at about 200m downstream of PS1 the new 1 500mmø pipeline will branch off from the existing 800mmø pumping main pipeline for about 7km, thus requiring the establishment of an access road with a cleared pipeline servitude for maintenance purpose. ➢ The design along the road reserve and for road crossing must be done in accordance with DoT standards. These designs will be required to secure wayleaves with regards to: pipeline situated within the road reserve; specifications and requirements for pipe crossings underneath the roads, which will be constructed by means of pipe jacking. Specification, requirements, and preferences with regards to access roads to the respective roads.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		➢ A design to provide for re-routing of pipeline where there is a likelihood of interception with heritage resource and grave sites, based on the Heritage Specialist recommendations. ➢ A design to provide for rerouting of pipeline, whereby a 7.1km bypass pipeline forming a diversion at 22.0 to 28.1 km section from PS1 and before terminating at the Specon reservoir. This diversion is to avoid intrusion into the residential development in Lebowakgomo S, which encroaches over the existing pipeline servitude. ➢ The design for pipeline route with rural settlement, urban periphery must be informed by the Social Facilitator through engagement with the households adjacent to pipeline route for assistance in identifying all unmarked graves that could be within the pipeline corridor, and review designs to prevent intrusion into grave sites, by designs that will re-route activities for a 30m buffer. Such areas must be marked as “No-Go” areas.	

Table 24: Construction Phase Impact Mitigation

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Loss of indigenous vegetation during construction: The development is an upgrade of pipeline, will result in vegetation clearance and obliteration of vegetation on site for the purpose of construction for laying of the pipeline infrastructure. Also uncontrolled construction activities beyond the required footprint of the project area. This could led to loss of flora habitat, such as Woodbush Granite Grassland (critically endangered grasslands) due to vegetation clearance.	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4+ 2) × 5** **SP = 55**	➢ Vegetation clearance for construction of the pipeline route and site camp must be minimal, and be limited only to demarcated servitude, as approved by the project plans and site layout. ➢ The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the river crossings (riparian zones), wetlands, and Woodbush Granite Grassland habitat. Clearance must not be more than 15m width on the remainder sections of pipeline, where there are no sensitive environment. ➢ The servitude must include the trench, one-way running track, topsoil stockpile corridor and subsoil stockpile corridor. All areas of watercourses outside this servitude must be considered no-go areas. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment.	**Very Low** **(12)** **SP = (M + D + S) × P** **SP = (3+ 2 + 1) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ The demarcations are to remain until construction and rehabilitation is complete. ➢ Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project. ➢ Only the approved existing access road must be used, and vehicles must not traverse virgin land. ➢ The project boundary must be demarcated and vegetation clearing as well as topsoil removal must be limited to the site only.	
Disturbance of terrestrial species habitat as a result of construction activities The uncontrolled construction activities may result in the loss of habitat and permanent loss of unidentified animal SCC. Also, this might encourage migration of species. Furthermore, the animals with limited mobility are often the first to be affected by habitat fragmentation due to the effects on population viability. Reptiles, bird species, small mammals, and invertebrates may be separated into distinct populations.	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4+ 2) × 5** **SP =55**	➢ The construction corridors must be surveyed for potential habitats such as burrowing and roasting sites, prior to site clearance. Such habitats must be protected especially for animal SCC. ➢ During site preparation, special care must be taken during the clearing of the works area in order to minimize damage or disturbance of roosting and nesting sites. ➢ The project area must be surveyed for potential animal SCC prior to construction in	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 2** **SP =10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		order to locate, capture and relocate any animal SCC. ➢ All construction activities must take place within an area demarcated for the development. ➢ Install buffers to restrict development from encroaching into sensitive environments. ➢ ECO must be appointed to oversee construction activities and ensure environmental legal compliance. ➢ All workers to undergo environmental awareness and training, including induction on conditions of the EA and permits to minimise or prevent impacts to animal SCC.	
Loss of plant SCC during construction: Uncontrolled construction activities may result in vegetation clearance and result in the permanent loss of various plant SCC, as the abstraction works will take place within the NFEPA river, and other portions of the pipeline will be constructed along the sensitive environment such as Woodbush Granite Grassland habitat, Sekhukhune Bushveld habitat, riparian, wetland habitat, CBA1, CBA2 and adjacent	**Medium (40)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 4** **SP = 40**	➢ The pipeline route within the demarcated CBA and ESA must be surveyed prior to construction for identification of plant SCC. ➢ Establish buffer by means of visible construction barricades to section off plant SCC and declare it a no-go area. ➢ The plant SCC must not be removed, or disturbed.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
protected areas. The CBAs and ESAs support the species diversity and SCC. Therefore, there is a likelihood that plant SCC be encountered during construction		➢ Relocate plant SCC to undisturbed areas within project locality. ➢ If needed, approval must be obtained from the ECO, before any disturbance or removal of plant species of conservational concern; plants to be relocated, by a Botanist.	
Encroachment of Invasive Alien Plant Species: Uncontrolled construction activities, such as vegetation clearance and excavation are likely to spread and/or exacerbate colonization and establishment of invasive alien species. Encroachment, proliferation and spread of weeds and invasive alien plant (IAP) species are mainly associated with clearance of vegetation. Disturbance to habitat and removal of vegetation will increase the likelihood of IAP invasion and noxious weeds. The colonisation by weeds and IAPs poses a risk to indigenous plant communities and habitat characteristics as IAPs outcompete indigenous vegetation and may reduce species richness or cause a loss in biodiversity.	**Medium** **(40)** **SP = (M + D + S) × P** **SP = (4 + 4 + 2) × 4** **SP = 40**	➢ Prevent large scale clearance, and only clear the areas as demarcated by the approved project plans. All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling/uprooting and adequately disposed. ➢ The control and eradication of a listed invasive species must be carried out during and post construction within the project site. ➢ All sites disturbed by construction activities must be monitored for colonization by exotics or invasive plants and be regular removed. ➢ Alien invasive plants (listed in this study) can be removed manually or with the help of simple tools. This entails damaging or removing the plant by physical action.	**Negligible** **(8)** **SP = (M + D + S) × P** **SP = (2 + 1 + 1) × 2** **SP = 8**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Overtime, IAP may disperse and proliferate into riparian and wetland habitat and alter the hydrology of the watercourses**.**		➢ An alien invasive removal and management plan must be compiled and implemented onsite.	
Disturbance to surrounding wildlife and fauna: Uncontrolled construction activities: vehicle movements, noise and habitat destruction will disturb animals in the area. As a result, the proposed construction activities are likely to result in the migration of species which are endemic to the project area or a loss of animal species currently found on site, as reptiles, bird species, mammals, and invertebrates may be separated into distinct populations. Inadvertent killing and injury of fauna species during vegetation clearance and construction activities. Loss/displacement of fauna species potentially present on site.	**Medium-High (44)** **SP= (M + D + S) × P** **SP= (5 + 3 + 3) × 3** **SP = 44**	➢ If any herpetological species are encountered or exposed during the construction phase, these must be removed and relocated to natural areas in the vicinity. This remedial action requires the employment of a herpetologist and or ecologist to oversee the removal of any herpetofauna during the initial ground clearing phase of construction (i.e. initial ground-breaking by earthmoving equipment). It is advisable that the earthworks be confined to the dry season, when there is likely to be less faunal movement. ➢ Walkways must be constructed allowing for animals to escape from the pipeline trenches, with an aid of a Herpetologist/Ecologist. ➢ Construction activities must be limited to the designated development footprint. ➢ During site preparation, special care must be taken during the clearing of the works area in	**Very Low (12)** **SP= (M + D + S) × P** **SP= (2 + 2 + 2) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		order to minimize damage or disturbance of roosting and nesting sites. ➢ No faunal species are to be disturbed, trapped, hunted or killed. ➢ Wetland fauna (e.g. snakes, frogs, small mammals) that are encountered during the construction phase must be relocated to other parts of the wetland under the guidance of the EO or ECO. ➢ All construction and maintenance vehicles must stick to properly demarcated and prepared roads. ➢ Driving on virgin land must be strictly prohibited. ➢ No fires should be allowed at the site. ➢ No dogs or other pets should be allowed at the site	
Potential loss of wetland and riparian zone habitat: Construction will result in alteration of hydrological and geomorphological processes. The infield watercourse delineation confirmed the presence of 35 wetland systems that fell within the	**High (60)** **SP = (M + D + S) × P** **SP = (5 + 5 + 2) × 5** **SP = 60**	➢ The project site servitude must be clearly demarcated to avoid unnecessary large-scale disturbances to adjacent areas. ➢ Where possible the pipeline must be re-aligned along the road reserve or gravel roads to prevent intrusion into wetlands.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
regulated area. Of the wetland systems identified, only 13 were identified to be at risk as a result of falling within the development footprint or these systems were located in close proximity to the proposed upgrade activities. Expanded / more intense edge impacts could occur as a result of deterioration in vegetation quality and cover and the potential for increased alien invasive plant invasion due to disturbance causing activities taking place within or near the wetlands and riparian zones. The degraded wetland systems within the project area as result of construction activities will not be able to provide ecosystems function and services such as: o CVB wetland function for flood attenuation reducing the velocity and volumes of surface runoff that reach the Olifants and Chunies Rivers. o UVB Effective in trapping sediment, flood attenuation and regulating flows.		➢ A pipeline construction corridor must not be more than 10m width for construction within the vicinity of wetland systems, including riparian zone. The servitude must include the trench, one-way running track, topsoil stockpile corridor and subsoil stockpile corridor. All areas of watercourses outside this servitude must be considered no-go areas. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment. ➢ Remain within development footprint, outside of wetlands. Install a ***28m buffer for CVB wetlands***; a ***26m buffer for UVB wetlands***; a ***25m buffer for seepage wetlands***; and ***20m buffer for dams*** to restrict development from encroaching into the wetland systems. The buffer must be in a form of pegs and construction barricades. ➢ Where applicable, the expansion of the footprint of any upgrade / refurbishment activities at the Water Treatment Plant and	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
○ The hillslope seepage effective in trapping sediment, assimilating toxins/nutrients and regulating flows, such as to regulate stormwater flows received from developments, as a result of its locality in the landscape. As well as erosion control. ○ Riparian zone within Olifants, Chunies and Greater Letaba Rivers were effective in erosion control. Limited in filtering toxins and nutrients and limited ability to attenuate floods. It is able to regulate flows to some extent due to the *Phragmites australis*. The construction of a new weir or extension of the existing weir will cut off the wetland system which will reduce its functionality. Work within the wetland may result in direct destruction and loss of wetland habitat.		pump stations must occur outside of all riparian and wetland areas and a 30m buffer zone to these watercourses. If buffer encroachment is required, this must be well-substantiated and a minimum 15m buffer should be maintained. ➢ The demarcations are to remain until construction and rehabilitation is complete. ➢ Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project. ➢ Vegetation at riparian zones within the vicinity of the abstraction works and river crossing must remain intact where possible, to limit high surface flows and mobilisation of sediments. ➢ Vegetation must be cleared in a phased approach and trench should not be left bare and exposed to erosion. ➢ Soils must be stabilised and sediment traps must prevent sediment from entering stormwater.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ The monitoring plan must be developed in order to quantify the impact on the watercourses. ➢ Disturbed watercourse habitats must be rehabilitated as soon as construction is complete or near complete and not left until the end of the project to be rehabilitated. ➢ Soil berms and sediment traps must be established to prevent sediment entering watercourses. ➢ Site camp must be located outside of wetlands and their buffers ➢ ECO must be appointed to oversee construction activities and ensure environmental legal compliance	
Degradation of freshwater (aquatic) habitat as a result of construction activities. Preferred construction of new weir at 740 mASL will result in disruption of river's longitudinal connectivity which affects fish distribution, migration and spawning patterns. The construction of a new weir downstream will likely result in the displacement of nomadic and weaker swimming	**Very High (65)** **SP= (M + D + S) × P** **SP= (5 + 5 + 3) × 5** **SP = 65**	➢ All work to be done within the sensitive riparian and instream habitats should be carried out during low flow conditions, and dry periods. ➢ The use of heavy machinery (excavator) within the watercourse must be closely supervised. If possible, the excavator must only be positioned as far as possible away	**Very Low (12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
fish species that prefer vegetated areas such as *Enteromius unitaeniatus*, *Enteromius viviparus* and *Pseudocrenilabrus philander*. Such a displacement may result in the migration of larger fish species that prey on them. The new weir will act as a new barrier to the movement of aquatic biota like fish and, macroinvertebrates, as well as modify aquatic habitat and contribute to overall decreased ecological connectivity along the reach. Direct disturbance of riverine habitat as a result of the upgrading of existing weir / establishment of new weir in the Olifants River. Accidental and/or direct impacts to riverine habitat and vegetation by heavy machinery during construction. If rehabilitation is undertaken poorly, the watercourses are likely to degrade slightly over time in terms of PES. Vegetation clearing and excavation within vicinity of abstraction works and pipeline river crossings will increase sediment inputs and sediment laden runoff		from the water edge, as it stretches the bucket to excavate the instream habitat. ➢ A one-way running track must be established across the river bed for the excavators to move along. The running track must be shielded with a wall of coffer dam and be constructed of a rock base overlain by coarse aggregate. ➢ All clearance for pipeline river crossing must be within 10m of the construction corridor. ➢ All clearance and excavations along the riparian and instream habitat for the purpose of construction new weir and pipeline river crossings must be limited to areas as demarcated and approved by the project plans. ➢ Material excavated from the trench must be stored away from river and away from the proposed dewatering areas. To avoid mixing, excavated trench material must be placed on a geotextile. ➢ Install buffers to restrict development from encroaching onto sensitive environments.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
entering watercourses. Sediment laden runoff will alter the hydrological regime, water quality (turbidity) and the watercourse characteristics. Excavation work required for the diversion channel, coffer dams etc. will mobilise sediment and contaminants may be released into the water column negatively impacting on water quality. A portion of flows will be re-directed which will alter water feeds downstream of the weir. Construction activities within a watercourse are likely to result in degradation of watercourse habitat which includes (i) undertaking bulk earthworks associated with implementing the bulk pipeline upgrades at the river crossing, (ii) placing infrastructure within watercourses, (iii) de-watering of the construction area when necessary and (iii) construction of concrete encase for the pipeline river crossing. Also, during construction activities it is highly likely that upstream flows will have to be diverted around the working area through the utilisation of coffer		➢ In the case that coffer dams are used to divert flow for construction purposes, these structures should be temporary in nature and be removed from the river immediately after the required construction has been completed. ➢ No construction of an artificial channel outside of the watercourse habitats for water diversion purposes will be permitted. Therefore, the de-watering process from the coffer dams should involve piping the water directly to the active channel downstream of the site as, or if, required. ➢ A dewatering site must be identified in conjunction with the ECO and should be on flat ground away from the edge of the stream channel and preferably in a well vegetated area. ➢ Pumped water must be discharged into a silt trap/hay-bale trap adequately sized to deal with the expected volumes. Outflow from this trap should be via sheet flow and energy dissipation measures may be required.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
dams. In addition, the poor construction processes could lead to stream siltation and further sedimentation of downstream. Moreover, the aquatic species (fish species) are likely to be affected by the construction activities as a result of the weir upgrade.		➢ Sediment barriers must be installed in areas sensitive to erosion to prevent stream siltation. ➢ The concrete encase for pipeline crossing at instream must be below the riverbed to prevent upstream ponding and inundation. ➢ Disturbed watercourse habitat must be rehabilitated as soon as construction is complete or near complete, and not left until the end of the project to be rehabilitated. ➢ ECO must be appointed to oversee construction activities and ensure legal environmental compliance.	
Alteration of flow regimes and fluvial systems: The construction will result in alteration of hydrological and geomorphological processes. The temporarily reduced riverine ecological connectivity during the construction of the new weir, abstraction works and pipelines river crossings. Preferred construction of a new weir will occur within the wetland; the weir must allow for natural flows through wetland system as currently the	**Very High (65)** **SP= (M + D + S) × P** **SP= (5 + 5 + 3) × 5** **SP = 65**	➢ Pre-development site hydrology (i.e., runoff, infiltration, interception, evapotranspiration, groundwater recharge, and stream baseflow) must be preserved as far as possible. ➢ Construct and maintain earth berm to prevent flooding and sedimentation during construction. ➢ To only use temporary cofferdams to divert flow within working area. ➢ Temporary pumping sump must be designed to achieve optimum hydraulic performance.	**Very Low (12)** **SP= (M + D + S) × P** **SP= (2+ 2 + 2) × 2** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
system is cut off. Also extension of existing weir will occur within the wetland. The area within the **OCSD** acts as a drainage line which will be active after heavy rainfall events. This will result in undertaking large scale earthworks activities near the Olifants River. Excavation will alter percolation through the area and may affect water feeds into the receiving environment. Construction related activities will therefore alter sediment and water inputs into the receiving environment and may affect groundwater recharge. Construction of OCSD will result in vegetation clearance, excavation, infill and alteration to volume and velocity of flows (hydraulic components) thereby increased sediment laden runoff, diversion of drainage and increased volumes entering aquatic habitat. Interception of catchment surface and surface water by the void created for the storage dam and reduced water inputs into the adjacent streams and rivers.		Minimise influence on downstream flow regime when diverting and impeding flow (cofferdams, earth berms etc). Use suitable stabilisation structures to prevent. ➢ A rock mattress must be created at the downstream outlet of the flume pipe to reduce erosion at this point to the satisfaction of the ECO. ➢ No construction of an artificial channel outside of the watercourse habitats for water diversion purposes will be permitted. Therefore, the de-watering process from the coffer dams should involve piping the water directly to the active channel downstream of the site as, or if, required. ➢ If it is necessary that the flows require diversion in order for the work to be carried out, the flows must be returned to their original pathways and velocities post establishment. ➢ Sediment barriers must be installed in areas sensitive to erosion to prevent stream siltation.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Construction activities for the purpose of pipeline river crossing, and wetland systems will result in the excavation of trenches within the ***wetland systems*** , the **riparian zone** and ***instream habitat*** will likely result in alteration of flow regime as water may be diverted as a result of excavations. Given that the pipeline involve the river crossings which will include excavation of spoils installation of concrete encase on the riverbed to cover the pipelines and prevent it from being eroded as a result of river crossings. Therefore, earth moving activity and excavating the trench will cause sediment mobilisation that will impact on aquatic and wetland habitats either through erosion or sedimentation. Areas upstream and downstream of the weir (abstraction works) will be drained and flows will be diverted which will alter the hydrological regime. The accumulation and deposition of sediment will alter the hydrological regime (water retention and distribution patterns) and large volumes of sediment laden runoff may incise the channel through bank		➢ Minimise impervious surfaces and maximise infiltration by maintaining vegetation as far as possible to convey and hold surface runoff and provide for a slow release into the receiving environment. ➢ Reno mattresses or gabions may be required to prevent further incision in areas where the banks of channels are incised and these banks must be stabilised for the pipeline. ➢ Stormwater management measures must be implemented in order to minimise diverted flows as the result of rains and prevent the siltation and sedimentation of nearby watercourse also minimise the impacts of the disturbed areas. ➢ Concrete encase alignment at river crossings must not form a heap but be aligned with the *In-sutu* instream habitat. ➢ Best engineering construction practice of construction the OCSD spillway designed for the maximum discharge associated with 100-year recurrence interval flood.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
and bed erosion. Unstable banks may collapse and areas will be prone to wind and water erosion.		➢ The OCSD Drainage must be diverted to allow for natural drainage through the landscape.	
Deterioration of surface water quality and streamflow reduction as a result of construction activity: The preferred construction of ***new weir*** at 740 mASL will result in excavation and infill; the increased sediment loads and erosion potential; the diversion of flows the reduction in water quality. Construction at abstraction work and pipeline river crossings will result in: Potential for increased sediments to enter the system through surface water dispersion causing siltation and other water pollution; Water pollution as a result of dispersing of water from dewatering process from the coffer dams; Water pollution as a result of hydrocarbon spills from construction machinery during excavation for weir and river crossings. Sediment laden runoff will alter the hydrological regime, water quality (turbidity) and the watercourse characteristics.	**Very High (65)** **SP = (M + D + S) × P** **SP = (5 + 5+ 3) × 5** **SP = 65**	➢ Excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow periods. The activities within watercourse must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, the clearing and excavation activities must be put on hold. In this regard, the contractor must be aware of weather forecasts. It is recommended to undertake majority of the construction activities during the drier months. ➢ Pre-development site hydrology (i.e., runoff, infiltration, interception, evapotranspiration, groundwater recharge, and stream baseflow) must be preserved as far as possible. ➢ Prevent pollutants from entering drainage lines in amounts that exceed the systems' natural ability to assimilate the pollutants and provide the desired functions.	**Negligible (10)** **SP = (M + D + S) × P** **SP = (2+ 1 + 2) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Construction vehicles and earth moving machinery within and in close proximity to watercourses will result in hydrocarbons reaching the channel through surface runoff causing contamination. Pollution of rivers ecosystems on the site and possibly also downstream, due to the mishandling of hazardous substances and/or improper maintenance of machinery during construction (e.g. oil and diesel leaks and spills). Depending on the properties of the pipe, it may cause corrosion or other impacts that alter water quality or constituents in water. Concrete encase pouring may also leach into water cause potential surface water contamination.		➢ Construct and maintain earth berm to prevent flooding and sedimentation during construction. ➢ Sediment barriers (e.g.: silt fences/sandbags/hay bales) must be installed immediately downstream of active work areas (including soil stockpiles) as necessary to trap any excessive sediments generated during construction. ➢ Temporary pumping sump must be designed to achieve optimum hydraulic performance. ➢ Create a coffer dam at watercourse crossing to protect the area from possible silt contaminated runoff. ➢ The de-watering process from the coffer dams must involve piping the water directly to the active channel downstream of the site as, or if, required. ➢ Minimise influence on downstream flow regime when diverting and impeding flow (cofferdams, earth berms etc). ➢ Implementing of a stormwater control/management plan with effective stormwater controls within all riparian at	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		abstraction work and throughout all rivers crossing. ➢ Make use of gabions along the pipeline within the riverbanks to prevent erosion as a result of loose banks due to excavation. ➢ Place topsoil of disturbed areas along the pipeline riverbanks and revegetated immediately, to prevent run-off and siltation. ➢ No construction machinery must be operated directly into the water, except where coffer dam is in place. The use of construction machinery must be limited only to riverbanks, only if necessary. ➢ Use of coffer dams to prevent concrete spills into the watercourse. ➢ Stockpiles must not be more than 2m in height, and stored at least 32m away from the watercourse. ➢ Machinery must be parked at least 32m away from the watercourse and only parked on the designated bunded areas and dip trays must be placed under the machinery, when not used to capture any possible hazardous substance leaks.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ ECO must be appointed to oversee construction activities. ➢ ECO to Conduct water quality monitoring (baseline and during construction) at suitable up and downstream sites ➢ After completion of a new weir demolish old weir to promote connectivity and improve hydrological flows.	
Ground water contamination as a result of construction activity: The uncontrolled construction activities may have potential for leaks of hazardous substances from equipment on site. Such hazardous substances have the potential to enter the soil and watercourses . Cement used in mortar lining may also see into the soil or runoff into watercourses and cause potential subsurface and groundwater contamination.	**High** **(52)** **SP = (M + D + S) × P** **SP = (5 + 4 + 4) × 4** **SP = 52**	➢ Suitable storage facilities for handling and storage of oils, paints, grease, fuels, chemicals, and any hazardous materials to be used; must be provided to prevent the migration of spillage into the ground and possible ingress into the groundwater regime. ➢ Implement protocols and emergency responses for accidental leakages or release of contaminants into environment. ➢ Machinery must be parked on the designated bunded areas and dip trays must be placed under the machinery, when not used to capture any possible oil leaks.	**Negligible** **(8)** **SP = (M + D + S) × P** **SP = (4+ 2 + 2) × 1** **SP = 8**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Vehicle maintenance must not take place on site unless a specific bunded area is constructed for such a purpose. ➢ Hazardous storage and refueling areas must be bunded prior to their use on site during the construction period following the appropriate SANS codes. The bund wall should be high enough to contain at least 110% of any stored volume. The surface of the bunded surface should be graded to the centre so that spillage may be collected and satisfactorily disposed of. ➢ All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site. Portable clean-up kits must be available on site to undertake immediate clean-up, should a spill occur. ➢ Contaminated water containing fuel, oil or other hazardous substances must never be released into the environment. It must be	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		disposed of at a registered hazardous landfill site.	
Soil management and soil erosion due to loss of vegetation cover: Erosion and degradation of habitats is likely to occur due to poor construction process during clearing of vegetation, topsoil removal and excavation works at riverbanks and instream habitat at pipeline river crossings as well as pipeline route. Therefore, excavation at riverbanks and instream is considered highly sensitive as it may result in stream sedimentation. Furthermore, the disturbed soils are prone to surface run-off. Increased soil erosion due to site clearance and incorrect storm water management measures.	**High** **(60)** **SP = (M + D + S) × P** **SP = (5 + 5 + 2) × 5** **SP = 60**	➢ During site preparation, topsoil and subsoil are to be stripped separately from each other and must be stored separately, away from spoil, for use post-construction. ➢ Vegetation clearing must be undertaken in a phased approach to avoid loose soils and erosion and ideally should take place in the dry period. Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts. It is recommended to undertake majority of the construction activities during the drier months. ➢ Vegetation clearance along the pipeline route must be kept as minimal as possible to areas as demarcated by the project plans and to make use of natural erosion suppressors such as good grassland cover. Rehabilitation	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		to begin immediately and not only when construction ends. ➢ All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of hay-bales, sandbags and/or silt fences aligned along the contours and spaced at regular intervals (e.g. every 2m) to break the energy of surface flows. ➢ No work within sensitive riparian area must be carried out during the wet period or peak flow conditions. ➢ Make use of gabions along the pipelines within the river banks, to prevent erosion as a result of loose banks caused by excavations. ➢ Regular maintenance of any sediment control dams must be undertaken during the construction / establishment period to ensure that these structures continue to function appropriately. ➢ Wherever possible, existing vegetation cover on the development site should be maintained during the construction phase.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes which will not be developed. ➢ If re-vegetation of exposed surfaces cannot be established immediately due to phasing issues, temporary erosion and sediment control measures must be maintained until such a time that re-vegetation can commence. ➢ Excavated material must be stockpiled along the trench within the working servitude for later backfilling and must not be more than 2m in height. ➢ Excavations must not be left open for extended periods and must not be undertaken until such time that all required materials are available on-site, to facilitate immediate laying of the construction of subsurface infrastructure. ➢ All temporary erosion and sediment control measures must be monitored for the duration of the construction phase and repaired immediately when damaged. All temporary erosion and sediment control structures must	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		only be removed once vegetation cover has successfully recolonised the affected areas. ➢ After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gullies must be filled-in with appropriate material and silt fences or fascine work must be established along the gulley for additional protection until vegetation has re-colonised the rehabilitated area. ➢ ECO must be appointed to oversee construction activities and to ensure environmental legal compliance.	
Soil erosion and geological degradation. Erosion and/or sedimentation of onsite and downstream rivers as a result of long-term channel dimension and material (hardening) modification at abstraction works (new weir) and pipeline river crossing sites. The *in-situ* material erodibility is considered to be moderate at the river crossing, owing to the proposed excavation works. The uncontrolled construction activities will likely exacerbate erosion	**High** **(55)** **SP = (M + D + S) × P** **SP = (5 + 5 + 1) × 5** **SP = 55**	➢ Best practice pipeline river crossing design and construction practices to be followed to provide good drainage and prevent erosion. ➢ Excavation for the pipeline river crossing that is carried out within the riparian zones must be limited to the development area as approved by project plans/site layouts. Also to be carried out in a manner to promote stable development of the site.	**Negligible** **(10)** **SP = (M + D + S) × P** **SP = (3 + 1 + 1) × 2** **SP = 10**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
and geological degradation. Therefore, excavation at riparian zones is considered highly sensitive as it is prone to erosion due to run-off and sedimentation from wet period. Also the exposed riverbanks are prone to erosion during peak flow events.		➢ Several slope stabilizing measures can be implemented for construction (the nature and design of which to be assessed and determined by responsible engineer) ➢ Modifying the slope geometry by reducing the slope angle, removing weight from the slope head, increasing weight at the slope toe and/or constructing of benches or berms. ➢ Constructing walls or other retaining elements (reinforced earth walls, gabion walls). ➢ Surface protection measures including wire meshes, geotextiles and using plant cover to help reinforce the ground surface of slopes, which were excavated in soils. ➢ Use suitable stabilisation structures to prevent erosion and select appropriate crossing points (geotechnical findings, sensitivity of riparian and in-stream habitat). ➢ Modifying the slope geometry by reducing the slope angle, removing weight from the slope head, increasing weight at the slope toe and/or constructing of benches or berms.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ It is recommended that excavations be carried out along the guidelines given in SANS 10400-G (current version). ➢ Excavation at riparian zones should not be undertaken during wet (rainy) periods or peak flow period. ➢ Construct storm water system and make provision for erosion protection. ➢ Excavations must not be left open for a long duration and must not be undertaken until such time that all required materials are available on-site. ➢ Density control of placed fill material should be undertaken at regular intervals during fill construction. ➢ After every rainfall event, the contractor must check the site for erosion damage and immediately repair any damage identified. ➢ Sediment barriers (gabions) must be installed in areas sensitive to erosion such as slopes, and actively eroding riverbanks.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Disturbance of Burial Grounds and Graves: Uncontrolled construction activities for pipeline projects are likely to unearth unmarked graves. It must be noted that the project is within a settlement and within a rural area. Moreover, there is evidence of isolated family grave sites within the study area. This must be considered within the Specon bypass project corridor	**Medium-High (48)** **SP = (M + D + S) × P** **SP = (5 + 5 + 2) × 4** **SP = 48**	➢ Excavation for the pipeline upgrade must be limited only to existing pipeline servitudes and development area, as approved by project plans and layouts. ➢ Engagement with the households adjacent to pipeline route for assistance in identifying all unmarked graves that could be on the section of pipeline route; designs to be reviewed to prevent intrusion into grave sites, such as deviations to avoid graves and 30m buffer marked as “No-Go” areas. ➢ Construction vehicles must only use the approved access roads. All construction machinery must be parked at designated areas. ➢ Monitoring must take place during site clearance for possible infant and still-born burials and implement the Chance Finds Procedure (CFP) if any such finds are uncovered. ➢ If any human remains, graves, archaeological and historical residues are discovered, the Limpopo Heritage Agency must be immediately informed. The National Heritage	**Negligible (5)** **SP = (M + D + S) × P** **SP (3 + 1 + 1) × 1** **SP = 5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		Resources Act, No 25 of 1999. requires that operations should cease immediately, pending an evaluation by the relevant heritage authorities.	
Loss of archaeological and paleontological resources: Uncontrolled construction activities could result in disturbance of surfaces and/or sub-surfaces which would be destroyed, damaged, altered, or removed from its original position of archaeological and paleontological material or objects. Furthermore, the excavations at the riverbanks (riparian zone) as results of pipeline river crossing as well as excavation for Specon Bypass pipeline route could uncover the following: stone foundations; ash middens associated with the farmsteads and homesteads that can contain bone, glass and clay ceramics; ash; metal objects such as spoons, knives, tools and other artefacts. However, there are no archaeological sites within the project site.	**Low** **(24)** **SP = (M + D + S) × P** **SP = (5 + 5 + 2) × 2** **SP = 24**	➢ Excavation for the bulk pipeline upgrade at riparian zone and along the pipeline route must only be limited to the development area as approved by project plans ➢ Measures must be taken to avoid any geological structure from being eroded and collapsing, and in the process causing loss of archaeological and paleontological resources. ➢ Regular Archaeological Watching Briefs should be carried out during construction in case any chance findings are made. ➢ Should any artefact or heritage resource be encountered, the contractor is advised to stop the operation immediately, and inform the ECO who must refer the matter to the Limpopo Heritage Agency.	**Negligible** **(5)** **SP = (M + D + S) × P** **SP = (3 + 1 + 1) × 1** **SP = 5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Destruction of heritage resources: Uncontrolled excavation works, particularly within the riparian zones and the rural settlement are most likely to cause disturbance or destruction of non-renewable heritage resources. However, there are no evidence of heritage resources within the locality of the project site.	**Medium** **(33)** **SP = (M + D + S) × P** **SP = (5 + 4 + 2) × 3** **SP = 33**	➢ Excavation for the bulk pipeline upgrade at the riparian zones and along the pipeline route must only be limited to the development area as approved by project plans. ➢ Whenever possible, all heritage sites identified during this study with High Significance must be preserved in-situ by designing the development footprints in such a way that a buffer area of at least 50m is kept clear between any development footprints and construction activities and these heritage sites. In cases where the preservation of such sites and buffer areas are not possible, site-specific mitigation measures would be required. ➢ A CFP should be implemented where possible heritage finds are uncovered/ discovered. ➢ Should any artefact or heritage resource be encountered, the contractor is advised to stop the operation immediately, report to the ECO who must refer the matter to Limpopo Heritage Agency. A heritage practitioner / archaeologist must be engaged in the event that any possible heritage resources or artefacts are identified.	**Negligible** **(5)** **SP = (M + D + S) × P** **SP = (3 + 1 + 1) × 1** **SP =5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Air pollution, dust and emissions: Dust could be generated during construction as a result of, rock blasting, earthworks and stockpiles for the weir upgrading construction. The major dust sources could emanate from the movement of vehicles on access road transporting material and equipment to the working areas. Furthermore, transportation and storage of fine sand, spoils and cement could result in dust. Emissions from construction vehicles and heavy machinery, especially those poorly maintained will result in air pollution.	**Medium** **(36)** **SP = (M + D + S) × P** **SP = (5 + 1 + 3) × 4** **SP = 36**	➢ Apply dust suppression to exposed soil and stockpiles. All transported and stored fine product must be covered to prevent spills and being blown by wind. ➢ Excavated material is to be stockpiled along the trench within the working servitude for later backfilling, of not more than 1.5m in height. ➢ Limit on-site vehicle speed to 40 km/h or lower according to driving conditions. ➢ All fine products must be covered during transportation. ➢ Minimise gas emission through regular servicing of construction vehicles and heavy equipment to meet minimum emission requirements.	**Negligible** **(7)** **SP = (M + D + S) × P** **SP = (3 + 1 + 3) × 1** **SP = 7**
Aesthetic / visual Impact: The viewshed area and zone of visual influence for the proposed bulk pipeline upgrade is considered ***"low visibility"*** as it can be visible from a small area around the project site (<1km radius), as this project involves underlaid infrastructure. However, during the construction phase, residents who live in close proximity to or overlook the	**Very Low** **(12)** **SP = (M + D + S) × P** **SP = (3 + 1 + 2) × 2** **SP = 12**	➢ Concentrate the construction activity and temporary infrastructure in a designated place. In this regard the site camp, must be constructed close enough to the construction area to avoid high visibility of construction activities. ➢ The contractor should maintain good housekeeping on-site to minimise waste generation and avoid litter.	**Negligible** **(4)** **SP = (M + D + S) × P** **SP = (1+ 1 + 2) × 1** **SP = 4**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
proposed project site will experience a change in their existing views as residents will have a view of the construction site characterized by exposed earth and machinery.		➢ Dust suppression is important to reduce the visibility of the development. ➢ Excavated material (not more than 2m in height) is to be stockpiled along the trench within the working servitude for later backfilling. ➢ Avoid the use of floodlights at site camp. Also, the light must not face the neighboring homesteads and oncoming traffic on the rural access roads. ➢ The clearance must be minimal, and only to a corridor as approved by the project plans and layouts.	
Noise pollution: The main sources of noise associated with the proposed construction activities include the following: rock blasting, construction activities and equipment delivery. Construction activities are likely to be confined to daytime and the noise levels will only affect the adjacent areas for a relatively short period of time.	**Medium (40)** **SP = (M + D + S) × P** **SP = (5 + 1 + 2) × 5** **SP = 40**	➢ In recognition of the inherently noisy and temporary nature of construction activities, work may only be undertaken during specify standard construction hours during which the usual fixed noise limits do not apply. ➢ Ensure that operating hours as determined by the EA are adhered to. Where work hours are not defined, construction work must be limited to daylight hours.	**Very Low (15)** **SP = (M + D + S) × P** **SP = (2+ 1 + 2) × 3** **SP = 15**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ All vehicles and machinery must be maintained in accordance with manufacturer's specifications to avoid excessive noise. ➢ Water trucks will be required to suppress dust by spraying water on affected areas producing dust. This will likely be required daily in the drier months or during dry periods.	
Traffic impact: Uncontrolled construction for the bulk pipeline upgrade would, likely disturb traffic, as a result of pipeline road crossings, and trucks transporting materials turning from the main road to access the site, vice versa. In addition, there will also be an increase in construction vehicles in and around the proposed site. However, it will be of temporary duration as it will only last for the duration of the construction phase of the project. Local community members (especially children) and livestock (cattle, goats), could be exposed due the movement of vehicles and equipment into and out of the project sites	**Medium** **(40)** **SP = (M + D + S) × P** **SP = (5 + 1 + 2) × 5** **SP = 40**	➢ Identify and delineate the existing multiple access points to the pipeline routes. These access routes must form an integral part of site layouts which must be communicated to the project team including delivery crew. ➢ The material hauling route must be demarcated. No construction trucks, trucks transporting material and equipment will be allowed to pass through the residential areas where there are restrictions in terms of the axle load permitted on the road. ➢ It is highly recommended that where there are no existing access road, or access road pass through residential areas, the construction access must follow the servitude of existing pipeline route. Progressive site clearance for	**Very Low** **(16)** **SP= (M + D + S) × P** **SP= (3 + 1 + 2) × 2** **SP =16**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		the pipeline and access route will be achieved through the following: ○ Site engineer will set out pipeline route and level control for excavation works. This will be along the existing pipeline route servitude and increase the servitude to accommodate the new pipeline. ○ The tractor excavator/bulldozer will strip the topsoil and set it aside for later reinstatement or soiling of batters as required. ○ The cleared area will form an area for a pipeline route and for access to reach further working areas of pipeline route and making provision for maintenance roads within the pipeline servitude. ○ In order to construct a pipeline, staging areas and storage yards are cleared, strategically located along the planned right-of-way. ➢ Appropriate temporary signage, traffic control signals, delineators and message boards,	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		must be used for traffic accommodation in the work zone and truck turning points, and this signage shall be visible by motorists and pedestrians. ➢ Allow for the accommodation of traffic during excavation for pipeline route road crossing. ➢ Along the road reserve all clearance and excavation must be done in accordance with DoT standards. All road crossings must be done according to DoT standards. At the tar or main road crossings, where possible, the pipe jacking must be done, to avoid disturbance to existing road and minimise the impact on the traffic; ➢ Establish and maintain strict speed limits where the road conditions dictate, vehicles must be driven slower and with an awareness of potential risks. ➢ Limit on-site vehicle speed to 40 km/h or lower due to driving conditions.	
Waste emanating from construction activities: Uncontrolled waste generated from construction activities such as: general, health care and	**Medium-High (50)** **SP = (M + D + S) × P**	➢ Educate of workers on pollution prevention practices. Training programmes must provide information on material handling and spill	**Negligible (8)** **SP = (M + D + S) × P**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
hazardous wastes are likely from construction activities.	**SP = (5 + 2 + 3) × 5** **SP = 50**	prevention and response, separation and recycling of waste. ➢ Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface and must be protected from the ingress and egress of stormwater. ➢ Have sufficient and separate bins for general, medical and hazardous waste disposal by implementing the Integrated Waste Management approach: segregation of waste into separate bins and clearly marked for each waste type. ➢ Refuse must be removed regularly to licensed landfill sites. ➢ Hazardous waste must be stored in a secured waste receptacle and disposed of at a registered waste disposal site. ➢ Adequate sanitary facilities and ablutions on the project site must be provided for all personnel throughout the project area. ➢ All waste manifest and disposal certificates must be kept on record	**SP = (2 + 1 + 1) × 2** **SP = 8**

Table 25: Operation/Maintenance Phase Impact Mitigation

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Impact on flow regime within wetland systems, riparian habitat , river crossings, abstraction works and OCSD: The construction corridor at river crossings involve infilling of concrete encase on the riverbed to cover the pipeline and prevent it from being eroded as a result of stream crossing. This could result in stream flow reduction, and inundation.	**Medium-High (50)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 5** **SP = 50**	➢ Concrete encase alignment must not form a heap but be aligned with the In-sutu instream habitat. ➢ Regular inspection at the weir vicinity and river crossings for evidence of sediment and debris build-up during wet season and dry season, alternatively after heavy rainfall, or peak flow conditions.	**Negligible (10)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 1** **SP =10**
Deterioration of surface water quality and streamflow reduction during operation period: Misuse and mismanagement, and poor refurbishments of Olifantspoort WTW leading to failures and ineffective treatment. Will result in Alteration to physico-chemical constituents in water. Poor monitoring and management of Operation of alternative Olifantspoort weir and new off-channel storage dam will result in aalteration to hydrological regime. Alteration to watercourse characteristics. fragmentation of biota.	**Medium-High (50)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 5** **SP = 50**	➢ Do not abstract more water than the approved allocation indicated in the water use license. ➢ Install an automatic measuring gauge to monitor water abstraction. ➢ Regular monitoring of water volumes and quality must be undertaken on a regular basis. ➢ Regular monitoring of treated water at Olifantspoort WTW must be undertaken. No treated water may be discharged into watercourses. The sludge lagoons must be monitored and no leakages into wetland may occur and any detection of seepage must be remedied immediately. ➢ The new dam must allow for natural drainage through the landscape.	**Negligible (10)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 1** **SP =10**

Poor monitoring and management of ooperation of upgraded Olifantspoort weir will result in Alteration to hydrological regime. Alteration to watercourse characteristics.		➢ The OCSD must be regularly inspected for siltation, storage capacity and any leakages. The weir must promote natural flows and allow for connectivity in the river. ➢ Ongoing water quality and biomonitoring should be implemented during operation. ➢ The weir must promote natural flows and allow for connectivity in the river.	
Soil erosion and geological degradation: Uncontrolled construction activities and poor storm water designs could lead to weathering of river banks in cut-face at sloping areas , in the process resulting in run-off and erosion during high precipitation and peak flow period. Also, a burst or leaking pipe at elevated areas, will cause water to flush down the slope gradient, in the process resulting in run-off and erosion.	**Medium-High (50)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 5** **SP = 50**	➢ It is important that the location and extent of the watercourses in the vicinity of project activities be incorporated into all formal maintenance and repair plans for the project. ➢ Construct storm water system and make provision for erosion protection ➢ Installation of gabion baskets and mattresses, energy dissipaters and grass lined drains ➢ Stormwater management through regular inspection for evidence of sediment and debris build-up during wet season. ➢ Adequate maintenance measures need to be implemented immediately when pipeline issues and failures are identified. ➢ Maintenance vehicles must use the existing access route. ➢ Adequate rehabilitation and maintenance measures, to be applied to areas susceptible to erosion along the pipeline route.	**Negligible (10)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 1** **SP =10**

Vegetation clearance during maintenance Uncontrolled maintenance could result in extensive vegetation cover removal. Disturbance to ecological processes due to altered habitat and disturbance to natural movements/processes. Loss of flora and fauna habitat due to operational activities.	**Medium-High** **(40)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 4** **SP = 40**	➢ All vehicles must use the existing access roads. ➢ Clearly demarcate the pipeline servitude ➢ Clearance during pipeline maintenance must be within the existing pipeline servitude ➢ Exposed soils must be vegetated as soon as possible in order not to impede surface runoff and inhibit erosion of the surface soils.	**Negligible** **(6)** **SP = (M + D + S) × P** **SP = (3 + 2 + 1) × 1** **SP = 6**
Alien Invasive Plant Species Infestation of alien invasive plant species within the pipeline servitude can occur when vegetation is cleared or IAP seeds are spread unknowingly. This could contribute to the spread of veld fires.	**Medium-High** **(40)** **SP = (M + D + S) × P** **SP = (5 + 3 + 2) × 4** **SP = 40**	➢ In terms of management, alien invasive plant control must be practiced on an on-going basis in line with the requirements of Section 2(2) and Section 3 (2) the National Environmental Management: Biodiversity Act (NEM:BA), which obligates the landowner/developer to control IAPs on their property. ➢ Progressively, remove alien plant species within the pipeline servitude. ➢ Establish and maintain an IAPs management programme.	**Negligible** **(6)** **SP = (M + D + S) × P** **SP = (3 + 2 + 1) × 1** **SP = 6**
Overall Mean significance (All Phases): Nature of a project without mitigation	**High** **(55)**	Nature of a project post mitigation	**Very-Low** **(13)**

15 CUMULATIVE IMPACT ASSESSMENT AND MITIGATION MEASURES

In terms of the EIA Regulations, the cumulative impact is considered from the holistic point of view. It means that the impacts of an activity are considered from the past, present and foreseeable future, together with the impact of activities associated with that activity. The activity itself may not be significant, but when combined with the existing and reasonably foreseeable impacts eventuating from similar or diverse activities may result in a significant change. “Cumulative impacts can be additive, synergistic, time crowding, neutralizing and space crowding” (DEAT, 2004b;14).

It is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

Table 26: Criteria for Cumulative Impacts

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

Table 27: Prioritisation Factor (Cumulative Impacts)

Impact Description	Alternative	Phase	Cumulative Impact	Irreplaceable Loss
Biodiversity (flora): Habitat fragmentation, loss of natural vegetation and introduction of invasive alien plant species (IAPS)	A, B, C & D	Construction + maintenance	2	1
Biodiversity (flora): Loss of plant species of conservation concern (SCC)	A, B, C & D	Construction + maintenance	2	1
Biodiversity (fauna) Loss of animal species of conservation concern (SCC)	A, B, C & D	Construction + maintenance	2	1
Impact on terrestrial surface water resource (rivers, wetlands)	A, B, C & D	Construction + maintenance	3	1
Impact on ground water resource (Oil spillages & Ground water contamination)	A, B, C & D	Construction + maintenance	1	1
Erosion, slits and compaction.	A, B, C & D	Construction + maintenance	3	1
Impact on Air Pollution: Dust from construction areas and emissions from vehicles and equipment.	A, B, C & D	Construction + maintenance	1	1
Waste (General, Hazardous Waste and HCW)	A, B, C & D	Construction + maintenance	1	1
Loss of Heritage Resources, fossils and Paleontological resources	A, B, C & D	Construction + maintenance	1	2
Visual Impact	A, B, C & D	Construction + maintenance	1	1
Socio-economic Impact	A, B, C & D	Construction + maintenance	3+	1
Impact on Traffic	A, B, C & D	Construction + maintenance	1	1
Noise Pollution	A, B, C & D	Construction + maintenance	1	1
Impacts on existing services (properties or utility infrastructure)	A, B, C & D	Construction + maintenance	1	1

Table 28: Description of Cumulative Impacts

Impact	Impact Level	Description	Mitigation
Loss of indigenous vegetation during construction	Medium (2)	Destruction of indigenous flora and potential loss of vegetation during construction along the existing pipeline route, with already disturbed vegetation. Construction will result in degradation of indigenous vegetation and remaining fragmentation of sensitive plant communities such as 'Critically Endangered' grassland (Woodbush Granite Grassland) including wetlands habitat. Moreover, the pipeline construction will also take place within Sekhukhune Plains Bushveld 'Vulnerable', currently eroded with extensive grazing and degraded as a result of illegal dumping sites.	• Re-routing 1.3 km pipeline between 6.0 to 8.0 km section of Ebenezer to Rustfontein Reservoir pipeline within Haenertsburg village pipeline, to avoid the environmentally sensitive 'Critically Endangered' grassland area (Woodbush Granite Grassland) within Haenertsburg Nature Reserve. The pipeline will be re-routed along areas that have been previously disturbed along the timber plantation boundary and behind Haenertsburg Cemetery. • The construction corridors must be demarcated and vegetation clearing as well as topsoil removal must be limited to demarcated corridor. • The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the river crossings (riparian zones), wetlands, and *Woodbush Granite Grassland* habitat. The servitude must include the trench, one-way running track, topsoil stockpile corridor and subsoil stockpile corridor. All areas of

Impact	Impact Level	Description	Mitigation
			watercourses outside this servitude must be considered no-go areas. • For the rest of the sections of pipeline route, the site clearance for the constriction corridor, including provision of access road, must not be more 15m width. • Install buffers through visible pegging with construction barricade to restrict development from encroaching the sensitive environment. • Only the approved existing access roads must be used, and vehicles must not traverse virgin land.
Disturbance of terrestrial species habitat as a result of construction activities	Medium (2)	Uncontrolled construction activities may result in vegetation clearance and result in the permanent loss of indigenous and various plant SCC and may also result in the loss of habitat and permanent loss of unidentified animal SCC. Burrowing and roosting sites may be destroyed.	• The pipeline route within the demarcated CBA and ESA must be surveyed prior to construction for identification of plant SCC. • Establish buffer by means of visible construction barricades to section off plant SCC and declare it a no-go area. • The construction corridors must be surveyed for potential habitats such as burrowing and roosting site. • During site preparation, special care must be taken during the clearing of the works

Impact	Impact Level	Description	Mitigation
			area in order to minimize damage or disturbance of roosting and nesting sites. • The project area within the construction corridors must be surveyed for potential animal SCC prior to construction in order to locate, capture and relocate any animal SCC. • All construction activities must take place within an area demarcated for the development.
Encroachment of Invasive Alien Plant Species	Medium (2)	Encroachment, proliferation and spread of weeds and alien invasive plant species are mainly associated with clearance of vegetation. Overtime, IAP may disperse and proliferate into riparian and wetland habitat and alter the hydrology of the watercourses.	• Prevent large scale clearance, and only clear the areas as demarcated by the approved project plans. All bare surfaces across the construction site must be checked for IAPs every two weeks and IAPs removed by hand pulling/uprooting and adequately disposed. • The control and eradication of a listed invasive species must be carried out during and post construction within the project site. • IAPs (listed in this study) can be removed manually or with the help of simple tools. This entails damaging or removing the plant by physical action.

Impact	Impact Level	Description	Mitigation
			• IAPs removal and management plan must be compiled and implemented onsite.
Potential loss of wetland and riparian zone habitat services and function.	High (3)	The infield watercourse delineation confirmed the presence of 35 wetland systems that fell within the regulated area. Of the wetland systems identified, only 13 were identified to be at risk as a result of falling within the development footprint or these systems were located in close proximity to the proposed upgrade activities. Expanded / more intense edge impacts could occur as a result of deterioration in vegetation quality and cover and the potential for increased alien invasive plant invasion due to disturbance causing activities taking place within or near the wetlands and riparian zones.	• The project site servitude must be clearly demarcated to avoid unnecessary large-scale disturbances to adjacent areas. • The alternatives provided must be explored to prevent intrusion into wetlands. • A pipeline construction corridor must not be more than 10m width for construction within the vicinity of wetland systems, including riparian zone. The servitude must include the trench, one-way running track, topsoil stockpile corridor and subsoil stockpile corridor. All areas of watercourses outside this servitude must be considered no-go areas. • Remain within development footprint, outside of wetlands. Install a ***28m buffer*** for CVB wetlands; a ***26m buffer*** for UVB wetlands; a ***25m buffer*** for seepage wetlands; and 20m buffer for dams to restrict development from encroaching into the wetland systems. The buffer must be in a form of pegs and construction barricades.

Impact	Impact Level	Description	Mitigation
			• The monitoring plan must be developed in order to quantify the impact on the watercourses. • Where necessary as determined by the ECO the wetlands offset the impacted wetlands.
Alteration of flow regimes and fluvial systems, and streamflow reduction.	High (3)	The construction will result in alteration of hydrological and geomorphological processes within wetlands and river systems. Construction activities for the purpose of pipeline river crossing, and wetland systems will result in the excavation of trenches within the wetland systems , the riparian zone and instream habitat will likely result in alteration of flow regime as water may be diverted as a result of excavations. Sediment laden runoff will alter the hydrological regime, water quality (turbidity) and the watercourse characteristics.	• Excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow periods. The activities within watercourse must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, the clearing and excavation activities must be put on hold. In this regard, the contractor must be aware of weather forecasts. It is recommended to undertake majority of the construction activities during the drier months. • Pre-development site hydrology (i.e., runoff, infiltration, interception, evapotranspiration, groundwater recharge, and stream baseflow) must be preserved as far as possible. • Minimise impervious surfaces and maximise infiltration by maintaining

Impact	Impact Level	Description	Mitigation
		The accumulation and deposition of sediment will alter the hydrological regime (water retention and distribution patterns) and large volumes of sediment laden runoff may incise the channel through bank and bed erosion. Unstable banks may collapse and areas will be prone to wind and water erosion. The temporarily reduced riverine ecological connectivity during the construction of the new weir, abstraction works and pipelines river crossings. The preferred construction of new weir at 740 mASL approximately 100m downstream of existing weir, will result in excavation and infill; the increased sediment loads and erosion potential; the diversion of flows the as well as flow reduction.	vegetation as far as possible to convey and hold surface runoff and provide for a slow release into the receiving environment. • Excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow periods. • Stormwater management measures must be implemented in order to minimise diverted flows as the result of rains and prevent the siltation and sedimentation of nearby watercourse also minimise the impacts of the disturbed areas. • Temporary pumping sump must be designed to achieve optimum hydraulic performance. • No construction of an artificial channel outside of the watercourse habitats for water diversion purposes will be permitted. Therefore, the de-watering process from the coffer dams should involve piping the water directly to the active channel downstream of the site as, or if, required. • If it is necessary that the flows require diversion in order for the work to be carried out, the flows must be returned to their

Impact	Impact Level	Description	Mitigation
			original pathways and velocities post establishment. • Sediment barriers must be installed in areas sensitive to erosion to prevent stream siltation. • Sediment barriers (e.g.: silt fences/sandbags/hay bales) must be installed immediately downstream of active work areas (including soil stockpiles) as necessary to trap any excessive sediments generated during construction. • Prevent pollutants from entering drainage lines in amounts that exceed the systems' natural ability to assimilate the pollutants and provide the desired functions. • Construct and maintain earth berm to prevent flooding and sedimentation during construction. • Create a coffer dam at watercourse crossing to protect the area from possible silt contaminated runoff. • After completion of a new weir demolish old weir to promote connectivity and improve hydrological flows.

Impact	Impact Level	Description	Mitigation
Soil erosion and geological degradation The uncontrolled construction activities will likely exacerbate erosion and geological degradation.	High (3)	Excavation at the riverbanks within the site locality for the purpose of bulk pipeline river crossing could result in run-off erosion and is likely to further exacerbate erosion.	• Construct storm water system and make provision for erosion protection. • Vegetation clearance should be kept to a minimal in areas demarcated by the project plans; make use of natural erosion suppressors such as good grassland cover. • No work within sensitive riparian zones must be carried out during wet period or peak flow season. • It is recommended that excavations be carried out along the guidelines given in SANS 10400-G (current version). • After every rainfall event, the contractor must check the site for erosion damage and immediately repair any damage identified. • Sediment barriers (gabions) must be installed in areas sensitive to erosion such as slopes, and actively eroding riverbanks.

15.1 Cumulative Impact Environmental Statement

The environmental assessment included an analysis of 14 key environmental aspects for potential cumulative impacts, three (3) of these are considered to have high (-) cumulative impacts with a low irreplaceable loss. Three of environmental aspects were considered to have medium (-) cumulative impacts with a low irreplaceable loss. Eight (8) of environmental aspects were considered to have low (-) cumulative impact with a low irreplaceable loss. One environmental aspect was considered to have a high positive cumulative impact.

The negative cumulative impacts could be experienced through vegetation clearance along the existing pipeline route, as well as upgrading of Olifantspoort abstraction works. The key impacts in this regard are linked to: Potential loss of wetland and riparian zone habitat; Loss of indigenous vegetation; alteration of flow regimes, fluvial systems and stream flow reduction; and Encroachment of Alien Invasive Species. However, based on impact assessment the EAP is of a view that environmental authorisation be granted, as many mitigation measures has been proposed for this development in aspect of working within wetland, riparian zone, and instream habitat as well as alternatives the *Woodbush Granite Grassland* as well as existing infrastructure. The mitigation to avoid and minimise the cumulative impacts also consider the buffer determination and explicitly describe the construction corridors within sensitive environment and along the rest of pipeline route. The applicant will be required to offset the wetlands where works take place within a heavily impacted through adherence to rehabilitation plan.

16 SPECIALIST STUDIES IDENTIFIED

There were eight specialist studies undertaken for this EIA, namely:

- Terrestrial Biodiversity Impact Assessment
- Aquatic Ecological Impact Assessment
- Hydrological Impact Assessment
- Wetland Delineation Impact Assessment
- Paleontological (Archaeological and Cultural Heritage) Impact Assessment
- Geotechnical Assessment
- Agricultural Impact Assessment

- Seismicity Assessment (Probabilistic Seismic Hazard Analysis)

Environmental Screening Tool on the site and surrounding is recognized on the following themes:

Table 29: Overall Summary of Area Environmental Sensitivity

Sensitivity	Sensitivity Theme
Very High	• Terrestrial Biodiversity Theme • Aquatic Biodiversity Theme • Defence Theme • Paleontology Theme • Archaeological and Cultural Heritage Theme • Civil Aviation Theme
High	• Agriculture Theme • Animal Species Theme
Medium	• Plant Species Theme
Low Sensitivity	

16.1 Compliance Statement for Civil Aviation and Defence Theme

The compliance statement for civil aviation and defence theme is attached as (***Appendix I***). These statements were compiled by a specialist who has investigated the project area during field assessments.

16.1.1 Civil Aviation Theme

According to the Screening Tool, the proposed project within the locality of the OCSD, Olifantspoort WTW (PS1) to Specon pipeline, Specon to PS2 pipeline, PS2 Witkos Reservoir pipeline, Witkos Reservoir to PS3 pipeline, Palmietfontein Reservoirs to OSA164, Ebenezer to Rustfontein reservoirs, Pipeline B from Chamber GB73 to the Mankweng reservoir off-take have '*High Sensitivity*' for a Civil Aviation Theme. The pipeline from OSA 164 to Krugersburg reservoirs has a '*Very High Sensitivity'.*

Findings from the field investigation concluded that no civil obstacles or aerodromes were identified to be at risk along the proposed development footprint despite the desktop analysis identifying high to very high sensitivities. It must be noted that a majority of the proposed

upgrades occur along the existing pipeline route with only minor deviations to avoid sensitive areas. Most of the pipeline will be underground with only some sections aboveground and therefore, there are no additional civil theme impacts anticipated.

It must be noted that the Pietersburg Civil Aerodrome was located north-east of the proposed activities along the OSA164 to Krugersburg pipeline route, approximately 0.38 km away. The pipeline route occurred alongside the R71 and therefore does not impact on this aerodrome region.

16.1.2 Defence Theme

According to the Screening Tool, the proposed project within the locality of the PS2 Witkos Reservoir pipeline has a '*Medium -High Sensitivity'* for a defence theme. The Witkos Reservoir to PS3 pipeline, Palmietfontein Reservoir pipeline, Palmietfontein Reservoirs to OSA164 pipeline, Ebenezer to Rustfontein reservoirs pipeline have 'High Sensitivity'. The OSA 164 to Krugersburg reservoirs pipeline, and Pipeline B from Chamber GB73 to the Mankweng reservoir off-take have '*Very High Sensitivity'*.

No military themes were identified to be at risk during the field investigations and therefore the proposed activities will not pose a risk on any military themes. Furthermore, most of the pipeline route will feature below ground and no overhead infrastructure is anticipated that could likely interfere with military operations.

16.2 Summary of Motivation for Exclusion of Other Specialist Studies

Environmental Screening Tool has identified studies outlined in ***Table 30*** below.

Table 30: Specialist Studies Identified by Environmental Screening Tool

Specialist Study	Motivation for Exclusion of Specialist Study
Landscape/Visual Impact Assessment	This study was not considered viable as the water pipeline runs parallel to the existing pipeline, with one small exception of rerouting to prevent interception of a sensitive environment. Where the pipeline is through or immediate adjacent built-up areas, the proposed new pipeline will travel through existing servitudes and will have no impact on adjacent land. The proposed development is the construction and upgrading of water conveyance and infrastructure which is considered to have no negative visual impacts, as the proposed infrastructure will be concentrated within existing footprints.
Archaeological and Cultural Heritage Impact Assessment	The Archaeological and Cultural Heritage Impact Assessment is covered in the Paleontological Impact Assessment , attached as (Appendix G5).
Palaeontology Impact Assessment	The Palaeontology Impact Assessment was conducted for this EIA.
Terrestrial Biodiversity Impact Assessment	The Terrestrial Biodiversity Impact Assessment was conducted for this EIA, attached as (Appendix G1).
Aquatic Biodiversity Impact Assessment	The Aquatic Biodiversity Impact Assessment was conducted for this EIA, attached as (Appendix G3).
Hydrology Assessment	Hydrology Impact Assessment was conducted for this EIA, attached as (Appendix G4).
Plant Species Assessment	This assessment was covered by Terrestrial Biodiversity Impact Assessment.
Animal Species Assessment	This assessment was covered by Terrestrial Biodiversity Impact Assessment.
Agricultural Impact Assessment	Agricultural Impact Assessment was conducted for this EIA, attached as (Appendix G6).
Geotechnical Assessment	Geotechnical Assessment form a basis for project design. This was conducted for this EIA, attached as (Appendix G8).
Seismicity Assessment	Seismicity Assessment was conducted for this EIA, attached as (Appendix G7).

Socio-Economic Assessment	This study was not considered viable as the project does not involve any relocation or displacement of people. The public participation has been conducted to solicit the socio-economic aspects for inclusion in the EIA.

17 SUMMARY OF FINDINGS BY SPECIALIST

The summary of findings detailed below, are derived from the: Seismicity Assessment; Geotechnical Assessment; Terrestrial Biodiversity Impact Assessment; Wetland Delineation Impact Assessment; Aquatic Ecological Impact Assessment; Hydrology Assessment; Paleontological (Archaeological and Cultural Heritage) Impact Assessment; and Agricultural Impact Assessment, and are summarised as follows:

17.1 Seismicity Assessment (Probabilistic Seismic Hazard Analysis) Findings

The probabilistic seismic hazard analysis at the OCSD site hazardous effects of seismic events, which include induced and triggered seismic events and earthquakes of tectonic origin were considered to be effects:

(a) resulting directly from a certain level of ground shaking;

(b) at the site resulting from physical surface faulting or deformations;

(c) triggered or activated by a certain level of ground shaking, such as the generation of a subsequent tsunami or landslide.

Due to incomplete and highly uncertain information on the geological features, the assessment of the seismic hazard parameters for the OCSD comes mainly from the knowledge of past seismicity. It was assumed that nine seismogenic sources determine the seismic hazard at the OCSD site: five zones of anthropogenic and four of tectonic origin.

The OCSD site is located in seismotectonic province 6 which covers the southern regions of Africa such as Mozambique, Namibia, and South Africa. This province is known for several large earthquakes, of which the most prominent is the recent Machaze earthquake of moment magnitude M_w7.0 that occurred on 22 February 2006 in Mozambique. The OCSD can be affected by the neighbourhood countries' seismicity, especially southern Mozambique, Botswana and Swaziland. Having said that there are number of known seismic events with

magnitude M_w 2.5 and stronger that occurred within 500 km from the OCSD. However, based on the available information, the seismic hazard for the OCSD site is rated as low.

The mean earthquake design levels for the OCSD site, calculated for return periods 475, 1000, 2475, 5000 and 10000 years (MCE) for $Vs30$ = 760 m/s, are as follows:

Table 31: Mean Earthquake Design Level for OCSD

Earthquake Design Level (the mean values)	Return Period (Years)	Estimated PGA
EDL_1	475	0.027 ± 0.012 g
EDL_2	1000	0.040 ± 0.016 g
EDL_3	2475	0.061 ± 0.023 g
EDL_4	5000	0.082 ± 0.030 g
EDL_4 (MCE)	10000	0.106 ± 0.038 g

17.2 Geotechnical Assessment Findings

The geotechnical assessment was incorporated in the Geophysical Surveys conducted by Applied Scientific Services and Technologies Pty, Ltd.

The geophysical data indicates that the depth to unweathered hard rock can be highly variable with vertical extent of weathered (fractured) zones in regions interpreted as faults. The area is dominated by highly weathered hard rock conditions along ridges. Hard rock conditions vary laterally as well as with depth below ground level.

17.2.1 Olifantspoort Abstraction Works and OCSD

The results from the geophysical surveys conducted at the Olifantspoort abstraction and OCSD site showed good correlation between two-dimensional P-wave velocity and soils resistivity data. Based on observed P-wave velocities measured on site, hard rock conditions can vary laterally as well as with depth below ground level. In general, the transition from softer weathered rock and soil conditions to less weathered or hard rock conditions, translate well to changes in both the velocity and resistivity data structures observed across the site. The material appears to be more sensitive to differentiating weathering patterns at depth. Therefore, it is suggest that the depth to un-weathered hard rock can be highly variable with vertical extent of weathered (fractured) zones in regions interpreted as faults.

The channel bank was seen to host a thick succession of fine sand, displaying an increase in clay content with an increase in depth (likely attributed to illuviation). The instream material is said to have a sequence of deposits, comprised of an upper fine sand (akin to the uppermost bank deposits), followed by a clay deposit, further underlain by a coarse sand. The riverbank material showed a high rate of collapse. The vicinity is deemed to have the soft excavation conditions, with Gabbro rock encountered at a depth of 2.7m below EGL, with the blanketing material is deemed to be backfill. Low values of resistivity and seismic velocity indicate a significant thickness of unconsolidated material, probably alluvium, beneath the north bank of the river. On the opposite bank, there is an inferred soil and sand layer that is no thicker than two metres, according to the seismic results. Between this layer and resistive basement, is almost ten metres of material of uncertain composition; the seismic velocity, however, associated with this layer suggests weathered rock.

The results of the geophysical survey, and corroborated by the excavations, the thickness of the unconsolidated sediment, deemed to be alluvium, is extensive across the north-western bank (appearing to exceed 5 m), with a distinct thinning out of these deposits along the south-eastern bank (as low as 2 m depth). Along the south-eastern bank, the exposures and geophysical test results indicate that the alluvium is underlain by what is deemed to be completely weathered Gabbro, transitioning into weathered Gabbro rock-mass within an increase in depth. Based on the results of the seismic survey, the degree of decomposition within the rock-mass along the north-western bank reduces rapidly with an increase in depth, compared to a more gradual transition along the south-eastern bank.

The OCSD is characterised by a combination of soil and boulders or highly fractured/jointed rock-mass with a relatively thin sequence of transported soils of clayey sand deposit, highly decomposed rock fragments underlain by Gabbronorite rock-mass. The OCSD is also attributed to the occurrence of deeply weathered and/or deeply jointed/fractured zones rendering the material to have poor excavatability 1.40 m below EGL. However, the bedrock outcrops were transitional within the underlying less jointed rock-mass and interlocking nature of the rock-mass, particularly at depth, rendering the excavatability to improve slightly for more open excavations.

17.2.2 Pipeline Routes

The section from PS1 to Specon is characterised by weathered Alluvium Gabbro bedrock, Residual Gabbro, Hillwash with localised alluvium, Residual Quartzite, Calcified and/or ferruginised residual Quartzite, Sporadic bedrock, and hardpan Calcrete. The sections of this pipeline demonstrated varying excavatability due to varying in-sutu characteristics, with other portions demonstrated good excavatability to 2.5m and some portions demonstrated poor excavatability at varying depth up to 2.5m, as a result of very dense soils, bedrock and/or hardpan Calcrete. Localised sidewall instabilities were encountered within the vicinity of the Chunies River crossings. The occurrence of groundwater seepage from a depth of 0.90am below EGL and perching of infiltrating groundwater on bedrock was observed in some section, and the groundwater predicted to perch on bedrock and/or hardpan Calcrete.

The section of pipeline route from Specon to PS2, and PS2 to Witkos is underlain by predominantly *apedal* soils; occasional bedrock outcrops also occur and the average soil thickness is approximately 0.2 m. The topsoil is predominantly underlain by weathered bedrock, with very occasional occurrences of hardpan Calcrete. This section demonstrated good excavatability at varying depth level. The section from PS2 to Witkos passes through ridge crests and upper side slopes (including the Chuniespoort passage).

This portion of pipeline between Witkos to Palmietfontein reservoir is also characterised by alluvium or colluvial deposits deemed to be hill wash and/or a pebble marker, residual Gneiss and/or completely weathered *Gneiss*, *residual Schist* and/or completely weathered Schist and/or Schist rock-mass, and dykes traversing this section of the route, with overall moderate to poor excavatability at varying depth to 2.5m due to very dense soils or localised bedrock. Infiltrating groundwater predicted to perch temporarily on bedrock or very dense soils. The section from Palmietfontein reservoirs to Krugersburg reservoirs is characterised by shallow rocky soils / hardpan *pedocretes* underlain mainly by saprolite, with localized occurrences of weathered bedrock at depth, occasional bedrock outcrops also occur with occasional occurrences of deep soils, unconsolidated material and gleying characteristics.

The section between Ebenezer to Rustfontein reservoirs is characterised by Ridge crests, mid slopes freely drained, a*pedal* soils that have undergone leaching, mainly associated with the Goudplaats Gneiss strata. The section within Ebenezer is characterised by ridge crests, mid

slopes freely drained, *apedal* soils that have undergone leaching, mainly associated with the Goudplaats Gneiss strata, with restricted depth of excavation due to slopes and predicted good excavatability to 5 m, with sidewall instabilities. Some portions in furthest areas will experience localised difficult excavation due to shallow bedrock or very dense soils but dominantly good excavation up to 2.5m depth. The Mankweng extension demonstrated mainly shallow hillwash soils occurrence across the vast majority of the site, with localized pockets of soils of variable thickness.

17.3 Terrestrial Biodiversity Impact Assessment Findings

The proposed route traverses through woodland habitat, which varies between broadleaved woodland, Acacia-dominated woodland, and open woodland with scattered small Acacia trees. The bird species within this habitat generally include a great variety of arboreal passerines, such as drongos, warblers, flycatchers, shrikes, sunbirds, waxbills and weavers, as well as arboreal non-passerines such as doves, cuckoos and woodpeckers. Many of these species make use of the thorny nature of these trees to build their nests. Acacia trees typically attract many insects and in turn attract a good diversity of typical bird species found in Acacia savanna.

No threatened plant species were observed within the project routes. However, four plant species within 'protected plants' in terms of Limpopo Environmental Management Act (LEMA) (Act No. 7 of 2003) Schedule 12, namely *Spirostachys africana* (Tamboti), Aloe *globuligemma*, Aloe *cf. marlothii* and Aloe *cryptopoda* (A. *wickensii*) were found along the pipeline routes. According to the information obtained from authorities, all provincially protected plant species found on the project site, should be preserved and incorporated into the landscaping around the project routes or plant an equivalent or greater number of new individuals elsewhere in the landscaped/rehabilitated area.

The Ebenezer Water Supply Scheme traverses through the critically endangered grassland/ecosystem, known as Woodbbush Granite Grassland. This fragment of grassland is formally protected within the Haenertsburg Nature Reserve. In order to conserve this vegetation and avoid further habitat degradation and fragmentation within this ecosystem, the pipeline should be re-routed along areas that have been previously disturbed by plantation activities or along the main road. Grasslands on site represent a significant feeding area for

many bird species. The grasslands are also a favourite foraging area for game birds such as francolins, Helmeted Guineafowl and Black-shouldered Kite. This in turn may attract raptors because of both the presence and accessibility of prey. Red Data Listed bird species such as Lanner Falcon and Martial Eagle, may often hunt in open grassland areas.

Data obtained from stakeholders indicates that the following invertebrates have been recorded in the Haenertsburg area, namely African Monarch, Acara Acraea, Blue Pansy, Gaudy Commodore, Garden Acraea, Green-banded Swallowtail, Broad-bordered Grass Yellow, Common Geranium Bronze and Gaika Blue.

Of the protected tree species that are known to occur within the region, two protected trees were recorded on or adjacent to the project route, namely Marula (*Sclerocarya birrea subsp. caffra*) and Shepherd's tree (*Boscia albitrunca*). Other protected trees such as Torchwood (*Balanites subsp. maughamii*) and Apple-leaf (*Philenoptera violacea*) could possibly be found within the project routes.

Some sections of the project site are dominated with anthropogenic activities such as illegal dumping of materials, human settlements and habitat degradation/fragmentation. Hunting by locals is prevalent in some sections of the Olifantspoort scheme route. However, sections of the OSA164-Krugersburg and Palmietfontein to OSA164 pipeline routes traverse through the Polokwane Nature Reserve, which is a home to the following mammals, namely White Rhino, Giraffe, Gemsbok, Blue Wildebeest, Sable, Tsessebe, Nyala and much more. This Reserve, however, is not well stocked with predators, but Leopard, Caracal and Brown Hyena are recorded from time to time. Nine mammal species recorded during the surveys, namely Common Mole-rat, Impala, House mouse, Bushveld Gerbil, Scrub hare, Common Duiker. Vervet Monkey, South African Spring Hare and Chacma baboon. Mammal species recorded were common and no SCC were found on site.

The Olifantspoort and Ebenezer Water Supply Schemes fall within the Wolkberg Forest Belt and Polokwane Nature Reserve IBAs. The reserve supports at least 350 bird species and is the only reserve in South Africa in which the isolated eastern population of Short-clawed Lark *Certhilauda chuana* occurs. Fifty-Four bird species were recorded during the field surveys. Species recorded were common and widespread and typical of savanna, grasslands and

forest biomes. No Red Data bird species associated within the study area were recorded, however, Red Data bird species such as Martial Eagle, Secretary bird, White-bellied Korhaan, Short-clawed Lark, African Pipit, European Roller, African Crowned Eagle and Bat Hawk are resident at the Polokwane Nature reserve. These birds can either forage and/possibly be breeding along the OSA164-Krugersburg and Palmietfontein to OSA164 pipeline routes.

Within the vegetation types found in the study area and immediate surrounding areas, four major bird micro-habitat systems were identified, namely river, grasslands, exotic plantations and woodlands. Rivers are considered important attractants to various bird species. Bird species such as herons, bishops, weavers, cisticolas and warblers will breed in the reeds growing on the banks of the rivers and will also feed on insects that live within the reeds. Many of these bird species make use of the thorny nature of the nearby acacia trees to build their nests. Water bodies represent sensitive areas because they provide habitat for a wide variety of terrestrial and aquatic species, particularly avifauna.

The trees, savanna, forest trees, water, rocks and dwellings provide suitable habitats for reptile species to occur along the project routes. Termite mounds were present on site and old termite mounds offer important refuges especially during veld fires as well as cold winter months for numerous snake species. No termite mounds were destroyed during the brief field surveys. All overturned rock material was carefully replaced in its original position. Only three reptile species were recorded during the surveys, namely Distant's Ground Agama (*Agama aculeata distanti*), Common Variable Skink (*Trachylepis varia*) and Speckled Rock Skink (*Trachylepis punctatissima*). No reptile SCC were recorded along the project development routes. No frog species were recorded along the project routes.

Exotic plantations usually do not offer a large variation in plant communities and these trees are mostly unpalatable in their live stage for insect and game species. As a result, few insect-eating bird species will occur within these plantations. A number of nectar feeding species, such as white-eyes and sunbirds, will feed on the nectar produced by the flowers of these trees, and some birds also make nests in these trees. A few species of bird of prey, which require tall trees for nest building, have increased their ranges due to the presence of these trees. These include Black Sparrowhawks and Bat Hawks have also benefited from large *Eucalyptus* (blue gum) trees.

17.4 Wetland Habitat Functionality and Impact Assessment Findings

17.4.1 Ebenezer Pipeline Routes

The Ebenezer WSS upgrades was assessed as moderate to low risk in terms of potential impacts imposed on the wetland systems.

The infield watercourse delineation confirmed the presence of 15 watercourses that occurred along the proposed pipeline route, within the regulated area. Of these systems, three wetland systems, in the form of two CVB wetlands and one UVB wetland were identified to be at risk. All of these systems will be traversed by the proposed WSS upgrades and therefore were identified to be at direct risk of impact and required further assessment. Most of the wetland systems were identified as Channelled Valley Bottom wetlands connected to drainage lines and had been diverted and dammed to be utilised for agricultural practices and a majority of them have been confined to corridors. All of the wetland systems were identified to be moderately modified predominantly as a result of anthropogenic activities in the form of monoculture (Pine and *Eucalyptus* plantations) and developments (housing, industries and road, powerline and pipeline servitudes).

Existing impacts identified within the wetlands that affected the PES and functionality include, *inter alia*:

- Modification to the CVB wetland (W02) by the construction of a road and culvert;
- Modification to the hydrology of wetland systems through increased surface runoff from hard surfacing;
- Alteration to the wetland characteristics (W09, W10 and W11) attributed to the construction of dams and excavation/infill activities associated with the roads, powerlines and existing pipeline;
- Increased sediment inputs from vegetation clearing and increased runoff volumes from surrounding agricultural practices mainly timber production;
- Reduction in water quality from waste related activities from surrounding developments/industries and increased nutrient inputs and turbidity from agriculture; and;

- Encroachment and proliferation of IAPs resulting in alteration to vegetation composition.

17.4.2 **Olifantspoort Scheme**

The infield watercourse delineation confirmed the presence of 35 wetland systems that fell within the regulated area. Of the wetland systems identified, only 13 were identified to be at risk as a result of falling within the development footprint or these systems were located in close proximity to the proposed upgrade activities.

Although the construction which entails upgrades of infrastructure for conveying raw water, is considered a low risk. However, there are some elements that are new infrastructure that will pose additional impacts on sensitive environments. Working directly within the Olifants River and the Channelled Valley Bottom (CVB) wetland within the abstraction works area has resulted in these activities falling within a full water use license. The alternative routes proposed for the pumping main traverse a large extent of wetlands and minor habitat destruction is anticipated. With the implementation of specific mitigative measures designed by the engineer, the pipeline upgrades could be reduced to low significance post mitigation and fall within the ambit of a general authorisation (GA) as no wetlands are anticipated to be significantly altered such that functionality ceases.

Currently, the watercourses have been moderately modified as a result of agricultural practices, infrastructural developments and poor land management practices. The pipeline upgrades will mostly fall within the road reserve and previously disturbed areas which minimises the impact posed on sensitive environments. It must however be noted that new sections of pipeline are also proposed that will have more significant impacts on wetland habitat.

The specialist explored the proposed re-routing (diversions) made the following findings:

a) The PS1 to Specon bypass by the sludge lagoon will now result in direct intrusion into the wetland for approximately 317 m. This wetland is densely vegetated with *Typha capensis* and the preferred route will result in direct wetland habitat destruction and may alter the functionality of this system. The route can be redirected along the existing dirt road to avoid

intrusion into this system and therefore, this is not a preferred route from a specialist's perspective and an alternative could be explored;

b) The PS1 to Specon bypass will directly intrude into a large hillslope seepage wetland that comprises of seasonable saturation. The pipeline will expand for approximately 420 m of wetland and caution must be taken to not impede subsurface flows feeding downstream. There is poor stormwater management along this section of the residential development with stormwater concentrating towards and being directed to the wetland. This system is currently regulating flows that would otherwise run downslope at high velocities and in high volumes. This is not a preferred route from a specialist's perspective given the flow of surface and subsurface flows through this system. When working in this wetland, specific mitigative measures should be considered by the engineer to allow for natural flows through the system.

c) Although no images or KMLs of the alternatives were provided, it must be noted that adjacent to the R37 and the Chuniespoort Dam, where the PS2 to Witkos pipeline currently features, there is a large NFEPA CVB wetland will be traversed along two sections. If this is the preferred route, an alternative would be to proceed along the R34 road reserve instead of directing the pipeline away from Chuniespoort Dam. There are however no potential alternatives that would eliminate intruding into the watercourses along this route and therefore this is the preferred route in the opinion of the specialist.

Existing impacts identified within the wetlands that affected the PES and functionality include, *inter alia*:

- The extension of the weir or construction of a new weir will cut off some of this wetland which has already occurred as a result of the existing weir. The concrete slab has resulted in water spilling over on to the sand banks. If the new weir is constructed, allowance should be made for this wetland to continue functioning.
- The PS1 to Specon pipeline will traverse the hillslope seepage wetland which will traverse more than 420 m of this system. Activities through such an extent of wetland will result in wetland habitat loss and alter the functionality of this system. This system has currently been modified as a result of the residential development and surrounding agricultural practices.
- The PS1 to Specon pipeline adjacent to the Olifantspoort WTW will traverse the wetland system. Whereby the construction works may affect subsurface feeds into this

system and may reduce the extent of this wetland. This system has been modified through subsistence farming, the Olifantspoort WTW, informal roads and poor land practices.

- The PS2 to Witkos pipeline will traverse two CVB wetlands. The first CVB wetland has undergone modifications as a result of the Chuniespoort Dam, the R34 road, surrounding informal roads and surrounding housing developments. The second CVB wetland has undergone modifications as a result of poor land practices causing rill erosion as well as informal dirt roads throughout. This system will be at risk as a result of activities occurring in close proximity (10 m).
- The PS2 to Witkos pipeline will traverse the UVB wetland. The Wetland system has been modified through impeding and diverting structures upstream, road networks, and poor land practices (rill and gully erosion). A small section, at the start of this UVB wetland will be at risk of impact by the PS2 to Witkos rising main construction activities. Impacts such as increased sediment and sediment laden runoff may enter and deposit in this system.

- The PS2 to Witkos pipeline also traverse the hillslope seepage wetland. This system also contained a perched water table and therefore a depression. The landscape has been modified through poor land management practices whereby head-cut, rill and gully erosion were present. Vegetation had been stripped and areas were left bare and therefore extra caution must be given in this area to prevent further degradation during construction.
- The PS3 to Palmietfontein pipeline will traverse two hillslope seepage wetlands. The first wetland system has been modified as a result of road networks and stormwater drainage, however only a small section at the start of this system, along the fence line, will be impacted upon through excavation and infill. The second wetland system will be traversed along the middle section by the PS3 to Palmietfontein reservoir pumping main. This system has been modified through the R34 road, infrastructural developments and poor land management practices.
- The seepage dam will not be traversed by the OSA to Krugersdorp pumping main, however the pipeline occurs upstream of the wetland in close proximity (13 m) and therefore may receive sediment inputs and sediment laden runoff during construction. Caution must be given with sedimentation occurring in this system as siltation will

impact on its functionality. The section of pipeline from OSA to Krugersdorp will directly traverse the hillslope seepage system, which This system has been altered as a result of road networks, fence line, livestock grazing and damming downstream. Will also traverse the UVB wetland system which has been modified as a result of road networks, fence line, and stormwater drainage systems. The road and fence line have cut off this system reducing its extent.

17.5 Aquatic Ecological Impact Assessment Findings

17.5.1 Ebenezer Pipeline

The aquatic ecological and impact assessment identified several riverine systems that stand to be negatively impacted by the proposed development. The identified riverine systems were classified into geomorphic groups based on terrain and morphology of the rivers, within the project locality: perennial, lower foothill rivers (Greater Letaba River); non-perennial, upper foothill rivers; non-perennial, mountain streams; non-perennial, drainage lines; non-perennial; and artificial channels. The most significant watercourses to be impacted by the project is the Great Letaba that was assessed to be moderately modified (PES Class C) and high EIS. The rest of the watercourses assessed were a lot more modified (PES D and F class) and were of low EIS.

The Ebenezer to Rustfontein reservoirs pipeline crosses the Greater Letaba River, which is a perennial, mixed alluvial bedrock river between 5 and 10m wide and approximately 1m deep. The available habitat was dominated by gravel and marginal vegetation with moderate sand and stones in current. The bank vegetation was dominated almost primarily by *Cyperus dives* and *Cyperus latifolius*. The riparian vegetation comprised mainly of alien thicket including *Acacia mearnsii* and *Solanum mauritianum*. Although impacted by the Ebenezer Dam, the lowland river (ie. The Groot Letaba River) was assessed as being of 'high' EIS due to its instream habitat diversity downstream of the dam, presence of sensitive instream biota and importance as a migration route for freshwater biota. The river is also flagged as a Fish Support Area. It is important to note that the area of the river assessed in the field at the proposed pipeline crossing is not representative of the entire local and regional reach, which this EIS assessment considers.

The drainage lines lacked channelled stream beds and wetland characteristics. No clearly defined channels were evident. The beds of the drainage lines were generally well vegetated with various grass species. No aquatic biotopes were present. Artificial channels were predominantly poorly defined channels with a generally well vegetated stream bed. The primary source of water was stormwater emanating from the surrounding hardened catchments and roadways. A significant level of disturbance in the form of excavations and litter disposal were observed within these channels.

The mountain streams occurred on steeply sloping valley and presented steep embankments with V-shaped channel characteristics. The available habitat was dominated by bedrock, sand/alluvium and marginal vegetation with low presence of stones and gravel. The bank vegetation was dominated by low herbs, *Cyperus dives* and *Cyperus latifolius*. The riparian vegetation was heavily invaded by *Acacia mearnsiii* and commercial plantations. The lower foothill rivers and mountain streams were determined to be of '*low*' EIS driven largely by low instream and riparian habitat sensitivity and lack of habitat diversity for supporting aquatic biota of conservation importance. This is predominantly due to the large-scale impacts of surrounding commercial plantations and non-perennial flow regime.

The upper foothill streams occurred on gentle to moderate sloping valley bottoms. The available habitat was dominated by bedrock, sand/alluvium and marginal vegetation with low presence of stones and gravel. As with the mountain streams, the bank vegetation was dominated by *Cyperus dives* and *Cyperus latifolius*. The riparian vegetation was heavily invaded by *Acacia mearnsiii*, *Solanum mauritianum* and commercial plantations.

17.5.2 **Olifantspoort Scheme**

The locality riverine habitats identified fall into the following geomorphological classification:

- Olifants River – Perennial, Lowland River.
- Chunies River – Non-perennial, Lowland River.
- Ephemeral Lower Foothill Rivers.
- Ephemeral Mountain Streams.

The lower foothills rivers were characterised by narrow, sandy alluvial banks with a very gentle gradient. Some areas had small patches of medium to large stones within the channel. Generally, the bed of these streams were vegetated with overgrazed, short grass species which could not be identified. The riparian areas were predominantly invaded by *Acacia mearnsii*.

The mountain streams occurred in steeply sloping valleys and presented steep embankments with V-shaped channel characteristics. The available habitat was dominated by bedrock, sand/alluvium and marginal vegetation with low presence of stones and gravel. The locality of pipeline route and abstraction also traversed by several un-channelled and non-wetland watercourses were also encountered and were classified as 'drainage lines'.

The abstraction works will take place at Olifants River, which presented a wide and deep channel with generally slow flowing deep waters. Flow velocity was relatively higher immediately downstream of the weir. The biotopes were dominated by gravel and sand with moderate muddy areas. Marginal vegetation was also fairly dominant and comprised almost exclusively of *Phragmites australis*. The habitat upstream to the weir is characterised predominantly by slow-deep conditions. The riverbanks are vegetated by reeds which offer good cover/refuge for aquatic species, as well as undercut banks were also present which provides refuge during high flow periods. The riparian area downstream of the weir has been cleared thus limiting the availability of marginal vegetation. Fast-deep conditions were prevalent below the weir with scattered zones of slow-shallow environments. Habitat is more variable downstream with the occurrence of scattered islands, sections of riffles associated with the gravel and sand biotopes and slower flowing sections providing refuge for weaker swimming fish species. Generally, the reach downstream promotes the occurrence of fish species preferring faster flowing water (rheophilic species), whereas the island sections and surrounding banks promotes the occurrence of weaker swimming or more benthic species. Upstream benthic species are likely to be dominant, however the stronger swimming rheophilic species may be able to traverse the established weir.

The Olifants River system has a combined ***PES classified as C*** due to Water abstraction for residential and agricultural purposes. Bed, channel and flow modifications due to road crossings/culverts and weir, as well as proliferation of alien plants. While the

The majority of river crossings take place at the Chunies River, which is a NFEPA river. The Chunies River system has a combined ***PES classified as D*** due to significant instream and bank erosion, proliferation of alien plant species, water quality impacts due to the surrounding semi-formal residential housing, bed modifications due to cattle trampling, vegetation removal to cater for housing as well significant litter due to illegal dumping within the streams.

17.6 Surface Water Hydrology Impact Assessment Findings

The area's surface water resources that will be impacted are the Olifantspoort and Great Letaba Rivers. The surface water quality were analyse on the basis that Olifants River form an abstraction site. Therefore, the water quality of downstream and upstream of Olifantspoort abstraction works can be described as neutral (pH 6.0 - 8.5), non-saline (TDS < 450 mg/l) and moderately hard (total hardness 150 - 200 $CaCO_3$) with E. coli and total coliforms detected. The proximity of human settlements to the river sample sites as well as the presence of livestock husbandry activities, evident when the site visit was undertaken, could explain the detection of E. coli and coliforms in the samples.

17.7 Paleontological (Archaeological and Cultural Heritage) Impact Assessment Findings

The project area is predominantly agricultural, tourism attraction area, urban residential and peri-urban areas and scattered rural villages which are linked with gravel roads. Most of the proposed pipeline routes are severely degraded from existing developments such as agriculture, existing bulk water pipelines, powerlines lines, residential infrastructure, and access roads. Although the general project area has a number of archaeological sites recorded, from a contextual studies perspective, no medium to high significance archaeological, heritage landmark or monument was recorded within the corridors of the proposed pipeline routes.

The outskirts of some villages hold informal graveyards and graves. Abandoned homesteads between these villages are sometimes associated with single, isolated graves. Some of these informal graves are not decorated, unmarked and therefore are inconspicuous. Formal graveyards are easily recognisable.

The Olifantspoort Scheme pipeline routes and the servitude cut across cultural tourism sites such as the Bakone Malapa Open Air Museum and other natural reserves where the scenic

beauty plays a role in attracting leisure tourists. The museum is situated on the R37 along Chuniespoort and is reconstructed in the style used by the Sotho people. Traditional beer brewing, maize grinding, fire making, pottery making, beading and basketry demonstrations are some of the activities available to tourists. The survey also noted the existence of an Iron Age Farming Community. The site is characterized by round hut foundations marked with stones and a number of Iron Age farming community cattle kraals found represent the 'Central Cattle Pattern' (CCP).

There were two formal cemeteries which were recorded within the study area, namely the New Polokwane Cemetery with marked and unmarked graves and a cemetery located in Haenertsburg Village.

No fossils were seen during the field survey although there are good exposures of the rocks.

The project will most likely impact on some cultural heritage resources during earthmoving activities. Since the construction phase of the project will involve extensive excavations, this impact could also occur on subterranean deposits. Often heritage sites are buried beneath years of alluvial deposits and there is no practical way of determining their location. Such finds will only be evident once the earthworks and excavations begin.

17.8 Agricultural Impact Assessment Findings

Significant land use change will occur at the off-channel storage dam. The majority of the pipeline route falls under municipal or state land, except for a small portion of the pipeline in the Haenertsburg area that traverses private pine plantations.

The area is characterised by open rangeland with the exception of a few hectares near Haenertsburg where there is open grassland, forestry and commercial forestry. The entire route passes through several savannah ecosystems. The whole savannah portion of the route has a livestock carrying capacity of less than 6-8 ha per livestock unit. There was a good blend of cattle as grazers and goats as browsers.

There was no evidence of food crops being grown within the pipeline servitude. With the exception of a timber plantation at Haenertsburg, there was no evidence of industrial crops being currently grown within the servitude or near to it.

Except for the Haenertsburg area which is in the Mistbelt and has good rains and good soils, the rest of the routes are served by poor and often erratic rainfall.

A sample was taken from a Hutton Soil Profile along the route PS1- Specon to assess the soil conditions. This was done due to the fact that, although Hutton soils have a very low erosion hazard, there was in this instance severe erosion even though the land was absolutely level.

The study area within the Olifantspoort scheme indicated a very low value agricultural land that apart from providing poor quality grazing and browsing is currently put to no productive use in terms of any significant socio-economic benefits, including job creation. Whereas the section of the Ebenezer pipeline runs through a highly productive pine plantation. Additionally, the servitude is within an existing well defined and well cleared firebreak layout.

18 RECOMMENDATIONS BY SPECIALISTS FOR INCLUSION IN EA

The following are recommendation prescribed by the various specialists in respect of proposed upgrading of the Olifantspoort and Ebenezer WSS:

18.1 Recommendations by Terrestrial Biodiversity Impact Assessment Specialist

The Terrestrial Biodiversity Impact Assessment Specialist recommended the following:

a) A permit from the regional Department of Forestry, Fisheries and the Environment (DFFE) is required should there be a need to cut, disturb or destroy the two protected trees found on site, namely Marula (*Sclerocarya birrea subsp.* caffra) and Shepherd's tree (*Boscia albitrunca*). There trees must be marked and workers made aware of their presence and the legal requirements should these trees need to be disturbed.

b) All provincially protected plant species found on the project site, should be preserved and incorporated into the landscaping around the project routes or an equivalent or greater number of new individuals planted elsewhere in the landscaped/rehabilitated area. Where this proves not to be possible, a permit will be required from the Limpopo Department of Economic Development, Environment and Tourism (LEDET) should there be a need to disturb, transplant, destroy or damage the trees, before construction activities commence.

c) A walk-down survey of the approved route must be undertaken prior to the start of the construction activities in order to conduct search and rescue exercises for the protected plant species and also to assess for new densities, nests and hollows not found during the assessment and for extractions activities to take place. This is relevant in the areas that have been labelled as ecologically sensitive. At the time of the surveys, no Red Data Listed Species were observed, however as suitable habitats are present, a pre-construction faunal walk-down must be conducted to ensure that no new species are affected, and appropriate exclusion procedures should be undertaken. Should any Threatened or protected Species (TOPS) be encountered, a permit from LEDET must be obtained in order to move or translocate these species.

d) In order to conserve the fragment of critically endangered grassland/ecosystem, known as *Woodbbush Granite Grassland*, which is formally protected within the Haenertsburg Nature Reserve and avoiding further habitat degradation and fragmentation within this ecosystem, the pipeline should be re-routed along areas that have been previously disturbed by plantation activities or along the main road.

e) Newly cleared soils must be re-vegetated and stabilised as soon as construction activities have been completed.

f) Ongoing monitoring programme is required to control and/or eradicate newly emerging alien invasive plant species.

g) The rehabilitation of any disturbed areas must be given high priority.

h) Plant species used during rehabilitation should be site specific and according to the surrounding vegetation composition.

i) The development footprint must be kept to a minimum and not encroach on surrounding areas.

18.2 Recommendations by Wetland and Impact Assessment Specialist

It is the opinion of the specialist that the proposed development be granted environmental authorisation and that the WUL application for the abstraction works fall within the ambit of a full WUL. The other activities associated with water conveyance may fall within the ambit of a GA on the condition that the mitigation measures provided are implemented and that the engineer accounts for sensitive environments in their design to ensure continued functionality of the wetland systems. Most of the pipeline route is existing and previously disturbed areas have been utilised as far as possible to reduce the negative impacts imposed on sensitive

environments. The wetland systems were assessed to be moderately modified as a result of historic anthropogenic activities and therefore the objective would be to maintain these systems.

The Wetland Habitat Impact Assessment Specialist recommended the following:

a) A water use license (WUL) application must be lodged with DWS, as the wetland systems will receive direct impacts as a result of excavation/infill and wetland habitat clearing activities.

b) All demarcated buffer zones must be maintained, and all of the following determined buffer for the construction and operation phase of the project, must be adhered to:

    - 28m buffer for CVB wetlands;
    - 26m buffer for UVB wetlands;
    - 25m buffer for seepage wetlands; and
    - 20m buffer for dams.

c) Develop a Stormwater Management in order to accurately account for both stormwater quality and quantity in the project upgrade process.

d) The location of the site camp and access roads must be determined and the site details must be submitted to the CA.

e) Site camp may not encroach into water courses.

f) An ECO must be appointed to monitor compliance to the EA, WUL and the EMPr

g) All mitigation measures detailed in the Wetland Habitat Functionality and Impact Assessment Report must be complied with.

h) Existing pre-disturbed areas (powerline and pipeline servitudes) must be utilised as much as possible.

i) The project footprint must remain within the pipeline servitude, except the site camp and laydown areas.

j) Structures or works that alter water courses must:

    - be structurally stable;
    - not induce sedimentation, erosion or flooding;

- not cause a detrimental change in quantity, velocity, pattern, timing, water level, and assurance of flow in a watercourse;
- not cause a detrimental change in the quality of the water in the watercourse;
- not cause a detrimental change in the stability or geomorphological structure of the watercourse;
- not create nuisance conditions or health or safety incidents.

18.3 Recommendations by Aquatic Ecological Impact Assessment Specialist

The Aquatic Ecological Impact Assessment Specialist recommended the following:

a) Where applicable, the expansion of the footprint of any upgrade / refurbishment activities at the Water Treatment Plant and the Ebenezer high-lift pump station must occur outside of all riparian and wetland areas and a 30m buffer zone to these watercourses. If buffer encroachment is required, this must be well-substantiated and a minimum 5m buffer should be maintained.

b) The crossing of watercourses will be inevitable. The objective of alignment design is then to ensure that the number of watercourse pipeline crossings are minimised.

c) Where pipeline watercourses crossings are required, the following mitigation measures should be implemented:

   - All pipeline crossings must be aligned and designed to minimise the extent of river habitat directly impacted by construction activities. In this regard the pipeline crossings should be aligned at right angles to flow and along existing or planned areas / corridors of disturbance.
   - Pipeline crossings should be established underground. However, where there are opportunities to attach to / include pipelines in the existing crossing structures, these must be investigated.
   - The pipelines and associated embedment material must be established below the base level and suitably secured in place to ensure that it does not act as barrier or impediment to flow (in the case of the pipeline). Ideally, pipelines should be placed above the watercourse via a pipe bridge where it does not impede the flow or characteristics of the stream bed and channel. Pipe bridges must be designed such that pipes are suspended sufficiently high above the channel bed and above the high-water mark so as not to interfere with natural flow regimes

and such that pipes do not act as traps for debris and sediment transported through the channel. Pipe bridge piers should be placed on either side of the watercourse for smaller rivers/streams and not to be placed within the channel bed. Piers should be placed with enough distance up the bank (preferably on the top of the upper bank) and not below the water mark/bank full level. The viability of this should be further investigated by the project engineer.

- Buried pipelines within watercourses will need to be protected to minimise the risk of damage or leakage. This means typically encasing the pipe in concrete or other suitable resistant material.

d) Out of the two proposed options for the Olifants weir (i.e. either upgrade or new construction), it is recommended that the weir be upgraded, and that provision of a fish way be made to maintain the basic functioning of this stretch of the Olifants River. In addition the Olifants EWR requirements should be adhered to.

18.4 Recommendations by Hydrological Impact Assessment Specialist

The Surface Water Hydrology Impact Assessment Specialist recommended the following:

a) Stormwater from upslope of the stripped areas must be diverted around these areas to limit the amount of stormwater flowing over these areas.

b) The timing of the topsoil stripping must be optimised to limit the time between stripping and construction/deposition.

c) Where areas need to be left stripped for long periods, contouring and ripping must be implemented to reduce run-off and erosion.

d) To prevent or minimise impacts on surface hydrology, the detailed recommendations (corrective actions) in the specialist report must be implemented

18.5 Recommendations by the Paleontological (Archaeological and Cultural Heritage Impact) Assessment Specialist

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the soils or ancient igneous rocks. Most of the project lies on non-fossiliferous rocks. Only the Lebowakagomo Pump station is on highly sensitive rocks of the Timeball Hill Formation but no fossils were found. There is a very small chance that trace fossils such as stromatolites or microbial structures may occur in

the shales or quartzites of the *Palaeoarchaean* Timeball Hill Formation (Pretoria Group, Transvaal Supergroup) so a Fossil Chance Find Protocol should be added to the EMPr. If trace fossils are found by the contractor, environmental officer, or other responsible person once excavations for the Lebowakgomo Pump Station have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample. The impact on the palaeontological heritage would be low, therefore as far as the palaeontology is concerned, the project should be authorised.

The Paleontological (Archaeological and Cultural Heritage Impact) Assessment Specialist recommended the following:

a) Whenever possible, all heritage sites identified during this study with High Significance must be preserved *in-situ* by designing the development footprints in such a way that a buffer area of at least 50m is kept clear between any development footprint and construction activities and these heritage sites. In cases where the preservation of such sites and buffer areas are not possible, site-specific mitigation measures must be implemented in consultation with the specialist or the ECO.

b) If any heritage resources listed in Appendix E are found during site preparation, construction, rehabilitation and any related activities to this pipeline upgrade project, work must cease, and such finds must be reported to the Limpopo Heritage Agency.

c) A Fossil Chance Find Protocol must be included in the EMPr.

d) If trace fossils are found during excavations, these should be rescued and a palaeontologist called to assess and collect a representative sample.

18.6 Recommendations by Geotechnical Assessment Specialist

The Geotechnical Assessment Specialist recommended the following:

a) It is recommended that all earthworks be carried out in accordance with standards put forward in SANS 10400-G (current version):

b) According to the SANS 2001-DP1:2008 Earthworks for buried pipelines and prefabricated culverts- specification, ideal selected ***granular material*** used in pipe bedding, i.e.: the material on which the pipe will rest, must be granular, freely draining, non-cohesive material composed of particles with a diameter not exceeding 20 mm, and a measured Compactibility Factor not exceeding 0.3.

c) According to the SANS 2001-DP1:2008 Earthworks for buried pipelines and prefabricated culverts- specification, ideal selected ***fill material***, i.e.: the material blanketing the pipe after placement, is defined as material exhibiting a Plasticity Index (PI) not exceeding 6, that is free from vegetation, lumps and granular material with a diameter exceeding 30 mm.

d) According to the SANS 2001-DP1:2008 Earthworks for buried pipelines and prefabricated culverts- specification, ideal ***fine granular material***, is comprised of material exhibiting a particle diameter ranging between 0.15 and 6.70 mm.

e) According to the SANS 2001-DP1:2008 Earthworks for buried pipelines and prefabricated culverts- specification:

- Except as specified as below, the material excavated from trenches may be used as backfill in all areas, provided that it contains little or no organic material, that it excludes stone of average dimension exceeding 150 mm, and that it can be placed without significant voids and so compacted as to avoid significant settlement.
- Material containing more than 10% of rock or hard fragments that are retained on a sieve of nominal aperture size 50 mm, and material containing large clay lumps that do not break up under the action of compaction equipment being used, will be regarded as unsuitable for use in backfilling.
- In areas subject to loads from road traffic and in other areas specified in the project specification, backfill shall have a PI not exceeding 12 and a minimum CBR of 15% at specified density if the backfill is to be placed in the upper 150 mm of the subgrade, and a minimum CBR of 7% if the backfill is to be placed lower in the subgrade.

f) Several slope stabilizing measures can be implemented for construction (the nature and design of which to be assessed and determined by responsible engineer):

- Modifying the slope geometry by reducing the slope angle, removing weight from the slope head, increasing weight at the slope toe and/or constructing of benches or berms.
- Constructing walls or other retaining elements (reinforced earth walls, gabion walls).

- Surface protection measures including wire meshes, geotextiles and using plant cover to help reinforce the ground surface of slopes, which were excavated in soils.

18.7 Recommendations by Agricultural Impact Assessment Specialist

Due to the marginal or temporary negative impacts on agriculture, no specific recommendations were made by the specialist.

18.8 Recommendations by Seismicity (Probabilistic Seismic Hazard Analysis) Assessment Specialist

The Seismicity (Probabilistic Seismic Hazard Analysis) Assessment Specialist recommended the following:

a) Regulatory guidelines and standards must be adopted for the safe seismic design of engineering structures.

19 RECOMMENDATIONS FROM THE EAP FOR INCLUSION IN EA

Having considered all issues, included the views of interested and affected parties and the inputs from the specialist reports, the EAP recommends the authorization of this application.

19.1 Pre-Construction Phase

The following conditions and mitigation measures are recommended and should be considered in any authorization that may be granted by the CA in respect of the application.

a) Appoint an ECO to monitor and enforce compliance of all EA, permit and licence conditions during construction.

b) Appoint a Social Facilitator to manage project social aspects.

c) A detailed method statement for working within the watercourse must be compiled by the contractor prior to the commencement of the project. This method statement must be approved by the aquatic ecologist or ECO and relevant workers to be inducted on the method statement.

d) The route design must incorporate a pipeline construction corridor of not more than 10m width for construction corridor within the vicinity of *Woodbush Granite Grassland*, river

crossings and wetlands, and of not more than 15m width on the remainder sections of pipeline.

e) Design must re-route the pipeline and divert the pipeline not to cross directly into the wetland habitat provided that no limitation due to certain developments adjacent to the pipeline route within a watercourse. It is highly recommended where the pipeline route intercept the wetland to be re-aligned along the road reserve. Remain within development footprint, outside of wetlands.

f) The proposed pipeline must be constructed outside of any other remnant of Woodbush Granite Grassland. Develop a site layout design for re-routing 1.3 km of pipeline between the 6.0 to 8.0 km section of the Ebenezer to Rustfontein Reservoir pipeline within the Haenertsburg Village pipeline, to avoid the environmentally sensitive 'Critically Endangered' grassland (Woodbush Granite Grassland) found in the Haenertsburg Nature Reserve. The pipeline must be re-routed along areas that have been previously disturbed along the timber plantation boundary and behind Haenertsburg Cemetery.

g) A plan to actively rehabilitate the construction area during construction and post-construction needs to be developed before construction commences

h) A traffic management plan must be developed for the construction phase which must include implementation of relevant Safety Management Systems during the construction, demarcated material hauling routes.

i) Identify and delineate the existing multiple access points to the pipeline routes. These access route must form an integral part of site layouts which must be communicated to the project team including the delivery crew.

j) Identify all existing underneath, surface and overhead infrastructure, such as water pipeline, telecommunication lines, powerlines which will likely impact on the pipeline construction, and submit the wayleaves to relevant authorities to approve the design and construction method. These designs will be required to secure the relevant wayleaves.

k) The design along the road reserve and for road crossing must be done in accordance with DoT standards. These designs will be required to secure wayleaves with regards to: pipelines situated within the road reserve; specifications and requirements for pipe crossings underneath the roads, which will be constructed by means of pipe jacking and specification, requirements, and preferences with regards to access to the respective roads.

l) A design to provide for re-routing of pipelines where there is a likelihood of interception with heritage resource and grave sites, based on the Heritage Specialist's recommendations.

m) The design for pipeline route with rural settlement and urban periphery must be informed by Social Facilitator who must engage with the households adjacent to pipeline route for assistance in identifying all unmarked graves that could be on the pipeline route. Route selection must prevent encroachments into grave sites, by designs that will incorporate a minimum 30m buffer from graves. Such areas must be marked as "No-Go" areas.

n) Pre-construction environmental induction and training must be conducted for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of the importance of protected plants/trees, medicinal plants, wildlife, heritage resources, waste management and social issues. The training must also include EA, permit and license conditions and the EMPr. Records of all training undertaken must be kept on file for audit purposes.

19.2 During Construction Phase

a) All excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow periods. The activities within watercourse must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, the clearing and excavation activities must be put on hold. In this regard, the contractor must be aware of weather forecasts. It is recommended to undertake majority of the construction activities during the drier months.

b) The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the river crossings (riparian zones), wetlands, and Woodbush Granite Grassland habitat. Clearance must not be more than 15m width on the remainder sections of pipeline, where there are no sensitive environment. The servitude must include the trench, one-way running track, topsoil stockpile corridor and subsoil stockpile corridor. All areas of watercourses outside this servitude must be considered no-go areas. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

c) Install a 28m buffer for CVB wetlands; a 26m buffer for UVB wetlands; a 25m buffer for seepage wetlands; and 20m buffer for dams to restrict development from encroaching into the wetland systems. The buffer must be in a form of pegs and construction

barricades. The demarcations are to remain until construction and rehabilitation is complete. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

d) The detailed method statement for working within the watercourse must be included in the contract document and implemented by the contractor.

e) The site layout plan must be complied with respect to the deviations indicated;

f) The corridor widths specified must be adhered to, especially where the Woodbush Granite Grassland is present. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

g) Implement the Traffic Management Plan during all phases of the project, including that no construction trucks, trucks transporting material and equipment are permitted to pass through the residential areas where there are restrictions in terms of the axle load permitted on these roads.

h) Maintain the 30m buffer for heritage resources (graves) and not disturb any heritage resource especially unmarked graves.

i) After every rainfall event, the contractor must check the site for erosion damage and immediately repair any damage identified.

j) Where coffer dams are used to divert flow for construction purposes, these structures must be temporary in nature and be removed from the river immediately after the required construction has been completed. The de-watering process from the coffer dams should involve piping the water directly to the active channel downstream of the site as, or if, required.

k) The weir must promote natural flows and allow for connectivity in the river. After completion of new weir demolish the old weir while the coffer dam upstream are still intact.

l) The construction of an artificial channel outside of the watercourse habitats for water diversion purposes is not permitted, as this could lead to unnecessary erosion and instream siltation.

m) The ECO to conduct weekly environmental compliance monitoring and monthly water quality monitoring. More regular water quality monitoring is required when major construction activity takes place directly within a watercourse, such as exaction of riverbanks, instream habitat disturbance, de-watering of coffer dams, and pouring of concrete;

n) Implement the rehabilitation plan and only use indigenous plants which are able to establish easily and will need less maintenance for re-vegetation during rehabilitation; the phase must be monitored and records kept

o) Ensure compliance to EA, permit and license conditions.

p) If there is any need to review or amend the environmental conditions/requirements, this must be done in consultation with and approval of the ECO.

19.3 During Operation/ Maintenance

a) Develop and implement the stormwater management plan throughout the operational and maintenance phases.

b) Ongoing maintenance and monitoring regimes must be implemented for the stormwater management system, such as regular inspection at the weir vicinity and river crossings for evidence of sediment and debris build-up during wet season and dry season, alternatively after heavy rainfall, or peak flow conditions.

c) The OCSD must be regularly inspected for siltation, storage capacity and any leakages. The weir must promote natural flows and allow for connectivity in the river.

d) Exposed soils must be vegetated as soon as possible in order not to impede surface runoff and inhibit erosion of the surface soils.

e) Establish and maintain an IAPs management programme.

20 ENVIRONMEMTAL IMPACT STATEMENT

The Mopani and Sekhukhune Regions of the Limpopo Province is currently experiencing serious water availability challenges. The lack of water is negatively affecting economic growth and the standards of living of the local communities, as well as exacerbating poverty in the area. To address this dire need, the Lepelle Northern Water (SOC) has proposed the upgrading of the Olifantspoort and Ebenezer WSS. Given the scope of work, the nature of the impacts and that some activities fall under the EIA Listing Notices of NEMA, this EIA is undertaken to support the application of the environmental authorization of the proposed upgrading of the Olifantspoort and Ebenezer WSS.

The environmental assessment included an analysis of 33 key environmental aspects of the project that were relevant to the area and the activity, as well as eight specialist studies and engagements with relevant stakeholders.

Of the 33 environmental aspects analysed, the significance was determined as follows: three (3) were rated very high, 12 were rated high, 9 were rated medium-high, 6 were rated medium, 2 were rated low and 1 very low. With the implementation of suitable mitigation measures, 20 of the impacts were rated negligible and 11 were rated very low.

All specialist studies concluded that the upgrading of the Olifantspoort and Ebenezer WSS will have little to minor impacts on environment. Notwithstanding, these impacts can be mitigated with appropriate measure detailed in and EMPr and implemented during the project.

21 CONCLUSION AND EAP OPINION

In view of the foregoing, it is evident that the proposed upgrading of the Olifantspoort and Ebenezer WSS will not have significant negative environmental impacts in the area.

The decision to grant or refuse authorisation in terms of Section 24 of NEMA must be made in the light of the provisions of the Principles of NEMA. Section 24 provides that, in order to give effect to the general objectives of integrated environmental management laid down in NEMA, the potential impact on the environment of listed activities must be considered, investigated, assessed, and reported on to the CA charged by the Act with deciding applications for EA. A Draft Environmental Impact Assessment Report (DEIR) concerning the impact of the proposed upgrading of the Olifantspoort and Ebenezer WSS including mitigation actions, has been compiled and submitted as prescribed and authorisation may only be issued after consideration of such report.

The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed upgrading of the Olifantspoort and Ebenezer WSS to proceed, provided that the recommended mitigation and management measures are implemented. Although, the Aquatic Impact Assessment recommend that the existing weir be upgraded as opposed to construction of new weir. The EAP recommend that the new weir be constructed and existing weir which has unknown structural integrity be demolished after completion of new weir, to allow for hydrological flow of river, and the new weir to have fishways constructed as per best weir design standard. The construction of new weir will have the similar impact to upgrading of existing weir, whereas the existing weir has an undetermined lifespan which will require regular maintenance.

We submit that the environmental process undertaken thus far complies with these requirements and that this report covers the full suite of potential environmental issues related to the proposed upgrading of the Olifantspoort and Ebenezer WSS. All potential impacts have been evaluated and responded to by either complete avoidance where possible, or by recommendation of the most appropriate and feasible mitigation measures. The preferred/mitigated development proposal presented in this report is responsive to the integrated results of the assessment of potential impacts made by the various specialists on the project team.

Based on comparative evaluation of the various alternatives, including the No-Go option, it is evident that the *'Alternative A: Routing Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Location Alternative'* can meet the required objections to offset the No-Go option (subject to the implementation of recommended development mitigation measures). This DEIR, therefore, concludes that the assessment of the impact for the proposed upgrading of the Olifantspoort and Ebenezer WSS has been considered via a balanced approach, mindful of cumulative impacts, need and desirability of the project and that the overall negative environmental impacts will be of very low significance. As such, the project can be considered for environmental authorisation subject to implementation of the recommended phased approach and specialist mitigation measures as specified in the EMPr.

Written submissions must be addressed to:

Emvelo Quality and Environmental Consultant (Pty) Ltd
Attention: **Ms Phumzile Lembede**
PO Box 101672, Meerensee, 3901
Tel: 035 789 0632 Fax: 086 577 5220
Email: info@emveloconsultants.co.za / dumisani@emveloconsultants.co.za

22 REFERENCES

Climate-Data.Org. Tzaneen Climate. [Access at: https://en.climate-data.org/africa/south-africa/limpopo/tzaneen-15345/ Dated 17 February 2022].

Climate-Data.Org. Polokwane Climate. [Access at: https://en.climate-data.org/africa/south-africa/limpopo/polokwane-3759/ Dated 17 February 2022].

DEAT (2002) Stakeholder Engagement, Integrated Environmental Management, Information Series 3, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT (2002) Specialist Studies, Information Series 4, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT (2004a) Criteria for determining Alternatives in EIA, Integrated Environmental Management, Information Series 11, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT (2004b) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT (2006) Guideline 5: Assessment of Alternatives and Impacts in support of the Environmental Impact Assessment Regulations, 2006.Integrated Environmental Management Guideline Series, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEA&DP (2007), NEMA EIA Regulations Guideline & Information Document Series Guideline on Alternatives (September 2007).

FitzPatrick Institute of African Ornithology (2019). BirdPix Virtual Museum. Summary information for locus 2329DC and 2429BC Quarter Degree Square. [Accessed at: http://vmus.adu.org.za/vm_summary.php Dated: 29 March 2022].

FitzPatrick Institute of African Ornithology (2019). FrogMAP Virtual Museum. Summary information for locus 2329DD, 2329CD, 2329 DC and 2429BC Quarter Degree Square. [Accessed at: http://vmus.adu.org.za/?vm=FrogMAP . Dated 29 March 2022].

FitzPatrick Institute of African Ornithology (2019). LepiMAP Virtual Museum. Summary information for locus 2329DD, 2329CD, 2329 DC and 2429BC Quarter Degree Square. [Accessed at: http://vmus.adu.org.za/?vm=FrogMAP . Dated 29 March 2022].

FitzPatrick Institute of African Ornithology (2019). MammalMAP Virtual Museum. Summary information for locus 2329DD, 2329CD, 2329 DC and 2429BC Quarter Degree Square . [Accessed at: http://vmus.adu.org.za/?vm=MammalMAP . Dated 29 March 2022].

FitzPatrick Institute of African Ornithology (2019). ReptileMAP Virtual Museum. Summary information for locus 2329DD, 2329CD, 2329 DC and 2429BC Quarter Degree Square. [Accessed at: http://vmus.adu.org.za/?vm=ReptileMAP . Dated 29 March 2022].

Limpopo Department of Economic Development, Environment and Tourism (LEDET). 2016. Mopani District Bioregional Plan. October 2016.

Limpopo Department of Economic Development, Environment and Tourism (LEDET). 2019. Capricorn District Bioregional Plan. February 2019.

Mucina, L. and Rutherford, M.C. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute. Pretoria. pp 349-436.

National Planning Commission (NPC). 2012. Our Future – make it work. National Development Plan 2030. Pretoria, South Africa.

BROWNLIE, S., 2005. Guideline for involving biodiversity specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 C. Republic of South Africa, Provincial Government of

the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

CSIR, 2011. Wetland Freshwater Priority Areas (FEPAs). Council for Scientific and Industrial Research (CSIR), Pretoria.

DEAT (2002) Stakeholder Engagement, Integrated Environmental Management, Information Series 3, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT (2002) Specialist Studies, Information Series 4, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

DEAT (2010a). Companion to the EIA Regulations 2010. Integrated Environmental Management Guideline Series 5. Department of Environmental Affairs (DEA), Pretoria.

DEAT (2010b). Public Participation 2010. Integrated Environmental Management Guideline Series 7. Department of Environmental Affairs (DEA), Pretoria.

Driver, M. (2005). South Africa's first National Spatial Biodiversity Assessment: conservation news. Veld & Flora 91, 11.

Mucina, L. and Rutherford, M.C. (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute. Pretoria. pp 349-436.

National Environmental Management Act (107 of 1998): EIA Regulation 2017, as Amended . Department of Environmental Affairs. Pretoria.

Richardson, D.M., Bond, W.J., Dean, W.R.J., Higgins, S.I., Midgley, G., Milton, S.J., Powrie, L.W., Rutherford, M.C., Samways, M., Schulze, R., 2000. Invasive alien species and global change: a South African perspective. Invasive species in a changing world, 303-349.

SANBI, 2017. Red List of South African Plants version 2017.1.

Todd S. 2013. Drennan solar energy facility: fauna and flora specialist report for impact assessment. (Accessed from: https://www.erm.com/ . Dated 14 August 2018)

APPENDICES

APPENDIX A. EAP DECLARATION OF INFORMATION

APPENDIX B. ENVIRONMENTAL MANAGEMENT PLAN(EMPR)

APPENDIX C. LOCALITY MAP AND CASE IMAGES

C-1: Locality & Sensitivity Map

C-2: Other Maps

C-3: Case Images

APPENDIX D. SITE LAYOUT

APPENDIX E. PUBLIC PARTICIPATION PROCESS

E-1: Onsite notices & List of Co-ordinates

E-2: Newspaper advert

E-3: PP Plan and Register of I&APs

E-4: Proof of Document Circulations

E-5: I&APs Comments and Responses

E-6: Background Information Document (BID)

E-7: Minutes of the Pre-Application meeting

E-8: Acknowledgement Letters

E-9 : Acceptance of Scoping Report

APPENDIX F. EAP'S CV(S)

APPENDIX G. SPECIALIST STUDIES

G-1: Terrestrial Biodiversity Impact Assessment

G-2: Wetland Habitat Impact Assessment

G-3:Aquatic Ecological Impact Assessment

G-4: Surface Water Hydrology Assessment

G-5: Paleontological, Cultural Heritage Impact Assessment

G-6: Agricultural Impact Assessment

G-7: Seismicity (Probabilistic Seismic Hazard Analysis) Assessment

G-8: Geotechnical Assessment

APPENDIX H: WEB-BASED ENVIRONMENTAL SCREENING REPORTS

APPENDIX I: COMPLIANCE STATEMENTS

I-1: Civil Aviation Compliance Statement

I-2: Defence Compliance Statement