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DRAFT BASIC ASSESSMENT REPORT

EIA REF: DC27/0003/2023

The Proposed Hlabisa Full Water-borne Sanitation: Development of Hlabisa Bulk Sewer Pipelines and the New Wastewater Treatment Works, within Big Five Hlabisa Local Municipality, uMkhanyakude District, KZN

14 JULY 2023

Prepared By:
Emvelo Quality and Environmental Consultant (PTY) Ltd

Prepared For:
DLV Project Managers and Engineers

On behalf of:
uMkhanyakude District Municipality

Applicant:

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PROJECT TEAM	CLIENT CONTACT PERSON
Phumzile Lembede Dumisani Myeni	Lumka Salukazana

Overview: Assessment of impacts related to the proposed development of Hlabisa Bulk Sewer Pipeline and the New Hlabisa Wastewater Treatment Works, in order to ensure the Client's compliance with all relevant environmental legislations.

Project Team Details	
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QMS - INFORMATION

PRINCIPAL EAP	STUDY LEAD &EAP
PHUMZILE LEMBEDE	DUMISANI MYENI
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QMS-REVISION HISTORY

Revision	Revision Date	Details	Authorized	Name	Position
1	03- 07-2023	DRAFT BAR	Y	Dumisani Myeni	Study Lead Env. Scientist
2	13-07-2023	DRAFT BAR	Y	Phumzile Lembede	Principal EAP Env. Scientist

EXECUTIVE SUMMARY

Emvelo Quality and Environmental Consultant (Pty) Ltd has been appointed by DLV Project Managers and Engineers (Pty) Ltd (the Project Principal Agent), on behalf of uMkhanyakude District Municipality (the Applicant), as the independent Environmental Assessment Practitioner (EAP), to facilitate the Basic Assessment Process required in terms of the National Environmental Management Act ,1998 (Act. No. 107 of 1998) (NEMA) for this application.

The uMkhanyakude District Municipality (UKDM) is the delegated Water and Sanitation Service Authority (WSSA) for all municipalities within the district, which include the Big 5 Hlabisa Local Municipality. The UKDM has identified various areas and settlements within the district, which require sanitation upgrades to a full water-borne sanitation system. Therefore, the district proposes to construct the water-borne sanitation system within Hlabisa town and the surrounding communities.

The proposed development of Hlabisa bulk sewer pipeline and the new Hlabisa Wastewater Treatment Works (WWTW) will facilitate the formalization of existing settlement and future housing development, as the implementation of Hlabisa water-borne sanitation project will provide a formalized water-borne sanitation system for settlement and businesses.

The proposed development of Hlabisa bulk sewer pipeline and the New Hlabisa WWTW will entail the following features: Construction of a 3230m (250mmø) uPVC bulk sewer gravity main from Matshamnyama – Ward 13 to Emabhanoyini; Construction of 1120m (250mmø) uPVC bulk sewer gravity main from Emabhanoyini to the new Hlabisa WWTW; Construction of 140m (250mmø) uPVC treated effluent discharge pipeline for the new Hlabisa WWTW. Along with bulk sewer gravity and rising main they will be Intermediate and collector mains. Four pumpstations will be constructed to support the raising main. The area of approximately will be cleared for construction of WWTW which constitutes the following features: Tie15.5mX 6.5m equalization tank; 21m X 10.4m anoxic tank and 21m X 14m aeration tank; Three Sludge Maturation Ponds: Pond 1 (30m X 30m X 1.5m); Pond 2 (30m X 30m X 1.5m); Pond 3 (22m X 22m X 1.5m); Two 3.5m X 12mØ (396m^3) settling tanks. The WWTW will be designed to operate at the of capacity of 1.5 Mℓ/day(1500m^3/day). The access road of 135m length will be constructed for the purpose of easy access to the WWTW site.

The construction of the bulk sewer gravity main will results in: Construction corridor of not more than 10m width within the vicinity of stream crossings and wetlands; The 10m length pipeline crossing at Emacekeni (28° 8'59.67"S, 31°52'9.75"E); 11m length pipeline crossing at Emacekeni (28° 9'25.52"S, 31°52'5.54"E); 17m length crossing at Emabhanoyini (28° 9'24.78"S, 31°52'44.96"E), and at (28° 9'21.14"S , 31°52'53.57"E). The Gravity Main between (Entry Point: 28° 9'6.83"S, 31°52'9.83"E) and

(Exit Point: 28° 9'14.63"S, 31°52'7.65"E) at Emacekeni traverse within 32m regulated area of the NFEPA Wetland. The construction of the new Hlabisa WWTW will result in the clearance of an extent area of 1.8ha of indigenous vegetation. There are no CBAs and ESA within the project reach. Having mentioned the above site characteristics, the planned activities will result in: Excavation within the watercourses, namely the wetlands and instream habitat; Infilling within the watercourses; vegetation clearance for pipeline route (12m width construction corridor.

The NEMA Environmental Impact Assessment (EIA) Regulations (2014) as amended on 7 April 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, namely: 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 the 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 12, 19 and 27. Therefore, this application will follow a Basic ***Assessment process***, as activities in Listing Notice 1 have been triggered.

The Public Participation Process (PPP) has, to date, included: displaying onsite notices, placing of an advertisement in the Ilanga Newspaper, distribution of Background Information Documents (BIDs), and Circulation of this Draft BAR.

The preferred alternatives are '*Routing, Design/Technology, Site Layout/Location Alternatives*'. These preferred alternatives cannot be undertaken in isolation, as they assessment is integrated considering this linear development (sewer conveyance) and construction of WWTW infrastructure.

The '*Alternative A: Routing Alternatives*', favours the best engineering design practices as the route is situated within the low-lying areas, thus favours efficiency of sewer flow along the bulk sewer gravity main to the new WWTW site. The '*Routing Alternative*' for the pipeline is also consolidated with the '*Alternative B: Design Alternative*'. Due to above mentioned factors other routes were not accessed as this was considered the best design route for efficiency of water-borne sanitation system for this project. However, it is also proposed that the pipeline route should be realigned where it encroaches the sensitive environment wherever possible, as the best practice and were feasible, traversing small sections of wetland, such as within W02 (***Figure 7***) can be avoided through rerouting around the system.

The '*Alternative B: Design Alternative*' can be also linked to *'Alternative C: Technology Alternative*'. These alternatives have distinctly catered for dual sludge processing within the WWTW. The proposed '*Design and Technology Alternatives'* proposed processes are based on an extended aeration activated sludge process, without primary sedimentation and with the addition of denitrification to the process. This design is proven to be economical on the expect of electricity input and construction costs compared to a complete denitrification process which is in any case not required.

The '*Alternative C: Technology Alternative*', the excavatibility and rippability determine the use of machinery, and due to inconsistence in geological formation from *'soft to intermediate'*. Therefore, for the purpose excavation for the bulk sewer conveyance and WWTW infrastructure, these materials can be efficiently ripped by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width. A consideration can also be given to use of a tracked excavator of flywheel power exceeding 0.10kW per millimetre of tined bucket width. Where outcrops are encountered, the excavation could be 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. Where the hard rock shows some resistance to single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW, the rock blasting will be an option. However, blasting must be considered a last resort where all means of heavy ripping have failed. No blasting within the watercourse will be allowed.

On the other hand, the '*Alternative D: Site Layout Alternative*' proposes for configuration of proposed site layout/position of the proposed new Hlabisa WWTW facility. The 'Site Layout Alternatives' for the WWTW involve looking at the impact likelihood and configuration of the site positioning to mitigate the impacts. The south-eastern corner or section of the current site lies with 100m buffer overage of Hlabisa River. As a result, the 'Site Layout Alternative' proposes that WWTW should be shifted at least 80m north from the current existing position.

The 'Alternative E: Location Alternative' where the choice of the location of pipeline route is over emphasise as determined by the topography of the project area, as it is proposed that the gravity main follow the low-lying areas for efficiency of gravitating of sewer to WWTW. Also, the location of the new proposed WWTW is so strategic as it is at the lowest point of the project area, thus enable efficiency of bulk sewer gravity main. It is also important to note that the current site (existing Hlabisa WWWT) has limited space and upgrading the existing WWTW after these proposed upgrades the site cannot support any further future expansion, and the current WWTW is now at the edge encircled by growing settlements within Hlabisa.

Although, there are impact associated with these preferred alternatives, but 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. The adherence to mitigation measures will render the impacts be of temporal nature, only during construction. This will be addressed by mitigation measures discussed under (***Section 15***) and EMPr.

Six (6) discrete habitat types were delineated within the assessment area, namely, wetlands, riparian and instream habitat, scarp forest, sourveld, and transformed (which is within settlement). The proposed development site traverses through the forest, grasslands, crosses the R618 provincial road, near human settlements and streams. The existing land use of the project area and its immediate surrounding area include cultivated land (subsistence farming), forest plantations (agricultural facility) and homesteads. The summary of impacts significant during construction and operation/maintenance phase are outlined by (***Table 1***) below.

Table 1: Summarised Impacts Significance

Impact	Construction Phase		Operational Phase	
	Without Mitigation	**With Mitigation**	**Without Mitigation**	**With Mitigation**
Biodiversity (flora): Habitat fragmentation, loss of indigenous vegetation during pipeline and WWTW construction and maintenance.	Medium-High	Negligible	Medium-High	Negligible
Biodiversity (flora): Habitat fragmentation, loss of natural vegetation and introduction of invasive alien plant species (IAPS)	High	Negligible	Very High	Very low
Biodiversity (flora): Habitat fragmentation, Loss of plant species of conservation concern (SCC)	Medium	Negligible	Very low	Negligible
Biodiversity (Fauna): Disturbance to surrounding wildlife and fauna	Medium-High	Negligible	Medium	Negligible
Impact on terrestrial surface water resource: Impacts on watercourse habitat functions and services.	High	Negligible	Medium-High	Negligible
Impact on hydrological flow regime (rivers, streams, wetlands**)**	High	Negligible	High	Negligible
Impact on surface water quality (stream and river pollution)	Medium-High	Negligible	High	Very low
Impact on ground water resource (Oil spillages & Ground water contamination)	High	Negligible	Medium-High	Negligible
Geological Impacts: Erosion, run-off slits and compaction.	High	Negligible	Medium-High	Negligible
Impact on Heritage Resources: Disturbance of Burial Grounds and Graves	Medium-High	Negligible	Medium-High	Negligible
Loss of other heritage resources	Low	Negligible	Negligible	Negligible
Impact on Paleontological resources: Archaeological and fossils	Low	Negligible	Negligible	Negligible
Waste (General, Hazardous Waste)	Medium-High	Negligible	Medium-High	Negligible
Waste (Eluent Waste)	Negligible	Negligible	High	Very low

Impact on Air Pollution: Dust from construction areas and emissions from vehicles and equipment.	Medium	Negligible	Low	Very low
Socio-economic Impact	Negligible	Negligible	Negligible	Negligible
Visual Impact	Very low	Negligible	Very low	Negligible
Noise Pollution	Medium	Very low	Very low	Negligible
Impact on Traffic	Medium-High	Very low	Medium	Negligible
Impacts on existing services (properties or utility infrastructure)		Very low	Very low	Negligible

The findings of this EIA Report as well as the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Five (5) specialist studies were considered for this EIA: Terrestrial Biodiversity Impact Assessment (Appendix G1); Wetland Impact Assessment (Appendix G2); Aquatic Ecological Impact Assessment (Appendix G3); Geohydrology Impact Assessment (Appendix G4); and Geotechnical Assessment (Appendix G5). Overall, anticipated adverse impacts linked with the planned activities (Hlabisa Water-borne Sanitation) during construction and operation are expected to be of *'Low'* impact significance, provided that mitigation measures prescribed in this report, EMPr and specialist studies and other attached documents are adhered to.

The EAP and Wetland Specialist has proposed that the preferred 'Site Layout Alternative' provides for the configuration of existing WWTW site layout. The WWTW site must be shifted at least 80m-100m further north of existing position (***Figure 3***). This will prevent the WWTW infrastructure to be prone to flooding in case of extremely event, and also prevent undesirable contamination Hlabisa River lying downstream of the WWTW. Furthermore, the configuration of WWTW site layout will mean exploring the use of site such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected. Therefore, the proposed alternative site position (***Figure 3***) could meet the desirable development objectives and provide impact mitigation as the site will be shifted further north by 80-100m from current location. This will also avoid the option of wetland offsetting, as this would be the case if the current WWTW position is considered. This will be in line with accordance to GN509 of the National Water Act, 1998 (Act No. 36 of 1998), the regulated area refers to the outer edge of the 1 in 100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 metres (m) from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act). Buffer determination for watercourse habitat outside

the construction corridor but at risk of being impacted. For the new WWTW 100m buffer determination is required between Hluhluwe River and new WWTW. This means the layout must be configured such that the WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***).

The EAP has also established that the guidelines for the protection of natural forest habitat suggest that no activities or development should be considered that would destroy the forest habitats unless of strategic provincial or national importance with no feasible alternatives. Therefore, where feasible the pipeline must be re-routed along the Zululand Lebombo Scarp Forest (*FOz5*). The 15m buffer determination along the Zululand Lebombo Scarp Forest (*FOz5*) must be adhered to. Also, a 33m buffer has been applied to the high- risk wetlands and a 20m buffer to the wetlands receiving indirect impacts and at lower risk of impact. A buffer cannot be applied to wetlands W01, W04 and W05 as a result of activities taking place within them and a 20m buffer cannot be applied to wetlands W02 and W03 due to their proximity to the proposed activities. The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the stream crossing (riparian zones), and wetlands (Subtropical Alluvial Vegetation (*Aza7*) vegetation). Thus, this will minimise impact associated with trenching for installation of sewer pipeline within some of the sensitive ecosystems.

Due the nature of works which involve working within the watercourses as a result of pipeline stream and wetland (riparian) crossing it is highly recommended that the planned activities be undertaken during dry period, where the streams and river are dry and of low peak flows condition.

It must be noted that the project is within the settlement area. Moreover, there was one grave site encountered during the infield assessment at location (28° 9'21.60"S, 31°52'4.68"E) but falls outside the project corridor. The grave site was within the household. The likelihood of gravesite encroachment could be mitigated through, appointment of the Project Social Facilitator to manage project social aspects and re-route the pipeline where there is encroachment to burial sites. Social Facilitator to undertake 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. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

The EAP submit that the environmental process undertaken thus far complies with the requirements as prescribed by Appendix 1 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 proposed construction and operation of the proposed Hlabisa Water-borne Sanitation Project :Bulk sewer

pipeline and new WWTW. 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.

The EAP is of the view that the Environmental Authorization should be granted on certain conditions that are outlined in this section. After an Authorization has been granted, it is the applicants' responsibility to ensure that all recommendations outlined in this report as well as in the EMPr are properly implemented.

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LIST OF ACRONYMS

BAR	Basic Assessment Report
CFP	Chance Finds Procedure
DWS	Department of Water and Sanitation
DOT	Department of Transport
EMPr.	Environmental Management Programme
ECO	Environmental Control Officer
EDTEA	Department of Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment
HGM	Hydrogeomorphic
MSDS	Material Safety Data Sheet
NEMA	National Environmental Management Act 107 (Act 107 of 1998)
NEMPAA	National Environmental Management: Protected Areas, 2003 (Act 57 of 2003)
I&AP	Interested and Affected Parties
EAP	Environmental Assessment Practitioner
GA	General Authorisation
SCADA	Supervisory Control and Data Acquisition
SCC	Species of Conservation Concern

GLOSSARY OF ITEMS

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.

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.

BASIC ASSESSMENT: The process of collecting, organizing, analyzing, interpreting and communicating information that is relevant to the consideration of the application, in terms of Listing Notice 1 (GNR 327 and 324 of 2017) of NEMA (as amended).

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

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

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.

ENVIRONMENT: in terms of the NEMA (as amended), the "environment" means the surroundings within which humans exist and that are made up of: the land, water, and atmosphere of the earth; 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 IMPACT: the change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

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

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

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.

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.

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.

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.

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.

INDIGENOUS VEGETATION: refers to vegetation consisting of indigenous 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.

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; bbusiness 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.

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.

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.

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 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.

1 INTRODUCTION AND BACKGROUND

Emvelo Quality and Environmental Consultant (Pty) Ltd has been appointed by DLV Project Managers and Engineers (Pty) Ltd (the Project Principal Agent), on behalf of uMkhanyakude District Municipality (the Applicant), as the independent Environmental Assessment Practitioner (EAP), to facilitate the Basic Assessment Process required in terms of the National Environmental Management Act ,1998 (Act. No. 107 of 1998) (NEMA) for this application.

The uMkhanyakude District Municipality (UKDM) is the delegated Water and Sanitation Service Authority (WSSA) for all municipalities within the district, which include the Big Five Hlabisa Local Municipality. The UKDM has identified various areas and settlements within the district, which require sanitation upgrades to a full water-borne sanitation system. Therefore, the district proposes to construct the water-borne sanitation system within Hlabisa town and the surrounding communities. The proposed development of Hlabisa bulk sewer pipeline and the new Hlabisa Wastewater Treatment Works (WWTW) will facilitate the formalization of existing settlement and future housing development, as the implementation of Hlabisa water-borne sanitation project will provide a formalised water-borne sanitation system for settlement and businesses. Consequently, an environmental impact assessment (EIA) has commenced, assisting the UKDM (applicant) in identifying all potential adverse environmental consequences of the project, their extent, significance and to ensure that the environmental management requirements are adequately implemented.

In addition, the construction of bulk sewer and reticulation will see the connection of businesses, schools and households which are currently serviced by a household's septic tanks. Thereby, providing a full water-borne sanitation system that will be connected to this sewer main lines and discharge to the new Hlabisa WWTW. Moreover, it is also important to note that the safe disposal of human excreta and greywater is vitally important in the control of infectious and other communicable diseases. Therefore, the design and construction of appropriate sanitation systems is of paramount importance in contributing to the safe disposal of human excreta (Water Research Commission, 2011).

1.1 Project Team

In accordance with Appendix 1, Section 3(1)(a) of GN No. 326 (7 April 2017), this section provides an overview of Emvelo Consultant and the company's EIA experience, as well as the details and experience of the EAPs that form part of the Emvelo Consultant project team.

Table 2: Environmental Assessment Practitioners

Name	Qualification	Experience (Years)	Duties
Phumzile Lembede	B.Sc. Honours in (Environmental Management), Registered: EAP (EAPASA) & Pr. Sci. Nat. (SACNASP) in the Environmental Science Field of Practice	11	Principal EAP and Environmental Scientist
Dumisani Myeni	B.Sc. Honours in (Environmental Management), Registered: EAP (EAPASA) & Cand. Sci. Nat. (SACNASP) in the Environmental Science Field of Practice	9	Study Lead/EAP and Environmental Scientist

1.2 Report Structure

The Environmental Basic Assessment has been undertaken in accordance with the requirements of sections 24 and 24D of the National Environmental Management Act, 1998 (Act 108 of 1998) ["NEMA"] and the Environmental Impact Assessment ("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 GN R 326 in GN 40772 of 07 April 2017.

This Basic Assessment Report (BAR) is compiled with accordance to **Appendix 1** of GNR 326 (EIA Regulation (2014) as amended on 07 April 2017). A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in (***Table 3***) below.

Table 3: Basic Assessment Report Structure (Appendix 1 GNR 326)

EIA Regulation	Description – EIA Regulation (2014) as amended on 07 April 2017	Content in Basic Assessment Report Section
Appendix 1. 3.1(a):	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	• Cover page • Section 1.1. • Appendix F
Appendix 1. 3.1(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 coordinates of the boundary of the property or properties;	• Section 3
Appendix 1. 3.1(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 coordinates 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 coordinates within which the activity is to be undertaken;	• Section 3
Appendix 1. 3.1(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 5 • Section 6
Appendix 1. 3.1(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 1. 3.1(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 location.	• Section 7
Appendix 1. 3.1(g):	A motivation for the preferred site, activity and technology alternative;	• Section 8
Appendix 1. 3.1(h):	A full description of the process followed to reach the proposed preferred alternative within the site, including– (i) details of all 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 associated with the alternatives; (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) the outcome of the site selection matrix; (x) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	• Section 8 • Section 10 • Appendix E5 • Section 11-Section 14 • Section 15 • Section 16 • Section 8.7

	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	
Appendix 1. 3.1(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (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;	• Section 15 • Section 16
Appendix1. 3.1(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 15 • Section 16
Appendix 1. 3.1(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 18 • Section 19
Appendix 1. 3.1(l):	An environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (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 21 • Section 3 • Section 20 • Section 21

Appendix 1. 3.1(m)	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	• Appendix B
Appendix 1. 3.1(n)	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 20
Appendix 1. 3.1(0)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	• Assumption and limitation
Appendix1. 3.1(p)	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 20
Appendix 1. 3.1(q)	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 1. 3.1(r)	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 interested or affected parties;	• Appendix A
Appendix 1. 3.1(s)	Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
Appendix 1. 3.1(t)	Any specific information that may be required by the competent authority; and	N/A
Appendix 1. 3.1(u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

2 PROJECT TITTLE

The Proposed Hlabisa Full Water-borne Sanitation: Development of Hlabisa Bulk Sewer Pipelines and the New Wastewater Treatment Works, within Big Five Hlabisa Local Municipality, uMkhanyakude District, KZN.

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 falls within the jurisdiction of the Big Five Hlabisa Local Municipality (BFHLM) and located at the south-western boundary of the municipality within uMkhanyakude District (UKDM), KwaZulu Natal. The project area is across Hlabisa traversing across ward 12 and 14 of the Hlabisa Big Five Local Municipality (***Figure 1***). The project area is within Quaternary Catchment W32E of Pongola-Mtamvuma Catchment Management Area (P-MCMA).

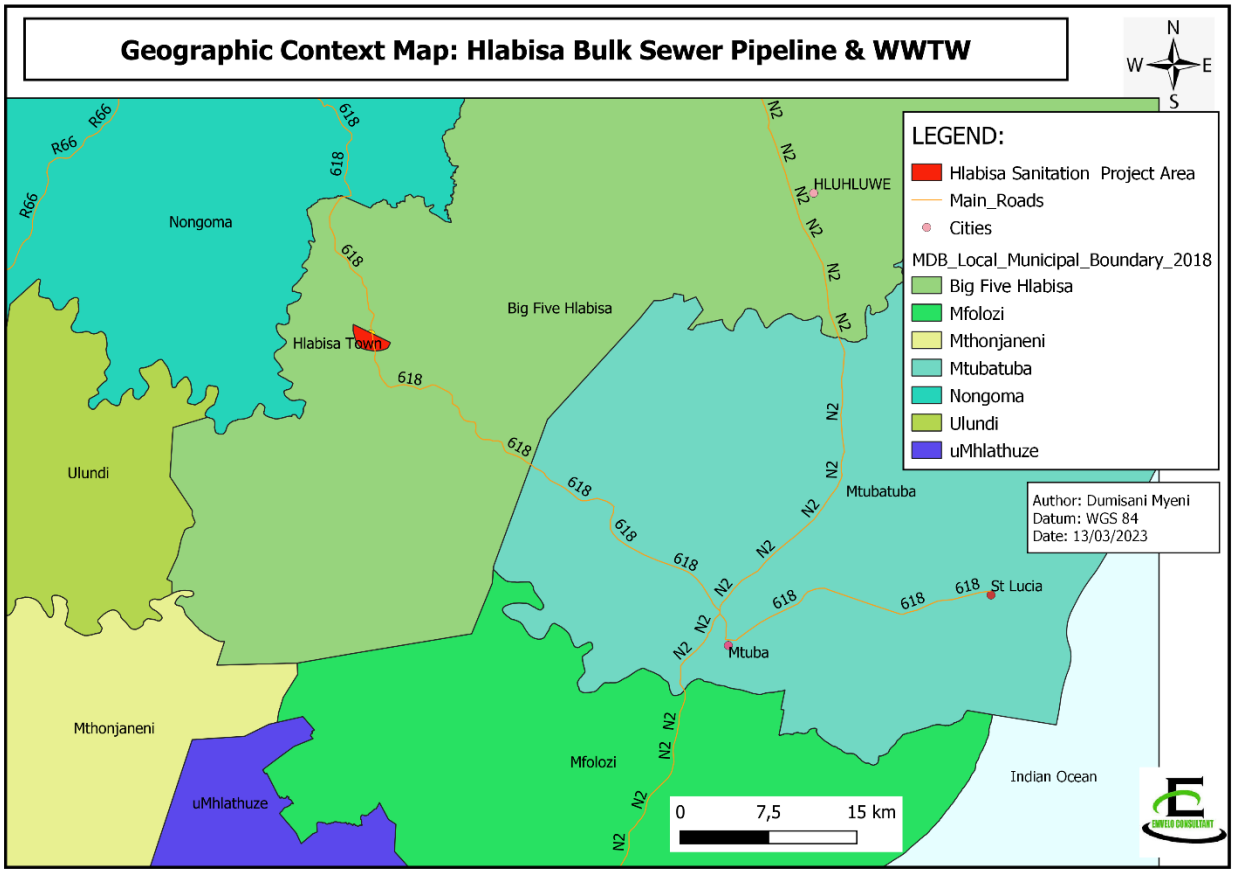

Figure 1: Geographical Context for the study area (Hlabisa Bulk Sewer)

3.2 Site Locality Context (Site Description)

The project will take place within Hlabisa Area, at Hlabisa-Abakwa farm no. 17435, 17435; Hlabisa Reserve No. 12 farm 15832 portion 14, across Ward 12 and 14 of BFHLM. The 5km bulk sewer gravity main traverse along the valley at the periphery of Hlabisa across Matshamnyama towards to Emabhanoyini in ward 12 and further to Bazane area in ward 14 where the WWTW will be located (***Figure 2***).

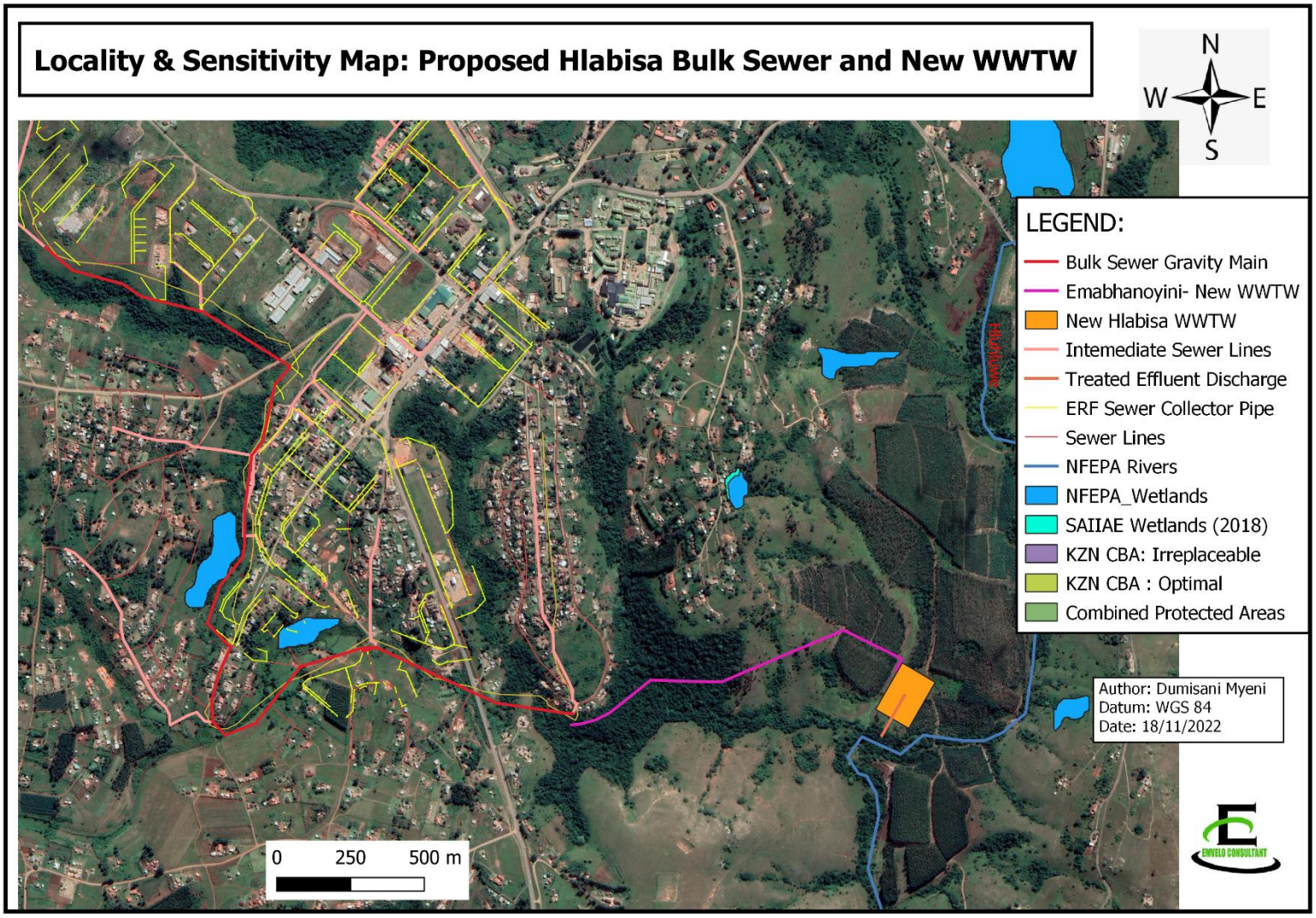

Figure 2: Locality & Sensitivity Map for Hlabisa Bulk Sewer Pipeline & WWTW

The (***Tables 4-5***) below, provides the Global Positioning System (GPS) co-ordinates for the proposed development site.

Table 4: Hlabisa Bulk Sewer Pipeline Co-ordinates

Gravity Main from Matshamnyama – Ward 13 to Emabhanoyini	
Start	28°8'23.87"S, 31°51'39.49"E
1st bend	28° 8'27.02"S, 31°51'42.06"E
2nd bend	28° 8'32.30"S, 31°51'41.60"E
3rd bend	28° 8'34.09"S, 31°51'44.72"E
4th bend	28° 8'37.96"S, 31°51'46.24"E
5th bend	28° 8'40.33"S, 31°51'48.41" E
6th bend	28° 8'48.78"S, 31°52'13.77"E
7th ben	28° 8'51.39"S, 31°52'14.88"E
8th bend	28° 8'54.84"S, 31°52'11.23"E
9th bend	28° 8'57.97"S, 31°52'10.73"E
10th bend	28° 9'1.17"S, 31°52'8.95"E
11th bend	28°9'10.45"S, 31°52'9.58"E
12th bend	28°9'12.82"S, 31°52'8.19"E
13th bend	28°9'14.94"S, 31°52'7.68"E
14th bend	28° 9'17.20"S, 31°52'7.87"E
15th bend	28° 9'24.53"S, 31°52’4.69” E
16th bend	28° 9'25.87"S, 31°52'5.21"E
17th bend	28° 9'26.12"S, 31°52'6.18"E
18th bend	28° 9'17.22"S, 31°52'22.57"E
End	28° 9'25.20"S, 31°52'45.29"E
Gravity Main from Emabhanoyini to the new Hlabisa WWTW	
Start (Join)	28° 9'25.20"S, 31°52'45.29"E
1st bend	28° 9'25.62"S, 31°52'45.84"E
2nd bend	28° 9'21.34"S, 31°52'53.55"E
3rd bend	28° 9'21.52"S, 31°53'1.44"E
4th bend	28° 9'16.49"S, 31°53'14.69"E

5th bend	28° 9'19.38"S, 31°53'21.10"E
6th bend	28° 9'20.51"S, 31°53'20.47"E
END (Inlet Works)	28° 9'21.01"S, 31°53'21.49"E
Rising Main	
Start	28° 9'25.20"S, 31°52'45.29"E
End	28° 8'50.20"S, 31°52'46.08"E

Table 5: Hlabisa New WWTW and Sewer Pumpstations

New Hlabisa WWTW Perimeter	
Corner 1	28° 9'19.70"S, 31°53'21.18"E
Corner 2	28° 9'21.54"S, 31°53'24.81"E
Corner 3	28° 9'26.02"S, 31°53'21.89"E
Corner 4	28° 9'24.20"S, 31°53'18.26"E
Sewer Pumpstations	
Pumpstation 1	28° 8'18.76"S, 31°51'31.58"E
Pumpstation 2	28° 8'45.72"S, 31°52'0.13"E
Pumpstation 3	28° 9'25.88"S, 31°52'6.99"E
Pumpstation 4	28° 8'30.42"S, 31°52'23.12"E

The (***Table 6***) below, provides the 21-digits Surveyor General Code (SGC).

Table 6: SG 21-digit codes for the proposed site

Farm name/s, Portions, and number/s	**SG 21-digit code**
Hlabisa-Abakwa, Reserve; Hlabisa Reserve No. 12, Farm 15832, Portion 14	N0GU00000001743500000 N0HU00000001583200014

Six (6) discrete habitat types were delineated within the assessment area, namely, wetland, riparian and instream habitat, scarp forest, and transformed (which is within settlement) (***Refer to Section 11.5***).

As depicted in (***Figure 2***) above, the bulk sewer gravity main will the streams and will traverse the NFEPA Wetlands. The pipeline route traverses the virgin land along the valley where will have a number of stream and drainage crossing. Adjacent to the valley is the land currently occupied by dispersed settlement dwellings. The area outside of Hlabisa town and the

settlement is currently not formalised. The area is made up of savanna biome overlain with fragment of Eastern scarp forest: Northern Zululand Lebombo scarp forest, Alluvial wetland: Sub-tropical alluvial vegetation, and dominated by Northern Zululand Sourveld vegetation.

4 SITES ACCESS

The Hlabisa Bulk Sewer Pipeline and WWTW can be access via R618 exiting from N2 at Mtubatuba, towards Hlabisa or Nongoma. Coming from Mtuba side enter the Hlabisa town and turn left via D1907 and travel about 1km and take the exit toward substation, travel down the valley where the project starts. The bulk pipeline traverse along the valley crossing R618 towards the new WWTW site. To access new WWTW is further east of Hlabisa town passing the Hlabisa Hospital, at about 500m turn right and downslope along the rural dwelling and forestry firebreak/boundary until reaching the open space adjacent the Hluhluwe River upper catchment.

5 PROJECT DESCRIPTION

The Proposed Hlabisa Full Water-borne Sanitation Project: Development of Hlabisa Bulk Sewer Pipeline and the New Hlabisa Wastewater Treatment Works, within Big 5 Hlabisa Local Municipality, uMkhanyakude District, KZN.

The proposed development of Hlabisa bulk sewer pipeline and the New Hlabisa WWTW will entail the following features:

a) *Construction of Bulk Sewer Pipeline*:

- Construction of a 3230m (250mmø) uPVC bulk sewer gravity main from Matshamnyama to Emabhanoyini;
- Construction of 1120m (250mmø) uPVC bulk sewer gravity main from Emabhanoyini to the new Hlabisa WWTW at Bazane;
- Construction of 140m (250mmø) uPVC treated effluent discharge pipeline from the new Hlabisa WWTW to adjacent Hluhluwe River (upper catchment);
- Construction of the Hlabisa town Intermediate 3294m (200mmø) uPVC sewer main;
- Construction of the Hlabisa town collector 5270m (160mmø) uPVC sewer main;

- Construction of the Matshamnyama intermediate 750m (200mmø) uPVC sewer main;
- Construction of the Matshamnyama collector 1184m (160mmø) uPVC sewer main;
- Construction of the Emacekeni intermediate 1220m (200mmø) uPVC sewer main;
- Construction of the Emacekeni Collector 2450m (160mmø) uPVC sewer main;
- Construction of the Emabhanoyini intermediate 822m (200mmø) uPVC sewer main;
- Construction of the Emabhanoyini collector 2007m (160mmø) uPVC sewer main.

b) Construction of the new Hlabisa WWTW:

The provision of a formal wastewater treatment facility of capacity of 1.5 Mℓ/day(1500m^3/day), will entail the construction of the following components:

- Clearance of approximately 1.8ha area for development of new Hlabisa WWTW facility;
- Tie15.5m X 6.5m equalization tank;
- 21m X 10.4m anoxic tank and 21m X 14m aeration tank;
- Three Sludge Maturation Ponds: Pond 1 (30m X 30m X 1.5m); Pond 2 (30m X 30m X 1.5m); Pond 3 (22m X 22m X 1.5m);
- Two 3.5m X 12mØ (396m^3) settling tanks;
- 534m^2 of six (6) sludge drying beds;
- 70.4 m^2 of two (2) sludge composition facility;
- Construction of 140m (250mmø) uPVC treated effluent discharge pipeline for the new Hlabisa WWTW from WWTW to Hluhluwe River (upper catchment);

The supporting infrastructure for the new Hlabisa WWTW entail:

- Construction of 135m access road to new WWTW;
- Construction of 547m perimeter fencing for the new WWTW.
- Operation room with electrical control equipment;
- Standby generator room;
- Housing for operating staff.

c) Construction of four sewer pumpstations:

- Construction of four (4) sewer pumpstation to supports the bulk sewer line on elevated areas, by pump the sewer to the new Hlabisa WWTW;
- The dimensions of all four (4) pumpstations are (5mx5mx3m);
- The pumpstations will have the pumping capacity ranging between 12ℓ/s and 5ℓ/s.

The implementation of Hlabisa bulk sewer pipeline and the new Hlabisa Wastewater Treatment Works (WWTW) will facilitate the formalization of existing settlement and future housing development, as the implementation of Hlabisa Full Water-borne Sanitation Project will provide a formalized water-borne sanitation system for settlement and businesses.

5.1 Project Anticipated Date

The Project is planned to start at within 2023/2024 financial. In favour of the anticipated start date is that due to the nature of works which involve working within the watercourses as a result of sewer bulk line stream crossings, wetland crossings and slope gradient for sewer gravity main construction, it is therefore highly recommended that the planned activities be undertaken during winter season (dry season), when the streams are dry or at low flow conditions, as well as when there is less chance of run-off from the disturbed soil at sloping areas. Therefore, for planning and tender process the applicant (UKDM) wishes to receive an authorisation by the end of October 2023.

5.2 Design Criteria

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

- Construction of a 5000m (250mmø) uPVC bulk sewer gravity main (whole bulk gravity main);
- Pumpstations – required to lift the sewage from low-lying areas to the WWTW or gravity main, whichever is applicable.
- Construction of wastewater treatment facility of capacity of 1.5 Mℓ/day(1500m^3/day);
- Construction of 140m (250mmø) uPVC treated effluent discharge pipeline from the new Hlabisa WWTW to Hluhluwe River;

5.3 Design Criteria for Bulk Sewer Pipeline

The following design criteria was used to ascertain the sanitation demand for each of the areas and are based on DWS – Technical Guidelines for the Development of Water and Sanitation Infrastructure and criteria as well as the CSIR Guidelines for Human Settlements Planning and design:

- The trench depth will be approximately 1m;
- Trench width will be approximately 1m
- Designed for a 20-year lifespan in accordance with the following technical guidelines:
    - Technical Guidelines for the Development of Water and Sanitation Infrastructure – Second Edition (2004): DWS.
    - Standard Specifications SANS 1200.

Table 7:Design Criteria for Bulk Sewer Pipeline

Parameter	Unit
Population Growth Rate	1.6 %
Projection	20 Years
Average HH Daily flow	600 ℓ/HH Middle income
Stormwater Infiltration	15% (allowance)
Peak Factor - Household	2
Peak Factor – Commercial Light Duty	4
Minimum Flow (Gravity Mains)	0.7m/s
Maximum Flow (Rising Mains)	2.5m/s
Pipe Material	uPVC, Class 34
Bulk Sewer Gravity Main	250mmø
Minimum Gradients	153.81m/s

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.

5.4 Design Criteria for WWTW

The following design criteria was used to ascertain the water-borne sanitation demand for each of the areas and are based on DWS – Technical Guidelines for the Development of Water and Sanitation Infrastructure and criteria as well as the CSIR Guidelines for Human Settlements Planning and design.

Table 8: Design Criteria for WWTW

Parameter	Unit
Population Growth Rate	1.6 %
Projection	20 Years
WWTW Operational Capacity	1.5 Mℓ/day
Average HH Daily flow	600 ℓ/HH Middle income
Stormwater Infiltration	15% (allowance)
Peak Wet Weather Flow (PWW) to enter the grit of WWTW	51.0 ℓ/s
Annual average dry weather flow (AADWF)	17.0 ℓ/s
Max flow allowed	64.6 ℓ/s
Outflow from the Equalization Basin with Emergency Overflow	25 l/s
Volume of Equalization Basin (including Emergency)	105 m^3 1.5 hours storage of PDWF 1.1 hours of PWWF

The WWTW capacity will be 1.5Mℓ/day, and the general standard for potential water quality parameters is applicable to the effluent from the proposed WWTW, as outlined in (***Table 9***) below.

Most of the generated sewage flow will be from domestic origin. The effluent from the new WWTW will be treated discharged into upper catchment of the Hluhluwe River, the grit and the screenings will dispose to approved landfill, as will be prescribed through waste classification.

Table 9: Applicable WWTW Effluent Parameters

Parameter	General Standard	Special Limit
PH	5.5 - 9.5	5.5-7.5
Biological Oxygen Demand (mg/l)	10-300	
Faecal Coliforms (MPN/100ml)	1000	0
Electrical Conductivity (mS/m)	70-150	50-100
Orthophosphate as phosphorous (mg/l)	10	1-2.5
Ammonia (ionised and un-ionised) as Nitrogen (mg/l)	6	2
Chemical Oxygen Demand (mg/l)	75	30
Total Suspended Solids (mg/l)	25	10
Nitrate/Nitrite as Nitrogen (mg/l)	15	1.5
Fluoride (mg/l)	1	1
Chlorine as Free Chlorine (mg/l)	0.25	0
Soap, oil or grease (mg/l)	2.5	0
Dissolved Arsenic (mg/l)	0.02	0.01
Dissolved Cadmium (mg/l)	0.005	0.001
Dissolved Chromium (VI) (mg/l)	0.05	0.02
Dissolved Copper (mg/l)	0.01	0.002
Dissolved Cyanide (mg/l)	0.02	0.01
Dissolved Iron (mg/l)	0.3	0.3
Dissolved Lead (mg/l)	0.01	0.006
Dissolved Manganese (mg/l)	0.01	0.01
Dissolved Zinc (mg/l)	0.01	0.04

The design caters for a sludge drying bed and also make use of an oxidation pond. The oxidation pond area will be partially filled, or concrete lined to be used as sludge maturation ponds. This proposed process design is based on an extended aeration activated sludge process, without primary sedimentation and with the addition of denitrification to the process.

The oxygen demand in the purification process is based on the carbonaceous and nitrification oxygen requirement and with denitrification 63% of the oxygen required for nitrification can be recovered if complete denitrification can be achieved. The proposed nitrogen removal process is based on a 3 - reactor system (modified Ludzack- Ettinger process) namely anoxic, aerobic and sedimentation anoxic, with a disinfection facility at the effluent side, an inlet section for screening, grit removal and flow measurement and modified oxidation ponds to serve as sludge maturation ponds for waste sludge. With this process complete denitrification is not possible and Nitrates in the effluent will be ± 5 to 7 mg/ℓ. This design is proven to be economical on the expect of electricity input and construction costs compared to a complete denitrification process which is in any case not required.

The treatment steps at the inlet works are screening, grit removal, solids grinder and flow measurement. Provision is made for a mechanical screen and a by-pass canal with a hand rake screen. Grit removal is manually from the grit canals and two canals are to be constructed.

The velocity in the grit canal is kept constant under variable flow conditions to allow for sedimentation of the grit particles in the bottom collector chute of the canal. The grit canals are rotated, and grit removed daily.

6 LISTED AND SPECIFIED ACTIVITIES TRIGGERED

The UKDM will require an Environmental Authorisation (EA) prior to undertaking the proposed construction of bulk sewer gravity main and new Hlabisa WWTW. The (***Table 10***) 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 10: Listed and specified activities triggered

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
GNR No. 327 (7 April **2017) Listing Notice 1.**	Listed Activity 12	[**The development of—** **(xii) infrastructure or structures with a physical footprint of 100 square metres or more;]** 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;	Matshamnyama to Emabhanoyini at Hlabisa-Abakwa farm no. 17435; Hlabisa Reserve No 12 farm 15832 portion 14. ***Applicability:*** *The pipeline construction will results in: Construction corridor of not more than 10m width within the vicinity of stream crossings and wetlands; The 10m length pipeline crossing at Emacekeni (28° 8'59.67"S, 31°52'9.75"E); 11m length pipeline crossing at Emacekeni (28° 9'25.52"S, 31°52'5.54"E); 17m length crossing at Emabhanoyini (28° 9'24.78"S, 31°52'44.96"E), and at (28° 9'21.14"S , 31°52'53.57"E). Therefore, this will results in clearance of 10m width construction corridor and construction of pipeline infrastructure, including the concrete encase covering the pipeline section at instream crossings. The infrastructure within watercourse will exceed 100m^2.* *The Gravity Main between (Entry Point: 28° 9'6.83"S, 31°52'9.83"E) and (Exit Point: 28° 9'14.63"S, 31°52'7.65"E) at Emacekeni traverse within 32m regulated area of the NFEPA Wetland.* *The locality of stream and wetland crossings are along the valley which is outside the Hlabisa town (urban area), as a result the valley has not been developed.*

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
		(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 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]	Matshamnyama to Emabhanoyini at Hlabisa-Abakwa farm no. 17435; Hlabisa Reserve No 12 farm 15832 portion 14. ***Applicability**:* *The pipeline traverse along the valley, as a result there will be three stream crossings at an un-named stream crossed by gravity sewer main, and immediate sewer lines for the construction of bulk sewer. Approximately 18m^3 of soil/spoils will be excavated at each stream crossing and therefore a combined stream crossings will have a total of 54m^3 of spoils/soils excavated within watercourse to facilitate pipeline alignment and installation of bulk sewer pipeline. There will be also infilling for pipelaying at stream crossings.*

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
		(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.	*These stream crossings will be as follows: 10m length pipeline crossing at Emacekeni (28° 8'59.67"S, 31°52'9.75"E); 11m length pipeline crossing at Emacekeni (28° 9'25.52"S, 31°52'5.54"E); 17m length crossing at Emabhanoyini (28° 9'24.78"S, 31°52'44.96"E). The pipeline from Emabhanoyini to the new Hlabisa WWT will have the stream crossing at (28° 9'21.14"S, 31°52'53.57"E).*
GNR No. 327 (7 April 2017) Listing Notice 1.	Listed Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	Hlabisa Reserve No 12 farm 15832 portion 14. ***Applicability**:* *Construction of New Hlabisa WWTW* *The clearance of approximately 1.8ha of indigenous vegetation for development of new Hlabisa WWTW facility.*
GNR No. 325 (7 April 2017) Listing Notice 2	N/A	N/A	N/A

GNR & Listing Notice No.	Listed Activity	Description of the applicable listed activity	Describe the portion of the proposed project to which the applicable listed activity relates; And Applicability
GNR No. 324 (7 April 2017) Listing Notice 3	N/A	N/A	N/A

7 ACTIVITY MOTIVATION

The need for and the desirability of a proposed development forms a key component of any EIA application, as the concept of “need and desirability” relates to, amongst others, the nature, scale and location of development being proposed, as well as the wise use of land. The “need and desirability” are interrelated and the two components collectively can be considered in an integrated and holistic manner (DEA, 2017).

The UMD is the delegated Water and Sanitation Service Authority (WSSA) all rural municipalities within the district, which include the Big 5 Hlabisa Local Municipality. The UKDM has identified various areas and settlements, within the district, which require sanitation upgrades to a full water-borne sanitation system. Therefore, the district proposes to upgrade the Hlabisa town sanitation to an efficient water-borne sanitation system.

It is also important to note that the safe disposal of human excreta and greywater is vitally important in the control of infectious and other communicable diseases and the design and construction of appropriate sanitation systems is of paramount importance in contributing to the safe disposal of human excreta (Water Research Commission, 2011).

7.1 The need

Considering the broader community’s needs and interests as reflected in a credible IDP, SDF and EMF for the area. The financial viability of adopted proposed development or activity location should be considered within the context of justifiable economic development, measured against the broader societal short-term and long-term needs. Therefore, what is needed and desired for a specific area should primarily be strategically and democratically determined beyond the spatial extent of individual EIAs (DEA, 2017).

In this regard, the UKDM has streamline the provision of water-borne sanitation with human settlement development for BFHLM. The periphery of Hlabisa town, such as Matshamnyama settlement has been planned for strategic development of approximately 192 low-cost housing and formalization of existing households which will require which will require a formal water borne sanitation system. Currently, these areas either discharge their sewage into septic tanks, which are emptied and then hauled to the existing Hlabisa Wastewater Treatment

Works (WWTW) situated adjacent the Hlabisa Hospital, or do not have any form of a water borne sanitation system. The sewer connection will also take place in Matshamnyama, Emacekeni and Emabhanoyini.

Moreover, since the discharge of sewage to be generated from these settlements cannot be handled by the current Hlabisa WWTW, it is then proposed that the new Hlabisa WWTW be constructed, as the current WWTW facility was primarily designed to cater for Hlabisa Hospital. There is also some evidence of effluent contribution by commercial centre that need to be formalised.

7.2 Desirability

The assessment of desirability of the environmental proposal is fundamental for streamlining the proposal to the baseline environment. This is done in order to meet the objective of the National Development Plan (NDP) 2030 by ensuring that the threat to the "environment and the challenge decent living and livelihood as well as poverty alleviation are closely intertwined through a balance between resource use for economic benefit, improving livelihoods and that of ecosystems protection (DEA, 2017).

As previously explained on (***section 10.1***), in response to UKDM need for sanitation upgrade the water-borne sanitation has been adopted, with focus on a cost effective and environmentally compatible process (extended aeration activated sludge process with nitrogen removal) also taking into consideration the operation and maintenance of the plant.

The 5km sewer conveyance infrastructure is required to traverse along the low-lying areas to facilitate the conveyance of sewer through gravity main. As a result, the bulk sewer gravity main traverse along the valley outside of Hlabisa town across Matshamnyama towards to Emabhanoyini in ward 12 and further to Bazane area in ward 14 where the WWTW will be located. This route allows for good design and practices based on the topography of the project area which will enable sewer to be transferred through gravity main as a result of the slope conditions as they are low-lying sloping areas, thus minimise the use of sewer pumpstation, energy use, and maintenance cost due pump failures. However, the pumpstations will be constructed in certain areas where the pipeline is on high lying areas along the route. These pumps must function continuously; therefore, the maintenance of electrical equipment and

motors, as well as back-up diesel generators to provide power in the event of electricity outages, is crucially important. The location of the new Hlabisa WWTW technical favours the engineering design and effectiveness of the Hlabisa water-borne sanitation, as it is located at approximately 1.5km east of existing WWTW on the lowest lying area in terms of topography of the project area, thus enable efficiency of gravity main. It is important to note that the current site (existing Hlabisa WWWT) has limited space and upgrading the existing WWTW cannot support any further future expansion, as the current WWTW is now at the edge encircled by growing settlements within Hlabisa.

The proposed construction of Hlabisa bulk sewer pipeline and WWTW will facilitate the formalization of existing settlement and future housing development, as the implementation of Hlabisa town sanitation system will provide a formalised water borne sanitation for settlement and businesses. In addition, the construction of bulk sewer and reticulation will see the connection of businesses, schools and households which are currently serviced by a household's septic tanks. Thereby, upgrading to a full water-borne sanitation system that will be connected to this sewer main lines and WWTW.

Apart from improved water-borne sanitation another the deliverable for bulk sewer infrastructure projects is jobs creation and stimulation of the local economy. Therefore, the inclusion of local labour during the construction period will create the much-needed temporary employment opportunities and transfer of skills to local community, as well as support local supply chains and businesses.

8 PROPOSAL 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: Site Layout 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 Alternatives)

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

The 'Routing Alternative' proposes that the 5km bulk sewer gravity main traverse along the valley outside of Hlabisa town across Matshamnyama towards to Emabhanoyini in ward 12 and further to Bazane area in ward 14 where the WWTW will be located. This route favours the best engineering design practices as the route is situated within the low-lying areas, thus favours efficiency of sewer flow along the bulk sewer gravity main to the new WWTW site.

Due to above mentioned factors other routes were not accessed as this was considered the best design route for efficiency of water-borne sanitation system for this project. However, it is also proposed that the pipeline route should be realigned where it encroaches the sensitive environment wherever possible, as the best practice and were feasible, traversing small sections of wetland, such as within W02 (***figure 7***) can be avoided through rerouting around the system.

The guidelines for the protection of natural forest habitat suggest that no activities or development should be considered that would destroy the forest habitats unless of strategic provincial or national importance with no feasible alternatives. Therefore, where feasible the route design must incorporate re-routing the construction corridor along the Zululand Lebombo Scarp Forest (FOz5).

8.2 Alternative B (Design Alternative)

The design alternative forms 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 5***. Therefore, this section provides for a project design for bulk sewer conveyance and WWTW infrastructure as previously described.

The design for bulk sewer conveyance and WWTW cannot be isolated to the 'Technology Alternative' as the infrastructure design cater for capability and efficiency bulk sewer conveyance and WWTW.

The design provides for the construction of a 5000m (250mmØ) uPVC bulk sewer gravity main along the low-lying areas of the project areas for efficiency of water-borne sanitation system. The pipeline route will have trench of 1m deep and 1m width in order to instal bulk sewer line. The clearance of 10m width construction corridor and construction of pipeline infrastructure, including the concrete encase covering the pipeline section at instream crossings. The sewer pumpstations will be constructed to lift sewer along the high-lying areas.

The WWTW will consist of Tie15.5m X 6.5m equalization tank; 21m X 10.4m anoxic tank and 21m X 14m aeration tank; Three Sludge Maturation Ponds: Pond 1 (30m X 30m X 1.5m); Pond 2 (30m X 30m X 1.5m); Pond 3 (22m X 22m X 1.5m); Two 3.5m X 12mØ (396m^3) settling tanks.

The process design is based on an extended aeration activated sludge treatment plant with biological nitrogen removal included in the process: The design caters for dual sludge processing methods; Inlet works with automated front rake screen and hand raked screen, grit canals, venture flume for measuring flow with ultrasonic level detector; Flow equalization tank;

BNR reactor with anoxic & aerobic reactors; Circular sedimentation tank with rotating half bridge; Return sludge pumpstation (RAS); Sludge draw-off holding and settling dams; A sludge drying bed and also make use of an oxidation pond. Dried sludge composting under cover area; The oxidation pond area will be partially filled, or concrete lined to be used as sludge maturation ponds, thus enable the contingency plan for efficiency of WWTW. The proposed process design is based on an extended aeration activated sludge process, without primary sedimentation and with the addition of denitrification to the process. This design is proven to be economical on the expect of electricity input and construction costs compared to a complete denitrification process which is in any case not required.

The treatment steps at the inlet works are screening, grit removal, solids grinder and flow measurement. Provision is made for a mechanical screen and a by-pass canal with a hand rake screen.

8.3 Alternative C (Technology Alternative)

The technology to be used in the activity, refers to a consideration of 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). Therefore, the construction of bulk sewer pipeline and WWTW will involve excavation for laying of pipeline infrastructure and founding for WWTW.

The technology for bulk sewer conveyance and WWTW cannot be isolated to the 'Design Alternative' discussed above, as the infrastructure design cater for capability and efficiency bulk sewer conveyance and WWTW.

The technology to be adopted for excavation will be based on *in-sutu* material as classified in (***Table 10***) below:

Table 11: SANS1200D Excavatibility Classes (Geology and excavation technologies)

***In-sutu* Geological Conditions at different depth**	**Description of material properties/ Excavatibility 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 loaded by a tractor type front-end loader or by a by a tractor loader backhoe (TLB)/back acting excavator

The study area within the pipeline route is predominantly underlain by sediments of the Vryheid Formation, and the WWTW location is underlain by the *Tillite* and shale of the *Dwyka* Group. No seepage was encountered at PSS 1 and PSS 2; PSS 3 although the section is located within the narrow flood plain within the valley along the bulk sewer pipeline route. Seepage was encountered at PSS 3 and PSS 4 and the two test pits excavated on the WWTW site. The sloping topography on PSS 1, 2, 4 and the WWTW provides good drainage, and no ponding was observed.

A 65KW powered 4x4 tractor-loader-backhoe (TLB) was used to excavate the six test pits on site. The test pits were excavated to shallow refusal or the maximum reach of the backhoe, up to 4.2m below Existing Ground Level (EGL). The topsoil, clayey-silt-sand mixes associated with residuum and decomposed to highly weathered sediments encountered on the five sites are soft excavatable. Shale bedrock present at an average depth of 2m that underlies the WWTW site ranges initially from soft to intermediate but becomes hard excavation with depth. The six (6) dynamic penetration (DPSH) tests were conducted to verify the consistency of the

substrate soils and to facilitate the location of the dilatometer tests. The DPSH testing experienced refusal at the depths ranging between 6 and 9m for the estimated depth of influence of a 9m² rectangular structure. Two (2) flat dilatometer tests (DMT's) were performed on site. The refusal was experienced at the dept of 7.4m EGL occurring on grey mudstone.

Bedrock on the five sites along the bulk sewer conveyance comprises Vryheid Formation sandstone with the balance made up of Dwyka tillite and shale in the vicinity of the WWTW. These excavatable materials are characterised of overall good excavatability, up to 4.2m below Existing Ground Level (EGL). The surrounding matrix/decomposed material is likely to require '*Soft*' to '*Intermediate*' excavation.

Therefore, for the purpose excavation for the bulk sewer conveyance and WWTW infrastructure, these materials can be efficiently ripped by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width. And where outcrops are encountered, the excavation could be 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. In addition, consideration can also be given to use of a tracked excavator of flywheel power exceeding 0.10kW per millimetre of tined bucket width. Where the hard rock shows some resistance to single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220Kw. No rock blasting will be required. However, when the hard pan rock outcrop is encountered, the blasting must be considered a last resort where all means of heavy ripping have failed.

The 'Impact Analysis' (***Refer to Section 15***) and the recommendations by the EMPr are based on this construction methods.

8.4 Alternative D (Site Layout Alternative)

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 Alternatives*' for the WWTW involve looking at the impact likelihood and configuration of the site positioning to mitigate the impacts. The south-eastern corner or section of the current site lies with 100m buffer overage of Hlabisa River. As a result, the 'Site Layout Alternative' proposes that WWTW should be

shifted at least 80m-100m further north of existing position (***Figure 3***). This will prevent the WWTW infrastructure to be prone to flooding in case of extremely event, and also prevent undesirable contamination Hlabisa River lying downstream of the WWTW. According to According to GN509 of the National Water Act, 1998 (Act No. 36 of 1998), the regulated area refers to the outer edge of the 1 in 100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 metres (m) from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act). Furthermore, the Wetland Specialist has also recommended that an alternative site for the WWTW be explored such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected. Therefore, the proposed alternative site position (***Figure 3***) could meet the desirable development objectives and provide impact mitigation as the site will be shifted further north by 80-100m from current location. This will also avoid the option of wetland offsetting, as this would be the case if the current WWTW position is considered.

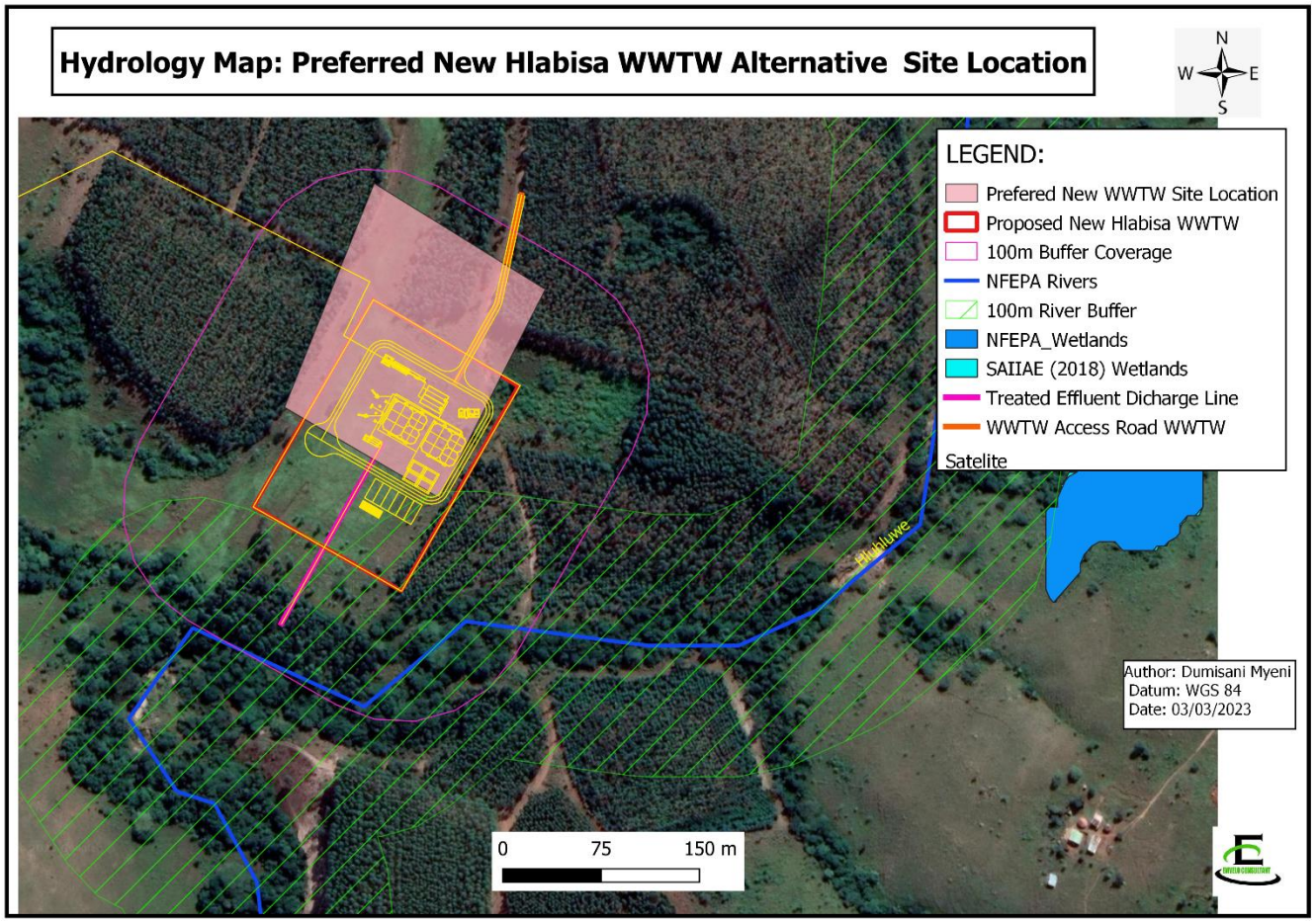

Figure 3: Map Showing the Preferred Alternative Site Layout/Location

8.5 Alternative E (Location Alternative)

The 'Location Alternative' could be considered part of site layout alternatives. However, the 'Location Alternative' is considered 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). The choice of gravity main location was determined through topography of the project site as incorporated into engineering design supporting efficiency of the water-borne sanitation system. The 5km bulk sewer gravity main will traverse along the valley at the periphery of Hlabisa across Matshamnyama towards to Emabhanoyini in ward 12 and further to Bazane area in ward 14 where the WWTW will be located. This route allows for good design and practices which will enable sewer to be transferred through gravity main as a result of the slope conditions as they are low-lying sloping areas, thus minimise the use of sewer pumpstation, energy use, and maintenance cost due pump failures. It is important to note that once the sewer conveyance infrastructure is within high-lying areas it will be subject to operational by means of number of pumpstations. These pumps must function continuously;

therefore, the maintenance of electrical equipment and motors, as well as back-up diesel generators to provide power in the event of electricity outages, is crucially important.

The location of the new Hlabisa WWTW technical favours the engineering design and effectiveness of the Hlabisa water-borne sanitation, as it is located at approximately 1.5km east of existing WWTW on the lowest lying area in terms of topography of the project area, thus enable efficiency of gravity main (**Figure *4***). It is important to note that the current site (existing Hlabisa WWWT) has limited space and upgrading the existing WWTW after these proposed upgrades the site cannot support any further future expansion, and the current WWTW is now at the edge encircled by growing settlements within Hlabisa.

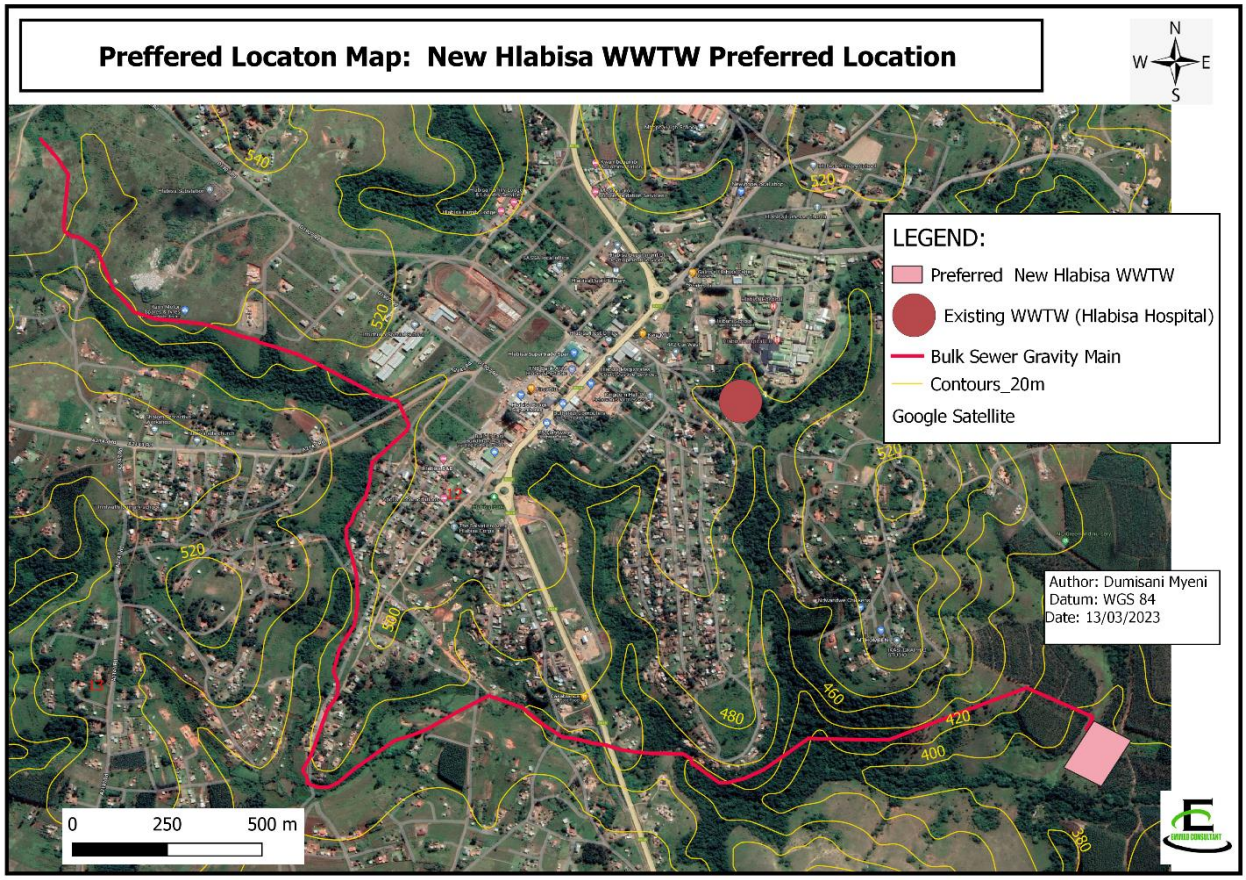

Figure 4: Map Showing a preferred new WWTW and Location

8.6 Alternative F (No-Go Alternative)

In the absence of the proposed development, the UKDM as a delegated WSSA for BFHLM would be unable to construct the water-borne sanitation system within Hlabisa town and the surrounding communities, which is required to address the sanitation of Hlabisa thereby

formalising water-borne sanitation for settlement and businesses, whist in the process streamline the provision of water-borne sanitation with human settlement development for BFHLM (***Refer to Section 7***). It is also important to note that this infrastructure project serves to provide public good (sanitation) from the proposed water-borne sanitation system. 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 water-borne sanitation for the safe disposal of human excreta and greywater is vitally important in the control of infectious and other communicable diseases and the design and construction of appropriate sanitation systems is of paramount importance in contributing to the safe disposal of human excreta (Water Research Commission, 2011). The provision of the decent sanitation 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 UKDM 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).

Looking at environmental impact likelihood and providing engineering to mitigate those impacts. The preferred alternatives are '*Routing, Design/Technology, Site Layout/Location Alternatives*'. These preferred alternatives cannot be undertaken in isolation, as they assessment is integrated considering this linear development (sewer conveyance) and construction of WWTW infrastructure.

The '*Alternative A: Routing Alternatives*', favours the best engineering design practices as the route is situated within the low-lying areas, thus favours efficiency of sewer flow along the bulk

sewer gravity main to the new WWTW site. The '*Routing Alternative*' for the pipeline is also consolidated with the '*Alternative B: Design Alternative*'. Due to above mentioned factors other routes were not accessed as this was considered the best design route for efficiency of water-borne sanitation system for this project. However, it is also proposed that the pipeline route should be realigned where it encroaches the sensitive environment wherever possible, as the best practice and were feasible, traversing small sections of wetland, such as within W02 (***Figure 7***) can be avoided through rerouting around the system.

The '*Alternative B: Design Alternative*' can be also linked to *'Alternative C: Technology Alternative*'. These alternatives have distinctly catered for dual sludge processing within the WWTW. The proposed '*Design and Technology Alternatives'* proposed processes are based on an extended aeration activated sludge process, without primary sedimentation and with the addition of denitrification to the process. This design is proven to be economical on the expect of electricity input and construction costs compared to a complete denitrification process which is in any case not required.

The '*Alternative C: Technology Alternative*', the excavatibility and rippability determine the use of machinery, and due to inconsistence in geological formation from *'soft to intermediate'*. Therefore, for the purpose excavation for the bulk sewer conveyance and WWTW infrastructure, these materials can be efficiently ripped by a tractor loader backhoe (TLB) of flywheel power approximately 0.10kW per millimetre of tined bucket width. A consideration can also be given to use of a tracked excavator of flywheel power exceeding 0.10kW per millimetre of tined bucket width. Where outcrops are encountered, the excavation could be 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. Where the hard rock shows some resistance to single-tine ripper suitable for heavy ripping, and of flywheel power approximately 220kW, the rock blasting will be an option. However, blasting must be considered a last resort where all means of heavy ripping have failed. No blasting within the watercourse will be allowed.

On the other hand, the '*Alternative D: Site Layout Alternative*' proposes for configuration of proposed site layout/position of the proposed new Hlabisa WWTW facility. The 'Site Layout Alternatives' for the WWTW involve looking at the impact likelihood and configuration of the

site positioning to mitigate the impacts. The south-eastern corner or section of the current site lies with 100m buffer overage of Hlabisa River. As a result, the 'Site Layout Alternative' proposes that WWTW should be shifted at least 80m north from the current existing position.

The 'Alternative E: Location Alternative' where the choice of the location of pipeline route is over emphasise as determined by the topography of the project area, as it is proposed that the gravity main follow the low-lying areas for efficiency of gravitating of sewer to WWTW. Also, the location of the new proposed WWTW is so strategic as it is at the lowest point of the project area, thus enable efficiency of bulk sewer gravity main. It is also important to note that the current site (existing Hlabisa WWWT) has limited space and upgrading the existing WWTW after these proposed upgrades the site cannot support any further future expansion, and the current WWTW is now at the edge encircled by growing settlements within Hlabisa.

Although, there are impact associated with these preferred alternatives, but 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. The adherence to mitigation measures will render the impacts be of temporal nature, only during construction. This will be addressed by mitigation measures discussed under (***Section 15***) and EMPr.

9 ENVIRONMENTAL STATUTORY FRAMEWORK

The NEMA is the primary South African legislation governing the requirements for Environmental Impact Assessments. In the context of the proposed development/operation the provisions of NEMA, and the associated EIA Regulations (regarding Basic Assessment Process) are of fundamental relevance. In terms of the Environmental Regulations promulgated under the NEMA, an EIA must be conducted for any development or activity that requires an Environmental Authorisation.

Apart from this EIA triggers, this project also triggers Section 21(c); Section 21 (i); Section 21 (f) and Section 21 (g) of National Water Act National Water Act (Act No. 36 of 1998). Consequently, the Water Use License Application is underway, due to proposed and

anticipated alterations to the wetland characteristics and impeding or diverting flows; due to the nature of handling sewage; and discharging treated effluent into a watercourse.

The applicable legislations, regulations and policies relevant to the proposed development/operations are outlined in (**Table 12**) below:

Table 12: Environmental Statutory Framework

Legislation	Relevance
Constitution of the Republic of South Africa, (No. 108 of 1996)	➢ Chapter 2 – Bill of Rights. ➢ Section 24 – Environmental Rights/ Health Or Well-Being / Depletion Of Natural Resources ➢ Section 32: Access to Information ➢ Section 33: Administrative Decisions ➢ Section 38: Locus Standi ➢ Section 68: Authority for Provincial Legislation
National Environmental Management Act (NEMA) (No. 107 of 1998)	➢ 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) ➢ 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)

Legislation	Relevance
	➢ 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. ➢ Activities that are relevant to this application are: **Listing Notice 1, Activity 12, 19, and 27**	
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. ➢ Section 21- WUL activities ***(Section 21C, Section 21i; Section 21f; & Section 21g)*** ➢ Chapter 4 – Water use ➢ Authority – Department of Water and Sanitation (DWS).
NEMA 1998 - GN R326 of 07 April 2017- 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

Legislation	Relevance
	➢ 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 – uMkhanyakude District Municipality
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	➢ 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 (➢ 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: Amafa Institute Heritage Agency
National Road Traffic Act 1996 (Act No. 96 of 1996)	➢ Section 51: Waste on Or Near National Road ➢ Authority – KZN Department of Transport and community safety

Legislation	Relevance
Environment Conservation Act (Act 73 Of 1989)	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 or 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) ➢ 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 43-59: Waste Management Licences for Listed Waste Activities or Compliance to Norms and Standards ➢ Section 21 and 22: Storage of Waste

Legislation	Relevance
	➢ 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 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 Development Act, 1940 (Act No. 21 of 1940)	➢ Section 8: Articles or Materials On or Near Public Roads
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

Legislation	Relevance
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 THE PUBLIC PARTICIPATION PROCESS

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 Environmental Authorisation, the public information and participation procedures which provide all interested and affected parties, 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.

10.1 Background

Public Participation Process (PPP) is part of the EIA process which is governed under the principles of NEMA as well as the EIA regulations. It is defined as the process by which an organization consults with all interested or affected parties (I&APs) which include organizations, government entities, affected communities, non-governmental organisations (NGOs), etc. It is a two-way communication process and collaborative problem solving with the goal of achieving better and more acceptable decisions.

The PPP also provides all the stakeholders including the community with a platform to raise their environmental concerns before the Competent Authority can make a final decision regarding the issuing of the Environmental Authorization. This prevents and minimizes disputes before they become unsolvable. Chapter 6 of the EIA regulations emphasize that the information related to the proposed project must be made available to I&APs, prior to a final

decision. Therefore, this process will allow I&APs to have access to the information relating to this project. The application was conducted according to Chapter 6 of the EIA Regulations 2017.

10.2 Objectives of public participation

The objectives are as follows:

- To inform and involve the community and the stakeholders about the proposed development;
- To identify and address the community and stakeholder's environmental concerns regarding this activity;
- To provide opportunities for the community, relevant government departments, surrounding businesses, the residents, and other stakeholders to raise their environmental concerns, suggest solutions and identify priorities or issues;
- To protect the environmental rights of the local community; and
- To optimise on local and indigenous knowledge of the area.

10.3 Landowner

According to Regulation 39(1) of GN No. 326 (7 April 2017), if the applicant is not the owner or person in control of the land on which the activity is to be undertaken, the applicant must, before applying for an Environmental Authorization in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land.

The notices were given to Ingonyama Trust Board as well as Traditional Council. The land consent for the new Hlabisa WWTW site was obtained from Traditional Council and Ingonyama Trust Board. However, The project entail construction of sewer conveyance infrastructure. 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.

10.4 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)

10.5 Consultation with the Competent Authority

The relevant authorities required to review the proposed project and to provide an Environmental Authorisation 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 Environmental Authorisation is the KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA).

However, other authorities with jurisdiction over elements of the receiving environment or project activities were consulted and listed as I&APs.

Authority consultation included the following activities:

- Submission of EA Enquiry to EDTEA;
- The EA Pre-Application Meeting was convened with EDTEA on 21st of October 2022 (***Refer to Appendix E*** for a copy of the minutes).
- An application for authorisation in terms of NEMA (Act 107 of 1998), is submitted to EDTEA as a competent authority.

10.6 Consultation with other Relevant Authorities

Background information (BID) regarding the proposed project was provided to relevant authorities and agencies, requesting their input into the EIA process. The authorities include *inter alia* as:

- Department of Water and Sanitation (DWS);
- Ezemvelo KZN Wildlife;

- Department of Forestry, Fisheries and Environment (DFFE)
- Department of Agriculture and Rural Development;
- Ingonyama Trust Board;
- KwaZulu Natal Department of Transport
- KZN Amafa Heritage and Research Institute;
- Big Five Hlabisa Local Municipality;
- uMkhanyakude District Municipality;

10.7 Notification of the Interested and Affected Parties (I&APs)

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 12***) and indicated by the green blocks.

Table 13: 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. *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. *The notices were given to Ingonyama Trust Board as well as Traditional Council. The land consent for the new Hlabisa WWTW site was obtained from Traditional Council and Ingonyama Trust Board.* *The project entail construction of sewer conveyance infrastructure. 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.*	**YES**	~~**NO/NA**~~
The municipal councillor of the Ward in which the site and alternative site of the proposed activity. *The BID was sent to the Ward 12 & 14 Councillors of the Big 5 Hlabisa Local Municipality.*	**YES**	~~**NO/NA**~~
The municipality which has jurisdiction in the area and other organs of state: *The BID was sent to Big 5 Hlabisa Local Municipality.*	**YES**	~~**NO/NA**~~

Placing an advertisement in-		
*Regional newspaper ((**Ilanga Newspaper**: 17/10/2022 - 19/10/2022 Edition).*	**YES**	~~**NO/NA**~~
Onsite Notices: *Onsite notices have been placed at boundaries and intersections as well as strategic points*.	**YES**	~~**NO/NA**~~
Any official Gazette that is published specifically for providing public notice of applications	~~**YES**~~	**NO/NA**
One provincial newspaper, any official Gazette that is published with the purpose of providing public notice of applications.	~~**YES**~~	**NO/NA**

Table 14: Public Participation Process

Basic Assessment Public Participation
Identification of I&APS: Interested and Affected Parties (I&APs) have been identified throughout the process. Initial identification of I&APs includes state departments/organs, state agencies, adjacent properties servitudes owners/operators, municipality, and ward councillors.
Notification BIDs have been circulated to all identified I&APs informing them of the proposed development and the opportunity to comment (Proof of Circulation attached in ***Appendix E***).
Notification by Onsite Notices: The Onsite notices have been placed at boundaries and intersections as well as strategic points (***Refer to Appendix E: Onsite Notices***)
Notification by Newspaper Notices/Advert: An advertisement was placed on (***Ilanga Newspaper****: 17/10/2022 - 19/10/2022 Edition*), attached on (***Appendix E***).
Registration of I&APS: Registration of I&APs was conducted from the period of 14 days, register attached on (***Appendix E***).
Public Participation Meeting: Public meeting was not held since the project constitute the linear activities. The BID was given to the adjacent occupants adjacent occupants and properties and servitudes owners/operators, municipality, and ward councillors.
Circulation of a Draft Basic Assessment Report: The EDTEA has received the hardcopy of the draft Basic Assessment Report (DBAR). The DBAR is circulated via email to all identified and registered I&APs. The Hard copy is placed at Hlabisa Library for 30 days public review and comments.

The DBAR is delivered and sent via email to relevant State Departments and Organs of State and their inputs and comments were requested. (Proof of circulation will be attached on the Final Basic Assessment Report in ***Appendix E***). The Proof of circulation will be attached on the Final Basic Assessment Report in (***Appendix E***).
Final Basic Assessment Report: All comments received from DBAR during the commenting period will be included in the Final Basic Assessment Report (FBAR) and attached in (Appendix E) comments and response report (CRR). The FBAR will be submitted to EDTEA for Environmental Authorisation decision.

10.1 Comments from the registered Interested and Affected Parties (I&APs).

Section 43 of Chapter 6 of NEMA (EIA Regulations 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 I&APs were provided with the opportunity to raise their concerns and comments regarding the proposed development project. Firstly, a Background Information Document (BID) was sent to all relevant I&APs on the 14th of October 2022, the revised BID was also forwarded on the 25th of January 2023 as attached in (***Appendix E***). The onsite notices were posted onsite on 17th of October 2022, and revised onsite notices were also posted onsite on the on 31st of January 2023. Notices were displayed in strategic positions in the project area in order to enhance accessibility from the public, as attached in (***Appendix E***). Following, the posting of onsite notices, the newspaper advert was published by (*Ilanga Newspaper: 17/10/2022 - 19/10/2022 Edition* as attached in (***Appendix E***). The DBAR was circulated for 30 days period. The I&APs were given a fair opportunity to comment public participation, and their comments are attached. All public participation activities are attached under (***Appendix E***).

Public participation activities and reports are attached in Appendix E (Public Participation).

11 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 Basic Assessment exercise was conducted. It also allows for an appreciation and identification of sensitive environmental features and possible receptors of the effects of the proposed project.

11.1 Climate

The Southern African region is divided into three climatic regions: Wet, dry, and moderate regions. In this regard the KwaZulu Natal encompasses the categories such as humid subtropical (*Cfa*), oceanic climate (*Cfb*), hot semi-arid climates (*BSh*) tropical savanna climate (*Aw*), subtropical highland oceanic climate (*Cwb*), but the most prevalent ones are *Cfa*, *Cfb*, *BSh* and Aw (Climate-Data.org). (Climate-Data.org).

The climate region of this study is referenced to Hlabisa town. The study district of UKDM has a temperate climate with winters being very mild and summers that can be hot and humid, with mostly precipitation received during the summer season, and the period between October to March. The southern and eastern parts of UKDM fall predominantly within the humid subtropical region of South Africa, with the western region being a more semi-arid region. The district experience mild winter temperatures are due to the oceanic climate (warm Agulhas current), with the lowest temperatures, which are experienced between March and July. The mean temperature in the UKDM varies between lowest 10°C in winter and highest at 32°C during summer. In Hlabisa, there is little rainfall throughout the year as its climate falls under the *BSh* and is classified as warm and temperate, with the mean annual temperature of 20.6˚C, and mean annual precipitation of 678mm, experienced during summer season, but some precipitation also experienced even in dry season (Ezemvelo KZN Wildlife, 2014; Climate-Data.Org). The study area has a Mean Annual Precipitation (MAP) of 828.9 mm (early and mid-summer).

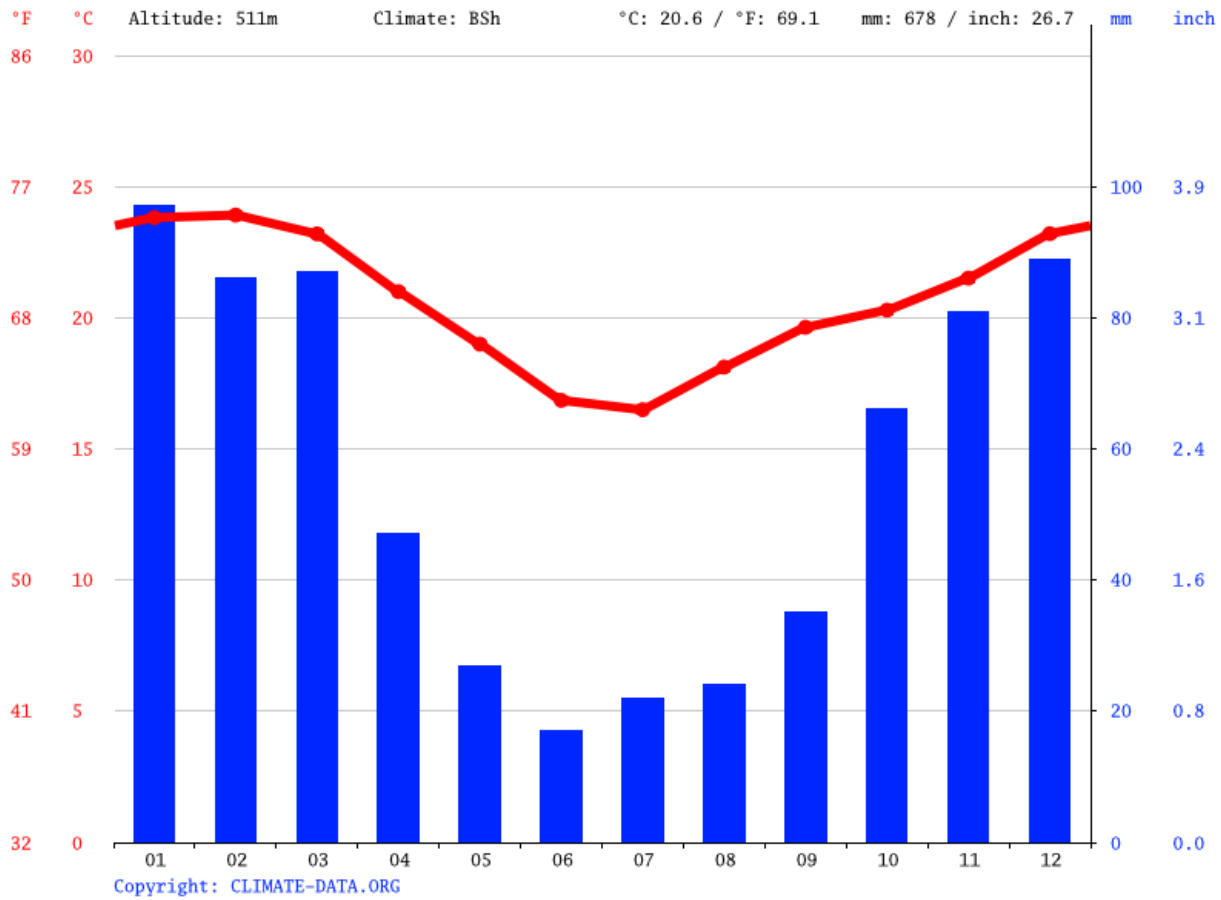

Figure 5: Hlabisa climate graph over a 12-month period [Source: Climate-Data.Org]

11.1.1 Potential impact

The project deeply relies on climate and seasonal trends such as stream discharge since pipeline construction corridor traverse un-named stream and wetlands. Due to various return periods and extreme events on the wetlands and stream associated with wet period, the excavation during the peak flow conditions will results to surface run-off, siltation and erosion within the vicinity of the pipeline wetland and stream crossing. Given the above-mentioned climatic trajectory (***Figure 5***), it is inferred that construction within the watercourse and the riparian zone, will have minimal impact on the hydrological and geological elements when conducted between April and September. The measures to mitigate the potential impacts will be considered further in the EMPr.

11.2 Surface Hydrology

The hydrological system of uMkhanyakude District conglomerate with high and low-lying areas. The high-lying areas with dominantly of non-perianal hydrological system at the western part of the district that rather drain eastwards to low-lying plains forming wetland systems. Also, the western areas further south is characterised of both of low-lying and high-lying areas whereby those low-lying areas are rich in flood-plain wetlands. The UKDM is rich in surface water resources that support a wide biodiversity and is the backbone of a thriving tourist industry. The district incorporates many areas relevant to the freshwater ecosystem conservation and conservation priorities, which include wetland clusters, refuge or critically endangered and endangered, as well as otherwise threatened, fish species within the Mkuze River, Pongola River, and the freshwater coastal lakes. These features are largely dependent on the quality of the resource that originates outside of conserved areas, which is difficult to manage. (Ezemvelo KZN Wildlife, 2014).

The study area is located in the Quaternary Catchments W32E, within the Pongola to Mtamvuna Water Management Area (WMA) 4.

The freshwater ecosystem within the UKDM comprises diverse rivers, dams wetlands, lakes as discussed below.

11.2.1 Rivers, dams and lakes

The UKDM is bordered by Mfolozi River at the southern region, and has Pongola River, which drains the north-western area northwards toward the Great Usutu River and Mozambique, the Msunduzi River and Mkuze River traversing central region in a southerly direction toward the iSimangaliso Wetland Park system, whilst the Hluhluwe, Nyalazi River and Mfolozi Rivers drain the southern areas towards the iSimangaliso Wetland Park system. These are free flowing rivers. The Pongola and Nawavuma River which originate west of the district cut though this mountain range via gorges. The Mkuze and Msunduzi Rivers, which also originated to the west of the district, drain the southern areas of the municipality into the iSimangaliso Wetland Park and ultimately southwards toward the Indian Ocean. The north-eastern region is drained by small rivers, of which the Swamanzi River is the only one classified as perennial. (Ezemvelo KZN Wildlife, 2014).

There is only one dam (Pongola Poort Dam/Jozini Dam) which is an instream dam situated within Pongola River within Jozini. The district is also a home to freshwater lakes situated along the coast region namely, Lake St Lucia, Lake Sibhayi, and Lake Nibela.

The study area drains into non perennial stream where there are pipeline stream crossings and the upper catchment of Hluhluwe River which traverse adjacent the new Hlabisa WWTW site. The treated effluent discharge drains upstream of Hluhluwe River at the upper catchment (***Figure 6***). The Hluhluwe River is one of the major rivers within uMkhanyakude District. There were no dams and lakes within the jurisdiction of the study area.

The infield riverine habitat delineation provided that the project area has a number of drainage line draining into the Vallely along the location of the Bulk Sewer Gravity Main. This valley later drains into upper catchment of Hluhluwe River downstream of WWTW. A single riverine unit (Hluhluwe River) was identified as a likely receiver of impacts from the proposed development. Riparian habitats were identified and delineated along the valley and at both downstream and downstream of the Hluhluwe River within WWTW location. The volume of the water within the watercourse at the time of assessment was moderate to low. The Hluhluwe River was characterised by long shallow pools, interlinked with slow flowing riffles dominated by sand and boulders.

The analysis of the overall Eco Status of the assessed unit within the Hluhluwe River was determined to be a '*Class D*' at the upstream site, and a '*Class D/E*' at the downstream site. The river is slightly more degraded upstream site is likely a result of the activities from the adjacent rural settlements who utilise the river for subsistence use. The results from the *in-situ* assessment show that all parameters are within both the TWQR for aquatic systems and the DWS General Effluent Standard. The results from the laboratory assessment show that all parameters are within both the TWQR for aquatic systems and the DWS General Effluent Standard with the exception of total suspended solids. However, whilst E. coli counts were low (>45 counts per 100ml water), total coliform counts are higher than the DWS limits. The high coliform counts suggest that perhaps there are moderate coliform sources upstream, possibly from animal manure or human settlements.

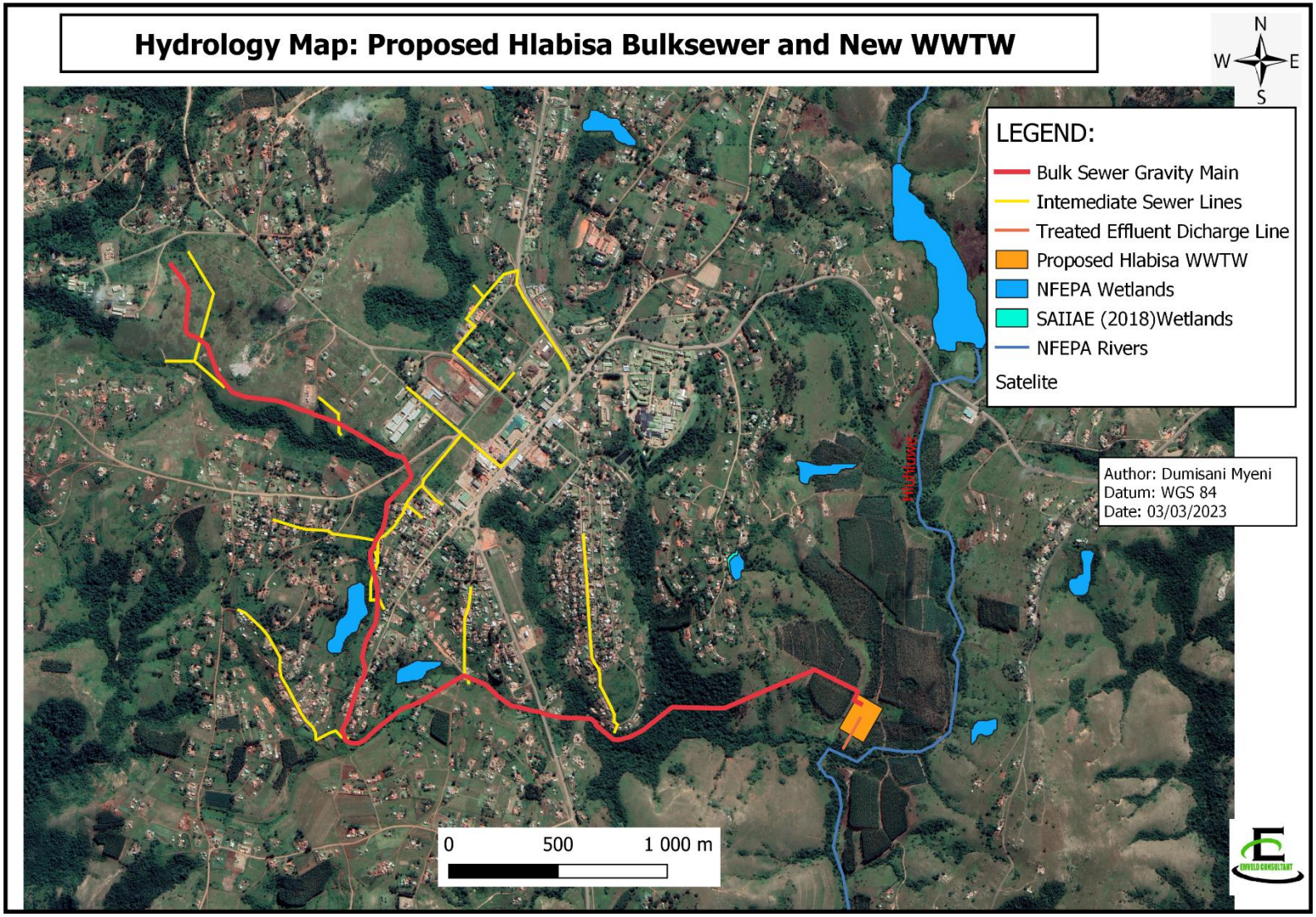

Figure 6: Map showing dam, rivers and wetlands with the study area

11.2.2 **Wetlands**

As discussed above in (***Section 10.2***), the major wetlands systems at uMkhanyakude District are mainly formed at the large areas of low-lying plains draining from the west of the district to Greater iSimangaliso Wetland Park. Also, (Ezemvelo KZN Wildlife, 2014).

Within the section of the study area, the NFEPA dataset, Ezemvelo KZN Wildlife and SAIIAE showed the presence of wetlands systems within 32m- 100m project coverage, as well as within the proposed pipeline route (***Figure 6 & 7***).

The infield watercourse delineation confirmed the presence of seven (7) wetland systems that fell within the study area and regulated area (falling within or close to the proposed development footprint) and only five (5) of these systems were identified to be at risk and required further assessment. These systems were identified as seepage, Unchanneled Valley Bottom (UVB) and Channelled Valley Bottom (CVB) wetlands and they were identified to be largely natural and moderately modified. Existing impacts placing pressure on these systems are livestock grazing, rural settlements and *Eucalyptus* plantations. As a result of their surrounding land uses, these wetlands were important overall in trapping sediment, controlling erosion, attenuating floods, regulating flows and assimilating toxins and nutrients. These systems were therefore of moderate to high ecological importance and sensitivity.

Riparian habitats were identified and delineated along the valley and at both downstream and downstream of the Hluhluwe River within WWTW location. The volume of the water within the watercourse at the time of assessment was moderate to low. The Hluhluwe River was characterised by long shallow pools, interlinked with slow flowing riffles dominated by sand and boulders.

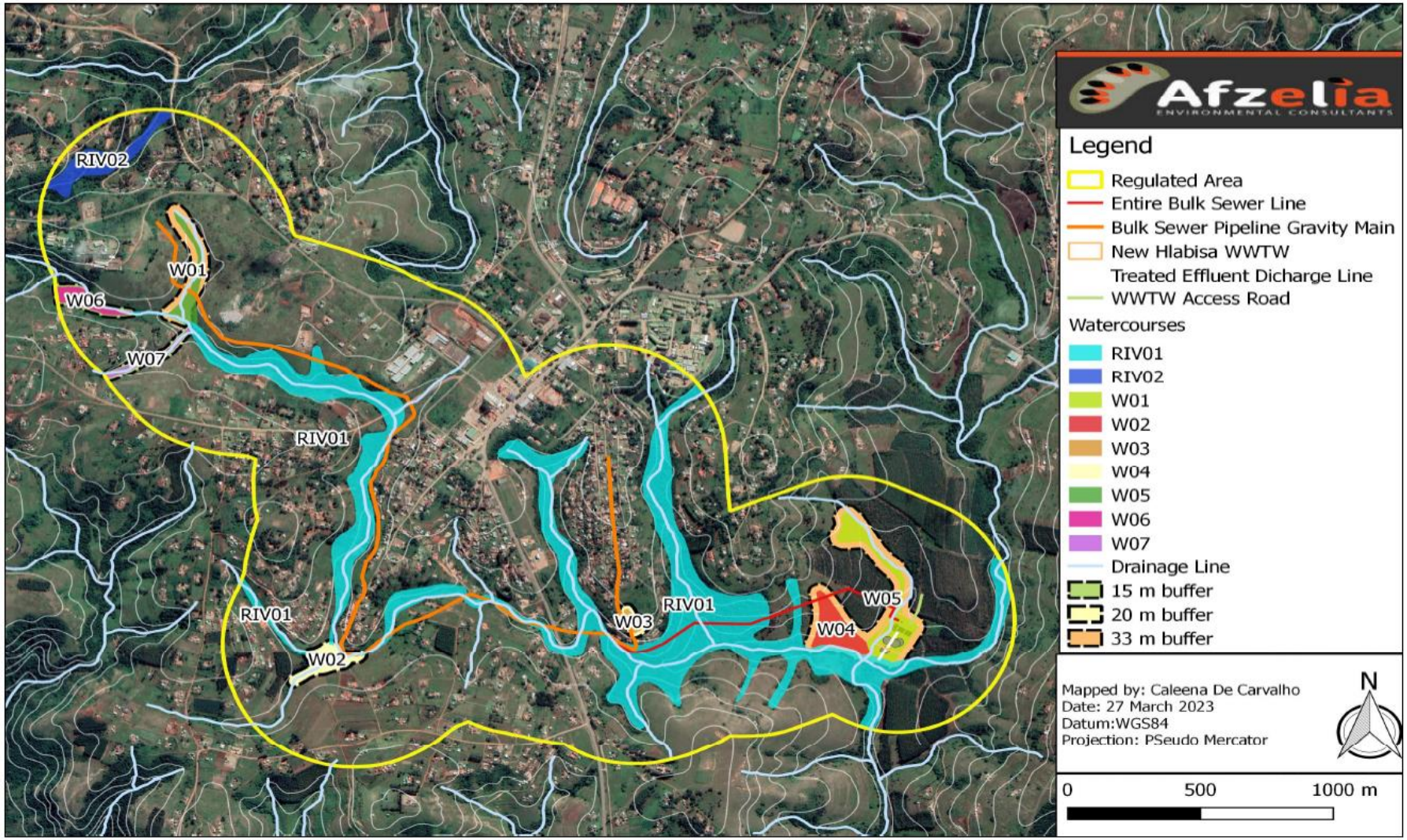

Figure 7: Map showing wetlands and drainage lines delineated within the study area

11.2.3 Potential impacts of the project hydrological features

The construction of the sewer conveyance will involve the excavation within wetland hydrological bodies, and excavation within stream for stream crossings. Therefore, any construction within the watercourse is considered environmental sensitive. It is highly recommended that the recommendations by the EMPr, Aquatic Ecological Assessment, and Wetland Habitat Impact Assessment be adhered to, in order to mitigate any impacts that may arise.

11.3 Ground Water

According to the DWS 'Aquifer Classification Map' the project area (new Hlabisa WWTW) comprises the 'Minor Aquifer System' in accordance with vulnerability map (***Figure 8***). Which, therefore, provides a moderate yielding aquifer systems of variable water quality.

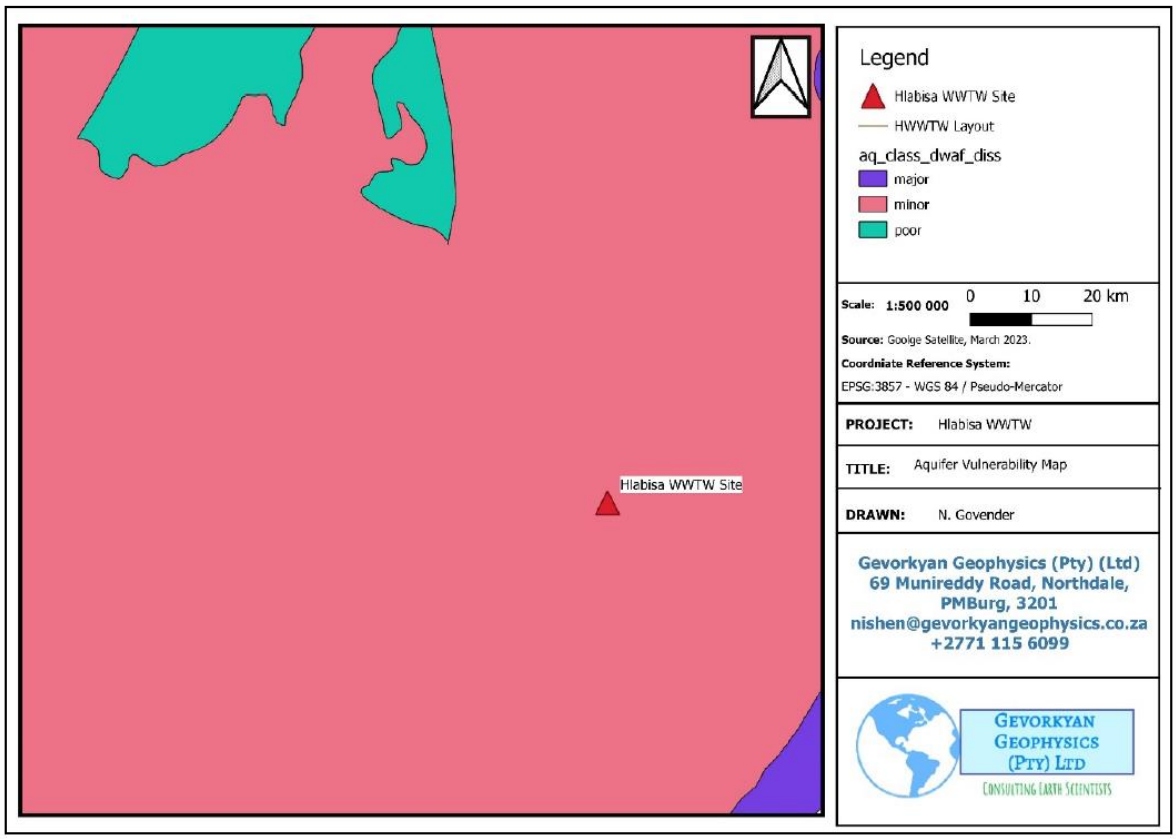

Figure 8: Aquifer Classification of the new Hlabisa WWTW site

The infield assessment provided that the project area is underlain by un fractures aquifer system with approximately yields between 0.1-0.5ℓ/s. The static ground water level is at

approximately 27m below EGL. The project area is also characterized by the faults which are considered as flow path for groundwater. The groundwater seepage was encountered within depth ranging from 0.7m- 0.9m below EGL, and this can be attributed to the rainfall and also known as perched groundwater conditions. The absence of dolerite intrusion creates an indication of weakness on surrounding rocks, aiding to pathways for groundwater movement. In instances of dolerite instruction, the fractures within the bedrocks were considered to be high.

11.3.1 Potential Impacts

The potential to groundwater contamination as a result of operation of WWTW. The groundwater seepage onsite was determined at approximately less than 1m below EGL, this elevated groundwater was associated with rainfall or classified as perch conditions. Therefore, any failure and spillage of effluent in new WWTW could risk in significant contamination in surface and perch groundwater. It is highly recommended that the recommendations by the EMPr, Hydrological Impact Assessment, Aquatic Ecological Assessment, and Wetland Habitat Impact Assessment be adhered to, in order to mitigate any impacts that may arise.

11.4 Biomes

The uMkhanyakude District traverses eight (6) biomes, namely; Azonal Forest, Forest, Indian Coastal Belt, Savanna, Grassland and Wetlands biomes and contains 45 vegetation types (Ezemvelo KZN Wildlife, 2014). The study area within Hlabisa bulk sewer gravity main and WWTW is overlaid by the Savanna Biome, and with intrusion of a Forest Biome near the new WWTW site (***Figure 9***). The study area is dominantly Eastern Valley Bushveld (SVs6).

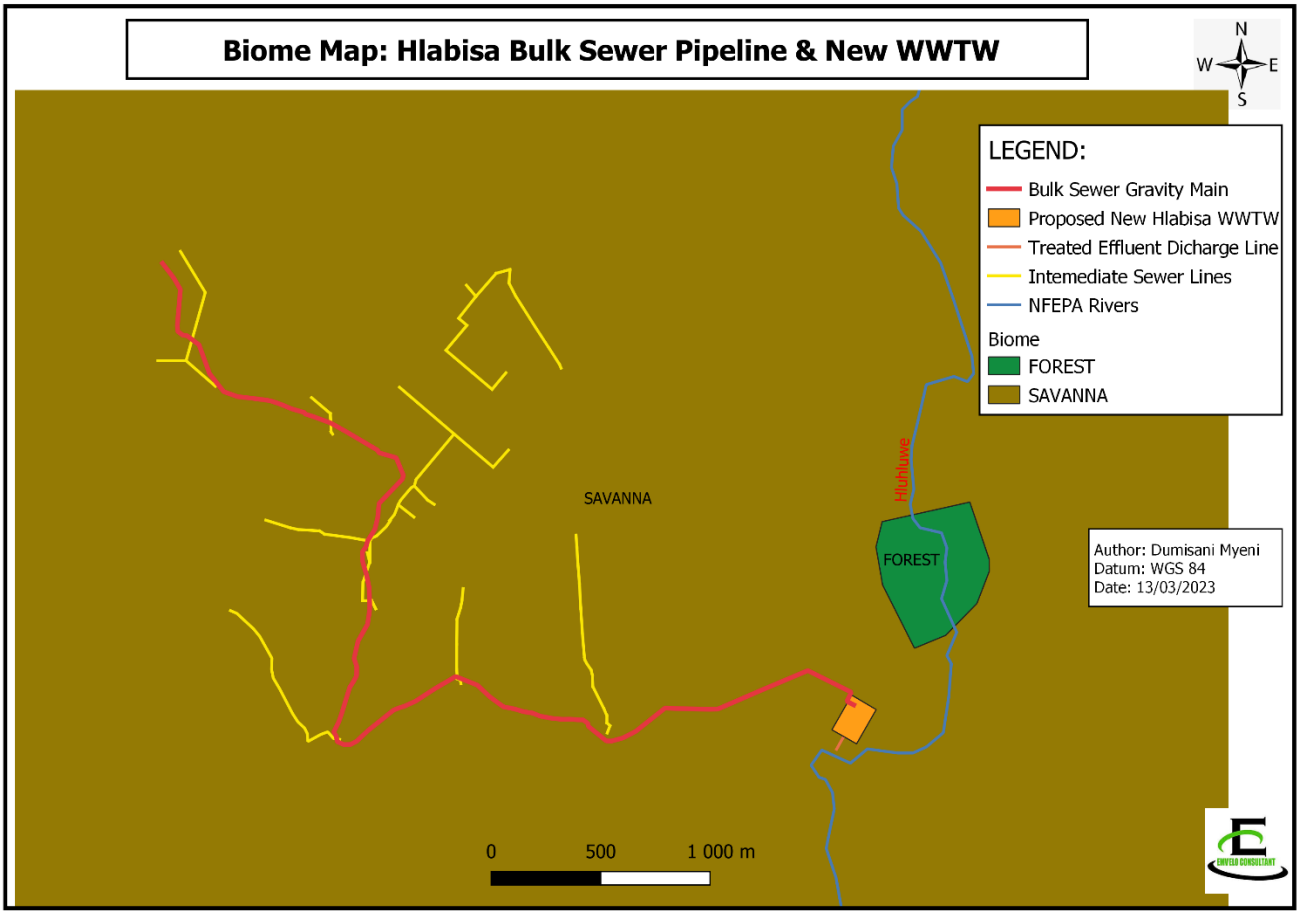

Figure 9: Map Showing Dominant Savanna Biome within project area

11.5 Flora

As discussed in (***Section 9.3***), the uMkhanyakude District has a very rich vegetation endemic from stratified biomes. Most noticeable the Maputaland region boasting with great conservation and biodiversity importance, hosting lush riverine and estuarine habitats, diverse savannah and foothill grasslands, and highly specialized and threatened dune forests, stretching from Mtubatuba towards South African and Mozambican boarder, with over 2500 species that occur within the Maputaland Centre of which at least 230 species are endemic or near endemic to the region (Ezemvelo KZN Wildlife, 2014).

Undisputable, the uMkhanyakude District is rich in vegetation species diversity endemic to Eastern Coastal region amongst other hosted by Arizona Forest, namely: Lowveld Riverine Forests, Mangrove Forests, *Ficus trichopoda* Swamp Forest, and *Raphia* Swamp Forest, Dukuduku Moist Coastal Lowlands Forest and East Coast Dune Forest all with a conservation

status classified as '*Critically Endangered*'. Whilst the Maputaland Dry Coastal Lowlands Forest; Maputaland Mesic Coastal Lowlands Forest; Maputaland Moist Coastal Lowlands Forest; Maputaland Dune Forest with a conservation status classified as '*Endangered*'. Moreover, the region also diversified by the Savanna vegetation, namely: Zululand Coastal Thornveld classified as '*Critically Endangered*'; Maputaland Coast Belt classified as '*Endangered*'; The Western Maputaland Clay Bushveld and Zululand Lowveld classified as '*Vulnerable*'. The district also hosts diversified wetlands vegetation species of conservational concern such as: Lowveld Floodplain Grasslands and Lacustrine classified as '*Critically Endangered*'. The Subtropical Alluvial Vegetation: Lowveld Floodplain Grasslands are classified as '*Endangered*'. Whilst the Tall Reed Wetland and Subtropical Freshwater Wetlands are classified as '*Vulnerable*'. Furthermore, the grassland vegetation comprises the Lebombo Summit Sourveld and Maputaland Wooded Grassland which are classified as 'Endangered' (Ezemvelo KZN Wildlife, 2014).

The vegetation type with the study area main as depicted by (***Figure 10***) is predominantly: Northern Zululand Sourveld (*Svi22*) '*Vulnerable*' with (19%) conservation target; with intrusion of Northern Zululand Lebombo Scarp Forest (*FOz5*) 'Least Threatened' with (40%) conservation target; and Subtropical Alluvial Vegetation (*Aza7*) 'Least Threatened' with (31%) conservation target (Mucina & Rutherford, 2006).

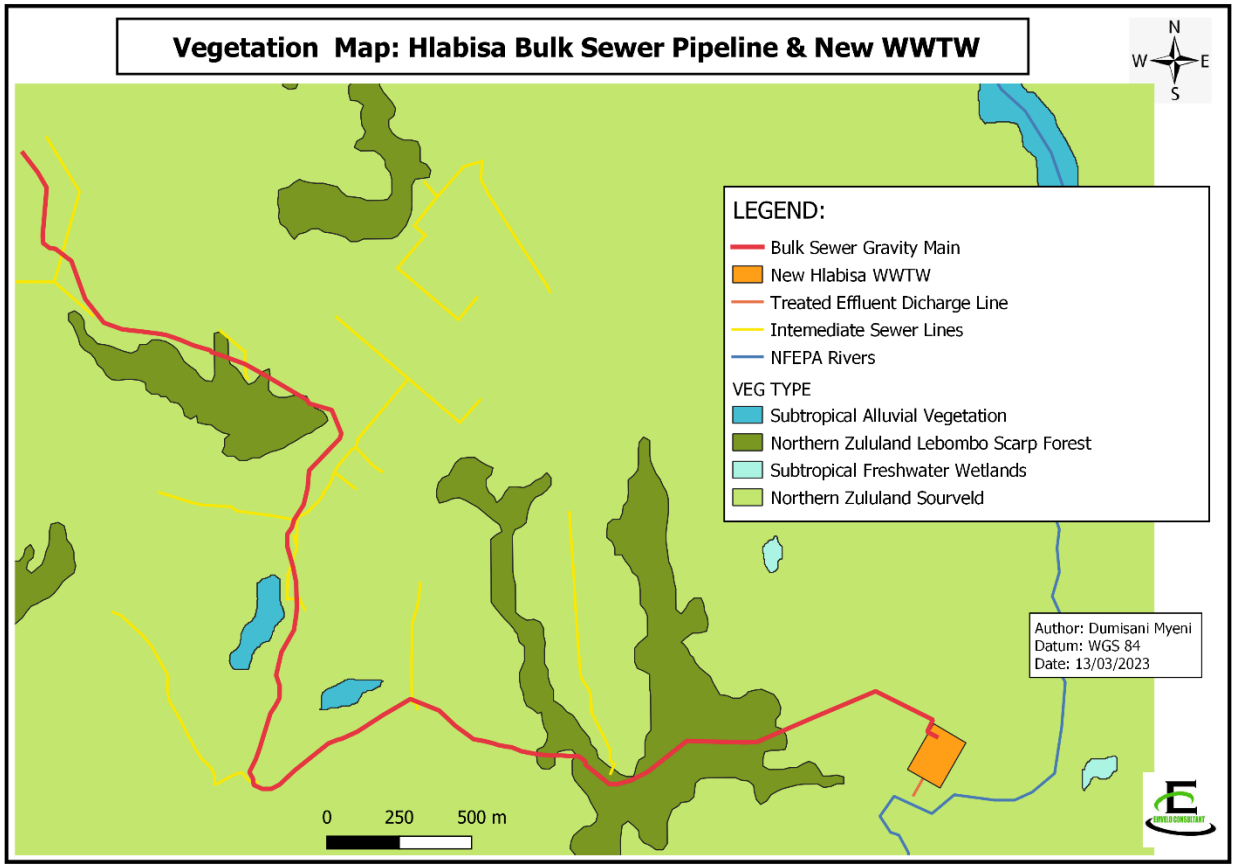

Figure 10: Map showing the vegetation type within the study area

Six (6) discrete habitat types were delineated within the assessment area, namely, wetlands, riparian and instream habitat, scarp forest, sourveld, and transformed (which is within settlement). The proposed development site traverses through the forest, grasslands, crosses the R618 provincial road, near human settlements and streams. The existing land use of the project area and its immediate surrounding area include cultivated land (subsistence farming), forest plantations (agricultural facility) and homesteads.

The riparian habitat vegetation in the region provides cover for bird species such as the *Circus ranivorus (*African Marsh Harrier*)*, *Caprimulgus natalensis* (Swamp Nightjar) and *Alcedo semitorquata* (Half-collared Kingfisher*)*. Scarp Forest habitat type within the study area will be utilized by numerous faunal species (birds, reptiles, insects and mammals).

The infield investigation within the construction corridor did not observe plant Species of Conservation Concern (SCC) within construction corridor and within the Project Area of Influence (PAOI) outside the constriction corridor. However, the plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL LILIACEAE, which includes *Aloe sp.* such as Aloe *marlothii* and Aloe *arborscens*. All provincially protected plant species within the project development site, should either be avoided or be preserved and incorporated into the landscaping around the proposed development site. The infield recorded 105 plant species within the study area. The plant species such as *Albizia adianthifolia* (Flat crown), *Combretum kraussii* (Forest Bushwillow), *Commiphora woodii* (Forest Corkwood), *Trichilia* dregeana (Forest Natal-mahogany), and *Trema orientalis* (Trema, Pigeon wood) were recorded in abundance along the Scarp Forest all having conservation status of '*Least Concern'*.

The edges of this Forest community comprise of dense thickets of *Chromolaena odorata* (Triffid weed), *Lantana camara* (Lantana) and *Ricinus communis* (Castor oil plant) all classified as '*Category 1b AIS'*. The grassland vegetation is being transformed by the invasion of *Psidium guajava* (Common guava) classified as '*Category 2 AIS'*. Alien invasive plant species on the study area were observed to occur in clumps, scattered distributions or as single individuals.

The riparian habitat of Hluhluwe River was largely surrounded by non-indigenous plants such as *Amorpha fruticose*, *Senna didymobotrya* (exotic) and *Cerbera manghas*.

11.5.1 **Potential Impacts**

Potential impacts to vegetation could result from the vegetation clearance for construction of sewer conveyance infrastructure, which will involve the clearance of vegetation in accordance with clearance for the construction of pipeline route, as well as clearance for the new WWTW. However, proper mitigation can be achieved through carefully implementation of recommendations given by the EMPr, and by Terrestrial Ecological Impact Assessment.

11.6 Protected Areas and Biodiversity Sector Plan

The aim of the National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM: PAA) is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable. 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.

The uMkhanyakude District falls within a bioregion and hosts a number of formally protected and other conservation areas, namely: iSimangaliso Wetland Park; Hluhluwe-iMfolozi Park System; Makasa Nature Reserve; Manguzi Forest Reserve; Tembe Elephant Park; Sileza Nature Reserve; Ubombo Mountain Nature Reserve; Ndumo Game Reserve; Hlatikulu Forest Reserve; Futululu Forest; Futululu Conservation Area; and a number of private game reserves (Ezemvelo KZN Wildlife, 2014).

The study area does not fall within any of the formal Protected Areas (PA) and the nearest PAs are situated approximately 2.8km east and south of the project area, namely: Hluhluwe-iMfolozi Nature Reserve, with eMpembeni, Obuka and Somopho Nature Reserves Systems. The Greater iSimangaliso Wetland Park and iSimangaliso Marine Protected Area (MPA) are situated at approximately 52km east, and 86km further east, respectively (**Figure 11**).

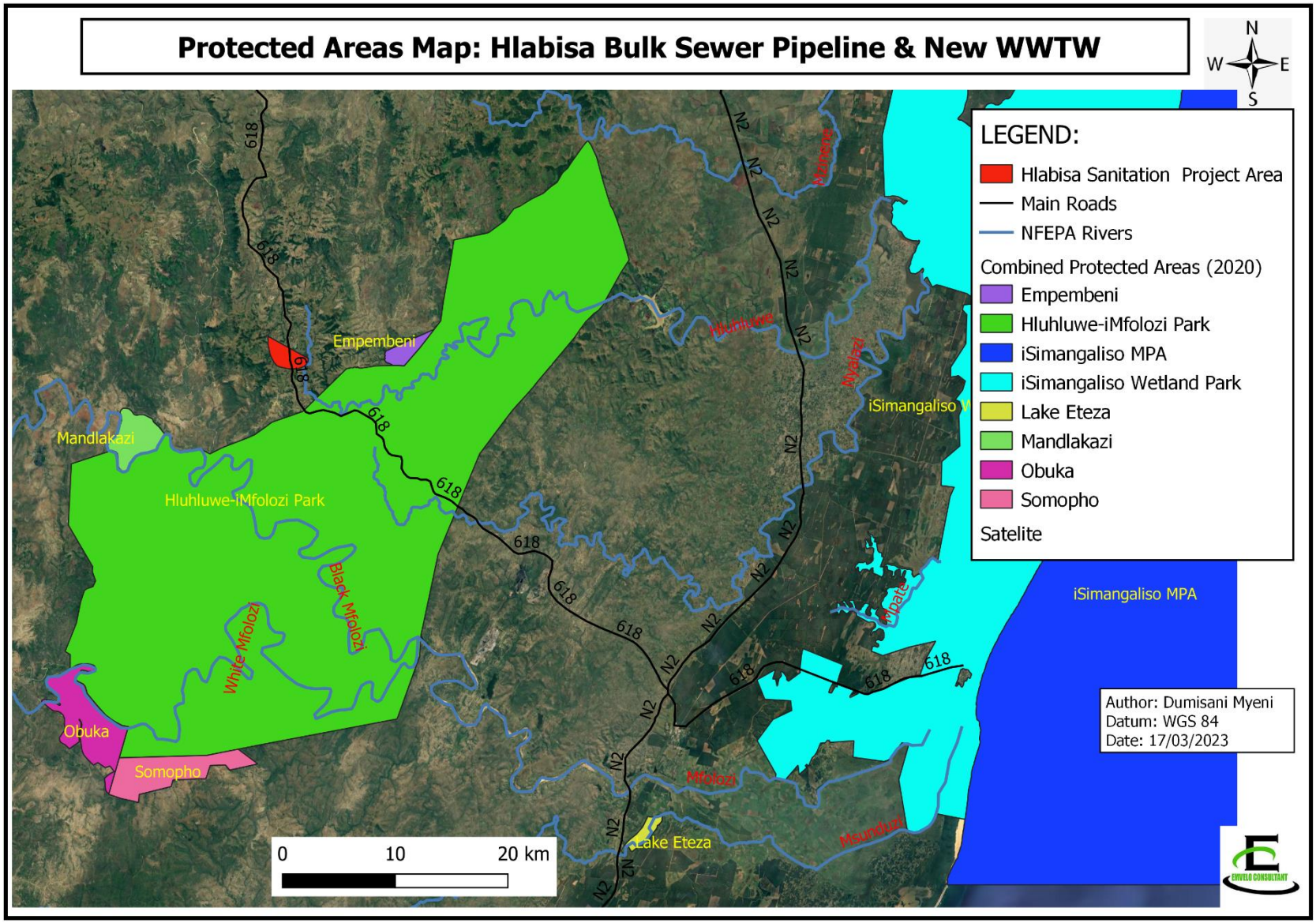

Figure 11: Map showing Protected Areas within the region of the study area

There are two main categories of areas that are required to meet conservation targets. These two main categories include 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 biodiversity and/or process 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 Critical Biodiversity Areas (***Refer to table 15***).

It is estimated that threatened ecosystems make up 9.5% of South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Biodiversity Sector Plans, municipal Strategic Environmental Assessments (SEAs) and Environmental Management Frameworks (EMFs), Environmental Impact Assessments (EIAs) and other environmental applications (Mucina et al. 2006).

Table 15: Subcategories of CBA and ESAs [Source: Ezemvelo KZN Wildlife,2014]

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 Critical Biodiversity Areas.**	
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 Critical

	Biodiversity Areas. 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.

According to the Ezemvelo KZN Wildlife (2016), the proposed development site does not fall within any of the KZN CBA: Optimal Areas or CBA: Irreplaceable Areas (***Figure 12***).

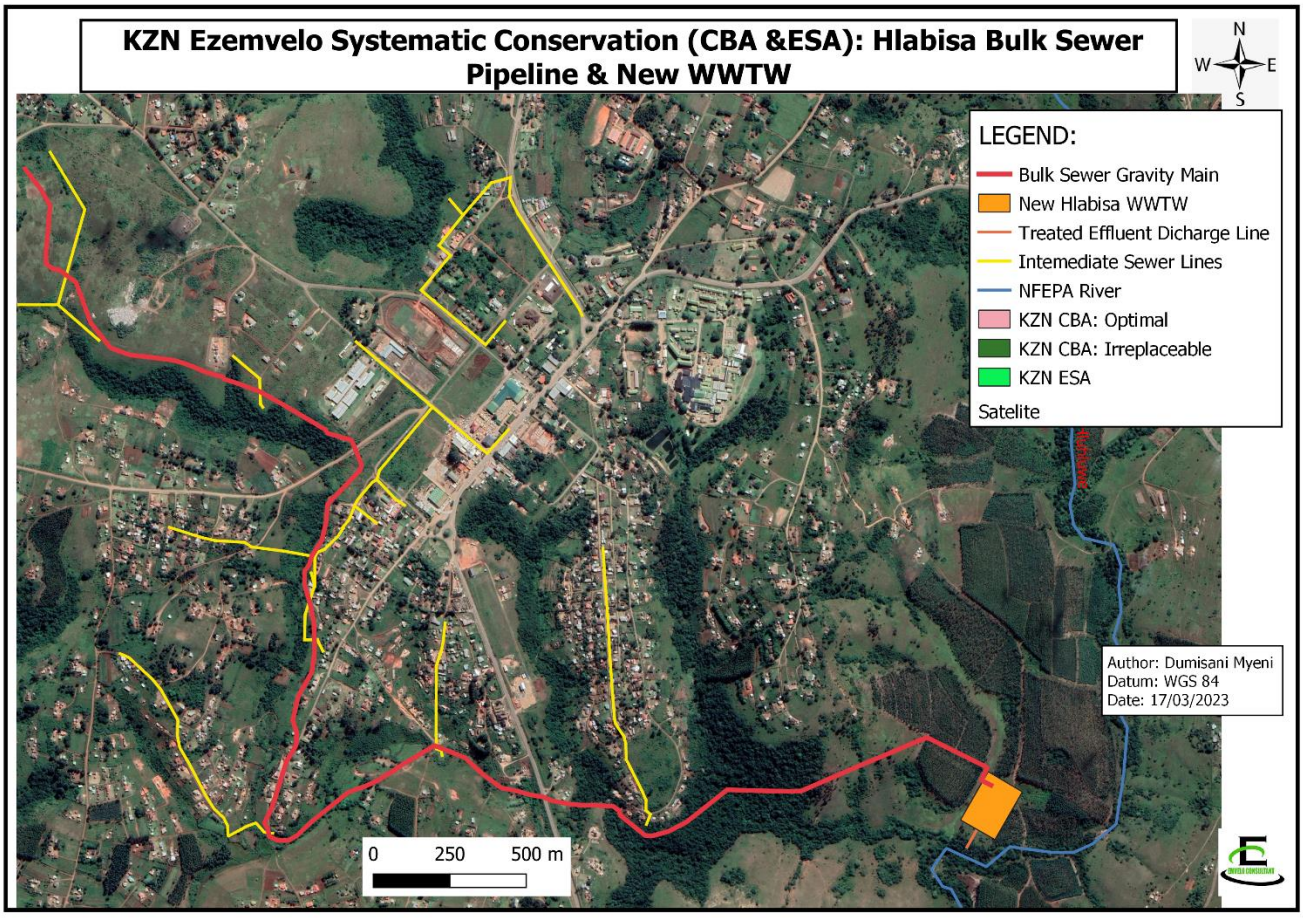

Figure 12: Sensitivity map showing no CBAs and ESA within the project reach

11.6.1 Potential Impacts

There are no protected areas and CBAs within the study area. It is important to note that intensive vegetation clearance at project site can lead to fragmentation, reduction, and loss of habitat as well as loss of plant species SCC and migration of animals away from the area. However, proper mitigation can be achieved through carefully implementation of recommendations given by the EMPr, and by Terrestrial Ecological Impact Assessment.

11.7 Fauna

The uMkhanyakude District lies within the Maputaland-Pondoland Albany bioregion hotspot which said to have high levels of species and endemism for fauna in avifauna, reptiles, mammals and marine biodiversity. Whereby, 14 of the 631 bird species that inhabit this region is endemic and 25 '*Red Data Species'*. Out of 208 species of mammal eight (8) of them are endemic to this region. The 'Critical Endangered' faunal species within the district is the *Cloeotis percivali australis sp*. (Short-eared trident bat), while other 12 are 'Endangered', and 40 of the faunal species within the district 'Vulnerable', and total of 20 species endemism (Ezemvelo KZN Wildlife, 2014).

In addition, the desktop survey interrogated the potential faunal species that could be found on the study area are those which have been recorded in the Quarter Degree Square 2831BB (***Figure 13***) obtained from FitzPatrick Institute of African Ornithology (2023). It is important to note that the project area is within the Quarter Degree Square 2831BB, and this region being interrogated cover the study area and stretch far to the Hluhluwe-iMfolozi Park System. Therefore, species being listed may be situated may also reflect the species within the protected area situated approximately 2.8km east and south of the project area.

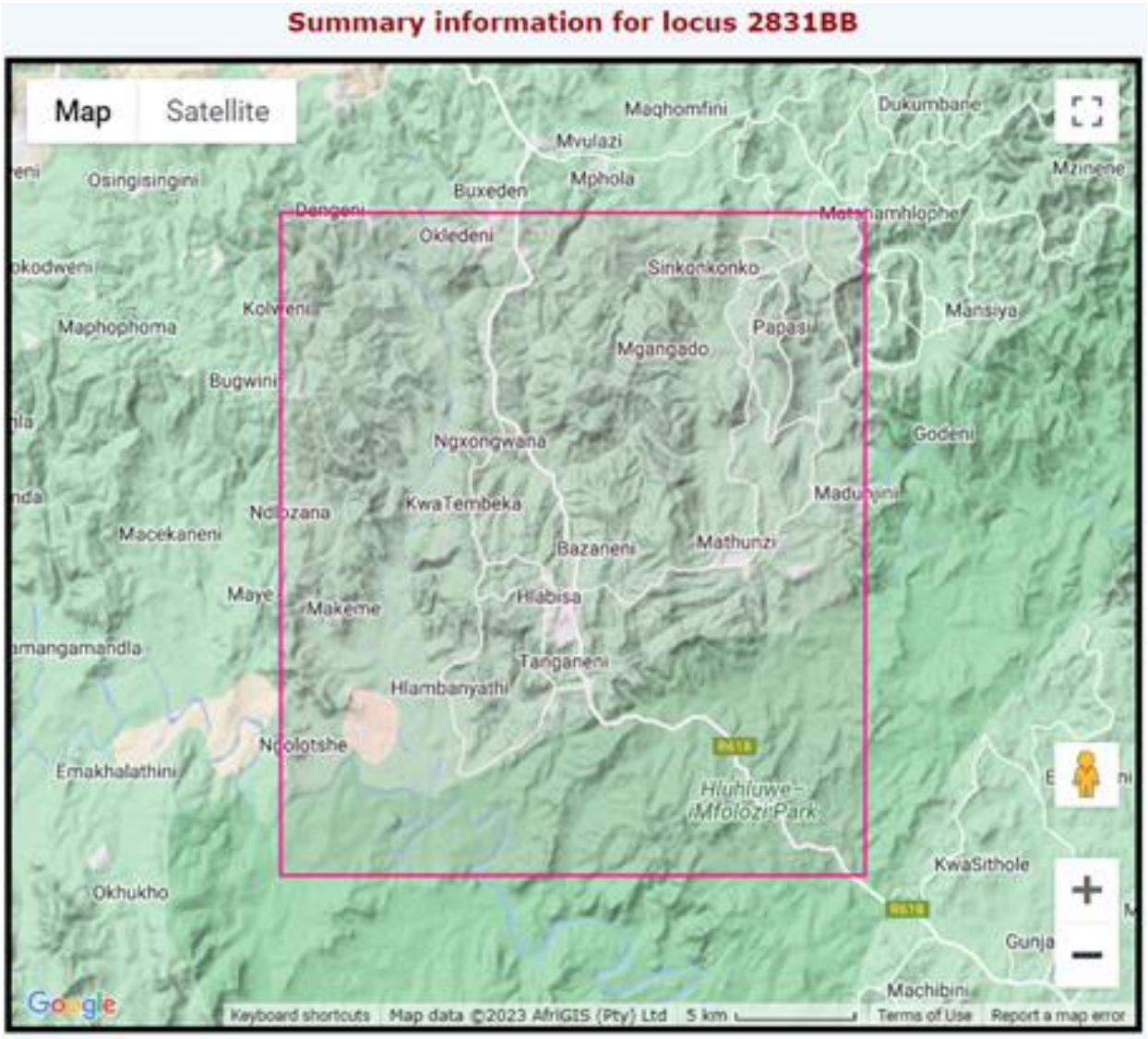

Figure 13: Figure 12: 2831CD Quarter Degree Square [Source: ADU, 2022]

The desktop observed the probability of occurrence of 21 frog species, 128 *Lepi* (butterfly) species, and 21 *Odonata* (dragonfly) with conservation status classified as '*Least Concern'*. There were 73 bird species which were recorded within the study region, to which one (1) amongst classified as '*Vulnerable*', three (3) were '*Endangered*', and two (2) were '*Critical Endangered*'. However, the identity of those species is withheld for their protection. There were 53 mammal species which were recorded, amongst which one (1) was classified as '*Endangered*'; three (3) were classified as '*Vulnerable*'; four were classifies as '*Near Threatened*'. There were 41 reptile species which were recorded amongst which one (1) was classified as '*Vulnerable*'; and two (2) were classified '*Near Threatened*'.

The field investigation by Terrestrial Ecological Assessment observed the existence of only mammal species, namely *Lepus saxatilis* (Scrub Hare). three frog species were recorded on site, namely *Hyperolius marmoratus* (Painted Reed Frog), *Amietophrynus gutturalis* (Guttural toad) and *Kassina senegalensis* (Bubbling Kassina). No frog species of conservation concern were recorded during the survey. No frog species of conservation concern were recorded during the survey. Twenty-eight (28) bird species were recorded during the field survey; However, no bird nests were identified on the study area, and bird species of conservation concern were recorded during the survey. Five reptile species were recorded during the survey, namely *Dispholidus typus* (Boomslang), *Trachylepis striata* (African Striped Skink), *Lygodactylus capensis* (Common Dwarf Gecko), *Causus rhombeatus* (Rhombic Night Adder), and *Acanthocercus atricollis* (Southern Tree Agama). No reptile species of conservation concern were recorded during the survey.

The following invertebrate species were recorded on the proposed development site, namely Elegant Grasshopper (*Zonocerus elegans subsp. elegans),* Brown Pansy (*Junonia natalica natalica*), African Yellow Pansy (*Junonia hierta cebrene*), Common Mother-of-Pearl (*Protogoniomorpha parhassus*), Broad-bordered Grass Yellow (*Terias brigitta brigitta*), Pirate (*Catacroptera cloanthe*), Soldier Pansy (*Junonia elgiva*), Plain Tiger/African Queen/African Monarch (*Danaus chrysippus*), Common grass yellow butterfly (*Terias hecabe solifera*), Inspector (*Chalcostephia flavifrons*), Citrus swallowtail (*Papilio demodocus*), Pea blue/Long-tailed blue (*Lampides boeticus*), Common Meadow White Butterfly (*Pontia helice helice*) and Buff-tipped Skipper (*Netrobalane canopus*). No invertebrate species of conservation concern were recorded during the survey.

The infield assessment by the Aquatic Ecological Assessment provides that the study area comprised primarily of taxa that are moderately tolerant to pollution, although multiple highly sensitive taxa were also sampled, which included: *Baetidae*, *Chironomids* and *Gomphidae*. Similarly, in the downstream reach, some highly sensitive taxa were collected including, *Baetidea*, *Leptophebidae* and *Gomphidae*. The fish species recorded within Hluhluwe River was the Southern mouthbrooder (*Pseudocrenilabrus philander*).

11.7.1 Potential Impacts

Vegetation clearance within the wetlands, riparian and instream, and scarp forest habitat for the purpose of construction of sewer conveyance infrastructure water pipeline could modify natural integrity of the species habitat, locality fauna disturbance might occur and could led to fragmentation, reduction, and loss of habitat as well as the ecological corridors and connectivity. However, proper mitigation can be achieved through carefully implementation of recommendations given by the EMPr, Terrestrial Ecological Assessment.

11.8 Topography

The uMkhanyakude District has a varied topography characterised by a diverse terrain consisting of coastal dunes and plains, mountain ranges and low-lying foothills, high hills and incised river valleys, that extends from the flat eastern coastal plans with undulating coastal dunes, and flat terrain from west, east and southern foothills of Lebombo Mountain range with peak altitude of 670m above mean sea-level(mAMS). The topography within the district ranges from 10-670 mAMS where the central is characterised of mountain range, the north-eastern and south-eastern, in fact the coastal region characterised of flat plains. The western boundary is characterised of undulating terrain and form a headwater for major rivers within the district (Ezemvelo KZN Wildlife, 2014).

The study area within Hlabisa Bulk Sewer Pipeline and new WWTW is located within the western region of uMkhanyakude District and is characterised by high altitudes and the undulating terrain with the altitude ranging between 380 and 250mAMSL, the lowest altitude is observed at the proposed new Hlabisa WWTW within Bazane area, whist the highest altitude is observed at the start of bulk sewer gravity main within Matshamnyama area. The locality of the project is characterised of incised valley represented by a green mash which is traversed by non-perennial stream, as the study area drains to the valley situated around western, southern and eastern parts, semi-surrounds the Hlabisa town (***Figure 14***), with Soil Erodibility Score (K-factor) of 0.22 (medium erodibility).

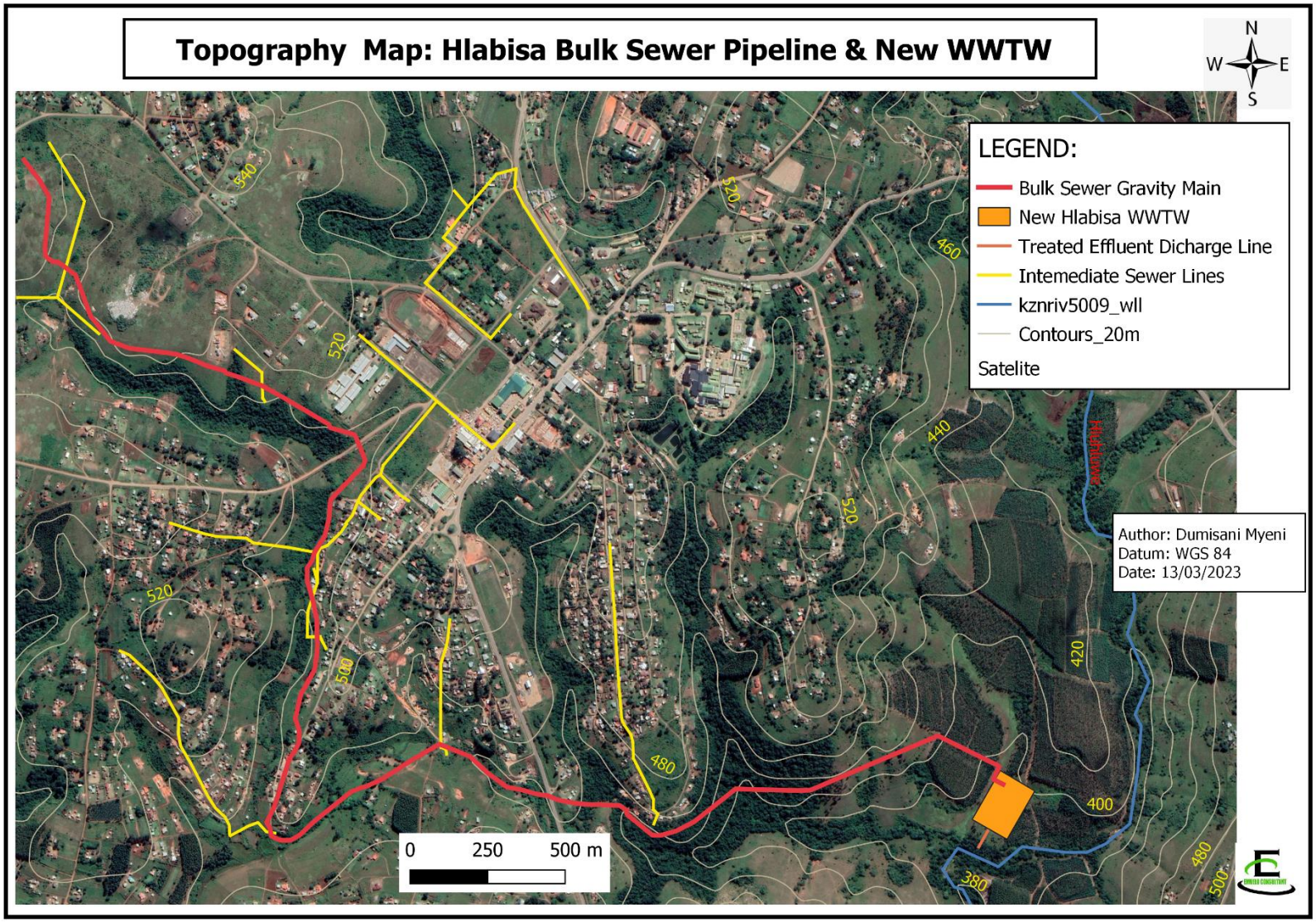

Figure 14: Contour Map showing elevations project area

11.8.1 Potential impacts

The vegetation clearance at slopes and incised valley can have surface run-off propensity. Notwithstanding, the Geotechnical investigation is required to determine the necessary mitigation and construction methods where the cut slopes will be required. This will be addressed in accordance with in-sutu material erodibility, excavatibility, rippability, and run-off propensity. However, proper mitigation can be achieved through carefully implementation of recommendations given by the Geotechnical Assessment and EMPr.

11.9 Geology

The uMkhanyakude District's geological features are stratified and with intrusion across the regions, which vary widely according to their topographical location. However, sandy soils which are susceptible to run-off erosion tend to dominate in the eastern and coastal region. The district is characterised by soils of well to moderate drainage, black soils, duplex soils and alluvial soils. The coastal (eastern region) is characterised of flat plains with coastal sand dunes. This part of the district is underlain by *Cainozoic* sediments of Maputaland Group formation and Zululand Group formation, which are later transitionally traversed by *Ecca Group Arenite* of dolerite formation, further in land at the eastern foothill of Lebombo Mountain range. Furthermore, the Lebombo Mountain range is predominantly underlain by Lebombo Group Basalt, with western foothills at the southern region underlain by a conglomerate intrusion of shale, *Ecca Group Arenite* formation and Vryheid Formation and *Dwyka Group* formation of shale, sandstone, coal, and alluvial formation (Ezemvelo KZN Wildlife, 2014).

The western region of uMkhanyakude District have stratified geological formation *Archaean* Basement Rocks and Karoo Supergroup, within numerous intrusions of sub-groups. The oldest *Swazian* basement rocks are exposed north of Hlabisa where the *Mandeva* Formation (*Mozaan* Group, Pongola Supergroup) conglomerate, banded iron formation and shale are intruded by the more extensive coarse grained porphyritic biotite granite and tonalite of the *Nzimane* Granite. The distinctive *Wela* Formation quartzite, schist and banded iron-formation are exposed in the Wela and Nzimane River valleys. These basement units are unconformably overlain by the Ordovician-Silurian sandstones of the Natal Group to the east and north of Hlabisa town. The distribution of these rocks is strongly influenced by north-south oriented block faulting. The Karoo Supergroup rocks are subdivided into the *Dwyka* and *Ecca* Groups which have a widespread distribution in the hilly terrain of Hluhluwe-iMfolozi Park near Hlabisa.

The *Permian* to *Triassic Emakwezeni, Ntabene, Nyoka and Clarens* Group Formations form the high hills defining the eastern boundary of the park and extend northwards as irregular, steep hilly terrain. The *Lebombo* Group volcanic rocks form the low-lying area extending through Ngweni, Mhlosinga and Bayala and the prominent Lebombo mountains (Ezemvelo KZN Wildlife, 2014).

The study area is situated at Hlabisa which is at the western boundary of uMkhanyakude District. The dominance geological formation comprises the *Tillite* Group, with *Arenite* and *Shale* intrusion, as the project area is within a stratified belt of *Tillite* Geological Groups Formation, with Shale and Mudstone of the Dwyka Group and Karroo Supergroup. (***Figure 15***).

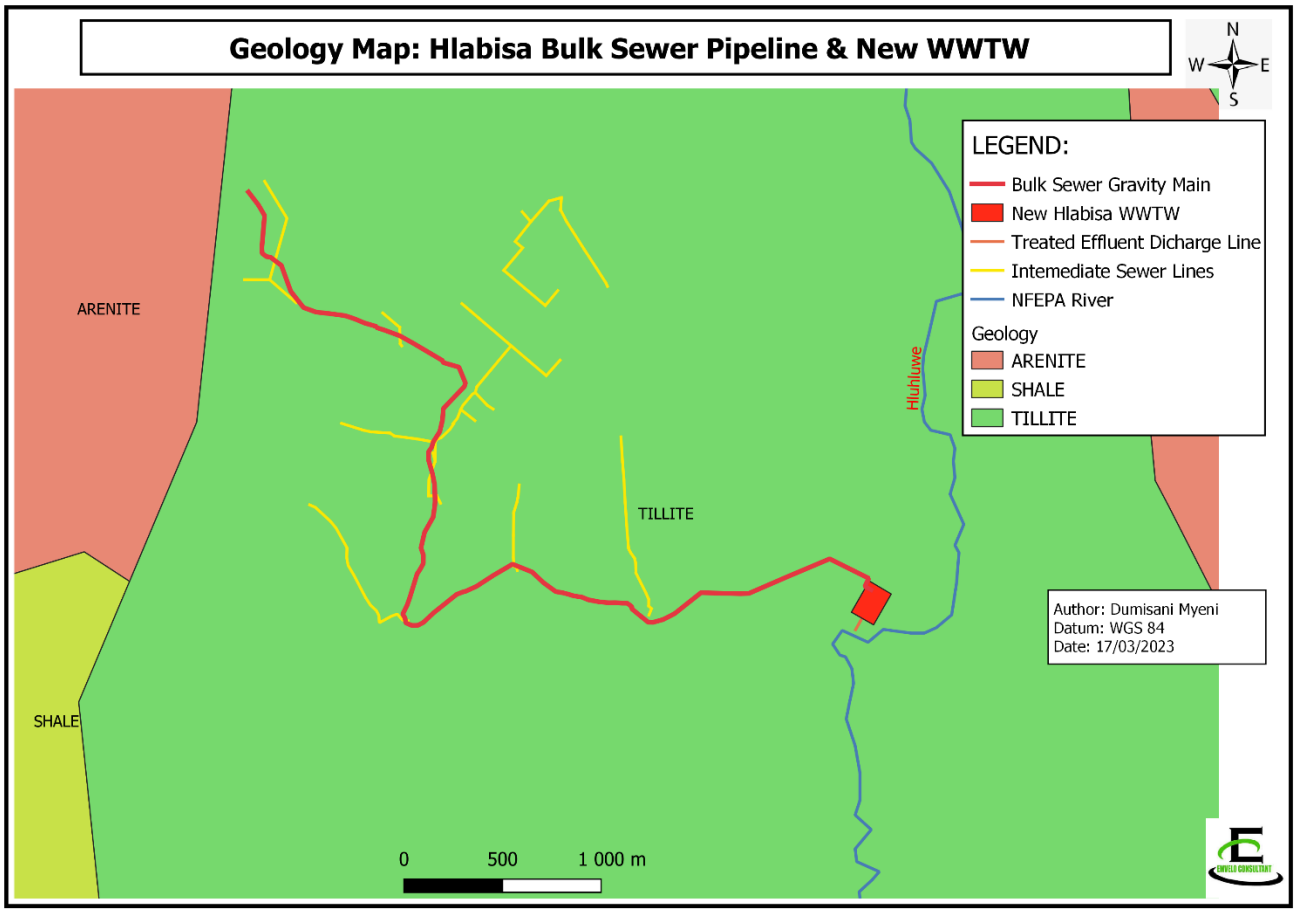

Figure 15: Map showing a dominance geological formation within study area

The infield investigation by the geotechnical assessment indicated that the prominent geological structures comprise the topsoil, clayey-silt-sand mixes associated with residuum and decomposed to highly weathered sediments along the bulk sewer conveyance route. Shale bedrock present at an average depth of 2m that underlies the WWTW site ranges initially from soft to intermediate but becomes hard excavation with depth. Bedrock on the five sites comprises Vryheid Formation sandstone pipeline route with the balance made up of *Dwyka* tillite and – shale in the vicinity of the WWTW. No seepage was encountered at PSS 1 and PSS 2; PSS 3 although the section is located within the narrow flood plain within the valley along the bulk sewer pipeline route. Seepage was encountered at PSS 3 and PSS 4 and the two test pits excavated on the WWTW site, mostly at 2m below EGL. The sloping topography on PSS 1, 2, 4 and the WWTW provides good drainage, and no ponding was observed.

11.9.1 **Potential impacts**

The construction activities for sewer conveyance infrastructure and WWTW include excavation for sewer conveyance infrastructure, and the founding for WWTW construction. This activity may have impact on geological stability within the vicinity of sewer conveyance and WWTW, and along the pipeline route at elevated areas, thus result in run-off erosion. Therefore, the mitigation measures given by the Geotechnical Assessment and EMPr must be adhered to in order to minimise any potential significant impacts that may arise.

11.10 Visual environment and land use character

Subject to the direct visual influence of the proposed project, 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).

Six (6) discrete habitat types were delineated within the assessment area, namely, wetlands, riparian and instream habitat, scarp forest, sourveld, and transformed (which is within

settlement). The proposed development site traverses through the forest, grasslands, crosses the R618 provincial road, near human settlements and streams. The existing land use of the project area and its immediate surrounding area include cultivated land (subsistence farming), forest plantations (agricultural facility) and homesteads. The Land use along bulk sewer gravity main route comprises of indigenous open spaces along the valley, low-high density settlements, subsistence farming which are characteristics along the gravity main (***Figure 16***).

Figure 16: Visual Characteristics along Bulk Sewer Gravity Pipeline Route

Notes: *Frame A, B, C & D depict the land use character along bulk sewer gravity main route comprises of indigenous open spaces along the valley, low-high density settlements, subsistence farming which are characteristics along the gravity main. Frame A depict the stream along the valley which is considered a drainage line.*

The proposed development is the construction bulk sewer pipeline which involves route clearance and excavation for the installation of sub-surface infrastructure (bulk sewer pipe) along the low-lying areas, which in this instance is the valley. The site camp establishment is considered to have no negative visual impacts, as the proposed infrastructure will be

concentrated within existing developed area, such as using site from households facilities. During construction activities it is likely that the project could be considered 'low visibility' as it can be visible from a small area around the project site (<1km radius). However, the visual impact will be temporary as will only be experience during construction.

The commercial forest and indigenous open space have been observed at the new Hlabisa WWTW site. The site is adjacent to Hlabisa River, as a result the treated wastewater from WWTW will be discharged in this river (***Figure 17***).

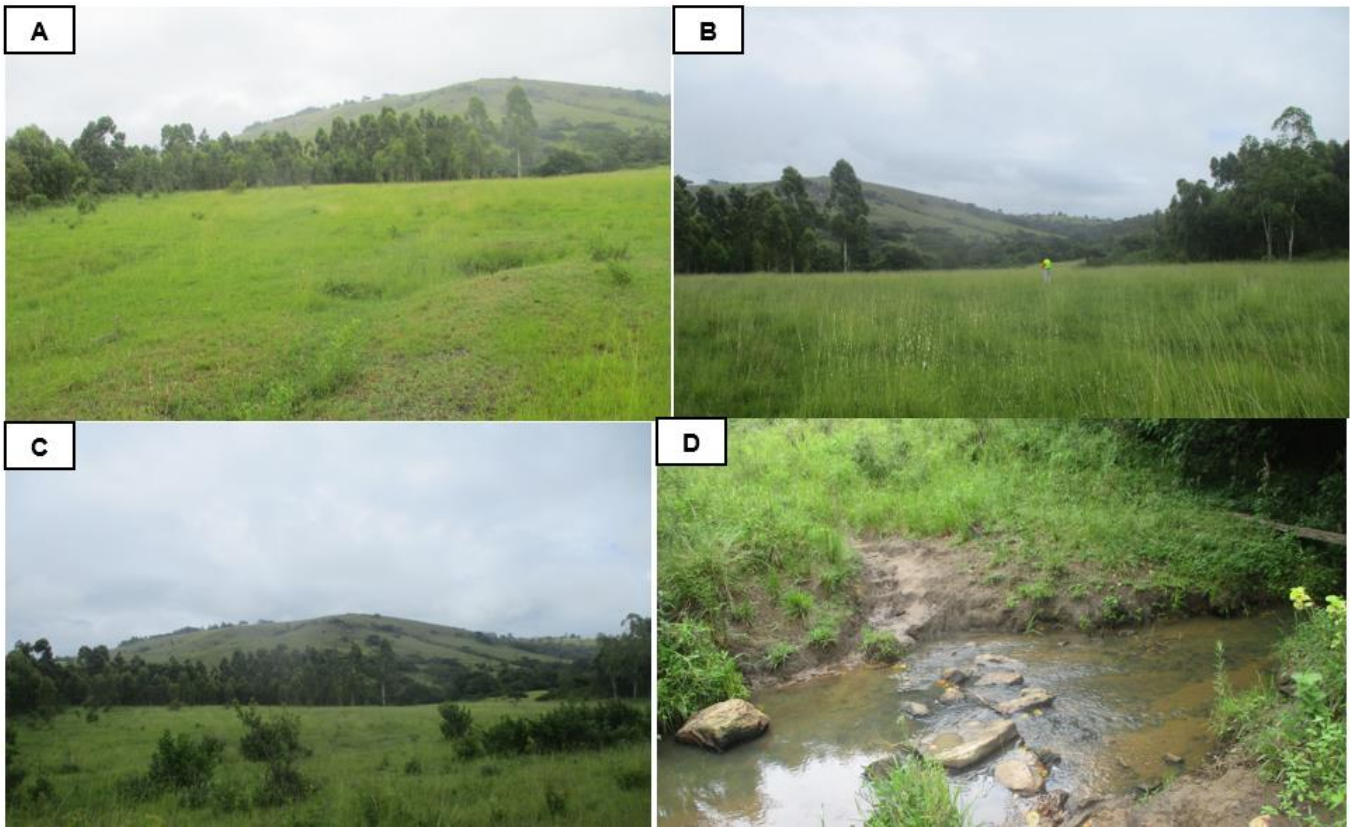

Figure 17: Visual Characteristics of Proposed New WWTW Site

Notes: *Frame A, B & C depict the land use character which comprise open space and commercial forest (Eucalyptus plantations) surrounding the new WWTW site. Frame D depict the upper reach of Hlabisa River adjacent to the new WWTW. The treated wastewater will be discharged into Hluhluwe River.*

The proposed development is the construction the new WWTW and associated infrastructure within indigenous open space surrounded by commercial forest. The WWTW infrastructure will be constructed in an isolated and remote area. However, will be considered to have 'Low

visibility' as the area is surrounded by the commercial forest, which is the WWTW vicinity were predominantly the *Eucalyptus plantations* which were concentrated along the Hluhluwe River. Therefore, the new WWTW will be hidden within the commercial forest, and it can be '*low visibility*' as it can be visible from a small area around the project site (<1km radius).

11.10.1 Potential Impacts

The proposed sewer conveyance infrastructure project consists of mainly sub-surface infrastructure. Also, the vicinity of the proposed new Hlabisa WWTW is predominantly the *Eucalyptus* plantations (commercial forest) which were concentrated along the Hluhluwe River WWTW. 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.

11.11 Heritage, cultural and palaeontological aspects

According to Ezemvelo KZN Wildlife (2011), the history of human inhabitation in the region around Mtubatuba and Hlabisa dated back since the early stone age to the late iron age, which involves San tribe and later Nguni tribe from the Middle Ages. Whereby, this history could be exhibited through kraals, burial, and smelting sites.

Archaeological and Cultural Heritage assessment is not considered viable the site has a low sensitivity theme, as depicted by Environmental Screening Tool (***Figure 17***).

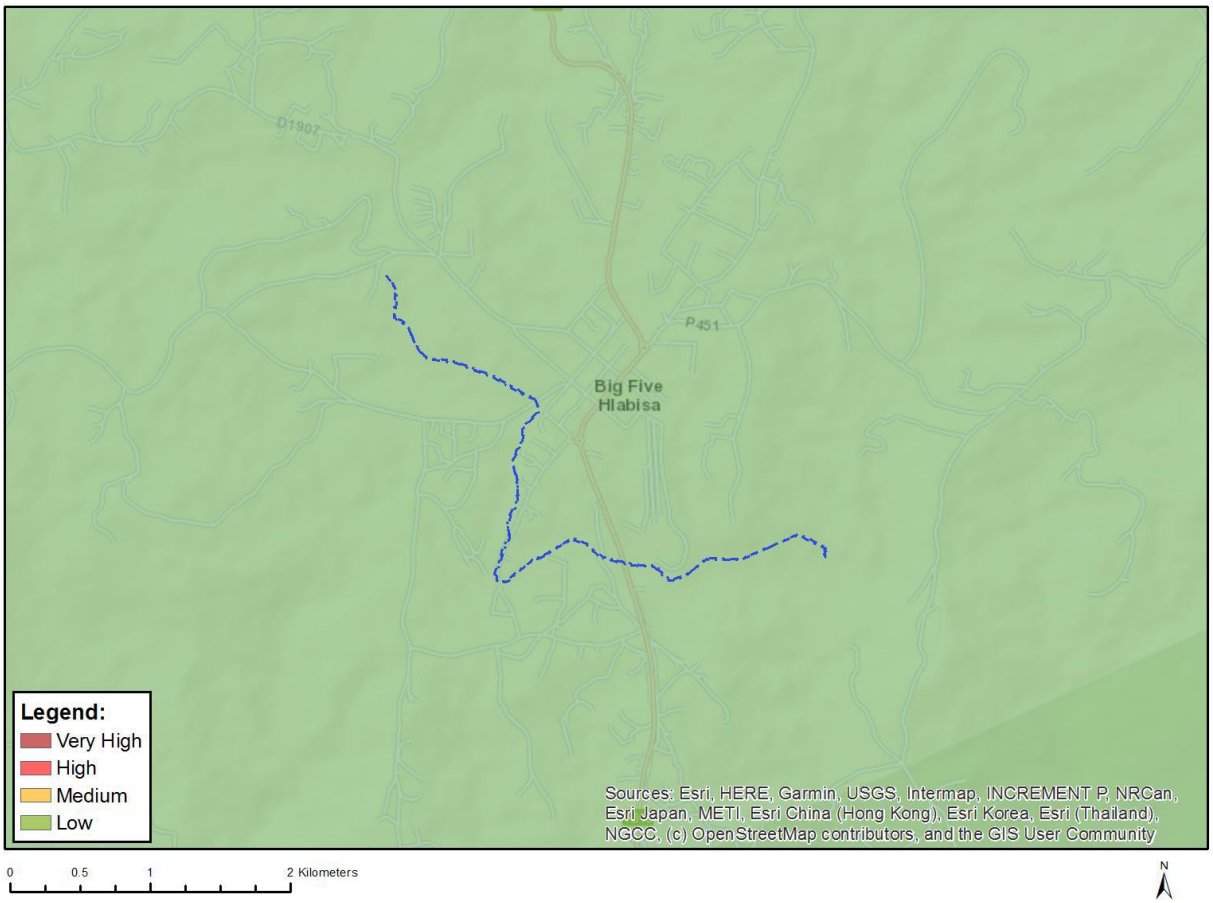

Figure 18: Archaeological and Cultural Heritage Sensitivity Theme

The SAHRIS palaeosensitivity provides that, the ***Red,*** 'Very High' - field assessment and protocol for finds is required; ***Orange/yellow***, '*High*'- desktop study is required and based on the outcome of the desktop study, a field assessment is likely; ***Green***, '*Moderate*' - desktop study is required; ***Blue***, '*Low*' - no palaeontological studies are required however a protocol for finds is required; ***Grey***, '*Insignificant/Zero*' - no palaeontological studies are required; ***White/Clear***, '*Unknown*' -these areas will require a minimum of a desktop study. As more information comes to light.

A preliminary desktop study for palaeontological fossils sensitivity of the proposed site, reveals that the site falls within a '*Moderate'* paleontological sensitivity, as result a field assessment is not required for this study (***Figure 19***). The high sensitivity intrusion on the further west, but this section of high sensitivity falls outside of the project area.

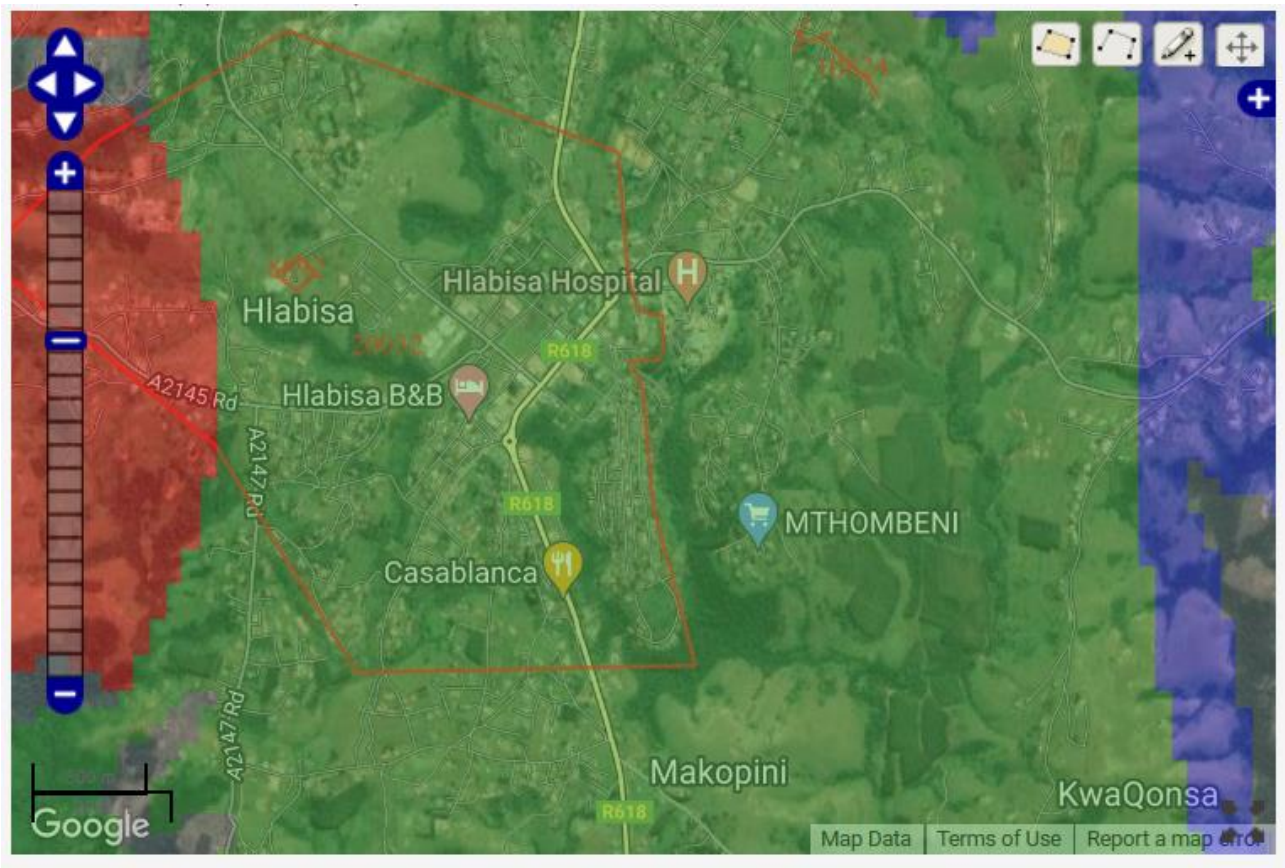

Figure 19: Palaeontological Sensitivity of the study area

[Source: https://sahris.sahra.org.za/node/add/heritage-cases]

Moreover, the environmental screening tool also describe that the section of the study area as having 'Medium' paleontological sensitivity and a '*Low*' archaeological and cultural heritage sensitivity (***Figure 20***).

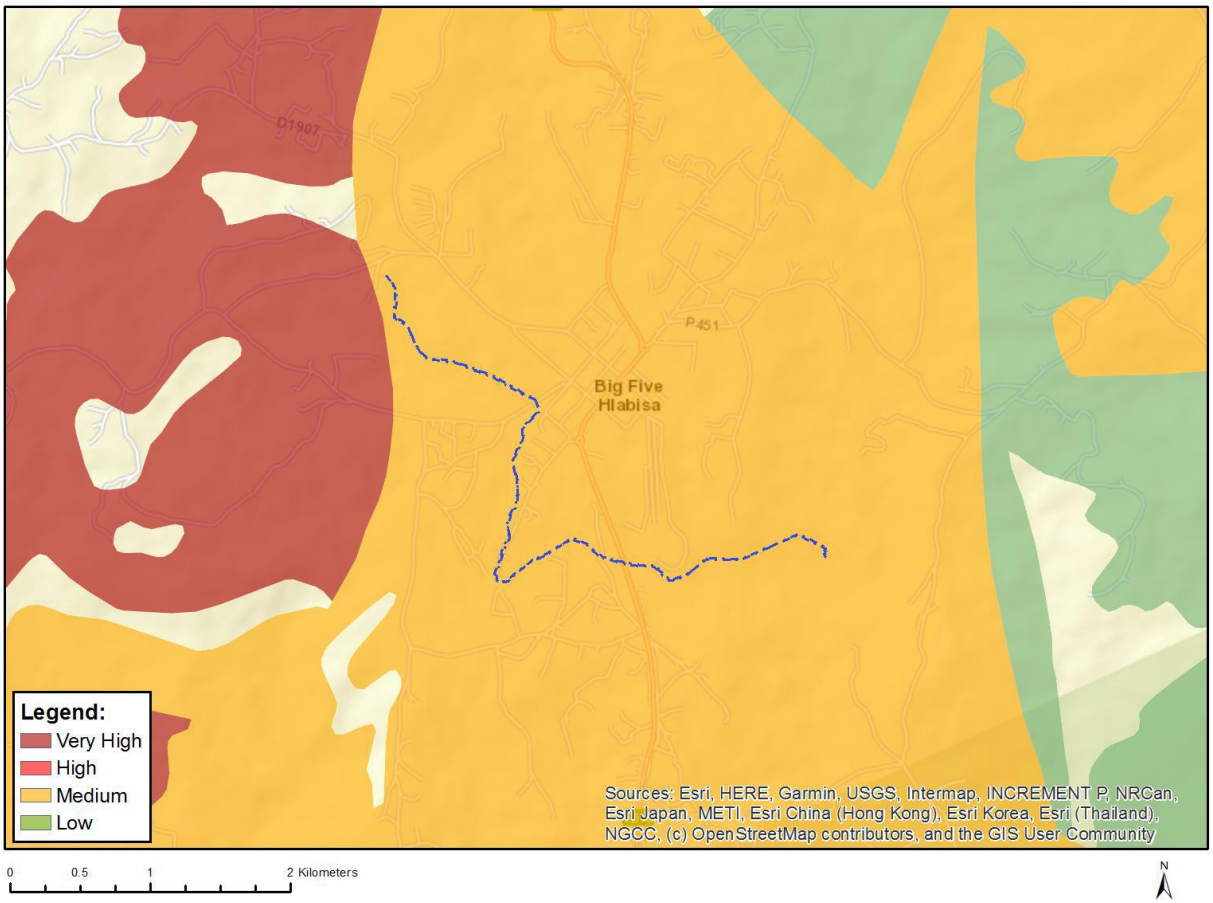

Figure 20: Environmental Screening Tool Palaeontological Sensitivity

Archaeological resources may still be discovered during excavations or any ground-breaking activities during the construction phase.

It must also be noted that the study area has no formal burial site, but community make use of the household burial sites. As, a result one grave within the household at location (*28° 9'21.60"S, 31°52'4.68"E*) was observed but falls outside the project corridor.

The inquiry has been lodged with South African Heritage Resource Agency care of AMAFA Heritage Resource Institute to ascertain whether there are any cultural and heritage sites within the study area. Findings will be incorporated into the final Basic Assessment Report.

11.11.1 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.

11.12 Social and economic aspects

The BFLM is a largely rural municipality with only two semi-urban areas being Hluhluwe and Hlabisa towns. The agriculture, tourism, retail sectors, game reserves and government institutions are the major sources of employment creation. The municipality is considered to experience brain drain due to exponential youth migration to the cities in quest for job and decent livelihood. This is also reflected in the smallest imbalance in gender ratios, i.e. the most evenly matched proportion of males and females, with the following population stratifications: Under 15 years (40.3%); 15 – 64 years (55.6%); and over 65 years (4.2%), making the half of the population which falls under economic active group, and with high rate of youth unemployment of approximately 70% with the highest rate recorded to youth under the age of 25 years which constitute 40%.

The BLFM three categorized of household, namely; formal, informal and traditional type housing, with 17 724 households falls under formal housing, 536 households fall under informal housing and 6 856 households falling under traditional housing. The study area comprises of hybrid human settlements which can be classified into semi-formal and traditional households.

The water and sanitation mandate of BFLM falls under the UKDM which is the delegated Water and Sanitation Service Authority (WSSA) for all municipalities within the district, which include the Big 5 Hlabisa Local Municipality. The access to basic water infrastructure remains one of the key challenges in UKDM. The proportion of households provided with water through regional and local water schemes is only 42% compared to the provincial percentage of 72%. About 30% of households are utilising untreated sources of water directly from springs, dams

or rivers, a figure significantly higher than the provincial total of 13%. In addition, the district experiences the backlog in terms of delivering sanitation which meets the minimum World Health Organisation (WHO) standards. A total of 65 675 households has below minimum level of service in terms of sanitation access. Only 16.6% of the entire population within the district have got access to water-borne sanitation with 15.2% having no access to any form of sanitation. Therefore, in light of above discussion the UKDM has identified various areas and settlements within the district, which require sanitation upgrades to a full water-borne sanitation system. Therefore, the district proposes to construct the water-borne sanitation system within Hlabisa town and the surrounding communities.

The project will have positive impacts in terms of improving livelihoods, through provision of efficient water-borne sanitation. It is also expected that the local community will benefit through jobs during the construction, operation, and maintenance phase, 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.

The bulk sewer gravity main is proposed to be situated at along the valley which is considered a low-lying area within the project area. There is subsistence agriculture land use within the valley at some section of the proposed bulk sewer gravity main. However, because the bulk sewer gravity main comprise mainly of sub-infrastructure which will be trenched and laid at approximately 1m depth, as a result there will be no change in land use, as the land can be later be used for substance agriculture after construction. Also, the pipeline is located within the valley outside settlements, therefore pose no threat of households relocation.

11.12.1 **Potential Impacts**

No negative impact associated by the proposed development, as there is no relocation of households is anticipated. In fact, the project will have positive impacts in terms of improving livelihoods, through provision of efficient water-borne sanitation. It is also expected that the local community will benefit through jobs during the construction, operation, and maintenance phase, 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.

11.13 Traffic

The access road to the project sites is linked to the settlement access roads. Local communities and road users including school children will be impacted during construction activities in the area. The route which are likely to be heavily impacted by heavy construction vehicle turning to site are R618 within Hlabisa Town, D1907 toward substation, down the valley (pipeline route) where the project starts, east of Hlabisa town passing the Hlabisa Hospital towards the new WWTW.

11.13.1 Potential Impacts

The hauling of material and equipment to site will utilise existing local roads. The access to the site will have impact main road traffic, as construction vehicles turn main road. 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. However, proper mitigation can be achieved through diligent implementation of the recommendations contained in the EMPr. 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.

12 WASTE AND POLLUTION DURING CONSTRUCTION AND OPERATION

Construction activities, like other operations, also lead to water pollution and waste generation, and such pollution and waste have detrimental effect on the receiving environment.

12.1 Waste management

Some of the possible solid and liquid waste 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 the Mkuze landfill site, which is situated at Mkuze (28° 8'59.67"S, 31°52'9.75"E), while the disposal of hazardous and

medicinal waste will be handled by a certified service provider. Proper measures will be put in place to contain generated during construction, as prescribed by EMPr.

12.2 Hazardous waste

The incorrect handling and disposal of hazardous waste (lubricants, fuel, chemicals, agricultural remedies, *inter alia*) 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. Proper measures will be put in place to contain any spillages (oil spills) occurring during construction, as prescribed by EMPr.

12.2.1 Potential Impacts

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

The 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.

12.3 Wastewater (effluent)

The waste to be produced during the operational phase will emanate from the WWTW. This waste will be dominantly the effluent waste. The WWTW capacity will be 1.5Mℓ/day, and the general standard for potential water quality parameters is applicable to the effluent from the proposed WWTW.

Most of the generated sewage flow will be from domestic origin. The effluent from the new WWTW will be treated discharged into upper catchment of the Hluhluwe River, the grit and the screenings will dispose to approved landfill, as will be prescribed through waste classification.

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

- surface runoff from construction activities
- washing of vehicles, equipment, implements, etc.
- site toilets, food preparation, personal hygiene

12.3.1 Potential Impacts

The incorrect handling and disposal of wastewater (chemicals toilet and grey water) from site during construction could have detrimental impacts on nearby watercourses. Proper measures will be put in place to contain any spillages (wastewater), sludge 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 of at the existing Hlabisa WWTW.

The potential impact during operation could be an overflow of WWTW due the block screens, and poor maintenance for WWTW, and conveyance infrastructure such as pumpstations. The wastewater may enter the nearby watercourse, or seep into groundwater. 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.

However, proper measures will be put in place to contain wastewater overflow and spillages from occurring during construction, and operational phase as prescribed by EMPr.

12.4 Air Pollution

The proposed development itself will not have direct impact on air pollution and atmospheric emission. However, certain activities during construction could have a minor impact 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.

12.4.1 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.

12.5 Noise Pollution

The project sites will emit different levels of noise due the various construction activities, movement of heavy construction vehicles, use of machinery as well as from large number of workers on site. However, noise impacts are expected to be of short duration and only during certain times of the construction phase, which is likely to only have impacts to the immediate environment.

12.5.1 Potential Impacts

The level of noise from the construction vehicle could be heard within the locality of the project sites and adjacent properties. However, proper measures will be put in place to contain any potential noise pollution impact occurring during construction, as prescribed by EMPr.

13 UTILITY SERVICES

The services imply to utilities supporting the construction and operation of the facility/activity. The service for consideration refers to; Water supply, sewer provision, and energy (electricity).

13.1 Water Supply

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

13.2 Sanitation Facilities

All construction sites will have chemical toilets located conveniently along the pipeline route and the new WWTW site, and all effluent waste will be disposed of at the existing WWTW next to Hlabisa Hospital.

13.3 Energy (Electricity)

The electricity during constriction will be supplied through the use of electricity generators. During operational phase at the WWTW, the facility will be electrified through connection to Eskom, and the use generator and solar power as a back-up.

14 OTHER EXISTING SERVICES

The existing services include the sub-surface infrastructure, such as water conveyance infrastructure; underground cables as well as overhead infrastructure such powerlines, telecommunication infrastructure, structures etc.; and existing roads.

The gravity main will have road crossings within the vicinity of R618 at approximately (*28° 9'22.09"S, 31°52'34.22"E*). This road crossing will take place at the main road (***Figure 21***). 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.

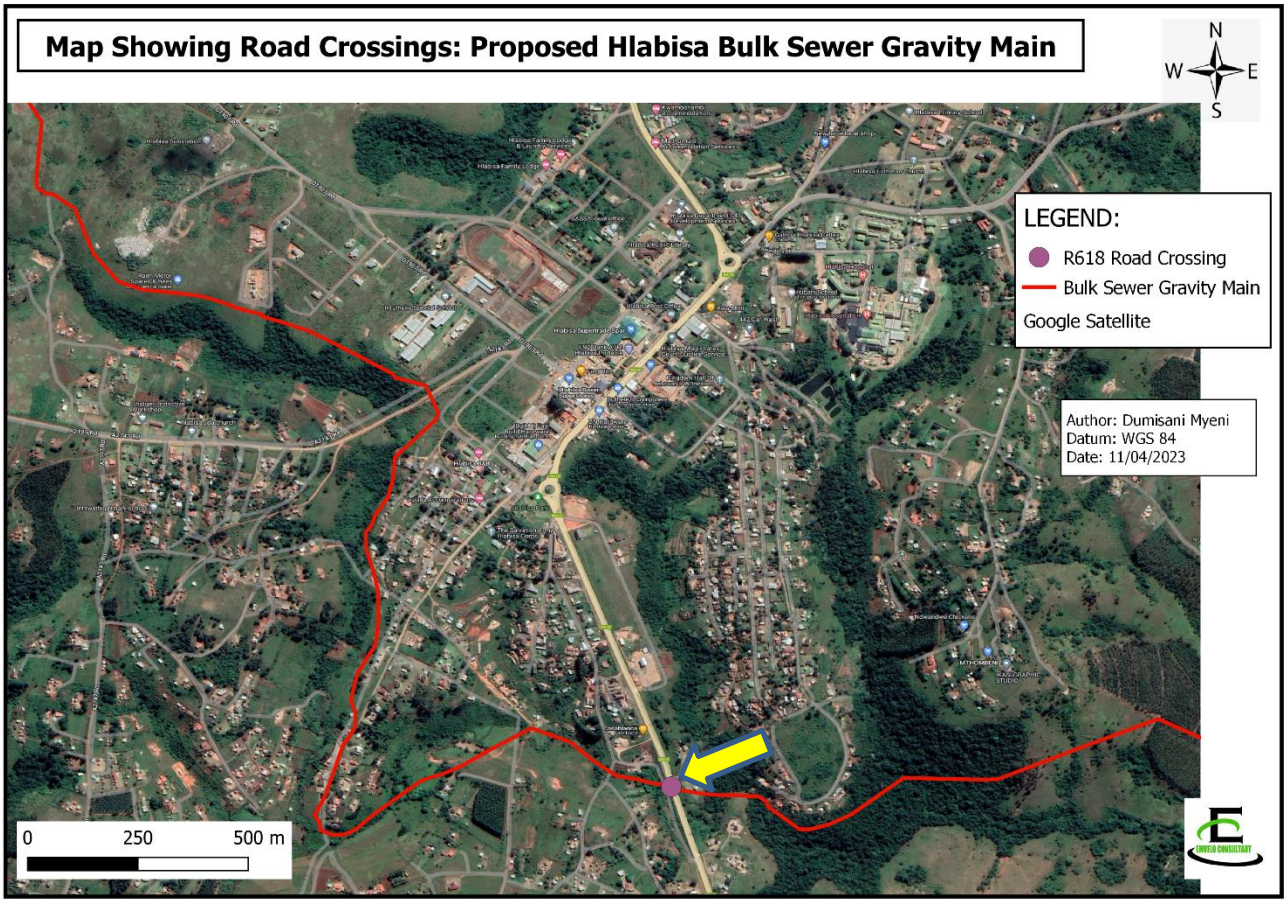

Figure 21: Map Showing R618 Road Crossings

14.1 Potential Impacts

The excavations for construction of the bulk sewer pipeline could unearth the existing services thus result in inconvenience to local communities serviced by the affected infrastructure. Uncontrolled construction activities within the vicinity of road crossings would undermine the road infrastructure integrity and result in road damage etc. However, proper measures will be put in place to prevent the damage to infrastructure during construction, as prescribed by EMPr.

15 IMPACT ASSESSMENT AND MITIGATION MEASURES

The Environmental Impact Assessment (EIA) conducted for the construction phase and the operational phase for the site, are discussed in (***section 15.1***) 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 proposed development:

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	*Duration = D*
5 – Definite (More than 80 % chance of occurrence)	5 – Permanent - The only class of impact that will be non-transitory (indefinite)
4 – Probable (Between 60-80% chance of occurrence)	4 - Long-term - The impact and its effects will continue or last for the entire operational life of the development (15 - 50years)
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)	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 impacts 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

15.1 Impact Analysis (Preferred Routing, Site Layout/Location and Design/Technology Alternatives)

Table 16: Impact Assessment Analysis for Project Planning Phase

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 topsoil removal and excavation for site set-up clearing could degradation of indigenous vegetation and sensitive plant communities such as *Northern Zululand Sourveld* (*Svi22*); *Zululand Lebombo Scarp Forest (FOz5);* and *Subtropical Alluvial Vegetation* (Aza7), and riparian habitats.	**Medium-High (50)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 5** **SP =50**	➢ The site layout plan must clearly delineate the servitude for the bulk sewer gravity mains construction corridor. ➢ The route design must incorporate a pipeline construction corridor of not be more than 10m width for the construction corridor within the vicinity of the stream crossing (riparian zones), and wetlands (*Subtropical Alluvial Vegetation (Aza7) vegetation*). ➢ The guidelines for the protection of natural forest habitat suggest that no activities or development should be considered that would destroy the forest habitats unless of strategic provincial or national importance with no feasible alternatives. Therefore, where feasible the route design must incorporate re-routing the construction corridor along the Zululand Lebombo Scarp Forest (*FOz5*). The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction	**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			
		corridor within the vicinity of the Zululand Lebombo Scarp Forest (*FOz5*). ➢ The design must incorporate a 15m buffer determination along the Zululand Lebombo Scarp Forest (*FOz5*). ➢ Should pipeline route runs along a Scarp Forest which is found within the study area. The permit will be required from DFFE in order to cut, destroy or disturb the natural forest. ➢ The design must incorporate a pipeline construction corridor of not be more than 15m width on the remainder sections of pipeline along habitat associated Northern Zululand Sourveld (*Svi22*), provided there are no sensitive environment. ➢ The design must incorporate a 15m buffer determination along the new WWTW and must be limited to demarcated footprint. ➢ The site layout plan must indicate areas that are no-go zones, to limit large scale and unnecessary vegetation clearance. ➢ Development planning must ensure that further loss of vegetation and disturbance are	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		restricted within the recommended site layout footprint. ➢ The site layout plan must clearly delineate the servitude for the bulk sewer gravity mains construction corridor around the *Zululand Lebombo Scarp Forest (FOz5*) with 15m buffer determination around the scarp forest. ➢ ECO must be appointed to oversee construction activities. ➢ A plan to actively rehabilitate the construction area post-construction needs to be developed. ➢ 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 importance of protected plants/trees and medicinal plants, as well as to conditions of the EA and the various permits/licenses.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
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 construction works will take place within a sensitive plant community such as Northern Zululand Sourveld (Svi22); Zululand Lebombo Scarp Forest (FOz5); and Subtropical Alluvial Vegetation (Aza7), and riparian habitats. There are no CBA1, CBA2 and ESA within the project reach. No threatened plant species or plant SCC were recorded within the construction corridor during the survey. However, there is a likelihood that plant SCC will be encountered during construction. However, plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL LILIACEAE, which includes which includes *Aloe sp*. such as Aloe *marlothii* and Aloe *arborscens*.	**Medium** **(36)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 3** **SP =36**	➢ The site layout for the bulk sewer gravity main and new Hlabisa WWTW construction must clearly illustrate the proposed construction footprint and clearly delineate the servitude for the construction corridor. ➢ The site layout plan must indicate no-go areas to limit large scale and unnecessary vegetation clearance. ➢ The site layout plan must indicate no-go areas to prevent disturbance or removal of ALL LILIACEAE, which includes *Aloe sp*. Where this proves not to be possible, a permit will be required from the provincial DFFE in order to disturb, and remove ALL LILIACEAE, which includes *Aloe sp*. before construction activities commence. ➢ Site camp must be established at already disturbed site, preferable for the new WWTW the site camp to be placed within fire break corridor of commercial forest. For the pipeline route, the site camp must be concentrated within existing developed area, such as using site from households' facilities and be demarcated by site layout.	**Negligible** **(5)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 1** **SP =5**

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 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.	
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 construction works will take place within or along the *Northern Zululand Sourveld* (*Svi22*); *Zululand Lebombo Scarp Forest (FOz5);* and *Subtropical Alluvial Vegetation* (Aza7), and riparian habitats. There are no CBA1, CBA2 and ESA within the project reach. However, there is a likelihood that animal SCC will be encountered during construction, as the riparian vegetation and woodlands provide suitable habitats for fauna species. Local fauna disturbance might occur and could led to fragmentation, reduction, and loss of	**Medium (36)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 3** **SP =36**	➢ The site layout for the construction of the bulk sewer gravity mains and new WWTW must clearly illustrate the proposed construction footprint and clearly delineate the servitude for the construction corridor. ➢ The site layout plan must make indicate no-go areas/zone, to limit large scale vegetation clearance. ➢ Site camp must be established at already disturbed site, preferable for the new WWTW the site camp to be placed within fire break corridor of commercial forest. For the pipeline route, the site camp must be concentrated within existing developed area, such as using site from households' facilities and be demarcated by site layout.	**Negligible (5)** **SP= (M + D + S) × P** **SP= (2 + 2 + 1) × 1** **SP =5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
habitat as well as destruction of ecological corridors and connectivity.			
Poor project planning will result in degradation of wetland, riparian and instream habitats: Poor design and / or implementation of the planned infrastructure associated with the bulk sewer gravity main, WWTW treated effluent discharge pipeline, and construction of new WWTW, such as pipeline stream crossings, wetland crossings and wetland clearance are likely to result in degradation of watercourse habitat include (i) undertaking bulk earthworks along the banks and riverbed (ii) placing infrastructure within watercourses, and (iii) dewatering 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. Seven (7) wetlands fell within the regulated area and only five (5) of these systems were identified to be at risk and required further assessment. These systems were identified as seepage, Unchanneled Valley Bottom (UVB) and Channelled Valley Bottom	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 5** **SP = 60**	➢ Design must incorporate the realignment of pipeline where it encroaches the sensitive environment wherever possible, as the best practice and were feasible, traversing small sections of wetland, such as within W02 (***Figure 7***) can be avoided through rerouting around the system. ➢ Develop the engineering designs to prevent or minimize alteration of flow regime within the vicinity of the stream crossings. ➢ 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. Preferable during the dry (winter season). ➢ A site layout plan must be compiled indicating the limits of disturbance associated with the construction of new Hlabisa WWTW and associated infrastructures in relation to the identified sensitive areas (i.e., Hluhluwe River and wetland system). No-go areas and	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (2 + 1 + 1) ×3** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
(CVB) wetlands and they were identified to be largely natural and moderately modified. The Bulk Sewer Gravity Mian traverse along the valley and the construction will have pipeline stream crossings. The Hluhluwe River is adjacent the new WWTW, as a result the treated wastewater from the WWTW will be discharged into this river. The effluent discharge pipeline from the new WWTW will be constructed.		any stormwater infrastructure must be indicated on this plan; ➢ The 'Site Layout Alternative' proposes the configuration of existing layout. The WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***). This will prevent the WWTW infrastructure to be prone to flooding in case of extremely event, and also prevent undesirable contamination Hlabisa River lying downstream of the WWTW. Furthermore, the Wetland Specialist has also recommended that an alternative site for the WWTW be explored such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected. Therefore, the proposed alternative site position (***Figure 3***) could meet the desirable development objectives and provide impact mitigation as the site will be shifted further north by 80-100m from current location. This will also avoid the option of	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		wetland offsetting, as this would be the case if the current WWTW position is considered. ➢ Buffer determination for watercourse habitat outside the construction corridor but at risk of being impacted. For the new WWTW 100m buffer determination is required between Hluhluwe River and new WWTW. This means the layout must be configured such that the WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***). ➢ The design for the pipeline route should be realigned where it encroaches the sensitive environment wherever possible, as the best practice and were feasible, traversing small sections of wetland, such as within W02 (***Figure 7***) can be avoided through rerouting around the system. ➢ The pipeline route along the wetlands must include buffer determination to design a layout to buffer at least 28m buffer for CVB wetlands; 26m buffer for UVB wetlands; and 25m buffer for seepage wetlands to protect	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		wetland habitat and ecological corridor and mark no-go areas. ➢ Clearly delineate the servitude for the construction corridor. A pipeline construction corridor must not be more than 10m width for construction within the vicinity of wetland systems, including riparian zone, and stream crossing. 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. ➢ 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. ➢ An ECO must be appointed to oversee construction activities, and establishment of	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		construction site camp, as well as to ensure compliance to all environmental legal requirements.	
Poor project planning will result in deterioration of surface water quality and streamflow reduction: Poor design and / or implementation of the planned infrastructure associated with the bulk sewer gravity main pipeline crossings at wetland, riparian and un named stream crossings along the valley, as well as construction of and new WWTW treated effluent discharge pipeline within the riparian of upper catchment of Hluhluwe River are likely to result in deterioration of surface water quality and streamflow reduction, include (i) undertaking bulk earthworks along the banks and 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.	**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. ➢ The design must provide that all pipeline crossings be aligned and designed to minimize 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. ➢ The design must provide that the pipeline stream/river crossings and associated embedment material 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). The Concrete encase design at river crossings must allow for adequate flow of water and be subject to change as	**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			
		determined by *in-sutu* conditions. 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 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 must 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. 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. However, the viability of this must be further investigated by the project engineer.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		➢ 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/wetland ecologist or ➢ Engineering design to mitigate extreme events from inundation upstream of the stream crossing.	
Poor project planning will result in site geological instability (soil erosion, banks incision and seepage): Poor project designs and planning would result in erosion and degradation of habitats is likely to occur during clearing of vegetation, topsoil removal and excavation works at riverbanks and instream habitat at pipeline river crossings as well as pipeline route, and excavation at WWTW for foundation of infrastructure. Therefore, excavation at riverbanks	**High (55)** **SP= (M + D + S) × P** **SP= (5 + 5 + 1) × 5** **SP = 55**	➢ 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.	**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			
and instream is considered highly sensitive as it may result in stream sedimentation. Furthermore, the disturbed soils are prone to surface run-off.		➢ Sections of trenches/excavations/cuts need to be either shored or flattened to less than 60° from horizontal; ➢ 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. ➢ Conceptual riparian zone rehabilitation and monitoring plan with a focus on erosion and alien vegetation management, be compiled prior to construction. ➢ Spoil from the trench excavations should not be placed closer than the equivalent depth of the trench to avoid unnecessary loading of the sidewalls, especially under moist to saturated conditions; ➢ Design an adequate stormwater management system to include surface drainage for continual drainage within the pipeline route and vicinity of the river	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Project Planning			
		crossings including abstraction works to prevent bank incision, seepage and geological instability as a result of ponding.	
Poor project planning will result in social distress and damage to existing services: Social impacts related to bulk water infrastructure emanate from: • Movement of heavy machinery turning and turning on R618 within Hlabisa Town, D1907 toward substation, down the valley (pipeline route) where the project starts, east of Hlabisa town passing the Hlabisa Hospital towards the new WWTW. • Disturbance of existing services (water infrastructure, powerline, telecommunication infrastructure and roads); • Disturbance of heritage resources, burial sites and paleontological resources	**Medium (40)** **SP= (M + D + S) × P** **SP= (5 + 2 + 3) × 4** **SP = 40**	➢ Appoint a Social Facilitator to manage project social aspects and re-route the pipeline where there is encroachment to burial sites. Social Facilitator to undertake 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. ➢ 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 the design and construction method. These designs will be required to secure wayleaves. ➢ The design along the road reserve and for road crossing will be done in accordance with Department of Transport (DoT) standards.	**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			
		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. ➢ 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. ➢ Appoint a Social Facilitator to manage project social aspects.	

Table 17: Impact Assessment Analysis for Construction Phase

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Loss of indigenous vegetation during construction: The development comprises construction of bulk sewer gravity main, WWTW and effluent discharge pipeline, will result in vegetation clearance and obliteration of vegetation on site for the purpose of construction for laying of the pipeline infrastructure, and WWTW construction. Also uncontrolled construction activities beyond the required footprint of the project area. This could lead to loss of flora habitat, as the construction will take place within the vicinity of the stream crossing (riparian zones), and wetlands (Subtropical Alluvial Vegetation (*Aza7*); the Zululand Lebombo Scarp Forest (*FOz5*) and the rest of the pipeline and WWTW will be constructed along habitat associated Northern Zululand Sourveld (*Svi22*).	**Medium-High (50)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 5** **SP =50**	➢ Clearly demarcate the construction footprint prior to clearing of vegetation. ➢ The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the stream crossing (riparian zones), and wetlands (*Subtropical Alluvial Vegetation (Aza7)* vegetation). ➢ The guidelines for the protection of natural forest habitat suggest that no activities or development should be considered that would destroy the forest habitats unless of strategic provincial or national importance with no feasible alternatives. Therefore, where feasible the pipeline must be re-routed along the *Zululand Lebombo Scarp Forest (FOz5)*. ➢ The 15m buffer determination along the *Zululand Lebombo Scarp Forest (FOz5)* must be adhered to. ➢ The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within	**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			
		the vicinity of the *Zululand Lebombo Scarp Forest (FOz5).* Should pipeline route runs within a Scarp Forest which is found within the study area. The permit will be required from DFFE in order to cut, destroy or disturb the natural forest. ➢ The vegetation clearance of pipeline construction corridor must not be more than 15m width on the remainder sections of pipeline along habitat associated *Northern Zululand Sourveld (Svi22)*, provided there are no sensitive environment. ➢ Vegetation clearance for construction of the new WWTW must be limited to demarcated footprint. A 15m buffer along the project site must be considered, and no development and stockpiling should take place outside 15 buffer of the new WWTW site. ➢ 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.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment. ➢ 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. ➢ Surrounding areas with indigenous vegetation must be under no circumstances be fragmented or disturbed further or used as an area for ruble and stockpiles ➢ 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. ➢ All laydown, storage areas, site camps etc. must be restricted to within the project area and should preferably be situated within areas of low sensitivity (already disturbed areas).	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Vegetation clearance in the construction phase is to be removed in a phased approach, as and when it becomes necessary as vegetation harbours fauna. ➢ Undertake progressive rehabilitation: Areas cleared of vegetation must be revegetated/ land scaped, immediately after the infrastructure in that portion has been installed. Do not wait for the project to be completed or contractor leaving the site. ➢ ECO must be appointed to oversee construction activities and enforce the conditions of the EA and permits for environmental legal compliance. ➢ All workers to undergo environmental awareness and training, including induction on conditions of the EA and permits to ensure effective implementation of the conditions of the EA and permits for environmental legal compliance.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
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. Unnecessary destruction of riparian vegetation habitat onsite which provides foraging and cover for all animal species; Unnecessary destruction grasslands vegetation habitat on site which provides a foraging and significant feeding area for animal species; Unnecessary destruction scarp forest vegetation habitat which is utilized by numerous mammals, raptors, bird species for foraging, and nesting.	**Medium-High (50)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 5** **SP =50**	➢ The construction corridors must be surveyed for potential habitats such as burrowing and roasting sites, prior to site clearance in order to delineate and buffer the areas, where not possible to locate them. ➢ Install buffers to restrict development from encroaching into sensitive environments. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment. ➢ The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the stream crossing (riparian zones), and wetlands (*Subtropical Alluvial Vegetation (Aza7*). ➢ The guidelines for the protection of natural forest habitat suggest that no activities or development should be considered that would destroy the forest habitats unless of strategic provincial or national importance with no feasible alternatives. Therefore, where feasible the pipeline must be re-routed	**Negligible (10)** **SP= (M + D + S) × P** **SP= (2+ 2 + 1) × 2** **SP =5**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		along the *Zululand Lebombo Scarp Forest (FOz5)*. ➢ The 15m buffer determination along the *Zululand Lebombo Scarp Forest (FOz5)* must be adhered to. ➢ The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the *Zululand Lebombo Scarp Forest (FOz5).* Should pipeline route runs along a Scarp Forest which is found within the study area. The permit will be required from DFFE in order to cut, destroy or disturb the natural forest. ➢ The vegetation clearance of pipeline construction corridor must not be more than 15m width on the remainder sections of pipeline along habitat associated *Northern Zululand Sourveld (Svi22)*, provided there are no sensitive environment. ➢ Vegetation clearance for construction of the new WWTW must be limited to demarcated footprint. A 15m buffer along the project site must be considered, and no development	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		and stockpiling should take place outside 15 buffer of the new WWTW site. ➢ All construction activities must take place within an area demarcated for the development. ➢ No *ad-hoc* roads are permitted, access roads must be defined and utilised and avoided within sensitive habitat. ➢ All laydown, storage areas, site camps etc. should be restricted to within the project area and should preferably be situated within areas of low sensitivity (already disturbed areas). ➢ ECO must be appointed to oversee construction activities and enforce the conditions of the EA and permits for environmental legal compliance.	
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 construction works will take place within the vicinity of the stream crossing (riparian zones), and wetlands (Subtropical Alluvial Vegetation (*Aza7*); the	**Medium (40)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 4** **SP = 40**	➢ The demarcated pipeline route and WWTW construction corridor must be surveyed prior to construction for identification of plant SCC. ➢ Establish buffer by means of visible construction barricades to section off plant SCC falling outside construction corridor and declare it a no-go area.	**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			
Zululand Lebombo Scarp Forest (FOz5) and the rest of the pipeline and WWTW will be constructed along habitat associated Northern Zululand Sourveld (*Svi22*). There were no CBA1, CBA2 and ESA within the project reach. No threatened plant species or plant SCC were recorded within the construction corridor during the survey. However, there is a likelihood that plant SCC will be encountered during construction. However, provincial protected plant species were recorded within the study area, namely Aloe sp. (Aloe *marlothii* and Aloe *arborscens).*		➢ The plant SCC outside construction corridor must not be removed or disturbed. ➢ Relocate plant SCC within the construction corridor to undisturbed areas within project locality. A plant 'rescue' operation must be undertaken under the directive of an ecologist/botanist ➢ 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. ➢ Buffer and indicate no-go areas to prevent disturbance or removal of *Aloe sp*. (Aloe *marlothii* and Aloe *arborscens).* Where this proves not to be possible (falls within construction corridor), a permit will be required from the provincial DFFE in order to disturb and relocate the Aloe sp. before construction activities commence. ➢ The removed *Aloe sp*. must be reintroduced to site during landscaping. ➢ ECO must be appointed to oversee construction activities and enforce the	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		conditions of the EA and permits for 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 plant SCC, and protected plant species.	
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.	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 55**	➢ 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. ➢ Stockpiles must be vegetated if they are to be stored for prolonged periods of time such as 3 to 6 months. ➢ All stockpiles must be kept free of weeds and IAPs.	
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. Unnecessary destruction of riparian vegetation habitat onsite which provides foraging and cover for all animal species; Unnecessary destruction grasslands vegetation habitat on site which provides a foraging and significant feeding area for	**Medium High (44)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 4** **SP = 4**	➢ The construction corridor must be surveyed prior clearance to locate animal species who mighty be foraging, roasting, or nestling within the construction corridor. ➢ 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 order to locate, capture and relocate any animal SCC. ➢ During construction special care must be taken to avoid prevent migration of species which are endemic to the project area or a loss of animal species currently found on site,	**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			
animal species; Unnecessary destruction scarp forest vegetation habitat which is utilized by numerous mammals, raptors, bird species for foraging, and nesting. Inadvertent killing and injury of fauna species during vegetation clearance and construction activities. Loss/displacement of fauna species potentially present on site.		animals with limited mobility are often the first to be affected by habitat fragmentation due to the effects on population viability as reptiles, bird species, small mammals, and invertebrates may be disintegrated into distinct populations. ➢ Avoid habitat fragmentation and allow for fauna migration corridors. ➢ Walkways must be constructed allowing for animals to escape from the pipeline trenches, with an aid of a Herpetologist/Ecologist. ➢ 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.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ 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 order to minimize damage or disturbance of roosting and nesting sites. ➢ If possible, the clearance of vegetation should commence during non-breeding season of fauna species (i.e., winter). ➢ No faunal species are to be disturbed, trapped, hunted, or killed. ➢ Wetland fauna (e.g., birds, 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. ➢ During the construction phase, no construction is to occur at night to minimise all possible disturbances to amphibian species possibly inhabiting the wetland. ➢ All construction and maintenance vehicles must stick to properly demarcated and prepared roads.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ 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 habitat: Construction will result in alteration of hydrological and geomorphological processes. The infield watercourse delineation confirmed the presence of seven (7) wetlands fell within the regulated area and only five (5) of these systems were identified to be at risk and required further assessment. These systems were identified as seepage, Unchanneled Valley Bottom (UVB) and Channelled Valley Bottom (CVB) wetlands and they were identified to be largely natural and moderately modified. Expanded / more intense edge impacts could occur as a result of deterioration in vegetation quality and cover and the potential for increased alien invasive	**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. ➢ All work to be done within the riparian and wetland habitats must be carried out during low flow conditions, and dry periods. ➢ An ecologist must conduct a walk through prior to vegetation clearing and a permit must be obtained to remove any TOPS. ➢ Clearing activities must be undertaken in a phased approach. ➢ 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	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (2 + 1 + 1) ×3** **SP = 12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
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 Mhlathuze River o UVB Effective in trapping sediment, flood attenuation and regulating flows. o 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. o Riparian zone effective in erosion control. Direct intrusion into the wetlands will result in		this servitude must be considered no-go areas. ➢ The vegetation clearance and earthworks must be limited to project area as demarcated by the layouts proposes the configuration of existing layout. The clearance and construction for the new WWTW must be shifted at least 80m-100m further north of existing position (***Figure 3***). ➢ Realigned pipeline where it encroaches the sensitive environment wherever possible, as the best practice and were feasible, traversing small sections of wetland, such as within W02 (***Figure 7***) can be avoided through rerouting around the system. ➢ Buffer determination for watercourse habitat outside the construction corridor at risk of being impacted. For the new WWTW 100m buffer determination is required between Hluhluwe River and new WWTW. This means the layout must be configured such that the WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***).	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
the destruction of habitat and complete loss of W05 wetland. The wetlands are currently of ecological and hydrological importance and loss of these systems will negatively impact on the catchment. These wetlands are remnants of natural habitat remaining in the area and therefore maintain biodiversity. Habitat that remains will be fragmented and this will affect ecological corridors. The removal of vegetation and the construction of hardened surfaces (WWTW) may lead to concentrated flows entering the wetlands, which may be high flow rates within a short space of time (increased flood peaks). Destruction of the W05 wetland infers water will no longer percolate into the soil and rather, large volumes of surface runoff will enter the river, and this will increase erosion and sediment inputs into the river. Fragmented wetlands from the bulk sewer line will also have flows impeded and alter natural inputs, throughputs, and outputs in the wetland.		➢ Where possible the pipeline route along the wetlands must include buffer determination of at least 28m buffer for CVB wetlands; 26m buffer for UVB wetlands; and 25m buffer for seepage wetlands to protect wetland habitat and ecological corridor and mark no-go areas. ➢ A 33m buffer has been applied to the high-risk wetlands and a 20m buffer to the wetlands receiving indirect impacts and at lower risk of impact. A buffer cannot be applied to wetlands W01, W04 and W05 as a result of activities taking place within them and a 20m buffer cannot be applied to wetlands W02 and W03 due to their proximity to the proposed activities. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment. ➢ The demarcations are to remain until construction and rehabilitation is complete.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ 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 sewer gravity main pipeline stream crossings and effluent discharge pipeline 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. ➢ Create berms downslope of working area to divert impacts away from wetlands. ➢ 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.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Soil berms and sediment traps must be established to prevent sediment entering watercourses. ➢ Topsoil must be stockpiled in stockpiles not exceeding 2 m in height. ➢ All stockpiles must be established outside the buffer of all watercourses and on relatively flat ground at least 30m away from the watercourse. ➢ If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile. ➢ No *ad-hoc* roads are permitted, access roads must be defined and utilised and avoided within wetlands. ➢ Site camp must be located outside of wetlands and their buffers, preferable within the site camp for new WWTW must be located along the fire break of commercial forest (Eucalyptus plantations) surrounding the new WWTW site, for gravity main the site camp must be located within the facility of homesteads., or already disturbed area.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ ECO ECO must be appointed to oversee construction activities and enforce the conditions of the EA and permits for environmental legal compliance.	
Degradation of freshwater (aquatic) habitat as a result of construction activities. Construction activities within a watercourse are likely to result in degradation of watercourse habitat include (i) undertaking bulk earthworks associated with implementing the bulk sewer gravity main at the stream crossings and effluent discharge pipeline within riparian, (ii) placing infrastructure within watercourses, (iii) dewatering of the construction area, when necessary, (iii) construction of concrete encase for pipeline river crossing, and (iv) Excavation within wetlands and riparian. 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 dams. In Modification/destruction of riparian	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 60**	➢ All work to be done within the riparian, instream habitats, and wetlands must 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 from the water edge, as it stretches the bucket to excavate the instream habitat. ➢ A one-way running track must be established across the riverbed 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	**Very Low** **(15)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 3** **SP = 15**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
habitat, loss of riverine habitat and loss of aquatic biota		of construction 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, the excavated trench material must be placed on a geotextile. ➢ Topsoil stockpile must be stockpiled in stockpiles not exceeding 2 m in height. ➢ All stockpiles must be established outside the buffer of all watercourses and on relatively flat ground at least 32m away from the watercourse. ➢ If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile. ➢ Install buffers to restrict development from encroaching onto sensitive environments. ➢ In the case that 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	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		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. ➢ Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion and siltation. ➢ 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			
		➢ Sediment barriers must be installed in areas sensitive to erosion to prevent stream siltation. ➢ Should the outcrop is intercepted within the vicinity of the river crossing, the excavator will access the river to clear boulders etc and where required a hydraulic breaker will be used to break any bedrock encountered, in order to make trench for installation of pipeline infrastructure. ➢ Rock blasting will never be allowed within the watercourse. ➢ The concrete encased 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. ➢ Rehabilitate all watercourses in accordance with DWS approved Rehabilitation and Maintenance Plan	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ ECO must be appointed to oversee construction activities and ensure legal environmental compliance.	
Alteration of flow regimes and fluvial systems, as well as streamflow reduction as a result of construction activities: The construction will result in alteration of hydrological and geomorphological processes. The temporarily reduced riverine ecological connectivity during the construction at the vicinity of pipelines stream crossing and wetlands crossings. 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. In addition, the poor construction processes could lead to stream siltation, further sedimentation of downstream, collapse of banks due to uncontrolled, Increased volumes of water altering hydrological regime stormwater runoff.	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 4+ 2) × 5** **SP =60**	➢ 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. ➢ In excavating the bed of the water body, the contractor must backfill the excavation with material which was originally removed from the stream bed. Further care must be taken to minimize the amount of material used for backfilling which have abrasive surfaces. ➢ To only use temporary cofferdams to divert flow within working area. ➢ Temporary pumping sump must be designed to achieve optimum hydraulic performance. Minimise influence on downstream flow regime when diverting and impeding flow (cofferdams, earth berms etc). Use suitable stabilisation structures to prevent.	**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			
		➢ 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. ➢ 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.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ 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 crossing must not form a heap but be aligned with the *In-sutu* instream habitat.	
Deterioration of surface water quality as a result of construction activities: Uncontrolled construction processes could lead to stream siltation, further sedimentation of downstream, collapse of banks due to uncontrolled, Increased volumes of water altering hydrological regime stormwater runoff. In addition will result in excessive run-off from excavations and/or hard surfaces; inappropriate stormwater management.	**Medium High (50)** **SP= (M + D + S) × P** **SP= (5 + 2 + 3) × 5** **SP = 50**	➢ Excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow conditions. 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	**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			
During construction especially excavation along riparian and instream habitat has potential to Oil, grease and chemical spills from construction machinery, also discharge of untreated effluent spill from unmanaged portable toilets onsite.		construction activities during the drier months. ➢ It is prudent however to be prepared for increased flows by scheduling work according to the weather forecast and to be adequately prepared for unexpectedly large runoff from a sudden storm. ➢ 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. Sediment barriers must be installed in areas sensitive to erosion such as near water supply points, slopes, and actively eroding riverbanks. These measures include but are not limited to - the use of sandbags, hessian sheets, silt fences, geotextiles, rock gabions, etc to prevent erosion and stream siltation. ➢ Minimise impervious surfaces and maximise infiltration by maintaining vegetation as far as possible to convey and hold surface runoff	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		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. ➢ Create a coffer dam at watercourse crossing to protect the area from possible silt contaminated runoff. ➢ During concrete pouring at the weir and encase concrete at the river crossing, the activity must be undertaken within a strictly controlled environment, such as the use of coffer dams to prevent concrete spills into the watercourse. The infilling of concrete encase at pipeline river crossings must be undertaken in with due diligent, such that there are no concrete spillages into the river. ➢ For the infilling/backfilling and levelling using concrete, dependent on the size of the pours, an excavator will place the concrete. The bucket or skip will be filled ¾ full to reduce spillages whilst transporting the concrete. If any spillages do occur, they will be removed	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		after the pour and disposed of at the concrete skip wash out bay. ➢ 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. ➢ Create a coffer dam at vicinity stream crossings to protect the area from possible silt contaminated runoff. ➢ 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. ➢ 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 from the water edge, as it stretches the bucket to excavate the instream habitat. ➢ The de-watering process from the coffer dams must involve piping the water directly	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		to the active channel downstream of the site as, or if, required. ➢ During concrete pouring for encase concrete at the stream crossings, the activity must be undertaken within a strictly controlled environment, such as the use of coffer dams to prevent concrete spills into the watercourse. ➢ 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 throughout all stream crossings. ➢ Potential stormwater run-off from hard surfaces requires careful attention to ensure that the nearby watercourse is not negatively impacted by sedimentation and run-off carrying oil, grease, hydrocarbons and/or harmful chemicals. ➢ Make use of gabions along the pipeline within the riverbanks to prevent erosion as a result of loose banks due to excavation.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Place topsoil of disturbed areas along the and revegetated immediately, to prevent run-off and siltation. Stockpiles must not be more than 2m in height and stored at least 30m away from the watercourse on the area with a relatively flat surface. ➢ 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. ➢ 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. ➢ The site must have portable toilets at the ratio of 1:10. These portable toilets must be positioned at relatively flat surface, with shoring and at least 30 meters away from any habitat near a watercourse.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Portable toilets must be maintained on a regular basis by a licensed service provider with the provision of service level agreement letter with WWTW facility, and waybills must be saved as documentation. ➢ Petroleum fuel must be kept in a covered, bunded structure. The bund must be able to hold at least 110 percent of the content amounts. ➢ All chemicals and hazardous substances including cement must be mixed and/or decanted on a tray, shutter boards, or an impermeable surface. ➢ ECO must be appointed to oversee construction activities. ➢ ECO to Conduct water quality monitoring (baseline and during construction) at suitable up and downstream sites	
Ground water contamination as a result of construction activities: 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	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5**	➢ 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	**Negligible** **(4)** **SP= (M + D + S) × P**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
watercourses. Hydrocarbons, oils and grease, cement, sewage from portable chemical toilets, and events involving the discharge of untreated effluent are examples of potential contaminants during the construction period. Machinery will use petroleum and oil products and if not properly managed can lead to contamination of the perched groundwater system. Cement used in mortar lining may also see into the soil or runoff into watercourses and cause potential subsurface and groundwater contamination through seepage. The oil spills from construction machinery may also leach the soil and contaminate the groundwater through groundwater seepage	**SP = 55**	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 showing some signs of leaks, when not used to capture any possible oil leaks. ➢ Vehicle maintenance must not take place on site unless a specific bunded area is constructed for such a purpose. ➢ Hazardous storage and refuelling 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	**SP= (2+ 1 + 1) × 1** **SP = 4**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		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 disposed of at a registered hazardous landfill site. ➢ Cement mixing must be done on impervious surface (concrete or shatter board)	
Soil degradation and soil erosion due to loss of vegetation cover: Uncontrolled construction processes would result in erosion and degradation of habitats is likely to occur during clearing of vegetation, topsoil removal and excavation works at riverbanks and instream habitat at pipeline river crossings as well as pipeline route, and excavation at WWTW for foundation of infrastructure. Therefore, excavation at riverbanks and instream is considered highly sensitive as it	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2 × 5** **SP =60**	➢ During the 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	**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			
may result in stream sedimentation. Furthermore, the disturbed soils are prone to surface run-off.		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 to begin immediately and not only when construction ends. ➢ All bare slopes and surfaces within the vicinity of the pipeline route and new WWTW along the high sloping areas 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 riparian, incised banks and wetland habitat area must be carried out during the wet period or peak flow conditions.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ No vegetation clearance and excavation must be carried within the highly sloping susceptible to surface erosion during wet period as this could increase erosion propensity. ➢ Make use of gabions along the pipelines within the riverbanks, 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. 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	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		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 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	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		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: The uncontrolled construction activities will likely exacerbate erosion 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. Excavation within sloping areas for pipeline construction, is considered highly sensitive with regard to erosion and geological degradation	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 5** **SP = 60**	➢ 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. ➢ 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.	**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			
		➢ 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). ➢ Sections of trenches/excavations/cuts need to be either shored or flattened to less than 60° from horizontal. ➢ Spoil from the trench excavations must not be placed closer than the equivalent depth of the trench to avoid unnecessary loading of the sidewalls, especially under moist to saturated conditions; ➢ It is recommended that excavations be carried out along the guidelines given in SANS 10400-G (current version).	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Excavation at riparian zones must not be undertaken during wet (rainy) periods or peak flow conditions. ➢ If seepage is present or an elevated moisture content is eminent or expected during the wetter part of the year, even trenches shallower than 1.5m should be regarded as dangerous and stand-up time could be measured in minutes. ➢ 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 must be undertaken at regular intervals during fill construction. ➢ All cut and fill embankments must be adequately vegetated or paved as soon as possible after construction to limit the potential for erosion. Where the recommended batters cannot be	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		accommodated, permanent lateral support should be incorporated. ➢ Seepage within the excavation should be dealt with symptomatically via either a furrow/channel draining downslope or by conventional sump and pump method, which will in any case be required to keep the excavation dry after heavy rains during the wet season; ➢ Permanent cut embankments in all the soil materials on site should be restricted to a slope batter of 1:2 (26E); ➢ General fill embankments should be constructed of suitable granular material (G10 or better) and placed in layers of maximum 300mm loose thickness and compacted to a minimum of 95% Mod AASHTO density prior to the placement of the next layer to minimise post construction settlement and potential stability problems; ➢ To ensure proper and uniform compaction across fill the maximum fill particle size should be no greater than two thirds the layer thickness;	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ General fill embankments should not exceed a maximum slope batter of 1:1.75 (30°); ➢ 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.	
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 the settlement area. Moreover, there was one grave site encountered during the infield assessment at location (28° 9'21.60"S, 31°52'4.68"E) but falls outside the project corridor. The grave site was within the household.	**Medium High (48)** **SP= (M + D + S) × P** **SP= (5 + 5 + 2) × 4** **SP = 48**	➢ Appoint a Social Facilitator to manage project social aspects and re-route the pipeline where there is encroachment to burial sites. Social Facilitator to undertake 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. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project. ➢ Excavation for pipeline upgrade must be limited only to existing pipeline servitudes and	**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			
		development area, as approved by project plans and layouts. ➢ 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 Amafa Heritage Resource Institute and the National Heritage 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.	**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 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.	**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			
However, there are no archaeological sites within the project site. The palaeosensitivity has recorded the area as medium. Archaeological resources may still be discovered during excavations or any ground-breaking activities during the construction phase. A preliminary desktop study for palaeontological fossils sensitivity of the proposed site, reveals that the site falls within a 'Moderate' paleontological sensitivity. The environmental screening tool also describe the section of the study area as having 'Medium' paleontological sensitivity and a 'Low' archaeological and cultural heritage sensitivity.		➢ 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, inform the ECO who must refer the matter to Amafa Heritage Resource Institute for attention.	
Destruction of heritage resources: Uncontrolled excavation works, particularly in within the riparian and 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.	**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 development area as approved by project plans ➢ 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	**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			
		the operation immediately, report to the ECO who must refer the matter to South African Heritage Resource Agency for attention. Therefore, a heritage practitioner / archaeologist must be engaged in the event that any possible heritage resources or artefacts are identified.	
Air pollution, dust, and emissions: Dust could be generated during construction as a result of earthworks and stockpiles. 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 + 2) × 3** **SP = 36**	➢ Apply dust suppression to exposed soil and stockpiles. All transported and stored fine product must be covered to prevent spills and been blown by wind. ➢ Excavated material is to be stockpiled along the trench within the working servitude for later backfilling, of not more than 2m in height. ➢ Limit on-site vehicle speed to 40 km/h or lower due to driving conditions. ➢ All fine products must be covered during transportation. ➢ Minimise gas emission through regular servicing of construction vehicles to meet minimum emission requirements.	**Negligible** **(10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP =10**
Aesthetic / visual Impact: The viewshed area and zone of visual influence for the proposed bulk pipeline upgrade is considered	**Very Low** **(12)**	➢ Landscaping all disturbed areas to Natural Ground Level (NGL).	**Negligible** **(8)**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
"low visibility" as it can be visible from a small area around the project site (<1km radius). As this project involve underlaid infrastructure. However, during the construction phase, residents who live in close proximity to or overlook the 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.	**SP= (M + D + S) × P** **SP= (3 + 1 + 2) × 2** **SP = 12**	➢ Removal of all construction material and debris from site. ➢ 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 must maintain good housekeeping on-site to minimise waste generation and avoid litter. ➢ Dust suppression is important to reduce the visibility of the development. ➢ Excavated material is to be stockpiled along the trench within the working servitude for later backfilling, of not more than 2m in height. ➢ Avoid the use of floodlight 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, only to a corridor as approved by project plans and layouts.	**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			
Noise pollution: The main sources of noise associated with the proposed construction activities include the following: 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, 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 not defined, development must be limited to daylight hours. ➢ All vehicles must be maintained in accordance with manufacturer's specifications to avoid excessive noise.	**Very Low** **(15)** **SP= (M + D + S) × P** **SP= (2+ 1 + 2) × 3** **SP = 15**
Traffic impact: Construction project result in the increase in construction vehicles in and around the proposed site, and trucks transporting materials turning from the main road to access road to site, vice versa. However, it will be of temporary duration as it will only last for the construction duration of the project. The traffic within the main road turning point will be affected by number of construction tricks turning to and from the site. The 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 High** **(45)** **SP= (M + D + S) × P** **SP= (5 + 1 + 3) × 5** **SP = 45**	➢ 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. ➢ Appropriate temporary signage, traffic control signals, delineators, message boards, must be used for traffic accommodation in the work zone, truck turning points and shall be visible by motorists and pedestrians. ➢ Allow for the accommodation of traffic during excavation for pipeline route road crossing.	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 1 + 2) × 2** **SP =12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
		➢ Along the road reserve all clearance and excavation must be done in accordance with DOT standards. ➢ The road crossings at 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 speed limits at an approach to construction vehicle turning point 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.	
Social distress and damage to existing services: Social impacts related to bulk water infrastructure emanate from:	**Medium High (45)** **SP= (M + D + S) × P** **SP= (5 + 1 + 3) × 5** **SP = 45**	➢ Identify all existing underneath and surface infrastructure, such as water pipeline, telecommunication lines, and powerlines which will be in the corridor, and construct in accordance with authority requirements, as	**Very Low (12)** **SP= (M + D + S) × P** **SP= (3 + 1 + 2) × 2** **SP =12**

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
• Disturbance of existing underneath services (water infrastructure, electricity cables, telecommunication infrastructure); • Disturbance of surface infrastructure such as road and roads; and • Disturbance of overhead infrastructure such as powerlines and telecommunication infrastructure.		per prescribed by approved design and wayleaves. ➢ The construction along the road reserve and for road crossing must be done in accordance with Department of Transport (DoT) standards, and design prescription as approved by DoT. 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. ➢ 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.	

Potential impact	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Construction Phase			
Waste emanating from construction activities: Uncontrolled waste generated from construction activities such as: general, health care and hazardous wastes are more likely inherited from construction activities.	**Medium High (50)** **SP= (M + D + S) × P** **SP= (5 + 2 + 3) × 5** **SP = 50**	➢ Educate of workers on pollution prevention practices. Training programme must provide information on material handling and spill prevention and response. ➢ 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	**Negligible (4)** **SP= (M + D + S) × P** **SP= (2 + 1 + 1) × 1** **SP = 4**

Table 18: Impact Assessment Analysis for Operation Phase

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Effluent Waste emanating from WWTW and Sewer Pumpstation activities: Uncontrolled waste generated from WWTW and sewer pumpstations activities such as: wet sludge, dry sludge, oil spoils, and other hazardous wastes are more likely inherited during operation and maintenance activities.	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 4 + 3) × 5** **SP = 60**	➢ Conduct waste classification of WWTW The waste resulted from operation of WWTW such as sludge, residues of waste, and other hazardous waste in accordance with the specified Minimum Requirements per 4(1) of the National Norms and Standards for Waste Disposal (NEM: WA Act No. 59 of 2008). ➢ Implement the operation and maintenance strategy plan for the pumpstations and WWTW. ➢ Implement Emergency Contingency Plain where there is a system failure ➢ To have temporary sludge handling sump at each pumpstation and at WWTW. ➢ Sludge composting to be done within the shaded area on concrete bunded surface ➢ Dispose of dry sludge at registered landfill with licensed professional service provider. ➢ Manholes must be sealed and used to inspect and maintain infrastructure. ➢ Adequate maintenance measures need to be implemented immediately when pipeline issues and failures are identified.	**Medium High** **(8)** **SP= (M + D + S) × P** **SP= (2 + 1 + 1) × 2** **SP = 8**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Deterioration of River water quality during operation of WWTW and Sewer pumpstations: Contamination of surface waters from inadequate treatment of effluent. The highest risk of pollution will be experienced during the operation of new WWTW as a result of treated effluent discharge, as a result the riverine ecosystem health will be affected by exponential change to physico-chemical constituents in water. The aquatic macroinvertebrates, instream biotopes, fish and water quality likely to be affected. Misuse and mismanagement, and poor maintenance of the WWTW and sewer pumpstations leading to failures and ineffective treatment. Will result in sewer spillage and water contamination, as a result the riverine ecosystem health will be affected by exponential change to physico-chemical constituents in water. Poor monitoring and management of bulk sewer gravity main at the vicinity of pipeline stream	**High** **(60)** **SP= (M + D + S) × P** **SP= (5 + 4 + 3) × 5** **SP = 60**	➢ Develop and Implement the Contingency Plan. ➢ A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management must be implemented, in order to manage the rehabilitation of the affected watercourse after the construction (if necessary). The rehabilitation plan must make provision for an aquatic biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish, given the important conservation value of the area. ➢ The sludge treatment including sludge thickening, storage and disposal process, will involve sludge drying bed and also make use of an oxidation pond. The oxidation pond area will be partially filled, or concrete lined to be used as sludge maturation ponds. This proposed process design is based on an extended aeration activated sludge process, without primary sedimentation and with the addition of denitrification to the process. ➢ Conduct monthly water quality tests on treated effluent.	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 1 + 2) × 2** **SP = 12**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
crossing could lead into pipe burst and sewer leakage, as a result the effluent would enter the water bodies and result in alteration to physico-chemical constituents in watercourse characteristics and fragmentation of biota. Collapse of banks due to uncontrolled stormwater runoff, will result in stream siltation and decreased water quality.		➢ Dispose of dry sludge at registered landfill with licensed professional service provider. ➢ Manholes must be sealed and used to inspect and maintain infrastructure. ➢ Remove contaminated soils immediately from the polluted area and rectify the impacts. ➢ Major spills must be reported to the authorities ➢ The stream crossing must promote natural flows and allow for connectivity in the river. ➢ Regular inspection at the effluent discharge vicinity and stream crossing for evidence of sediment and debris build-up during wet season and dry season, alternatively after heavy rainfall, or peak flow conditions. ➢ Regular monitoring of treated effluent at the new Hlabisa WWTW must be undertaken. Do not discharge untreated effluent. The discharged effluent must be in accordance with approved TWQR allocation indicated in the water use license. Records of effluent discharge quantity and TWQR parameters must be kept. No untreated effluent may be discharged into watercourses.	

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
		➢ The sludge lagoons must be monitored and no leakages into wetland may occur, and any detection of seepage must be remedied immediately. ➢ Adequate maintenance measures need to be implemented immediately when pipeline issues and failures are identified. ➢ Ongoing Quarterly water quality and biomonitoring must be implemented during operation. monitoring at the upstream and downstream of WWTW at Hluhluwe River.	
Soil erosion and geological degradation: Poor placement or design of the on-site WWTW stormwater infrastructure during the operation phase could lead to increased erosion and sedimentation into the watercourse. Uncontrolled construction activities and poor storm water designs within the vicinity of stream crossings could lead in withering of riverbanks in cut-face at sloping areas, in the process resulting in run-off and erosion in event of high precipitation and peak flow period.	**Medium-High (50)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 5** **SP = 50**	➢ Implement the Stormwater Management Plan ➢ Concrete lined upslope interception drains must be installed at each site. ➢ Implement Maintenance and Monitoring Plan. ➢ 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. ➢ The disturbed watercourse habitat and rehabilitated areas must be monitored for potential erosion and scouring. This must	**Negligible (10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP =10**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Increased erosion from uncontrolled release of effluent volumes into watercourse. Collapse of banks due to uncontrolled stormwater runoff. .		initially take place immediately after construction, thereafter quarterly for two years and thereafter annually. ➢ 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	
Impact on flow regime as a result of infilled concrete encased overlaid the stream crossing: Alteration to hydrological regimes from impeding and diverting flows. Poor stream crossing design and construction would impact the flow regime. Given that the construction corridor at river crossing involve infilling of concrete encase on the riverbed to cover	**High** **(55)** **SP= (M + D + S) × P** **SP= (5 + 4 + 2) × 5** **SP = 55**	➢ Engineering design and good construction practice to mitigate the impact on flow region and prevent inundation upstream of the pipeline stream crossings. ➢ Concrete encase alignment must not form a heap but be aligned with the *In-sutu* instream habitat.	**Negligible** **(5)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 1** **SP = 5**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
the pipeline and prevent it from being eroded as a result of stream crossing. This could result in stream flow reduction, and inundation. Collapse of banks due to uncontrolled stormwater runoff, will result in stream siltation.		➢ Regular inspection at river crossing for evidence of sediment and debris build-up during wet season and dry season, alternatively after heavy rainfall.	
Groundwater pollution: Contamination of groundwater from pipeline leaks and failed sewer pumpstations and other sewer infrastructure. Contamination of ground waters from Inadequate treatment of effluent, result in effluent spillages	**Medium High (50)** **SP= (M + D + S) × P** **SP= (5 + 4 + 3) × 5** **SP = 50**	➢ Develop and Implement Contingency Plan. ➢ Conduct monthly water quality tests on treated effluent. ➢ Conduct groundwater monitoring quarterly to ensure no leaks. ➢ Adequate maintenance measures need to be implemented immediately when pipeline issues and failures are identified. ➢ Implement a Biomonitoring program. ➢ Dispose of dry sludge at registered landfill with licensed professional service provider. ➢ Manholes must be sealed and used to inspect and maintain infrastructure. ➢ Remove contaminated soils immediately from the polluted area and rectify the impacts. ➢ Major spills must be reported to the authorities.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP = 10**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Degradation of freshwater (aquatic) habitat as a result of uncontrolled activities: Uncontrolled use of WWTW and discharge into watercourse Die off of sensitive species at riparian and instream habitat which supports the aquatic macroinvertebrates, instream biotopes, and fish. Collapse of banks due to uncontrolled stormwater runoff	**Medium High (50)** **SP= (M + D + S) × P** **SP= (5 + 4 + 3) × 5** **SP = 50**	➢ Rehabilitate all watercourses in accordance with DWS approved Rehabilitation and Maintenance Plan ➢ Rehabilitation and Maintenance Plan ➢ Compile and implement a conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management, in order to manage the rehabilitation of the affected watercourse after the construction (if necessary). ➢ The rehabilitation plan must make provision for an aquatic biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish, given the important conservation value of the area. ➢ Implement Contingency Plan. ➢ Conduct monthly water quality tests on treated effluent. ➢ Conduct surface water monitoring quarterly to monitor the effluent discharge. ➢ Implement a Biomonitoring program. ➢ Dispose of dry sludge at registered landfill with licensed professional service provider.	**Negligible (10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 2) × 2** **SP = 10**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
		➢ Manholes must be sealed and used to inspect and maintain infrastructure. ➢ Remove contaminated soils immediately from the polluted area and rectify the impacts. ➢ Major spills must be reported to the authorities	
Vegetation clearance and rehabilitation during maintenance Uncontrolled maintenance, could result in extensive vegetation cover removal Poor reinstatement of vegetation. Steep slopes causing head cut erosion and sedimentation.	**Medium-High (40)** **SP= (M + D + S) × P** **SP= (5 + 3 + 2) × 4** **SP = 40**	➢ Implement a Rehabilitation and Maintenance Plan. ➢ Once a rehabilitation method statement has been established and undertaken, monitoring activities must be put in place to verify the progress made on the rehabilitation objectives and targets ➢ Maintenance vehicles must use the existing access route. ➢ All vehicles must use the existing access roads. ➢ Mark the pipeline servitude ➢ 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 (10)** **SP= (M + D + S) × P** **SP= (3 + 1 + 1) × 2** **SP = 10**

Potential Impacts	Impact Significance without Mitigation	Proposed Mitigation Measures	Impact Significance with mitigation
Operation Phase			
Alien Invasive Plant Species Alien invasive plant species within the pipeline servitude. Encroachment of IAPs. Permanent alteration to wetland functionality.	**Very High** **(65)** **SP= (M + D + S) × P** **SP= (5 + 5 + 3) × 5** **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.	**Very Low** **(12)** **SP= (M + D + S) × P** **SP= (3 + 2 + 1) × 2** **SP = 12**
Overall Mean significance: Nature of a project without mitigation	**Medium-High** **(48)** **$1735 \div 36=48$**	Nature of a project post mitigation	**Negligible** **(9)** **$332 \div 36=9$**

16 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 19: 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 20: Prioritisation Factor (Cumulative Impacts)

Impact Description	Alternative	Phase	Cumulative Impact	Irreplaceable Loss
Biodiversity (flora): Habitat fragmentation, loss of natural vegetation during pipeline and WWTW construction maintenance.	A, B, C, D & E	Construction +Operation +Maintenance	2	1
Biodiversity (flora): Habitat fragmentation, loss of natural vegetation and introduction of invasive alien plant species (IAPS)	A, B, C, D & E	Construction +Operation +Maintenance	2	1
Biodiversity (flora): Habitat fragmentation, Loss of plant species of conservation concern (SCC)	A, B, C, D & E	Construction +Operation +Maintenance	1	1
Biodiversity (fauna): Loss of animal species of conservation concern (SCC)	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Impact on terrestrial surface water resource: Impacts on watercourse habitat functions and services.	A, B, C, D & E	Construction +Operation + Maintenance	2	1
Impact on hydrological flow regime (rivers, streams, wetlands)	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Impact on surface water quality (stream and river pollution)	A, B, C, D & E	Construction +Operation + Maintenance	2	1
Impact on ground water resource (Oil spillages & Ground water contamination)	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Geological Impacts: Erosion, run-off slits and compaction.	A, B, C, D & E	Construction +Operation + Maintenance	2	1
Impact on Air Pollution: Dust from construction areas and emissions from vehicles and equipment.	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Waste (General, Hazardous Waste)	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Waste (Eluent Waste)	A, B, C, D & E	Construction +Operation + Maintenance	2	1
Impact on Heritage Resources: Loss of Heritage Resources, Burial Sites.	A, B, C, D & E	Construction +Operation + Maintenance	1	2
Impact on Paleontological resources: Archaeological and fossils	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Visual Impact	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Socio-economic Impact	A, B, C, D & E	Construction +Operation + Maintenance	3+	1
Impact on Traffic	A, B, C, D & E	Construction +Operation + Maintenance	1	1
Noise Pollution	A, B, C, D & E	Construction +Operation+ Maintenance	1	1
Impacts on existing services (properties or utility infrastructure)	A, B, C, D & E	Construction +Operation + Maintenance	1	1

Table 21: Description of Cumulative Impacts of High Value

Impact	Impact Level	Description	Mitigation
Loss of indigenous vegetation during construction and Maintenance: Uncontrolled vegetation clearance beyond the required footprint of the project area could lead to loss of flora habitat.	Medium (2)	Vegetation clearance for construction and maintenance will take place within the vicinity of the riparian zo and wetlands (Subtropical Alluvial Vegetation (*Aza7*); the Zululand Lebombo Scarp Forest (*FOz5*) and the rest of the pipeline and WWTW will be constructed along habitat associated Northern Zululand Sourveld (*Svi22*).	➢ Clearly demarcate the construction footprint prior to clearing of vegetation. ➢ The vegetation clearance pipeline construction corridor for pipeline construction and maintenance must not be more than 10m width for the construction corridor within the vicinity of the stream crossing (riparian zones), and wetlands (Subtropical Alluvial Vegetation (Aza7) vegetation). ➢ The 15m buffer determination along the Zululand Lebombo Scarp Forest (FOz5) must be adhered to. ➢ The vegetation clearance pipeline construction corridor for pipeline construction and maintenance of must not be more than 15m width on the remainder sections of pipeline along habitat associated Northern Zululand Sourveld (Svi22), provided there are no sensitive environment. ➢ Vegetation clearance for construction and maintenance at the new WWTW must be limited to demarcated footprint. A 15m buffer along the project site must be considered, and no development and stockpiling should take

Impact	Impact Level	Description	Mitigation
			place outside 15 buffers of the new WWTW site.
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	Medium (2)	Uncontrolled vegetation clearance would result in habitat fragmentation, loss of natural vegetation and introduction of invasive alien plant species (IAPS)	➢ 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. ➢ Implementation of Rehabilitation Plan ➢ The control and eradication of a listed invasive species must be carried out during and post construction within the project site. ➢ Comprehensive mitigation will include rehabilitation plan and prevention of spreading of Alien Invasive Plant Species.
Impacts on watercourse habitat functions and services (stream, river, riparian, and wetlands): Expanded / more intense edge impacts could occur due to disturbance causing activities taking place within or near the wetlands and riparian zones.	Medium (2)	Uncontrol vegetation clearance and excavation within watercourse such as identified which are stream, seepage, Unchanneled Valley Bottom (UVB) and Channelled Valley Bottom (CVB) wetlands and they were identified to be largely natural and moderately modified. Construction activities within a watercourse are likely to result in degradation of watercourse habitat	➢ All work to be done within the riparian, instream habitats, and wetlands must be carried out during low flow conditions, and dry periods. ➢ Where possible the pipeline route along the wetlands must include buffer determination of at least 28m buffer for CVB wetlands; 26m buffer for UVB wetlands; and 25m buffer for seepage wetlands to protect wetland habitat and ecological corridor and mark no-go areas.

Impact	Impact Level	Description	Mitigation
		include (i) undertaking bulk earthworks associated with implementing the bulk sewer gravity main at the stream crossings and effluent discharge pipeline within riparian, (ii) placing infrastructure within watercourses, (iii) dewatering of the construction area, when necessary, (iii) construction of concrete encase for pipeline river crossing, and (iv) Excavation within wetlands and riparian.	➢ 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 pipeline river crossings must be limited to areas as demarcated and approved by the project plans. ➢ Install buffers to restrict development from encroaching onto sensitive environments. ➢ 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. ➢ 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 from the water edge, as it stretches the bucket to excavate the instream habitat. ➢ Install buffers through visible pegging with construction barricades to restrict development from encroaching the sensitive environment.

Impact	Impact Level	Description	Mitigation
			➢ A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management should be compiled, in order to manage the rehabilitation of the affected watercourse after the construction (if necessary). The rehabilitation plan should make provision for an aquatic biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish, given the important conservation value of the area.
Deterioration of downstream surface water quality as a result of poor sludge handling practices: Misuse and mismanagement, and poor refurbishments of the WWTW leading to failures and ineffective treatment, and sludge handling.	Medium (2)	Potential for WWTW sludge to enter the watercourse. Potential for untreated effluent to enter the watercourse as a results of WWTW failures, pumpstation failure and leaks in bulk sewer line.	➢ Develop and Implement the Contingency Plan. ➢ The sludge treatment including sludge thickening, storage and disposal process, will involve sludge drying bed and also make use of an oxidation pond. The oxidation pond area will be partially filled, or concrete lined to be used as sludge maturation ponds. This proposed process design is based on an extended aeration activated sludge process, without primary sedimentation and with the addition of denitrification to the process. ➢ Conduct monthly water quality tests on treated effluent. ➢ Dispose of dry sludge at registered landfill with licensed professional service provider.

Impact	Impact Level	Description	Mitigation
			➢ Manholes must be sealed and used to inspect and maintain infrastructure. ➢ Regular monitoring of treated effluent at the new Hlabisa WWTW must be undertaken. Do not discharge untreated effluent. The discharged effluent must be in accordance with approved TWQR allocation indicated in the water use license. Records of effluent discharge quantity and TWQR parameters must be kept. No untreated effluent 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. ➢ Ongoing Quarterly water quality and biomonitoring must be implemented during operation. monitoring at the upstream and downstream of WWTW at Hluhluwe River. ➢ A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management should be compiled, in order to manage the rehabilitation of the affected watercourse after the construction (if necessary). The rehabilitation plan should make provision for an aquatic

Impact	Impact Level	Description	Mitigation
			biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish, given the important conservation value of the area.
Soil erosion and geological degradation such as run-off, slits and compaction. The uncontrolled construction activities will likely exacerbate erosion and geological degradation.	Medium (2)	Excavation at the riverbanks within the site locality for the purpose of bulk pipeline stream crossing could result in run-off erosion and might further exacerbate erosion.	➢ Construct storm water system and make provision for erosion protection. ➢ Sections of trenches/excavations/cuts need to be either shored or flattened to less than 60° from horizontal. ➢ Vegetation clearance should 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. ➢ No work within sensitive riparian should be carried out during wet period or peak flow season. ➢ It is recommended that excavation be carried out along the guidelines given in SANS 1200 (current version). ➢ Concrete lined upslope interception drains must be installed at each site.

17 SPECIALISTS STUDIES

There were five specialist studies undertaken for this Environmental Assessment, namely:

- Terrestrial Biodiversity Impact Assessment (*Appendix G1*);
- Wetland Impact Assessment (*Appendix G2*);
- Aquatic Ecological Impact Assessment *(Appendix G3);*
- Geohydrology Impact Assessment *(Appendix G4);* and
- Geotechnical Assessment (*Appendix G5*).

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

Table 22: Environmental Screening Tool Sensitivity Theme

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

17.1 Motivation for excluding compliance statements:

The compliance statement for Agriculture and Civil Aviation Themes were deemed to be unnecessary due the following reasons:

17.1.1 Agriculture Theme

The bulk sewer gravity main is proposed to be situated at along the valley which is considered a low-lying area within the project area. There is subsistence agriculture land use within the valley at some section of the proposed bulk sewer gravity main. However, because the bulk sewer gravity main comprise mainly of sub-infrastructure which will be trenched and laid at

approximately 1m depth, as a result there will be no change in land use, as the land will be later be used for substance agriculture after construction.

17.1.2 Civil Aviation Theme

The Civil Aviation Theme responds to aerodrome which was located within the study area. The aerodrome is now of non-existence as the area is now transformed into settlement area called '*Emabhanoyini*' which is translated in isiZulu as '*the place of aircrafts*' due to fact that the area was previously an aerodrome.

17.2 Motivation for Exclusion of other Specialist Studies

Motivation for exclusion of other specialist studies prescribed by the Environmental Screening Tool is outlined in (***Table 24***) below.

Table 23: Specialist Studies Identified by Environmental Screening Tool

Specialist Study	Motivation for Exclusion of Specialist Study
Agricultural Impact Assessment	This study is not considered viable as the pipeline traverse along the valley, to which the preliminary infield assessment for site verification confirmed that the pipeline will traverse Six (6) discrete habitat types delineated within the assessment area, namely, wetlands, riparian and instream habitat, scarp forest, sourveld, and transformed (which is within settlement). There are fragments of cultivated land (subsistence farming), forest plantations (agricultural facility) mostly within the homesteads. However, because the bulk sewer gravity main comprise mainly of sub-infrastructure which will be trenched and laid at approximately 1m depth, as a result there will be no change in land use, as the land will be later be used for substance agriculture after construction. Therefore, the Agricultural Impact Assessment as deemed to not necessary as there will be no change in landcover inputs.
Archaeological and Cultural Heritage Impact Assessment	This study was not considered viable the site has a low Archaeological and Cultural Heritage sensitivity theme.
Palaeontology Impact Assessment	The Palaeontology Impact Assessment is not considered viable as the site has a medium sensitivity theme. A preliminary

Specialist Study	Motivation for Exclusion of Specialist Study
	desktop study for SAHRIS palaeosensitivity provides that the site falls within a 'Moderate' paleontological sensitivity, as result a field assessment is not required for the study area. Therefore, the Palaeontology Impact Assessment was not considered for this project.
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*). For the best assessment practice this assessment has been augmented by Wetland Habitat Delineation Impact Assessment, as the pipeline traverse the wetland, and some construction works will take place with the regulated areas, attached as (*Appendix G2*).
Hydrology Assessment	The Geohydrological Impact Assessment was undertaken to assess the impact of the development on ground water resources, attached as (*Appendix G4.*
Geotechnical Assessment	The Geotechnical Assessment was conducted for this EIA, attached as (*Appendix G5*).
Socio-Economic Assessment	This study was not considered viable as, the design for sewer pipeline route does not constitute relocation of households, but rather the pipeline will be re-routed where occurrences of encroachment occur. The Project Social Facilitator will be appointed to monitor and manage the social aspects during the project planning and implementation. In addition, the construction of bulk sewer and reticulation will see the connection of businesses, schools and households which are currently serviced by a household's septic tanks. Thereby, upgrading to a full water-borne sanitation system that will be connected to this sewer main lines and WWTW (refer to needs and desirability). Thus, improves livelihoods and social conditions.

Specialist Study	Motivation for Exclusion of Specialist Study
Plant Species Assessment	This assessment is covered by Terrestrial Biodiversity Impact Assessment, which was conducted for the proposed development (Appendix G1)
Animal Species Assessment	This assessment is covered by Terrestrial Biodiversity Impact Assessment, which was conducted for the proposed development (Appendix G1)
Seismicity Assessment	The Geotechnical Assessments scope has a provision of Seismicity Assessment for excavation of pipeline routes. Therefore, this will form part of Geotechnical Assessment.

18 SUMMARY OF FINDINGS BY SPECIALISTS

The summary of findings detailed below, are derived from the: Terrestrial Biodiversity Impact Assessment (*Appendix G1*); Wetland Impact Assessment (*Appendix G2*); Aquatic Ecological Impact Assessment (*Appendix G3*); Geohydrology Impact Assessment (*Appendix G4*); and Geotechnical Assessment (*Appendix G5*), and are summaries as follows:

18.1 Terrestrial Biodiversity Impact Assessment Findings

The Terrestrial Biodiversity Theme sensitivity of the proposed Development of Hlabisa Bulk Sewer Pipeline and new WWTW (project area) is assigned as 'Very High Sensitivity'. The project area is considered Very High due to the presence of National Forestry Inventory and Strategic Water Source Areas. However, the infield site verification concluded that since this is a linear project, the ecological sensitivities of the project site vary from Low to High. Only the forest and riparian vegetations are considered to be of high sensitivities as they are known for high species diversity and potentially higher number of species of conservation concern. The species recorded have a much wider distribution beyond this habitat or locality. Considering that this project is a linear project, the impacts can be mitigated. The sensitivity status of the forest is severely challenged by the invasion of alien plant species.

The project area does not fall within any of the Important Bird and Biodiversity Area (IBAs), with Hluhluwe IMfolozi Park (HiP) situated East of the project site. Four micro-habitats on and around the proposed development site represent a significant breeding, feeding and foraging areas for bird species, namely river and riparian habitat, grasslands, forest habitat and exotic

trees. Twenty-Eight (28) bird species were recorded during the field survey. No bird species of conservation concern were recorded during the survey.

The existing land use of the project area and its immediate surrounding area include cultivated land (subsistence farming), plantations (agricultural facility) and homesteads. The edges of the forest are dominated by alien invasive plant species. Plant species such as *Albizia adianthifolia*, *Combretum kraussii*, *Commiphorawoodii*, *Trichilia dregeana* and T*rema orientalis* were recorded in abundance along the Forest area. The edges of this Forest community comprise of dense thickets of *Chromolaena odorata*, *Lantana camara* and *Ricinus communis*. The grassland vegetation is being transformed by the invasion of *Psidium guajava*. No threatened species or plant species of conservation importance were observed within the proposed development site. However, plant species listed as "Specially Protected Indigenous Plants" in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL LILIACEAE, which includes *Aloe sp*. According to the information obtained from authorities, all provincially protected plant species within the project development site, should either be avoided or be preserved and incorporated into the landscaping around the proposed development site. Where this proves not to be possible, an Ordinary Permit will be required from the Department of Forestry, Fisheries and the Environment (DFFE) to transplant these species outside of the region.

The proposed development traverses along the Northern Zululand Lebombo Scarp Forest (FOz5) '*Least Threatened*' and therefore the least option (clearance method) that will cause minimal impacts/damage to the forest will be recommended.

Five (5) reptile species were recorded during the field survey. No reptile species of conservation concern were recorded during the survey. According to the information obtained from the locals, snake species such as Southern African Python (*Python natalensis*), Twig Snake (*Thelotornis capensis*), Brown House Snake (*Boaedon capensis*) and Eastern Natal Green Snake (*Philothamnus natalensis*) have previously been seen in and around the project area.

The Bazaneni stream traversed the proposed development site, and it holds water on a temporary basis. It is an important breeding habitat for most of the frog species which occur

within the study area. The infield survey observed three frog species, namely Painted Reed Frog (*Hyperolius marmoratus*), Guttural toad (*Amietophrynus gutturalis*) and Bubbling Kassina (*Kassina senegalensis*). No frog species of conservation concern were recorded during the survey.

Most of the mammal species observed during the site visit were domestic animals, including dogs, goats, donkeys and cattle. A number of small wild mammal species are however expected to be present occasionally, however, these species are being hunted by the domestic dogs. According to the information obtained from the locals, hunting by locals is prevalent in the area and mammal species such as Common Warthog (*Phacochoerus africanus*), Vervet Monkey (*Chlorocebus pygerythrus*) and Common Slender Mongoose (*Herpestes sanguineus*) had been seen on or near the project site. The river and its associated riparian vegetation provide suitable habitat for water-dependant mammal species. Only one mammal species was seen on site, namely Scrub Hare (*Lepus saxatilis*).

The infield survey also recorded the following invertebrate species, namely Elegant Grasshopper (*Zonocerus elegans subsp. elegans*), Brown Pansy (*Junonia natalica natalica*), African Yellow Pansy (*Junonia hierta cebrene*), Common Mother-of-Pearl (*Protogoniomorpha parhassus*), Broad-bordered Grass Yellow (*Terias brigitta brigitta*), Pirate (*Catacroptera cloanthe*), Soldier Pansy (*Junonia elgiva*), Plain Tiger/African Queen/African Monarch (*Danaus chrysippus*), Common grass yellow butterfly (*Terias hecabe solifera*), Inspector (*Chalcostephia flavifrons*), Citrus swallowtail (*Papilio demodocus*), Pea blue/Long-tailed blue (*Lampides boeticus*), Common Meadow White Butterfly (*Pontia helice helice*) and Buff-tipped Skipper (*Netrobalane canopus*). No invertebrate species of conservation concern were recorded during the survey.

The Ecologist concluded that that the impacts of the proposed development on flora and fauna can be mitigated to a satisfactory level and as such, the development is deemed acceptable from the ecological perspective and as such should not be prevented from proceeding based on the ecological considerations. Once the proposed development has been constructed, rehabilitation process needs to take place and should also ensure that alien plant emergence and erosion do not occur. The development activities proposed within the project area will not have a significant impact on biodiversity conservation within the site. In order to conserve the

faunal species community structures within the study area, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that operations are limited to the approved footprint only and effectively designed and managed fence to allow migratory movement of fauna. The impact on fauna is likely to be localized and may result in species being displaced (e.g., snakes and lizards) but no significant and irreversible impact on these species is expected. Mitigation measures to reduce any potential direct and acute impact on faunal species, such as conducting phased earthworks over time to allow various species to move away from the site of development, must be implemented.

18.2 Wetland Habitat Impact Assessment Findings

The findings of the Wetland Hydrologist indicated that seven (7) wetlands fell within the regulated area and only five (5) of these systems were identified to be at risk and required further assessment. These systems were identified as seepage, Unchanneled Valley Bottom (UVB) and Channelled Valley Bottom (CVB) wetlands and they were identified to be largely natural and moderately modified. Existing impacts placing pressure on these systems are livestock grazing, rural settlements and Eucalyptus plantations. As a result of their surrounding land uses, these wetlands were important overall in trapping sediment, controlling erosion, attenuating floods, regulating flows and assimilating toxins and nutrients. These systems were therefore of moderate to high ecological importance and sensitivity.

All construction related activities, apart from the site camp and access road will pose a moderate risk pre and post mitigation. This is as a result of the access road and site camp remaining outside of wetlands. The proposed activities will cause the following impacts:

- Disturbance and destruction to wetland habitat
- Alteration to wetland functionality in terms of vegetation composition, geomorphic features and hydrological regime.
- Contamination of water bodies (surface and groundwater)
- Reduction in water quality from increased turbidity

The findings form infield survey provides that, the wetland unit 01 (W01) UVB wetland be traversed by the bulk sewer line and is therefore at direct risk of impact and required further

assessment; the wetland unit 02 (W02) CVB wetland that is connected to the river falls in close proximity to the proposed activities and therefore this system is at direct risk of impact and required further assessment; wetland unit 03 (W03) seepage wetland occurs alongside the bulk sewer line reserve and its close proximity to the proposed activities infers this system is at direct risk of impact. This system required further assessment; wetland unit 04 (W04) seepage wetland will be traversed slightly by the bulk sewer line whereby activities will directly impact on the remainder of this system. This system was identified to be at risk and required further assessment; wetland unit 05 (W05) UVB wetland occurs upslope of the proposed activities and will be directly impacted/destroyed as a result of the proposed WWTW. This system required further assessment; wetland unit 06 (W06) CVB wetland occurs upslope of the proposed activities, approximately 50 m away and was identified to not be at risk and did not require further assessment; and the wetland unit 07 (W07) seepage wetland occurs approximately 80 away upslope of the proposed activities and was identified to not be at risk and did not require further assessment.

The infield Assessment provides that the; W01 was located a distance away from the informal settlements and therefore was relatively undisturbed. There have been no major changes to the wetland functionality, however informal pathways have been created through the wetland and this increased sediment inputs and has slightly altered flows through the creation of a small impeding feature and from the outcome of erosion and soil compaction. Its location in the valley infers that it receives surface runoff from the surrounding land uses making this system effective in flood attenuation and regulating flows that reach the river. Its location also makes it effective in trapping sediment that is received from surface runoff.

The W02 was connected to the river and was located within an informal settlement. There was a road that had been washed away which is altering the natural flows through this system and has also caused erosion and sedimentation. Due to human disturbance, Invasive Alien Plant Species (IAPs) have proliferated the area and confined indigenous species to small areas. The wetland is used by livestock and by locals for cultivation purposes. Although this system was moderately modified, the location and surrounding land uses make this system important in assimilating nutrients and toxins. The dense reeds also assist in flood attenuation and regulating flows. This system was effective in trapping sediment that runs off from poor land management practices.

The W03 has a dense vegetation made it effective in trapping sediment, controlling erosion and assimilating any toxins and nutrients. Its location within the landscape also made it affective in regulating flows downstream by promoting diffuse flows. This system fell within grazing pastures whereby vegetation has been removed and altered. Grazed areas have led to compacted soils and exposed areas which have altered geomorphology and led to erosion and the formation of head cuts. Erosion has thus affected the retention and distribution patterns in the wetland but not to a significant extent. Manure is also rich in nutrients which has further reduced water quality, along with increased sediment laden runoff.

The W04 was located alongside the Eucalyptus plantation and was used by livestock, it was therefore effective in assimilating nutrients. The diffuse nature of this system also assists in surface runoff from clearing activities taking place in the plantation. This system was therefore also effective in flood attenuation. This system was confined between *Eucalyptus* plantations and clearing activities were the only risk currently posed on this system. The area surrounding the wetland was largely undeveloped and therefore human interference is limited.

The W05 was confined between Eucalyptus plantations and clearing activities were the only risk currently posed on this system. The area surrounding the wetland was largely undeveloped and therefore human interference is limited. This system was mostly effective in regulating flows from the drainage line to the river downstream. The change in topography also promoted diffuse flows which assisted in flood attenuation and trapping sediment that is released from clearing activities. The system was well vegetated which also controls erosion and assists in filtering any nutrients from the plantations.

The buffer tool was used to generate an appropriate buffer to prevent any impacts from reaching the wetlands. A 33 m buffer was generated for the high-risk wetlands and a 20 m buffer to the wetlands receiving indirect impacts and at lower risk of impact. The buffers cannot be applied as activities are taking place within wetlands W01, W04 and W05 and wetlands W02 and W03 are in too close proximity to the proposed activities.

The following impacts were identified as moderate risk: Clearing of vegetation within and in close proximity to watercourses; Excavation for development; and Operation of various components of the proposed development and could not be reduced to low risk, post

mitigation. Therefore, It is the specialist's opinion that an alternative site for the WWTW be explored such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected, particularly W04 and W05.

18.3 Aquatic Ecological Impact Assessment Findings

All watercourses within the study area were observed to fall withing the DWS quaternary catchment area W32E.

The findings of the Aquatic Ecologist indicated the presence of a single riverine unit, the Hluhluwe River was identified as a likely receiver of impacts from the proposed development. The river is characterised by long shallow pools, interlinked with slow flowing riffles dominated by sand and boulders. There appears to be little to no modification of the immediate vicinity (i.e., within 10 m) in the downstream site, however, there is evidence of modification on the upstream site. The upstream site has been transformed into a bridge that has since been flooded, additionally there is evidence of pipes that could be linked to water abstraction; however, it is unclear what the purpose was due to the flooding. The surrounding area is dominated by commercial Gum tree plantations. The riverbanks downstream are at a valley, whereas upstream the riverbanks are moderately steep and prone to sediment flow and erosion during periods of high-water flow or flooding. There was evidence of high surface water around the drainage line, suggesting that the river system is permanent and subject to seasonal flooding. The riparian habitat both upstream and downstream sites contained moderate abundances of exotic or alien invasive species, specifically, *Lantana camara* (Common lantana), *Hibiscus rosa-sinensis* (Shoeblack plant), and *Senna didymobotrya* (Peanutbutter cassia). No aquatic alien plant species were observed within the riparian reach.

Data collected from the Hluhluwe River during the site investigation included aquatic macroinvertebrates, instream biotopes, fish and water quality. One fish species were observed within the study site, namely, the Southern mouthbrooder (*Pseudocrenilabrus philander*). The instream biotopes within the river reaches assessed indicated a fair biotope availability score at the upstream site and a poor biotope score at the downstream site, with overall poor diversity of macroinvertebrates, the majority of which were tolerant of poor water quality conditions, and overall fish community structure is in a critically modified state (***Class F***).

The water quality results indicated that Total Suspended Solids exceeded the Target Water Quality Range whilst the rest of the determinants were in the natural levels. The overall EcoStatus of the assessed unit within the Hluhluwe River was determined to be a ***Class D*** at the upstream site, and a ***Class D/E*** at the downstream site. The slightly more degraded upstream site is likely a result of the activities from the adjacent rural settlements who utilise the river for subsistence use.

The results from the laboratory assessment show that all parameters are within both the TWQR for aquatic systems and the DWS General Effluent Standard with the exception of total suspended solids. The total suspended solids (TSS) concentration is a measure of the amount of material suspended in water. The concentration of suspended solids increases with the discharge of sediment washed into rivers due to rainfall and resuspension of deposited sediment. Increases in total suspended solids may also result from anthropogenic sources, including: Discharge of domestic sewage and; Physical perturbations from road, bridge and dam construction. Whilst the E. coli counts were low (>45 counts per 100ml water), total coliform counts are higher than the DWS limits. The high coliform counts suggest that perhaps there are moderate coliform sources upstream, possibly from animal manure or human settlements.

Potential impacts to the riverine areas arising from the construction and operation phase of the development are linked to; Direct habitat disturbance; Soil erosion and sedimentation; and Pollution of water resources and soil.

Although there is a 45 m buffer between the WWTW and the Hluhluwe watercourse, the topography is steep (>10%), where increased run-off from hard surfaces (such as concrete infrastructure and road surfaces) would flow directly into the river, further altering the already modified flow regime within the watercourses and/or alter the base level of the watercourses, which may lead to flow impoundment and/or worsen existing erosion and scouring. Poor placement or design of the on-site stormwater infrastructure during the operation phase could lead to increased erosion and sedimentation into the watercourse. Therefore, it is crucial that the stormwater management system is properly developed and put into place. The likely impacts on riverine habitat associated with the proposed development of the Hlabisa WWTW

can be divided into three distinct impact groups, namely; Loss of Freshwater Habitat & Biota Impact; Degradation of Freshwater Habitat Impact; Water and Soil Pollution Impact.

18.4 Geohydrology Impact Assessment Findings

The findings of the Geohydrologist indicated that the hydro-census study, the static groundwater level is at an approximate depth of 27m below EGL. The pH is between 5 and 9.7, TDS is less than 1200 mg/l, Ammonia (NH4) is less than 1.5 mg/l, Nitrate is less than 11 mg/l which are all within sans limits. The infield assessment provides that there are faults in the area which are considered as preferential flow paths for groundwater. The dolerite intrusion creates planes of weaknesses within the surrounding rock which can create pathways for groundwater movement. In areas of dolerite intrusion, the fractures within the bedrock are considered to be higher. Groundwater seepage was encountered on site at depths in the range 0.70m to 0.9m below EGL. This is the elevated groundwater condition that is a result of rainfall in the area, this is also known as a perched groundwater condition. The perched groundwater condition and the aquifer groundwater level are two different levels.

The project area comprised colluvium, residual shale and weathered shale and tillite rock. The materials, in general, can be described as follows: *Colluvium* – Material can be described as slightly moist, dark grey, soft to firm, fissured and pinholed, sandy CLAY. The colluvial material extended to approximate depths in the range of 0.5m (AH01) to 0.65m (AH04) below EGL; *Residual Shale* – Material can be described as slightly moist, light grey to orange, firm to stiff, silty CLAY. The residual material extended to approximate depths in the range of 0.7m (AH04) to 2.3m (TP02) below EGL; *Weathered Shale Rock* – Material can be described as olive grey, completely to highly weathered, fine grained, laminated, highly fractured, soft to medium hard rock. The weathered shale rock was encountered at surface at EXP01 and from approximate depths in the range 2.2m to 2.3m below EGL. The shale rock in TP02 exhibited signs of metamorphism which is indicative of dolerite activity close to the site; Weathered Tillite Rock – Material can be described as yellowish orange stained black, completely to highly weathered, fine grained with drop stones, highly fractured, soft rock. The weathered tillite rock was encountered at surface at EXP02 at a road cutting which was approximately 2m thick.

The interrogation of the Hydrogeological Map Sheet “2730 Vryheid” provided that the site is underlain by an fractured aquifer system with approximate yields in the range 0.1 to 0.5 ℓ/s,

the DWS classifies the aquifer as '*b2*'. According to the groundwater level map of the area, groundwater within the aquifer is anticipated to be between 17 to 35m below EGL.

Based on the laboratory results in Table 4, the materials classify as CLAY soils with classification of CL. The permeability rates for these soils are 1x10-6 to 1x10-8 cm/s (approximately 0.01296 m/day to 0.00017 m/day). The shale rock at the site is considered as an impermeable membrane and will prevent any contamination from entering the acquire in the area, particularly considering the aquifer is at least 17m below EGL. Below the shale is the tillite rock which is also an impermeable membrane.

The groundwater level within the main aquifer in the area which is classified as potable water source is greater than 15m below EGL and within the solid rock. This is a low-risk vulnerability class. The risk to the perched groundwater condition is high and the risk to the potable water aquifer is low. The main concern from an environmental perspective was if the development will have a negative risk to the potable groundwater aquifer system. However, the impact to potable aquifer system is classified as a low risk, thus, here is no concern for contamination to the potable aquifer. Should there be a failure at the WWTW then the contamination of effluent into the environment will be a significant volume. This is considered as a high load risk. Considering that the site comprised shallow shale rock at depths less than 3m below EGL there is more than sufficient overburden to prevent any contamination from affecting the potable aquifer. Any contamination to the environment may only effect the perched groundwater condition if the site is not rehabilitated and / or remediations are not implemented within 24 days assuming worst case that water level is at 0.35m below EGL.

Due to the depth to the potable aquifer system in the area, overall, the development is considered as a low risk for contamination. Nonetheless, it is strongly recommended that protection of the environment and aquifer system is given careful consideration pre, during and post construction.

18.5 Geotechnical Assessment Findings

The locality of the bulk sewer conveyance route is predominantly underlain by sediments of the Vryheid Formation, and the WWTW location is underlain by the Tillite and shale of the Dwyka Group. Bedrock on the five sites along the bulk sewer conveyance comprises Vryheid Formation sandstone with the balance made up of Dwyka tillite and – shale in the vicinity of the WWTW. The study area *in-sutu* material comprise the topsoil, clayey-silt-sand mixes associated with residuum and decomposed to highly weathered sediments encountered on the five sites of bulk sewer conveyance characterised of soft excavatable. Shale bedrock present at an average depth of 2m that underlies the WWTW site ranges initially from soft to intermediate but becomes hard excavation with depth. These excavatable materials are characterised of overall good excavatability, up to 4.2m below EGL. The surrounding matrix/decomposed material is likely to require 'Soft' to 'Intermediate' excavation.

No seepage was encountered at PSS 1 and PSS 2; PSS 3 although the section is located within the narrow flood plain within the valley along the bulk sewer pipeline route. Seepage was encountered at PSS 3 and PSS 4 and the two test pits excavated on the WWTW site. The sloping topography on PSS 1, 2, 4 and the WWTW provides good drainage, and no ponding was observed.

A 65KW powered 4x4 tractor-loader-backhoe (TLB) was used to excavate the six test pits on site. The test pits were excavated to shallow refusal or the maximum reach of the backhoe, up to 4.2m below Existing Ground Level (EGL). The topsoil, clayey-silt-sand mixes associated with residuum and decomposed to highly weathered sediments encountered on the five sites are soft excavatable. Shale bedrock present at an average depth of 2m that underlies the WWTW site ranges initially from soft to intermediate but becomes hard excavation with depth. The six (6) dynamic penetration (DPSH) tests were conducted to verify the consistency of the substrate soils and to facilitate the location of the dilatometer tests. The DPSH testing experienced refusal at the depths ranging between 6 and 9m for the estimated depth of influence of a $9m^2$ rectangular structure. Two (2) flat dilatometer tests (DMT's) were performed on site. The refusal was experienced at the dept of 7.4m EGL occurring on grey mudstone.

The visual stability assessment of the test pits excavated indicated that the soils were dry enough and had a sufficient silt/clay fraction within the matrix to provide adequate strength against collapse of the test pit side walls with sufficient stand-up time of more than one week. The topsoil, fine grained residual materials and decomposed, soft excavatable sandstone and shale comply with > G10 type material, unsuitable for backfill and subgrade. The site soils are mildly to moderately corrosive.

19 RECOMMENDATIONS BY SPECIALISTS

19.1 Recommendations by the Terrestrial Biodiversity Assessment

The following were recommended by Terrestrial Biodiversity Ecologist, and should be included in the Environmental Authorisation:

a) Plant species listed as “Specially Protected Indigenous Plants” in terms of Schedule 12 of Natal Nature Conservation Ordinance, No. 15 of 1974 were identified within the study area, namely ALL LILIACEAE, which includes *Aloe sp*. According to the information obtained from authorities, all provincially protected plant species within the project development site, should either be avoided or be preserved and incorporated into the landscaping around the proposed development site. Where this proves not to be possible, an Ordinary Permit will be required from Ezemvelo KZN Wildlife (EKZNW) to transplant these species outside of the region.

b) The proposed development traverses the Least threatened forest and therefore the least option (clearance method) that will cause minimal impacts/damage to the forest will be recommended.

c) In order to conserve the faunal species community structures within the study area, habitat destruction should be limited to an absolute minimum as intact habitat would result in higher faunal and floral species diversity. It is therefore critical that construction activities are limited to the required footprint only.

d) All development footprint areas must remain as small as possible and should not encroach onto surrounding areas.

e) Newly cleared soils must be re-vegetated and stabilised as soon as construction activities have been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging alien invasive plant species.

f) In order to alleviate the loss of habitat within the study area, it is recommended that a clear, concise and well formulated rehabilitation plan be implemented after the construction activities, focusing on fauna species

g) The rehabilitation of disturbed areas must receive high priority and the plant species used during rehabilitation should be site specific and according to the surrounding vegetation composition. Once the proposed development has been constructed, rehabilitation process needs to take place and must also ensure that alien plant emergence and erosion do not occur.

h) Any fauna threatened by the construction activities must be moved to safety by a suitable qualified Ecologist.

19.2 Recommendations by the Wetland Habitat Impact Assessment

The following were recommended by Wetland Habitat Specialist, and should be included in the Environmental Authorisation:

a) A 33m buffer was generated for the high-risk wetlands and a 20 m buffer to the wetlands receiving indirect impacts and at lower risk of impact. The buffers cannot be applied as activities are taking place within wetlands W01, W04 and W05 and wetlands W02 and W03 are in too close proximity to the proposed activities.

b) Where applicable, the buffer zones must be applied to the at-risk wetland systems. A minimum 15 m buffer must be applied to the remaining wetland systems, as best practice, and the systems must be demarcated as “no-go” entry zones.

c) The Applicant must establish the location of the site camp which must be submitted to the competent authorities as part of the application and the site camp may not intrude into watercourses and their buffers.

d) An alternative site for the WWTW be explored such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected, particularly W04 and W05.

e) Due to most of the bulk sewer line falling within aquatic systems, a Biomonitoring Plan is required.

f) A Groundwater and Surface Water Monitoring Program is recommended.

g) A Wetland Rehabilitation and Maintenance Plan must accompany the application.

h) An Environmental Control Officer (ECO) must be appointed for the construction phase to ensure compliance with the authorisations and Environmental Management Programme (EMPr)

i) The following Water Use License conditions applies:

- WULA Section 21 (g) due to the nature of handling sewage, will be required.
- WULA Section 21 Section 21 (f) due to discharging treated effluent into a watercourse, will be required.
- WULA 21 (c) & (i) for every wetland that is traversed, whereby alterations to the wetland characteristics and impeding or diverting flows are anticipated.

19.3 Recommendation by Aquatic Ecological Impact Assessment

The following were recommended by Aquatic Ecological Specialist, and should be included in the Environmental Authorisation:

a) A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management, should be compiled in order to manage the rehabilitation of affected watercourse after the construction of the proposed crossing. The rehabilitation plan should make provision for an aquatic biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish.

b) Potential stormwater run-off from hard surfaces requires careful attention to ensure that the nearby watercourse is not negatively impacted by sedimentation and run-off carrying oil, grease, hydrocarbons and/or harmful chemicals.

19.3.1 Other mitigation measures

a) All work to be done within sensitive riparian and instream habitats, if any, should be carried out at a time of low flow conditions (winter to early spring). It is prudent however to be prepared for increased flows by scheduling work according to the weather forecast and to be adequately prepared for unexpectedly large runoff from a sudden storm.

b) A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management should be compiled, in order to manage the rehabilitation of the affected watercourse after the construction (if necessary). The rehabilitation plan should make provision for an aquatic biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish, given the important conservation value of the

area. The survey must be conducted within one month after the construction upgrades to determine the impacts, if any, and implement adaptive management, if required.

c) Sediment barriers must be installed in areas sensitive to erosion such as near water supply points, slopes, and actively eroding riverbanks. These measures include but are not limited to - the use of sandbags, hessian sheets, silt fences, geotextiles, rock gabions, etc.

d) The silt fence / curtain must be maintained regularly to ensure continual functionality during the construction phase.

e) During the operation phase it is recommended that disturbed watercourse habitat and rehabilitated areas are monitored for potential erosion and scouring. This should initially take place immediately after construction, thereafter quarterly for two years and thereafter annually.

19.4 Recommendations a Geohydrology Impact Assessment

The following were recommended by a Geohydrology Specialist, and should be included in the Environmental Authorisation:

a) The groundwater monitoring boreholes be drilled at WWTW site. It is recommended that two boreholes be drilled downgradient of the site and a single borehole upgradient to a depth of approximately 10m.

b) Groundwater monitoring must be carried out on a quarterly basis and the upgradient borehole should be used as a general indicative marker. Should any contamination occur, the downgradient boreholes in theory should reflect this in their results whilst the upgradient borehole has a baseline of the area.

c) A hydrogeologist is recommended to supervise the drilling activity, such that, adequate information about, geology, groundwater strikes, groundwater levels, and water samples are collected. It is therefore recommended that a hydrogeological practitioner be appointed to carry out periodic inspections during construction.

d) The borehole design should comprise the following:

- Borehole adequately drilled.
- PVC Casing needs to be installed within the borehole.
- Perforated PVC Casing will need to be installed from at least 3m begl.

- The space between the PVC casing and borehole side walls need to be filled with a gravel pack.
- A bentonite seal will need to be placed on the top 3m.
- A concrete plinth at the top with a borehole marker.
- The boreholes need to be adequate diameter to allow for easy sampling.

e) The following parameters are recommended as a minimum for groundwater testing: pH, conductivity, Potassium (K), Chloride (Cl), Nitrate (NO_3), Ammonia (NH_4), Phosphorus (P), Sodium (Na), Calcium (Ca), Carbonates (HCO_3), Iron (Fe), Manganese (Mn), Titanium (Ti), Chrome (Cr), Cadium (Cd), Lead (Pb), Nickel (Ni), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Coliforms, and E. Coli. However, DWS may recommend that additions determinants be included and/or indicate some of the above is not required. This will be indicated on the approved license.

f) During the construction of WWTW, if adequate designs are done to ensure structures are built correctly to prevent contamination of faecal coliforms into the stream/river.

g) During the operation of WWTW, ensure that the protection measures are in place to mitigate contamination.

h) Regular monitoring of groundwater quality during the lifespan of the WWTW is required.

19.5 Recommendation by a Geotechnical Assessment

The following were recommended by Geotechnical Specialist, and should be included in the Environmental Authorisation:

a) Replacement of the foundation materials at the pump station sites with mechanically modified backfill, imported and compacted in layers should curtail future soil movements. The soil raft foundation design will be suitable for modified normal construction – that is reinforced strip footings, light reinforcement in masonry, good drainage and foundation

pressure not exceeding 50KPa;

b) The rockfill and proposed 2m thick engineered soil raft at the WWTW should ensure stable founding conditions, suitable for normally constructed foundations – that is strip footings and slab-on-the-ground; surface water is to be collected and disposed of in storm-water channels draining south-eastwards to the local Bazaneni Stream;

c) Good compaction control of all layer works is to be carried out to ensure that required densities are achieved;

d) Representative bulk soil samples of the mechanically modified material should be taken prior and during the construction of engineered fills to ensure that the quality of the backfill material is within specification;

e) Sections of trenches/excavations/cuts need to be either shored or flattened to less than 60° from horizontal;

f) Spoil from the trench excavations should not be placed closer than the equivalent depth of the trench to avoid unnecessary loading of the sidewalls, especially under moist to saturated conditions;

g) Concrete lined upslope interception drains should be installed at each site; and

h) Wearing course material for access roads and fills is to be sourced from the dolerite borrow pit.

i) Any temporary lateral support system opted for by the contractor should be reviewed and approved by the design Engineers prior to excavation commencing.

20 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. After an Authorization has been granted, it is the applicants' responsibility to ensure that all recommendations outlined in this report as well as in the EMPr are properly implemented.

20.1 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) Developed site layout for the construction of bulk sewer gravity main and WWTW must clearly illustrate the proposed construction footprint and clearly delineate the servitude for the construction corridor.

b) A site layout plan must be compiled indicating the limits of disturbance associated with the construction of new Hlabisa WWTW and associated infrastructures in relation to the

identified sensitive areas (i.e., Hluhluwe River and wetland system). No-go areas and any stormwater infrastructure must be indicated on this plan;

c) The route design must incorporate a pipeline construction corridor and must not be more than 10m width for the construction corridor within the vicinity of the stream crossing (riparian zones), and wetlands (Subtropical Alluvial Vegetation (*Aza7*). Also, must not be more than 15m width on the remainder sections of pipeline, where there is no sensitive environment.

d) The site layout plan must indicate no-go areas, through a buffer determination to prevent intrusion of wetlands where such wetlands could be avoided.

e) The 'Site Layout Alternative' proposes the configuration of existing layout. The WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***). This will prevent the WWTW infrastructure to be prone to flooding in case of extremely event, and also prevent undesirable contamination Hlabisa River lying downstream of the WWTW. Furthermore, the Wetland Specialist has also recommended that an alternative site for the WWTW be explored such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected. Therefore, the proposed alternative site position (***Figure 3***) could meet the desirable development objectives and provide impact mitigation as the site will be shifted further north by 80-100m from current location. This will also avoid the option of wetland offsetting, as this would be the case if the current WWTW position is considered.

f) Buffer determination for watercourse habitat outside the construction corridor but at risk of being impacted. For the new WWTW 100m buffer determination is required between Hluhluwe River and new WWTW. This means the layout must be configured such that the WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***).

g) 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.

h) A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management should be compiled, in order to manage the rehabilitation of the affected watercourse after the construction (if necessary). The rehabilitation plan should

make provision for an aquatic biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish, given the important conservation value of the area.

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

j) The guidelines for the protection of natural forest habitat suggest that no activities or development should be considered that would destroy the forest habitats unless of strategic provincial or national importance with no feasible alternatives. Therefore, where feasible the pipeline must be re-routed along the Zululand Lebombo Scarp Forest (*FOz5*). 15m buffer determination along the vicinity of Zululand Lebombo Scarp Forest (FOz5) must be considered.

k) Design the pipeline alignment at stream crossing is such a way that the concrete encased for pipeline crossing at instream must be below the riverbed to prevent upstream ponding and inundation.

l) Appoint a Social Facilitator to manage project social aspects and re-route the pipeline where there is encroachment to burial sites. Social Facilitator to undertake 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.

m) 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.

n) Identify and delineate the existing access point to the pipeline the construction site. The access route must form an integral part of site layouts which must be communicated to the project team including the delivery crew.

o) 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.

p) 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.

q) Appoint an ECO to monitor and enforce compliance of all EA, permits and licences conditions during construction.

20.2 During Construction Phase

a) The development area must again be surveyed prior to construction in order to locate and capture any animal and plant SCC and relocate them.

b) Clearly delineate the servitude for the construction corridor. The vegetation clearance of pipeline construction corridor must not be more than 10m width for construction within the vicinity of stream crossing (riparian zones), and wetlands (Subtropical Alluvial Vegetation (*Aza7*) vegetation). 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) The 15m buffer determination along the Zululand Lebombo Scarp Forest (*FOz5*) must be adhered to.

d) The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the Zululand Lebombo Scarp Forest (*FOz5*). Should pipeline route runs within a Scarp Forest which is found within the study area. The permit will be required from DFFE in order to cut, destroy or disturb the natural forest.

e) The vegetation clearance of pipeline construction corridor must not be more than 15m width on the remainder sections of pipeline along habitat associated Northern Zululand Sourveld (*Svi22*), provided there are no sensitive environment.

f) Vegetation clearance for construction of the new WWTW must be limited to demarcated footprint. A 15m buffer along the project site must be considered, and no development and stockpiling should take place outside 15m buffer of the new Hlabisa WWTW site and mark it No-Go areas. The demarcations are to remain until construction and rehabilitation is complete.

g) Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

h) 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.

i) Where possible the pipeline route along the wetlands must include buffer determination of at least 28m buffer for CVB wetlands; 26m buffer for UVB wetlands; and 25m buffer for seepage wetlands to protect wetland habitat and ecological corridor and mark no-go areas.

j) Pre-development site hydrology (i.e., runoff, infiltration, interception, evapotranspiration, groundwater recharge, and stream baseflow) must be preserved as far as possible.

k) 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.

l) A one-way running track must be established across the riverbed 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.

m) 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 from the water edge, as it stretches the bucket to excavate the instream habitat.

n) The concrete encased for pipeline crossing at instream must be below the riverbed to prevent upstream ponding and inundation.

o) 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.

p) Detailed method statement for working within the watercourse with provision for spillage and construction debris management must be compiled by the contractor prior to the commencement of the project;

q) A conceptual riverine rehabilitation and monitoring plan with a focus on erosion and alien vegetation management should be implemented, in order to manage the rehabilitation of the affected watercourse after the construction (if necessary). The rehabilitation plan should make provision for an aquatic biomonitoring survey which includes an assessment of water quality, habitat, SASS5 and fish, given the important conservation value of the area.

r) At stream crossing, the 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.

s) Stockpiles must not be more than 2m in height, and be stored on ideally flat area 32m away from the watercourse;

t) Rehabilitate all watercourses in accordance with DWS approved Rehabilitation and Maintenance Plan.

u) It is highly recommended that site camp be developed at already disturbed site, on ideal flat surface area which is at least 32m away from the watercourse. Also, the construction machinery must be parked only at site camp on the designated bunded areas and dip trays must be placed under the machinery, when not in use to capture any possible hazardous substance leaks;

v) 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 encased concrete at stream crossings;

a) Excavations must not be left open for an extended period, 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;

b) All stockpiles must be kept free of weeds and invasive alien plants;

c) If at risk of being eroded, all stockpiles must be secured with sandbags around the base of the soil stockpile;

d) Appoint a Social Facilitator to manage project social aspects and re-route the pipeline where there is encroachment to burial sites. Social Facilitator to undertake 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. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

e) 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.

f) Regular Archaeological Watching Briefs should be carried out during construction in case any chance findings are made.

g) The Contractor must ensure that all temporary structures, materials, waste and facilities used for construction activities are removed upon completion of the project.

h) Fully rehabilitate all disturbed areas and protect them from erosion

i) The control and eradication of a listed invasive species from the construction footprint, including the site camp must be carried out using methods that are appropriate for the species concerned and the environment within which it occurs.

j) The methods employed to control and eradicate a listed invasive species must also be directed at the new growth, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

k) The local community must take priority when it comes to employment and all skills that can be sourced from the local communities. Additionally, locals must be given the opportunity to participate in the development and only specialized skills must be sourced from outside of the surrounding communities;

l) All reasonable precautions must be taken to minimize noise generated on-site.

m) Storage areas must be managed properly by applying the suggested mitigation measures recommended in this document and EMPr;

n) All employees and contractor staff must undergo environmental training covering the following areas: The Environmental Authorisation, the EMPr, Spill Management, Waste Management, Emergency Procedures and Evacuation Procedures;

o) No workers are permitted to be accommodated overnight in the site except for essential security personnel.;

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

q) Construction method statements are to be adhered to. These method statements must consider the environmental facets associated with the rivers such as hydrological flow regimes, flora and fauna. These should be approved by the relevant departments (i.e. EDTEA and DWS);

r) It is recommended that education of workers is key to establishing good pollution prevention practices. Training programs must provide information on material handling and spill prevention and response, to better prepare employees in case of an emergency;

s) Petrochemical storage tanks must be enclosed in a bunded area that makes provision for 110% of the total volume of tanks that they contain. All these bunded areas must be supplied with a closable valve through which any spillage can be safely removed;

t) During operation, the sludge ponds must be regularly inspected (quarterly) for any signs of failure, damage or leaks. Adequate maintenance measures need to be implemented upon finding sludge ponds issues and failures.

u) 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.

20.3 During Operation/ Maintenance

a) Compile and implement the detailed operational maintenance plan, detailing the maintenance of sewer pumpstation, gravity main, and WWTW.

b) Compile and implement a contingency plan detailing management of system failure at WWTW site.

c) Develop and Implement the Contingency Plan.

d) Conduct waste classification of WWTW The waste resulted from operation of WWTW such as sludge, residues of waste, and other hazardous waste in accordance with the specified Minimum Requirements per 4(1) of the National Norms and Standards for Waste Disposal (NEM: WA Act No. 59 of 2008).

e) Dispose of dry sludge at registered landfill with licensed professional service provider. Manholes must be sealed and used to inspect and maintain infrastructure.

f) The sludge treatment including sludge thickening, storage and disposal process, will involve sludge drying bed and also make use of an oxidation pond. The oxidation pond area will be partially filled, or concrete lined to be used as sludge maturation ponds. This proposed process design is based on an extended aeration activated sludge process, without primary sedimentation and with the addition of denitrification to the process.

g) Regular monitoring of treated effluent at the new Hlabisa WWTW must be undertaken. Do not discharge untreated effluent. The discharged effluent must be in accordance with approved TWQR allocation indicated in the water use license. Records of effluent discharge quantity and TWQR parameters must be kept. No untreated effluent may be discharged into watercourses.

h) The sludge lagoons must be monitored and no leakages into wetland may occur, and any detection of seepage must be remedied immediately.

i) Ongoing Quarterly water quality and biomonitoring must be implemented during operation. monitoring at the upstream and downstream of WWTW at Hluhluwe River.

j) Remove contaminated soils immediately from the polluted area and rectify the impacts.

k) Major spills must be reported to the authorities

l) The stream crossing must promote natural flows and allow for connectivity in the river.

m) Regular inspection at the effluent discharge vicinity and stream crossing for evidence of sediment and debris build-up during wet season and dry season, alternatively after heavy rainfall, or peak flow conditions.

n) The disturbed watercourse habitat and rehabilitated areas must be monitored for potential erosion and scouring. This should initially take place immediately after construction, thereafter quarterly for two years and thereafter annually.

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

p) Ongoing maintenance and monitoring regimes must be implemented for the stormwater management system, such as regular inspection at the vicinity of stream crossings, effluent treated effluent discharge point, and stormwater drainage systems for evidence of sediment and debris build-up during wet season and dry season, alternatively after heavy rainfall, or peak flow conditions.

q) The pipeline should be regularly inspected (quarterly) for any signs of failure, damage or leaks. Adequate maintenance measures need to be implemented should evidence of pipeline issues and sewer pumpstation failures are identified, to prevent surface and groundwater pollution as a result of effluent water spillage. Adequate maintenance measures need to be implemented immediately when pipeline issues and failures are identified,

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

s) Establish and maintain an IAPs management programme.

21 ENVIRONMENTAL IMPACT STATEMENT

The findings of this EIA Report as well as the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Five (5) specialist studies were considered for this EIA: Terrestrial Biodiversity Impact Assessment (Appendix G1); Wetland Impact Assessment (Appendix G2); Aquatic Ecological Impact Assessment (Appendix G3); Geohydrology Impact Assessment (Appendix G4); and Geotechnical Assessment (Appendix G5). Overall, anticipated adverse impacts linked with the planned activities (Hlabisa Water-borne Sanitation) during construction and operation are expected to be of low- medium impact significance.

The project impacts were assessed on the basis of discrete alternatives '*Alternative A: Routing Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, Alternative D: Site Layout Alternative*', and *Alternative E: Location Alternative'*. The environmental assessment included an analysis of 36 key environmental aspects of the project that were relevant to the area and the activities, as well as five (5) specialist studies and engagements with relevant stakeholders. Of the 36 environmental aspects analysed, the significance was determined as follows: One (1) was rated '***Very High'***'; 13 were rated '***High***'; 13 were rated '***Medium-High'***'; Six (6) were rated '***Medium***'; two (2) were rated '***Low***' and one (1) '***Very Low***'. With the implementation of suitable mitigation measures, 27 of the impacts were rated '***Negligible***' and nine (9) were rated '*Very Low*'. Overall Mean significance: Nature of a project without mitigation is rated '***Medium-High***', while with mitigation the impacts are considered '***Negligible***'.

All specialist studies concluded that the of the proposed Hlabisa Water-borne Sanitation 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.

The EAP and Wetland Specialist has proposed that the preferred '*Site Layout Alternative'* provides for the configuration of existing WWTW site layout. The WWTW site must be shifted at least 80m-100m further north of existing position (***Figure 3***). This will prevent the WWTW infrastructure to be prone to flooding in case of extremely event, and also prevent undesirable contamination Hlabisa River lying downstream of the WWTW. Furthermore, the configuration of WWTW site layout will mean exploring the use of site such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected. Therefore, the proposed alternative site position (***Figure 3***) could meet the desirable development objectives and provide impact mitigation as the site will be shifted further north by 80-100m from current location. This will also avoid the option of wetland offsetting, as this would be the case if the current WWTW position is considered. This will be in line with accordance to GN509 of the National Water Act, 1998 (Act No. 36 of 1998), the regulated area refers to the outer edge of the 1 in 100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 metres (m) from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act). Buffer determination for watercourse habitat outside the construction corridor but at risk of being impacted. For the new WWTW 100m buffer determination is required between Hluhluwe River and new WWTW. This means the layout must be configured such that the WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***).

The EAP has also established that the guidelines for the protection of natural forest habitat suggest that no activities or development should be considered that would destroy the forest habitats unless of strategic provincial or national importance with no feasible alternatives. Therefore, where feasible the pipeline must be re-routed along the Zululand Lebombo Scarp Forest (*FOz5*). The 15m buffer determination along the Zululand Lebombo Scarp Forest (FOz5) must be adhered to. Also, a 33m buffer has been applied to the high- risk wetlands

and a 20m buffer to the wetlands receiving indirect impacts and at lower risk of impact. A buffer cannot be applied to wetlands W01, W04 and W05 as a result of activities taking place within them and a 20m buffer cannot be applied to wetlands W02 and W03 due to their proximity to the proposed activities. The vegetation clearance of pipeline construction corridor must not be more than 10m width for the construction corridor within the vicinity of the stream crossing (riparian zones), and wetlands (Subtropical Alluvial Vegetation (Aza7) vegetation). Thus, this will minimise impact associated with trenching for installation of sewer pipeline within some of the sensitive ecosystems.

Due the nature of works which involve working within the watercourses as a result of pipeline stream and wetland (riparian) crossing it is highly recommended that the planned activities be undertaken during dry period, where the streams and river are dry and of low peak flows condition.

It must be noted that the project is within the settlement area. Moreover, there was one grave site encountered during the infield assessment at location (28° 9'21.60"S, 31°52'4.68"E) but falls outside the project corridor. The grave site was within the household. The likelihood of gravesite encroachment could be mitigated through, appointment of the Project Social Facilitator to manage project social aspects and re-route the pipeline where there is encroachment to burial sites. Social Facilitator to undertake 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. Any contractor found working within No-Go areas must be fined as per fining schedule/system setup for the project.

22 CONCLUSION AND EAP OPINION

In view of the foregoing, it is evident that the proposed Hlabisa Water-borne Sanitation Project will not have significant negative environmental impacts in the area.

The 5km sewer conveyance infrastructure is required to traverse along the low-lying areas to facilitate the conveyance of sewer through gravity main. As a result, the bulk sewer gravity main traverse along the valley outside of Hlabisa town across Matshamnyama towards to Emabhanoyini in ward 12 and further to Bazane area in ward 14 where the WWTW will be located. This route allows for good design and practices based on the topography of the project area which will enable sewer to be transferred through gravity main as a result of the slope conditions as they are low-lying sloping areas, thus minimise the use of sewer pumpstation, energy use, and maintenance cost due pump failures. However, the pumpstations will be constructed in certain areas where the pipeline is on high lying areas along the route. These pumps must function continuously; therefore, the maintenance of electrical equipment and motors, as well as back-up diesel generators to provide power in the event of electricity outages, is crucially important. The location of the new Hlabisa WWTW technical favours the engineering design and effectiveness of the Hlabisa water-borne sanitation, as it is located at approximately 1.5km east of existing WWTW on the lowest lying area in terms of topography of the project area, thus enable efficiency of gravity main. It is important to note that the current site (existing Hlabisa WWWT) has limited space and upgrading the existing WWTW cannot support any further future expansion, as the current WWTW is now at the edge encircled by growing settlements within Hlabisa.

The proposed construction of Hlabisa bulk sewer pipeline and WWTW will facilitate the formalization of existing settlement and future housing development, as the implementation of Hlabisa town sanitation system will provide a formalised water borne sanitation for settlement and businesses. In addition, the construction of bulk sewer and reticulation will see the connection of businesses, schools and households which are currently serviced by a household's septic tanks. Thereby, upgrading to a full water-borne sanitation system that will be connected to this sewer main lines and WWTW.

The WWTW site must be shifted at least 80m-100m further north of existing position (***Figure 3***). This will prevent the WWTW infrastructure to be prone to flooding in case of extremely

event, and also prevent undesirable contamination Hlabisa River lying downstream of the WWTW. Furthermore, the configuration of WWTW site layout will mean exploring the use of site such as above the plantations, along previously disturbed corridors as the wetlands serve high ecological and hydrological value and should be preserved and protected. Therefore, the proposed alternative site position (Figure 3) could meet the desirable development objectives and provide impact mitigation as the site will be shifted further north by 80-100m from current location. This will also avoid the option of wetland offsetting, as this would be the case if the current WWTW position is considered. This will be in line with accordance to GN509 of the National Water Act, 1998 (Act No. 36 of 1998), the regulated area refers to the outer edge of the 1 in 100-year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; In the absence of a determined 1 in 100-year flood line or riparian area the area within 100 metres (m) from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act). Buffer determination for watercourse habitat outside the construction corridor but at risk of being impacted. For the new WWTW 100m buffer determination is required between Hluhluwe River and new WWTW. This means the layout must be configured such that the WWTW should be shifted at least 80m-100m further north of existing position (***Figure 3***).

The implementation of Hlabisa Water-borne Sanitation Project will facilitate the construction of bulk sewer and reticulation which will see the connection of businesses, schools and households which are currently serviced by a household's septic tanks. Thereby, providing a full water-borne sanitation system that will be connected to this sewer main lines and discharge to the new Hlabisa WWTW. Moreover, it is also important to note that the safe disposal of human excreta and greywater is vitally important in the control of infectious and other communicable diseases. Therefore, the design and construction of appropriate sanitation systems is of paramount importance in contributing to the safe disposal of human excreta (Water Research Commission, 2011). To realise this goal and to ensure that the Sustainable Development Goal 6 and the NDP objectives are realised through this project, the National Web-Based Environmental Screening Tool (NWBEST) was used to generate the environmental sensitivity report of the proposed development site. Additionally, an Initial Site Sensitivity Verification study was undertaken to confirm or dispute the environmental sensitivity as identified by the NWBEST was conducted.

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 Basic Assessment Report (DBAR) concerning the impact of the proposed Hlabisa Water-borne Sanitation Project including mitigation actions, has been compiled and submitted as prescribed and authorisation may only be issued after consideration of such report.

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 Hlabisa Water-borne Sanitation Project. 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 preferred '*Alternative A: Routing Alternative, Alternative B: Design Alternative, Alternative C: Technology Alternative, and Alternative D: Site Layout Alternative, Alternative E: Location Alternative'* for the proposed Hlabisa Water-borne Sanitation Project can meet the required objections to offset the No-Go option (subject to the implementation of recommended development mitigation measures). This DBAR therefore, concludes that the proposed development 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. Due the nature of works which involve working within the watercourses such as wetland and stream crossings it is highly recommended that the planned activities be undertaken during dry period, where the streams are dry or of low flows condition.

This Draft Scoping Report is available for a review and comment period of 30 days, from ***14th of July 2023*** to the ***14th of August 2023***. Comments and submissions received in response to this report will be submitted to EDTEA (the competent authority).

Written submissions must be addressed to:

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APPENDICES

APPENDIX A. EAP DECLARATION OF INFORMATION

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C-2: Other Maps

C-3 Case Images/Site Photographs

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E-4: I&APs Register

E-5: Department Acknowledgements Letters

E-6: Minutes of the EIA Pre-Application meeting

E-7: Proof of Documents Circulation

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APPENDIX F. EAP'S CV(S)

F-1: Principal EAP (Phumzile Lembede)

F-2: Study Lead/EAP (Dumisani Myeni)

APPENDIX G. SPECIALIST STUDIES

G-1: Terrestrial Biodiversity Impact Assessment

G-2: Wetland Delineation and Impact Assessment

G-3: Aquatic Ecological Impact Assessment

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APPENDIX H: SCREENING TOOL SENSITIVITY VERIFICATION

APPENDIX I: ENVIRONMENTAL SCREENING REPORT

APPENDIX J: STORMWATER MANAGEMENT PLAN

APPENDIX K: CONTINGENY PLAN