LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME AND ASSOCIATED INFRASTRUCTURE:

PROPOSED DESIGN CHANGES TO NGWADINI SYSTEM (UMDONI LOCAL MUNICIPALITY AND UGU DISTRICT MUNICIPALITY AS WELL AS ETHEKWINI MUNICIPALITY) AND GOODENOUGH SYSTEM (ETHEKWINI MUNICIPALITY), KWAZULU-NATAL

ENVIRONMENTAL MANAGEMENT PROGRAMME

DFFE REFERENCE NO.: 14/12/16/3/3/1/3034

FINAL

SEPTEMBER 2024

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Title and Approval Page

Project Name:	Lower uMkhomazi Bulk Water Supply Scheme and Associated Infrastructure: Proposed Design Changes to Ngwadini System (Umdoni Local Municipality and Ugu District Municipality as well as eThekwini Municipality) and Goodenough System (eThekwini Municipality), KwaZulu-Natal
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Date	Nature of Amendment	Amendment No.
July 2024	Draft EMPr for Review by Authorities and the Public	0
September 2024	Final for submission to DFFE for Decision-Making	1

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List of Abbreviations

BA	Basic Assessment
BAR	Basic Assessment Report
CA	Competent Authority
CBA	Critical Biodiversity Area
DFFE	Department of Forestry, Fisheries and the Environment
D'MOSS	Durban Metropolitan Open Space System
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EWR	Ecological Water Requirements
EO	Environmental Officer
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
GN	Government Notice
GRM	Grievance Redress Mechanism
HGM	Hydro Geomorphic
IAP	Interested and Affected Party
MSDS	Material Safety Data Sheet
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
REC	Recommended Ecological Category
SCC	Species of Conservation Concern

1 PURPOSE OF THE DOCUMENT

In 2018, the former Umgeni Water (now known as uMngeni-uThukela Water) received the following Environmental Authorisations in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) for the components of the Lower uMkhomazi Bulk Water Supply Scheme (LUBWSS):

- LUBWSS - Goodenough weir, abstraction works and associated infrastructure within the eThekwini Municipality, KwaZulu-Natal (KZN) (reference no.: 14/12/16/3/3/2/1030); and
- LUBWSS - Ngwadini weir, abstraction works and pipeline within the Umdoni Local Municipality and Ugu District Municipality, as well as the eThekwini Municipality, KZN (reference no.: 14/12/16/3/3/1/1884).

Post authorisation, during the detail design phase of the Ngwadini and Goodenough Systems (hereafter referred to as the "2023 detailed design"), changes were required to various components of the proposed infrastructure. To accommodate these changes, uMngeni-uThukela Water (the "Applicant") initially intended to seek an amendment to the existing Environmental Authorisations, however, after engagements with the Department of Forestry, Fisheries and the Environment (DFFE) it was concluded that the existing authorisations would remain in place, but that the following two processes would need to be undertaken to address the changes to the layouts:

a) A new application for Environmental Authorisation would be made to cover the majority of the infrastructure changes to the Ngwadini System (rising main pipeline) as well as the Goodenough System (abstraction system, including weir, abstraction works, pump stations, balancing tank, pipelines, reservoirs, and associated infrastructure) as these changes would themselves trigger listed activities. A Basic Assessment (BA) process would be followed for this application.
b) An amendment application would be made specifically for the Water Treatment Plant (WTP), as the proposed changes to the WTP would not trigger any listed activities.

The BA for item (a) above is being undertaken according to the process prescribed in the Environmental Impact Assessment (EIA) Regulations of 2014, published under Government Notice (GN) No. 982 in Gazette No. 38282 of 4 December 2014 and amended by GN 326 of 7 April 2017 published in Gazette No. 40772 (the "EIA Regulations").

This document serves as the final Environmental Management Programme (EMPr), which accompanies the Basic Assessment Report (BAR) for the new application for the proposed design changes to the Ngwadini and Goodenough Systems. Apart from ensuring compliance with the EIA Regulations, this EMPr also serves to satisfy the requirements of Condition 16 of the Environmental Authorisation (reference no.: 14/12/16/3/3/2/1030) for specifically the Goodenough System.

An EMPr represents a detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the lifecycle of a project. This EMPr must be read in conjunction with the BAR.

The scope of the EMPr is as follows:

- Establish management objectives during the project's pre-construction, construction and operational phases in order to enhance benefits and manage (i.e. prevent, reduce, rehabilitate and/or compensate) adverse environmental impacts;
- Provide targets for management objectives, in terms of desired performance;
- Describe actions required to achieve management objectives;
- Outline institutional structures and roles required to implement the EMPr; and
- Provide the legislative framework.

2 DOCUMENT ROADMAP

As a minimum, the EMPr aims to satisfy the following:

1. The requirements stipulated in Appendix 4 of the EIA Regulations – refer to **Table 1** below; and
2. The requirements stipulated in Condition 16 of the EA (reference no.: 14/12/16/3/3/2/1030) for the Goodenough System – refer to **Table 2** below.

Table 1: Document composition in terms of Appendix 4 of the EIA Regulations

Chapter	Title	Correlation with Appendix 4 of the EIA Regulations	
1	**Purpose of the Document**	-	
2	**Document Roadmap**	-	
3	**Project Overview**	-	
4	**Project Location**	-	
5	**Environmental Assessment Practitioner**	1(a)	Details of – (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including curriculum vitae.
6	**Legal Framework**	-	
7	**Roles & Responsibilities**	1(i)	An indication of the persons who will be responsible for the implementation of the impact management actions contemplated in paragraph (f).
8	**Monitoring**	1(g)	The method of monitoring the implementation of the impact management actions contemplated in paragraph (f).
		1(h)	The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f).
		1(k)	The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f).

Chapter	Title	Correlation with Appendix 4 of the EIA Regulations	
		1(l)	A programme for reporting on compliance, taking into account the requirements as prescribed by the Regulations.
9	**Environmental Training & Awareness Creation**	1(m)	An environmental awareness plan describing the manner in which - (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.
10	**EMPr Review**	-	
11	**Environmental Activities, Aspects & Impacts**	1(b)	A detailed description of the aspects of the activity that are covered by the final environmental management plan.
12	**Sensitive Environmental Features**	1 (c)	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers.
13	**Impact Management**	1(d)	Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by the EIA Regulations, including environmental impacts or objectives in respect of – (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities.
		1(e)	A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d).
		1(f)	A description of proposed impact management sections, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to - (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.
		1(j)	The time periods within which the impact management actions contemplated in paragraph (f) must be implemented.
		1(l)	A programme for reporting on compliance, taking into account the requirements as prescribed by the Regulations.
-		1(n)	Any specific information that may be required by the competent authority

Table 2: Document composition in terms of Condition 16 of the EA (reference no.: 14/12/16/3/3/2/1030)

Condition of EA	Requirements in Condition 16 of the EA	Relevant Section in EMPr
16.1	The requirements and conditions of this authorisation.	The EMPr incorporated the requirements and conditions of the EA (as relevant)

Condition of EA	Requirements in Condition 16 of the EA	Relevant Section in EMPr
16.2	All recommendations and mitigation measures recorded in the EIAr.	The mitigation measures contained in the original EIA Report (EIAr) were initially included in the EMPr that was appended to the EIAr. This final EMPr is based on the aforementioned document.
16.3	Mitigation measures for the reduced working corridors.	Section 13.3.20 - Management of Flora
16.4	All mitigation measures as listed in the specialist reports must be included in the EMPr and implemented.	The mitigation measures identified by the specialists were incorporated into the relevant sections of this EMPr.
16.5	The final site layout map.	Appendix A
16.6	An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Appendix B
16.7	A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site in consultation with the ECO and be implemented prior to commencement of the construction phase.	Appendix F
16.8	A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	Appendix I
16.9	A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Appendix G
16.10	An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Appendix E
16.11	An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	Appendix C
16.12	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	▪ Section 13.3.14 - Management of Pollution Generation Potential ▪ Section 13.3.20 - Management of Flora ▪ Section 13.3.21 - Management of Fauna

Condition of EA	Requirements in Condition 16 of the EA	Relevant Section in EMPr
		▪ Section 13.3.25 - Management of Watercourses ▪ Appendix G
16.13	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	Section 12 - Sensitive Environmental Features
16.14	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map. This map must reflect the proposed location of the turbine as stated in the EIAr and this authorisation.	

It is noted that although Table 2 was not included in the draft EMPr that was appended to the draft Basic Assessment Report which was lodged for public review, the content of this EMPr has not changed substantially. Table 2 merely assists DFFE in identifying the relevant sections of the document where the specific EA conditions related to the EMPr are addressed.

3 PROJECT OVERVIEW

The current water resources supplying the South Coast of KZN are insufficient to meet the projected water demands. The Upper and Middle South Coast are currently supplied by water from local rivers and dams, augmented by the Mgeni System. The Mgeni System is the main water source that supplies about six million people and industries in the eThekwini Municipality, uMgungundlovu District Municipality (DM), Msunduzi Local Municipality (LM), and a small portion of Ugu DM. These municipal areas comprise the economic powerhouse of the KZN.

Currently, uMngeni-uThukela Water is pursuing the project further as a scheme for domestic water supply to the South Coast. Augmentation of the water resources supplying the South Coast is urgently needed to both relieve the load on the Umgeni Water supply system, and to meet growing water demands along the South Coast of KZN.

Recently, Ugu DM and the Department of Water and Sanitation (DWS) agreed on the Cwabeni Off-channel Storage (OCS) Dam as a solution for the Lower South Coast Area. As such, a dedicated augmentation for the Upper and Middle South Coast supply area (Hibberdene to Amanzimtoti) is required.

The LUBWSS is being pursued as the preferred augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. The supply area extends from Amanzimtoti in the north to Hibberdene in the south and covers both eThekwini and Ugu Municipalities (**Figure 1**).

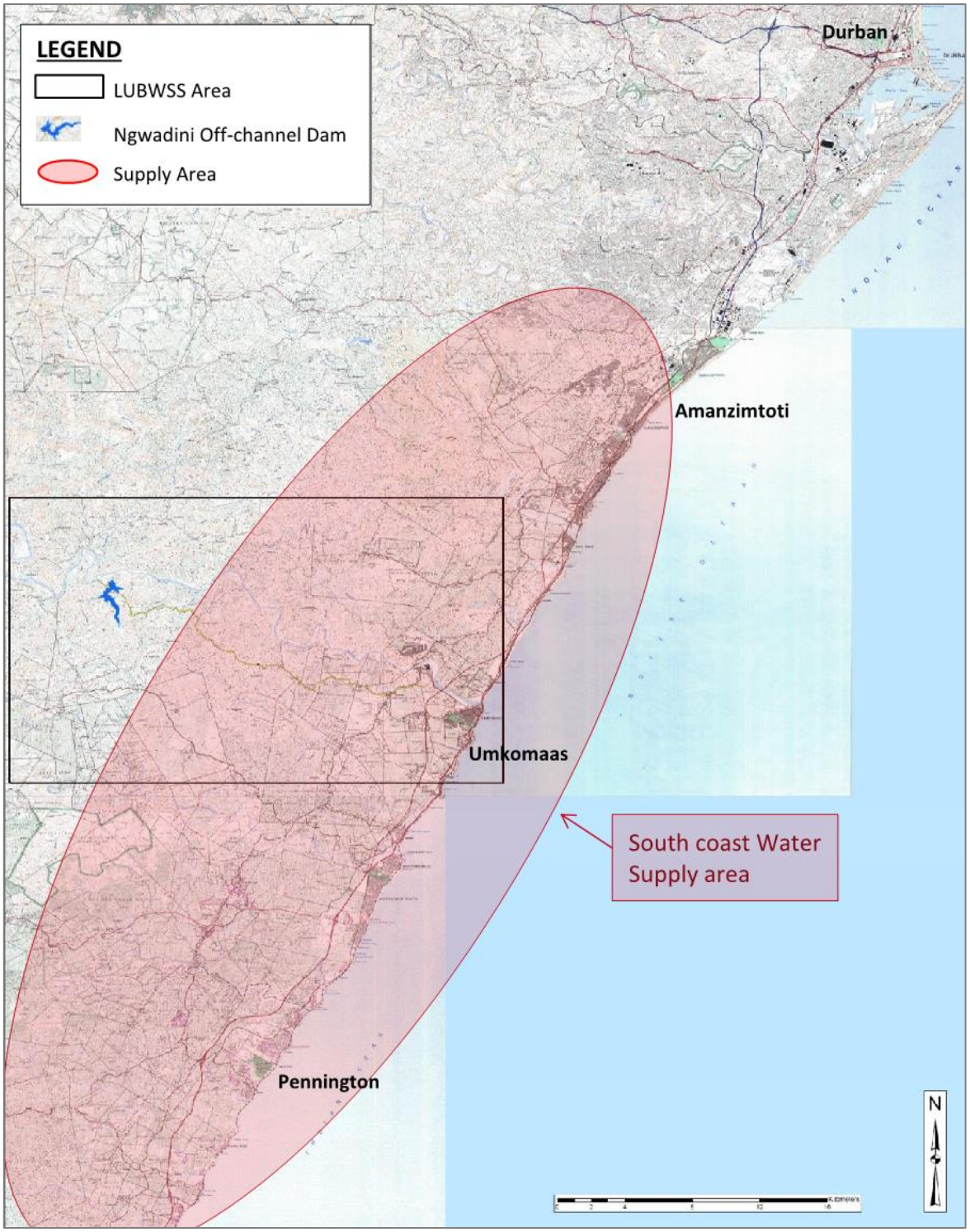

Figure 1: Map of the South Coast Water Supply area (AECOM, 2016)

Water requirements for the Upper and Middle South Coast supply area in 2014 were 85Ml/d on average, with peaks up to 110Ml/d. This supply excludes an estimated 25Ml/d suppressed demand in the supply area, due to infrastructure constraints. Water requirement projection scenarios, taking into account the growth and development plans by the municipalities as well as Water Conservation and Water Demand Management measures, determined that the 30

year water demand projection will be between 155 to 205Ml/d for the supply area. The scenarios are as follows:

- **Scenario A (Low):** Growth projection with WC/WDM;
- **Scenario B (Medium):** WC/WDM and suppressed demands; and
- **Scenario C (High):** Suppressed demands and no WC/WDM savings.

Based on the medium growth scenario as the preferred planning scenario, the LUBWSS has been sized to provide an additional average volume of 100Ml/d (with a 130 Ml/d designed peak capacity), to meet the future 30-year demand projection.

A Detailed Feasibility Study, which included preliminary design of components, was completed for the LUBWSS by AECOM SA (Pty) Ltd in 2016. Of the options investigated, "Scheme B" was selected as the preferred option for the LUBWWS. This would entail the return of stored water to the river from Ngwadini Dam in the low flow periods and abstraction at the existing Goodenough weir and delivery to the WTP through a shorter 7km pipeline.

As the cost of the two schemes were considered similar, other factors including risk were focused on. While some risks can be mitigated or absorbed as a small cost increase, key risks are associated with impacts on water delivery timeframes due to the urgency of the project.

The overall LUBWSS (**Figure 2**) consists of the following:

- Ngwadini System components (**Figure 3**) –
  - The Ngwadini Weir and abstraction works to fill the Ngwadini Dam during summer periods of excess flow (*excluded from the scope of this report*);
  - The Ngwadini pipeline (*included in the scope of this report*); and
  - The Ngwadini OCS Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods (*excluded from the scope of this report*).
- Goodenough System components (**Figure 4**) –
  - A second abstraction downstream at the Goodenough Weir site to abstract the raw water for delivery to the WTP (*included in the scope of this report*);
  - Hydrocyclones before the pump station and WTP to remove sediments during periods of higher turbidity river flows and reduce the WTP residual ("sludge") (*included in the scope of this report*);
  - A pump station to pump water from the Goodenough abstraction to the WTP via (*included in the scope of this report*);
  - A short rising main and 7km gravity main (*included in the scope of this report*);

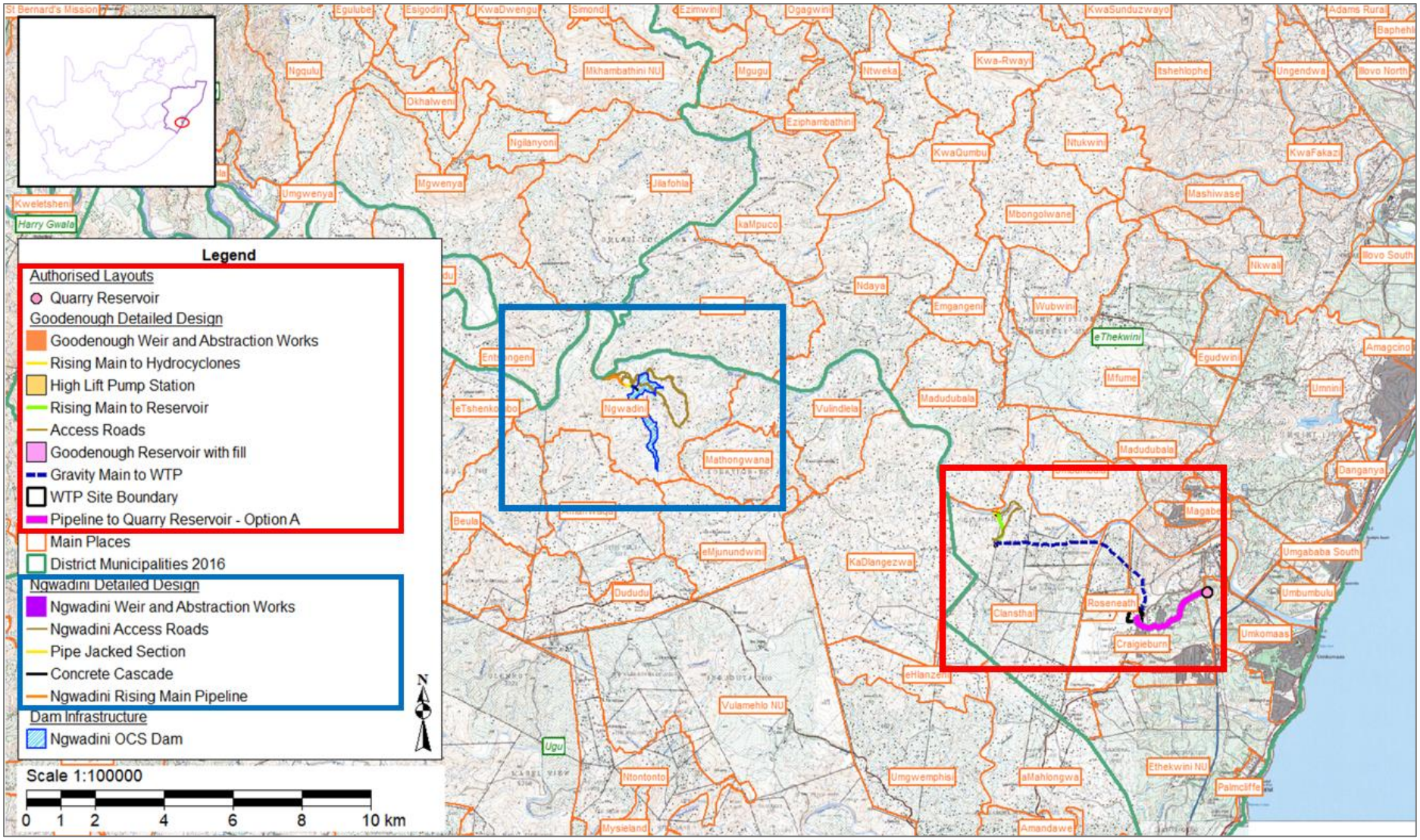

Figure 2: LUBWSS Layout (updated 2023 design). Ngwadini and Goodenough components highlighted.

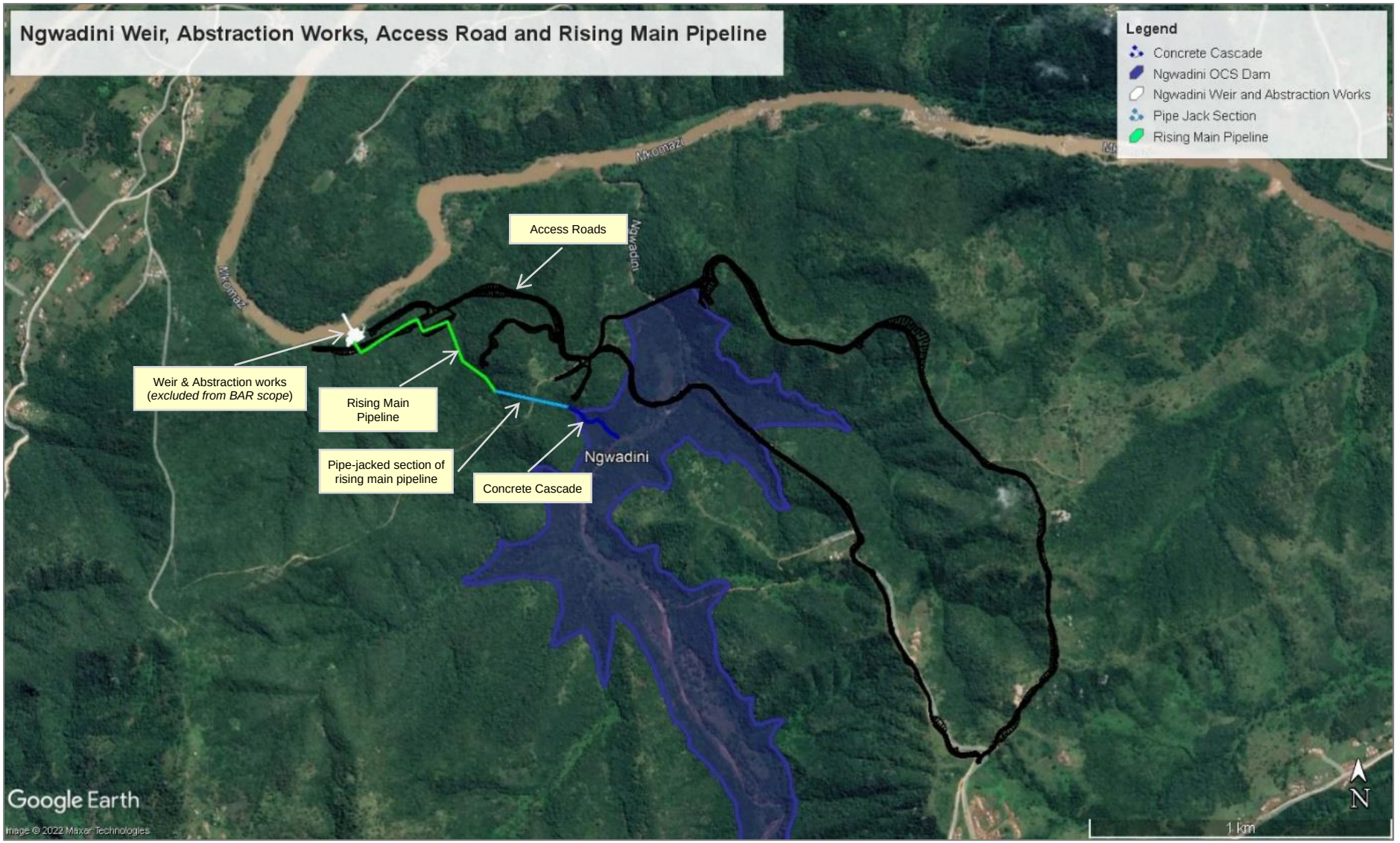

Figure 3: Aerial view of Ngwadini System components

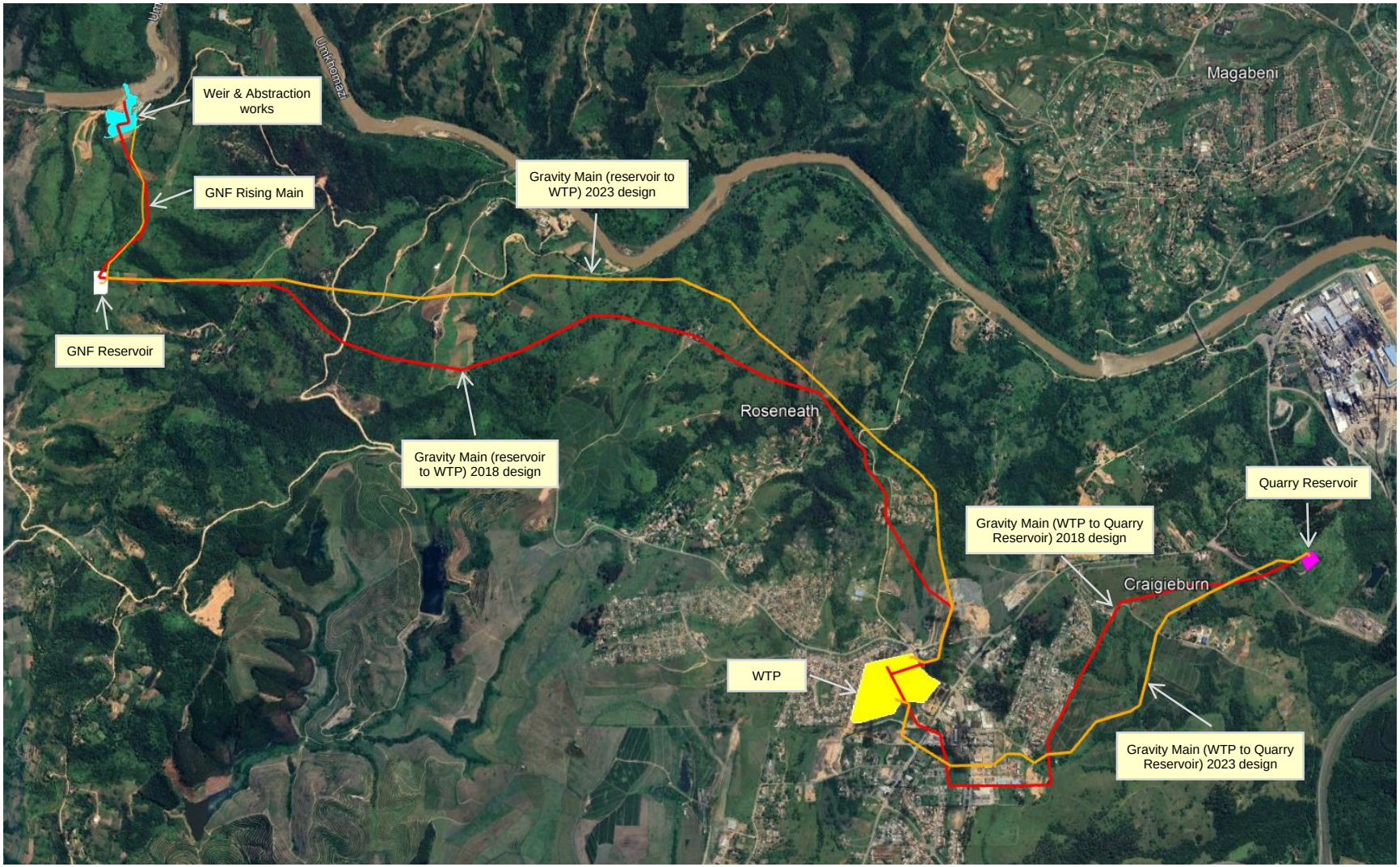

Figure 4: Aerial view of Goodenough System components, showing the approved 2018 pipeline route (red) and the revised 2023 detailed design routes (orange)

- A raw water storage reservoir (*included in the scope of this report*);
- A 100 Mℓ/d WTP in Craigieburn (*excluded from the scope of this report*); and
- A potable gravity water pipeline from the WTP to Quarry Reservoir (*included in the scope of this report*).

The reader is referred to the BAR for a detailed description of the proposed project.

4 PROJECT LOCATION

4.1 Ngwadini System Components

The components of the Ngwadini System are primarily located within the Umdoni LM and the Ugu DM, in KZN (**Figure 2**). The weir structure ties into the left bank of the uMkhomazi River, which falls in the eThekwini Municipality. The study area is situated on land that is administered by the Ingonyama Trust Board. The project area is approximately 20km northwest of Scottburgh. The Ngwadini components are shown in **Figure 3**.

4.2 Goodenough System Components

The components of the Goodenough System are located approximately 5km inland of Umkomaas on the KZN south coast. The proposed weir is located approximately 14.5km upstream of the mouth of the uMkhomazi River, with the abstraction works on the southern bank of the river. These abstraction works, and all other components of the Goodenough System, fall within the eThekwini Municipality (**Figure 2**).

The Goodenough components are shown in (**Figure 4**). The Goodenough Weir and Abstraction Works are located along the uMkhomazi River. The rising main to hydrocyclones runs towards the High Lift Pump Station. A rising main then runs from the High Lift Pump Station to the Raw Water Goodenough Reservoir. The gravity main runs from the Goodenough Reservoir to the WTP site. The WTP site, the gravity main, and the Quarry Reservoir are located within the town of Craigieburn. The towns Roseneath, Naidooville and Magabeni are located near these proposed developments.

5 ENVIRONMENTAL ASSESSMENT PRACTITIONER

Nemai Consulting was appointed by the Applicant as the independent Environmental Assessment Practitioner (EAP) to undertake the BA Process for the proposed project. The CV of the EAP is appended to the BAR.

6 LEGAL FRAMEWORK

6.1 Overview of Legislation

Activities during the pre-construction, construction and operational phases will be undertaken according to recognised best industry practices and will include measures prescribed within this EMPr. The EMPr shall form part of the contract documents and informs the Contractor about his duties in the fulfilment of the Project's objectives, with particular reference to the mitigation of environmental impacts that may potentially be caused by construction activities. The Contractor will note that obligations imposed by the EMPr are legally binding.

All Project activities must comply with all relevant South African legislation and regulations. All environmental statutory requirements should be included in the Contractors' conditions. Some of the pertinent environmental legislation that has bearing on the proposed development is captured in **Table 3** below.

Table 3: Environmental statutory framework

Legislation	Relevance
Constitution of the Republic of South Africa (Act No. 108 of 1996)	▪ Chapter 2 – Bill of Rights. ▪ Section 24 – Environmental Rights.
National Environmental Management Act (Act No. 107 of 1998)	▪ Key sections (amongst others): ○ Section 2 – Principles. ○ Section 24 – Environmental Authorisation (control of activities which may have a detrimental effect on the environment). ○ Section 28 – Duty of care and remediation of environmental damage. ▪ Authorisation type – Environmental Authorisation (*required for the Project*). ▪ Authorities – DFFE (national) (competent authority for this application) and the KZN Department of Economic Development, Tourism & Environmental Affairs (DEDTEA) (provincial).
GN No. 326 of 7 April 2017 (EIA Regulations)	▪ 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 EIA, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.
GN No. 327 of 7 April 2017 (Listing Notice 1)	▪ Purpose – identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. ▪ The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of the EIA Regulations.
GN No. 325 of 7 April 2017 (Listing Notice 2)	▪ Purpose - identify activities that would require environmental authorisations prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of NEMA. ▪ The investigation, assessment and communication of potential impact of activities must follow a S&EIR process, as prescribed in regulations 21 to 24 of the EIA Regulations. *Not relevant to this application.*
GN No. 324 of 7 April 2017 (Listing Notice 3)	▪ Purpose - list activities and identify competent authorities under sections 24(2), 24(5) and 24D of NEMA, where environmental

Legislation	Relevance
	authorisation is required prior to commencement of that activity in specific identified geographical areas only. ▪ The investigation, assessment and communication of potential impact of activities must follow a Basic Assessment process, as prescribed in regulations 19 and 20 of the EIA Regulations.
National Water Act (Act No. 36 of 1998)	▪ Key sections (amongst others): o Chapter 3 – Protection of water resources. o Section 19 – Prevention and remedying effects of pollution. o Section 20 – Control of emergency incidents. o Chapter 4 – Water use. ▪ Authorisation type – General Authorisation / Water Use Licence (*required for the Project*). ▪ Authority – DWS.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	▪ Protection and conservation of ecologically viable areas representative of SA's biological diversity and natural landscapes. ▪ *Not relevant to the Project*.
National Environmental Management Air Quality Act (Act No. 39 of 2004)	▪ Key sections (amongst others): o Chapter 2 – National Framework and National, Provincial and Local Standards. o Chapter 4 – Air Quality Management Measures. o Chapter 5 – Licensing of Listed Activities. ▪ Authorisation type – Atmospheric Emission Licence (*not required for the Project*). ▪ Authority – DFFE (national), DEDTEA (provincial) and Ugu DM & eThekwini Municipality (local).
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	▪ Key sections (amongst others): o Section 7 – National environmental management principles. o Section 40 – Bioregions and bioregional plans. o Chapter 4 – Threatened or Protected Ecosystems and Species. o Chapter 5 – Species and Organisms Posing Potential Threats to Biodiversity. o Chapter 7 – Permits. ▪ Authorisation type – Permit (*will be required for the removal of protected species if they cannot be avoided*). ▪ Authority – Ezemvelo KZN Wildlife (EKZNW).
National Environmental Management: Waste Act (Act No. 59 of 2008)	▪ Key sections (amongst others): o Part 2 – General duty on the holder of waste in respect of waste management. o Part 3 – Reduction, re-use, recycling and recovery of waste. o Part 4 – Regulation of waste management activities. o Part 5 – Storage, collection and transportation of waste. o Part 6 – Treatment, processing and disposal of waste. o Part 8 – Legal mechanism for managing contaminated land. ▪ Authorisation type – Waste Management Licence (*not required for the Project*). ▪ Authority – DFFE (national) and DEDTEA (provincial).
National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)	▪ Key sections (amongst others): o Section 58 – Duty to avoid causing adverse effects on coastal environment. o Section 63 – Environmental authorisations for coastal activities. o Section 69 – Discharge of effluent into coastal waters. o Section 71 – Dumping permits. ▪ Authorisation types (*none of these are required for the Project*) – o Approval for reclamation of land. o Coastal Waters Discharge Permit. o Dumping Permit. ▪ Authority – DFFE Oceans & Coasts.

Legislation	Relevance
National Heritage Resources Act (Act No. 25 of 1999)	▪ Key sections: o Section 34 – protection of structure older than 60 years. o Section 35 – protection of heritage resources. o Section 36 – protection of graves and burial grounds. o Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m^2 in extent, etc. ▪ Authorisation type – Permit (*not required for the Project*). ▪ Authority – South African Heritage Resources Agency (SAHRA) and Amafa and Research Institute.
National Forests Act (Act No. 84 of 1998)	▪ Key sections (amongst others): o Chapter 3 – Special Measures to Protect Forests and Trees. ▪ Authorisation type – Licence (*not required for the Project*). ▪ Authority – DFFE.
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	▪ Key sections (amongst others): o Section 22 – Application for mining right. o Section 27 – Application for, issuing and duration of mining permit. o Section 53 – Use of land surface rights contrary to objects of Act. ▪ Authorisation type – Mining Permit / Mining Right (*not required for the Project*). ▪ Authority – Department of Mineral Resources and Energy (DMRE).
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	▪ Control measures for erosion. ▪ Control measures for alien and invasive plant species. ▪ Authority – KZN Department of Agriculture and Rural Development (DARD).
National Road Traffic Act (Act No. 93 of 1996)	Authority – KZN Department of Transport (DoT).
KZN Nature Conservation Management Act (Act No. 9 of 1997)	▪ Institutional bodies for nature conservation in KZN. ▪ Establish control and monitoring bodies and mechanisms. ▪ Authority – Ezemvelo KZN Wildlife.
KZN Heritage Act (Act No. 4 of 2008)	▪ Conservation, protection and administration of both the physical and the living or tangible heritage resources of KZN. ▪ Authority – Amafa and Research Institute.
Spatial Planning and Land Use Management Act (Act No. 16 of 2013)	▪ Framework for spatial planning and land use management in SA. ▪ Land development and land use applications. ▪ Authority – Umdoni LM & eThekwini Municipality.
Occupational Health & Safety Act (Act No. 85 of 1993)	▪ Provisions for Occupational Health & Safety. ▪ Authority – Department of Employment and Labour. ▪ Relevant regulations, such as Electrical Installation Regulations, Construction Regulations, etc.

Refer to Section 8 of the BAR for an overview of the relationship between the proposed project and certain key pieces of environmental legislation.

6.2 Method Statements

The Contractor shall provide detailed method statements on how the performance criteria in the EMPr will be met. These method statements are to be reviewed and approved by the Project Manager to ensure that they are adequate.

The method statements must be project- and site specific and should explain in detail the following:

1. The manner in which the work is to be undertaken;
2. The estimated schedule for the works (timing);

3. The area where the works will be executed (location);
4. The materials and plant / equipment needed for the works;
5. The necessary mitigation measures that need to be implemented to adequately safeguard the environment, construction workers and the public (where applicable);
6. Training of employees;
7. Roles and responsibilities; and
8. Monitoring and reporting requirements.

The list of method statements required to assist in the implementation of this EMPr includes at least the following (where applicable):

- ❑ Method Statement for site clearing;
- ❑ Method Statement for establishing the construction camp(s);
- ❑ Method Statement with regard to waste and wastewater management;
- ❑ Method Statement to show procedures for dealing with possible emergencies that can occur, such as fire and accidental leaks and spillage of carbon fuels and oils;
- ❑ Method Statement for dust control;
- ❑ Method Statement for the storage and handling of hazardous substances;
- ❑ Method Statement for management of concrete and batching plants;
- ❑ Method Statement for managing spoil material;
- ❑ Method Statement for controlling alien invasive species and noxious weeds;
- ❑ Method Statement for the decommissioning of the construction works area;
- ❑ Method Statement for rehabilitation of construction footprint; and
- ❑ Method Statement for the management of stormwater and erosion.

7 ROLES AND RESPONSIBILITIES

7.1 Department of Forestry, Fisheries and the Environment

DFFE is the Competent Authority in terms of NEMA to decide on the application.

DFFE also fulfils a compliance and enforcement role with regards to the Environmental Authorisation. DFFE may perform random inspections to checks compliance. DFFE will also review the monitoring and auditing reports compiled by the independent Environmental Control Officer (ECO).

7.2 Project Applicant

uMngeni-uThukela Water is the Applicant in terms of NEMA and is ultimately responsible for the development and implementation of the EMPr and ensuring that the conditions in the

Environmental Authorisation are adhered to. The liability associated with environmental non-compliance rests with the Applicant.

7.3 Project Manager

The Project Manager (PM) has over-all responsibility for managing the Contractors and for ensuring that the environmental management requirements are met. During the construction phase, the PM will be the Applicant's construction manager. During the operations phase it is expected that this role will be fulfilled by the operations manager.

The PM will be on site and the responsibilities of this party will include the following (amongst others):

- Overseeing of all environmental matters and compliance with all environmental requirements and authorisations; and
- Act as the interface between the ECO and the other project role players.

7.4 Environmental Control Officer

The ECO is a competent (minimum of 3 years' experience) and independent representative appointed by the Applicant. The ECO will undertake weekly inspections of the site and at least 6-monthly full compliance auditing against the EMPr and Environmental Authorisation. The audit reports will be submitted to the PM, and DFFE for their records, and also be made available to the relevant authorities, on their request.

The ECO will check the following:

- Compliance with the EMPr and the Environmental Authorisation;
- The record of environmental incidents (spills, impacts, legal transgressions, etc.) as well as corrective and preventive actions taken;
- The public complaints register in which all complaints are recorded, as well as actions taken; and
- Results from the environmental monitoring programme.

7.5 Contractor's Environmental Officer

The primary role of the competent Environmental Officer (EO) is to coordinate the environmental management activities of the Contractor on site.

Specific responsibilities of the EO, who will be on site, will include the following:

- Aiding the Contractor to comply with all the project's environmental management requirements;
- Assisting the Contractor in compiling Method Statements;

- Facilitating environmental activities and environmental awareness training of relevant persons on site;
- Exercise an internal compliance management system on behalf of the Contractor;
- Inspect the site as required to ensure adherence to the management actions of the EMPr and the Method Statements, as well as the requirements of the Environmental Authorisation;
- Provide inputs to the regular environment report to be prepared by the ECO (as required);
- Liaise with the construction team on issues related to implementation of, and compliance with the EMPr and Environmental Authorisation;
- Maintain a record of environmental incidents (such as spills, impacts, legal transgressions) as well as corrective and preventive actions taken; and
- Maintain a public complaints' register in which all complaints are recorded, as well as action taken.

8 MONITORING

Monitoring is required to ensure that the receiving environment is suitably safeguarded against the identified potential impacts, and to ensure that the environmental management requirements are adequately implemented and adhered to during the execution of the Project.

8.1 Baseline Monitoring

8.1.1 General

Baseline monitoring aims to determine the pre-construction state of the receiving environment and serves as a reference to measure the residual impacts of the Project by evaluating the deviation from the baseline conditions and the associated significance of the adverse effects.

8.1.2 Pre-Construction Survey

A pre-construction survey needs to be conducted for all areas that are to be affected by construction activities. The survey needs to include the following:

- Site investigations by appropriate members of the project team and specialists (as relevant);
- Generate records from survey which include site details, photographs, explanatory notes, etc. (as required);
- Record the condition of existing structures and infrastructure on the site; and
- Identify site-specific mitigation measures.

The records from the pre-construction survey must be used to establish and inform the reinstatement and rehabilitation requirements for the affected areas.

8.2 Environmental Monitoring

Environmental monitoring entails checking, at pre-determined frequencies, whether thresholds and baseline values for certain environmental parameters are being exceeded. The parameters and sampling localities used during the baseline monitoring will form the basis of the environmental monitoring programme.

The following requirements need to be incorporated into the programme:

- Monitoring during normal operations, abnormal situations and emergency situations;
- Measuring equipment must be accurately calibrated;
- Adequate quality control of the sampling must be ensured;
- Certified methods of testing must be employed;
- Where legal specifications exist for testing and sampling methods, these must be considered; and
- Establish a process for identifying and implementing corrective measures.

8.3 Compliance Monitoring and Auditing

Compliance monitoring will commence in the pre-construction phase, where those conditions in the Environmental Authorisation that need to be adhered to prior to project implementation will need to be checked and recorded, as well as to check compliance with the provisions in the EMPr. Compliance monitoring will be completed at the end of the defects liability period to check the performance of rehabilitation measures and whether the related objectives have been met.

It is recommended that the ECO undertake weekly monitoring and compliance auditing, including an audit at the end of construction and one at the end of the defects notification period. Audit reports will be submitted to DFFE.

Auditing of compliance with the Environmental Authorisation and EMPr must be conducted in accordance with Regulation 34 of the EIA Regulations in terms of the following:

1. The holder of the Environmental Authorisation must, for the period during which the Environmental Authorisation and EMPr remain valid -
   a. Ensure that the compliance with the conditions of the Environmental Authorisation and EMPr is audited; and
   b. Submit an environmental audit report to DFFE.
2. The environmental audit report must -
   a. Be prepared by an independent person with the relevant environmental auditing expertise;
   b. Provide verifiable findings, in a structured and systematic manner, on-
      i. The level of performance against and compliance of an organization or project with the provisions of the requisite Environmental Authorisation and EMPr; and

ii. The ability of the measures contained in the EMPr to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity;

c. Contain the information set out in Appendix 7 of GN No. R. 982 of 4 December 2014 (as amended); and
d. Be conducted and submitted to DFFE at intervals as indicated in the Environmental Authorisation.

3. The environmental audit report must determine-
   a. The ability of the EMPr to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an ongoing basis and to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and
   b. The level of compliance with the provisions of the Environmental Authorisation and EMPr.

A document handling system must be established to ensure accurate updating of EMPr documents, and availability of all documents required for the effective functioning of the EMPr.

Supplementary EMPr documentation may include:

- ❑ Method Statements;
- ❑ Site instructions;
- ❑ Emergency preparedness and response procedures;
- ❑ Record of environmental incidents;
- ❑ Non-conformance register;
- ❑ Training records;
- ❑ Site inspection reports;
- ❑ Monitoring reports;
- ❑ Auditing reports;
- ❑ Public complaints register; and
- ❑ Grievance Mechanism/Process for public and contractor/employees.

9 ENVIRONMENTAL TRAINING AND AWARENESS CREATION

Training aims to create an understanding of environmental management obligations and prescriptive measures governing the execution of the project. It is generally geared towards project team members that require a higher-level of appreciation of the environmental management context and implementation framework for the project.

Awareness creation strives to foster a general attentiveness amongst the construction workforce to sensitive environmental features and an understanding of implementing environmental best practices.

The various means of creating environmental awareness during the construction phase of the project may include:

- Induction course for all workers before commencing work on site;
- Refresher courses (as and when required);
- Daily toolbox talks, focusing on particular environmental issues (task- and area specific);
- Courses must be provided by suitably qualified persons and in a language and medium understood by the workers;
- Erect signage and barricading (where necessary) at appropriate points in the construction domain, highlighting sensitive environmental features (e.g. grave sites, protected trees); and
- Place posters containing environmental information at areas frequented by the construction workers (e.g. eating facilities).

Training and awareness creation will be tailored to the audience, based on their designated roles and responsibilities. Records will be kept of the type of training and awareness creation provided, as well as containing the details of the attendees.

The Contractor must compile a project-specific Environmental Training and Awareness Programme, taking into consideration the abovementioned factors, to be approved by the PM/ECO.

10 EMPr REVIEW

Due to its dynamic nature, this EMPr will be reviewed and revised when necessary to ensure continued environmental improvement.

Following detailed design and planning, the EMPr may need to be revised to render the management actions more explicit and accurate to the final project specifications. Changes to the EMPr shall also be required where the existing system:

- ❑ Does not make adequate provision for protecting the environment against the pre-construction, construction and/or operational activities;
- ❑ Needs to be modified to meet conditions of statutory approval;
- ❑ It is not achieving acceptable environmental performance;
- ❑ Requires changes due to the outcome of a monitoring or auditing event or management review;
- ❑ Provides redundant, impracticable or ineffective management measures; and
- ❑ Based on provisions in Regulation 34 of the EIA Regulations, as amended.

The amendment of the EMPr will be undertaken in terms of Regulation 34 – 37 of the EIA Regulations, as applicable.

11 ENVIRONMENTAL ACTIVITIES, ASPECTS AND IMPACTS

11.1 Introduction

In order to establish best management practices and prescribe mitigation measures, the following project-related information needs to be adequately understood:

- **Activities** associated with the proposed project;
- **Environmental aspects** associated with the project activities;
- **Environmental impacts** resulting from the environmental aspects; and
- The nature of the surrounding **receiving environment**.

11.2 Project Activities

In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project life-cycle, as listed in the tables to follow.

Table 4: Activities associated with the Pre-construction Phase

ACTIVITIES: PRE-CONSTRUCTION PHASE	
Project Activities	
1.	Negotiations and agreements with the individual affected landowners and stakeholders
2.	Detailed engineering design
3.	Detailed geotechnical design
4.	Site survey
5.	Procurement of contractors
6.	Mark construction servitude
7.	Pre-construction photographic records
8.	Development and approval of method statements
9.	Development and approval of construction plans
10.	Development of employment strategy
11.	Construction site planning, access and layout
Environmental Activities	
1.	Applicant to appoint ECO
2.	Undertake a walkdown survey of the project footprint by the relevant environmental specialists
3.	Implement site-specific plans under the EMPr
4.	Demarcation of buffers around sensitive areas
5.	Diligent compliance monitoring of the EA, EMPr and other relevant environmental legislation
6.	Barricading and installing barriers around buffer areas identified in specialist studies
7.	Ongoing consultation with landowners and affected parties
8.	Establish baseline water quality data for river crossings based on aquatic and wetland studies

Table 5: Activities associated with the Construction Phase

ACTIVITIES: CONSTRUCTION PHASE	
Project Activities	
1.	Site establishment (including site camp and laydown area)
2.	Fencing of the construction area (as relevant)
3.	Registration of the servitude
4.	Pegging of central line and overall footprint
5.	Site clearing
6.	Delivery of construction material
7.	Transportation of equipment, materials and personnel
8.	Storage and handling of material
9.	Cut and cover activities
10.	Stockpiling (sand, crushed stone, aggregate, etc.)
11.	Stormwater control mechanisms
12.	Management of topsoil and spoil
13.	Waste and wastewater management
14.	Traffic control measures
15.	Bulk earthworks
16.	Site security
17.	Electrical supply
18.	Construction of proposed infrastructure
19.	Road surface finishes
20.	Concrete works
21.	Temporary river diversion for weir and pipeline crossings
22.	Landscaping
Environmental Activities	
1.	Reinstatement and rehabilitation of construction domain
2.	Control of invasive plant species
3.	Diligent compliance monitoring of the EA, EMPr and other relevant environmental legislation
4.	Conduct environmental awareness training
5.	Implement EMPr
6.	Ongoing consultation with landowners and affected parties
7.	Ongoing search, rescue and relocation of red data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities) – permits to be in place
8.	Ongoing monitoring for red data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities)

Table 6: Activities associated with Operational Phase

ACTIVITIES: OPERATIONAL PHASE	
Project Activities	
1.	Servitude access arrangements and requirements
2.	Routine maintenance inspections
3.	Repair and maintenance works
4.	Operation of the Ngwadini and Goodenough Systems
Environmental Activities	
1.	Ongoing consultation with landowners and affected parties
2.	Erosion monitoring programme

3.	Management of sensitive areas or buffered areas
4.	Management of vegetation clearance
5.	Stormwater management
6.	Pollution control measures
7.	Control of invasive plant species
8.	Satisfy Ecological Water Requirements (EWR)

11.3 Environmental Aspects

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact. **Table 7** provides the environmental aspects that have been identified for the proposed project, are linked to the project activities (note that only high-level aspects are provided).

Table 7: Environmental aspects associated with Pre-Construction, Construction and Operational Phases

ENVIRONMENTAL ASPECTS	
Pre-construction Phase	
1.	Insufficient construction site planning and layout
2.	Poor consultation with landowners, affected parties, stakeholders and authorities
3.	Site-specific environmental issues not fully understood
4.	Inadequate environmental and compliance monitoring
5.	Absence of relevant permits
6.	Lack of barricading of sensitive environmental features
7.	Poor waste management
8.	Absence of ablution facilities
Construction Phase	
1.	Poor consultation with landowners and affected parties
2.	Inaccurate walk-down survey
3.	Inadequate environmental and compliance monitoring
4.	Lack of environmental awareness creation
5.	Construction starting without or inadequate search and rescue
6.	Indiscriminate site clearing
7.	Poor site establishment
8.	Poor management of access and use of access roads
9.	Inadequate provisions for working on steep slopes
10.	Poor transportation practices
11.	Poor traffic management
12.	Disturbance of topsoil
13.	Disruptions to existing services
14.	Inadequate storage and handling of material
15.	Inadequate storage and handling of hazardous material
16.	Erosion
17.	Poor maintenance of equipment and plant
18.	Poor management of labour force
19.	Pollution from ablution facilities
20.	Inadequate management of construction camp
21.	Poor waste management practices – hazardous and general (solid and liquid waste types)
22.	Poor management of pollution generation potential

23.	Poor management of water
24.	Damage to fauna and flora Species of Conservation Concern
25.	Environmental damage of sensitive areas
26.	Disruption of archaeological and culturally significant features (if encountered)
27.	Dust and emissions
28.	Noise nuisance due to construction activities
29.	Influence to resource quality (I.e., water quality, aquatic biota, flow and habitat) of the affected rivers
30.	Poor reinstatement and rehabilitation
	Operational Phase
1.	Poor consultation with landowners, affected parties, stakeholders and authorities
2.	Inadequate environmental and compliance monitoring
3.	Inadequate management of access, routine maintenance and maintenance works
4.	Inadequate management of vegetation
5.	Not satisfying the EWR

11.4 Potential Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable. Refer to **Table 8** and **Table 9** for the potential significant impacts associated with the preceding activities and environmental aspects for the construction and operational phase, respectively.

Table 8: Potential significant environmental impacts during Construction Phase

Feature	Impact
Geology and Soil	• Unsuitable geological conditions • Impacts associated with the sourcing of construction material and loss of topsoil • Soil erosion (land clearance and construction activities) • Compaction and erosion of removed and stockpiled soils • Soil contamination from incorrect storage/handling/disposal of hazardous waste and chemicals • Soil contamination through spillages and leakages • Poor stormwater management
Topography	• Visual impacts during construction • Crossing topographic features • Erosion of affected areas
Geohydrology	• Groundwater pollution due to spillages and poor construction practices
Surface Water	• Impacts due to temporary diversions • Impacts to the flow regime of the uMkhomazi River • Contamination of surface water bodies • Increased stormwater runoff and poor stormwater management • Impacts to lawful water users • Water leakages and wastage
Flora	• Loss of sensitive vegetation and habitat • Damage and loss of vegetation of conservation significance • Proliferation of exotic vegetation in disturbed areas • Damage to vegetation in surrounding areas • Destruction of potential red list plants during site clearing and construction • Disturbance of sensitive plant species if relocated • Loss of Critical Biodiversity Areas (CBAs), threatened ecosystems and Durban Metropolitan Open Space System (D'MOSS) • Damage to vegetation outside the project area

Feature	Impact
Fauna	• Loss of habitat through site clearing and construction • Illegal killing or hunting of mammals • Killing of snakes during construction phase due to poor environmental education procedures • Potential illness and/or death of fauna due to pollution and/or littering • Loss of habitat and habitat fragmentation • Loss of fauna/floral species of conservation concern • Destruction to indigenous flora • Obstruction to animal movement corridors • Introduction of alien species • Displacement of animal species
Air Quality	• Excessive dust levels • Greenhouse gas emissions
Transportation	• Construction-related traffic • Increase in traffic on the local road network • Damage to roads by heavy construction vehicles • Risks to road users
Noise	• Localised noise increase • Noise nuisance
Aesthetics	• Reduction in visual quality of area
Safety and Security	• Safety risk to landowners and surrounding communities • Uncontrolled access to properties • Injury to contractor personnel • Risk of open trenches
Waste Management	• Waste generated from site preparations (e.g. plant material) • Domestic waste • Surplus and used building material • Hazardous waste (e.g. chemicals, oils, soil contaminated by spillages, diesel rags) • Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks • Land, air and water pollution through poor waste management practices
Socio–Economic Environment	• Generation of employment opportunities for local community (positive) • Contribution to local economy (positive) • Conflicted land uses • Nuisance from noise and dust • Safety and security
Heritage Resources	• Damage to heritage resources and loss of resources of heritage and cultural significance.
Water Users	• Water quality deterioration and disturbance to flow caused by construction activities may adversely affect downstream water users • Water abstracted from watercourses for construction purposes
Riparian Habitat	• Loss of riparian and instream vegetation within construction domain • Destabilisation of channel morphology at river • Wetland/aquatic habitat unit destruction • Soil erosion
Aquatic Ecology	• Disruptions to aquatic biota community due to water contamination, alteration of flow and disturbance to habitat during construction (particularly relevant to construction activities that take place instream or in close proximity to watercourses) • Alteration of habitat • Loss of aquatic-dependent biodiversity
Water Quality	• Inflow of contaminated storm water • Release of contaminants from equipment and concreting activities • Water quality impacts due to spillages and poor construction practices • Water quality impacts due to siltation and pollution
Flow Regime	• Alteration of flow • Affect aquatic biodiversity

Table 9: Potential significant environmental impacts for Operational Phase

Feature	Impact
Topography	• Visual impacts from disturbed area and infrastructure • Crossing topographic features (watercourses) • Erosion of affected areas
Water	• Damage to weir and abstraction works from major flood events • Decrease in sediment loads from abstractions • Poor monitoring and control of sediment releases back into the river • Alterations to flow regime • Change in water quality
Flora	• Encroachment by exotic species through inadequate eradication • Habitat loss due to impoundment at the weir
Aesthetics	• Visibility of weir and abstraction works to visual receptors • Inadequate reinstatement and rehabilitation of construction footprint
Socio–Economic Environment	• Servitude restrictions along pipelines • Visual impacts to surrounding communities • Impacts to other water users in the uMkhomazi River • Alteration of floodlines by weir • Safety and security issues through improper access control during inspections and maintenance activities • Use of local road network for operation and maintenance purposes

12 SENSITIVE ENVIRONMENTAL FEATURES

Some of the sensitive and significant environmental features and aspects that are associated with the project's receiving environment are highlighted, for which mitigation measures are included in the BAR and EMPr (as relevant):

- ❑ The proposed development site falls within Ecological Support Areas (ESAs), CBAs, Threatened Ecosystems and D'MOSS.
- ❑ Species of Conservation Concern were identified in the project area.
- ❑ The proposed Goodenough Weir is located within the uMkhomazi River.
- ❑ Two wetland Freshwater Ecosystem Priority Areas (FEPAs) and two hydro geomorphic (HGM) Units were identified within 500m of the Ngwadini project area.
- ❑ One wetland FEPA and eight HGM Units were identified within 500m of the Goodenough project area.
- ❑ A Hindu Temple established in 1915 is located in the vicinity of the proposed pipeline servitude.
- ❑ The proposed Ngwadini and Goodenough pipelines traverse natural areas.
- ❑ The proposed Goodenough pipeline runs through the town of Craigieburn and passes dwellings in rural areas.
- ❑ The proposed Goodenough pipeline traverses cultivated land.
- ❑ The proposed Goodenough pipeline crosses steep terrain.
- ❑ The proposed Goodenough pipeline crosses various gravel and tarred roads.

The sensitivity maps for terrestrial ecology and watercourses, based on the ground-truthed sensitivity determined by the respective specialist studies, are presented below.

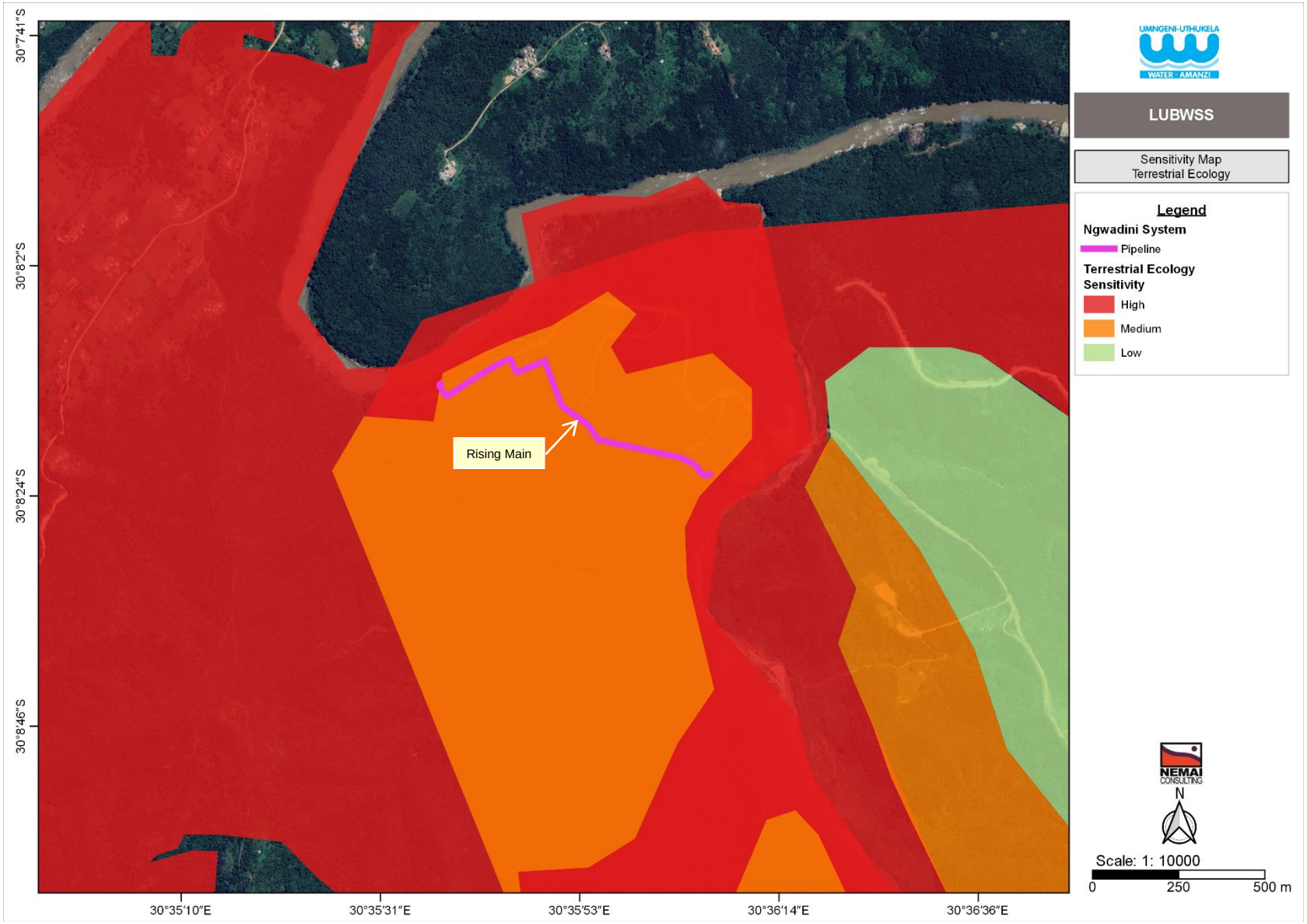

Figure 5: Terrestrial ecology sensitivity map – Ngwadini System (rising main)

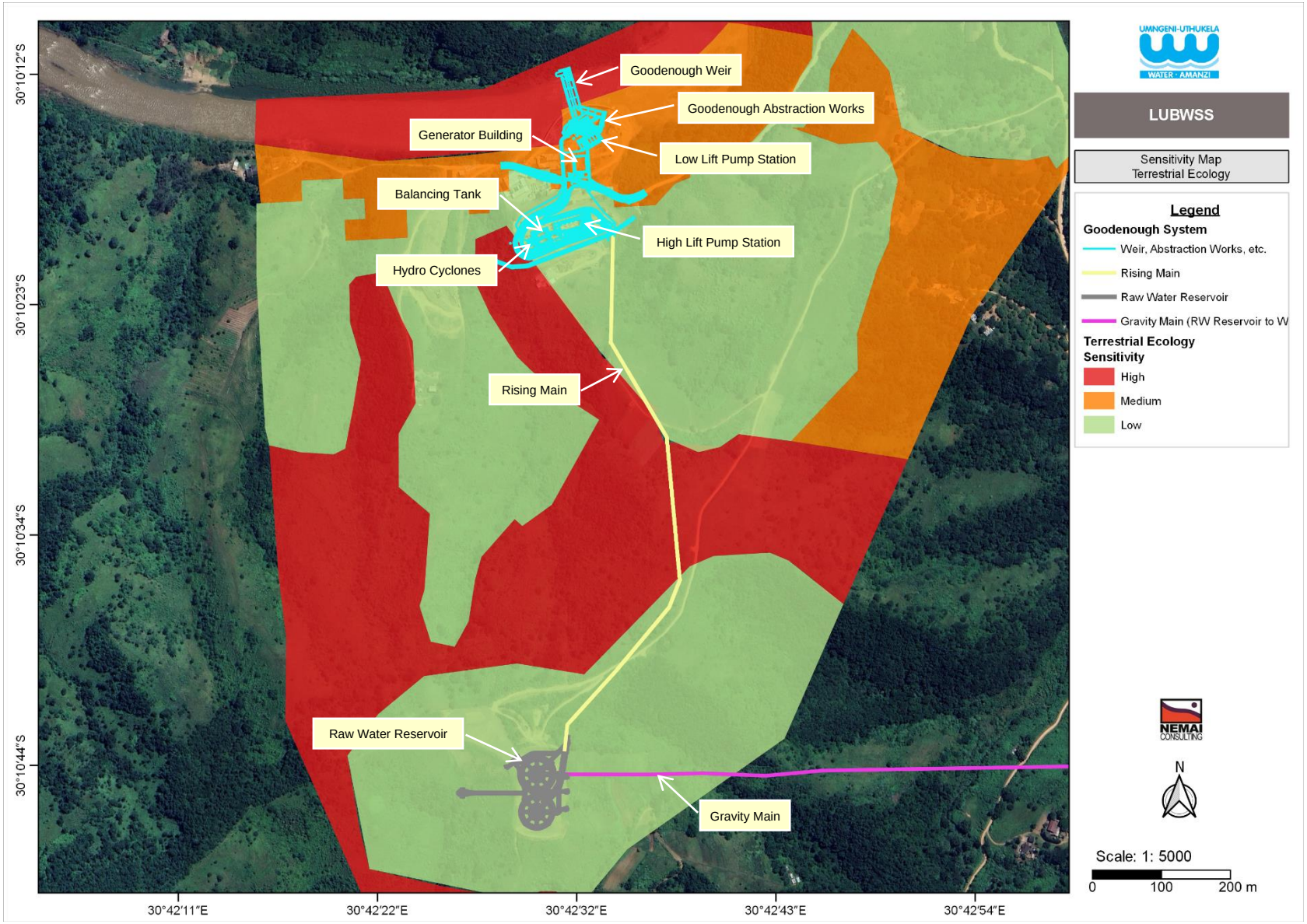

Figure 6: Terrestrial ecology sensitivity map – Goodenough System (weir, abstraction works, pump stations, balancing tank, hydro cyclones, rising main, raw water reservoir, gravity main to WTP)

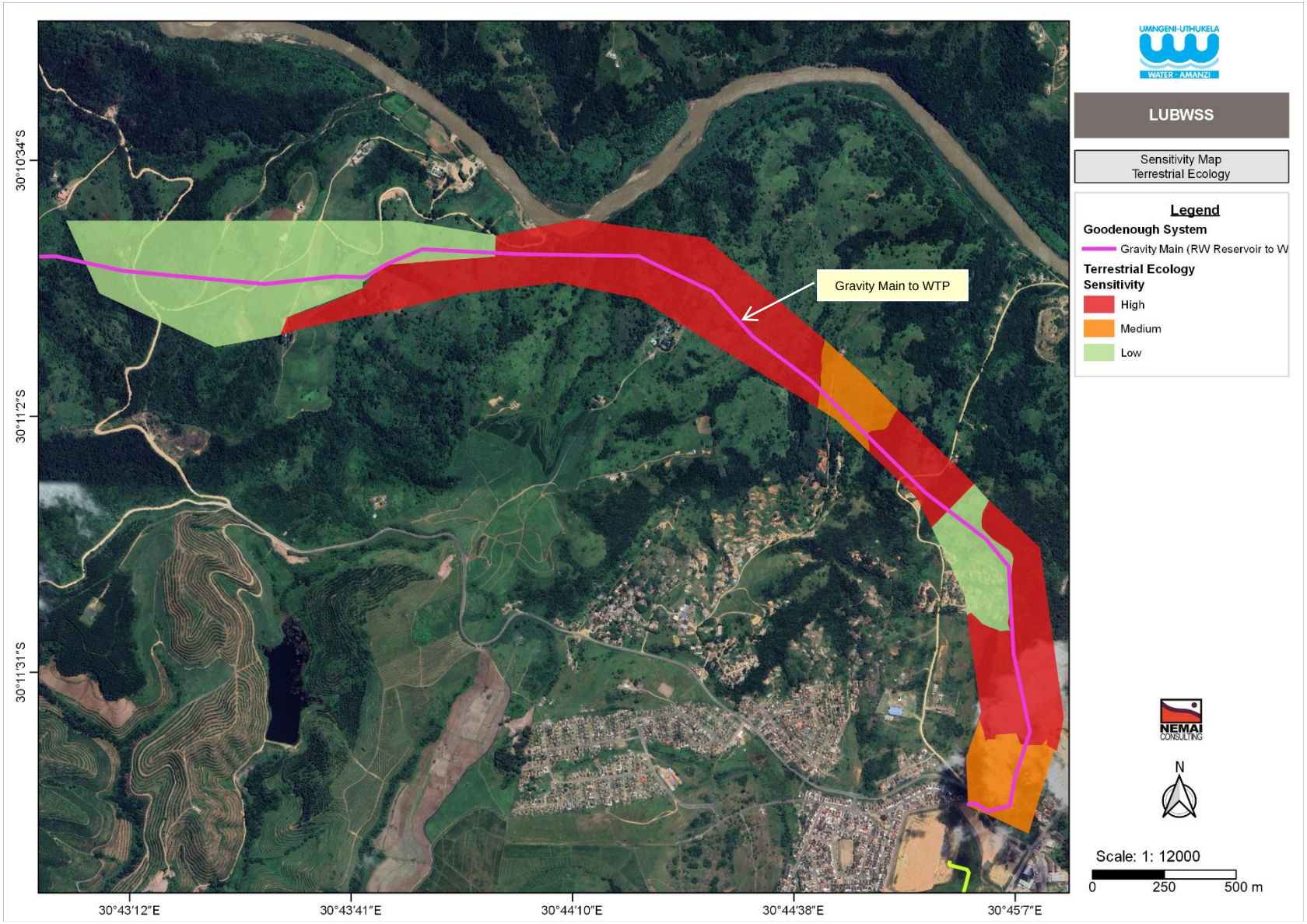

Figure 7: Terrestrial ecology sensitivity map – Goodenough System (gravity main to WTP)

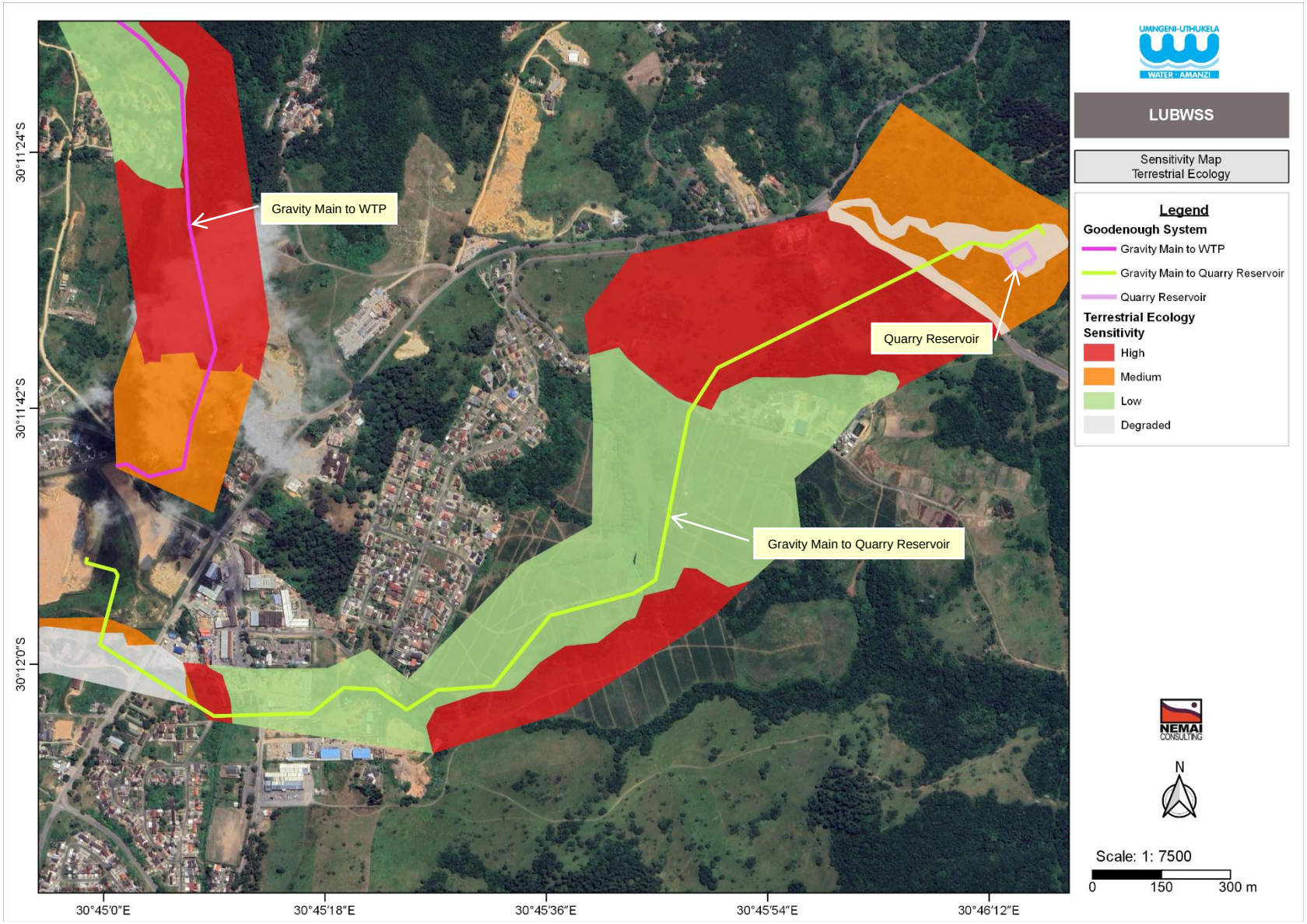

Figure 8: Terrestrial ecology sensitivity map – Goodenough System (gravity main to WTP, gravity main to Quarry Reservoir, Quarry Reservoir)

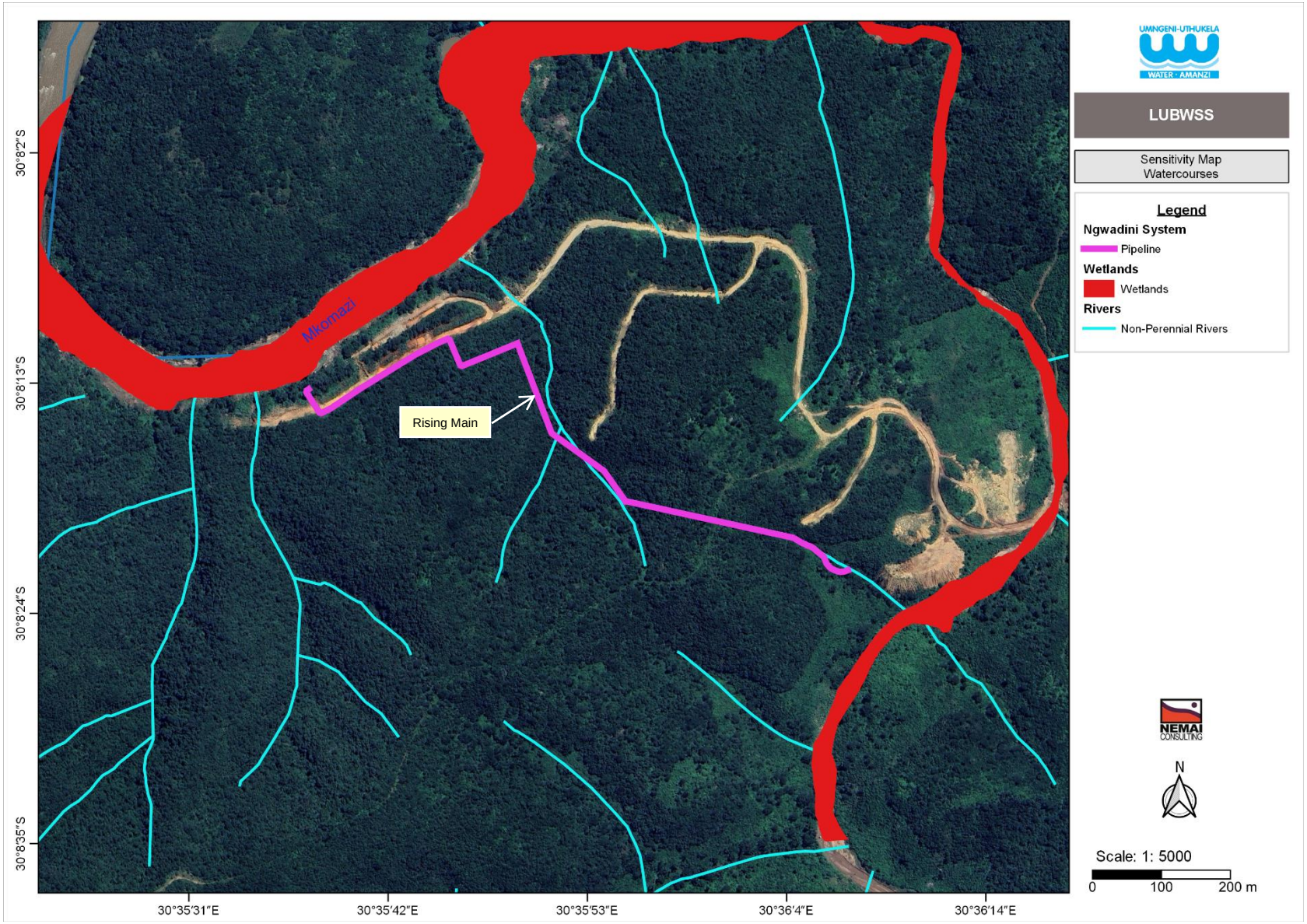

Figure 9: Watercourses sensitivity map – Ngwadini System (rising main)

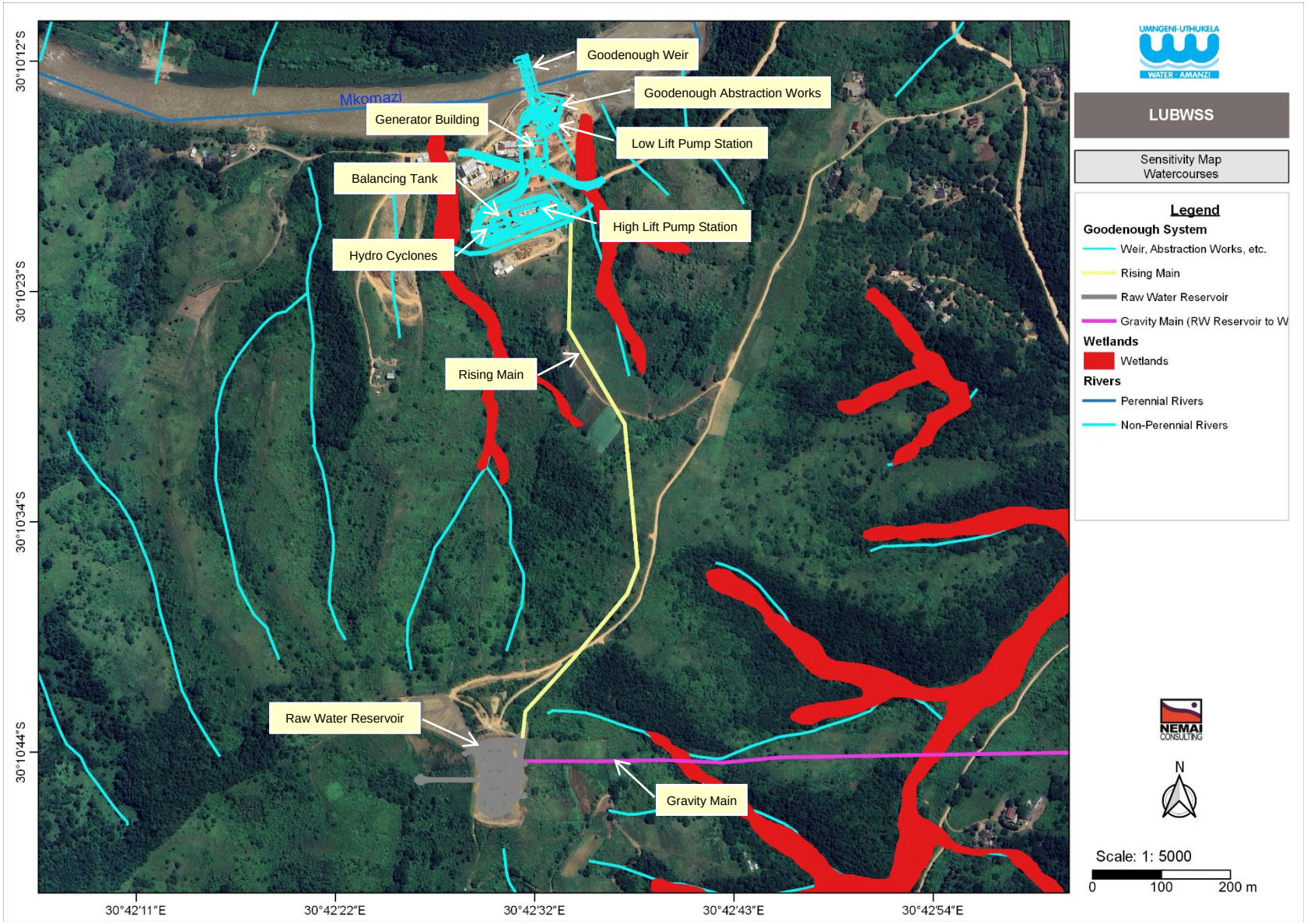

Figure 10: Watercourses sensitivity map – Goodenough System (weir, abstraction works, pump stations, balancing tank, hydro cyclones, rising main, raw water reservoir, gravity main to WTP)

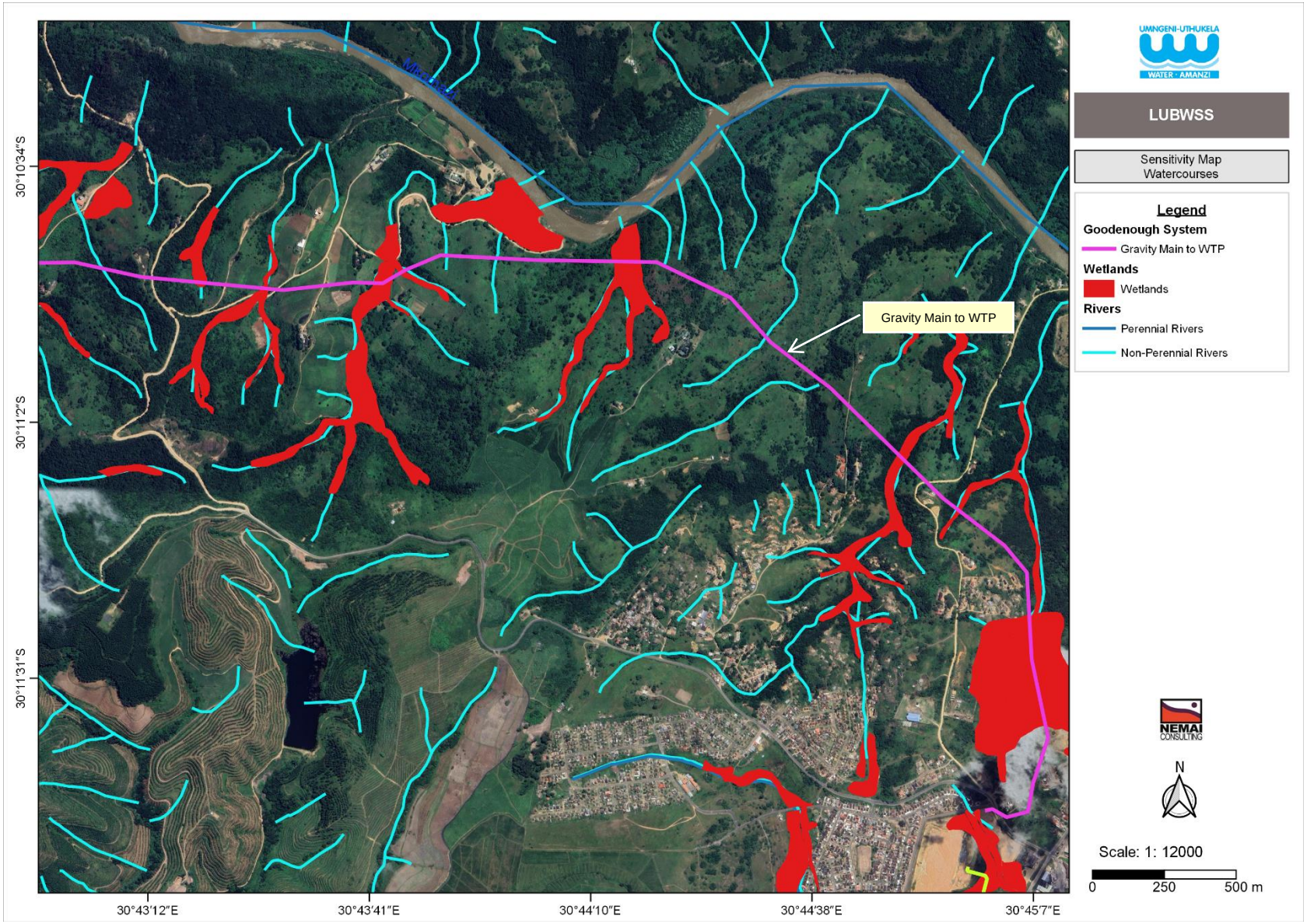

Figure 11: Watercourses sensitivity map – Goodenough System (gravity main to WTP)

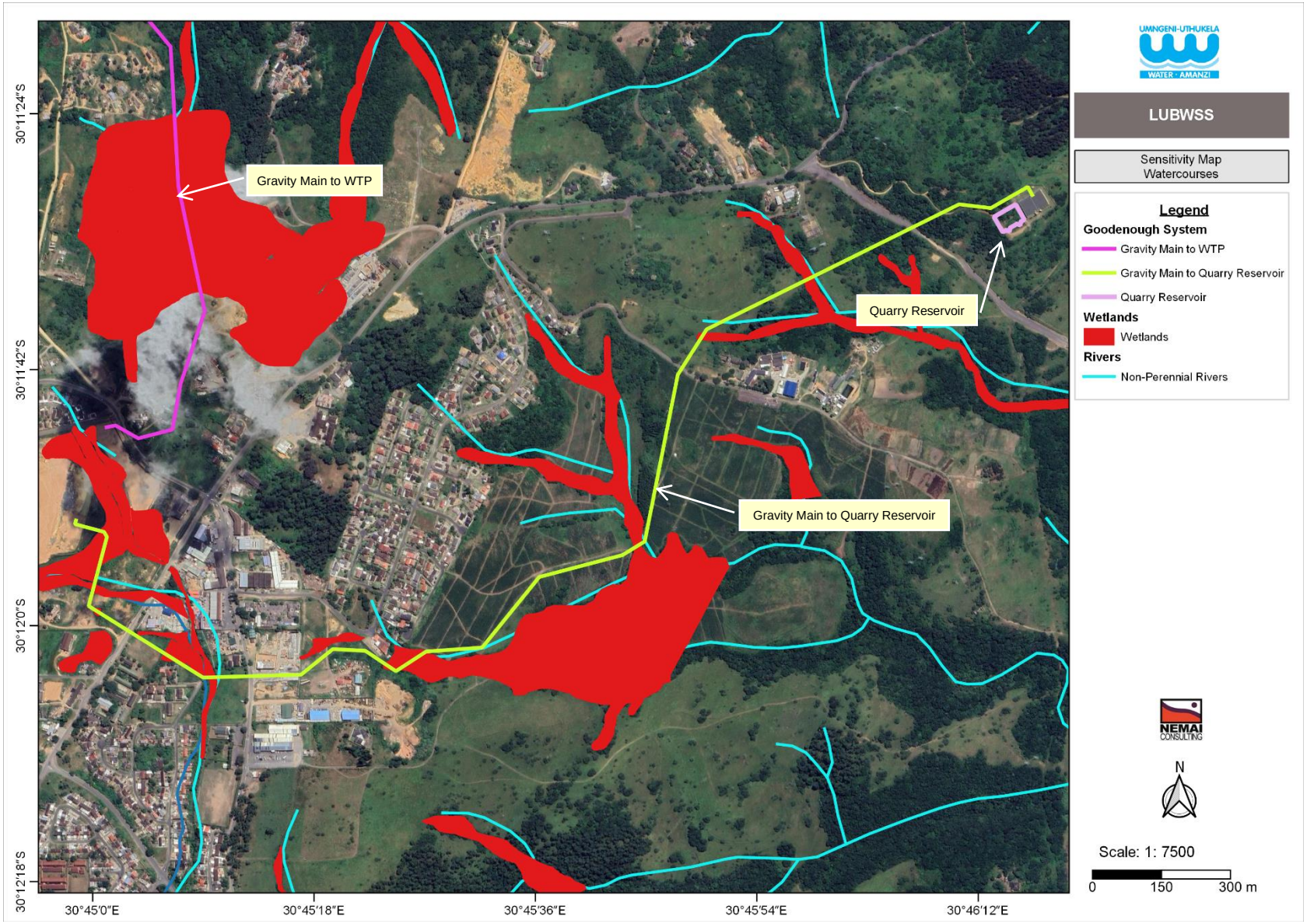

Figure 12: Watercourses sensitivity map – Goodenough System (gravity main to WTP, gravity main to Quarry Reservoir, Quarry Reservoir)

13 IMPACT MANAGEMENT

13.1 Introduction

The framework for the subsequent management measures consists of the following:

- **Management objectives** – i.e. desired outcome of management measures for mitigating negative impacts and enhancing the positive impacts related to project activities and aspects (i.e. risk sources);
- **Targets** – i.e. level of performance to accomplish management objectives;
- **Management actions** – i.e. practical actions aimed at achieving management objectives and targets;
- **Responsibilities**; and
- **Monitoring requirements**.

13.2 Pre-construction Phase

13.2.1 Specialist Environmental Investigations

Management Objective:

- Identify and manage impacts to sensitive and protected environmental features.

Target:

- All sensitive and protected environmental features to be identified in the construction domain.
- All relevant approvals to be obtained prior to relocation of red data, protected and endangered flora and fauna species, medicinal plants, heritage resources and graves.

Management Actions:

- Undertake a walkdown survey of the project footprint by the relevant environmental specialists. Suitable specialist(s) to identify sensitive environmental features (including watercourses, fauna, and flora) where special care needs to be taken and implement suitable mitigation measures to safeguard these features (e.g. barricading, signage and awareness creation).
- Undertaking a search and rescue exercise for Species of Conservation Concern (SCC).
- Baseline studies should be undertaken to be completed as soon as possible before implementation commences in order to provide a benchmark against which impacts resulting from the construction and operation of the project can be measured. Aspects to be included are terrestrial ecology, air quality and noise.
- Given that construction activities will expose workers to excessive noise rating levels, it is recommended that a baseline noise survey also be conducted as soon as possible

following commencement of site activities – in accordance with the requirements of the Noise Induced Hearing Loss Regulations (OHS Act 85 of 1993) and SANS 10083:2004.

- The following plans, which are appended to the EMPr, shall be implemented:
  - Alien Invasive Management Plan (**Appendix B**);
  - Contingency Plan (effective monitoring system to detect any leakage or spillage of a hazardous substance during their transportation, handling, use and storage.) (**Appendix C**);
  - Emergency Preparedness Response Plan (**Appendix D**);
  - Erosion Management Plan (**Appendix E**);
  - Plant Rescue and Protection Plan (**Appendix F**);
  - Stormwater Management Plan (**Appendix G**);
  - Traffic Management Plan (**Appendix H**); and
  - Re-Vegetation and Habitat Rehabilitation Plan (**Appendix I**).
- The buffer zones determined in the Aquatic and Wetland Baseline and Impact Assessment Report should be strictly adhered to during the construction phase of the project, with exception of the activities and structures required to traverse a watercourse.

Responsibilities:

- Applicant to appoint suitably qualified specialists.
- Specialists to execute the management actions.
- Contractor: Barricading of sensitive features and displaying of signage (no-go areas). Relocation of SCC, under Specialist supervision.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• All necessary environmental consents to be in place with due consideration to the Project programme. • Pre-construction survey report. • Inspection of barricading (photographic records). • Visible signage (photographic records).

13.2.2 Construction Site Planning and Layout

Management Objective:

- Appropriate planning and layout of construction site to ensure environmental protection.

Target:

- No impacts to sensitive environmental features as a result of construction site planning and layout.

Management Actions:

- Conduct a pre-construction survey of the area to be affected by the development. This must include site investigations with photographic records.
- Before construction commences, all sensitive habitats and areas must be clearly demarcated with fencing or orange mesh netting. These demarcations must remain for the duration of the construction period. These sensitive areas are to be defined in accordance with recommendations from the appointed specialists including a botanist, zoologist and an archaeologist. Barricading measures to be utilised should not restrict the movement of the fauna in the area.
- Prior to construction commencing the construction areas, including construction site camp, access roads, stockpile areas, construction and excavation areas, storage facilities and parking areas, must be clearly demarcated for the duration of the construction period.
- Storage areas must be located more than 50m from the watercourse.
- It must be ensured that buffer zones, of undisturbed vegetation of an appropriate width, must be maintained between construction areas and bodies of water, watercourses and wetlands.
- Sensitive plant species that must be protected within the working area footprint must be clearly demarcated during construction period.
- Where necessary and required, the construction site must be screened from surrounding sensitive social facilities (such as schools and clinics) and residences, with fencing and shade cloth.
- The removal, cutting, pruning or relocation of protected indigenous species or vegetation must be approved by the relevant competent authority if required, or by the ECO if no permit is required.
- During site preparation, special care must be taken during the clearing of the works area where organic material will be stored separately from the topsoil and spoil material to ensure for the protection thereof. This topsoil must be re-used during the rehabilitation phase.
- During site preparation, topsoil and subsoil are stripped separately from each other and must be stored separately from spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater.
- Records of all environmental incidents must be maintained and a copy of these records must be made available to authorities on request throughout the project execution.
- No access to no-go areas without the permission of the PM.
- The Contractor to develop method statements to be approved by the PM prior to construction taking place.
- Define and communicate roles and responsibilities for the implementation of the EMPr.
- Determining and documenting the road conditions for all identified haul roads.
- Develop and implement an environmental awareness plan.

- Records of compliance/non-compliance must be kept on site at all times for DFFE on request.
- Records of all environmental incidents must be maintained and a copy of these records be made available to DFFE on request throughout the project execution.
- Prior to establishment of the site camp(s), the Contractor shall produce a plan showing the positions of all buildings, lay down yards, batch plants, vehicle wash areas, vehicle repair area, batching areas and infrastructure for approval by the PM.
- Project Management shall allocate a laydown area for Contractor-supplied items. At all times, the Contractor shall be responsible for the safe and adequate storage of all materials and equipment on site which he is to install, whether they are supplied by himself or others. The safe handling, unloading and loading of material receipts and dispatches at site or storage areas shall be the Contractors' responsibility.
- eThekwini Electricity's main records (held in the drawing office at eThekwini Electricity Headquarters) must be consulted for the presence of underground electrical services. In addition should any overhead line and/or servitude be affected, the specific permission of the Head: Electricity must be sought regarding the proposed development.
- The relocation of MV/LV electrical services, if required in order to accommodate the proposed development, will be carried out at the expense of the applicant.
- eThekwini Water and Sanitation must be contacted for records of existing sewer services in the area. The relocation of any of these services, should it be necessitated by the proposed project, will be to the expense of the applicant. Should there be a requirement to tie into the Municipalities wastewater network, then Bulk Sewer Clearance must be applied for and the applicant must contact eThekwini Water and Sanitation in this regard.

Responsibilities:

- Applicant – acquire permits.
- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Approved method statements • Evidence of site establishment in accordance with method statements (photographic records) • Pre-construction survey report • Approved site plan

13.2.3 Environmental Awareness Creation

Management Objective:

- Ensure that the Contractor, construction workers and site personnel are aware of the relevant provisions of the EMPr.

Target:

- All construction workers and employees to have completed appropriate environmental training.
- A record of environmental training undertaken to be kept on site.

Management Actions:

- All relevant parties, including the Applicant, all project managers, Contractors and Sub-Contractors shall be made aware of their responsibility for compliance with the provisions for Duty of Care and remediation of environmental damage contained in Section 28 of NEMA.
- The Contractor must arrange that all of his employees and those of his sub-contractor go through the project specific environmental awareness training courses before the commencement of construction and as and when new staff or sub-contractors are brought on site.
- The contractor's site staff including foremen and site management staff shall attend an environmental awareness training course provided by the ECO and a signed attendance register shall be kept available for confirmation.
- The environmental training is compulsory for all employees and structured in accordance with their relevant rank, level and responsibility, as well as the Environmental Specification as they apply to the works and site.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Records of training and awareness creation (e.g. training material, training programme, completed attendance registers, etc.)

13.2.4 Ongoing Consultation with Affected Parties

Management Objective:

- Establish and maintain a record of all complaints and claims against the project and ensure that these are timeously and effectively verified and responded to.
- Adhere to agreements made with adjacent landowners and community members regarding communication.

Target:

- All complaints and claims are to be acknowledged within five (5) working days and are to be responded to within 10 working days of receipt, unless additional information and/or clarification are required.
- No deviations from agreements made with adjacent landowners and community members.

Management Actions:

- Develop Grievance Redress Mechanism (GRM).
- Establish lines of communications with affected parties, adjacent landowners, and community members.
- Establish processes and procedures to effectively verify and address complaints and claims received.
- Complaints or liaison with affected parties, adjacent landowners, and community members with regard to environmental aspects, compensation or disturbance to activities or animals, must be recorded, reported to the correct person and a record of the response is to be entered in the complaints register.
- Provide the relevant contact details of the contractor, the ECO and/or other relevant project team members to affected parties, adjacent landowners, and community members for queries/raising of issues or complaints.
- Continued liaison with authorities with regards to compliance with the EA.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Documented and functional GRM • Proof of communication • Related entries into Public Complaints Register

13.3 Construction Phase

13.3.1 Site Clearing

Management Objective:

- Manage environmental impacts associated with site clearing.
- Ensure that only areas that are specifically required for the construction purposes are cleared.

Target:

- No damage is caused to sensitive environmental features outside of the demarcated construction areas, including marked and barricaded heritage resources, protected trees, structures and infrastructure.

Management Actions:

- Vegetation clearing must be kept to an absolute minimum, and must be within footprints of the servitude, laydown area, construction camp or roads to be used. Mitigation measures must be implemented to reduce the risk of erosion and the invasion of alien species.
- Clearing of vegetation to be conducted in a phased manner (where possible), with due consideration of the search and rescue activities.
- Method Statement to be developed by the Contractor, which will provide the details of how site clearing will be executed. Where possible, clearing by hand is recommended in order to create employment opportunities.
- Maintain barricading around sensitive environmental features.
- Avoid any disturbance to demarcated sensitive environmental features.
- Suitably experienced personnel (relevant to the potentially affected environmental features) to monitor the clearing activities, with particular focus on heritage resources, as well as protected fauna and flora species.
- During site preparation, topsoil and subsoil are to be stripped separately from each other and must be stored separately from spoil material for use in the rehabilitation phase. It should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO	Monthly	• Approved method statement.

Responsible party	Frequency	Evidence of compliance
& ECO		• Related entries into Public Complaints Register. • Visual inspections (photographic records) of cleared areas, barricading and signage.

13.3.2 Site Establishment

Management Objective:

- Minimise environmental impacts associated with site establishment.

Target:

- No damage to the environment outside construction area during site establishment.
- No access or encroachment into no-go areas.
- No justifiable complaints regarding general disturbance and nuisance received from the affected parties and community members.

Management Actions:

- The Contractor is to produce a site plan for the approval by the PM prior to the establishment of the site, which aims to identify construction activities, facilities and structures in relation to sensitive environmental features. This plan will serve as a spatial tool that facilitates the execution of the construction phase with due consideration of sensitive environmental features.
- Locate construction camp in an area where sensitive environmental features will not be impacted on.
- Facilities and structures shall be located with due cognisance of the terrain and geographical features of the project site.
- Positioning of the storage and laydown areas should aim to minimise visual impacts.
- Control the movement of all vehicles and plant (including suppliers), such that they remain on designated routes and comply with relevant agreements.
- Maintain barricading around sensitive environmental features until the cessation of construction works.
- Barricading should be established around the electrical powerlines present on site in order to prevent damage to the powerlines and to prevent people on site from possible harm.
- Appoint security personnel.
- Ensure noise levels are within their lawfully acceptable limits as per SANS 10103.
- Minimise disturbance from lighting of the construction camp and site.
- The extent of the site should by all means be limited, to avoid any additional clearance of vegetation.
- The Contractor shall ensure that the Contractors camp and working areas are kept clean and tidy at all times. The PM or/and the ECO shall inspect these areas on a regular basis.

- The Contractor shall comply with all safety requirements enforced; these include emergency evacuation procedures, fire preventative measures, etc.
- The Contractor shall supply firefighting equipment in proportion to the fire risk presented by the type of construction and other on-site activities and materials used on site. This equipment shall be kept in good operating order. This particularly applies to welding activities, etc.
- The contractor is to provide designated safe smoking areas.
- Every precaution should be taken, to prevent pollution of air, soil, ground and surface water as a result of construction or associated activities at the construction site.
- Fuel, lubricants, transmission and hydraulic fluids shall only be stored in the designated areas that comply with the OHS Act.
- Restrict development footprint to absolute minimum area necessary.
- A copy of the EA must be kept at the property where the activity will be undertaken. The EA must be produced to any authorised official from mandated authorities who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertakes work at the property.
- All stone, sand and other building materials must be sourced from sites that have a lawful Environmental Authorisation and/or mining permit/right as the need may be. Copy of proof of source of materials must be kept and made available on request.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Related entries into Public Complaints Register. • Visual inspections (photographic records).

13.3.3 Management of Construction Camp

Management Objective:

- Minimise environmental impacts associated with the construction camp and eating areas.

Target:

- No environmental contamination associated with the construction camp.
- Minimise visual impact associated with the construction camp.
- No complaints regarding the construction camp.

Management Actions:

- Construction camp to be screened to minimise the visual impact, where practicable.

- The Contractor shall provide eating areas for all staff. Eating areas be cleaned on a daily basis and shall provide adequate temporary shade.
- Open uncontrolled fires will be forbidden at the site camp. Rather, 'contained' cooking mechanisms will be used (e.g. gas stoves or an enclosed braai facility).
- Eating areas will be designated and demarcated.
- Refuse bins must be placed at all eating areas.
- The feeding, or leaving of food for animals, is strictly prohibited.
- Sufficient vermin/weatherproof bins will be present in this area for all waste material.
- Dishwashing facilities will be provided to ensure that wastewater is disposed of appropriately.
- Failure to comply with the general code of conduct, or the rules and procedures implemented at the construction camp will result in disciplinary actions.
- Provide safe potable water for food preparation, drinking and bathing.
- Prohibit the felling of trees for firewood.
- Provide medical and first aid facilities at the camp area.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Fencing register • Waste disposal records • Related entries into Public Complaints Register • Visual inspections (photographic records) • Proof of training

13.3.4 Management of Ablution Facilities

Management Objective:

- Minimise environmental impacts associated with ablution facilities.

Target:

- No environmental contamination associated with ablution facilities.
- Minimise visual impact associated with ablution facilities.

Management Actions:

- Ablution facilities shall be provided for the workers on site. The use of these facilities must not cause any pollution to any water resources as well as pose a health hazard. In addition, these toilets must be situated outside of the buffer zones of watercourses. as determined in the Aquatic and Wetland Baseline and Impact Assessment Report.
- Provide sufficient ablution facilities (e.g. mobile/portable/VIP toilets) at the construction camp and along construction sites, which conform to all relevant health and safety standards and codes.
- No pit latrines, french drain systems or soak away systems shall be allowed. Install and maintain conservancy tanks for site offices. The location of conservancy tanks is to be approved by the PM.
- A sufficient number of toilets shall be provided to accommodate the number of personnel working in any given area. Toilets may not be further than 100m from any working area. Toilet facilities supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers.
- All staff to use the provided toilets at all times.
- Chemical toilets must be serviced by registered service provider on at least a weekly basis.
- Temporary ablutions and toilets must be established at least 50m from any watercourse or water source.
- All temporary/portable/mobile toilets shall be secured to the ground to prevent them from toppling over due to wind or any other cause.
- Some form of screened off changing facility must be provided separately for each sex.
- All sanitary fees that may be payable to any local authority shall be paid by the Contractor.
- Ablutions are to be cleaned/emptied on a regular basis, before they are full and contaminate the environment.
- Informal ablutions within riparian areas must be prohibited.
- The entrances to the toilets will be adequately screened from public view.
- Sanitary hygiene bins will be provided for female staff.
- Toilet paper shall be provided.
- The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed service provider removes the contents from site. Disposal of such waste is only acceptable at a licensed waste disposal facility.
- Should shower facilities be provided for use by staff staying on site, the following controls must be imposed:
    - Positioning of the shower, and specifically its discharge point, will be carried out to ensure that erosion and build-up of detergents does not occur.
    - All discharge from the shower and other washing facilities must be managed to prevent environmental contamination.
    - Use of the shower facilities must be limited to staff or authorised persons only.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Maintenance register for ablution facilities • Waste disposal records • Related entries into Public Complaints Register • Visual inspections (photographic records) • Proof of training

13.3.5 Management of Workshop and Equipment

Management Objective:

- Minimise environmental impacts associated with workshops and equipment use*.*

Target:

- No environmental contamination associated with workshops and equipment use*.*

Management Actions:

- Vehicles must be maintained and serviced according to the manufacturers' standards
- Daily checklists must be completed by drivers and operators before the vehicles and equipment are used.
- Vehicles and equipment must be turned off when not in use.
- Maintenance of equipment and vehicles will be performed in such a manner so as to avoid any environmental contamination (e.g. use of drip trays).
- All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site.
- Suitable storage and disposal of hydraulic fluids and other vehicle oils.
- All diesel powered equipment and vehicles used in construction activities must be suitably serviced, maintained and repaired in order to minimise the emission of diesel particulate matter and reduce subsequent worker exposure to this carcinogenic substance.
- All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site.
- Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use.
- No washing of plant may occur on the construction site. Plant to be washed in dedicated areas.

- Drip trays will be provided for the stationary plant and for the "parked" plant.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Updated maintenance schedule • Visual inspection of workshop, storage areas, signage, spill kits, plant, etc. (photographic records) • Disposal records • Proof of training

13.3.6 Fencing and Barricades

Management Objective:

- To ensure and assist with controlled fencing and barricades in the working environment.
- Minimise disturbance to animals.

Target:

- Provide a clearly demarcated and safe working area.
- No direct harm to fauna due to inadequate fencing arrangements.

Management Actions:

- No pedestrian or vehicular access shall be allowed to such fenced areas.
- In places where temporary fencing is required, the Contractor shall erect such fencing when and where required and re-erect and maintain temporary fencing as necessary. Temporary fencing shall remain in position either until it is replaced by permanent fencing or until completion of the works.
- Any fences damaged by the Contractor shall be repaired as soon as possible at his/her cost and shall be of the standard of the original fence.
- Fences should be constructed to meet the following requirements:
    - The fence should be straight and vertical;
    - All the straining posts should be firmly and vertically anchored;
    - All the posts should extend to the same height above ground level by corresponding to the terrain form;
    - The straining posts and droppers should not be too far apart – the closer they are, the firmer the fence;

  - Each wire strand should be firmly attached to the standards or line posts at a specific height above ground level and should be a certain distance apart from each other;
  - The droppers should be neatly and evenly spaced between the standards. The wire strands should be firmly attached to maintain the proper space between the strands and to prevent vertical movement;
  - Fences should never be constructed of inferior quality material. Therefore, fencing material with the SABS mark should be used; and
  - Comply with Nature and Environmental Conservation Ordinance (Act No. 19 of 1974) with regards to the accommodation of relevant large mammal species.
- All fences erected for construction purposes (e.g. fences around camp sites, fencing around trenches, etc.) should be inspected on a daily basis to detect whether any damage has occurred. Damaged fences/barricading to be repaired immediately.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Fencing register • Related entries into Public Complaints Register • Visual inspections (photographic records) • Proof of training

13.3.7 Management of Labour Force

Management Objective:

- Ensure suitable management of labour force to prevent security-related issues.
- Optimise the use of local labour.
- Provide a work environment that is conducive to effective labour relations.

Target:

- No complaints from adjacent landowners and community members regarding trespassing or misconduct by construction workers.
- All unskilled labour to be sourced from local communities.

Management Actions:

- Develop a Code of Conduct in terms of behaviour of construction staff.
- Prevent trespassing of construction workers onto private property.

- Construction workers must be provided with identity cards and must wear identifiable clothing and remain within the working servitude for the project.
- Make suitable provision for transport and/or accommodation of workforce.
- Creating nuisances and disturbances in or near communities shall be prohibited.
- Machine/vehicle operators shall receive clear instructions to remain within demarcated access routes and construction areas.
- Designated and demarcated smoking areas should be provided, with special bins for discarding of cigarette butts.
- Create opportunities for the employment of women.
- Use local labour as far as possible, where necessary (e.g. unskilled labour).
- Develop a community labour agreement with targets for employment and for progression.
- Training of labour to benefit individuals beyond completion of the project.
- Local people should be employed to increase support for the project and reduce the potential for criminal activities.
- No unauthorised entry into private properties other than the designated construction footprint areas without prior engagement with the landowner.

Responsibilities:

- Applicant – employment targets.
- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	▪ Documented GRM ▪ Proof of communication ▪ Related entries into Public Complaints Register ▪ Proof of training

13.3.8 Management of Health and Safety

Management Objective:

- Provide a safe and healthy working environment to construction workers and the public.

Target:

- Approved Health and Safety Plan.
- No incidents.
- Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993), Construction Regulations (2014) and other relevant regulations.

Management Actions:

- The Contractor must submit a Health and Safety Plan, prepared in accordance with the Health and Safety Specification, for approval prior to the commencement of work. These requirements are aligned with the Construction Regulations (2014).

Health –

- The Construction Regulations (2014) require that all contractors conduct an initial health risk assessment of their workers activities prior to initiating any work on site.
- All construction workers should be subject to baseline (pre-employment) medical examinations.
- Ensure all workers are medically fit to conduct their activities, with priority being given to those workers required to engage in manual physical labour activities – pre-employment medical examinations are recommended.
- Ensure that all workers are suitably informed and trained in the signs and symptoms of heat stress which they may be exposed in the course of their work.
- Ensure that all workers are trained in appropriate measures to prevent heat stress related injuries or illnesses. Informing workers of the need to drink regular quantities of water should be prioritised. Ready access to drinking water must be provided at all work locations.
- Issuing of appropriate protective wear (jackets, hats and gloves) should suffice in preventing workers from developing any adverse health effects following exposure to cold working conditions.

Safety –

- First aid officers should be trained on site (levels 1 to 3) to deal with construction related injuries.
- Protective clothing of SABS approval shall be provided.
- When working in the area of encroachment is prevalent all open excavated trenches and foundations should be clearly marked and secured to keep people and fauna from falling in.
- Storage areas, assembling areas where construction material is stored on site should similarly be secured. No stacking and storing of material will be allowed underneath any operational power lines.
- The Contractor must establish site access rules and implement and maintain these throughout the construction period. Access control must, amongst other, include the rule that non-employees will not be allowed on site unaccompanied.
- Access by non-construction staff into any construction related sites should be restricted and clearly indicated as such by signposts.
- Maintain access control to prevent access of the public to the construction areas.
- The requirements of the Occupational Health and Safety Act (Act No. 85 of 1993) and related regulations shall be adhered to.

- Speed limits shall be enforced in all areas, including public roads and private properties. All drivers of the construction teams shall be sensitised to this effect and courteous behaviour is expected from everybody in this regard.
- Applicable notice boards and hazard warning notices will be put in place and secured. Night hazards will be indicated suitably (e.g. reflectors, lighting, and traffic signage).
- Emergency contact details will be prominently displayed.
- All construction personnel must be clearly identifiable. All employees must also be issued with employee cards for identification purposes.
- All workers will be supplied with the required Personal Protective Equipment.
- Appropriate signage must be posted to this effect and all employees on site must be instructed to ensure that non-employees are protected at all times. All non-employees entering the site must receive induction into the hazards and risks of the site and the control measures to be observed.
- All complaints and/or problems related to impacts on man-made facilities and activities must be promptly addressed by the Contractor and documented.

Responsibilities:

- PM and ECO – to check.
- Dedicated Occupational Health and Safety system to be implemented by Contractor's Safety Officer. To be monitored and audited by the Client's Safety Agent, in terms of the Construction Regulations (2014).
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Visual inspections (photographic records) • Records of incidents and corrective measures taken • Proof of training

13.3.9 Management of Emergency Procedures

Management Objective:

- Minimise environmental impacts associated with emergency procedures.

Target:

- No site fires to be caused by construction activities and workers.
- Approved emergency response procedures, where relevant.

Management Actions:

- Implement the Emergency Preparedness Response Plan (**Appendix D**) and Contingency Plan (**Appendix C**).
- Fire –
    - Comply with the National Veld and Forest Fire Act (No. 101 of 1998).
    - Proper emergency response procedure to be in place for dealing with fires.
    - Burning of waste is not permitted.
    - Suitable precautions will be taken (e.g. suitable fire extinguishers, water bowsers, welding curtains) when working with welding or grinding equipment.
    - All fire control mechanisms (firefighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services.
    - All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the presence of a fire.
    - No fires are allowed on site, unless in dedicated areas approved by the PM.
    - Dedicated smoking areas to be provided. Cigarette butts may not be disposed of onsite.
- Accidental Leaks and Spillages –
    - Proper emergency response procedure to be in place for dealing with spills and leaks.
    - Ensure that the necessary materials and equipment for dealing with spills and leaks are available on site, where practicable.
    - Remediation of the spill areas will be undertaken to the satisfaction of the PM and ECO.
    - In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured. The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, breakdown and where possible, encapsulate a minor hydrocarbon spillage.
    - All staff on site will be made aware of actions to be taken in case of a spillage.
    - Provide contact details of person to be notified in a case of spillages – signage to be displayed at strategic points within the construction domain (e.g. workshop, fuel storage area, hazardous material containers).

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Compliance with the Emergency Preparedness Response Plan (Appendix D) and Contingency Plan (Appendix C)

Responsible party	Frequency	Evidence of compliance
		• Emergency contact list displayed • Updated maintenance schedule for fire-fighting equipment • Visual inspections (photographic records) • Records of incidents and corrective measures taken • Proof of training

13.3.10 Management of Access and Traffic

Management Objective:

- Ensure that all construction vehicles use only dedicated access routes to construction sites.
- Ensure that landowners and the community have reasonable access to their land during construction.
- Ensure proper access control.
- Prevent unlawful access to construction domain.
- Adhere to agreements made with individual landowners and community members regarding access.
- Ensure the safety of all road users by implementing proper signage and traffic control measures.
- Limit construction-related nuisance to service nodes.

Target:

- No reports of construction vehicles using other unauthorised routes.
- No transporting of unsafe loads. Permits are to be obtained for abnormal loads.
- No speeding.
- No accidents.

Management Actions:

- Implement the Traffic Management Plan (**Appendix H**).
- Undertake negotiations and confirm arrangements with the adjacent landowners regarding the use of traffic arrangements.
- Make provision for landowners and affected parties to access their properties.
- Site access should be controlled and no unauthorised persons should be allowed onto the site.
- Any clearing for access or haul roads outside the demarcated works area shall only be undertaken after approval from the PM.
- Ensure appropriate traffic safety measures are implemented. This will include flagmen on sharp corners of the roads to be used.
- Comply with all traffic-related requirements in the Occupational Health and Safety Act (Act No. 85 of 1993).

- The Contractor must comply with all driving, vehicle, licensing and driver ability requirements.
- Permission required from the PM for the movement of any vehicles and/or personnel outside of designated working areas.
- Existing roads shall be used as far as possible for construction purposes.
- Where ever possible, heavy vehicles must not be allowed within 32m of watercourses. Where this is not possible, measures must be put in place to limit soil compaction and the extent of the working areas.
- Contractor to ensure safe access for adjacent landowners on all roads.
- Wet suppression of unpaved areas should be applied during dry windy periods, using a water cart and/or fixed sprinklers.
- Chemical suppression can also be used in conjunction with wet suppression. This involves the use of chemical additives in the water, which help to form a crust on the surface and bind the dust particles together. Chemical stabilisation reduces watering requirements, but any savings can be offset by the cost of the additives. Repeat treatments are usually required at intervals of 1-4 weeks. The method is best suited to permanent site roads and usually not cost-effective on temporary roads, which are common in construction sites.
- Provide hard-standing areas for vehicles and regularly inspect and clean these areas.
- The Contractor shall organise the site in such a manner that pedestrians and vehicles can move safely and without risks to health, including sufficient and suitable traffic routes and safe walkways with relevant signage.
- Access roads to be maintained in a suitable condition.
- During rainy conditions, no usage of access road due to maintenance.
- Suitable erosion protective measures to be implemented for access roads during the construction phase.
- Traffic safety measures (e.g. traffic warning signs, flagmen) to be implemented.
- Consult with adjacent landowners, local authorities and communities to ensure that all affected parties are informed of the timing and extent of any disruptions.
- Clearly demarcate all access roads. Clearly mark pedestrian-safe access routes.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Related entries into Public Complaints Register • Visual inspections (photographic records) • Proof of training

13.3.11 Management of Waste

Management Objective:

- Minimise environmental impacts associated with waste.
- Apply waste management principles of prevent, minimise, recycle or re-use, with disposal as a last option.

Target:

- No littering on construction site.
- Maintain a clean and tidy construction site.
- 100% record of all waste generated and disposed at waste disposal facilities.
- Valid disposal certificates for all waste disposed.
- Provision of adequate waste containers that are easily accessible and maintained.
- Waste bins to be removed and cleaned weekly.

Management Actions:

- Waste management activities must comply with the National Environmental Management: Waste Act (Act No. 59 of 2008).
- All waste generated during the construction phase shall be disposed of to an approved landfill site.
- Vermin/weatherproof bins will be provided in sufficient numbers and capacity to store domestic waste. These bins must be kept closed to reduce odour build-up and emptied regularly to avoid overfilling and other associated nuisances.
- Where possible, waste must be separated at source (e.g. containers for glass, paper, metals, plastics, organic waste and hazardous wastes).
- Provide waste skips at the construction areas. These skips should be sufficient in number, the skip storage area should be kept clean, skips should be emptied and replaced before overflowing or spillage occurs.
- Ensure daily site clean-ups to prevent the build-up of litter
- The Contractor will ensure that no burying, dumping or burning of waste materials, vegetation, litter or refuse occurs. All waste will be disposed of at suitable licensed disposal sites, based on the waste type (general versus hazardous).
- Ensure that solid waste is transported so as to avoid waste spills en-route.
- If excess material is generated during operation, it cannot be sold without the requisite mining permits/rights but may be dumped/disposed of at a registered landfill site or used within the property for improvements provided that the environmental documents and environmental authorisation addresses this issue. In addition, there must be a checks and balances for material removed from site for disposal to ensure that the material is not sold commercially.

- No form of secondary pollution should arise from the disposal of sewage and refuse. Any pollution problem arising from the above development is to be addressed immediately by the Applicant.
- The following requirements shall be incorporated into the waste management programme:
    - Solid Waste:
        - Littering on site and the surrounding areas is prohibited.
        - Clearly marked litterbins must be provided on site. The Contractor must monitor the presence of litter on the work sites as well as the construction campsite.
        - All bins must be cleaned of litter regularly.
        - All waste removed from site must be disposed at a municipal/permitted waste disposal site.
        - Excess concrete, building rubble or other material must be disposed of in areas designated specifically for this purpose and not indiscriminately over the construction site.
        - The entire works area and all construction sites must be swept of all pieces of wire, metal, wood or other material foreign to the natural environment.
        - Contaminated soil must be treated and disposed of at a permitted waste disposal site, or be removed and the area rehabilitated immediately.
        - Waste must be recycled wherever possible.
        - Removal and disposal of solid waste to a permitted waste disposal site is required and this is the responsibility of the Applicant.
        - Waste removal and safe disposal certificates must be maintained and made available on request.
        - Contaminated materials are to be disposed of at a permitted hazardous landfill site.
        - All waste generated from the proposed activity must be disposed of in a suitable manner so as not to cause any water pollution or health hazard.
        - The recycling of suitable material (i.e. glass, paper, plastic, etc.) is encouraged by this Department.
    - Liquid Waste
        - The Contractor must install and maintain mobile toilets at work sites.
        - The Contractor must provide adequate and approved facilities for the storage and recycling of used oil and contaminated hydrocarbons. Such facilities must be designed and sited with the intention of preventing pollution of the surrounding area and environment.
        - All vehicles must be regularly serviced in designated area within the Contractors camp such that they do not drip oil. Where required, vehicles will be serviced in bunded areas and drip trays will be provided.
        - All chemical spills must be contained and cleaned up by the supplier or professional pollution control personnel.

- Oil interceptors and drip trays must be used in vehicle parking areas and during refuelling, and must be inspected and cleaned regularly.

- Hazardous Waste:
  - Hazardous waste streams must be established separate from general waste streams, and hazardous waste must be disposed of at an appropriate and lawful hazardous waste disposal facility.
  - No hazardous materials must be disposed of in the veld or anyplace other than a registered landfill for hazardous material.
  - Hazardous waste must be stored in containers with tight lids that must be sealed and must be disposed at an appropriately permitted hazardous waste disposal site. Such containers must not be used for purposes other than those originally designed for.
  - The Contractor must maintain a hazardous material register.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Approved method statement • Waste management and disposal records • Visual inspections of waste management facilities (photographic records) • Related entries into Public Complaints Register • Proof of training

13.3.12 Management of Storage and Handling of Non-Hazardous Material

Management Objective:

- Effective and safe management of materials on site, in order to minimise the impact of non-hazardous materials on the environment.

Target:

- No pollution due to handling, use and storage of non-hazardous material.

Management Actions:

- Materials to be suitably stored to prevent environmental contamination and visual impacts. Storage requirements to be determined based on chemical qualities of material and Material Safety Data Sheets (MSDS).

- Where required, stored material to be protected from rain and run-off to avoid environmental contamination.
- Materials to be appropriately transported to avoid environmental contamination. Loose loads (e.g. sand, stone chip, refuse, paper and cement) to be covered.
- Suitable remedial measures, depending on the nature of the contaminant and the receiving environment, to be instituted for spillages.
- Materials to be suitably used to prevent environmental contamination.
- Storage of material, chemicals, fuels, etc. must not pose a risk to the surrounding environment and this includes surface and groundwater. Such storage areas must be located outside the 1:100 year floodline of any watercourse and must be fenced to prevent unauthorised access into the area. Temporary bunds must also be constructed around chemical or fuel storage areas to contain possible spillages.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Records (e.g. copies of MSDSs) • Visual inspections (photographic records) • Proof of training

13.3.13 Management of Storage and Handling of Hazardous Material

Management Objective:

Ensure the protection of the natural environment and the safety of personnel on site, by the correct management and handling of hazardous substances.

Target:

- No pollution due to handling, use and storage of hazardous material.
- In the event of a spill, appropriate containment, clean up and disposal of contaminated material. Spills to be cleaned within 24 hours.

Management Actions:

- Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (Act No. 85 of 1993), relevant associated Regulations, and applicable SANS and international standards.
- Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination and must adhere to the requirements stipulated on the MSDS.

- Where flammable liquids are being used, applied or stored the workplace must be effectively ventilated.
- No person may smoke in any place in which flammable liquid is used or stored.
- Install an adequate number of fire-fighting equipment in suitable locations around the flammable liquids store.
- Where flammable liquids are decanted, the metal containers must be bonded or earthed.
- No flammable material (e.g. paper, cleaning rags or similar material) may be stored together with flammable liquids.
- Staff that will be handling hazardous materials must be trained to do so.
- Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor. Suitable ventilation to be provided.
- All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material.
- MSDSs, which contain the necessary information pertaining to a specific hazardous substance, must be present for all hazardous materials stored on the site.
- Spill kits must be available for the clean-up of hazardous material spillages.
- Provide secondary containment where a risk of spillage exists.
- Drip trays to be placed under parked heavy vehicles, equipment and other receptacles of hazardous material to prevent spillages.
- Regularly inspect all vehicles for leaks.
- Re-fuelling of vehicles must take place off-site; if this is not possible then re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.
- In the event of spillages of hazardous substances, the appropriate clean up and disposal measures are to be implemented.
- Spill reporting procedures to be displayed at all locations where hazardous substances are being stored.
- Hazardous materials will be disposed of at registered sites or handed to registered hazardous waste disposal facilities for disposal/recycling.
- Proper and timeous notification of any pollution incidents associated with hazardous materials.
- Hazardous chemical substances containers be clearly marked with the contents and main hazardous category e.g. “Flammable” or “Corrosive”.
- Storage of material, chemicals, fuels, etc. must not pose a risk to the surrounding environment and this includes surface and groundwater. Such storage areas must be located outside of the buffer zones of watercourses. as determined in the Aquatic and Wetland Baseline and Impact Assessment Report. Temporary bunds must also be constructed around chemical or fuel storage areas to contain possible spillages.

Responsibilities:

- PM and ECO – to check.

- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Records (e.g. copies of MSDSs) • Visual inspections (photographic records) • Proof of training

13.3.14 Management of Pollution Generation Potential

Management Objective:

- Ensure that all possible causes of pollution are mitigated as far as possible to minimise impacts to the surrounding environment.

Target:

- No complaints regarding pollution.
- No measurable signs of pollution.
- Noise – Comply with SANS 10103:2008.

Management Actions:

General –

- Accidental pollution incidents shall be reported to the ECO immediately they occur and shall be cleaned-up (to the satisfaction of the PM or ECO) by the Contractor or a nominated clean-up organization at the expense of the Contractor.

Soil –

- Soil should be exposed for the minimum time possible once cleared of invasive vegetation, that is the timing of clearing and grubbing should be co-ordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion. Stockpiled topsoil must be either vegetated with indigenous grasses or covered with a suitable fabric to prevent erosion and invasion by weeds.
- All cut and fill surfaces need to be stabilized with appropriate material or measures when major civil works are complete.
- All equipment must be inspected regularly for oil or fuel leaks before it is operated. Leakages must be repaired on mobile equipment or containment trays placed underneath immobile equipment until such leakage has been repaired.
- Soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site or the soil can be regenerated using bio-remediation methods.

- Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person.

Noise –

- Noisy fixed facilities should be located well away from noise sensitive areas. Once the proposed final layouts are made available by the Contractor(s), the sites must be evaluated in detail and specific measures designed in to the system.
- The provisions of SANS 10103:2008 will apply to all areas at the perimeter of the site, within audible distance of residents.
- Working hours to be agreed upon with PM, so as to minimise disturbance to adjacent landowners and community members.
- No unnecessary noise disruption or disturbance during school hours is to be allowed.
- No amplified music will be allowed on the site. The use of radios, tape recorders, compact disc players, television sets etc. will not be permitted unless at a level that does not serve as an intrusion to adjacent land-owners.
- Construction activities generating output levels of 85dB or more will be confined to the hours during normal working hours.
- The Contractor will take preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to minimise complaints regarding noise and vibration nuisances from sources such as power tools.
- With regards to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities.
- Construction working hours will also be set accordingly to prevent unnecessary disruption, usually from 07H00-17H00. If the set hours need to change or be extended, this will be communicated with the relevant landowners.
- Noise attenuation features are to be considered for inside the pump house to lower the noise levels created.
- All the precautionary measures to minimize noise to the acceptable standard are maintained in terms of Noise Control Regulations.

Dust –

- Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, straw, brush packs, chipping), particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area, access roads, site yard, etc.
- Fine materials must be covered during transportation.
- Set speed limits of 35km/hr or less for site traffic on paved roads and 10-15km/hr on unpaved surfaces. Speed controls on vehicles have an approximately linear effect on dust

emissions. Thus, by reducing the speed from 30km/hr to 15km/hr dust emissions can be reduced by 50%.
- Speed limits to be strictly adhered to.
- The Contractor will take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, and pre-notification of affected parties).
- Dust control measures to be in place.

Lights –

- Prior to construction the position and type of lighting will be planned to ensure unnecessary light pollution will be eliminated.
- All lighting installed on site must not lead to unacceptable light pollution to the surrounding community and natural environment (e.g. use of down-lighters).
- Light is to be directed away from the residences, in order to minimise light pollution to private properties.

Erosion –

- Protect areas of the construction site that are susceptible to erosion through suitable measures (e.g. watering, planting, retaining structures, commercial anti-erosion compounds).
- Particular care must be taken to prevent carrying of sediment onto roadways.
- Any erosion channels caused by construction activities to be suitably stabilised and rehabilitated.
- All efforts to prohibit ponding on surface and ensure stormwater runoff is channelled from the site must be made. The method used will be appropriate to the expected stormwater flows and the topography and geology of the site.
- Erosion and donga crossings must be dealt with as river crossings. Appropriate soil erosion and control procedures must be applied to all embankments that are disturbed and destabilized.
- Soil erosion control on site must be prevented at all times, i.e. pre-, during- and postconstruction activities.
- Erosion control measures to be implemented in areas sensitive to erosion such as near water supply points, edges of slopes, etc. These measures could include the use of sand bags, hessian sheets, retention or replacement of vegetation.

Cement and Concrete Batching –

- Cement mixing to take place on an impervious surface (e.g. cement mixing pit).
- Batching operations to take place in a designated area, which will be kept clean at all times.
- Location of batching plant to be approved by the PM, with due consideration of the relevant management measures.
- Ensure separation of clean and dirty water from batching plant.
- Wastewater from batching operations to be suitably disposed of.

- Waste concrete and cement sludge to be removed on a regular basis (to prevent overflowing) and to be disposed of at a suitable facility.
- Unused cement bags will be stored in an area not exposed to the weather and packed neatly to prevent hardening or leakage of cement.
- Used cement bags will be stored so as to prevent windblown dust and potential water contamination. Used bags will be disposed of adequately at a licenced waste disposal facility.
- Limit concrete batching to single sites where possible.
- Concrete transportation will not result in spillage.
- Cleaning of equipment and flushing of mixers will not result in pollution, with all contaminated wash water entering the waste water collection system.
- To prevent spillage onto roads, ready mix trucks will rinse off the delivery shoot into a suitable sump prior to leaving the site.
- Suitable screening and containment will be in place to prevent windblown contamination from cement storage, mixing, loading and batching operations.
- All contaminated water and fines from exposed aggregate finishes will be collected and stored in sumps and will be adequately disposed of.
- All visible remains of excess concrete will be physically removed on completion of the plastering or concrete pouring and disposed of in an acceptable manner.
- Any spilled concrete to be cleaned up immediately.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.
- Contractor to conduct environmental monitoring for air quality (dust), noise and water quality.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Results from environmental monitoring programme • Updated dust suppression schedule • Approved method statement • Related entries into Public Complaints Register • Visual inspections (photographic records) • Disposal records • Proof of training

13.3.15 Management of Topsoil

Management Objective:

- Ensure suitable removal, storage, transportation of topsoil for reuse during rehabilitation.

Target:

- An adequate amount of recovered topsoil from disturbed areas to be stored for future use.
- No visual evidence of erosion from topsoil stockpiles.
- No visual evidence of erosion from areas where topsoil has been reinstated.

Management Actions:

- Topsoil from the construction camp should be stored for post-construction rehabilitation work and should not be disturbed more than is absolutely necessary.
- Topsoil should also be stored in such a way that does not compromise its plant-support capacity.
- Determine the average depth of the topsoil prior to excavations.
- Identify suitable areas to store topsoil.
- Stockpiled topsoil should not be compacted and should be replaced as the final soil layer. No vehicles are allowed access onto the stockpiles after they have been placed.
- Stockpiled soil should be protected by erosion-control berms if exposed for a period of greater than 14 days during the wet season. The need for such measures will be indicated in the site-specific report.
- Topsoil stripped from different sites must be stockpiled separately and clearly identified as such. Topsoil obtained from sites with different soil types must not be mixed.
- Remove topsoil from areas to be affected by construction activities.
- Topsoil to be adequately protected from contamination from construction activities and by aggregate, cement, concrete, fuels, litter, oils, domestic and industrial waste.
- Protect stored topsoil from compaction.
- Wind and water erosion-control measures to be implemented to prevent loss of topsoil.
- Do not store topsoil in drainage lines or areas exposed to strong winds or heavy rain.
- Following the construction phase, the topsoil should be used in rehabilitation of affected areas and landscaping around the development.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO	Monthly	• Approved method statement

& ECO		• Visual inspections (photographic records) • Proof of training

13.3.16 Management of Excavations

Management Objective:

- Minimise environmental impacts associated with excavations.

Target:

- No damage to sensitive environmental features outside construction area during excavations.

Management Actions:

- Construction activities to remain within the designated construction areas.
- Subsoil and overburden should be stockpiled separately to be returned for backfilling in the correct soil horizon order.
- Suitable barricading to be erected around open excavations/trenches, as per the Construction Regulations (2014). Provide signage as a warning of open excavations.
- Divert runoff away from excavations, where necessary.
- Trench lengths will be kept as short as practically possible.
- Trench walls are to be stabilised using battering, shoring and bracing or similar techniques depending on the stability of the trench sides (where relevant).
- Inspect open trenches at least daily basis to ensure that animals have not become trapped. Such animals will be safely removed and released, where possible. Special equipment for handling of venomous snakes should be available on site to ensure safe removal.
- Filing of trenches to make provision for subsidence.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Approved method statement • Updated Excavation Register • Visual inspections (photographic records) • Proof of training

13.3.17 Management of Blasting

Management Objective:

- Minimise environmental impacts associated with blasting.

Target:

- Compliance with blasting-related legislation and standards.
- No blasting-related impacts to private property, livestock or human health.

Management Actions:

- Prior to commencing with blasting activities, the blasting Contractor should submit a Method Statement which should comply with the Explosives Regulations (2003) and all relevant SANS standards and health and safety standards for mitigating blasting.
- The Contractor shall employ industry standard methods to control the impact of blasting and limit the risk of damage to buildings and structures by reducing blast vibrations induced in the rock mass, eliminating fly rock and limiting air-blast and noise to acceptable levels.
- Blast mats should be used wherever fly-rock may result in damage to any infrastructure or where it could result in death or injury of animals, or where damage could be caused to sensitive environmental features.
- Blasting operations should be controlled to ensure sound pressure levels are kept below the generally accepted 'no damage' level of 140 decibels.
- All explosives shall be transported, stored and handled in accordance with applicable laws and good design engineering and constructions practices.
- Blasting operations are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timings of explosions. The number of blasts per day should be limited, blasting should be undertaken at the same times each day and no blasting should be allowed at night.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Noise and vibration levels • Approved method statement • Proof of notification of landowners • Related entries into Public Complaints Register • Visual inspections (photographic records) • Proof of training

13.3.18 Management of Socio-Economic Impacts

Management Objective:

- To have no adverse impact on private properties in the area.
- The protection of existing farming activities.
- To maintain a good relationship and communications with the private landowners and farmers.

Management Target:

- No private property or infrastructure are damaged during construction.
- Interruption of farming activities during construction is minimised.

Management Actions:

- Prior notice must be given to residents, sensitive social receptors, such as schools or clinics, and businesses adjacent to work areas of any noisy or dusty activities that may be undertaken.
- Where appropriate and necessary, dust suppression measures need to be applied to limit dust impacts on adjoining land uses.
- Any damages incurred must be repaired on the same day if possible for any pipes, fences, etc.
- Construction working hours will also be set accordingly to prevent unnecessary disruption, usually from 07H00-17H00. If the set hours need to change or be extended, this will be communicated with the relevant landowners.
- Where-ever possible, the final routing of the project infrastructure should be moved to avoid impacts. For example, if the pipeline servitude is such that it allows pipeline movement to the extent that an impact on a dwelling can be avoided, this should be done.
- Where impacts cannot be avoided, all negotiations and payments relating to compensating affected landowners should be conducted and concluded before construction begins.
- Those landowners who will be required to sell their property to uMngeni-uThukela Water must be compensated for any business that is operating on the premises.
- All landowners whose businesses will be affected by the proposed project should be compensated to the full value of their immovable assets and any loss of income.
- Negotiations should take place between the landowner and uMngeni-uThukela Water for any compensation of potential income denied as a result of the servitude agreements.
- Install area lighting with shields to reduce light emitted to the sky and to neighbours;
- Install as few as possible lights;
- All area lights should be installed with timers or photoelectric cells to ensure they are only operational during night hours.
- Where possible install area lighting linked to movement sensors, thus the lights are only used when they are needed.

- Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.
- The main contractor should employ non-core labour from the four sub-places as far as possible during the construction phase.
- The principles of Expanded Public Works Programme can be used during construction.
- Spaza shops may open next to the site as a consequence of construction. These should be controlled by the contractor to limit their footprint and to ensure that the eThekwini Metro Municipality – Informal Trading By-Law, 2014 is complied with.
- Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site.
- Minimise impacts on the safety of road users. Restrictions should include appropriate speed limitations, restricting travel times to daylight hours, communication measures and the establishment of haul routes.
- Measures must be put in place to prevent construction vehicles from entraining dirt onto public roads.
- A condition survey of the local roads to be used during the construction phase should be made prior to construction
- Haul and delivery routes should be defined and adhered to during the construction phase.
- Maintenance of local roads should take place during the construction phase to ensure that the local roads used by the contractor are left in the same or better condition than they were prior to the start of construction.
- Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms.
- Mitigation measures management should be adhered to according to the relevant specialist studies.
- All employment of locally sourced labour should be controlled on a contractual basis. If possible, and if the relevant Ward Councillors deem it necessary, the employment process should include the affected Ward Councillors.
- People in search of work may move into the area, however, the project will create a limited number of job opportunities. Locally based people should be given an opportunity.
- No staff accommodation should be allowed on site.
- The provisions of the OHS Act 85 of 1993 and the Construction Regulations of 2014 should be implemented on all sites.
- Account should be taken of the safety impacts on the local community when carrying out the longitudinal aspects of the project, such as the pipelines.
- Contractors should establish HIV/AIDs awareness programmes at their site camps.
- The sites should be fenced for the duration of construction and operation phases.
- All contractors staff should be easily identifiable through their uniforms.
- A security policy should be developed which amongst others requires that permission be obtained prior to entering any property and provisions controlling trespassing by contractor staff.

- No staff, apart from security staff, should be allowed to reside at contractor camps.
- Contractors should establish a crime awareness programmes at their site camps.
- Prior should be given to surrounding communities of blasting events;
- Construction work should take place during working hours – defined as 07h00 to 17h00 on weekdays and 07h00 to 14h00 on Saturdays. Should overtime work be required, that will generate noise, consultation with the affected community or landowner should take place.
- If a risk existing of damage taking place on a property as a result of construction, a condition survey should be undertaken prior to construction
- The contractor is to make good any damage that occurs on any property as a result of construction work
- Where crops are damaged, compensation is to be paid to the farmer for the loss of these crops.

Responsibilities:

- Applicant.
- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Documented and functional GRM • Proof of communication • Related entries into Public Complaints Register

13.3.19 Management of Visual Aspects

Management Objective:

- Minimise impacts to the aesthetics/visual quality.
- Ensure that the visual appearance of the construction site is not an eyesore the adjacent areas.

Target:

- No complaints regarding impacts to visual quality.

Management Actions:

- Advertising and lighting will be in accordance with relevant standards.
- Lighting must not constitute an eyesore/hazard to users of the road and the surrounding community.
- Lighting will be sufficient to ensure security but will not constitute ‘light pollution’ to the surrounding areas.

- The site will be shielded /screened to minimise the visual impact, where practicable.
- Where practicable, development designs to compliment the natural surroundings in order to preserve a sense of place.
- On-going housekeeping to maintain a tidy construction area.
- Discourage the unnecessary usage of high voltage lights during through-night construction. Lighting should be kept to an acceptable minimum and designed in position and height to minimise negative impact on surrounding inhabitants.
- The extent of unnecessary damage to natural surrounds must be kept to a minimum.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Approved method statement • Related entries into Public Complaints Register • Visual inspections (photographic records) • Proof of training

13.3.20 Management of Flora

Management Objective:

- Preserve protected flora species outside of construction areas.
- Control alien plants and noxious weeds.

Target:

- No unpermitted disturbance to protected flora species.
- No disturbance to vegetation outside the development footprint.
- Ongoing eradication of alien plants and noxious weeds.

Management Actions:

- Comply with the requirements of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), National Forests Act (Act No. 84 of 1998) and National Veld and Forest Fire Act (Act No. 101 of 1998).
- Implement the Alien Invasive Management Plan (**Appendix B**) and the Plant Rescue and Protection Plan (**Appendix F**).
- Ecological sensitive areas and their appropriate buffers must be protected and should not be degraded by the activities arising from the proposed development.
- Should it be approved, risk to the project through delays would be best managed by applications to the competent permit authorities for Provincially Protected Plants (EKZNW)

and/or Nationally Protected Species (DFFE) immediately upon receipt of the Environmental Authorisation so that after a 'walk-through' of the site, plants can be removed or more preferably relocated where appropriate.

- A suitably qualified Botanist/Ecologist should be appointed to conduct a walkthrough survey before construction when the routes and servitudes are pegged and if these species are encountered, permits should be sought.
- It is recommended that prior to construction, the *Hypoxis hemerocallidea* plant species recorded must be searched and rescued and then following construction activities, they can be re-established at the site.
- Should approval for the proposed development be forthcoming, the presence of Specially Protected species in the general area such as *Millettia grandis, Dioscorea cotinifolia* (Dioscoreaceae) and *Ledebouria ovatifolia* (Liliaceae/Hyacinthaceae) and nationally Protected Trees species such as *Pittosporum viridiflorum* and *Sclerocarya caffra* will require the developers to apply to the relevant competent authority for permits to move or destroy such species (as appropriate) should they be encountered during construction.
- Restrict the construction activities to the smallest practical/functional footprint.
- Care should be taken to keep soils stabilized when removing vegetation during construction and as part of alien plant eradication. Also, care should be taken to prevent the contamination of soil (and ultimately ground water) from accidental fuel and oil spills from earth-moving and construction equipment and vehicles.
- Plant permits for specially protected species (i.e. *Millettia grandis, Dioscorea cotinifolia* and *Ledebouria ovatifolia*) must be obtained from relevant authorities prior to any construction activities commencing. This includes Nationally Protected Trees species such as *Pittosporum viridiflorum* and *Sclerocarya birrea caffra* which are protected in terms of the National Forests Act (Act No. 84 of 1998).
- The indigenous trees constituting a natural forest and/or protected tree species in terms of the National Forests Act (Act No. 84 of 1998) that will need to be disturbed, will require that the relevant licence application form(s) be completed by the applicant and submitted to the DFFE Forest Resource Protection (based in Pietermaritzburg) for review and consideration prior to any vegetation clearing taking place.
- Once pegged, the pipeline route must be inspected during the summer season by a suitably qualified Botanist/Ecologist and all conservation-important species identified (such as *Aloe maculata, Hypoxis hemerocallidea, Kniphofia spp.* and *Freesia laxa*) will require a permit from EKZNW to be translocated prior to any construction activities.
- Indigenous trees removed during construction must be replaced at a ratio of 1:3 (3 trees must be planted for every 1 tree removed) and protected trees at a ratio of 1:10 (10 trees must be planted for every 1 tree removed).
- The clearing of vegetation must be kept to a minimum and restricted to the working servitude. It is practical to reduce the construction servitude from 40m to a servitude considered suitable to work within by the construction engineers within sensitive areas. ECO should be available on-site prior and during construction activities on areas of high sensitivity.

- Loss of indigenous tree in the forested areas must be kept to a minimum (i.e. the working servitude should be minimized).
- Erosion control measures must be implemented in areas sensitive to erosion such as edges of slopes, exposed soil etc. These measures include but are not limited to - the use of sandbags, hessian sheets, silt fences and retention or replacement of vegetation.
- Comprehensive rehabilitation of the corridor must follow closely behind the active working zone to prevent further degradation, erosion and alien invasive plant infestation.
- Disturbed areas must be rehabilitated immediately after construction has been completed in that area by planting appropriate indigenous plant species.
- During the construction phase, workers must be limited to areas under construction within the project area and access to the undeveloped areas must be strictly regulated.
- Rehabilitated areas must be monitored to ensure the establishment of re-vegetated areas and to ensure a ground cover of over 85%.
- Pipeline sections that traverse D'MOSS:
    - A strict working servitude needs to be instituted that takes into account 1) 32m Watercourse Buffer, 2) a working servitude of not more than 20m in D'MOSS (Good & Intermediate) and 3) a working servitude of less than 30m in D'MOSS (Degraded & Transformed). Infrastructure located in areas under D'MOSS (unknown) should follow the Precautionary Principle to natural resources management and utilize the 20m working buffer.
- Pipeline sections within 32m of watercourse buffer zone and/or crossings points:
    - Maintain a 20m or less servitude.
    - Implement ecosystem rehabilitation and erosion control measures.
    - Due to the high propensity of Invasive Alien Plants observed at most of the sites investigated during field assessments, it is recommended that the Control Invasive Alien Plant populations 50m upstream and downstream of crossing points should take place for an appropriate period but not less than 1 follow up.
    - Due to the observed domestic and in some cases industrial waste pollution within the riparian zones, it is recommended that pollution control measures should be strictly adhered to in order to reduce the impacts on the aquatic species that depend on the rivers and riparian zones.
- General Terrestrial:
    - Work within a defined servitude (40m or less);
    - Ensure that pollution is avoided;
    - Have demarcated areas for workers during breaks, ablution and equipment storage and repair; and
    - Maintain low noise levels.
- Biodiversity Importance (Protected Flora):
    - Locate and verify;

  - Demarcate and avoid boundary. Clear demarcations of breeding areas and high potential areas of occurrence; and
  - Relocate Plants.
- Spread of Invasive Alien Plants (IAPs):
  - Document alien species found on site;
  - Alien plant distribution and densities;
  - Document and record alien control measures implemented;
  - Review alien control success rate;
  - Document rehabilitation measures implemented and success achieved in problem areas; and
  - Monitor re-vegetated area and the success of indigenous species re-establishment.
- Rehabilitation:
  - Avoid exposing the area to soil erosion; and
  - Ensure correct rehabilitation takes place during construction phase (phased rehabilitation planning).
- Additional requirements:
  - All construction activities should be restricted to the construction footprint.
  - All disturbed areas that are no longer in use should be rehabilitated using 100% indigenous trees/vegetation.
  - Where the pipeline bisects natural moist riparian zones, it should be shifted towards any transformed or alien invaded sections.
  - A suitably qualified ecologist should facilitate and monitor the indigenous vegetation disturbance process.
  - Construction sites and any temporary access roads as well as construction camp should be successfully rehabilitated to their preconstruction state or better as soon as the construction activities are completed.
  - Rehabilitation must be conducted in a progressive manner (i.e. once construction in an area has been completed the area will be rehabilitated). The rehabilitation of the area with indigenous vegetation must coincide with the rainfall events and all invasive vegetation shall be removed.
  - The EMPr must strictly be adhered to.
  - Should there be a need to disturb indigenous trees in a natural forest and/or protected tree species a licence application must be submitted to DAFF office in Pietermaritzburg prior any activity commencement.

Responsibilities:

- Applicant – acquire permits
- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Pre-construction survey report • Permits on record • Records of herbicide usage • Visual inspections (photographic records), including relocated species and presence of alien invasive species • Approved method statement • Proof of training

13.3.21 Management of Fauna

Management Objective:

- Ensure the protection of animals

Target:

- No direct/indirect harm to animals from construction activities.

Management Actions:

- Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), Natal Nature Conservation Ordinance (15 of 1974) and Animal Protection Act (No. 71 of 1962).
- Ecological sensitive areas and their appropriate buffers must be protected and should not be degraded by the activities arising from the proposed development.
- To avoid and minimise direct mortality of species during the construction phase, every effort should be made to save and relocate any animal encountered during site preparation that cannot flee of its own accord. These animals should be relocated to a suitable area immediately outside the proposed footprint, but under no circumstance to an area further away. No formal searches would be required before site preparation starts as these would in all likelihood prove ineffective.
- The Contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase.
- Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- Trenches should only be opened as needed to prevent excessive open trench ahead of the pipe laying process. All trenches must have at least one sloping side to allow animals to escape and must be checked on a daily basis for animals which may have fallen in.
- Rehabilitation of areas where vegetation was disturbed during the construction phase should be undertaken to ensure that habitats for animals are restored.

- Restrict the construction activities to the smallest practical/functional footprint.
- The riparian habitat provides migratory corridors and in order to protect habitat for the detected African/Cape Clawless Otter. Maintain the buffer zone, as determined in the Aquatic and Wetland Baseline and Impact Assessment Report.
- Rocky areas provide valuable habitat for herpetofauna and care should be exercised during construction within these areas to minimize disturbance and habitat loss.
- Sensitive Amphibian Breeding Areas:
  - Locate and verify breeding site;
  - Demarcate and avoid working within 15m of site boundary; and
  - Assess site integrity.
- Biodiversity Importance (Protected Fauna):
  - Locate and verify areas of possible occurrence and breeding; and
  - Demarcate and avoid boundary.

Responsibilities:

- Applicant – acquire permits (if applicable)
- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Pre-construction survey report • Permits on record • Visual inspections (photographic records), including relocated species • Approved method statement • Proof of training

13.3.22 Management of Archaeological and Cultural Features

Management Objective:

- To have no adverse impact on the historical inheritance of the area.
- The protection of land considered to be of traditional cultural value.
- The protection of known archaeological sites against vandalism, destruction and theft during the construction phase.
- To avoid damage to or destruction of previously unknown or excavated archaeological artefacts during construction.
- The preservation and appropriate management of new findings should these be discovered during construction.

Management Target:

- No archaeological and cultural resources or graves to be damaged during construction.

Management Actions:

- Include mitigation measures identified as part of environmental pre-construction survey.
- It is recommended that at inception of earthworks for the pipeline alignment within the Umkhomazi valley, that an Archaeologist be appointed to monitor excavations. This will enable the archaeologist to ascertain whether subterranean in situ material is possibly present; and the possible areal extent of any deposits.
- Should Fountain View Rd, running directly in front of the temple, be used as access for plant and trucks during construction; the implementing of dust suppression mechanisms should then be considered.
- All staff involved in the construction phase should be advised of the nature of cultural heritage resource material that may be found and informed of their obligation to report any items found that they may happen upon during the construction process.
- For any chance finds, all work will cease in the area affected and the Contractor will immediately inform the PM. A registered Heritage Specialist must be called to site for inspection. Amafa and Research Institute must be informed about the finding.
- Permits to be obtained in terms of the National Heritage Resources Act (Act No. 25 of 1999) if heritage resources are to be impacted on and for the removal of graves.
- Should any remains be found on site that is potentially human remains, the South African Police Service and archaeologist should also be contacted.
- All archaeological, palaeontological and historical sites older than 60 years are protected in terms of the National Heritage Resources Act (Act No 25 of 1999). In terms of this Act it is an offence to disturb any part of such site or material without a permit, should an archaeological or other such discovery be made during any excavations.
- Under no circumstances shall archaeological artefacts be removed, destroyed or interfered with by the Contractor, his employees, his sub-contractors or his sub - contractors' employees. Any person who causes intentional damage to archaeological or historical sites and artefacts could be penalised or legally prosecuted in terms on the National Heritage Resources Act (Act No 25 of 1999).

Responsibilities:

- Applicant – acquire permits.
- Applicant to appoint suitably qualified specialists.
- Specialists to execute the management actions.
- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Implement Chance Finds procedure • Pre-construction survey report • Permits on record • Inspection of barricading and visible signage (photographic records) • Visual inspections (photographic records) • Records of chance finds • Proof of training

13.3.23 Management of Existing Services and Infrastructure

Management Objective:

- Prevent impacts to existing services and infrastructure, including agricultural infrastructure.
- Adhere to agreements made with owners / custodians of the services and infrastructure.

Management Target:

- No unwarranted complaints regarding adverse impacts to existing services and infrastructure.
- No adverse impacts to existing services and infrastructure.
- All relevant approvals to be obtained prior to working within existing servitudes (including roads, railway line, gas pipeline, powerlines, telephone lines, etc.).

Management Actions:

- Identify and record all existing services and infrastructure.
- Negotiations and agreements with owners and landowners regarding existing services and infrastructure to be undertaken prior to construction and adhered to throughout the project lifecycle.
- Conform to requirements of relevant service providers. Agreements to be in place.
- Ensure access to infrastructure is available to service providers and owners at all times.
- Immediately notify service providers of disturbance to services. Rectify disturbance to services, in consultation with service providers. Maintain a record of all disturbances and remedial actions on site.
- Notify landowners of any disruptions to essential services and infrastructure.
- Deviate/relocate landowners' existing services and infrastructure (e.g. reticulation, irrigation lines, pump houses), where possible and if necessary, to accommodate project activities.
- Land compensation (if necessary) to adhere to legal framework.

- Adequate reinstatement and rehabilitation of environment affected as a result of the project.
- The applicant must consult eThekwini Electricity's mains records (held in the drawing office at eThekwini Electricity Headquarters), for the presence of underground electrical services. In addition, should any overhead line and/or servitude be affected, the specific permission of the Head: Electricity must be sought regarding the proposed development.
- The relocation of MV/LV electrical services, if required in order to accommodate the proposed development, will be carried out at the expense of the applicant.

Responsibilities:

- Applicant – acquire permits.
- PM and ECO - to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Approved method statement. • Wayleaves on record. • Related entries into Public Complaints Register. • Visual inspections (photographic records).

13.3.24 Management of Water on Site

Management Objective:

- Minimise environmental impacts associated with storm water as well as water services for construction workers.
- Minimise stormwater runoff from the site onto neighbouring roads.
- Minimise water use through recycling and water efficient practices.

Target:

- No visual evidence of erosion caused by wastewater or stormwater practices.
- No environmental contamination associated with wastewater or stormwater practices.

Management Actions:

- All construction activities to comply with the National Water Act (Act No. 36 of 1998).
- During the construction stage, water will be required for various purposes, such as concrete batching, washing of plant and equipment in dedicated areas, dust suppression, potable use by construction workers, etc. Water tankers will supply water to the site.
- Water use during construction phase may only be extracted or used from a water source approved by the relevant authority.

- Manage stormwater from construction site to avoid environmental contamination and erosion.
- Establish a dedicated vehicle maintenance area and wash-bay, where suitable storm water management measures are in place to prevent pollution.
- Manage stormwater from construction site to avoid environmental contamination and erosion.
- Stormwater runoff from workshops, vehicle maintenance area, wash-bays and other potential pollution sources shall be collected and treated in hydrocarbon separation pits/tanks before discharged to drains and waterways.
- Measures must be taken to divert unpolluted water and runoff away from the site.
- All wastewater discharges to comply with legal requirements associated with the National Water Act (Act No. 36 of 1998).
- Ensure proper storage of material (including fuel, paint) that could cause water pollution. Ensure proper storage and careful handling of hazardous substances with spill prevention materials at hand.
- Visual inspections for the occurrence of erosion should be undertaken on a weekly basis.
- It is imperative there is proper management of stormwater on the site during and after construction.
- After construction, the site should be contoured to ensure free flow of runoff and to prevent ponding of water.
- Drainage must be controlled to ensure that runoff from the project area will not culminate in off-site pollution or result in damage to properties downstream of any stormwater discharge

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Proof of water use authorisation from DWS, if relevant • Monitoring records of water use • Visual inspections (photographic records) • Approved method statement • Proof of training

13.3.25 Management of Watercourses

Management Objective:

- Ensure that the watercourses (including affected rivers, natural channels, and drainage lines) are protected and incur minimal negative impact to resource quality (i.e. flow, water quality, riparian habitat, morphology, and aquatic biota).
- Existing water use entitlements not to be affected.

Target:

- Minimise the habitat unit destruction and potential loss of wetland/aquatic-dependent biodiversity.
- Unaltered downstream flow regime.
- Downstream water quality to remain within acceptable ranges, as determined through baseline monitoring.
- Ecological category not to be influenced by construction activities.

Management Actions:

- General –
    - Establish and maintain buffer zones.
    - Implement an adequate water, sediment and biological monitoring programme together in the form of a management action plan.
    - Construction in the watercourse channel and riparian area must be undertaken as quickly as possible to limit environmental impact.
    - Construction work within watercourse channels and riparian areas should be undertaken outside of the peak rainfall period of the year, as far as possible.
    - Where disturbance to the watercourse is unavoidable, modification should be kept to a minimum in terms of the removal of riparian vegetation or the excavation of the steam channel, bed or banks.
    - Stream bank vegetation may only be removed where absolutely necessary and the river banks must be stabilised and re-vegetated immediately following construction.
    - Trench breakers or other compacted impervious materials must be installed where required on steep slopes to prevent pipeline trench subsurface erosion and scouring.
    - Trench breakers must be installed adjacent to watercourses; at the edges of wetlands; and, on other similar sites where unconsolidated backfill or organic materials are prone to washing out.
    - Trench breakers must be installed on each side of a wetland where the pipeline trench crosses and may drain the wetland.
    - A single access point through riparian vegetation for abstraction and weir updated construction activities should be utilised.
    - All construction materials must be removed following the completion of this project.

- A water bar diverts water flowing down a surface (e.g. road) to one side. This reduces the volume of water that flows down the surface and the subsequent erosion that occurs;
- During the excavation of watercourses, flows should be diverted around active work areas where required. Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion;
- Construction areas should be demarcated, and watercourses marked as “restricted” in order to prevent the unnecessary impact too and loss of these systems;
- Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;
- Prevent uncontrolled access of vehicles through the wetlands that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds; and
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- It is recommended that the pipelines be constructed under the wetlands to avoid the loss of these systems. In the event that the pipelines need to be constructed across the results, an offset strategy is recommended to compensate for the loss of these systems (and functioning).

- Each component poses a different risk to the delineated wetlands and as a result the buffer assessment is calculated accordingly:
  - The pipeline associated with the project has been given a calculated buffer zone of 15m for the construction- and operational phases.
  - The access road associated with the project has a calculated buffer zone of 28m for the construction- and operational phases.
  - The pump station associated with the project has been given a calculated buffer zone of 23m and 15m for the construction- and operational phases, respectively.
  - The raw water reservoir associated with the project have been given a calculated buffer zone of 23m and 15m for the construction- and operational phases respectively.
  - A buffer zone of 30m from the edge of the riparian zone is recommended. Considering that the proposed project is for an instream barrier, the buffer derived is only applicable for associated construction activities such as mixing areas, stockpiles and laydown yards. Based on the proposed developments level of disturbance, a riverine buffer zone of 32m from the delineated riparian zone is recommended.

- Maintenance of connectivity
  - The implementation of the fishway must adhere to the recommendations of the Aquatic and Wetland Specialist as provided in the Water Resource Assessment and the Goodenough Weir Fish Movement.

- In order to facilitate the movement of fish species, a fish ladder is recommended as the mitigation action. The following fishway concepts should be adhered to in the preferred option:
  - The fishway should have water passing through it during both high flows and low flows to encourage fish to make use of the fishway no matter the flow levels;
  - The fishway should cater for both rheophilic (fastmoving water) and anti-rheophilic (slow moving water) fish species. This can be achieved through having several different flow velocity areas across the fishway;
  - It is recommended that a rough stone surface be cast into the fishway channel floor to cater for climbing and crawling species;
  - Rocks used for the fishway should have flat sides with rounded edges (typical of quarried rock) rather than rounded rocks, as they provide a variety of water velocity and depths that easy for fish to navigate;
  - Pools or depressions of varying sizes and depths should be created at random throughout the length and width of the fishway and should be placed behind large rocks to create lower velocity resting areas (eddies) for fish. The more pools incorporated in the design, the more successful the fishway will be; and
  - Additional guidelines for fishway design include:
    - Channel slope (gradients) – between 1/8 and 1/10 is recommended for South African fish;
    - Fishway entrance – furthest point upstream that the fish can penetrate, usually in a suitable pool (low turbulence with sufficient depth) located at the base of the low level weir;
    - Fishway exit – located in a quiet area, sheltered, low velocity to prevent fish from being swept downstream and to afford protection from predators;
      - the invert level of the exit (i.e. water inflow) should be lower than that of the weir overflow to ensure the low flows are directed down the fishway;
    - Depth of pool - small fish (20 to 200 mm in length: at least 300 mm to reduce predation and limit turbulence;
      - Larger fish (>200 mm): at least 500 mm can be deeper to reduce turbulence, if necessary;
    - Length of pool – at least 2.5 times the length of the largest fish catered for;
    - Drop height between pools/rock levels – maximum of 100 mm to cater for small fish;

- Mitigation for Impaired Water Quality Protection
  - No construction vehicles may be washed within a watercourse or in a manner that may result in contamination of a water resource.
  - Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;

- Laydown yards, camps and storage areas must be beyond the water resource areas and associated buffers where applicable;
- During construction contractors used for the project must have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- All chemicals and toxicants during construction must be stored in bunded areas;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- Cofferdams are temporary structures used to displace water and provide dry access to usually submerged areas (such instream construction and maintenance of bridges etc). They can also be built to prevent water coming into contact with high impact zones (e.g. construction and mining sites) and reduce the amount of sedimentation and pollution;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- No dumping of construction material on-site may take place; and
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

- Mitigation for Erosion and Sedimentation
  - Storm water drainage must not damage surrounding properties or infrastructure.
  - Appropriate and adequate erosion protection measures must be implemented throughout the construction phase.
  - Silt laden water must be diverted into sediment ponds and sediments allowed to settle before water is discharged into any watercourse.
  - Silt fences or other silt and sediment trapping devices must be installed around all areas used for the storage of excavated and fill materials.
  - Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion.
  - During the excavation of watercourses, flows should be diverted around active work areas where required. Water diversion must be temporary and re-directed flow must not be diverted towards any stream banks that could cause erosion.

- All removed soil and material must not be stockpiled within the delineated buffer zones. Stockpiling should take place outside of the buffer zones. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.
- A water bar diverts water flowing down a surface (e.g. road) to one side. This reduces the volume of water that flows down the surface and the subsequent erosion that occurs.
- Water from flumes, diversions or other methods used to maintain downstream flow must not cause erosion or introduce sediment into the channel.
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- The natural sediment regime of the river reach should be replicated through the continuous discharge of fine sediments through a passive process from the weir and abstraction facilities.

- Pipeline Trench Rehabilitation Measures
  - Techniques to minimise the compaction of soils, such as restricting access during wet conditions, and using protective boarding and low ground pressure machinery should be used.
  - Trench must be side dug (where possible) from the access routes, or already disturbed areas.
  - Trenches must be dug on-line (where applicable) creating narrower trenches.
  - If necessary, soil should be carefully removed and stored for subsequent reinstatement. Excavated soils must be replaced in same sequence as they were removed, and must be compacted to an equivalent compaction as the surrounding soil profile.
  - Where trench breakers are required, these must be imported appropriately and installed by the backfill crew, ahead of backfilling.
  - Careful separation of soil types/ strata as identified.
  - To ensure correct backfilling, the soil that is removed from the trench at its deepest point must be laid closest to the trench. The first layer of topsoil must be laid furthest away from the trench.
  - Excess spoil must be temporarily windrowed over the trench to permit natural settling of the material prior to the reinstatement phase.
  - Stripping must be demarcated to avoid unnecessary removals (survey pegs). Keep stripping areas to a minimum footprint area.
  - Trenches within watercourses must be in excess of 1m to enable interflow within the system.

- Vegetation should be stripped / removed in a phased manner. Where possible, store vegetation for re-planting. Impacted areas can be re-vegetated using sods from removed vegetation.
- To avoid compaction of the backfilled trench, ripping should be done to a maximum depth of 300mm in two directions at right angles.
- Ripping should be conducted during the drier period.
- After construction, compacted topsoil should be ripped and vegetation re-planted or seeds dispersed.

- Monitoring Programme
  - Considering the potential negative impacts to aquatic ecology arising from the proposed project, an aquatic monitoring programme has been recommended. Details pertaining to this monitoring programme are provided below.

Table 10: Aquatic Biomonitoring Programme

Component	Details
Survey Period	Annual monitoring during the low flow period (April-October) for a period of 5 years through construction and into operation.
Survey Location	A site upstream, adjacent and downstream of the abstraction works should be surveyed.
Survey Method	The techniques applied in the desktop study should be utilised. Alternatively, other approved methods can be adapted.

- Mitigation for Release of Sediment
  - The release of sediment back to the river facilitates the impacts the project will have on sediment load within the river and estuary. The placement of 5 814 ton/a additional sediment in the river by flushing at Ngwadini and 29 673 ton/a sediment at Goodenough is supported.
  - Flushing of sediments should only be carried out during small floods and not under normal or low river flow conditions.
  - It is recommended to investigate and implement the exploitation of other sources of sand, instead of sandmining
  - As mitigation measure, consideration should be given to apply long settlers at the proposed Ngwadini abstraction works to settle out smaller grain sizes (fine sand and silt), which could be flushed back to the river during floods.
  - To further minimize the impact of the abstraction works on the river and to assist restoration of the sediment balance, flushing of boulder traps and gravel traps should be of a short duration, of non-cohesive sediment and aerated, and only during floods.
  - If the settler at the Goodenough weir is to return the flushed sediment, this should be done during floods even though relatively short settlers typically cannot trap the washload.

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly	• Public complaints register. • Aquatic biomonitoring programme • programme • Contractor's method statement.

13.3.26 Management of Rehabilitation

Management Objective:

- Adequate reinstatement and rehabilitation of construction areas
- Conduct concurrent or progressive rehabilitation of areas affected by construction activities that are situated outside of the construction footprint.

Target:

- Complete site clean-up.
- Reinstate and rehabilitate areas disturbed by construction activities that are located outside of the construction area.
- Landscaping of the finished development to complement the surrounding area.

Management Actions:

- Determine and record (including photographic records) baseline conditions of the areas to be affected by construction activities for rehabilitation purposes.
- Implement the Re-Vegetation and Habitat Rehabilitation Plan (**Appendix I**), including management actions for the following:
    - Removal of structures and infrastructure;
    - Inert waste and rubble;
    - Hazardous waste and pollution control;
    - Landscaping;
    - Topsoil replacement and soil amelioration;
    - Ripping and scarifying;
    - Planting;
    - Grassing; and
    - Maintenance.

- Implement the Alien Invasive Management Plan (**Appendix B**) and the Plant Rescue and Protection Plan (**Appendix F**).

Responsibilities:

- PM and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

Responsible party	Frequency	Evidence of compliance
Contactor/EO & ECO	Monthly, throughout construction period, as relevant to the concurrent or progressive reinstatement and rehabilitation of affected areas. Up to end of defects liability period	▪ Approved method statement ▪ Pre-construction survey report ▪ Visible signage ▪ Related entries into Public Complaints Register ▪ Visual inspections (photographic records) ▪ Proof of training

13.4 Operational Phase

13.4.1 General Environmental Management

Where relevant, all management actions are to be carried forward from the construction phase to the operational phase. Specific management measures for the operational phase follow.

13.4.2 Management of Access, Routine Maintenance Inspections & Maintenance Works

- Restrict operation and maintenance activities to the development footprint. Where this is not possible, the landowners need to be notified and adequate arrangements made in advance.
- During maintenance related activities, damage to access roads as well as existing structures and infrastructure, will be restored to its original condition.
- Ensure that landowners and the community have reasonable access to their land during the operational phase.
- Maintain access control to the servitude.
- Strict adherence to speed limits by operation and maintenance vehicles.
- All roads used for maintenance inspections and maintenance works shall be maintained and repaired where necessary.
- Monitoring to be conducted to detect erosion and remediate.
- Protect all areas susceptible to erosion resultant from operation and maintenance activities.
- Maintenance work shall be undertaken as per the provisions of the EMPr for the pre-construction and construction phases, as relevant.

13.4.3 Management of Vegetation

- Undertake survey to assess the recovery of the environment, success of reinstatement and rehabilitation measures, and presence of invasive species. Implement corrective measures, if necessary.
- Implement the following plans:
    - Re-Vegetation and Habitat Rehabilitation Plan (**Appendix I**);
    - Alien Invasive Management Plan (**Appendix B**); and
    - Plant Rescue and Protection Plan (**Appendix F**).

13.4.4 Management of Fauna

- The disturbance of fauna should be minimized.
- Animals residing within the designated area shall not be unnecessarily disturbed.

13.4.5 Waste Management

- Develop and implement a waste management system, based on the waste management hierarchy of reduce, re-use, recycle, treatment and disposal.
- All residents must be encouraged to apply best practice in terms of waste management.
- Recycling opportunities to be provided at the centre (e.g. bins).

13.4.6 Water Conservation

- Investigate water efficient systems.
- Ensure that water is used sparingly.
- Irrigation systems to function optimally to avoid water wastage.
- Repair leaks timeously.

13.4.7 Management of Spillages

- Implement the Emergency Preparedness Response Plan (**Appendix D**) and Contingency Plan (**Appendix C**) for the development.
- Spillages of hazardous material (e.g. hydrocarbons) to be appropriately cleaned.
- Large spillages of hazardous material (>15litres depending on the nature of the material and the receiving environment), to be cleaned and remediated by a competent service provider.
- Hazardous waste to be appropriately disposed of.

13.4.8 Stormwater Management

- Implement the Stormwater Management Plan (**Appendix G**) for the development.

- Prevent water quality deterioration of the receiving watercourses from stormwater discharges.
- Prevent erosion associated with stormwater runoff.
- No illegal discharges into the stormwater system to be allowed.
- Ensure the following maintenance activities are undertaken:
- Stormwater Channels:
    - Routine cleaning and de-silting of channels.
    - Removal of debris to prevent channel blockage.
- Stormwater Culverts:
    - Routine cleaning and de-silting of culverts.
    - Removal of debris to prevent culverts blockage.
    - Repairs of embankment after overtopping of culvert structure.
    - Routine inspection and repairs, if required, of approach channels and foundations.
- Detention Ponds:
    - To ensure optimal performance, the detention ponds shall require annual inspection, preferably at the start of the rainy season. The following is a brief list of the maintenance items that require consideration.
    - All detention ponds must be accessible from the internal road network.
    - Routine mowing and the possible trimming and / or removal of unwanted vegetation – twice per annum.
    - The removal of debris and litter from the outlets to prevent clogging and from the basin area to improve aesthetics - three times a year. The first cleaning at the beginning of the summer rainy season (September, October), the second after the first rains (November) and the last towards the end of the rainy season (February).
    - The condition of the structures, embankments, inlets and outlets must be inspected annually. This must include checking for animal burrows, cracking, bulging and subsidence of pond walls.
    - Silt will need to be removed at least three times a year. First cleaning at the beginning of the summer rainy season (September, October), secondly after the first rains (November) and again towards the end of the rainy season (February). It is also likely that during the construction period more frequent silt removal will be required.
    - The emergency spillway should be clear of obstructions at all times.

13.4.9 Management of Roads and Traffic

- Implementation of the Traffic Management Plan (**Appendix H**).

13.4.10 Management of Watercourses

- A natural flow and sedimentation regime must be promoted as far as practically possible.
- The incorporation and implementation of the fish ladder is to be undertaken to maintain connectivity.
- Compensation for affected landowners for land lost to inundation as a result of the weirs.

- Recommendations for the required scouring of pipelines:
  - The objective is to reduce the potential negative impacts to local watercourses.
  - Scouring outfall points are recommended to be located outside of the delineated buffer zones stipulated in this study.
  - Scouring outfall structures are recommended to be designed in a manner that dissipates discharge and does not lead to erosion.
  - Should potable water be discharged, vigorous aeration to control chlorine concentrations is recommended.
  - The monitoring of free chlorine, ammonia and chloramine downstream of the discharge points is recommended.
  - Scouring outfall structures are recommended to be located outside of regular flooded areas, should this prove unfeasible, the structures must be designed to withstand flooding and regularly monitored for signs of erosion.
  - Sensitive instream habitats such as those with cobbled substrates or within the eroding zonation must be prioritised for protection over more gentle gradient river reaches.
  - Standard monitoring of the scouring points during and immediately after the scouring activities is recommended to take place.
- The Ecological Water Requirements (EWR) stipulated in DWS (2014) should be strictly adhered to for the proposed project. The EWR site 3 on the uMkhomazi River system is located approximately 8km upstream of the proposed weir upgrade. The table below presents the EWR for EWR site 3 on the uMkhomazi.

Table 11: Ecological Water Requirements at EWR3 in the uMkhomazi River (DWS, 2014)

Month	Low Flows		High Flows	
	Drought (90%) (m^3/s)	70% (m^3/s)	Daily Average (m^3/s)	Duration (Days)
Oct	2.249	3.076		
Nov	3.198	4.100	45	6
Dec	3.909	6.048	45	6
Jan	5.557	7.905	75	7
Feb	6.606	9.845	75	7
Mar	7.796	9.922	45	6
Apr	6.645	8.915		
May	4.736	6.412		
Jun	3.009	4.063		
Jul	1.659	2.980		
Aug	1.420	2.341		
Sep	1.647	2.651		

13.4.11 Management of Estuary Impacts

- To achieve the Recommended Ecological Category (REC) for the estuary, namely ensuring that minimum freshwater flow at the head of the estuary should not drop below 1.2 m^3/s.
- Limit time taken to complete construction activities in the uMkhomazi River.
- Constrain spatial extent of impacts to the minimum required.
- Redirect water flow downstream of weir.
- Return sediment to system guided by an appropriate management scenario.
- It is recommended that projected water requirements for the LUBWSS should be achieved through implementation of one of the flow scenarios identified in the Mvoti to Umzimkulu Classification study (DWS, 2014) that enabled the uMkhomazi estuary to achieve the REC for the system of a "B" (viz. MK21, MK22, MK23, and MK42). The Mvoti to Umzimkulu Classification study (DWS, 2014) also included a number of additional non-flow related environmental offset interventions that should be implemented in conjunction with the recommended flow scenario. While it is recognised that most of these interventions are not within the power of uMngeni-uThukela Water to implement these are nonetheless included here for completeness:
    - Remove sandmining from the upper reaches below the Sappi Weir to increase natural function, i.e. restore intertidal area;
    - Restoration of vegetation upper reaches and along the northern bank, e.g. remove aliens and allow disturbed land to revert to natural land cover (is already on upwards trajectory);
    - Curb recreational activities in the lower reaches through zonation and improve compliance;
    - Reduce/remove castnetting in the mouth area through estuary zonation or increase compliance; and
    - Relocate upstream, or remove, the Sappi Weir to restore upper 15% of the estuary.
- Detailed baseline and long-term monitoring requirements to ascertain impacts of changes in freshwater flow to the uMkhomazi Estuary and any improvement or reductions therein are listed in Mvoti to Umzimkulu Classification study (DWS, 2014) and are replicated in the tables below. Ultimate responsibility for implementing these monitoring activities resides with the DWS. However, given that uMngeni-uThukela Water will be the primary recipients of the water abstracted from the uMkhomazi River, they should be expected to fund the baseline (Year 1) monitoring costs at least.

Table 12: Recommended baseline monitoring requirements

Ecological Component	Monitoring Action	Temporal Scale (Frequency & When)	Spatial Scale (No. Stations)
Hydrodynamics	Record water levels	Continuous	At bridge
	Measure freshwater inflow into the estuary	Continuous	Above the estuary
	Aerial photographs of estuary (spring low tide)	Every 3 years	Entire estuary

Ecological Component	Monitoring Action	Temporal Scale (Frequency & When)	Spatial Scale (No. Stations)
Sediment dynamics	Bathymetric surveys: Series of cross-section profiles and a longitudinal profile collected at fixed 500 m intervals, but in more detailed in the mouth (every 100m). The vertical accuracy should be about 5 cm.	Every 3 years	Entire estuary
	Set sediment grab samples (at cross section profiles) for analysis of particle size distribution (PSD) and origin (i.e. using microscopic observations)	Every 3 years (with invert sampling)	Entire estuary (6 stations)
Water quality	Measurements of organic content and toxic substances (e.g. trace metals and hydrocarbons) in sediments along length of the estuary, where considered an issue (must also include sediment grain size analysis of samples).	Every 3 - 6 years	Focus on sheltered, depositional areas
Microalgae	▪ Record relative abundance of dominant phytoplankton groups, i.e. flagellates, dinoflagellates, diatoms and blue-green algae. ▪ Chlorophyll-a measurements taken at the surface, 0.5 m and 1 m depths, under typically high and low flow conditions using a recognised technique, e.g. HPLC. ▪ Intertidal and subtidal benthic chlorophyll-a measurements.	Monthly sampling for 2 years (seasonal trends)	Entire estuary (5 stations)
Fish	Record species and abundance of fish, based on seine net and gill net sampling. The data will establish Zone specific baselines and provide a measure of natural variability. They should be based on replicate sampling of stations and wet and dry seasons.	Late spring, summer and two winter survey every year for 3 years	Entire estuary (9 stations) (increase to 12 to include Zone D)
Birds	Undertake counts of all water associated birds, identified to species level.	A series of monthly counts for a yea	Entire estuary (3 sections)

Table 13: Recommended long-term monitoring requirements for the uMkhomazi estuary

Ecological Component	Monitoring Action	Temporal Scale (Frequency & When)	Spatial Scale (No. Stations)
Hydrodynamics	Record water levels	Continuous	At bridge
	Measure freshwater inflow into the estuary	Continuous	Above the estuary
	Aerial photographs of estuary (spring low tide)	Every 3 years	Entire estuary
Sediment dynamics	Bathymetric surveys: Series of cross-section profiles and a longitudinal profile collected at fixed 500 m intervals, but in more detailed in the mouth (every 100 m). The vertical accuracy should be about 5 cm.	Every 3 years	Entire estuary
	Set sediment grab samples (at cross section profiles) for analysis of PSD and origin (i.e. using microscopic observations).	Every 3 years (with invert sampling)	Entire estuary (6 stations)
Water quality	Water quality (e.g. system variables, nutrients and toxic substances) measurements on river water entering at the head of the estuary.	Monthly continuous	DWS WQ monitoring station(U1H006)

Ecological Component	Monitoring Action	Temporal Scale (Frequency & When)	Spatial Scale (No. Stations)
	Longitudinal salinity and temperature profiles ((and any other in situ measurements possible e.g. pH, DO, turbidity) collected during high and low tide at: End of low flow season (i.e. period of maximum seawater intrusion/closed mouth). Peak of high flow season (i.e. period of maximum flushing by river water).	Seasonally every year	Entire estuary (9 stations)
	Water quality parameters (i.e. system variables, and inorganic nutrients) taken along the length of the estuary (at least surface and bottom samples).	Coinciding with biotic surveys or when significant change in quality expected	Entire estuary (9 stations)
	Measurements of organic content and toxic substances (e.g. trace metals and hydrocarbons) in sediments along length of the estuary, where considered an issue (must also include sediment grain size analysis of samples).	Every 3 - 6 years	Focus on sheltered, depositional areas
Microalgae	Record relative abundance of dominant phytoplankton groups, i.e. flagellates, dinoflagellates, diatoms and blue-green algae. Chlorophyll-a measurements taken at the surface, 0.5 m and 1 m depths, under typically high and low flow conditions using a recognised technique, e.g. HPLC, fluoroprobe. Intertidal and subtidal benthic chlorophyll-a measurements,	Summer and winter survey every 3 years	Entire estuary (5 stations)
Macrophytes	Map the area covered by the different macrophyte habitats during a field survey. Compile a species list and check for expansion of invasive plants, reed, sedge and grass areas.	Summer survey every 3 years	Entire estuary
Invertebrates	Record species and abundance of zooplankton, based on samples collected across the estuary at each of a series of stations along the estuary; Record benthic invertebrate species and abundance, based on subtidal and intertidal core samples at a series of stations up the estuary, and counts of hole densities; Measures of sediment characteristics at each station	Winter/low flow survey every year	Entire estuary (6 stations) include extra upper station if weir removed
Fish	Record species and abundance of fish, based on seine net and gill net sampling.	Late spring/ summer and winter survey every year. Repeated within season if any Ecospec is not met	Entire estuary (9 stations) (increase to 12 to include Zone D)
Birds	Undertake counts of all water associated birds, identified to species level.	Winter and summer surveys every year Coordinated Waterbird Counts (CWAC)	Entire estuary

14 REFERENCES

AECOM, 2016. Lower uMkhomazi Bulk Water Supply Scheme Detailed Feasibility Study and Preliminary Design.

DWA, 2014. Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area: Volume 2b: Supporting Information on the Determination of Water Resource Classes – uMkhomazi (U1) Estuary EWR and Ecological Consequences of Operational Scenarios. Prepared by MER for Rivers for Africa eFlows Consulting PTY Ltd. DWA Report: RDM/WMA11/00/CON/CLA/0614.

APPENDIX A FINAL SITE LAYOUTS

PRIMARY CONTROL POINTS

NAME	Y	X	Z	DESCRIPTION
PW2	39766.499	3335459.552	244.738	16mm Iron Peg in Concrete
PW3	38528.509	3335492.298	174.569	16mm Iron Peg in Concrete

PHOTO CONTROL

SR4	38118.780	3335584.144	84.298	12mm Peg with Y Photo Control Mark
SR5	39734.742	3335932.191	334.773	12mm Peg with Y Photo Control Mark

NOTE:
1. HEIGHT IS BASED ON SA GEOID 2010 AND AVERAGE OF SURROUNDING TRIGNOMETRIC POINTS
2. NO OTHER CONTROL TO BE USED EXCEPT AS GIVEN ON THIS LIST

LEGEND
FIBRE OPTIC CABLE

N

PERMANENT ACCESS ROAD TO WEIR
FIBRE OPTIC CABLE
NGWADINI WEIR AND PUMPSTATION
UMKHOMAZI RIVER
CAMP AND LAYDOWN AREA
ROAD CONSTRUCTED AS PART OF ADVANCED WORKS CONTRACT
RISING MAIN
PW2
PW3
SR4
SR5
ACCESS TO JACKING LOCATION TO BE COMPLETED UNDER THIS CONTRACT FOLLOWING SITE CLEARANCE
INLET / RISING MAIN TERMINAL STRUCTURE
TUNNEL / PIPEJACK
ACCESS TO JACKING LOCATION TO BE COMPLETED UNDER THIS CONTRACT FOLLOWING SITE CLEARANCE
OUTLET STRUCTURE
ROAD CONSTRUCTED AS PART OF ADVANCED WORKS CONTRACT
NGWADINI DAM FSL
FARM NO.17448
FOR TENDER PURPOSES ONLY

ON ORIGINAL
0 5 10 15 20 25 30 40 50MM

REFERENCE DRAWINGS

DRAWING No.	TITLE/DESCRIPTION	SOURCE

NOTES:

REV	DATE	DESCRIPTION	NAME	SIGNATURE
A	18/10/23	ISSUED FOR TENDER	D.SHAW	

APPROVED

	BY	DRAWN	CHECKED
SURVEYED		xxx	xxx
DESIGNED	D SHAW	C ROSS	D SHAW

CONSULTING ENGINEER APPROVAL

CONSULTING ENGINEER DRAWING No. J38056-GB-5.1-NGW-000-002-CE-A

NAME:	SIGNATURE:	DATE:
N.MKHWANAZI		18/10/23

GIBB ENGINEERING & ARCHITECTURE

UMGENI WATER APPROVAL

ENGINEERING SERVICES

	NAME	SIGNATURE	DATE
DESIGN ENGINEER	xxx		
ENGINEERING MANAGER	ALAN KOCKOTT		

OPERATIONS

	NAME	SIGNATURE	DATE
MAINTENANCE MANAGER	xxx		
AREA MANAGER	xxx		
ASSET MANAGER	xxx		
GENERAL MANAGER	xxx		

310 Burger Street
Pietermaritzburg
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Tel 033 341 1111

UMNGENI-UTHUKELA WATER • AMANZI
Improving Quality of Life and Enhancing Sustainable Economic Development

LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME: PHASE 1

CONSTRUCTION OF NGWADINI ABSTRACTION WORKS, PUMPING SYSTEM AND RISING MAIN

SITE LAYOUT, FIBRE OPTIC CABLE AND BENCHMARKS

SCALE	SHEET SIZE	SHEET
AS SHOWN	A1	1 OF 1

CONTRACT No.	DRAWING No.	REVISION
2018/008	SC/H01/CI.00156/CIV/ 2000002	A

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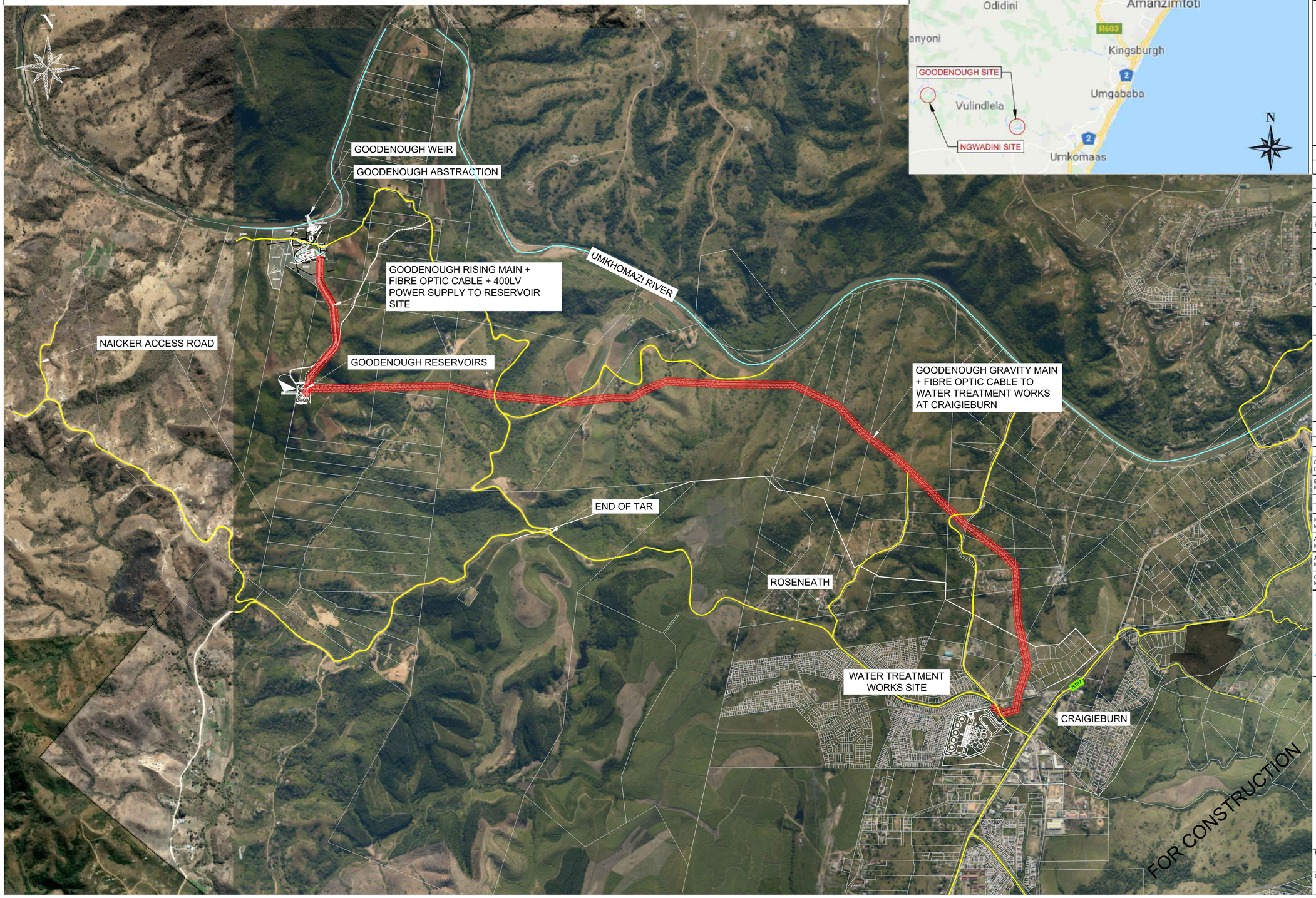

ON ORIGINAL

0 5 10 15 20 25 30 40 50MM

REFERENCE DRAWINGS

DRAWING No.	TITLE/DESCRIPTION	SOURCE

GENERAL NOTES:

REV	DATE	DESCRIPTION	CHK	APPD
0	06-05-22	ISSUED FOR CONSTRUCTION	DS	NM

CONSULTING ENGINEER APPROVAL

Project No:	Drg No:	Rev:
J38056	GB-4.1-GNF-000-001-CE-C	0

Approved By:

N.MKHWANAZI

Drawn By:	Designed By:	Reviewed By:
C ROSS	C MAINE	D SHAW

GIBB ENGINEERING & ARCHITECTURE

UMGENI WATER APPROVAL

ENGINEERING SERVICES

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DESIGN ENGINEER			
ENGINEERING MANAGER			

OPERATIONS

	NAME	SIGNATURE	DATE
MAINTENANCE MANAGER			
AREA MANAGER			
ASSET MANAGER			
GENERAL MANAGER			

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UMGENI WATER • AMANZI
Improving Quality of Life and Enhancing Sustainable Economic Development

LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME: PHASE 1

GOODENOUGH ABSTRACTION, DESILTING AND PUMPING SYSTEM

LOCALITY PLAN AND FIBRE-OPTIC CABLE ROUTE

FILE No.	SCALE	SHEET SIZE	SHEET
	1 : 500	A1	1 OF 1
CONTRACT No.	DRAWING No.		REVISION
2018/008	SC/H01/CIV/CI.00156/ 1000001		0

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QUARRY PIPELINE AND RESERVOIR SITE LAYOUT

SCALE 1:2500

ISSUED FOR APPROVAL

REFERENCE DRAWINGS

DRAWING No.	TITLE/DESCRIPTION	SOURCE

NOTES:

REV	DATE	DESCRIPTION	NAME	SIGNATURE APPROVED
A	XX/XX/24	FOR APPROVAL		

	BY	DRAWN	CHECKED
SURVEYED			
DESIGNED			

CONSULTING ENGINEER APPROVAL

CONSULTING ENGINEER DRAWING No.

NAME:	SIGNATURE:	DATE:
D. NARAINSAMY		

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UMNGENI-UTHUKELA WATER APPROVAL

ENGINEERING SERVICES

	NAME	SIGNATURE	DATE
DESIGN ENGINEER	.		
ENGINEERING MANAGER	ALAN KOCKOTT		

OPERATIONS

	NAME	SIGNATURE	DATE
MAINTENANCE MANAGER	.		
AREA MANAGER	.		
ASSET MANAGER	.		
EXECUTIVE OPERATIONS	.		

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LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME- PHASE 2

GRAVITY MAIN BULK WATER PIPELINE FROM WTP TO QUARRY RESERVOIR

SITE LAYOUT

PROJECT No.	SCALE	SHEET SIZE	SHEET
DD172800	AS SHOWN	A0	1 OF 1
CONTRACT No.	DRAWING No.		REVISION
202X/XXX	SC/H01/PIPE/CI.00156/2/22/0500		A

APPENDIX B ALIEN INVASIVE MANAGEMENT PLAN

Lower Umkhomazi Bulk Water Supply Sceme

Invasive Alien Plant Management Plan

PREPARED FOR NM ENVIRONMENTAL

BY

JEFFREY MAIVHA (*Pr. Sci. Nat.*)

06 March 2018

Table of Content

Introduction

The applicant (Umngeni Water) proposes to construct a water pipeline and associated infrastructure in the lower uMkomazi area within the EThekwini Municipality. The main aim of this assessment was to identify any limitations that the environment may impose on the proposed development and the proposed project on the receiving biophysical, cultural and socio-economic environments.

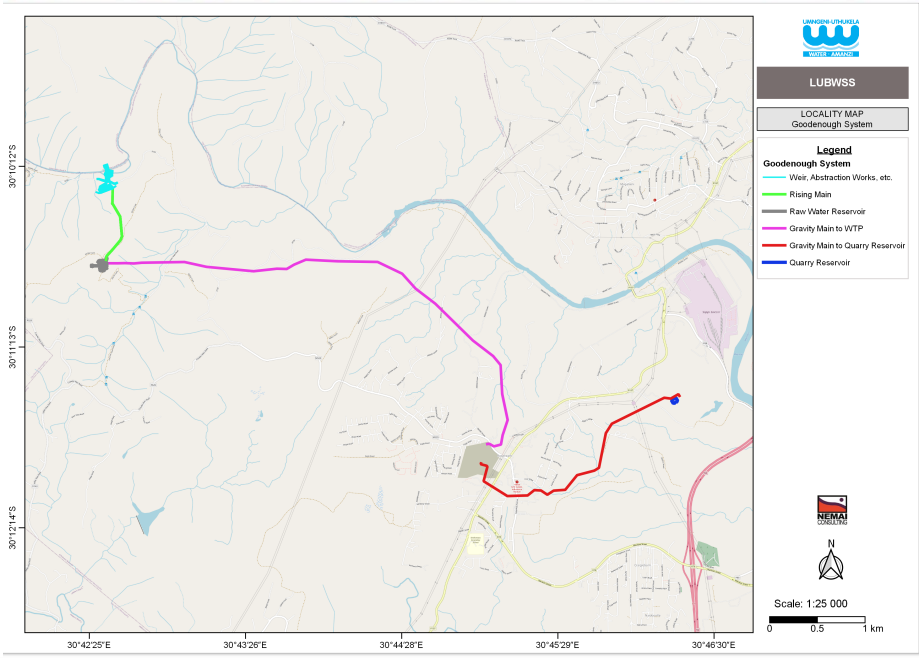

Fig 1: Proposed area of activity

ALIEN MANAGEMENT PLAN OBJECTIVE

The purpose of the Alien Plant Management Plan is to provide a framework for the management of alien and invasive plant species during the construction and operation at the Lower Umkhomazi Bulk Water Supply Scheme. The broad objectives of the plan includes the following:

- Ensure alien plants do not become dominant in parts or the whole site through the control and management of alien and invasive species presence, dispersal & encroachment,
- Initiate and implement a monitoring and eradication programme for alien and invasive species,
- Promote the natural re-establishment and planting of indigenous species.

PROBLEM BACKGROUND & LEGISLATIVE BACKGROUND

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (Act 43 of 1983), as amended in 2001, requires that land-users clear Declared Weeds from their properties and prevent the spread of Declared Invader Plants on their properties.

The Conservation of Agricultural Resources Act (CARA) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader.

- Category 1 – These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a land-user must obtain a water use licence as these plants consume large quantities of water.
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species: Bromilow, C. 2010. Problem Plants and Alien Weeds of South Africa. Briza, Pretoria

ACTIVITIES LIKELY TO IMPACT ALIEN SPECIES ABUNDANCE

Alien species are expert at taking advantage of disturbance. The weedy and annual species listed below will take advantage of any disturbance at the Lower Umkhomazi Bulk Water Supply Scheme site. The site is also in close proximity to several sources of alien species, including roads and housing which has abundant alien species along the track as well as the areas of intensive agriculture (e.g. sugarcane farming). As a result any activities which result in the loss of plant cover or the disturbance of the soil surface will stimulate the invasion of alien species. This includes clearing for access roads, substations, treatment works and any other infrastructure. Within the context of the site, areas which receive runoff and those areas of disturbed soil which are not rehabilitated are likely to be most vulnerable to alien invasion, in the short term as well as during the operational phase of the development. As runoff can create erosion and disturbance, it is also likely that poor runoff management at the site will promote the invasion of alien species.

ALIEN SPECIES PRESENCE & ABUNDANCE AT LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME

The Lower Umkhomazi Bulk Water Supply Scheme site has a rather high dominance of alien and invasive species. The density of alien species within the intact vegetation is high, furthermore, the most commonly encountered species have been listed below:

Acacia mearnsii	*Amaranthus hybridus*
Achyranthes aspera	*Ambrosia artemisiifolia*
Agave sp.	*Arundo donax*
Agave sisalana	*Bauhinia variegate*
Ageratum spp.	*Bidens pilosa*
Boerhavia diffusa	*Mimosa pudica*
Caesalpinia decapetala	*Musa hybrid*
Callisia repens	*Nicandra physaloides*
Canna indica	*Oxalis corniculata*
Cardiospermum grandiflorum	*Oxalis rosea*
Cassia spp.	*Passiflora edulis*
Centella asiatica	*Passiflora subpeltata*
Chromolaena odorata	*Pennisetum purpureum*
Citrus limon	*Persea Americana*
Coix lacryma-jobi	*Plantago lanceolata*
Conyza spp.	*Plectranthus comosus*
Costus sp.	*Psidium guajava*
Cynodon dactylon	*Richardia brasiliensis*
Dactyloctenium australe	*Ricinus communis*
Desmodium incanum	*Rumex acetosella*
Emex spinosa	*Senna didymobotrya*
Eucalyptus spp.	*Sesbania bispinosa*
Euphorbia cyathophora	*Solanum mauritianum*
Euphorbia hirta	*Solanum nigrum*
Galinsoga parviflora	*Sphagneticola trilobata*
Ipomoea purpurea	*Stachytarpheta urticifolia*
Jatropha integerrima	*Syzygium cumini*
Lagerstroemia indica	*Tagetes minuta*
Lantana camara	*Tecoma stans*
Litsea glutenosa	*Thevetia peruviana*
Malvastrum coromandelianum	*Tithonia diversifolia*
Mangifera indica	*Verbena brasiliensis*
Melia azedarach	*Xanthium strumarium*
Melilotis albus	

Most alien plants are restricted to disturbed areas such as along roadsides and near watering points, other species generally do not invade intact veld, but quickly invade disturbed areas and as they are already present in the area and would increase rapidly at the site following construction activities of the Lower uMkhomazi project. The additional information on these alien species including photographs can be found on the following website: http://www.invasives.org.za/invasive-plants.html

GENERAL CLEARING & GUIDING PRINCIPLES

- Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area.
- The lighter infested areas should be cleared first to prevent the build-up of seed banks.
- Pre-existing dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are currently.
- Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses. The current site is relatively small and therefore seed input from adjacent already disturbed areas is likely to be the major source of alien species at the site. Therefore for effective control, a larger area than the site may need to be cleared.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.

CLEARING METHODS

- Different species require different clearing methods such as manual, chemical or biological methods or a combination of both.
- However care should be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum.
- Fire is not a natural phenomenon in the area and fire should not be used for alien control or vegetation management at the site.
- The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the Working for Water Website.

USE OF HERBICIDES FOR ALIEN CONTROL

- Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also be ineffective for many woody species which resprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:
- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products should be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following guidelines should be followed: Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.

ALIEN PLANT MANAGEMENT PLAN

CONSTRUCTION PHASE ACTIVITIES

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

Action	**Frequency**
The ECO is to provide permission prior to any vegetation being cleared for development	Daily
Daily Clearing of vegetation should be undertaken as the work front progresses – mass clearing should not occur unless the cleared areas are to be surfaced or prepared immediately afterwards.	Weekly
Where cleared areas will be exposed for some time, these areas should be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute Weekly (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose should be brought onto site. Brush from cleared areas should be used as much as possible. The use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation is not allowed within 32m of any wetland, 80m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas.	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment.) Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly
Alien vegetation regrowth on areas disturbed by construction must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines should adhere to best-practice for the species involved. Such information can be obtained from the DWS Working for Water website.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only.	
Wetlands and other sensitive areas should remain demarcated with appropriate fencing or hazard tape. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

MONITORING – CONSTRUCTION PHASE

The following monitoring actions should be implemented during the construction phase of the development

Monitoring Action	Indictor	Timeframe
Document alien species present at the site	List of alien species	Preconstruction
Document alien plant distribution	Alien plant distribution map within priority area	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannual

OPERATIONAL PHASE ACTIVITIES

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Action	Frequency
Surveys for alien species should be conducted regularly. Every 6 months for the first two years after construction and annually thereafter. All aliens identified should be cleared.	Every 6 months for 2 years and annually thereafter
Where areas of natural vegetation have been disturbed by construction activities, revegetation with indigenous, locally occurring species should take place where the natural vegetation is slow to recover or where repeated invasion has taken place following disturbance	Biannually, but revegetation should take place at the start of the rainy season
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used.	When necessary

MONITORING – OPERATIONAL PHASE

The following monitoring and evaluation actions should take place during the operational phase of the development.

Monitoring Action	Indictor	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually

Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Biannually
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

CONCLUSIONS AND RECOMMENDATIONS

- As there are already a number of alien species present at the Lower uMkhomazi site, alien invasion following disturbance at the site is likely to occur rapidly. As a result, alien control should begin during the construction phase to ensure that the density and abundance of alien species remains manageable into the operational phase.
- In the short-term, soil disturbance is likely to be the dominant driver of alien invasion at the site. While, in the long-term the distribution of runoff is likely to be a key driver as those areas which receive water will be wetter and likely to contain a higher alien abundance.
- As disturbance is the major initial driver of alien species invasion, keeping the disturbance footprint to a minimum is a key element in reducing alien abundance. Wherever possible, the indigenous vegetation should be left intact as this will significantly reduce the likelihood of alien invasion.

PHOTOS OF ALIEN PLANTS IN THE PROJECT AREA

Figure 1: Weir section

Figure 2: Pumpstation site

Figure 3: Goodenough reservoir site

Figure 4: gravity main crossing forest

Figure 4: pipeline crossing section

Figure 5: rising main section

WTW site 2

Figure 6: alien Infestation on WTW 2

Figure 7: More infestation (e.g. wattle trees)

WTW site 1

Figure 8: D'MOSS area infested with aliens

Figure 9: WTW 1 site

APPENDIX C CONTINGENCY PLAN

terratest
Geotechnical, Environmental & Earth Science Consultants

APRIL 2015

CONTINGENCY PLANS

Prepared by:

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1 Introduction

Contingency planning is necessary to prevent a delayed, or ineffective, response to unexpected events, or conditions that may occur during construction within, or near the watercourse. An essential element of contingency planning is the preparation of emergency plans and procedures that can be activated if unexpected events occur. The absence of contingency plans may result in short or long term environmental effects and could possibly threaten public safety.

Unexpected events requiring contingency planning that may occur during construction in or near a watercourse include: extreme climatic events, changes to the construction schedule and human error. Although these problems are not anticipated to occur during construction, the contractor should be prepared to take appropriate action quickly. The Environmental Control Officer (ECO) should identify situations where contingency plans should be implemented. The Contractor should also know when to immediately cease operations, for example in the case of watercourse siltation. All staff should be made aware of and know how to implement contingency emergency response measures.

2 Watercourse Siltation/Erosion

During the construction phase, it is necessary to divert stormflows from areas up-catchment of the construction sites, around the respective sites so that erosion and flooding within the site are avoided. In order to ensure that the potential risk of flooding of the construction site is kept to acceptable limits, the proposed stormwater management berms and channels have been sized to accommodate the 1:10 year return period storm event.

Even with appropriately installed erosion and siltation control measures, extreme runoff events could result in the collapse of sediment control fencing, slope or trench failures and other problems which could lead to siltation of watercourses. If siltation to a watercourse occurs, construction should cease immediately until the situation is rectified. Immediate action should be taken to install temporary measures to contain the extent of erosion and siltation as quickly as possible. Temporary protection measures such as sediment control fencing, sand bags, riprap, logs or planks should be utilized.

When site conditions permit, permanent protection measures should be installed on erodible surfaces including hydroseeding, erosion control matting, rip-rap, and willow staking. Additional layers of sediment control fencing or a more sturdy type of base fencing may be appropriate in erosion prone areas until vegetative cover is established.

If siltation has occurred, due to a construction related activity (e.g. dewatering), the activity should be halted immediately until the situation is rectified. A supply of emergency materials (i.e. sediment control fencing, rip rap, shovels, etc.) should be available on-site. The Contractor should be fully prepared to respond quickly to siltation events.

All site staff are to be advised to implement the following protocol should an erosion event occur:

1. Stop the activity that has caused the erosion;
2. Contain the erosion as quickly as possible;
3. Report the incident to the Site Manager.
4. Utilising emergency materials stored on site, make repairs and install a more permanent/effective erosion control structure.
5. The site manager is to determine in conjunction with the ECO if there is any environmental impact;
6. If deemed necessary by the Department of Economic, Development, Tourism & Environmental Affairs (EDTEA), DWS or the ECO, remedial follow-up action must be taken;
7. **All** incidents and remedial actions taken must be documented by the ECO and kept on file for reference purposes.

The above protocol must be relayed to site staff during their induction and must be discussed on a regular basis during Toolbox Talks.

3 Vegetation Damage

Potential for damage to vegetation situated adjacent to the construction area increases during wet soil conditions. In the event of flooding and/or siltation of lands adjacent to area, small swales should be hand dug to direct water away from the construction area. In areas where topography will not allow natural drainage, it may be necessary to use pumps to prevent prolonged standing water.

If the Contractor damages woody vegetation beyond the identified limit of clearing, the ECO should assess the damage and recommend appropriate measures. The Contractor should be shown the damage to ensure the problem does not reoccur.

4 Construction Delays

Delays in the construction schedule may be necessary due to field conditions, work progress or land acquisition issues. To minimize the impact of a construction delay, and if field conditions permit, equipment should be moved and construction should be resumed in a more suitable location. Once field conditions permit, construction should commence or resume at problem areas.

5 Accidental Spills

Where concrete, bitumen, petrochemicals or any other hazardous substances are spilled, clean-up and rehabilitation must be executed as a matter of urgency. All concrete mixing that is to take place for the construction phase must be undertaken in a controlled environment and on a suitable surface to avoid the contamination of the soil surrounding the area where

the concrete is to be used. Any spillage or concrete that has leaked off the designated mixing areas needs to be collected and disposed of at a registered landfill site or re-used in construction. Waybills for safe disposal at registered landfill sites must be provided on request to the Environmental Control Officer (ECO).

Construction phase chemicals (e.g. diesel, lubricating oils, paints and solvents) are to be stored in a temporary impervious bund if they are stored on site, bunds must at a minimum have a capacity for 110% of the volume of chemical which is being stored and be fitted with an appropriate outlet valve. Absorbent materials and containers (i.e. spill kits) must be kept on site at all times whether chemicals are stored on site or transported to the site daily, all vehicles which transport chemicals to and from the site must be equipped with appropriate spill kits and drip trays. Should temporary bunds be utilised for chemical storage, rainwater which may collect within these areas (if no roof is provided) must be emptied after every rainfall event and is to be regarded as potentially contaminated. Storm water from these areas must not be released to the environment unless it is established by chemical analysis (e.g. COD) that water is not contaminated.

Portable construction equipment (e.g. generators, construction plant, pumps etc.) should preferably be parked on impervious surfaces; alternatively drip trays need to be provided for portable construction equipment. Any chemical spills onto soil must be reported by site staff to the Designated Environmental Officer (DEO) and ECO. The DEO must evaluate the extent of spill and must report spill to the Department of Economic, Development, Tourism & Environmental Affairs (EDTEA) and Department of Water and Sanitation if it is regarded as significant. Monitoring and / or rehabilitation of impacted soils and / or groundwater may be required depending on authority or ECO requirements. The Contractor is responsible for the cost of monitoring and / or rehabilitation of any soils / groundwater impacted by chemical spills from construction activities.

In order to reduce the occurrences of spillages / contamination no concrete, or bitumen transport vehicles must be washed on site and all general plant maintenance must take place at a designated area with an impermeable surface. Drip trays must also be made available on the site and utilised during all decanting and refuelling activities that involve hazardous chemicals.

Safe disposal certificates must be retained by Contractor and / or Project Manager for any disposal of materials associated with chemicals / chemical spills.

All site staff are to be advised to implement the following protocol should a spillage occur:

Should any chemical / hazardous substance spillages occur the following general steps must be followed:

1. Stop the source of the spill;
2. Contain the spill;
3. Report the spill to the Site Manager. **Note that all significant spills must be reported by the DEO to the Department of Water and Sanitation (DWS), Department of Economic, Development, Tourism & Environmental Affairs (EDTEA), and the ECO**;
4. In the case of a minor spillage clean the affected area and drum all contaminated material for temporary storage until the waste can be collected and disposed of by a registered hazardous waste disposal contractor. In the case of a significant spillage the EDTEA and DWS will advise on appropriate emergency action protocol to be followed for the type of spillage;
5. The DEO is to determine in conjunction with the ECO if there is any soil, groundwater or other environmental impact;
6. If deemed necessary by the EDTEA, DWS or the ECO, remedial follow-up action must be taken;
7. **All** spillages / incidents and remedial actions taken must be documented by the DEO and kept on file for reference purposes.

The above protocol must be relayed to site staff during their induction and must be discussed on a regular basis during Toolbox Talks.

6 Heritage and Archaeological

A Heritage Impact Assessment has been carried out prior to construction and no archeological and other heritage sites were observed in the immediate vicinity. The study area is not part of any known cultural landscape. However, it is possible that such resources could be encountered along the route during construction. Should buried archaeological material and/or human remains be encountered during construction, construction in the vicinity should cease immediately pending an evaluation by the provincial heritage agency.

6.1 Flooding

High water conditions may occur while construction is in progress. Plans and specifications for the proposed work must address measures to maintain the integrity of the construction site during these periods. Common measures include dewatering, construction of ring levees, and emergency backfilling of open excavations. Sandbags and pumping can also be used to supplement the effort.

All site staff are to be advised to implement the following protocol should a flood event occur:

1. Stop work immediately;
2. Contain the flooding using sandbags as quickly as possible;
3. Report the incident to the Site Manager.
4. If flooding continues, use additional methods to protect equipment/infrastructure-pumping, dewatering, backfilling.
5. The site manager is to determine in conjunction with the ECO if there is any environmental impact;
6. If deemed necessary by the Department of Economic, Development, Tourism & Environmental Affairs (EDTEA), DWS or the ECO, remedial follow-up action must be taken;
7. **All** incidents and remedial actions taken must be documented by the ECO and kept on file for reference purposes.

The above protocol must be relayed to site staff during their induction and must be discussed on a regular basis during Toolbox Talks.

7 Approval Of The Design Engineer

It is understood that these contingency plans are generic statements developed by Terratest for the WULA submission and deal with the activities that are likely to occur for this project. As the design engineer, we have read through these statements and deem them appropriate guidelines to pass on to the Contractor once appointed. The Contractor remains legally responsible for the development of contingency plans alongside work method statements.

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APPENDIX D EMERGENCY PREPAREDNESS RESPONSE PLAN

LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME AND ASSOCIATED INFRASTRUCTURE:

NGWADINI & GOODENOUGH SYSTEMS

EMERGENCY PREPAREDNESS RESPONSE PLAN

SEPTEMBER 2024

PREPARED FOR: UMNGENI-UTHUKELA WATER

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1 PURPOSE OF THE DOCUMENT

Nemai Consulting was appointed by uMngeni-uThukela Water as the Environmental Assessment Practitioner (EAP) to seek Environmental Authorisation in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) for the Lower uMkhomazi Bulk Water Supply Scheme (LUBWSS): Ngwadini and Goodenough Systems.

This document serves to outline the measures to implement in the event of an emergency during the construction and operational phases of the project and to ensure compliance with NEMA and other applicable regulations.

Activities undertaken during the construction and operational phases of the LUBWSS have the potential to result in unwanted outcomes and/or emergency situations. The Emergency Preparedness Response Plan is aimed at defining the response process and responsibilities for managing these situations.

The following are examples of potential unplanned emergency situations that may be encountered during the construction and operation of the LUBWSS. The list is not exhaustive and the influencing elements on the site must always be taken into account. Emergency situations include the following:

- Hazardous Substances Incidents (i.e. Chemical/Fuel Spills);
- Medical Emergency;
- Fire;
- Bomb Threat;
- Social Unrest or Civil Disorder Situation;
- Flooding;
- Prolonged Power Outage;
- Severe Weather/Storm Damage;
- Damage to Services;
- Structural Instability; and
- Transport and Road Accidents.

The Emergency Preparedness Response Plan must continually undergo review and revision to meet changing conditions. This plan will need to be amended periodically in light of operational changes, lessons learnt during its implementation and other activities that can affect the risk profiles.

2 PROJECT OVERVIEW

The LUBWSS is being pursued as the preferred augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area.

The supply area extends from Amanzimtoti in the north to Hibberdene in the south and covers both eThekwini and Ugu Municipalities.

The overall LUBWSS consists of the following:

- Ngwadini System components (Figure 1) –
  - The Ngwadini Weir and abstraction works to fill the Ngwadini Dam during summer periods of excess flow (*excluded from the scope of this report*);
  - The Ngwadini pipeline (*included in the scope of this report*); and
  - The Ngwadini OCS Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods (*excluded from the scope of this report*).
- Goodenough System components (Figure 2) –
  - A second abstraction downstream at the Goodenough Weir site to abstract the raw water for delivery to the Water Treatment Plant (WTP) (*included in the scope of this report*);
  - Hydrocyclones before the pump station and WTP to remove sediments during periods of higher turbidity river flows and reduce the WTP residual ("sludge") (*included in the scope of this report*);
  - A pump station to pump water from the Goodenough abstraction to the WTP via (*included in the scope of this report*);
  - A rising main and gravity main (*included in the scope of this report*);
  - A raw water storage reservoir (*included in the scope of this report*);
  - A 100 Mℓ/d WTP in Craigieburn (*excluded from the scope of this report*); and
  - A potable gravity water pipeline from the WTP to Quarry Reservoir (*included in the scope of this report*).

The reader is referred to the Basic Assessment Report and EMPr for a detailed description of the project.

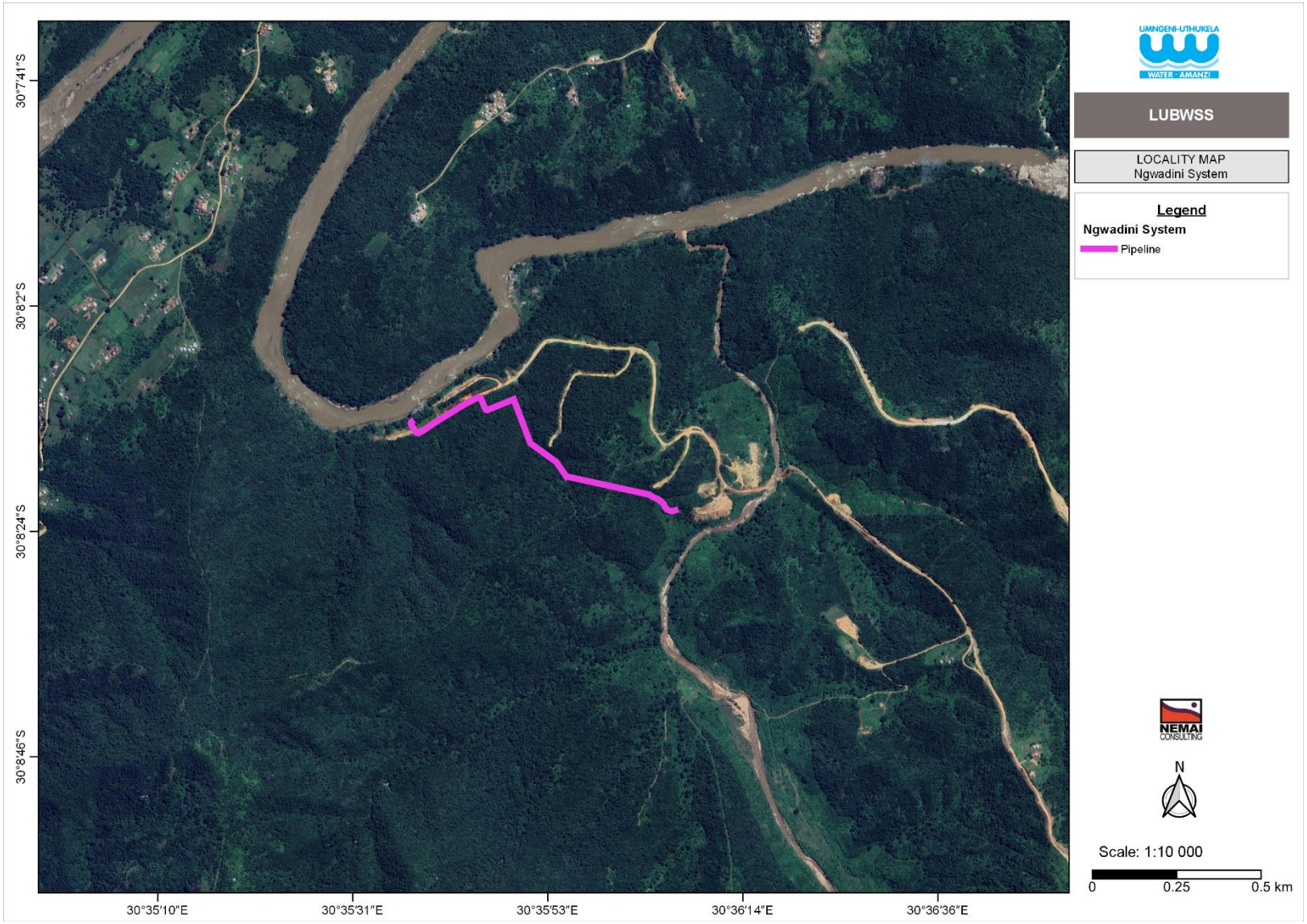

Figure 1: Ngwadini System (components excluded from the scope are not shown)

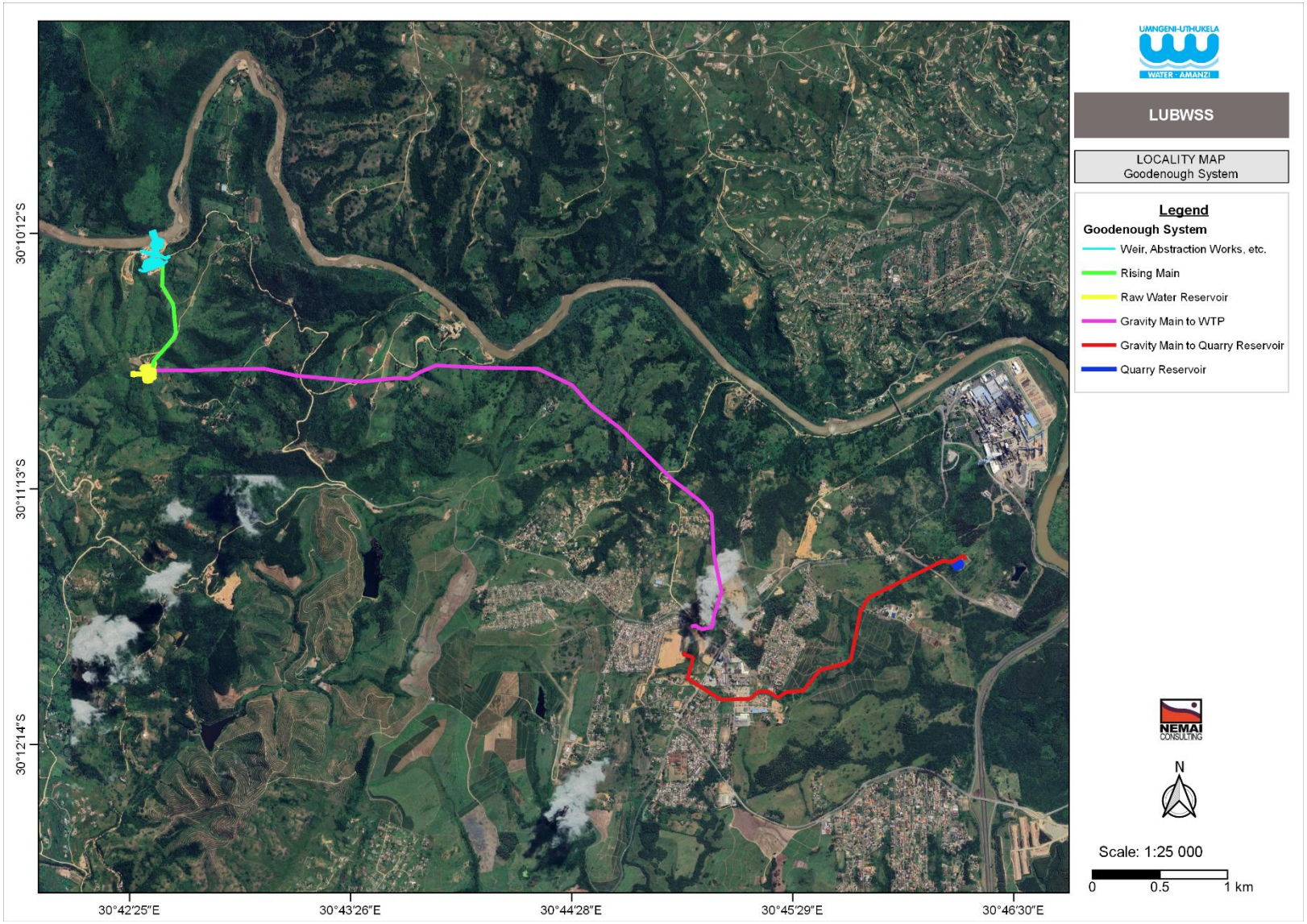

Figure 2: Goodenough System (components excluded from the scope are not shown)

3 OBJECTIVES

The objectives of the Emergency Preparedness Response Plan are as follows:

- Protect the site personnel and the environment through the development of emergency response strategies and capabilities.
- Set out the framework for hazard identification in order to define procedures for response to the situations including the development of contingency measures.
- Structure a process for rapid and efficient response to a manage emergency situations during the construction and operational phases of the scheme.

4 LEGISLATION AND GUIDELINES CONSIDERED

With regards to emergency procedures, specific legislation was consulted that must be complied with includes, but is not necessarily limited to:

- Emergency Services By-Laws;
- Occupational Health and Safety Act (Act No. 85 of 1993);
- Disaster Management Act (Act No. 57 of 2002);
- Fire Brigade Act (Act No. 99 of 1987);
- SANS 100400 Part T;
- ISO/PAS 22399: 2007; and
- SANS 23601: 2010.

5 ROLES AND RESPONSIBILITIES

With respect to this plan, uMngeni-uThukela Water has the responsibility to provide emergency response services and to structure and coordinate emergency response procedures, ensure that specific emergency responsibilities allocated are organised and undertaken and ensure that employees and contractors are trained and aware of all required emergency procedures.

Response personnel must develop the specific response strategies for individual scenarios, whilst relying on the general measures described in this plan.

Table 1 below indicates the potential roles and responsibilities on site with regards to emergency procedures.

Table 1: Roles and Responsibilities

Role	Responsibility
Emergency Response Coordinator	• Respond to emergencies on site. • Coordinate personnel on site during an emergency procedure. • Ensure the necessary resources required in the event of an emergency.
Evacuation Officer	• To ensure they are easily recognisable to site personnel and the emergency services by wearing the orange vest or coat during an evacuation • Responsible for all onsite occupants' safety during evacuations and to ensure the safety for personnel to renter the building. • Keep an updated list of employees and visitors on site and carry the name list with them during evacuation. • Ensure all occupants of the site have evacuated the area where the incident has taken place. • To be fully trained in the provision of first aid.
Health and Safety Officer	• Distribution of the Emergency Preparedness Response Plan to all parties with responsibilities in implementing the plan (including Contractors). • Plan emergency response drills with Contractors and Project Manager. • Develop and conduct training on the Emergency Preparedness Response Plan. • Lead any reviews or investigations into reported accidents/incidents. • Receive all notifications of incidents/accidents and ensure proper appropriate measures are being followed, including documentations.
Project Manager	• Responsible for staffing, planning and daily execution of the management measures contained in this plan during the Construction Phase of the scheme. • Develop and propose staff plans and contractual language to ensure that these measures are implemented by employees and contractors throughout the Construction Phase of the scheme, as needed.

6 TRAINING

Training aims to create an understanding of the Emergency Preparedness Response Plan and the responsibilities of the relevant personnel, as well as educate site employees on the procedures to be followed during an emergency. To be effective, an Emergency Preparedness Response Plan must be clearly communicated to all site personnel.

Training will be tailored to the audience, based on their designated roles and responsibilities. Records will be kept of the training provided, as well as containing the details of the attendees.

All employees and contractors will be trained in emergency response procedures. The Health and Safety Officer shall distribute the Emergency Preparedness Response Plan to all parties in charge of ensuring the plans implementation. All relevant information in the Emergency Preparedness Response Plan shall be communicated to all employees and contractors. This

information shall include information on potential emergency risks/threats, appropriate first-person response to incidents/emergencies and notification procedures.

All site personnel, including contractors, are to be trained in the appropriate responses for emergencies. The training is mandatory and is to be conducted on a regular basis. The frequency and timing of training is at the discretion of the Project Manager and Contractor.

Training is to include, but not limited to the following:

- Firefighting;
- First Aid;
- Emergency Evacuation; and
- Medical and Environmental Emergencies.

7 DRILLS AND MONITORING

The Health and Safety Officer's responsibility is to implement the Emergency Preparedness Response Plan. In order to ensure site personnel are fully aware of the procedures to be followed when an emergency event takes place, emergency drills must be undertaken. These include the following:

- Fire Drills;
- Medical Drills;
- Chemical / Fuel Spill Drills; and
- Emergency Evacuation Drills.

Reporting and monitoring requirements for the Emergency Preparedness Response Plan will include:

- Monthly inspections and audits;
- Quarterly report of accidents/incidents;
- Reporting at the time of any environmental incidents;
- Bi-annual emergency response drills; and
- Annual reporting on training.

Emergency response drills and reporting will provide information regarding required revisions to training or the measures contained in the Emergency Preparedness Response Plan. Each incident reported will be reviewed and investigated upon occurring. Actions will be identified where possible to improve the site's overall response to emergencies.

8 MANAGEMENT OF EMERGENCY PROCEDURES

The following are general emergency procedures for some of the high-risk emergencies that may occur during the construction and operation of the LUBWSS.

Management Objective:

- Minimise environmental impacts associated with emergency procedures.
- Provide a safe and healthy working environment to construction workers and the public.

Target:

- No site fires to be caused by construction activities and workers.
- Approved emergency response procedures, where relevant.
- Ensure the safety of all onsite personnel and site occupants.
- No incidents.

Management Actions:

8.1.1 Evacuation

8.1.1.1 Evacuation Site Plan

A site plan must be on site at all times and be visible to all personnel. The plan must display the areas of responsibility of the contingency officers, as well as all emergency exits. Site plan of the construction site and camps including all buildings, boundaries and outside features must indicate the positions of the following:

- Emergency exits;
- Assembly points;
- Locations of fire extinguishers
- Fire alarm pull stations' location
- Roads; and
- Site layout plan.

8.1.1.2 Evacuation Procedure

All staff must be aware of the possible evacuation routes prior to the emergency situation through organised training and drill sequences. Always assure safety of the assembly point prior to evacuation. The procedure is provided below:

- The designated Emergency Response Coordinator will provide instruction or the alarm will sound to evacuate a specific area.
- All personnel appointed as Evacuation Officers must assist with the evacuation.
- All personnel onsite must follow the instructions of the Evacuation Officer.
- In the case of fire or smoke, evacuating personnel must move under the level of the smoke and cover their nose/mouth.
- Evacuation must be undertaken in accordance to the Evacuation Site Plan.
- Onsite personnel must stay calm and must not panic.
- Visitors that are not familiar with the evacuation procedure must be assisted.
- A daily record of staff and visitors must be kept.
- The professional Emergency Services entering the site must not be obstructed.

- All personnel onsite must report directly to the allocated assembly point.
- Personnel must not leave the assembly point until it has been deemed safe to do so.

8.1.2 Medical Emergency

- First aid officers should be trained on site (Levels 1 to 3) to deal with construction related injuries.
- The requirements of the Occupational Health and Safety Act (Act 85 of 1993) and related regulations shall be adhered to.
- All workers will be supplied with the required Personal Protective Equipment as per the Occupational Health and Safety Act (Act No. 85 of 1993).
- All complaints and/or problems related to impacts on man-made facilities and activities must be promptly addressed by the Contractor and documented.

The procedure is provided below:

- Do not panic and keep the injured person calm.
- Notify the personnel trained in First Aid of injury.
- For minor injuries that does not require a doctor or hospital, the First Aider must apply First Aid treatment.
- If the injured person is unconscious, do not move the person.
- If the injured person's injury is serious, call Emergency Services.
- If personnel trained in First Aid are not available, as a minimum, attempt to provide the following assistance:
  - Stop the bleeding with firm pressure on the wounds (avoid contact with blood or other bodily fluids).
  - Clear the air passages using the Heimlich Manoeuvre in case of choking.
- Take names of witnesses and photos of area and injury if possible, to assist with the cause investigation and to put proper controls in place to prevent similar incidents.

8.1.3 Fire

- Comply with the National Veld and Forest Fire Act (No. 101 of 1998).
- Proper emergency response procedure to be in place for dealing with fires.
- Burning of waste is not permitted.
- Suitable precautions will be taken (e.g. suitable fire extinguishers, water bowsers, welding curtains) when working with welding or grinding equipment.
- All fire control mechanisms (firefighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services.
- All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the presence of a fire.
- No fires are allowed on site, unless in dedicated areas approved by the Project Manager.
- Dedicated smoking areas to be provided. Cigarette butts may not be disposed of onsite.

The following emergency procedures must be implemented when fire occurrence (or evidence thereof) is noted in the vicinity of the proposed development site during the Construction and Operational phases. The procedure is provided below:

- The Emergency Response Coordinator must be notified.
- Personnel in the immediate vicinity of the fire must be immediately notified.
- All persons located in the immediate area of the fire must be evacuated. Evacuation must be carried out as per the Evacuation Procedure detailed above.
- All doors and windows of buildings and vehicles that are in the immediate vicinity of the fire must be closed.
- The fire must be contained with the correct extinguisher by trained personnel.
- Those requiring assistance must be assisted and first aid must be rendered by trained personnel.

If a fire is discovered:

- Raise the fire alarm or notify the relevant emergency personnel.
- Notify the local Fire Department.
- Remove anyone from immediate danger.
- Confine fire by closing doors and windows.
- Do not attempt to put out the fire unless trained to do so.

In the event of a fire, the following procedures need to be carried out in sequence:

- Notify the location of the fire to:
  - The relevant emergency personnel; or
  - The site manager.
- The above personnel will immediately notify the necessary emergency services.
- Proceed directly to the nearest designated emergency exit.
- Do not panic or run.
- Do not try and collect personal belongings.
- Assemble in the designated assembly points.
- Once assembled, help to account for occupants and report to the emergency staff if any occupants are unaccounted for and may be still in the building.
- Remain at the assembly point until the relevant authority states it is safe to re-enter.

8.1.4 Flooding

The following proactive actions must be carried out to understand the risks of flash flooding for the Project:

- The weather forecast in the surrounding areas must be constantly monitored, especially during the wet season.
- All key equipment must be placed outside of the 1:100 year floodline of surrounding watercourses.
- Bund and water channels to divert flood water to safe areas.

- In the event of a flash flood onsite, the following emergency procedures will be implemented:
  - The Emergency Response Coordinator must be notified.
  - All personnel onsite, including the designated Evacuation personnel must be immediately notified.
  - All equipment must be safely shutdown and all electrical equipment must be isolated.

8.1.5 Accidental Leaks and Spillages

- Proper emergency response procedure to be in place for dealing with spills and leaks.
- Ensure that the necessary materials and equipment for dealing with spills and leaks are available on site, where practicable.
- Remediation of the spill areas will be undertaken to the satisfaction of the Project Manager and ECO.
- In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured. The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, breakdown and where possible, encapsulate a minor hydrocarbon spillage.
- All staff on site will be made aware of actions to be taken in case of a spillage.
- Provide contact details of person to be notified in a case of spillages – signage to be displayed at strategic points within the construction domain (e.g. workshop, fuel storage area, hazardous material containers).

Responsibilities:

- Project Manager and ECO – to check.
- Contractor to implement management actions.
- Refer to roles and responsibilities in Table 1 above.

Monitoring Requirements:

- Approved Emergency Response Plan.
- Training and awareness creation records.
- Signage displayed.
- Contractor's method statement.

APPENDIX E EROSION MANAGEMENT PLAN

LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME AND ASSOCIATED INFRASTRUCTURE:

NGWADINI & GOODENOUGH SYSTEMS

EROSION MANAGEMENT PLAN

SEPTEMBER 2024

PREPARED FOR: UMNGENI-UTHUKELA WATER

NEMAI CONSULTING

Environmental, Social and OHS Consultants

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This Erosion Management Plan serves to outline the measures to manage erosion during the construction and operational phases of the project and to ensure compliance with the NEMA and other applicable regulations.

In the short term, erosion leads to a change of soil stability, thus affecting the safety of the slopes. Over a longer term, erosion causes exposure of soil and displacement of sediment.

The purpose of the plan is to implement mitigation measures to reduce the erosion potential, and the likely impact of erosion associated with the construction and operational phases of the proposed scheme. As part of the management plan, measures to reduce the negative impacts of erosion on biodiversity and ecologically sensitive areas, and to protect hydrological features from erosion damage. The plan does not cover any engineering measures related to soil management and erosion.

This plan is to be implemented during the construction and operation of the facility. The plan must be refined during the planning and detailed design stages of the project implementation. The specifications may include more detailed requirements in terms of erosion management. The Contractor will also be required to compile a Method Statement that deals specifically with erosion management (amongst others).

2 PROJECT OVERVIEW

The LUBWSS is being pursued as the preferred augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. The supply area extends from Amanzimtoti in the north to Hibberdene in the south and covers both eThekwini and Ugu Municipalities.

The overall LUBWSS consists of the following:

- Ngwadini System components (Figure 1) –
  - The Ngwadini Weir and abstraction works to fill the Ngwadini Dam during summer periods of excess flow (*excluded from the scope of this report*);
  - The Ngwadini pipeline (*included in the scope of this report*); and
  - The Ngwadini OCS Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods (*excluded from the scope of this report*).

- Goodenough System components (Figure 2) –
  - A second abstraction downstream at the Goodenough Weir site to abstract the raw water for delivery to the Water Treatment Plant (WTP) (*included in the scope of this report*);
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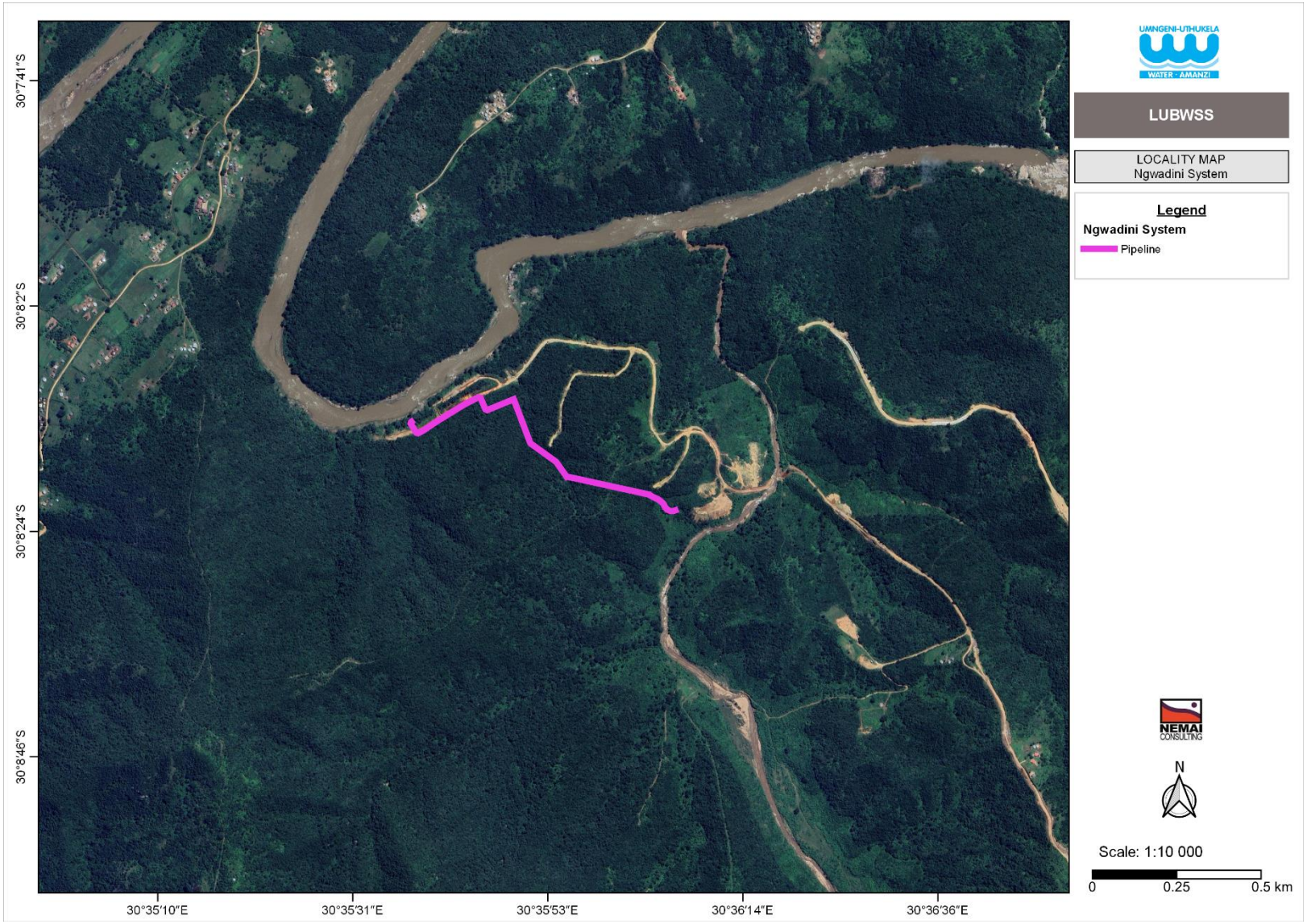

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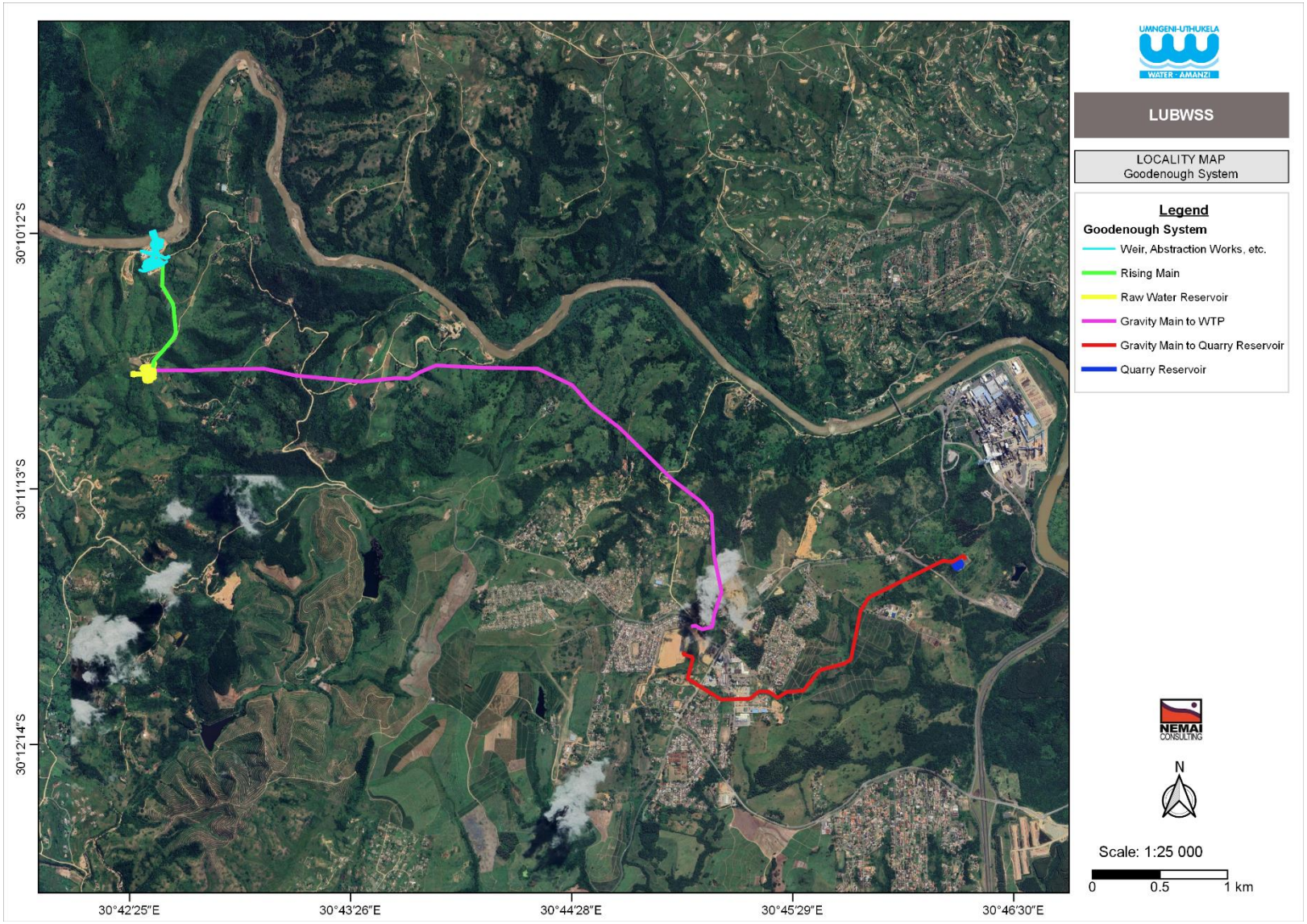

Figure 2: Goodenough System (components excluded from the scope are not shown)

3 OBJECTIVES

The objectives of erosion and sediment control during construction and operation are to:

- Protect the land surface from erosion;
- Intercept and safely direct run-on water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment;
- Revegetate or stabilise disturbed areas; and
- Prevent damage to hydrological features such as drainage lines or wetlands, either within or adjacent to the proposed development areas.

4 EROSION MANAGEMENT PLAN

4.1 Characteristics of the Site

The uMkhomazi River Catchment originates within the Drakensberg, with the upper reaches of the river catchment at an altitude of 2 500m. The remainder of the river catchment comprises incised river valleys and mountains (eWISA, 2004). The rugged landscape in the study area is largely a result of river and/or water erosion.

The geology of the uMkhomazi River Catchment is mainly sandstone and shale with intrusive Karoo Dolerites. The river traverses a whole succession of geological formations in its catchment ranging from old granite to Stormberg series with some sediments overlying bedrock in certain places.

The topography consists of steep elevation and valleys, sloping down towards the uMkhomazi River. The area flattens out towards the WTP site.

4.2 Areas Susceptible to Erosion

All watercourses within the study area are regarded as sensitive and susceptible to erosion, and therefore require suitable protection from the construction activities. In addition, inadequate measures to protect the riverbed material from flows immediately downstream of the weir may result in scouring and erosion of substrates from below the structure.

Steep areas and valleys are susceptible to erosion. Steeper slopes cause runoff flow velocities to increase, resulting in increased erosion. As the slope length increases the opportunity for runoff to concentrate and achieve an erosive velocity increase.

Consideration should further be given to all areas where no groundcover exists (e.g. areas cleared for construction purposes) in terms of erosion protection.

Soil surface cover such as vegetation protect the soil surface through the reduction in flow velocity, the dispersing of flow, and the promotion of infiltration. This is a basic erosion management principle which aims to modify the surface characteristics to reduce the potential for erosion. It is important to note that many of the practices which are used to enhance rehabilitation are also used for the reduction of erosion potential.

4.3 Implementation Programme

Management Objective:

- Ensure erosion is managed and controlled on site.
- Adequate reinstatement and rehabilitation of construction areas.

Target:

- No visual evidence of erosion.
- Use erosion controls to prevent on-site and off-site damage.

Management Actions:

- Protect areas of the construction site that are susceptible to erosion through suitable measures (e.g. watering, planting, retaining structures, commercial anti-erosion compounds).
- Particular care must be taken to prevent carrying of sediment onto roadways.
- Any erosion channels caused by construction activities to be suitably stabilised and rehabilitated.
- All efforts to prohibit ponding on surface and ensure stormwater runoff is channelled from the site must be made. The method used will be appropriate to the expected stormwater flows and the topography and geology of the site.
- Erosion and donga crossings must be dealt with as river crossings. Appropriate soil erosion and control procedures must be applied to all embankments that are disturbed and destabilized.
- Suitable erosion protective measures to be implemented for access roads.
- Stabilisation of cleared areas to prevent and control erosion. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to the site-specific conditions.
- Monitoring to be conducted to detect erosion. The status of the erosion susceptible areas must be documented in order to identify areas that need erosion protective measures to be implemented.
- Exposed areas to be rehabilitated as soon as possible to avoid erosion.
- The Contractor shall take measures to the approval of the Engineer to ensure that there is no undue stormwater damage and soil erosion resulting from the construction activities outside the construction camp and works areas.

- During construction, water diversion soil berms will be constructed to divert surface and stormwater from traversing the disturbed areas.
- Cross and side stormwater drainage measures shall be constructed on access roads to the site.
- Topsoil should be stored in such a way that it does not compromise its plant-support capacity.
- Topsoil from the construction activities should be stored for post-construction rehabilitation work and should not be disturbed more than is absolutely necessary.
- Protect topsoil in order to avoid erosion loss on steep slopes.
- The Stormwater Management Plan must be implemented during construction and appropriate water diversion systems put in place.
- All areas to be affected by the proposed project will be rehabilitated after construction activities.

The following requirements for soil pollution management shall apply:

- Soil should be exposed for the minimum time possible once cleared of invasive vegetation, that is the timing of clearing and grubbing should be co-ordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion. Stockpiled topsoil must be either vegetated with indigenous grasses or covered with a suitable fabric to prevent erosion and invasion by weeds.
- All cut and fill surfaces need to be stabilized with appropriate material or measures when major civil works are complete.
- All equipment must be inspected regularly for oil or fuel leaks before it is operated. Leakages must be repaired on mobile equipment or containment trays placed underneath immobile equipment until such leakage has been repaired.
- Soil contaminated with oil must be appropriately treated and disposed of at a permitted landfill site or the soil can be regenerated using bio-remediation methods.
- Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person.

Responsibilities:

- Project Manager and ECO – to check.
- Contractor to implement management actions.
- Contractor to conduct monitoring during construction.
- uMngeni-uThukela Water to conduct monitoring during operational phase.

Monitoring Requirements:

- Public complaints register.
- Visual inspections.
- Evidence of erosion.
- Monitoring records.

- Contractor's Method Statement.

4.4 Monitoring Requirements

4.4.1 Construction Phase

Table 1 below provides the monitoring requirements that should be implemented during the Construction Phase of the scheme.

Table 1: Monitoring Requirements during Construction Phase

Monitoring Action	Indicator	Timeframe
Identification of all susceptible erosion areas including steep slopes and watercourse crossings	• Map of susceptible erosion areas	Pre-Construction
Monitor watercourse crossings	• Visual inspections • Monitoring records of watercourse crossings • Appropriate management actions to be implemented if problems are identified	• Monthly during the rainy season • Bi-monthly during dry season • Immediately following significant rainfall events
Monitor cleared areas for erosion problems	• Visual inspections • Monitoring records of cleared areas • Appropriate management actions to be implemented if problems are identified	
Monitor vegetation clearing activities near sensitive areas such watercourses and steep slopes	• Visual inspections • Monitoring records • Appropriate management actions to be implemented if problems are identified	
Monitor revegetated and stabilised areas	• Visual inspections • Monitoring records • Appropriate management actions to be implemented if problems are identified	

4.4.2 Operational Phase

Table 2 below provides the monitoring requirements that should be implemented during the Operational Phase of the scheme.

Table 2: Monitoring Requirements during Operational Phase

Monitoring Action	Indicator	Timeframe
Monitor for new erosion problems in development area	• Visual inspections • Monitoring records	Quarterly
Document erosion control measures implemented	• Visual inspections • Records of control measures and their success rate	Quarterly

Monitoring Action	Indicator	Timeframe
	• Appropriate management actions and erosion control measures to be implemented if problems are identified	
Document the extent of erosion in development area and the actions implemented	• Evidence of erosion over time	Biannually

APPENDIX F PLANT RESCUE AND PROTECTION PLAN

LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME AND ASSOCIATED INFRASTRUCTURE:

NGWADINI & GOODENOUGH SYSTEMS

PLANT RESCUE AND PROTECTION PLAN

SEPTEMBER 2024

PREPARED FOR: UMNGENI-UTHUKELA WATER

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The document serves as the Plant Rescue and Protection Plan which supplements the mitigation measures contained in the Environmental Management Programme (EMPr). This plan provides the framework for the rescue, relocation and protection of flora species of conservation concern in the project area. The purpose of this plan is to provide guidance on the steps to be undertaken in order to achieve the successful rescue and protection of conservation-worthy flora species before construction can commence.

2 PROJECT OVERVIEW

The LUBWSS is being pursued as the preferred augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. The supply area extends from Amanzimtoti in the north to Hibberdene in the south and covers both eThekwini and Ugu Municipalities.

The overall LUBWSS consists of the following:

- Ngwadini System components (Figure 1) –
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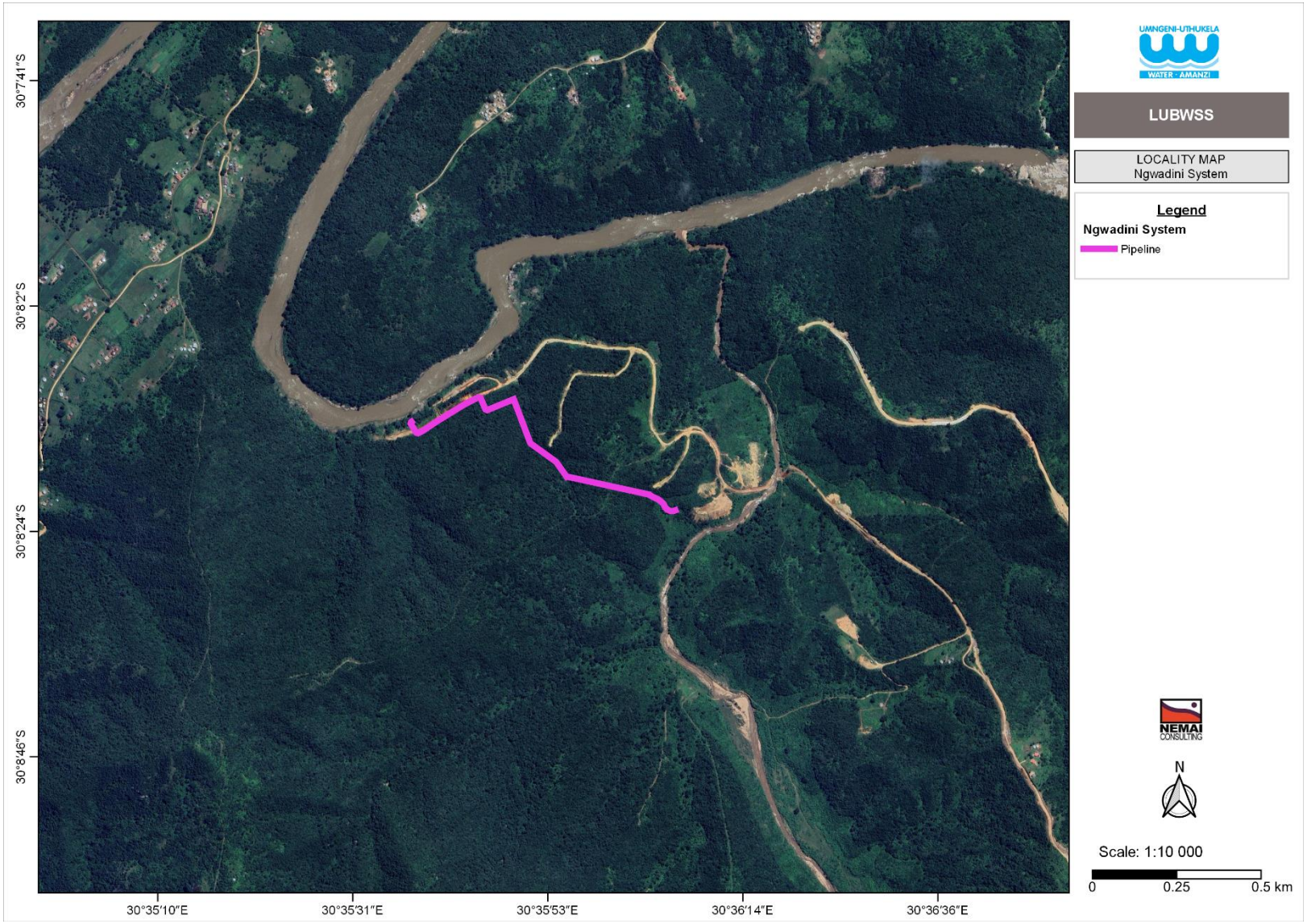

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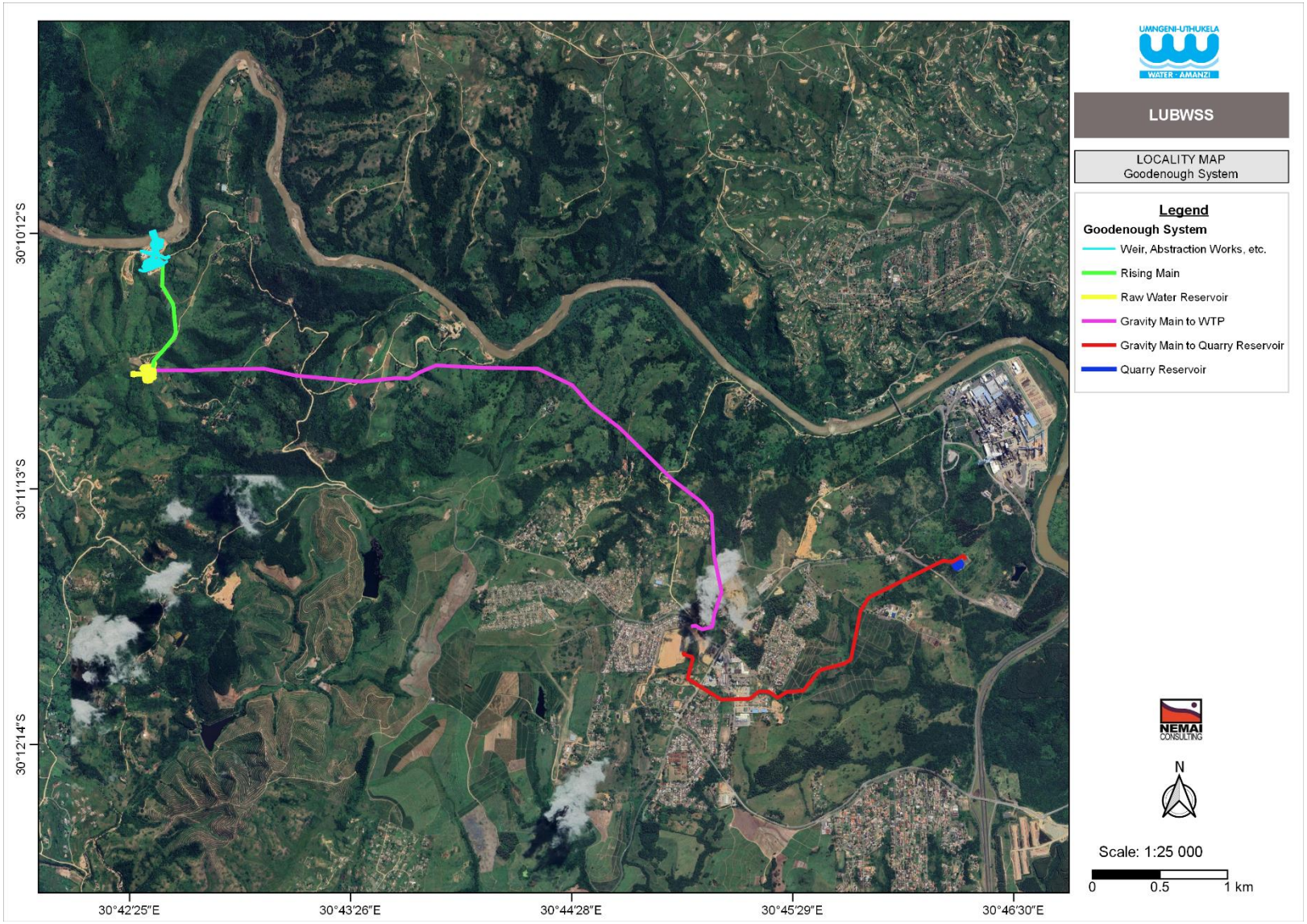

Figure 2: Goodenough System (components excluded from the scope are not shown)

- A rising main and gravity main (*included in the scope of this report*);
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- A potable gravity water pipeline from the WTP to Quarry Reservoir (*included in the scope of this report*).

The reader is referred to the Basic Assessment Report and EMPr for a detailed description of the project.

3 PLANT SPECIES OF CONSERVATION CONCERN

During the site visit, the following species of conservation importance were observed and recorded:

- Specially protected species in the general area such as *Millettia grandis, Dioscorea cotinifolia* (Dioscoreaceae) and *Ledebouria ovatifolia* (Liliaceae/Hyacinthaceae)
- *Pittosporum viridiflorum*, *Sclerocarya caffra* and *Phoenix reclinate* were encountered in the general area.
- Red-Listed species *Hypoxis hemerocallidea* (Declining) is encountered in large numbers at the WTP site.
- Species encountered within the proposed development footprint include *Aloe maculata* (Liliaceae/Asphodelaceae), *Hypoxis hemerocallidea* (Declining), *Kniphofia linearifolia* (Liliaceae/Asphodelaceae) and *Freesia laxa* (Iridaceae).

Prior to construction, the species directly affected by the project footprint must be rescued and relocated to suitable locations with adequate survival and growth-enabling conditions.

4 PLAN OF ACTION

Table 1 below provides details on the actions that are required to rescue the plant species of conservation concern from the development footprint area and the steps to be followed in order to relocate them successfully. The ECO will ensure compliance against the Plan. Before construction commences at the site, the following actions must be taken:

Table 1: Action Plan

Action	Responsible person
Confirmation of all listed species that may occur within the development footprint area that will be incorporated into the relocation plan. This is completed through a walk-through of the site.	Experienced Botanist/Ecological Specialist

Action	Responsible person
A permit application must be submitted to Ezemvelo KZN Wildlife and DFFE to cut, destroy or damage the plants and trees identified within the project footprint. The authorities may require a site visit.	Experienced Botanist/Ecological Specialist
It is assumed that the rescue and protection process will follow a phased approach and that not all areas will be cleared and developed at the same time. Rescued plants must be limited to only those areas where plants will be destroyed by the development. No plants should be removed from areas that will otherwise not be disturbed.	Contractor
All labour involved in the relocation of the plants must attend an awareness training on the significance and importance of the plant species.	Contractor/Landscape Architect
In order to successfully remove the species of concern from the site, the soil must be loosened on all sides of the plant, without breaking or damaging the roots and bulbs, and dug out at approximately 20 - 30cm deep. A pickaxe could be used to dig out the plants and store them in potting bags/containers. This process should be supervised by a qualified individual such as a horticulturist and/or the landscape architect.	Contractor/Landscape Architect
For each individual plant that is rescued, soil from where this species is found must be used to fill up the container bag. The soil must be packed firmly, but not too tightly to restrict water and oxygen. The plants must be watered before relocation.	Contractor
Rescued plants must be planted into a container to be kept within a temporary nursery on site or immediately planted into the target habitat. If planted into natural habitat, it must be protected from construction activities and monitored to ensure survival.	Contractor
The landscape architect must ensure that all species rescued must be included in the landscape design and rehabilitated on site.	uMngeni-uThukela Water/ Landscape Architect
In cases where the rescued plants cannot be relocated on the same day, a nursery must be established on site. The Landscape Architect must inspect all plant materials on a regular basis for rodents, excessive sun, wind, or weeds. If any are identified, appropriate control measures must be applied. The nursery shall be adequately secured to prevent loss or theft of the plant species.	Contractor/Landscape Architect

Action	Responsible person
In the area designated for the replanting of these species, a hole must be dug which is slightly larger and deeper than the plant which must be placed therein. The plant must be placed in the hole and ensure that it is deep enough that the roots are covered. The plants should not be planted in straight lines, but rather randomly as in the natural environment.	Contractor
Should there be a need to relocate these plant species off site, an agreement should be in place between the two parties concerned. The receiving site must be matched as closely as possible with the origin of the plants and, where possible, be placed as near as possible to where they originated.	Contractor
ECO to give permission to clear vegetation only once all relevant areas have been cordoned off.	ECO
Conduct a photographic baseline survey for the project. Capturing the area to be developed, and photographs of the plants and trees that will be removed and require permits.	ECO

5 MEASURES FOR PROTECTION OF PLANT SPECIES

The following measures must be implemented in order to protect plant species that do not require a permit for removal:

- Site induction for contractors and labourers must include information of the tree and plant species identified for protection.
- Areas where the plants and trees were recorded are considered to be sensitive and should be demarcated as no-go areas. The locations of these plants and trees should be demarcated prior to the initiation of the construction phase.
- An area of 4m^2 should be cordoned off (no-go area) around the plants and trees intended for protection, for the construction phase of the project. This demarcation can be done with chevron/danger tape.
- Monitoring (inspections) of the remaining markers within the project footprint should be conducted monthly throughout the construction phase of the project. This is to ensure that these areas remain cordoned off and that they have not been impacted on. In the event that these areas (markers) are affected by the project, such incidents must be reported to the relevant authority.

6 MONITORING AND RECOMMENDATIONS

It is recommended that the species recorded must be rescued and relocated on site and the Landscape Architect must ensure that all species rescued is included in the landscape design.

With regards to the plant species which have been stored in a temporary nursery facility, 90% survival rate is to be achieved. Dead plants must be replaced by the Contractor and these plants must be sourced from a reputable source.

The ECO shall monitor compliance with the Plant Recue and Protection Plan.

7 MITIGATION OF RISKS

The following risks and mitigation measures have been identified:

- Improper means of up-rooting plants and damaging plants: A suitably qualified person should conduct a plant demonstration on how to up-root and handle the plants;
- Plants are not planted in suitable soil: A suitably qualified person should conduct a plant demonstration and ensure root mass is in contact with the soil (where applicable). Only local soils will accompany the relocated plans. Fertilizers are not recommended;
- Relocation in winter which is not the ideal period: Relocation of plants during the winter months is not ideal as most of the plants are not flowering and the leaves are dead which makes it difficult to locate the bulbs of certain species even with the tagged species; and
- Theft of the plants: The Contractor must undertake a toolbox talk on the awareness of the plant species, detailing the importance of the plants. The Client is encouraged to implement a fine system for anyone caught removing the plants without permission.

APPENDIX G STORMWATER MANAGEMENT PLAN

LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME AND ASSOCIATED INFRASTRUCTURE:

NGWADINI & GOODENOUGH SYSTEMS

STORMWATER MANAGEMENT PLAN

SEPTEMBER 2024

PREPARED FOR: UMNGENI-UTHUKELA WATER

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This document serves to outline the measures to manage stormwater during the construction and operational phases of the project and to ensure compliance with NEMA and other applicable regulations.

The Stormwater Management Plan must prevent off-site mitigation of contaminated stormwater or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of stormwater run-off. The stormwater measures strive to prevent destabilisation of watercourse channels, soil erosion, and water quality deterioration due to sedimentation.

This plan is to be implemented during the construction and operation of the facility. The plan must be refined during the planning and detailed design stages of the project implementation. The specifications may include more detailed requirements in terms of stormwater management. The Contractor will also be required to compile a Method Statement that deals specifically with stormwater management (amongst others) during construction. uMngeni-uThukela Water must ensure that stormwater is adequately managed during the operational phase.

2 PROJECT OVERVIEW

The LUBWSS is being pursued as the preferred augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. The supply area extends from Amanzimtoti in the north to Hibberdene in the south and covers both eThekwini and Ugu Municipalities.

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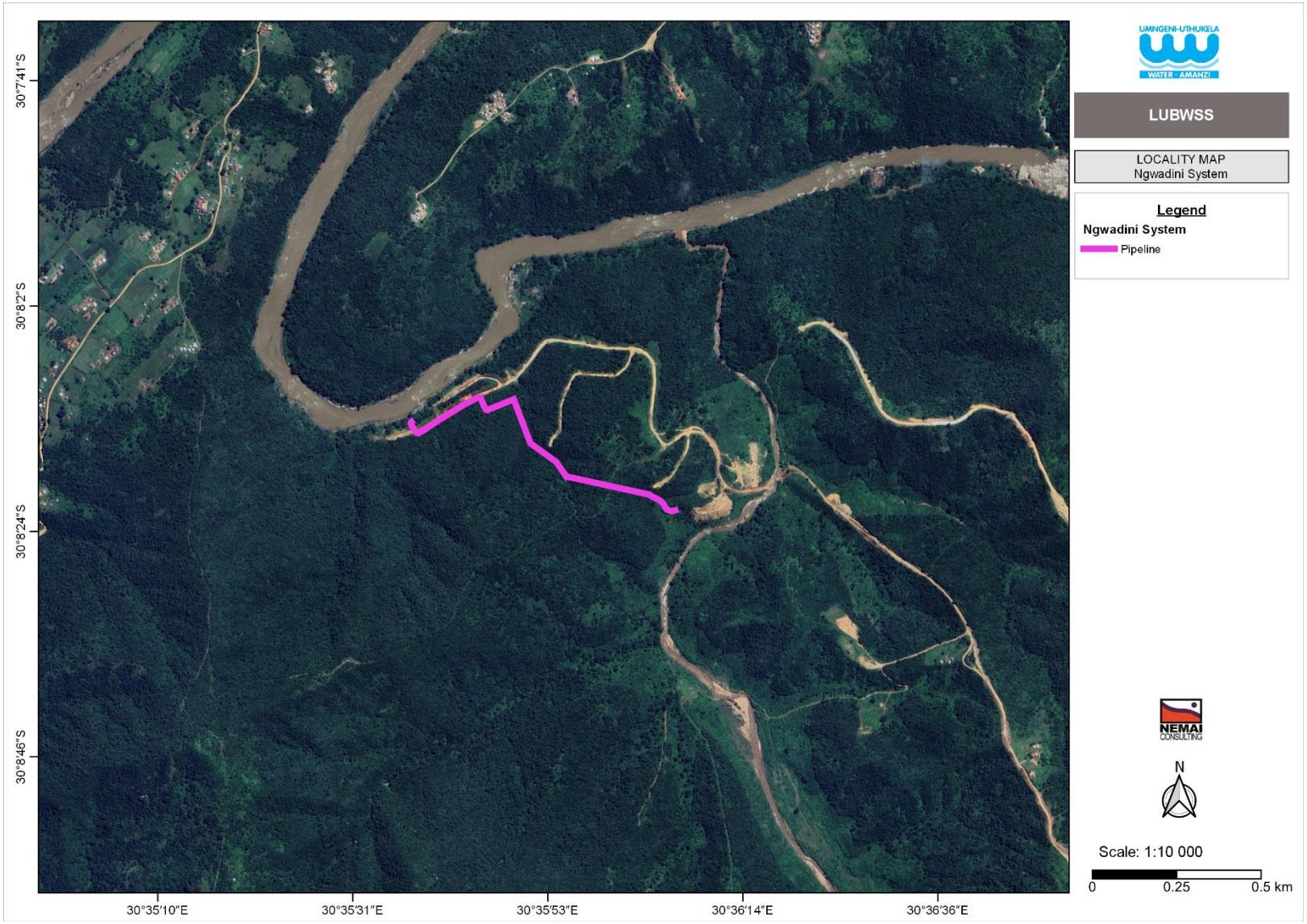

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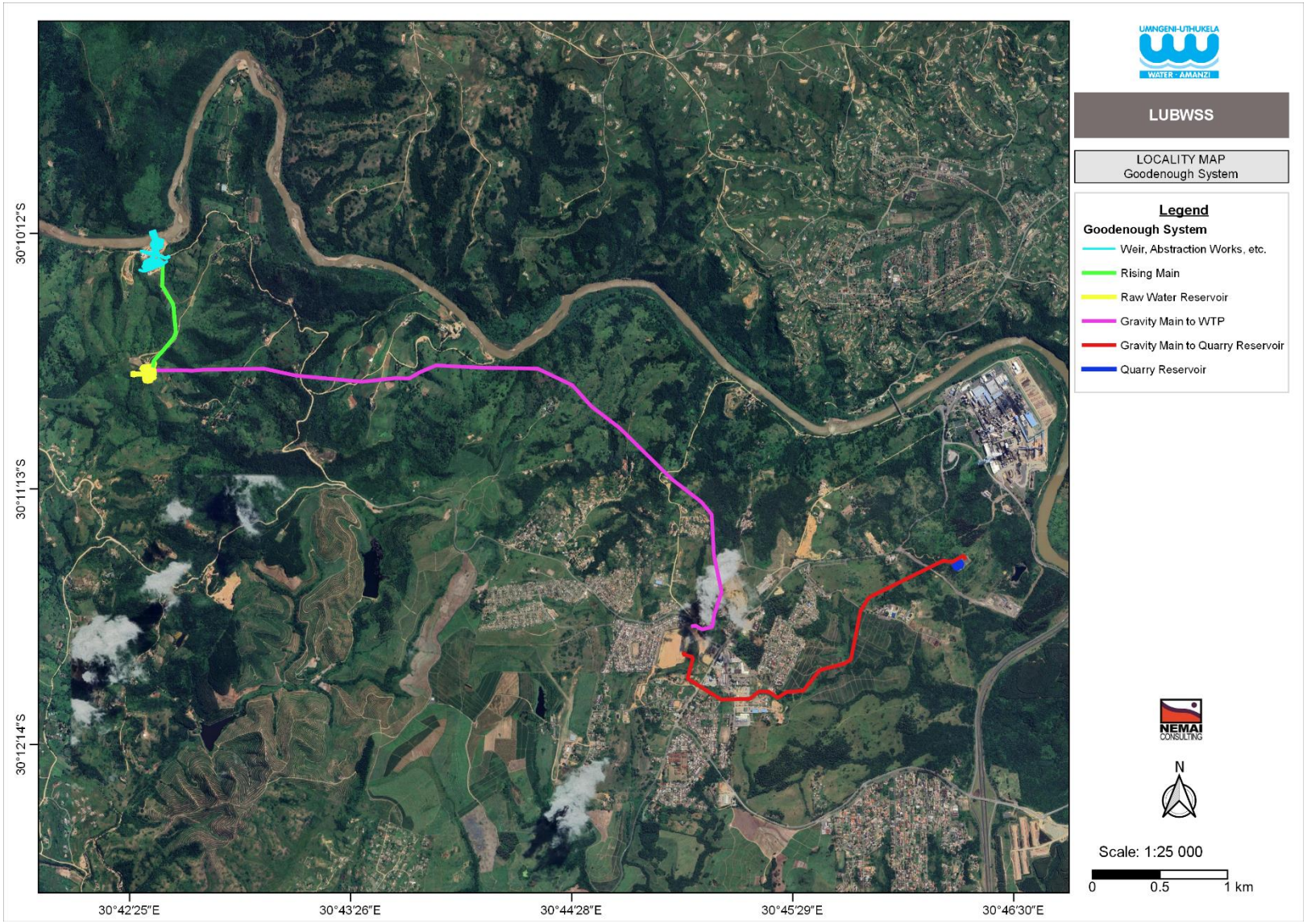

Figure 2: Goodenough System (components excluded from the scope are not shown)

3 OBJECTIVES

The objectives of stormwater management is as follows:

- To protect the health, welfare and safety of the public, and to protect properties from flooding events by safely routing and discharging stormwater from the development sites;
- To preserve the natural environment;
- To strive for a sustainable environment while pursuing economic development; and
- To provide the optimum methods of controlling runoff in such a way that the main beneficiaries pay in accordance with their potential benefits.

4 STORMWATER MANAGEMENT PLAN

4.1 Characteristics of the Site

The Mean Annual Precipitation (MAP) of the uMkhomazi River catchment can reach a maximum of 1500mm in the upper reaches of the Drakensberg. The central regions are generally the drier with an average MAP of 1200mm. In general, the project area has a moderate climate, with summer rainfall characterised by afternoon thunder showers.

The uMkhomazi River Catchment originates within the Drakensberg, with the upper reaches of the river catchment at an altitude of 2 500m. The remainder of the river catchment comprises incised river valleys and mountains. The rugged landscape in the study area is largely a result of river and/or water erosion.

The topography consists of steep elevation and valleys, sloping down towards the uMkhomazi River. The area flattens out towards the WTP site.

4.2 Areas Susceptible to Erosion

All watercourses within the study area are regarded as sensitive and susceptible to erosion, and therefore require suitable protection from the construction activities. In addition, inadequate measures to protect the river bed material from flows immediately downstream of the weir may result in scouring and erosion of substrates from below the structure.

Consideration should further be given to all areas where no groundcover exists (e.g. areas cleared for construction purposes) in terms of erosion protection.

4.3 Stormwater Management Philosophy

The Stormwater Management Philosophy for the project entails the following:

- Maintain adequate groundcover at all areas affected by construction activities to negate the erosive forces of water;
- Prevent concentration of stormwater flow at any point within the construction domain where the ground is susceptible to erosion;
- Reduce stormwater flows as much as possible by the effective use of attenuating devices (as required);
- Ensure that all stormwater control works are constructed in a safe and environmentally friendly manner;
- Prevent pollution of watercourses by suspended solids and dissolved solids in storm water discharges; and
- Avoid situations where natural or artificial slopes may become saturated and unstable, both during and after the construction process.

4.4 Implementation Programme

4.4.1 Construction Phase

Management Objective:

- Minimise environmental impacts associated with stormwater as well as water services for construction workers.
- Minimise stormwater runoff from the site onto neighbouring roads.
- Minimise water use through recycling and water efficient practices.

Target:

- No visual evidence of erosion caused by wastewater or stormwater practices.
- No environmental contamination associated with wastewater or stormwater practices.
- Ensure that the watercourses are protected and incur minimal negative impact to resource quality (i.e. flow, water quality, riparian habitat, morphology and aquatic biota).
- Unaltered downstream flow regime.
- Downstream water quality to remain within acceptable ranges, as determined through baseline monitoring.
- Ecological category not to be influenced by construction activities.

Management Actions:

- All construction activities to comply with the National Water Act (Act No. 36 of 1998).
- Minimise construction footprint where the construction activities take place in-stream or in close proximity (<50m) to watercourses.
- The delineated aquatic and wetland areas outside of the specific project site area must be avoided where possible.
- Laydown yards, camps and storage areas must be beyond the aquatic and wetland areas.

- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly.
- It is preferable that construction within watercourses takes place during the dry season to reduce the erosion potential of the exposed surfaces.
- Temporary stormwater channels and preferential flow paths should be filled with aggregate and logs (branches included) to dissipate and slow flows limiting erosion.
- Contamination of the uMkhomazi River system and other river tributaries affected with unset cement or cement powder should be negated as it is detrimental to aquatic biota. Pre-cast structures should be made use of (where possible) to avoid the mixing of these materials on site, reducing the likelihood of cement in the river system.
- All chemicals and toxicants to be used for construction must be stored outside the channel system and in a bunded area.
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.
- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- All removed soil and material must not be stockpiled within the system. Stockpiling should take place outside of the riparian and wetland areas. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.
- Erosion and sedimentation into the channel must be minimised through the effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed banks.
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.
- Minimise influence to downstream flow regime when diverting and impeding flow for cofferdams, temporary river crossings or for any other purposes.
- Construction activities not to interfere with downstream water users.
- Water abstracted from the uMkhomazi River must not impact the EWR of the uMkhomazi River and uMkhomazi Estuary, i.e. the EWR must be satisfied and over abstraction must not take place.
- Install suitable buttressing to prevent future erosion, if required.
- No illegal crossing of watercourses with construction plant. Suitable temporary river crossing to be built. Select most appropriate crossing point based on geotechnical conditions, sensitivity of riparian habitat (e.g. protected trees, large trees that afford bank stabilisation) and instream habitat, depending on technical feasibility.
- During the construction stage, water will be required for various purposes, such as concrete batching, washing of plant and equipment in dedicated areas, dust suppression, potable use by construction workers, etc. Water for construction purposes will be sourced directly from watercourses on site and groundwater (boreholes) will also be utilised. Water tankers will also supply water to the site.

- Prevent leakages from pipes or taps.
- Establish a dedicated vehicle maintenance area and wash-bay, where suitable storm water management measures are in place to prevent pollution.
- Any erosion channels caused by construction activities to be suitably stabilised and rehabilitated.
- All efforts to prohibit ponding on surface and ensure stormwater runoff is channelled from the site must be made. The method used will be appropriate to the expected stormwater flows and the topography and geology of the site.
- Where necessary, install instream silt traps during construction within the watercourse channel and along the riparian habitat. Instream silt traps are to be maintained and serviced on a regular basis. The style of silt trap will depend on materials used and the water movement patterns. If silt traps are not deemed feasible, other suitable measures need to be taken to limit unnaturally high sediment volumes in the watercourses.
- Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. straw bales). These are to be serviced regularly and removed when no longer in use.
- All diffuse pollution sources to be managed to prevent pollution of the watercourses in the project area.
- Ensure proper storage of material (including fuel, paint) that could cause water pollution. Ensure proper storage and careful handling of hazardous substances with spill prevention materials at hand.
- Stormwater runoff from workshops, vehicle maintenance area, wash-bay and other potential pollution sources shall be collected and treated in hydrocarbon separation pits/tanks before discharged to drains and waterways.
- Storage area and ablution facilities not to be located closer than 50m from edge of riparian habitat.
- All wastewater discharges to comply with legal requirements associated with the National Water Act (Act No. 36 of 1998), including the General Authorisation that specifically deals with S21 (f) and (g) water uses.
- Wastewater discharges to form part of water monitoring programme.
- Prevent erosion on access roads due to construction traffic.
- Exposed river banks / soils must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion of the area.
- Visual inspections for the occurrence of erosion should be undertaken on a weekly basis.
- The Contractor shall take measures to the approval of the Engineer to ensure that there is no undue stormwater damage and soil erosion resulting from the construction activities outside the construction camp and works areas.
- During construction, water diversion soil berms will be constructed to divert surface and stormwater from traversing the disturbed areas.
- Specific measures to be implemented at watercourse crossings include the following:

- Trench to be excavated across dry river channel;
- Provide measures to safeguard the pipeline such as concrete bedding and restraining measures to prevent flotation.
- Re-shape affected area to its original topography;
- Rehabilitate disturbed area; and
- If erosion of the disturbed riverbanks is a concern, suitable measures will be implemented to ensure the stabilisation of the river structure (e.g. gabions).

❖ At all stages of the project lifespan, stormwater control measures as specified by the Contractor/Engineer shall be applied to keep soil on site by minimising:

- Erosion of temporary stockpiles of topsoil and permanent spoil dumps;
- Erosion from construction roads, excavations and other cleared areas;
- Silt-laden run off from all areas stripped of vegetation, including excavation surfaces and stockpiles of spoil and topsoil; and
- Contaminated run off from storage areas.

Responsibilities:

- Project Manager and ECO – to check.
- Contractor to implement management actions.

Monitoring Requirements:

- Water monitoring programme – instream and discharges.
- Contractor's method statement.
- Visual inspections.
- Public complaints register.

4.4.2 Operational Phase

Note that where any activity and aspect associated with the operational phase of the project coincides with the receiving environment and activities of the construction, the same management requirements will apply.

The following maintenance activities are undertaken during operation of the scheme:

❖ Stormwater Channels:

- Routine cleaning and de-silting of channels.
- Removal of debris to prevent channel blockage.

❖ Stormwater Culverts:

- Routine cleaning and de-silting of culverts.
- Removal of debris to prevent culverts blockage.
- Repairs of embankment after overtopping of culvert structure.

- Routine inspection and repairs, if required, of approach channels and foundations.

❖ Detention Ponds:

- To ensure optimal performance, the detention ponds shall require annual inspection, preferably at the start of the rainy season. The following is a brief list of the maintenance items that require consideration.
- All detention ponds must be accessible from the internal road network.
- Routine mowing and the possible trimming and / or removal of unwanted vegetation – twice per annum.
- The removal of debris and litter from the outlets to prevent clogging and from the basin area to improve aesthetics - three times a year. The first cleaning at the beginning of the summer rainy season (September, October), the second after the first rains (November) and the last towards the end of the rainy season (February).
- The condition of the structures, embankments, inlets and outlets must be inspected annually. This must include checking for animal burrows, cracking, bulging and subsidence of pond walls.
- It is anticipated that silt will need to be removed at least three times a year. First cleaning at the beginning of the summer rainy season (September, October), secondly after the first rains (November) and again towards the end of the rainy season (February). It is also likely that during the construction period more frequent silt removal will be required.
- The emergency spillway should be clear of obstructions at all times.

APPENDIX H TRAFFIC MANAGEMENT PLAN

8 Elements of a Traffic Management Plan (TMP)

One of the key recommendations from this TIA is the development of a Traffic Management Plan (TMP) as part of the Environmental Management Plan (EMP).

The TMP should be developed by an experienced civil or traffic engineer and should cover the following key elements:

Traffic Demand Forecast

1. Prepare a high level demand forecast indicating the number of daily truck trips that will be generated during the various stages of construction.

Operational Time

2. Define the time periods during which heavy vehicles should operate on the external road network.
3. The recommended operational time for heavy vehicle traffic on the external road network is 09:00 to 15:00.
4. In addition to item 3, if there are any schools along the heavy vehicle route then the aforementioned time must be adjusted to account for the school dismal time such that truck traffic and school dismal times do not coincide
5. The time period indicated under item 3 may be amended by 30 minutes on either side provided that they are motivated for using traffic counts that are not older than 2 years.
6. Light vehicle traffic (cars and bakkies) may travel at any time.

Vehicle Types

7. Define the type of heavy vehicles that would be used depending on the construction material and approach:
    a. This is to include the need for any abnormal loads and the anticipated period or date on which this load is expected.
    b. Any clearances required for abnormal load should be specified and the method in obtaining these approval must be indicated.

Source of Material

8. The TMP should indicate the location and source of the key materials that would be used for the construction
9. In conjunction with item 8, vehicles approaching from the N2 should follow the route described in Section 5 of this report.
10. In conjunction with item 8, an appropriate route must be identified and motivated for, for any material being sourced locally.

Road Closures

11. If there is a need for full or partial road closure, then the TMP should include the following:

    c. A map showing the location of the road closures

    d. An indication of the duration of each road closure

    e. A typical signage plan for a full and/or partial closure

    f. For a full closure, details are to be provided on measures that will be put in place to assist vehicle to detour

    g. A list of the local road authorities whom will be contacted for approval of the signage plan.

The aforementioned elements are not prescriptive and is to be used as guide in the development of the TMP. Any proposal should be appropriately motivated for in the TMP

APPENDIX I RE-VEGETATION AND HABITAT REHABILITATION PLAN

LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME AND ASSOCIATED INFRASTRUCTURE:

NGWADINI & GOODENOUGH SYSTEMS

RE-VEGETATION & HABITAT REHABILITATION PLAN

SEPTEMBER 2024

PREPARED FOR: UMNGENI-UTHUKELA WATER

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1 PURPOSE OF THE DOCUMENT

Nemai Consulting was appointed by uMngeni-uThukela Water as the Environmental Assessment Practitioner (EAP) to seek Environmental Authorisation in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) for the Lower uMkhomazi Bulk Water Supply Scheme (LUBWSS): Ngwadini and Goodenough Systems.

This document serves as the Re-Vegetation and Habitat Rehabilitation Plan which supplements the mitigation measures contained in the Environmental Management Programme (EMPr). The purpose of this plan is to mitigate the ecological damage caused by the project's construction activities and to restore the affected areas to a pre-construction condition as much as possible.

2 PROJECT OVERVIEW

The LUBWSS is being pursued as the preferred augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. The supply area extends from Amanzimtoti in the north to Hibberdene in the south and covers both eThekwini and Ugu Municipalities.

The overall LUBWSS consists of the following:

- Ngwadini System components (Figure 1) –
  - The Ngwadini Weir and abstraction works to fill the Ngwadini Dam during summer periods of excess flow (*excluded from the scope of this report*);
  - The Ngwadini pipeline (*included in the scope of this report*); and
  - The Ngwadini OCS Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods (*excluded from the scope of this report*).
- Goodenough System components (Figure 2) –
  - A second abstraction downstream at the Goodenough Weir site to abstract the raw water for delivery to the Water Treatment Plant (WTP) (*included in the scope of this report*);
  - Hydrocyclones before the pump station and WTP to remove sediments during periods of higher turbidity river flows and reduce the WTP residual ("sludge") (*included in the scope of this report*);
  - A pump station to pump water from the Goodenough abstraction to the WTP via (*included in the scope of this report*);
  - A rising main and gravity main (*included in the scope of this report*);
  - A raw water storage reservoir (included in the scope of this report);

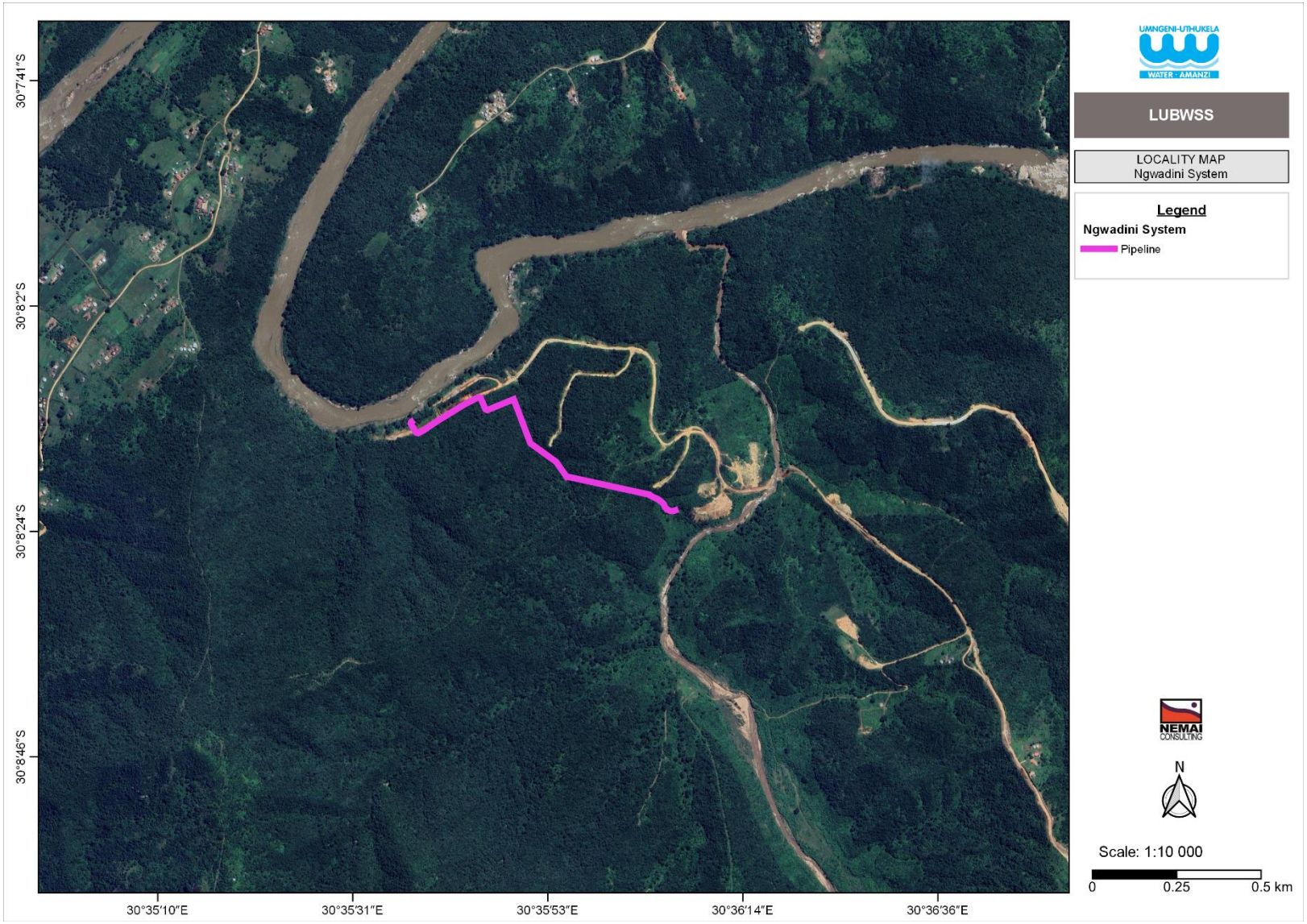

Figure 1: Ngwadini System (components excluded from the scope are not shown)

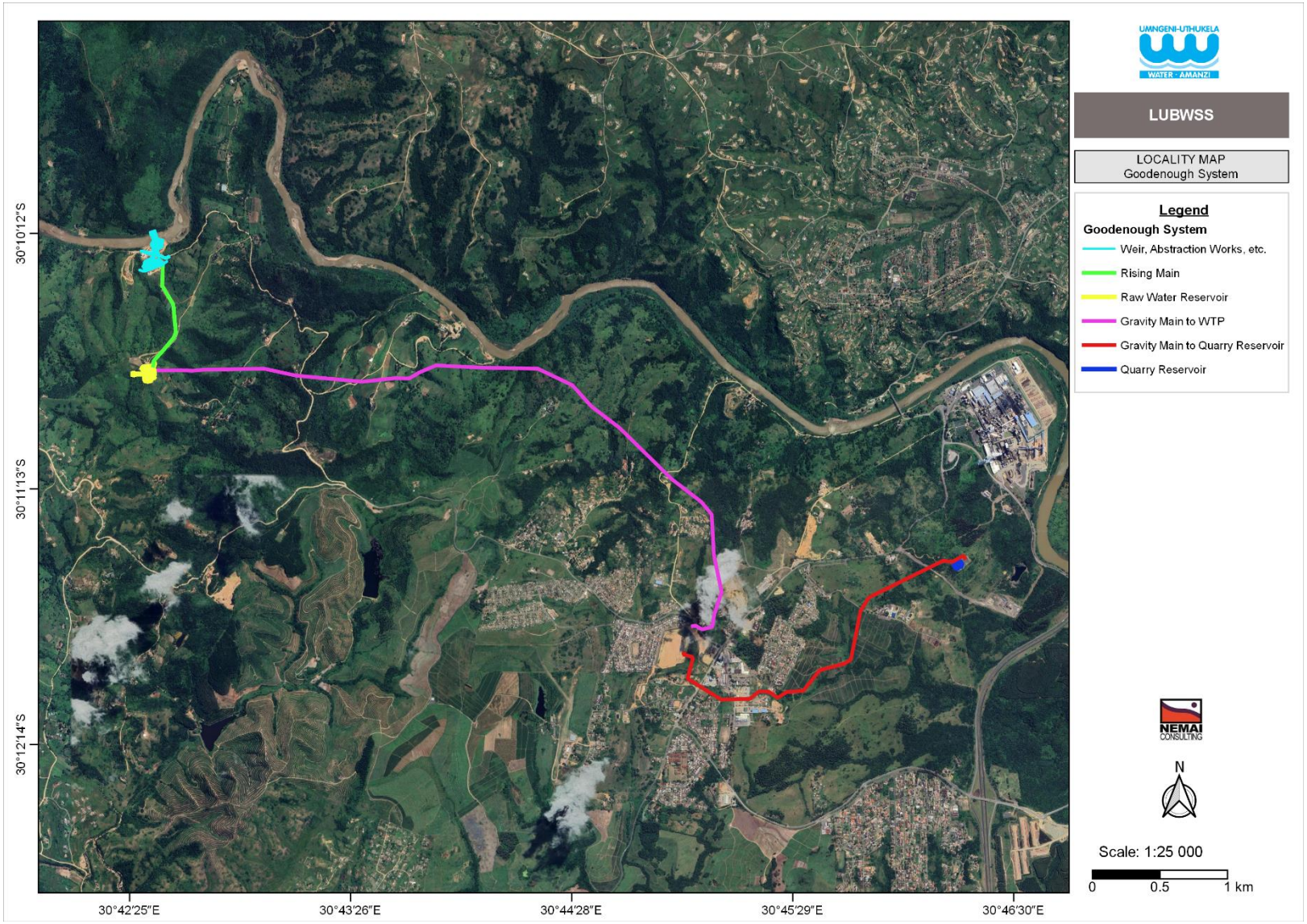

Figure 2: Goodenough System (components excluded from the scope are not shown)

- A 100 Mℓ/d WTP in Craigieburn (*excluded from the scope of this report*); and
- A potable gravity water pipeline from the WTP to Quarry Reservoir (*included in the scope of this report*).

The reader is referred to the Basic Assessment Report and EMPr for a detailed description of the project.

3 SITE CONDITIONS

The following vegetation types are encountered in the Goodenough project area:

- Goodenough Weir to Goodenough Reservoir -
  - The area contains some areas of ecological significance such as open grasslands and forest patches confined to drainage lines.
  - The northern boundary of the assessment area is the uMkhomazi River. The riparian zone associated with the proposed development is heavily transformed with crop farming activities on the riverbanks.
  - The grassland areas are mainly secondary grasslands with high altitude areas containing primary grasslands resembling the original vegetation characteristic. The grasslands are dominated by *Aristada junciformis*.
  - The forest areas have been significantly reduced by suspected increased burning and replaced with crops and mango plantations. The remaining forests are limited in extent and species richness.
- Pipeline from Goodenough Weir -
  - The area is mostly open grassland, pockets of forests confined to drainage lines, subsistence and commercial farming and associated farm housing and infrastructure. The grassland areas are in healthy condition and are dominated by a good mix of grass species including *Cymbopogon excavatus, Monocymbium ceresiiforme, Aristada junciformis*, and *Erogrostis sp*.
  - The forest areas are in good condition. The most conspicuous trees include *Buxus macowanii, B. natalensis, Drypetes gerrardii, Englerophytum natalense, Harpephyllum caffrum, Heywoodia lucens, Memecylon natalense, Millettia grandis, Oricia bachmannii, Philenoptera sutherlandii, Rinorea angustifolia, Rothmannia globosa* and *Umtiza listeriana*.
- Pipeline from WTP to Quarry Reservoir -
  - The area is deemed medium to low sensitivity with a major stream running on the southern border of the assessment area. The area is bordered by gardens with banana and small mango plots associated with a small township.
  - The area adjacent to the SAPPI Skills Centre is characterized by patches of healthy grassland vegetation and forest pockets along the drainage lines.

- The site has a number of invasive alien plant species that include *Lantana camara, Solanum mauritianum, Tithonia diversifolia, Senna didymobotrya, Psidium guajava, Chromolaena odorata, Melia azedarach, Arundo donax, Ricinus communis, Passiflora subpeltata, Rubus cuneifolius, Passiflora edulis* and *Ipomoea indica.*

4 RE-VEGETATION AND HABITAT REHABILITATION PLAN

4.1 Construction Phase

Management Objective:

- Adequate reinstatement and rehabilitation of areas affected by construction.
- Conduct concurrent or progressive rehabilitation of areas affected by construction activities that are situated outside of the construction footprint.

Target:

- Complete site clean-up.
- Reinstatement and rehabilitation of areas physically disturbed by construction activities.
- 80% indigenous vegetation cover within 1 year of the completion of by construction activities.

Management Actions:

- Determine and record (including photographic records) baseline conditions of the areas to be affected by construction activities for rehabilitation purposes.
- The Contractor shall prepare a method statement for re-vegetation and habitat rehabilitation, which shall be approved by the PM.
- Removal of structures and infrastructure
  - After the construction phase, the area disturbed outside of the pipeline servitude must be rehabilitated by appropriate landscaping, levelling, topsoil dressing, land preparation, alien plant eradication and vegetation establishment.
  - Clear and completely remove from site all construction plant, equipment, storage containers, temporary fencing, temporary services, and fixtures.
  - Ensure that all access roads utilised during construction which are outside of the pipeline servitude and not earmarked for use during the operational phase, are returned to a state no worse than prior to construction.
- Inert waste and rubble

- Clear the site of all inert waste and rubble, including surplus rock, foundations and batching plant aggregates. After the material has been removed, the site shall be re-instated and rehabilitated.
- Load and haul excess spoil and inert rubble to fill in borrow pits/dongas or to dump sites indicated/approved by the Project Manager (PM).
- Remove from site all domestic waste and dispose of in the approved manner at a registered waste disposal site.

❖ Hazardous waste and pollution control

- Remove from site all pollution containment structures.
- Remove from site all temporary sanitary infrastructure and wastewater disposal systems. Take care to avoid leaks, overflows and spills and dispose of any waste in the approved manner.
- Comply with relevant provisions under the following EMPr sections: Management of Storage and Handling of Hazardous Material, Management of Water, Management of Waste, Management of Pollution Generation Potential.

❖ Landscaping

- The landscape profile should be restored, matching as closely as possible to the original landform prior to the distribution of the topsoil.
- In general, no slopes steeper than 1(V):3(H) are permitted in cut-and-fill areas, unless otherwise specified by the PM.
- Programme the backfill of excavations so that subsoil is deposited first, followed by the topsoil. Compact in layers for best results.
- Monitor backfilled areas for subsidence (as the backfill settles) and fill depressions using available material.
- Ensure that no excavated material or stockpiles are left on site and that all material remaining after backfilling is landscaped to blend in with the surrounding landscape.
- Rehabilitate construction camp area.

❖ Topsoil replacement and soil amelioration

- Execute top soiling activity prior to the rainy season or any expected wet weather conditions.
- Execute topsoil placement only after all construction work has ceased.
- Replace and redistribute stockpiled topsoil together with herbaceous vegetation, overlying grass and other fine organic matter in all disturbed areas of the construction site, including temporary access routes. Replace topsoil to the original depth.

- Place topsoil in the same area from where it was stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other areas of similar quality.
- The suitability of substitute material will be determined by means of a soil analysis addressing soil fraction, fertility, pH and drainage.
- Do not use topsoil suspected to be contaminated with the seed of alien vegetation. Alternatively, the soil is to be appropriately treated.
- Ensure that stormwater run-off is not channelled alongside the gentle mounding, but that it is taken diagonally across it.
- Shape remaining stockpiled topsoil not utilised elsewhere in an acceptable manner so as to blend in with the local surrounding area.
- After topsoil placement is complete, spread available stripped vegetation randomly by hand over the top-soiled area.
- Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging invasives.
- Machines should remove the stone material and transported to another location and re-used if it is required, removed correctly to a licensed facility, or offered to the landowner.
- The geotextile base material, and other foreign material should also then removed during rehabilitation.

❖ Ripping and scarifying

- Rip and/or scarify all areas following the application of topsoil to facilitate mixing of the upper most layers. Whether ripping and/or scarifying is necessary will be determined based on the site conditions immediately before these works begin.
- Rip and/or scarify all disturbed (and other specified) areas of the construction site, including temporary access routes and roads, compacted during the execution of the works.
- Rip and/or scarify along the contour to prevent the creation of down-slope channels.
- Do not rip and/or scarify areas under wet conditions, as the soil will not break up.
- The area should be ripped to an appropriate depth (at least 300 mm) to remove any minor compaction.

❖ Planting

- The areas that have been denuded and disturbed as a result of the construction on site must be vegetated with indigenous vegetation as soon as possible.
- No exotic plants may be used for rehabilitation purpose, only indigenous plants of the area may be utilised.

- Plants should be located from other undisturbed areas, and this along with the original seed-bank within the replaced topsoil will assist with stabilising soils and re-vegetation of the area.
- All planting work is to be undertaken by suitably experienced personnel, making use of the appropriate equipment.
- Transplanting entails the removal of plant material and replanting the same plants in another designated position.
- Transplant trees and shrubs into designated positions.
- Establish further specifications for transplanted plants.
- Plant all trees, shrubs and individual plants in designated positions.
- Planting should preferably be done during the rainy season.
- After planting, each plant must be well watered, adding more soil upon settlement if necessary.
- Establish further specifications for nursery plants.
- Tree seedling material should be fresh and of local origin. Resist using plants from far afield as they may not be best suited to local climatic or soil conditions.
- Small seedlings are likely to transplant more successfully than will large ones. These should be potted and kept under nursery conditions until they are large enough to plant out.
- Establish further specifications for seeds and seedlings.

❖ Grassing

- Suitably trained personnel must undertake grassing by making use of the appropriate equipment and grass species as specified by the Terrestrial Ecologist.
- Sodding may be done at any time of the year, but seeding must be done during the summer when the germination rate is better.
- Hydroseeding with a winter mix will only be specified where regrassing is urgent and cannot wait for the summer.
- Establish further specifications for sods, runners and hand seeding.

❖ Maintenance

- Undertake survey to assess the recovery of the environment, success of reinstatement and rehabilitation measures, and presence of invasive species. Implement corrective measures, if necessary.
- Cordon off areas that are under rehabilitation as no-go areas.
- Revegetation must match the vegetation type, which previously existed, unless otherwise indicated by a suitable specialist.
- Control invasive plant species and noxious weeds by means of extraction, cutting or other approved methods.
- For planted areas that have failed to establish, replace plants with the same species as originally specified.

- Quarterly vegetation rehabilitation monitoring should be undertaken for at least 1 year after the construction phase has been completed.
- Establish further specifications for maintenance.

Responsibilities:

- ❖ PM and ECO – to check.
- ❖ Contractor to implement management actions.

Monitoring Requirements:

Environmental Themes	Monitoring Parameter	Method	Frequency	Responsible Party	Target/Standard
Soil Quality	Soil compaction, erosion, contamination	Soil sampling, visual inspection	Quarterly (up to end of defects liability period)	Contractor & ECO	• Compare with baseline levels • Pre-construction condition of affected areas
Vegetation Recovery	Vegetation regrowth, success of rehabilitation, and presence of invasive species	Visual inspection, vegetation surveys	Monthly, throughout construction period, as relevant to the concurrent or progressive reinstatement and rehabilitation of affected areas. Up to end of defects liability period.	Contractor & ECO	80% indigenous vegetation cover within 1 year of the completion of construction.
Waste Management	Presence of waste, soil contamination	Visual inspection	Once-off following closure of construction site	Contractor & ECO	100% removal of all waste generated during construction
Site Rehabilitation	Removal of facilities, equipment and debris	Visual inspection	Once-off following closure of construction site	Contractor & ECO	100% removal of equipment/debris

Evidence of compliance will include:

- ❖ Approved Contractor's method statement.
- ❖ Pre-construction survey report.
- ❖ Visible signage.
- ❖ Related entries into Public Complaints Register.
- ❖ Visual inspections (photographic records).
- ❖ Proof of training.

4.2 Operational Phase

Management Actions:

Where relevant, all management actions are to be carried forward from the construction phase to the operational phase.

Specific management measures in terms of re-vegetation and rehabilitation for the operational phase are as follows:

- All areas to be affected by the proposed project will be rehabilitated after construction activities.
- As much vegetation growth as possible should be promoted within the proposed development site in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping. The plant material to be used for rehabilitation should be similar to what is found in the surrounding area.
- Monitor the re-growth of invasive vegetative material.
- Cordon off areas that are under rehabilitation as no-go areas.
- For planted areas that have failed to establish, replace plants with the same species as originally specified.
- Establish further specifications for maintenance.
- Implement the Alien Invasive Management Plan and the Plant Rescue and Protection Plan (appended to the EMPr).

Monitoring Requirements:

Environmental Themes	Monitoring Parameter	Method	Frequency	Responsible Party	Target/Standard
Soil	Soil erosion.	Visual inspection	Quarterly	UUW	Compare with baseline levels.
Vegetation Recovery	Vegetation regrowth, success of rehabilitation, and presence of invasive species	Visual inspection, vegetation surveys	Quarterly	UUW	Maintain 80% indigenous vegetation cover.