LOWER UMKHOMAZI BULK WATER SUPPLY SYSTEM – WATER SUPPLY SCHEME IN KWAZULU-NATAL

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

14/12/16/3/3/2/1030

FEBRUARY 2018

DRAFT

PREPARED FOR: UMGENI WATER

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Title and Approval Page

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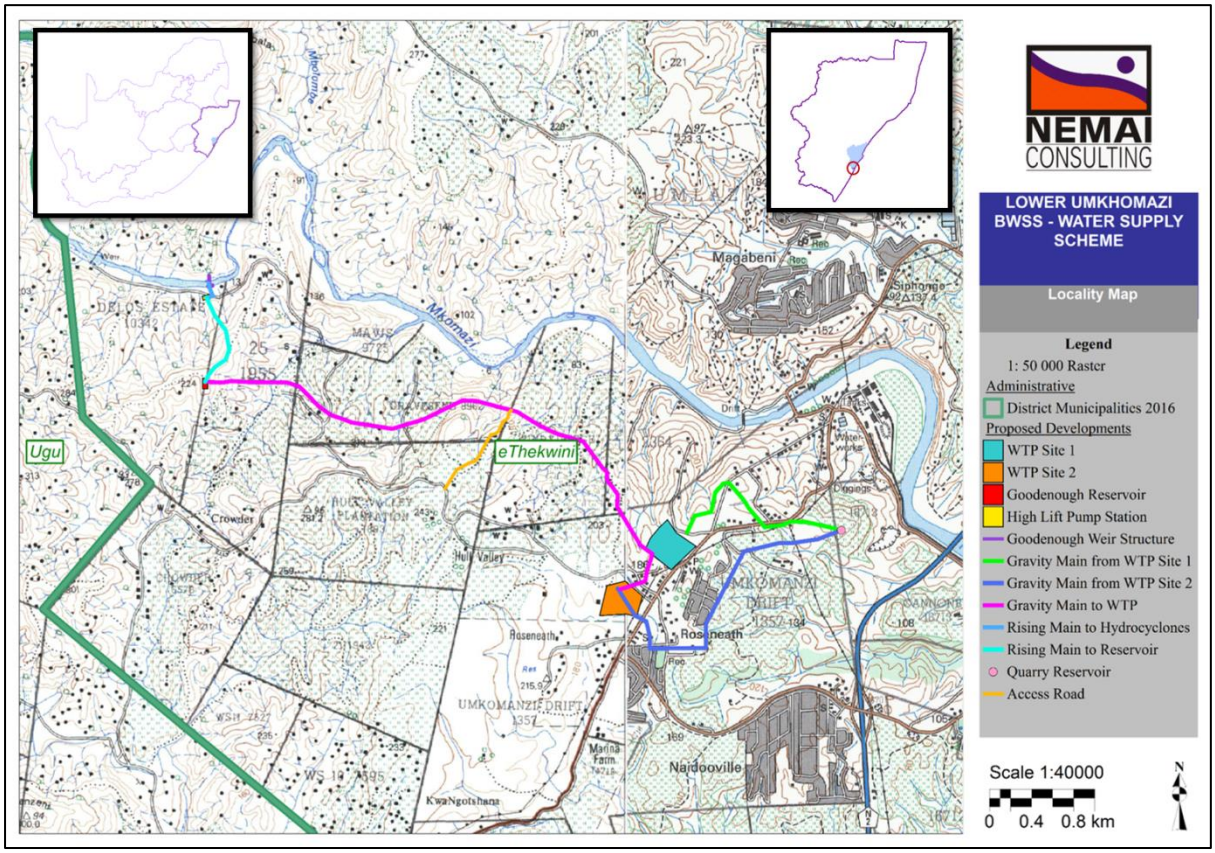
Amendments Page

Date:	Nature of Amendment	Amendment Number:
19/02/2018	Draft Report for 30-Day Authority and Public Review	01

Executive Summary

The current water resources supplying the South Coast of KwaZulu-Natal are insufficient to meet the projected water demands. The Lower uMkhomazi Bulk Water Supply System is the recommended augmentation option for the existing Upper and Middle South Coast Supply area. Therefore, Umgeni Water propose to construct the Lower uMkhomazi Bulk Water Supply System – Water Supply Scheme in order to increase the assurance of water supply.

The project area is situated in the eThekwini Metropolitan Municipality in KwaZulu-Natal. The proposed scheme will supply water to the Middle and Upper South Coast areas (Hibberdene to Amanzimtoti) within KwaZulu-Natal. The proposed developments are located approximately 10km north of Scottburgh.



Locality Map

The overall Lower uMkhomazi Bulk Water Supply System will consist of the following project components:

- The Ngwadini Weir and abstraction works to fill the Ngwadini Off-channel Storage Dam during summer periods of excess flow;

- The Ngwadini Off-channel Storage Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods;
- A second abstraction downstream at the Goodenough Weir site to abstract the raw water for delivery to the Water Treatment Plant;
- A pump station to pump water from the Goodenough abstraction to the Water Treatment Plant via;
- A short rising main and 7km gravity main with;
- A break pressure tank that also serves as a raw water storage reservoir;
- Hydrocyclones before the pump station and Water Treatment Plant to remove sediments during periods of higher turbidity river flows and reduce the Water Treatment Plant residual ("sludge");
- A 100 Ml/d Water Treatment Plant in the town of Craigieburn; and
- A potable gravity water pipeline from the Water Treatment Plant to Quarry Reservoir, the potable water delivery and tie-in point on the South Coast Pipeline.

The requirements in terms of the National Environmental Management Act (Act No. 107 of 1998) for the Lower uMkhomazi Bulk Water Supply System project components are detailed below.

Lower uMkhomazi Bulk Water Supply System Components and National Environmental Management Act (Act No. 107 of 1998) Requirements

No.	Project Component		National Environmental Management Act Requirements
1	**Water Resource Development**	Ngwadini weir and abstraction works to fill the Ngwadini Off-channel Storage Dam during summer periods of excess flow.	Authorisation previously received in terms of the Environment Conservation Act (Act No. 73 of 1989). However, it was confirmed in consultation with KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs that a new Basic Assessment would need to be conducted due to changes in location and design. A separate Application will be submitted to Department of Environmental Affairs.
2		Ngwadini Off-channel Storage Dam, with a capacity of 10 million m^3, and outlet infrastructure to release water back into the river and augment low flow periods.	Authorisation was previously received in terms of Environment Conservation Act (Act No. 73 of 1989). However, it was confirmed in consultation with KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs that an amendment to the authorisation would need to be applied for due to slight changes in design. A separate Environmental Authorisation Amendment Application will be submitted to KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs.
3	**Water Supply Scheme** – Abstraction Works, Conveyance Infrastructure and Water Treatment Plant		This will be the focus of this Application, where a Scoping and Environmental Impact Assessment process needs to be conducted.

The Environmental Impact Assessment Phase focuses on the Water Supply Scheme which forms part of the overall Lower uMkhomazi Bulk Water Supply System.

Nemai Consulting was appointed by the Umgeni Water as the Environmental Assessment Practitioner to undertake the Environmental Impact Assessment for the Lower uMkhomazi Bulk Water Supply System – Water Supply Scheme.

Alternatives to be assessed as part of the Environmental Impact Assessment process are two Water Treatment Plant site alternatives, and the resulting gravity main route to the existing quarry reservoir. Of the two sites considered, Site 2 is the preferred site from a hydraulic perspective, due to the natural topography of the site allowing the works to be gravity fed, with minimal earthworks.

The EIA Report provides a general description of the status quo of the receiving environment in the project area, and also provides local and site-specific discussions on those environmental features investigated by the respective specialists. This allows for an appreciation of sensitive environmental features and possible receptors of the effects of the proposed project.

The study area includes the entire footprint of all the project components, which includes the construction domain and surrounding receiving environment.

The receiving environment is assessed and discussed in terms of the following:

- Climate;
- Geology and Soils;
- Geohydrology;
- Topography;
- Surface Water;
- Flora;
- Fauna;
- Socio-economic Environment
- Land Use
- Existing Infrastructure and Structures;
- Services;
- Heritage;
- Air Quality;
- Noise; and
- Visual Quality.

The following specialist studies were undertaken during the Environmental Impact Assessment to inform the best alternative for the project:

- Terrestrial Biodiversity Report;
- Aquatic Assessment and Wetland Delineation;
- Socio-Economic Impact Assessment;
- Phase 1 Heritage Impact Assessment;

- Estuarine Specialist Study; and
- Sediment Impact Specialist Study.

The information obtained from the respective specialist studies was incorporated into the Environmental Impact Assessment report in the following manner:

1. The information was used to complete the description of the receiving environment in a more detailed and site-specific manner;
2. A summary of each specialist study is provided, focusing on the approach to the study, key findings and conclusions drawn;
3. The specialists' impacts assessment, and the identified mitigation measures, were included in the overall project impact assessment;
4. The evaluations performed by the specialists on the alternatives of the project components were included in the comparative analysis to identify the most favourable option;
5. Specialist input was obtained to address comments made by Interested and Affected Parties that related to specific environmental features pertaining to each specialist discipline;
6. Salient recommendations made by the specialists were taken forward to the final Environmental Impact Assessment Conclusions and Recommendations; and
7. The assumptions and limitations identified in each study were noted.

The Environmental Impact Assessment Report assessed the pertinent environmental impacts that could potentially be caused by the proposed project during the pre-construction, construction and operational phases of the project.

Impacts were identified as follows:

- An appraisal of the project activities and components;
- Impacts associated with listed activities contained in Government Notice No. R. 983, R. 984 and R. 985 of the 2014 Environmental Impact Assessment Report Regulations, as amended (07 April 2017), for which authorisation has been applied for;
- An assessment of the receiving biophysical, social, economic and built environment;
- Findings from specialist studies;
- Issues highlighted by environmental authorities; and
- Comments received during public participation.

The impacts and the proposed management measures are discussed on a qualitative level and thereafter quantitatively assessed by evaluating the nature, extent, magnitude, duration, probability and ultimately the significance of the impacts. The assessment considered impacts before and after mitigation, where in the latter instance the residual impact following the application of the mitigation measures is evaluated.

The proposed mitigation of the impacts associated with the project includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices. The Environmental Management Programme provides a comprehensive list of mitigation measures for specific elements of the project, which extends beyond the impacts evaluated in the body of the Environmental Impact Assessment Report.

The Environmental Impact Assessment Report provides an appraisal of all the environmental and technical considerations associated with the various alternatives through a comparative analysis to eventually distil the Best Practicable Environmental Option.

The Environmental Impact Assessment Report provides a full account of the Public Participation Process that was followed as per Government Notice No. R. 982 of the amended 2014 Environmental Impact Assessment Regulations (2017) for the Scoping and Environmental Impact Assessment Process for the Lower uMkhomazi Bulk Water Supply System – Water Supply Scheme.

A summary of the process is provided below.

Scoping and EIA Phase	Proposed Timeframe
Project Notification / Announcement	30 June 2017
IAP Registration Period	03 July to 03 August 2017
Submission of Application Form to DEA	28 August 2017
Submission of Draft Scoping Report to DEA	28 August 2017
Public Meeting to Present the Draft Scoping Report	07 September 2017
Authority and Registered IAPs Review Period of Draft Scoping Report – 30 Days	29 August to 29 September 2017
Submission of Final Scoping Report to DEA	06 October 2017
DEA Review and Decision Making	09 October to 20 November 2017
Notification of Draft EIA Review	14 February to 16 February 2018
Authority and Registered IAPs Review Period of Draft EIA Report – 30 Days	19 February to 21 March 2018
Public Meeting to Present the Draft EIA Report	08 March 2018
Submission of Final EIA Report to DEA	28 March 2018

All comments received during the public participation process have been assessed in the Final Scoping Report and are noted in the Comments and Responses Report. All comments received during the public participation process are assessed in the Environmental Impact Assessment Report and are also noted in the Comments and Response Report. Comments received from Interested and Affected Parties help shape the Environmental Impact Assessment Phase. The Final Environmental Impact Assessment Report will then submitted to the Department of Environmental Affairs, who is the Competent Authority in respect to this proposed development.

Attention is drawn to specific sensitive environmental features (with an accompanying sensitivity map) for which mitigation measures are included in the Environmental Impact Assessment Report, and Environmental Management Programme.

An Environmental Impact Statement is provided and critical environmental activities that need to be executed during the project life-cycle are also presented.

With the selection of the Best Practicable Environmental Option, the adoption of the mitigation measures included in the Environmental Impact Assessment Report and the dedicated implementation of the suite of Environmental Management Programme, it is believed that the significant environmental aspects and impacts associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

The Environmental Impact Assessment Report is concluded with key recommendations, which may also influence the conditions of the Environmental Authorisation (where relevant).

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List of Abbreviations

ASPT	Average Score per Taxon
BID	Background Information Document
BPEO	Best Practicable Environmental Option
CBA	Critical Biodiversity Areas
CR	Critically Endangered
DAFF	Department of Forestry and Fisheries
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DM	District Municipality
D'MOSS	Durban Metropolitan Open Space System
DMR	Department of Mineral Resources
DoT	Department of Transport
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EBA	Endemic Bird Area
ECA	Environment Conservation Act (Act No. 73 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Areas
EWR	Ecological Water Requirements
GIS	Geographical Information System
GN	Government Notice
HIA	Heritage Impact Assessment
IAPs	Interested and Affected Party
IBA	Important Bird and Biodiversity Areas
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
IWULA	Integrated Water Use License Application
KZN	KwaZulu-Natal
KZN EDTEA	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs
LM	Local Municipality
LUBWSS	Lower uMkhomazi Bulk Water Supply Scheme

LUBWSS – WSS	Lower uMkhomazi Bulk Water Supply Scheme – Water Supply System
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MOSS	Metropolitan Open Space System
MPA	Marine Protected Area
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act (Act No. 107 of 1998
NEMAQA	National Environmental Management: Air Quality Act (Act No. 39 of 2004)
NEMBA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMPA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEMA: WA	National Environmental Management Waste Act (Act No. 56 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NT	Near Threatened
NWA	National Water Act (Act No. 36 of 1998)
OCS	Off-channel Storage
OHS	Occupational Health and Safety
PMC	Project Management Committee
QDS	Quarter Degree Squares
SABAP	Southern African Bird Atlas Project
SANBI	South African National Biodiversity Institute
SASS	South African Scoring System
SDF	Spatial Development Framework
UCSC	Unified Soil Classification System
VU	Vulnerable
WC/WDM	Water Conservation and Water Demand Management
WMA	Water Management Area
WTP	Water Treatment Plant
WUL	Water Use License
WULA	Water Use License Application
WwTW	Wastewater Treatment Works

1 PURPOSE OF THE DOCUMENT

The current water resources supplying the South Coast of KwaZulu-Natal (KZN) are insufficient to meet the projected water demands. The Lower uMkhomazi Bulk Water Supply System (LUBWSS) is the recommended augmentation option for the existing Upper and Middle South Coast Supply area, which is currently supplied by water from local rivers and dams and augmented by the Mgeni System. Therefore, Umgeni Water propose to construct the LUBWSS – Water Supply Scheme (WSS) in order to increase the assurance of water supply.

This document serves as the Environmental Impact Assessment (EIA) Report for the proposed LUBWSS – WSS and consists of the following:

- Goodenough weir and abstraction works;
- High Lift Pump Station;
- Rising main to hydrocyclones;
- Hydrocyclones;
- Rising Main to Reservoir;
- Raw Water Reservoir;
- Gravity main to WTP (Water Treatment Plant);
- WTP – treatment component;
- WTP – sludge handling;
- Gravity main to Quarry Reservoir;
- Potable Water Storage – Quarry Reservoir; and
- Associated access roads.

According to Government Notice (GN) No. R. 982 of the EIA Regulations, as amended (07 April 2017), the objective of the EIA process is to undertake the following, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

- Determine the--
    - Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    - Degree to which these impacts-
        - Can be reversed;
        - May cause irreplaceable loss of resources, and
        - Can be avoided, managed or mitigated;
- Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

The Scoping Phase of the project has been completed. The Final Scoping Report and Plan of Study for the EIA was submitted to the Department of Environmental Affairs (DEA) on 28 August 2017 and approved on 21 November 2017 (**Appendix A**). The Scoping Phase allowed Registered Interested and Affected Parties (IAPs) the opportunity to comment on the overall environmental assessment approach and environmental issues. These comments helped to focus the efforts from technical specialists during the subsequent EIA Phase.

The Draft EIA Report was made available to IAPs for a 30-Day Review Period from **19 February 2018 to 21 March 2018**. All comments that were received have been assessed in the Final EIA Report and are also be noted in the Comments and Response Report. The Final EIA Report will then be made available for further public review at the same time as it is submitted to DEA, the Competent Authority in respect to this proposed development.

2 DOCUMENT ROADMAP

The EIA Report is intended to meet all requirements as stipulated in Appendix 3 of GN No. R. 982 of the EIA Regulations, as amended (07 April 2017). In order to provide clarity to the reader, a document roadmap is provided in terms of the aforementioned regulatory requirements (**Table 1**).

Table 1: Document Roadmap

Chapter	Title	Correlation with Appendix 3 of GN No. R. 982
1	Purpose of the Document	N/A

Chapter	Title	Correlation with Appendix 3 of GN No. R. 982	
2	Document Roadmap	N/A	
3	Project Background and Motivation	3 (f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity within the context of the preferred location.
4	Project Location	3 (b)	The location of the activity including – (i) The 21 digit Surveyor General code of each Cadastral land parcel; (ii) Where available, the physical address and farm name; and (iii) Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property or properties
		3 (c)	A plan which locates the proposed activity or activities applied for at an appropriate scale, or if it is – (i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is undertaken; and (ii) On land where the property has not yet been defined, the coordinates within which the activity is to be undertaken.
5	Legislation and Guidelines Considered	3 (e)	A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.
6	Scoping and EIA Process	N/A	
7	Assumptions and Limitations	3 (p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.
8	Environmental Assessment Practitioner	3 (a)	Details of – (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae.
9	Need and Desirability	3 (f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity within the context of the preferred location.
10	Project Description	3 (d)	A description of the scope of the proposed activity, including – (i) All listed and specified activities triggered; and

Chapter	Title	Correlation with Appendix 3 of GN No. R. 982	
			(ii) A description of the activities to be undertaken, including associated structures and infrastructure.
		3 (g)	A motivation for the preferred development footprint within the approved site.
11	Alternatives	3 (h)	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including: (i) Details of all alternatives considered; (ix) The outcome of the site selection matrix; (x) If no alternatives including alternative locations for the activity were investigated, the motivation for not considering such.
12	Profile of the Receiving Environment	3 (h)	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including: (iv) The environment attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
13	Public Participation	3 (h)	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including: (ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations including copies of supporting documents and inputs; and (iii) A summary of the issues raised by IAPS and an indication of the manner in which the issues were incorporated or the reasons for not including them.
14	Summary of Specialist Studies	3 (k)	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.
15	Impact Assessment	3 (h)	A full description of the process followed to reach the proposed development footprint within the approved site, including: (v) The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – a. can be reversed; b. may cause irreplaceable loss of resources; and c. can be avoided, managed or mitigated. (vi) The methodology used in determining and ranking the nature, significance,

Chapter	Title	Correlation with Appendix 3 of GN No. R. 982	
			consequences, extent, duration and probability of potential environmental impacts and risks. (vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects. (viii) The possible mitigation measures that could be applied and level of residual risk.
		3 (i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including – (i) A description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.
		3 (j)	An assessment of each identified potentially significant impact and risk, including- (i) Cumulative impacts; (ii) The nature, significance and consequences of the impact and risk; (iii) The extent and duration of the impact and risk; (iv) The probability of the impact and risk occurring; (v) The degree to which the impact and risk can be reversed; (vi) The degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) The degree to which the impact and risk can be mitigated.
16	Analysis of Alternatives	3 (h)	A full description of the process followed to reach the proposed preferred activity, site and location within the site, including: (ix) The environment attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;
17	EIA Conclusions and Recommendations	3 (l)	An environmental impact statement which contains – (i) A summary of the key findings of the environmental impact assessment: (ii) A map at an appropriate scale which superimposes the proposed activity and its associated structures and

Chapter	Title	Correlation with Appendix 3 of GN No. R. 982	
			infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.
		3 (m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.
		3 (o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.
		3 (q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.
18	Oath of EAP	3 (s)	An undertaking under oath or affirmation by the EAP in relation to: (i) The correctness of the information provided in the reports; (ii) The inclusion of comments and inputs from stakeholders and IAPs; (iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.
19	References	-	-
N/A		3 (r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.
N/A		3 (u)	An indication of any deviation from the approved scoping report, including the plan of study, including – (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks (ii) a motivation for the deviation
N/A		3 (v)	Any specific information that may be required by the competent authority.
N/A		3 (w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.

3 PROJECT BACKGROUND AND MOTIVATION

3.1 Projected Water Requirements for the Middle and Upper South Coast

The information to follow was sourced from the Technical Feasibility Study (AECOM, 2016a).

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, Umgeni 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. Two main options are being investigated at a feasibility level; namely Desalination of Seawater, and the LUBWSS.

The LUBWSS is the recommended augmentation option to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. To determine the size of the proposed LUBWSS, the supply area and current and future water requirements had to be defined. The supply area extends from Amanzimtoti in the north to Hibberdene in the south, and covers both eThekwini and Ugu Municipalities (**Figure 1**).

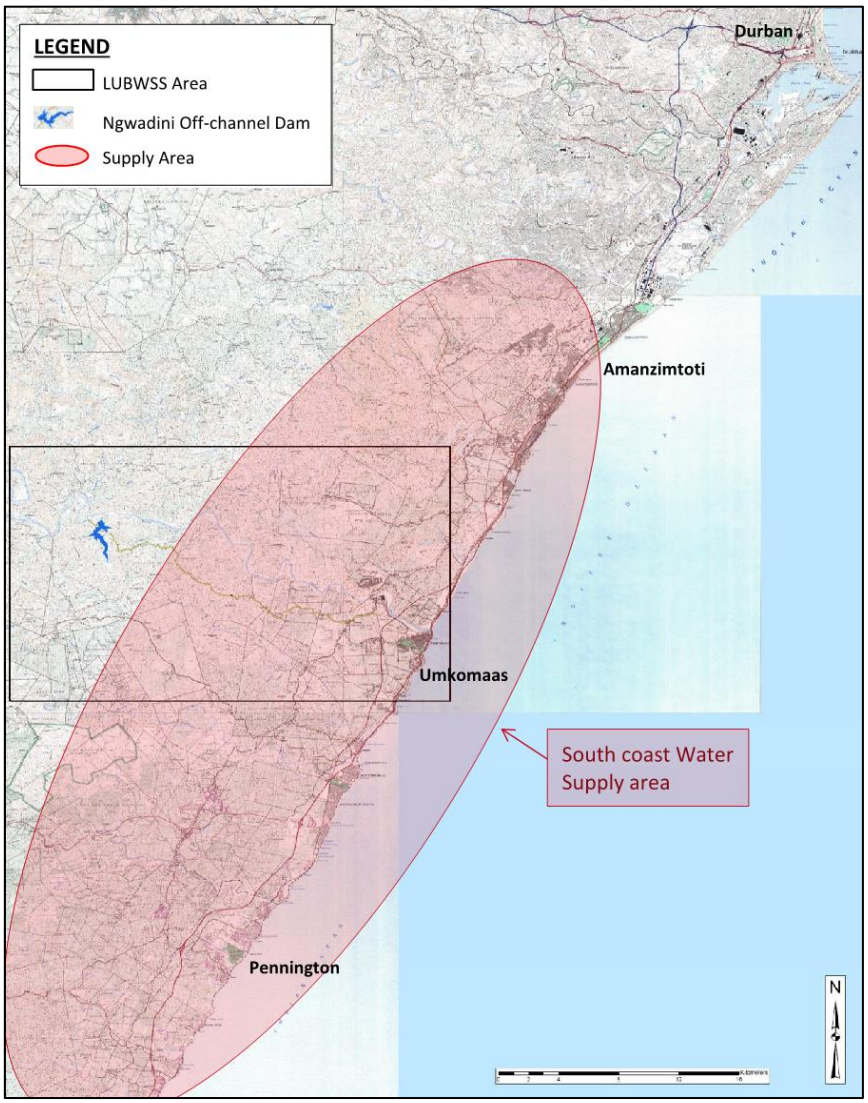


Figure 1: Map of the South Coast Water Supply area (AECOM, 2016a)

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 (**Figure 2**), the LUBWSS needs to be 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.

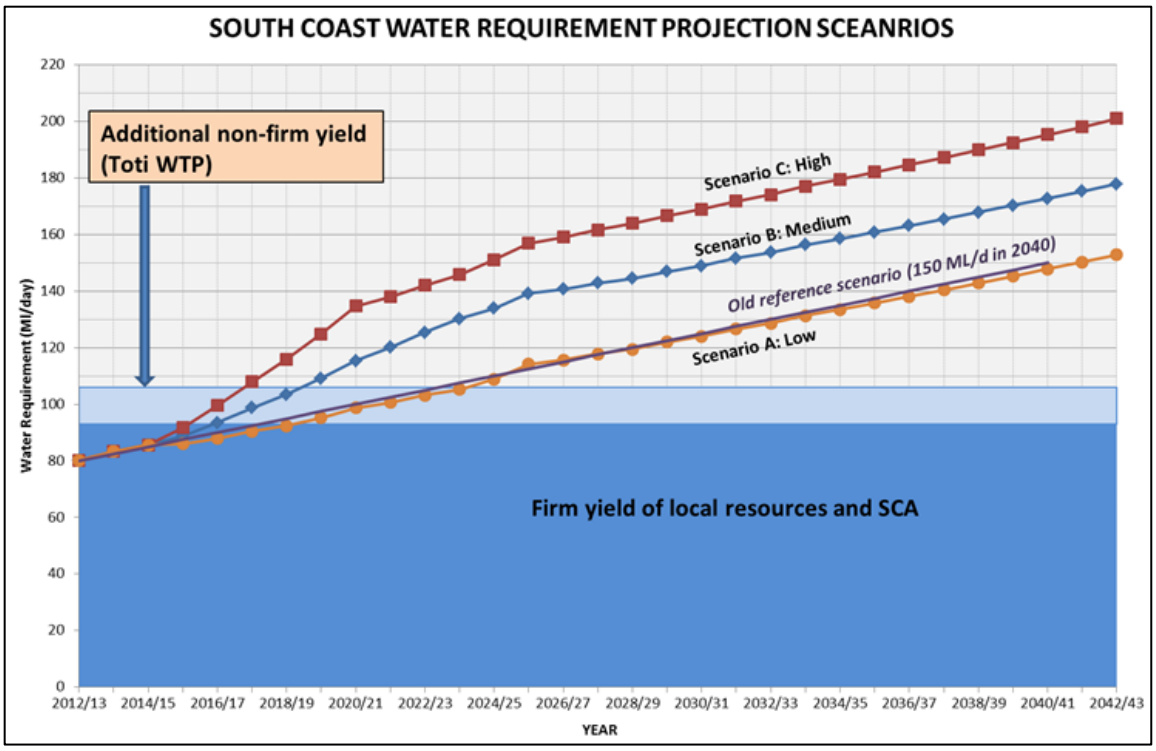


Figure 2: 30-year water demand projections and current water availability within the selected Upper and Middle South Coast supply area (AECOM, 2016a)

In 2008, SAPPI SAICCOR completed investigations and designs on the Ngwadini OCS dam to increase supply assurance for their industrial plant situated near the town of Umkomass in KZN. SAPPI SAICCOR, however, chose not to implement the dam and have handed over the project to Umgeni Water to implement for potable water supply.

A pre-feasibility scheme concept was provided by Umgeni Water which investigated scheme configuration options for the LUBWSS based on the supply area and current and future water requirements. The scheme configuration options investigated are as follows:

- A WTP at the Ngwadini Dam and a long pipeline of around 23km to connect to, and deliver potable water, to the South Coast Pipeline.
- Releasing water from the Ngwadini Dam into the river in the dry months and abstracting the water again at two alternative points lower down the uMkhomazi River (previously Mkhomazi River); one point 13km downstream at the existing Goodenough weir, and one point 17km downstream at the existing SAPPI SAICCOR abstraction weir.

A Detailed Feasibility Study, which included preliminary design of components, has been completed for the LUBWSS by AECOM SA (Pty) Ltd. Of the options investigated, two scheme configuration options were carried forward to the feasibility investigation phase, and are defined as follows:

- **Scheme A:** Water supplied directly from the Ngwadini Dam to the WTP through a proposed 22km long pipeline; and

- **Scheme B:** 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.

Please refer to **Section 11.2** on Alternatives for a detailed overview of alternatives assessed during the Feasibility Study.

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.

Based on the supply risks associated with Scheme A and Scheme B's increased flexibility for phasing and integrating with other regional schemes, Scheme B was selected as the preferred scheme to take forward to preliminary design. Initial supply from Scheme B's can commence before completion of the dam, but at lower levels of water assurance. Timeous implementation of Smithfield Dam upstream may mitigate the need for Ngwadini Dam for a lengthy period.

4 PROJECT LOCATION

The proposed scheme will supply water to the Middle and Upper South Coast areas (Hibberdene to Amanzimtoti) within KZN (**Figure 3**). The project area is situated in the eThekwini Metropolitan Municipality in KZN (**Figure 4**). The proposed developments are located approximately 10km north of Scottburgh.

The Goodenough Weir and Abstraction Works, and Goodenough High Lift Pump Station are located on the uMkhomazi River. From the abstraction works and pump station, 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 two alternative WTP sites. The two WTP alternatives, the gravity mains, and the Quarry Reservoir are located within the town of Craigieburn. The towns Roseneath, Naidooville and Magabeni are located near the proposed developments.

The LUBWSS pipeline routes traverse both Ingonyama Trust land and private land. Affected landowners and land users have been consulted during the Pre-feasibility and Feasibility Studies, as well as during the Scoping and EIA process. It was essential that the first interactions provided a solid base from which Umgeni Water can continue engagement and negotiations (AECOM, 2016).

Please refer to **Appendix F1** for affected property details.

Figure 3: Regional Locality Map of the LUBWW – WSS

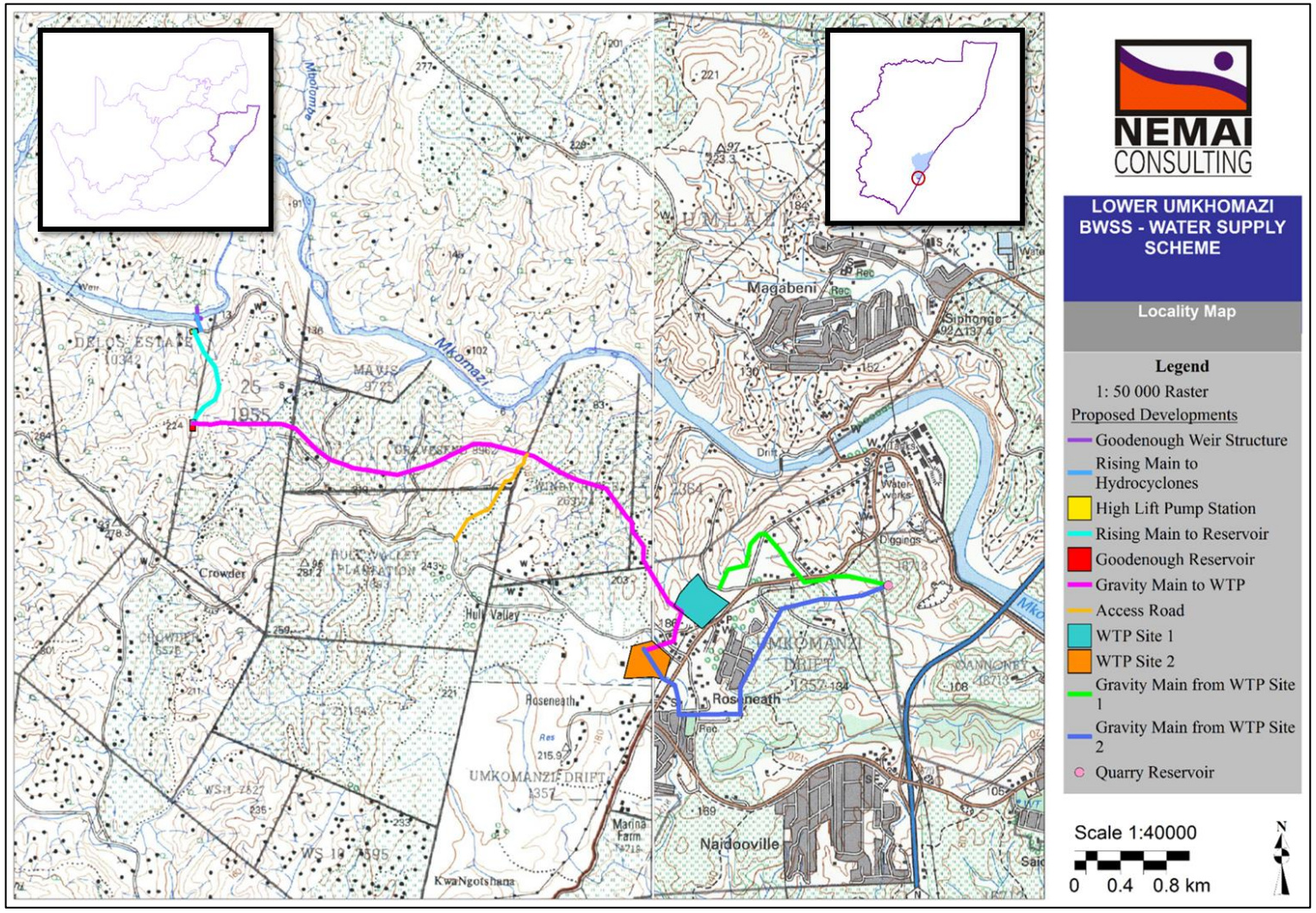


Figure 4: Locality Map of the LUBWSS – WSS

The position of the proposed development area using the latitude and longitude co-ordinates is indicated below. The coordinates are displayed in degrees, minutes and seconds (**Table 2**).

Table 2: Coordinates of the proposed infrastructure

No.	Proposed Development	Coordinates		
		Start	Middle	End
1	Goodenough Weir and Abstraction Works	30°10'13.70"S 30°42'31.68"E		
2	Rising Main to Hydrocyclones	30°10'14.56"S 30°42'31.50"E	30°10'16.58"S 30°42'32.14"E	30°10'18.58"S 30°42'31.98"E
3	High Lift Pump Station	30°10'18.85"S 30°42'30.69"E		
4	Rising Main to Reservoir	30°10'18.85"S 30°42'30.69"E	30°10'29.25"S 30°42'37.57"E	30°10'44.81"S 30°42'30.29"E
5	Goodenough Reservoir	30°10'44.81"S 30°42'30.29"E		
6	Gravity Main to WTP	30°10'44.81"S 30°42'30.29"E	30°10'50.73"S 30°44'4.29"E	30°11'48.83"S 30°44'58.27"E
7	Access Road	30°10'53.64"S 30°44'18.88"E	30°11'3.78"S 30°44'9.91"E	30°11'17.82"S 30°43'55.36"E
8	WTP Site 1	30°11'35.59"S 30°45'14.97"E		
9	WTP Site 2	30°11'51.74"S 30°44'57.91"E		
10	Gravity Main from WTP Site 1	30°11'31.21"S 30°45'21.49"E	30°11'29.57"S 30°45'48.89"E	30°11'30.26"S 30°46'14.96"E
11	Gravity Main from WTP Site 2	30°11'48.54"S 30°44'56.80"E	30°11'49.61"S 30°45'33.98"E	30°11'31.01"S 30°46'14.82"E
12	Quarry Reservoir	30°11'30.63"S 30°46'16.12"E		

5 LEGISLATION AND GUIDELINES CONSIDERED

5.1 Overview of Legislation

Some of the pertinent environmental legislation that has bearing on the proposed development is captured below (**Table 3**). More detailed information is provided in **Section 5.2.** to **5.13**.

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)	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. Environmental management principles. Authority – DEA.
GN. R. 982 of amended 2014 EIA Regulations (07 April 2017)	Purpose – regulate the procedure and criteria as contemplated in Chapter 5 of the Act relating to the preparation, evaluation, submission, processing and consideration of, and decision on,

Legislation	Relevance
	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. R. 983 of amended 2014 EIA Regulations (07 April 2017) (Listing Notice 1)	Process for undertaking Basic Assessment / Scoping and EIA process.
GN. No. R. 984 of amended 2014 EIA Regulations (07 April 2017) (Listing Notice 2)	Activities that need to be assessed through a Basic Assessment process.
GN. No. R. 985 of amended 2014 EIA Regulations (07 April 2017) (Listing Notice 3)	Activities that need to be assessed through a Scoping and EIA process.
National Water Act (Act No. 36 of 1998)	Chapter 3 – Protection of water resources. Section 19 – Prevention and remedying effects of pollution. Section 20 – Control of emergency incidents. Chapter 4 – Water use. Chapter 12 – Safety of dams Authority – DWS.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	Protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes. Authority –DEA.
National Environmental Management: Air Quality Act (Act No. 39 of 2004)	Air quality management. Section 32 – dust control. Section 34 – noise control. Authority – DEA.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Management and conservation of the country's biodiversity. Protection of species and ecosystems. Authority – DEA.
National Environmental Management: Waste Act (Act No. 59 of 2008)	Chapter 5 – licensing requirements for listed waste activities (Schedule 1). Authority – Minister (DEA) or MEC (provincial authority)
Occupational Health & Safety Act (Act No. 85 of 1993)	Provisions for Occupational Health & Safety. Authority – Department of Labour.
National Heritage Resources Act (Act No. 25 of 1999)	Section 34 – protection of structure older than 60 years. Section 35 – protection of heritage resources. Section 36 – protection of graves and burial grounds. Section 38 – Heritage Impact Assessment for linear development exceeding 300m in length; development exceeding 5 000m2 in extent. Authority – Amafa aKwaZulu-Natali.
KZN Heritage Act (Act No. 04 of 2008)	Conservation, protection and administration of both the physical and the living or tangible heritage resources of KZN. Authority – Amafa aKwaZulu-Natali.
Conservation of Agricultural Resources Act (Act No. 43 of 1983)	Control measures for erosion. Control measures for alien and invasive plant species. Authority – Department of Forestry and Fisheries (DAFF) and Department of Agriculture.
National Forestry Act (Act No. 84 of 1998)	Section 15 – authorisation required for impacts to protected trees. Authority – DAFF.

Legislation	Relevance
Minerals and Petroleum Resources Development Act (Act No. 28 of 2002)	Permit required for borrow pits. Authority – Department of Mineral Resources (DMR).
National Road Traffic Act (Act No. 93 of 1996)	Authority – Department of Transport (DoT).
Tourism Act of 1993	Authority – South African Tourism Board.
KwaZulu-Natal Nature Conservation Management Act (Act No. 09 of 1997).	Institutional bodies for nature conservation in KZN. Establish control and monitoring bodies and mechanisms. Authority – Ezemvelo KZN Wildlife.
Kwazulu-Natal Planning and Development Act (Act No. 06 of 2008)	Directs and regulates planning and development in KZN. An application may be required before land may be used or developed for a particular purpose. All developments need to be in accordance with the municipality's planning scheme. Authority – Municipality
Integrated Coastal Management Act (Act No. 24 of 2008)	Management of uMkomaas Estuary. Authority – DEA.
Spatial Planning and Land Use Management Act (Act No.16 of 2013)	Directs and regulates planning and development in South Africa. Govern planning permissions and approvals, sets parameters for new developments and provides for different lawful land uses in South Africa. Authority – DEA.

5.2 The Constitution of the Republic of South Africa (Act No. 108 of 1996)

The Constitution of the Republic of South Africa (Act No. 108 of 1996) is the supreme law of the land and provides amongst others the legal framework for legislation regulating coastal management in general. It also emphasises the need for co-operative governance. In addition, the Environmental clause in Section 24 of the Constitution provides that:

"Everyone has the right –

a) To an environment which is not harmful to their health or wellbeing;

b) To have the environment protected for the benefit of present and future generations through reasonable legislation and other measures that:

I. Prevent pollution and ecological degradation;
II. Promotes conservation;
III. Secure ecologically sustainable development and the use of natural resources while promoting justifiable economic and social development".

The Constitution provides the overarching framework for sustainable development.

5.3 The National Environmental Management Act (Act No. 107 of 1998)

The LUBWSS – WSS requires authorisation in terms of the National Environmental Management Act (NEMA) (Act No. 107 of 1998), and the EIA will be undertaken in accordance with the amended 2014 EIA Regulations (2017).

The amended 2014 EIA Regulations (2017) consist of the following:

- EIA procedures - Government Notice No. R. 982;
- Listing Notice 1 - Government Notice No. R. 983;
- Listing Notice 2 - Government Notice No. R. 984; and
- Listing Notice 3 - Government Notice No. R. 985.

The proposed development trigger activities under Listing Notices 1, 2 and 3, and thus a Scoping and EIA process needs to be undertaken. The listed activities are fully explained in the context of the project in **Table 4**.

Table 4: Listed Activities triggered by the proposed project

<table>
<tr><th>Listed Activity</th><th>Listed Activity Description</th></tr>
<tr><td>GN 983 – Activity 9

The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water—
(i) with an internal diameter of 0,36 metres or more; or
(ii) with a peak throughput of 120 litres per second or more;</td><td>Pipelines that form part of the water conveyance scheme:
<table>
<tr><th>Pipeline</th><th>Velocity (m/s)</th><th>Length (m)</th><th>Diameter (mm)</th></tr>
<tr><td>Low-lift pipeline</td><td>1.117 m/s</td><td>185 m</td><td>DN1400</td></tr>
<tr><td>Rising main to Reservoir</td><td>1.432 m/s</td><td>950 m</td><td>DN1200</td></tr>
<tr><td>Gravity main to WTP 1</td><td>1.432 m/s</td><td>6000 m</td><td>DN1200</td></tr>
<tr><td>Gravity main to WTP 2</td><td>1.432 m/s</td><td>6000 m</td><td>DN1200</td></tr>
<tr><td>Gravity main to Quarry from WTP 1</td><td>1.371 m/s</td><td>2000 m</td><td>DN1200</td></tr>
<tr><td>Gravity main to Quarry from WTP 2</td><td>1.371 m/s</td><td>3000 m</td><td>DN1200</td></tr>
</table></td></tr>
<tr><td>GN 983 – Activity 12

The development of—
(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or
(ii) infrastructure or structures with a physical footprint of 100 square metres or more;
where such development occurs—
(a) within a watercourse;
(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; —</td><td>Various infrastructure within 32m from watercourse(s) and within a watercourse, including:
Weir and abstraction works (uMkhomazi River);
Pump station;
Pipelines;
Access roads;
Other.</td></tr>
<tr><td>GN 983 – Activity 13

The development of facilities or infrastructure for the off-stream storage of water, including dams and</td><td>A raw water reservoir is required at the end of the rising main to perform the role of a break pressure tank and to provide operational storage for the WTP. Storage reservoir capacity of 6 hour, which equates to 25 ML.</td></tr>
</table>

<table>
<tr><th>Listed Activity</th><th>Listed Activity Description</th></tr>
<tr><td>reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.</td><td>The Quarry Reservoir will be upgraded from 15ML to 25ML.</td></tr>
<tr><td>GN 983 – Activity 14

The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.</td><td>There will be chemical storage at the WTP.</td></tr>
<tr><td>GN 983 – Activity 19

The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;</td><td>Construction of various infrastructure within watercourse(s), including:
Weir and abstraction works;
Pump station;
Pipelines;
Access roads;
Other.
This will result in the excavating, dredging and infilling within a watercourse of more than 10m^3.</td></tr>
<tr><td>GN 983 – Activity 24

The development of a road—
(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or
(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;</td><td>New access roads (temporary for construction and permanent to reach infrastructure) are to be constructed. The roads will be approximately 8m wide gravel roads with a construction servitude of 12m. A summary of the proposed access roads is provided below.

<table><tr><th>Access Road</th><th>Length</th></tr><tr><td>New Access Roads</td><td>13.90 km</td></tr><tr><td>Upgrading of Existing Access Roads</td><td>5.95 km</td></tr></table></td></tr>
<tr><td>GN 983 – Activity 27

The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for—
(i) the undertaking of a linear activity; or
(ii) maintenance purposes undertaken in accordance with a maintenance management plan.</td><td>The combined area of the footprint of WTP and potable water reservoir will be greater than 20 hectares.

The proposed construction of the WTP and reservoir will result in the clearance KZN CBA Irreplaceable areas.

The developments also fall within parts of a D’Moss area. D’Moss is a network of natural open spaces, defined by the eThekwini Municipality as critical for the ecosystem goods and services that they supply to the residents of the municipal area. D’Moss aims to conserve local biodiversity and to ensure the supply of environmental services for current and future generations.

The areas of indigenous vegetation to be cleared is to be confirmed by the Terrestrial Ecological Specialist.</td></tr>
<tr><td>GN 983 – Activity 28

Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:
(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or
(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;</td><td>Most of the properties traversed by the pipeline are agricultural and small holdings.

Status of land use in areas earmarked for project infrastructure to be confirmed.</td></tr>
</table>

Listed Activity	Listed Activity Description
GN 983 – Activity 30 Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	The proposed developments will fall within areas of KZN CBA Irreplaceable areas. The developments also fall within parts of a D'Moss area. D'Moss is a network of natural open spaces, defined by the eThekwini Municipality as critical for the ecosystem goods and services that they supply to the residents of the municipal area. D'Moss aims to conserve local biodiversity and to ensure the supply of environmental services for current and future generations.
GN 983 – Activity 31 The decommissioning of existing facilities, structures or infrastructure for— (i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (iii) …. (iv) any phased activity or activities for development and related operation activity or expansion or related operation activities listed in this Notice or Listing Notice 3 of 2014; or (v) any activity regardless the time the activity was commenced with, where such activity: (a) is similarly listed to an activity in (i) or (ii) above; and (b) is still in operation or development is still in progress;	The Quarry Reservoir will be upgraded from 15ML to 25ML.
GN 983 – Activity 48 The expansion of— (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more; where such expansion occurs— (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	Goodenough weir and abstraction works requires raising of the existing weir by 2.8m, and the removal of the existing gated structure on the right-hand bank, and the construction of a new abstraction works. The expansion of the weir will occur within a watercourse, namely the uMkhomazi River.
GN 983 – Activity 56 The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres;	New access roads (temporary for construction and permanent to reach infrastructure) are to be constructed. The roads will be approximately 8m wide gravel roads with a construction servitude of 12m.
GN 983 – Activity 67 Phased activities for all activities— (i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which	There is a possibility of the project to be phased.

Listed Activity	Listed Activity Description
commenced on or after the effective date of such previous NEMA Notices; excluding the following activities listed in this Notice- 17(i)(a-d); 17(ii)(a-d); 17(iii)(a-d); 17(iv)(a-d); 17(v)(a-d); 20; 21;22; 24(i); 29; 30; 31; 32; 34; 54(i)(a-d); 54(ii)(a-d); 54(iii)(a-d); 54(iv)(a-d); 54(v)(a-d); 55; 61; 64; and 65; or (ii) listed as activities 5, 7, 8(ii), 11, 13, 16, 27(i) or 27(ii) in Listing Notice 2 of 2014 or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	
GN 984 – Activity 4 The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	Storage of chemicals (e.g. lime, Soda Ash) at WTP in excess of 500 m^3.
GN 984 – Activity 15 The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	The combined area of the footprint of WTP and potable water reservoir will be greater than 20 hectares. The proposed construction of the WTP and reservoir will result in the clearance KZN CBA Irreplaceable areas. The developments also fall within parts of a D'Moss area. D'Moss is a network of natural open spaces, defined by the eThekwini Municipality as critical for the ecosystem goods and services that they supply to the residents of the municipal area. D'Moss aims to conserve local biodiversity and to ensure the supply of environmental services for current and future generations. The areas of indigenous vegetation to be cleared is to be confirmed by the Terrestrial Ecological Specialist.
GN 985 – Activity 2(d)(viii, xi and xii)(aa) The development of reservoirs, excluding dams, with a capacity of more than 250 cubic metres. d. KwaZulu-Natal viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; xii. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve	A raw water reservoir is required at the end of the rising main to perform the role of a break pressure tank and to provide operational storage for the WTP. Storage reservoir capacity of 6 hour, which equates to 25 ML. The Quarry Reservoir will be upgraded from 15ML to 25ML. The proposed reservoirs will traverse KZN CBA Irreplaceable areas. The Goodenough Weir traverses KwaZulu-Natal Coastal Belt, which is a threatened ecosystem. The proposed developments occur outside an urban area and falls within 10km from the Aliwal Shoal MPA. In addition, The developments also fall within parts of a D'Moss area.

<table>
<tr><th>Listed Activity</th><th>Listed Activity Description</th></tr>
<tr><td>GN 985 – Activity 4(d)(viii, xi and xii)(aa)

The development of a road wider than 4 metres with a reserve less than 13,5 metres.

d. KwaZulu-Natal
viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

xii. Outside urban areas
(aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve</td><td>New access roads (temporary for construction and permanent to reach infrastructure) are to be constructed. The roads will be approximately 8m wide gravel roads with a construction servitude of 12m. A summary of the proposed access roads is provided below.

<table><tr><th>Access Road</th><th>Length</th></tr><tr><td>New Access Roads</td><td>13.90 km</td></tr><tr><td>Upgrading of Existing Access Roads</td><td>5.95 km</td></tr></table>
The roads will traverse KZN CBA Irreplaceable areas.

The roads occur outside an urban area and fall within 10km from the Aliwal Shoal MPA. The roads also fall within parts of a D’Moss area.</td></tr>
<tr><td>GN 985 – Activity 10(d)(ix, xii and xiii)(aa and cc)

The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.

d. KwaZulu-Natal
ix. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
xii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

xiii. Outside urban areas
(aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.
(cc) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland;</td><td>There will be chemical storage at the WTP.

The proposed development will traverse KZN CBA Irreplaceable areas. The proposed developments occur outside an urban area and falls within 10km from the Aliwal Shoal MPA. In addition, The developments also fall within parts of a D’Moss area.</td></tr>
<tr><td>GN 985 – Activity 14(d)(vii, viii and x)(aa)

The development of—
(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or
(ii) infrastructure or structures with a physical footprint of 10 square metres or more;

where such development occurs—
(a) within a watercourse;
(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;

d. KwaZulu-Natal</td><td>The construction of various infrastructure will occur within watercourse(s) or within 32m of a watercourse, including:
• Weir and abstraction works;
• Pump station;
• Pipelines;
• Access roads;
• Other.

The Goodenough Abstraction Weir and works requires raising of the existing weir by 2.8m.

The proposed developments will traverse KZN CBA Irreplaceable areas. The Goodenough Weir traverses KwaZulu-Natal Coastal Belt, which is a threatened ecosystem. The proposed developments occur outside an urban area and falls within 10km from the Aliwal Shoal</td></tr>
</table>

<table>
<tr><th>Listed Activity</th><th>Listed Activity Description</th></tr>
<tr><td>vii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

x. Outside urban areas
(aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.</td><td>MPA. In addition, the developments also fall within parts of a D’Moss area.</td></tr>
<tr><td>GN 985 – Activity 16(d)(viii, xi and xii)(aa)

The expansion of reservoirs, excluding dams, where the capacity will be increased by more than 250 cubic metres.

d. KwaZulu-Natal
viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

xii. Outside urban areas
(aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.</td><td>Possible expansion of Quarry reservoir from 15 to 25 Mℓ for the storage of potable water.

The proposed developments will traverse KZN CBA Irreplaceable areas. The proposed developments occur outside an urban area and falls within 10km from the Aliwal Shoal MPA. In addition, The developments also fall within parts of a D’Moss area.</td></tr>
<tr><td>GN 985 – Activity 18(d)(viii, xi and xii)

The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.

d. KwaZulu-Natal
viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;
xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

xii. Outside urban areas
(aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.</td><td>New access roads (temporary for construction and permanent to reach infrastructure) are to be constructed. The roads will be approximately 8m wide gravel roads with a construction servitude of 12m. A summary of the proposed access roads is provided below.

<table><tr><th>Access Road</th><th>Length</th></tr><tr><td>New Access Roads</td><td>13.90 km</td></tr><tr><td>Upgrading of Existing Access Roads</td><td>5.95 km</td></tr></table>
The proposed roads will traverse KZN CBA Irreplaceable areas. The roads occur outside an urban area and fall within 10km from the Aliwal Shoal MPA. In addition, The development also fall within parts of a D’Moss area.</td></tr>
<tr><td>GN 985 – Activity 23(d)(vii, viii and x)(aa)

The expansion of—
(i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or
(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;</td><td>Goodenough Abstraction Weir and works requires raising of the existing weir by 2.8m and the removal of the existing gated structure on the right-hand bank, and the construction of a new abstraction works.

The expansion of the weir will occur within a watercourse, namely the uMkhomazi River.</td></tr>
</table>

Listed Activity	Listed Activity Description
where such expansion occurs— (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; d. KwaZulu-Natal vii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; x. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.	
GN 985 – Activity 26(d) Phased activities for all activities— i. listed in this Notice and as it applies to a specific geographical area, which commenced on or after the effective date of this Notice; or ii. similarly listed in any of the previous NEMA notices, and as it applies to a specific geographical area, which commenced on or after the effective date of such previous NEMA Notices— where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold; — excluding the following activities listed in this Notice— 7; 8; 11; 13; 20; 21; and 24.	There is a possibility of the project to be phased.

5.4 The National Environmental Management: Waste Act (Act No. 59 of 2008)

The National Environmental Management Waste Act (Act No. 56 of 2008) (NEM: WA) regulates waste management in order to protect the health and environment of South African citizens. This is achieved through pollution prevention, institutional arrangements and planning matters, national norms and standards and the licensing and control of waste management activities.

The list of waste management activities that have or are likely to have a detrimental effect (GN No. 921 of 29 November 2013) contains activities listed in Categories A and B that would require licensing from the provincial or national authorities and activities contained in Category C which would require meeting the requirements of various Norms and Standards.

The purpose of the Norms and Standards for the Storage of Waste is to provide a uniform approach to the management of waste storage facilities, ensure best practice is the management of waste storage facilities and provide minimum standards for the design and operation of new and existing waste storage facilities.

The Norms and Standards require registration of new storage facilities. They also provide details on the management of all storage facilities in terms of access control and notices, operation, general requirements of waste storage containers, minimum requirements for above ground storage facilities and minimum requirements for below ground storage facilities.

The Norms and Standards also require that training be undertaken and an emergency preparedness plan be compiled. In addition, specific monitoring and inspections need to be undertaken as well as internal and external audits.

As part of the operation of the facility, waste will be stored temporarily on site prior to disposal. These storage facilities will be managed in line with the Norms and Standards for Storage.

A WTP has been proposed as part of the LUBWSS – WSS to allow for the purification of water that has been transferred via the raw water infrastructure from the uMkhomazi River. Depending on the manner in which the sludge generated at the WTP will be managed, a Waste Management Licence may be required for the WTP in terms of NEM: WA. The option of disposing residual to landfill was selected for the LUBWSS feasibility and preliminary design. Therefore, no Waste Management License will be required for this activity

With regards to disposal of sediment, a Waste Management License may have been required to release the sediment back into the river. However, after a meeting with DEA and subsequent correspondence, DEA provided a letter that stated that the LUBWSS – WSS project does not trigger any listed activities in terms of NEM: WA, therefore no Waste Management License will be required.

Please refer to **Appendix F** for the letter from DEA.

The following should be noted with regards to waste management during the Construction Phase:

- Temporary waste storage facilities will remain below the thresholds contained in the listed activities under Schedule 1 of NEM: WA; and
- The Environmental Management Programme (EMPr) will make suitable provisions for waste management, including the storage, handling and disposal of waste.

5.5 The National Water Act (Act No. 36 of 1998)

The National Water Act (Act No. 36 of 1998) (NWA) regulates the water resource of South Africa and aims to achieve the sustainable use water for the benefit of all users. Water is considered a scarce commodity and should therefore be adequately protected. Amongst others, the act deals with the protection of water sources, water uses, water management

strategies and catchment management, dam safety and general powers and functions, as well as water quality.

The purpose of the act is to ensure that South Africa's water resources are protected, used, developed, conserved, managed and controlled, and for achieving this purpose, to establish suitable institutions and to ensure that they have appropriate community, racial and gender representation..

Section 21 of the NWA provides information on what water uses require approval (i.e. Water Use License Applications or WULAs). These include:

a) Taking water from a water resource;
b) Storing water;
c) Impeding or diverting the flow of water in a watercourse;
d) Engaging in a stream flow reduction activity;
e) Engaging in a controlled activity;
f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) Disposing of waste in a manner which may detrimentally impact on a water resource;
h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
i) Altering the bed, banks, course or characteristics of a watercourse;
j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) Using water for recreational purposes.

Any development within a regulated area of a watercourse, namely the riparian habitat, 1:100 year floodline, wetland systems or a 500m radius of a wetland will require an authorisation from DWS.

As the proposed development occur within a regulated area of a watercourse and involves abstraction of water, an Integrated WULA (IWULA) is required in terms of Sections 21 (a), (b), (c) and (i) of the NWA (**Table 5**).

Table 5: Explanation of the relevant NWA Section 21 Activities

Section 21	Description of Water Use	Relevance to Project
21 (a)	Taking water from a water resource	Abstraction from uMkhomazi River at Goodenough Weir for treatment and potable supply.
21 (b)	Storing water	Storage of water at Goodenough Reservoir and Quarry Reservoir
21 (c)	Impeding or diverting the flow of water in a watercourse	Construction activities within the regulated area of any watercourse. This includes encroachments into the regulated areas of watercourses by the following project infrastructure – weir, abstraction works and watercourse crossings (pipelines and access roads).
21 (i)	Altering the bed, banks, course or	

Section 21	Description of Water Use	Relevance to Project
	characteristics of a watercourse	

The requisite documentation to satisfy DWS's requirements for the Water Use Authorisation process will be compiled and appended to the EIA Report. In addition, a Terrestrial Biodiversity Report, inclusive of an aquatic and wetland assessment will be conducted as part of the EIA Phase.

5.6 The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)

The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA) sets out the requirements with which applicants for prospecting rights, mining rights and mining permits must comply in Sections 16, 22 and 27 of the MPRDA. The MPRDA aims "to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources; and to provide for matters connects therewith"**.**

No Mining Permits are required for the proposed development as borrow pit material (e.g. soil, gravel or sand) will be sourced from a commercial source.

5.7 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA) was promulgated for the management and conservation of South Africa's biodiversity through the protection of species and ecosystems and the sustainable use of indigenous biological resources.

The main implication of this act is the protection of biodiversity.

The proposed development falls within threatened ecosystems, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), and traverses a number of watercourses, therefore NEMBA needs to be considered.

5.8 The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)

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

The proposed developments do not occur within a Protected Area. However, the proposed developments fall within 10km of a Protected Area.

5.9 National Forest Act (Act No. 84 of 1998)

In terms of the National Forests Act (Act 84, 1998), trees in natural forests or protected tree species (as listed in Government Gazette Notice 1012 of 27 August 2004) may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under licence granted by the DAFF.

5.10 National Heritage Resources Act (Act No. 25 of 1999)

The National Heritage Resources Act (Act No. 25 of 1999) was promulgated for the protection of National Heritage Resources and the empowerment of civil society to conserve their heritage resources.

The proposed developments will trigger certain categories as listed below that require a Heritage Impact Assessment (HIA) in terms of Section 38 of the National Heritage Resources Act. These categories are:

- Any development or other activity which will change the character of a site
  - Exceeding 5 000 m^2 in extent; or
  - Involving three or more existing erven or subdivisions thereof; or
  - Involving three or more erven or divisions thereof which have been consolidated within the past five years;
  - The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority; or
  - Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

The Act also makes provision for General Protections, which apply automatically to certain categories of heritage resources such as archaeological and paleontological sites, cemeteries and graves, and structures older than 60 years.

As the gravity mains, rising main, and access road exceed 300m and the WTP, pump station, and reservoirs exceed 5 000 m^2, a Phase 1 HIA is required. The HIA will need to be submitted to Amafa aKwaZulu-Natali for comment and approval.

5.11 The National Environmental Management: Air Quality Act (Act No. 39 of 2004)

The National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEMAQA) provides for the setting of national norms and standards for regulating air quality monitoring, management and control and describes specific air quality measures so as to protect the environment and human health or well-being by:

- Preventing pollution and ecological degradation; and
- Promoting sustainable development through reasonable resource use.

It also includes the establishment of national ambient dust fall out levels that may be relevant to the construction.

There will be dust impacts associated with the construction phase of the project. Therefore, no authorisation in terms of NEMAQA is required. However, NEMAQA needs to be considered to decrease ambient dust impacts associated with construction activities.

5.12 The Occupational Health and Safety Act (Act No. 85 of 1993)

The Occupational Health and Safety Act (Act No. 85 of 1993) provides for the health and safety of people at work as well as the health and safety of persons using plant and machinery.

This act will need to be taken into account should the proposed development be approved.

5.13 Policy, Programmes, Guidelines and Plans

5.13.1 Guidelines

The following guidelines were considered during the preparation of the Scoping Report:

- Integrated Environmental Management Information Series, in particular Series 2 – Scoping (DEAT, 2002);
- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP, 2010a);
- Guideline on Need and Desirability, EIA Guideline and Information Document Series (DEA&DP, 2010b);
- Integrated Environmental Management Guideline Series 5: Companion to the EIA Regulations 2010 (DEA, 2010a);
- Integrated Environmental Management Guideline Series 7: Public Participation in the EIA Process (DEA, 2010b); and
- Guidelines for Involving Specialists in the EIA Processes Series (Brownlie, 2005).

5.13.2 Regional Plans

The following regional plans will be considered during the execution of the EIA:

- National Development Plan;
- KZN Provincial Biodiversity Plan;
- Durban Metropolitan Open Space System;
- eThekwini Municipality Durban's Systematic Conservation Assessment;
- Municipal Spatial Development Frameworks (SDF);
- Municipal Integrated Development Plans (IDP); and
- Relevant provincial, district and local policies, strategies, plans and programmes.

6 SCOPING AND EIA PROCESS

6.1 Environmental Assessment Triggers

An Application for Environmental Authorisation (EA) was made for the LUBWSS – WSS in terms of NEMA and the amended 2014 EIA Regulations (2017).

Refer to **Section 5** for further discussion in the project's legal framework.

The process for seeking authorisation under NEMA is undertaken in accordance with GN. No. R. 982 of the amended 2014 EIA Regulations (2017), promulgated in terms of Chapter 5 of NEMA.

Based on the types of activities involved, which include activities listed in GN No. R. 983, R. 984 and R. 985 of the amended 2014 EIA Regulations (07 April 2017), the requisite environmental assessment for the project is a Scoping and EIA process.

6.2 Environmental Assessment Authorities

In terms of NEMA, the lead decision-making authority for the environmental assessment is the National DEA, as the project proponent (Umgeni Water) is a statutory body in terms of NEMA Section 24C.

6.3 Scoping Process

6.3.1 Formal Process

Key objectives for the EIA phase include the following:

- Carry out relevant specialist studies;
- Conduct public participation;

- Assess receiving environment;
- Undertake quantitative assessment of significant environmental impacts and identify concomitant mitigation measures;
- Evaluate project alternative through a comparative analysis; and
- Compile EIA Report in accordance with the requirements stipulated in Appendix 3 of GN No. R. 982 (04 December 2014) for review by IAPs. Refer to **Chapter 2** for the document's composition, in terms of the regulatory requirements.

The Scoping and EIA Process serves to build on the following environmental investigations that were undertaken as part of the pre-feasibility and feasibility studies:

- Lower uMkhomazi Bulk Water Supply Scheme Detailed Feasibility Study and Preliminary Design: Main Report (Umgeni Water, 2016a); and
- Lower uMkhomazi Bulk Water Supply Scheme Detailed Feasibility Study and Preliminary Design: Environmental Screening Report for the uMkhomazi River System (Umgeni Water, 2016b).

The findings of the abovementioned studies have been incorporated into the EIA Report. An outline of the Scoping and EIA process for the LUBWSS – WSS is provided in **Figure 5**.

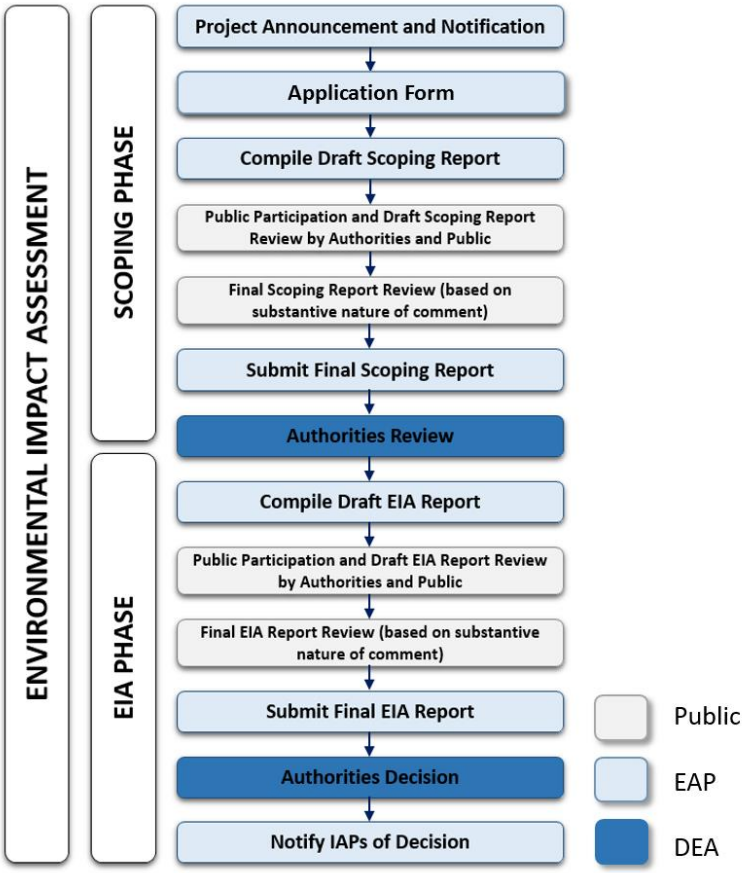


Figure 5: Overview of Scoping and EIA process

6.3.2 Landowner Consent

According to Regulation 39(1) of GN No. 982 of the amended 2014 EIA Regulations, if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land (i.e. landowner consent must take place prior to the submission of the application form to DEA).

This requirement does not apply *inter alia* for linear developments (e.g. pipelines, power lines, roads) or if it is a Strategic Integrated Project (SIP) as contemplated in the Infrastructure Development Act (2014).

This project is a SIP project and therefore landowner consent is not required. However, consent was received from some of the landowners through engagement.

Proof of landowner consent is contained in **Appendix F6**.

6.3.3 Landowner Notification

The LUBWSS – WSS traverses both Ingonyama Trust Board land and private land. Affected landowners and land users have been consulted during the Pre-feasibility and Feasibility Studies. Landowners were notified of the project.

Proof of written notification to the landowners / persons in control of the land as part of the EIA is included in **Appendix F5**.

6.3.4 Application Form

An Application Form for the Scoping and EIA process, in terms of Regulation 10 of GN No. R. 982 of the amended 2014 EIA Regulations, was submitted to DEA on 28 August 2017.

The activities triggered in terms of GN No. R. 983, R. 984 and R. 985 of the amended 2014 EIA Regulations (07 April 2017) was confirmed based on the following:

- Current understanding of the project;
- Available technical information;
- Feedback received from the technical team; and
- Feedback received from DEA and KZN EDTEA.

A copy of the Application Form submitted is provided in **Appendix B**.

6.3.5 Screening of Alternatives

Various options to meeting the project's objectives were considered during previous studies (including the Pre-Feasibility and Feasibility Studies), which eventually lead to the identification of alternatives. This includes the assessment of these options as part of the

Scoping exercise, which forms part of the Scoping and EIA phase. The “no go” option is also evaluated to understand the implications of the project not proceeding.

The feasible options are taken forward in the impact prediction, where the potential positive and adverse effects to the environmental features and attributes are examined further. The EIA phase will include a detailed comparative analysis of the project’s feasible alternatives that emanate from the Scoping exercise, which will include environmental (with specialist input) and technical evaluations. This will ultimately result in the selection of a Best Practicable Environmental Option (BPEO).

See **Section 11** for further discussions on alternatives.

6.3.6 Public Participation and Review of Scoping Report

Scoping which was the first phase of the formal EIA process, aimed to:

- Identify and engage with IAPs and allow for adequate participation in the process;
- Duly consider alternatives for achieving the project’s objectives;
- Identify significant issues to be investigated further during the execution of the EIA phase;
- Clarify the roles and responsibilities of various stakeholders in the process;
- Determine the scope of the ensuing EIA phase, in terms of specialist studies, public participation, assessment of impacts and appraisal of alternatives; and
- Allow for informed decision-making with regard to the EIA process.

In order to meet the aforementioned aims, the Scoping Report provides information on the following:

- The Need and Desirability of the proposed development;
- How the proposed development will be undertaken (if approved);
- Alternatives which are being considered;
- The Specialist Studies required in the pending EIA Phase;
- The receiving environment that could be affected by the proposed project;
- The Scoping and EIA processes as well as the Public Participation Process;
- The legislation that has been considered; and
- The Plan of Study for the pending EIA Phase of the project.

Scoping was the first phase of the formal EIA process. The following milestones were reached during the Public Participation and Scoping Report Review:

- The public were given the opportunity to register as IAPs from 03 July 2017 to 03 August 2017;
- Newspaper advertisements were placed in the South Coast Fever, published on 29 June 2017;
- Onsite notices were placed at all specific points around the project area;

- Background Information Documents (BIDs) were emailed to IAPs on this database;
- The Draft Scoping Report was made available for a 30-Day Public and Authority Review Period from 29 August to 29 September 2017.
- A Public Meeting was held on 07 September 2017.
- The Approval of the Final Scoping Report was received, dated 21 November 2017.

7 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations accompany the Scoping exercise:

- The detailed engineering design will be finalised at a later stage. The conditions of the environmental authorisation, if issued, must be factored into the final design.
- The findings of the Impact Assessment are informed by the Specialist reports which are assumed to be accurate.
- The mitigation measures provided in the EMPr will be implemented and it assumed that the measures are adequate and will successfully enhance positive impacts while limit the negative impacts.

8 ENVIRONMENTAL ASSESSMENT PRACTITIONER

Nemai Consulting was appointed as the independent EAP to undertake the environmental assessment for the LUBWSS – WSS. In accordance with Section 2(a) of Appendix 2 of GN 921 of the amended 2014 EIA Regulations (07 April 2017), this section provides an overview of Nemai Consulting and the company's experience with EIAs, as well as the details and experience of the EAPs that form part of the Scoping and EIA team.

Nemai Consulting is an independent, specialist environmental, social development and Occupational Health and Safety (OHS) consultancy, which was founded in December 1999. The company is directed by a team of experienced and capable environmental engineers, scientists, ecologists, sociologists, economists and analysts. The company has offices in Randburg (Gauteng), Durban (KwaZulu-Natal), and Cape Town (Western Cape).

The core members of Nemai Consulting that are involved with the Scoping and EIA process for the LUBWSS – WSS are provided in **Table 6**, and their respective Curricula Vitae are contained in to **Appendix C**.

Table 6: Scoping and EIA Core Team Members

Name	Qualifications	Duties
Ms. D. Naidoo	BSc – Eng (Chem)	Project Manager and Environmental Engineering

Name	Qualifications	Duties
Mr. D. Henning	MSc – Aquatic Health Ecology	Environmental Assessment Practitioner/Study Leader
Ms. S. Gerber	BSc (Hons) – Environmental Sciences	Environmental Assessment Practitioner

9 NEED AND DESIRABILITY

In terms of Regulation 2(f) of Appendix 2 of GN No. R. 921 of the amended 2014 EIA Regulations (07 April 2017), this section discusses the need and desirability of the project. The format contained in the Guideline on Need and Desirability (DEA&DP, 2009) has been used in **Table 7**.

Table 7: Need and Desirability of the project

No.	Question	Response
NEED ('timing')		
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP).	The Ugu DM IDP mentions the LUBWSS as part of Umgeni Water's Master Plan for Umgeni Water to provide bulk water infrastructure for the provision of potable water to Ugu District Municipality. In addition, one of the key issues identified in the Ugu IDP with regards to Service Delivery and Infrastructure Development was the rapidly aging infrastructure especially water infrastructure which has led to numerous water outages and slowed down the pace of backlog eradication. The continued economic growth and development of the KwaZulu-Natal Coastal Metropolitan area requires an assured water supply in line with DWS's policy of water for growth and development. The eThekwini Metropolitan Municipality SDF highlights one of the key interventions as improving basic infrastructure, provision of supporting infrastructure and services including housing opportunities and adequate facilities. This would include the provision of water. In addition, the provision of bulk water is identified as critical for the municipality. Therefore, the land use is considered in the SDFs and IDPs for the municipal areas.
2.	Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?	As explained in Section 11.2, a number of options were identified and investigated as potential solutions to augment the water needs of the South Coast supply area.

		The uMkhomazi River was identified as a potential viable source of water to augment the Mgeni System. The LUBWSS will support the surrounding land use by augmenting the South Coast water supply area.
3.	Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate)	The strategic need for the project is discussed in Section 3. The provision of basic services and bulk infrastructure such as water has been identified as a priority for the Ugu DM, and eThekwini Metropolitan Municipality. Localised impacts associated with the project such as noise, dust, and visual impacts have been assessed in the EIA phase.
4.	Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	Power supply to the WTP, abstraction works and the pump stations will be required, which will be installed and supplied by Eskom. The sludge generated during the operational pahse of the WTP will need to be disposed of. The residue from the WTP will be disposed of at a licensed landfill site. A formal commitment will be required from the custodian of a licensed landfill to accept the sludge, as well as confirmation that sufficient capacity exists at the facility.
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services)?	The current water resources supplying the Upper and Middle South Coast of KZN are insufficient to meet the projected water demands, therefore the LUBWSS is to be implemented to supplement potable water supply to the existing Upper and Middle South Coast supply area. The proposed development is categorised as water service provision and therefore is planned for under eThekwini Metropolitan Municipality due to the need for increased water supply to the municipality.
6.	Is this project part of a national programme to address an issue of national concern or importance?	There is an urgent need to provide water services to communities within South Africa. With the completion of this project, basic water services will be provided to the citizens within the South Coast Water Supply Area in South Africa through the provision of water. This project aims to increase the yield of this system to supply the long-term water requirements of these areas.
DESIRABILITY ('placing')		
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	During the Feasibility Study, the following scheme configuration options were investigated:

		• A WTP at the Ngwadini Dam and a long pipeline of around 23 km to connect to, and deliver potable water, to the South Coast Pipeline. • Releasing water from the Ngwadini Dam into the river in the dry months and abstracting the water again at two alternative points lower down the uMkhomazi River; one point 13km downstream at the existing Goodenough weir, and one point 17km downstream at the existing SAPPI SAICCOR abstraction weir. Of the options investigated, two scheme configuration options were carried forward to the feasibility investigation phase, and are defined as follows: • Scheme A: Water supplied directly from the Ngwadini Dam to the WTP through a proposed 22km long pipeline; and • Scheme B: 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. Scheme B was selected as the preferred scheme based on the supply risks associated with Scheme A and Scheme B's increased flexibility for phasing and integrating with other regional schemes. Of Scheme B, there are WTP locality alternatives, and thus two associated gravity main alternatives from the WTPs to the Quarry Reservoir.
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and Spatial Development Framework (SDF) as agreed to by the relevant authorities?	The Ugu IDP mentions the LUBWSS as part of Umgeni Water's Master Plan for Umgeni Water to provide bulk water infrastructure for the provision of potable water to Ugu DM. It is not anticipated that the proposed developments will contradict or be in conflict with the Metropolitan IDP and SDF.
9.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?	Currently, there is no existing EMF for the region. Therefore, this application will not compromise the integrity of environmental management priorities in the area as the project involves supplying water to the South Coast water supply area.
10.	Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).	The proposed development aims to augment the supply of water to the South Coast of KZN, therefore the land use is favoured.

		In addition, the proposed development will set a precedent within the municipality to support and upgrade water services to the communities.
11.	How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	The impact of the proposed activity on sensitive features is discussed in Section 15.
12.	How will the development impact on people's health and wellbeing (e.g. i.t.o. noise, odours, visual character and sense of place, etc)?	The impact of the proposed development on sensitive features and people's health and wellbeing is discussed in Section 15. There will be negative impacts such as dust, visual quality, and noise impacts that will mainly occur during the construction phase of the project and therefore will be short term. The positive impact would be the sufficient water supply to the Upper and Middle South Coast of KZN. These benefits will have a positive and long-term impact during the operational phase of the water supply scheme.
13.	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	The weir will be located within the uMkhomazi River, it does not require a change in land use. In addition, the pipeline will be an underground pipeline and the land use will not be impacted. However, there will be a land use change associated with the construction of the WTP which may incur some costs.
14.	Will the proposed land use result in unacceptable cumulative impacts?	There will be a land use change associated with the WTP within Craigieburn. In addition, a servitude may be registered for the pipeline route which may have a cumulative impact. For an assessment of the cumulative impacts, please refer to Section 15.

10 PROJECT DESCRIPTION

10.1 Project Description

The following Feasibility Study reports compiled by AECOM informed the project design of the LUBWSS:

- Lower uMkhomazi Bulk Water Supply Scheme Detailed Feasibility Study and Preliminary Design (AECOM, 2016a);

- Lower uMkhomazi Bulk Water Supply Scheme Feasibility Design of Ngwadini Dam, Ngwadini Abstraction Works and Goodenough Abstraction Work (AECOM, 2016b); and
- Environmental Screening Report for the uMkhomazi River System (AECOM, 2016c).

The overall LUBWSS will consist of the following project components (**Figure 6**):

- The Ngwadini Weir and abstraction works to fill the Ngwadini OCS Dam during summer periods of excess flow;
- 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;
- A second abstraction downstream at the Goodenough Weir site to abstract the raw water for delivery to the WTP;
- A pump station to pump water from the Goodenough abstraction to the WTP via;
- A short rising main and 7km gravity main with;
- A break pressure tank that also serves as a raw water storage reservoir;
- Hydrocyclones before the pump station and WTP to remove sediments during periods of higher turbidity river flows and reduce the WTP residual ("sludge");
- A 100 Ml/d WTP in the town of Craigieburn; and
- A potable gravity water pipeline from the WTP to Quarry Reservoir, the potable water delivery and tie-in point on the South Coast Pipeline.

The requirements in terms of NEMA for the LUBWSS project components are detailed in **Table 8**.

Table 8: LUBWSS Components and NEMA Requirements

No.	Project Component		NEMA Requirements
1	**Water Resource Development**	Ngwadini weir and abstraction works to fill the Ngwadini OCS Dam during summer periods of excess flow.	Authorisation previously received in terms of the Environment Conservation Act (ECA) (Act No. 73 of 1989). However, it was confirmed in consultation with KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) that a new Basic Assessment would need to be conducted due to changes in location and design. A separate Application will be submitted to DEA.
2		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.	Authorisation was previously received in terms of ECA. However, it was confirmed in consultation with KZN EDTEA that an amendment to the authorisation would need to be applied for due to slight changes in design. A separate EA Amendment Application will be submitted to KZN EDTEA.
3	**Water Supply Scheme** – Abstraction Works, Conveyance Infrastructure and WTP		This will be the focus of this Application, where a Scoping and EIA process needs to be conducted.

The EIA Phase focuses on the LUBWSS – WSS. The LUBWSS – WSS project components are detailed in the sections below.

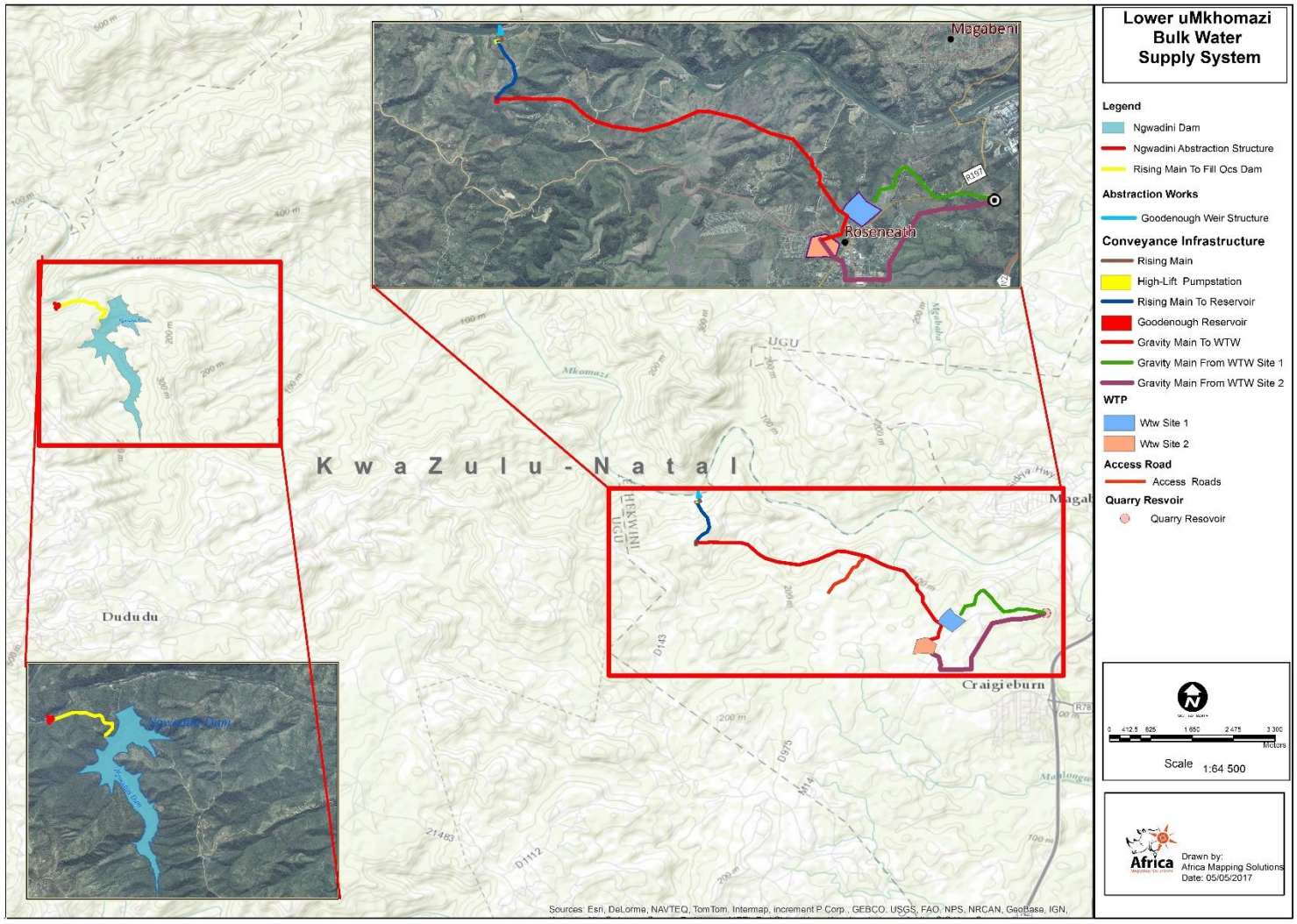


Figure 6: Overall layout of the LUBWSS project components

10.1.1 Goodenough Weir and Abstraction Works

The Goodenough Weir requires the raising of the existing weir (**Figure 7**) (owned by SAPPI SAICCOR and no longer used for creating a temporary berm) by 2.8m, and the removal of the existing gated structure on the right hand bank, and the construction of a new abstraction works.

Figure 7: The existing Goodenough weir

The proposed abstraction works at the Goodenough Weir has the same design principles and layout as the Ngwadini abstraction works to standardise implementation and operation (**Figure 8**).

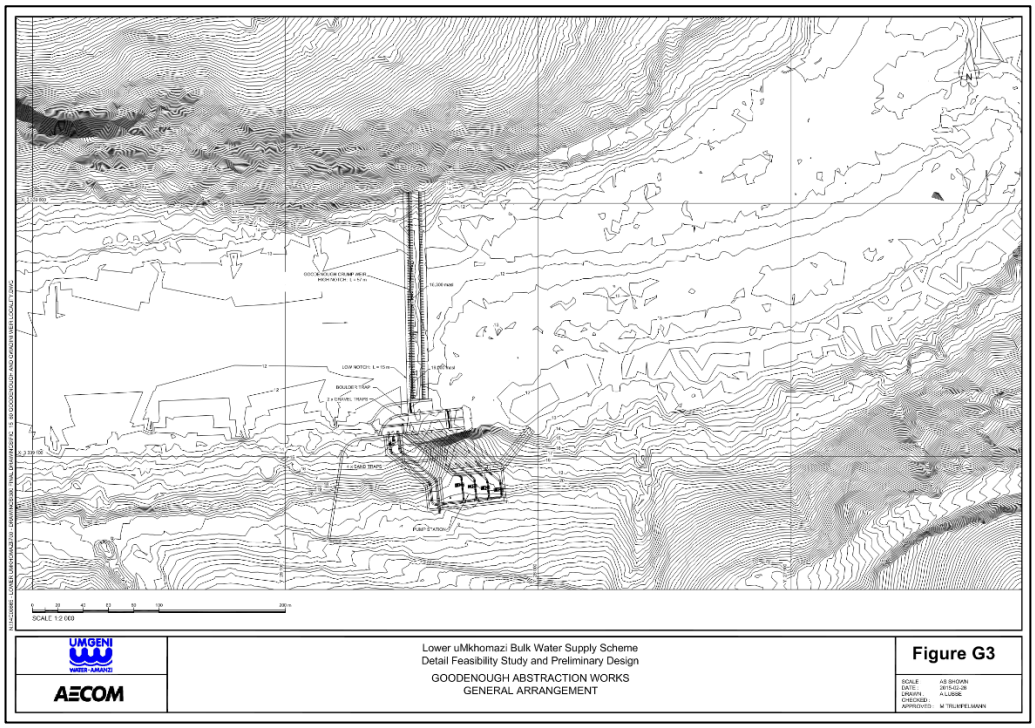


Figure 8: Goodenough Abstraction Works

Due to the greater width of the river at the Goodenough abstraction works site compared with the Ngwadini abstraction works site, the 1:100 year flow depth is lower. The 1:100 year floodline level is at 23.5 metres above sea level (masl) and the flow depth is 11.0m, compared with the flow depth at the Ngwadini site of 15.5m. The non-overflow level of the high walls for the Goodenough abstraction works is at 24 masl to prevent heavy sediment laden water from entering the gravel trap and sand traps, as well as to prevent floods from bypassing the abstraction works.

A diagram indicated the 1:100 year floodline associated with the raising of the Goodenough weir structure is provided in **Figure 9**.

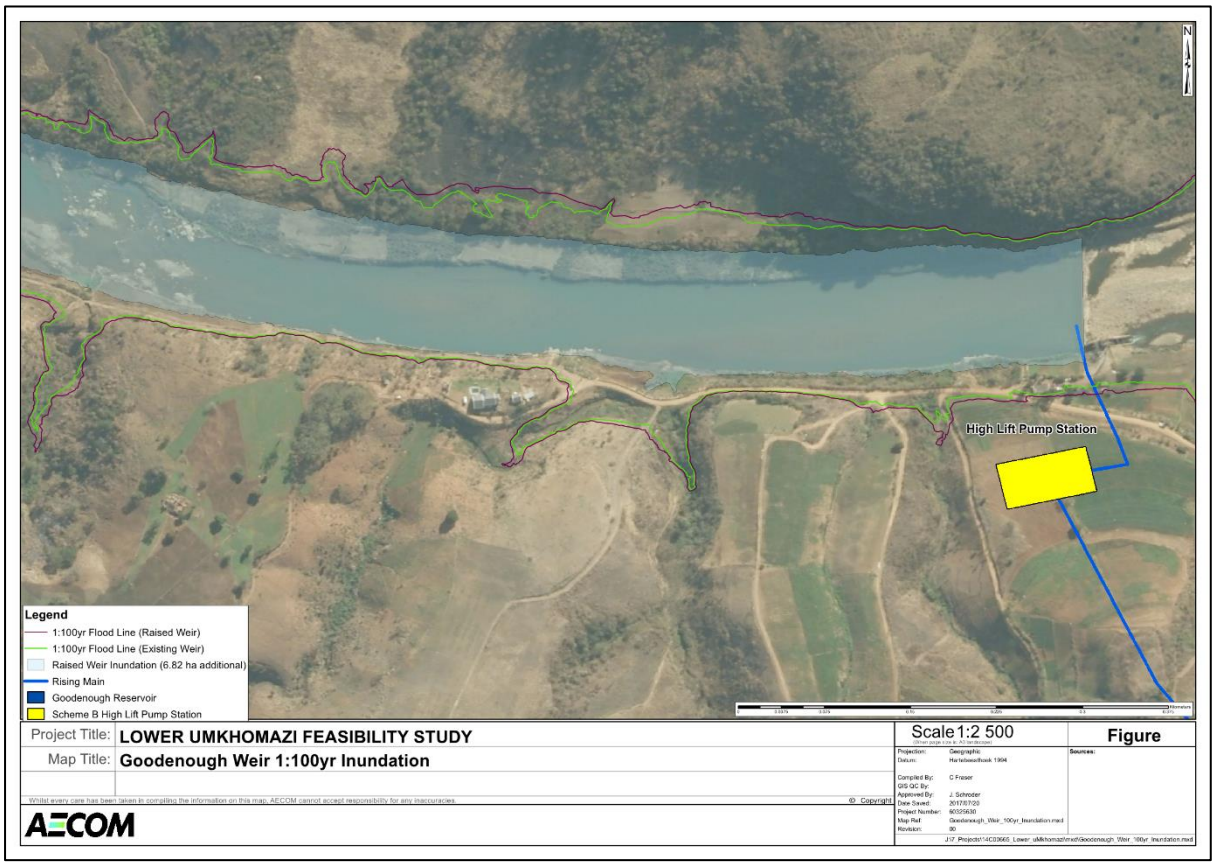


Figure 9: 1:100 year floodline associated with the raising of the Goodenough weir

The Goodenough abstraction works was designed for a capacity of 1.7 m^3/s, with an ultimate maximum capacity of the civil infrastructure of 2.6 m^3/s. The abstraction pumping capacity included provision for raw water losses that could be experienced at the hydrocyclones as well as losses in the WTP process. The Ecological Water Requirements (EWR) of 1 m^3/s and the additional downstream abstraction allocation of 1.7 m^3/s to SAPPI SAICCOR must be supplied before water may be abstracted from the river. A minimum pump standby capacity of 50% is required.

10.1.2 High Lift Pump Station

The Goodenough Pump Station will be located next to the Goodenough Weir on the right bank outside the 1:200 year floodline that has an elevation of 25.50 masl. The design flow for the pump station is 6200 m^3/hr, to account for losses at the WTP and deliver the 100 Ml/d average flow. Horizontal split-casing pumps have been selected with a 3 pump configuration, two active pumps in parallel and one stand-by. The pump station consists of a 500 kl wet-well (into which the hydrocyclones deliver the de-silted water), a main pump room, loading bay and control room. For controlled start-ups and for flexibility in operations, variable speed drives (VSDs) are recommended for each pump. The pump station layout has been designed with individual pump lines at 60 degrees to the suction and delivery manifolds.

The high lift pumping configuration schematic, including the relative location of the wet-well and hydrocyclones for the selected scheme is presented in **Figure 10**. The pump station layout plan is provided in **Figure 11**.

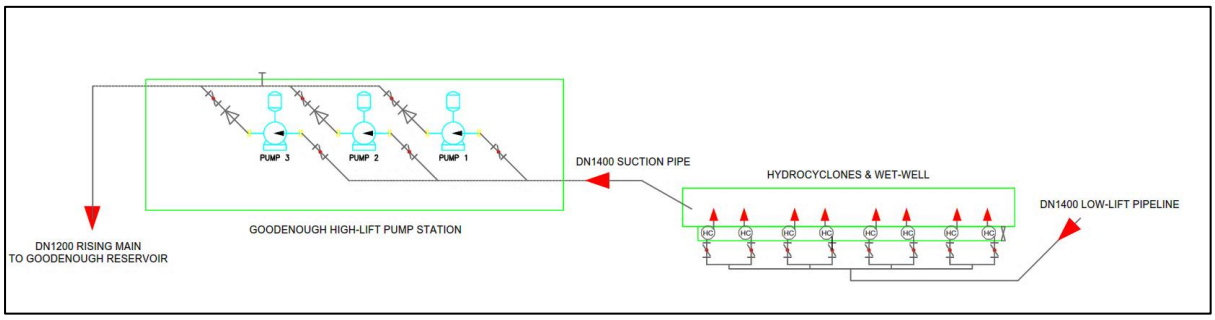


Figure 10: High-lift pumping configuration schematic (AECOM, 2016a)

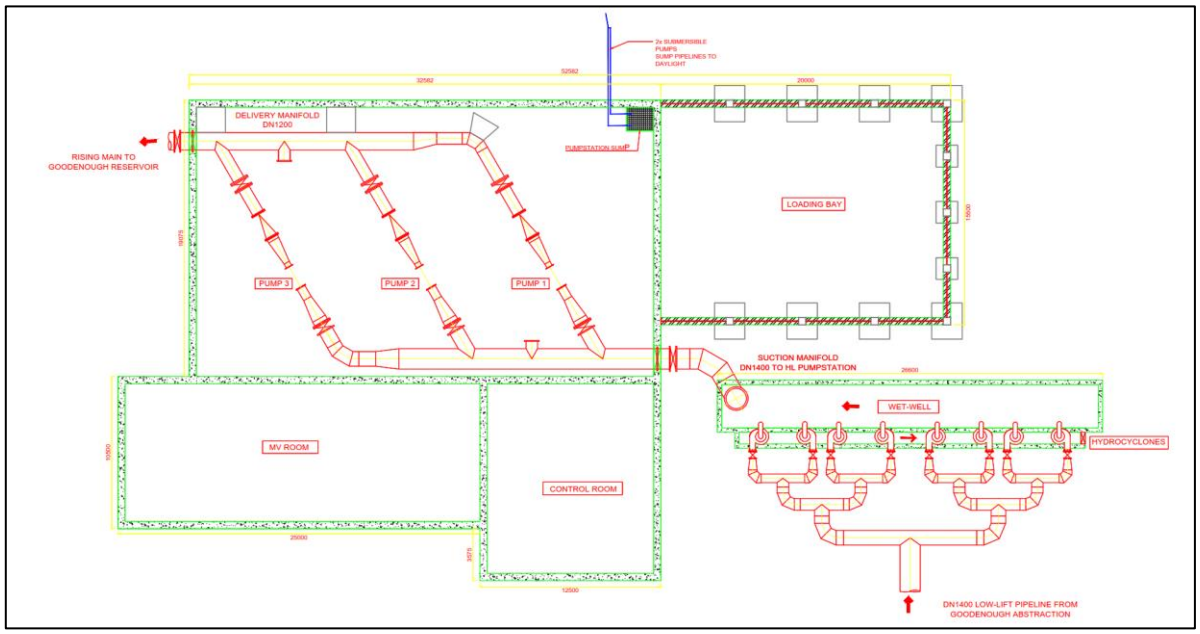


Figure 11: Proposed high lift pump station layout (AECOM, 2016a)

10.1.3 Hydrocyclones

Water will be drawn directly from the uMkhomazi River therefore pre-treatment is required. For the removal of excess sediment during higher flow and turbidity periods, hydrocyclones were selected. An eight-way cluster fitted with 750mm diameter cyclones is recommended to handle the full capacity of 6200 m^3/hr. The cyclones are designed to achieve a D50c cutpoint of 28 µm, under an incoming raw water pressure of 135kPa. The design has been based on a conservative 5% return flow. Approval will need to be obtained to return the underflow from the hydrocyclones back to the uMkhomazi River.

To ensure equal distribution of flow amongst the hydrocyclones particular consideration was given to the rising main discharge into the hydrocyclones (**Figure 12**). Whether the feed pipework to the hydrocyclones is to be buried or positioned aboveground is to be determined during the detail design stage.

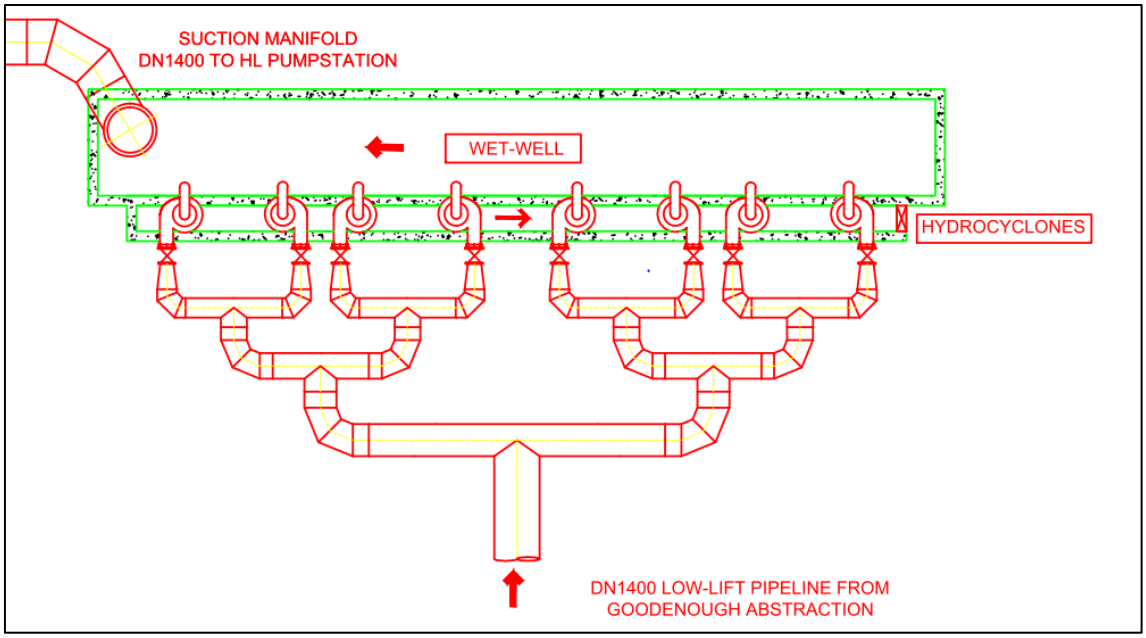


Figure 12: Hydrocyclones configuration (AECOM, 2016a)

10.1.4 Raw Water Reservoir

A raw water reservoir is required at the end of the rising main to perform the role of a break pressure tank and to provide operational storage for the WTP. The location of the reservoir at the critical high point allows a short rising main and long gravity main to the WTP. A storage reservoir capacity of 6 hour was selected, which equates to 25Ml for the 100Ml/d scheme. The 25Ml capacity will allow for operation and maintenance to be conducted on the pipeline and the continued supply of raw water to the WTP during times of electrical supply issues, e.g. load shedding, or to address problems with the rising main or pumping infrastructure. The reservoir has the dimensions of 100m x 50m x 5.5m and has been designed with a sloped floor and five channels to allow for periodic flushing of finer sediment not removed by the

hydrocyclones. The return of the flushed volumes and associated sediment to a local tributary needs to be explored further.

10.1.5 Water Treatment Plant

The selected process during feasibility design was for two stages of sedimentation to handle higher turbidity flows, associated with a conservative design of limited impact on finer particles by the hydrocyclones. The WTP is a conventional design and consists of primary hydraulic mixing, pre-settlement using clariflocculators, secondary mixing, primary sedimentation using pulsators, filtration, and chlorination.

Due to the seasonal fluctuation in sediment loads, pre-sedimentation (i.e. a dual sedimentation process) was considered for raw water directly from the uMkhomazi River. The pre-sedimentation tanks will be used to aid the removal of turbidity and settable solids that are not removed at the intake pre-treatment (Hydrocyclones).

Due to the operational reservoir located near the abstraction and the gravity main to the WTP, no raw water storage was required on site. Similarly, since the potable supply can be gravity fed to the distribution point, Quarry Reservoir, no potable water storage will be required on site. This will have a positive impact on the WTP footprint.

Two locality alternatives are being considered for the WTP. Please refer to **Section 11** for a detailed overview of the alternatives considered for the LUBWSS – WSS.

10.1.5.1 Process Designs

With the selection of Scheme B as the preferred scheme and the source of water being direct abstractions from the uMkhomazi River, both pre-sedimentation and Primary settling will be required (**Figure 13**).

The process design for the WTP allows for the pre-settling clariflocculators to be by-passes in seasons where suspended solids are low. Both the primary and the secondary sedimentation processes have the provision for coagulation and flocculation chemicals. Pre-sedimentation clariflocculator units (Reactor Clarifier) are recommended before the primary sedimentation Pulsator units, for this process design.

The sections to follow summarise the various aspects of the WTP preliminary design. For all components of the design, the average daily design flow 100 Ml/d, and the daily peak design flow is 130 Ml/d.

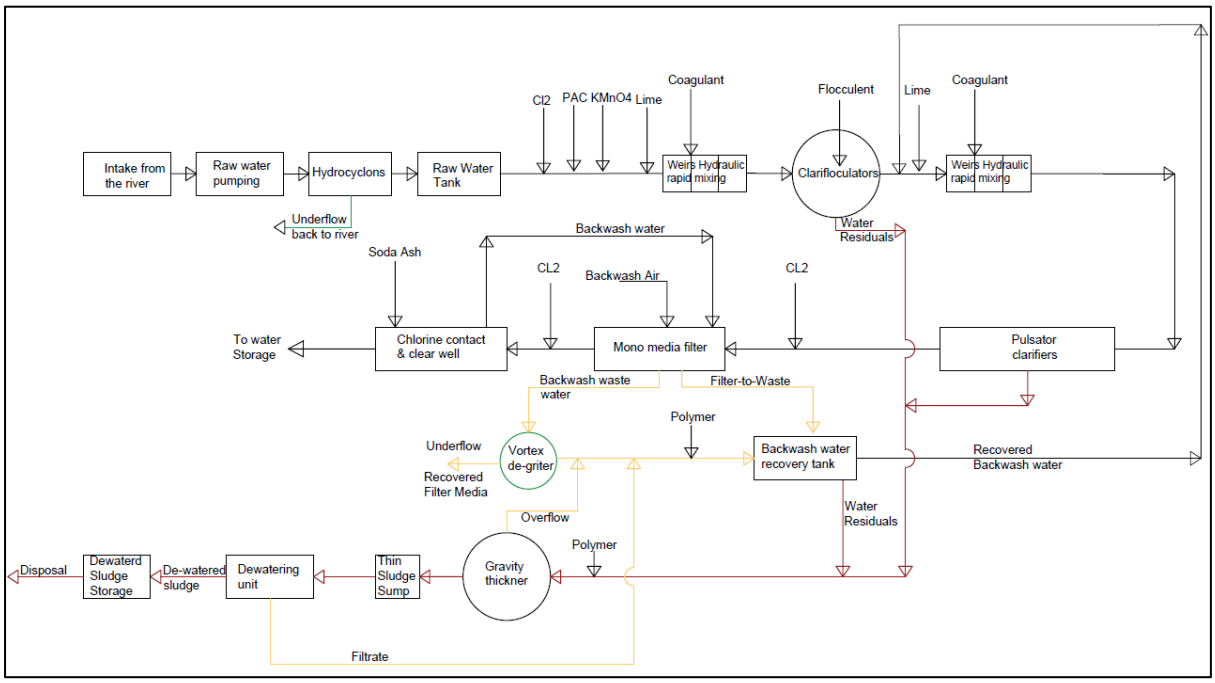


Figure 13: Design process for the WTP (AECOM, 2016a)

10.1.5.2 Pre-Sedimentation

The pre-sedimentation tanks will be used to aid the removal of turbidity and settable solids that were not removed at the intake pre-treatment process (Hydrocyclones). Pre-sedimentation tanks will be located upstream of the Pulsator. A clariflocculator (Reactor Clarifier) will be used for pre-sedimentation, with dosing provision for coagulation and flocculation chemicals.

In the clariflocculator (solids contact unit), the cylindrical flocculation zone is located in the centre of the settling tank. Inlet and outlet conditions shall prevent short circuiting and destruction of flocs. As per Umgeni Water's preference, the design for the WTP will consider conventional clariflocculators with a cylindrical flocculation zone, without internal sludge recycle, where the flow passes upward through the sludge blanket. A summary of the clariflocculator design parameters are included in **Table 9**.

Table 9: Clariflocculator design parameters summary (AECOM, 2016a)

Design Parameter	Dimension/Detail
No. of tanks	4 + 1 (standby)
Size of tanks	42m diameter
Retention time in flocculation zone	15 – 20 min
Upflow velocity	1.2 $m^3/m^2/hr$
Water loss due to desludging	2%
Settling time	60 – 120 minutes
Weir loading	8.5 to 10 $m^3/m/h$

10.1.5.3 Primary Sedimentation

Pulsator Clarifiers (Sludge blanket clarifier) were considered for primary sedimentation, as this is Umgeni Water's preference for clarification unit.

Pulsator clarifiers are solid contact clarifiers with distinct solid layers that are maintained as a suspended filter through which flow passes. Pulsator clarifiers are generally acceptable for combined softening and clarification where water characteristics do not fluctuate rapidly, flow rates are uniform, and operation is continuous. The sludge blanket level is designed to be 1.5 to 2m below the water surface. The sludge blanket depth is controlled by the overflow weir. The pulsator should typically pulse once every 60 seconds (40 seconds to fill the vacuum chamber and 20 sec to drain into the clarifier).

A summary of the pulsator design parameters are included in **Table 10**.

Table 10: Pulsators design parameters summary

Design Parameter	Dimension/Detail
No. of tanks	2
Size of tanks	24 m x 26 m
Cycle Time	60 seconds
Upflow velocity	2.5 $m^3/m^2/hr$
Lift Volume	0.7 – 0.9 m

10.1.5.4 Filtration

The conventional filtration treatment process including gravity mono-media filter (sand) were found to be the most suitable solution. The gravity filters do not have the smallest foot print but the combination of coagulation/flocculation sedimentation, met all other selection criteria. The proposed gravity filtration system is also suited to high turbidity. This process responds well to rapid changes in the source water quality.

The filters will be positioned as close as possible to the upstream and downstream processes to minimize yard piping, land requirements and to make use of gravity flow.

a. Filter Size

Eight sand filters were selected for the WTP. The filter number and arrangement considers one filter out of service and one filter in backwash mode simultaneously. Each rapid filter surface area is $110m^2$ (10m x 11m).

For preliminary design the filtration rates are as following;

- Max. 7.5 $m^3/m^2/h$ with one filter offline or one filter in backwash mode.
- Max. 10 $m^3/m^2/h$ with one filter offline and one filter in backwash mode.

b. Pipe Galleries

A configuration with filters on both sides of a pipe gallery will be utilised. The top of the backwash supply piping will be located at least 0.6m below the top of the backwash troughs to minimize the potential for air entering these pipes. Likewise, air supply pipes (for air or water

backwash) will be located at least 0.6m above the maximum filter water level to prevent water from siphoning into the air line. Galleries will have drainage and sloped floors, and adequate lighting and ventilation.

c. Underdrains

The Nozzle System was selected for the underdrain system. Nozzle underdrain systems are typically used with air and water backwash systems. They normally do not require a gravel layer to support the filter media, however a 15cm layer of gravel over the nozzles is recommended. The nozzle slit openings should be approximately one-half the effective size of the filter media covering the nozzles. The nozzle stem height should be adjustable, thus compensating for uneven floor construction. The nozzle underdrain systems must have a plenum under the entire filter floor area. Inlet water velocities to the plenum should not exceed 1.2 m/s; lower velocities are preferred. Nozzles density of 50 nozzles/m^2 are recommended.

d. Backwash Filters

Backwash water should be recovered and is delivered to the filters through backwash pumps (a minimum of three), each of which is sized to deliver the maximum backwash rate. With two duty pumps and one standby pumps; two filters can be backwashed at the same time. Air / (air + water) / water is the recommended backwash sequence. The selected backwash sequence is capable of removing a large quantity of solids in a reasonable length of time. The dirty backwash water will be gravitated to a vortex degritting unit for washed sand media recovery. The overflow from the vortex degritter will flow to a filter backwash water recovery tank.

The filter backwash water recovery tank is divided into two tanks where the filtered solids will be allowed to settle and then sent to the solid handling facility. Supernatant water will be sent to the head of the plant before the coagulation process. The tanks will have sufficient capacity to accommodate four backwash cycles. Provision of adding polymer at the head of the recovery tank is recommended to maximize the settling of fine particles. The backwash rates provided are included in **Table 11**.

Table 11: Backwash rates for preliminary design

Backwash air flow:		
Minimum backwash air flow through filter-bed	50	$m^3/m^2.h$
Maximum backwash air flow through filter-bed	60	$m^3/m^2.h$
Backwash water flow:		
Backwash rate with air-scour:		
Minimum backwash water flow with air-scour	7	$m^3/m^2.h$
Maximum backwash water flow with air-scour	10	$m^3/m^2.h$
Backwash rate (with water only):		
Minimum backwash water flow (with water only)	16	$m^3/m^2.h$

Maximum backwash water flow (with water only)	30	$m^3/m^2.h$

This arrangement will provide the necessary flexibility for fluidization of the mono–media bed. As the filters feed water will not stop during backwash, the backwash water recovery and receiving facility will be designed to accommodate the total flow.

e. Filter Media

Mono-media will be used, consisting of a single deep layer of sand typically 0.6 to 0.8m deep. The filter depth and media size are interrelated. Filtered water turbidity of less than 0.5 NTU is achievable with this configuration. If effluent turbidity of lower than 0.3 NTU is desired on a consistent basis, duel or tri-media filters may be selected and a provision for adding filter aid should be made to enhance filtration during periods of poor settled water quality. A gravel layer of 15cm is recommended to provide support to the filter media and prevent smaller particles from entering the underdrains and blocking the nozzles (nozzles must be of non-clog type) to help in evenly distribute backwash water and air.

10.1.5.5 Disposal of Residue (“sludge”)

The drinking water treatment processes typically generates waste streams (or residuals). These residuals contain organic and inorganic turbidity-causing solids, including algae, bacteria, viruses, silt and clay, and precipitated chemicals that are produced during treatment. At the LUBWW – WSS WTP, the treatment process that will produce residuals are:

- Coagulation;
- Flocculation;
- Sedimentation (Clariflocculator and Pulsator Clarifier); and
- Media Filtration (Gravity Sand Filters).

These residuals are generated by addition of chemicals for coagulation/flocculation, pH adjustment, iron and manganese removal, odour and taste removal. Typically, 60 to 90% of these residuals will be captured in the sedimentation basins (Clariflocculators and/or Pulsator Clarifiers) and the remainder in the filters.

Landfill application is the most common disposal method for WTP residuals. If the option of disposing the residue from the proposed WTP at a permitted landfill site is to be pursued, there will not be a need to seek approval in terms of the NEM: WA. The reason for this is that no waste management activities will be triggered.

The option of disposing residue to a licensed landfill was selected for the LUBWSS feasibility and preliminary design, as well as the EIA. A formal commitment will be required from the custodian of a licensed landfill to accept the residue, as well as confirmation that sufficient capacity exists at the facility. The landfill selected will need to be in possession of the requisite environmental approvals to accept the residue.

A residual handling facility including four gravity thickeners followed by mechanical dewatering via five centrifuges has been designed with on-site residual storage silos. An annual production of residual ("sludge") for the WTP operating at full capacity is 620 260 m^3/a, and 4 605 600 kg/a after dewatering.

10.1.5.6 Major Hazard Installation

In terms of the Major Hazard Installation (MHI) Regulations (GN R.692 of 30 July 2001), which were promulgated under the Occupational Health and Safety Act (Act No. 85 of 1993), a MHI means an installation:

1. Where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or
2. Where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident.

The proposed LUBWSS – WSS WTP may be classified as a MHI. A preliminary MHI screening study and Risk Assessment will be conducted by Umgeni Water.

10.1.6 Potable Water Storage – Quarry Reservoir

As the treated water can be gravity fed from the WTP to the Quarry Reservoir, no potable storage is required at the WTP and Quarry reservoir can be upgraded to serve this purpose. The plans and space for upgrading Quarry Reservoir from 15 to 25 Ml already exist. The upgraded reservoir will be able to provide 6 hours storage for the full 100Ml/d scheme. Further hydraulic investigations are required to confirm the storage requirements at the Quarry Reservoir, taking into account the other existing and planned storage available within the integrated South Coast Pipeline and bulk infrastructure.

10.1.7 Pipelines

Pipelines required for the LUBWSS – WSS are as follows:

- Rising main to hydrocyclones;
- Rising main to Raw Water Reservoir;
- Gravity main to WTP; and
- Gravity main to Quarry Reservoir.

Mild steel was selected for the LUBWSS – WSS pipeline design. All the pipelines will be constructed within a 40m wide construction servitude. The pipeline diameters selected for the water conveyance scheme are provided in **Table 12**.

Due to the presence of high voltage powerlines in the region and three planned crossing of these by the pipeline route, cathodic protection is recommended, as well as temporary cathodic protection systems during construction. A design life of the Cathodic Protection system of 30 years or better was targeted.

Table 12: Pipeline details for LUBWSS – WSS (AECOM, 2016a)

Pipeline	Full capacity of scheme designed			
	Flow (Mℓ/d in 18hours)	Velocity (m/s)	Length (m)	Diameter (mm)
Low-lift pipeline (Rising main to hydrocyclones)	112 Mℓ/d	1.117 m/s	185 m	DN1400
Rising main to Reservoir	105 Mℓ/d	1.432 m/s	950 m	DN1200
Gravity main to WTP 1	105 Mℓ/d	1.432 m/s	6000 m	DN1200
Gravity main to WTP 2	105 Mℓ/d	1.432 m/s	6000 m	DN1200
Gravity main to Quarry from WTP 1	100 Mℓl/d	1.371 m/s	2000 m	DN1200
Gravity main to Quarry from WTP 2	100 Mℓl/d	1.371 m/s	3000 m	DN1200

A number of river crossings were noted for the LUBWW – WSS. Instead of making use of expensive bridge structures, reinforced concrete bedding and backfill was recommended for length of pipeline submerged under each river crossing. The typical section of the river crossing is included in **Figure 14**. Detailed design will need to confirm the river crossing approach and further investigate the smaller drainage line crossings.

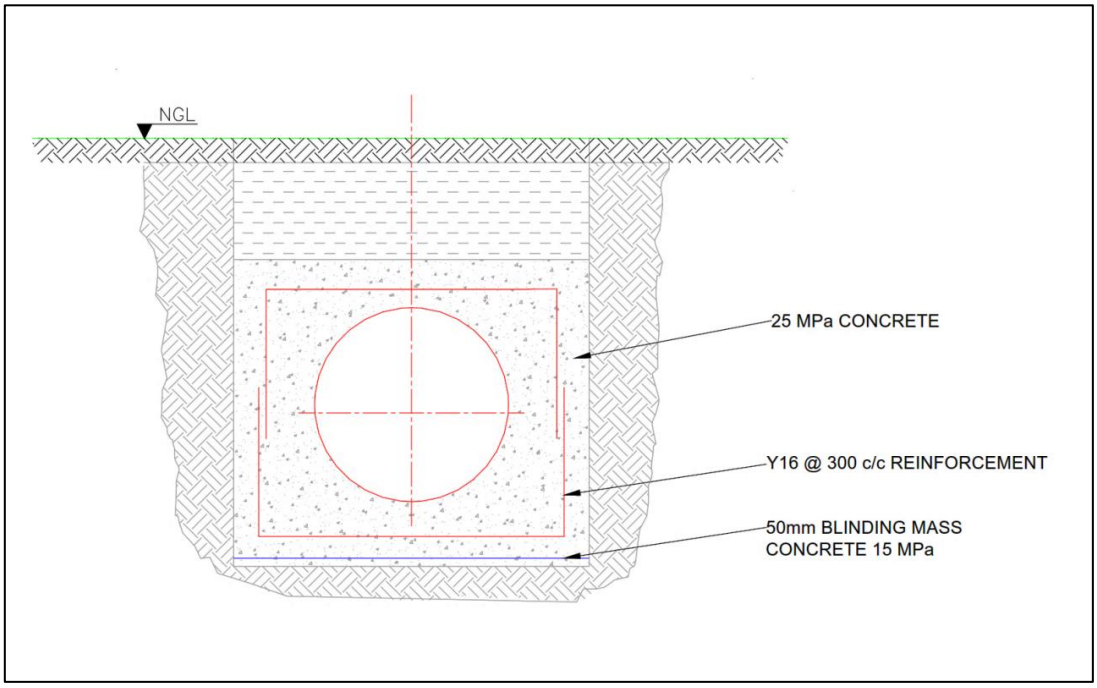


Figure 14: Proposed typical river crossing concrete encasement

Due to the two WTP locality alternatives, there are also two gravity main pipeline alternatives to each of the two WTP locations.

The rising main to hydrocyclones runs from the Goodenough weir and abstraction works at the uMkhomazi River to the High Lift Pump Station. From the High Lift Pump Station, a rising main runs to the raw water reservoir. A gravity main runs from the raw water reservoir to the selected WTP which in turn will have a gravity that will run from the WTP to the Quarry Reservoir. **Figure 15** provides the pipeline routes in relation to the affected private properties.

Please refer to **Section 11** for a detailed overview of the alternatives considered for the LUBWSS – WSS.

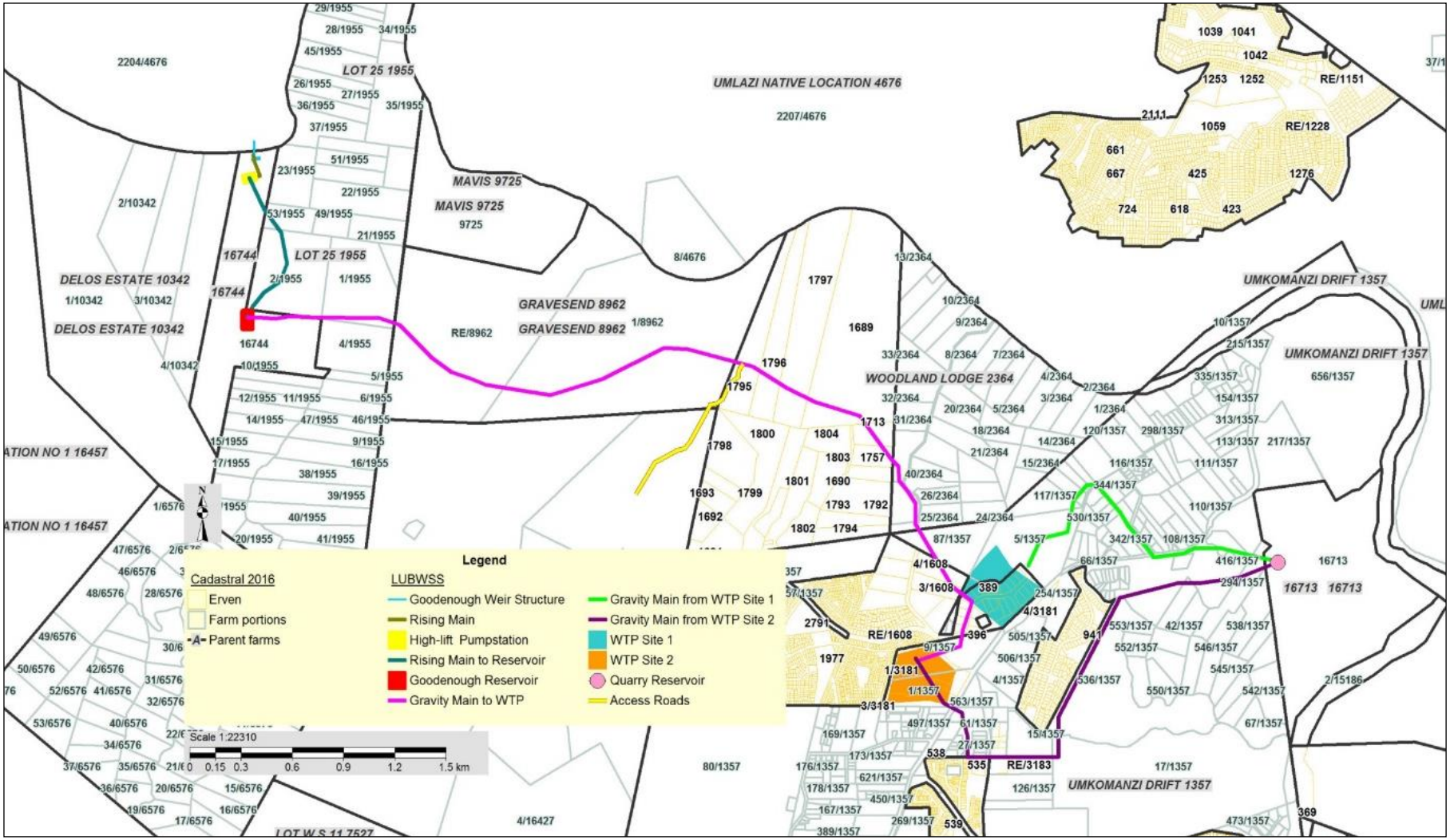


Figure 15: Cadastral Map showing the pipeline routes (based on 2016 cadastral data)

10.1.8 Access Roads

10.1.8.1 External

The pipeline is routed through hilly and often forested areas with limited existing access roads. An access plan has been developed to ensure access to the pipelines and other relevant infrastructure. Where new access roads are required, a new 8m wide gravel road was allowed for. A summary of the proposed access roads is provided in **Table 13**.

Table 13: Access roads for the LUBWSS – WSS

Access Road	Length
New Access Roads	13.90 km
Upgrading of Existing Access Roads	5.95 km

An additional 1.03km long, 8m wide new gravel access road with two layers is to be constructed connecting the pipeline to the existing main road. The access roads will have a construction servitude to be 12m wide.

The proposed access road will connect into an existing road and run down a valley towards the gravity main route (**Figure 16**).

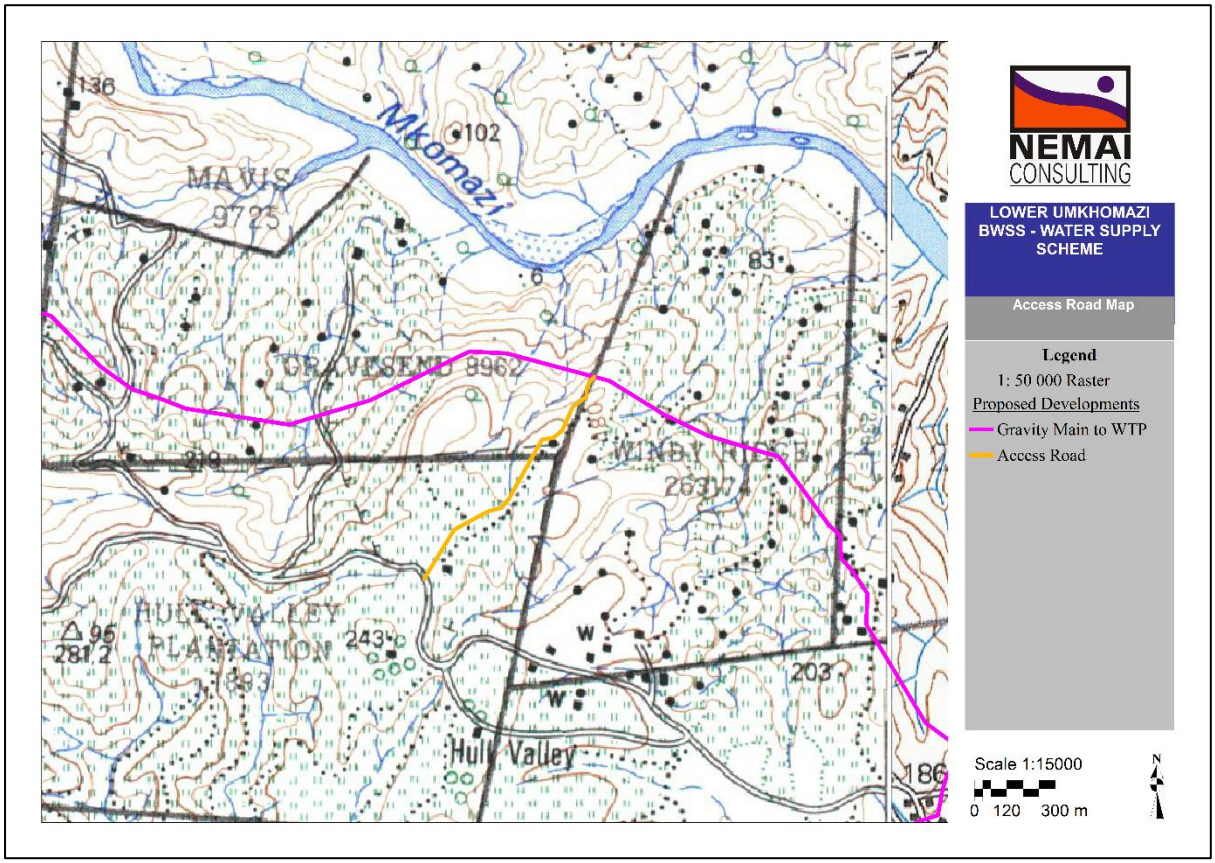


Figure 16: Proposed Access Road Map

The WTP is located adjacent to the road P529. Access from the existing main road to the works will thus be very short.

10.1.8.2 Internal

Provision has been made for two roads within the WTP site, to allow for chemical delivery and residual disposal to be separate from the administration access. Two-way roads have been designed to be 10m wide and there has been a provision for loading bays and weighing stations at the chemical and chlorine buildings. One-way internal roads between structures have not been displayed on the layouts, but infrastructure spacing has taken the internal roads into account. Internal roads traverse the boundary of the property to allow for easy access across the site and to create further distance from the key buildings to the perimeter boundary. This is relevant with the location of the site being adjacent to residential properties. The internal access roads along with landscape and irrigation have been included in the WTP capital costing.

Figure 17 below indicates the internal roads within the WTP site.

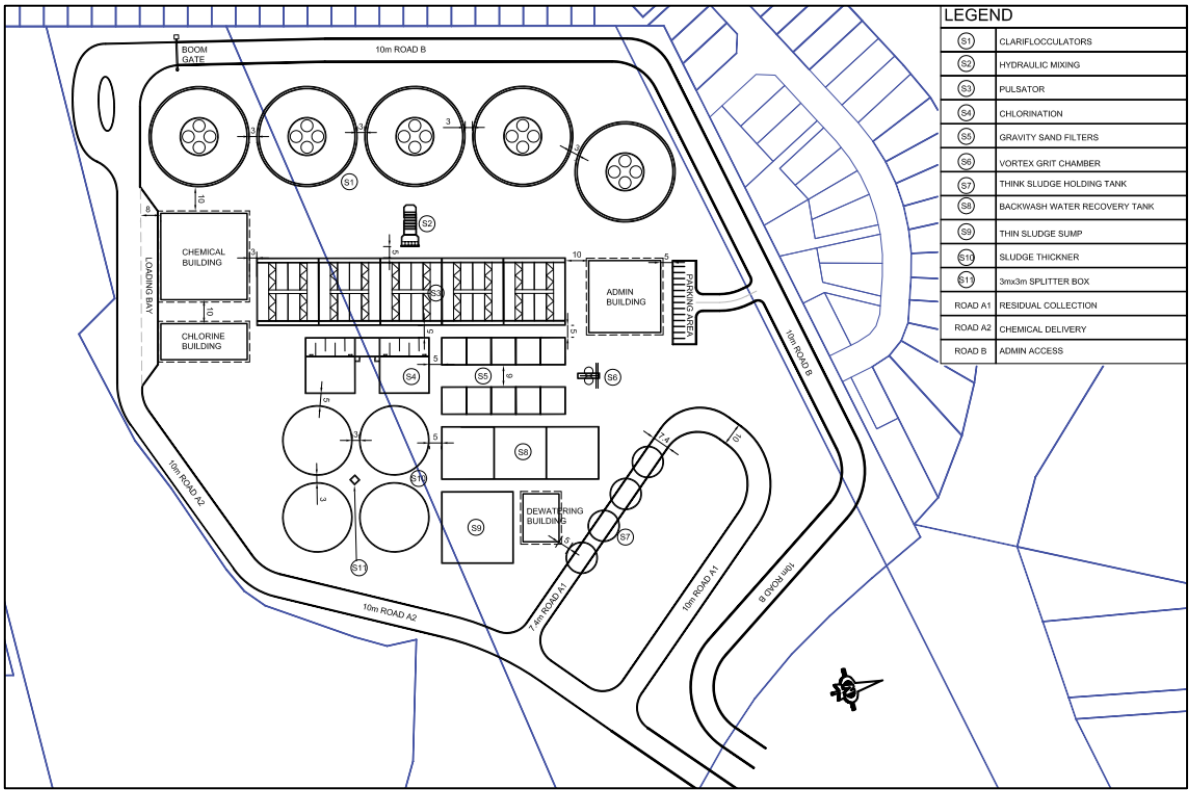


Figure 17: WTP 2 Layout (AECOM, 2016a)

10.1.9 Associated Electrical Conveyance Infrastructure

The following information was extracted from the Lower Umkhomazi Bulk Water Supply Scheme: Detailed Feasibility Study and Preliminary Design: Bulk Electrical Services compiled by DNA Consulting Engineers and Project Managers in 2016.

Bulk electrical power is required at all the proposed abstraction and WTP sites. Spur lines would need to be constructed from the Eskom backbone to the abstraction and WTP sites.

The Feasibility Study confirmed that Eskom will be the electrical supplier for the LUBWSS and not the municipality. Eskom's existing supply networks are constrained and new bulk power infrastructure is required to deliver adequate power to the LUBWSS infrastructure sites.

Eskom has transmission networks (132kV – 275kV) in the area but not in close proximity**.** A 132kV and 275kV network infrastructure is available in the region. The closest 132kV line that has the available capacity and is not constrained is approximately 25km away along the coastal belt.

Eskom Distribution Networks (11kV – 22kV) are available in the area of the LUBWSS. Many of the networks in the area are constrained with insufficient power available to provide power for the proposed scheme.

The positions of infrastructure sites 1 to 5 that require electrical bulk supply from Eskom for the LUBWSS are provided in **Figure 18**.

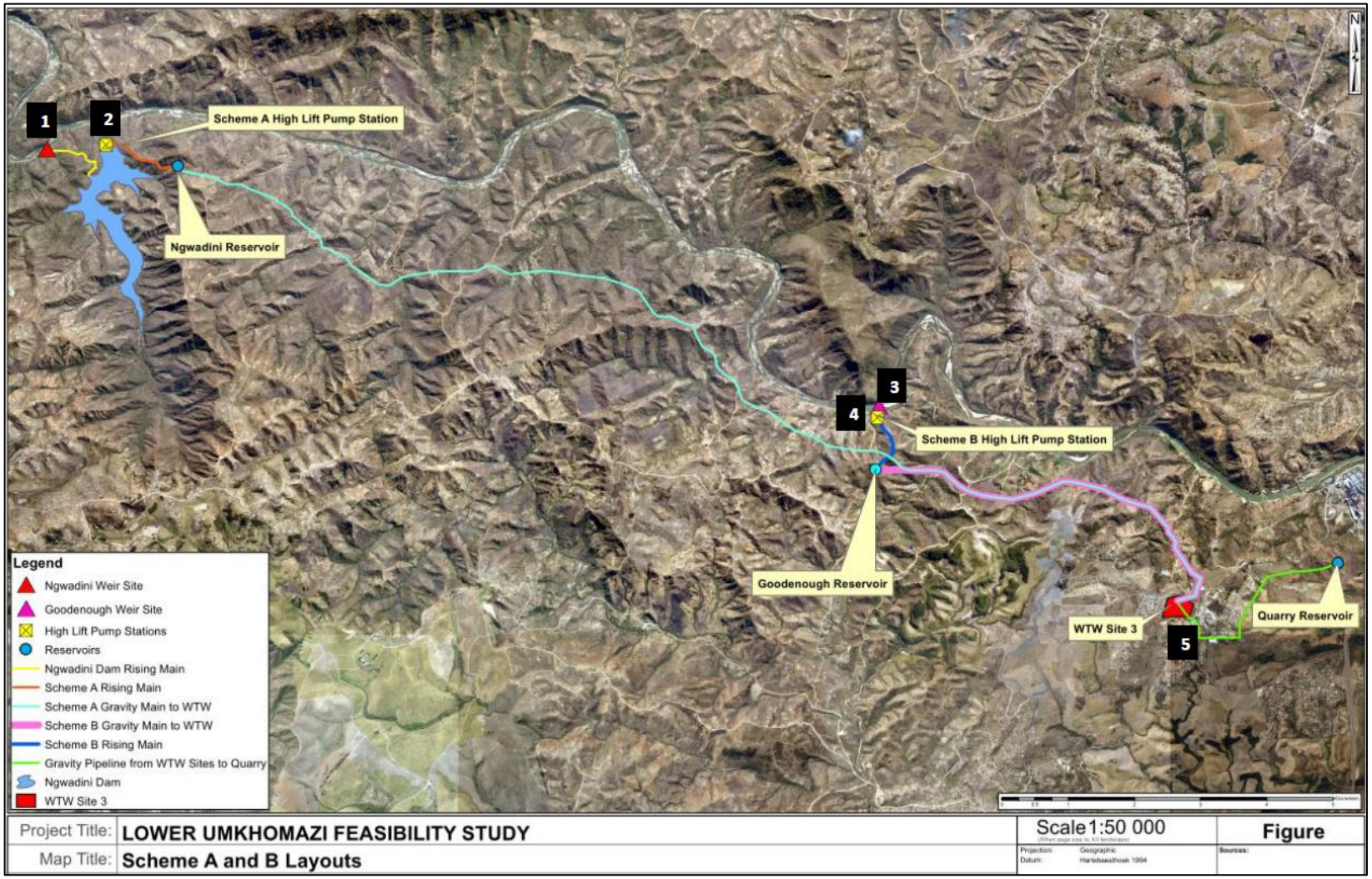


Figure 18: Bulk electrical supply points for the LUBWSS

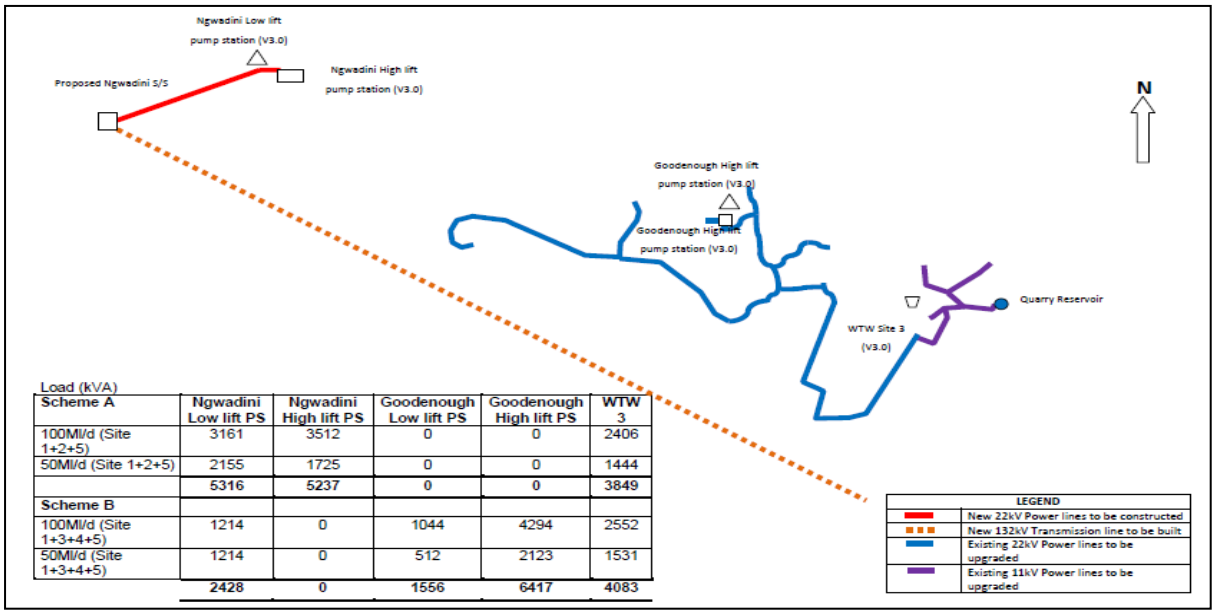
A total of seven applications were made with Eskom for bulk power supplies in September 2015. Changes in loads and scheme options associated with the overall concept designs by AECOM did result in changes that need to be made on the Eskom applications. In consultation with Eskom, it was agreed that the current applications would remain and adjustments would be made on the applications during detailed design stage.

Based on analysis received from Eskom, there is no power supply available on the sites requested and it will therefore be necessary to extend the Eskom existing transmission and distribution networks to the various sites. There are 22kV and 11kV existing Eskom networks in the area.

Eskom has confirmed that they will need to construct a new substation (Ngwadini substation) in the area. This is on the condition that other consumers can be supplied off this new substation. Eskom cannot guarantee that such a substation will be built or if another alternative supply can be provided for the required full load.

As indicated by the Eskom Transmission Development Plan for 2013-2022, Eskom are currently ugrading and expanding their 132kV Transmission Network in the Umkomaas region. This has been confirmed by Eskom Planning.

Figure 19 below reflects the existing electricity infrastructure in relation to the proposed pump stations and WTPs for LUBWSS. For LUBWSS, a new 132kV transmission line is currently under construction to a proposed Ngwadini substation located in the proximity of the Ngwadini OCS Dam. Power supplies to Goodenough pump stations and the WTPs is proposed to be fed off existing infrastructure that would need to be upgraded.



Load (kVA)

Scheme A	Ngwadini Low lift PS	Ngwadini High lift PS	Goodenough Low lift PS	Goodenough High lift PS	WTW 3
100Ml/d (Site 1+2+5)	3161	3512	0	0	2406
50Ml/d (Site 1+2+5)	2155	1725	0	0	1444
	5316	5237	0	0	3849
Scheme B					
100Ml/d (Site 1+3+4+5)	1214	0	1044	4294	2552
50Ml/d (Site 1+3+4+5)	1214	0	512	2123	1531
	2428	0	1556	6417	4083

Figure 19: Proposed electrical infrastructure

The new Eskom infrastructure required is a regional substation already identified in Eskom's long term plans, and a 132kV transmission line.

The final total power required is 4000kVA for all key locations, including the Ngwadini abstraction works, Goodenough abstraction works, high lift pump station, and at the WTP. The new substation is required due to constrained local networks, and has already been identified as part of a regional solution. The substation is close to the Ngwadini Dam site and on private land.

Eskom will be responsible for the power supply and therefore apply for EA for the infrastructure.

10.1.10 Construction Site Camps

The location and number of the construction camps will in part depend on the number of construction packages. Preliminary locations for the following construction camp sites have been identified:

- Ngwadini abstraction, Ngwadini rising main and Ngwadini Dam site;
- Goodenough abstraction, high lift pump station, reservoir site and associate pipeline;
- WTP;
- The gravity main from Goodenough Reservoir to the WTP; and
- The gravity main form the WTP to Quarry reservoir.

The suggested locations for the construction camps are provided in **Figures 20** and **21**. No construction camp sites were identified within the dam basin due to the narrow, steep-sided dam basin. The construction camp locations will need to be reviewed further during the detailed design phase. Two site camps will be required at the Ngwadini Dam and abstraction site. One shall be used as a lay-down area and the other as a professional camp. Site dimensions are assumed to be 50 000m^2. Site camps near the Goodenough infrastructure and WTP are slightly smaller, at a suggested 18 000m^2. Lay-down areas along the pipeline route have been designed to vary between 18 000m^2 and 8 000m^2, depending on site topography.

Figure 20: Construction Camp Sites Section 1

Figure 21: Construction Camp Sites Section 2

10.2 Project Lifecycle

To adequately consider the impacts associated with the LUBWSS – WSS, the major activities during each phase of the project lifecycle are listed in the sub-sections to follow.

10.2.1 Pre-feasibility and Feasibility Phases

Major activities that form part of the Pre-feasibility and Feasibility Phases include:

- Assessment of base conditions;
- Technical, economic and environmental screening of alternatives;
- Surveying;
- Sizing and costing of infrastructure; and
- Geotechnical investigations.

10.2.2 Pre-Construction Phase

Major activities that form part of the pre-construction phase include:

- Negotiations and agreements with the affected landowners, stakeholders and authorities;
- Detailed engineering design;
- Detailed geotechnical investigations;
- Geophysical investigations;
- Survey and mark construction servitude;
- Survey and map topography for determination of post-construction landscape, rehabilitation and shaping (where necessary);
- Possible removal of trees within construction servitude;
- Possible further phases of heritage site investigation and fencing of heritage sites;
- Procurement process for Contractors;
- Selective improvements of access roads to facilitate the delivery of construction plant and materials;
- Arrangements for accommodation of construction workers;
- The building of a site office and ablution facilities;
- Permits if protected trees are to be cut, disturbed, damaged, destroyed or removed;
- Permits if heritage resources are to be impacted on and for the relocation of graves;
- Confirmation of arrangements with individual landowners and/or land users for managing and mitigating issues such as fencing and gate dimensions for traversing servitude, traversing patterns of livestock over servitude, access to livestock drinking points, security, opening and closing of gates and access to private property;
- Confirmation of the location and condition of all buildings, assets and structures within the servitude; and
- Determining and documenting the road conditions for all identified haul roads.

10.2.3 Construction Phase

General activities associated with the construction phase for the LUBWSS – WSS include the following:

- Site establishment;
- Relocation of infrastructure;
- Prepare access roads;
- Establish construction camp;
- Bulk fuel storage;
- Storage and handling of material;
- Construction employment;
- Site clearing;
- Excavation;
- Blasting;
- Establishment of and operations at crusher;
- Establishment of and operations at batching plant;
- Establishment of and operations at materials testing laboratory;
- Create haul roads;
- Concrete Works;
- Steel works;
- Mechanical and Electrical Works;
- Temporary river diversions for pipeline crossings;
- Electrical supply;
- Construction of WTP;
- Construction of pipelines;
- Cut and cover activities;
- Stockpiling (sand, crushed stone, aggregate, etc.);
- Waste and wastewater management;
- Relocation of graves, protected species, etc.; and
- Reinstatement and rehabilitation of construction domain (as necessary).

The methodology for the installation of the pipeline is as follows:

- Site clearing.
- Remove topsoil in the area where construction will take place and stockpile separately for later re-instatement.
- Excavate pipe trench.
- Install and compact pipe bedding.
- Install pipe sections by means of side booms (special cranes) and weld joints.

Figure 22: Typical trench excavation and pipe installation activities

- Repair field joints and backfill and compact pipe trench in layers.
- Construct air and scour valves. Air valves, which are generally positioned at high points along the route, release air from the pipeline as it fills, allow air into the pipeline when it is draining and 'bleed' off air during normal operations. The scour valves serve to drain water from the pipeline (typically during maintenance), and are located a low points along the route for drainage purposes. A detailed hydraulic analysis for the positioning of the valves will be performed as part of the detail design.
- Construct access chambers.

Figure 23: Typical examples of chambers (left - during construction; right – completed)

- Re-shape the impacted area to its original topography and replace stripped topsoil.

Figure 24: Typical views of reinstated (left) and rehabilitated (right) pipeline routes

- Install final Cathodic Protection measures.
- Install AC mitigation measures.
- Install pipeline markers (concrete posts) at changes in direction and at regular intervals along the route.
- Rehabilitation.

Watercourse crossings will generally consist of pipe sections encased in concrete in accordance with the relevant Umgeni Water criteria. The typical construction methodology for a river crossing is as follows:

- An earthen berm (coffer dam) and temporary bypass canal is constructed to divert the water around the construction site.
- The trench is excavated across the dry river channel
- A concrete bedding is constructed first, followed by the installation and restraining of the pipe to prevent flotation. Encasement is completed by the construction of further concrete lifts.
- Once the concrete has set, the temporary coffer dam is removed and the bypass canal backfilled to re-instate the flow.
- The impacted area is re-shaped to its original topography.
- The disturbed area is rehabilitated.
- If erosion of the disturbed river banks is a concern, suitable measures will be implemented to ensure the stabilisation of the river structure.

Figure 25: Typical river crossing showing concrete encased pipe section

10.2.4 Operation Phase

Key activities to be undertaken as part of the operation and maintenance of the LUBWW – WSS include the following:

- WTP operation –
    - Raw water intake;
    - Chemical dosing;
    - Phase separation (Clarification and Filtration);
    - Sludge treatment process;
    - Chemical storage, disinfection and final water storage;
    - Administrative buildings; and
    - General housekeeping, security and biodiversity.
- WTP mechanical, electrical and civil –
    - Routine planned maintenance;
    - Major breakdown repairs; and
    - Minor breakdown repairs.
- Potable Water Pipeline –
    - Create access track along pipeline servitude;
    - Conduct routine maintenance inspections of the project infrastructure;
    - Scouring of pipeline, where the water conveyed and stored within this system will be released into the receiving watercourses along the alignment from scour valves. A detail hydraulic analysis will be conducted to determine the optimum positioning of the scour valves;
    - Undertake maintenance and repair works, where necessary; and
    - Ongoing consultation with directly affected parties.

10.2.5 Decommissioning Phase

Decommissioning is not considered applicable to the scheme. However, should decommissioning be required the activity will need to comply with the appropriate environmental legislation and best practices at that time.

10.3 Preliminary Implementation Programme

Various project packaging and delivery alternatives were considered. The packaging of the overall project was also explored to identify packages that can be lumped together for functionality purposes. Two packages were proposed:

- **Package 1 – Potable supply**: This package includes the Goodenough abstraction weir and works, high lift pump station, the rising and gravity main to and from the Goodenough Reservoir, the WTP, and the gravity main to Quarry Reservoir.
- **Package 2 – The water resource augmentation**: This package includes the Ngwadini abstraction weir and works, rising main to the dam, and the Ngwadini Dam.

Since there is an urgent need to augment water supply to the Upper and Middle South Coast by 2018, delivery mechanisms were explored with the primary focus on expedited project

delivery time frames. For this purpose, two delivery mechanisms are proposed, and for each of which a project program developed:

- A Design-Bid-Build approach and contract (current Umgeni Waters' standard).
- A Design-Build approach and contract which can reduce the need for two tender phases and cultivate innovation.

Neither delivery mechanism can have the scheme implemented by 2018, but the design-build approach can potentially reduce the time to first delivery of water from September 2021 to December 2019. This is based on the time frames of package 1. Package 1 can deliver water, albeit with a 10% risk, before Package 2, the water resource augmentation is completed. A Design-Build package is recommended for Package 1 to expedite first water delivery, and a design-bid-Build for Package 2. If selected as the preferred scheme for the South Coast, the implementation packages of the LUBWSS need to be confirmed, and the preferred delivery mechanism for each selected as soon as possible.

10.4 Resources Required for Construction and Operation

This section briefly outlines the resources that will be required to execute the project.

10.4.1 Water

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. All water use triggered in terms of Section 21 of the NWA must comply with DWS's requirements.

10.4.2 Sanitation

Sanitation services along the pipeline route will be required for construction workers in the form of chemical toilets, which will be serviced at regular intervals by the supplier. A temporary septic field/ tank system will be provided at the site camps and site offices. At the WTP camp site, these facilities can be used into the operational phase at the offices for the WTP operators.

10.4.3 Waste

Solid waste generated during the construction phase will be temporarily stored at suitable locations (e.g. at construction camps) and will be removed at regular intervals and disposed of at approved waste disposal sites within each of the local municipalities that are affected by the project. All the waste disposed of will be recorded.

Construction-related wastewater, which refers to any water adversely affected in quality through construction activities and human influence, will include the following:

- Sewage;
- Water used for washing purposes (e.g. equipment, staff); and
- Drainage over contaminated areas (e.g. cement batching / mixing areas, workshop, equipment storage areas).

The management of the WTP residues during the operational phase of the plant is discussed under **Section 10.1.5.5**.

10.4.4 Electricity

Electricity will be obtained from diesel generators or temporary electricity connections during the construction phase. Electricity requirements for the operation of the scheme will be supplied by Eskom. A separate EIA will be conducted to seek approval for supplying electricity to the project. The power supply is discussed in detail in **Section 10.1.9**.

10.4.5 Construction Workers

The appointed Contractor will make use of skilled labour where necessary. In those instances where casual labour is required, Umgeni Water will request that such persons are sourced from local communities as far as possible.

10.5 Land Acquisition

The information contained in the sections to follow was obtained from the Landowner Identification, Access to Properties and Landowner Engagement Report (AECOM, 2016e).

Land, where the LUBWSS infrastructure is proposed, falls under four key entities:

- Ingonyama Trust;
- Privately owned, i.e. farmers;
- eThekwini Municipality; and
- uGu District Municipality.

There are significant tracts of land linked to the Goodenough abstraction, pump stations and pipeline which are privately owned and used for commercial agriculture, i.e. seasonal vegetable production mostly sold at the Durban markets. Although, some portions of the land are currently vacant, information gathered from landowners indicate that they were previously used for commercial agriculture.

Most of the eThekwini properties are located in the Cragieburn area. Permission to access the land for the purposes of geo-technical investigations was granted. The relevant officials of the uGu DM were kept updated of landowner consultation, including meetings within their jurisdiction.

WTP Site 1 is owned by eThekwini Municipality, while WTP Site 2 is owned by Mr and Mrs Pillay. The property is currently vacant but earmarked for a private project, which is a housing

development. The landowners have expressed their support for the LUBWSS and would consider selling the piece of land. This would however be subject to negotiations.

Mr Govender owns Portion 5, Delos Estate, which is the area containing the following proposed infrastructure components:

- Goodenough Weir and abstraction;
- Rising main to high lift pump station;
- Desilting mechanisms and high lift pump station;
- Rising main to raw water storage reservoir; and
- 25Ml Goodenough Reservoir.

Mr Govender is also part of the Gounden Family Trust and a majority shareholder. His farming is exclusively dedicated to seasonal vegetables. Based on the engagements held with his family, he indicated that he expects the technical team to exercise extra caution when dealing with his land due to sensitivity of his crops and potential contamination.

Should LUBWSS be implemented, maintaining good relations with Mr Govender will be important. Any lack of communication or mishandling of relationship with Mr Govender is a risk that could result in unnecessary project delays as well as escalated project costs.

With increasing knowledge that LUBWSS is being investigated for possible implementation, the cost of land could start to escalate. At the time of engagement with landowners and based on the properties enquired, a 4 hectare piece of vacant land was estimated at ± R600 000.

The key recommendations for the LUBWSS future phases and implementation regarding landowner engagement and acquisition are summarised as follows:

- Establishing and managing good relationship with Mr Govender with a view to minimise negative impacts on his seasonal crops and/or commercial vegetable farming.
- Securing the servitude for the pipeline and WTP site earlier to avoid escalation in costs.
- Where possible, issues and concerns identified during the feasibility study should inform the Terms of Reference for future project phases, e.g. the EA process.
- Communication with all landowners is maintained to ensure continuity and to build trust which would be beneficial for future project phases.

11 ALTERNATIVES

11.1 Introduction

The amended 2014 EIA Regulations (07 April 2017) require that feasible project specific alternatives are identified (including the "do nothing" option). Alternatives are defined as different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

- property on which or location where the activity is proposed to be undertaken;
- type of activity to be undertaken;
- design or layout of the activity;
- technology to be used in the activity; or
- operational aspects of the activity; and
- the option of not implementing the activity.

The sub-sections to follow discuss the alternatives investigated during the Feasibility Study that led to the LUBWSS – WSS being selected as the best option to implement. LUBWSS – WSS project alternatives are also considered during the Scoping process. The EIA process will provide a detailed comparative analysis of feasible alternatives from environmental (including specialist input) and technical perspectives.

By conducting the comparative analysis, the BPEO can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term".

The following sections were completed from information contained in the Technical Feasibility Study (AECOM, 2016a).

11.2 Alternatives Screened during the Feasibility Phase

11.2.1 Scheme Configuration Options

A pre-feasibility scheme concept was provided by Umgeni Water which investigated scheme configuration options for the LUBWSS based on the supply area and current and future water requirements. The scheme configuration options investigated are as follows:

- **Scheme A:** Water supplied directly from the Ngwadini Dam to the WTP through a proposed 23km long pipeline;
- **Scheme B:** The return of stored water to the uMkhomazi 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; and
- **Scheme C:** The return of stored water to the uMkhomazi River from Ngwadini Dam in the low flow periods and abstraction at the SAPPI SAICCOR weir.

The layout of the three scheme configuration options is provided in **Figure 26**.

The main difference between the three schemes is the length of pipeline and the number of weirs and abstractions. These differences will drive the main cost differences between schemes. The following additional criteria were considered during the comparison of the three scheme options:

- Constructability;

- Impacts on downstream users; and
- Environmental impacts.

The option to abstract water at SAPPI SAICCOR's existing weir (Scheme C) was discarded due to the following:

- The site is within the uMkhomazi estuary zone and is highly unlikely to receive the authorisations/permits required for implementation; and
- Construction close to the existing abstraction of SAPPI SAICCOR is likely to impact on the quantity and quality of the water the plant receives which may risk their industrial plant functions.

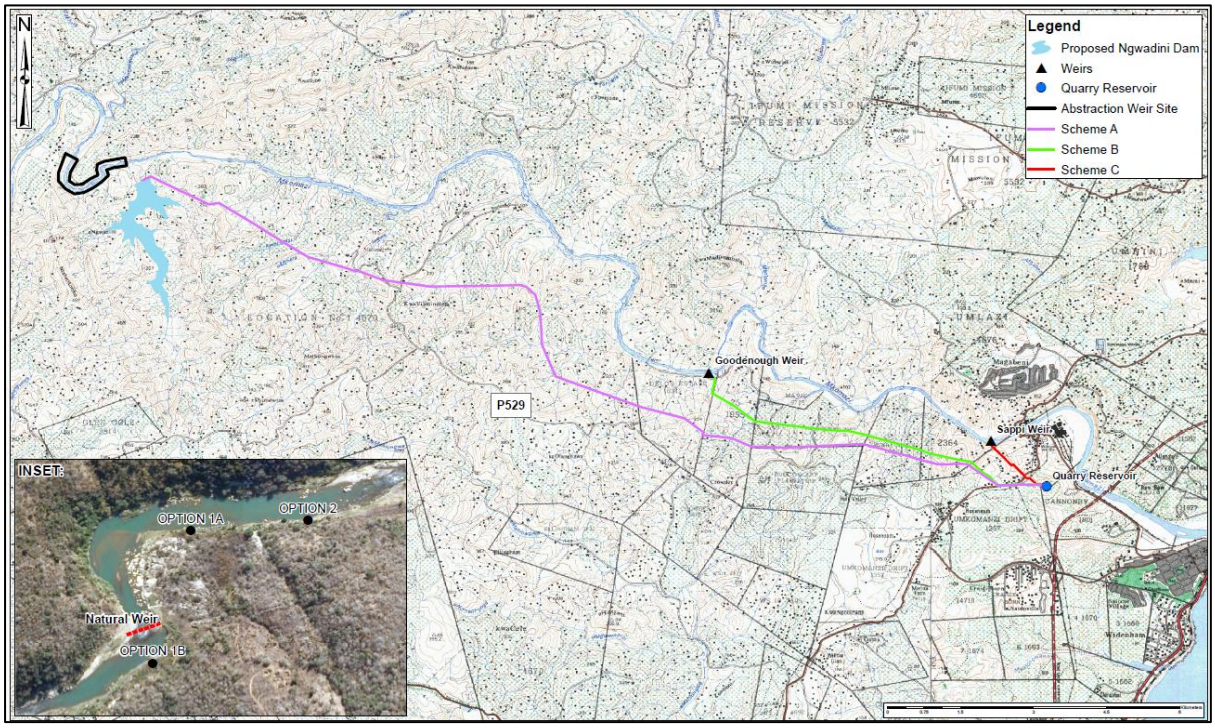


Figure 26: The three configuration options considered for the LUBWSS (AECOM, 2016a)

As a result, the Scheme A and Scheme B options were carried forward to feasibility investigation phase. A detailed Feasibility Study, which included preliminary design of components, has been completed for the two schemes considered for the LUBWSS by AECOM SA (Pty) Ltd.

The feasibility investigations conducted feasibility level designs of the two scheme options to better quantify the infrastructure required, and associated costs and risks to compare the two options and select the preferred scheme option. The feasibility design was based on Umgeni Water Design criteria, which allowed for the design of a 30% seasonal peak (pumping the average flow in 18 hours and the peak flow in 24 hours). The associated peak design flow for the scheme is 130 Ml/d.

Based on the feasibility investigation and design, capital cost estimates for each key component of infrastructure, together with operation and maintenance costs were determined. As the cost of the two schemes were considered similar, other factors including risk were focused on. The key risks for each scheme were identified and are detailed below.

Scheme A:

- Risks of increases in construction costs, delays in completion, and increases in health and safety risks and costs, exist due to the significant length of pipeline to be laid through steep terrain. Alternative pipe delivery methods will most likely be needed together with deeper excavations.
- Environmental risks along the pipeline closer to the Ngwadini OCS Dam, where the area has greater sensitivity, based on biodiversity.
- Significantly more water crossings and associated water use licenses (WULs) will be required.
- The possibility that supply could be delayed or problematic before completion of the Ngwadini OCS Dam, which is the longest construction period item.

Scheme B:

- Risks associated with the construction of an extra weir in a large river with increases in cost if unexpected flooding occurs.
- Risk of poor operations resulting in operational losses of water between the dam release and the Goodenough abstraction.
- Risk of increased residual handling costs if the WTP residual is classified as hazardous.

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.

Based on the supply risks associated with Scheme A and Scheme B's increased flexibility for phasing and integrating with other regional schemes, Scheme B was selected as the preferred scheme to take forward to preliminary design.

11.2.2 Alternative Goodenough Abstraction Works Locations

Initial design options for the Goodenough weir and abstraction works considered different possible sites and were identified based on the following:

- A study of orthophoto mapping (aerial photography) to evaluate the river morphology and to identify areas where durable rock outcrops in the river are present;
- Site visit to the proposed abstraction works site and surrounding areas;
- An assessment of various flows in the physical hydraulic model of the uMkhomazi River and identification of the most appropriate sites with acceptable flow conditions at the position of the inlet to the abstraction works;
- Review of geotechnical investigations of previous studies; and

- Further geotechnical investigations conducted by means of drilling of boreholes at the preferred abstraction works site.

Four site options were identified as follows:

- Option 1: Abstraction on the sharper bend downstream of the existing weirs.
- Option 2: Abstraction at the existing Goodenough weir.
- Option 3: Abstraction at DWS's existing gauging station weir U1H006.
- Option 4: Abstraction on the sharper bend upstream of the existing weirs.

The location of the four possible sites are indicated in **Figure 27**.

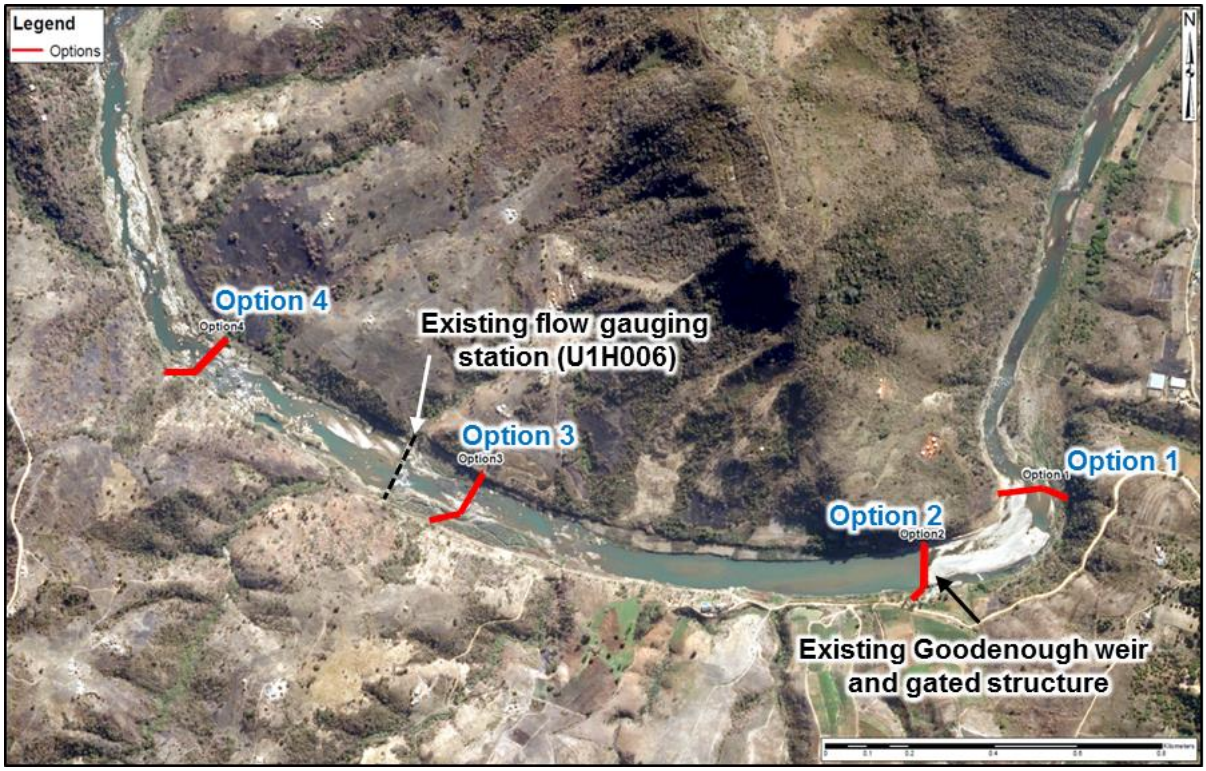


Figure 27: Abstraction weir position options for Scheme B (AECOM, 2016a)

Option 1 is located approximately 320m downstream of the existing Goodenough weir. The weir and gated structure on the right bank were previously incorporated into a temporary embankment constructed annually. The embankment stored water during the low flow winter months and was released to SAPPI SAICCOR as needed by the opening the gated structure. The temporary embankment was usually washed away after the first large flood of the high flow season. The geological conditions at Option 1 are not considered favourable due to deep bedrock. Deep excavations will be required for good foundations.

Option 2 is located at the existing Goodneough weir and situated on a gradual bend to induce secondary currents to scour the intake of the works. The layout of Option 2 for the proposed Goodenough abstraction works is such that it will incorporate the existing weir or concrete structure at Goodenough in the uMkhomazi River. The gated structure, however, will have to

be removed prior to construction. The focus on this option was to determine the feasibility of rehabilitating and increasing the height of the existing weir. The layout comprises of a diversion weir, incorporating the existing weir, a gravel trap, a sand trap which conforms to a pump canal at the downstream end and a fishway.

Option 3 for the river abstraction works is located upstream of the existing Goodenough weir and approximately 170m downstream of the existing DWS flow gauging weir, U1H006, which is not in use anymore. The location was selected because the geological conditions at the location seemed favourable and the existing flow gauging structure can be used as a cofferdam during construction. A similar layout as Option 2 was incorporated for comparative cost purposes.

Option 4 is the most upstream site, located approximately 500m upstream of the U1H006 gauging weir. Although Option 4 was identified as a possible site, it was eliminated mainly due to the following:

- Significant pipeline cost;
- Significant access road construction cost; and
- Flat left river bank side slope.

A physical hydraulic model study was conducted at the DWS Pretoria Laboratory to determine the position in the uMkhomazi River. From the study, the existing Goodenough weir site was the most preferable from a combination of hydraulic performance and geotechnical founding conditions perspective. In addition, it appears to be the first suitable site upstream of the estuary that will have a combination of the characteristics for a suitable weir site i.e. right hydraulics, visible rock for founding structures, and reasonably short weir lengths. This site would require the existing 1.5m weir to be raised to 2.5m.

The same layout proposed for the Ngwadini abstraction works are proposed for the Goodenough abstraction works for the following reasons:

- The general layout has been successfully applied to other abstraction works with the same characteristics such as the Lower Thukela abstraction works (Umgeni Water, 2012) and the Vlieëpoort abstraction works (DWAF, 2010);
- The general layout has been tested in hydraulic model studies and showed to operate sufficiently;
- The sediment exclusion capability of the abstraction works is higher compared to the other options initially proposed;
- The maximum abstraction capacity of the civil components of the abstraction works as designed for Ngwadini is 2.6 m^3/s which provides for some contingency over the 1.7m^3/s required at the Goodenough abstraction works; and
- Theoretical calculations indicated that the difference between the upstream water level and the tailwater level is such that the abstraction works components can be sufficiently flushed during small floods.

The abstraction works comprise of a boulder trap, high wall with openings to a gravel trap with protected trash racks, sand traps or pump canals and a diversion weir. The feasibility layout of the selected Option 2, the raised Goodenough weir site, is provided in **Figure 28**.

Figure 28: Layout of the Goodenough weir

11.2.3 Alternate WTP Locations

In a previous study report (Brown & Roots (Pty) Ltd, August 1998), a number of WTP sites were identified within the lower reaches of the uMkhomazi River and adjacent tributaries for regional supply to the South Coast. While the proposed regional scheme was not implemented, the sites are now potentially relevant for the LUBWSS – WSS.

The WTP sites identified are as follows:

- **Hull Valley WTP Site**: The site is located approximately 4.5km away from Quarry Reservoir. The elevation of the site is 240 masl. This site is a possible option due to the distance from the pipeline route but the elevation may result in a higher pumping head than needed as the Quarry Reservoir is only at an elevation of 155 masl.
- **Magabeni WTP Site**: The site is located approximately 5km from Quarry Reservoir but is situated on the other side of the uMkhomazi River. The pipeline would have to cross the river from the WTP back to the tie in point (Quarry Reservoir) therefore this site is not ideal due to the extra costs in pipeline and crossing the uMkhomazi River.
- **Willow Glen WTP Site**: The site is located approximately 8km from Quarry Reservoir, 9km south of Goodenough Weir. The site is in an isolated area which means the pipelines will have to be substantially longer, and as such is not ideal.

- **Roseneath WTP Site**: The site is approximately 7km from Goodenough Weir and along the pipeline route and approximately 450m from SAPPI SAICCOR weir pipeline route. This site is considered good from a position perspective, and the elevation of the site is also suitable at 185 masl.

From the above sites, Hull Valley and Roseneath were considered further. Of the two, Roseneath appears preferable, both from a position, and elevation perspective. The Hull Valley WTP site was found to be unfavourable, as this site is at an elevation of 240 masl, significantly higher than Quarry Reservoir.

The Feasibility Study identified two additional sites close to the Roseneath site, one to the North East and one to the South West of the Roseneath site, around the town of Craigieburn, were found that had sufficient area at a gentle slope and the correct elevation. This allows for easy access for chemical delivery and staff commute. Desilting mechanisms near the source water were also explored to minimize the amount of sediment in the raw water and volume of residual generated at the WTP.

The three WTP sites are provided in **Figure 29**, with Site 2 being the Roseneath site.

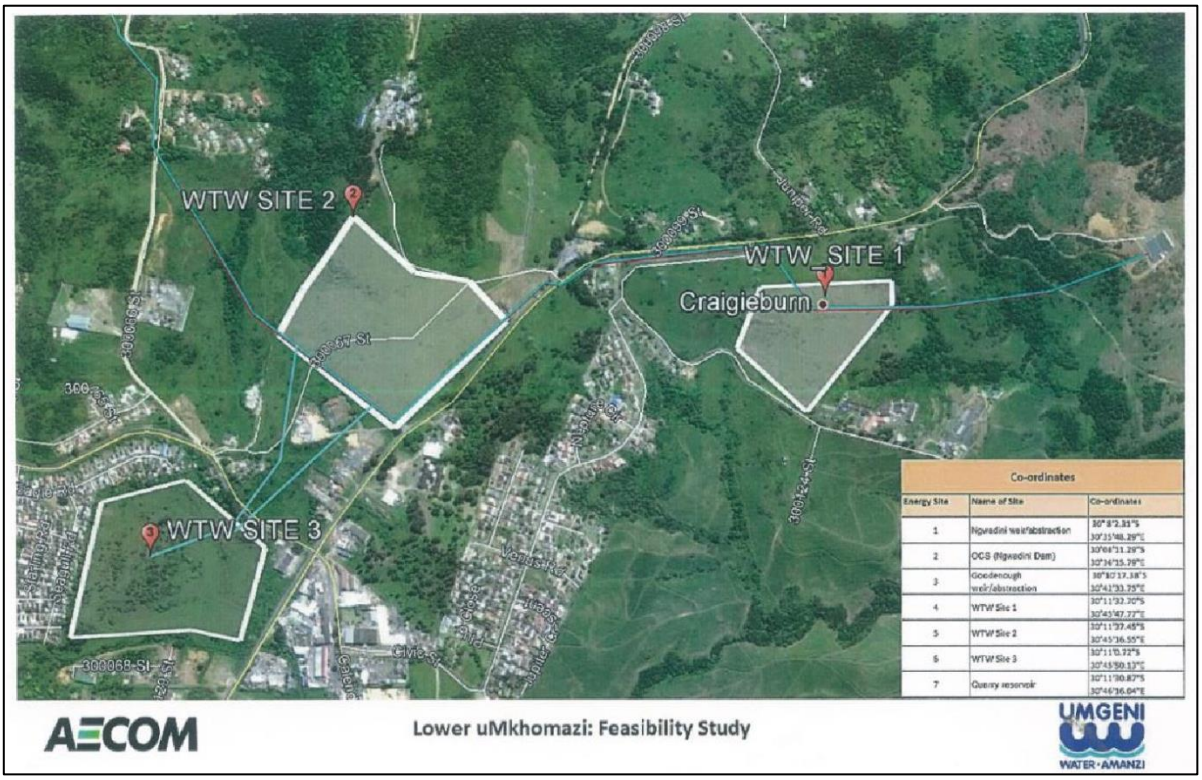


Figure 29: The three WTP locations (Umgeni Water, 2016)

The area available for Site 2 and Site 3 is greater than what is required, while the area for Site 1 is marginally adequate. It was determined that existing powerlines run along the northern perimeter of the Site 1, which reduced the usable area of the site. Additionally, the elevation of Sites 2 and 3 is ideal to be able to potentially gravity feed to the Quarry Reservoir, hence

reducing pumping costs. Due to the limitations regarding the size and less favourable elevation of Site 1, it was not considered further and thus screened out. As a result, Sites 2 and 3 are considered as WTP site alternatives for the LUBWS – WSS Scoping and EIA Process.

11.3 Alternatives assessed as part of the EIA

11.3.1 Alternate WTP Locations

The two WTP sites are considered as alternatives to be assessed as part of the Scoping and EIA Process. These two sites are located in the towns of Roseneath, near Craigieburn (**Figure 30**). Images of the two WTP sites are provided in **Figures 31** and **32**.

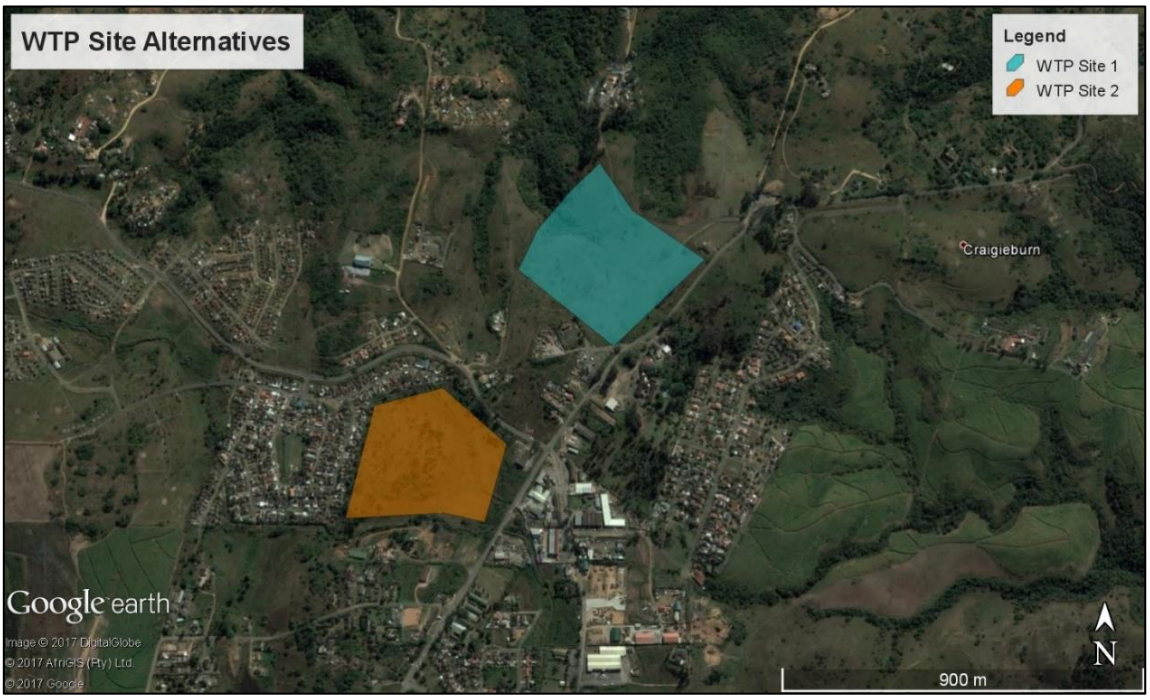


Figure 30: WTP Site Alternatives

Figure 31: WTP Site 1

Figure 32: WTP Site 2

The dimensions and elevations of the two proposed sites are provided in **Table 14**.

Table 14: WTP site options

Water Treatment Plant Sites				
WTP	**Area Available**		**Elevation**	**Slope**
WTP Site 1	55 000	m^2	164m – 175m	1:20
WTP Site 2	70 000	m^2	168m – 185m	1:20

The layout of each WTP alternative is provided in **Figures 33, 34** and **35**.

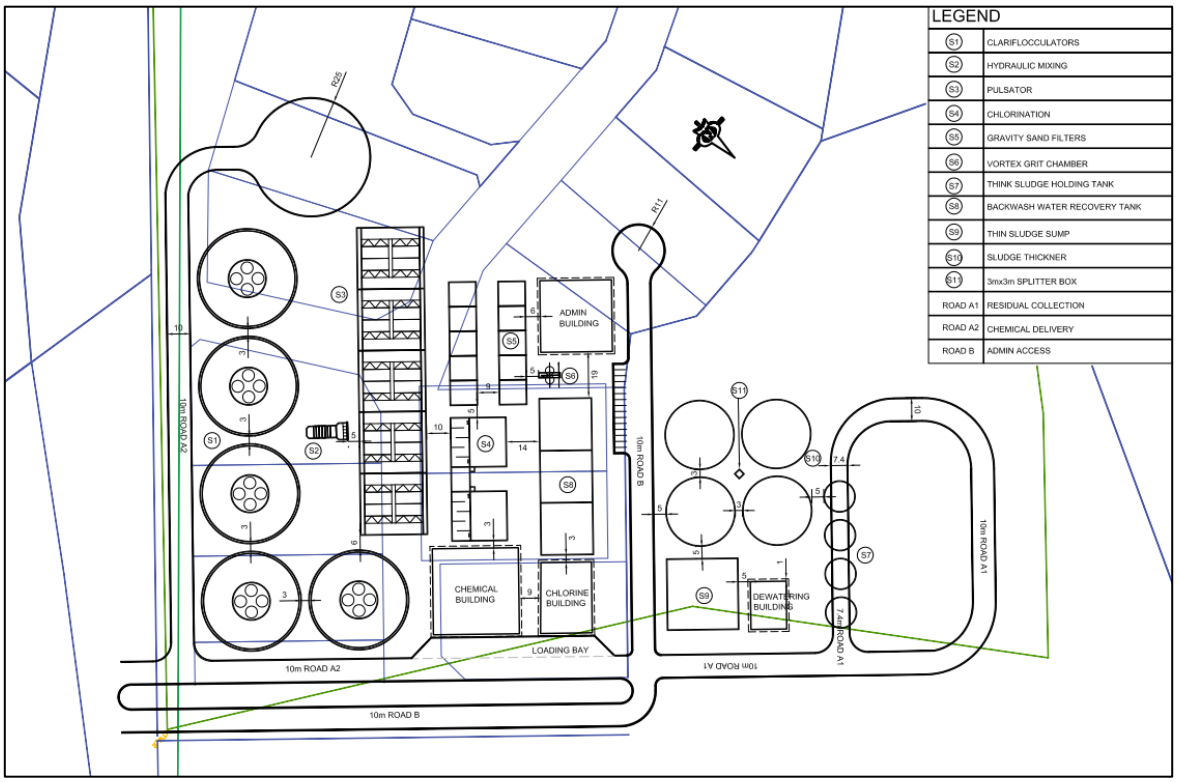


Figure 33: WTP 1 Layout (AECOM, 2016a)

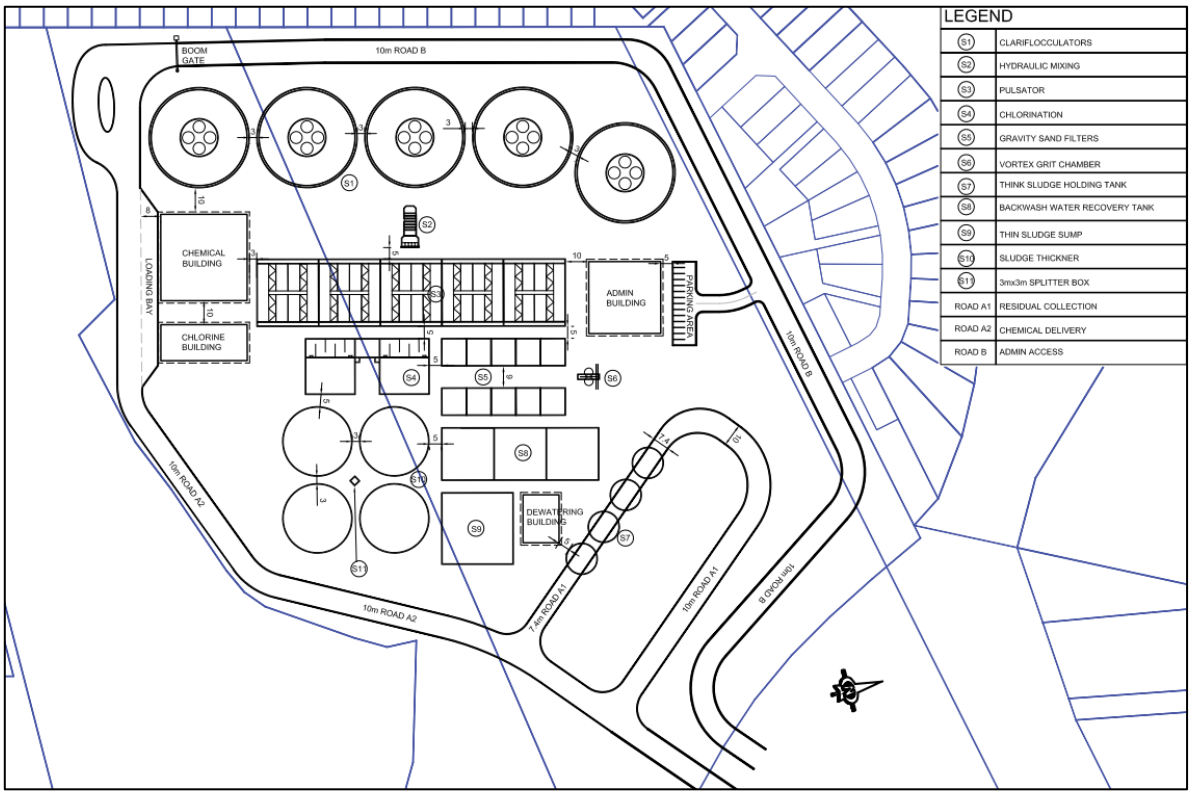


Figure 34: WTP 2 Layout (AECOM, 2016a)

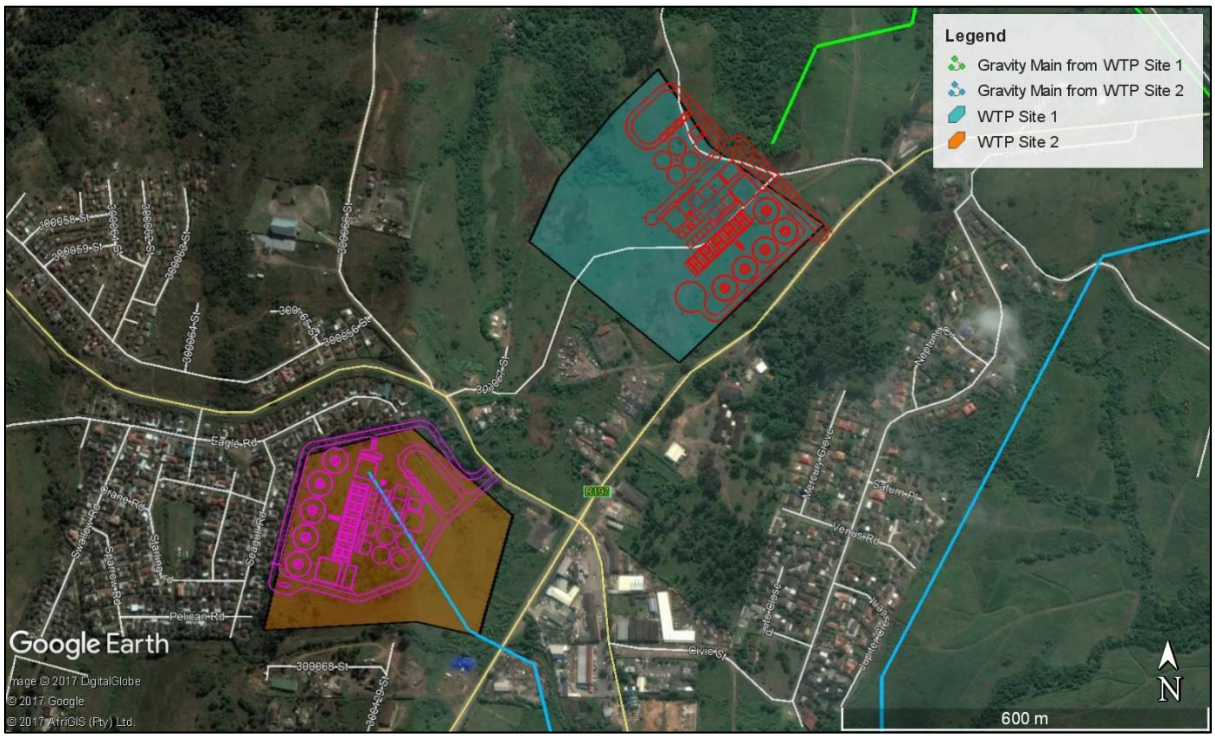


Figure 35: WTPs Layouts

Of the two sites considered, Site 2 is the preferred site from a hydraulic perspective, due to the natural topography of the site allowing the works to be gravity fed, with minimal earthworks. Site 2 is located on a vacant plot in the small urban centre of Craigieburn near the Quarry Reservoir.

Details regarding the selection of Site 2 as the preferred option are as follows:

- The valley caused by the perennial water course is situated centrally in Site 1, whilst it is on the boundary at Site 2. Site 2 thus has a more consistent slope across the site.
- Based on the topography of the land and WTP layouts generated, the preferred site from a hydraulic perspective is Site 2.
- The valley within Site 1 will make it difficult to construct the WTP and there will therefore be more cut and fill activities undertaken which will have a larger visual impact than for Site 2.
- Site 2 is larger than Site 1.
- From a cost perspective, the excavation volumes at Site 1 are anticipated to be higher. As platforms with common components at similar levels would need to be excavated to suitable founding levels, the excavation volumes would most likely be greater for WTP Site 1 with the valley through the middle of the site.
- From a geological perspective, test pitting was conducted on both WTP sites. No refusal was encountered at Site 2 to depths of 3m. At Site 1, refusal was encountered on a cemented residual tillite soil layer. However, there was a possibility of an

unconsolidated residual tillite soil layer underlying the cemented layer. Further geotechnical investigations were recommended for the selected preferred site.

- The preferred site from a social and environmental perspective is also believed to be WTP Site 2.

As there are two WTP alternative sites considered in the Scoping and EIA study, there are two alternative gravity mains that will run from each of the two WTPs to the Quarry Reservoir (**Figure 36**). The gravity main to be implemented will depend on which WTP site location is selected.

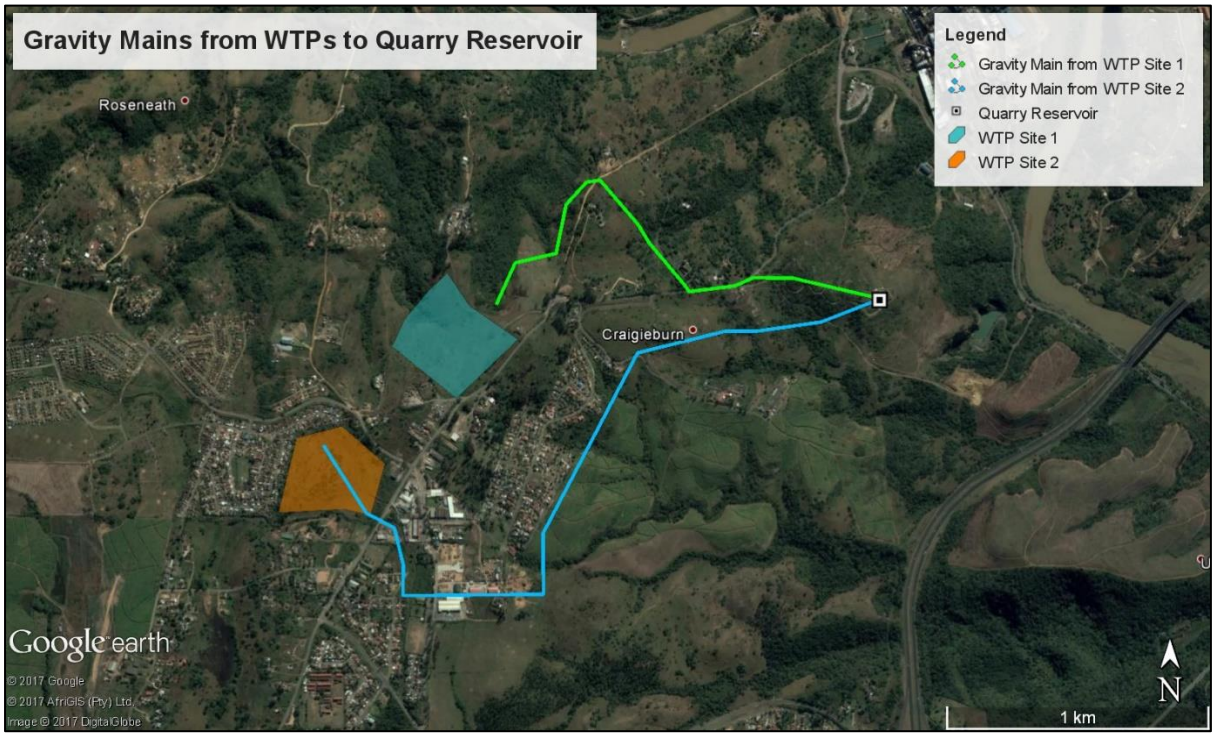


Figure 36: The routes of the two gravity mains associated to the two WTPs alternative sites

11.4 No-go Alternative

As standard practice and to satisfy regulatory requirements, the option of not proceeding with the project is included in the evaluation of the alternatives.

The no-go alternative refers to a situation where the LUBWSS – WSS is not built. This would mean that there would not be an increase in water supply to the Middle and Upper South Coast.

Based on the medium growth scenario, the LUBWSS needs to be sized to provide an additional average volume of 100Ml/d (with a 130Ml/d designed peak capacity), to meet the future 30-year demand projection. The project is aimed at 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. If future water requirements are not

met, severe and frequent restrictions of water supply may need to be implemented in the region. These restrictions would be in effort to support the projected growth and water requirements in the water supply area of the South Coast.

In addition, local employment opportunities will be created during the construction phase and operational phase. The project will allow further economic growth and development within the area and therefore is of importance as the local area will benefit from this development in general.

12 PROFILE OF THE RECEIVING ENVIRONMENT

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

The study area includes the entire footprint of the project components. Where necessary, the regional context of the environmental features is also explained, with an ensuing focus on the local surrounding environment.

Where necessary, the regional context of the environmental features is also explained, with an ensuing focus on the local surrounding environment. Refer to Section 14 for more elaborate explanations of the Specialist Studies and their findings for specific environmental features.

The potential impacts to the receiving environment are discussed further in Section 15.

As previously mentioned, the Feasibility Study reports compiled were used to assess the profile of the receiving environment for the LUBWSS – WSS.

12.1 Climate

The Climate Change Vulnerability Study (2009) highlighted the following sectoral issues relating to climate change:

- KZN's growing economy is dependent on energy but the energy sources it requires to meet the needs of its population for economic growth, job creation and poverty eradication are contributing to changes in the climate. The province contributes to global greenhouse gases through various energy and non-energy greenhouse gas sources. These emissions must be reduced.
- The energy sector (electricity generation) is the main contributor to greenhouse gases in KZN because of the coal-based economy. Electricity consumption is rising.
- The industrial and transport sectors are the highest consumers of fuel. This is an indicator of GHG emissions.

- KZN's transport sector is expanding and vehicle emissions are expected to increase.
- The biggest potential for reducing greenhouse gas emissions lies within the residential sector.
- The waste sector offers opportunities for the generation of alternative energy.
- The agricultural sector in KZN contributes to greenhouse gas emissions through a variety of processes and activities but there are many opportunities for reduction.
- KZN has already taken commendable steps to contribute to global greenhouse gas stabilisation. This provides a solid platform to strengthen future initiatives within the context of the National Climate Change Framework.

12.1.1.1 Temperature and Precipitation

The climate in the coastal areas of KZN is subtropical. In summer, temperatures often rise above 30˚C. Precipitation is expected in the summer months of December, January and February. KZN is the province with the most rain in South Africa. The winters are mild to warm, the temperatures on average are over 20˚C, and the probability of rain is low.

As the nearest meteorological station is located in Durban, KwaZulu-Natal, the information to follow was obtained from the South African Weather Services (SAWS) for this station.

On average, Durban's warmest months are January, February and December. Most rainfall is seen in January, February, March, November and December. Durban has dry periods in May, June, July and August. On average, the warmest and wettest month is January and the coolest month is July. Midwinter temperatures range from 16 to 23˚C and midsummer temperatures range from 28 to 33˚C (**Figures 37** and **38**).

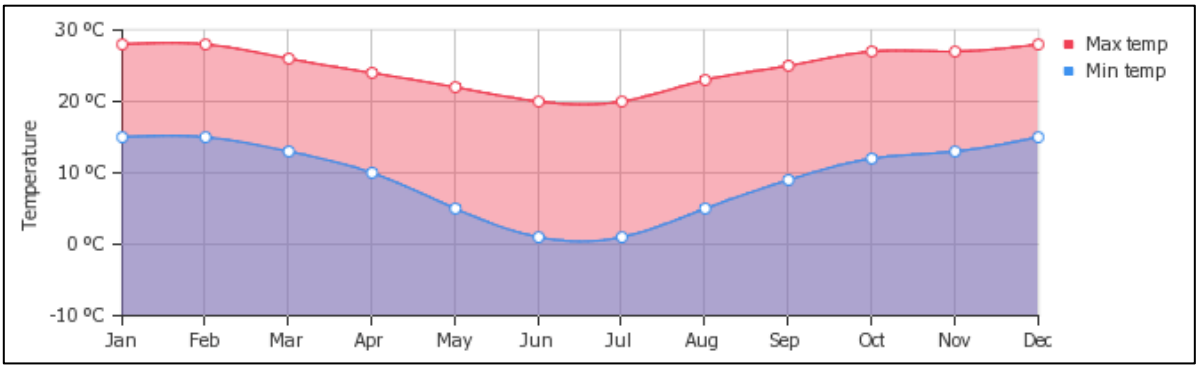


Figure 37: Average minimum and maximum temperatures in Durban (Copyright© 2015 www.weather-and-climate.com)

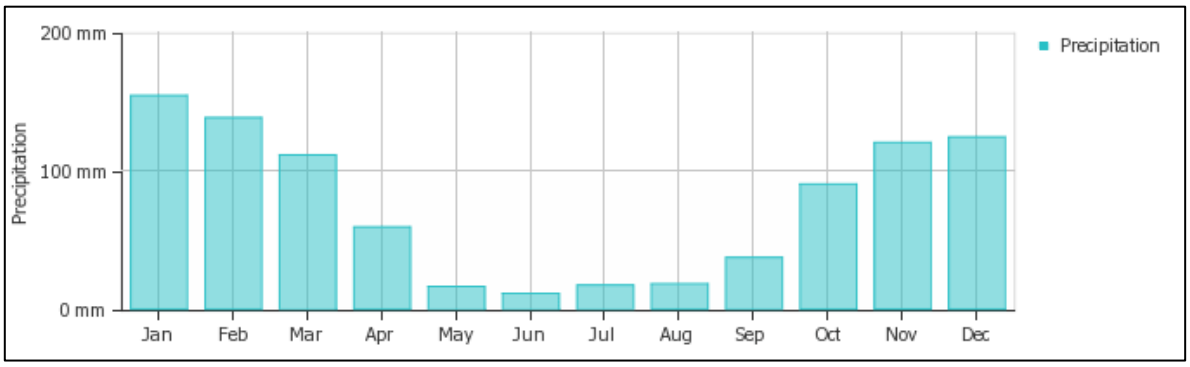


Figure 38: Average precipitation in Durban (Copyright© 2015 www.weather-and-climate.com)

12.1.1.2 uMkhomazi River Catchment

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 (DWAF, 2004). Mild to warm temperatures are experienced during the summer, whilst winters are characterised as being cold with frost occurring regularly. Rainfall occurs predominantly during summer but isolated winter rainfalls may occur. The winters are generally dry with cold nights and warm days.

12.1.1.3 Wind

The wind rose for Pietermaritzburg shown in **Figure 39** for a 10-year period (2003 – 2013) is interpreted as follows:

- Prevailing wind direction is south-east;
- Highest percentage of winds blow with speeds of 0.5 – 2.5 m/s; and
- 43.4% of all winds are calm.

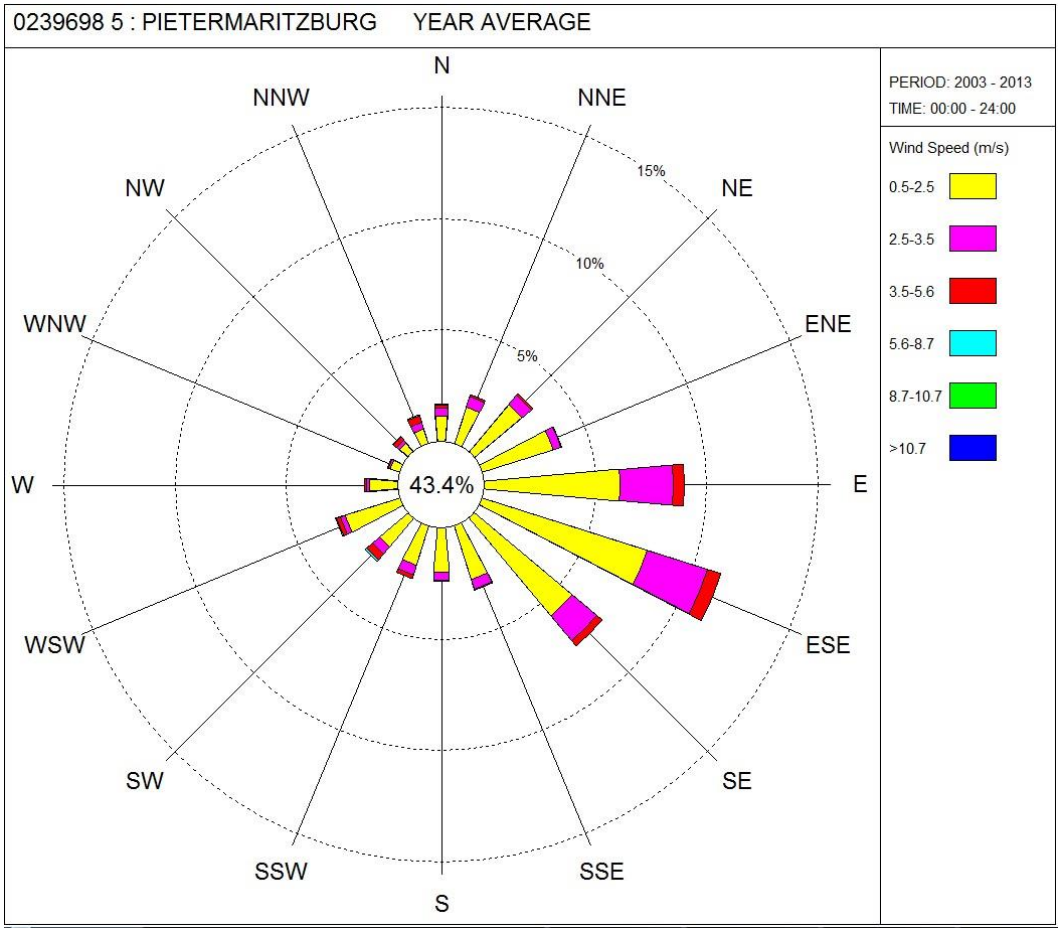


Figure 39: Wind rose for the Pietermaritzburg weather station

12.2 Geology and Soils

AECOM (Pty) Ltd undertook a geotechnical and materials investigation in 2016 as part of the Feasibility Study for the LUBWSS – WSS.

The geotechnical investigation conducted along the Goodenough to Craigieburn route which is the preferred scheme included:

- A shallow pipeline investigation;
- A detailed investigation at the Goodenough balancing reservoir; and
- Two investigations at the two sites proposed for the water treatment plant (WTP2 and WTP3) in Craigieburn

The study area of the Geotechnical Investigation is provided in **Figure 40** below.

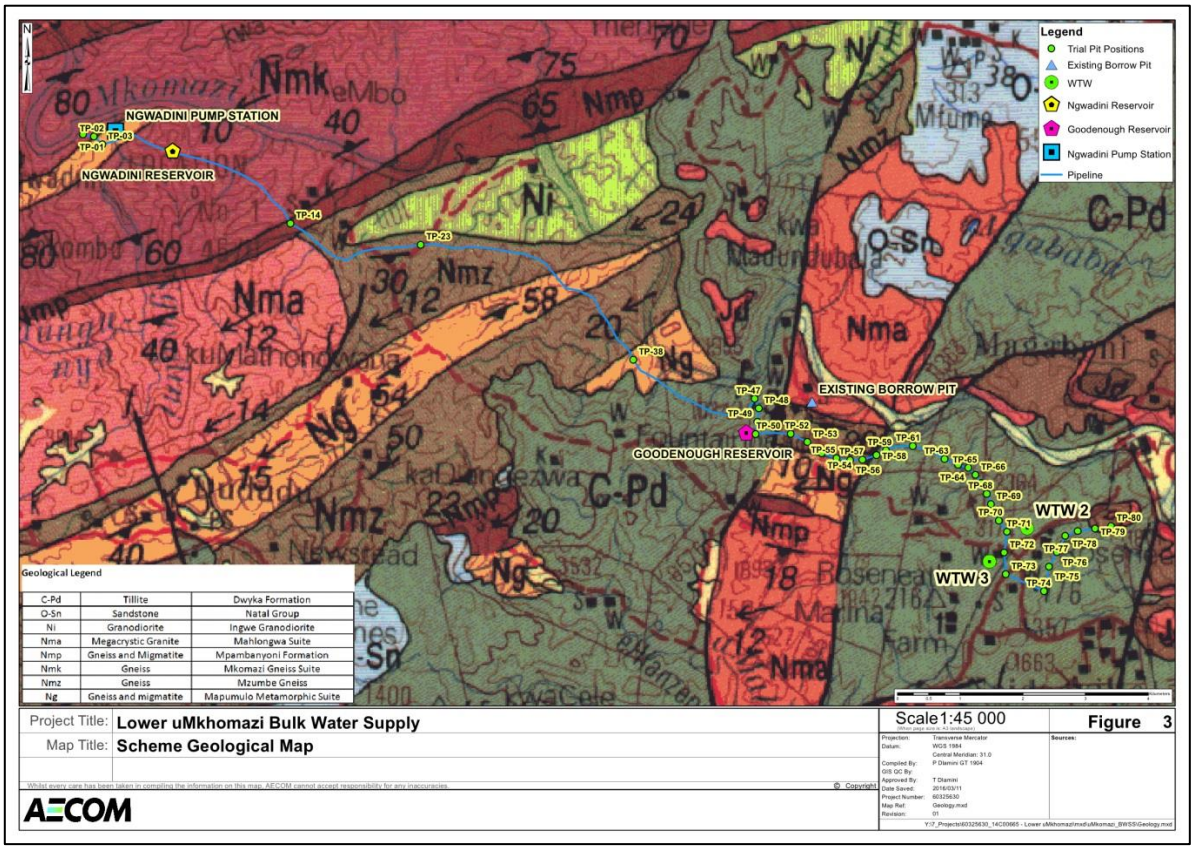


Figure 40: Scheme Geological Map

12.2.1.1 Geology

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 (DWAF, 2004).

According to the published 1:250 000 geological map of Port Shepstone (3030), the site is underlain by a combination of igneous, sedimentary and metamorphic rocks that vary in age and distribution. The western half of the pipeline's route intercepts a variety of Namibian metamorphic rocks belonging to the Natal Structural and Metamorphic Province. These are predominantly Mkomazi and Mzumbe Gneiss suites interspersed with gneiss and migmatite of the Mapumulo Metamorphic Suite and Ingwe granodiorite. The majority of the eastern half of the pipeline's route traverses tillite of the Dwyka Formation and small pockets of intrusive Jurassic dolerite as well as Quaternary unconsolidated deposits.

12.2.1.2 Assessment of Goodenough to Craigieburn Route

The initial ±2.5km from Goodenough towards Craigieburn is underlain by gneissic rock and its overlying residual component. From TP57 (2.5km from Goodenough) towards Craigieburn, the subsurface is dominated by transported soil overlying residual tillite which is underlain by tillite bedrock.

The residual tillite (TP76) and tillite rock (TP63) sampled along the pipeline route classified as clayey sands according to the Unified Soil Classification System (UCSC). These soils are generally regarded as:

- Having a good workability as a construction material;
- Having a low compressibility when compacted saturated; and
- Impervious when compacted.

The residual tillite in the vicinity of TP70 classified as low organic clay according to UCSC. This soil possesses a low expansiveness potential and is characterised as follows:

- Has a good to fair workability as a construction material;
- Has a medium compressibility when compacted saturated; and
- Is impervious when compacted.

Groundwater seepage was not encountered in any of the trial pits except for TP57 adjacent to a small intermittent stream. Near-surface/surficial seepage may be anticipated at topographical lows such as valleys.

Colluvium is the dominant transported layer along the route and was encountered almost along the entire route of the pipeline as the surficial layer. The colluvium is generally composed of gravelly sand and clayey silt and extends to depths of between 0.1m and 0.9m below the surface. The pebble marker is a silty gravel layer that was encountered in TP71 – TP72 and TP74 – TP78 at depths between 0.3m and 0.8m.

The colluvium (TP54) classified as silty sand according to UCSC. These soils have a low potential for expansiveness:

- Fair workability as a construction material;
- Low compressibility when compacted saturated; and
- Semi-pervious to impervious when compacted.

Generally the residual gneiss, completely to highly weathered gneiss and tillite rock may be considered as pipe bedding material while the residual tillite is unsuitable for use as bedding material. The material for common back fill in pipe trenches shall be from bulk excavation for the pipeline, where the maximum particle size shall not exceed 150mm.

12.2.1.3 Assessment of the Goodenough Reservoir

The site earmarked for the Goodenough reservoir is underlain by a surficial layer of colluvium overlying residual gneiss which in turn overlies gneiss bedrock. The colluvium is underlain by residual gneiss comprising either sandy gravel or clayey sand and extends to depths between 0.35m and 0.85m. Completely weathered very soft rock gneiss underlies the residual horizon to depths between 0.8m and 1.2m which in turn grades into highly weathered soft rock gneiss which extends beyond 1.3m, at which depth refusal was encountered. No seepage was encountered in any of the excavated trial pits.

The residual gneiss at the Goodenough Reservoir site (TP2) classified as clayey sands according to the USCS. These soils are generally regarded as:

- Have a good workability as a construction material;
- Have a low compressibility when compacted saturated; and
- Are impervious when compacted.

The geotechnical investigation revealed that highly fractured very soft rock gneiss occurs between depths of 0.35m and 0.85m with soft rock gneiss being encountered at depths between 0.8 to 1.2m beneath the surface. It is recommended that the proposed reservoir be founded on shallow foundations within soft rock gneiss.

It is recommended that the proposed reservoir be founded on shallow foundations within soft rock gneiss. Allowable bearing pressure of 750kPa can be achieved within the soft rock gneiss. However, it is important that an engineering geologist or geotechnical engineer inspect foundation excavations to ensure the correct founding material.

12.2.1.4 Assessment of WTP 1

The general soil profile at the WTP 1 site comprises an upper layer of colluvium overlying residual tillite. In some instances, the residual tillite is overlain by a reworked layer of residual tillite.

Lightly loaded structure of the treatment facility may be constructed on deep strip or pad footings below the potentially expansive clayey residual tillite within the dense residual clayey sand at depths of approximately 1.5m. An allowable bearing pressure of 100kPa may be used for design. Additional drilling investigations will be required to confirm the founding conditions at depths greater than the reach of the present investigation for structures that are heavily loaded and / or intolerant to settlement.

12.2.1.5 Assessment of WTP 2

The WTP 2 site is underlain by a layer of colluvium overlying residual tillite with cobbles and boulders overlying tillite rock of varying degrees of weathering and strengths.

It is recommended that the lightly loaded structures should be founded on a soil raft (engineered fill layer) in the case of shallow foundations where the clayey material is removed and replaced. The residual tillite (silty clay) at a depth of 1.5m has an approximate allowable bearing pressure of 200kPa.

Heavily loaded structures and structures that are intolerant to settlement will need to be founded on rock of at least moderate weathering, very soft or soft rock quality with an allowable bearing pressure of 750kPa to 3MPa at depths between 1.7 and 4.5m. Foundations would include deep pad type footings onto the appropriate rock.

In areas where soft rock has not been encountered at depths of approximately 4.5m then end bearing piles may be considered for the foundations of settlement sensitive and heavily loaded structures.

12.3 Geohydrology

According to Department of Water Affairs and Forestry (DWAF) (2004), groundwater aquifer types present in the Mvoti to Mzimkulu WMA are almost entirely of the 'hard rock' secondary porosity, 'weathered and fractured', and 'fractured' classes. 'Inter-granular' primary porosity class aquifers are present to a very limited extent in riverbeds in close proximity to the coast. In the 'fractured' class, zones of preferential groundwater presence include faults, major joints, bedding planes, and the contacts of intrusive Karoo dolerite sheets and dykes with the host rock.

Although significant quantities of water could be abstracted from groundwater in the WMA, the actual utilisation is relatively small. This is mainly attributable to the generally well-watered nature of the water management area and the wide occurrence of perennial surface streams, which reduces the need for groundwater abstraction.

Strong inter-dependence between surface water and groundwater also occurs over much of the WMA, where a large portion of the surface flow (base flow) originates from groundwater. Areas where this is of particular importance are parts of the Mgeni River catchment as well as at locations near the coast. Appropriate management of aquifers to prevent the intrusion of seawater is also of importance in the coastal area.

The quality of groundwater is generally of a very high standard. No pollution of groundwater in the WMA has been recorded.

12.4 Topography

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 topography consists of steep elevation and valleys, sloping down towards the uMkhomazi River (**Figures 41** and **42**). **Figures 43** and **44** indicates the terrain to be traversed by the different project components. The area flattens out towards the WTP sites.

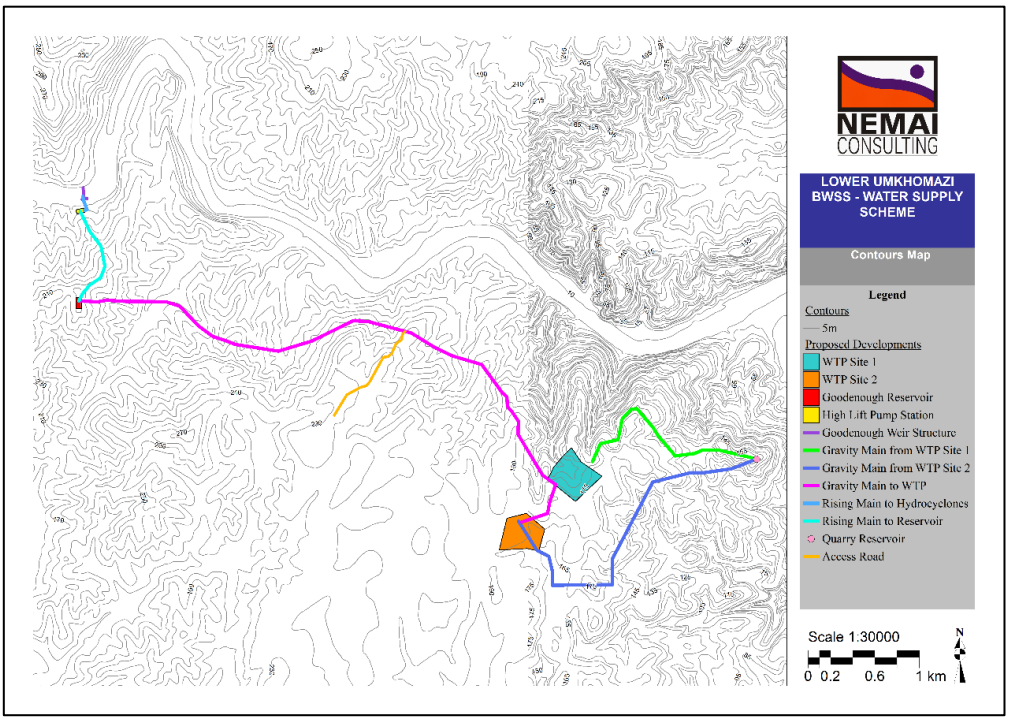


Figure 41: 5m contour map

Figure 42: Topography at the existing Goodenough weir

Figure 43: General view of the terrain to be traversed by the pipelines

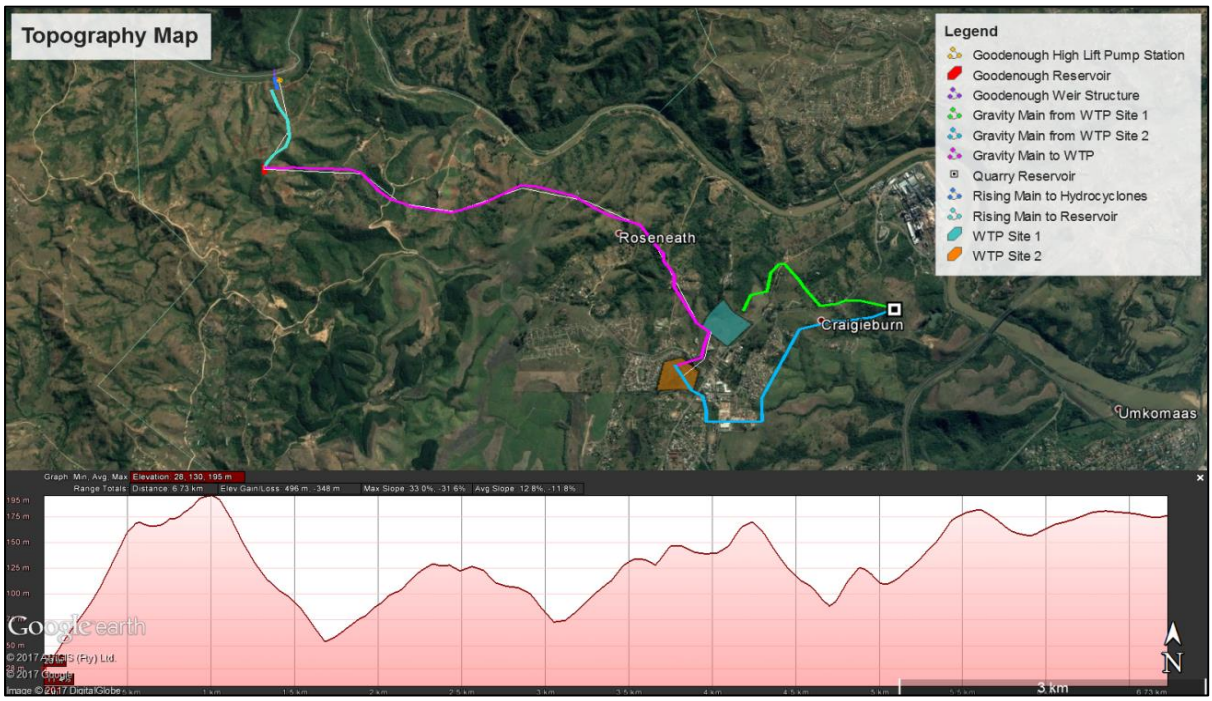


Figure 44: Elevation and topography of the project area

12.5 Surface Water

12.5.1 Hydrology

The LUBWSS are located in quaternary catchments U10M and U80L of the Mvoti to Umzimkulu WMA in the uMkhomazi River Catchment.

The uMkhomazi River catchment has a catchment area of 4 387 km². The hydrological characteristics of the catchment are summarised in **Figure 45**. The total natural Mean Annual Runoff (MAR) of the catchment is 1 078 million m³/a, with 571 million m³/a (or 53%) generated upstream of the proposed Impendle Dam site and a further 151 million m³/a (14%) upstream of the Smithfield Dam site. The uMkhomazi River catchment is fairly undeveloped, with the notable exception of large tracts of commercial forestry and irrigated areas in the central catchment areas around the towns of Richmond, Ixopo, Bulwer and Impendle.

The net water use in the catchment totals 159 million m³/a at the 2012-development level. This is projected to increase to over 190 million m³/a by 2050.

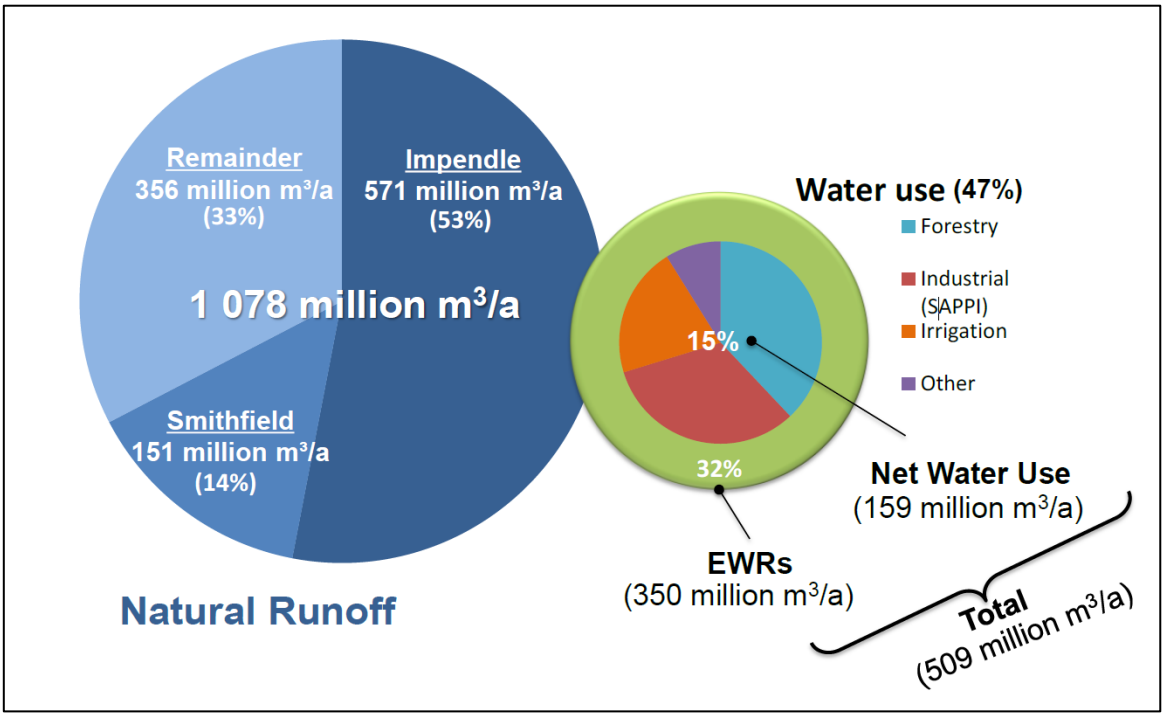


Figure 45: Summary of the hydrology and water use in the uMkhomazi River catchment (DWA, 2015)

Water users in the river catchment included urban and industrial, irrigation and afforestation. The results of this hydrological assessment are summarised in **Table 15** below.

Table 15: Hydrological information for the uMkhomazi River Catchment (DWA, 2014)

Incremental sub-catchment		Catchment area (km²)	Observed incr. MAR (million m³)	Annual average (million m³)[1]					Natural incremental MAR	
Name				Nett irrigation supply	Nett effect of small dams	Reduction in runoff - afforestation and sugar cane	Nett urban and industrial demands	Inter-basin transfers[2]	(million m³)	(mm)
UMKHOMAZI RIVER CATCHMENT										
U1H005	Camden	1 742	669	3.2	0.07	3.9	0	0	676	388
U1H006	Delos Estate	2 608	366	7.9	0.31	12.4	0	0.0	387	148
I-06	Impendle Dam	1 422	Natural runoff generated by scaling and simulation						568	399
I-22	Smithfield Dam	632	Natural runoff generated by scaling and simulation						163	258
I-19	Ngwadini Dam	2 243	Natural runoff generated by scaling and simulation						325	145
I-15	uMkhomazi mouth	91	Natural runoff generated by scaling and simulation						11	124
Total uMkhomazi River catchment		4 388	–						1 067	243

12.5.2 Water Users

The uMkhomazi River catchment is currently fairly undeveloped, with the notable exception of large tracts of commercial forestry and irrigated areas in the central catchment areas around the towns of Richmond, Ixopo, Bulwer and Impendle. The largest single water user in the catchment is the SAPPI SAICCOR mill (**Figure 46**). Water is abstracted for the SAPPI SAICCOR mill located near the coastal town of Umkomaas, at the mouth of the river catchment. SAPPI SAICCOR is licensed to abstract a total volume of 53.0 million m³/a directly from the uMkhomazi River. However, due to a lack of storage, SAPPI-SAICCOR's current assurance of supply is very low. Other water users include small towns and rural settlements, stock watering, dry-land sugarcane and invasive alien plants.

Figure 46: SAPPI SAICCOR on the banks on the uMkhomazi River

It is estimated that current net water use for forestry totals 159 million m^3/a, or 15% of the total natural MAR of the catchment (**Figure 45**). The water demands from forestry are about 5% to 8% of the MAR for the present and future (2040) scenarios, while irrigation water demands are 3% (current) and 6% (future (2040)). The industrial demand from SAPPI SAICCOR is at about 5% of the natural MAR. Domestic and livestock demands amount for this area are noted as being less than 1% of the natural MAR and thus are deemed less significant.

An additional 350 million m³/a (32% of the natural MAR) is allocated for supplying EWRs and sustaining the system's riverine health at a desirable level after the implementation of project.

12.5.3 Affected Watercourses

The Goodenough weir and abstraction works will be located on the uMkhomazi River, while the associated project components, namely the pipelines, will traverse a number of tributaries of the uMkhomazi River (**Figures 47** and **48**). The National Freshwater Ecosystem Priority Areas (NFEPA) data does not identify any wetlands to be directly affected by the proposed project components, other than the uMkhomazi River system.

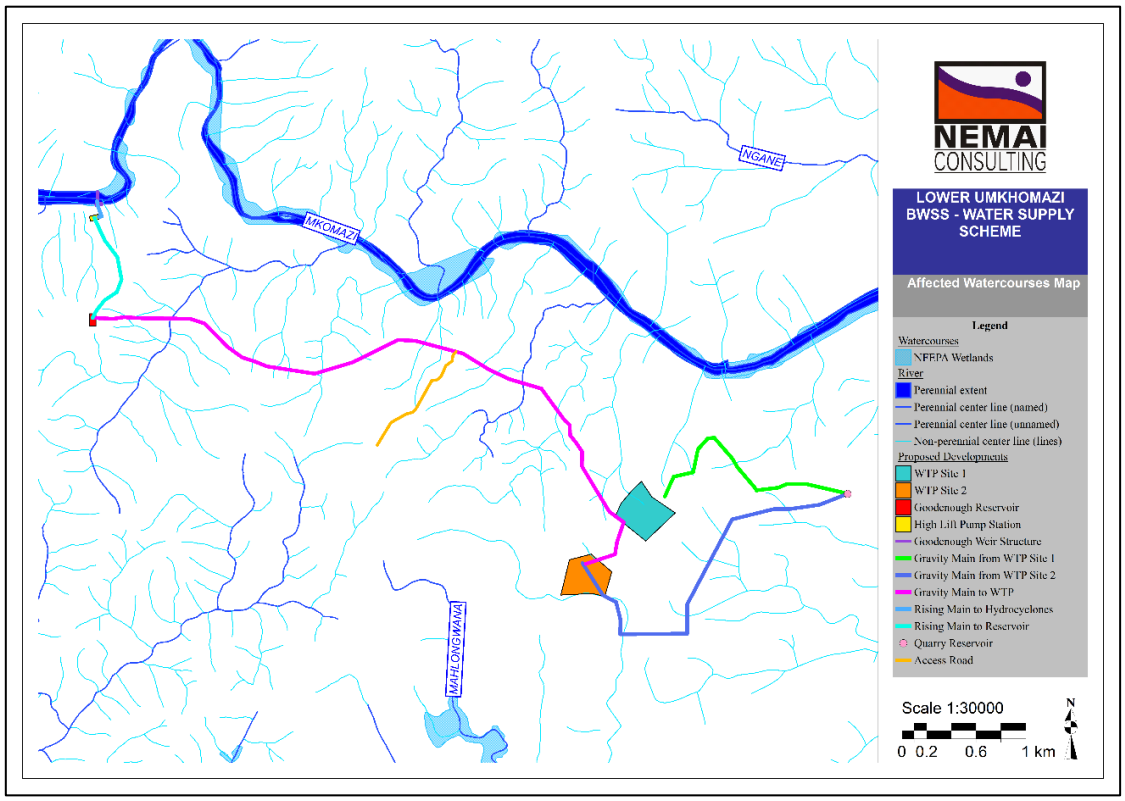


Figure 47: Affected Watercourses according to the NFEPA database

Figure 48: The uMkhomazi River system

12.5.4 Water Quality

A water quality assessment was conducted for the uMkhomazi River catchment by Umgeni Water in 2013.

Water quality in the uMkomazi River is generally relatively good with little upstream industrial discharge in the catchment. The river will, however, be affected by faecal coliforms and is not suitable for untreated domestic consumption.

Overall, the uMkhomazi River is considered to be in a natural ecological condition, and the DWA scoring system places the uMkhomazi River as Class A.

12.5.5 Aquatic Biota

Fish species recorded in the uMkhomazi River Catchment were obtained from Ezemvelo KZN Wildlife in March 2012. These species are listed in **Table 16** with a Red Data Categorisation in terms of the International Union for Conservation of Nature and Natural Resources.

Table 16: Fish species in the uMkhomazi River Catchment (Karssing, 2012)

Scientific name	Common Name	Locality
Endagered (En)		
Pseudobarbus quathlambae	Maloti minnow	Presence in uMkhomazi not confirmed
Near Threatened (NT)		
Oreochromis mossambicus	Mozambique tilapia	uMkhomazi River and Estuary
Barbus viviparus	Bowstripe barb	uMkhomazi River
Myxus capensis	Freshwater mullet	uMkhomazi River and Estuary
Not Evaluated (NE)		
Awaous aeneofuscus	Freshwater goby	uMkhomazi River
Hypseleotris cyprinoides	Golden sleeper	uMkhomazi River SAICCOR weir
Alien Invasive Species (AIS)		
Salmo trutta	Brown trout	uMkhomazi River and Lotheni Nature Reserve
No Category		
Anguilla sp.	N/A	uMkhomazi River Mouth

12.5.6 Riparian Habitat

The riparian area provides habitat for aquatic and terrestrial species, contributes towards maintaining the form of the river channel and serves as filters for sediment, nutrients and light.

As shown in **Figure 49**, the riparian habitat of the uMkhomazi River is relatively intact, due to the steep slopes on either side of the river. However, the riparian habitat is disturbed in some areas, such as the existing Goodenough weir (**Figure 50**) and the SAPPI SAICCOR mill. The structure and function of riparian vegetation in the study area has been altered by vegetation removal, cultivation, erosion, sedimentation and invasion by alien vegetation within or close to the riparian zone.

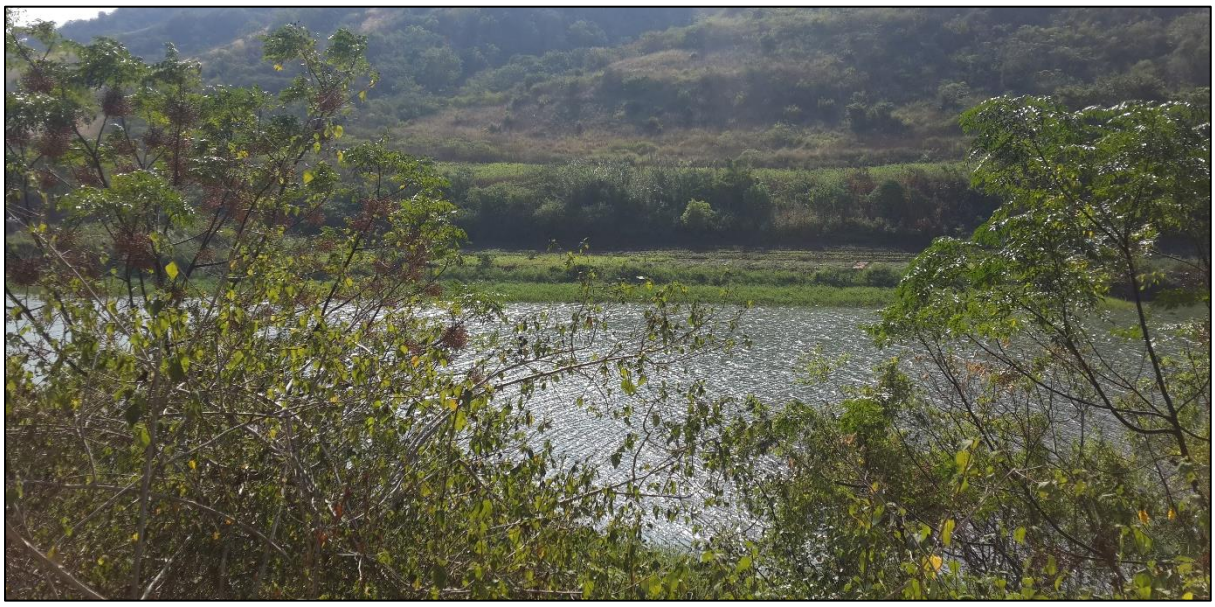


Figure 49: Riparian habitat along the uMkhomazi River

Figure 50: Riparian habitat at the existing Goodenough weir

12.5.7 Estuary

By definition, an estuary constitutes a partly enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea. These systems form a transition zone between river and ocean environments and are subject to both marine influences (e.g. tides, waves, and the influx of saline water) and riverine influences (e.g. flows of fresh water and sediment). The high productivity in estuaries stems from the inflow of both seawater and freshwater, which provide high levels of nutrients in both the water column and sediment.

The Umkomaas Estuary is located approximately 42km south of Durban, at the river mouth of the uMkhomazi River (**Figure 51**). The existing Goodenough weir is located 14km from the river mouth of the Umkomaas (**Figure 52**).

Figure 51: Umkomaas estuary located at the uMkhomazi River

Figure 52: Umkomaas Estuary

The water quality in a large number of estuaries in the Mvoti to Umzimkulu WMA has been modified significantly. This is largely attributed to diffuse agricultural runoff in rural areas (e.g. fertilizers, herbicides and pesticides) and contaminated stormwater runoff from urban development (e.g. nutrients and toxic substances). In some estuaries, water quality has been compromised by point source wastewater treatment works (WwTWs') effluent being discharged into estuaries or into rivers near the head of estuaries.

Within the Umkomaas estuary, the aspects that need targeting for restoration/rehabilitation were identified as significant flow reduction, poor water quality, and habitat destruction.

The Present Ecological State (PES) of the uMkhomazi estuary is rated as Class C, moderately modified (**Table 17**). A loss and change of natural habitat and biota have occurred but the basic ecosystem functions and processes are still predominantly unchanged.

Table 17: Present Ecological State of the estuaries of Mvoti to Umzimkulu WMA (extracted from DWA, 2013)

Name	Hydrology	Hydrodynamics	Water Quality	Physical Habitat	Habitat Score	Microalgae	Macrophytes	Invertebrates	Fish	Birds	Biological Score	PES
uMkhomazi	C	A	C	D	C	C	D	C	D	D	C	C

The KZN Provincial Growth and Development Strategy highlighted that the current SAPPI SAICCOR abstraction during low flows impacts on the water availability at the estuary of the uMkhomazi River which will need to be addressed as part of the future implementation of the Reserve.

The Technical Feasibility Study identified the need to return sediment from the abstraction works (Hydrocyclones) and operational reservoir back to the uMkhomazi River. This may result in adverse impacts to the uMkhomazi Estuary, which is situated less than 15 km downstream from the proposed Goodenough Weir site.

The scope of the Estuarine Specialist Study was to assess the impacts to the aquatic ecosystem and uMkomaas Estuary due to the release of the sediments back into the river from the LUBWSS.

12.6 Flora

12.6.1 Biome and Vegetation

According to Scott-Shaw and Escott (2011), the study area falls within the Indian Ocean Coastal Belt (**Figure 53**).

The LUBWSS – WSS falls within the KZN Coastal Belt (Scott-Shaw and Escott, 2011) (**Figure 54**). The KZN Coastal Belt is listed as **Endangered** with a Conservation Target (percent of area) of 25%. Only very small part statutorily conserved in Ngoye, Mbumbazi and Vernon Crookes Nature Reserves. About 50% of the vegetation has been transformed for cultivation, by urban sprawl and for road-building. Alien plant species prevalent in the vegetation type includes *Chromolaena odorata*, *Lantana camara*, *Melia azedarach* and *Solanum mauritianum*.

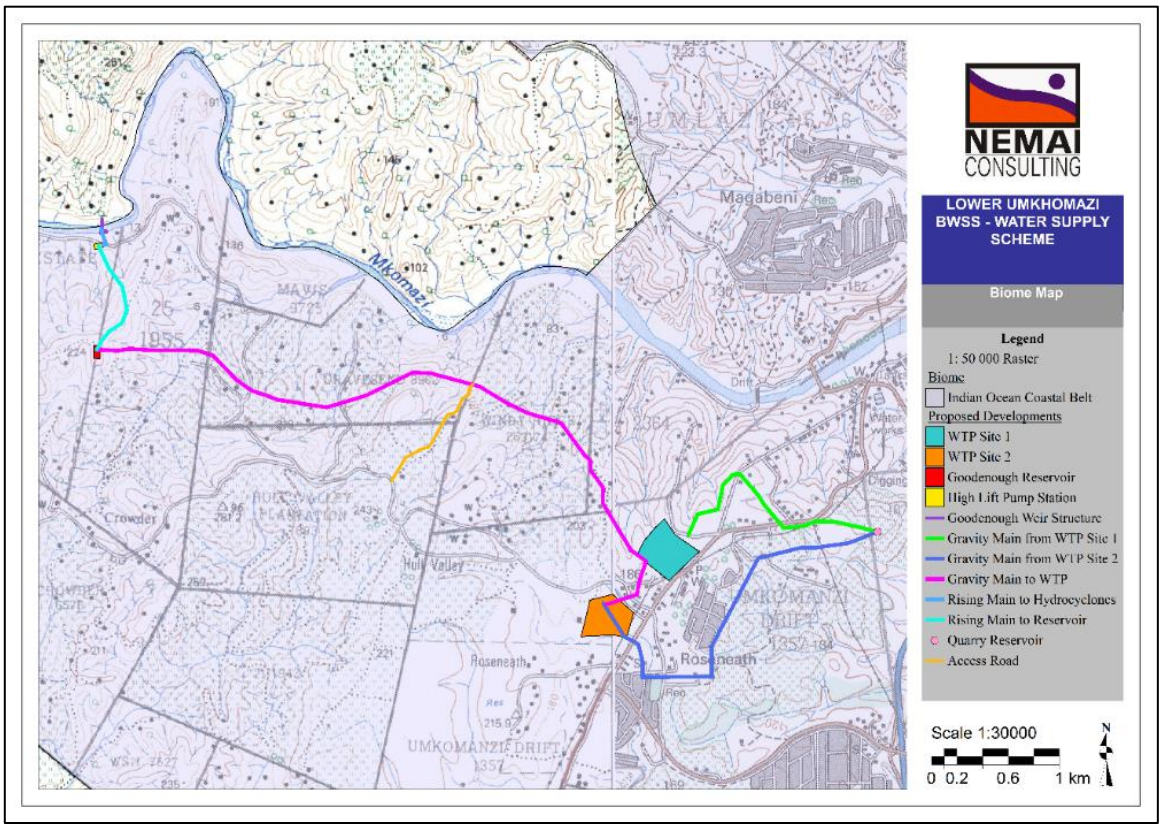


Figure 53: Biome

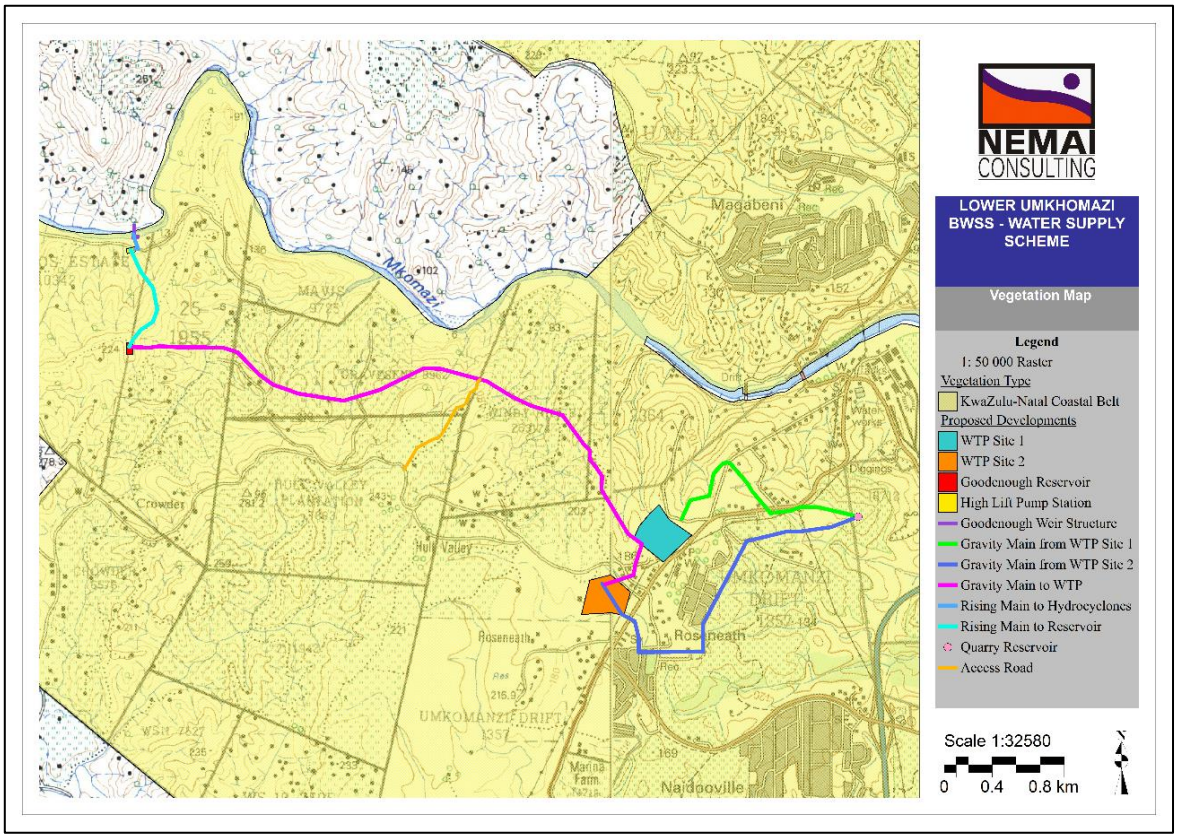


Figure 54: Vegetation Type

12.6.2 KZN Provincial Biodiversity Plan

According to Escott *et al.* (2013), the KZN Provincial Biodiversity Plan is an amalgamation of the four systematic conservation plans and provides a spatial representation of land and coastal marine area that is required to ensure the persistence and conservation of biodiversity within the KZN Province. The plan further provides the framework for the Bioregional Plans which in turn feed into a range of multi-sect oral planning and assessment processes such as IDPs, SDFs, Environmental Implementation or Environmental Management Plans (EIPs & EMPs), Environmental Management Frameworks (EMFs), as well as EIAs.

The KZN Provincial Biodiversity Plan covers terrestrial, aquatic and marine environs, and consists of two main layers namely, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) with legislated Protected Areas, modified areas, and other natural areas included as a base layer.

The above layers are informed by the outcomes of the KZN systematic conservation planning process, as well as several other datasets identifying CBA areas, including the National Threatened Ecosystems coverage's, and the NFEPAs.

The CBAs can be divided into two subcategories, namely Irreplaceable and Optimal (Ezemvelo KZN Wildlife, 2016). According to Ezemvelo KZN Wildlife (2016), the LUBWW – WSS falls within both CBA: Irreplaceable and CBA: Optimal (**Figure 55**):

An overview of which project components fall within the CBA regions is provided:

- CBA: Irreplaceable –
    - Rising Main to Reservoir;
    - Goodenough Reservoir;
    - Gravity Main to WTP;
    - Access Road;
    - WTP Site 1;
    - WTP Site 2;
    - Gravity Main from WTP 1; and
    - Gravity Main from WTP 2.
- CBA: Optimal –
    - Rising Main to Reservoir;
    - Goodenough Reservoir;
    - Gravity Main to WTP;
    - Access Road;
    - WTP Site 1;
    - Gravity Main from WTP 1; and
    - Gravity Main from WTP 2.

The **CBA: Irreplaceable Areas** are identified as having an Irreplaceability value of 1, these Planning Units (PU's) represent the only localities for which the conservation targets for one

or more of the biodiversity features contained within can be achieved, i.e. there are no alternative sites available. In the Terrestrial Systematic Conservation Assessment (SCA), this category was previously referred to as a Biodiversity Priority 1 Area (KZN CBA Irreplaceable version 01022016, 2016).

CBA: Optimal Areas are areas which represent the best localities out of a potentially larger selection of available PU's that are optimally located to meet both the conservation target but also the criteria defined by either the Decision Support Layers or the Cost Layer. In the Terrestrial SCA, this category was previously referred to as a Biodiversity Priority 3 Area (Ezemvelo KZN Wildlife, 2016).

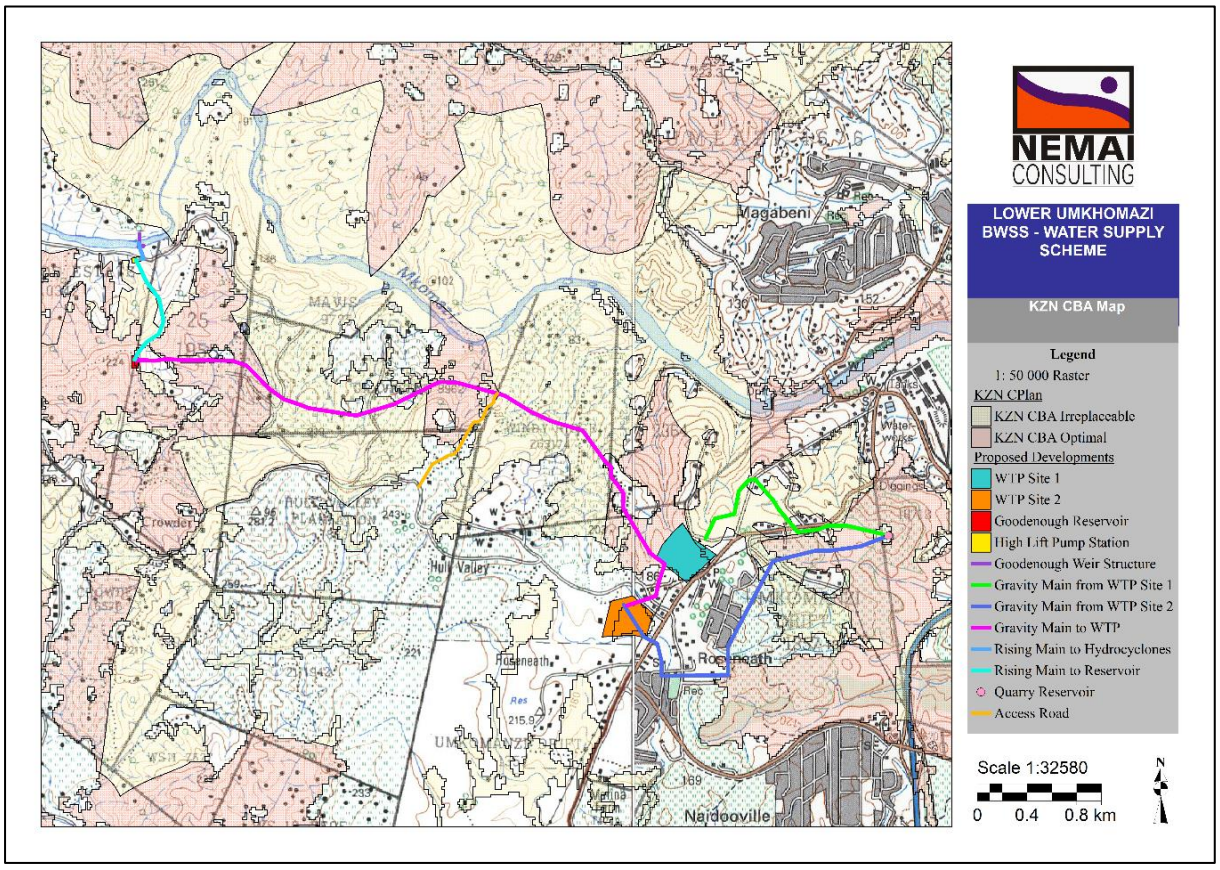


Figure 55: KZN CBA Map

ESAs are areas required to support and sustain the ecological functioning of CBAs. For terrestrial and aquatic environments, these areas are functional but are not necessarily pristine natural areas. They are however required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs, and which also contributes significantly to the maintenance of Ecological Infrastructure (EI) (Ezemvelo KZN Wildlife, 2016).

According to Ezemvelo KZN Wildlife (2016), the LUBWW – WSS falls within KZN ESA (**Figure 56**). An overview of which project components fall within the ESA regions is provided:

- Rising Main to Reservoir;

- Goodenough Reservoir;
- Gravity Main to WTP;
- Access Road;
- WTP Site 1;
- Gravity Main from WTP 1; and
- Gravity Main from WTP 2.

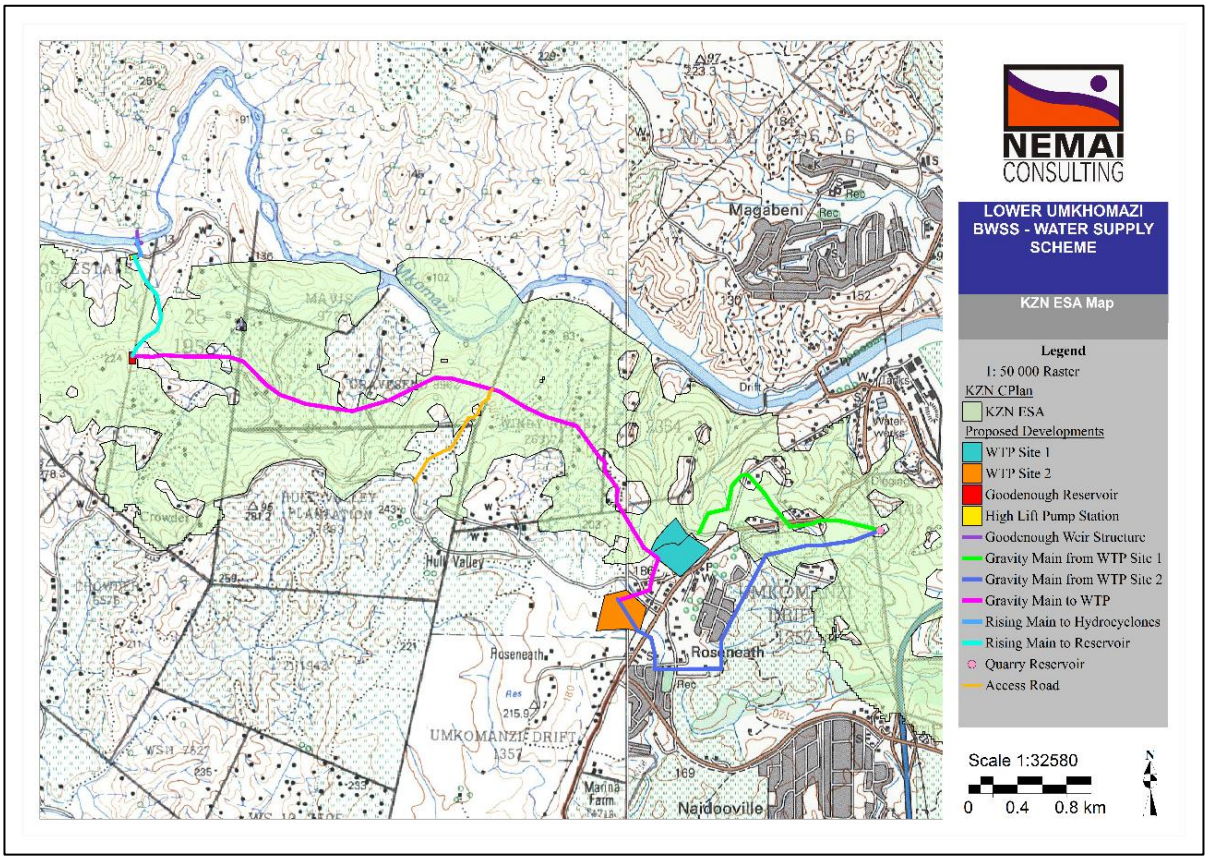


Figure 56: KZN ESA Map

12.6.3 Terrestrial Threatened Ecosystems

The South African National Biodiversity Institute (SANBI), in conjunction with the Department of Environmental Affairs and Tourism (DEAT), released a draft report in 2009 entitled "Threatened Ecosystems in South Africa: Descriptions and Maps" to provide background information on the abovementioned List of Threatened Ecosystems (SANBI, 2009). The purpose of this report was to present a detailed description of each of South Africa¡¦s ecosystems and to determine their status using a credible and practical set of criteria. The following criteria were used in determining the status of threatened ecosystems:

- Irreversible loss of natural habitat;
- Ecosystem degradation and loss of integrity;
- Limited extent and imminent threat;
- Threatened plant species associations;

- Threatened animal species associations; and
- Priority areas for meeting explicit biodiversity targets as defined in a systematic conservation plan.

In terms of section 52(1) (a), of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), a national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2011 (GN 1002 (http://bgis.sanbi.org/ecosystems/project.asp). The list classified all threatened or protected ecosystems in South Africa in terms of four categories; *Critically Endangered* (CR), *Endangered* (EN), *Vulnerable* (VU) or *Protected*. The purpose of categorising these ecosystems is to prioritise conservation areas in order to reduce the rates of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems. It is estimated that threatened ecosystems make up 9.5% of the land in South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Environmental Impact Assessments and other environmental applications (Mucina *et al.*, 2006*)*.

The LUBWSS – WSS falls within the following threatened ecosystems (**Figure 57**):

- Interior South Coast Grasslands, listed as **Critically Endangered**;
- KwaZulu-Natal Coastal Belt, listed as **Vulnerable**; and
- Southern Coastal Grasslands, listed as **Critically Endangered**.

An overview of which project components fall within the threatened ecosystems is provided:

- Interior South Coast Grasslands –
  - Rising Main to Reservoir;
  - Goodenough Reservoir;
  - Gravity Main to WTP;
  - Access Road;
  - WTP Site 1;
  - Gravity Main from WTP 1; and
  - Gravity Main from WTP 2.
- KwaZulu-Natal Coastal Belt –
  - Goodenough weir;
  - Rising Main to Hydrocyclones;
  - High Lift Pump Station; and
  - Rising Main to Reservoir.
- Southern Coastal Grasslands –
  - Gravity Main to WTP;
  - WTP Site 1;
  - Gravity Main from WTP 1;

- Gravity Main from WTP 2; and
- Quarry Reservoir.

Interior South Coast Grasslands is listed as Critically Endangered, with only 9% of natural area of ecosystem remaining. There are 24 threatened or endemic plant and animal species which occur within the ecosystem. Approximately 2% of the ecosystem is protected in Oribi Gorge Nature Reserve, Vernon Crookes Nature Reserve and Mbumbazi Nature Reserve.

KwaZulu-Natal Coastal Belt is listed as Vulnerable, with approximately 45% of the natural area of ecosystem remaining. Less than 1% of the ecosystem is protected in Ngoye, Mbumbazi and Vernon Crookes Nature Reserves. There are three endemic plant species known to occur within the ecosystem.

Southern Coastal Grasslands is listed as Critically Endangered, with only 6% of natural area of ecosystem remaining. Less than 1% of the ecosystem is protected in the Skyline Nature Reserve, Trafalgar Marine Reserve and Mpenjati Nature Reserve. There are nine threatened or endemic plant and animal species that are known to occur within the ecosystem.

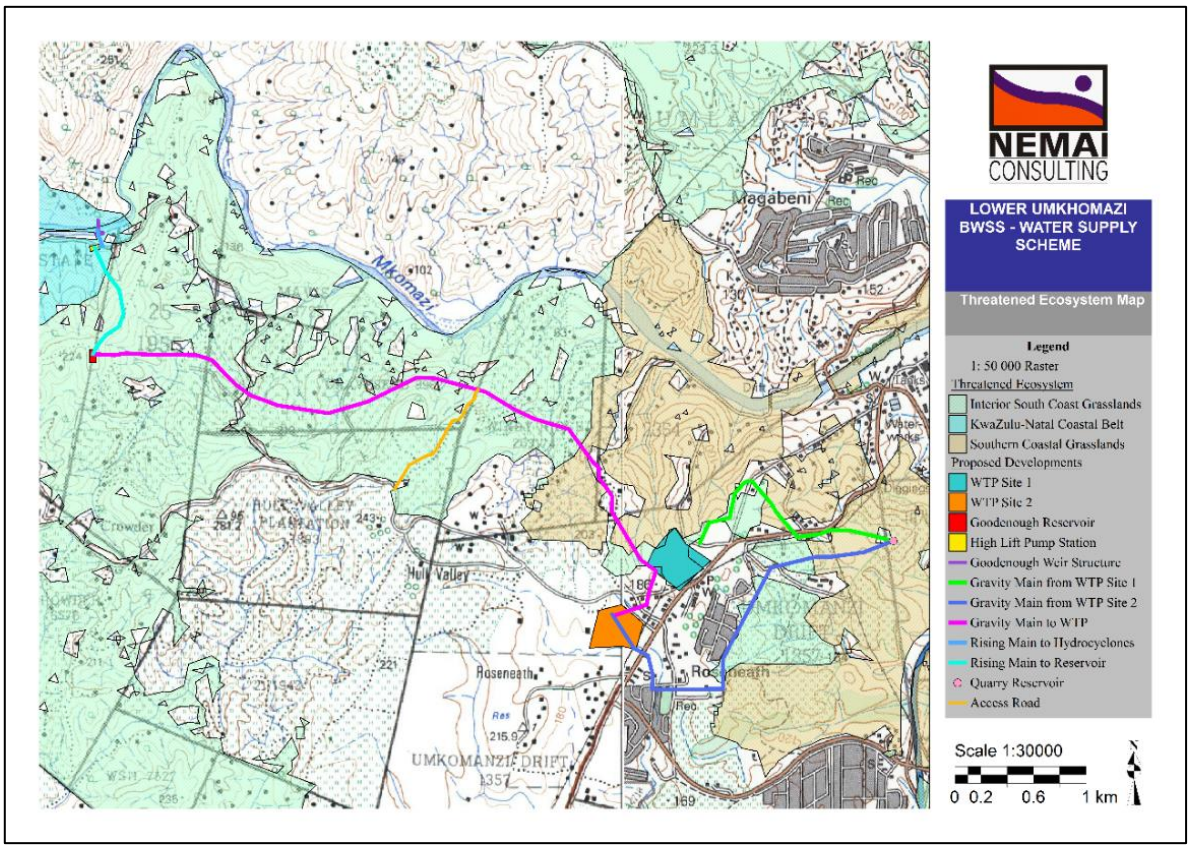


Figure 57: Threatened Ecosystem

12.6.3.1 Durban Metropolitan Open Space System

Durban Metropolitan Open Space System (D'Moss) is a network of natural open spaces, defined by the eThekwini Metropolitan Municipality as critical for the ecosystem goods and services that they supply to the residents of the municipal area. D'Moss aims to conserve local

biodiversity and to ensure the supply of environmental services for current and future generations.

Many smaller conservation areas, identified as part of the Municipal Open Space System (MOSS), fall directly into the study area. The MOSS was initially adopted in 1979 as part of the MOSS to ensure that open spaces within the greater Durban Municipality were maintained for recreation, improving stormwater management, reducing noise pollution and for the maintenance of urban conservation areas (eThekwini Municipality, 2009).

The LUBWSS – WSS falls within D'Moss areas (**Figure 58**). An overview of which project components fall within the D'Moss areas is provided:

- Goodenough weir;
- Rising Main to Hydrocyclones;
- Rising Main to Reservoir;
- Goodenough Reservoir;
- Gravity Main to WTP;
- Access Road;
- WTP Site 1;
- WTP Site 2;
- Gravity Main from WTP 1; and
- Gravity Main from WTP 2.

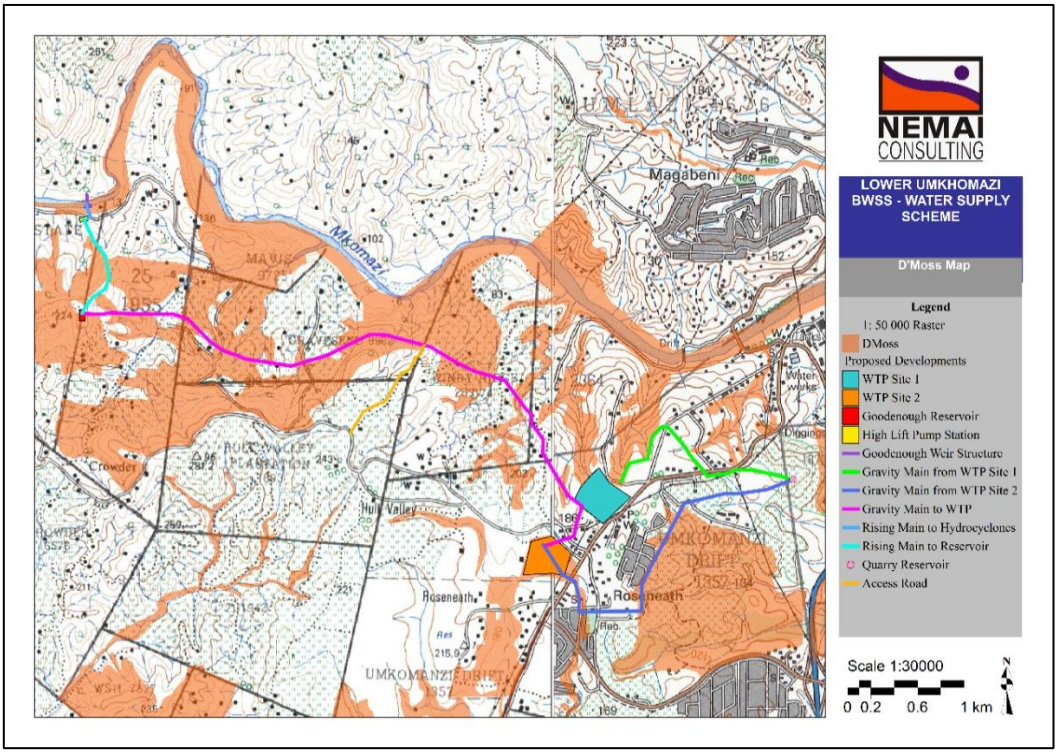


Figure 58: D'Moss Map

12.6.4 Protected Areas

The aim of the NEMPA is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable.

The LUBWSS – WSS does not fall within a Protected Area, but falls within 10km of a Protected Area, namely the Aliwal Shoal Marine Protected Area (MPA) (**Figure 59**).

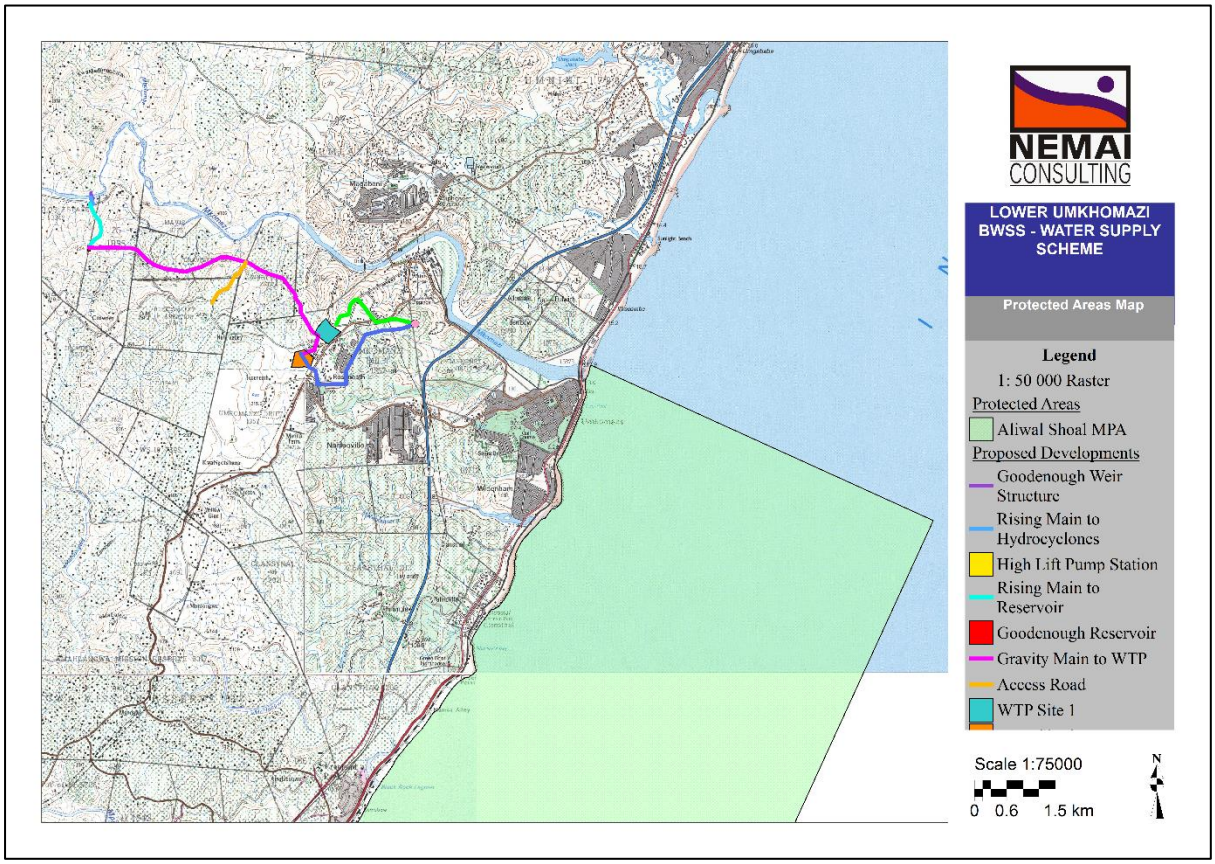


Figure 59: Protected Areas Map

12.6.5 Plant Species

The proposed developments is located within the 3030BA and 3030BB Quarter Degree Squares (QDS) in terms of the 1:50 000 grid of South Africa. The Pretoria Computerised Information System (PRECIS) list of Red Data plants was obtained from SANBI (http://posa.sanbi.org/searchspp.php).

The list was consulted to verify the record of occurrence of the plant species seen in the vicinity of the proposed development. The site sampled is also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS list may not be present at the areas sampled.

A list of threatened plant species that occur in the grid is provided in **Table 18**. Conservation status and definitions of each status is listed in **Table 19**.

Table 18: Red Data Plant species recorded in grid cell 3030BA and 3030BB which could potentially occur in the study area (SANBI data)

Family	Species	Threat Status	SA Endemic
ASPHODELACEAE	*Aloe thraskii*	NT	No
ASTERACEAE	*Helichrysum pannosum*	EN	No
FABACEAE	*Argyrolobium longifolium*	VU	No
GUNNERACEAE	*Gunnera perpensa*	Declining	No
ORCHIDACEAE	*Eulophia speciosa*	Declining	No
OROBANCHACEAE	*Hyobanche fulleri*	CR	No
RHIZOPHORACEAE	*Cassipourea gummiflua*	VU	No
RHIZOPHORACEAE	*Cassipourea malosana*	Declining	No
ZAMIACEAE	*Encephalartos ghellinckii*	VU	No

Note: CR=Critically Endangered; VU=Vulnerable; EN=Endangered; NT=Near Threatened

Table 19: Definitions of Red Data plant status (Raimondo et al., 1999)

Symbol	Status	Description
CR	Critically Endangered	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the five International Union for Conservation of Nature (IUCN) criteria for Endangered, and is therefore facing a very high risk of extinction in the wild.
EN	Endangered	A taxon is Endangered when the best available evidence indicates that it meets any of the five International Union for Conservation of Nature (IUCN) criteria for Endangered, and is therefore facing a very high risk of extinction in the wild.
VU	Vulnerable	A taxon is Vulnerable when the best available evidence indicates that it meets any of the five) an IUCN criterion for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild.
NT	Near Threatened	A taxon is Near Threatened when available evidence indicates that it is close to meeting any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.
	Declining	A taxon is Declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.

12.7 Fauna

12.7.1 Mammals

According to the Animal Demography Unit (http://vmus.adu.org.za/vm_sp_list.php), two sensitive mammal species are known to occur in the grid 3030BB around the site (**Table 20**). No mammal species were recorded in the grid 3030BA.

Table 20: Mammal species recorded in grid cell 3030BB which could occur in the area

Species	Common Name	Threat Status	No. Records
Philantomba monticola	Blue Duiker	VU	5
Hypsugo anchietae	Anchieta's Pipistrelle	NT	2

Note: VU=Vulnerable; NT=Near Threatened

12.7.2 Reptiles

According to the Reptile Atlas of Southern African (http://vmus.adu.org.za/vm_sp_list.php), two reptile species were recorded in grid cell 3030BB and are shown in **Table 21**. No reptile species were recorded in the grid 3030BA.

Table 21: Reptile species recorded in grid cell 3030BB which could occur in the area

Species	Common name	Red List Category	No. Records
Bradypodion melanocephalum	KwaZulu Dwarf Chameleon	VU	12
Scelotes inornatus	Durban Dwarf Burrowing Skink	CR	20

Note: VU=Vulnerable; CR=Critically Endangered

12.7.3 Amphibians

Amphibians are an important component of South Africa's exceptional biodiversity and are such worthy of both research and conservation effort.

Frogs are useful environmental bio-monitors (bio-indicators) and may acts as an early warning system for the quality of the environment. Frogs and tadpoles are good species indicator on water quality, because they have permeable, exposed skins that readily absorb toxic substances. The presence of amphibians is also generally regarded as an indication of intact ecological functionality and therefore construction activities within these habitat units should be undertaken in an ecologically-sensitive manner.

According to the Frog Atlas of Southern African (http://vmus.adu.org.za/vm_sp_list.php), the frog species that were recorded in grid cell 3030BB are shown in **Table 22**. No frog species were recorded in the grid 3030BA.

Table 22: Amphibian species recorded in grid cell 3030BB which could occur in the area

Species	Common name	Red List Category	No. Records
Afrixalus spinifrons	Natal Leaf-folding Frog	VU	3
Hyperolius pickersgilli	Pickersgill's Reed Frog	EN	3

Species	Common name	Red List Category	No. Records
Natalobatrachus bonebergi	Kloof Frog	EN	1

Note: VU=Vulnerable; EN=Endangered

12.7.4 Avifauna

Important Bird and Biodiversity Areas (IBAs) form a network of sites, at a bio-geographic scale, which are crucial for the long-term viability of naturally occurring bird populations (Barnes, 2000). IBAs are classified on the basis of the following criteria:

- The site regularly holds significant numbers of a globally threatened species;
- The site is thought to hold, a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area; and
- The site is known or thought to hold a significant component of a group of species whose distributions are largely or wholly confined to one biome.

Conservation and planning tools were consulted for relevancy for this project, and found that one IBA falls within the study area. The LUBWSS – WSS does not fall within an IBA (**Figure 60**). The closest IBA is the KZN Mistbelt Grasslands which is approximately 50km from the study area.

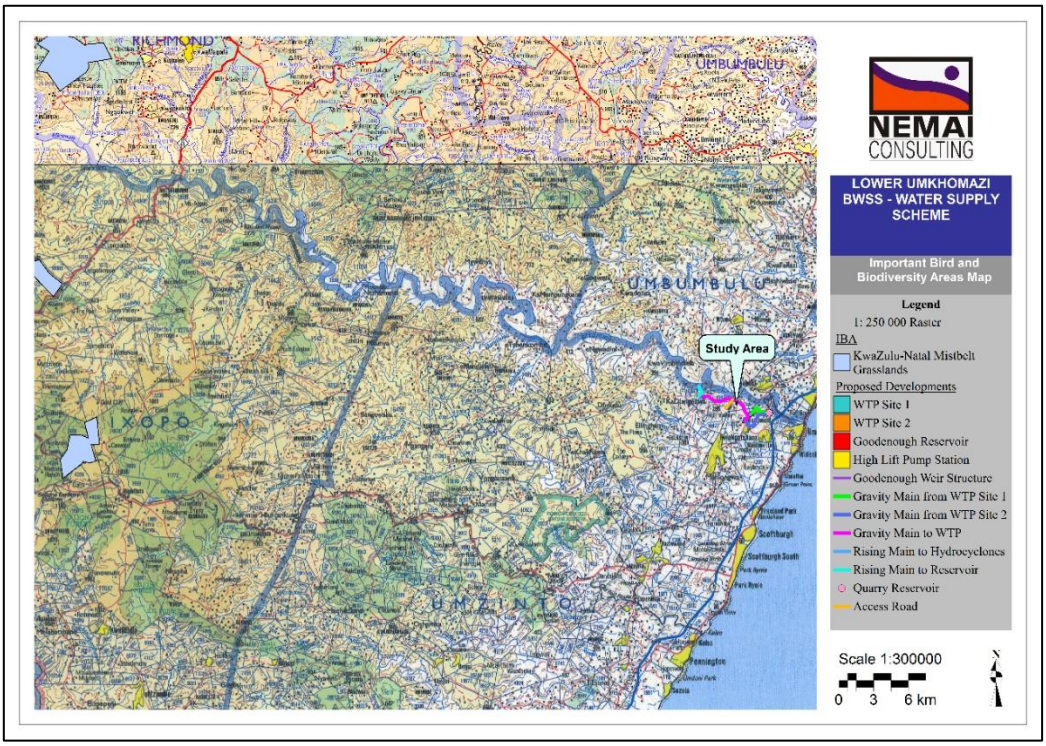


Figure 60: Important Bird and Biodiversity Areas Map

The first atlas data was collected over an 11 year period between 1986 and 1997. Although it is now quite old, it remains the best long term data set on bird distribution and abundance available to us at present. This data was collected on the basis of quarter degree squares, which is a relatively large spatial scale. The more recent Southern African Bird Atlas Project (SABAP) 2 collected data on the basis of pentads which are roughly 8km x 8km squares, and are hence much smaller than the quarter degree squares used in SABAP 1. This project is ongoing and as more counts are done in each pentad the data becomes available.

According to the SABAP 2, a number of sensitive bird species have been noted in grid cell 3030BA and 3030BB which might occur on site (**Table 23**).

Table 23: Bird species recorded in cell 3030BA and 3030BB which could occur in the area

Species	Common Name	Threat Status
Thalassarche melanophris	Black-browed Albatross (Mollymawk)	EN
Pelecanus onocrotalus	Great White Pelican	NT
Pelecanus rufescens	Pink-backed Pelican	VU
Morus capensis	Cape Gannet	VU
Phalacrocorax capensis	Cape Cormorant	NT
Ciconia nigra	Black Stork	NT
Mycteria ibis	Yellow-billed Stork	NT
Phoenicopterus roseus	Greater Flamingo	NT
Phoeniconaias minor	Lesser Flamingo	NT
Sagittarius serpentarius	Secretary bird	NT
Polemaetus bellicosus	Martial Eagle	VU
Stephanoaetus coronatus	African Crowned (Crowned) Eagle	NT
Circus ranivorus	African Marsh-Harrier	VU
Falco biarmicus	Lanner Falcon	NT
Balearica regulorum	Grey Crowned- (Crowned) Crane	VU
Rostratula benghalensis	Greater Painted-snipe	NT
Sterna caspia	Caspian Tern	NT
Alcedo semitorquata	Half-collared Kingfisher	NT
Halcyon senegaloides	Mangrove Kingfisher	VU
Bucorvus leadbeateri	Southern Ground-Hornbill	VU
Smithornis capensis	African Broadbill	NT
Geokichla guttata	Spotted (Natal) Ground-Thrush	EN
Schoenicola brevirostris	Broad-tailed Warbler	NT
Platysteira peltata	Black-throated (Wattle-eyed) Wattle-eye (Flycatcher)	NT
Spermestes fringilloides	Magpie (Pied) Mannikin	NT

Note: EN=Endangered; VU=Vulnerable; NT=Near Threatened

12.8 Socio-economic Environment

12.8.1 General

The LUBWSS – WSS is located in the Lower uMkhomazi catchment area in the eThekwini Metropolitan Municipality. The eThekwini Metropolitan Municipality spans an area of almost 2 300 km^2, and has a population of about 3.5 million people. It has the third largest population

in South Africa after City of Johannesburg (about 4.5 million people) and City of Cape Town (3.7 million people).

Information presented in this section has been taken from the 2011 Census published by Statistics South Africa.

Key statistics for eThekwini Metropolitan Municipality are as follows:

Table 24: Key statistics of eThekwini Metropolitan Municipality (Census, 2011)

eThekwini Metropolitan Municipality	
Total population	3 442 361
Young (0-14)	25.2%
Working Age (15-64)	70%
Elderly (65+)	4.8%
Dependency ratio	42.8
Sex ratio	95.6
Growth rate	1,08% (2001-2011)
Population density	1 502 persons/km^2
Unemployment rate	30.2%
Youth unemployment rate	39%
No schooling aged 20+	4.2%
Higher education aged 20+	12.3%
Matric aged 20+	37.1%
Number of households	956 713
Average household size	3.4
Female headed households	40%
Formal dwellings	79%
Housing owned/paying off	54.5%
Flush toilet connected to sewerage	63.4%
Weekly refuse removal	86.1%
Piped water inside dwelling	60.2%
Electricity for lighting	89.9%

12.8.2 Demographics

eThekwini's population comprises of almost 957 000 households. The average household consists of three to four members, and the population density is 1 502 people per km. The population growth rate between 2001 and 2011 was 1.1%, compared to the national growth rate of almost 16% during the same period.

The eThekwini Metropolitan Municipality is predominantly Black Africans (74%) followed by 17% Indians and Asians, and 7% Whites. The Coloured population is in the minority at 3%. The dominant home language is IsiZulu spoken by about 62% of the population followed by English at 26%.

eThekwini is primarily an urban area, with 85% of households being classified as such; the remaining 15% reside in tribal or traditional areas.

- **Age and Gender Distribution**

The gender ratio among the inhabitants of the eThekwini Metropolitan Municipality shows there are slightly more women than men in the population (51% females vs. 49% males), and 40% of households are headed by women.

The age and gender distribution of the population is shown in **Figure 61**; it reveals that the population growth rate has slowed slightly in the past, but has increased again slightly. The young economically active population (aged 20 – 34 years) represent the largest age group in the metro, indicative of economic opportunity in the area. Overall, 25% of the population are aged 14 years or younger, 69% of working age (between 15 and 64 years), while the remaining 5% are aged 65 and older.

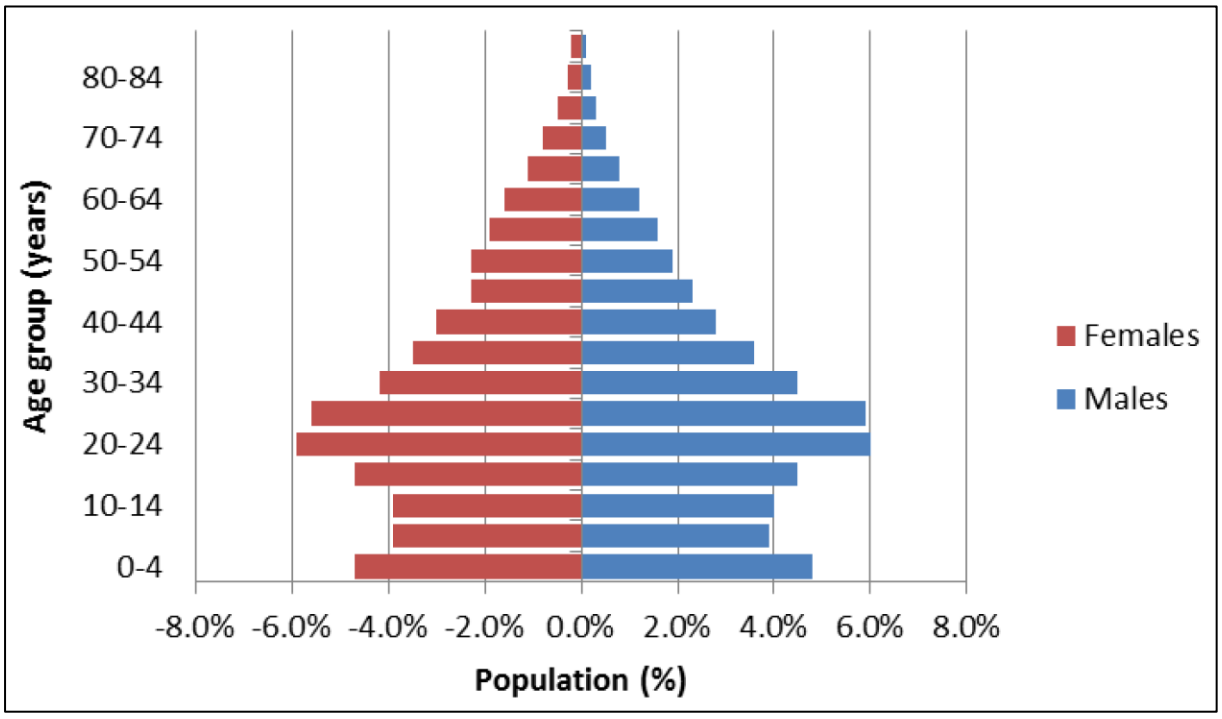


Figure 61: Age and gender distribution

- **Education**

Educational levels influence the economic and human development of an area; low levels of education are typically associated with a low skills base and low income levels.

Approximately 21% of the population have completed their high school education, while only 3.4% have received high education (**Figure 62**). 35% of the population have only received some primary education. About 2.5% of the population have received no schooling.

In 2001, 29.2% of the population had matric; that has increased to 36.7% in 2011. Whilst the percentage of matriculants are increasing, students in the Higher Education have dropped from 9.6% to 6.7% within the last decade.

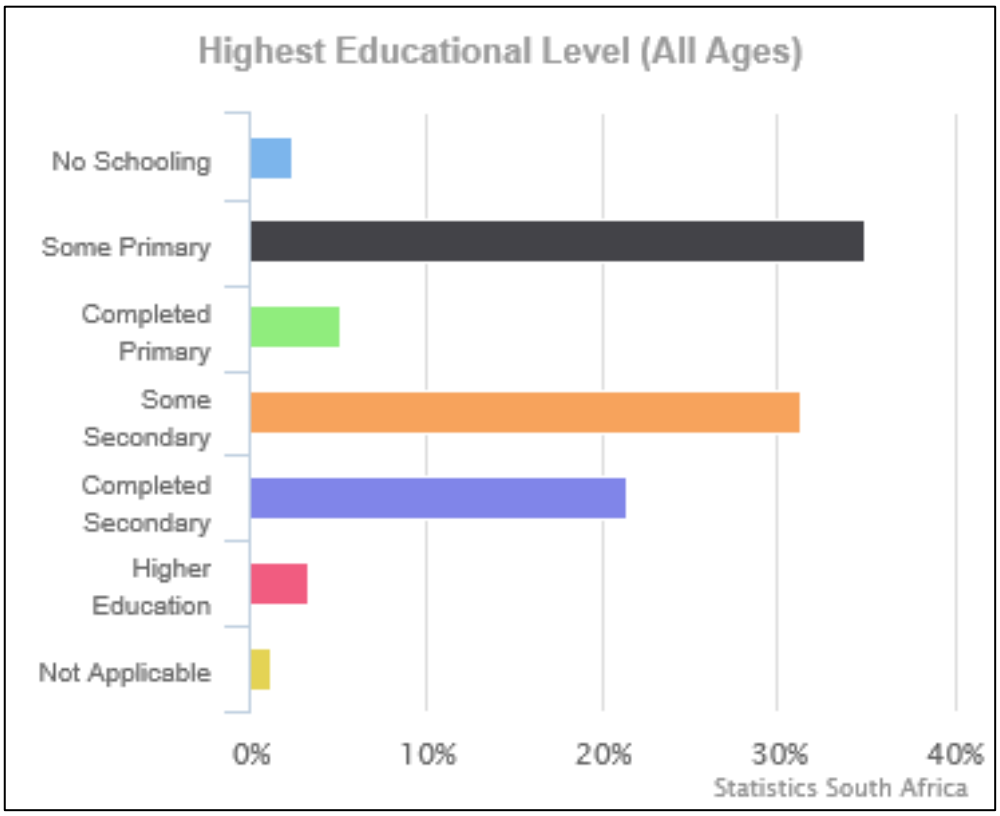


Figure 62: The highest educational level for the eThekwini population

12.8.3 Employment and Income

Employment and income levels are important indicators of human development, as well as the level of disposable income and associated spending power of the residing population.

Within the eThekwini Metropolitan Municipality, 64% of individuals between 15 to 64 years are economically active (**Figure 63**). Of these, 65% are employed, 28% unemployed, and 7% are discouraged work seekers. The official unemployment rate for eThekwini is at 13%, while the youth unemployment rate (individuals between the ages of 15 and 34 years) is 39%.

Almost one in every 5 households (17%) in eThekwini do not earn a cash income, while a further 42% survive on less than R3 200 per month. Thus, 59% of households are classified as poverty stricken, indicating that they experience difficulty meeting their basic needs. A high poverty level results in social dependency on the government, and could cause strain on its budget with the implication that its ability to implement development programs is diminished.

The unemployment rate in the metro was approximately 43% in 2001 and it has dropped by 12.8 % according to Census 2011.

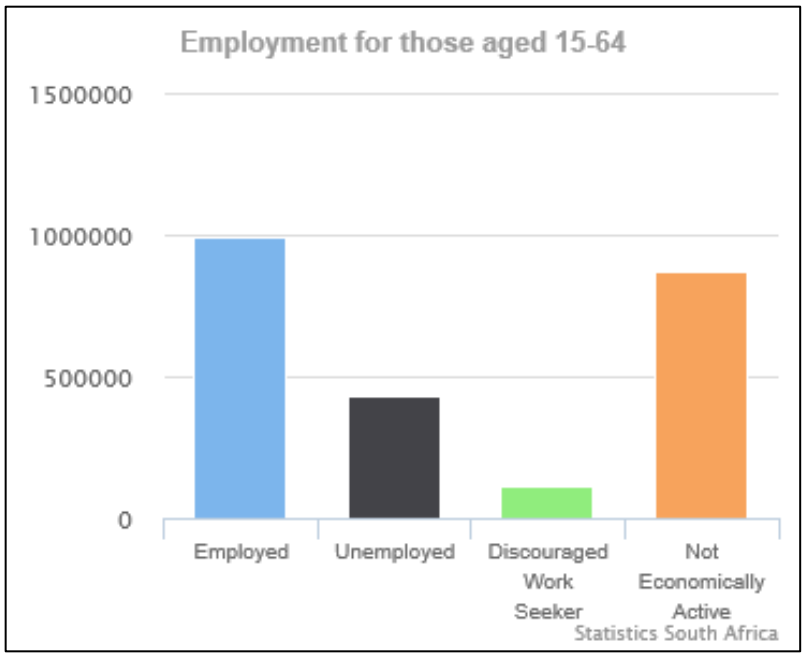
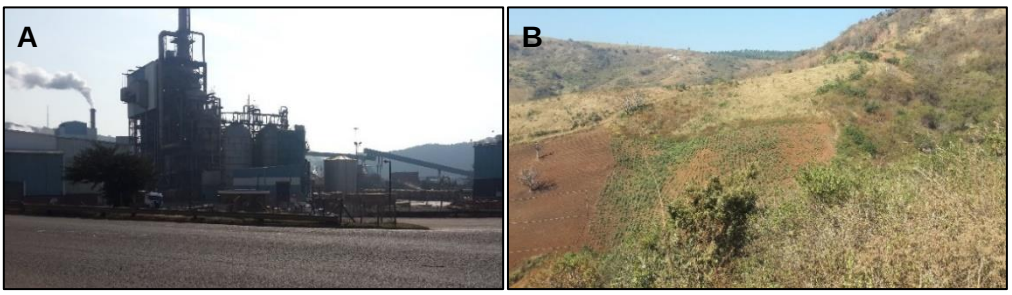


Figure 63: Employment for the eThekwini population aged 15-64

12.9 Land Use

The main land use activities in the study area are large industry, namely forestry at the SAPPI SAICCOR mill, located at the mouth of the river catchment, irrigation and afforestation along the length of the river. Other main land use types in the study area include agriculture, forestry, and small rural and peri-urban settlements characterised by a high level of subsistence farming. Significant areas of subsistence agriculture were observed, with crops of maize, beans and potatoes being grown. Communal gazing is practiced and animal densities (primarily cattle and goats, with some sheep also noted) were moderate to high relative to the carrying capacity of the land, and there were some indications of the significant over-gazing in some areas.

Figure 64 provides an overview of the land use activities within the uMkhomazi River catchment.



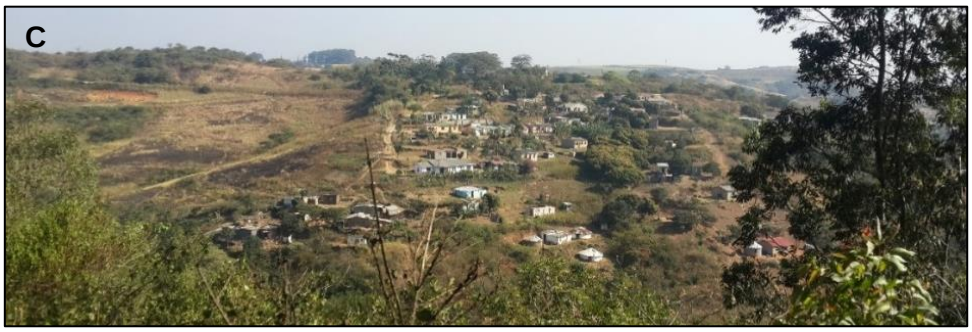


Figure 64: Land use activities includes (A) forestry at SAPPI SAICCOR mill; (B) subsistence farming on small plots, and (C) small rural and peri-urban settlements

Informal agriculture activities including livestock farming and subsistence crop farming is currently being undertaken by land occupiers on Ingonyama Trust Board land on the north bank of the uMkomaas River by the Goodenough weir site.

12.10 Existing Infrastructure and Structures

Infrastructure and structures that occur in the study area, which were primarily identified on a desktop level via GIS and aerial imagery, are shown in **Figure 65**.

The LUBWSS – WSS project components affect the following existing structures and infrastructure:

- The WTP Site 2 encroaches into an existing powerline servitude.
- The gravity main to the WTPs and the two gravity main pipeline alternatives to Quarry Reservoir pass underneath powerlines.
- The two gravity main pipeline alternatives to Quarry Reservoir cross the R197 roadway.
- The gravity main to the WTPs cross the M529 road.
- All the project components cross unclassified roads within the study area.
- Some of the gravity main pipelines run through areas of high density within Roseneath and Craigieburn.

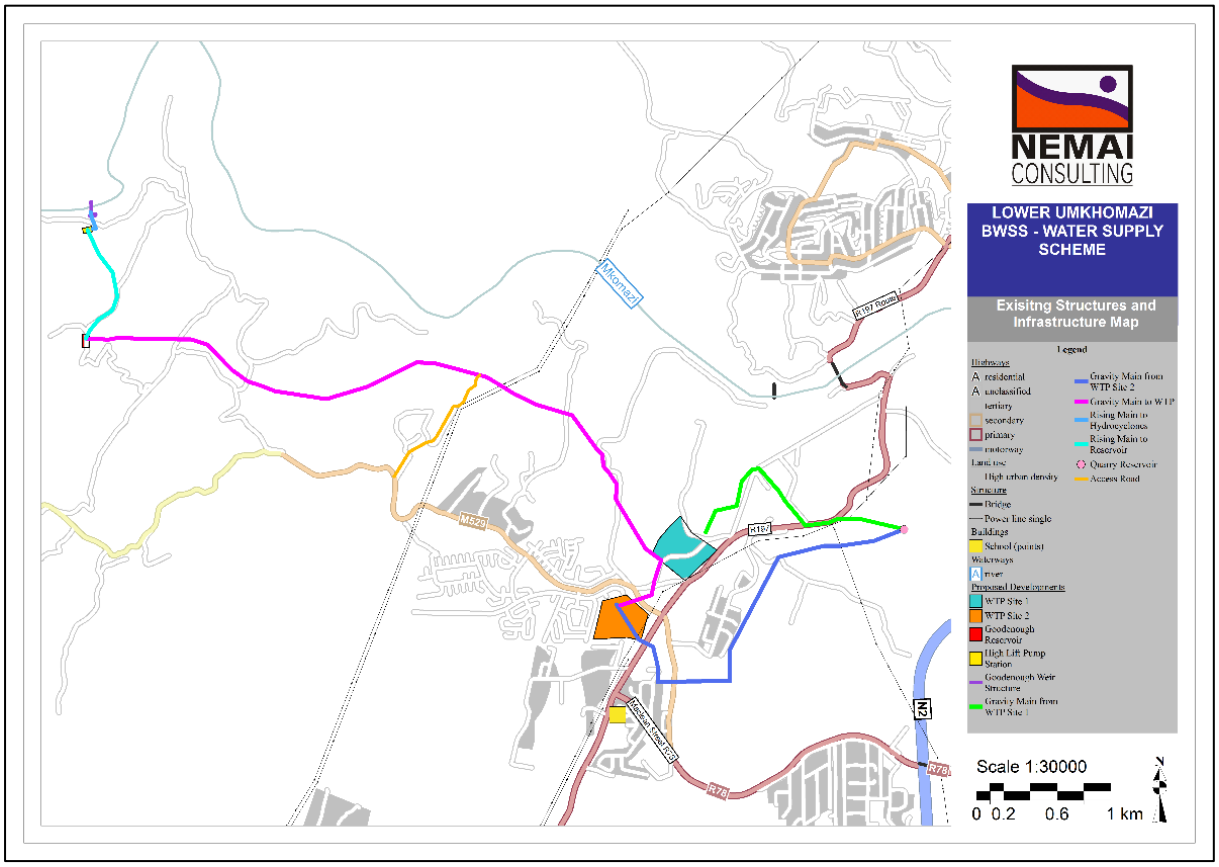


Figure 65: Existing infrastructure and structures in the study area

All existing services such as water, sewer and powerlines to be identified and protected. Services coordination and wayleave approvals will be undertaken with the relevant custodians of the infrastructure.

The negotiations with the landowners for the registration of the servitude will be undertaken by Umgeni Water, and the land rights acquisition process will adhere to all statutory requirements.

12.11 Services

Service provision is at a low level. The dispersed low-density settlement pattern and topography in the project area complicate the provision of service, and substantially increase the costs of installing, maintaining and operating the associated infrastructure.

The proposed development falls mostly within Ward 99 of the eThekwini Metropolitan Municipality, with the weir structure partly falling within Ward 105 (**Figure 66**). Therefore, the sections to follow focus on the service provision for Ward 99.

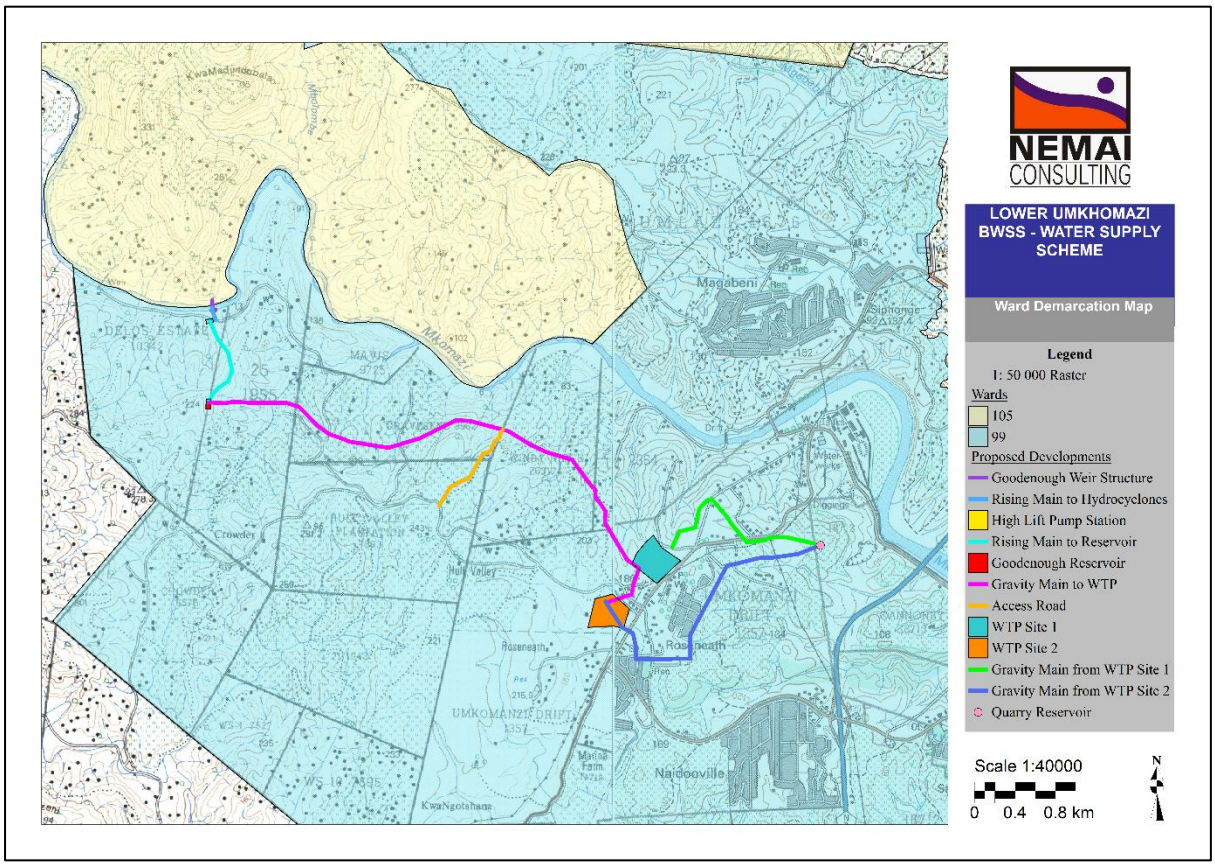


Figure 66: Ward Demarcation Map

12.11.1 Water

Piped water and the sources of water in the Ward 99 in the eThekwini Metropolitan Municipality, based on Census 2011, are shown in **Tables 25** and **26**.

Within the ward, about 46% of the households have piped water inside their dwelling or institution. About 27% have piped water inside their yard, while 8.8% of the population do not have access to piped water.

Approximately 80% of the population are supplied by a water scheme. About 6.1% of the Ward 99 households obtain water through boreholes.

Table 25: Piped water within Ward 99 population

Piped Water	Percentage
Piped (tap) water inside dwelling/institution	46.3
Piped (tap) water inside yard	27.1
Piped (tap) water on community stand: distance less than 200m from dwelling/institution	11.7
Piped (tap) water on community stand: distance between 200m and 500m from dwelling/institution	3.7
Piped (tap) water on community stand: distance between 500m and 1000m (1km) from dwelling /institution	1.6

Piped Water	Percentage
Piped (tap) water on community stand: distance greater than 1000m (1km) from dwelling/institution	0.9
No access to piped (tap) water	8.8

Table 26: Source of water of the Ward 99 population

Source of Water	Percentage
Regional/Local water scheme (operated by municipality or other water services provider)	79.7
Borehole	6.1
Spring	1.2
Rain water tank	1.0
Dam/Pool/Stagnant water	1.6
River/Stream	4.5
Water vendor	1.2
Water tanker	2.6
Other	2.1

12.11.2 Sanitation

Sanitation is mainly onsite in nature, and pit latrines predominate. However, due to the relatively low housing density, and also the location of most dwellings either high on ridgelines or else at the foot of slopes at some distance from surface water resources, the likelihood of serious direct pit latrine contamination remains low, even in cases of pits overfilling or being exposed to the surface runoff ingress problems.

The toilet facilities in Ward 99 of the eThekwini Metropolitan Municipality, based on Census 2011, are shown in **Table 27**. About 57% of people have access to flush toilets and only 5% have no access to sanitation at all.

Table 27: Toilet facilities of the Ward 99 population

Toilet Facilities	Percentage
Flush toilet (connected to sewerage system)	57.0
Flush toilet (with septic tank)	3.1
Chemical toilet	2.5
Pit toilet with ventilation (VIP)	8.8
Pit toilet without ventilation	19.3
Bucket toilet	2.1
None	5.2
Other	2.1

12.11.3 Electricity

Energy sources in Ward 99 of the eThekwini Metropolitan Municipality, based on Census 2011, are shown in **Table 28**. Most households in the ward use electricity for cooking, heating and lighting. About 74% of households use electricity for cooking, 8.5% use paraffin and 12% still use wood, mainly those households in informal and traditional dwellings.

Table 28: Energy sources of Ward 99 households in eThekwini Metropolitan Municipality

Energy Source	Percentage		
	Cooking	Heating	Lighting
Electricity	73.9	58.8	84.7
Gas	3.5	2.5	0.2
Paraffin	8.5	8.5	2.9
Wood	12.5	15.2	0.0
Coal	0.7	2.0	0.0
Animal dung	0.3	0.3	0.0
Solar	0.2	0.3	0.4
Candles	0.0	0.0	11.4
Other	0.2	0.0	0.0
None	0.2	12.3	0.3

12.11.4 Transportation

Roads are mostly gravel/dirt roads and the road network density is moderate through the uMkhomazi River catchment (**Figure 67**). Some road related erosion is observed within the area. The major road infrastructure in the study area is shown in **Figure 68**. The project will influence the road network as follows:

- The two gravity main pipeline alternatives cross the R197 roadway (**Figure 69**).
- The gravity main to the WTPs cross the M529 road.
- All the project components cross unclassified roads within the study area.

Figure 67: Dirt road near the existing Goodenough weir site

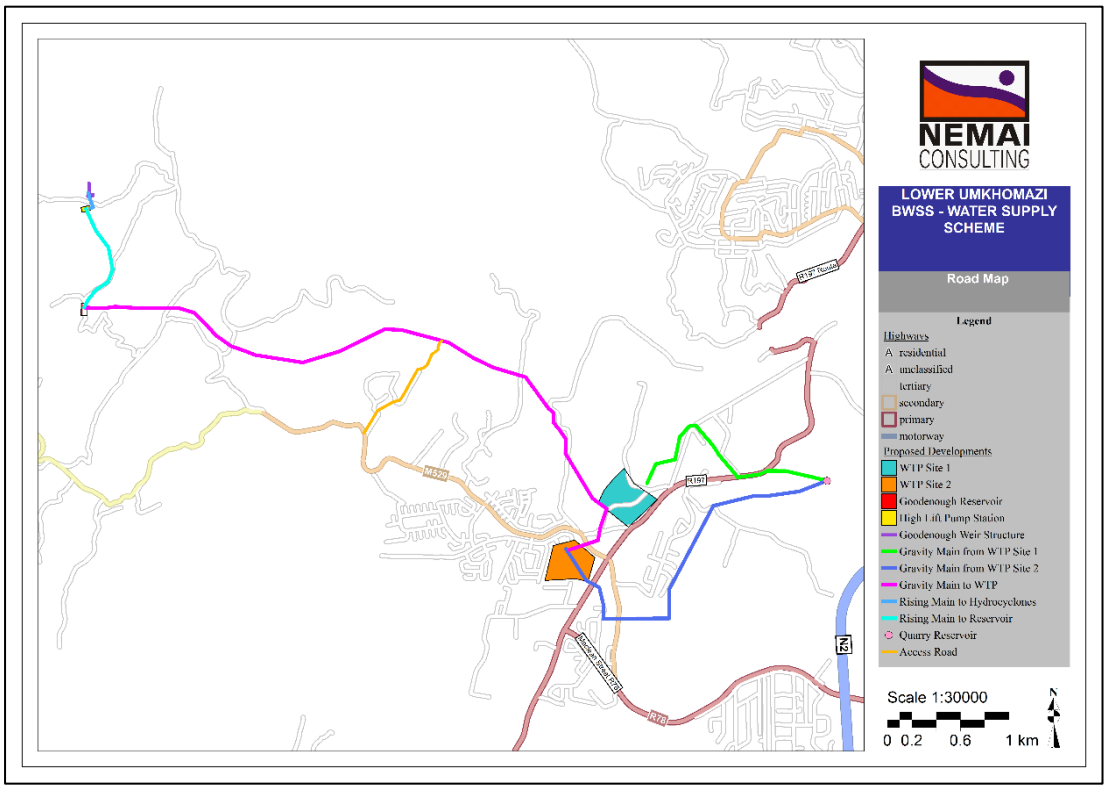


Figure 68: Road network affected by the LUBWSS – WSS

Figure 69: The roads traversed by (A) the gravity main from WTP 1 and (B) the gravity main from WTP 2 to the Quarry Reservoir

12.11.5 Solid Waste

The types of refuse disposal in Ward 99 in the eThekwini Metropolitan Municipality, based on Census 2011, are shown in **Table 29**. Within the ward, about 62% of households have their refuse removed by a local authority/private company at least once a week. Approximately 28% of households have their own refuse dump.

Table 29: Refuse disposal of Ward 99 households in eThekwini Metropolitan Municipality

Refuse Disposal	Percentage
Removed by local authority/private company at least once a week	62.1
Removed by local authority/private company less often	1.5
Communal refuse dump	1.9
Own refuse dump	28.2
No rubbish disposal	5.4
Other	0.9

12.12 Heritage

Heritage resources, including historical structures, artefacts from the Stone and Iron Age, Rock Art, are protected by the KZN Heritage Act (Act No. 04 of 2008). Impacts of heritage resources require a permit issued by the SAHRA.

Other critical heritage resources that will also need to be considered are those related to the culture of the local communities. Such items may include features related to tribal differences, culturally important landscapes, so-called “initiation” schools, baptism and open-air / informal church sites, and graves ranging from a single grave upwards to formal graveyards.

WTP Site 1 has been established as a grave site (**Figure 70**). Only a smaller portion of the site has graves (**Figure 71**). It is understood that Craigieburn residents are still using the old cemetery, which has not yet reached its full capacity (Personal Communication with Mrs Salome Singh, eThekwini Municipality, Craigieburn Office).

Figure 70: Entrance of Umkomaas Memorial Park the location of WTP Site 1

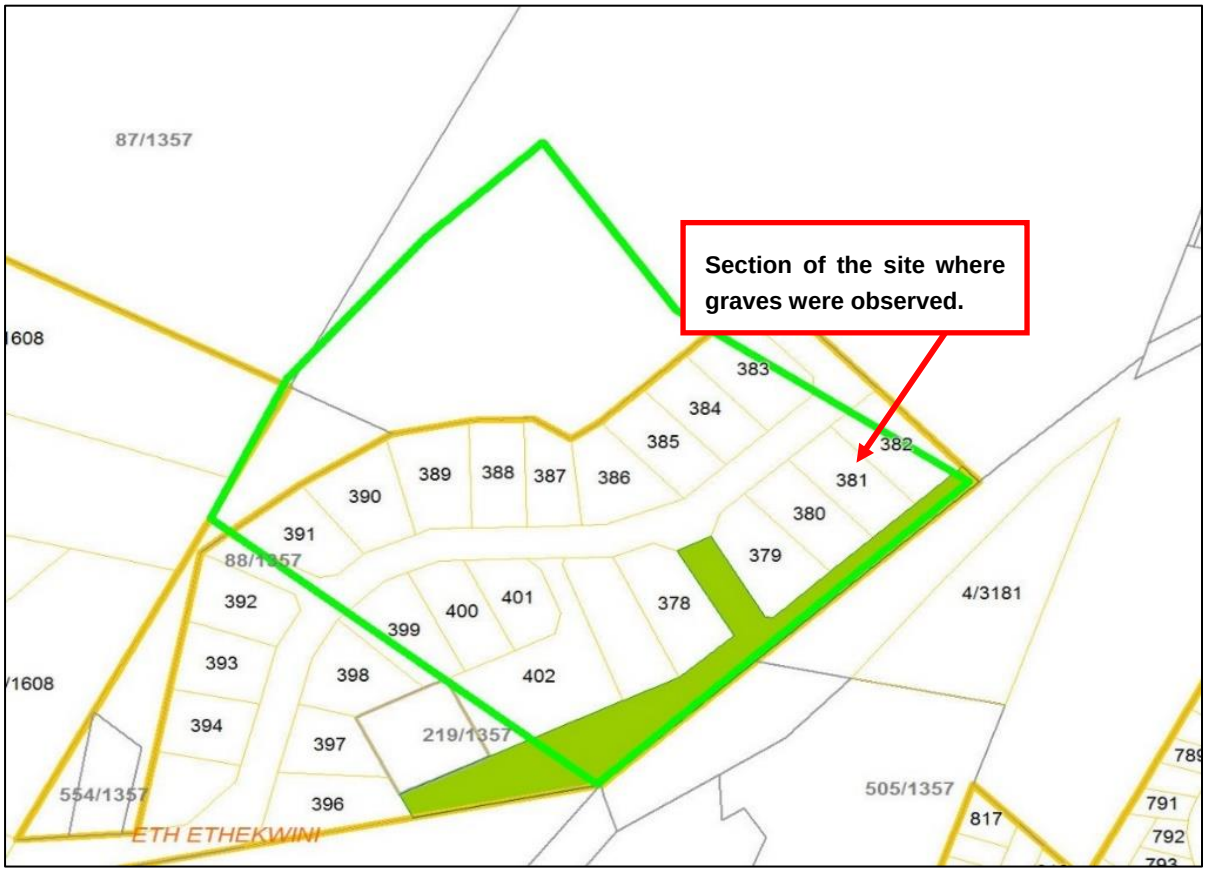


Figure 71: Location of the grave sites within WTP Site 1

12.13 Air Quality

Due to the predominantly rural nature of the study area, the air quality is regarded to be good. Localised impacts to air quality include burning of fossil fuels, emissions from vehicles travelling on the surrounding road network, dust from un-vegetated areas and dirt roads, smoke (veld fires), agricultural activities, and methane release from cattle. Sugar cane burning also constitutes a substantial seasonal source of particulates and CO emissions.

In the greater area, air quality is influenced by anthropogenic activities in urbanised areas such as the SAPPI SAICCOR mill.

The SAPPI SAICCOR mill is largest industrial zone within the uMkhomazi area. Its contribution to the regional and local economies aside, the Plant is also the largest contributor to air pollution in the area. Since initiating its operations in 1955, SAPPI has endeavoured to improve its overall impact on the environment. The SAICCOR plant was ISO [1]9002 certified in 1995 which is indicative of the commitment SAPPI has for improving their production standards. SAPPI have also implemented eight ambient air quality monitoring stations to ensure the protection of local uMkhomazi residents and the members of neighbouring communities (Airey, 2009).

Sensitive receptors to dust and other air quality impacts in the study area include human settlements. In addition, sensitive receptors also include the communities within the towns of Craigieburn and Roseneath.

12.14 Noise

The rural state of the study area affords it tranquillity. Dwellings are sparsely situated within certain sections of the project footprint. However, the WTP is located within Craigieburn, which is a populated urban town.

Noise in the region emanates primarily from the rural settlements, farming operations (e.g. use of farming equipment), households and commercial activities within Craigieburn, vehicles on the road network, and operational activities from SAPPI SAICCOR mill. The undulating hills and valleys serve as noise attenuation features, although the ambient noise levels are regarded as insignificant.

The following were identified as sensitive noise receptors in the study area:

- Dwellings and rural settlements; and
- The communities and households within Craigieburn and Roseneath.

12.15 Visual

The sense of place of the study area is largely associated with scattered settlements, and rugged topography (**Figures 72** and **73**).

The study area is afforded aesthetic appeal through the topographical features such as undulating hills, mountains, valleys, and watercourses, namely the uMkhomazi River. The openness and undeveloped state of the area and the presence of the undulating terrain contribute to the visual qualities.

The location of the WTP site alternatives and the quarry reservoir are located within the town of Craigieburn, thus the area is more built-up than the area in which the Goodenough weir, pump stations, and gravity main to the WTP sites are located.

Figure 72: The scattered settlements in the mountains

Figure 73: View of the uMkhomazi River among the rugged terrain

13 PUBLIC PARTICIPATION

The purpose of the public participation process for the proposed development includes:

- Providing IAPs with an opportunity to obtain information about the project;
- Allowing IAPs to express their views, issues and concerns with regard to the project;
- Granting IAPs an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the project; and
- Enabling the project team to incorporate the needs, concerns and recommendations of IAPs into the project, where feasible.

The public participation process that was followed for the LUBWSS – WSS is governed by NEMA and GN No. R. 982 (07 April 2017).

13.1 Landowner Consent

According to Regulation 39(1) of GN No. 982 of the amended 2014 EIA Regulations, if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land (i.e. landowner consent must take place prior to the submission of the application form to DEA).

This requirement does not apply *inter alia* for linear developments (e.g. pipelines, powerlines, roads) or if it is a Strategic Integrated Project (SIP) as contemplated in the Infrastructure Development Act (2014).

This project is a SIP project and therefore landowner consent is not required. However, consent was received from some of the landowners through engagement.

Proof of landowner consent is contained in **Appendix F6**.

13.2 Landowner Notification

The LUBWSS – WSS traverse both Ingonyama Trust Board land and private land. Affected landowners and land users have been consulted during the Pre-feasibility and Feasibility Studies, as well as during the Scoping and EIA process. Landowners were notified of the project. Proof of written notification to the landowners/persons in control of the land is included in **Appendix F5**.

13.3 Identification of IAPs and Compilation of IAP Database

A database of IAPs, which includes authorities, different spheres of government (national, provincial and local), parastatals, stakeholders, landowners, interest groups and members of the general public, was prepared for the project. IAPs were identified based on regulatory requirements and the specific site/project requirements. In summary, the database includes the following:

- Landowners, adjacent landowners/occupiers;
- Relevant Organs of State / Authorities including the following;
    - DEA;
    - KZN EDTEA;
    - DWS: KZN Region;
    - Ezemvelo KZN Wildlife;
    - Department of Mineral Resources (DMR);
    - DAFF: KZN Offices;
    - Department of Transport (DoT);

- Amafa AkwaZulu-Natali /Heritage KZN;
- eThekwini Metropolitan Municipality;
- Municipal Ward Councillor for Ward 105; and
- Municipal Ward Councillor for Ward 99.

- General IAPs that may have an interest in the project.

Please note that a copy of the IAP database is available in **Appendix F1**.

13.4 Announcement Phase

13.4.1 IAP 30-Day Registration Period

A 30-Day Registration Period was conducted **from 03 July 2017 to 03 August 2017** which provided the public with the chance to register as an IAP in order to review and provide comments on the draft reports, as well as to be invited to the public meetings.

The 30-Day Registration Period was advertised in the South Coast Fever (published 29 June 2017). The notice was published in English and in IsiZulu.

13.4.2 Notification Process

The notification process undertaken is detailed in the sections to follow.

13.4.2.1 Background Information Document

Background Information Documents (BIDs) and Reply Forms were distributed by email or hand delivered to IAPs contained in the IAP Database. BIDs contained a brief background and description of the project, as well as the EIA process, and listed the details for submitting comments regarding the proposed development. The BID served to notify IAPs of the project and the details on how to register as an IAP. In addition, the BID provided details of the public meeting to be held.

Notification of the LUBWSS – WSS took place on 30 June 2017. Proof of initial notification is provided in **Appendix F**. All reply forms from registered IAPs and landowners to date are included in **Appendix F7**.

13.4.2.2 Onsite Notices

Three site notices were placed at strategic points at the existing pump station near the Goodenough weir and abstraction works, at the WTP sites, and at the existing quarry reservoir. Notification of the LUBWSS – WSS and how to register as an IAP were provided on the site notice. Onsite notices were primarily placed in proximity to the project components, based on the availability of public access.

Proof of onsite notices and the accompanying photographs are contained in **Appendix F3**.

Additional onsite notices were placed in and around the study area on 24 August 2017. These notices notified the public of the 30-Day Review Period for the Draft Scoping Report and the

Scoping Phase public meeting to be held. Proof of these additional site notices will be included in the Final Scoping Report.

13.4.2.3 Newspaper Notices

Advertisements in English and IsiZulu were placed in the following newspaper as notification of the project, how to register as an IAP, and details of the public meeting:

- The South Coast Fever, published 29 June 2017.

Refer to copies of the newspaper advertisements contained in **Appendix F4**.

Another newspaper advertisement was placed in the South Coast Fever, published on 24 August 2017, to notify the public of the 30-Day Review Period for the Draft Scoping Report and the Scoping Phase public meeting to be held.

Proof of the additional newspaper advertisement was included in the Final Scoping Report in **Appendix F4**.

13.4.2.4 Public Meeting

A public meeting was convened during the announcement phase of the EIA Process on 08 July 2017 at the Malundi Sports Ground (V Section) (**Figure 74**).

Figure 74: Image from the public meeting held during the Announcement Phase of the project

The purpose of the public meeting included the following:

- Introduction of the project;
- An overview of the EIA process;
- Provision of a platform for project-related discussions; and
- Obtaining input into the Scoping Phase.

Minutes of the meeting are contained in **Appendix F9**.

13.5 Review of the Draft Scoping Report

13.5.1 Application Form

The Application Form was submitted to DEA on **28 August 2017**. The reference number 14/12/16/3/3/2/1030 was provided by DEA.

13.5.2 30-Day Public Review Period

In accordance with G.N. No. R. 982 of the amended 2014 EIA Regulations (2017), IAPs are granted an opportunity to review and comment on the Draft Scoping Report. Hardcopies of the document were placed at a number of venues within the project area. Emails and SMSes were sent to all registered IAPs to notify them of the review of the Draft Scoping Report.

The public review of the Draft Scoping Report will occur for a 30-Day Review Period **from 29 August 2017 to 29 September 2017**.

Proof of the notification of the public review period is contained in **Appendix F**.

13.5.3 Authority Review

Hardcopies of the document were provided to the key regulatory and commenting authorities for a 30-Day Review Period **from 29 August 2017 to 29 September 2017**.

13.5.4 Meetings

13.5.4.1 Authority Meeting

An Authority Meeting was convened on 07 September 2017. However, no authorities were in attendance, therefore there are no minutes.

13.5.4.2 Public Meeting

A public meeting was convened with the registered IAPs and Landowners on 07 September 2017 (**Figure 75**). The aim of the meeting was to present the Draft Scoping Report and to provide IAPs with a platform for project related discussions. All registered IAPs were notified of the public meeting via site notice, newspaper advert, email or SMS.

As the venue was advertised incorrectly, some attendees went to the wrong venue and had to be redirected to the correct venue for the public meeting. This resulted in a few informal, impromptu discussions held at the incorrect venue. These discussions were noted and minutes were compiled.

The minutes and attendance registers of the meeting are contained in **Appendix F9**.

Figure 75: Images from the public meeting

13.6 Review of the Draft EIA Report

13.6.1 Public Review of Draft EIA and IWULA

In accordance with GN. No. R. 982 of the 2014 EIA Regulations, as amended (07 April 2017), IAPs are granted an opportunity to review and comment on the Draft Reports. Hardcopies of the Draft Reports were placed at the venue listed below (**Table 30**). An electronic copy of the reports was also made available. Emails or SMSes were sent to all registered IAPs which will include the details of the review period of the Draft EIA and IWULA.

Table 30: Location of Draft EIA and IWULA Report for Review

Venue	Address	Contact Details
uMkomaas Library	41 Barrow Street, Umkomaas	039 311 5444
Craigieburn Library	1 Civic Street, Craigieburn	039 311 5400

The public review of the Draft EIA and IWULA took place for a 30-Day Review Period **from 19 February 2018 to 21 March 2018**.

13.6.2 Authority Review

Hardcopies of the document were provided to the key regulatory and commenting authorities for a 30-Day Review Period **from 19 February 2018 to 21 March 2018**.

13.6.3 Meetings

13.6.3.1 Public Meeting

A public meeting will be convened with the registered IAPs and landowners on 08 March 2018. The aim of the meeting is to present the Draft EIA Report and to provide IAPs with a platform

for project related discussions. All registered IAPs were notified of the public meeting via site notice, newspaper advert, email or SMS.

13.6.4 Comments and Responses Report

The Comments and Responses Report, which summarises the salient issues raised by IAPs and the project team's response to these matters, is contained in **Appendix F8**. The issues listed in the Comments and Responses Report were identified from minutes of meetings, completed Reply Forms and other correspondence received to date.

14 SUMMARY OF SPECIALIST STUDIES

14.1 Specialist Studies undertaken as part of the EIA

A crucial element of the Plan of Study for the EIA prepared during the Scoping phase was to provide the Terms of Reference for the requisite specialist studies triggered during Scoping. According to Münster (2005), a 'trigger' is "*a particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an issue and/or potentially significant impact associated with that proposed development that may require specialist input*". The requisite specialist studies 'triggered' by the findings of the Scoping process, aimed at addressing the key issues and compliance with legal obligations, included:

- Terrestrial Biodiversity Report;
- Aquatic Assessment and Wetland Delineation;
- Socio-Economic Assessment;
- Phase 1 Heritage Impact Assessment;
- Estuarine Specialist Study; and
- Sediment Impact Specialist Opinion.

In addition, a number of technical studies were required including:

- Geotechnical Investigation;
- Traffic Impact Assessment;
- Stormwater Management Plan; and
- Technical Drawings.

These technical studies have not been summarised below, but are included in **Appendix H**. For the inclusion of the findings of the specialist studies into the EIA report, the following guideline was used: *Guideline for the review of specialist input in EIA processes* (Keatimilwe & Ashton, 2005). Key considerations included:

- Ensuring that the specialists have adequately addressed IAPs' issues;
- Ensuring that the specialists' input is relevant, appropriate and unambiguous; and

- Verifying that information regarding the receiving ecological, social and economic environment has been accurately reflected and considered.

14.2 Terrestrial Biodiversity Report

14.2.1 Details of the Specialist

Specialist	
Organisation:	Khuselimvelo Consulting
Name:	GJ McDonald
Affiliation (if applicable):	Pr. Sci. Nat. Reg No. 400083/97

14.2.2 Main Findings

The proposed development is sited in an area which has either been transformed or impacted upon by commercial and small-scale agricultural activities and alien plant invasion to a greater or lesser extent. Such vegetation as is found is often of a secondary nature where cane fields have been allowed to become fallow and these disturbed and secondary habitats are substantially invaded by forbs and woody species. Near-natural vegetation is limited and may be found along water courses and certain roads.

The following Specially Protected species will be affected by the proposed development: *Aloe maculata* (Liliaceae/Asphodelaceae) found at and around 30°11'27.09"S/ 30°45'46.30"E*, Freesia laxa* (Iridaceae) found at WTP Site 1, *Kniphofia* sp. (Liliaceae/Asphodelaceae) found at both WTP Site 1 and WTP Site 2. These will require a permit from eKZNw to translocate. Specially Protected species in the **general area** such as *Millettia grandis, Dioscorea cotinifolia* (Dioscoreaceae) and *Ledebouria ovatifolia* (Liliaceae/Hyacinthaceae) 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. Although these species were not encountered in the proposed footprint of the areas sampled for this survey, this was not an exhaustive survey and the potential exists that they may be present. *Pittosporum viridiflorum* and *Sclerocarya caffra* were encountered in the general area during this survey and, if encountered once the final pipeline route is selected, will require a permit from DAFF for their removal. The Red-Listed species *Hypoxis hemerocallidea* (DECLINING) is encountered in large numbers at the sites designated as WTP Site 1 and WTP Site 2 and will require permit authorization for their translocation.

The faunal study revealed that a number of species of potential Conservation Significance have been recorded from suitable habitat within the same Quarter Degree Grid Squares. None was recorded from the site during the site visit, nor are they expected to occur there for the most part due to the absence of suitable habitat for these species at the study site. If present, many of these species are likely to move away from the area during construction and should

return after rehabilitation of the area. However, the areas designated as WTP Site 1 and WTP Site 2 constitute sensitive areas in the context of the proposed development, especially from an amphibian perspective.

Rocky areas as indicated in red (**Figure 76** below) provide valuable habitat for herpetofauna and care should be exercised during construction within these areas to minimize disturbance and habitat loss.

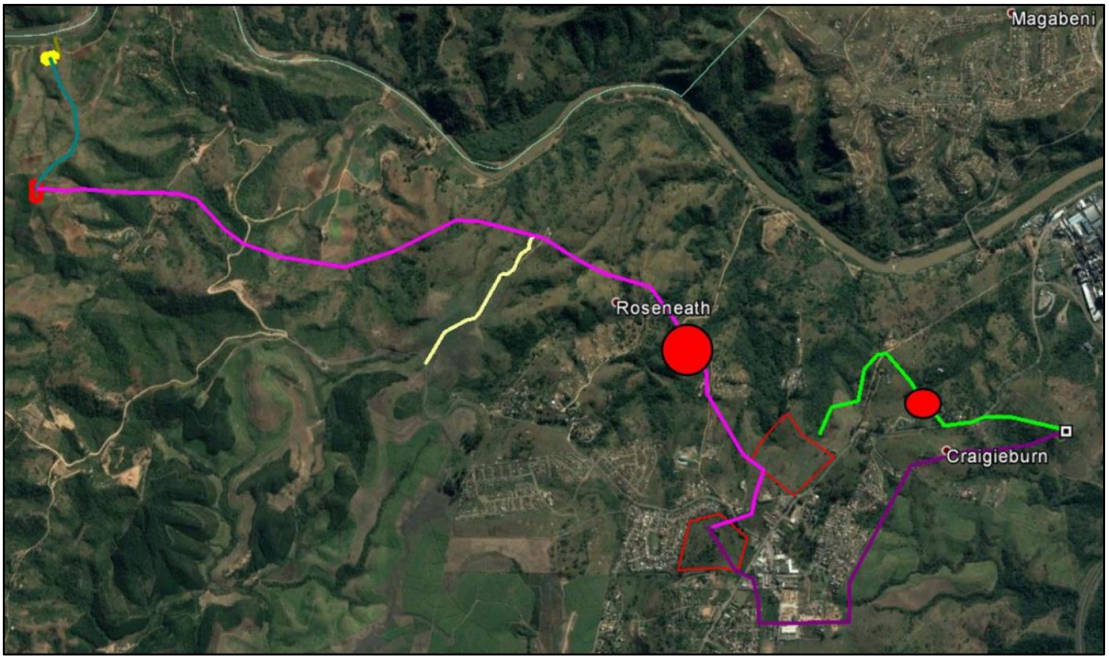


Figure 76: Sensitive rocky areas

Floral and faunal diversity is likely to be highest in the region of 30°11'27.09"S/ 30°45'46.30"E and 30°11'18.84"S/30°44'56.82"E as these areas are most natural and undisturbed and contain rock habitats suitable for reptiles in particular.

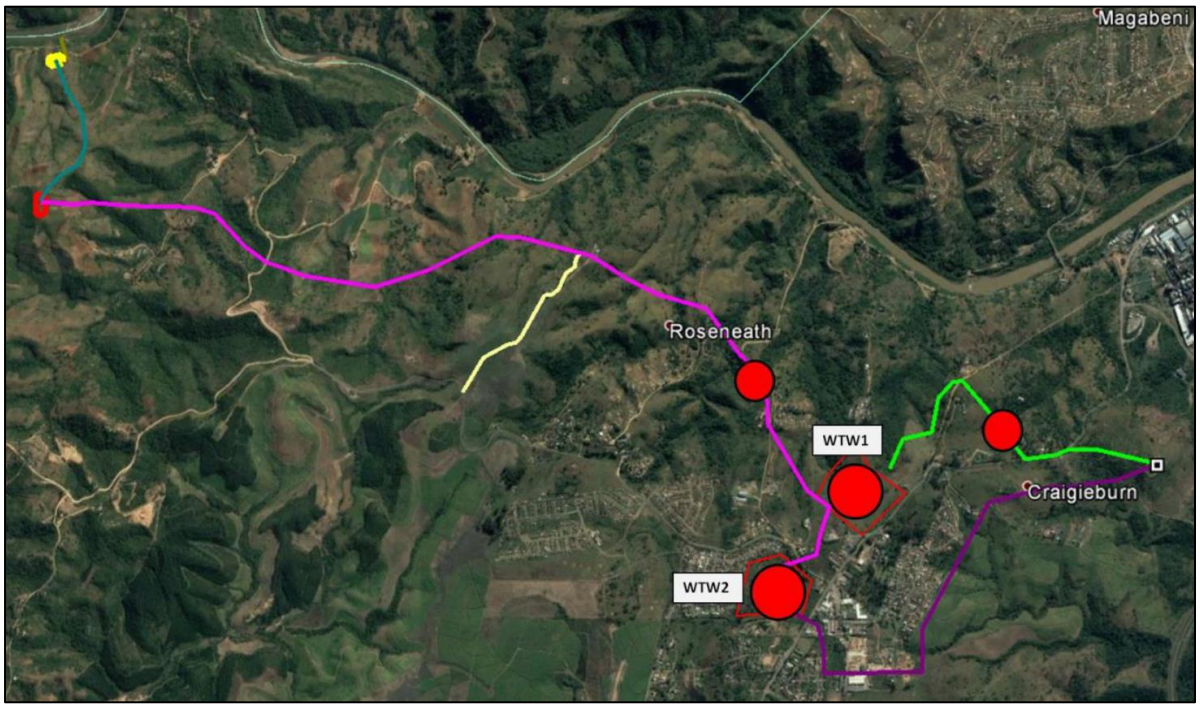


Figure 77: Sensitive habitats with species of conservation significance

14.2.3 Conclusions and Recommendations

For the most part, the proposed development can be executed within acceptable limits of impact on the environment; many of these impacts can be mitigated. The proposed pipeline, pump station and reservoir are to be sited in highly transformed habitat and/or secondary habitat and can be supported. The proposed WTP sites are problematic. WTP Site 1 is a hygrophilous grassland and is a sensitive habitat on the broader environmental context of the area. Any activity in this area would require a WULA and should take into account the possibility that the site may provide breeding and transit opportunities for amphibians of conservation significance. The same can be said of the WTP Site 2 with the additional restriction of the site being designated as part of the D'MOSS.

14.3 Aquatic and Wetland Baseline and Impact Assessment

14.3.1 Details of the Specialist

Specialist	
Organisation:	The Biodiversity Company
Name:	Mr. Russell Tate
Qualifications:	MSc (Aquatic Health)
Affiliation (if applicable):	Professional Natural Scientist- Ecological Science, Environmental Science and Aquatic Science (Reg number: 400213/11) with

Specialist	
	South African council for Natural Scientific Professions (SACNASP)

14.3.2 Main Findings

14.3.2.1 Wetlands NFEPAs

One (1) wetland FEPA was located within 500m of the project area in three different locations. The FEPA wetlands within the 500m project boundaries are shown **Figure 78**. The FEPA wetland is listed in **Table 31**.

The identified FEPA wetland was classified as a natural channelled valley-bottom wetland. The FEPA is classified as a Rank 4 FEPA wetland with a wetland vegetation condition of A/B (> 75% Natural Cover). The NFEPA wetland information is a coarse data set and must be ground truthed. Following the site survey, this NFEPA has been determined to be characterised as a river system.

Table 31: NFEPA Description for the FEPA sites within the Study Area

Classification Levels				Wetland Vegetation Class	Natural / Artificial	Wetland Condition	Rank
L1 (System)	**L2 (Ecoregion)**	**L3 Landscape Position**	**L4 HGM Classification**				
Inland System	North Eastern Coastal Belt	Valley Floor	Channelled valley-bottom	Indian Ocean Coastal Belt Group	Natural	AB	4

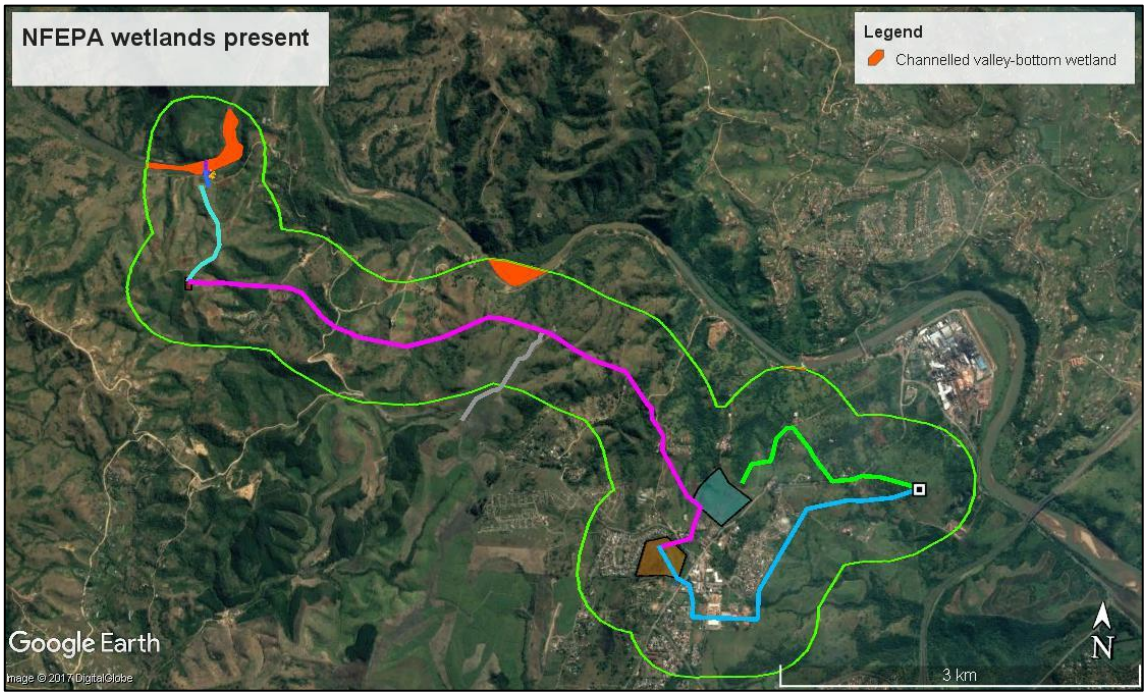


Figure 78: The NFEPA wetlands associated with the project area

14.3.2.2 Wetland Assessment

The on-site assessment showed a series of channelled valley-bottoms present within the 500m project boundaries of which them all are grouped together in one HGM units (HGM1). One unchannelled valley-bottom wetland (HGM2) is located to the western side of the project site next to a large sugar cane crop field. A small natural depression (HGM3) which is predominantly fed by a seep is located directly within one of the two water treatment plant locations (WTP 1). A floodplain (HGM4) is located alongside the banks of a channelled valley-bottom wetland within the second of the two proposed WTP sites. A seep (HGM5) linked to a nearby channelled valley-bottom is located within the WTP1 site, which is the main source for a small depression nearby (as mentioned earlier). An isolated seep (HGM6) is located to the western parts of the project site. Another floodplain (HGM7) is located to the northern parts of the project site adjacent to the river system. Lastly, another isolated seep (HGM8) is located directly within an existing sugar cane crop field.

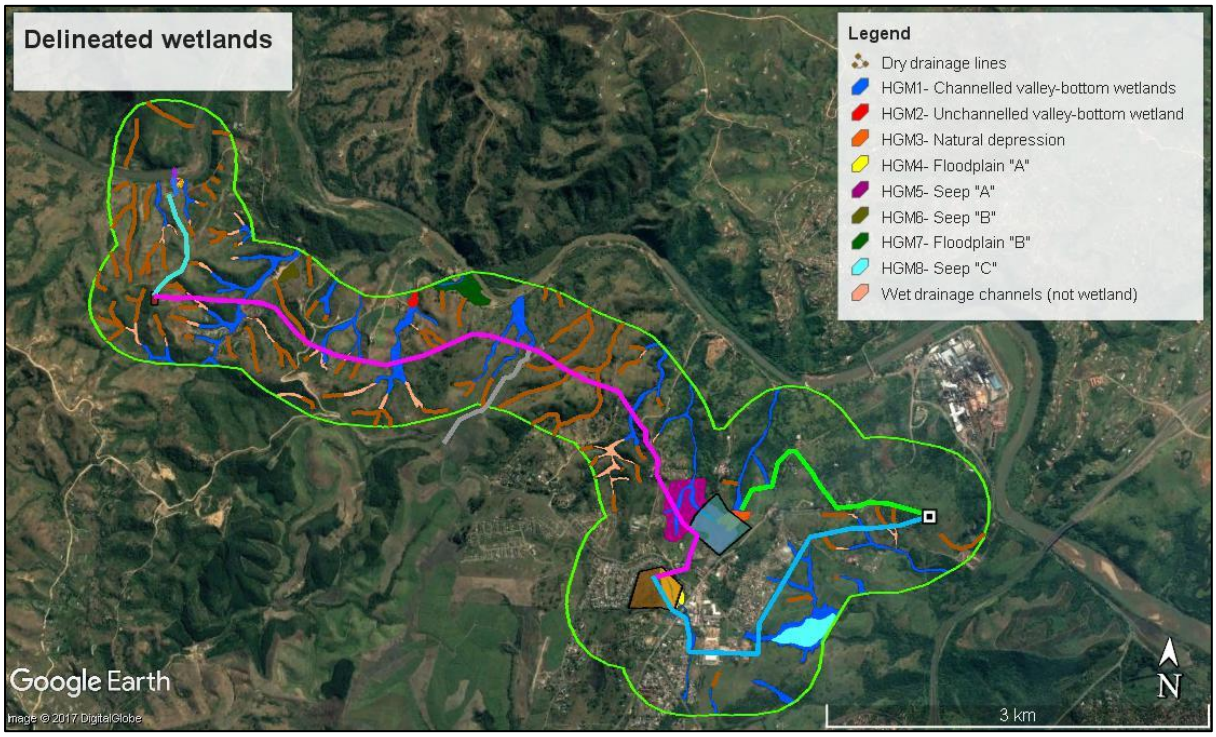


Figure 79: The project area Wetland Delineation

14.3.2.3 Present Ecological Status

The PES results are described in the sections below with **Table 32** showing the combined overall results.

Table 32: The PES Results for the Wetlands Associated with the Proposed Project

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM1	20	E: Seriously Modified	6,5	B: Largely Natural	1,7	D: Largely Modified	4,1

Overall PES Score	4,4	Overall PES Class	D: Largely Modified

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM2	1,00	D: Largely Modified	4,0	A: Unmodified Natural	0,7	E: Seriously Modified	6,6
Overall PES Score		3,8		Overall PES Class		C: Moderately Modified	

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM3	0,5	B: Largely Natural	1,0	C: Moderately Modified	2,7	C: Moderately Modified	2,8
Overall PES Score		2,0		Overall PES Class		C: Moderately Modified	

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 4	2	C: Moderately Modified	3,5	A: Unmodified Natural	0,4	D: Largely Modified	5,0
Overall PES Score		3,0		Overall PES Class		C: Moderately Modified	

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 5	3	B: Largely Natural	1,0	B: Largely Natural	1,3	C: Moderately Modified	3,3
Overall PES Score		1,7		Overall PES Class		B: Largely Natural	

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 6	0.5	E: Seriously Modified	6,0	A: Unmodified Natural	0,4	A: Unmodified Natural	0,8
Overall PES Score		2,9		Overall PES Class		C: Moderately Modified	

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 7	3	B: Largely Natural	1,5	A: Unmodified Natural	0,4	B: Largely Natural	1,0
Overall PES Score		1,0		Overall PES Class		B: Largely Natural	

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 8	5	E: Seriously Modified	6,0	A: Unmodified Natural	0,4	F: Critically Modified	9,8
Overall PES Score		5,5		Overall PES Class		D: Largely Modified	

14.3.2.4 Ecological Importance and Sensitivity

The EIS assessment was applied to the HGM units described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetland.

The only aspects scored a High (B) is EIS (HGM1 & 2) and Hydrological/functional importance (HGM2, 3, 4, 5 & 7). Therefore, HGM2 is undoubtedly the HGM units with the highest rated

scores when it comes to ecological importance and sensitivity. The other HGM units are not valued as much in regard to EIS seeing that low scores were achieved for all aspects.

Two (2) HGM units have been rated a High (B) score for EIS. This level of EIS typically illustrates a high presence or high potential for red data species and other significant species. Also, the size and rarity as well as the sensitivity of the wetland to flooding events and contaminants polluting the water sources play an enormous role in this score.

Five (5) wetlands have been scored High (B) for hydrological/functional importance. This score can be explained by the following eco-services; flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation, erosion control and carbon storage.

14.3.2.5 Buffer Zones

The pipeline associated with the project has been given a calculated buffer zone of 23m and 15m for the construction- and operational phases respectively before the application of any mitigation measures. However, after the application of relevant mitigation measures, these buffer requirements are 15m for both phases.

The access road associated with the project has a calculated buffer zone of 43m and 28m for the construction- and operational phases respectively before the application of any mitigation measures. After the application of relevant mitigation measures, these buffer requirements were 28m for both phases.

The pump station associated with the project has been given a calculated buffer zone of 43m and 15m for the construction- and operational phases respectively before the application of any mitigation measures. However, after the application of relevant mitigation measures, these buffer requirements were 23m and 15m for the construction and operational phases respectively.

The WTPs associated with the project have been given a calculated buffer zone of 43m and 15m for the construction- and operational phases respectively before the application of any mitigation measures. After the application of relevant mitigation measures, the buffer requirements drop to 23m and 15m for the construction and operational phases respectively.

14.3.2.6 Aquatic Assessment

In situ water quality analysis results from the January 2018 survey are provided in **Table 33**.

Table 33: In situ Water Quality Results for the January 2018 Survey

Site	pH	Conductivity (µS/cm)	DO (mg/l)	Temperature (°C)
TWQR*	**6.5-9.0**	**<700****	**>5.00**	**5-30**
S1	7.37	114	8.3	25

S2	7.15	116	7.9	25
***TWQR – Target Water Quality Range **Expert opinion range**				

The results of the January 2018 survey derived no constituents exceeding the water quality guidelines. The results obtained indicated neutral pH levels with low concentrations of dissolved solid content. These water quality results indicate excellent water quality. The water quality results observed in this study should be used to monitor the potential impacts of the proposed development.

The results of the IHIA for the considered river reach were determined to be largely natural (class B) for the instream habitat and moderately modified (class C) for the riparian habitat. Limited impacts were observed during the survey and could be defined from aerial imagery of the river reach. Small impacts were derived for abstraction which consists of local community water abstraction and abstraction by SAPPI SAICCOR. Two impoundments are present on the river reach whilst physical modification to the instream habitat was generally absent for the river reach within 15km upstream of the proposed abstraction point and largely consisted predominantly of roads which are located adjacent to the river. Indigenous vegetation removal was observed, the removal of which was observed in lands where communities have been established. The results of the PES assessment are provided in the table below (**Table 34**).

Table 34: Present Ecological Status of the River Reach Assessed in the January 2018 Survey

Aspect Assessed	Ecological Category
Riparian ecological category	**class C**
Aquatic invertebrate ecological category	**class B**
Ecostatus	**class B**

The results of the PES assessment derived largely natural (class B) conditions in the river reach considered in this assessment. This result was in agreement with the desktop data. Based on the overall results, the attainable ecological class was currently not being attained. The established PES will be used to guide the potential impacts of the proposed project.

14.3.3 Conclusions and Recommendations

The results of the risk assessment indicate several moderate and low risks with limited mitigation actions possible. This is due to the construction activities directly within the active river channel, and the location of either WTP in delineated wetland areas. The physical construction of the abstraction works and the upgrading of the weir were found to have the highest potential impact to aquatic ecology. This was due to the physical construction activities which will directly alter the instream aquatic habitat down- and upstream of the weir.

The following recommendations are provided for the project:

- The recommended buffer zones should be strictly adhered to during the construction phase of the project, with exception of the activities and structures required to traverse a watercourse. This includes structures such as culverts for drainage lines and the weir structure itself. Any supporting aspects and activities, such as laydown and mixing yards, not required to be within the buffer area should adhere to the buffer zone.
- The inclusion and construction of a fish ladder is strongly advised for the proposed project. Baseline conditions indicate that fish and invertebrates alike are currently able to migrate the existing barriers, this should be allowed to continue through the construction of a fishway.
- Should the WTP alternative 1 be selected, it is recommended that a wetland offset strategy be formulated for the project in order to compensate for the expectant loss of wetland areas.
- Due to potential negative effects to the estuary, it is proposed that an estuarine study is completed.
- It is ultimately recommended that WTP site alternative 2 be favoured instead of WTP site alternative 1.

14.4 Socio-Economic Impact Assessment

14.4.1 Details of the Specialist

Specialist	
Organisation:	Nemai Consulting
Name:	Ciaran Chidley
Qualifications:	• B.Sc (Eng) Civil Engineering – University of the Witwatersrand • B.A. Economics, Philosophy – University of South Africa • Master of Business Administration – University of the Witwatersrand • Certified training as an Occupational Health and Safety Officer
Affiliation (if applicable):	• Registered Professional Engineer with the Engineering Council of South Africa – Reg. no. 980360 • Associate Member of the Institute of Safety Management

14.4.2 Main Findings

The project is located entirely within Ward 99 of the eThekwini Metropolitan Municipality. The Census 2011 subplaces that are affected by the project are listed in the table below.

Table 35: Census 2011 Sub-Places Affected by the Proposed Project

Sub-Place Name and Code	Project Component Affected
Clansthal – 599194001	Goodenough Weir, Pump Station and half of the length of raw water gravity main
Roseneath – 599193001	Portion of raw water gravity main
Craigieburn – 599195003	Remainder of raw water gravity main, WTP Sites 1 and 2, clean water gravity pipeline from WTP Site 2, portion of clean water gravity pipeline from WTP Site 1
Mkomanzi Drift SH - 599195002	Portion of WTP Site 1, portion of clean water gravity pipeline from WTP Site 1

14.4.2.1 Situational Analysis

The land use in the area is predominantly agricultural. Crops are planted along some of the route of the gravity main, with larger areas being open grazing. The pipeline passes near dwellings and in one case crosses through a farmer's homestead. As the pipeline reaches into Craigieburn the land use changes to high density residential and commercial uses. As the pipeline exits the two water treatment works options, industrial land uses are impacted upon.

The sites of the proposed two alternative water treatment plants are unused. Site 1 is located outside the main centre of town on land that is zoned in the future for light industrial use. Site 2 is located in the centre of Craigieburn, adjacent to the main existing residential areas of the town. The land use on this site is zoned for residential use in the future.

The study area contains a population of 9 343 people, living within 2 734 households. The dominant housing typology is brick or traditional structures with there being very few informal settlements. Levels of service for water supply are high with over seventy-five percent of the population serviced by piped water inside their dwellings. Sanitation services within the study area show that sixty-eight percent of the households have flush toilets within their houses.

Education levels are low, with seventy percent of the population above twenty years old not having achieved matric. Craigieburn is the area with the highest education levels, where thirty-seven percent of the population have at least a matric certificate.

Annual household income figures for the study area show that a substantial portion of the Clansthal, Roseneath and Mkhomazi Drift SH sub-places have no or low household income. The community of Craigieburn is relatively wealthier and this is mirrored by the data on education. The official unemployment rate in lowest in Craigieburn, at 17%, and highest in Clansthal, at 50%. The degree to which the potential labour force in an area is employed provides a measure of the engagement of the community with the economy. This measure is lowest in Roseneath, at 50% and indicates a labour sending area. It is highest in Craigieburn and Mkomanzi Drift SH at 69% and 57% respectively. These two areas are generally labour absorbing areas.

14.4.2.2 eThekwini Metro Municipality Town Planning

During a review of the Umkhomazi Local Area Plan, which was developed in 2010, it is clear that the two sites identified for the Water Treatment Plant in the town of Craigieburn have been earmarked for future development.

In terms of the planned activities on Site 1, the city has proposed light industrial use and the upgrading of the existing gravel road in the area.

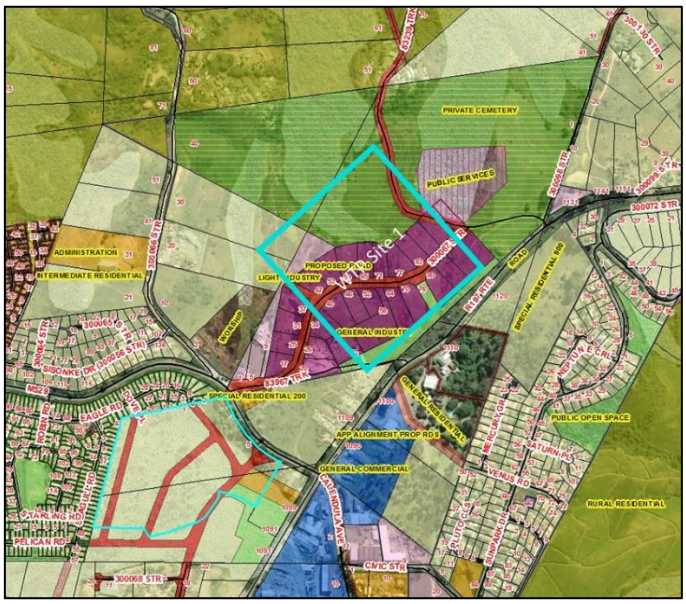


Figure 80: WTP Site 1 Town Planning

In terms of the planned activities on Site 2, the city has proposed specialist residential uses and included a number of roads to facilitate this use.

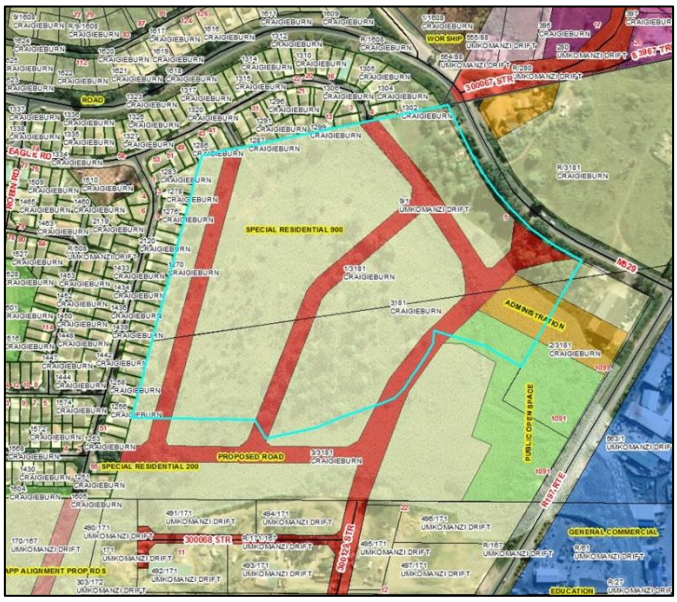


Figure 81: WTP Site 2 Town Planning

14.4.2.3 Contact with Directly Affected Landowners

Contact with directly affected landowners has been conducted as part of the Public Participation process of the EIA. During this process individual meetings were held with many landowners, as well as there being telephonic discussions and two public meetings. During these interactions, the following socio-economic issues related to the proposed project were identified:

- Noise;
- Lighting;
- Financial compensation;
- Security issues;
- Reduced access to amenities;
- Traffic conditions;
- Access to weir;
- Crop health;
- Damage to private property; and
- Direct economic benefit.

14.4.3 Conclusions and Recommendations

Having regard to the project aim of increasing the supply of water to the lower Mkhomaas catchment and the assessment above which does not indicate any fatal socio-economic flaws, the No-Go option is not supported. The benefits from the project going ahead, from a socio-economic perspective, will be larger than the project not proceeding.

14.5 Phase 1 Heritage Impact Assessment

14.5.1 Details of the Specialist

Specialist	
Organisation:	eThembeni Cultural
Name:	Len van Schalkwyk

14.5.2 Main Findings

We identified one heritage resource of significance within the proposed project area. A Hindu Temple established in 1915 is located in the vicinity of the proposed BWS pipeline servitude. However, it will not be affected or impinged upon by the proposed project activities.

The Hindu Temple observed within the assessment corridor (30°10'36.95"S; 30°43'4.65"E) will not be directly affected by the installation of the rising main pipeline from the Goodenough Weir. However, 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. Telephonic communication with a Mr M. Pillay (IAP) confirms the establishment of the temple in 1915; and that the resident Indian farming community have resided in that part of the valley since the late 19th C. The established families are descendants of indentured Indian labourers (1870's – 1890's) who, on release from their contracts, stayed on in South Africa and began market gardening and farming. These farmers were renowned for the pineapple production and the supply of fresh produce to the Durban Indian Market.

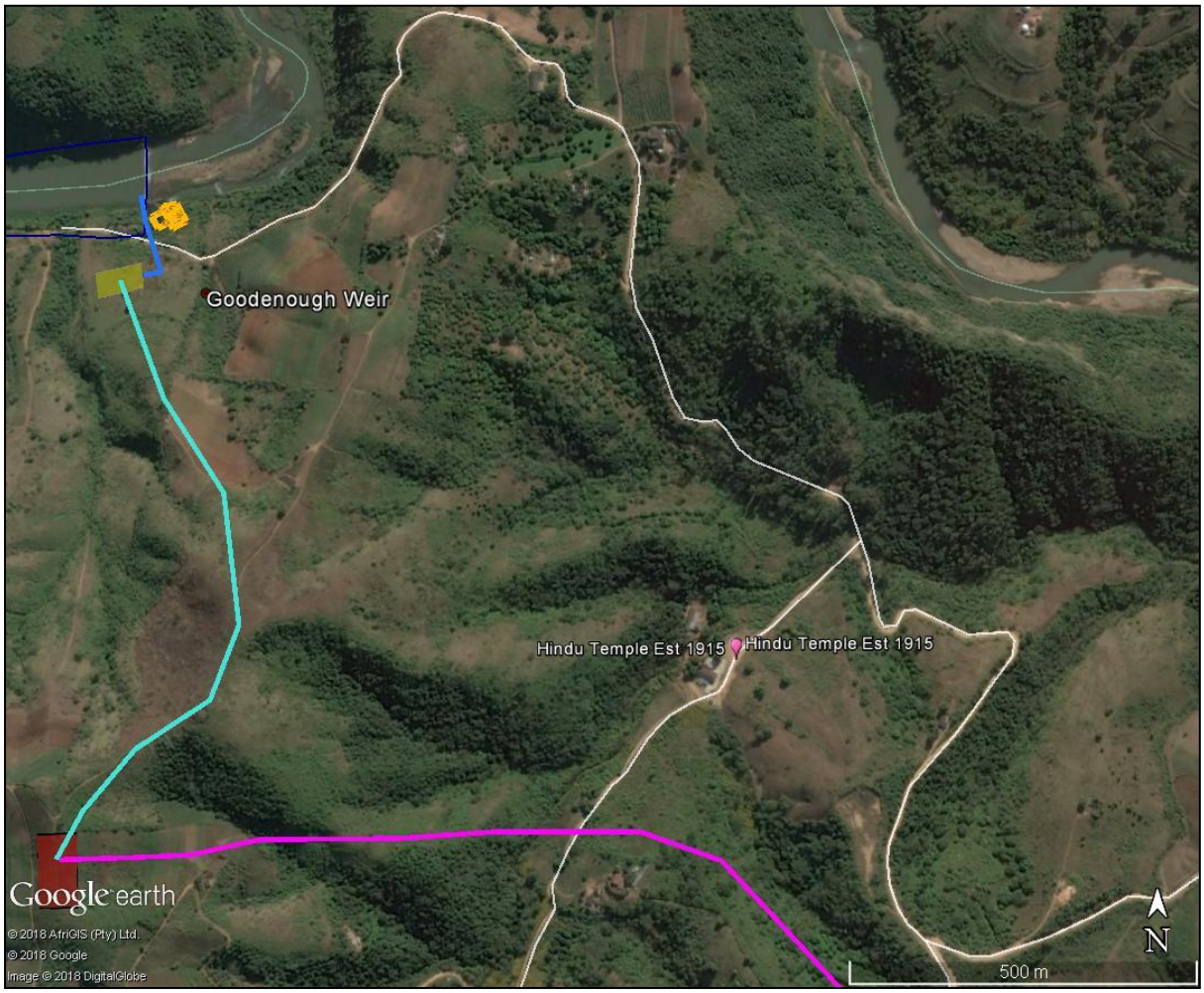


Figure 82: Location of Hindu Temple

Figure 83: Hindu Temple established in 1915

No graves were observed in the vicinity of the pipeline corridor. The pipeline alignment to the Quarry Reservoir traverses the boundary of the Craigieburn Municipal Cemetery. However, there is sufficient buffer to survey the alignment away from any existing graves.

No archaeological residues were observed at spot checks along the proposed pipeline servitude. Albeit that vegetation was rank and surface visibility constrained, it is my opinion that the archaeological footprint in this deeply incised and steep sided portion of the Umkhomazi Valley is ephemeral to non-existent. However, we recommend a monitoring brief during construction over specific — greenfield sections of the pipeline alignment.

The proposed development will impose no permanent or negative transformation of the current agricultural and peri-urban landscape. Such services infrastructure provision is in keeping with the current development trends along this section of the KwaZulu-Natal southern coastal landscape.

14.5.3 Conclusions and Recommendations

We recommend that this development project proceed with the proposed heritage resource mitigation recommended in the report.

If permission is granted for development to proceed, the client is reminded that the Act requires that a developer cease all work immediately and notify Amafa should any heritage resources, as defined in the Act, be discovered during the course of development activities.

14.6 Estuarine Specialist Study

14.6.1 Details of the Specialist

Specialist	
Organisation:	Anchor Environmental Consultants (Pty) Ltd
Name:	Dr Barry Clark
Affiliation (if applicable):	Pr. Sci. Nat. (Zoology, Ecological Science)

14.6.2 Main Findings

The uMkhomazi Estuary is situated 50 km south-west of Durban and is one of only two estuarine systems within the eThekwini Municipal boundary classified as permanently open and one of only five such systems between uThukela and Mtamvuna. This classification is not totally rigid however, as a number of mouth closure events have been recorded for this system in the last few decades. With a catchment area of ca. 4 300 km^2 it is one of Kwazulu-Natal's largest estuaries. At present, the Sappi weir above the old metal bridge about 6 km from the mouth, sets an artificial and absolute limit on tidal and to some extent saline penetration into the system.

The uMkhomazi Estuary in its present state is estimated to be 69% similar to the natural condition, which translates into a PES of a "C" Category which is attributed to the following factors:

- The weir in the upper reaches reducing the connectivity between the river and estuary and contributing to loss of estuarine habitat;
- Sand mining that has taken away the sandbanks in the upper reaches, resulting in loss of intertidal areas and backwater refuge areas;
- Recreational activities (e.g. boat launching) in the lower reaches affecting bird abundance;
- Over exploitation of living resources (e.g. cast netting and line fishing); and
- Agricultural activities and disturbance in the Estuary Functional Zone (EFZ) causing loss of estuarine habitat.

The PES of the uMkhomazi estuary is rated as Class C, moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions and processes are still predominantly unchanged.

Both flow and non-flow related impacts have played a role in the degradation of the estuary. Of significant importance is the quality of influent water. Non-flow-related impacts to the system include habitat loss (within the 5m contour and above the Sappi weir) along with water quality problems because of the high nutrient load associated with the WwTWs, are considered to be the most important factors influencing the ecological health of the system. Excess nutrients in the inflowing water are likely to become increasingly important in future

especially with increased abstraction of freshwater from the system. Retention of these high concentrations of nutrients could lead to nuisance algal growth, low dissolved oxygen in the water and reduced habitat quality.

Estuary Importance was estimated at 85, i.e. the estuary is rated as “Highly Important”. The functional Importance of the uMkhomazi Estuary is very high. It serves as an important nursery for exploited fish stock. In addition, it is also an important movement corridor for eels, all of which are CITES listed species. The contribution of the uMkhomazi Estuary to ecological functioning of the nearshore marine environment is also considered to be very high. It is one of five key systems (Mfolozi, Mvoti, uMngeni, uMkhomazi, and Umzimkulu) that supply sediment, nutrients and detritus to the coast. The sediment load from the uMkhomazi is especially important as it is habitat forming, and plays an important role in maintaining the beaches and near shore habitats along this coast. uMkhomazi is especially important as it is habitat forming, and plays an important role in maintaining the beaches and near shore habitats along this coast.

Overall impacts on health status of the uMkhomazi estuary under the MK2 scenario (“Scenario MK2: Ultimate Development, uMkhomazi Water project (uMWP-1) and Ngwadini OCD (No uMWP-1 Support)”) is projected to decline from 68 to 54% and will drop from a “C” category to a “D” category. The Recommended Ecological Category (REC) for the uMkhomazi estuary is a “B” owing it being rated as “Very Important” from a biodiversity perspective and the fact that it also forms part of the core set of priority estuaries in need of protection to achieve biodiversity targets in the National Estuaries Biodiversity Plan for the NBA (DWS 2014, Turpie *et al*., 2013).

The proposed LUBWSS development will have a potentially negative effect on the uMkhomazi estuary. In total two potential impacts on the estuarine environment were identified for the construction phase and two for the operational phase of the project:

- Decreased or haulted flow of water due to abstraction of water from the river; and
- Impact to sediment balance.

The abstraction of water will greatly decrease the sediment load down-stream of the abstraction points. A lack of sediment transport will cause environmental issues. Sediment starvation is often caused by man-made structures such as dams, though natural barriers can also limit sediment transport. Without sediment transport and deposition, new habitats cannot be formed, and without some nutrient enrichment (carried with sediment into the water), submerged vegetation growth is stunted (EPA 2012). Too little sediment can alter an ecosystem to the point that indigenous species cannot survive. In addition to the effect on aquatic life, the loss of sediment transport and deposition can cause physical changes to the terrain. Downstream of dammed rivers, it is common to see receding riparian zones and wetlands due to the loss of transported sediment. Erosion downstream of a barrier is common, as is coastline erosion when there is not a large enough sediment load currently carried by the water. The flowing water will pick up new sediment from the bottom and banks of a

waterway (eroding instead of refreshing habitats) as it attempts to adjust to a uniform flow rate (EPA 2012, USCOP 2004). The duration of the impact is long term, the significance of this impact is rated as **Medium**. Further detail in sediment transport volumes, impacts and management of this system will be addressed in the Sediment Specialist Report.

14.6.3 Conclusions and Recommendations

it is suggested that projected water requirements for the LUBWSS should be achieved through one of the flow scenarios identified in the Mvoti to Umzimkulu Classification study (DWA 2014) that enabled the uMkhomazi estuary to achieve the REC for the system of a "B" (viz. MK21, MK22, MK23, and MK42) in combination with the following environmental offset interventions:

- 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.

14.7 Sediment Impact Specialist Opinion

14.7.1 Details of the Specialist

Specialist	
Organisation:	ASP Technology (Pty) Ltd
Name:	Professor Gerrit Basson
Affiliation (if applicable):	• SANCOLD SA National Committee on Large Dams Management Committee (2002 – date) • SAICE SA Institute of Civil Engineering member (1987 – date) • Fellow SAAE SA Academy of Engineering (2014 – date)

14.7.2 Main Findings

14.7.2.1 Comparison of Sediment Loads for Current and Future Scenarios

A direct comparison of the non-cohesive and total sediment loads at the different sites is presented in Table 4.3. The total load would be reduced by 15% (or 238 583 t/a) at the river mouth and by 8% (or 136 969 t/a) at the Goodenough weir. However, cohesive sediment transport (washload) has no effect on coastal erosion and a reduction in washload will actually be good since this counters the land degradation and associated higher sediment yield of the

current scenario. Only non-cohesive sediment > 0.063 mm which has been lost from the uMkhomazi River will have a negative impact on the river and the coast. This is because the beaches mainly contain sand, and very little silt and clay, due to the relatively high energy coastline. The non-cohesive sediment load of 24 033 t/a removed from the river at Ngwadini to the off-channel dam alone would have a negative impact on the relevant downstream beaches. The total non-cohesive sediment load is therefore of primary concern and would be reduced by 8% at the river mouth and by 10% at the Goodenough weir.

Table 36: Comparison by percentage reduction in sediment load from the current scenario at different sites

	Coarse Non-Cohesive Sediment			Total Non-Cohesive Sediment	Total Cohesive Sediment	Total Sediment Load
	Fraction 1 7.28 mm	Fraction 2 1.17 mm	Fraction 3 0.14 mm			
% reduction in sediment load at the Ngwadini Site	0%	0%	0%	0%	0%	0%
% reduction in sediment load at the Goodenough Weir	0%	0%	14.5%	10.4%	8.0%	8.3%
% reduction in sediment load at the River Mouth	0%	0%	10.5%	7.6%	16.6%	14.8%

14.7.2.2 The release of sediment back into the uMkhomazi River

Returning sediment to the river is supported because it facilitates the loss of sediment from the river system, thereby reducing any negative impact the abstraction works could have on the river and estuary. Abstraction works interrupt the continuity of sediment transport through river systems by starving downstream reaches of sediment which are essential for channel form and riparian ecosystems.

The boulder and gravel traps at the Ngwadini site and Goodeough site, and the hydrocyclones at the Goodenough abstraction works are necessary to ensure the greatest quantity of non-cohesive materials is removed from the river. Based on the sediment balance in Section 4, if none of the abstracted sediment load is returned to the river by flushing, the total load would be reduced by 17% at the river mouth and by 9% at the Goodenough weir (as opposed to the 15% and 8% with flushing respectively). The total non-cohesive sediment load would be reduced by 19% at the river mouth and by 13% at the Goodenough weir (as opposed to the 8% and 10% with flushing respectively). Therefore, the placement of 5 814 ton/a additional sediment in the river by flushing at the Ngwadini site and 29 673 ton/a sediment at the Goodenough weir is justified, ensuring 35 487 ton/a is returned to the estuary.

14.7.2.3 Consideration of the South KwaZulu-Natal Coastal Sediment Erosion

In 2007/2008, Theron *et al* (2008) conducted an investigation on behalf of the eThekwini Municipality regarding the long-term sustainability of the coastal sand resource and potential implications for coastal "stability", which specifically entailed quantifying the possible reduction in sand supply to the coast. This study included deriving estimates of sediment yield for all rivers within the eThekwini Municipal jurisdiction, and an assessment of the impacts of dams and sand mining on fluvial sand yields. It was found that there are 12 large dams on the 18 rivers within the eThekwini jurisdiction (Tongati River to Mahlongwa River) and that these dams reduce the sand yield to the eThekwini coast by about one third. Based on a survey of sand mining operations on the 18 eThekwini related rivers, the total mined volumes were estimated to be at least 400 000 m^3/a in 2008.

Potential sediment sources along the KZN coast are fluvial discharge, coastal and submarine erosion, aeolian transport, biogenic products and in situ authigenic mineralisations. These were all assessed and quantified, clearly indicating that the sediments contributed by river discharge dominate total production. From these studies, it follows that in the long-term, the amount and character of central KZN coastal sediments is ultimately determined by the larger rivers (and the nature of their catchments) within the region.

It was concluded in the 2008 study that the combined impacts of the dams and mining could result in mean coastal erosion of > 1 m/a. A strong recommendation was made to ban river sand mining from the eThekwini rivers as soon as practicable, while urgently seeking and evaluating other sources of sand. The fact that large in-stream impoundments have significant detrimental impacts, including on sediment yield to coastal areas and thus on coastal stability, was also emphasised.

Regarding the present study on the uMkhomazi River, it must be emphasised that this river is by far the most dominant source of fluvial sand supply to the whole coastline between the uMzimkulu River mouth and Durban. The 2008 study (Theron *et al*, 2008) estimated the sand (i.e. coarse sediment fraction only) yield of the uMkhomazi River to the coast at between about 140 000 m^3/a to 215 000 m^3/a, while the present (2017) study on the impacts of the abstraction works estimates the sand yield at about 200 000 m^3/a. The present (2017) study further estimates that the sand yield will reduce by about 15 000 m^3/a as a result of sand removed by the proposed abstraction works, which would be an 8% reduction in sand supply to the coast from this river.

It is estimated that the uMkhomazi River naturally contributed between about 50% to 85% of the additional sand inputs required for the coast from Port Shepstone to Durban. Besides the longshore transport input from further south of Port Shepstone, the uMkhomazi River is thus by far the most dominant source of fluvial sand supply to the whole coastline between the uMzimkulu River mouth and Durban.

In addition to the above potential impact to the sand yield of the uMkhomazi River, this important source of sand has also already been impacted on by sand mining (as is the case

with many of the other central KZN rivers). Much of the sand mining operations extract sand directly from the main river channel and active/dynamic sand banks along the main channel.

14.7.2.4 Shoreline Variability and Long-Term Stability

From the aerial photographic analyses and the topographic survey results it cannot be clearly ascertained whether there is currently a significant long-term trend in the shoreline location in the vicinity of the uMkhomazi River Mouth. Horizontal shoreline variations are naturally relatively large on this exposed high energy coastline and are further subject to the effects of episodic flood derived pulses of sediment input from the larger rivers in the region. However, based on the longer-term aerial photographic analyses it appears that if indeed an eroding trend were present, it would have to be quite small (<=0.3 m/a, i.e. <=15 m over 50 years) to remain undetected at this stage.

Nevertheless, it is clear that the proposed abstraction works on the uMkhomazi River could have a long-term effect on the coastal erosion due to the volume of sand of 15 000 m^3/a (8% reduction in sand supply) to the coast that will be trapped by the abstraction works. The impact in terms of net coastal erosion will be most noticeable in the first 10 km to the north of the mouth of the river, but even in this area it may be a decade or more after completion of the abstraction works before the impact is clearly apparent. However, in the long-term the impact (although reducing in magnitude/intensity towards the north), will gradually spread further north and could possibly eventually even result in a reduction of the longshore sand supply to the Durban Bluff area.

14.7.3 Conclusions and Recommendations

If major developments on the uMkhomazi River are inevitable, then the potential impacts in terms of reduced fluvial sand supply to the coast could be mitigated by stopping the current sand mining in the river. While the abstraction works may cause an 8% reduction in sand supply to the coast from the river, sand mining constitutes a loss of at least 21% of the “natural” sand yield. Furthermore, it is recommended to investigate and implement the exploitation of other sources of sand.

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. Provision should be made in the design of the rising main to the WTP to ensure that the velocity in the pipe is higher than the scour velocity for the washload.

15 IMPACT ASSESSMENT

15.1 Overview

This section focuses on the pertinent environmental impacts that could potentially be caused by the proposed LUBWSS-WSS during the pre-construction, construction and operational phases of the project.

Please note that an "impact" refers to the change to the environment resulting from an environmental aspect (or activity), whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity.

The impacts to the environmental features are linked to the project activities, which in broad terms relate to the proposed development and its associated services and infrastructure.

Impacts were identified as follows:

- Impacts associated with listed activities contained in GN No. R. 983, R. 984 and R. 985, for which authorisation has been applied for;
- Issues highlighted by environmental authorities;
- Comments received during public participation;
- An appraisal of the project description and the receiving environment; and
- Findings from specialist studies.

The following sections provide an overview of the potential impacts raised by Authorities (no concerns were raised by IAPs), as well as those relating to the relevant listed activities contained in GN No. R. 983, R. 984 and R. 985 of the 2014 EIA Regulations, as amended (07 April 2017).

This summary is then followed by the impact assessment overview based on the specialist studies. Please note that special attention was placed on the findings of the Specialist studies as they incorporated information on the receiving environment (or baseline conditions), comments from IAPs as well as specialist knowledge. The assessment of impacts was based on the professional judgment of the specialists, fieldwork and desktop analysis.

15.1.1 Impacts associated with Listed Activities

As mentioned, the project requires authorisation for certain activities listed in the EIA Regulations, as amended (2017), which serve as triggers for the environmental assessment process. The potential impacts associated with the key listed activities are broadly stated in **Table 37** below.

Please note that the potential impact overview does not take into account mitigation measures as this will be discussed in further detail in relation to each environmental feature.

Table 37: Potential Impacts related to GN. R. 983, 984 and 985 of EIA Regulations, as amended (07 April 2017)

Listed Activity	Potential Impact Overview
GN 983 – Activity 9 The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more;	• Impacts associated with the footprint of the physical infrastructure (proposed water pipeline). • Erosion on steep slopes. • Effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with traversing the watercourses. • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Visual impact during construction.
GN 983 – Activity 12 The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs— (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; —	• Impacts associated with the footprint of the physical infrastructure – weir, abstraction works, water pipelines, pump stations, reservoirs, access road, and WTP (mixing and concrete batching plant, site camp and site office) within 32m of a watercourse and within a watercourse. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Potential loss of sensitive vegetation and habitat. • Visual impact.
GN 983 – Activity 13 The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.	• Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Potential loss of sensitive vegetation and habitat.
GN 983 – Activity 14 The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	• Pollution of bio-physical environment through poor practices associated with onsite storage of dangerous goods.
GN 983 – Activity 19 The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;	• Construction activities (including bulk earthworks) to be undertaken within a watercourse for physical infrastructure – weir and embankment, abstraction works, access road, pump station, WTP and water pipelines. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside the watercourses. • Destabilisation of affected watercourses.
GN 983 – Activity 24 The development of a road— (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or	• Impacts associated with the construction of roads to the various sites (construction and operational phases). • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions.

Listed Activity	Potential Impact Overview
(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	
GN 983 – Activity 27 The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	• Clearance of large areas of indigenous vegetation associated with the construction footprint, including weir and embankment, abstraction works, pump station, construction laydown areas, reservoirs, WTP, and water pipeline. • Potential loss of sensitive fauna and flora species. • Potential loss of sensitive vegetation and habitat.
GN 983 – Activity 28 Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;	• Potential loss of agricultural land.
GN 983 – Activity 30 Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	• Potential loss of sensitive fauna and flora species. • Potential loss of sensitive vegetation and habitat.

GN 983 – Activity 31
 	
The decommissioning of existing facilities, structures or infrastructure for—
(i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;
(ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;
(iii) ….
(iv) any phased activity or activities for development and related operation activity or expansion or related operation activities listed in this Notice or Listing Notice 3 of 2014; or
(v) any activity regardless the time the activity was commenced with, where such activity:
(a) is similarly listed to an activity in (i) or (ii) above; and
(b) is still in operation or development is still in progress;
	• Impacts associated with the removal of existing structure(s), including:
	  ○ Site clearing;
	  ○ Removal of vegetation;
	  ○ Poor stormwater management; and
	  ○ Encroachment of alien vegetation.
	• Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside the watercourse.
	• Pollution associated with improper waste management.

GN 983 – Activity 48 The expansion of— (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more; where such expansion occurs— (a) within a watercourse;	• Impacts associated with the footprint of the physical infrastructure – weir and quarry reservoir. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Potential loss of sensitive vegetation and habitat.

Listed Activity	Potential Impact Overview
(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	
GN 983 – Activity 56 The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres;	• Impacts associated with widening existing roads to the various sites (construction and operational phases). • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions.
GN 983 – Activity 67 Phased activities for all activities— (i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; excluding the following activities listed in this Notice- 17(i)(a-d); 17(ii)(a-d); 17(iii)(a-d); 17(iv)(a-d); 17(v)(a-d); 20; 21;22; 24(i); 29; 30; 31; 32; 34; 54(i)(a-d); 54(ii)(a-d); 54(iii)(a-d); 54(iv)(a-d); 54(v)(a-d); 55; 61; 64; and 65; or (ii) listed as activities 5, 7, 8(ii), 11, 13, 16, 27(i) or 27(ii) in Listing Notice 2 of 2014 or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	• Impacts associated with type of phased activities. • Cumulative impacts.

GN 984 – Activity 4
 	
The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.
	• Pollution of bio-physical environment through poor practices associated with onsite storage of dangerous goods.
	• Potential impacts include:
	  ○ Soil and groundwater contamination from incorrect storage/handling/disposal of hazardous waste;
	  ○ Soil contamination through spillages and leakages;
	  ○ Soil contamination due to mismanagement and/or incorrect storage of hazardous chemicals;
	  ○ Poor stormwater management;
	  ○ Contamination of groundwater through spillages from equipment, machinery and vehicle storage or from a leakage caused by a fracture/crack or rupture in the fuel storage tanks; and
	  ○ Contamination of surface water resources through runoff containing suspended solids, sediments and fuel residue.

GN 984 – Activity 15	• Clearance of large areas of indigenous vegetation associated with the construction footprint, including weir and embankment, abstraction works, pump

Listed Activity	Potential Impact Overview
The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	station, reservoirs, WTP and construction laydown areas. • Potential loss of sensitive fauna and flora species. • Potential loss of sensitive vegetation and habitat.
GN 985 – Activity 2(d)(viii, xi and xii)(aa) The development of reservoirs, excluding dams, with a capacity of more than 250 cubic metres. d. KwaZulu-Natal viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; xii. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve	• Impacts associated with the footprint of the physical infrastructure – weir, abstraction works, water pipelines, pump stations, reservoirs, access road, and WTP (mixing and concrete batching plant, site camp and site office) within 32m of a watercourse and within a watercourse. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Potential loss of sensitive vegetation and habitat.
GN 985 – Activity 4(d)(viii, xi and xii)(aa) The development of a road wider than 4 metres with a reserve less than 13,5 metres. d. KwaZulu-Natal viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; xii. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve	• Impacts associated with the construction of access roads to the various sites (construction and operational phases). • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions.
GN 985 – Activity 10(d)(ix, xii and xiii)(aa and cc) The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. d. KwaZulu-Natal ix. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	• Pollution of sensitive, threatened or protected ecosystems through poor practices associated with onsite storage of dangerous goods. • Potential impacts include: o Soil and groundwater contamination from incorrect storage/handling/disposal of hazardous waste; o Soil contamination through spillages and leakages; o Soil contamination due to mismanagement and/or incorrect storage of hazardous chemicals; o Poor stormwater management; o Contamination of groundwater through spillages from equipment, machinery and vehicle storage or from a leakage caused by a

Listed Activity	Potential Impact Overview
xiii. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve. (cc) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland;	fracture/crack or rupture in the fuel storage tanks; and ○ Contamination of surface water resources through runoff containing suspended solids, sediments and fuel residue.
GN 985 – Activity 14(d)(vii, viii and x)(aa) The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; d. KwaZulu-Natal vii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; x. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.	• Impacts associated with the footprint of the physical infrastructure – weir, abstraction works, water pipelines, pump stations, reservoirs, access road, and WTP (mixing and concrete batching plant, site camp and site office) within 32m of a watercourse and within a watercourse. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Potential loss of sensitive vegetation and habitat.
GN 985 – Activity 16(d)(viii, xi and xii)(aa) The expansion of reservoirs, excluding dams, where the capacity will be increased by more than 250 cubic metres. d. KwaZulu-Natal viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; xii. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.	• Impacts associated with the footprint of the physical infrastructure – weir, abstraction works, water pipelines, pump stations, reservoirs, access road, and WTP (mixing and concrete batching plant, site camp and site office) within 32m of a watercourse and within a watercourse. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Potential loss of sensitive vegetation and habitat.

Listed Activity	Potential Impact Overview
GN 985 – Activity 18(d)(viii, xi and xii) The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. d. KwaZulu-Natal viii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; xi. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; xii. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.	• Impacts associated with widening existing roads to the various sites (construction and operational phases). • Potential loss of sensitive environmental features (e.g. heritage resources, sensitive fauna and flora species). • Traffic disruptions.
GN 985 – Activity 23(d)(vii, viii and x)(aa) The expansion of— (i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs— (a) within a watercourse; (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; d. KwaZulu-Natal vii. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; viii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; x. Outside urban areas (aa) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any terrestrial protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.	• Impacts associated with the footprint of the physical infrastructure – weir, abstraction works, water pipelines, pump stations, reservoirs, access road, and WTP (mixing and concrete batching plant, site camp and site office) within 32m of a watercourse and within a watercourse. • Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) associated with working in-stream and alongside watercourses. • Destabilisation of affected watercourses. • Potential loss of sensitive environmental features (e.g. sensitive fauna and flora species). • Potential loss of sensitive vegetation and habitat.
GN 985 – Activity 26(d) Phased activities for all activities— i. listed in this Notice and as it applies to a specific geographical area, which commenced on or after the effective date of this Notice; or ii. similarly listed in any of the previous NEMA notices, and as it applies to a specific geographical area, which commenced on or after the effective date of such previous NEMA Notices— where any phase of the activity was below a threshold but where a combination of the phases,	• Impacts associated with type of phased activities. • Cumulative impacts.

Listed Activity	Potential Impact Overview
including expansions or extensions, will exceed a specified threshold; — excluding the following activities listed in this Notice— 7; 8; 11; 13; 20; 21; and 24.	

15.1.2 Impacts raised by IAPs

During the public review of the Scoping Report, a number of concerns were raised and are summarised in the Comments and Responses Report (**Appendix F8**). A summary of the main concerns raised by IAPs include:

- The inundation and loss of agricultural land on the north bank as a result of the raising of the Goodenough Weir.
- Noise and light impacts associated with the Goodenough Weir and Abstraction Works.
- Safety and security during Construction and Operation.
- Compensation for affected private properties.

15.1.3 Project Activities and Environmental Aspects

This section identifies any potential impact, either positive or negative that has/may occur as a result of any construction associated with the proposed LUBWSS-WSS. All impacts identified must be then prevented, mitigated against or managed. The EMPr strives to provide a comprehensive list of mitigation measures associated with the overall project-related negative aspects and impacts for the entire project lifecycle (pre-construction, construction, and operational).

In order to understand the impacts related to the project it is necessary to unpack the activities associated with the project lifecycle.

Table 38: Activities associated with the Pre-Construction Phase

PRE-CONSTRUCTION PHASE
Project Activities
1. Applicant to appoint ECO
2. Servitude negotiations and registration
3. Negotiations and agreements with the individual affected landowners and stakeholders
4. Detailed engineering design
5. Detailed geotechnical design
6. Site survey
7. Procurement of contractors
8. Mark construction servitude
9. Pre-construction photographic records
10. Development and approval of method statements
11. Development and approval of construction plans
12. Development of employment strategy
13. Construction site planning, access and layout

14. Determining and documenting the road conditions for all identified access roads
15. Improvements of access roads to facilitate the delivery of construction plant and materials
Environmental Activities
1. Diligent compliance monitoring of the EA, EMPr and other relevant environmental legislation
2. Obtain all relevant permits as recommended by the Specialists.
3. Barricading and installing barriers around buffer areas identified in specialist studies
4. Ongoing consultation with landowners and affected parties
5. Demarcation of buffers around sensitive areas

Table 39: Activities associated with the Construction Phase

CONSTRUCTION PHASE
Project Activities
1. Site establishment (including site camp and labour camp)
2. Fencing of the construction area
3. Pegging of central line and overall footprint
4. Site clearing
5. Delivery of construction material
6. Construction/widening of access roads
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. Temporary river diversion for weir and pipeline crossings
19. Construction of project components
20. Road surface finishes
21. Concrete works
22. Landscaping
Environmental Activities
1. Control of invasive plant species
2. Diligent compliance monitoring of the EA, EMPr and other relevant environmental legislation
3. Conduct environmental awareness training
4. Implement EMPr
5. Ongoing consultation with landowners and affected parties
6. 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
7. Ongoing monitoring for red data, protected and endangered species, medicinal plants, heritage resources and graves (based on area of influence of the construction activities)
8. Reinstatement and rehabilitation of construction domain

Table 40: Activities associated with Operational Phase

OPERATIONAL PHASE

Project Activities
1. Servitude access arrangements and requirements
2. Routine maintenance inspections of the project components
3. Repair and maintenance works of the project components
4. Operation of the scheme
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. Monitoring of sediment releases

15.1.4 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. **Tables 41, 42** and **43** provide 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 41: Environmental aspects associated with the Pre-Construction Phase

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

Table 42: Environmental aspects associated with the Construction Phase

ENVIRONMENTAL ASPECTS
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

ENVIRONMENTAL ASPECTS
Construction Phase
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, liquid
22. Poor management of pollution generation potential
23. Poor management of water
24. Damage to significant fauna and flora
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 of the affected rivers from river diversions
30. Poor reinstatement and rehabilitation

Table 43: Environmental aspects associated with the Operational Phase

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. Poor monitoring and control of sediment releases back into the river

15.1.5 Potential Significant Environmental Impacts

Note that it is not the intention of the impact assessment to evaluate all potential environmental impacts associated by the project's environmental aspects, but rather to focus on the potentially significant direct and indirect impacts identified during the Scoping phase and any additional issues uncovered during the EIA stage.

The potential significant environmental impacts associated with the project, as listed in **Table 44** (construction phase) and **Table 45** (operational phase), were identified through an appraisal of the following:

- Project-related components and infrastructure (**Section 10.1**);
- Activities associated with the project life-cycle (i.e. pre-construction, construction, operational and decommissioning) (**Section 10.2**);

- Proposed alternatives to project components (**Section 11**);
- Nature and profile of the receiving environment and potential sensitive environmental features and attributes (**Section 12**), which included a desktop evaluation (via literature review, specialist input, GIS, topographical maps and aerial photography) and site investigations;
- Findings from Specialist Studies (**Section 14**);
- Understanding of direct and indirect effects of the project as a whole (**Section 15**);
- Input received during public participation from authorities and IAPs (**Section 13**); and
- Legal and policy context (**Section 5**).

Table 44: 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) • Soil pollution e.g. hydrocarbon and cement spillages • Compaction and erosion of removed and stockpiled soils • Soil contamination from incorrect storage/handling/disposal of hazardous waste • Soil contamination through spillages and leakages • Soil contamination due to mismanagement and/or incorrect storage of hazardous chemicals • Poor stormwater management during construction
Topography	• Visual impacts during construction • Crossing topographic features (watercourses) • Erosion of affected areas
Geohydrology	• Groundwater pollution due to spillages and poor construction practices
Surface Water	• Increased stormwater runoff • 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
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 • Damage / clearance of habitat of conservation importance • Loss of fauna species of conservation significance • Obstruction to animal movement corridors
Air Quality	• Excessive dust levels • Greenhouse gas emissions

Feature	Impact
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
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	• 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
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 45: 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
Flora	• Encroachment by exotic species through inadequate eradication programme
Aesthetics	• Visibility of weir and abstraction works, pump stations, reservoirs and WTPs to visual receptors • Inadequate reinstatement and rehabilitation of construction footprint
Socio – Economic	• Generation of employment opportunities for local community (positive) • Sustained economic and social beneficiation from the continued supply of electricity (positive) • Safety and security issues through improper access control during inspections and maintenance activities • Use of local road network for operation and maintenance purposes • Permanent inundation of agricultural activities and thus loss of agricultural land on the north bank of the uMkhomazi River • Inundation of a road on the south bank

15.1.6 Impact Mitigation

Impacts are to be managed by assigning suitable mitigation measures. According to DEAT (2006), the objectives of mitigation are to:

- Find more environmentally sound ways of executing an activity;
- Enhance the environmental benefits of a proposed activity;
- Avoid, minimise or remedy negative impacts; and
- Ensure that residual negative impacts are within acceptable levels.

Mitigation should strive to abide by the following hierarchy – (1) prevent; (2) reduce; (3) rehabilitate (/remediate); and/or (4) compensate (offset) for the environmental impacts.

Figure 84: Mitigation hierarchy

The proposed mitigation of the impacts associated with the proposed LUBWSS-WSS includes specific measures identified by the technical team (including engineering solutions) and environmental specialists, stipulations of environmental authorities and environmental best practices.

Note that the mitigation measures in the subsequent sections are not intended to be exhaustive, but rather focus on the potentially significant impacts identified.

An EMPr (contained in **Appendix I**) provide a comprehensive list of mitigation measures for specific elements of the project, which extends beyond the impacts evaluated in the body of the EIA Report.

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 life-cycle of a project.

Table 46: Overview of the EMPr

Overview of the EMPr
The EMPr aims to satisfy the requirements stipulated in Section 24N of NEMA and Appendix 4 of GN No. R. 982 of the 2014 EIA Regulations, as amended (07 April 2017). The scope of the proposed LUBWSS-WSS are as follows: • Establish management objectives during the project life-cycle in order to enhance benefits and minimise 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; • Provide legislative framework; and • Description of requirements for record keeping, reporting, review, auditing and updating of the EMPr. All liability for the implementation of the EMPr (as well as the EIA findings and environmental authorisation) lies with the project proponent (i.e. Umgeni Water).

The following considerations and assumptions accompany the compilation of the EMPrs:

- The EMPrs are guided by the following principles (based on Lochner, 2005) –
  - **Continuous improvement** – The project proponent (or implementing organisation) should be committed to review and to continually improve environmental management, with the objective of improving overall environmental performance;
  - **Broad level of commitment** – A broad level of commitment is required from all levels of management as well as the workforce in order for the implementation of the EMPrs to be successful and effective;
  - **Flexible and responsive** – The implementation of the EMPr needs to be responsive to new and changing circumstances. The EMPr report is a dynamic "living" document that will need to be updated regularly throughout the duration of the project life-cycle.

- Any changes to the EMPr must be submitted to DEA for acceptance. In accordance with Appendix 4 of GN No. R. 982 of the 2014 EIA Regulations, as amended (07 April 2017), the Environmental Authorisation (if granted) will specify the requirements for amending or updating the EMPr.
- The EMPr for the proposed LUBWSS-WSS provide the framework for the overarching environmental management requirements for the project life-cycle. 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.
- Although every effort has been made to ensure that the scope and level of detail of the EMPr are tailored to the level of environmental risk (i.e. type and scale of activity and the sensitivity of the affected environment) and the project- and site-specific conditions, certain of the environmental management requirements within the EMPr may be regarded as generic to make provision for activities that may take place as part of the overall project.

15.1.7 Impact Assessment Methodology

Information provided by specialists was used to calculate an overall impact score by multiplying the product of the nature, magnitude and the significance of the impact by the sum of the extent, duration and probability based on the following equation:

Overall Score = (NxMxS)x(E+D+P)

Where: N = Nature;
E = Extent
M = Magnitude
D = Duration
P = Probability
S = Significance

Table 47: Impact methodology table

Nature			
Negative	Neutral	Positive	
-1	0	+1	
Extent			
Local	Regional	National	International
1	2	3	4
Magnitude			
Low	Medium	High	
1	2	3	
Duration			
Short Term (0-5yrs)	Medium Term (5-11yrs)	Long Term	Permanent

1	2	3	4	
Probability				
Rare/Remote	Unlikely	Moderate	Likely	Almost Certain
1	2	3	4	5
Significance				
No Impact/None	No Impact After Mitigation/Low	Residual Impact After Mitigation/Medium	Impact Cannot be Mitigated/High	
0	1	2	3	

The following definitions apply:

For the methodology of the impact assessment, the analysis is conducted on a quantitative basis with regard to the nature, extent, magnitude, duration, probability and significance of the impacts. The following definitions and scoring system apply:

Nature (/Status)

The project could have a positive, negative or neutral impact on the environment.

Extent

- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

Magnitude

Degree to which impact may cause irreplaceable loss of resources.

- Low – natural and social functions and processes are not affected or minimally affected.
- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

Duration

- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.
- Rare/Remote – the event may occur only in exceptional circumstances.

Significance

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

0 – Impact will not affect the environment. No mitigation necessary.

1 – No impact after mitigation.

2 – Residual impact after mitigation.

3 – Impact cannot be mitigated.

For example, the worst possible impact score of -117 would be achieved based on the following ratings:

N = Nature = -1

M = Magnitude = 3

S = Significance = 3

E = Extent = 4

D = Duration = 4

P= Probability = 5

Worst impact score = (-1 x 3 x 3) x (4+4+5) = -117

On the other hand, if the nature of an impact is 0 (neutral or no change) or the significance is 0 (no impact), then the impact will be 0.

Impact Scores will therefore be ranked in the following way:

Table 48: Ranking of overall impact score

Impact Rating	Low/Acceptable impact	Medium	High	Very High
Score	0 to -30	-31 to -60	-61 to -90	-91 to -117

15.2 Climate

15.2.1 Potential Impacts

Greenhouse gases will be emitted during construction (e.g. fossil fuel combustion), maintenance, operation (e.g. energy usage), distribution and water treatment.

15.2.2 Impact Assessment

Climate							
Project Lifecycle:	Construction and Operational Phases						
Potential Impact:	Greenhouse gas emissions (such as from building materials and vehicle emissions)						
Proposed Mitigation:	• Materials with a high recycled content should be used where possible and the re-use of site materials should be considered. • In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys. • All vehicles used during the project should be properly maintained and in good working order.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Regional	Medium	Medium	Likely	2	-32
With Mitigation	-	Regional	Low	Medium	Likely	1	-8

15.3 Geology and Soil

15.3.1 Potential Impacts

AECOM (Pty) Ltd undertook a geotechnical and materials investigation in 2016 as part of the Feasibility Study for the LUBWSS – WSS.

The geotechnical investigation found that proposed developments do not have an impact on the geology of the study area. The geology was found to be suitable for the construction of the pipeline, reservoir, and either of the two WTPs. However, during the construction phase, there is a possibility of soil erosion which will be addressed during the EIA phase.

During the construction phase, large areas will be cleared of vegetation, which may lead to soil erosion. The EMPr will include suitable erosion and stormwater management measures to prevent the occurrence of erosion. 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. Should erosion prevention measures be implemented, this will have lower risk. Since there are cases of existing severe erosion within the study site, erosion measures implemented during construction could have a positive impact.

Soil may be polluted by poor storage of construction material, spillages and inadequate housekeeping practices. Specific mitigation measures are contained in the EMPr, where the primary objective is the effective and safe management of materials on site, in order to minimise the impact of these materials on the biophysical environment. The same objective applies to the correct management and handling of hazardous substances (e.g. fuel).

15.3.2 Impact Assessment

Geology and Soil							
Project Lifecycle:	Construction and Operational Phases						
Potential Impact:	Soil Erosion						
Proposed Mitigation:	Erosion Control: • 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. • Rehabilitate all areas disturbed during construction. • 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.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Medium	Likely	2	-28
With Mitigation	-	Local	Low	Short	Unlikely	1	-4
Project Lifecycle:	Construction Phase						
Potential Impact:	Loss of topsoil						
Proposed Mitigation:	• Wind and water erosion-control measures to be implemented to prevent loss of topsoil. • After excavation, all soils must be replaced in the same order as they were removed. • Remove, stockpile and preserve topsoil for re-use during rehabilitation. • Topsoil should be temporarily stockpiled, separately from (clay) subsoil and rocky material, when areas are cleared. If mixed with clay sub-soil the usefulness of the topsoil for rehabilitation of the site will be lost. • 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. • Topsoil stockpiles must not be contaminated with oil, diesel, petrol, waste or any other foreign matter, which may inhibit the later growth of vegetation and microorganisms in the soil. • Soil must not be stockpiled on drainage lines or near watercourses without prior consent from the Project Manager. • Soil should be exposed for the minimum time possible once cleared of invasive vegetation, that is the timing of clearing and grubbing should be coordinated 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.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Medium	Likely	2	-28
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

15.4 Geohydrology

15.4.1 Potential Impacts

The following impacts may result due to the project:

- Potential disturbance of the aquifer from blasting;
- Potential contamination of groundwater during the construction stage;

- Impacts to groundwater caused by the operation of the WTP, including the improper management of the dangerous goods (chemical storage and loading areas) and sludge; and
- Appropriate management of shallow groundwater at river crossings and waterlogged areas – e.g. suitable dewatering of excavations.

15.4.2 Impact Assessment

Geohydrology							
Project Lifecycle:	Construction and Operational Phases						
Potential Impact:	Contamination through spillage of fuel, hazardous chemicals, leaking vehicles, etc.						
Proposed Mitigation:	• All construction activities to comply with NWA. • Ensure that all hazardous storage containers and storage areas comply with the relevant SANS standards to prevent leakage. • 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. • Littering must be prohibited by providing adequate number of rubbish bins during the construction and operational phases to ensure proper disposal of rubbish. • Staff must be trained to deal with fuel/chemical spills and spill kits must be easily available at all times. • Mixing of cement must be done on impermeable surface and all spills must be cleaned up immediately. • Ensure that all activities impacting on groundwater resources are managed according to the relevant DWS licensing requirements.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Moderate	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

15.5 Surface Water

15.5.1 Potential Impacts

Activities linked with the construction and operational phases can cause significant adverse impacts to the "resource quality" of the affected watercourses, which is defined by NWA as the following:

- Quantity, pattern, timing, water level and assurance of in-stream **flow**;
- **Water quality**, including physical, chemical and biological characteristics of the water;
- Character and condition of the in-stream and riparian **habitat**; and
- Characteristics, condition and distribution of the **aquatic biota**.

15.5.1.1 Hydrology

Areas will be inundated as a result of the raising of the Goodenough weir. These areas include agricultural land on the north bank of the uMkhomaas River and a dirt access road on the south bank of the uMkhomaas River.

The pipeline crossings could lead to the alteration of the structure (i.e. bed and banks) and damage to the riparian habitat of the various affected watercourses. The flow within the

affected watercourses would need to be diverted to create a dry works areas and to allow for construction activities to take place.

The Contractor will prepare detailed method statements on how the river diversions will be undertaken to accommodate the construction of the proposed project infrastructure. Best practices to manage the flow of the rivers to be affected by the diversions are included in the EMPr.

15.5.1.2 Riparian Habitat

Sections of the riparian zone on the uMkhomazi River will be lost due to the construction of the abstraction works and the pipeline.

During construction, the riparian habitat will be damaged at the proposed developments sites for the pipeline and pump station. The earth moving activities and the establishment of the construction laydown area will result in the temporary loss of riparian habitat. Instream habitat will also be affected as machines will be working within the active channel. Once construction is complete, the direct disturbance associated with the construction activities will cease, however revegetation will be required to prevent long term degradation.

During operational phase, flooding may occur as a result of the weir which may result in the loss of riparian habitat.

15.5.1.3 Aquatic Biota

The existing Goodenough weir has transformed the watercourse from a free-flowing river ecosystem to a reservoir habitat, with accompanying changes in temperature, chemical composition, dissolved oxygen levels and the physical properties.

Most indigenous fish species undertake annual migrations within river systems for a number of reasons, such as feeding, dispersal, refuge areas during unfavourable conditions and reproductive success. The weir structure will acts as barriers that prevents the up- and downstream movement of aquatic biota.

The weir positioning poses a barrier to the movement of species. This has both a positive and a negative risk to aquatic faunal species – (a) positive as it limits movement of alien invasive species upriver thus stopping the colonisation of new areas, but (b) negative as it limits the migration of indigenous species from the ocean to their spawning grounds upriver and thus potentially destroy their environmental niches.

The raising of the Goodenough weir will exacerbate the current impacts associated with the weir structure in the uMkhomazi River.

During construction, the instream works (i.e. at the weir, river crossings) will increase the turbidity in the affected watercourses, which could adversely affect aquatic biota as follows:

- Suspended sediment –
    - The creation of low light conditions that reduce photosynthetic activity and the visual abilities of foraging fish;

  - High rates of downstream drift by benthic invertebrates that can reduce population densities and diversity;
  - Behavioural and physiological effects (including mortality) to invertebrates and fish;
  - Clogging of gills of aquatic fauna;
- Sediment deposition downstream of disturbance –
  - Smothering aquatic plants;
  - Changing streambed conditions;
  - Reducing habitat suitability;
  - Infilling pools and reducing the size of riffle areas.

15.5.1.4 Water Quality

Construction activities may result in contamination of the river if management actions are not implemented and enforced. Such actions could include fuel or other chemical spills, poor maintenance of equipment, insufficient facilities for workers and the possible increase in sediment release as part of vegetation clearing and road construction. During the construction phase, potential contamination of surface water could occur through sedimentation from instream works, silt-laden runoff from disturbed areas, and improper practices (e.g. poor management of waste water and disposal of solid waste) which will be addressed in the EMPr.

As part of the EIA that is currently underway for the uMkhomazi Water Project Phase 1 (uMWP-1), a study was undertaken to assess the impact of the proposed Smithfield Dam (located more than 180km from the estuary) on the coastal sediment budget and shoreline stability. The eThekwini Metropolitan Municipality have also raised concerns in this regard.

The Technical Feasibility Study identified the need to return sediment from the abstraction works (Hydrocyclones) and operational reservoir back to the uMkhomazi River. It was recommended that an opinion be sought with regards to the impacts of the proposed release of sediments back into the river.

The water quality impacts during the construction phase will be managed by employing environmental best practises that will be contained in the EMPr.

15.5.1.5 Water Users

As a positive impact, the intention of the LUBWSS – WSS is to meet long-term water requirements of the South Coast in order to satisfy the demands of the water users.

It is not anticipated that the project will adversely affect existing water users. It forms part of an overall scheme to transfer water from the uMkhomazi River to the existing Upper and Middle South Coast supply area.

Permanent inundation of agricultural activities and thus loss of agricultural land on the north bank of the uMkhomazi River and inundation of a dirt access road on the south bank will occur as a result of the raising of the Goodenough weir.

15.5.2 Impact Assessment

Surface Water – Hydrology							
Project Lifecycle:	Construction Phase						
Potential Impact:	Impacts to watercourses from temporary diversions						
Proposed Mitigation:	• Minimise influence to downstream flow regime when diverting and impeding flow (cofferdams, temporary river crossings etc.). • Prevent erosion caused by temporary in-stream diversion. Install suitable buttressing / stabilisation structures to prevent future erosion, if required. • Select appropriate crossing points (geotechnical conditions, sensitivity of riparian habitat and in-stream habitat), depending on technical feasibility.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

Surface Water – Hydrology							
Project Lifecycle:	Operational Phase						
Potential Impact:	Impacts to flow regime in the uMkhomaas River during the operation of LUBWSS-WSS						
Proposed Mitigation:	• Water abstracted from the uMkhomaas River must not impact the EWR of the uMkhomaas River and uMkhomaas Estuary, i.e. the EWR must be satisfied and over abstraction must not take place.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Moderate	2	-12
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

Surface Water – Water Quality							
Project Lifecycle:	Construction Phase						
Potential Impact:	• Contamination of surface water through sedimentation from instream works and silt-laden runoff from disturbed areas. • Water quality impacts due to spillages and poor construction practices.						
Proposed Mitigation:	• Conduct water quality monitoring (baseline and during construction) at suitable up- and downstream sites on the uMkhomaas River. • All diffuse pollution sources to be managed to prevent pollution of the watercourses in the project area. • Storage area and ablution facilities to be located 50m from edge of riparian habitat. • Where necessary, install in-stream silt traps during construction within the watercourse channel and along the riparian habitat. The style of silt trap will depend on materials used and the water movement patterns. • Implement suitable stormwater measures during construction to manage ingress of runoff into watercourses. • 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. • Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. constructed out of geo-textiles and hay bales).						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	High	Short	Likely	3	-54
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

Surface Water – Water Users							
Project Lifecycle:	Construction and Operational Phases						
Potential Impact:	• Impacts to lawfully entitled water users						
Proposed Mitigation:	• Manage water quality during construction. • Relocation of infrastructure, if impacted on by the proposed developments. • Compensation for affected landowners for land lost to inundation as a result of the raising of the Goodenough weir.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Regional	High	Long Term	Likely	3	-81
With Mitigation	-	-	-	-	-	0	0

The methodology used by the aquatic and wetland specialist differs slightly from that described in Section 15.1.7. All impacts were analysed with regard to their nature, extent, magnitude, duration, probability and significance. The assessments below were extracted from the Aquatic and Wetland baseline and Impact Assessment (The Biodiversity Company, 2017) (**Tables 49**, **50** and **51**).

Table 49: Activity and Impact Table for the Proposed Project

Phase	Activity	Aspect	Impact
Construction	Construction of road and pipeline network	Site clearing and compaction	The activity would result in the deterioration of water and habitat quality within the downstream river reaches. Wetlands will be traversed and flows (surface and interflow) disrupted.
		Storage and use of construction materials	
		Alteration of catchment drainage	
	Weir and abstraction works	Physical construction of the structure including the excavation of the streambed and removal of bank vegetation	Direct instream habitat loss and up and downstream habitat deterioration. Water quality impacts may also be anticipated through increased nutrients, suspended and dissolved solids
		Diversion of river for construction activities	
		Temporary infrastructure including mixing areas and ablutions	
		Runoff of construction materials	
		Spills and leaks of hydrocarbons and the operation of machinery	
	Reservoir	Construction of reservoirs	Increased runoff emanating from the hardened surface
	Water Treatment Plant	Site clearing and compaction	Increased runoff emanating from the hardened surface. Loss of wetland areas.
		Storage and use of construction materials	Potential for downstream water quality impacts
		Alteration of catchment drainage	Increased runoff and potential alterations from the hardened surfaces

Phase	Activity	Aspect	Impact
	Pump stations	Alteration of catchment drainage	Increased runoff and potential alterations to wetlands and aquatic habitats from the hardened surfaces
		Storage and use of construction materials	Potential for downstream water quality impacts
Operation	Operation of the weir and abstraction	Initial flooding of the impoundment	The flooding of upstream aquatic habitat and loss of water quantity downstream
		Maintenance of the impoundment and presence of barrier	The barrier will alter the hydrology of the river system resulting in negative effects to the ecology of the river system. The barrier will serve to sever connectivity between up and downstream river reaches
		Physical abstraction of water	Alteration of natural wetlands, instream and riparian habitats
	Operation of the roads and pipeline infrastructure	Runoff of contaminants and alteration of catchment hydrology	Water and habitat quality impacts to downstream river reaches
	Operation of reservoir	Alteration of catchment drainage	Potential for downstream water quality impacts
	Operation of pump stations	Alteration of catchment drainage	Increased runoff and potential alterations to wetlands and aquatic habitats from the hardened surfaces
		Hydrocarbon spillages	Potential for downstream water quality impacts
	Operation of Water Treatment Plant	Chemical spillage	Potential for downstream water quality impacts
		Alteration of catchment drainage	Increased runoff and potential alterations to wetlands and aquatic habitats from the hardened surfaces

Table 50: DWS Risk Impact Matrix for the Proposed Project

Risk Matrix (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol) This risk assessment was completed by Russell Tate (Pr. Sci. Nat: 400089/15)								
Aspect	**Flow Regime**	**Water Quality**	**Habitat**	**Biota**	**Severity**	**Spatial scale**	**Duration**	**Consequence**
Construction Phase								
Site clearing and compaction	2	2	2	2	2	2	3	7
Storage/runoff of construction materials	0	3	1	3	1.75	2	3	6.75
Alteration of catchment drainage (Weir)	3	1	3	2	2.25	2	3	7.25
Alteration of catchment drainage (Associated Infrastructure)	1	3	1	2	1.75	1	3	5.75
Physical construction of the weir and abstraction works structure including the excavation of the streambed and removal of bank vegetation	2	2	3	3	2.5	2	3	7.5
Diversion of river for construction activities	3	2	3	2	2.5	1	3	6.5
Temporary infrastructure including mixing areas and ablutions	1	3	1	2	1.75	1	3	5.75
Spills and leaks of hydrocarbons and the operation of machinery	0	3	0	2	1.25	1	3	5.25
Runoff of construction materials	0	2	1	2	1.25	**1**	**3**	5.25
Operational Phase								
Initial flooding of the impoundment	4	2	4	4	3.5	2	4	9.5
Maintenance of the impoundment and presence of barrier	1	1	1	1	1	1	4	6
Physical abstraction of water	1	1	1	1	1	1	4	6
Runoff of contaminants and alteration of catchment hydrology	1	1	1	1	1	1	4	6

Table 51: DWS Risk Impact Matrix for the Proposed Project

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase								
Site clearing and compaction	2	4	**5**	1	12	84	**Moderate**	**Moderate**
Storage of construction materials	2	3	1	3	9	60.75	**Moderate***	**Low**
Alteration of catchment drainage (Weir)	2	4	5	1	12	87	**Moderate**	**Moderate**
Alteration of catchment drainage (Associated Infrastructure)	2	4	5	1	12	90	**Moderate**	**Moderate**
Physical construction of the weir and abstraction works structure including the excavation of the streambed and removal of bank vegetation	2	4	5	1	12	78	**Moderate***	**Low**
Diversion of river for construction activities	2	3	5	3	13	84.5	**Moderate**	**Low**
Temporary infrastructure including mixing areas and ablutions	2	1	1	3	7	36.75	**Moderate***	**Low**
Spills and leaks of hydrocarbons and the operation of machinery	2	1	1	3	7	36.75	**Low**	**Low**
Runoff of construction materials	2	3	1	3	9	47.25	**Low**	**Low**
Operational Phase								
Initial flooding of the impoundment	1	5	5	1	12	114	**Moderate**	**Moderate**
Maintenance of the impoundment and presence of barrier	5	5	5	1	16	96	**Moderate**	**Moderate**
Physical abstraction of water	5	4	5	3	17	102	**Moderate**	**Moderate**
Runoff of contaminants	4	3	1	2	10	60	**Moderate**	**Low**

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

15.5.3 Mitigation Measures

15.5.3.1 Maintenance of Connectivity

The loss of connectivity between areas up- and downstream of the weir/abstraction works are anticipated to have the largest ecological impact, especially when considering the listed Near Threatened Eel species. It is anticipated that the weir will act as a barrier to fish migration. Therefore, in order to facilitate the movement of fish species, a fish ladder is recommended as the mitigation action. A fish ladder has been included in the initial proposed weir design options. However, the option considered from an aquatic ecology perspective should pose the least risk to fish migration.

Detailed fish ladder designs should implement the established protocols found in Water Research Commission (WRC) report No 1270/2/04 and WRC report No 1310/1/05. Essentially, four types of fishways should be considered namely: Pool and weir, vertical-slot, pool and slot, and natural by-pass channels.

Considering this literature, 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;

15.5.3.2 Mitigation for Altered Hydrology

The following mitigation measures are prescribed:

- The Ecological Water Requirements of the downstream environment must be determined and adhered to.
- An Ecological Water Requirement assessment for the downstream uMkomazi Estuary must be completed. The derived volume of water to maintain the estuary in a healthy state must be released.
- 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;
- Stormwater 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.

15.5.3.3 Mitigation for Impaired Water Quality Protection

The following mitigation measures are prescribed:

- Stormwater 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.

15.5.3.4 Mitigation for Erosion and Sedimentation

The following mitigation measures are prescribed:

- Stormwater 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 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;

- 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;
- 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; and
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.

15.5.3.5 Pipeline Trench Rehabilitation Measures

The following measures are required for digging within the watercourses:

- 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;
- 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;
- The soils must be removed in such a way that they can be easily reinstated in the reverse order;
- 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 top soil should be ripped and vegetation re-planted or seeds dispersed; and
- The construction of the pipeline should be undertaken in the dry season.

15.6 Estuary

15.6.1 Potential Impacts

The proposed developments can have an impact on the Umkomaas Estuary. The impact of the proposed project on the estuary downstream of the river is considered very sensitive and impacts are likely to occur on this ecosystem. The water requirements for the Umkomaas Estuary need to be met in order to not have an impact on the estuary. The weir and pump station need to be designed in order to meet the water requirements of the estuary.

The Estuarine Specialist noted two potential impacts on the estuarine environment during the construction phase were identified and two during the operational phase of the project:

- Decreased or halted flow of water due to abstraction of water from the river; and
- Impact to sediment balance.

15.6.2 Impact Assessment

The impact assessment below was extracted from the Estuarine Specialist Study (Anchor Environmental Consultants, 2017):

15.6.2.1 Construction Phase

Table 52: Impact 1: Alteration of water flow during weir upgrade

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local **1**	Low **3**	Short-term **1**	**Low 5**	Definite	**LOW**	**- ve**	Low
Essential mitigation measures: • 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;								
With mitigation	Local **1**	Low **1**	Short-term **1**	**Very low 3**	Definite	**VERY LOW**	**- ve**	Low

Table 53: Impact 2: Decrease in sediment load

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local **1**	Medium **1**	Short-term **1**	**Low 3**	Definite	**LOW**	**- ve**	Low
Essential mitigation measures: • Return sediment to system guided by an appropriate management scenario								
With mitigation	Local **1**	Low **1**	Short-term **1**	**Very Low 3**	Definite	**VERY LOW**	**- ve**	Low

15.6.2.2 Operational Phase

Table 54: Impact 1: Abstraction of water during periods of high flow

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional **2**	High **3**	Long-term **3**	**Very high 8**	Probable	**VERY HIGH**	**- ve**	Medium
Essential mitigation measures: • Implement alternative flow scenarios (MK21, MK22, MK23 or MK42) as identified in the Mvoti to Umzimkulu Classification study (DWA 2012) • Implement the following additional offset measures identified in the Mvoti to Umzimkulu Classification study (DWA 2012): ○ 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.								
With mitigation	Local **1**	Low **1**	Long-term **3**	**Medium 6**	Probable	**MEDIUM**	**- ve**	Medium

Table 55: Impact 2: Decrease in sediment load

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	Medium 2	Long-term **3**	**High 7**	Possible	**MEDIUM**	**- ve**	Low
Essential mitigation measures: • Return sediment to system guided by an appropriate specialist management scenario								
With mitigation	Regional 2	Low 1	Long-term **3**	**Medium 6**	Possible	**LOW**	**- ve**	Low

15.7 Terrestrial Ecology

15.7.1 Potential Impacts

15.7.1.1 Flora

Vegetation will be lost within areas that are to be cleared for the project infrastructure such as the pump station. The potential loss of significant flora species may occur, which needs to be investigated further.

Clearing of vegetation for construction purposes may result in the proliferation of exotic vegetation, which could spread beyond the construction domain. This potential impact will need to be managed.

15.7.1.2 Fauna

Vulnerable species could occur within the study area and the construction of the proposed development will have a negative impact on the habitats of such species. Fauna could be adversely affected through construction-related activities (noise, illegal poaching, and habitat loss).

Animal species may be impacted upon directly through mortality of individuals during site preparation and site clearing for the proposed pipeline and related infrastructure.

Faunal habitats will be lost through the clearing of vegetation as well as alteration of habitat. The areas designated as WTP Site 1 and WTP Site 2 constitute sensitive areas in the context of the proposed development, especially from an amphibian perspective.

15.7.2 Impact Assessment

The impact assessment below was extracted from the Terrestrial Biodiversity Report (Khuselimvelo Consulting, 2017):

Table 56: Impact Significance Scoring

	Spatial extent		Severity / intensity / magnitude		Duration		Resource loss		Reversibility		Probability		SIGNIFICANCE SCORE	
Mitigation	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Impacts														
Habitat Disturbance (Amphibian Breeding)	3	3	3	2	3	3	5	4	7	7	0,8	0,3	16,8	5,7
Habitat Disturbance (General Terrestrial)	1	1	3	1	1	1	3	2	3	3	0,8	0,5	8,8	4
Biodiversity importance (protected flora)	3	2	4	2	3	1	5	2	3	1	0,8	0,5	14,4	4
Biodiversity importance (protected fauna)	3	2	5	2	3	1	3	1	3	1	0,8	0,3	13,6	2,1
Spread of IAPs	3	1	4	2	3	1	6	3	3	1	1	0,5	19	4
Inadequate Rehabilitation	5	2	7	4	7	6	6	6	6	6	1	0,5	31	12
									Overall Impact/Risk				Medium	Medium to low
													14,08	3,975

Table 57: Mitigation Measures Proposed

Mitigation	Indicator	Timeframe	Person Responsible
Sensitive Amphibian Breeding Areas			
Locate and verify breeding site	GPS Coordinates, Confirmation of site from Specialist	Prior to project commencement	Project Manager, Environmental Officer
Demarcate and avoid working within 15m of site boundary	Demarcated area, Education Plan including Amphibian sensitivity	Prior to project commencement	Engineer, Project Manager, Environmental Officer
Assess site integrity	Confirmation of breeding site integrity from Specialist	Prior to project commencement and annually thereafter.	Project Manager, Environmental Officer
Mitigation	**Indicator**	**Timeframe**	**Person Responsible**
General Terrestrial			
Work within a defined servitude (40m or less)	No work or disturbance beyond working servitude	Throughout project life cycle	Engineer, Project Manager, Environmental Officer
Ensure that pollution is avoided	No pollution from the construction and operation of proposed development	Throughout project life cycle	Environmental Officer

Have demarcated areas for workers during breaks, ablution and equipment storage and repair	Clearly demarcated workers areas	Throughout project life cycle	Environmental Officer
Maintain low noise levels	Noise levels at acceptable levels, vehicles fitted with silencing technology	Throughout project life cycle	Environmental Officer
Mitigation	**Indicator**	**Timeframe**	**Person Responsible**
Biodiversity importance (protected flora)			
Locate and verify	GPS Coordinates, Confirmation of site from Specialist	Prior to project commencement and biannually thereafter	Project Manager, Environmental Officer
Demarcate and avoid boundary	Demarcated area, Education Plan including plant sensitivity	Throughout project life cycle	Environmental Officer
Relocate Plants	Permission to demarcate from relevant authority (EKZNW)	Prior to project commencement	Environmental Officer

Mitigation	**Indicator**	**Timeframe**	**Person Responsible**
Biodiversity importance (protected fauna)			
Locate and verify areas of possible occurrence and breeding	GPS Coordinates, Confirmation of site from Specialist	Prior to project commencement and biannually thereafter	Project Manager, Environmental Officer
Demarcate and avoid boundary	Clear demarcations of breeding areas and high potential areas of occurrence	Throughout project life cycle	Environmental Officer

Mitigation	**Indicator**	**Timeframe**	**Person Responsible**
Spread of IAPs			
Document alien species found on site	List of Invasive alien plants	Prior to project commencement and monthly thereafter.	Project Manager, Environmental Officer
Alien plant distribution and densities	Distribution Maps, Density estimates, GPS coordinates	Monthly	Project Manager
Document and record alien control measures implemented	Record of Clearing Activities	Quarterly	Project Manager
Review alien control success rate	Decline in the abundance of alien plant species over time	Annually	Project Manager
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Annually	Project Manager, Environmental Officer
Monitor re-vegetated area and the success of indigenous species re-establishment	Alien plant surveys and distribution map. Records of control measures and their success rate.	Biannually.	Project Manager, Environmental Officer

Mitigation	**Indicator**	**Timeframe**	**Person Responsible**
Rehabilitation			
Avoid exposing the area to soil erosion	Ensure correct rehabilitation takes place during construction phase (phased rehabilitation planning)	Throughout project life cycle	Engineer, Project Manager, Environmental Officer

15.8 Socio-Economic Environment

15.8.1 Potential Impacts

A positive impact could be the creation of short-term work opportunities for local residents during construction, as well as long-term work during the operation of the pump station and maintenance of the pipeline.

There could be an influx of job seekers during the construction phase that could lead to tensions between local residents wanting to find employment and those coming from outside the area to do the same.

The influx of construction workers could also have a similar effect especially if the workers are not respectful of local customs and traditions.

Given the quiet pristine nature of the project area, construction activity is likely to cause a number of social nuisances as well as economic implications on the communities and farming activities.

The following impacts were identified by the Socio-Economic Impact Assessment:

- Impacts due to land acquisition:
    - Partial loss of livelihood on the part of landowners;
    - Reduced access to productive land;
    - Development constraints within Craigieburn; and
    - Visual Impact.
- Impacts Due to Scheme Operations:
    - Economic growth and induced impacts;
    - Opportunity for local business;
    - Employment of local people;
    - Skills development;
    - Noise;
    - Odour;
    - Light pollution;
    - Access across the weir; and
    - Safety concerns.
- Impacts occurring at the construction phase
    - Security Concerns;
    - Damage to property or equipment;
    - Damage or wear to access roads;
    - Improvement of access in the project area;
    - Proximity to construction work and associated inconvenience and dangers;
    - Employment of local people;
    - Sourcing of equipment, machinery and services locally;

- Noise;
- Dust;
- Noise;
- Influx of workers;
- Employment of local people;
- Sourcing of equipment, machinery and services locally;
- Temporary road closures;
- Increased traffic;
- Security;
- Improved access to amenities;
- Noise;
- Employment of local people; and
- Sourcing of equipment, machinery and services locally.

15.8.2 Impact Assessment

The impact assessment below was extracted from the Socio-Economic Impact Assessment (Nemai Consulting, 2017):

Environmental Feature	Impact owing to Land and Rights Acquisition
Relevant Alternatives & Activities	Acquisition of land
Project life-cycle	Pre-construction
Potential Impact	Proposed Management Objectives / Mitigation Measures
Loss of income from the acquisition of land	• 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 Umgeni 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 Umgeni Water for any compensation of potential income denied as a result of the servitude agreements.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Regional	Medium	Medium term	Likely	3
After Mitigation	Negative	Local	Medium	Medium term	Likely	1
Significance of Impact and Preferred Alternatives	The final routing of the pipelines and the selection of the WTP site are the primary mitigation measure that should be adopted. The routing and site selection should be carried out so as to avoid impacting upon existing development as far as possible.					

	There will exist other considerations, such as hydraulic and other engineering considerations that influence the routing and site selection, thus, if it is not possible to avoid the impacts, they should be mitigated through the process of landowner negotiation and compensation for loss. On this basis, and for the avoidance of impact, this study prefers Site 1 for the WTP owing to the least impact on existing development for the gravity pipeline from the WTP to the Quarry Reservoir.
Environmental Feature	Impact of the siting of WTP 2 on Craigieburn Urban Core
Project life-cycle	Operational Phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Fugitive light which lights up the night sky	• Locate the WTP in a site that least impacts on the future development trajectory of Craigieburn; • Alternatively, the WTP should occupy as small footprint as possible on Site 2.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	High	Long Term	Likely	3
After Mitigation	Negative	Local	Medium	Long Term	Likely	2

Significance of Impact and Preferred Alternatives	The siting of the WTP on Site 2 will impact upon the location of future residential development within the town. Currently the zoning for future residential development is located close to the urban centre and will contribute to the development of the urban centre. A land use such as the WTP will not contribute as much to the urban centre since it is a less people intensive activity, who will need less goods and services to be provided by the town centre than the WTP. As a result, this study shows a preference for Site 1 as a suitable location for the WTP.
Environmental Feature	Impacts generated from area lighting at night
Project life-cycle	Construction and Operational Phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Fugitive light which lights up the night sky	• 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.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Regional	High	Long Term	Likely	3
After Mitigation	Negative	Local	Medium	Long Term	Likely	2

Significance of Impact and Preferred Alternatives	Lighting impacts can be controlled through engineering interventions which should be very effective. This mitigation measure does not influence the alternatives considered in the study.
Environmental Feature	Economic opportunities arising from the construction phase
Project life-cycle	Construction phase

Potential Impact	Proposed Management Objectives / Mitigation Measures
SMME Creation	• Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.
Job Creation and Skills Development	• 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.
Indirect Employment Impacts	• 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.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Positive	Local	Medium	Short Term	Likely	1
After Mitigation	Positive	Local	Low	Short Term	Likely	3
Significance of Impact and Preferred Alternatives	Those who will benefit during the construction is limited to those who actively participate in the construction activity through employment, sub-contracting or other economic opportunities. Active participation should be encouraged. The benefits on such a construction will take place irrespective of which routing and site alternative is preferred.					

Environmental Feature	Short-term disturbance arising from the construction phase
Project life-cycle	Construction phase
Potential Impact	Proposed Management Objectives / Mitigation Measures
Traffic	• Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site. • The EMPr must include restrictions on the Contractor and its sub-contractors related to minimising 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.
Local Road Condition	• 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.
Increase in Dust	• 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.
Influx of workers	• 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.

Worker Health and Safety	• 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.
Security	• 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.
Noise impacts	• 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.
Damage to property	• 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.

	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Short Term	Likely	2
After Mitigation	Negative	Local	Low	Short Term	Moderate	1
Significance of Impact and Preferred Alternatives	Disturbances during the construction phase can be successfully mitigated through contractor specifications issued at tender stage and through monitoring of contractor performance during the construction phase. Negative impacts owing to the construction will be experienced irrespective of the site and routing alternative that is chosen.					

15.9 Heritage Resources

15.9.1 Potential Impacts

Heritage resources such as archaeological and cultural-historical sites or artefacts may be found in or near the dam sites that could be destroyed during construction. Such heritage resources will need to be identified (if any) and protected (if required).

No archaeological residues were observed at spot checks along the proposed pipeline servitude.

No graves were observed in the vicinity of the pipeline corridor. The pipeline alignment to the Quarry Reservoir traverses the boundary of the Craigieburn Municipal Cemetery. However, there is sufficient buffer to survey the alignment away from any existing graves.

A Hindu Temple observed within the assessment corridor will not be directly affected by the installation of the rising main pipeline from the Goodenough Weir. However, 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.

15.9.2 Impact Assessment

Summary of findings in terms of the NHRA, Act 25 of 1999 Section 38 (3):

(a) the identification and mapping of all heritage resources in the area affected

i. A Hindu Temple dated to inception in 1915

(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in regulations

i. Hindu Temple – high heritage significance at all levels for its historic, social and spiritual values

(c) an assessment of the impact of development on such heritage resources

Low. Possible dust inconvenience during construction

The proposed development will impose no permanent or negative transformation of the current agricultural and peri-urban landscape. Such services infrastructure provision is in keeping with the current development trends along this section of the KwaZulu-Natal southern coastal landscape.

The impact assessment below was extracted from the HIA (eThenbeni Cultural Heritage, 2017):

Table 58: Assessment of Heritage Resources

Heritage Resources Assessment Table				
Category	**Observed**	**Significance**	**Impact**	**Mitigation**
Places, buildings and structures	Hindu Temple	High	Low	dust supression
places attached to oral traditions; associated with living heritage	None	~	None	None
historical settlements and townscapes	None	~	Low	None
geological sites of scientific or cultural importance	None	~	None	None
archaeological and palaeontological sites	None	~	Low	None *
graves and burial grounds	None	High	Low	None **
public monuments and memorials	None	~	None	None
Battlefields	None	~	None	None

HERITAGE							
Potential Impact:	Damage to heritage resources and archaeological sites.						
Proposed Mitigation:	• If any archaeological material, such as sites, objects or features, as well as graves and burials are uncovered during construction activities on site, work will cease immediately and an archaeologist should be contacted as a matter of urgency in order to assess such occurrences. • Permits to be obtained from the PHRAG if heritage resources are to be impacted upon. • No person may, without a permit issued by SAHRA or a provincial heritage resources authority: o Destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves; o Destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority or; o Bring onto or use at a burial ground or grave referred to in above any excavation equipment, or any equipment which assists in the detection or recovery of metals.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Low	Short	Unlikely	2	-10
With Mitigation	-	Local	Low	Short	Unlikely	1	-6

Mitigation measures to be implemented:

- If permission is granted for development to proceed, the client is reminded that the Act requires that a developer cease all work immediately and notify Amafa should any heritage resources.
- 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. Further, the appointed project ECO can be inducted as to the protocols for any chance discoveries of archaeological material or human remains during the course of the project. Should such be present, rescue excavation of these will be motivated for as and when their significance has been ascertained.
- In the event of the discovery of unmarked or hidden graves the Graves Protocol appended to the HIA.
- 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.
- It is possible that sub-surface heritage resources could be encountered during the construction phase of this project. The ECO and all other persons responsible for site management and excavation should be aware that indicators of sub-surface sites could include:
  - Ash deposits (unnaturally grey appearance of soil compared to the surrounding substrate);
  - Bone concentrations, either animal or human;
  - Ceramic fragments, including potsherds;
  - Stone concentrations that appear to be formally arranged (may indicate the presence of an underlying burial, or represent building/structural remains); and
  - Fossilised remains of fauna and flora, including trees.
- In the event that such indicator(s) of heritage resources are identified, the following actions should be taken immediately:
  - All construction within a radius of at least 20m of the indicator should cease. This distance should be increased at the discretion of supervisory staff if heavy machinery or explosives could cause further disturbance to the suspected heritage resource.

- This area must be marked using clearly visible means, such as barrier tape, and all personnel should be informed that it is a no-go area.
- A guard should be appointed to enforce this no-go area if there is any possibility that it could be violated, whether intentionally or inadvertently, by construction staff or members of the public.
- No measures should be taken to cover up the suspected heritage resource with soil, or to collect any remains such as bone or stone.
- If a heritage practitioner has been appointed to monitor the project, s/he should be contacted and a site inspection arranged as soon as possible.
- If no heritage practitioner has been appointed to monitor the project, the head of archaeology at Amafa's Pietermaritzburg office should be contacted; telephone 033 3946 543.
- The South African Police Services should be notified by an Amafa staff member or an independent heritage practitioner if human remains are identified. No SAPS official may disturb or exhume such remains, whether of recent origin or not.
- All parties concerned should respect the potentially sensitive and confidential nature of the heritage resources, particularly human remains, and refrain from making public statements until a mutually agreed time.
- Any extension of the project beyond its current footprint involving vegetation and/or earth clearance should be subject to prior assessment by a qualified heritage practitioner, taking into account all information gathered during the initial assessment.

15.10 Air Quality

15.10.1 Potential Impacts

Potential impacts during the construction phase include:

- Dust will be generated during the construction period from various sources, including blasting, earthworks, stockpiles, use of access roads, transportation of spoil material and general construction activities on site; and
- Exhaust emissions from vehicles and equipment.

Mitigation measures are included in the EMPr to ensure that the air quality impacts during the construction phase are suitably monitored (dust fallout and particulate matter) and managed and that regulated thresholds are not exceeded.

Potential sources of air pollution during the operational phase of the WTP include unmitigated storage and use of dangerous goods (chlorine and other chemicals) and the use of the emergency back-up generator.

15.10.2 Impact Assessment

Air Quality

Project Lifecycle:	Construction Phase						
Potential Impact:	• Excessive dust levels as a result of construction activities						
Proposed Mitigation:	• 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 and access roads. Note that all dust suppression requirements should be based on the results from the dust monitoring and the proximity of sensitive receptors. • 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, pre-notification of affected parties). • Air quality to be monitored (baseline and during construction) for dust fallout and particulate matter. Sampling locations to consider major sources of dust and sensitive receptors.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

15.11 Noise

15.11.1 Potential Impacts

During construction, localised increases in noise will be caused by blasting, earthworks, vehicles on haul roads and access roads, and general construction activities on site. Vibration would be felt close to construction equipment. Use of local roads to WTP for collection and disposal of sludge, delivery of materials, and general staff access.

Noise that emanates from construction activities will be addressed through targeted best practices for noise monitoring and management in the EMPr. It is assumed that the pump station will comply with best practices to limit any noise impacts.

It is not anticipated that the noise generated at the WTP will be audible beyond the property boundary of the facility. However, the potential noise impacts need to be considered in terms of the nature of the WTP site within Craigieburn. In addition, the operation of the pump station may increase the noise levels in the study area.

15.11.2 Impact Assessment

Noise							
Project Lifecycle:	Construction Phase						
Potential Impact:	• Excessive noise levels as a result of construction activities						
Proposed Mitigation:	• The provisions of SABS 1200A will apply to all areas within audible distance of residents. • Working hours to be agreed upon with Project Manager, so as to minimise disturbance to landowners/occupiers and community members. • Construction activities generating output levels of 85 dB or more will be confined to normal working hours. • Noise preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to be employed. • Blasting operations to be controlled to ensure sound pressure levels are kept below the generally accepted 'no damage' level of 140 decibels. • Noise to be monitored (baseline and during construction). Sampling locations to consider major noise sources and sensitive receptors.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24

With Mitigation	-	Local	Low	Short	Unlikely	1	-4

15.12 Visual

15.12.1 Potential Impacts

Potential visual impacts during the construction phase will be caused by poor placement of the construction camp and equipment, as well as poor management of rubble, refuse and construction material on site. Thus, the visual impacts should be minimised.

The gravity main will be buried while the pump station will be located in a valley next to the uMkhomazi River at the weir location. However, there is a visual impact to the surrounding landowners from the weir and abstraction works. The gravity mains running through Craigieburn will be underground and thus there will be minimal visual impact. The WTP built within the town will have a visual impact to the communities in and around the area.

Due to the valley within WTP Site 1, the WTP will be more difficult to construct and therefore there will be more cut and fill activities which would result in a larger visual impact than at WTP Site 2. Although WTP Site 1 is surrounded by less residences than WTP Site 2, it is proposed that an access road be constructed which can be lined with trees to create a buffer between the residences and the WTP.

15.12.2 Impact Assessment

Visual							
Project Lifecycle:	Construction Phase						
Potential Impact:	• Reduction in visual quality due to construction activities.						
Proposed Mitigation:	• On-going housekeeping to maintain a tidy construction area. • Construction camp to be positioned so as to minimize its visual impacts. • Damage to the natural environment should be minimised. • Vegetation should be cut only if absolutely necessary. • The clearing of all sites should be kept to a minimum and surrounding vegetation should as far as possible be left intact as a natural shield. • The fragmentation of stands of indigenous vegetation and straight lines on trees should as far as possible be minimized. • No painting or marking of natural features shall be allowed. Marking for surveying and other purposes shall only be with pegs and beacons. • Trees and all woody shrubs should be protected from damage to provide a natural visual shield. Excavated material should not be placed on such plants and movement across them should not be allowed as far as practical. • No construction rubble, construction material, refuse, litter or any other material not found naturally in the surroundings should be allowed at any time to be lying around on the construction site. • Particular aspects of concern to landowners and local residents should be addressed during construction.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Medium	Short	Unlikely	1	-8
Project Lifecycle:	Operational Phase						
Potential Impact:	• Reduction in visual quality due to permanent structures (WTP, reservoir, pump stations).						

Proposed Mitigation:	• On-going housekeeping to maintain a tidy construction area. • No painting or marking of natural features shall be allowed. • Lighting features are to be directed away from residences in order to minimise light pollution to private properties. • Particular aspects of concern to landowners and local residents should be addressed.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Permanent	Likely	2	-36
With Mitigation	-	Local	Medium	Permanent	Likely	1	-18

15.13 Access Roads

15.13.1 Potential Impacts

- During the construction period, there will be an increase in traffic on the local road networks due to the delivery of plant and material, transportation of staff and normal construction-related traffic. Haul roads and access roads will also be created on site, within the construction domain.
- As part of the construction phase, measures will be implemented for the selective upgrade of the roads (if necessary) and to render these roads safe for other users (amongst others).
- After the construction phase, the local roads will only need to be used for operation and maintenance purposes.

Any disruptions to the transportation network must be mitigated, and will be discussed in the EMPr.

15.13.2 Impact Assessment

Access Roads							
Project Lifecycle:	Construction Phase						
Potential Impact:	• Inadequate road conditions • Disruptions to existing road users • Safety risks • Increase in dust levels						
Proposed Mitigation:	• Make provision for landowners and affected parties to access their properties. • Speed limit of 40km/h on public and other roads within the project area to be adhered to. • Access roads to be maintained in a suitable condition. • 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. • Clearly demarcate all access roads. Clearly mark pedestrian-safe access routes.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	3	-36
With Mitigation	-	Local	Low	Short	Moderate	1	-5

15.14 Traffic

15.14.1 Potential Impacts

During the construction period, there will be an increase in traffic on the local road networks due to the delivery of plant and material, transportation of staff and normal construction-related traffic. Haul roads and access roads will also be created on site, within the construction domain.

As part of the construction phase, measures will be implemented for the selective upgrade of the roads (if necessary) and to render these roads safe for other users (amongst others). After the construction phase, the local roads will only need to be used for operation and maintenance purposes.

All the appropriate traffic safety measures and control must be implemented to minimise any potential impacts associated with the construction of the LUBWSS-WSS. Any disruptions to the transportation network must be mitigated, and will be discussed in the EMPr.

A Traffic Impact Assessment was conducted and the recommendations from the assessment has been incorporated into the EMPr to be implemented.

15.14.2 Impact Assessment

Traffic							
Project Lifecycle:	Construction Phase						
Potential Impact:	• Inadequate road conditions • Disruptions to existing road users • Safety risks • Increase in dust levels						
Proposed Mitigation:	• Make provision for landowners and affected parties to access their properties. • Speed limit of 40km/h on roads within the project area to be adhered to. • Access roads to be maintained in a suitable condition. • 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. • Clearly demarcate all access roads. Clearly mark pedestrian-safe access routes.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	3	-36
With Mitigation	-	Local	Low	Short	Moderate	1	-5

15.15 Safety and Security

15.15.1 Potential Impacts

All environmental hazards and safety risks must be included in the employees' safety file for inclusion into the contractor's mitigation measures.

15.15.2 Impact Assessment

Safety and Security							
Project Lifecycle:	Construction Phase						
Potential Impact:	• Uncontrolled access to proposed boundary extension. • Demolition activities. • Construction employees getting injured. • Open trenches and construction vehicles may pose a safety risk.						
Proposed Mitigation:	• Compliance with Occupational Health and Safety Act (Act No. 85 of 1993). • Contractor to provide an Occupational Health and Safety Management Plan to the Construction Manager for approval prior to the commencement of works in terms of the Construction Regulations (2014). • Proper supervision of employees at all times. Employees to be clearly identifiable. • Employees to remain within the site boundary and no loitering to be allowed. • Access into and out of the servitude must only be via existing access roads from local public roads. • Contractor to prepare and submit, for approval, a rescue procedure for employees in the case of an injury. • Any employees of the Contractor or his sub-contractors found to be in breach of any of the Environmental Protection specifications may be ordered to leave the site forthwith. • Supervisory staff of the contractor, or sub-contractors shall not direct any person to undertake any activities, which would place such person/organization in contravention to any law, regulation or the EMPr itself. • Depending on the type of contravention or action it may also be necessary for the work to be called to a halt until such time as the contravention or action is corrected and investigated. • 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.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	High	Short	Unlikely	3	-36
With Mitigation	-	Local	High	Short	Rare	1	-9

15.16 Waste Management

15.16.1 Potential Impacts

Waste management aims to avoid waste pollution of both land and water resources during and as a consequence of the proposed project. The following describes the impacts during the construction phase:

- 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);
- Wastewater (sanitation facilities, washing of plant, operations at the batching plant, etc.); and
- Disposal of excess spoil material (soil and rock) generated as part of the bulk earthworks.

15.16.2 Impact Assessment

Waste Management	
Project Lifecycle:	Construction Phase

Potential Impact:	• Land, air and water pollution through poor waste management practices						
Proposed Mitigation:	• No ablution facilities to be positioned within riparian or wetland area. • Sufficient ablution facilities to be provided at the Construction Camp and along construction servitude. • Suitable litter receptacles to be positioned strategically across the site at all working areas. • Waste must be separated at source (e.g. containers for glass, paper, metals, plastics, organic waste and hazardous wastes). • The Contractor shall dispose of all refuse generated on site or from the activities of construction or its related activities. The contractor shall on a weekly basis dispose of all refuse at an approved refuse disposal site. Proof of disposal must be kept on record. • Littering by the workers is prohibited. Clearly marked litterbins must be provided on site. • Monitor the presence of litter on site. All staff shall be sensitised to this effect. • The entire site will be cleared of construction material, metal, tins, glass bottles, and food packaging or any other type of empty container or waste material or waste equipment used by the construction team on a daily basis. • Waste material that may harm man or animals should be removed immediately. • No hazardous materials, e.g. oil, diesel and fuel should be disposed of in the veldt. Any diesel, oil or petrol spillages are to be collected and stored in specially marked containers and disposed of at a permitted waste disposal site and must be treated as hazardous waste. • No refuse or litter is allowed to be burnt on site. • The recycling of all waste is to be encouraged of both the contractor and staff. • All vehicle parking areas and vehicle servicing areas are to be inspected carefully for diesel, oil and other spillages weekly.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	3	-36
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

15.17 No-Go Impacts

Based on the medium growth scenario, the LUBWSS needs to be sized to provide an additional average volume of 100Ml/d (with a 130Ml/d designed peak capacity), to meet the future 30-year demand projection. The project is aimed at 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. If future water requirements are not met, severe and frequent restrictions of water supply may need to be implemented in the region. These restrictions would be in effort to support the projected growth and water requirements in the water supply area of the South Coast. Therefore, if the LUBWSS – WSS is not built, there would not be an increase in water supply to the Middle and Upper South Coast.

In addition, local employment opportunities will not be created and further economic growth and development within the area will not be promoted.

In contrast, should the proposed LUBWSS-WSS not go ahead, any potentially significant environmental issues associated with the project would be irrelevant and the status quo of the local receiving environment would not be affected by the project-related activities. The objectives of the project and the economic benefits discussed above would however not materialise.

15.18 Cumulative Impacts

According to GN No. R. 982 of the 2014 EIA Regulations, as amended (07 April 2017), a ***"cumulative impact"***, in relation to an activity, means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Cumulative impacts can be identified by combining the potential environmental implications of the proposed project with the impacts of projects and activities that have occurred in the past, are currently occurring, or are proposed in the future within the project area.

The following cumulative impacts are anticipated:

- Loss of sensitive vegetation types;
- Encroachment of alien vegetation;
- Damage to wetland habitat; and
- Traffic impacts.

Cumulative Impacts							
Potential Impact:	Loss of sensitive vegetation types						
Proposed Mitigation:	• 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. • Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks. • 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. • Implement suitable erosion control measures. • All conditions of the EMPr must be adhered to.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Long Term	Likely	2	-32
With Mitigation	-	Local	Low	Long Term	Unlikely	1	-6
Potential Impact:	Encroachment of alien vegetation						
Proposed Mitigation:	• Rehabilitation measures must be implemented once construction activities are complete to ensure that alien vegetation will be controlled during the construction and operational phases. • All conditions of the EMPr must be adhered to.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Moderate	2	-20
With Mitigation	-	Local	Low	Short	Unlikely	1	-4
Potential Impact:	Damage to wetland habitat						
Proposed Mitigation:	• Keep all demarcated sensitive zones outside of the construction area off limits during the construction and rehabilitation phases of the development. • Monitor all systems for erosion and incision. • Revegetate all disturbed areas with indigenous riparian species. • All conditions of the EMPr must be adhered to.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4
Potential Impact:	Construction-related traffic disruptions and deterioration of road conditions						

Proposed Mitigation:	• Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site. • 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 • All conditions of the EMPr must be adhered to.						
	Nature +/-	**Extent**	**Magnitude**	**Duration**	**Probability**	**Significance**	**Score**
Without Mitigation	-	Local	Medium	Short	Likely	2	-24
With Mitigation	-	Local	Low	Short	Unlikely	1	-4

The Aquatic and Wetland Specialist provided the following statement based on cumulative impacts:

There will be a reduced PES of the aquatic and wetland ecosystems associated with the proposed project. The scale of the impact may be observed up and downstream of the proposed abstraction point. In addition, should flow and sediment volumes be altered, an impact to the downstream uMkomazi Estuary can be anticipated. Therefore, it is proposed that more detailed assessments are conducted.

16 ANALYSIS OF ALTERNATIVES

Alternatives are the different ways in which the project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for the project. By conducting the comparative analysis, the BPEOs can be selected with technical and environmental justification. Münster (2005) defines BPEO as the alternative that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term".

16.1 No-Go Alternative

Based on the medium growth scenario, the LUBWSS needs to be sized to provide an additional average volume of 100Ml/d (with a 130Ml/d designed peak capacity), to meet the future 30-year demand projection. The project is aimed at 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. If future water requirements are not met, severe and frequent restrictions of water supply may need to be implemented in the region. These restrictions would be in effort to support the projected growth and water requirements in the water supply area of the South Coast.

In addition, local employment opportunities will be created during the construction phase and operational phase. The project will allow further economic growth and development within the area and therefore is of importance as the local area will benefit from this development in general.

16.2 Comparative Analysis of Alternatives based on Impact Assessment

Table 59 summarises and compares the findings of the various relevant specialists in terms of their respective preferences for the project alternatives based on the outcome of the specialist studies and impact assessment.

Table 59: Summary of the Specialists' Preferred Options

Environmental Feature/Attribute	WTP Site		Gravity Main	
	Site Option 1	Site Option 2	Option 1	Option 2
Terrestrial Ecology	**X**		**X**	
Riparian Habitat and Wetland		**X**		**X**
Heritage	No Preference			
Socio-Economic	**X**		**X**	
Technical		**X**		**X**

From an ecological perspective, the proposed WTP sites are problematic. The areas designated as WTP Site 1 and WTP Site 2 constitute sensitive areas in the context of the proposed development, especially from an amphibian perspective. WTP Site 1 is a hygrophilous grassland and is a sensitive habitat on the broader environmental context of the area. Any activity in this area would require a WULA and should take into account the possibility that the site may provide breeding and transit opportunities for amphibians of conservation significance. The same can be said of the WTP Site 2 site with the additional restriction of the site being designated as part of the D'MOSS.

It is the opinion of the Ecological Specialist that there should be no opposition to the proposed development provided that the WTP2 option is not entertained and that an alternative siting for WTP1 is investigated.

Considering the layout of the alternatives from an aquatic ecology perspective, the WTP Site alternative 1 and its associated pipeline infrastructure was more suitable. This conclusion was drawn largely due to the reduced number of pipeline watercourse crossings required. Therefore, this alternative would have a reduced impact to riverine conditions as compared to alternative 2. However, from a wetland perspective, WTP alternative 2 is more suited. A channelled valley-bottom and a floodplain is the only wetland within the proposed project site. The floodplain has been created due to artificial interferences (artificial surfaces) that has

caused an increase in run-off during high rainfall events, which ultimately leads to the flooding of the channelled valley-bottom's banks. Impacts to this wetland are therefore negligible.

Impacts on the floodplain wetland however cannot be avoided. Therefore, minimising relevant impacts as well as the implementation of rehabilitation methods will decrease the impacts to such an extent that the client may proceed with the intended construction project without a wetland offset.

Minimising impacts can be achieved by:

- Planning for the construction period to take place during the dry season;
- Trench footprints should be avoided as much as possible;
- Silt traps should be installed and
- On-site debris should be used to dissipate flows.

The layout of WTP alternative 1 is directly situated on top of three different HGM units, the moderate risks associated with the operational phase cannot be mitigated by means of extensions as in the case of WTP alternative 2. The infrastructure components are proposed to be constructed within the wetlands instead of roads (as in the case of WTP alternative 2), no mitigation can decrease the associated impacts. Considering this, should WTP alternative 1 be selected wetland offsets would be required. Therefore, regardless of the statement made regarding the number of crossings over channelled valley-bottom wetlands, it is recommended that WTP option 2 be favoured.

From a Socio-Economic perspective, in terms of the planned activities on Site 2, the city has proposed specialist residential uses and included a number of roads to facilitate this use. This site is adjacent to the primary residential area of Craigieburn and will sterilise future residential development within this node. Thus, there will be less activity in the nearby commercial centre, which would represent an economic loss to the town. The city has proposed light industrial use and the upgrading of the existing gravel road in the area on Site 1. For the avoidance of impact, the study prefers Site 1 for the WTP owing to the least impact on existing development for the gravity pipeline from the WTP to the Quarry Reservoir. Therefore, the Socio-Economic Specialist has recommended that Site 1 be the selected site. In addition, Option 1 for the gravity main from the WTP to the quarry reservoir is preferred as the pipeline route traverses largely un-used land and Option 2 pipeline route runs through Craigieburn's industrial area. The installation of Option 2 will result in disturbance to the companies operating in the industrial area. Possible long-term impacts will be felt through having to maintain and replace the pipeline in the future. This is a further factor militating against this route option.

From a heritage perspective, either option can be considered. There is no preference. One heritage resource of significance was identified within the proposed project area. A Hindu Temple established in 1915 is located in the vicinity of the proposed LUBWS pipeline servitude. However, it will not be affected or impinged upon by the proposed project activities.

16.3 Best Practicable Environmental Option (BPEO)

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts associated with the two WTP sites and associated gravity main to the quarry reservoir, WTP Site 2 was selected.

WTP Site 2 was selected due to the following reasons:

- From an aquatic and wetland perspective, WTP option 2 is favoured due to WTP option 1 being directly situated on top of three different HGM units and the moderate risks associated with the operational phase cannot be mitigated by means of extensions as in the case of WTP alternative 2. The infrastructure components are proposed to be constructed within the wetlands instead of roads (as in the case of WTP alternative 2), no mitigation can decrease the associated impacts. Considering this, should WTP alternative 1 be selected wetland offsets would be required.
- The valley caused by the perennial water course is situated centrally in Site 1, whilst it is on the boundary at Site 2. Site 2 thus has a more consistent slope across the site.
- Based on the topography of the land and WTP layouts generated, the preferred site from a hydraulic perspective is Site 2.
- The valley within Site 1 will make it difficult to construct the WTP and there will therefore be more cut and fill activities undertaken which will have a larger visual impact than for Site 2.
- Site 2 is larger than Site 1.
- From a cost perspective, the excavation volumes at Site 1 are anticipated to be higher. As platforms with common components at similar levels would need to be excavated to suitable founding levels, the excavation volumes would most likely be greater for WTP Site 1 with the valley through the middle of the site.
- From a geological perspective, test pitting was conducted on both WTP sites. No refusal was encountered at Site 2 to depths of 3m. At Site 1, refusal was encountered on a cemented residual tillite soil layer. However, there was a possibility of an unconsolidated residual tillite soil layer underlying the cemented layer. Further geotechnical investigations were recommended for the selected preferred site.

The BPEO therefore includes the following:

- WTP Site 2 and associated gravity main to the quarry reservoir;
- Mitigation measures recommended by the Specialists; and
- The measures proposed by the Stormwater Management Plan (appended to the EMPr), Traffic Impact Assessment, and the Geotechnical Investigation.

17 EIA CONCLUSIONS AND RECOMMENDATIONS

17.1 Sensitive Environmental Features

Within the context of the project area, cognisance must be taken of the following sensitive environmental features, attributes and aspects, for which mitigation measures are included in the EIA Report and EMPr (**Figures 85, 86** and **87**):

- The existing agricultural activities in the area.
- The affected landowners and surrounding communities.
- Some of the project components fall within areas of D'MOSS.
- Project components from the LUBWSS-WSS fall within CBA: Irreplaceable Areas, CBA: Optimal Areas, and ESAs.
- The LUBWSS – WSS falls within the following threatened ecosystems:
    - Interior South Coast Grasslands, listed as Critically Endangered;
    - KwaZulu-Natal Coastal Belt, listed as Vulnerable; and
    - Southern Coastal Grasslands, listed as Critically Endangered.
- Three FEPA systems, a series of channelled valley-bottom wetlands, a unchannelled valley-bottom wetland, a small natural depression, floodplains, and seeps were identified within the study area.
- Specially Protected species in the general area such as *Millettia grandis, Dioscorea cotinifolia* (Dioscoreaceae) and *Ledebouria ovatifolia* (Liliaceae/Hyacinthaceae)
- *Pittosporum viridiflorum* and *Sclerocarya caffra* were encountered in the general area.
- Red-Listed species *Hypoxis hemerocallidea* (Declining) is encountered in large numbers at the sites designated as WTP Site 1 and WTP Site 2.
- Species encountered within the proposed development footprint include *Aloe maculata* (Liliaceae/Asphodelaceae), *Hypoxis hemerocallidea* (Declining), *Kniphofia* sp. (Liliaceae/Asphodelaceae) and *Freesia laxa* (Iridaceae).
- The areas designated as WTP Site 1 and WTP Site 2 constitute sensitive areas in the context of the proposed development, especially from an amphibian perspective.
- All existing infrastructure and structures, including the road network in the area, are regarded as sensitive and need to be safeguarded from construction activities.
- All traffic and pedestrians on the public roads are regarded as sensitive and measures need to be implemented to safeguard these road users.

The sensitivity map shown in **Figures 85, 86** and **87**and needs to be made available to the implementation team (including the Project Manager, Environmental Control Officer (ECO) and Contractor) in GIS format to allow for further consideration and adequate interpretation at an appropriate scale.

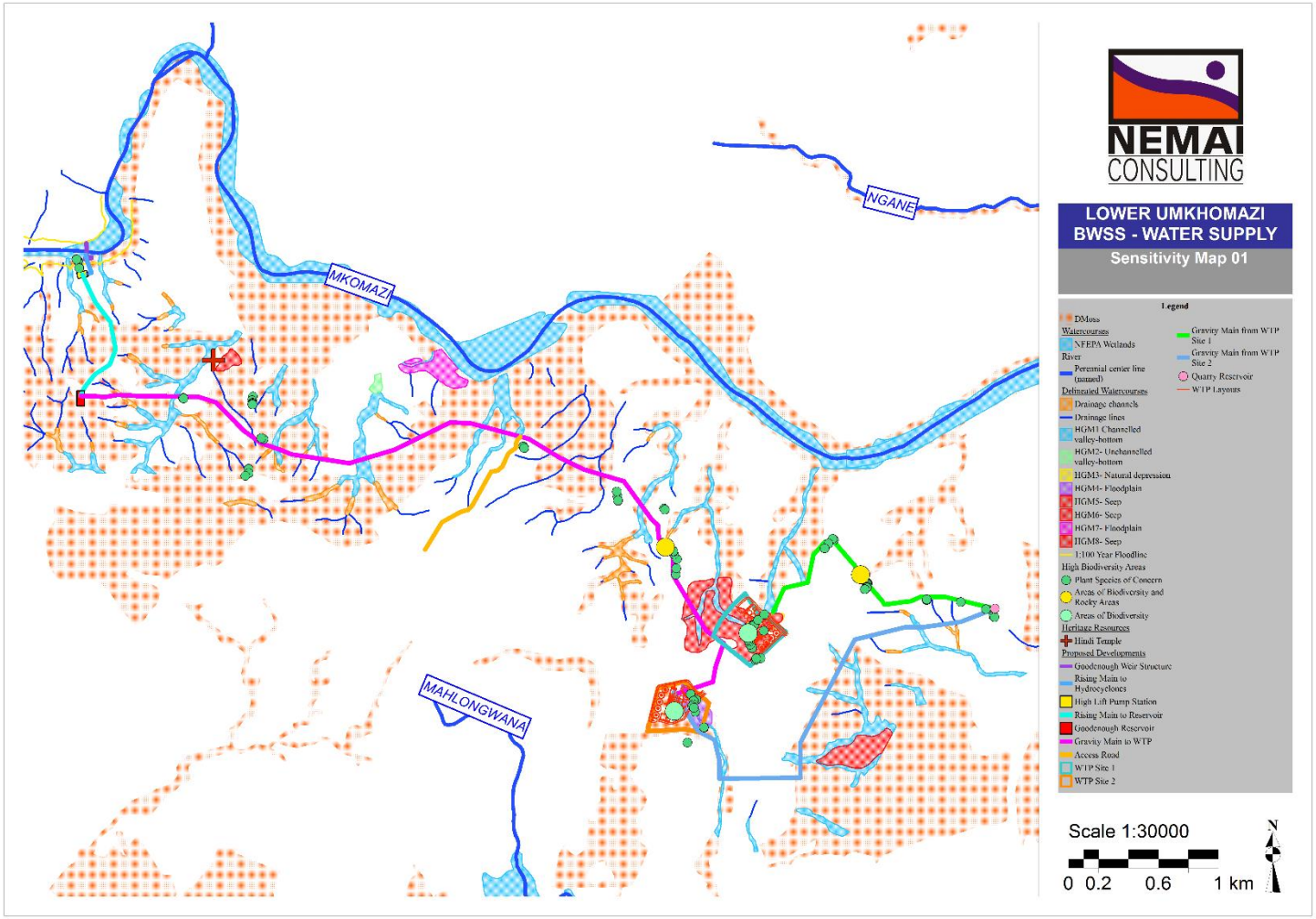


Figure 85: Sensitivity Map 01

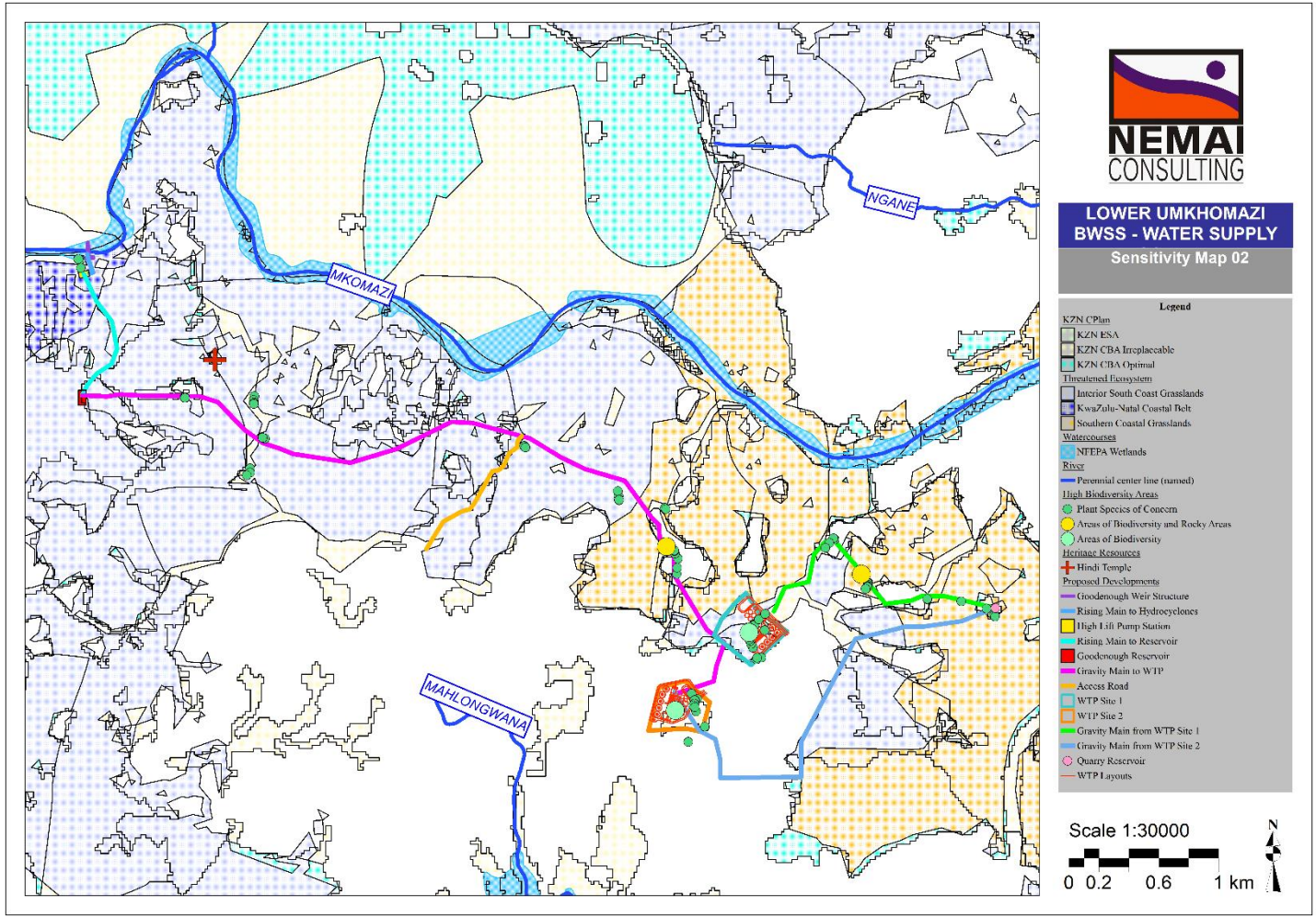


Figure 86: Sensitivity Map 02

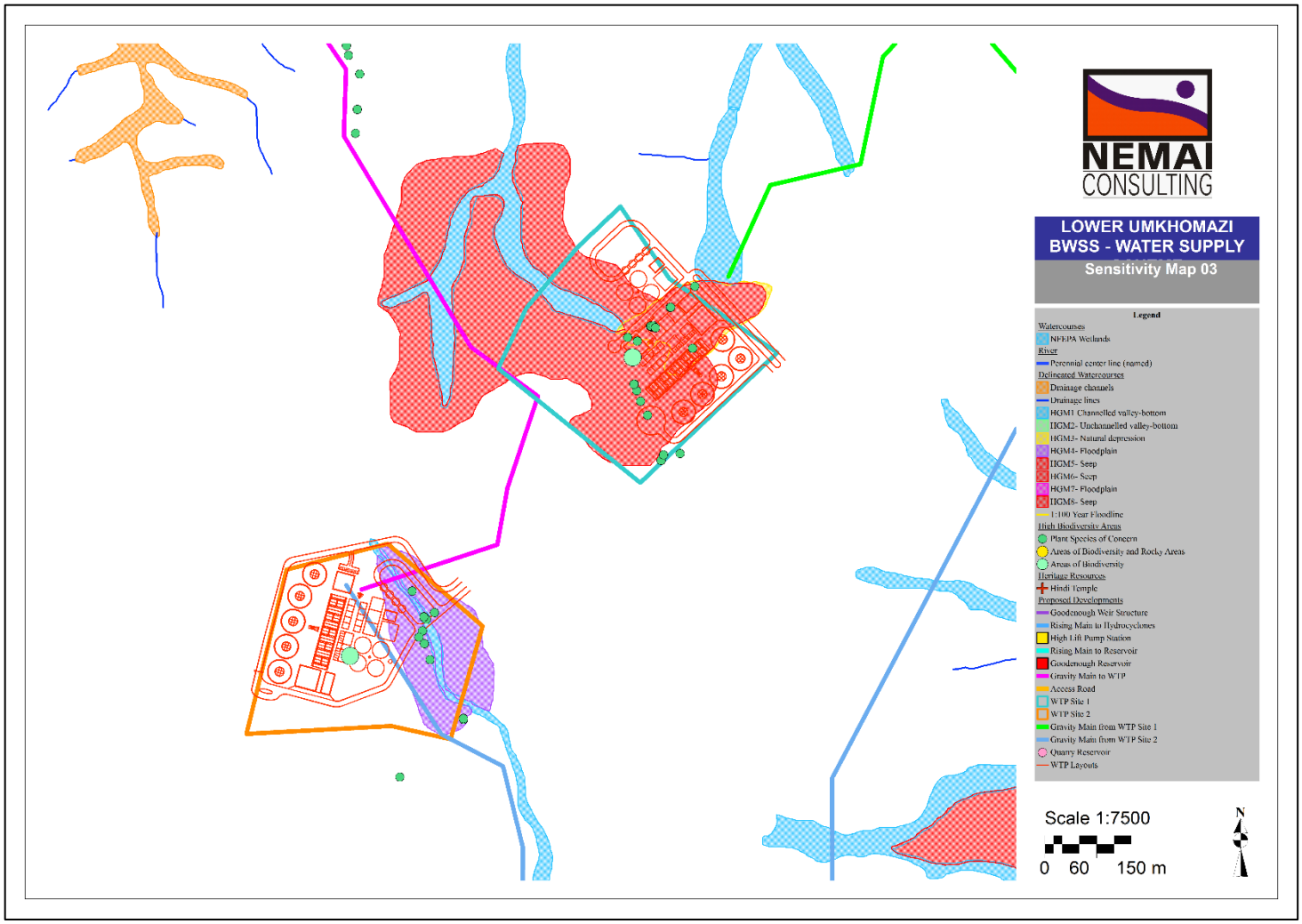


Figure 87: Sensitivity Map 03

17.2 Environmental Impact Statement

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 DM, Msunduzi LM, and a small portion of Ugu DM. These municipal areas comprise the economic powerhouse of the KZN.

Therefore, Umgeni Water propose to construct the LUBWSS – WSS in order to increase the assurance of water supply.

The LUBWSS-WSS will consist of the following project components:

- An abstraction point downstream at the Goodenough Weir site to abstract the raw water for delivery to the WTP;
- A pump station to pump water from the Goodenough abstraction to the WTP via;
- A short rising main and 7km gravity main with;
- A break pressure tank that also serves as a raw water storage reservoir;
- Hydrocyclones before the pump station and WTP to remove sediments during periods of higher turbidity river flows and reduce the WTP residual (“sludge”);
- A 100 Ml/d WTP in the town of Craigieburn; and
- A potable gravity water pipeline from the WTP to Quarry Reservoir, the potable water delivery and tie-in point on the South Coast Pipeline.

Based on the location and nature of the proposed development, the following environmental specialist studies were conducted:

- Terrestrial Ecological Assessment Report;
- Aquatic and Wetland Baseline and Impact Assessment;
- Phase 1 HIA;
- Socio-Economic Impact Assessment;
- Estuarine Specialist Study; and
- Sediment Impact Specialist Opinion.

In addition, a number of technical studies were required including:

- Stormwater Management Plan (appended to the EMPr);
- Traffic Impact Assessment;
- Geotechnical Investigation; and
- Technical Drawings.

The Terrestrial Biodiversity Report identified 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. Species encountered within the proposed development footprint include *Aloe maculata* (Liliaceae/Asphodelaceae), *Hypoxis hemerocallidea* (DECLINING), Kniphofia sp. (Liliaceae/Asphodelaceae) and *Freesia laxa* (Iridaceae). These will require a permit from eKZNw to relocate.

For the most part, the proposed development can be executed within acceptable limits of impact on the environment, many of which can be mitigated. The proposed pipeline, pump station and reservoir will be sited in highly transformed habitat and/or secondary habitat and can be supported.

The proposed WTP sites are problematic. WTP Site 1 is a hygrophilous grassland and is a sensitive habitat on the broader environmental context of the area. Any activity in this area would require a WULA and should take into account the possibility that the site may provide breeding and transit opportunities for amphibians of conservation significance. The same can be said of the WTP Site 2 site with the additional restriction of the site being designated as part of the D'MOSS.

The wetland assessment indicated three FEPA systems of some importance (AB rating) within the assessment boundary. The on-site assessment showed a series of channelled valley-bottoms present within the 500m project boundaries of which them all are grouped together in one HGM units (HGM1). One unchannelled valley-bottom wetland (HGM2) is located to the western side of the project site next to a large sugar cane crop field. A small natural depression (HGM3) which is predominantly fed by a seep is located directly within one of the two water treatment plant locations (WTP 1). A floodplain (HGM4) is located alongside the banks of a channelled valley-bottom wetland within the second of the two proposed WTP sites. A seep (HGM5) linked to a nearby channelled valley-bottom is located within the WTP1 site, which is the main source for a small depression nearby (as mentioned earlier). An isolated seep (HGM6) is located to the western parts of the project site. Another floodplain (HGM7) is located to the northern parts of the project site adjacent to the river system. Lastly, another isolated seep (HGM8) is located directly within an existing sugar cane crop field.

The results of the risk assessment indicate several moderate and low risks with limited mitigation actions possible. This is due to the construction activities directly within the active river channel, and the location of either WTP in delineated wetland areas. The physical construction of the abstraction works and the upgrading of the weir were found to have the highest potential impact to aquatic ecology. This was due to the physical construction activities which will directly alter the instream aquatic habitat down- and upstream of the weir.

The raising of the weir and construction of the abstraction works will require that construction activities take place within the river channel during which the river will be diverted in some form. The aspects as listed in the tables above will impact on the following:

- The alteration of flow volumes and patterns (Construction and Operation Phases);
- The increased sediment and turbidity (Construction Phase);
- The risk of hydrocarbon contamination (Construction Phase); and
- The increase in water temperature (Operation Phase).

During the construction phase of the weir, the moderate risks can be mitigated to low risks by implementing the mitigation measures in the subsequent section. These measures attempted to reduce the significance of the identified impacts, and do not make considerations for potential rehabilitation initiatives and offset strategies.

The operational phase shows a moderate impact of the abstraction works due to the further impedance of the natural flow and sediment regime of the river system. Subsequently, reduced flooding and siltation of downstream wetland areas may occur. This will reduce the rate of maintenance of the wetland areas to high flow periods and modify aquatic habitats resulting in a lowered PES.

The Socio-Economic Specialist stated that the construction activity will impact the social environment both positively and negatively. Given the nature of the project area, construction activity is likely to cause a number of social nuisances as well as possible economic implications on the communities and commercial activities. No socio-economic fatal flaws were identified for the project and the most serious long-term impact would be the location of the water treatment works at Site 2, which may impact upon the future development trajectory of the town. During the construction phase communities may be exposed to increased dust, noise, visual and other nuisance disturbances. Once access to a property is granted, mitigation measures should be taken to ensure that any damage that is caused as a result of this access is made good. This includes damage to infrastructure such as fences, gates, pipelines, electrical connections or roads.

From a heritage perspective, one heritage resource of significance was identified within the proposed project area. A Hindu Temple established in 1915 is located in the vicinity of the proposed BWS pipeline servitude. However, it will not be affected or impinged upon by the proposed project activities.

No archaeological residues were observed at spot checks along the proposed pipeline servitude. Albeit that vegetation was rank and surface visibility constrained, it is my opinion that the archaeological footprint in this deeply incised and steep sided portion of the Umkhomazi Valley is ephemeral to non-existent. However, we recommend a monitoring brief during construction over specific —greenfield‖ sections of the pipeline alignment.

The heritage specialist recommends that this development project proceed with the proposed heritage resource mitigation recommended in the HIA.

The proposed development will impose no permanent or negative transformation of the current agricultural and peri-urban landscape. Such services infrastructure provision is in keeping with

the current development trends along this section of the KwaZulu-Natal southern coastal landscape.

The Estuarine Specialist stated that the uMkhomazi Estuary in its present state is estimated to be 69% similar to the natural condition, which translates into a PES of a “C” Category which is attributed to the multiple factors detailed in the study. The PES of the uMkhomazi estuary is rated as Class C, moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions and processes are still predominantly unchanged.

Overall impacts on health status of the uMkhomazi estuary under the MK2 scenario (“Scenario MK2: Ultimate Development, uMkhomazi Water project (uMWP-1) and Ngwadini OCD (No uMWP-1 Support)”) is projected to decline from 68 to 54% and will drop from a “C” category to a “D” category. The Recommended Ecological Category (REC) for the uMkhomazi estuary is a “B” owing it being rated as “Very Important” from a biodiversity perspective and the fact that it also forms part of the core set of priority estuaries in need of protection to achieve biodiversity targets in the National Estuaries Biodiversity Plan for the NBA (DWS 2014, Turpie *et al*., 2013).

The proposed LUBWSS development will have a potentially negative effect on the uMkhomazi estuary. In total two potential impacts on the estuarine environment were identified for the construction phase and two for the operational phase of the project:

- Decreased or haulted flow of water due to abstraction of water from the river; and
- Impact to sediment balance.

It is suggested that projected water requirements for the LUBWSS should be achieved through one of the flow scenarios identified in the Mvoti to Umzimkulu Classification study (DWA 2014) that enabled the uMkhomazi estuary to achieve the REC for the system of a “B” (viz. MK21, MK22, MK23, and MK42) in combination with the provided environmental offset interventions.

The Sediment Specialist supports returning sediment to the river because it facilitates the loss of sediment from the river system, thereby reducing any negative impact the abstraction works could have on the river and estuary. Abstraction works interrupt the continuity of sediment transport through river systems by starving downstream reaches of sediment which are essential for channel form and riparian ecosystems.

It is estimated that the uMkhomazi River naturally contributed between about 50% to 85% of the additional sand inputs required for the coast from Port Shepstone to Durban. Besides the longshore transport input from further south of Port Shepstone, the uMkhomazi River is thus by far the most dominant source of fluvial sand supply to the whole coastline between the uMzimkulu River mouth and Durban.

In addition to the above potential impact to the sand yield of the uMkhomazi River, this important source of sand has also already been impacted on by sand mining (as is the case with many of the other central KZN rivers). Much of the sand mining operations extract sand directly from the main river channel and active/dynamic sand banks along the main channel.

If major developments on the uMkhomazi River are inevitable, then the potential impacts in terms of reduced fluvial sand supply to the coast could be mitigated by stopping the current sand mining in the river. While the abstraction works may cause an 8% reduction in sand supply to the coast from the river, sand mining constitutes a loss of at least 21% of the "natural" sand yield. Furthermore, it is recommended to investigate and implement the exploitation of other sources of sand.

Based on the recommendations of the specialists, technical considerations and the comparison of the impacts, the following was identified as the BPEO for the related project components:

- WTP Site 2 and associated gravity main to the quarry reservoir;
- Mitigation measures recommended by the Specialists; and
- The measures proposed by the Stormwater Management Plan (appended to the EMPr), Traffic Impact Assessment, and the Geotechnical Investigation.

With the selection of the BPEO (WTP Site 2 and associated gravity main to the quarry reservoir), the adoption of the mitigation measures includes in the EIA Report and the dedicated implementation of the EMPr, it is believed that the significant environmental aspects and impacts associated with this project can be suitably mitigated. With the aforementioned in mind, it can be concluded that there are no fatal flaws associated with the project and that authorisation can be issued, based on the findings of the specialists and the impact assessment, through the compliance with the identified environmental management provisions.

17.3 Recommendations

Based on the information contained in this report, and taking into account the outcome of the impact assessment, opinions and recommendations included in the specialist studies as well as all supporting documentation, it is the recommendation of the practitioner that EA be granted by the DEA for the proposed LUBWSS-WSS.

The following key recommendations, which may also influence the conditions of the EA (where relevant), accompany the EIA for the proposed LUBWSS-WSS:

1. WTP Site 2 and associated gravity main to the quarry reservoir are recommended.
2. Appointment of an ECO to monitor compliance with the EA and the approved EMPr.
3. As discussed in the EMPr, various forms of monitoring are 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. The types of monitoring to be undertaken include:

a. Baseline Monitoring needs to be undertaken to determine to 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;
b. Environmental Monitoring entails checking, at pre-determined frequencies, whether thresholds and baseline values for certain environmental parameters are being exceeded; and
c. Compliance Monitoring and Auditing for the independent Environmental Control Officer (ECO) to monitor and audit compliance against the EMPr and Environmental Authorisation.

4. Pertinent recommendations from the Terrestrial Ecological Impact Assessment (Khuselimvelo Consulting, 2017) include:
   a. The identified Specially Protected species require a permit from eKZNw to translocate.
   b. Should it be approved, risk to the project through delays would be best managed by applications to the competent permit authorities (eKZNw for Provincially Protected plants and DAFF for Nationally Protected species) immediately upon receipt of an environmental authorisation so that after a 'walk-through' of the site, plants can be removed or more preferably relocated where appropriate.
   c. 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.
   d. Restricting the construction activities to the smallest practical/functional footprint to minimise the loss of habitat as far as possible and to contain construction-related activities.
   e. Care should be taken to keep soils stabilized when removing vegetation during construction and as part of alien plant eradication.
   f. 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.
5. Pertinent recommendations from the Aquatic and Wetland Baseline and Impact Assessment (The Biodiversity Company, 2017) include:
   a. The recommended buffer zones should be strictly adhered to during the construction phase of the project, with exception of the activities and structures required to traverse a watercourse. This includes structures such as culverts for drainage lines and the weir structure itself. Any supporting aspects and activities,

such as laydown and mixing yards, not required to be within the buffer area should adhere to the buffer zone.

b. The inclusion and construction of a fish ladder is strongly advised for the proposed project. Baseline conditions indicate that fish and invertebrates alike are currently able to migrate the existing barriers, this should be allowed to continue through the construction of a fishway.
c. The EWRs of the downstream environment must be determined and adhered to.
d. An EWR assessment for the downstream uMkhomazi Estuary must be completed. The derived volume of water to maintain the estuary in a healthy state must be released.
e. Construction areas should be demarcated and watercourses marked as "restricted" in order to prevent the unnecessary impact too and loss of these systems.
f. 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.
g. Stormwater channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion.
h. The construction of the pipeline should be undertaken in the dry season.

6. Pertinent recommendations from the HIA (eThembeni Cultural Heritage, 2017) include:
   a. Should any remains be found on site that is potentially human remains, the South African Police Service should also be contacted.
   b. If there are chance finds of fossils during construction, a palaeontologist must be called to the site in order to assess the fossils and rescue them if necessary (with a SAHRA permit). The fossils must then be housed in a suitable, recognized institute.
   c. 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.
   d. It is recommended that at inception of earthworks for the pipeline alignment within the Umkhomazi valley, that an archaeologist be appointed to monitor excavations.
7. Pertinent recommendations from the Estuarine Specialist Study (Anchor Environmental Consultants, 2017) include:
   a. It is suggested that projected water requirements for the LUBWSS should be achieved through one of the flow scenarios identified in the Mvoti to Umzimkulu Classification study (DWA 2014) that enabled the uMkhomazi estuary to achieve

the REC for the system of a "B" (viz. MK21, MK22, MK23, and MK42) in combination with the following environmental offset interventions:

i. Remove sandmining from the upper reaches below the Sappi Weir to increase natural function, i.e. restore intertidal area.
ii. 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).
iii. Curb recreational activities in the lower reaches through zonation and improve compliance.
iv. Reduce/remove castnetting in the mouth area through estuary zonation or increase compliance; and
v. Relocate upstream, or remove, the Sappi Weir to restore upper 15% of the estuary.

8. Pertinent recommendations from the Sediment Impact Specialist Opinion (Basson, 2017) include:
   a. Mitigation for Release of Sediment
      i. 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.
      ii. Flushing of sediments should only be carried out during small floods and not under normal or low river flow conditions.
      iii. It is recommended to investigate and implement the exploitation of other sources of sand, instead of sandmining
      iv. 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.
      v. 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.
      vi. 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. Provision should be made in the design of the

rising main to the WTP to ensure that the velocity in the pipe is higher than the scour velocity for the washload.

9. Pertinent recommendations from the Socio-Economic Impact Assessment (Nemai Consulting, 2017) include:
    i. 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.
    ii. Where impacts cannot be avoided, all negotiations and payments relating to compensating affected landowners should be conducted and concluded before construction begins.
    iii. Locate the WTP in an area that least impact on future development of Craigieburn.
    iv. Alternatively, the WTP should occupy as small footprint as possible on Site 2.
    v. Install area lighting with shields to reduce light emitted to the sky and to neighbours
    vi. Local SMMEs should be given an opportunity to participate in the construction of the project through the supply of services, material or equipment.
    vii. Ensure that the necessary signage and traffic measures are implemented for safe and convenient access to the site.
    viii. A condition survey of the local roads to be used during the construction phase should be made prior to construction.
    ix. Dust and disturbance can be mitigated through the use of appropriate dust suppression mechanisms.
    x. Where crops are damaged, compensation is to be paid to the farmer for the loss of these crops.

18 OATH OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

I (name and surname) Samantha Gerber

Of (address) 147 Bram Fischer Drive

ID No. 9004010057084 *Contact No.* 011 781 1730

I hereby make an oath and state that:

In accordance with Appendix 2 of Government Notice No. R. 982 amended 2104 EIA Regulations (2017), this serves as an affirmation by the Environmental Assessment Practitioner (EAP) in relation to:

Section 2(i) -

1. *The correctness of the information provided in this report;*
2. *The inclusion of comments and inputs from stakeholders and interested and affected parties; and*
3. *Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.*

Section 2(k) -

The level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment.

1. I know and understand the contents of this declaration.

2. I do not have any objection in taking prescribed oath.

3. I consider the prescribed oath to be binding on my conscience.

Signature _____ *Date:* 02/02/2018

I certify that the deponent has acknowledged that he/she knows and understands the contents of the statement and the deponent signature was placed there on in my presence.

CERTIFIED A TRUE COPY OF THE ORIGINAL DOCUMENT
GESERTIFISEER 'N WARE AFSKRIF VAN
OORSPRONKLIKE DOKUMENT
BRENDA PERUMAL
MALANI PADAYACHEE AND ASSOCIATES (PTY) LTD
Reg No: 1997/009813/07
JOHANNESBURG NORTH MAGISTERIAL DISTRICT
HANDBOEK
REF No: 12/04/2018
EX OFFICIO COMMISSIONER OF OATHS
02/02/2018

COMMISSIONER OF OATH

FULL NAME

Financial Manager
DESIGNATION

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APPENDICES