UNIVERSAL ACCESS PLAN PHASE III – PROGRESSIVE DEVELOPMENT OF A REGIONAL CONCEPT SECONDARY BULK WATER MASTER PLAN FOR THE CITY OF UMHLATHUZE LOCAL MUNICIPALITY

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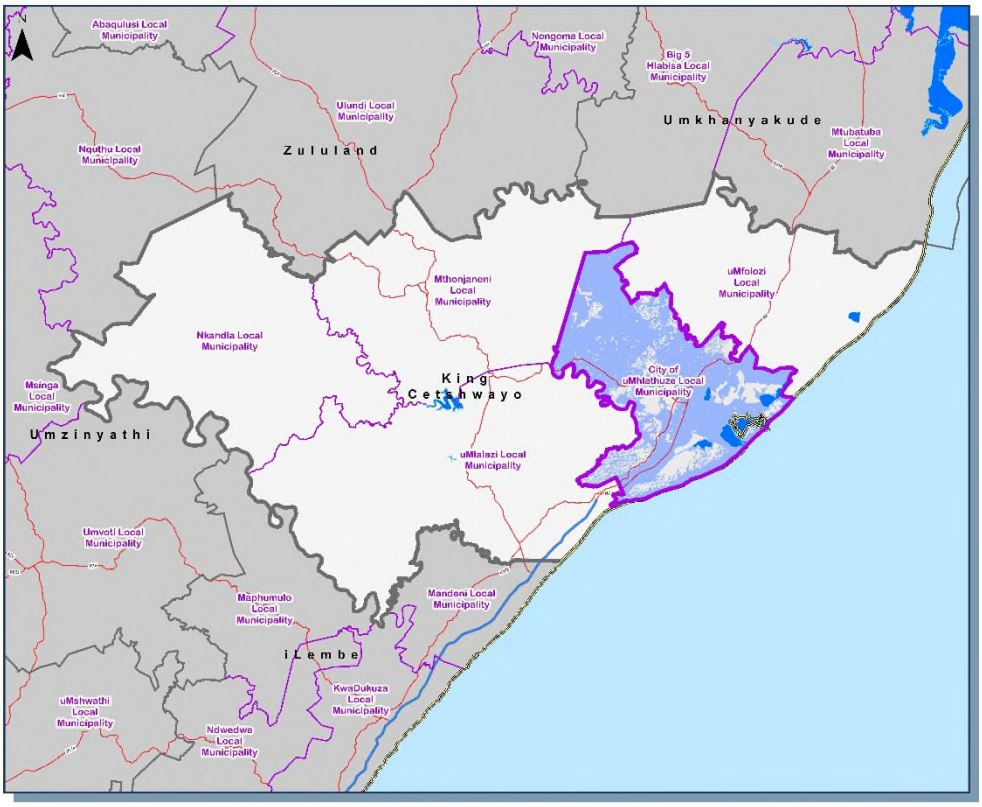

Reconnaissance Report

January 2021

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EXECUTIVE SUMMARY

A. Introduction

Phase III follows on the Phase II study for the Development of a Universal Access Plan (UAP) for Water Supply in the KwaZulu-Natal Province which was completed in June 2016 by various Professional Service Providers (PSP's) that were appointed by Umgeni Water.

The deliverables for UAP Phase II were divided in two phases where Phase 1 included the information review and development of a High Level Status Quo Assessment and Phase 2 included the development of a demand model and needs development plan, culminating in a Reconnaissance Study report for each Water Services Authority (WSA) on bulk water supply. Water Supply Intervention Areas (WSIAs) were identified during UAP Phase II and were based on areas that could be served either by existing schemes or through planned scheme developments (planned projects).

However, the level of detail within the final outcome of UAP Phase II varied between the various PSP's and the magnitude of the cost requirement resulted in Umgeni Water to revisit the process and the need for UAP Phase III was initiated. The main objective of Phase III will be to further develop the conceptual bulk water master plan that would clearly distinguish between primary and secondary bulk.

B. Demographics

The City of uMhlathuze is situated on the north-east coast of KwaZulu-Natal province, about 180 km north of Durban and about 370 km south of Maputo on the East Coast of South Africa. The uMhlathuze land area currently covers 123 359 ha. The Municipality is characterised by highly developed urban areas surrounded by large areas of undeveloped, rural land. CoU Municipality comprises of Richards Bay, Empangeni, Vulindlela, Esikhaleni, Nseleni, Felixton, Ngwelezane and four Traditional Authority Areas.

The Mhlathuze River and Nseleni River flow within the boundaries of the CoU and there are a number of fresh water coastal lakes in the vicinity, including Mzingazi, Nsezi, Chubu and Mpangeni. The CoU is predominantly supplied out of the Mhlathuze River, Lake Mzingazi, Lake Nsezi, Lake Cubhu; and Lake Nhlabane.

The total population for the City of uMhlathuze is 410 465 people residing in 110 503 households within the Municipality. The average household size is 3.7.

Table B-1: Population & Household Figures for City of uMhlathuze

LM Name	Total Population	Total No. of Households	Avg HH Size
City of uMhlathuze	410 465	110 503	3.95

Source: City of uMhlathuze WSDP, 2018/2019

Over the years there has been an influx of people from the rural to the urban areas of the uMhlathuze Municipality. The highest population densities are observed in Nseleni and Esikhaleni while the predominantly settled areas around Nseleni, Esikhaleni and Ngwelezane towns depict the second highest population density. The lowest population densities are found in the non-traditional authority rural areas of the municipality.

Population growth was determined until 2050 that resulted in the projected number of people residing within COU will be approximately 540 000 people. The projected population per Municipality is tabled within Table B-2 below.

Table B-2: Project Population per Local Municipality until 2050

Municipality	WSDP Pop 2020	Population						
		2020	2025	2030	2035	2040	2045	2050
City of uMhlathuze Local Municipality	410 465	414 209	425 136	436 003	448 965	509 306	524 448	540 039

C. Service Levels

C.1 Water

Approximately 4.23% of the households do not have access to formal water supply.

Table C-1: Water Supply Backlog within City of uMhlathuze Local Municipality

Service Level	Baseline (2017/2018)	2018/2019 Target	Stats Ending December 2018
Total households = 110 503 (2016 Community Survey)	**Households with access to water**	**Amended Targets based on 2016 Community Survey**	**Households with access to water**
ACCESS TO WATER	**104 789**	**104 880**	**105 829**
House connections	47 511	47 511	47 511
Yard Connections	53 778	54 788	55 727
Communal Supply <200m (Backlog) Supplied with JOJO Tanks	2 591	2 591	2 591
Communal Supply > 200 m (Backlog) Supplied with JOJO Tanks	5 716	4 716	4 674
New Installations reducing Backlogs (Target)	1 000	1 000	Actual Q1 = 223 Actual Q2= 225

Source: City of uMhlathuze WSDP, 2018/2019

C.2 Sanitation

In formalised urban areas a waterborne system is implemented and in rural areas Ventilated Improved Pit (VIP) Latrines are installed. In peri-urban areas or dense settlements adjacent to urban areas, which a close to a water resources, the Municipality promotes the installation of shallow sewers to protect a water resource.

Table C-2: Sanitation Backlogs within City of uMhlathuze Local Municipality

Service Level	Baseline (2017/2018)	2018/2019 Target	Stats Ending December 2018
Total households = 110 503 (2016 Community Survey)	Households with access to sanitation	Amended Targets based on 2016 Community Survey	Households with access to sanitation
ACCESS TO SANITATION	86 865	89 365	88 206
Waterborne Sewerage	43 068	43 068	43 068
VIP Toilets	43 797	46 297	45 138
Backlogs	23 638	21 138	19 797
New Installations (VIP)	2 904	2 500	Actual Q1 = 971 Actual Q2 =370

Source: City of uMhlathuze WSDP, 2018/2019

D. Water Resources

D-1: Mhlathuze River and Lake Phobane (Goedertrouw Dam)

The Lake Phobane on the Mhlathuze River regulates the water to downstream irrigators as well as urban and industrial users in CoU. The dam had a storage capacity of 321 million m^3 when it was commissioned in 1982; a decreased capacity of approximately 301 million m^3 in 2000; and is decreasing at an estimated rate of 1.1 million m^3/annum due to siltation.

The water from the dam is abstracted from an irrigation canal, from run-of-river abstractions for agriculture, and at the Mhlathuze Weir. Nkwaleni, Mfule and Heatonville irrigators draw water from the river for the irrigation of sugar and citrus, between Lake Phobane and the Mhlathuze Weir. Irrigation is supplied under the Goedertrouw Government Water Scheme, with some irrigators fed directly from the dam, the Heatonville irrigators from a system of concrete channels that are fed from a pump station on the Mhlathuze River (DWS, 2014).

D-2: Ntuze River

The Ntuze river catchment area consists of various sub-catchments ranging in size from 0.7 km^2 to 82 km^2. The total catchment area is 82.9 km^2. It stretches from the Mlalazi River in the south to the Umgoye forest in the north. The eastern boundary of the catchment is approximately 2 km west of Vulindlela urban centre.

Other main rivers in the catchment area are:

- ✓ Msasandla River;
- ✓ Kwagugushe River; and
- ✓ Manzamnyama River.

D-3: Lake Mzingazi

Lake Mzingazi is a freshwater coastal lake fed by several streams, the main ones being the Mdibi and Mzingazi Rivers. The coastal dune barrier separates the lake from the sea. The Mhlathuze flood plain separates the lake from the Richards Bay Harbour. The southern part of the lake is approximately 14m below mean sea level and therefore susceptible to saline water intrusion, especially during drought conditions. A weir was constructed across the lake's outlet in order to increase its capacity and meet the local demands for water. A second weir is downstream of the lake to limit saltwater intrusion into the lake from the Mzingazi River (Moloi P, 2012).

The historical firm yield of Lake Mzingazi is documented as 10.5 million m^3/a (28.8Mℓ/day). The total catchment area of Lake Mzingazi is 164 km^2 and at full supply level the volume is 47.6 Mm^3 (Cornelius, 1981).

The CoU has a lawful water use of 21 762 000 m^3/a (59.62 Mℓ/d on average) from Lake Mzingazi. Water can also be provided from Mhlathuze Water's WTP at Lake Nsezi when the water level in Lake Mzingazi drops to a predetermined level.

D-4: Mzingwenya River and Lake Chubu

The Mzingwenya River runs along the northern perimeter of Esikhaleni urban centre. A significant proportion of stormwater drainage of the township drains towards the Mzingwenya River, which in turn drains into Lake Chubu.

Lake Chubu is a natural shallow freshwater system situated in a shallow valley 4,6 km inland from the sea and 2 km north east of Esikhaleni. The lake's elevation is approximately 3,0 m above MSL and has a mean depth of about 2.5 m. The lawful water use that the CoU holds is 6 026 400 m^3/a (16.51 Mℓ/d on average)

D-5: Nseleni River and Lake Nsezi

The Nseleni River feeds Lake Nsezi which is an inland lake, located in W12F quaternary catchment on the southern end of the Nseleni River. The section from Lake Nsezi out flow to the Mhlathuze River has been canalised to accommodate sugar cane farming by uMhlathuze Valley Sugar. The Nseleni River includes for a substantial catchment area to the north of Empangeni including mostly tribal areas. Tribal areas of note are Khoza / Bhojane, Cebekhulu, Ndlazini (Mambuka) and Ntambanana (WSDP, 2005). The Thukela-Mhlathuze Government Water Scheme augments the supply in the lake through a pipeline that conveys water from Mhlathuze Water's weir in the Mhlathuze River.

Lake Nsezi acts as balancing storage for Mhlathuze Water's WTP. These works supply much of the CoU's requirements, including when the water level in Lake Mzingazi drops to a level that might result in salt water intrusion into the lake. The volume of the lake is 25 million m^3, and the historical firm yield is 6.6 million m^3/a (18Mℓ/day) (DWS, 2014). When levels at Lake Nsezi and Lake Cubhu drop, the water is supplemented from the Mhlathuze River via the Mhlathuze Weir. The Mhlathuze Weir water supply is regulated by releases from the upstream Lake Phobane.

The CoU currently has an allocation of 62 Mℓ/d from Lake Nsezi for potable water, of which 37 Mℓ/d is intended for Empangeni/Ngwelezane and 25 Mℓ/d to augment the supply for Richards Bay/Nseleni. The raw water is treated by CoU and delivers the potable water to receiving reservoirs in Empangeni and Richards Bay.

D-6: Lake Nhlabane

Lake Nhlabane has a historical firm yield of approximately 7.9 million m^3/a (21.6Mℓ/d) (DWS, 2014). The lake has been significantly transformed by Richards Bay Minerals (RBM) through the building of a concrete barrage that blocks the lake's connection with the sea.

E. Existing Water Supply Schemes and Water Requirements

Table E-1 below details the water scheme supply areas with their respective sources of supply within CoU. CoU owns and operated currently five (5) existing Water Treatment Plants that are in operating condition.

E-1: Regional Scheme Supply Areas with their respective Water Sources

Raw Water	WTP	Owner	Operator	Scheme Supply Area
Lake Mzingazi	Mzingazi	CoU	CoU	Northern Scheme
				Nseleni Scheme
				Ntambanana Scheme
Lake Nsezi and Mhlathuze Weir	Nsezi	CoU	CoU	Mhlathuze Water
				Northern Scheme
				Nseleni Scheme
				Ntambanana Scheme
				Empangeni Scheme
				Western Scheme
Mhlathuze River	Ngwelezane	CoU	CoU	Western Scheme
Mhlathuze Weir and Lake Chubu	Esikhaleni	CoU	CoU	Southern Scheme
Indian Ocean	Richards Bay Desalination Plant	CoU	CoU	Northern Scheme
				Nseleni Scheme
				Ntambanana Scheme
Crocodile Dam and Luwamba Raw Water Supply Scheme	Crocodile Dam	CoU	King Cetswayo DM	Ntambanana Scheme

CoU BWMP, 2019

The water requirements for the CoU are presented within Table E-2. These water requirements were calculated for consumers having formal water supply schemes and for consumers not yet supplied from a formal water supply scheme. The CoU would require by the year 2050,161Mℓ/day.

Table E-2 Water Requirements (Mℓ/d)

Local Municipality	Population 2020	Water Requirements (Mℓ/day)						
		2020	2025	2030	2035	2040	2045	2050
City of uMhlathuze	**414 209**	**284.6**	**326.9**	**369.2**	**411.7**	**456.9**	**498.9**	**500.2**

The water requirements for CoU per existing Water Supply Scheme (WSS) area and potential future Water Supply Intervention Area (WSIA) is presented within Table E-3. The Empangeni WSS/WSIA and Northern WSS/WSIA have the highest water demands of approximately 44% and 36% followed by 12% from the Southern Scheme. These WSS/WSIA would be serving close to 67% of the CoU population and most of the industries. The majority of large commercial industries such as Mondi, Bayside Aluminium, Hillside Aluminium, Foskor, Tongaat Hulett and Mpact Packaging Mill are located within these two (2) WSS/WSIAs.

Table E-3: Water Demand per WSS/WSIA in Mℓ per day

Water Supply Scheme / WSIA		Population 2020	Water Requirements (Mℓ/day)						
			2020	2025	2030	2035	2040	2045	2050
UTG001	Empangeni Scheme	40 781	100.6	124.3	148.0	171.7	195.4	219.1	219.1
UTG003	Southern Scheme	171 294	50.5	53.0	55.5	58.0	60.5	62.1	62.1
UTG012	Western Scheme	60 407	15.5	16.0	16.4	16.9	20.1	20.8	21.5
UTG015	Northern Scheme	65 144	103.6	118.9	134.1	149.4	164.6	179.9	179.9
UTG017	Nseleni Scheme	42 284	8.4	8.6	8.8	9.1	9.5	9.8	10.1
UTG018	Ntambanana Scheme	34 299	6.0	6.2	6.4	6.6	6.9	7.1	7.4
Total		**414 209**	**284.6**	**326.9**	**369.2**	**411.7**	**456.9**	**498.9**	**500.2**

F. Existing Sanitation Supply Schemes

There are six (6) Wastewater Treatment Plants within the CoU that serves the major towns but all of them are in need of refurbishment and improved operations and maintenance. None of these works have achieved Green Drop status.

G. Planned and Implementation Projects

The existing regional bulk projects were considered and evaluated to identify potential gaps within the existing project footprints to the extent that a total “wall-to-wall” bulk water services needs perspective is visualised and realised. This was done in the context to improve access to basic services but at the same time support economic growth and development and ensure sustainable services.

The funding streams available for infrastructure development over the next three years within CoU amount to R 303 030 700. However, the proposed cost requirement for bulk water supply services within CoU is R 3.417 billion and would represent a wall to wall coverage of the total bulk water supply need.

H. Bulk Water Supply Interventions Considered

This study aims to ensure that the CoU can make provision for and plan to supply all consumers within its area of jurisdiction with at least basic water supply services. Not all consumers are currently supplied with formal schemes and part of the objectives of this study were to determine where these consumers are, what their water requirements are and the options that could be considered to ensure universal access to water supply up to 2050.

Water Supply Intervention Areas (WSIAs) were identified during this process based on areas that can be served either by linkage to existing schemes or through planned scheme developments (planned projects). These WSIAs, number of applicable households, population and their water requirements are illustrated within Table H-1**.**

Table H-1: Conceptual Scheme Areas, Population and Water Requirements

WSIA No	WSIA Name	Population 2020	Population 2050	Demand2020	Demand 2050
UTG002	Empangeni Scheme	40 781	55 641	16,50	23,13
UTG006	Southern Scheme	171 294	202 724	42,68	51,64
UTG007	Western Scheme	60 407	84 342	15,54	21,47
UTG009	Northern Scheme	65 144	106 698	27,32	47,25
UTG010	Nseleni Scheme	42 284	50 042	8,36	10,12
UTG014	Ntambanana Scheme	34 299	40 592	5,99	7,38
CoU		414 209	540 039	116,38	161,00

The Southern WSS/WSIA and Northern WSS/WSIA have the highest water demands of approximately 32% and 29% respectively. These WSS/WSIA are not the biggest supply areas within CoU but would be serving close to 57% of the CoU population and most of the industries

The total volume of water required is compared to the existing proposed water supply interventions are tabled within Table H-2 below:

Table H -2: Water Resources Required vs proposed WSI

WSIA	WSIA Name	Population (2050)	2050 Demand (Ml/day)	2050 Demand (Mm^3/a)	Existing Resources (Mm3/a)	Proposed Additional under UAP Phase 3 (Mm^3/a)	Total (Mm3/a)	Balance (Mm3/a)
UTG001	Empangeni Scheme	55 641	219.13	79.98	87.6	0	87.6	7.62
UTG003	Southern Scheme	202 724	62.14	22.68	23.36	0	23.36	0.68

UTG012	Western Scheme	84 342	21.47015892	7.84	106.9	4.38	111.28	111.28
UTG015	Northern Scheme	106 698	179.9451863	65.68	40.15	0	40.15	-25.53
UTG017	Nseleni Scheme	50 042	10.12494265	3.70	4.82	0	4.82	1.12
UTG018	Ntambanana Scheme *	40 592	7.383969784	2.70	1.46	0.548	2.008	-0.69
TOTAL		**540 039**	**161**	**59**	**231**			

*** The balance from the Empangeni Scheme and the western Scheme could be used to augment the Northern Scheme**

**** The balance from the Nseleni Scheme is taken to augment the shortfall but still leaves a deficit of 0,69 Mm3/annum. This could be augmented to increase the supply from the Nzesi WTP or from the Luwamba scheme supplying the Crocodile WTP.**

From the table above, it is noted all the schemes will have adequate raw water resources to meet the 2050 demand requirements. The investigation to augment the water shortage within Ntambanana and the Northern Scheme could be addressed by among other to increase the supply from the Nzesi WTP.

A total estimate of approximately R 4.066 billion is required to address the total bulk water supply requirement by 2050 for the CoU. The total cost requirement per WSIA is tabled below.

H-3: Total Cost requirement

WSIA	WSIA Name	Total Cost Requirement				
		Primary	**Secondary**	**Tertiary**	**10% Contingencies**	**Total Cost (Excl VAT)**
UTG001	Empangeni Scheme	R209 116 000	R269 127 000	R138 666 000	R61 690 900	R678 599 900
UTG003	Southern Scheme	R536 386 000	R401 193 898	R56 837 000	R99 441 690	R1 093 858 588
UTG012	Western Scheme	R138 805 000	R47 131 000	R146 092 000	R33 202 800	R365 230 800
UTG015	Northern Scheme	R577 569 310	R802 134 206	R73 427 000	R145 313 052	R1 598 443 568
UTG017	Nseleni Scheme	R48 063 000	R30 526 000	R71 638 000	R15 022 700	R165 249 700
UTG018	Ntambanana Scheme	R20 997 500	R73 260 000	R55 533 000	R14 979 050	R164 769 550
City Of uMhlatuze		**R1 530 936 810**	**R1 623 372 104**	**R542 193 000**	**R369 650 191**	**R4 066 152 106**

I. Conclusions and Recommendations

The CoU still faces some backlog in water supply – not only in providing all consumers within its area of jurisdiction with access to water supply according to its WSA duties, but also in ensuring sustainable water services of existing supply. 4.23% of the consumers within CoU does not have access to reliable water supply across the whole of the CoU's geographic extent. Furthermore, there are areas where the existing water supply infrastructure as well as water source, are insufficient to meet current and projected future water requirements. New developments and urbanisation put further strain on existing supplies and resources.

The CoU relies mainly on grant funding programmes to fund their water supply projects. These funding programmes are mainly IUDG, WSIG and RBIG. Based on all the current funding streams available to the WSA over the MTEF period, it will take a minimum of twenty years for the CoU to address their bulk water supply requirements.

The provision of water services remains the responsibility of the CoU as the WSA. The CoU should ensure that they meet all the requirements to take these interventions to implementation readiness. These planning studies are in various stages of readiness to lobby for grant funding.

The six (6) proposed water supply intervention areas (WSIAs) are the appropriate solutions for bulk water supply development within CoU and are as follows:

- UTG001 WSIA: Empangeni;
- UTG003 WSIA: Southern;
- UTG012 WSIA: Western;
- UTG015 WSIA: Northern;
- UTG 017 WSIA: Nseleni; and
- UTG018 WSIA: Ntambanana.

The implementation programme will depend on the availability of funds from National Treasury as well as the capacity of the WSA to implement projects. All six (6)) area interventions would be an implementation priority for the WSA, It is proposed to consider the following three (3) priorities detailed within Table I-1. It is also proposed to follow a phased approach for implementation for e.g. initiate only the upgrade to the WTP at first and then when funding permits, can the bulk conveyance and storage be extended, upgraded or constructed.

However, the order would most likely be determined by the availability of funds or intervention programmes and should be confirmed with the WSA.

Table I-1: Proposed Implementation Order (Phased Approach)

Proposed Priorities (Phased Approach)	WSIA No and Name		Proposed Project Name	Proposed Estimated Project Value
1	UTG001	Empangeni Scheme	Upgrade the primary bulk pipeline (P9 and P10) from the Nzesi WTP to the augment the supply to the Empangeni Pearce Crescent reservoir	R154 709 000
	UTG015	Northern Scheme	Increase the bulk distribution (P2A, P3A, P4 and P5) and pumping capacity at the Nzesi WTP to augment the supply to the Nseleni and Empangeni Schemes	R303 795 000
2	UTG017	Nseleni Scheme	Augment the storage capacity to maintain 48-hour storage capacity within the Nseleni Scheme and upgrade the bulk supply accordingly	R165 249 700
3	UTG018	Ntambanana Scheme	Augment the storage capacity to maintain 48-hour storage capacity within the Ntambanana Scheme and upgrade the bulk supply accordingly	R164 769 550

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LIST OF ABBREVIATIONS

CoGTA	Department of Cooperative Governance and Traditional Affairs
CR	Command Reservoir
CoU	City of uMhlathuze
EMF	Environmental Management Framework
DM	District Municipality
DWS	Department of Water and Sanitation
GIS	Geographical Information System
IRDP	Integrated Residential Development Programme
IDP	Integrated Development Plan
KZN	KwaZulu-Natal
ℓ/c/d	Liters per capita per day
LED	Local Economic Development Programme
LM	Local Municipality
LoS	Level of Service
LTBWSS	Lower Thukela Bulk Water Supply Scheme
m^3	Cubic meter
Mm^3	Million Cubic meter
MIG	Municipal Infrastructure Grant
Mm^3	Million Cubic Meters
Mm^3/a	Million Cubic Meters per annum
Mℓ/day	Mega liter per day
NRW	Non-Revenue Water
PSP	Professional Service Provider
R ‘000	Rand Thousands
RBIG	Regional Bulk Infrastructure Grant
RDP	Reconstruction and Development Plan
Res	Reservoir
RF	Reference Framework
RWSS	Regional Water Supply Scheme
SDF	Spatial Development Programme
SIV	System Input Volume
UAP	Universal Access Plan
VAT	Value Added Tax
WMA	Water Management Area
WSA	Water Services Authority
WSDP	Water Services Development Plan

WSI	Water Supply Intervention
WSIA	Water Supply Intervention Area
WSIG	Water Services Infrastructure Grant
WSP	Water Service Provider
WSS	Water Supply Scheme
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1. OBJECTIVES AND METHODOLOGY

This report is the Bulk Water Master Plan for the study titled "Universal Access Plan Phase III – Progressive Development of a Regional Concept Secondary Bulk Water Master Plan for the City of uMhlathuze Local Municipality (CoU)" – in this instance also the Water Services Authority (WSA).

This section provides the background of the study, an introduction and description of the study objectives.

1.1 BACKGROUND AND INTRODUCTION

This study follows on the Phase II study for the Development of a Universal Access Plan (UAP) for Water Supply in the KwaZulu-Natal Province which was completed in June 2016 by various Professional Service Providers (PSP's) that were appointed by Umgeni Water.

However, the level of detail within the final outcome of UAP Phase II varied between the various PSP's and the magnitude of the cost requirement resulted in Umgeni Water to revisit the process and the need for UAP Phase III was initiated. The main objective of Phase III will be to further develop the conceptual bulk water master plan that would clearly distinguish between primary and secondary bulk.

Umgeni Water appointed Mariswe (Pty) Limited (previously UWP Consulting), in association with JTN Consulting in November 2018 to review the UAP Phase II process by the developing of UAP Phase III for the whole of the KwaZulu-Natal province. The areas are as follows:

- ✓ Amajuba District Municipality (ADM);
- ✓ City of uMhlathuze Local Municipality (CoU);
- ✓ Harry Gwala District Municipality (HGDM);
- ✓ Ilembe District Municipality (IDM);
- ✓ King Cetshwayo District Municipality (KCDM);
- ✓ Newcastle Local Municipality (NLM);
- ✓ The Msunduzi Local Municipality (TMLM);
- ✓ Ugu District Municipality (Ugu);
- ✓ Umgungundlovu District Municipality (UMDM)
- ✓ uMkhanyakude District Municipality (UKDM);
- ✓ uMzinyathi District Municipality (UZDM);
- ✓ uThukela District Municipality (UTDM); and
- ✓ Zululand District Municipality (ZDM).

The abovementioned municipalities were allocated WSA status for their respective areas of jurisdiction. Amajuba, King Cetshwayo and Umgungundlovu's responsibilities as WSA excludes the areas covered by the Newcastle, City of uMhlathuze, and The Msunduzi Local Municipalities which themselves are WSA's. UAP Phase III reports are developed per WSA, i.e. 13 reports are prepared.

1.2 PURPOSE OF THE REPORT

This report is the second deliverable of the study, namely the Reconnaissance Study that outlines the conceptual master plan of primary and bulk regional schemes per WSA.

The UAP Phase III aims to review and update the UAP Phase II study reports in order to clearly distinguish between primary and secondary bulk water requirements. The implementation of the UAP Phase III study will be executed in two phases and are as follows:

Phase	Description	Deliverables
Phase 1	Due diligence of the conceptual Regional Bulk Scheme Reports from UAP Phase II	High Level Water Services Intervention Areas (WSIA) due diligence report outlining the viability and sustainability of the already proposed regional schemes
Phase 2	Reconnaissance into the Proposed Regional Primary and Secondary Bulk Schemes per Water Services Authority	Reconnaissance Study that outlines the conceptual master plan of primary and bulk regional schemes

Phase 1 includes the information review and conducting a due diligence of the conceptual regional bulk schemes proposed during UAP Phase II.

Phase 2 includes the development of a demand model up to 2050 and needs development plan, culminating in a Reconnaissance Study report on primary and secondary bulk water supply.

The Report would also provide status quo information on sanitation level of service per WSA inclusive of sanitation bulk scheme components. The sanitation status quo information was collected, verified and validated during the Municipal visits and incorporated within the geo database.

The UAP Phase III study information would be used to update the DWS Reference Framework (RF) geodatabase where possible.

1.3 INFORMATION SOURCES

Information used in this study was obtained from current and existing reports and inputs from knowledgeable municipal officials. The following reports were reviewed to contribute to this report:

- ✓ City of uMhlathuze Water Services Development Plan, April 2019;
- ✓ City of uMhlathuze Bulk Water Master Plan, June 2019; and
- ✓ Monthly water balance reports as submitted by DWS (KZN) for each WSA.

Meetings were held with managers and technical staff of the CoU to obtain their input and to ensure the latest available specifications and information is used for the purpose of this study.

Existing spatial and non-spatial data sets were used as reference such as the 2016 Community Survey, UAP Phase II Study, 2016, the Department of Water and Sanitation (DWS) Reference Framework geodatabase as well as spatial data received from the WSA itself.

1.4 STAKEHOLDER ENGAGEMENT

The PSP engaged each WSA individually during inception meetings to introduce the study, its objectives and detailed approach.

The first deliverable was a Due Diligence Report on demographics, water services levels, existing bulk water supply infrastructure, water resources, water requirements, current and planned bulk infrastructure projects and viability of water supply intervention areas.

The Due Diligence Report has now been followed by the development of a water requirements model for 2050. Further individual engagements were held with each WSA.

This resulted in the development of a Reconciliation Report, which presents the alignment of water requirements with existing and planned bulk infrastructure and available water sources for all areas within the WSA.

The Draft Reconciliation Report was presented to each WSA to obtain comments and inputs, which were considered for the final study report submitted to Umgeni Water, DWS and COGTA.

1.5 WATER REQUIREMENTS MODEL METHODOLOGY

A report outlining the methodology, design criteria and assumptions to be used to develop the water demand model for this study, UAP Phase III was approved by the Client.. The approved water demand model was then applied to determine the demands for all areas included in the study, at least at a town level. The water demands are required to inform the concept design for a design horizon period up to 2050, with the minimum level of service a yard connections at 100ℓ capita per day.

1.5.1 Total Water Demand Calculations

This section provides information on the base data used for the modelling, assumptions made and outputs of the water demand model, based on a pilot Water Services Authority area.

1.6 BASE DATA

The base data used for this study includes the following:

- ✓ 2011 Census: Spatial data for the Main Places, Sub-Places and Small Areas Layer. Main Places are similar to the level of towns, Sub-Places are similar to the level of suburbs and the Small Areas Layer are of a smaller level of detail than Sub-Places, encompassing a number of enumerated census areas;
- ✓ 2011 Census: alpha-numeric data, linking to the spatial data, for household income categories, combined with water Level of Service (LoS). The derived household income and LoS information was combined into categories as follows:

- Category 1 (Very High Income): Households with a house connection and an income more than R 1 228 000 per year;
- Category 2 (Upper Middle Income): Households with a house connection and an income between R 153 601 and R 1 228 000 per year;
- Category 3 (Average Middle Income): Households with a house connection and an income of between R 38 401 and R 153 600 per year;
- Category 4 (Low Middle Income): Households with a house connection and an income of between R 9 601 and R 38 400 per year;
- Category 5 (Low Income): Households with a house connection and an income between R1 and R 9 600 per year;
- Category 6 (Yard Connections): all Households with a Yard Connection;
- Category 7 Households with access to interim services and
- Category 8 Households with access to below interim services.

✓ 2011 Census: categorisation of Main Places – similar to town level data, based on best-known characteristics of the Main Place. The types of Towns/Centre categories include:

- Category 1: Long Established Metropolitan Centres (M): Large conurbation of several largely independent local authorities generally functioning as an entity;
- Category 2: City (c): Substantial authority functioning as a single entity isolated or part of a regional conurbation;
- Category 3: Town: Industrial (Ti): A town serving as a centre for predominantly industrial activities;
- Category 4: Town: Isolated (Tis): A town functioning generally as a regional centre of essentially minor regional activities;
- Category 5: Town: Special (Ts): A town having significant regular variations of population consequent on special functions. (Universities, holiday resorts, etc.);
- Category 6: Town: Country (Tc): A small town serving essentially as a local centre supporting only limited local activities.
- Category 7: Contiguous (Nc): A separate statutory authority or several authorities adjacent to, or close to, a metropolis or city and functioning as a component part of the whole conurbation;
- Category 8: Isolated (Nis): A substantial authority or group of contiguous authorities not adjacent to an established metropolis or authority;
- Category 9: Minor (Nm): Smaller centres with identifiable new or older established centres not constituting centres of significant commercial or industrial activity;
- Category 10: Rural (Nr): All other areas not having significant centres.

✓ Population Growth: Population numbers per Small Areas Layer as provided by Umgeni Water that developed with Statistics South Africa the population growth for the following years:

- 2016; 2020; 2025; 2030; 2035; 2040; 2045 and 2050.

✓ 2019 Updated Levels of Service as provided by Water Services Authorities. The 2019 LoS may be recorded in different formats and at different spatial levels (settlement / town, ward, other). The following categories were applicable the pilot WSA, based on wards and spatially allocated to the Small Areas Layer:

- Below: Assumed for the purposes of this study to include all areas below the standpipe level of service in 2019;
- At: All areas at standpipe level of service in 2019 and
- Above: All areas above the standpipe level of service in 2019.

1.6.1 Assumptions

The following assumptions were made in order to calculate the demands per Small Area:

✓ That the ratio of population within each income category in the House Connection LoS category has not changed since 2011. The assumption is that the individuals in each category may be earning more since 2011, but that the categories themselves should have also then moved upwards by the same average quantum. The ratio of population in each category may then be assumed to have stayed more or less the same, even though the actual income values may have changed. This will not influence the demand allocated to each category.

✓ That the categorisation of Centres has not changed since the 2011 Census. The categorisation of Main Places may be reviewed if necessary.

✓ The projected population growth numbers as provided by Umgeni Water was used without any further analyses.

✓ The 2019 updated Level of Service as provided for the pilot WSA was used, which also indicated potential future levels of service. However, it was found that some areas are marked as below standpipe level when the 2011 Census recorded these areas as above RDP level. We assumed that these areas may have been marked as below standpipe level subsequent to the Census due to factors such as water availability / reliability or other factors. It was decided, in these cases, that the infrastructure probably still exists in these areas as recorded during the Census and that it would be prudent, for water demand modelling purposes, to assume the Census RDP levels still apply. In cases where the WSA indicated areas to be in higher categories than recorded in the Census, the WSA for Level of Service was used, since it is assumed that these areas have since been upgraded to a higher level of service. No area was therefore downgraded from the Census data, but some areas were upgraded to a higher LoS with the new 2019 data.

✓ Average of the Annual Average Daily Demand (AADD) values (Direct Demands) were assumed, as shown in Table 1-1. These were informed by the previous UAP Phase II study.

✓ Indirect demands, as a ratio of AADD, were assumed, as summarised in Table 1-2 per Centre category.

Table 1-1: Assumed average AADD per person per combined income and LoS category

Category	Description of consumer category	Household Annual Income range	Average AADD (l/c/d)
1	House Connections: Very High Income	>R1 228 000	410
2	House Connections: Upper middle income	R 153 601 – R 1 228 000	295
3	House Connections: Average Middle Income	R 38 401 – R 153 600	228
4	House Connections: Low middle Income	R 9 601– R 38 400	170
5	House Connections: Low income	R 1 – R 9600	100
6	Yard Connections		100
7	Households with access to interim services		70
8	Households with access to below interim services		12

Table 1-2 Indirect demands, as a ratio of direct demands per Centre classification

				Indirect demands as a ratio of direct demands			
Classification	Type of Centre	Description	Typical CSIR / SACN Settlement Typology	Commercial	Industrial	Institutional	Municipal
1	Long established Metropolitan centres (M)	Large conurbation of several largely independent local authorities generally functioning as an entity.	City Region	0.2	0.3	0.15	0.08
2	City (c)	Substantial authority functioning as a single entity isolated or part of a regional conurbation.	City / Regional Centre 1 / Regional Centre 2				
3	Town: Industrial (Ti)	A town serving as a centre for predominantly industrial activities.	Regional Centre 1 / Regional Centre 2				
4	Town: Isolated (Tis)	A town functioning generally as a regional centre of essentially minor regional activities	Service Town				
5	Town: Special (Ts)	A town having significant regular variations of population consequent on special functions. (Universities, holiday resorts, etc.)	Service Town / Local or Niche Town	0.3	0.15	0.08	0.03
6	Town: Country (Tc)	A small town serving essentially as a local centre supporting only limited local activities	Local or Niche Town	0.1	0.15	0.03	0.1
7	Contiguous (Nc)	A separate statutory authority or several authorities adjacent to, or close to, a metropolis or city and functioning as a component part of the whole conurbation.	Regional Centre 2	0.15	0.08	0.08	0.08

				Indirect demands as a ratio of direct demands			
Classification	Type of Centre	Description	Typical CSIR / SACN Settlement Typology	Commercial	Industrial	Institutional	Municipal
8	Isolated (Nis)	A substantial authority or group of contiguous authorities not adjacent to an established metropolis or authority.	High Density Rural				
9	Minor (Nm)	Smaller centres with identifiable new or older established centres not constituting centres of significant commercial or industrial activity.	Local or Niche Town				
10	Rural (Nr)	All other areas not having significant centres.	Rest of South Africa				

The phased upgrading of Level of Service up to 2050 was assumed as summarised in Table 1-3 .

Table 1-3 Level of Service Upgrade

Dwelling Type	LoS Upgrade
House Connections: Very High Income	Grows with Population growth
House Connections: Upper middle income	Grows with Population growth
House Connections: Average Middle Income	Grows with population growth + additional 2.5% increase from Low Middle Income by between 2019 and 2030 + additional 5% increase from Low Middle Income between 2031 and 2050
House Connections: Low middle Income	Grows with population growth + additional 5% increase from Low Income by between 2019 and 2030 + additional 10% increase from Low Income between 2031 and 2050
House Connections: Low income	Grows with population growth + additional 7.5% increase from Yard Connections by between 2019 and 2030 + additional 15% increase from Yard Connections between 2031 and 2050
Yard Connections	Grows with Population growth + minimum LOS by 2030
Households with access to interim services	Reduce to 0 by 2030
Households with access to below interim services	Reduce to 0 by 2030

Finally, an additional 10 % and 15% were added to the total water demand (Sum of Direct and Indirect Demands) for water treatment losses and distribution losses, respectively.

1.6.2 Output of the Water Demand Model

The output of the water demand model is a total water demand (including direct demands, indirect demands and acceptable losses) for 2019; 2020; 2025; 2030; 2035; 2040; 2045 and 2050 per Small Area, in Million Cubic Meters per annum (Mm^3/a). This water demand will be compared to available supply demands if possible and an opinion on potential discrepancies will be given.

As the output is based on the Census Small Areas Layer and coded accordingly, it can be used in a GIS environment for further analysis.

1.7 DWS Reference Framework Geodatabase

The DWS Directorate: Water Services – Planning and Information – maintains a national database for water services planning. It is a spatial database, in a GIS format, that includes layers for settlements, water supply infrastructure, sanitation supply infrastructure, water resources and projects.

This study aims to update the service levels for settlements based on feedback from each WSA. Furthermore, where possible, the bulk and reticulation infrastructure components in the geodatabase were also updated to include not only the latest existing, but also planned water supply infrastructure.

1.8 Reconnaissance Report

The final deliverable of this study is a Reconnaissance Report – this report – to reconcile the water requirements, with available water sources, for all areas in a WSA. This includes the evaluation of existing capacities of infrastructure, potential extensions to new areas, or scheme development options for areas where linkage to existing schemes are not feasible.

The potential costs for scheme development and timeframes were investigated and are presented in this report. Umgeni Water provided unit reference costs for infrastructure components that have been applied where possible.

Information on available water sources were mainly obtained from existing DWS Reconciliation Strategies (larger systems and from the All Towns Studies). Where available, project-specific studies or technical reports were consulted to verify information on available water sources. Information on groundwater availability and quality is however not readily available to a sufficient level of detail.

2. STUDY AREA

This section provides an overview of the study area, setting the scene and discusses the institutional arrangements for water supply. It also provides a brief overview of the demographics in the area and the development opportunities.

2.1 CONTEXT

The City of uMhlathuze is situated on the north-east coast of KwaZulu-Natal province, about 180 km north of Durban and about 370 km south of Maputo on the East Coast of South Africa. The uMhlathuze land area currently covers 123 359 ha and depicted in Figure 2-1: Study Area.

The Municipality is characterised by highly developed urban areas surrounded by large areas of undeveloped, rural land. CoU Municipality comprises of Richards Bay, Empangeni, Vulindlela, Esikhaleni, Nseleni, Felixton, Ngwelezane and four Traditional Authority Areas. The Traditional areas (Dube, KwaKhoza, Mkhwanazi North and South, Magwetshana, Bukhanana, Ntamabana, Esikadeni and Zunge-Madlebe) cover approximately 35% of the Municipal area.

The Mhlathuze River and Nseleni River flow within the boundaries of the CoU and there are a number of fresh water coastal lakes in the vicinity, including Mzingazi, Nsezi, Chubu and Mpangeni.

The CoU is predominantly supplied out of the Mhlathuze River, Lake Mzingazi, Lake Nsezi, Lake Cubhu; and Lake Nhlabane.

Richards Bay is the economic centre of the City of uMhlathuze Local Municipality which further comprises Empangeni, Ngwelezane, Nseleni, Esikhaleni and a number of rural villages. Richards Bay is one of the strategic economic hubs of the country. Though the water resources available to the uMhlathuze Municipality are currently sufficient to cater for the existing requirements, should anticipated growth and industrial development materialise, the current water sources are likely to come under stress.

The municipality borders a coastline that spans approximately 45 kilometers. The N2 highway traverses the uMhlathuze Municipality in a north-east direction towards the Swaziland border and south-west towards Durban. It effectively forms a division between Empangeni and Richards Bay. The R34 Provincial Main Road passes through Empangeni towards Melmoth.

The main access into the municipal area is via the N2 in a north south direction and in an east west direction the R34 from Ntambanana. Other significant roads in the area include the MR431 (that provides a northerly entry into Richards Bay from the N2) as well as the Old Main Road that straddle the N2. Railway lines are prevalent in the municipal area but do not provide a passenger service, only a commercial/industrial service is provided.

N

Nongoma Local Municipality

Ulundi Local Municipality

Big 5 Hlabisa Local Municipality

Umkhanyakude

Zululand

Mtubatuba Local Municipality

Nquthu Local Municipality

Ulundi

Mpungose

Babanango

Saint Lucia

Mtubatuba

River View

Mthonjaneni Local Municipality

Melmoth

uMfolozi Local Municipality

Nkandla Local Municipality

Nseleni

City of uMhlathuze Local Municipality

King Cetshwayo

Nzalabantu

Empangeni

Richard's Bay

Ngwelezana

Felixton

Vulindlela

Esikhawini

Umzinyathi

Eshowe

uMlalazi Local Municipality

Umvoti Local Municipality

Gingindlovu

Maphumulo Local Municipality

Mandeni Local Municipality

iLembe

Darnall

Zinkwazi Beach

KwaDukuza Local Municipality

uMshwathi Local Municipality

Princes Grant

Blythdale Beach

Stanger

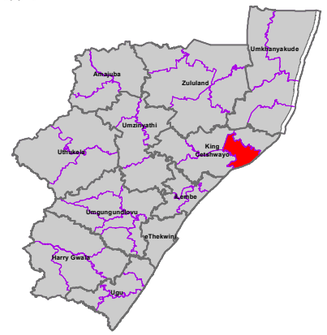
Ndwedwe Local Municipality

10 5 0 10 20 Kilometers

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- National Roads
- Main Roads
- Dams & Dam Names
- Rivers
- Settlements
- Eshowe — Major Towns

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

DISTRICT MUNICIPALITY:

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Study Area

City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

MAP NO.:

LM282: Figure 2.1

The development of the Richards Bay Industrial Development Zone is boosting economic activity and attracting international investors. Significant economic centres are Richards Bay and Empangeni. Richards Bay, as a harbour and industrial town, attracts people from surrounding towns, rural settlements and from beyond the district.

2.2 Physical Characteristics of the Study Area

The Municipality is characterised by highly developed urban areas surrounded by large areas of undeveloped, rural land. Settlement densities are highest in the formal urban areas, i.e. Empangeni, Richard's Bay, Esikhaleni, Ngwelezane, Nseleni, Vulindlela and Felixton. Areas of denser settlement in the rural (Traditional Council) areas have developed at further distances from the formal urban areas. The distribution and allocation of land in the Ingonyama Trust Board land leads to the formation of unplanned settlements which puts pressure on the Municipality to provide water and sanitation services.

Commercial farmland is under sugar cane and timber.

2.2.1 City of uMhlathuze Local Municipality

In accordance with the Municipal Structures Act (No. 117 of 1998), the City of uMhlathuze Local Municipality (CoU) is the Water Services Authority (WSA) and the Water Services Provider (WSP) in its area of jurisdiction.

The City of uMhlathuze comprises the economic powerhouse of Richards Bay and Empangeni, and its supporting areas of Esikhawini, Ngwelezane, Nseleni, Felixton, Vulindlela and rural areas. The Municipality has the benefit of about 45km of coastline of which about 80% is in its natural state. The deep-water port located in Richards Bay (the country's largest) has been instrumental in the spatial development of the area. The port is also a provincial priority in that it is the growth engine for one of the primary provincial growth nodes.

The uMhlathuze Municipal area is comprised of settlements of three types, urban, peri-urban, and rural. Within the urban fabric of the main urban centres there are formal residential areas (including high-rise flats), former R293 towns (the old townships), and recently constructed low-income residential areas. Felixton, Ngwelezane, Esikhaleni, and Nseleni are smaller urban centres in the Municipality. Traditional authority areas are characterized by dense unplanned settlement, particularly on the borders of towns, driven by ad hoc land allocation through the Amakhosi. Some of these densely settled rural areas are, in effect, urban.

The Municipality's population is in the range of 410 457 people residing in 110 503 households. The average household size is 3.7 persons per household.

2.3 Climate and Climate Change

uMhlathuze's climate is characterized by a warm to hot and humid subtropical climate, with warm moist summers. Average daily maximum temperatures range from 29 ℃ in January to 23 ℃ in July, and extremes can reach more than 40 ℃ in summer. The average annual rainfall is 1 228 mm and most (~80%) of the

rainfall occurs in the summer, from October to March, although rainfall also occurs in winter ~20%). The Richards Bay area is generally very flat and is situated on a coastal plain and whilst going west towards Empangeni the terrain rises and becomes undulating.

Climate change strategies are drafted on the basis of two fundamental principles, i.e. mitigation and adaptation. To this end, a Climate Change Municipal Action Plan is in place that also has to be extended/reviewed to include the enlarged municipal area. The areas that were added to the Municipality experience climate change in a different manner and are generally more vulnerable. The Municipal Action plan adopts a phased approach to allow for a systematic and realistic response to potential climate impacts.

Council adopted a Climate Change Action Plan in October 2018 that set out the following objectives:

- ✓ An outline of the institutional framework for Climate Change linking global policy with national, provincial, and local imperatives;
- ✓ An overview of the uMhlathuze climate risk profile and associated vulnerability for the Municipality;
- ✓ A presentation of the adopted Climate Change and Energy strategies as a basis for prioritising actions/projects for implementation of the Climate Change Action Plan;
- ✓ Development of a Climate Change Action Plan which focuses on priority climate adaptation and mitigation interventions;
- ✓ Strategic Partners and Global affiliations to scale up on climate actions; and
- ✓ Institutional arrangements, which talks to the establishment of a formally constituted committee to implement and report on the climate change action plan.

The Department of Environment's Climate Change Adaptation Strategy (2017) denotes that there has been an overall increase in temperature throughout South Africa, but most predominantly in the drier western and north-eastern parts of the country, extending to the east coast of KwaZulu-Natal.

2.4 Topography, Geology and Soils

The geomorphology of the landscape is generally described as a low-relief area that is bounded by a coastline and a high-relieve terrain on the landward side. Forming part of the Zululand Coastal Plain, the area indicates a history of erosion and sedimentation, and sea level fluctuations. Past geomorphologic processes have resulted in a unique landscape that supports complex hydrological systems, which in turn have resulted in high level of species diversity. The low level coastal floodplain is subject to natural flooding, climate change and sea level rise, and may increase flood risks over time Landscape features are therefore important factors for decision-making and development planning.

2.5 Environmental

The geology and geomorphology of the area controls the transport and storage of water and influences the hydraulic functions of the ground water system. Furthermore, the soils are very permeable and almost all the rainfall infiltrates into the groundwater, where it is temporarily stored before being discharged into the streams,

lakes and wetlands. Consequently, the streams are generally perennial and seldom stop flowing even in drought conditions. This also creates a large underground storage reservoir that consistently sustains the coastal lakes which form the main water supply resources for the municipality.

The municipal area falls within an area which is recognized as the second richest floristic region in Africa: containing approximately 80 % of the of South Africa's remaining forests, rich birdlife and many other significant flora and fauna species. The uMhlathuze Municipal Area supports more than 170 Red Data species, which has been reported as amongst the highest in the country for an area of its size.

2.6 Institutional Arrangements for Water Supply

In accordance with the Municipal Structures Act (No 117 of 1998), the City of uMhlathuze Local Municipality is the Water Services Authority (WSA) and the Water Service Provider (WSP). The WSA has a duty to all consumers, or potential consumers, in its area of jurisdiction to progressively ensure efficient, affordable, economical and sustainable access to water supply and sanitation (collectively referred to as water services). As a WSA, the City of uMhlathuze Municipality focuses on water services and on providing at least a basic level of service to consumers in its area of jurisdiction.

3. DEMOGRAPHICS

3.1 EXISTING POPULATION DISTRIBUTION

The City of uMhlathuze Local Municipality has experienced a population increase between 2011 and 2016. The significant population growth for the City of uMhlathuze Local Municipality is due to the Ntambanana Local Municipality being disestablished and its municipal area merged into the City of uMhlathuze, Mthonjaneni and uMfolozi Local Municipalities on 3 August 2016 after the Local Government Elections.

Over the years there has been an influx of people from the rural to the urban areas of the uMhlathuze Municipality. The highest population densities are observed in Nseleni and Esikhaleni while the predominantly settled areas around Nseleni, Esikhaleni and Ngwelezane towns depict the second highest population density. The lowest population densities are found in the non-traditional authority rural areas of the municipality. The population distribution is illustrated within Figure 3-1.

The City of uMhlathuze's Water Services Development Plan of 2018/2019 and Draft IDP 2019/2020 reports 410 465 people are residing in 110 503 households within the Municipality. According to the CoU Draft IDP Review, 2019/2020 average household size of 3.95 is used as baseline and not 3.7 persons per household as indicated in the table below.

Table 3-1: Population & Household Figures for City of uMhlathuze

LM Name	Total Population	Total No. of Households	Avg HH Size
City of uMhlathuze	410 465	110 503	3.7

Source: City of uMhlathuze WSDP, 2018/2019

Table 3-2 below shows the population and household figures of CoU in relation with the other Local Municipalities within the King Cetshwayo District Municipality.

Table 3-2: Population & Household Figures for KCDM

LM Name	Total Population	Total No. of Households	Avg HH Size
Mthonjaneni	112 189	17 759	6.3
Nkandla	143 316	22 484	6.4
uMfolozi	174 925	24 802	7.0
uMlalazi	279 331	43 851	6.4
City of uMhlathuze	410 465	110 503	3.7

Source: Overall Master Plan of Water Supply to King Cetshwayo District Municipality: 2015 Revision, Date: March 2017), City of uMhlathuze WSDP, 2018/2019 & City of uMhlathuze Draft IDP Review 2019/2020

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

King Cetshwayo

City of uMhlathuze Local Municipality

uMlalazi Local Municipality

Nseleni

Empangeni

Ngwelezana

Felixton

Vulindlela

Esikhawini

Nzalabantu

Richard's Bay

Lake Mzingazi

Nkwazi

Mhlathuze Lagoon

Lake Cubhu

Nhlabane

N2

R34

R102

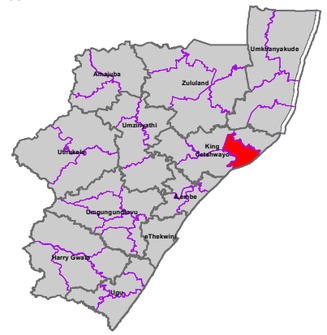
Kilometers

10 5 0 10 20

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- National Roads (N1)
- Main Roads
- Dams & Dam Names (Driel Dam)
- Rivers
- Settlements
- Major Towns (Eshowe)

LOCALITY:



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DISTRICT MUNICIPALITY:

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Population Distribution

City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

MAP NO.:

LM282: Figure 3.1

Population Distribution

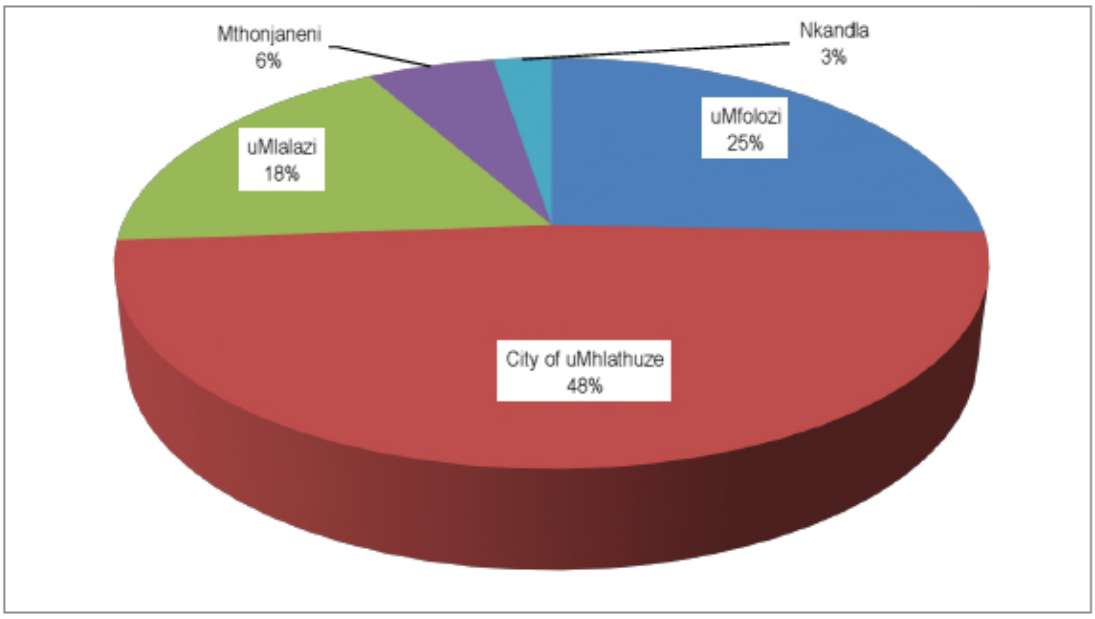
- 0 - 200 people
- 201 - 500 people
- 501 - 1 000 people
- 1 001 - 5 000 people
- 5 001- 10 000 people
- 10 001 and more people

3.2 SOCIAL AND ECONOMIC INDICATORS

According to the Global Insight 2015 Statistics, it is noted that the vast majority of economic performance (48%) in the district is vested in the City of uMhlathuze Local Municipality with its primary urban centres in Richards Bay and Empangeni. City of uMhlathuze has the most developed economy of all the municipalities in the KCDM and is the major contributor to the District Gross Domestic Product (GDP) (it is the third largest economy in KwaZulu-Natal). Although it has the smallest surface area, it has the largest population of the municipalities in the District. It has the characteristics of a highly industrialized urban complex.

From Figure 3-2 it is evident that uMhlathuze remain the strong contributor to the District GDP, with 48% contribution.

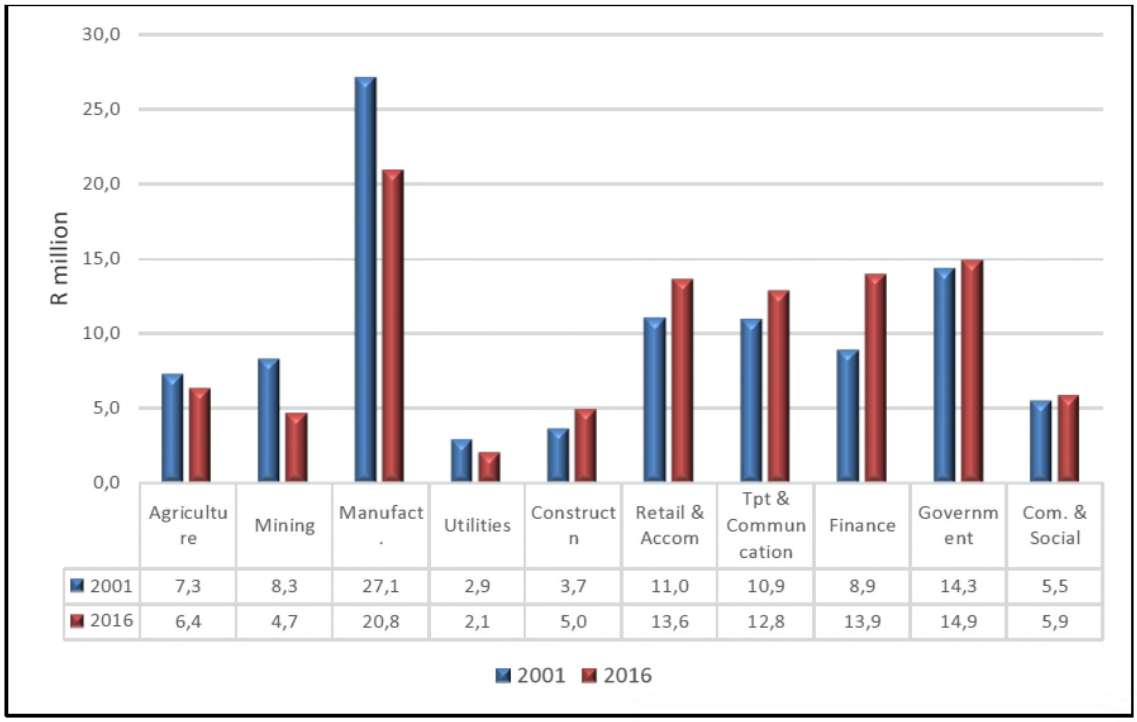
Figure 3-2: % GDP Contributions per Local Municipality



Source: Global Insights 2015

The most dominant economic sectors in KCDM is the manufacturing sector (20.8%), the government sector (14.9%) and the financial and business services sector (13.9%). The financial and business sector showed the biggest increase between 2001 and 2016. Other sectors showing significant growth includes the retail, catering and accommodation sector. Figure 3-3 displays the contributions per sector within KCDM.

Figure 3-3: Sectoral Contributions in KCDM



Source: KCDM DGDP Draft Version 08, June 2018

The agriculture and mining sectors have decreased in their contributions to the GDP. The decrease in the agricultural sector can be attributed to the slowdown in the production of field crops and horticultural products.

uMhlathuze is contributing 49.3% towards formal employment within the King Cethswayo District and about 45.2% of informal employment. Because of its economic position, uMhlathuze is contributing more to the regional employment.

Table 3-3: Formal and Informal Sector Employment

	Formal Employment	Informal Employment	Total Employment	% share of King Cetshwayo formal employment	% share of King Cetshwayo informal employment
King Cetshwayo	155 150	37 965	193 114	100	100
uMfolozi	31 984	8 579	40 563	20.6	22.6
City of uMhlathuze	76 488	17 158	93 646	49.3	45.2
uMlalazi	27 721	7 631	35 352	17.9	20.1
Mthonjaneni	11 213	2 729	13 941	7.2	7.2
Nkandla	7 744	1 868	9 612	5	4.9

Source: HIS Markit, 2018

3.3 Population Growth Scenarios

The current uMhlathuze population figure (410 457) indicates that the population of the Municipality has increased by approximately 22% between 2011 and 2016. It has to be borne in mind that a portion of the

population increase is the result of an enlarged municipal area following the inclusion of three (3) wards from the former Ntambanana Local Municipality after the 2016 Local Government Elections. Community Survey 2016 population figure forms the baseline population for the Municipality.

3.4 Main Development Nodes

Richards Bay is identified as a provincial secondary node and is an urban centre with good existing economic development and the potential for growth and services to the regional economy. The two primary nodes in the municipal area are Richards Bay and Empangeni with Esikhaleni emerging as a primary node. The towns of Ngwelezane, Vulindlela and Felixton are secondary nodes while Nseleni and Bukhanana have been classified as a tertiary nodes. Port Dunford has been identified as an emerging tertiary node as it is fulfilling a local need and has the potential to develop further. Nineteen nodes were identified by their spatial characteristics, primary land use characteristics, roles and functions to the city and the region. (City of uMhlathuze, Draft IDP Review, 2019/2020).

The CoU has also identified several new housing projects to be implemented in the next five years by the Department of Human Settlement (DoHS) and Private developments that should be included when determining the overall demand for the various water schemes within the CoU. The details of these developments are tabled within Table 3-4 below.

Table 3-4: No of new Housing Units planned for CoU

WSS No	WSS name	No of New Housing Units (DoHS)	No of Private Development Housing Units
UTG001	Empangeni Scheme	11 164	1 722
UTG003	Southern Scheme	4 936	-
UTG012	Western Scheme	1 250	-
UTG015	Northern Scheme	5 510	6 910
UTG017	Nseleni Scheme	-	-
UTG018	Ntambanana Scheme	-	-
Total		**22 860**	**8 632**

4. WATER REQUIREMENTS

This section provides an overview of the water requirements as calculated using the demand model developed for the purpose of this study.

4.1 WATER SUPPLY SERVICE LEVEL

The City of uMhlathuze has formulated a level of service policy for Water and Sanitation and is defined in the Free Basic Water (FBW) policy. The policy identifies and deals with the following levels of water services:

- ✓ Supply of water through communal water services, i.e. standpipes; and
- ✓ Supply of controlled volume of water to a household where a water meter is installed.

The number of households that have access to water services for 2018/2019 is 95.73% (105 829 households), sourced from the CoU Backlogs Report of 31 December 2018 and illustrated within Figure 4-1. This figure is also reflected in the CoU WSDP, 2018/2019. The current overall water backlog is 4.23% (4 674 households). Table 4-1 below clarifies the number of households with access to water as well as the targets that were met.

Table 4-1: Water Supply Backlog within City of uMhlathuze Local Municipality

Service Level	Baseline (2017/2018)	2018/2019 Target	Stats Ending December 2018
Total households = 110 503 (2016 Community Survey)	**Households with access to water**	**Amended Targets based on 2016 Community Survey**	**Households with access to water**
ACCESS TO WATER	**104 789**	**104 880**	**105 829**
House connections	47 511	47 511	47 511
Yard Connections	53 778	54 788	55 727
Communal Supply <200m (Backlog) Supplied with JOJO Tanks	2 591	2 591	2 591
Communal Supply > 200 m (Backlog) Supplied with JOJO Tanks	5 716	4 716	4 674
New Installations reducing Backlogs (Target)	1 000	1 000	Actual Q1 = 223 Actual Q2= 225

Source: CoU Backlogs Report, 31 December 2018

The target 300 households for quarter 2 was not met. CoU states in their Draft IDP Review, 2019/2020 that the challenge that is being experienced is that there are currently no water projects that is dealing with the upgrade of pipelines. The new project in Mkhwanazi North has just commenced. Completing the Mkhwanazi North projects will help the water division to reach its target. Shortage of water meters has been identified as a major challenge but a supply tender is being prepared by the department.

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

King Cetshwayo

City of uMhlathuze Local Municipality

uMlalazi Local Municipality

Nseleni

Empangeni

Ngwelezana

Felixton

Vulindlela

Esikhawini

Nzalabantu

Richard's Bay

Lake Nsezi

Lake Mzingazi

Richard Bay

Mhlatuze Lagoon

Lake Cubhu

N2

R34

R102

Nhlabane

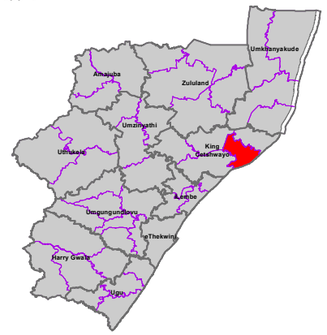
Kilometers

10 5 0 10 20

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- National Roads (N1)
- Main Roads
- Dams & Dam Names (Driel Dam)
- Rivers
- Settlements
- Major Towns (Eshowe)

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

DISTRICT MUNICIPALITY:

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Water Reliability Profile

City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

MAP NO.:

LM282: Figure 4.1

Water Reliability Profile

- Communities receiving a reliable service
- Communities not receiving a reliable service due to having no access to any water supply infrastructure
- Communities not receiving a reliable service due to a need for infrastructure requirements (upgrades)
- Communities not receiving a reliable service due to a need for water security requirements (resource problems)

4.2 WATER LOSSES AND DEMAND MANAGEMENT

Water losses are a major concern for the City of uMhlathuze (CoU) as they affect not only the operational processes, but also impact the financial, social and environmental aspects of the Municipality. The non-revenue water percentage has stabilised to an average of 18% which is much lower since the Reduction of Non-Revenue Contract was implemented in 2014.

The CoU does have a Water Conservation and Demand Management Strategy in place and the following activities were successfully implemented:

- ✓ Pressure reducing valve zones were designed, audited, and maintained;
- ✓ Leak detection programme;
- ✓ Bulk meters audited and replaced where necessary;
- ✓ Reservoir outlet meters repaired and replaced; and
- ✓ All properties within CoU have been visited and meter and water connections audited.

4.3 WATER BALANCE

The water balance for CoU is presented in Table 4-2 for the month of December 2018.

Table 4-2: Water Balance, December 2018

Total System Input Volume 4 394 615 m3/month 146.48Mℓ/d	Authorised Consumption 3 588 416 m3/month Percentage of SIV = 81.7% 119.61Mℓ/d	Billed Authorised Consumption 3 170 343 m3/month Percentage of SIV = 72.1% 105.67Mℓ/d	Billed Metered Consumption-Domestic 3 103 032 m3/month Percentage of SIV = 70.6%	Revenue Water 3 170 343 m3/month Percentage of SIV = 72.1% 105.67Mℓ/d
			Billed Metered Consumption-Commercial - m3/month Percentage of SIV = 0.0%	
			Export Volume - m3/month Percentage of SIV = 0.0%	
			Billed Unmetered Consumption 67 311 m3/month Percentage of SIV = 1.5%	
		Unbilled Authorised Consumption 418 073 m^3/month Percentage of SIV = 9.5% 13.93Mℓ/d	Unbilled Metered Consumption 352 607 m3/month Percentage of SIV = 8.0%	Non-Revenue Water 1 224 272 m3/month Percentage of SIV = 27.9% 40.8Mℓ/d
			Unbilled Unmetered Consumption 65 466 m3/month Percentage of SIV = 1.5%	
	Water Losses 806 199 m^3/month Percentage of SIV = 18.3% 26.87Mℓ/d	Apparent Losses 108 837 m^3/month Percentage of SIV = 2.5% 3.62Mℓ/d	Unauthorised Consumption - m3/month Percentage of SIV = 0.0%	
			Metering Inaccuracies - m3/month Percentage of SIV = 0.0%	
		Real Losses 697 362 m^3/month Percentage of SIV = 16% 23.24Mℓ/d	Mains and Distribution Leaks - m3/month Percentage of SIV = 0.0%	
			Reservoir Overflows - m3/month Percentage of SIV = 0.0%	
			Service Connection Leaks - m3/month Percentage of SIV = 0.0%	

Source: KZN IWA Water Balances, 2018

The CoU is in the process to develop a Management Plan to reduce non-revenue water in the Municipality. Although the CoU is accelerating the delivery of water services, it is also facing the challenge of significant non-revenue water. The Municipality is aware that if water losses are not addressed, it will jeopardise the financial viability of the Municipality and undermine the sustainability of service delivery.

The CoU faces the following challenges in its efforts to keep the volume of non-revenue water to acceptable levels:

- ✓ Allocated budget is insufficient and operating costs cannot be recovered due to non-payment of services and the tariff structure;
- ✓ Lack of skilled and experienced staff;
- ✓ Key O&M staff work overtime to address leaks, burst pipes and equipment failure;
- ✓ Poor and ageing water and sanitation infrastructure;
- ✓ Insufficient funds to refurbish infrastructure and for standby equipment;
- ✓ Minimal or no bulk or zonal metering in the rural areas;
- ✓ Rural areas have a high need for pressure management interventions;
- ✓ Pressure management devices are not maintained due to lack of skilled staff; and
- ✓ Lack of education and water conservation awareness.

Not all the reduction in non-revenue water can be attributed to the programme as water restrictions were also imposed as well as industries reducing their usage to alleviate the effects of the drought.

4.4 Water Demand Model

The Water Demand Model as described within Section 1.5 was applied to the City of uMhlathuze Local Municipality and the population growth estimates utilising Census' Community Survey 2016 as base were used to determine the project population until 2050 of which the detailed are provided within the paragraphs hereafter.

4.4.1 Water Demand for City of uMhlathuze Local Municipality

The water requirements (in Mℓ/d) for the CoU are presented within Table 4-3: Water Requirements (Mℓ/d), for City of uMhlathuze Local Municipality. These water requirements were calculated for consumers having formal water supply schemes and for consumers not yet supplied from a formal water supply scheme. Section 1.5 Water Demand Methodology in this report explains the approach for the calculations to determine the theoretical water requirements and adjusted for water losses. The CoU would require by the year 2050, 500.2 Mℓ/day.

Table 4-3: Water Requirements (Mℓ/d), for City of uMhlathuze Local Municipality

Local Municipality	Population 2020	Water Requirements (Mℓ/day)						
		2020	2025	2030	2035	2040	2045	2050
City of uMhlathuze	**414 209**	**284.6**	**326.9**	**369.2**	**411.7**	**456.9**	**498.9**	**500.2**

Richards Bay is the economic centre of the City of uMhlathuze Local Municipality and would therefore have a high water demand.

4.4.2 Demand per Regional Water Scheme

The water requirements for CoU are presented in this section per existing Water Supply Scheme (WSS) area and potential future Water Supply Intervention Area (WSIA) area for the entire LM, thus covering all consumers in the municipality. Table 4-4 represents the water demands in Mℓ/day.

The Empangeni WSS/WSIA and Northern WSS/WSIA have the highest water demands of approximately 44% and 36% respectively followed by the Southern Scheme with a demand of 12% . These WSS/WSIA are not the biggest supply areas within CoU but would be serving close to 67% of the CoU population and most of the industries. The majority of large commercial industries such as Mondi, Bayside Aluminium, Hillside Aluminium, Foskor, Tongaat Hulett and Mpact Packaging Mill are located within these two (2) WSS/WSIAs.

Table 4-4: Water Demand per WSS/WSIA in Mℓ per day

Water Supply Scheme / WSIA		Population 2020	Water Requirements (Mℓ/day)						
			2020	2025	2030	2035	2040	2045	2050
UTG001	Empangeni Scheme	40 781	100.6	124.3	148.0	171.7	195.4	219.1	219.1
UTG003	Southern Scheme	171 294	50.5	53.0	55.5	58.0	60.5	62.1	62.1
UTG012	Western Scheme	60 407	15.5	16.0	16.4	16.9	20.1	20.8	21.5
UTG015	Northern Scheme	65 144	103.6	118.9	134.1	149.4	164.6	179.9	179.9
UTG017	Nseleni Scheme	42 284	8.4	8.6	8.8	9.1	9.5	9.8	10.1
UTG018	Ntambanana Scheme	34 299	6.0	6.2	6.4	6.6	6.9	7.1	7.4
Total		**414 209**	**284.6**	**326.9**	**369.2**	**411.7**	**456.9**	**498.9**	**500.2**

5. EXISTING WATER SUPPLY INFRASTRUCTURE

This section provides an overview of the available water resources as well as the current surface water supplied schemes and the larger groundwater schemes (not for individual consumption). Some of the water sources are also shared for the purpose of industrial use within the WSA.

The six (6) water schemes areas within CoU are discussed in detail after Section 5.2. The water scheme areas are as follows:

- ✓ Empangeni Scheme;
- ✓ Southern Scheme;
- ✓ Western Scheme;
- ✓ Northern Scheme;
- ✓ Nseleni Scheme; and
- ✓ Ntambanana Scheme.

5.1 WATER RESOURCE AVAILABILITY

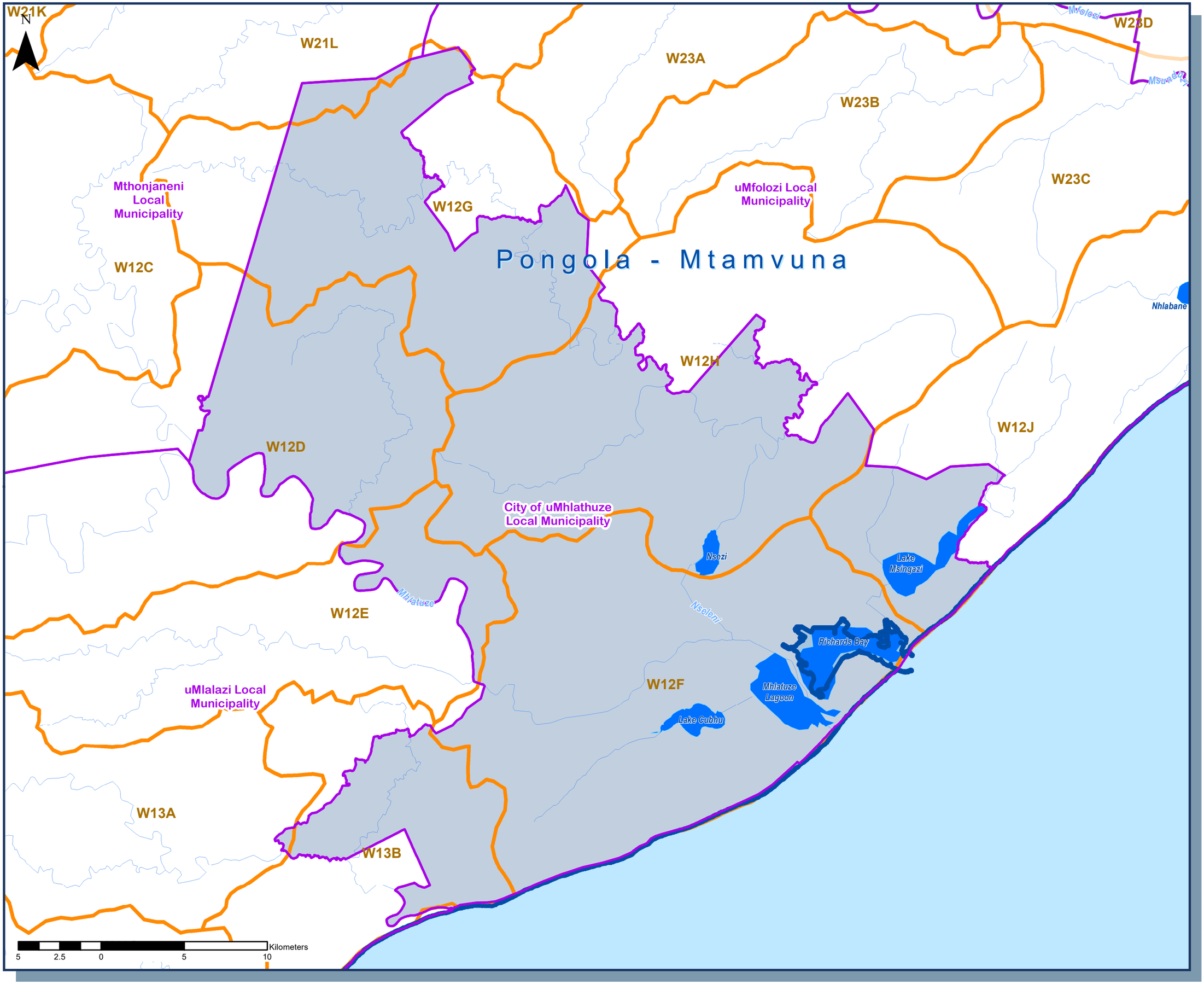
The CoU currently receives water mainly from ssurface water sources, as most borehole developments are restricted to rural areas and privately-owned farmlands, additionally most boreholes are considered to have fallen into disuse (see Figure 5-1 overleaf). Furthermore, based on the 2014 Bulk Water Master Plan the CoU does not have a water use entitlement for groundwater. Consequently, consideration of water availability under this section is restricted mainly to surface water resources.

5.1.1 Surface Water

5.1.1.1 Mhlathuze River and Lake Phobane (Goedertrouw Dam)

The Lake Phobane on the Mhlathuze River regulates the water to downstream irrigators as well as urban and industrial users in CoU. The dam had a storage capacity of 321 million m^3 when it was commissioned in 1982; a decreased capacity of approximately 301 million m^3 in 2000; and is decreasing at an estimated rate of 1.1 million m^3/annum due to siltation.

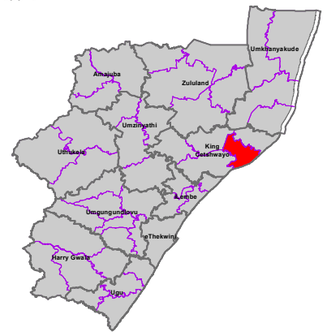
The water from the dam is abstracted from an irrigation canal, from run-of-river abstractions for agriculture, and at the Mhlathuze Weir. Nkwaleni, Mfule and Heatonville irrigators draw water from the river for the irrigation of sugar and citrus, between Lake Phobane and the Mhlathuze Weir. Irrigation is supplied under the Goedertrouw Government Water Scheme, with some irrigators fed directly from the dam, the Heatonville irrigators from a system of concrete channels that are fed from a pump station on the Mhlathuze River (DWS, 2014).



Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Water Management Area
- Quaternary Boundaries & Numbers (W22F)

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

DISTRICT MUNICIPALITY:

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Water Resources

City of uMhlathuze Local Municipality

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LM282: Figure 5.1

Lake Phobane is supplemented with water transfers from the Thukela River when the Lake drops below 90%. The transfer scheme was built as an emergency intervention during the drought of 1994 and aimed to supply 37 million m^3 /a (1.2m^3 /s) to the Mvuzane Stream, which flows into the Mhlathuze River upstream of Lake Phobane. During the recent drought this transfer was doubled and is now capable of supplying 2.4 m^3/s (based on personal communication with AECOM 2019).

5.1.1.2 Ntuze River

The Ntuze river catchment area consists of various sub-catchments ranging in size from 0,7 km^2 to 82 km^2. The total catchment area is 82,9 km^2. It stretches from the Mlalazi River in the south to the Umgoye forest in the north. The eastern boundary of the catchment is approximately 2 km west of Vulindlela urban centre.

Other main rivers in the catchment area are:

- ✓ Msasandla River;
- ✓ Kwagugushe River; and
- ✓ Manzamnyama River

The land within the Ntuze River catchment rises from 10 m above MSL in the south to 460 m above MSL in the north. Approximately 60% of the Ntuze catchment falls within the CoU's municipal boundary. This includes the traditional authority area of Mkhwanazi North. In 1977, the then Department of Water Affairs built five weirs along the Ntuze River – a tributary of the Umlalazi River.

Mtunzini abstracts water from a weir in the Ntuze River, approximately 700 m upstream of the confluence with the Mlalazi River.

5.1.1.3 Lake Mzingazi

Lake Mzingazi is a freshwater coastal lake fed by several streams, the main ones being the Mdibi and Mzingazi Rivers. The coastal dune barrier separates the lake from the sea. The Mhlathuze flood plain separates the lake from the Richards Bay Harbour. The southern part of the lake is approximately 14m below mean sea level and therefore susceptible to saline water intrusion, especially during drought conditions. A weir was constructed across the lake's outlet in order to increase its capacity and meet the local demands for water. A second weir is downstream of the lake to limit saltwater intrusion into the lake from the Mzingazi River (Moloi P, 2012).

The historical firm yield of Lake Mzingazi is documented as 10.5 million m^3/a (28.8Mℓ/day). The total catchment area of Lake Mzingazi is 164 km^2 and at full supply level the volume is 47,6 Mm^3 (Cornelius, 1981).

The registered water use allocated to the City of uMhlathuze Local Municipality for Richards Bay is much higher than the historical firm yield. DWS has determined the 98% assured allocation from Lake Mzingazi as 36,7 Megalitres per day (Mℓ/d). Full supply level of the lake is at 3,03 m above MSL, at which level the total surface area is 12,17 km^2.

The CoU has a lawful water use of 21 762 000 m³/a (59,62 Mℓ/d on average) from Lake Mzingazi. Water can also be provided from Mhlathuze Water's WTP at Lake Nsezi when the water level in Lake Mzingazi drops to a predetermined level.

5.1.1.4 Mzingwenya River and Lake Chubu

The Mzingwenya River runs along the northern perimeter of Esikhaleni urban centre. A significant proportion of stormwater drainage of the township drains towards the Mzingwenya River, which in turn drains into Lake Chubu.

Lake Chubu is a natural shallow freshwater system situated in a shallow valley 4,6 km inland from the sea and 2 km north east of Esikhaleni. The lake's elevation is approximately 3,0 m above MSL and has a mean depth of about 2,5 m. An earth wall was constructed in 1979 in order to raise the lake level. The outflow passes over a weir in the North East corner of the lake and flows through a wetland to the Mhlathuze Estuary (Martin and Cyprus, 1994). The quoted yield of Lake Cubhu, was determined in the 1970's at 30Mℓ/day (WSDP, 2005). The lawful water use that the CoU holds is little more than half that figure at 6 026 400 m³/a (16,51 Mℓ/d on average). However, in the recent DWS Reconciliation Strategy it was determined that the yield was only 0.4 million m³/a (1.1Mℓ/day). If the lake levels drop too low, then the area can be supplied from the Mhlathuze Water transfer scheme. The lake level dropped to 18% in the 2014/15 financial year due to drought. The catchment of Lake Chubu is relatively small (81 km²) and the Mzingwenya River is primarily responsible for surface water input into the lake. Outflow from the lake discharges into the Mntantatweni Stream and flows through a wetland into the Mhlathuze Estuary.

5.1.1.5 Nseleni River and Lake Nsezi

The Nseleni River feeds Lake Nsezi which is an inland lake, located in W12F quaternary catchment on the southern end of the Nseleni River. The section from Lake Nsezi out flow to the Mhlathuze River has been canalised to accommodate sugar cane farming by uMhlathuze Valley Sugar. The Nseleni River includes for a substantial catchment area to the north of Empangeni including mostly tribal areas. Tribal areas of note are Khoza / Bhojane, Cebekhulu, Ndlazini (Mambuka) and Ntambanana (WSDP, 2005). The Thukela-Mhlathuze Government Water Scheme augments the supply in the lake through a pipeline that conveys water from Mhlathuze Water's weir in the Mhlathuze River.

Lake Nsezi acts as balancing storage for Mhlathuze Water's WTP. These works supply much of the CoU's requirements, including when the water level in Lake Mzingazi drops to a level that might result in salt water intrusion into the lake. The volume of the lake is 25 million m³, and the historical firm yield is 6.6 million m³/a (18Mℓ/day) (DWS, 2014). When levels at Lake Nsezi and Lake Cubhu drop, the water is supplemented from the Mhlathuze River via the Mhlathuze Weir. The Mhlathuze Weir water supply is regulated by releases from the upstream Lake Phobane.

The CoU currently has an allocation of 62 Mℓ/d from Lake Nsezi for potable water, of which 37 Mℓ/d is intended for Empangeni/Ngwelezane and 25 Mℓ/d to augment the supply for Richards Bay/Nseleni. Mhlathuze Water treats the raw water and delivers the potable water to receiving reservoirs in Empangeni and Richards Bay.

5.1.1.6 Lake Nhlabane

Lake Nhlabane has a historical firm yield of approximately 7.9 million m^3/a (21.6Mℓ/d) (DWS, 2014). The lake has been significantly transformed by Richards Bay Minerals (RBM) through the building of a concrete barrage that blocks the lake's connection with the sea. This barrage resulted in the north and south sections of the lake merging, and the lake changing from an estuarine to fresh water lake, with the consequent change in fauna and flora.

This barrage was built in order to increase the water available for the RBM ponds and smelters (DWS, 2015). In addition to the supply from Nhlabane, RBM transfers about 18 million m^3/a from the Mfolozi catchment near the estuary into their mining ponds in order to supplement the water they abstract from Lake Nhlabane. RBM also has a supplementary supply source in Lake Nsezi, and they have an agreement with Mhlathuze Water for 16.4 million m^3/a.

5.1.2 Ground Water Sources

The Namaqua-Natal Province is comprised mainly of intrusive gneisses, including the gneisses which form part of the Matigulu Steep Belt (Cornell *et al*., 2006). These gneisses include quartz feldspar gneisses, biotite gneisses and amphibole gneisses. These underlie the southern portion of the CoU. The northern portion of the CoU, is underlain by intrusive gneisses, including the gneisses of the Ngoye Complexes, which form part of the Tugela Group (Cornell *et al*., 2006). These lithologies include gneisses, olivine norites, granitic gneisses and amphibolies

The underlying gneisses, amphibolies and norites of the area are considered secondary aquifers which are described as weathered and fractured rock aquifers with negligible primary porosity since groundwater movement is confined to joints, fractures and geological contacts, therefore groundwater development options are often limited to these zones. According to *"Characterisation and Mapping of the Groundwater Resources, Mapping Unit 3"* May 1995, as prepared by Groundwater Development Services, borehole yields can be described as poor to moderate and usually range between 0.1ℓ/sec and 3.0ℓ/sec. Most water-strikes are encountered in the transition / contact zone between the weathered and un-weathered units.

As such bboreholes geophysical sited to intersect the major geological structures identified within the study area can produce borehole yields in excess of 3.0ℓ/sec.

Ambient groundwater quality in this region is generally moderate to poor due to elevated total dissolved solids (TDS) concentrations, which raise electrical conductivity (EC) levels to between 100 mS/m and 150 mS/m. Sporadically-elevated concentrations of fluoride (F), nitrate (NO_3) and sodium (Na) also occur in these

geological environments, whilst elevated total coliforms and *E.coli* levels are common, and are usually attributed to anthropogenic activities and livestock grazing.

The hydro-chemical characteristics classify the groundwater quality in the fresh water to slightly saline range.

The major concerns with the use of ground water are as follows:

- ✓ No recent borehole data is available;
- ✓ Over-utilisation of boreholes and aquifers lower groundwater levels;
- ✓ Extremely limited data is available for the primary (unconsolidated sediment) aquifers;
- ✓ Access to land and acquiring of land to drill new boreholes is expected to be a challenge; and
- ✓ Operation and maintenance of large scale well fields have proved to be challenging in the past for local municipalities.

5.1.3 Desalination

Seawater could yield a limitless volume. The water demand versus other available sources at the time of implementation will determine the yield of the scheme to be developed. Reverse Osmosis (RO) is currently the most widely implemented desalination process globally. RO technology has been applied in over 90% of the municipal desalination plants built over the past two decades (Voutchkov) and RO is the recommended desalination process. The costs of operating RO plants have been lowered by two significant developments over the past decade:

- ✓ The development of membranes that can operate under lower pressures, and
- ✓ The incorporation of an energy recovery device in the brine stream leaving the pressure vessel.

Membrane desalination is based on the ability of semi-permeable membranes to separate mineral salts and water by allowing the selective migration of water (but almost no salts) from one side of the membrane to the other side. The preferred technologies and final process configurations chosen for the plant components are informed by the preferred site location.

5.1.4 Effluent Re-Use

Large volumes of wastewater and industrial effluent are discharged to the CoU's waste Water Treatment Plants and Mhlathuze Water's marine outfall. Wastewater from Richards Bay is screened and macerated, mixed with sea water and then discharged out to sea through Mhlathuze Water's marine outfall pipelines A and B. It should be noted that the marine outfall pipelines, operated by Mhlathuze Water, also receive a substantial portion of industrial effluent from Mondi, Foskor and Tronox.

The Mhlathuze Water Marine outfall consists of two lines, A-line and B-Line. The A-line handles domestic and industrial effluent while the B-line handles slurry from Foskor and pulp from Mondi. The effluent and slurry

are mixed with sea water and then pumped approximately 4km out to sea and discharged through a diffuser. The main contributors to the Marine Outfall Lines are indicated in Table 5-1.

Treated wastewater and sewage effluent from the Ngwelezane, the Empangeni and the Vulindlela WWTP together with the Tongaat Hulett effluent return are discharged to the Mhlathuze River upstream of Mhlathuze Water's weir. This means that that the volume of effluent flowing from these facilities are already indirectly reused, due to its location above the Mhlathuze Water abstraction point in the Mhlathuze river.

Utilizing this effluent will not add to the water balance as its contribution is already taken into account with the yield determination of the Mhlathuze River Weir. Moving this effluent around to different end users will merely enable a more targeted use.

Table 5-1: Existing Marine Outfall Pipeline Volumes

Line	Contributor	Type of Effluent	Effluent Volumes
A-Line	Alton	Raw Sewage	5.0Mℓ/day
	Arboretum	Raw Sewage	10.0Mℓ/day
	Mondi	Treated Effluent	45.0Mℓ/day
	Felixton	Treated Effluent	7.0Mℓ/day
	Tronox	Treated Effluent	1.5Mℓ/day
	Hillside Aluminium	Treated Effluent	1.5Mℓ/day
	Bayside Aluminium	Treated Effluent	1.5Mℓ/day
	Total		**71.5Mℓ/day**
B-Line	Mondi	Pulp	25
	Foskor	Gypsum Slurry	5
	Total		**30.0Mℓ/day**

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019

Treated sewage effluent from the Nseleni WWTP is discharged to the Nseleni River upstream of Lake Nsezi. Treated wastewater and sewage effluent from the Esikhaleni WWTP and macerated effluent from Richards Bay are discharged to sea without being re-used. Utilisation of these effluent streams will have a positive effect on the water balance of the region. Table 5-2 shows the average "Targetable for reuse" effluent volumes received at the above-mentioned works.

Table 5-2: Average Treated Effluent Received by CoU and Targetable for Re-use

Wastewater Treatment Plants	Volume of Treated Effluent Returned to Source	Volume of Treated Effluent Targetable for Re-use
Empangeni*	9.0Mℓ/day	0.0Mℓ/day
Esikhaleni	8.0Mℓ/day	8.0Mℓ/day
Ngwelezane*	2.0Mℓ/day	0.0Mℓ/day
Nseleni*	1.0Mℓ/day	0.0Mℓ/day
Vulindlela*	1.0Mℓ/day	0.0Mℓ/day

Wastewater Treatment Plants	Volume of Treated Effluent Returned to Source	Volume of Treated Effluent Targetable for Re-use
Marine Outfalls (30.0Mℓ/day discharged through the 'B-line' which cannot be treated sufficiently)**	71.5Mℓ/day	71.5Mℓ/day
Total	**92.5Mℓ/day**	**79.5Mℓ/day**

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019

*Effluent currently being discharge upstream of existing abstraction points.

*** A portion of this flow emanates from water that is provided directly to industry by Mhlathuze Water, of which Mondi is the biggest consumer.*

Portions of the volumes indicated in Table 5-2 above are currently discharged into the ocean and could therefore be targeted as sources of re-use water.

The industries listed in Table 5-3 have indicated their willingness to make use of the proposed re-treated water.

Table 5-3: Possible Re-use Water End Users as indicated in the PPP Feasibility

Industry	Current Usage as Indicated (2017)	Future Use as Indicated	Planned date of use	Current source of Water
Foskor	14.2Mℓ/day	25.0Mℓ/day	Not indicated	Mhlatuze Water (Current User)
RBM	10.0Mℓ/day	30.0Mℓ/day	2020	Mhlatuze Water (New User)
RB IDZ	0.0Mℓ/day	11.7Mℓ/day	2020	Mhlatuze Water (New User)
South 32 (Hillside Aluminium)	1.2Mℓ/day	1.2Mℓ/day	0	Mhlatuze Water (Current User)
Eskom	0.0Mℓ/day	5.0Mℓ/day	2023	Mhlatuze Water (New User)
Total	**25.4Mℓ/day**	**72.9Mℓ/day**		

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019

5.1.5 Existing Water Users and Allocations

The industrial current and future water use and demand should also be considered when the total water demand for 2050 is determined. The Bulk Water Master Plan of 2019 for CoU determined a 25-year demand horizon that indicates a total industrial demand of 516.65 Mℓ/day as illustrated within Table 5-4 below.. The later would also be included when determining the projected water demand for 2050 and the associated infrastructure requirements.

Table 5-4: Industrial Water Use Allocation and Calculated Current and Future Demand

Supply Sector	User	Allocation		Demands	
		Annual (M^3/Annum)	Daily (Mℓ/d)	Current (Mℓ/d)	25Yr (Mℓ/d)
Industry	Mondi Richards Bay	36.5	100.0	62.1	100.0
	RBM - Total	60.4	165.6	64.1	148.0
	RBM - Nhlabane	23.0	63.0	19.2	63.0
	RBM - uMfolozi	21.0	57.5	27.4	40.0

Supply Sector	User	Allocation		Demands	
		Annual (M³/Annum)	Daily (Mℓ/d)	Current (Mℓ/d)	25Yr (Mℓ/d)
	RBM - Nsezi	16.4	45.0	17.5	45.0
	Tronox - Total	11.5	31.5	20.0	48.0
	Tronox - Hillendale	11.5	31.5	20.0	48.0
	Tronox - potable	0.0	0.0	0.0	0.0
	Foskor - Total	10.4	28.6	14.2	32.7
	Foskor - clarified	6.2	17.0	14.2	11.3
	Foskor - potable	5.0	13.6	0.0	21.4
	Mpact	2.5	6.8	6.0	6.8
	Tongaat Hulett	1.4	3.7	1.8	3.7
	Bayside - Total	0.3	0.9	0.0	0.0
	Bayside - raw	0.3	0.9	0.0	0.0
	Bayside - potable	0.0	0.0	0.0	0.0
	Hillside	0.8	2.1	0.0	0.0
	RBCT	0.0	0.0	0.0	0.0
	Total	123.8	339.1	168.3	339.2
Urban	Empangeni	13.51	37.00	21.766	42.979
	Richards Bay	9.13	25.00	45.518	58.316
	Esikhaleni	11.32	31.00	30.323	51.664
	Nseleni	0.00	0.00	12.476	17.274
	Ngwelezane	2.92	8.00	6.494	7.24
	Ntambanana	0.00	0.00		
	Total	**36.87**	**101.00**	**116.577**	**177.473**
GRAND TOTAL		**128.17**	**350.21**	**284.837274**	**516.6461507**

Potable Water
Clarified Water
Raw Water

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019

5.2 WATER SUPPLY SCHEMES

The six (6) major schemes are listed below and are depicted in Figure 5-2 for the CoU overleaf

- ✓ Northern Scheme;
- ✓ Empangeni Scheme;
- ✓ Western Scheme;
- ✓ Southern Scheme;
- ✓ Ntambanana Scheme; and
- ✓ Nseleni Scheme.

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

uMlalazi Local Municipality

City of uMhlathuze Local Municipality

King Cetshwayo

Ntambanana Scheme

Empangeni Scheme

Nseleni Scheme

Northern Scheme

Western Scheme

Southern Scheme

Crocodile Dam WTP
1Ml/d

Nseleni

Empangeni

Ngwelezana

Ngwelezane WTP
8Ml/d

Nseleni WTP
204Ml/d

Richard's Bay

Mzingazi WTP
65Ml/d

Nzalabantu

Meer-en-See Desalination Plant

Felixton

Vulindlela

Esikhawini

Esikhaleni WTP
36Ml/d

Kilometers
5 2.5 0 5 10

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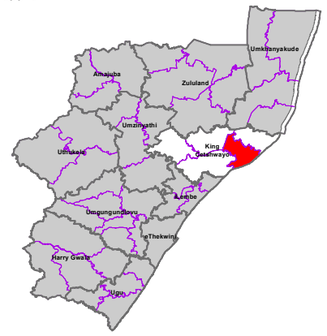
- Existing Water Pumpstations
- Existing Water Treatment Plants
- Surface Water Abstraction Works
- Existing Weir
- Existing Regional Bulk Pipelines
- Water Scheme Areas & Names (Hlabisa)

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Scheme Areas & Infrastructure Components
City of uMhlathuze Local Municipality

DATE COMPLETED:
30 September 2020

MAP NO.:
LM282 Figure 5.2

5.2.1 Northern Regional Supply Scheme

The Northern Scheme, owned by CoU and operated by CoU, abstracts raw water from Lake Mzingazi, which is then treated and distributed into Richards Bay and the industrial areas (DWS, 2011) and illustrated within Figure 5-3 overleaf. The industrial area within the Richards Bay includes the Alton area, where Mondi, Hillside and Bayside Aluminium and Foskor are located. The residential suburbs include Meerensee, Arboretum and Veld en Vlei and the commercial/ light-industrial centre. Both residential and commercial/light-industrial users, are primarily supplied from the Mzingazi treatment plant, and supplemented when necessary from the Nsezi treatment plant. However, the Mzingazi WTP was mothballed in 2014, due to the water level in the lake dropping to the point where saline concentrations were becoming a treatment issue. This plant has only recently been brought back into service but at greatly reduced volume due to operational issues brought about by the extended period of mothballing.

The Nseleni Scheme is also supplied via this scheme as the old Nseleni WTP is no longer functioning but the potable water pump station at the scheme is used to supply the area (DWS, 2014).

5.2.1.1 Abstraction and Treatment

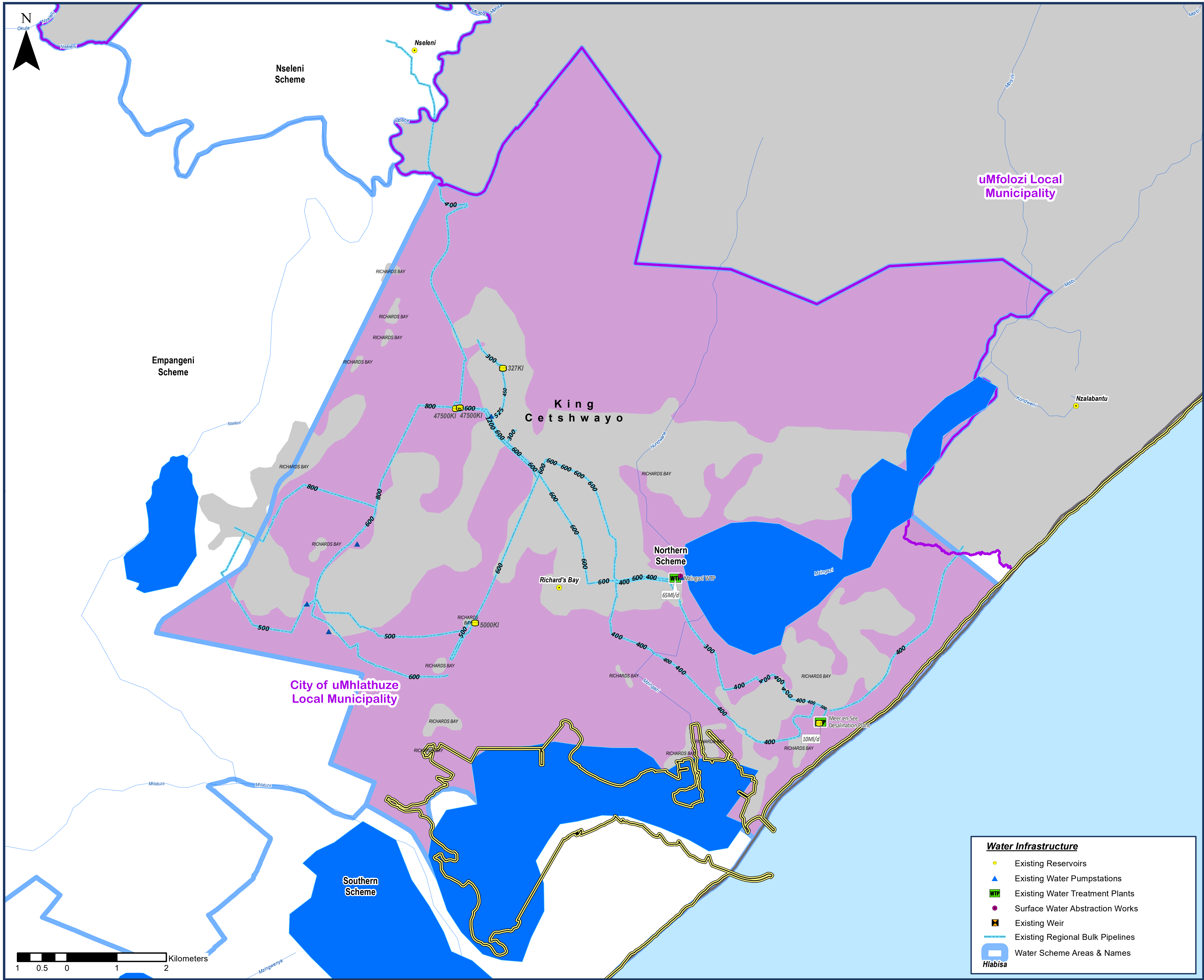
The historical firm yield of Lake Mzingazi is documented as 10.50 million m^3/a (28.77 Mℓ/d) (DWS, 2014.) The registered water use allocated to the City of uMhlathuze Local Municipality for Richards Bay is much higher than the historical firm yield, at 24.18 million m^3/a (66.25 Mℓ/d). The actual abstractions between 2008 and 2018 fluctuated from a low of zero during the drought and a high of 22.4 million m^3/a (61.4 Mℓ/d).

The raw water pumping capacity can deliver up to 97.5 Mℓ/d from the lake, however the flow rate of the treatment plant when lake levels permit, is 50-60 Mℓ/d (2008-2013 data). This abstraction takes place until the lake drops to the level at which seawater intrusion becomes a possibility, at which point abstraction must cease. Water supply is supplemented by water from the Nsezi WTP, with a contracted volume of 25Mℓ/day (DWA, 2011). However, between September 2014 and 2018 Nsezi WTP was supplying the complete requirement for the Northern Scheme due to the saline levels in the lake and operational problems at the works.

Approximately 50% - 60% of the total water supplied by the Northern Scheme is for urban Richard's Bay with the remainder being supplied to Nseleni and industrial companies (Mondi, Hillside, Bayside Aluminium and Foskor).

5.2.1.2 Distribution and Storage

Water is distributed to three (3) command reservoirs from Mzingazi WTP, namely Mandlazini (x 2) and Meerensee Reservoirs from which potable water is distributed to urban Richards Bay and the industrial areas. A bulk line from Mandlazini Reservoir feeds water to Nseleni. Water can also be supplied to the Mandlazini reservoir from the Nsezi WTP, this is then supplied to the storage reservoir at the Mzingazi WTP under gravity from where it is pumped to the Meerensee Reservoir.



Legend

- Provincial Boundaries
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- Rivers
- Settlements & Settlement Names
- Major Towns (Eshowe)

LOCALITY:

CLIENT: UMGENI WATER · AMANZI

LOCAL MUNICIPALITY: CITY OF UMHLATHUZE LOCAL MUNICIPALITY

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Scheme Areas & Infrastructure Components - Northern City of uMhlathuze Local Municipality

DATE COMPLETED: 30 September 2020

MAP NO.: LM282 Figure 5.3

A summary of the Northern Scheme bulk water infrastructure is presented in Table 5-5**.**

Table 5-5: Northern Scheme Infrastructure Summary

Infrastructure Component	Existing Infrastructure Capacity		
Treatment	**Capacity (Mℓ/d)**		
Mzingazi WTP	65		269
Nsezi WTP	204		
Storage	**Capacity (Mℓ)**		
Meerensee Reservoir	10		110.32
Foskor Reservoir	5		
Mandlazini Reservoir	2x47.5 (95)		
Brakenham Water Tower	0.32		
Bulk Distribution	**Dia (mm)**	**Length (m)**	**Flow (Mℓ/day)**
Mzingazi WTP – Meerensee Reservoir	400	3 199	13.2
Meerensee Reservoir to Meerensee	400	1 023	13.2
T-off on Mzingazi/Meerensee line to Foskor Reservoir	400	10 231	13.2
Mzingazi WTP to Mandlazini Reservoir	600	6 087	34
Mandlazini Reservoir to Foskor Reservoir	800	unknown	69.22
Mandlazini Reservoir to Nseleni Reservoir	400	9 422	13.2
Nseleni Reservoir to KwaKhoza Reservoir	200	2 403	2.87
Brakenham Pump station to Brackenham water tower	450	1 373	17.25

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019 &UAP Phase II, City of uMhlathuze, 2016

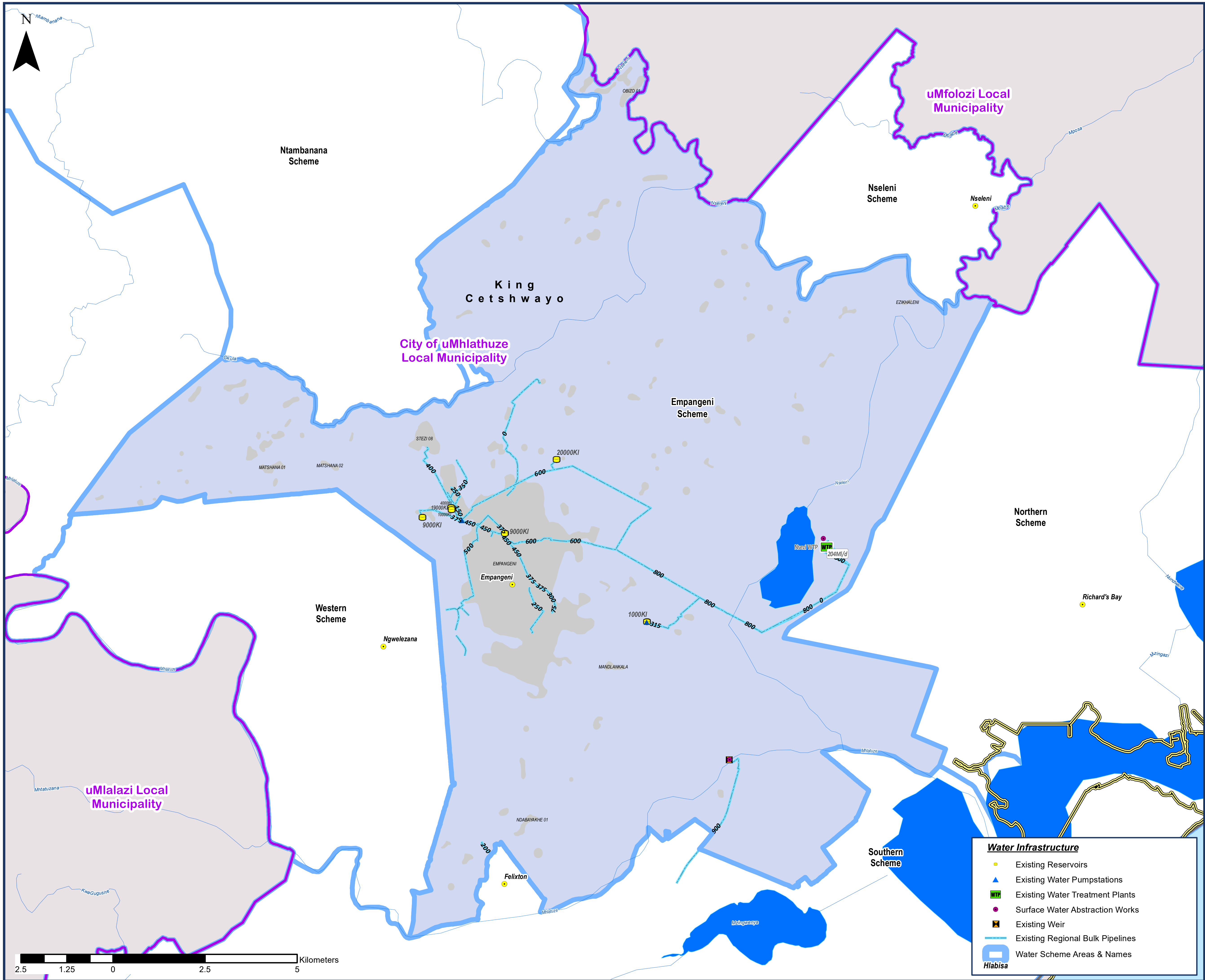
5.2.2 Empangeni Scheme

The Empangeni Scheme which is owned and operated by the CoU and water is supplied via the Nsezi WTP and illustrated within Figure 5-4 overleaf. The Scheme supplies the Empangeni urban centre which contains a large light industry and commercial sector, in addition to the residential users. The scheme also augments the Western Scheme via the Magazulu Reservoirs if required.

There was previously a WTP on the western shore of Lake Nsezi to serve Empangeni. However, this was decommissioned and the new Lake Nsezi WTP on the eastern shore was built to supply Empangeni, Mondi Richards Bay, Foskor, and the Richards Bay Minerals (RBM) smelter.

5.2.2.1 Abstraction and Treatment

The scheme is supplied from the Nsezi WTP. However, the yield of Lake Nsezi can no longer meet the water requirements, and as such is supplemented by transfers from the Mhlathuze River, via the Mhlathuze Weir which is owned and operated by Mhlathuze Water.



Legend

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LOCALITY:

CLIENT: UMGENI WATER · AMANZI

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Scheme Areas & Infrastructure Components - Empangeni
City of uMhlathuze Local Municipality

DATE COMPLETED:
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MAP NO.:
LM282 Figure 5.4

The water abstracted from the weir is supplied from Lake Phobane (Lake Phobane, owned and operated by the Department of Water and Sanitation) along the Mhlathuze River. The water is released from the dam and flows for about 90km to the weir. From the weir, water is pumped into Lake Nsezi, which acts as balancing storage for the Nsezi WTP. The works has a capacity of 204Mℓ/day.

The operating rules for Lake Phobane (Goedertrouw Dam) are such that, when the dam level is below 90%, water is pumped from the Thukela River through the Middledrift ppipeline to supplement the water supplies of the Mhlathuze River system. The capacity of the transfer scheme adds an additional yield of 75 million m^3/a (based on personal communication with AECOM) to the Mhlathuze River system.

5.2.2.2 Distribution and Storage

Water is distributed to five (5) command and distribution reservoirs from the Nsezi WTP, namely Pearce Crescent, Hilltop, Hillview, Magazulu and John Ross elevated reservoir, from which potable water is distributed to both the Empangeni urban and light industrial areas. An additional bulk pipeline can also augment the Western Scheme from the Magazulu reservoir.

A summary of the Empangeni Scheme bulk water infrastructure is presented in Table 5-6.

Table 5-6: Empangeni Scheme Infrastructure Summary

Infrastructure Component	Existing Infrastructure Capacity		
Treatment	**Capacity (Mℓ/d)**		
Nsezi WTP	204		
Storage	**Capacity (Mℓ)**		
John Ross (Elevated)	1		58.8
Hilltop Reservoir	20		
Pearce Crescent	1x3.4 1x4.5 1x0.9 (8.8)		
Hillview Reservoir	1x10 2x5 (20) 4 reserved for Prison		
Magazulu	2x4.5 (9)		
Bulk Distribution	**Dia (mm)**	**Length (m)**	**Flow (Mℓ/d)**
Nsezi WTP to Pearce Reservoir	800 till T-off 600 thereafter	7459	36.6
T- off to Hilltop and Hillview Reservoirs	600	6761	
Hilltop Reservoir to Hilltop	600	500	
Pearce Crescent Reservoir to Hillview Reservoir	450	1351	5.7
Pearce Crescent Reservoir to Hillview Reservoir – T-off back to reservoir	375	218	3.98
Hillview Reservoir to Magazulu Reservoir	375	1366	3.98
Magazulu Reservoir to Ngwelezane	450	4782	20

Infrastructure Component	Existing Infrastructure Capacity		
T-off to John Ross Elevated Tank	315	1954	

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019 &UAP Phase II, City of uMhlathuze, 2016

5.2.3 Western Scheme

The Western Scheme is owned by the CoU. The Ngwelezane WTP (8Mℓ/day) is also operated by CoU. The Scheme supplies Ngwelezane Town and the Madlebe tribal areas and illustrated within Figure 5-5. These communities are supplied via the Ngwelezane reservoir complex which consists of five (5) reservoirs ranging in size from 1.6 Mℓ. to 6.5 Mℓ.

5.2.3.1 Abstraction and Treatment

The scheme is supplied from the Ngwelezane WTP. Water abstracted via a run of river abstraction works upstream of the Mhlathuze weir and is supplied from Lake Phobane (Goedertrouw Dam, owned and operated by the Department of Water and Sanitation). The water is released from the dam and flows for about 73km to the abstraction tower.

The operating rules of Lake Phobane (Goedertrouw Dam) are such that, when the dam level is below 90%, water is pumped from the Thukela River through the Middledrift pipeline to supplement the water supplies of the Mhlathuze River system. The capacity of the transfer scheme adds an additional yield of 75 million m^3/a (based on personal communication with AECOM) to the Mhlathuze River system.

The Works has a design capacity of 8Mℓ/day and operates at full capacity. However, based on average production volumes prior to the drought, the plant's distributed production volume only averages 7.7Mℓ/day due to operational constraints.

5.2.3.2 Distribution and Storage

Water is pumped to the Ngwelezane command reservoir complex. Water is then distributed to a number of small distribution reservoir scattered throughout the Madlebe tribal area. If required, additional water can be supplied to the scheme from the Magazulu Reservoir.

N

Western Scheme

Empangeni Scheme

King Cetshwayo

City of uMhlathuze Local Municipality

uMlalazi Local Municipality

Southern Scheme

Ngwelezane WTP

8Ml/d

3500Kl

1880Kl

1800Kl

6500Kl

Ngwelezane

Empangeni

Felixton

Hlabisa

EBINGOMA

NQOTSHENI 02

SGISI 03

INIWE 02

Mhlathuze

Mhlatuzana

KwaGugushe

Kilometers

1 0.5 0 1 2

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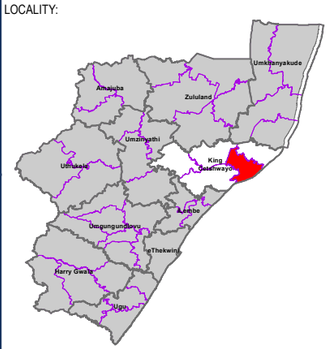
- Existing Water Pumpstations
- Existing Water Treatment Plants
- Surface Water Abstraction Works
- Existing Weir
- Existing Regional Bulk Pipelines
- Water Scheme Areas & Names

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Scheme Areas & Infrastructure Components - Western City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

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LM282 Figure 5.5

A summary of the Western Scheme bulk water infrastructure is presented in Table 5-7.

Table 5-7: Western Scheme Infrastructure Summary

Infrastructure Component	Existing Infrastructure Capacity		
Treatment	**Capacity (Mℓ/d)**		
Ngwelezane WTP	8	7.7	
Storage	**Capacity (Mℓ)**		
Ngwelezane Command	1x0.05 1x6.5 1x3.5 1x1.8 1x1.6	13.45	
Bulk Distribution	**Dia (mm)**	**Length (m)**	**Flow (Mℓ/d)**
Ngwelezane WTP to Ngwelezane Reservoir	250	4 001	4.66
Ngwelezane WTP to Ngwelezane Reservoir	225	4 001	
Empangeni Scheme to Ngwelezane Reservoir	450	4 782	17.25

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019 &UAP Phase II, City of uMhlathuze, 2016

5.2.4 Southern Scheme

The Southern Scheme is owned by CoU and operated by CoU. The scheme supplies water to the town of Esikhaleni, the village of Felixton and the Vulindlela tribal areas and illustrated within Figure 5-6.

The plant abstracts raw water from Lake Cubhu, which is then treated and distributed within the scheme via the Forest command reservoir complex. When necessary, additional raw water is supplied to the plant from the Mhlathuze weir via infrastructure owned and operated by Mhlathuze Water.

5.2.4.1 Abstraction and Treatment

Esikhaleni WTP relies on a dual system for the supply of raw water. The two (2) sources consist of Lake Cubhu and the Mhlathuze River. The system from the Mhlathuze River is only utilized when Lake Cubhu fails to supply the required volumes.

Historically Esikhaleni relied completely on Lake Cubhu as a source. The lake has a quoted yield of 30Mℓ/day, which was determined during the 1970's. However, based on a DWS water interventions report, dated 2015, the firm historic yield (based on surface water only) is only 0.4 Million m³/a (1Mℓ/day). During the 1992/94 drought, problems were experienced with low lake levels, after which it was decided to augment supply from the Mhlathuze River. The scheme from the Mhlathuze River was implemented as part of the Iscor Mining water supply scheme and was completed during May/June 2001. This system has a rated transfer capacity of 34Mℓ/day. Lake Cubhu is utilized as a source for as long as possible as the turbidity in the lake varies between 5 and 30 NTU. Whereas the turbidity in the Mhlathuze River varies between 20 and 300 NTU. As the Esikhaleni WTP is a direct filtration plant this increased turbidity requires additional processing.

N

Empangeni

Ngwelezana

Western Scheme

Empangeni Scheme

Northern Scheme

Richard's Bay

City of uMhlathuze Local Municipality

King Cetshwayo

uMlalazi Local Municipality

1250KI

Felixton

Vulindlela

20000KI

Esikhaleni WTP

36Ml/d

Esikhawini

Southern Scheme

Kilometers

2.5 1.25 0 2.5 5

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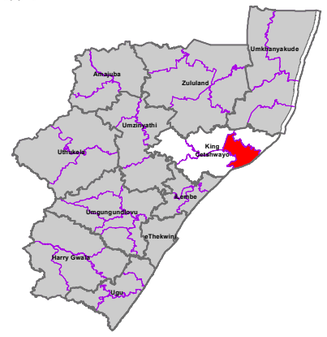
- Major Towns (Eshowe)

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

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Email: pretoria@mariswe.com

PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Scheme Areas & Infrastructure Components - Southern
City of uMhlathuze Local Municipality

DATE COMPLETED: 30 September 2020

MAP NO.: **LM282 Figure 5.6**

Water Infrastructure

- Existing Reservoirs
- Existing Water Pumpstations
- Existing Water Treatment Plants
- Surface Water Abstraction Works
- Existing Weir
- Existing Regional Bulk Pipelines
- Water Scheme Areas & Names (Hlabisa)

Additionally, water from the lake can be supplied to the works under gravity conditions whereas supply from the Mhlathuze River requires pumping.

5.2.4.2 Distribution and Storage

Water pumped to the Forest command reservoir complex which consists of three (3) reservoirs. Water is then distributed to the Felixton and Vulindlela Reservoirs, and directly into the Esikhaleni reticulation system.

A summary of the Southern Scheme bulk water infrastructure is summaries in Table 5-8.

Table 5-8: Southern Scheme Infrastructure Summary

Infrastructure Component	Existing Infrastructure Capacity		
Treatment	**Capacity (Mℓ/d)**		
Esikhaleni WTP	36		
Storage	**Capacity (Mℓ)**		
Forest	3x20 (60)	81.25	
Vulindlela	20		
Felixton	1.25		
Bulk Distribution	**Dia (mm)**	**Length (m)**	**Flow (Mℓ/d)**
Esikhaleni WTP to Forest Reservoir	600	9 300	34
Forest Reservoir to Felixton	300	3 000	7.02
	200	1 900	2.87
Forest Reservoir to Port Durnford	700	1 700	49.88
	500	2 950	22.05
	400	5 420	13.2
Forest Reservoir to Vulindlela Reservoir	400	5 800	13.2

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019 &UAP Phase II, City of uMhlathuze, 2016

5.2.5 Ntambanana Scheme

The Ntambanana area was only transferred to the CoU after the 2016 local government elections. It included the Magwetshana, Bukhanana, Ntamabana and Esikadeni area and illustrated within Figure 5-7. Currently the reticulation is supplied with potable water from two sources the Crocodile Dam WTP and the Nsezi WTP via the Nseleni pumping station.

The Luwamba Raw Water Scheme was funded by the Office of the Premier and is now owned by CoU. However, due to some operational considerations is still being operated by the King Cetshwayo District Municipality. The Scheme supplies additional raw water to the Crocodile Dam WTP by pumping from the main irrigation balancing dam at Hilltop near Heatonville (Part of the Heatonville irrigation scheme which is owned by Tongaat Hulett) to supplement the supply.

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

City of uMhlathuze Local Municipality

King Cetshwayo

Ntambanana Scheme

Empangeni Scheme

Crocodile Dam WTP

1Ml/d

500Kl

200Kl

Kl

110Kl

100Kl

50Kl

0Kl

66Kl

560Kl

108Kl

40Kl

150Kl

150Kl

BHUKHANANA

MAKHOLWASE 01

MAKHOLWASE 02

MAQEDIPULETI

MALUNGWINI

KWAHLAZA

NQUTSHINI 04

INDODWANE

MHLANA 03

MQUZANKUNZI 01

OBIZO 02

NINGIZIMU 02

SIHUZU 01

STEZI 08

MAKHWELA 02

ESITHOMBENI

Ntambanana

Nseleni

Mvamanzi

Mhlabuyalingana

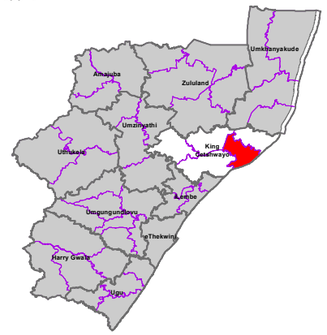
Kilometers

1 0.5 0 1 2

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Settlements & Settlement Names
- Major Towns (Eshowe)

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Scheme Areas & Infrastructure Components - Ntambanana
City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

MAP NO.:

LM282 Figure 5.7

Water Infrastructure

- Existing Reservoirs
- Existing Water Pumpstations
- Existing Water Treatment Plants
- Surface Water Abstraction Works
- Existing Weir
- Existing Regional Bulk Pipelines
- Water Scheme Areas & Names (Hlabisa)

The water is treated at the Crocodile Dam WTP from which it is pumped to the steel sectional tank located above the works. Potable water is gravitated into the command reservoir above Bukhanana town.

Additionally, potable water is supplied to the scheme from the east via a number of balancing and terminal reservoirs and gravity mains from the Nseleni scheme. This water is supplied from the Nsezi WTP via the Mandlazini reservoirs.

5.2.5.1 Abstraction and Treatment

Crocodile Dam WTP relies on a dual system for the supply of raw water. The two (2) sources consist of the dam itself and the recently completed Luwamba Raw water supply scheme. The firm yield of the dam is unknown at this stage, however, the capacity of the raw water supply scheme is 3Mℓ/day. The WTP capacity 1Mℓ/day, however there are plans to upgrade it to 2.5Mℓ/day.

The potable water supplied via the Nseleni pumping station is abstracted and treated by either the Nsezi or Mzingazi WTP's, these have been discussed further under the previous schemes.

5.2.5.2 Distribution and Storage

Raw water via the Luwamba scheme is pumped from the balancing dam at Hilltop to a 500kℓ pressed steel tank from where it gravity feeds to another 500kℓ pressed steel tank above the Crocodile Dam WTP, any overflow from this tank is fed into the dam itself. This scheme can also be used to fill the dam should the need arise.

The water is treated at the Crocodile Dam WTP from where it is pumped up to the Crocodile Dam potable water reservoir (unknown size pressed steel tank). From this reservoir, water is supplied directly into the reticulation scheme supplying parts of the Bukhanana and Esikadeni areas. Water is also gravity fed from here to the Bukhanana Town command reservoir.

Water suppled via the Nseleni pumping station is pumped to the Hlaza area where the rising main branches to supply terminal reservoirs in the Ndodwane, Mabeka, Ubizo, Ningizimu and Sihuzu areas.

The rising main then passes through Hlaza to a command reservoir located in Magwetshana. From where water is supplied to the local communities (located within the KCDM) and via a gravity main and two (2) further terminal reservoirs to the Bukhanana Town command reservoir.

A summary of the Ntambanana Scheme bulk water infrastructure is presented in Table 5-9.

Table 5-9: Ntambanana Scheme Infrastructure Summary

Infrastructure Component	Existing Infrastructure Capacity
Treatment	**Capacity (Mℓ/d)**
Crocodile Dam WTP	Unknown
Storage	**Capacity (Mℓ)**

Infrastructure Component	Existing Infrastructure Capacity		
Crocodile Dam Raw Water	0.5		1
Luwamba Raw Water Balancing	0.5		
Crocodile Dam Potable Water	Unknown		1.718
Bukhanana Command	Unknown		
Hlaza and Mambuka	0.35		
Hlaza Nqutsheni	Unknown		
Mqunzankunzi	2x0.03		
Obizo (Elevated)	0.108		
Obizo 2	0.15		
Ndodwane (Elevated)	0.11		
Bulk Distribution	**Dia (mm)**	**Length (m)**	**Flow (Mℓ/d)**
Luwamba Raw Water Rising Main	250	11 500	4.8
Luwamba Raw water Gravity main	250	3 600	5
Crocodile dam to Bukhanana Command	150		
to Bukhanana Command	160		
Supply to Hlaza Nqutsheni	160		
Supply to Ndodwane	90		
Supply to Hlaza Mambuka	200		
Supply to Mqunzankunzi	110		
Supplies to Obizo 1 and 2	110		

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019

5.2.6 Nseleni Scheme

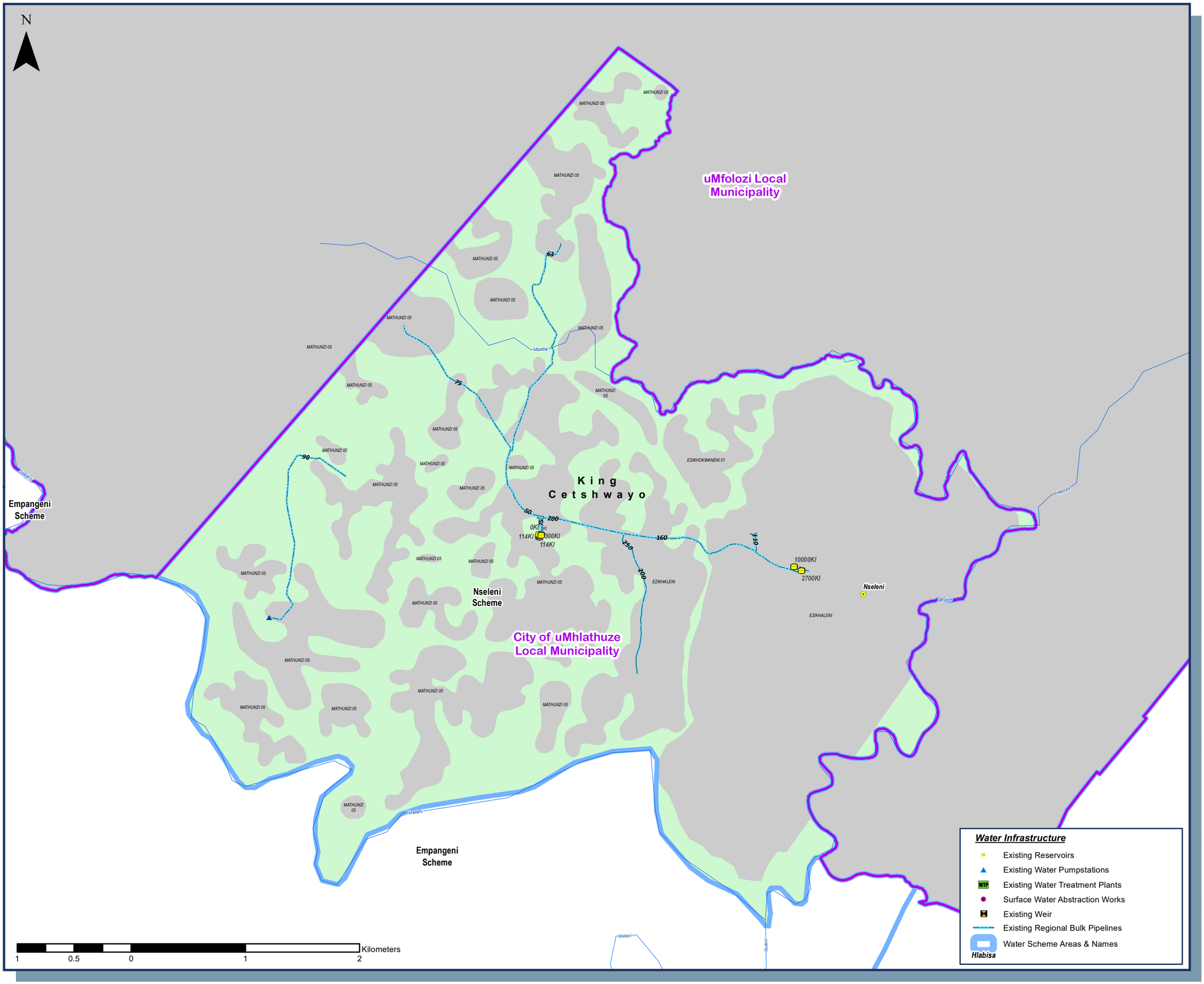
The Nseleni Scheme is owned by the CoU. The Scheme is supplied from Nsezi WTP via the Mandlazini reservoirs located in the Northern Scheme and illustrated within Figure 5-8. The Scheme supplies Nseleni Town and Khoza tribal area. These communities are supplied via the reservoirs at the old Nseleni WTP site.

5.2.6.1 Abstraction and Treatment

The scheme is supplied from the Nsezi WTP, which forms part of the Northern and Empangeni Schemes.

5.2.6.2 Distribution and Storage

Water is pumped from the Mandlazini Reservoirs to the reservoirs at the old Nseleni WTP site from where it is distributed to the communities.



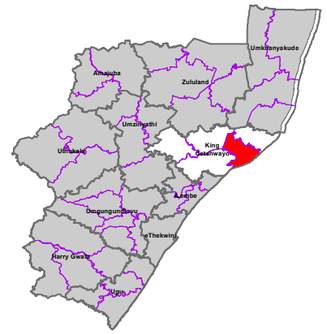
Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Settlements & Settlement Names
- Major Towns (Eshowe)

Water Infrastructure

- Existing Reservoirs
- Existing Water Pumpstations
- Existing Water Treatment Plants (WTP)
- Surface Water Abstraction Works
- Existing Weir
- Existing Regional Bulk Pipelines
- Water Scheme Areas & Names (Hlabisa)

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

eMA uMHLATHUZE

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS:

Project No.: 27814

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Scheme Areas & Infrastructure Components - Nseleni
City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

MAP NO.:

LM282 Figure 5.8

A summary of the Nseleni Scheme bulk water infrastructure is presented in Table 5-10.

Table 5-10: Nseleni Scheme Bulk Infrastructure Summary

Storage	Capacity (Mℓ)		
Nseleni Reservoirs	1x2.7 1x10 1x0.248 (Elevated)		12.95
KwaKhoza Reservoir	2x0.114 1x0.3 1xUnknown 1x Unknown (Elevated)		0.53
Bulk Distribution	**Dia (mm)**	**Length (m)**	**Flow (Mℓ/d)**
Mandlazini Reservoir to Nseleni Reservoir	400	9 422	13.2
Nseleni Reservoir to KwaKhoza Reservoir	200	2 403	2.87

Source: City of uMhlathuze Local Municipality, Consolidated and Updated Bulk Water Master Plan, June 2019

6. EXISTING SANITATION BULK INFRASTRUCTURE

6.1 SANITATION SERVICE LEVEL

The City of uMhlathuze has formulated a level of service policy for Water and Sanitation and is defined in the Free Basic Water (FBW) policy. In formalised urban areas a waterborne system is implemented and in rural areas Ventilated Improved Pit (VIP) Latrines are installed. In peri-urban areas or dense settlements adjacent to urban areas, which a close to a water resources, the Municipality promotes the installation of shallow sewers to protect a water resource.

Table 6-1: Sanitation Backlogs within City of uMhlathuze Local Municipality

Service Level	Baseline (2017/2018)	2018/2019 Target	Stats Ending December 2018
Total households = 110 503 (2016 Community Survey)	**Households with access to sanitation**	**Amended Targets based on 2016 Community Survey**	**Households with access to sanitation**
ACCESS TO SANITATION	86 865	89 365	88 206
Waterborne Sewerage	43 068	43 068	43 068
VIP Toilets	43 797	46 297	45 138
Backlogs	23 638	21 138	19 797
New Installations (VIP)	2 904	2 500	Actual Q1 = 971 Actual Q2 =370

Source: City of uMhlathuze Draft IDP Review, 2019/2020 & City of uMhlathuze WSDP, 2018/2019

At the start of the financial year a total of 78.82% households had access to the basic level of service for sanitation. Access to sanitation as at 31 December 2018 is 79.82% and the sanitation backlog is 20.18% (19 797 households) and illustrated within overleaf.Figure 6-1.

6.2 EXISTING SANITATION BULK INFRASTRUCTURE

City of uMhlathuze Bulk Sewerage Master Plan (BSMP) prepared in 2015/2016 proposes a rational bulk sewerage scheme for the municipal area and identify financing options. The BSMP illustrates the Municipality's planning of its bulk sewerage system that is based on the land use proposals/applications that are identified in the IDP, SDF and the Human Settlements Plan as well as the development potential of expansion areas provided in the SDF. The planning has been done for the full developmental potential where after proposals were formulated for the installation of the bulk sewer infrastructure in line with the land use proposals/applications identified. Hydraulic modelling was used to model the existing bulk sewer system of the Municipality as well as to model a future system to cater for the wastewater that could be generated.

Information on the existing Wastewater Treatment Plants and macerators presented in the following paragraphs were extracted from the Status Quo Report, Annexure to the Feasibility Study for Wastewater and Associated By-Products re-use for the City of uMhlathuze prepared in 2017.

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

King Cetshwayo

City of uMhlathuze Local Municipality

uMlalazi Local Municipality

Nseleni

Nzalabantu

Empangeni

Ngwelezana

Felixton

Vulindlela

Esikhawini

Richard's Bay

Lake Nsezi

Lake Mzingazi

Mhlathuze Lagoon

Lake Cubhu

Nhlabane

N2

R34

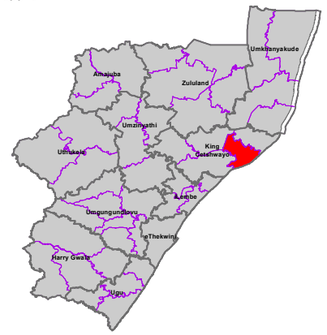
R102

5 2.5 0 5 10 Kilometers

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- National Roads (N1)
- Main Roads
- Dams & Dam Names (Driel Dam)
- Rivers
- Settlements
- Major Towns (Eshowe)

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

DISTRICT MUNICIPALITY:

CITY OF UMHLATHUZE

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Sanitation Reliability Profile

City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

MAP NO.:

LM282: Figure 6.1

Sanitation Reliability Profile

- Communities not receiving a reliable service
- Communities receiving a reliable service

The bulk sewerage system consists of the following existing sewerage sub-systems and illustrated within Figure 6-2:

- ✓ Alton Macerator;
- ✓ Arboretum Macerator;
- ✓ Empangeni WWTP;
- ✓ Nseleni WWTP;
- ✓ Esikhaleni WWTP;
- ✓ Ngwelezane WWTP; and
- ✓ Vulindlela WWTP

6.2.1 Alton Macerator

The Alton Macerator plant is a conventional screening plant that screens the raw sewerage before pumping the effluent into the rising main that transports the screened effluent to the marine outfall line pump station. The Alton Macerator receives sewerage from Alton South, Alton North, Brackenham, Aquadene and a portion of Wildeweide.

The Alton Macerator consists of an inlet works, mechanical screens and pump station. The facility also has emergency overflow and storage dams. The plant currently receives an ADWF of 7Mℓ/d.

The Alton Macerator consists of the following process units:

- ✓ Inlet works with a hand raked screen, porcupine rag catchers and three grit channels;
- ✓ A division box with venture flumes, dividing the flow into three streams;
- ✓ Three rotating drum mechanical screens;
- ✓ A final screened effluent pump station with submersible pumps, to pump screened effluent to the marine outfall pump station and outfall; and
- ✓ HDPE lined emergency overflow and storage dams.

The raw influent enters the plant at the head of works where screening and grit removal is facilitated through a hand rake screen and three grit channels. From the inlet works the flow enters a division box with venture flumes that divides the flow into three streams. Each of the three streams flows through a rotating drum mechanical screen, before entering the final effluent pump station sump with submersible pump sets.

The Alton Macerator currently receives in the order of 7Mℓ/day of raw sewerage.

The Alton Macerator site was in a fair to good condition. One possible improvement would be to add a drop-off facility for the honey sucker tankers that frequently visit the site.

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

City of uMhlathuze Local Municipality

King Cetshwayo

uMlalazi Local Municipality

Nseleni

Nseleni WWTP

New Regional Plant

Empangeni

Empangeni WWTP

Ngwelezana

Ngwelezane WWTP

Felixton

Felixton WWTP

Vulindlela

Vulindlela WWTP

Esikhawini

eSikhaleni WWTP

Alton Macerator

Arboretum Macerator

Richard's Bay

Richards Bay Sea Outlet

Nzalabantu

Kilometers
5 2.5 0 5 10

Legend

- Provinical Boundaries
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- National Roads (N1)
- Main Roads
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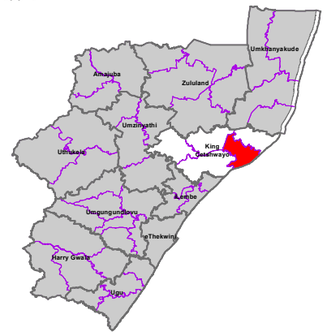
- Major Towns (Eshowe)

Sanitation Infrastructure

- Existing Wastewater Treatment Plant
- Existing Sewer Pump Stations
- Existing Sewer Bulk Pipe Lines
- Sanitation Scheme Areas

LOCALITY:



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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Existing Sanitation Infrastructure
City of uMhlathuze Local Municipality

DATE COMPLETED:
30 September 2020

MAP NO.:
LM282 Figure 6.2

6.2.2 *Arboretum Macerator*

The Arboretum Macerator plant is a conventional screening plant that screens the raw sewerage before pumping the effluent into the rising main that transports the screened effluent to the marine outfall line pump station. The Arboretum Macerator receives sewerage from Arboretum, Arboretum Ext, Birdswood, CBD, Meerensee, Sports Complex, Veldenvlei, Waterfront/Harbour, Wildeweide and parts of Brackenham. The Arboretum Macerator consists of an inlet works, mechanical screens and pump station. The facility also has emergency overflow and storage dams.

The Arboretum Macerator consists of the following process units:

- ✓ Inlet works with a hand raked screen, porcupine rag catchers and six grit channels;
- ✓ A division box with venture flumes, dividing the flow into three streams;
- ✓ Three rotating drum mechanical screens;
- ✓ A final screened effluent pump station with submersible pumps, to pump screened effluent to the marine outfall pump station and outfall; and
- ✓ HDPE lined emergency overflow and storage dams.

The raw influent enters the plant at the head of works where screening and grit removal is facilitated through a hand rake screen and six grit channels. From the inlet works the flow enters a division box with venture flumes that divides the flow into three equal streams. Each of the three streams flows through a rotating drum mechanical screen, before entering the final effluent pump station sump with submersible pump sets.

The Arboretum Macerator currently receives in the order of 12Mℓ/day of raw sewerage.

The Arboretum Macerator site was in a fair to good condition.

6.2.3 *Empangeni Wastewater Treatment Plant*

The Empangeni Waste Water Treatment Plant (WWTP) is a conventional activated sludge plant and consists of a single module with a reported capacity of 14.5Mℓ/d. The WWTP is located south of Empangeni's residential areas and north of the industrial area. The flow gravitates to three pump stations from where it is pumped into the gravity outfall sewer. The pump stations were not visited and are therefore not discussed in this report. The final effluent from the works is discharged at the confluence of the Odakaneni and Mpangeni River, which eventually flows into the Mhlathuze River.

The WWTP consists an inlet works, two primary sedimentation tanks, three biological reactors, three, final clarifiers, a chlorination system, various pump stations, a primary and secondary anaerobic digester, 32 sludge drying beds and a sludge lagoon.

The plant currently receives an ADWF of 9Mℓ/d, which is substantially lower than the reported design capacity of 14,5 Mℓ/d. The final effluent quality therefore generally complies with the General Standards required by DWS.

The process units have been checked for hydraulic and organic capacity. The primary and secondary sedimentation tanks can handle the design flow of 14.5Mℓ/d, while the three biological reactors are sized for only 9Mℓ/d. Preliminary calculations show that the number of drying beds have to be increased.

The civil structures are generally in a fairly good condition and requires limited refurbishment. The mechanical equipment is old but is still in a working condition. It should be refurbished or replaced in the medium term. Some of the electrical panels have recently been replaced and needs very little attention.

The following major issues should be addressed:

- ✓ The existing digesters are blocked, and raw primary sludge is therefore placed directly on the sludge drying beds. The digesters should be unblocked, cleaned, and refurbished;
- ✓ The inlet works is not suitable for a plant of this capacity. A completely new inlet works with two mechanical screens, a conveyor, and screenings press, as well as two new vortex degritters, complete with mechanical equipment, should be constructed; and
- ✓ A program to refurbish all the mechanical and electrical equipment should be instituted.

6.2.4 Esikhaleni Wastewater Treatment Plant

The Esikhaleni Waste Water Treatment Plant (WWTP) is a conventional activated sludge plant and consists of a single module with a reported capacity of 12.5Mℓ/d. The WWTP is located south of Esikhaleni town and approximately 800m from the coast. All the flow gravitates to a central pump station in town and is pumped approximately 7km from there to the works. The final effluent from the plant is discharged into a natural water course running to the coast.

There is an inlet works upstream of the pump station, which is equipped with four raw sewage pumps, electrical control equipment, as well as a standby generator.

The WWTP consists an inlet works, a Pasveer type biological reactor, two final clarifiers, a chlorination system, various pump stations and sludge drying beds. The plant currently receives an ADWF of 8Mℓ/d, which is substantially lower than the reported design capacity of 12.5Mℓ/d. The final effluent quality therefore generally complies with the General Standards required by DWS.

The process units could not be checked for hydraulic and organic capacity due to a lack of drawings and detailof the mechanical equipment. The civil structures are generally in a fairly good condition and require limited refurbishment. The mechanical equipment is not new but is mostly in working condition. However, at the time of the site visit, some of the aerators were not running. The aerators are critical to the operation of

the plant and should receive urgent attention. Generally, the electrical panels are fairly new and needs very little attention.

The following major issues should be addressed:

- ✓ A plant of this size should have a mechanised inlet works with two mechanical screens and two vortex degritters;
- ✓ The defective aerators should be repaired urgently; and
- ✓ A program to refurbish all the mechanical and electrical equipment should be instituted.

6.2.5 Ngwelezana Wastewater Treatment Plant

The Ngwelezane Waste Water Treatment Plant (WWTP) is a conventional activated sludge plant and consists of a single module with a reported capacity of 5.8Mℓ/d. The WWTP is located on the western perimeter of Ngwelezana and all the flow gravitates to the works. The final effluent from the works is discharged into the Odakaneni River 300m upstream of its confluence with the Mpangeni River. This river eventually flows into Lake Mpangeni and from there into the Mhlathuze River.

The WWTP consists an inlet works, a biological reactor, two final clarifiers, a chlorination system, various pump stations and sludge lagoons.

The plant currently receives an ADWF of 2.4Mℓ/d, which is substantially lower than the reported design capacity of 5.8Mℓ/d. The final effluent quality therefore generally complies with the General Standards required by DWS.

The process units have been checked for hydraulic and organic capacity and are generally sized for 5.8Mℓ/d. However, the aeration capacity of the biological reactor is only adequate for 4.2Mℓ/d.

The civil structures are generally in a fairly good condition and require limited refurbishment. The mechanical equipment is old, but is still in a working condition. It should be refurbished or replaced in the medium term. Some of the electrical panels have recently been replaced and needs very little attention.

The following major issues should be addressed:

- ✓ The screening channel should be modified to ensure that all the flow goes through the mechanical screen;
- ✓ The sludge ponds should be emptied and cleaned; and
- ✓ A program to refurbish all the mechanical and electrical equipment should be instituted.

6.2.6 Nseleni Wastewater Treatment Plant

The Nseleni Wastewater Treatment Plant (WWTP) is a conventional activated sludge plant and consists of a single module with a reported capacity of 3Mℓ/d. The WWTP is located on the southern outskirts of Nseleni

town and all the flow gravitates to the works. The final effluent from the works is discharged into the Mposa River 2.5km upstream of its confluence with the Mhlathuze River.

The WWTP consists an inlet works, a Pasveer type biological reactor, one final clarifier, a chlorination system, various pump stations, two sludge ponds and five sludge drying beds. The plant currently receives an ADWF of 1Mℓ/d, which is substantially lower than the reported design capacity of 3Mℓ/d. The final effluent quality therefore generally complies with the General Standards required by DWS.

Some of the process units could not be checked for hydraulic and organic capacity due to a lack of drawings and detail of the mechanical equipment.

The civil structures are generally in a fairly good condition and require limited refurbishment. The mechanical equipment is not new, but is mostly in working condition. However, at the time of the site visit, some of the aerators were not running. The aerators are critical to the operation of the plant and should receive urgent attention. Generally, the electrical panels are fairly new and needs very little attention.

The following major issues should be addressed:

- ✓ The sludge ponds need to be emptied and cleaned;
- ✓ The defective aerators should be repaired urgently; and
- ✓ A program to refurbish all the mechanical and electrical equipment should be instituted.

6.2.7 Vulindlela Wastewater Treatment Plant

The Vulindlela Waste Water Treatment Plant (WWTP) is a conventional activated sludge plant and consists of a single module with a reported capacity of 2.8Mℓ/d. The sewage from Vulindlela town drains to a pump station located north of the town, from where it is pumped to the WWTP. The University of Zululand's sewage gravitates to the WWTP, which is located on the eastern boundary of the campus. The final effluent from the works is discharged into a small stream, which eventually joins the Mhlathuze River.

The WWTP consists an inlet works, a biological reactor, one final clarifier, a chlorination system, various pump stations and sludge drying beds.

The plant currently receives an ADWF of 1.6Mℓ/d, which is substantially lower than the reported design capacity of 28Mℓ/d. The final effluent quality therefore generally complies with the General Standards required by DWS.

The process units have been checked for hydraulic and organic capacity and are generally sized for 2.8Mℓ/d.

The civil structures are generally in a fairly good condition and require limited refurbishment. The mechanical equipment is old, but is still in a working condition. It should be refurbished or replaced in the medium term.

Some of the electrical panels have recently been replaced and needs very little attention. There are no major issues to be addressed in the short term, although a maintenance program should be instituted to keep the mechanical and electrical equipment operational.

7. BULK WATER SUPPLY PROJECTS CURRENTLY IN PLANNING

The existing funding grants for the municipal capital projects and operating subsidies for water services are mainly funded by the Municipal Infrastructure Grant (MIG) followed by the Regional Bulk Infrastructure Grant (RBIG) and the Water Services infrastructure Grant (WSIG). The main objective of MIG is to assist WSAs by providing grant funding in removing the backlog concerning basic municipal services to poor households. RBIG focusses on the infrastructure required to connect or augment the water resource on a macro[1] or sub regional [2] scale (over vast distances [3]), with internal bulk and reticulation systems or any bulk supply infrastructure that may have a significant impact on water resources in terms of quantity and quality. The bulk infrastructure that would have a "significant impact on water resources" includes:

- ✓ Any bulk scheme that is designed for maximum demand of 5Mℓ/day or more;
- ✓ Any wastewater treatment plant that discharges into a freshwater resource system; and
- ✓ Any water treatment plant that is designed for a maximum demand of more than 2Mℓ/day.

For the purpose of this study, the existing regional bulk projects were considered and evaluated to identify potential gaps within the existing project footprints to the extent that a total "wall-to-wall" bulk water services needs perspective is visualised and realised. This must be done in the context to improve access to basic services but at the same time support economic growth and development and ensure sustainable services.

7.1 REGIONAL BULK WATER PROJECTS IN PLANNING

The City of uMhlathuze mainly receives their funding from WSIG and the Integrated Urban Development Grant (IUDG). Currently no RBIG funding is allocated to regional bulk infrastructure for the Municipality.

The funding streams for infrastructure development that CoU receive over the next three years, are tabled in Table 7-1 below.

Table 7-1: Grant Funding Streams

Grant Funding Programme	2019/2020 (R '000)	2020/2021 (R '000)	2021/2022 (R '000)	Total Funding over Next 3 Financial Years
Water Services Infrastructure Grant (WSIG)	R40 000	R42 200	R45 000	**R127 200**
Integrated Urban Development Grant	R139 988	R112 972	R121 813	**R374 773**

Source: Division of Revenue Bill Schedule (DORA), 2019/2020

[1] "Macro" is defined as infrastructure serving extensive areas across multi-municipal boundaries

[2] "Sub-regional" is defined as large regional bulk infrastructure serving numerous communities over a large area normally within a specific district or local municipal area

[3] Over "vast distances" is considered as any distances greater than 5km

Table 7-2 below lists the water services projects presented in the Municipality's 2018/2019 WSDP.

Table 7-2: Projects listed in the City of uMhlathuze' s WSDP 2018/2019

Project Description	Planned Start Date of Project	Planned Completion Date of Project	Adopted 2017/18	Adopted 2018/19	Adopted 2019/20
Standby pumps	Jul 17	Jun 20	R600 000	R700 000	R876 100
Upgrading of MS2 pump station capacity	Jul 17	Jun 20	R5 000 000	R3 000 000	R3 000 000
Upgrading of Birdswood pump station capacity	Jul 17	Jun 19	R2 000 000	R3 000 000	R0
Upgrade of MS9 pump station capacity	Jul 17	Jun 20	R2 000 000	R1 500 000	R1 500 000
Replacement of pumps	Jul 17	Jun 20	R2 000 000	R2 000 000	R2 000 000
Hillview sewer pump line upgrade	Jul 17	Jun 19	R1 000 000	R1 000 000	R0
Furniture - water and sanitation section	Jul 17	Jun 18	R300 000	R0	R0
Meerensee - Garrick rise sewer line replacement 450mm	Jul 17	Jun 20	R1 000 000	R300 000	R2 000 000
Rural sanitation (counter funding)	Jul 17	Jun 18	R1 000 000	R0	R0
Mzingazi sewer	Jul 17	Jun 18	R4 000 000	R0	R0
Veldenvlei pump station	Jul 17	Jun 20	R1 000 000	R7 000 000	R7 500 000
Upgrade - Vulindlela sewer pipeline	Jul 17	Jun 20	R5 000 000	R1 000 000	R2 000 000
Wastewater management (sanitation) projects	Jul 18	Jun 20	R0	R13 000 000	R13 000 000
Water quality equipment (software)	Jul 17	Jun 20	R3 500 000	R1 000 000	R2 000 000
Water quality equipment	Jul 17	Jun 19	R3 500 000	R1 500 000	R0
Water quality equipment	Jul 19	Jun 20	R0	R0	R3 000 000
New water meters (rural) - Kwa-Dube traditional areas	Jul 19	Jun 20	R500 000	R300 000	R800 000
9 water pumps 4inch	Jul 17	Jun 20	R300 000	R80 000	R158 000
Upgrade of 110mm water pipe in Alton (behind ZCBF to bus depot)	Jul 17	Jun 18	R500 000	R0	R0
Upgrading of valves in Birdswood	Jul 17	Jun 20	R300 000	R500 000	R737 100
Replacement of water pipe reticulation in Meerensee	Jul 17	Jun 20	R200 000	R300 000	R1 053 000
Replacement of water pipe reticulation in Meerensee	Jul 17	Jun 18	R500 000	R0	R0
200 jojo tanks	Jul 17	Jun 18	R600 000	R0	R0
Water loss and drought relief project	Jul 16	Jun 20	R1 000 000	R500 000	R0
Water loss and drought relief project	Jul 19	Jun 20	R0	R0	R526 500
Water projects	Jul 17	Jun 20	R13 300 000	R13 000 000	R0
Water projects	Jul 17	Jun 20	R0	R0	R15 000 000
Nseleni pipe replacement (WSIG)	Nov 16	Mar 17	R14 000 000	R0	R0
Richards bay pipe replacement (WSIG)	Nov 16	Jun 20	R0	R17 000 000	R30 000 000

Project Description	Planned Start Date of Project	Planned Completion Date of Project	Adopted 2017/18	Adopted 2018/19	Adopted 2019/20
Ngwelezane pipe replacement (WSIG)	Nov 16	Jun 19	R0	R14 000 000	R0
Reduction of non-revenue (WSIG)	Mar 17	Jun 20	R14 500 000	R9 500 000	R4 500 000
Esikhaleni wastewater Treatment Plants (WSIG)	Nov 16	Mar 17	R0	R0	R0
Kwa Dube reticulation (WSIG)	Sep 16	Jun 17	R0	R0	R0
Kwa Madlebe reticulation (WSIG)	Sep 16	Jun 17	R0	R0	R0
Empangeni water network improvements (WSIG)	Nov 16	Feb 17	R0	R0	R0
Upgrade of 110mm water pipe in Alton (behind ZCBF to bus depot)	Jul 17	Jun 18	R300 000	R0	R0
Construction of a second Meerensee reservoir (20ml)	Jul 17	Jun 20	R100 000	R8 000 000	R7 000 000
Empembeni reservoir	Jul 17	Jun 20	R1 000 000	R7 000 000	R7 000 000
New Madlebe water meters	Jul 17	Jun 20	R2 000 000	R500 000	R500 000
Construction of a fourth Esikhaleni reservoir	Jul 18	Jun 20	R0	R4 000 000	R5 000 000
Bulk master plan	Jul 17	Jul 19	R1 200 000	R1 000 000	R0
Total			**R82 200 000**	**R110 680 000**	**R109 150 700**

Source: City of uMhlathuze WSDP, 2018/2019

8. SYNOPSIS OF EXISTING AND COMMITTED SCHEMES

A gap analysis has been undertaken for the water schemes in the CoU. The gap analysis has taken into account current planning interventions by the WSA. In this regard, the entire CoU has been demarcated into regional water schemes in line with short and long term plans by the WSA. Six (6) regional schemes have been identified and are as follows:

- ✓ UTG001: Empangeni Scheme;
- ✓ UTG003: Southern Scheme;
- ✓ UTG012: Western Scheme;
- ✓ UTG015: Northern Scheme;
- ✓ UTG017: Nseleni Scheme; and
- ✓ UTG018: Ntambanana Scheme.

The gap analysis for the six (6) regional schemes is discussed under this section.

8.1 UTG001 WSIA: EMPANGENI SCHEME

[4]The scheme is supplied from the Nsezi WTP with a capacity of 204Mℓ/day . However, the yield of Lake Nsezi can no longer meet the water requirements, and as such is supplemented by transfers from the Mhlathuze River. Water is distributed to five (5) command and distribution reservoirs from the Nsezi WTP, namely Pearce Crescent, Hilltop, Hillview, Magazulu and John Ross elevated reservoir, from where potable water is distributed to both the Empangeni urban and light industrial areas. An additional bulk pipeline can also augment the Western Scheme from the Magazulu reservoir.

UAP Phase II recommended that Richards Bay and Empangeni is supplied from the Lower Thukela Scheme. It was proposed to construct an 82km long, ø 1 200mm pipeline that has been sized to transfer the full 110Mℓ/day available from the Lower Thukela Scheme under gravity to the value of R 2.332 billion. UAP III will extend the proposals to include secondary bulk but also increase the capacities to meet the 2050 demand.

Currently, the total storage capacity of the Empangeni Scheme is 57Mℓ (divided between the Magazulu, Hillview, Hilltop and Pearce Crescent reservoirs). An upgrade to the existing storage within the Empangeni Scheme will be required to meet the projected demand of 2050. The main distribution pipeline within the Empangeni Scheme is the pipeline from Nseleni WTP to Junction 50003 and from Junction 50003 to Pearce Crescent as well as the pipeline from Junction 50003 to Hillview and Hilltop reservoirs. The existing Pearce Crescent pipeline has a capacity of 36.6Mℓ/day that is enough for the current and future demands until 2030 but would require an upgrade to meet the demand in 2050.

[4] CoU Consolidated and Updated Bulk Water Master Plan, June 2019

No IUDG projects are earmarked for implementation within the next three years. The existing and planned storage and distribution infrastructure capacity when compared with the projected 2050 demand and infrastructure requirements will not meet the demand of 24Mℓ/day.. This comparison is provided in Table 8-1.

Table 8-1: Empangeni Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
***Water Treatment (Mℓ/d)**	204	0	204	204	0
Storage (Mℓ)	57	20.3	77.3	119.5	42.2
Bulk conveyance - Clear Water (Mℓ/d)	111.43	0	111.43	161.9	50.45

Based on the capacities of existing and planned infrastructure, there are gaps within the water supply requirements for the projected 2050 demand and the capacity of the bulk pipelines and secondary and tertiary reservoirs would need to be increased to meet the demand of 2050.

8.2 UTG003 WSIA: SOUTHERN SCHEME

[5]The Esikhaleni WTP has a stated treatment capacity of 36Mℓ/day. However, the firm yield of Lake Cubu is 1.1Mℓ/day and the Mhlatuze Water weir transfers up to 30Mℓ/day directly to the WTP. The current demand in 2020 is already at 42 Mℓ/day. The WTP needs to be increased to at least 50 Mℓ/day by 2024.

UAP Phase II recommended that Richards Bay and Empangeni are supplied from the Lower Thukela Scheme. It was proposed to construct an 82km long, 1 200mm diameter pipeline that has been sized to transfer the full 110Mℓ/day available from the Lower Thukela Scheme under gravity to the value of R 2.332 billion. UAP III will extend the proposals to include secondary bulk but also increase the capacities to meet the 2050 demand.

The total storage capacity of the Southern Scheme is 82Mℓ (Forest Reservoirs only). The main distribution pipeline within the Southern Scheme is the ppipeline from Esikhaleni WTP to the Forest Reservoirs. The pipeline has a capacity of 34Mℓ/day. However, it is proposed that the the pipelines and the storage capacities need to be augmented under UAP III.

The WSA has one (1) IUDG project earmarked listed for implementation within the next three years - the cconstruction of a fourth Esikhaleni reservoir to the value of R 9 million. The latter should be considered when planning the bulk infrastructure requirements.

[5] CoU Consolidated and Updated Bulk Water Master Plan, June 2019

The existing and planned infrastructure capacity when compared with the projected 2050 demand and infrastructure requirements will not meet the demand of close to 62Mℓ/day. This comparison is provided in Table 8-2.

Table 8-2: Southern Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
***Water Treatment (Mℓ/d)**	36	14	50	65	15
Storage (Mℓ)	81.47	20	101.47	169.64	68.17
Bulk conveyance - Clear Water (Mℓ/d)	198.6	0	198.6	277.16	78.57

Based on the capacities of existing and planned infrastructure, there are gaps within the water supply requirements for the projected 2050 demand and the capacity of the bulk pipelines and secondary and tertiary reservoirs would need to be increased to meet the demand of 2050

8.3 UTG012 WSIA: WESTERN SCHEME

The existing treatment capacity of the Ngwelezane WTP is 8Mℓ/day and is supplied from the Mhlathuze River. The total storage capacity of the Western Scheme is 13.8Mℓ. The main distribution pipelines within the Western Scheme are the pipeline from Ngwelezane WTP to the Ngwelezane Reservoirs and the pipeline from the Magazulu Reservoir to the Ngwelezane Reservoirs.

UAP Phase II recommended that Richards Bay and Empangeni are supplied from the Lower Thukela Scheme. It was proposed to construct an 82km long, ø1 200mm pipeline that has been sized to transfer the full 110Mℓ/day available from the Lower Thukela Scheme under gravity to the value of R 2.332 billion. UAP III will extend the proposals to include secondary bulk but also increase the capacities to meet the 2050 demand.

The current infrastructure within the Western Scheme would not be able to meet the demand in the near future let alone 2050. The water supply could in future be supplemented by the Empangeni scheme via the Magazulu Pipeline, which has a capacity of 17.3Mℓ/day. However, the 2050 demand is 21.47Mℓ/day. The scheme is currently operating very close to it maximum capacity and without sufficient storage to allow for any demand fluctuations or system failures.

The WSA has one (1) WSIG project earmarked listed for implementation within the next three years - the Ngwelezane pipe replacement (WSIG) to the value of R 14 million that would not address the augmentation of the water supply. The latter should be considered when planning the bulk infrastructure requirements. The existing and planned infrastructure capacity when compared with the projected 2050 demand and infrastructure requirements will not meet the demand of 21.47Mℓ/day.. This comparison is provided in Table 8-3.

Table 8-3: Western Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
***Water Treatment (Mℓ/d)**	8	0	8	20	12
Storage (Mℓ)	105.3	110.61	5.3	345	234
Bulk conveyance - Clear Water (Mℓ/d)	73.52	0	73.52	95.7	22.18

Based on the capacities of existing and planned infrastructure, there are gaps within the water supply requirements for the projected 2050 demand and the capacity of the WTP, the bulk pipelines and secondary and tertiary reservoirs would need to be increased to meet the demand of 2050.

8.4 UTG015 WSIA: NORTHERN SCHEME

[6]Lake Mzingazi supplies the Mzingazi WTP that has a treatment capacity of 65Mℓ/day. The WTP should be able to supply the whole of the Northern Scheme in the long term. However, the historic firm yield (HFY) of Lake Mzingazi is limited to 28Mℓ/day that resulted in the assured supply of 28.8Mℓ/day. The shortfall is augmented from Nsezi when required.

UAP Phase II recommended that Richards Bay and Empangeni are supplied from the Lower Thukela Scheme. It was proposed to construct an 82km long, ø1 200mm pipeline that has been sized to transfer the full 110Mℓ/day available from the Lower Thukela Scheme under gravity to the value of R 2.332 billion. UAP III will extend the proposals to include secondary bulk but also increase the capacities to meet the 2050 demand

Currently the total storage capacity of the Northern Scheme is 105.3Mℓ (divided between the Mandlazini, Meerensee and Brackenham reservoirs). Based on a forty-eight (48) hour storage volume requirement, the maximum twenty-four-hour (24) demand currently catered for is 52.6Mℓ. Additionally, as the Nseleni Scheme is supplied via the Mandlazini Reservoirs, these act as balancing storage for the Nseleni Scheme and as such twelve (12) hours of balancing storage for the Nseleni Scheme should be provided for at Mandlazini which results in a further reduction of the available forty-eight (48) hour storage volume to 45.15Mℓ.

The main distribution pipelines within the Northern Scheme are the ppipeline from Nsezi WTP to the Mandlazini Reservoirs and the pipeline from Mzingazi WTP to both Meerensee and Mandlazini reservoirs. The Meerensee pipeline was constructed at the same time as the Mzingazi WTP and sized for 65Mℓ/day.

However, it is proposed that the the pipelines from Nsezi WTP to the Mandlazini Reservoir be upgraded within the next five years and the pipeline from Mandlazini to Development Zone G1 and G2 will need to be upgraded immediately.

[6] CoU Consolidated and Updated Bulk Water Master Plan, June 2019

The WSA has one (1) IUDG project earmarked listed for implementation within the next three years, the increase of the Meerensee Reservoirs to 20Mℓ. The latter should be considered when planning the bulk infrastructure requirements.

The existing and planned infrastructure capacity when compared with the projected 2050 demand and infrastructure requirements will not meet the demand of 47.5Mℓ/day. This comparison is provided in Table 8-4.

Table 8-4: Northern Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
***Water Treatment (Mℓ/d)**	28.77	0	28.77	-	-
Storage (Mℓ)	105.3	110.61	5.3	345	234
Bulk conveyance - Clear Water (Mℓ/d)	528.6	0	528.6	700.41	171.8

Based on the capacities of existing and planned infrastructure, there are gaps within the water supply requirements for the projected 2050 demand and the capacity of the bulk pipelines and secondary and tertiary reservoirs would need to be increased to meet the demand of 2050

8.5 UTG017 WSIA: NSELENI SCHEME

The total storage capacity of the Nseleni Scheme is 12.7Mℓ. The main distribution pipeline to the Nseleni Scheme is the pipeline from the Mandlazini Reservoirs that has a capacity of 13Mℓ day. However, the storage capacity as well as the bulk distribution capacity are insufficient and need to be augmented as a matter of urgency. It will also not be able to augment the supply to Ntambanana.

UAP Phase II recommended that a 25km long, ø 600mm pipeline from the Mfule reservoir to the Crocodile Water Treatment Plant be constructed to supply 24.4 Mℓ/day to the Crocodile WTP and the supply to be extended to the Nseleni supply area to the value of R 637 million. This option will be revised under UAP III to be supplied from the Northern Scheme.

The current storage volumes within the system are inadequate and a new reservoir located at around the Nseleni WTP is required immediately to maintain a 48hr storage reserve within the system. The pipeline from Mandlazini to Development Zone G1 and G2 proposed under the Northern Scheme needs to be extended to the Nseleni WTP immediately as the development is currently under construction. It will also further reduce the available capacity to the Nseleni and Ntambanana Scheme.

The WSA has no projects earmarked for implementation over the next three years.

The existing and planned infrastructure capacity when compared with the projected 2050 demand and infrastructure requirements will not meet the demand of 10.21Mℓ/day. This comparison is provided in Table 8-5Table 8-4.

Table 8-5: Nseleni Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
***Water Treatment (Mℓ/d)**	25	0	25	-	-
Storage (Mℓ)	13	15	28	28.5	.5
Bulk conveyance - Clear Water (Mℓ/d)	230.36	0	230.36	276.43	46.07

Based on the capacities of existing and planned infrastructure, there are gaps within the water supply requirements for the projected 2050 demand and the capacity of the bulk pipelines and secondary and tertiary reservoirs would need to be increased to meet the demand of 2050.

8.6 UTG018 WSIA: NTAMBANANA SCHEME

The Ntambanana Scheme is supplied by the Crocodile Dam WTP that should be upgraded to at least 2.5 Mℓ/day in the near future to meet the ultimate demand of 7.38Mℓ/day. The water is sourced from the Crocodile Dam and the Luwamba Raw Water Supply Scheme. The storage capacity of the existing reservoirs should also be increased to meet the demand.

UAP Phase II recommended that a 25km long, ø 600mm pipeline from the Mfule reservoir to the Crocodile Water Treatment Plant be constructed to supply 24.4 Mℓ/day to the Crocodile WTP to the value of R 637 million. However, the WSA has planned to upgrade the Crocodile WTP to 2.5Mℓ/day that differs from the proposal made in UAP 2. UAP III will use the planned upgrade of the WTP as base from where the storage and conveyance will be augmented accordingly.

The WSA has no projects earmarked for implementation over the next three years.

The existing and planned infrastructure capacity when compared with the projected 2050 demand and infrastructure requirements will not meet the demand of 7.38Mℓ/day. This comparison is provided in Table 8-6.

Table 8-6:Ntambanana Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
***Water Treatment (Mℓ/d)**	-	2.5	2.5	2.5	0

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
Storage (Mℓ)	3.43	0	3.43	14.03	10.6
Bulk conveyance - Clear Water (Mℓ/d)	20.4	0	20.4	24.9	4.5

Based on the capacities of existing and planned infrastructure, there are gaps within the water supply requirements for the projected 2050 demand and the capacity of the WTP, the bulk pipelines and secondary and tertiary reservoirs would need to be increased to meet the demand of 2050.

9. PROPOSED BULK WATER SUPPLY INTERVENTIONS

This section details the water supply reconciliation options for bulk water services within the CoU– considering exiting use and future supplies and water sources, per scheme area. It must be noted that the Water Supply Intervention Areas (WSIAs) were demarcated based on all the existing planning initiatives that are currently underway within the WSA. However, the demand model that was proposed to be used within this project will be used to determine the proposed bulk infrastructure requirements and would be sized accordingly to meet the demand of 2050.

The details of the each WSIA split between existing upgrade and future additional requirements are provided per WSIA within the paragraphs hereafter and illustrated for the entire WSA within Figure 9-1 and per proposed WSIA.

9.1 UTG001 WSIA: EMPANGENI SCHEME

9.1.1 Demand Model Intervention

9.1.1.1 Water Demand

The water demand for the Empangeni WSI was determined for 2020 and 2050 and included within Table 9-1: Population and Water demand 2020 and 2050. It includes approximately ten (10) communities of which the majority are urban. The scheme serves the Empangeni town and surrounding formal urban areas. The projected water demand is 219.13Mℓ/day in 2050.

Table 9-1: Population and Water demand 2020 and 2050 for the Empangeni WSIA

Population	**Population 2020**	**Population 2050**
	38 405	55 641
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	100.60	219.13

9.1.1.2 Water Resource Consideration

The existing Empangeni scheme draws water from the 204Mℓ/day Nsezi WTP. The water abstracted from the weir is supplied from Lake Phobane along the Mhlathuze River to Lake Nsezi that acts as a balancing storage for the Nsezi WTP.

Water is distributed to five (5) command and distribution reservoirs from the Nsezi WTP, namely Pearce Crescent, Hilltop, Hillview, Magazulu and John Ross elevated reservoir, from where potable water is distributed to both the Empangeni urban and light industrial areas.

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

uMlalazi Local Municipality

City of uMhlathuze Local Municipality

King Cetshwayo

Crocodile Dam WTP

Ntambanana Scheme

Nseleni Scheme

Nseleni

Empangeni Scheme

Empangeni

Western Scheme

Ngwelezane WTP

Ngwelezana

Felixton

Vulindlela

Esikhawini

Southern Scheme

Nseleni WTP

Northern Scheme

Richard's Bay

Mzingazi WTP

Lake Mzingazi

Meer-en-See Desalination Plant

Lake Cubhu

Esikhaleni WTP

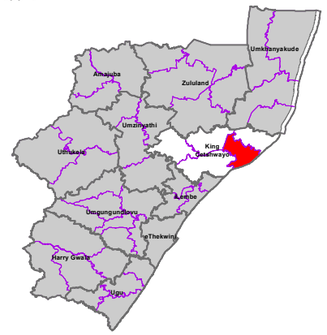
Nzalabantu

Kilometers
5 2.5 0 5 10

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Settlements & Settlement Names
- Eshowe — Major Towns

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

uMHLATHUZE

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

MARISWE

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Total Bulk Water Supply Interventions
City of uMhlathuze Local Municipality

DATE COMPLETED:
30 September 2020

MAP NO.:
LM282 Figure 9.1

Proposed New / Upgrade Infrafrastructure

- Hlabisa — Water Scheme Areas & Names
- Weir (Existing)
- Existing Water Treatment Plants
- Surface Water Abstraction Works (Existing)
- Primary Bulk Pipelines (Existing)
- Secondary Bulk Pipelines (Existing)
- Tertiary Bulk Pipelines (Existing)
- Primary Reservoirs (Existing)
- Secondary Reservoirs (Existing)
- Tertiary Reservoirs (Existing)
- Pump Stations (Existing)
- 19Ml/d — Upgrade of WTW
- Water Treatment Plants (Future)
- Surface Water Abstraction Works (Future)
- Primary Bulk Pipelines (Future)
- Secondary Bulk Pipelines (Future)
- Tertiary Bulk Pipelines (Future)
- Primary Command Reservoirs (Future)
- Secondary Reservoirs (Future)
- Tertiary Reservoirs (Future)
- Pump Stations (Future)

9.1.2 Water Supply Infrastructure

The following infrastructure upgrades and augmentation will be required in order to adequately supply the Empangeni WSIA and is illustrated within Figure 9-2 overleaf followed by the schematic layout of the WSIA within Figure 9-3.

9.1.2.1 Bulk Conveyance:

From the Nzesi WTP, water is pumped via an existing ø 500mm primary bulk pipeline that should be upgraded to a ø 800mm primary bulk pipe until it t-off via a ø 600mm bulk pipe that should be upgraded to a ø 762mm primary bulk pipe. The pump station should be upgraded to a pumping capacity of 514kW to reach the Pearce Crescent Command Reservoir (CR Res 14). From the Pearce Crescent Reservoir, the scheme distributes to:

- ✓ An existing ø 450mm secondary bulk pipe to be upgraded to ø 600mm to reach the Hillview reservoir (CR 11b)
    - o From the Hillview Reservoir, water is conveyed to the west via a ø 375mm secondary pipe to the Magazulu Command Reservoir (Cr Res 9) from where it connects to ø 450mm secondary bulk to the Ngwelezana Reservoir (CR Res 20) within the Western Scheme;
    - o Water is also conveyed north west from CR Res 10 with a ø 400mm and ø 450mm secondary pipe to reach Stezi that will in future be extended by a secondary bulk pipe ranging between ø 50mm and ø 63mm to supply Matshana.
- ✓ An existing ø 600mm secondary bulk pipe to reach the Hilltop Command Reservoir (CR Res 7) is extended to a future secondary bulk pipe ranging between ø 90mm and ø 75mm to supply Empangeni and surrounds. The latter also connects to the ø 800mm primary bulk pipe.
- ✓ The existing ø 600mm secondary bulk pipe towards Hilltop also t-off in a ø 90mm secondary pipe to the north east to reach Stezi from where it is extended in a ø 75mm future secondary pipe to reach Obizo.

The ø 800mm primary bulk pipe branches via a ø 315 mm to reach the John Ross Elevated Tank (CR Res 16). The Pearce Crescent Command Reservoir (CR Res 14) extends south west with a ø 375mm secondary pipe to be connected in future to the John Ross Elevated Tank (CR Res 16) via a ø 75mm secondary pipe that would also branch to the south west in future to supply Ndabayakhe. Parallel to the latter, a ø 110mm future secondary pipe will be extended from the primary ø 800mm primary bulk to supply the Mandlankala area and to connect in future to Reservoir 24 in the Southern Scheme.

A future ø 900mm pipe should also be constructed from the Nzesi WTP to connect in future to the Southern Scheme.

N

uMfolozi Local Municipality

uMfolozi Local Municipality

Ntambanana Scheme

Nseleni Scheme

Nseleni

Empangeni Scheme

Northern Scheme

City of uMhlathuze Local Municipality

Western Scheme

King Cetshwayo

Southern Scheme

uMlalazi Local Municipality

Ngwelezana

Empangeni

Richard's Bay

Felixton

Vulindlela

EMPANGENI

MANDLANKALA

NDABAYAKHE 01

MATSHANA 01

MATSHANA 02

STEZI 08

OBIZO 01

EZIKHALENI

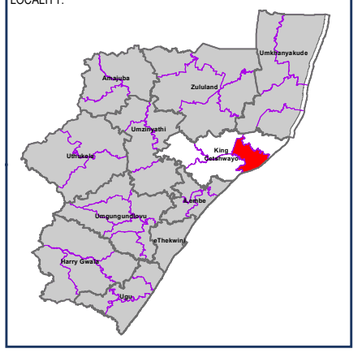
240kl
180kl
63
2030kl
2030kl
400
350
10000kl
4000kl
9000kl
19000kl
4000kl
9000kl
450
630
18540kl
11780kl
9000kl
2760kl
500
5300kl
480kl
90kl
90kl
90
20000kl
20000kl
600
580kl
75
800
375
1000kl
1000kl
315
762
110
900
0kl
160kl
190kl
1100kl
300kl
160kl
50
1250kl
275kl
204Ml/d

Kilometers
2.5 1.25 0 2.5 5

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Settlements & Settlement Names
- Major Towns

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Total Bulk Water Supply Interventions - Empangeni
City of uMhlathuze Local Municipality

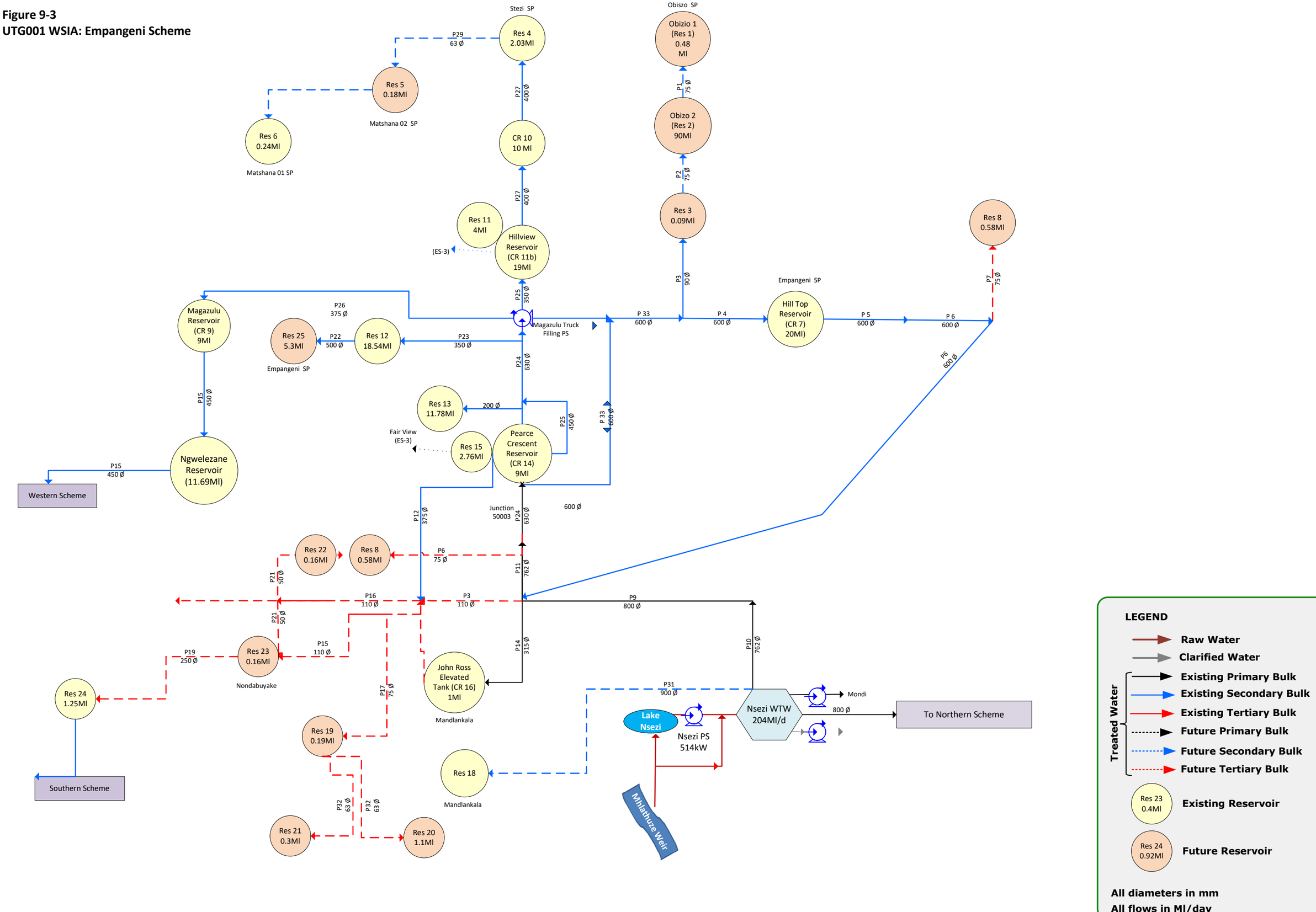
DATE COMPLETED: 30 September 2020

MAP NO.: **LM282 Figure 9.2**

Proposed New / Upgrade Infrafrastructure

- Hlabisa Water Scheme Areas & Names
- Weir (Existing)
- Existing Water Treatment Plants
- Surface Water Abstraction Works (Existing)
- Primary Bulk Pipelines (Existing)
- Secondary Bulk Pipelines (Existing)
- Tertiary Bulk Pipelines (Existing)
- Primary Reservoirs (Existing)
- Secondary Reservoirs (Existing)
- Tertiary Reservoirs (Existing)
- Pump Stations (Existing)
- 19Ml/d Upgrade of WTW
- Water Treatment Plants (Future)
- Surface Water Abstraction Works (Future)
- Primary Bulk Pipelines (Future)
- Secondary Bulk Pipelines (Future)
- Tertiary Bulk Pipelines (Future)
- Primary Command Reservoirs (Future)
- Secondary Reservoirs (Future)
- Tertiary Reservoirs (Future)
- Pump Stations (Future)

Figure 9-3
UTG001 WSIA: Empangeni Scheme



9.1.2.2 Storage

The capacities of the six (6) existing primary command reservoirs is sufficient to meet the demand in 2050 and is tabled in Table 9-2.

Table 9-2: Storage Capacity of Command Reservoirs in the Empangeni Scheme

Reservoir Name	Capacity (Mℓ/day)	Capacity (Kl)
CR Res 10	7.66	10 000
Hillview Reservoir (CR Res 11b)	7.66	19 000
Pearce Crescent Command Reservoir (CR Res 14)	7.66	9 000
John Ross Elevated Tank (CR Res 16)	0.44	1 000
Hilltop Command Reservoir (CR Res 7)	0.5	20 000
Magazulu Command Reservoir (CR Res 9)	0.5	9 000

9.1.2.3 Proposed interventions

- ✓ The existing primary bulk of 14.2km should be upgraded to range between ø 110mm and ø 800mm;
- ✓ The existing secondary bulk mains of 26.12km should be upgraded to range between ø 75mm and ø 600mm;
- ✓ The existing secondary and tertiary bulk mains should be extended to include 48.67 km of secondary bulk ranging between ø 63mm and ø 900mm and 7.14km of tertiary bulk ranging between ø 50mm and ø 63mm;
- ✓ The existing tertiary storage should be increased from 5.175 Mℓ to 36.05 Mℓ and the additional tertiary storage capacity to be added is 11.53 Mℓ; and
- ✓ The pumping capacity of the pump station at the Nzesi Plant should be increased to 514 kW to be able to deliver 0.44 M^3/s.

Design details of all the infrastructure components are provided within Annexure B.

9.1.3 Financial Requirements

The bulk cost requirement for UTG001: Empangeni WSIA is tabled within Table 9-3.

Table 9-3: UTG001 Empangeni Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R209 116 000	R20 911 600	R230 027 600
Secondary	R269 127 000	R26 912 700	R296 039 700
Tertiary	R138 666 000	R13 866 600	R152 532 600
Total	**R616 909 000**	**R61 690 900**	**R678 599 900**

The total bulk cost requirement for the Empangeni Scheme is R 678 599 900 (excl VAT). The scheme development cost per household is approximately R 45 125. Due to the size of the project, it will take close to 24 years to complete.

9.2 UTG003 WSIA: SOUTHERN SCHEME

9.2.1 Demand Model Intervention

9.2.1.1 Water Demand

The water demand for the Southern WSI was determined for 2020 and 2050 and included within Table 9-4. It includes approximately ten (10) communities of which the urban rural split is 40:60. The scheme serves the urban communities of Esikhaweni, Gubethuka and Msasandla and surrounding rural areas. The projected water demand is 62.14 Mℓ/day in 2050.

Table 9-4: Population and Water demand 2020 and 2050 for the Southern WSIA

Population	**Population 2020**	**Population 2050**
	161 311	202 724
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	50.48	62.14

9.2.1.2 Water Resource Consideration

Esikhaleni WTP sources its water from Lake Cubhu and is augmented from the Iscor Mining WSS that is supplied by the Mhlathuze River. The Lake has a quoted yield of 30Mℓ/day and the transfer capacity of the Iskor Mining scheme is 34Mℓ/day.

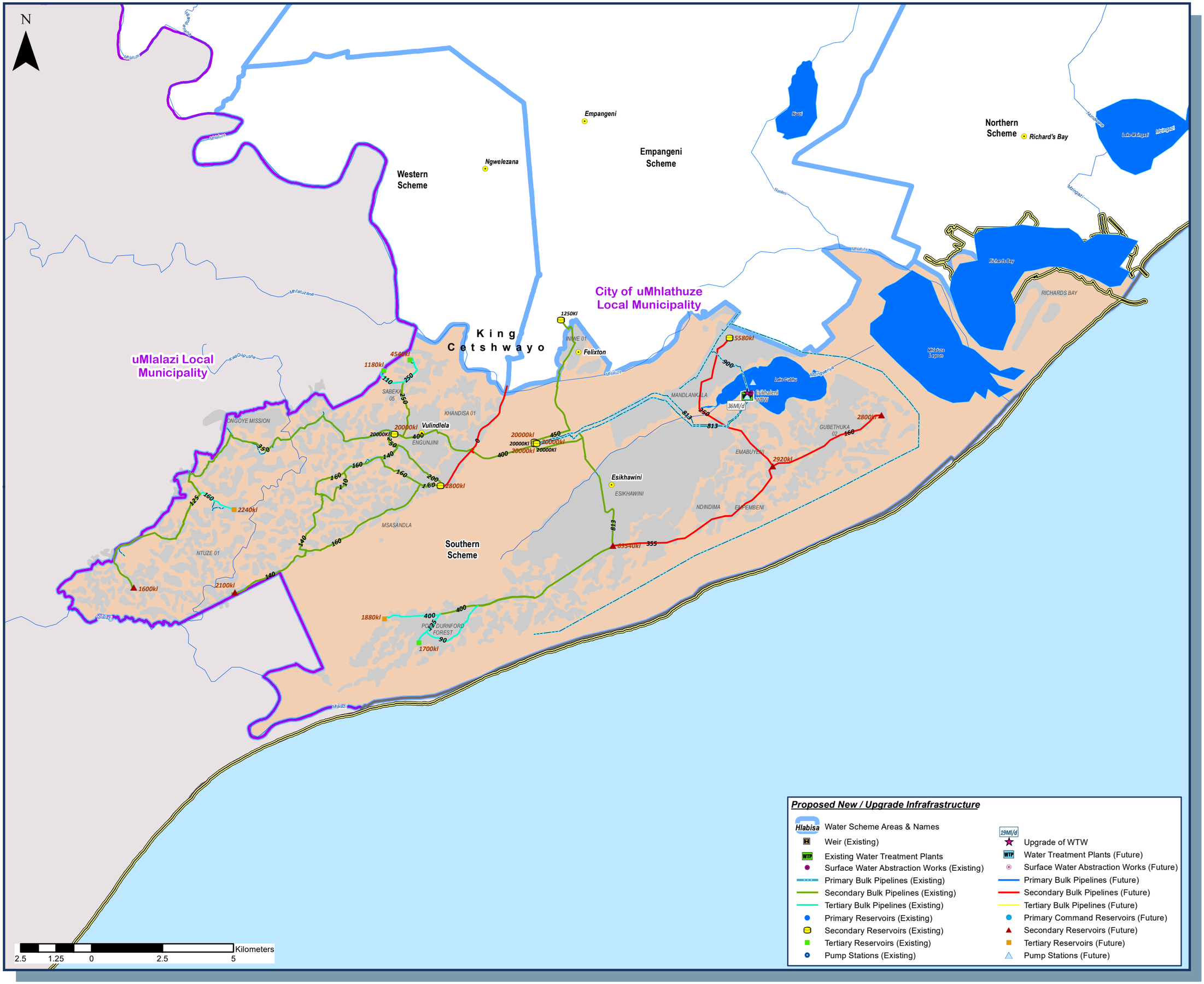
The current treatment capacity of the Esikhaleni WTP is 36Mℓ/day but should be increased to 65Mℓ/day to be able to meet the demand of 2050.

9.2.2 Water Supply Infrastructure

The following infrastructure upgrades and augmentation will be required in order to adequately supply the Southern WSIA and is illustrated within Figure 9-4 overleaf followed by the schematic layout of the WSIA within Figure 9-5.

9.2.2.1 Bulk Conveyance:

Water is abstracted from Lake Chubu and pumped via a ø 900mm primary bulk pipe to the Esikhaleni WTP. It is proposed that the pumping capacity of the pump station at the abstraction point be increased to 7kW. From the Esikhaleni WTP, water is pumped via an existing ø 600mm primary bulk pipeline that should be upgraded to a ø 813mm primary bulk pipe to the three (3) Forest Reservoirs Complex (Res 11, Res 12 and Res 13). The pump station at the WTP should be upgraded to a pumping capacity of 1 571kW to reach the Forrest Reservoir Complex.



Legend

- Provinical Boundaries
- District Municipality Boundaries
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- Dams & Dam Names
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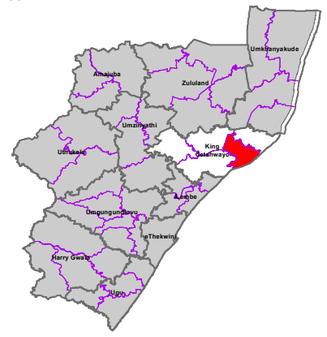
- Settlements & Settlement Names
- Major Towns

LOCALITY:



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LOCAL MUNICIPALITY:

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Total Bulk Water Supply Interventions - Southern City of uMhlathuze Local Municipality

DATE COMPLETED:

30 September 2020

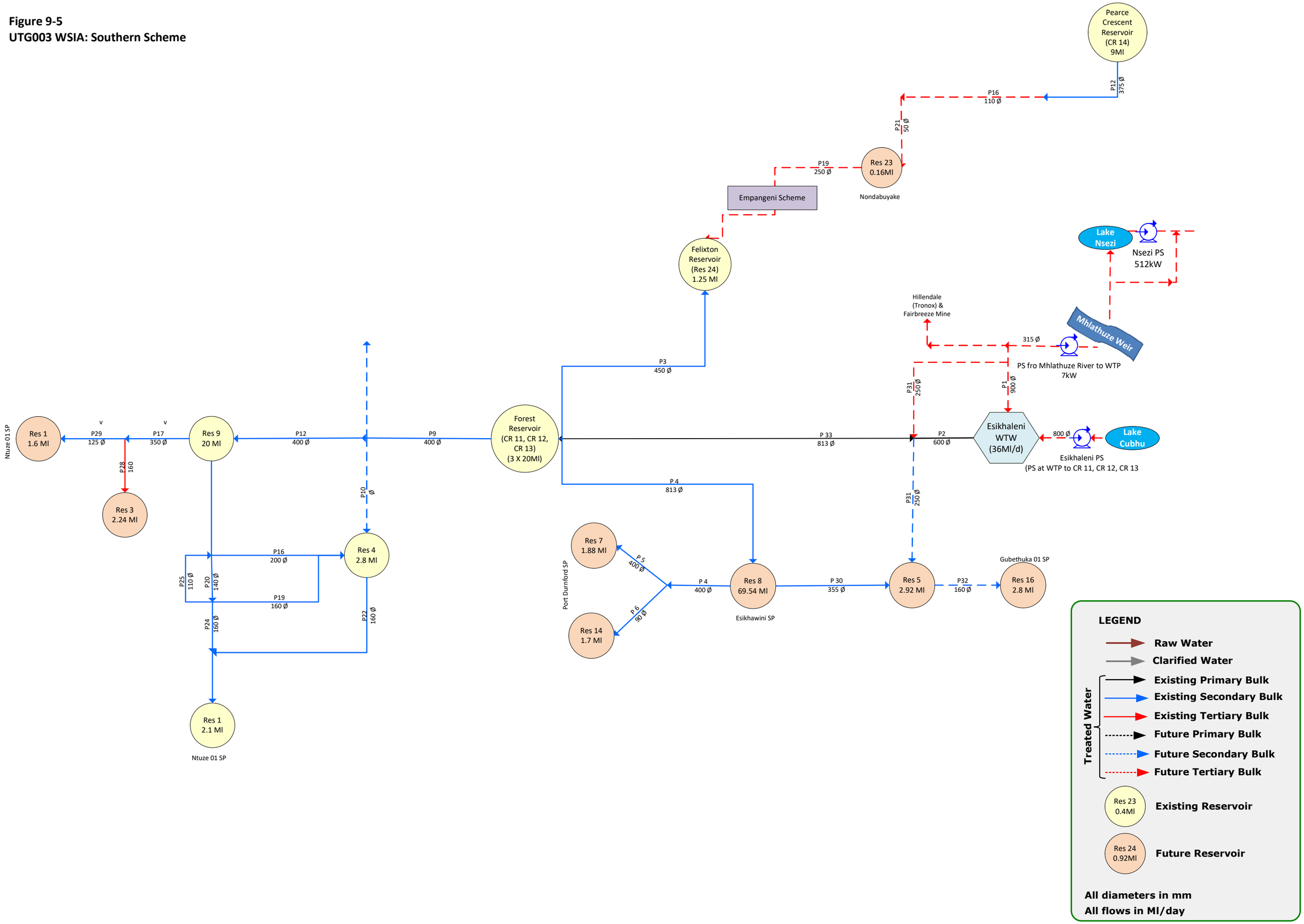
MAP NO.:

LM282 Figure 9.4

Proposed New / Upgrade Infrafrastructure

- Water Scheme Areas & Names
- Weir (Existing)
- Existing Water Treatment Plants
- Surface Water Abstraction Works (Existing)
- Primary Bulk Pipelines (Existing)
- Secondary Bulk Pipelines (Existing)
- Tertiary Bulk Pipelines (Existing)
- Primary Reservoirs (Existing)
- Secondary Reservoirs (Existing)
- Tertiary Reservoirs (Existing)
- Pump Stations (Existing)
- Upgrade of WTW
- Water Treatment Plants (Future)
- Surface Water Abstraction Works (Future)
- Primary Bulk Pipelines (Future)
- Secondary Bulk Pipelines (Future)
- Tertiary Bulk Pipelines (Future)
- Primary Command Reservoirs (Future)
- Secondary Reservoirs (Future)
- Tertiary Reservoirs (Future)
- Pump Stations (Future)

Figure 9-5
UTG003 WSIA: Southern Scheme



The existing ø 600mm primary bulk pipeline t-off just before it reaches the Reservoir complex to

- ✓ the north via ø 200mm bulk pipe that should be upgraded to a ø 450 mm secondary bulk pipe to supply Iniwe and surrounds as well as to connect to the Empangeni Scheme at Reservoir 24; and
- ✓ the south via secondary pipelines ranging from ø 500mm to ø 700 secondary bulk pipe to be upgraded to a ø 813 mm secondary bulk pipe to supply Esikhaleni. At Reservoir 8, the existing secondary bulk pipe continues to the west to supply Port Durnford Forest with a ø 400mm and should be extended towards the east with a ø 355mm to supply Empembeni and surrounds and should continue in a future ø 160mm to supply Gubethuka.

A ø 400mm secondary bulk pipe from the Forest Reservoirs Complex conveys water to the west via existing secondary bulk pipes ranging between ø 63mm and ø 110mm to ultimately reach Ntuze. These secondary bulk pipes need to be upgraded to range between ø 110mm and ø 250mm.

The ø 400mm secondary bulk pipe mentioned above also distributes to the southwest into secondary bulk pipes ranging between ø 63mm and ø 200mm that should be upgraded to range between ø 110mm and ø 250mm to supply Ongoye Mission and Ntuze. It also t-off to the north via a ø 400mm secondary bulk pipe to supply Sabeka.

9.2.2.2 Storage

The storage capacities of the three (3) existing Forrest Reservoir Complex (Res 11, Res 12 and Res 13) and the Felixton Reservoir (Res 9) is sufficient to meet the demand in 2050. The total storage capacities of these four (4) reservoirs are 20 Mℓ.

9.2.2.3 Proposed interventions

- ✓ The existing primary bulk of 22.6km should be upgraded to range between ø 813mm and ø 900mm;
- ✓ The existing secondary bulk mains of 70.75km should be upgraded to range between ø 160 mm and ø 813mm;
- ✓ The existing tertiary bulk mains of 9.76km should be upgraded to range between ø 90 mm and ø 400mm;
- ✓ The existing secondary bulk mains should be extended to include 22.14km of secondary bulk ranging between ø 160mm and ø 355mm;
- ✓ The existing six (6) secondary storage reservoirs should be increased from 80.62Mℓ to 85.72Mℓ and the three (3) tertiary storage reservoirs should be increased from 0.845Mℓ to 7.42 Mℓ;
- ✓ Five (5) additional secondary reservoirs with a total storage capacity of 81.62Mℓ and two (2) tertiary additional reservoirs with a total storage capacity of 4.12Mℓ should augment the existing storage capacity; and
- ✓ The pumping capacity of the pump station at the abstraction point should be increased to 7kW to be able to deliver 0.65M^3/s and the pumping capacity of the pump station at the WTP should be increased to 1 571kW to be able to deliver 1.16M^3/s.

Design details of all the infrastructure components are provided within Annexure B.

9.2.3 Financial Requirements

The bulk cost requirement for UTG003: Southern WSIA is tabled within Table 9-5.

Table 9-5: UTG003 Southern Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R536 386 000	R53 638 600	R590 024 600
Secondary	R401 193 898	R40 119 390	R441 313 288
Tertiary	R56 837 000	R5 683 700	R62 520 700
Total	**R994 416 898**	**R99 441 690**	**R1 093 858 588**

The total bulk cost requirement for the Southern Scheme is R 1.094 billion (excl VAT). The scheme development cost per household is approximately R 19 964. Due to the size of the project, it will take close to 24 years to complete.

9.3 UTG012 WSIA: WESTERN SCHEME

9.3.1 Demand Model Intervention

9.3.1.1 Water Demand

The water demand for the Western WSI was determined for 2020 and 2050 and included within Table 9-1: Population and Water demand 2020 and 2050Table 9-6. It includes approximately four (4) densely populated communities. The projected water demand is 21.47 Mℓ/day in 2050.

Table 9-6: Population and Water demand 2020 and 2050 for the Western WSIA

Population	**Population 2020**	**Population 2050**
	56 886	84 342
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	15.54	21.47

9.3.1.2 Water Resource Consideration

Water is abstracted from a run of river abstraction works at Lake Phobane to supply the existing 8Mℓ/day Ngwelezane WTP. The water is released from the dam and flows for about 73km to the abstraction tower. If the dam level of Lake Phobane (Goedertrouw Dam) is below 90%, water is pumped from the Thukela River through the Middledrift pipeline to supplement the water supplies of the Mhlathuze River system. The capacity of the transfer scheme adds an additional yield of 75 million m^3/a.

However, the treatment capacity of the Ngwelezane WTP should be increased to 20Mℓ/day to be able to meet the demand in 2050.

9.3.2 Water Supply Infrastructure

The following infrastructure upgrades and augmentation will be required in order to adequately supply the Southern WSIA and is illustrated within Figure 9-6 overleaf followed by the schematic layout of the WSIA within Figure 9-7.

9.3.2.1 Bulk Conveyance:

From the Ngwelezane WTP, water is pumped via an existing ø 250mm primary bulk pipeline that should be upgraded to an ø 660mm primary bulk pipe to the Ngwelezane Command Reservoir (Res 20). It is proposed that the pumping capacity of the pump station at the WTP be increased to 381kW. From the WTP, water is distributed to the south with an existing ø 250mm secondary bulk pipeline to reach Iniwe. Various existing tertiary take-offs are connected to the latter ranging between ø 50mm and ø 160mm that should be upgraded to range between ø 125mm and ø 250mm

From the Ngwelezane Command Reservoir (Res 20), water is conveyed north via an existing ø 450mm secondary bulk pipe to connect to the Magazulu Reservoir (CR Res 9) in the Empangeni Scheme. The existing ø 450mm secondary bulk pipeline t-off to the west with secondary bulk pipelines ranging from ø 110mm to ø 160mm to supply Nqotsheni and Sgisi but should be upgraded to range from ø 160mm to ø 200mm. Various existing tertiary take-offs are connected to the latter ranging between ø 75mm and ø 160mm that should be upgraded to range between ø 90mm and ø 250mm.

The existing ø 160mm secondary bulk pipe at Nqotsheni and Reservoir 4 should be extended in future to supply Ebingoma via ø 50mm and ø 90mm secondary bulk pipes.

9.3.2.2 Storage

The storage capacities of the existing primary Ngwelezane Command Reservoir (Res 20) should be increased from 6.5Mℓ to 11.69Mℓ and storage capacity of the remaining primary reservoirs should be upgraded by 3.48Mℓ, specifically at Reservoir 22 and Reservoir 23.

N

Western Scheme

Empangeni Scheme

Southern Scheme

King Cetshwayo

City of uMhlathuze Local Municipality

uMlalazi Local Municipality

Empangeni

Ngwelezana

Felixton

EBINGOMA

SGISI 03

NQOTSHENI 02

INIWE 02

Nwelezane WTW

380kl
420kl
620kl
680kl
1440kl
580kl
180kl
3980kl
1580kl
3500kl
3240kl
6500kl
11690kl
1600kl
2520kl
2300kl
5300kl
2280kl
1220kl
560kl
820kl
1180kl
1060kl
600kl

20Ml/d
8Ml/d

Kilometers
1 0.5 0 1 2

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Settlements & Settlement Names
- Major Towns

Proposed New / Upgrade Infrafrastructure

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- Secondary Bulk Pipelines (Existing)
- Tertiary Bulk Pipelines (Existing)
- Primary Reservoirs (Existing)
- Secondary Reservoirs (Existing)
- Tertiary Reservoirs (Existing)
- Pump Stations (Existing)
- Upgrade of WTW
- Water Treatment Plants (Future)
- Surface Water Abstraction Works (Future)
- Primary Bulk Pipelines (Future)
- Secondary Bulk Pipelines (Future)
- Tertiary Bulk Pipelines (Future)
- Primary Command Reservoirs (Future)
- Secondary Reservoirs (Future)
- Tertiary Reservoirs (Future)
- Pump Stations (Future)

LOCALITY:

CLIENT:
UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:
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CONSULTANTS: Project No.: 27814

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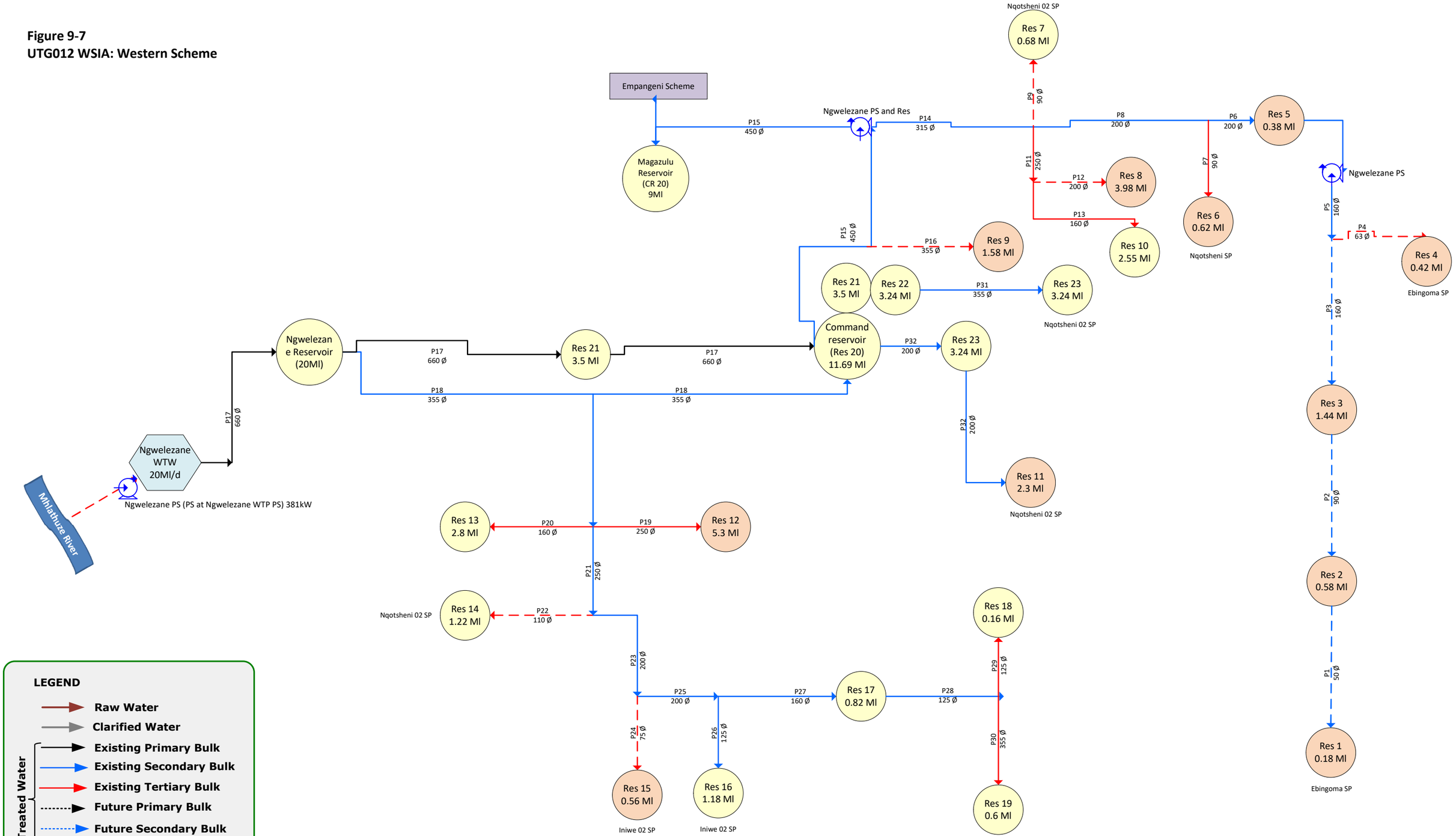
PROJECT TITLE
City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:
Total Bulk Water Supply Interventions - Western City of uMhlathuze Local Municipality

DATE COMPLETED:
30 September 2020

MAP NO.:
LM282 Figure 9.6

Figure 9-7
UTG012 WSIA: Western Scheme



LEGEND

Treated Water
- Raw Water
- Clarified Water
- Existing Primary Bulk
- Existing Secondary Bulk
- Existing Tertiary Bulk
- Future Primary Bulk
- Future Secondary Bulk
- Future Tertiary Bulk

Res 23 0.4Ml — Existing Reservoir

Res 24 0.92Ml — Future Reservoir

All diameters in mm
All flows in Ml/day

9.3.2.3 Proposed interventions

- ✓ The Ngwelezane WTP should be upgraded to 20Mℓ/day;
- ✓ The existing primary bulk of 4.26 km should be upgraded to range between ø 660mm;
- ✓ The existing secondary bulk mains of 23.85 km should be upgraded to range between ø 160mm and ø 355mm;
- ✓ The existing tertiary bulk mains of 10.39km should be upgraded to range between ø 63 mm and ø 255mm;
- ✓ The existing secondary bulk mains should be extended to include 5.18km of secondary bulk ranging between ø 50mm and ø 160mm;
- ✓ The existing distribution network should be extended to include 7.08km of tertiary bulk mains ranging between ø 75mm and ø 200mm;
- ✓ The existing four (4) primary storage reservoirs should be increased from 13.48Mℓ to 21.67Mℓ and the six (6) tertiary storage reservoirs should be increased to from 0.371Mℓ to 8.46Mℓ;
- ✓ 13 additional tertiary reservoirs with a total storage capacity of 19.06Mℓ should augment the existing storage capacity; and
- ✓ The pumping capacity of the pump station at the WTP should be increased to 381kW to be able to deliver 0.34M^3/s.

Design details of all the infrastructure components are provided within Annexure B.

9.3.3 Financial Requirements

The bulk cost requirement for UTG012: Western WSIA is tabled within Table 9-7.

Table 9-7: UTG012 Western Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R138 805 000	R13 880 500	R152 685 500
Secondary	R47 131 000	R4 713 100	R51 844 100
Tertiary	R146 092 000	R14 609 200	R160 701 200
Total	**R332 028 000**	**R33 202 800**	**R365 230 800**

The total bulk cost requirement for the Southern Scheme is R 365.2 million (excl VAT). The scheme development cost per household is approximately R 16 022.

9.4 UTG015 WSIA: Northern Scheme

9.4.1 Demand Model Intervention

9.4.1.1 Water Demand

The water demand for the Northern WSI was determined for 2020 and 2050 and included within Table 9-8. It supplies both the residential and commercial/light-industrial users in the town of Richard's Bay . The projected water demand is 179.95Mℓ/day in 2050.

Table 9-8: Population and Water demand 2020 and 2050 for the Northern WSIA

Population	**Population 2020**	**Population 2050**
	61 348	106 698
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	103.62	179.95

9.4.1.2 Water Resource Consideration

The Northern Scheme abstracts raw water from Lake Mzingazi (HFY of 10.5 million m^3/a or 28.77Mℓ/d) and is treated at the Mzingazi WTP for distribution into Richards Bay and the industrial areas. Water supply is supplemented when necessary from the Nsezi WTP with a contracted volume of 25Mℓ/day.

The Mzingazi WTP has an existing treatment capacity of 65Mℓ/day and cannot be upgraded in future due to the HFY of Lake Mzingazi that restricts the allocation per day to or 28.77Mℓ/d.

9.4.2 Water Supply Infrastructure

The following infrastructure upgrades and augmentation will be required in order to adequately supply the Northern WSIA and is illustrated within Figure 9-8 overleaf followed by the schematic layout of the WSIA within Figure 9-9.

9.4.2.1 Bulk Conveyance:

Water is distributed to three (3) command reservoirs from Mzingazi WTP, namely Mandlazini (x 2) and Meerensee Reservoirs and distributed as follows:

- ✓ An existing primary bulk pipe from the Mzingazi WTP ranging between ø 400mm and ø 900mm distributes potable water to the two Mandlazini CR (CR 1 and CR 2). The aforementioned primary bulk pipe should be upgraded to range between ø 600mm and ø 1200mm as it also feeds water to Nseleni. The primary bulk pipe to Nseleni ranges between ø 600mm and ø 814mm but should be upgraded to range between ø 914mm and ø 1 016mm primary bulk pipe towards CR 1 and CR 2;
- ✓ Water also gravitates from the Nsezi WTP to the Mzingazi WTP via a secondary bulk pipe of ø 600mm that flows towards CR 5, continues to Reservoir 12 where it is stored and then pumped to the Meerensee Reservoir (CR res 8) via a secondary bulk pipe of ø 300mm that should be upgraded to ø 400mm;

N

Nseleni Scheme

Empangeni Scheme

King Cetshwayo

uMfolozi Local Municipality

City of uMhlathuze Local Municipality

Northern Scheme

Southern Scheme

Nseleni

Richard's Bay

Nzalabantu

Mzingazi WTW

65Ml/d

Lake Mzingazi

Meer-en-See Desalination Plant

10Ml/d

RICHARDS BAY

Nseleni

Mzingwenya

Kilometers

1 0.5 0 1 2

Legend

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- Rivers
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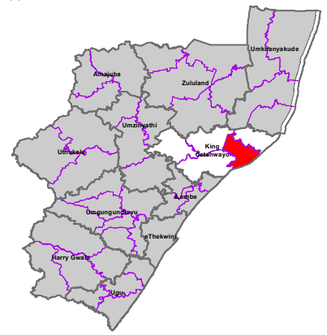
- Major Towns

LOCALITY:



CLIENT:

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CONSULTANTS: Project No.: 27814

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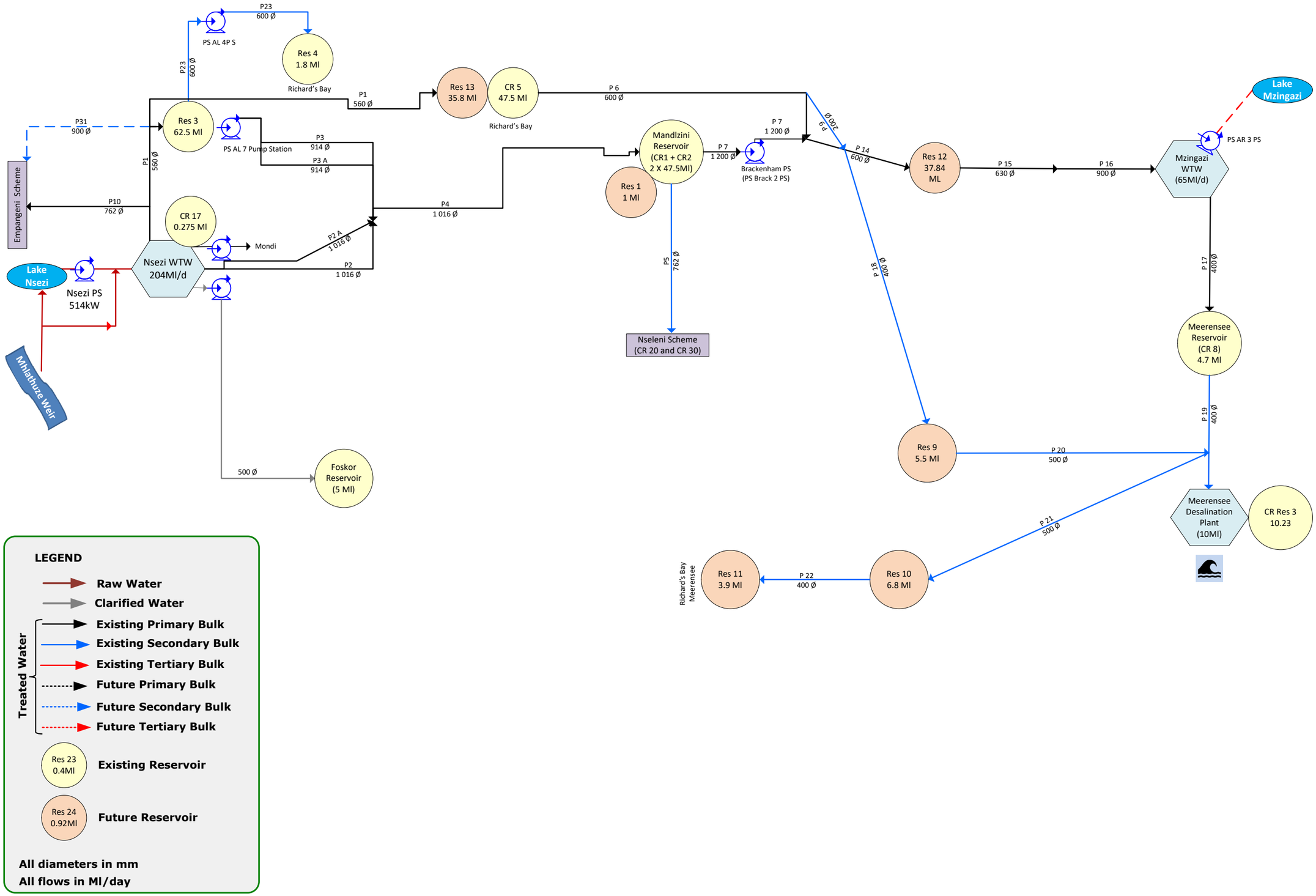
MAP NO.:

LM282 Figure 9.8

Proposed New / Upgrade Infrafrastructure

- Water Scheme Areas & Names
- Weir (Existing)
- Existing Water Treatment Plants
- Surface Water Abstraction Works (Existing)
- Primary Bulk Pipelines (Existing)
- Secondary Bulk Pipelines (Existing)
- Tertiary Bulk Pipelines (Existing)
- Primary Reservoirs (Existing)
- Secondary Reservoirs (Existing)
- Tertiary Reservoirs (Existing)
- Pump Stations (Existing)
- Upgrade of WTW
- Water Treatment Plants (Future)
- Surface Water Abstraction Works (Future)
- Primary Bulk Pipelines (Future)
- Secondary Bulk Pipelines (Future)
- Tertiary Bulk Pipelines (Future)
- Primary Command Reservoirs (Future)
- Secondary Reservoirs (Future)
- Tertiary Reservoirs (Future)
- Pump Stations (Future)

Figure 9-9
UTG015 WSIA: Northern Scheme



LEGEND

- Raw Water
- Clarified Water

Treated Water

- Existing Primary Bulk
- Existing Secondary Bulk
- Existing Tertiary Bulk
- Future Primary Bulk
- Future Secondary Bulk
- Future Tertiary Bulk

Res 23 0.4Ml — Existing Reservoir

Res 24 0.92Ml — Future Reservoir

All diameters in mm
All flows in Ml/day

- ✓ From the Meerensee Reservoir (CR res 8), water is distributed via existing secondary bulk pipelines ranging between ø 400mm and ø 500mm to the Meerensee Desalination Plant from where it continues to flow to Reservoir 11 for further distribution.
- ✓ Water flows north from the two (2) Mandlazini CR 1 and CR 2 with an existing ø 400mm secondary bulk pipe to be upgraded to ø 762mm to augment the supply to the Nseleni Scheme at Reservoir 30; and
- ✓ A future secondary pipe ranging between ø 916mm and ø 1 016mm is proposed to augment the water supply to CR 5 through a proposed Reservoir 3 that would serve as temporary storage.

9.4.2.2 Storage

The storage capacities of three (3) of the four (4) CRs are sufficient but CR 5 should be increased from 5Mℓ to 47Mℓ to augment the supply from the Nsezi WTP to the Mzingazi WTP in order to meet the demand in 2050. Two additional primary storage reservoirs need to be implemented to increase the storage capacities of the six (6) primary reservoirs to 153.23Mℓ.

9.4.2.3 Proposed interventions

- ✓ The existing primary bulk of 28.49km should be upgraded to range between ø 560mm and ø 1 200mm;
- ✓ The existing secondary bulk mains of 36.04 km should be upgraded to range between ø 400mm and ø 762mm;
- ✓ The existing tertiary bulk mains of 1.26km should be upgraded to ø 525mm;
- ✓ The existing primary bulk should be extended to include 3.65km of ø 1 160mm primary bulk to augment the supply to the Nseleni Scheme, the secondary bulk mains should be extended to include 24km to range between ø 400mm and ø 762mm and the tertiary bulk should be extended by a 1.13km ø 525mm tertiary bulk pipes;
- ✓ The existing four (4) primary storage reservoirs should be increased from 110.23Mℓ to 152.23Mℓ and the one (1) tertiary storage reservoirs should be increased from 0.327Mℓ to 10.5Mℓ;
- ✓ Two additional primary storage reservoirs with a total storage capacity of 5.7Mℓ, eight (8) secondary reservoirs with a total storage capacity of 165.46Mℓ and one (1) tertiary reservoir with a total storage capacity of 11.14 Mℓ should augment the existing storage capacity; and
- ✓ The pumping capacities of all five (5) pump stations are sufficient.

Design details of all the infrastructure components are provided within Annexure B.

9.4.3 Financial Requirements

The bulk cost requirement for UTG015: Northern WSIA is tabled within Table 9-9.

Table 9-9: UTG015 Northern Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R577 569 310	R57 756 931	R635 326 241
Secondary	R802 134 206	R80 213 421	R882 347 627

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Tertiary	R73 427 000	R7 342 700	R80 769 700
Total	**R1 453 130 516**	**R145 313 052**	**R1 598 443 568**

The total bulk cost requirement for the Northern Scheme is R 1.598 billion (excl VAT). The scheme development cost per household is approximately R 55 430. Due to the size of the project, it will take close to 24 years to complete.

9.5 UTG017 WSIA: NSELENI SCHEME

9.5.1 Demand Model Intervention

9.5.1.1 Water Demand

The water demand for the Nseleni WSI was determined for 2020 and 2050 and included within Table 9-10Table 9-8. It supplies mainly rural communities of Esikhaleni and Mathunzi. The projected water demand is 10.12Mℓ/day in 2050.

Table 9-10: Population and Water demand 2020 and 2050 for the Nseleni WSIA

Population	**Population 2020**	**Population 2050**
	39 819	50 042
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	8.36	10.12

9.5.1.2 Water Resource Consideration

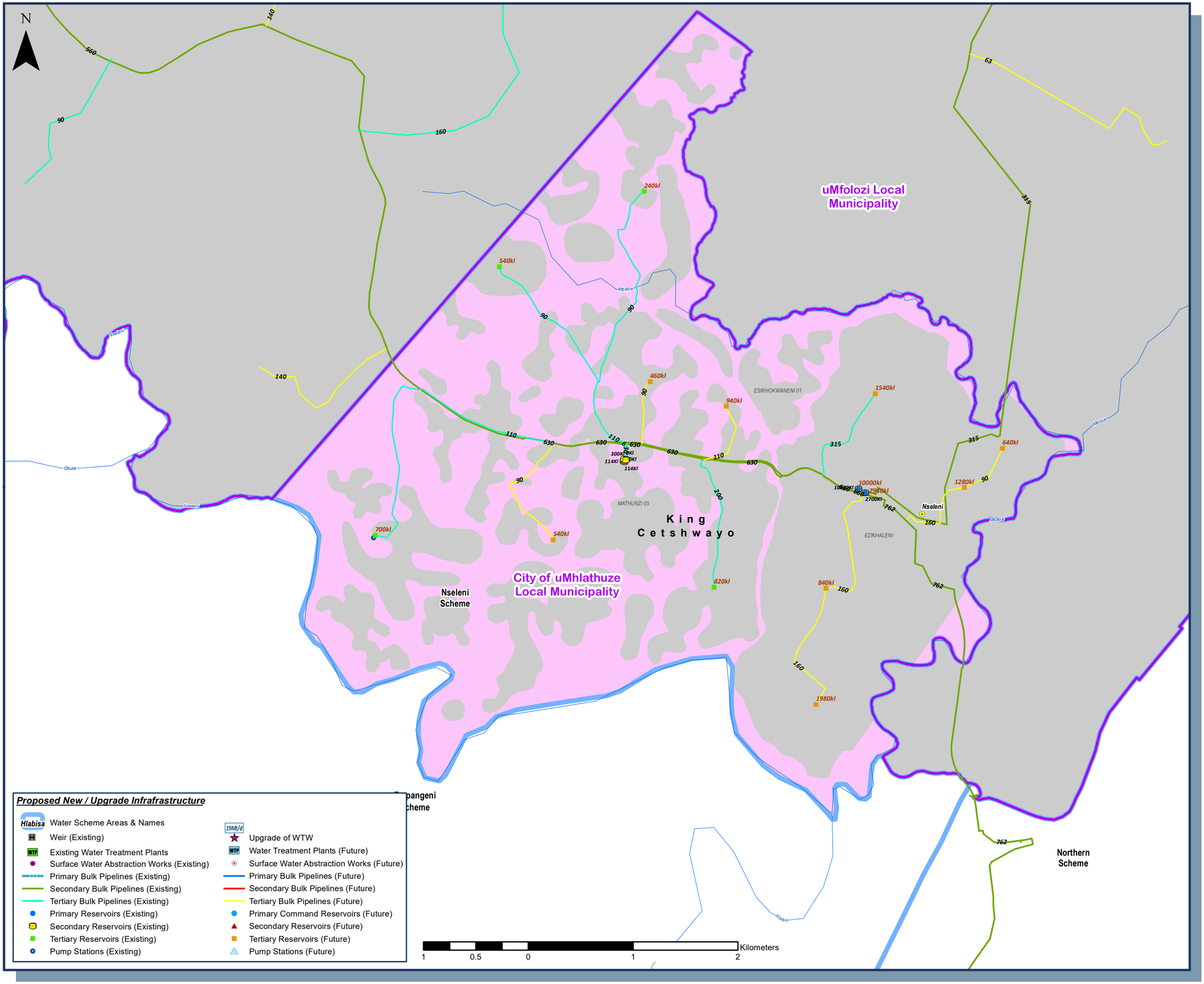
The Nseleni Scheme is supplied from the Mandlazini Reservoirs (CR 1 and CR 2) located within the Northern Scheme. The water allocation is 13.2Mℓ/day or 4.82 Mm^3/annum. The water source is sufficient to meet the demand in 2050 and only the storage capacity of the scheme should be increased.

9.5.2 Water Supply Infrastructure

The following infrastructure upgrades and augmentation will be required in order to adequately supply the Nseleni WSIA and is illustrated within Figure 9-10 overleaf followed by the schematic layout of the WSIA within Figure 9-11.

9.5.2.1 Bulk Conveyance:

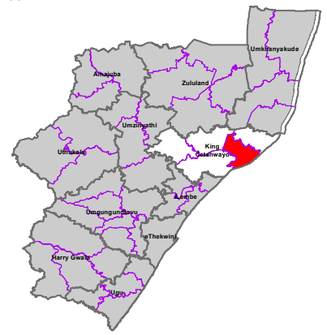
The main distribution to the Nseleni Scheme is the pipeline to be upgraded to a ø 762 secondary bulk pipeline from the Mandlazini Reservoirs in the Northern Scheme to reach Nseleni reservoirs (CR 20 and CR 30). From the CRs, an existing ø 200mm secondary bulk pipe is pumped north west into Sub Supply areas 1 and 2 of the Upper-Nseleni-Mhlana Scheme within KCDM to connect again to the Ntambanana Scheme. The aforementioned secondary bulk pipe should be upgraded to range between ø 630mm and ø 660mm bulk pipe sections.



Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Settlements & Settlement Names
- Major Towns

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

LOCAL MUNICIPALITY:

CITY OF UMHLATHUZE LOCAL MUNICIPALITY

CONSULTANTS: Project No.: 27814

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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Total Bulk Water Supply Interventions - Nseleni City of uMhlathuze Local Municipality

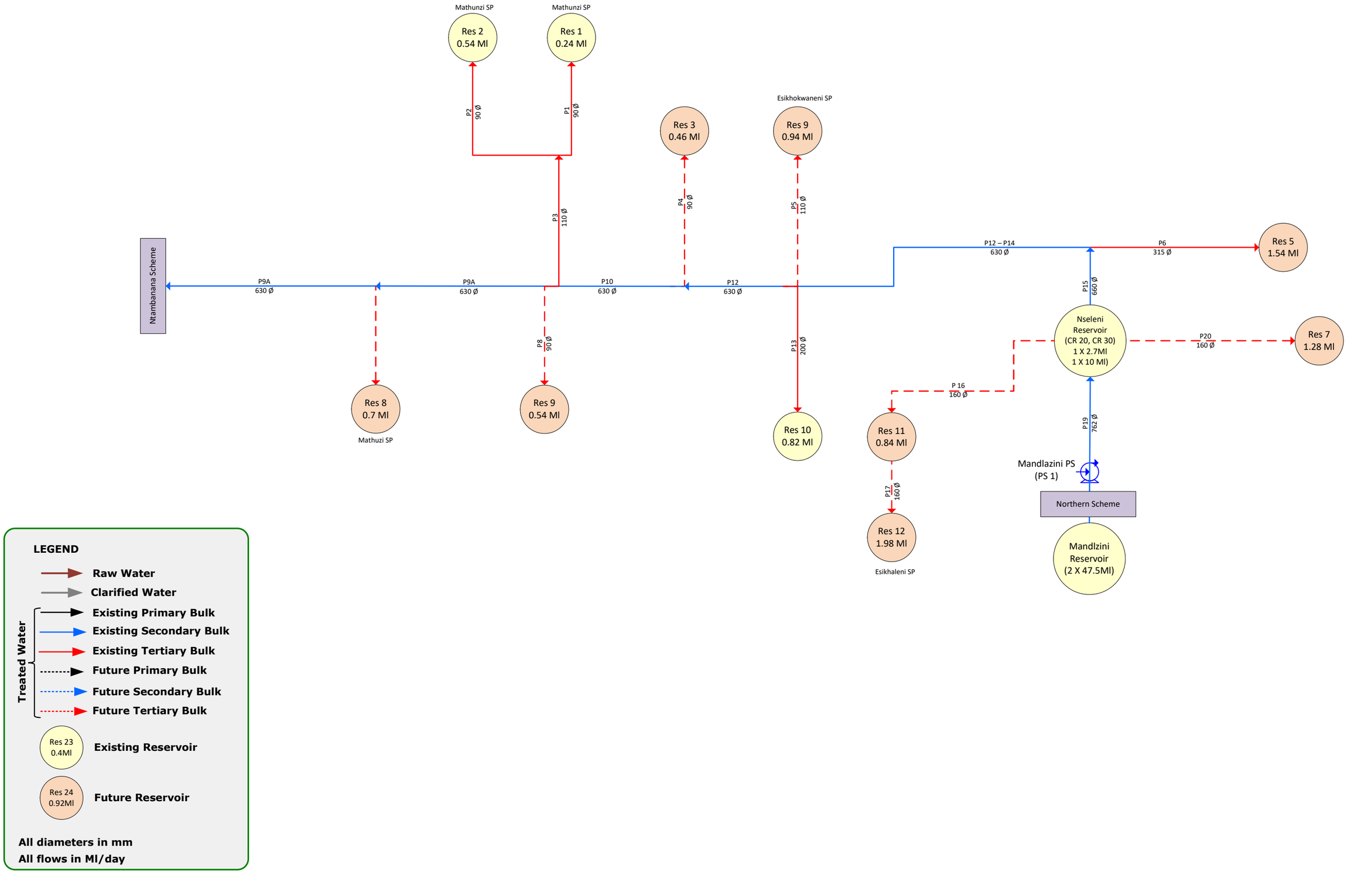
DATE COMPLETED: 30 September 2020

MAP NO.: **LM282 Figure 9.10**

Proposed New / Upgrade Infrafrastructure

- Hlabisa — Water Scheme Areas & Names
- Weir (Existing)
- Existing Water Treatment Plants
- Surface Water Abstraction Works (Existing)
- Primary Bulk Pipelines (Existing)
- Secondary Bulk Pipelines (Existing)
- Tertiary Bulk Pipelines (Existing)
- Primary Reservoirs (Existing)
- Secondary Reservoirs (Existing)
- Tertiary Reservoirs (Existing)
- Pump Stations (Existing)
- 19Ml/d — Upgrade of WTW
- Water Treatment Plants (Future)
- Surface Water Abstraction Works (Future)
- Primary Bulk Pipelines (Future)
- Secondary Bulk Pipelines (Future)
- Tertiary Bulk Pipelines (Future)
- Primary Command Reservoirs (Future)
- Secondary Reservoirs (Future)
- Tertiary Reservoirs (Future)
- Pump Stations (Future)

Figure 9-11
UTG017 WSIA: Nseleni Scheme



It also t-off as the water is pumped towards Ntambanana to various tertiary bulk pipes ranging between ø 90mm and ø 200mm to reach the rural communities of Esikhaleni and Mtunzini.

9.5.2.2 Storage

The storage capacities of the existing two (2) primary CRs totalling 12.7Mℓ should be increased to 17.94Mℓ. Additional storage capacity should be provided as a matter of urgency to ensure that a minimum of 48 hours storage capacity is maintained and the existing four (4) reservoirs should be increased from 0.28Mℓ to 2.3Mℓ and an additional eight (8) reservoirs with a total capacity of 8.22Mℓ should augment the storage to meet the demand of 2050.

9.5.2.3 Proposed interventions

- ✓ The existing primary bulk of 2.1km should be upgraded to ø 762mm under the Northern Scheme;
- ✓ The existing secondary bulk mains of 3.1km should be upgraded to range between ø 600mm and ø 630mm;
- ✓ The existing tertiary bulk mains of 10.24km should be upgraded to range between ø 90mm and ø 630mm;
- ✓ The existing tertiary bulk should be extended by 6.7km ranging between ø 90mm and ø 160mm;
- ✓ The existing two primary storage reservoirs should be increased from 12.7Mℓ to 17.94Mℓ and the four (4) tertiary storage reservoirs should be increased from 0.28Mℓ to 3.2Mℓ;
- ✓ Eight (8) additional primary storage reservoirs with a total storage capacity of 8.22Mℓ should augment the existing storage capacity; and
- ✓ The pumping capacities of both pump stations are sufficient.

Design details of all the infrastructure components are provided within Annexure B.

9.5.3 Financial Requirements

The bulk cost requirement for UTG017: Nseleni WSIA is tabled within Table 9-11 below.

Table 9-11: UTG017 Nseleni Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R48 063 000	R4 806 300	R52 869 300
Secondary	R30 526 000	R3 052 600	R33 578 600
Tertiary	R71 638 000	R7 163 800	R78 801 800
Total	**R150 227 000**	**R15 022 700**	**R165 249 700**

The total bulk cost requirement for the Nseleni Scheme is R 165.25 million (excl VAT). The scheme development cost per household is approximately R 12 218.

9.6 UTG018 WSIA: NTAMBANANA SCHEME

9.6.1 Demand Model Intervention

9.6.1.1 Water Demand

The water demand for the Ntambanana WSI was determined for 2020 and 2050 and included within Table 9-12Table 9-10Table 9-8. It supplies mainly rural communities of Bukhanana, Ntamabana, Makholwa, Nqotsheni, Ngizumu and Obizo. The projected water demand is 7.38Mℓ/day in 2050.

Table 9-12: Population and Water demand 2020 and 2050 for the Ntambanana WSIA

Population	**Population 2020**	**Population 2050**
	32 300	40 592
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	5.99	7.38

9.6.1.2 Water Resource Consideration

Potable water is sourced from the Crocodile Dam WTP (1Mℓ/day) and the Nsezi WTP via the Nseleni pumping station. The sources is further augmented by the Luwamba Raw Water Scheme with an allocation of 3Mℓ/day. The balance of 1.2Mm^3/annum from the Nseleni Scheme is taken to augment the shortfall but still leaves a deficit of 0.69Mm^3/annum. This could be augmented to increase the supply from the Nzesi WTP or the Luwamba Scheme supplying the Crocodile WTP.

The WSA's intent to increase the Crocodile WTP to 2.5Mℓ/day is still required.

9.6.2 Water Supply Infrastructure

The following infrastructure upgrades and augmentation will be required in order to adequately supply the Ntambanana WSIA and is illustrated within Figure 9-12 overleaf followed by the schematic layout of the WSIA within Figure 9-13.

9.6.2.1 Bulk Conveyance:

From the Crocodile WTP, water flows south towards Makholwa via existing primary bulk pipes ranging between ø 200mm and ø 250mm. It also distributes water to the east to Bukhanana Town and Makholwa via an existing secondary ø 160mm bulk pipe towards Reservoir 6.

From Reservoir 6, it flows south again with an existing ø 400mm secondary bulk pipe towards Mhlana and Reservoir 9 that is connected to the Nseleni Scheme through Sub Supply areas 1 and 2 of the Upper-Nseleni-Mhlana Scheme within KCDM. From Reservoir 9, water is distributed via various existing tertiary bulk pipelines ranging between ø 90mm and ø 160mm that should be upgraded to range between ø 110mm and ø 250mm.

N

Mthonjaneni Local Municipality

uMfolozi Local Municipality

City of uMhlathuze Local Municipality

Ntambanana Scheme

Empangeni Scheme

King Cetshwayo

Nseleni

Mvamanzi

Ntambanana

Crocodile Dam WTW

2.5Ml/d

1Ml/d

540kl

500kl

160

140

250

1540kl

Kl

BHUKHANANA

200kl

1520kl

90

200

125

500kl

500kl

190kl

700kl

460kl

MAKHOLWASE 02

MAQEDIPULETI

50

MALUNGWINI

50kl

540kl

400

INDODWANE

590kl

100kl

110kl

590kl

NQUTSHINI 04

0kl

110

120kl

KWAHLAZA

390kl

56kl

560kl

560kl

315

MQUZANKUNZI 01

150kl

108kl

220kl

40kl

MHLANA 03

MAKHOLWASE 01

140kl

OBIZO 02

NINGIZIMU 02

900kl

150kl

SIHUZU 01

MAKHWELA 02

150kl

2190kl

2190kl

108kl

STEZI 08

ESITHOMBENI

Okhalweni

Kilometers

1 0.5 0 1 2

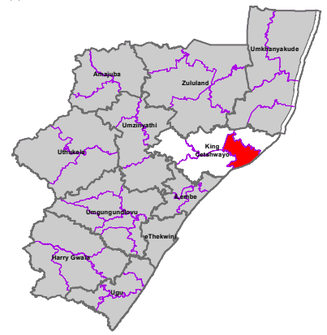
Proposed New / Upgrade Infrafrastructure

- Hlabisa — Water Scheme Areas & Names
- Weir (Existing)
- WTP — Existing Water Treatment Plants
- Surface Water Abstraction Works (Existing)
- Primary Bulk Pipelines (Existing)
- Secondary Bulk Pipelines (Existing)
- Tertiary Bulk Pipelines (Existing)
- Primary Reservoirs (Existing)
- Secondary Reservoirs (Existing)
- Tertiary Reservoirs (Existing)
- Pump Stations (Existing)
- 19Ml/d — Upgrade of WTW
- WTP — Water Treatment Plants (Future)
- Surface Water Abstraction Works (Future)
- Primary Bulk Pipelines (Future)
- Secondary Bulk Pipelines (Future)
- Tertiary Bulk Pipelines (Future)
- Primary Command Reservoirs (Future)
- Secondary Reservoirs (Future)
- Tertiary Reservoirs (Future)
- Pump Stations (Future)

Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dam — Dams & Dam Names
- Rivers
- Empangeni — Settlements & Settlement Names
- Eshowe — Major Towns

LOCALITY:



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PROJECT TITLE

City of uMhlathuze LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE:

Total Bulk Water Supply Interventions - Ntambanana
City of uMhlathuze Local Municipality

DATE COMPLETED:

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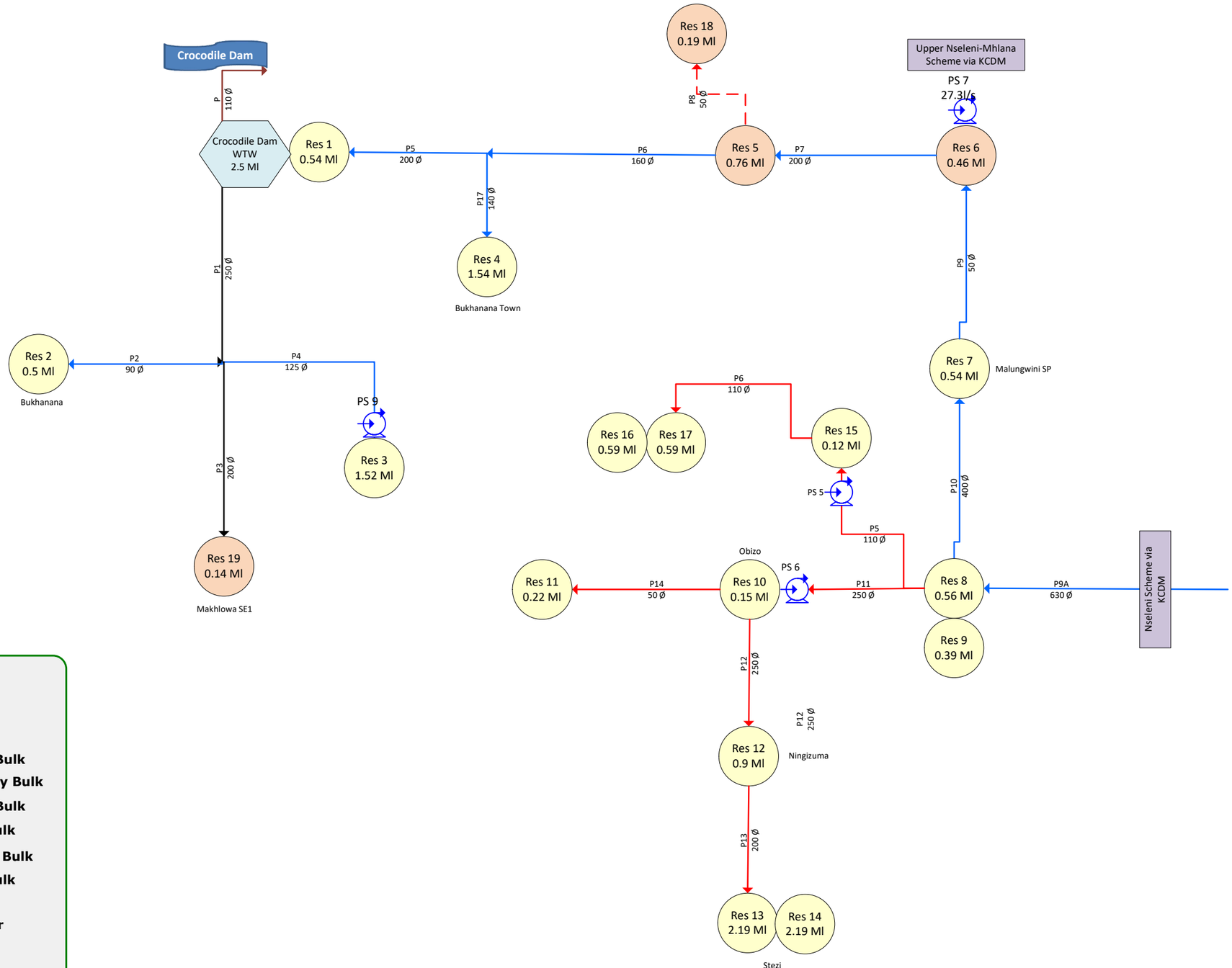
MAP NO.:

LM282 Figure 9.12

Figure 9-13
UTG018 WSIA: Ntambanana Scheme



LEGEND

- **Raw Water**
- **Clarified Water**
- **Treated Water**
  - **Existing Primary Bulk**
  - **Existing Secondary Bulk**
  - **Existing Tertiary Bulk**
  - **Future Primary Bulk**
  - **Future Secondary Bulk**
  - **Future Tertiary Bulk**
- Res 23 0.4Ml — **Existing Reservoir**
- Res 24 0.92Ml — **Future Reservoir**

All diameters in mm
All flows in Ml/day

9.6.2.2 Storage

The storage capacities of the existing one (1) primary reservoir of 0.5Mℓ should be increased to 0.54Mℓ. The existing six (6) secondary reservoirs should be increased from 1.37Mℓ to 5.05Mℓ and the eight (8) tertiary reservoirs with a total capacity of 0.77Mℓ should be increased to 6.95Mℓ. Future storage capacity to be added is two (2) secondary reservoirs of 1.16Mℓ and two (2) tertiary reservoirs of 0.33Mℓ to augment the storage to meet the demand of 2050.

9.6.2.3 Proposed interventions

- ✓ The existing primary bulk of 15.15km should be upgraded to range between ø 200mm and ø 250mm;
- ✓ The existing secondary bulk mains of 37.48km should be upgraded to range between ø 50mm and ø 400mm;
- ✓ The existing tertiary bulk mains of 20.46km should be upgraded to range between ø 50mm and ø 250mm;
- ✓ The existing tertiary bulk should be extended by 1.67km with ø 50mm tertiary bulk pipe;
- ✓ The existing primary storage reservoir should be increased from 0.5 Mℓ to 0.54 Mℓ, the six (6) secondary reservoirs should be increased from 1.37Mℓ to 5.05Mℓ and the eight (8) tertiary reservoirs from 0.77Mℓ to 6.95Mℓ; and
- ✓ Two (2) additional tertiary storage reservoirs with a storage capacity of 0.33Mℓ should augment the existing storage capacity.

Design details of all the infrastructure components are provided within Annexure B.

9.6.3 Financial Requirements

The bulk cost requirement for UTG018: Ntambanana WSIA is tabled within Table 9-13.

Table 9-13: UTG018 Ntambanana Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R20 997 500	R2 099 750	R23 097 250
Secondary	R73 260 000	R7 326 000	R80 586 000
Tertiary	R55 533 000	R5 553 300	R61 086 300
Total	**R149 790 500**	**R14 979 050**	**R164 769 550**

The total bulk cost requirement for the Ntambanana Scheme is R 164.77 million (excl VAT). The scheme development cost per household is approximately R 15 019.

10. CONCLUSIONS

10.1 Total Water Demand per Supply Area

The total water demand per WSIA is detailed within Table 10-1 below.

Table 10-1: Total Water Demand 2050 per WSIA

Water Supply Scheme / WSIA		Population 2020	Water Requirements (Mℓ/day)						
			2020	2025	2030	2035	2040	2045	2050
UTG001	Empangeni Scheme	40 781	16.50	16.96	17.42	9.14	21.75	22.43	23.13
UTG003	Southern Scheme	171 294	42.68	43.92	45.19	17.96	48.25	49.90	51.64
UTG012	Western Scheme	60 407	15.54	15.97	16.42	29.73	20.09	20.76	21.47
UTG015	Northern Scheme	65 144	27.32	28.07	28.83	16.94	44.43	45.81	47.25
UTG017	Nseleni Scheme	42 284	8.36	8.60	8.85	46.68	9.45	9.78	10.12
UTG018	Ntambanana Scheme	34 299	5.99	6.18	6.38	6.61	6.85	7.11	7.38
Total		**414 209**	**116.38**	**119.71**	**123.08**	**127.07**	**150.82**	**155.80**	**161.00**

10.2 Total Water Resources Required vs Proposed Water Supply Interventions (WSIs)

The total volume of water required is compared to the existing proposed water supply interventions are tabled within Table 10-2 below:

Table 10-2: Water Resources Required vs proposed WSI

WSIA	WSIA Name	Population (2050)	2050 Demand (Ml/day)	2050 Demand (Mm^3/a)	Existing Resources (Mm3/a)	Proposed Additional under UAP Phase 3 (Mm^3/a)	Total (Mm3/a)	Balance (Mm3/a)
UTG001	Empangeni Scheme	55 641	219.13	79.98	87.6	0	87.6	7.62
UTG003	Southern Scheme	202 724	62.14	22.68	23.36	0	23.36	0.68
UTG012	Western Scheme	84 342	21.47015892	7.84	106.9	4.38	111.28	111.28
UTG015	Northern Scheme	106 698	179.9451863	65.68	40.15	0	40.15	-25.53
UTG017	Nseleni Scheme	50 042	10.12494265	3.70	4.82	0	4.82	1.12
UTG018	Ntambanana Scheme *	40 592	7.383969784	2.70	1.46	0.548	2.008	-0.69
TOTAL		**540 039**	**161**	**59**	**231**			

*** The balance from the Empangeni Scheme and the western Scheme could be used to augment the Northern Scheme**

**** The balance from the Nseleni Scheme is taken to augment the shortfall but still leaves a deficit of 0,69 Mm3/annum. This could be augmented to increase the supply from the Nzesi WTP or from the Luwamba scheme supplying the Crocodile WTP.**

From the table above, it is noted all the schemes will have adequate raw water resources to meet the 2050 demand requirements. The investigation to augment the water shortage within Ntambanana and the Northern Scheme could be addressed by among other to increase the supply from the Nzesi WTP.

10.3 Summary of Total Bulk Water Infrastructure Requirements per WSIA

A summary of the total bulk water infrastructure requirements per proposed WSIA is provided within the tables and pages hereafter.

10.3.1 UTG001 Empangeni Scheme

Table 10-3: WSIA Summary for the UTG001: Empangeni WSIA

Empangeni Water Scheme						
Item	Description					
1	Infrastructure				**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	Existing	WTW	Nsezi WTW Raw	Primary Bulk	36	36
			Nsezi WTW potable	Primary Bulk	204	204
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	110 ømm -800 ømm	14.2km
				Secondary Bulk	75 ømm -600 ømm	26.12km
				Tertiary Bulk	-	-
		Reservoirs	Command Reservoir	Primary Bulk	6	1 000- 2 000Kl
			Command Reservoir	Secondary Bulk	-	
			Supply Reservoirs	Tertiary Bulk	9	275 - 18 540 Kl
		Pump stations		Primary Bulk		
1.2	Future	Bulk Pipelines		Primary Bulk	-	
				Secondary Bulk	63 ømm - 900 ømm	48.67 km
				Tertiary Bulk	50 ømm - 63ømm	7.14 km
		WTW		Primary Bulk	-	-
				Secondary Bulk	-	-
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	-	
			Supply Reservoirs	Tertiary Bulk	12	90 - 5 300 Kl
		Pump stations	PS at Nsezi WTW to CR Res 14	Primary Bulk	0.43926 M^3/s	514 kW

10.3.2 UTG003 Southern Scheme

Table 10-4: WSIA Summary for the UtG003: Southern WSIA

Southern Scheme						
Item	Description					
1	Infrastructure				**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	Existing	WTW	Esikhaleni WTW	Primary Bulk	36	65
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	813 ømm -900 ømm	22.6 km
				Secondary Bulk	160 ømm - 813 ømm	70.75 km
				Tertiary Bulk	90ø mm - 400ømm	9.76 km
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	6	2 000Kl - 2 800 Kl
			Supply Reservoirs	Tertiary Bulk	3	1 700 - 4 540Kl
		Pump stations		Primary Bulk		
1.2	Future	Bulk Pipelines		Primary Bulk	-	-
				Secondary Bulk	160 ømm - 355 ømm	22.14 km
				Tertiary Bulk		
		WTW		Primary Bulk	-	-
				Secondary Bulk	-	-
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	5	1 600 -69 540Kl
			Supply Reservoirs	Tertiary Bulk	2	1 880 - 2240 Kl
		Pump stations		Primary Bulk	2	7- 1 751 kW

10.3.3 UTG012 Western Scheme

Table 10-5: WSIA Summary for the UTG012: Western WSIA

Western Scheme						
1	Infrastructure				**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	Existing	WTW	Ngwelezane WTW	Primary Bulk	8	20
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	660 ømm	4.26 km
				Secondary Bulk	160 ømm - 355 ømm	23.85 km
				Tertiary Bulk	63ø mm -355ømm	10.39 km
		Reservoirs	Command Reservoir	Primary Bulk	4	1 169 - 3 240 Kl
			Command Reservoir	Secondary Bulk	-	-
			Supply Reservoirs	Tertiary Bulk	6	820 - 2 520 Kl
		Pump stations	PS at Ngwelezane WTW to CR	Primary Bulk	0,346296 M^3/s	381 kW
1.2	Future	Bulk Pipelines		Primary Bulk	-	
				Secondary Bulk	50ømm - 160 ømm	5.18 km
				Tertiary Bulk	75ø mm -200ømm	7.08 km
		WTW		Primary Bulk	-	-
				Secondary Bulk	-	-
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	-	-
			Supply Reservoirs	Tertiary Bulk	13	380 - 5 300 Kl
		Pump stations		Primary Bulk		

10.3.4 UTG015 Northern Scheme

Table 10-6: WSIA Summary for the UTG001: Northern WSIA

Northern Scheme						
Item	Description					
1	Infrastructure				**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	Existing	WTW	Mzingazi WTW	Primary Bulk	65	65
			Nzesi WTP	Primary Bulk	204	204
		Bulk Pipelines	uPVC. Steel. HDPE. AC	Primary Bulk	560 ømm -1 200 ømm	28.49 km
				Secondary Bulk	400 ømm -762 ømm	36.04km
				Tertiary Bulk	525 ømm	1.26km
		Reservoirs	Command Reservoir	Primary Bulk	4	10 230 - 47 500kl
			Command Reservoir	Secondary Bulk	-	-
			Supply Reservoirs	Tertiary Bulk	1	327 Kl
		Pump stations		Primary Bulk	5	-
1.2	Future	Bulk Pipelines		Primary Bulk	1 1060 ømm	3.65km
				Secondary Bulk	400 ømm - 762 ømm	24 km
				Tertiary Bulk	525 ømm	1.13 km
		WTW		Primary Bulk	-	-
				Secondary Bulk	-	-
		Reservoirs	Command Reservoir	Primary Bulk	2	1 000- 47 000 Kl
			Command Reservoir	Secondary Bulk	8	1 680 - 37 840 Kl
			Supply Reservoirs	Tertiary Bulk	1	1140 Kl
		Pump stations		Primary Bulk		

10.3.5 UTG017 Nseleni Scheme

Table 10-7: WSIA Summary for the UTG017: Nseleni WSIA

Nseleni Scheme						
Item	Description					
1	Infrastructure				**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	Existing	WTW	Nsezi WTW	Primary Bulk	25	25
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	762 ømm	2.1km
				Secondary Bulk	630 ømm -660 ømm	3.1km
				Tertiary Bulk	90 ømm - 630 ømm	10.24 km
		Reservoirs	Command Reservoir	Primary Bulk	2	7 940 - 10 000 Kl
			Command Reservoir	Secondary Bulk	-	-
			Supply Reservoirs	Tertiary Bulk	4	240 - 820 Kl
		Pump stations		Primary Bulk		
1.2	Future	Bulk Pipelines		Primary Bulk	-	-
				Secondary Bulk	-	-
				Tertiary Bulk	90 ømm - 160 ømm	6.7 km
		WTW		Primary Bulk	-	-
				Secondary Bulk	-	-
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	-	-
			Supply Reservoirs	Tertiary Bulk	8	460 - 1 980 Kl
		Pump stations		Primary Bulk		

10.3.6 UTG018 Ntambanana Scheme

Table 10-8: WSIA Summary for the UTG018: Ntambanana WSIA

Ntambanana Water Scheme						
Item	Description					
1	Infrastructure				**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	Existing	WTW	Crocodile Dam WTW	Primary Bulk	1	2.5
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	200 ømm -250 ømm	15.15 km
				Secondary Bulk	50 ømm - 400 ømm	37.48 km
				Tertiary Bulk	50ø mm -250ømm	20.46 km
		Reservoirs	Command Reservoir	Primary Bulk	1	540 Kl
			Command Reservoir	Secondary Bulk	6	390 - 1540Kl
			Supply Reservoirs	Tertiary Bulk	8	150 - 2900Kl
		Pump stations		Primary Bulk		
1.2	Future	Bulk Pipelines		Primary Bulk	-	-
				Secondary Bulk	-	-
				Tertiary Bulk	50 ømm	1.67 km
		WTW		Primary Bulk	-	-
				Secondary Bulk	-	-
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	2	460 - 700Kl
			Supply Reservoirs	Tertiary Bulk	2	140 - 190 Kl
		Pump stations		Primary Bulk		

10.4 Financial Requirements

The financial requirements for the provision of bulk infrastructure per WSIA based on the demand model intervention by 2050 is summarised in the table below.

Table 10-9: Financial Requirement per WSIA

WSIA	WSIA Name	Total Cost Requirement				
		Primary	Secondary	Tertiary	10% Contingencies	Total Cost (Excl VAT)
UTG001	Empangeni Scheme	R209 116 000	R269 127 000	R138 666 000	R61 690 900	R678 599 900
UTG003	Southern Scheme	R536 386 000	R401 193 898	R56 837 000	R99 441 690	R1 093 858 588
UTG012	Western Scheme	R138 805 000	R47 131 000	R146 092 000	R33 202 800	R365 230 800
UTG015	Northern Scheme	R577 569 310	R802 134 206	R73 427 000	R145 313 052	R1 598 443 568
UTG017	Nseleni Scheme	R48 063 000	R30 526 000	R71 638 000	R15 022 700	R165 249 700
UTG018	Ntambanana Scheme	R20 997 500	R73 260 000	R55 533 000	R14 979 050	R164 769 550
City Of uMhlatuze		**R1 530 936 810**	**R1 623 372 104**	**R542 193 000**	**R369 650 191**	**R4 066 152 106**

A total estimate of approximately R 4.066 billion is required to address the total bulk water supply requirement by 2050.

10.5 Funding Options

The CoU relies mainly on grant funding programmes to fund their water supply projects. These funding programmes are mainly WSOG and IUDG. Based on all the current funding streams available to the WSA over the MTEF period. it will take a minimum of 24 years for the WSA to address their water supply requirements. Another funding option that the CoU could consider is loan funding through the Development Bank of Southern Africa (DBSA) and the establishment of Public Private Partnerships (PPPs). Special submissions to National Treasury could also be considered to create an awareness of the DM's planning and implementation readiness.

10.6 Implementation Programme

The implementation programme will depend on the availability of funds from National Treasury as well as the capacity of the Municipality to implement projects. All six (6)) area interventions would be an implementation priority for the WSA. It is proposed to consider the following three (3) priorities detailed within Table 10-10. It is also proposed to follow a phased approach for implementation for e.g. initiate only the upgrade to the WTP at first and then when funding permits, can the bulk conveyance and storage be extended, upgraded or constructed.

However, the order would most likely be determined by the availability of funds or intervention programmes and should be confirmed with the WSA.

Table 10-10: Proposed Implementation Order (Phased Approach)

Proposed Priorities (Phased Approach)	WSIA No and Name		Proposed Project Name	Proposed Estimated Project Value
1	UTG001	Empangeni Scheme	Upgrade the primary bulk pipeline (P9 and P10) from the Nzesi WTP to the augment the supply to the Empangeni Pearce Crescent reservoir (	R154 709 000
	UTG015	Northern Scheme	Increase the bulk distribution (P2A, P3A, P4 and P5) and pumping capacity at the Nzesi WTP to augment the supply to the Nseleni and Empangeni Schemes	R303 795 000
2	UTG017	Nseleni Scheme	Augment the storage capacity to maintain 48-hour storage capacity within the Nseleni Scheme and upgrade the bulk supply accordingly	R165 249 700
3	UTG018	Ntambanana Scheme	Augment the storage capacity to maintain 48-hour storage capacity within the Ntambanana Scheme and upgrade the bulk supply accordingly	R164 769 550

11. RECOMMENDATIONS

11.1 SELECTION OF SOLUTIONS

The six (6) proposed water supply intervention areas (WSIAs) are the appropriate solutions for bulk water supply development within CoU and are as follows:

- ✓ UTG001 WSIA: Empangeni;
- ✓ UTG003 WSIA: Southern;
- ✓ UTG012 WSIA: Western;
- ✓ UTG015 WSIA: Northern;
- ✓ UTG 017 WSIA: Nseleni; and
- ✓ UTG018 WSIA: Ntambanana.

The following three WSIs are prioritised for consideration:

- ✓ Priority 1 Phased implementation of the Northern and Empangeni Schemes
    - o UTG001: Empangeni Scheme - Upgrade the primary bulk pipeline (P9 and P10) from the Nzesi WTP to the augment the supply to the Empangeni Pearce Crescent reservoir; and
    - o UTG015: Northern Scheme - Increase the bulk distribution (P2A, P3A, P4 and P5) and pumping capacity at the Nzesi WTP to augment the supply to the Nseleni and Empangeni Schemes

- ✓ Priority 2 UTG017: Nseleni Scheme - Augment the storage capacity to maintain 48-hour storage capacity within the Nseleni Scheme and upgrade the bulk supply accordingly.

- ✓ Priority 3 UTG018: Ntambanana Scheme - Augment the storage capacity to maintain 48-hour storage capacity within the Ntambanana Scheme and upgrade the bulk supply accordingly.

11.2 PERTINENT LEGISLATION

Various Acts of Parliament make provision for existing or planned institutional structures for management of water resources and water and sanitation services. These are:

- ✓ Current Acts of Parliament: National Water. Water Services. Municipal Structures. Municipal Systems. Division of Revenue Acts; and
- ✓ Existing and proposed policy documents such as The White Paper on Water Services. the Local Government White Paper. and the White Paper on Municipal Service Partnerships.

These Acts deal with the management of water resources and the provision of water services. Provision for the bodies listed below is made in these acts:

- ✓ The Catchment Management Agencies (CMA's) which will be established throughout South Africa over the next three years;
- ✓ Water User Associations comprising co-operative associations of individual water users at a restricted local level;
- ✓ National Government;
- ✓ Water Service Authorities comprising District Municipalities or Local Municipalities;
- ✓ Water Boards;
- ✓ Water Service Providers;
- ✓ Provincial Government; and
- ✓ Advisory Committees.

11.2.1 Municipal Structures Act

The Municipal Structures Act (117 of 1997). which was subsequently amended by the Municipal Structure Amendment Act (33 of 2000). addresses the basis for establishing municipalities (Category A.B & C) and stipulates that Category A and C (Metropolitan and District) municipalities are WSA's and the Category B (local) municipalities can only be WSA's if authorised by the Minister of DPLG.

11.2.2 Municipal Systems Act

The Municipal Systems Act (32 of 2000) legislates internal systems and addresses the differences between the authority and the provider functions as well as alternative mechanisms for providing municipal services.

11.2.3 Water Services Act

The Water Services Act (Act 108 of 1997) states that each WSA must for its area of jurisdiction. prepare a Water Services Development Plan (WSDP). Whilst the WSDP is a legal requirement. the real value in preparing the WSDP lies in the need to plan for Water Services (Water Supply and Sanitation Provision) whereby key targets are set over the next five years. At least six WSDP key focus areas need to be addressed during the planning process. These are:

- ✓ Basic Service: Water supply. sanitation. free basic water supply and free basic sanitation;
- ✓ Higher Levels of Service: Water supply. sanitation. associated needs. and economic development;
- ✓ Water Resources: Appropriate choice. demand and water conservation management. water resource protection and integrated water resource management;
- ✓ Environmental Issues: Health. natural and social environment;
- ✓ Effective Management: planning. organisational or institutional aspects. management. financial and regulatory aspects; and
- ✓ Transfers: Infrastructure related transfers.

Water services development planning must also be done as part of the IDP process (section 12 (1) (a)) and the WSDP must be incorporated into the IDP (section 15 (5)).

Water Services Authorities must report on the implementation of its WSDP every year i.e. annual performance reporting (section 18).

Water Services Authorities must also comply with applicable regulations including Regulation No. R. 509. Government Gazette No. 22355. 8 June 2001 which requires the inclusion of a Water Services Audit as part of the annual performance report.

The Department must monitor the performance of every water services authority to ensure its compliance with every applicable water services development plan… section 62 (1) (c).

The Minister may- issue guidelines to water services institutions on performing their functions in terms of this Act section 73 (1) (h).

The Minister must ensure that there is a national information system on water services….to monitor the performance of water services institutions. section 68 (b) (i).

The Minister may require any …water services institution…to furnish information to be included in the national information system. section 68 (a).

Based on the above. the preparation of a WSDP is a legal requirement

ANNEXURE A – REFERENCE

Reference List

DWS (2011)	Support to the Implementation and Maintenance of Reconciliation Strategies for Towns in the Southern Region. 2016
DWS (2018)	Reference Framework Geo database. March 2018
Umgeni Water	UAP Phase II: Towards the Development of a Regional Bulk Water Requirements for the City of uMhlathuze District Municipality. June 2015
Statistics SA	Census 2011; Community Survey 2016
WSDP	2018/2019 City of uMhlathuze WSDP
IDP	City of uMhlathuze Municipality 2019/2020 Financial Year. June 2019
Water Requirements Report	Water Reconciliation Strategy for Richards Bay & Surrounding Towns. 2014
BWMP	CoU Consolidated and Updated Bulk Water Master Plan. June 2019.
Umgeni Water	Umgeni Water Infrastructure Master Plan, 2020
Aecom	Overall Master Plan of Water Supply to King Cetshwayo District Municipality: 2015 Revision, Date: March 2017
KCDM	KCDM DGDP Draft Version 08, June 2018

ANNEXURE B – DETAILED PROPOSED WSI INFRASTRUCTURE COMPONENT DETAIL

UTG001 WSIA: Empangeni

The total bulk cost requirement for the Empangeni Scheme is R 678 599 900 (excl VAT). The scheme development cost per household is approximately R 45 125. Due to the size of the project, it will take close to 24 years to complete

Empangeni Water Scheme						
Item	Description					
1	Population	**Scheme Name**	**Sub scheme No**	**Population 2020**	**Population 2050**	
		Empangeni Water Scheme	UTG001	38 405	55 641	
		Total		38 405	55 641	
2	Demand	**Scheme Name**	**Sub scheme No**	**Demand 2020 (Ml/day)**	**Demand 2050 (Ml/day)**	
		Empangeni Water Scheme	UTG001	100.60	219.13	
		Total		100.60	219.13	
3	Water Resource		HFY (Mm^3/a)	HFY (Ml/d)	Comments	
		Dams	Nsezi WTW via the Mandlazini reservoirs located in the Northern Scheme	204		
		River	Supplemented by transfers from the Mhlathuze River			
4	Infrastructure			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
4.1	Existing	WTW	Nsezi WTW Raw	Primary Bulk	36	36
			Nsezi WTW potable	Primary Bulk	204	204
		Bulk Pipelines	uPVC. Steel. HDPE. AC	Primary Bulk	110 ømm -800 ømm	14.2km
				Secondary Bulk	75 ømm -600 ømm	26.12km
				Tertiary Bulk	-	-
		Reservoirs	CR Res 10	Primary Bulk	10 000	10 000
			CR Res 11b	Primary Bulk	19 000	19 000
			CR Res 14	Primary Bulk	9 000	9 000
			CR Res 16	Primary Bulk	1 000	1 000
			CR Res 7	Primary Bulk	20 000	20 000
			CR Res 9	Primary Bulk	9 000	9 000
				Secondary Bulk		
			Res 11	Tertiary Bulk	4 000	4 000
			Res 12	Tertiary Bulk	0	18 540
			Res 13	Tertiary Bulk	2 250	11 780
			Res 15	Tertiary Bulk	0	2 760
			Res 17	Tertiary Bulk	275	275
			Res 18	Tertiary Bulk	0	0
			Res 20	Tertiary Bulk	1 100	1 100
			Res 21	Tertiary Bulk	300	300

			Res 24	Tertiary Bulk	1 250	1 250
		Pump stations		Primary Bulk	-	
4.2	Future	Bulk Pipelines		Primary Bulk	-	
				Secondary Bulk	63 ømm - 900 ømm	48.67 km
				Tertiary Bulk	50 ømm - 63ømm	7.14 km
		WTW		Primary Bulk	-	
				Secondary Bulk	-	
		Reservoirs		Primary Bulk	-	
				Secondary Bulk	-	
			Res 1	Tertiary Bulk	0	480
			Res 19		25	190
			Res 2		0	90
			Res 22		5	160
			Res 23		80	160
			Res 25		0	5 300
			Res 26		0	2 030
			Res 3		0	90
			Res 4	Primary Bulk	0	2 030
			Res 5	Primary Bulk	0	180
			Res 8	Primary Bulk	20	580
			Res 6		0	240
		Pump stations	PS at Nsezi WTW to CR Res 14	Primary Bulk	0.43926 M^3/s	514 kW
5	Cost Requirement		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary	R 209 116 000	R20 911 600	R 230 027 600	
		Secondary	R 269 127 000	R26 912 700	R 296 039 700	
		Tertiary	R138 666 000	R13 866 600	R 152 532 600	
		Total	**R616 909 000**	**R61 690 900**	**R678 599 900**	

UTG003 WSIA: Southern

The total bulk cost requirement for the Southern Scheme is R 1.094 billion (excl VAT). The scheme development cost per household is approximately R 19 964. Due to the size of the project. it will take close to 24 years to complete

Southern Scheme						
Item	Description					
1	Population	**Scheme Name**	**Sub scheme No**	**Population 2020**	**Population 2050**	
		Southern Scheme	UTG003	161 311	202 724	
		Total		161 311	202 724	
2	Demand	**Scheme Name**	**Sub scheme No**	**Demand 2020 (Ml/day)**	**Demand 2050 (Ml/day)**	
		Southern Scheme	UTG003	50.48	62.14	
		Total		50.48	62.14	
3	Water Resource		HFY (Mm3/a)	HFY (Ml/d)	Comments	
		Dams	Lake Cubhu	30		
		River	Mhlathuze River	34	Iskor Mining WSS	
4	Infrastructure			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
4.1	Existing	WTW	Esikhaleni WTW	Primary Bulk	36	65
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	813 ømm -900 ømm	22.6 km
				Secondary Bulk	160 ømm - 813 ømm	70.75 km
				Tertiary Bulk	90ø mm - 400ømm	9.76 km
		Reservoirs		Primary Bulk	-	
			Res 4	Secondary Bulk	620	2 800
			Res 9	Secondary Bulk	20 000	20 000
			Res 11	Secondary Bulk	20 000	20 000
			Res 12	Secondary Bulk	20 000	20 000
			Res 13	Secondary Bulk	20 000	10 760
			Res 15	Secondary Bulk	334	390
			Res 6	Tertiary Bulk	4 340	4 540
			Res 5	Tertiary Bulk	1 135	1 180
			Res 14	Tertiary Bulk	1 100	1 700
		Pump stations		Primary Bulk		
4.2	Future	Bulk Pipelines		Primary Bulk	-	-
				Secondary Bulk	160 ømm - 355 ømm	22.14 km
				Tertiary Bulk		
		WTW		Primary Bulk	-	
				Secondary Bulk	-	
		Reservoirs		Primary Bulk		

			Res 1	Secondary Bulk	0	1 600
			Res 2	Secondary Bulk	0	2 100
			Res 8	Secondary Bulk	0	69 540
			Res 16	Secondary Bulk	0	2 800
			Res 17	Secondary Bulk	5	5 580
			Res 3	Tertiary Bulk	2 240	2 240
			Res 7	Tertiary Bulk	1 880	1 880
		Pump stations	PS from Mhlatuze River to Esikhaleni WTW	Primary Bulk	0.648148 M^3/s	7 kW
			PS at Esikhaleni WTW to Res 11,12 & 13	Primary Bulk	1.150741 M3/s	1 571 kW
5	Cost Requirement		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary	R 536 386 000	R53 638 600	R 590 024 600	
		Secondary	R 401 193 898	R40 119 390	R 441 313 288	
		Tertiary	R 56 837 000	R5 683 700	R 62 520 700	
		Total	**R 994 416 898**	**R99 441 690**	**R1 093 858 588**	

UTG012 WSIA: Western

The total bulk cost requirement for the Southern Scheme is R 365.2 million (excl VAT). The scheme development cost per household is approximately R 16 022.

Western Scheme						
Item	Description					
1	Population	**Scheme Name**	**Sub scheme No**	**Population 2020**	**Population 2050**	
		Western Scheme	UTG012	56 886	84 342	
		Total		56 886	84 342	
2	Demand	**Scheme Name**	**Sub scheme No**	**Demand 2020 (Ml/day)**	**Demand 2050 (Ml/day)**	
		Western Scheme	UTG012	15.54	21.47	
		Total		15.54	21.47	
3	Water Resource		HFY (Mm3/a)	HFY (Ml/d)	Comments	
		Dams	Lake Phobane (Goedertrouw Dam)	293		
		River	Run of river abstraction works upstream of the Mhlathuze weir			
4	Infrastructure			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
4.1	Existing	WTW	Ngwelezane WTW	Primary Bulk	8	20
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	660 ømm	4.26 km
				Secondary Bulk	160 ømm - 355 ømm	23.85 km
				Tertiary Bulk	63ø mm - 355ømm	10.39 km
		Reservoirs	Command Reservoir (Res20)	Primary Bulk	6 500	11 690
			Res 21	Primary Bulk	3 500	3 240
			Res 22	Primary Bulk	1 880	3 240
			Res 23	Primary Bulk	1 600	3 240
				Secondary Bulk	-	
			Res 10	Tertiary Bulk	50	2 520
			Res 13	Tertiary Bulk	80	2 280
			Res 16	Tertiary Bulk	75	1 180
			Res 17	Tertiary Bulk	58	820
			Res 18	Tertiary Bulk	50	1 060
			Res 19	Tertiary Bulk	58	600
		Pump stations	PS at Ngwelezane WTW to CR	Primary Bulk	0.346296 M^3/s	381 kW
4.2	Future	Bulk Pipelines		Primary Bulk	-	
				Secondary Bulk	50ømm - 160 ømm	5.18 km

				Tertiary Bulk	75ø mm - 200ømm	7.08 km
		WTW		Primary Bulk	-	
				Secondary Bulk	-	
		Reservoirs		Primary Bulk	-	
				Secondary Bulk	-	
			Res 1	Tertiary Bulk	0	180
			Res 2	Tertiary Bulk	0	580
			Res 3	Tertiary Bulk	0	1 440
			Res 4	Tertiary Bulk	0	420
			Res 5	Tertiary Bulk	0	380
			Res 6	Tertiary Bulk	0	620
			Res 7	Tertiary Bulk	0	680
			Res 8	Tertiary Bulk	0	3 980
			Res 9	Tertiary Bulk	0	1 580
			Res 11	Tertiary Bulk	0	2 300
			Res 12	Tertiary Bulk	0	5 300
			Res 14	Tertiary Bulk	0	1 220
			Res 15	Tertiary Bulk	0	560
		Pump stations		Primary Bulk		
5	Cost Requirement		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary	R 138 805 000	R13 880 500	R152 685 500	
		Secondary	R 47 131 000	R4 713 100	R 51 844 100	
		Tertiary	R 146 092 000	R14 609 200	R 160 701 200	
		Total	**R332 028 000**	**R33 202 800**	**R365 230 800**	

UTG015 WSIA: Northern

The total bulk cost requirement for the Northern Scheme is R 1.598 billion (excl VAT). The scheme development cost per household is approximately R 55 429. Due to the size of the project. it will take close to 24 years to complete.

Northern Scheme						
Item	Description					
1	Population	**Scheme Name**	**Sub scheme No**	**Population 2020**	**Population 2050**	
		Northern Scheme	UTG015	61 348	106 698	
		Total		61 348	106 698	
2	Demand	**Scheme Name**	**Sub scheme No**	**Demand 2020 (Ml/day)**	**Demand 2050 (Ml/day)**	
		Northern Scheme	UTG015	103.62	179.95	
		Total		103.62	179.95	
3	Water Resource		HFY (Mm3/a)	HFY (Ml/d)	Comments	
		Lake Mzingazi	10,5	28,77		
		Augmentation from Nsezi WTP		25,7		
4	Infrastructure			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
4.1	Existing	WTW	Mzingazi WTW	Primary Bulk	65	65
			Nzesi WTP	Primary Bulk	204	204
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	560 ømm -1 200 ømm	28.49 km
				Secondary Bulk	400 ømm -762 ømm	36.04km
				Tertiary Bulk	525 ømm	1.26km
		Reservoirs	CR 1	Primary Bulk	47 500	47 500
			CR 2	Primary Bulk	47 500	47 500
			CR (Res 5)	Primary Bulk	5 000	47 000
			CR 3	Primary Bulk	10 230	10 230
				Secondary Bulk		
			Res 2	Tertiary Bulk	327	10 500
		Pump stations	PS AL1-Pump Station	Primary Bulk	-	-
			PS AL4-Pump Station	Primary Bulk	-	-
			PS AL7-Pump Station	Primary Bulk	-	-
			PS AR3-Pump Station	Primary Bulk	-	-
			PS BRACK2-Pump Station	Primary Bulk	-	-
4.2	Future	Bulk Pipelines		Primary Bulk	1 1060 ømm	3.65km
				Secondary Bulk	400 ømm - 762 ømm	24 km
				Tertiary Bulk	525 ømm	1.13 km
		WTW		Primary Bulk		

				Secondary Bulk	-	
		Reservoirs	Res 1	Primary Bulk	47 500	47 500
			CR (Res 8)	Primary Bulk	47 500	47 500
			Res 3	Secondary Bulk	48	1 000
			Res 4	Secondary Bulk	0	4 700
			Res 7	Secondary Bulk	0	62 500
			Res 9	Secondary Bulk	0	1 800
			Res 10	Secondary Bulk	0	16 440
			Res 11	Secondary Bulk	0	5 500
			Res 12	Secondary Bulk	0	1 680
			Res 13	Secondary Bulk	0	3 900
			Res 6	Tertiary Bulk	0	37 840
			Res 3	Tertiary Bulk	0	35 800
			Res 6	Tertiary Bulk	0	11 140
		Pump stations		Primary Bulk		
5	Cost Requirement		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary	R 577 569 310	R57 756 931	R 635 326 241	
		Secondary	R 802 134 206	R80 213 421	R 882 347 627	
		Tertiary	R 73 427 000	R7 342 700	R 80 769 700	
		Total	**R1 453 130 516**	**R145 313 052**	**R1 598 443 568**	

UTG 017 WSIA: Nseleni

The total bulk cost requirement for the Northern Scheme is R 165.25 million (excl VAT). The scheme development cost per household is approximately R 12 218.

Nseleni Scheme						
Item	Description					
1	Population	**Scheme Name**	**Sub scheme No**	**Population 2020**	**Population 2050**	
		Nseleni Scheme	UTG017	39 819	50 042	
		Total		39 819	50 042	
2	Demand	**Scheme Name**	**Sub scheme No**	**Demand 2020 (Ml/day)**	**Demand 2050 (Ml/day)**	
		Nseleni Scheme	UTG017	8.36	10.12	
		Total		8.36	10.12	
3	Water Resource		HFY (Mm3/a)	HFY (Ml/d)	Comments	
		Dams	Nsezi WTW via the Mandlazini reservoirs located in the Northern Scheme	13.2		
			Lake Mzingazi	61.4		
4	Infrastructure			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
4.1	Existing	WTW	Nsezi WTW	Primary Bulk	25	25
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	762 ømm	2.1km
				Secondary Bulk	630 ømm -660 ømm	3.1km
				Tertiary Bulk	90 ømm - 630 ømm	10.24 km
		Reservoirs	CR (Res 20)	Primary Bulk	10 000	10 000
			CR (Res 30)	Primary Bulk	2 700	7 940
				Secondary Bulk		
			Res 1	Tertiary Bulk	60	240
			Res 2	Tertiary Bulk	80	540
			Res 8	Tertiary Bulk	140	700
			Res 10	Tertiary Bulk	0	820
		Pump stations		Primary Bulk		
4.2	Future	Bulk Pipelines		Primary Bulk	-	-
				Secondary Bulk	-	-
				Tertiary Bulk	90 ømm - 160 ømm	6.7 km
		WTW		Primary Bulk		
				Secondary Bulk	-	
		Reservoirs		Primary Bulk		
				Secondary Bulk		
			Res 9	Tertiary Bulk	0	540
			Res 4	Tertiary Bulk	0	940
			Res 3	Tertiary Bulk	0	460
			Res 6	Tertiary Bulk	0	640

			Res 5	Tertiary Bulk	0	1 540
			Res 7	Tertiary Bulk	0	1 280
			Res 12	Tertiary Bulk	0	1 980
			Res 11	Tertiary Bulk	0	840
		Pump stations		Primary Bulk		
5	Cost Requirement		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary	R 48 063 000	R4 806 300	R 52 869 300	
		Secondary	R 30 526 000	R3 052 600	R 33 578 600	
		Tertiary	R 71 638 000	R7 163 800	R 78 801 800	
		Total	**R150 227 000**	**R15 022 700**	**R165 249 700**	

UTG018 WSIA: Ntambanana

The total bulk cost requirement for the Ntambanana scheme is R 164.77 million (excl VAT). The scheme development cost per household is approximately R 15 019.

Ntambanana Water Scheme						
Item	Description					
1	Population	**Scheme Name**	**Sub scheme No**	**Population 2020**	**Population 2050**	
		Ntambanana Water Scheme	UTG018	32 300	40 592	
		Total		32 300	40 592	
2	Demand	**Scheme Name**	**Sub scheme No**	**Demand 2020 (Ml/day)**	**Demand 2050 (Ml/day)**	
		Ntambanana Water Scheme	UTG018	5.99	7.38	
		Total		5.99	7.38	
3	Water Resource		HFY (Mm3/a)	HFY (Ml/d)	Comments	
		Dams	Crocodile Dam			
		River	Luwamba Raw Water Supply Scheme	3		
4	Infrastructure			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
4.1	Existing	WTW	Crocodile Dam WTW	Primary Bulk	1	2.5
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	200 ømm -250 ømm	15.15 km
				Secondary Bulk	50 ømm - 400 ømm	37.48 km
				Tertiary Bulk	50ø mm - 250ømm	20.46 km
		Reservoirs	Res 1	Primary Bulk	40	540
			Res 2	Secondary Bulk	0	500
			Res 3	Secondary Bulk	1 320	1 520
			Res 4	Secondary Bulk	1 540	1 540
			Res 7	Secondary Bulk	490	540
			Res 8	Secondary Bulk	0	560
			Res 9	Secondary Bulk	334	390
			Res 10	Tertiary Bulk	108	150
			Res 11	Tertiary Bulk	40	220
			Res 12	Tertiary Bulk	150	900
			Res 13	Tertiary Bulk	150	2 190
			Res 14	Tertiary Bulk	108	2 190
			Res 15	Tertiary Bulk	0	120
			Res 16	Tertiary Bulk	110	590
			Res 17	Tertiary Bulk	100	590
		Pump stations		Primary Bulk		

4.2	Future	Bulk Pipelines		Primary Bulk	-	-
				Secondary Bulk	-	-
				Tertiary Bulk	50 ømm	1.67 km
		WTW		Primary Bulk	-	
				Secondary Bulk	-	
		Reservoirs		Primary Bulk		
			Res 5	Secondary Bulk	600	700
			Res 6	Secondary Bulk	150	460
			Res 18	Tertiary Bulk	50	190
			Res 19	Tertiary Bulk	0	140
		Pump stations		Primary Bulk		
5	Cost Requirement		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary	R 20 997 500	R2 099 750	R 23 097 250	
		Secondary	R73 260 000	R7 326 000	R 80 586 000	
		Tertiary	R 55 533 000	R5 553 300	R 61 086 300	
		Total	**R149 790 500**	**R14 979 050**	**R164 769 550**	