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

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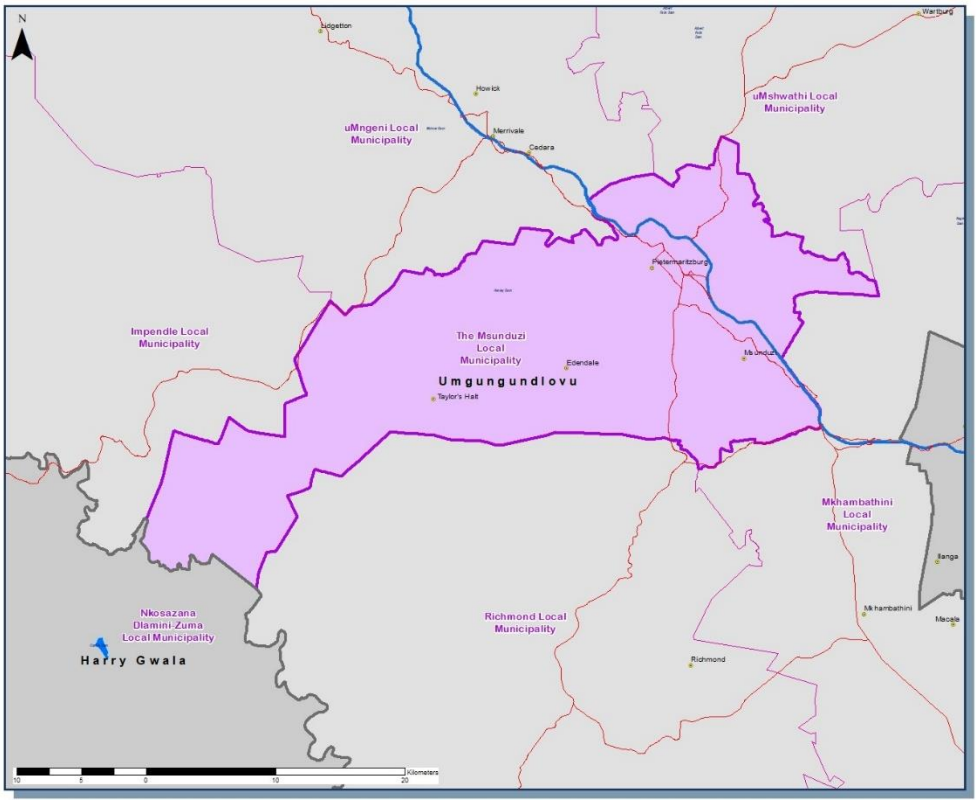

Reconnaissance Report

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 water supply systems.

B. Demographics

The Msunduzi Local Municipality (TMLM) is one of seven (7) Local Municipalities within the Umgungundlovu District Municipality (UMDM) and covers an area of approximately 634 km². The Municipality is bordered to the north-east by uMshwathi LM, north-west by uMngeni LM, west by Impendle LM, south by Richmond LM and east by Mkhambathini LM.

The Msunduzi Local Municipality is its own Water Service Authority and is covered in this UAP Phase III study and is excluded from the UMDM UAP Phase III study.

The Msunduzi Local Municipality recorded a total population of 708 496 people within 191 054 households, resulting in an average of 3.71 persons per household.

Table B-1: TMLM Population and Households per Local Municipalities

LM Name	No of Households	No of Population	People per Household
The Msunduzi Local Municipality	191 054	708 496	3.71

Source: DWS Reference Framework, April 2019

Population growth was determined until 2050 that resulted in the projected number of people residing within Msunduzi will be approximately 900 000 people. The projected population per Municipality is tabled within **Table B-2** below.

Table B-2: Projected Population until 2050

	DWS RF Pop 2019	Population						
		2020	2025	2030	2035	2040	2045	2050
The Msunduzi LM	708 496	613 768	651 269	696 017	742 073	791 177	843 529	899 347

C. Service Levels

C.1 Water

The main source for 54% of households within TMLM is piped (tap) water inside the yard of households and 40% of households is piped (tap) water inside the dwelling/house. The TMLM exhibits a water backlog of approximately 37%.

C.2 Sanitation

Approximately 48% of households within TMLM use a flush toilet connected to a public sewerage system. The current sanitation backlog within TMLM is at approximately 12%

D. Water Resources

The TMLM area is served via the Upper Mgeni Water Supply System via the DV. Harris WTP and Midmar WTP. The current demand off the Upper Mgeni System is approximately 304.56Mℓ/day (14% for uMgungundlovu DM, **58% for Msunduzi**, and 28% for eThekwini). With the completion of the second phase of the Mooi Mngeni Transfer Scheme, the 99% assured yield of the Mgeni System, at Midmar Dam, has increased from 322.5 Mℓ/day to 476.2 Mℓ/day.

Raw water is pumped from Mearns Weir, and alternatively from Spring Grove Dam, into the upper reaches of the Mgeni River to supplement the raw-water supply into Midmar Dam. The Midmar WTP then supplies the DV Harris WTP via gravity.

The Midmar WTP had an initial design capacity of 250 Mℓ/day and has since been upgraded to 395 Mℓ/day. The DV Harris WTP has a design capacity of 110 Mℓ/day, with a current utilisation of 89 Mℓ/day. (UW IMP, 2019)

The system distributes potable water from the Midmar and DV Harris Water Treatment Plant to the various municipal areas and sub-supply areas.

E. Existing Water Supply Schemes and Water Requirements

Msunduzi is supplied from the Upper Mgeni System and is supplied via the following existing schemes/systems:

- ✓ Upper Mgeni System
    - Midmar WTP to Umlaas Reservoir Sub-System
        - '251 Pipeline: Midmar WTP to DV. Harris Off-Take;
        - Clarendon Reservoir;
        - '61 Pipeline: DV. Harris to World's View Reservoir;
        - '61 Pipeline: World's View Reservoir to ED2;
        - '61 Pipeline: ED2 to Umlaas Road Reservoir;
        - ED2 to ED4 to Umlaas Road;
        - Ashburton Water Supply;
        - Thornville/Hopewell Water Supply;
        - '53 Pipeline: DV. Harris WTP to Umlaas Road Reservoir; and
        - DV Harris WTP to Belfort and Haythorns.

The projected water requirements as per the demand model generated for TMLM up to 2050 amounts to **298.25 Mℓ/d**.

LM	2050 Population	2020 (Mℓ/d)	2025 (Mℓ/d)	2030 (Mℓ/d)	2035 (Mℓ/d)	2040 (Mℓ/d)	2045 (Mℓ/d)	2050 (Mℓ/d)
Msunduzi	1 011 813	200.18	212.84	228.01	243.71	260.58	278.72	298.25

Census 2011 Base Figures

F. Existing Sanitation Supply Schemes

There are two (2) sanitation schemes and wastewater treatment plants currently in operation within TMLM. The Darvill WWTP is owned by Umgeni Water whereas the Lynnfield Park WWTP is operated by Umgeni Water.

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 (3) years within TMLM amount to approximately R761 759 000.

H. Bulk Water Supply Interventions Considered

This study aims to ensure that the TMLM 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 (WSIA's) 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 WSIA's, number of applicable households, population and their water requirements are illustrated within **Table H-1.**

Table H-1 Conceptual Scheme Areas, Households and Water Requirements

WSIA No	WSIA Name	Population 2020	Population 2050	Water Demand 2020 (Mℓ/day)	Water Demand 2050 (Mℓ/day)
TM001	Vulindlela Scheme	136 393	199 854	23.50	35.20
TM002	Ncwadi Scheme	18 853	27 598	3.60	5.32
TM003	Greater Edendale Scheme	96 977	142 099	23.56	35.40
TM004	Pietermaritzburg Scheme	298 225	436 987	108.10	160.50
TMLM		**550 448**	**806 538**	**158.76**	**236.42**

The Pietermaritzburg WSIA has the highest water demand of approximately 68%. The total volume of water required is compared to the existing proposed water supply interventions and tabled within **Table H2** below:

Table H2: Water Resources Required vs proposed WSI

WSIA	WSIA Name	Population (2050)	2050 Demand (Mℓ/day)	2050 Demand (Mm^3/a)	Existing Resources (Mm^3/a)	Proposed Additional under UAP Phase 3 (Mm^3/a)	Total (Mm^3/a)	Balance (Mm^3/a)
TM001	Vulindlela Scheme	199 854	35.20	12.85	0.00	144.18	144.18	131.33
TM002	Ncwadi Scheme	27 598	5.32	1.94	0.00	0.00	0.00	-1.94
TM003	Greater Edendale Scheme	142 099	35.40	12.92	0.00	47.45	47.45	34.53
TM004	Pietermaritzburg Scheme	436 987	160.50	58.58	0.00	155.13	155.13	96.54

From the table above, it is noted all the schemes will have adequate raw water resources inclusive of upgrades/interventions to meet the 2050 demand requirements. The feasibility studies for the proposed resources and, in addition, the implementation of the Vulindlela Scheme should be prioritised.

A total estimate of approximately R 1.5 billion is required to address the total bulk water supply requirement by 2050. The total cost requirement per WSIA is tabled within Table H-3

H-3: Total Cost requirement

WSIA	WSIA Name	Total Cost Requirement				
		Primary	Secondary	Tertiary	10% Contingencies	Total Cost (excl VAT)
TM001	Vulindlela Scheme	-	R375 418 269.83	R27 181 536.92	R40 259 980.68	R442 859 787.43
TM002	Ncwadi Scheme	-	-	-	-	-
TM003	Greater Edendale Scheme	R49 081 094.48	R539 892 039.25	R49 081 094.48	R539 892 039.25	R49 081 094.48
TM004	Pietermaritzburg Scheme	R507 880 885.11	R434 269 906.39	R4 452 594.30	R94 660 338.58	R1 041 263 724.37
Total		R556 961 979.59	R1 349 580 215.47	R80 715 225.70	R674 812 358.51	R1 533 204 606.28

I. Conclusions and Recommendations.

The TMLM still faces a 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. 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 TMLM relies mainly on grant funding programmes to fund their water supply projects. These funding programmes are mainly MIG and WSIG. Based on all the current funding streams available to the Local Municipality over the MTEF period, it will take a minimum of fifteen years for the TMLM to address their bulk water supply requirements.

The provision of water services remains the responsibility of the TMLM as the WSA. The TMLM 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 and Umgeni Water could consider as a Regional Utility to assist the TMLM to take this process further.

The four (4) proposed water supply intervention areas (WSIA's) are the appropriate solutions for bulk water supply development within TMLM and are as follows:

- ✓ TM001 WSIA: Vulindlela Scheme
- ✓ TM002 WSIA: Ncwadi Scheme
- ✓ TM003 WSIA: Greater Edendale Scheme
- ✓ TM004 WSIA: Pietermaritzburg Scheme

The implementation programme will depend on the availability of funds from National Treasury as well as the capacity of the Municipality to implement projects. Although all four (4) area interventions would be an implementation priority for the LM, 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.

I-1: Proposed Implementation Order (Phased Approach)

Proposed Priorities (Phased Approach)	WSIA No and Name		Proposed Project Name	Proposed Estimated Project Value
1	Detailed feasibility study of the Mkhomazi to Mgeni inter-catchment raw water transfer as well as the Mzimkhulu to Mkhomazi inter-catchment transfer to augment the 2050 raw water deficit in the Upper Mgeni System.			
2	TM001	Vulindlela Scheme	Primary and secondary reservoirs and pipelines upgrade	R442 859 787.43
3	TM003	Greater Edendale Scheme	Primary and secondary reservoirs and pipelines upgrade	R49 081 094.48
4	TM004	Pietermaritzburg Scheme	Primary and secondary reservoirs and pipelines upgrade	R1 041 263 724.37

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LIST OF ABBREVIATIONS

CoGTA	Department of Cooperative Governance and Traditional Affairs
CR	Command Reservoir
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
m^3	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
MPNRW	Management Plan to Reduce Non-Revenue Water
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
TMLM	The Msunduzi Local Municipality
UAP	Universal Access Plan
UMDM	Umgungundlovu District Municipality
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 Msunduzi Local Municipality (TMLM)" – 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 (CouM);
- ✓ 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:

- ✓ StatsSA Community Survey, 2016;
- ✓ UAP Phase II, Umgungundlovu District Municipality, 2016;
- ✓ Umgeni Water, Infrastructure Masterplan Volume 2, 2020;
- ✓ Vulindlela Bulk Water Supply System Upgrade – Preliminary Design Report, 2016;

- ✓ Msunduzi Local Municipality Water Services Development Plan, 2018 – 2019;
- ✓ Msunduzi Local Municipality Final Draft Integrated Development Plan, 2019 – 2020; and
- ✓ Monthly water balance reports as submitted by DWS (KZN) for each WSA.

Meetings were held with managers and technical staff of the TMLM 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, UMDM 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 also reported on a preliminary gap analysis that was conducted utilising the outcome from the proposed WSIA from UAP II and the TMLM Water Services Development Plan that is currently being updated. Following the gap analysis, specific recommendations were made when determining the 2050 water demands suggested for the UAP Phase III study. Follow-up meetings were arranged with the WSAs to share the information that are presented in the Due Diligence Report and these reports were submitted to Umgeni Water.

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.

1.5.1.1 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 a number of 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 a number of 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.

1.5.1.2 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 a number of 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 a number of 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
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.

1.5.2 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.

1.6 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.

1.7 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 Msunduzi Local Municipality (KZN225) is located within the Umgungundlovu District Municipality (UMDM) in the central region of the KwaZulu-Natal Province and it covers an area of approximately 634 km².

TMLM is one of seven (7) Local Municipalities within the Umgungundlovu District Municipality (DC22) and is bordered to the north-east by uMshwathi LM (KZN221), north-west by uMngeni LM (KZN222), west by Impendle LM (KZN224), south by Richmond LM (KZN227) and east by Mkhambathini LM (KZN226).

The provincial capital, Pietermaritzburg lies within Msunduzi and is the second largest municipality in KZN and the fifth largest in South Africa. It is the capital city of the Province of KwaZulu-Natal and the main economic hub within Umgungundlovu District Municipality and the Midlands.It is well developed with industrial and commercial activities and is the service centre for the surrounding commercial farmlands, rural settlements, rural towns and tourist destinations such as the Midlands Meander.

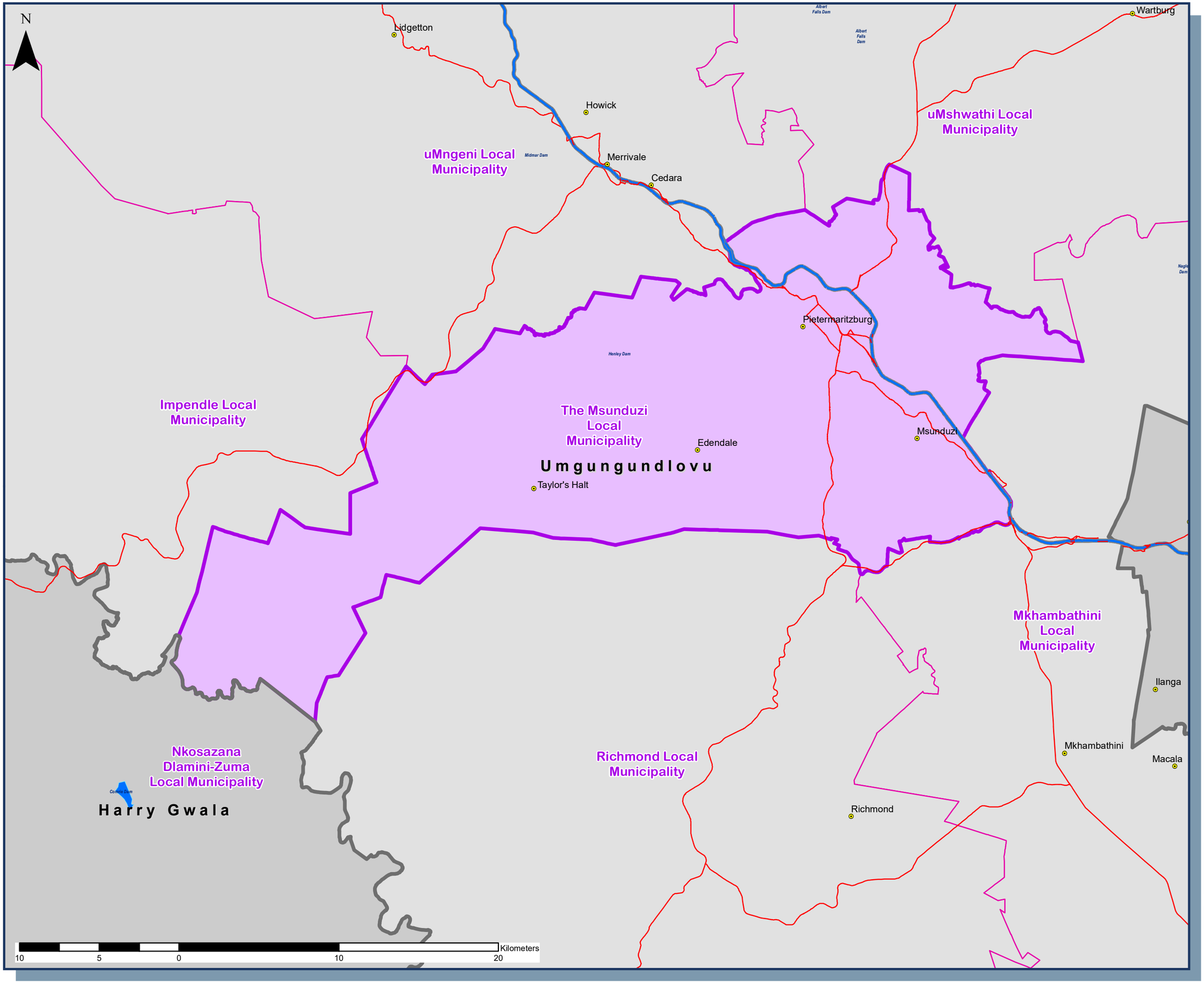
TMLM is predominantly urban to peri-urban in nature, with areas of rural residential.

The study area and locality of TMLM is illustrated in **Figure 2-1** overleaf.

2.2 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

Msunduzi, as a City, sits at a critical point of change. As the second largest metropolitan complex in the province, it's ever-present possibility of reaching Metropolitan Status and a shift toward City Development. The geographic location of Msunduzi municipality allows it the opportunity of becoming well connected in the global economy due to the access it has to the N3 highway leading to major harbours and airports. The surrounding municipalities and towns access various connectivity and growth opportunities through Msunduzi, across various sectors such as Tourism and Agriculture. As such it is essential for physical connectivity to be further improved to stimulate these economic linkages. (TMLM IDP, 2019)

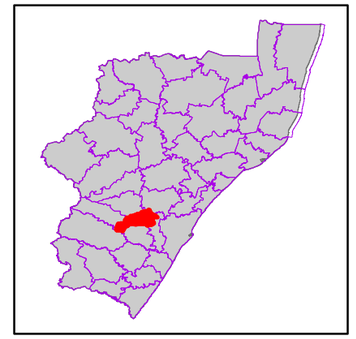
Undulating terrain typical of large portions of the KwaZulu-Natal Province influence settlement patterns of the LM. Settlements within the LM range from low density sprawling rural settlements in Vulindlela through the Edendale valley area which faces a threat of degenerating into an urban slum and the poorly developed townships to well-developed suburbs along the N3 corridor and the northern areas where relatively large informal settlements have also developed.



Legend

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

LOCALITY:



CLIENT:

UMGENI WATER • AMANZI

MUNICIPALITY:

CITY OF CHOICE
PIETERMARITZBURG MSUNDUZI

THE MSUNDUZI LOCAL MUNICIPALITY

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PROJECT TITLE

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

MAP TITLE:

Locality Map

The Msunduzi Local Municipality

DATE COMPLETED:

January 2021

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KZN 225 Figure 2-1

Msunduzi is the economic power house of the district and has a huge potential for agri-processing since the district is dominated by agriculture. The location along provincial and national routes also supports this proposal. The LM is traversed by a good network of roads. The N3 national highway (corridor) and the R56 provincial arterial route runs through the municipality in an east-west and north-south directions respectively. Portraying Pietermaritzburg as a strategic location in terms of infrastructure nationally amongst other major cities.

The area of Msunduzi possesses high rates of migration as it comprises of pull factors such as employment opportunities, with many people migrating into the city at high rates from a daily basis at district context searching for better opportunities.

2.3 Climate and Climate Change

The Msunduzi LM falls predominantly within the summer rainfall area of South Africa. The typical rainfall season extends from October to April, with the highest rainfall occurring during December and January.

Msunduzi's weather and climate are largely influenced by its topography. The higher lying areas of Msunduzi are cooler and receive more rainfall than other parts of the city. Average annual temperature vary between 16.3°C and 17.9°C.

The city is located within a hollow created by the valleys of the Msunduzi River and its tributaries which contributes to the development of an atmospheric inversion layer, which traps pollutants and does not allow them to escape. This is a major issue of concern, predominantly during winter. The majority of industrial development within Msunduzi have been established below the level at which the inversion layer forms as this land is flat and in close proximity to transportation routes (SRK Consulting, 2010). As a result, the city suffers from short-term peaks in pollution.

The Mean Annual Precipitation (MAP) averaged across municipality vary from 63 mm to 1 179 mm as tabulated in **Table 2-1**.

It is projected that storms and rainfall intensities will increase as a result of climate change. The intermediate projection is that short duration rainfall events will increase across the entire district with the exception of northern parts of Mpofana, western Impendle and Southern Richmond. This increase in short term rainfall events will result in increased disaster management risks due to severe storms and flooding. (TMLM IDP, 2019)

Table 2-1: Climate variables of TMLM

Precipitation (mm)	
Annual min	663
Annual mean	880
Annual max	1 179
Temperature (°C)	
Annual min	-6
Annual mean	17
Annual max	41

Source: Ezemvelo KZN Wildlife, 2017

Climate studies indicate that he TMLM will face a warmer and wetter future according to the climate change projections undertaken and is likely to have both negative and positive impacts. Changes in the mean annual rainfall are expected and are also likely to include an increased number of flash flood and storm events due to an increase in short duration rainfall. Floods, severe storms and wildfires already being among the main hazards currently faced by communities in the TMLM and UMDM as a whole and climate change projections indicate an increased risk of these climate-driven events. The potential for an increase in drought events has also been identified.

Various sectors have been identified which will be the most impacted on by climate change/climate change related impacts in Msunduzi that are as follows:

- ✓ Impacts on biodiversity, ecosystems and sensitive natural environments;
- ✓ Changes and impacts to water resources particularly water availability, quality and quantity;
- ✓ Impacts on food provision and agricultural sustainability;
- ✓ Impacts on human health due to temperature extremes and prevalence/occurrence of vector borne diseases;
- ✓ Impacts on storm water infrastructure and other infrastructure located in areas of flood potential;
- ✓ Waste management;
- ✓ Increased energy utilisation and impacts on electricity infrastructure; and
- ✓ Impacts on the transportation sector and infrastructure.

Climate change poses threats to the quality of water resources due to the fact that increased flooding instances and runoff into watercourses bring contaminants into the water, as well as increased nutrients from waste and vegetation washed into the rivers from flood events, which will cause eutrophication.

There is a need to focus strategies on climate change, paying particular attention to mitigation factors as well as looking at adaptation strategies. This will reduce communities' susceptibility to climate change. (TMLM IDP, 2019)

2.4 Topography, Geology and Soils

Pietermaritzburg is situated in the basin of the uMsunduzi River and its tributaries. An escarpment rises approximately 400m above the city to the West and North West. Altitude within the Municipality ranges from 495 to 1795 metres above sea level, and the Municipality generally slopes from west to east.

The mountains around the city bowl create a distinction between the urban and rural parts of the Municipality. While this has provided opportunities to manage the urban/rural interface, it has limited the city's expansion potential, resulting in the formation of a number of small urban hubs outside the city.

The predominant lithologies present in the Msunduzi municipal area are comprised of sedimentary rocks of the Ecca Group and Dwyka Formation which form part of the lower Karoo Supergroup. The aforementioned sediments are extensively intruded by Jurassic post-Karoo dolerite sheets, dykes and sills that intermittently outcrop across the entire municipal area.

A small area on the eastern border of the municipal area comprises lithostratigraphic sequences of the Natal Metamorphic Province (including the Mapumulo Group and Oribi Gorge Suite) overlain unconformably by the Natal Group and the Karoo Supergroup.

Each major lithological sequence exhibits a distinct set of geotechnical conditions. When combined with general slope characteristics of the area, these conditions can be expected to vary greatly within a region of similar underlying geology. The diversity of the geotechnical conditions in the Msunduzi Municipality brought about by the geology and geomorphology (combined with the hilly areas surrounding the Pietermaritzburg CBD result in a very complex interplay between slope gradient and potentially unstable transported sediments and soils. (SRK Consulting, 2010)

Elevations across the municipality range from 453m above sea level to a height of 1 573m as presented in **Table 2-2**.

Table 2-2: Topological variables of TMLM (derived from a 20m DEM of KZN)

Elevation (meters above sea level)	
Minimum	453
Mean	940
Maximum	1 573
Slope (degree)	
Mean	8
Maximum	56

Source: Ezemvelo KZN Wildlife, 2017

Soils within the Municipality vary greatly. The topography, rainfall patterns and geology have resulted in the high agricultural potential of the area, however, large portions of highly productive agricultural land have been developed for other uses such as housing. The remaining areas of highly productive agricultural land occur mainly on communally owned land in the Vulindlela area. Poor agricultural practices in these areas are affecting the productivity of the land. (SRK Consulting, 2010)

2.5 ENVIRONMENTAL

Msunduzi has an extremely rich cultural, architectural, historical, and archaeological resource base, that collectively makes up the heritage resources of the area. A Cultural Heritage Specialist Study identified and mapped a total of 646 heritage resource points, and 32 heritage resource zones, within the Msunduzi Municipal area. These consisted of architectural resources, archaeological resources, as well as historical and cultural resources. (TMLM IDP, 2019)

Maintaining a 'green' built environment is important for both the image of the city and the social and environmental health of residents. There is a need to focus on planting programmes in the CBD to replace storm-damaged and old/ dangerous trees with indigenous alternatives that are hardy and drought tolerant.

Msunduzi Municipality constitutes almost entirely one catchment. This has benefits in terms of catchment management but also means that any impact within the catchment will affect the entire municipality. The majority of the water produced in the Msunduzi catchment goes towards servicing/supplementing Ethekwini's water requirements while Msunduzi sources the majority of its water from the Mgeni catchment. The uMsunduzi River (and its various tributaries) is an important feature of the municipal landscape. Significant proportions of the Msunduzi Municipality have catchments that are currently in either a fair, poor or seriously modified ecological state. Catchments within the municipality that are transformed have reached their full supply capacity. Water quality varies between catchments but the impact of the city is evident from the

decrease in water quality that occurs as it passes through the urbanised portions of the municipality. Rivers within Msunduzi are the source of a number of goods and services and these include:

- ✓ Water supply for industry, domestic use, agriculture and livestock watering;
- ✓ Dilution and removal of pollutants from agricultural, domestic and industrial sources;
- ✓ Reducing sediment inputs to coastal zone;
- ✓ Decomposing organic matter;
- ✓ Storing and regenerating essential elements;
- ✓ Provision of building materials in the form of clay bricks;
- ✓ Grazing fodder during dry seasons;
- ✓ Recreational and subsistence fishing;
- ✓ Providing aesthetic pleasures;
- ✓ Storm water management and control
- ✓ Sites for recreational swimming;
- ✓ Recreational sport, such as canoeing and income generated in the area from events;
- ✓ Open spaces within the City;
- ✓ Environment for contemplation and spiritual renewal; and
- ✓ River-based educational activities.

The extent of wetlands has declined significantly, particularly in developed areas. Wetlands have been transformed and most of the remaining wetland areas are in a degraded state due to inappropriate land use and inadequate catchment management. There is a lack of ground level information regarding the functionality of most of the wetland habitats within Msunduzi.

A wetland specialist study was undertaken that mapped a total of 1049 wetlands. Most wetlands within the municipality were small, with an average wetland size of approximately 1 Ha. While the condition of wetlands was not specifically evaluated as part of the wetland specialist study, observations made during ground truthing suggest that most of the wetlands that remain are in a degraded state. The network of wetland habitats do, however, form part of the system that generates the goods and services as listed above. Wetlands also provide unique goods and services such as storm water attenuation. (SRK Consulting, 2010)

The municipality is aware that environmental accounting needs to be become more integrated into the development planning process and must be considered in the very initial phases of planning any new development or upgrade, prior to any costly mistakes being made.

2.6 INSTITUTIONAL ARRANGEMENTS FOR WATER SUPPLY

The MEC for Local Government, Traditional Affairs, and Housing designated the Msunduzi Municipality a Water Service Water Authority through a Government Gazette dated 13 June 2003. This notice authorized the Msunduzi Municipality to perform the functions and exercise the powers referred to in Section 84(1) (b) of the Municipal Structures Act (117 of 1998), which provides for the provision of potable water supply and sanitation systems. In terms of Section 11 of the Water Services Act (108 of 1997), every Water Services Authority has a duty to ensure adequate and sustainable access to water and sanitation for all consumers within the area of jurisdiction. (TMLM IDP, 2019)

The Msunduzi Municipality has signed and entered into a Bulk Services Agreement with Umgeni Water, which came into effect from December 2012. This is a 10-year agreement that regulates the supply and sale of bulkwater from Umgeni Water to Msunduzi Municipality. The LM is Umgeni Water's second largest customer after eThekwini, accounting for 15.2% of the organization's total sales. (UW IMP, 2020)

3. DEMOGRAPHICS

3.1 EXISTING POPULATION DISTRIBUTION

TMLM is in the process to review their WSDP and has updated their demographics accordingly in the 2018/2019 Water Services Development Plan.

As the WSDP demographics for TMLM has not been updated to date and does not reflect the latest demographics when compared to the reference framework, the UAP Phase III will adopt the figures reflected by the DWS Reference Framework (2019).

There is currently 708 496 people within 191 054 households residing within 30 settlements in TMLM. The average household size is 3.71 persons per household as indicated within **Table 3-1** below whereas **Table 3-2** indicates the settlement type as per the WSDP. The population distribution of TMLM is illustrated in **Figure 3-1** overleaf.

Table 3-1: Population & Household Figures for TMLM

Municipality	Population	Households	People per Household
The Msunduzi	708 496	191 054	3.71

Source: DWS Reference Framework, April 2019

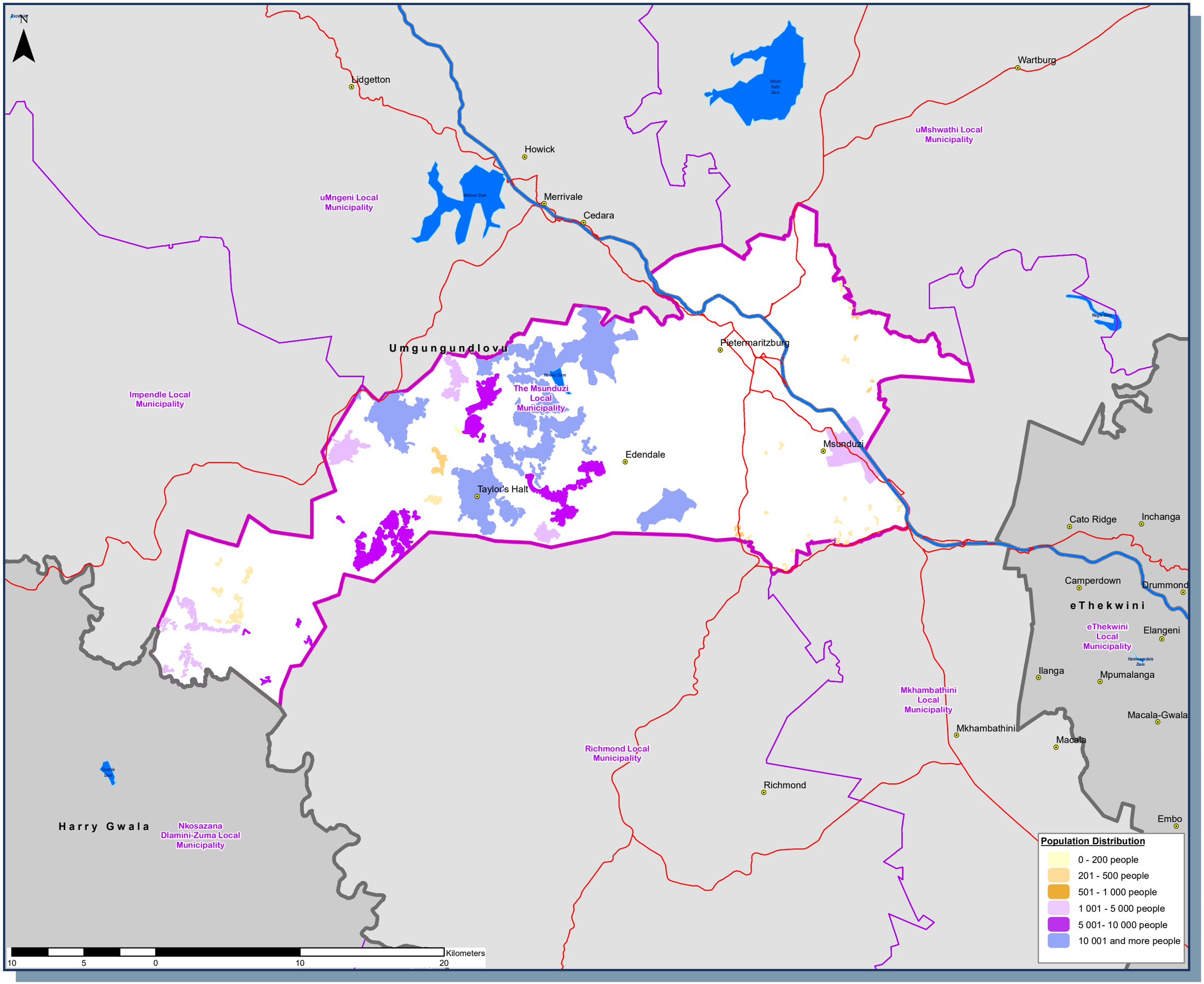
Table 3-2: Settlement distribution for TMLM

Settlement Type		No. of Settlements
Rural	Rural - Dense Village > 5000 persons	7
	Rural - Small Village <= 5000 persons	11
	Rural Scattered	8
Urban	Urban - Formal Town	2
	Urban - Former Township	2

Source: TMLM WSDP, 2018

The Msunduzi Integrated Development Plan for 2019/2020 financial year reviewed the anticipated growth rates for the period between 2017 and 2021 and was based on the historical growth rates between the 2001 and 2011 Census that was estimated as being 1.1%. (TMLM IDP, 2019)

Table 3-3 presents the anticipated, medium and high growth rates within the LM.



Legend

- Provinical Boundaries
- District Municipality Boundaries
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- Rivers
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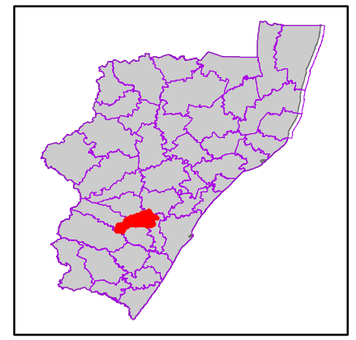
- Major Towns

LOCALITY:



CLIENT:

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PROJECT TITLE

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

MAP TITLE:

Population Distribution

The Msunduzi Local Municipality

DATE COMPLETED:

January 2021

MAP NO.:

KZN 225 Figure 3-1

Table 3-3: Population growth rates (Msunduzi IDP 19/20)

Year	Anticipated Growth Rate 1.1%	Medium Growth Rate 2.2%	High Growth Rate 3.3%
2017	671 994	704 807	751 565
2018	679 582	720 313	776 367
2019	687 256	736 160	793 447
2020	695 017	752 355	810 903
2021	702 865	768 907	828 743

Source: Msunduzi IDP 19/20

This population growth is anticipated to be distributed throughout TMLM, consideration of the rate of change of individual wards have been used to identify the changes across areas of the Municipality. Greater Edendale and Imbali, while already very densely settled, will continue to attract new settlement as a result of the low barriers to entry for lower income households. Similarly, Vulindlela, is anticipated to experience higher growth as location preference for inward migration.

3.2 Social and Economic Indicators

TMLM constitutes 0.7% of the area and ±6.3% of the population of KZN. The municipality is one of the fastest growing areas in terms of both population and the economy. The municipality is diverse and made up of sub-areas, each with unique attributes that combine in a systematic manner to establish the municipality as a distinct geographic functional region with Pietermaritzburg as the main economic and service hub.

Msunduzi is an important economic hub within KwaZulu-Natal is subject to several advantageous components, such as:

- ✓ Its strategic location along the N3 corridor and in close proximity to the Durban Port and the King Shaka International Airport (KSIA);
- ✓ Its good transport networks (road, air and rail);
- ✓ Is an administrative and service centre for the inland region;
- ✓ Is home to leading tertiary institutions such as the UKZN and the Durban University of Technology (DUT);
- ✓ Is well equipped with services (commercial, community and infrastructure);
- ✓ Has an established business base with an integrated Chamber of Business (CoB);
- ✓ Its manufacturing basis includes textiles, agriculture (timber, beef, dairy, agri-processing), aluminium, construction material, clothing and leather goods, motor components, and steel; and
- ✓ Its assortment of development projects and planned growth.

The Msunduzi Local Municipality contributes 7.45% to the GDP of KwaZulu-Natal Province and 1.19% to the GDP of South Africa thathad a total GDP of R 4.34 trillion in 2016 (as measured in nominal or current prices) as presented below in **Table 3-4**. (TMLM IDP, 2019)

Table 3-4: Gross Domestic Product (GDP) - Msunduzi, Umgungundlovu, Kwazulu-Natal and National Total, 2006-2016 [R Billions, current prices]

	Msunduzi	UMDM	KwaZulu-Natal	National Total	Msunduzi as % of DM	Msunduzi as % of province	Msunduzi as % of national
2012	36.5	53.7	520.4	3 253.9	67.9%	7.0%	1.12%
2013	40.3	59.2	563.9	3 539.8	68.0%	7.1%	1.14%
2014	44.6	65.5	611.0	3 807.7	68.0%	7.3%	1.17%
2015	48.0	71.3	649.1	4 049.8	67.3%	7.4%	1.19%
2016	51.7	77.1	694.4	4 337.0	67.1%	7.4%	1.19%

Source: Msunduzi IDP, 2019

Gross Value Added (GVA) is a measurement of Gross Domestic Product (GDP), with the relationship defined as: GDP = GVA + Taxes – Subsidies. As the total aggregates of taxes and subsidies on products are only available at the level of the whole economy, GVA is used for measuring Gross Geographic Product (GGP) and other measures of the output of entities smaller than a whole economy.

Table 3-5 below provides the total Rand value added at each stage of production in 2017 prices, the percentage contribution of Msunduzi to KwaZulu-Natal's economy, as well as the compound average annual growth rate (CAAGR) measured over five years, in constant 2010 prices.

Table 3-5: Municipal contribution to the district economy

Area	GVA 2017	% Contribution	5 Yr CAAGR
KwaZulu-Natal	661 739 104	-	1.6%
Msunduzi	46 306 741	6.7%	1.7%

Source: Human Settlements Sector Plan (HSSP) for the Msunduzi Local Municipality, 2019

In 2016, the Msunduzi Local Municipality achieved an annual growth rate of 1.36% which is a significantly higher GDP growth than the KwaZulu-Natal Province's 0.44% and is also higher than that of South Africa, where the 2016 GDP growth rate was 0.28%. Similar to the short-term growth rate of 2016, the longer-term average growth rate for Msunduzi (3.20%) is also significantly higher than that of South Africa (2.12%).

Employment figures for the TMLM demonstrates that majority of employment is of a formal nature. Formal employment rates grew by 1.5% between 2005 and 2015, however this rate is too slow to absorb the growing

labour force, which is evident in the fact that unemployment rate in 2015 was 30%. The majority of formal employment is generated by the community services sector, followed by the trade, finance and manufacturing sectors. The informal employment is dominated by the trade sector, with other main contributors being community services, construction and transport sectors.

Table 3-6: Total Employment per Broad Economic Sector, 2016

Sector	Msunduzi
Agriculture, forestry and fishing	7 860
Mining and quarrying	341
Manufacturing	25 000
Electricity, gas and water	1 110
Construction	15 100
Wholesale and retail trade, catering and accommodation	45 100
Transport, storage and communication	10 800
Finance, insurance, real estate and business services	26 800
Community services	62 500
Households	20 800
Total	**215 000**

Source: Msunduzi IDP, 2019

Table 3-7 below shows the number of formally and informally employed persons in the Msunduzi Local Municipality, along with the percentage contribution to KZN as well as the CAAGR of employment from 2012-2017.

Table 3-7: Employment Levels

Area	Unemployment Rate	Formal Employment	% Formal of Total	Informal mployment	% Informal Of Total	Total Employment	% Contribution	5 Yr CAAGR
KwaZulu-Natal	24%	2 151 665	81%	493 468	19%	2 645 133	-	1.8%
Msunduzi	25%	175 239	84%	33 448	16%	208 687	8%	2.7%

Source: Human Settlements Sector Plan (HSSP) for the Msunduzi Local Municipality, 2019

3.3 Population Growth Scenarios

Population and economic growth rates are used to determine future developmental requirements within the TMLM. This determines the required increase or decrease in water services. Non-domestic consumer unit growth, particularly commercial, industrial and agricultural growth, also gives an indication of the expected increase in water demand and associated wastewater flow discharges. Factors that affect population growth rate include:

- ✓ Immigration due to displaced farm labour, land restitution and declining job opportunities in neighbouring provinces;
- ✓ Emigration to urban centres or outward migration from the region in search of job opportunities; and
- ✓ The HIV/AIDS epidemic that is predicted to seriously affect economically active persons (18-45 years). Full-blown AIDS sufferers who are unable to continue working may return home to the rural areas. This may be an internal urban/rural shift, or migration from urban areas outside the DM. With the prevalence of HIV/AIDS, especially in KZN, it is important to ensure adequate water services provision in the rural areas.

There is currently 708 496 people within 191 054 households residing within 30 settlements in TMLM. The year-on-year average households growth within the municipality is currently at 1.6%. (TMLM IDP, 2019)

The municipality's population has grown steadily from the 2001 to 2016. One of the major contributing factors is the migration of individuals from surrounding rural municipalities as well as the migration from individuals from rural communities within the municipality towards the city.

3.4 Main Development Nodes[1]

The importance of development nodes is a reflection of an area's economic development potential and the range of service that should be provided. The Msunduzi Municipality can broadly be divided into four main sub-areas, namely:

- ✓ Vulindlela area;
- ✓ Greater Edendale area;
- ✓ Central areas; and
- ✓ Northern areas.

[1] Sourced from the Msunduzi Local Municipality Housing Sector Plan, 2019

3.4.1 Vulindlela

Vulindlela is located along the southern boundary of the municipal area on Ingonyama Trust land and is characterised by an expansive rural settlement. It is poorly developed with economic opportunities and generally serves as a dormitory area for people who want to lead a rural lifestyle while also enjoying good access to urban opportunities. As a result, location in relation to public transport routes and the urban centres is one of the critical factors that determines settlement and land use pattern in the area.

Vulindlela has experienced steady population growth with much of this occurring in areas along the main roads and those adjoining onto the urban parts of the municipal area. Affordable access to land and a desire to relocate to areas where the chances for accessing services and other urban opportunities are greater than the remote rural areas is a driving force. The Vulindlela Rural Housing Project, Vulindlela Water Scheme and upgrading of some of the roads in the area has also attracted several people into this area.

3.4.2 Greater Edendale

The Greater Edendale Area has two (2) sub-components, that is Edendale and Imbali Township. The Edendale area is located to the south of the city centre and covers the area generally from Ekrosini to the boundary with Vulindlela. Although the area has a rich history and the municipality has expropriated a significant portion from private landowners for human settlement purposes, the area is one of the most underdeveloped parts of the Msunduzi Municipality. The majority of informal settlements have located in this area on privately owned land thus making it difficult for the municipality to provide services and promote development. The influx of people into Edendale came as a result of urbanisation processes involving rural people seeking employment opportunities.

3.4.3 Northern Areas

The northern areas comprises mainly of the residential suburbs stretching from the leafy areas of Claridge, Town Bush and Chase valley in the west, through Northdale and Woodlands to Eastwood and the low income areas of Thembalihle, Madiba and Tamboville.

Old Greytown Road Corridor forms part of the north-south development axis linking the northern areas through the city centre with Greater Edendale in the South. It represents a significant economic opportunity, which should be adequately utilized in manner, which realizes its full potential in developmental terms.

3.4.4 CBD, Ashburton and Eastern Areas

The CBD, Ashburton and Eastern Areas includes areas with different development challenges. With the development of community shopping centres such as Hayfields, Scottsville, Cascades, and the Midlands Mall, the CBD has gone through a process of decay, decline and transformation.

The declaration of the CBD as an urban development zone (UDZ) by the National Treasury, and relocation of government departments from Ulundi and Durban to Pietermaritzburg has contributed to the renewal and regeneration of the CBD.

Ashburton has developed as a low-density residential settlement on the outskirts of Pietermaritzburg. With the amount of development pressure the area is currently experiencing and its strategic location in relation to the N3 corridor it should be identified as the logical area where massive integrated mixed land use development should be encouraged. Development in Ashburton will also change the role of R103 from being a mere local collector distributor road into a potential mixed land use corridor providing direct access and improved functional linkages with the N3. Development along R103 and N3 between Ashburton on the one hand and Mkhondeni and Lincoln Meade on the other will facilitate integration with Pietermaritzburg in the long term. It will also transform the area from being small agricultural holdings (interface area between agricultural areas and urban development) into an integral part of the urban components of the municipality.

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. The total number of households (HH) as obtained from the 2011 Census and the number of households below RDP standards are also provided. (Households below RDP standards include all households having water supply – any form – further than 200m from the household).

4.1 WATER SUPPLY SERVICE LEVEL

Service levels currently differ across the TMLM, predominantly based on a rural/urban split. In general urban areas have water services equal to or higher than, and many rural areas have either no water services or these services do not meet, the compulsory national standards determined by the Minister of Water and Sanitation in terms of Section 9(1)(a) of the Water Services Act, 1997 (Table 4a).

The Municipality is a Water Services Authority and provides free basic services, that are part of the municipality's mandate, to its registered Indigents. Indigents qualify for 7kl of water per month, an amount determined from time to time by Council and as reflected in the applicable Tariff Register. (TMLM IDP, 2019)

Access to water in the Msunduzi Municipality improved significantly between 2011 and 2016. The number of households who have piped water inside their dwellings increased from 14% in 2011 to 39% in 2016 in the Msunduzi Municipality. A substantial increase (from 39% to 53%) was recorded among those who receive piped water within their yard. This category also increased from 37% to 45% in the UMDM. Water backlog in both areas is less than 10%. (Isibuko, 2019)

The Msunduzi LM WSDP 2018/2019 reports that the current water backlog for the District is as follows:

Table 4-1: Water Backlogs within Msunduzi Local Municipality

Direct Backlogs	Totals
Direct settlement backlog water households. Total household of settlement with a water need (irrelevant the type of need)	16 935
Direct settlement backlog water population. Total population of settlement with a water need (irrelevant the type of need)	63 274

Source: TMLM WSDP, 2018

According to the DWS reference framework database, the main source for the majority of households within TMLM is piped (tap) water inside the dwelling/house and yard of households (approximately 40% and 54% respectively). (DWS, 2019)

Table 4-2 overleaf presents the distribution of households by main source of water for drinking.

Table 4-2: Distribution of households by main source of water for drinking, DWS RF 2019

LM Name	Piped (tap) water inside the dwelling/house	Piped (tap) water inside yard	Distance below 200m	Distance greater than 200m	Borehole	Spring	Rain-water tank	Dam/pool/stagnant water	River/stream	Water vendor	Other	Total
Msunduzi	75 346	102 884	8 029	2 673	178	0	202	569	139	857	179	**191 056**

Source: DWS Reference Framework, April 2019

The service levels for TMLM is depicted in **Figure 4-1** overleaf.

4.2 Water Losses and Demand Management

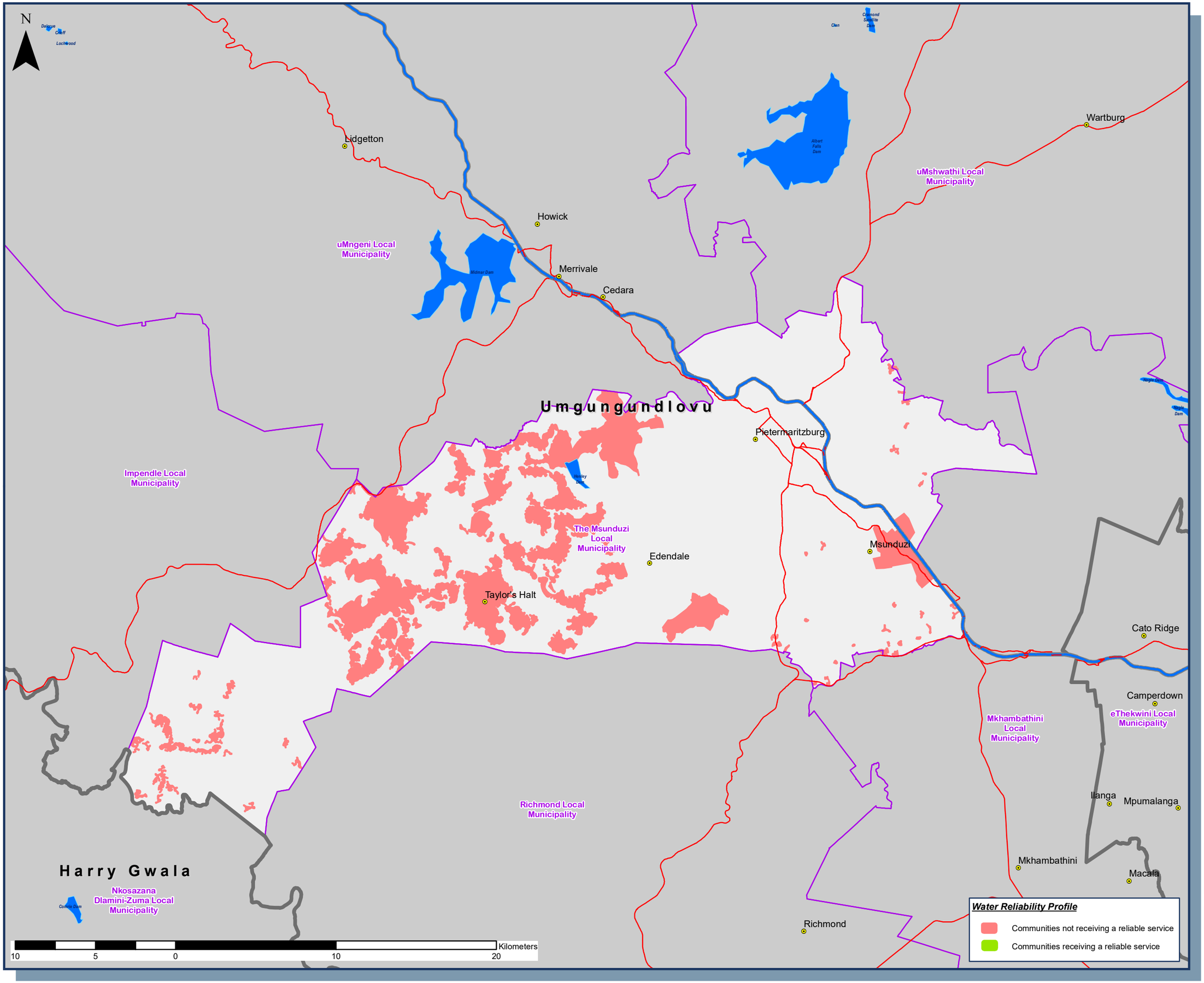
The Msunduzi Local Municipality (TMLM) has increased its drive to accelerate the delivery of water services in its area of jurisdiction. As part of the Non-Revenue Water Master Plan, a total of 16 core Non-Revenue water initiatives were identified and programmed, for which realistic goals and targets were set. The 16 core interventions were made up of eight (8) real loss and eight (8) billing control interventions, which are summarised below:

Real Loss Improvements

- ✓ Pressure reduction (rezoning);
- ✓ Pressure reduction (implementation);
- ✓ PRV (pressure reducing valves) optimization;
- ✓ Leak detection;
- ✓ Leak repair;
- ✓ Reservoir inspection and repair;
- ✓ Existing pipe replacement; and
- ✓ Creation of district metered areas.

Billing Improvements

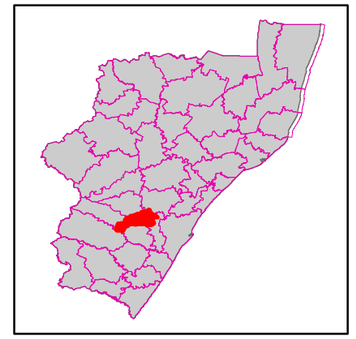
- ✓ Top consumer investigation;
- ✓ Meter reading accuracy;



Legend

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

LOCALITY:



CLIENT:

UMGENI WATER · AMANZI

MUNICIPALITY:

CITY OF CHOICE
PIETERMARITZBURG MSUNDUZI

THE MSUNDUZI LOCAL MUNICIPALITY

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PROJECT TITLE

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

MAP TITLE:

Water Supply Reliability Profile

The Msunduzi Local Municipality

DATE COMPLETED:

January 2021

MAP NO.:

KZN 225 Figure 4-1

- ✓ Non-domestic meter replacement;
- ✓ Domestic meter replacement;
- ✓ Custody transfer points;
- ✓ Damaged/inaccessible meters;
- ✓ Standpipe/low cost housing metering; and
- ✓ New connection growth.

As per TMLM's Non-Revenue Water Reduction Program, the reduction of average system operating pressures is being carried out in accordance with both National standards (as recommended by the Department of Water and Sanitation) and a long-term strategy recently adopted by the Msunduzi Municipality. Reducing unnecessarily high pressures has the following benefits:

- ✓ Reducing water leak volume;
- ✓ Reducing the number of frequency of pipe bursts;
- ✓ Extending the life of the water distribution system;
- ✓ Ensuring that all consumers receive water in the future; and
- ✓ Lowering the operating costs of the Municipality, which ultimately lowers the cost of water for the consumer.

4.3 WATER BALANCE

The WSA prepares monthly water balances, in the IWA format, on a local municipality level, for submission to the DWS. These water balances help provide a greater understanding of each of the supply systems/waterworks and also assist in the preparation of specific intervention strategies and cost/benefit calculations.

The latest available water balance for the WSA is presented in **Table 4-3** for the month of December 2018.

Table 4-3: TMLM Water Balance, December 2018

Total System Input Volume 5 718 401 m³/month 190.61 Mℓ/d	Authorised Consumption 4 251 231 m³/month Percentage of SIV = 74.3% 141.71 Mℓ/d	Billed Authorised Consumption 3 379 269 m³/month Percentage of SIV = 59.1% 112.64 Mℓ/d	Billed Metered Consumption-Domestic 3 379 269 m³/month Percentage of SIV = 59.1%	Revenue Water 3 379 269 m³/month Percentage of SIV = 59.1% 112.64 Mℓ/d
			Billed Metered Consumption-Commercial - m³/month Percentage of SIV = 0.0%	
			Export Volume - m³/month Percentage of SIV = 0.0%	
			Billed Unmetered Consumption - m³/month Percentage of SIV = 0.0%	
		Unbilled Authorised Consumption 871 962 m³/month Percentage of SIV = 15.2% 29.07 Mℓ/d	Unbilled Metered Consumption - m³/month Percentage of SIV = 0.0%	Non-Revenue Water 2 339 132 m³/month Percentage of SIV = 40.9% 77.97 Mℓ/d
			Unbilled Unmetered Consumption 871 962 m³/month Percentage of SIV = 15.2%	
	Water Losses 1 467 170 m³/month Percentage of SIV = 25.7% 48.91 Mℓ/d	Apparent Losses 381 464 m³/month Percentage of SIV = 6.7% 12.72 Mℓ/d	Unauthorised Consumption - m³/month Percentage of SIV = 0.0%	
			Metering Inaccuracies - m³/month Percentage of SIV = 0.0%	
		Real Losses 1 085 706 m³/month Percentage of SIV = 19% 36.19 Mℓ/d	Mains and Dsitribution 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 non-revenue water for the LM in 2018 was at 77.97 Mℓ/d. If using a rate of R6.00/kℓ, this amounts to a loss of R467 820 per day. Only 112.64 Mℓ/d of the SIV of 190.61 Mℓ/d can be billed and accounted for.

4.4 WATER DEMAND MODEL

This section provides an overview of the water requirements as calculated using the demand model developed for the purpose of this study. As mentioned in Section 1.5 of this report, the water demand model, approved by Umgeni Water, for this study was applied to determine the demands for all areas included in the study, at least at a town level. The water demands were modelled in five year increments up to 2050, with the minimum level of service as yard connections at 100ℓ capita per day. The base data used for the modelling is explained in Section 1.6.

The water demands for TMLM is presented below and per supply scheme area. It must be noted that the Water Supply Scheme (WSS) boundaries do not necessarily coincide with municipal boundaries. The water requirements reported on are per LM and if a WSS is split by a LM, the water requirements are reported based on this split.

4.4.1 Water Demand for The Msunduzi Local Municipality

The water requirements (in Mℓ/d) for TMLM are presented within **Table 4-4** below. 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 TMLM would require 298.25 Mℓ/day by the year 2050.

Table 4-4: Water Requirements (Mℓ/d)

LM	2050 Population	2020 (Mℓ/d)	2025 (Mℓ/d)	2030 (Mℓ/d)	2035 (Mℓ/d)	2040 (Mℓ/d)	2045 (Mℓ/d)	2050 (Mℓ/d)
Msunduzi	1 011 813	200.18	212.84	228.01	243.71	260.58	278.72	298.25

4.4.2 *Demand per Regional Water Scheme*

The water demands for the Water Supply Schemes (WSS) within TMLM is presented below in **Table 4-5.**

Table 4-5: TMLM Water supply scheme demands

WSS	2050 Population	2020 (Mℓ/d)	2025 (Mℓ/d)	2030 (Mℓ/d)	2035 (Mℓ/d)	2040 (Mℓ/d)	2045 (Mℓ/d)	2050 (Mℓ/d)
Ashburton Reservoir	3 977	1.12	1.19	1.27	1.36	1.45	1.55	1.65
Balancing1 Reservoir	31 155	8.45	8.98	9.60	10.25	10.95	11.69	12.49
Belfort Reservoir	49 061	13.09	13.92	14.90	15.91	17.00	18.16	19.40
Bisley Reservoir	50 466	15.36	16.32	17.46	18.64	19.90	21.24	22.68
Blackridge Reservoir	5 463	1.62	1.72	1.84	1.96	2.09	2.24	2.39
Clarendon Reservoir	8 107	2.87	3.04	3.25	3.47	3.70	3.95	4.22
Copesville Reservoir	55 186	11.03	11.74	12.59	13.47	14.42	15.44	16.53
Eastwood Reservoir	65 945	13.91	14.79	15.84	16.93	18.10	19.36	20.72
Ferncliff Reservoir	6 646	2.34	2.49	2.66	2.84	3.03	3.23	3.44
Groenekloof Reservoir	2 803	0.99	1.05	1.13	1.20	1.28	1.37	1.46
Hathorns Reservoir	51 983	13.36	14.20	15.21	16.25	17.37	18.56	19.84
Masons Reservoir	19 548	4.86	5.17	5.54	5.92	6.33	6.77	7.23
Murray Road Reservoir	16 551	5.35	5.68	6.07	6.48	6.92	7.38	7.88
Oribi Reservoir	32 014	9.50	10.09	10.80	11.54	12.32	13.16	14.05
Symons Reservoir	36 887	10.10	10.73	11.49	12.27	13.11	14.00	14.96
Ashdown_Lower_Reservoir_Polygon	12 998	1.96	2.09	2.24	2.40	2.57	2.76	2.96
Ashdown_Upper_Reservoir	16 682	3.24	3.44	3.69	3.95	4.23	4.52	4.84
Imbali_Dome_Reservoir	44 136	9.30	9.89	10.60	11.33	12.11	12.95	13.86
Kwapata_Reservoir	12 466	1.78	1.89	2.03	2.17	2.33	2.50	2.68
Kwaphupha_Reservoir	5 465	0.61	0.65	0.70	0.75	0.80	0.86	0.92
Machibisa_Reservoir	22 315	3.51	3.74	4.02	4.30	4.62	4.95	5.32
Masons_Industrial_BPT	14 357	2.12	2.26	2.43	2.60	2.78	2.99	3.20
Paramount Reservoir_polygon	4 461	0.61	0.65	0.69	0.74	0.79	0.85	0.91
Reservoir_D	33 268	6.01	6.40	6.86	7.35	7.87	8.43	9.03
Reservoir_F_(PATA)_BPT	1 262	0.18	0.19	0.20	0.22	0.23	0.25	0.27
Reservoir_F	61 306	11.20	11.91	12.76	13.64	14.59	15.62	16.72
RR_Tafuleni_Reservoir	2 524	0.35	0.37	0.40	0.43	0.46	0.49	0.53
Shayamoya_Reservoir	2 961	0.46	0.49	0.53	0.56	0.60	0.65	0.70
Sinathing_GG_Reservoir	4 427	0.62	0.66	0.71	0.75	0.81	0.87	0.93
Sinathing_Reservoir	7 913	1.12	1.19	1.28	1.37	1.47	1.57	1.69
Siyamu_BPT_Reservoir	4 458	0.65	0.69	0.74	0.79	0.85	0.91	0.97
Terminus_Reservoir	1 789	0.22	0.23	0.25	0.27	0.29	0.31	0.33

WSS	2050 Population	2020 (Mℓ/d)	2025 (Mℓ/d)	2030 (Mℓ/d)	2035 (Mℓ/d)	2040 (Mℓ/d)	2045 (Mℓ/d)	2050 (Mℓ/d)
Waterworks (Simeye) Reservoir	7 723	1.14	1.21	1.30	1.40	1.50	1.61	1.73
Willowfountain Reservoir	12 251	2.59	2.76	2.95	3.16	3.38	3.62	3.87
Vulindlela Reservoir 17	3 060	0.34	0.36	0.38	0.41	0.44	0.47	0.50
Vulindlela Reservoir 19	3 667	0.40	0.43	0.46	0.49	0.53	0.56	0.60
Vulindlela Reservoir 5	13 782	1.55	1.65	1.76	1.89	2.02	2.17	2.33
Vulindlela Reservoir 7	9 587	1.11	1.18	1.26	1.35	1.45	1.55	1.66
Vulindlela Reservoir 6	17 619	2.12	2.26	2.42	2.59	2.77	2.97	3.18
Vulindlela Reservoir 9	15 379	1.68	1.78	1.91	2.04	2.19	2.34	2.51
Vulindlela Reservoir 8	14 129	1.76	1.88	2.01	2.15	2.31	2.47	2.65
Phupha Reservoir	24 247	2.98	3.17	3.40	3.64	3.89	4.17	4.47
Vulindlela Reservoir 3	3 069	0.33	0.35	0.38	0.41	0.43	0.47	0.50
Vulindlela Reservoir 10	15 314	1.71	1.82	1.95	2.09	2.23	2.39	2.57
Vulindlela Reservoir 2	16 666	2.10	2.24	2.40	2.57	2.75	2.94	3.16
Vulindlela Reservoir 13	14 852	1.65	1.75	1.88	2.01	2.15	2.31	2.47
Vulindlela Reservoir 4	1 353	0.15	0.16	0.17	0.18	0.19	0.20	0.22
Vulindlela Reservoir 14	6 874	0.76	0.81	0.87	0.93	0.99	1.06	1.14
Vulindlela Reservoir 1	27 332	3.34	3.55	3.81	4.07	4.36	4.67	5.01
Vulindlela Reservoir 15	15 866	2.02	2.15	2.31	2.47	2.64	2.83	3.03
Vulindlela Reservoir 16	13 022	1.56	1.66	1.79	1.91	2.05	2.19	2.35
Vulindlela Reservoir 18	8 284	0.92	0.98	1.05	1.12	1.20	1.29	1.38
Azalea Reservoir E	34 093	5.66	6.02	6.45	6.90	7.38	7.90	8.47
Endlovu Ambleton BPT	45 066	6.42	6.83	7.32	7.83	8.38	8.98	9.63

5. EXISTING WATER SUPPLY INFRASTRUCTURE

This section provides an overview of the available water resources as well as the current surface water supplied schemes.

Umgungundlovu District Municipality is the Water Service Authority (WSA) and Water Service Provider (WSP) for six of the seven local municipalities within its jurisdiction. These municipalities include uMshwathi, Mkhambathini, Richmond, Impendle, uMngeni and Mpofana. As such, they are responsible for the provision of water and sanitation services within these areas. The Msunduzi Municipality, on the other hand, was designated as a separate WSA in 2003 and has entered into a Bulk Services Agreement with Umgeni Water, which came into effect from December 2012.

Msunduzi includes the urban areas of Pietermaritzburg and surrounds, and the rural area of Vulindlela. The entire municipality is supplied from the Upper Mgeni System.

For extremely remote communities where no bulk services are feasible or possible (cannot be served by the Regional Scheme or Intermediate Schemes), a rudimentary water level of service is implemented in the form of boreholes with handpumps, or spring protections. In some areas a small reticulation scheme with RDP level of services will be constructed where possible.

5.1 WATER RESOURCE AVAILABILITY

5.1.1 Surface Water

The Mooi/Mngeni catchment (U20 and V20) is the most important resource for the municipality. There are four (4) major dams on the uMngeni River, namely Midmar, Albert Falls, Nagle and Inanda dams. These dams are supported by the Spring Grove Dam and Mearns Weir in the Mooi River catchment.

A Mooi-Mgeni Transfer system was initially set up during the 1983 drought to provide additional water into the Mgeni System. The scheme consisted of a 3m high weir and pump station at Mearns, just downstream of the confluence of the Mooi and Little Mooi Rivers, a 13.3km long 1 400mm diameter rising main to a break pressure tank situated at Nottingham Road and an 8.3km long 900mm diameter gravity main to an outfall structure on the Mpofana River. From here the water flows via the Mpofana, Lions and Mgeni rivers to Midmar Dam. The scheme has a maximum transfer capacity of 3.2m^3/s and was operated on a run-off-river basis due to the insignificant storage capacity. In 2002, the Mearns Weir was raised to 8m, increasing the storage to 5.116 Mm^3 and the Midmar Dam wall was raised an additional 3.5m. This was referred to as the Mooi-Mgeni Transfer Scheme 1 (MMTS-1) and was viewed as an interim solution whilst the feasibility of a dam on the Mooi was investigated.

In 2004 the demand in the Mgeni System first exceeded the system yield. With further growth in demand placing the system at a risk of failure, the DWS planned and constructed the Mooi/Mgeni Transfer Scheme-Phase 2A (Spring Grove Dam) and 2B (pump station and raw water pipeline) to mitigate this risk of non-supply. With Spring Grove Dam now fully impounded, the risk of water restrictions within the next few years is expected to be minimised. In the Mooi River catchment, the only domestic and industrial water demands are associated with the town of Mooi River and Rosetta village. Numerous groundwater schemes feed many of the rural and outlying peri-urban centres in the region. (UW IMP, 2020)

The Mooi-Mngeni Transfer Scheme 2 (MMTS-2) involved the construction of a dam, 4.5 m^3/s pump station and bulk raw water infrastructure for inter-basin transfer. The Spring Grove Dam is located on the Mooi River approximately 2km South West of Rosetta, and 8km upstream of the Mearns Weir. It drains an area of 339km^2 and has a gross storage volume of 139.5 Mm^3. Water is released from Spring Grove Dam and is abstracted at the Mearns Weir on the Mooi River and transferred into Midmar Dam to support supply in this system. In addition, a new raw water pipeline from Spring Grove Dam to the Mngeni catchment has been completed, enabling a continuous transfer of water at a higher rate and increasing the yield of the greater Mgeni System. In addition, a water treatment plant is been built at the dam to supply the Greater Mpofana Water Supply Scheme, with the ultimate capacity of 60 Mℓ/day. Both the Mooi and the Mngeni catchments are now fully utilised and no additional water use can be licensed. (UW IMP, 2020)

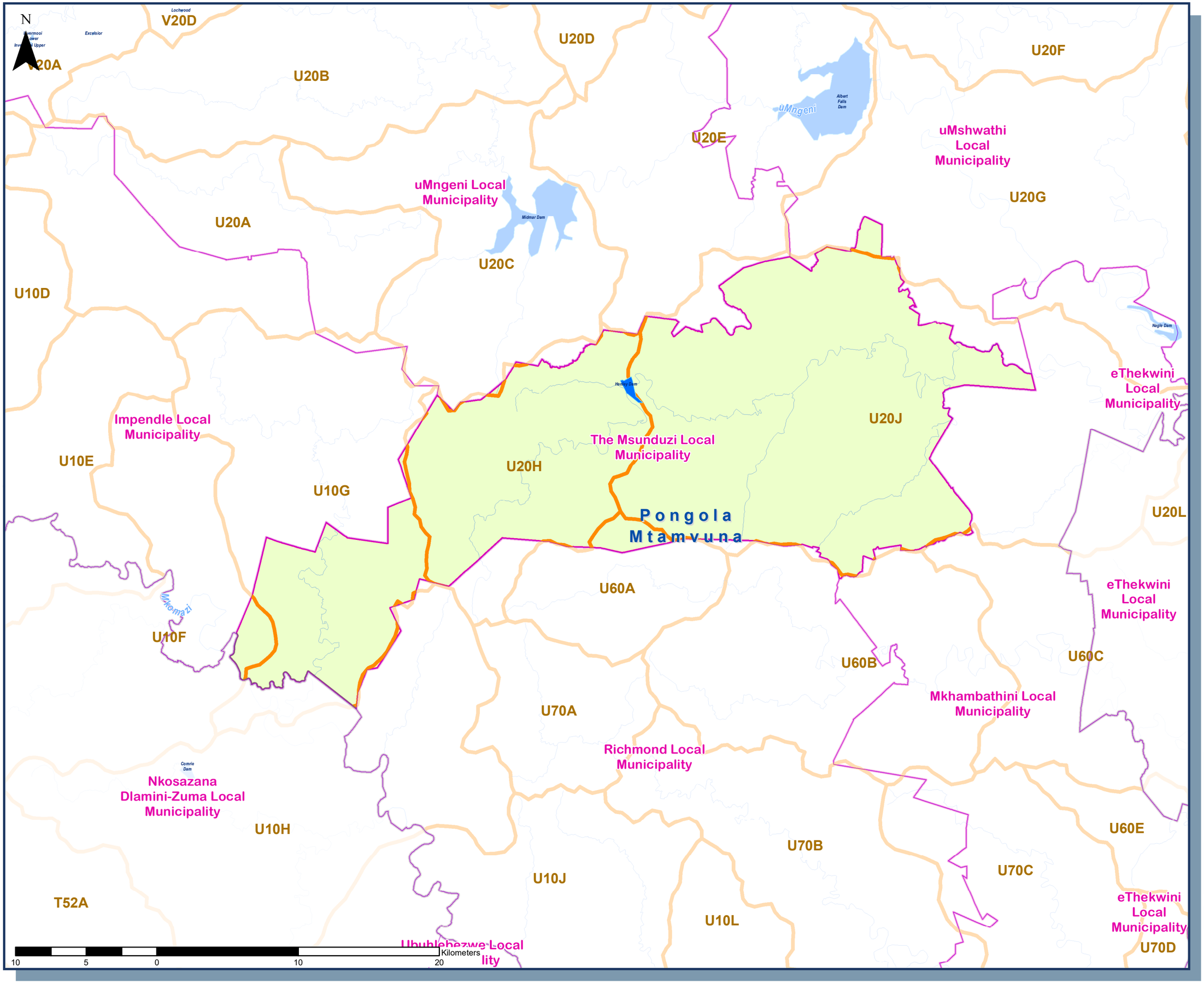
The Msunduzi Local Municipality is supplied by the Umgeni Water Upper Mgeni System. The current demand off the Upper Mgeni System is approximately 304.56Mℓ/day (14% for uMgungundlovu DM, 58% for Msunduzi, and 28% for eThekwini).

Raw water is pumped from Mearns Weir, and alternatively from Spring Grove Dam, into the upper reaches of the Mgeni River to supplement the raw-water supply into Midmar Dam. The Midmar WTP then supplies the DV Harris WTP via gravity.

The Midmar WTP had an initial design capacity of 250 Mℓ/day and has since been upgraded to 395 Mℓ/day. The DV Harris WTP has a design capacity of 110 Mℓ/day, with a current utilisation of 89 Mℓ/day. (UW IMP, 2020)

The system distributes potable water from the Midmar and DV Harris Water Treatment Plant to the various municipal areas and sub-supply areas.

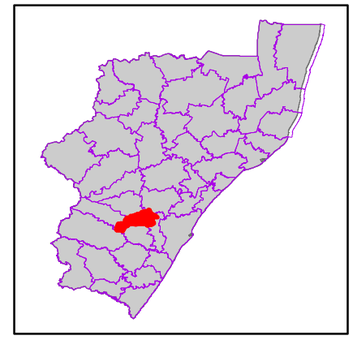
The water resources of TMLM is illustrated in **Figure 5-1 overleaf**.



Legend

- Provinical Boundaries
- District Municipality Boundaries
- Local Municipality Boundaries
- Dams & Dam Names
- Rivers
- Water Management Area
- Quaternary Boundaries & Numbers (W13A)

LOCALITY:



CLIENT:

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PROJECT TITLE

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

MAP TITLE:

Water Resources

The Msunduzi Local Municipality

DATE COMPLETED:

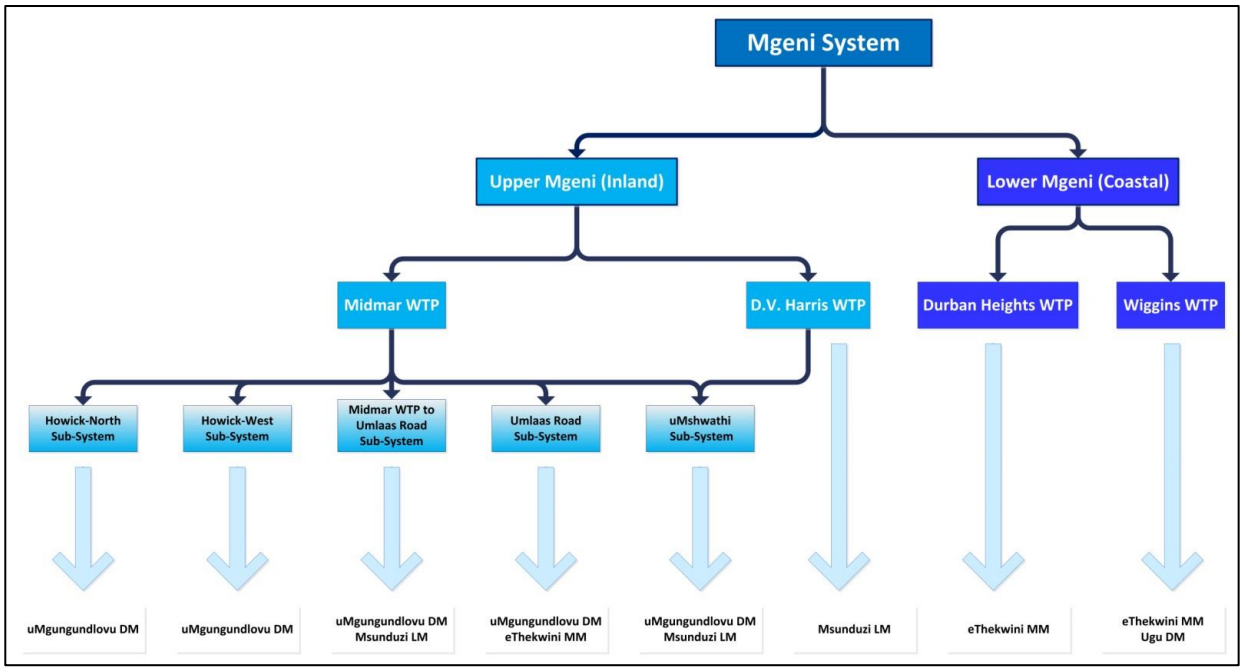
January 2021

MAP NO.:

KZN 225 Figure 5-1

Figure 5-2 below presents a network chart of the Mngeni system and **Table 5-1** presents the yield information for the existing water resource infrastructure in the Mooi/Mgeni Region including transfers from the MMTS.

Figure 5-2: Network chart of the uMgeni Water Supply System



Source: UW IMP, 2020

Table 5-1: Yield Information for the existing water resource infrastructure in the Mooi/Mgeni Region including transfers from the MMTS

Phase	Position in System	Historic Firm Yield	Stochastic Yield (1 in 50 years risk of failure)		Stochastic Yield (1 in 100 years risk of failure)	
		mcm/annum	mcm/annum	Mℓ/day	mcm/annum	Mℓ/day
MMTS	Midmar Dam	177.3	192.0	526.0	173.8	476.2
	Nagle Dam	283.5	329.0	901.4	302.0	827.4
	Inanda Dam	384.0	428.0	1 172.6	400.0	1 095.9

Source: Umgeni Water, 2020

With the completion of the second phase of the MMTS, the 99% assured yield of the Mgeni System, at Midmar Dam, has increased from 322.5 Mℓ/day (117.7 Mm^3/a) to 476.2 Mℓ/day (173.8 Mm^3/a). (UW IMP, 2020)

5.2 PHYSICAL INFRASTRUCTURE

5.2.1 Upper Mgeni System

The existing infrastructure of various sub-systems of the Upper Mgeni system that supply the Msunduzi LM is summarised from Section 5.2.2 onwards.

The existing scheme areas of TMLM are depicted in **Figure 5-3** while **Figure 5-4** presents the existing infrastructure of the LM.

5.2.2 '61 Pipeline: DV. Harris to World's View Reservoir

The Msunduzi Local Municipality is supplied by two (2) command reservoirs, namely, the Clarendon and World's View reservoirs which is supplied via the DV Harris and Midmar WTP's respectively. The Clarendon reservoir is fed from the DV Harris through the 800 mm diameter '60 pipeline and the World's View reservoir is fed from the Midmar WTP via a collective 6.20km, 1 000mm diameter and a newer 900/1 200 mm diameter steel pipeline ('61 pipeline).

The '61 pipeline has been in operation for 35 years as at October 2014 and was restricted to accommodate a maximum flow of 330 Mℓ/d, due to the capacity of the tunnel, while the capacity of the pipeline is 347 Mℓ/d.

When the demand downstream of World's View Reservoir reaches 245 Mℓ/day, the 800 mm diameter '60 pipeline will have to be utilised to augment the supply from Midmar WTP into World's View Reservoir. This will mean that Clarendon Reservoir will then have to be fed from Midmar WTP. (UW IMP, 2020)

Table 5-2 below presents the reservoir details of the Clarendon and World's View reservoirs.

Table 5-2: Reservoir details of Clarendon and World's View (UW IMP, 2020)

Reservoir	Capacity (Mℓ/d)	Function	TWL (m)
Clarendon	25.0	Terminal	970.0
World's View	80.0	Bulk	962.0

Source: UW IMP, 2020

The DV Harris WTP has a design capacity of 110Mℓ/day but has accommodated peak demands of up to 125Mℓ/day according to Umgeni Water. Expansion of the treatment plant is not required as the plant is able to receive the maximum available raw water from Midmar Dam. A 99% assurance yield of supply at Midmar Dam, with the Mooi/Mgeni Transfer System Phase 1 (MMTS 1) and Mooi/Mgeni Transfer System Phase 2 (MMTS 2), is 476.2 Mℓ/day. Midmar WTP will treat 376.2 Mℓ/day and the balance of 100 Mℓ/day will be treated at DV Harris WTP.

5.2.3 '61 Pipeline: World's View Reservoir to ED2

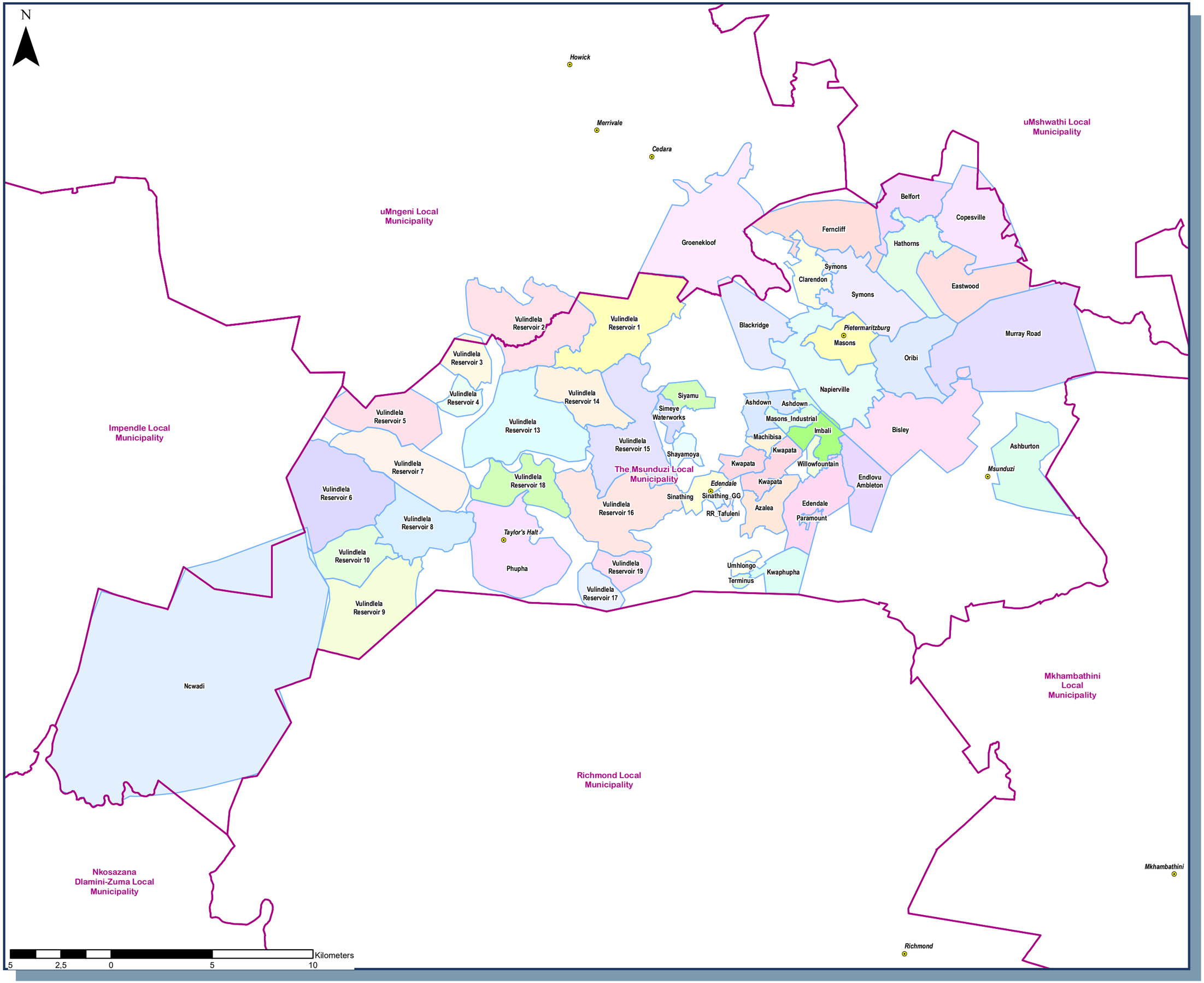
A dual 1 000 mm diameter gravity pipelines provide water from World's View Reservoir to the ED2 offtake which is a sales point to The Msunduzi Municipality's Edendale area. One (1) of these pipelines is a dedicated supply to the western portions of The Msunduzi Municipality, consisting of Edendale (ED1, ED2 and ED3) and the H.D. Hill supply zones (mainly Pietermaritzburg's western suburbs).

The two (2) pipelines connect via a cross connection at ED2. (UW IMP, 2020)

5.2.4 Ashburton Supply

An off-take from the '61 Pipeline supplies the Ashburton High-Level Reservoir through a 160mm diameter galvanised mild steel pipeline. The reservoir feeds directly into the Msunduzi Municipality's Ashburton Lower Reservoir. The supply zone of this reservoir is the Ashburton and Lynnfield Park areas. (UW IMP, 2020)

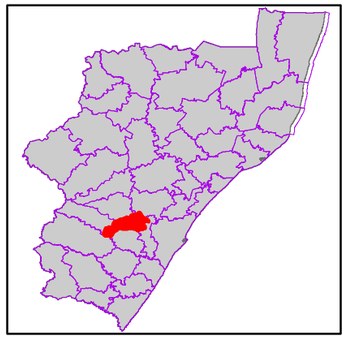
The average flow in Ashburton pipeline is currently 2.4Mℓ/day. This system has sufficient capacity for the foreseeable future. (UAP Phase II, 2016)



Legend

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

LOCALITY:



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PROJECT TITLE

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

MAP TITLE:

Water Scheme Areas

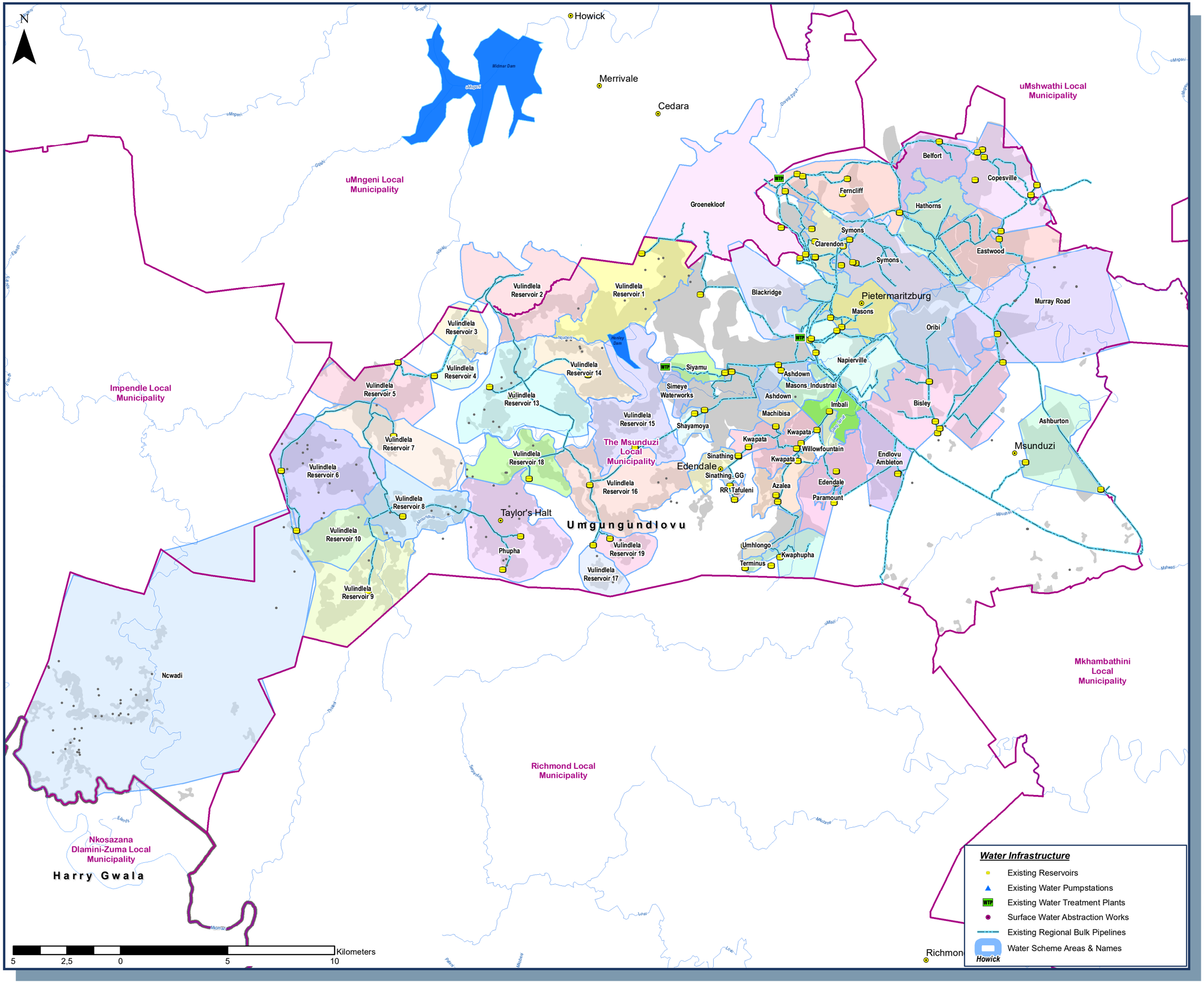
The Msunduzi Local Municipality

DATE COMPLETED:

January 2021

MAP NO.:

KZN 225 Figure 5-3


N
Howick
Merrivale
Cedara
Midmar Dam
uMngeni
uMngeni Local Municipality
uMshwathi Local Municipality
Impendle Local Municipality
Groenekloof
Belfort
Copesville
Ferncliff
Hathorns
Symons
Clarendon
Eastwood
Blackridge
Pietermaritzburg
Masons
Murray Road
Oribi
Napierville
Ashdown
Masons Industrial
Bisley
Ashburton
Msunduzi
Imbali
Machibisa
Siyamu
Simeye Waterworks
Shayamoya
Kwapata
Willowfountain
Endlovu Ambleton
Sinathing
Sinathing GG
RR Tafuleni
Edendale
Azalea
Paramount
Umhlongo
Kwaphupha
Terminus
Taylor's Halt
Phupha
Umgungundlovu
The Msunduzi Local Municipality
Henley Dam
Vulindlela Reservoir 1
Vulindlela Reservoir 2
Vulindlela Reservoir 3
Vulindlela Reservoir 4
Vulindlela Reservoir 5
Vulindlela Reservoir 6
Vulindlela Reservoir 7
Vulindlela Reservoir 8
Vulindlela Reservoir 9
Vulindlela Reservoir 10
Vulindlela Reservoir 13
Vulindlela Reservoir 14
Vulindlela Reservoir 15
Vulindlela Reservoir 16
Vulindlela Reservoir 17
Vulindlela Reservoir 18
Vulindlela Reservoir 19
Ncwadi
Nkosazana Dlamini-Zuma Local Municipality
Harry Gwala
Richmond Local Municipality
Mkhambathini Local Municipality
Kilometers
5 2,5 0 5 10
Water Infrastructure
Existing Reservoirs
Existing Water Pumpstations
Existing Water Treatment Plants
Surface Water Abstraction Works
Existing Regional Bulk Pipelines
Water Scheme Areas & Names
Howick
Legend
Provinicial Boundaries
District Municipality Boundaries
Local Municipality Boundaries
National Roads
Main Roads
Dams & Dam Names
Rivers
Settlements
Hilton
Major Towns
LOCALITY:
CLIENT:
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PROJECT TITLE
The Msunduzi LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan
MAP TITLE:
Existing Scheme Areas & Infrastructure Components
The Msunduzi Local Municipality
DATE COMPLETED:
January 2021
MAP NO.:
KZN 225 Figure 5-4

6. EXISTING SANITATION BULK INFRASTRUCTURE

6.1 SANITATION SERVICE LEVEL

The National Water and Sanitation Master Plan (NW&SMP), prepared in 2018 for South Africa, puts an emphasis on the reliability of water services (water and sanitation). The NW&SMP reported that "In the 27 priority district municipalities the water reliability is only 42%, with the worst 10 WSA's below 30% reliability" and that "Approximately 56% of the over 1 150 WWTP and approximately 44% of the 962 WTP's are in poor or critical condition and in need of urgent rehabilitation."

Reliability of services are affected by aging infrastructure, operation and maintenance, reliability of electricity supply, stormwater ingress into sewer systems, vandalism and theft, or extreme weather events. All these then affect sanitation security to consumers and may have negative impacts on the environment.

The DWS Reference Framework database yields that majority of households within TMLM use a flush toilet connected to a public sewerage system (approximately 47.6%).

Table 6-1 below presents the distribution of households by type of toilet facility as per the DWS Reference Framework database as at 2019.

Table 6-1: Distribution of households by type of toilet facility, DWS RF 2019

LM Name	Flush toilet connected to a public sewerage system	Flush toilet connected to a septic tank or conservancy tank	Chemical toilet	Pit latrine/toilet with ventilation pipe	Pit latrine/toilet without ventilation pipe	None	Bucket toilet (collected by municipality) – Bucket toilet (emptied by household)	Total
Msunduzi	90 906	8 882	45 483	32 168	465	11 028	2 113	**191 045**

Source: DWS Reference Framework, April 2019

The current sanitation backlog is at 3.1% as illustrated in the TMLM WSDP 2018/2019 and in **Table 6-2** overleaf. However, settlements are continuously expanding, and household growth will maintain an increase in the future.

The TMLM WSDP 2018/2019 reports that the current sanitation backlog for the District in **Table 6-2**.

Table 6-2: Sanitation Backlogs within Msunduzi Local Municipality

Direct Backlogs	Totals
Direct settlement backlog sanitation households. Total household of settlement with a sanitation need (irrelevant the type of need)	4 949
Direct settlement backlog sanitation population. Total population of settlement with a sanitation need (irrelevant the type of need)	19 763

Source: TMLM WSDP, 2018-2019

6.2 EXISTING SANITATION BULK INFRASTRUCTURE

As per the IDP, the municipal sewer system is aging, and broken pipes and dislodged joins frequently cause sewer blockages, which then impact on river systems and therefore the general health of the population.

Planning is required in the urban areas to confirm the suitability of the bulk infrastructure, especially with regards to increased pressures on the infrastructure due to an increasing urbanisation trend that has been occurring and also to allow for future growth in population.

According to the DWS Reference Framework, the following two sanitation schemes are currently operating within TMLM:

- ✓ Darvill; and
- ✓ Lynnfield Park.

Two (2) wastewater treatment plants are operational within the Msunduzi LM and are listed in **Table 6-3** below. The Darvill WWTP is owned by Umgeni Water whereas the Lynnfield Park WWTP is operated by Umgeni Water.

Table 6-3: List of Wastewater Treatment Plants

WWTP Name	Capacity Mℓ/day
Darvill WWTP	120.0
Lynnfield Park WWTP	0.5

Source: UW IMP, 2020

The sanitation reliability profile and existing infrastructure are presented in **Figure 6-1** and **Figure 6-2** overleaf.

N

Albert Falls Dam

Midmar Dam

Henley Dam

Nagle Dam

Hammarsdale Dam

Combe Dam

uMshwathi Local Municipality

uMngeni Local Municipality

Impendle Local Municipality

The Msunduzi Local Municipality

Umgungundlovu

eThekwini

eThekwini Local Municipality

Mkhambathini Local Municipality

Richmond Local Municipality

Harry Gwala

Nkosazana Dlamini-Zuma Local Municipality

Sanitation Reliability Profile

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

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 (Hilton)

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PROJECT TITLE

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

MAP TITLE:

Sanitation Reliability Profile

The Msunduzi Local Municipality

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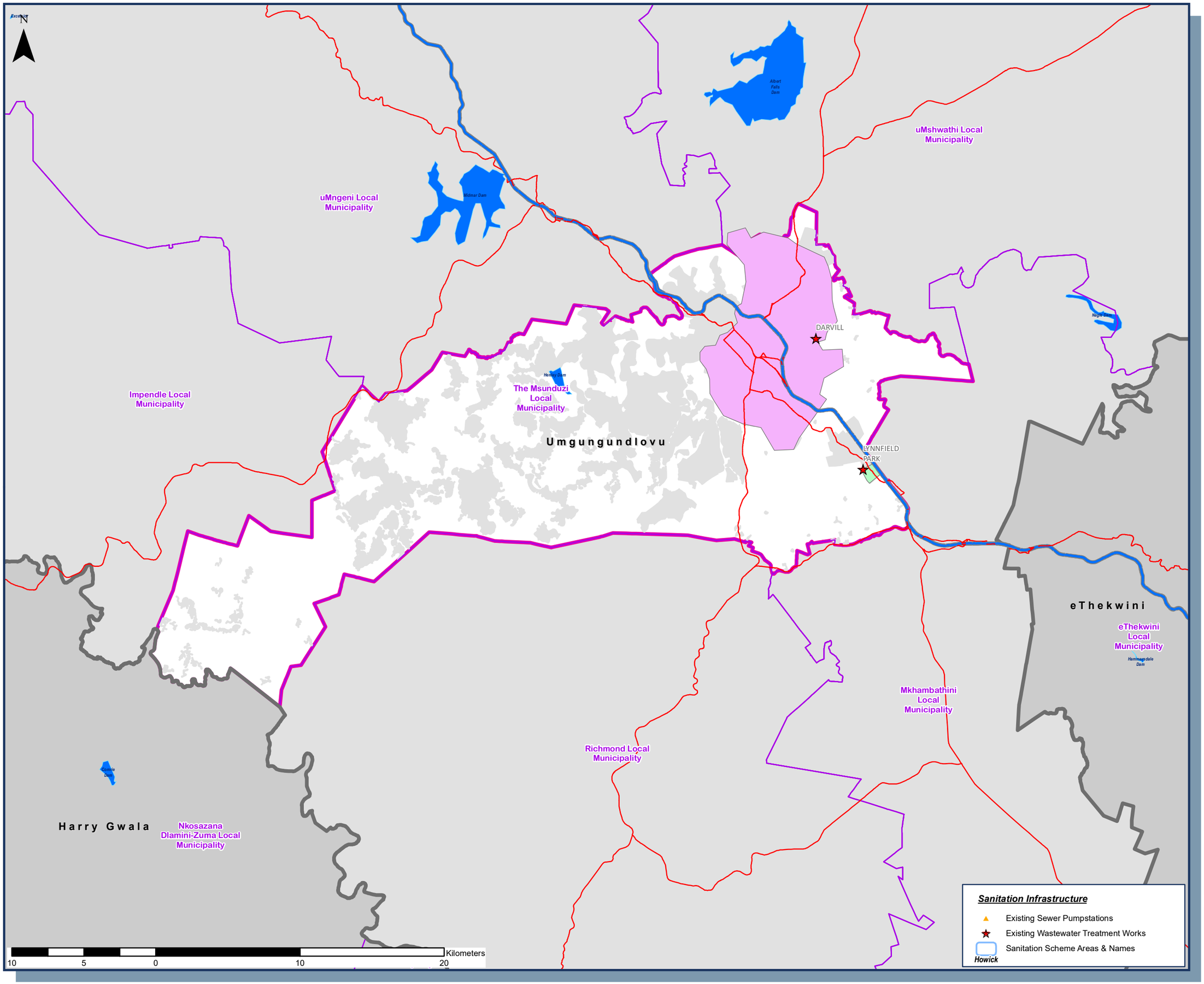
MAP NO.:

KZN 225 Figure 6-1



Legend

- Provinical Boundaries
- District Municipality Boundaries
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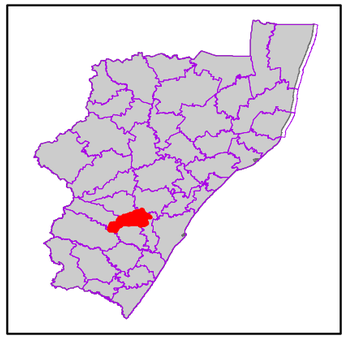

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PROJECT TITLE

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

MAP TITLE:

Existing Sanitation Infrastructure

The Msunduzi Local Municipality

DATE COMPLETED:

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MAP NO.:

KZN 225 Figure 6-2

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[2] or sub regional [3] scale (over vast distances [4]), 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.

This Chapter provides a brief overview of existing and planned bulk water infrastructure projects sourced from the TMLM 2018/2019 WSDP.

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

[3] "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

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

7.1 Regional Bulk Water Projects in Planning

The TMLM mainly receives their funding from MIG and WSIG. No regional bulk infrastructure projects within TMLM receive funding from RBIG according to the Division of Revenue Bill Schedule.

The funding streams for infrastructure development 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
Municipal Infrastructure Grant (MIG)	R197 516	R209 136	R225 852	R632 504
Water Services Infrastructure Grant (WSIG)	R41 000	R43 255	R45 000	R129 255
Regional Bulk Infrastructure Grant (RBIG)	-	-	-	-
Total: Msunduzi Local Municipality	R238 516	R252 391	R270 852	R761 759

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

The funding allocations per Local Municipality as presented in DORA, is presented in **Table 8-2** below.

Table 7-2: Three-Year Medium-Term Expenditure Framework (MTEF)

LM Name	Municipal Infrastructure Grant (MIG)			Water Services Infrastructure Grant (WSIG)		
	2019/2020 (R '000)	2020/2021 (R '000)	2021/2022 (R '000)	2019/2020 (R '000)	2020/2021 (R '000)	2021/2022 (R '000)
Msunduzi	R197 516	R209 136	R225 852	R41 000	R43 255	R45 000

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

Msunduzi Municipality is a Water Services Authority (WSA) with Umgeni Water as the Water Services Provider (WSP). **Table 7-3** below outlines the projects planned by Umgeni Water in the TMLM municipal area.

Table 7-3: Umgeni Water Projects for TMLM (2019)

Project Name	Beneficiary LM	Project Cost	Project Status	Implementation Timeframe	Project Components
Midmar WTP Upgrade	uMngeni, Msunduzi, Richmond, Mkhambathini & eThekwini	R 280 775 350.70	Complete	2012-2019	Upgrade of WTP
Howick-West Reservoir Upgrade	Msunduzi	R 108 431 277.16	Construction	2014-2022	Reservoir Upgrade
Vulindlela Upgrade	Msunduzi	R 330 057 203.05	Detailed Design	2015-2021	Reservoir, Pump station and Pipeline Upgrades

Source: UW IMP, 2020

8. SYNOPSIS OF EXISTING AND COMMITTED SCHEMES

A gap analysis has been undertaken for the water schemes in the TMLM. The purpose of the gap analysis is to check the adequacy of infrastructure to allow the 2050 water demand to be supplied, and where necessary identify upgrades to infrastructure.

The gap analysis has taken into account current planning interventions by the WSA. The interventions required to meet the 2050 water demand inclusive of infrastructure planning and recommended water resource investigations is discussed in Chapter 9 of this study.

The entire TMLM has been demarcated into regional water schemes in line with short and long-term plans by the WSA. gap analysis has been undertaken for the water schemes in the TMLM. The gap analysis has taken into account current planning interventions by the WSA. Four (4) regional schemes have been identified and are as follows:

- ✓ TM001 WSIA: Vulindlela Scheme;
- ✓ TM002 WSIA: Ncwadi Scheme;
- ✓ TM003 WSIA: Greater Edendale Scheme; and
- ✓ TM004 WSIA: Pietermaritzburg Scheme.

NOTE: For all the WSIA's hereunder raw water is conveyed to Midmar Dam via the Mgeni River, with augmentation from the Mooi-Mgeni Transfer Scheme (MMTS), via a pumping scheme from Spring Grove Dam and Mearns Weir respectively. The firm yield of Midmar Dam, including the raw water augmentations, is 476.2 Mℓ/day. Raw water is pumped via 2 steel pipelines (1 500mm diameter and 1 600mm diameter) to the Midmar WTP. Water is then treated at the 395 Mℓ/day Midmar WTP, which is located in Howick West. Raw water is also gravity fed via a 1 500mm diameter steel pipeline to the 130 Mℓ/day DV Harris WTP, located in Pietermaritzburg, where the water is then treated. The TM002 Ncwadi WSIA is supplied via a different source which is highlighted in Section 8.2.

The capacities of 395 Mℓ/day Midmar and 130 Mℓ/day DV Harris Water Treatment Plants, are insufficient for all downstream demands. Based on the 2050 demands the Midmar WTP and DV Harris WTP will have to be upgraded from 395 Mℓ/day to 421 Mℓ/day and 130 Mℓ/day to 174 Mℓ/day respectively.

From the demand analysis carried out in this UAP Phase III study, the water demand on the Upper Mgeni System in 2050 will be 595 Mℓ/day. This is after the implementation of the Umkhomazi Water Project that will have capacity to supply 602 Mℓ/day to Ethekwini Municipality and thus shed the current Ethekwini Municipality load on the Upper Mgeni System. The Mgeni Water Supply system is fully developed and the only other

infrastructure option available to increase the system yield would be an inter catchment raw water transfer. This is discussed further in Section 9.

8.1 TM001 WSIA: VULINDLELA SCHEME

The existing Vulindlela Water Supply Scheme abstracts water from the Midmar WTP through the Howick West and Groenekloof pump stations and reservoirs. In 2018 the Midmar WTP was upgraded from 250 Mℓ/day to 395 Mℓ/day. The raw water supply to the Midmar WTP is sourced from the Midmar Dam (476.2 Mℓ/day) that is situated on the Mgeni River with augmentation from the Mooi-Mgeni Transfer Scheme (MMTS), that is pumped from the Spring Grove Dam and Mearns Weir respectively.

The Vulindlela system receives potable water from the Groenekloof Reservoir Complex through two (2) pumping systems via two (2) bulk supply systems with a high-level pumping station and a low-level pumping station. The high-level pumping system feeds four (4) reservoirs with a 500mm diameter steel pipeline, including two (2) command reservoirs (Reservoir 2 at KwaDulela and Reservoir 5 at Kanzakana) and two (2) local reservoirs (Reservoir 3 and Reservoir 4). The low-level pumping system only feeds command Reservoir 1 with a 400mm diameter steel pipeline. From Reservoir 2, potable water is gravity fed to Reservoirs 13 through to Reservoir 19. From Reservoir 5 potable water is gravity fed to Reservoirs 6 through to Reservoir 12.

The Vulindlela Water Supply Scheme is currently being supplied from the Groenekloof Reservoir. This configuration is currently being upgraded. The system will eventually be supplied from the Howick West Reservoir via a new pump set. An additional 15 Mℓ reservoir will be constructed next to the Vulindlela Reservoir 2. Pump sets will also be constructed to feed the Vulindlela Reservoir 5, which will in turn gravitate to feed Reservoirs 3 and 4.

The existing and planned infrastructure capacity is compared with the projected 2050 demand. This comparison is provided in **Table 8-1** below.

Table 8-1: Vulindlela Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
Water Treatment (Mℓ/d)	-	-	-	-	-
Storage (Mℓ)	50.9	-	50.9	95.9	45.34
Bulk conveyance - Raw Water (Mℓ/d)	-	-	-	-	-
Bulk conveyance - Clear Water (Mℓ/d)	50.9	-	50.9	95.9	45.34

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, secondary and tertiary reservoirs would need to be increased to meet the demand of 2050.

8.2 TM002 WSIA: Ncwadi Scheme

The Ncwadi area is currently supplied via a borehole and spring feeding Reservoir J/1. The 400kℓ reservoir J/1 acts as the command reservoir for Ncwadi. From Reservoir J/1 water gravitates to the lower lying area to Reservoirs M, L, O and Q, where it supplies their respective areas via standpipes. Reservoir J/1 also supplies some local surrounding areas directly via standpipes.

The water master plan for Ncwadi, prepared by GLS Consulting in 2018, recommended four (4) options that can be considered in supplying the Ncwadi area with reliable water supply.

- ✓ Option 1 - Borehole and spring supply

The first option involves the optimal use of the current infrastructure. The option would entail the refurbishment of the spring and incorporate the newly drilled Borehole 3 to supply to Reservoir J/1. A new borehole is proposed to be drilled near the existing Ncwadi spring. The Furth area would still require a supply reservoir with a separate borehole to be drilled to supply the area. This option is the most viable for the short term due to the remoteness of the Ncwadi area.

- ✓ Option 2 - Supply Ncwadi from Vulindlela

The second option is to augment the scheme with additional water from Vulindlela. Business plans have been prepared by consultants to utilise a new Reservoir 10A in Ward 7, to supply the Ncwadi clinic area. This business plan has been submitted for consideration. The proposed pipeline is proposed to supply constant and sufficient supply of water to the Ncwadi community. The proposed supply scheme would require the Vulindlela bulk supply to Reservoir 10 to be further upgraded to cope with the increased future demands as the current masterplan does not account for the Ncwadi area.

- ✓ Option 3 - Mkhomazi/Smithfield Dam Supply

According to the Ward 39 Spatial Development Framework document, there is a long-term plan to construct a small package plant near or at the new Mkhomazi offtake from the proposed Mkhomazi/Smithfield Dam, which will supply Ncwadi and the surrounding rural communities within the Harry Gwala DM area. These areas should be supplied via a reticulation network. The proposed Mkhomazi/Smithfield dam is a major project with funding applications currently under review by the Department of Water and Sanitation.

- ✓ Option 4 – Stephen Dlamini Dam Supply

In a previous masterplan conducted by the Harry Gwala WSA, the Greater Bulwer scheme was proposed to supply Ncwadi with water. The scheme itself would have only been able to augment the supply. The scheme is still very far from completion and the possibility of the scheme being able to supply Ncwadi with adequate water is low and was thus not considered.

The Vulindlela and the Mkhomazi options are the only options capable of meeting the long-term water supply needs of Ncwadi. Between these two (2) options, the Vulindlela Scheme was chosen as the most economical of the feasible schemes and is currently awaiting funding for implementation.

The existing and planned infrastructure capacity is compared with the projected 2050 demand. This comparison is provided in **Table 8-2** below.

Table 8-2: Ncwadi Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
Water Treatment (Mℓ/d)	-	-	-	-	-
Storage (Mℓ)	16.6	-	16.6	58.7	42.1
Bulk conveyance - Raw Water (Mℓ/d)	-	-	-	-	-
Bulk conveyance - Clear Water (Mℓ/d)	345	-	345	58.7	N/A

Based on the capacities of existing and planned infrastructure, there are no gaps within the water supply requirements for the projected 2050 demand and the bulk pipelines, secondary and tertiary reservoirs would not need to be increased to meet the demand of 2050.

8.3 TM003 WSIA: Greater Edendale Scheme

The Greater Edendale study area is currently being supplied via the Umgeni Water bulk system from their World's View Reservoir via the '61 pipeline and another separate off-take dedicated to a 400mm diameter steel pipeline from water meter Edendale Three. There are several outlet pipelines from the World's View Reservoir, including a second separate 1 000 diameter pipeline which is parallel to the '61 pipeline from World's View Reservoir that feeds the Umlaas Rd Reservoir as well as Richmond via the Thornville pump station.

From the Worlds View Reservoir, the '61 pipeline feeds three off-take pipelines in the Edendale Scheme. The off takes are metered. The meters are called Edendale 1, 2 and 4. Edendale 1 has a 300mm diameter steel pipeline that feeds the Waterworks Simeye Reservoir, with the option of supplementing the system from

Edendale 3. Edendale 2 has a 600mm diameter pipeline with two off takes. The first off take feeds Reservoirs D1 and D2 and the second off take feeds the Azelea Reservoir. Reservoirs D1 and D2 feed the Imbali Dome Reservoir, the Willowfountain Reservoir, the Machibisa Reservoir, the Kwapata Reservoir, and the Tafuleni Reservoir. Azalea Reservoir feeds the Kwaphupha Reseservoir and the Phupha Reservoir. Edendale 4 has a 650mm diameter steel pipeline feeding two reservoirs, Reservoir F1 and Reservoir F2. Reservoir F2 feeds the Paramount Reservoir.

The 400mm diameter off take Edendale 3 from the World's View Reservoir feeds the Ashdown Upper and Lower Reservoirs and the Chaluza Reservoir, with an option of supplementing the Waterworks Simeye Reservoir. Edendale 3 also has the option to supplement the Edendale 2 system as well.

The existing and planned infrastructure capacity is compared with the projected 2050 demand. This comparison is provided in **Table 8-3** below.

Table 8-3: Greater Edendale Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
Water Treatment (Mℓ/d)	-	-	-	-	-
Storage (Mℓ)	56.07	-	56.07	190.79	131.72
Bulk conveyance - Raw Water (Mℓ/d)	-	-	-	-	-
Bulk conveyance - Clear Water (Mℓ/d)	56.07	-	56.07	190.79	131.72

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

8.4 TM004 WSIA: PIETERMARITZBURG SCHEME

The existing Pietermaritzburg Scheme receives water from two (2) water treatment plants, the Midmar WTP and the DV Harris WTP. In 2018, the Midmar WTP was upgraded from 250 Mℓ/day to 395 Mℓ/day. The DV Harris has a design capacity of 110 Mℓ/day although it has accommodated peak demands of up to 125 Mℓ/day in the past. The raw water supply to the Midmar WTP is sourced from the 476.2 Mℓ/day yielding Midmar Dam which is situated on the Mgeni River with augmentation from the Mooi-Mgeni Transfer Scheme (MMTS), which is pumped from Spring Grove Dam and Mearns Weir respectively. The combination of the two (2) WTP's working at their peak output capacity can accommodate the maximum allowed yield of 476.2 Mℓ/day of the Midmar Dam.

The Pietermaritzburg Water Supply Scheme can be summarized into two (2) integrated systems; the system supplied by the DV Harris WTP and the system supplied by the Midmar WTP. The DV Harris WTP directly supplies three (3) reservoir systems in the Pietermaritzburg Water Supply Scheme, the Clarendon Reservoir system, the Ferncliff Reservoir system and the two Belfort Reservoir systems. The Clarendon Reservoir is supplied via a 750mm diameter pipeline, while the Ferncliff Reservoir is supplied through a 300mm diameter pipeline and the two (2) Belfort Reservoirs are fed though a 1 000mm diameter pipeline. The Clarendon Reservoir goes on to feed three (3) other reservoirs, namely the Wembley, the Symons and the Haythorns Reservoirs. The Ferncliff Reservoir is a local reticulation reservoir that does not feed any further reservoirs. The Belfort Reservoirs go on to feed the Copesville Reservoir, with the option to supplement the Haythorns Reservoir. The Copesville Reservoir continues to feed the Eastwood Reservoir, as well as the Murray Road Reservoir.

The Midmar WTP supplies several reservoirs, including the Balancing Reservoir within the Pietermaritzburg Water Supply Scheme. The Balancing Reservoir goes on the feed two (2) main reservoirs, namely the Bisley and Masons Reservoirs, with the option of supplementing the Symons Reservoir and the Haythorns Reservoir through an 800mm diameter pipeline. The Bisley Reservoir goes on to feed the Oribi Reservoir with the option to supplement the Murray Road Reservoir through a pipeline ranging in size between 500mm to 600mm in diameter.

The Midmar WTP also supplies water to the to the Howick West Reservoir, which supplies water to the Groenekloof Reservoir that feeds part of the Pietermaritzburg Scheme. The Groenekloof Reservoir feeds two reservoirs in the Pietermaritzburg Water Supply Scheme, namely the Sweetwaters Reservoir and the Blackridge Reservoir. These two reservoirs are local reticulation reservoirs.

The existing and planned infrastructure capacity is compared with the projected 2050 demand. This comparison is provided in **Table 8-1** below.

Table 8-4: Pietermaritzburg Scheme Gap Analysis

Criteria	Existing Capacity	Planned Additional	Total	Desired 2050	Additional Requirements
Water Treatment (Mℓ/d)	-	-	-	-	-
Storage (Mℓ)	240.1	-	240.1	416.63	176.53
Bulk conveyance - Raw Water (Mℓ/d)	-	-	-	-	-
Bulk conveyance - Clear Water (Mℓ/d)	240.1	-	240.1	416.63	176.53

Based on the capacities of existing and planned infrastructure, there are gaps within the water supply requirements for the projected 2050 demand and the bulk pipelines, 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 TMLM – considering existing use and future supplies and water sources, per scheme area. It must be noted that the Water Supply Intervention Areas (WSIA's) 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 each proposed upgrade and future additional requirements/interventions are provided per WSIA within the sections and paragraphs hereafter and illustrated for the entire WSA within **Figure 9-1**.

The following WSIA's receive their raw water supply via the Upper Mgeni System:

- ✓ TM001 WSIA: Vulindlela Scheme;
- ✓ TM002 WSIA: Ncwadi Scheme;
- ✓ TM003 WSIA: Greater Edendale Scheme; and
- ✓ TM004 WSIA: Pietermaritzburg Scheme

For all the above WSIA's, raw water is conveyed to the Midmar Dam via the Mgeni River, with augmentation from the Mooi-Mgeni Transfer Scheme (MMTS), via a pumping scheme from Spring Grove Dam and Mearns Weir respectively. The firm yield of Midmar Dam, including the raw water augmentations, is 476.2 Mℓ/day. Raw water is pumped via two (2) steel pipelines (1 500mm ø and 1 600mm ø) to the Midmar WTP. Water is then treated at the 395 Mℓ/day Midmar WTP, which is located in Howick West. Raw water is also gravity fed via a 1 500mm ø steel pipeline to the 130 Mℓ/day D.V Harris WTP, located in Pietermaritzburg, where the water is then treated.

The capacities of the Midmar (395 Mℓ/day) and the D.V Harris (130 Mℓ/day) Water Treatment Plants, are insufficient for all downstream demands. Based on the 2050 demands, the Midmar WTP and D.V Harris WTP will have to be upgraded from 395 Mℓ/day to 421 Mℓ/day and 130 Mℓ/day to 174 Mℓ/day respectively.

As highlighted at the beginning of Chapter 8, the projected demand on the Upper Mgeni System after the implementation of the Umkhomazi Water Project will be 596.72 Mℓ/day. As the Mgeni Water supply system is fully developed (476.2 Mℓ/day), there will be a shortfall of 120.52 Mℓ/day in the system.

The UW 30-year demand on the Mgeni system is as follows:

- ✓ Msunduzi LM – 334.36 Mℓ/day;
- ✓ Umgungundlovu DM – 194.36 Mℓ/day;
- ✓ Ilembe DM - 28 Mℓ/day; and
- ✓ Ethekwini - 40 Mℓ/day (Umbumbulu pipeline only).

It is recommended that a detailed feasibility be undertaken to investigate the possibility of an inter-catchment raw water transfer from the Mkhomazi catchment to the Mgeni catchment to address the projected 2050 water deficit. Possible options to be investigated would include:-

- ✓ The Smithfield Dam to Midmar Dam raw water transfer;
- ✓ Timing of the implementation of the Impendle Dam; and
- ✓ Development of a water source on the upper Mzimkhulu River catchment (New Biggen Dam) for an inter-catchment transfer to the Mkhomazi System to augment this as well as the Upper Mgeni system. The three (3) sites for the proposed New Biggen Dam will require environmental, social and land investigations. As this dam is a long-term option to augment the raw water resources of the Mkhomazi and Upper Mgeni system, Umgeni Water should start the process of addressing the environmental, social and land issues now.

Only then, can the capacities of the Midmar and the D.V Harris Water Treatment Plants as well as infrastructure detailed in this section be upgraded to supply the projected 2050 demands on the Upper Mgeni System.

The Midmar WTP and DV Harris WTP will have to be upgraded from 395 Mℓ/day to 421 Mℓ/day and 110 Mℓ/day to 174 Mℓ/day respectively. (UMDM UAP Phase III study)

N

Lidgetton

Howick

Midmar WTP

375Ml/d

Midmar Dam

Albert Falls Dam

Merrivale

Cedara

uMngeni Local Municipality

uMshwathi Local Municipality

DV Harris WTP

130Ml/d

17kl

PIETERMARITZBURG

PIETERMARITZBURG NU 17

PIETERMARITZBURG NU 18

Pietermaritzburg

EZIBOMVINI 02

MGWAGWA

Henley Dam

MPANDE

KWAMNCANE 03

KWAMNCANE 02

EDENDALE 01

The Msunduzi Local Municipality

Msunduzi

ASHBURTON

Edendale

KWAMNCANE 01

MVUNDLWENI

GEZUBUSO 01

DEDA 04

SONGONGOZA

MUNYWINI

Taylor's Halt

MAHLABATHINI 07

EDENDALE 03

PIETERMARITZBURG NU 06

CAMPERDOWN NU 22

CAMPERDOWN NU 01

UMKONDENI 06

Impendle Local Municipality

MAGELEKEDLE 02

SIMONGOZI

EZIBOMVINI 01

MTHUNJU 03

Mkhambathini Local Municipality

Richmond Local Municipality

Nkosazana Dlamini-Zuma Local Municipality

Comrie Dam

Kilometers

5 2,5 0 5 10

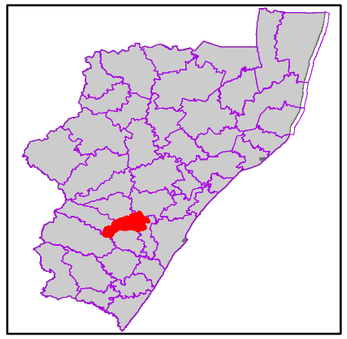
Proposed New / Upgrade Infrastructure

- Pata — Water Scheme Areas & Names
- 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
- 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
- Dams & Dam Names
- Rivers
- Ncxola — Settlements
- Hilton — Major Towns

LOCALITY:



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MUNICIPALITY:

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PROJECT TITLE

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

MAP TITLE:

Total Bulk Water Supply Interventions

The Msunduzi Local Municipality

DATE COMPLETED:

January 2021

MAP NO.:

KZN 225 Figure 9-1

9.1 TM001 WSIA: VULINDLELA SCHEME

9.1.1 Demand Model Intervention

9.1.1.1 Water Demand

The water demand for the Vulindlela Scheme was determined for 2020 and 2050 and included within **Table 9-1** below.

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

Population	**Population 2020**	**Population 2050**
	136 393	199 854
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	23.5	35.2

9.1.1.2 Water Resource Consideration

The Vulindlela Water Supply Scheme is supplied with water off of the Upper Mgeni System from the Midmar WTP through the Howick West and Groenekloof pump stations and reservoirs.

9.1.2 Water Supply Infrastructure

9.1.2.1 Proposed Interventions

The following infrastructure upgrades will be required in order to adequately supply the Vulindlela WSIA and is illustrated within **Figure 9-2** with the schematic layout of the WSIA depicted in **Figure 9-3.**

- ✓ The existing secondary bulk mains that supply the Vulindlela system needs to be upgraded in order to meet the 2050 demand. Secondary pipelines ranging from 110mm ø to 300mm ø are proposed.
- ✓ The current storage capacity will have to be upgraded to 46 Mℓ in order to meet the 2050 demand.

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

9.1.3 Financial Requirements

The bulk cost requirement for the Vulindlela WSIA is summarised within **Table 9-2**.

Table 9-2: TM001 Vulindlela Scheme Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	-	-	-
Secondary	R375 418 269.83	R37 541 826.98	R412 960 096.82
Tertiary	R27 181 536.92	R2 718 153.69	R29 899 690.61
Total	**R402 599 806.76**	**R40 259 980.68**	**R442 859 787.43**

The total bulk cost requirement for the Vulindlela Scheme is R442 859 787.43 (excl VAT). The scheme development cost per household is approximately R 8 900.

N

Midmar Dam

Henley Dam

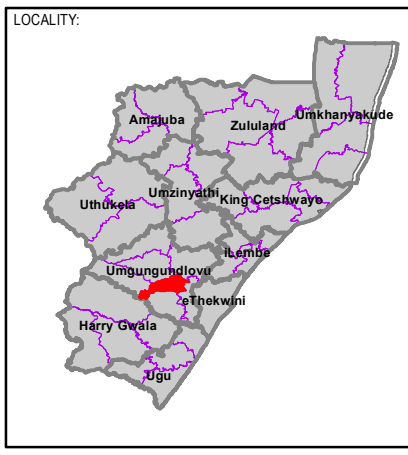
DEDA 04

375Ml/d
WTP
1600
44300kl
1600
800
17300kl
500
450
10000kl
315
315
315
1000kl
315
400
11800kl
450kl
200
2200kl
5000kl
250
300
250
3350kl
300
6400kl
300
5300kl
110
2800kl
110
860kl
250
5050kl
5150kl
200
3100kl
250
150
4700kl
150
140
140
140
2800kl
1000kl

Legend

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

LOCALITY:



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MSUNDUZI

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PROJECT TITLE

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

MAP TITLE:

Total Bulk Water Supply Interventions - TM001: Vulindlela The Msunduzi Local Municipality

DATE COMPLETED:

January 2021

MAP NO.:

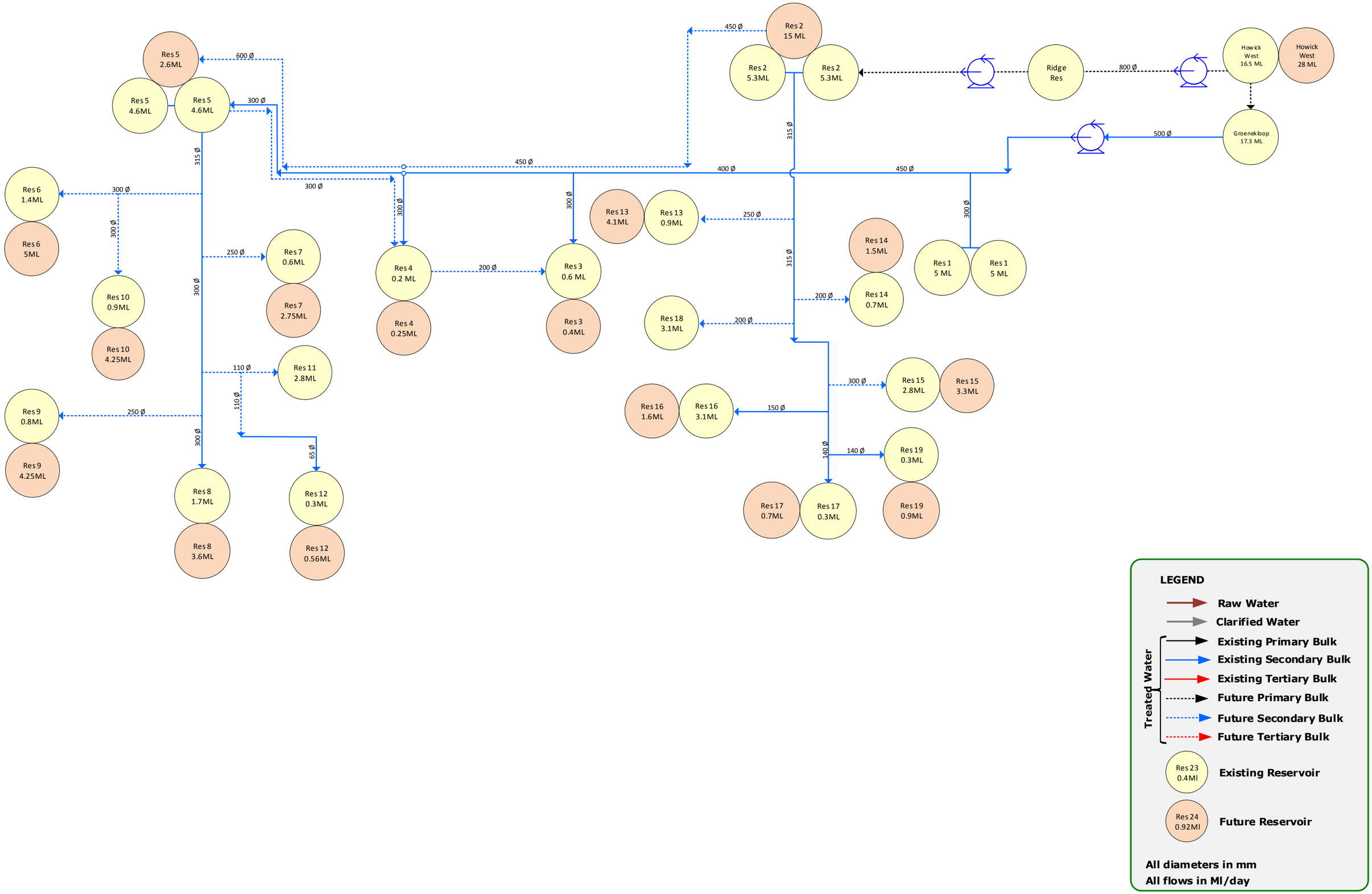
DC 22 Figure 9-2

Proposed New / Upgrade Infrastructure

- Water Scheme Areas & Names (Vulindlela)
- Existing Water Treatment Plants (WTP)
- 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)
- Upgrade of WTW (19Ml/d)
- 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)

2 1 0 2 4 Kilometers

Figure 9-3
TM001 WSIA:VULINDLELA



9.2 TM002 WSIA: NCWADI SCHEME

9.2.1 Demand Model Intervention

9.2.1.1 Water Demand

The water demand for the Ncwadi Scheme was determined for 2020 and 2050 and included within **Table 9-3**.

Table 9-3: Population and Water demand 2020 and 2050 for the Ncwadi WSS WSIA

Population	**Population 2020**	**Population 2050**
	18 853	27 598
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	3.6	5.32

9.2.1.2 Water Resource Consideration

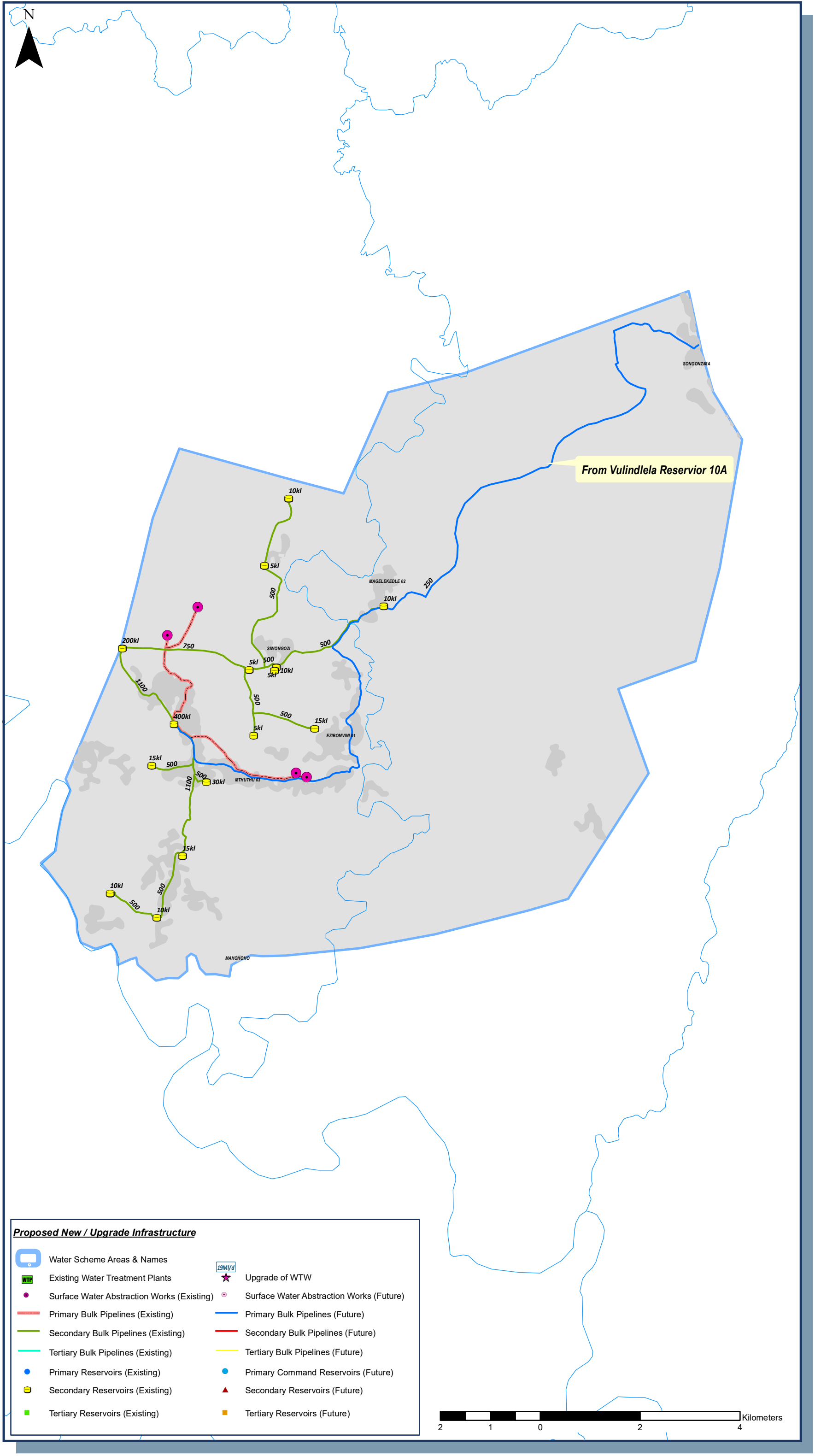
The Ncwadi area is currently supplied via a borehole and spring feeding the 400kℓ Command Reservoir J/1. Water is planned to be supplied from the Vulindlela Reservoir 10A in Ward 7.

9.2.2 Water Supply Infrastructure

9.2.2.1 Proposed Interventions

The Ncwadi WSIA is illustrated within **Figure 9-4** with the schematic layout of the WSIA depicted in **Figure 9-5.**

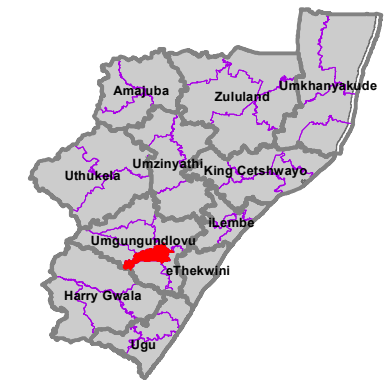
No upgrades or interventions are proposed for the Ncwadi Scheme Area. As per Section 8.2, there are no gaps in supply as the scheme area is adequately covered for the 2050 demand horizon by existing and planned infrastructure.



Legend

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

LOCALITY:



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

MAP TITLE:

Total Bulk Water Supply Interventions - TM002: Ncwadi The Msunduzi Local Municipality

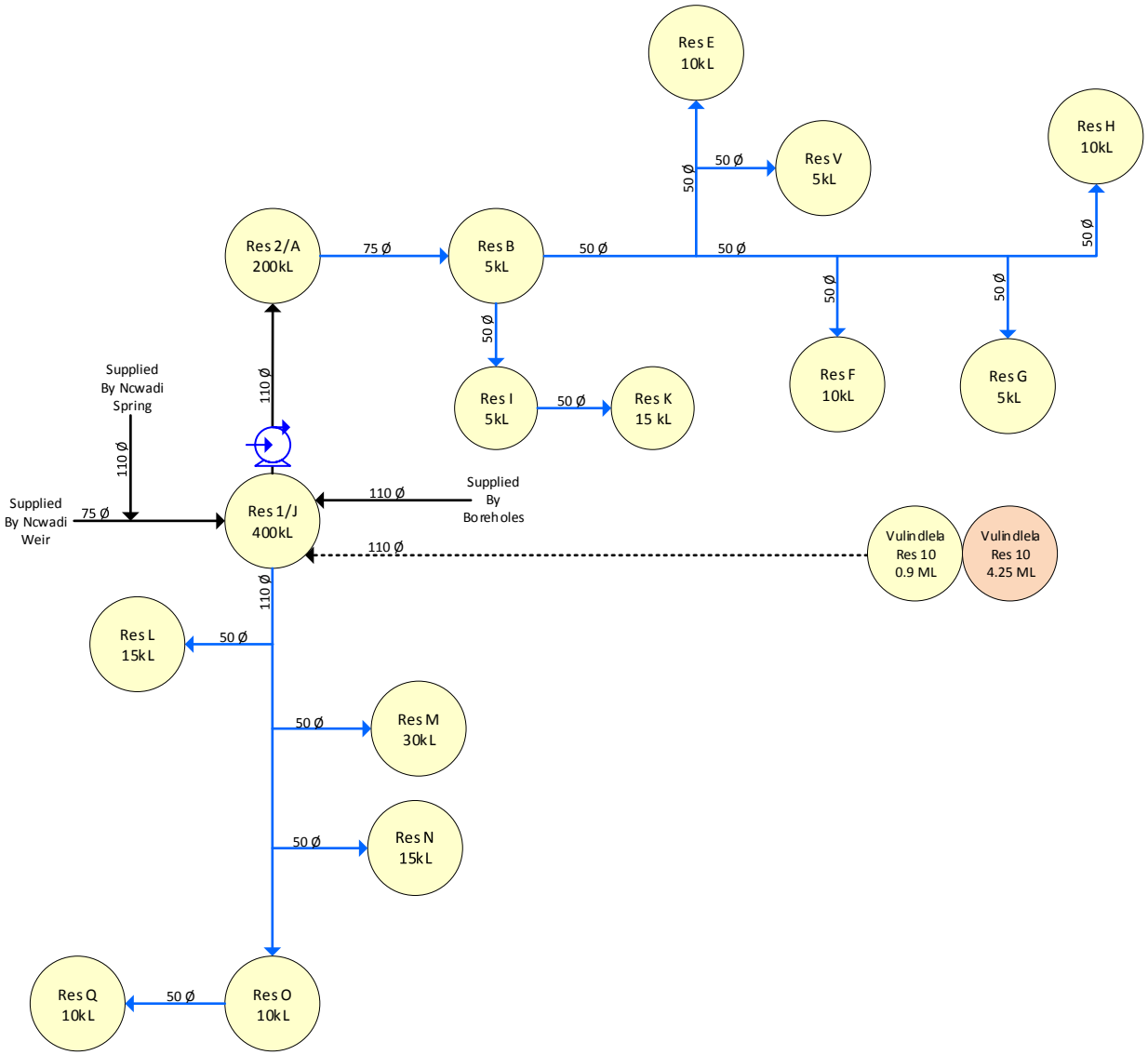
DATE COMPLETED:

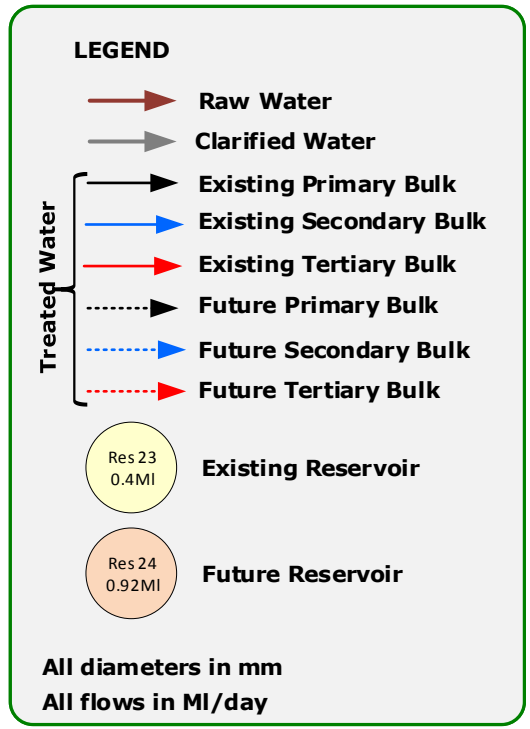
January 2021

MAP NO.:

DC 22 Figure 9-4

Figure 9-5
TMOO2 WSIA: NCWADI SCHEME





9.3 TM003 WSIA: GREATER EDENDALE SCHEME

9.3.1 Demand Model Intervention

9.3.1.1 Water Demand

The water demand for the Greater Edendale Scheme was determined for 2020 and 2050 and included within **Table 9-4**.

Table 9-4: Population and Water demand 2020 and 2050 for the Greater Edendale WSS

Population	**Population 2020**	**Population 2050**
	96 977	142 099
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	23.56	35.4

9.3.1.2 Water Resource Consideration

The Greater Edendale Scheme receives its water from from the Balancing Reservoir via the World's View Reservoir in the Upper Mgeni System.

9.3.2 Water Supply Infrastructure

9.3.2.1 Proposed Interventions

The following infrastructure upgrades will be required in order to adequately supply the Greater Edendale WSIA and is illustrated within **Figure 9-6** with the schematic layout of the WSIA depicted in **Figure 9-7**.

- ✓ The existing primary and secondary bulk mains that supply the Greater Edendale Supply Scheme need to be upgraded in order to meet the 2050 demand. Primary pipelines ranging from 400mm ø to 1 000mm ø and secondary pipelines ranging from 200mm ø to 315mm ø are proposed.
- ✓ The current storage capacity will have to be upgraded to 132 Mℓ in order to meet the 2050 demand.

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

9.3.3 Financial Requirements

The bulk cost requirement for the Greater Edendale WSIA is summarised within **Table 9-5** below.

Table 9-5: TM003 Greater Edendale Scheme Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R99 648 062.21	R9 964 806.22	R109 612 868.43
Secondary	R381 510 815.30	R38 151 081.53	R419 661 896.83
Tertiary	R9 652 067.27	R965 206.73	R10 617 274.00
Total	**R490 810 944.77**	**R49 081 094.48**	**R539 892 039.25**

The total bulk cost requirement for the Greater Edendale Scheme is R539 892 039.25 (excl VAT). The scheme development cost per household is approximately R 11 200.

N

Kilometers
1 0,5 0 1 2

Pietermaritzburg

Supplied by Midmar WTP

1100

Blackridge

57710kl

Henley Dam

Nqabeni

Siyamu

3450kl

250

400

3700kl

200

300

300

13830kl

300

300

5900kl

650

Ashdown

Simeye Waterworks

Umsunduzi

200

Ashdown

Masons_Industrial

800

Imbali

890kl

61kl

150

21720kl

Machibisa

1000

Slang Sprut

EDENDALE 01

Shayamoya

5910kl

650

7740kl

Bisley

The Msunduzi Local Municipality

315

Kwapata

400

Kwapata

Willowfountain

Vulindlela Reservoir 15

5620kl

450

14270kl

14270kl

1860kl

51kl

750

600

Kwapata

Endlovu Ambleton

Vulindlela Reservoir 16

Sinathing

Edendale

160

35000kl

600

Sinathing_GG

Edendale

14450kl

750

450kl

140

Azalea

RR_Tafuleni

6300kl

250

Paramount

19170kl

3500kl

400

EDENDALE 03

350kl

150

Umhlongo

150

8950kl

110

75

31,9kl

Kwaphupha

Terminus

35kl

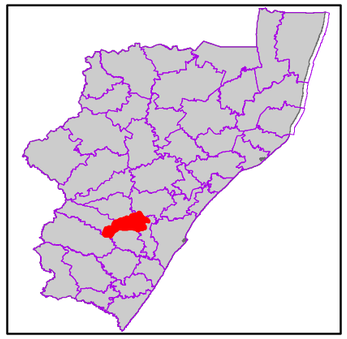
Richmond Local Municipality

Mooi River

Legend

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

LOCALITY:



CLIENT:

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MUNICIPALITY:

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PIETERMARITZBURG MSUNDUZI

THE MSUNDUZI LOCAL MUNICIPALITY

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PROJECT TITLE

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

MAP TITLE: **Total Bulk Water Supply Interventions - TM003: Greater Edendale The Msunduzi Local Municipality**

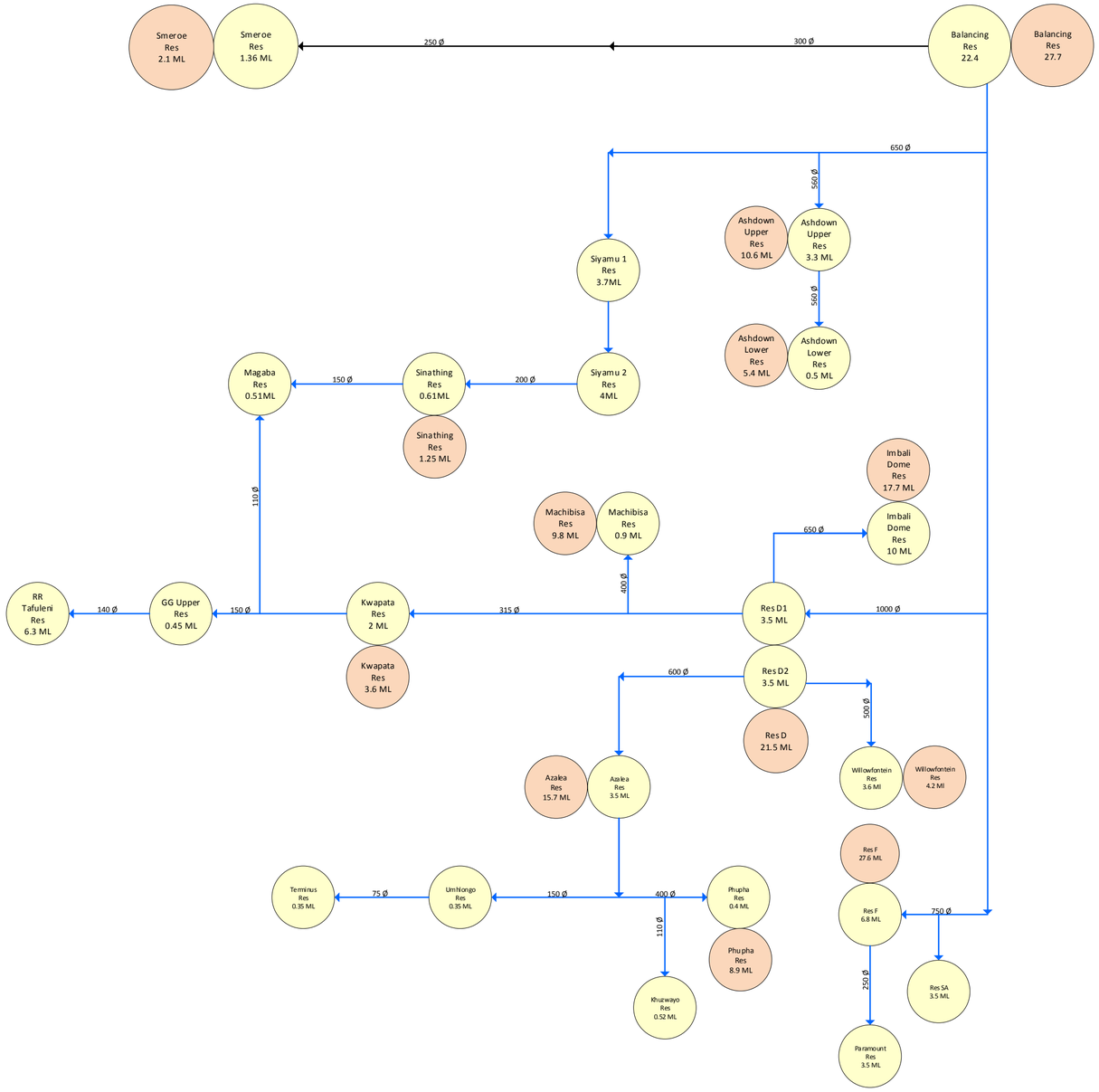
DATE COMPLETED: January 2021

MAP NO.: **DC 22 Figure 9-6**

Proposed New / Upgrade Infrastructure

- Pata — Water Scheme Areas & Names
- 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
- 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 9-7
TM003 WSIA: GREATER EDENDALE



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

9.4 TM004 WSIA: PIETERMARITZBURG SCHEME

9.4.1 Demand Model Intervention

9.4.1.1 Water Demand

The water demand for the Pietermaritzburg Scheme was determined for 2020 and 2050 and included within **Table 9-6** below.

Table 9-6: Population and Water demand 2020 and 2050 for the Pietermaritzburg Scheme

Population	**Population 2020**	**Population 2050**
	298 225	436 987
Water Demand	**Demand 2020 (Mℓ/day)**	**Demand 2050 (Mℓ/day)**
	108.1	160.5

9.4.1.2 Water Resource Consideration

The Pietermaritzburg Scheme receives its water off of the Upper Mgeni System via the Midmar WTP and the DV Harris WTP.

9.4.2 Water Supply Infrastructure

9.4.2.1 Proposed Intervention

The following infrastructure upgrades will be required in order to adequately supply the Pietermaritzburg WSIA and is illustrated within **Figure 9-8** with the schematic layout of the WSIA depicted in **Figure 9-9**.

- ✓ The existing primary and secondary bulk mains that supply the Pietermaritzburg Supply Scheme needs to be upgraded in order to meet the 2050 demand. Primary pipelines ranging from 355mm ø to 1 500mm ø and secondary pipelines ranging from 200mm ø to 250mm ø are proposed.
- ✓ The current storage capacity will have to be upgraded to 177 Mℓ in order to meet the 2050 demand.

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

9.4.3 Financial Requirements

The bulk cost requirement for WSIA is summarised within **Table 9-7** below.

Table 9-7: TM004 Pietermaritzburg Scheme Cost Requirement

	Capital Cost	10% Contingencies	Total Cost (Excl VAT)
Primary	R507 880 885.11	R50 788 088.51	R558 668 973.62
Secondary	R434 269 906.39	R43 426 990.64	R477 696 897.02
Tertiary	R4 452 594.30	R445 259.43	R4 897 853.73
Total	**R946 603 385.79**	**R94 660 338.58**	**R1 041 263 724.37**

The total bulk cost requirement for the Pietermaritzburg Scheme is R1 041 263 724.37 (excl VAT). The scheme development cost per household is approximately R 7 400.

N

Kilometers
2 1 0 2 4

Albert Falls Dam

uMshwathi Local Municipality

uMngeni Local Municipality

The Msunduzi Local Municipality

Mkhambathini Local Municipality

Howick
Midmar WTP 375Ml/d
Midmar Dam
45000kl
1600
27700kl
Merrivale
Cedara
600
Groenekloof
250
500kl
EZIBOMVINI 02
Blackridge
2270kl
EDENDALE 01
Edendale
Henley Dam
DV Harris WTP 130Ml/d
6700kl
1400
Ferncliff
1200
1000
700
Clarendon
80000kl
25000kl
1000kl
1000kl
1000
Symons
30000kl
Symons
PIETERMARITZBURG
1500
Pietermaritzburg
Masons
28900kl
28900kl
1100
14500kl
Oribi
Napierville
50000kl
25000kl
1200
25000kl
Belfort
450
40000kl
Hathorns
20000kl
12000kl
Copesville
1000
PIETERMARITZBURG NU 17
30000kl
Eastwood
PIETERMARITZBURG NU 18
400
Murray Road
20000kl
1100
28100kl
110
Bisley
600
53000kl
NKONDENI 06
Endlovu Ambleton
Ashburton
Msunduzi
ASHBURTON
3300kl
250
Mpushini
CAMPERDOWN NU 01

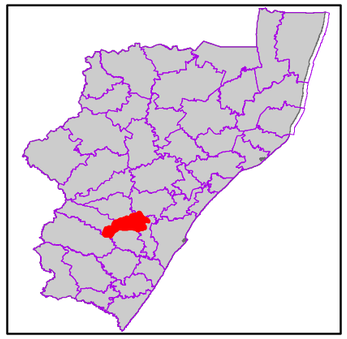
Proposed New / Upgrade Infrastructure

- Pata — Water Scheme Areas & Names
- 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
- 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
- Dams & Dam Names
- Rivers
- Settlements (Ncxola)
- Major Towns (Hilton)

LOCALITY:



CLIENT:

UMGENI WATER • AMANZI

MUNICIPALITY:

CITY OF CHOICE
PIETERMARITZBURG MSUNDUZI

THE MSUNDUZI LOCAL MUNICIPALITY

CONSULTANTS

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PROJECT TITLE

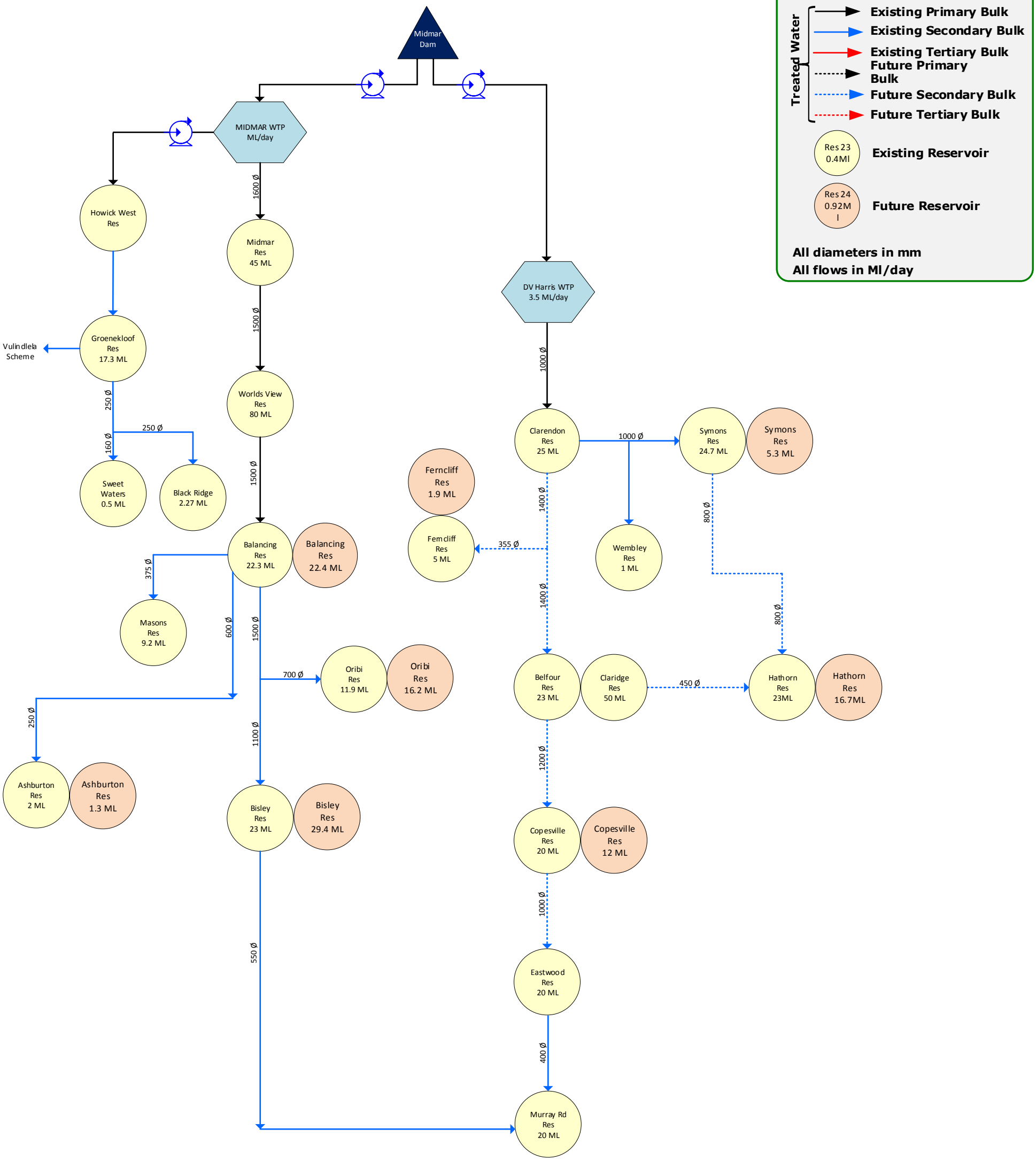
The Msunduzi LM: Universal Access Plan Phase III - Progressive Development of a Regional Concept Secondary Bulk Water Master Plan

MAP TITLE: **Total Bulk Water Supply Interventions - TM004: Pietermaritzburg The Msunduzi Local Municipality**

DATE COMPLETED: January 2021

MAP NO.: **DC 22 Figure 9-8**

Figure 9-9
TM004 WSIA: Pietermaritzburg



10. CONCLUSIONS

10.1 Total Water Demand per Water Supply Intervention Area (WSIA)

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

Table 10-1: Total Water Demand 2050 per WSIA

WSIA	Population 2020	Population 2050	Water Demand 2020 (Mℓ/d)	Water Demand 2050 (Mℓ/d)
Vulindlela Scheme	136 393	199 854	23.50	35.20
Ncwadi Scheme	18 853	27 598	3.60	5.32
Greater Edendale Scheme	96 977	142 099	23.56	35.40
Pietermaritzburg Scheme	298 225	436 987	108.10	160.50

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

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 (Mm^3/a)	Proposed Additional under UAP Phase 3 (Mm^3/a)	Total (Mm^3/a)	Balance (Mm^3/a)
TM001	Vulindlela Scheme	199 854	35.2	12.85	0.00	144.18	144.18	131.33
TM002	Ncwadi Scheme	27 598	5.32	1.94	0.00	0.00	0.00	-1.94
TM003	Greater Edendale Scheme	142 099	35.4	12.92	0.00	47.45	47.45	34.53
TM004	Pietermaritzburg Scheme	436 987	160.5	58.58	0.00	155.13	155.13	96.54
TOTAL		**806 538**	**236.42**	**86.29**	**0.00**	**346.75**	**346.75**	**260.46**

From **Table 10-2** above, it is noted that some of the schemes will not have adequate raw water resources after upgrades/interventions to meet the 2050 demand requirements. The feasibility studies for the proposed resources and, in addition, the implementation of the Vulindlela Scheme should be prioritised.

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 TM001: Vulindlela WSIA

Table 10-3: WSIA Summary for the TM001: Vulindlela WSIA

Vulindlela Scheme						
Item	**Description**					
1	**Infrastructure**			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	**Existing**	WTW	Various	Regional Bulk	0	0
		WTW	Various	Internal Bulk	0	0
		Pump Stations	Various	Regional Bulk	0	0
		Pump Stations	Various	Internal Bulk	0	0
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	0.00
				Secondary Bulk	160 ø mm - 300 ømm	0.00
				Tertiary Bulk	50 ø mm - 110 ømm	0.00
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	0	-
			Supply Reservoirs	Tertiary Bulk	-	-
1.2	**Future**	Bulk Pipelines		Primary Bulk	>350	0
				Secondary Bulk	160 ø mm - 300 ømm	43.2
				Tertiary Bulk	50 ø mm - 110 ømm	2
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	17	400 kl to 20300 kl
			Supply Reservoirs	Tertiary Bulk	-	-
		Pump stations	-	-	-	-

10.3.2 TM003: Greater Edendale WSIA

Table 10-4: WSIA Summary for the TM003: Greater Edendale WSIA

Greater Edendale Scheme						
Item	**Description**					
1	**Infrastructure**			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	**Existing**	WTW	Various	Regional Bulk	0	0
		WTW	Various	Internal Bulk	0	0
		Pump Stations	Various	Regional Bulk	0	0
		Pump Stations	Various	Internal Bulk	0	0
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	0.00
				Secondary Bulk	160 ø mm - 300 ømm	0.00
				Tertiary Bulk	50 ø mm - 110 ømm	0.00
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	-	-
			Supply Reservoirs	Tertiary Bulk	-	-
1.2	**Future**	Bulk Pipelines		Primary Bulk	>350	26.9
				Secondary Bulk	160 ø mm - 300 ømm	8.2
				Tertiary Bulk	50 ø mm - 110 ømm	0
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	12	1200 kl to 31000 kl
			Supply Reservoirs	Tertiary Bulk	-	-
		Pump stations	-	-	-	-

10.3.3 TM004: Pietermaritzburg WSIA

Table 10-5: WSIA Summary for the TM004: Pietermaritzburg WSIA

Pietermaritzburg Scheme						
Item	**Description**					
1	**Infrastructure**			**Class**	**Size / No**	**Capacity (Ml/d or Length or kW)**
1.1	**Existing**	WTW	-	-	-	-
		Pump Stations	-	-	-	-
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	0.00
				Secondary Bulk	160 ø mm - 300 ømm	0.00
				Tertiary Bulk	50 ø mm - 110 ømm	0.00
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	-	-
			Supply Reservoirs	Tertiary Bulk	-	-
1.2	**Future**	Bulk Pipelines		Primary Bulk	>350	37.1
				Secondary Bulk	160 ø mm - 300 ømm	3
				Tertiary Bulk	50 ø mm - 110 ømm	0
		Reservoirs	Command Reservoir	Primary Bulk	-	-
			Command Reservoir	Secondary Bulk	11	1300 kl to 38400 kl
			Supply Reservoirs	Tertiary Bulk	-	-
		Pump stations	-	-	-	-

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 10-6** below. A total estimate of approximately R 1.5 billion is required to address the total bulk water supply requirement by 2050.

Table 10-6: Financial requirements

WSIA	WSIA Name	Total Cost Requirement				
		Primary	Secondary	Tertiary	10% Contingencies	Total Cost (excl VAT)
TM001	Vulindlela Scheme	-	R375 418 269.83	R27 181 536.92	R40 259 980.68	R442 859 787.43
TM002	Ncwadi Scheme	-	-	-	-	-
TM003	Greater Edendale Scheme	R49 081 094.48	R539 892 039.25	R49 081 094.48	R539 892 039.25	R49 081 094.48
TM004	Pietermaritzburg Scheme	R507 880 885.11	R434 269 906.39	R4 452 594.30	R94 660 338.58	R1 041 263 724.37
Total		**R556 961 979.59**	**R1 349 580 215.47**	**R80 715 225.70**	**R674 812 358.51**	**R1 533 204 606.28**

10.5 Funding Options

The TMLM relies mainly on grant funding programmes to fund their water supply projects. These funding programmes are mainly MIG and WSIG. Based on all the current funding streams available to the District Municipality over the MTEF period, it will take a minimum of 30 years for the WSA to address their water supply requirements. Another funding option that the TMLM could consider is loan funding through the Development Bank of Southern Africa (DBSA). Special submissions to National Treasury could also be considered to create an awareness of the LM'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. Although all four (4) area interventions would be an implementation priority for the LM, it is proposed to consider the following three (3) priorities detailed within **Table 10-7**. 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 10-7: Proposed Implementation Order (Phased Approach)

Proposed Priorities (Phased Approach)	WSIA No and Name		Proposed Project Name	Proposed Estimated Project Value
1	Detailed feasibility study of the Mkhomazi to Mgeni inter-catchment raw water transfer as well as the Mzimkhulu to Mkhomazi inter-catchment transfer to augment the 2050 raw water deficit in the Upper Mgeni System.			
2	TM001	Vulindlela Scheme	Primary and secondary reservoirs and pipelines upgrade	R442 859 787.43
3	TM003	Greater Edendale Scheme	Primary and secondary reservoirs and pipelines upgrade	R49 081 094.48
4	TM004	Pietermaritzburg Scheme	Primary and secondary reservoirs and pipelines upgrade	R1 041 263 724.37

11. RECOMMENDATIONS

11.1 Responsibilities

The provision of water services remains the responsibility of the TMLM as the WSA. The TMLM 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 and Umgeni Water could consider this as a Regional Utility to assist the TMLM to take this process further.

11.2 Selection of Solutions

The three (3) proposed water supply intervention areas (WSIA's) are the appropriate solutions for bulk water supply development within TMLM and are as follows:

- ✓ TM001 WSIA: Vulindlela Scheme;
- ✓ TM003 WSIA: Greater Edendale Scheme; and
- ✓ TM004 WSIA: Pietermaritzburg Scheme.

11.3 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.

11.3.1 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.

11.3.2 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.

11.3.3 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 – REFERENCES

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ANNEXURE B – DETAILED PROPOSED WSI INFRASTRUCTURE COMPONENT DETAIL

TM001: Vulindlela Scheme

The total bulk cost requirement for the Vulindlela Scheme is R442 859 787.43 (excl VAT). The scheme development cost per household is approximately R 8 900.

Vulindlela Scheme						
Item	**Description**					
1	**Population**	**Scheme Name**	**Subscheme No**	**Population 2020**	**Population 2050**	
		Vulindlela Scheme	MSD037	2 088	3 060	
			MSD038	2 503	3 667	
			MSD039	9 405	13 782	
			MSD040	6 543	9 587	
			MSD041	12 024	17 619	
			MSD042	10 495	15 379	
			MSD043	9 643	14 129	
			MSD045	2 094	3 069	
			MSD046	10 451	15 314	
			MSD047	11 374	16 666	
			MSD048	10 136	14 852	
			MSD049	924	1 353	
			MSD050	4 691	6 874	
			MSD051	18 653	27 332	
			MSD052	10 828	15 866	
			MSD053	8 887	13 022	
			MSD054	5 654	8 284	
		Total		**136 392**	**199 854**	
2	**Demand**	**Scheme Name**	**Subscheme No**	**Demand 2020**	**Demand 2050**	
		Vulindlela Scheme	MSD037	0.34	0.50	
			MSD038	0.40	0.60	
			MSD039	1.55	2.33	
			MSD040	1.11	1.66	
			MSD041	2.12	3.18	
			MSD042	1.68	2.51	
			MSD043	1.76	2.65	
			MSD045	0.33	0.50	
			MSD046	1.71	2.57	

			MSD047	2.10	3.16	
			MSD048	1.65	2.47	
			MSD049	0.15	0.22	
			MSD050	0.76	1.14	
			MSD051	3.34	5.01	
			MSD052	2.02	3.03	
			MSD053	1.56	2.35	
			MSD054	0.92	1.38	
		Total		**23.51**	**35.27**	
3	**Water Resource**	**Dams**	**HFY (Mm3/a)**	**HFY (Ml/d)**	**Comments**	
		Midmar Dam	173.38	475	Water is sourced from the Midmar Dam	
4	**Infrastructure**		**WTW Name**	**Class**	**Scheme Number**	**Capacity (Ml/d or Length or kW)**
4.1	**Existing**	**WTW**	-	-	-	-
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	0.00
				Secondary Bulk	160 ø mm - 300 ømm	0.00
				Tertiary Bulk	50 ø mm - 110 ømm	0.00
		Pump stations	-	-	-	-
		Reservoirs	-	-	-	-
4.2	**Future**	Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	0
				Secondary Bulk	160 ø mm - 300 ømm	43.2
				Tertiary Bulk	50 ø mm - 110 ømm	2
		Reservoirs	Reservoir	Secondary Bulk	1	20300
			Reservoir	Secondary Bulk	1	11800
			Reservoir	Secondary Bulk	1	6400
			Reservoir	Secondary Bulk	1	6100
			Reservoir	Secondary Bulk	1	5300
			Reservoir	Secondary Bulk	1	5100
			Reservoir	Secondary Bulk	1	5000
			Reservoir	Secondary Bulk	1	4900
			Reservoir	Secondary Bulk	1	4700
			Reservoir	Secondary Bulk	1	3300
			Reservoir	Secondary Bulk	1	2800
			Reservoir	Secondary Bulk	1	2300
			Reservoir	Secondary Bulk	1	1200

			Reservoir	Secondary Bulk	2	1000
			Reservoir	Secondary Bulk	1	900
			Reservoir	Secondary Bulk	1	400
		Pump stations	-	-	-	-
5	**Cost Requirement**		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary Bulk	**R0.00**	**R0.00**	**R0.00**	
		Secondary Bulk	R375 418 269.83	**R37 541 826.98**	**R412 960 096.82**	
		Tertiary Bulk	R27 181 536.92	**R2 718 153.69**	**R29 899 690.61**	
		Total	**R402 599 806.76**	**R40 259 980.68**	**R442 859 787.43**	

TM003: Greater Edendale Scheme

The total bulk cost requirement for the Greater Edendale Scheme is R539 892 039.25 (excl VAT). The scheme development cost per household is approximately R 11 200.

Greater Edendale Scheme						
Item	**Description**					
1	**Population**	**Scheme Name**	**Subscheme No**	**Population 2020**	**Population 2050**	
		Greater Edendale Scheme	MSD019	30 121	44 136	
			MSD017	8 871	12 998	
			MSD022	15 229	22 315	
			MSD024	3 045	4 461	
			MSD020	8 508	12 466	
			MSD028	1 722	2 524	
			MSD030	3 021	4 427	
			MSD031	5 401	7 913	
			MSD032	3 042	4 458	
			MSD035	5 271	7 723	
			MSD036	8 361	12 251	
			MSD044	16 548	24 247	
			MSD055	23 267	34 093	
		Total		**132 406**	**194 012**	
2	**Demand**	**Scheme Name**	**Subscheme No**	**Demand 2020**	**Demand 2050**	
		Greater Edendale Scheme	MSD019	9.30	13.86	
			MSD017	1.96	2.96	
			MSD022	3.51	5.32	
			MSD024	0.61	0.91	
			MSD020	1.78	2.68	
			MSD028	0.35	0.53	
			MSD030	0.62	0.93	
			MSD031	1.12	1.69	
			MSD032	0.65	0.97	
			MSD035	1.14	1.73	
			MSD036	2.59	3.87	
			MSD044	2.98	4.47	
			MSD055	5.66	8.47	

		Total		**32.27**	**48.38**	
3	**Water Resource**	**Dams**	**HFY (Mm3/a)**	**HFY (Ml/d)**	**Comments**	
		Midmar Dam	173.38	475	Water is sourced from the Midmar Dam	
4	**Infrastructure**		**WTW Name**	**Class**	**Scheme Number**	**Capacity (Ml/d or Length or kW)**
4.1	**Existing**	**WTW**	-	-	-	-
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	0.00
				Secondary Bulk	160 ø mm - 300 ømm	0.00
				Tertiary Bulk	50 ø mm - 110 ømm	0.00
		Pump stations	-	-	-	-
		Reservoirs	-	-	-	-
4.2	**Future**	Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	26.9
				Secondary Bulk	160 ø mm - 300 ømm	8.2
				Tertiary Bulk	50 ø mm - 110 ømm	0
		Reservoirs	Reservoir	Secondary Bulk	1	31000
			Reservoir	Secondary Bulk	1	21500
			Reservoir	Secondary Bulk	1	17700
			Reservoir	Secondary Bulk	1	15700
			Reservoir	Secondary Bulk	1	10600
			Reservoir	Secondary Bulk	1	9700
			Reservoir	Secondary Bulk	1	8900
			Reservoir	Secondary Bulk	1	5400
			Reservoir	Secondary Bulk	1	4200
			Reservoir	Secondary Bulk	1	3600
			Reservoir	Secondary Bulk	1	2100
			Reservoir	Secondary Bulk	1	1200
		Pump stations	-	-	-	-
5	**Cost Requirement**		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary Bulk	**R99 648 062.21**	**R9 964 806.22**	**R109 612 868.43**	
		Secondary Bulk	R381 510 815.30	**R38 151 081.53**	**R419 661 896.83**	
		Tertiary Bulk	R9 652 067.27	**R965 206.73**	**R10 617 274.00**	
		Total	**R490 810 944.77**	**R49 081 094.48**	**R539 892 039.25**	

TM004: Pietermaritzburg Scheme

The total bulk cost requirement for the Pietermaritzburg Scheme is R1 041 263 724.37 (excl VAT). The scheme development cost per household is approximately R 7 400.

Pietermaritzburg Scheme						
Item	**Description**					
1	**Population**	**Scheme Name**	**Subscheme No**	**Population 2020**	**Population 2050**	
		Pietermaritzburg Scheme	MSD001	2 714	3 977	
			MSD002	21 262	31 155	
			MSD016	25 174	36 887	
			MSD004	33 482	49 061	
			MSD005	34 441	50 466	
			MSD006	3 728	5 463	
			MSD007	5 533	8 107	
			MSD008	37 662	55 186	
			MSD009	45 005	65 945	
			MSD010	4 536	6 646	
			MSD012	35 476	51 983	
			MSD013	13 340	19 548	
			MSD014	11 295	16 551	
			MSD015	21 848	32 014	
			MSD021	3 730	5 465	
			MSD023	9 798	14 357	
			MSD027	41 839	61 306	
			MSD029	2 021	2 961	
			MSD033	1 221	1 789	
			MSD056	30 756	45 066	
		Total		**384 861**	**563 932**	
2	**Demand**	**Scheme Name**	**Subscheme No**	**Demand 2020**	**Demand 2050**	
		Pietermaritzburg Scheme	MSD001	1.12	1.65	
			MSD002	8.45	12.49	
			MSD016	10.10	14.96	
			MSD004	13.09	19.40	
			MSD005	15.36	22.68	
			MSD006	1.62	2.39	

			MSD007	2.87	4.22	
			MSD008	11.03	16.53	
			MSD009	13.91	20.72	
			MSD010	2.34	3.44	
			MSD012	13.36	19.84	
			MSD013	4.86	7.23	
			MSD014	5.35	7.88	
			MSD015	9.50	14.05	
			MSD021	0.61	0.92	
			MSD023	2.12	3.20	
			MSD027	11.20	16.72	
			MSD029	0.46	0.70	
			MSD033	0.22	0.33	
			MSD034	0.00	0.00	
			MSD056	6.42	9.63	
		Total		**133.99**	**198.99**	
3	**Water Resource**	**Dams**	**HFY (Mm3/a)**	**HFY (Ml/d)**	**Comments**	
		Midmar Dam	173.38	475	Water is sourced from the Midmar Dam	
4	**Infrastructure**		**WTW Name**	**Class**	**Scheme Number**	**Capacity (Ml/d or Length or kW)**
4.1	**Existing**	**WTW**				
		Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	0.00
				Secondary Bulk	160 ø mm - 300 ømm	0.00
				Tertiary Bulk	50 ø mm - 110 ømm	0.00
		Pump stations				
		Reservoirs				
4.2	**Future**	Bulk Pipelines	uPVC, Steel, HDPE, AC	Primary Bulk	>350	37.1
				Secondary Bulk	160 ø mm - 300 ømm	3
				Tertiary Bulk	50 ø mm - 110 ømm	0
		Reservoirs	Reservoir	Secondary Bulk	1	38400
			Reservoir	Secondary Bulk	1	29400
			Reservoir	Secondary Bulk	1	27700
			Reservoir	Secondary Bulk	1	21400
			Reservoir	Secondary Bulk	1	16700
			Reservoir	Secondary Bulk	1	16200

			Reservoir	Secondary Bulk	1	13100
			Reservoir	Secondary Bulk	1	5300
			Reservoir	Secondary Bulk	1	5200
			Reservoir	Secondary Bulk	1	1900
			Reservoir	Secondary Bulk	1	1300
			Reservoir	Secondary Bulk	0	0
			Reservoir	Secondary Bulk	0	0
			Reservoir	Secondary Bulk	0	0
			Reservoir	Secondary Bulk	0	0
			Reservoir	Secondary Bulk	0	650
			Reservoir	Secondary Bulk	0	550
			Reservoir	Secondary Bulk	0	500
			Reservoir	Secondary Bulk	0	450
			Reservoir	Secondary Bulk	0	250
			Reservoir	Secondary Bulk	0	200
		Pump stations	-	-	-	-
5	**Cost Requirement**		**Capital Cost**	**10% Contingencies**	**Total Cost (Excl VAT)**	
		Primary Bulk	**R507 880 885.11**	**R50 788 088.51**	**R558 668 973.62**	
		Secondary Bulk	R434 269 906.39	**R43 426 990.64**	**R477 696 897.02**	
		Tertiary Bulk	R4 452 594.30	**R445 259.43**	**R4 897 853.73**	
		Total	**R946 603 385.79**	**R94 660 338.58**	**R1 041 263 724.37**	