Infrastructure Master Plan 2023
2023/2024 – 2053/2054
Volume 5:
North Coast System

UMGENI
WATER · AMANZI



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Umgeni Water

Infrastructure Master Plan 2023

2023/2024 – 2053/2054

June 2023

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PREFACE

This Infrastructure Master Plan 2023 describes:

- Umgeni Water's infrastructure plans for the financial period 2023/2024 – 2053/2054, and
- Infrastructure master plans for other areas outside of Umgeni Water's Operating Area but within KwaZulu-Natal.

It is a comprehensive technical report that provides information on current infrastructure and on future infrastructure development plans. This report replaces the last comprehensive Infrastructure Master Plan that was compiled in 2022.

The report is divided into **ten** volumes as per the organogram below.

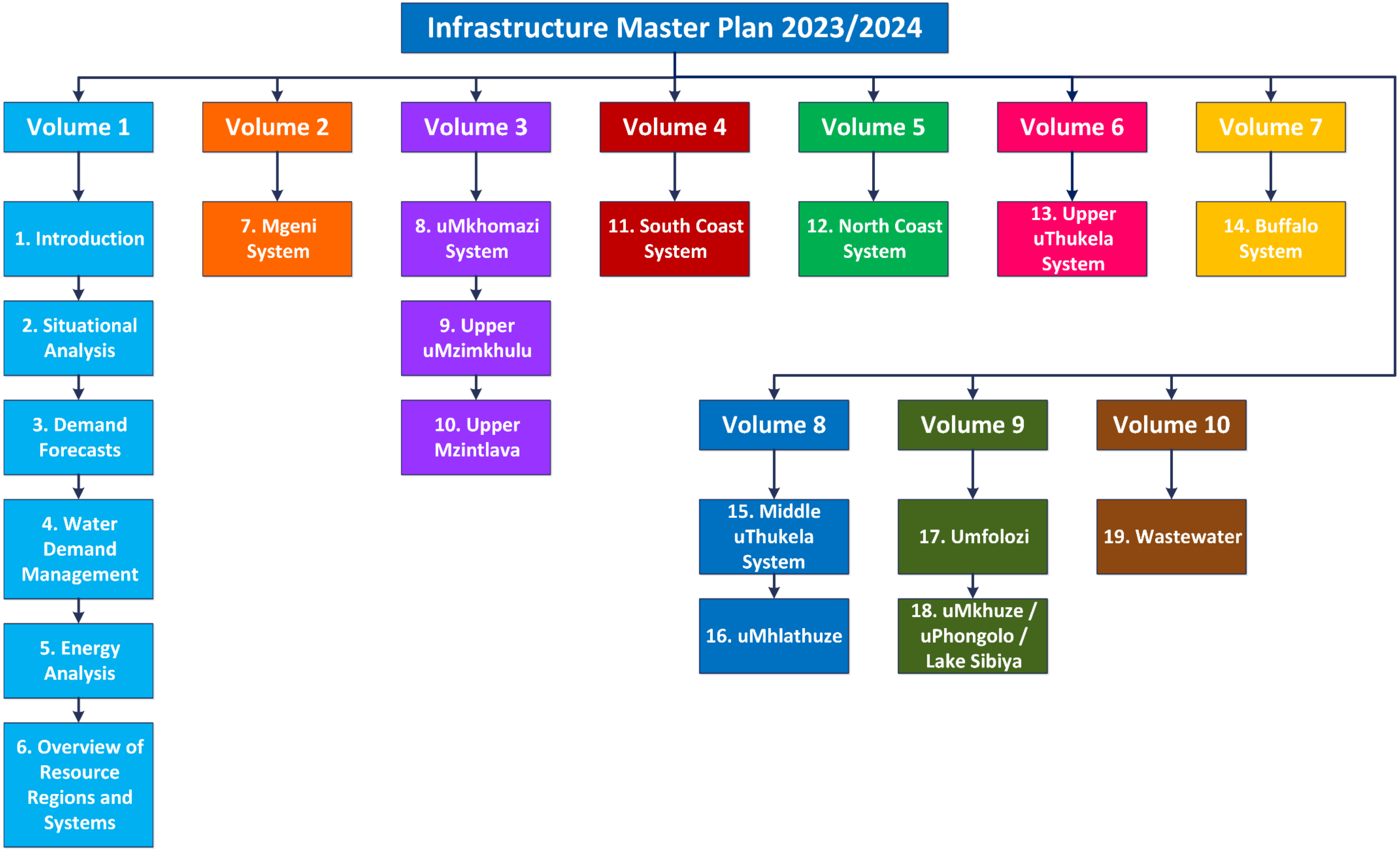
Volume 1 includes the following sections and a description of each is provided below:

- **Section 2** describes the most recent changes and trends within the primary environmental dictates that influence development plans within the province.
- **Section 3** relates only to the Umgeni Water Operational Areas and provides a review of historic water sales against past projections, as well as Umgeni Water's most recent water demand projections, compiled at the end of 2021.
- **Section 4** describes Water Demand Management initiatives that are being undertaken by the utility and the status of Water Demand Management Issues in KwaZulul-Natal.
- **Section 5**, which also relates to Umgeni Water's Operational Area, contains a high level review of the energy consumption used to produce the water volumes analysed in **Section 3**.
- **Section 6** provides an overview of the water resource regions and systems supplied within these regions.

The next eight volumes describe the current water resource situation and water supply infrastructure of the various systems in KwaZulu-Natal, including:

•	**Volume 2**	**Section 7**	Mgeni System.
•	**Volume 3**	**Section 8**	uMkhomazi System
		Section 9	uMzimkhulu System
		Section 10	Mzintlava System
•	**Volume 4**-	**Section 11**	South Coast System
•	**Volume 5**	**Section 12**	North Coast System
•	**Volume 6**	**Section 13**	Upper uThukela System
•	**Volume 7**	**Section 14**	Buffalo System
•	**Volume 8**	**Section 15**	Middle uThukela System
		Section 16	Mhlathuze System
•	**Volume 9**	**Section 17**	Umfolozi System
		Section 18	uMkhuze / uPhongolo / Lake Sibiya System

Volume 10, Section 19 describes the wastewater works currently operated by Umgeni Water (shown in pale brown in the adjacent figure) and provides plans for development of additional wastewater treatment facilities. The status of wastewater treatment in WSA's that are not supplied by Umgeni Water are also described in this section.



Infrastructure Master Plan 2023/2024
Volume 1
Volume 2
Volume 3
Volume 4
Volume 5
Volume 6
Volume 7
1. Introduction
2. Situational Analysis
3. Demand Forecasts
4. Water Demand Management
5. Energy Analysis
6. Overview of Resource Regions and Systems
7. Mgeni System
8. uMkhomazi System
9. Upper uMzimkhulu
10. Upper Mzintlava
11. South Coast System
12. North Coast System
13. Upper uThukela System
14. Buffalo System
Volume 8
Volume 9
Volume 10
15. Middle uThukela System
16. uMhlathuze
17. Umfolozi
18. uMkhuze / uPhongolo / Lake Sibiya
19. Wastewater

It is important to note that information presented in this report is in a summarised form and it is recommended that the reader refer to relevant planning reports if more detail is sought. Since the primary focus of this Infrastructure Master Plan is on bulk supply networks, the water resource infrastructure development plans are not discussed at length. The Department of Water and Sanitation (DWS), as the responsible authority, has undertaken the regional water resource development investigations. All of these investigations have been conducted in close collaboration with Umgeni Water and other major stakeholders in order to ensure that integrated planning occurs. Details on these projects can be obtained directly from DWS, Directorate: Options Analysis (East).

The Infrastructure Master Plan is a dynamic and evolving document. Outputs from current planning studies, and comments received on this document will therefore be taken into account in the preparation of the next update.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AADD	Annual Average Daily Demand
AC	Asbestos Cement
ADWF	Average Dry Weather Flow
API	Antecedent Precipitation Index
AVGF	Autonomous Valveless Gravity Filter
BID	Background Information Document
BPT	Break Pressure Tank
BWL	Bottom Water Level
BWSP	Bulk Water Services Provider
BWSS	Bulk Water Supply Scheme
CAPEX	Capital Expenditure
CMA	Catchment Management Agency
CoGTA	Department of Co-operative Governance and Traditional Affairs
CWSS	Community Water Supply and Sanitation project
DAEA	Department of Agriculture and Environmental Affairs
DEA	Department of Environmental Affairs
DEFF	Department of Environment, Forestry and Fisheries
DM	District Municipality
DRDLR	Department of Rural Development and Land Reform
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DWAF	Department of Water Affairs and Forestry
EFR	Estuarine Flow Requirements
EIA	Environmental Impact Assessment
EKZN Wildlife	Ezemvelo KZN Wildlife
EMP	Environmental Management Plan
EWS	eThekwini Water Services
EXCO	Executive Committee
FC	Fibre Cement
FL	Floor level
FSL	Full Supply level
GCM	General Circulation Model
GDP	Gross Domestic Product
GDPR	Gross Domestic Product of Region
GVA	Gross Value Added
HDI	Human Development Index
IDP	Integrated Development Plan
IFR	In-stream Flow Requirements
IMP	Infrastructure Master Plan
IRP	Integrated Resource Plan

ISP	Internal Strategic Perspective
IWRM	Integrated Water Resources Management
KZN	KwaZulu-Natal
LM	Local Municipality
LUMS	Land Use Management System
MA	Moving Average
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MBR	Membrane Bioreactor
MMTS	Mooi-Mgeni Transfer Scheme
MMTS-1	Mooi-Mgeni Transfer Scheme Phase 1
MMTS-2	Mooi-Mgeni Transfer Scheme Phase 2
mPVC	Modified Polyvinyl Chloride
MTEF	Medium-Term Expenditure Framework
MTSF	Medium-Term Strategic Framework
MWP	Mkomazi Water Project
MWP-1	Mkomazi Water Project Phase 1
NCP-1	North Coast Pipeline I
NCP-2	North Coast Pipeline II
NCSS	North Coast Supply System
NGS	Natal Group Sandstone
NPV	Net Present Value
NRW	Non-Revenue Water
NSDP	National Spatial Development Perspective
NWSP	National Water Sector Plan
OPEX	Operating Expenditure
p.a.	Per annum
PES	Present Ecological Status
PEST	Political, Economical, Sociological and Technological
PGDS	Provincial Growth and Development Strategy
PPDC	Provincial Planning and Development Commission (KZN's)
PSEDS	Provincial Spatial Economic Development Strategy
PWSP	Provincial Water Sector Plan
RDP	Reconstruction and Development Programme
RO	Reverse Osmosis
ROD	Record of Decision
RQO	Resource Quality Objective
SCA	South Coast Augmentation
SCP	South Coast Pipeline
SCP-1	South Coast Pipeline Phase 1
SCP-2a	South Coast Pipeline Phase 2a
SCP-2b	South Coast Pipeline Phase 2b

SDF	Spatial Development Framework
SHR	St Helen's Rock (near Port Shepstone)
STEEPLE	Social/demographic, Technological, Economic, Environmental (Natural), Political, Legal and Ethical
SWRO	Seawater Reverse Osmosis
TEC	Target Ecological Category
TWL	Top Water Level
uPVC	Unplasticised Polyvinyl Chloride
UW	Umgeni Water
WA	Western Aqueduct
WC	Water Conservation
WDM	Water Demand Management
WMA	Water Management Area
WRC	Water Research Commission
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSNIS	Water Services National Information System
WSP	Water Services Provider
WTP	Water Treatment Plant
WWW	Wastewater Works

Spellings of toponyms have been obtained from the Department of Arts and Culture (DAC). DAC provides the official spelling of place names and the spellings, together with the relevant gazette numbers, can be accessed at http://www.dac.gov.za/content/toponymic-guidelines-map-and-other-editors.

When using any part of this report as a reference, please cite as follows:

Umgeni Water, 2023. *Umgeni Water Infrastructure Master Plan 2023/2024 – 2053/54, Vol 1 - 10*. Prepared by Planning Services, June 2023.

LIST OF UNITS

Length/Distance:	mm	millimetre
	m	metre
	km	kilometre
Area:	m^2	square metres
	ha	hectare
	km^2	square kilometres
Level/Altitude:	mASL	metres above sea-level
Time:	s	second
	min	minute
	hr	hour
Volume:	m^3	cubic metres
	Mℓ	megalitre
	million m^3	million cubic metres
	mcm	million cubic metres
Water Use/Consumption/Treatment/Yield:	ℓ/c/day	litre per capita per day
	kℓ/day	kilolitre per day
	Mℓ/day	megalitre per day
	million m^3/annum	million cubic metres per annum
	kg/hr	kilograms per hour
Flow velocity/speed:	m/s	metres per second
Flow:	m^3/s	cubic metres per second
	ℓ/hr	litres per hour
	m^3/hr	cubic metres per hour

12. NORTH COAST SYSTEM

12.1 Synopsis of North Coast System

The North Coast System comprises of the Maphumulo System, Mdloti System and the Lower Thukela System (**Figure 12.1)**. The Mdloti and Lower Thukela Systems have been integrated to allow for water resource interdependencies and infrastructure integration that is required to supply bulk potable water along the coastal strip of the North Coast Region. As shown in **Figure 12.1**, it includes the Lower Thukela Water Resource Region (V5 catchment), the Mvoti Water Resource Region (Nonoti River catchment (U5) and the lower Mvoti River Catchment (U4)) and part of the Mdloti Water Resource Region (U3 catchment).

The bulk supply infrastructure along the coastal strip is known as the North Coast Supply System (NCSS), and currently comprises two bulk supply systems, viz:

- The Mdloti Supply System serving Phoenix, Verulam and La Mercy in northern eThekwini, a portion of rural Ndwedwe Local Municipality and the coastal towns along the Dolphin Coast; and
- The Lower Thukela Supply System serving the towns of Darnall, Zinkwazi, Blythedale and KwaDukuza, low cost housing areas of Etete and Groutville as well as other residential and rural developments between the uThukela River and Shakaskraal.

In addition to this bulk system, Umgeni Water implemented the Maphumulo Bulk Water Supply Scheme (**Figure 12.1**) in May 2013 to alleviate supply deficiencies of borehole schemes in the Maphumulo Local Municipality.

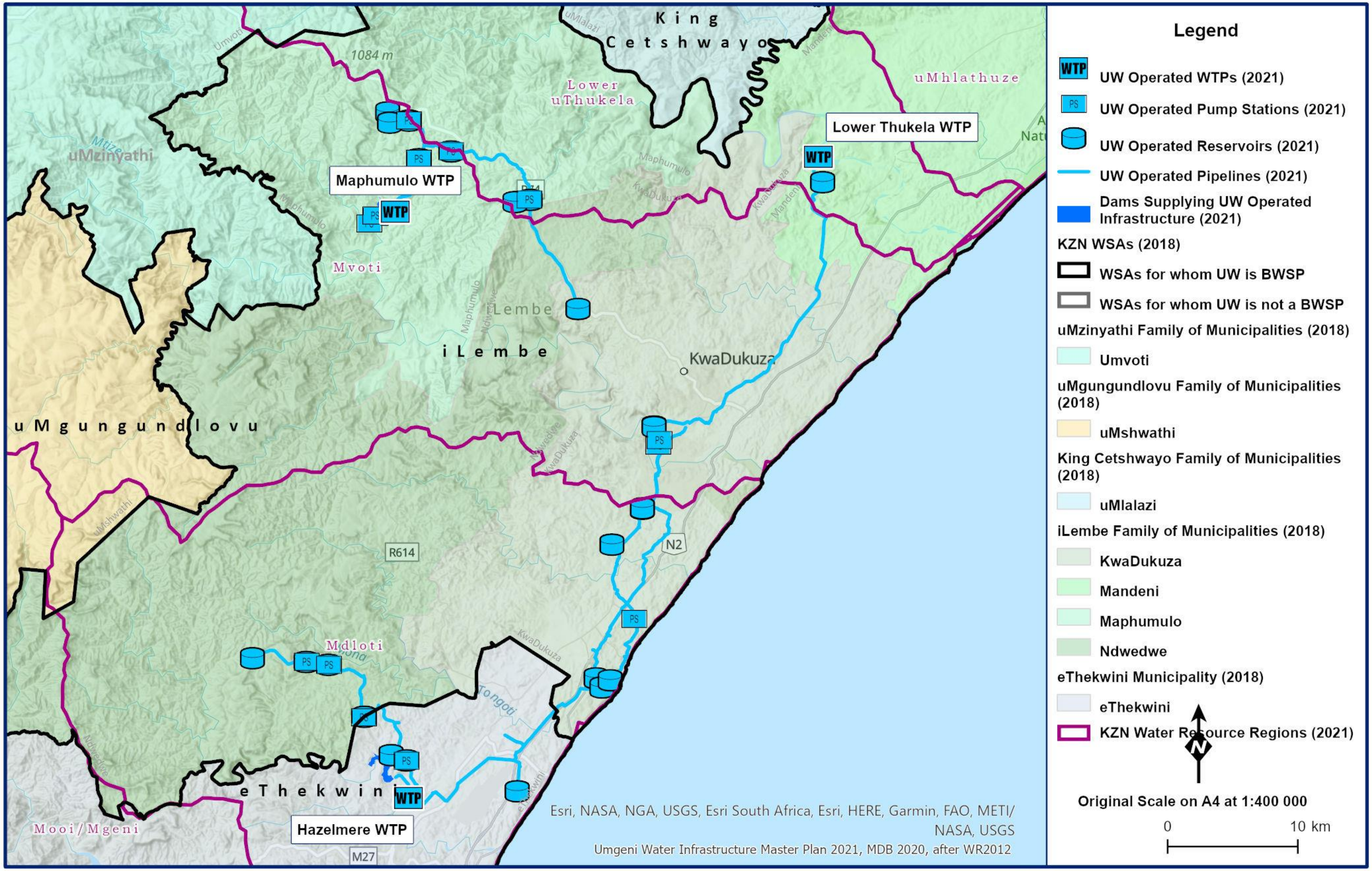


Figure 12.1 General layout of the North Coast Supply System.

12.2 Water Resources of the North Coast System

12.2.1 Description of the North Coast System Water Resource Regions

(a) Lower Thukela Region

(i) Overview

The Lower uThukela region (**Figure 12.2**) comprises the lower portion of the uThukela River, one of the largest rivers within the country. The water resources of the uThukela River have been allocated to:

- users within the uThukela basin itself,
- to inter-basin transfers to the Vaal, and
- to the Mhlathuze Catchment.

This region consists of the tertiary catchments V40 and V50, and quaternary catchments V33C, V33D and V60K, and includes the town of Mandini and the Isithebe industrial area.

(ii) Surface Water

The hydrological characteristics for this region are summarised in **Table 12.1**.

Table 12.1 Hydrological characteristics of the Lower uThukela Region (WR2012).

Region	River (Catchment)	Area (km^2)	Annual Average			
			Evaporation (mm)	Rainfall (mm)	Natural Runoff (million m^3/annum)	Natural Runoff (mm)
Lower uThukela (V50)	uThukela River (lower portion)	1 349	1 340	848	434	104

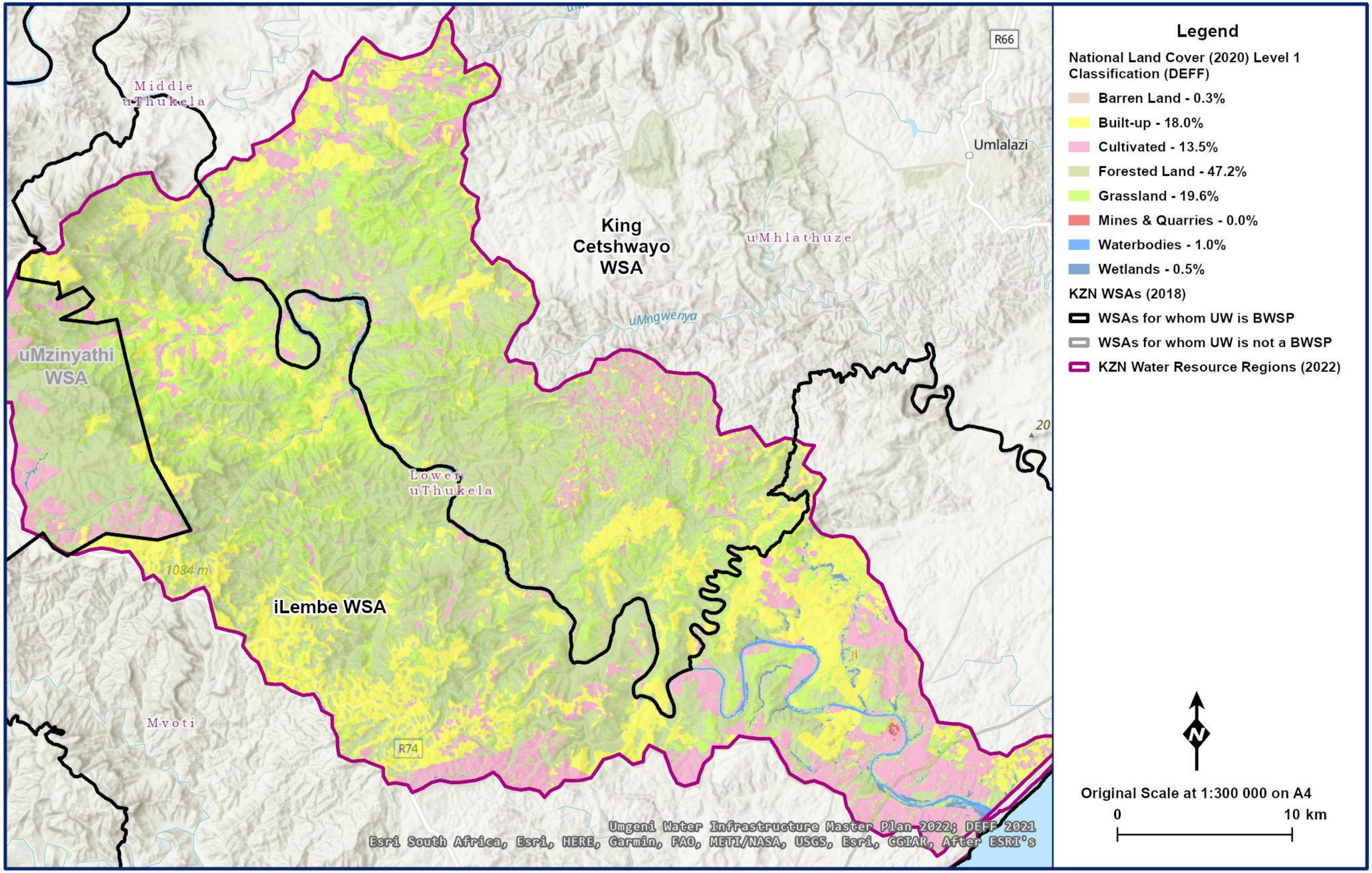


Figure 12.2 General layout of the Lower uThukela Region (DEFF 2020; MDB 2020; Umgeni Water 2022; WR2012).

(iii) Groundwater

The Lower uThukela region is located in the KwaZulu-Natal Coastal Foreland Groundwater Region (**Section 2 in Volume 1**). This Groundwater Region is characterised by fractured aquifers which are formed by predominantly arenaceous rocks consisting of sandstone and diamictite (Dwyka tillite).

- **Hydrogeological Units**

The area is entirely underlain by hard rocks (Granites) of the Basement Complex and compacted sedimentary strata of the Natal Group Sandstone (NGS) and Karoo Supergroup.

- **Geohydrology**

Eighty-nine per cent of all reported borehole yields are less than 3 ℓ/s, confirming that overall the groundwater resources are moderately poor to marginal.

- **Groundwater Potential**

The development potential in the area (**Figure 12.3**) can be classified as moderate, where resources are, on average, suitable for development of small reticulation schemes for small villages, schools, clinics and hospitals. Recharge calculations indicate the potential groundwater resources are underutilised: less than 25% of potentially available groundwater is presently used.

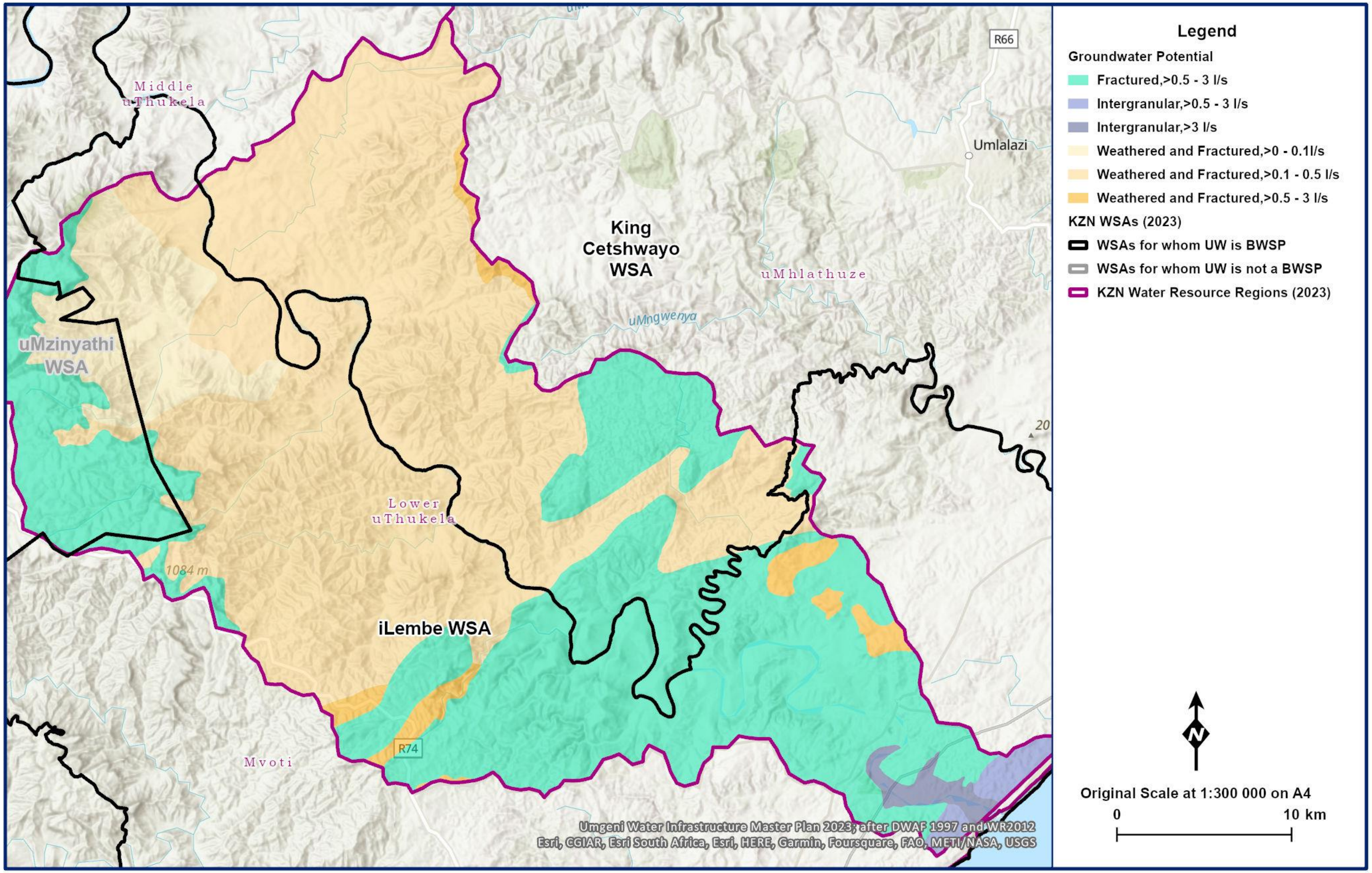
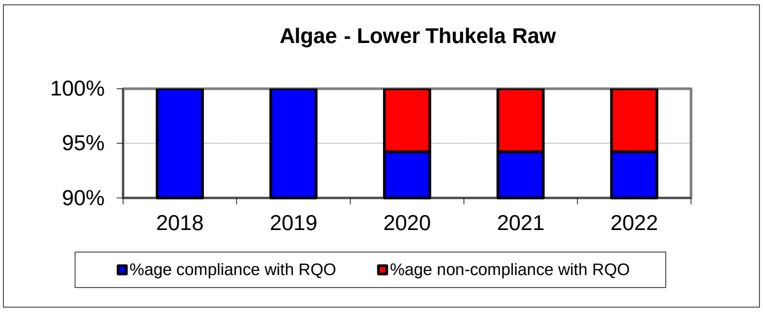


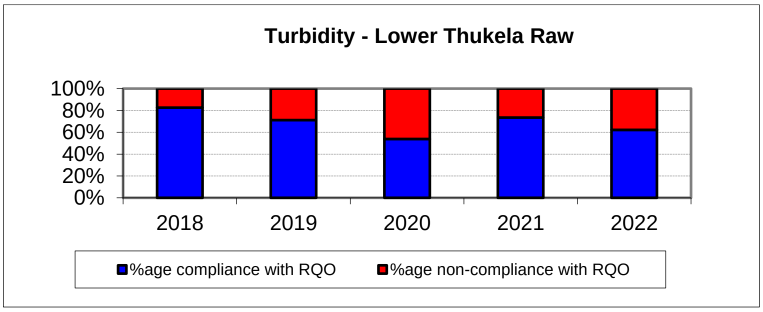
Figure 12.3 Groundwater potential in the uThukela Region (MDB 2018; Umgeni Water 2022; after DWAF 1997 and WR2012).

(iv) Water Quality

- ### Surface Water

The recorded elevated turbidity (**Figure 12.4**) results are due to erosion challenges experienced in the catchment. The elevated *E. coli* are largely due to general faecal contamination from the catchment.





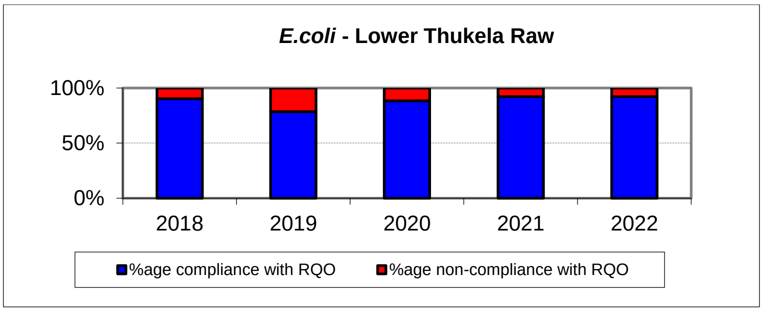


Figure 12.4 Percentage compliance vs. non-compliance with the Resource Quality Objective for Lower Thukela Raw Water.

- ### Groundwater

The groundwater quality is generally good with an electrical conductivity (EC) of 450 mg/ℓ (less than 70 mS/m). The water quality in the uThukela Valley is classified as acceptable with EC between 70 and 300 mS/m. The groundwater quality poses no limitation to use for human consumption, and is therefore not a constraint to development.

(b) Mvoti Region

(i) Overview

The Mvoti region comprises two tertiary catchments, viz. U40 (uMvoti River) and U50 (Nonoti River) (**Figure 12.5**). Land cover consists primarily of communal land in the inland areas, commercial timber in the upper reaches of the Mvoti catchment and dry-land and irrigated sugar cane along the coastal strip.

The urban and peri-urban areas of the town of KwaDukuza (previously known as Stanger), Greytown, Zinkwazi, Darnall and Groutville are located within this region. The town of KwaDukuza relies on run-of-river abstractions from uMvoti River, supported by water transfers from the Mdloti catchment. Groutville also uses water transfers from the Mdloti catchment. Zinkwazi utilises local groundwater resources, while Greytown relies on Lake Merthley and groundwater. The Darnall Dam on the Nonoti River supports the town of Darnall.

(ii) Surface Water

The hydrological characteristics of the catchments in the Mvoti region are shown in **Table 12.2**.

Table 12.2 Hydrological characteristics for the Mvoti region (WR2012).

Region	River (Catchment)	Area (km^2)	Annual Average			
			Evaporation (mm)	Rainfall (mm)	Natural Runoff (million m^3/annum)	Natural Runoff (mm)
Mvoti	Nonoti River (U50)	179	1,250	1, 056	35.8	200
	uMvoti River (U40)	3 035	1,223	892	435.0	143

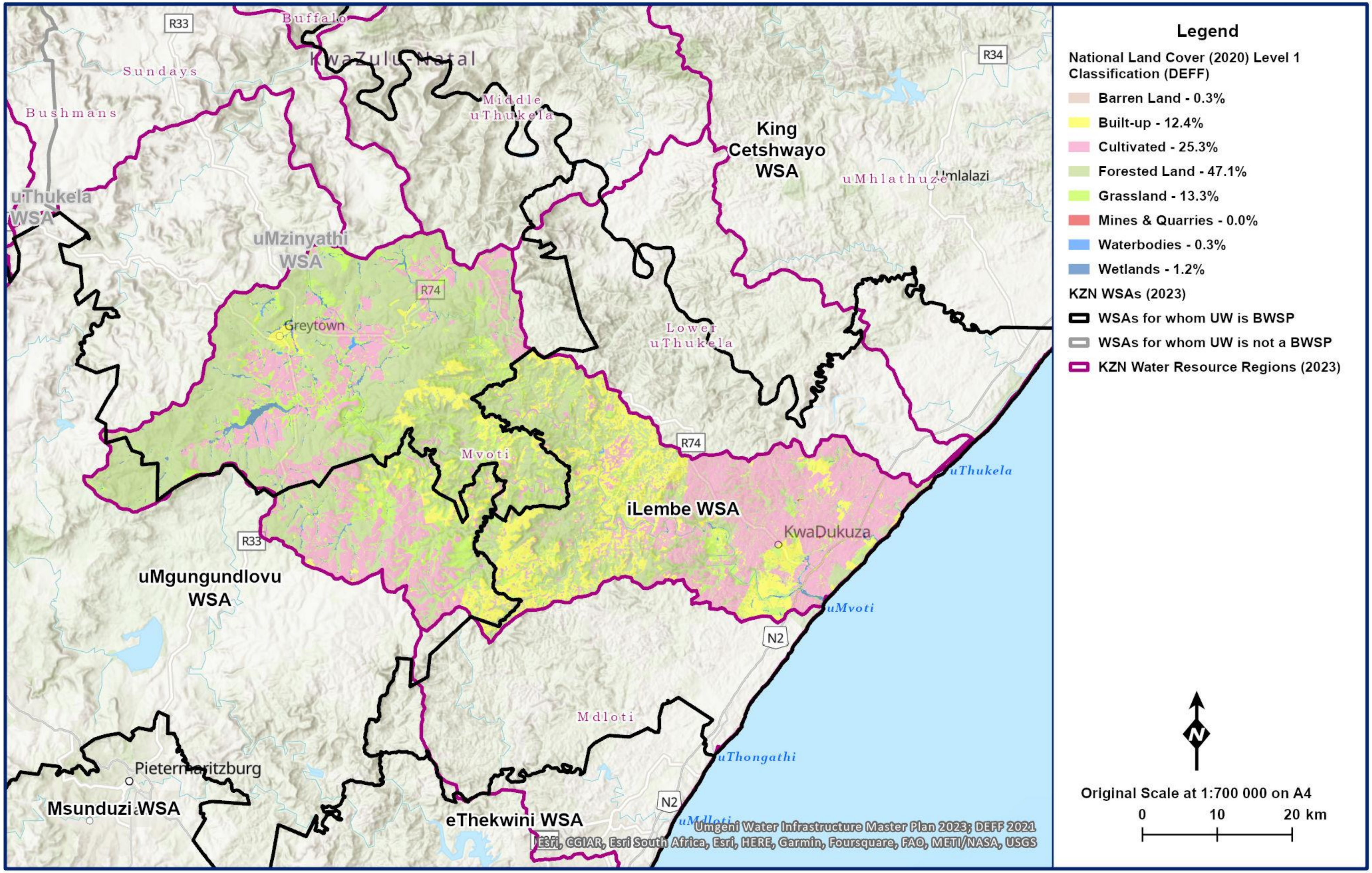


Figure 12.5 General layout of the Mvoti region (DEFF 2020; MDB 2020; Umgeni Water 2022; WR2012).

(iii) Groundwater

The Mvoti region is located in the KwaZulu-Natal Coastal Foreland Groundwater Region (**Section 2 in Volume 1**). This Groundwater Region is characterised by fractured aquifers which are formed by predominantly arenaceous rocks consisting of sandstone and diamictite (Dwyka tillite).

- #### Hydrogeological Units

The hydrogeologically relevant lithologies recognised in the study area comprise sandstone, tillite and mudstone/shale supporting fractured groundwater regimes and dolerite intrusions and granite/gneiss supporting fractured and weathered groundwater regimes.

- #### Geohydrology

Natural groundwater discharge occurs in the form of springs, seeps and in isolated cases, uncapped artesian boreholes. The wetlands and dams in the headwaters of uMvoti River are supported by perennial groundwater seeps associated with the dolerite sill intrusions in the mudstone/shale lithologies. Springs rising in the sandstone and granite/gneiss lithologies relate to structural features (faults and fracture zones, lineaments). An analysis of baseflow-derived stream runoff values per quaternary catchment suggests that groundwater recharge from rainfall varies in the range 3% to 7% of the mean annual precipitation.

- #### Groundwater Potential

The greatest widespread demand on the groundwater resources in this catchment is represented by its use as a source of potable water for communities in the rural areas and, to a lesser extent, households in the farming areas. Other demands of a more concentrated nature are represented by its use to supplement rainfall and traditional surface water supplies for irrigation.

The sandstone of the Natal Group represents the most productive groundwater-bearing lithology, followed by mudstone/shale lithologies, the granite/gneiss lithologies and the tillite sediments of the Dwyka Formation.

A good to fair correlation exists between boreholes supporting yields in the moderate (greater than 0.5 ℓ/s to less than 3.0 ℓ/s) and high (greater than 3.0 ℓ/s) classification ranges and structural features represented by faults and remotely sensed lineaments.

The groundwater potential is particularly high (greater than 3.0 ℓ/s) in the upper catchment in the Natal Group sandstones in a band just south of the towns Greytown, Kranskop and Seven Oaks (**Figure 12.6**). Greytown augments its surface water supply from the Townlands production boreholes (9 No.), which were drilled as part of the drought relief programme in 2015. The old production boreholes in town are no longer functional due to vandalism.

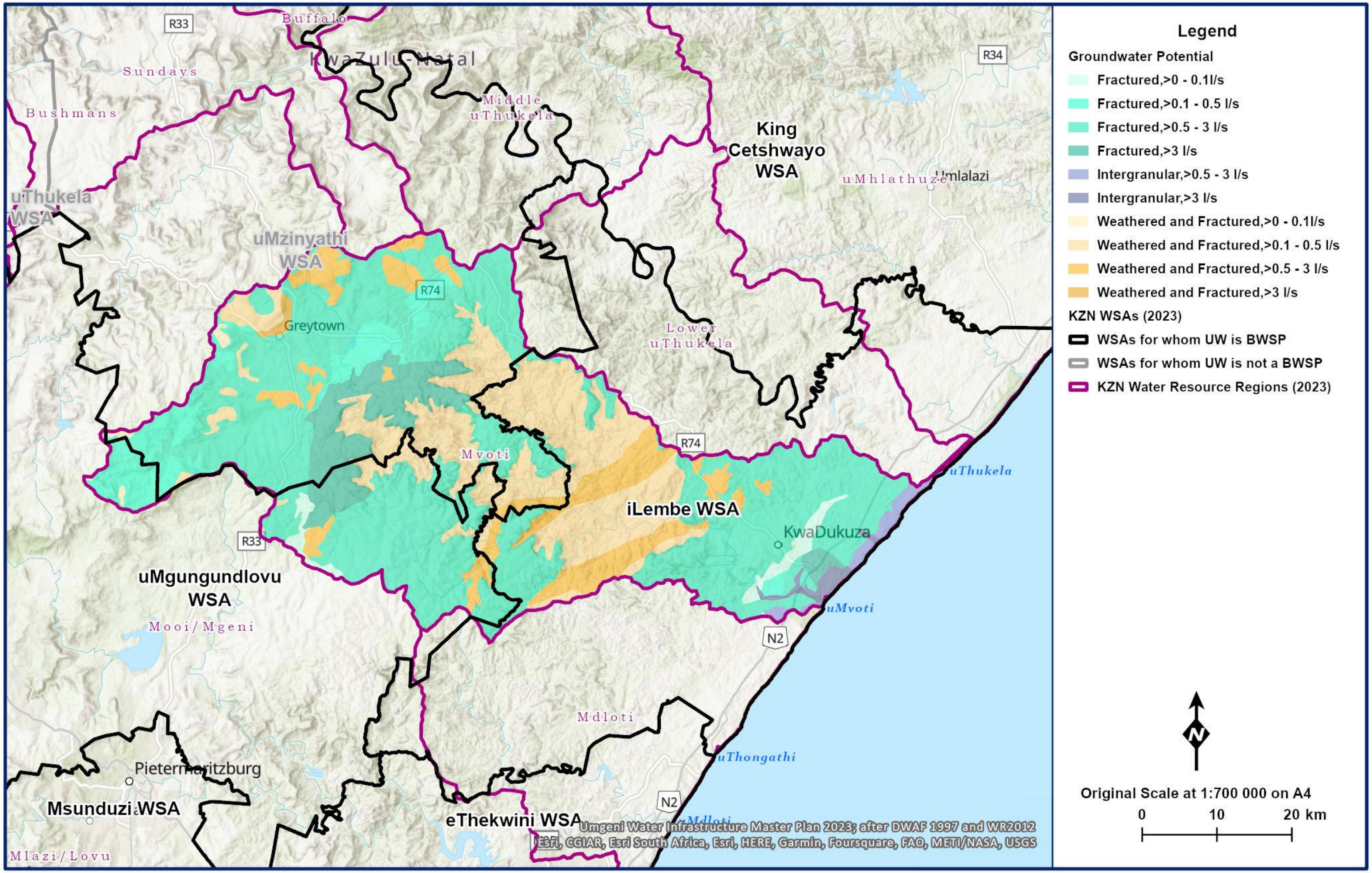


Figure 12.6 Groundwater potential in the Mvoti region (MDB 2020; Umgeni Water 2022; after DWAF 1997 and WR2012).

(iv) Water Quality

Erosion resulting from human activities (overgrazing) is the most significant water quality related problem in the iMvutshane Dam catchment and in 2022 this was exacerbated by the floods. An increase in nutrient loading is evident in the iMvutshane Dam (**Figure 12.7**). However, the recorded iMvutshane dam algae results reflect that the recorded nutrient input has not had a major impact on the impoundment water quality. Currently, the iMvutshane Dam level is being maintained at reduced levels (~60%) due to structural integrity concerns of the dam wall. This may be another factor that is influencing the recorded algal numbers.

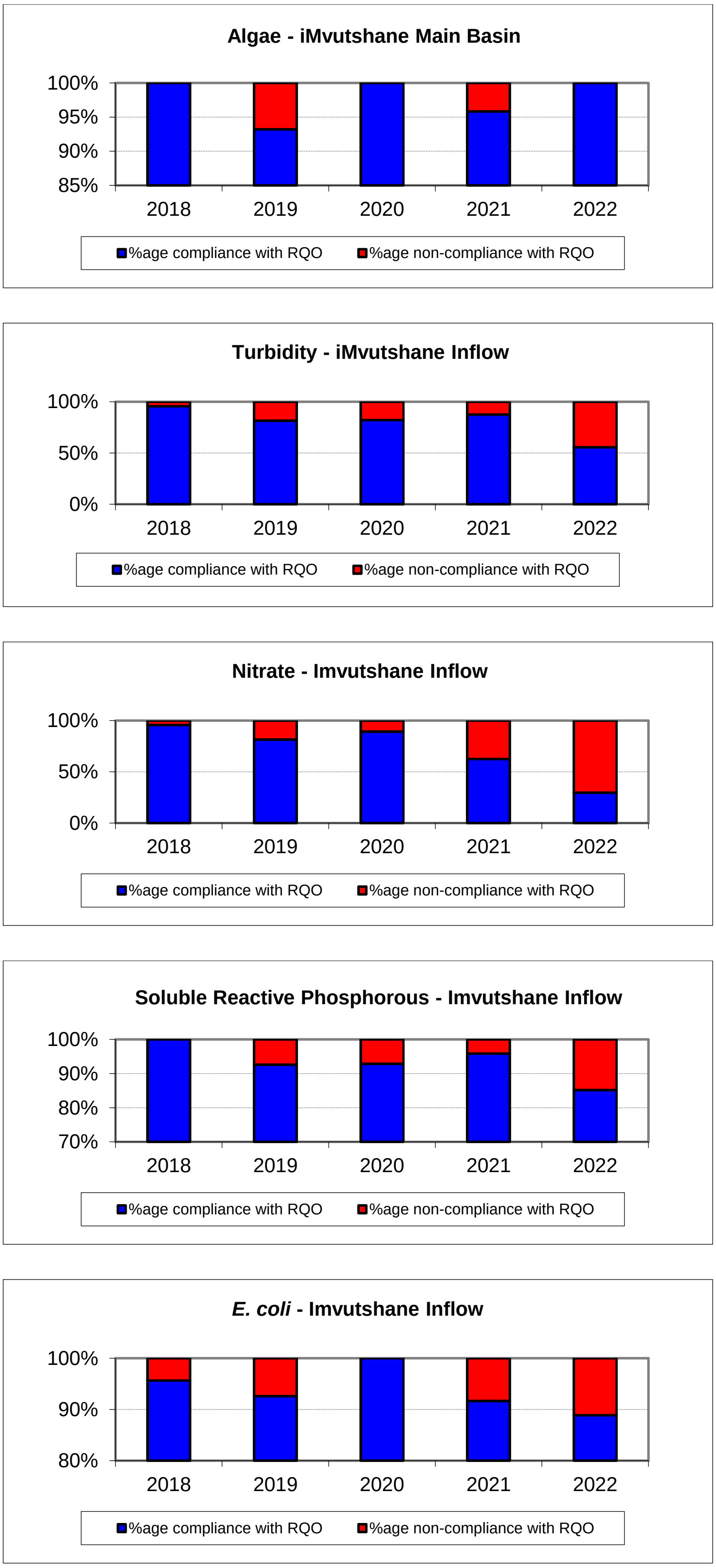


Figure 12.7 Percentage compliance vs. non-compliance with the Resource Quality Objective for iMvutshane Dam.

(c) Mdloti Region

(i) Overview

The Mdloti region is located in the U30 tertiary catchment and covers the uMdloti, uThongati and uMhlali rivers (**Figure 12.8**). The main urban areas located in this region are Tongaat, Canelands, Verulam and Umhlanga.

The main water use activities in the catchment are irrigation (mainly in quaternary catchment U30B, U30C and U30D), dryland sugar cane (widespread but especially in quaternary catchment U30E), domestic use, commerce and industry.

The Mdloti region obtains its raw water primarily from Hazelmere Dam on the uMdloti River. Raw water is abstracted from the dam for treatment at Umgeni Water's Hazelmere WTP and supply into the North Coast Supply System. Raw water is also abstracted from the Mdloti River, upstream of Hazelmere Dam, to supply the Ogunjini WTP, which is currently operated by eThekwini Municipality. eThekwini Municipality also operates the Tongaat WTP which receives raw water from a run-of-river abstraction from the uThongathi River. Hazelmere Dam Wall is currently being raised by the Department of Water and Sanitation. This project is expected to be completed during the first half of 2018.

(ii) Surface Water

The hydrological characteristics for the Mdloti region catchments are shown in **Table 12.3**.

Table 12.3 Hydrological characteristics of the Mdloti Region.

Region	River (Catchment)	Area (km^2)	Annual Average			
			Evaporation (mm)	Rainfall (mm)	Natural Runoff (million m^3/annum)	Natural Runoff (mm)
Mdloti	uMhlali River (U30E)	290	1,252	1,075	46.7	162
	uThongathi River (U30C and U30D)	423	1,252	1,075	72.0	170
	uMdloti River (U30A and U30B)	597	1,200	977	100.0	168

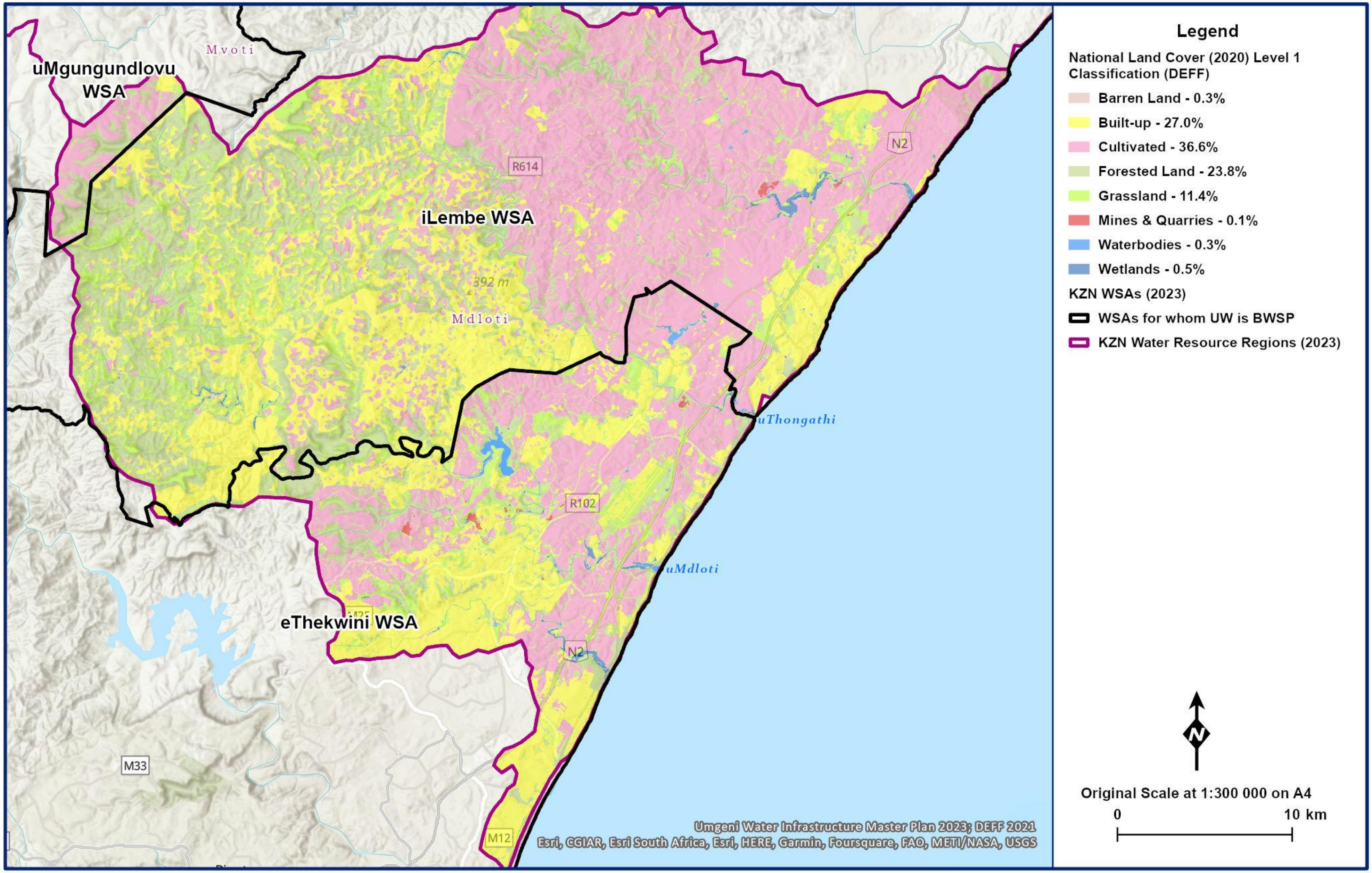


Figure 12.8 General layout of the Mdloti Region (DEFF 2020; MDB 2020; Umgeni Water 2022; WR2012).

(iii) Groundwater

The Mdloti region occurs in the KwaZulu-Natal Coastal Foreland Groundwater Region (**Section 2 in Volume 1**). This Groundwater Region is characterised by fractured aquifers which are formed by predominantly arenaceous rocks consisting of sandstone and diamictite (Dwyka tillite).

- **Hydrogeological Units**

The hydrogeologically relevant lithologies recognised in the study area comprise sandstone, tillite and mudstone/shale supporting fractured groundwater regimes and dolerite intrusions and granite/gneiss supporting fractured and weathered groundwater regimes.

- **Geohydrology**

The overall median yield (0.33 ℓ/s) of boreholes tapping the Natal Group Sandstone (NGS) identifies this lithology as one of the more productive hydrogeological units in the Mdloti catchment. The highest percentage of boreholes (8%) yielding greater than 4.5 ℓ/s can be found in this lithology. The Mdloti catchment is predominantly underlain by this lithology.

The mudstone/shale of the Ecca Group occurs in a NE-SW trending band separated from the coastline by quaternary deposits. Boreholes tapping these lithologies have median yields of 0.4 ℓ/s.

The tillite of the Dwyka Formation s supports an overall median yield of 0.14 ℓ/s and a relatively high percentage (40%) of dry boreholes.

In the headwaters of the Mdloti catchment the granite/gneisses predominate. This lithological unit supports a median yield of 0.18 ℓ/s.

An analysis of baseflow-derived stream run-off values per quaternary catchment suggests that groundwater recharge from rainfall varies in the range 3% to 7% of the mean annual precipitation.

- **Groundwater Potential**

The groundwater potential for this region is illustrated in **Figure 12.9**. The greatest widespread demand on the groundwater resources in this catchment is represented by its use as a source of potable water for communities in the rural areas and, to a lesser extent, households in the farming areas. Other demands of a more concentrated nature are represented by its use to supplement rainfall and traditional surface water supplies for irrigation.

The sandstone of the Natal Group represents the most productive groundwater-bearing lithology, followed by mudstone/shale lithologies, the granite/gneiss lithologies and the tillite sediments of the Dwyka Tillite Formation.

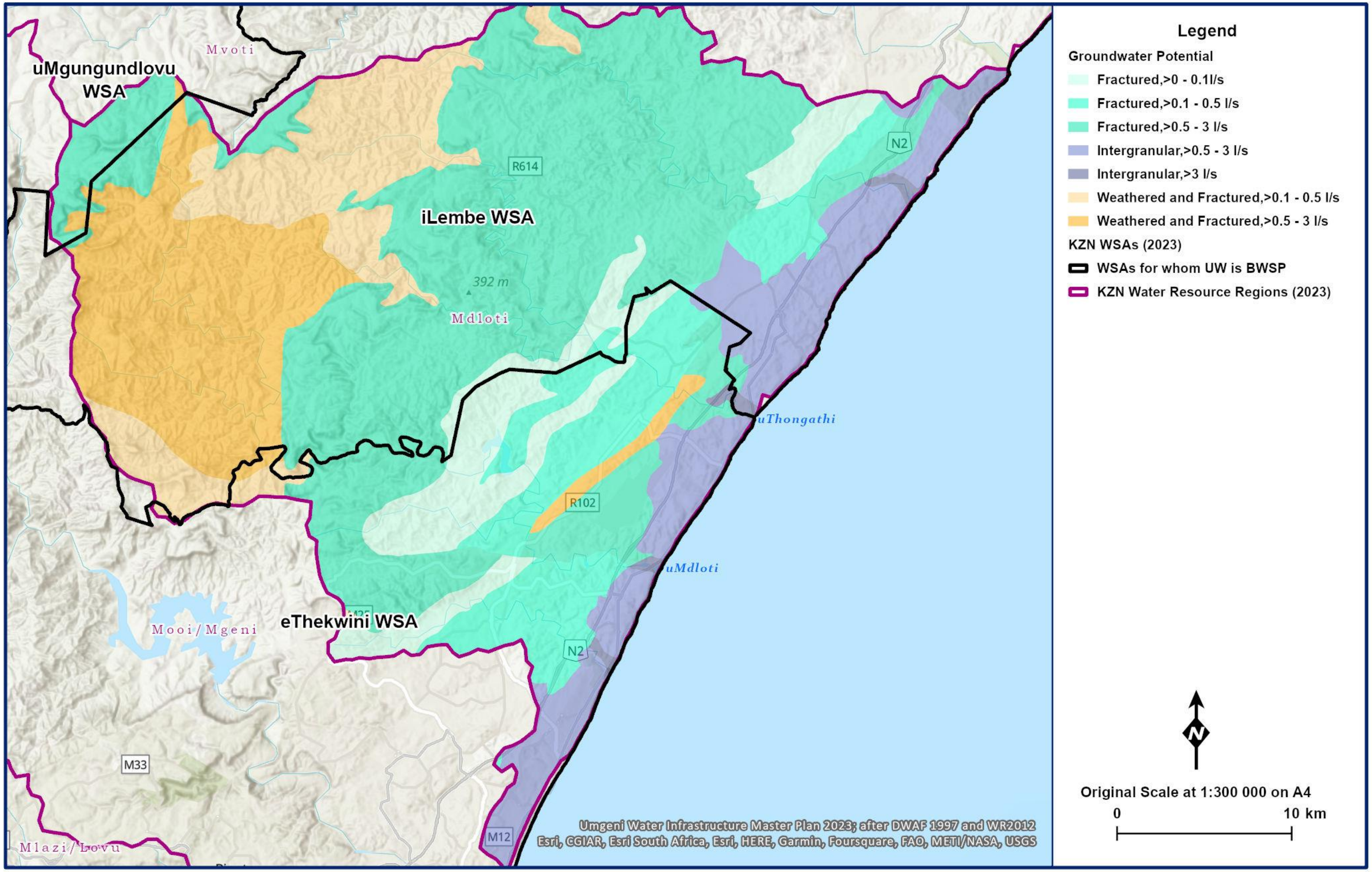


Figure 12.9 Groundwater potential in the Mdloti Region (MDB 2020; Umgeni Water 2022; after DWAF 1997 and WR2012).

(i) Water Quality

Inflows to the Hazelmere impoundment are primarily by rainfall in the catchment. The upper reaches of the catchment area are mainly rural with some commercial farming. Intensive sand mining occurs in the uMdloti River. Major floods in 2022 had an impact in the deterioration of the water quality in Hazelmere Dam as most transport into the dam occurs during times of heavy rainfall/inflow. This is signified by the recorded elevated *E. coli*, SRP and nitrate results at the inflow (**Figure 12.10**).

However, the recorded Hazelmere dam algae results (**Figure 12.10**) reflect that the recorded nutrient input has not had a major impact on the impoundment water quality. This is largely due to the assimilative capacity of the impoundment. The increased water quantity and raising of the dam wall (although not finalised) has increased the storage capacity and the assimilative capacity of the dam thus improved water quality status. The assimilative capacity of Hazemere Dam prevents emergence of instantaneous impacts but the risk associated with the cumulative impact remains.

12.2.2 Reserve

(a) Lower Thukela Region

The uThukela Region was not part of the DWS 2016 study to determine the Reserve and RQOs. DWS has just commissioned the Reserve and RQO'S study for the whole of uThukela region in 2020. Water for the Ecological Reserve is water that must remain in the river and may not be abstracted. This translates into a reduction in yield available for supply.

As part of the "Thukela Reserve Determination Study" (2004b), a comprehensive water resource evaluation assessment indicated a surplus in the uThukela catchment even after meeting the Reserve requirements. However, in the uThukela Water Management Area Internal Strategic Perspective (ISP) it is reported that "after careful review and consideration of the Reserve Study results, it became clear that assumptions made for the Reserve Study, while valid for Reserve determination, are not valid for the allocation of water in the uThukela Catchment today or in the short-term". The reasons for this are as follows:

- The uThukela Reserve Water Resource Analysis assumed that the Reserve would be met through the application of curtailments to users throughout the catchment. This curtailment results in surplus water becoming available in the lower reaches of the uThukela River.
- The uThukela Reserve Water Resource Analysis assumed that the Spioenkop, Ntshingwayo and Wagendrift dams will all contribute to the users and the Reserve in the Lower uThukela. The conjunctive use of these three dams results in large theoretical surpluses in the Lower uThukela.
- The methodology used in the uThukela Reserve Analysis, whereby the excess yield is determined at the bottom of each key area, represents the best-case scenario. If the yield is required further upstream in the catchment, then the excess yield is reduced. Releases are only made from the large dams to meet the users' shortfalls after they have made use of run-of-river yields. The further downstream a user is situated, the more run-of-river yield becomes available, with the result that less water is required to be released from the dams and hence more surplus is available.

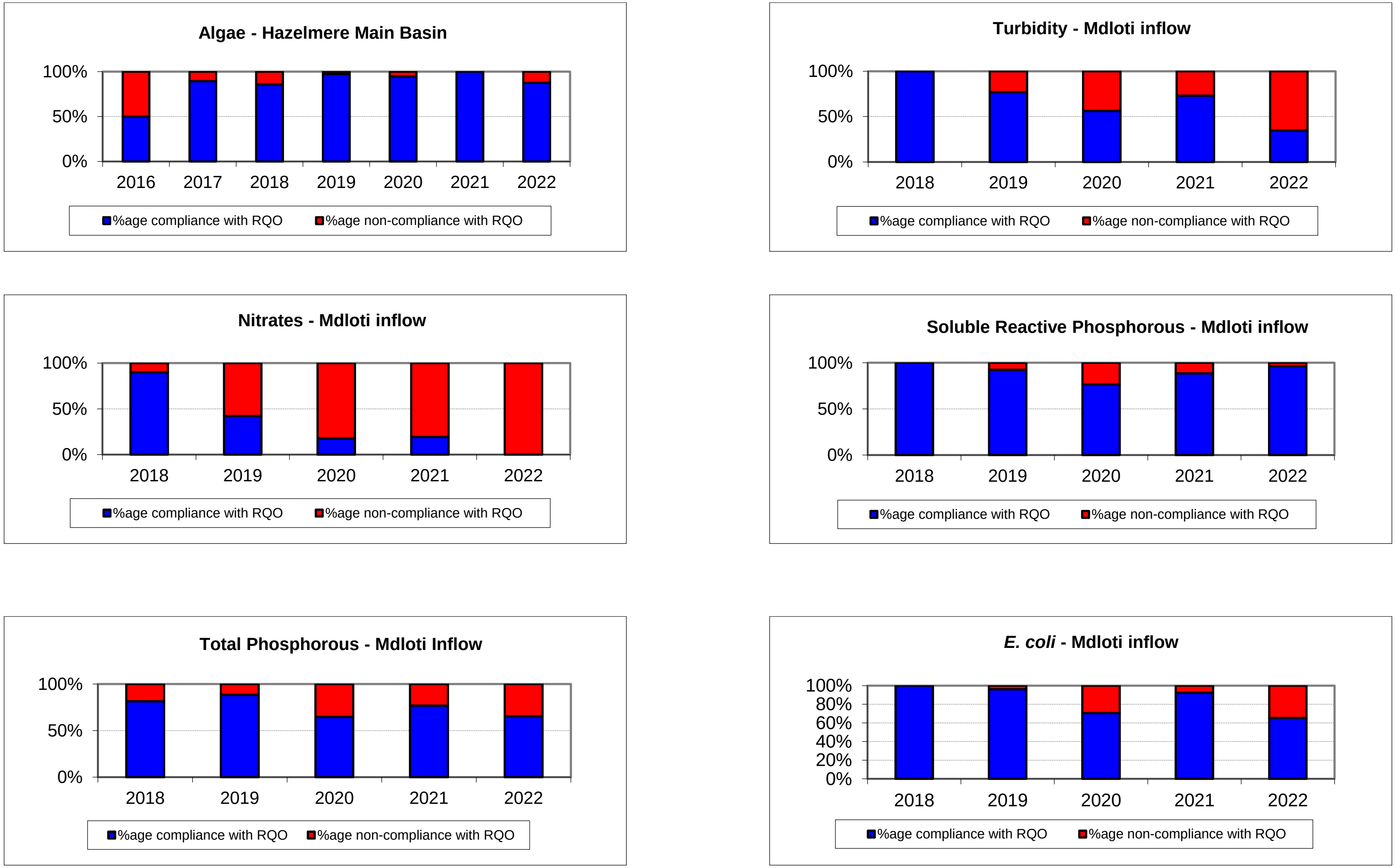


Figure 12.10 Percentage compliance vs. non-compliance with the Resource Quality Objective for Hazelmere WTP.

(b) Mvoti Region

The Ecological Reserve of the uMvoti River was determined in the late 1990s before the reserve determination techniques and methodologies were refined and standardised across the country. Hence, the Reserve has not been implemented to date and will need to be recalculated at a comprehensive level using the standardised methodology. Notwithstanding this, the highly stressed nature of the catchment is a clear indication that it is unlikely that the Reserve will be fully met if implemented. This is particularly the case during dry periods, while in the wetter periods the Reserve is more likely to be met. The implementation of the ecological Reserve in the catchment will result in the aggravation of the current situation, which is already marked by periods of curtailments during low flows.

Based on a desktop analysis (DWA 2004), the ecological requirement is estimated to be 22% of the MAR for a Class C Ecological Management Category. The impact of this on the available yield is estimated at 10 million m^3/annum (27 Mℓ/day). The broad strategy for this catchment will most likely be to implement the Ecological Reserve in a phased manner together with compulsory licensing to deal with the issue of over-allocation.

The present ecological state (PES) of various rivers in the Mvoti Region is detailed in the DWS report (DWS, 2016). The target ecological categories (TEC) of various rivers in the Mvoti Region are in the report**.** Various nodes require improvements as a result of non-flow-related/anthropogenic issues. If the recommended ecological category (REC) is attainable then it has been included in the catchment configuration.

(c) Mdloti Region

No comprehensive assessment of the Ecological Reserve has been undertaken for the uMdloti River. In the 2003 feasibility study of the raising of Hazelmere Dam the Reserve was established at a desktop level of detail (DWA 2003). This study also determined that the 98% assured yield of Hazelmere Dam would reduce from an estimated 25.5 million m^3/annum to 16.2 million m^3/annum when the ecological Reserve is implemented. It has been agreed by DWS to not implement the Reserve on the uMdloti River immediately, but rather to do it in a phased manner, once further water resources have been developed in the region. The option also exists to supply this reserve from other sources (wastewater reuse) so that the full yield of the dam can still be utilised.

The present ecological state (PES) of various rivers in the Mdloti Region is detailed in the DWS report (DWS, 2016). The target ecological categories (TEC) of various rivers in the Mdloti Region are in DWS report. Various nodes require improvements as a result of non-flow-related/anthropogenic issues. If the recommended ecological category (REC) is attainable then it has been included in the catchment configuration when the analysis was undertaken.

12.2.3 Existing Water Resource Infrastructure and Yields

(a) Lower Thukela Region

Historically, the Lower uThukela Catchment has been unregulated with no significant water resource infrastructure. Umgeni Water commissioned the Lower Thukela Bulk Water Supply Scheme (BWSS) in 2017 and this scheme abstracts available yield for treatment to potable standards and supply it to areas within KwaDukuza and Mandini Local Municipalities. The scheme includes an abstraction works and a WTP positioned on the banks of the uThukela River in the vicinity of Mandini (**Figure 12.39**), utilising a run-of-river abstraction mechanism. The abstraction works, weir and WTP were commissioned in the second half of 2017. The WTP is currently able to abstract 20 million m^3/annum (55 Mℓ/day) but can be upgraded to 110 Mℓ/day when needed.

The storage dams in the upper reaches of the uThukela catchment (including Spring Grove Dam) can make releases in the winter months to ensure that the required quantity of water is available at the treatment plant.

(b) Mvoti Region

(i) Surface Water

There are no major storage dams on the uMvoti and Nonoti Rivers and consequently there is limited available yield from this system. The only impoundments of significance include Lake Merthley, situated in the upper reaches of the Mvoti catchment, the Darnall Dam on the Nonoti River and the iMvutshane Dam on the iMvutshane River although these are all relatively small dams.

The Mvoti Region has a high MAR, although the high sediment loads on the main rivers make the development of small dams on these rivers non-viable. Large storage dams or off-channel storage dams are therefore required. **Table 12.4** shows a summary of water resource impoundments and **Table 12.5** provides a summary of the water resource statistics.

Table 12.4 Existing Dams in the Mvoti Region.

Impoundment	River	Capacity (million m^3)	Purpose
Lake Merthely	Heine	1.98	Domestic
Darnall Dam	Nonoti	0.3	Domestic and Industrial
Craigieburn Dam	Mnyamvubu	23.07	Domestic and Irrigation
iMvutshane Dam	iMvutshane	3.2	Domestic

Table 12.5 Yield information for the existing water resource abstractions in the Mvoti Region.

Impoundment	River	Capacity (million m³)	Yield (million m³/annum)	Stochastic Yield (million m³/annum)	
			Historical	1:50	1:100
Lake Merthely	Heinespruit (tributary of the uMvoti)	1.98	0.74 (2.02 Mℓ/day)	0.95 (2.60 Mℓ/day)	0.89 (2.44 Mℓ/day)
Darnall Dam	Nonoti	0.3	Not Available	1.8 (4.9 Mℓ/day)	1.1 (3.0 Mℓ/day)
Craigieburn Dam	Mnyamvubu	23.07	TBC	TBC	TBC
iMvutshane Dam	iMvutshane	3.2	Not Available	2.4 (6.5 Mℓ/day)	Not Available

 # excl. Ecological Reserve

(ii) Lake Merthley and Craigieburn Dam

Lake Merthley (**Figure 12.11** and **Table 12.6)** is located on the Heine Spruit River approximately 5 km from the town of Greytown. The dam was commissioned in 1983 with a capacity of 1.98 million m^3 (**Table 12.6**) and supplies the Greytown WTP with raw water. It is owned by the uMvoti Local Municipality and is used for domestic water supply. The total raw water abstraction, from the dam, over the last two years, has averaged approximately 4.3 Mℓ/day (1.6 million m^3/annum). This is more than the historical firm yield of the dam but less than the capacity of the Greytown WTP of 7 Mℓ/day.

A project is underway to supplement the raw water supply to the Greytown WTP from the Craigieburn Dam (**Figure 12.12** and **Table 12.7**) located 29 km from the town of Mooi River and in the Mooi catchment (**Section 7.2**). Craigieburn Dam is owned by DWS and is used for both domestic supply to the local communities and for irrigation releases. The dam was completed in 1963 and has a capacity of 23.03 million m^3 (**Table 12.7**).

(iii) iMvutshane Dam

The iMvutshane Dam is located on the iMvutshane River approximately 10 km south of the town of Maphumulo and approximately 1 km upstream of the confluence of the iMvutshane and Hlimbitwa Rivers. The iMvutshane Dam was commissioned in April 2015 but only started impounding in September 2016 due to low flows in the iMvutshane River during the 2014/15 drought (**Figure 12.13**). The dam can be augmented with an emergency transfer scheme from the Hlimbitwa River. A permanent transfer from this source is being investigated to improve the yield of the system (**Section 12.5.2 (d)**). The characteristics of the iMvutshane Dam are shown in **Table 12.8**.

Figure 12.11 Lake Merthley.

Table 12.6 Characteristics of Lake Merthley.

Catchment Details	
Incremental Catchment Area:	16.79 km^2
Total Catchment Area:	16.79 km^2
Mean Annual Precipitation:	868 mm
Mean Annual Runoff:	1.84 million m^3
Annual Evaporation:	1250 mm
Dam Characteristics	
Gauge Plate Zero:	N/A mASL
Full Supply Level:	N/A mASL
Spillway Height:	11 m
Net Full Supply Capacity:	1.98 million m^3
Dead Storage:	
Total Capacity:	1.98 million m^3
Surface Area of Dam at Full Supply Level:	0.90 km^2
Original Measured Dam Capacity	
Dam Type:	Arch
Crest Length:	Spillway Section: 20 m Non-Spillway Section: 133 m Crest Length 153 m
Type of Spillway:	Broad-Crested Weir
Capacity of Spillway:	
Date of Completion:	1983
Date of Area Capacity Survey:	N/A
Date of a next Area Capacity Survey	N/A

Figure 12.12 Craigieburn Dam (News 24 22 March 2017: website).

Table 12.7 Characteristics of Craigie Burn Dam

Catchment Details	
Incremental Catchment Area:	154 km^2
Total Catchment Area:	154 km^2
Mean Annual Precipitation:	867 mm
Mean Annual Runoff:	25.4 million m^3
Annual Evaporation:	1300 mm
Dam Characteristics	
Gauge Plate Zero:	1283.19 mASL
Full Supply Level:	1305.66 mASL
Spillway Height:	39.9 m
Net Full Supply Capacity:	23.1 million m^3
Dead Storage:	
Total Capacity:	23.1 million m^3
Surface Area of Dam at Full Supply Level:	2.07 km^2
Original Measured Dam Capacity	
Dam Type:	Arch and Earthfill
Crest Length:	Spillway Section: 50 m Non-Spillway Section: 470.6 m Crest Length 520.6m
Type of Spillway:	Uncontrolled Ogee
Capacity of Spillway:	
Date of Completion:	1963
Date of Area Capacity Survey:	1983
Date of Area Capacity Survey:	2002
Date of a next Area Capacity Survey	2022

Figure 12.13 iMvutshane Dam.

Table 12.8 Characteristics of iMvutshane Dam.

Catchment Details	
Incremental Catchment Area:	42.8 km^2
Total Catchment Area:	42.8 km^2
Mean Annual Precipitation:	1 108 mm
Mean Annual Runoff:	8.9 million m^3
Annual Evaporation:	1 300 mm
Dam Characteristics	
Gauge Plate Zero:	255.5 mASL
Full Supply Level:	277.0 mASL
Net Full Supply Capacity*:	2.88million m^3
Dead Storage:	0.32 million m^3
Total Capacity*:	3.2 million m^3
Surface Area of Dam at Full Supply Level:	0.360 km^2
Dam Type:	Concrete lined spillway with main embankment and saddle embankment
Material Content of a Dam Wall:	Clay core with concrete spillway on the left flank
Crest Length:	Spillway section : 40m Main embankment section : 230m Saddle embankment : 74m
Type of Spillway:	Un-controlled
Capacity of Spillway:	788 m^3/s
Future Capacity Once Dam Wall has been Raised:	N/A
Date of Completion:	2015
Date of Area Capacity Survey:	2015
Date of a next Area Capacity Survey	2025

(iv) Hlimbitwa Transfer

The Maphumulo WTP is currently operating at above its design capacity of 6 Mℓ/day and will soon be upgraded to 12 Mℓ/day. The stochastic yield of the iMvutshane Dam at 1:50 assurance of supply is 6.5 Mℓ/day, this leaves the iMvutshane Dam with a shortfall, especially during dry seasons. To mitigate this shortfall a more permanent inter basin transfer will be developed so that the iMvutshane Dam can be supplemented with flows from the Hlimbitwa River. The Maphumulo Bulk Water Supply Scheme Phase 4 (**Figure 12.14**) will be constructed to pump water from the Hlimbitwa River to augment the iMvutshane Dam during dry periods.

Figure 12.14 Locality map showing the proposed Hlimbitwa River weir pump station in relation to iMvutshane Dam.

(v) Groundwater

The Efaye Groundwater Scheme is operated by the uMgungundlovu District Municipality. The Efaye community is situated just north of Mount Elias. The scheme is supplied by two production boreholes with a combined sustainable yield of approximately 256 kℓ/day, although the demand is far greater and new groundwater resources are required. Umgeni Water completed a groundwater resources investigation in 2010, with a view to augmenting the supply to the scheme. This involved the drilling of 6 exploration boreholes. Pump testing (24 hrs) results indicated that four of the boreholes had a combined sustainable yield of 265 kℓ/day and could potentially be utilised to augment existing supplies. The other two boreholes were low yielding. The development of this groundwater resource, however, has been shelved in favour of the uMshwathi Regional Bulk Water Supply Scheme.

There are a number of rural stand-alone water supply schemes in the Mvoti catchment that currently rely on boreholes for their water supply. Most of these are located in and operated by the iLembe District Municipality.

Sugar mills such as Dalton, Noodsberg and Glendale successfully utilise groundwater resources for industrial purposes. Numerous commercial poultry farms also utilise boreholes with success.

(c) Mdloti Region

(i) Surface Water

The significant dams in this catchment include the Hazelmere Dam (**Figure 12.15** and **Table 12.9**) in Quaternary Catchment U30A and the Dudley Pringle Dam and Siphon Dam in Quaternary Catchment U30D (**Table 12.10**). The yields for the water resource developments in the Mdloti Region are shown in **Table 12.11.**

Figure 12.15 Hazelmere Dam showing raise dam wall.

Table 12.9 Characteristics of Hazelmere Dam (after raising of dam wall).

Catchment Details	
Incremental Catchment Area:	377 km^2
Total Catchment Area:	377 km^2
Mean Annual Precipitation:	967 mm
Mean Annual Runoff:	70.7 million m^3
Annual Evaporation:	1 200 mm
Dam Characteristics	
Gauge Plate Zero:	61.04 mASL
Full Supply Level:	93.00 mASL
Spillway Height:	31.96 m
Net Full Supply Capacity:	35.28 million m^3
Dead Storage:	1.85 million m^3 (5% - 2011)
Total Capacity:	37.13 million m^3 (2011)~
Surface Area of Dam at Full Supply Level:	3.29 km^2
Original Measured Dam Capacity	22.338 million m^3 (October 1979)
Dam Type:	Concrete gravity wall with central spillway
Crest Length:	Spillway Section: 91 m Non-Spillway Section: 372 m
Type of Spillway:	Uncontrolled
Capacity of Spillway:	950 m^3/s
Date of completion:	1975
Date of Area Capacity Survey:	2011
Date of the Next Area Capacity Survey	2026

~ Dam wall raising not complete

Table 12.10 Existing Dams in the Mdloti Region.

Impoundment	River	Capacity (million m^3)	Purpose
Hazelmere Dam	uMdloti	37.1~	Domestic/Irrigation
Siphon Dam	uThongathi	0.4	Domestic
Dudley Pringle Dam	Wewe	2.3	Domestic

~ Dam wall raising complete. Impounding licence not in place, can only impound 80% of the total capacity

Table 12.11 Yield Information for the existing water resource developments in the Mdloti Region (DWAF, 2003).

Impoundment	River	Capacity (million m^3)	Yield (million m^3/annum)	Stochastic Yield (million m^3/annum)#	
			Historical	1:50	1:100
Hazelmere Dam (after raising of dam wall)	uMdloti	37.1	31 (84.9 Mℓ/day)	32 (87.7 Mℓ/day)	30.2 (82.7 Mℓ/day)
Siphon Dam	uThongathi	0.4	Not Available	Not Available	Not Available
Dudley Pringle Dam	Wewe	2.3	Not Available	Not Available	Not Available

 # Excluding Ecological Reserve

~ Dam wall raising completed. The yield shown is for a raised dam wall (from 21.0 to 37.1 million m^3).

(vi) Groundwater

There are two significant groundwater schemes in the Mdloti Catchment owned and operated by the iLembe District Municipality, namely Driefontein and Ntabaskop.

Driefontein production borehole has a sustainable yield of 180 kℓ/day and pumps to a distribution reservoir that feeds the Driefontein community. The borehole is drilled into Natal Group Sandstone to a depth of 110 m and is cased to the bottom. The water strike occurs at 72 m in fractured sandstone. The borehole does not intersect any dolerite dykes or geological lineaments.

The Ntabaskop scheme is a conjunctive use scheme, with a single production borehole augmenting the surface water supply. The sustainable yield of the borehole is unknown.

12.2.4 Operating Rules

(a) Lower Thukela Region

DWS is commissioning a water resources study for the region, this study will include detailed operating rules of the entire uThukela System. Water levels are monitored at the Lower Thukela Weir and at the Sundumbili Weir to ensure that there is sufficient water in the river to supply both parties, the minimum river flow should not be less than 1.4 m^3/s. If the river level is not sufficient to supply this need then releases are requested, from Spioenkop Dam, by DWS. The distance from Spioenkop Dam to the Lower Thukela means that releases can take up to 14 days to reach the Lower Thukela Abstraction and hence these releases have to be requested well ahead of time to allow for this delay.

High sediment loads are common in the uThukela River during high river flow periods and sedimentation exclusion is needed at both the abstraction point and at the Water Treatment Works. Water from the river first enters a boulder trap at the abstraction point where larger particles are deposited. After the boulder trap, the water enters gravel traps through a set of submerged slots. Deposition would naturally occur upstream of the submerged inlet and the boulder trap has been positioned to allow for the regular removal of the sediment to prevent silting up of the inlet. The weir is designed to provide sufficient differential head to assist in the efficient flushing of the boulders and sediment when radial gates are opened during high flow conditions. Once the water has reached the gravel traps, lower levels of turbulence allow for the deposition of gravel and larger sand particles before the water is abstracted by low lift pumps.

(b) Mdloti Region

The North Coast region, from Phoenix/Verulam to KwaDukuza, is supplied with water from Hazelmere Dam on the uMdloti River. The area of Verulam (Grange) can be supplied from the both the Hazelmere Water Treatment Plant and from the Mgeni System. During periods of drought, if there is an imbalance in the water resource availability between the Hazelmere System and the Mgeni System then Verulam is supplied, primarily, from the system with the greater resource availability.

The supply of raw water to the Tongaat WTP is via a run-of-river abstraction from the uThongathi River. During dry periods, the yield from this source is lower than the demands in the Tongaat area and the WTP supply is then supplemented from the Mdloti system.

The North Coast Pipeline extends from Ballito to KwaDukuza Town and thereafter the Lower Thukela Pipeline extends from KwaDukuza Town to the Lower Thukela WTP. Both of these pipelines are bi-directional and, as such, water can be supplied to these areas from either resource. At present water is supplied from the Hazelmere System north to Groutville and water is supplied south from the Lower Thukela WTP to KwaDukuza Town. As demands increased in eThekwini and on the Dolphin Coast it is expected that Hazelmere WTP will only supply north as far as Ballito and the Lower Thukela WTP will supply south as far as Ballito. These operating rules will be based on demands and resource availability.

12.3 Supply Systems

12.3.1 Description of the North Coast System

(a) Overview

A schematic showing the bulk water distribution of the North Coast System is presented in **Figure 12.16.** Other schemes that supply potable water to residents in the region are Umgeni Water's Durban Heights WTP and eThekwini Municipality's Tongaat and Ogunjini WTP's. iLembe District Municipality operates the Mvoti WTP which supplies KwaDukuza. The demand in KwaDukuza is augmented by the Lower Thukela Supply System.

The Mdloti Supply System is presented in **Figure 12.17**.

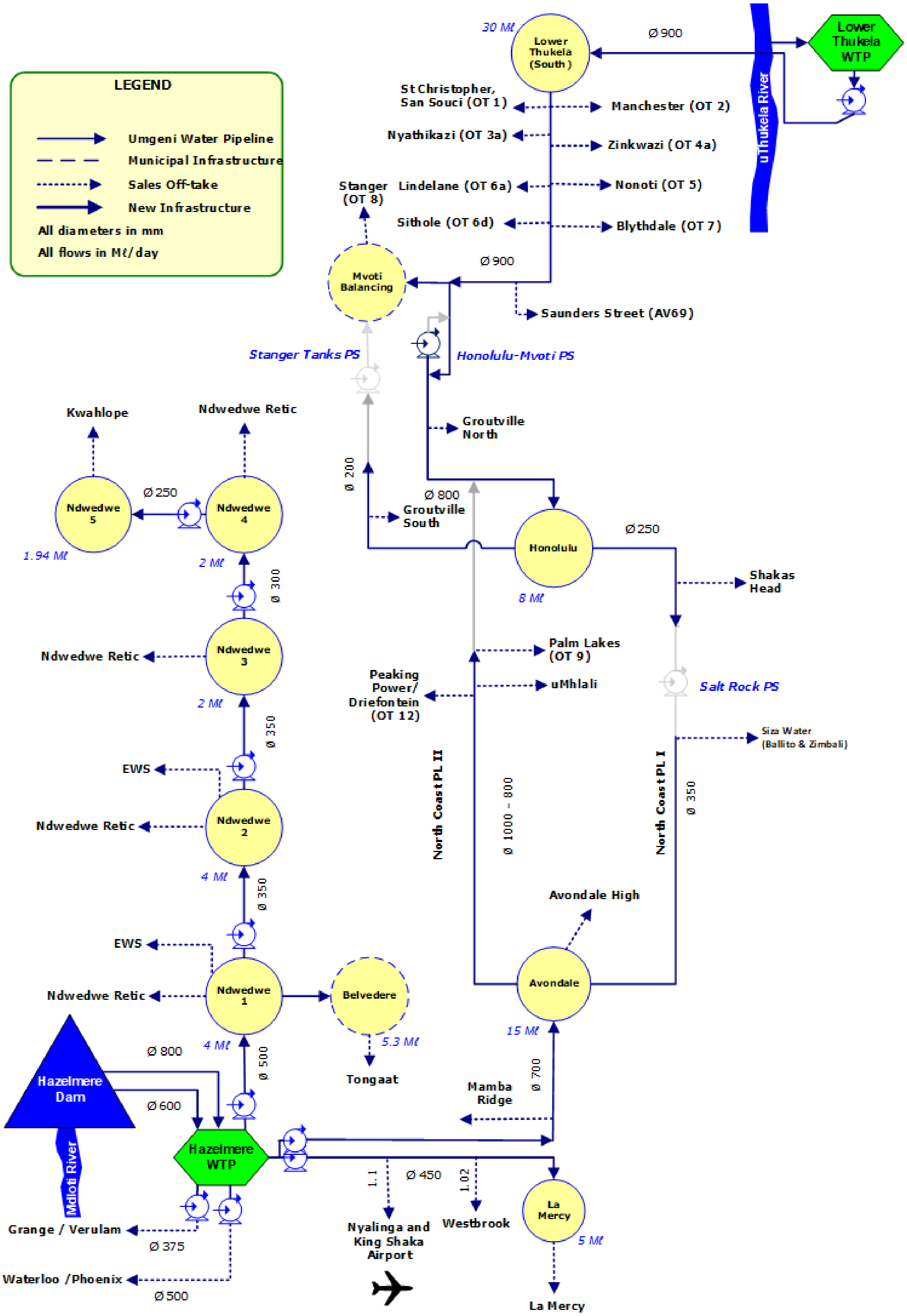


Figure 12.16 Schematic of the North Coast Supply System.

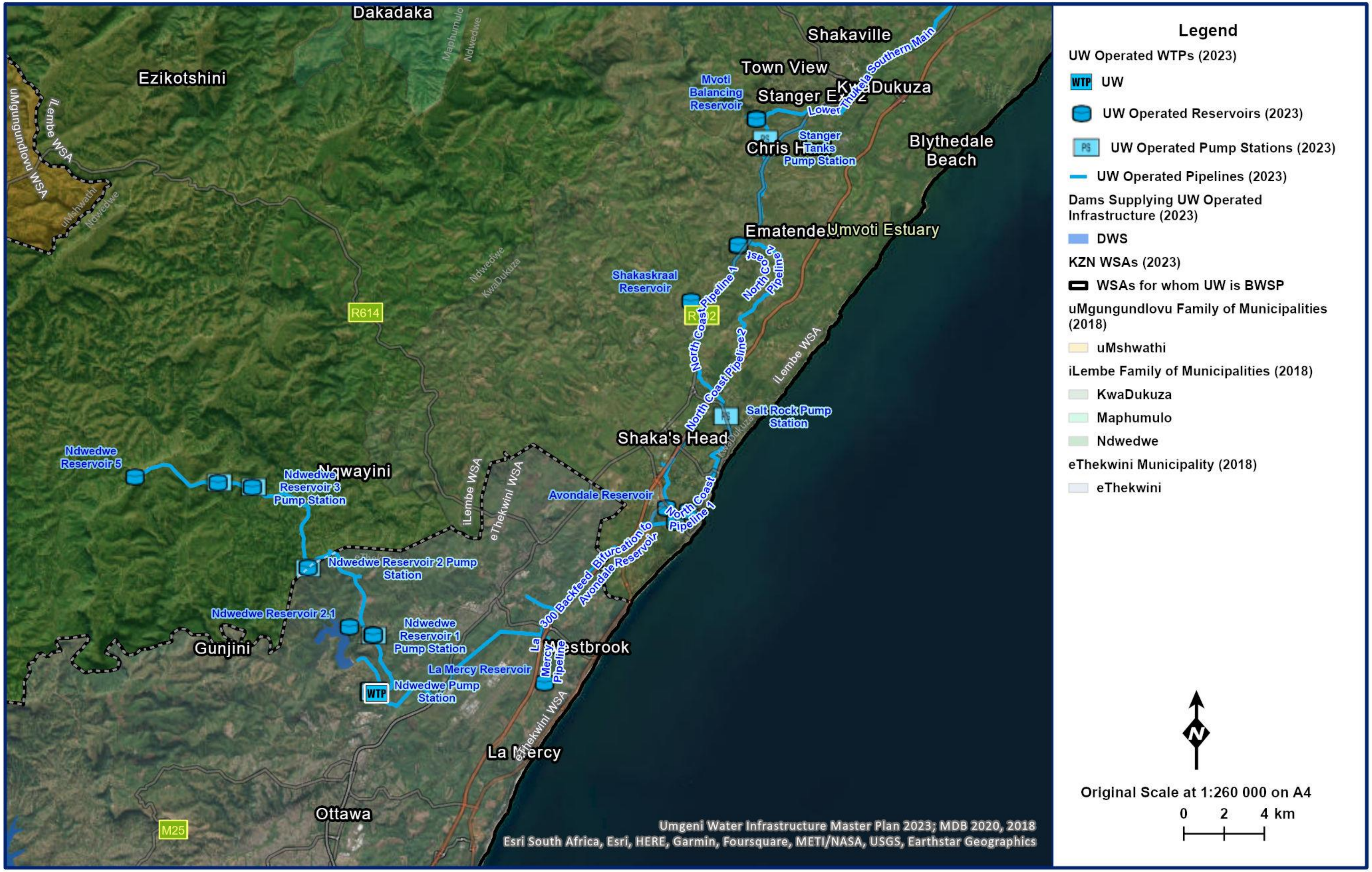


Figure 12.17 Detailed layout of the Mdloti Supply System.

(b) Hazelmere Water Treatment Plant

Hazelmere Dam is the source of raw water for the Hazelmere WTP (**Figure 12.18, Table 12.12**). The current yield of the dam, at a 98% assurance of supply, is 88 Mℓ/day. The WTP has a current design capacity of 75 Mℓ/day and receives raw water through an 800 mm diameter steel pipeline (**Table** 12.13).

Figure 12.18 Hazelmere Water Treatment Plant.

The treatment process at Hazelmere WTP consists of chemical dosing, clarification, filtration and disinfection. Sludge treatment is by means of a gravity settling and a Centrifuge Sludge Dewatering System. The characteristics of the Hazelmere WTP are shown in **Table 12.12**. There is 25 Mℓ of clear water storage available on the site in the form of two 12.5 Mℓ tanks. The operational philosophy for the two balancing tanks is to allow the concrete roof balancing tank to supply Avondale and the floating roof balancing tank to supply Grange, Waterloo and Ndwedwe Reservoirs.

Table 12.12 Characteristics of the Hazelmere WTP.

WTP Name:	Hazelmere WTP	
System:	North Coast Supply System	
Maximum Design Capacity:	75 Mℓ/day	
Current Utilisation (Oct 2022):	60.5 Mℓ/day	
Raw Water Storage Capacity:	0 Mℓ	
Raw Water Supply Capacity:	90.0 Mℓ/day	
Pre-Oxidation Type:	Prechlorination	
Primary Water Pre-Treatment Chemical:	Polymeric Coagulant	
Total Coagulant Dosing Capacity:	1800 kg/day	
Rapid Mixing Method:	Hydraulic Jump	
Clarifier Type:	Clari-Flocculator	Pulsator Clarifier
Number of Clarifiers:	7	4
Total Area of all Clarifiers:	1469 m^2	800 m^2
Total Capacity of Clarifiers:	45 Mℓ/day	60 Mℓ/day
Filter Type:	Slow Sand Filters	Constant Rate Rapid Gravity Filters
Number of Filters:	9	6
Filter Floor Type	Laterals without Nozzles	Precast with nozzles
Total Filtration Area of all Filters	540 m^2	294 m^2
Total Filtration Design Capacity of all Filters:	75 Mℓ/day	
Total Capacity of Backwash Water Tanks:	300 m^3	200 m^3
Total Capacity of Sludge Treatment Plant:		
Capacity of Used Washwater System:	0.98 Mℓ/day	
Primary Post Disinfection Type:	Chlorine	
Disinfection Dosing Capacity:	450 kg/day	
Disinfectant Storage Capacity:	5 tonne	
Total Treated Water Storage Capacity:	24 Mℓ	

Table 12.13 Pipeline details: Hazelmere Raw Water Pipeline.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity[1] (Mℓ/day)	Age (years)
North Coast	Hazelmere Raw Water Pipeline[2]	Hazelmere Dam	Hazelmere WTP	2.42	600	AC	48.93	40
North Coast	Hazelmere Raw Water Pipeline	Hazelmere Dam	Hazelmere WTP	2.42	800	Steel	90.0	9

[1] Based on a velocity of 2 m/s.
[2] This pipeline is not operational.

Table 12.14 Reservoir details: Hazelmere WTP.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
North Coast	Hazelmere WTP	Hazelmere WTP	25	Balancing	47.0	42.0

(c) Hazelmere/Phoenix Sub-System

The eThekwini area of Phoenix is supplied via the eThekwini owned and managed, 500 mm diameter Waterloo Pumping Main (**Table 12.15**). Water treated at Hazelmere WTP is pumped via the Umgeni Water Waterloo Pump Station (**Table 12.16**) situated at the Hazelmere WTP and sold to eThekwini Municipality at a metered point at the outlet of the pump station.

(d) Hazelmere/Verulam Sub-System

The eThekwini area of Verulam is supplied via the eThekwini owned and managed, 375 mm diameter Grange Pumping Main (**Table 12.17**, **Table 12.18**) which is metered at the outlet of the pump station.

(e) Hazelmere/Ndwedwe Sub-System

This sub-system (**Figure 12.19**) supplies the rural communities of Ndwedwe and EWS by staged pumping from Hazelmere WTP through Ndwedwe Reservoirs 1, 2.1, 2, 3, 4 and 5 (**Table 12.19, Table 12.20** and **Table 12.21**). Ndwedwe Reservoir 1 also feeds the southern areas of Tongaat through an emergency gravity line via Belvedere Reservoir. This emergency line is to augment the supply to the town of Tongaat when the Tongaat WTP (owned and operated by eThekwini Municipality) has insufficient water to supply the town's needs. Ndwedwe Reservoir 1 is fed directly from Hazelmere WTP through a 500 mm diameter steel rising main (**Table 12.20**) from a dedicated pump station (**Table 12.21**) at the WTP.

There are three pumps in the Hazelmere to Ndwedwe Reservoir 1 and Ndwedwe Reservoir 2 pump station. One or two pumps are utilised, depending on the system demand. Ndwedwe Reservoir 1 and Ndwedwe Reservoir 2 were upgraded through the construction of a second 2 Mℓ reservoir, at each site, during 2010/2011. The pumps at Ndwedwe Reservoirs 1 and 2 were upgraded in 2018.

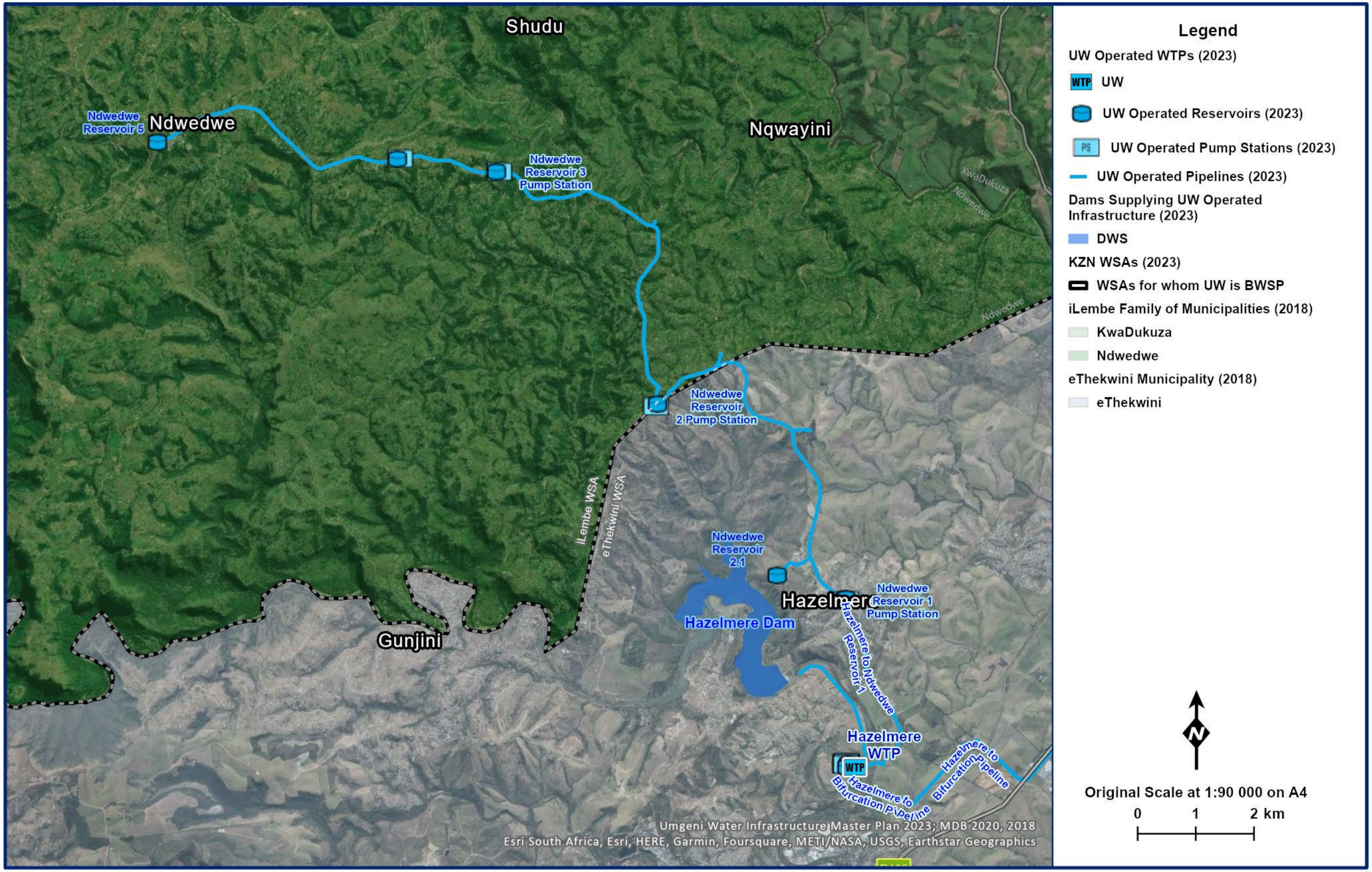


Figure 12.19 Layout of the Hazelmere/Ndwedwe sub-system.

Table 12.15 Pipeline details: Waterloo Pumping Main.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity* (Mℓ/day)	Age (years)
North Coast	Waterloo Pipeline	Hazelmere WTP	Waterloo Sales Meter	0.05	500	Steel	25	27

* Based on a velocity of 1.5 m/s.

Table 12.16 Pump details: Waterloo Pump Station.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	Waterloo Pump Station	1		KSB Omega 200-670	Hazelmere WTP	Waterloo Reservoir	112.0	125	15.55
North Coast	Waterloo Pump Station		1	Sulzer Bb HSC	Hazelmere WTP	Waterloo Reservoir	112.0	115*	2.80*

* Assumption

Table 12.17 Pipeline details: Grange Pumping Main.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity* (Mℓ/day)	Age (years)
North Coast	Grange Pipeline	Hazelmere WTP	Grange Sales Meter	0.05	375	AC	14.30	32

* Based on a velocity of 1.5 m/s.

Table 12.18 Pump details: Grange Pump Station.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	Grange Pump Station	1	1	Sulzer BPK 35	Hazelmere WTP	Grange Reservoir	68.9	96	11.5

Table 12.19 Reservoir details: Hazelmere/Ndwedwe Sub-System.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
North Coast	Ndwedwe	Ndwedwe 1	3.94	Distribution	209.8	205.8
North Coast	Ndwedwe	Ndwedwe 2.1	0.22	Terminal	238.6	234.6
North Coast	Ndwedwe	Ndwedwe 2	4.00	Distribution	318.4	314.4
North Coast	Ndwedwe	Ndwedwe 3	2.00	Distribution	417.4	413.4
North Coast	Ndwedwe	Ndwedwe 4	2.00	Distribution	530.9	526.9
North Coast	Ndwedwe	Ndwedwe 5	1.94	Terminal	661.8	657.2

Table 12.20 Pipeline details: Hazelmere/Ndwedwe Sub-System.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity* (Mℓ/day)	Age (years)
North Coast	Hazelmere to Ndwedwe Reservoir 1	Hazelmere WTP	Ndwedwe Reservoir 1	3.76	500	Steel	25.48	28
North Coast	Ndwedwe Reservoir 1 to Ndwedwe Reservoir 2	Ndwedwe Reservoir 1	Ndwedwe Reservoir 2	6.93	350	Steel	12.49	27
North Coast	Ndwedwe Reservoir 2 to Ndwedwe Reservoir 3	Ndwedwe Reservoir 2	Ndwedwe Reservoir 3	6.46	350	Steel	12.49	27
North Coast	Ndwedwe Reservoir 3 to Ndwedwe Reservoir 4	Ndwedwe Reservoir 3	Ndwedwe Reservoir 4	1.78	300	Steel	9.17	27
North Coast	Ndwedwe Reservoir 4 to Ndwedwe Reservoir 5	Ndwedwe Reservoir 4	Ndwedwe Reservoir 5	4.69	250	Steel	6.37	27

* Based on a velocity of 1.5 m/s.

Table 12.21 Pump details: Hazelmere/Ndwedwe Sub-System.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	Ndwedwe Pump Station	3		KSB WKLn 150/5	Hazelmere WTP	Ndwedwe Reservoir 1	165.8	199	7.46
North Coast	Ndwedwe Pump Station		1	KSB WKLn 160/5	Hazelmere WTP	Ndwedwe Reservoir 1	165.8	199	7.46
North Coast	Ndwedwe Reservoir 1 Pump Station	2	1	KSB WKLn 150/5	Ndwedwe Reservoir 1	Ndwedwe Reservoir 2	111.6	198	7.5
North Coast	Ndwedwe Reservoir 2 Pump Station	2	1	KSB WKLn 150/5	Ndwedwe Reservoir 2	Ndwedwe Reservoir 3	102.0	165	6.5
North Coast	Ndwedwe Reservoir 3 Pump Station	1	1	KSB WKLn 125/4	Ndwedwe Reservoir 3	Ndwedwe Reservoir 4	116.5	135	3.72
North Coast	Ndwedwe Reservoir 4 Pump Station	1	1	KSB WKLn 125/5	Ndwedwe Res 4	Ndwedwe Res 5	133.9	177	3.34

(f) Hazelmere/La Mercy/Avondale Sub-System

The Hazelmere/La Mercy/Avondale sub-system (**Figure 12.17**) consists of two pipelines, a 450 mm and 700 mm diameter steel main respectively (**Table 12.22).** The pipelines are parallel to each other from Hazelmere WTP to the Tongaat Toll Plaza on the N2. From there, the 450 mm diameter steel pipeline (**Table 12.22**) supplies La Mercy Reservoir (**Table 12.23**) and the 700 mm diameter steel main (**Table 12.22**) continues in a northerly direction to supply Avondale Reservoir (**Table 12.23**) in Ballito. Both pipelines are discrete rising mains with the pump stations located at Hazelmere WTP.

The 700 mm Avondale (**Table 12.22**) pipeline has two off-takes that can supply the Mamba Ridge Reservoir and reticulation to the Greylands/Frasers area.

(g) Avondale/Honolulu Sub-System

Avondale Reservoir (**Table 12.23**) supplies the areas of Zimbali and Simbithi to the south of Ballito through a series of gravity pipelines and reservoirs (**Figure 12.17**). There is a 300 mm backfeed gravity pipeline, which also supplies the areas along the Hazelmere/La Mercy/Avondale subsystem's 700 mm rising main (**Table 12.22**). In addition, Avondale Reservoir supplies water north, through the North Coast Pipeline I (NCP-1) (**Table 12.27**) to Shakas Rock, Chakas Head, Salt Rock, Sheffield Beach, and Tinley Manor. Up until December 2009, the option existed to boost pressure at the Salt Rock Pump Station (**Table 12.28**) to supply Tiffany, Umhlali Village, Shakas Kraal and the Honolulu Reservoir (**Table 12.26**) through the NCP-1. In 2009 Umgeni Water commissioned the North Coast Pipeline II (NCP-2) (**Table 12.27**) to supply additional water from Avondale to Honolulu Reservoir. This is a bi-directional gravity pipeline with diameters ranging from 1 000 mm to 800 mm. Subsequent to the commissioning of the NCP-2, the Salt Rock Pump Station was decommissioned and water is supplied to uMhlali and Tiffany from Honolulu Reservoir via a back-feed on the NCP-1 pipeline.

(h) Honolulu/KwaDukuza Sub-System

The Honolulu Reservoir, which was previously fed from Avondale Reservoir is now being supplied from the Lower Thukela Balancing Reservoir. The Honolulu Reservoir supplies the areas of Etete and Groutville and can provide a supplementary feed to the Mvoti Balancing Reservoirs (**Table 12.29**). The Lower Thukela Bulk Water Supply Scheme (BWSS), which was commissioned in September 2017, augments supply to Mvoti Balancing Reservoir.

Table 12.22 Pipeline details: Hazelmere/La Mercy/Avondale Sub-System.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
North Coast	Hazelmere to Bifurcation Pipeline	Hazelmere WTP	La Mercy Bifurcation	10.86	450	Steel	20.64*	42
North Coast	La Mercy Pipeline	La Mercy Bifurcation	La Mercy Reservoir	2.62	450	Steel	20.64*	24
North Coast	Hazelmere to Bifurcation Pipeline	Hazelmere WTP	La Mercy Bifurcation	10.86	700	Steel	49.88*	10
North Coast	Bifurcation to Avondale Reservoir	La Mercy Bifurcation	Avondale Reservoir	9.87	700	Steel	49.94*	24
North Coast	Avondale to Ballito Reservoir	Avondale Reservoir	Ballito Reservoir	0.83	375	Steel	19.11**	35
North Coast	300 Backfeed	Ballito Reservoir	La Mercy Bifurcation	9.79	300	Steel	12.23**	42

* Based on a velocity of 1.5 m/s
** Based on a velocity of 2 m/s

Table 12.23 Reservoir details: Hazelmere/La Mercy/Avondale Sub-System.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
North Coast	Ballito	Avondale Reservoir	15.0	Distribution	137.4	130.6
North Coast	Ballito	Ballito Terminal Reservoir	3.0	Distribution	117.0	112.0
North Coast	La Mercy	La Mercy Reservoir	5.0	Distribution	156.0	152.0

Table 12.24 Pump details: Hazelmere to La Mercy

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	La Mercy Pump Station	1	1	Sulzer RPK 42	Hazelmere WTP	La Mercy Reservoir	96	152	19.0
North Coast	La Mercy Pump Station	1		Samco	Hazelmere WTP	La Mercy Reservoir	96	135	24.0

Table 12.25 Pump details: Hazelmere to Avondale Sub-System.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	Avondale Pump Station	2	1	KSB Omega 250-800A	Hazelmere WTP	Avondale Reservoir	90	186	32

Table 12.26 Reservoir details: Avondale/Honolulu Sub-System.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
North Coast	Shakas Kraal	Honolulu Reservoir	8.0	Distribution	105.0	99.8

Table 12.27 Pipeline details: Avondale/Honolulu Sub-System.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
North Coast	North Coast Pipeline 1	Avondale Reservoir	Salt Rock Pump Station	7.01	350	Steel	16.65**	35
North Coast	North Coast Pipeline 1	Umhlali Off-take	Salt Rock Pump Station	3.10	300	uPVC	9.17*	35
North Coast	North Coast Pipeline 1	Honolulu Reservoir	Umhlali Off-take	6.90	250	uPVC	6.37*	35
North Coast	North Coast Pipeline 2	Avondale Reservoir	Honolulu Reservoir	17.65	800/1000	Steel	86.98**	13

* Based on a velocity of 1.5 m/s
** Based on a velocity of 2 m/s

Table 12.28 Pump details: Avondale/Honolulu Sub-System.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	Salt Rock Pump Station	1	1	APE Ritz	Salt Rock Pump Station	Honolulu Reservoir	44	58	3.9

Note: This pump station has been decommissioned

Table 12.29 Reservoir details: Honolulu/KwaDukuza Sub-System.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
North Coast	KwaDukuza	Mvoti Balancing Reservoirs (owned and operated by iLembeDM)	4.3	Balancing	146.5	142.5*

*Assumption

Table 12.30 Pipeline details: Honolulu/KwaDukuza Sub-System.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
North Coast	Honolulu to Groutville Pipeline	Honolulu Reservoir	Groutville Bifurcation	4.67	350/300	AC	12.23*	28
North Coast	Groutville Pipeline	Groutville Bifurcation	Groutville	2.95	300	AC	12.23*	28
North Coast	Stanger Tanks Pipeline	Groutville Bifurcation	Stanger Tanks	0.72	200	AC	5.44*	28
North Coast	Stanger Tanks to Mvoti Balancing Reservoir	Stanger Tanks	Mvoti Balancing Reservoir	1.94	200	AC	4.08**	28
North Coast	Honolulu to Mvoti Balancing Reservoir	Honolulu Reservoir	Mvoti Balancing Reservoir/ Darnall	7.33	800	Steel	65**	13

* Based on a velocity of 2 m/s
** Based on a velocity of 1.5 m/s

Table 12.31 Pump details: Honolulu/KwaDukuza Sub-System.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	Stanger Tanks	1	1	KSB WKLn 100/5	Stanger Tanks	Mvoti Balancing Reservoir	93	115*	2.69*
North Coast	Honolulu-Mvoti	1	1	KSB Omega 200-420A	Honolulu Reservoir	Mvoti Balancing and Darnall	11	45	15

* Assumption

(i) Lower Thukela Water Treatment Plant and Supply System

The Lower Thukela Bulk Water Supply System (LTBWSS) abstracts water directly from the uThukela River in the vicinity of Mandini for treatment at a WTP situated in close proximity to the abstraction works (**Figure 12.20**). Bulk potable water is then supplied from the WTP southwards through a 900 mm diameter rising main into a 30 Mℓ balancing reservoir (**Figure 12.21**). From this balancing reservoir, a 900 mm diameter pipeline extends up to the Mvoti Balancing Reservoir (**Table 12.33**, **Table 12.34** and **Table 12.35**)

The LTBWSS was commissioned in September 2017. The scheme currently has a capacity of 55 Mℓ/day with the option to upgrade the scheme to 110 Mℓ/day. At its termination point, there is a supply into the Mvoti Balancing Reservoir and into Honolulu Reservoir via the NCP-2 pipeline. At the connection point, a pressure control valve is installed to ensure that the pressure does not exceed the pressure rating of the NCP-2. . The Lower Thukela pipeline has off-takes to Nkwazi, Sakamkhanye, Nonoti, Zinkwazi, Saunders Street Reservoir and Blythedale.

Figure 12.20 Lower Thukela Water Treatment Plant

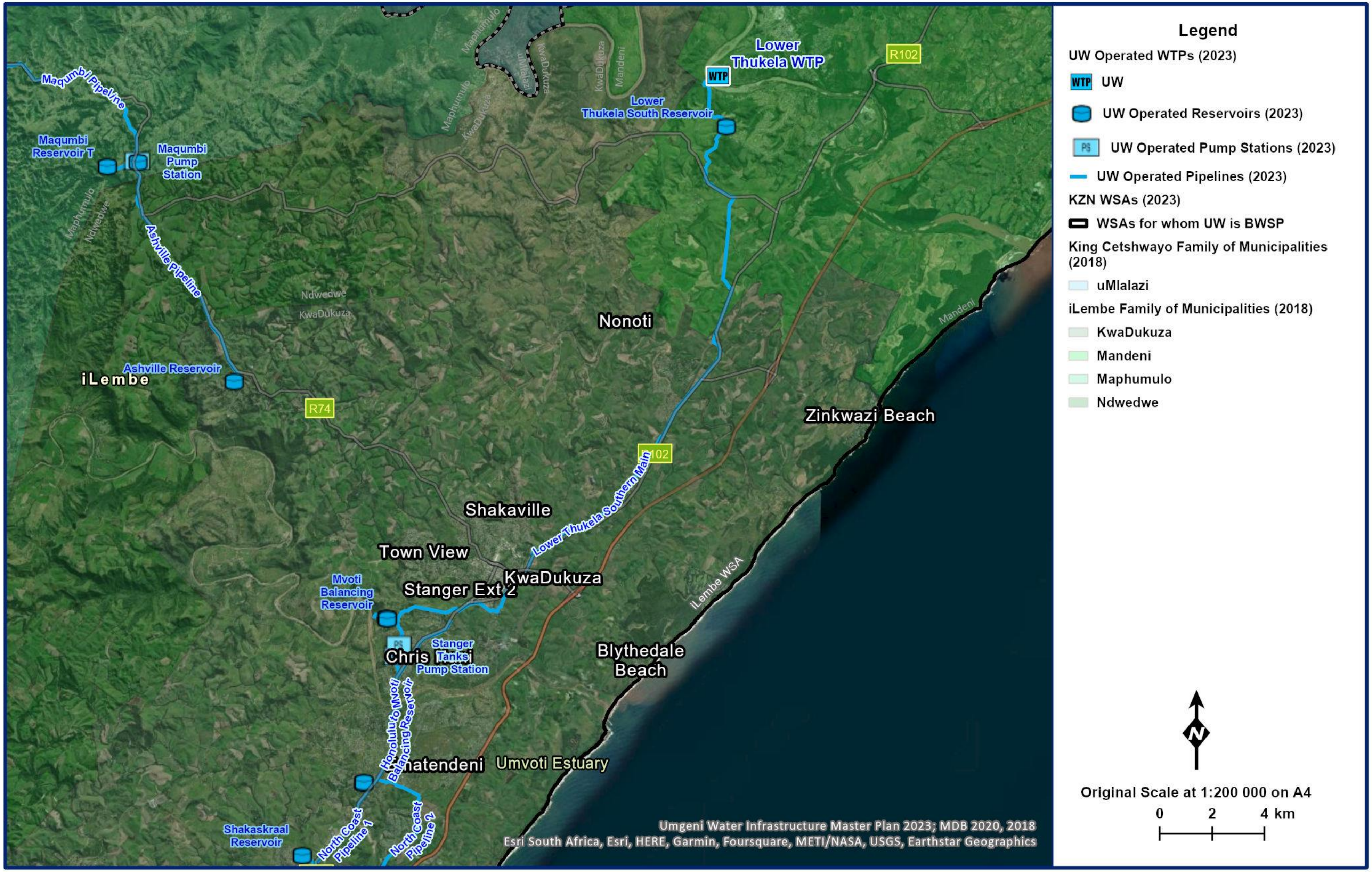


Figure 12.21 Layout of the Lower Thukela Bulk Water Supply Scheme.

The characteristics of the Lower Thukela WTP are shown in **Table 12.32**.

Table 12.32 Characteristics of the Lower Thukela WTP.

WTP Name:	Lower Thukela WTP
System:	North Coast Supply System
Maximum Design Capacity:	55 Mℓ/day
Current Utilisation (October 2022):	46 Mℓ/day
Raw Water Storage Capacity:	0 Mℓ
Raw Water Supply Capacity:	120 Mℓ/day
Pre-Oxidation Type:	Prechlorination / Potassium Permanganate
Primary Water Pre-Treatment Chemical:	Poly aluminium chloride blend
Total Coagulant Dosing Capacity:	0-250 ℓ/hour
Rapid Mixing Method:	Rapid mixing over weirs
Clarifier Type:	Clarrifloccculators
Number of Clarifiers:	3 (2 duty, 1 stand-by)
Total Area of all Clarifiers:	2,802 m^2
Total Capacity of Clarifiers:	30 Mℓ per clarrifloccculator. 2 duty, one standby provides 60 Mℓ/day capacity
Filter Type:	Pulsator
Number of Filters:	3 (2 duty, 1 stand-by)
Filter Floor Type	1068 m^2
Total Filtration Area of all Filters	30 Mℓ per pulsator. 2 duty, one standby provides 60 Mℓ/day capacity
Total Filtration Design Capacity of all Filters:	Constant Rate, constant level, Rapid Gravity Filters
Total Capacity of Backwash Water Tanks:	8 (6 duty, 2 standby)
Total Capacity of Sludge Treatment Plant:	Monolithic false floor with nozzles
Capacity of Used Washwater System:	416 m^2
Primary Post Disinfection Type:	55 Mℓ/day
Disinfection Dosing Capacity:	980 m^3
Disinfectant Storage Capacity:	Solid Bowl Centrifuges
Total Treated Water Storage Capacity:	2 * 6 Mℓ modules = 12 Mℓ

Table 12.33 Pipeline details: Lower Thukela Supply System.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
North Coast	Raw Water	Abstraction Weir	Lower Thukela WTP	0.59	950	Steel	122*	6
North Coast	Lower Thukela Rising Main	Lower Thukela WTP	Lower Thukela South Reservoir	2.57	900	Steel	110*	6
North Coast	Lower Thukela Southern Main	Lower Thukela South Reservoir	Mvoti Balancing Reservoir	28.9	900	Steel	110*	6

* Based on a velocity of 2.0 m/s

Table 12.34 Reservoir details: Lower Thukela Supply System.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
North Coast	Tugela	Lower Thukela South Reservoir	30.0	Balancing	249	232

Table 12.35 Pump details: Lower Thukela Supply System

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
North Coast	Lower Thukela Raw Water	2	1	Sulzer SM 302-450	Thukela Weir	Lower Thukela WTP	27.7	45.9	34.5
North Coast	Lower Thukela – High Lift	1	1	Sulzer SM 303-800	Lower Thukela WTP	Lower Thukela South Reservoir	204.9	227.9	57.5

(j) Ngcebo Bulk Water Supply System

The Ngcebo BWSS was implemented in the early 2008 to meet the backlogs within Ngcebo. The area consists of rural communities that have a basic level of service. Water is abstracted from the uThukela River upstream of the Lower Thukela abstraction point. The treatment works, which has a capacity of 2 Mℓ/day is located on the right hand side of the river and transfers water to command reservoirs in the rural areas of Ngcebo.

(k) Maphumulo Water Treatment Plant and Supply System

The demand for water on the KwaZulu-Natal North Coast, and in particular the inland rural areas of the iLembe District Municipality, are forecast to increase significantly in the future. The requirement for potable water supply to rural backlog areas has resulted in Umgeni Water implementing the Maphumulo Bulk Water Supply Scheme with its source on the iMvutshane River. Phase 1 of this scheme (**Figure 12.22 and Figure 12.23**), was commissioned in May 2013 and the construction of Phase 2 - iMvutshane Dam was completed in 2015.

Figure 12.23 shows a schematic of the Maphumulo Bulk Water Supply Scheme, which includes the iMvutshane Dam, an abstraction works, a water treatment plant and bulk rising and gravity mains to supply potable water from the water treatment works into the iLembe District Municipality's greater Maphumulo area.

Raw water is treated at the Maphumulo WTP and pumped to a booster reservoir. From the booster reservoir potable water is pumped to the Maphumulo and the Nyamazane Reservoirs (**Table 12.25**, **Table 12.36** and **Table 12.38**). The Maphumulo Reservoir serves as a distribution reservoir for the town of Maphumulo and also supplies the Masibambisane Reservoir, which in turn supplies Maphumulo Hospital Reservoir. The Nyamazane Reservoir serves as a distribution reservoir for the towns of Nyamazane and Maqumbi (from Reservoir F). The Maqumbi Reservoir F in turn supplies both the Maqumbi Reservoir T and Ashville Reservoirs (**Figure 12.22**). The raw water pumps were upgraded in December 2018 with a capacity to supply 12 Mℓ/day to the WTP.

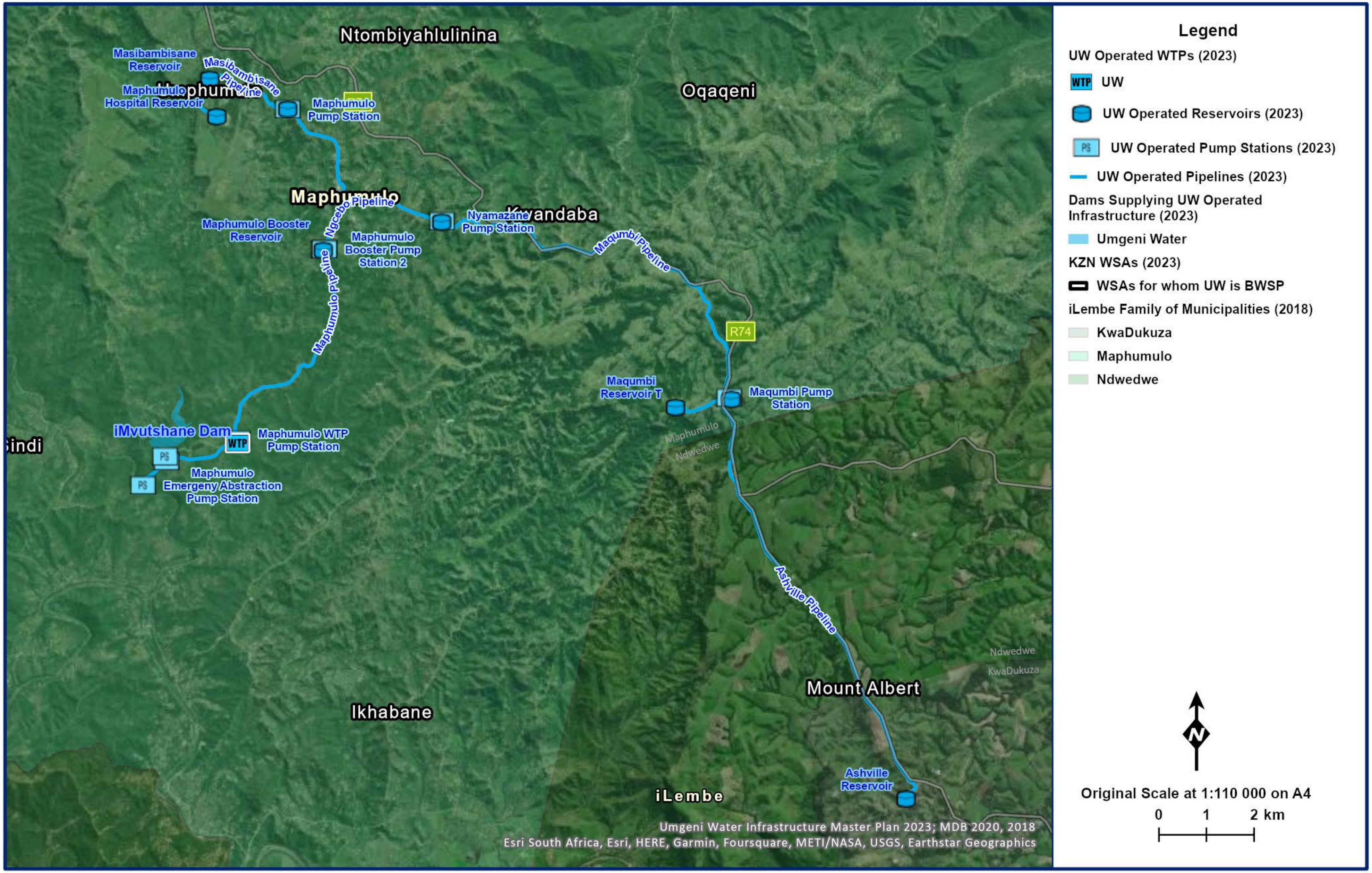


Figure 12.22 General layout of the Maphumulo BWSS.

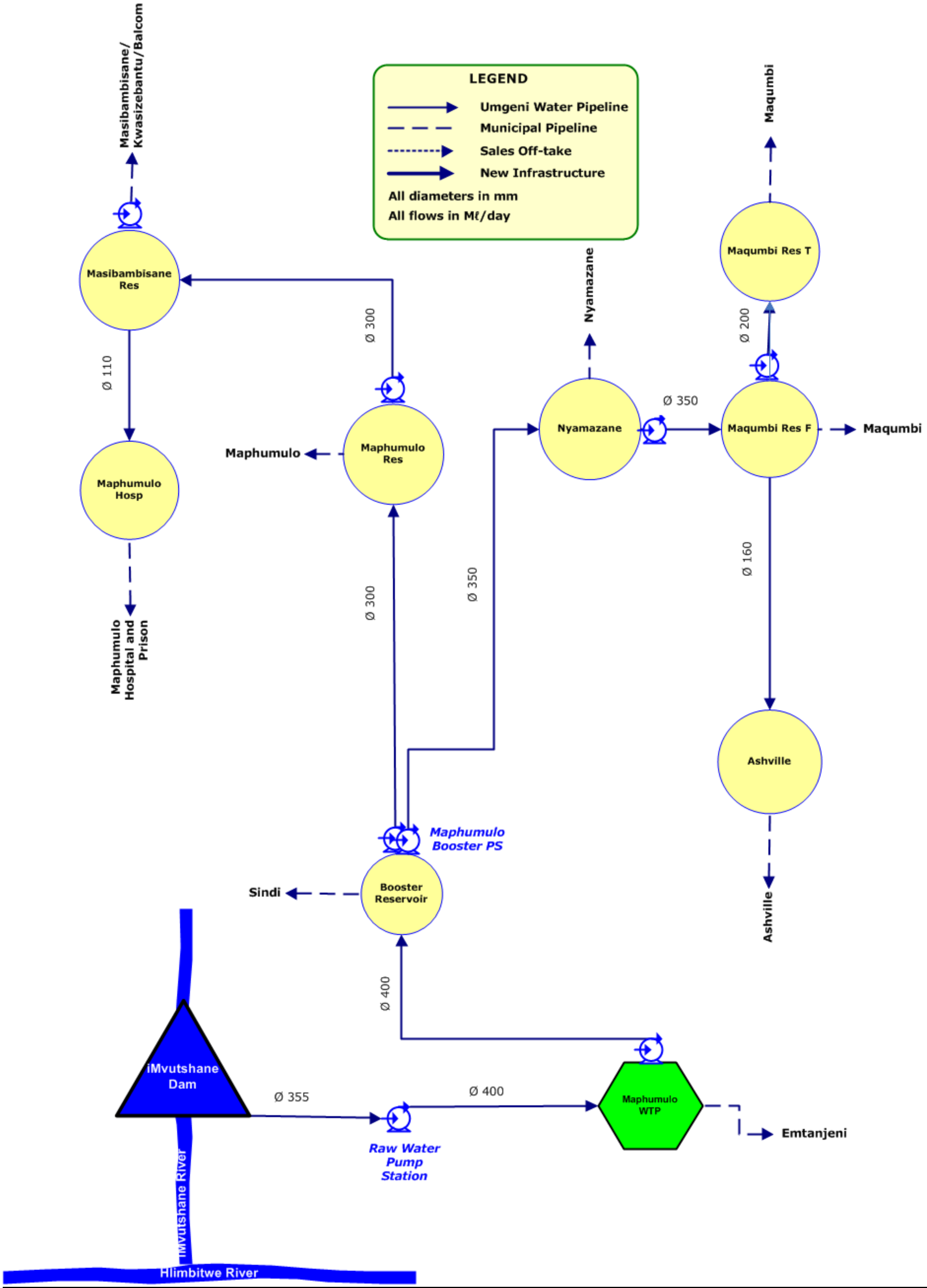


Figure 12.23 Schematic of the Maphumulo Supply System.

Table 12.36 Pump details: Maphumulo BWSS.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
Maphumulo	Raw water Pump Station	2	1	KSB – WKLN 150/5	Raw Water Pump Station	Maphumulo WTP	160	188	16
Maphumulo	Maphumulo WTW Pump Station	2	1	KSB – WKLN 150/5	Maphumulo WTW	Booster Reservoir	166	197	12
Maphumulo	Booster Pump Station 1	2	1	KSB – WKLN 100/7	Booster Reservoir (PS 1)	Maphumulo Reservoir	83	136	6.6
	Booster Pump Station 2	2	1	KSB – WKLN 125/2	Booster Reservoir (PS 2)	Ngcebo Reservoir	47	73.3	7
Maphumulo	Maphumulo Pump Station	2	1	KSB – WKLN 100/8	Maphumulo Reservoir	Masibambisane Reservoir	124	154	6
Maphumulo	Nyamazane (Ngcebo) Pump Station	2	1	KSB – WKLN 100/5	Nyamazane Reservoir	Maqumbi Reservoir F	53	91.2	5
Maphumulo	Maqumbi Pump Station	2	1	KSB – WKLN 65/10	Maqumbi Reservoir F	Maqumbi Reservoir T	85	104	1.63

Table 12.37 Reservoir details: Maphumulo BWSS.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
Maphumulo	Maphumulo	Maphumulo WTW Res	0.5	Distribution	424.1	420.5
Maphumulo	Maphumulo	Booster Reservoir	0.3	Distribution	585.5	582.5

Table 12.38 Pipeline details: Maphumulo BWSS.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
Maphumulo	Raw Water Pipeline	Raw Water Pump Station	Maphumulo WTP	1.85	400	Steel	16.3**	9
Maphumulo	Maphumulo Pipeline	Maphumulo WTP	Booster Reservoir	5.08	400/300	Steel	16.3**	9
Maphumulo	Ngcebo Pipeline	Booster Reservoir	Ngcebo Reservoir T	3.535	350	Steel	12.5**	9
Maphumulo	Maqumbi Pipeline	Ngcebo Reservoir	Maqumbi Reservoir F	10.15	300	Steel	9.16**	9
Maphumulo	Maqumbi Pipeline	Maqumbi Reservoir F	Maqumbi Reservoir T	1.38	200	Steel	4.07**	9
Maphumulo	Ashville Pipeline	Maqumbi Reservoir T	Ashville Reservoir	9	160	Steel	3.5*	9
Maphumulo	Maphumulo Pipeline	Booster Reservoir	Maphumulo Reservoir	3.815	300	Steel	9.16**	9
Maphumulo	Masibambisane Pipeline	Maphumulo Reservoir	Masibambisane Reservoir	2.25	300	steel	9.16**	9

* Based on a velocity of 2 m/s

** Based on a velocity of 1.5 m/s

The characteristics of the Maphumulo WTP are shown in **Table 12.39**.

Table 12.39 Characteristics of the Maphumulo WTP.

WTP Name:	Maphumulo WTP
System:	North Coast Supply System
Maximum Design Capacity:	6 Mℓ/day for Phase 1 and 5 Mℓ/day package plant
Current Utilisation (October 2022):	6.8 Mℓ/day
Raw Water Storage Capacity:	0 Mℓ
Raw Water Supply Capacity:	7 Mℓ/day for Phase 1 and 12 Mℓ/day for Phase 2
Pre-Oxidation Type:	Prechlorination
Primary Water Pre-Treatment Chemical:	Polymeric Coagulant
Total Coagulant Dosing Capacity:	15 ℓ/hour
Rapid Mixing Method:	Conventional Paddle Flash Mixer
Clarifier Type:	Dortmund manual clarifiers
Number of Clarifiers:	4 for phase 1 increasing to 6 for Phase 2
Total Area of all Clarifiers:	345.6 m^2
Total Capacity of Clarifiers:	12.5 Mℓ/day
Filter Type:	Constant Rate Rapid Gravity Filters
Number of Filters:	5 for Phase 1 increasing to 8 for Phase 2
Filter Floor Type	Laterals without Nozzles
Total Filtration Area of all Filters	80 m^2
Total Filtration Design Capacity of all Filters:	12.5 Mℓ/day
Total Capacity of Backwash Water Tanks:	100 m^3
Total Capacity of Sludge Treatment Plant:	None
Capacity of Used Washwater System:	0 Mℓ/day
Primary Post Disinfection Type:	Chlorine Gas
Disinfection Dosing Capacity:	10 $kgCl_2$/hr
Disinfectant Storage Capacity:	
Total Treated Water Storage Capacity:	0.5 Mℓ

12.3.2 Description of the Upper Mvoti System

(a) Overview

The Upper Mvoti System is located in the Mvoti Local Municipality in the upper reaches of the Mvoti Water Resource Region (**Figure 12.24**). The main urban centre in the Upper Mvoti System is Greytown, the administrative seat of the Mvoti Local Municipality. Other settlements include Kranskop (located on the Upper Mvoti-Middle uThukela watershed), Ahrens, Seven Oaks, Mount Elias and Mount Alida (located on the Upper Mvoti-Mooi watershed). Greytown, which can be viewed as a strong regional centre with substantial commercial and agricultural activity, is supplied by the Greytown WTP which abstracts water from Lake Merthley and groundwater.

The existing schemes in the Upper Mvoti are summarised in **Table 12.40** below showing the All Towns Reconciliation Study water supply scheme areas, WTPs and their capacity, abstraction sources and supply areas.

Table 12.40 Summary of Upper Mvoti existing infrastructure per Water Supply Scheme (DWS 2011).

Scheme Area	Source	Water Treatment Plant	Reservoir Capacity (Mℓ)
Greytown	Lake Merthley	Greytown WTP – 6.00 Mℓ/day, Conventional Plant	6.22
Kranskop	Groundwater	Kranskop WTP – 0.92 Mℓ/day, Conventional Plant	0.60

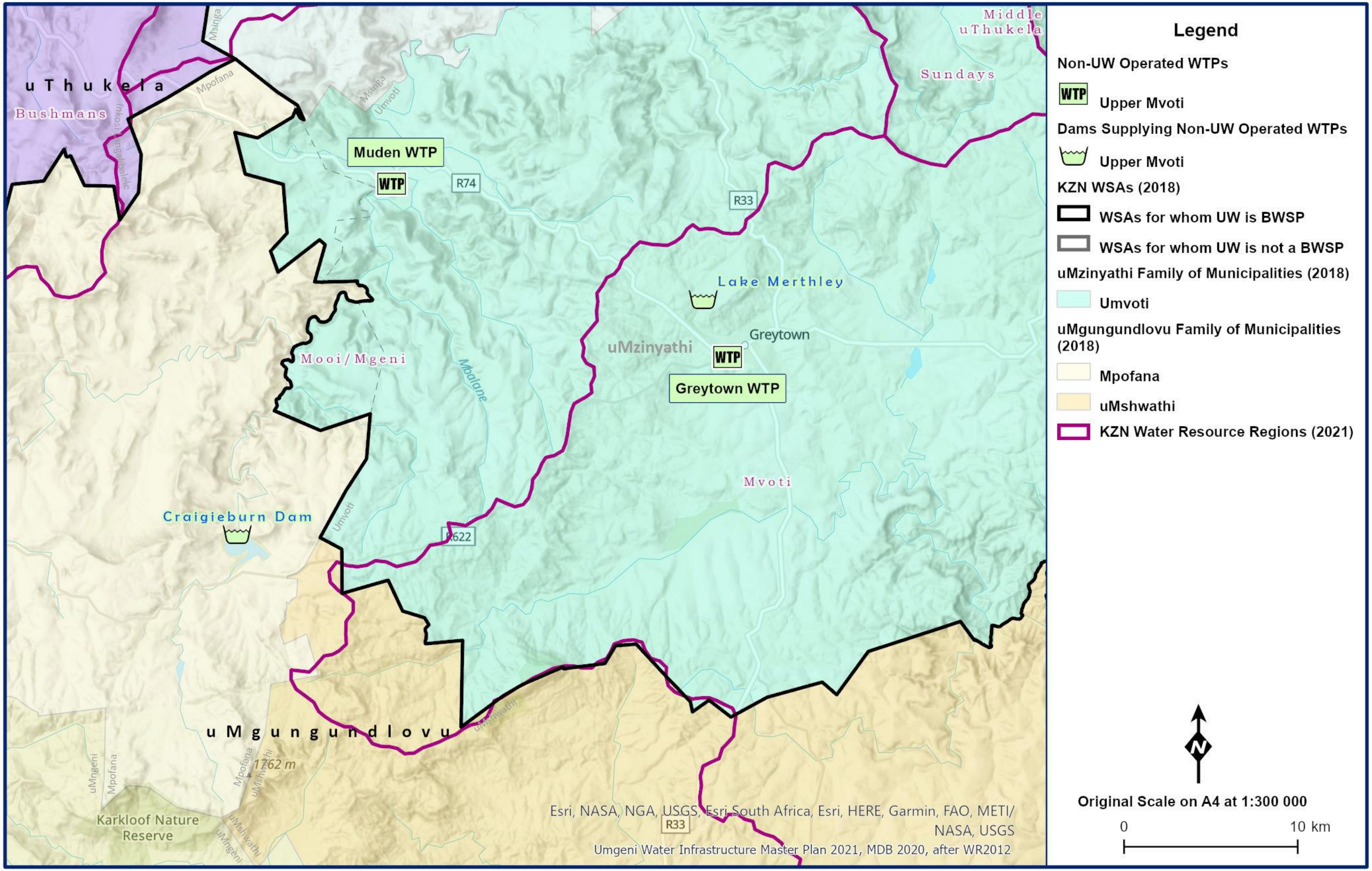


Figure 12.24 General layout of the Upper Mvoti System.

(b) Greytown Water Treatment Plant and Supply System

Water resources in the Greytown WTP supply area consists of Lake Merthley Dam and six boreholes (currently not in use due to low levels or completely dry), which have a combined yield of 4 Mℓ/day. Water is fed via gravity from Lake Merthley Dam to the WTP. This gravity pipeline was upgraded in 2010. A further thirteen boreholes have been drilled under a project funded by CoGTA, and these have sufficient yield to meet the current demand. Water from the boreholes is fed directly to the WTP.

The Greytown Water Supply Scheme (**Figure 12.25**) includes the raw water resources as noted above, a water treatment plant (**Table 12.41** and **Figure 12.26**) and bulk gravity mains (**Table 12.43**) to supply potable water from the water treatment works into the Mvoti LM's Greytown area.

Raw water is treated at the Greytown WTP and gravity fed to four terminal reservoirs. From the terminal reservoirs, potable water is fed to various suburbs in Greytown. The pump station details are listed in **Table 12.44**.

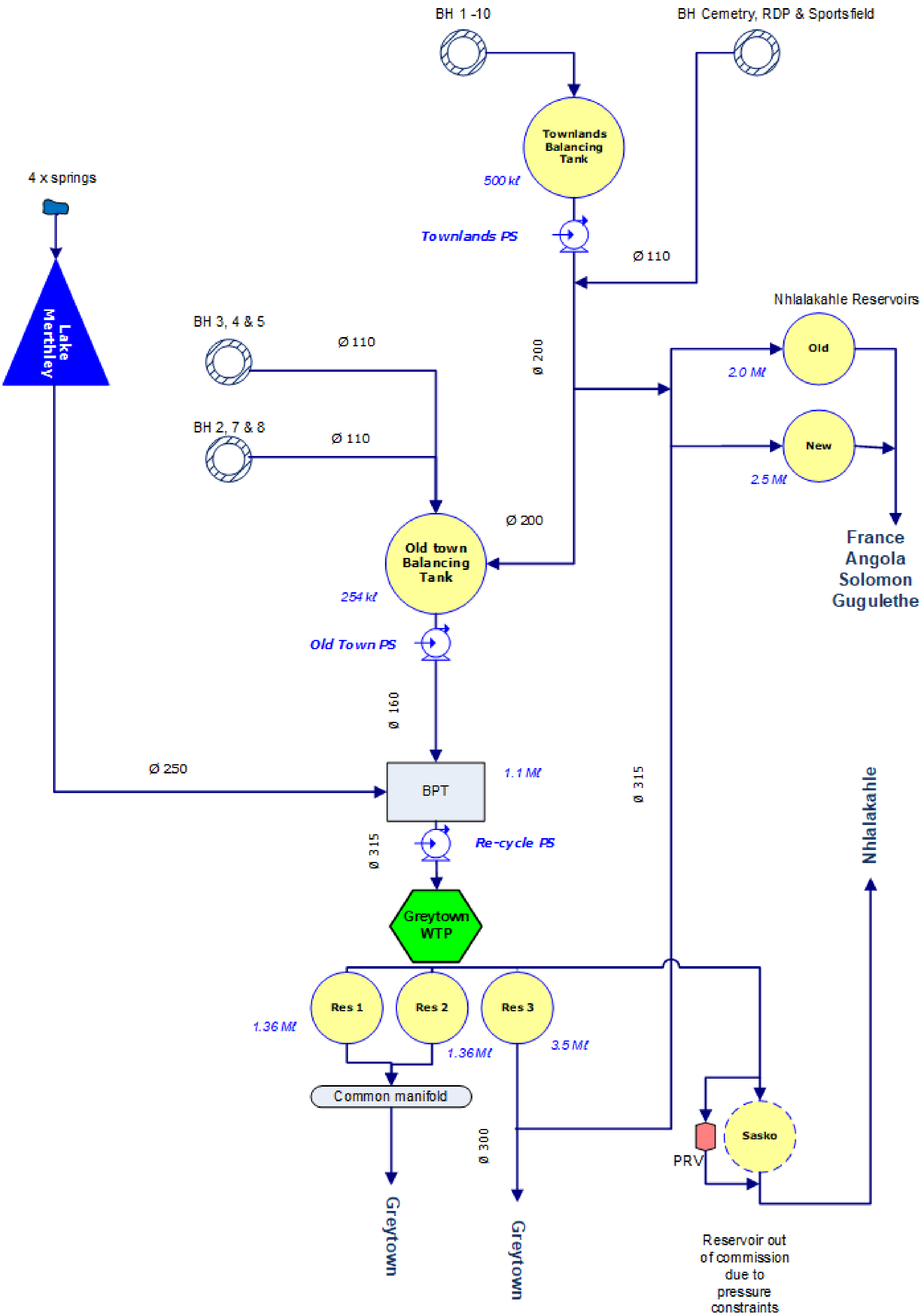


Figure 12.25 Schematic of the Greytown Supply System.

The characteristics of the Greytown WTP are shown in **Table 12.39**.

Table 12.41 Characteristics of the Greytown WTP.

WTP Name:	Greytown WTP
System:	Mvoti Supply System
Maximum Design Capacity:	6 Mℓ/day
Current Utilisation:	4.7 Mℓ/day (Demand is restricted until Craigie Burn pipeline is commissioned)
Raw Water Storage Capacity:	0 Mℓ
Raw Water Supply Capacity:	xx Mℓ/day
Pre-Oxidation Type:	None
Primary Water Pre-Treatment Chemical:	Polymeric Coagulant
Total Coagulant Dosing Capacity:	13 ℓ/hour maximum
Rapid Mixing Method:	Conventional Paddle Flash Mixer
Clarifier Type:	Dortmund manual clarifloculators
Number of Clarifiers:	2
Total Area of all Clarifiers:	265.46 m^2
Total Capacity of Clarifiers:	6 Mℓ/day
Filter Type:	Constant Rate Rapid Gravity Filters
Number of Filters:	3
Filter Floor Type	Laterals with Nozzles
Total Filtration Area of all Filters	59.4 m^2
Total Filtration Design Capacity of all Filters:	6 Mℓ/day
Total Capacity of Backwash Water Tanks:	0 m^3
Total Capacity of Sludge Treatment Plant:	None
Capacity of Used Washwater System:	6 Mℓ/day
Primary Post Disinfection Type:	Sodium Hypocloride
Disinfection Dosing Capacity:	3.93 ℓ NaOCl/hr
Disinfectant Storage Capacity:	
Total Treated Water Storage Capacity:	6.22 Mℓ

Figure 12.26 Aerial view of the Greytown Water Treatment Plant (Google Earth 2018).

Table 12.42 Reservoir details: Greytown BWSS.

System	Reservoir Site	Reservoir Name	Capacity (Mℓ)	Function	TWL (aMSL)	FL (aMSL)
Greytown	Greytown	Greytown Reservoir 1	1.36	Terminal	1146.3	1143.1
Greytown	Greytown	Greytown Reservoir 2	1.36	Terminal	1146.3	1143.1
Greytown	Greytown	Greytown Reservoir 3	3.5	Terminal	1146.3	1140.7
Greytown	Greytown	Nhlalakahle Old Reservoir	2.0	Terminal	1116	1111
Greytown	Greytown	Nhlalakahle Old Reservoir	2.5	Terminal	1116	1109
Greytown	Greytown	Old Town Balancing Tank	0.254	Balancing	1073.4	1071
Greytown	Greytown	Townlands Balancing Tank	0.5	Balancing	1020.55	1018
Greytown	Greytown	Greytown BPT	1.1	Balancing	1142.55	1140

Table 12.43 Pipeline details: Greytown BWSS.

System	Pipeline Name	From	To	Length (km)	Nominal Diameter (mm)	Material	Capacity (Mℓ/day)	Age (years)
Greytown	Raw water Pipeline	Lake Merthley	Greytown WTP	4.2	250	uPVC	8.4*	60
Greytown	Raw water Pipeline	Boreholes 2, 7 & 8 2	Old Town Balancing Tank	0.7^	110	uPVC	1.6**	60
Greytown	Raw water Pipeline	Boreholes 3 - 5	Old Town Balancing Tank	0.7^	110	uPVC	1.6**	60
Greytown	Raw water Pipeline	Boreholes 1 -10	Townlands Balancing Tank	0.8^	200	uPVC	5.4*	5
Greytown	Raw water Pipeline	Boreholes Cemetery, RDP & Sportsfield	Old Town Balancing Tank	4.87	200	uPVC	5.4*	5
Greytown	Potable water Pipeline	Reservoir 3	Nhlalakahle Old and new Reservors	4.87	315	HDPE	10**	5
Greytown	Potable water Pipeline	Greytown WTP	Sasko Reservoir	4.3	160	uPVC	3.5*	60

* Based on a velocity of 2 m/s ** Based on a velocity of 1.5 m/s ^ Length is an estimate

Table 12.44 Pump details: Greytown Supply System.

System	Pump Station Name	Number of Pumps		Pump Description	Supply From	Supply To	Static Head (m)	Duty Head (m)	Duty Capacity (Mℓ/day)
		Number of Duty Pumps	Number of Standby Pumps						
Greytown	Old Town Pump Station	1	1	KSB WKLn 65/5	Old Town Balancing Tank	Greytown BPT	69.15	72**	0.72
Greytown	Townlands Pump Station	1	1	KSB WKLn 80/4	Townlands Balancing Tank	Old Town Balancing Tank	52.85	56	1.44
Greytown	Recycle Pump Station	1	1	Grundfos NK 125-250/236- A-BAQE	Greytown BPT	Head of Works	12.45	15.2	6.09

** This figure need to be verified

12.3.3 Status Quo and Limitations of the North Coast System

(a) Hazelmere WTP Supply System

Figure 12.16 illustrates the North Coast System in its current configuration and the current demands being placed on the network. This schematic should be referred to when reading this Section.

The primary source of potable water supplied to the North Coast Supply System (NCSS) is from the Hazelmere WTP and the Lower Thukela Bulk Water Supply System. During the period between November 2021 and October 2022, the average demand placed on the Hazelmere WTP was 60.5 Mℓ/day. The Lower Thukela WTP supplied 46 Mℓ/day bringing the total supply into the coastal strip of the North Coast to 106.5 Mℓ/day.

The historical and projected demand placed on Hazelmere WTP is presented in **Figure 12.27**.

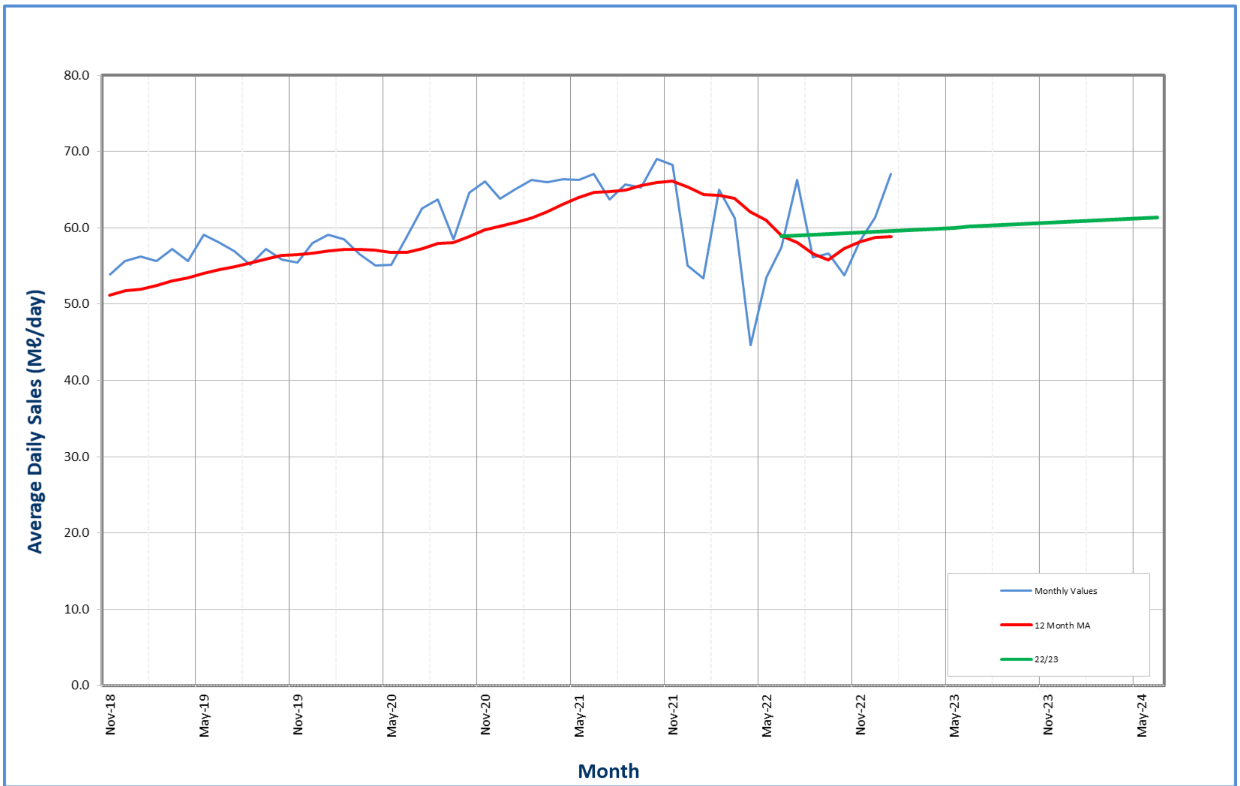


Figure 12.27 Water demand from Hazelmere WTP.

The decrease in demand in October 2021 was as a result of a load shift of the Honolulu supply from the Hazelmere to the Lower Thukela System. Following this load shift, there have been numerous changes in the source of supply to Honolulu supply area between Hazelmere WTP and Lower Thukela WTP. This is due to regular outages on the Lower Thukela pipe.

An analysis of daily historical production for the Hazelmere WTP over the past year (November 2021 to October 2022) is presented in **Figure 12.28.** It shows that for 94% of the time, the WTP was being operated above its optimal operating capacity which is 80% of the plants design capacity and for 34% of the year, the plant operated above its maximum design capacity.

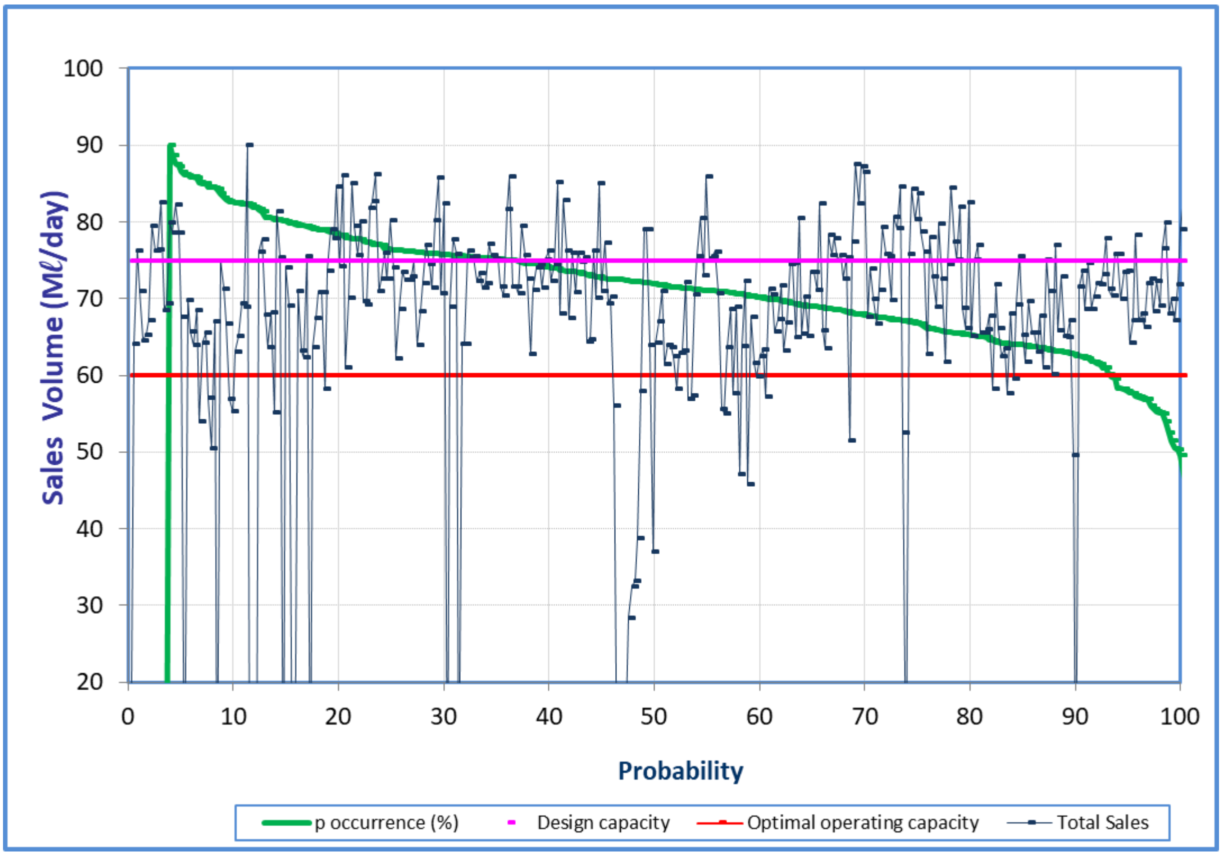


Figure 12.28 Analysis of historical production at Hazelmere WTP (November 2021 to October 2022).

(b) Lower Thukela Bulk Water Supply System

The LTBWSS was commissioned in September 2017. At the time of commissioning, the demand was 7.7 Mℓ/day. There has since been a steady increase in demand as new supply zones were added to the system. In November 2021, Groutville supply was shifted from Hazelmere WTP to the Lower Thukela WTP. This resulted in a stepped increase in demand on the plant, resulting in it currently operating close to its design capacity. This is reflected in the plant production analysis below.

The historical and projected demand placed on the Lower Thukela WTP is presented in **Figure 12.29.** Demand is significantly higher than the projection and this is of concern, particularly because the plant is operating at capacity.

An analysis of daily historical production for the Lower Thukela WTP over the past year (November 2021 to October 2022) is presented in **Figure 12.30** and shows that for 97% of the time the WTP operated above its optimal operating capacity (80% of the plant's design capacity) and 73% of the time, the plant operated above its design capacity.

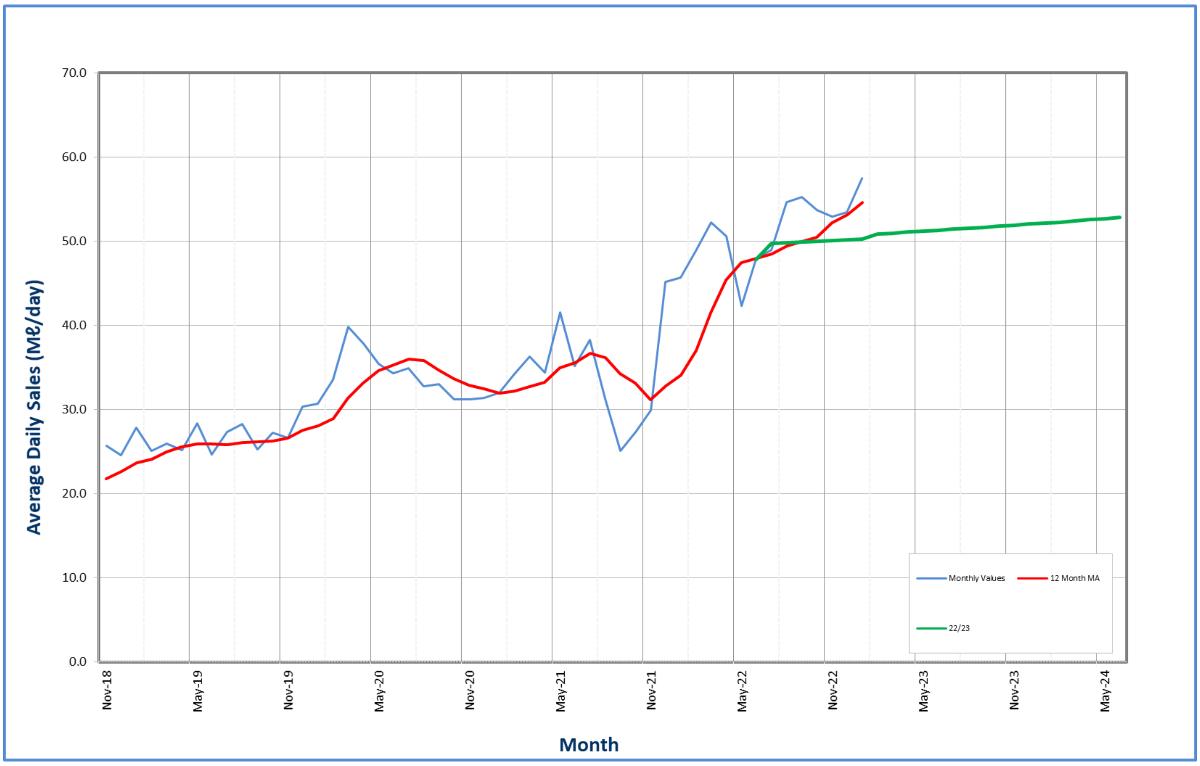


Figure 12.29 Water Demand from Lower Thukela WTP

iLembe DM has not been operating the Mvoti WTP and this demand of about 10Ml/day has been supplied from the Lower Thukela WTP. This accounts for the significant increase in demand, resulting in the plant now operating at or above its design capacity.

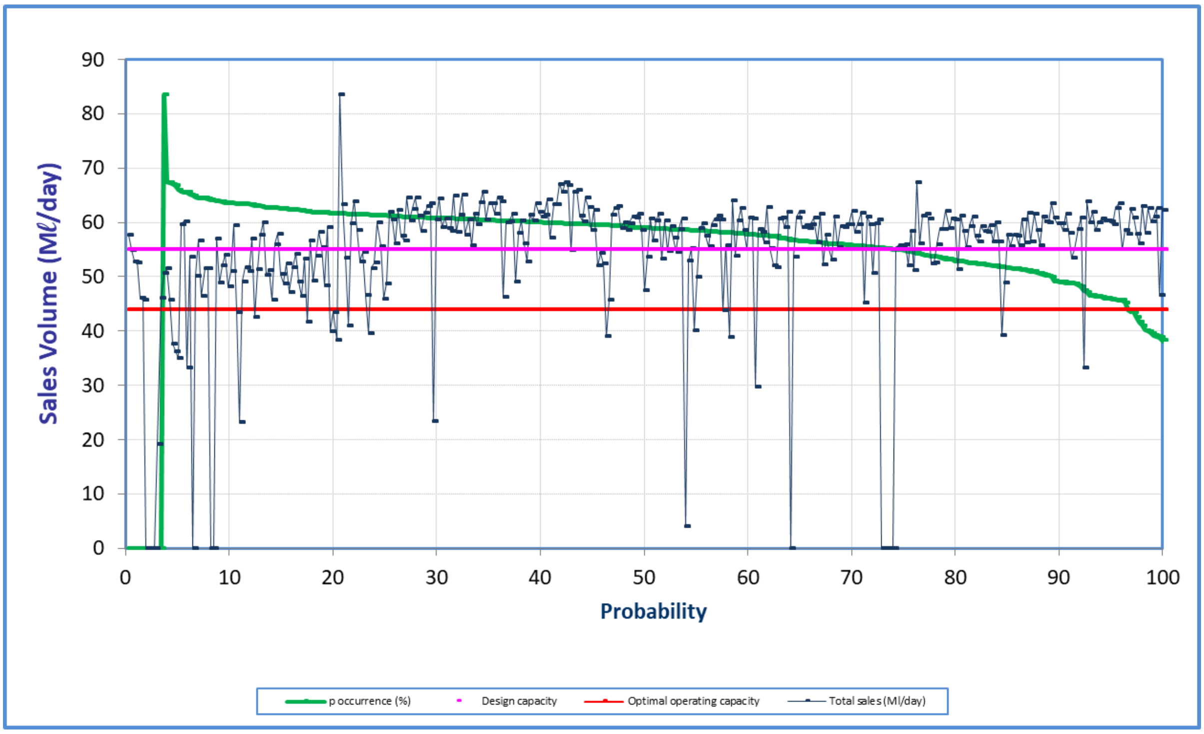


Figure 12.30 Analysis of historical production at Lower Thukela WTP (November 2021to October 2022).

(c) Maphumulo WTP Supply System

The town of Maphumulo and surrounding areas are supplied from the Maphumulo WTP. The average demand placed on the WTP in the past year was 6.0 Mℓ/day. The current design capacity of the WTP is 6 Mℓ/day with plans of upgrading it to 12 Mℓ/day. A 5 Mℓ/day package plant has been installed to augment the current capacity in the interim until the upgrade is implemented.

The historical and projected demand placed on the Maphumulo WTP is presented in **Figure 12.31**. Supply to the Maphumulo communities is through pumping systems and demand has been constrained due to electricity power outages in the area. This is reflected in the declining demand in 2022.

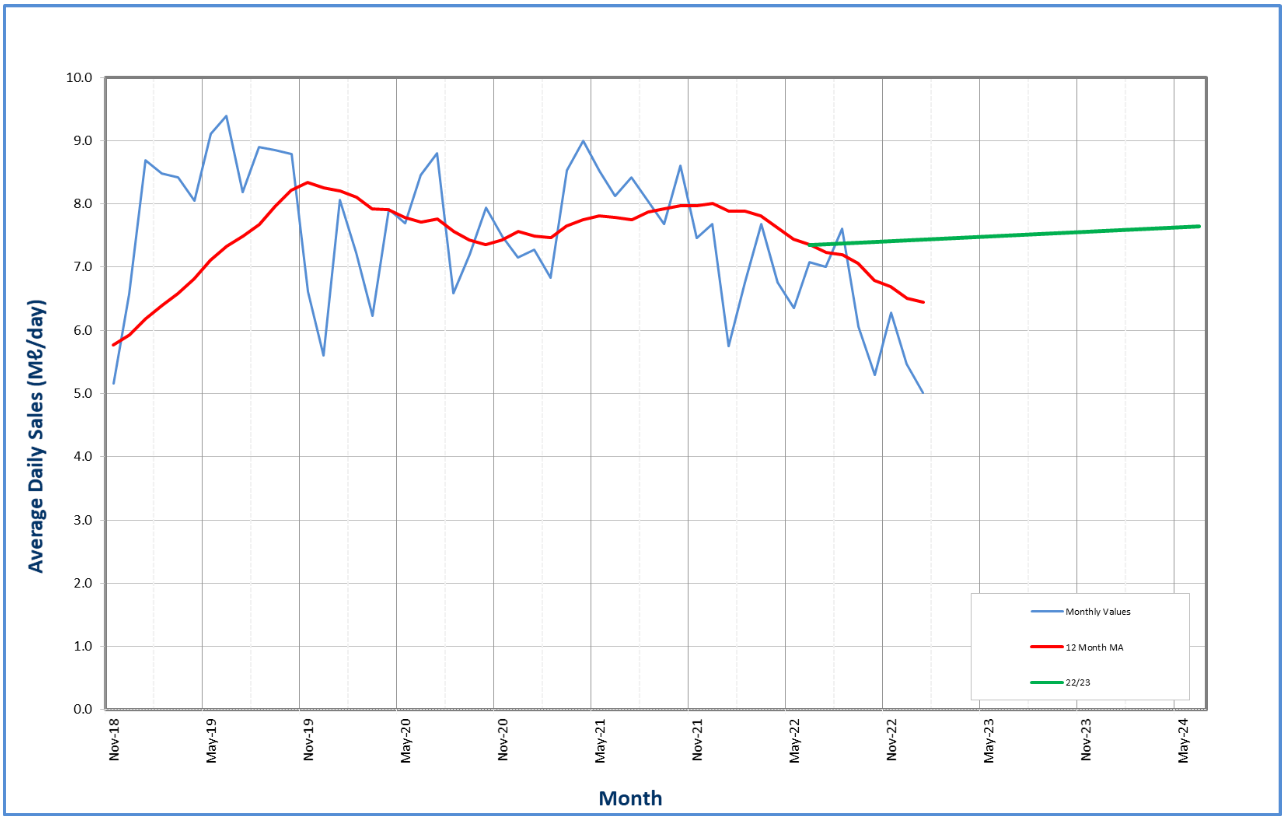


Figure 12.31 Water Demand from Maphumulo WTP.

An analysis of daily historical production for the Maphumulo WTP over the past year (November 2021to October 2022) is presented in **Figure 12.32**, and shows that the WTP was being operated above its optimal operating capacity for 9% of the time. The plant did not operate above its design capacity.

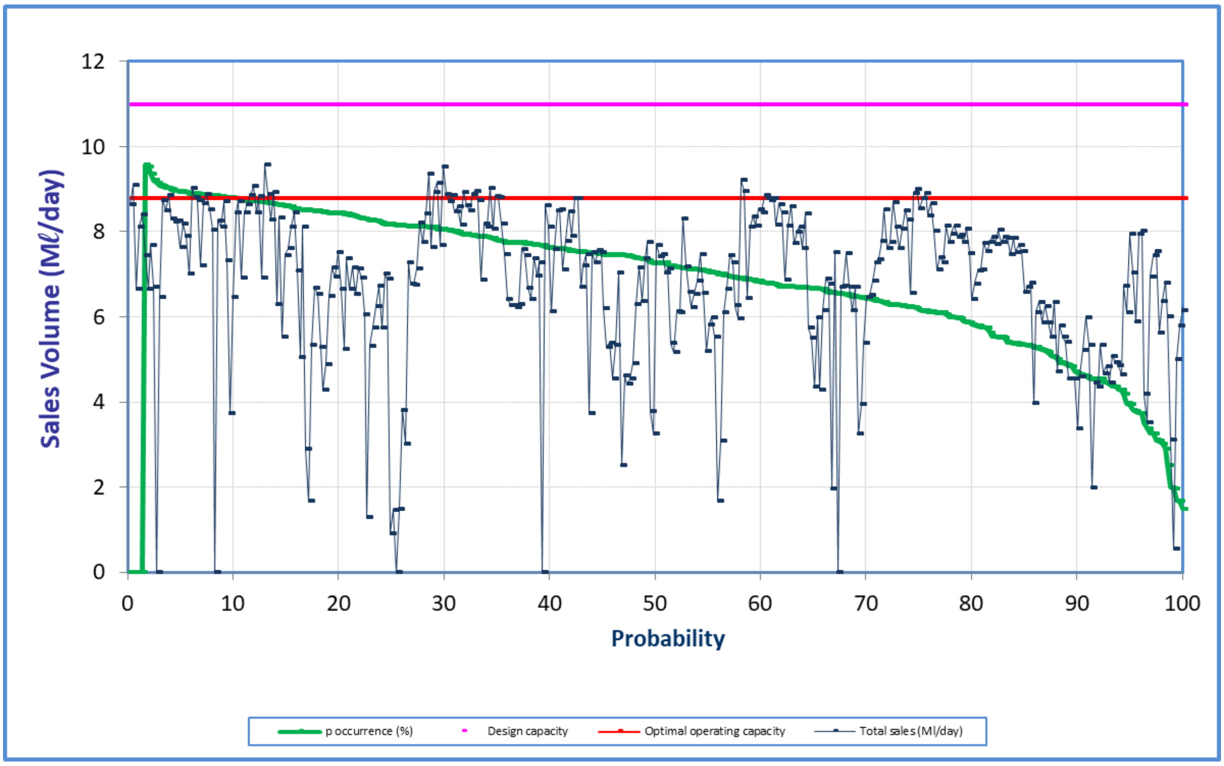


Figure 12.32 Analysis of historical production at Maphumulo WTP (November 2021 to October 2022).

(d) North Coast Supply System (NCSS)

The total current demand, together with a breakdown of sales throughout the NCSS, is presented in **Figure 12.33**. Identified future development nodes include:

- The Phase 1 of the Cornubia Development, planned by eThekwini Municipality near Verulam, has already commenced. This project has a projected growth over the next 30 years to 60 000 residential housing units and industrial and commercial sites. Implementation has, however, been slower than initially anticipated.
- The King Shaka International Airport became operational on the 1st May 2010. Demand from the airport, associated Dube Trade-Port, and other developments surrounding the area is expected to grow from the current 1.4 Mℓ/day to greater than 10 Mℓ/day over the next ten years.
- More than 70 development projects are proposed within the area covered by the NCSS. These include up market housing developments such as Blythedale and Royal Palm Estates, low cost housing developments such as the Etete Low Cost Housing Projects, the Driefontein Medium Income Housing Project and the Nonoti Land Restitution Project and commercial and industrial developments. The Ballito Hills development is being commissioned is phases and is set to be completed within the next 5 years.
- There are numerous off-takes that have been connected on the Lower Thukela pipeline between the Lower Thukela Reservoir and Mvoti Balancing Reservoir.

The current economic climate and the COVID pandemic has resulted in a "slowdown" in the housing development sector. However, many of the developments are still likely to be implemented although the timing is expected to be extended. The current (October 2022), five, ten, twenty and thirty year forecasts are shown in **Figure 12.33, Figure 12.34, Figure 12.35, Figure 12.36, and Figure 12.37**.

These figures depict the potential for growth in the NCSS over the next five, ten, twenty and thirty years respectively. Also shown in these figures is the configuration of the system that is planned to supply this demand. The following section provides the details of how each subsystem of the NCSS will be affected by the growth in demand over the next thirty years and how the configuration of the system will have to be altered and projects implemented to supply the demand.

The following are the long-term proposals for the region:

- The supply for the next thirty years will be from the raised Hazelmere Dam (now complete) and the uThukela River via the Hazelmere WTP and Lower Thukela WTP respectively.
- Upgrade Hazelmere WTP by 15 Mℓ/day from 75 Mℓ/day to 90 Mℓ/day capacity.
- Upgrade Lower Thukela WTP by 55 Mℓ/day to 110 Mℓ/day capacity. In addition, install pumps and construct a pipeline to supply a new reservoir on the outskirts of Mandini. This upgrade will allow for increased supply south to Kwadukuza.
- Develop a water resource in the upper Mvoti River (Mvoti-Poort Dam) to augment supply into the inland regions of iLembe DM.
- Develop bulk supply to serve the anticipated developments in the northern areas of Tongaat and provide a sustainable supply to Mamba Ridge Reservoir.
- Develop a desalination plant to link into the NCSS as a long-term strategy that would be implemented as and when demands are predicted to exceed supply from the other systems. It should be noted that this intervention could be developed ahead of a regional scheme on the Mvoti River if either demands in the Mgeni System require it or if it proves of better financial value than the Mvoti scheme (**Section 12.5.1 (b)(i) and Section 7 in Volume 2**).

The infrastructure to be constructed, as detailed above, will incur a high capital cost and as such the philosophy is to only develop the schemes as and when demand dictates. With the long lead time in feasibility and design of projects of this size and nature, the intention is to undertake the feasibility investigations and design of the schemes as early as possible and then to implement the schemes as and when demand dictates.

The Lower Thukela WTP and Hazelmere WTP are interconnected by the NCP-2. This allows operational leverage to supply Avondale and Honolulu Reservoirs from either of the WTP's. EWS intents maximising the demand at the Grange and Waterloo supply nodes, thereby relieving pressure on the Mgeni System. About 50 Mℓ/day will potentially be needed through these sales points over the next ten years until the uMkhomazi Water Project is commissioned. The additional 50 Mℓ/day will result in Hazelmere WTP reaching its capacity within the next five years. To relieve demand on this WTP, the treatment capacity will be increased to 90 Mℓ/day and Avondale Reservoir will be supplied by the Lower Thukela WTP. This is likely to be the operating rule up to 2035 (assuming the uMkhomazi Water Project is commissioned by then). The system under this scenario is shown in **Figure 12.35.** When the uMkhomazi Water Project is operational then Waterloo and Grange will be supplied from the Durban Heights WTP. Thereafter, the NCSS will likely revert to the current operating rule as shown in **Figure 12.36,** and **Figure 12.37**.

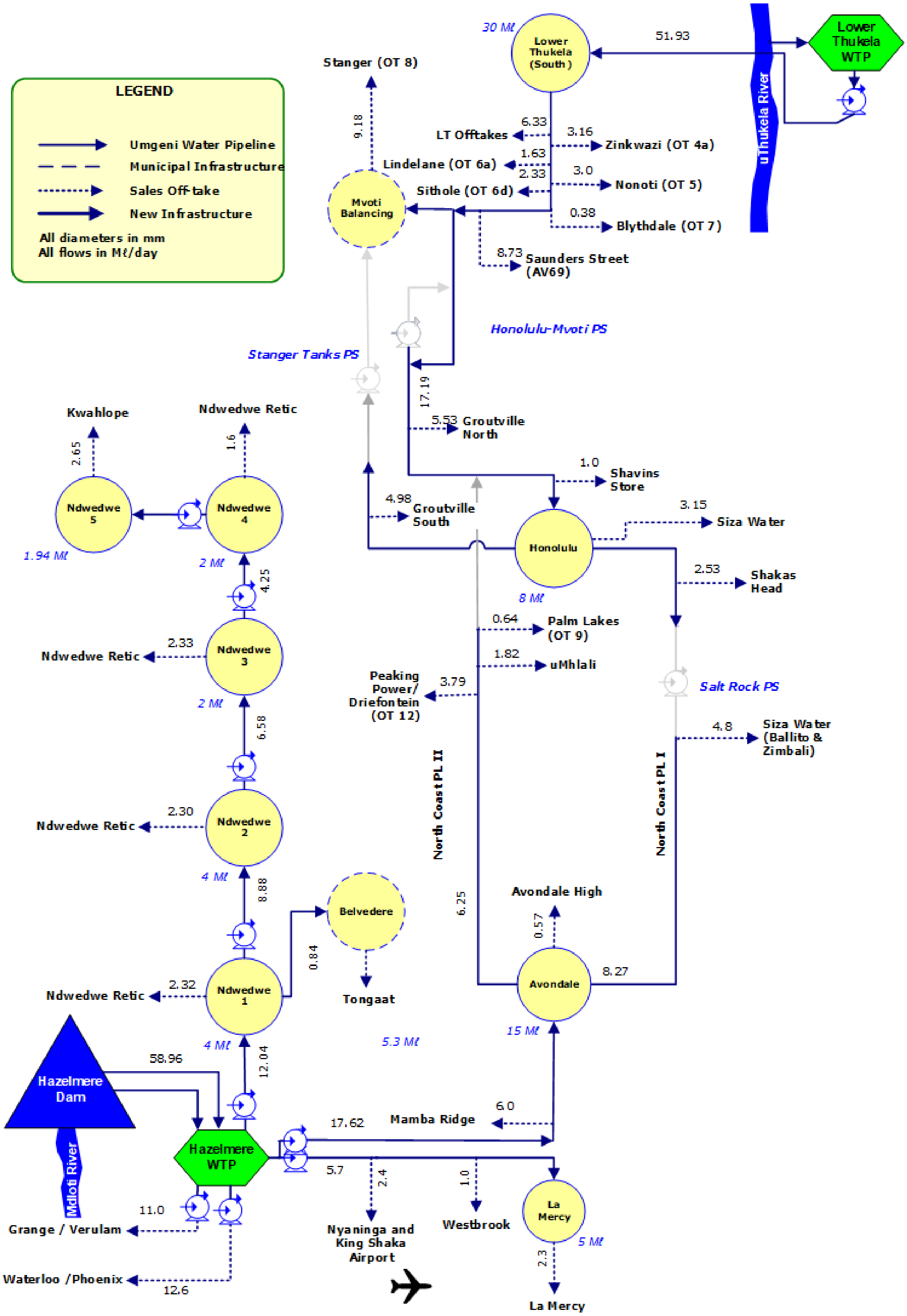


Figure 12.33 Demand on the North Coast Supply System as at October 2022.

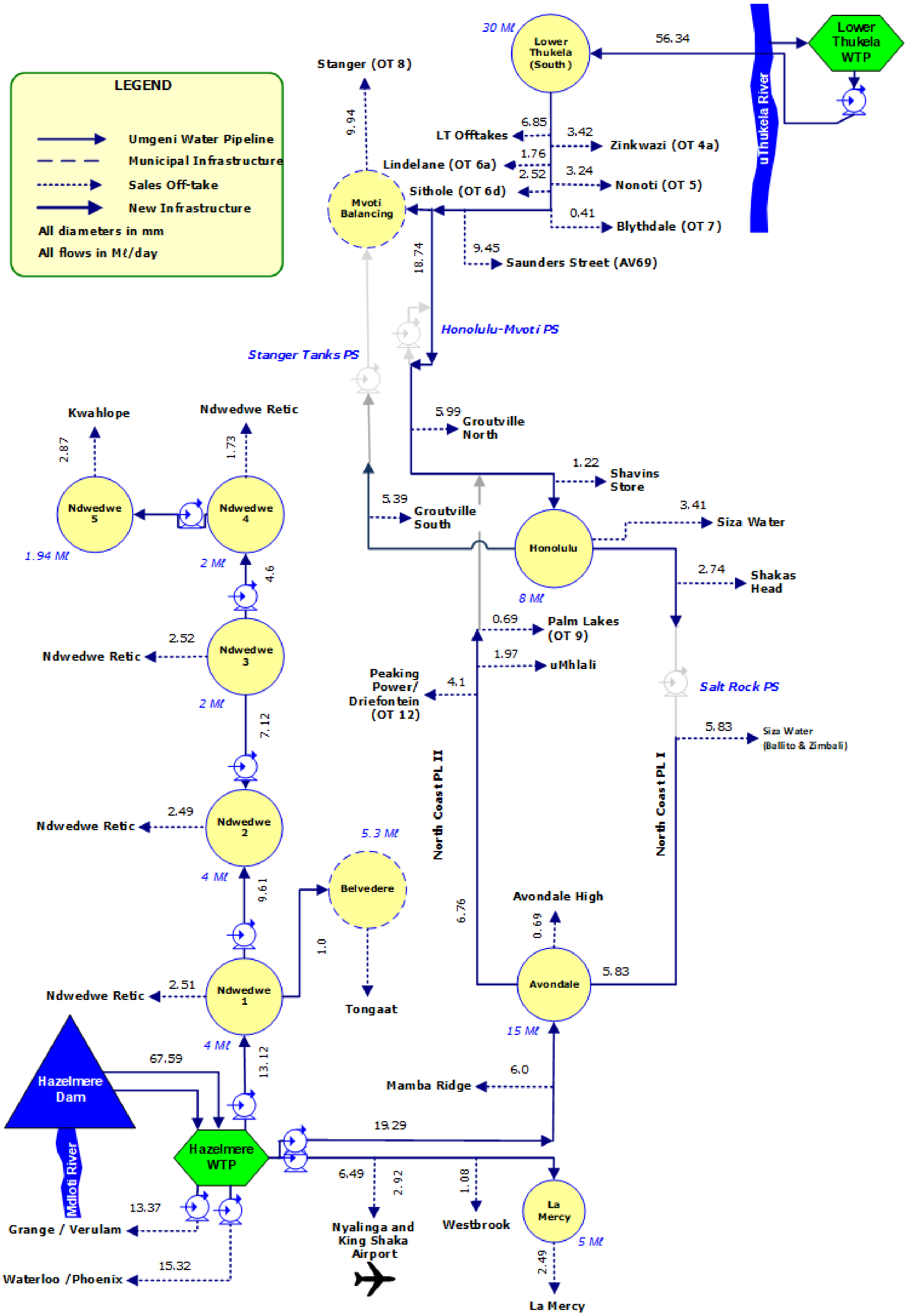


Figure 12.34 Five year demand forecast for the North Coast Supply System.

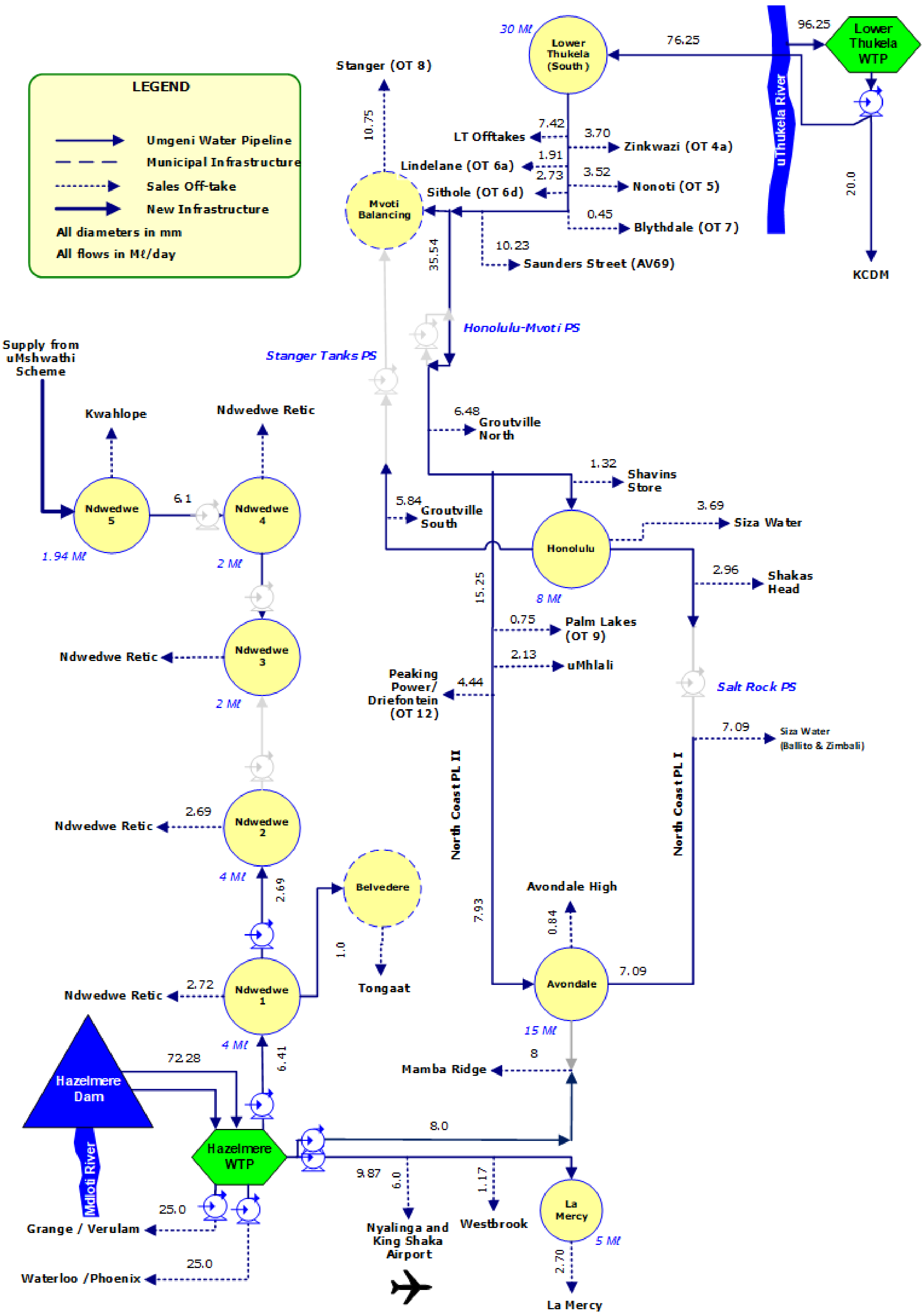


Figure 12.35 Ten year demand forecast for the North Coast Supply System.

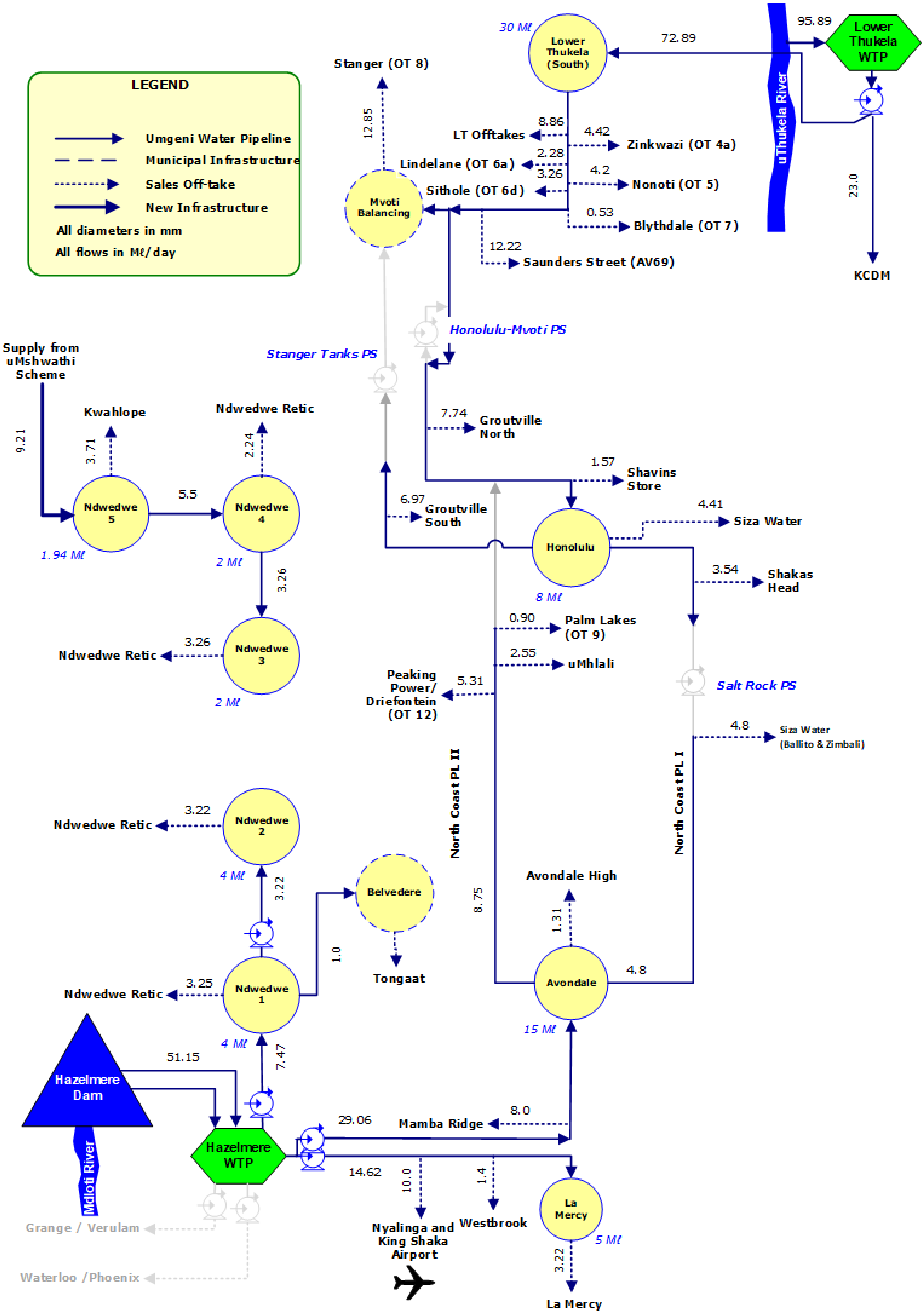


Figure 12.36 Twenty year demand forecast for the North Coast Supply System.

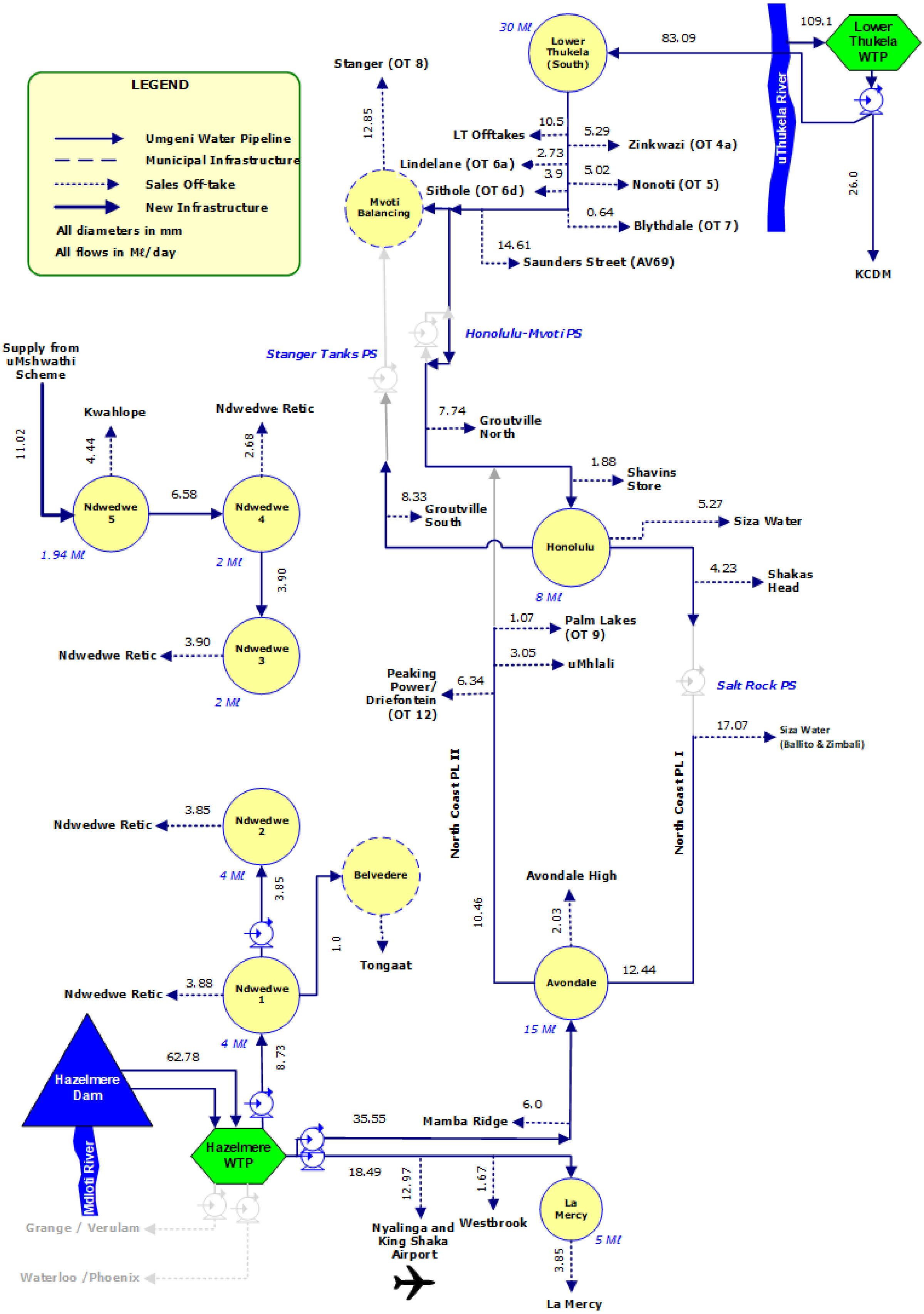


Figure 12.37 Thirty year demand forecast for the North Coast Supply System.

12.3.4 Status Quo and Limitations of the Upper Mvoti System

(a) Greytown Water Treatment Plant and Supply System

The town of Greytown and surrounding areas is supplied from the Greytown WTP. The current design capacity of the WTP is 6 Mℓ/day. The plant is operating at capacity and treatment regularly exceeds design capacity. Plans to upgrade the plant are in place, however, there is no programme to upgrade due to a lack of funds.

The water resources that supply the Greytown WTP include Lake Merthley, 6 boreholes in the Old Town region and 13 boreholes in the Townlands area. Lake Merthley is dependent on 4 springs and these rely on seasonal rainfall to sustain the dam's yield. During the recent drought period, Lake Merthley dropped to a level that rendered this raw water source inadequate.

The aquifer in the six boreholes in the Old Town region is currently too low for current operations and hence are not being utilised at this time. With the intervention of CoGTA and MIG funding, thirteen new boreholes were drilled in the Townlands area and these, together with Lake Merthley, have sufficient yield to meet the current demand of the WTP.

The projected demand for the Greytown WTP is 14.42 Mℓ/day over the next 30 years. This demand increase is as a result of standard growth in the town but also as a result of new RDP housing projects that are currently being implemented or that are planned for implementation.

A study was recently undertaken by DWS to consider augmenting the raw water supply to Greytown from Craigieburn Dam. Subsequently a licence of 12.3 Mℓ/day has been approved for this purpose. The construction of the pipeline from Craigieburn Dam to Greytown, is currently in progress. Plans are also in place to upgrade the WTP by an additional 7 Mℓ/day to a total design capacity of 13 Mℓ/day. The construction of the upgrade to the WTP is on hold indefinitely, subject to funding.

The greatest constraint within this supply area is the availability of a sustainable raw water resource. A feasibility study of an Upper Mvoti Regional Scheme was identified as the long-term strategy to ensure a sustainable raw water source for this area. A feasibility study on this project may have to be brought forward to the short to medium-term to ensure a sustainable supply to Greytown and the surrounding areas in the future.

12.4 Water Balance/Availability

The resource of the North Coast System comprises Hazelmere Dam and Phase 1 of the Lower Thukela BWSS. The yield of the raised Hazelmere Dam is 28 x million m^3/annum and Lower Thukela BWSS has a yield of 40 x million m^3/annum (at a 98% assurance level). The current system water availability as indicated by **Figure 12.38** is 48 x 10^{6}m^3 million m^3/annum (132 Mℓ/day).

While the entire resource of 40 million m^3/annum from Lower Thukela is indicated as being available for the North Coast System, it is likely that a portion of this water will be supplied to other areas to the north of the uThukela River.

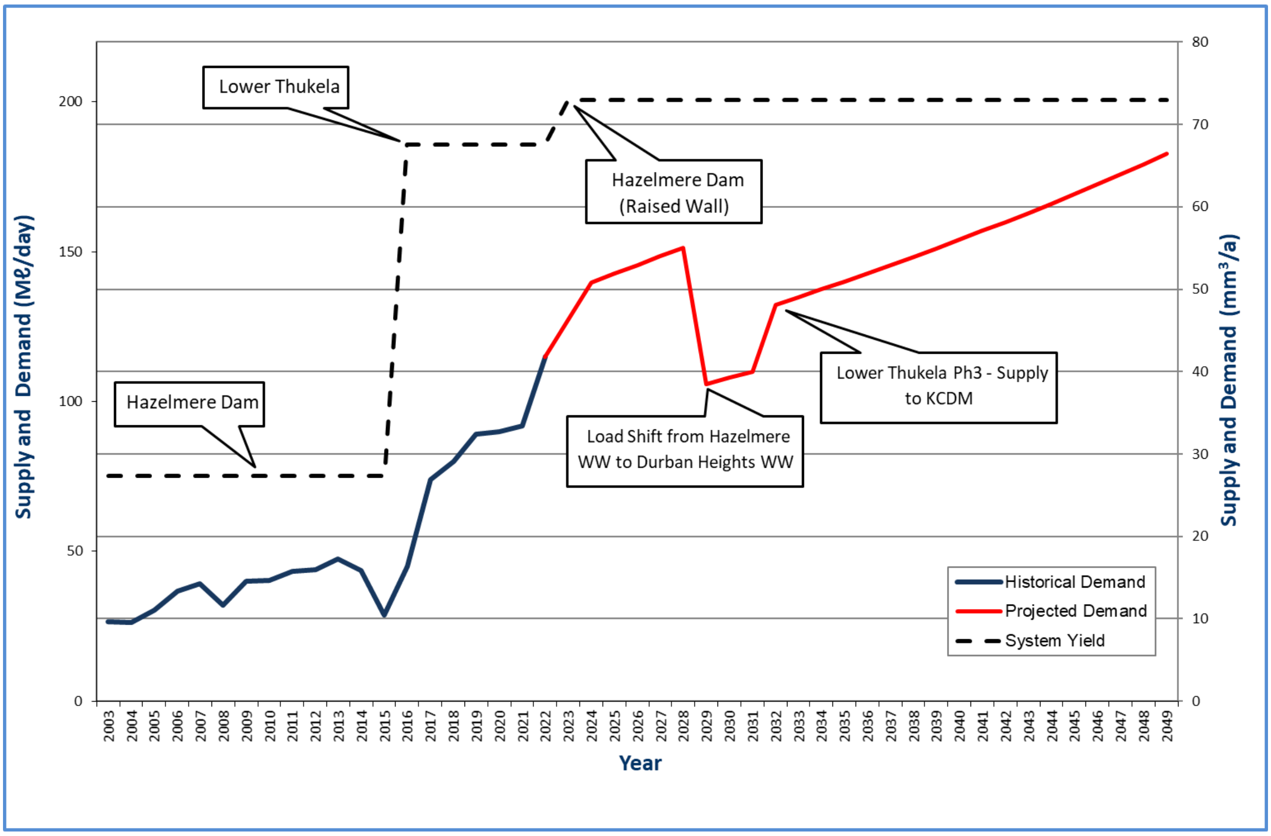


Figure 12.38 North Coast System Balance

In 2025, it is anticipated that the supply to Grange will be increased to 25 Mℓ/day. This is a load shift from the Mgeni System onto the Hazelmere System. An increased demand of up to 25 Mℓ/day is also expected to be supplied to Waterloo to meet the future needs of the Cornubia development. This is anticipated to be supplied in 2025. When the uMkhomazi Water Project is commissioned, these demand nodes will revert to the Mgeni System. This accounts for the sharp drop in demand in 2030.

12.5 Recommendations for the North Coast System

12.5.1 System Components

(a) Lower Thukela Region

The second phase of the Lower Thukela BWSS (**Figure 12.39**) will be to upgrade the WTP and associated infrastructure from 20 million m^3/annum (55 Mℓ/day) to 40 million m^3/annum (110 Mℓ/day) (refer to **Section 12.5.2 (c)** for more details on Phase 2 of the Lower Thukela Bulk Water Supply Scheme).

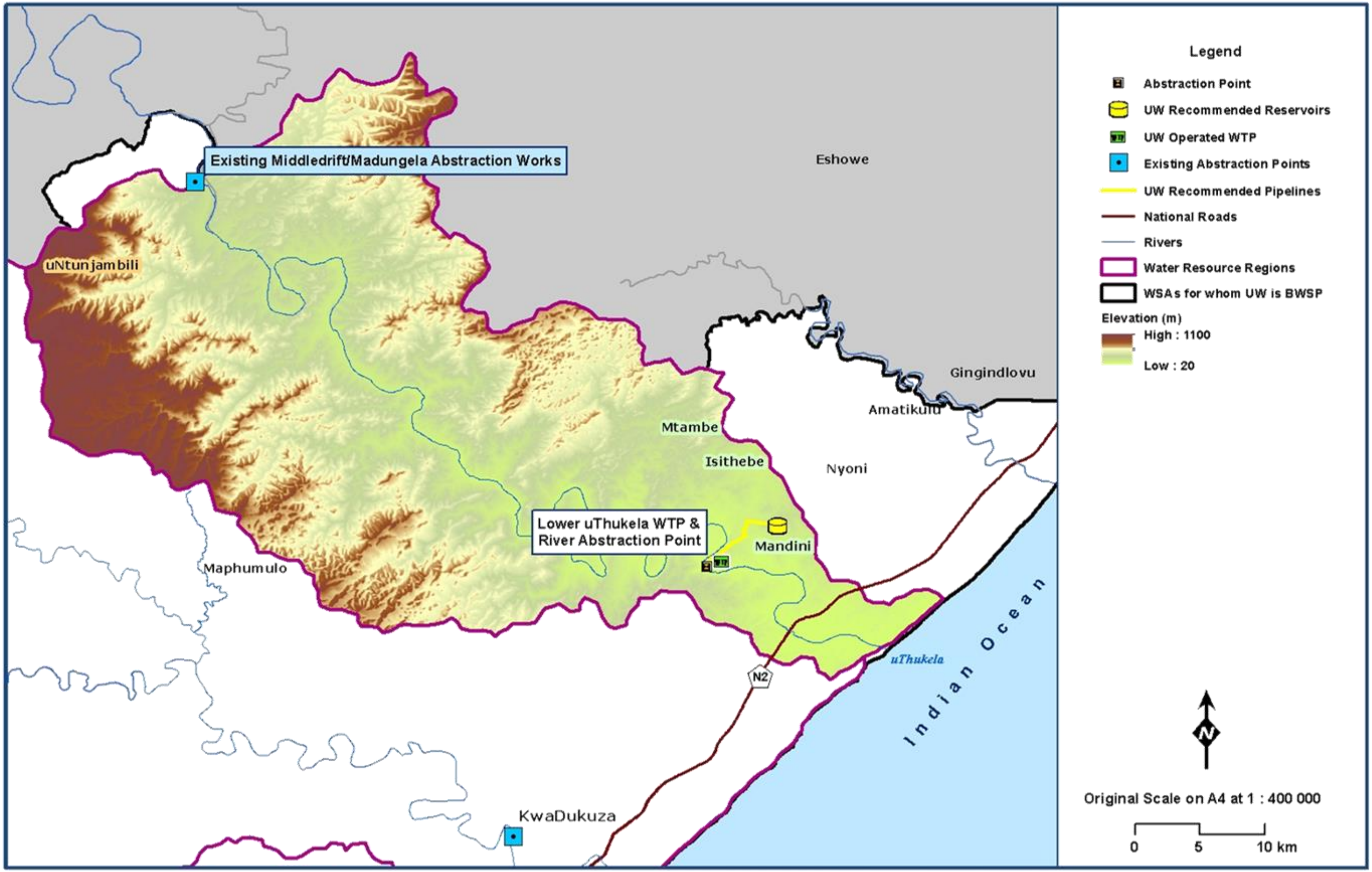


Figure 12.39 Proposed water resource infrastructure in the Lower uThukela Region (KZN DoT 2011; MDB 2016; Umgeni Water 2017; WR2012).

(b) Mvoti Region

(i) Major Surface Water Developments

The long-term macro development strategy for water supply to the KwaZulu-Natal coastal strip between Ballito and the uThukela River is logically centred around the uMvoti River and the lower reaches of the uThukela River.

Investigations of the various uMvoti River options, completed in the late 1990s, concluded that the most favourable water resource development option is the proposed Isithundu Dam (**Figure 12.40**), situated on the uMvoti River immediately upstream of its confluence with the Hlimbitwa River. Water would be released from the dam back into the river for abstraction by downstream irrigators. The remaining released water would be diverted through an existing weir and tunnel at Mvoti View to supply raw water into a small balancing dam situated on a tributary of the uMvoti River. Water would then be pumped to the proposed Fawsley Park WTP to supply into the NCSS under gravity.

Subsequent changes to legislation saw the irrigators withdrawing from the proposed scheme due to the higher cost of raw water from the scheme becoming unaffordable for them. With the resultant shift to a single purpose scheme for domestic and industrial supply only, the criteria used to select the preferred option changed. This implies that the findings of the selection process will have to be reviewed in order to confirm the preferred development option. An alternate option of developing a dam lower on the uMvoti River at Welverdient (**Figure 12.40**) to supply directly to the proposed Fawsley Park WTP now has to be considered. A detailed investigation to determine the preferred option is to be undertaken by DWS.

A potential dam site in the upper reaches of uMvoti River at Mvoti-Poort (**Figure 12.40**) in the vicinity of Greytown was identified during the initial investigations of supply options for the northern coastal regions. Whilst not deemed a suitable option to supply the town of KwaDukuza and surrounds, this site could be developed as a water resource that could support an Upper Mvoti regional bulk scheme to supply potable water to Greytown, Kranskop and surrounds on a sustainable basis in the long-term. A detailed investigation of this site still has to be undertaken by DWS.

DWS is currently developing a terms of reference for a Pre-Feasibility and Feasibility Study of the entire Mvoti System to assess the feasibility of the options mentioned above.

Similarly, to supply the Ozwathini community a scheme had been investigated on the Sikoto River, which is a tributary of uMvoti River. A dam site has been identified on the Sikoto River that has the potential to support this community in the medium to long-term. However, this scheme will not be implemented as the preferred uMshwathi Regional Bulk Water Supply Scheme is now being implemented (**Section 12.5.2 (a)**).

Details of the proposed water resources infrastructure developments in the Mvoti Region are given in **Table 12.45**.

Table 12.45 Proposed water resource infrastructure in the Mvoti Region.

Impoundment	River	Capacity (million m^3)	Yield (million m^3/annum)	Stochastic Yield (million m^3/annum)		
			Historical	1:50	1:100	1:200
Mvoti-Poort Dam	uMvoti	80.1	Not Available	Not Available	Not Available	Not Available
Isithundu Dam	uMvoti	51.3	45 (123 Mℓ/day)	49.0 (134 Mℓ/day)	47.0 (129 Mℓ/day)	45.1 (124 Mℓ/day)
Raised Isithundu Dam	uMvoti	102.0	57 (156 Mℓ/day)	67.0 (184 Mℓ/day)	63.2 (173 Mℓ/day)	59.4 (163 Mℓ/day)
Welverdient Dam	uMvoti	108.1	Not Available	Not Available	Not Available	Not Available

 # excl. Ecological Reserve

Refer to **Section 12.5.2 (d)** for more detail on the Maphumulo Bulk Water Supply Scheme.

(ii) Efaye Groundwater

The additional groundwater resources (265 kℓ/day), secured in 2010 through the drilling of six boreholes, was not realised. The boreholes had not been equipped with pumps or water distribution infrastructure and had been capped. A decision was made not to equip these boreholes, but to rather connect the scheme up to the uMshwathi Regional Bulk Water Supply Scheme as has now been done (**Section 12.5.2 (a)**).

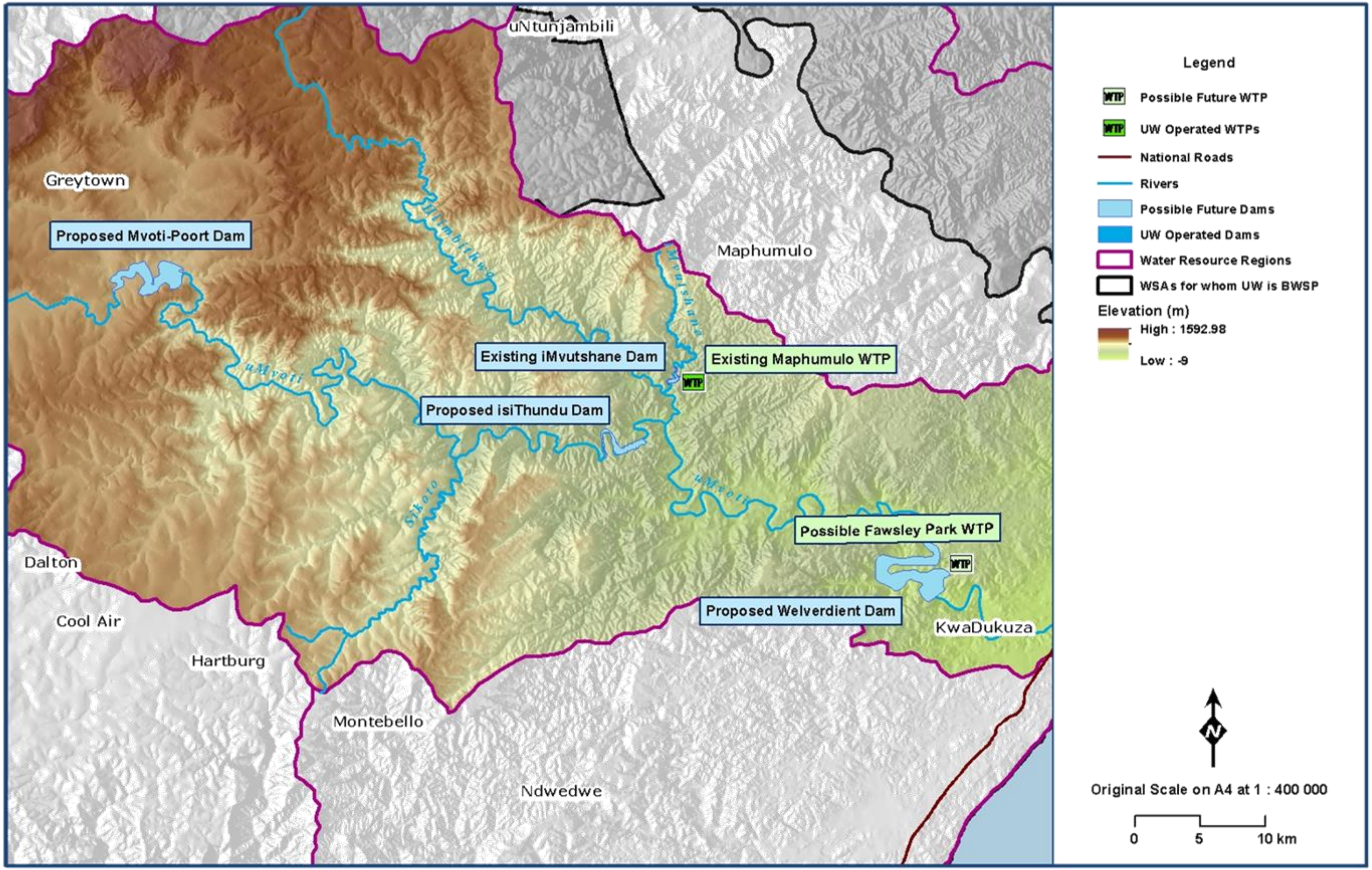


Figure 12.40 **Proposed water resource infrastructure in the Mvoti Region (KZN DoT 2011; MDB 2016; Umgeni Water 2017; WR2012).**

(c) Mdloti Region

The DWS project of raising Hazelmere Dam (**Figure 12.41**) wall by 7 m commenced in the latter part of 2015 after being postponed in 2013. At the time of writing of this document the wall had been raised and additional storage of up to 127% of the original dam capacity was possible. However, a number of rock anchors have not been pre-stressed and as a result DWS have requested that the dam not be filled to greater than 55% as a dam safety measure. Once the project is complete the dam will store 36.123 x 10^6 m^3 which is 202% of the original capacity.

The raising of Hazelmere Dam will not adequately provide for the long-term requirements of the North Coast region, even with its interconnection with the Tongati and Mvoti systems. Therefore, augmentation of this system will be required in the future. These options include:

- The second phase of the Lower Thukela Bulk Water Supply Scheme,
- A scheme to utilise water from the uMvoti River,
- The reuse of treated effluent, and
- Seawater desalination.

Details of the proposed water resources infrastructure developments in the Mdloti Region are provided in **Table 12.46**.

Table 12.46 Proposed water resource infrastructure for the Mdloti Region.

Impoundment	River	Capacity (million m^3)	Yield (million m^3/annum)	Stochastic Yield (million m^3/annum)#		
			Historical*	1:50	1:100	1:200
Raised Hazelmere Dam	uMdloti	36.1	31.0 (84.9 Mℓ/day)	27.7 (75.9 Mℓ/day)	26.5 (72.6 Mℓ/day)	25.7 (70.4 Mℓ/day)

**UW, 2011* *#Excluding Ecological Reserve*

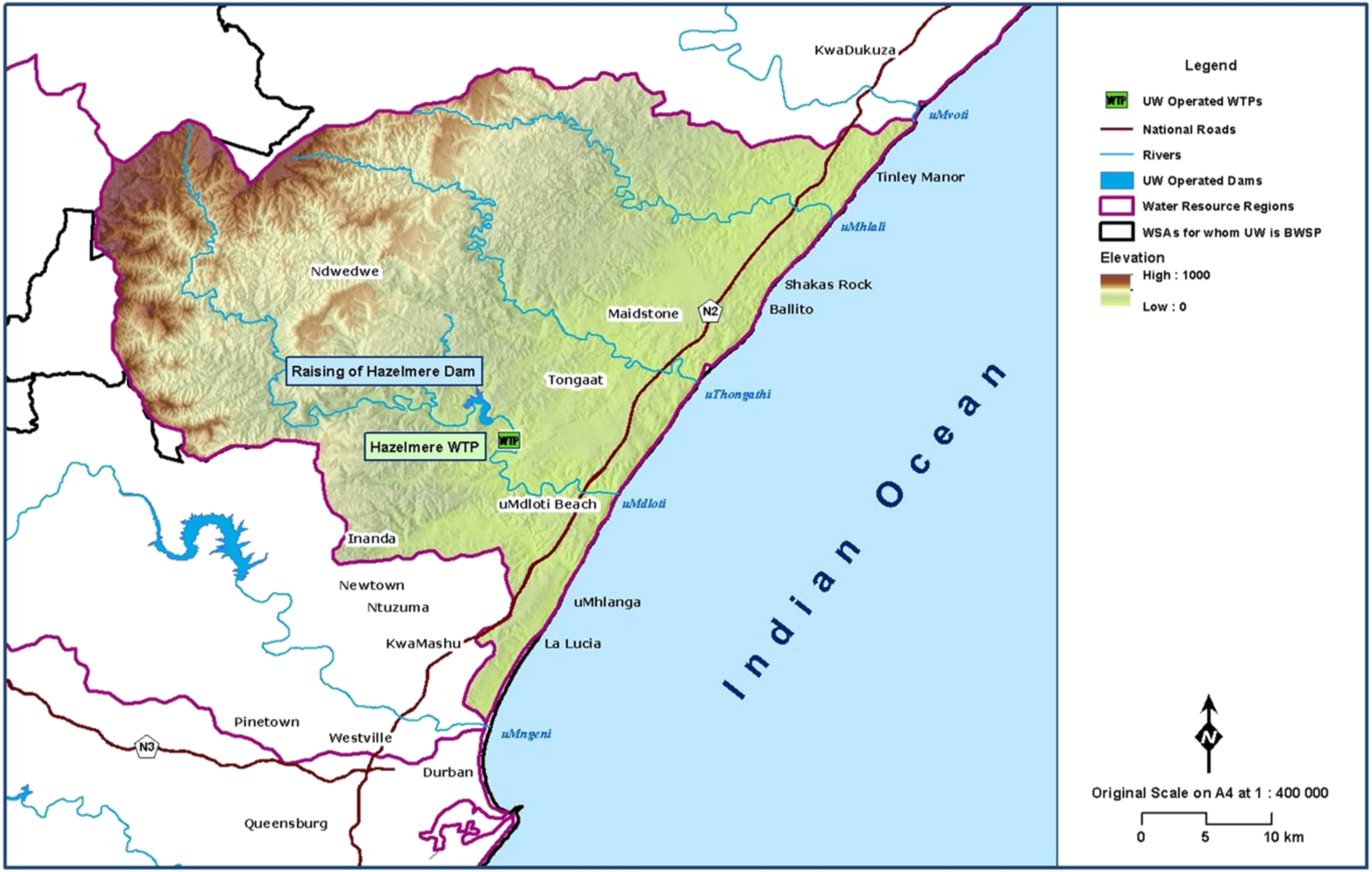


Figure 12.41 Proposed water resource infrastructure in the Mdloti Region (KZN DoT 2011; MDB 2016; Umgeni Water 2017; WR2012).

The following sections detail the recommendations for the development of supply infrastructure within each subsystem.

(d) Hazelmere/Verulam Sub-System

The demand at Verulam (Grange) has been shifted from the Durban Heights WTP onto the Hazelemere WTP. The demand at this node is expected to increase to 25 Mℓ/day by 2025. This will require an upgrade of the Grange Pump Station. Once eThekwini Municipality completes the Northern Aqueduct and the uMkhomazi Water Project is completed, this demand will once again be shifted from Hazelmere WTP to Durban Heights WTP.

(e) Hazelmere/Phoenix Sub-System

The demand at Phoenix (Waterloo) has been shifted from the Durban Heights WTP onto the Hazelemere WTP. The demand at this node is expected to increase to 25 Mℓ/day by 2025 to support developments in Cornubia. This will require an upgrade of the Waterloo pumps. The load shift onto Hazelmere WTW will relieve the demand on the Mgeni System until the completion of uMkhomazi Water Project. This supply will be transferred back onto the Durban Heights WTP once the Northern Aqueduct extension is commissioned by eThekwini Municipality and the uMkhomazi Water Project is completed.

(f) Hazelmere/Ndwedwe Sub-System

The uMshwathi Regional Bulk Water Supply Scheme (Phase 4) will be extended to supply water up to Reservoir 5 in Ndwedwe. This will then back-feed into Ndwedwe Reservoirs 4 and 3 (**Figure 12.42**). The demand from these two reservoirs will thus be removed from the Hazelmere Supply System. The pumps at Reservoirs 2 and 3 have been upgraded to meet the short term demand.

Grange and Waterloo in Ethekwini Metro is supplied from separate pumps housed at the Hazelmere WTP. These pumps are planned to be upgraded to each supply 25 Mℓ/day.

uMshwathi Phase 6 (**Section 12.5.2 (a)**) will supply water into the Southern Ndwedwe region via Bruyns Hill Reservoir. Supply will terminate at Cameni Reservoir in southern Ndwedwe. A take-off before Cameni Reservoir will supply eThekwini's communities to the north of Inanda Dam.

(g) Avondale/Honolulu Sub-System

In **Figure 12.33** the North Coast Pipeline supplies water from the Hazelmere System north as far as KwaDukuza. In **Figure 12.37** and **Figure 12.35** the pipeline is reversed to supply water from the Lower Thukela WTP to Avondale Reservoir and the southern areas of the NCSS. The North Coast Pipeline 1 (NCP-1) is now used to supply users along the pipeline from Avondale to Salt Rock in a northerly direction and is also used to supply south from Honolulu Reservoir to off-takes along the pipeline route including Shakas Kraal. The Salt Rock Pump Station has been decommissioned.

(h) Lower Thukela Water Treatment Plant and Supply System

The Lower Thukela Supply System supplies the areas, which were previously supplied by Mvoti WTP. It will also supply developments along the route. The 55 Mℓ/day WTP is reaching its design capacity due to the decommissioning of the Mvoti WTP. Phase 2 of the scheme (**Figure 12.45**) will be implemented within the next five years. Should there be a requirement to supply areas north of the uThukela River, then, apart from an upgrade of the WTP, a pipeline and reservoir located on the outskirts of Mandini would be required.

(i) Maphumulo Bulk Water Supply Scheme

Phase 2 of the Maphumulo BWSS, the iMvutshane Dam, was commissioned in early 2015. Future infrastructure upgrades to this scheme are recommended as follows:

- Phase 3 - Upgrade the WTP by 6 Mℓ/day to a new treatment capacity of 12 Mℓ/day;
- Phase 4 – Construct a new weir, abstraction works and pump station on the Hlimbitwa River and a pipeline to convey raw water into the iMvutshane Dam to meet the future 12 Mℓ/day demand at a 98% assurance of supply (**Figure 12.46**).

The Maphumulo BWSS will not be able to meet the expected 20 year demands. The uMswathi BWSS Phase 5 will augment supply into the Maphumulo BWSS. The Mvoti-Poort Dam should be developed to serve the long term requirements of Maphumulo, Ndwedwe and Ngcebo.

12.5.2 Projects

(a) Upgrade of Hazelmere Water Treatment Plant

Planning No.	203
Project No.	
Project Status	Planning

(i) Project Description

The Hazelmere WTP supplies the northern areas of Ethekwini Metro, iLembe DM and Siza Water. Over the last five years, there has been a steady increase in demand that has resulted in the plant operating at its operational capacity with daily peaks often well above its design capacity of 75 Ml/day (**Figure** 12.28).

In 2015, the plant was upgraded from 55 Ml/day to 75 Ml/day. At the time, all the process trains where constructed to 90 Ml/day capacity besides the filters. The previous upgrade allowed more filters to be installed on the chlorine contact tanks. This project have 3 * 5 Ml/day filter modules installed.

(ii) Institutional Arrangements

As with the current operation of the plant, Umgeni Water will own, operate and maintain the treatment works and will sell potable water to the iLembe District Municipality as per the Bulk Water Supply Agreement.

(iii) Implementation

The anticipated completion date is 2025 and is estimated to cost R20m.

(b) uMshwathi Regional Bulk Water Supply Scheme Phase 4 (Southern Ndwedwe Bulk Water Supply Scheme)

Planning No.	204.18
Project No.	CI.00186
Project Status	Tender

(i) Project Description

The uMshwathi Regional Bulk Water Supply Scheme (RBWSS) supplies the rural hinterland east of Pietermaritzburg in KwaZulu-Natal. The Scheme will provide bulk water supply to large areas within the uMgungundlovu and iLembe WSA boundaries and will include the rural areas of Swayimane, Ozwathini, Efaye and the major part of Ndwedwe Local Municipality. The scheme will also supply economic activities in the areas of Appeldoorns and Marburg and will reinforce the supply to the towns of Wartburg, Dalton, Cool Air and Schroeders.

Umgeni Water implemented the uMshwathi RBWSS, which is an expansion of the earlier Wartburg Bulk Water Supply (**Section 7.3.1 (h) in Volume 2**). The extension will enable economic growth and provision of social services in existing centres, whilst greatly extending the supply area into the traditional settlement areas thereby improving the quality and reliability of water supply and supporting backlog eradication.

The uMshwathi RBWSS initially consisted of three phases with the fourth, fifth and sixth phase added during the implementation stage. Following is a brief detail of each phase:

- Phase 1 – Pipeline from Claridge Reservoir to Wartburg (**Section 7.5.2 (f) in Volume 2**)
- Phase 2 – Pipeline from Wartburg to Dalton (**Section 7.5.2 (f) in Volume 2**)
- Phase 3 – Pipeline from Dalton to Efaye including Ozwathini Reservoir (**Section 7.5.2 (f) in Volume 2**)
- Phase 4 – Supply from Ozwathini Reservoir into Central Ndwedwe linking with the Hazelmere System
- Phase 5 – Supply from Ozwathini Reservoir in a northerly direction within Central Ndwedwe, linking with the Maphumulo Supply System. Phase 5 is being implemented by iLembe District Municipality on behalf of Umgeni Water.
- Phase 6 – This is a new phase added onto the uMshwathi BWSS. It is a supply from Bruyns Hill Reservoir into the southern portion of Ndwedwe.

Umgeni Water completed a detailed feasibility study (DFS) for Phase 4 of the uMhwathi RBWSS (previously known as the Southern Ndwedwe BWSS) at the end of November 2015, which included a preliminary design phase (**Figure 12.42**).

The supply area of Phase 4 comprises the central and southern parts of the Ndwedwe Local Municipality and occupies roughly 50% of the total area of Ndwedwe Municipality. Within the study area the proximity of neighbouring eThekwini and the Dube Trade Port are the major economic drivers leading to densification in the southern parts of the study area. The area immediately around Montebello Hospital is another minor growth node. The remainder of the study area is predominantly rural in nature with dispersed settlement patterns.

The DFS determined that the proposed source of water for the southern Ndwedwe area is the uMshwathi RBWSS. The uMshwathi RBWSS is supplied with water from the D.V. Harris WTP in

Pietermaritzburg. One of the terminal points, the Dalton Reservoir, will be the supply node to the Nondabula and Montebello reservoirs, whereas the Bruyns Hill Reservoir, another terminal point of the uMshwathi RBWSS, will be the supply node to the Swayimane area and the western parts of the southern Ndwedwe area.

The uMshwathi RBWSS design has allowed for 25 Mℓ/day of potable water to be available at the Ozwathini Reservoir for distribution to consumers in both northern and southern Ndwedwe areas.

Figure 12.42 shows an overview of the proposed infrastructure. This will ensure that all backlogs within the Greater Ndwedwe area are addressed. It will also relieve the supply of the Hazelmere BWSS by supplying Reservoir 5 and back-feeding into to the existing Ndwedwe Reservoirs 3 and 4.

(ii) Institutional Arrangements

Umgeni Water will own, operate and maintain the infrastructure of the uMshwathi RBWSS Phase 4 and will sell potable water from this system to the iLembe District Municipality as per the Bulk Water Supply Agreement.

(iii) Beneficiaries

Phase 4 of the uMshwathi RBWSS will supply both rural and peri-urban settlement areas. Stats SA 2011 Census results and the Eskom 2011 building count were used to estimate the design population. For ease of planning, population estimates were determined for individual reservoir supply zones in the study area.

The population that will be supplied by this scheme is presented in **Table 12.47**.

Table 12.47 Supply from uMshwathi BRWSS Phase 4.

Reservoir Zone	Eskom 2011 Building Count	2011 Estimated Population	2011 Adjusted Population	2045 Estimated Population
Ozwathini (Direct supply to consumers)	347	2778	3008	4219
Esigedleni Main	430	3440	3502	4912
Esigedleni Res No 1	124	992	992	1391
Esigedleni Res No 2	204	1632	1632	2289
KwaHlope Res No 3	31	248	248	348
KwaHlope Res No 2	564	4512	4512	6328
Mgazini	188	1504	1504	2109
KwaSonkomba Res No 1	1439	11512	11780	16522
Ndwedwe Res 5	1709	13672	16539	23197
Matholamnyama	492	3936	4087	5704
KwaSonkomba Res No 2	885	7080	9440	13240
Ndwedwe Res 3	1129	9032	11587	16252
Ndwedwe Res 4	869	6952	7475	10484
Montabello	441	3528	3583	5025
Totals	8852	70816	79869	112022*

*The 2011 calculated population within the study area is 79 869. The project design year is 2045 and the estimated design population is based on a 1.0% annual growth rate.

(iv) Implementation

The anticipated completion date is 2027. This phase of the uMshwathi RBWSS project is expected to cost R 1.3bn.

UW has secured grant funding from the Regional Bulk Infrastructure Grant programme for this project.

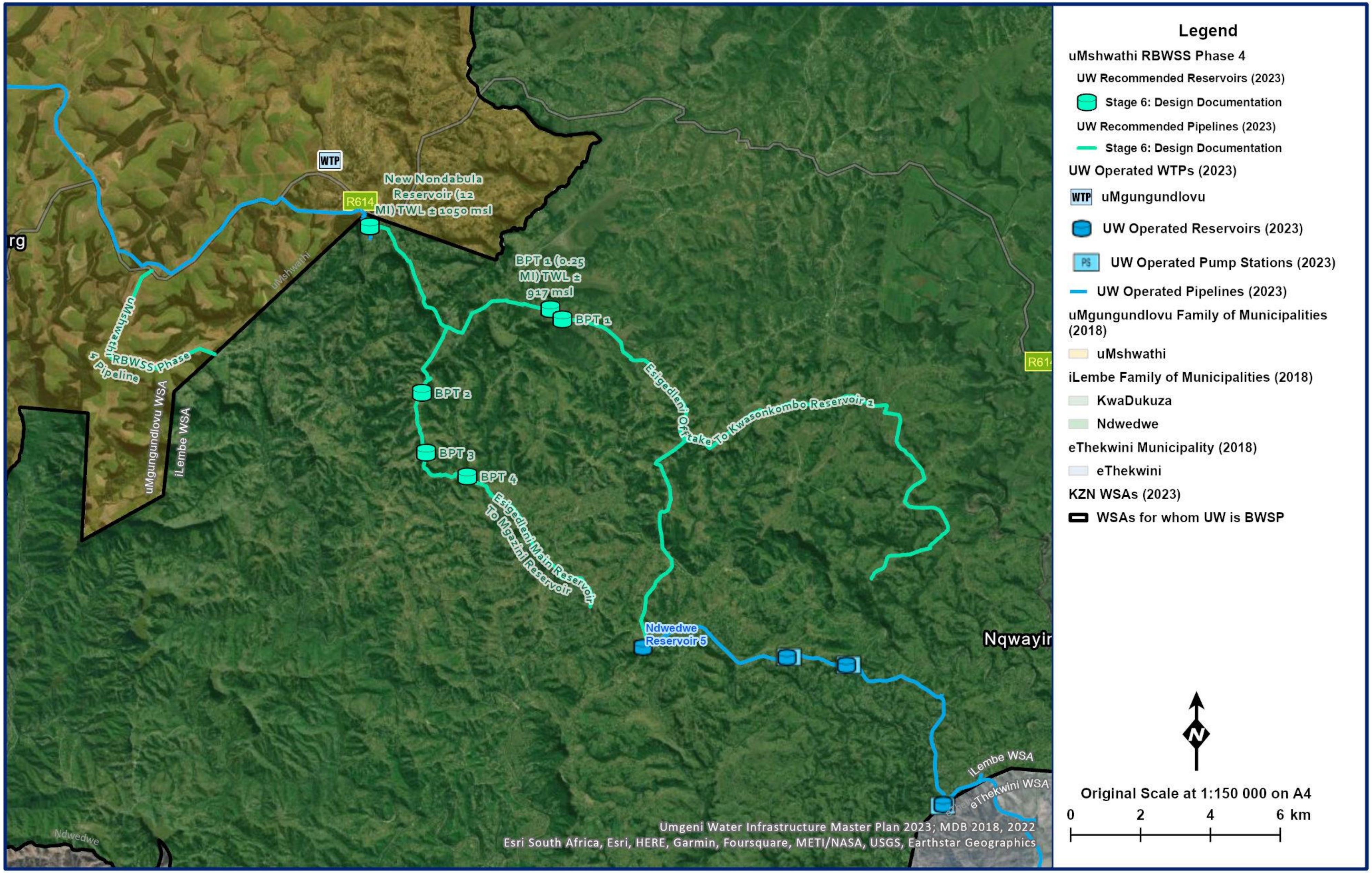


Figure 12.42 uMshwathi Regional Bulk Water Supply Scheme Phase 4.

(b) uMshwathi Regional Bulk Water Supply Scheme Phase 5 (Northern Ndwedwe Bulk Water Supply Scheme)

Planning No.	204.28
Project No.	CI 00172
Project Status	Construction

(i) Project Description

The uMshwathi Regional Bulk Water Supply Scheme (RBWSS) supplies the rural hinterland east of Pietermaritzburg in KwaZulu-Natal. The Scheme will provide bulk water supply to large areas within the uMgungundlovu and iLembe WSA boundaries and will include the rural areas of Swayimane, Ozwathini, Efaye and the major part of Ndwedwe Local Municipality. The scheme will also supply economic activities in the areas of Appeldoorns and Marburg and will reinforce the supply to the towns of Wartburg, Dalton, Cool Air and Schroeders.

Umgeni Water implemented the uMshwathi RBWSS, which is an expansion of the earlier Wartburg Bulk Water Supply (**Section 7.3.1 (h) in Volume 2**). The extension will enable economic growth and provision of social services in existing centres, whilst greatly extending the supply area into the traditional settlement areas thereby improving the quality and reliability of water supply and supporting backlog eradication.

The uMshwathi RBWSS initially consisted of five phases with a sixth phase added during the implementation phase. Following is a brief detail of each phase:

- Phase 1 – Pipeline from Claridge Reservoir to Wartburg (**Section 7.5.2 (f) in Volume 2**)
- Phase 2 – Pipeline from Wartburg to Dalton (**Section 7.5.2 (f) in Volume 2**)
- Phase 3 – Pipeline from Dalton to Efaye including Ozwathini Reservoir (**Section 7.5.2 (f) in Volume 2**)
- Phase 4 – Supply from Ozwathini Reservoir into Central Ndwedwe linking with Hazelmere System
- Phase 5 – Supply from Ozwathini Reservoir in a northerly direction within Central Ndwedwe, linking with the Maphumulo Supply System.
- Phase 6 – This is a new phase added onto the uMshwathi BWSS. It is a supply from Bruyns Hill Reservoir into the southern portion of Ndwedwe.

In October of 2020, Umgeni Water entered into an agreement with iLembe District Municipality (IDM) to implement Phase 5 of the scheme. This will entail the construction of a pipeline which will originate at the Ozwatnini Reservoir and then follow a route in a north easterly direction towards Maphumulo. It will include online take-offs and a termination point and will supply areas in Ndwedwe that are currently serviced through the Maphumulo BWSS.

Phase 5 will supply 18 Mℓ/day of potable water into Central and Northern Ndwedwe.

Figure 12.43 shows an overview of the proposed infrastructure.

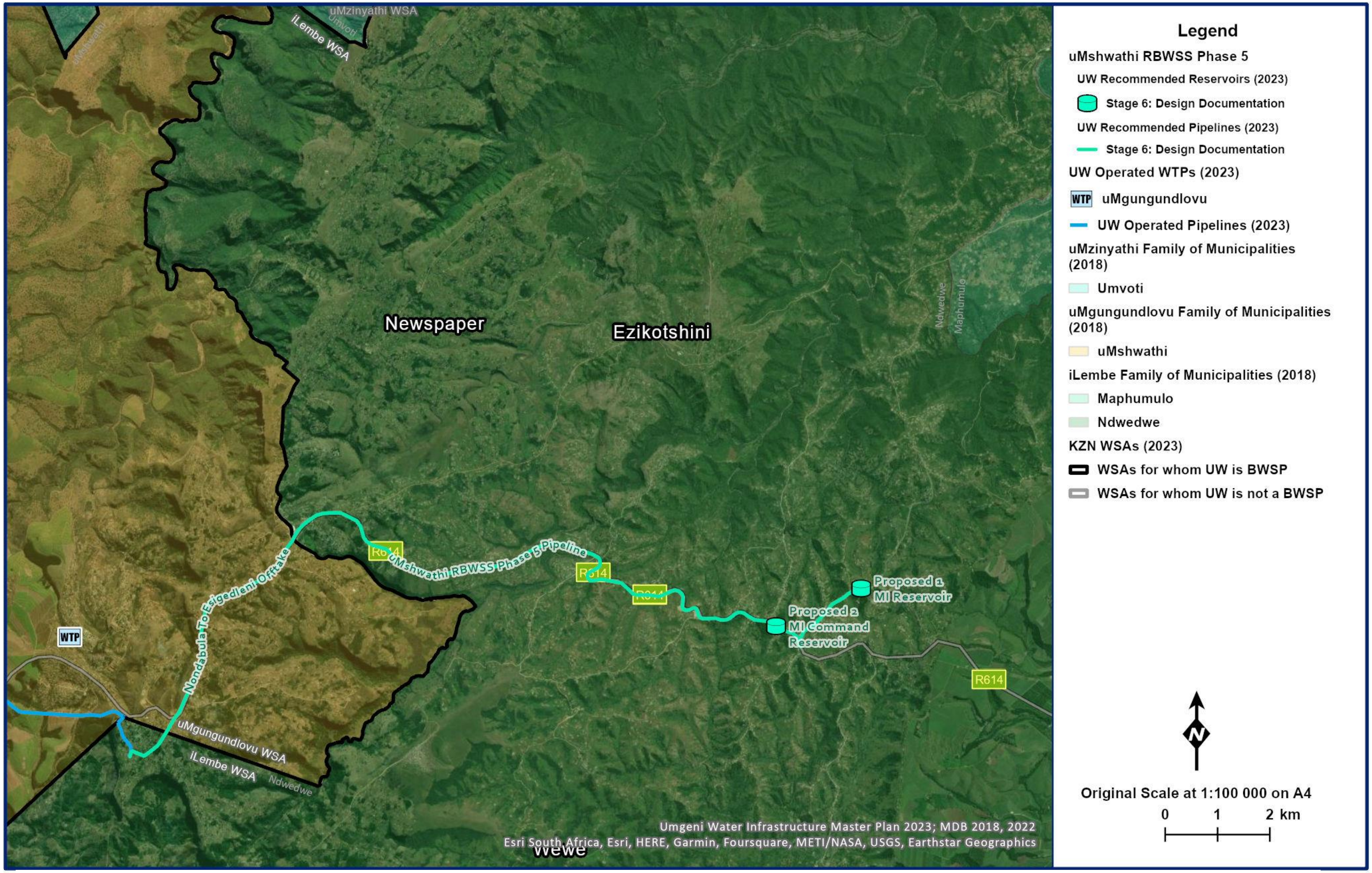


Figure 12.43 uMshwathi Regional Bulk Water Supply Scheme Phase 5.

(ii) Institutional Arrangements

Umgeni Water will own, operate and maintain the infrastructure of the uMshwathi RBWSS Phase 5 and will sell potable water from this system to iLembe District Municipality as per the Bulk Water Supply Agreement.

(iii) Beneficiaries

Phase 5 of the uMshwathi RBWSS will supply rural settlements in Southern and Northern Ndwedwe. The estimated population that will be served is 80 000.

(iv) Implementation

IDM will implement the project on behalf of Umgeni Water. The detail design is complete and the project is being prepared for tender with completion by 2025. This phase of the uMshwathi RBWSS project is expected to cost R231 million.

(c) uMshwathi Regional Bulk Water Supply Scheme Phase 6 (Southern Ndwedwe Bulk Water Supply Scheme)

Planning No.	204.18
Project No.	CI 00171
Project Status	Detail Design

(i) Project Description

The uMshwathi Regional Bulk Water Supply Scheme (RBWSS) supplies the rural hinterland east of Pietermaritzburg in KwaZulu-Natal. The Scheme will provide bulk water supply to large areas within the uMgungundlovu and iLembe WSA boundaries and will include the rural areas of Swayimane, Ozwathini, Efaye and the major part of Ndwedwe Local Municipality. The scheme will also supply economic activities in the areas of Appeldoorns and Marburg and will reinforce the supply to the towns of Wartburg, Dalton, Cool Air and Schroeders.

Umgeni Water implemented the uMshwathi RBWSS, which is an expansion of the earlier Wartburg Bulk Water Supply (**Section 7.3.1 (h) in Volume 2**). The extension will enable economic growth and provision of social services in existing centres, whilst greatly extending the supply area into the traditional settlement areas thereby improving the quality and reliability of water supply and supporting backlog eradication.

The uMshwathi RBWSS initially consisted of five phases with a sixth phase added during the implementation phase. Following is a brief detail of each phase:

- Phase 1 – Pipeline from Claridge Reservoir to Wartburg (**Section 7.5.2 (f) in Volume 2**)
- Phase 2 – Pipeline from Wartburg to Dalton (**Section 7.5.2 (f) in Volume 2**)
- Phase 3 – Pipeline from Dalton to Efaye including Ozwathini Reservoir (**Section 7.5.2 (f) in Volume 2**)
- Phase 4 – Supply from Ozwathini Reservoir into Central Ndwedwe linking with Hazelmere System
- Phase 5 – Supply from Ozwathini Reservoir in a northerly direction within Central Ndwedwe, linking with the Maphumulo Supply System. Phase 5 will be implemented by iLembe District Municipality on behalf of Umgeni Water.
- Phase 6 – This is a new phase added onto the uMshwathi BWSS. It is a supply from Bruyns Hill Reservoir into the southern portion of Ndwedwe (**Figure 12.44**).

In February 2017 iLembe District Municipality (iLDM) approached Umgeni Water with a request to supply water to the south western portion of Ndwedwe from the uMshwathi BWSS. Umgeni Water is currently upgrading the supply from Wartburg to Bruyns Hill (**Section 7.5.2 (g)**). This will have to be extended to ilembe's Municipal boundary to also supply off-takes to eThekwini Metro. The south eastern areas of Ndwedwe currently rely on boreholes and river abstraction. These sources are however, not adequate to meet growing demands.

Umgeni Water supplies Swayimane from the Bruyns Hill Reservoir. The proposed pipeline will have the added benefit of meeting the future growth in demands by having en-route take-offs into Swayimane.

The uMshwathi RBWSS design has allowed for 10 Mℓ/day of potable water to be available at Bruyns Hill Reservoir for distribution to consumers in Swayimane and Southern Ndwedwe.

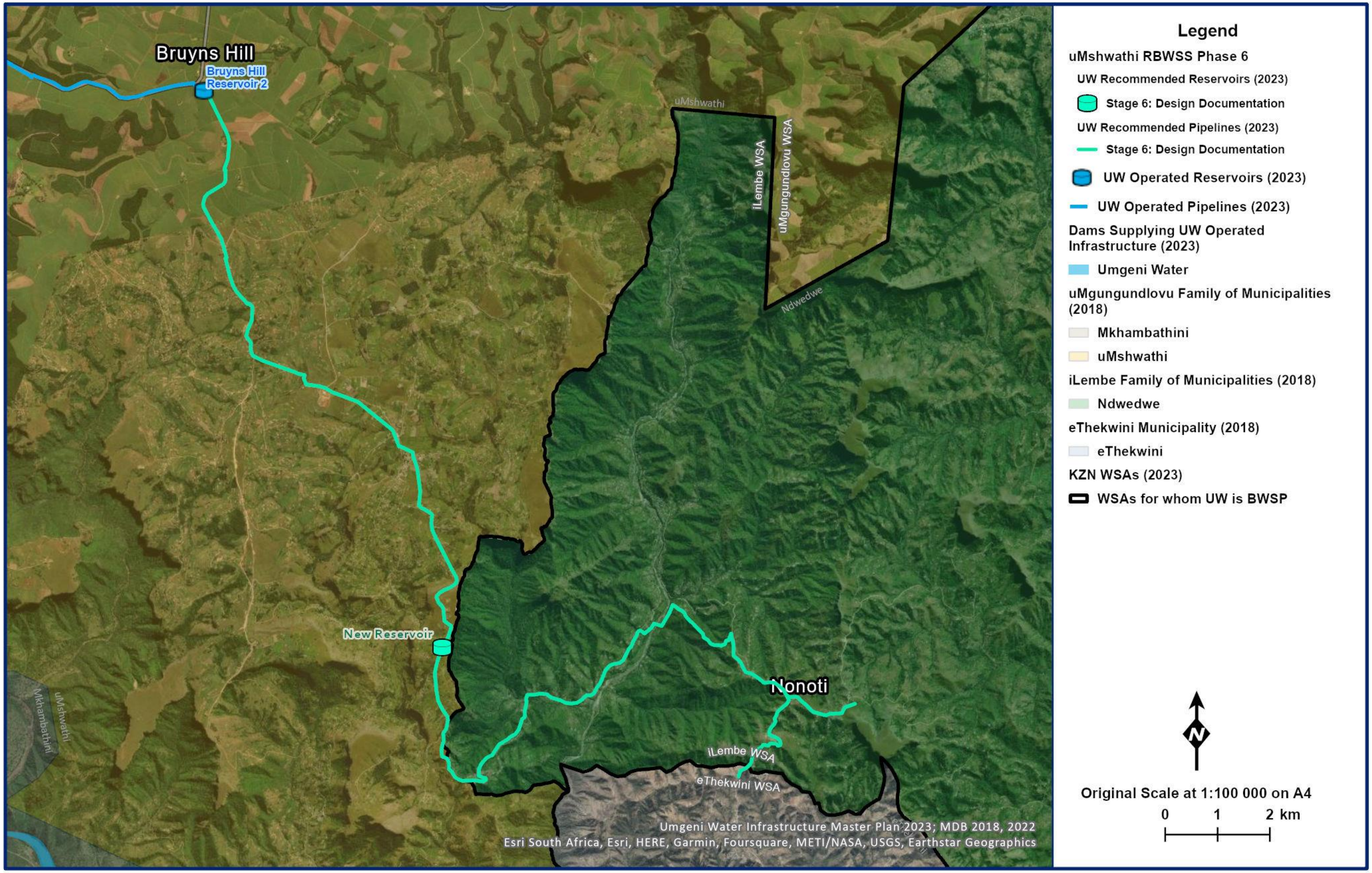


Figure 12.44 uMshwathi Regional Bulk Water Supply Scheme Phase 6.

(ii) Institutional Arrangements

Umgeni Water will own, operate and maintain the infrastructure of the uMshwathi RBWSS Phase 6 and will sell potable water from this system to Umgungundlovu and iLembe District Municipalities as well as Ethekwini Metro as per the Bulk Water Supply Agreement.

(iii) Beneficiaries

Phase 6 of the uMshwathi RBWSS will supply both rural and peri-urban settlement areas. The estimated population that will be served is 80 000.

(iv) Implementation

The detail design has been completed. This phase of the uMshwathi RBWSS project is expected to cost R200 million.

(c) Lower Thukela Bulk Water Supply Scheme – Phase 2

Planning No.	204.19
Project No.	CI.00174
Project Status	Tender

(i) Project Description

Construction of Phase 1 of the Lower Thukela Bulk Water Supply Scheme (LTBWSS) was completed in August 2017. The Lower Thukela Bulk Water Supply Scheme will supply the town of KwaDukuza and en route communities in the KwaZulu-Natal North Coast. The Univeral Access Plan Phase 2 planning study (Umgeni Water 2016; see **Section 2.7 in Volume 1**) identified the option to use LTBWSS to supply the King Cetshwayo District Municipality and the City of uMhlathuze. Phase 2 of the LTBWSS will double the treatment capacity from 55 Mℓ/day to 110 Mℓ/day and construct a pipeline to feed into a new 30 Mℓ reservoir on the outskirts of Mandini (**Figure 12.45**).

Key information on this project is summarised in **Table 12.48**.

Table 12.48 Project information: Lower Thukela BWSS – Phase 2 .

Project Components	• Upgrade WTP capacity from 55 Mℓ/day to 110 Mℓ/day. • Additional raw and potable pumps and 7.2 km of 900 mm diameter bulk supply pipelines to deliver water from the WTP to Mandini. • 30 Mℓ Command Reservoir in Mandini.
Capacity	110 Mℓ/day

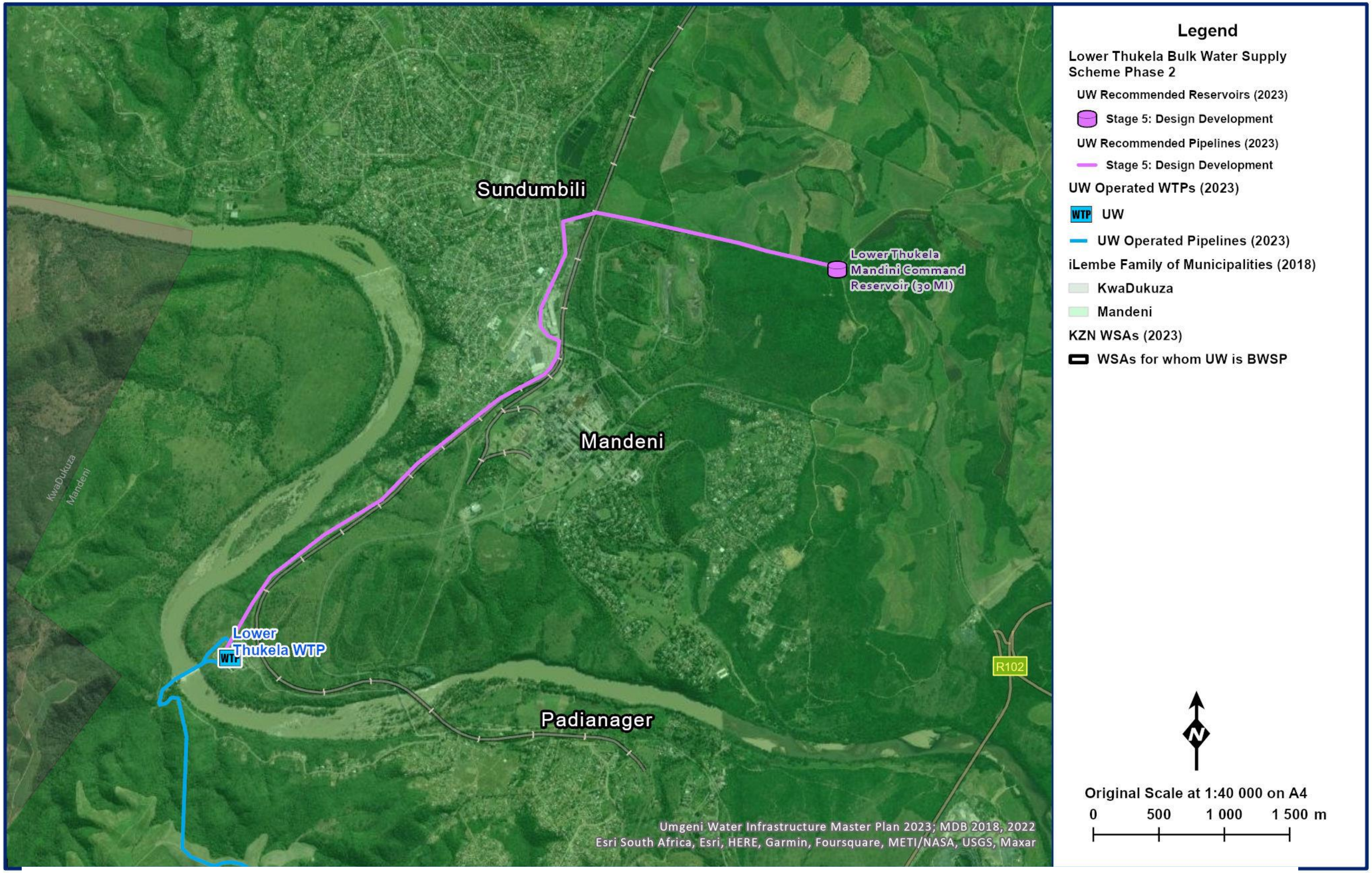


Figure 12.45 Lower uThukela Bulk Water Supply Scheme – Phase 2.

(ii) Institutional Arrangements

Umgeni Water will own, operate and maintain the infrastructure of the Lower Thukela BWSS and will sell potable water from this system to the iLembe District Municipality. Investigations will be undertaken to determine if it is feasible for potable water from this system to be supplied to King Cetshwayo District Municipality and City of uMhlathuze.

(iii) Beneficiaries

The beneficiaries of this scheme will be the town of KwaDukuza and the areas of the North Coast region and possibly communities and industries in King Cetshwayo District Municipality and City of uMhlathuze. Assuming 200 ℓ/person/day, the estimated number of beneficiaries from the anticipated capacity of 110 Mℓ/day may be 550 000 people.

(iv) Implementation

The Lower Thukela Bulk Water Supply Scheme – Phase 1 is complete and Phase 2 is at detail design stage. The Universal Access Plan identified various options to supply King Cetshwayo District Municipality and City of uMhlathuze . Phase 2 will be implemented should it be determined to be a preferred supply option.

The estimated total cost of Phase 2 of the project is estimated to be 1.4 billion.

(d) Maphumulo Bulk Water Supply Scheme

Planning No.	204.22
Project No.	UI0307A / UI0307B / UI0307C / UI0307D / UI0308A
Project Status	Phase 1 – iMvutshane River Abstraction, pump station and raw water rising main, 6 Mℓ/day WTP, bulk pipelines and reservoirs – Complete. Phase 2 – Imvutshane Dam – Complete. Phase 3 – WTP upgrade to 12 Mℓ/day – Tender Phase 4 – Abstraction from Hlimbitwe River and raw water pipeline to iMvutshane Dam – Design

(i) Project Description

This scheme supplies the communities in Maphumulo, Maqumbi and Ashville from the iMvutshane River. This river is a tributary of the Hlimbitwa River (which in turn is a tributary of the Mvoti River) and is situated approximately 10 km south of Maphumulo Town. The construction of a run-of-river abstraction works on the iMvutshane River and 6 Mℓ/day WTP has been completed as part of Phase 1 of the project and was commissioned in August 2013. Phase 2 of the project, which was the construction of the iMvutshane Dam on the iMvutshane River (**Figure 12.46**), was completed in March 2015.

Future phases to the scheme include:

- Phase 3: Upgrade WTP by 6 Mℓ/day to new treatment capacity of 12 Mℓ/day and upgrade the raw water and potable water pumps;
- Phase 4: New weir, abstraction works, pump station on the Hlimbitwa River and pipeline to convey raw water into the iMvutshane Dam to meet the future 12 Mℓ/day demand.

Key information on this project is summarised in **Table 12.49**.

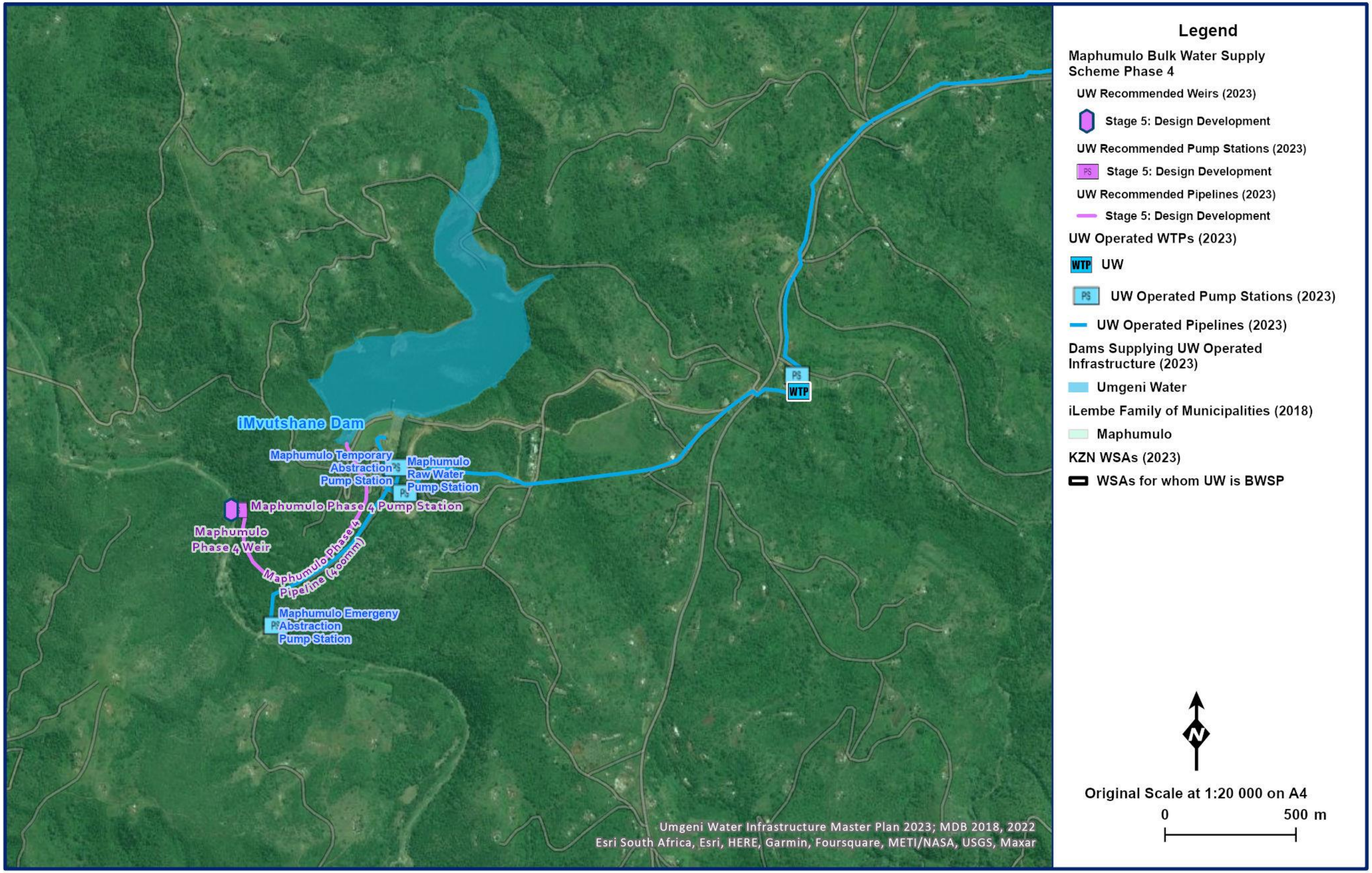


Figure 12.46 Maphumulo Bulk Water Supply – Phase 4.

Table 12.49 Project information: Maphumulo BWSS.

Project Components	**Phase 1** • iMvutshane River Abstraction, pump station and raw water rising main, 6 Mℓ/day WTP, bulk pipelines and reservoirs. **Phase 2** • 3.2 million m^3 iMvutshane Dam. **Phase 3** • Upgrade of the WTP to 12 Mℓ/day and new pumps. **Phase 4** • Weir and abstraction from Hlimbitwa River, pump station and pipeline to iMvutshane Dam.
Capacity	Phase 1: 6 Mℓ/day Phases 2, 3 &4: 12 Mℓ/day

(ii) Institutional Arrangements

Umgeni Water will own, operate and maintain the infrastructure of the Maphumulo BWSS and will sell potable water from this system to the iLembe District Municipality as per the Bulk Water Supply Agreement.

(iii) Beneficiaries

The Maphumulo BWSS will supply both rural and peri-urban settlement areas. The population that will be supplied by the Maphumulo BWSS is presented in **Table 12.50**.

Table 12.50 Rural demand to be supplied by the Maphumulo BWSS (MSW 2008).

Rural Supply Area	Population
Maphumulo	4 872
Maqumbi (Phase 1)	26 280
Masibambasane CWSS	17 248
Kwa Sizabantu	17 192
Ngcebo 2	72 900
Ashville	11 264
TOTAL	**149 756**

(iv) Implementation

Phases 1 and 2 of the Maphumulo BWSS are complete. Phase 3 has been split into Phase 3a – upgrade of the raw and potable pumps and Phase 3b – Upgrade of the WTW. Phase 3a was completed at the end-2018 and Phase 3b is scheduled for completion by 2024. A package plant has been installed to augment the capacity to meet the demand up to 2025. The package plant is limited to 3 Ml/day resulting in a maximum of 9Ml/day that can be treated. Phase 4 is planned to be completed by 2025. The estimated total cost of phases 3 and 4 of the project is R354 million.

(c) Greytown BWSS

Planning No.	
Project No.	KNR015
Project Status	Construction of Phase 2 (Phase 1 complete)

(i) Project Description

Greytown and Enhlalakahle form the urban 'core' of the uMvoti Local Municipality (KZN245), which is part of DC24 (uMzinyathi District Municipality).

The project area is centred in the uMvoti Local Municipality area, which is in central KwaZulu-Natal to the north of Pietermaritzburg and west of Stanger in uMzinyathi DM. The prime supply area of the Greytown Bulk Water Scheme Phases 1 & 2 is the town of Greytown and Enhlalakahle (parts of Wards 7, 9, 10 & 11) as well as the settlement of Kranskop to the east. The project area comprises a mixture of high, medium and low income urban settlement, business and light industry, with a present population in the range of 23 000 (Greytown plus Kranskop).

Part of the scheme lies outside of the uMvoti District in the Mpofana Local Municipality areas in uMgungundlovu District. This includes Craigieburn Dam, which is the major water source for the scheme, the raw water pump station, raw water pumping main/gravity main 36 km long and 3 Nº Reservoirs en-route. uMzinyathi DM and uMgungundlovu DM have reached an agreement on a raw water supply as an offtake from the Craigieburn raw water pipeline which supplies the Craigieburn Housing Development. The development is located within the Mpofana Local Municipality.

The 2001 Census population for the uMvoti Municipality area was recorded as 92 294 persons and the 2011 Census population was recorded as 103 093, representing a growth of 11.7% for the period, or 1.1% per annum for the uMvoti area. This is somewhat higher than the growth rate of 0.86% per annum recorded for the province of KwaZulu-Natal over the same period.

The area of the uMvoti Municipality is 2 509 km^2, thus the 2011 average population density was 41 persons per km^2. However, population is unevenly distributed between the urban centres and traditional areas, which are more densely populated, and the farms and commercial plantations with very sparse population. A more recent development is the clustering of shelters on some areas of previous farmland to create informal settlements which have no planned services. This is primarily observed along the road between Greytown and Muden.

The main beneficiary community is the uMvoti Local Municipality, which is located within the uMzinyathi District Municipality on the southern boundary of the district. uMvoti Local Municipality shares a boundary with the uMgungundlovu District to the west and the uThungulu District to the east. The town lies at the crossroads of the Pietermaritzburg to Dundee (R33) and Stanger to Ladysmith (R74) roads and the road to Mooi River (R622).

The augmentation of the Greytown Bulk Water Supply Scheme is being undertaken in two phases which are described below:

- **Phase 1**

i) A 250 mm diameter Class 25 mPVC raw water main 3.5 km long from a Valve Chamber adjacent the existing disused Break Pressure Tank approximately 1 km downstream of Lake Merthley to Greytown Water Treatment Works (WTW).

ii) Refurbishment and Upgrading of the Waterworks, comprising Civil, Mechanical and Electrical Works to replace ageing and obsolete equipment. Complete replacement of electrical systems, process additions and improvements, Internal roadwork's and drainage, administrative building with statutory staff facilities, backup generator set, wash water recovery and new interconnecting pipes with valves chambers to restore the Treatment Works to its estimated peak capacity of 6 Mℓ/d.

Phase 1 of the project is complete.

- **Phase 2**

iii) Extension of the Greytown Water Treatment Works by 7 Mℓ/day, the total capacity of the WTW will then be 13 Mℓ/day.

iv) Development of abstraction works at Craigie Burn Dam (**Figure 12.47**) raw water pumps station (**Figure.12.48**) and bulk conveyance (34.5 km pipeline) between Craigie Burn Dam and Greytown WTW for a capacity of 12 Mℓ/day (AADD), 16 Mℓ/day (PSD).

v) Additional potable water storage to maintain specific hours of storage capacity and achieve spatial balance of bulk delivery with the growth of the town: 2.5 Mℓ Reservoir at Greytown WTW, additional 2.5 Mℓ Reservoir at Enhlalakahle Reservoir site to east of town and rehabilitation of existing 2.5 Mℓ Enhlalakahle Reservoir.

vi) Bulk distribution measures including a potable water pipeline from Greytown WTW to Enhlalakahle Reservoir (5.3 km long 315 mm diameter HDPE) plus a trunk distribution main from the Enhlalakahle Reservoir site to Enhlalakahle and nearby housing projects. (5.0 km long 315/400 mm diameter HDPE).

vii) Connection of 2° additional boreholes to supply at Kranskop, rising main pipeline from western boreholes to Kranskop WTW, 3.5 km HDPE, various sizes and classes up to 140 mm diameter.

viii) New 2 Mℓ ground level reservoir and an elevated tank at Kranskop WTW, together with transfer pump system.

(ii) Beneficiaries

The Greytown BWSS will provide 27 824 people with an assured supply of potable water.

(iii) Implementation

The construction duration of this project is anticipated to be ten years. Construction started in August 2011 and is estimated to be completed by 2024. The project completion is delayed due to community issues. The total cost is estimated to be R523 million at current prices. One kilometre of bulk raw water pipeline was stopped by the local community in March 2017 and this has now delayed the implementation of this line. The matter has been escalated to KZN provincial political leadership as well as top management of DWS. All efforts to resolve the matter with the community have not produced results. Upgrading of the Greytown WTW (phase 2) is in progress. The project milestones, funding allocations and project expenditure to date is summarised in **Table 12.51**

Detailed progress is as follows:

- Extension of Greytown WTW capacity by 7 Mℓ = 4% complete (Project put on hold in June 2020);
- Abstraction works from Craigieburn Dam = 100% complete;
- Raw water pump station = 100% complete;
- Construction of 34.6 km of Bulk pipeline from the dam to WTP = 95% complete;
- Construction of 2x250 kℓ reservoirs = 100% complete
- and 2.5 Mℓ reservoir =100% complete
- mechanical and electrical contracts have been awarded (WTP upgrade) – Project on hold due to insufficient funds.

Table 12.51 Funding allocations and Project Expenditure to Date

Description	**Amounts**
Project Cost	R523 412 969
RBIG commitment	R490 214 314
Other funding sources	R33 198 655
Spent up to 31 March 2019	R465 476 777
FY 2019/2020 Allocation	R20 000 000
Spent by WSA on 2019/20 allocation as at 31 Dec 2019	R8 069 622
Start date	Aug 2011
Planned Completion Date	**Jun 2024***
Implementing Agent: uMzinyathi DM	

*Community issues have delayed completion.

Figure 12.47 Abstraction point (Craigie Burn Dam)

Figure.12.48 Transfer Pump Station in Construction (Late 2019)

Source: DWS, RBIG progress report as at January 2020; Powerpoint presentation from DWS (March 2020); DWS RBIG financial spreadsheet
All documents prepared by uMzinyathi DM.

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- Graham Metcalf (Geohydrologist) Groundwater and Wastewater
- Gavin Subramanian (Planning Engineer) Infrastructure on the North Coast System
- Angus Nicoll (Planning Engineer) Infrastructure on the South Coast and Mgeni Central Systems
- Vernon Perumal (Planning Engineer) Infrastructure on the uMkhomazi, Upper uMzintlava, Upper uMzimkhulu and the uMhlathuze and Middle uThukela Systems and compiling the Energy Section
- Mark Scott (Planning Engineer) Infrastructure on the Mgeni Inland, uMfolozi, uMkhuze, uPhongolo and Lake Sibiya Systems
- Nathaniel Padayachee (Planning Engineer) Infrastructure on the Upper uThukela and Buffalo Systems
- Ntuthuko Ngcamu (Head – Water Demand Management Unit) with support from Siphokazi Mabaso, Mathews Nokhanga and Dillon Jacks Water Demand Management Section
- Sakhile Hlalukane (Hydrologist) Water resources of the North Coast, South Coast and Upper uThukela Systems
- Sandile Sithole (Hydrologist) Water resources of all systems excluding the North Coast, South Coast and Upper uThukela Systems
- Mlungisi Shabalala (Hydrologist) Water resources of the Middle uThukela, uMhlathuze, uMfolozi, uMkhuze, uPhongolo and Lake Sibiya Systems
- Sithembile Mbonambi (Hydrologist – Graduate Trainee) Water resources of the uMkhomazi, Upper uMzintlava and Upper uMzimkhulu Systems

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