UMGENI WATER · AMANZI

Infrastructure Master Plan 2020
2020/2021 – 2050/2051

Volume 10: Wastewater

Infrastructure Development Division, Umgeni Water

310 Burger Street, Pietermaritzburg, 3201, Republic of South Africa
P.O. Box 9, Pietermaritzburg, 3200, Republic of South Africa
Tel: +27 (33) 341 1111 / Fax +27 (33) 341 1167 / Toll free: 0800 331 820
Email: info@umgeni.co.za / Web: www.umgeni.co.za

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For further information, please contact:

Planning Services

Infrastructure Development Division

Umgeni Water

P.O.Box 9, Pietermaritzburg, 3200

KwaZulu-Natal, South Africa

Tel: 033 341-1522

Fax: 033 341-1218

Email: info@umgeni.co.za

Web: www.umgeni.co.za

UMGENI WATER

INFRASTRUCTURE MASTER PLAN 2020

2020/2021 – 2050/2051

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Prepared by:

Graham Metcalf

Geohydrologist

Approved by:

Kevin Meier *PrEng*

Manager: Planning Services

Sibusiso Mjwara *PrTechEng*

Executive: Infrastructure Development

PREFACE

This Infrastructure Master Plan 2020 describes:

- Umgeni Water's infrastructure plans for the financial period 2020/2021 – 2050/2051, 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 2019 and which only pertained to the Umgeni Water Operational area.

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

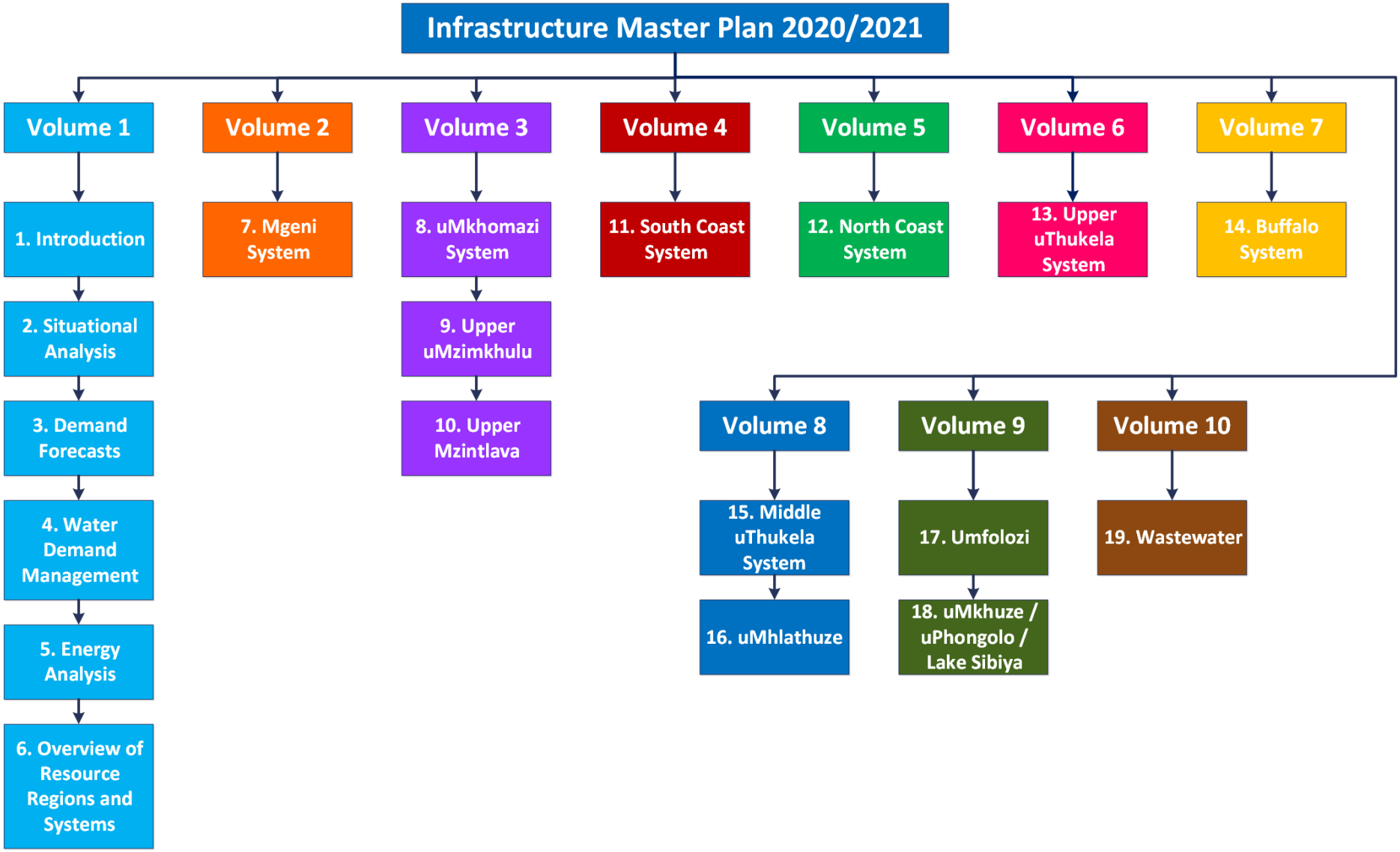
Volume 1 includes the following sections and a description of each is provided below:

- **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 2019.
- **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.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1. Introduction
2. Situational Analysis
3. Demand Forecasts
4. Water Demand Management
5. Energy Analysis
6. Overview of Resource Regions and Systems
Volume 2
7. Mgeni System
Volume 3
8. uMkhomazi System
9. Upper uMzimkhulu
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Volume 10
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.

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LIST OF ACRONYMS

AADD	Annual Average Daily Demand
AC	Asbestos Cement
ADWF	Average Dry Weather Flow
API	Antecedent Precipitation Index
AsgiSA	Accelerated and Shared Growth Initiative of South Africa
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
DFA	Development Facilitation Act (65 of 1995)
DM	District Municipality
DMA	District Management Area
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
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
RCC	Roller Compacted Concrete
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
TBM	Tunnel Boring Machine
TLC	Transitional Local Council
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, 2020. *Umgeni Water Infrastructure Master Plan 2020/2021 – 2050/51, Vol 1 - 10*. Prepared by Planning Services, June 2020.

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

19 WASTEWATER

19.1 Overview

Umgeni Water operates a number of Wastewater Works (WWW). These are shown in relation to the existing water system configurations as shown in **Figure 19.1** and discussed in **Section 6 in Volume 1** and are illustrated in the preface above. Umgeni Water owns and operates the Darvill, Ixopo, Albert Falls North and South WWW, but manages and operates a number of other WWW on behalf of municipalities (**Figure 19.2**). Management contracts are in place for the operation and maintenance of the Howick, Cool Air, Mpofana, Appelsbosch, Camperdown and Richmond WWW for the uMgungundlovu District Municipality (UMDM) and the Lynnfield Park WWW for the Msunduzi Local Municipality. All the WWW operations use aeration basins for biological nutrient removal and clarifiers for the separation process.

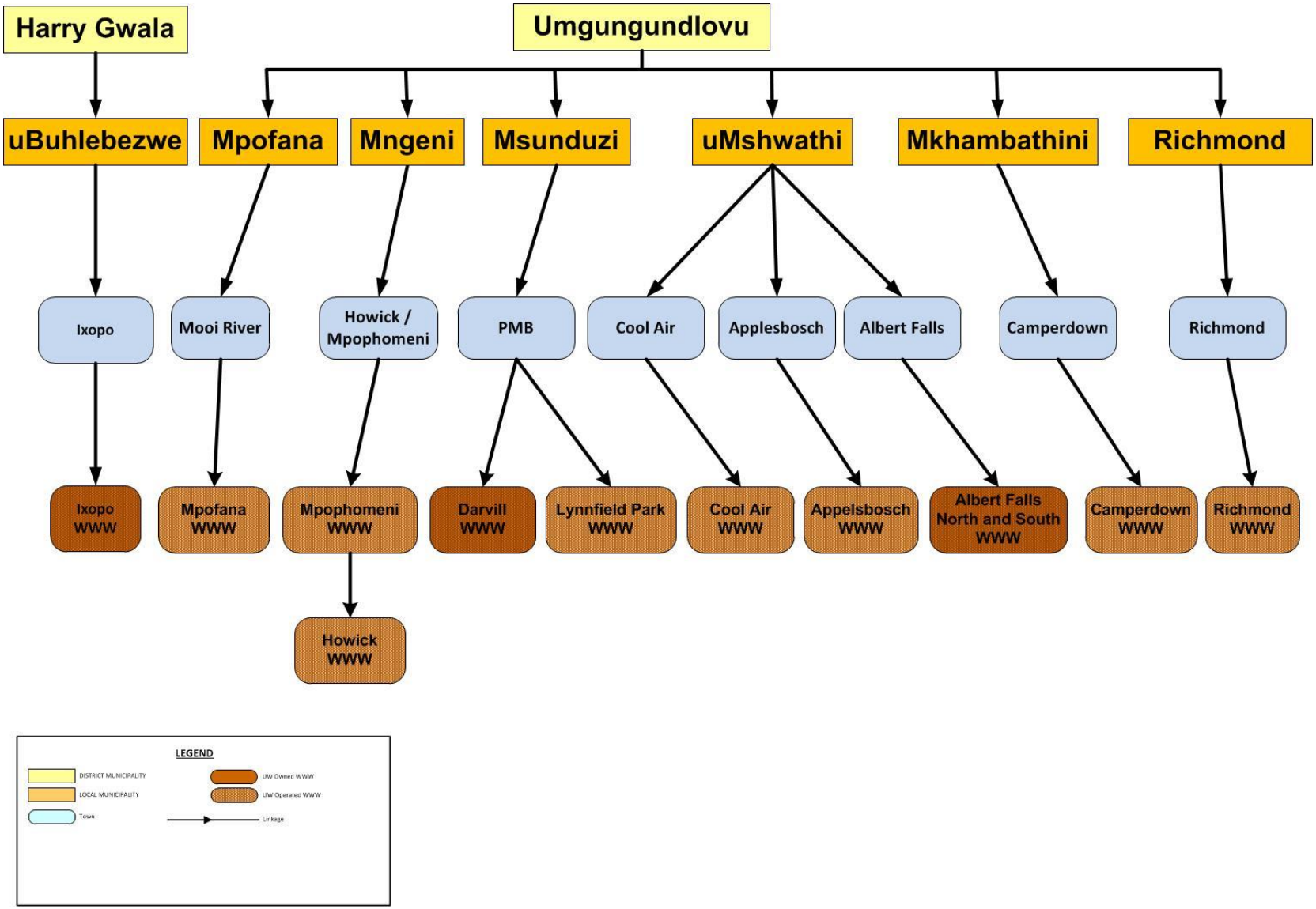

Figure 19.1 Location of Umgeni Water operated WWWs.

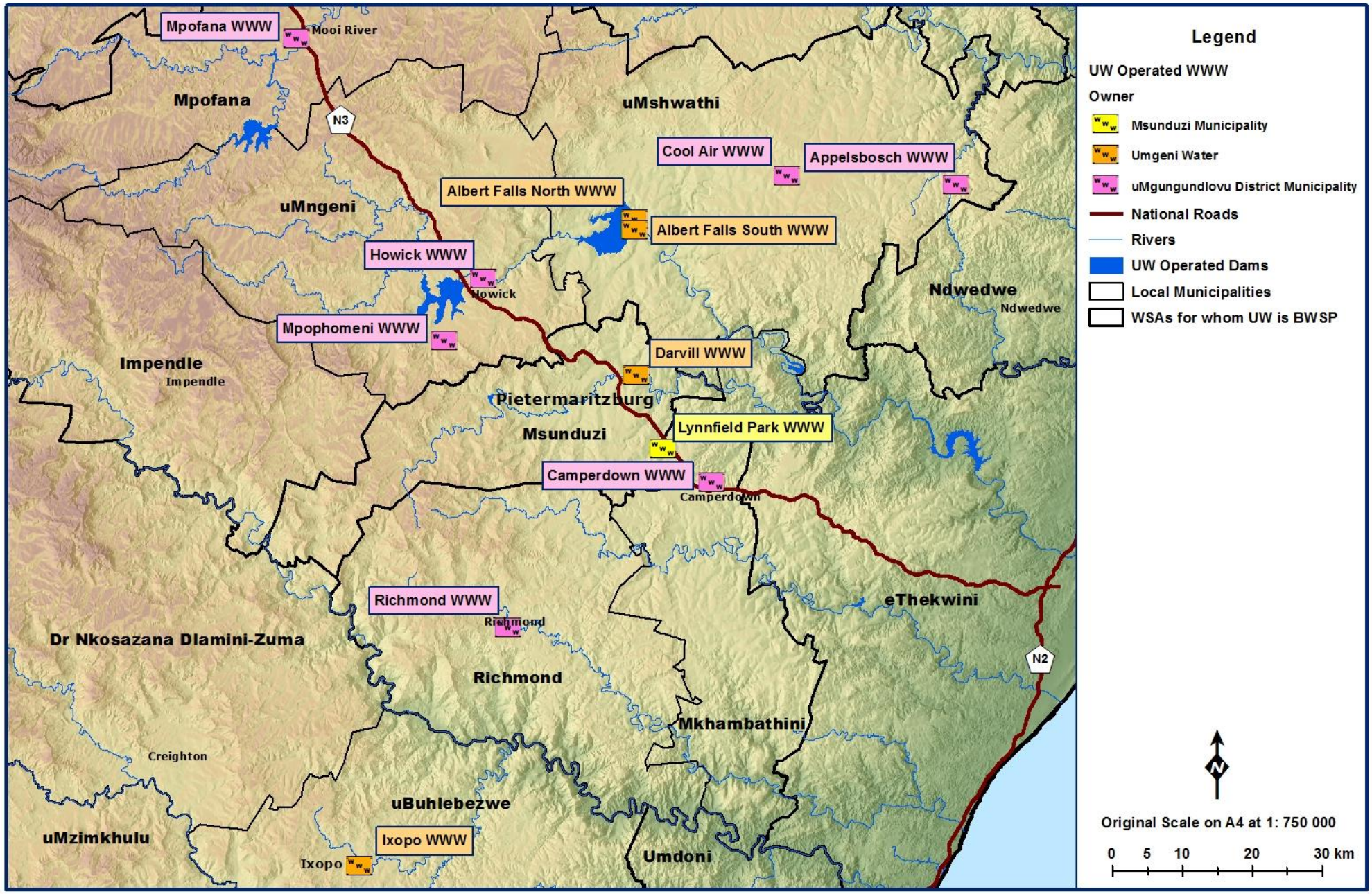

Figure 19.2 Location of WWWs operated by Umgeni Water.

19.2 Umgeni Water Owned Wastewater Works

19.2.1 Darvill Wastewater Works

The Darvill WWW is the largest and most significant under Umgeni Water's management and serves the Msunduzi Local Municipality. A summary of the characteristics of the Darvill WWW are shown in **Table 19.1** and the location of Darvill WWW in Msunduzi Municipality is shown in **Figure 19.3**.

Table 19.1 Darvill WWW infrastructure.

WWW Name:	Darvill WWW
System:	Upper Mgeni System
Maximum Design Capacity:	120 Mℓ/day
Current Utilisation:	71 Mℓ/day
Screens:	2 x Front raked bar screen followed by 3 mm stepped screen; 1 x Hand raked by-pass 25 mm screen
Balancing Tank:	10 Mℓ/day
Primary Settling Tanks:	4 (3 x 20 Mℓ/day; 2 x 40 Mℓ/day)
Settled Sewage Pump Station:	150 Mℓ/day
Aeration Basin Area:	
Aeration Basin Capacity:	74 415 m^3
Aerators:	Diffused aeration
Clarifier Type:	Circular scraped floor
Number of Clarifiers:	7
Total Area of all Clarifiers:	6720 m^2
Total Capacity of Clarifiers:	120 Mℓ/day
Upflow Velocity:	1 m/h
RAS Pump Station Capacity:	120 Mℓ/day
Primary Sludge Thickeners	2
Anaerobic Digesters:	4 (4 x4500 m^3)
Chlorine Storage Capacity:	18 x 900 kg drums
Chlorine Dosing Capacity:	7.5 mg/ℓ
Total Capacity of Chlorine Contact Tanks:	
Total Capacity of Sludge Treatment Plant:	
Wash Water Capacity:	2 Mℓ/day
Sludge Irrigation Area:	

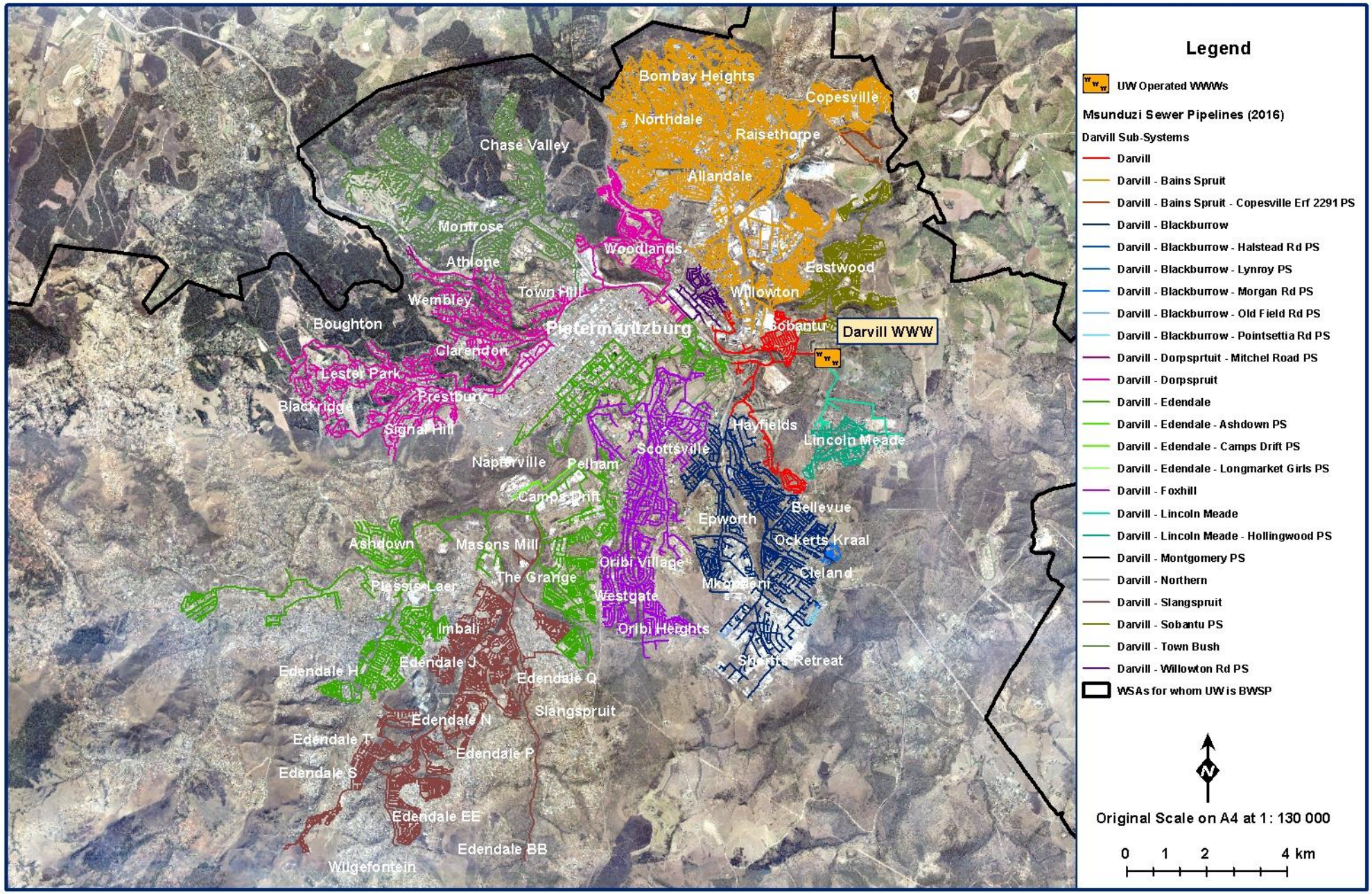

Figure 19.3 Location of Darvill WWW in relation to the collection system.

In 2011 a decision was made to upgrade the WWW to 100 Mℓ/day as the plant had been operating above its capacity. The average daily inflow (November 2018 to October 2019) is approximately 71 Mℓ/day (**Figure 19.4**) which is meaningfully higher than the plant's previous treatment capacity of 65 Mℓ/day.

It is clear from the graph (**Figure 19.4**) that inflows to the works have, for of the past five months, been below the 12 month moving average, with the average inflow in October 2019 only 54 Mℓ/day. This is historically low and Umgeni Water is concerned that not all of the flow is reaching the WWW. There could be a number of reasons for this such as broken or leaking sewers which are resulting in losses. Umgeni Water is engaging with the Municipality to establish the root cause and to develop possible solutions.

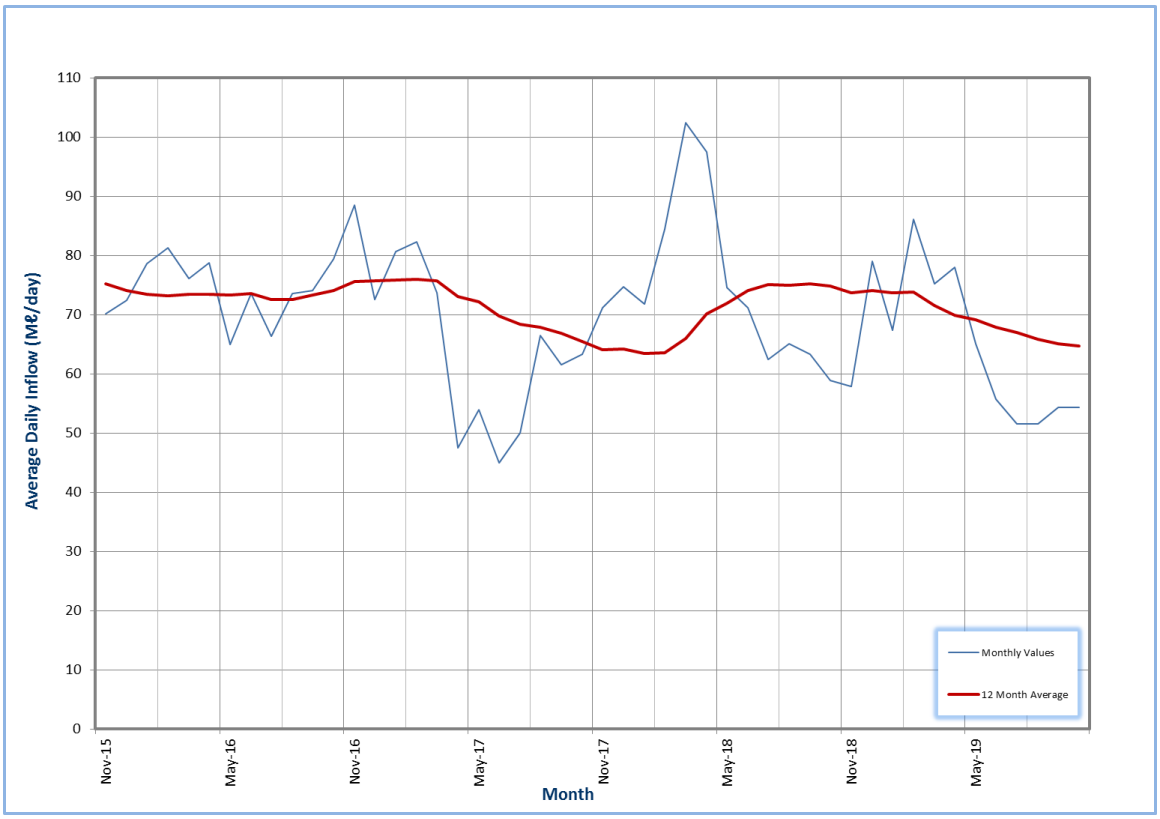

Figure 19.4 Average daily inflow (Mℓ/day) to Darvill WWW.

The plant capacity has been increased by 35 Mℓ/day to cope with the predicted wastewater demands (**Figure 19.5**). ADWF within the Darvill WWW catchment is expected to grow to about 90 Mℓ/day by 2021 (**Figure 19.5**), although this is not reflected on the graph due to the sharp drop in influent in 2017. This drop was due to various construction and maintenance activities impacting on the flow. The upgraded design allows for future expansion, to a maximum capacity of 120 Mℓ/day, which is forecast to occur in 2028. Some of the proposed demand scenarios are illustrated in **Figure 19.5.**

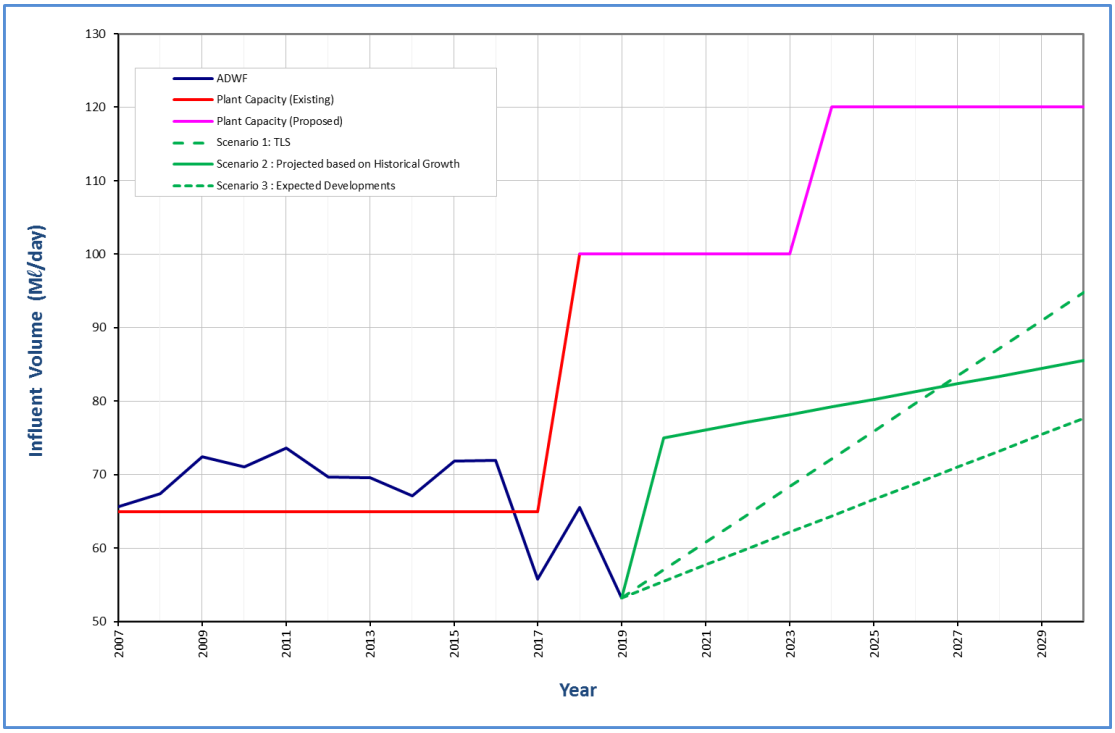

Figure 19.5 Projected inflow into Darvill WWW.

An analysis of daily historical production (November 2018 to October 2019) for the upgraded Darvill WWW is presented in **Figure 19.6.** It shows that for 18 % of the time the WWW was being operated above the optimal operating capacity. The plant operated above the new 100 Mℓ/day design capacity for only 5% of the time.

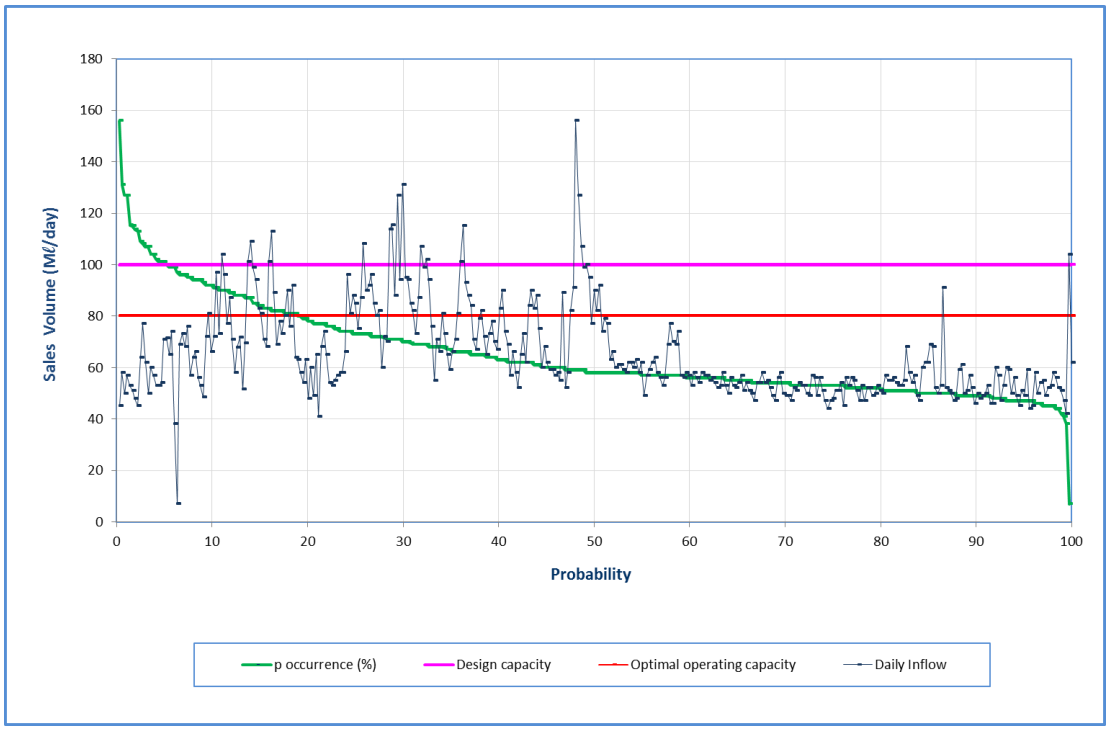

Figure 19.6 Analysis of historical production at Darvill WWW (November 2018 to October 2019).

The upgraded WWW plant comprises the following unit processes:

- Storm water overflow and storage facility
- Excess storm water chlorination facility and storm water return pump installation
- Inlet works with Fat, Oils, Grease and Grit (FOGG) removal facility
- Primary sedimentation tanks
- Activated sludge process (anaerobic, anoxic, and aeration zones (**Figure 19.7**)
- Aluminum sulfate addition to assist phosphate removal
- Secondary clarifiers for separation and return of activated sludge
- Chlorination of final effluent
- Pre-thickener for primary sludge
- Anaerobic Digesters
- Sludge dewatering facility (linear screens) and disposal
- Wash Water Plant

The inlet works consists of two inlet channels each equipped with hand raked coarse screens, four mechanical screens (installed in pairs), four vortex flow grit separators complete with submersible centrifugal grit pumps, grit classifier and belt conveyor with screenings compactor and flow measurement. The Fat, Oils and Grease (FOG) plant is combined with grit removal as an element of the inlet works to form a Fat, Oils, Grease and Grit removal facility (FOGG).

Primary treatment consists of four primary settling tanks (PST), two 30 m in diameter and two 40 m in diameter. Primary sewage is fed from the PSTs to a balancing tank (10 Mℓ).

Primary settled sewage is transferred and lifted from the balancing tank by the main pump station to an elevated level at the activated sludge tanks inlet from where the sewage receives secondary treatment. The pump station consists of two receiving sumps with two large horizontal split casing centrifugal pumps servicing each sump. A central manifold connects the two pump sets to allow for interchangeable operation. The two pumps, per sump, operate in a full duty/standby configuration and are designed to operate in a flow range of 70 – 130 Mℓ/day.

The activated sludge plant at Darvill WWW consists of a number of pre anoxic / anoxic / anaerobic zones followed by the aeration basin. A total biological volume of 74 415 m^3 is provided in the new system. Aeration in the aerobic zone of the biological reactor is achieved with fine bubble diffused air (FBDA) aeration. Air is supplied to the system by four duty and one standby blower.

Secondary treatment consists of seven clarifiers with a Return Activated Sludge (RAS) pump station fitted with centrifugal pumps operating on variable speed drives. The effluent from the clarifiers is disinfected using a high concentration chlorine solution which is discharged into the effluent upstream of the chlorine contact tank.

The chlorine disinfection unit process is followed by a series of maturation rivers / lagoons. In total there are three rivers / lagoons with a combined volume of 20 428 m^3 giving a total retention time of 8.2 hours for the design flow of 60 Mℓ/day.

The sludge treatment system has two sources of sludge produced and subsequently processed. Primary sludge withdrawn from the underflow of the primary sedimentation tanks is forwarded to a gravity sludge thickening stage before passing through a pre-fermentation process and then onto anaerobic digestion. The pre-fermentation process produces a supernatant high in volatile fatty acids (VFA's) which is returned to the liquid treatment phase and aids in denitrification ahead of the aeration basis.

The methane gas generated by the anaerobic digestion process will, in future, be utilised in a co-generation plant to produce electricity. The co-generation gas engines will be cooled by water and this water will be utilised in the digesters for heating purposes. The digested sludge will pass into the post thickeners and then be dewatered and treated with lime to provide a stable product which may be used for agricultural purposes or landfill cover.

The second sludge phase is the wasting of activated sludge. At Darvill WWW mixed liquor is wasted directly from the activated sludge reactor upstream of the final clarifiers. The waste mixed liquor will gravitate to a new building housing linear screens where it will be thickened to 6%. The sludge to the linear screens will be dosed with a cationic polyacrylamide conditioning polyelectrolyte. Thereafter it will be blended with the digested sludge and disposed of on the sludge lands adjacent to the WWW site.

The high pressure water system will operate at a pressure of 8 bar with two duty and one standby pumps. The high pressure water system will draw treated water directly from the wash water treatment plant.

Figure 19.7 Darvill Aeration Basin.

19.2.2 Ixopo Wastewater Works

Ixopo WWW serves the town of Ixopo in the Harry Gwala District Municipality and is a Class D accredited WWW. It is located next to the R612 regional road and downstream of the Home Farm Dam, which supplies the raw water to Umgeni Water's Ixopo WTP (**Figure 19.8**).

The Ixopo WWW process train follows a typical extended aeration process consisting of an inlet works, one reactor with three aerators on timers and two clarifiers (**Figure 19.8**), five drying beds and chlorine contact channels. Sludge is dried on beds and disposed of on a local farm owned by Harry Gwala District Municipality. The characteristics of the Ixopo WWW are shown in **Table 19.2**.

Table 19.2 Ixopo WWW infrastructure.

WWW Name:	Ixopo WWW
System:	uMkhomazi System
Maximum Design Capacity:	1 Mℓ/day
Current Utilisation:	0.49 Mℓ/day
Balancing Ponds:	3 Mℓ
Raw Sewage Pump Station:	
Screens:	1 x Hand raked, 2.5 cm gaps
Grit Chambers:	2 x Constant velocity grit channel
Aeration Basin Area:	
Aeration Basin Capacity:	1150 m^3
Aerators:	3 x 18.5 kW slow speed aerators
Clarifier Type:	1 x scraped floor (12.5 m), 1 x suction lift (14.5 m)
Number of Clarifiers:	2
Total Area of all Clarifiers:	274 m^2
Total Capacity of Clarifiers:	6.6 Mℓ/day
Upflow Velocity:	1 m/h
RAS Pump Station Capacity:	
Chlorine Storage Capacity:	8 x 68 kg cylinders
Chlorine Dosing Capacity:	0 – 1 kg/h
Total Capacity of Chlorine Contact Tanks:	62 m^2
Total Capacity of Sludge Treatment Plant:	
Anaerobic Ponds:	None
Sludge Drying Beds Area:	720 m^2

Figure 19.8 Location of Ixopo WWW.

Figure 19.9 Clarifier No. 1 Ixopo WWW.

The average daily inflow to the Ixopo WWW is shown in **Figure 19.10.**

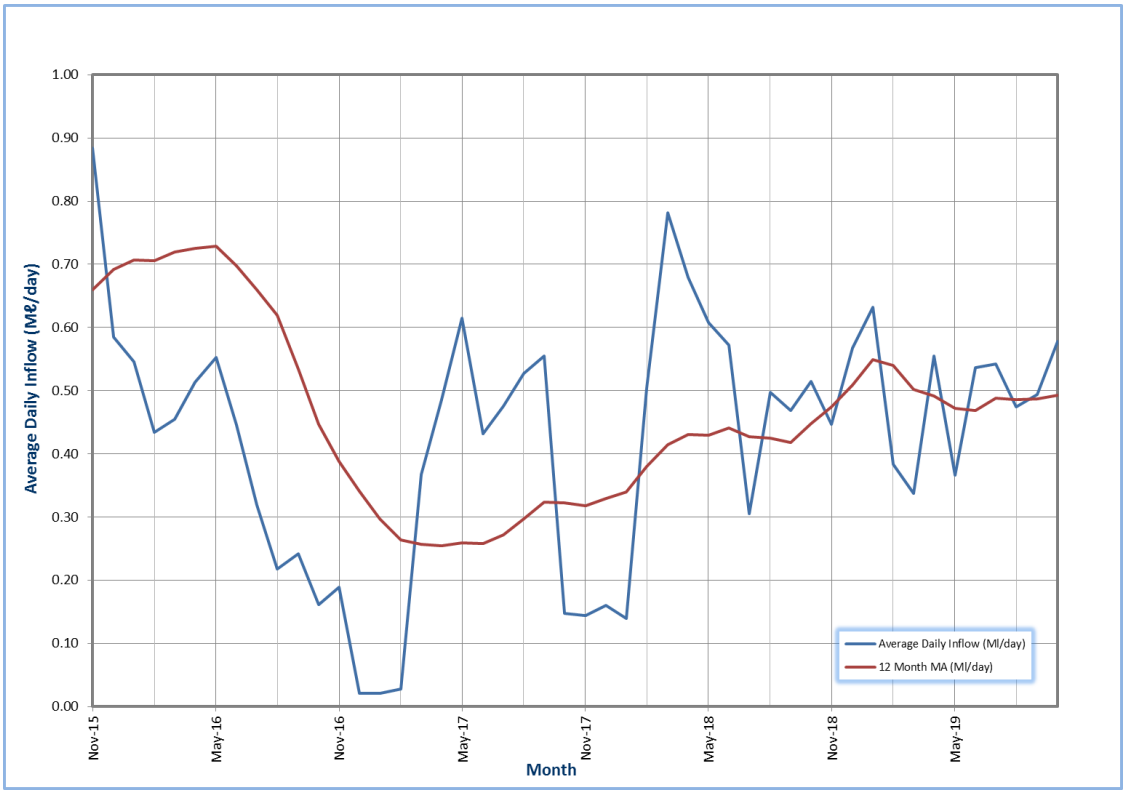

Figure 19.10 Average daily inflow (Mℓ/day) for Ixopo WWW.

Flows to the WWW have, for a number of years, been reduced as a result of blockages in the Ixopo sewer network. The situation has improved somewhat over the last two years with a 12 month moving

average in October 2019 of 0.49 Mℓl/day. The flow remains well below the anticipated return flows of 1.9 Mℓ/day (75% of potable water sales).

Of concern is that sewage meant for the works is undoubtedly spilling into the environment and polluting water resources as well as placing communities at risk. Sampling from Umgeni Water's Home Farm Dam indicates elevated Ammonia and Phosphorous levels as a direct result of pollution from sewage.

An analysis of daily historical production (November 2018 to October 2019) for the Ixopo WWW is presented in **Figure 19.11.** It shows that for 2.5 % of the time the WWW was being operated above the optimal operating capacity. The plant operated above the design capacity only 1.4% of the time. This shows the plant is being underutilised, especially considering that it was upgraded in October 2016 (see **UW IMP 2017**) with the installation of a second clarifier.

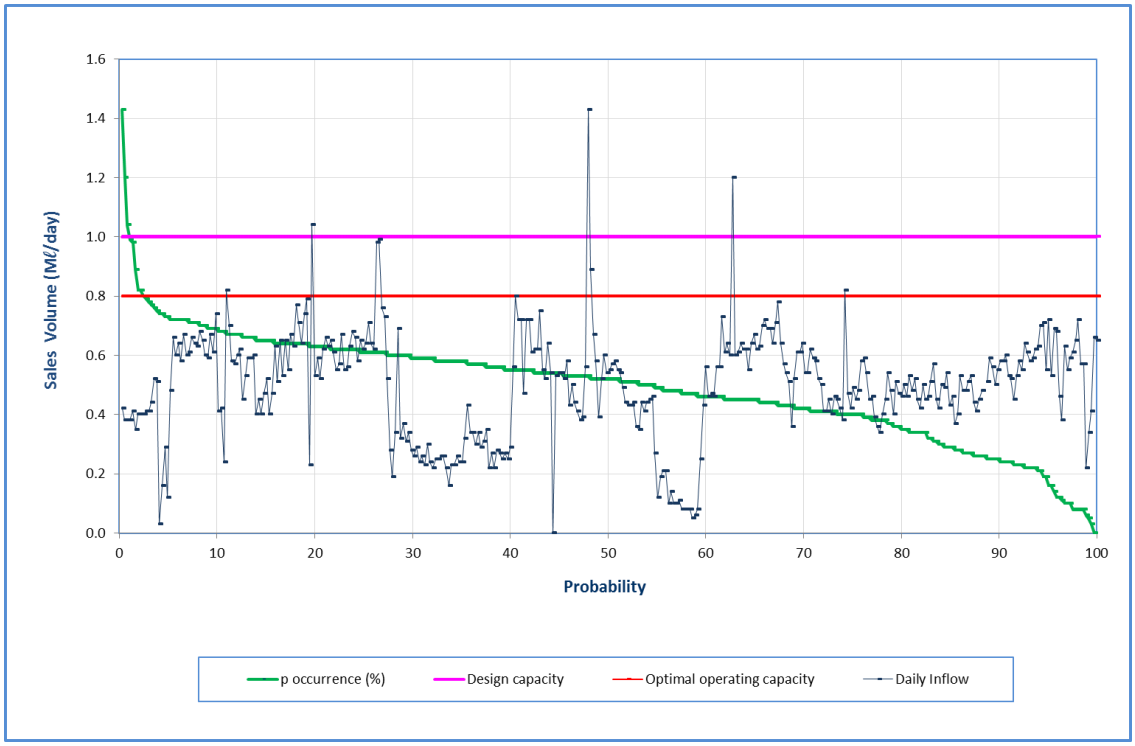

Figure 19.11 Analysis of historical production at Ixopo WWW (November 2018 to October 2019).

19.2.3 Albert Falls North and South Wastewater Works

Albert Falls North (**Figure 19.12**; **Figure 19.13**) and South WWW (**Figure 19.13**) are aerobic sequencing batch reactors (SBRs) with design capacities of 55 m^3/day and 40 m^3/day respectively. Raw sewage from the staff quarters, surrounding households and tankers is fed into the reactor via two grit channels at the Northern works and through a sump at the Southern works. Equalisation, biological treatment and secondary clarification are performed in a single tank using a timed control sequence.

The system is fitted with diffusers for oxygen supplied by two blowers for biological nutrient removal. Solid-liquid separation occurs in the reactor during an idle period when no diffusion or mixing takes place, allowing the solids to settle and a sludge-blanket to form. The diffusion occurs when the actuator valve is in a closed position and decanting occurs after the diffusion process is completed. Supernatant flows through a chlorination unit including a contact tank for disinfection. The chlorinated effluent then gravitates to a maturation pond for further stabilization and polishing. After the maturation pond the final effluent is discharged to the environment**.**

The available clarifiers are no longer in use for clarification but serve as a safe guard for over spill during actuator valve failure and pipe blockages. Waste Activated Sludge (WAS) is discharged to the neighbouring sludge drying beds. The characteristics of the Albert Falls North and South WWW are shown in **Table 19.3** and **Table 19.4** respectively.

Figure 19.12 Sequencing Batch Reactor (SBR) Albert Falls North WWW.

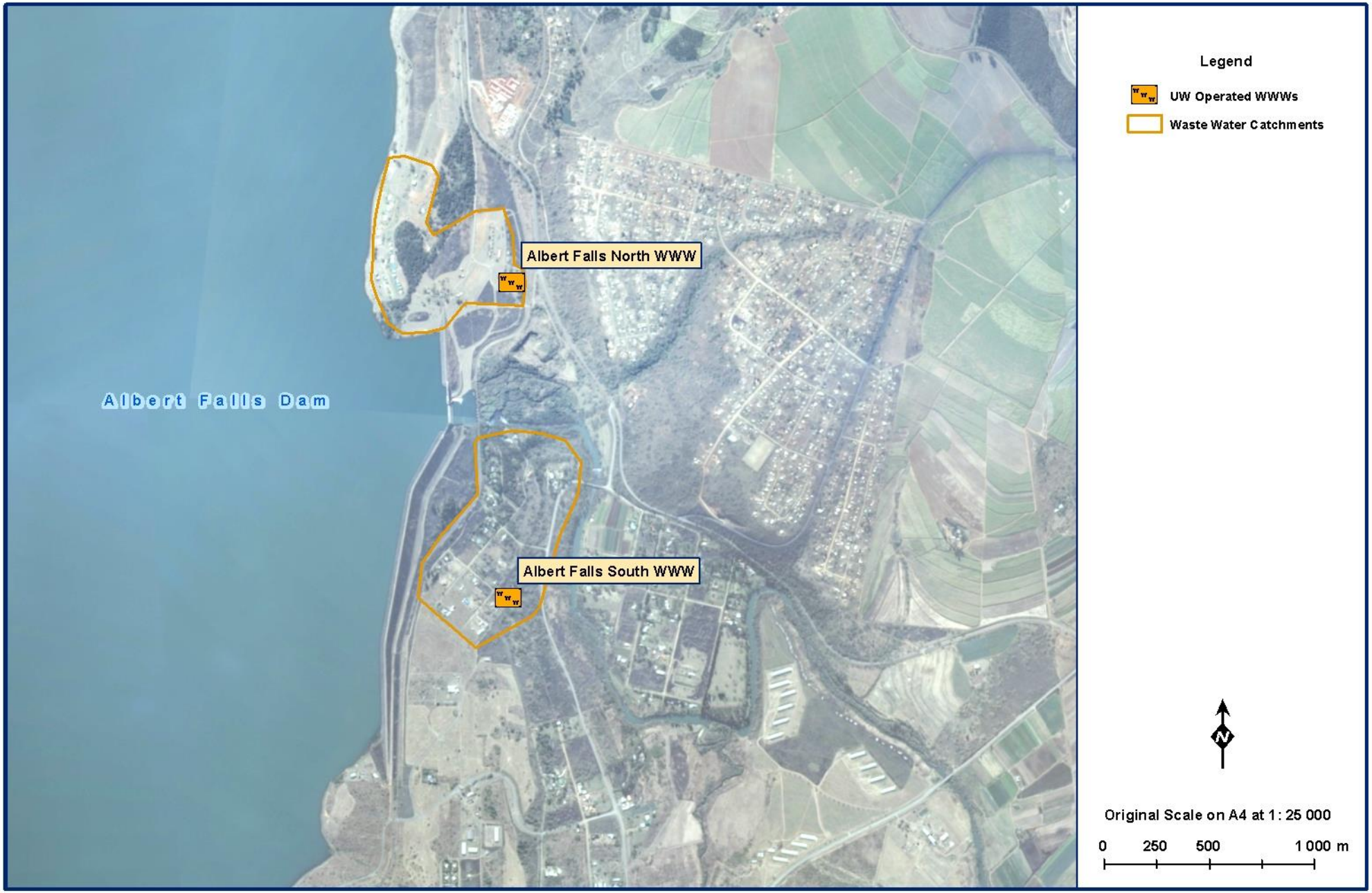

Figure 19.13 Location of Albert Falls North and South WWW.

Table 19.3 Albert Falls North WWW infrastructure.

WWW Name:	Albert Falls North WWW
System:	Upper Mgeni System
Maximum Design Capacity:	0.055 Mℓ/day
Current Utilisation:	Unknown (No inflow meter)
Screens:	None
Grit Chambers:	2 x grit channels
Aeration Basin:	1 x Sequencing Batch Reactor
Aeration Basin Capacity:	165 m^3
Aeration:	8 x Fine Bubble Diffuses
Blowers:	2 x 7.5 kW
Clarifier Type:	Used as overflow tank
Number of Clarifiers:	2
Total Area of all Clarifiers	NA
Total Capacity of Clarifiers:	20 m^3
Chlorine Storage Capacity:	Calcium Hypochlorite tablets
Total Capacity of Chlorine Contact Tanks:	11.34 m^3
Sludge Drying Beds Area:	51 m^2
Maturation Pond Capacity:	475 m^3

Table 19.4 Albert Falls South WWW infrastructure.

WWW Name:	Albert Falls WWW
System:	Upper Mgeni System
Maximum Design Capacity:	0.055 Mℓ/day
Current Utilisation:	Unknown (No inflow meter)
Screens:	None
Grit Chambers:	2 x grit channels
Aeration Basin:	1 x Sequencing Batch Reactor
Aeration Basin Capacity:	115 m^3
Aeration:	6 x Fine Bubble Diffuses
Blowers:	2 x 7.5 kW
Clarifier Type:	Used as overflow tank
Number of Clarifiers:	2
Total Area of all Clarifiers:	NA
Total Capacity of Clarifiers:	20 m^3
Chlorine Storage Capacity:	Calcium Hypochlorite tablets
Total Capacity of Chlorine Contact Tanks:	11.34 m^3
Sludge Drying Beds Area:	46 m^2
Maturation Pond Capacity:	140 m^3

19.3 Umgeni Water Operated Wastewater Works

In 2014 Umgeni Water entered into a management contract to manage all the wastewater works within UMDM, having previously only operated the Howick WWW. Umgeni Water is now responsible for the operation and maintenance of six wastewater works (Mpophomeni WWW is currently decommissioned) within the UMDM. Additionally, Umgeni Water operates the Lynnfield Park WWW on behalf of the Msunduzi Local Municipality.

19.3.1 Howick Wastewater Works

Howick WWW (**Figure 19.15**) is situated in the town of Howick in the Natal Midlands. It is owned by UMDM and operated by Umgeni Water. The WWW is a Class C accredited WWW with an extended aeration process consisting of three separate reactors and four clarifiers. All reactors follow the Johannesburg Process configuration and are fitted with mechanical mixers in the anoxic and anaerobic zones and with surface aerators in the aerobic zones. Mixed liquor from the basins is settled in four downstream clarifiers. Waste activated sludge from the reactors is dewatered in drying beds and treated effluent is disinfected using chlorine (**Figure 19.14**) before being discharged to the uMngeni River. Howick WWW is operating within its overall design capacity for the biological removal of COD, ammonia and phosphate.

Figure 19.14 Howick WWW Chlorine Contact Tank.

The characteristics of the Howick WWW are summarised in **Table 19.5**.

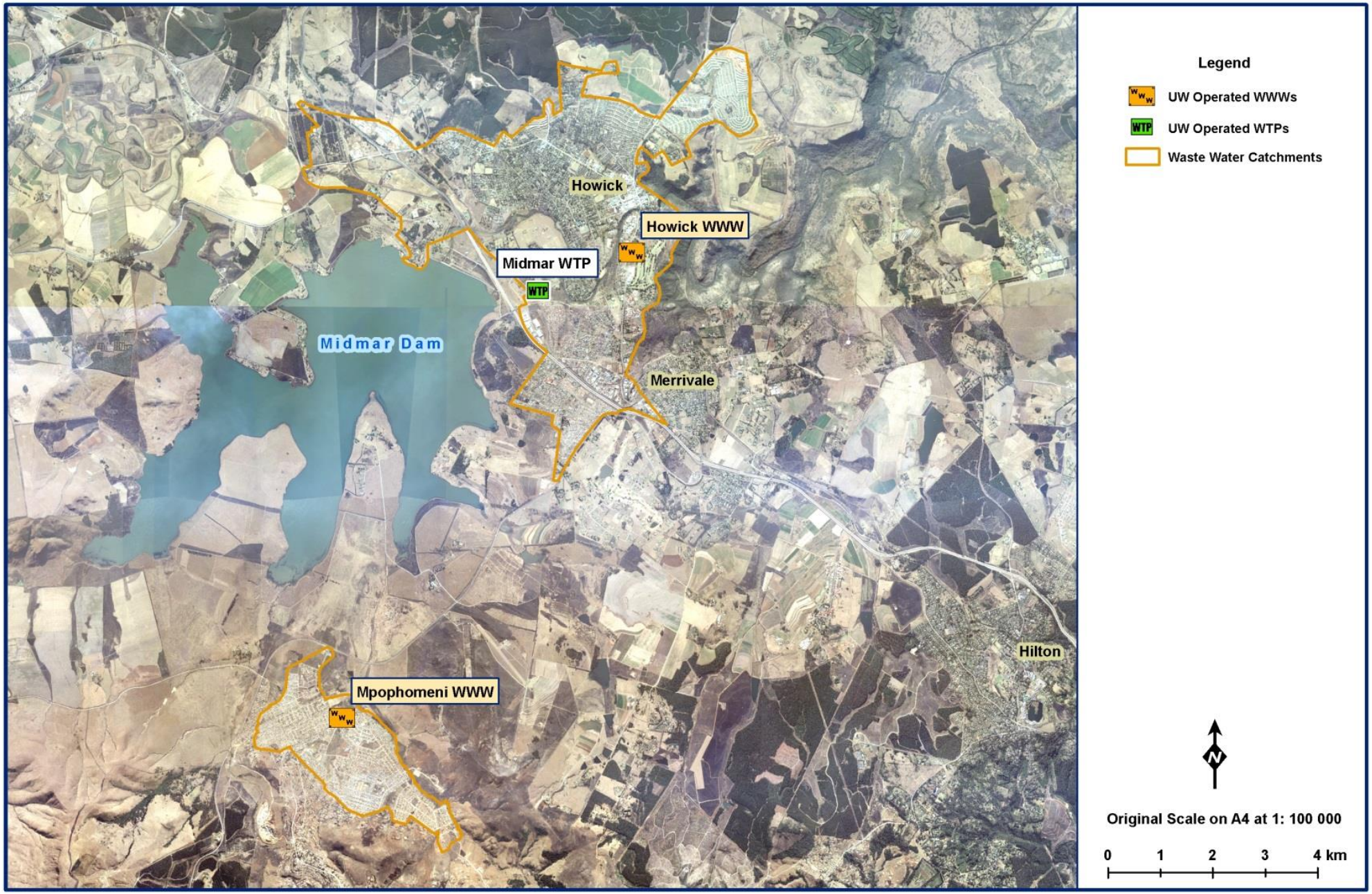

Figure 19.15 Location of Howick WWW.

Table 19.5 Howick WWW infrastructure.

WWW Name:	Howick WWW
System:	Upper Mgeni System
Maximum Design Capacity:	6.8 Mℓ/day
Current Utilisation:	5.7 Mℓ/day
Raw Sewage Pump Station:	
Screens:	2 x Hand Raked, 5.5 cm 1 x Mechanical Screen Raker, 1 cm (Huber); 0.75 kW Motor (Bauer)
Screw Press:	Rotary Screw Conveyor; 0.55 kW Motor (Flender)
Grit Chambers:	2 x Vortex Degritters
Degritter Pump:	2 x Airlift; 7.5 kW (Wade)
Anaerobic Basin Mixers:	6 x 1.5 kW, 3 x 2.2 kW Mixers
Anoxic Basin Mixers:	9 x 2.2 kW Mixers
Aerators:	3 x 15.5 kW (Hansen) 3 x 18.5 kW (WEG), 4 x 30 kW (Hansen)
Anaerobic Basin Area:	575 m^2
Anoxic Basin Area:	640 m^2
Aeration Basin Area:	1790 m^2
Aeration Basin Capacity:	1.7 Mℓ/day , 1.7 Mℓ/day and 3.4 Mℓ/day (9850 m^3)
Clarifier Type:	2 x Suction Lift, 2 x Mechanically Scraped
Number of Clarifiers:	4
Total Area of all Clarifiers:	830 m^2
Total Capacity of Clarifiers:	20 Mℓ/day
Upflow Velocity:	1 m/h
RAS Pump Station:	
Chlorine Storage Capacity:	68 kg Cylinder
Chlorine Dosing Capacity:	
Total Capacity of Chlorine Contact Tanks:	9 Mℓ/day
Total Capacity of Sludge Treatment Plant:	
Sludge Dewatering:	2 x Mechanical Screw Presses (Max. 5 m^3/h)
Sludge Drying Beds Area:	1920 m^2

Howick WWW (**Table 19.5**) has a design capacity of 6.8 Mℓ/day and is currently treating 5.7 Mℓ/day (**Figure 19.16**) based on a 12-month moving average. This includes wastewater pumped from the decommissioned Mpophomeni WWW (**Section 19.3.2**). Mechanical dewatering equipment installed in 2013 has alleviated operational problems to a degree although the works still has capacity constraints within some processes.

An analysis of daily historical production (November 2018 to October 2019) of the Howick WWW is presented in **Figure 19.17.** It shows that for 69 % (60% in 2018) of the time the WWW was being operated above the optimal operating capacity. The plant operated above design capacity 20% (10% in 2018) of the time.

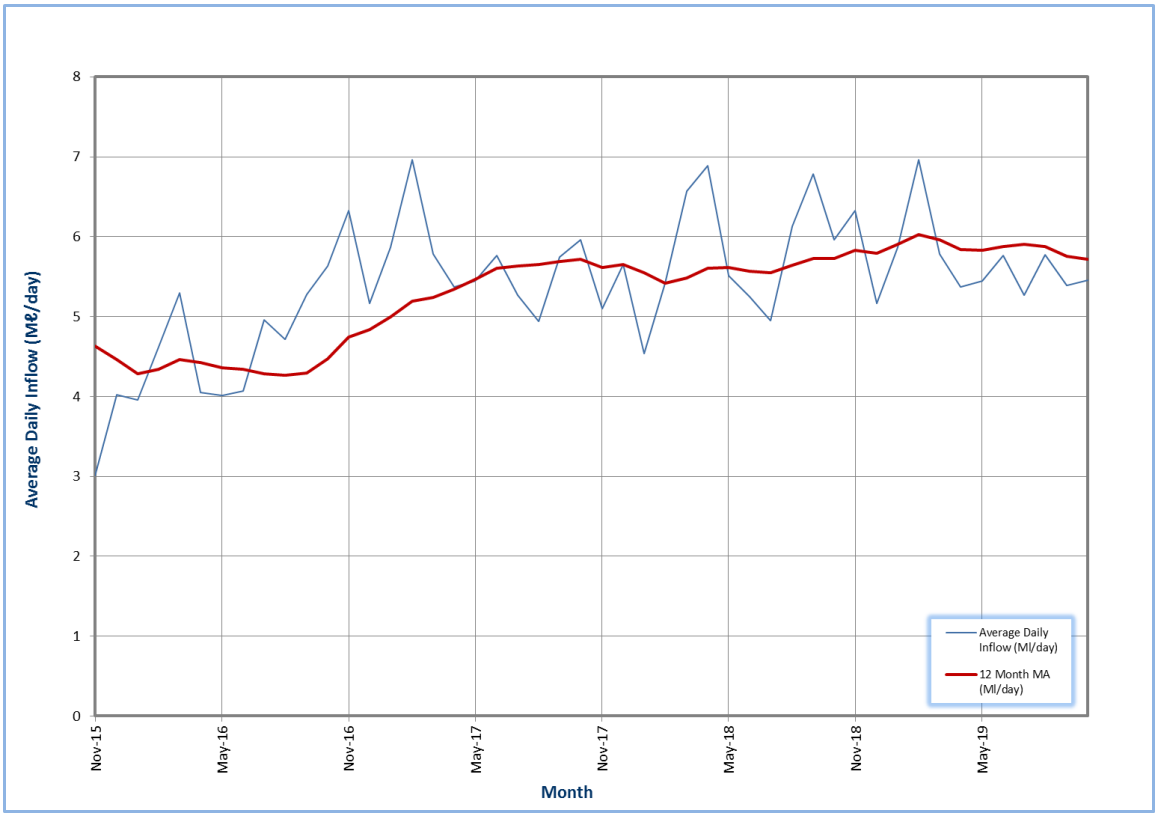

Figure 19.16 Howick WWW average daily outflows (Mℓ/day).

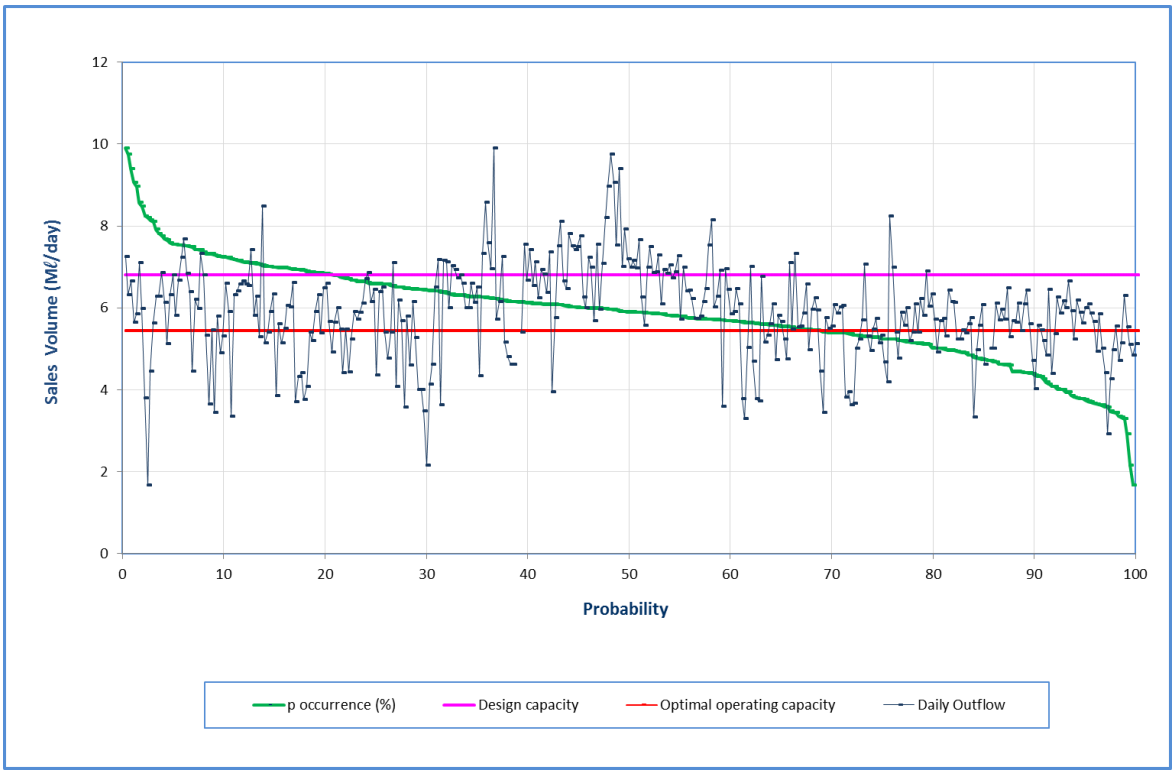

Figure 19.17 Analysis of historical production at Howick WWW (November 2018 to October 2019).

Based on these figures it is clear that the works is being over utilised and is in need of an increase in capacity. This may, however, be avoided in the short to medium term once the new Mpophomeni WWW is constructed as this will reduce the volume of wastewater to be treated by 2 to 3 Mℓ/day.

19.3.2 Mpophomeni Wastewater Works

Presently wastewater from Mpophomeni Township is pumped from the site of the decommissioned Mpophomeni WWW (**Figure 19.18**) to Howick WWW (**Section 19.3.1**), a distance of approximately 11 km. The existing wastewater pumping and conveyance system, with an estimated operating capacity of 4.3 Mℓ/day, is inadequate to pump the projected ADWF of 5.9 Mℓ/day. Umgeni Water plans to start construction of a new WWW in Mpophomeni in early 2020 (**Section 19.4.2)**. The new WWW has been designed to treat 6 Mℓ/day with the possibility of increasing the capacity to 12 Mℓ/day. The site has adequate land available for a WWW of at least 20 Mℓ/day. The existing WWW infrastructure is listed in **Table 19.6**, some of which will be retained as part of the new plant.

Table 19.6 Mpophomeni WWW infrastructure.

WWW Name:	Mpophomeni WWW
System:	Upper Mgeni System
Maximum Design Capacity:	3.5 Mℓ/day
Current Utilisation:	Decommissioned
Balancing Ponds:	2.25 Mℓ/day wet weather storage pond
Raw Sewage Pump Station:	
Screens:	1 x 30 mm Manually raked 1 x Mechanical Screen Raker (Huber)
Grit Chambers:	2 x Vortex
Primary Settling Tank:	2
Rotating Biofilters:	2 x 454 m^2
Clarifier Type:	
Number of Clarifiers:	1 x 18 m diameter
Total Area of all Clarifiers	255 m^2
Total Capacity of Clarifiers:	6 Mℓ/day
Upflow Velocity:	1 m/h
Cold Digesters:	2 x 600 kℓ
Supernatant Tank:	1 x 450 kℓ
Humus Tanks:	3
RAS Pump Station:	
Chlorine Storage Capacity:	
Chlorine Dosing Capacity:	
Total Capacity of Chlorine Contact Tanks:	
Total Capacity of Sludge Treatment Plant:	
Dewatering Facility:	
Sludge Drying Beds Area:	8

Figure 19.18 Location of decommissioned Mpophomeni WWW.

19.3.3 Lynnfield Park Wastewater Works

The Lynnfield Park WWW is a small (0.5 Mℓ/day) works that services part of the Ashburton area (**Figure 19.19**). Umgeni Water took over the operation of the works on behalf of the Msunduzi Local Municipality in April 2014. Inflow to the works averages 0.11 Mℓ/day on a twelve month moving average (**Figure 19.20**), down from 0.2 Mℓ/day the previous year. This is well below the works capacity. Prior to the installation of a flow measuring device no records were available and hence inflow readings only started in May 2017. The WWW was upgraded in 2016 with the addition of a new Sequencing Batch Reactor (SBR). The old extended aeration activated sludge reactors were decommissioned and are now used as balancing tanks and chlorine contact tanks. The Head of Works (HOW) was upgraded and comprises two channels comprising manual and mechanical screening (**Figure 19.21**).

The addition of a duplicate SBR (0.5 Mℓ/day) is planned and this would increase the capacity of the plant to 1 Mℓ/day. Any upgrades to the works are being funded by a private developer and thus the increase in capacity is being timed to coincide with planned property developments in the area. Further upgrades to 2 and 4 Mℓ/day are planned based on expected future requirements.

The characteristics of the Lynnfield Park WWW are shown in **Table 19.7**.

Table 19.7 Lynnfield WWW infrastructure.

WWW Name:	Lynnfield WWW
System:	Upper Mgeni System
Maximum Design Capacity:	0.5 Mℓ/day
Current Utilisation:	0.11 Mℓ/day
Balancing Ponds:	Storm Dam
Screens:	New 1 x Mechanical raked screen, 6 mm aperture New standby 1 x Hand raked screen, 12 mm aperture
Grit Chambers:	1 x vortex
Aeration Basin:	2 x Sequencing Batch Reactor
Aeration Basin Capacity:	500 kℓ/day
Aeration:	Fine Bubble Diffused Aeration
Blowers:	2 x 9.5 kW
Clarifier Type:	
Number of Clarifiers:	2 (decommissioned)
Total Area of all Clarifiers:	
Total Capacity of Clarifiers:	
Upflow Velocity:	
Chlorine Storage Capacity:	25 ℓ tank Liquid Sodium Hypochlorite (NaOCL)
Total Capacity of Chlorine Contact Tanks:	11.34 m^3
Sludge Drying Beds Area:	Geofabric dewatering bag contained in a disposable skip

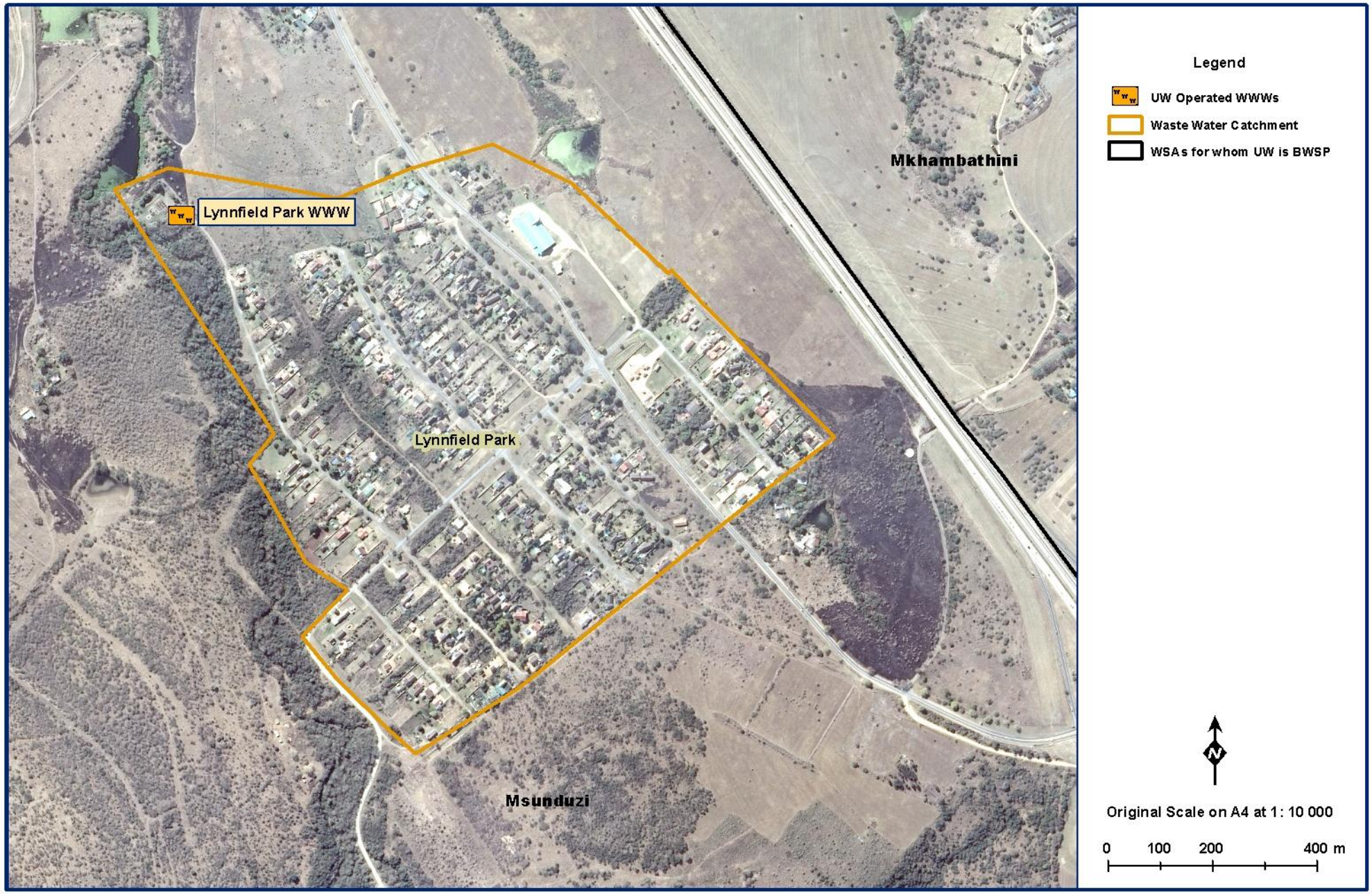

Figure 19.19 Location of Lynnfield Park WWW.

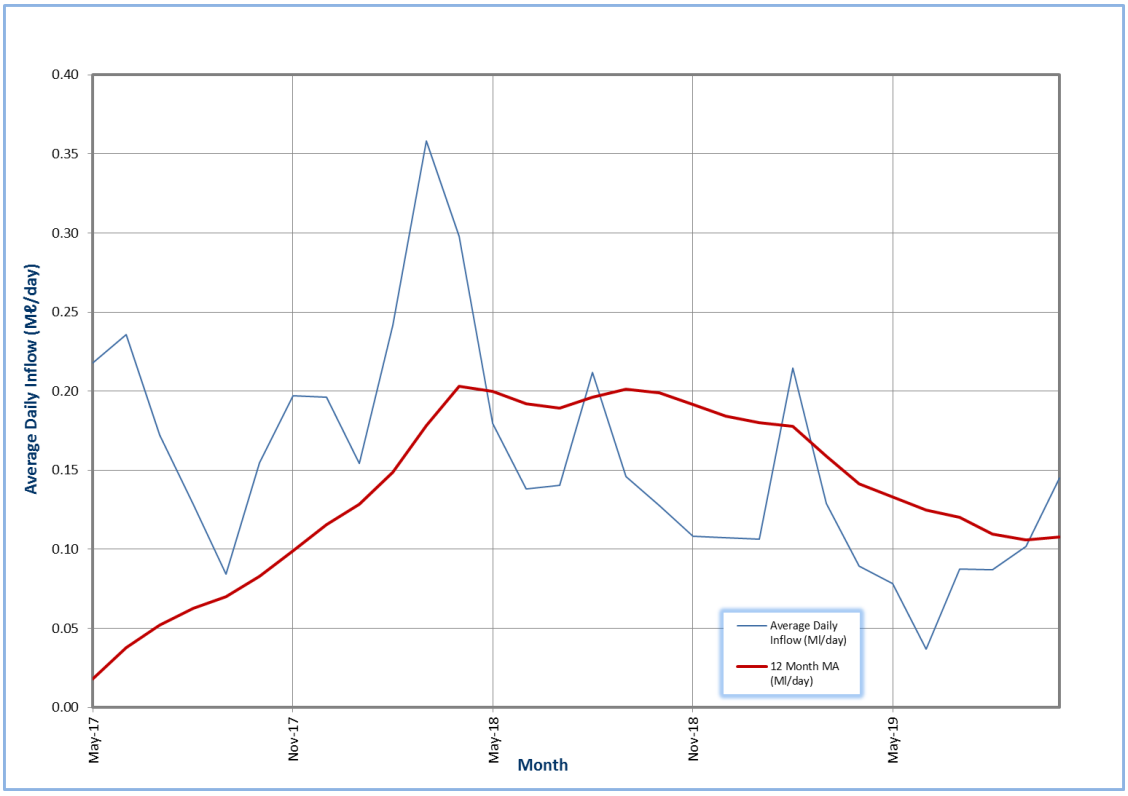

Figure 19.20 Lynnfield Park WWW average daily inflows (Mℓ/day).

Figure 19.21 Lynnfield Park WWW head of works showing manual and mechanical screening channels.

The decrease in the 12-month moving average and the decline visible in **Figure 19.20** indicate that a problem exists with inflow to the works. Umgeni Water suspects that there are blockages in the

sewage reticulation system resulting in a reduction in flow reaching the works. The Msunduzi Municipality has been contacted and requested to investigate.

19.3.4 Mpofana Wastewater Works

Umgeni Water operates the Mpofana WWW (**Figure 19.22**) on behalf of UMDM. The wastewater works services the town of Mooi River, and adjacent township of Bruntville (**Figure 19.23**). Sewage from Mooi River flows into the works by gravity whilst catchment sewage is pumped to the wastewater works by eight pump stations.

Figure 19.22 Mpofana WWW head of works.

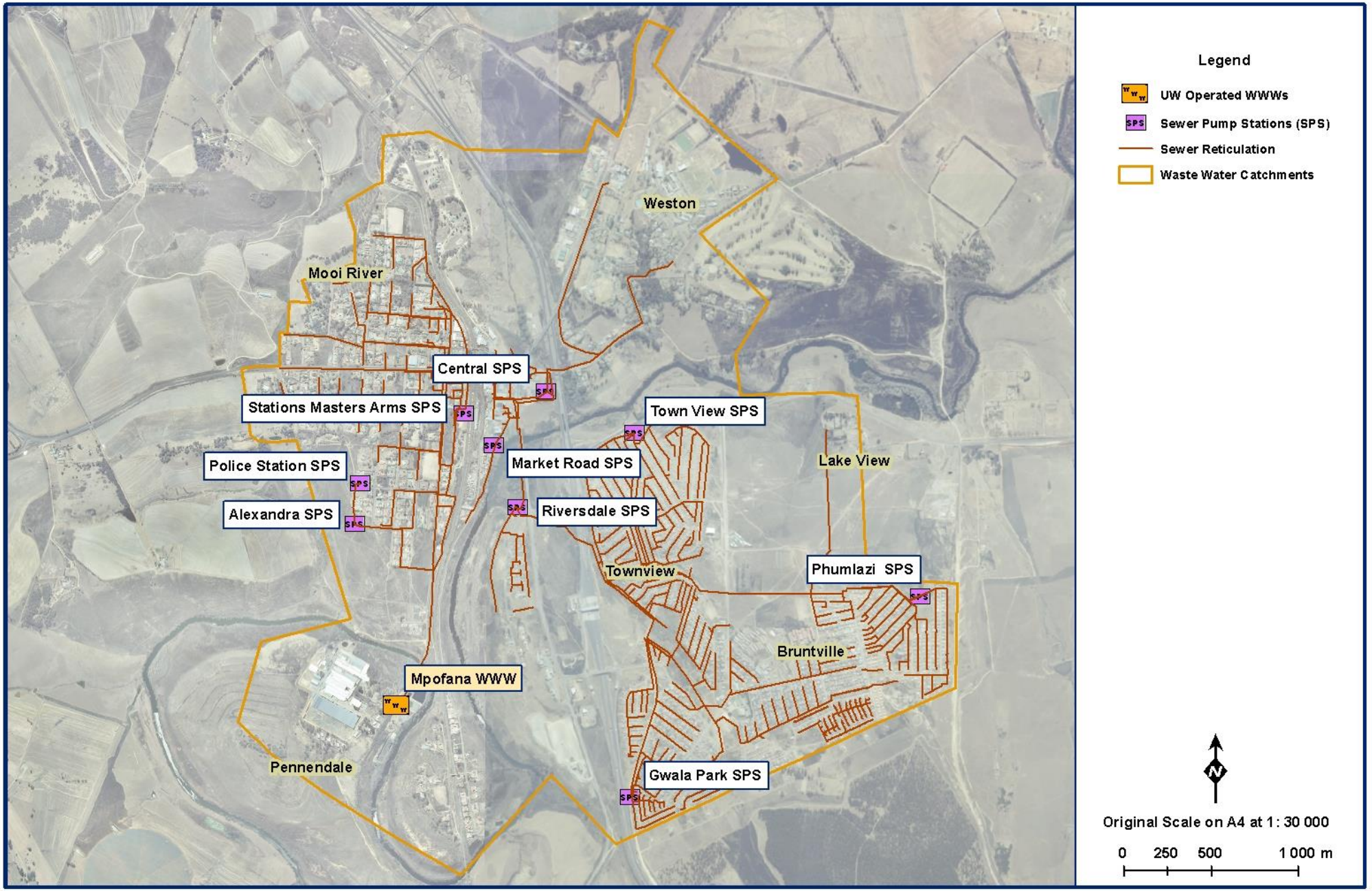

Figure 19.23 Location of the Mpofana WWW.

The characteristics of the Mpofana WWW are shown in **Table 19.8.**

Table 19.8 Mpofana WWW infrastructure.

WWW Name:	Mpofana WWW
System:	Mooi System
Maximum Design Capacity:	3.5 Mℓ/day
Current Utilisation:	3.59 Mℓ/day
Balancing Ponds:	Combined 75000 m^3
Raw Sewage Pump Station:	375 Mℓ/day @ velocity of 2.3 m/s
Screens:	3 x Hand-raked bar screen
Grit Chambers:	None
Aeration Basin:	2 x Activated sludge (1 x not operational)
Aeration Basin Capacity:	Operational 4500 m^3
Aerators:	3 x Hansen QVPD-3_UDN (45kW, 1480 rpm) 3 x SEW Eurodrive (not operational)
Clarifier Type:	Suction Lift Clarifier
Number of Clarifiers:	2 x 20 m diameter
Total Area of all Clarifiers:	628 m^2
Total Capacity of Clarifiers:	15 Mℓ/day
Upflow Velocity:	1 m/h
RAS Pump Station:	None (gravity)
Chlorine Storage Capacity:	Wallace & Tiernan, S10k Gas Chlorinator 68 kg cylinder
Chlorine Dosing Capacity:	Max. allowable 2.0 kg/h (existing)
Total Capacity of Chlorine Contact Tanks:	25m^3
Total Capacity of Sludge Treatment Plant:	5 m^3/hr
Dewatering Facility:	Operational
Sludge Drying Beds Area:	None

The works has a design capacity of 3.5 Mℓ/day and is currently treating 3.59 Mℓ/day based on a twelve month moving average (**Figure 19.24**). The works receives approximately 1.2 Mℓ/day of industrial influent from the adjacent textile industry. The textile factory shuts down on Sundays and this then reduces the average flow when calculated over seven days.

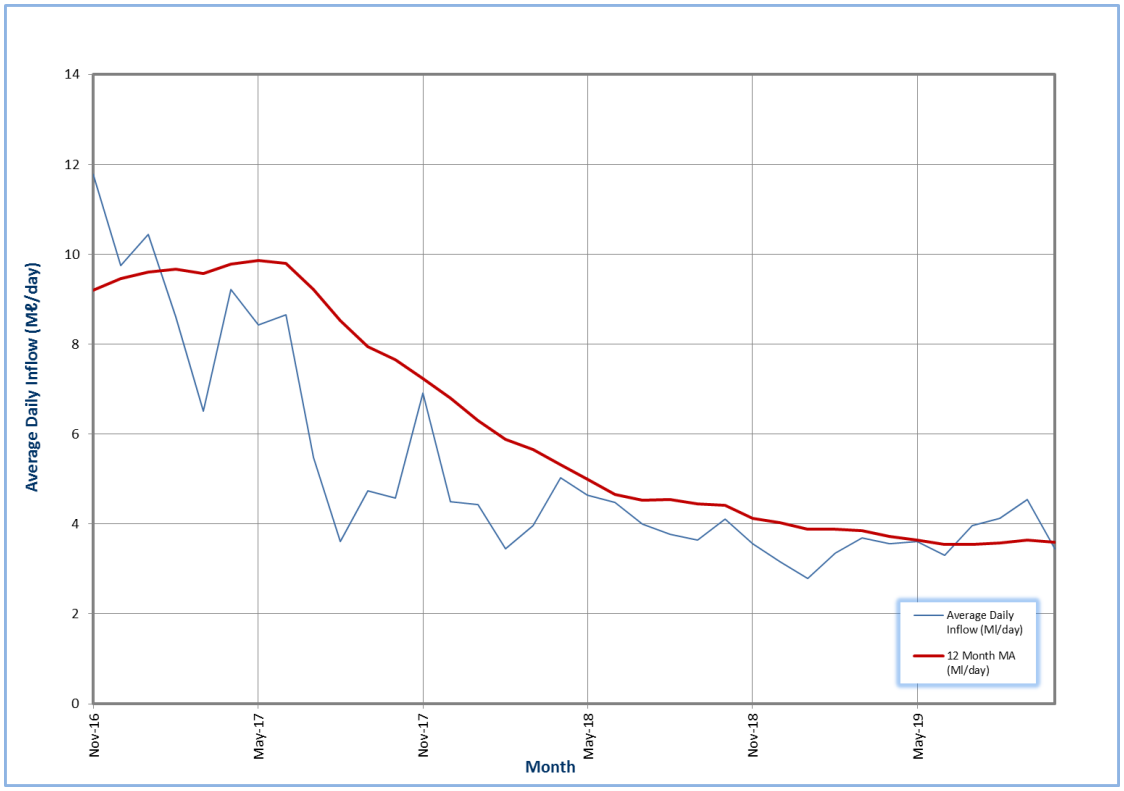

Figure 19.24 Mpofana WWW average daily inflows (Mℓ/day).

The average inflow of 3.59 Mℓ/day exceeds the capacity of the works (**Figure 19.24**). An analysis of daily historical production (November 2018 to October 2019) of the Mpofana WWW is presented in **Figure 19.25.** It shows that for 81% of the time the WWW was being operated above the optimal operating capacity. The plant operated above design capacity 60% of the time. The flow entering the works in October 2019 was reduced due to zero inflow from the Textile factory. Production was halted at the factory for over a month as a result of fire damage.

A Detailed Feasibility Study (DFS) is being undertaken to; among other things determine an appropriate capacity for the works (**Section 19.4.5**). This DFS will be completed in 2020 and thereafter the project will progress to the design and upgrade of the WWW. A number of operational issues have also been identified at the works (mainly due to aging infrastructure) and these will be scheduled for refurbishment or replacement.

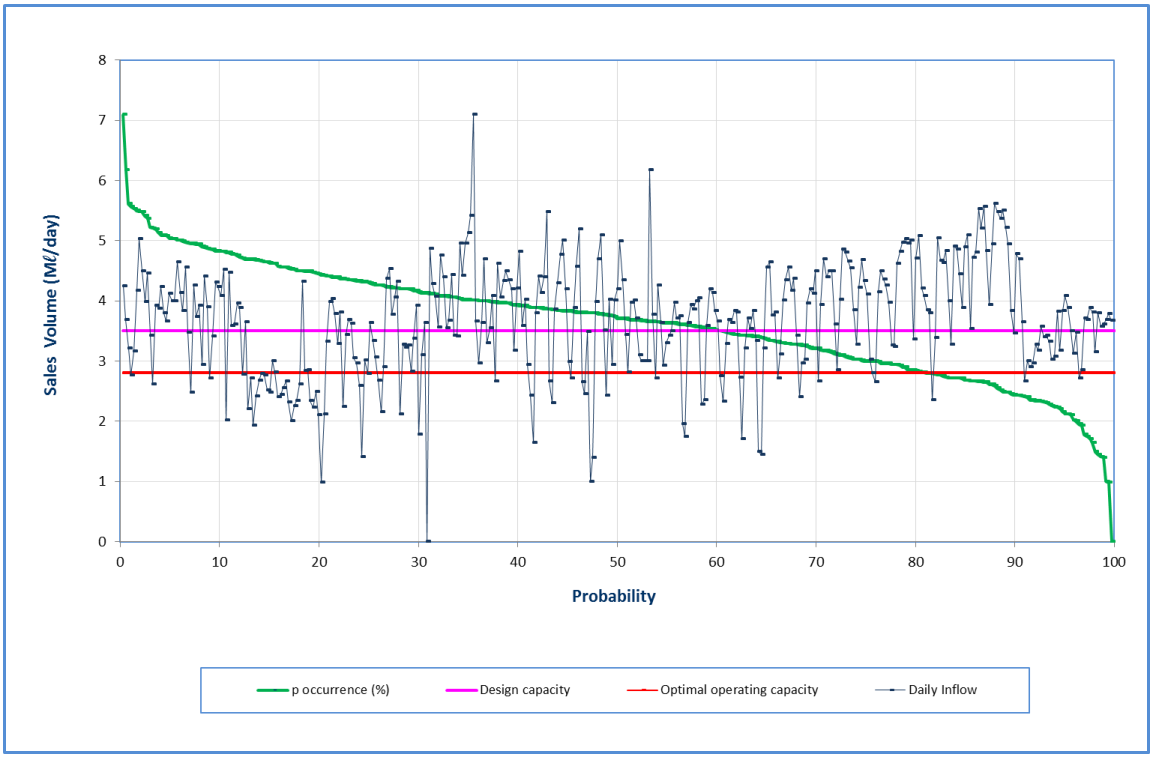

Figure 19.25 Analysis of historical production at Mpofana WWW (November 2018 to October 2019).

19.3.5 Appelsbosch Wastewater Works

The Appelsbosch WWW is situated in Appelsbosch in the uMshwathi Municipality (**Figure 19.26**). The WWW comprises a single rectangular aeration tank fitted with turbine aerators (**Figure 19.27**), a clarifier, three anaerobic ponds and a chlorine contact tank. The current treatment capacity is reported as 0.5 Mℓ/day. The plant receives sewerage from the Hospital, College and Appelsbosch Waterworks. The plant is classified as a Class E works requiring a Class 1 operator onsite and a Class V supervisor available who does not necessarily have to be onsite. The characteristics of the Appelsbosch WWW are shown in **Table 19.9**.

The existing flow measuring flume is not measuring flows accurately and this makes presenting the flow results superfluous. This issue is being addressed and the installation of an accurate flow measuring device is planned.

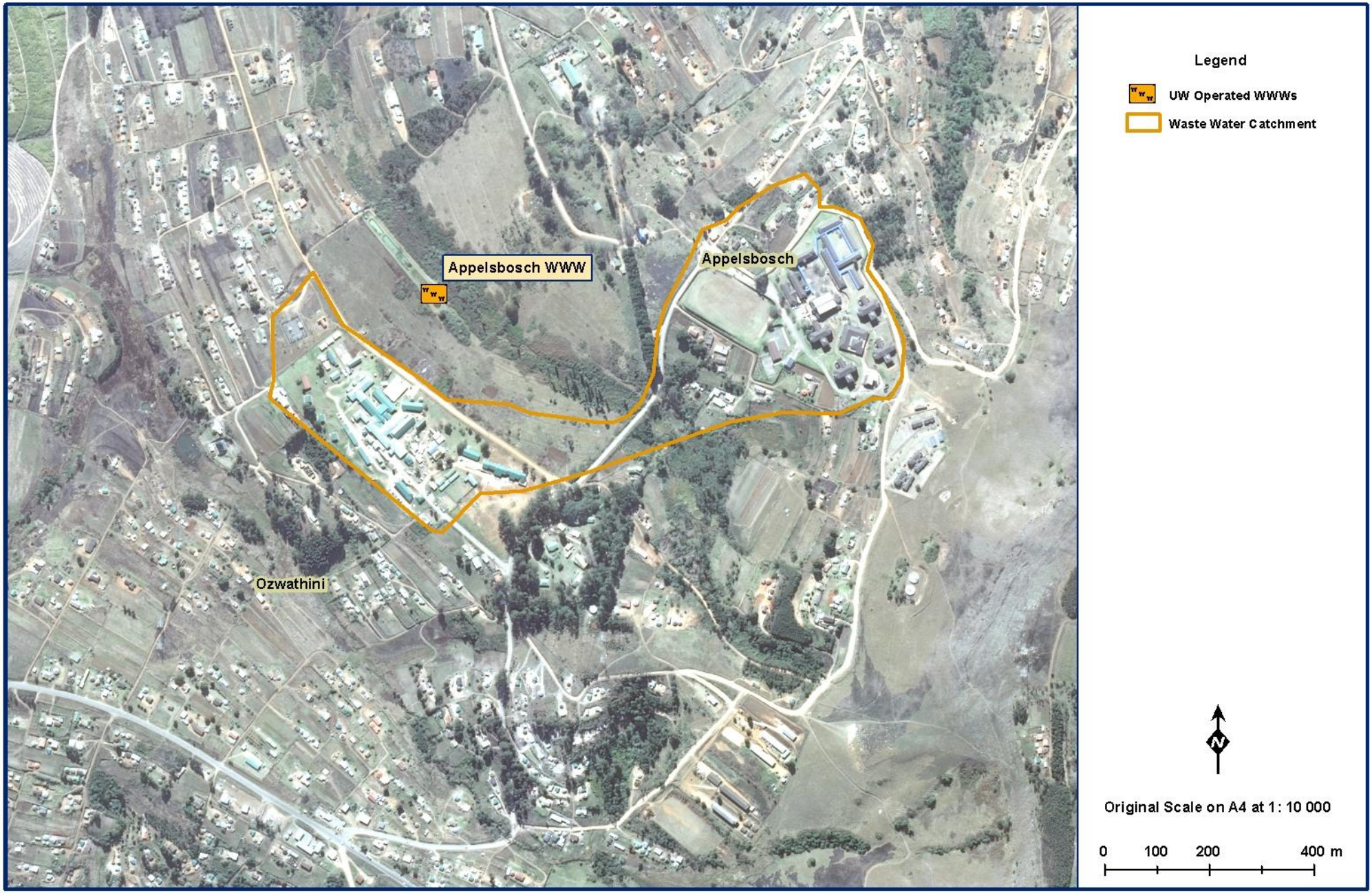

Figure 19.26 Location of the Appelsbosch WWW.

Figure 19.27 Appelsbosch WWW Oxidation Ditch (Aeration Tank).

Table 19.9 Appelsbosch WWW infrastructure.

WWW Name:	Appelsbosch WWW
System:	Upper Mgeni System
Maximum Design Capacity:	0.5 Mℓ/day
Current Utilisation:	0.05 Mℓ/day
Balancing Ponds:	None
Raw Sewage Pump Station:	Gravity
Screens:	1 x Hand Raked
Grit Chambers:	None
Aeration Basin:	1 x Oxidation Ditch
Aeration Basin Capacity:	667 m^3
Aerators:	2 x Brush Aerators
Clarifier Type:	Scraped Floor
Number of Clarifiers:	1
Total Area of all Clarifiers	38 m^2
Total Capacity of Clarifiers:	0.9 Mℓ/day
Upflow Velocity:	1 m/h
RAS Pump Station:	
Chlorine Storage Capacity:	
Chlorine Dosing Capacity:	
Total Capacity of Chlorine Contact Tanks:	
Total Capacity of Sludge Treatment Plant:	None
Anaerobic Ponds:	3 (35 m x 10 m)
Sludge Drying Beds Area:	Not operational

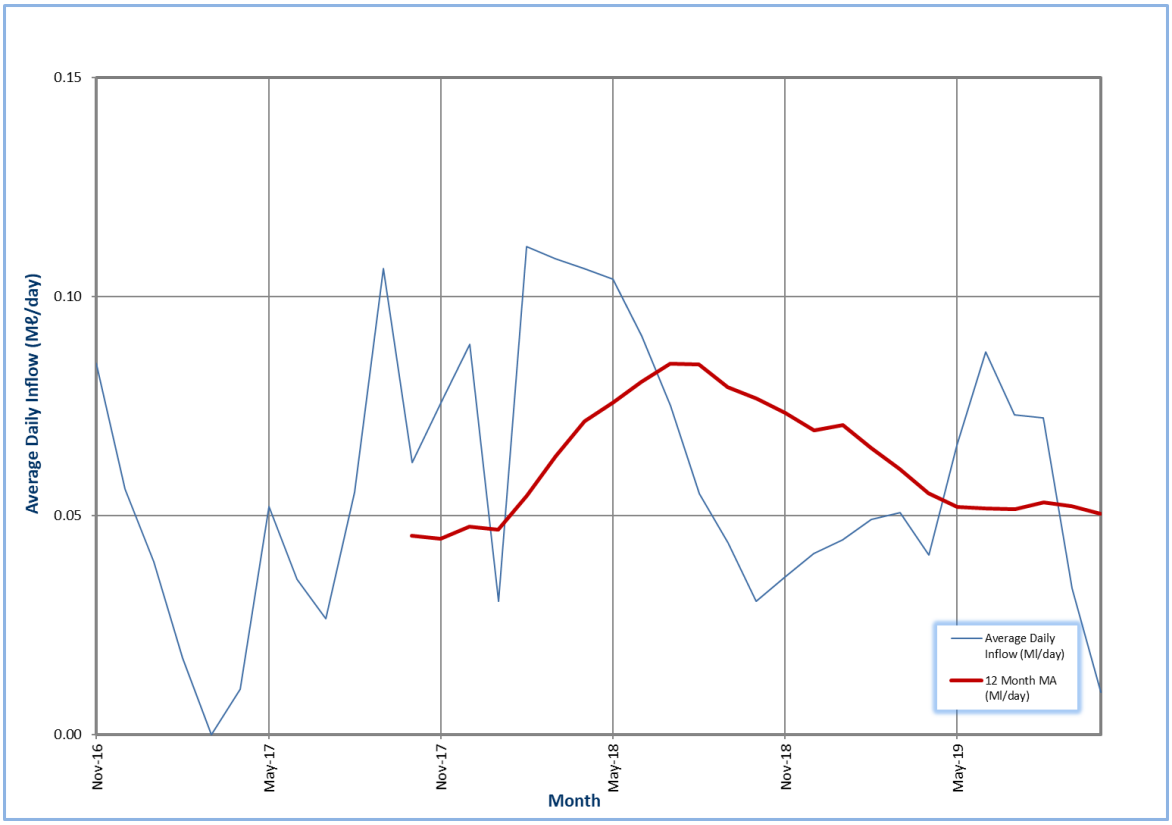

Figure 19.28 Appelsbosch WWW average daily inflows (Mℓ/day)

19.3.6 Cool Air Wastewater Works

The Cool Air WWW is situated near the Cool Air Township (**Figure 19.29**) in the uMshwathi Local Municipality. The plant is owned by UMDM and operated by Umgeni Water. The plant is classified as a Class C and is required to have a Class 3 Operator, and a Class V Supervisor available. These staff do not necessarily have to be on the plant all of the time.

The WWW is an extended aeration activated sludge process (**Figure 19.30**) with two rectangular aeration tanks, two clarifiers and a chlorine contact tank. The characteristics of the Cool Air WWW are shown in **Table 19.10.**

Table 19.10 Cool Air WWW infrastructure.

WWW Name:	Cool Air WWW
System:	Upper Mgeni System
Maximum Design Capacity:	1.5 Mℓ/day
Current Utilisation:	0.35 Mℓ/day
Balancing Ponds:	None
Raw Sewage Pump Station:	Gravity
Screens:	Hand raked 1 x 3.5 cm, 1x2.0 cm
Grit Chambers:	None
Aeration Basin:	2 x Extended aeration
Aeration Basin Capacity:	2 x 883 m^3
Aerators:	2 x 4.48 kW, 2 x 7.5 kW
Clarifier Type:	1 x suction lift, 1 x scraped
Number of Clarifiers:	2
Total Area of all Clarifiers:	129 m^2
Total Capacity of Clarifiers:	3.12 Mℓ/day
Upflow Velocity:	1 m/h
RAS Pump Station:	2 x Archimedes Screw Pumps
Chlorine Storage Capacity:	68 kg cylinder chlorine gas
Chlorine Dosing Capacity:	0 – 1 kg/h
Total Capacity of Chlorine Contact Tanks:	
Total Capacity of Sludge Treatment Plant:	None
Anaerobic Ponds:	None
Sludge Drying Beds Area:	835 m^2

Figure 19.29 Location of the Cool Air WWW.

Figure 19.30 Different Mechanical Surface Aerators in Cool Air Reactor 1 and 2.

Cool Air WWW has a design capacity of 1.5 Mℓ/day and is currently treating 0.35 Mℓ/day (**Figure 19.31**) based on a 12-month moving average. This is 150 kℓ/day less than the average for 2018. The decrease in flow is possibly attributable to blockages in the sewer network and the issue has been raised as a concern with the Umgungundlovu District Municipality.

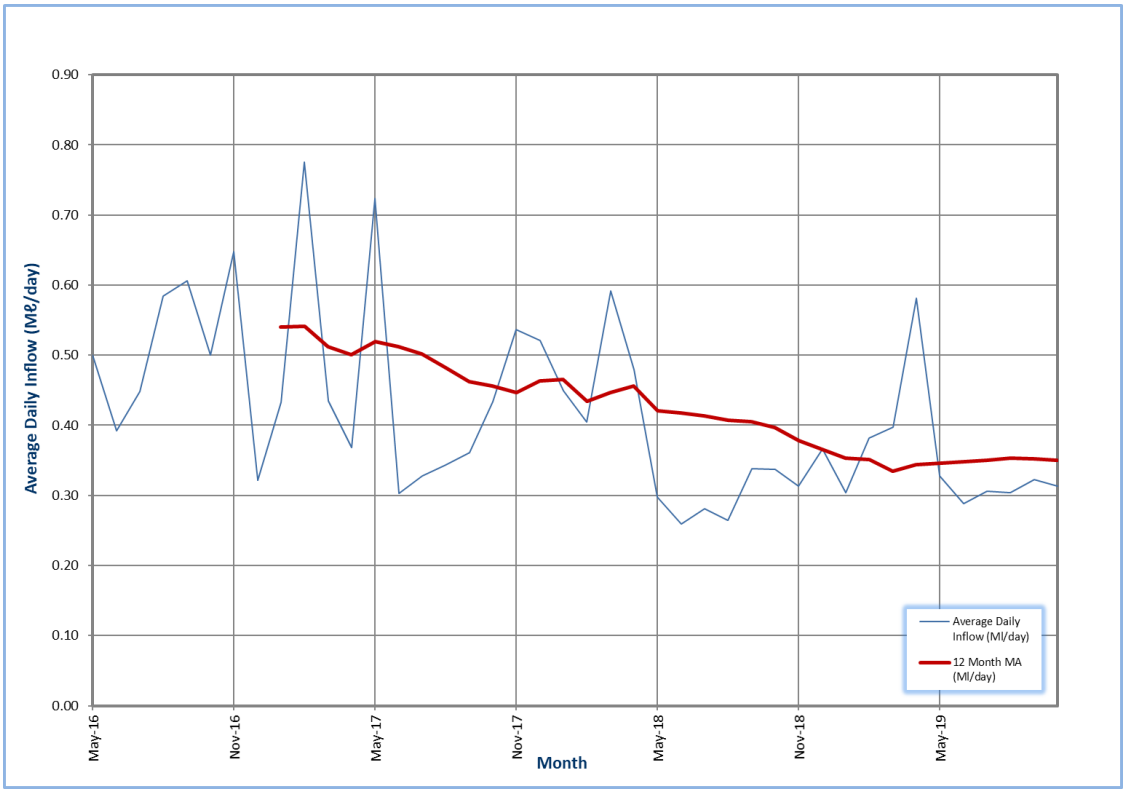

Figure 19.31 Average daily inflows to Cool Air WWW (Mℓ/day).

An analysis of daily historical production (November 2018 to October 2019) of the Cool Air WWW is presented in **Figure 19.32.** It shows that for 1 % of the time the WWW was being operated above the optimal operating capacity. The plant operated above design capacity only 0.8 % of the time and this was due to large rainfall events which resulted in storm water runoff into the sewer network.

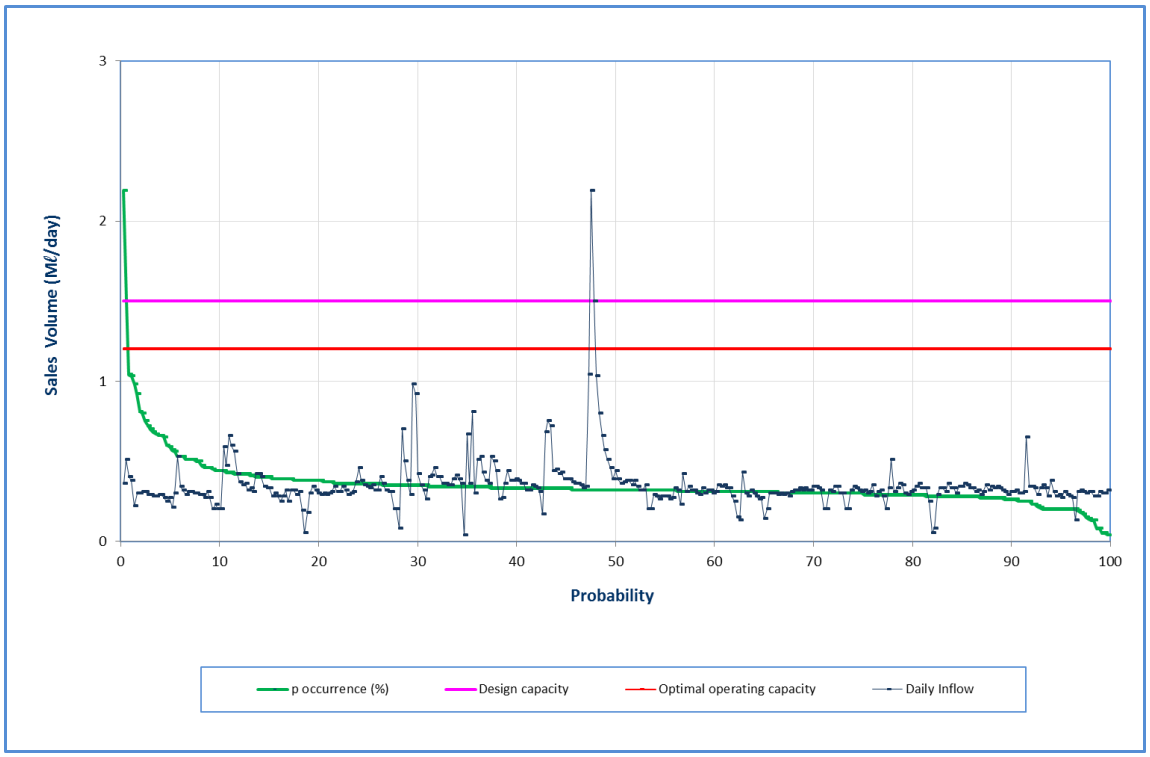

Figure 19.32 Analysis of historical production at Cool Air WWW (November 2018 to October 2019).

19.3.7 Camperdown Wastewater Works

Camperdown WWW is situated in Camperdown (**Figure 19.33**) approximately half-way between Pietermaritzburg and Cato Ridge. The WWW falls within the Mkhambathini Local Municipality and UMDM, which is the WSA for the area. The plant is owned by UMDM and is operated by Umgeni Water. The plant is classified as a Class E works requiring a Class 1 Operator onsite and a Class V Supervisor available but not necessarily onsite.

The WWW has an extended aeration activated sludge process using a rectangular aeration tank and two scraped clarifiers. The characteristics of the Camperdown WWW are shown in **Table 19.11.**

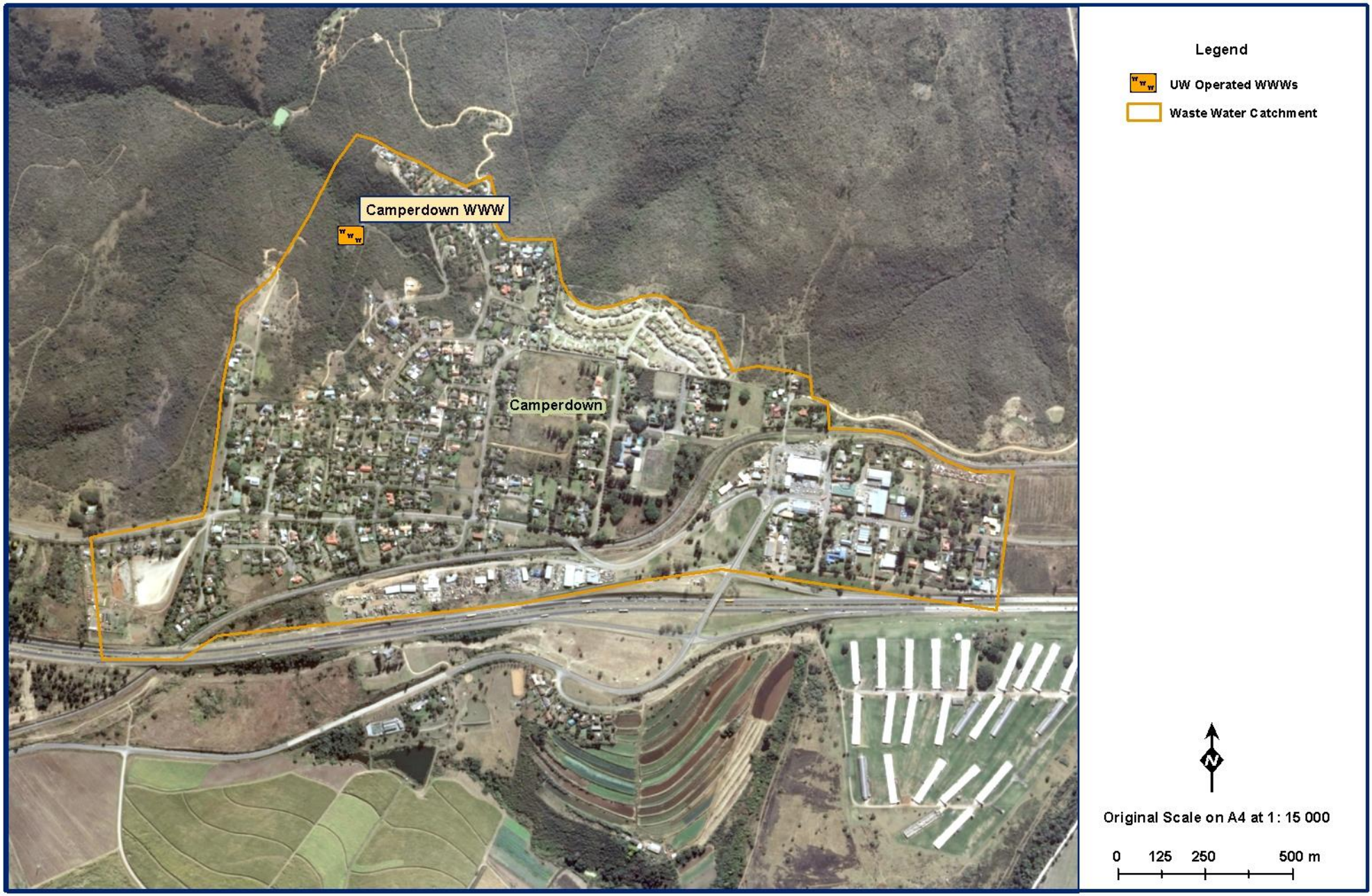

Figure 19.33 Location of the Camperdown WWW.

Table 19.11 Camperdown WWW infrastructure.

WWW Name:	Camperdown WWW
System:	Lower Mngeni System
Maximum Design Capacity:	0.5 Mℓ/day
Current Utilisation:	0.09 Mℓ/day
Balancing Ponds:	None
Raw Sewage Pump Station:	Gravity
Screens:	1 x Hand Raked, 2.5 cm Gaps
Grit Chambers:	1 x Vortex Degritter
Aeration Basin:	1
Aeration Basin Capacity:	234 m^3
Aerators:	2 x 5.5 kW
Clarifier Type:	Scraped Floor
Number of Clarifiers:	1
Total Area of all Clarifiers:	28 m^2
Total Capacity of Clarifiers:	1 x 85 m^3 (New Steel)) , 6.72 Mℓ/day,
Upflow Velocity:	1 m/h
RAS Pump Station:	
Chlorine Storage Capacity:	Sodium Hypochlorite
Chlorine Dosing Capacity:	
Total Capacity of Chlorine Contact Tanks:	
Total Capacity of Sludge Treatment Plant:	
Anaerobic Ponds:	1 x 30 m^2
Sludge Drying Beds Area:	130 m^2

Camperdown WWW (**Figure 19.35**) has a reported design capacity of 0.5 Mℓ/day and is currently treating 0.09 Mℓ/day (**Figure 19.34**) based on a 12-month moving average. There is a noticeable decreasing trend in inflow to the works and sewer blockages and pump station breakdowns are contributing factors to this reduction in flow. These issues have been raised with the Umgungundlovu District Municipality.

An analysis of the daily historical production is not provided as the inflow data is not a true reflection of the volume of wastewater being produced in the catchment. Only a limited portion of sewage is actually reaching the plant rendering any analysis of plant capacity superfluous. It is, however, clear that the capacity of the works is more than sufficient for the foreseeable future as the average daily inflow is low in comparison to the works capacity. Currently the sewage network serves only a portion of Camperdown and this has been a constraint on development in the area (**Figure 19.33**). A detailed design has been completed for a new 2 Mℓ/day wastewater works named Mkhambathini WWW, to be located west of the N3 freeway (**Section 19.4.6**). This project requires that the UMDM first upgrade and expand the sewer reticulation network to accommodate all existing and future demand. Umgeni Water is engaging with UMDM in an effort to resolve the impasse and investigate alternative funding mechanisms for the project.

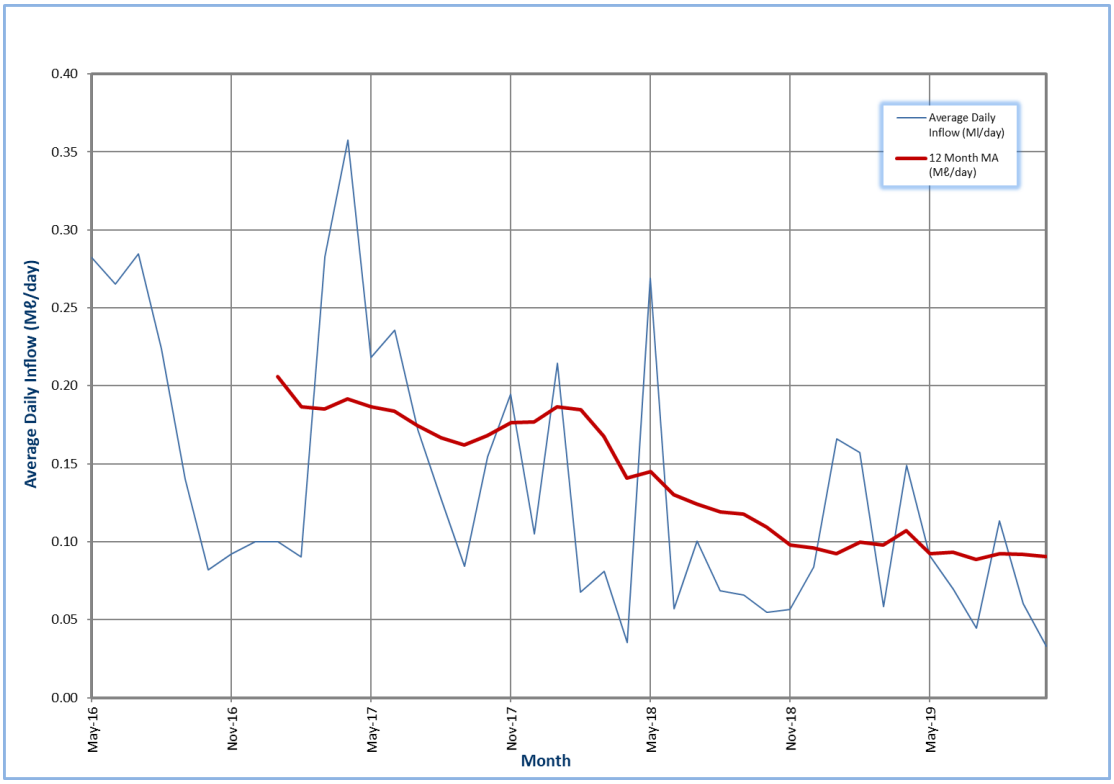

Figure 19.34 Average daily inflows to Camperdown WWW (Mℓ/day).

Figure 19.35 Camperdown Clarifier No. 2.

19.3.8 Richmond Wastewater Works

Umgeni Water operates the Richmond WWW on behalf of UMDM. The wastewater works services the town of Richmond (**Figure 19.36**), but does not include the adjacent township of Ndaleni. Sewage from Richmond flows by gravity to the wastewater works.

The plant is an extended aeration activated sludge process consisting of an inlet works, a single rectangular aeration tank fitted with two surface aerators and a suction lift clarifier (**Figure 19.37**). Final treated wastewater is disinfected using chlorine gas.

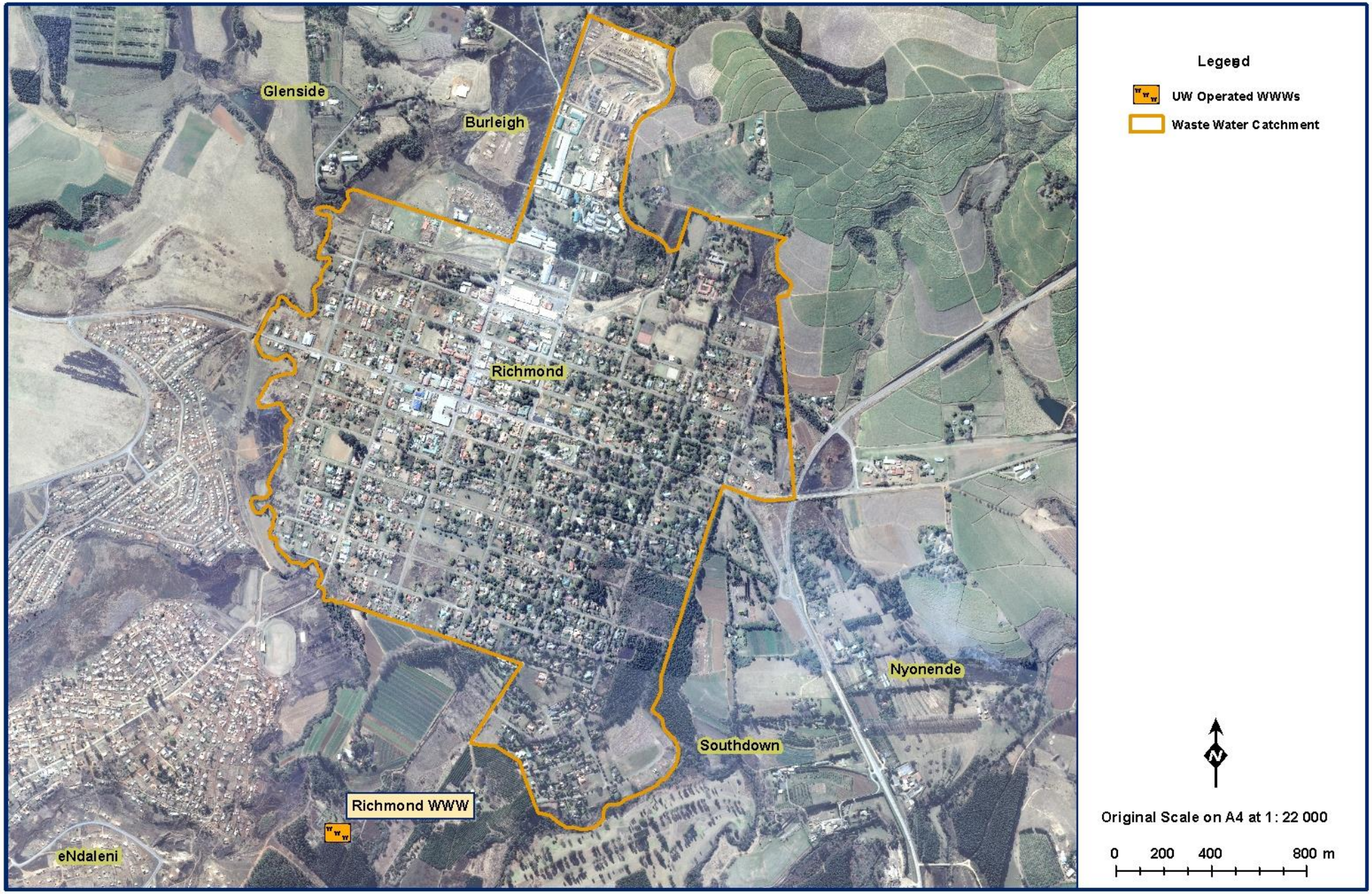

Figure 19.36 Location of the Richmond WWW.

Figure 19.37 Richmond WWW clarifier.

The works was designed for ADWF of 1 Mℓ/day with a COD loading of 740 kg/day. The WWW is classified as a Class E works requiring a Class 1 Operator onsite, and a Class V Supervisor available, but not necessarily onsite. The characteristics of the Richmond WWW are shown in **Table 19.12.**

Table 19.12 Richmond WWW infrastructure.

WWW Name:	Richmond WWW
System:	Upper Mgeni System
Maximum Design Capacity:	1 Mℓ/day (Based on ADWF) 2.9 Mℓ/day
Current Utilisation:	0.83 Mℓ/day
Raw Sewage Pump Station:	T-series Gormann Rupp
Screens:	Hand-raked 11 mm gap bar screen
Grit Chambers:	Two
Aeration Basin:	Activated sludge
Aeration Basin Capacity:	1110 m^3
Aerators:	Two slow speed Hansen Patent (18.5 kW each)
Clarifier Type:	Suction Lift Clarifier
Number of Clarifiers:	1
Total Area of all Clarifiers:	95 m^2
Total Capacity of Clarifiers:	2.28 Mℓ/day
Upflow Velocity:	1 m/h
RAS Pump Station:	T-series Gormann Rupp
Chlorine Storage Capacity:	68kg cylinder
Chlorine Dosing Capacity:	Max. allowable 2.5 kg/h
Total Capacity of Chlorine Contact Tanks:	25m^3
Total Capacity of Sludge Treatment Plant:	Sludge lagoon (volume unknown)
Sludge Drying Beds Area:	500 m^2 (not used)

Richmond WWW has a design capacity of 1.0 Mℓ/day and is currently treating 0.83 Mℓ/day (**Figure 19.38**) based on a 12-month moving average. Historically, over the last few years, the works

has had insufficient capacity to meet the demand, although, the flows have reduced over the last year. This could be due to pumping problems and blockages in the sewer network. An upgrade of the works to 2 Mℓ/day (**Section 19.4.4**) is planned.

An analysis of the daily historical production for the year is not provided as a result of errors in the flow measurement due to operational problems.

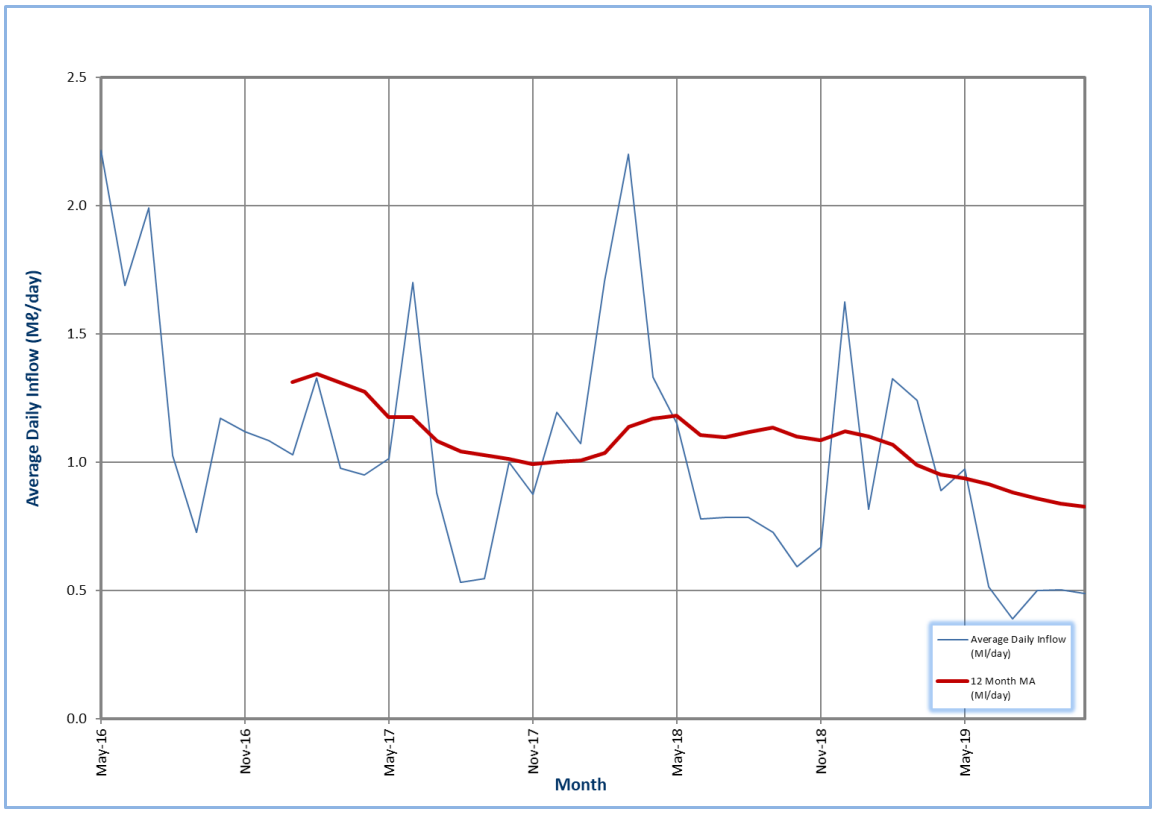

Figure 19.38 Average daily inflows to Richmond WWW (Mℓ/day).

An analysis of daily historical production (November 2018 to October 2019) of the Richmond WWW is presented in (**Figure 19.39)** It shows that for 35 % of the time the WWW was being operated above the optimal operating capacity. The plant operated above design capacity only 19 % of the time and this was often due to large rainfall events which resulted in storm water runoff into the sewer network.

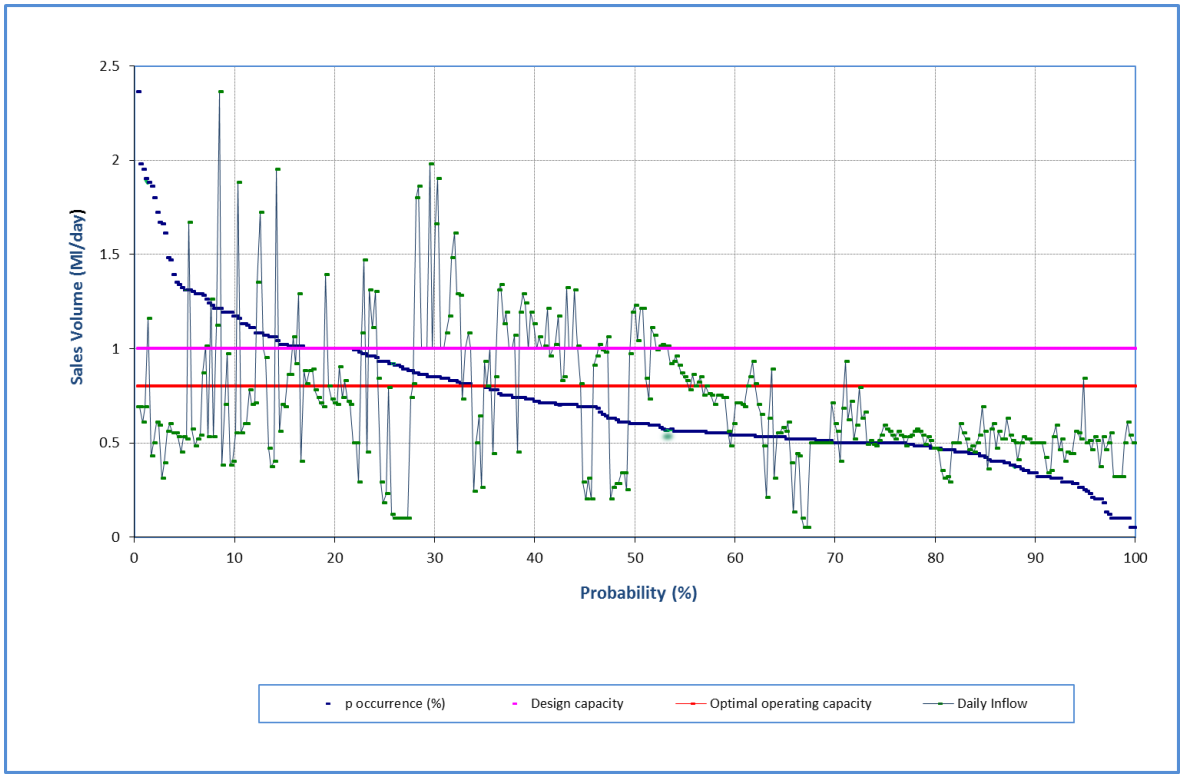

Figure 19.39 Analysis of historical production at Richmond WWW (November 2018 to October 2019)

19.4 Recommended Projects

19.4.1 Darvill Wastewater Works Upgrade

Planning No.	104.1
Project No.	UI0665A
Project Status	Construction

(a) Project Description

The Darvill WWW serves the city of Pietermaritzburg and surrounding communities. All water borne sewage flows by gravity or is pumped to Darvill, with the exception of a small community in Lynnfield, which has its own water borne sewage that is treated by the Lynnfield Park WWW (**Section 19.3.3**). There are, however, large areas of the city that are not served by the sewer reticulation network that are reliant on on-site sanitation systems e.g. septic tanks and pit latrines. The extent of Darvill's water borne sewer catchment area is illustrated in (**Figure 19.3**). Darvill WWW is thus of strategic importance to the city and to the environment at large as the quality of the effluent discharged needs to comply with regulations.

Demand was exceeding the treatment capacity of the works and a capacity upgrade was therefore required. It was also determined through process evaluations that the current process was inadequate and needed to be adapted.

The wastewater works is being upgraded from 65 Mℓ/day to 100 Mℓ/day to meet current and future demands (**Figure 19.40**). This is a comprehensive upgrade with the majority of the existing processes and infrastructure being impacted upon. Details of the process upgrades are given in **Table 19.13**.

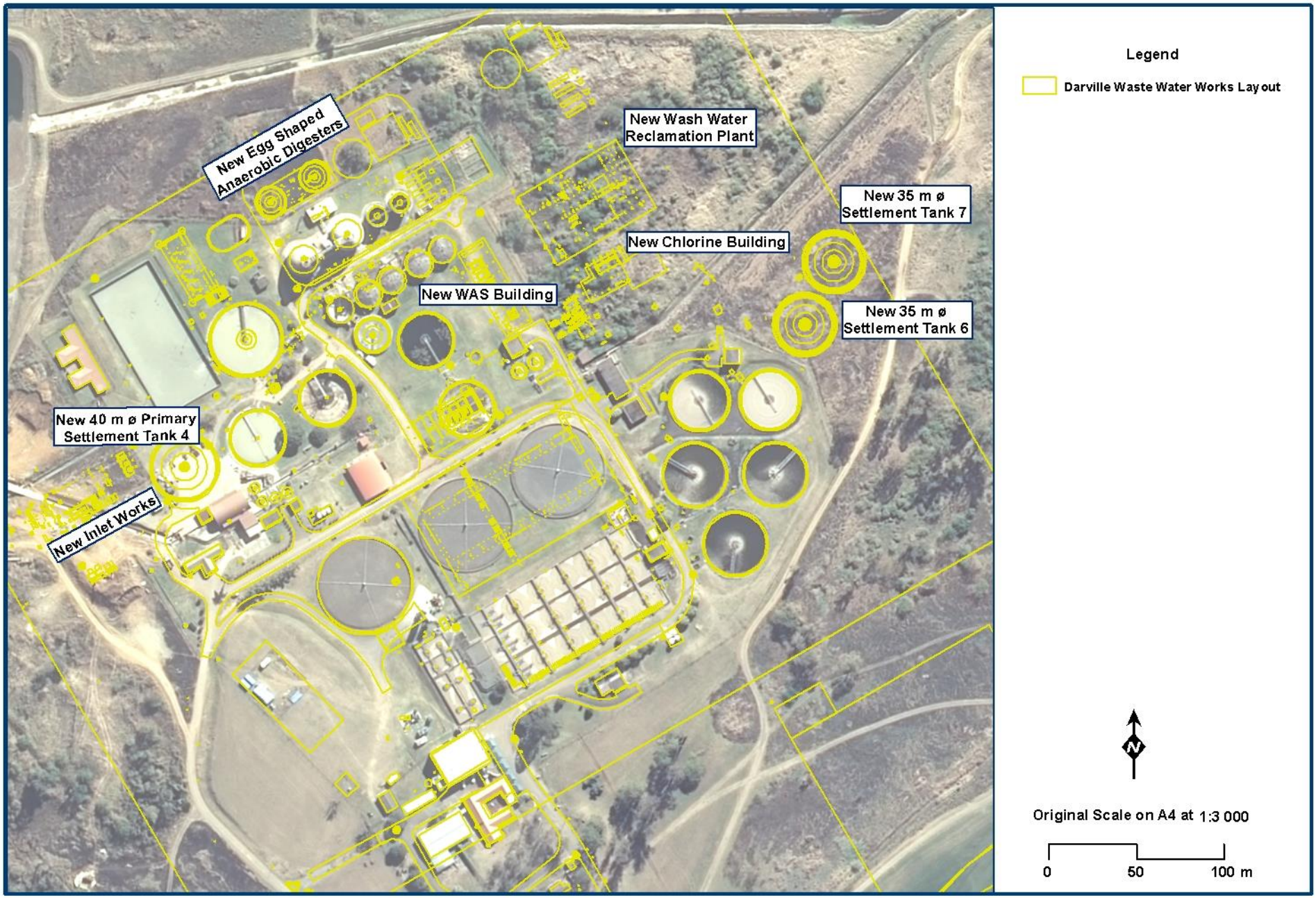

Figure 19.40 Upgrade of Darvill WWW.

Two key elements of the upgrade are the sludge treatment and biological treatment aeration system. The present method of disposal of sludge by spray irrigation to land is operating adequately, but has its limitations especially as the capacity of the works increases to address growth. A new method of sludge thickening and dewatering is to be implemented involving the construction of a new sludge treatment building. The new facility will use linear screens for mechanical thickening and dewatering of waste activated sludge and digester sludge.

The traditional surface aerators are inefficient and will be removed and replaced by a fine bubble diffused aeration (FBDA) system. The FBDA system is made up of 22 680 diffusers in three aeration lanes that are connected by a pipe network that is supplied with air from four blowers. As opposed to surface aeration which requires a lot of mechanical energy to introduce oxygen into the system, FBDA release the air at the bottom of the aeration basin through the diffusers thus achieving an even dispersion and improved oxygen transfer.

Key information on this project is summarised in **Table 19.13**.

Table 19.13 Project information: Darvill Wastewater Works Upgrade.

Project Components:	• Inlet Works
	  ▪ New inlet works design to handle a maximum flow of 200 Mℓ/day in 4 channels.
	  ▪ Two mechanical screens in each channel.
	• Fat, Oil, Grease (FOG) and Grit Removal
	  ▪ Additional unit process because of high FOG loads in influent.
	  ▪ 200 Mℓ/day in 3 lanes.
	• Primary Settling
	  ▪ Additional 40 m PST added.
	• Settled Sewage Pump Station (SSPS)
	  ▪ The SSPS replaces the existing “Main Pump Station” which has reached its design life.
	  ▪ 3 duty, 1 standby and 1 spare.
	• Biological treatment
	  ▪ Convert the existing anaerobic reactor to an activated sludge selector.
	  ▪ Convert the existing Aerobic Reactor to an Anaerobic / Anoxic reactor.
	  ▪ Construct a new deep basin reinforced concrete Aerobic Reactor with fine bubble diffused aeration (40 150 m^3).
	• Air for Biological Treatment
	  ▪ Blower House.
	  ▪ 4 x 645 kW Blowers each with a rated delivery of 7 m^3/sec @ 90 kPa.
	  ▪ Air Header Mains.
	  ▪ 22 680 diffusers in three aeration lanes.
	• Secondary Settling
	  ▪ 2 x 35 m diameter secondary settling tanks.
	• Anaerobic Sludge Digesters
	  ▪ 2 x 4500 m^3 digesters.
	• Wash Water Treatment
	  ▪ Construct 2 Mℓ/day wash water / reclamation plant.
	  ▪ Unit processes will include disc filters, coagulation/flocculation, Ozonation granular activated carbon, ultra-filtration and hydrogen peroxide addition.

Capacity:	100 Mℓ/day Plant

(b) Institutional Arrangements

Umgeni Water owns and operates the plant and is funding the project internally. The Msunduzi Municipality is charged a monthly tariff for discharging the city's wastewater to Darvill.

(c) Beneficiaries

The Msunduzi Municipality is the main beneficiary of the upgrade as it will remove the constraint to development in the city.

(d) Implementation

Construction on this R977 million project has stopped as the lead contractor has been placed in business rescue (**Figure 19.41**). The contract was subsequently terminated. It is now anticipated that the completion of the upgrade will only be by mid-2021 or possibly later due to delays experienced with the award of new contracts. The estimated value of the remaining work is R107 million in 2019 prices.

Figure 19.41 New head of works in the foreground with overflow channel teeing-off to the left.

19.4.2 Mpophomeni Wastewater Works Upgrade

Planning No.	610.1
Project No.	UI0801A
Project Status	Detailed Design Complete

(a) Project Description

The Mpophomeni WWW is currently not operational and sewage from Mpophomeni Township is pumped to the Howick WWW for treatment. The demand at Mpophomeni has increased to the extent that, on occasion, the flow exceeds the volume of effluent that the Howick WWW can treat. Additionally, there are a number of planned developments that will increase this flow significantly over the next few years. It was therefore proposed by UMDM that the Mpophomeni WWW be upgraded to treat 6 Mℓ/day with the possibility of upgrading the works to 12 Mℓ/day. The site has space for a plant of at least 20 Mℓ/day (**Figure 19.42**).

The following development initiatives by the municipality will be serviced by the Mpophomeni WWW, viz.:

- Refurbishment of the existing sewage reticulation system in Mpophomeni Township will increase wastewater flows to the works (ADWF 3.6 Mℓ/day);
- The development of the Khayelisha social housing development on the banks of Midmar Dam (ADWF 1.3 Mℓ/day); and
- Planned light/mixed industrial development park (3 Mℓ/day).

The effluent from the works will be pumped and disposed of to the Sakubula stream adjacent to the national road (N3) in Howick. The pumping main will be approximately 6.8 km in length and of various diameters.

Key information on this project is summarised in **Table 19.14**.

Table 19.14 Project information: Mpophomeni Wastewater Works Upgrade.

Project Components:	• Inlet Works including a mechanical screen and vortex grit tanks (2No). • Two 14 m diameter primary settling tanks. • Primary sludge pump station. • Refurbished digesters with new heating and sludge circulating system. • Mechanical equipment to dewater digested primary and activated sludge. • 6 Mℓ/d (BNR Activated Sludge Treatment Plant. • Return Activated Sludge (RAS) pumping system. • Waste Activated Sludge (WAS) pumping system. • RAS and Storm Flow Recycle Refurbished Pump Station • Sludge and Storm Flow Recycle Mechanical/Electrical Plant. • Refurbished 2.25 Mℓ Storm bypass pond. • One 25 m diameter secondary clarifier. • One refurbished 18 m diameter secondary clarifier. • Aluminium sulphate, lime and chlorine chemical dosing systems. • Recycle pump station, pumping plant and pumping main from Maturation Ponds. • Disposal pipeline (6.8 km) of various diameters. • Pump station (2 duty, 1 stand-by)
Capacity:	6 Mℓ/day Plant

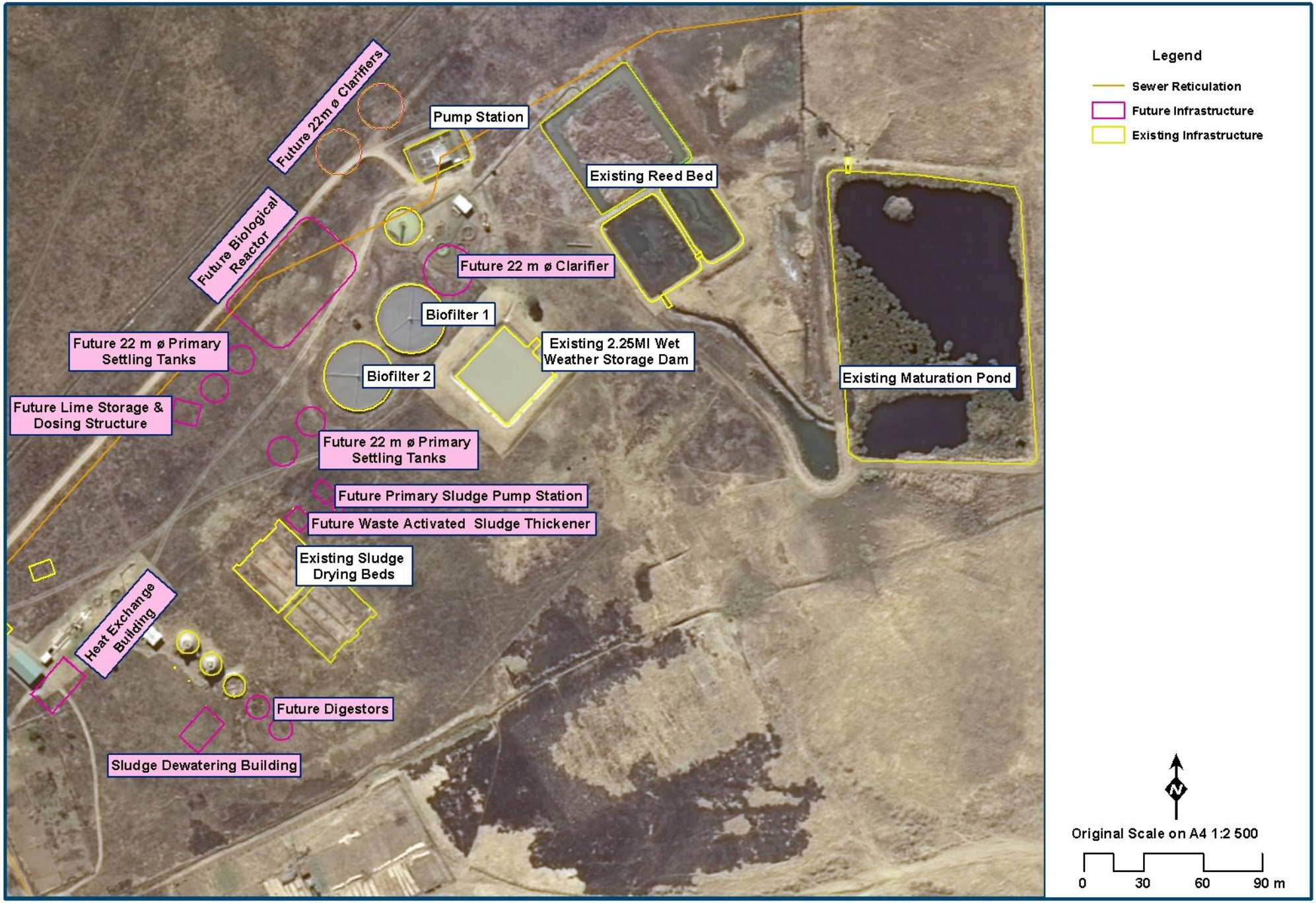

Figure 19.42 Upgrade of Mpophomeni WWW.

(b) Institutional Arrangements

Umgeni Water will operate the plant on behalf UMDM under a twenty-year management contract. Umgeni Water is responsible for funding any capital improvements required by the plant. Umgeni Water charges a monthly management fee to the Municipality to cover all operation and maintenance costs and this fee includes capital redemption.

(c) Beneficiaries

UMDM and uMngeni Local Municipality are the main beneficiaries of the upgrade.

(d) Implementation

The construction contract has been awarded. The lead contractor is currently establishing on site and will start construction in February 2020. The estimated date of construction completion is February 2022.

The estimated cost of the project is R350 million in 2019 prices.

19.4.3 Trust Feeds Wastewater Works

Planning No.	610.4
Project No.	CI.00231
Project Status	Detailed Design

(a) Project Description

UMDM requested that Umgeni Water design and construct a new WWW at Trust Feeds (**Figure 19.43**). The wastewater works will serve the existing Trust Feeds community as well as a new housing development proposed by the Department of Human Settlements. The ultimate capacity of the wastewater works will be 2 Mℓ/day, but initially only half the capacity will be constructed (1 Mℓ/day).

The project area is located approximately 4 km north west of Wartburg, on the eastern periphery of the uMshwathi Local Municipality boundary within Ward 8 of uMshwathi Local Municipality.

The project includes:

- The existing semi-formal low income housing development known as Trust Feeds, which comprises approximately 800 houses.
- A proposed 3000 unit low income development which has been approved by the Department of Human Settlements to eliminate the housing backlog within the region. The new development is adjacent to Trust Feeds.

Key information on this project is summarised in **Table 19.15**.

Table 19.15 Project information: Trust Feeds Wastewater Works.

Project Components:	• Inlet Works including a mechanical screen, vortex grit chamber and flume type flow meter. • 2 Mℓ/day (BNR) Activated Sludge Treatment Plant. • Return Activated Sludge (RAS) pumping system. • Waste Activated Sludge (WAS) pumping system. • Two circular 15 m diameter secondary clarifiers. • Chlorine chemical dosing tank. • 15 no rectangular shaped drying beds
Capacity:	2 Mℓ/day Plant

(b) Institutional Arrangements

Umgeni Water will in future operate the plant on behalf of UMDM under a twenty-year management contract. Umgeni Water is responsible for funding any capital improvements required for the plant. Umgeni Water charges a monthly management fee to the Municipality to cover all operation and maintenance costs and capital redemption is included in this fee.

(c) Beneficiaries

UMDM and uMshwathi Local Municipality are the main beneficiaries of the upgrade.

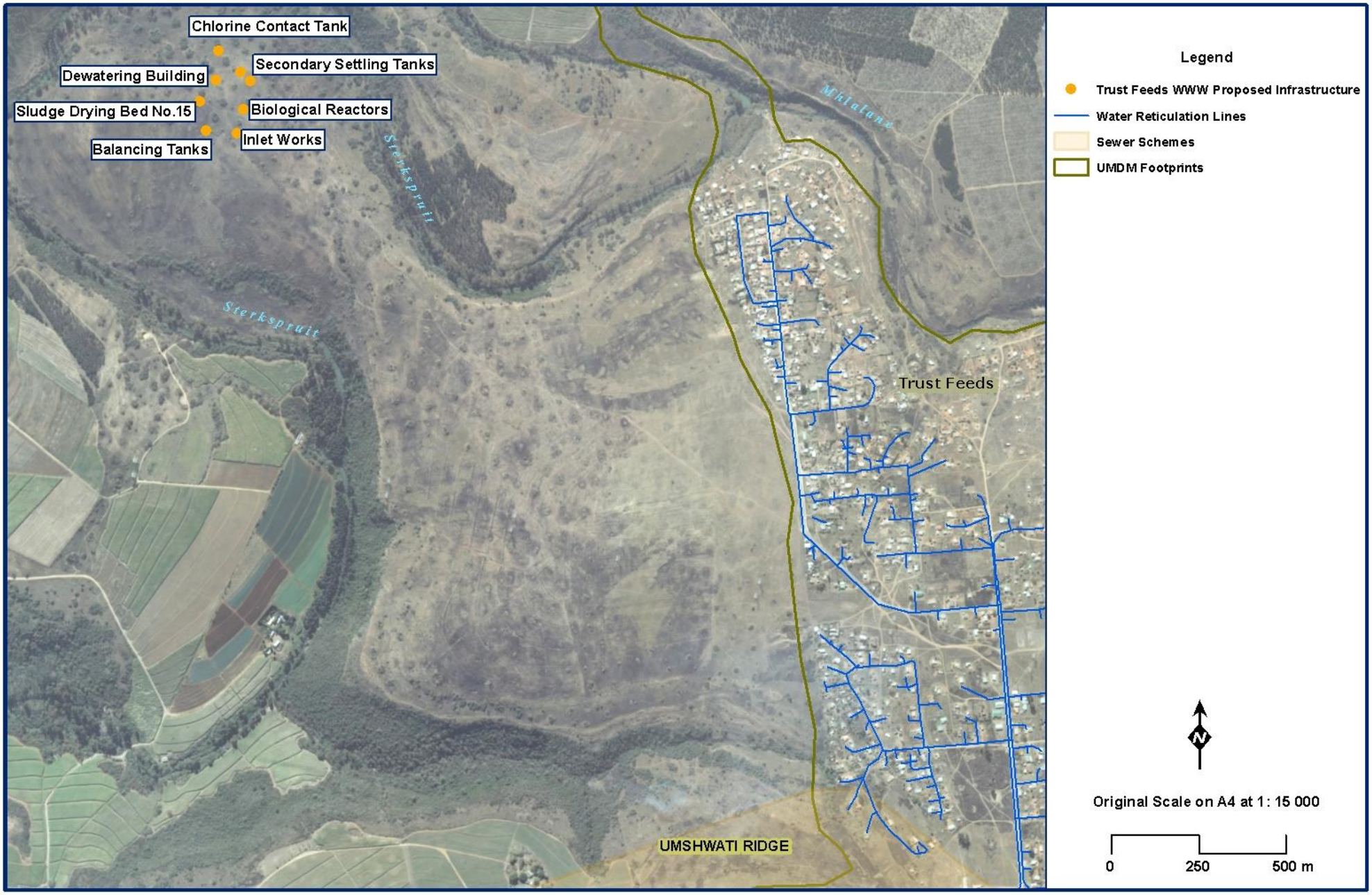

Figure 19.43 Proposed Trust Feeds WWW.

(d) Implementation

Construction of the wastewater works and ancillary infrastructure is approximately 95% complete and will be completed end April 2020.

The slow housing delivery will, however, have a huge implication/impact on the plant commissioning process due to the unavailability of effluent. This means that, at this stage, only the cold commissioning will proceed and the hot commissioning date can only be confirmed once Umgeni Water gets a commitment from the Department of Human Settlements (DOHS). Equipment preservation, extension of insurances, warranties and guarantees will need to be put in place with the suppliers before the practical completion certificate is issued.

The capital cost of the project is R 75 million. .

19.4.4 Richmond Wastewater Works Upgrade

Planning No.	610.3
Project No.	UI0939A
Project Status	Detailed Design

(a) Project Description

The Richmond WWW cannot currently cater for the peak demands placed on the infrastructure. As a result, UMDM have requested that Umgeni Water upgrade the Richmond WWW (**Figure 19.44**). The existing WWW serves the town of Richmond but not the low income settlements of Siyathuthuka and Lusaka that currently make use of pit latrines for basic sanitation. Once UMDM implements water borne sanitation in these low income areas then additional demand will be placed on the Richmond WWW. There are also some residential units located within the existing Richmond residential area that still need to be connected to the existing sewer network.

The proposed new extensions will cater for Biological Excess Phosphorous Removal with back-up chemical dosing facility. An increase in capacity of 1 Mℓ/day to 2 Mℓ/day is proposed.

Key information on this project is summarised in **Table 19.16**.

Table 19.16 Project information: Richmond Wastewater Works.

Project Components:	•	• New inlet works including a mechanical screen, mechanical degritters, screenings conveyor and compactor and venture flume. • 2 No additional aeration basins • Return Activated Sludge (RAS) pumping system. • Waste Activated Sludge (WAS) pumping system. • 1 No additional circular 18 m diameter secondary clarifier. • New chlorine contact channel. • Upgrade the existing chlorine dosing building and chlorine dosing equipment • New mechanical sludge handling equipment and housing building • New sludge drying beds and scum trap • New ferric dosing equipment • Refurbishment of sewage retention pond • Refurbishment of all ancillary facilities • New SCADA system
Capacity:		5 Mℓ/day Plant

(b) Institutional Arrangements

Umgeni Water will operate the plant on behalf of UMDM under a twenty-year management contract. Umgeni Water is responsible for funding any capital improvements required by the plant. Umgeni Water charges a monthly management fee to the Municipality to cover all operation and maintenance costs and capital redemption is included in this fee.

(c) Beneficiaries

UMDM and Richmond Local Municipality are the main beneficiaries of the upgrade.

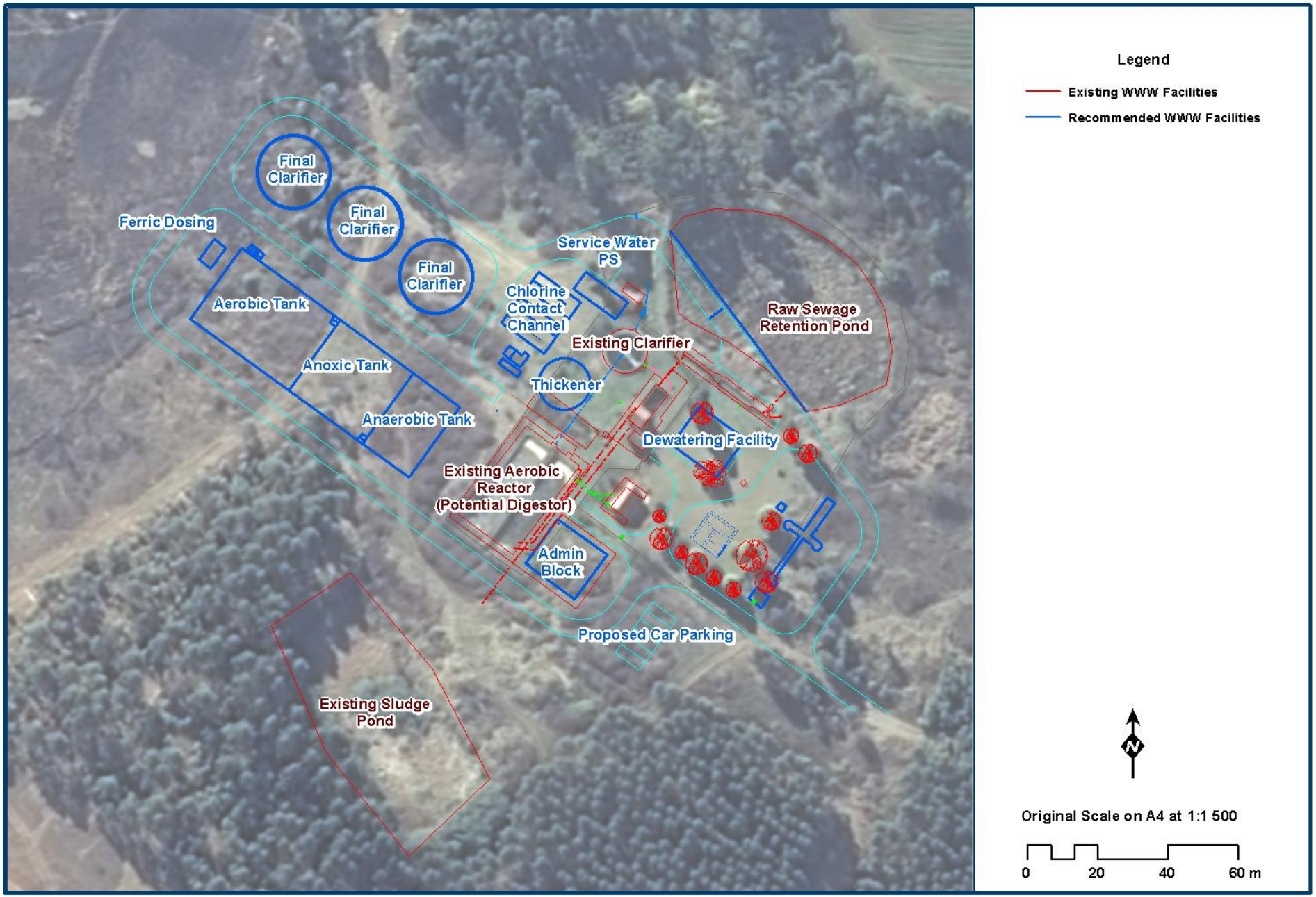

Figure 19.44 Richmond WWW upgrade.

(d) Implementation

Umgeni Water is in the process of finalising a Framework Agreement Contract. This contract allows for suitable qualified professional service providers to be selected from a pre-qualified list of providers. Once the Framework Contract is available for use, a service provider will be appointed to undertake the detailed design for the upgrade of the WWW. The estimated project cost is R121 million in 2019 prices. This figure includes the cost of all project phases: Planning, Design & Tender Preparation and Construction.

19.4.5 Mpofana Wastewater Works Upgrade

Planning No.	610.2
Project No.	UI0940A
Project Status	Tender

(a) Project Description

Umgeni Water has a management contract with UMDM to operate and maintain the Mpofana WWW and two large sewage pump stations. The WWW services the town of Mooi River, which includes the adjacent township of Bruntville (**Figure 19.45**). The majority of the wastewater received by the works is domestic sewerage but there is also a large industrial component of between 1 to 2 Mℓ/day received from a textile plant situated near the works.

The works has a design capacity of 3.5 Mℓ/day and a reported operating capacity of 5 Mℓ/day. The works is, however, receiving average dry weather inflows (AADW) of 6 Mℓ/day and is therefore operating above capacity. Operational issues, as a result of aging infrastructure, have been identified at the works and these are being addressed. Umgeni Water has also identified the need for increasing the treatment capacity to meet the current and future demands of Mooi River.

Due to the urgency of the project a detailed feasibility and detailed design will be awarded as one contract. As the feasibility study has yet to be undertaken the nature of the upgrade to the works is unknown. The existing works is situated adjacent to the Mooi River on a narrow stretch of land south-west of the town. The existing site may not be able to accommodate an upgraded WWW and the possibility exists that a new location for the works may have to be found.

(b) Institutional Arrangements

Umgeni Water currently operates the plant on behalf of UMDM under a twenty-year management contract. Umgeni Water is responsible for funding any capital improvements required at the plant. Umgeni Water charges a monthly management fee to the Municipality to cover all operation and maintenance costs and capital redemption is included in this fee.

(c) Beneficiaries

UMDM and Mpofana Local Municipality are the main beneficiaries of the upgrade.

(d) Implementation

The project is currently in the detailed feasibility phase which will be completed in December 2020. The environmental impact assessment and associated environmental specialist studies has recently been completed and is under review. This study included an assessment of alternative sites for the location of the upgraded Mpofana WWW. Three sites, including the existing site, were assessed, with the current site determined as having the least environmental impact.

The estimated project cost is R 363 million in 2019 prices. This figure includes the cost of all project phases including Planning, Design, Tender Preparation and Construction.

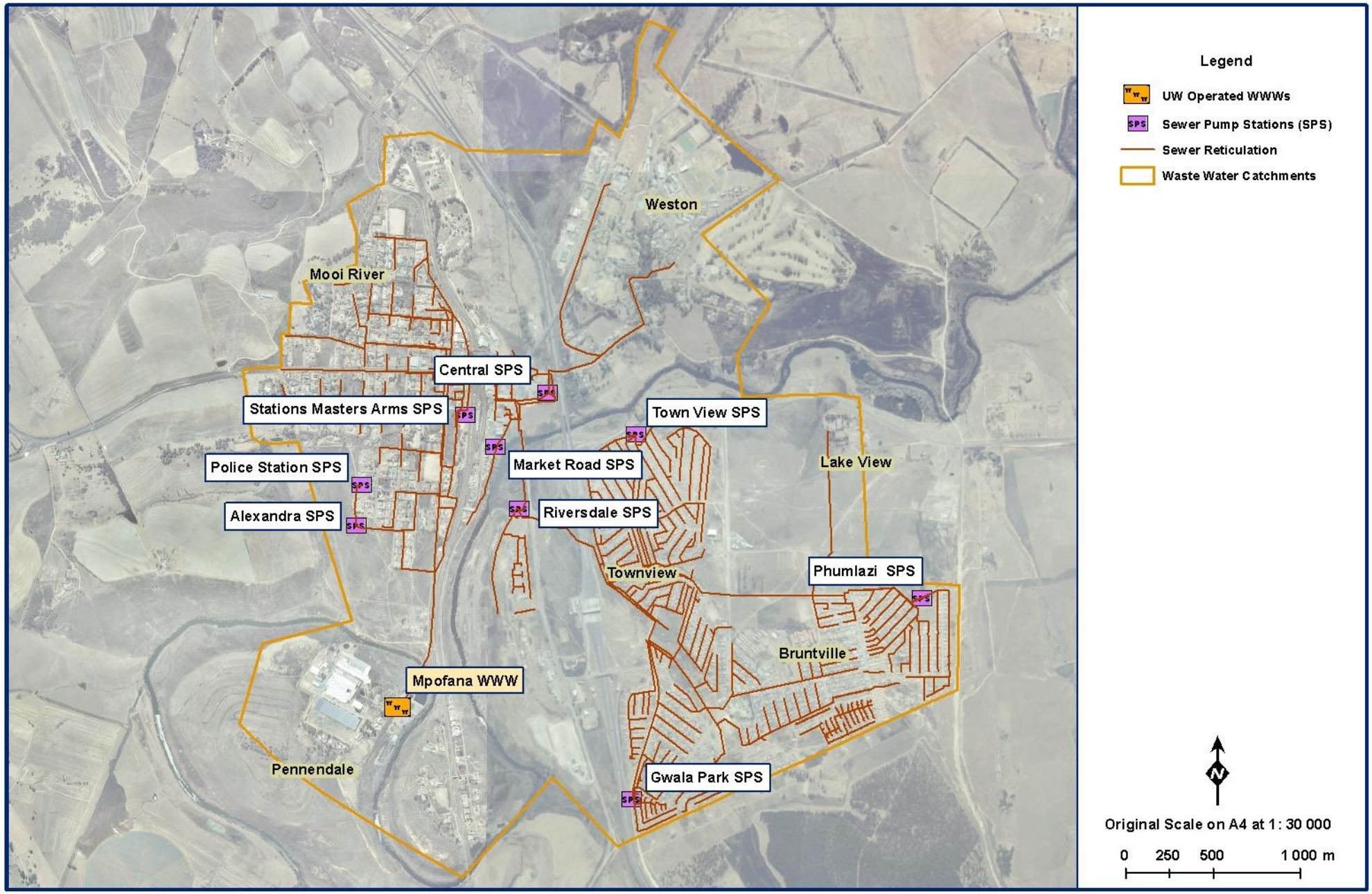

Figure 19.45 Mpofana WWW upgrade.

19.4.6 Mkhambathini Wastewater Works Upgrade

Planning No.	610.6
Project No.	
Project Status	Detailed Design

(a) Project Description

Umgeni Water has a management contract with UMDM to operate and maintain the Camperdown WWW. The WWW has a small demand (0.2 Mℓ/day) as a limited number of households are connected to the sewer reticulation network (**Figure 19.46**). The majority of households and businesses in the Town still make use of on-site sanitation, such as septic tanks.

A feasibility study was undertaken which identified the need for a new WWW that would service all existing households and businesses as well as cater for future developments. A site west of the N3 freeway was identified (**Figure 19.46)** and detailed designs for a WWW and new bulk sewer network were completed.

The proposed works will include the construction of a bulk sewer network inclusive of three pump stations, as well as a 2Mℓ capacity wastewater treatment plant that will service the local population.

The proposed infrastructure (**Figure 19.47**) associated with the treatment process will consist of the following:

- Head of Works with mechanical screening and degritting, and a flow meter.
- Aeration Tank
- Settling Tank (clarifier) to settle out and return the activated sludge back to the aeration tank.
- Chlorine dosage with contact tank, or Ultraviolet (UV) Irradiation for disinfection.
- Sludge Drying Beds for dewatering of activated sludge:

(b) Institutional Arrangements

Umgeni Water currently operates the Camperdown WWW on behalf of UMDM under a twenty-year management contract. It was identified by the feasibility study that Camperdown requires a new WWW that can serve the entire population and future development. As the existing WWW has insufficient capacity to meet future growth Umgeni Water will fund the construction and implementation of a new WWW from its CAPEX budget. Umgeni Water will charge a monthly management fee to the Municipality to cover the CAPEX and operation and maintenance of the new WWW once commissioned.

(c) Beneficiaries

UMDM and Mkhambathini Local Municipality are the main beneficiaries of the upgrade.

(d) Implementation

The detailed design phase is complete, but work has been temporality suspended until such time as funding is available. The new WWW requires the construction of a new sewage network and sewage pump stations which is the responsibility of the Municipality. The estimated cost for the construction of the WWW is R94 million in 2019 prices.

Figure 19.46 **Location of the proposed Mkhambathini WWW in relation to the existing Camperdown WWW.**

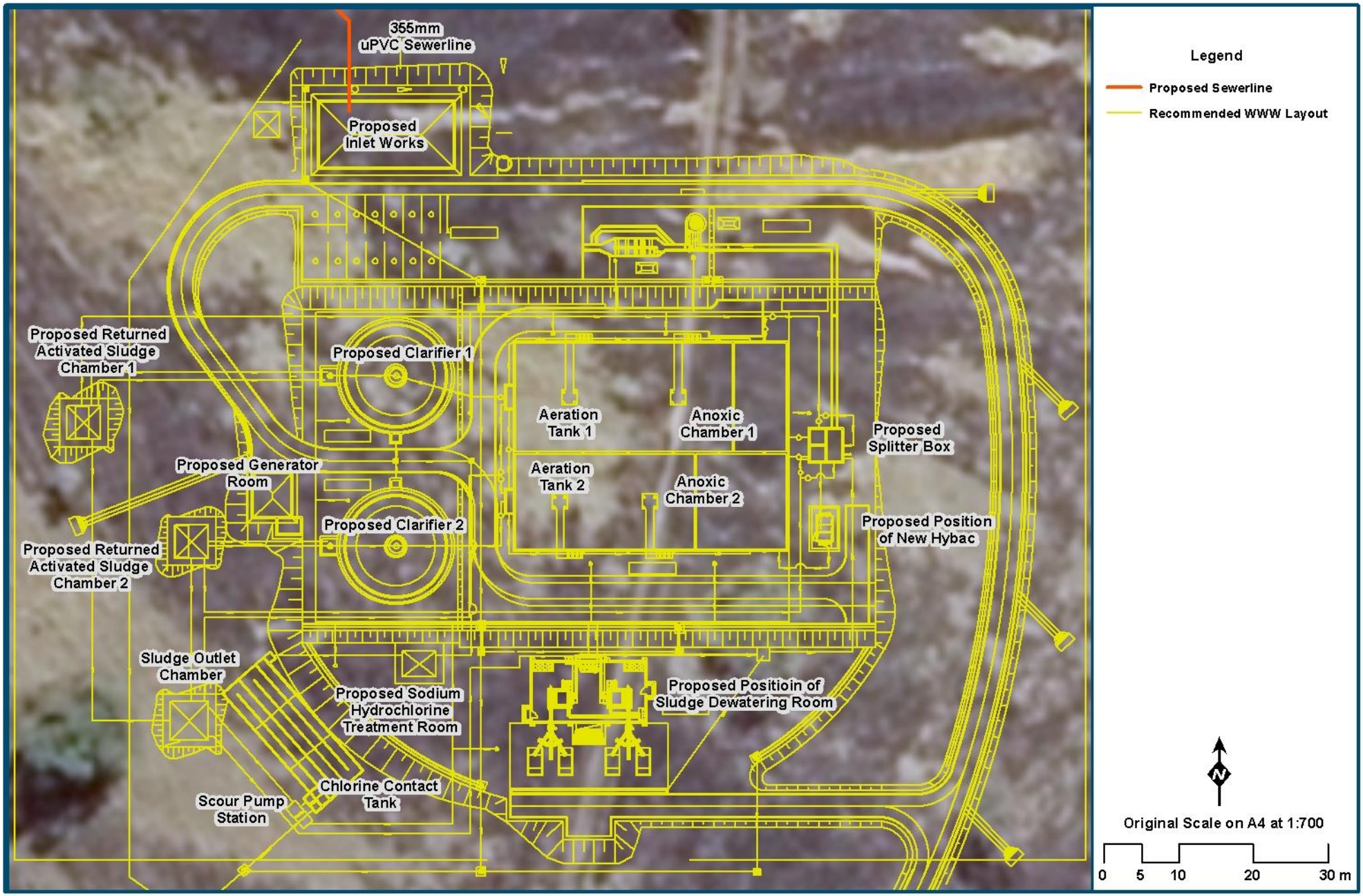

Figure 19.47 Proposed Mkhambathini WWW layout.

19.5 New Areas

New areas can be defined as those areas in KZN outside Umgeni Water traditional area of supply. In some of these areas Umgeni Water has received a mandate from the District Municipality to provide bulk water services, uThukela District Municipality being one of those. Umgeni Water's services are, at this stage, limited to potable water provision and no bulk wastewater infrastructure is yet being managed. The organisation's knowledge of the status of the bulk sanitation infrastructure throughout the province is thus limited to existing reports. Umgeni Water is committed to providing bulk water and sanitation throughout the province and therefore is in the process of obtaining as much sanitation information as possible from existing sources. With time, this information will have to be verified by site visits and possibly process audits so that the necessary infrastructure planning can take place. In the interim, however, the focus will be on identifying all the wastewater works within KZN and providing the salient infrastructure details.

The class of wastewater works is defined as A, B, C, D or E according to a scoring system derived from draft regulations published by the Department of Water and Sanitation. In general, the greater the capacity and the more sophisticated the treatment process the higher the class. A large WWW with a complex treatment process may be classified as Class A. Smaller more rudimentary WWW, only using saturation ponds, will be classified as Class E, such as Winterton (DWS, 2013)

19.5.1 uThukela District Municipality

The uThukela District Municipality (DM) has nine wastewater works, eight of which are operational (**Figure 19.48**). The capacity of the WWW ranges from very small (0.1 Mℓ/day) serving the small town of Winterton to relatively large (12 Mℓ/day) serving the large towns of Ladysmith, Estcourt and Esakeni. A list of the WWW in the uThukela DM is provided in **Table 19.17**.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in the **Table 19.18**.

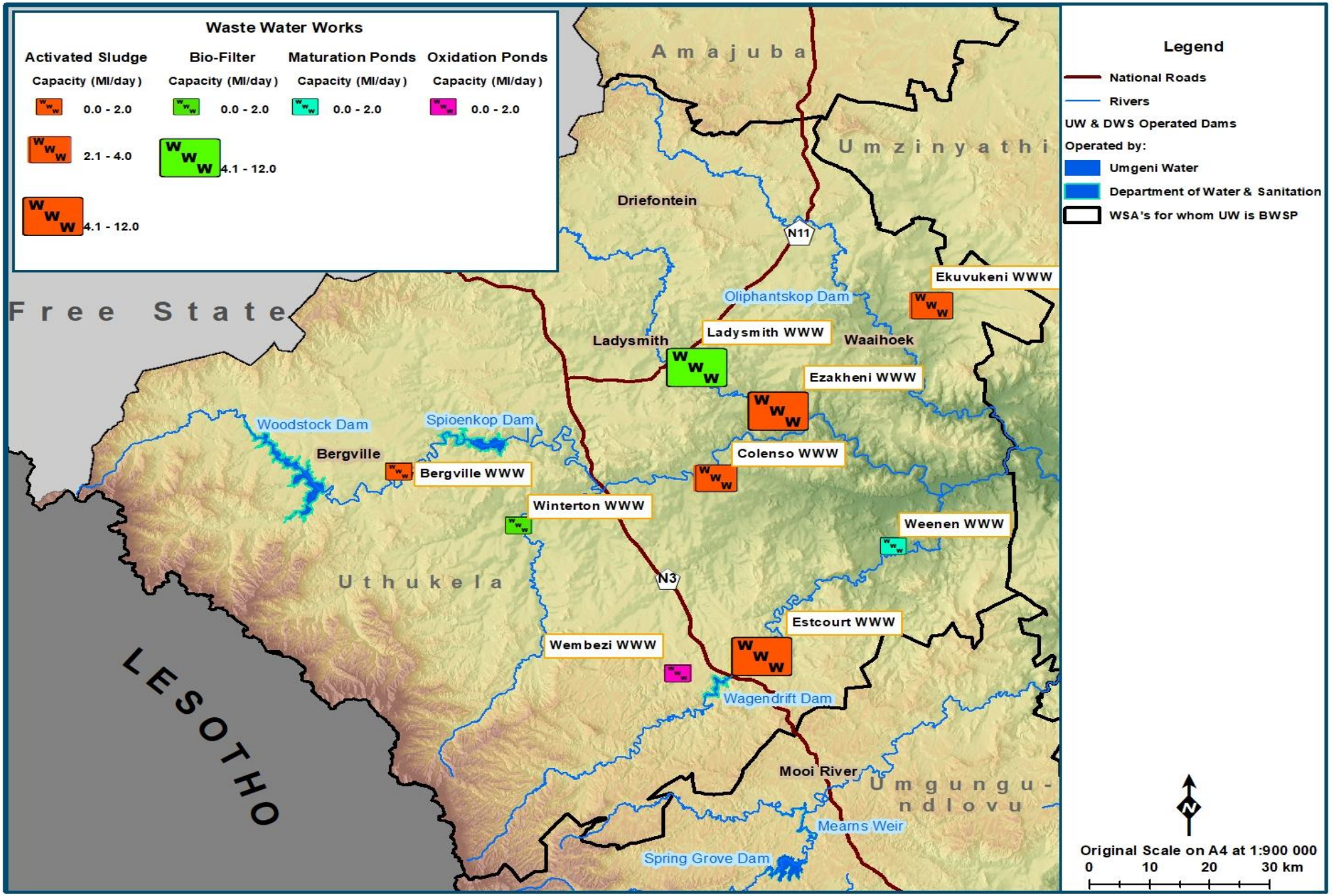

Figure 19.48 Location of uThukela DM Wastewater Works

Table 19.17 uThukela District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Esakeni	Activated Sludge	uThukela DM	C	Y	12.0	38750	Y	Unknown	R 3 333 000
Ekuvukeni	Activated Sludge	uThukela DM	D	Y	2.4	8750	Y	Unknown	R 1 340 000
Bergville	Activated Sludge	uThukela DM	E	Y	0.4	500	Y	Unknown	R 2 382 000
Colenso	Activated Sludge	uThukela DM	E	Y	3.2	6250	Y	Unknown	R 3 384 000
Ladysmith	Bio-filter	uThukela DM	C	Y	12.0	26250	Y	Unknown	R 5 827 000
Estcourt	Activated Sludge	uThukela DM	D	Y	12.0	10000	N	Major refurbishment required to most unit processes	R 4 256 000
Weenen	Activated Sludge	uThukela DM	E	Y	0.1	131	Y	Unknown	R 802 000
Winterton	Activated Sludge	uThukela DM	E	N	1.25	188	Y	Unknown	R 1 197 000
Wembezi	Activated Sludge	uThukela DM	E	N	0.11	2500	Y	Unknown	R 958 000

Table 19.18 MIG funded Sanitation Projects in uThukela District Municipality

Project	Status
Waterborne Sanitation Project Bergville Phase 2	Construction 40%
Ezakheni Sanitation Project Phase 2	Construction 80%
Weenen – Ezitendeni Sanitation Project	Construction 40%

19.5.2 uMzinyathi District Municipality

The uMzinyathi District Municipality has nine WWW, seven of which are operational. (**Figure 19.49**). The capacity of the WWW's range from very small (0.25 Mℓ/day) serving the community of Wasbank to small (3.2 Mℓ/day) serving the town of Greytown. A list of the WWW in the uMzinyathi DM is provided in **Table 19.20**.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in the **Table 19.19**.

Table 19.19 MIG funded Sanitation Projects in uMzinyathi District Municipality

Project	**Status**
KwaSenge Sanitation Project	Design & Tender
Eradication of Sanitation Backlogs Umvoti LM	Construction 60%
Nquthu North Eastern Waterborne Sanitation Project	Feasibility Completed

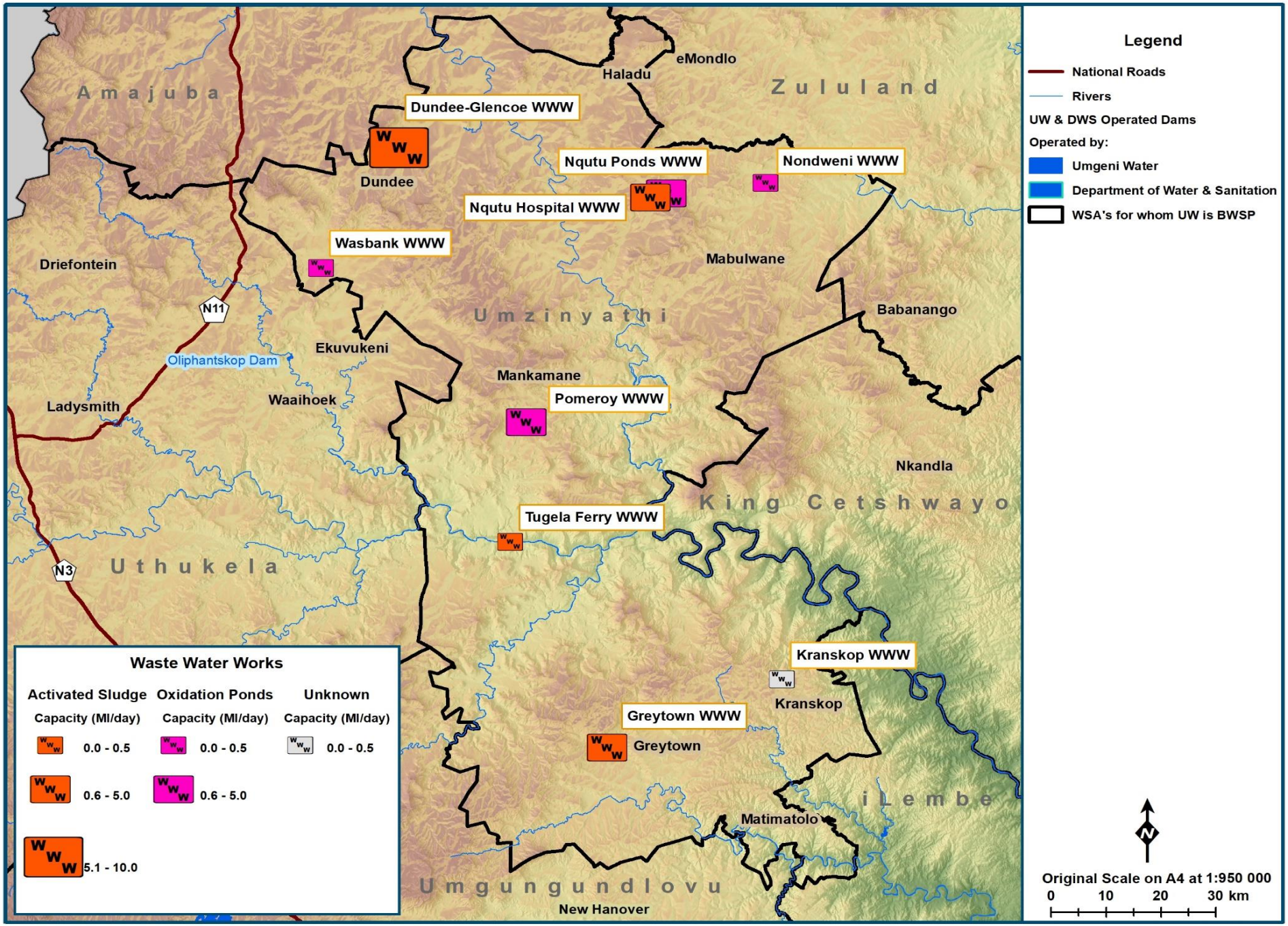

Figure 19.49 Location of uMzinyathi Wastewater Works

Table 19.20 uMzinyathi District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Tugela Ferry	Activated Sludge	uThukela Water	D	N	0.5	625	Y	Aerators, Ponds	R 746 000
Dundee-Glencoe	Activated Sludge	uThukela Water	B	Y	10	12500	Y	Sludge management, Digesters, Disinfection	R 5 676 000
Greytown	Activated Sludge	uThukela Water	D	N	3.2	4000	Y	Pumps, Aerators, Electrical, Ponds, Grounds, Security	R 5 698 000
Kranskop	None	uThukela Water	E	N	0.0	63	N	No existing plant – discharge of raw sewage into the bush	Unknown
Nondweni	Oxidation Ponds	uThukela Water	D	Y	0.0	625	N	Aurecon BP available	Unknown
Nqutu Hospital	Activated Sludge	uThukela Water	D	Y	2.0	2500	Y	None	Unknown
Nqutu Ponds	Oxidation Ponds	uThukela Water	E	Y	3.0	Unknown	Y	Weed control, Fencing	R 125 000
Pomeroy	Oxidation Ponds	uThukela Water	D	Y	1.0	1250	Y	Pond walls, Disinfection	R1 003 000
Wasbank	Activated Sludge	uThukela Water	D	Y	0.25	625	Y	Unknown	Unknown

19.5.3 iLembe District Municipality

The iLembe District Municipality (DM) has Fifteen WWW including two that are operated by Siza Water (Frasers and Shakaskraal). All the wastewater works are reported operational with the exception of Melville, which has yet to be commissioned (**Figure 19.50**). The capacity of the WWW's range from very small (0.05 Mℓ/day) serving Ntunjambili Hospital to relatively large (12 Mℓ/day) serving the Sundumbili community. A list of the WWW in the iLembe DM is provided in **Table 19.22**.

In the Ilembe DM 19% of the population still do not have access to basic sanitation. The urban areas have proper waterborne sanitation systems, but the peri-urban and rural areas rely on pit latrines or no system at all. Plans are currently in place to construct a regional wastewater scheme (in planning phase) in KwaDukuza to address the current infrastructure limitations of the area. Proposed wastewater works are planned for Ndwedwe, Mandeni, Maphumulo and various parts of KwaDukuza.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in the **Table 19.21**.

Table 19.21 MIG funded Sanitation Projects in iLembe District Municipality

Project	**Status**
Inyoni Housing Development Bulk Sewer Project	Construction 80%
Mandeni Sanitation Master Business Plan	Construction 80%
Ndwedwe Sanitation Master Business Plan	Construction 60%
Mdlebeni Sanitation Project	Construction 80%
Southern Bulk Water and Sanitation Scheme	Construction 20%
Darnall Sewer Upgrade	Design & Tender
Groutville D Sanitation Project Phase 2	Construction 40%
KwaDukuza Regional Wastewater Works	Design & Tender

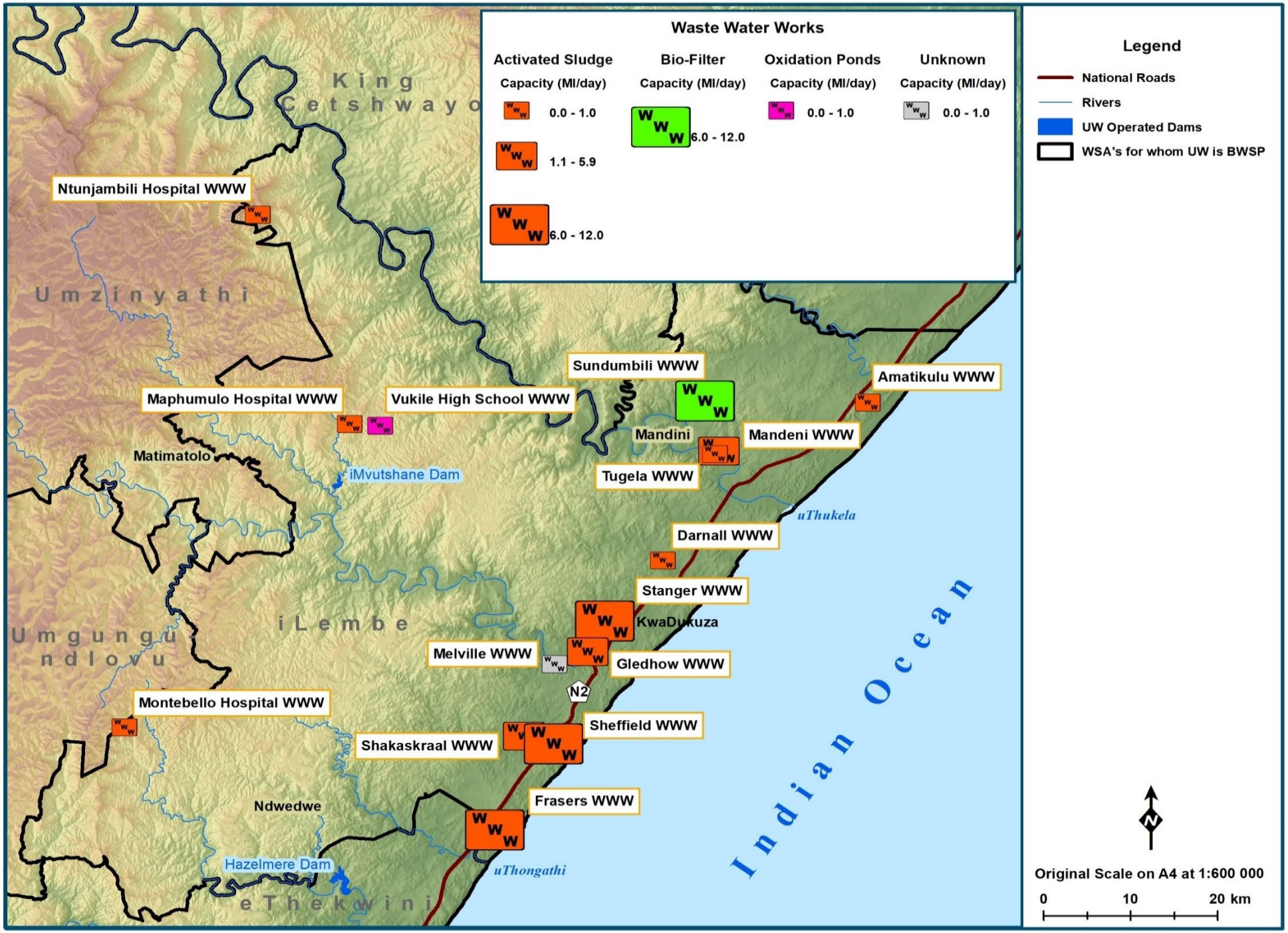

Figure 19.50 Location of iLembe District Municipality Wastewater Works

Table 19.22 iLembe District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Sundumbili	Bio-filter	iLembe DM	B	N	12.0	15000	Y	Flow meter, Clarifier, ,Aerator, Sludge return, Digesters, Drying beds	R 3 707 000
Frasers	Activated Sludge	Siza Water	C	Y	12.0	15000	Y	Unknown	R 441 000
Mandeni	Activated Sludge	iLembe DM	D	Y	1.3	1500	Y	Flow meter, Clarifier, Aerator	R 441 000
Darnall	Activated Sludge	iLembe DM	D	Y	0.33	375	Y	Clarifier, aerator, Sludge return	R 990 000
Shakaskraal	Activated Sludge	Siza Water	D	Y	1.6	1500	Y	Unknown	R 440 000
Stanger	Activated Sludge	iLembe DM	D	Y	10.0	12500	Y	Flow meter, Clarifier, Aerator, Sludge return, Digesters, Drying beds	R 5 225 000
Tugela	Activated Sludge	iLembe DM		Y	0.75	750	Y	Flow meter, Clarifier, Aerator	R1 543 000
Maphumulo Hospital	Activated Sludge	iLembe DM	D	Y	0.15	37	Y	Flow meter, Clarifier, Aerator, Sludge return	R 1238 000
Amatikulu	Activated Sludge	iLembe DM	D	Y	0.25	250	Y	Clarifier, aerator, Sludge return	R 757 000
Gledhow	Activated Sludge	iLembe DM	C	Y	3.0	250	Y	Flow meter, Clarifier, Aerator, Sludge return	R 3 148 000
Melville	Not commissioned	iLembe DM		Y	0.06	0	N	Unknown	Unknown
Montebello Hospital	Activated Sludge	iLembe DM	D	Y	0.15	188	Y	Flow meter, Clarifier, Aerator, Sludge return	R 2 171 000
Ntunjambili Hospital	Activated Sludge	iLembe DM	D	Y	0.05	375	Y	Flow meter, Clarifier, Aerator, Sludge return	R 526 000

Sheffield	Activated Sludge	iLembe DM		Y	6.0	Unknown	Y	Unknown	R 97 000
Vukile High School	Oxidation Ponds	iLembe DM		Y	0.03	Unknown	Y	Unknown	R 94 000

19.5.4 Harry Gwala District Municipality

The Harry Gwala District Municipality (DM) has ten WWW, nine of which are operational (**Figure** 19.51)**.** The capacity of the WWW's range from very small (0.1 Mℓ/day) serving the community of Franklin to small (1 Mℓ/day) serving the town of Ixopo. A list of the WWW in the Harry Gwala DM is provided in **Table 19.24**.

The municipality reported that sanitation backlogs have been eradicated in the Greater Kokstad Local Municipality. The municipality is working to eradicate sanitation backlogs in the remaining three local municipalities i.e. DR Nkosazana Dlamini Zuma (a merger between Ingwe and KwaSani), Umzimkhulu and Ubuhlebezwe. The total sanitation backlog equates to 22 % of the households in HGDM without basic RDP sanitation.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in **Table 19.23**.

Table 19.23 MIG funded Sanitation Projects in Harry Gwala District Municipality

Project	**Status**
Umzimkhulu Urban and Peri Urban Sanitation	Construction 80%
Donnybrook Bulk Sewer Upgrade	Design & Tender
Upgrade of Fairview and Ixopo Sewer System	Design & Tender
Umzimkhulu Sewers Upgrade Phase 2 (Ward 16)	Design & Tender
Shayamoya Emergency Sewer Intervention	Construction 80%
Himeville Sanitation Project	Registered
Ibisi Sewer Reticulation	Design & Tender
Universal Rural Sanitation Coverage Ubuhlebezwe	Construction 20%
Horseshoe Sanitation Project Phase 2	Design & Tender

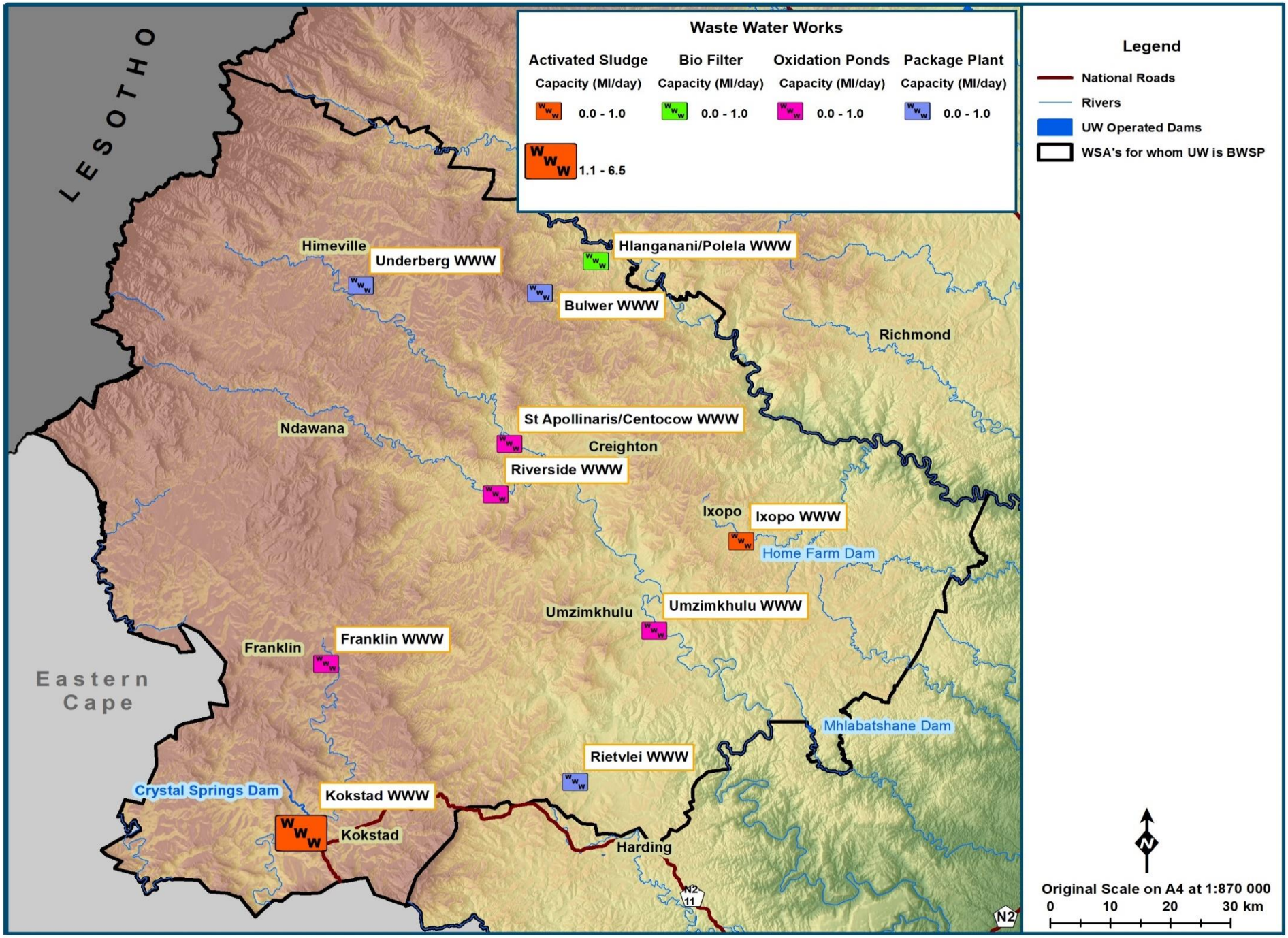

Figure 19.51 Location of Harry Gwala District Municipality Wastewater Works

Table 19.24 Harry Gwala District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class: Harry Gwala	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Ixopo	Activated Sludge	Umgeni Water	C	Y	0.95		Y	Sludge pumps	R 314 000
Kokstad	Activated Sludge	Harry Gwala DM	C	Y	6.4	22500	Y	Aerators, Clarifiers	R 2 106 000
Underberg	Package Plant	Harry Gwala DM	D	N	0.1	125	Y	Aerators	R 960 000
Bulwer	Package Plant	Harry Gwala DM	C	Y	0.08	125	Y	Chlorinator	R 615 000
Franklin	Oxidation Ponds	Harry Gwala DM	D	Y	0.1	125	Y	Aerators	R 949 000
Hlanganani/Polela	Bio-filter	Harry Gwala DM	D	Y	0.22	313	N	Bio-filter	R 1572 000
Riverside	Oxidation Ponds	Harry Gwala DM	E	Y	0.36	500	Y	Pump station	R 614 000
St Apollinaris/Centocow	Oxidation Ponds	Harry Gwala DM	D	Y	0.09	125	Y	Aerators	R 590 000
Umzimkhulu	Oxidation Ponds	Harry Gwala DM	C	Y	0.56	750	Y	Inlet works	R 872 000
Rietvlei	Package Plant	Harry Gwala DM	D	Y	Unknown	625	Y	None	R 1 037 000

19.5.5 Ugu District Municipality

The Ugu District Municipality (DM) has sixteen WWW the majority of them small. All but one of them are reported as being operational (**Figure 19.52**). The capacity of the WWW's range from very small (0.2 Mℓ/day) serving the community of Eden Wilds to relatively large (12 Mℓ/day) serving the large town of Port Shepstone. A list of the WWW in the DM is provided in **Table 19.26**.

The urban areas within Ugu are located predominantly within a narrow coastal strip comprising erven occupied by a combination of permanent residents and local tourists who descend on the area during holiday periods. The Sanitation Services Master Plan (SSMP) (SSI, 2005) suggests that the water demand (and hence wastewater flows) in the peak December/January period is typically 33% higher than the annual average values. Although largely "residential" most urban areas include some "commercial" activity and there are some "light and/or service industrial" nodes particularly at Port Shepstone (Marburg) and at Park Rynie to a lesser extent. The urban sanitation comprises a combination of waterborne sewerage linked to Wastewater Works as well as a system of septic tanks and conservancy tanks in the less densely populated areas.

Most of the treatment facilities are owned and managed by Ugu although there are also a number of privately owned and managed, small sewage treatment plants,– mostly "package" plants. With the exception of Gamalakhe, the sewerage coverage of formal, urban areas, which have a Municipal water connection, is approximately 30%.

A total estimated capital investment (2014) of the order of R 3 billion is required to reticulate and upgrade sanitation within the urban strip. The urban strip are areas adjoining the coastal, urban strip which by nature of their density should be provided with reticulated, waterborne sewerage as opposed to a basic level of service - septic tanks.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in **Table 19.25**.

Table 19.25 MIG funded Sanitation Projects in Ugu District Municipality

Project	Status
Margate Sewer Pipeline Replacement	Construction 40%
Pennington Waterborne Bulk Sewer Sanitation Project	Construction 80%
Sanitation Refurbishment Phase 1 – Port Edward to Park Rynie	Construction 80%
Kwalatshoda Water and Sanitation Project	Construction 80%
Extension (5.5 Ml/day)to uMbango WWW Planning Phase	Registered
New 1.5 Ml/day Melville WWW Planning Phase	Registered

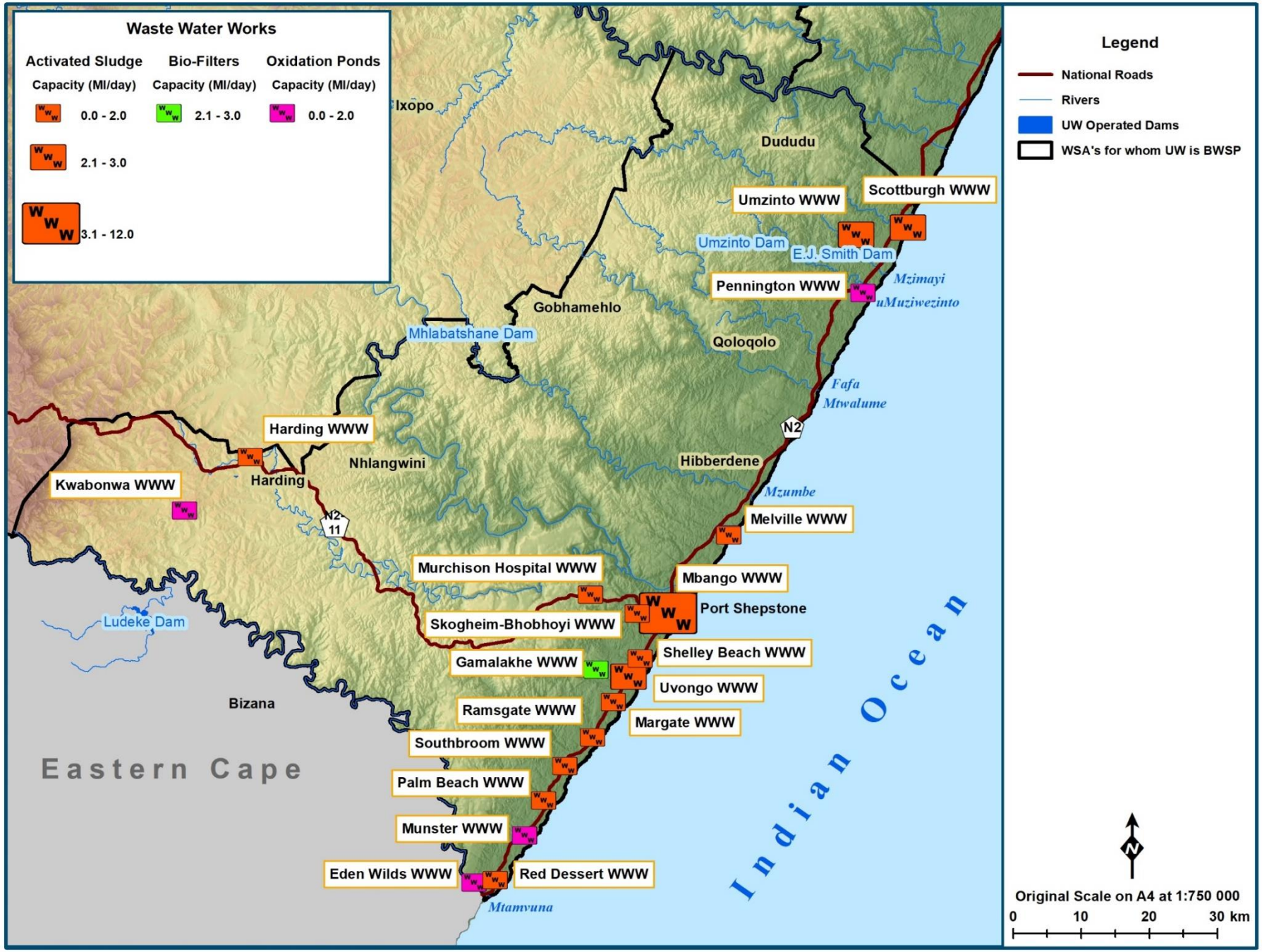

Figure 19.52 Location of Ugu District Municipality Wastewater Works

Table 19.26 Ugu District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Kwabonwa	Oxidation Ponds	Ugu DM	D	Y	0.6	63	Y	Unknown	R 293 000
Gamalakhe	Bio-filter	Ugu DM	C	Y	3.0	2500	Y	Unknown	R 1 160 000
Ramsgate	Activated Sludge	Ugu DM	C	N	1.2	1125	Y	Unknown	R 817 000
Uvongo	Activated Sludge	Ugu DM	B	Y	2.4	1875	Y	Unknown	R 860 000
Palm Beach	Activated Sludge	Ugu DM	C	Y	0.7	750	Y	Unknown	R 714 000
Umzinto	Activated Sludge	Ugu DM	C	Y	2.5	2000	Y	Unknown	R 984 000
Shelley Beach	Activated Sludge	Ugu DM	C	N	0.75	875	Y	Unknown	R 589 000
Scottburgh	Activated Sludge	Ugu DM	B	Y	2.3	2250	Y	Unknown	R 1 995 000
Margate	Activated Sludge	Ugu DM	B	Y	0.6	6250	Y	Unknown	R 590 000
Murchiston Hospital	Activated Sludge	Ugu DM		Y	0.2	2500	Y	Unknown	R 619 000
Eden Wilds	Oxidation Ponds	Ugu DM	D	Y	0.2	188	Y	Unknown	R 625 000
Southbroom	Activated Sludge	Ugu DM	D	Y	0.2	63	Y	Unknown	R 209 000
Harding	Activated Sludge	Ugu DM	C	Y	1.6	563	Y	Unknown	R 700 000
Hibberdene	Oxidation Ponds	Ugu DM	C	Y	0.28		N	Decommissioned	
Mbango	Activated Sludge	Ugu DM	B	N	12.0	11250	Y	Unknown	R 2 114 000
Melville	Activated Sludge	Ugu DM	C	Y	0.28	344	Y	Unknown	R 307 000
Munster	Oxidation Ponds	Ugu DM	D	Y	0.25	225	Y	Unknown	R 762 000

Pennington	Oxidation Ponds	Ugu DM	C	N	2.0	750	Y	Unknown	R 1 044 000
Red Dessert	Activated Sludge	Ugu DM	D	Y	0.6	563	Y	Unknown	R 391 000
Skogheim-Bhobhoyi	Activated Sludge	Ugu DM	D	Y	0.14	150	Y	Unknown	R 482 000

19.5.6 Umkhanyakude District Municipality

The Umkhanyakude District Municipality (DM) has eleven WWW all of which are 1 Mℓ/day and smaller in capacity (**Figure 19.53**). A list of the WWW in the DM is provided in **Table 19.28**. The provision of appropriate sanitation in the DM is a serious issue with massive backlogs.

The percentage of households in the district with access to a flush toilet (connected to either a sewerage system or a septic tank) is only 13%, a figure significantly lower than the 45% at provincial level. About 18 % of households in UKDM do not have access to any form of sanitation facilities compared to only 6.3% at provincial level. The dominant forms of sanitation infrastructure in the district include ventilated improved pit latrines (25% of households) and unimproved pit toilets (19% of households).

The sanitation access backlogs were determined utilising a combination of Census 2011 and the StatsSA 2016 Community survey. The sanitation backlog for the district was 43% in 2016 compared to 45% in 2011. This shows a very slow pace in the eradication of sanitation backlogs which can be attributed to the municipality's main focus on water provision. In accordance with the 2016 Community Survey, a total of 65 675 households have below minimum level of service in terms of sanitation access.

The sanitation eradication backlog cost is estimated at R 985 million assuming dry sanitation to all those households without access at present. Similar to the water backlogs eradication cost, this figure does not account for maintenance backlogs as there are some households which were previously served but their schemes are currently dysfunctional due to prolonged lack of maintenance.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in **Table 19.27.**

Table 19.27 MIG funded Sanitation Projects in Umkhanyakude District Municipality

Project	Status
Thembalethu Sanitation Project	Construction 40%
Jozini Low Cost Housing Sewer Upgrade	Construction 60%
Jozini Umhlabuyalingana VIP Sanitation Project	Registered
Refurbishment of Sewer Pipeline Umtuba LM	Registered

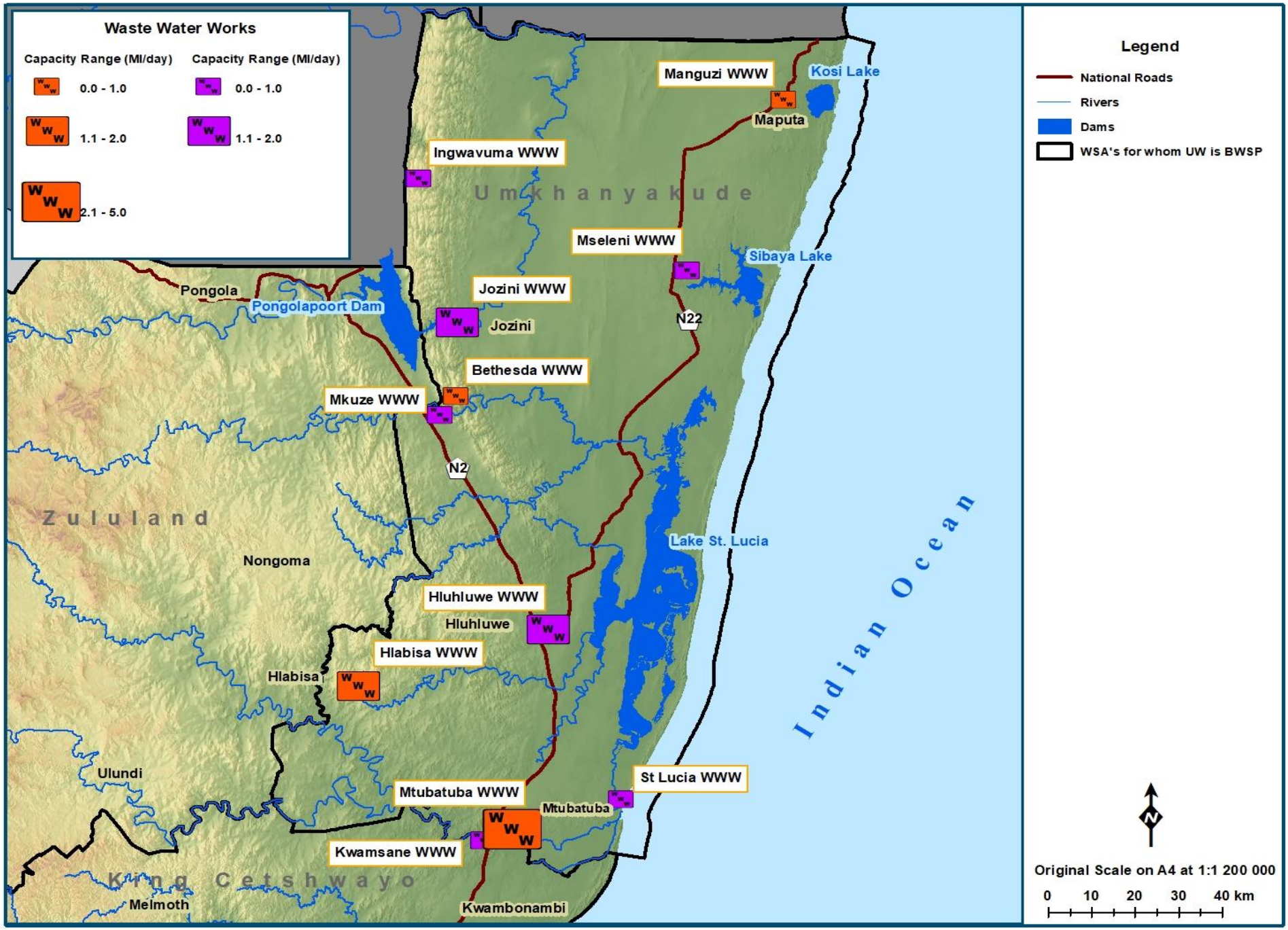

Figure 19.53 Location of Umkhanyakude District Municipality Wastewater Works

Table 19.28 Umkhanyakude District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Jozini	Oxidation Ponds	Umkhanyakude DM	Unknown	N	1.0	625	Y	Security	R 1 774 000
Hluhluwe	Oxidation Ponds	Umkhanyakude DM	Unknown	Y	0.75	250	Y	Security, Structures	R 3 158 000
Mtubatuba	Activated Sludge	Umkhanyakude DM	E	Y	0.7	2500	Y	Sludge management	R 498 000
Hlabisa Hospital	Activated Sludge	Umkhanyakude DM	E	Y	0.75	625	Y	Aeration	R 2 293 000
St Lucia	Oxidation Ponds	Umkhanyakude DM	Unknown	Y	1.0	1250	Y	Security	R 2 613 000
Mseleni	Oxidation Ponds	Umkhanyakude DM	Unknown	Y	0.7	625	Y	Security	R 1 472 000
Bethesda	Activated Sludge	Umkhanyakude DM	Unknown	N	1.0	375	Y	Aeration	R 2 810 000
Ingwavuma	Oxidation Ponds	Umkhanyakude DM	Unknown	N	1.0	625	Y	Security, Structures	R 1 998 000
KwaMsane	Activated Sludge	Umkhanyakude DM	Unknown	N	1.0	1250	Y	Security, Structures	R 1 891 000
Manguzi Hospital	Activated Sludge	Umkhanyakude DM	Unknown	N	1.0	625	Y	Sludge management	R 1 517 000
Mkuze	Oxidation Ponds	Umkhanyakude DM	Unknown	N	1.0	625	Y	Security, Structures	R 3 050 000

19.5.7 uThungulu District Municipality

The uThungulu District Municipality (DM) has twenty WWW the majority of them small, all of which are reported operational. (**Figure 19.54)**. The capacity of the WWW's range from very small (0.08 Mℓ/day) serving the community of Kwabadda to relatively large (14.5 Mℓ/day) serving the town of Empangeni. A list of the WWW in the DM is provided in **Table 19.31**.

The uThungulu DM consists of largely rural areas where dry sanitation systems predominate due to the scattered nature of settlements. The exception is the uMhlathuze Local Municipality (LM) that includes towns such as Empangeni and the industrial centre of Richards Bay. The bulk sanitation system in the uMhlathuze LM is managed by the City of uMhlathuze (CoM). The seven bulk sewerage sub-systems that together make up the CoM's existing (current) bulk sewerage system are listed in **Table 19.29**.

Table 19.29 City of uMhlathuze existing bulk sewerage sub-systems

Description
Alton macerator bulk sewerage sub-system
Arboretum macerator bulk sewerage sub-system
Empangeni WWTW bulk sewerage sub-system
eNseleni WWTW bulk sewerage sub-system
eSikhaleni WWTW bulk sewerage sub-system
Ngwelezane WWTW bulk sewerage sub-system
Vulindlela WWTW bulk sewerage sub-system

It is important to note that, because of the City's proximity to the sea, some wastewater only receives primary treatment in the form of maceration and is then discharged directly to sea via sewer outfalls. Thus, a large proportion of the City's wastewater remains relatively untreated. It is estimated that the capacity of the Alton and Arboretum macerators is 7 and 12 Mℓ/day respectively.

Based on planned and approved developments, augmentation of the Alton and Arboretum systems is proposed by 7 & 5 Mℓ/day respectively. Present indications are that spare capacity exists at the Empangeni, eNseleni, eSikhaleni and Ngwelezane WWW and no augmentation is currently required.

The City of uMhlathuze is considering closing the Vulindlela WWW for operational reasons. In that event, sewage/wastewater could be transferred into the bulk.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in **Table 19.30.**

Table 19.30 MIG funded Sanitation Projects in uThungulu District Municipality

Project	Status
Ntambanana Rural Sanitation Area Business Plan	Construction 60%
Nkandla VIP Sanitation Area Business Plan	Construction 80%
Umlalazi Sanitation Area Business Plan	Construction 80%
Upgrade of Sewer Infrastructure Melmoth	Construction 40%
Upgrade of Sewer Infrastructure Eshowe	Design & Tender
Mthunzini Sanitation Project	Construction 80%

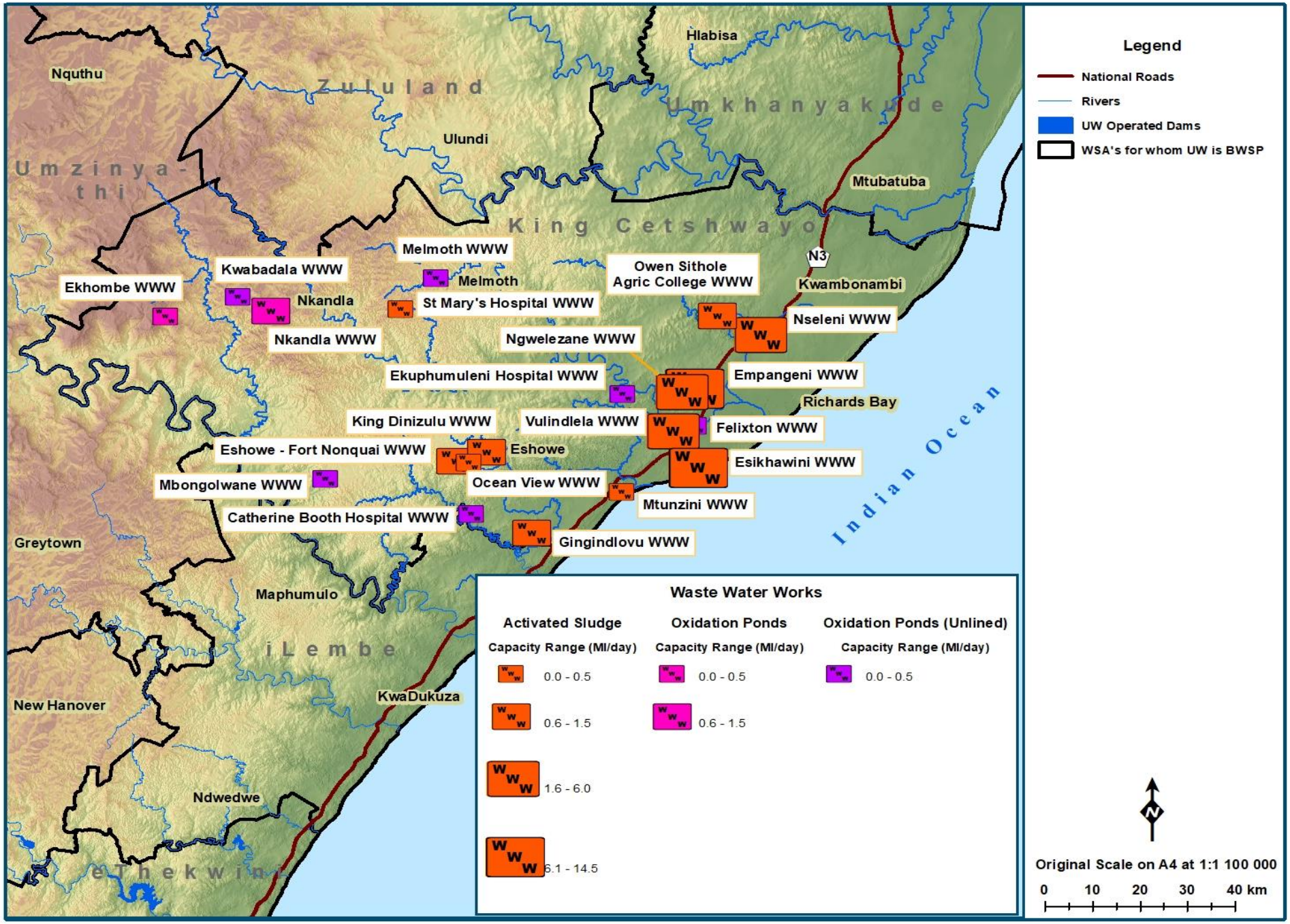

Figure 19.54 Location of uThungulu District Municipality Wastewater Works

Table 19.31 uThungulu District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Vulindlela	Activated Sludge	uMhlathuze LM	D	Y	3.0	Unknown	Y	Unknown	Unknown
Esikhawini	Activated Sludge	uMhlathuze LM	C	N	12.5	Unknown	Y	Aeration	Unknown
Ekhombe	Unknown	uThungulu DM	E	N	0.15	1250	Y	Unknown	R 349 000
Empangeni	Activated Sludge	uMhlathuze LM	B	Y	14.5	Unknown	Y	Unknown	Unknown
Ngwelezane	Activated Sludge	uMhlathuze LM	C	Y	5.8	Unknown	Y	Unknown	Unknown
Eshowe	Unknown	uThungulu DM	E	N	1.5	875	Y	Unknown	R 882 000
King Dinizulu	Unknown	uThungulu DM	D	Y	0.7	1875	Y	Unknown	R 818 000
Melmoth	Unknown	uThungulu DM	E	Y	0.4	500	Y	Unknown	R 450 000
Mtunzini	Unknown	uThungulu DM	E	Y	0.32	375	Y	Unknown	R 1 195 000
Nkandla	Unknown	uThungulu DM	E	Y	0.8	1050	Y	Unknown	R 575 000
Nseleni	Activated Sludge	uMhlathuze LM	C	Y	3.0	Unknown	Y	Unknown	Unknown
Catherine Booth Hospital	Unknown	uThungulu DM	E	Y	0.15	138	Y	Unknown	R 484 000
Mbongolwane	Unknown	uThungulu DM	E	Y	0.2	270	Y	Unknown	R 556 000
Gingindlovu	Unknown	uThungulu DM	E	N	0.8	1000	Y	Unknown	R 1 072 000

Felixton	Transferred to Vulindlela WWW	uMhlathuze LM		Y	0.0		Y	Unknown	Transfer Pipeline
Ekuphumuleni Hospital	Unknown	uThungulu DM	E	Y	0.1	563	Y	Unknown	R 485 000
Kwabadala	Unknown	uThungulu DM	E	Y	0.08	89	Y	Unknown	R 682 000
Ocean View	Unknown	uThungulu DM	E	Y	0.5	1050	Y	Unknown	R 682 000
Owen Sithole Agric College	Unknown	uThungulu DM	E	Y	1.5	44	Y	Unknown	R 1 112 000
St Mary's Hospital	Unknown	uThungulu DM	E	Y	0.45	0	Y	Unknown	R 210 000

19.5.8 Zululand District Municipality

The Zululand District Municipality (DM) has nineteen WWW (**Figure 19.55**), the majority of them being very small and rudimentary in nature (Class E). Fourteen of the wastewater works are reported as operational. The capacity of the WWW's range from very small (0.08 Mℓ/day) serving the Thlasizwe Hospital to relatively large (16 Mℓ/day) serving the town of Klipfontein. A list of the WWW in the DM is provided in **Table 19.33**.

In terms of sanitation, 34,973 or 19% of households have no access to sanitation. eDumbe carries the highest percentage with Nongoma (24%) and Abaqulusi and Ulundi at 22% respectively. Investment of R1.064 billion is required to eradicate the sanitation backlog.

Over the years the number of households and non-domestic customers with sanitation, in the district, has steadily increased – from 105 077, in the year 2011/12, to 117 228 in 2015/16. The number of ventilated pit-latrines has also steadily increased over the same period – from 69 475 to 84 105.

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in **Table 19.32**.

Table 19.32 MIG funded Sanitation Projects in Zululand District Municipality

Project	Status
Zululand Rural Sanitation Phase 2D	Construction 80%

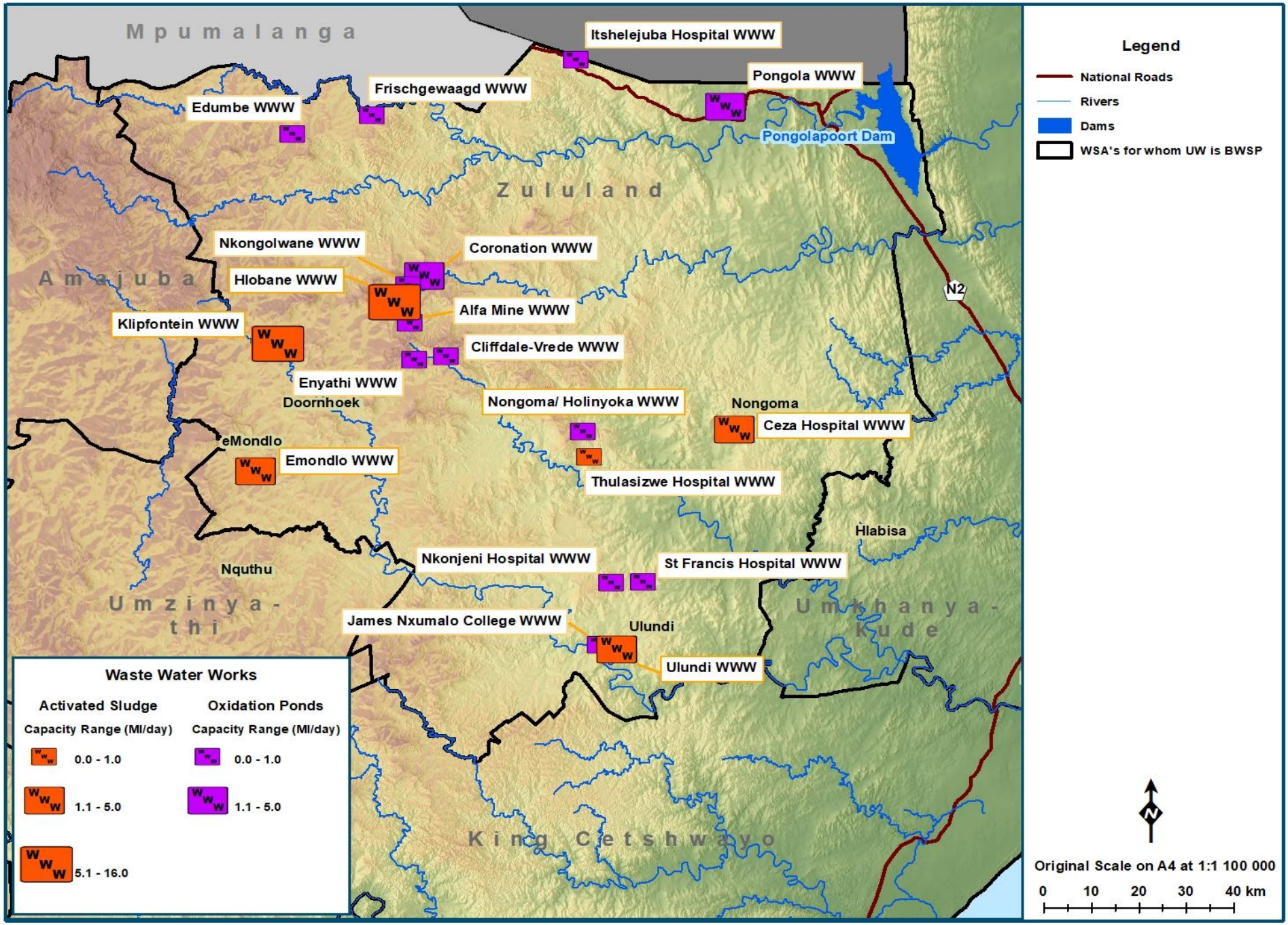

Figure 19.55 Location of Zululand District Municipality Wastewater Works

Table 19.33 Zululand District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Frishgewald	Oxidation Ponds	Zululand DM		Y	0.15	0	Y	Unknown	R 425 000
St Franics Hospital	Oxidation Ponds	Zululand DM	E	N	0.12	250	Y	Unknown	R 121 000
Ceza Hospital	Activated Sludge	Zululand DM	E	N	0.2	250	Y	Unknown	R 632 000
Nonggoma/Holiyoka	Oxidation Ponds	Zululand DM	C	Y	3.0	3750	N	Unknown	R 2 575 000
Thlasizwe Hospital	Oxidation Ponds	Zululand DM	E	Y	0.08	103	N	Unknown	R 1 630 000
Itshelejuba Hospital	Oxidation Ponds	Zululand DM	E	N	0.18	225	Y	Unknown	R 209 000
Pongola	Oxidation Ponds	Zululand DM	D	N	2.0	2500	Y	Unknown	R 359 000
James Nxumalo College	Oxidation Ponds	Zululand DM	E	N	0.17	213	Y	Unknown	R 540 000
Nkojeni Hospital	Oxidation Ponds	Zululand DM	E	Y	0.14	170	Y	Unknown	R 190 000
Ulundi	Activated Sludge	Zululand DM	C	Y	5.0	6250	Y	Unknown	R 2 780 000
Emondlo	Activated Sludge	Zululand DM	B	Y	4.0	5000	Y	Unknown	R 818 000
Alfa Mine	Oxidation Ponds	Zululand DM	E	Y	0.0	0	N	Unknown	
Cliffdale-Vrede	Oxidation Ponds	Zululand DM	E	Y	0.2	250	N	Unknown	
Coronation	Oxidation Ponds	Zululand DM	D	N	2.0	2500	Y	Unknown	R 1 168 000
Edumbe	Oxidation Ponds	Zululand DM	E	Y	0.2	250	Y	Unknown	R 511 000
Enyathi	Oxidation Ponds	Zululand DM	E	Y	0.0	0	N	Unknown	

Hlobane	Activated Sludge	Zululand DM	C	Y	6.0	7500	Y	Unknown	R 658 000
Klipfontein	Activated Sludge	Zululand DM	B	Y	16.0	20000	Y	Unknown	R 1 561 000
Nkongolwane	Oxidation Ponds	Zululand DM	E	Y	0.3	0	Y	Unknown	R 438 000

19.5.9 Amajuba District Municipality

The Amajuba District Municipality (DM) has ten WWW, nine of which are reported as being operational. (**Figure 19.56)**. The capacity of the WWW are generally 2 Mℓ/day and lower, however, the municipality is unique in that it has four wastewater exceeding 10 Mℓ/day in capacity with the largest servicing Newcastle at 25 Mℓ/day. A list of the WWW in the DM is provided in **Table 19.35.**

About 58% (Community Survey 2016) of the households in Amajuba DM area have flush toilets that are connected to a sewerage system of some type. This is an improvement of 4% when compared to figures from Census 2011. The 2016 figures also indicate that only 41% of households in the ADM do not have any form of sanitation. There are, however, wide variations within the district.

- 74% of households in the eMadlangeni municipality do not have access to any form of toilet i.e pit with no ventilation, other (home built or none)
- 7% of households within the Dannhauser municipality are below the basic level of service (backlog).
- Out of the three municipal areas, the highest level of service is found in Newcastle Municipality where over 68% of households have either flush or chemical toilets or pit latrines

A number of sanitation projects have been implemented, are under construction or are proposed in the Municipality. A list of the sanitation projects funded by the Municipal Infrastructure grant (MIG) and their status are provided in **Table 19.34**.

Table 19.34 MIG funded Sanitation Projects in Amajuba District Municipality

Project	**Status**
Emadlangeni Sanitation Project	Construction 80%
Goedehoop Bulk Water and Sanitation	Construction 20%
Dannhauser Housing Development Bulk Water and Sanitation	Construction 20%

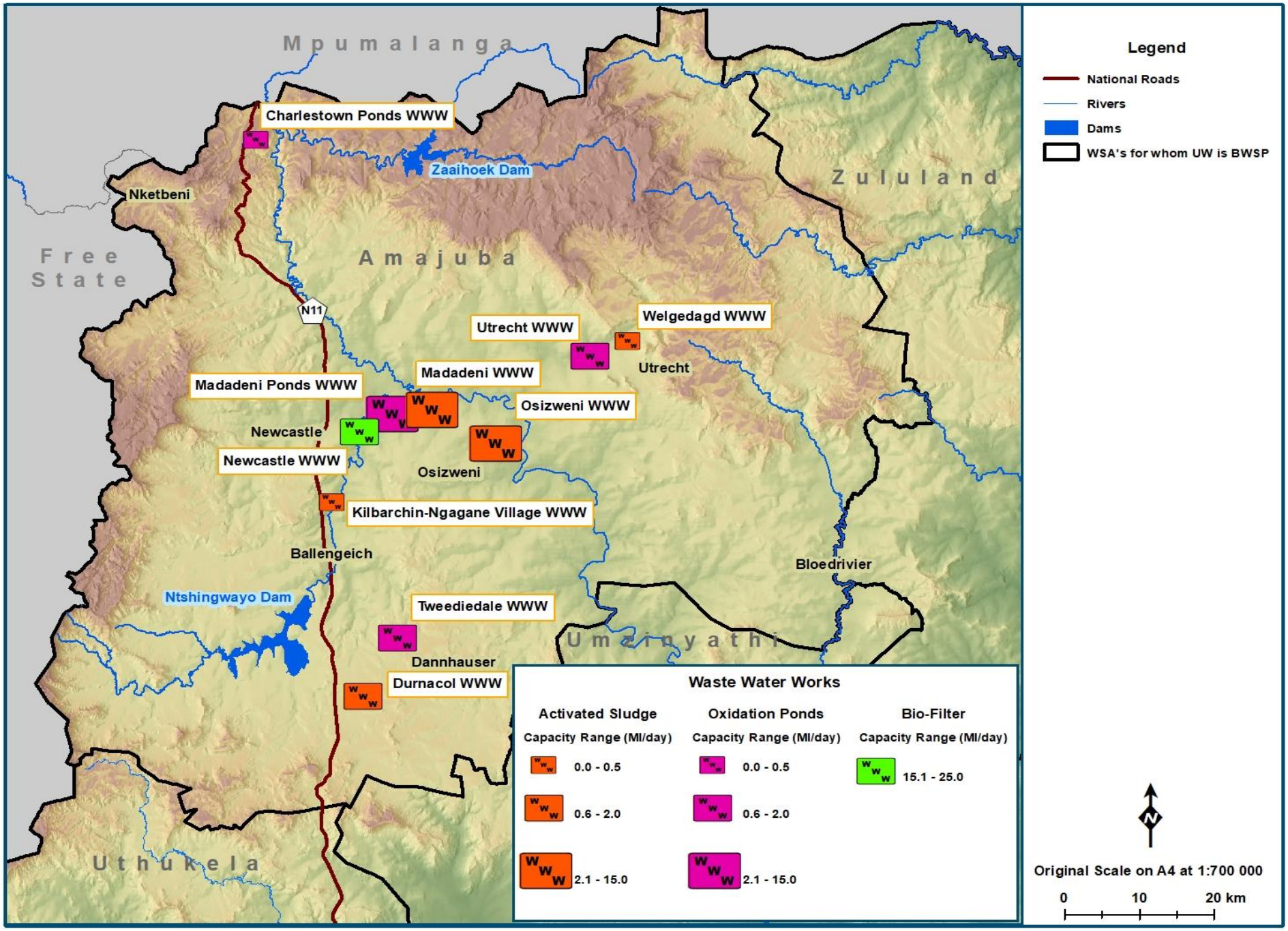

Figure 19.56 Location of Amajuba District Municipality Wastewater Works

Table 19.35Amajuba District Municipality Wastewater Works Specifications

WWW	Description	Owner	Class: Harry Gwala	Capacity Sufficient	ADWF Capacity (Mℓ/day)	People Served	Operational	Critical Refurbishment	Cost Estimate
Utrecht	Oxidation Ponds	uThukela Water	D	Y	1.0	1250	Y	Grounds, buildings	R 545 000
Charslestown Ponds	Oxidation Ponds	uThukela Water	E	Y	0.5		Y	Pond improvements, Security	Unknown
Durnacol	Activated Sludge	uThukela Water	D	Y	2.0	2500	Y	Maturation Ponds	R 1 191 000
Tweediedale	Oxidation ponds	uThukela Water	D	Y	2.0	2500	Y	Oxidation Ponds, Sludge drying beds	R 1 113 000
Kilbarchin-Ngagane Village	Activated Sludge	uThukela Water	C	N	0.5		Y	Fine bubble aeration, Sludge drying beds	Unknown
Osizweni	Activated Sludge	uThukela Water	B	N	15.0		Y	Sludge drying beds	Unknown
Madadeni	Activated Sludge	uThukela Water	B	N	12.0		Y	Digesters, Clarifiers, Reactors, Sludge drying beds	Unknown
Newcastle	Bio-filter	uThukela Water	B	Y	25.0		Y	Sludge drying beds	Unknown
Welgedagd	Activated Sludge	uThukela Water	D	Y	0.5	625	N	Clarifiers, Digesters, Ponds, Sludge drying beds	R 1 692 000
Madadeni Ponds	Oxidation ponds	uThukela Water	E	N	12.0		Y	Convert to emergency holding dams	Unknown

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Kevin Meier,
PLANNING SERVICES MANAGER