UMGENI WATER · AMANZI

Infrastructure Master Plan 2020
2020/2021 – 2050/2051

Volume 1

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

Think Water, think Umgeni Water.

Improving Quality of Life and Enhancing Sustainable Economic Development.

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

JUNE 2020

Compiled by:

Alka Ramnath *PrPln GPr GISc*

Planner

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.

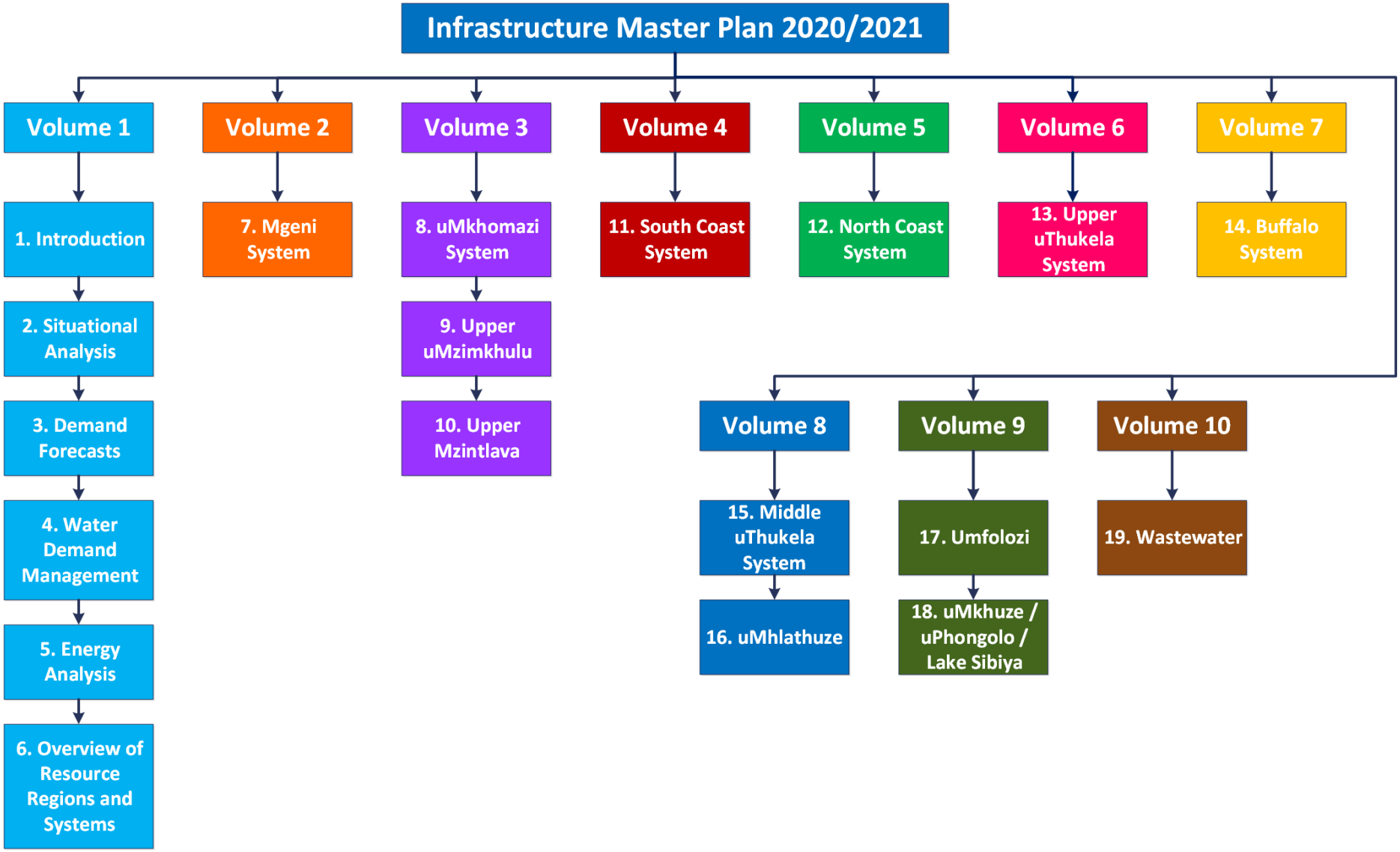
Volume 1 includes the following sections and a description of each is provided below:

- **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.


Infrastructure Master Plan 2020/2021
Volume 1
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
10. Upper Mzintlava
Volume 4
11. South Coast System
Volume 5
12. North Coast System
Volume 6
13. Upper uThukela System
Volume 7
14. Buffalo System
Volume 8
15. Middle uThukela System
16. uMhlathuze
Volume 9
17. Umfolozi
18. uMkhuze / uPhongolo / Lake Sibiya
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.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AADD	Annual Average Daily Demand
AC	Asbestos Cement
ADWF	Average Dry Weather Flow
API	Antecedent Precipitation Index
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

1. INTRODUCTION

1.1 Purpose

"A man who does not plan long ahead will find trouble at his door."

Confucius, Chinese philosopher

Established in 1974, Umgeni Water has developed into the second largest water utility in South Africa, supplying over 410 million cubic metres of bulk potable water annually to, traditionally, six Water Services Authorities (WSAs), comprising one metropolitan municipality, four District Municipalities, and one Local Municipality (LM), within the province of KwaZulu-Natal (KZN). Towards the end of 2017 Umgeni Water signed an additional Bulk Supply Agreement with uThukela District Municipality (DM) with the anticipated date of operation being 1 July 2018. The extent of these seven WSAs, is shown in **Figure 1.1**.

Figure 1.1 Locality of Umgeni Water's area of operation.

The seven WSAs with whom Umgeni Water currently has a signed bulk supply agreement, collectively contribute approximately 84%[1] of the province's Gross Value Added (GVA). However, the highest poverty densities in KZN are also located in these areas. Hence, Umgeni Water is faced with the dual challenge of ensuring that the province's economic engine remains served with a reliable supply of potable water, whilst also ensuring that water is adequately provided for the eradication of water backlogs, the improvement of the level of water services, and the alleviation of poverty.

In December 2015 the Minister of Water and Sanitation published a Government Gazette (No. 39491) which extends Umgeni Water's operational area to include all WSA's within the province. With this instruction, Umgeni Water can become the bulk water provider for any of the WSA's in KZN if a Bulk Supply Agreement is concluded with the WSA.

This Infrastructure Master Plan (IMP) includes, not only detailed planning for the seven WSAs supplied by Umgeni Water, but also bulk water infrastructure master plans for the remaining WSA's in KwaZulu-Natal. Umgeni Water recognises that many of the WSA's in KZN do not have the funds or resources to undertake comprehensive planning. As a result, plans for the areas are included here to assist these WSA's in understanding and planning water supply through their areas.

It is also important to note that, even though Umgeni Water has a bulk supply agreement with a WSA, it is not mandated to supply bulk water across the entire WSA. In particular, Umgeni Water does not supply bulk water in the southern portion of Ugu DM, the inland portion of iLembe DM or the entire Harry Gwala DM apart from the town of Ixopo and a small portion of the southern uBuhlebezwe Local Municipality (that was formerly a part of the Umzumbe Local Municipality in Ugu DM). Umgeni Water recently handed back the management of the small run of river and borehole schemes within iLembe DM to the municipality. In addition, the area north of the uThukela River is also managed by iLembe DM.

WSAs are responsible for water service delivery to the people who reside within their respective areas of jurisdiction. The areas that currently receive reticulated water from the WSAs, who in turn receive bulk potable water from Umgeni Water, are shown in **Figure 1.2.**

[1] KZN Treasury 2018 after IHA Markit Regional eXplorer 1156 (2.6a)

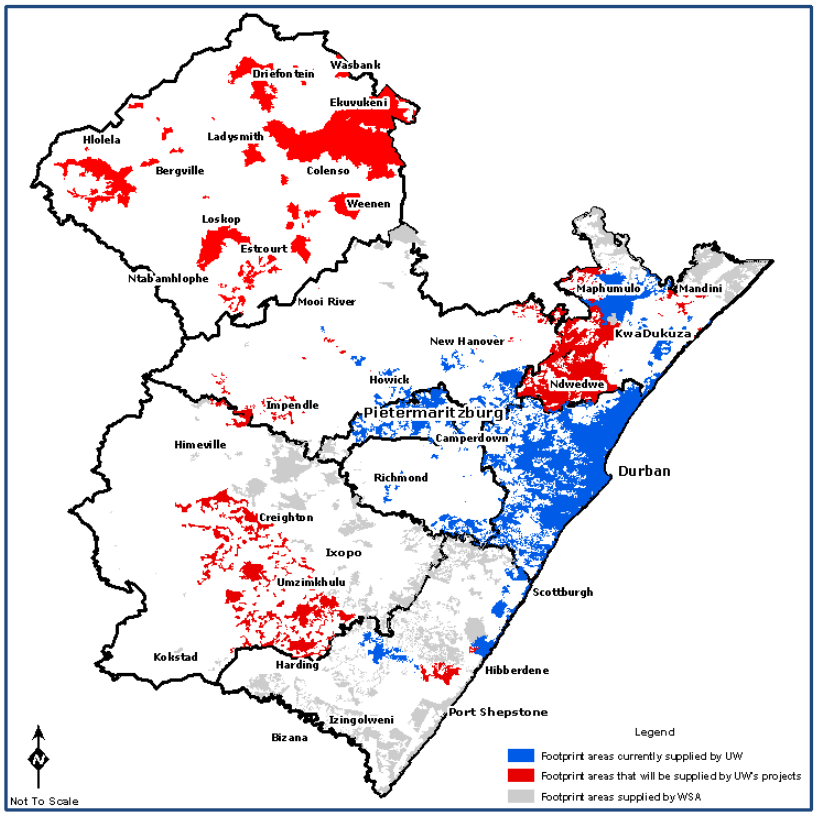


Figure 1.2 Umgeni Water's supply footprint including uThukela DM.

This collective reticulated area constitutes Umgeni Water's 'supply footprint' and comprises of various levels of service based on a number of bulk supply schemes that are both interdependent and stand-alone.

The environment within which Umgeni Water is required to fulfil its function as a regional bulk water service provider is constantly undergoing change, with many factors influencing both the water demand and water supply components of its business. In particular, the economic up- and down-turns that the country, including KZN, has experienced over the past few years as well as the most recent drought, have a marked influence. Umgeni Water's infrastructure planning therefore needs to be continually reviewed, updated and adapted in order to be responsive (wherever possible) to this dynamic external environment.

For Umgeni Water or any WSA for that matter, to effectively achieve its mission, it must have, amongst other things, a clearly defined plan of what is required in the future so that it can be addressed in the present. This Infrastructure Master Plan 2020 (IMP 20w0) describes how Umgeni Water intends to address the future bulk water infrastructure requirements within its area of operation in order to meet the anticipated needs and provides plans for other WSA's in KZN so that these areas can ultimately achieve universal access to water. It also shows the proposed integration between water supply infrastructure plans and the regional water resource plans being developed by the DWS.

This infrastructure master plan comprises the following sections:

- **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.

Water Resource Catchments and Water Supply Systems, unfortunately, do not follow WSA / Municipal boundaries. As a result, Water Supply Infrastructure often crosses municipal boundaries and for this reason this IMP has been divided into 12 "Systems". A system is described as a water resource region (generally conforming to catchment boundaries) and the area supplied by that resource. The next 12 Sections describe the current water resource situation and water supply infrastructure of the various systems that have been identified by Umgeni Water for the purpose of this IMP and which cover the full extent of the KZN Province. These 12 systems include:

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

Section 19 describes the wastewater works currently operated by Umgeni Water 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.

1.2 Setting the Scene

The extent of the WSA's in KwaZulu-Natal are shown in **Figure 1.3** together with the Umgeni Water operational Area. Also shown in this figure are the system boundaries that have been defined for the purposes of this IMP and the location of the bulk Water Treatment Plants and Wastewater Treatment Plants that exist in the province**.**

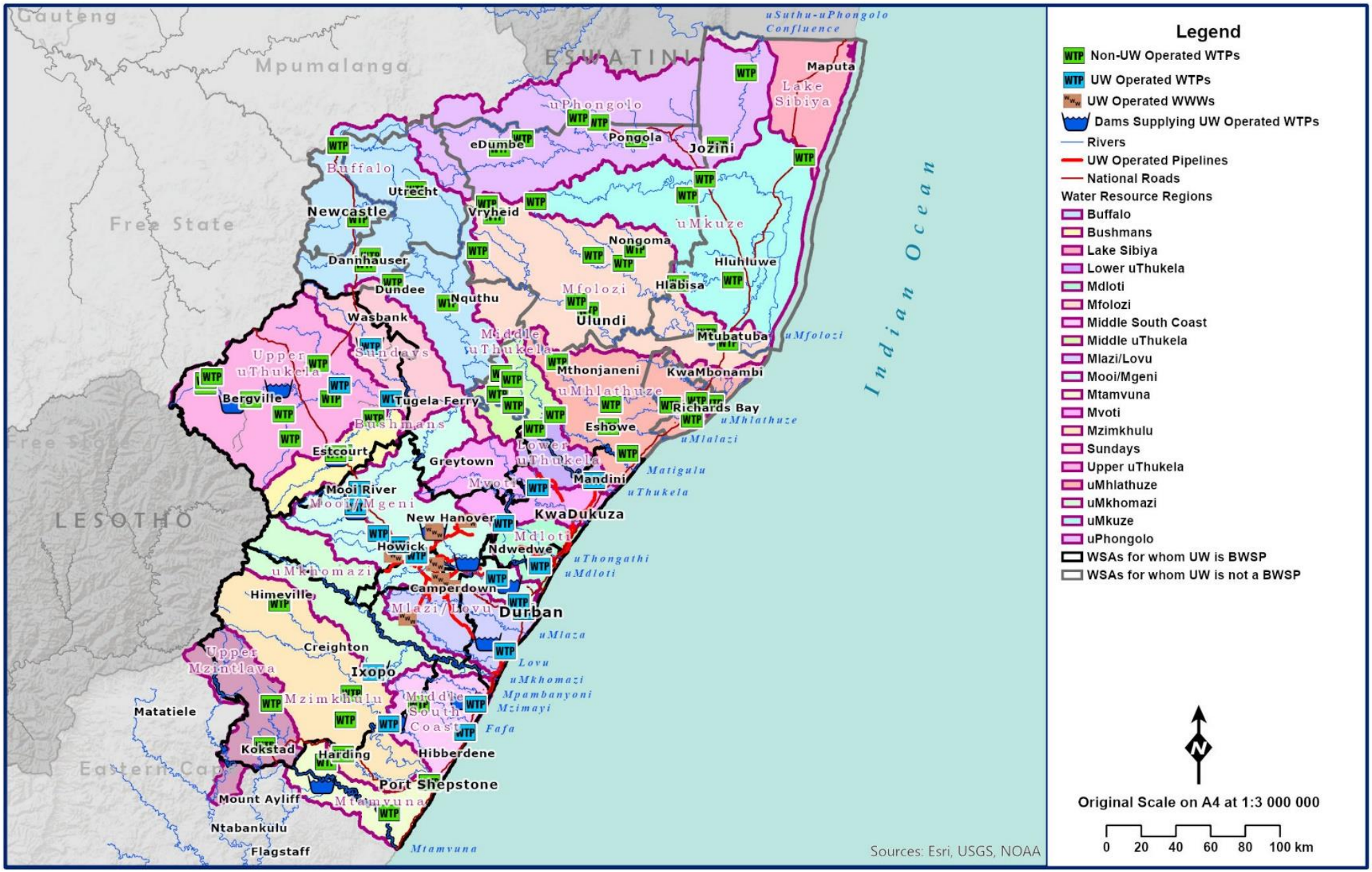


Figure 1.3 KZN water resource regions and WSA boundaries.

2. SITUATIONAL ANALYSIS

2.1 Administrative Landscape

The KwaZulu-Natal (KZN) "administrative landscape" (KZN Planning Commission 2011: 35) consists of 14 Water Service Authorities (WSAs) as shown in **Figure 2.1**. These 14 WSAs are composed of eThekwini Municipality (the only KZN metropolitan municipality), all ten KZN district municipalities and three local municipalities viz. Msunduzi Municipality, Newcastle Municipality and the City of uMhlathuze (**Table 2.1** and **Figure 2.2**).

Table 2.1 KZN Water Service Authorities (after MDB 2016).

Umgeni Water		Non-Umgeni Water	
Water Service Authority (WSA)	**Constituent Local Municipalities**	**Water Service Authority (WSA)**	**Constituent Local Municipalities**
eThekwini Metropolitan Municipality	N/A	City of uMhlathuze Local Municipality	N/A
Msunduzi Local Municipality	N/A	Newcastle Local Municipality	N/A
uMgungundlovu District Municipality	uMngeni Municipality Mpofana Municipality Impendle Municipality uMshwathi Municipality Richmond Municipality Mkhambathini Municipality	Amajuba District Municipality	Dannhauser Municipality Emadlangeni Municipality
iLembe District Municipality	KwaDukuza Municipality Mandeni Municipality Maphumulo Municipality Ndwedwe Municipality	King Cetshwayo District Municipality	Mfolozi Municipality Mthonjaneni Municipality Nkandla Municipality uMlalazi Municipality
Ugu District Municipality	Umdoni Municipality uMzumbe Municipality Ray Nkonyeni Municipality uMuziwabantu Municipality	uMkhanyakude District Municipality	Big Five Hlabisa Municipality Jozini Municipality Mtubatuba Municipality uMhlabuyalingana Municipality
Harry Gwala District Municipality	Dr Nkosazana Dlamini-Zuma Municipality Greater Kokstad Municipality uBuhlebezwe Municipality uMzimkhulu Municipality	uMzinyathi District Municipality	Endumeni Municipality Msinga Municipality Nqutu Municipality uMvoti Municipality
uThukela District Municipality	Alfred Duma Municipality Inkosi Langalibalele Municipality Okhahlamba Municipality	Zululand District Municipality	AbaQulusi Municipality Nongoma Municipality Ulundi Municipality eDumbe Municipality uPhongolo Municipality

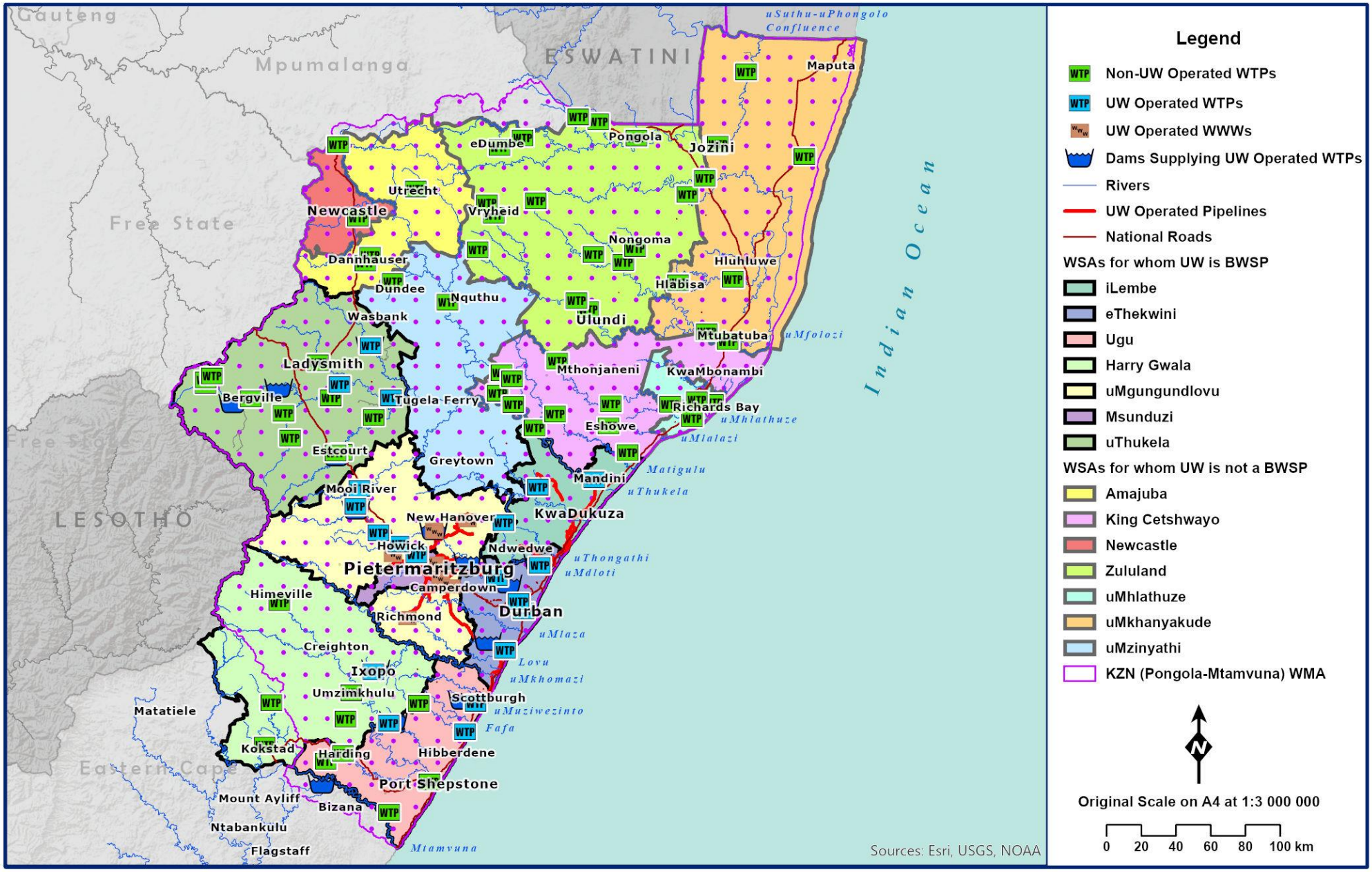


Figure 2.1 Institutional boundaries (DWS 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

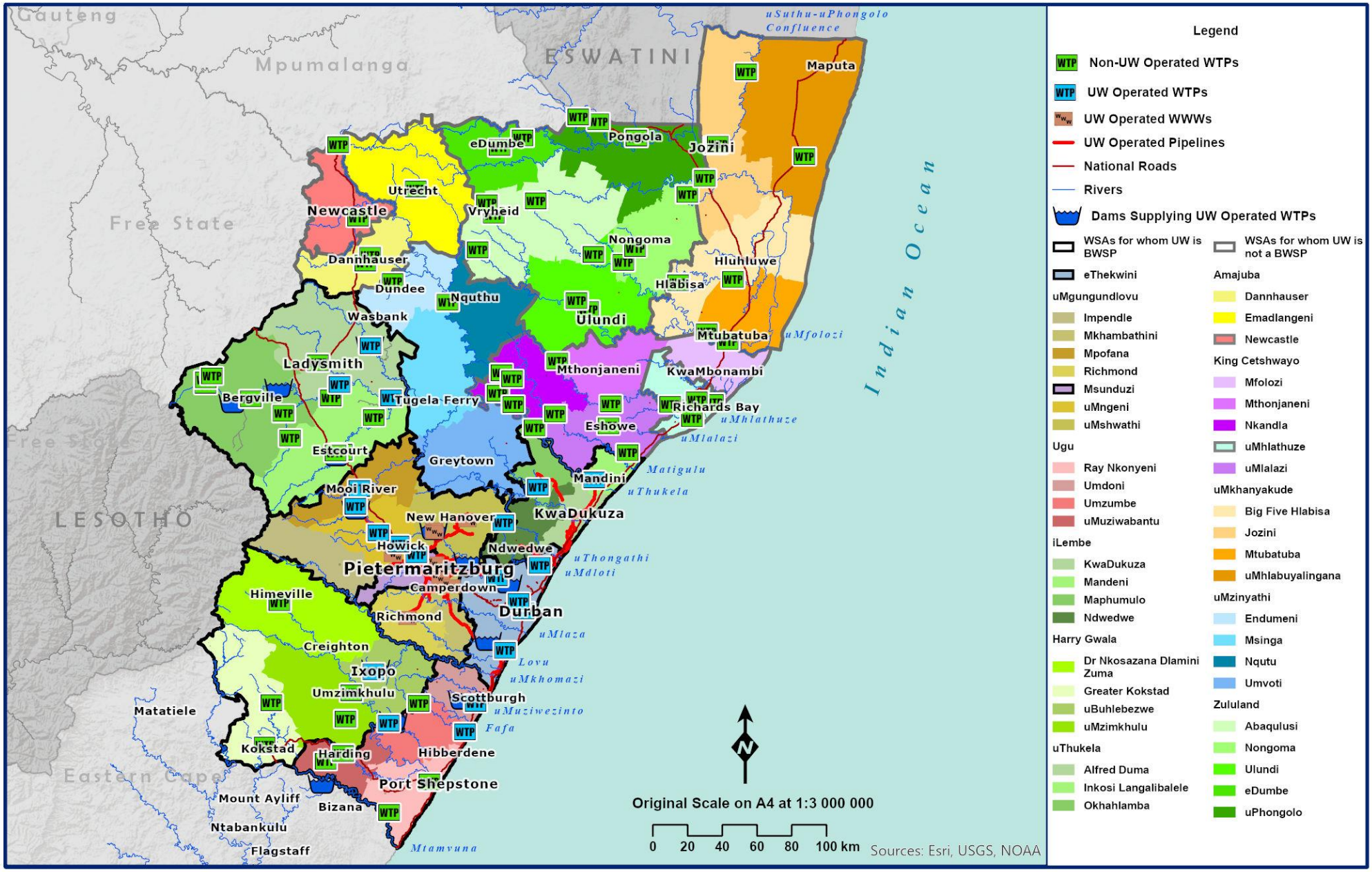


Figure 2.2 WSAs and their constituent local municipalities (KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

The changing "human footprint" (after KZN PGDS 2011) within Umgeni Water's area of operation is summarised in **Figure 2.3**. The 2011 KZN PGDS explains that "the human footprint depicts human impact on the environment and is related to population density, infrastructure investment and economic activities" (2011: 33). The "human footprint" shown here is the result of the "assessment of the REGIO-OECD[2] degree of urbanisation model using population as an input for the years 1975, 1990, 2000, and 2015" (GHS 2019: website).

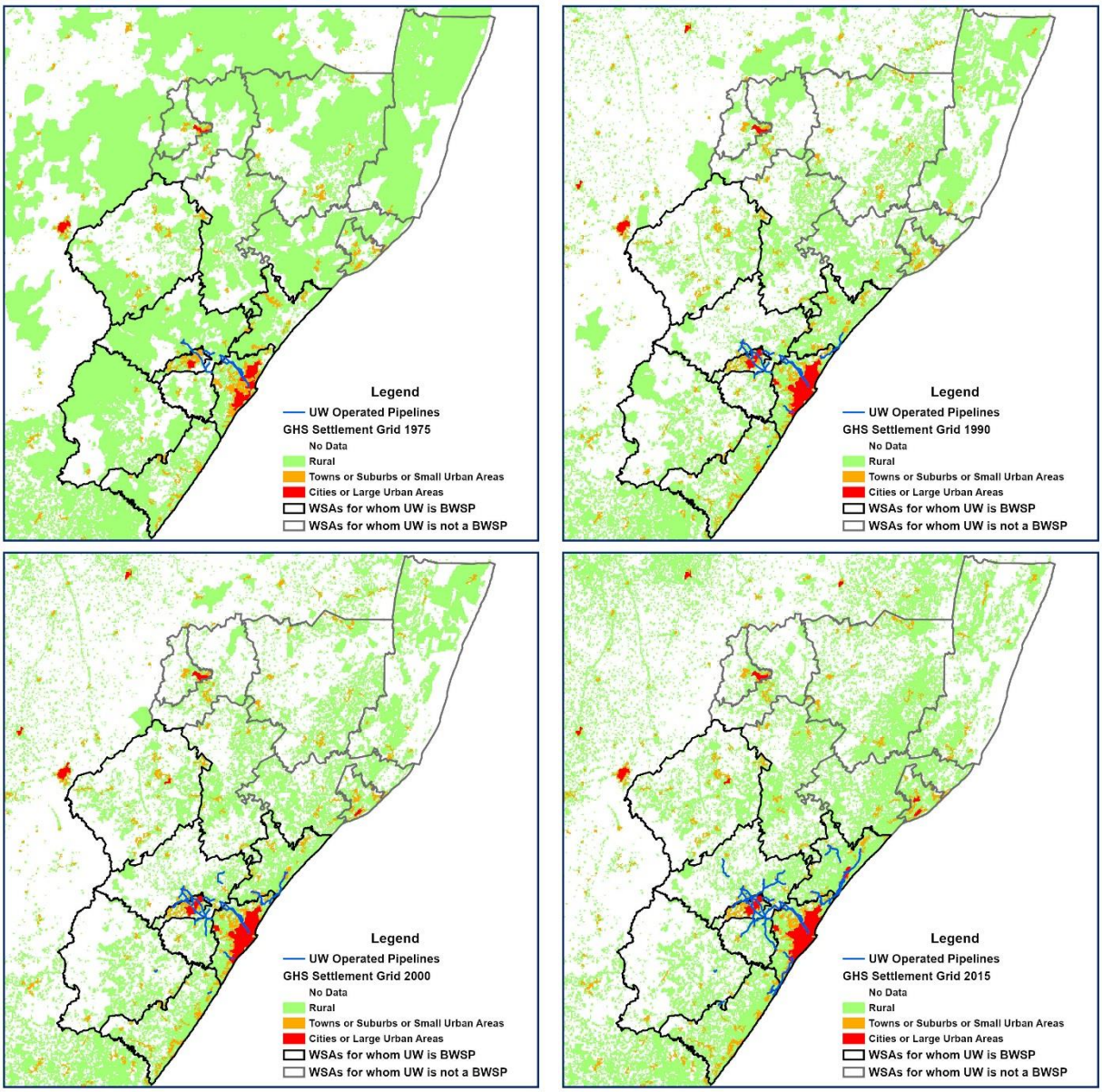


Figure 2.3 Change in the degree of urbanisation for four epochs, 1975; 1990; 2000; and 2015 (Global Human Settlements 2019).

[2] European Commission's Directorate-General for Regional and Urban Policy and the Organisation for Economic Co-Operation and Development.

The results are illustrated with the following three categories in **Figure 2.3**:

1 = "rural cells" defined as the grid cells outside high density clusters and urban clusters.
2 = "towns or suburbs or small urban areas" defined as "urban clusters" or low density clusters which are contiguous grid cells with a density of at least 300 inhabitants per km^2 and a minimum population of 5 000 inhabitants.
3 = "cities or large urban areas" defined as "urban centres" or high density clusters which are contiguous grid cells with a density of at least 1 500 inhabitants per km^2 or a density of built-up area greater than 50% and a minimum of 50 000 inhabitants.

(GHS 2019: website after Dijkstra, Lewis and Poelmann 2014)

It is shown in **Figure 2.3** that within Umgeni Water's operational area, the provision of bulk water infrastructure "follows those areas in which population density increases". This trend will be confirmed for the non-Umgeni Water operational areas in the next IMP once the age of the non-Umgeni Water operated infrastructure is confirmed.

The land cover components of the "human footprint" are shown in **Figure 2.4** at a finer resolution. The building density (a Thiessen polygon analysis on Eskom's 2013 Building Count dataset), as shown in **Figure 2.5**, correlates with the spatial distribution of urban areas as illustrated in **Figure 2.4**. The relationship between the distribution of people (using the building density as a proxy) and access (using the national and provincial roads as a proxy) is shown in **Figure 2.6**.

The increasing trend in the transformation of the natural environment, with urban areas increasing, is shown in **Figure 2.7**[3].

The highest levels of human impact are shown to be along the key routes of accessibility viz. the "T-junction" formed by the N3 and N2 highways and along the provincial roads. In addition to the "T-junction" (**Figure 2.4**), **Figure 2.5, Figure 2.6** and **Figure 2.7** show that there is a concentration of people in the "shadow corridor" which runs parallel to the N2 highway.

The urban category of land cover consists of settlements with land uses i.e. "human activity that is associated with a specific land unit in terms of utilisation, impact or management practice" (Thompson 1999: presentation) such as residential, commercial, industrial, administration, recreation etc. The KZN office of the Department of Rural Development and Land Reform (DRDLR) updated the methodology used in the 2009 study on "Rural Settlements" and "Urban Edges" (see **Section 2.1 in IMP 2016**) to identify the larger settlements shown in **Figure 2.8**.

[3] Inaccuracies may be present due to inconsistent scales between each land cover dataset.

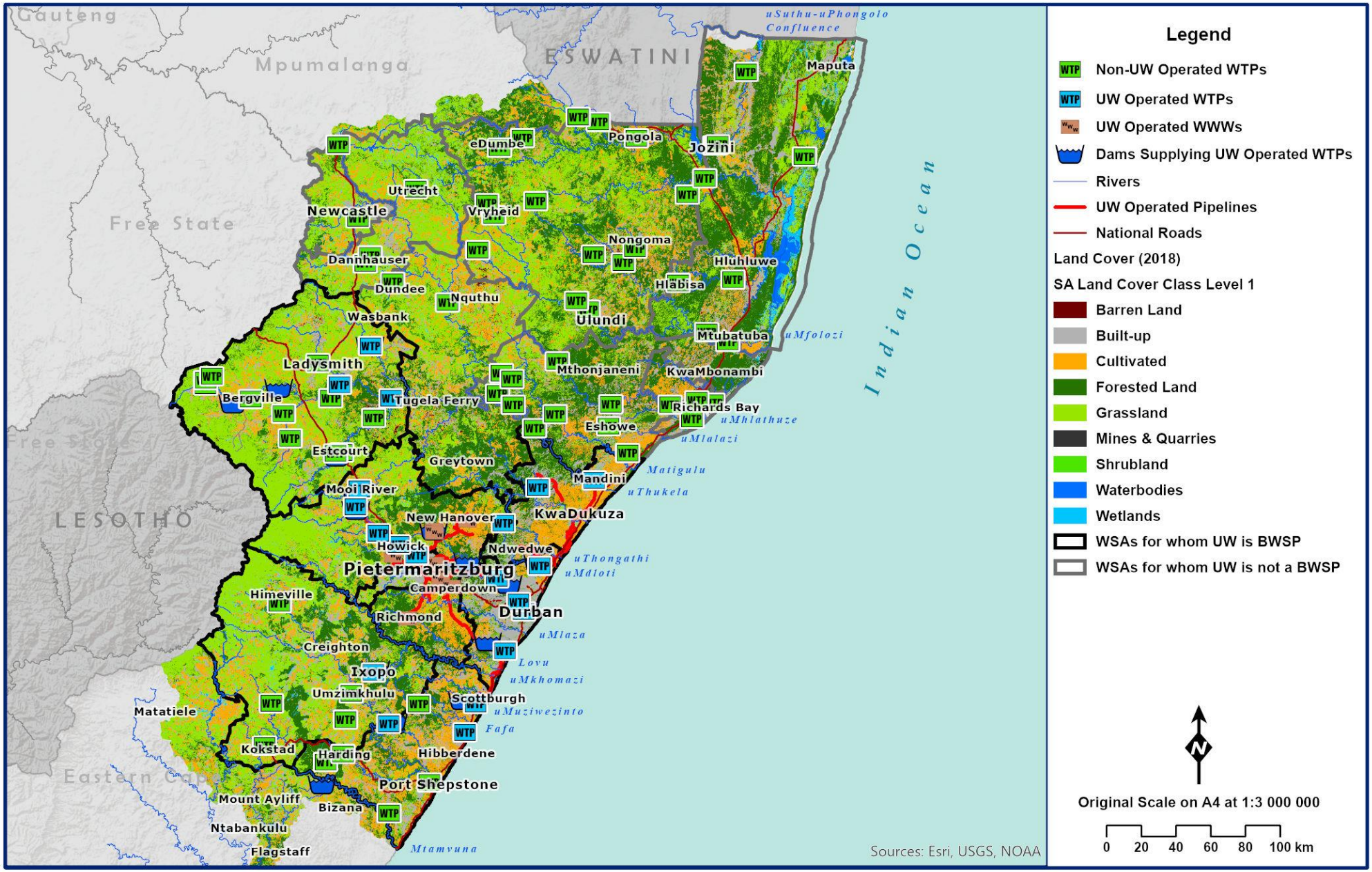


Figure 2.4 Land cover (DEA and GTI 2018; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

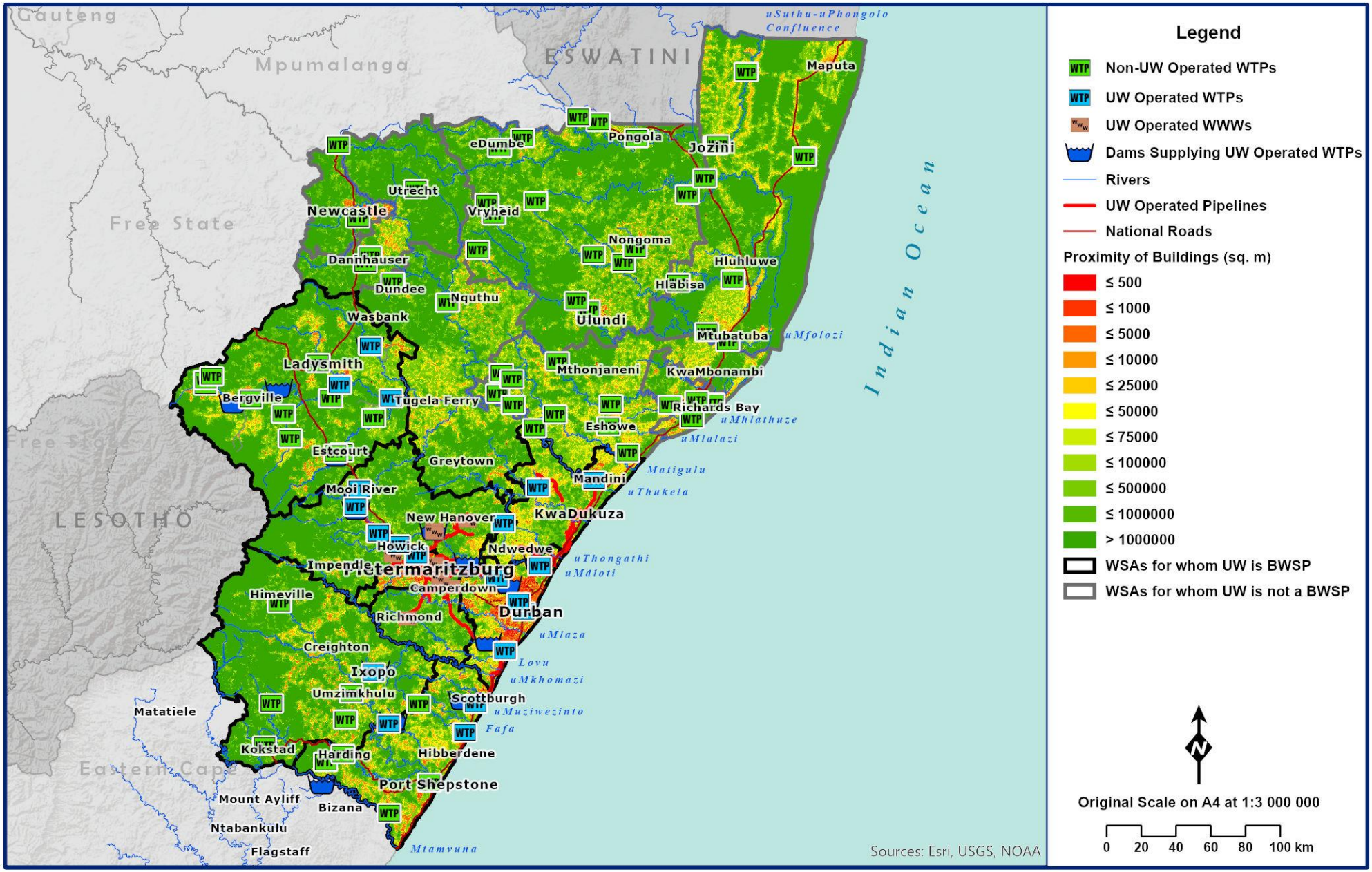


Figure 2.5 Thiessen polygon analysis showing proximity of buildings to one another (per m^2) (after Stats SA DF 2015; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

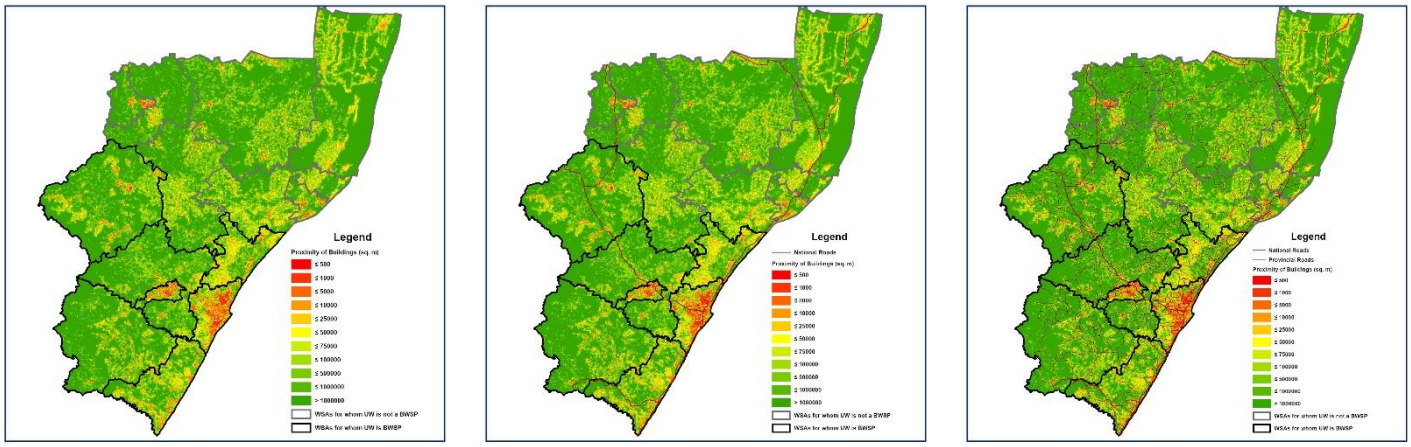


Figure 2.6 Relationship between distribution of people and access using proximity of buildings to one another and national and provincial roads as proxies (after Stats SA Dwelling Framework 2015, KZN DoT 2017, MBD 2016).

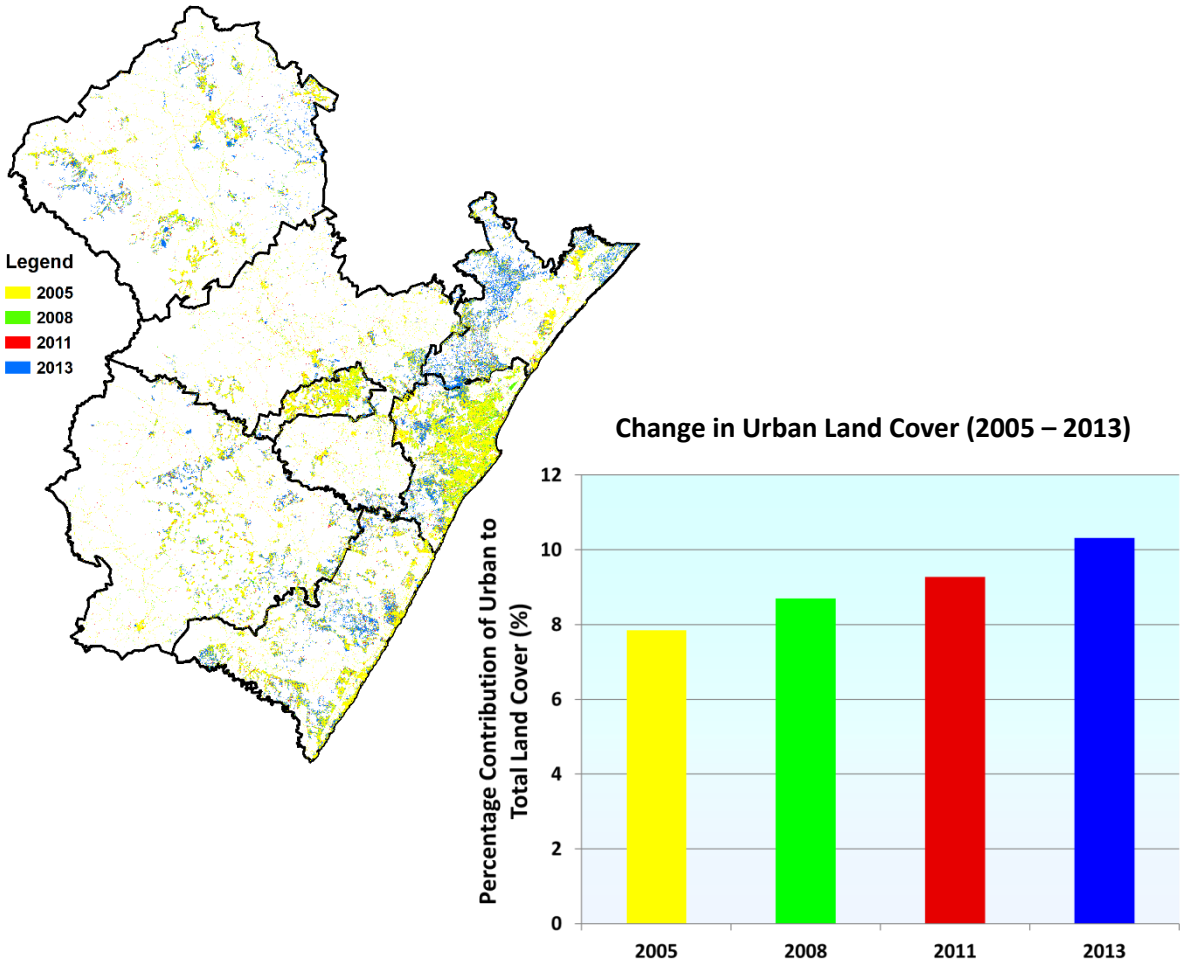


Figure 2.7 Change in urban category of land cover in Umgeni Water's operational area (2005 – 2013) (after EKZNW 2014; DEA and GTI 2015).

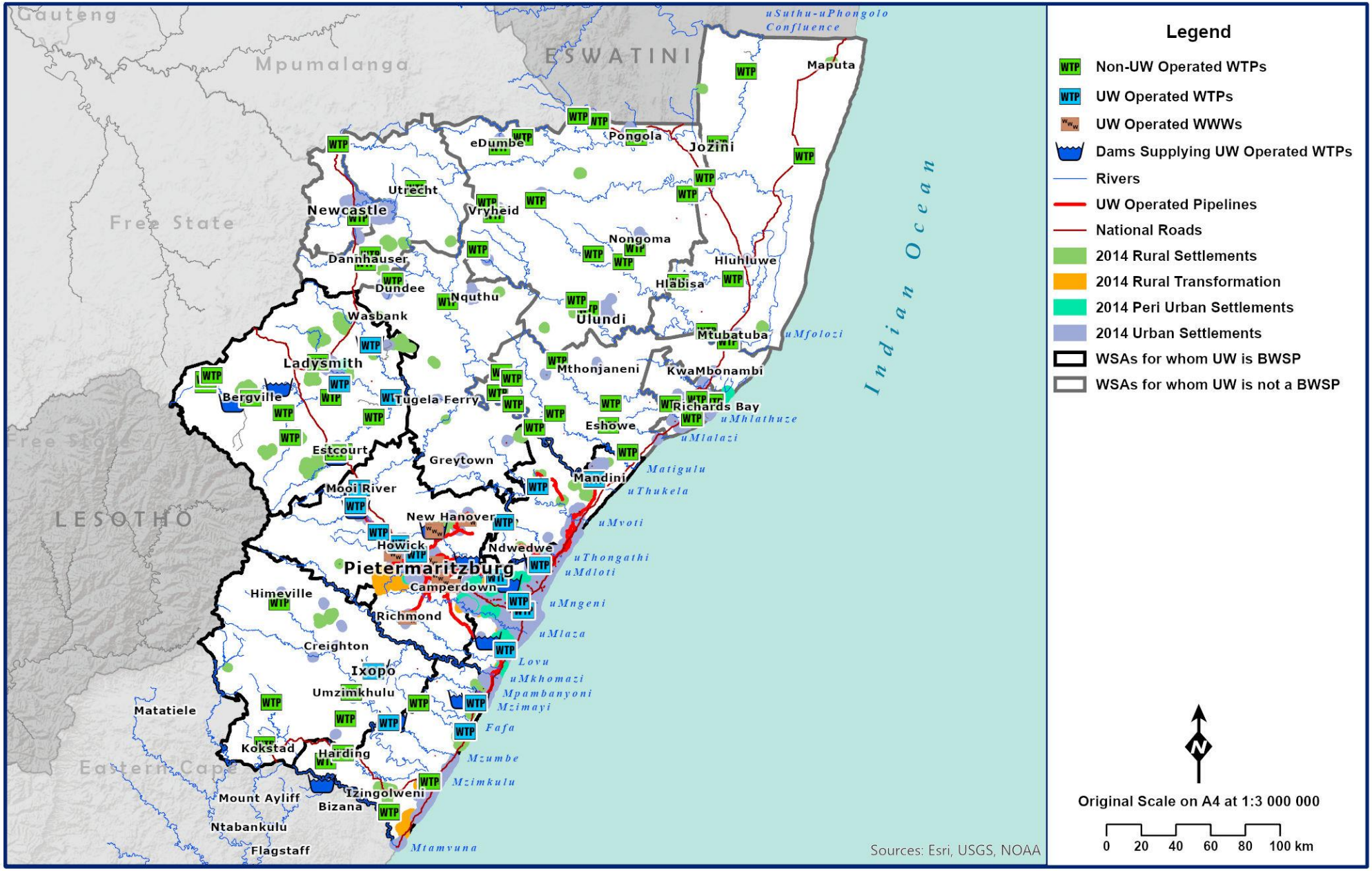


Figure 2.8 Settlement footprints (DRDLR 2015; eThekwini Municipality 2014; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

It is shown in **Figure 2.9** that whilst uThukela District Municipality has the largest surface area within Umgeni Water's area of operation, it only contributes 9.51% (706 588 people) to the total number of people, whilst eThekwini Municipality has the highest number of people (3 702 231 people) but the second smallest surface area (Community Survey 2016).

The change in the number of people per WSA for the period 2011 - 2016 is shown in **Figure 2.10**. The change in the number of households per WSA for the period 2011 – 2016 is shown in **Figure 2.11**. It is noted that these two figures are comparing data from two different sources viz. the Census 2011 and the Community Survey 2016. The numbers therefore should be read as estimates as the Community Survey 2016 is a sample in which the results are extrapolated to represent entire municipalities[4].

The average household size decreased in the eThekwini and iLembe WSAs for the period 2011 – 2016 (3.6 people to 3.3 people in eThekwini and 3.8 people to 4 people in iLembe) as shown in **Figure 2.12**. It is further shown that the average household size remained constant in the Msunduzi, uMgungundlovu, Harry Gwala and uThukela WSAs (3.8 people, 3.7 people, 4.1 people and 4.5 people respectively) and increased in the Ugu WSA from 4.0 people to 4.3 people (**Figure 2.12**).

The change in the population growth rates (percentage per annum) for the periods 1996 – 2001, 2001 – 2011 and 2011 – 2016 for Umgeni Water's operational area is shown in **Figure 2.13**. This figure shows that whilst eThekwini WSA and Msunduzi WSA are still experiencing positive growth rates, Maphumulo Municipality in iLembe WSA and Impendle Municipality in uMgungundlovu have consistently experienced negative growth rates. Umzumbe Municipality in Ugu WSA further experienced negative growth rates in the periods 2001 – 2011 and 2011 – 2016. Both Maphumulo Municipality and Umzumbe Municipality had bulk water supply schemes commissioned in the 2011 – 2016 period (Maphumulo Bulk Water Supply Scheme discussed in **Section 12** and Mhlabatshane Bulk Water Scheme discussed in **Section 11**) and both these schemes are demonstrating growth in water demand. A possible reason for the growth in water consumption, whilst experiencing a negative population growth rate, is that with an assured supply of water, the water service levels in the areas have increased. The growth rates for the two municipalities in uThukela WSA that experienced negative growth in the 2001 – 2011 period increased to positive growth in the 2011 – 2016 period.

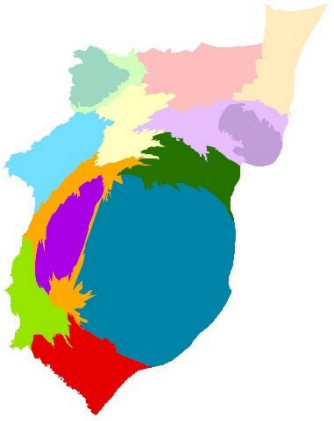
The mid-year population estimates per district municipality (2016 municipal boundaries)[5] is presented in **Table 2.2**.

[4] See http://cs2016.statssa.gov.za/?portfolio_page=cs-2016-technical-report-web for the methodology report on the Community Survey 2016 and http://cs2016.statssa.gov.za/?portfolio_page=cs-2016-metadata for the metadata report.

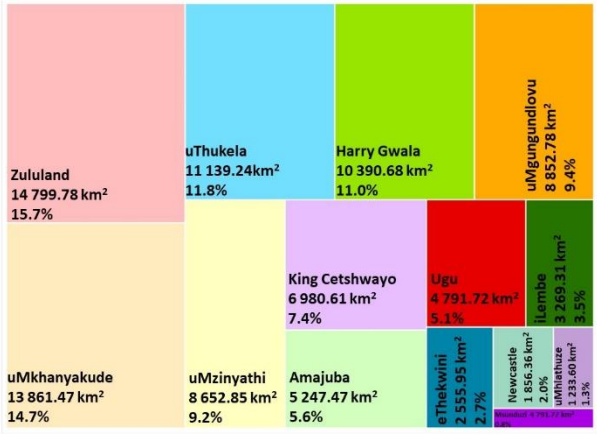
[5] See http://www.statssa.gov.za/?page_id=1854&PPN=P0302.

Surface Area (km^2) of WSAs (MDB 2016)

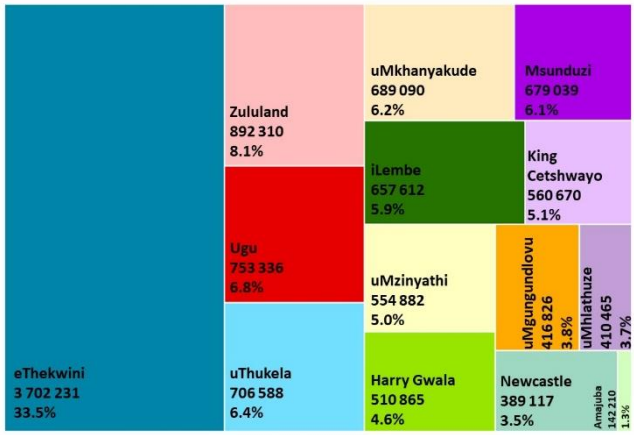
Cartogram of Number of People per WSA (CS 2016)



Contribution of WSA Surface Area to KZN



Contribution of Number of People per WSA to KZN



WSA Name	Area (sq. km) (MDB 2016)	Percentage Contribution per Area	Percentage Contribution per Number of People	Number of People (CS 2016)
Amajuba	5 247.47	5.56	1.29	142 210.00
eThekwini	2 555.95	2.71	33.46	3 702 231.00
iLembe	3 269.31	3.46	5.94	657 612.00
Newcastle	1 856.36	1.97	3.52	389 117.00
Harry Gwala	10 390.68	11.01	4.62	510 865.00
Msunduzi	751.19	0.80	6.14	679 039.00
Ugu	4 791.72	5.08	6.81	753 336.00
uMgungundlovu	8 852.78	9.38	3.77	416 826.00
uMhlathuze	1 233.60	1.31	3.71	410 465.00
uMkhanyakude	13 861.47	14.69	6.23	689 090.00
uMzinyathi	8 652.85	9.17	5.01	554 882.00
uThukela	11 139.24	11.80	6.39	706 588.00
King Cetshwayo	6 980.61	7.40	5.07	560 670.00
Zululand	14 799.78	15.68	8.06	892 310.00
Total	**94 383.02**	**100.00**	**100.00**	**11 065 241.00**

Figure 2.9 Contribution per number of people (Community Survey 2016) and surface area (MDB 2016) to UW's operational area.

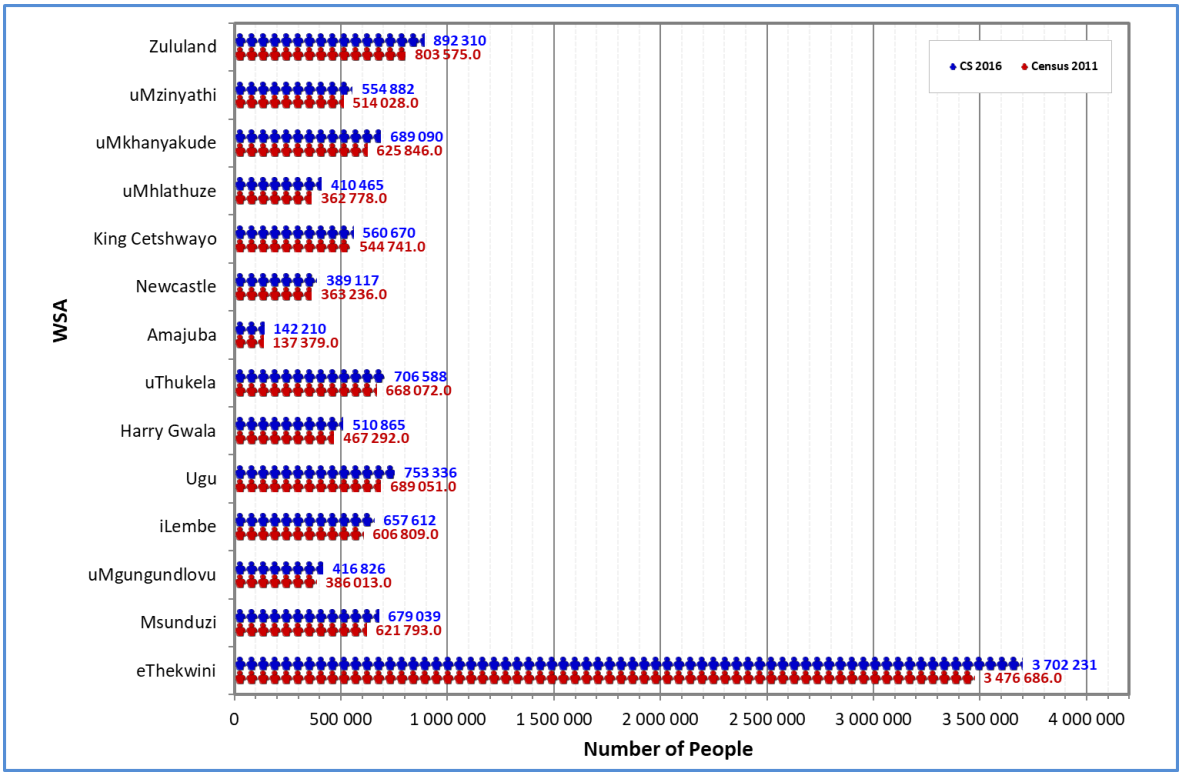


Figure 2.10 Change in number of people per WSA for 2011 and 2016 (Stats SA 2017).

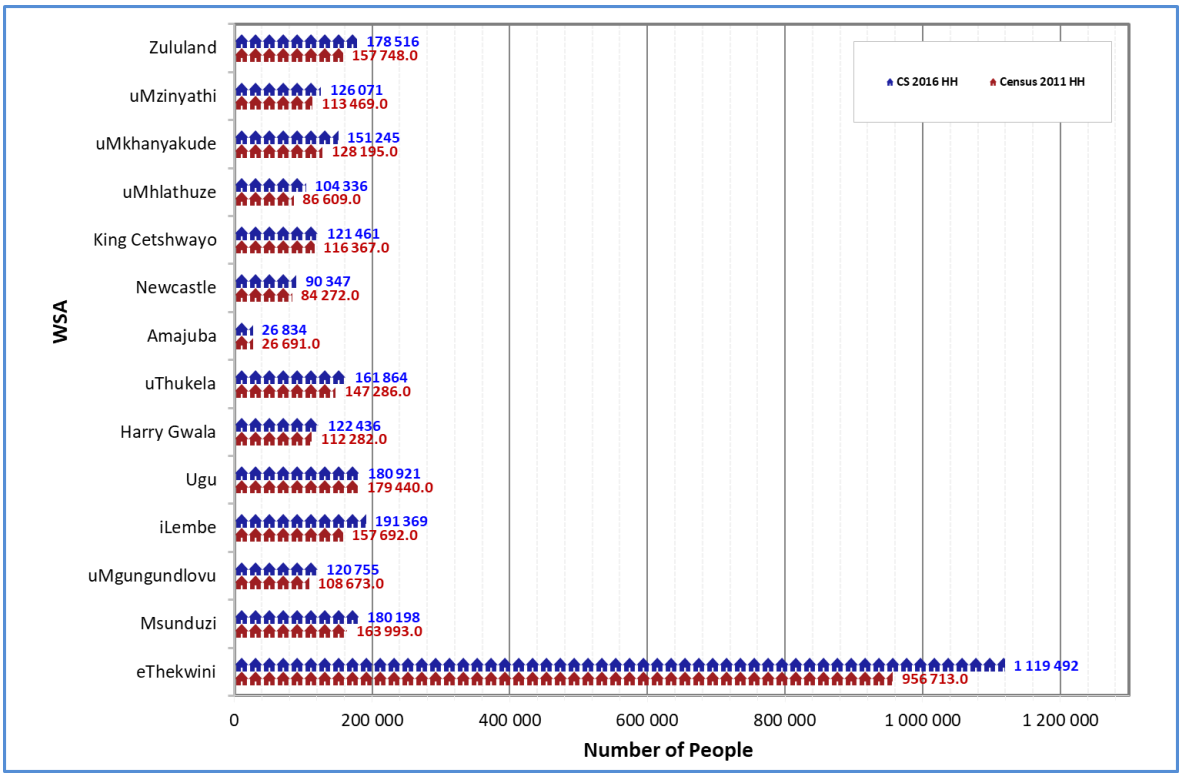


Figure 2.11 Change in number of households per WSA for 2011 and 2016 (Stats SA 2017).

WSA Name	Census 2011 Household Size	Change	CS2016 Household Size
eThekwini	3.6	↓	3.3
iLembe	3.8	↓	3.4
Msunduzi	3.8	=	3.8
uMgungundlovu	3.7	=	3.7
Ugu	4.0	↑	4.3
Harry Gwala	4.1	=	4.1
uThukela	4.5	=	4.5
Newcastle	4.3	=	4.3
Amajuba	4.5	=	4.5
uMzinyathi	4.5		4.4
Zululand	5.1	↓	5.0
uMkhanyakude	4.9	↓	4.6
City of uMhlathuze	3.9	↓	3.6
King Cetshwayo	4.5	↓	4.3

Figure 2.12 Change in average household size per WSA for 2011 and 2016 (Stats SA 2017).

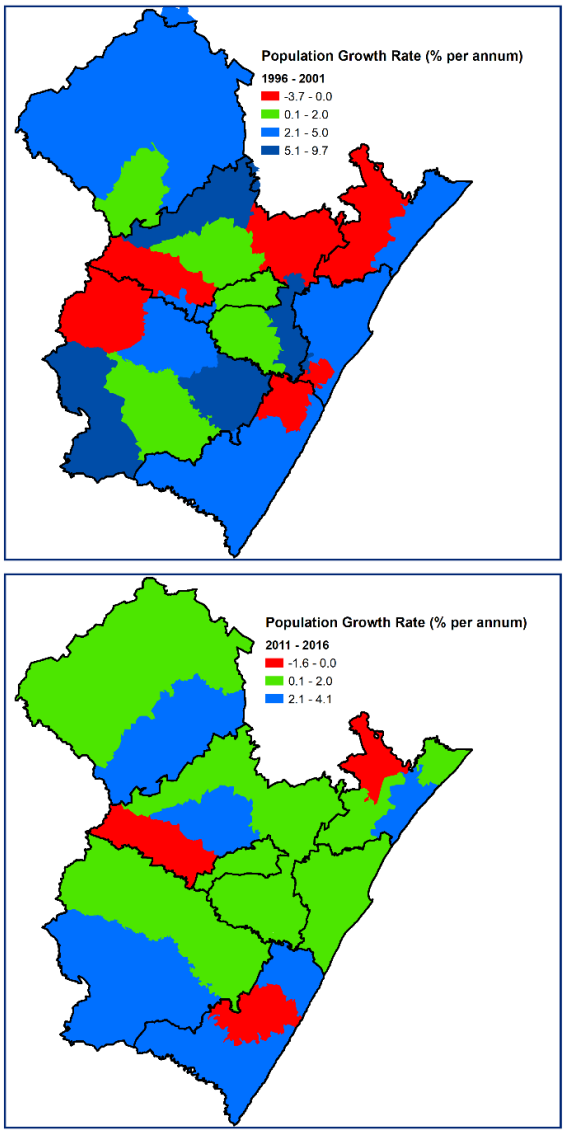


Figure 2.13 Change in population growth rate (percentage per annum) in Umgeni Water's operational area for 1996 – 2001[6], 2001 – 2011[7] and 2011 - 2016[8] (Stats SA 2013; 2018).

[6] 2011 municipal boundaries as presented in Stats SA 2013.

[7] 2011 municipal boundaries as presented in Stats SA 2013.

[8] 2016 municipal boundaries as presented in Stats SA 2018.

Table 2.2 Mid-year population estimates per district municipality[9] (2020 – 2030) (Stats SA 2020: spreadsheet).

District Municipality	Census 2011	CS 2016	Mid-Year Population Estimates		
			2020	2025	2030
eThekwini	3 476 686	3 702 231	3 947 020	4 215 613	4 475 240
uMgungundlovu	1 007 806	1 095 865	1 133 714	1 202 984	1 285 639
iLembe	606 809	657 612	678 167	713 550	746 233
Ugu	689 051	753 336	813 460	871 753	941 129
Harry Gwala	467 292	510 865	506 181	524 780	547 800
uThukela	668 072	706 588	706 263	718 603	733 603
Amajuba	500 615	531 327	563 811	592 621	622 394
uMzinyathi	514 028	554 882	562 159	594 953	631 882
Zululand	803 575	892 310	862 184	886 398	911 793
uMkhanyakude	625 846	689 090	674 997	697 528	721 621
King Cetshwayo	907 519	971 135	963 681	989 104	1 014 387
Total	**10 267 300**	**11 065 240**	**11 411 637**	**12 007 887**	**12 631 723**

2.2 Natural Environment

There are three distinct climatic zones within Umgeni Water's operational area (**Figure 2.14**), namely:

- The Köppen classification Cwa which is the humid subtropical climate with long, hot dry winters found in the Battlefields region (see distribution of grassland and thicket, bushland and scrub forest in **Figure 2.4**).
- The Köppen classification Cwb which is the alpine-type climate found in and along the Drakensberg Mountains (see distribution of grassland in **Figure 2.4**).
- The Köppen classification Cfb which is the more temperate summer rain climate of the Midlands region (see distribution of forests in **Figure 2.4**).
- The Köppen classification Cfa which is the subtropical perennial rainfall characterising the areas along the coast (see distribution of thicket, bushland and scrub forest in **Figure 2.4**).

The mean annual precipitation (MAP) within the Umgeni Water operational area varies between 700 and 1000 mm (**Figure 2.14**) with most rains falling in summer (October to March), although there are occasional winter showers. The national average MAP is about 450 mm per year. The peak rainfall months are December to February in the inland areas and November to March along the coast.

[9] 2016 municipal boundaries.

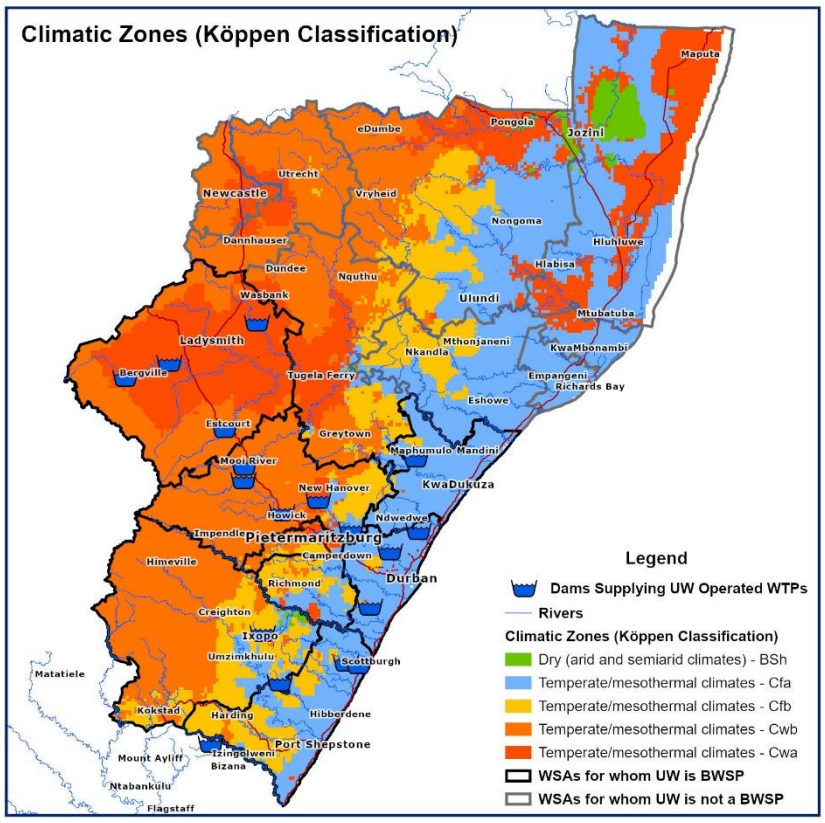
The prevailing weather patterns are predominantly orographic, where warm moist air moves in over the continent from the Indian Ocean, rises up the escarpment, cools down and creates rainfall. Rain shadows occur in the interior valley basins of the major rivers where the annual rainfall can drop to below 700 mm.

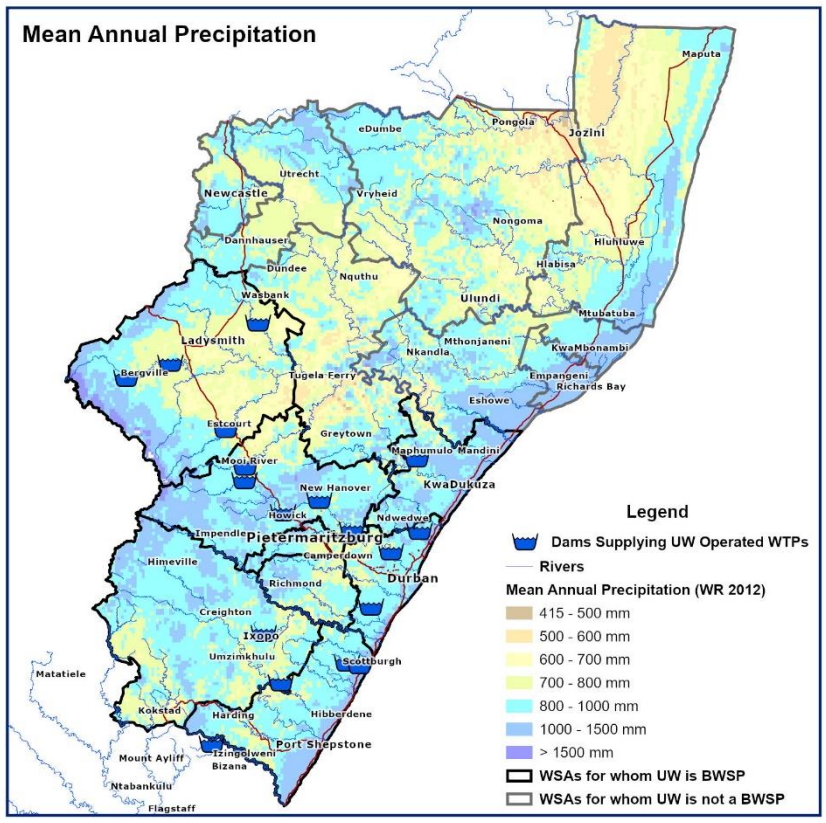
The precipitation shown in **Figure 2.14** drain into the catchments shown in **Figure 2.15**. These catchments encompass, and impact upon, Umgeni Water's operational area. These catchments have been grouped into logical regions as shown in **Figure 2.15**.

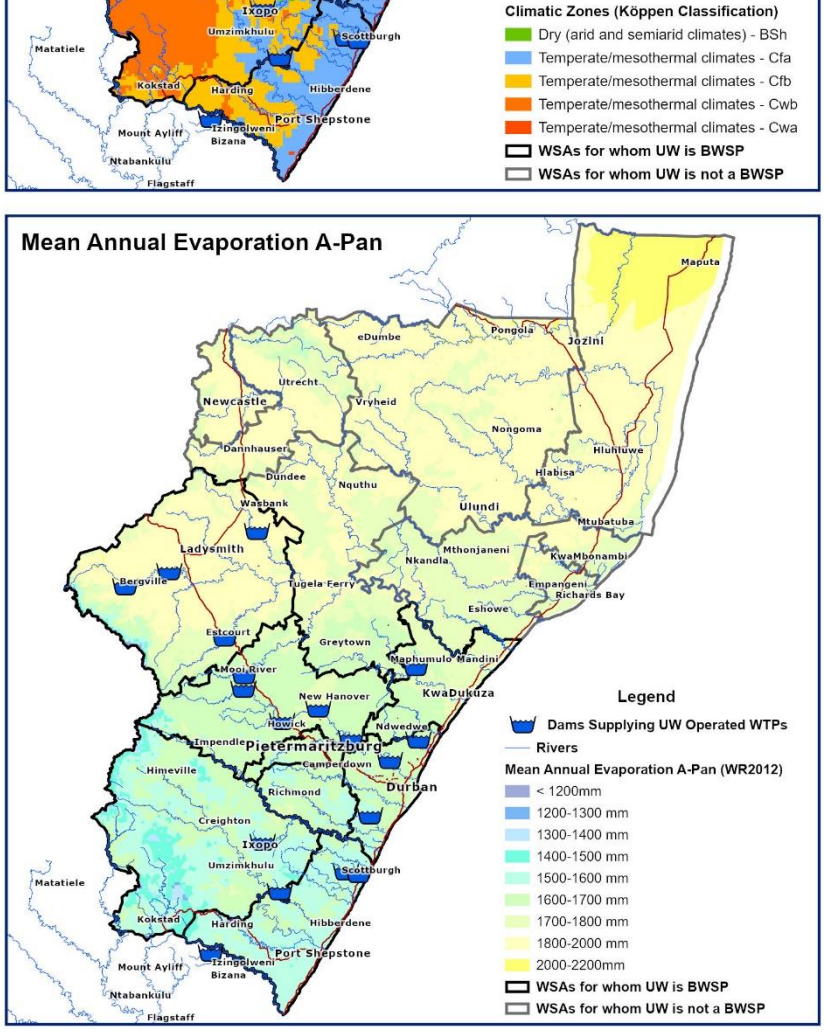
The spatial distribution of evaporation is shown in **Figure 2.14** (A-Pan and S-Pan). This distribution has a similar pattern to rainfall where a relative high humidity is experienced in summer. There is a daily mean peak in February, ranging from 68% in the inland areas to greater than 72% for the coast and a daily mean low in July, ranging from 60% in the inland areas to greater than 68% at the coast. Potential mean annual gross evaporation (as measured by 'A' pan) ranges from between 1 600 mm and 2 000 mm in the west to between 1 400 mm and 1 600 mm in the coastal areas (**Figure 2.14**).

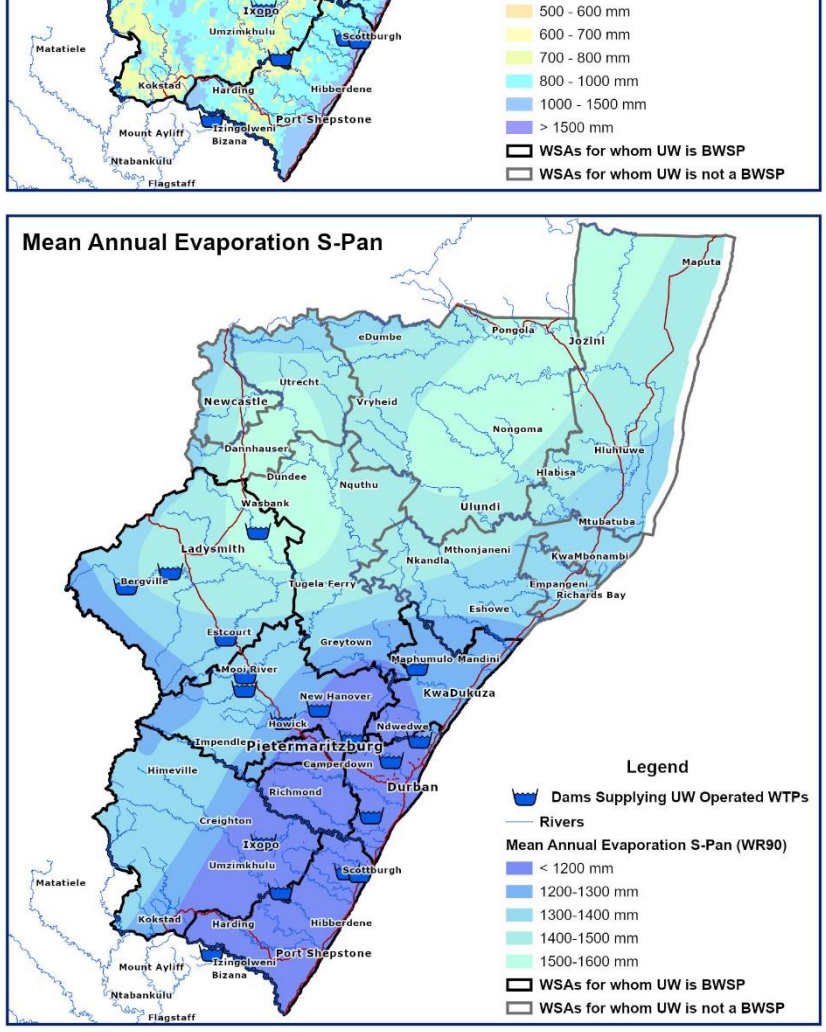
Temperature distribution is shown in **Figure 2.14**. The mean annual temperature ranges between 12°C and 14°C in the west to between 20°C and 22°C at the coast. Maximum temperatures are experienced in the summer months of December to February and minimum temperatures in the winter months of June and July. Snowfalls on the Drakensberg Mountain between April and September have an influence on the climate. Frost occurs over the same period in the inland areas. The average number of heavy frost days per annum range from 31 to 60 days for inland areas to nil for the eastern coastal area.

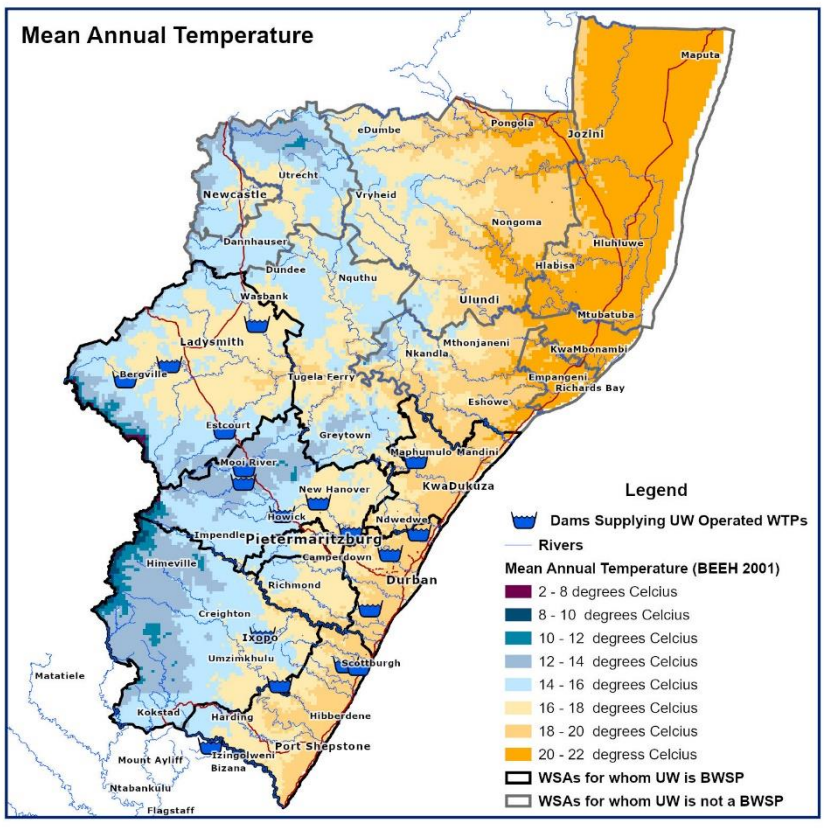
The mean annual runoff is illustrated in **Figure 2.14**. The spatial distribution of mean annual runoff is highly variable from the Drakensberg mountain range towards the coastal areas with more runoff generated from the mountains and the coastal areas and lesser generated in the inland regions. It is estimated that the surface runoff and groundwater resources occurring in the catchments of the Mvoti to uMzimkhulu are 433 million m^3/annum and 6 million m^3/annum, respectively.











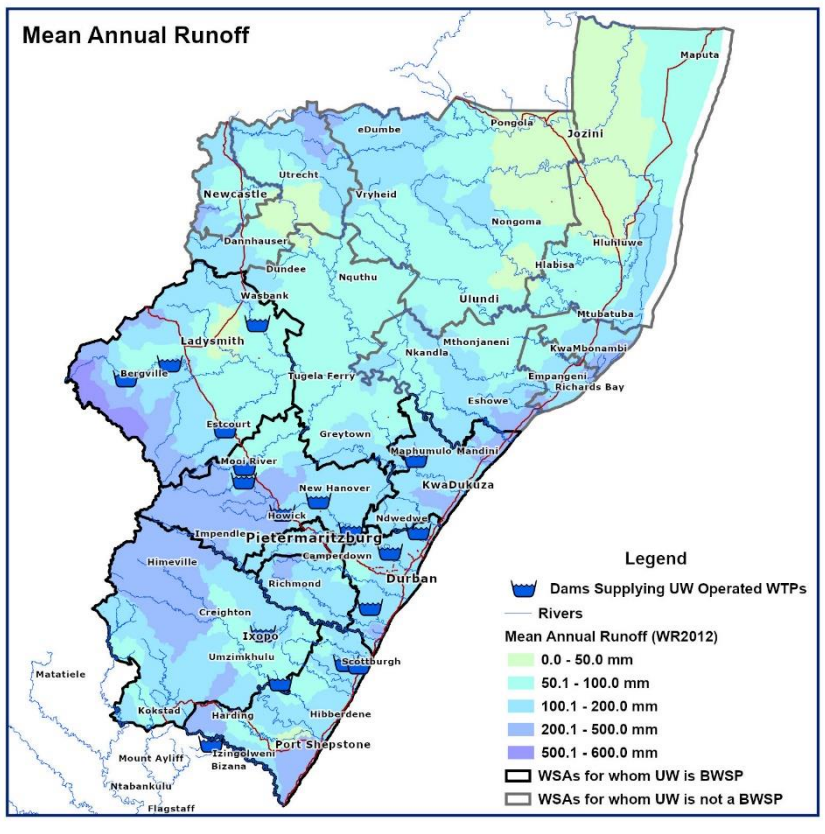


Figure 2.14 Climatic variables (BEEH 2011; KZN DoT 2017; MDB 2016; Umgeni Water 2019; WR2012).

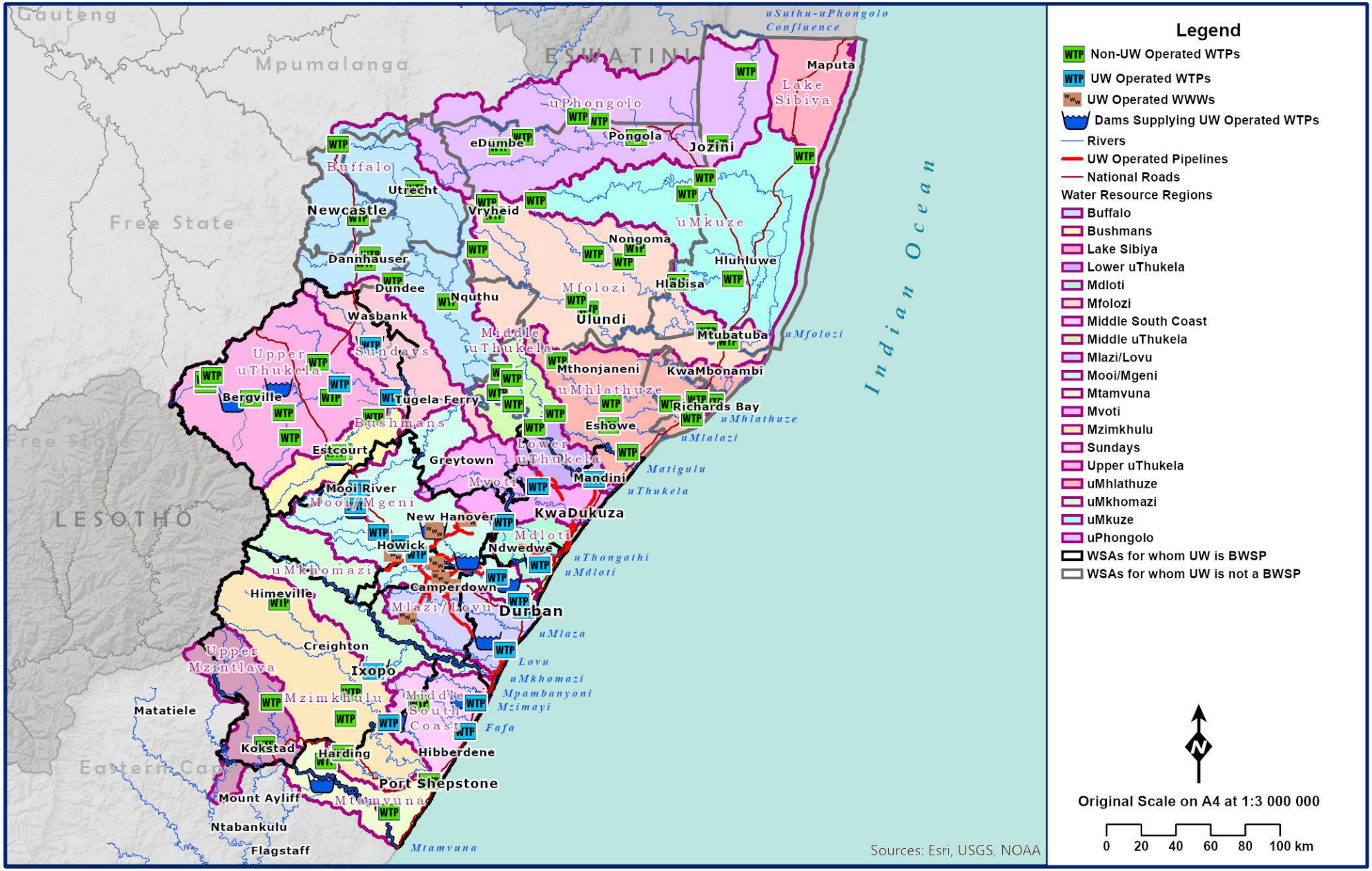


Figure 2.15 Water resource regions (KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

The groundwater regions (commonly referred to as the Vegter regions) based on lithology and climatology are shown in **Figure 2.16**. It is shown that there are three regions in Umgeni Water's operational area:

- *KwaZulu-Natal Coastal Foreland* where "the fractured aquifers are formed by predominantly arenaceous rocks consisting of sandstone and diamictite that is Dwyka tillite, which forms very productive aquifers in KZN. The intergranular and fractured aquifers are formed meta-arenaceous and acid/intermediate intrusive rocks" (DWA 2008: 18).

- *Transkeian Coastal Foreland and Middleveld* where DWS states that the "aquifer types occurring in this region are mapped as low to medium potential and the geology consists of mostly arenaceous rocks" (DWA 2008: 20).

- *Northwestern Middleveld* where "the 1 : 500 000 scale hydrogeological map indicate the aquifer type as intergranular and fractured with an extremely low to medium development potential. The underlying geology is mostly arenaceous rock of the Ecca Formation" (DWA 2008: 16).

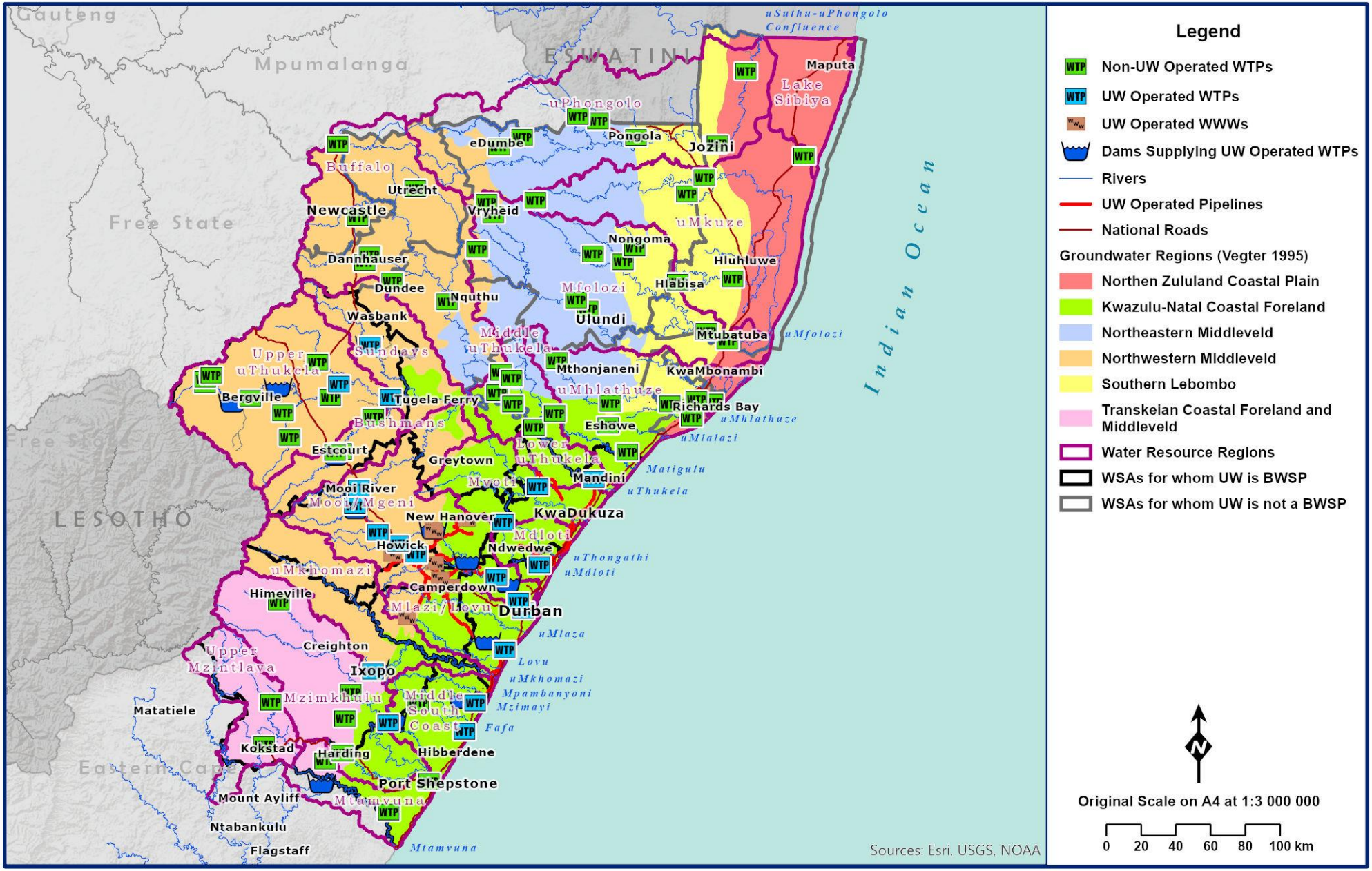


Figure 2.16 Groundwater regions (KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

Ezemvelo KZN Wildlife (EKZNW) explains that the:

> "KZN Biodiversity Plan (KZN BP) provides a spatial representation of land and coastal marine area required to ensure the persistence and conservation of biodiversity within KZN, reflected as *Critical Biodiversity Areas (CBA)* and *Ecological Support Areas (ESA)*".
>
> (EKZNW 2016: 23)

The definitions and categories of the CBAs and ESAs are defined in **Table 2.3**. The distribution of these areas in relation to Umgeni Water's existing and recommended infrastructure (**Volumes 2 – 6 and 10**) and the KZN WTPs is shown in **Figure 2.17**.

Table 2.3 Definitions of key KZN Biodiversity Plan terms (EKZNW 2016: 25).

KZN Biodiversity Plan Area	Purpose of this Area
Critical Biodiversity Areas: Irreplaceable	"Areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence of viable populations of species and the functionality of ecosystems".
Critical Biodiversity Areas: Optimal	"Areas that represent an optimised solution to meet the required biodiversity conservation targets while avoiding high cost areas as much as possible (Category driven primarily by process, but is informed by expert input)".
Ecological Support Areas	"Functional but not necessarily entirely natural terrestrial or aquatic areas that are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the Critical Biodiversity Areas. The area also contributes significantly to the maintenance of *Ecosystem Services*".
Ecological Support Areas: Species Specific	"Terrestrial modified areas that provide a critical support function to a threatened or protected species, for example agricultural land or dams associated with nesting/roosting sites".

It is shown in **Figure 2.17** that some of Umgeni Water's existing infrastructure and recommended infrastructure are located within CBAs and ESAs. Similarly, it is shown in **Figure 2.18** that some of Umgeni Water's existing infrastructure and recommended infrastructure are located on high-value agricultural land i.e. land the KZN Department of Agriculture and Rural Development (DARD) have identified as "Category A: Irreplaceable" and "Category B: Threatened".

KZN DARD undertook a study in 2012 categorising all agricultural land within KZN. This study (**Figure 2.18**) is important for food security as it shows the most high-value agricultural land as well as those areas in which the land has been completely transformed. It is shown in **Figure 2.18** that most of the transformed land is within Msunduzi WSA and eThekwini WSA. It is also shown that the most high-value agricultural land i.e. the agricultural land that is "Category A – Irreplaceable" is predominantly located in uMgungundlovu WSA with large areas in Harry Gwala WSA, along the "shadow corridor" in iLembe WSA and along the Drakensberg in uThukela WSA.

Conventionally the provision of bulk infrastructure acts as a catalyst in transforming land into "urban" areas. This means that when Umgeni Water receives requests for the provision of bulk potable water in areas that are categorised as CBAs and ESAs in terms of biodiversity value or "Irreplaceable" in terms of agricultural value, Umgeni Water will need to work in close consultation with the EKZNW and/or KZN DARD to determine the most appropriate form of infrastructure provision.

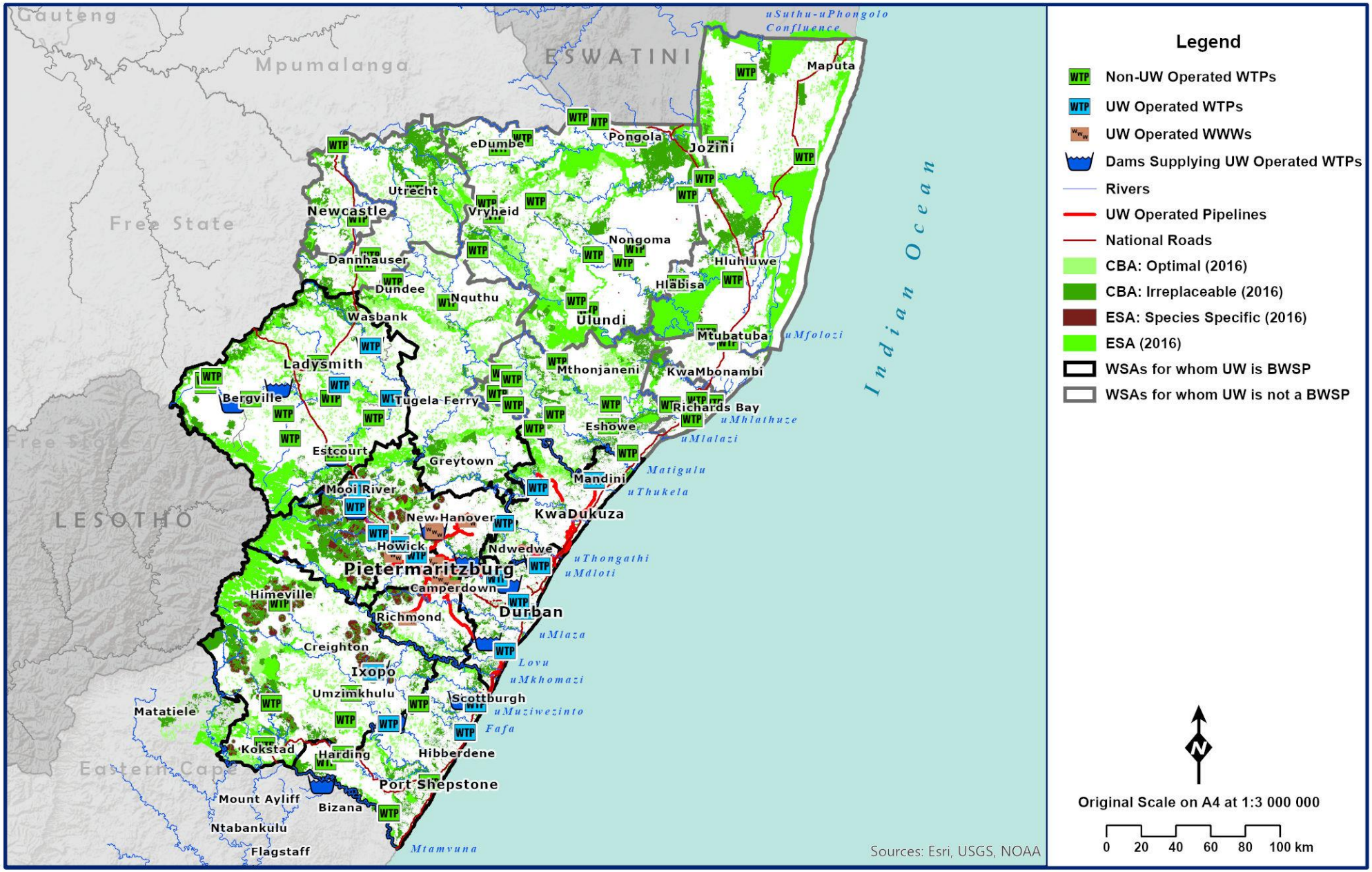


Figure 2.17 KZN Biodiversity Plan Critical Biodiversity Areas and Ecological Supports Areas (EKZNW 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

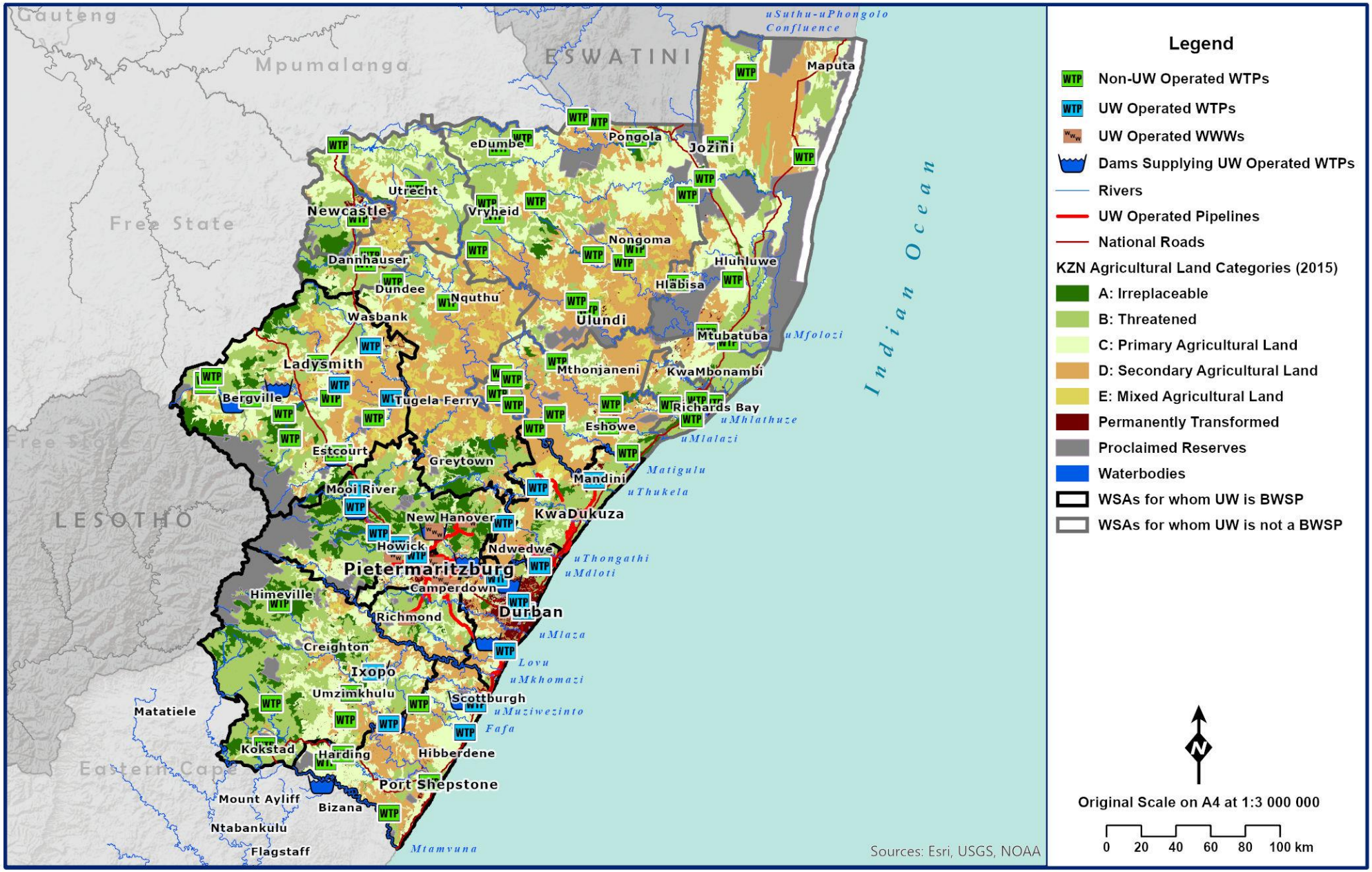


Figure 2.18 Agricultural land categories (KZN DARD 2015; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

The land use occurring on traditional areas (DRDLR 2012) is illustrated in **Figure 2.19**. A comparison of **Figure 2.18** and **Figure 2.19** shows that there are pockets of high-value agricultural land within traditional areas. There is a common perception that all traditional areas require a complete network in service provision. However, **Figure 2.19** shows that the predominant land use within traditional areas is agriculture. Therefore, the assumption that a network is required for service provision may unintentionally compromise food security.

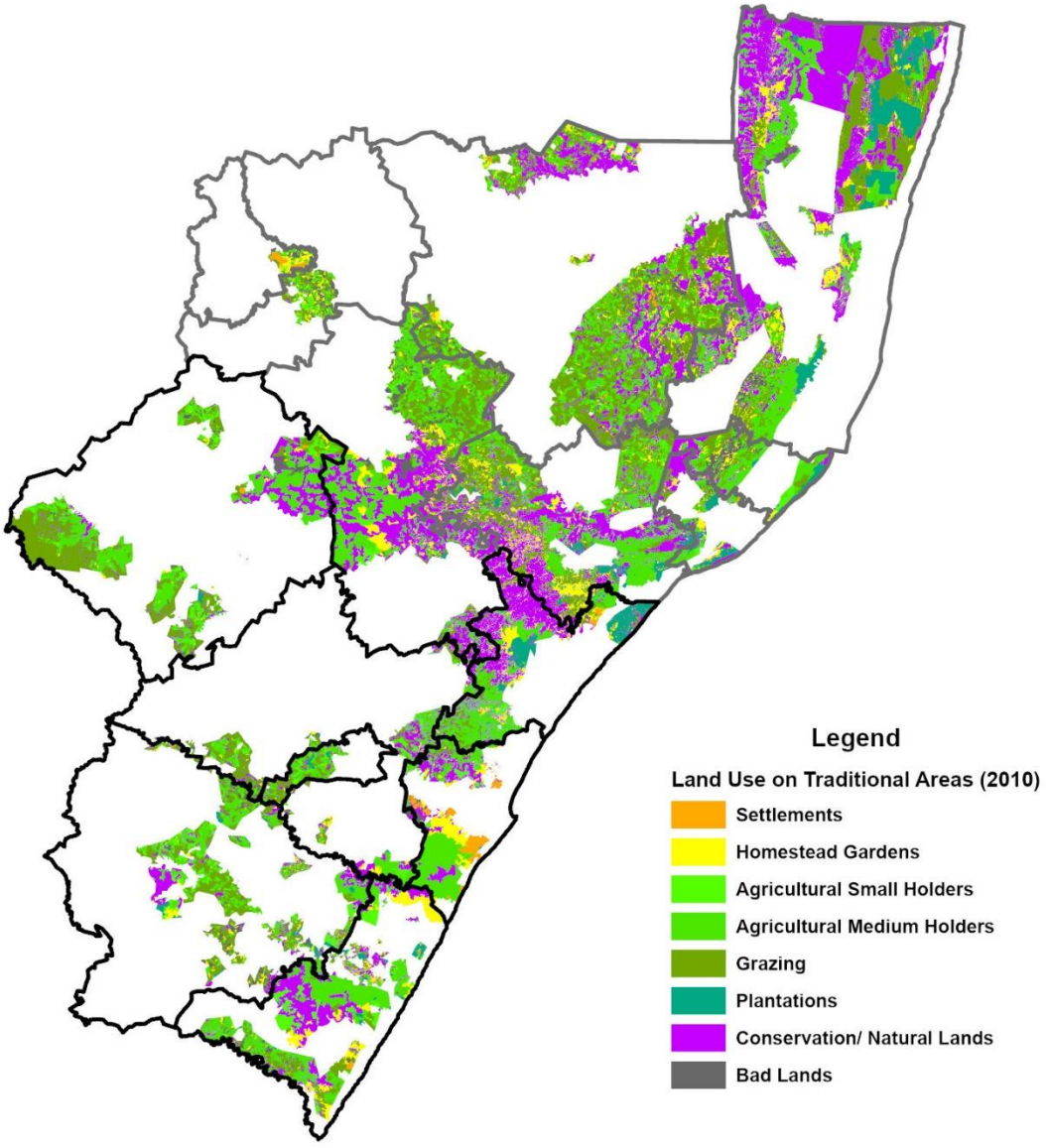


Figure 2.19 2010 land use on traditional areas (DRDLR 2012).

2.3 Existing Development Status

The Gross Domestic Product by Region (GDP-R) for the KZN WSAs for the period 2001 – 2019 is shown in **Figure 2.20** and the percentage contributions of municipal GDP-R to the total KwaZulu-Natal GDP-R for 2017 is illustrated in **Figure 2.21**.

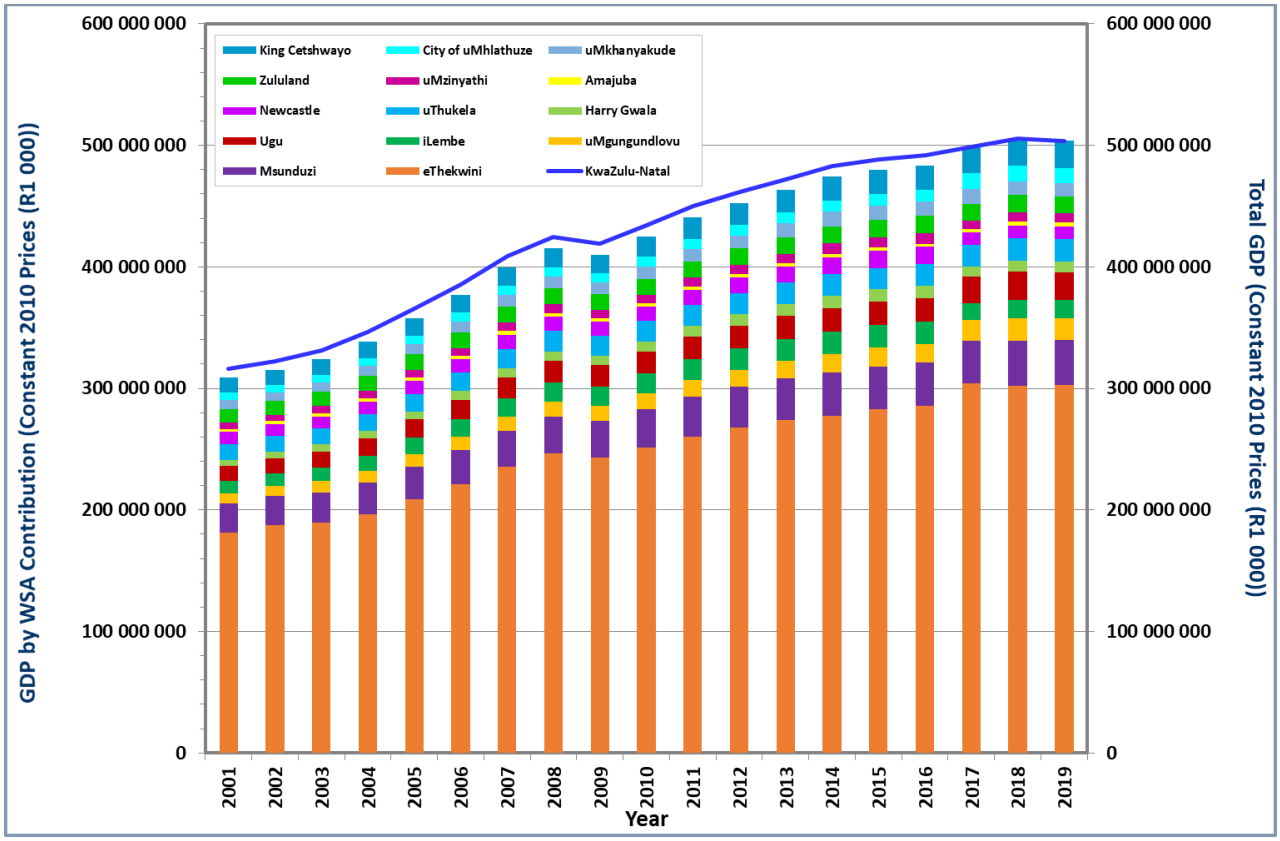


Figure 2.20 GDP by WSA Contribution for the period 2001 – 2019 (KZN Treasury after Global Insight 2018; 2016 municipal boundaries).

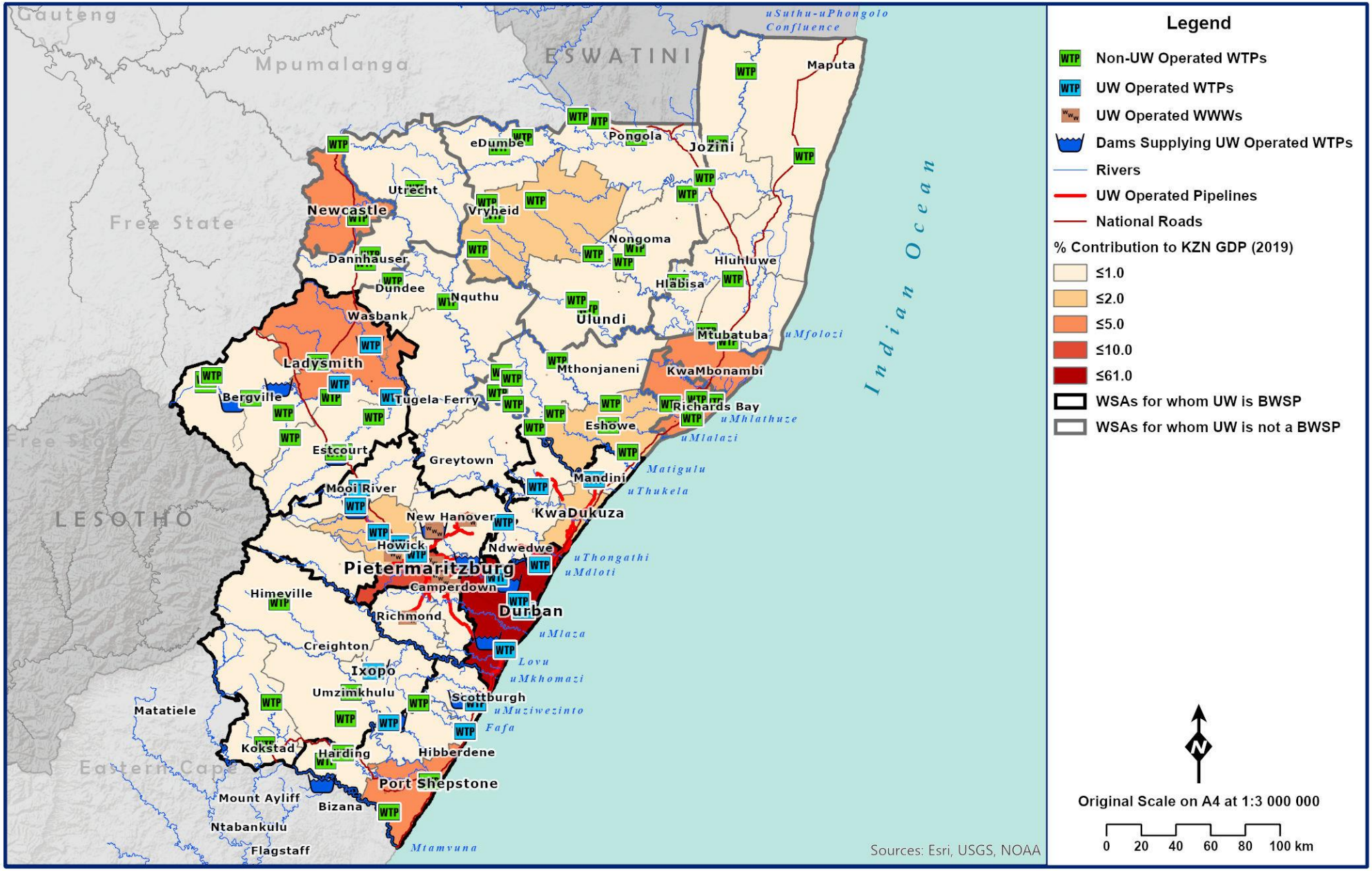


Figure 2.21 Percentage contribution of municipal GDP to KZN GDP (2019) (KZN Treasury after Global Insight 2020).

The categorisation of municipalities and settlements assists in planning for the appropriate level of service provision. Schmidt and Du Plessis state that the primary variables used in the classification of settlement typology are administration; morphology; demographics and function (2013: 13).

The Municipal Infrastructure Investment Framework (MIIF) categorisation (Municipal Demarcation Board 2012) was developed in 2009 using administration as the predominant variable (the criteria included municipal category type; budget size; number of people; size of settlements etc.). Based on the 2009 State of Local Government Report (CoGTA 2009a) and using the 2011 municipal boundaries, this categorisation is still used in some planning reports e.g. the 2018 KZN Citizen Satisfaction Survey: Analytical Report. The MIIF categorisation has been used by the National Treasury, Municipal Demarcation Board (MDB) and Statistics South Africa (Stats SA). Research undertaken to date has not identified if this categorisation has been updated.

The MIIF categorisation for KZN is illustrated in **Figure 2.22**. A comparison between **Figure 2.21** and **Figure 2.22** shows that Umgeni Water's existing infrastructure is predominantly located in the higher performing municipalities.

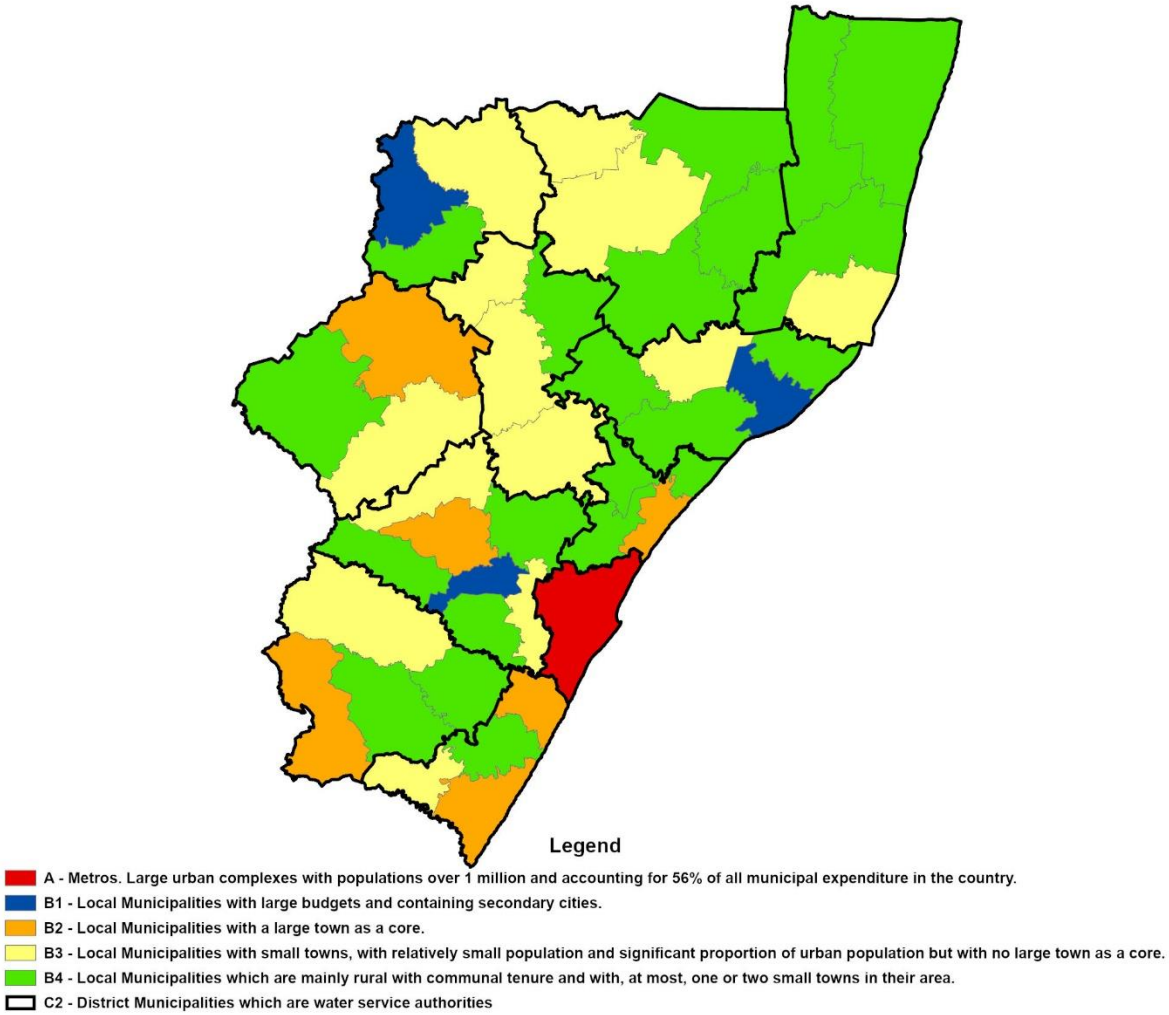


Figure 2.22 Municipal Infrastructure Investment Framework categorisation of municipalities (CoGTA 2009; MDB 2016; Stats SA 2018).

The "Functional Settlement Typology" was "originally developed by the Council for Scientific and Industrial Research (CSIR) as part of the National Spatial Trends Overview project (2008 – 2009) commissioned by the South African Cities Network, The Presidency and the former DPLG to inform Cabinet discussions on urban development policy aspects and the process of developing a National Urban Development Framework" (CSIR 2015: 2). This settlement typology is commonly referred to as the "CSIR/SACN South African Settlement Typology"[10] and was updated in 2015 with the objective of "supporting the identification, description and understanding of:

- Nodes, settlement and land use patterns;
- Sparsely populated areas of South Africa, in terms of key land; and
- Municipality-wide settlement patterns."

(CSIR 2015: 3)

The definitions used in this typology are shown in **Table 2.4** and the typology classification is illustrated in **Figure 2.23**.

Table 2.4 CSIR/SACN Settlement Typology functional settlement type (CSIR 2015: 6 – 8).

CSIR/SACN Settlement Typology Type	Definition	Example
City Region	Population > 1 million Government and Economic Services Index > 7	eThekwini City Region
City	Population 500 000 – 1 million Government and Economic Services Index 2 - 5	Pietermaritzburg
Regional Centre 1	Population 300 000 – 500 000 Government and Economic Services Index 1 – 2 High population numbers and high economic activity	This type is not found within Umgeni Water's area of operation
Regional Centre 2	Population 100 000 – 300 000 Government and Economic Services Index > 0.3 High population numbers in densely settlement areas	KwaDukuza
Regional Centre 3	Population 40 000 – 100 000 Government and Economic Services Index > 0.25 Low population numbers playing a key role in sparsely populated areas	This type is not found within Umgeni Water's area of operation
Service Town	Population mostly > 20 000 Significant role in hinterland (Service Index 0.065 – 0.25)	Mandini
Local or Niche Town	Population size varies widely Service role in immediate surroundings (Service Index 0.001 – 0.065)	Mooi River
High Density Rural	Rural nodes in high density settlement areas – meso zones with > 100 people/km^2 OR more than 10 people/km^2 PLUS economic activity in service sector – identified as areas within high density settlement areas, with highest levels of access to household income. These areas typically have very little economic activity, no consolidated town centre/nodes, and a spread out morphological structure.	Ozwathini
Rest of South Africa	Less densely populated areas, sparsely populated areas, mountainous areas, national parks.	

[10] See http://stepsa.org/pdf/profiler/201508_South%20African%20Settlement%20Typology_Technical_Report.pdf for the CSIR/SACN South African Settlement Typology technical report.

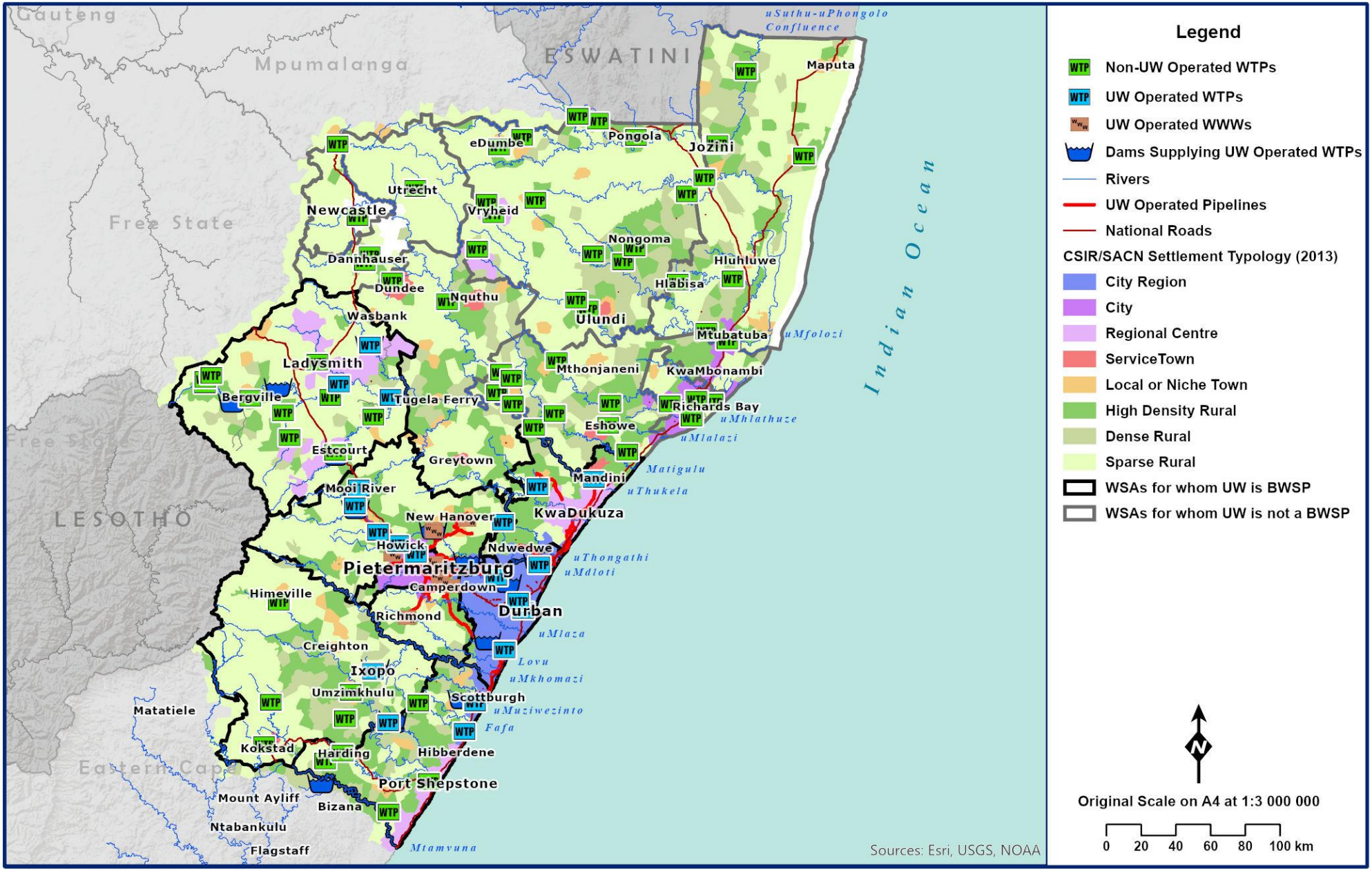


Figure 2.23 CSIR/SACN Settlement Typology (CSIR and SACN 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

It is noted in **Figure 2.23** that Umgeni Water's infrastructure is predominantly located in those settlements categorised as city region; city; regional centre; local or niche town; high density rural and dense rural i.e. the infrastructure is located where there is the greatest demand as these areas have higher numbers of people.

The KZN DRDLR in their 2015 study refined the settlement typology that had been developed in their 2009 study. The 2015 DRDLR settlement typology (**Figure 2.24**) is useful as the differentiation includes the function of the settlement and this therefore assists in bulk infrastructure planning as the type of demands per settlement function can be estimated in the demand projections.

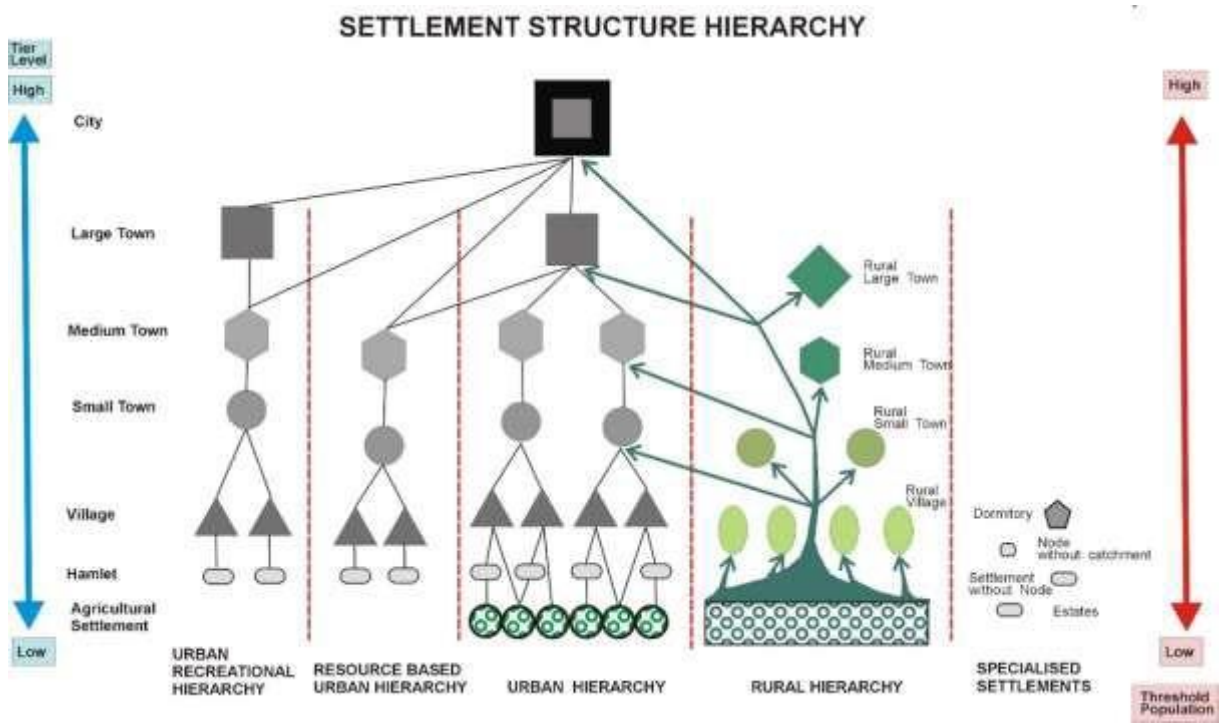


Figure 2.24 The 2015 DRDLR Settlement Typology structure hierarchy (Kahn in DRDLR 2015: 40).

It is shown in **Figure 2.25** that Umgeni Water's infrastructure is predominated located in those settlements categorised as "urban" and "recreational" in the 2015 DRDLR Settlement Typology with the Maphumulo System (**Section 12**) the only system that is predominated located in settlements classified as "rural". The Mhlabatshane System (**Section 11**) supplies settlements that were not identified by the 2015 DRDLR Settlement typology methodology i.e. these settlements are less than the thresholds used.

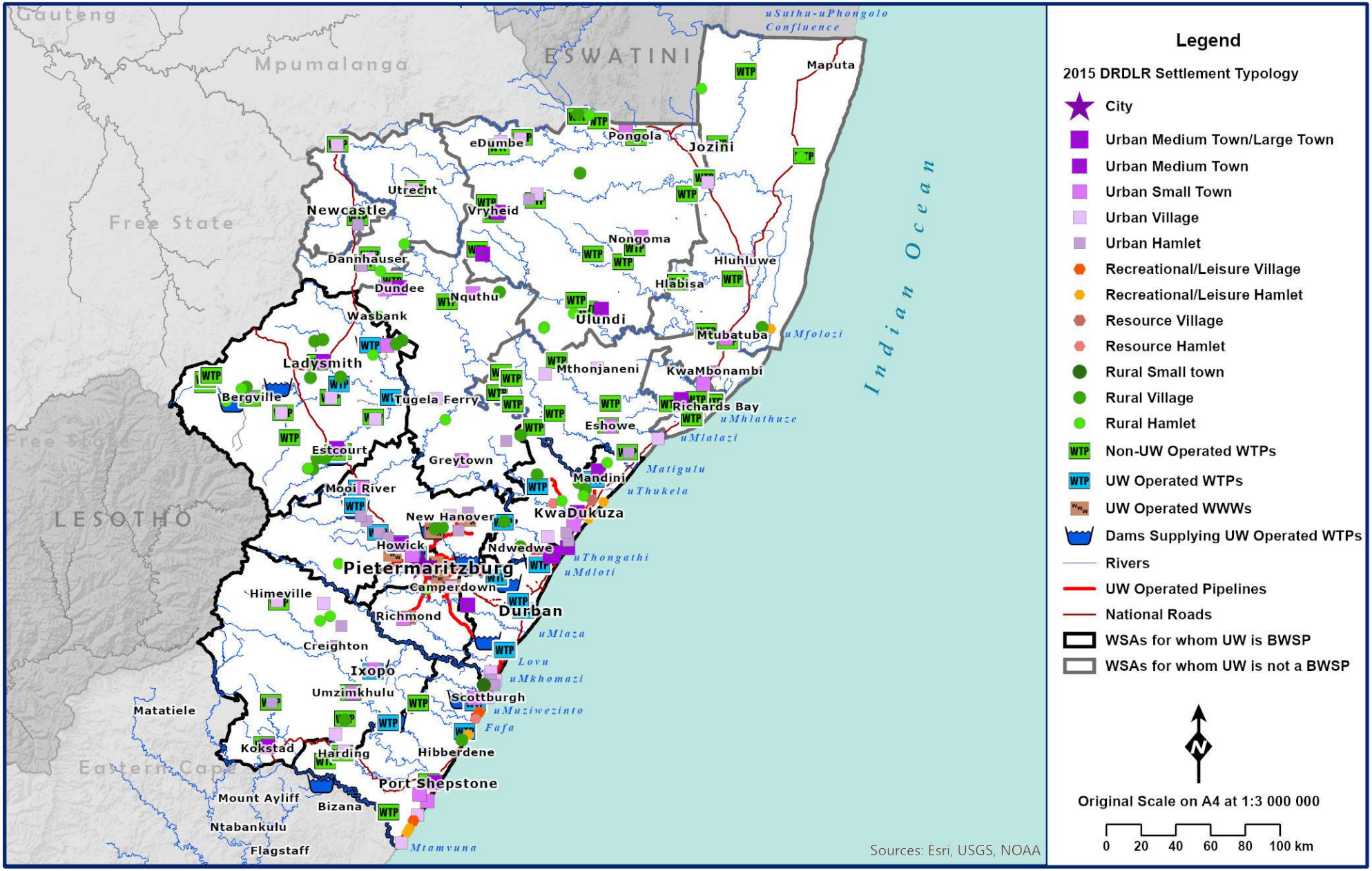


Figure 2.25 DRDLR 2015 Settlement Typology (DRDLR 2015; KZN DoT 2017; MDB 2016; Umgeni Water 2020; WR2012).

2.4 Basic Needs

The KZN Provincial Growth and Development Strategy (PGDS) determined the areas of social need using population density, dependency ratio and the provincial index of multiple deprivation (KZN Planning Commission 2011; 2016). This is shown in **Figure 2.26**. The comparison of this figure with **Figure 2.4**, **Figure 2.8** and **Figure 2.26** shows that those with the highest social need are residing in the "shadow corridor". A comparison with **Figure 2.22** further shows that these municipalities are classified as "B3"; and "B4" and the comparison with **Figure 2.23** identifies that these areas are predominantly classified as "high density rural"; "dense rural"; and "sparse rural" in the CSIR/SACN Typology.

Stats SA have improved the provincial index of multiple deprivation by adapting the global Multidimensional Poverty Index (MPI) which "complements traditional income/expenditure-based poverty measures by capturing the severe deprivations that each person or household faces with respect to education, health and living standards" (Stats SA 2014b: 3 after OPHI 2014).

The 2011 SAMPI score per ward is shown in **Figure 2.27**. It is illustrated in **Figure 2.27** that the areas in which Umgeni Water operated infrastructure is located have relatively low SAMPI scores (shown in shades of green) except for the Tugela Estates WTP in the uThukela WSA, which located in an area with a high SAMPI score (shown in red). Therefore, it may be deduced that the areas with high SAMPI scores (those shown in shades of green) have reasonable access to "piped water in dwelling or on stand" and a "flush toilet".

A comparison of **Figure 2.27** with **Figure 2.21** shows that those areas which have relatively low SAMPI scores make a larger percentage contribution to the KZN GDP. Therefore, the provision of bulk water infrastructure in those areas with relatively high SAMPI scores will require additional public sector funding or cross-subsidisation from those areas with high GDP and relatively low reliance on government grants as a source of income (**Figure 2.29 in UW IMP 2019**). The information could also be inferred that areas with good access to water have the higher contribution to GDP.

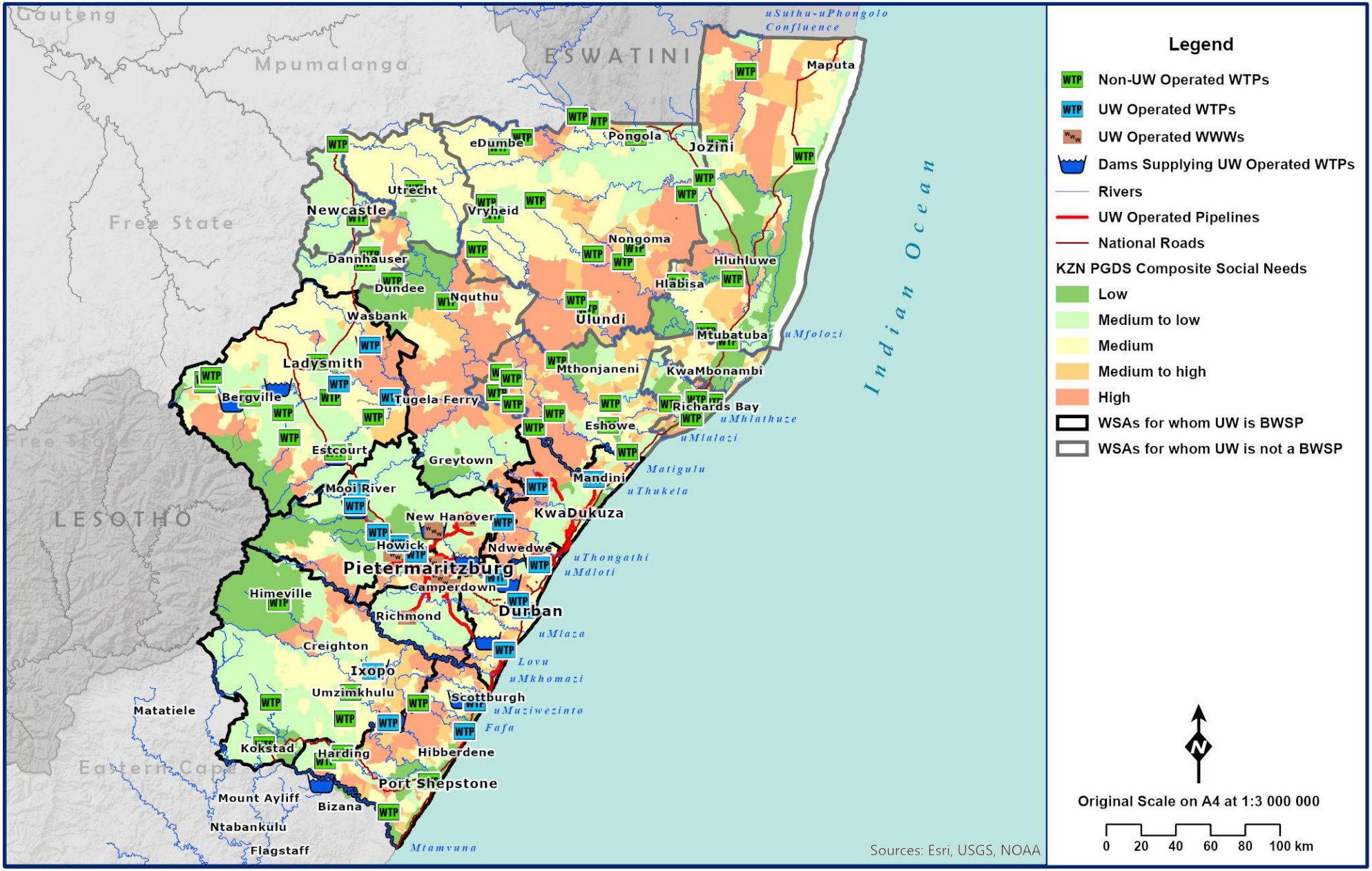


Figure 2.26 KZN PGDS composite social needs (KZN Planning Commission 2016).

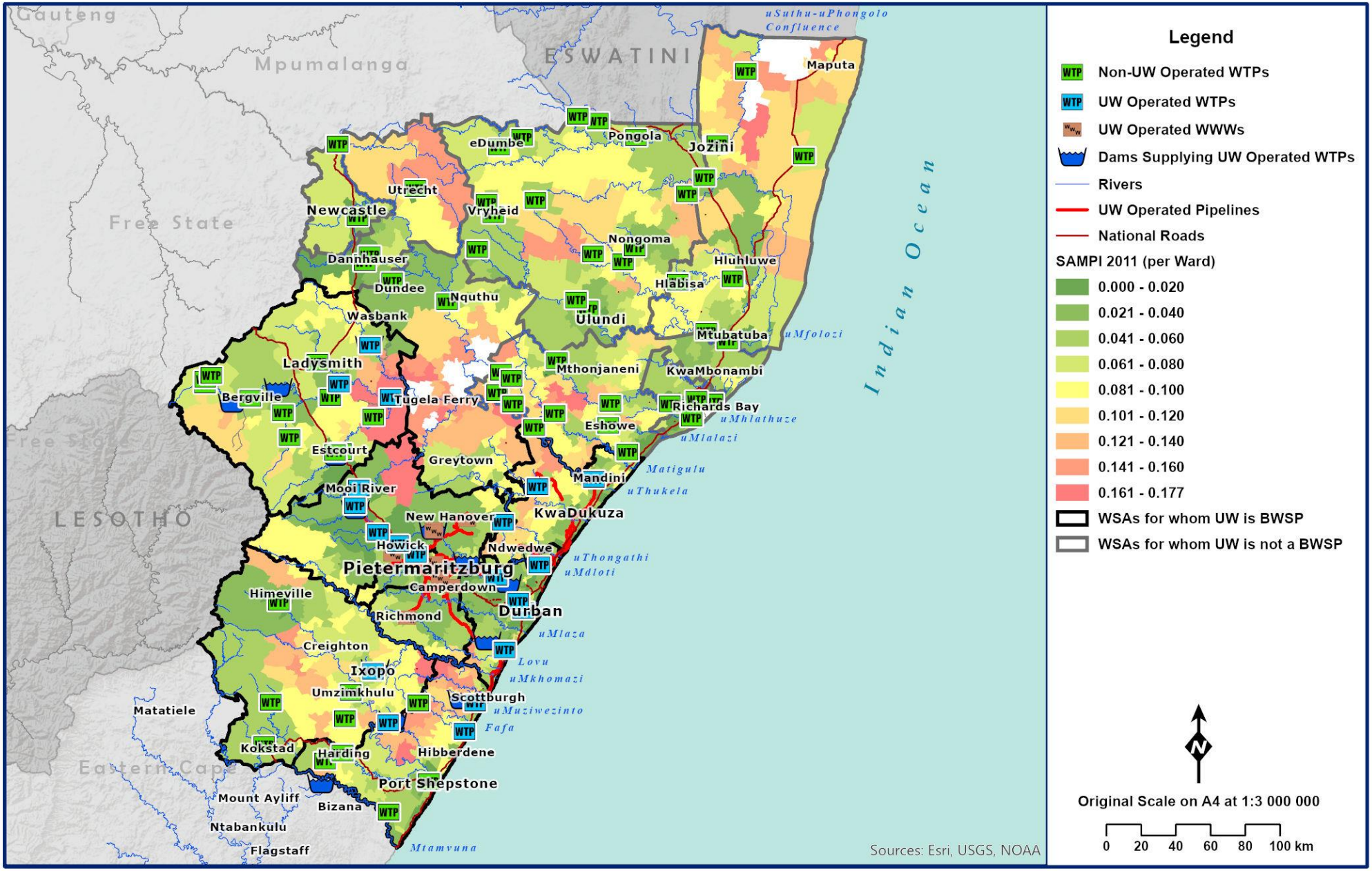


Figure 2.27 2011 SAMPI score per ward (Stats SA 2014).

The contribution of the weighted indicators to SAMPI 2011 in KwaZulu-Natal is shown in **Figure 2.28**. It is shown that sanitation is the third largest contributor at 8% and water and heating the fourth largest contributor at 7%.

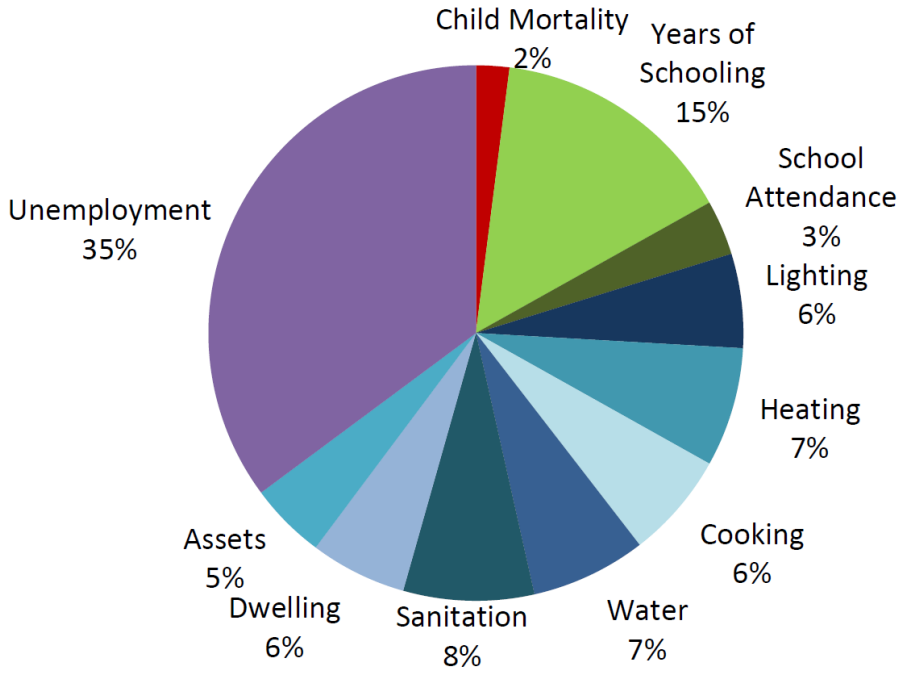


Figure 2.28 Contribution of weighted indicators to SAMPI 2011 in KwaZulu-Natal (Stats SA 2014b: 32).

The distribution of the largest three weighted indicators to SAMPI 2011 per ward in Umgeni Water's operational area is shown in **Figure 2.29**.

A comparison of **Figure 2.28** and **Figure 2.29** shows that contribution of weighted indicators to SAMPI 2011 per ward follows a similar distribution to that of KwaZulu-Natal i.e. sanitation (shown in red in **Figure 2.29**) is the third largest contributor.

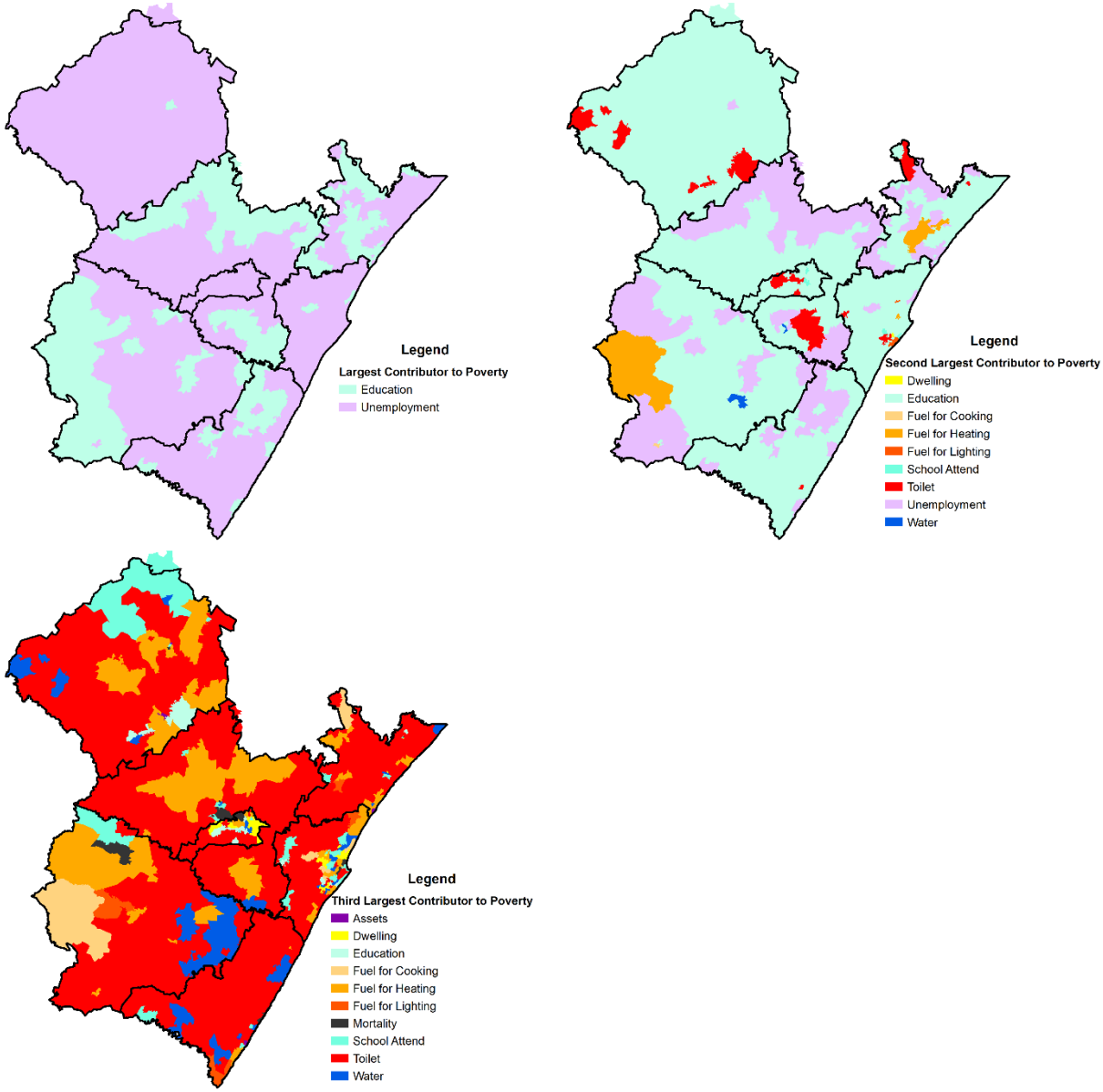


Figure 2.29 Distribution of largest three weighted indicators to SAMPI 2011 per ward (Stats SA 2014).

The KZN government has been implementing a number of programmes and projects to address the components of poverty as discussed above. In 2018, the KZN Office of the Premier and Statistics SA implemented the second iteration of the KZN Citizen Satisfaction Survey (KZN CSS 2018). The aim of this survey is to "understand how KZN citizens rated services provided by their provincial and local governments to assess service delivery performance, inform improved service delivery plans, and to provide a platform for government to engage more directly with its constituent" (Statistics SA 2018: 8). This survey was undertaken from April to May 2018 and the results released in August 2018. The overall ranking of water and sanitation services in KZN is shown in **Table 2.5**; the level of satisfaction with the provision of water and sanitation services in **Table 2.6**; and if service delivery complaints were made with reference to water and sanitation services in **Table 2.7**. The KZN CSS 2018 further identified the perceived prioritisation of the municipal services (**Table 2.8**).

Table 2.5 The top six very important municipal services in KZN as identified by the KZN CSS 2018 (Stats SA 2018: 3).

Top six very important municipal services	Not important	Important	Very important
Water services	1.1%	25.8%	73.2%
Electricity services	0.8%	27.6%	71.6%
Municipal clinic services	1.5%	30.6%	68.0%
Affordable housing	1.6%	32.3%	66.1%
Sanitation services	1.9%	33.0%	65.1%
Road maintenance	1.6%	33.6%	64.8%

Table 2.6 Level of satisfaction with KZN local municipal performance on the top five very important services (Stats SA 2018: 3).

Level of satisfaction with local municipal performance on top five very important services	Outright dissatisfied	Somewhat satisfied	Outright satisfied
Water services	25.5%	24.7%	49.8%
Electricity services	19.7%	27.7%	52.6%
Municipal clinic services	15.0%	27.0%	58.1%
Affordable housing	48.6%	21.4%	30.0%
Sanitation services	38.3%	19.3%	42.4%

Table 2.7 Service delivery complaints on the top five very important services (Stats SA 2018: 3).

Whether (or not) service delivery complaints were made	Yes	No
Water services	40.8%	59.2%
Electricity services	29.1%	70.9%
Refuse disposal	19.1%	80.9%
Housing	34.0%	66.0%
Sanitation services	23.9%	76.1%

Table 2.8 Top five municipal services perceived as important by MIIF category in the KZN CSS 2018 (Stats SA 2018: 82).

	MIIF Category A	MIIF Category B1	MIIF Category B2	MIIF Category B3	MIIF Category B4
Highest Proportion	Water Services	Water Services	Water Services	Water Services	Water Services
2nd Highest Proportion	Electrical Services	Electrical Services	Electrical Services	Electrical Services	Electrical Services
3rd Highest Proportion	Municipal Clinic Services	Municipal Clinic Services	Municipal Clinic Services	Affordable Housing	Municipal Clinic Services
4th Highest Proportion	Road Maintenance	Sanitation Services	Affordable Housing	Municipal Clinic Services	Affordable Housing
5th Highest Proportion	Sanitation Services	Affordable Housing	Sanitation Services	Road Maintenance	Road Maintenance

It is shown in **Figure 2.30** that the KZN CSS 2018 identified that:

> "… approximately half of KZN citizens (49.8%) were outright satisfied with the quality of their main source of drinking water. This is also true across all MIIF categories. MIIF categories B2 and B1 had the highest proportion of citizens (59.0% and 58.6%, respectively) who were outright satisfied with the quality of their main source of drinking water. MIIF categories B3 and B4 had the largest proportion of citizens who were outright dissatisfied."
>
> (Stats SA 2018: 82)

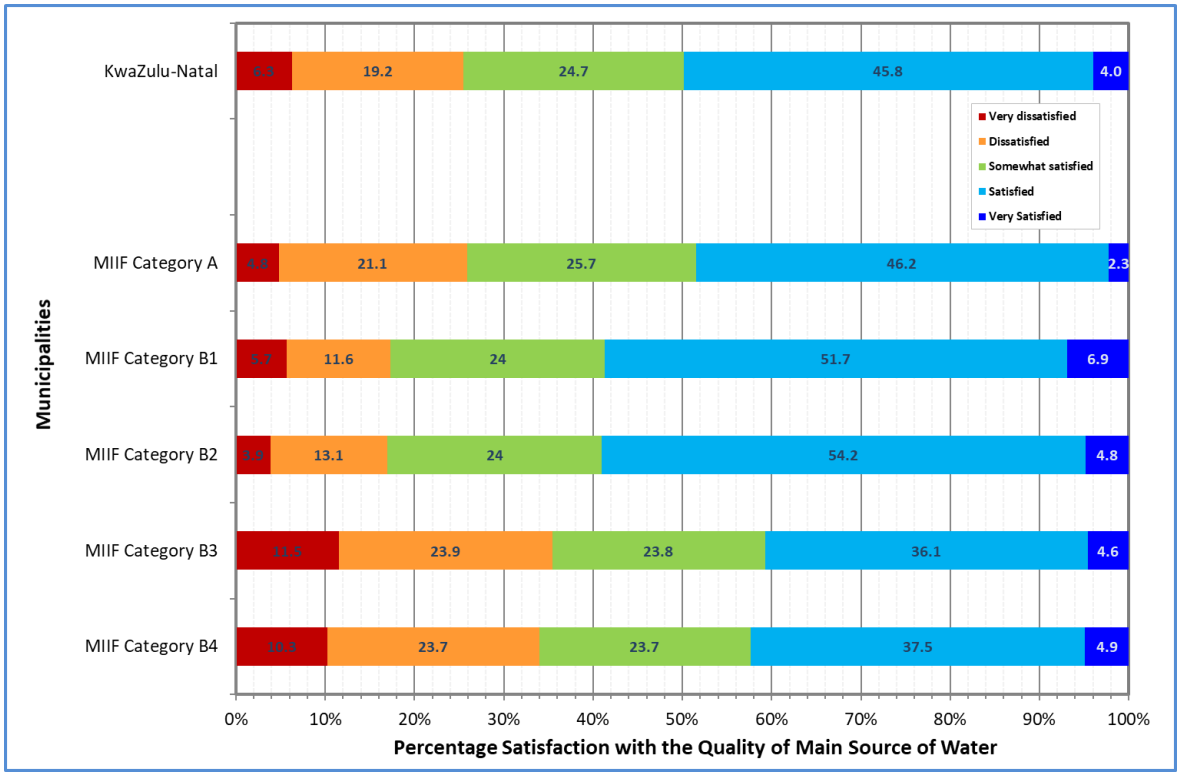


Figure 2.30 Percent distribution of persons aged 15 years and older by MIIF category and level of satisfaction with the quality of their main source of water as identified in the KZN CSS 2018 (Stats SA 2018: 83).

The KZN CSS 2018 results identified that:

> "As seen in the previous analysis (**Table 2.8**), citizens of KZN perceived sanitation services as one of the most important services. It is evident from **Figure 2.31** that regardless of MIIF category, less than 5% of citizens reported being very satisfied with the sanitation services used by their households. In terms of satisfaction, 42.4% of citizens were outright satisfied with the overall quality of sanitation services used by their households. Moreover, 19.3% were somewhat satisfied and 38.3% were outright dissatisfied with the overall quality of sanitation services used by their households. Over 40% of citizens were outright satisfied with the overall quality of sanitation services used by their households in MIIF categories A, B1 and B2 with 44.9%, 44.2%, and 52.7%, respectively."

(Stats SA 2018: 91)

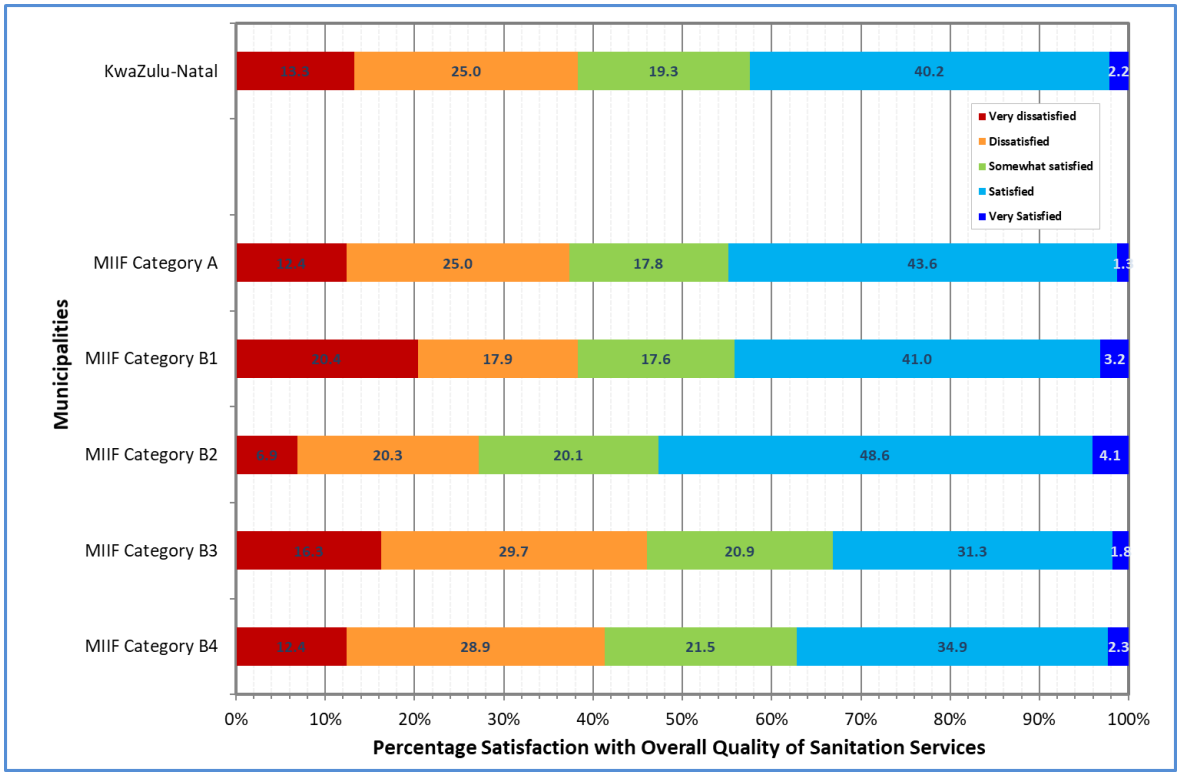


Figure 2.31 Percent distribution of persons aged 15 years and older by MIIF category and level of satisfaction with the overall quality of sanitation services used by their households as identified by the KZN CSS 2018 (Stats SA 2018: 91).

The Community Survey results showing the number of people with the main source of water for drinking per WSA is shown in **Figure 2.32**. The number of people with the main source of water for drinking per WSA in Umgeni Water's operational area is listed in **Table 2.9**.

Table 2.9 Community Survey 2016 number of people with main source of water for drinking per WSA with whom Umgeni Water is BWSP (Stats SA 2017).

Main Source of Water	eThekwini	Msunduzi	uMgungundlovu	iLembe	Ugu	Harry Gwala	uThukela
Piped (tap) water inside the dwelling/house	2 205 755	267 470	108 140	118 349	125 739	45 814	120 240
Piped (tap) water inside yard	992 591	361 535	129 268	145 753	95 485	105 593	227 213
Piped water on community stand	283 625	23 894	63 654	171 811	286 129	126 563	94 457
Borehole in the yard	9 880	723	3 700	2 796	2 705	7 689	8 024
Rain-water tank in yard	4 278	858	4 128	12 630	8 940	13 011	4 652
Neighbours tap	63 646	10 208	8 131	8 280	3 192	3 418	10 162
Public/communal tap	85 045	7 205	26 490	23 180	134 285	38 591	54 570
Water-carrier/tanker	29 603	4 544	23 493	49 406	22 306	10 771	42 996
Borehole outside the yard	8 263	401	4 405	3 097	8 024	22 300	67 233
Flowing water/stream/river	9 413	970	37 701	110 867	63 772	125 157	45 009
Well	0	123	79	345	500	776	5 967
Spring	227	48	4 825	7 598	690	9 940	24 032
Other	9 903	1 062	2 811	3 500	1 568	1 242	2 032
Total	3 702 231	679 039	416 825	657 612	753 336	510 865	706 588

The distance people travel on average to their main source of water for drinking per WSA is illustrated in **Figure 2.33**. The main supplier of drinking water per WSA is shown in **Figure 2.34**.

The main type of toilet facility per WSA is presented in **Figure 2.35**.

eThekwini Municipality is the predominant contributor of people to Umgeni Water's operated area at 55% (**Figure 2.9**) and has the largest number of people with access to piped water inside their dwellings (**Figure 2.32**) as well as with a flush toilet connected to a public sewerage system (**Figure 2.35**).

A comparison of **Table 2.9**, **Figure 2.32**, **Figure 2.33**, **Figure 2.34** and **Figure 2.35** with **Figure 2.36** and **Figure 2.37** show that the data categories currently collected are not aligned with those of the National Norms and Standards for Domestic Water and Sanitation Services (Government Gazette No. 41100 No. 982, 8 September 2017). It is anticipated that this mis-alignment may be addressed in the Census 2021.

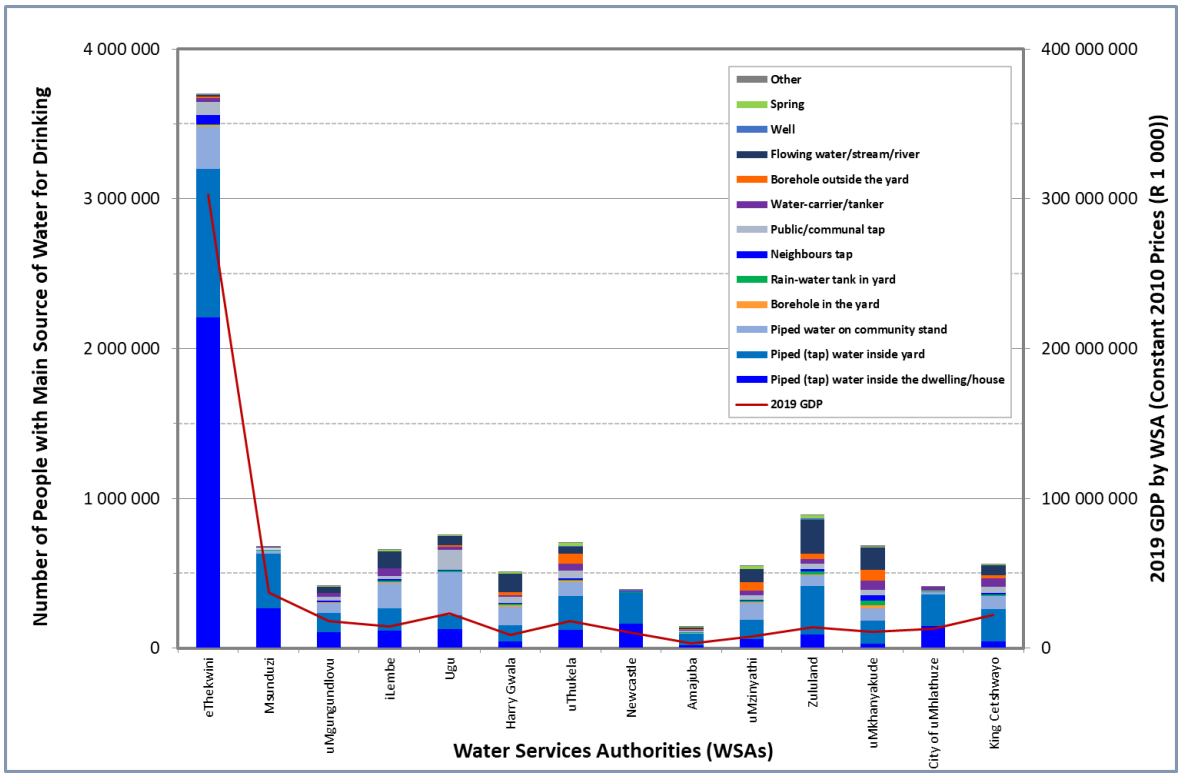


Figure 2.32 Community Survey 2016 number of people with main source of water for drinking per WSA (Stats SA 2017; KZN Treasury after Global Insight 2019).

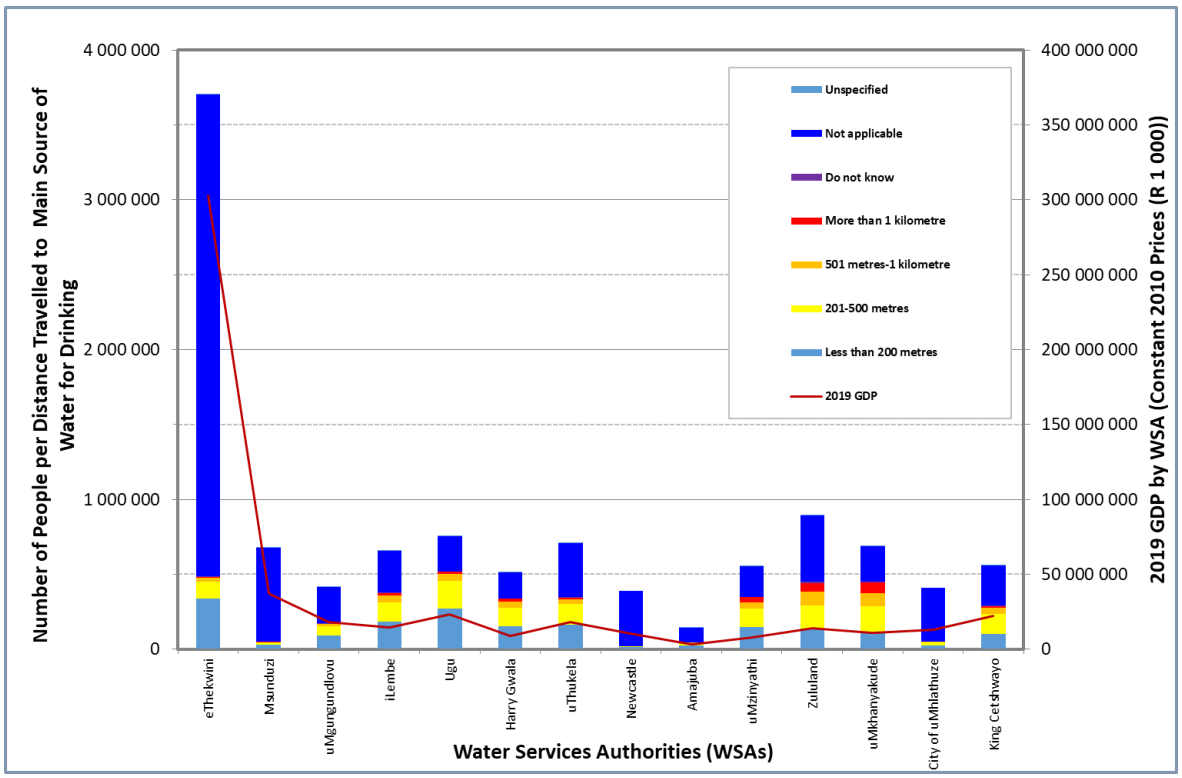


Figure 2.33 Community Survey 2016 number of people per distance travelled to main source of water for drinking per WSA (Stats SA 2017; KZN Treasury after Global Insight 2018).

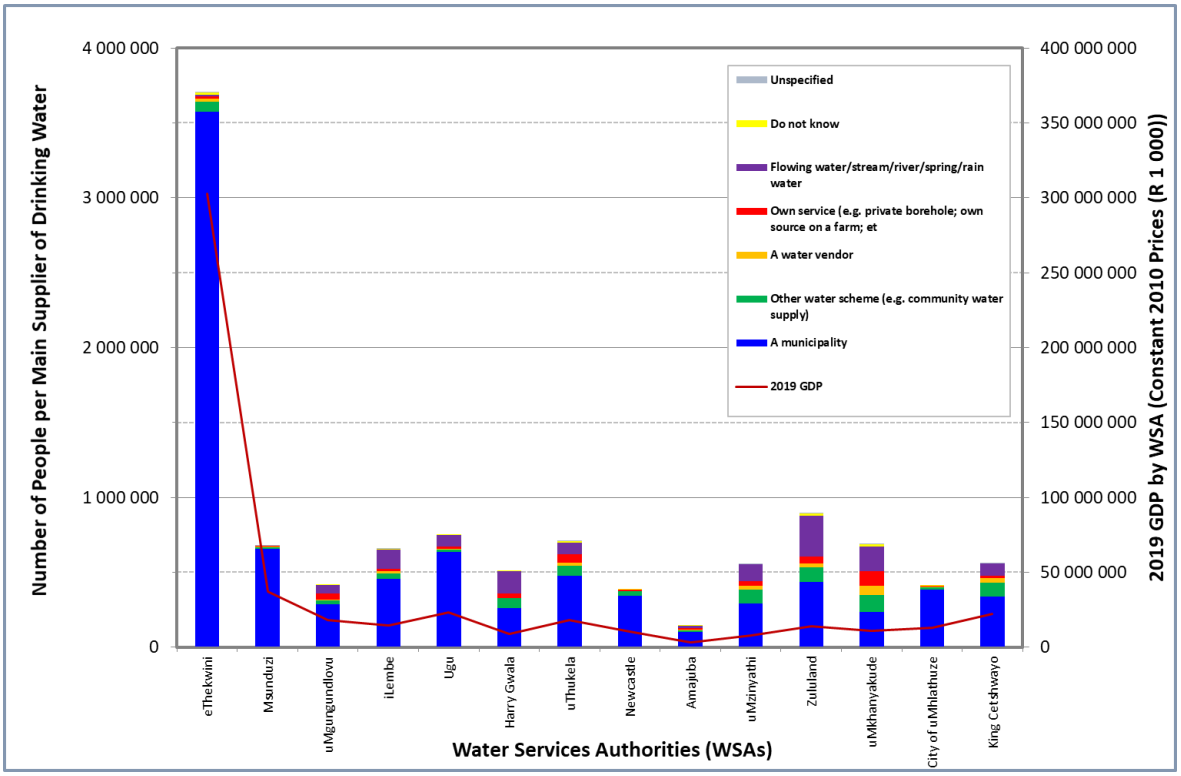


Figure 2.34 Community Survey 2016 number of people per main supplier of drinking water per WSA (Stats SA 2017; KZN Treasury after Global Insight 2018).

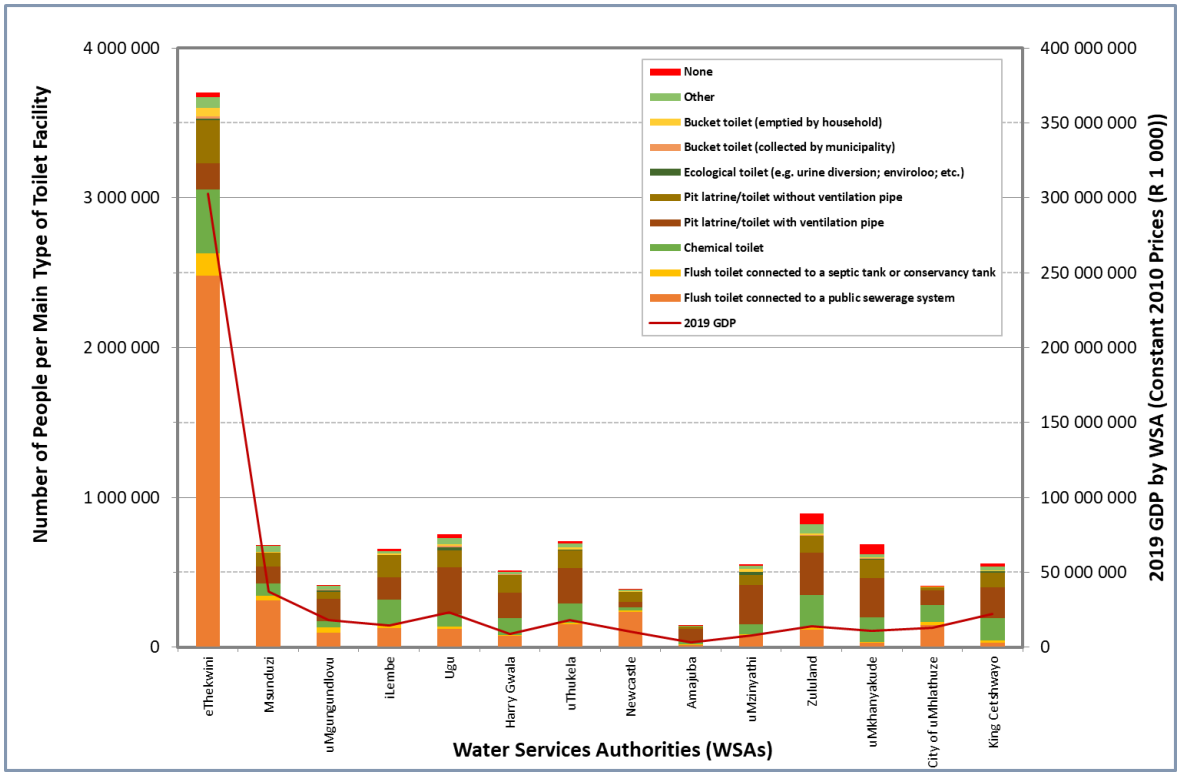


Figure 2.35 Community Survey 2016 number of people per main type of toilet facility per WSA (Stats SA 2017; KZN Treasury after Global Insight 2018).

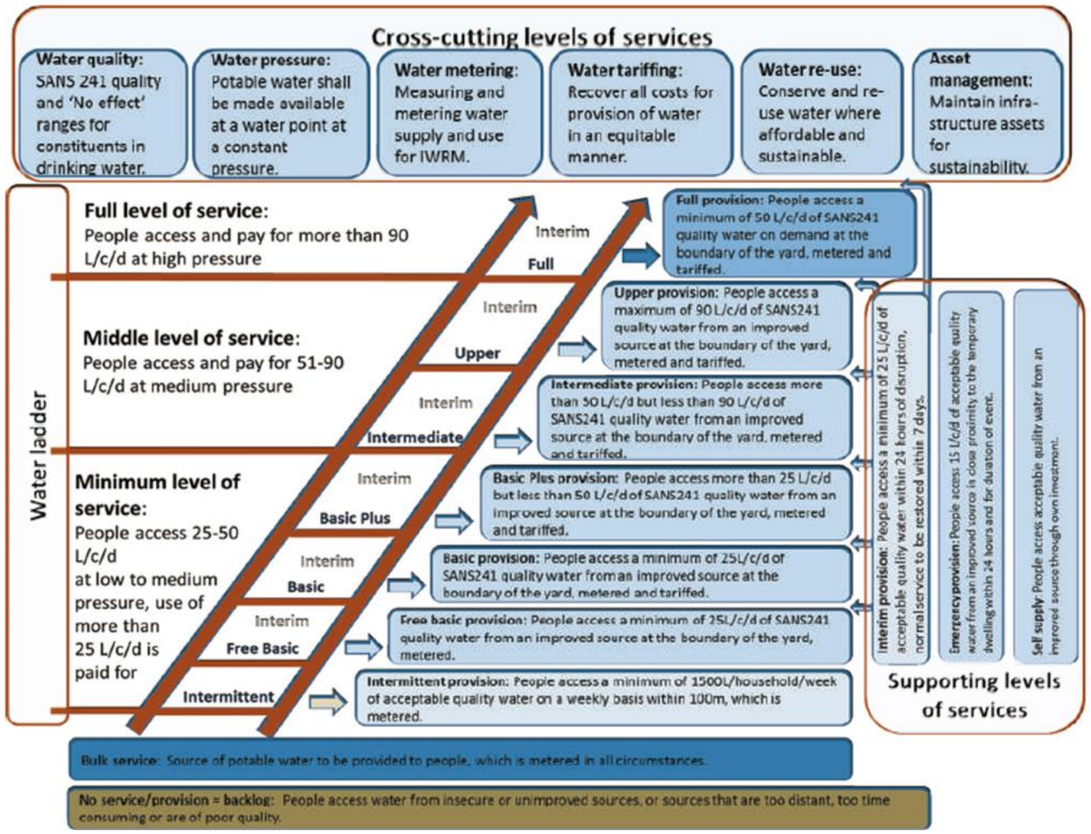


Figure 2.36 Norms and standards for water supply services (DWS 2017: 14).

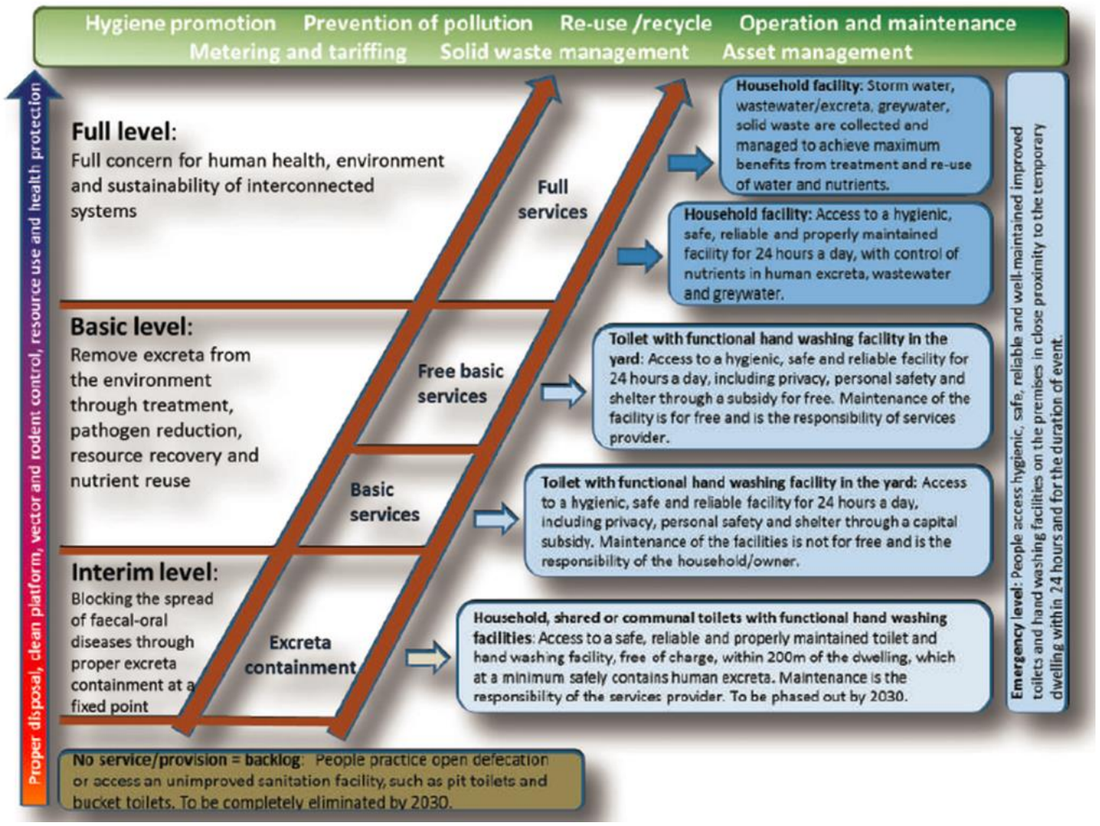


Figure 2.37 Norms and standards for sanitation services (DWS 2017: 32).

2.5 Development Plans

The KZN Planning Commission summarises the alignment of the key strategic plans occurring at the different spheres in **Figure 2.38**.

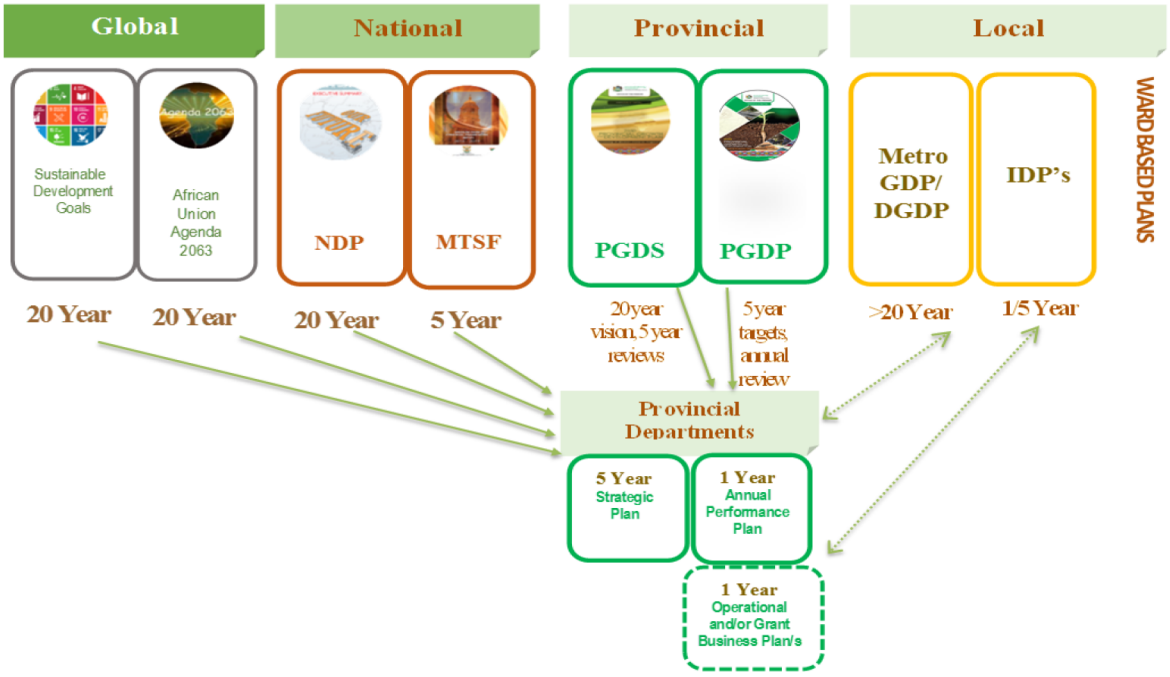


Figure 2.38 Alignment between key strategic plans occurring at the different spheres (KZN Planning Commission 2018a: 5).

At the global scale, the *17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development* (adopted by the 193 Member States of the United Nations in September 2015) became officially operational on 1 January 2016 (United Nations 2016: website). The global indicator framework for the SDGs was agreed upon at the 48th session of the United Nations Statistical Commission in March 2017 (United Nations Statistical Commission 2017: i). The targets and indicators for *Goal 6 Ensure availability and sustainable management of water and sanitation for all* is listed in **Table 2.10**.

Table 2.10 Targets and indicators for SDG Goal 6 Ensure Availability and Sustainable Management of Water and Sanitation for All (United Nations Statistical Commission 2017: 9/26 – 10/26).

Targets	Indicators
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all.	6.1.1 Proportion of population using safely managed drinking water services.
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.	6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water.
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.	6.3.1 Proportion of wastewater safely treated. 6.3.2 Proportion of bodies of water with good ambient water quality.
6.4 By 2030, substantially increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.	6.4.1 Change in water use efficiency over time. 6.4.2 Level of water: freshwater withdrawal as a proportion of available freshwater resources.
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.	6.5.1 Degree of integrated water resources management implementation (0 – 100). 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation.
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.	6.6.1 Change in the extent of water-related ecosystems over time.
6.a By 2030, expand international cooperation and capacity-building support to development countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan.
6.b Support and strengthen the participation of local communities in improving water and sanitation management.	6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management.

Put forward as "an extension of the 2030 Agenda for Sustainable Development" (UN Habitat 2016: website), the *New Urban Agenda*, the "framework that lays out how cities should be planned and managed to best promote sustainable urbanisation" was adopted at Habitat III, the United Nations Conference on Housing and Sustainable Development in October 2016 in Quito, Ecuador (UN Habitat 2016: website). The *New Urban Agenda* is unique as it has four items out of 175 items that are specific to water i.e. in contrast to the convention of water issues being included with the natural environment or with all basic services:

> "72. We commit to long-term urban and territorial planning processes and spatial development practices that incorporate integrated water resources planning and management, considering the urban-rural continuum at the local and territorial scales, and including the participating of relevant stakeholders and communities.
>
> 73. We commit to promote conservation and sustainable use of water by rehabilitating water resources within the urban, peri-urban, and rural areas, reducing and treating

waste water, minimising water losses, promoting water reuse, and increasing water storage, retention, and recharge, taking into consideration the water cycle.

119. We will promote adequate investments in protective, accessible, and sustainable infrastructure and service provision systems for water, sanitation, and hygiene, sewage, solid waste management, urban drainage, reduction of air pollution, and storm water management, in order to improve safety against water-related disasters, health, and ensure universal and equitable access to safe and affordable drinking water for all; as well as access to adequate and equitable sanitation and hygiene for all; and end open defecation, with special attention to the needs and safety of women and girls and those in vulnerable situations, We will seek to ensure that this infrastructure is climate resilient and forms part of integrated urban and territorial development plans, including housing and mobility, among others, and is implemented in a participatory manner, considering innovative, resource efficient, accessible, context specific, and culturally sensitive sustainable solutions.

120. We will work to equip public water and sanitation utilities with the capacity to implement sustainable water management systems, including sustainable maintenance of urban infrastructure services, through capacity development with the goal of progressively eliminating inequalities, and promoting both the universal and equitable access to safe and affordable drinking water for all, and adequate and equitable sanitation and hygiene for all."

(UN Habitat 2016: 10; 16)

The water sector falls within two priority areas in the African Union (AU) Agenda 2063:

- The "*Priority Area Water Security*" under the "*Environmentally sustainable and climate resilient economies and communities*" Goal which falls under the "*A prosperous Africa, based on inclusive growth and sustainable development*" Aspiration (African Union 2015: 94 – 95); and
- The "*Priority Area Modern, affordable and liveable habits and quality basic services*" which falls under the "*A high standard of living, quality of life and wellbeing for all citizens*" Goal which falls under the same Aspiration as above (AU 2015: 94).

At the national sphere, the National Development Plan (adopted in 2011) identified 17 Strategic Integrated Projects (SIPs) and required the preparation of a National Spatial Development Framework (NSDF). A draft version of this NSDF was released in September 2018 and once adopted, will be discussed in the next version of the IMP. The National Infrastructure Plan (2012) elaborates on the 17 identified SIPs and added an additional SIP viz. SIP 18, Water and Sanitation. The National Water Resources Strategy Second Edition (NWRS2) responds to the National Development Plan and "outlines the strategy for protecting, using, developing, conserving, managing and controlling South Africa's scarce water resources towards achieving the 2030 Vision" (DWS 2013: 1). The NWRS2 therefore responds directly to SIP 18. The 18 SIPs and those which are applicable to KZN are illustrated in **Table 2.11**.

Table 2.11 Strategic Integrated Projects applicable to KZN (KZN Planning Commission 2013).

SIP No.	Strategic Integrated Project	KZN
1	Unlocking the Northern Mineral Belt with Waterberg as a Catalyst	
2	**Durban - Free State - Gauteng Logistics and Industrial Corridor**	**Yes**
3	South Eastern Node and Corridor Development	
4	Unlock the Economic Opportunities in the North West Province	
5	Saldanha - Northern Cape Development Corridor	
6	**Integrated Municipal Infrastructure Project**	**Yes**
7	Integrated Urban Space and Public Transport Programme	Yes
8	Green Economy in Support of the South Africa Economy	Yes
9	Electricity Generation to Support Socio-Economic Development	Yes
10	Electricity Transmission and Distribution for All	Yes
11	Agri-Logistics and Rural Infrastructure	Yes
12	Revitalisation of Public Hospitals and other Health Facilities	Yes
13	National School Build Programme	Yes
14	Higher Education Infrastructure	Yes
15	Expanding Access to Communication Technology	Yes
16	SKA and Meerkat	
17	Regional Integration for African Co-operation and Development	
18	**Water and Sanitation**	**Yes**

Note: SIPs 2, 6 and 18 influence Umgeni Water's planning.

The study for the KZN portion of SIP 2 was completed in 2016. Called the "N3 Strategic Corridor Development Plan 2016", the study area is illustrated in **Figure 2.39**. The regions identified by this study occurring in Umgeni Water's area is summarised in **Figure 2.40**.

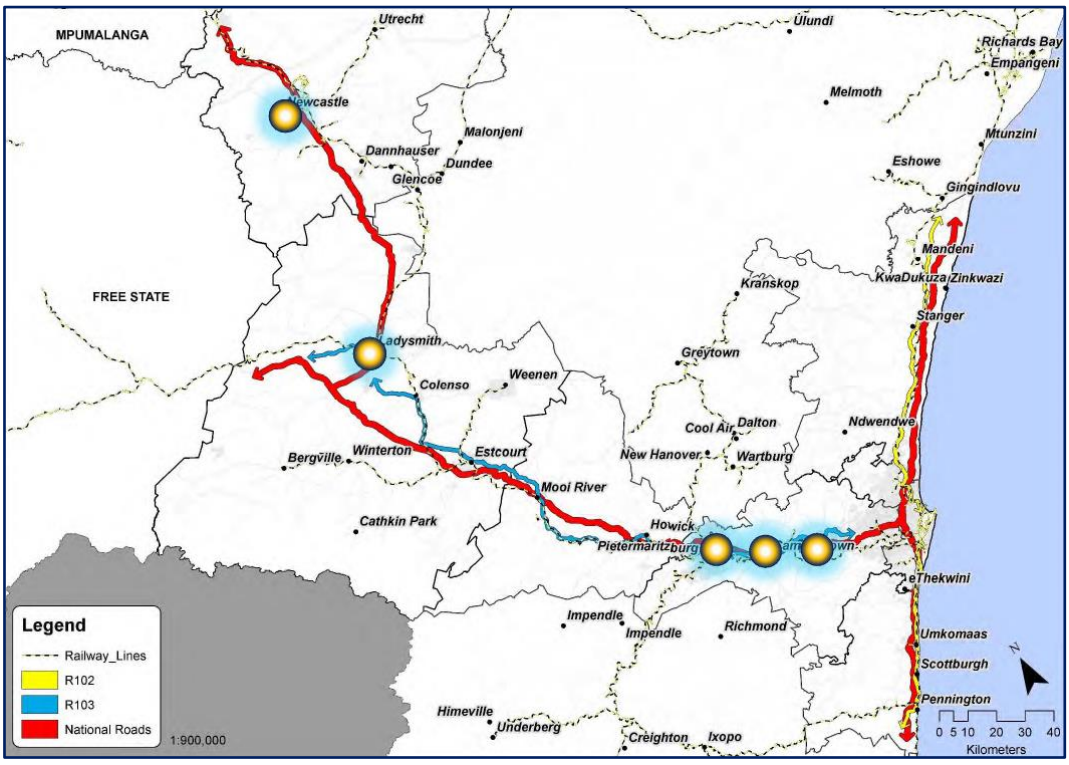


Figure 2.39 "N3 Strategic Corridor Development Plan 2016" study area (KZN CoGTA 2016).

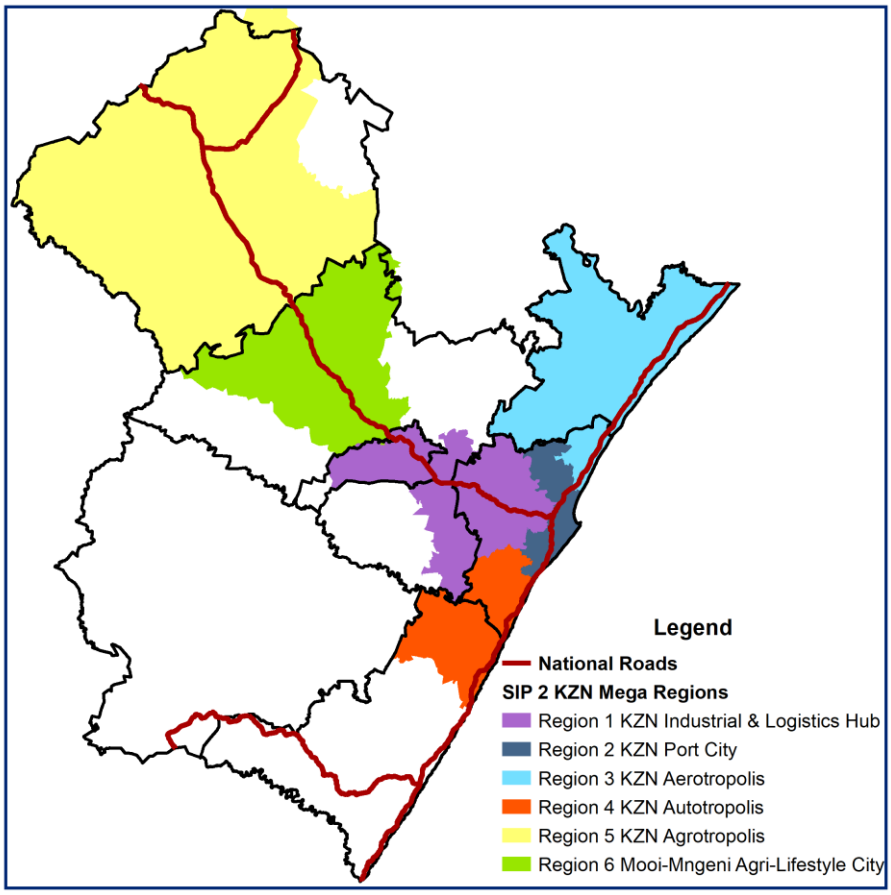
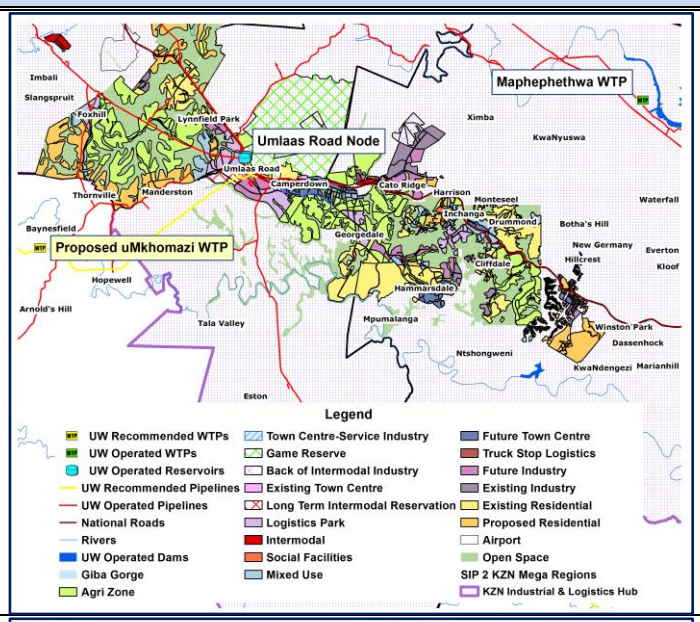
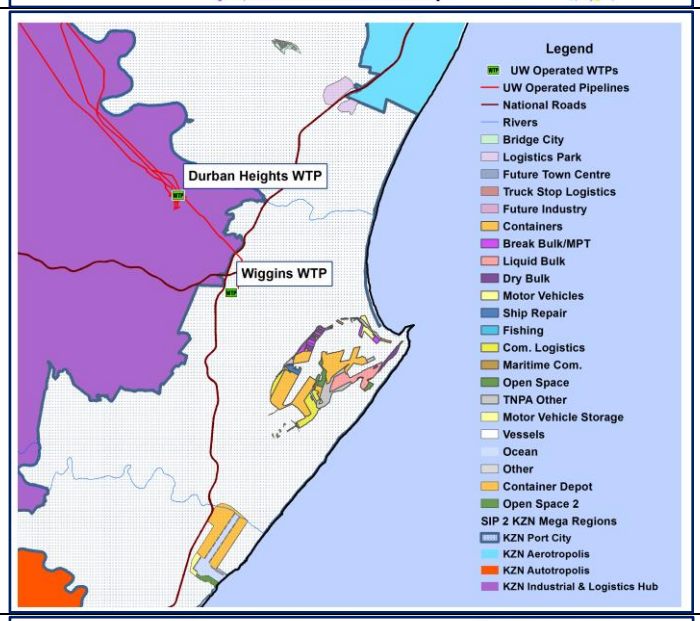
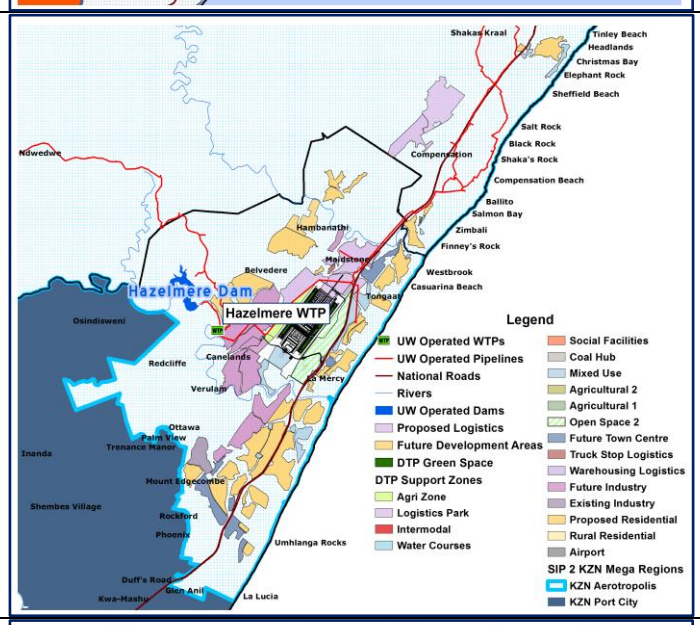
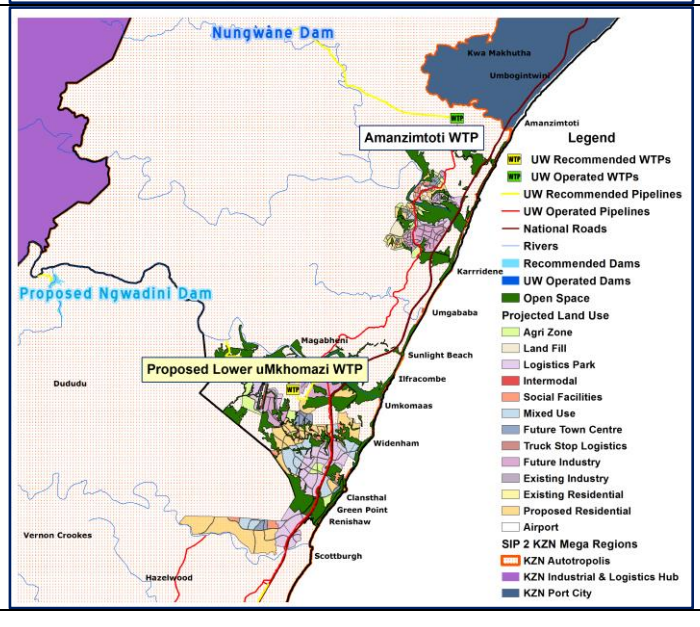


Figure 2.40 Location of the SIP 2 KZN Mega Regions in Umgeni Water's area (KZN CoGTA 2016; KZN DoT 2017; MDB 2016).

A summary of the regional interventions required for water and sanitation as identified by this study is shown in **Table 2.12**. Those regional interventions identified by this study that are direct water users are summarised in **Table 2.13**. It is noted that Region 5, the KZN Agrotropolis displays a polycentric nodal approach and is different from the other regions in that the identified nodes are not all located along the national roads (**Table 2.12**). From a bulk water supply planning perspective, this means that not all the identified nodes in Region 5 may be supplied from one regional bulk WTP in an economically sustainable manner (see **Section 12**).

Table 2.12 Summary of regional interventions required for water and sanitation (KZN CoGTA 2016: 258).

SIP 2 KZN Region	Proposed Land Use	Utilities Sector Development – Bulk Water Capacity Improvements – Water Demand (Ml/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Bulk Sanitation Capacity Improvements – Sewer Flow (Ml/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Water Transfer Schemes / Augmentation Schemes
Region 1 Industrial and Logistics Hub 		282 Ml/day.	212 Ml/day.	Western Aqueduct.
Region 2 Durban Port City 		274 Ml/day.	217 Ml/day.	Western Aqueduct.
Region 3 Aerotropolis 		318 Ml/day.	235 Ml/day.	Northern Aqueduct Augmentation Project.
Region 4 Autotropolis 		78 Ml/day.	53 Ml/day.	uMkhomazi-Mgeni Transfer Scheme.

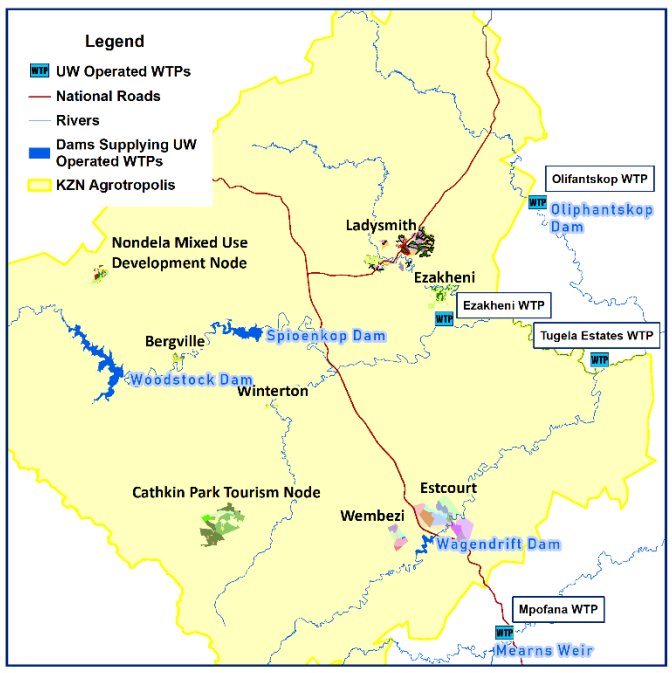
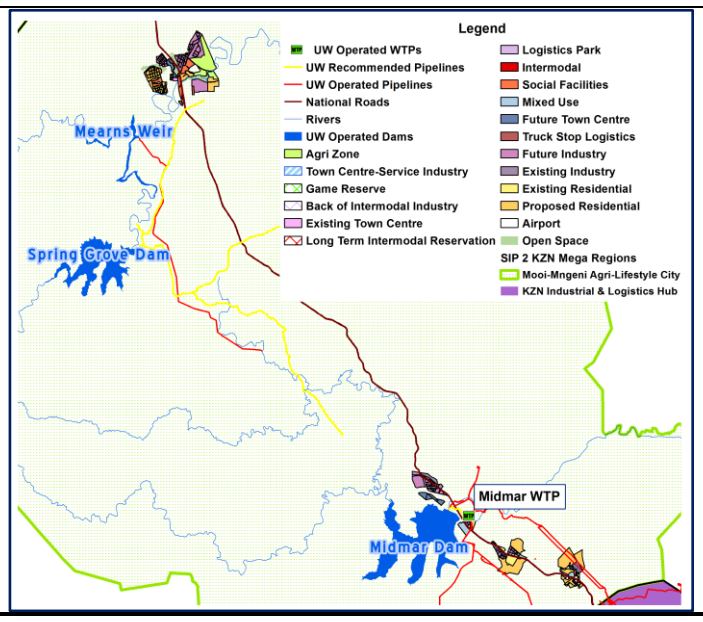
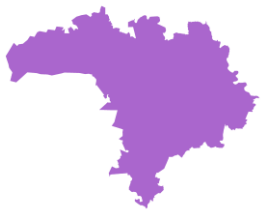
SIP 2 KZN Region	Proposed Land Use	Utilities Sector Development – Bulk Water Capacity Improvements – Water Demand (Ml/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Bulk Sanitation Capacity Improvements – Sewer Flow (Ml/day) (Additional Capacity Required 30 Years)	Utilities Sector Development – Water Transfer Schemes / Augmentation Schemes
Region 5 Agrotropolis		87 Ml/day.	66 Ml/day.	Wagendrift Dam/Tugela River/Klip River
Region 6 Agri-Tourism and Lifestyle City 		55 Ml/day.	42 Ml/day.	Midmar Dam / Mearns Weir.

Table 2.13 Summary of regional interventions that are direct water users (KZN CoGTA 2016: 256).

SIP 2 KZN Region	Agriculture Sector Development	AgriParks / Agri-Villages / Commercial Agrizones (Intensive Farming)	Manufacturing Sector Development	Tourism Sector Development (No. of Hotels up to 2045) (Short-Stay Accommodation)	Warehouse and Distribution Sector	Retail Sector Development	Office and Services Sector Development – sq. m (additional up to 2045)	Integrated Sustainable Human Settlements
Region 1 Industrial and Logistics Hub 	Unleashing 10 000 ha of new agricultural land.	*Mkhambathini* - AgriPark (Eston) / Agri-village / Commercial AgriZones potential. *Msunduzi* – Agri-Village / Commercial AgriZones potential. *eThekwini* – Commercial AgriZones (Intensive farming).	908 ha required by 2045.	10.	1 328 ha required by 2045.	118 738 m^2.	107 871 m^2.	179 751 units.
Region 2 Durban Port City 	Unleashing 600 ha of new agricultural land.	Commercial AgriZones (Intensive farming).	132 ha required by 2045.	12	193 ha required by 2045.	20 996 m^2.	73 282 m^2.	240 140 units.
Region 3 Aerotropolis 	Unleashing 16 000 ha of new agricultural land.	AgriPark (DTP/Stanger) / Agri-Village / Commercial AgriZones potential.	1 323 ha required by 2045.	13	1 935 ha required by 2045.	87 260 m^2.	64 006 m^2.	180 108 units.
Region 4 Autotropolis 	Unleashing 2 000 ha of new agricultural land.	Agri-Village / Commercial AgriZones potential.	648 ha required by 2045.	6	948 ha required by 2045.	214 m^2.	3 746 m^2.	18 119 units.
Region 5 Agrotropolis	Unleashing 25 000 ha of new agricultural land.	*uMtshezi*- Agri-village / Commercial AgriZones potential. *Okhahlamba*- AgriPark (Bergville) / Agri-Village / Commercial AgriZones potential. *Emnambithi/Ladysmith*- Agri-village / Commercial AgriZones potential.	250 ha required by 20245.	7	366 ha required by 2045.	58 297 m^2.	39 859 m^2.	56 807 units.
Region 6 Agri-Tourism and Lifestyle City 	Unleashing 7 000 ha of new agricultural land.	*uMngeni* – AgriPark (Dargle / Cedara) / Agri-Village / Commercial AgriZones potential. *Mpofana* – Agri-Village / Commercial AgriZones potential.	161 ha required by 2045.	2	236 ha required by 2045.	25 926 m^2.	21 699 m^2.	36 553 units.

In October 2018, DWS released **Version 10.1 of the Draft National Water and Sanitation Master Plan (NW&SMP)**. Consisting of three volumes, the National Water and Sanitation Master Plan:

- "Sets out a schedule of prioritised actions for the period to 2030 that will create a water and sanitation sector that can meet national objectives as set out in the National Development Plan and the Sustainable Development Goals" (**Table 2.10**).
- "Sets out the roles and responsibilities in government, the private sector and civil society for the implementation of the plan".

(DWS 2018: 1-16).

DWS explains the three volumes as follows:

> "Volume One of the NW&SMP is the Call to Action, which is divided into two sections, Water and Sanitation Management, and Enabling Environment, each having six sub-sections. Each section includes critical actions that, when implemented, will have a significant impact on addressing the crisis…
>
> Volume Two: Plan to Action provides a more detailed analysis of and rationale for the key issues identified in the Call to Action.
>
> Volume Three: Schedule of Actions provides a detailed costed implementation plan covering all the actions required across the sector to achieve the objectives of the plan."
>
> (DWS 2018: 1-16 – 1-17)

The philosophy of the NW&SMP is illustrated in **Figure 2.41** and the alignment with other planning instruments' timelines in **Figure 2.42**.

The NW&SMP shows that there is a 63% reliability of water and sanitation services in KZN (**Figure 2.43**). **Section 4** and **Section 19** discuss Umgeni Water's water demand management planning and wastewater planning respectively as initiatives contributing towards improving the reliability of water and sanitation services in KZN.

The NW&SMP further notes that the predominant water quality problems in KZN are agricultural chemicals, urban/industrial effluent and metals (from mining and waste disposal). **Sections 7, 8, 11, 12 and 13** summarise briefly the water quality monitoring at the dams Umgeni Water operates in the different systems.

Critically, the NW&SMP identifies the "key strategic water source areas i.e. the 10% of South Africa's land that delivers 50% of South Africa's water which must be protected and maintained if water security is to be achieved" (DWS 2018a: 35). It is shown in **Figure 2.45** that some of these key strategic water source areas are located in Umgeni Water's area of operation and these are discussed further in **Sections 7, 8 11, 12 and 13**. The NW&SMP summarises the inter-basin transfers in South Africa (**Figure 2.46**) and shows these water transfers out of the key strategic water source areas (**Figure 2.47**). It is shown in **Figure 2.47** that the uThukela key strategic water source area, located within Umgeni Water's operational area, supplies the Johannesburg economic hub. **Figure 2.46** shows that a portion of this water also supplies the Richard's Bay area i.e. Umgeni Water now contributes to the water supply management to the largest economic hub in the country and to the second largest economic hub in KZN.

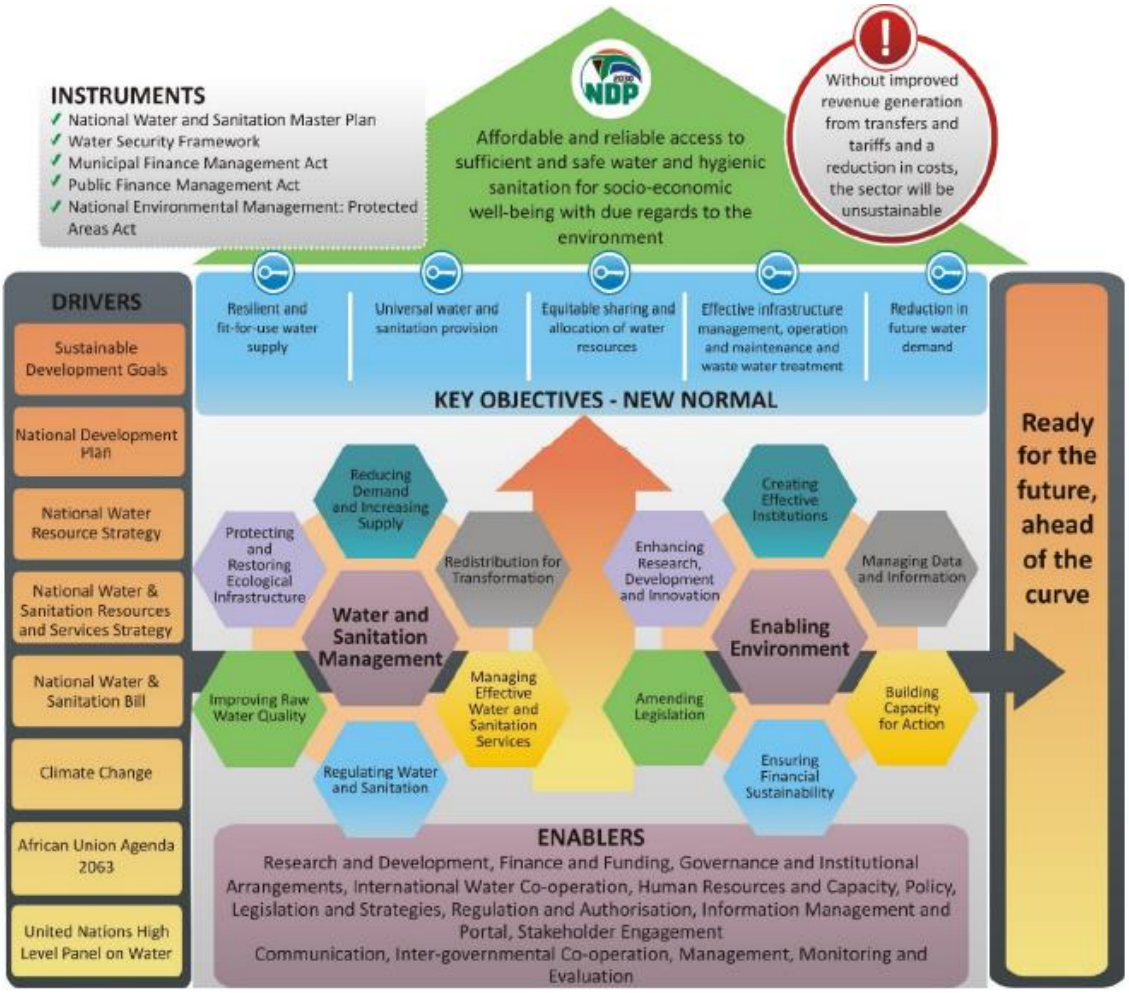


Figure 2.41 National Water and Sanitation Master Plan philosophy (DWS 2018: 7).

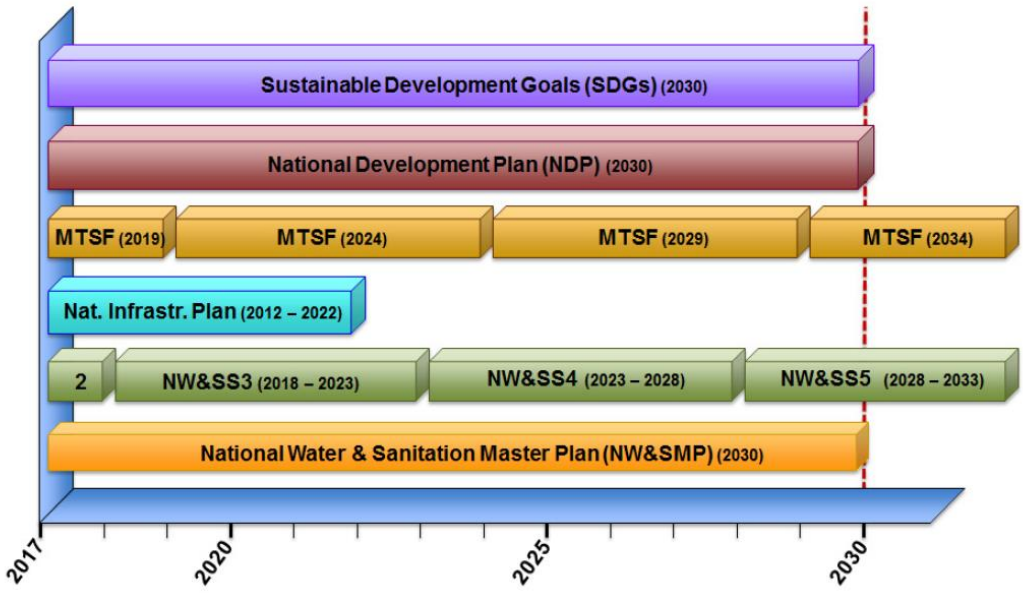


Figure 2.42 National Water and Sanitation Master Plan timelines relative to other planning instruments (DWS 2018: 2-2).

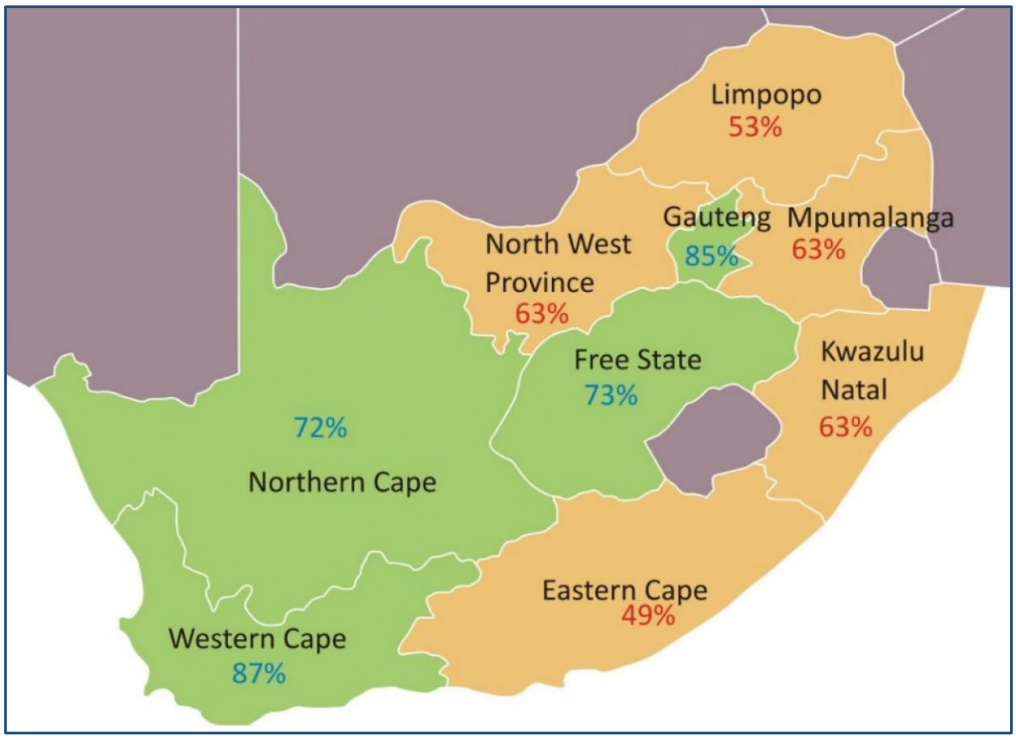


Figure 2.43 Reliability of water and sanitation services per province (DWS 2018a: 21).

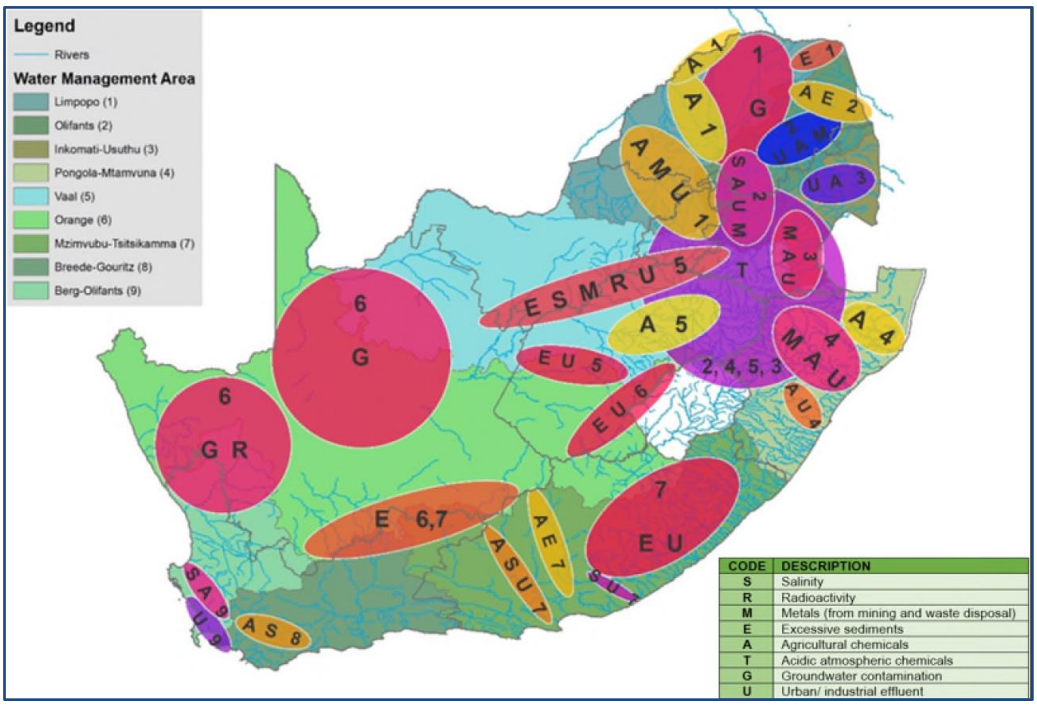


Figure 2.44 Different types of water quality problems across South Africa (Ashton 2012 in DWS 2018a: 30).

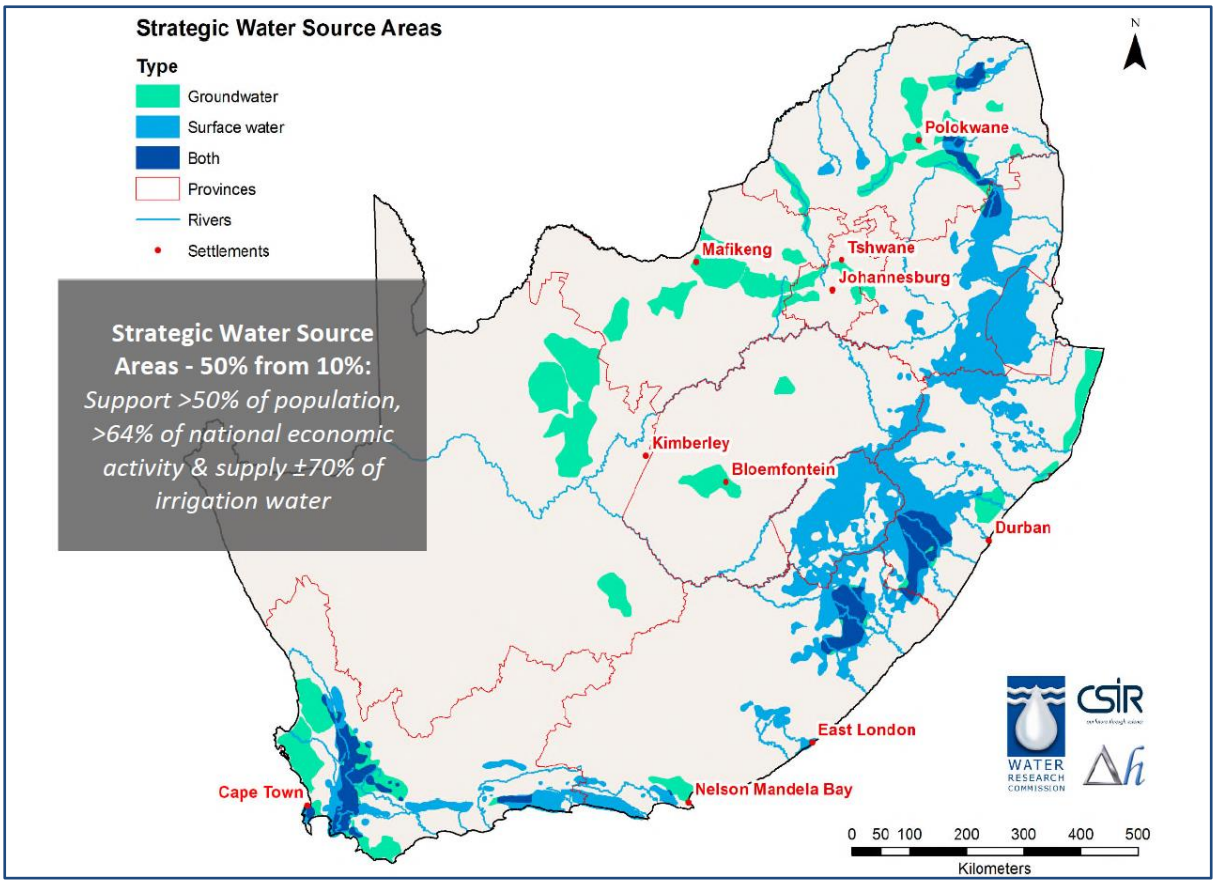


Figure 2.45 "Strategic water source areas: the 10% of South Africa's land that delivers 50% of our water" (DWS 2018a: 36).

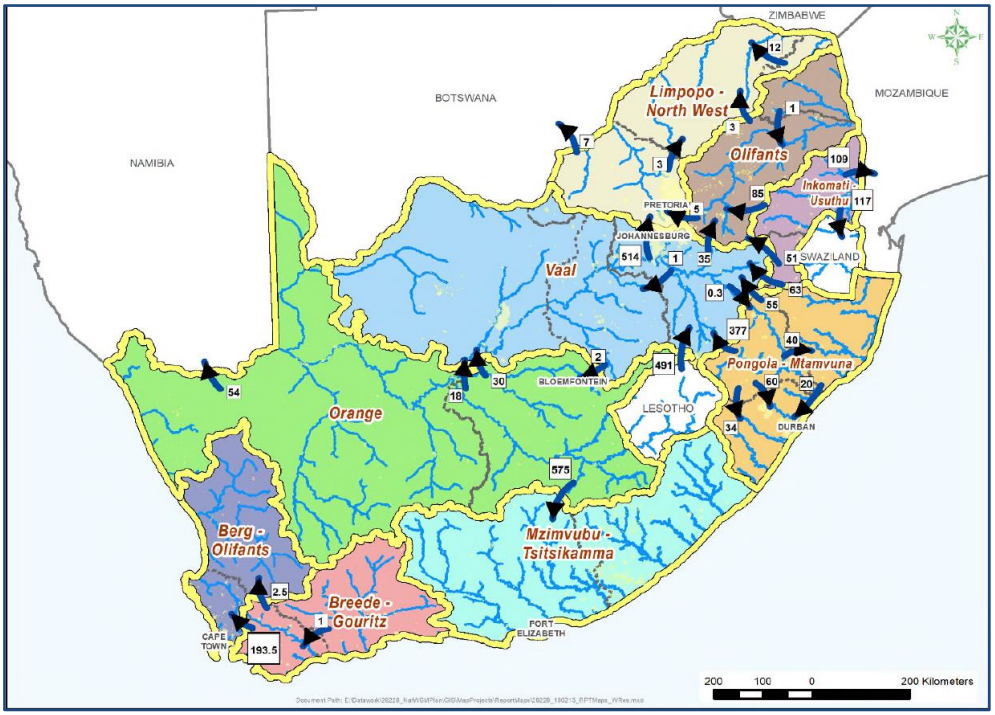


Figure 2.46 Inter-basin water transfers in South Africa (DWS 2018b: 3-12).

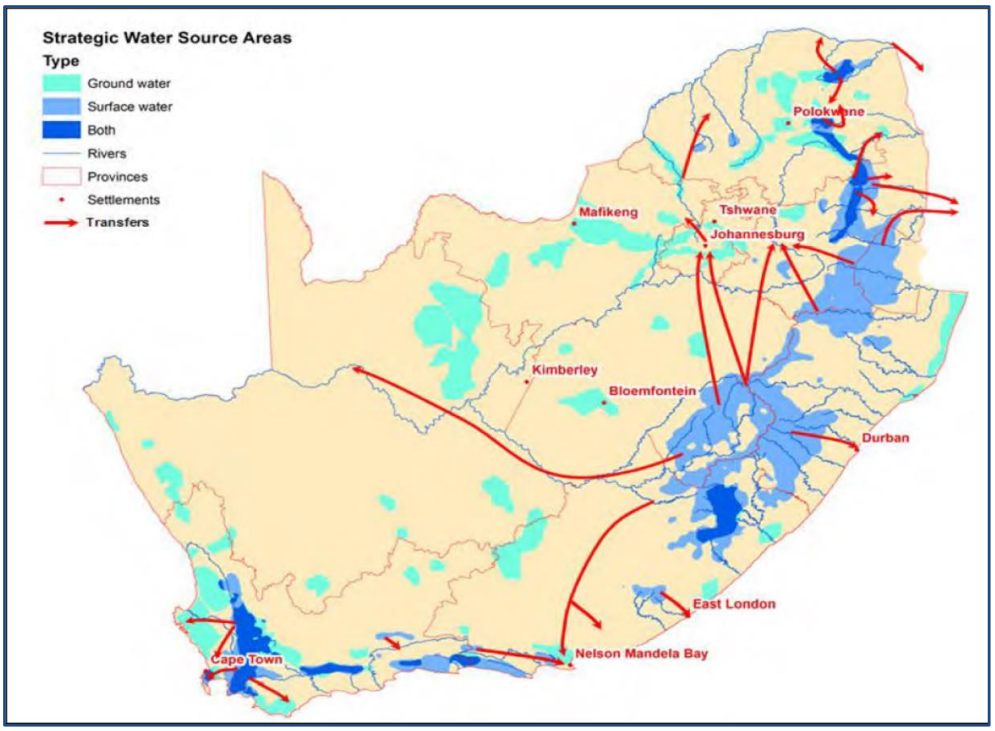


Figure 2.47 Water transfers out of the key water source areas (DWS 2018b: 8-9).

The KZN Situational Overview 2016; the KZN Provincial Growth and Development Strategy (PGDS) and KZN Provincial Growth and Development Plan were reviewed in 2016 with the development of a 2035 Vision: "KwaZulu-Natal, a prosperous Province with a healthy, secure and skilled population, living in dignity and harmony, an acting as gateway to Africa and the world" (KZN Planning Commission 2018: 13). It is noted that the KZN Situational Overview 2016 briefly summarised the information on the water resource regions from the Umgeni Water 2015 IMP. This information is updated in **Section 7**, **Section 8**, **Section 11**, **Section 12** and **Section 13** of this report.

The seven long term goals shown in **Figure 2.48** are identified in the KZN PGDS 2016 to "guide policy making, programme prioritisation and resource allocation" (KZN Planning Commission 2018b: 8).

The KZN PGDS Sustainability Framework is illustrated in **Figure 2.49**.

Umgeni Water contributes directly to *Strategic Objective 4.4 Ensure availability and sustainable management of water and sanitation for all* under *Strategic Goal 4 Infrastructure Development* in the KZN PGDS (Umgeni Water contributes to *Outcome 6: An efficient, competitive and responsive economic infrastructure network* and the *Sub-Outcome 4: Maintenance and supply of our bulk water resources ensured* in the NDP) (KZN Planning Commission 2018a: 15).

The alignment between the AU Agenda 2063 Strategic Goals, the 2016 KZN PGDS and the SDG Goals to which Umgeni Water contributes is summarised in **Table 2.14**.

Strategic Goals and Objectives for KZN until the Year 2035

The PPC generated many far-reaching and ambitious responses to the challenges raised in this analysis. It needed to group these responses, a culmination of months of discussion and synthesis, in a way that reflects the main aims embodied in the Vision. It was found that the responses cohered around a number of goal areas and objectives and finally shaped into seven goal areas and 31 objectives.

STRATEGIC GOAL	No	STRATEGIC OBJECTIVE 2016
1 INCLUSIVE ECONOMIC GROWTH	1.1	Develop and promote the agricultural potential of KZN
	1.2	Enhance sectoral development through trade investment and business retention
	1.3	Enhance spatial economic development
	1.4	Improve the efficiency, innovation and variety of government-led job creation programmes
	1.5	Promote SMME and entrepreneurial development
	1.6	Enhance the Knowledge Economy
2 HUMAN RESOURCE DEVELOPMENT	2.1	Improve early childhood development, primary and secondary education
	2.2	Support skills development to economic growth
	2.3	Enhance youth and adult skills development and life-long learning
3 HUMAN AND COMMUNITY DEVELOPMENT	3.1	Eradicate poverty and improve social welfare services
	3.2	Enhance health of communities and citizens
	3.3	Safeguard and enhance sustainable livelihoods and food security
	3.4	Promote sustainable human settlements
	3.5	Enhance safety and security
	3.6	Advance social cohesion and social capital
	3.7	Promote youth, gender and disability advocacy and the advancement of women
4 INFRASTRUCTURE DEVELOPMENT	4.1	Development of seaports and airports
	4.2	Develop road and rail networks
	4.3	Develop ICT infrastructure
	4.4	Ensure availability and sustainable management of water and sanitation for all
	4.5	Ensure access to affordable, reliable, sustainable and modern energy for all
	4.6	Enhance KZN waste management capacity
5 ENVIRONMENTAL SUSTAINABILITY	5.1	Enhance resilience of ecosystem services
	5.2	Expand the application of green technologies
	5.3	Adapt and respond climate change
6 GOVERNANCE AND POLICY	6.1	Strengthen policy, strategy coordination and IGR
	6.2	Build government capacity
	6.3	Eradicate fraud and corruption
	6.4	Promote participative, facilitative and accountable governance
7 SPATIAL EQUITY	7.1	Enhance the resilience of new and existing cities, towns and rural nodes, ensuring equitable access to resources, social and economic opportunities
	7.2	Ensure integrated land management use across the Province, ensuring equitable access to goods and services, attracting social and financial investment

Figure 2.48 The KZN PGDS Vision 2035, Goals and Strategic Objectives (KZN Planning Commission 2018b: 8).

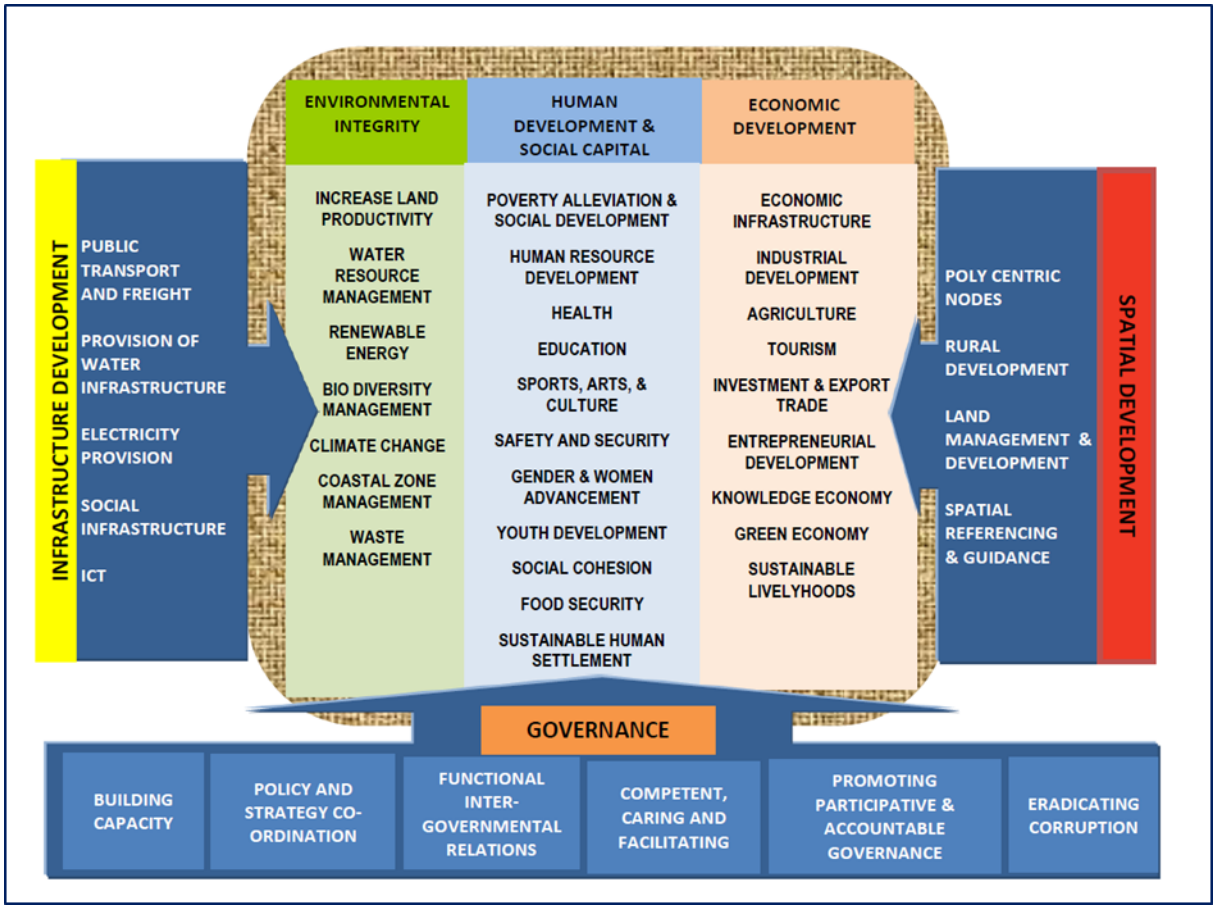


Figure 2.49 KZN PGDS Sustainability Framework (KZN Planning Commission 2018b: 6).

Table 2.14 Alignment between the AU Agenda 2063 Strategic Goals, the KZN PGDS 2016 Goals and the SDG Goals to which Umgeni Water contributes (KZN Planning Commission 2017: 23 – 24).

AU Agenda 2063 Goals	KZN PGDS 2016	SDG Goals
7. Environmentally sustainable and climate resilient economies and communities.	4. Strategic Infrastructure (4.4 Ensure availability and sustainable management of water and sanitation).	6. Ensure availability and sustainable management of water and sanitation for all. 12. Ensure sustainable consumption and production patterns. 13. Take urgent action to combat climate change and its impacts.
10. World class infrastructure criss-crosses Africa.	4. Strategic Infrastructure.	6. Ensure availability and sustainable management of water and sanitation for all. 7. Ensure access to affordable, reliable, sustainable and modern energy for all. 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation.

The indicators and the interventions for Strategic Objective 4.4 identified in the KZN PGDS 2018 are listed in **Table 2.15**.

Table 2.15 Indicators and interventions for Strategic Objective 4.4 (KZN Planning Commission 2018a: 128).

Strategic Objective 4.4 Indicators	Strategic Objective 4.4 Interventions
4.4.1 Surface water storage as a percentage of surface mean annual runoff per district.	4.4(a) Review and implement the Provincial Water Sector Investment Strategy.
4.4.2.1 Quantity of surface water abstracted per annum in each district.	4.4(b) Policy and guidelines on the inclusion of quaternary catchment for groundwater, grey water and desalination.
4.4.2.2 Quantity of groundwater abstracted per annum in KZN as a percentage of groundwater potential in each district.	4.4(c) Develop and implement water sector capacity building programme with all water institutions.
4.4.3 Percentage of households with access to a basic level of sanitation (Ventilated Improved Pit Latrine) and higher.	4.4(d) Develop new water and sanitation tariff policy.
4.4.4 Percentage of households with access to potable drinking water, within 200m of the dwelling.	4.4(e) Expedite the approval of water use licences.
4.4.5.1 Non-revenue water – real physical water loss as a percentage.	4.4(f) Programme for development of water sources (desalination, rainwater, recycling, groundwater).
4.4.5.2 Non-revenue water – non-physical water loss as a percentage.	4.4(g) Programmes for reduction of non-revenue water.
4.4.6 Percentage of water service systems in balance (supply and demand).	
4.4.7 Percentage of households with infrastructure access to 75 litres of water per person per day and higher.	
4.4.8 Percentage of households with yard water connections and higher level of service.	

The KZN PGDP 2018 elaborates on the interventions listed in **Table 2.15** and further identifies targets for the indicators shown in **Table 2.15** (see pgs. 128 – 131 in the KZN PGDP 2019).

The KZN PGDP 2019 explains that "spatial variables were considered collectively and a ranking order to key elements applied" to update the KZN Provincial Spatial Development Framework (SDF) (KZN Planning Commission 2018: 23). This process identified "Broad Provincial Spatial Planning Categories" as shown in **Figure 2.50**.

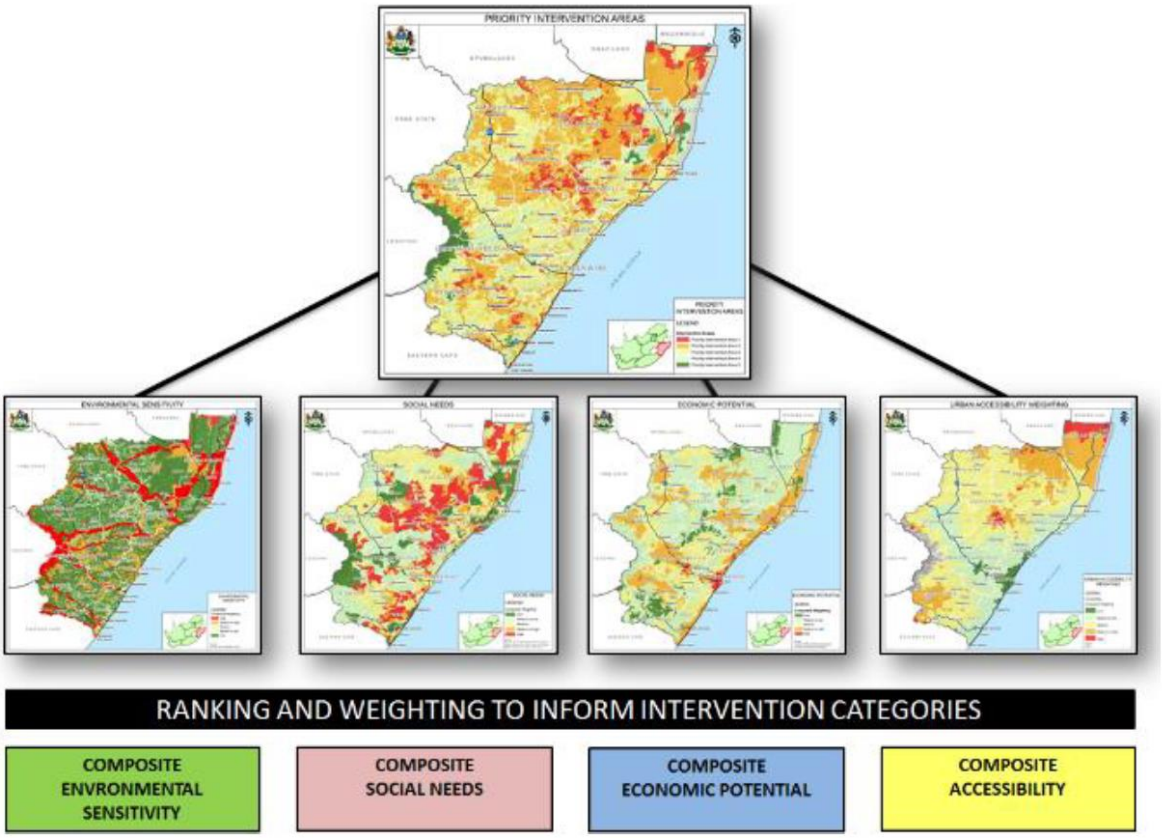


Figure 2.50 Composite map of priority intervention areas in KZN (KZN Planning Commission 2018a: 23).

The KZN PSDF 2016 is shown in **Figure 2.51** and Umgeni Water's infrastructure and the KZN WTPs in relation to the KZN PSDF 2016 is illustrated in **Figure 2.52**. It is shown that Umgeni Water's existing infrastructure is predominantly located in those areas identified as "economic support areas" and "economic value adding areas" and that the recommended projects (**Figure 2.63 in UW IMP 2019**) are predominately located in those areas identified as "priority intervention areas".

With reference to the KZN WTPs, it is shown in **Figure 2.52** that whilst some of the WTPs are located in the identified nodes and corridors; mandated service delivery areas, agricultural service areas and priority intervention areas, there are some nodes that do not have WTPs in close proximity. This suggests that these planned nodes may not have an assured supply of water.

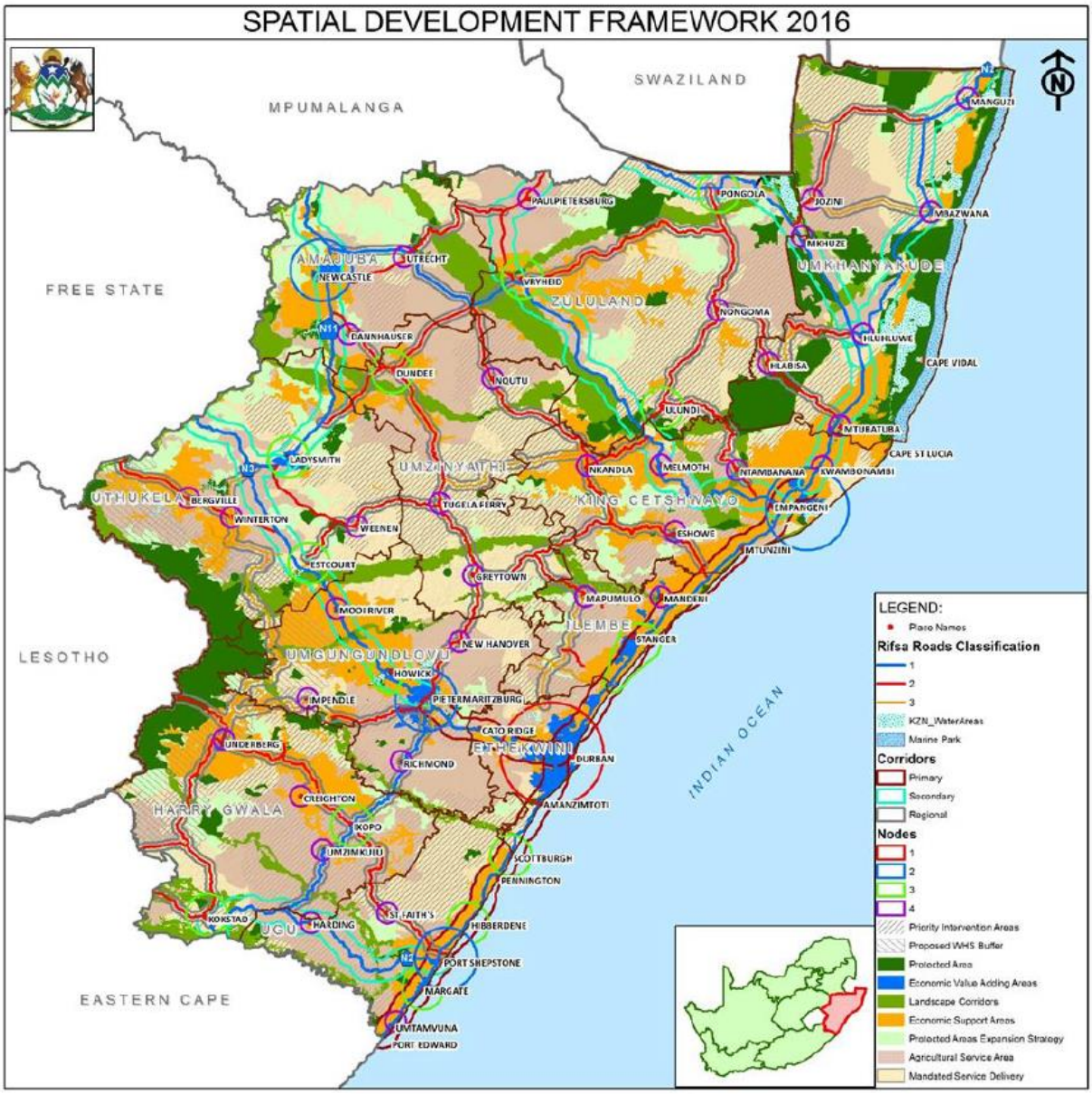


Figure 2.51 KZN PSDF 2016 (KZN Planning Commission 2018a: 25).

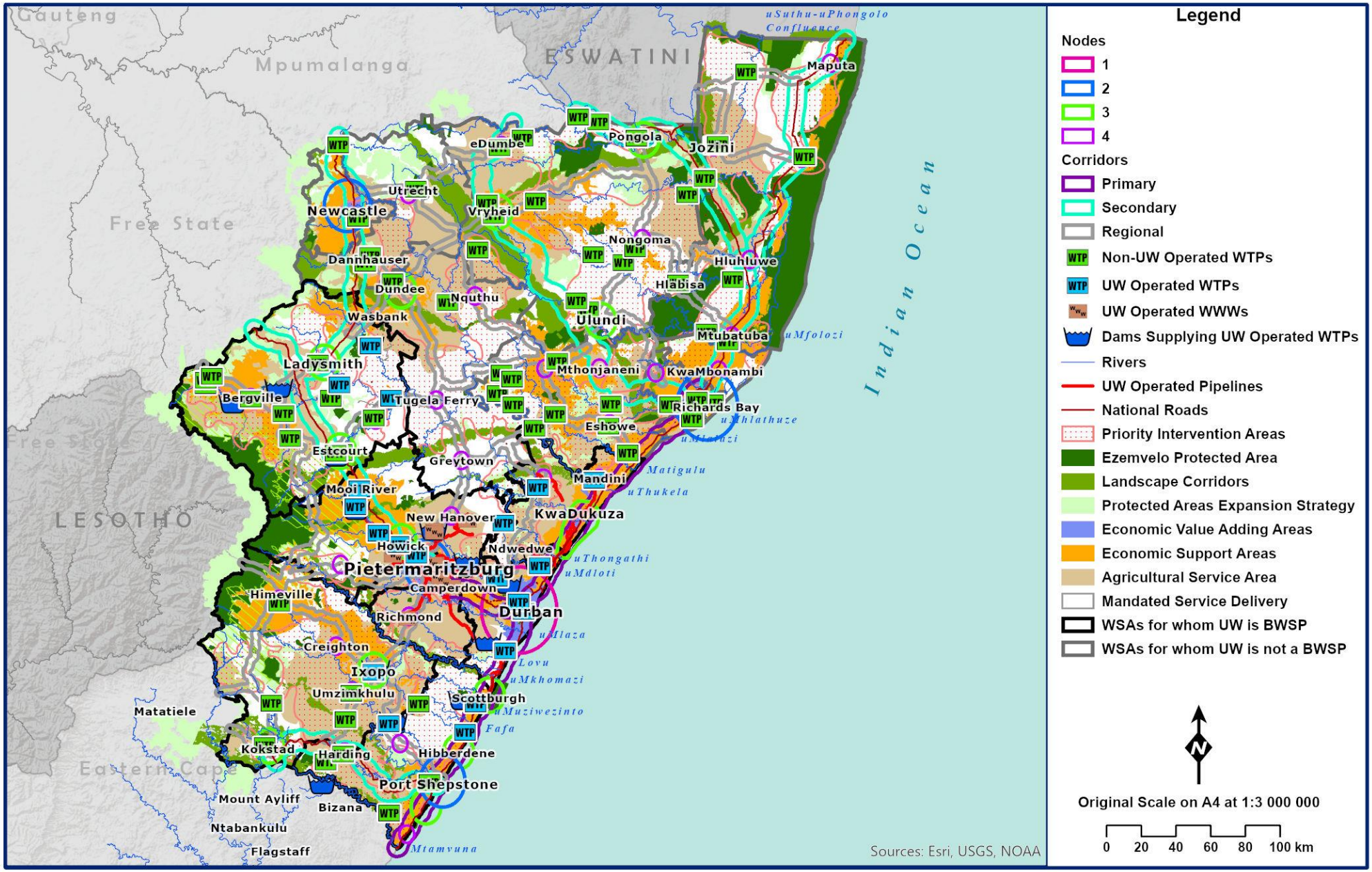


Figure 2.52 KZN WTPs in relation to the KZN PSDF 2016 (KZN DoT 2017; KZN Planning Commission 2018; MDB 2016; Umgeni Water 2020; WR2012).

The development of the "KZN Provincial Infrastructure Master Plan" was initiated to facilitate the achievement of the PGDP Strategic Goal 4: Strategic Infrastructure. The KZN Planning Commission explains that the "KZN Infrastructure Master Plan (KZN-IMP) attempts to provide a basis for alignment of the sector master plans of infrastructure implementing agents operating in the Province, focussing on:

- Sea Ports and Airports;
- Road and Rail;
- Water and Sanitation;
- Electricity;
- ICT;
- Health and Education Facilities;
- Human Settlements; and
- Waste Management."

(KZN Planning Commission 2017: 10)

The KZN Planning Commission continues to state that:

> "The KZN-IMP *is not* an attempt to write a unique Provincial Infrastructure Master Plan, but to record and co-ordinate stakeholder sector Infrastructure Master Plans to align with the Provincial objectives. It does not execute or dictate sector master planning.
>
> The KZN-IMP is being developed to:
>
> - Promote provincial alignment to national SIPs, the PGDP, National and Provincial policy as well as support the co-ordination of Strategic Infrastructure Integration.
> - Provide an institutionalised decision-making framework and tools in support of the above."
>
> (KZN Planning Commission 2017: 11)

The KZN Planning Commission explains that the KZN-IMP "attempts to provide a model for integration, alignment and prioritisation support to stakeholders based on variables related to:

- Policy and Planning performance and spatial/land use considerations and alignment to national, provincial and sector policies as well as norms and standards;
- Infrastructure Delivery Management System (IDMS): Service delivery and positioning in the project life-cycle;
- Projects alignment and contribution to PGDP/S Strategic Goals;
- Financial and funding model considerations."

(KZN Planning Commission 2017: 16)

The institutional framework for the KZN-IMP is illustrated in **Figure 2.53**. Umgeni Water engages with the KZN-IMP through Action Work Group (AWG) 14 (**Figure 2.54**) and the Provincial Infrastructure Co Ordination Work Group[11].

[11] See **Section 2.5 in IMP 2016** for a discussion on the institutional model.

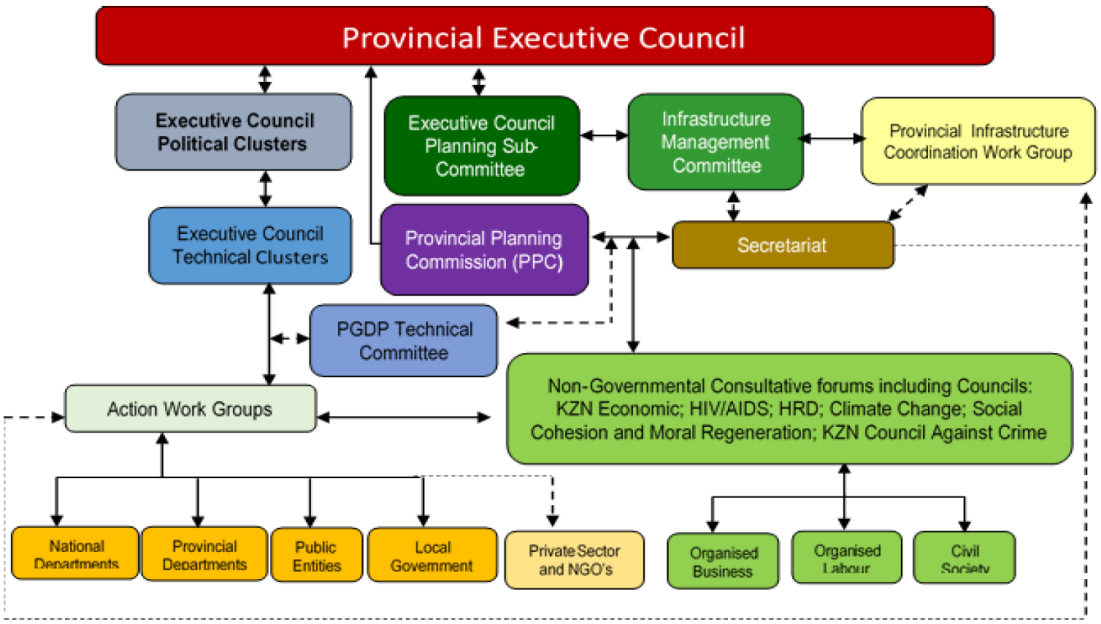


Figure 2.53 The KZN-IMP institutional framework (KZN Planning Commission 2018a: 181).

Executive Council Cluster	Cluster receives reports from		Responsible for the following Strategic Objectives	
	AWG No.	Convening Dept		
Economic Sector and Infrastructure Development	1	DARD	1.1	Develop and promote Agricultural Potential
	2	DEDTEA	1.2	Enhance sectoral development through trade investment and business retention
			1.3	Enhance spatial economic development
	3	DPW	1.4	Improve the efficiency, innovation and variety of government-led job creation programmes
	4	DEDTEA	1.5	Promote SMME and entrepreneurial development
	5	DEDTEA	1.6	Enhance the knowledge economy
	12	DOT	4.1	Development of seaports and airports
			4.2	Develop road and rail networks
	13	DEDTEA	4.3	Develop Information and Communications Technology (ICT) infrastructure
	14	COGTA	4.4	Ensure availability and sustainable management of water and sanitation for all
			4.5	Ensure access to affordable, reliable, sustainable and modern energy for all
	15	DEDTEA	5.2	Expand the application of green technologies
	16	DEDTEA	4.6	Enhance KZN waste management capacity
			5.1	Enhance resilience of ecosystem services
			5.3	Adapt and respond to climate change

Figure 2.54 Action Work Groups reporting to the Economic Sector and Infrastructure Development Cluster of the KZN Executive Council and the PGDP Technical Committee (KZN Planning Commission 2017: 13).

The KZN-IMP is summarised in **Figure 2.55**.

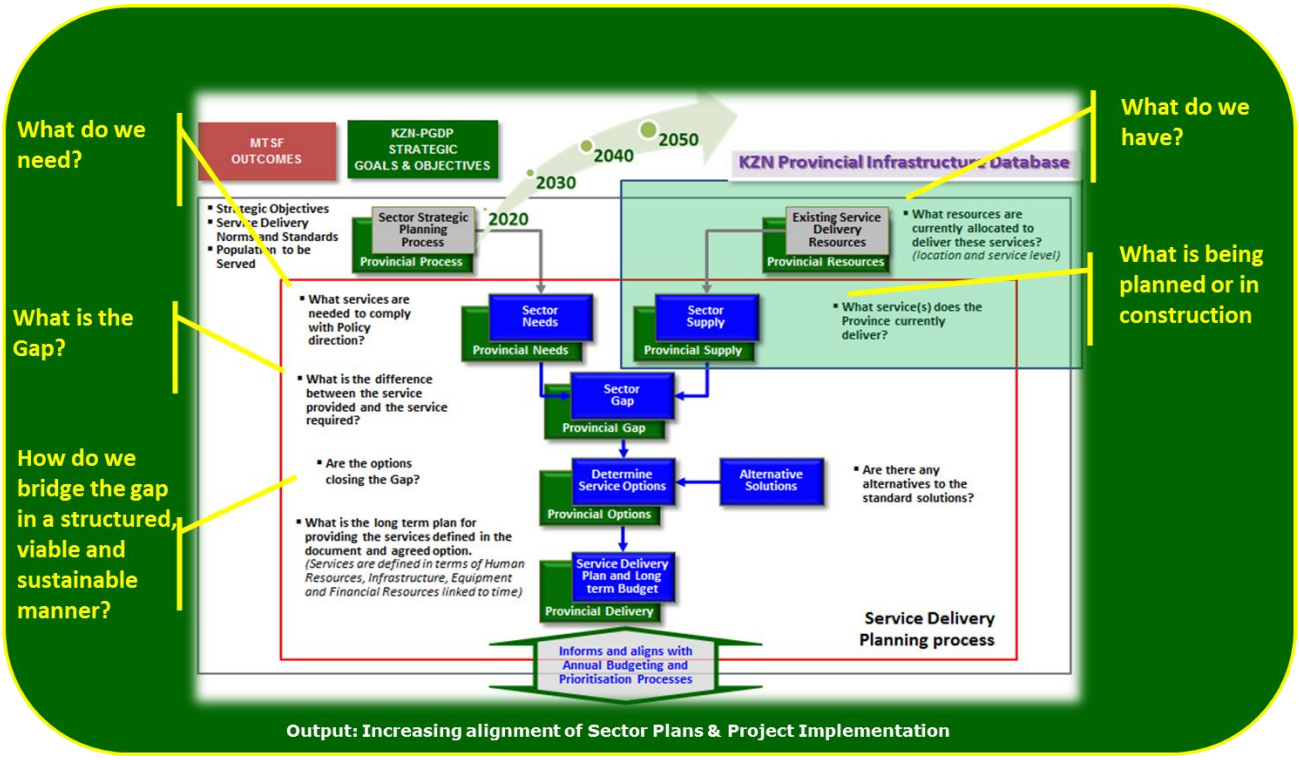


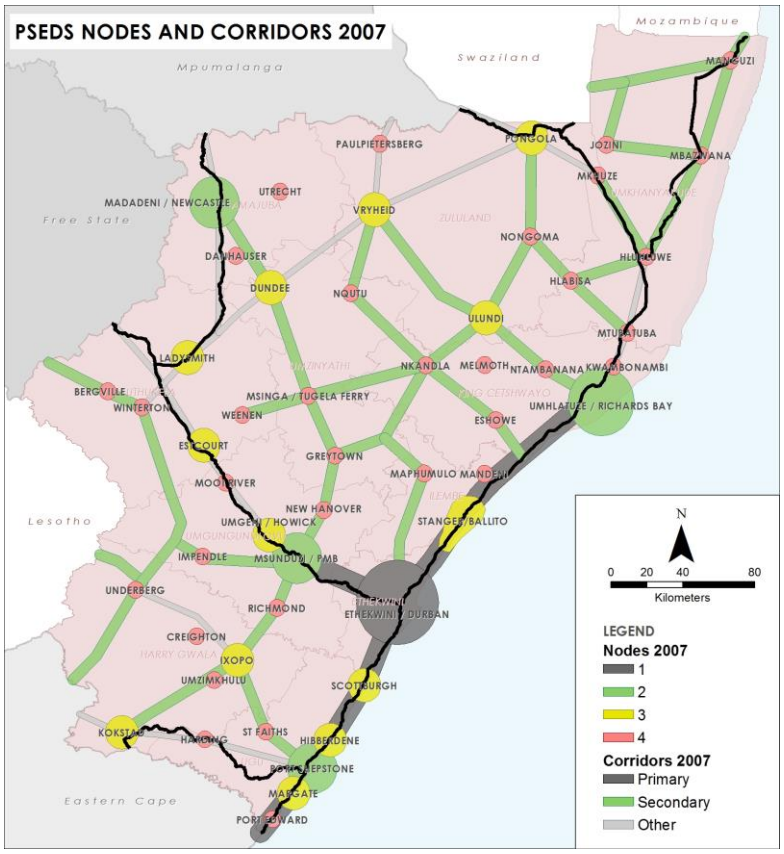
Figure 2.55 Illustration of what the KZN-IMP is (KZN Planning Commission 2017: 28).

The 2007 KZN Provincial Spatial Economic Development Strategy (PSEDS) (**IMP 2008**) was reviewed and updated in 2016. The KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) undertook research to identify the main economic drivers in the KZN district municipalities and analysed the comparative advantages of each district municipality. The results were then spatially analysed to "objectively determine a framework for the prioritisation of spatial economic development initiatives in the province" (KZN EDTEA 2017: ii). The refinement of the PSEDS is shown in **Figure 2.56**.

Umgeni Water's infrastructure and the KZN WTPs in relation to the 2016 PSEDS is shown in **Figure 2.57**. It is shown in this figure that Umgeni Water's existing infrastructure and recommended projects (**Figure 2.68 in UW IMP 2019**) align with the proposed nodes and corridors of the PSEDS 2016.

However, it is also shown in **Figure 2.57** that some of the identified nodes of local influence do not have WTPs located in close proximity and therefore may not have an assured supply of water.

PSEDS Nodes and Corridors 2007



PSEDS Nodes and Corridors 2016

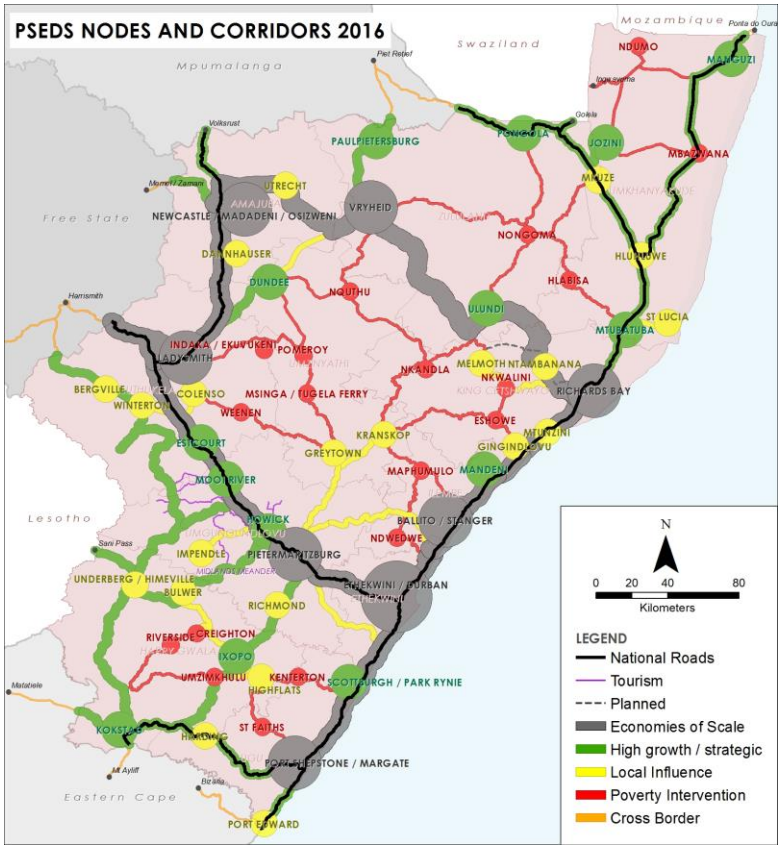


Figure 2.56 The PSEDS 2007 and 2016 (KZN EDTEA 2017: database).

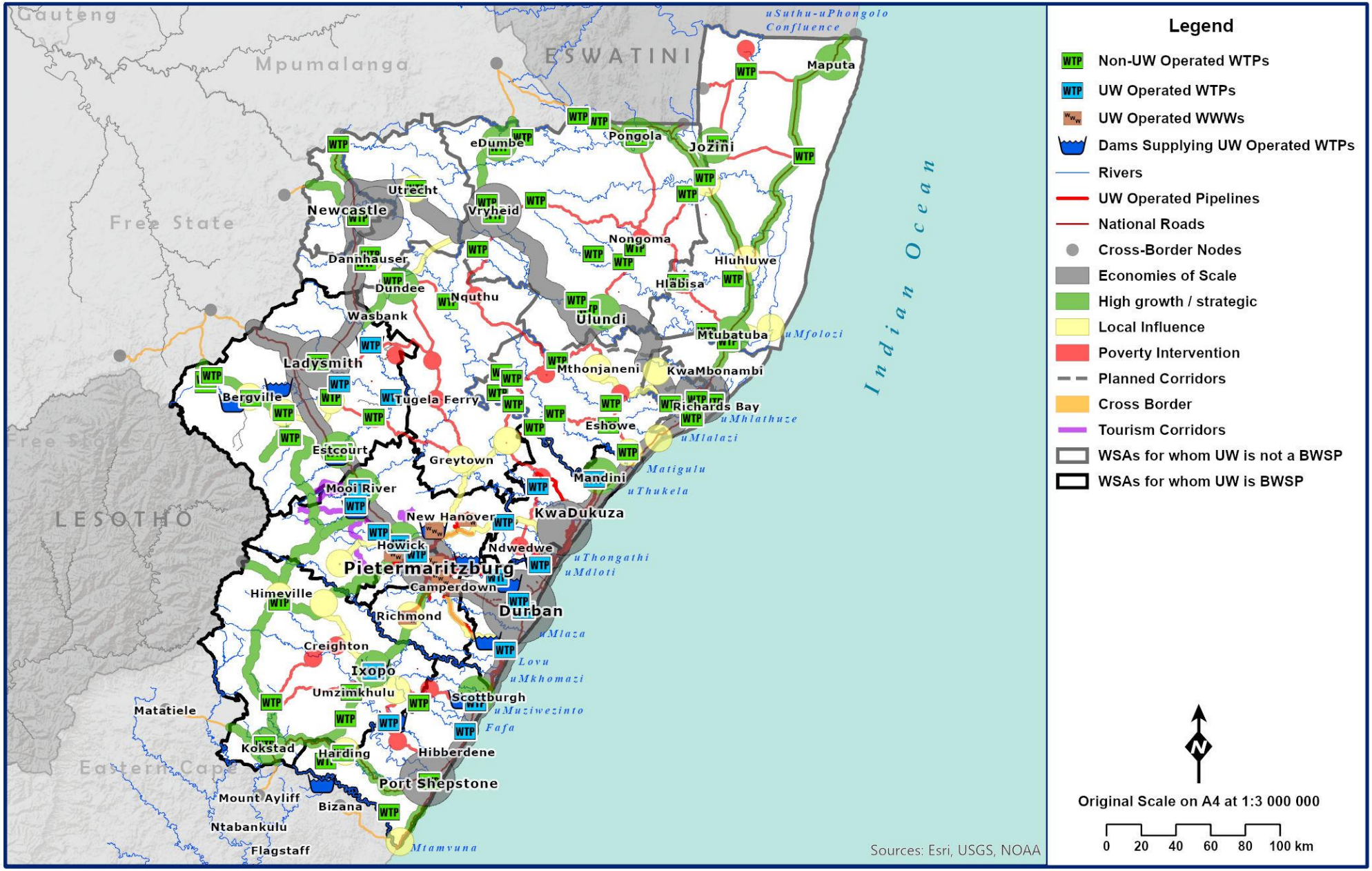


Figure 2.57 KZN WTPs in relation to the KZN PSEDS 2016 (KZN DoT 2017; KZN EDTEA 2017; MDB 2016; Umgeni Water 2019).

The KZN Department of Human Settlements (DHS) and the KZN branch of the Housing Development Agency (HDA) developed the KZN Human Settlements Master Spatial Plan in 2016. The purpose of this plan is to:

- "Create a spatial framework to guide investment by all state departments and state owned companies and private sector actors in relation to the human settlement sector.
- Achieve a create balance between spatial equity, economic competiveness and environmental sustainability to overcome the legacy of apartheid spatial planning.
- Provide guidance to the implementation of all Medium-Term Strategic Framework (MTSF) targets in alignment with a human settlement spatial plan.
- Provide guidance to the implementation of strategically chosen catalytic interventions to achieve spatial transformation."

(KZN DHS and HDA 2016: 4)

This plan used the HDA's Land Identification and Assessment Criteria (**Figure 2.58**) with a scoring system and a sensitivity analysis to identify focus areas for human settlements.

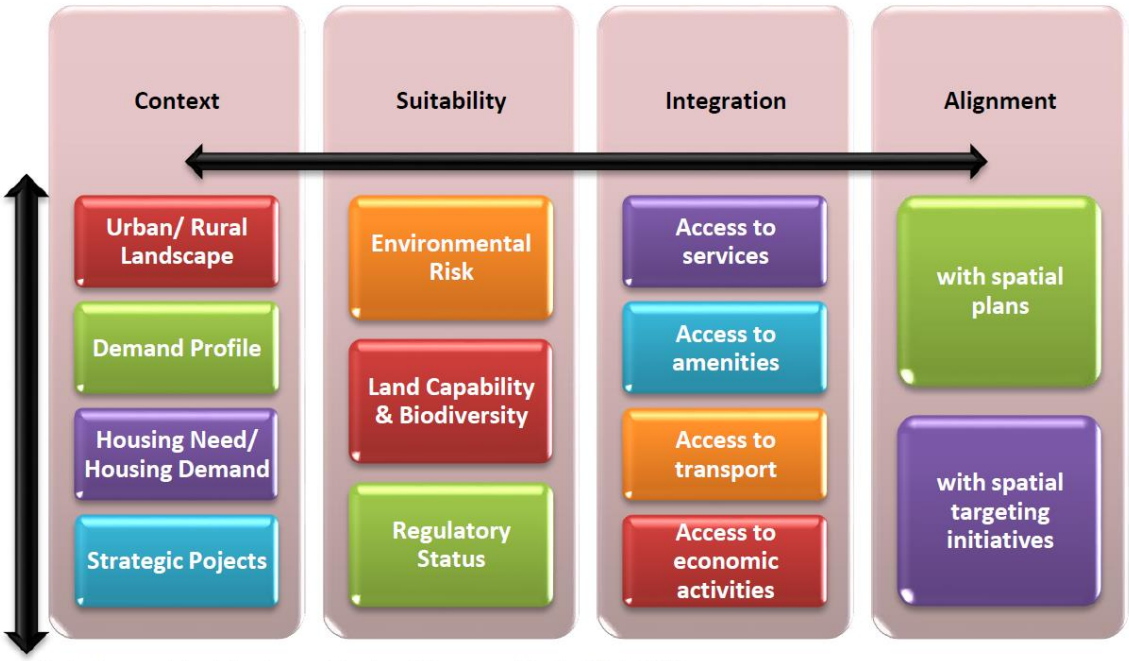


Figure 2.58 HDA's Land Identification and Assessment Criteria (LIAC) (KZN DHS and HDA 2016: 143).

The alignment of these focus areas with Umgeni Water's infrastructure and the KZN WTPs is shown in **Figure 2.59**.

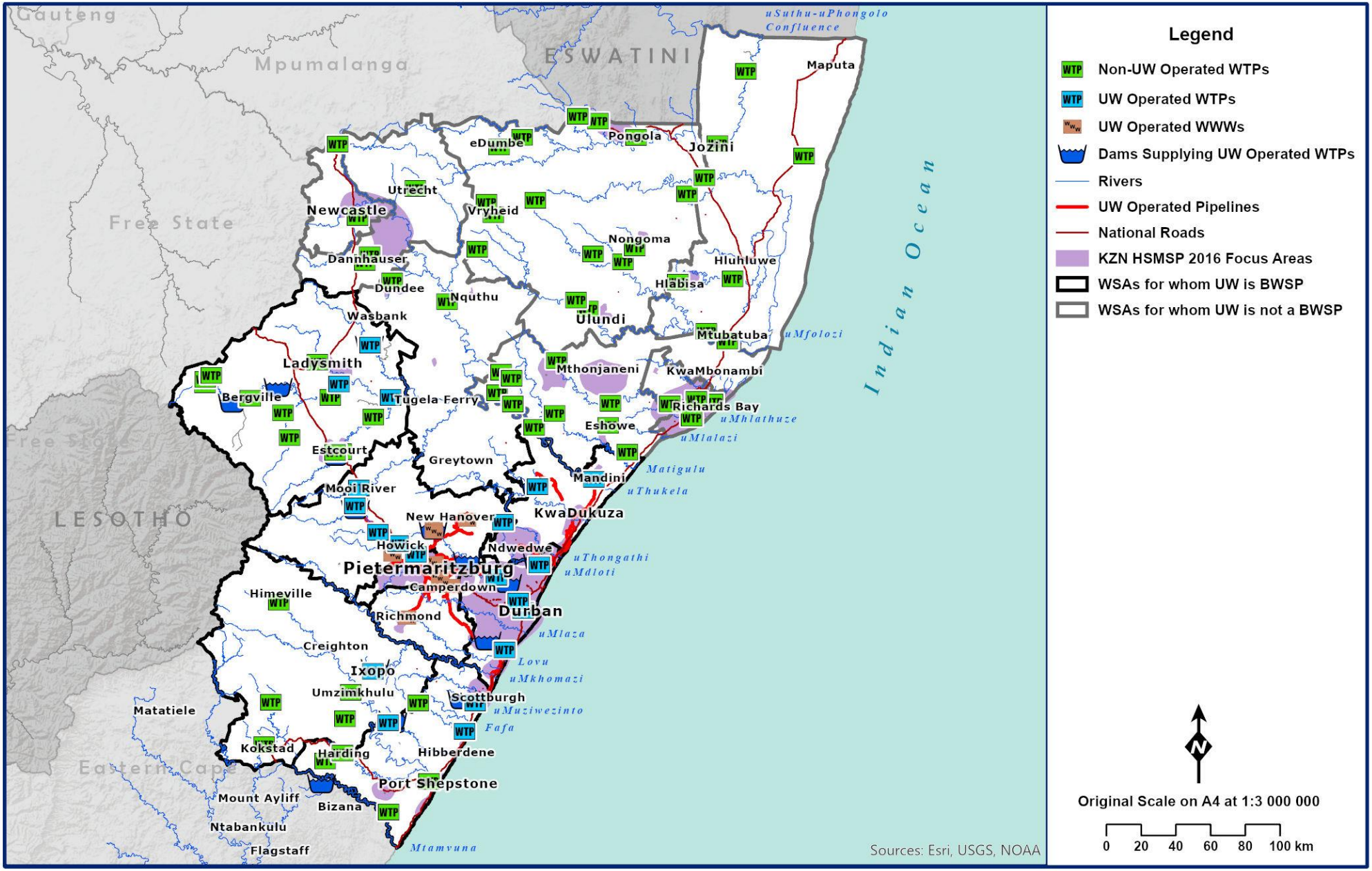


Figure 2.59 KZN WTPs in relation to the KZN Human Settlements Master Spatial Plan 2016 Focus Areas (KZN DHS and HDA 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2019).

In May 2020, the Minister of Human Settlements declared 22 Priority Housing Developments Areas (PHDAs) (Government Notice No. 526, 15 May 2020) in KZN. Section 1 of the Housing Development Agency Act, 2008 defines "Priority Housing Development Areas" as "land identified by the Agency for housing purposes where buildings or structures will be built for the purpose of housing delivery". The HDA elaborates further by identifying the following criteria:

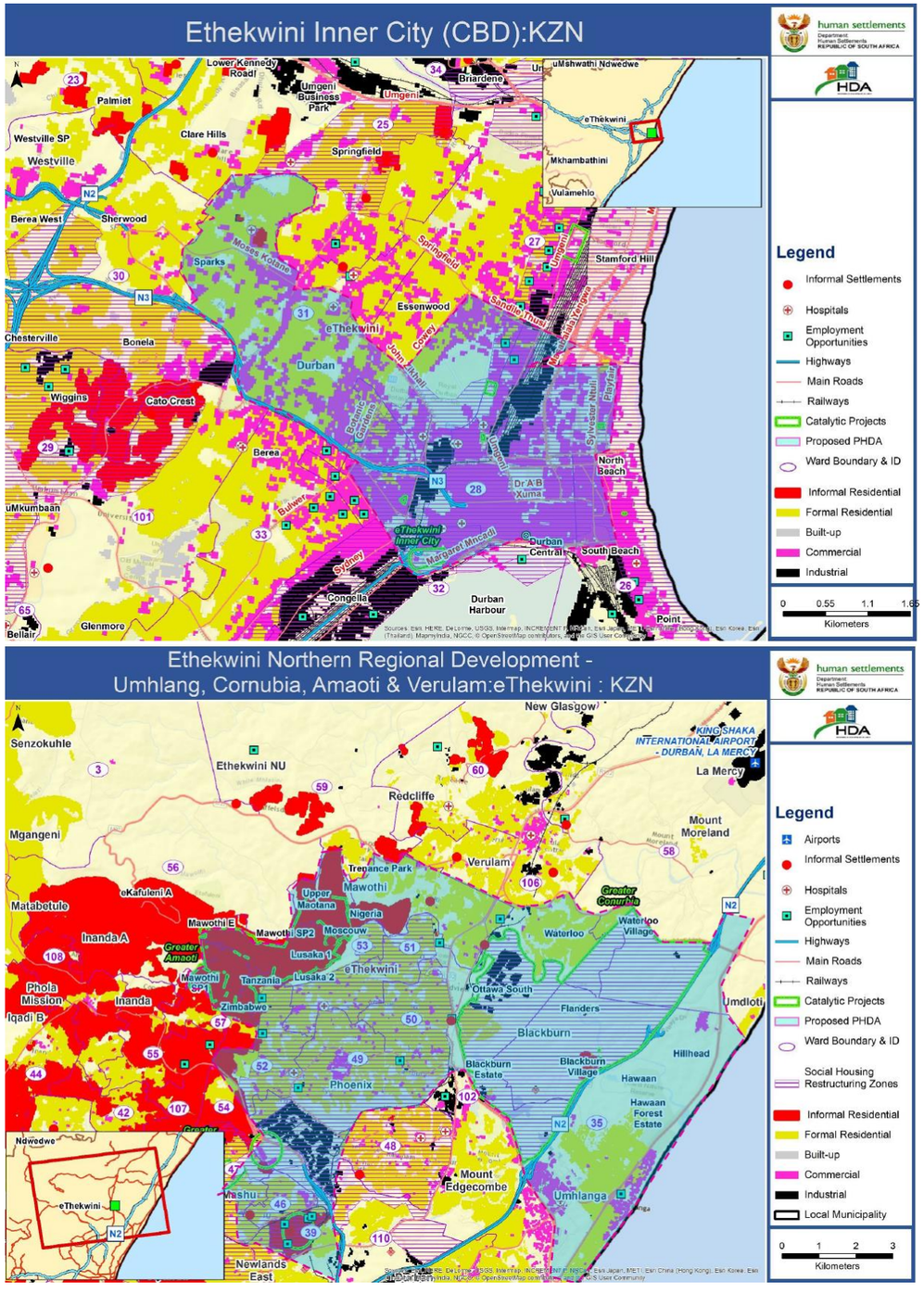
- "High housing demand.
- Large enough to accommodate social and economic amenities.
- Supports sustainable environmental management and integrated land uses.
- Integrated transportation, integrated bulk services, sustainable economic activities.
- Not situated in environmental sensitive areas."

(KZN HDA 2019: Slide 4)

Of the 22 PHDAs identified in KZN, four are located in Umgeni Water's operational area (**Figure 2.60**). Two of the PHDAs viz. the eThekwini Inner City PHDA and the Edendale PHDA are supplied by the Mgeni System (**Section 7**) and the remaining two viz. the eThekwini Northern Regional Development PHDA and the Shakaskraal, Tinley Manor and Ballito PHDA are supplied by the North Coast System (**Section 12**). The Edendale PHDA could be supplied by the Darvill WWW (**Section 19**). Umgeni Water does not operate the wastewater infrastructure supplying the remaining PHDAs.

A summary of the municipal Spatial Development Frameworks (SDFs) within Umgeni Water's operational area is presented in **Figure 2.61**. It is shown in this figure that Umgeni Water's existing and proposed infrastructure align with the nodes and corridors identified by the municipalities.

A comparison of **Figure 2.52**, **Figure 2.57**, **Figure 2.59** and **Figure 2.61** shows that there is alignment between the different public sector plans within Umgeni Water's operational area. This alignment is summarised in **Figure 2.62**. Whilst it is clearly shown in **Figure 2.62** that there is existing and planned bulk water infrastructure in the areas that are densifying, it is unclear whether there is sufficient sanitation infrastructure to support the growth.



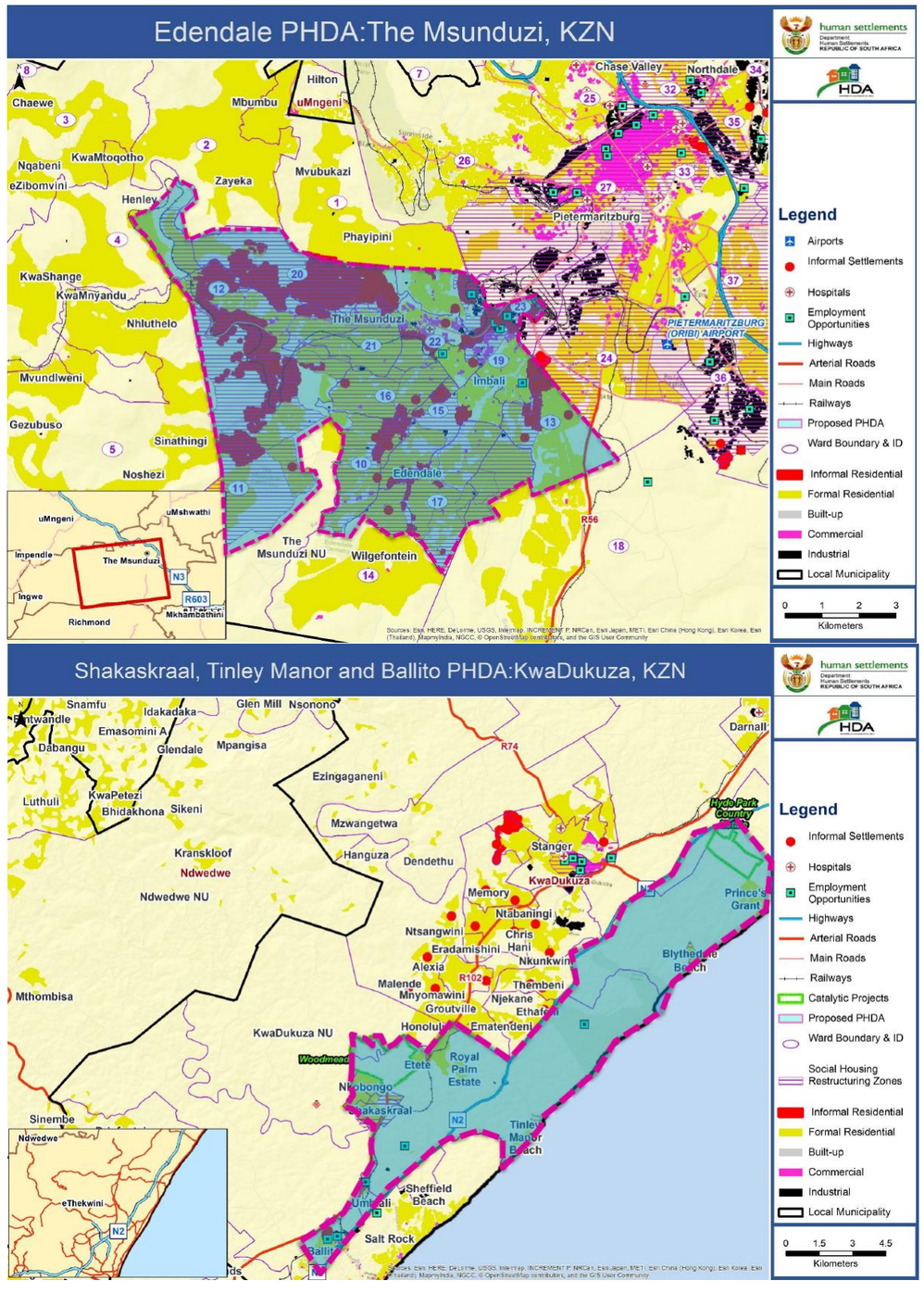


Figure 2.60 Proposed Priority Housing Development Areas located in Umgeni's operational area (KZN HDA 2019: slides 15, 16, 17, 19).

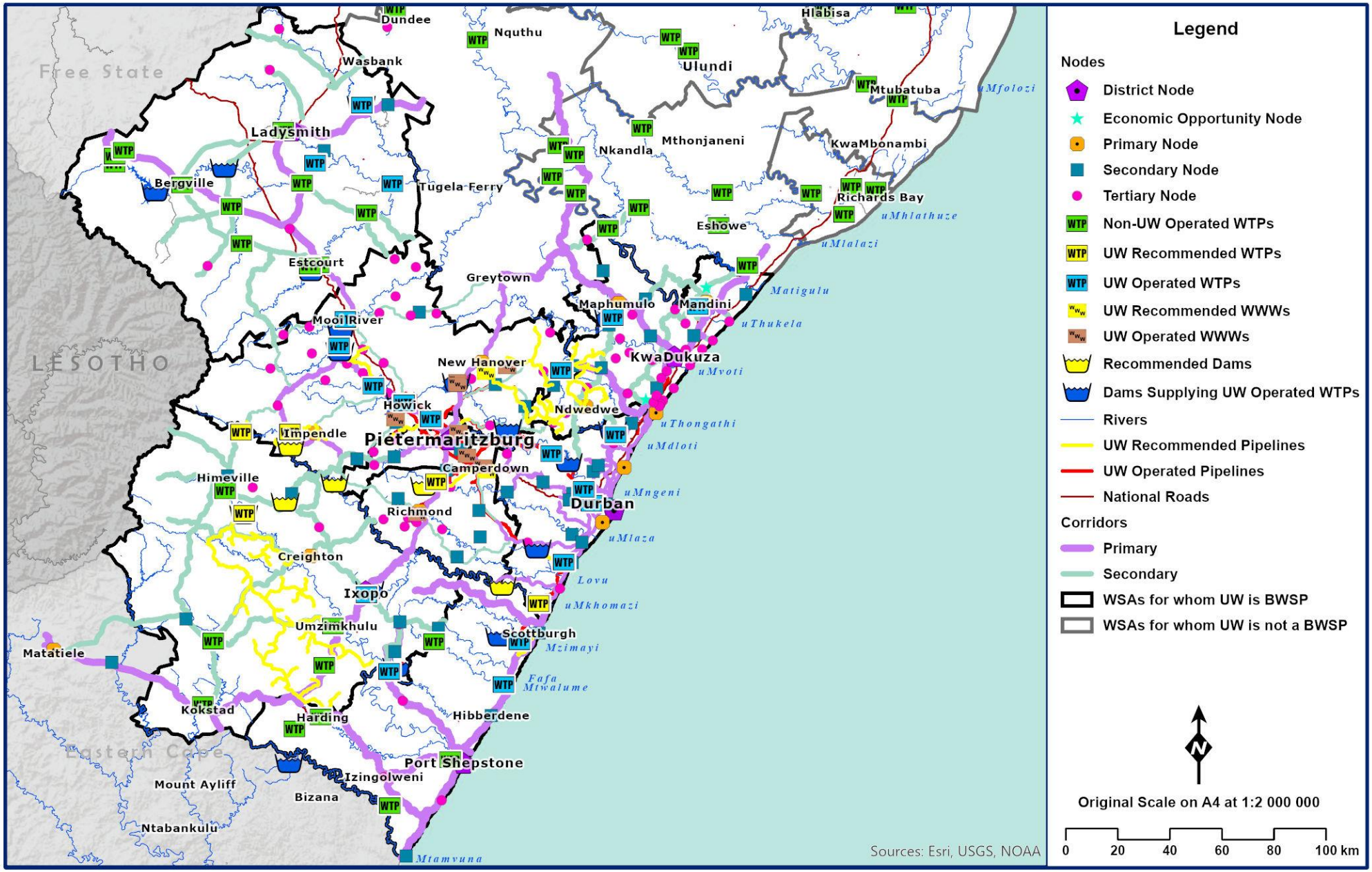


Figure 2.61 Municipal SDFs (eThekwini 2019; Harry Gwala 2016; iLembe 2016; KZN DoT 2017; MDB 2016; Umgeni Water 2019; Ugu 2016; uMgungundlovu 2018; uThukela 2018).

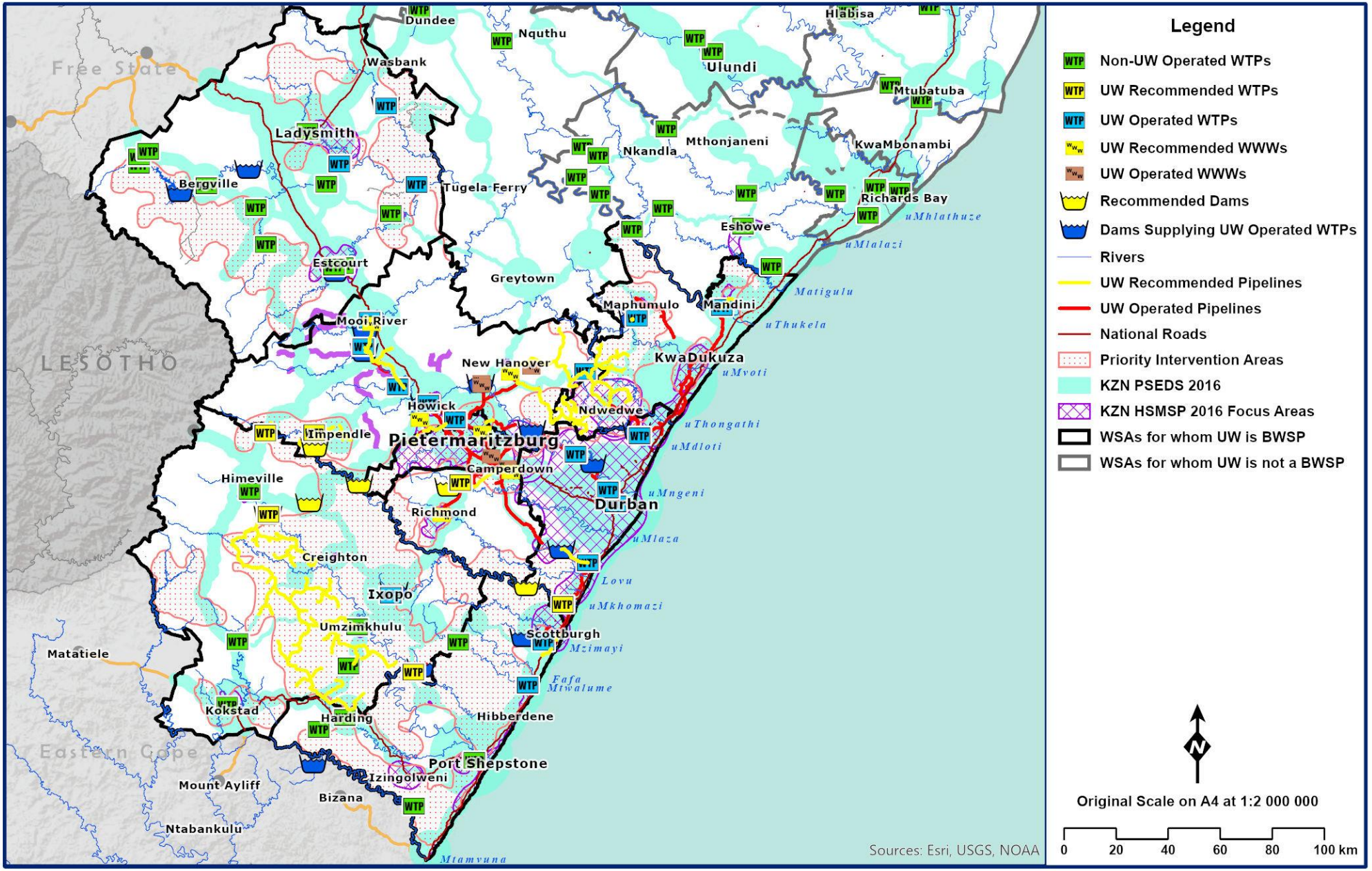


Figure 2.62 Alignment of the different spatial plans (KZN DHS and HDA 2016; KZN DoT 2017; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016; Umgeni Water 2020; WR2012).

Sanitation system/technology types may be categorised as those shown in **Table 2.16**.

Table 2.16 Sanitation system/technology types (after DoH and CSIR 2000: 10.4).

Sanitation System Type	Water Added	Conveyance Required (Either Sewer Pipelines or Truck)
Full waterborne sanitation	Yes	Yes
Flushing toilet with conservancy tank	Yes	Yes
Shallow sewers	Yes	Yes
Flushing toilet with septic tank and subsurface soil absorption field	Yes	No
Low-flow on-site sanitation systems	Yes	No
Aqua-privy toilet	Yes	No
Chemical toilet	No	Yes
Ventilated improved pit toilet	No	No
Ventilated improved double-pit toilet	No	No
Ventilated vault toilet	No	No
Urine-diversion toilet	No	No
Pit	No	No
Bucket	No	No
Other	No	No
No sanitation system	No	No

The planned changes in the sanitation system/technology type is explained by Bradley (2012: Slide 23) who states that:

> *"Feasible solutions to domestic water and sanitation needs are dependent upon residential density to a substantial degree, and the transition from 'standard' approaches to alternatives is at a higher residential density for sanitation than for water… This is particularly so with current technological advances…"*.
>
> Bradley (2012: Slide 23)

This is summarised in **Figure 2.63**. It is shown in **Figure 2.63** that as residential densities increase, the most appropriate (conventional) sanitation system/technology is that of "piped/sewered waste from household" and that this is the sanitation/technology conventionally used when there is "piped water to household".

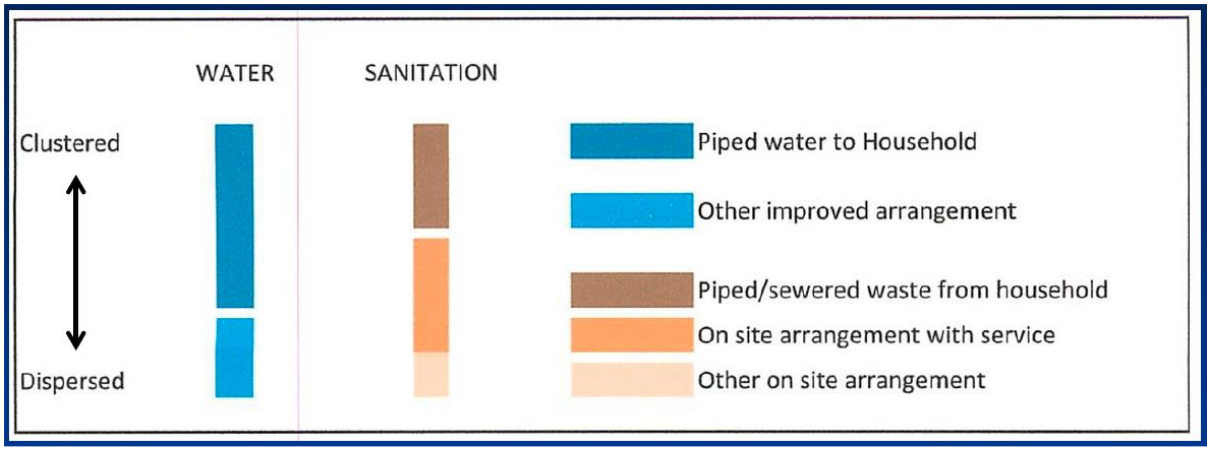


Figure 2.63 Relationship between residential densities and water and sanitation supply options (Bradley 2012: Slide 23).

A simplistic analysis using the relationship shown in **Figure 2.63** was undertaken to identify if there is sufficient existing and planned sanitation infrastructure for the areas planned for densification (**Figure 2.62**) within Umgeni Water's operational area:

- The planned areas for densification are shown in **Figure 2.64** (after **Figure 2.62)**. It is noted that these areas have been identified at a strategic level.
- The location of the planned densification areas in relation to those areas in which the dominant access to piped water is "piped water inside the dwelling" as identified by the Census 2011 is shown in **Figure 2.65**. It is shown in this figure that not all the planned densification areas have piped water inside the dwelling and therefore water service levels are likely to increase in these areas. However, it was shown in **Figure 2.62** that there is planned bulk water infrastructure to cater for this increase in water demand (see **Sections 7, 8, 11, 12 and 19**).
- The location of those areas in which the dominant toilet facility is a "flush toilet connected to a sewerage system" as identified by the Census 2011 in relation to the planned densification areas and those areas in which the dominant access to piped water is "piped water inside the dwelling" is shown in **Figure 2.66**. It is shown clearly in this figure that there are "gaps" between the sewered system areas and the areas that will be densifying and some areas with piped water inside the dwelling.
- Those areas in which the dominant toilet facility is a "flush toilet with a septic tank" are shown in **Figure 2.67**. As densification increases, the use of a septic tank technology becomes a public health hazard and the sanitation technology should change to a sewered system. It is shown in this figure that when the sanitation technology changes from septic tank to that of a sewered system, there will still be "gaps" between the sewered system areas and the areas that will be densifying.

The above analysis, based on a number of assumptions, suggests that existing wastewater infrastructure may not be sufficient to cater for existing and future needs. This is discussed further in **Section 19**.

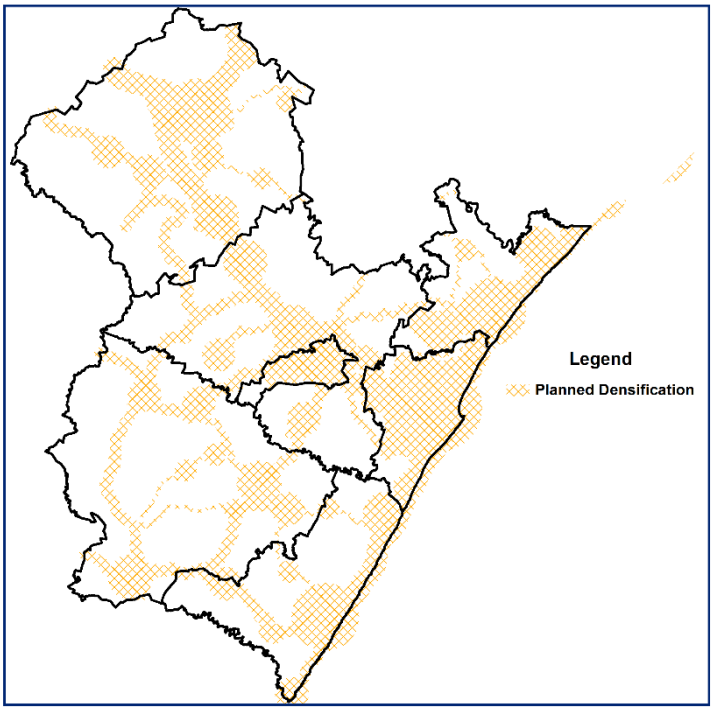


Figure 2.64 Public sector planned densification areas (KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016).

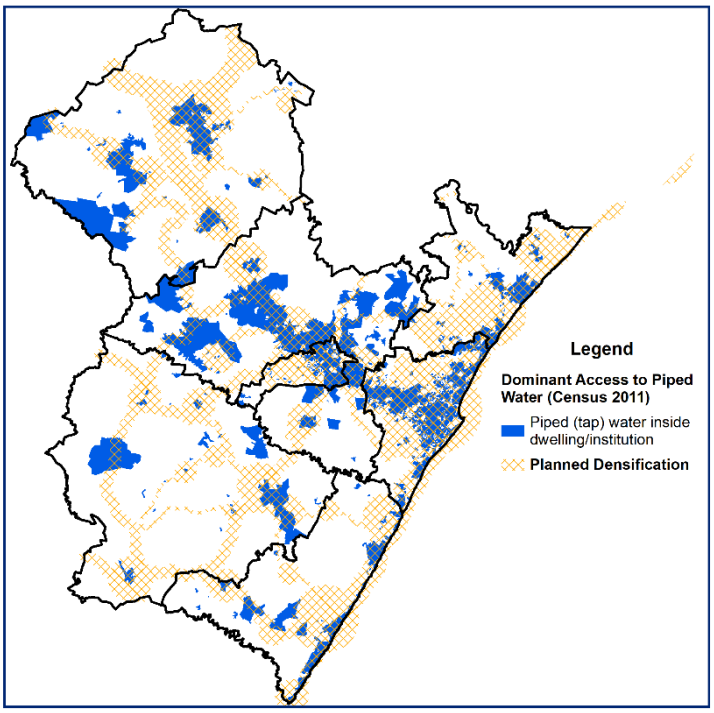


Figure 2.65 Public sector planned densification areas and those areas with a dominant access to piped water inside the dwelling (Census 2011; KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016).

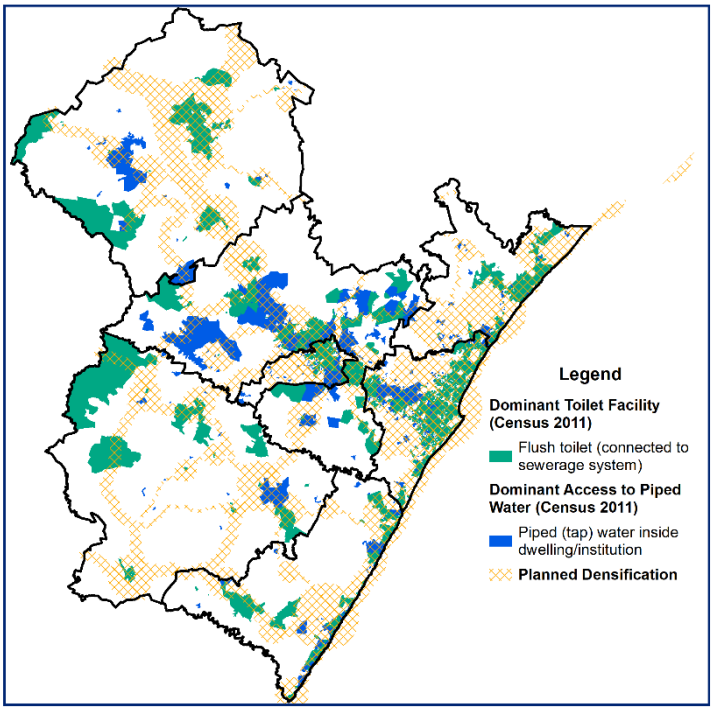


Figure 2.66 Public sector planned densification areas and those areas with a dominant access to piped water inside the dwelling and flush toilet connected to sewerage system (Census 2011; KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016).

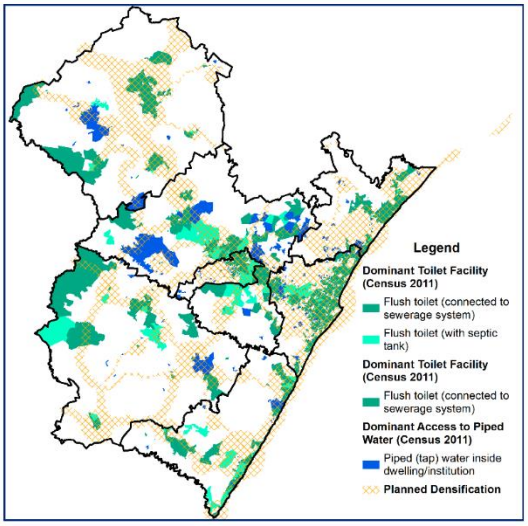


Figure 2.67 Public sector planned densification areas and those areas with a dominant access to piped water inside the dwelling, flush toilet connected to sewerage system and flush toilet with septic tank (Census 2011; KZN DHS and HDA 2016; KZN EDTEA 2017; KZN Planning Commission 2018; MDB 2016).

2.6 Regional Water Planning Overview

This section provides an overview of the infrastructure and supply planning throughout Umgeni Water's Operational Area. The 2020 Infrastructure Master Plan now includes the status quo of water resources and supply infrastructure for all areas in KwaZulu-Natal, even those areas outside of Umgeni Waters Operational Area. Included in this IMP are Umgeni Water's recommendations of regional and other schemes that could be implemented to improve bulk water supply services to these other areas. Since these recommendations have not, necessarily, been adopted by the WSA's, the areas outside of Umgeni Water's Operational Area are not included in this Chapter.

As shown in the previous section, the municipalities of eThekwini and uMgungundlovu are the two main economic contributors within KwaZulu-Natal (KZN). This economic activity is dominated by the two cities of Durban and Pietermaritzburg.

With reference to **Figure 2.52** and **Figure 2.57**, the Provincial Growth and Development Strategy (PGDS) (KZN Provincial Planning Commission 2018) and the PSEDS 2016 identifies eThekwini Municipality as a Primary Node within KZN, which is an urban centre with very high existing economic growth and with the potential for expansion and is of national and provincial economic importance. It is the only Primary Node in the province. Pietermaritzburg has been identified in the PGDS as a Secondary Node within KZN, which is an urban centre with good existing economic development and the potential for growth and services to the regional economy. It is one of four such nodes in the province. These two centres and the development corridor between them is the economic hub of the province (**Figure 2.52**).

Richards Bay on the North Coast, as the second busiest port in KZN and the third largest contributor to the provincial economy, is also classified as a Secondary Node. The corridor between Durban and Richards Bay is also considered to be of economic importance where significant development is expected to occur in the future, particularly in the area surrounding the Dube Trade Port and King Shaka International Airport.

Port Shepstone is also classified as a Secondary Node, and the corridor between it and Durban is experiencing steady growth and has potential for further economic development.

This key KZN developmental region (T-shaped) defined by primary and secondary nodes and corridors constitutes the KZN portion of SIP2 and falls largely within Umgeni Water's current area of operation (**Figure 2.39** and **Figure 2.40**). It was further shown in **Figure 2.46** and **Figure 2.47** that the water within Umgeni Water's area of operation not only supports this area but is also transferred to the largest economic hub in the country viz. that Gauteng region and the Richard's Bay area, the second largest economic hub in KZN.

The primary, secondary and tertiary development nodes are indicated as circles in **Figure 2.68** with the size proportional to its hierarchical level of importance. The KwaZulu-Natal Reconciliation Strategy Study that was completed by the Department of Water and Sanitation[12] (DWAF 2009) termed this region "the KwaZulu-Natal Coastal Metropolitan Area".

In order to maintain its significance, and realise its future growth potential, this region needs to be supported by a sustainable long-term supply of water. The responsibility for the planning, constructing and operating of the required water resource and water supply infrastructure rests with the Department of Water and Sanitation, Umgeni Water and the relevant Water Service

[12] At the time the study was published, the department was called the Department of Water Affairs and Forestry (DWAF).

Authorities. The roles and responsibilities of these institutions in this regard vary, with some overlap in certain instances.

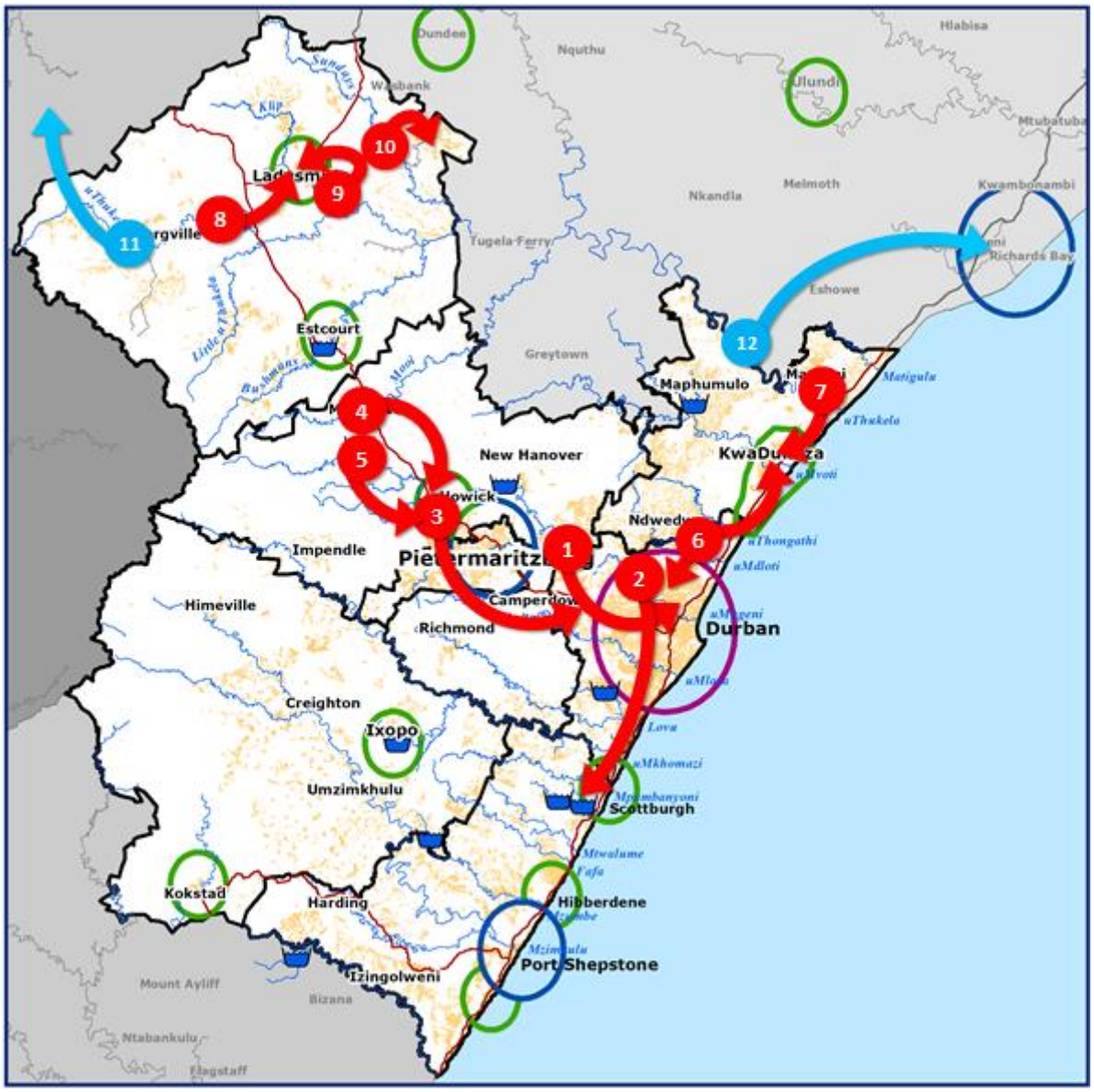


Figure 2.68 Current bulk water supply strategy.

With reference to **Figure 2.68**, the major sources of water to supply the area are as follows:

1. Water is abstracted from Nagle Dam on the uMngeni River to supply primarily the northern and central parts, and to a lesser extent the western part, of eThekwini Municipality. Raw water storage for this abstraction is provided at Albert Falls Dam, and can be supported by Midmar Dam situated upstream;
2. Water is abstracted from Inanda Dam on the uMngeni River to supply primarily the central and southern parts, and to a lesser extent the northern part, of eThekwini Municipality and the southern coastal strip as far south as Scottburgh within Ugu District Municipality. Raw water storage for this abstraction is provided at Inanda Dam, and can be supported by Albert Falls and Midmar dams upstream;

3. Water is abstracted from Midmar Dam on the uMngeni River to supply the Msunduzi Local Municipality (Pietermaritzburg), the western part of the eThekwini Municipality and the connecting corridor, which is within Umgungundlovu District Municipality;
4. When the volume at the Mearns Weir is greater than 60% of its capacity then water is transferred from both the Mearns Weir and from Spring Grove Dam to support the Mgeni System. In this scenario the following applies:
    a. 3.2 m^3/s is abstracted from Mearns Weir; and
    b. 1.3 m^3/s from Spring Grove Dam;
5. When the Mearns Weir is less than 60% of full supply capacity then 4.5 m^3/s is transferred directly from Spring Grove Dam, to the Mgeni System, to support all abstractions from the uMngeni River; and
6. Water is abstracted from Hazelmere Dam on the uMdloti River to supply the northern part of eThekwini Municipality and the northern coastal strip of iLembe District Municipality as far north as the town of KwaDukuza.
7. Water is abstracted from the uThukela River to supply the southern coastal areas of Mandini LM and the northern coastal areas of KwaDukuza LM as far south as the town of KwaDukuza.
8. Water is abstracted from Spioenkop Dam on the uThukela River to supply the Ladysmith area.
9. Water is abstracted from the uThukela River to supply the Ezakheni Area.
10. Water is abstracted from the Olifantskop Dam to supply the Ekuvukeni Area.
11. Water is abstracted from the upper reaches of the uThukela River to augment the water supply to the Gauteng economic region.
12. Water is abstracted from the lower reaches of the uThukela River to augment the water supply to the Richard's Bay area.

From a planning perspective, water from the Mgeni system is required to be supplied at a 99% level of assurance (i.e. a 1:100 year risk of failure) due to the economic and strategic significance (based on the industrial and commercial output) of the greater eThekwini-Msunduzi region. A 98% level of assurance (i.e. a 1:50 year risk of failure) is currently required for the supply from the Mdloti system, the uThukela System and for the South Coast as these regions are predominantly of a domestic nature.

A holistic view of the projected water demands from the entire Mgeni System is shown in **Figure 2.69** together with the existing yield (at a 99% level of assurance) available from the system. This yield includes the maximum additional support that it can obtain from the Mooi River. The demand is projected to exceed the available yield once current drought curtailments are lifted. This deficit means that water is being supplied at a lower level of assurance than is required and therefore the risk of a shortfall being experienced has increased. This risk increases as the size of the deficit increases.

Figure 2.70 illustrates a holistic view of the projected water demands from the entire North Coast Supply System (including supply from Hazelmere and Lower Thukela) together with the historical and existing yield (at a 98% level of assurance) available for the system. Similarly, **Figure 2.71** illustrates a holistic view of the projected water demands for the entire South Coast Supply System and includes the historical yield (at a 98% level of assurance).

The recent commissioning of Phase 1 of the Lower Thukela Bulk Water Supply Scheme and the raising of Hazelmere Dam Wall have increased the yield of the system to greater than the anticipated 30 year projected demand.

Umgeni Water have only recently become the bulk water supplier to uThukela District Municipality and in particular to Ezakheni and Ekuvukeni. As a result, it has not been possible to undertake an analysis of supply versus demand for these areas. This will be included in the next version of the Umgeni Water Infrastructure Master Plan.

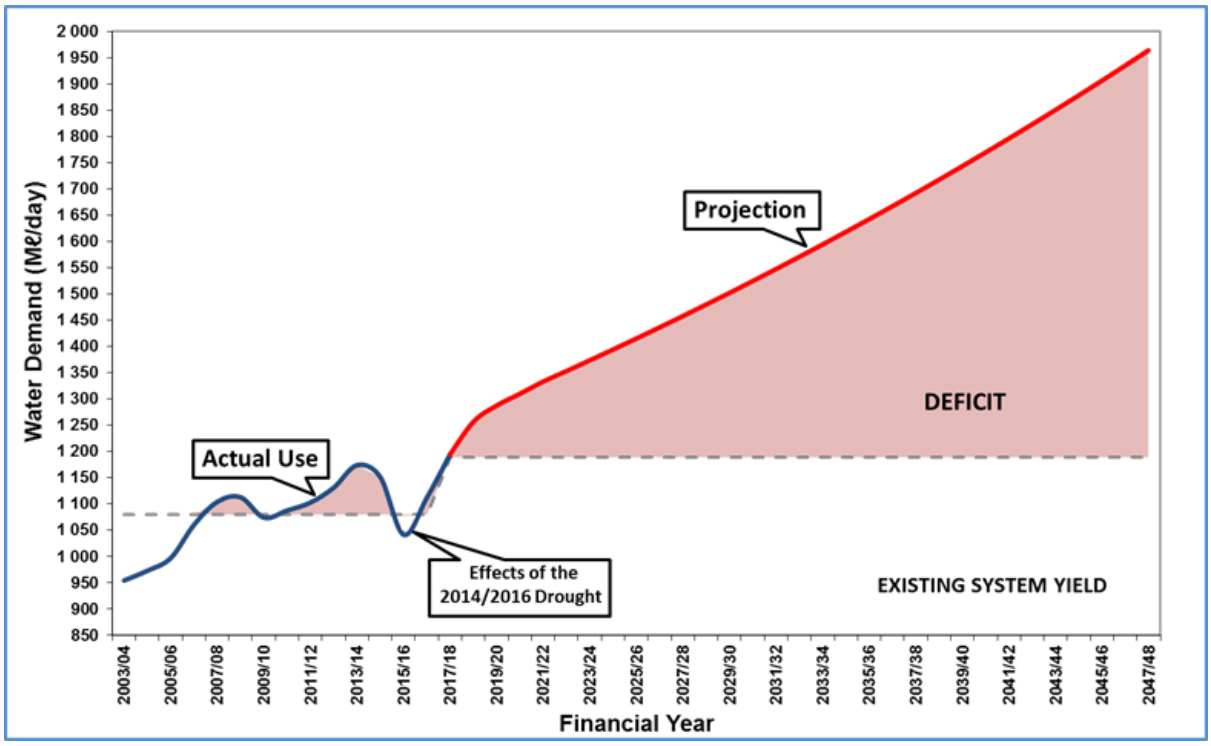


Figure 2.69 Mgeni System - Existing Water Balance

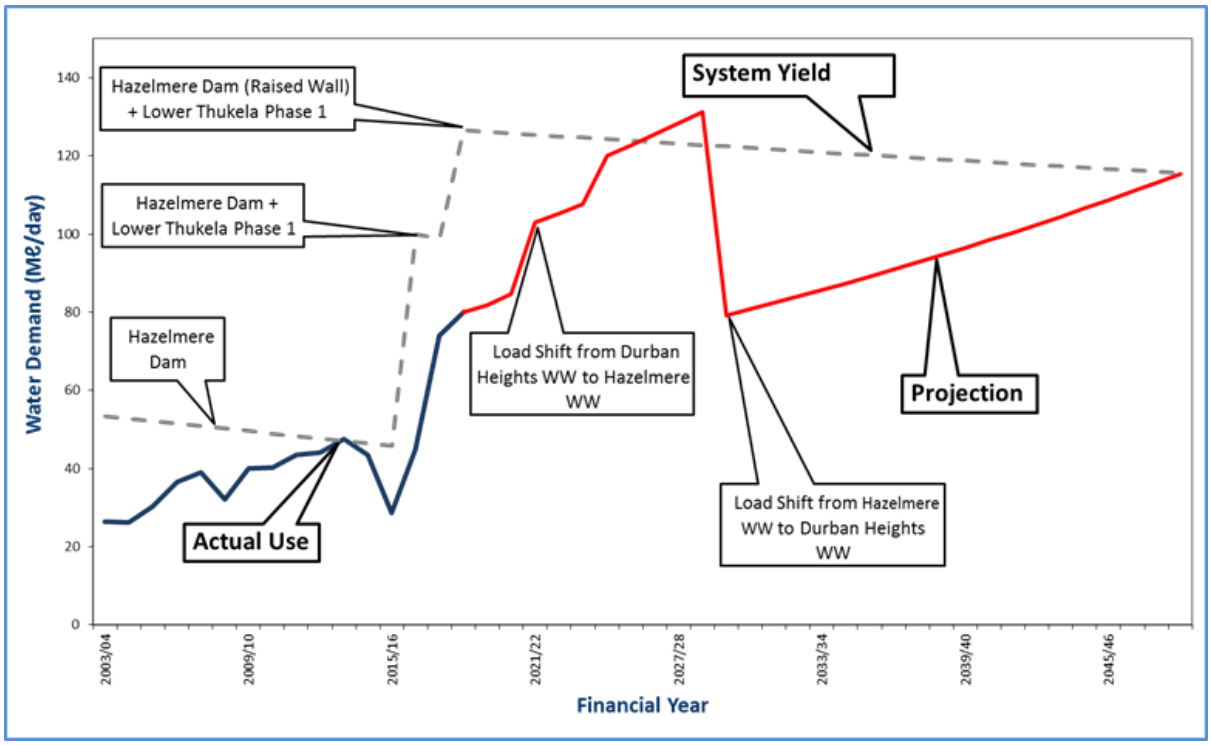


Figure 2.70 North Coast Supply System – Existing Water Balance

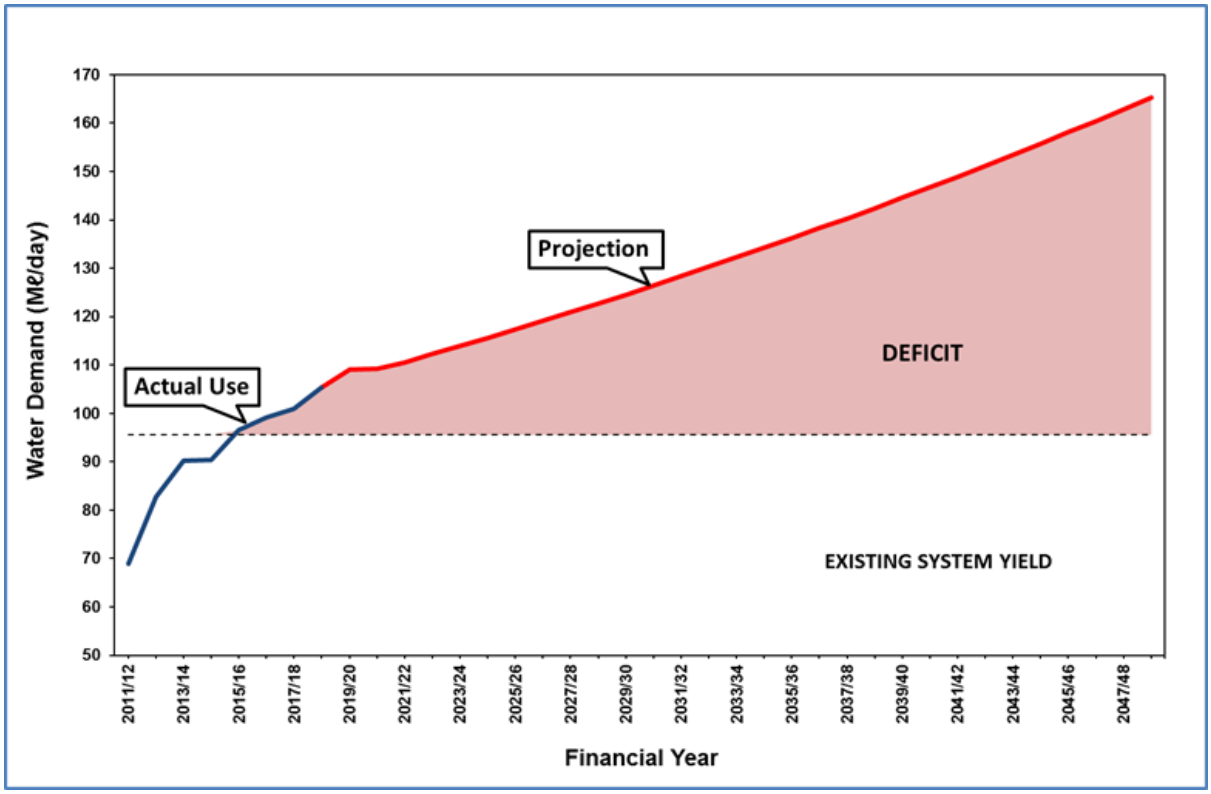


Figure 2.71 South Coast Supply System – Existing Water Balance

Water Demand Management (WDM) initiatives are the quickest measure to implement and have the effect of lowering the demand curve and thereby either reducing the deficit or by delaying the need to implement other measures. However, the extent of the success to be achieved through the implementation of WDM initiatives is very difficult to accurately predict, and once achieved can be difficult to maintain unless there is constant monitoring and management of the systems. Nevertheless, the municipalities that Umgeni Water supply are implementing a wide range of WDM initiatives and these can have a marked impact on the demand requirements from the systems. Notwithstanding these initiatives, it is evident that the long-term projection still anticipates a growth in water demand for the regions where economic development and improved levels of water service outweigh any savings achieved through the WDM initiatives. Hence, further water resource augmentation measures still have to be considered.

eThekwini Municipality is in the process of constructing the Western Aqueduct Pipeline and this will extend the existing pipeline system that runs from Midmar Dam to the western area of eThekwini. The Western Aqueduct will be able to supply parts of the central and northern areas of the municipality. This project will create an important modification to the current bulk water supply strategy and is being sized to cater for future demand growth (**Arrow 3 in Figure 2.72**).

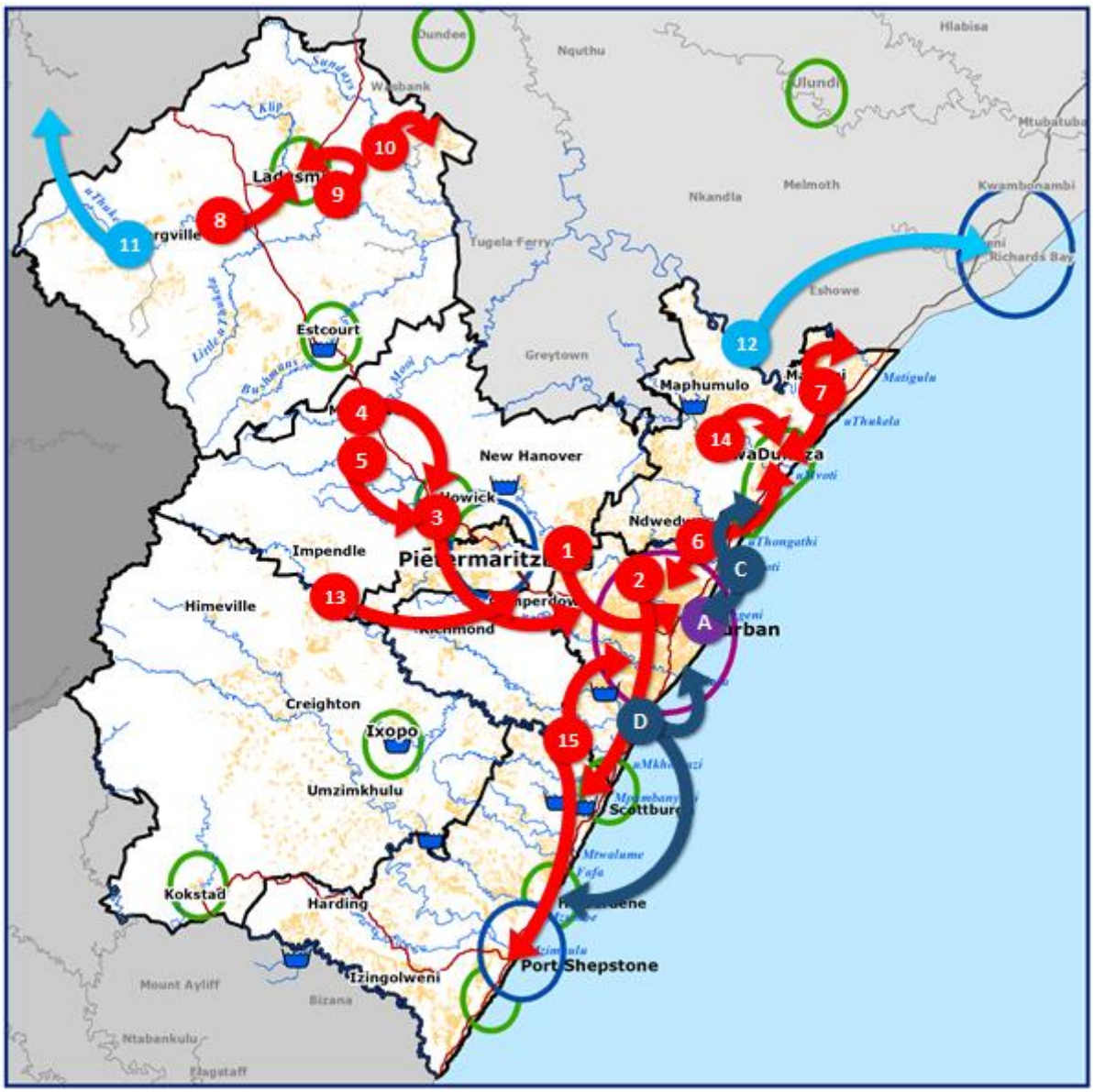


Figure 2.72 Future bulk water supply strategy.

The following have been identified as feasible surface water options available to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area:

- Transfer water from the adjacent uMkhomazi River into the Mgeni catchment. An inter-basin transfer scheme, known as the uMkhomazi Water Project, is current being investigated. This entails the construction of two dams on the river, viz. Smithfield Dam (Phase 1) and Impendle Dam (Phase 2), a new Water Treatment Plant, and a conveyance system of a tunnel and pipelines. Potable water can then be added into the conveyance system (**3**) from Midmar Dam that supplies the eThekwini area (western, central and northern). Supply would be primarily under gravity and pre-feasibility indications are that the yield (99% assurance) obtainable from Phase 1 is approximately 600 Mℓ/day (**Arrow 13 in Figure 2.72**);
- The Department of Water and Sanitation is currently implementing a project to raise the Hazelmere Dam Wall by 7m. This will increase the yield (98% assurance) that can be supplied

to the northern part of eThekwini Municipality and the northern coastal strip by an additional 20 Mℓ/day excluding Reserve requirements (**Arrow 6 in Figure 2.72**). This project will be completed in 2019;

- The Lower Thukela Bulk Water Supply Scheme can be upgraded from 55 Mℓ/day to a maximum capacity of 110 Mℓ/day when needed. The Lower Thukela Bulk Water Supply Scheme can feed water south into the North Coast Pipeline (currently supplied from Hazelmere Dam on the uMdloti River) thereby allowing areas along the North Coast Pipeline to be fed from two separate sources if needed. The Lower Thukela Bulk Water Supply Scheme currently supplies demands as far south as Stanger. Hazelmere Dam can, therefore, be used to satisfy increasing local demands (**Arrow 7 in Figure 2.72**). Once upgraded, the Lower Thukela Bulk Water Supply Scheme will also have the capacity to supply north of the uThukela River if needed;
- A dam can be developed on the uMvoti River to link into the supply system from Hazelmere Dam (and the uThukela River). Earlier studies indicated that a supply of approximately 127 Mℓ/day (98% assurance) could be available from this scheme (**Arrow 14 in Figure 2.72**) although this figure will likely reduce once the In-stream Flow Requirements of the Mvoti River are modified;
- Water can be abstracted from the lower reaches of the uMkhomazi River and linked into the existing pipeline system to supply a large portion of the south coast economic corridor. Water could be supplied northwards to the southern area of eThekwini Municipality and southwards to the northern areas of Ugu Municipality. Reliance on the Mgeni system (**2**) to supply this area could then be removed. The South Coast Supply System could be extended to link into the supply from the Mzimkulu River to create an integrated system. The total capacity of this system is 100 Mℓ/day and the project is to be completed by 2023 (**Arrow 15 in Figure 2.72**).

The following have been identified as ***wastewater reus***e options available to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area:

- eThekwini Municipality have identified their Northern Wastewater Works (WWW) and KwaMashu WWW as potential sites for reclamation plants. These WWWs are both situated within the northern part of the municipality, and the intention is to treat the effluent back to potable standards on site and feed it directly into the local bulk supply network. These reclamation plants could, jointly, augment the system by approximately 110 Mℓ/day by either a direct reuse option (not considered favourable at present because of public resistance) or indirect reuse through the discharge of treated effluent into existing impoundments such as Hazelmere Dam (**Point A in Figure 2.72**); and

Two ***seawater desalination*** options have been identified at **Points C and D in Figure 2.72.** These options would be able to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area and are as follows:

- A desalination plant situated in the vicinity of the uMdloti River Estuary to the north of the city of Durban. Potable water can be fed into the local bulk supply network to augment the northern part of eThekwini Municipality as well as into the bulk supply network running northwards from Hazelmere Dam (**5**) into the iLembe District Municipality. It is estimated that the maximum volume that these bulk networks can accommodate (based on pipeline capacities) is in the order of 150 Mℓ/day; and
- A desalination plant in the vicinity of the Lovu River Estuary to the south of the city of Durban. Potable water can be fed into the local bulk supply network to augment the southern part of eThekwini Municipality as well as into the bulk supply network running

southwards from Inanda Dam (**2**) into the Ugu District Municipality. It is estimated that the maximum volume that these bulk networks can accommodate (based on pipeline capacities) is in the order of 150 Mℓ/day.

The time it takes to commission any of the options listed above becomes important if the existing and projected supply deficits are to be adequately addressed. Further to this, there is a spatial context to each option. The importance of developing any specific option is also linked to its area of supply and the rate at which the water demands in that specific area is predicted to increase.

Phase 2A of the Mooi-Mgeni Transfer Scheme was commissioned in November 2013 and Phase 2B in April 2016. This augmentation maximizes the benefit obtained from the Mooi River to support the entire Mgeni system. The total available yield, at a 99% assurance level, is still, however, below the projected demand and hence a deficit will remain in the system.

Of all the remaining options for the Mgeni system, the uMkhomazi Water Project (**12**) can provide the largest contribution and has the ability to meet the long-term requirements of the eThekwini region, particularly making use of the new Western Aqueduct infrastructure (**3**) which is scheduled to be completed in 2018. This option would relieve the demands placed on other Mgeni abstraction points (**1**) (**2**) (**4**) (**6**) so that all the Mgeni system needs could be met. However, the earliest date for the commissioning of Phase 1 of this project is estimated to be 2028, whilst a more realistic date is likely to be around 2030. With either of these dates, a deficit in the system will still exist and will have to be managed or mitigated through the implementation of one or more of the other options.

The reuse (**A**) and seawater desalination (**C**) (**D**) options, are relatively quick to implement and can be commissioned as early as 2024 if required and all legislative environment requirements can be met. None of these options are able to make as significant a contribution as the uMkhomazi Water Project and would only be able to supply the coastal strip. The DWS Reconciliation Strategy Study has hence highlighted that the uMkhomazi Water Project should proceed in the earliest possible time frame and the Department of Water and Sanitation has now instructed TCTA and Umgeni Water to proceed with the development of the project without delay.

The raising of of Hazelmere Dam Wall (**6**) is considered adequate to meet the short-term water resource requirements of the Mdloti System.

With the implementation of both the Lower Thukela Bulk Water Supply Scheme and the Raising of Hazelmere Dam and the potential to further augment the Mdloti system from the Northern Seawater Desalination Plant (**C**), the requirements of the northern coastal region should be adequately addressed in the medium to long-term.

The Lower uMkhomazi Bulk Water Supply Scheme (**15**) is the preferred option for augmenting supply on the South Coast. The detailed design of the scheme began in 2018 and a five year implementation programme is expected for the project.

REFERENCES

CSIR. 2015. *Updated CSIR/SACN South African Settlement Typology*, Prepared by van Huyssteen, E., Mans, G., le Roux, A, Maritz, J., Ngidi, M. and Maditse, K., March 2015. CSIR.

CSIR and SACN, 2016. *South African Settlement Typology*. GIS Dataset.

Department of Arts and Culture. "*Toponymic Guidelines for Maps and Other Editors*". Department: Arts and Culture, South Africa. 2016. < http://www.dac.gov.za/content/toponymic-guidelines-map-and-other-editors>.

Department of Cooperative Governance and Traditional Affairs. 2009. *State of Local Government in South Africa Overview Report National State of Local Government Assessments*, Working Documents CoGTA 2009. Pretoria: South Africa.

Department of Cooperative Governance and Traditional Affairs. 2009. *Local Government Turn-Around Strategy*, November 2009. Pretoria: South Africa.

DEA, DWA, GIZ and SANBI 2013. *Climate Change and the Water Sector***.** Climate and Impacts Factsheet Series, Factsheet 3 of 7. Pretoria: DEA.

Department of Environmental Affairs. 2013. *National Climate Change Response White Paper*. Pretoria, South Africa.

Department of Environmental Affairs. 2018. 'National Climate Change Bill', *Government Notice No. 636*, Gazette No. *41689* 8 8 June 2018.

Department of Environmental Affairs. 2013. *Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) for South Africa.* Climate Change Implications for the Water Sector in South Africa. Pretoria: DEA.

Department of Environmental Affairs and Geoterraimage (GTI). 2015. *2013 – 2014 South African National Land-Cover Dataset*. March 2015, Version 05#2 (DEA Open Access). GIS Dataset.

Department of Rural Development and Land Reform. 2015. *Development Edges: A Settlement Typology Update Approach and Data Report*, Prepared by Michael Kahn and Dataworld, RDLR-0075 (September 2015). Pietermaritzburg: Department of Rural Development and Land Reform.

Department of Rural Development and Land Reform. 2009. *Rural Settlements Update Project in KwaZulu-Natal*, March 2009. Pietermaritzburg: Department of Rural Development and Land Reform.

Department of Rural Development and Land Reform. 2009. KwaZulu-*Natal Urban Edges Close-Out Report*, September 2009. Pietermaritzburg: Department of Rural Development and Land Reform.

Department of Trade and Industry. 2016. 'Dube TradePort Designated as SEZ'. *Government Notice No. 1093,* Gazette No. 40515 23 September 2016.

Department of Water and Sanitation. 2018. *National Water and Sanitation Master Plan Volume 1: Call to Action (Version 10.1) Ready for the Future and Ahead of the Curve 31 October 2018*. Pretoria: Department of Water and Sanitation.

Department of Water and Sanitation. 2018. *National Water and Sanitation Master Plan Volume 2: Comprehensive Action Plan (Version 3) 13 March 2018*. Pretoria: Department of Water and Sanitation.

Department of Water and Sanitation. 2017. 'Classes of Water Resources and Resource Quality Objectives for the Catchments of the Mvoti to uMzimkhulu'. *Government Notice No. 1386*, Gazette No. 41306 8 December 2017.

Department of Water and Sanitation. 2017. 'National Norms and Standards for Domestic Water and Sanitation Services Version 3 – Final'. *Government Notice No. 982,* Gazette No. 41100 8 September 2017.

Department of Water and Sanitation. 2016. 'New Nine (9) Water Management Areas of South Africa'. *Government Notice No. 1056,* Gazette No. 40279 16 September 2016.

Department of Water Affairs. "WS NIS". DWA Internet Home. 2012. <http://www.dwaf.gov.za/dir_ws/WSNIS/>.

Department of Water Affairs and Forestry. 2008. *KwaZulu-Natal Groundwater Plan*. Version No. 2, January 2008. Pretoria: Department of Water Affairs and Forestry.

Dijkstra, L. and Poelman, H. 2014. *A Harmonised Definition of Cities and Rural Areas: the New Degree of Urbanisation*, Regional Working Paper 2014 WP 01/2014. European Commission.

Eskom. *Umgeni Water Accounts for February – December 2018*. 29 January 2019. Excel spreadsheet received via email.

Eskom. 2011. *SPOT Building Count (SBC)*. GIS Dataset.

Eskom. 2013. *SPOT Building Count (SBC)*. GIS Dataset.

Ezemvelo KZN Wildlife. 2016. *KZN CBA Irreplaceable*, Version 01022016. GIS Dataset.

Ezemvelo KZN Wildlife. 2016. *KZN CBA Optimal*, Version 03032016. GIS Dataset.

Ezemvelo KZN Wildlife. 2016. *KZN ESA*, Version 01022016. GIS Dataset.

Ezemvelo KZN Wildlife. 2016. *KZN ESA Species Specific*, Version 11072016. GIS Dataset.

Ezemvelo KZN Wildlife. 2016. *Draft KwaZulu-Natal Biodiversity Spatial Planning Terms and Processes*, Version 3.3, 27 January 2016. Pietermaritzburg: Ezemvelo KZN Wildlife.

Ezemvelo KZN Wildlife. 2014. 2008 *Land Cover*. GIS Dataset.

Ezemvelo KZN Wildlife. 2014. 2011 *Land Cover*. GIS Dataset.

Ezemvelo KZN Wildlife. 2010. *Terrestrial Systematic Conservation Plan*. GIS Dataset.

Global Human Settlement. 2017. *Global Human Settlement Layer*. GIS Dataset. < http://data.jrc.ec.europa.eu/collection/GHSL>.

Joat. 2017. *KZN NRW Status for Umgeni Water 20171127*. Spreadsheet. (27 November 2017).

Joat. 2018. *KZN NRW Status for Umgeni Water 20181127*. Spreadsheet. (27 November 2018).

KZN Department of Agriculture and Environmental Affairs. 2015. *KZN Agricultural Land Categories*. GIS Dataset.

KZN Department of Co-operative Governance and Traditional Affairs. 2016. *KwaZulu-Natal Strategic Corridor Development Plan*, 13 April 2016. Pietermaritzburg: KZN CoGTA.

KZN Department of Co-operative Governance and Traditional Affairs. 2016. *KwaZulu-Natal Strategic Corridor Development Plan*. GIS Dataset.

KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA). 2017. *Climate Change Adaptation Action Plan for the KwaZulu-Natal Province. Final Draft. 31 March 2017*. Pietermaritzburg: KZN EDTEA.

KZN Department of Economic Development, Tourism and Environmental Affairs. 2017. *PSEDS 2016*. GIS Dataset.

KZN Department of Economic Development, Tourism and Environmental Affairs. 2017. *Formulation of Provincial Spatial Economic Development Strategy (PSEDS) Corridor and Nodal Framework and Data Mapping*, Q 41 EDTEA 15/16. Pietermaritzburg: KZN EDTEA.

KZN Department of Human Settlements and Housing Development Agency. 2016. *Defining a Provincial Human Settlements Master Spatial Plan for KwaZulu-Natal for Human Settlements Investment*, May 2016, HAD/KZN/2015/001. Durban: HDA.

KZN Department of Human Settlements and Housing Development Agency. 2016. *KZN Human Settlements Master Spatial Plan*. GIS Dataset.

KZN Department of Transport. 2017. *Road Infrastructure Framework of South Africa*. GIS Dataset.

KwaZulu-Natal Provincial Planning Commission. 2018. *KwaZulu-Natal 2035 Provincial Growth and Development Plan, 2019*. Pietermaritzburg: KwaZulu-Natal Provincial Planning Commission.

KwaZulu-Natal Provincial Planning Commission. 2018. *KwaZulu-Natal 2035 Provincial Growth and Development Plan*, 2018, ISBN1-920041-28-1. Pietermaritzburg: KwaZulu-Natal Provincial Planning Commission.

KwaZulu-Natal Provincial Planning Commission. 2017. *KwaZulu-Natal 2035 Provincial Growth and Development Strategy*, 2016, ISBN1-920041-15-X. Pietermaritzburg: KwaZulu-Natal Provincial Planning Commission.

KwaZulu-Natal Provincial Planning Commission. 2017. *KwaZulu-Natal 2035 Provincial Growth and Development Plan*, 2016/17, ISBN1-920041-24-9. Pietermaritzburg: KwaZulu-Natal Provincial Planning Commission.

KwaZulu-Natal Provincial Planning Commission. 2017. *Moving KZN Toward Achieving Vision 2035 Nerve Centre, KZN IMP and Catalytic Project Support Focus*, Presentation by KZN Department of

Public Works at the PGDP-DGDP-IDP Alignment Sessions April 2017. < http://www.kznppc.gov.za/index.php?option=com_content&view=article&id=125&Itemid=159>.

KwaZulu-Natal Provincial Planning Commission. 2016. *2035 Provincial Growth and Development Strategy*, 2016. GIS Dataset.

KwaZulu-Natal Provincial Planning Commission. 2016. *KwaZulu-Natal Situational Overview*, 2016. Pietermaritzburg: KwaZulu-Natal Provincial Planning Commission.

KwaZulu-Natal Provincial Planning Commission. 2011. *Provincial Growth and Development Strategy 2011*, Version 22 Final 31-08-2011. Pietermaritzburg: KwaZulu-Natal Provincial Planning Commission.

KZN Treasury. 2019. *KZN Gross Domestic Product by Region Spreadsheet (after Global Insight*). Pietermaritzburg: KZN Treasury.

Midgley, D.C., Pitman, W.V. and Middleton, B.J. 1994. *Surface Water Resources of South Africa 1990. Volume VI. Drainage Regions U,V,W,X - Eastern Escarpment– Appendices and Book of Maps*. WRC Report Number 298/6.1/94. Pretoria: WRC.

Municipal Demarcation Board. 2016. *Municipal and Ward Boundaries*. GIS Dataset. <www.demarcation.org.za>.

Municipal Demarcation Board. 2011. *Municipal and Ward Boundaries*. GIS Dataset. <www.demarcation.org.za>.

National Planning Commission. 2012. *National Development Plan 2030 Our Future – Make it Work*. Pretoria: National Planning Commission.

Presidential Infrastructure Coordinating Commission. 2012. *National Infrastructure Plan*. < http://www.info.gov.za/issues/national-infrastructure-plan/index.html>.

RSA. 2018. *Carbon Tax Bill*, [B46 – 2018]. Pretoria: South Africa.

RSA. 1996. *Constitution of the Republic of South Africa, 1996*. Pretoria, South Africa.

Schulze, R. 1995. *Hydrology and Agrohydrology: A Text to Accompany the ACRU 3.00 Agrohydrological Modelling System*, WRC Report TT69/95. Pretoria: Water Research Commission.

Statistics South Africa. 2017. *Community Survey 2016*. SuperCross Database. <www.statssa.org.za>.

Statistics South Africa. 2018. *2018 KwaZulu-Natal Citizen Satisfaction Survey: Analytical Report*, Report No. 03-00-07 (2018). Pretoria: South Africa.

Statistics South Africa. 2016. *2015 KwaZulu-Natal Citizen Satisfaction Survey: Analytical Report*, Report No. 03-00-07. Pretoria: South Africa.

Statistics South Africa. 2014. *South African Multidimensional Poverty Index*. GIS Dataset.

Statistics South Africa. 2014. *The South African MPI*, Report No. 03-10-06, 2014. Pretoria: Statistics SA.

Statistics South Africa. 2013. *Census 2011*. <www.statssa.org.za>

Umgeni Water. 2020. *Draft Infrastructure Master Plan 2020/2021Geodatabase*. GIS Dataset.

Umgeni Water. 2017. *Infrastructure Master Plan 2017 Volume 1 2017/2018 – 2047/2048 June 2017*. Pietermaritzburg: Umgeni Water.

Umgeni Water. 2017. *Infrastructure Master Plan 2017 Volume 2 2017/2018 – 2047/2048 June 2017*. Pietermaritzburg: Umgeni Water.

Umgeni Water. 2016. *Universal Access Plan Phase 2*. Prepared by Bigen Africa; Hatch Goba; JTN Consulting; UWP Consulting; Ziyanda Consulting. Pietermaritzburg: Umgeni Water.

Umgeni Water. 2016. *Infrastructure Master Plan 2016 Volume 1 2016/2017 – 2046/2047 March 2016*. Pietermaritzburg: Umgeni Water.

Umgeni Water. 2016. *Infrastructure Master Plan 2016 Volume 2 2016/2017 – 2046/2047 March 2016*. Pietermaritzburg: Umgeni Water.

Umgeni Water. 2015. *Infrastructure Master Plan 2015 Volume 1 2015/2016 – 2045/2046 March 2015*. Pietermaritzburg: Umgeni Water.

Umgeni Water. 2015. *Infrastructure Master Plan 2015 Volume 2 2015/2016 – 2045/2046 March 2015*. Pietermaritzburg: Umgeni Water.

Umgeni Water. 2013. *Water Demand Management Strategy Make Every Drop Count*. January 2013. Pietermaritzburg: Umgeni Water.

Umgeni Water. 1999. *Water Conservation Policy*. Pietermaritzburg: Umgeni Water.

UN Habitat. 2016. *Habitat III New Urban Agenda*, 2016. Quito: UN Habitat.

United Nations Statistical Commission. 2017. *Annex III Revised List of Global Sustainable Development Goal Indicators*, Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators (E/CN.3/2017/2). New York: United Nations.

3. DEMAND FORECASTS IN THE UMGENI WATER OPERATIONAL AREA

This section documents Umgeni Water's water demand forecast review that was completed in September 2019. This process:

- Reviewed the figures for the financial year ending in June 2019 (2018/2019).
- Assessed and revised the short-term forecast for the financial year ending in June 2020 (2019/2020);
- Compiled short-term forecasts for the financial years ending in June 2021 (2020/2021), June 2022 (2021/2022) and June 2023 (2022/2023); and
- Extended these short-term forecasts to a long-term forecast (30-year forecast) to the end of June 2050 (2049/2050)

All data presented has been updated to include the November 2019 sales figures and all statistics and trends have been based on the moving annual average and year-on-year growth figures as determined at 30 November 2019.

3.1 Review of 2018/19 Sales

The initial forecasted water sales value for the financial year ending in June 2019 (2018/19), as determined in September 2017, was 1 100 Mℓ/day. In September 2018 this figure was revised to 1 233 Mℓ/day after updated discussions with customers. Total sales recorded for the 2018/19 financial year averaged 1 294 Mℓ/day (472 355 Mℓ). This was 4.9% higher than the September 2018 projection and can mainly be attributed to the increased sales following the lifting of restrictions in the Mgeni Catchment as well as new sales to uThukela District Municipality.

Total average water sales for the 2017/18 financial year was 1 192 Mℓ/day, and hence the 2018/19 sales were 8.6% year-on-year higher than the 2017/18 financial year. As discussed above, this increase in demand was as a result of increased sales following the lifting of restrictions in the Mgeni System and new sales to uThukela District Municipality. Demand is expected to increase further over the next year as a result of the commissioning of eThekwini Municipality's Western Aqueduct. **Figure 3.1** shows the 12-month moving average of Umgeni Water's total average daily water sales for the past 10 years.

Bulk water sales to eThekwini Municipality constituted by far the largest percentage (71.2%) of Umgeni Water's total water sales for 2018/19. Their proportion of the total sales decreased slightly from the previous year (74.4%). The Msunduzi Municipality is Umgeni Water's second largest customer, accounting for 15.0% of the organisation's total sales. The remaining customers make up the balance of the sales. **Figure 3.2** illustrates the average daily sales volume distribution per customer for the financial year 2018/19.

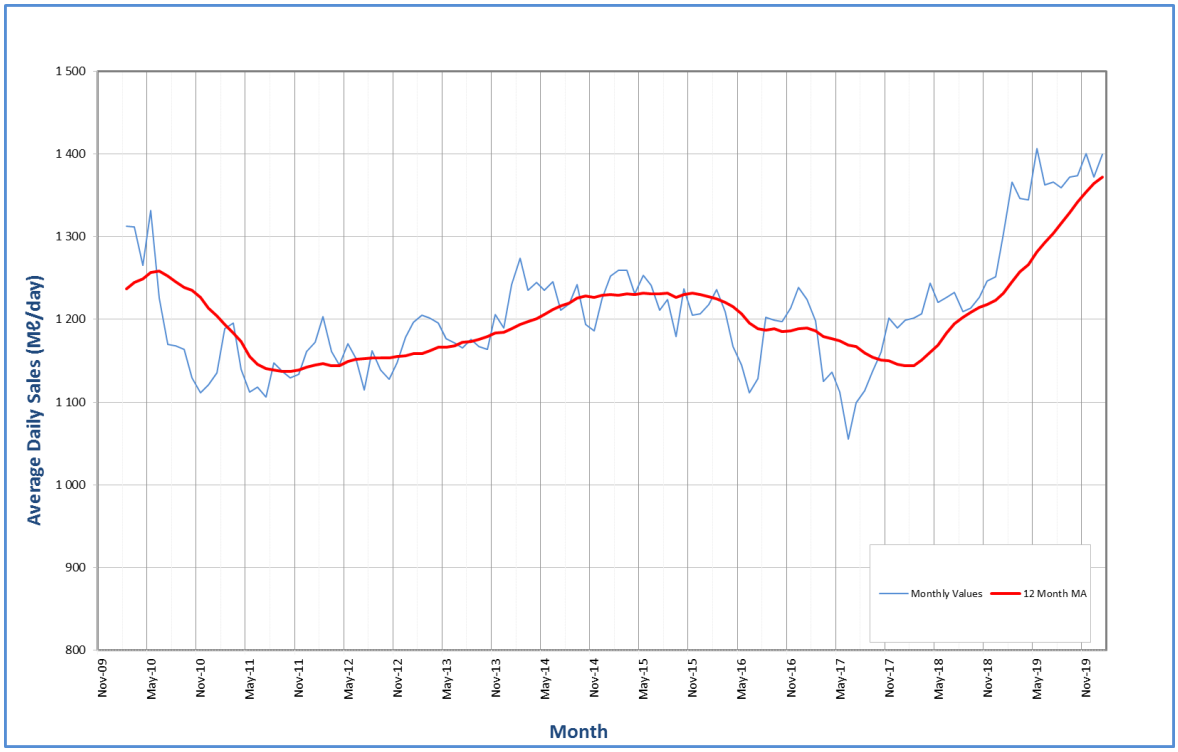


Figure 3.1 Umgeni Water Total Average Daily Sales.

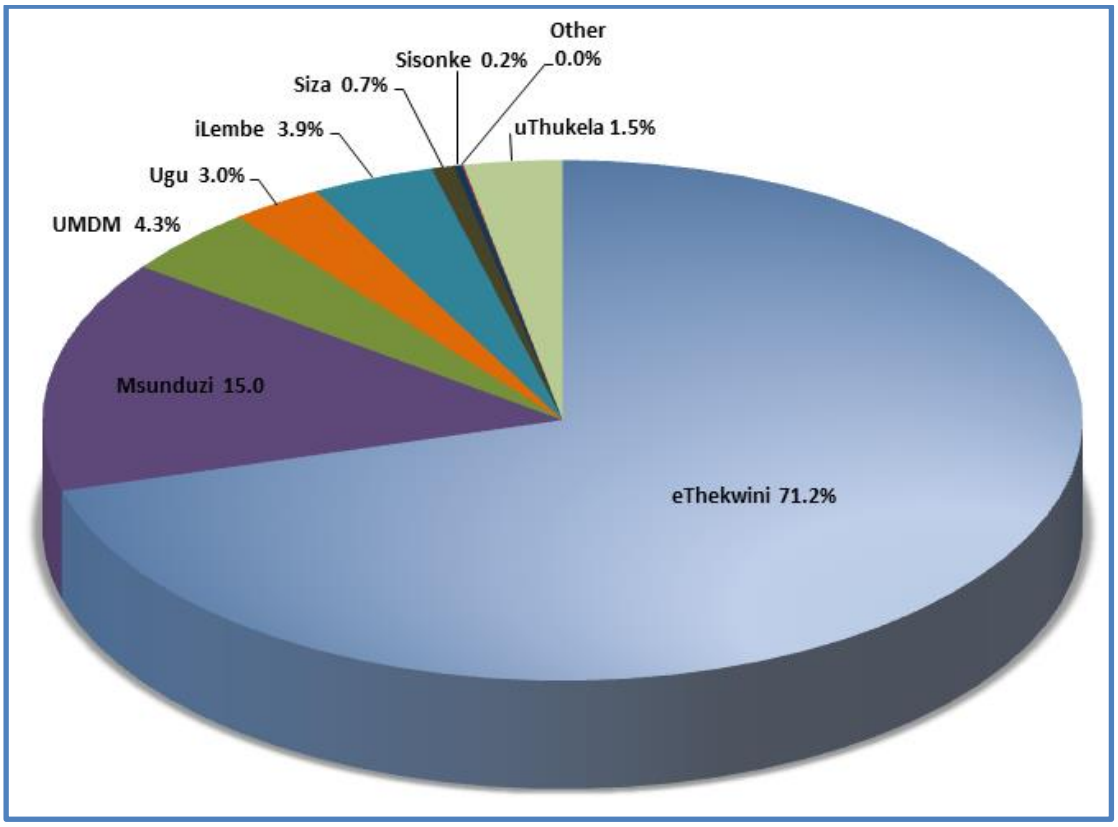


Figure 3.2 Distribution of Sales Volumes for 2018/2019.

3.2 2019 Short-Term Bulk Water Sales Forecasts

Curtailments were lifted in the Mgeni System in April 2018. This resulted in an increase in demands to pre-drought figures in December 2018. Increased growth, as a result of the commissioning of eThekwini Municipality's Western Aqueduct, coupled with Umgeni Water's expansion into uThukela District Municipality means that a steady growth in demand is expected over the next few years. This demand growth is projected to 1 357 Mℓ/day for the 2019/2020 financial year following which demand growth is expected to increase to 1 428 Mℓ/day in 2020/2021, 1 456 Mℓ/day in 2021/2022 and 1 484 Mℓ/day in 2022/2023 (**Figure 3.3**).

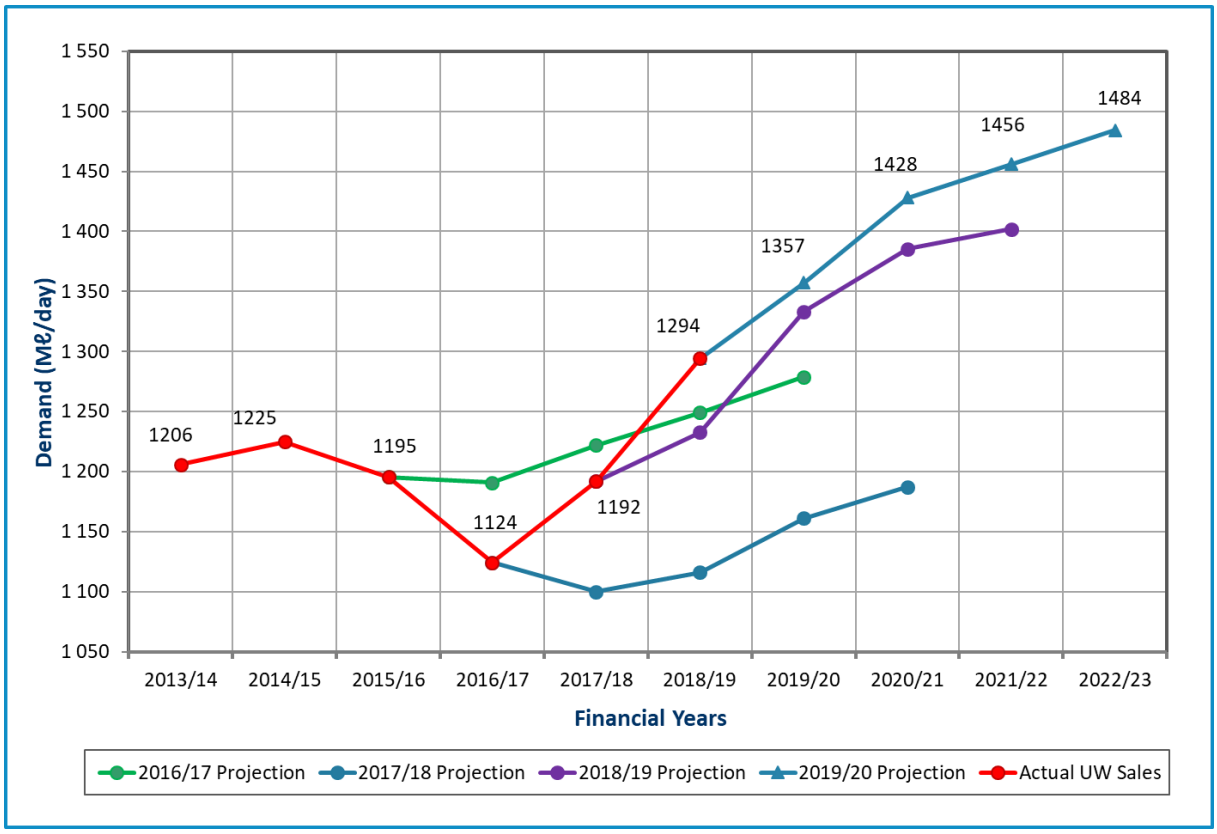


Figure 3.3 Total Average Daily Sales Volumes - Annual short-term forecast comparison.

3.2.1 eThekwini Municipality

In the 2018/2019 financial year, the year-on-year growth in sales to eThekwini Municipality increased by 7.64%. The continued increase in sales is attributed to the lifting of curtailments in the Mgeni System during the first half of 2018. The growth in sales is shown in **Figure 3.4**, where the twelve-month moving average of sales increased from 863 Mℓ/day in July 2017 to 919 Mℓ/day in June 2019.

Proposed developments and the associated demand, as a result of these developments within the eThekwini area of supply, were discussed with the municipality during August 2019. The subsequent demand scenario was based on a hybrid demand projection taking into consideration the commissioning of the Western Aqueduct in full by end 2019, as well as organic growth in the existing demands. A year-on-year increase in demand of 1.3% is expected and includes the anticipated 0.5% reduction due to WC/WDM initiatives, explaining the mild upward trend of the 12-month moving

average in **Figure 3.4.** The historical sales and future demand projection for eThekwini Municipality is presented in **Figure 3.4**.

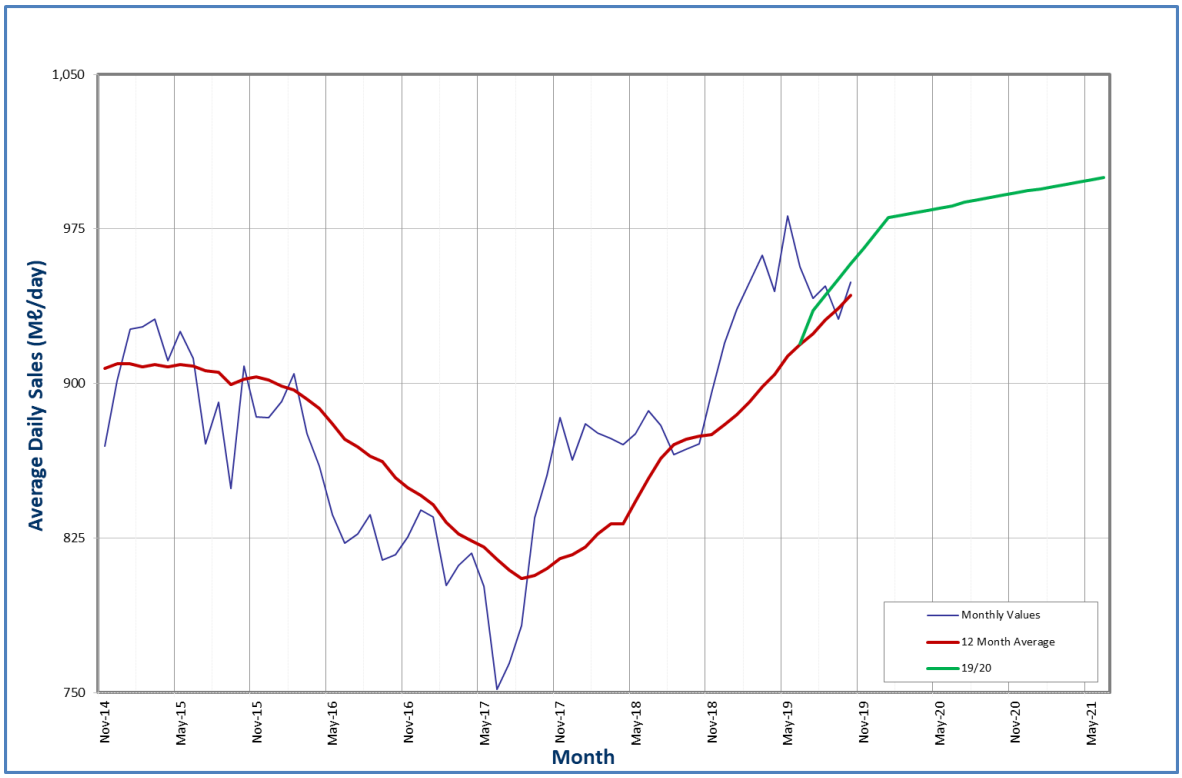


Figure 3.4 eThekwini Municipality Total Volumes - Annual short-term forecast.

3.2.2 The Msunduzi Municipality

The water sales to Msunduzi Municipality increased by 7.6% from 184 Mℓ/day in the 2017/2018 financial year to 202 Mℓ/day in 2018/2019. Projected demands for 2019/2020 were determined in consultation with the municipality and it was agreed that, since water restrictions had been lifted, the demand would increase to 209 Mℓ/day.

Msunduzi Municipality's council have approved low cost to medium income housing development in the Shenstone/ Ambleton area over the next two years. The bulk of this new demand will be taken up during this financial year. There has been a significant growth in demand in the northern areas due to natural growth and consumer behaviour. Msunduzi envisage that a major part of the growth will be in this area. Also, the Pietermaritzburg tourism portfolio envisage a major drive to increase tourism in the Edendale area around the Henley Dam Hotel and this will increase demand in this area.

Msunduzi Municipality has just completed a masterplan to realise a sustainable water supply to Ward 39 off Vulindlela Res 10 and they plan to implement the recommendations over the next 4 years. The majority of the supply to the municipality will be from the Midmar WTP. The year-on-year growth, is estimated at 1.5%.

The Msunduzi Municipality is implementing water demand management (WDM) initiatives within the Vulindlela area. It is estimated that savings from these initiatives will offset the growth in sales in the area in the short term.

The projection for Msunduzi Municipality is reflected in **Figure 3.5.**

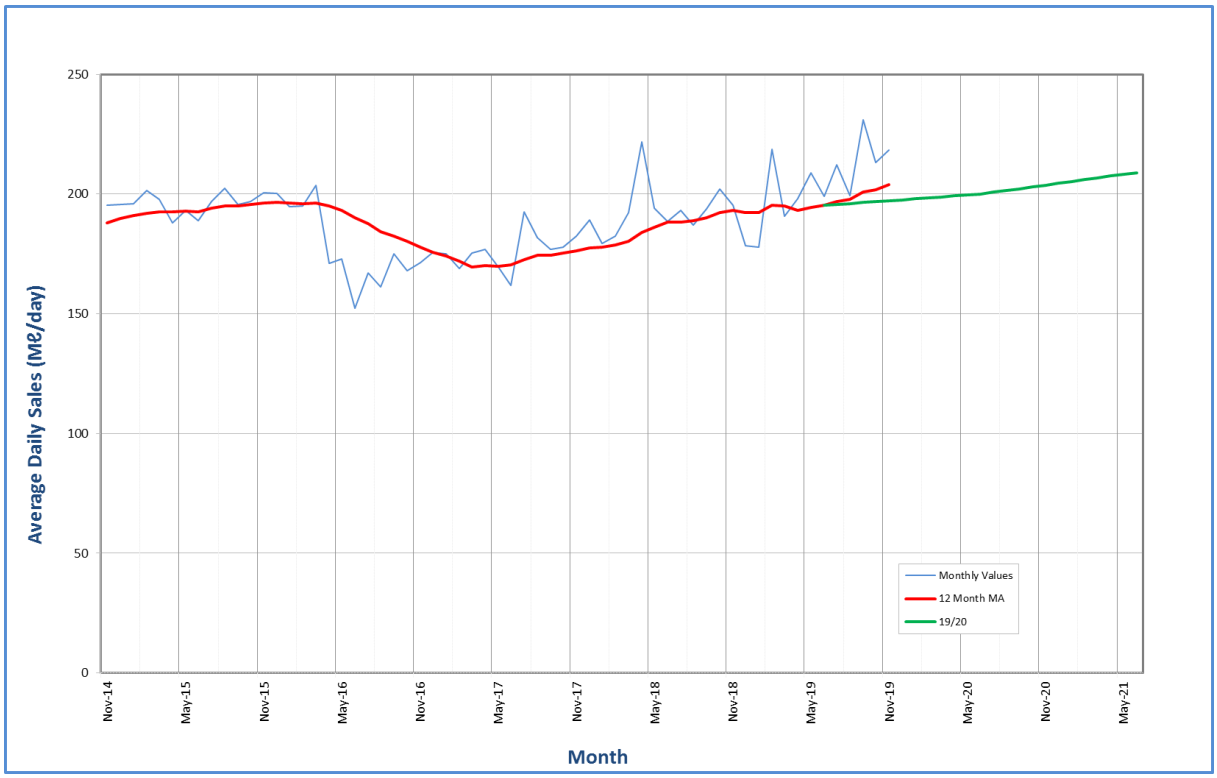


Figure 3.5 Msunduzi Municipality Total Sales Volumes - Annual short-term forecast.

3.2.3 uMgungundlovu District Municipality

The water sales to uMgungundlovu District Municipality (UMDM) followed the projection as set last year at 56 Mℓ/day in 2018/2019.

The projected demands for 2019/2020 were determined in consultation with the municipality and it was agreed that the demand would increase to 65 Mℓ/day for the short-term forecast. It is envisaged that growth in housing development will be experienced in the Mid Illovo area over the next two years and this will increase the demand in this area. Additionally, UMDM is planning to improve the level of service in the Greater Richmond area to yard connections and plan to install waterborne sewerage systems in this area. This project will start at the beginning of the 2020/2021 financial year.

An increase in housing development in the Lion Park/Manyavu area is also planned towards the end of the 2019/20 financial year and is likely to extend over the next 3 years. Uncontrolled building regulations have also resulted in high growth in the Vulindlela area and a high increase in water demand is foreseen in this area over the next 4 years.

The uMshwati BWSS is now fully commissioned and operational and increases in supply to Cool Air, Dalton and Swayimana has already been noted. UMDM is in the process of connecting the Efaye and Oswathini areas within the uMshwati BWSS.

The projection for uMgungundlovu District Municipality is shown in **Figure 3.6.**

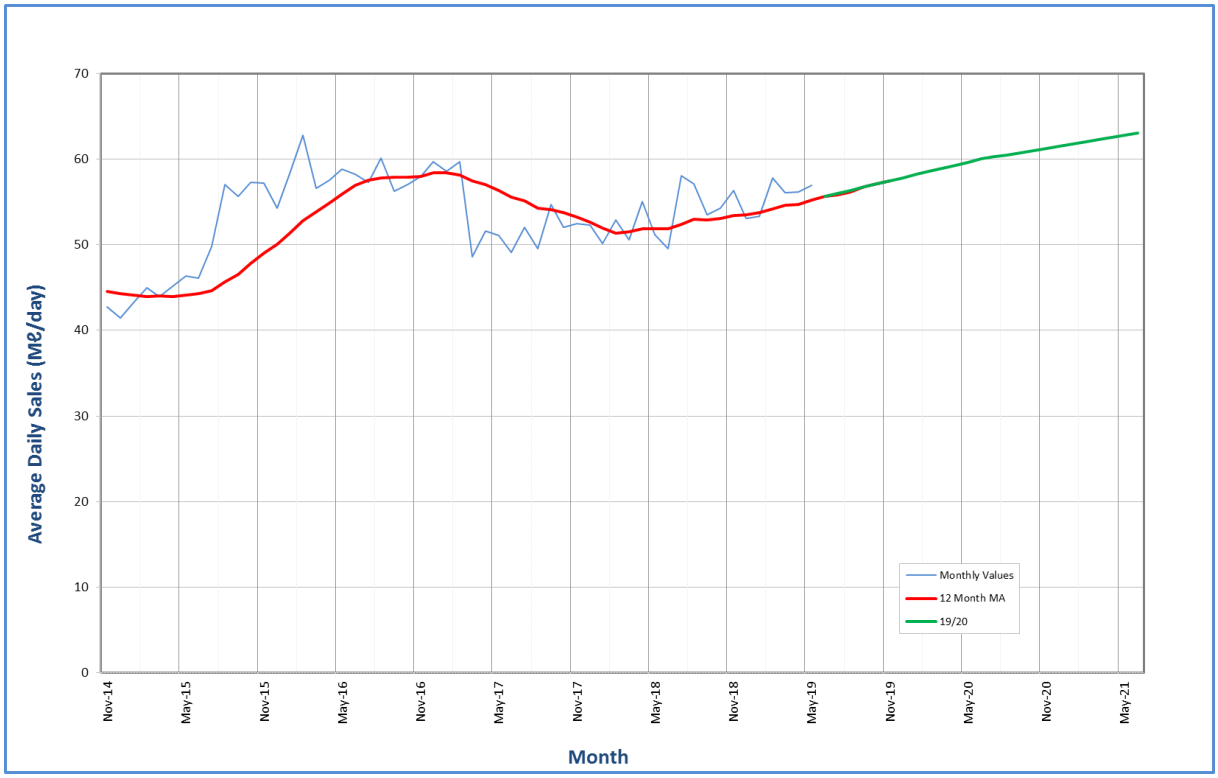


Figure 3.6 uMgungungdlovu District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.4 iLembe District Municipality (including Siza Water)

Sales to Ilembe District Municipality can be described as follows:

- Sales to the Coastal Area of iLembe through Siza Water.
- Sales to the Coastal Area of iLembe through iLembe District Municipality.

Historical demand has been gradually increasing over the past year. This is reflected in **Figure 3.7** and **Figure 3.8**.

It is predicted that Siza Water's demand will grow at a rate of approximately 2%. The balance of the demand, to take it up to pre-drought demands, will be made up using wastewater recycling. Siza Water has implemented a wastewater recycling plant that injects up to 3 Mℓ/day into its potable water system. The demand for Siza Water is expected to be 9.86 Mℓ/day in 2019/2020, 10.1 Mℓ/day in 2020/2021 and 10.3 Mℓ/day in 2021/2022. The historical and future predicted increase in demand for the company is presented in **Figure 3.7**.

The uptake of demand on the Lower Thukela Pipeline is reflected in the steep increase in iLembe District Municipality's demand in 2018 and early 2019. A recent upgrade of the pump stations in the Ndwedwe Supply Area has resulted in an average 1.5 Mℓ/day increase in supply into Ndwedwe. The demand for iLembe District Municipality is expected to be 53.2 Mℓ/day in 2019/2020, 55.3 Mℓ/day in 2020/2021 and 56.9 Mℓ/day in 2021/2022. Delays in implementing municipal secondary bulks on the Lower Thukela System means that the anticipated demand increases are unlikely to materialise as previously predicted. The historical and future projected increase in demand for iLembe District Municipality is presented in **Figure 3.8**.

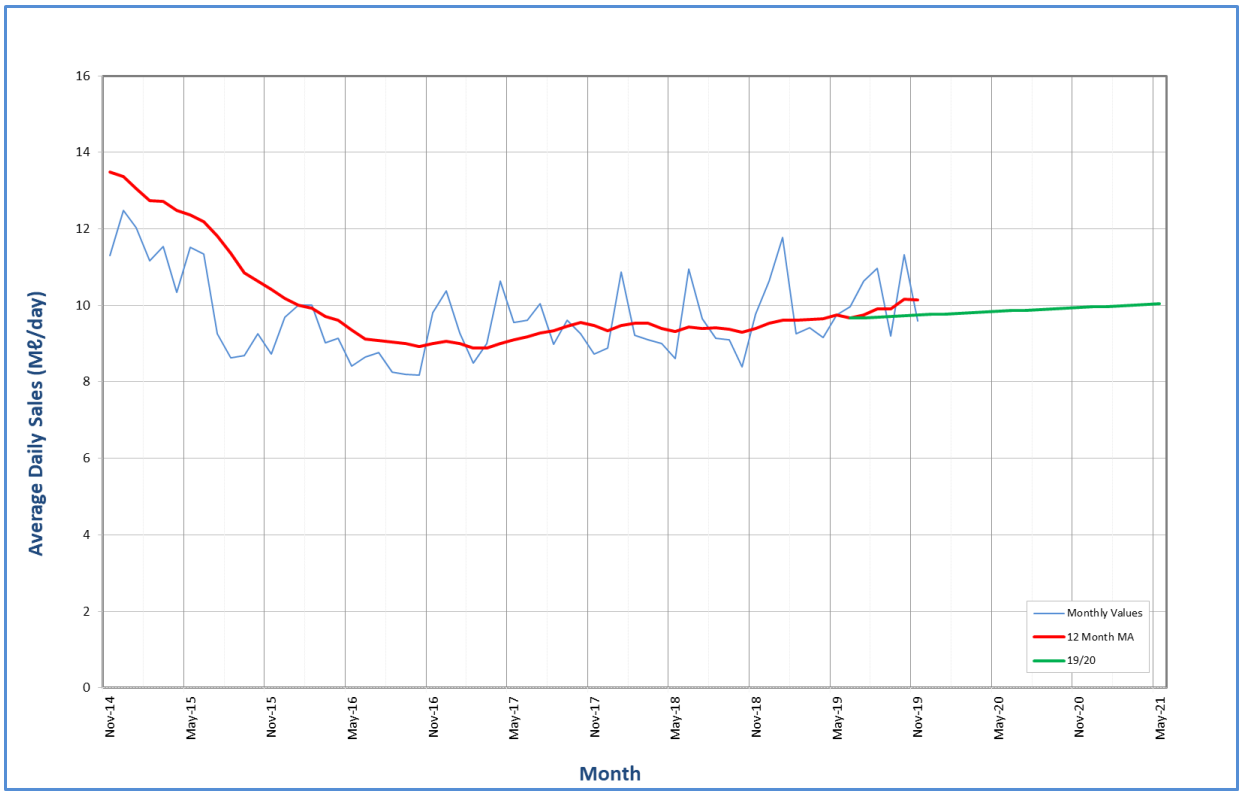


Figure 3.7 Siza Water Total Sales Volumes - Annual short-term forecast.

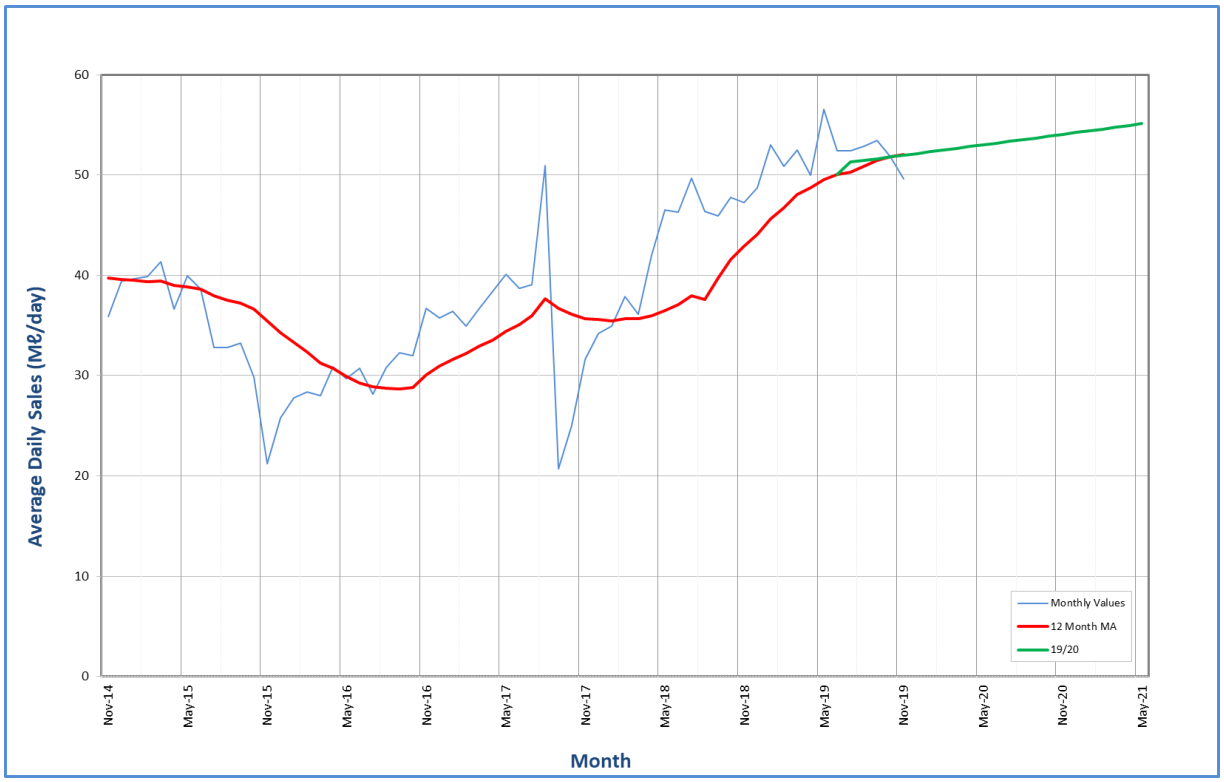


Figure 3.8 iLembe District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.5 Ugu District Municipality

Total sales to the Ugu District Municipality remained "constant" during the 2018/2019 financial year. The flattening out of sales to Ugu DM may be attributed to the active detection and leak repairs undertaken by the municipality. In addition, the municipality has experienced challenges in existing supply to various areas.

The expected growth in sales to the Municipality is estimated at 2.0% in the 2019/2020 financial year and 2.4% in 2020/2021 (**Figure 3.9**). The current water resources are insufficient to meet the projected water demands. Furthermore, the water requirements exclude an estimated 25 Mℓ/day suppressed demand within the supply area as a result of infrastructure constraints. Although the water resources within the local rivers and dams have recovered, the area is still augmented by up to 70% from the Mgeni System via the South Coast Augmentation Pipeline and the South Coast Pipeline.

The demand projection scenario was based on operating the local Water Treatment Plants at design capacity. Hence the forecast sales growth is constrained by the available supply in the short term.

The recommended augmentation for the Upper and Middle South Coast Supply Area (refer to **Section 11**) is the Lower uMkhomazi Bulk Water Supply Scheme (LUBWSS). A shortfall in water supply is projected from 2017 until the LUBWSS is implemented.

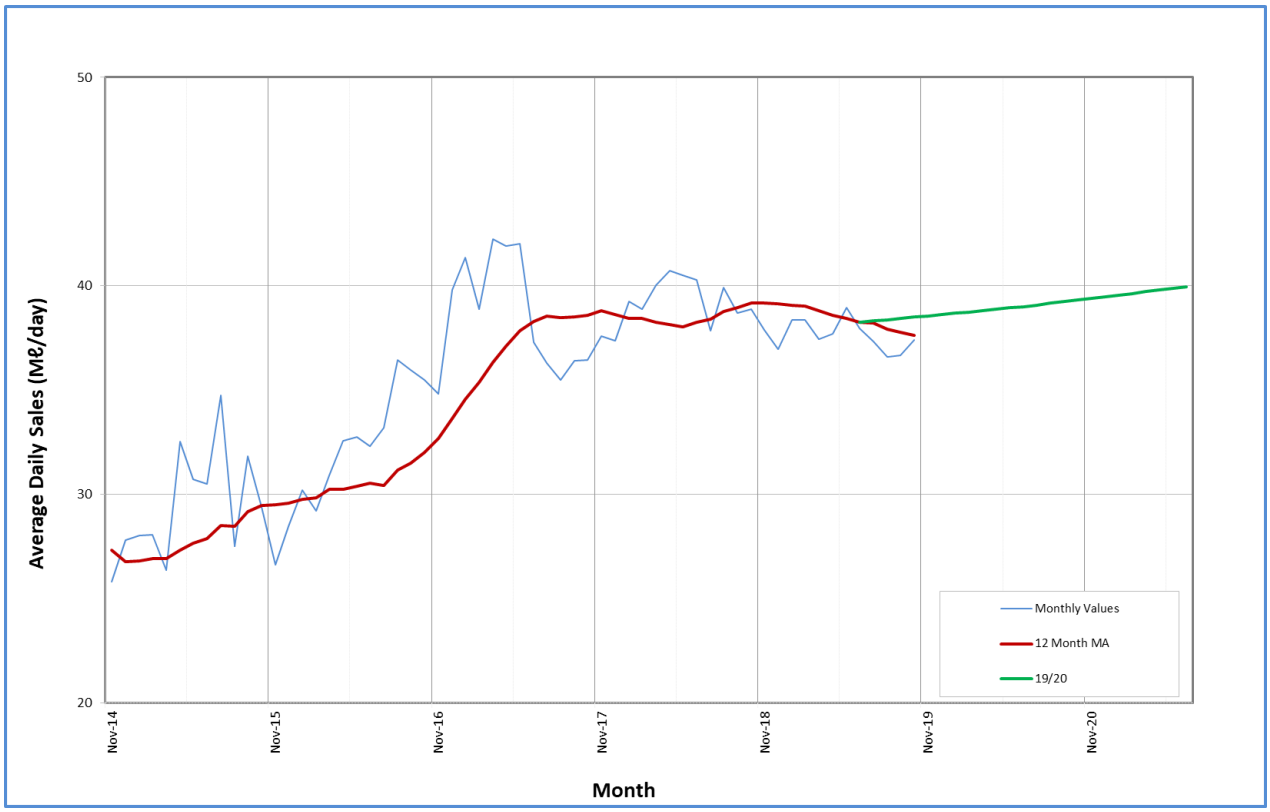


Figure 3.9 Ugu District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.6 Harry Gwala District Municipality

The Ixopo WTP supplies the Greater Ixopo Area. Average daily sales from the WTP between July 2018 and June 2019 were approximately 2.6 Mℓ/day. There was an increase in the monthly sales from July 2018 to June 2019 due to normal growth in demand. The demand in Ixopo has subsequently increased to pre-drought levels. The Harry Gwala Municipality has agreed that a growth of 1% is appropriate for demand projections over the next four years for this area (**Figure 3.10)**.

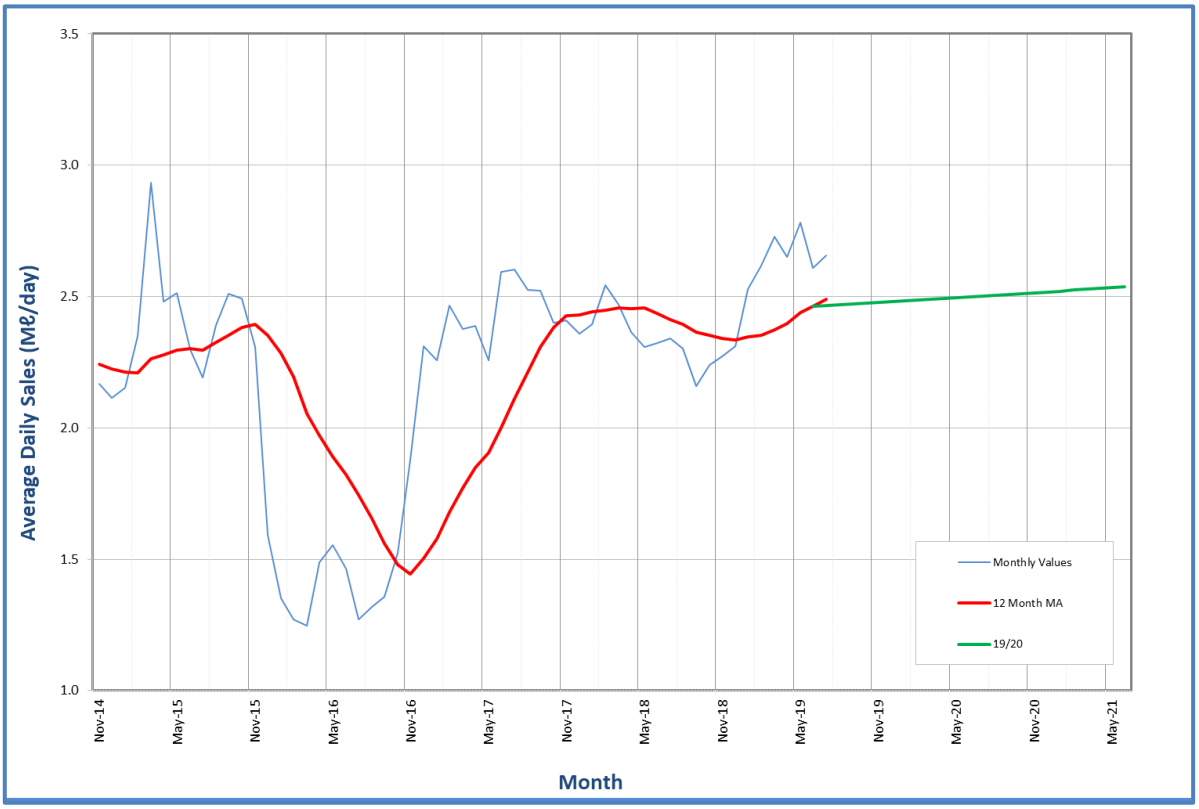


Figure 3.10 Harry Gwala District Municipality Total Sales Volumes - Annual short-term forecast.

3.2.7 uThukela District Municipality

Umgeni Water became the bulk potable water provider for three systems in the uThukela District Municipality in January 2019. These include the Ezakheni Supply System, the Olifantskop Supply System and the Tugela Estates Supply System. From January to June 2019 the average sales to these three areas was 39.4 Mℓ/day (**Figure 3.11**).

Umgeni water have started implementing projects to reduce water losses and there is an expectation that the volume of supply could decrease. However, once a reliable supply of water is realised, then the municipality may reticulate to other previously un-serviced areas and this would cause a corresponding increase in demand. As a result, projected demands from these three schemes (as agreed with uThukela DM in August 2019) are expected to increase to 42.0 Mℓ/day in June 2020 and 44.7 Mℓ/day by June 2021 (**Figure 3.11**).

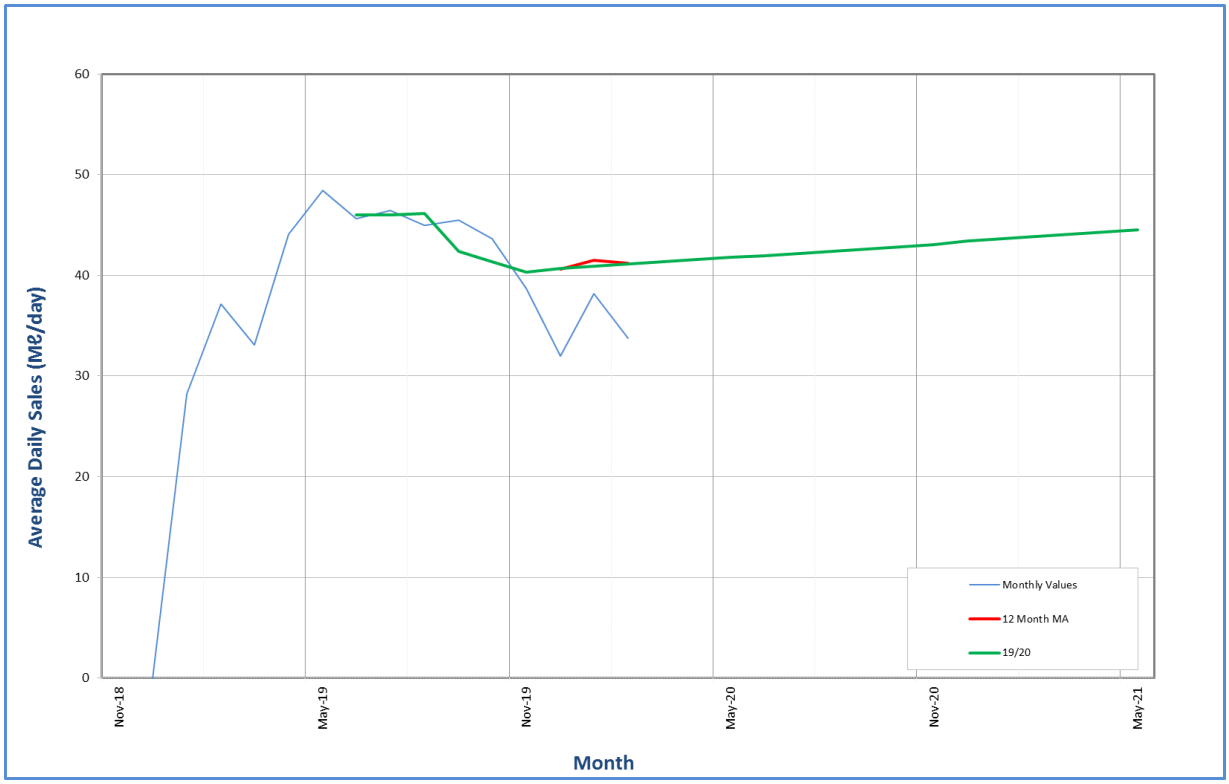


Figure 3.11 uThukela District Municipality Total Sales Volumes - Annual short-term forecast.

3.3 Long-Term Forecast

The 30-year long-term sales forecast for Umgeni Water's supply area (**Figure 3.12**) takes into account increased sales (following the recent drought and commissioning of the eThekwini Western Aqueduct, new supply to the uThukela District Municipality, anticipated natural growth from the existing supply system, and bulk sales from new supply infrastructure that would extend the area supplied. A base projection has been developed from the short-term forecasts described in **Section 3.2** of this report and then extended at a compounded 1.5% per annum growth rate until 2049/2050. This growth rate has been agreed to by the major water users in the region and is considered acceptable for this long-term forecast as it closely matches the forecast that was independently derived as part of the "Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas" undertaken by DWS, which used a population projection technique to estimate demand forecasts.

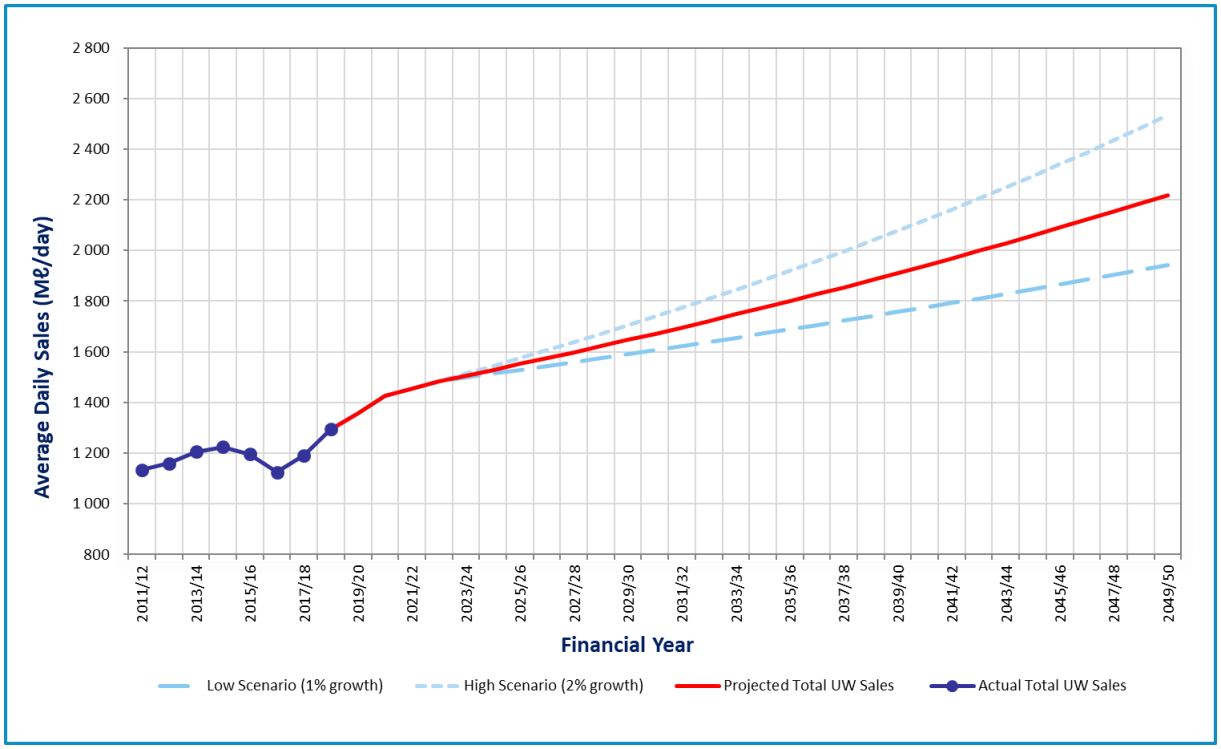


Figure 3.12 Umgeni Water Long-Term Bulk Water Sales Forecast.

4. WATER CONSERVATION AND WATER DEMAND MANAGEMENT

4.1 Background

Umgeni Water's Water Conservation (WC) Policy was adopted in 1999 and the Water Demand Strategy in 2013. These two documents elaborate on the legislative requirements (Umgeni Water 1999; 2013) and the primary reasons for Umgeni Water implementing water demand management, namely:

- To be able to supply all reasonable demands without placing undue stress on exploitable water resources
- To minimise expenditure on developing new resources
- To postpone capital expenditure on expanding bulk water infrastructure.

(Umgeni Water 2013: 3)

The purpose of this section is to:

(i) Summarise briefly the water demand management (WDM) practices currently being implemented within Umgeni Water; and

(ii) To elaborate on the WDM initiatives that Umgeni Water is undertaking in partnership with Department of Water and Sanitation (DWS) to assist the Water Service Authorities (WSAs) within the KwaZulu-Natal (KZN) province.

4.2 Current Water Demand Management Practices within Umgeni Water

Umgeni Water undertakes water balances in each of the bulk water supply systems that it operates (**Sections 7**, **8**, **11**, **12** and **13**) in order to determine the indication of water losses. The results of these water balances indicate that the overall water loss in the bulk systems (including losses from backwash water at the water treatment plants) is less than 5%. This does not include the Upper uThukela System which is a new growth area/region of Umgeni Water. Umgeni Water is committed to reducing or maintaining the average water loss below this level of 5% by continuing to implement asset management plans and ensuring targeted investment in maintenance throughout all the bulk systems.

Current WDM practices being implemented within Umgeni Water include:

- Monthly water balance exercises
- Meter accuracy testing, and calibration thereof
- Monitoring and reduction of the average turn-around time to repair leaks and bursts
- Education programme / communication on water conservation water demand management (WCWDM)

The above practices are undertaken diligently and are budgeted for, and thus contribute to the achievement of Umgeni Water's WCWDM objectives summarised in **Table 4.1**.

Table 4.1 Water Demand Management objectives for Umgeni Water (2013: 10).

Objective	Purpose
1. Implement efficient distribution management measures.	Minimise non-revenue water and manage distribution losses.
2. Ensure adequate information to support decision-making.	Accurate information on all aspects of the supply system is vital for the management of system performance.
3. Promote the efficient use of water by customers.	Educate all consumers on the efficient use of water.
4. Adopt Integrated Planning principles.	Develop a sound relationship with customers to integrate planning and development initiatives.
5. Contribute to the Catchment Management strategy.	Effective WDM initiatives will relieve the stress on the resource and thus aid in the management of catchments.
6. Ensure adequate institutional and financial capacity for WDM.	Constantly review and modify (if needed), Umgeni Water's structure and work ethic.

4.3 Assisting WSA's in Reducing Non-Revenue Water

Umgeni Water, as a Bulk Water Services Provider, is cognisant of the impact that Non-Revenue Water (NRW) has on the ability of WSA's to sustainably supply consumers. WSA's within KZN face the challenges of poor and ageing infrastructure. They also lack the technology and vital skills needed to combat NRW. As a result the municipalities are "faced with almost insurmountable odds in combatting water loss".

Umgeni Water, in response to the mandate provided by the Honourable Minister of Water and Sanitation, has been providing strategic assistance to all KZN WSA's so that sustainable improvements can be made in the province. This assistance is through the KZN Regional Office of DWS and the Department of Cooperative Governance and Traditional Affairs (CoGTA).

Umgeni Water established a WDM Unit in 2016 to provide support to WSA's in curbing water losses in their respective water supply systems. This WDM Unit provides measurement and analytical support with technical recommendations where necessary. Four areas of framework support that Umgeni Water is currently providing assistance with are:

(i) **Strategic** – preparation/updating of specific WCWDM master plans for each WSA
(ii) **Tactical** – provision of specialist technical assistance and engineering advice for WCWDM or NRW reduction implementation.
(iii) **Regulatory** – provision of assistance and support for No Drop assessments, monthly reporting to DWS (e.g. WSA submission of water balance and water saving reports to DWS in compliance with regulatory requirements) and training to WSA's to ensure sustainability. This includes tailor made WCWDM handbooks for each WSA.
(iv) **Financial** – not direct funding support, but assistance in preparation of business plans and funding applications, and for the tailor made WCWDM handbooks for each WSA. etc.

In 2016/17 the DWS developed a report into the State of Non-Revenue Water in KwaZulu-Natal. This report provided comprehensive water balances for each of the 14 Water Service Authorities (WSA's) in the Province. In addition, Key Performance Measures, economic analysis and an institutional assessment of the capacity and capability of the WSA's to plan, deliver and monitor Water Conservation/Water Demand Management projects were also defined.

The first study was completed in 2019 and an update of the Non-Revenue Water state in the Province was prepared to highlight any changes in water supply conditions. The figures used in The State of Non-Revenue Water report for the 2018/19 financial year have been based on information provided by the WSA's in terms of their regular reporting to DWS. It has not been possible to verify the accuracy of the data provided – where relevant, comments on the validity of the submitted data per WSA have been raised and the WSAs have been sensitised to this at the quarterly WCWDM forums.

The full report therefore presents the following:

i) A summary review of the status of Non-Revenue Water in KwaZulu-Natal for the 2017/18 financial year;
ii) The status of Water Conservation/Water Demand Management Master Plans in the Province;
iii) An assessment of the status of Non-Revenue Water in KwaZulu-Natal for the 2018/19 financial year, as well as a comparison to the 2017/18 financial year;
iv) A review of historical trends of water balances in the Province, dating from the 2013/14 financial year (pre-drought conditions);
v) Challenges experienced by the WSA's;
vi) Cautionary notes; and
vii) Recommendations for continued assistance, monitoring and evaluation.

In the spirit of intergovernmental relations (IGR), a partnership between DWS, Umgeni Water and the CoGTA was formed in 2017/18 to further assess the state of Non-Revenue Water across the Province, and to identify cost-effective measures to reduce Non-Revenue Water. This partnership is ongoing and is part of KZN Water Conservation and Water Demand Management Forum.

4.4 Update of Relevant Water Supply Scheme Information

A comparison of the 2017/2018 data with the 2018/2019 data identified the following:

- The total length of pipes/mains was reported as being 45 516km. This is less compared to the length reported in 2017/18. The The decrease is as a result of improved system information and accuracy, rather than actual removal of pipelines;
- The number of connections was reported as being 1 423 269. This is 54 254 more than that recorded in 2017/18 and represents a 4% increase from the previous year. A number of errors have been identified from the data submitted by the WSA's, including confusion on what constitutes a connection. It is evident that the reported numbers are higher than the actual number of connections, due to this lack of clarity in some WSAs on what constitutes a connection;
- The overall average supply pressure has not changed from a Provincial perspective, although a number of individual WSA's did make significant improvements in reducing operating pressures during the year, whilst other WSA's increased their average operating pressures;
- Percentage time pressurised in the networks was not accurately completed by the WSA's – each of the WSA's reported a 100% pressurized system for the financial year, which is not the case in reality (highly unlikely). An approximation of percentage time pressurized using the service provider's knowledge (based on WSAs questioned at the WCWDM quarterly workshop) was used for the 2018/19 financial year. On average, the population/consumers

in the province served by the WSA's received water for 6.3 days per week, with the highest assurance of supply being the City of uMhlathuze (6.9 days per week) and lowest assurance of supply being iLembe and King Cetshwayo District Municipalities (4.5 days/week).

4.5 Update on Water Balance

The International Water Association (IWA), developed the standard water balance to benchmark and evaluate the performance of water distribution systems (bulk and reticulation) and it is being promoted across the world as best practice. The IWA standard water balance was slightly modified for South Africa to allow for free basic water (**Table 4.2**).

Table 4.2 Modified International Water Association (IWA) Water Balance.

<table>
<tr><td rowspan="10">Volume from Own Sources (corrected for known errors)

Water Imported (corrected for known errors)</td><td rowspan="10">System Input Volume</td><td>Water Exported (corrected for known errors)</td><td colspan="3">Billed Water Exported</td><td>Revenue Water</td></tr>
<tr><td rowspan="9">Water Supplied</td><td rowspan="2">Authorized Consumption</td><td>Billed Authorized Consumption</td><td>Billed Metered Consumption</td><td>Revenue Water</td></tr>
<tr><td>Billed Unmetered Consumption</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled metered Consumption</td><td rowspan="7">Non-revenue Water</td></tr>
<tr><td>Unbilled unmetered consumption</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="3">Apparent Losses</td><td>Systematic Data Handling Errors</td></tr>
<tr><td>Customer Metering Inaccuracies</td></tr>
<tr><td>Unauthorized Consumption</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage on Transmission and Distribution Mains</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks</td></tr>
<tr><td>Leakage on Service Connections up to the point of Customer Metering</td></tr>
</table>

NOTE: All data in volume for the period of reference, typically one year.

The water balance tracks, from left to right, how a water utility supplies water volumes from source to customer, and provides the format for the utility to quantify amounts of billed and lost water.

Figures indicated below are mostly based on this IWA table and are supplied by WSA's on a monthly basis as part of DWS's regulatory requirements on a specially prepared spreadsheet.

The following is noted in terms of the change in water balance components across the Province from the 2017/18 to 2018/19 financial years:

- Conservatively, a total of 1 958 Mℓ/day is supplied to the Province's served population, with only 1 087 Mℓ/day of that being billed to consumers (revenue water). That indicates that 871 Mℓ/day is classified as Non-Revenue Water, of which 560 Mℓ/day is lost to leaks (real losses);

- The average Infrastructure Leakage Index (ILI) in the Province is 5.8, which means that leakage is(on average) 5.8 times higher than the theoretical best that it could be;
- Water Supplied (System Input Volume) into reported water supply systems increased by 5.5% year-on-year. It is still noted that many WSA's are not correctly or accurately reporting the Water Supplied volumes (due to lack of water meters and reading inaccuracies), particularly from standalone or borehole-supplied schemes. It is estimated that water supplied across the province may be under-reported by as much as 10% although a detailed investigation will need to be undertaken to confirm this;
- Authorised Consumption increased by 0.3% year-on-year. However, Billed Metered Consumption increased by 1.3% while Billed Unmetered Consumption increased by 0.1%. This indicates that the WSA's might be transferring consumption previously recorded as either Unbilled Authorised Consumption or Unauthorised Consumption into Authorised Consumption, to make NRW performance appear better (this issue is raised at the quarterly WCWDM forums);
- Potential Revenue Water (volume only, not revenue as measured in monetary terms) increased by 1.2% year-on-year;
- Unbilled Authorised Consumption increased to 4.4% from the 2017/18 financial years. This must be viewed in terms of an offset for what might have been recorded as *Unauthorised Consumption*, which increased 41,4% year-on-year (mostly as a result of inaccurate previous reporting);
- Apparent Losses increased by 15.9% year-on-year, and Real Losses (leakage) increased by 16.6% from 2017/18 to 2018/19 financial years;
- Non-Revenue Water volumes increased 11.5% year-on-year.

The overall radical increase in both losses and unbilled authorized consumptions (year on year) shows clear signs of regression for NRW in KZN and is a cause for concern.

4.6 Non-Revenue Water Economics

The unit cost of water increased 18.7% from a provincial average of R6.05/kℓ to R7.18/kℓ excluding VAT, while the lowest average sales tariff for domestic consumers increased by 12.5% from a provincial average of R11.14/kℓ to R12.53/kℓ. These rates were used to calculate either the cost or equivalent lost revenue of various water balance components.

In summary, the following can be noted for the 2018/19 financial year:

- The annual estimated cost of Water Supplied across the province increased 24.4% from R4 098 942 752 in the 2017/18 financial year to R5 091 258 637 in the 2018/19 financial year;
- The annual estimated cost of Non-Revenue Water across the province increased 29.3% from R1 752 587 163 in the 2017/18 financial year to R2 266 792 728 in the 2018/19 financial year;
- The annual estimated equivalent lost revenue from Non-Revenue Water across the province increased 33.2% from R3 186 439 932 in the 2017/18 financial year to R4 243 912 062 in the 2018/19 financial year;
- The annual estimated equivalent lost revenue from Unbilled Authorised Consumption across the province increased 6.7% from R815 492 918 in the 2017/18 financial year to R870 960 233 in the 2018/19 financial year; and
- The annual estimated cost of Real Losses (Leakage) across the province increased 38.0% from R1 055 567 601 in the 2017/18 financial year to R1 456 429 094 in the 2018/19 financial year.

The following high-level, provisional assessment of the economics of non-Revenue Water reduction in the Province of KwaZulu-Natal is presented below:

i) The total 5-year investment required for the reduction of Non-Revenue Water is R9 496 329 776 excluding VAT, of which R6 387 642 262 is Capital Expenditure (Capex) and R3 108 687 515 is Operating Expenditure (Opex);
ii) The total 5-year investment required for billing improvement (revenue enhancement projects) is R1 873 935 964 excluding VAT;
iii) The total 5-year investment required for leakage reduction is R7 622 393 812 excluding VAT;
iv) The current cost of Non-Revenue Water in the province is R2 266 792 728 excluding VAT. This would provide a Return Of Investment (ROI) of 4.2 years on the total required NRW investment budget;
v) The current cost of leakage in the province is R1 456 429 094 excluding VAT and this would provide a ROI of 5.2 years on the total required leakage reduction budget;
vi) The current cost of equivalent lost revenue (unbilled authorized consumption, unauthorised connections and under-reading of meters) in the province is R1 617 187 007 excluding VAT and this would provide a ROI of 1.2 years on the total required leakage reduction budget.

The budgets presented in this report exclude the budget requirements for the installation of bulk water meters to accurately record water supplied in all water supply schemes. This is estimated to be in the order of R100 000 000 excluding VAT.

4.7 KZN WSA Non-Revenue Water Trends

A comparison for the period 2017/18 – 2018/19 for the KZN WSA's is summarised below.

The length of mains, as reported 2018/19, was reported as being 45 516km, which is 1 289km less than that recorded in 2017/18 (**Figure 4.1**). This was not a physical decrease in pipeline length but is rather a result of improved system information and accuracy. The accuracy of the data reported in 2018/19 could not be completely verified at the time of drafting this report, but such information is becoming progressively more accurate

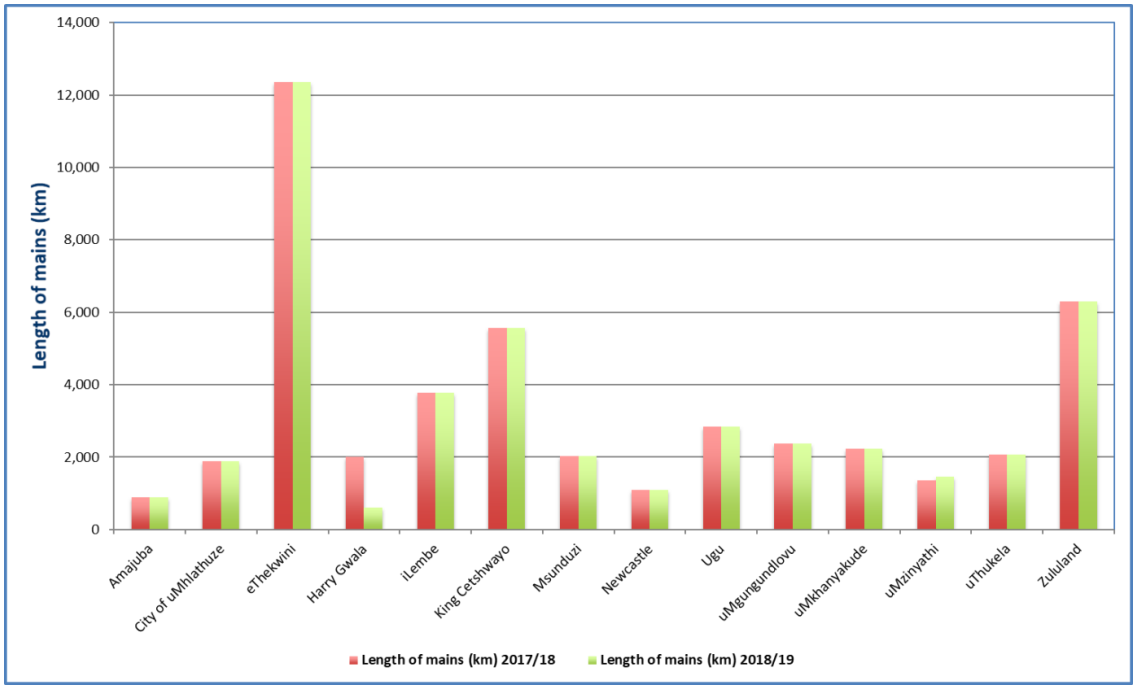


Figure 4.1 WSA length of mains (2017/2018 vs 2018/2019) (Bigen/Joat 2019).

The number of connections was reported as being 1 423 269, an increase of 54 254 between 2017/18 and 2018/19 (**Figure 4.2**). This represents a 4% increase from the previous year. As mentioned earlier, a number of errors have been identified from the data submitted by the WSA's, including confusion on what constitutes a water connection. There is an indication that the reported numbers are higher than the actual number of connections.

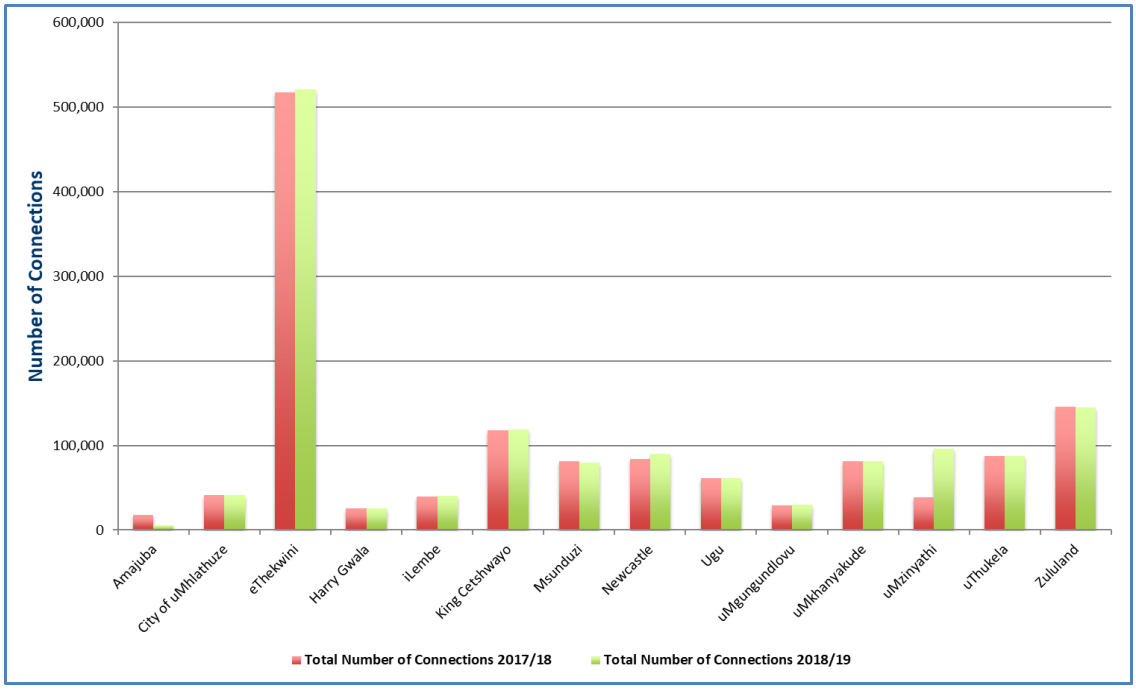


Figure 4.2 WSA total number of connections (2017/2018 vs 2018/2019) (Bigen/Joat 2019).

Percentage time pressurised in the networks was not accurately completed by the WSA's – each of the WSA's reported a 100% pressurized system for the financial year, which is not the case in reality (highly unlikely). On average, the population/consumers in the province served by the WSA's received water for 6.3 days per week, with the highest assurance of supply being the City of uMhlathuze (6.9 days per week) and lowest assurance of supply being iLembe and King Cetshwayo District Municipalities (4.5 days/week) (**Figure 4.3**).

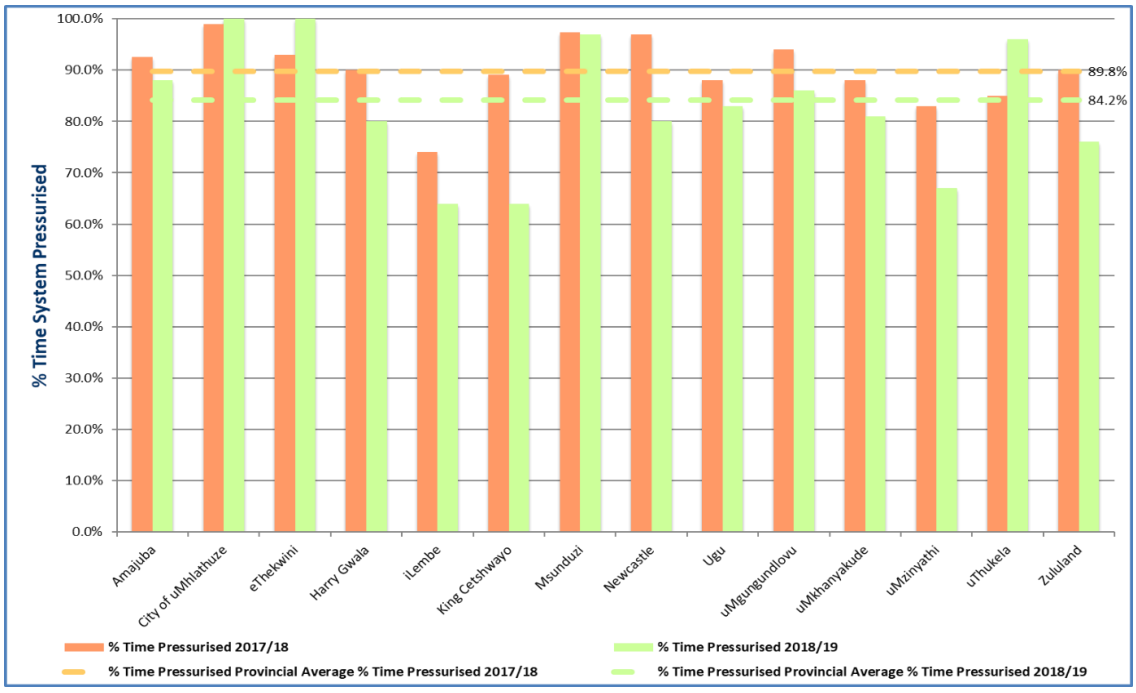


Figure 4.3 WSA percentage time system pressurised (2017/2018 vs 2018/2019) (Bigen/Joat 2019).

A total of 1 958 Mℓ/day (compared to 1 857 Mℓ/day from the previous financial year) is supplied to the province's served population, with only 1 087 Mℓ/day of that being billed to consumers (compared to 1 075 Mℓ/day from the previous financial year. This means that 871 Mℓ/day is being lost to Non-Revenue Water (compared to 782 Mℓ/day from the previous financial year), of which 560 Mℓ/day is lost to leaks (compared to 480 Mℓ/day from the previous financial year) (**Figure 4.4)**.

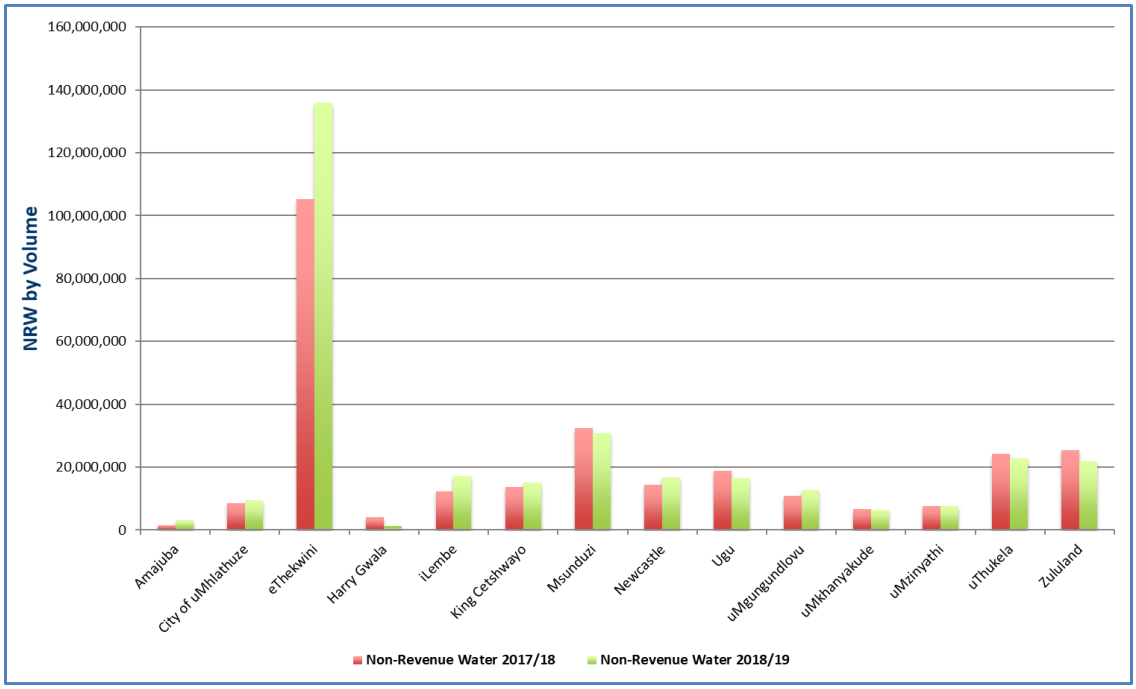


Figure 4.4 WSA non-revenue water by volume (2017/2018 vs 2018/2019) (Bigen/Joat 2019).

Non-Revenue Water by Volume Percentage regressed from 42.1% to 44.5% year-on-year (**Figure 4.5** and **Figure 4.6**). However, the use of percentages as a performance measure is not considered international best practice and is actively discouraged. However the performance measure is presented for compliance purposes for the Department of Water and Sanitation.

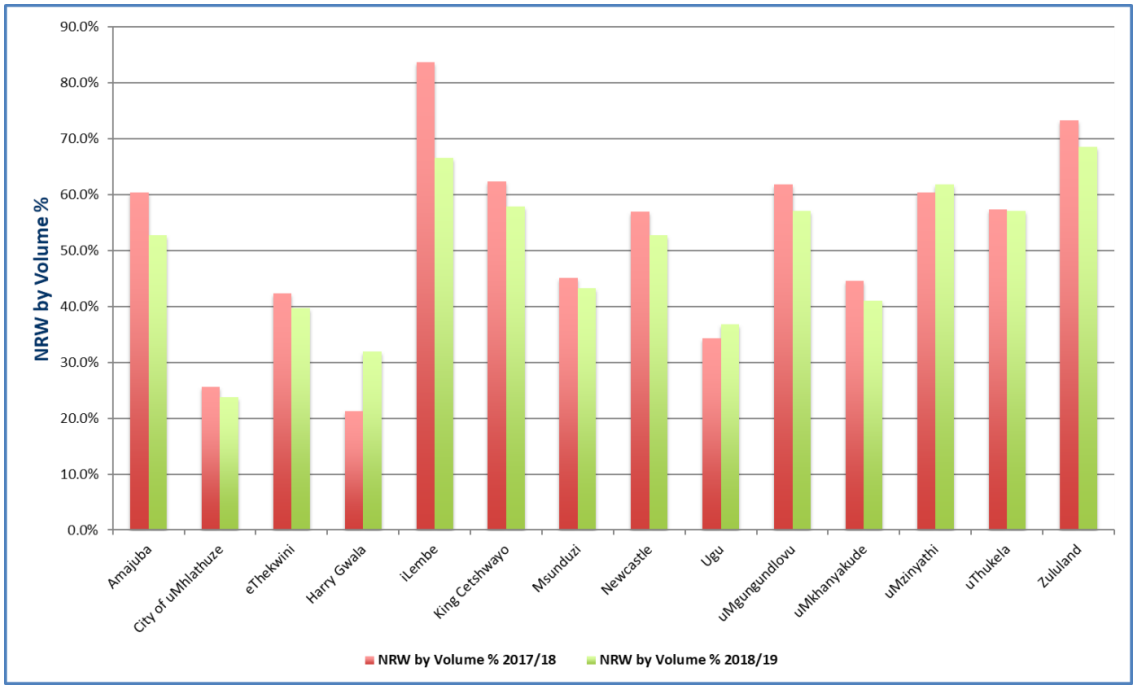


Figure 4.5 WSA non-revenue water by percentage (2017/2018 vs 2018/2019) (Bigen/Joat 2019).

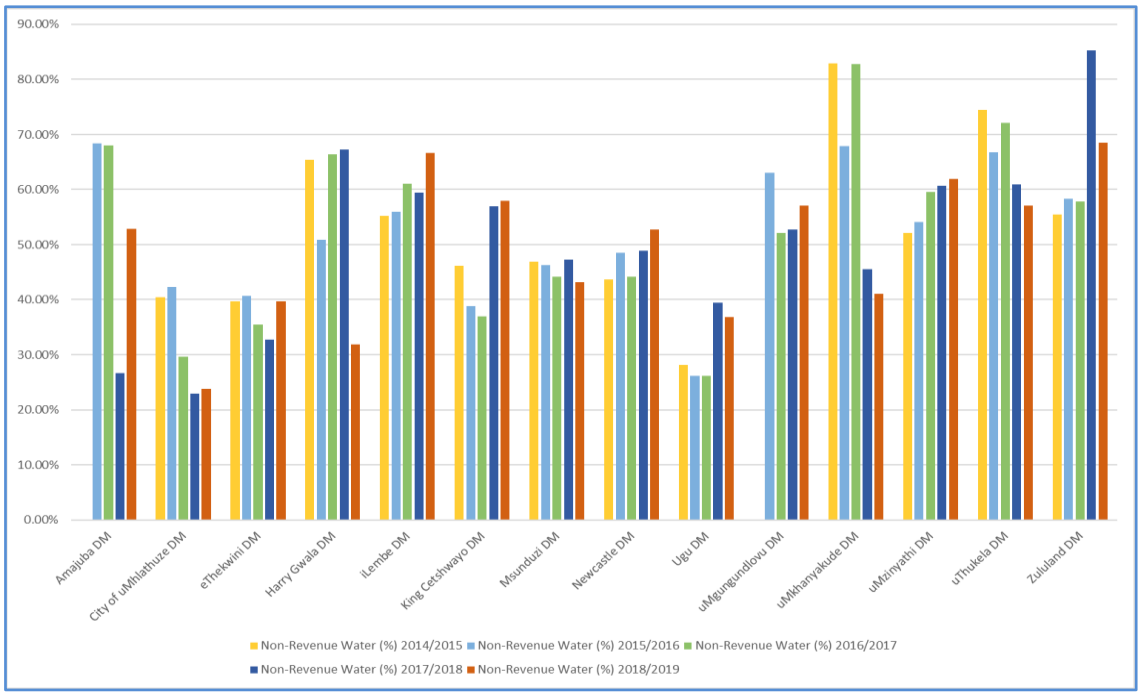


Figure 4.6 Historical NRW comparison between KZN WSAs by percentage volume (2014/2015 – 2018/2019) (Bigen/Joat 2019).

The annual estimated cost of Real Losses (Leakage) across the province increased from R1 023 509 220 to R1 456 429 094 year-on-year (**Figure 4.7**). Such regression is most concerning and the water sector needs to collaborate and react accordingly to reduce this impact.

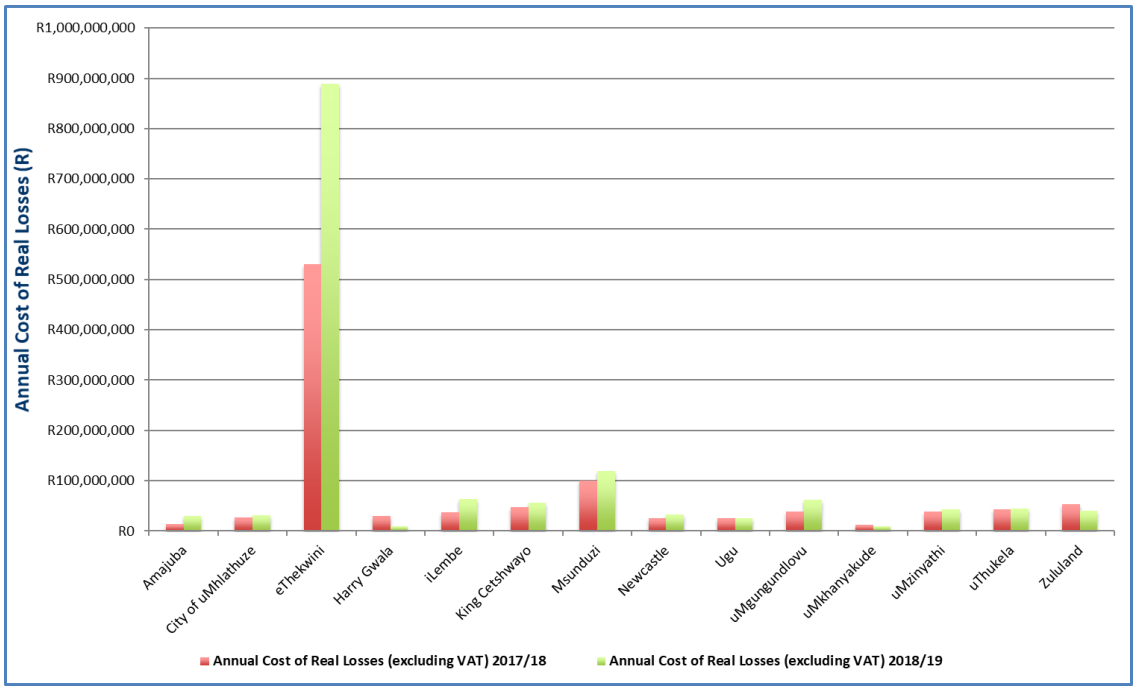


Figure 4.7 WSA annual cost of real losses (2017/2018 vs 2018/2019) (Bigen/Joat 2019).

Figure 4.8 indicates the 5-year historical trends, comparison of non-revenue water by volume for all 14 KZN WSAs.

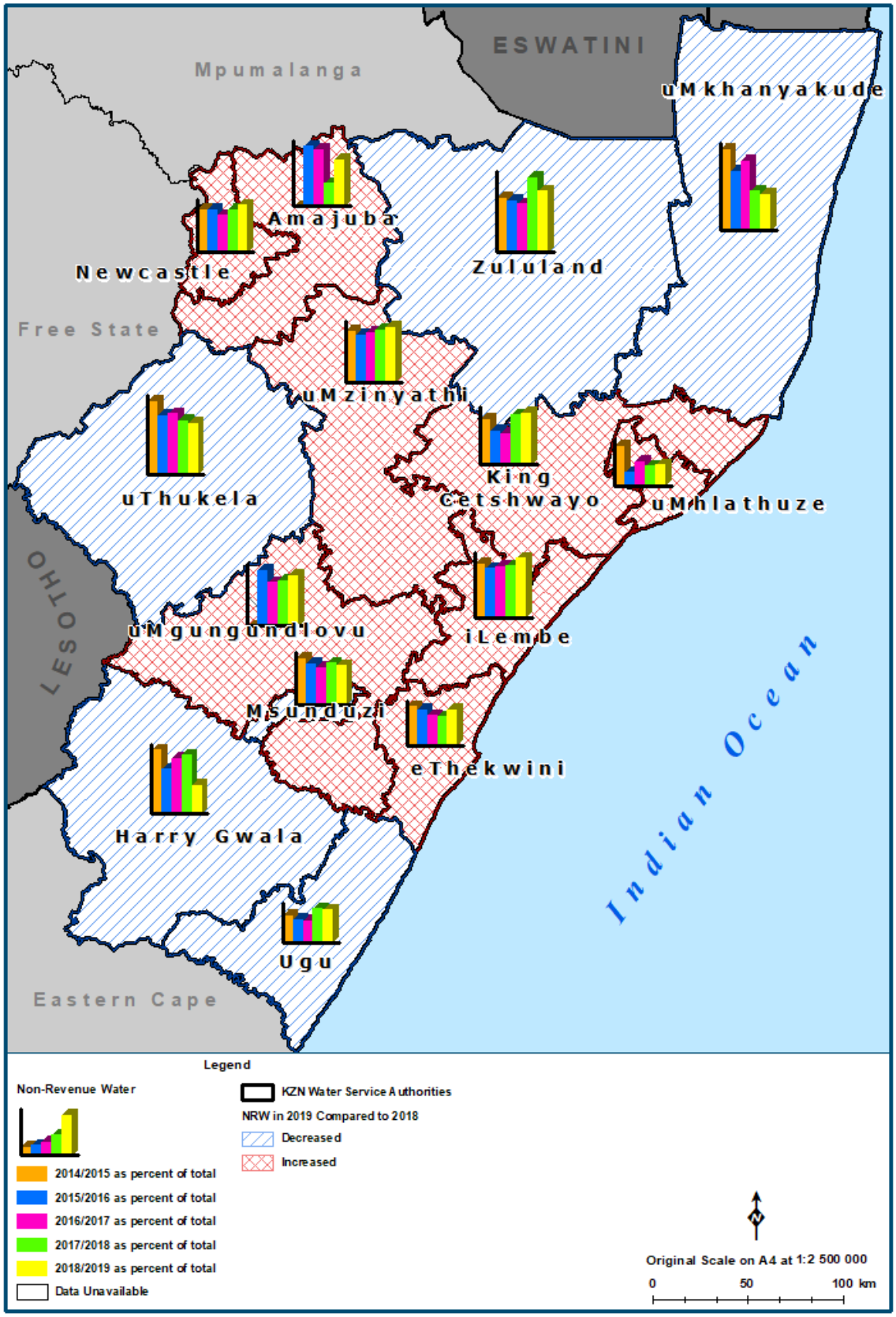


Figure 4.8 Comparison of non-revenue water by volume (Bigen/Joat 2019).

4.8 Future WCWDM Projects

Umgeni Water will continue to support the KZN WCWDM programme in the 2019/20 financial year, with further improvements based on lessons learned and on WSA requests. In support of the overall programme objectives, six Key Support Areas (KSA's) have been identified. These are summarised as follows and will form part of the 2019/20 financial year project:

- KSA 1: WCWDM Master Plans (updating where necessary)
- KSA 2: Development of Revenue Improvement Strategies (identifying and conceptualising revenue enhancement projects)
- KSA 3: Determination of True Cost of Water (which will ultimately assist with tariff modelling)
- KSA 4: DWS Reporting Assistance (UW actively participates in and facilitates the KZN WCWDM quarterly forum)
- KSA 5: WSA WCWDM Mentorship
- KSA 6: Program Support

Umgeni Water is committed in ensuring that the continued implementation of the NRW reduction support programme yields positive results and as such the following future projects are proposed:

(i) **Confirmation of System Input Volume for Water Balance for UW and WSAs**

- This will involve an assessment and evaluation of bulk meter points. As part of this exercise any new bulk meters that are required for the NRW systems will be identified and motivation made for damaged meters to be repaired, replaced or calibrated. Many WSAs employ estimation for water schemes that do not contain water meters. Other areas of focus such as zoning and thus zonal meters will also be considered, in order to improve monitoring and control.

(ii) **System Stabilisation**

- During this process, areas of intermittent water supply will be identified in each WSA. Special projects will then be motivated to address these intermittent supply problems.
- Pressure management areas should also be identified within each WSA and motivations done to ensure that the average zone pressure is approximately 50 m. Excess pressure causes undue stress on pipeline networks, resulting in premature aging and bursts/leaks. Reduction of pressures at night through modulated pressure reduction valves can also relieve the stress on the pipeline infrastructure, and reduce water losses, thus promoting reliability of supply.

(iii) **On-going Monitoring and Evaluation for UW and WSAs**

- Preparation of quarterly water balances.
- Preparation of water savings reports.
- No drop assessment improvement reports.

4.9 Way Forward

Water conservation and water demand management has become an integral part of Umgeni Water's operating philosophy. WSA's have been assisted to develop 5 year WC/WDM master plans to specifically deal with NRW. NRW can be reduced to acceptable levels when the KZN water sector has:

- A common vision regarding water efficiency;
- Identified NRW reduction as a critical business activity;
- Strong and informed leadership;
- Dedicated NRW teams;
- Strong cooperation between departments; and
- A strong asset management philosophy.

Water conservation and water demand management is often listed as the top priority in all the DWS Reconciliation Strategies for areas of KZN (2012 onwards). This has not changed, and UW views this as the TOP priority for WSAs to implement with urgency. This will result in the sustainable use of the natural water resources and improvement of reliability of supply. By default, it will also free up water for use in areas where there is still a backlog. Considering the unacceptably high water losses and non-revenue water, the WSAs cannot afford to continue with new capital works, without also replacing old AC pipes, resolving illegal connections, and metering all customers with individual connections. Bulk metering is also a key priority in order to be able to calculate the water balance in each scheme. It should also be remembered that the water demand model utilised for the water master plans of WSAs includes the assumption that water losses percentage will decrease over time, as it plans for good business, not poor management. If the WSAs do not intervene, and reduce water losses, the demands predicted for the various schemes will almost certainly exceed the resource yield leading to reduced supply to consumers.

In the longer term, as the service landscape changes, the WSAs needs to move out of the current crisis management to a pro-active WCWDM programme that includes the four elements of WCWDM (**Figure 4.9**) expounded on in the National Water Resources Management Strategy (DWA 2013).

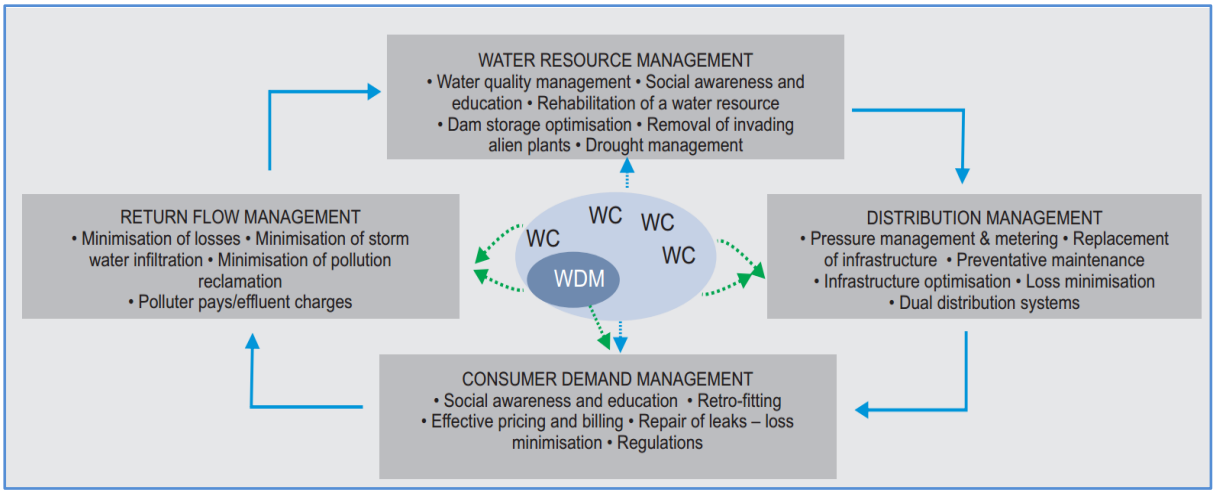


Figure 4.9 Elements of Water Conservation and Water Demand Management (NWRMS, DWS, 2013).

An aggressive, expanding WCWDM project needs to be planned for each water supply scheme in the preparation for schemes migrating to a higher level of service. A dedicated WCWDM team is not needed. Instead, the reticulation operations teams, and the maintenance teams in each WSA need to have WCWDM KPIs, with maintenance schedules that ensure coverage of all schemes. This should be coupled with a strong consumer awareness programme, and the implementation of a "citizen science" reporting mechanism to report leaks, bursts etc. This system should be implemented immediately as part of business as usual, by the staff of WSAs. A 5 year WCWDM Master Plan was

developed for each of the WSAs by JOAT through support of UW, DWS and CoGTA KZN but these are not being used by the WSAs to initate projects. The costed interventions within the primary schemes of each WSA are available in these 5 year WCWDM Master Plans. This is an intense programme dealing with the highest priority interventions.

Due to the significant backlog of water problems, and the urgent nature thereof (and the scale or magnitude of these water supply schemes), this should be a set of outsourced projects to make a rapid, significant impact on NRW in the WSAs. WSAs need to be compelled by Cogta and DWS to prioritise a certain minimum percentage of funding for implementation of NRW projects.

A significant aspect that is not dealt with specifically in the 5 year WCWDM Master Plan is AC pipe replacement in the older areas of the established towns e.g. Vryheid, Greytown, Pietermaritzburg etc. This ageing infrastructure is a significant contributor to the water losses in these towns and a prioritized programme of replacement needs to be developed and implemented. A set of projects for this replacement, over the next 10 years, is needed urgently and funding would have to be sought from DBSA or international donors e.g. the Orio projects of uMgungundlovu DM.

UW will therefore continue to raise the above issues with the water sector (especially the WSAs) at the quarterly WCWDM forums and assist where possible, in an effort to get the WSAs to priortise funding for NRW reduction programmes and revenue enhancement programmes.

REFERENCES

Bigen Africa. 2019. *Update on the Status of Non-Revenue Water in the Province of KwaZulu-Natal, end of the 2018/2019 Financial Year,* C0209MAS_R0034*,* Durban.

Joat. 2017. *KZN NRW Status for Umgeni Water 20171127*. Spreadsheet. (27 November 2017).

Joat. 2018. *KZN NRW Status for Umgeni Water 20181127*. Spreadsheet. (27 November 2018).

South African Local Government Association. 2008. *Framework for Water Conservation and Demand Management*.

Umgeni Water. 2013. *Water Demand Management Strategy Make Every Drop Count.* January 2013. Pietermaritzburg: Umgeni Water.

Umgeni Water. 1999. *Water Conservation Policy*. Pietermaritzburg: Umgeni Water.

5. SYSTEMS ENERGY ANALYSIS IN THE UMGENI WATER OPERATIONAL AREA

5.1 Overview

The energy efficiency of water supply cannot be optimised unless the impact of infrastructure on energy use is understood. With this in mind, an analysis of energy use is provided in this section and shows the energy "cost" of regional and local water supply.

Umgeni Water's operational area consists of the following systems:

- Mgeni System comprising the Upper Mgeni and Lower Mgeni (**Chapter 7**)
- uMkhomazi System (**Chapter 8**)
- South Coast System (**Chapter 11**)
- North Coast System (**Chapter 12**)
- Upper uThukela (**Chapter 13**)

This section focuses on the period July 2018 to June 2019 and for areas where information was not available, the closest full year cycle was used. Values indicated in this section are an indication of power use and some values have been averaged due to the lack of available meter readings.

Figure 5.1 indicates the power usage per system. An average of 239 330MWh was used across all systems within Umgeni Water to supply approximately 524 795 Mℓ per annum. The two systems with the highest power usage are the Upper and Lower Mgeni Systems and their combined systems account for 80.95 % of water produced and 81.81 % of total power usage. The majority of water produced by these systems supply the uMgungundlovu and eThekwini municipalities with a smaller percentage being supplied to the southern and northern coastal area.

Table 5.1 shows a 12.55 % increase in the energy consumption across the company, with the largest increase (in percentage terms) being the North Coast System and the Upper Mgeni System.

The large increase (41.12%) in the electricity usage in the North Coast System is attributed to the increase in supply from the Lower Thukela Bulk Water Supply System together with the upgrade of three of the Ndwedwe pump stations.

The significant increase in the energy usage in the Upper Mgeni System (31.87%) is attributed to the following factors: -

- Continuous pumping from the MMTS
- Increase in the demand in the Howick West system
- The increased supply to Midmar WTW
- The commissioning of the uMshwathi Bulk Water Supply Scheme

Table 5.1 Yearly comparison on power usage.

Year	2018	2019	% Diff
System	kWh/annum	kWh/annum	kWh
Upper Mgeni	60,191,456	79,376,654	31.87
Lower Mgeni	122,846,580	123,682,795	0.68
North Coast	15,114,568	21,329,373	41.12
South Coast	14,496,025	14,942,358	3.08
Upper uThuleka		1,210,098	
Total	**212,648,628.60**	**239,331,180.20**	**12.55**

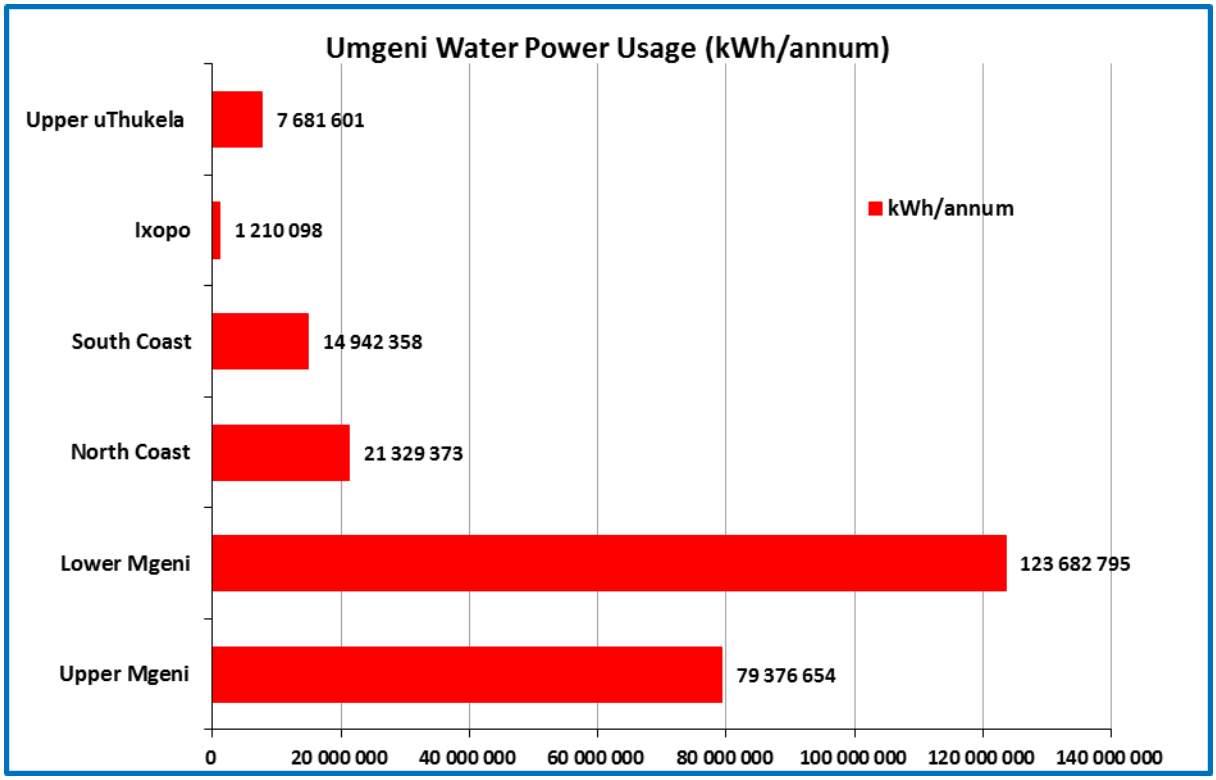


Figure 5.1 Total Energy Consumption for Umgeni Water Systems 2018/19.

Energy Intensity graphs provide an indication of the rate at which power is consumed to produce or transport water i.e. kWh per Kℓ. This indicator is used to compare power usage of different infrastructure components and systems.

Figure 5.2 represents the different power intensity rates for the Umgeni Water systems. The average energy requirement is 0.47 kWh/kℓ i.e. the power used across the entire Umgeni Water supply area divided by the total volume produced or pumped. This value is a decrease of 4.1 % from the previous year. The Ixopo system is 2.9 times above the average and is by far the costliest system in the Umgeni Supply area.

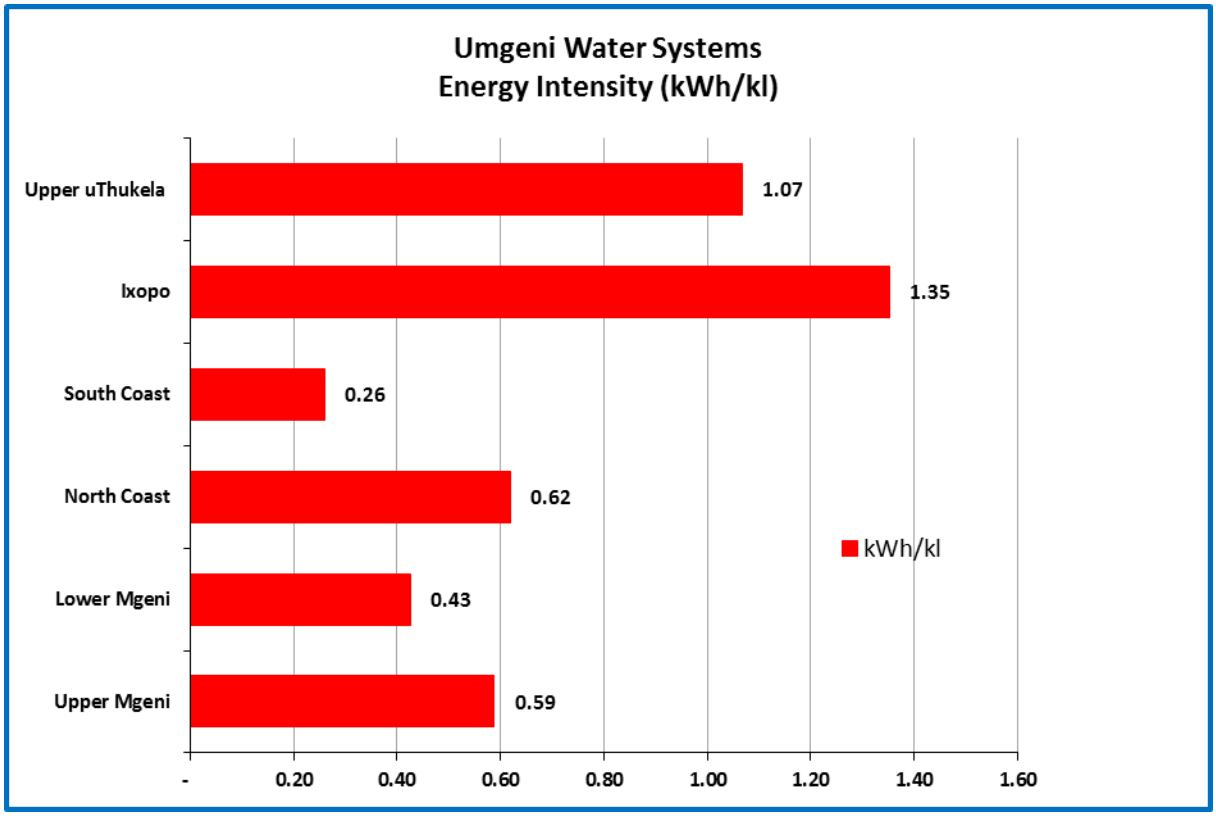


Figure 5.2 Energy requirement to supply water in Umgeni Water Systems 2018/19.

5.2 Energy Usage per Infrastructure Component

The analysis is further broken down per Umgeni Water's individual infrastructure components (mainly WTP's and Pump Stations) across the area of supply (**Figure 5.3**).

Figure 5.3 and **Figure 5.4** show that the largest power consumers across all the Umgeni Water systems is the Durban Heights Shaft Pumps, with an annual consumption of approximately 34 000 MWh per annum followed by the Wiggins High Lift Pump Station and then the Spring Grove Pump Station.

5.3 Energy Intensity per Supply Point

To further illustrate the power intensity usage across Umgeni Waters Supply area, the energy requirement was further analysed per supply point and is illustrated in **Figure 5.5**. This graph provides an indicative cost per kilolitre in terms of energy usage from source to supply point.

Figure 5.5 indicates the most expensive points of supply, in terms of energy usage, throughout all Umgeni Water's Supply Areas. The average energy requirement across the 55 supply points is 1.052 kWh/kℓ and 22 of the 55 supply points are supplied at a rate above the average.

The highest energy requirement per kilolitre of water supplied is the supply to Ndwedwe Reservoir 5 from Hazelmere WTP at 3.93 kWh/kℓ followed by the Midmar supply to Vulindlela Reservoir 5 with an energy requirement of 3.23 kWh/kℓ.

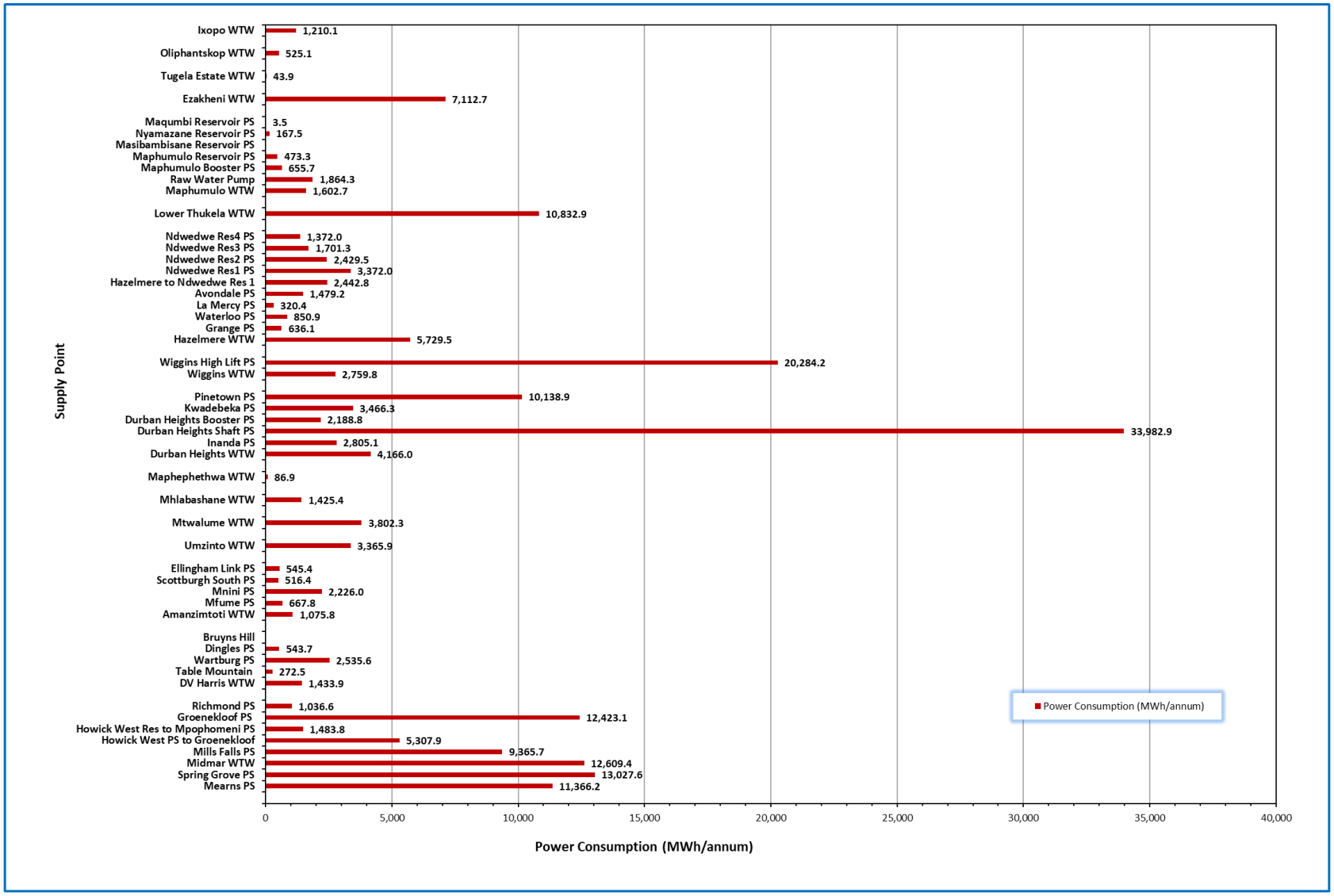


Figure 5.3 Annual Power Usage Comparison Umgeni Water Installations.

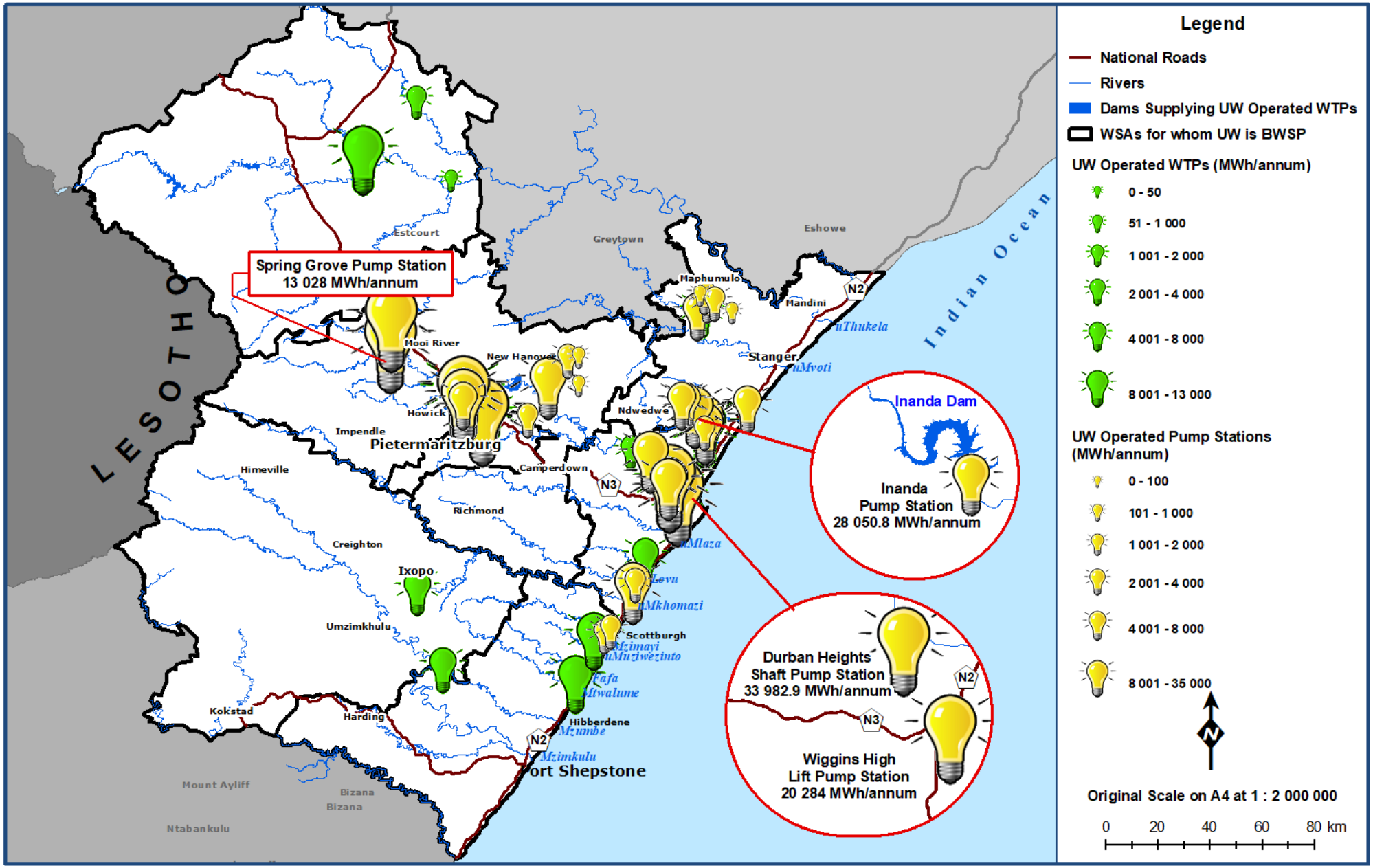


Figure 5.4 Distribution of the highest energy consumers.

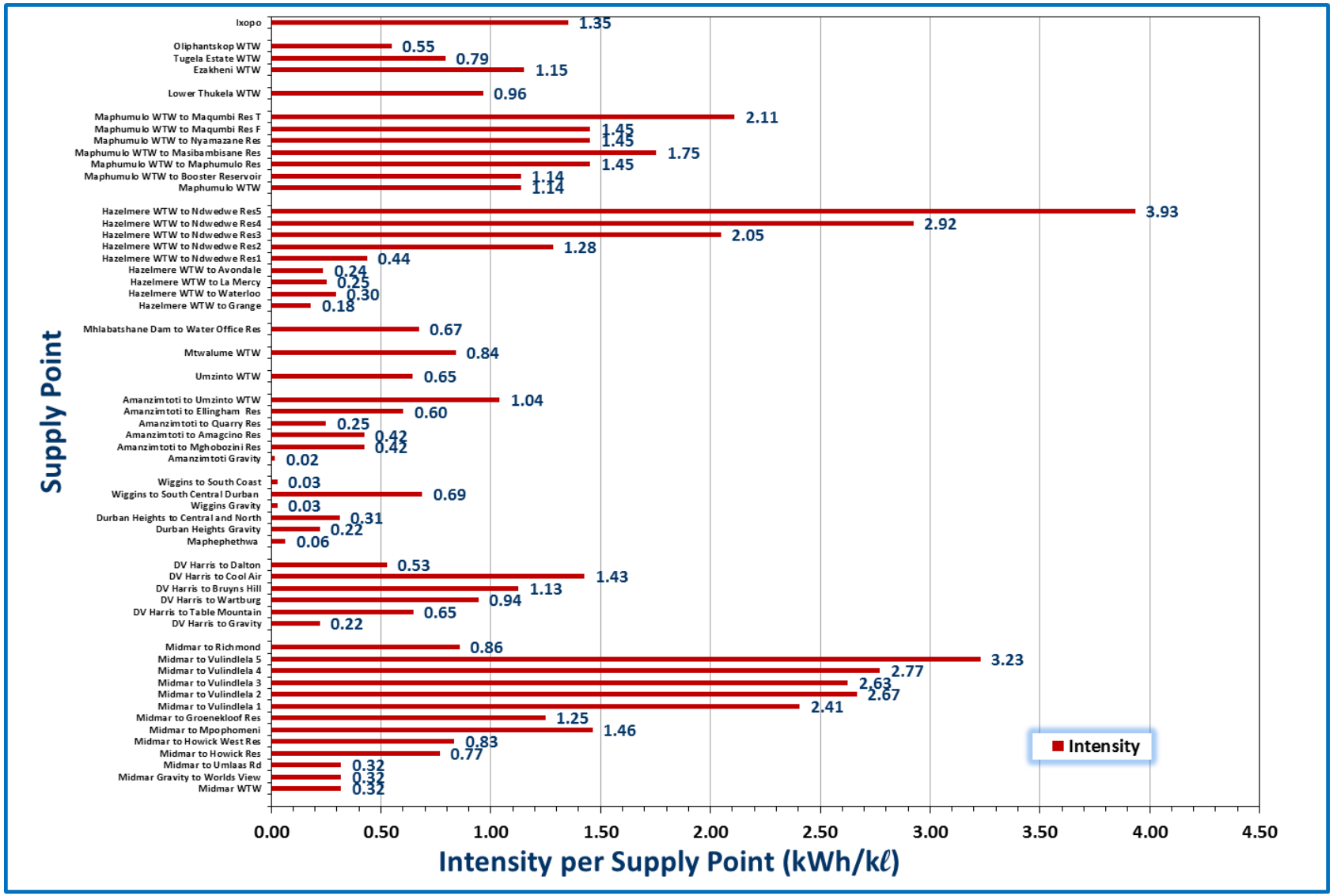


Figure 5.5 Annual Energy Intensity per Supply Point.

5.4 Observations and Recommendations

The two most energy intensive sub-systems are the supply to the Vulindlela area from Midmar Dam and the supply to the Ndwedwe area from the Hazelmere Dam. The Maphumulo System has also increased in the power intensity and may be attributed to an increase in supply to the higher portions of the system.

The highest energy use per annum are the high lift pump stations that deliver raw water to the systems.

Monitoring of the energy usage throughout the organisation is conducted by the Operations Division and detailed records are kept in the majority of the areas.

Certain installations, such as Hazelmere WTP, receive a consolidated billing account. This cannot be used to accurately measure the cost of supply to the various areas supplied by this WTP.

Umgeni Water will have to invest in electrical sub-meters to ensure the accurate recording of energy per sub system.

The following recommendations are made to better monitor and improve the energy usage throughout the supply area:

- Electrical and flow meters be installed and monitored in all Umgeni Water's pump stations.
- The electrical meters can be used as check meters as there is no means to currently verify the readings supplied by the power suppliers.
- Monitoring of the energy usage will provide an early warning sign to mechanical wear on pumps and maintenance can be planned timeously.
- Umgeni Water should investigate the use of power saving technology to reduce its carbon footprint and operational costs.
- Investigations should be undertaken on the Ixopo System to determine the cause of the high energy usage.
- UW to invest in smart meters which can be monitored and operated online and remotely.

6. OVERVIEW OF SYSTEMS

6.1 Overview of Systems

All existing water resources and water supply infrastructure, as well as the proposed infrastructure, has been categorised into a number of **primary systems** in order to assist with better describing and understanding the dependencies and interconnectivity between the many components (refer to **Figure 6.1**). Each of these systems is defined by the catchment which forms the primary, or original, source of water for a particular bulk supply network. The catchments are grouped in logical regions as shown in **Figure 6.1**. The exception here is the South Coast where a number of small adjacent catchments provide the necessary water resources, and hence have been grouped together. It is further noted that whilst the Mgeni and Mooi Systems are primary systems, with the Mooi-Mgeni Transfer Scheme, these two systems work concurrently and therefore the Mooi System is discussed with the Mgeni System in **Section 7**.

For further clarity, the larger primary systems have been divided into **secondary systems** as shown in **Figure 6.2** for Umgeni Water's operational area.

Within a primary system, and where applicable a secondary system, logical networks of water supply infrastructure have been classified as **sub-systems**. The larger networks can contain a number of sub-systems.

Whilst each water supply system is generally self-contained, in most cases there is interconnectivity between the various systems. Linking the various supply systems such that they can receive potable water from more than one source is important to ensure that a sustainable supply of water can be provided within each system at all times. These linkages therefore form part of the long-term planning processes undertaken by Umgeni Water.

Figure 6.2 illustrates all the existing and proposed water system configurations and linkages (within the Umgeni Water Operational Area), and provides a point of reference for **Section 7**, **Section 8**, **Section 11**, **Section 12** and **Section 13** of the IMP 2020.

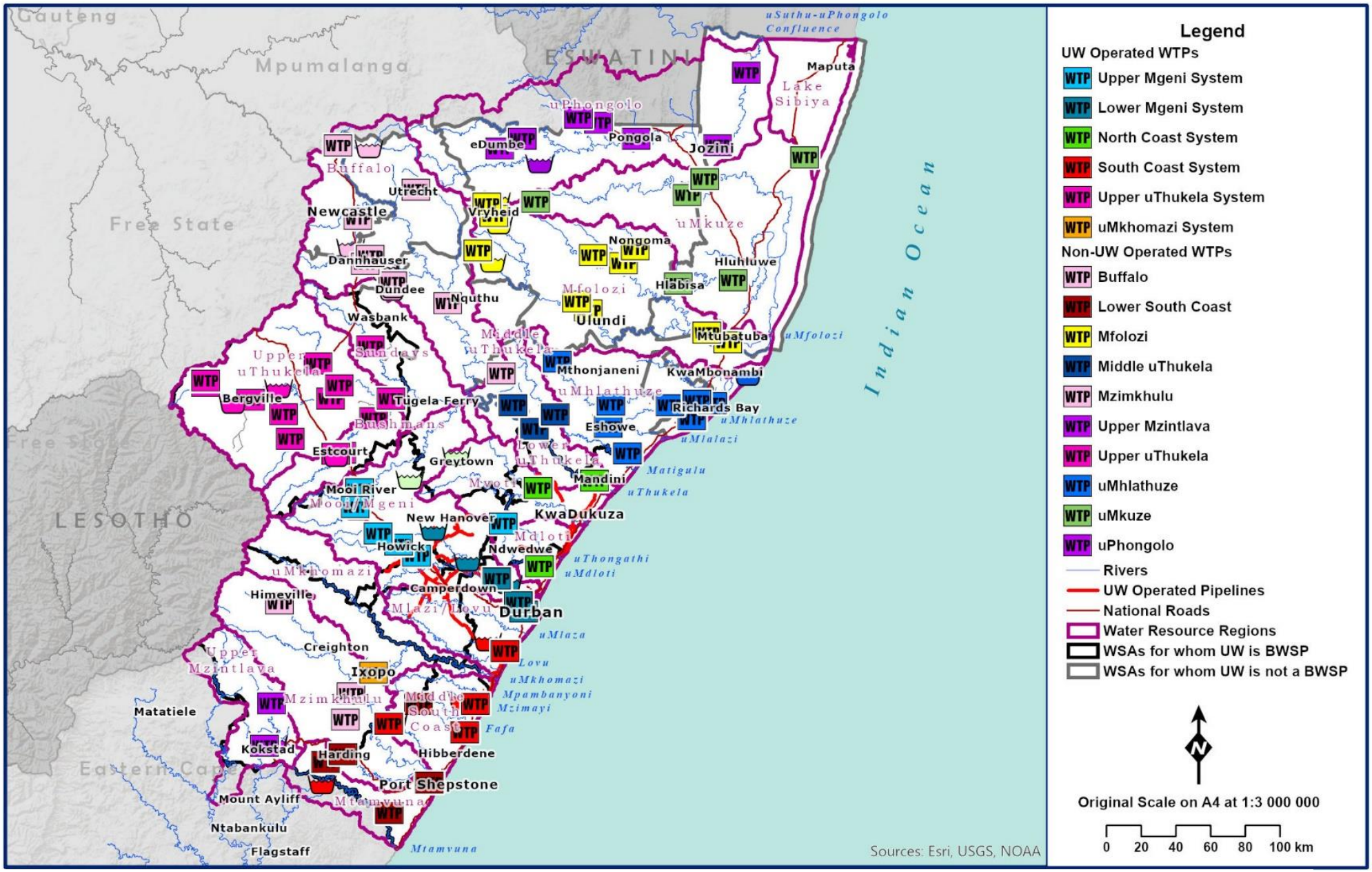


Figure 6.1 KZN primary systems.

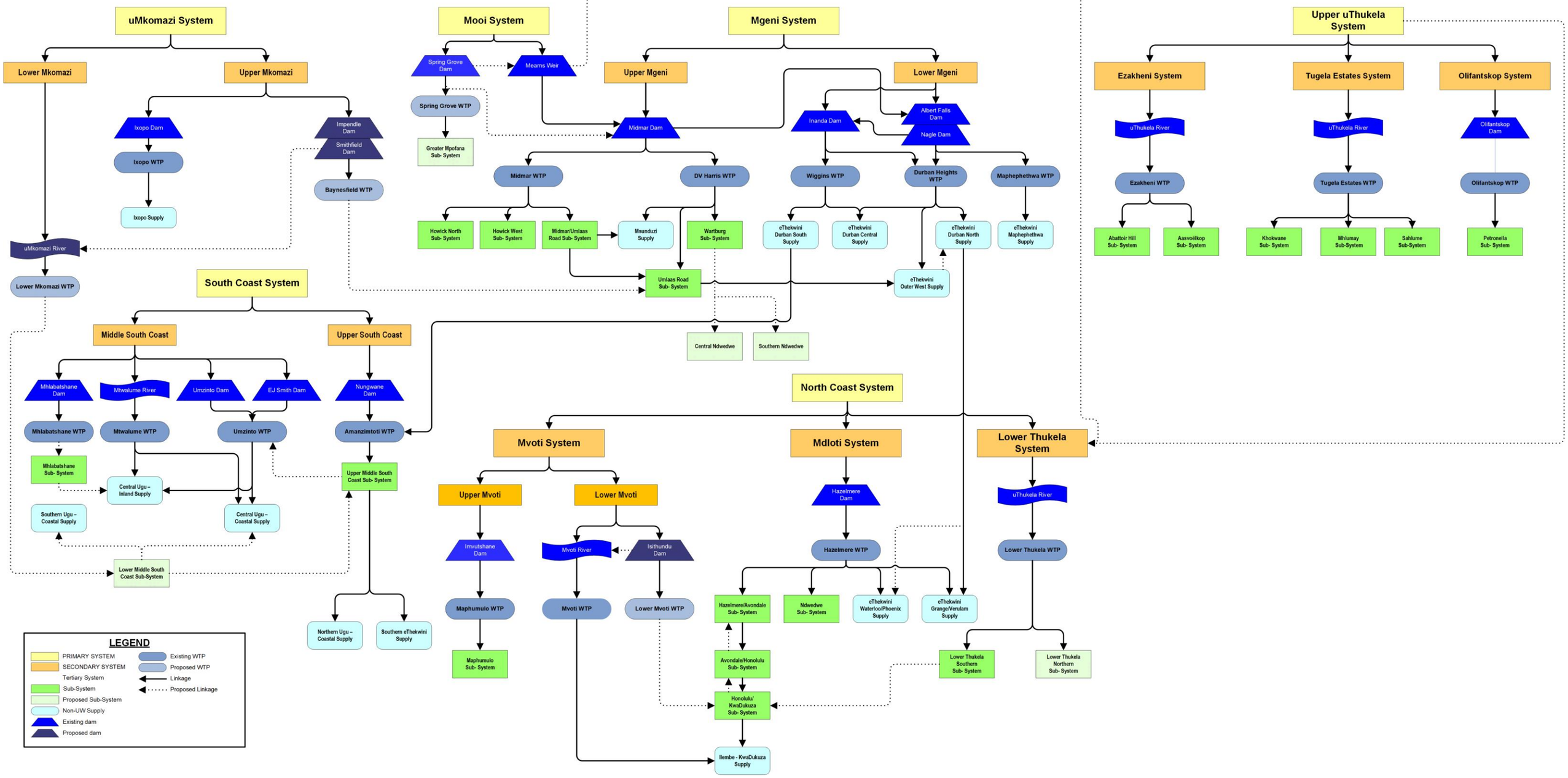


Figure 6.2 Water infrastructure system configurations and linkages.

ACKNOWLEDGEMENTS

Umgeni Water's comprehensive 2019 Infrastructure Master Plan has been updated and improved to produce this 2020 version. The concerted effort of the Planning Services Department as a whole in producing this document is acknowledged and appreciated. This was all achieved under ever trying conditions with many staff working remotely whilst contending with the COVID-19 Lockdowns. Specific contributions by the various team members deserves acknowledgement:

- Alka Ramnath (Planner) Project management, Section 2, Spatial information, Research and input to all volumes
- Graham Metcalf (Geohydrologist) Groundwater and Wastewater
- Gavin Subramanian (Planning Engineer) Infrastructure on the North Coast and Mhlathuze Systems
- Angus Nicoll (Planning Engineer) Infrastructure on the South Coast and Mgeni Central Systems
- Vernon Perumal (Planning Engineer) Infrastructure on the uMkhomazi, Upper Mzintlava and Upper Umzimkhulu Systems and compiling the Energy Section
- Mark Scott (Planning Engineer) Infrastructure on the Mgeni Inland, uThukela Central and Umfolozi Systems
- Reshina Maharaj (Planning Engineer) Infrastructure on the uMkhuze, uPhongolo and Lake Sibaya Systems
- Nathaniel Padayachee (Planning Engineer) Infrastructure on the Upper uThukela and Buffalo Systems
- Nkosi Cele (Planning Engineer) Infrastructure data acquisition
- Ntuthuko Ngcamu (Head – Water Demand Management Unit) with support from Mathews Nokhanga and Nkukuleko Ndlovu Water Demand Management Section
- Sakhile Hlalukane (Hydrologists) Water resources of the North Coast, South Coast and Upper uThukela Systems
- Sandile Sithole (Hydrologist) Water resources of all systems excluding the North coast, South Coast and Upper uThukela Systems
- Sifiso Khathi (Graduate Trainee – Hydrologist) Mapping and hydrology support
- Thabani Zondi (Graduate Trainee - Hydrologist) Hydrology Support
- Nombuso Dladla (Data Analyst) Spatial information
- Hlgeniwe Cele (Administrator) kept the department functioning throughout the project

The 2020 Infrastructure Master Plan was not completed by the abovementioned people without the valued assistance of numerous other persons and parties. Their contributions are gratefully acknowledged. These include Umgeni Water and WSA Operations Staff, Umgeni Water's Water and Environment Department (water quality), Umgeni Water's Process Services Department (process and treatment details for UW plants and others) and Umgeni Water's Catchment Management Department (climate change).

Kevin Meier,
PLANNING SERVICES MANAGER