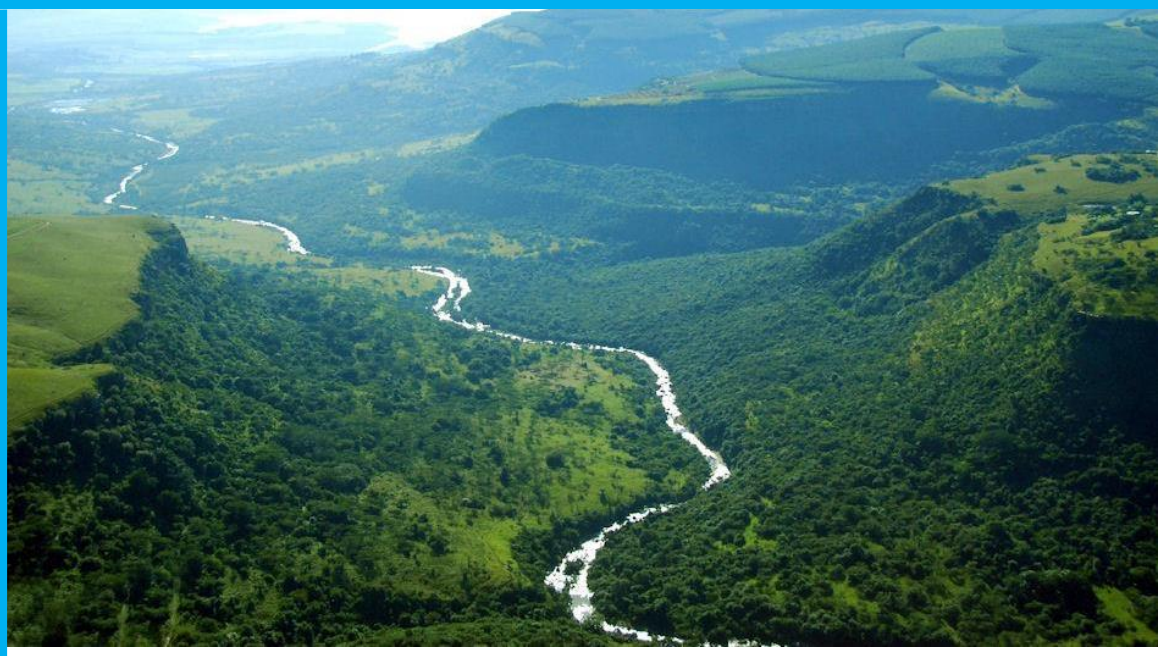

Support to the Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coastal Metropolitan Area: Phase 2

Updated Reconciliation Strategy 2017

P WMA 04/000/00/3517



Project Name:	***Support on the Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coastal Metropolitan Area: Phase 2***
Report Title:	***Updated Reconciliation Strategy 2017***
Authors:	***HS Pieterse, JH Schroder, G de Jager***
DWS Report No.:	***P WMA 04/000/00/3517***
DWS Contract No.:	***WP 10728***
AECOM Reference No.:	***60326618 (J02172)***
Status of Report:	***Final***
First Issue:	***November 2016***
Final Issue:	***February 2017***

Approved for:

AECOM SA (Pty) Ltd

FGB de Jager
Study Leader

HS Pieterse
Study Director

Approved for:

DEPARTMENT OF WATER AND SANITATION

Directorate: National Water Resource Planning

NJ van Wyk
Chief Engineer: National Water Resource Planning (East)

P Mlilo
Director: National Water Resource Planning

Prepared by:

AECOM SA (Pty) Ltd
PO Box 3173
Pretoria
0001

EXECUTIVE SUMMARY

The Department of Water and Sanitation (DWS) commissioned the Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Area *in 2006 to develop a strategy to ensure adequate management of water supply to the metropolitan areas in the Central KZN Region. Subsequently, two continuation phases of the Reconciliation Strategy have been undertaken with the objective of updating the original Strategy, namely* Phase 1 *(over the period 2009 to 2012) and then* Phase 2 *which is presented in this document (commencing in 2014).*

The Reconciliation Strategy builds on the information and recommendations emanating from previous studies conducted by the DWS and various institutions involved in water resource management in the Central KZN Region. It is a coordinated effort that brings together the planning of various government departments, water services authorities (WSAs) and water services providers (WSPs), as well as interested and affected parties that represent water users and environmental concerns.

The area associated with the Reconciliation Strategy now extends from the Thukela River Mouth on the KZN North Coast to the uMtwalume River on the South Coast, as well as from Howick in the KZN Midlands to Durban on the East Coast. It includes the eThekwini Metropolitan Municipality (MM), Msunduzi Local Municipality (LM), as well as portions of uMgungundlovu, iLembe, and Ugu District Municipalities (DMs). The area consists of three main water supply systems (WSSs), namely the ***North Coast WSS****, the integrated* ***Mgeni WSS*** *and the* ***South Coast WSS****.*

The process to update the Reconciliation Strategy includes:

- *the delineation and subdivision of the Strategy Area into three main water supply systems (WSSs),*
- *updating of water requirement projections,*
- *assessing water availability,*
- *identification, prioritisation and timing of intervention options,*
- *development of water balances for various scenarios, and*
- *discussions and decisions made at various meetings by key stakeholders and other affected parties.*

Three types of intervention options, namely management, infrastructure and support interventions have been considered as part of the Updated Reconciliation Strategy.

The proposed priority intervention options for the three main WSSs are summarised below.

NORTH COAST WSS

- *Priority infrastructure implementation projects*
  - *Commissioning of the LTBWSS-1 by the end of 2016.*
  - *Complete the raising of Hazelmere Dam by August 2017.*
  - *Commence with the design and implementation of the LTBWSS-2 for delivery by 2021.*
- *Priority feasibility studies*
  - *Commission a feasibility study for water re-use at Hazelmere Dam. This will allow for a better comparison of this option with the Mvoti River Development Project (iSithundu Dam) and will assist in making a final decision on the preferred long-term supply option for the North Coast WSS.*

MGENI WSS

- *Priority infrastructure implementation projects*
  - *Implement uMWP-1 (Smithfield Dam) and associated transfer and bulk infrastructure scheme as soon as possible;*
  - *Complete the Western and Northern aqueducts to deliver water from uMWP-1 to the planned areas in the eThekwini MM;*
  - *Review the feasibility of the eThekwini MM Re-mix Project once the pilot plant has been commissioned and tested for a reasonable period.*
- *Priority feasibility studies*
  - *While feasibility studies have been completed for the uMkhomazi Water Project, desalination of seawater, and re-use of water from Northern and KwaMashu WwTWs, the outcomes of these studies must be reviewed based on the recently completed Classification Study.*
  - *A study reviewing the possible short-term options for reducing or managing the risk of non-supply to users in the Mgeni WSS until the next planned scheme can be implemented.*

SOUTH COAST WSS

- *Umgeni Water to select the preferred option for the South Coast WSS as either the Lower uMkhomazi BWSS or the desalination of seawater and implement this option as soon as possible.*

The Reconciliation Strategy is a powerful management tool for maintaining and aligning stakeholders and their efforts to sustain future water supply. As the Strategy is continuous and dynamic it is important that lessons learnt in this update of the Strategy are shared for consideration in further updates and implementation phases.

TABLE OF CONTENTS

Page

APPENDICES

LIST OF FIGURES

Page

LIST OF TABLES

Page

LIST OF ABBREVIATIONS

BWSS	Bulk Water Supply Scheme
DM	District Municipality
DWAF	Department of Water Affairs and Forestry (now DWS)
DWA	Department of Water Affairs (now DWS)
DWS	Department of Water and Sanitation
EC	Electric Conductivity
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EWR	Ecological Water Requirement
FBW	Free Basic Water
GCM	General Circulation Models
GDP	Gross Domestic Product
HFY	Historical Firm Yield
IAPs	Interested and Affected Parties
IMP	Infrastructure Master Plan
JOC	Joint Operating Committee
KZN	KwaZulu-Natal (Province)
LM	Local Municipality
LTBWSS	Lower Thukela Bulk Water Supply Scheme
MM	Metropolitan Municipality
MMTS	Mooi-Mgeni Transfer Scheme
MMTS-2	Mooi-Mgeni Transfer Scheme Phase 2 (Spring Grove Dam and Transfer Infrastructure)
NRW	Non-revenue Water
NWRS2	National Water Resources Strategy 2
O&M	Operation and Maintenance
RDP	Reconstruction and Development Programme
REC	Recommended Ecological Category
RQO	Resource Quality Objectives
RWH	Rainwater Harvesting
SANBI	South African National Biodiversity Institute
SCA	South Coast Augmentation
SCP	South Coast Pipeline
SIP	Strategic Infrastructure Project
SOF	System Operations Forum
SSC	Strategy Steering Committee
TCTA	The Trans Caledon Tunnel Authority
TDS	Total Dissolved Solids
TSG	Technical Support Group
TWP	Thukela Water Project

UEIP	uMngeni Ecological Infrastructure Partnership
URV	Unit Reference Value
uMWP-1	uMkhomazi Water Project Phase 1 (Smithfield Dam)
VRS	Vaal River System
WC/WDM	Water Conservation and Water Demand Management
WISA	Water Institute of South Africa
WRPM	Water Resource Planning Model
WRYM	Water Resource Yield Model
WSA	Water Services Authority
WSP	Water Service Provider
WSS	Water Supply System
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works

LIST OF UNITS

kℓ/a	kilolitres per annum
m	metre
m²	square metre
m³	cubic metre
m^3/a	cubic metres per annum
m³/s	cubic metres per second
masl	metres above sea level
mg/ℓ	milligrams per litre
Mℓ/d	Mega litres per day
mS/m	micro Siemens per metre
R	Rand

1 INTRODUCTION

1.1 BACKGROUND

The KwaZulu-Natal Coastal Metropolitan area is the third largest contributor to the national economy and is the economic hub of KwaZulu-Natal (KZN). This area is experiencing rapid growth in water requirements because of the influx of people from the rural areas, economic growth and development initiatives. Strategic planning is therefore essential to ensure the long-term, sustainable development of the available water resources to meet expected water requirements.

Within this context, in 2006 the Department of Water and Sanitation (DWS), then Department of Water Affairs (DWA), commissioned the *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Area* (DWAF, 2009) to develop a strategy to ensure adequate management of water supply to the metropolitan areas in the Central KZN Region (see **Figure 1-1**). Subsequently, two continuation phases of the Reconciliation Strategy have been undertaken with the objective of updating the original Strategy, namely *Phase 1* (over the period 2009 to 2012) and then *Phase 2* which is presented in this document (commencing in 2014).

The Reconciliation Strategy builds on the information and recommendations emanating from previous studies conducted by the DWS and various institutions involved in water resource management in the Central KZN Region. It is a coordinated effort that brings together the planning of various government departments, water services authorities (WSAs) and water services providers (WSPs), as well as interested and affected parties (IAPs) that represent water users and environmental concerns.

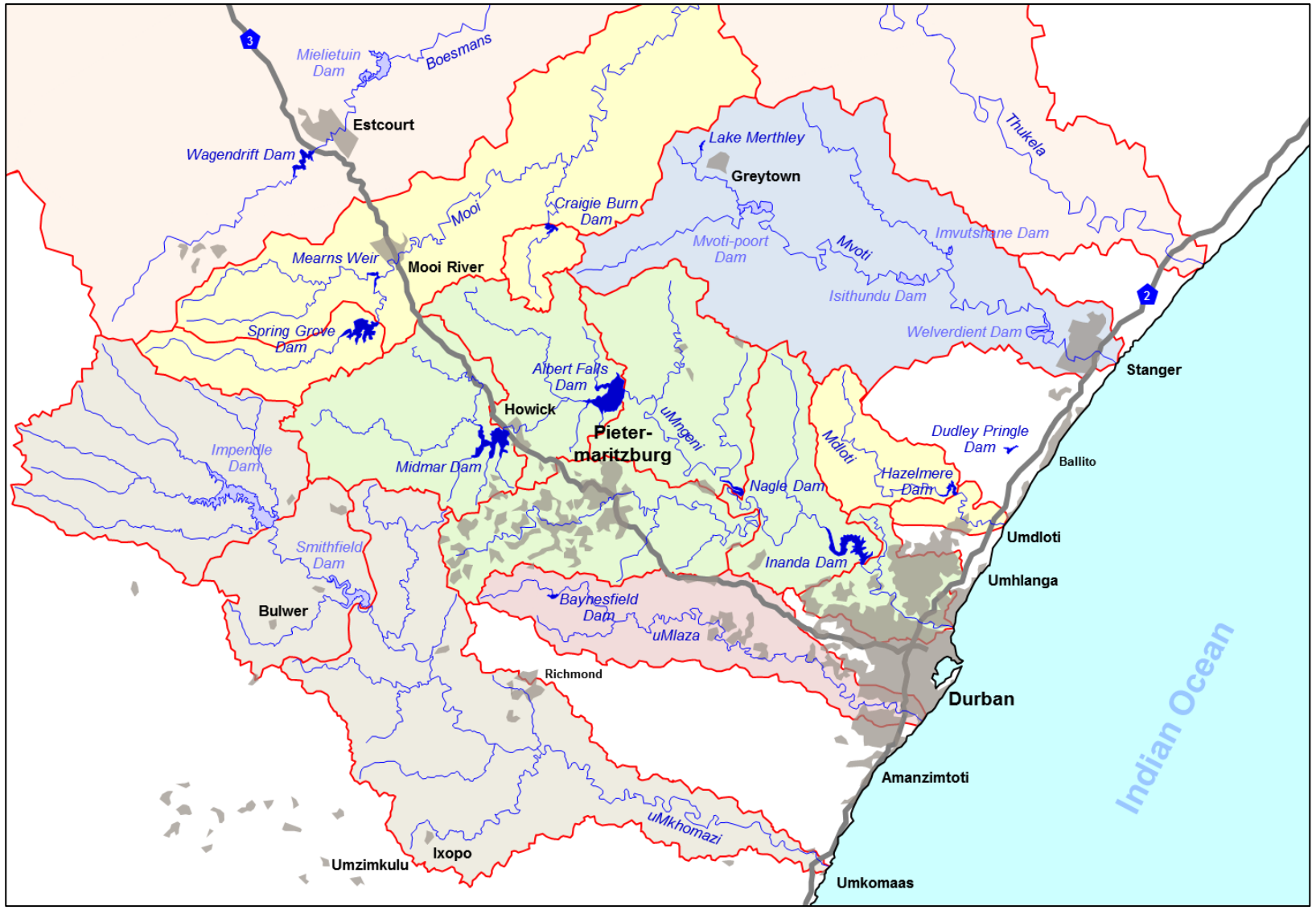

Figure 1-1: Catchments and metropolitan areas in the Central KZN Region

1.2 OBJECTIVES OF THE RECONCILIATION STRATEGY

The key objective of the Reconciliation Strategy is to identify, evaluate and prioritise the interventions that should be implemented to meet current and future water requirements. Within this context the Strategy is used as a decision support framework for making informed and timeous recommendations on interventions through a collaborative process constituting stakeholders and institutions involved in the water supply cycle.

The Updated Strategy presented in this document describes the intervention options identified to reconcile water requirements and water resources for a planning horizon of approximately 25 years up to 2040. These intervention options are grouped as **management interventions** (such as water conservation and water demand management (WC/WDM)), **infrastructure interventions** and **support interventions** (including considerations such as water quality and catchment care).

1.3 RECONCILIATION STRATEGY AREA

The area associated with the Reconciliation Strategy now extends from the Thukela River Mouth on the KZN North Coast to the uMtwalume River on the South Coast, as well as from Howick in the KZN Midlands to Durban on the east coast. It includes the eThekwini Metropolitan Municipality (MM), Msunduzi Local Municipality (LM), as well as portions of uMgungundlovu, iLembe, and Ugu District Municipalities (DMs). The area consists of three main water supply systems (WSSs), namely the **North Coast WSS**, the integrated **Mgeni WSS** and the **South Coast WSS**.

The location of these systems, their integrated nature and main sources of water are shown in **Figure 1-2**. These include the Mooi-Mgeni Transfer Scheme (MMTS) with Mearns Weir (Phase 1) and Spring Grove Dam and Transfer Infrastructure (Phase 2), as well as linkages between the supply systems via the Northern and Western Aqueducts, as well as the South Coast Augmentation (SCA) and Lower Thukela Bulk Water Supply Scheme (LTBWSS) bulk conveyance infrastructure. The figure also indicates the proposed transfer from the uMkhomazi Catchment to the uMngeni River Catchment via the uMkhomazi Water Project Phase 1 (uMWP-1).

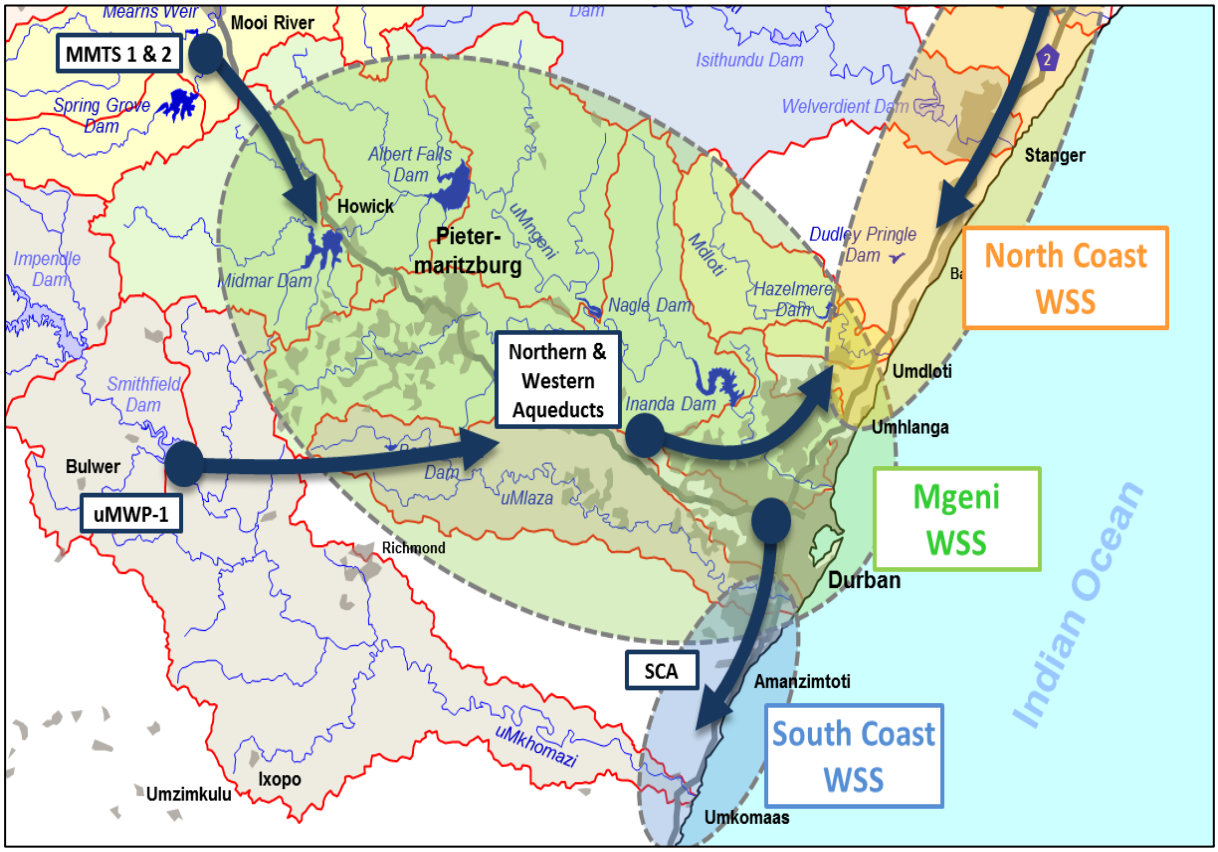

Figure 1-2: Reconciliation Strategy Area

1.4 OVERVIEW OF RECONCILIATION STRATEGY PHASES AND DOCUMENTATION

As discussed earlier, the *Reconciliation Strategy Update* presented in this document was preceded by the original *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Area* of 2006 and subsequent *Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coastal Metropolitan Area: Phase 1* in 2009. For reference purposes, documentation from these initiatives is briefly discussed in the following two subsections.

This is followed by an overview of the purpose and layout of this document, referred to as the *Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coastal Metropolitan Area: Phase 2*.

1.4.1 Original Reconciliation Strategy Study

During the original *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Area*, a "First-stage" (DWAF, 2009) and "Second-stage" (DWA, 2010) *Reconciliation Strategy Report* together with various other supporting reports were produced. These documents and associated DWS report numbers are summarised in **Table 1.1**.

Table 1.1: Reports from the original Reconciliation Strategy Study

Report No.	Title	Date
First Stage		
PWMA 11/000/00/2609	Water Quality Review	Jan 2009
PWMA 11/000/00/2509	First Stage Strategy: Water Requirements	May 2008
PWMA 11/000/00/2809	First Stage Strategy: Water Conservation & Demand Management	Jan 2009
PWMA 11/000/00/2709	First Stage Strategy: Infrastructure	Jan 2009
PWMA 11/000/00/0907	First Stage Reconciliation Strategy	Jan 2009
Second Stage		
PWMA 11/000/00/1007	Second Stage Reconciliation Strategy	Mar 2010
PWMA 11/000/00/1107	Executive Summary	Nov 2009

Note: As on March 2010.

1.4.2 Continuation of the Reconciliation Strategy: Phase 1

In 2009, Phase 1 of the *Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coastal Metropolitan Area* was initiated as a continuation and update (then termed "maintenance") of the original *Reconciliation Strategy Study*. During this first phase of the continuation of the Reconciliation Strategy progress with the update and implementation of the Strategy was captured in *Status Reports* (also referred to as "Progress Reports"). These reports were deemed to provide intermediate monitoring and updates of the Strategy and typically published after each *Strategy Steering Committee* (SSC) meeting (as described at the beginning of **Section 1.5**).

The overall study approach that was followed during the first phase of the *Continuation of the Reconciliation Strategy* was to develop the Strategy in two stages. Due to the limited changes in the overall Strategy during the first stage of Phase 1 of the Continuation of the Reconciliation Strategy (*First Stage Reconciliation Strategy*), a new version of the main *Reconciliation Strategy Report* was not considered to be necessary. Instead, further investigations that were identified for assessment during the development of the first phase of the *Continuation of the Reconciliation Strategy* were incorporated in the *Second Stage Strategy Report*.

1.4.3 Continuation of the Reconciliation Strategy: Phase 2 (this update)

During this second phase of the continuation of the Reconciliation Strategy some key changes and significant progress were made and these are presented here as the *Updated Reconciliation Strategy*. The document includes the following:

- An introduction, background and overview of the Strategy development methodology (this section, **Section 1**).
- The review and update of the water requirements and return flow scenarios for the three WSS in the Strategy area (**Section 2**).
- Management interventions, infrastructure intervention options and support interventions considered in the Strategy (**Sections 3**, **4** and **5**, respectively).
- Strategy scenarios (or "water balances") with projected water requirements vs. water availability for each WSS (**Section 6**).
- Other elements impacting on the Strategy, specifically ecological considerations and the potential impact of climate change (**Section 7**).
- The stakeholder engagement process, critical to the success of the Strategy (**Section 8**).
- A summary of the Strategy Action Plan (**Section 9**).
- As a conclusion, the way forward and lessons learnt from this update of the Strategy (**Section 10**).

1.5 RECONCILIATION STRATEGY DEVELOPMENT METHODOLOGY

The methodology used to develop the original *Reconciliation Strategy Study* is documented in the original study reports (as discussed earlier in **Section 1.4.1**) and is not repeated here. Instead, a summary is provided below of the methodology used to monitor the implementation progress and updating of the Strategy, which consists of the following two main components:

- A **technical** component that is concerned with the updating of the key information that was used to drive the technical matters including: water requirements, water balances and the details of intervention options. This component is carried out through a *Technical Support Group* (TSG). At this level information from other studies and institutions is considered and factored into the Reconciliation Strategy.
- A **communication** component that is concerned with communicating progress and updates on the strategy with and between the various stakeholders. The *Strategy Steering Committee* (SCC) is a platform at which higher level decision-making is typically conducted and, as such, typically involves more senior representation from the various stakeholder institutions.

Importantly, these two components of the study are conducted in a cyclical manner where the TSG provides the necessary technical support and background work to inform the SSC. The SSC then guides the Strategy as well as further technical investigations by the TSG through sound and informed decision-making.

In this way, the Strategy is monitored, updated and able to respond to the various changing factors that impact water requirements and water availability. The process is presented in Figure 1-3.

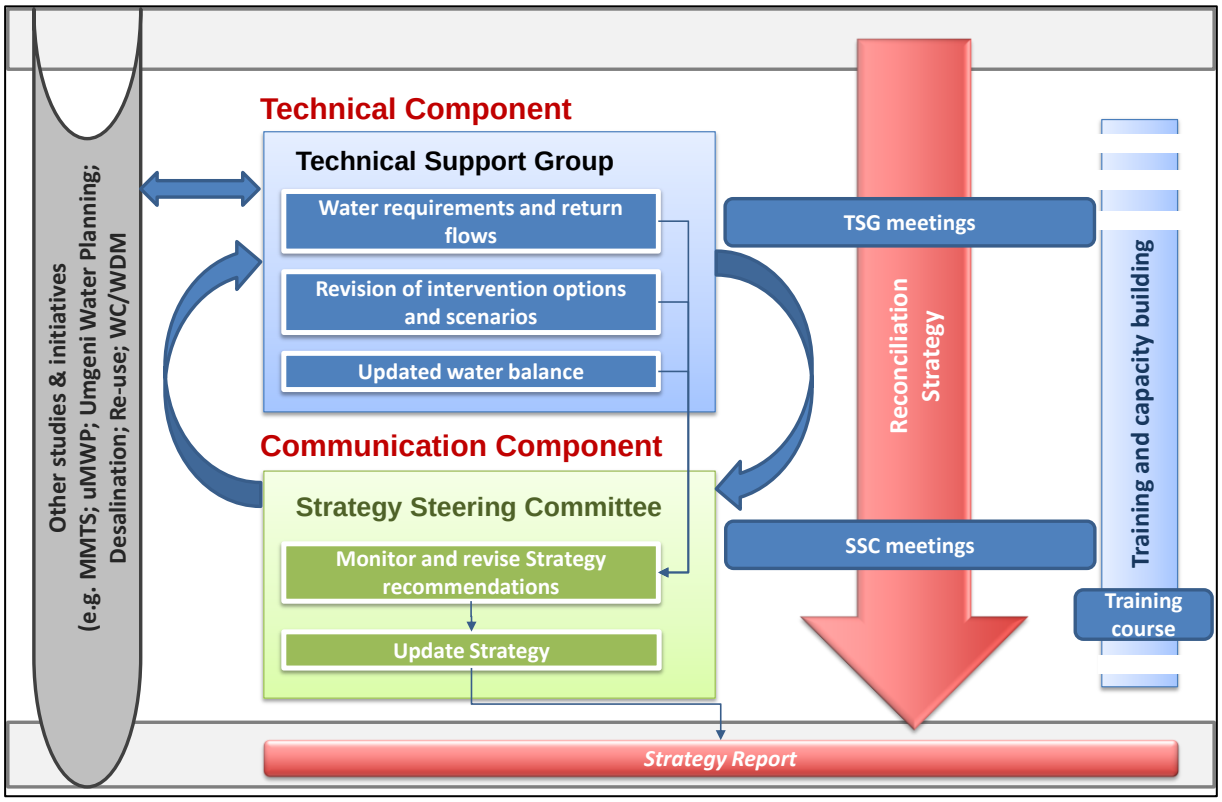

Figure 1-3: Process for monitoring and updating the Reconciliation Strategy

However, while the methodology follows a cyclical process, each cycle involves a number of steps as outlined below:

- Updating of water requirement projections.
- Identifying and quantifying of the available water resources.
- Identifying, prioritising and determining the timing of intervention options and scenarios (i.e. combinations of intervention options).
- Updating of water balances for various scenarios.
- Monitoring and revising Strategy recommendations as well as actions.

More information on each step is provided in the following subsections.

a) Water requirement projections

A key component of the Reconciliation Strategy is realistic and up-to-date water requirement projections that guide the need for, and timing of interventions. Regular updating and revision of water requirement projections ensure that the Strategy remains relevant by taking into account the various socio-economic and other dynamic influencing factors that cannot be predicted with absolute certainty.

For the purpose of updating the Strategy water requirement projections are updated for the three defined water supply systems (as discussed earlier), namely the North Coast WSS, Mgeni WSS and South Coast WSS. Over the course of the Strategy Update process the SSC suggested that the Lower Thukela WSS is also included due to its linkages with the original *Reconciliation Strategy Study Area*.

The development of the water requirement projections considers the following users and factors:

- Urban water requirements, that includes domestic, commercial and small/light industry water use.
- Industrial water requirements, typically representing the larger industries supplied separately from the urban water supply networks.
- Irrigation water requirements.
- The impact of water losses as well as water loss reduction and improvements in water use efficiency through Water Conservation and Water Demand Management (WC/WDM).
- Growth projections from various sources including development planning by the private and public sectors, historical trends and industry norms.

Furthermore, a key activity in monitoring and updating of the water requirement projections is through the comparison and incorporation of actual water supply volumes. However, while actual water supply volumes are often used as the base point for revision of projections, care needs to be taken when supply is suppressed due to supply constraints and the volumes are not truly representative of the full requirements. This can happen in areas with intermittent supply as well as during periods of drought and the associated water restrictions.

b) Water availability

The second key input into the development of the Strategy is quantifying the current and possible future water sources available for supplying growing water requirements. The following water resources are available in the Strategy Area and were considered in the development of the Strategy:

- Existing dams.
- Run-of-river abstractions schemes with installed infrastructure.
- Groundwater sources that are utilised as part of an existing water supply system. However, while groundwater supplies or supplements some individual users or isolated communities, due to the limited volumes, it is not

introduced into any of the large water supply systems. It should, however, be noted that the *Reconciliation Strategy Study* identified groundwater as a resource of importance at local level in isolated areas, although not on a regional scale. Groundwater is, however, considered for localised supply in the earlier *Reconciliation Strategies for All Towns in the Eastern Region* undertaken by the, then, Department of Water Affairs (DWA, 2011).

The volume of water available from these sources is quantified by means of specialised modelling and analysis using computer simulation models such as the *Water Resources Yield Model* (WRYM) and *Water Resources Planning Model* (WRPM). For this *Reconciliation Strategy Update*, modelling was undertaken based on model configurations developed in earlier studies and Strategy updates. Where possible, these models were also used to quantify the water supply potential of new infrastructure intervention options as part of this Strategy Update.

c) Intervention options

Three types of intervention options have been considered as part of the Reconciliation Strategy, namely:

- **Management interventions** such WC/WDM and system operations.
- **Infrastructure interventions** such as dams and water transfer schemes.
- **Support interventions**, such as rainwater harvesting and catchment care.

These interventions can either be classified as supply-side measures that create additional water to supply, or requirement-side measures that aim to improve water use efficiency and reducing water losses. For infrastructure intervention options, the volume of water and associated costs are generally known or relatively easy to quantify. For management and support interventions the benefits and cost estimates often require further investigation, but their significant contribution to the overall success of the Strategy is well recognised.

In the following subsections more information is provided on the process followed in this *Reconciliation Strategy Update* for the identification, prioritisation and timing of intervention options.

Identification of intervention options

The intervention options identified and recommended during earlier studies and Strategy updates, in particular the *Continuation of the Reconciliation Strategy Phase 1*, were carried over for consideration in this *Updated Reconciliation*

Strategy. Additional intervention options were also identified based on new research, planning and studies shared via the TSG and SSC forums. The resulting management, infrastructure, and support intervention options are further discussed later in **Sections 3** to **5** of this document.

Prioritisation and timing of Interventions

A key objective of the Reconciliation Strategy is to ensure that the required intervention options are implemented timeously in order to mitigate the possibility of a shortfall in water supply. Due to the timeframes required to plan, design and implement water resources infrastructure, the responsible institutions need to initiate the various phases of planning and implementation of developments a number of years, if not decades, prior to when the water is actually required. A typical programme of water resources developments is shown in **Figure 1-4** (DWA, 2010).

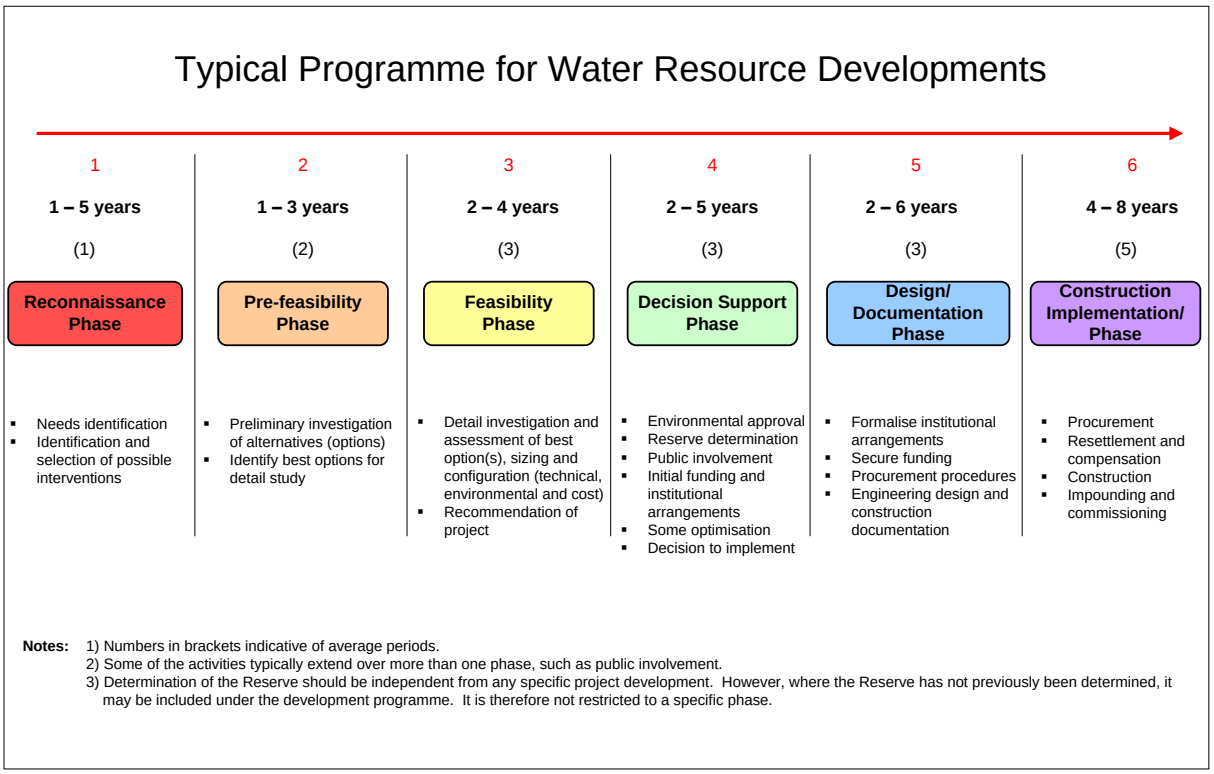

Figure 1-4: Typical programme for water resource developments

The prioritisation of the intervention options is based on a number of factors, including:

- The unit cost of water, based on the total cost of the scheme and the volume of water that can be supplied. Typically unit costs are developed during planning by the responsible institutions by calculating unit reference values

(URVs). Where necessary, URVs may be adjusted in order to be comparable between interventions;

- The volume of water that can be supplied and the extent at which the considered intervention can secure supply into the future;
- The time required for implementing the intervention and, in particular, the date at which the intervention can start augmenting water supply. In some cases, a more expensive option (i.e. with a higher URV) may be selected in favour of a less expensive option if the latter could not be implemented in time; and
- Other risk factors (e.g. environmental considerations, cost over-runs etc.) and the capacity of the responsible institution for implementation.

The timing of prioritised interventions is based on the objective to maintain a positive water balance as water requirements grow. As such, water balances are key in scheduling the interventions and determining the timing when each prioritised intervention needs to be completed and implemented. This is discussed in the following subsection.

d) Water balances

Water balances are developed by comparing water requirements with water availability, typically in graphical format. Water balances are key in both the technical component of the Reconciliation Strategy to determine the scheduling of intervention options, as well as a communication tool for stakeholder engagement.

Water balances can also be used to show the negative impacts of delayed implementation of interventions, as well as the extent to which different scenarios and combinations of intervention options can maintain a positive balance into the future. The most up-to-date water balances for the supply areas within the Reconciliation Strategy area are discussed in **Section 6** of this document.

e) Strategy development

Based on water balances of the various scenarios, the most favourable combination(s) of intervention options is/are selected and adopted as part of the Reconciliation Strategy. The Strategy thus defines which interventions need to be implemented, by whom and by when, in order to reconcile projected water requirements with water availability. The Strategy is continually maintained and remains flexible throughout the various processes of its development, continuation and updating.

The selected scenario(s) defines the timing for the prioritised interventions, which in turn guides the dates for the key activities needed to achieve the target completion dates. This is captured in the Reconciliation Strategy as a *List of Intervention Options* with associated key activities and milestones against which to monitor and track progress. Due to the extent of legislation and administration required to implement large infrastructure projects, where possible, some contingency is typically built into the proposed timeframes. However, for a number of the key interventions, the timelines are very tight (highlighted in **Section 6**).

2 WATER REQUIREMENTS

2.1 OVERVIEW

A key component of the Reconciliation Strategy is realistic and up-to-date water requirement projections that guide the need for, and timing of, intervention options. Regular updating and revision of water requirement projections ensures that the Strategy remains relevant by taking into account the various socio-economic and dynamic influencing factors that cannot be predicted with absolute certainty.

Water requirement projections have been developed for four water supply systems (WSSs) within the Strategy Area, namely:

- The **North Coast WSS**, which includes the Mdloti and Mvoti Supply areas along the coast, from La Mercy to Zinkwazi.
- The integrated **Mgeni WSS**, which includes the main centres of Durban, Pietermaritzburg and Howick, and the surrounding areas supplied from the uMngeni and Mooi rivers.
- The **South Coast WSS**, along the coast, from Amanzimtoti to Mtwalume.
- The **Lower Thukela WSS**.

Water requirement projections are updated bi-annually, based on actual water supply and sales figures, as well as information from other studies where confidence in the data was considered to be at an acceptable level. Water requirements were projected to 2040, based on an area-specific growth factor(s) that is influenced by the relevant public and private sector development plans. In some cases, multiple growth scenarios have been considered due to the possible development in certain sectors and areas.

To avoid an excessive number of scenarios and creating confusion rather than guidance and direction, a preferred planning scenario was selected in each case. This was guided by the need to be sufficiently conservative in order to ensure that the Strategy and associated interventions are ready when required, but also realistic so as to not result in premature or unnecessary expenditure. Based on each selected scenario, the following two additional scenarios were also developed:

- The effects of aging and deterioration of existing infrastructure, referred to as “system attrition”, was also incorporated into the projections as an additional water requirement on the system. A **“high road” scenario** was developed

based on the selected water requirement projections (described above) with additional losses through system attrition (typically estimated as 1% per annum).

- Similarly, a **"low road" scenario** was development based on the projected impact of implementing WC/WDM measures. For the purposes of planning, the less aggressive WC/WDM savings targets were adopted from the *5-year WC/WDM Master Plans* of the relevant Water Services Authorities (WSAs).

The water requirement projections selected for each WSS are discussed in the following sections and more information on the WC/WDM measures and planned implementation by the WSAs is provided later in **Section 3.1**.

2.2 URBAN WATER REQUIREMENTS AND RETURN FLOWS

2.2.1 Earlier water requirement projections

a) Mgeni WSS

The urban sector represents the largest water user group in the Strategy Area and has the highest growth in water requirements, predominantly due to urban migration and economic growth.

Through the original *Reconciliation Strategy Study*, as well as during the *Continuation of the Reconciliation Strategy Phase 1*, water requirement projections were developed and updated. In Phase 1 the aim was to develop projections for the eThekwini and Msunduzi areas. This was based on a demographic study and population projections (DWAF, 2007) coupled with a water requirements and return flows database model used to project water requirements and calibrate the water requirements-vs.-return flows-relationship in urban drainage areas (DWA, 2004b). More information can be found in the *Water Requirements Report* of the Phase 1 Strategy (DWA, 2008b).

The urban water requirement projections for eThekwini and Msunduzi areas were developed for three population growth rates, namely low, medium and high. The more conservative high growth-scenario was taken as the preferred planning scenario. The projection was combined with annual projection scenarios developed by Umgeni Water based on the historical trends for the remainder of the Mgeni WSS. The impacts of preliminary WC/WDM estimates were also considered (with and without) and these were used in Phase 1 for the 2009 to 2011 water balances.

b) North Coast WSS

In both the original *Reconciliation Strategy Study* and the *Continuation of the Reconciliation Strategy Phase 1*, the Mdloti and Mvoti River systems were considered separately. Rural areas and small inland towns are dealt with by a separate study, namely the *Reconciliation Strategy for All Towns in the Eastern Region* (DWA, 2011).

Two water requirement projection scenarios were considered for the Mdloti River System, one based on the *iLembe DM Master Plan* and the other based on the projections from Umgeni Water, which were developed in 2007. The Umgeni Water projection was originally adopted as the preferred scenario, but was adjusted downward in Phase 1 in order to account for the shedding (or shifting of supply) from Hazelmere Dam onto the Mgeni WSS via the Northern Aqueduct.

For the Mvoti River System, the *iLembe DM Master Plan* projections were adopted with some development-specific adjustments.

c) Lower Thukela WSS

During the first and second stages of the original *Reconciliation Strategy Study*, the Lower Thukela was treated as a separate system. However, in the *Continuation of the Reconciliation Strategy Phase 1* the Lower Thukela was incorporated into the Mdloti and Mvoti WSS balances in anticipation of the planned Lower Thukela Bulk Water Supply Scheme (LTBWSS) (discussed in **Section 4.1.3**). The same approach was adopted for this Strategy Update with the area that is planned to be supplied by the LTBWSS included with the water requirements of the North Coast WSS.

d) South Coast WSS

In both the original *Reconciliation Strategy Study* and *Continuation of the Reconciliation Strategy Phase 1* the South Coast water requirements were included in the Mgeni WSS since the water is supplied from the Mgeni via the South Coast Augmentation (SCA) Pipeline. These water requirements were therefore limited to the infrastructure capacity of the SCA.

2.2.2 New sources of water requirement information

During this *Reconciliation Strategy Update* a number of revisions were made to the water requirements projections based on the following additional data and studies becoming available:

- The recent *uMkhomazi Water Project Phase 2: Potable Water* (Umgeni Water, 2014) in which detailed water requirement projections were made for the supply area identified for the proposed scheme, determined in close cooperation with the eThekwini MM.
- Updated supply and sales volumes from Umgeni Water for the various WSAs for the period 2011 to 2015.
- Information from the *Lower uMkhomazi Bulk Water Supply Scheme Detailed Feasibility Study and Preliminary Design* (Umgeni Water, 2015) that focused on the Upper and Middle South Coast areas;
- The Umgeni Water *Infrastructure Master Plans*, from 2012 to 2015.
- The *5-year WC/WDM Master Plans* from eThekwini MM, Msunduzi LM, iLembe, Ugu and uMgungundlovu DMs, that were either still within the five year planning period, or had been updated as part of an initiative by the DWS KZN Regional Office in 2015.

Information from these sources was incorporated into the water requirement projections of the different supply areas (i) at the beginning of this Strategy Update where such information was already available; and (ii) on a bi-annual basis as new information and study results became available.

2.2.3 Revised water requirement projections

a) Mgeni WSS

During the *Continuation of the Reconciliation Strategy Phase 1* the water requirement projection for the Mgeni WSS was updated at a water treatment works (WTW) -level, by adjusting the base point of the projection to actual supply volumes and adding on an additional 4% to account for plant losses.

One of the first main changes to the water requirement projections for the Mgeni WSS implemented as part of this *Reconciliation Strategy Update* were the incorporation of the more detailed projections at a bulk reservoir-level determined during the *uMkhomazi Water Project Phase 1: Feasibility Study* (DWS, 2014). This information was combined with the previous projections across the Mgeni WSS, but without double counting or omitting supply areas and associated water requirements. As such, significant effort was put into disaggregating the total Mgeni WSS and the inclusion of the new information where available. The spatial extent of the supply area associated with the uMkhomazi Water Project (uMWP), and therefore the area for which new information was available, is shown in **Figure 2-1**.

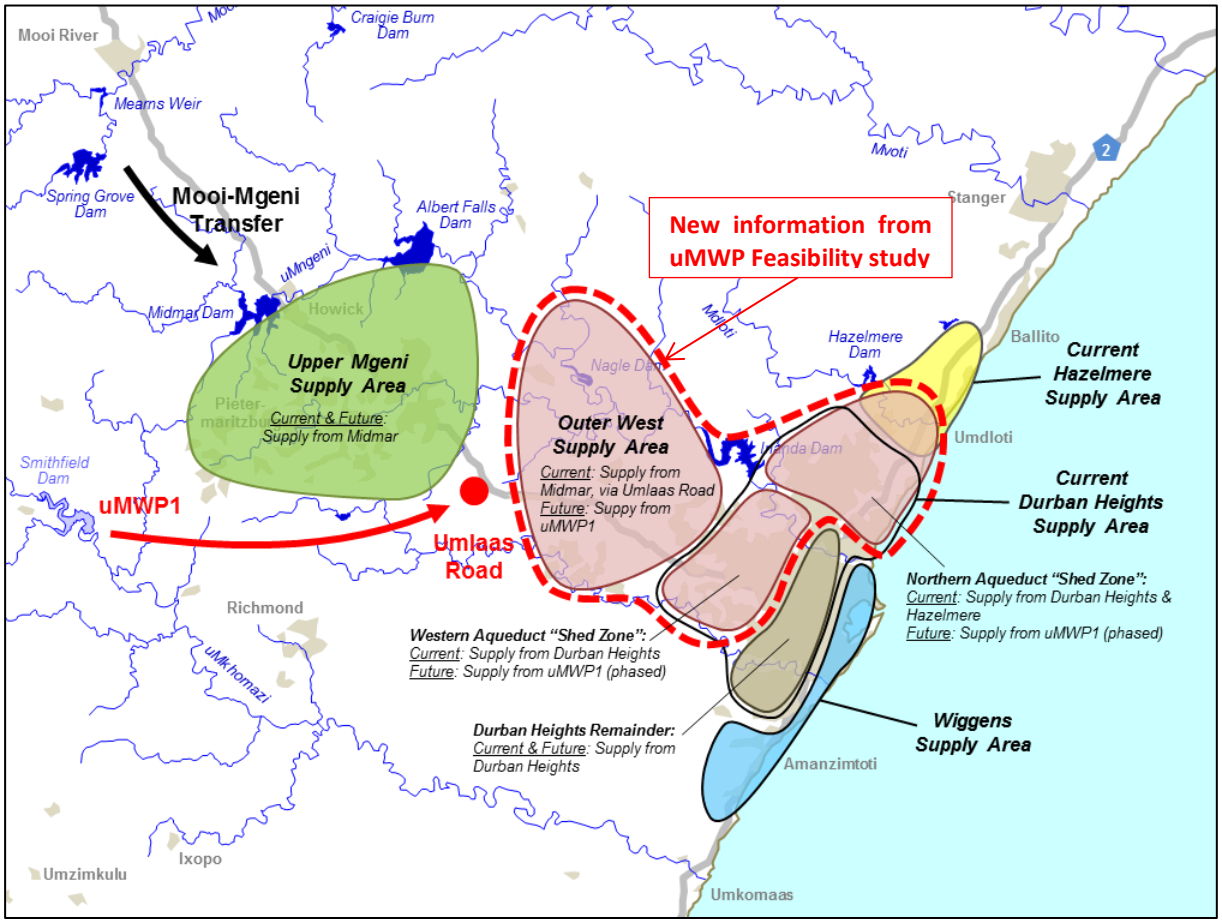

Figure 2-1: Extent of supply area associated with the uMkhomazi Water Project

It is projected that water use in the supply area associated with the uMWP Feasibility Study will account for the higher growth in water requirements in the Mgeni WSS. For all other supply areas as shown in **Figure 2-1** growth rates as adopted in earlier Reconciliation Strategy updates were retained.

The second significant revision to the water requirement projections for the Mgeni WSS was the level of information and the way in which WC/WDM impacts were accounted for. More detail on the WC/WDM measures and associated metrics are included in **Section 3.1**. In the past, a WC/WDM scenario was developed by imposing the impact of reducing losses and improving water use efficiency upon a base scenario – where the latter is based on projected population growth, economic growth and increases in level of services, while assuming the current level of water losses.

However, based on the current *WC/WDM Master Plans* and growing industry understanding of water losses, this basic approach ignores the reality of system attrition, where additional losses will occur as infrastructure ages and no WC/WDM measures are implemented. A revised approach was therefore followed where:

- The impact of system attrition (increasing water losses due to deterioration of infrastructure) was first imposed to produce a new **base scenario**. This scenario then represents the upper envelope of projected water requirements.
- The benefit of WC/WDM measures was then added to this new base scenario to obtain a more realistic **WC/WDM scenario**. For this purpose, the conservative scenario selected from the *WC/WDM Master Plans* was the "most probable" scenario. The high savings scenarios proposed in the Master Plans were not adopted as these savings are not always achieved in reality and would lead to the water requirements being underestimated. The impact of the WC/WDM measures is the reduction of real losses and not the change in non-revenue water (NRW). This scenario with WC/WDM forms the new lower envelope of projected water requirements.

This process is shown in **Figure 2-2** and **Figure 2-3**. Both figures also show two dotted lines representing the original *Reconciliation Strategy Study* projections with and without WC/WDM developed in 2007. Note that there is not a significant difference between the new and old scenarios, but that there is greater confidence in the new projections that are based on accepted *WC/WDM Master Plans*. The final scenarios for the Mgeni WSS, with and without WC/WDM, are shown in **Figure 2-4**.

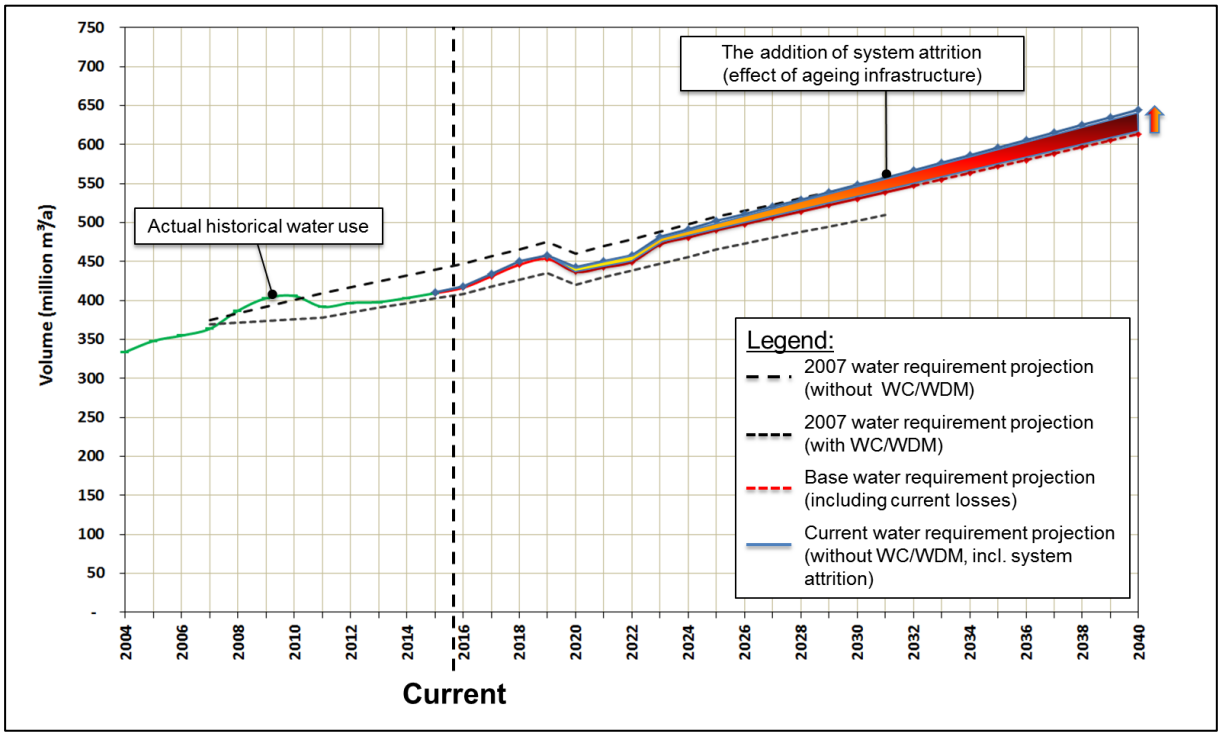

Figure 2-2: Mgeni WSS water requirement projections with impact of system attrition

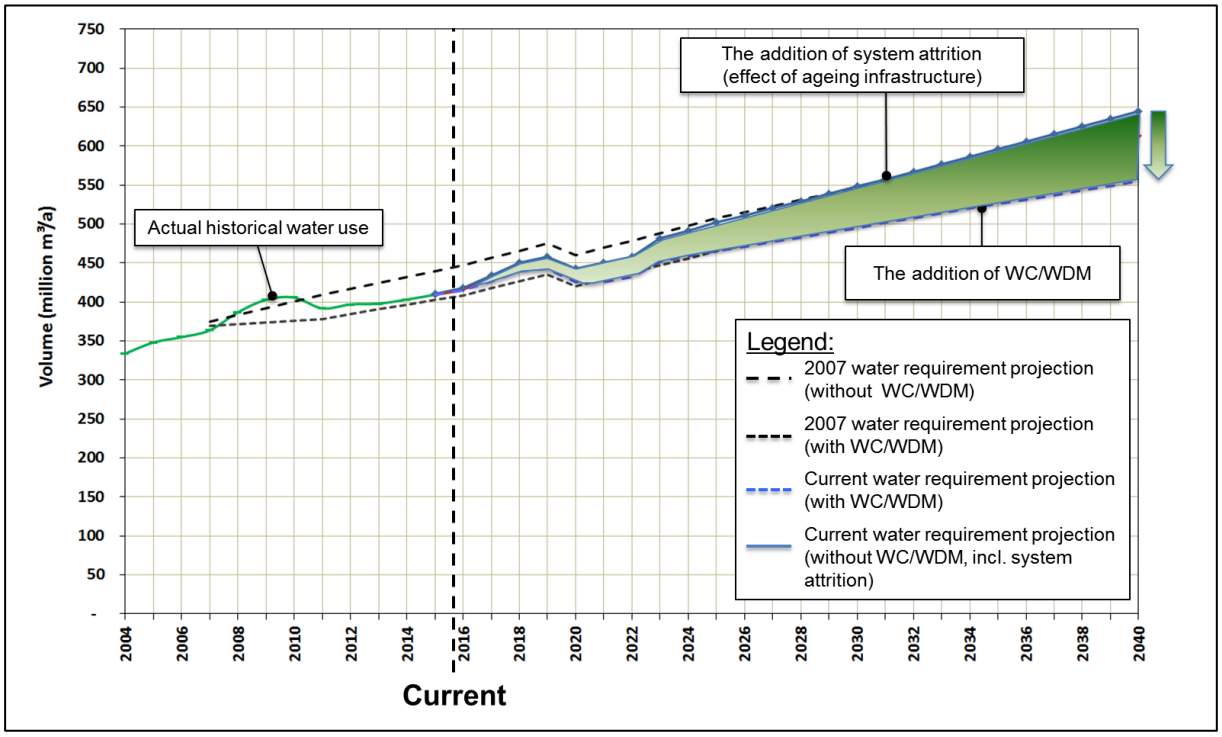

Figure 2-3: Mgeni WSS water requirement projections with WC/WDM

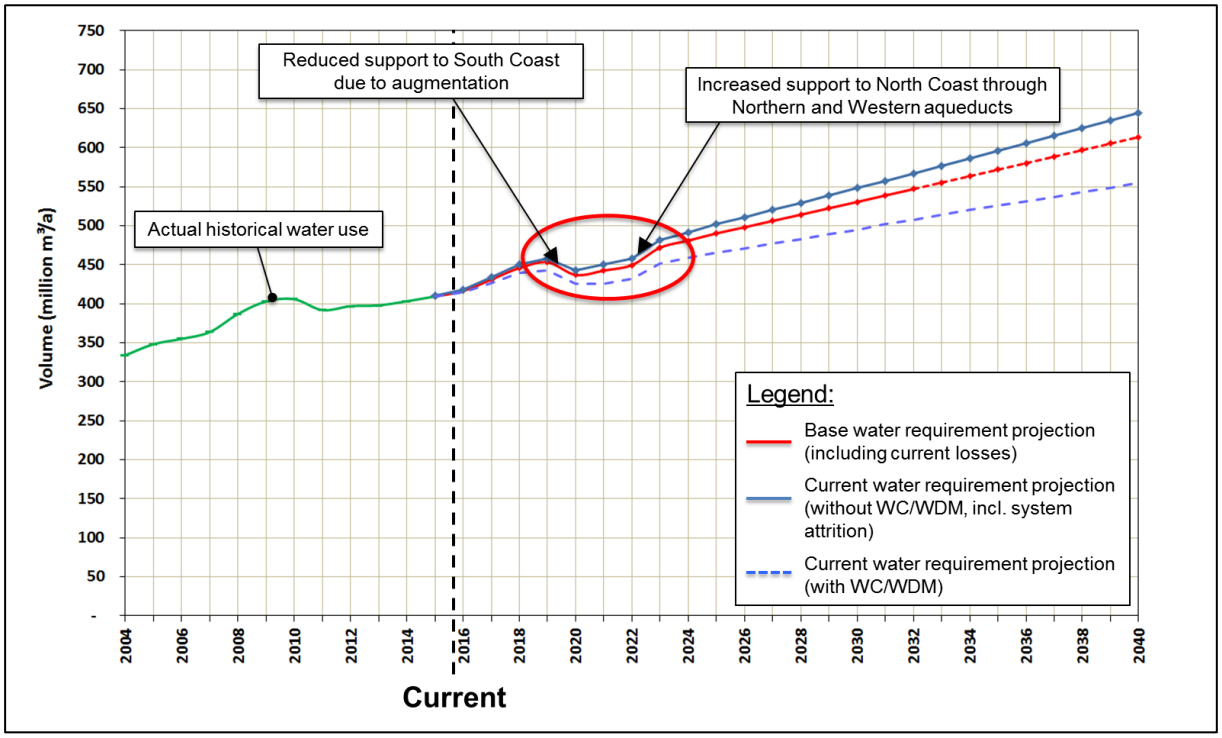

Figure 2-4: Mgeni WSS water requirement projections with and without WC/WDM

Figure 2-4 also highlights the linkages of the Mgeni WSS with the North Coast and South Coast WSS and the possible shifting of supply off and onto the Mgeni WSS as needed. These are represented by:

- A drop in the requirements in 2022 due to reduced support from the Mgeni to the South Coast WSS via the SCA due to the development of local resources in the South Coast System.

- An increase in 2025 due to the shift in water supply from the Hazelmere Dam, onto the Mgeni WSS once the Northern and Western aqueducts are completed.

It should be noted that while these linkages allow for the regional management of water resources and shifting of supply as new sources are added, such planning also needs to take into account infrastructure and operational constraints and limitations.

b) North Coast WSS

For the purpose of the Strategy Update, the previously separate Mdloti and Mvoti systems have been combined due to the completion of the North Coast Pipeline, which is bi-directional and has essentially created an integrated system. Furthermore, once completed, the LTBWSS will link the North Coast Area south of the Thukela River Mouth with an area to the north of the mouth through a common resource. The combined water requirements for the three areas of the North Coast WSS, i.e. the Mdloti, Mvoti and areas south and north of the Thukela River Mouth, are shown in **Figure 2-5**. Note that according to Umgeni Water's planning department (Meier, 2016), the area to the north of the Thukela River Mouth linked to the LTBWSS has a projected requirement estimated at 20 Mℓ/d (7.3 million m^3/a) by the end of the planning horizon.

The red dotted line in **Figure 2-5** shows the combined water requirement projection based on information published at the end of the *Continuation of the Reconciliation Strategy Phase 1* (September 2012 Progress Report after SSC Meeting 5). The solid green line shows the new base water requirement projection adopted for the Strategy Update, including the corresponding drop in water requirements in 2025 due to increased support from the Mgeni WSS via the Northern and Western Aqueducts (mentioned in the previous subsection).

The dotted green line represents the scenario with WC/WDM and this was developed based on the same methodology as described earlier for the Mgeni WSS. However, for this purpose the WC/WDM master plan for iLembe DM had to be split up, as the North Coast WSS only covers part of the DM (Ndwedwe and KwaDukuza). More information on the WC/WDM volumes from the *5-year WC/WDM Master Plans* is provided in **Section 3.1**.

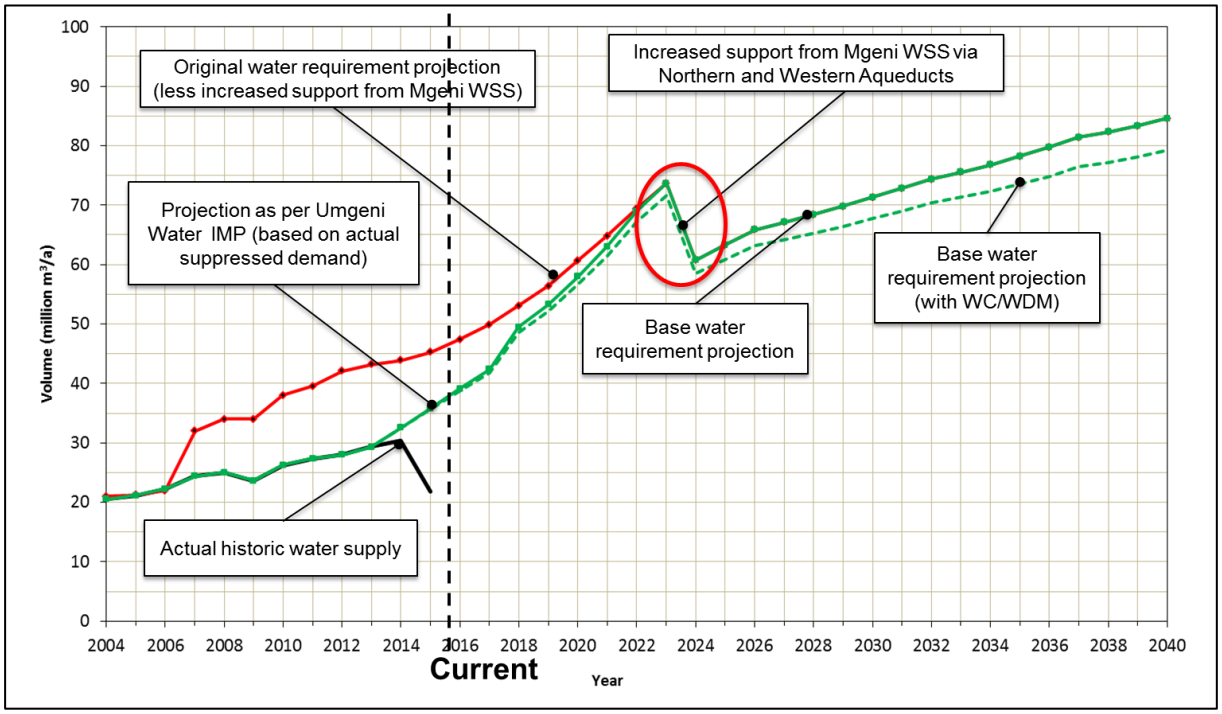

Figure 2-5: Water requirement projections for combined North Coast WSS

Finally, Figure 2-5 also shows that there has been a delay in the growth of water requirements. This has in part been due to a "suppression of demand" as the available resources were constraining supply. Significant growth in water requirements is however anticipated once the water supply constraints are addressed.

c) South Coast WSS

In both the original *Reconciliation Strategy Study* and the *Continuation of the Reconciliation Strategy Phase 1* water requirements of the South Coast were typically accounted for in terms of the volume supplied from the Mgeni WSS via the SCA. The South Coast WSS also receives water from other local water sources, namely the Nungwane Dam, the Umzinto and EJ Smith dams and the Mtwalume River Abstraction. With the continued extension of the South Coast Pipeline (SCP), the Upper and Middle South Coast systems have become more integrated and were, therefore, treated as a separate system in this *Reconciliation Strategy Update*.

Water requirement information for the combined Upper and Middle South Coast systems was based on planning work undertaken by Umgeni Water, in collaboration with the eThekwini MM and Ugu DM, at a bulk distribution reservoir level. These water requirement projection scenarios were developed in 2013 and projected at growth rates based on remaining potential for each supply zone. It

also took individual planned developments into account in addition to the general growth potential.

The water requirement projections are shown in Figure 2-6 for the scenarios without (dashed red line) and with WC/WDM (solid red line), together with actual supplied volumes up to 2015 (black line). These water requirement projections include the phasing-in of the supply of currently (November 2016) "suppressed demands", not captured in the actual supply volumes (described further in Section 2.7). Through discussions with Umgeni Water operations staff, and confirmed by Ugu DM and eThekwini MM, there is a volume of around 25 Mℓ/d (9.13 million m^3/a) that could be taken up if the supply was not constrained. This additional volume was assumed to be phased in as supply constraints are resolved, with the full volume being possible by 2025 (as discussed in Section 6.3).

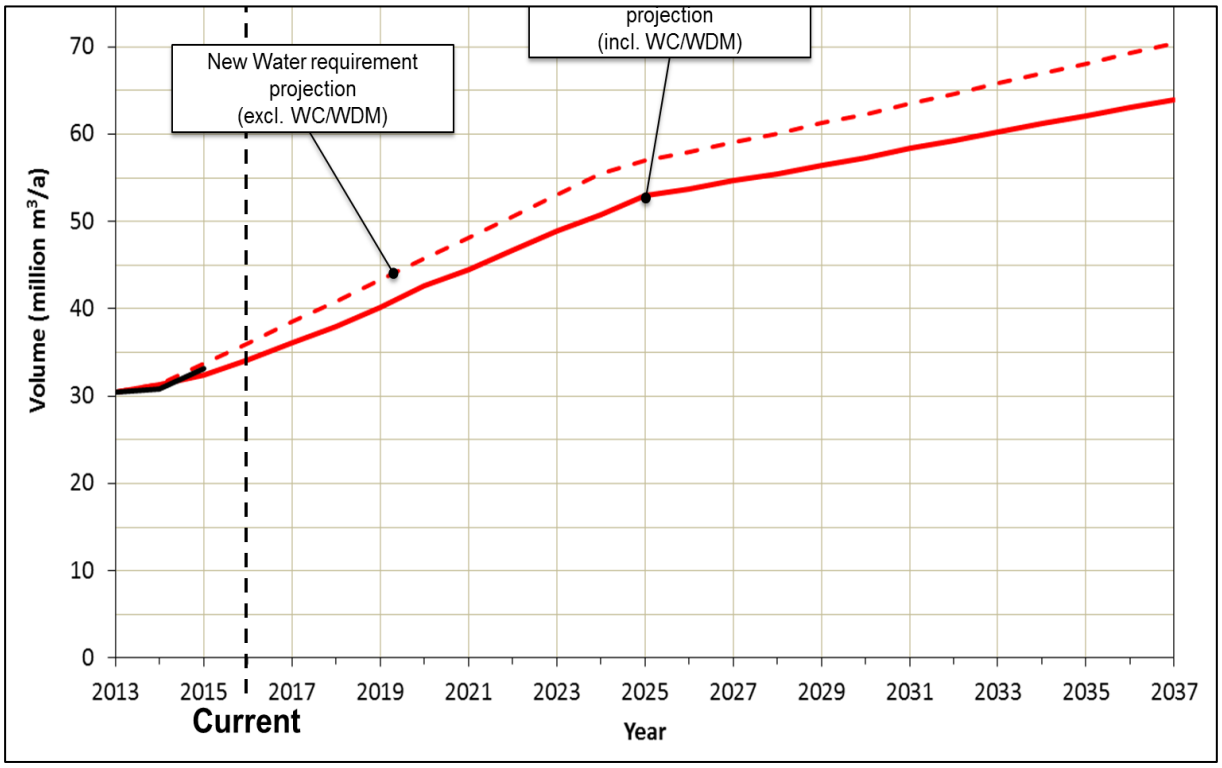

Figure 2-6: South Coast WSS water requirement projections (2016)

2.2.4 Return flows

Return flows and the re-use of water are viable sources of water, particularly in coastal areas were return flows are often discarded as sea outfall. As a result, extensive investigations were undertaken for the original *Reconciliation Strategy Study* and the *Continuation of the Reconciliation Strategy Phase 1* to estimate the current and future return flow volumes, and to capture the relationship between

water supplied and return flows. For this *Reconciliation Strategy Update* new information on actual return flow volumes being generated at the various Wastewater Treatment Works (WwTWs) in the Strategy Area became available and allowed for these estimates to be refined. This is discussed in the following subsections.

a) Mgeni WSS

Return flows are modelled explicitly in the *Water Resources Planning Model* (WRPM) used to support the development of water balances for the Mgeni WSS. Where necessary, the relationship between return flow volume and water supply volume was revised in order to provide an updated estimate of the volume of water potentially available for re-use.

A key location where this relationship was updated was at the Darvill WTW that receives effluent from Msunduzi River. Treated effluent is returned back to the Mgeni WSS via the Msundusi River from where it flows into the Mgeni River and Inanda Dam where it is indirectly re-used. The average return flow volume in 2013 was in the order of 75 Mℓ/d (27.37 million m^3/a).

A number of WwTWs in eThekwini MM also return flow back to the Mgeni River. This contributes to available water resources in the system by either providing water for direct re-use by industry, or by augmenting flows into the Mgeni River estuary. No further growth in direct re-use of treated effluent was provided for, and it was assumed that any growth in return flows to the Mgeni River downstream of the Inanda Dam would off-set the required releases from Inanda Dam for the estuary.

The return flow volume from the Howick WwTW was also reviewed and accounted for in the *WRPM*. In 2014 this volume was estimated at 5.5 Mℓ/d (2.01 million m^3/a).

The total projected return flow volume in the Mgeni WSS that contributes towards the available water resources is presented in **Figure 2-7** (red line). Note that this is the total volume returned to the river system, and not the total volume of effluent generated in the system. The remaining effluent generated in the system is either disposed directly to the ocean or in some cases re-used by industrial users.

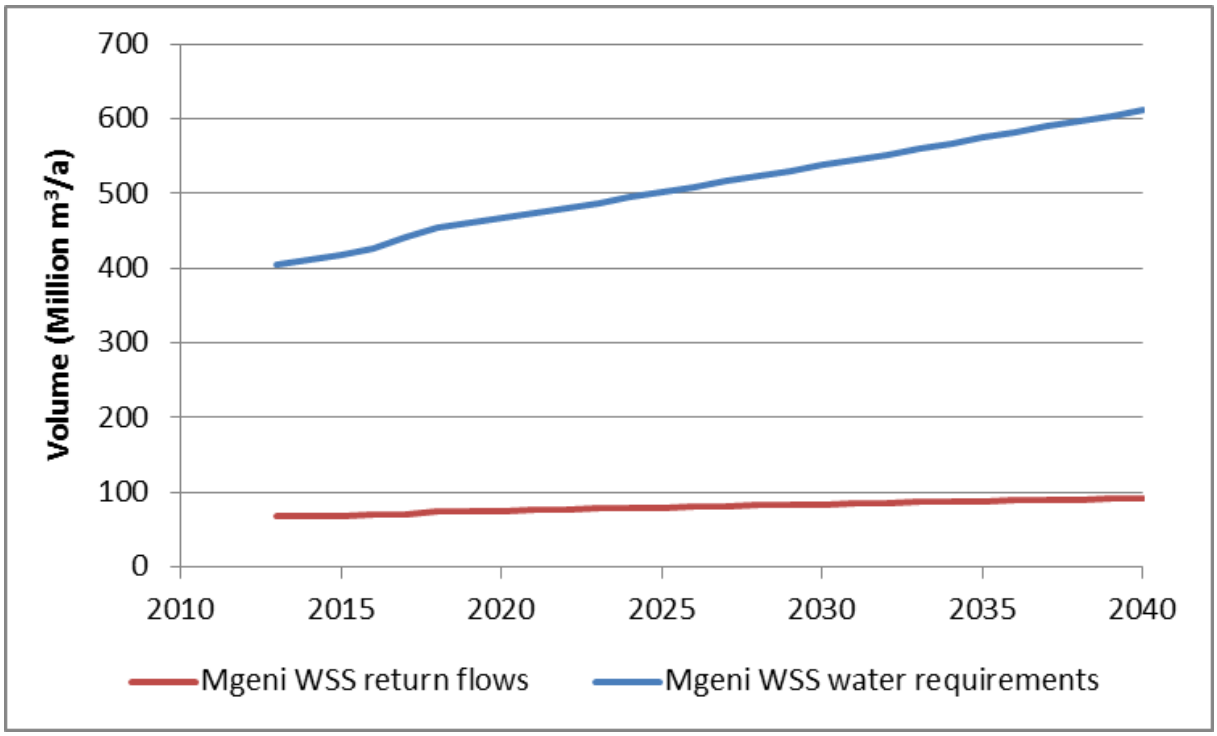

Figure 2-7: Projected return flow volumes to the Mgeni WSS

b) North Coast WSS

During the recent *Classification of Water Resources* undertaken by DWS (2015) (as discussed later in **Section 7.1**) the management of return flows to estuaries on the North Coast was highlighted at a key issue, with a number of estuaries having limited additional assimilative capacity to receive further volumes of treated effluent. As most of the development on the North Coast is along the coast, the return flows occur downstream of current abstraction points on the Mdloti and Mvoti rivers.

The current and ultimate return flow volumes were obtained from the eThekwini MM. The potential re-use of some of these return flows as a new intervention, was identified by the eThekwini MM through a parallel study to the Classification Process, referred to the as the *Total Outflow Strategy* (eThekwini MM, 2015). More information on this new initiative and the return flow volumes considered is provided for in **Section 4.1.6**.

c) South Coast WSS

The return flows along the South Coast are predominantly from a number of smaller WwTWs positioned close to the coast. These return flows are not re-used, and currently cause water quality issues that the Classification Process identified. These return flows were not included in the available water resources of the South Coast WSS since the small volumes available at various points do

not currently provide an attractive opportunity for re-use. As the volumes grow and as the cost of water increases this may change in the future.

2.3 IN-CATCHMENT DOMESTIC WATER USE

Other in-catchment urban and rural domestic water users upstream of the Strategy Area, while not supplied directly from any of the defined WSSs, do impact on water availability. Water supply challenges in these areas are addressed through separate studies and initiatives by the DWS, but the impact is taken into account in the Reconciliation Strategy water balances. This was done when quantifying the yields of current and future sources in the original *Reconciliation Strategy Study*. Where new information became available, typically as a result of hydrology updates, it was incorporated into the water balances as appropriate.

Specifically, new information on in-catchment water requirements in the uMkhomazi River Catchment was produced by the recent DWS *uMkhomazi Water Project Phase 1: Feasibility Study* (2014). This new information was factored into the water availability assessment of the proposed scheme, one of the key interventions of the Reconciliation Strategy as discussed later in **Section 4.2.3**. However, no significant changes have been made for projected in-catchment water use in the uMngeni, Mooi, Mvoti or Mdloti River catchments since the original *Reconciliation Strategy Study* and this was therefore left unchanged for the purposes of updating the Strategy.

2.4 IRRIGATION WATER REQUIREMENTS

While extensive irrigation occurs through the various catchments that supplies water in the Strategy Area, only a limited volume is supplied from, or downstream of, the main large dams and abstractions that feed the various WSSs. Most of the irrigation occurs in the headwaters and tributaries of the catchments and often from farm dams. As such, the impact of irrigation was considered in terms of its impact on water availability at key abstraction points, specifically dam yields, rather than a water requirement.

In the original *Reconciliation Strategy Study* an extensive investigation was undertaken to quantify irrigation water requirements in the Strategy Area. These have been included in the various hydrological and systems models used to support the development of water balances for the Strategy. Since very little provision has been made for further irrigation in the Strategy Area, irrigation

water requirements were kept unchanged for this Strategy Update. As such, however, managing irrigation water use will be key to the successful implementation of the Strategy.

2.5 ECOLOGICAL WATER REQUIREMENTS

Ecological water requirements (EWRs) were accounted for in the Strategy by assessing the impact of supporting EWRs on the supply potential of existing and proposed water resources schemes, rather than including EWRs in water requirement projections.

Both the original *Reconciliation Strategy Study* and the *Continuation of the Reconciliation Strategy Phase 1* considered EWRs that were derived from Reserve determination studies or in some cases existing compensation releases practices. New EWRs have now been determined as part of the *Classification of Water Resources* undertaken by DWS (2015) (discussed later in **Section 7.1**). Form a Strategy perspective, some key impacts of the Classification process on EWRs and associated water availability in the Strategy area can be summarised as follows:

- No significant impacts in the uMngeni or Mooi River systems.
- An impact and reduction in the potential yield of the Mvoti River Dam project (a possible intervention option for the North Coast).
- A small reduction in the yield of the uMWP of about 5 million m^3/a, from the original 220 million m^3/a as determined by the *Feasibility Study* (DWS, 2014).

These impacts have been considered in the *Reconciliation Strategy Update* and are reflected in the water balances for the various WSSs presented later in this document.

2.6 WATER USE ASSURANCE OF SUPPLY CRITERIA

To enable a realistic reconciliation of water availability and water requirements, the extent to which (or likelihood) users can tolerate the undersupply of water needs to be considered. This is generally defined in terms of the risk of non-supply (expressed as a recurrence interval, in years), or inversely the annual assurance of supply (expressed as a percentage probability). Water user assurance of supply criteria must be considered both in the long-term availability of water resources and associated planning, as well as the short-term management of water supply under drought conditions (referred to as “drought operating rules”).

The assurance of supply criteria for the various water users in the different WSSs in the Strategy area were defined and adopted during previous studies, and are summarised below in Table 2.1. The table also includes a split of the different water use categories into priority classes that determine which water use type is restricted during times of water scarcity. The end result is not that a specific water user is prioritised over another, but rather that low priority water use is rationed across water users in a manner that reflects the economic and social value of water, agreed upon up front by the stakeholders.

Table 2.1: Water use priority classification and assurance of supply criteria

User category	Portion of water supply within indicated priority class, with associated recurrence interval of failure (in years) and annual assurance of supply (as a %)					
	Very High	High	Medium	Low	Very Low	Total
	1:200 (99.5%)	1:100 (99%)	1:50 (98%)	1:20 (95%)	1:10 (95%)	
Mgeni WSS						
Irrigation	5%	25%	-	70%	-	100%
Domestic and Urban	63%	13%	12%	12%	-	100%
Power and Industry	70%	20%	-	10%	-	100%
Compensation flows(1)	50%	25%	-	25%	-	100%
North Coast WSS(2)						
Irrigation	5%	5%	20%	70%	-	100%
Domestic and Urban	35%	40%	20%	5%	-	100%
Power and Industry	40%	50%	10%	-	-	100%
Losses	100%	-	-	-	-	100%
South Coast WSS						
Irrigation	-	-	20%	30%	50%	100%
Domestic and Urban	-	50%	30%	-	20%	100%
Losses and return flows	-	100%	-	-	-	100%

Note: (1) Preliminary EWR.
(2) Hazelmere Dam.

2.7 DROUGHT IMPACTS ON WATER REQUIREMENTS

The recent actual water supply volumes are shown earlier in Figure 2-4, Figure 2-5 and Figure 2-6 for the North Coast, Mgeni and South Coast WSSs, respectively, and illustrate to some extent the impacts of the ongoing drought and associated water restrictions. Restrictions on the North Coast have been in place since November 2014, while restrictions in the Mgeni WSS were implemented towards the end of 2016. Restrictions on the South Coast were initially implemented due to the state of the smaller local dams, that subsequently

recovered, but have been implemented again towards the end of 2016 due to linkages with the stressed Mgeni WSS. The reason for the differences in timing of restrictions is linked to the availability of storage in the different WSSs and the rate at which the dams respond to dry and wet periods. The Mgeni WSS with its four large dams responds much more slowly to lower rainfall, but also tends to recover more slowly with increased rainfall.

A key consideration for the Strategy Update is how to factor in noticeably lower current water supply volumes. Typically current supply volumes are used as a base point for updating water requirement projections. However, the restricted volumes do not represent the full water requirement, but rather a "suppressed demand". As such, it is anticipated that after the drought has ended and supply can again be unrestricted, that the water requirements will recover and trend towards the original projection. There are, however, some factors that might impact upon the rate and extent to which water requirements will respond. These factors include:

- The savings achieved through drought-focused interventions and the extent to which these can be maintained;
- Impacts of water shedding on condition of pipes and possible increase in leakage once full supply returns;
- Changes in consumer attitude and behaviour towards water use;
- Changes in behaviour by WSAs towards managing and planning water resources. and
- Impacts on revenue (through reduced sales) and tariff structures.

The reality is that there is uncertainty around a number of these factors and the associated impacts will most likely only be known once the drought has come to an end and water supply normalises[1]. It is, however, important that the savings and awareness that were achieved are maintained as much as possible, particularly until supply to key systems can be augmented.

[1] *At the time of completion of this Study (November 2016), the drought has not lifted yet.*

3 MANAGEMENT INTERVENTIONS

3.1 WATER CONSERVATION AND WATER DEMAND MANAGEMENT

In the original *Reconciliation Strategy Study*, emphasis was placed on water conservation and demand management (WC/WDM) as a key short- and medium-term intervention option. WSAs were encouraged to implement and maintain appropriate WC/WDM initiatives to improve the condition of water supply infrastructure and mitigate water losses and shortages in their supply areas. Due to the interconnectedness of the supply systems in the Strategy Area the failure or success of WC/WDM has a significant impact on all water users in the region. In this *Reconciliation Strategy Update* it is recommended that WSAs have a focussed strategy with associated budgets to implement WC/WDM initiatives. To ensure its success WC/WDM must be viewed as more than simply a series of technical interventions as it depends heavily on social perceptions and behaviours and strong public support.

Preliminary information from the *5-year WC/WDM Master Plans* for the five WSAs in the Reconciliation Strategy Area is presented in **Table 3.1**. As part of the Strategy Update these WC/WDM initiatives and associated potential savings on water use were continually monitored and reviewed. Projected savings were then incorporated into the water requirement projections discussed earlier in **Section 2.2** and the Reconciliation Strategy scenarios presented later in **Section 6**. In this regard it was noted during SSC meetings that ageing infrastructure within various municipalities is one of the main causes of water losses in the region.

Table 3.1: Preliminary information from 5-year WC/WDM Master Plans

WSA[1]	Water supply volume (Mℓ/d)			Saving	
	Baseline value (2013/14)	5-year projection value (2018/19)		Mℓ/d	million m³/a
		Without WC/WDM	With WC/WDM		
eThekwini DM	911	1 014	943	71	25.9
Msunduzi LM	183	206	185	21	7.7
Ugu DM[2]	111	113	102	11	4.0
iLembe DM[2]	63	79	74	5	1.8
uMgungundlovu DM[2]	61	75	62	13	4.7
Total saving:	**40 to 48 million m³/a**				

Note: (1) Water Services Authority
(2) Partially located within Reconciliation Strategy Area

3.2 SYSTEM OPERATION AND DROUGHT MANAGEMENT

WC/WDM is an on-going initiative to use water sustainably. However, during times of low rainfall and drought, more stringent measures may be needed. During the development of the original *Reconciliation Strategy* the *Umgeni Water Supply System Operations Forum* (SOF) was established to focus on improving system operation and the management of water restrictions in the event of a drought. The purpose of drought management is to manage the risks and to maintain the assurance of supply levels for high priority water use in line with the criteria (as discussed earlier in **Section 2.6**).

Information for the 2014 SOF (July 2014) was presented and discussed at SSC Meeting 6 (July 2014), but subsequently the situation deteriorated and rainfall during the wet season (summer) of 2014/2015 was below average. At SSC Meeting 7 (February 2015), the DWS KZN Regional Office reported back on the situation and interventions in the province. At SSC Meeting 8 (September 2015) the key discussion points and decisions from the 2015 SOF (May 2015) were presented and are summarised as follows:

- Due to low dam storage levels, the urgent implementation of water restrictions was required at a number of schemes across the province and within the Strategy Area. Water restrictions included the North Coast and South Coast WSSs for users supplied from Hazelmere and the Umzinto dams, respectively.
- As a short-term emergency measure to maintain water supply for basic human needs and to avoid the dams running empty, Umgeni Water implemented emergency pumping schemes to transfer water from neighbouring catchments. Pumping from the oThongati River was augmenting Hazelmere Dam by up to 8 Mℓ/d and a scheme from the Mphambanyoni River was augmenting EJ Smith Dam.
- Further drought relief funds and interventions were being administered, following the declaration by the Premier of KZN of a *Provincial State of Disaster* due the continued drought conditions. It was noted that various activities and allocated budgets associated with the drought relief plans in iLembe, uMkhanyakude, Zululand, uThungulu and Ugu DMs were being implemented at the time.

Due to the continued drought and reduction of storage levels, water restrictions of 15% across the Mgeni WSS were decided upon in December of 2015 at the joint operating committee (JOC). These were confirmed in May 2016 at the SOF.

The situation for the larger Mgeni WSS remains critical (November 2016). Due to more rainfall along the coastal areas, and the imminent commissioning of the Lower Thukela BWSS, the restrictions on the Hazelmere supply area of the North Coast WSS were subsequently lifted.

It was agreed that while resolution of the drought situation in KZN required short-term actions, the ongoing long-term planning and implementation of the Reconciliation Strategy was critical to manage the impacts of similar future water scarcity situations. Furthermore, while water restrictions are not desirable and need to be carefully managed, restrictions are sometimes unavoidable and are at times the most effective measure to deal with short-term drought conditions – particularly when sufficient time is not available to implement the next infrastructure development intervention.

A Drought Management Plan (DMP), produced by Umgeni Water, was developed for Umgeni Water's area of supply in order to manage water supplies during uncontrolled events such as was experienced during the 2016 drought event. The purpose of the DMP is to reduce the risk of drought disasters by providing guidelines for a proactive and coordinated response to drought events. The DMP outlines measures to be used to mitigate the effects of droughts and actions to respond to drought conditions (Umgeni Water, 2016).

3.3 RE-ESTABLISHMENT OF EXISTING GROUNDWATER USE

The majority of the KZN Coastal Metropolitan Area is located in the KwaZulu-Natal Coastal Foreland and Northwestern Middleveld groundwater regions (Umgeni Water, 2016). As mentioned in **Section 1.5**, there is limited potential for groundwater development in the Strategy Area. The use of groundwater resources is therefore not considered as one of the current or future main sources of supply of water for the greater KZN Coastal Metropolitan Area. Groundwater exploitation is, however, of significant importance for the supply of water in rural areas, augmenting surface water supply for irrigation purposes and stock watering.

The refurbishment of decommissioned groundwater schemes in the Strategy Area could potentially alleviate the impact of a drought event and associated restrictions. The portion of groundwater schemes that were developed as part of rural development programmes, which were either not maintained or decommissioned, should be considered for re-commissioning as part of small reticulation systems for small villages, schools, clinics and hospitals.

Groundwater levels in the existing groundwater schemes should be monitored to prohibit the over-exploitation of the resources. Where poor water quality limits the potential supply from existing or potential boreholes (as was one of the main reasons for a number of boreholes being decommissioned in the past), suitable developments in water quality treatment may now be available. Technologies such as nanofiltration membranes can be applied to treat the groundwater to improve the quality for the application. The re-establishment of use of existing groundwater sources also can provide a potentially viable alternative to the generally expensive practice of water tankering for the WSAs.

4 INFRASTRUCTURE INTERVENTION OPTIONS

As part of the original *Reconciliation Strategy Study* and subsequent *Continuation of the Reconciliation Strategy Phase 1*, the following strategic infrastructure intervention options were identified:

- Mooi-Mgeni Transfer Scheme Phase 2, MMTS-2 (Spring Grove Dam and Transfer Infrastructure).
- uMkhomazi Water Project Phase 1, uMWP-1 (Smithfield Dam and Transfer Infrastructure).
- Mvoti River Development Project (iSithundu Dam).
- Lower Thukela Bulk Water Supply Scheme (LTBWS).
- Options for the re-use of treated wastewater.

In addition to those listed above, various other infrastructure intervention options were considered in this *Reconciliation Strategy Update*. These were based on the needs highlighted in the reconciliation scenarios and water balances presented later in **Section 6**, as well as on feedback and guidance provided by SSC members and other stakeholders. Key milestones and observations for these options are summarised in the following sections for each WSS.

It should be noted that since infrastructure interventions often involve lengthy planning and implementation processes, an important aspect of updating the Strategy is by continually monitoring progress and revising target implementation dates as required. This could be as a result of various factors, such as changes in water requirement projections, re-prioritisation of interventions and project delays.

A consolidated list of all infrastructure interventions identified as part of this Strategy Update, with associated implementation phases and target dates, is provided in **Appendix A** of this document.

4.1 NORTH COAST WSS

As discussed in **Section 2.2.3** the North Coast Area has been experiencing rapid growth in recent years, increasing the water requirements above the available resources and infrastructure capacities. A number of possible infrastructure intervention options have been identified to augment the existing water resources and these are discussed below. Note that the first five options, discussed in **Sections 4.1.1** to **0**, were identified during the original *Reconciliation Strategy*

Study and subsequent *Continuation of the Reconciliation Strategy Phase 1* and more information in this regard can be found in associated reports as listed earlier in **Section 1.4**. A number of further intervention options were identified as part of this Strategy Update and these are discussed in **Sections 4.1.6** and **4.1.7**.

4.1.1 Raising of Hazelmere Dam

The raising of Hazelmere Dam by 7 m with a piano key weir to increase the gross storage capacity from 23.9 to 43.7 million m^3 will augment the water supply to the North Coast WSS (from the Mdloti to the Thukela River) and sustain irrigation downstream of the dam. The raising of the Hazelmere Dam will also increase water availability to the North Coast Region by some 10 million m^3/a. This intervention has been prioritised by the Reconciliation Strategy and should have been commissioned already some years ago. Unfortunately construction was delayed due to various financial and administrative issues, but did commence in Mid-2016.

4.1.2 North Coast Pipeline and Hazelmere Supply Infrastructure

In line with the planned raising of Hazelmere Dam and anticipated increase in water availability, Umgeni Water has proceeded with upgrading the Hazelmere WTW and supply infrastructure linked to the dam. This includes the following, all of which have recently been completed:

- A new raw water pipeline from Hazelmere Dam to the Hazelmere WTW.
- Upgrading of the Hazelmere WTW from 45 to 75 Mℓ/d.
- A pump station at the Hazelmere WTW.

However, the Hazelmere WTW and new infrastructure can only be operated at the increased capacity on a sustained basis once the raising of Hazelmere Dam has been completed.

4.1.3 Lower Thukela BWSS

The expected growth in the water requirements in the KwaDukuza Area will be supplied from the Lower Thukela Bulk Water Supply Scheme (LTBWSS) currently (November 2016) under construction. The scheme is being developed in two phases, each with a capacity of 55 Mℓ/d and involves the abstraction of water from the Lower Thukela River (near the SAPPI Mill) and treatment at a regional WTW with a capacity of 110 Mℓ/d. **Figure 4-1** shows the layout of the LTBWSS.

Construction started in February 2014, comprising of the abstraction works, pump stations, de-silting works, WTW and storage reservoirs. The construction of a gravity pipeline from the Mvoti Reservoir to Darnall is also underway. It is anticipated that the first phase of scheme will be commissioned by the end of 2016 and the second two to three years thereafter. The figure below shows the general layout of the LTBWSS.

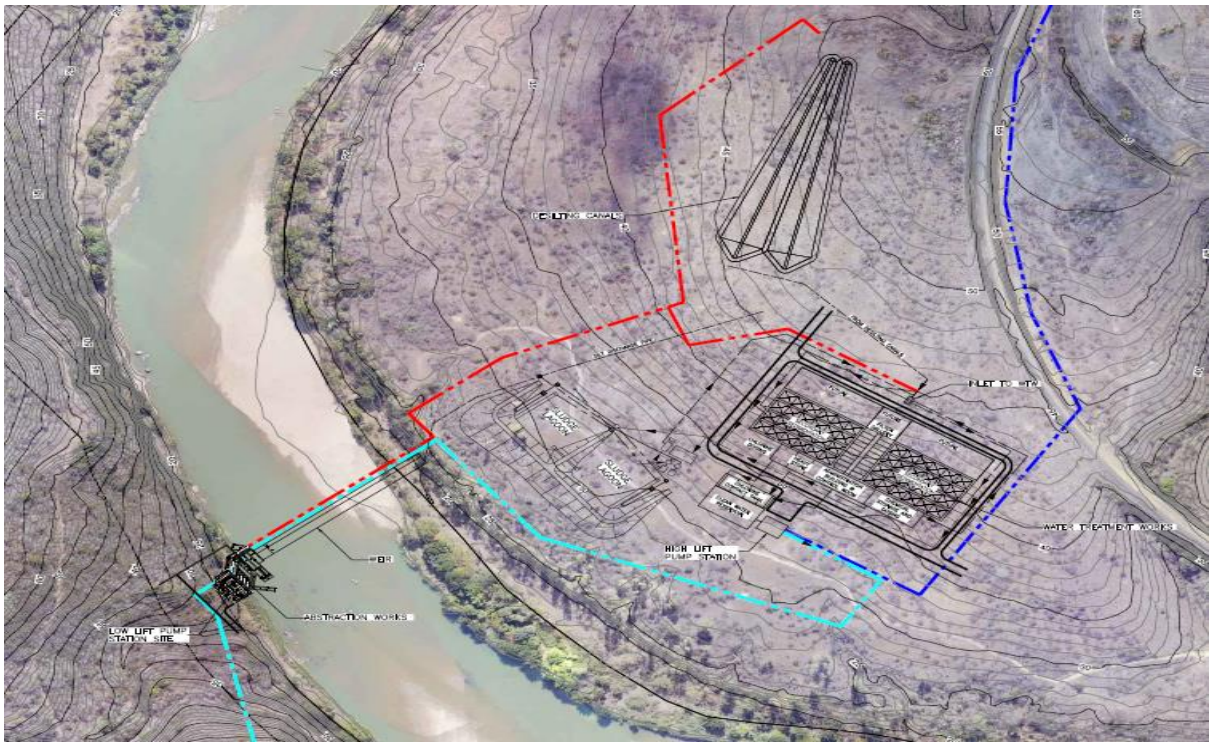

Figure 4-1: Schematic layout of the LTBWSS

4.1.4 Mvoti River Development Project

The Mvoti River Development Project involves the development of a large dam on the Mvoti River, either at iSithundu or Welverdient, with a regional WTW (Fawsley Park) and bulk distribution infrastructure. A pre-feasibility study was completed in the late 1990s. The next planning phase, a feasibility study, is yet to be undertaken and it is anticipated that the yield and associated benefit of the scheme will be reduced as a result of revised EWRs for the Mvoti River resulting from the recently completed Classification Process (discussed later in **Section 7.1**). **Figure 4-2** shows the location of the proposed iSithundu and Mvoti dams.

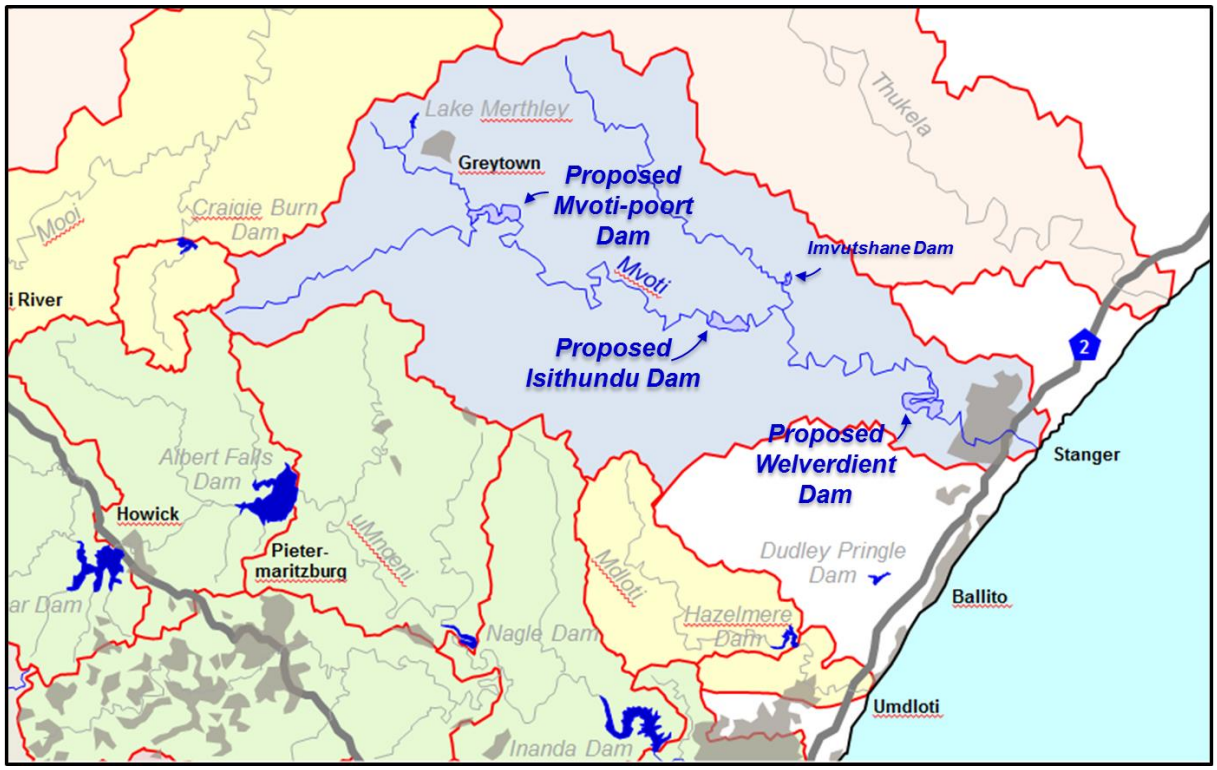

Figure 4-2: Location of the proposed Isithundu and Mvoti dams

4.1.5 Desalination of seawater at Tongaat

Umgeni Water has been investigating the feasibility of seawater desalination plants as an alternative water source for both the North Coast and South Coast Areas (the latter discussed in **Section 4.3.1**). The proposed Tongaat Plant on the North Coast was sized to 150 Mℓ/d based on the capacity of existing and proposed bulk water supply infrastructure in this area, which can be utilised to convey potable water from the plants to the various distribution points. The location of the proposed Tongaat Plant is shown **Figure 4-9**.

However, during the TSG and SSC meetings held as part of this Strategy Update it was noted that the Tongaat Plant may not be required in the long-term as the LTBWSS (discussed in **Section 4.1.3**) and raising of Hazelmere Dam (discussed in **Section 4.1.1**) will address the short-term needs of the area, while the medium- to long-term needs will be addressed by the uMWP-1 (see **Section 4.2.3**). The Environmental Impact Assessment (EIA) Study for the proposed Tongaat Plant is, however, currently (November 2016) being completed in the event that the scheme is still required.

4.1.6 Indirect re-use of treated wastewater via Hazelmere Dam

To address constraints in the return of growing volumes of treated effluent to estuaries on the North Coast, eThekwini MM (as part of their *Total Outflow*

Strategy – a parallel initiative to the Classification Process), identified the re-use of water as a potential solution. This solution addresses both the constraint of dealing with treated effluent, as well as providing an additional water resource.

As part of a supporting investigation to the Total Outflow Strategy, the option of re-using treated effluent generated by return flows in the uMdloti and oThongati River catchments was investigated at a desktop level. The investigation included the indirect re-use of treated effluent via Hazelmere Dam as well as the potential associated impact on the water quality in the dam – in particular the assimilation of salinity and soluble reactive phosphorous.

This option was also reviewed from a water resource perspective, and where necessary, assumptions revised to provide conservative results. The resulting volumes of water available from the two drainage areas were quantified as follows:

- The ultimate development volumes were assumed to be achieved by 2065, a later date than the 2050 originally assumed. This results in a growth in return flows more in line with the projected water requirements discussed earlier in **Section 2.2**.
- Growing releases of treated effluent to the river and estuary at the Tongaat Wastewater Treatment Works (WwTW) is limited to 20 Mℓ/d (7.3 million m³/a), which is the estimated assimilative capacity of the river. Growth in return flows above this volume therefore cannot be returned to the rivers and estuaries and must be re-used, as shown in **Figure 4-3** (represented by the green line).
- Growing releases of treated effluent to the river and estuary at the uMdloti WwTW is limited to 55 Mℓ/day (20.1 million m³/a). The growth in return flow volumes above this volume must also be re-used as shown in **Figure 4-4** (green line).
- The total volume of treated effluent that can be re-used via Hazelmere Dam is, however, limited to a maximum total dissolved solids (TDS) concentration build-up in the dam of 450 mg/ℓ, based on the *Water Quality Guidelines for South Africa* (1996). This limitation represents a volume of treated effluent of 140 Mℓ/d (51.1 million m³/a) and the resulting total volume of return flows that can be re-used via Hazelmere Dam is shown in **Figure 4-5**.

As suggested by **Figure 4-5** the re-use of water needs to commence by around 2020 in order to avoid the need for an alternative effluent disposal or management solution (e.g. a sea outfall). The volume that must be re-used would

grow over time and is projected to reach the water quality constraint by 2055. It is possible that the technology to provide further pre-treatment will have advanced sufficiently by that time to address associated water quality challenges.

The re-use of water provides a disposal management solution as well as a water resource that could potentially off-set the need for other intervention options (e.g. the iSithundu Dam on the Mvoti River). As such, the timing of the scheme is also reviewed from a water balance perspective (see **Section 6.1**).

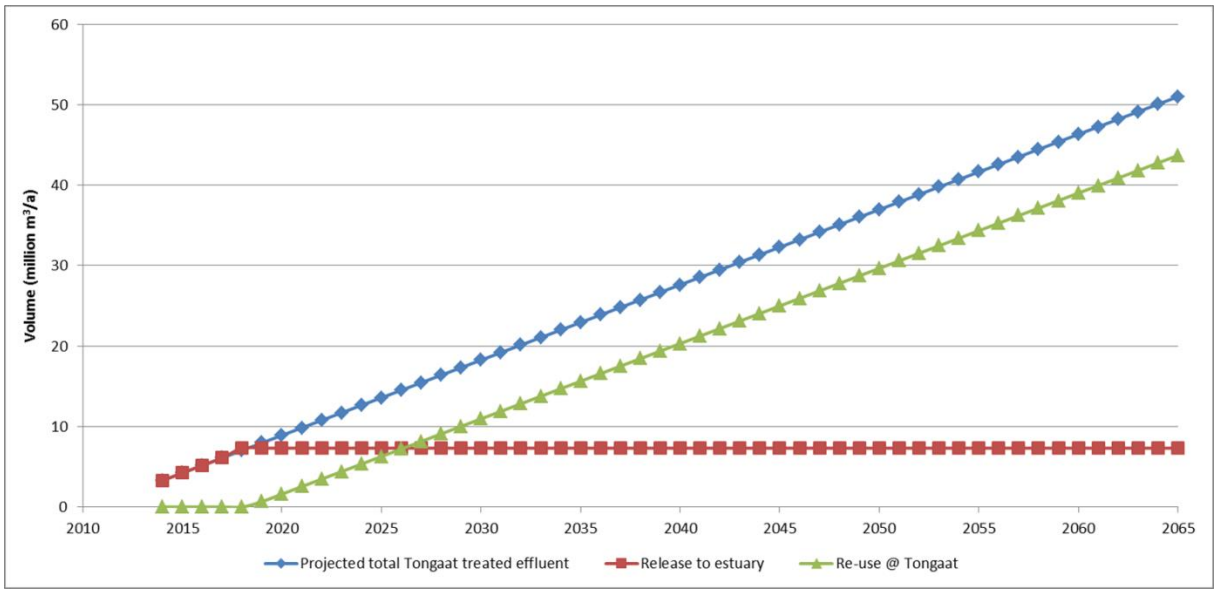

Figure 4-3: Projected return flow volumes for re-use, oThongati Drainage Area

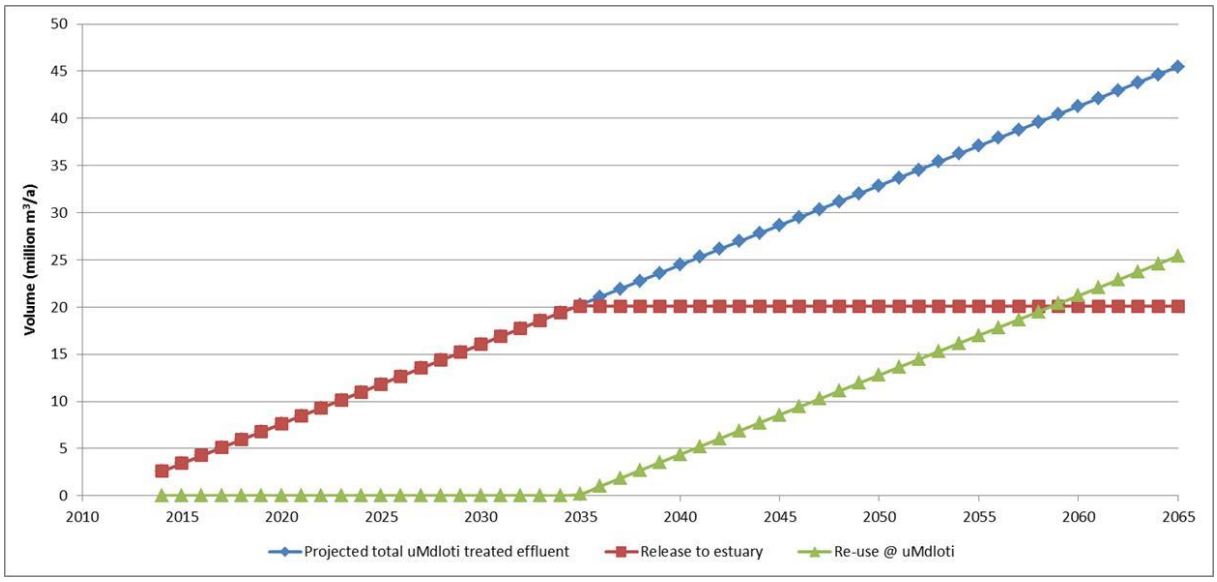

Figure 4-4: Projected return flow volumes for re-use, uMdloti Drainage Area

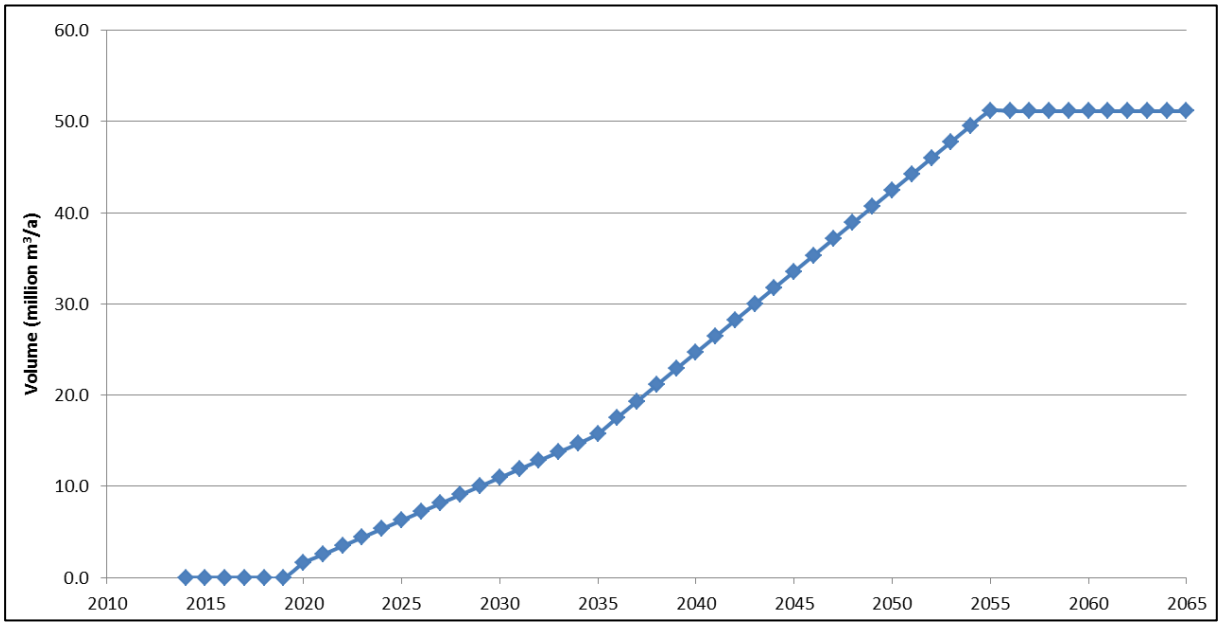

Figure 4-5: Total return flow volumes for re-use, within TDS build-up limitation

4.1.7 Direct re-use of treated wastewater

Siza Water, the WSP in a concession area within the iLembe DM, provided approximately 500 kℓ/d (0.18 million m^3/a) of wastewater as a drought mitigation measure for the filling of swimming pools and construction activities. The water was supplied from their Frasers WwTW, a Green Drop-accredited plant that receives mostly domestic sewage.

Siza Water reported that in January 2014 they found an appropriate treatment method to treat the wastewater to meet the *SANS 241:2014 Drinking Water Quality Standards*, as was verified by two independent laboratories. Prior to investing in a full recycling plant, public acceptance for re-using treated wastewater was tested with a survey supported by the relevant communication initiative. Reportedly, 97% of homes (linked to municipal account number) that participated voted in favour of such a process. Thereafter a full recycling plant was implemented, injecting recycled treated wastewater directly into the water distribution network as from December 2015.

4.1.8 Thukela Water Project

The Thukela Water Project (TWP) is a major proposed water resource development located in the upper Thukela River Catchment in the northern part of KZN. The first phase, the existing Tugela Vaal Transfer Scheme (TVTS) includes the transfer scheme from Woodstock Dam to Sterkfontein Dam (in the upper Vaal River Catchment) and the Drakensberg Pumped Storage Scheme near the Oliviershoek Pass. The proposed second phase (TWP) was identified as a long-

term water resource development project to further augment water supply to the Vaal River System (VRS) and includes two dams and a number conveyance infrastructure components. The dam sites are located at Jana and Mielietuin in the vicinity of Ladysmith on the Thukela and Boesmans rivers, respectively (see Figure 4-6).

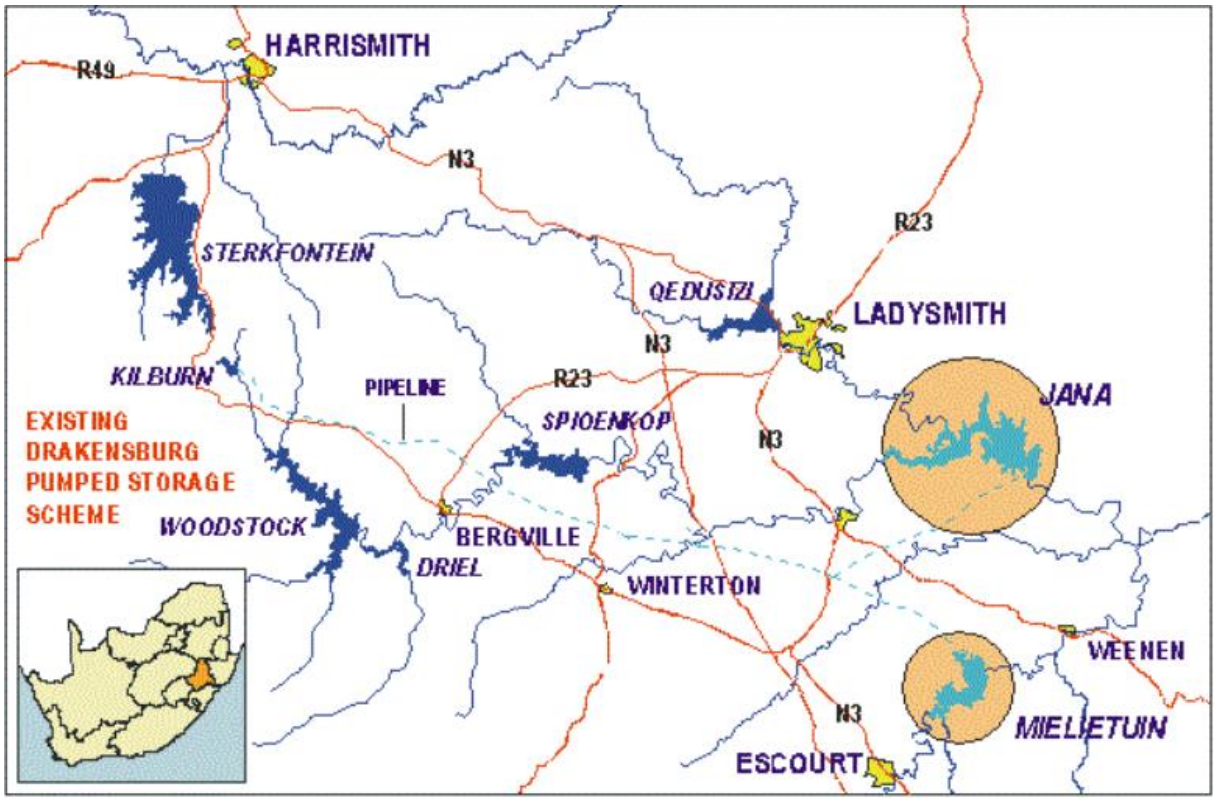

Figure 4-6: Layout of the Thukela Water Project (sourced from Thukela Water Project Feasibility Study (DWAF, 2001))

Although TWP was originally conceived for augmenting the VRS, the need was identified as part of this *Reconciliation Strategy Update* to investigate the possibility of fast-tracking a selected component of the project as a regional water supply option for KZN. Specifically, the project could provide medium- to long-term augmentation to the lower Thukela and, therefore, a portion of the Reconciliation Strategy Area. Another option would be to utilise surplus water from the TWP to reduce the water shortage projected to occur in the Richards Bay WSS from 2016 to 2027. This will involve utilising the existing Thukela-Mhlathuze Transfer Scheme, subsequent to an increase in the transfer capacity of the existing conveyance infrastructure.

A high-level desktop assessment of these options was undertaken for this Strategy Update based on information obtained from earlier studies. The outcomes of this assessment are presented in Appendix E of this document and show that:

- Implementing the TWP before 2049 will result in surplus yield in the VRS. The benefit will, however, diminish as the water requirements in the VRS increase over time.
- Implementing Mielietuin Dam will result in a surplus yield of approximately 60 million m³/a, but only up to 2033 (assuming the "high" water requirement scenario for the VRS).
- If both the Jana and Mielietuin dams were implemented, a surplus of approximately 300 million m³/a is realised in 2037, which diminishes to approximately 100 million m³/a in 2050 (for the "high" water requirement scenario).
- However, the financial and institutional arrangements related to this option may prove to be difficult, specifically with regard to the allocation of project costs between users in KZN and the VRS.

At the time of the TWP Feasibility Study (2001), there was little possibility of a disadvantage to KZN envisaged. However, considering the impact of the current drought event (November 2016), transferring water from the Thukela River Catchment to the neighbouring Vaal River Catchment could potentially further limit the water resources availability in KwaZulu-Natal and have a negative impact on the economic development future of the province. Based on the findings of the desktop assessment the TWP-2 was not considered in the Strategy Update as a potential resource for the North Coast WSS.

4.2 MGENI WSS

The following interventions are projects and options for addressing growing water requirements in the Mgeni WSS, which is the largest supply system in the Strategy Area. Also, refer to the Strategy Poster **(Figure C-1**) for the layout of the projects and options.

4.2.1 Mooi-Mgeni Transfer Scheme

The Mooi-Mgeni Transfer Scheme (MMTS) was implemented to augment water supply to the Mgeni WSS, and comprises of Mearns Weir, Spring Grove Dam on the upper Mooi River and their associated conveyance infrastructure. The first phase of the MMTS, Mearns Weir, was completed in the 1990s. The second phase includes two components, namely Phase 2a, Spring Grove Dam, and Phase 2b, the additional pump station and pipelines for transferring water directly from the dam to the uMngeni River Catchment. Recently commissioned in its entirety, MMTS-2a and 2b has increased the yield of the Mgeni WSS by

60 million m^3/a (as determined at Inanda Dam). Refer to Figure 4-7 for the location and general layout of both Phase 1 and 2 of the MMTS.

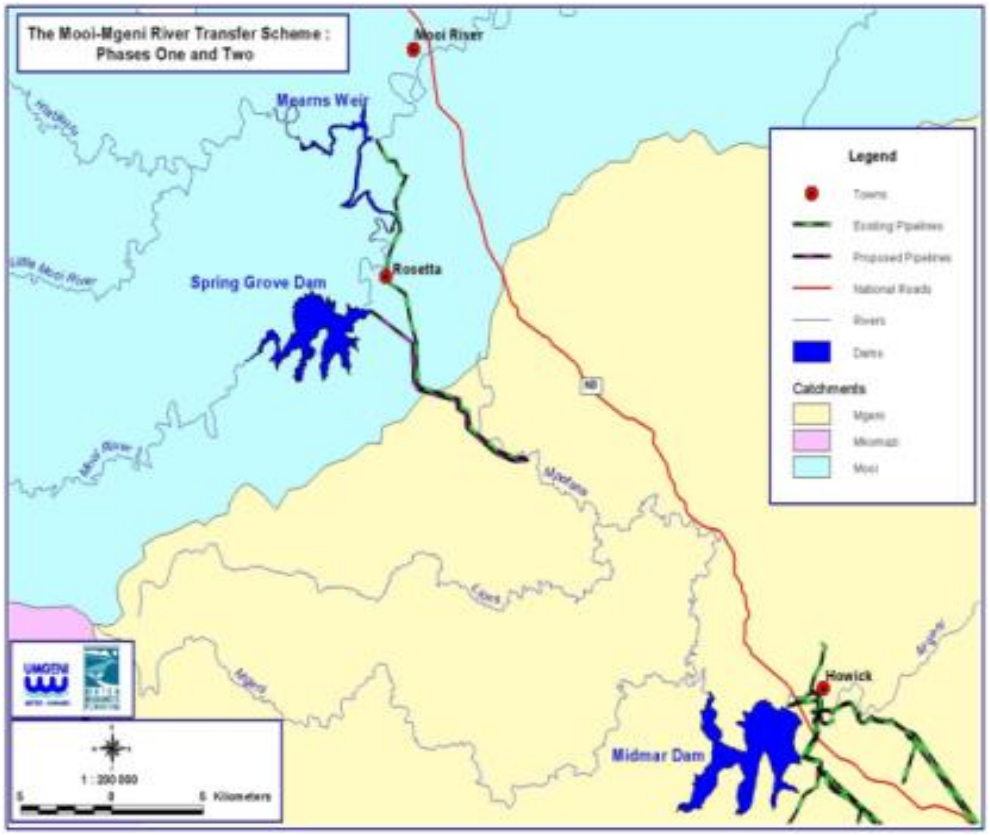

Figure 4-7: General layout of MMTS – Phase 1 and 2

4.2.2 Direct re-use of treated wastewater

During earlier phases of the Reconciliation Strategy development, the re-use of wastewater from the larger WwTW in eThekwini Region was selected as a preferred intervention option. However, the implementation of this option has since been stalled due to negative public sentiment. It is hoped that the recent successes of Siza Water in the iLembe DM (discussed in **Section 4.1.7**) will encourage renewed interest in the re-use option within the eThekwini MM.

4.2.3 The uMkhomazi Water Project

Feasibility studies were recently completed by DWS and Umgeni Water providing the project layout and size of infrastructure components, for both the raw water and potable water components of the proposed uMkhomazi Water Project (uMWP). The specialist EIA is currently (November 2016) underway and the aim is to present submissions to the relevant authorities by early-2017.

The first phase of the scheme (uMWP-1) will comprise of a new dam at Smithfield on the upper uMkhomazi River, water conveyance infrastructure (including a

32 km tunnel), a balancing dam and WTW in the adjacent uMlaza River Valley, as well as a gravity potable water pipeline connecting the scheme to the existing Umgeni Water Bulk Distribution Network. The uMWP-1 will generate about an additional 220 million m^3/a (602.7 Mℓ/d). **Figure 4-8** shows the layout of the proposed uMWP.

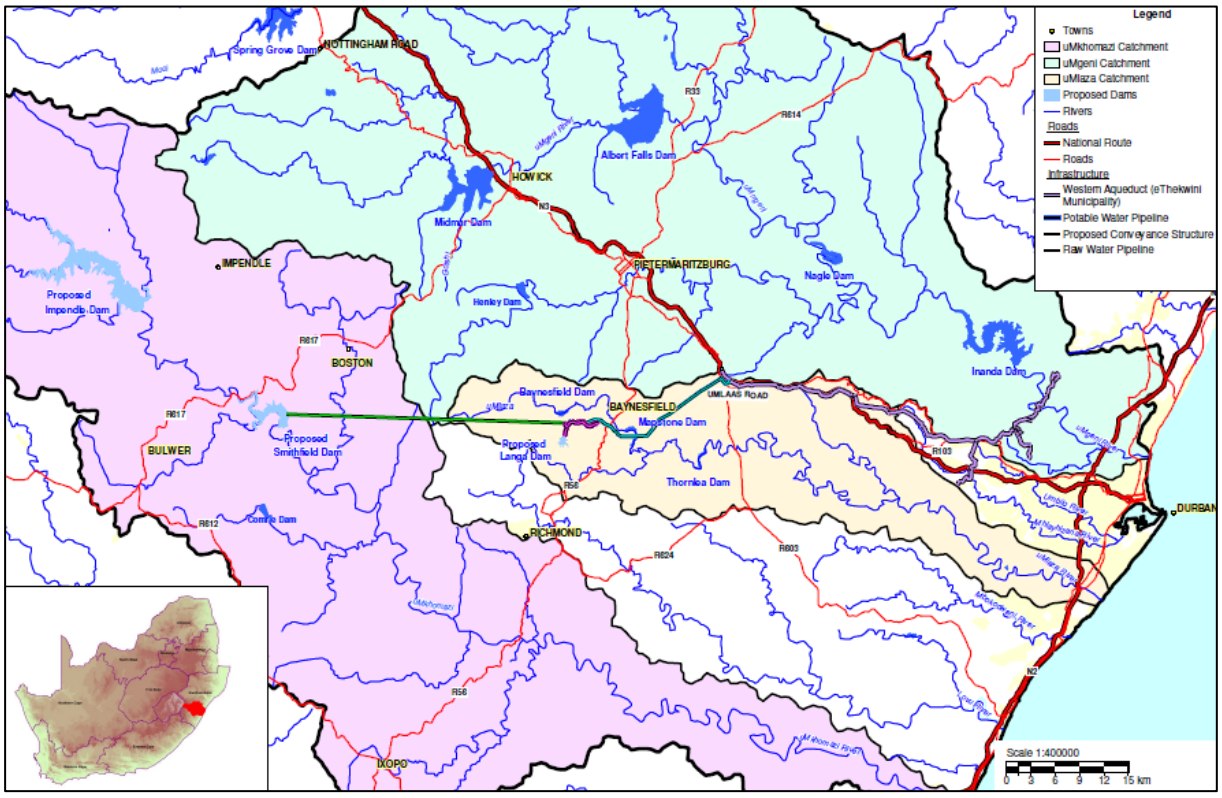

Figure 4-8: Layout of the uMWP Phase 1 and 2

Although augmentation of the Mgeni WSS is required from 2016 onwards, it is anticipated that the uMWP-1 can only be implemented, at the earliest, by 2024. Institutional arrangements to ensure the timely implementation of this scheme are therefore of critical importance. There is also a linkage between the uMWP and a proposed intervention option on the Lower uMkhomazi for the South Coast WSS, as discussed later in **Section 4.3.2**.

4.2.4 Re-mix Project

The eThekwini MM is currently (November 2016) proceeding with a pilot plant of their proposed *Re-mix Project*, named such as it involves a combination of desalination and the re-use of wastewater. According to feedback at SSC Meeting 10, the project will use treated effluent from the Central WwTW to dilute seawater and produce water of a lower salinity as input to a desalination plant. Before the project is pursued at a large scale a pilot plant is being constructed to test the technology and approach. The pilot plant will generate approximately

6.25 Mℓ/d (2.3 million m^3/a) that can be injected into the central Durban Supply Area. The project is planned to be completed by 2019. When the demonstration plant has been successfully implemented, the remix treatment plant will be upgraded to a capacity of 100 Mℓ/d.

4.3 SOUTH COAST WSS

Two alternative infrastructure developments are being considered for augmenting supply to the South Coast WSS, namely the desalination of seawater or the Lower uMkhomazi Bulk Water Supply Scheme (BWSS). It should be noted that at the time of the publication of this Updated Strategy (November 2016) in this document, Umgeni Water was in the process of comparing and evaluating the two options but that a final decision had not yet been made.

4.3.1 Desalination of seawater at Illovo

As discussed in **Section 4.1.5**, Umgeni Water investigated the feasibility of desalinating seawater as an alternative water supply source. The feasibility study of the 150 Mℓ/d plant, located at Illovo on the South Coast, has recently been finalised and the EIA is underway. The size of this plant is based on the capacity of existing and proposed bulk water supply infrastructure in these areas, which can be utilised to convey the potable water from the plant to the various distribution points. According to the Umgeni Water Feasibility Study, the current estimates show that the total cost of the Illovo plant's infrastructure will be approximately R4.2 billion (in 2015-Rands), at a cost of around R13/kℓ. Implementation can potentially be achieved by 2021/2022.

The feasibility of the Illovo plant depends on an economic comparison with the other proposed scheme for the South Coast WSS, the Lower uMkhomazi BWSS (discussed in the following subsection). Delivery and institutional and financing arrangements will also be key in deciding whether this project is pursued as the selected scheme for the South Coast. **Figure 4-9** shows the proposed locations of both the Tongaat and Illovo desalination plants.

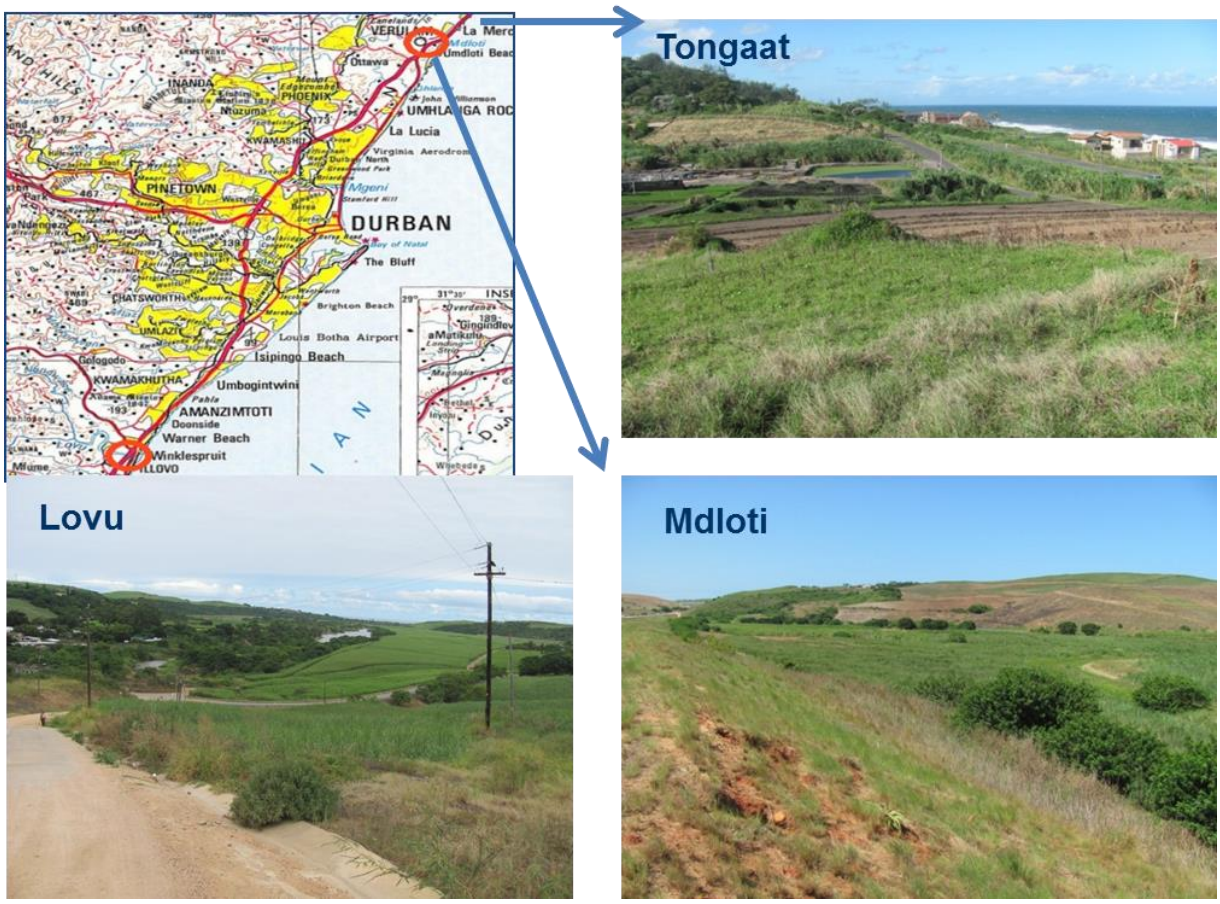

Figure 4-9: Proposed locations of the North and East Coast Desalination Plants

4.3.2 Lower uMkhomazi BWSS

The Lower uMkhomazi BWSS (see **Figure 4-10**), an alternative augmentation scheme to the proposed Illovo Desalination Plant (discussed above), consists of an abstraction works on the uMkhomazi River, a 50 m high off-channel storage dam on the Ngwadini River (a tributary of the lower uMkhomazi River), a second abstraction works near Goodenough Weir, a 100 Mℓ/d WTW, pump station and pipeline to deliver water to the South Coast WSS.

The project can be developed in the following two phases:

- Phase 1: Including the treatment infrastructure and abstraction works near Goodenough.
- Phase 2: The Ngwadini Off-channel Storage Dam and the associated abstraction works.

The option is available to delay Ngwadini Dam if the uMWP-1 scheme on the upper uMkhomazi River can be implemented in time to support abstractions at Goodenough and, in this way, provide the needed assurance of supply. However, if uMWP-1 is delayed, Ngwadini Dam will be required to store and provide water

during the dry winter month periods. The estimated capital cost for both phases of the Lower uMkhomazi Bulk Water Supply Scheme is approximately R2.9 billion (in 2015-Rands).

Umgeni Water's detailed feasibility study was completed Mid-2016 and the EIA is currently (November 2016) underway. The estimated implementation date of the scheme is Mid-2022 for both phases. However, the first phase can be implemented by 2020.

Figure 4-10: Layout of the Lower uMkhomazi Bulk Water Supply Scheme

5 SUPPORT INTERVENTIONS

Important support interventions to this *Updated Reconciliation Strategy* are discussed in this section. These interventions do not involve typical system-focused management programs or infrastructure developments, but rather catchment-wide practices to be followed by landowners and residents aimed at improving the water resources of the area in terms of quantity, quality and the protection of ecosystems. As such, these include initiatives such as catchment care and the maintenance of "ecological infrastructure", rainwater harvesting and water quality management.

5.1 CATCHMENT CARE AND ECOLOGICAL INFRASTRUCTURE

Although water resources management and development historically focussed on water resources infrastructure such as dams, the Strategy recognises the role of ecological infrastructure, defined as "naturally functioning ecosystems that produce and deliver valuable services to people" (DBSA, 2015). Ecological infrastructure can be considered the nature-based equivalent of built infrastructure. The *National Water Resources Strategy (2013)* explicitly considers ecological and built infrastructure as mutually supportive elements of an integrated approach to managing water.

The *uMngeni Ecological Infrastructure Partnership* (UEIP) is an initiative dedicated to maintaining and investing in ecological infrastructure as a means to contribute to water security and improve and maintain water quality in the uMngeni River Catchment. As noted previously, the uMngeni River Catchment contains one of the primary economic hubs in South Africa, where substantial infrastructure interventions are being planned (as discussed in **Section 4**) to address the growing demand for water. At the same time, the extent of degradation of ecological infrastructure within the uMngeni River Catchment is also compromising the natural system's ability to perform optimally in delivering strategically important water-related ecosystem services. Therefore, the uMngeni River Catchment is considered to provide an ideal opportunity to demonstrate the benefits of a coordinated and collaborative investment in ecological infrastructure for water security. The catchment is also identified as the first national priority for ecological infrastructure, the proposed *19th Strategic Infrastructure Project*[2] (SIP).

2 The National Infrastructure Plan identified 18, proposed to be extended to 19, Strategic Infrastructure Projects to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the

For the uMngeni River catchment, the water-related ecosystem services include:

- Dry-season base flow and associated water quality maintenance.
- Sustained water supply.
- Erosion control and avoidance of sedimentation.
- Flood attenuation.

These services will be managed through the maintenance, restoration and rehabilitation of grasslands and woodlands, and the removal of invasive alien plants (specifically Wattle) through initiatives such as the *Working for Water Programme*.

The UEIP, that is promoting ecological infrastructure solutions in the uMngeni River Catchment, is a partnership between government, business, academia and civil society and is headed by the *South African National Biodiversity Institute* (SANBI) with support from a number of the SSC member institutions[3].

An *Ecological Infrastructure Investment Plan* (DBSA, 2015) was drafted to guide investments in ecological infrastructure in the uMngeni River Catchment in order to support water security and to advance the inclusion of the concept of ecological infrastructure in decision-making and policy development, such as contained in this *Updated Reconciliation Strategy*. This involves the prioritising of sub-quaternary catchments within uMngeni River Catchment to provide an indication of where investments are required. The prioritisation was based on the following objectives:

- Conserve and maintain natural vegetation in sub-catchments where streamflow and base flow generated from natural vegetation is maximised, and where sediment yield is minimised.
- Rehabilitate degraded vegetation in sub-catchments where the greatest potential increase in streamflow and base flow, and the greatest potential decrease in sediment yield, can be achieved.
- Remove and rehabilitate areas infested with invasive alien plants such as wattle in sub-catchments where the greatest potential increase in streamflow and base flow, and the greatest potential decrease in sediment yield, can be achieved.

integration of African economies. SIP 19, Ecological Infrastructure, was championed by the Department of Environmental Affairs.

[3] *UEIP Partners: University of KwaZulu-Natal, Water Research Commission, Institute of Natural Resources, Msunduzi Municipality, uMgungundlovu Municipality, eThekwini Metropolitan Municipality, Department of Environmental Affairs, Department Water and Sanitation, Provincial Department Agriculture and Environmental Affairs, Umgeni Water, Ezemvelo KZN Wildlife, Endangered Wildlife Trust, Wildland Conservation Trust, WWF, Msinisi Resorts and Game Reserves, WESSA, Duzi uMngeni Conservation Trust, SAPPI, Mondi, South African Sugar Association*

- Reduce the impacts of small- to medium-sized flood events by improving the ability of ecological infrastructure in sub-catchments to attenuate floods.

Figure 5-1 and Figure 5-2 show the prioritisation of sub-quaternary catchments in the uMngeni River Catchment for securing natural vegetation and rehabilitation of degraded vegetation, respectively.

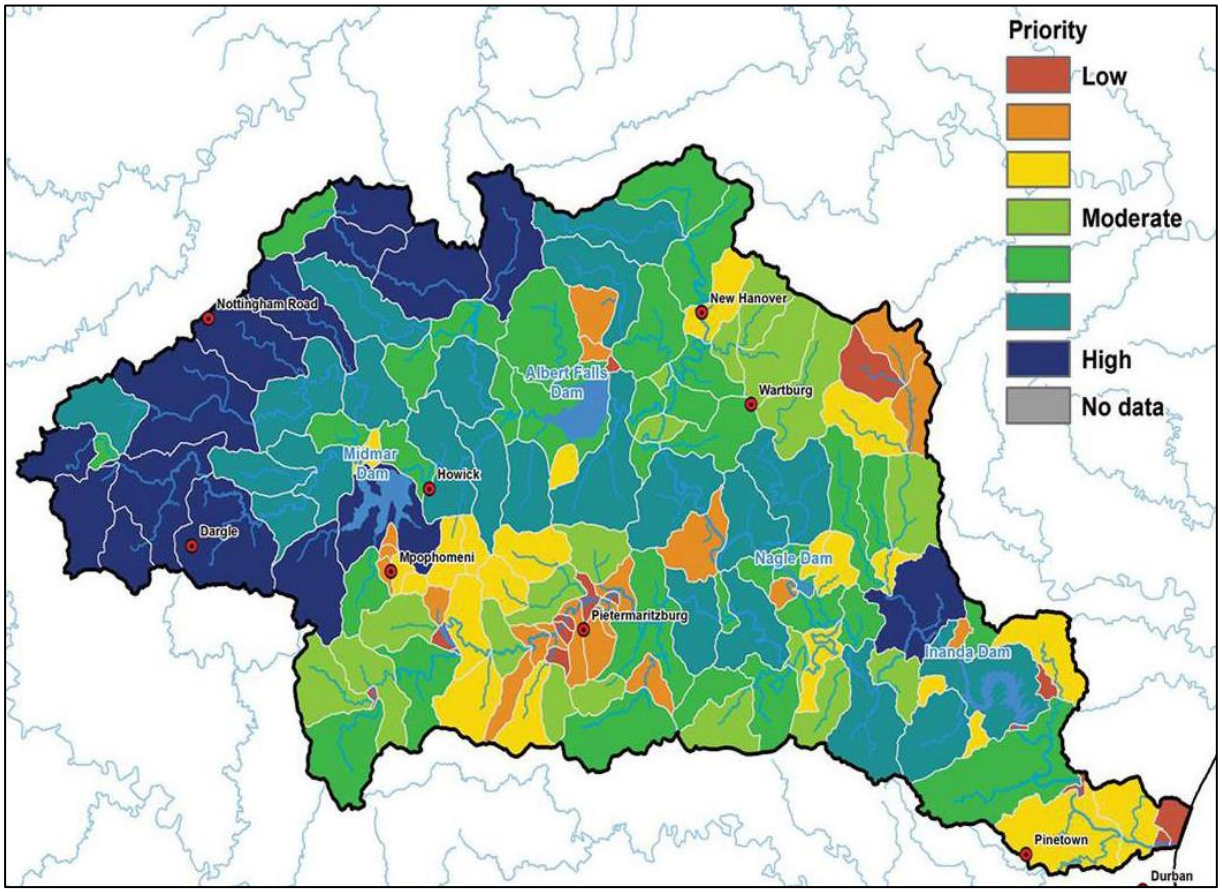

Figure 5-1: Prioritisation of sub-catchments for securing natural vegetation

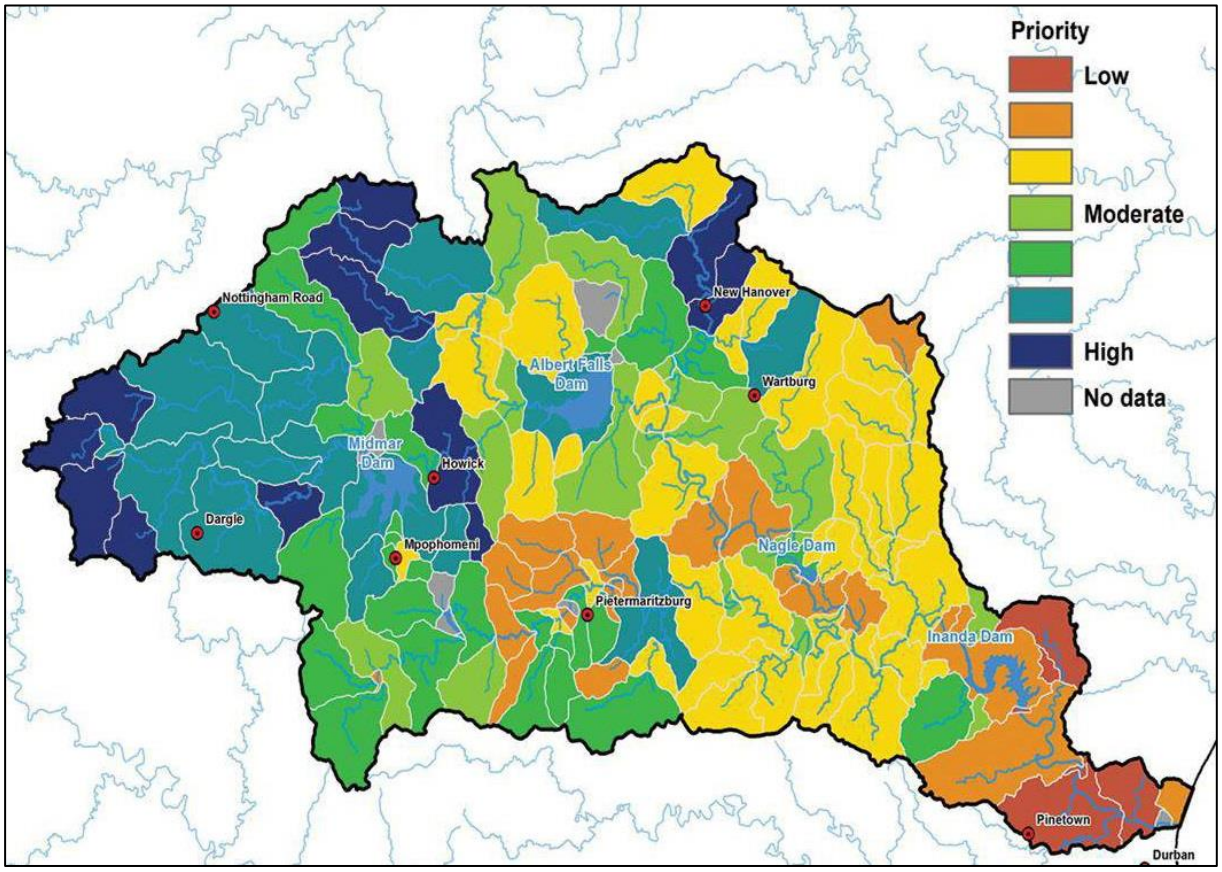

Figure 5-2: Prioritisation of sub-catchments for rehabilitation of degraded vegetation

This *Investment Plan* demonstrates the importance and benefits of investing in ecological infrastructure in the uMngeni River Catchment. However, the success of ecological infrastructure investment depends on partnerships between sectors and stakeholders and the rise of champions to scale up investment to secure the delivery of water-related services. There has already been a significant amount of investment in the uMngeni River Catchment by both the public and private sectors and stakeholders and investors can partner and build on these investments in a variety of ways.

The UEIP commenced with the implementation of the *Investment Plan* and are currently (November 2016) undertaking the following pilot projects and research:

- *Baynespruit Rehabilitation Project* (Msunduzi DM).
- *Save the Midmar Dam Project* (uMgungundlovu DM).
- *Palmiet Rehabilitation Project* (eThekwini MM)
- Research on the demonstration of how healthy ecological infrastructure can be utilized to secure water for the benefit of society and the green economy through a programmatic research approach based on selected landscapes.
- Investing in ecological infrastructure to enhance water security in the uMngeni River Catchment research.

The SSC recognises the great importance of catchment care and the maintenance of ecological infrastructure within the Reconciliation Strategy Area and, as such, have indicated their continued commitment to collaborating with the UEIP. It should be noted, however, that while catchment care would likely improve water resources, specifically in the maintenance of water yield and quality, there is currently a lack of quantifiable data in this regard. Catchment care was therefore not explicitly accounted for in the reconciliation scenarios and water balances developed as part of this *Reconciliation Strategy Update* (presented later in **Section 6**).

5.2 RAINWATER HARVESTING

a) Information from earlier studies

As mentioned in **Section 1.5**, rainwater harvesting (RWH) was identified as a possible intervention option to supplement water supply in the Reconciliation Strategy Area. In *First Stage of the Reconciliation Strategy* a preliminary assessment was undertaken of the potential benefits of RWH. The focus of this investigation was mainly on urban RWH in eThekwini MM and particularly the potential for rooftop RWH. The assessment was based on historical daily rainfall data from four gauging stations in the area and additional parameters and assumptions as follows:

- Storage tank capacities of either 5 000 ℓ or 10 000 ℓ.
- Varying start storage levels in the tank.
- The assumption that tanks would be installed in all formal housing units within the eThekwini Municipal area.
- An average roof size of 150 m² for all formal housing units.
- Rainfall-recovery efficiency.

The “historical firm yield” (HFY) was defined as the maximum volume of water that can be supplied from the storage tank without causing it to run dry. The results estimated the total HFY for the eThekwini MM, based on the 5 000 ℓ and 10 000 ℓ tank capacities, to be 7.6 and 13.5 million m³/a respectively.

Based on this preliminary assessment it was concluded that the implementation of RWH would not significantly benefit the water balance of the Mgeni WSS. However, considerable local benefits would be created, such as the support of subsistence food gardening or supplementing formal water supply in times of water restrictions to meet basic water needs. Another important benefit of RWH is that it could create public awareness of the importance of using water sparingly

and efficiently. It also has the benefit of having water available on site in the case of short-term municipal water supply failures.

b) Assessment of RWH options

At the request of the SSC a review and detailed assessment of RWH were undertaken as part of *Second Stage of the Reconciliation Strategy*. The aim of the investigation was to assess the potential yield of rooftop RWH for various scenarios and also to determine the economic feasibility and benefits of RWH from the perspectives of both end-users and municipalities. The complete report compiled for this assessment is included in *Appendix B* of the *Second Stage Reconciliation Strategy*.

The following four scenarios were analysed as outlined below. The first two scenarios are considered from a municipal perspective where the municipality subsidises the installation of the RWH systems. These scenarios quantify the overall benefit to the municipality considering all formal housing units in the municipal area. The latter two scenarios are from a household's perspective where the household pays for the installation and would need to assess the offset of payment for municipal supply against the benefit of supply from the RWH system. The results for the latter two scenarios are therefore expressed per household and not as a collective benefit.

RWH from a municipal perspective

- *Scenario 1: Full conjunctive use*

  The maximum potential volume for rooftop RWH was determined by assuming full conjunctive use (i.e. making maximum use of rainwater at all times and switching to municipal supply only when unavoidable) of rainwater and municipal supply at maximum drawdown. In this scenario the use of rainwater is prioritised over municipal water supply. The drawdown was modelled as being close to the full monthly municipal water requirement for the variety of formal housing units. For this scenario it was assumed that households adopt point-of-use treatment of water to potable water standards.

- *Scenario 2: Reduced drawdown with conjunctive use*

  This scenario assumes rainwater is again used conjunctively with a reduced drawdown of the rainwater in storage. In this case rainwater is limited to secondary and outdoor uses, such as laundry, flushing of toilets, gardening and filling of swimming pools.

RWH from a household's perspective

- *Scenario 3: Conjunctive use with reliable alternative water supply*

  This scenario assumes that a reliable alternative water supply is in place, i.e. municipal supply. The household withdraws as much as possible of their water requirement from rainwater tanks, while only switching to alternative supply when the storage tank is empty.

- *Scenario 4: Conjunctive use with conservative drawdown*

  For this scenario it is assumed that an alternative water supply is either not available or unreliable, e.g. an informal housing unit with limited municipal supply. In this scenario households aim to minimise their "dry tank days" by reducing the drawdown from the storage tanks in winter months and varying the drawdown in summer. The typical households considered for this scenario is an RDP house with an average roof size of 40 m² and 5 000 ℓ storage tank capacity.

c) Results

Results from the analysis of the above scenarios are summarised below:

- **Scenario 1: Full conjunctive use with maximum drawdown**: The upper limit of the total potential RWH yield for all formal housing units in the eThekwini MM is 43 million m³/a.
- **Scenario 2: Conjunctive use with conservative drawdown**: For this option the total potential RWH yield for all formal housing units in the eThekwini MM is 33 million m³/a. This could potentially increase when non-residential buildings, such as industrial and city buildings, and informal housing units are included. However, the likelihood of achieving this volume will depend largely on public support in the various sectors.
- **Scenario 3: Conjunctive use with reliable alternative water supply**: The findings of the investigation concluded that for a suburban household with an average roof size of 200 m² and a storage tank with a capacity of 5 000 ℓ, the conjunctive use rainwater yield is 117.1 kℓ/a per unit. The conjunctive use rainwater yield for an RDP house with an average roof 40 m² or 60 m² and a storage tank capacity of 5 000 ℓ is 30.6 kℓ/a and 41.1 kℓ/a respectively, which is 43% and 57% of the Free Basic Water per unit.
- **Scenario 4: Conjunctive use with conservative drawdown**: The conservative drawdown rainwater yield for an RDP house with an average

roof size of 40 m² and storage tank capacity of 5 000 ℓ is 28.7 kℓ/a, which is equal to 40% of the Free Basic Water per unit.

d) Implementation of RWH

From a household perspective, the initial cost of implementation is offset by the savings in the cost of water that it would otherwise have paid to the municipality. With the implementation of RWH in rural areas, subsistence gardening can be motivated with the benefit of improved water supply. With the new building regulations requiring the flood flows at pre-development levels to be maintained at the developed site, the implementation of RWH can provide on-site flood attenuation. Stored rainwater can then be used for maintenance of the development or as a point-of-use water supplement.

From a municipality's perspective, investing in RWH could reduce the overall operational cost of the municipality's supply systems. More so, the cost of implementing RWH in the municipal area could compare better than the tankering of water to the rural areas, which was quoted at R170/kℓ (in 2009). Another benefit of RWH is that it could reduce the demand on current and planned water resources and related infrastructure.

A number of RWH initiatives were implemented in eThekwini MM, notably at the Dube Trade Port and Inanda Road sites. Flood flows are captured on-site and used for landscaping and general cleaning purposes, significantly reducing potable water demand.

e) Conclusion

The SSC supports the implementation of RWH within the Reconciliation Strategy Area, and recognises its significant potential benefits from both the household and municipal perspectives. Specifically, it is proposed that:

- Municipalities should consider incentivising the installation of RWH systems through subsidies.
- The implementation of RWH systems in the rural areas should be prioritised by municipalities to either supplement the water supply at standpipe level or tankering of water.
- Considering the temporal and spatial variability of rainfall, the optimum size for a rainwater tank should be determined for various areas and roof sizes.
- Proper training programmes should be developed to ensure the successful implementation and maintenance of RWH systems.

These initiatives could potentially reduce the overall cost of supplying water and improve the general quality of life in rural areas. Furthermore, subsidising the implementation of RWH systems could form part of the poverty alleviation plans of municipalities.

5.3 WATER QUALITY

A high-level overview of the water quality characteristics of the Reconciliation Strategy Area is provided in this section. The overview is based on information obtained from previous studies and investigations, most notably a detailed review undertaken as part of the Second Stage of the original *Reconciliation Strategy Study* (DWAF, 2009), a subsequent *Surface Water Resource Quality Assessment* by DWS (2015) and the Umgeni Water *Infrastructure Master Plan 2016* (Umgeni Water, 2016).

The aim of the review undertaken as part of the original *Reconciliation Strategy Study* was to develop an understanding of the water quality profiles of the major rivers in the Reconciliation Strategy area and included the uMngeni (and its major tributaries), uMdloti, Mvoti and uMkhomazi River catchments. The water quality profiles of the major rivers impact the treatability of the water resources. If the water is of poor quality, the cost of treating the water typically increases, with the worst case being that the water resource is no longer usable without an intervention, such as a specific blending rule or additional treatment processes. Declining water quality also affects the ecological functioning of the system and reduces the rivers suitability for human contact and recreation.

In the KZN Coastal Metropolitan Area, water quality has typically not had an overall impact on the availability of water in the system that can be considered for the reconciliation process and water balances.

A number of specific water quality parameters were selected as indicators that reflect the state of water quality for each river system, namely:

- Electrical Conductivity (EC) (in units of mS/m): Provides an indication of the salinity of the water resource.
- Orthophosphate (PO_4) (mg/ℓ): Indicates the nutrient levels in the water resource, with an excess generally contributing to eutrophication.
- Sulphate (SO_4) (mg/ℓ): Provides an indication of the impact of mining activities.
- Chloride (Cl) (mg/ℓ): Indicates the impact of agricultural and industrial activities and treated sewage effluent discharge.

- Ammonia (NH_3) (mg/ℓ): Indicates the level of toxicity of the water resource.
- pH: Indicates the impacts of mining activities and the natural variability.

The state of the each water resource was evaluated against a generic set of Resource Quality Objectives (RQOs) indicators identified by DWS (2015). The RQOs for domestic use are summarised in **Table 5.1**.

Table 5.1: Summary of RQOs

Range limits	EC (mS/m)	SO_4 (mg/ℓ)	Cl (mg/ℓ)	PO_4 (mg/ℓ)	NH_3 (mg/ℓ)	pH
Ideal	30	80	40	0.025	0.015	≥ 6.5 & ≤ 8.0
Acceptable	50	165	120	0.075	0.044	≥ 8.0 & ≤ 8.4
Tolerable	85	250	175	0.125	0.073	-
Unacceptable	> 85	> 250	> 175	> 0.125	> 0.073	< 6.5 & > 8.4

The following subsections provide a summary of the historical and current water quality profiles of the major river systems in the area.

5.3.1 North Coast WSS

a) Mvoti River

The Mvoti WTW is supplied from the Mvoti River. There were a number of instances in 2015 where turbidity exceeded the set RQOs. Also the algae non-compliance count increased compared to the previous year (Umgeni Water, 2016). The overall water quality is negatively affected by return flows from agriculture, urban areas and industries.

b) uMdloti River

The elevated algae counts and non-compliance of turbidity in the Hazelmere System can be ascribed to the low storage levels in Hazelmere Dam. This has, to some extent, affected the water treatment process at the Hazelmere WTW. Also of note is the significant increase from the previous year in the non-compliance of E. coli as a water quality indicator at the Hazelmere WTW (Umgeni Water, 2016).

c) Lower Thukela River

The water quality in the Lower Thukela River is at an acceptable level with indicators such as EC ranging between 70 and 300 mS/m (Umgeni Water, 2016).

5.3.2 Mgeni WSS

a) Mgeni River

The water quality in the upper part of the uMngeni River is at an acceptable level. The situation, however, deteriorates downstream of Nagle Dam where the river is joined by the Msunduzi River. Here the water quality is very poor with high conductivity, very high faecal contamination, very high nitrate concentrations, high ammonia, high phosphorus and high turbidity (DWAF, 2009).

The poor sewage infrastructure in the Mpophomeni Region, which has been an on-going problem, also leads to sewage contamination of Midmar Dam. The agricultural activities in the catchment area also contributed in the nutrients load which has resulted in elevated algae counts. Furthermore, Nagle Dam has shown an increase in the percentage of non-compliance of nitrates and E. coli in the river. However, there has been a significant improvement in the compliance with the turbidity limits as set out in the RQOs. Finally, the nitrate levels in Inanda Dam have improved over the past few years, although it has not yet reached 100% compliance with the RQOs. The observed turbidity in the catchment was also noted as being non-compliant with the RQOs on a number of occasions. The non-compliance of the nutrient levels in the catchment is largely due to sewer problems experienced in the Msunduzi DM with associated outfall into the Msunduzi River (Umgeni Water, 2016).

b) Mooi River Catchment

The water quality profile, specifically the nitrate and phosphate levels, of the Mooi River are at an acceptable level. However, an increasing trend has been noted in the nutrients and ammonia concentrations in the Mooi River (DWAF, 2009).

c) uMhomazi River

The uMkhomazi River Catchment is relatively undeveloped and no water quality problems have been experienced in this system (DWAF, 2009).

5.3.3 South Coast WSS

a) Mlazi and Lovu rivers

In the past, some water quality parameters in the Mlazi and Lovu catchments, specifically E. coli, turbidity and nitrates, were generally found to be non-compliant (DWAF, 2009). This has, however, improved in the last year, although

the algae count was still non-compliant on a number of occasions (Umgeni Water, 2016).

b) Mzinto River

The non-compliance to the RQOs in the Umzinto Region can be ascribed to the sewage input into EJ Smith Dam. The sewer problems experienced in this area have contributed largely to the elevated non-compliances (Umgeni Water, 2016).

c) Mtwalume River

The Mtwalume WTW abstracts water from the Mtwalume River. With no impoundment before the abstraction of water, point source and rainfall related pollution will have immediate effects on the raw water quality. Algae, E. coli and turbidity remained non-compliant in the uMtwalume Region. Most non-compliance can be ascribed to catchment runoff and rainfall events (Umgeni Water, 2016).

5.3.4 Conclusion

According to the Surface Water Resource Quality Assessment (DWS, 2015), the current overall water quality of the *Reconciliation Strategy Area* is of an acceptable level. The responsible authorities need to maintain the monitoring of the RQOs in the relevant resources and the implementation of treatment processes to ensure that the discharges and return flows from the various treatment works are compliant with the proposed Blue Drop and Green Drop requirements.

The gazetted Recommended Ecological Category (REC) for each catchment, as proposed in *Classification Study* (refer to **Section 7.1**), should either be maintained or achieved by implementing interventions to maintain or improve the water quality respectively. These interventions could have a negative impact on the future cost of water due to the increase in treatment processes and ultimately treatment costs.

6 RECONCILIATION SCENARIOS AND WATER BALANCES

6.1 NORTH COAST WSS

Due to the inter-connectedness of the Mdloti and Mvoti systems on the North Coast, the water balances of these systems have been integrated into a single water balance for the North Coast WSS. The current (November 2016) water balance is presented in Figure 6-1 and considers the existing water resources as well as the soon-to-be commissioned Lower Thukela BWSS Phase 1 (LTBWSS-1), as discussed earlier in Section 4.1.3). The water balance clearly shows (and this is currently being experienced) that the North Coast is currently experiencing a supply shortfall (negative balance) and the rapid growth in water requirements anticipated on this region requires the urgent implementation of further augmentation.

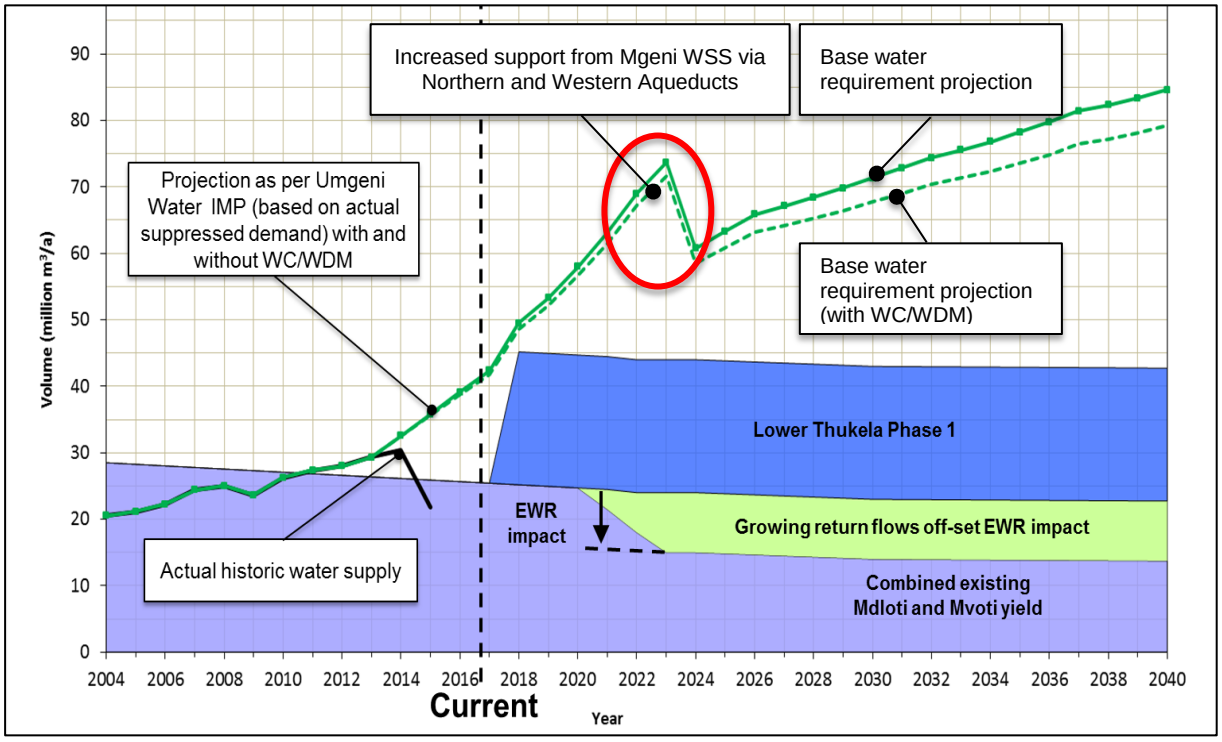

Figure 6-1: North Coast water balance with current infrastructure

For reconciliation planning purposes, two intervention scenarios have been identified for the North Coast WSS. Both scenarios assume the following:

- LTBWSS-1 is commissioned in 2016 (shown in a darker blue).
- The raising of Hazelmere Dam is completed by 2018 (shown in orange).
- LTBWSS-2 be commissioned by 2021 (shown in light blue).

In addition, two alternative options are considered to ensure longer-term water supply, as follows:

- **Option 1**: iSithundu Dam (as described in Section 4.1.4) is implemented and commissioned by 2035. This is shown in Figure 6-2.
- **Option 2**: Indirect re-use of treated wastewater via Hazelmere Dam (as described in Section 4.1.6). This option, which is shown in Figure 6-3, will address both effluent discharge constraints in the estuaries and make additional raw water available at Hazelmere Dam. Based on the estimated growth in available return flows this will result in the proposed iSithundu Dam being delayed beyond the planning horizon of 30 years.

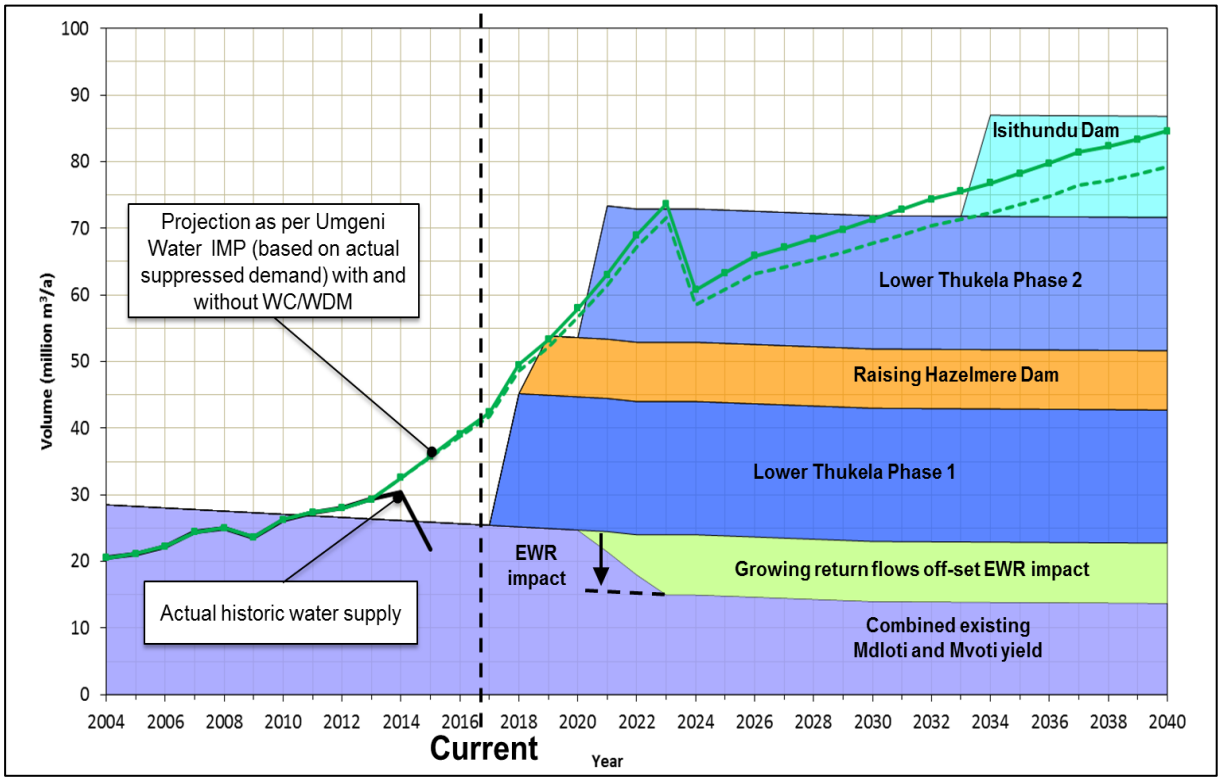

Figure 6-2: North Coast water balance with iSithundu Dam

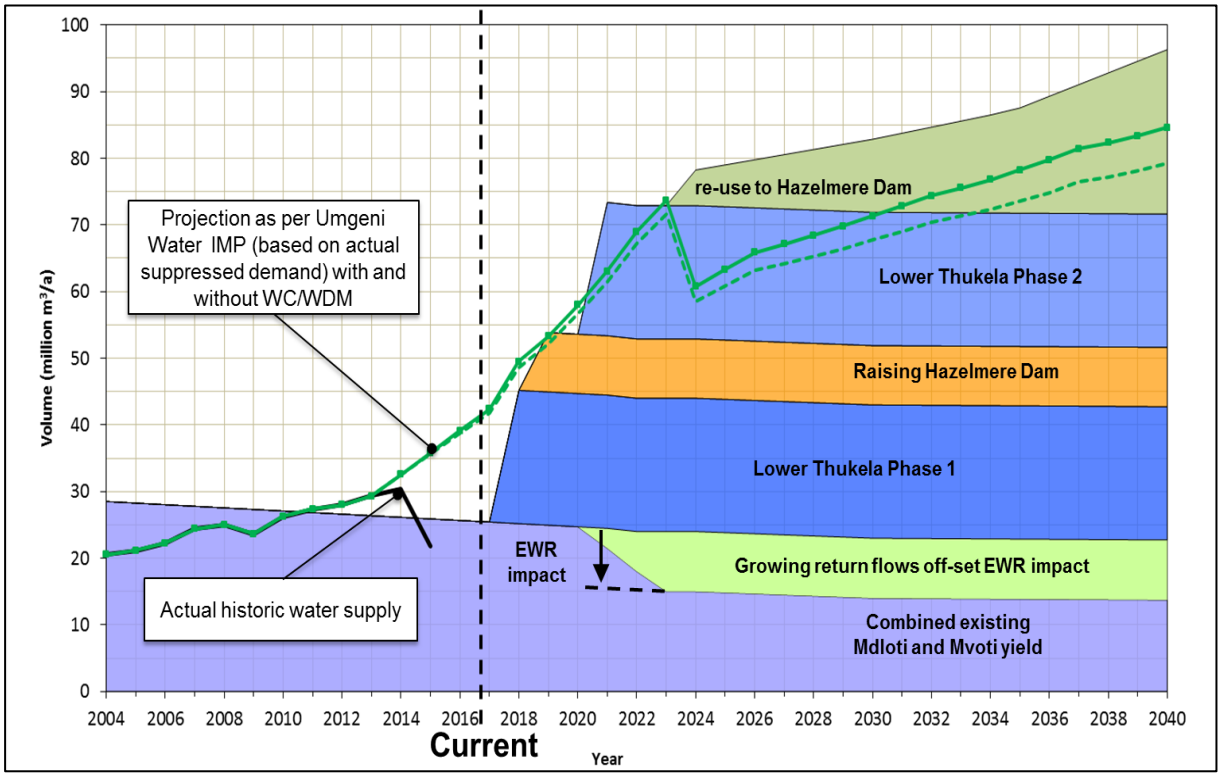

Figure 6-3: North Coast water balance with indirect re-use

Further points to note regarding the water balances shown above are the following:

- As discussed earlier in **Section 2.2.3** the reduction in water requirements on the North Coast WSS in 2024 results from moving a portion of the water supply from Hazelmere Dam onto the Mgeni WSS when the uMWP-1 is commissioned. This water will be supplied via the Northern and Western Aqueducts. Note that this implies the need for commissioning uMWP-1 and the new Northern Aqueduct by 2024 (as discussed in later in **Section 6.2**).
- The impact of implementing the Reserve and associated EWRs has been estimated as a decrease of 10 million m^3/a (shown as a decrease in the purple portion at the bottom of the water balances). Potentially, however, this will be off-set through increased return flow volumes as show in light green.
- The long-term option of either iSithundu Dam or the re-use of wastewater via Hazelmere Dam need to be compared from a cost perspective to support the selection process.

In this regard note that the earlier eThekwini MM *Total Outflow Strategy* (discussed in **Section 2.2.4**) focused only on the cost of indirect re-use from a treated effluent disposal perspective, and not from a water resource development perspective. A high-level cost comparison was therefore undertaken as part of this *Reconciliation Strategy Update* and included the difference in infrastructure costs associated with (i) pumping treated wastewater back to Hazelmere Dam;

and (ii) the less expensive option of a direct sea outfall. These results were then compared with the cost of iSithundu Dam, escalated to 2015 cost levels, and factoring in the yield impact of implementing new EWRs (as discussed earlier in **Section 2.5**).

In summary, the cost comparison showed that the benefit of indirect re-use depends on the period for which the iSithundu Dam option can be delayed. Since re-use could potentially meet the growth in water requirements beyond 2040, and the impact of new EWRs on the yield of iSithundu Dam will cause an increase in the unit cost of water, re-use currently appears to be the more favourable option. However, further investigations in this regard will have to be undertaken in order to support these findings.

6.2 MGENI WSS

a) Water balance scenarios

The current water balance of the Mgeni WSS is presented in **Figure 6-4**. For the period prior to the implementation of the MMTS-2 (Spring Grove Dam and Transfer Infrastructure) the system was in a potential supply shortfall situation (negative balance). While the MMTS-2, which was recently commissioned, did bring the system close to balance, a growing shortfall is still projected from 2015 onwards.

Furthermore, as discussed earlier in **Sections 2.2.3** and **3.1** the water requirements projection shown in **Figure 6-4** also account for the impacts of:

- The reduction in support from the Mgeni WSS to the South Coast WSS after the implementation of either the proposed Lower uMkhomazi BWSS (Ngwadini Dam) or the desalination of seawater in 2022.
- Increasing the support from the Mgeni WSS to a portion of the area currently supplied from Hazelmere Dam, through the Northern and Westerns aqueducts, in 2024.
- The potential impacts of system attrition due to the aging and deterioration of water supply infrastructure (higher dashed black line) and the implementation of appropriate WC/WDM initiatives (lower dashed black line).

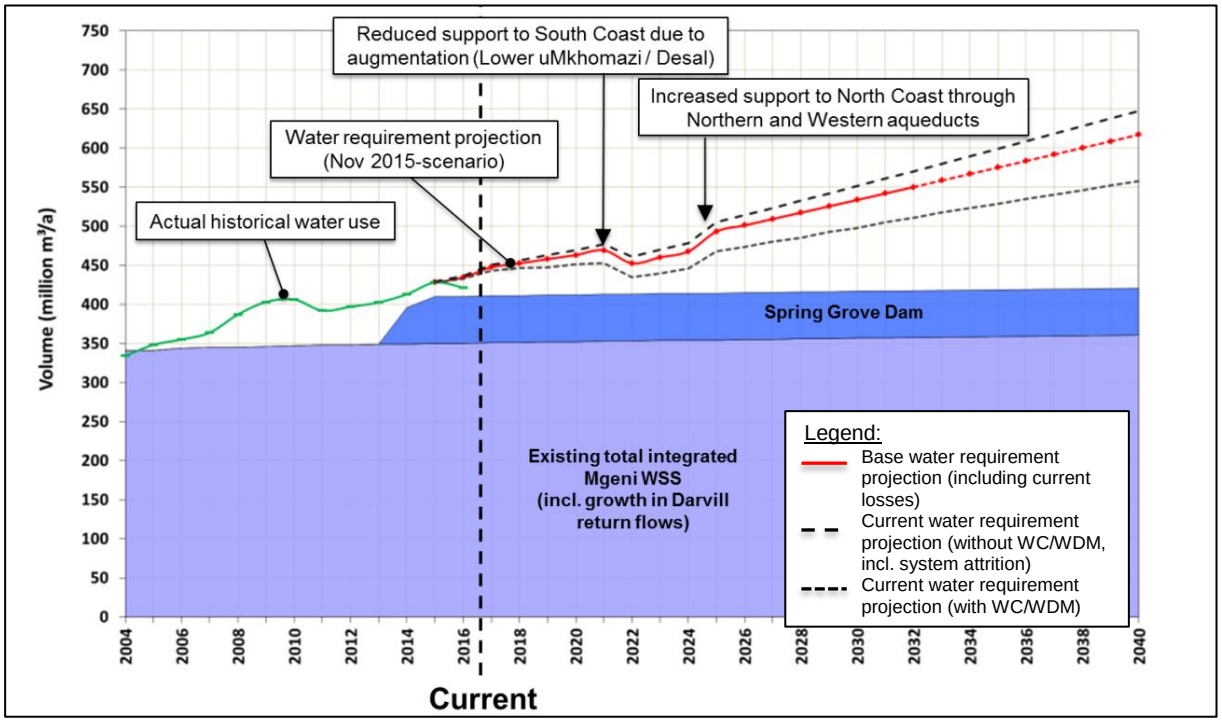

Figure 6-4: Mgeni water balance with current infrastructure

While the water balance clearly shows the significant benefit of WC/WDM, this will only reduce the projected shortfall and not eliminate it completely. Further infrastructure developments are therefore required in the Mgeni WSS to augment existing water resources. Within this context, three intervention scenarios have been identified for the Mgeni WSS as outlined below:

- **Option 1**: Implementation of either the direct re-use of treated wastewater or the desalination of seawater on the North Coast, followed by the uMWP-1 (shown in **Figure 6-5**).
- **Option 2**: Implementation of both direct re-use and desalination, followed by a delayed uMWP-1 (shown in **Figure 6-6**).
- **Option 3**: Implementation of only the uMWP-1 (shown in **Figure 6-7**).

Note that all of these options include the re-mix pilot plant project by the eThekwini MM (discussed earlier in **Section 4.2.4**) – although the associated volume is relatively small at under 3 million m^3/a and therefore barely visible on the system water balance.

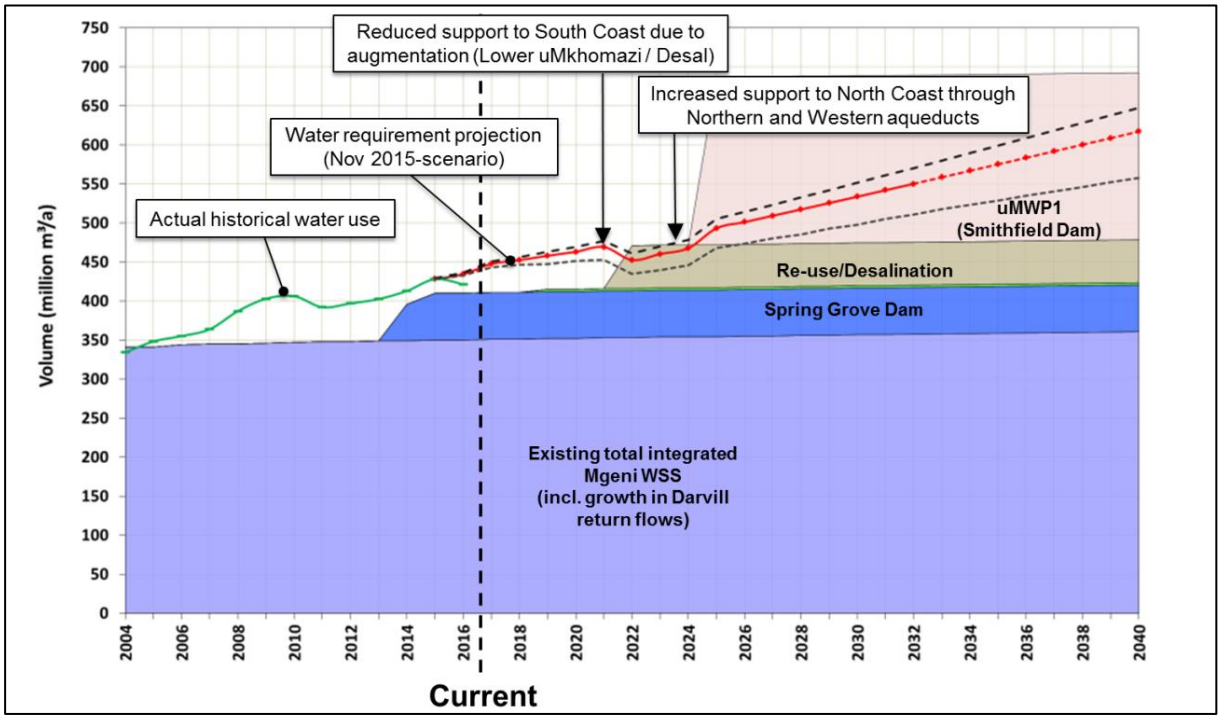

Figure 6-5: Mgeni water balance with re-use or desalination and then uMWP-1

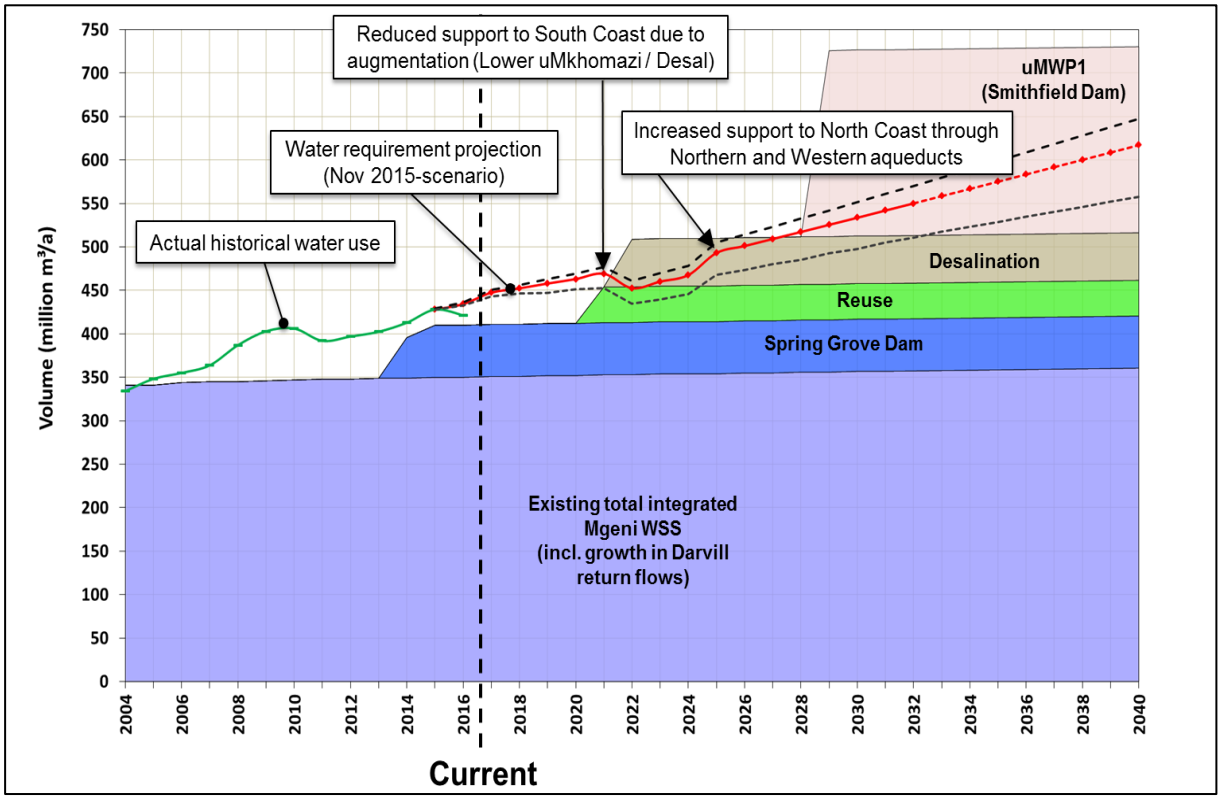

Figure 6-6: Mgeni water balance with re-use and desalination and delayed uMWP-1

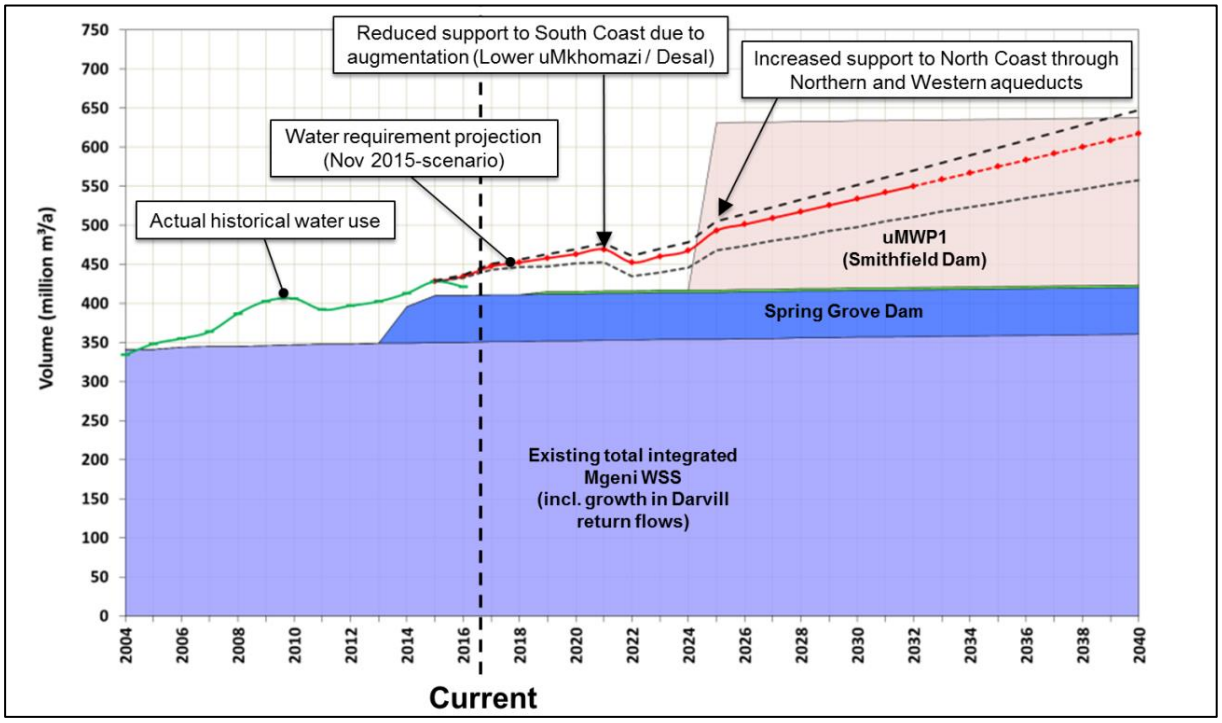

Figure 6-7: Mgeni water balance with uMWP-1 only

Based on the water balances shown above the following is noted:

- Even with the recently commissioned MMTS-2 (Spring Grove Dam and Transfer Infrastructure) the Mgeni WSS remains in a shortfall situation after 2015, which will increase over time until the system can be further augmented.
- If either the re-use or desalination option is implemented a positive water balance can be maintained from 2022. However, the uMWP-1 (Smithfield Dam and Transfer Infrastructure) will still need to be commissioned by no later than 2024.
- If both re-use and desalination are implemented, the uMWP-1 will be delayed, although only for 4 to 5 years.
- The re-use and desalination options both have high energy and operation and maintenance (O&M) costs. As a result, it is conceivable that these plants may be decommissioned when the uMWP-1, a gravity scheme, is commissioned. This scenario is shown in **Figure 6-8**.
- If the uMWP-1 is implemented without re-use or desalination, a longer period of potential shortfall of about seven years is projected, from 2017 to 2023. The cost of implementing either re-use or desalination to reduce the water supply risk for only 2 to 3 years is very high and most likely not practical.

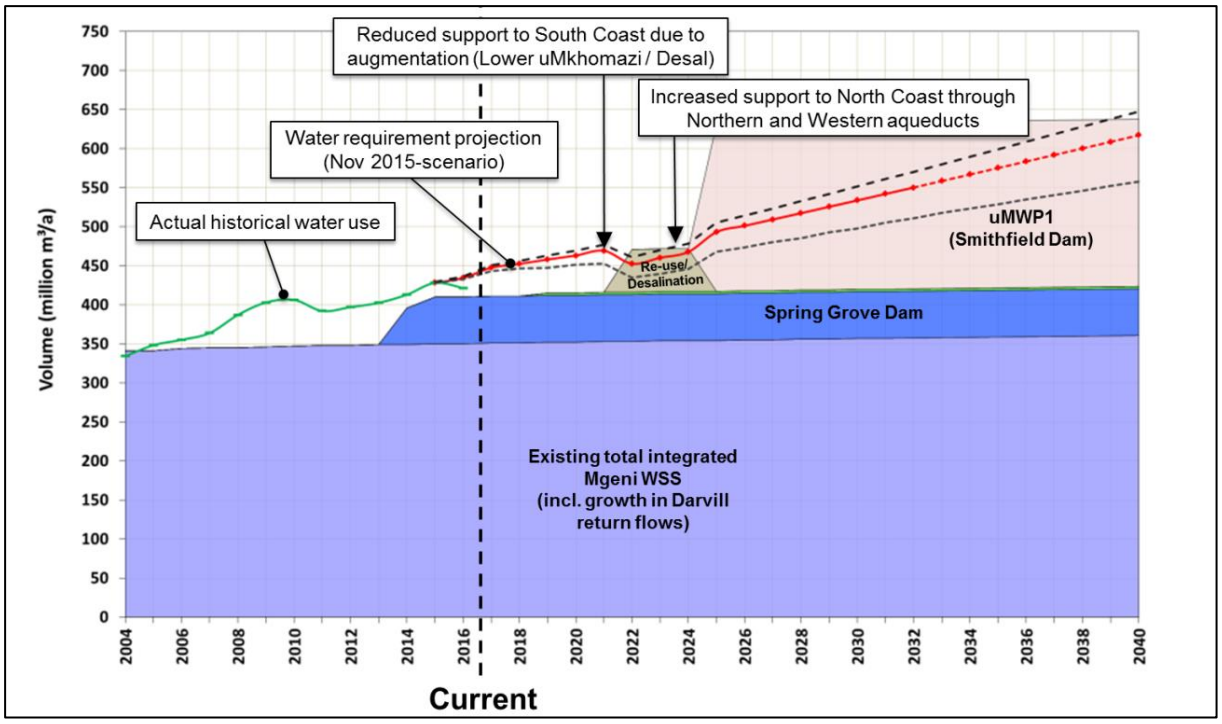

Figure 6-8: Mgeni water balance with decommissioning of re-use/desalination

b) Risk assessment

The water balances discussed above clearly illustrate the urgent need for augmenting the Mgeni WSS and that the uMWP-1 (Smithfield Dam and Transfer Infrastructure) needs to be commissioned as soon as possible. Of interest is that the projected seven-year shortfall period (2017 to 2023) will be similar in length and magnitude to that which was experienced in the system prior to the commissioning of Spring Grove Dam (i.e. 2006 to 2014). It was fortunate that during this period above average rainfall was experienced, thereby masking the reality that the system was in a deficit situation. This may not be the case in the future projected deficit period.

Within this context, an assessment was undertaken to quantify the possible implications for water users in the Mgeni WSS of the projected shortfall, based on the risks of non-supply during the shortfall period. The assessment involved a comparison of (i) projected water requirements in the system; and (ii) projected water supply, based on both water volume and assurance of supply characteristics. The approach and results of the assessment are discussed below.

Projected water requirements

As discussed earlier in Section 2.6 a specific water use priority classification and assurance of supply criteria have been adopted for the Mgeni WSS. Disaggregating the total projected water requirements in the Mgeni WSS (as discussed earlier in Section 2.2) into the volume that would be required in each of the four priority classes results in a plot as shown in Figure 6-9.

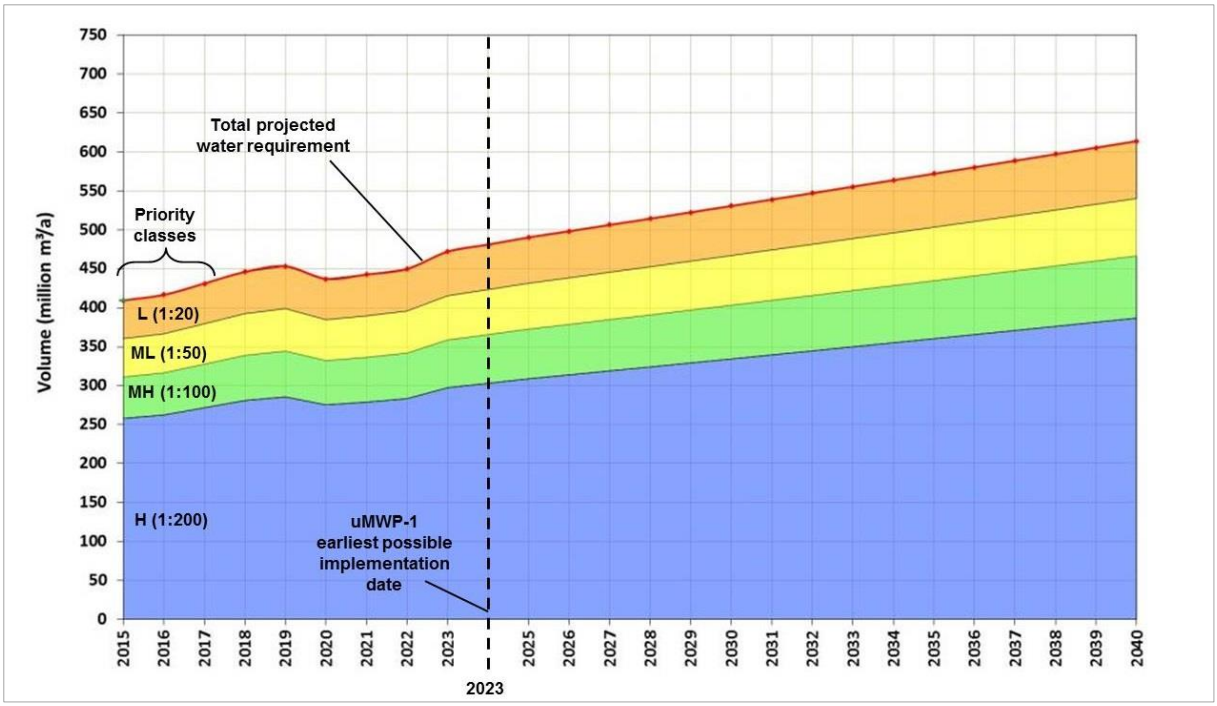

Figure 6-9: Mgeni projected water requirements per priority classes (see Table 2.1)

Projected water supply

The projected supply of water to users in the Mgeni WSS was modelled using the *Water Resources Planning Model* (WRPM) to analyse two scenarios as follows:

- **Scenario 1: Full water requirement is targeted**: Under this scenario, projected water requirements (as shown earlier in Figure 6-9) are fully supplied when water is available in the system. The result is presented in Figure 6-10 and shows how achievable assurances of supply will decrease significantly over time.
- **Scenario 2: Water supply is curtailed**: For this scenario, water supply is curtailed based on a combination of (i) the current assurance of supply characteristics of the system; and (ii) the assumption that lower priority water use will be curtailed in order to protect the higher priority water user. The result is presented in Figure 6-11 and shows an increasing shortfall in water supply (in red), totalling almost 20% of the total water requirement in 2023 –

currently considered to be the earliest possible implementation date of uMWP-1.

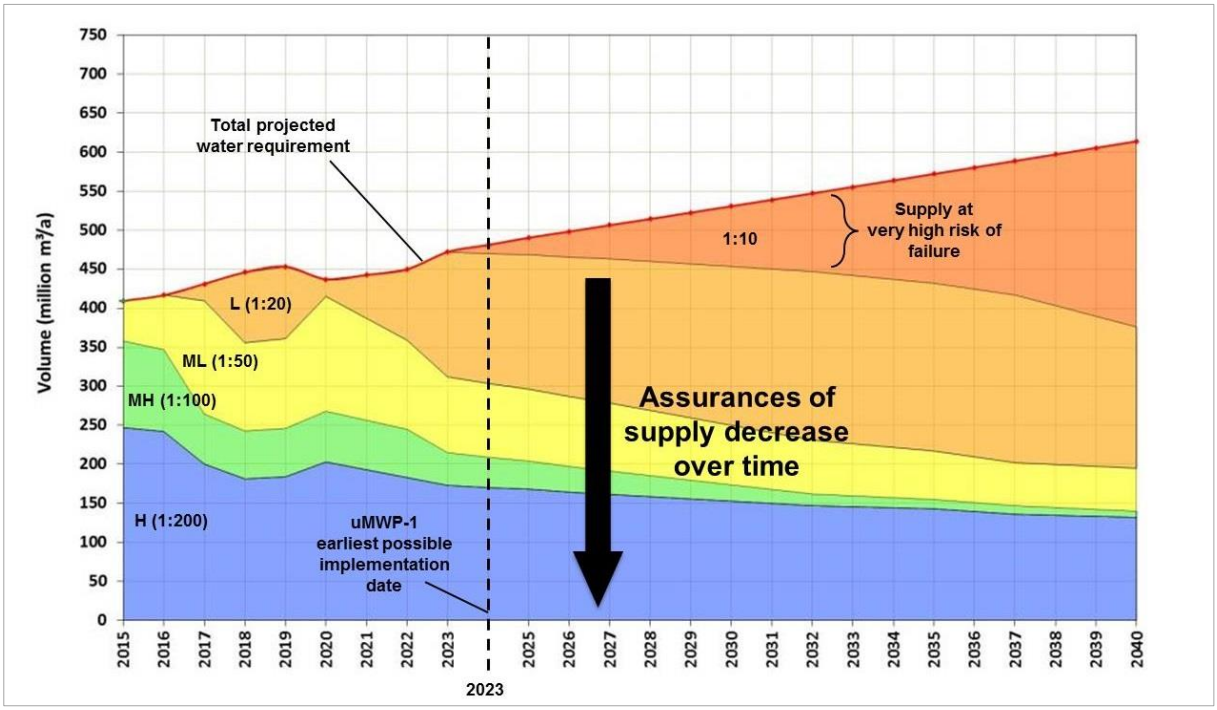

Figure 6-10: Mgeni projected water supply, targeting full water requirement

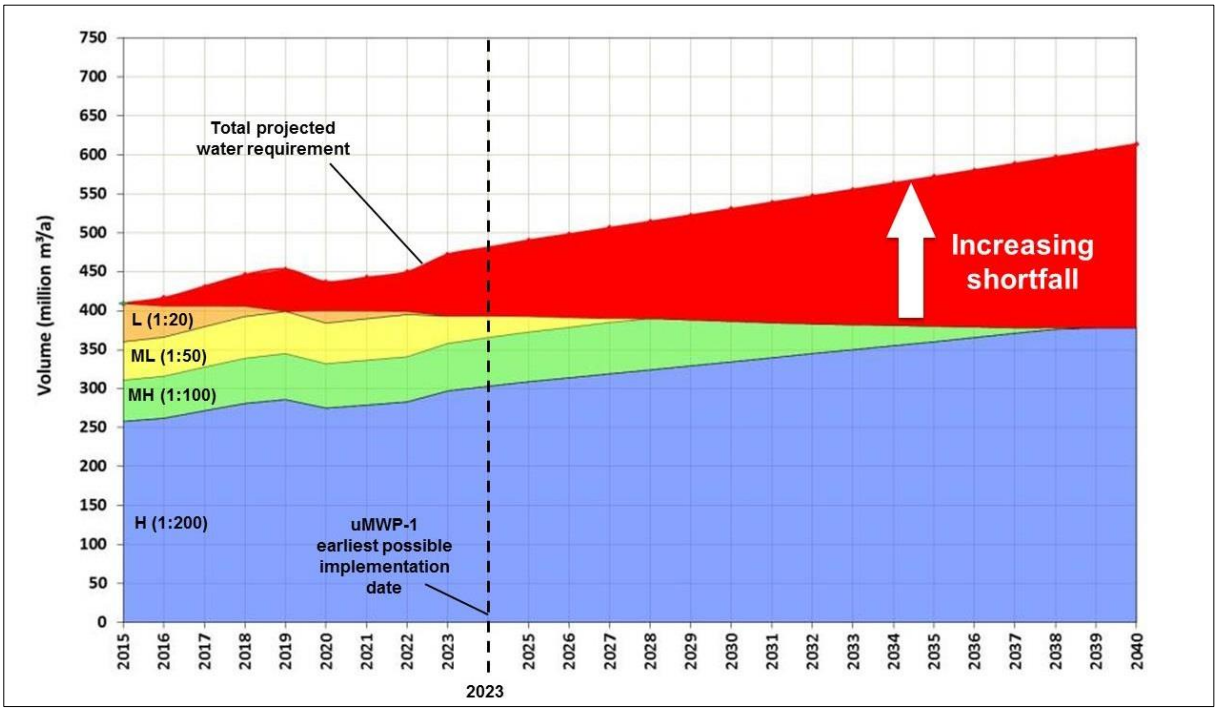

Figure 6-11: Mgeni projected water supply, with curtailments

These results confirm that water users in the Mgeni WSS are at significant risk of experiencing one of the following situations prior to the implementation of the uMWP-1:

- Without curtailments, water supply at the required levels of assurance of supply will continue to decrease, and eventually reach an unacceptably high risk of failure.
- Even with curtailments, an increasing shortfall in water supply if water use is curtailed based on available water resources.

Furthermore, it is also clear that the situation will increase in severity if the implementation of the uMWP-1 is delayed. This will result in more regular water restrictions and possibly significant negative socio-economic impacts. The implementation of the uMWP-1 must therefore be prioritised with focused decision making and adherence to the project programme. It should be noted that the perception of whether the projected risks are acceptable will most likely vary from one institution to another. However, the risk should be evaluated against the potential monetary savings associated with not implementing costly interim intervention options such as re-use or desalination prior to the uMWP-1.

6.3 SOUTH COAST WSS

The South Coast WSS includes the upper and middle south coast areas from Amanzimtoti in the north to Mtwalume in the south. The system is supplied by the following resources:

- Nungwane Dam with treatment at the Amanzimtoti WTW.
- Umzinto and EJ Smith Dams with treatment at the Umzinto WTW.
- A run-of-river abstraction on the Mtwalume River and treatment at the Mtwalume WTW.
- The South Coast Augmentation (SCA) scheme that delivers water from the Mgeni WSS, treated at the Wiggins WTW, and delivered to Amanzimtoti. The SCA was recently upgraded with new booster pumps and now represents the largest water resource for the South Coast WSS.

The current water balance for the South Coast WSS is shown in **Figure 6-12**. The existing water availability represents both local resources (shown in light blue) as well the support from the Mgeni through the SCA pipeline (shown in dark blue). Projected water requirements are shown as red lines, with and without the planned implementation of WC/WDM initiatives.

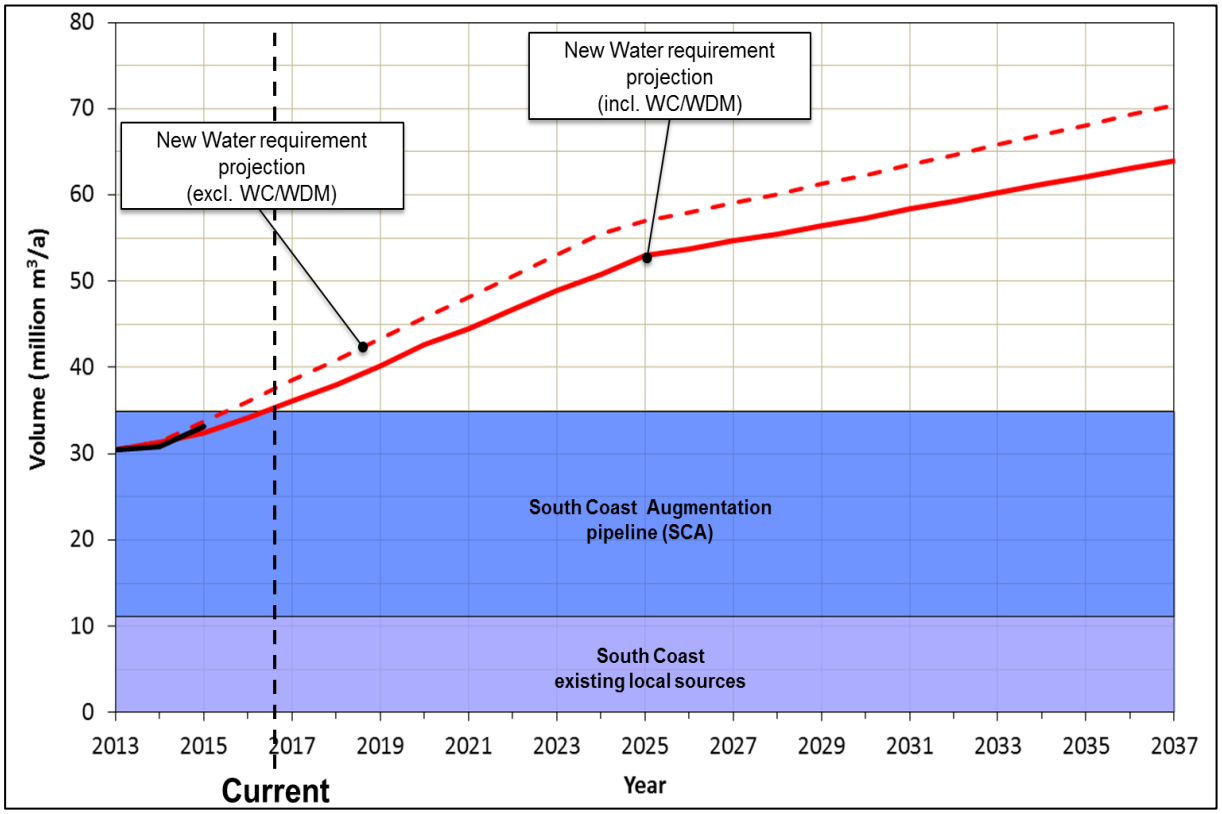

Figure 6-12: South Coast water balance with current infrastructure

For reconciliation planning purposes, the following two intervention scenario options have been identified for the South Coast WSS, as describe below:

- **Option 1**: Implementation of either the proposed Lower uMkhomazi BWSS (Ngwadini Dam, as discussed Section 4.3.2) or the desalination of seawater, as shown in Figure 6-13 (both schemes represented in green). With earliest implementation in 2019/2020 a short-term shortfall is likely around 2018 to 2019. WC/WDM initiatives will be a key measure in minimising risk over this period, as well as for long-term sustainable supply once the system is augmented.
- **Option 2**: The water balance in Figure 6-14 illustrates that once the South Coast is augmented (as for **Option 1**) the support currently provided from the Mgeni through the SCA can be reduced (as discussed earlier in Section 6.2).

From the water balances the following is noted:

- The South Coast needs to be augmented as soon as possible, while a short-term potential deficit period is likely as neither of the schemes can be implemented fully in time.

The augmentation of the South Coast will allow the volume supplied from the Mgeni WSS to augment the South Coast to be reduced for some time. This can provide some short term assistance to the Mgeni WSS.

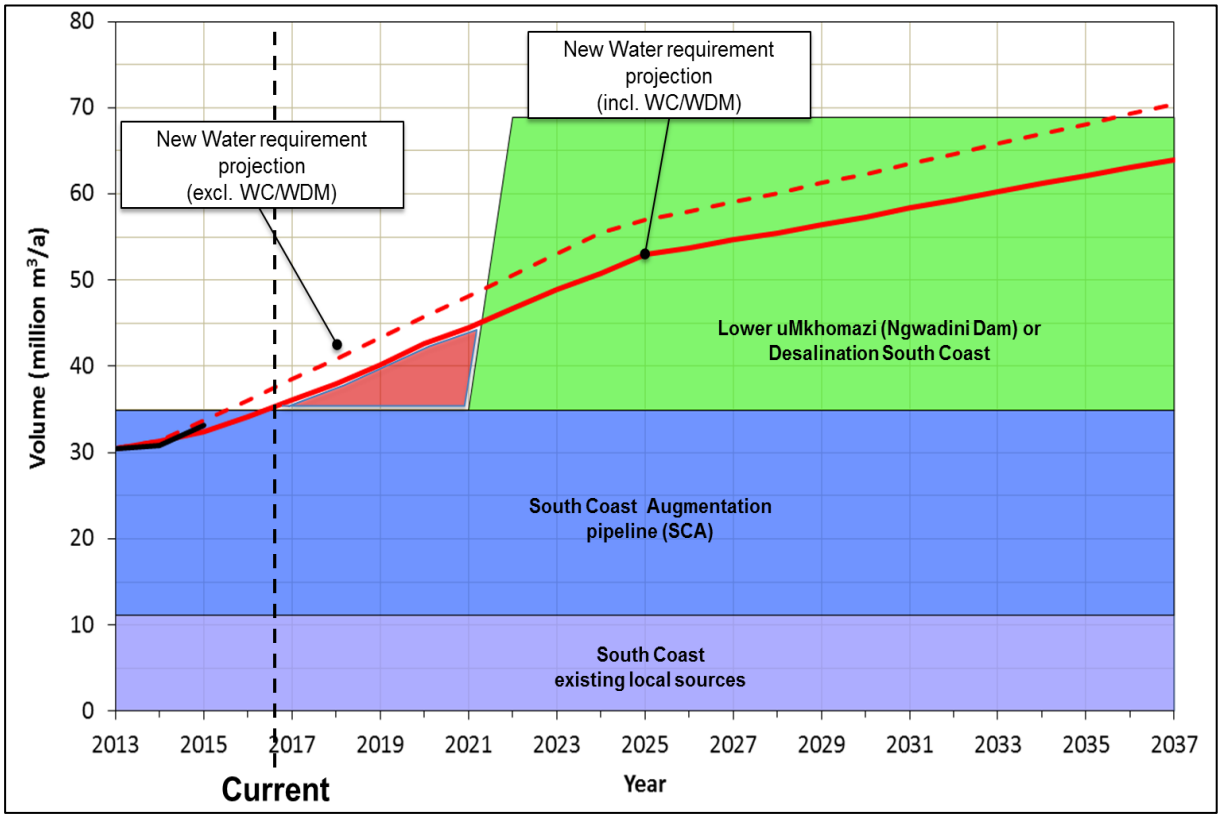

Figure 6-13: South Coast water balance with augmentation

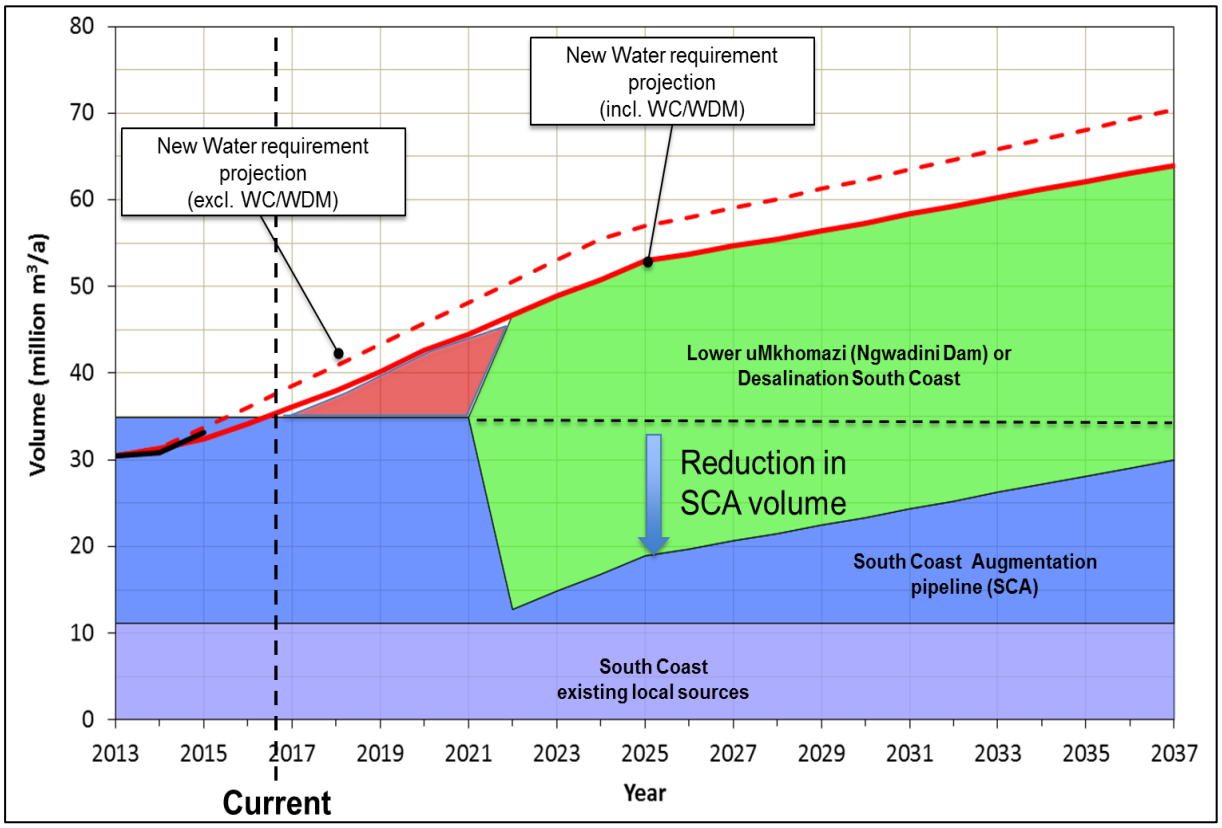

Figure 6-14: South Coast water balance with augmentation and reduced Mgeni support

7 OTHER ELEMENTS IMPACTING THE STRATEGY

7.1 CLASSIFICATION OF WATER RESOURCES

The DWS has recently concluded the *Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area* (DWS, 2015) and the proposed classes of water resources and Resource Quality Objectives (RQOs) published in the *Government Gazette* of 17 June 2016 (Government Gazette, 2016).

The study extended across the entire U-primary catchment and therefore included a number of major catchments and estuaries located within the Reconciliation Strategy area, most notably, the uMkhomazi, uMngeni, and Mvoti River catchments. It should be noted that the eventual implementation of the RQOs and associated EWRs will require careful consideration in subsequent updates of the Strategy.

7.1.1 uMkhomazi River Catchment

The recommended *Classification Study* scenario for the uMkhomazi River Catchment is referred to as “MK21” under which the following was assumed:

- 2040-development levels.
- Meeting the Recommended Ecological Category (REC).
- Implementation of Smithfield Dam as well as the Ngwadini Off-channel Storage Dam (as discussed in **Sections 4.2.3** and **0**, respectively).

The results are shown in **Figure 7-1** and **Table 7.1**.

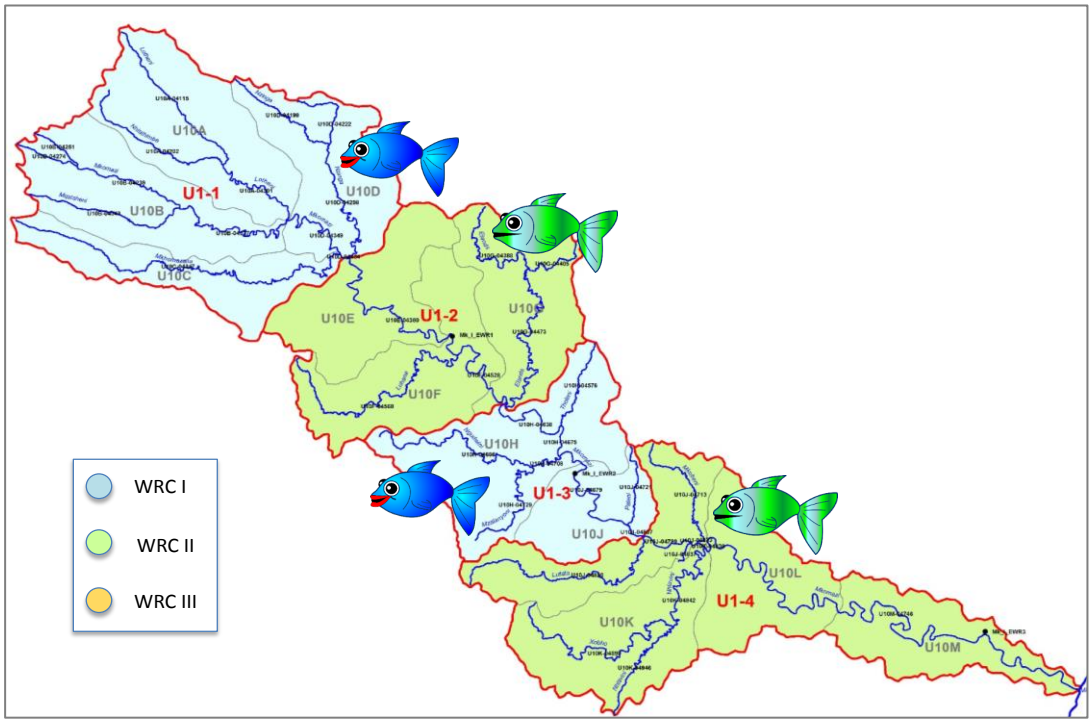

Figure 7-1: Classification of the uMkhomazi River catchment (sourced from the Classification Study (DWS, 2015))

Table 7.1: Proposed ecological classes for the uMhkomazi River Catchment (sourced from the Classification Study (DWS, 2015))

IUA	Class	River	PES	REC	Implications	Target EC
U1-1	I	Nzinga	B/C	B	Difficult to achieve the REC as catchment management would be required to amongst others manage sedimentation.	B
U1-1	I	uMkhomazi	B/C	B	Difficult to achieve the REC as catchment management would be required to amongst others manage sedimentation.	B
U1-2	II	Elands	C	B	Target improvement especially in the upper reach. Buffer zone, alien removal, water quality practices. Also flow improvements but should be able to reach at least a B/C without any improvement in flow.	B
U1-3	II	Ngudwini	B/C	B	Address erosion to reduce sedimentation (overgrazing, forestry, informal agriculture). As none of the scenarios are relevant to this SQ, the improvement is valid irrespective of the recommended scenario.	B
U1-4	II	Mkobeni	C	B	Riparian buffer zone in forestry and agricultural areas. Also alien removal. As none of the scenarios are relevant to this SQ, the improvement is valid irrespective of the recommended scenario.	B
U1-4	II	Lufafa	B/C	B	Erosion control, riparian buffer. Due to the catchment scale of the problem, this is deemed to be difficult and the PES must be maintained.	B/C
U1-5		uMkhomazi Estuary	C	B	Remove sand mining from the upper reaches to increase natural function, i.e. restore intertidal area. Restoration of vegetation in the upper reaches and along the northern bank in the middle and lower reaches, e.g. remove alien vegetation and allow disturbed land to revert to natural land cover (is already on upwards trajectory). Curb recreational activities in the lower reaches through zonation and improved compliance. Reduce/remove cast netting in the mouth area through estuary zonation or increased compliance.	B/C

The conclusions and recommendations from the assessment are:

- River nodes require improvement based on non-flow-related/anthropogenic issues that have to be addressed.
- Smithfield Dam has to have specific EWR releases so that the operating rules will not impact on the class and the overall state of the river.
- With the implementation of Smithfield Dam the river geomorphology, fish and invertebrates will be in a worse state than present.
- If operated according to the recommended scenario, however, it is anticipated that the dam will positively impact upon the gross domestic product (GDP) and job creation.

7.1.2 uMngeni River Catchment

Results for the uMngeni River Catchment are presented below. In all future scenarios selected for the reserve the system was analysed with current operating rules as well as an assumed release of 1.5 m³/s from Inanda Dam.

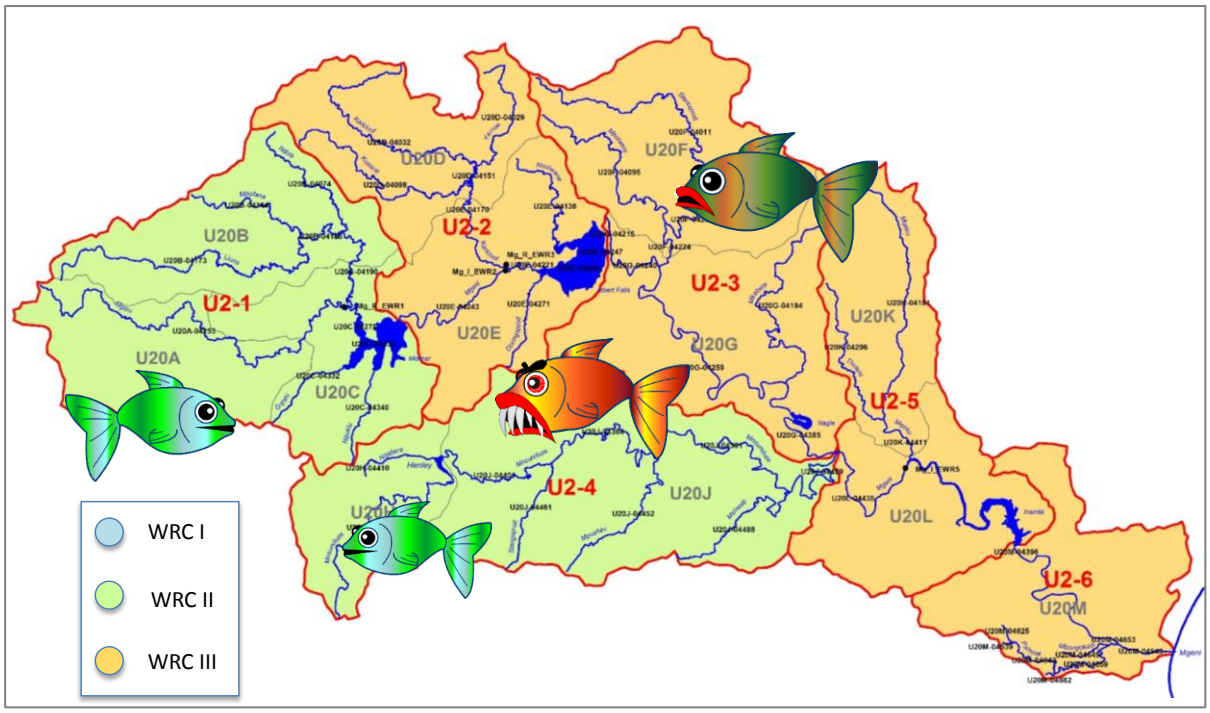

Figure 7-2: Classification of the uMngeni River catchment (sourced from the Classification Study (DWS, 2015))

Table 7.2: Proposed ecological classes for the uMngeni River Catchment (sourced from the Classification Study (DWS, 2015))

IUA	Class	River	PES	REC	Implication	Target EC
U2-1	II	Ndiza	B/C	B	Reinstate riparian zone in forestry.	B
		Lions	C	B	Reinstate riparian zone in forestry and wetland buffers. Address irrigation return flows (wq) & town runoff	B
		Lions	B/C	B	IBT a given - constant flows, no seasonality, but reinstating wetland buffers (off channel) and riparian river zones	B
		Gqishi	B/C	B	Riparian zone buffer to be improved.	B
U2-2	III	Yarrow	B/C	B	Agricultural area - wetland buffers,	B
		Karkloof	B/C	B	Reinstate riparian buffer zone and wetland buffers.	B
U2-4	III	uMnsunduze	D/E	D	Water quality improvement	D
		Mpushini	B/C	B	Water quality from Ashburton amongst others.	B
		Mshwati	B/C	B	Lower section in worse state. Reinstate riparian zone, address erosion.	B
U2-5	III	Tholeni	C	B/C	Riparian zone buffer to be improved.	B/C
		Mqeku	B/C	B	Riparian zone buffer to be improved.	B

The conclusions and recommendations from the assessment are:

- Current and planned system operating rules, including projected water use and return flows can be implemented.
- Scenarios analysed focused on assessing how future operation conditions could influence the ecological health. There will mostly be improvement, except for the period just after augmentation of the Mngeni WSS.
- Scenarios analysed achieved the REC and did not reduce the yield of the uMngeni WSS.
- Future scenarios are anticipated to positively impact upon GDP and job creation.

7.1.3 Mvoti River Catchment

For the selected *Classification Study* scenario the following was assumed:

- Updated water requirement and return flow projections.
- Meeting the REC.
- The implementation of iSithundu Dam and iMvutshane Dam.

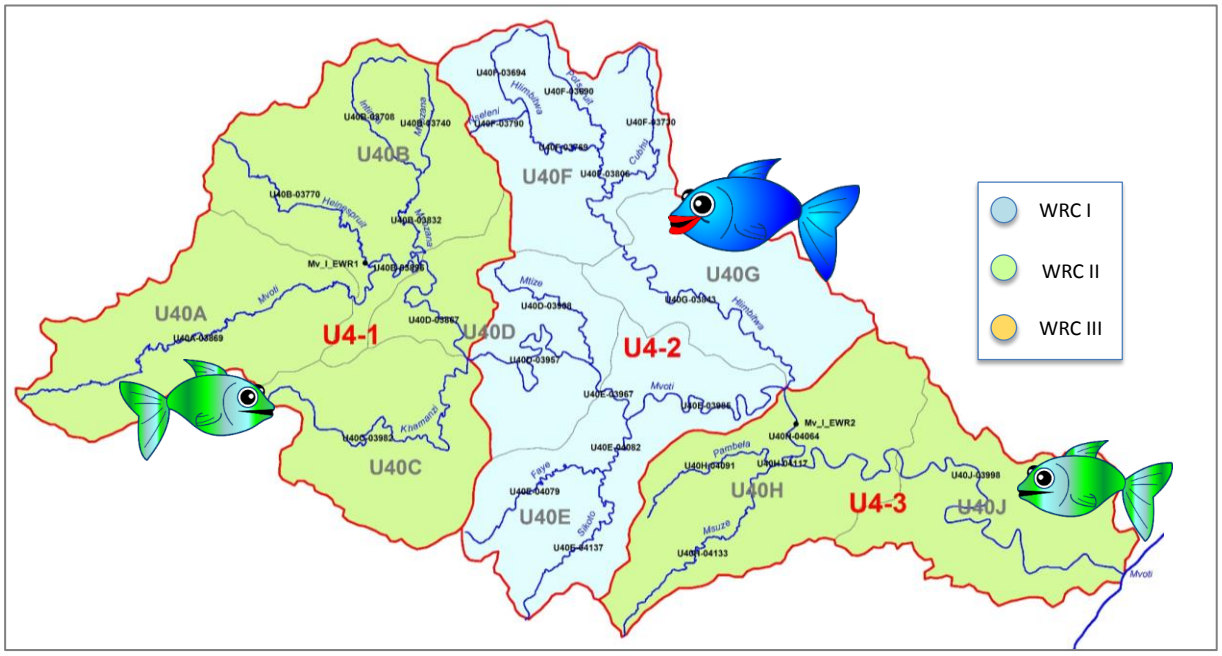

Figure 7-3: Classification of the Mvoti River catchment (sourced from the Classification Study (DWS, 2015))

Table 7.3: Proposed ecological classes for the Mvoti River Catchment (sourced from the Classification Study (DWS, 2015))

IUA	Class	River	PES	REC	Implication	Target EC
U4-1	II	Mvoti	B/C	B	Improve riparian buffer in forestry and agriculture areas.	B
U4-1	II	Khamanzi	B/C	B	Improve riparian buffer in forestry and agriculture areas.	B
U4-3	II	Pambela	B/C	B	Reinstate riparian zone.	B
U4-3	II	Nsuze	B/C	B	Reinstate riparian zone.	B
U4-3	II	Nsuze	B/C	B	Reinstate riparian zone, erosion control.	B
U4-4		Mvoti Estuary	D	C	Improvement of oxygen levels in the estuary, through for example, removal of the high organic content from the Sappi Stanger effluent. Reduce the nutrient input from the catchment by 20%. Remove the sugarcane from the Estuary Functional Zone.*	C

The conclusions and recommendations from the assessment are:

- River nodes require improvements based on non-flow-related/anthropogenic issues that have to be addressed.
- iSithundu Dam will require specific EWR releases so that the operating rules will not impact on the class and the overall state of the river.
- With the implementation of iSithundu Dam the river geomorphology and fish will be in a worse state than present.
- If operated according to the recommended scenario, however, it is anticipated that the dam will positively impact upon GDP and job creation.

7.1.4 Estuaries

Finally, conclusions and recommendations were made in the *Classification Study* based on the assessment of estuaries, as follows:

- All wastewater generated within the uThonghati River Catchment must be re-used indirectly via Hazelmere Dam (as described earlier in **Section 4.1.6**).
- Treated wastewater effluent discharged into the uMdloti Estuary may be increased up to the assimilative capacity of the estuary.
- However, it is acknowledged that the implementation of indirect re-use could take many years. Therefore, as an interim approach to accommodate the pressures of development, further discharge into the uThonghati Catchment may be allowed, but it must be noted that this will reduce the ecological health of the estuary to very poor over the medium-term.
- WwTWs must be designed for expansion to accommodate indirect re-use. As a result, the REC will be achieved over the long-term, resulting in an improvement of the current state.
- The recommended EWR must be implemented at the uMngeni Catchment and the pumping scheme to the Mgeni WSS operated for the Umhlanga Estuary.
- No further waste must be discharged into the uMkhomazi Estuary.
- Further waste could be discharged in the Little Amanzimtoti and Mbokodweni rivers, as long as estuaries stay within acceptable standards for human use, such as recreation.

7.2 CLIMATE CHANGE

It is widely accepted that the climate is changing globally and that this could have an amplified impact on water resources and therefore on water security and supply. Within this context Umgeni Water conducted an *Assessment of the Potential Impact of Climate Change on the Long-Term Yield of Major Dams in the Mgeni River System* (Umgeni Water, 2012). The Mgeni River System was selected for the assessment since it serves as the main source of water for the central KZN Region and therefore the important role it plays in the operations of Umgeni Water.

The assessment involved a specialist study aimed at:

- Developing a practical methodology for assessing the potential impacts of climate change on water resources systems.

- Obtaining runoff time-series data for the uMngeni River Catchment representing 31 possible climate futures, comprising selected combinations of 14 different General Circulation Models (GCMs), from 12 different international research institutions and for five different CO_2-emission scenarios.
- Applying these data sets in an existing Water Resources Yield Model (WRYM) configuration for the Mgeni WSS.
- Based on the modelled results draw conclusions regarding the possible impacts of climate change on the region's water security.
- Make recommendations for the development of adaptation strategies aimed at mitigating negative impacts.

The results of the study are summarised in Figure 7-4 and system yield for the *Intermediate Future* time-horizon (2046 to 2065) presented relative to that of the *Present* time-horizon, for each climate future scenario. The results are representative of the total (combined) yield of the Mgeni WSS at a recurrence interval of 1:100-years (annual assurance of supply of 99%).

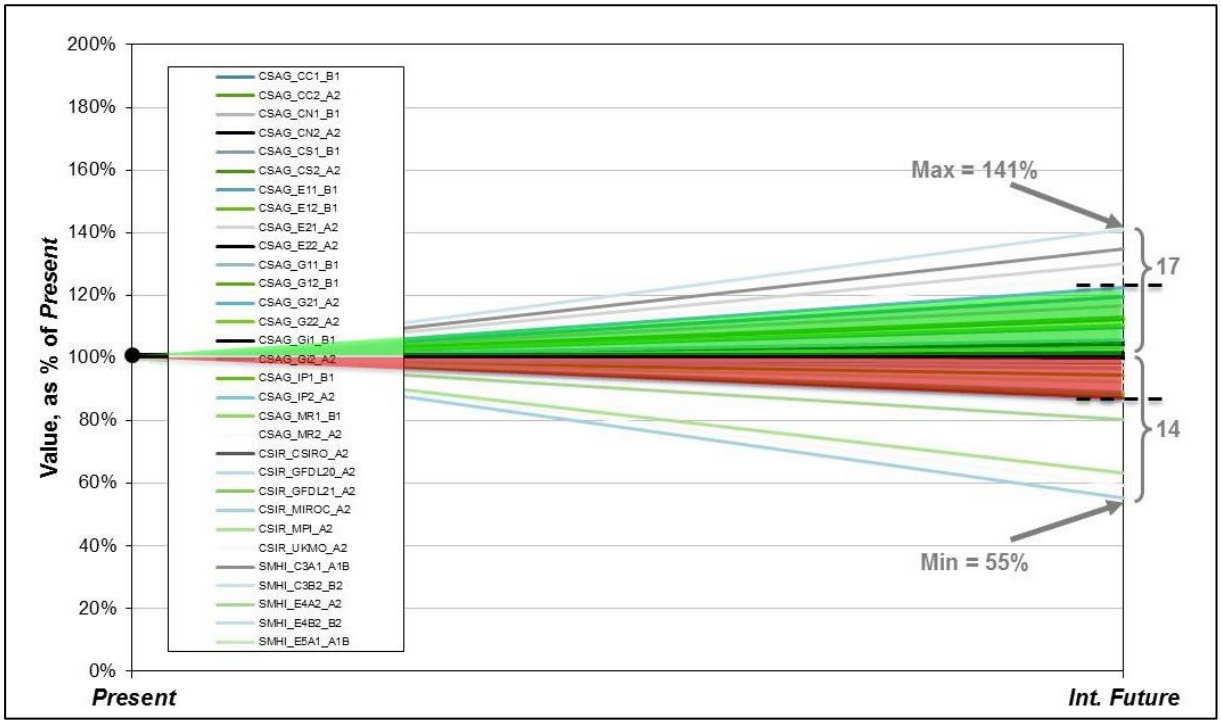

Figure 7-4: Yields for 31 selected climate change scenarios for the Mgeni WSS (*Intermediate Future*)

The results suggest a large variance ranging from a 41% increase in system yield (17 scenarios) to a decrease of 45% (14 scenarios). However, by discarding the highest and lowest three scenarios as "outliers" a much narrower band of results

emerges, ranging from a 25% increase (shown in green) to a 15% decrease (shown in red).

To assess the potential impact of these results on the Reconciliation Strategy, the water balance of the Mgeni WSS (as discussed earlier in **Section 6.2**) was used as a basis and adjusted to represent a growing climate change impact up to the *Intermediate Future*. The resulting water balances are shown in **Figure 7-5** and **Figure 7-6**.

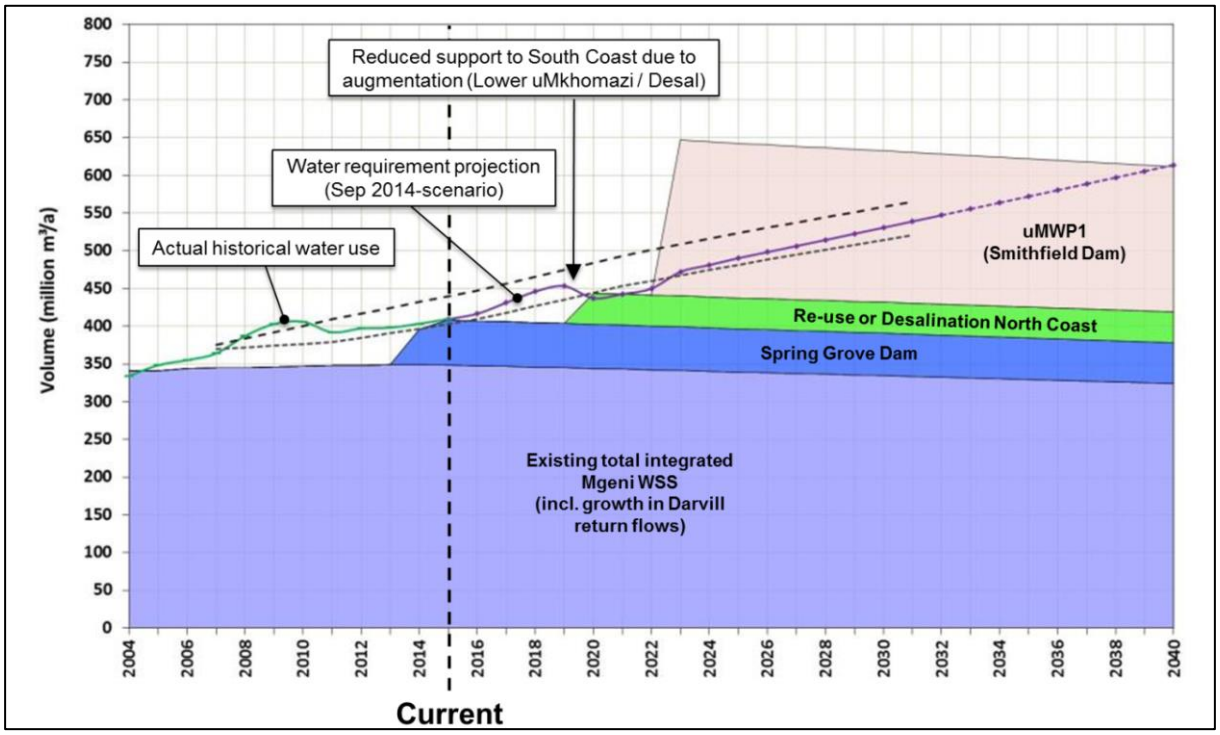

Figure 7-5: Water balance assuming a 15% decrease in yield (*Intermediate Future*)

The following is noted:

- The possible impact of climate change, whether an increase or decrease in yield, is assumed, has a limited impact on the water balance over the short-term (up to 2025) but a greater impact over the longer term (2040 and beyond).
- Assuming a 15% decrease in system yield for the *Intermediate Future* (**Figure 7-5**) the impact manifests as the full utilisation of the uMWP-1 Scheme by 2040.
- Assuming a 25% increase in system yield *Intermediate Future* (**Figure 7-6**) the uMWP-1 will provide adequate resources for the Mgeni WSS far beyond 2040.
- Any climate change impacts will, however, not meaningfully affect the short-term reality of the need for and timing of the uMWP-1.

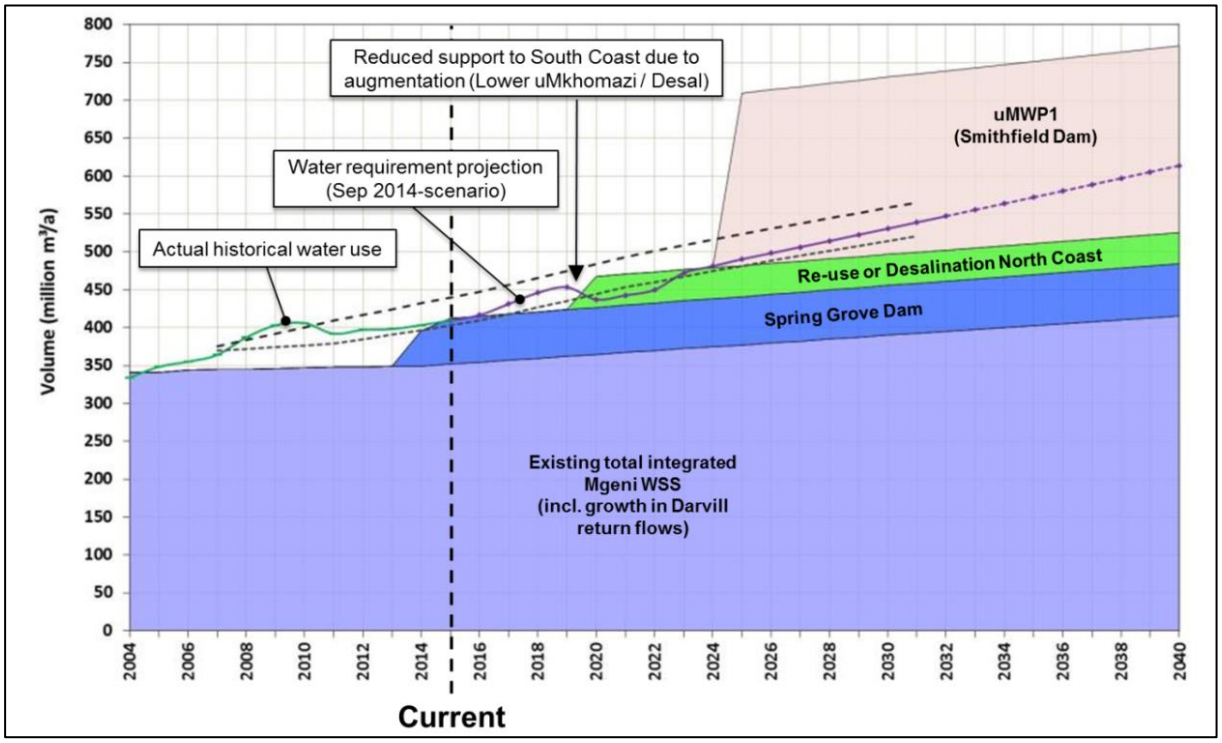

Figure 7-6: Water balance assuming a 25% increase in yield (*Intermediate Future*)

In summary, there is uncertainty around the future impacts of climate change on the water resources in the KZN Coastal Metropolitan Area, with both a possible positive or negative impact on water availability. However, the impacts do not meaningfully change the required interventions of the Reconciliation Strategy in the near future. As such, the Strategy recognises the need for continued good water resources management practice (i.e. that accounts for the current significant hydrological variability), as a practical climate change adaptation strategy. In the longer term, as the science of global circulation modelling and climate change impact assessment mature, it is expected that the results will become more convergent, allowing for more accurate predictions and improved planning.

8 STAKEHOLDER ENGAGEMENT PROCESS

8.1 STRATEGY STEERING COMMITTEE

The objective of the *Strategy Steering Committee* (SSC) is to ensure the monitoring of the implementation of the recommended intervention options as included in the Reconciliation Strategy. The SSC includes a wide variety of stakeholder groups in the Strategy Area with representatives from agriculture, local authorities, water service providers, industry, national departments, provincial government and civil society. A list of SSC members is included in **Appendix B** of this document.

The SSC meets on a bi-annual basis to discuss the continued implementation, progress and updating of the Reconciliation Strategy. **Table 8.1** provides a summary of the SSC meetings held as part of this Strategy Update process.

Table 8.1: Summary of SSC meetings

Meeting No.	Date	Venue	Number of attendees
6	24 July 2014	Durban Jewish Centre	38
7	25 February 2015	Durban Jewish Centre	35
8	09 September 2015	Durban Jewish Centre	36
9	03 March 2016	Durban Jewish Centre	42
10	30 August 2016	Durban Jewish Centre	35
11	02 February 2017	Durban Jewish Centre	37

8.2 TECHNICAL SUPPORT GROUP

The *Technical Support Group* (TSG) is represented by key or directly affected stakeholders in the study area and provides technical support to the implementation and updating of the Reconciliation Strategy. The TSG is responsible for the information required to update the Strategy and providing feedback to the SSC. The TSG meets every six to 12 months to discuss the technical issues pertaining to the Strategy and to update the relevant information affecting its implementation.

8.3 STRATEGY PUBLICATIONS AND WEBSITE

Apart from TSG and SSC meetings discussed above, formal stakeholder communication occurs through a number of publications and a Strategy Website

(*https://www.dwa.gov.za/Projects/KZN%20Recon/*) as outlined in the following subsections.

a) Status Report

A Strategy *Status Report* is published subsequent to each SSC meeting and concludes the findings and recommendations emanating from the proceedings. The report summarises the main issues discussed at the particular meeting and includes inputs from stakeholders. The Status Report is published on the Strategy Website (discussed at the end of this section) and is available to the public.

b) Press release

A Strategy press release is compiled as a summary of the SSC meeting proceedings. It highlights the important issues raised at the SSC meetings and states the focus of the Strategy for the period that follows.

c) Strategy Poster

To enable efficient communication with decision makers and the public, a Reconciliation Strategy Poster (or map) was created (provided in **Appendix C** of this document. The poster has been used by eThekwini MM, who assisted with its production, at the 2016 Water Institute of South Africa (WISA) Conference as a reference for communication with stakeholders around water security. The poster captures the purpose and high level findings of the Strategy and also shows the layout of existing and proposed schemes and water balances for the three WSSs.

d) Summary list of key interventions

A list summarising the key interventions, both management and infrastructure interventions, relevant to the Strategy Study Area, is included in **Appendix D**. The list includes a high level description of the various intervention options, the possible date of implementation and the expected volume to be delivered by the intervention.

e) Website

The Strategy Website *(https://www.dwa.gov.za/Projects/KZN%20Recon/)* forms part of the official DWS website and contains the information pertaining to the Strategy. This includes all the documentation published during this Strategy Update (discussed above) as well as documents from earlier Strategy updates and studies.

9 STRATEGY ACTION PLAN

Various aspects of the process to update the Reconciliation Strategy are presented in the preceding sections of this document. This includes the delineation and subdivision of the Strategy Area into three main water supply systems (WSSs), updating of water requirement projections, assessing water availability, identification, prioritisation and timing of intervention options, development of water balances for various scenarios and discussions and decisions made at various meetings by key stakeholders and other affected parties.

Based on the outcomes of these processes, the most favourable combination of intervention options have been selected and are presented in this section as the *Updated Reconciliation Strategy*. The Strategy is presented in two main parts, namely interventions for implementation across the entire Strategy Area, **Section 9.1** and interventions specific to each system in **Sections 9.2**, **9.3** and **9.4**, for the North Coast WSS, Mgeni WSS and South Coast WSS, respectively. For each system, details are provided on both priority infrastructure implementation projects and priority feasibility studies.

9.1 AREA-WIDE INTERVENTIONS

a) WC/WDM

The efficient use of water and the reduction of water leaks and losses through WC/WDM measures is a primary intervention option applicable to all supply systems within the Reconciliation Strategy Area. The WC/WDM measures have been quantified in the Master Plans for each WSA and progress with the implementation of these plans and associated water loss savings must be continually monitored as part of the Strategy. WC/WDM is also a key short-term intervention for the Mgeni and South Coast WSSs to minimise projected shortfalls until the next planned infrastructure development can be completed. System attrition needs to be addressed as a matter of urgency in both Metropolitan and District municipalities to ensure the efficient use of water and the protection of water courses.

b) Water supply and drought operating rules

In order to sustain the water supply potential of water resources in the Reconciliation Strategy Area, appropriate water supply and drought operating

rules must be implemented and maintained. This involves, amongst others, planning and managing water resources under drought conditions by implementing controlled water supply restrictions, if required, aimed at protecting high-priority water use. The implementation of these rules is critical for achieving the long-term water supply volumes and assurances of supply adopted for water users in the Reconciliation Strategy Area.

Water supply and drought operating rules have been developed for all WSSs in the Strategy Area. The collaborative implementation of these rules and monitoring of system performance needs to continue, through the existing Systems Operating Forums (SOFs) and Joint Operating Committees (JOCs).

c) Catchment care

The management of catchments and investment in maintaining and rehabilitating ecological infrastructure is critical for maintaining water quantity and quality. Along these lines, the Reconciliation Strategy aligns with and supports the uMgeni Ecological Infrastructure Partnership (UEIP) and its associated efforts in the Mgeni WSS. Further to this the continuation and strengthening of other catchment management forums are supported to provide stakeholders with a platform to share information and collaboratively manage the catchments.

d) Rainwater harvesting

The practice of rainwater harvesting and the associated installation of infrastructure at a household and complex level are encouraged and supported by the Reconciliation Strategy. Rainwater harvesting is an effective option for providing low assurance supply at a household and industry level to supplement municipal water supply. Furthermore, the rainwater harvesting has the added benefit of promoting public awareness and efficient water use practices.

9.2 NORTH COAST WSS

a) Priority infrastructure implementation projects

- Commissioning of the LTBWSS-1 by the end of 2016.
- Complete the raising of Hazelmere Dam by August 2017.
- Commence with the design and implementation of the LTBWSS-2 for delivery by 2021.

- Closely monitor the growth in water requirements in the system to establish the extent to which actual water use reverts back to the high projected growth trajectory once the drought comes to an end.

b) Priority feasibility studies

Commission a feasibility study for water re-use at Hazelmere Dam. This will allow for a better comparison of this option with the Mvoti River Development Project (iSithundu Dam) and will assist in making a final decision on the preferred long-term supply option for the North Coast WSS.

9.3 MGENI WSS

a) Priority infrastructure implementation projects

- Implement uMWP-1 (Smithfield Dam) and associated transfer and bulk infrastructure scheme as soon as possible. This required timeous decision making for the scheme to be completed by the end of 2024 and the EIA to be completed as a first step.
- Complete the Western and Northern aqueducts to deliver water from uMWP-1 to the planned areas in the eThekwini MM.
- Review the feasibility of the eThekwini MM *Re-mix Project* once the pilot plant has been commissioned and tested for a reasonable period.

b) Priority feasibility studies

- While feasibility studies have been completed for the uMkhomazi Water Project, desalination of seawater, and re-use of water from Northern and KwaMashu WwTWs, the outcomes of these studies must be reviewed based on the recently completed *Classification Study*.
- A study reviewing the possible short-term options for reducing or managing the risk of non-supply to users in the Mgeni WSS until the next planned scheme can be implemented.

9.4 SOUTH COAST WSS

Umgeni Water to select the preferred option for the South Coast WSS as either the Lower uMkhomazi BWSS or the desalination of seawater and implement this option as soon as possible.

10 WAY FORWARD AND LESSONS LEARNT

The Reconciliation Strategy is a powerful management tool for maintaining and aligning stakeholders and their efforts to sustain future water supply. As the Strategy is continuous and dynamic it is important that lessons learnt in this update of the Strategy are shared for consideration in further updates and implementation phases. A short summary is provided below:

- The success of the Strategy depends on the extent to which it is adopted and maintained, including associated actions by the various stakeholders and role players. Delays in implementing the interventions on which the Strategy is based can result in significant water supply consequences. An example was the delayed implementation of the raising of Hazelmere Dam, exacerbating the impacts of the drought in the North Coast WSS.
- For effective communication and timeous decision making, the correct representatives from the various stakeholder organisations need to be present at meetings. In particular, the attendance of decision makers at the SSC meetings is of key importance. These meetings only takes place on a bi-annual basis and it is critical that each organisation uses the opportunity for adequate representation – both to be informed on progress and updates, as well as to provide input on steering the Strategy.
- System management and drought operating rules, in particular associated water supply restrictions must be implemented to protect high priority water use and avoid water security risks. The reconciliation scenarios adopted in the Strategy for planning purposes are based on a reasonable level of risk and avoiding the implementation of appropriate drought management interventions may actually increase the risk of catastrophic water supply failures, e.g. dams running empty. Refer to the Drought Management Plan (Umgeni Water, 2016) for a detailed description on the lessons learnt during the recent drought event.
- As such, the proactive implementation of prioritised interventions, based on cost effectiveness and adherence to agreed implementation timeframes, is the most sustainable solution to managing future water scarcity challenges.
- The Reconciliation Strategy must be continually updated and its implementation monitored by the relevant stakeholders and role players. This, together with appropriate public communication, will be critical in managing growing water requirements in the KZN Coastal Metropolitan Areas.

- Lastly, stakeholder engagement and public communication should form an integral part of the Reconciliation Strategy, as it informs the public of the proposed Strategy, which could assist in improving public acceptance and timeous implementation of the proposed interventions.

11 REFERENCES

DBSA, 2015. *An Investment Plan for securing ecological infrastructure to enhance water security in the uMngeni River catchment,* Midrand: Pringle, C., Bredin, I., McCosh, J., Dini, J., Zunckel, K., Jewitt, G., Hughes, C., de Winnaar, G. and M. Mander.

DBSA, 2015. *Investing in ecological infrastructure to enhance water security in the uMngeni River catchment, Green Economy Research Report No. 1,* Midrand: Jewitt, G., Zunckel, K., Dini, J., Hughes, C., de Winnaar, G., Mander, M., Hay, D., Pringle, C., McCosh, J., and Bredin, I. (eds.).

DWA, 2010. *Assessment of the Ultimate Potential and Fututre Marginal Cost of Water Resources in South Africa,* s.l.: Compiled by BKS on behalf of the Directorate: National Water Resource Planning.

DWA, 2010. *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas: Second Stage Strategy Report,* s.l.: Compiled by WRP Consulting Engineers (Pty) Ltd, in association with DMM Developement Consultants cc, Golder Associates Africa, Kwezi V3 Engineers and Zitholele Consulting.

DWA, 2011. *Development of a Reconciliation Strategy for All Towns in the Eastern Region,* s.l.: Department of Water Affairs.

DWAF, 1996. *South African Water Quality Guidelines, Volume 1: Domestic Water Use (2nd Ed),* s.l.: Director: Water Quality Management.

DWAF, 2007. *Water Reconciliation strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas: Demographic Projections,* s.l.: Copiled by Prof. Jeff McCarthy for WRP Consulting Engineers (Pty) Ltd. on behalf of the Directorate: National Water Resources Planning, 2007.

DWAF, 2009. *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas: First Stage Reconciliation Strategy Report,* s.l.: Compiled by DMM Development Consultants, Golder Associates Africa, Kwezi V3 Engineers, WRP Consulting Engineers and Zitholele Consulting.

DWAF, 2009. *Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas: Water Quality Review Report,* s.l.: Compiled by DMM Development Consultants, Golder Associates Africa, Kwezi V3 Engineers, WRP Consulting and Zitholele Consulting.

DWS, 2014. *Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coast Metropolitan Area: Phase 2, Status Report: August 2014,* s.l.: Compiled by AECOM on behalf of Directorate: National Water Resource Planning.

DWS, 2014. *uMkhomazi Water Project Phase 1: Module 1:Technical Feasibility Study: Raw Water: Water Requirements and Return Flows,* s.l.: AECOM in association with AGES, Mogoba Maphuti and Associates, Urban-Econ.

DWS, 2015. *Classification of Water Resources and Determination of the Comprehensive Reserve and Resource Quality Objectives in the Mvoti to Umzimkulu Water Management Area ,* s.l.: Compiled by Rivers for Africa, eFlows Consulting (Pty) Ltd.

DWS, 2015. *Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coast Metropolitan Area: Phase 2, Status Report: February 2015,* s.l.: Compiled by AECOM on behalf of Directorate: National Water Resource Planning.

DWS, 2015. *Continuation of the Reconciliation Strategy of the KwaZulu-Natal Coast Metropolitan Area: Phase 2, Status Report: September 2015,* s.l.: Compiled by AECOM on behalf of Directorate: National Water Resource Planning.

DWS, 2015. *Surface Water Resource Quality Assessment,* s.l.: Department of Water and Sanitation.

eThekwini MM, 2015. *Reclamation and Re-use of Treated Wastewater - Way Forward,* s.l.: eThekwini Water and Sanitation Services.

Government Gazette, 2016. Government Gazette of the Republic of South Africa. *No. 40075*, 17 June, pp. 20 - 38.

Meier, K., 2016. *Umgeni Water* [Interview] 2016.

Umgeni Water, 2012. *Assessment of the Potential Impact of Climate Change on the Long-Term Yield of Major Dams in the Mgeni River System,* s.l.: Umgeni Water.

Umgeni Water, 2014. *Umgeni Water Infrastructure Master Plan 2014,* s.l.: Planning Services, Engineering and Scientific Services Division, Umgeni Water.

Umgeni Water, 2014. *uMkhomazi Water Project: Water Demand Projections and Phasing of Infrastructure,* s.l.: Compiled by Knight Piésold Consulting on behalf of Umgeni Water.

Umgeni Water, 2015. *Lower uMkhomazi Bulk Water Supply Scheme Detailed Feasibility Study and Preliminary Design,* s.l.: Compiled by AECOM in association with Mafahleni Engineers, DNA Consulting Engineers and Project Managers, Wakhiwe, Paradigm Projects and RMAS.

Umgeni Water, 2015. *Umgeni Water Infrastructure Master Plan 2015,* s.l.: Planning Services, Engineering and Scientific Services Division, Umgeni Water.

Umgeni Water, 2015. *Verbal feedback from Kevin Meier* [Interview] 2015.

Umgeni Water, 2016. *Drought Management Plan,* s.l.: Umgeni Water: Engineering & Scientific Services Division.

Umgeni Water, 2016. *Umgeni Water Infrastructure Master Plan 2016,* s.l.: Planning Services, Engineering and Scientific Services Division, Umgeni Water.

Appendix A

Action List of Key Infrastructure Intervention Options

Table A.1: List of infrastructure interventions and target dates

Main scheme	Start date	End date	Comment/s
North Coast Pipeline and Hazelmere Supply Infrastructure (Umgeni Water)			
Upgrade Hazelmere WTW	-	Jun 2014	Completed
Construction pipeline from Honolulu to Mvoti Pump Station	-	Jun 2014	Completed
Mooi-Mgeni Transfer Scheme Phase 2A (DWS/TCTA)			
Spring Grove Dam	-	-	Completed
Water delivery via MMTS-2	-	Oct 2015	Completed
Upgrade Mearns Pump Station and Pipeline (3.2 m^3/s)	-	Dec 2015	Completed
Mooi-Mgeni Transfer Scheme Phase 2B (DWS/TCTA)			
Construction	Oct 2014	Apr 2015	Completed
Delivery via MMTS2b (1.8 m^3/s)	-	February 2016	Completed
Hazelmere Dam Raising (DWS)			
Preliminary design work and geotechnical investigation to confirm best option	Feb 2012	Oct 2014	Completed
Decision to continue with raising of dam as an option	-	Apr 2015	Completed
Finalise design/tenders	May 2015	Jun 2015	Completed
Construction	Jul 2015	Dec 2017	
Delivery		2018/2019	Based on impounding levels
Lower Thukela Bulk Water Supply Scheme (Umgeni Water)			
Construction Phase 1	Feb 2014	Dec 2016	Completed
Delivery Phase 1 (55 Mℓ/d)	-	Jan 2017	Completed
Design Phase 2	Jan 2018	Dec 2018	
Construction Phase 2	Jan 2019	Jul 2020	To be confirmed based on growth
Delivery Phase 2 (55 Mℓ/d, total 110 Mℓ/d)	-	End 2020	-
uMkhomazi Water Project Phase 1 (DWS)			
Feasibility Study (Raw Water)	Oct 2011	Nov 2015	Completed
Feasibility Study (Potable Water)	Aug 2012	Jul 2014	Completed
Feasibility Study EIA	Nov 2012	Dec 2017	EIA scoping completed, proceed with EIA
Decision to proceed with uMWP-1 and off-take agreements	Dec 2016	Dec 2017	-
Detailed design	Jan 2018	Dec 2019	-
Construction	Jan 2020	Dec 2023	-
Delivery (220 million m^3/a, or 214 with release to Lower uMkhomazi)	-	Apr 2024	-
Lower uMkhomazi Bulk Water Supply Scheme (Umgeni Water)			
Feasibility Study	Jul 2014	Nov 2016	Completed
EIA (Additional infrastructure to dam)	Mid 2016	Apr 2018	

Main scheme	Start date	End date	Comment/s
Detailed design	Apr 2017	Jul 2018	
Construction	Aug 2018	Aug 2022	Existing ROD for dam expires Aug 2018
Delivery (100 Mℓ/d)	-	Dec 2021	Delivery possible before Ngwadini Dam
Desalination of seawater (Umgeni Water)			
Feasibility Study	Jan 2012	Dec 2015	Completed
Funding procurement, design and tender phase	Jan 2023	Dec 2025	Assumed after completion of Lower uMkhomazi BWSS
Construction		TBC based on South Coast growth	2 years assumed
Delivery (150 Mℓ/d)	-	TBC based on South Coast growth	Lovu option
Upgrade of North Coast WwTWs and planning of re-use (eThekwini MM)			
Regional Umdloti WwTW & Tongaat WwTW upgrade site selection	Late 2015	Mar 2017	Currently done by eThekwini MM (includes basic re-use assessment)
EIA for Regional WwTW	Mar 2017	Oct 2018	To commence after feasibility
Feasibility for WwTW and re-use (including institutional arrangements)	Mar 2017	Aug 2017	Roles & funds by eThekwini, DWS & Umgeni Water?
PPP for Design & construct of Phase 1 WwTWs (Umdloti 40-50 Mℓ/d; Tongaat 20 Mℓ/d)	Sept 2017	Mar 2019	eThekwini can return these to estuaries. Contribute /off-set Mdloti EWR
Confirm re-use for next WwTW upgrade phases (dates and volumes)	Require monitoring after phase 1 complete		Current basic projections: Tongaat - 20 Mℓ/d cap 2020 uMdloti - 55 Mℓ/d cap 2035
Design & construct additional WwTW phases & re-use infrastructure (including WTP upgrades if required)	2018	2020	WwTW By eThekwini MM. Re-use by selected implement agent. Timing based on discharge capacity and water resource need
Delivery of Tongaat re-use (in-direct via Tongaat and/or Hazelmere WTP)	2020	Beyond 2065	Ultimate potential: Tongaat - 120 Mℓ/d
Deliver uMdloti re-use water (in-direct via Hazelmere WTP)	2035	Beyond 2065	Ultimate potential: uMdloti - 85 Mℓ/d
Direct re-use of treated wastewater (eThekwini MM)			
Decision to proceed with scheme	-	Jul 2017	Public perception may be improved due to North Coast initiative (Siza Water)
Tender preparation and adjudication	Jan 2018	Jun 2018	Possible timeline should scheme be pursued as short – to medium term intervention
Tender award, financing and site establishment	Jul 2018	Jun 2019	
Construction and commissioning	Jul 2019	Dec 2021	
Delivery (41 million m^3/a)	-	Jan 2022	

Main scheme	Start date	End date	Comment/s
Mvoti River Scheme (DWS)			
Feasibility Study	Apr 2021	Apr 2024	Estimated start date (timeline moved) due to possible alternative of re-use
EIA (including estuary)	Jun 2021	Apr 2024	-
Detailed design	Aug 2024	Jul 2026	-
Construction	Oct 2026	Oct 2030	Construction may be delayed by implementation of re-use
Delivery	-	Apr 2030	-

Appendix B

SSC Members

Title	First Names	Surname	Co/Org	Position	E-mail
Department of Water and Sanitation - National					
Mr	Johan	Fourie	Department of Water and Sanitation	Scientific Manager: WS Planning	FourieJ@dws.gov.za
Mr	Yakeen	Atwaru	Department of Water and Sanitation	Director: RDM-RR	atwaruy@dws.gov.za
Mr	Geert	Grobler	Department of Water and Sanitation	Water Resources Planning	GroblerG@dws.gov.za
Ms	Khumbuzile	Moyo	Department of Water and Sanitation	Acting Director: Water Use Efficiency	MoyoK@dws.gov.za
Mr	Kobus	Bester	Department of Water and Sanitation	Deputy Chief Engineer: NWRP-Options Analysis	BesterK@dws.gov.za
Mr	Livhuwani	Mabuda	Department of Water and Sanitation	Chief Director: IWRP	MabudaL@dws.gov.za
Ms	Marlene	Kamffer	Department of Water and Sanitation	PA to Chief Director, Mr Mabuda	kamfferm@dws.gov.za
Dr	Beason	Mwaka	Department of Water and Sanitation	Director: WRPS	mwakab@dws.gov.za
Mr	Patrick	Mlilo	Department of Water and Sanitation	Director: NWRP	MliloP@dws.gov.za
Ms	Patricia	Viljoen	Department of Water and Sanitation	PA to Director, Mr Patrick Mlilo	viljoenP@dws.gov.za
Ms	Celiwe	Ntuli	Department of Water and Sanitation	Scientific Manager	NtuliC@dws.gov.za
Mr	Kennedy	Mandaza	Department of Water and Sanitation	Water Resource Planner	mandazak@dws.gov.za
Ms	Mmaphefo	Thwala	Department of Water and Sanitation	Production Scientist	ThwalaM@dws.gov.za
Mr	Niel	van Wyk	Department of Water and Sanitation	Chief Engineer: NWRP Options Analysis (East)	vanwykn@dws.gov.za
Mr	Steven	Arumugam	Department of Water and Sanitation	Chief Director: Infrastructure Development	arumugams@dws.gov.za
Ms	Zanele	Mvusi	Department of Water and Sanitation	Director: Implementation Planning	mvusiz@dws.gov.za
Mr	Pieter	Viljoen	Department of Water and Sanitation	Scientific Manager	ViljoenP2@dws.gov.za
Mr	Johann	Enslin	Department of Water and Sanitation	Chief Engineer: NWRP Options Analysis	enslinj@dws.gov.za
Department of Water and Sanitation - KZN Regional Office					
Mr	Norman	Ward	Department of Water and Sanitation	Chief Engineer	WardN@dws.gov.za
Mr	Neo	Leburu	Department of Water and Sanitation	Environmental Officer	leburun@dws.gov.za
Ms	Angela	Masefield	Department of Water and Sanitation	Director: Regulation	masefieldA@dws.gov.za
Ms	Esme	Wood	Department of Water and Sanitation	PA to Ms Angela Masefield	woode@dws.gov.za
Mrs	Manisha	Maharaj	Department of Water and Sanitation	Deputy Director: Regulation Planning	thakurdinm@dws.gov.za
Ms	Renelle	Pillay	Department of Water and Sanitation	Control Environmental Officer	pillayr@dws.gov.za
Mr	Michael	Singh	Department of Water and Sanitation	Deputy Director: Water Regulations	SinghM@dws.gov.za
Mr	Ashley	Starkey	Department of Water and Sanitation	Chief Director: KZN Regional Office	starkeya@dws.gov.za
Ms	Matshidiso	Nhlanhla	Department of Water and Sanitation	PA to Chief Director: KZN Regional Office	nhlanhlam@dws.gov.za
Umgeni Water					
Mr	Percy	Sithole	Umgeni Water	Planning Services: Water Resources	sandile.sithole@umgeni.co.za
Mr	Steve	Gillham	Umgeni Water	Manager: Engineering & Scientific Services	steve.gillham@umgeni.co.za
Ms	Futhi	Ntombela	Umgeni Water	PA to Mr Steve Gillham	futhi.ntombela@umgeni.co.za
Mr	Kevin	Meier	Umgeni Water	Planning Services Manager	kevin.meier@umgeni.co.za
eThekwini Metropolitan Municipality					
Mr	Frank	Stevens	eThekwini Metropolitan Municipality	Deputy Head : Technical Support	frank.stevens@durban.gov.za
Ms	Hope	Joseph	eThekwini Metropolitan Municipality	Civil Engineer,Water & Sanitation	Hope.Joseph@durban.gov.za
Mr	Ednick	Msweli	eThekwini Metropolitan Municipality	Head: Water & Sanitation	Ednick.Msweli@durban.gov.za
Ms	Kim	Brackenridge	eThekwini Metropolitan Municipality	Assistant to Head: Water & Sanitation	kim.brackenridge@durban.gov.za'
Mr	Speedy	Moodliar	eThekwini Metropolitan Municipality	Planner: Water Services	speedy.moodliar@durban.gov.za
Ms	Nokwanda	Mpofana	eThekwini Metropolitan Municipality	Senior Engineer	nokwanda.mpofana@durban.gov.za
Mrs	Siphiwe	Zama	eThekwini Metropolitan Municipality	Acting: Senior Manager - Water Network	siphiwe.zama@durban.gov.za
Mr	Niren	Appalsamy	eThekwini Water & Sanitation	Senior Engineer	niren.appalsamy@durban.gov.za
Mr	Bill	Pfaff	Stakeholder	Planning Engineer	billandsally@saol.com

Title	First Names	Surname	Co/Org	Position	E-mail
Mr	Simon	Scruton	eThekwini Metropolitan Municipality	Manager: Non-Revenue Water Branch	simon.scruton@durban.gov.za
Mr	Rob	Dyer	eThekwini Metropolitan Municipality	Planning Engineer: Water & Sanitation	rob.dyer@durban.gov.za
Mr	Richard	Mngoma	eThekwini Metropolitan Municipality	Deputy Head: Water Operations	richard.mngoma@durban.gov.za
Ms	Bhavna	Soni	eThekwini Metropolitan Municipality	Deputy Head : Engineering Services	bhavna.soni@durban.gov.za
Ugu District Municipality					
Ms	Lungile	Cele	Ugu District Municipality	General Manager: Water Services	lungile.cele@ugu.gov.za
Ms	Premi	Mahadev	Ugu District Municipality	PA to General Manager, Ms Lungi Cele	Premi.Mahadev@ugu.gov.za
Mrs	Thuli	Mwelase	Ugu District Municipality	Manager: Water Resource Management	thuli.mwelase@ugu.gov.za
Dr	Johan	van der Walt	Ugu District Municipality	Senior Manager :WSA	johan.vanderwalt@ugu.gov.za
Ilembe District Municipality					
Ms	Nonhlanhla	Gamede	Ilembe District Municipality	Municipal Manager	Nonhlanhla.Gamede@ilembe.gov.za
Ms	Salora	Pillay	Ilembe District Municipality	PA to Municipal Manager	Salora.Pillay@ilembe.gov.za
Mr	Kuhle	Mthonjeni	Ilembe District Municipality	Director: Technical Services	kuhle.mthonjeni@ilembe.gov.za
Ms	Jarissa	Joseph	Ilembe District Municipality	PA to Director Tech Services, Mr Mthonjeni	jarissa.joseph@ilembe.gov.za
Ms	Logie	Govender	Ilembe District Municipality	Admin Officer: Technical Services	logi.govender@ilembe.gov.za
Mr	Geoffrey	Kumalo	Ilembe District Municipality	Director: Corporate Services	Geoffrey.Kumalo@ilembe.gov.za
Ms	Vanessa	Abrahams	Ilembe District Municipality	PA to Director: Corporate Services	Vanessa.Abrahams@ilembe.gov.za
Mr	Dumisani	Khoza	Ilembe District Municipality	Deputy Director: Planning & Implementation	dumisanik.khoza@ilembe.gov.za
Ms	Zama	Mfeka	Ilembe District Municipality	PA to Mr Dumisani Khoza	zama.mfeka@ilembe.gov.za
Umgungundlovu District Municipality					
Mr	Bheki	Mbambo	uMgungundlovu District Municipality	Head: Technical Services	Bheki.Mbambo@umdm.gov.za
Mr	Buhle	Msomi	uMgungundlovu District Municipality	WSA Manager	Buhle.Msomi@umdm.gov.za
Mr	Jabulani	Dlamini	uMgungundlovu District Municipality	Water Operations	Jabulani.Dlamini@umdm.gov.za
Dr	Terrence	Hlongwane	uMgungundlovu District Municipality	PMU Manager	Terrence.Hlongwane@umdm.gov.za
Harry Gwala District Municipality					
Mr	Nkululeko	Biyase	Harry Gwala District Municipality	Executive Director: Water Services	biyasenk@harrygwaladm.gov.za
Mr	Bheki	Makwakwa	Harry Gwala District Municipality	Technical Manager	makwakwadb@gmail.com
Msunduzi Local Municipality					
Mr	Mike	Greatwood	Msunduzi Local Municipality	Manager: Water Services Authority	mike.greatwood@msunduzi.gov.za
Cllr	Themba	Njilo	Msunduzi Local Municipality	Mayor	themba.njilo@msunduzi.gov.za
Mr	Sizwe	Hadebe	Msunduzi Local Municipality	Acting: City Manager	sizwe.hadebe@msunduzi.gov.za
Ms	Kavina	Christian	Msunduzi Local Municipality	PA to Municipal Manager	kavina.christian@msunduzi.gov.za
Mr	Rod	Bartholomew	Msunduzi Local Municipality	Manager: Environmental Manager	rodney.bartholomew@msunduzi.gov.za
M	Brenden	Sivparsad	Msunduzi Local Municipality	Senior Manager: Water and Sanitation	Brenden.Sivparsad@msunduzi.gov.za
COGTA					
Ms	Noluthando	Magewu	COGTA	General Manager: Municipal Infrastructure	noluthando.magewu@kzncogta.gov.za
Ms	Khuthalile	Mahlaba	COGTA	Manager: FBS	khuthalile.mahlaba@kzncogta.gov.za
Mr	Nathaniel	Padayachee	COGTA	Municipal Infrastructure	nathaniel.padayachee@kzncogta.gov.za
South African Local Government Association					
Mr	Bright	Nkontwana	South African Local Government Association	Programme Manager: Municipal Infrastructure & Services	bnkontwana@salga.org.za
Ms	Slindile	Masondo	South African Local Government Association	Advisor: Municipal Infrastructure & Services	smasondo@salga.org.za
Ms	Bathandwa	Vazi	South African Local Government Association	Advisor: Municipal Infrastructure & Services	bvazi@salga.org.za

Title	First Names	Surname	Co/Org	Position	E-mail
Industry & Business					
Ms	Kerisha	Govender	SAPPI	Environmental Engineer	kerisha.govender@sappi.com
Mr	Allen	van Zyl	SAPPI	Technical Manager	allen.vanzyl@sappi.com
Dr	Marilyn	Govender	South African Sugar Association	Natural Resource Manager	marilyn.govender@sasa.org.za
Mr	Justice	Matarutse	Durban Chamber of Commerce and Industry	Manager: Policy and Advocacy	matarutsej@durbanchamber.co.za
Ms	Margie	Pillai	Durban Chamber of Commerce and Industry	Liaison Officer: Northern Area	pillaim@durbanchamber.co.za
Mr	Zingisa	Mavuso	Tongaat Hulett	Water Resources: Strategy and Coordination	zingisa.mavuso@tongaat.com
Conservation Organisations and Programmes					
Mr	Bryan	Ashe	Geasphere	KZN Coordinator:Water & Climate Change	earthbryan@gmail.com
Mr	Rod	Bulman	Coastwatch KZN/Duzi Umngeni Conservation Trust	Committee Member	rod@phelamanga.co.za
Ms	Margaret	Burger	Umgeni Estuary Conservancy		margaret@burgerip.co.za
Mr	Rob	Crankshaw	Conservation KZN	Chief Executive Officer	rob.crankshaw@amamarketing.co.za
Ms	Di	Jones	Dolphin Coast Conservation and WESSA	Committee Member	dijones@iafrica.com/coastwatch@telkomsa.net
Mr	Paddy	Norman	Wildlife and Environment Society of Southern African (WESSA)	Branch Chairman	paddyn@telkomsa.net
Mr	Peter	Saville	Zinkwazi Blythedale Conservancy	Vice Chairman	zinkwazi@iafrica.com
Dr	Nontuthuzelo	Gola	SANBI/uMngeni EI Partnership (UEIP)	Coordinator: uMngeni Ecological Infrastructure Partnership	n.gola@sanbi.org.za
Ms	Sue	Viljoen	WWF-SA	Resilient Landscapes Manager: Freshwater Programme	sviljoen@wwf.org.za
Mr	Vaughan	Koopman	WWF-SA	Water Stewardship Project Manager	vkoopman@wwf.org.za
Mr	Wade	Holland	Mdloti Catchment Forum	Chairperson	sealodge@iafrica.com
Education and Research Institutions					
Prof.	Chris	Buckley	University of KwaZulu-Natal	Head: Pollution Research Group	buckley@ukzn.ac.za
Mr	Chris	Brouckaert	University of KwaZulu-Natal	Research Fellow	brouckae@ukzn.ac.za
Agriculture					
Ms	Sandy	La Marque	KwaZulu-Natal Agricultural Union	CEO	sandy@kwanalu.co.za
Mr	Mike	Honeywell	First National Bank	Regional Head - KZN Coastal	MHoneywell@fnb.co.za
Government Departments - Provincial					
Mr	Sihle	Mkhize	Dept of Economic Development & Tourism	Economic Planning	mkhize@kznded.gov.za
Prof.	Sipho	Shabalala	Office of the Premier		canhamb@premier.kzntl.gov.za
Mr	Ranveer	Persad	Dept of Economic Development & Tourism	Local Economic Development	persadr@kznded.gov.za
Ms	Naledi	May	Dept of Economic Development, Tourism and Environmental Affairs	Deputy Manager	naledi.may@kznedtea.gov.za
Government Departments - National					
Ms	Mary Jean	Gabriel	Department of Agriculture, Forestry and Fisheries	WUM and Irrigation Development	MaryJeanG@daff.gov.za
Mr	Ndwamato	Ramabulana	Department of Agriculture, Forestry and Fisheries	Assistant Director: Water Management	RamabulanaN@daff.gov.za
PSP - AECOM					
Ms	Hermien	Pieterse	AECOM	Executive: Water Resources Development and Planning	hermien.pieterse@aecom.com
Mr	Jonathan	Schroder	AECOM	Senior Engineer: Water	jonathan.schroder@aecom.com
Mr	Gerald	de Jager	AECOM	Water Resources Practice Area Manager	gerald.dejager@aecom.com
Ms	Bongi	Shinga	Wakhiwe SES (on behalf of AECOM)	Stakeholder Communication Coordinator	bongi.shinga@wakhiwe.co.za

Appendix C Strategy Poster

The KZN Coastal Metropolitan Reconciliation Strategy

What is the Reconciliation Strategy?

- In 2008 the Water Reconciliation Strategy was developed to ensure adequate supply of water for the metropolitan areas in the central KZN region.
- The study area extends from the Thukela River Mouth on the North Coast to the uMtwalume River on the South Coast, and from Howick in the west to Durban in the east.
- The purpose is to ensure we can meet future water requirements and minimise impacts and vulnerabilities to drought.
- The objective is to identify, evaluate and prioritise the interventions that should be implemented to meet future water requirements.

Why develop a Reconciliation Strategy?

- It takes between 8 and 25 years to plan, design and construct significant water resources infrastructure.
- If we do not plan for the future, we will limit growth and development through inadequate water supply and be in a state of emergency during times of drought.

What is being done (Interventions)?

- For all areas the first intervention is water conservation and water demand management (WC/WDM) which includes fixing leaks, replacing old pipes and using water more efficiently.

WC/WDM

Non-revenue water and water loss statistics (2013/214):

- National Average = 37.2%
- KZN's average = 46.0%
- Ethekwini MM = 39.3%
- Ugu DM = 30.9%
- uMgungundlovu DM = 66.1%
- iLembe DM = 58.3%

North Coast Water Supply System

The following interventions are planned options to meet current and future water requirements on the North Coast:

- The 1st phase of the Lower Thukela Bulk Water Supply Scheme (BWSS) (nearing end of construction: completion mid 2016);
- Raising of Hazelmere Dam (completion 2018);
- The 2nd phase of Lower Thukela BWSS (still in planning);
- Then either:
  1. The construction of Isithundu Dam; or
  2. Indirect reuse of the water via Hazelmere Dam from effluent return flows generated.

Integrated Mgeni Water Supply System

The Mgeni WSS was recently augmented by the completion of Spring Grove Dam on the neighbouring Mooi River. The WSS however needs further water sources. There are several options and combinations of interventions to augment the Mgeni WSS:

- Reduction in support from the Mgeni WSS to the South Coast (can be done once the South Coast is augmented);
- uMkhomazi Water Project - Phase 1. Comprises a new large dam at Smithfield on the uMkhomazi River and a 35 km tunnel to the Mgeni WSS (Earliest completion by 2024.) This is a key scheme for long-term supply.
- Direct re-use of water from the larger WWTWs (this option is stalled due to concerns around public resistance); and
- Desalination on the north coast (this option does not appear favourable due to high unit cost of water).

South Coast Water Supply System

The sources of water for the Upper and Middle South coast is a combination local dams and a small river abstraction, and support from the Mgeni WSS through the South Coast Augmentation Pipeline.

- Future augmentation of the South Coast will be by the implementation of either:
  1. Desalination of seawater at Lovu; or
  2. The Lower uMkhomazi Bulk Water Supply Scheme consisting of the Ngwadini off-channel storage dam to make up for shortages in flow during winter months.

Neither scheme can be completed before the end of 2019.

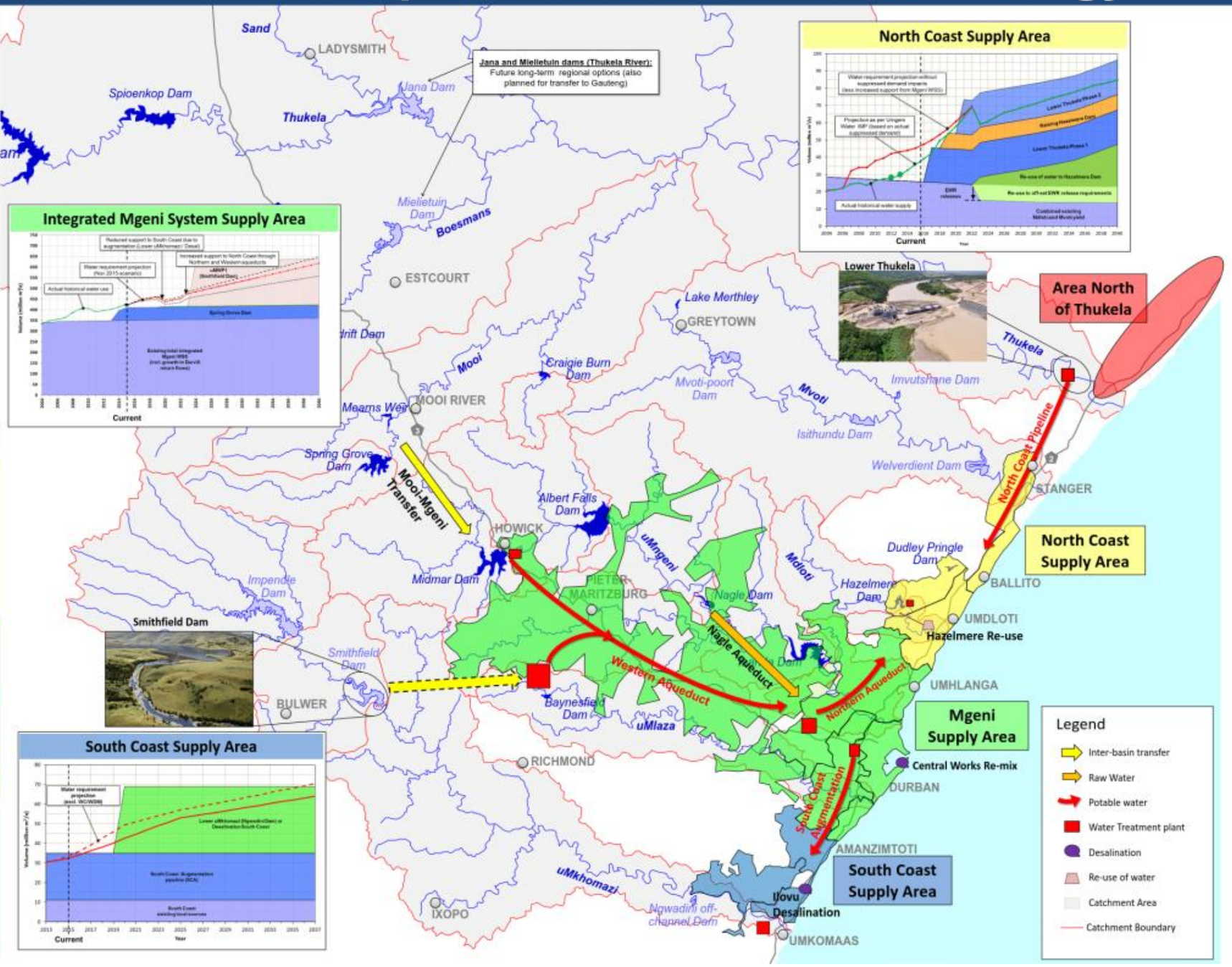

Figure C.1: Map of intervention options for the KZN Reconciliation Strategy

PARTNERS

Custodian

Professional Services Provider

Bulk Water Services Provider

Water Services Authorities

Other Partners:
A number of other government, private, and non-profit organisations contribute as Strategy Steering Committee members

Appendix D Summary List of Recon Strat Interventions

Table D.1: Summary list of key interventions

Main scheme	Date	Volume	Comment/s
Recently completed or under construction infrastructure interventions			
Sustainable supply interventions			
Mooi-Mgeni Transfer Scheme Phase 2A & B (DWS/TCTA)	2016	4.5 m³/s	Completed
North Coast Pipeline and Hazelmere Supply Infrastructure (Umgeni Water)	2014	30 Mℓ/d	Completed
Hazelmere Dam Raising (DWS)	2018	19.8 million m³ increase in capacity	Raising of dam by 7 m with piano key weir. Estimated completion date – Dec 2017
Lower Thukela Bulk Water Supply Scheme Phase 1 (Umgeni Water)	2016	55 Mℓ/d	Commissioning commenced Jan 2017
Emergency drought interventions			
Mpambanyoni Emergency Abstraction Scheme (Umgeni Water)	2014	8 Mℓ/d	Augment the Mzinto System (Umzinto and EJ Smith dams)
uThongati Emergency Transfer	2015	8 Mℓ/d	Augment supply of raw water to Hazelmere Dam
Sembcorp Siza Water – Frasers WwTW	2015	3 - 5 Mℓ/d	Treated effluent used for potable water supply in iLembe DM
Planned interventions			
Priority management interventions			
Water Conservation and Water Demand Management	Continuous	40 – 48 million m³/a	Sourced from WSA WC?WDM Master Plans
System Operations and Drought Management Forums	Continuous	-	Protection of priority water users
Priority infrastructure interventions			
North Coast WSS			
Lower Thukela Bulk Water Supply Scheme Phase 2 (Umgeni Water)	2021	55 Mℓ/d	Water delivery expected end of 2020
Re-use of treated effluent via Hazelmere Dam	2020	140 Mℓ/d	Compare to the Mvoti River Development Project for implementation
Mgeni WSS			
uMkhomazi Water Project Phase 1 (DWS)	2024	220 million m³/a	Smithfield and Langa dams with transfer tunnel
South Coast WSS			
Lower uMkhomazi Bulk Water Supply Scheme (Umgeni Water)	2022	100 Mℓ/d	Yield available before & after uMWP1 with releases
Lovu Desalination Plant	2021	150 Mℓ/d	Desalination of sea water at Lovu. Option compared to Lower uMkhomazi BWSS

Main scheme	Date	Volume	Comment/s
Support interventions			
Catchment Care and Ecological Infrastructure	Continuous	-	Critical for maintaining water quantity and quality
Rainwater Harvesting	Continuous	-	Implementation of RWH in both formal and informal housing areas
Long-term interventions			
uMkhomazi Water Project Phase 2 (DWS)	2044	-	Impendle Dam
Mvoti River Scheme – Isithundu Dam (DWS)	Post 2040	15.2/ 28.1 million m^3/a (with and without ecological consideration)	Implementation is offset by the re-use of treated effluent via Hazelmere Dam
Remix Project (eThekwini MM)	2018	3 million m^3/a	Combination of desalination and re-use of wastewater
Desalination of seawater at Tongaat	-	150 Mℓ/d	Long-term option due to implementation of Lower Thukela BWSS.
Thukela Water Project	Post 2040	-	Supply KZN from surplus yield from Jana and Mielietuin dams

Appendix E Thukela Water Project

a) Introduction

The Thukela Water Project (TWP) is a major proposed water resources development located in the upper Thukela River Catchment in north-western KZN. The Tugela Vaal Transfer Scheme (TVTS), already completed, includes the Woodstock and Sterkfontein dams and the transfer and hydropower scheme near the Oliviershoek Pass known as the Drakensberg Pump Storage Scheme. Although the TWP has been planned as another augmentation scheme for Vaal River System (VRS), the possibility has been proposed of fast-tracking a selected component of the project as a regional water supply option for KZN. In particular, the project could provide medium to long-term augmentation to the lower Thukela and, therefore, a portion of the Reconciliation Strategy Area.

b) Phase 2 of the Thukela Water Project

The Thukela Water Project was identified as a water resource development project to possibly augment the water supply to the Vaal River System (VRS), and comprises two dams and a number conveyance infrastructure components. The two dams, Jana Dam and Mielietuin Dam, are located in the vicinity of Ladysmith and between Weenen and Escourt, respectively. Jana Dam is situated on the Thukela River and Mielietuin Dam on the Bushman's River. The aqueducts will link the proposed dams with Kilburn Dam for transfer via the Drakensberg Pumped Storage Scheme at a rate of 15 m³/s.

As per the *Main Feasibility Report (2001)*, the design characteristics of both Jana and Mielietuin dams are included in **Table D-1**.

Table D-1: Design characteristics of Jana and Mielietuin dams

	Mielietuin Dam	Jana Dam
Cumulative catchment area (km²)	1 350	6 600
Cumulative mean annual runoff (million m³)	288	1 446
Storage in catchment upstream (million m³)	60	863
Total storage in dam reservoir (million m³)	350	1 500
Full supply level (masl)	1 025	860
Type of dam	Roller Compacted Concrete Arch Dam	Roller Compacted Concrete Gravity Dam
Height of dam (m)	87	160
Spillway length (m)	69	165
Transferable yield (at 99% assurance) (10^6 m³/a)	112	355

Figure D-1 below shows the relative positions of the proposed dams.

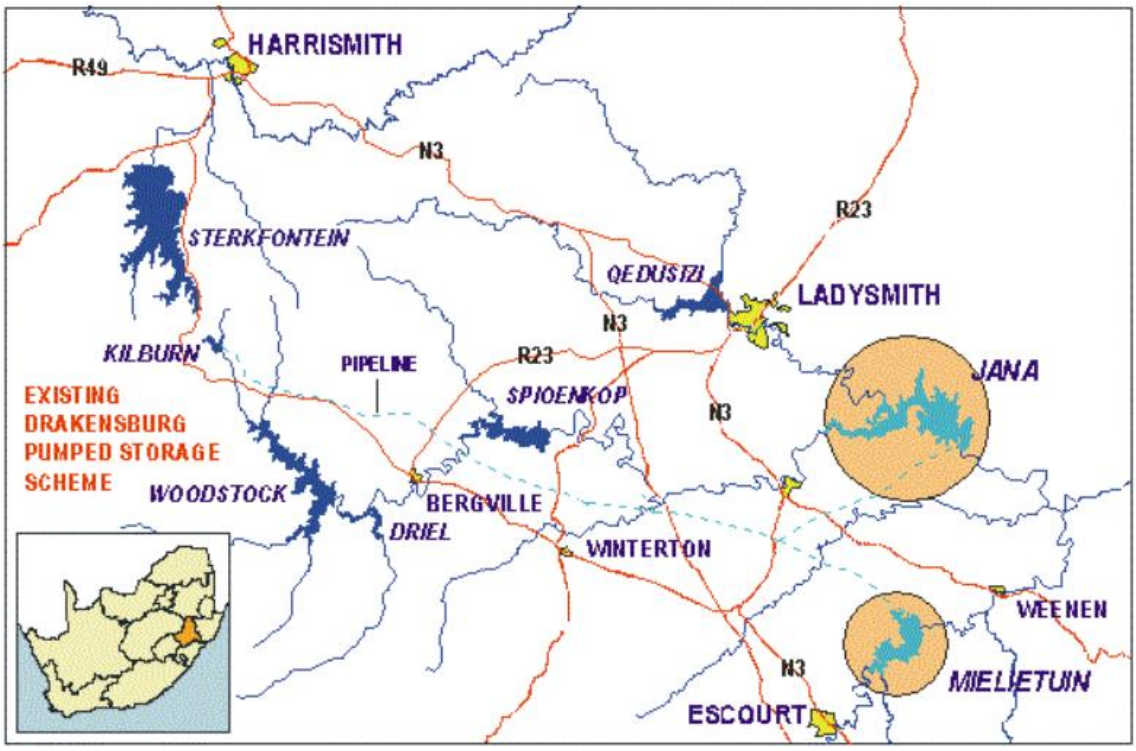

Figure D-1: Locality map of the Thukela Water Project *(sourced from https://www.dwa.gov.za/thukela/Locality.htm)*

c) Advantages of the TWP

Up to 15 m³/s of raw water can be transferred out of the Thukela River to Kilburn Dam, adding to the existing Tugela Vaal Transfer Scheme and the Drakensberg Pumped Storage Scheme for augmentation of the VRS.

As previously mentioned, the TWP is located in the north-western part of KwaZulu-Natal (KZN). The relative project location provides flexibility in that the proposed transfer options are not only limited to the VRS, but transfer to the surrounding areas of the project area could also be investigated.

The water balance graphs shown in **Figure D-2 and D-3**, sourced from the *Reconciliation Strategy for the Vaal River System*, are used to depict the advantages associated with implementing the TWP within the next 15 years.

The water balance graphs reflect the “high” water requirement scenario (blue line) and “low” water requirement scenario (green line). Each scenario includes a number of intervention options to reduce the water requirements of the users in the VRS.

For the purpose of assessing the advantages of implementing the TWP, the “high” water requirement scenario was considered. It could be accepted that

the actual water requirement line would fall within the envelope of the developed scenarios. The transfer from the Lesotho Highlands Water Project (LHWP) Phase 2 will be able to meet the "low" water requirement scenario over most of the planning horizon. Implementing the TWP before 2049 will result in a surplus yield in the VRS. The TWP (Mielietuin Dam) could therefore be assigned for water delivery to KZN up to the date where the VRS experiences a deficit (shown as 2049 onwards) (see **Figure D-2**). The surplus transferable to KZN is approximately 110 million m³/a.

When following a conservative approach and only considering the "high" water requirement scenario, the benefit of implementing only Mielietuin Dam in 2030 will result in a surplus yield of approximately 60 million m³ in 2033 only. Thereafter the benefit will diminish as the water requirements increase over time.

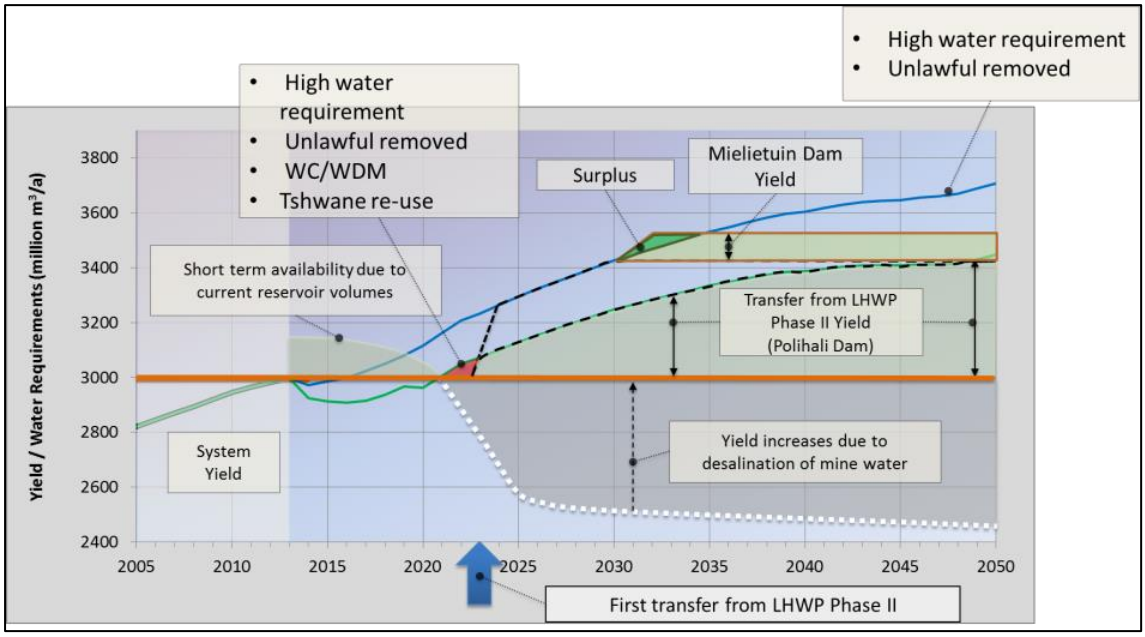

Figure D-2: Yield vs. water requirements for the Vaal River System – additional yield from Mielietuin Dam *(sourced from: Update from Vaal Reconciliation Strategy (2015))*

Considering the implementation of both the Jana and Mielietuin dams, the "high" water requirement scenario is fully supplied with a diminishing surplus of approximately 300 million m³/a in 2037 to a surplus of approximately 100 million m³/a in 2050 (see **Figure D-3**).

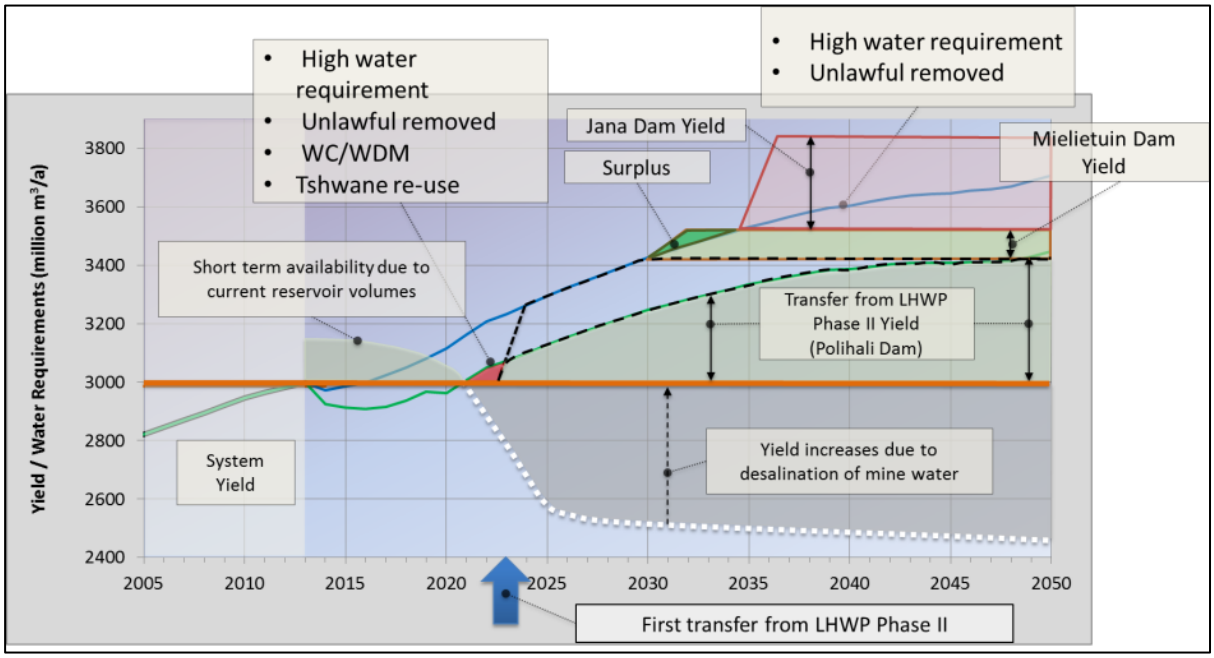

Figure D-3: Yield vs. water requirements for the Vaal River System – additional yield from Mielietuin and Jana dams *(sourced from: Update from Vaal Reconciliation Strategy (2015))*

The option arises to fast-track the implementation of the TWP therefore possibly reducing the water shortage (2016 to 2027) in the Richards Bay Water Supply System (WSS) from the surplus water from the TWP. The surplus water can be conveyed via the existing Thukela-Mhlatuze Transfer Scheme, subsequent to an increase in the transfer capacity of the existing conveyance infrastructure. However, there is still considerable already allocated, but unused water in the Thukela River and the uptake of this water needs to be investigated before the timing of the TWP's support to the Richards Bay WSS is determined.

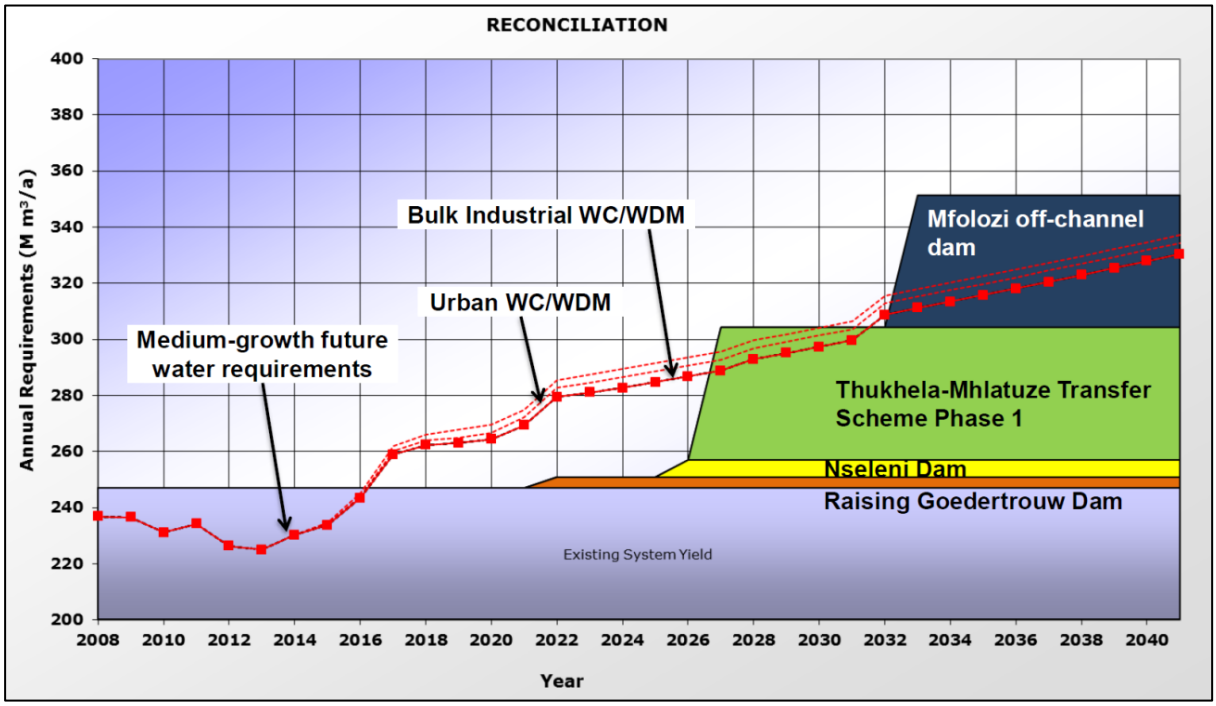

Figure D-4: Yield vs. water requirements for the Richards Bay WWS *(sourced from: Reconciliation Strategy for Richards Bay Water Supply System (2015))*

The proposed project is located in a relatively poor region of KwaZulu-Natal. The implementation of the TWP could benefit the local and regional economy by creating employment opportunities, while improving local infrastructure and attracting potential investment opportunities.

Due to the TWP being located within the boundaries of South Africa, no international regulations or arrangements would be required during the planning and implementation of the project.

d) Disadvantages of the TWP

As noted in the TWP's *Main Feasibility Report (2001)*, the industrial and economic powerhouse of South Africa is located in the VRS. Ensuring water supply to this area is of utmost importance as water shortages could have a negative effect on the economic growth of the area.

At the time of the TWP Feasibility Study (2001), there was little possibility of a disadvantage to KZN envisaged. However, considering the impact of the current drought event (November 2016), transferring water from the Thukela River Catchment to the neighbouring Vaal River Catchment could potentially further limit the water resources availability in KwaZulu-Natal and have a negative impact on the economic development future of the province.

The financial and institutional arrangements related to the TWP may prove difficult when the option of supplying water, firstly to KZN and secondly to the VRS, is considered. The cost incurred by the project would have to be carried by either water users in KZN or the VRS, or both.

e) Costing of the TWP

The costing of the TWP, reflected in 1998 Rand-value, was sourced from the TWP's *Main Feasibility Report (2001)*. The cost of each of the relevant components was escalated to 2015 Rand-value as seen in **Table D-2**.

Table D-2: Cost breakdown of the TWP

Component	Feasibility study cost	
	1998 Rands (million)	Based on 2015 Rands (million)
Jana Dam (FSL 860 masl)	1 329.40	3 141.51
Mielietuin Dam (FSL 1025 masl)	293.40	693.33
Roads*	49.56	133.45
Power Supply	-	-
Total construction cost	**1 672.36**	**3 968.30**
Engineering fees	608.90	1 639.63
Social costs		-
Jana Dam	29.09	78.33
Mielietuin Dam	9.74	26.23
Construction environmental management	30.40	81.86
Project administration	50.00	134.64
Total project cost excl. VAT	**2 400.49**	**5 928.99**
VAT at 14%	101.94	274.50
Total project cost incl. VAT	**2 502.43**	**6 203.48**

** Note: Cost of roads related to conveyance infrastructure was not included in the total cost*

f) Conclusion

Based on the preliminary investigation of the advantages, disadvantages and preliminary costing of the TWP-2, the implementation of the project for supply to the KZN Province, specifically the Richards Bay Region, is not deemed as feasible as the cost of implementation outweighs the benefit of the diminishing yield.