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Water and Sanitation
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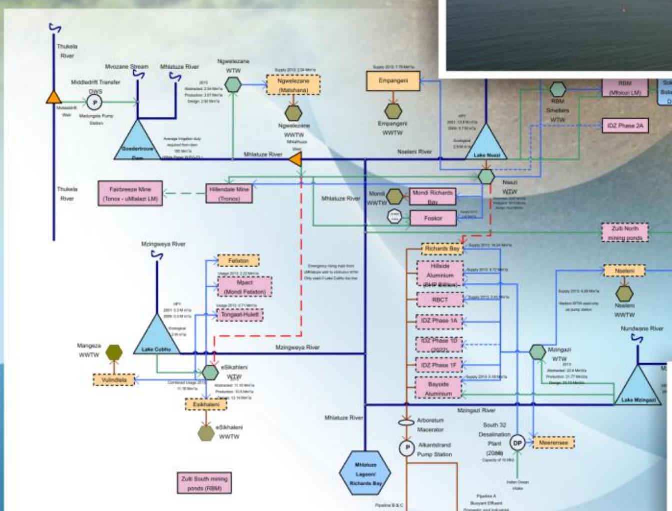
The Implementation and Maintenance of the Water Reconciliation Strategy for Richards Bay and Surrounding Towns

Water Requirements and Return Flows Report



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September 2018

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Department:
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IMPLEMENTATION AND MAINTENANCE OF THE WATER RECONCILIATION STRATEGY FOR RICHARDS BAY AND SURROUNDING TOWNS

WATER REQUIREMENTS AND RETURN FLOWS REPORT

FINAL

SEPTEMBER 2018

COMPILED FOR:	COMPILED BY:
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IMPLEMENTATION AND MAINTENANCE OF THE WATER RECONCILIATION STRATEGY FOR RICHARDS BAY AND SURROUNDING TOWNS

WATER REQUIREMENTS AND RETURN FLOWS REPORT

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Report Name	Report Number	DWS Report Number
Inception	1	P WMA 04/W100/00/9118
Economic Growth and Demographic Analysis for the Richards Bay Reconciliation Strategy	2	P WMA 04/W100/00/9218
Water Requirements and Return Flows Report	**3**	**P WMA 04/W100/00/9318**
Water Conservation / Water Demand Management	4	
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Executive Summary: Updated Reconciliation Strategy	8	

Title:	**Water Requirements and Return Flows Report**
Authors:	**Study Team**
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Consultants: **BJE/iX/WRP Joint Venture**

Approved for the Consultants by:

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EXECUTIVE SUMMARY

The Department of Water and Sanitation (DWS) commissioned a study on the Water Reconciliation Strategy for Richards Bay and Surrounding Towns (2013-2015) to inform the planning and implementation of water resource management interventions necessary to reconcile future water requirements and water use patterns up to a period of thirty years until 2044.

For the Reconciliation Strategy for Richards Bay and Surrounding Towns (DWS, 2015a), referred to as the Strategy (2015) hereafter, to be implemented, and for the Strategy (2015) to remain relevant in order to properly fulfil its purpose into the future it has to be dynamic. Hence the water balance has to be continuously monitored and the developed Strategy has to be regularly updated and maintained. This would ensure that planned intervention options to be implemented will also consider any changes, including climate change, that may have potential impacts on the projected water balance.

The overall objective of this Study is to systematically update and improve the Strategy (2015) in order for the Strategy (2015) to remain technically sound, economically feasible, as well as socially acceptable and sustainable. To assist with this, this Study has been divided into a number of tasks, each focusing on various aspects that will support the updating of the Strategy (2015). The Task that was undertaken and reported on in this Report focuses on the review and update of the water requirements and return flows of the water users in the Study Area. Updated information on historical water use and future water requirements of the various user sectors has been obtained as part of this Task. These water requirement projections will be used in the water balance which is an important component of the Strategy. In addition to the footprint of the Strategy (2015), smaller towns in the neighbouring catchments were also considered at a lower resolution in this Study, and in so doing the Strategy (2015) will be extended to cover selected smaller towns also affected by the Strategies recommendations.

Compulsory Licensing was undertaken in the Study Area at the same time that the Strategy (2015) was being developed. As a result, the final Allocation Schedule determined during Compulsory Licensing and Gazetted in 2015 was not considered in the Strategy (2015). The updated allocations have now been incorporated as part of this Task.

The three main Water Service Providers (WSPs) in the Study Area are the City of uMhlathuze Local Municipality (CoMLM), Mhlathuze Water (MW) and the King Cetshwayo District Municipality (KCDM). All of these organisations were consulted during the undertaking of this Task.

The Richards Bay Water Supply System (RBWSS), the main focus area of this Study, is supplied with water through a number of resources and important infrastructure components. Four water treatment works (WTW) and six waste water treatment works (WWTW) are presently operating in the RBWSS. The main water resources supplying the RBWSS are the Goedertrouw Dam on the Mhlathuze River and four natural Coastal Lakes namely Lake Nhlabane, Lake Mzingazi, Lake Cubhu and Lake Nsezi. The Mhlathuze weir on the Mhlathuze River provides temporary storage for abstraction from the Mhlathuze River. There are also two inter-catchment transfers currently in the RBWSS. The Thukela transfer from Middeldrift in the South offers support to Goedertrouw Dam and a transfer from the Umfolozi River in the North augments the water requirements of Richards Bay Minerals. Furthermore, water is also supplied from desalination plants, storm water runoff and groundwater abstractions throughout the Study Area.

The definition of the urban water use sector includes water requirements for both residential and light industrial purposes. The CoMLM consists of the main urban centres of Richards Bay, Empangeni, Esikhaweni, Ngwelezane and Nseleni. Both the projected growth in populations (at a high and realistic growth determined in the Demographics Task of this Study) and the assumed Level of Service (LOS) increase for each urban centre have been *considered in producing the future water requirement projections for the urban sector in this Study. This is an improvement on the approach used in the Strategy (2015) where the growth in urban requirements were merely set at a low (1% growth), medium (2% growth) and high (3% growth) of 2013 observed water use for each demand centre.*

*A summary of five year intervals of historic use and future requirements for each of the main water use sectors is provided in **Table i**, units are in million m^3/annum. The grey shaded values represent actual use. Details of the information are provided in the relevant Sections of this Report, and in **Appendix C**.*

Table i: Summary of water requirements per sector

Sector	Scenario	2010	2015	2020	2025	2030	2035	2040	2045
		million m³/a							
Urban	Strategy (2015) Low		40.8	42.9	45.1	47.4	49.8	52.3	
	Strategy (2015) Medium	31.8	41.6	46.0	50.7	56.0	61.9	68.3	
	Strategy (2015) High		42.4	49.2	57.0	66.1	76.7	88.9	
	This Study High		41.6	46.0	52.1	58.9	66.4	74.7	84.4
	This Study Moderate			44.2	47.5	51.1	54.9	59.0	63.4
	Allocation CoMLM		30.4	30.4	30.4	30.4	30.4	30.4	30.4
	Allocation MW		17.4	17.4	17.4	17.4	17.4	17.4	17.4
	Total Allocation		47.8	47.8	47.8	47.8	47.8	47.8	47.8
Industrial	Strategy (2015)	70.3	63.9	90.9	106.3	112.0	122.8	127.0	
	This Study		47.0	89.1	89.1	89.1	91.5	91.5	91.5
	Allocation CoMLM		5.8	5.8	5.8	5.8	5.8	5.8	5.8
	Allocation MW		68.5	68.5	68.5	68.5	68.5	68.5	68.5
	Total Allocation		113.2	113.2	113.2	113.2	113.2	113.2	113.2
Irrigation	Strategy (2015)	87.8	88.5	88.5	88.5	88.5	88.5	88.5	
	This Study		114.0	114.0	114.0	114.0	114.0	114.0	114.0
	Allocation		113.9	113.9	113.9	113.9	113.9	113.9	113.9

Note: Cells shaded in grey are actual water use values

Irrigated agriculture is a major user of the water resources in the Mhlathuze Catchment. After Compulsory Licensing, the sectors' allocations were reduced by 66% (differing dependant on source and location) from 178 million m^3/annum to a total of 128.5 million m^3/annum (which includes new applicants). This new allocation is more in line with what the sector actually uses. Of the 128.5 million m^3/annum, 114 million m^3/annum is allocated to irrigators making use of the main water resources in the Mhlathuze Catchment, and 14.5 million m^3/annum is allocated to diffuse irrigators making use of smaller tributaries. The irrigated agriculture sector is not set to grow into the future.

Other water users in the Mhlathuze Catchment include afforestation which is a Streamflow Reduction Activity (SFRA), dryland sugarcane, Invasive Alien Plants (IAPs) and Ecological Water Requirements (EWRs). Afforestation was included in Compulsory Licensing and it is evident that the existing afforestation is larger than the allocated areas. Information on afforestation, dryland sugarcane IAPs and EWRs have all been obtained from previous, detailed studies.

*The future water requirements of the smaller towns in the neighbouring catchments incorporated into the Strategy update are presented in **Table ii**.*

Table ii: Future water requirements of surrounding towns

Town	Growth Scenario	2016	2020	2025	2030	2035	2040	2045	Compounded Growth (%)
		million m³/a							
Eshowe	Moderate	2.08	2.15	2.24	2.33	2.43	2.53	2.64	0.82
	High	2.08	2.23	2.43	2.64	2.85	3.07	3.33	1.64
Gingindlovu / Amatikulu	Moderate	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.57
	High	0.33	0.34	0.36	0.37	0.39	0.41	0.43	0.93
Melmoth	Moderate	0.86	0.89	0.92	0.96	1.00	1.05	1.09	0.82
	High	0.86	0.92	1.00	1.09	1.17	1.26	1.36	1.59
Mtunzini	Moderate	0.46	0.47	0.49	0.50	0.52	0.54	0.56	0.67
	High	0.46	0.49	0.52	0.56	0.60	0.65	0.70	1.43

In addition to the water requirements, the return flows from the various water use sectors have been considered. Irrigation return flows are assumed to be approximately 15% of the use. Return flows from the urban and industrial sectors pass through the various WWTWs within the RBWSS. While some are discharged back into nearby rivers, the bulk of the return flows, are currently discharged into the Indian Ocean.

*An overall perspective of the current use per sector in the Mhlathuze Catchment (million m^3/annum) is presented in **Figure i**.*

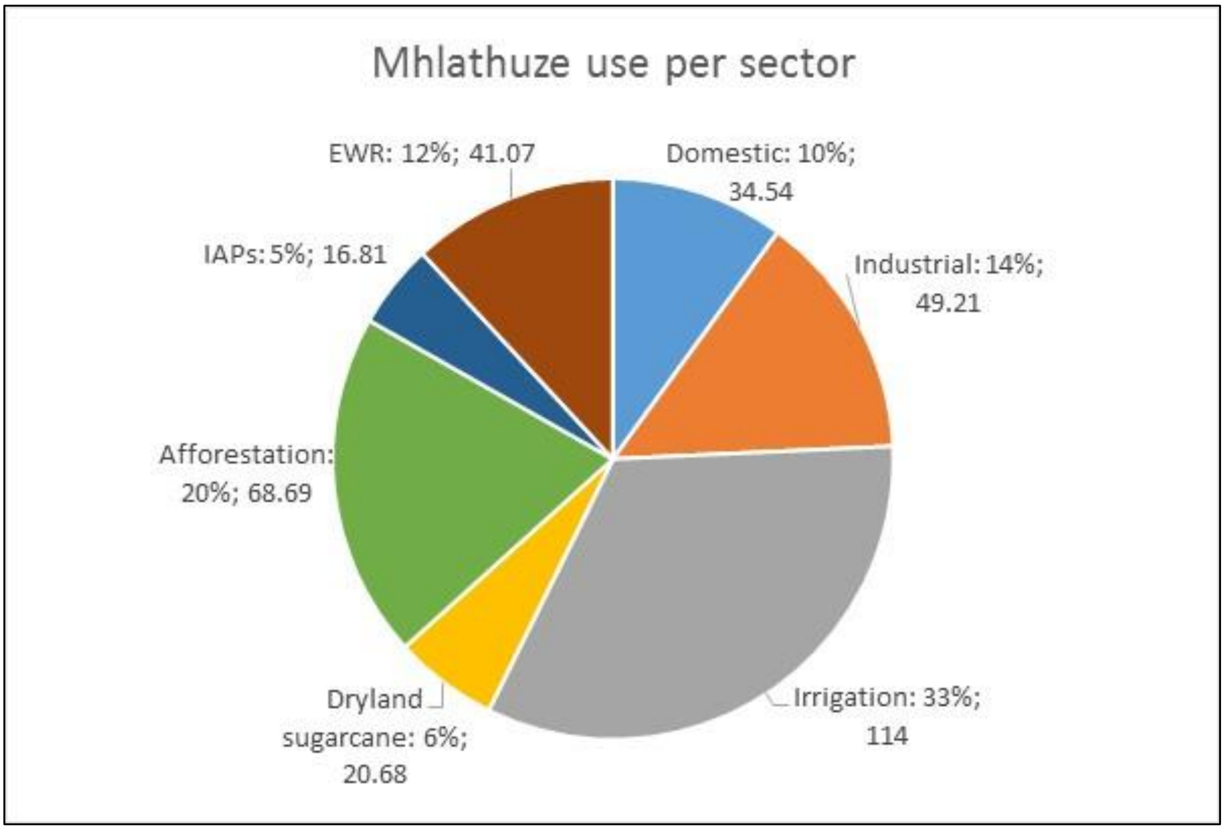

Figure i: Water use per sector in the Mhlathuze Catchment (2017)

*The total water requirements of the RBWSS are presented in **Figure ii**. The graph includes the historical use from 2008 until 2017. The impact of reduced use over the recent drought period from 2015 till current is evident. The graph also includes the Strategy (2015) low, medium and high projection scenarios. These scenarios were based on broad assumptions, and it is believed that the updated projections resulting from this Study have been determined using a more systematic approach. The graph also presents the updated allocations provided to users who depend on the water resources that supply the RBWSS.*

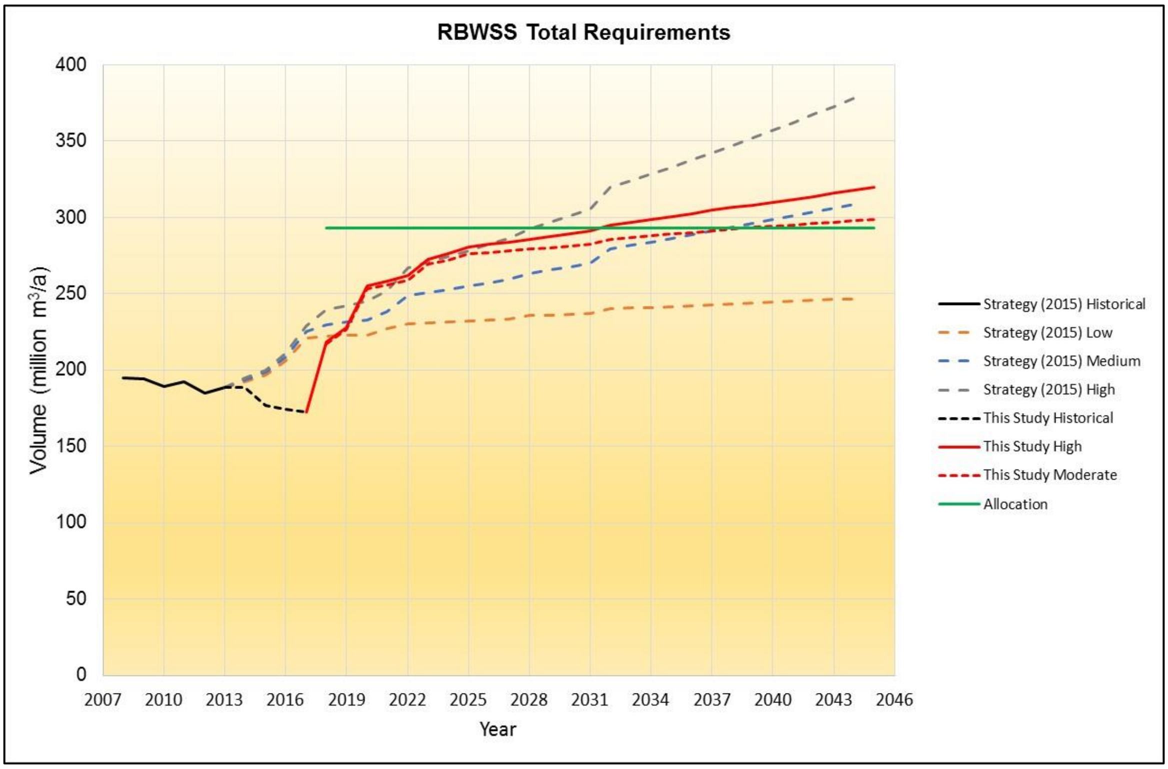

Figure ii: Total water requirements of the RBWSS

The following recommendations are made as a result of executing the Task of updating the water requirements in the Study Area.

- *Future water requirements should not be projected from a low base point as a result of a drought. Experience shows that water use returns to the historical trend experienced prior to the drought.*
- *Actual use should be gathered continuously from the major water users in the RBWSS in order to compare it with the Strategy projections, with the aim to make adjustments if required.*
- *Improved monitoring of water use should take place, especially in the urban sector, where estimates had to be made to fill the gaps in the raw data obtained. This recommendation is for both the CoMLM and the KCDM.*
- *The water requirement projections formulated as part of this of this Study (this Report) should be used in the analyses of scenarios in order to update the Strategy (2015) as part of this Study.*

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LIST OF ABBREVIATIONS AND ACRONYMS

BJ	Black Jills Engineers Pty Ltd. (BJE)
CCGT	Combined Cycle Gas Turbine
CoMLM	City of uMhlathuze Local Municipality
DWA	Department of Water Affairs (now DWS)
DWAF	Department of Water Affairs and Forestry (now DWS)
DWS	Department of Water and Sanitation
ELU	Existing Lawful Use
EWR	Ecological Water Requirement
IAPs	Invasive Alien Plants
IDZ	Industrial Development Zone
iX	iX Engineers Pty Ltd.
KCDM	King Cetshwayo District Municipality
KZN	KwaZulu-Natal
LOS	Level of Service
MAR	Mean Annual Runoff
MW	Mhlathuze Water
MWAAS	Mhlathuze Water Availability Assessment Study
NWA	National Water Act
RBCT	Richards Bay Coal Terminal
RBM	Richards Bay Minerals
RBWSS	Richards Bay Water Supply System
RDP	Reconstruction and Development Programme
RFF	Return Flow Factor
SFRA	Streamflow Reduction Activity
StraSC	Strategy Steering Committee
TSG	Technical Support Group
WARMS	Water Allocation Registration Management System
WP	White Paper
WRP	WRP Consulting Engineers Pty Ltd.
WSA	Water Service Authority
WSP	Water Service Provider
WSSA	Water and Sanitation Services South Africa
WSS	Water Supply Scheme
WTW	Water Treatment Works
WWTW	Waste Water Treatment Works

LIST OF UNITS AND SYMBOLS

km	Kilometre
ℓ/c/d	Litre per Capita per Day
ℓ/s	Litre per second
Mℓ/day	Mega Litre per Day
m	Metre
mm	Millimetre
m^3/annum (in text)	Cubic Metre per Annum
m^3/a (in tables)	Cubic Metre per Annum
m^3/s	Cubic Metre per Second
%	Percentage

1 INTRODUCTION

1.1 Background to this Study

The Department of Water and Sanitation (DWS) commissioned a study on the Water Reconciliation Strategy for Richards Bay and Surrounding Towns (2013-2015) to inform the planning and implementation of water resource management interventions necessary to reconcile future water requirements and water use patterns up to a period of thirty years until 2044.

For the Reconciliation Strategy for Richards Bay and Surrounding Towns (DWS, 2015a), referred to as the Strategy (2015) hereafter, to be implemented, and for the Strategy (2015) to remain relevant in order to properly fulfil its purpose into the future it has to be dynamic. Hence the water balance has to be continuously monitored and the developed Strategy has to be regularly updated and maintained. This would ensure that planned intervention options to be implemented will also consider any changes, including climate change, that may have potential impacts on the projected water balance.

The DWS commissioned the Implementation and Maintenance of the Water Reconciliation Strategy for Richards Bay and Surrounding Towns Study, referred to as this Study hereafter, to facilitate a process to maintain the relevance of the Strategy (2015).

1.2 Objectives of this Study

The overall objective of this Study is to systematically update and improve the Strategy (2015) in order for the Strategy (2015) to remain technically sound, economically feasible, as well as socially acceptable and sustainable. To assist with this, this Study has been divided into a number of tasks, each focusing on various aspects that will support the updating of the Strategy (2015). The Task that was undertaken and reported on in this Report focuses on the review and update of the water requirements and return flows of the water users in the Study Area. Updated information on historical water use and future water requirements of the various user sectors has been obtained as part of this Task. These water requirement projections will be used in the water balance which is an important component of the Strategy. In addition to the footprint of the 2015 Strategy, smaller towns in the neighbouring catchments were also considered at a lower resolution in this Study, and in so doing the Strategy (2015) will be extended to cover selected smaller towns also affected by the Strategies recommendations.

1.3 Study Area

The main focus of this Study is the Richards Bay Water Supply System (RBWSS). The RBWSS supplies water to the City of uMhlathuze Local Municipality (CoMLM), which comprises the towns of Richards Bay, Empangeni, Ngwelezane and Esikhaweni, as well as a number of rural villages. Furthermore, the RBWSS also supplies large well-developed industries, commercial areas and business centres within the Study Area. The RBWSS's supply area is within the Mhlathuze River Catchment, which is the major water resource. Water is, however, also sourced from various natural lakes within the Catchment such as Lake Nhlabane, Lake Mzingazi and Lake Cubhu. The Catchment also serves as the resource for agriculture, both irrigated and dryland, afforestation, as well as ecological requirements.

The Study Area includes the Mhlathuze River Catchment as illustrated in **Figure 1.1**. The Mhlathuze River Catchment receives inter-catchment transfers from the Umfolozi River and Thukela (Tugela) River Catchments and, as a result, these Catchments are also part of the Study Area. Additional smaller towns not incorporated in the Strategy (2015), namely, Eshowe, Mtunzini, Melmoth, Gingindlovu and Amatikulu, have been included in this Study. They will be addressed at a desktop level.

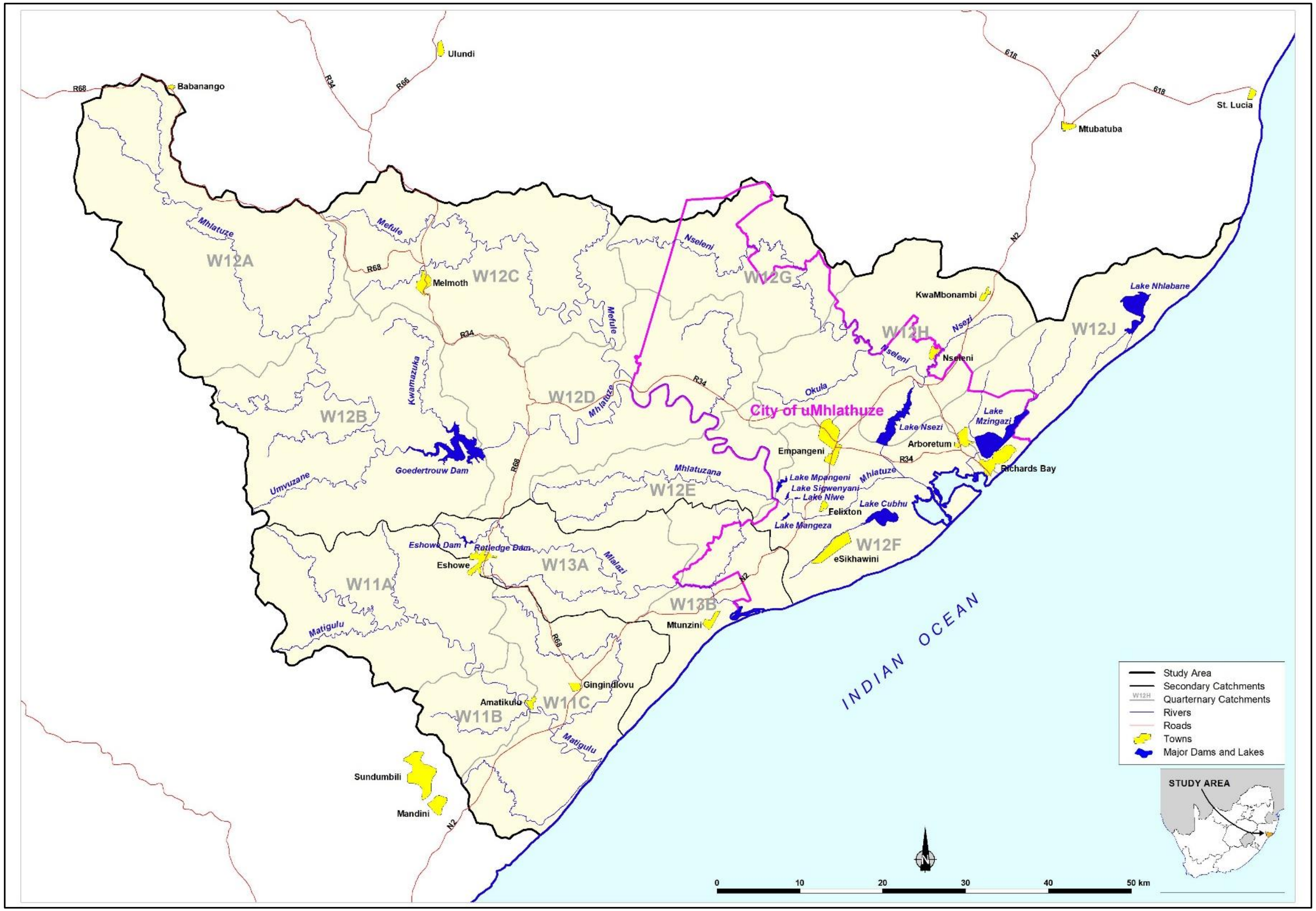

Figure 1.1: Locality map of the Study Area

1.4 Overview of the Reconciliation Strategy (2015)

The Strategy (2015) presented historical water use data for various users from 2008 to 2013. Thereafter, future water requirement projections were determined and incorporated as a low, medium and high growth scenario. The historical use and future projections of the total water requirements included in the Strategy (2015) are presented in **Figure 1.2**.

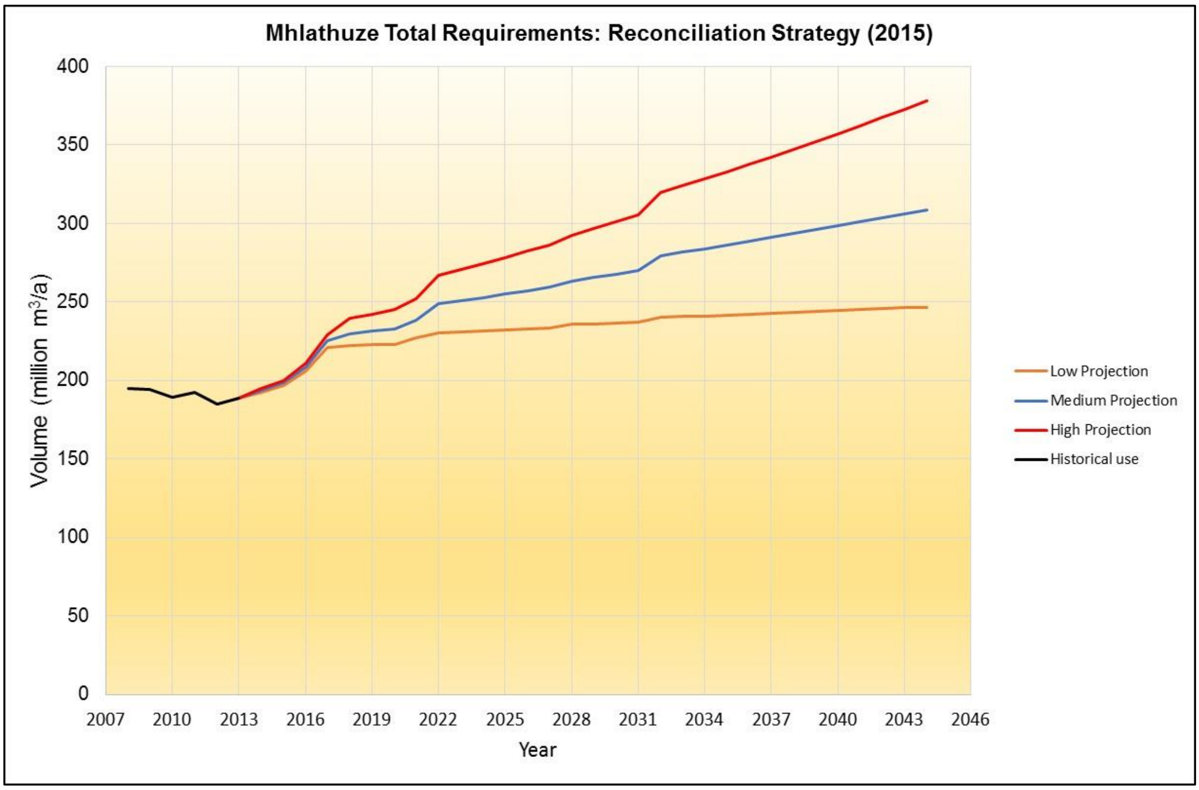

Figure 1.2: Total historical use and growth projection scenarios included in the Strategy (2015)

1.5 Purpose and Structure of this Report

The historical water use for each major water user has been updated to include the period from 2014 to 2017 as part of this Task. Water use information was sourced from various Stakeholders, such as Water Service Providers (WSPs), Municipalities, major industries and irrigation boards. The updated historic water use data is used as a departure point for the future water requirement projections for each water user and these projections have been updated as part of this Task. It is important to note, however, that the Study Area has been experiencing a drought in recent years from 2015 to date, and this has been taken into consideration when developing the updated future water requirement projections. A summary of the main water users per sector is provided in **Table 1.1**.

Table 1.1: Summary of main water users in the Mhlathuze Catchment

Urban Sector	Bulk Industrial Sector	Irrigation Sector	Other Water Users
Richards Bay	Richards Bay Minerals	Heatonville	Afforestation
Esikhaweni	Mondi	Mfuli	Ecological Requirements
Felixton	Tronox	Nkwaleni	Dryland Sugarcane
Empangeni	Foskor	Lower Mhlathuze	Invasive Alien Plants
Ngwelezane	Bayside Aluminium		
	Hillside Aluminium		
	Richards Bay Coal Terminal		
	Tongaat Hulett		
	Mpact Felixton		

Compulsory Licensing was undertaken in the Study Area at the same time that the Strategy (2015) was being developed. As a result, the final Allocation Schedule determined during Compulsory Licensing and Gazetted in 2015 (SA, 2015) was not considered in the Strategy (2015). The updated allocations have now been incorporated as part of this Task.

To summarise the purpose of this Report is:

- To categorise and summarise the water users in the Study Area in terms of their water requirements and water sources;
- to provide an overview of current and historic water requirements for the water users in the Study Area;
- to present the updated future water requirement projections until 2045;
- to determine the return flows generated by the water users; and
- to compare the updated water requirements versus the allocations scheduled as part of Compulsory Licensing that was undertaken in the Study Area.

This Report comprises of the following sections:

- The first section provides an introduction and an overview of the Task reported on in this Report.
- Section 2 provides an overview of the water resources that supply the various water users. It should be noted that the water sources are only summarized in this Report, and the reader is referred to the Water Resources Report for more detailed information relating to the water resource capability of each water resource.
- Sections 3, 4 and 5 present the information relating to the water users in the urban, industrial and agricultural sectors respectively. This Report has been structured such that all information relating to each specific water user is grouped together. Each subsection provides a brief overview of the specific water user, as well as their updated historical use, future water requirements and updated scheduled allocation.
- Section 6 provides an overview of the other water requirements in the Study Area, such as the Ecological Water Requirements, Invasive Alien Plants (IAPs) and General Authorisations.
- Section 7 provides conclusions and recommendations relating to water requirements and return flows in the Study Area.

- The final section provides an overview of the Stakeholders engaged with throughout the execution of this Task.

2 WATER SOURCES AND LAYOUT

2.1 Water Supply Schematic

A simplified water supply schematic was created for the RBWSS, comprising of industrial and domestic demand centres. This simplified schematic is included in **Appendix A.** The schematic was compiled by reviewing the Strategy (2015), the Mhlathuze Water Availability Assessment Study (MWAAS) (DWAF, 2009), Modelling Support for Compulsory Licensing Report, (DWA, 2012a), Blue and Green Drop Reports (DWA, 2012b and DWA 2013) as well as correspondence and liaison with Stakeholders.

2.2 Water Service Providers

2.2.1 City of uMhlathuze Local Municipality

The City of uMhlathuze Local Municipality (CoMLM) supplies the domestic demand centres of Richards Bay, Esikhaweni East and Esikhaweni West (Vulindlela), Empangeni, Ngwelezane, Nseleni and Felixton.

The CoMLM owns the Mzingazi water treatment works (WTW), Ngwelezane WTW and Esikhaweni WTW. These WTW were previously operated by Water and Sanitation Services South Africa (WSSA) and the operation thereof was recently transferred to Mhlathuze Water. The CoMLM owns and operates the Arboretum macerator which disposes of industrial and domestic waste 3 km offshore into the Indian Ocean.

The CoMLM has a total allocation of 36.22 million m^3/annum for the urban and industrial sectors according to the updated Allocation Schedule gazetted in 2015.

2.2.2 Mhlathuze Water

Mhlathuze Water (MW) is a Water Service Provider (WSP) in the KwaZulu-Natal (KZN) Province which supplies water services to an area stretching from the Thukela River in the South to the Mozambique and Swaziland borders in the North and the town of Vryheid in the West, covering an approximate area of 37 000 km^2. MW owns and operates the Alkantstrand pump station offshore waste water disposal pipeline, the Nsezi WTW and various waste water treatment works (WWTW) for municipalities and industries. In addition to the operation of major water infrastructure and bulk services, MW also manages raw water sources. Furthermore, MW operates the inter-catchment water transfer scheme from the Thukela Catchment into the Mhlathuze Catchment, via the Goedertrouw Dam, also known as the Middeldrift Transfer Scheme.

MW currently has contracts to supply water to the CoMLM's Richards Bay, Empangeni and Esikhaweni urban demand centres as well as the following industrial users: Mondi, Richards Bay Minerals (RBM), Foskor and Tronox. The industrial users make use of varying combinations of raw, clarified or semi purified and potable water, which is abstracted and sold by MW. MW operates the main WTW and WWTW for RBM.

After Compulsory Licensing, MW was provided a reduced allocation of 94.48 million m^3/annum to supply its users. MW have requested further clarification from the DWS Regulation Directorate relating to the reduction in their allocation, as the new allocation is less than the contracts they currently have with existing water users. A summary of the previous allocations (from the WARMS Database), updated allocation and MW supply contracts is provided in **Table 2.1**.

Table 2.1: Summary of MW allocations and supply contracts with users

User (naming as per WARMS database)	WARMS data	90% of original allocation: Gazetted		MW contracts with users	
	million m^3/a	million m^3/a	Mℓ/d	million m^3/a	Mℓ/d
Mondi Kraft - Richards Bay	54.75	49.28	135	36.53	100
RBM (Lake Nsezi)	16.43	14.78	41	16.44	45
City of Mhlathuze for Foskor	4.96	4.47	12	6.21	17
Ticor Hillendale	9.49	8.54	23	17.84	49
City of uMhlathuze for Empangeni	6.57	5.91	16	13.51	37
City of uMhlathuze for Richards Bay	7.30	6.57	18	17.53	48
City of uMhlathuze for Esikhaweni	5.48	4.93	14	5.48	15
Mondi Packaging*	3.15	0.00	0	0.00	0
Total	**108.13**	**94.48**	**259**	**113.54**	**311**

*Note: Mondi has their own allocation and is not supplied by MW

2.2.3 King Cetshwayo District Municipality

The King Cetshwayo District Municipality (KCDM) is the WSP for the smaller towns included in the Study Area. These towns are Mtunzini, Gingindlovu, Amatikulu, Eshowe and Melmoth. The KCDM is responsible for abstracting, treating and distributing water to these smaller towns. The KCDM was previously known as the uThungulu District Municipality, and the name changed in 2015. After Compulsory Licensing, the KCDM was provided an allocation of 20.8 million m^3/annum, which is sufficient to supply its users. The bulk of this allocation (13.5 million m^3/annum) is for a direct abstraction from the Goedertrouw Dam.

2.3 Treatment Works

2.3.1 Water Treatment Works

CoMLM owns and operates three major WTW, namely Esikhaweni, Ngwelezane and Mzingazi. The Nsezi WTW is owned and operated by MW. The WTW production volumes, design capacities and water resource (abstractions) for the four afore mentioned WTW are summarised in **Table 2.2**. The previously used Nseleni and Felixton WTW are no longer operational from a water treatment perspective, however, the Nseleni WTW is still used as a pump station to supply rural areas.

Table 2.2: Summary of WTW production volumes, water resource and design capacities

WTW	Production volume (2016) (million m^3/a)	Design capacity (million m^3/a)	Water resource
Esikhaweni	10.4	13.1	Lake Cubhu
Ngwelezane	1.9	2.9	Mhlathuze River
Mzingazi	21.9	23.7	Lake Mzingazi
Nsezi	48.0*	74.8	Lake Nsezi
Total	**82.2**	**114.5**	

*This volume was assumed as no data was available. The basis for the assumption was as follows: The total of Mondi (25 million m^3/annum), Foskor (5.9 million m^3/annum), Tronox (3.6 million m^3/annum), Empangeni (7.1 million m^3/annum) and

Richards Bay (13.1 million m^3/annum) is 54.7 million m^3/annum. However 6.8 million m^3/annum is reused by Mondi and Foskor from their own WWTW. Therefore the final operating capacity was assumed to be 48 million m^3/annum.

2.3.2 Wastewater Treatment Works

There are six WWTW in the CoMLM, namely, Ngwelezane, Empangeni, Nseleni, Mondi, Esikhaweni and Vulindlela. Only the formal urban areas of the CoMLM have waterborne sanitation. Some of the industries such as Mondi operate their own WWTW. The design capacities, operational capacities and discharge points WWTW volumes for these WWTW are summarised in **Table 2.3**.

Table 2.3: Summary of WWTW discharge points and capacities

WWTW	Design Capacity (million m^3/a)	Utilisation (2015)	Operational Capacity (million m^3/a)	Discharge point
Empangeni	5.3	55%	2.9	Mhlathuze River
Esikhaweni	4.6	54%	2.5	Sea Outfall
Ngwelezane	2.1	34%	0.7	Mhlathuze River
Vulindlela	1.0	32%	0.3	Mhlathuze River
Nseleni	1.4	23%	0.3	Mposa River
Mondi	20.1	93%	18.7	Reused in process
Total	**34.5**	**74%**	**25.4**	

2.3.3 Alton and Arboretum Macerators

Treated and screened industrial and domestic effluent from Richards Bay is pumped by the Alkantstrand Pump Station, which is owned by MW, into the Indian Ocean. Minor screening is done at the Alton and Arboretum macerators, where it is diluted with seawater and pumped to sea. There are a total of three outfall pipelines, reaching 4 km into the sea, where effluent is discharged into the ocean through diffusers. The first pipeline (A) conveys the buoyant effluent from domestic and industrial users. The second and third pipelines (B and C) convey the dense effluent from Foskor at high pressure to the sea. The outfall discharges a total of 51 million m^3/annum into the ocean.

2.4 Water Sources

2.4.1 Goedertrouw Dam

The Goedertrouw Dam was completed in 1982 and is located on the Mhlathuze River near Eshowe. The dam is owned and operated by DWS. The dam consists of an earth fill embankment and a 160 m long spillway, which is located about 230 m from the right flank. The dam is 88 m high with a crest length of 660 m and a storage capacity of 320 million m^3. The historical firm yield determined in the MWAAS (DWAF, 2009) is 214.3 million m^3/annum. This yield is used to support a number of water users in the Mhlathuze system.

2.4.2 Mhlathuze Weir

The Mhlathuze Weir, located approximately 90 km downstream of Goedertrouw Dam, is an important component for efficient operation of the Mhlathuze River. The weir is used to maintain an abstraction head at the weir pump station on the western river bank which supplies water to Richards Bay and the Hillendale Mine. Furthermore, the weir is also used for flow gauging, DWS station number W1H032. The existing structure was constructed in 1983, however, it was severely damaged during the floods of 1987. The structure was reinforced with sheet piling after the 1987 floods, however, the bridge was not replaced. This remedial action taken after the floods did, however, not prevent the current structure from slipping further and it was declared unstable. The risk of the structure collapsing is no longer acceptable to MW (MW, 2017).

The yield of Lake Nsezi cannot meet the requirements of the Nsezi WTW and the weir therefore forms a vital part of the water supply scheme. There is also an emergency pipeline from the weir to the Esikhaweni WTW to be utilized if the level in Lake Cubhu is too low. MW, however, prefers to abstract water from the coastal lakes due to the better water quality and lower operating costs.

2.4.3 Natural Lakes

There are four natural lakes in Richards Bay and the surrounding area. The locations of Lake Nsezi (North), Lake Nhlabane (North-East), Lake Mzingazi (East) and Lake Cubhu (East) are shown in **Figure 2.1**. A Surveyed area-capacity relationship is only available for Lake Nsezi. While Lake Nsezi is augmented by a transfer from the Mhlathuze Weir, the other three lakes are believed to be extensions of local groundwater resources. A summary of the water users supplied from each lake follows:

- Lake Mzingazi supplies Bayside (Isizinda) Aluminium and the Mzingazi WTW, from where the treated water is distributed to Richards Bay and the industrial areas. The lake has a live storage volume of 20.2 million m^3 and a natural inflow of 52.5 million m^3/annum.
- Lake Nsezi supplies water to the Nsezi WTW which in turn supplies water to the RBM smelter (if needed) and Richards Bay. Lake Nsezi has a live storage volume of 3.3 million m^3 and a natural inflow of 88.7 million m^3/annum. Water quality issues have been raised due to the inadequate water quality of the return flow from the Nseleni WWTW entering the lake.
- Lake Cubhu supplies water to the Esikhaweni WTW, which supplies Esikhaweni and Vulindlela townships, the University of Zululand as well as the Mtunzini area within the KCDM. Lake Cubhu has a live storage volume of 3.6 million m^3 and a natural inflow of 18 million m^3/annum.
- Lake Nhlabane supplies RBM's mining ponds and smelter plant. This lake has a live storage volume of 22.3 million m^3 and a natural inflow of 33.2 million m^3/annum. Lake Nhlabane also receives the inter-catchment transfer from the Umfolozi River via the Umfolozi Transfer Scheme.

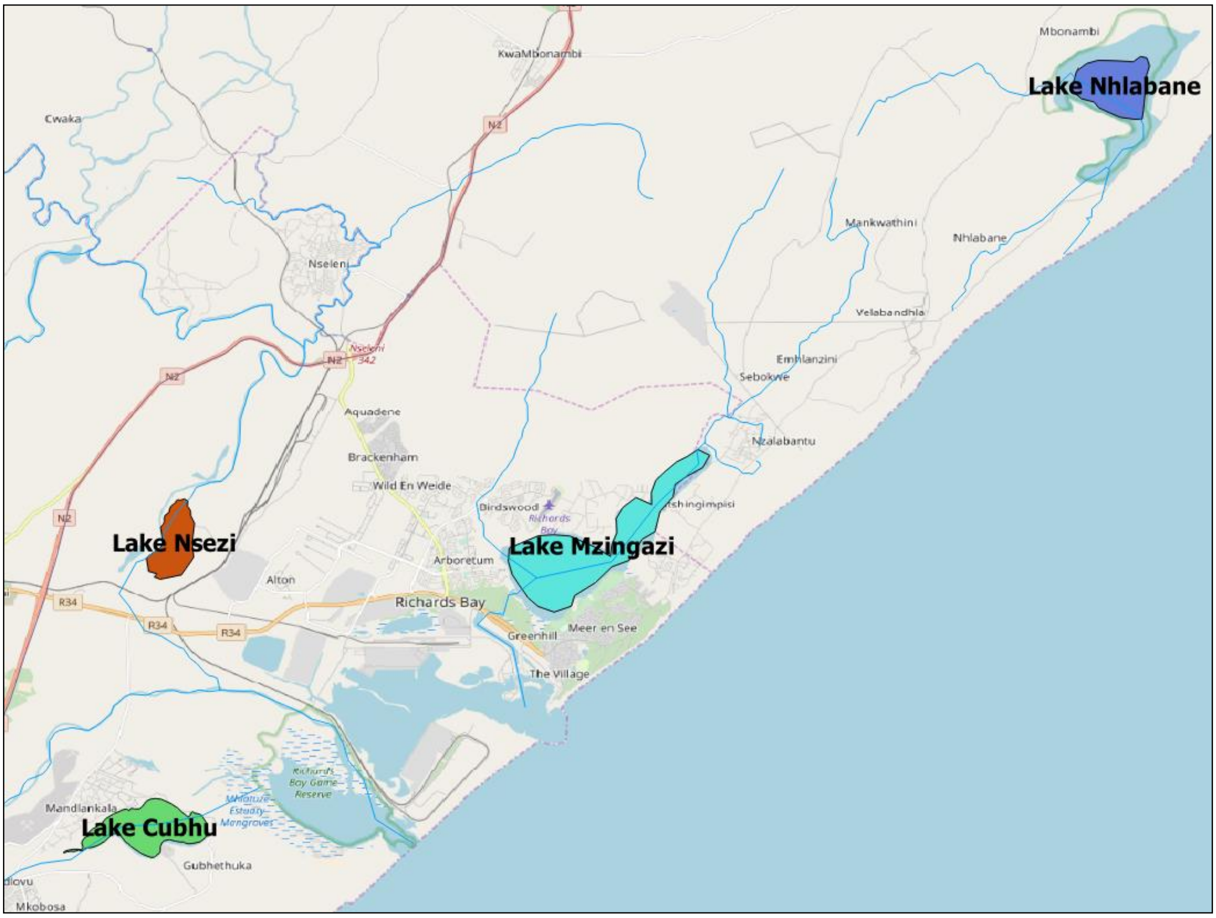

Figure 2.1: Natural lakes in the Study Area

2.5 Inter-Catchment Transfers

2.5.1 Thukela Transfer

The original plan included in the White Paper (WP-E94) was to transfer 8 m^3/s (250 million m^3/annum) from the Thukela River to the Mhlathuze Catchment. The first phase of the Thukela Transfer Scheme was implemented during the 1994 droughts under emergency conditions and it can currently deliver 1.2 m^3/s (37 million m^3/annum). Water from the Thukela River is transferred to the Mvuzane Stream, which is a tributary of the Mhlathuze River entering upstream of Goedertrouw Dam. This transfer scheme includes a run-of-river abstraction works in the Thukela River near Middeldrift with a low-lift pump station. A high lift pump station at Madungela is used through a 13.7 km long 1.5 m diameter pipeline, and a second high lift pump station at Mkhalazi to pump water over the watershed, through a 3.5 km, 800 mm diameter rising main and a 1 km, 600 mm diameter gravity main pipeline.

Construction is currently underway to double the current capacity of the Thukela Transfer Scheme. This was considered as a high priority intervention in the Strategy (2015) and was fast tracked as a result of the recent drought. The additional transfer capacity is expected to be available towards the end of 2019, and will result in an overall transfer of 2.2 m^3/s (69 million m^3/annum) to Goedertrouw Dam.

Any further future transfers will need to be reassessed in the context of the availability of water from the Thukela Catchment. The hydrology of the Thukela Catchment has not been updated for a number of years, and should be revisited prior to any decisions on further transfers being made. The planned additional transfers from the Thukela Catchment to the

Vaal Catchment (Thukela Water Project) should also be considered in future planning decisions.

The approximate transfer volume from the Thukela River to the Goedertrouw Dam for 2016 was reported as 26.3 million m^3/annum. This translates to the scheme being operated 17 hours per day at the design flow rate of 1.2 m^3/s or 72 Mℓ/day. Partial data was received for 2017 until July 2018, which indicated a transfer of 4 million m^3/annum and 6.2 million m^3/annum respectively.

2.5.2 Umfolozi Transfer

The RBM Zulti North mining ponds are currently supplemented by raw water from the Umfolozi River. The RBM run-of-river abstraction scheme is located near the Umfolozi estuary, where water is pumped from the RBM Monzi pump station either directly to RBM's mining operations or to Lake Nhlabane. The Sokhulu off-stream storage dam that was previously used was demolished to allow for re-mining and there are no plans to rebuild this dam. The Umfolozi Transfer is used as an additional resource, however, the resource is described by RBM as sporadic and not reliable. The available historical transfers obtained from RBM are presented in **Table 2.4**.

Table 2.4: Umfolozi transfer for RBM

Year	Transfer Volume (million m^3/a)
2016	1.91
2017	4.71
2018 up to (August 2018)	4.11

2.6 Other Water Resources

2.6.1 Desalination

There are currently two desalination plants located in Richards Bay, a smaller plant with a design capacity of 2 Mℓ/day and a larger plant with a design capacity of 10 Mℓ/day. The larger plant is currently only operated at an estimated 4.8 Mℓ/day, due to siltation of the intake as well as algae growth. The smaller desalination plant is owned and operated by South 32 Hillside Aluminium. The larger plant is used to supply the low lying Meer En See reservoir.

The current requirement from the Meer En See reservoir is on average 6 Mℓ/day. Further supply to other areas of the WSS are currently not possible due to pipe network infrastructure constraints. Further issues have been reported pertaining to the sea water intake of the larger 10 Mℓ/d plant near the effluent pipeline. During power failures there are also issues in terms of gypsum backflow that clogs this desalination plant.

The larger 10 Mℓ/day desalination plant is owned by the DWS Infrastructure Branch and is on a five year loan to the RBWSS, after which it may be relocated, as it is a mobile plant. A temporary environmental approval was granted for the larger plant as an emergency scheme. The plant is operated by North Coast Water on a short term contract. The site for the larger plant was provided to DWS by the CoMLM at no cost, in exchange for potable water. The water is supplied into the Richards Bay municipal network at no cost to the municipality as no tariff was negotiated before the plant was commissioned.

Scope for additional desalination in the Study Area requires further investigation.

2.6.2 Storm Water Runoff

The recent drought in the Study Area has prompted a number of major users to consider storm water runoff in order to reduce their reliance on the traditional water resources. There is already a storm water reuse facility, which is situated on the South-Eastern boundary of the Foskor site. This facility collects most of the storm water runoff from the developed Foskor site. This storm water is reused in two of Foskor's phosphoric acid plants. There is also a similar storm water facility on the South 32 Hillside Aluminium site. Richards Bay Coal Terminal (RBCT) also makes use of storm water.

2.6.3 Groundwater

There are no major groundwater users (from boreholes) in the RBWSS. There is, however, significant potential for groundwater development in the Eshowe, Gingindlovu, Mtunzini and Melmoth Water Supply Schemes (WSSs). The groundwater abstraction in the Eshowe WSS was 0.3 million m^3/annum in 2008, in Mtunzini the groundwater abstraction was 0.2 million m^3/annum in 2008 and 0.1 million m^3/annum for the Melmoth WSS in 2008. The groundwater abstraction volume for Gingindlovu is unknown. (DWA, 2011a,b,c,d).

Groundwater is an important water resource when considering the groundwater surface water interaction of the coastal lakes. The groundwater aspects are further dealt with under the groundwater component of the Water Resources Task, part of this Study.

2.7 Final Allocation Schedule

Due to the large imbalance of allocated water versus available yield in the Study Area, the Mhlathuze Catchment was the second in the country to undergo Compulsory Licensing which was undertaken between 2013 and 2015. The final Allocation Schedule that was produced after Compulsory Licensing is presented in **Appendix B**. The schedule was included in the Government Gazette no. 38599 dated 25 March 2015. The individual allocations relating to the totals included in the Gazette are presented under each of the relevant sections of this report. For the most part, previous Existing Lawful Use (ELU) was curtailed, with the general approach taken to allocate 90% of the previous urban/industrial sector's ELU and 66% of the irrigation sector's ELU in the final Allocation Schedule.

3 URBAN WATER USE SECTOR

The definition of the urban water use sector includes water requirements for both residential and light industrial purposes. The CoMLM consists of the main urban demand centres of Richards Bay, Empangeni, Esikhaweni, Ngwelezane and Nseleni. These urban demand centres are discussed in the remaining subsections of this chapter. For each urban demand centre, the historic use, the projected growth in requirements and the updated allocations resulting from Compulsory Licensing are provided. The future projections included in the Strategy (2015) are also presented for comparison purposes.

A locality map of the main demand centres in the RBWSS is provided in **Figure 3.1**. The figure should be reviewed in conjunction with the Schematic included in **Appendix A**, which provides an overview of the various sources supplying each urban demand centre. The colours of the map in **Figure 3.1** and the Schematic in **Appendix A** have been kept consistent for ease of reference.

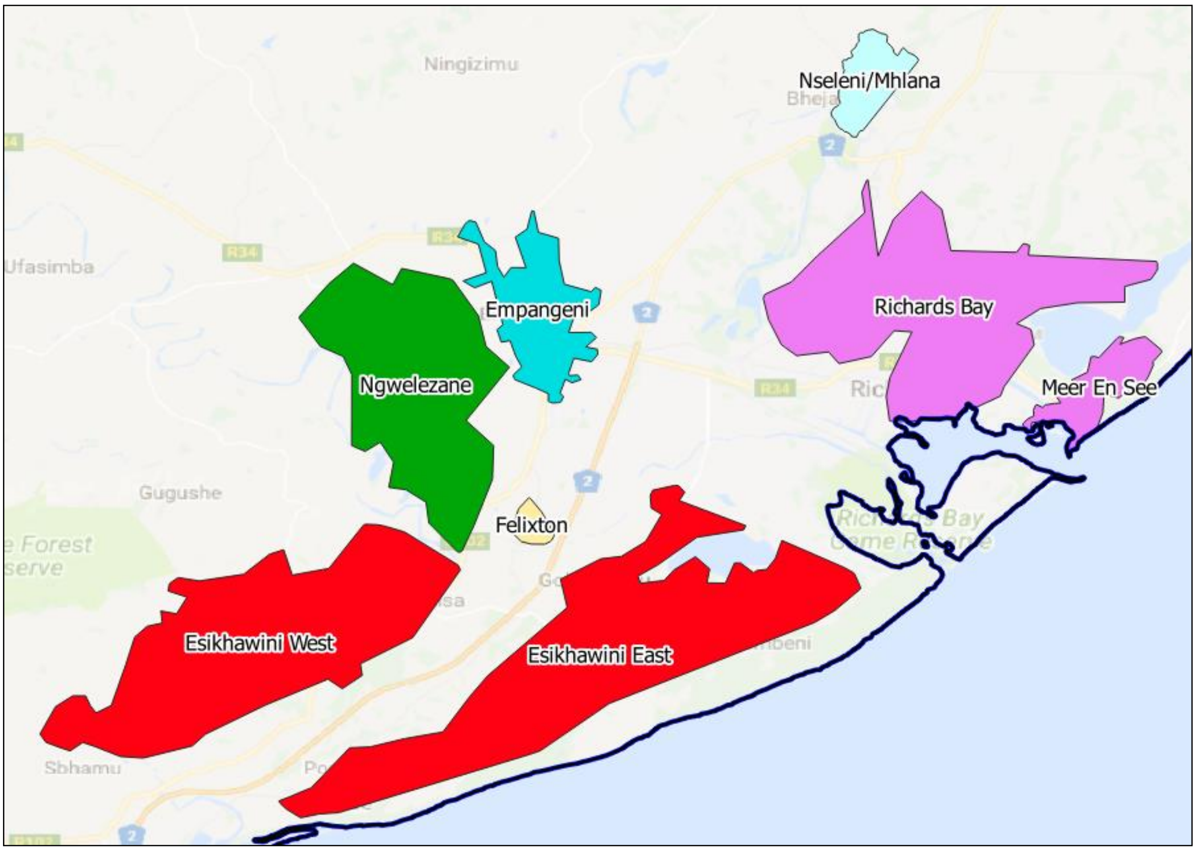

Figure 3.1: Map of urban demand centres in the RBWSS

The information relating to the surrounding towns of Eshowe, Mtunzini, Melmoth, Gingindlovu and Amatikulu is presented in **Section 3.8**. The locations of these towns are shown in **Figure 1.1**.

3.1 Methodology Used to Determine Future Water Requirements

For each urban demand centre, the high and the realistic population projections, from the base year of 2016 through to 2045, were obtained from the Economic Growth and Demographic Analysis Task Report produced as part of this Study (DWS, 2018). The five year interval population projections are summarized in **Table 3.1** and **Table 3.2**. The various levels of service (LOS) for the urban demand centres were also obtained. A total of nine LOS categories were formulated as summarised in **Table 3.3**.

Table 3.1: High population projections

Urban Centre	2016	2020	2025	2030	2035	2040	2045
Richards Bay	57 672	63 259	71 067	79 737	89 430	100 417	112 715
Esikhaweni	164 563	178 670	197 902	218 995	242 052	267 165	295 544
Felixton	1 099	1 164	1 247	1 335	1 430	1 532	1 642
Empangeni	24 181	26 945	30 829	35 249	40 276	45 990	52 581
Ngwelezane	61 245	67 586	75 981	84 924	94 608	105 058	117 558
Nseleni	42 500	47 267	53 386	59 683	66 099	72 579	81 139
Total	**351 260**	**384 891**	**430 412**	**479 923**	**533 895**	**592 741**	**661 179**

Table 3.2: Realistic population projections

Urban Centre	2016	2020	2025	2030	2035	2040	2045
Richards Bay	57 672	63 169	70 670	78 834	87 709	97 581	108 564
Esikhaweni	164 563	177 601	194 106	211 319	229 175	247 619	266 063
Felixton	1 099	1 155	1 217	1 283	1 352	1 426	1 500
Empangeni	24 181	26 902	30 638	34 804	39 436	44 574	49 712
Ngwelezane	61 245	66 638	72 919	79 083	85 079	90 868	96 657
Nseleni	42 500	46 552	51 305	56 002	60 599	65 062	69 525
Total	**351 260**	**382 017**	**420 855**	**461 325**	**503 350**	**547 130**	**592 021**

Table 3.3: LOS categories

Demand Category	Requirement (ℓ/c/d)*
Flats	226
Clusters	255
Low Income	101
Medium Income	189
High Income	304
Very High Income	442
Below RDP** Level	12
RDP* Level	40
Above RDP** Level	80

** Note that the current national average per capita water use is 237 ℓ/c/d. The DWS National Water and Sanitation Master Plan states that this should be reduced to the world average value of 173 ℓ/c/d world average.

* RDP = Reconstruction and Development Programme

In order to develop the high projection scenario, two cases were considered depending on the typical housing occurring in each demand centre. The cases considered different changes in the LOS. The first case (Case A) is applicable to intermediate towns with initially low to intermediate LOS, as listed below:

- The minimum LOS is assumed to be at Reconstruction and Development Programme (RDP) Level by 2030.
- Residential Low Income LOS increases by 5% from 2016 to 2030 and a further 6% increase by 2040 (total of 11%).
- Residential Medium Income LOS increases by 2.5% from 2016 to 2030 and a further 2.3% increase by 2040 (total of 4.8%).

The second case (Case B) is applicable to small towns and settlements, where most of the residents only receive below RDP LOS and free basic water. In this case it will be difficult to increase the LOS due to limited revenue collection:

- The minimum LOS is assumed to be at RDP Level by 2030.
- The RDP LOS increases by 5% from 2016 to 2030 and a further 6.7% increase by 2040 (total of 11.7%).
- Residential Low Income increases by 2.5% from 2016 to 2030 and a further 3% increase by 2040 (total of 5.5%).

These cases were derived through consultations with the DWS and other Stakeholders. The changes in the LOS were assumed to occur linearly over the reference time from 2018 to 2045. A water requirement projection spreadsheet model was configured in order to develop the future water requirement scenarios. The case (A or B) specific to each demand centre was selected using the current LOS, population figure and estimated growth depending on size and current development level of the demand centre. The assumed case for each of the urban demand centres assessed separately is presented in **Table 3.4**.

The first step requires calibration of the spreadsheet model using observed volumes. The 2015 theoretical water requirements were calculated using information on the LOS for domestic users, a standard percentage loss estimate of 15% as well as an additional volume for indirect use (commercial and light industrial) for each urban demand centre. Indirect use is assumed to be 51% for established towns and 38% for smaller towns and settlements (DWAF, 2001). The calculated theoretical use was then compared with the observed 2015 use, and the model was calibrated using a factor to account for differences that occurred. The increasing populations and improved LOS over time were then used as inputs to the model in order to project the future water requirements.

Table 3.4: Selected case per urban demand centre

Urban Centre	Case A or B
Richards Bay	A
Esikhaweni	B
Felixton	A
Empangeni	A
Ngwelezane	B
Nseleni	B

To summarise, both the projected growth in populations (at a high growth assumption) and the assumed increases in the LOS for each urban demand centre have been considered in order to project the high future water requirements for the purposes of this Study. These projections are an improvement on the approach followed in the Strategy (2015) where the growth in urban requirements were merely set at a low (1%), medium (2%) and high (3%) of the 2013 observed water use for each urban demand centre.

A moderate growth scenario was also determined for each one of the urban demand centres. This was based on the realistic population projections (**Table 3.2**) and the assumption that the LOS will remain similar to the current situation into the future. Under this condition, no growth in light industrial and commercial users was assumed and the only driver for the increase in water requirements was the increase in population.

3.2 Urban, Commercial and Domestic Water Use Sector Allocations

The total volume allocated to the Municipal Sector after Compulsory Licensing is 58.73 million m^3/annum (Table C in Government Gazette included in **Appendix B**). This allocation is the individual entries as presented in **Table 3.5**.

Table 3.5: Final Allocation Schedule: municipal use (DWS, 2015b)

Applicant (name as per Schedule)	Property Description	Allocated Volume (m^3/a)
KZ282 - uMhlathuze Local Municipality	PTN 0 NO. 15827	2 628 000
KZ282 - uMhlathuze Local Municipality	PTN 0 NO. 15830	6 026 400
KZ282 - uMhlathuze Local Municipality	PTN 0 NO. 5494 RICHARDS BAY	21 762 000
KZ282 - uMhlathuze Local Municipality	PTN 0 NO. 15830	5 799 600
DC28 – Uthungulu*	74 individual entries	20 811 511
Ingonyama Trust	PTN 36 OF RESERVE NO. 5 NO. 15824	1 591 596
Total		**58 619 107****

* Now KCDM

** slight difference in total of 58.75 million m^3/annum in Gazette, possibly due to rounding errors

The users presented in **Table 3.6** have allocations included in the total volume allocated to the Commercial / Domestic Sector of 0.18 million m^3/annum. (Table C in Government Gazette included in **Appendix B**).

Table 3.6: Final Allocation Schedule: commercial and domestic use (DWS, 2015b)

Applicant (name as per Schedule)	Property Description	Allocated Volume (m^3/a)
EMPANGENI COUNTRY CLUB	REM/7948 EMPANGENI	10 098
I L PHILLIPS	PTN 84 OF NKWALINI SETTLEMENT NO. 12785	24 212
SHAKALAND (PTY) LTD	PTN 2 OF NORMANHURST NO. 13023	8 213
INTABA INGWE GAME RANCH	PTN 0 NO. 15728 EMPANGENI	108 000
SHAKALAND (PTY	LTD PTN 2 OF NORMANHURST NO. 13023 22 028	22 028
Total		**172 551***

* slight difference in total of 0.18 million m^3/annum in Gazette, possibly due to rounding errors

3.3 Richards Bay

Richards Bay is the main urban centre in the CoMLM and includes Meer En See and Arboretum, Veld en Vlei, Alton (light industrial), Brackenham, Richards Bay Central (light industrial) and Aquadene. Both the CoMLM and MW have allocations to supply the Richards Bay demand centre. The primary supply of water should be from the Mzingazi WTW, however, a secondary, emergency supply is also available from the Nsezi WTW.

The overall water requirements for Richards Bay are included in **Figure 3.2**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained in this Study from information provided by MW. The reduction in use resulting from restrictions due to the drought is evident in this information.
- The previous low, medium and high projections included in the Strategy (2015) are shown. These previous projections were assumed to be a growth of 1%, 2% and 3% of the 2013 observed use figure.
- The updated projections (high and moderate) as determined using the methodology explained in **Section 3.1** are presented. The high projection includes the impacts of the high population projections as well as the improved LOS over time. The moderate projection is based on the realistic population projection, no change in LOS and no increase in light industrial and commercial use over time. It can be seen that the updated high projection lies below the 2015 Strategy's high projection scenario and the updated moderate projection lies below the 2015 Strategy's medium projection scenario. The point of departure of the projection line has purposefully not been selected as the 2017 actual use as a result of the recent drought.
- The "licensed" line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. In the case of Richards Bay, a portion of the overall allocation provided to the CoMLM of 36.22 million m^3/annum (Section **2.2.1**) assumed to be 11.6 million m^3/annum was added to the MW portion allocated to Richards Bay (6.57 million m^3/annum as per **Table 2.1**). This results in a total allocation specifically for Richards Bay of 18.17 million m^3/annum. The high projected future requirement may therefore exceed the allocation in 2020.

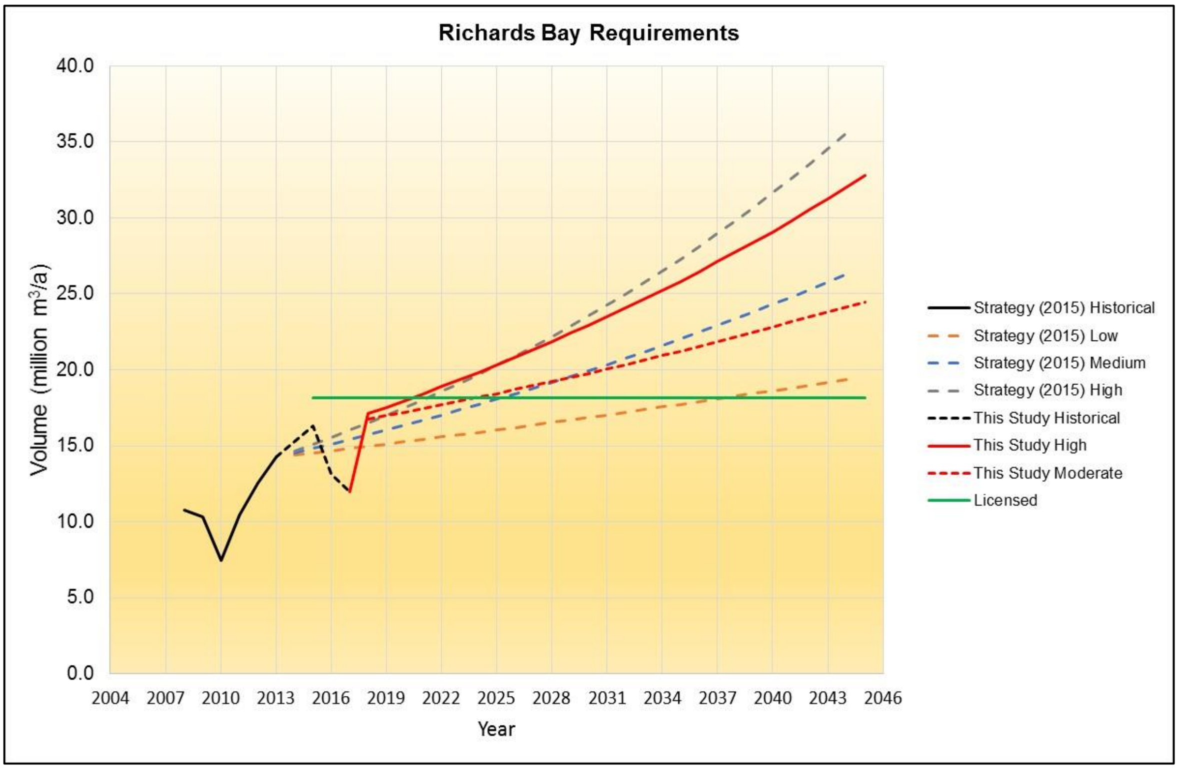

Figure 3.2: Water requirements of Richards Bay

3.4 Empangeni

The demand centre of Empangeni is located in the northern part of the uMhlathuze LM, consisting of a formal town centre. Empangeni is primarily supplied from the Nsezi WTW, via an abstraction from Lake Nsezi and during emergencies directly from the Mhlathuze Weir. Both the CoMLM and MW have allocations to supply the Empangeni demand centre.

The overall water requirements for Empangeni are included in **Figure 3.3**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained in this Study from information provided by MW. The reduction in use resulting from restrictions due to the drought is evident in this information.
- The previous low, medium and high projections included in the Strategy (2015) are shown. These previous projections were assumed to be a growth of 1%, 2% and 3% of the 2013 observed use figure.
- The updated projections (high and moderate) as determined using the methodology explained in **Section 3.1** are presented. The high projection includes the impacts of the high population projections as well as the improved LOS over time. The moderate projection is based on the realistic population projection, no change in LOS and no increase in light industrial and commercial use over time. It can be seen that the updated high projection lies below the 2015 Strategy's high projection scenario and the updated moderate projection lies below the 2015 Strategy's medium projection scenario. The point of departure of the projection line has purposefully not been selected as the 2017 actual use as a result of the recent drought.

- The "licensed" line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. In the case of Empangeni, a portion of the overall allocation provided to the CoMLM of 36.22 million m^3/annum (Section **2.2.1**) assumed to be 3.45 million m^3/annum was added to the MW portion allocated to Empangeni (5.91 million m^3/annum as per **Table 2.1**). This results in a total allocation specifically for Empangeni of 9.36 million m^3/annum. The high projected future requirement may therefore exceed the allocation in 2020.

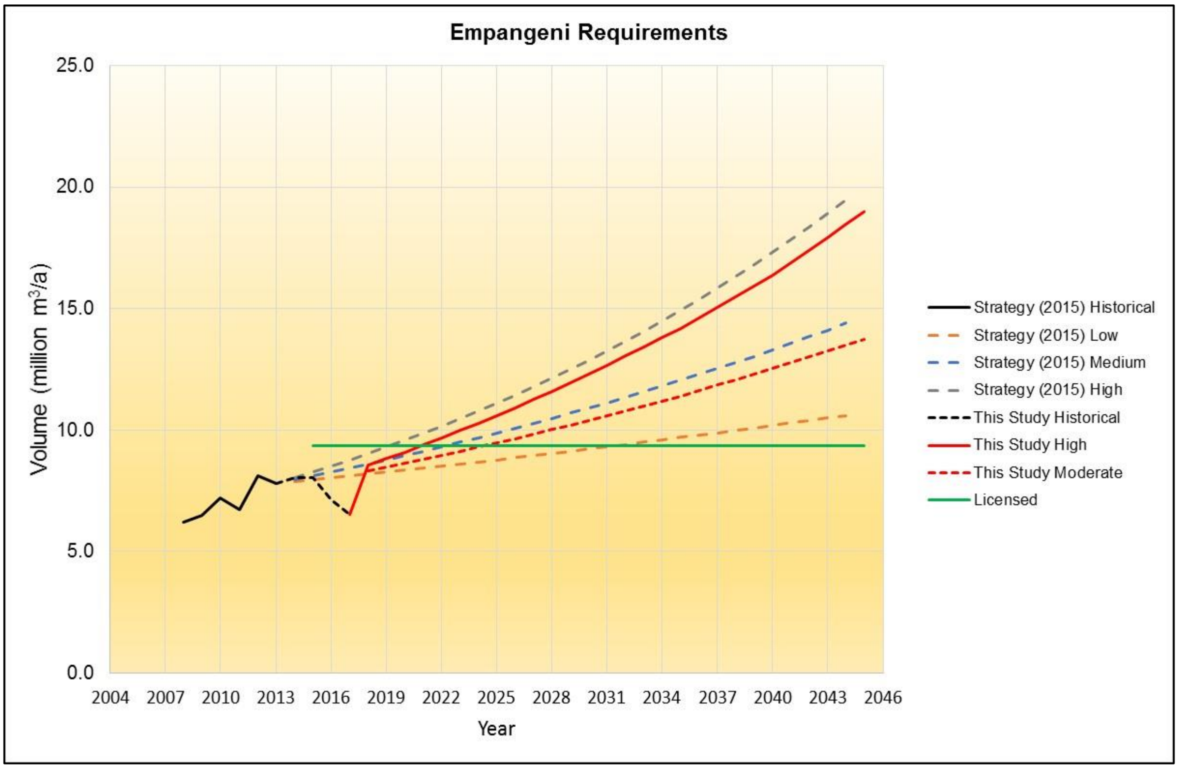

Figure 3.3: Water requirements of Empangeni

3.5 Esikhaweni

The demand centre of Esikhaweni has been grouped together from the water supply areas of Esikhaweni, Vulindlela and Felixton, since all of these areas are supplied from the same source, the Esikhaweni WTW. During emergencies, when the water level in Lake Cubhu is too low, water can be supplied to these areas from the Mhlathuze Weir. The demand centre has a major rural component to the South-West, which is partially supplied by the Mtunzini WSS. Esikhaweni is one of the most densely populated demand centres, and is surrounded by low income settlements. The Esikhaweni-Vulindlela Corridor has been identified as key relocation area for the uMzingwenya communities, as a low and medium income residential income. Furthermore, the University of Zululand is located in Vulindlela.

The overall water requirements for Esikhaweni are included in **Figure 3.3**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained in this Study from information provided by MW.

- The previous low, medium and high projections included in the Strategy (2015) are shown. These previous projections were assumed to be a growth of 1%, 2% and 3% of the 2013 observed use figure.
- The updated projections (high and moderate) as determined using the methodology explained in **Section 3.1** are presented. The high projection includes the impacts of the high population projections as well as the improved LOS over time. The moderate projection is based on the realistic population projection, no change in LOS and no increase in light industrial and commercial use over time. It can be seen that the updated high projection lies below the 2015 Strategy's medium projection scenario and the updated moderate projection lies below the 2015 Strategy's low projection scenario. The point of departure of the projection line has purposefully not been selected as the 2017 actual use as a result of the recent drought.
- The "licensed" line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. In the case of Esikhaweni, a portion of the overall allocation provided to the CoMLM of 36.22 million m^3/annum (Section **2.2.1**) assumed to be 7.56 million m^3/annum was added to the MW portion allocated to Esikhaweni (4.93 million m^3/annum as per **Table 2.1**). This results in a total allocation specifically for Esikhaweni of 12.49 million m^3/annum. The high projected future requirement may therefore exceed the allocation in 2025.

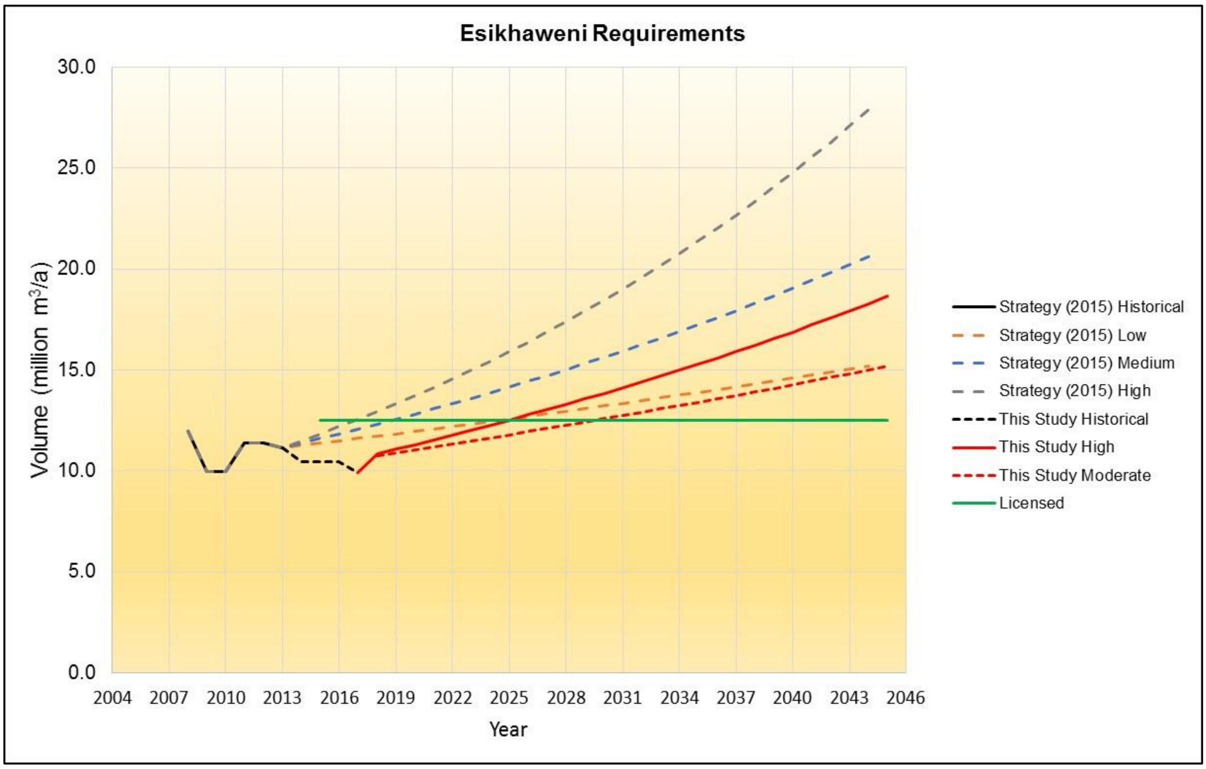

Figure 3.4: Water requirements of Esikhaweni

3.6 Ngwelezane

Ngwelezane is adjacent to Empangeni, and is a low income peri-urban area. Ngwelezane is supplied with water from the Ngwelezane WTW which abstracts raw water from the Mhlathuze River.

The overall water requirements for Ngwelezane are included in **Figure 3.5**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained in this Study from information provided by MW.
- The previous low, medium and high projections included in the Strategy (2015) are shown. These previous projections were assumed to be a growth of 1%, 2% and 3% of the 2013 observed use figure.
- The updated projections (high and moderate) as determined using the methodology explained in **Section 3.1** are presented. The high projection includes the impacts of the high population projections as well as the improved LOS over time. The moderate projection is based on the realistic population projection, no change in LOS and no increase in light industrial and commercial use over time. It can be seen that the updated high projection lies below the 2015 Strategy's medium projection scenario and the updated moderate projection lies below the 2015 Strategy's low projection scenario. The point of departure of the projection line has purposefully not been selected as the 2017 actual use as a result of the recent drought.
- The "licensed" line is included on the graph in order to provide a perspective of the future growth in requirements and the current allocation. A portion of the overall allocation provided to the CoMLM of 36.22 million m^3/annum (Section **2.2.1**) dedicated to Ngwelezane was assumed to be 2.8 million m^3/annum. The high projected future requirement may therefore exceed the allocation in 2023.

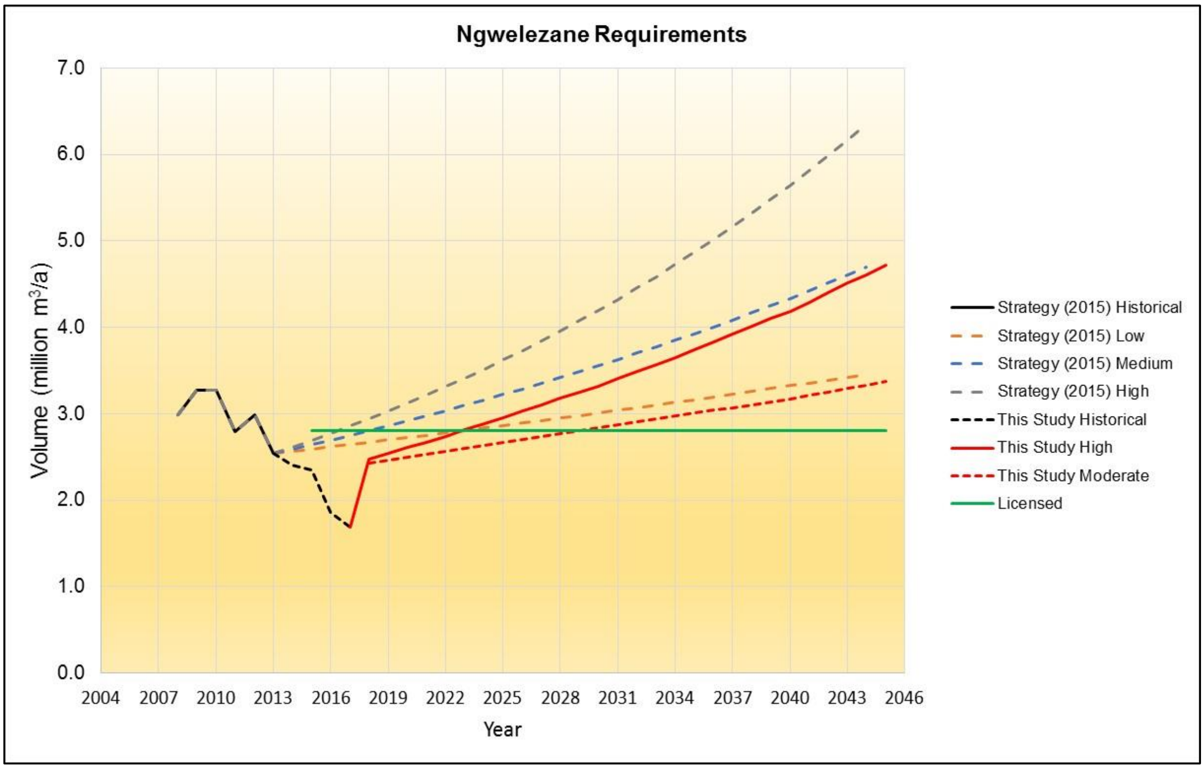

Figure 3.5: Water requirements of Ngwelezane

3.7 Nseleni

Nseleni is located in the North-East of CoMLM and comprises of the formal Nseleni Town and informal settlements in the northern part of Nseleni. Nseleni is supplied from the Mzingazi WTW.

The overall water requirements for Nseleni are included in **Figure 3.5**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained in this Study from information provided by MW.
- The previous low, medium and high projections included in the Strategy (2015) are shown. These previous projections were assumed to be a growth of 1%, 2% and 3% of the 2013 observed use figure.
- The updated projections (high and moderate) as determined using the methodology explained in **Section 3.1** are presented. The high projection includes the impacts of the high population projections as well as the improved LOS over time. The moderate projection is based on the realistic population projection, no change in LOS and no increase in light industrial and commercial use over time. It can be seen that the updated high projection lies below the 2015 Strategy's high projection scenario and the updated moderate projection lies below the 2015 Strategy's medium projection scenario. The point of departure of the projection line has purposefully not been selected as the 2017 actual use as a result of the recent drought.
- The "licensed" line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. A portion of the overall allocation provided to the CoMLM of 36.22 million m^3/annum (Section **2.2.1**) dedicated to Nseleni was assumed to be 5 million m^3/annum. The high projected future requirement may therefore exceed the allocation in 2020.

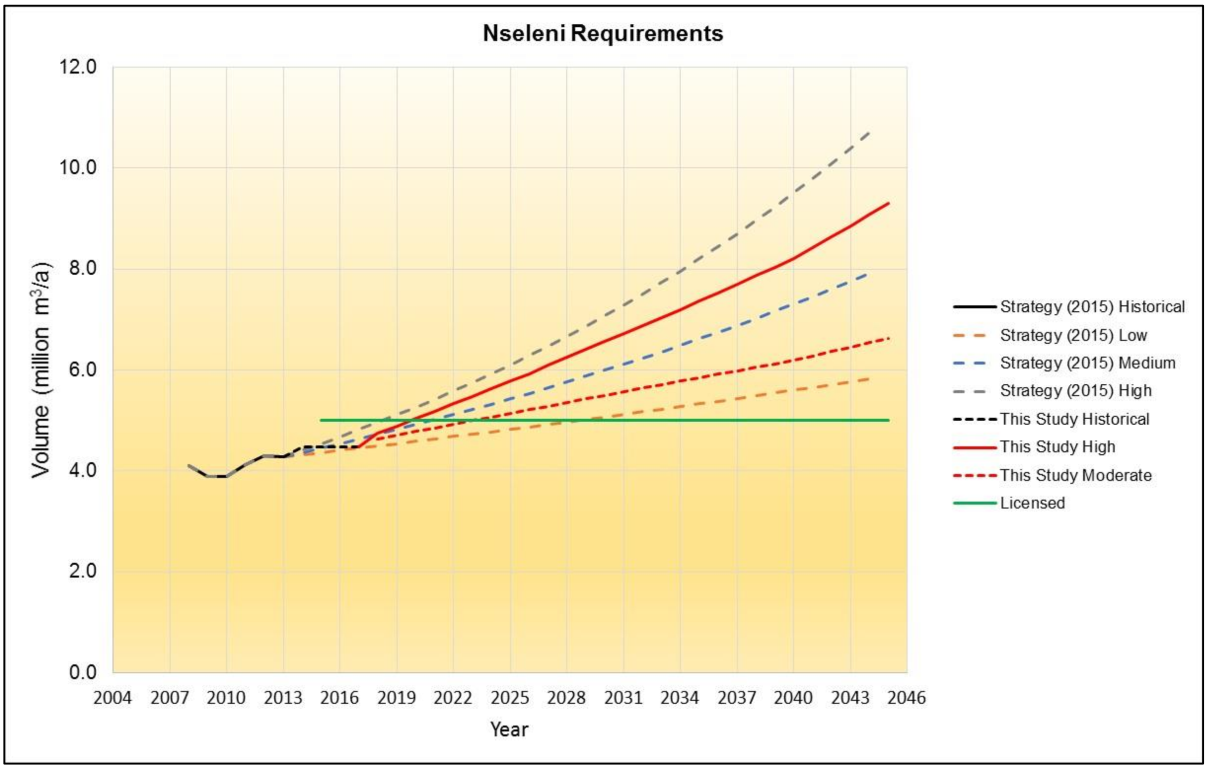

Figure 3.6: Water requirements of Nseleni

3.8 Surrounding Towns

The surrounding towns that were assessed at a desktop level are Eshowe, Melmoth, Mtunzini, Gingindlovu and Amatikulu, and are indicated in **Figure 3.7**. Historical data has been sourced from the previous All Towns Strategies (DWA, 2011a,b,c,d) and updated water use data was requested from the KCDM, the Water Services Authority (WSA) for the surrounding towns.

The Town of Eshowe forms part of the Eshowe WSS consisting of several smaller villages which are serviced by the uMlalazi LM. The town is located in the Matigulu and Mlalazi River Catchments. Furthermore, the town is an agricultural and tourist town, with some industrial activity related to commercial forestry and sugarcane. Eshowe has two local resources, the Eshowe Dam and the Rutledge Dam on the Mlalazi River, and is supplemented with water from Goedertrouw Dam in the Mhlathuze Catchment.

Gingindlovu, including Amatikulu, is a small town with an urban area. Similar to Eshowe, Gingindlovu is dependent on tourism and commercial afforestation.

The Town of Mtunzini forms part of a WSS which supplies the town and surrounding areas, which includes the University of Zululand. Mtunzini forms part of the uMlalazi LM and is reliant on tourism, commercial afforestation as well as mining. The Fairbreeze mining operations of Tronox is supplied by the Mtunzini WSS.

The Town of Melmoth forms part of the Melmoth WSS and is situated in the upper parts of the Mhlathuze Catchment. Similar to the other small towns in the area, Melmoth is also dependent on tourism and agriculture, such as commercial afforestation and sugarcane.

The latest All Towns Strategies completed in 2011 for the surrounding towns only contain historic data of raw and treated volumes up to the year of 2008. The historic raw and treated water volumes are shown in

Table 3.7 for the period from 2015 to 2017. The KCDM was unable to provide data from 2009 to 2014. The use in 2015 and 2016 is low as a result of the recent drought.

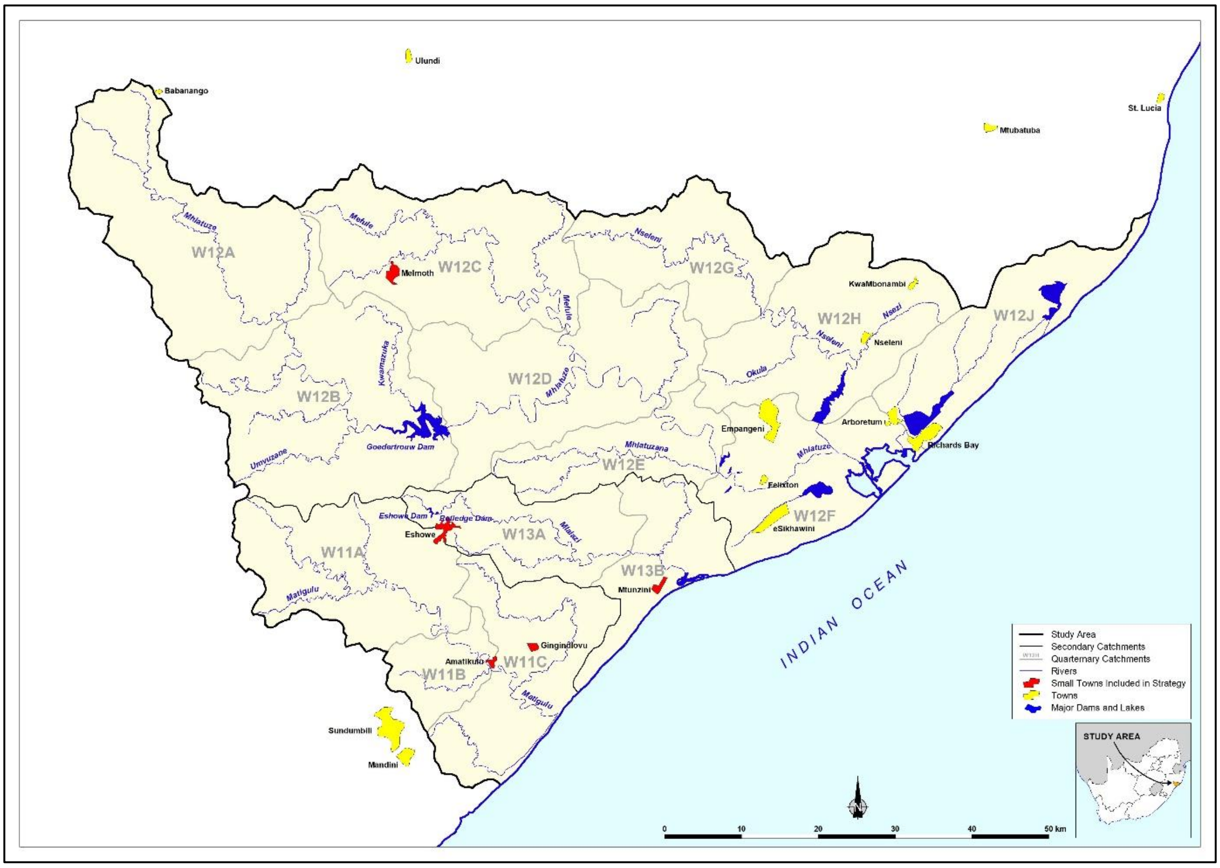

Figure 3.7: Surrounding Towns included incorporated into Reconciliation Strategy

Table 3.7: Historic water use of surrounding towns

Town	Raw or Treated	2008	2015	2016	2017
		million m³/a			
Eshowe	Raw from Rutledge Dam	3.28	0.15	0.29	1.45
	Total Treated*	2.88	1.94	2.08	3.16
Gingindlovu (incl. Amatikulu)	Raw	0.34	0.18	0.44	0.47
	Treated	0.30	0.15	0.33	0.37
Mtunzini	Raw	0.66	0.04	0.00	0.00
	Treated**	0.58	0.49	0.46	0.46
Melmoth	Raw	0.9	NA	NA	NA
	Treated	0.79	NA	NA	NA

* Supplemented by Greater Mthonjaneni WTW with 1.83 million m^3/annum

** Supplemented by CoMLM with 0.46 million m^3/annum

The future growth in water requirements for the surrounding towns included in the All Towns Strategies are summarized in **Table 3.8**. The updated future requirements that were obtained for the purposes of this Study are provided in **Table 3.9**.

Table 3.8: Future water requirements of surrounding towns (All Towns)

Town	Growth Scenario	2016	2020	2025	2030	2035	2040	2045	Compounded Growth (%)
		million m^3/a							
Eshowe	High	4.78	5.53	6.57	7.77	9.45	11.50	13.99	4.00
	Medium	4.25	4.71	5.3	5.93	6.78	7.76	8.88	2.73
	Low	3.79	4.01	4.28	4.55	4.90	5.28	5.69	1.50
Gingindlovu (incl. Amatikulu)	High	0.49	0.56	0.66	0.76	0.91	1.10	1.32	3.72
	Medium	0.44	0.49	0.54	0.59	0.67	0.76	0.86	2.54
	Low	0.41	0.43	0.45	0.46	0.49	0.53	0.57	1.38
Melmoth	High	1.05	1.27	1.58	1.92	2.45	3.12	3.98	4.97
	Medium	0.92	1.05	1.21	1.38	1.63	1.93	2.28	3.41
	Low	0.80	0.86	0.93	0.99	1.09	1.19	1.31	1.86
Mtunzini	High	1.28	1.46	1.7	1.97	2.35	2.81	3.36	3.63
	Medium	1.17	1.3	1.44	1.59	1.81	2.06	2.34	2.62
	Low	1.08	1.16	1.23	1.29	1.40	1.52	1.65	1.65

Table 3.9: Future water requirements for surrounding towns (this Study)

Town	Growth Scenario	2016	2020	2025	2030	2035	2040	2045	Compounded Growth (%)
		million m^3/a							
Eshowe	Moderate	2.08	2.15	2.24	2.33	2.43	2.53	2.64	0.82
	High	2.08	2.23	2.43	2.64	2.85	3.07	3.33	1.64
Gingindlovu (incl. Amatikulu)	Moderate	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.57
	High	0.33	0.34	0.36	0.37	0.39	0.41	0.43	0.93
Melmoth	Moderate	0.86	0.89	0.92	0.96	1.00	1.05	1.09	0.82
	High	0.86	0.92	1.00	1.09	1.17	1.26	1.36	1.59
Mtunzini	Moderate	0.46	0.47	0.49	0.50	0.52	0.54	0.56	0.67
	High	0.46	0.49	0.52	0.56	0.60	0.65	0.70	1.43

3.9 Other Municipal Sector Water Requirements

In addition to the allocations presented in Sections 3.3 to 3.7, further allocations are provided to the Municipal Sector as indicated in **Table 3.5**. Some of these allocated volumes are from tributaries and, while their use is considered when determining the available water resources of the Catchment, they will not specifically form part of the water balance of the main Catchment requirements. A summary of the other Municipal Sector requirements is provided in **Table 3.10**. The Uthungulu DM is the applicant according to the final Allocation Schedule, however, this name has been changed to the KCDM.

Table 3.10: Summary of other Municipal sector allocations

Existing / New	Details	Allocation (m^3/a)
Existing applicants	Diffuse	1 010 570
Existing applicants	Supported from Goedertrouw	2 379 495
New applicants	Diffuse	2 056 462
New applicants	Supported from Goedertrouw	15 364 984
DC28 – UTHUNGULU	Total of 74 individual entries	20 811 511

The Strategy (2015) also made provision for future water requirements for the Mtubatuba / Mpukunyoni WSSs in the medium and high growth projection scenarios. These transfers were anticipated to start out of the RBWSS to Mtubatuba and Mpukunyoni in 2018. This has not occurred to date. No further information relating to these schemes was obtained, and the average of the previous medium and high growths has been included in the updated future water requirements as part of this Study. The transfer was delayed to start in 2023.

3.10 Return Flows from the Urban Sector

No measured return flow data for the WWTWs were obtained from the CoMLM or MW, and therefore data obtained from the latest comprehensive Green Drop Report (DWA, 2013) and the Strategy (2015) was relied on. The return flow factor (RFF) is the ratio of the System Input Volume and the treated wastewater volume released from the WWTWs. The RFFs for the various WWTW are 0.36 for Empangeni WWTW, 0.27 for Esikhaweni WWTW, 0.3 for Ngwelezane WWTW and 0.07 for Nseleni WWTW. With an increase in the LOS it can be assumed that the RFFs will grow as more households are connected to formal sanitation systems (waterborne systems). The discharge points are listed in **Table 2.3**. The largest of the urban users, Richards Bay, currently discharges waste water into the Indian Ocean. The 2015 historical wastewater volumes discharged into the ocean from light industrial and domestic users was 11.5 million m^3/a. The future projected return flow volumes are provided in **Table 3.11**.

Table 3.11: Projected future return flow volumes

Centre	Growth Scenario	2018	2020	2025	2030	2035	2040	2045
		million m^3/a						
Richards Bay	Moderate	7.99	8.21	8.79	9.43	10.12	10.89	11.68
	High	8.17	8.57	9.69	10.93	12.30	13.87	15.64
Empangeni	Moderate	3.01	3.12	3.41	3.74	4.11	4.52	4.96
	High	3.08	3.28	3.81	4.43	5.12	5.90	6.84
Esikhaweni	Moderate	2.24	2.32	2.54	2.79	3.06	3.36	3.69
	High	2.91	3.04	3.36	3.72	4.10	4.53	5.01
Ngwelezane	Moderate	0.72	0.74	0.80	0.85	0.90	0.94	1.00
	High	0.74	0.78	0.88	0.99	1.11	1.25	1.41
Nseleni	Moderate	0.31	0.32	0.35	0.37	0.39	0.42	0.44
	High	0.32	0.34	0.39	0.44	0.49	0.55	0.62
Eshowe	Moderate	0.37	0.38	0.39	0.41	0.43	0.44	0.46
	High	0.38	0.39	0.43	0.46	0.50	0.54	0.59

Centre	Growth Scenario	2018	2020	2025	2030	2035	2040	2045
		million m^3/a						
Gingindlovu	Moderate	0.45	0.45	0.46	0.48	0.49	0.51	0.52
	High	0.45	0.46	0.48	0.50	0.53	0.55	0.58
Melmoth	Moderate	0.28	0.28	0.30	0.31	0.32	0.34	0.35
	High	0.29	0.29	0.32	0.35	0.37	0.40	0.44
Mtunzini	Moderate	0.09	0.09	0.10	0.10	0.10	0.11	0.11
	High	0.09	0.10	0.10	0.11	0.12	0.13	0.14

4 BULK INDUSTRIAL WATER USE SECTOR

4.1 Major Industries

4.1.1 Mondi

Mondi processes pulp and paper, which is used to make a number of products such as Baycel and a premier grade bleached hardwood pulp. These processes require large amounts of potable water. Effluent that is recycled for process purposes has to be treated to a high standard. Mondi is supplied with water by Mhlathuze Water from Lake Nsezi. The effluent from Mondi is treated at their own WWTW which is then discharged through Alkantstrand pump station to the sea outfall.

The overall water requirements for Mondi are included in **Figure 4.1**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained directly from Mondi. The reduction in use resulting from restrictions due to the drought is evident in this information.
- The Strategy (2015) assumed a growth projection as indicated in the graph. No information was provided as to how the projection was determined.
- The updated projection has been provided by Mondi directly (see **Table 8.1**). They stated that they are planning to upgrade their production in 2020, however the water use should still remain as per the current trend.
- The “licensed” line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. In the case of Mondi, a portion of the overall allocation of 94.48 million m^3/annum allocated to MW was dedicated to Mondi (49.28 million m^3/annum as per **Table 2.1**) in Compulsory Licencing. However, Mondi and MW believe the allocation provided to Mondi is 100 Mℓ/day which equates to 36.5 million m^3/annum. Both the two allocation figures exceed the anticipated future water requirements.

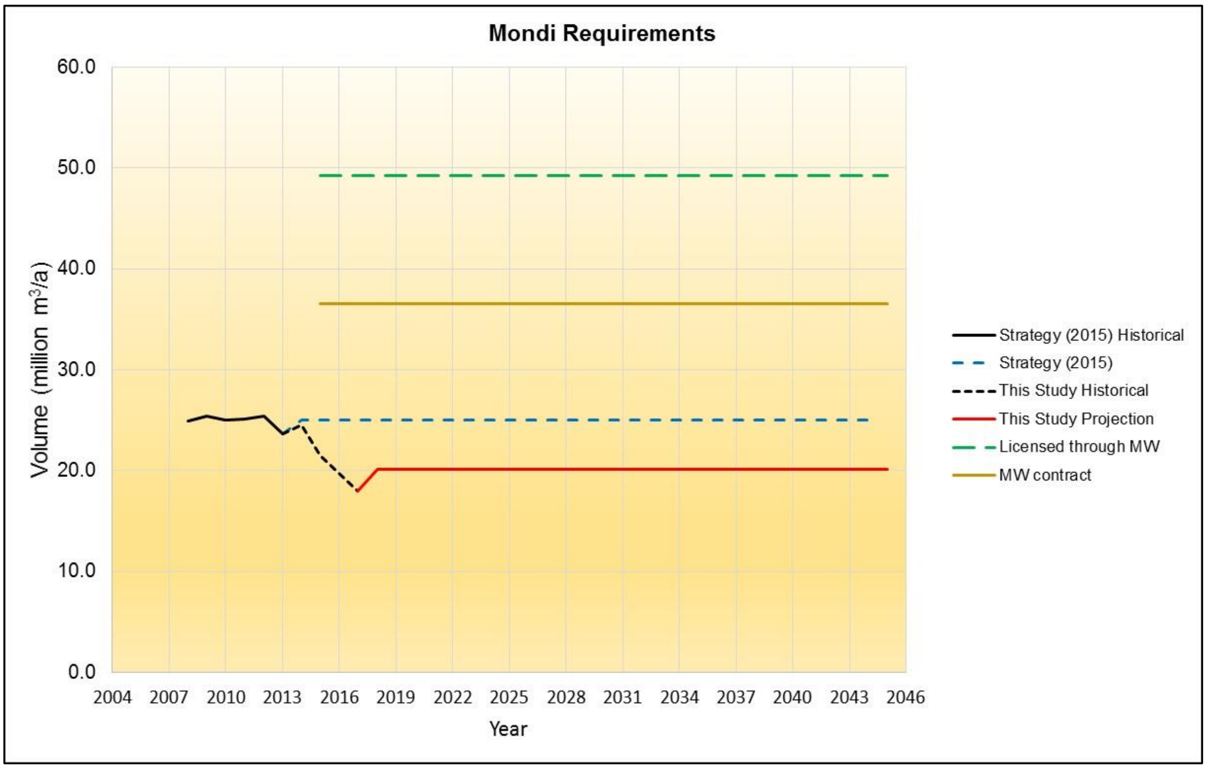

Figure 4.1: Water requirements of Mondi

4.1.2 Foskor

Foskor produces fertiliser, sulphuric and phosphoric acid. Foskor makes use of potable and clarified (semi-purified) water. The clarified water is supplied from the Nsezi WTW by MW and the potable water supplied from the Mzingazi WTW by the CoMLM.

The overall water requirements for Foskor are included in **Figure 4.2**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained directly from Foskor (see **Table 8.1**). The reduction in use resulting from restrictions due to the drought is evident in this information.
- The Strategy (2015) assumed a growth projection as indicated on the graph. Foskor stated that they would increase their use until 2018, and thereafter it would remain constant. It is evident that this growth has not taken place in reality as yet, however, the recent drought could be a contributing factor to this.
- Foskor did not obtain permission from management to provide an updated projection. They did however state that production would increase from 2019, and that the Strategy (2015) projection was higher than they anticipate. An updated projection in line with their allocation was therefore assumed.
- The "licensed" line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. In the case of Foskor, a portion of the overall allocation of 94.48 million m^3/annum allocated to MW was dedicated to Foskor (4.47 million m^3/annum as per **Table 2.1**) in Compulsory Licencing. This is for their clarified water. MW currently have a contract to supply

Foskor with 17 Mℓ/day which equates to 6.21 million m^3/annum. The remaining portion of their allocation for the potable use (5.8 million m^3/annum) was assumed to form part of the CoMLM allocation of 36.22 million m^3/annum. The total allocation for Foskor was therefore assumed to be 10.27 million m^3/annum.

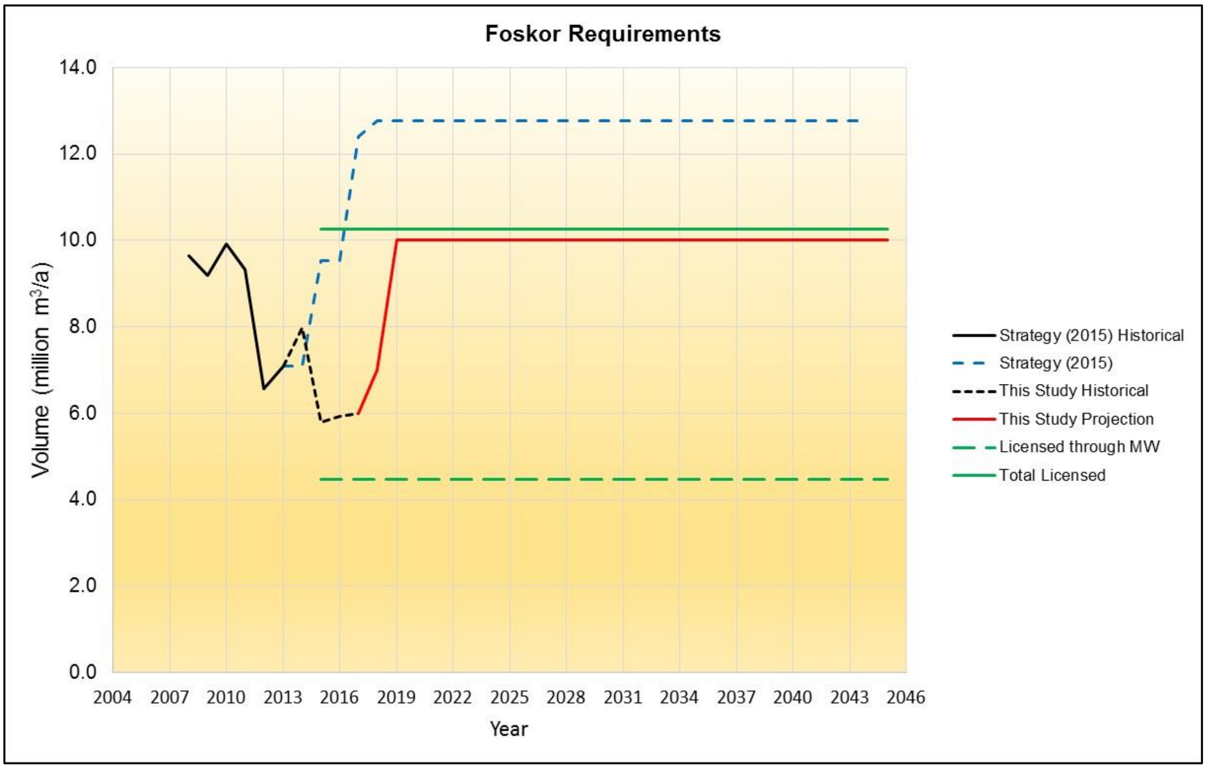

Figure 4.2: Water requirements of Foskor

4.1.3 Hillside (South 32) Aluminium

The Hillside (South 32) Aluminium smelter, which produces ingots is supplied by potable water from Mzingazi WTW. South 32 has its own desalination plant which supplies an average of 2 Mℓ/day (0.73 million m^3/annum). Hillside did not provide updated historical use, nor a future water requirement projection. The Strategy (2015) projection of 0.72 million m^3/annum was therefore again assumed for this Study.

4.1.4 Bayside (Isizinda) Aluminium

The Bayside Aluminium smelters process Aluminium. They are supplied with potable water from the Mzingazi WTW by the CoMLM. The plant was planned to close down due to low commodity prices in 2016. This, however, did not materialise, and the plant is still operating.

The overall water requirements for Bayside Aluminium are included in **Figure 4.3**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015). The Strategy (2015) only obtained a 2013 value, and the years previous were assumed to be the same.
- The updated historical data from 2014 to 2017 were obtained directly from Bayside Aluminium (see **Table 8.1**). The reduction in use resulting from restrictions and a downsizing of activities is evident in this information.

- The Strategy (2015) assumed a growth projection as indicated on the graph. The assumption stated that the potable use would continue as per the 2013 use value, and the raw abstraction would stop.
- The updated projection has been provided by Bayside Aluminium directly. They stated that they are planning to expand the business and that the current water use will triple by 2020.
- The “licensed” line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. Bayside Aluminium has an individual allocation of 0.34 million m^3/annum which is included in the total allocation of 5.74 million m^3/annum provided to industries (see Table C in Government Gazette included in **Appendix B)**. The licensed allocation is greater than the future projected requirements.

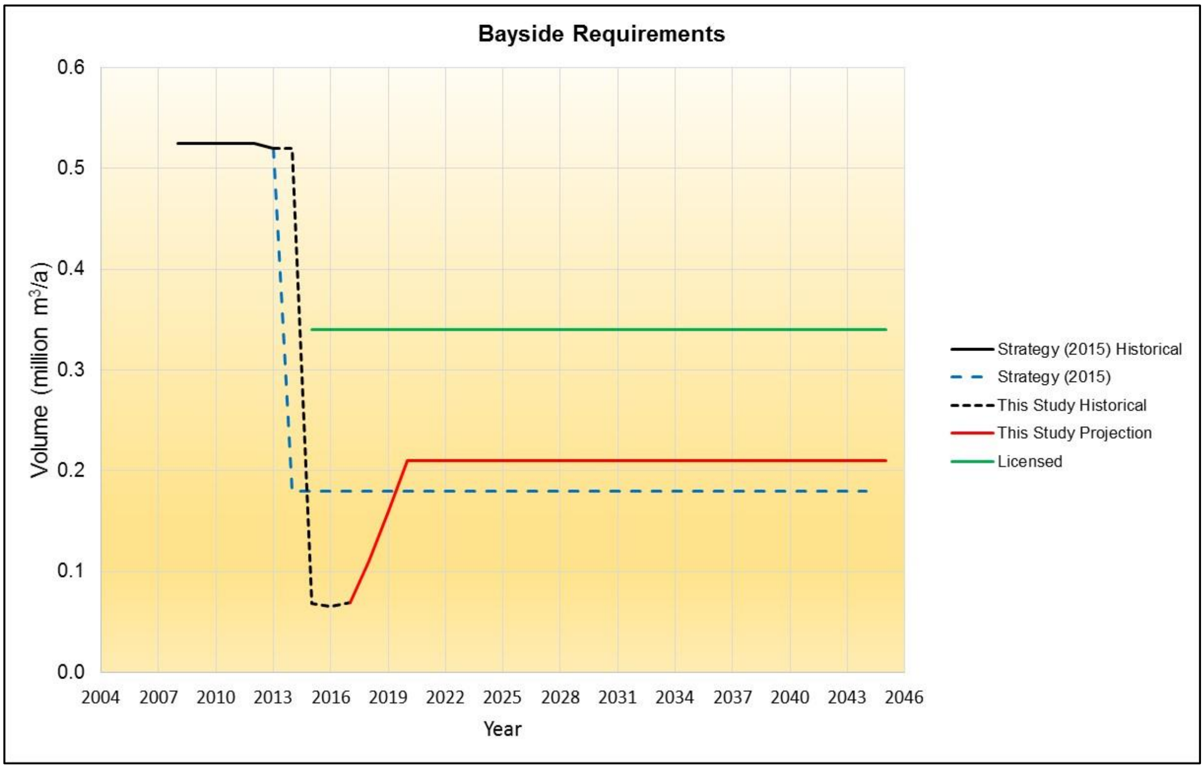

Figure 4.3: Water requirements of Bayside Aluminium

4.1.5 Richards Bay Coal Terminal

The RBCT and harbour are supplied with potable water from the Mzingazi WTW. Furthermore, the RBCT also has an effective storm water reuse plan, which drastically reduced the water requirements from the RBWSS in recent years.

The overall water requirements for the RBCT are included in **Figure 4.4**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).

- The updated historical data from 2014 to 2017 were obtained directly from the RBCT (see **Table 8.1**). The reduction in water use resulting from extensive rainwater harvesting and reuse is evident in this information.
- The Strategy (2015) assumed a growth projection as indicated on the graph. The assumption stated that the 2013 use would continue until 2015, after which it would increase by 25%. It was assumed that a further increase of 50% would occur in 2025.
- The updated projection has been provided by directly by the RBCT. The RBCT stated that they believe their use will remain low into the future if the rainfall harvesting is sufficient to utilise, however, to be conservative, a volume on 0.5 million m^3/annum has been incorporated as the future water requirement.
- No specific license is provided for the RBCT and they fall under the CoMLM's overall allocation. Their requirement is relatively small when compared to other users in the CoMLM.

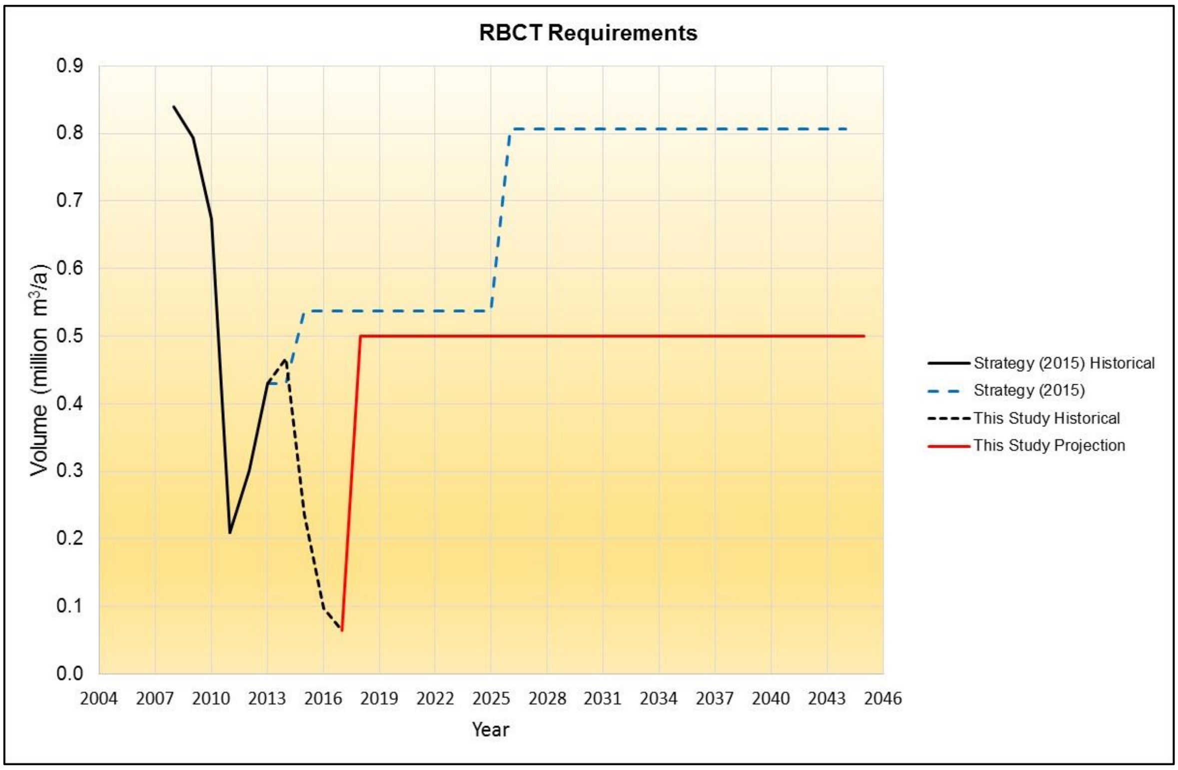

Figure 4.4: Water requirements of the RBCT

4.1.6 Tongaat Hulett Sugar Mill

Tongaat Hulett Sugar Mill was constructed in 1970 and processes harvested sugarcane from the surrounding area. Water is abstracted from the Mhlathuze River and is treated at the Tongaat Hulett WTW.

The overall water requirements for the Tongaat Hulett Sugar Mill are included in **Figure 4.5**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).

- The updated historical data from 2014 to 2017 were obtained directly from Tongaat (see **Table 8.1**).
- The Strategy (2015) assumed a growth projection as indicated on the graph. The assumption stated that the average water use over the period from 2008 to 2013 would be allowed to continue until 2015, after which it would increase by 25%. It was assumed that a further increase of 50% would occur in 2025.
- Tongaat were not able to provide a specific future water requirement projection. They did, however, state that the future requirement would be in accordance to the existing allocation of 1.9 million m^3/annum. This value was therefore considered as the future water requirement for the Tongaat Hulett Sugar Mill.
- There are currently two allocations assigned to Tongaat in the updated Allocation Schedule. The Tongaat Hulett Sugar Mill has an allocation of 1.888 million m^3/annum. The “Rem of Felixton No. 17401”, which is registered to Tongaat Hulett, has an allocation of 0.9 million m^3/annum and is described as a new applicant. Both these values are included in the total allocation of 5.74 million m^3/annum provided to industries (see Table C in Government Gazette included in **Appendix B)**.

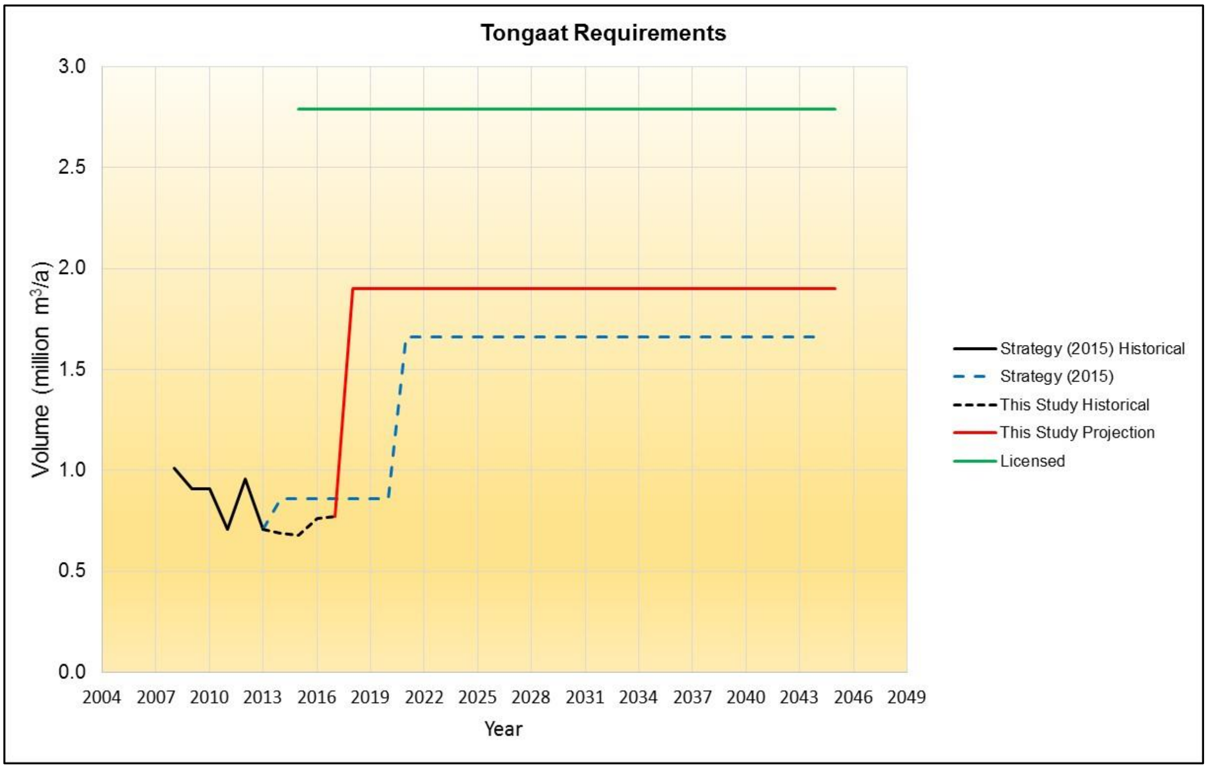

Figure 4.5: Water requirements of the Tongaat Hulett Sugar Mill

4.1.7 Mpact Felixton

Mpact Felixton, previously Mondi Felixton, is a paper mill in the town of Felixton which demerged from the Mondi Group in 2011. A major portion of the raw material for the paper mill manufacturing process is obtained from the nearby Tongaat Hulett Sugar Mill bagasse, a dry pulpy residue left after the extraction of juice from the sugarcane.

The overall water requirements of Mpact Felixton are included in **Figure 4.6**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015). The Strategy (2015) only obtained a 2013 value, and the years previous were assumed to be the same.
- The updated historical data from 2014 to 2017 were obtained directly from Mpact Felixton (see **Table 8.1**). The reduction in water use resulting from restrictions is evident in this information.
- The Strategy (2015) assumed a growth projection as indicated on the graph. The assumption stated that the 2013 use would continue into the future.
- Mpact stated that the future growth in requirements can be identical to their updated allocation.
- The "licensed" line is included on the graph in order to provide a perspective of the future growth in requirements and the current allocation. Mpact Felixton has an individual allocation of 2.48 million m^3/annum which is included in the total allocation of 5.74 million m^3/annum provided to industries (see Table C in Government Gazette included in **Appendix B)**.

Figure 4.6: Water requirements of Mpact Felixton

4.1.8 Industrial Development Zone

The Industrial Development Zone (IDZ) is an industrial estate in Richards Bay, which consists of various phases to be implemented in future. The current focus is on Phase 1F and to date, the following five investors have been incorporated into the IDZ Phase 1F:

- Nyanza Light Metals;
- Byromate;

- Elegant Afro Line Chemical;
- EMv Nanomaterials; and
- ESK Paper Industries.

The overall water requirements for the IDZ are included in **Figure 4.7**. A description of the information is as follows and the values are included in **Appendix C**.

- The Strategy (2015) assumed three growth scenarios for the IDZ, namely a low, medium and high scenario as indicated on the graph.
- The IDZ representative (**Table 8.1**) stated that the future water requirements are expected to be stable at 18 Mℓ/day (6.57 million m^3/annum) and MW confirmed that they have been approached to provide this water to the IDZ from 2020.
- There is no specific allocation provided to the IDZ, however, the Allocation Schedule has set aside 10.7 million m^3/annum of water to be taken up. For comparison purposes, this has been included on the graph (Table B of Government Gazette, **Appendix B**).

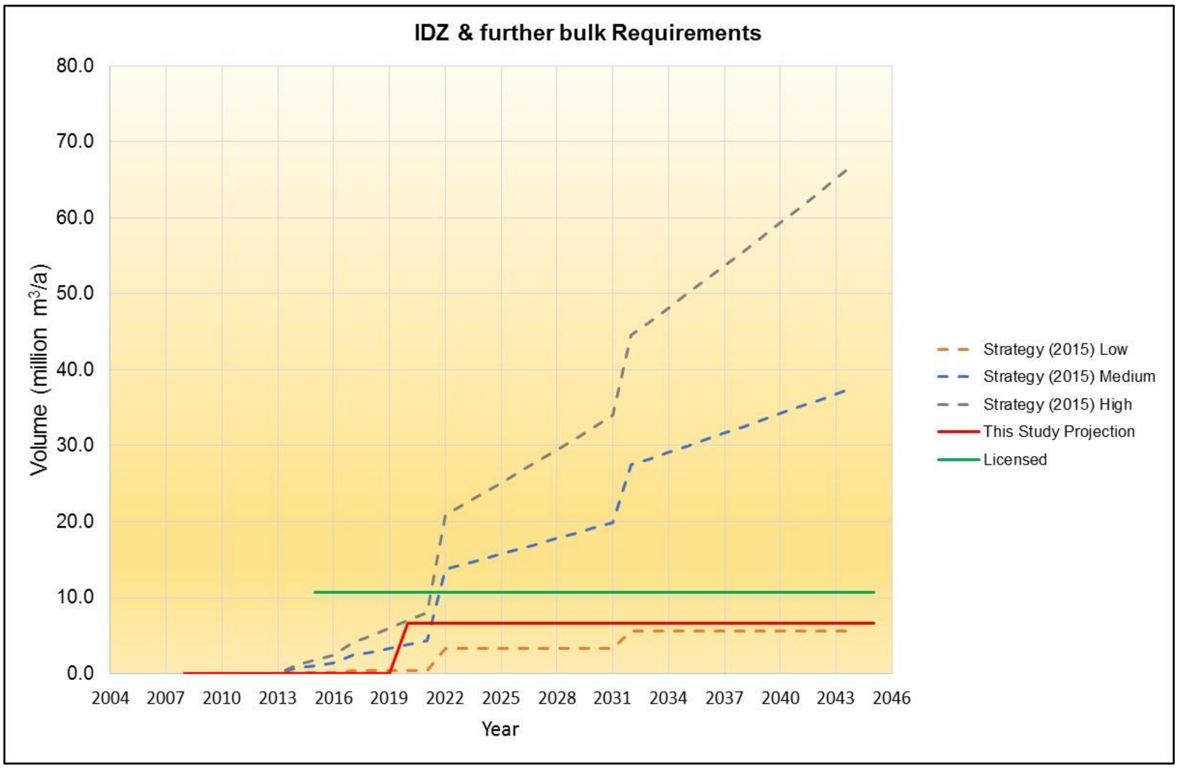

Figure 4.7: Water requirements of the IDZ

4.1.9 Other Industries and Bulk Users

The three additional industries that are listed in **Table 4.1** have allocations included in the total volume allocated to the Industry Sector of 5.74 million m^3/annum. (See Table C in Government Gazette included in **Appendix B**). These are all minor requirements compared with the other users.

Table 4.1: Other industries with allocations

Applicant	Property	Allocation (m^3/a)
Nkwaleni Processors	Perseverance 6128 Ptn 1	26 163
Empangeni Milling	Ptn 5 of erf 12052	259
Ukumba Brick & Quarry	Reserve no. 5 no. 15824 of District Lower Umfolozi	3 564

Eskom has indicated a need for water in the future for a planned Combined Cycle Gas Turbine (CCGT). The estimated requirement is 5 Mℓ/day for the full scale CCGT plant, which equates to 1.8 million m^3/annum, that will be required from 2023. However, this water requirement is currently forming part of the plans involving industrial effluent reuse projects, and will therefore not be an additional requirement on the RBWSS. It has been considered as a future requirement, as indicated in **Appendix C**.

4.2 Mining Sector

4.2.1 Richards Bay Minerals

The RBM mines sand dunes in Richards Bay for heavy minerals, including Ilmenite. Zircon and Rutile. Their mining operations consist of two areas; namely the Tsand/Zulti North area, which is to the North of Richards Bay, and Zulti South area, which is close to eSikhaweni. The Zulti South area is not yet active. According to the Strategy (2015), the Zulti South operations were planned to commence in 2016, however, these operations have not yet commenced.

Water is used in RBM's mining operations to liquefy sand and for the separation of heavy metals in a concentrator plant. Currently the mining plant is supplied form Lake Nhlabane and supplemented with raw water from the Umfolozi River. Lake Nsezi, which is an additional source is expensive to use for the mining operations and therefore operation is aimed at reducing the water demand from Lake Nsezi.

The minerals that are mined by RBM are processed in a smelter, which uses raw water from Lake Nsezi. The smelter also has its own WTW which treats the raw water to potable standards.

The overall water requirements for RBM are included in **Figure 4.8**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained directly from RBM (see **Table 8.1**).
- The Strategy (2015) assumed a growth projection as indicated on the graph. The assumption was that use would remain at 20 million m^3/annum until 2017, and would thereafter increase and then remain constant.
- The updated projection has been provided by RBM directly. RBM stated that they are expecting to increase their current use in 2020 when Zulti South becomes operational, and thereafter they will remain within their updated allocation throughout the planning period.
- The "licensed" line is included on the graph in order to provide a perspective of the future growth in water requirements and the current allocation. In the case of RBM, a portion of the overall allocation of 94.48 million m^3/annum provided to MW was dedicated to RBM (14.78 million m^3/annum as per **Table 2.1**) in Compulsory

Licencing. In addition to that, RBM has their own allocation of 14.02 million m³/annum, resulting in a total allocation of 28.8 million m³/annum.

Figure 4.8: Water requirements of RBM

4.2.2 Tronox

Tronox mines dunes to the South of Richards Bay for heavy minerals, such as Ilmenite and Zircon. Rutile is mined at Tronox's Fairbreeze Mine, south of Mtunzini. Tronox has a heavy minerals refinery and smelter plant North-West of Empangeni. The central processing plant receives water from the Nsezi WTW. Water for the mining operation is abstracted at the Mhlathuze Weir. It was initially envisaged that water would be obtained from the Thukela transfer from Mandini, however, this has not yet materialised.

The overall water requirements for Tronox are included in **Figure 4.9**. A description of the information is as follows and the values are included in **Appendix C**.

- The historical use data dating from 2008 to 2013 were obtained from the Strategy (2015).
- The updated historical data from 2014 to 2017 were obtained directly from Tronox (see **Table 8.1**).
- The Strategy (2015) assumed a growth projection as indicated on the graph. The expected future use was provided by Tronox at the time.
- The updated projection has again been provided by Tronox. They stated that they are expecting to increase their current use in 2018 and a further increase in 2021. Another increase will occur in 2031 when the Port Durnford Mine becomes operational.

- The “licensed” line is included on the graph in order to provide a perspective of the future growth in requirements and the current allocation. In the case of Tronox (WARMS applicant Ticor: Hillendale), a portion of the overall allocation of 94.48 million m^3/annum provided to MW was dedicated to Tronox (8.54 million m^3/annum as per **Table 2.1**) in Compulsory Licencing. This volume is however lower than the Tronox expected growth in water requirements.

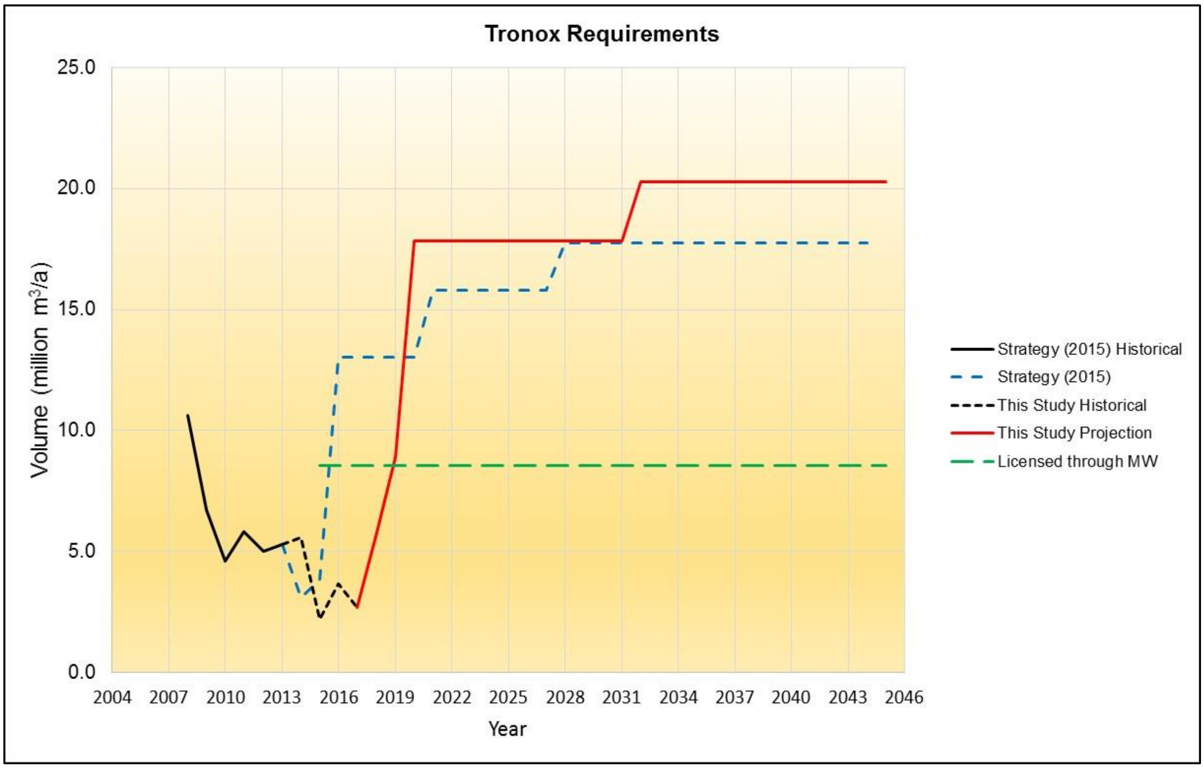

Figure 4.9: Water requirements of Tronox

4.3 Return Flows from the Bulk Industrial Sector

The only additional WWTW dedicated to the bulk industrial sector and not already reported on in **Section 3.10** is the Mondi WWTW. The remainder of the industrial users discharge their treated and screened wastewater into the ocean through the Alton and Arboretum Macerators. The information on return flows obtained for the industrial users are summarised in **Table 4.2**. The table shows a reduction in return flows as a result of reduced water use during the recent drought. The design capacity of the Mondi WWTW is 20.1 million m^3/annum (55 Mℓ/day) and the current average treated volume is 18.6 million m^3/annum (51 Mℓ/day). The treated water is reused in Mondi’s own processes and supplied to nearby industries.

Table 4.2: Summary of return flows from industrial users

Industrial User	2013	2014	2015
	(million m^3/a)		
Mpact	1.90	2.05	1.93
Bayside (Isizinda)	0.27	0.16	0.00
Hillside (South 32)	0.13	0.08	0.04
Tronox	0.67	0.71	0.58

Industrial User	2013	2014	2015
	(million m^3/a)		
Foskor Buoyant Effluent	0.67	0.71	0.58
Foskor Dense Effluent	0.67	0.71	0.58
Mondi*	19.5	19.3	17.1
Total	**4.31**	**4.42**	**3.72**

*Mondi wastewater is treated and reused

5 AGRICULTURAL WATER USE SECTOR

5.1 Irrigation

Irrigation for agriculture is a large water user in the Mhlathuze Catchment upstream of the RBWSS.

5.1.1 Strategy Assumptions

The Strategy (2015) considered two scenarios of irrigated agriculture. The first scenario was the assumed allocation at the time of 125 million m^3/annum (as Compulsory Licensing was not yet finalised) and the second scenario was an assumed actual use volume of 88.5 million m^3/annum. It should be noted that the Strategy (2015) used the second scenario (88.5 million m^3/annum) for the future water requirements in the water balance, without any consideration of growth towards the allocated volume.

5.1.2 Allocations from Compulsory Licensing

The final volume allocated to the irrigation sector is 128.59 million m^3/annum. This allocation is a combination of 124.41 million m^3/annum (Table C) and 4.18 million m^3/annum (Table A: Existing Licenses) as indicated in the Government Gazette included in **Appendix C**. A breakdown summary per scheme is presented in **Table 5.1**.

Table 5.1: Summary of Final Allocation Schedule for irrigation (DWS, 2015c)

Location	Allocation (million m^3/a)
1) Heatonville	43.62
2) Lower Mhlathuze	7.73
3) Mfuli	5.55
4) Nkwaleni	57.00
5) Other-irrigation	8.93
c) Existing licenses under NWA	4.18
b) Applications for new water uses	1.54
Total	**128.54***

* slight difference in total, possibly due to rounding errors

Some of these applicants are diffuse irrigators, meaning that they obtain their water from tributaries. While their use is considered when determining the available water resources of the Catchment, they will not specifically form part of the water balance of the main Catchment requirements. Furthermore, these users do not form part of an Irrigation Board. Only the Irrigation Boards indicated in **Table 5.1** (Heatonville, Lower Mhlathuze, Mfuli and Nkwaleni) are dependent on the Goedertrouw Dam for their water. Therefore, the volume allocated to irrigation forming part of the water balance is 113.9 million m^3/annum.

5.1.3 Actual Water Use for Irrigation

The irrigators belonging to an Irrigation Board should submit their actual use to the DWS on a monthly basis. Some information was obtained from the DWS, however, significant gaps exist in the data. It was therefore not possible to obtain an updated estimate of actual water used for irrigated agriculture in the Catchment.

It should, however, be noted that the irrigation sector has been on an 80% restriction over the recent drought period. This means that they have only made use of 20% of their allocated volumes. For this reason, it will not be possible to make meaningful assumptions using the actual use over recent years. In addition, it was stated that many farms have stopped production over the drought period.

Given that the irrigation sector allocations were reduced to 66% of their original quotas during Compulsory Licensing, it is likely that the previous large difference between allocated use and actual use is no longer applicable. For the purposes of this Study, the allocated volume of 114 million m^3/annum is assumed for the irrigation sector in this Study. This is the maximum volume allowed for, and will not grow further into the future.

5.2 Dryland Sugarcane

Though not officially declared a Stream Flow Reduction Activity (SFRA) the extent of dryland sugarcane is large in the Catchment, and it is therefore important to consider the impacts thereof. No further information was available on dryland sugarcane, and the MWAAS values are therefore presented. The areas and estimated volumes used by dryland sugarcane are summarized in **Table 5.2**.

Table 5.2: Summary of dryland sugarcane in the Mhlathuze Catchment

Quaternary	Existing area (km^2)	Existing use average (million m^3/a)
W12A	1	0
W12B	36	2.28
W12C	32	2.61
W12D	16	1.53
W12E	18	1.96
W12F	85	6.65
W12G	3	0.25
W12H	73	5.4
W12J	0	0
Total	**264**	**20.68**

5.3 Afforestation

An extensive investigation into the status of existing afforestation in the Mhlathuze Catchment was undertaken during the MWAAS. Subsequently after Validation, Verification and the determination of the existing lawful use, Compulsory Licensing finalized allocated areas and volumes for afforestation (indicated in the Gazette as SFRAs, see **Appendix B**).

The information indicates that there is a significant difference between the existing and allocated afforestation. The DWS KZN Office indicated that no progress has yet been made on the removal of unlawful afforestation, though it was mentioned as a priority intervention in the Strategy (2015). Removal of unlawful afforestation will result in a positive impact on the water balance of the Study Area. No further afforestation will be allowed for in the future. A summary of the information available on afforestation is provided in **Table 5.3**. This provides the afforested areas and estimated volumes used the Mhlathuze Catchment (W12) affecting the RBWSS.

Table 5.3: Summary of afforestation in the Mhlathuze Catchment

Quaternary	Existing area (ha)	Existing use average (million m^3/a)	Allocated area (ha)	Allocated use average (million m^3/a)	Unlawful use (million m^3/a)
W12A	17 308	12.87	15884	11.96	0.91
W12B	5 077	3.61	4306	3.09	0.52
W12C	13 314	9.55	7780	5.66	3.89
W12D	919	0.81	720	0.65	0.16
W12E	53	0	0	0.00	0.00
W12F	3 457	3.04	2803	2.50	0.54
W12G	5	0	0	0.00	0.00
W12H	12 935	14.17	12348	13.69	0.48
W12J	14 642	24.64	12131	20.57	4.07
Total	**67 711**	**68.69**	**55 971**	**58.12**	**10.57**

5.4 Return Flows from the Agriculture Sector

Return flows from irrigated agriculture are not measured in the Study Area. The MWAAS assumption of approximately 15% of the irrigation requirements return back into the Mhlathuze system as return flows will be used in this Study.

6 OTHER WATER REQUIREMENTS

6.1 Ecological Water Requirements

A reserve determination process was first undertaken in the Study Area as part of the Mhlathuze Operating Rules and Future Phasing Study (DWAF, 2001). The MWAAS subsequently updated and extended the hydrology of the Mhlathuze Catchment, and the originally determined Ecological Water Requirements (EWRs) were then scaled in order to reflect the adjusted hydrology. These scaled EWRs were "signed off" as the preliminary reserves applicable to the Catchment in May 2012 (DWA, 2012c).

The preliminary reserve was considered during Compulsory Licensing. During Compulsory Licensing, a closer review of the "signed off" preliminary reserves indicated that some errors had occurred in developing the EWRs. These errors were as a result of incorrect scaling of hydrological data sets and the incorrect positioning of the EWR sites. These errors were rectified prior to the Compulsory Licensing analyses, and the correct EWRs were incorporated and analysed.

The resulting Gazette (see **Appendix B**) included a summary of the correct reserve requirements, which is shown in **Table 6.1**. The table presents the average flows at each of the EWR sites over the historical record period.

No further work relating to the EWRs has been undertaken since these flows were Gazetted, and these will therefore be used as part of this Study. The DWS still needs to undertake a Classification Study before the final EWRs for the Mhlathuze Catchment can be determined. The DWS recently called for proposals for Service Providers to undertake the Determination of Water Resource Classes and Associated Resource Quality Objectives in the Usuthu and Mhlathuze Catchments, however, the Study has not yet commenced.

Table 6.1: EWR summary according to Gazette No. 38599

EWR Site	Position	Volume (million m^3/a)
1	W12A Outlet	16.97
2	Downstream Goedertrouw Outlet of W12B	41.07
3	W12C Outlet	7.06
4	W12D downstream of Mhlathuze-Mfuli Confluence	32.61
5	W12D Outlet	31.81
6	W12E Outlet, not including Mhlathuzana river contribution	32.19
7	Upstream of Mhlathuze-Nsezi Confluence	37.19
8	W12G Outlet	3.40
9	W12H Outlet	10.22
10	Mhlathuze Mouth	10.85
11	W12J2 Mouth	0.76

6.2 Invasive Alien Plants

Invasive Alien Plants (IAPs) can cause a significant reduction in runoff, especially if these plants are riparian. No further information relating to the extent and use of IAPs in the Catchment was available, and therefore the MWAAS data in assumed in this Study. The IAP Survey Dataset from 2010 was reviewed, differences in area distribution were found, which are summarised in **Table 6.2** (ARC, 2010). The total IAP area for the two sources of information is very similar and only differs by 5 km^2 in total. The water requirements for the condensed IAP Survey were not derived.

Table 6.2: Summary of IAPs in the Mhlathuze Catchment

Quaternary	Condensed IAP area (km^2) MWAAS (2006)	MWAAS water use average (million m^3/a)	Condensed IAP survey area (km^2) (2010)
W12A	18	2.01	33.3
W12B	21	2.5	31.8
W12C	10	0.65	30.0
W12D	12	0.97	23.7
W12E	10	1.43	4.1
W12F	41	5.99	0
W12G	4	0	0
W12H	11	1.42	13.3
W12J	13	1.84	8.9
Total	**140**	**16.81**	**145.1**

6.3 General Authorisations

According to the National Water Act (Act No 26 of 1998), no water use license is required until the General Authorisation is revoked. A revision of General Authorisation water use was undertaken and is Gazetted in Gazette No 40243 of September 2016 (SA, 2016). This updated Gazette indicates that 2000 m^3/annum, or a maximum of 1 ℓ/s may be abstracted per person on communal land or per property for surface water throughout the year in the Mhlathuze Catchment (Tertiary Catchment W12). This applies to rural communal land and other properties, which are not part of formal WSSs and have access to a watercourse. For groundwater the abstraction volume is given per property size for different Tertiary Catchments. Where no General Authorisation volume is provided for a catchment, an application for a water use license has to be completed. A summary of the General Authorisations for surface water is provided in **Table 6.3** and for groundwater in Table 6.4.

Table 6.3: General Authorisations for surface water applicable to the Study Area

Drainage Region	Main River	Maximum volume of surface water that may be abstracted on each property or by each person on communal land in terms of the authorisation (m^3/a)	Maximum rate at which surface water may be abstracted by on each property or by each person on communal land in terms of the authorisation (l/s)	Months in which water may be abstracted in terms of this authorisation	Maximum volume that may be stored on each property or by each person on communal land in terms of the authorisation (m^3)
W11	Mhlathuze	20 000	4	December to April	20 000
W12	Mhlathuze	2 000	1	Whole year	2 000
W13	Mhlathuze	20 000	4	December to April	20 000

Table 6.4: General Authorisations for groundwater applicable to the Study Area

Quaternary Catchments	Abstraction rate (m^3/ha/a)
W11A - W11C; W12A - W12C; W13A	150
W12D - W12J; W13B	400
W11A - W11C; W12A - W12C; W13A	150

The Study Area has a rural population of approximately 40 000 individuals which are not covered by any formal WSSs. If it is assumed that only 10% of the rural population has access to a watercourse and that an average property located next to a watercourse has four occupants, there would be approximately 1000 properties. If each property uses 2000 m^3/annum, this would add an additional requirement of approximately 2 million m^3/annum for the Study Area. This is relatively small compared to the total water requirements. The assumed requirement is, however, an indicative estimate with a great deal of uncertainty. Furthermore, there is a possibility of double counting the rural water requirements component included in the basic human needs component of the Reserve as well as the allocation provision set aside for Community Cooperatives and Traditional Authorities during Compulsory Licensing. It is therefore recommended that the General Authorisation consumption is not included as an additional requirement in this Study

6.4 SFRAs: W11 & W13 Tertiary Catchments

The total water used by afforestation, IAPs and dryland sugarcane in the two neighbouring Tertiary Catchments, namely W11 and W13, where the surrounding towns are located is summarised in **Table 6.5**. The majority of the afforestation areas can be found in the W11A and W13B quaternaries, with the largest dryland sugarcane areas occurring in W11C.

Table 6.5: SFRAs in catchments W11 and W13

	SFR Water Use		SFR Areas			
Quaternary	**Water Use (million m^3/a)**	**As a % of Naturalised MAR**	**Forest km^2)**	**IAPs (km^2)**	**Dryland sugarcane (km^2)**	**Total (km^2)**
W11A	20	27	30	68	97	195
W11B	5	24	1	16	59	76
W11C	14	16	15	38	230	283
W13A	14	25	0	26	91	117
W13B	5	10	35	7	68	110
Total	**58**		**81**	**155**	**545**	**781**

7 CONCLUSIONS AND RECOMMENDATIONS

Accurate water requirement projections are an important part of a Reconciliation Strategy. The required size and implementation dates of future interventions are directly related to the growth in future water requirements. Historical use information has been obtained for all the major users in the Study Area. Two updated future requirement projections have been determined, namely a high growth and a moderate growth projection. The high growth projection is based on future high population and the LOS increases in the urban sector, individual discussions of future water requirements in the bulk industrial sector as well as updated allocations in the irrigation sector. The moderate growth projection is based on future realistic population increases, however, no change in the LOS and increase in light industrial and commercial uses is accounted for. The bulk industrial and irrigation sector future requirements are identical to the high growth scenario. Generally, all the Stakeholders were forthcoming with their information and understood the need to provide accurate information for future planning.

The overall perspective of the water requirements of the RBWSS is presented in **Figure 7.1**. The graph includes the historical use from 2008 until 2017. The impact of reduced use over the recent drought period is evident. Furthermore, the graph also includes the Strategy (2015) low, medium and high projection scenarios. These scenarios were based on broad assumptions, and it is believed that the updated projections resulting from this Study have been determined using a more systematic approach. The graph also presents the updated allocations provided to users dependant on the water resources supplying the RBWSS.

The updated future projection initially grows steeply which is partly as a result of the past few years of slower growth due to the drought. Many bulk water users have specific plans to increase use over the next few years. The projection slope then evens off and finishes slightly higher than the 2015 Strategy's medium projection scenario in 2045. It is expected that the high projection will exceed the allocated volume in 2032.

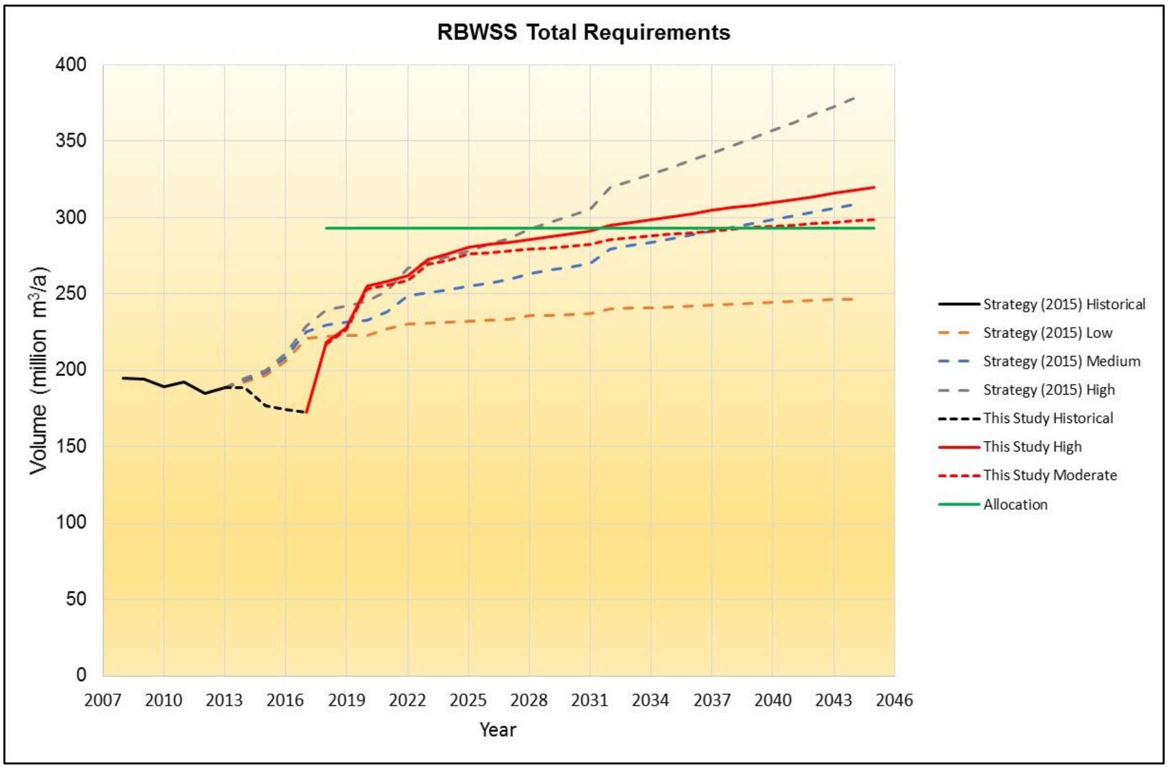

Figure 7.1: RBWSS total water requirements

The following recommendations are made as a result of executing the Task of updating the water requirements in the Study Area.

- Future water requirements should not be projected from a low base point resulting from a drought. Experience shows that water use rapidly returns to the historical trend experienced prior to a drought.
- Actual use should continuously be gathered from the major users in the RBWSS in order to compare with the Strategy projections with the aim to make adjustments if required.
- Improved monitoring of water use should take place in especially the urban sector, where estimates had to be made to fill the gaps in the raw data obtained. This recommendation applies to both the CoMLM and the KCDM.
- The water requirement projections formulated as part of this Study (this Report) should be used in the analyses of scenarios in order to update the Strategy (2015) as part of this Study.

8 STAKEHOLDER ENGAGEMENT

Extensive Stakeholder Engagement was undertaken during the execution of this Task in order to gather the required information included in this Report. The engagements ranged from formal meetings (28 February 2018, 23 May 2018 and 1 August 2018) to numerous telephonic conversations, email communication as well as WhatsApp messages.

MW was able to provide most of the information relating to the urban sector. For the industrial sector, summary data sheets were prepared for each major user, and sent out for comment. Compulsory Licensing information was used for the agricultural sector.

The relevant Stakeholders engaged with in this task are summarised in **Table 8.1**. A summary of the communications is also provided.

Table 8.1: Stakeholders engaged with during the execution of this task

Name	Organisation	Contact	Communication	Information
Zama Zuma	Mhlathuze Water	zzuma@mhlathuze.co.za	Emails, StraSC meeting	Historical WTW & WWTW volumes: urban sector (CoMLM)
Rheenie Mbatha	CoMLM	mbatharb@umhlathuze.gov.za	Emails, Phone calls, WhatsApps	No information provided
Muzi Khanyile	King Cetshwayo DM	Khanyilem@kingcetshwayo.gov.za	Emails, Phone calls, StraSC meeting	Historic use: surrounding towns
Brendan Crawford	Mondi	Brendan.Crawford@mondigroup.com	Emails, Phone calls, WhatsApps	Historical use & future requirements
Sumaya Khan	Foskor	SumayaK@foskor.co.za	Emails, Phone calls, WhatsApps	Historical use & future requirements
Wendy Botes	Hillside (South 32) Aluminium	wendy.botes@south32.net	Emails	No information provided
Jacques du Toit	Bayside (Isizinda) Aluminium	Jacques.duToit@isizindal.co.za	Emails, StraSC meeting	Historical use & future requirements
Alan Naidoo	RBCT	anaidoo@rbct.co.za	Emails, Phone calls	Historical use & future requirements
Zingisa Mavuso	Tongaat	Zingisa.Mavuso@tongaat.com	Emails, StraSC meeting	Historical use & future requirements
Siyabonga Buthelezi	Mpact	SButhelezi@mpact.co.za	Emails, Phone calls, StraSC meeting	Historical use & future requirements
Sifiso Thwala	IDZ	Sifiso.Thwala@rbidz.co.za	Emails	Future requirements
Anesh Surendra	Eskom	SurendA@eskom.co.za	Emails	Future requirements
Nick Okello	RBM	Nick.Okello@riotinto.com	Emails, Phone calls	Historical use & future requirements
Marius Vlok	Tronox	Marius.Vlok@Tronox.com	Emails, Phone calls, StraSC meeting	Historical use & future requirements
John Readman	Irrigated Agriculture	jreadman@iafrica.com	Emails, StraSC meeting	Historical use & future requirements
Bhengu	DWS Midmar	BhenguS@dws.gov.za	Emails	Historical use: irrigators

Name	Organisation	Contact	Communication	Information
Stanley				
Norman Ward	Ex DWS	wardnorma@gmail.com	Emails, Phone calls	Historical use & future requirements
Cobus van der Walt	DWS	VanDerWaltC2@dws.gov.za	Emails	Transfer volumes
Thembinkosi Mkhize	DWS Midmar	mkhizet@dws.gov.za	Emails	Transfer volumes

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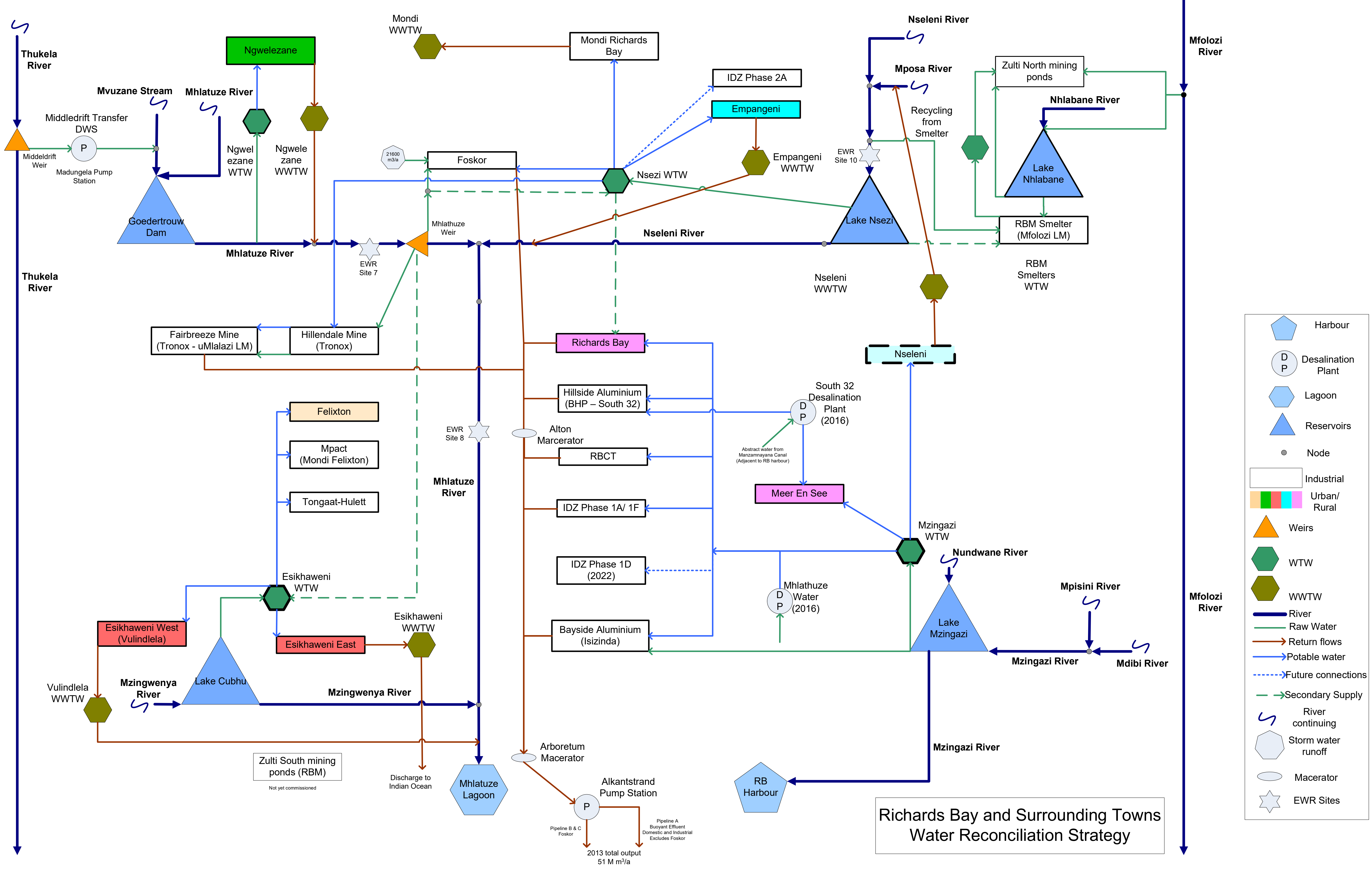
APPENDIX A

RBWSS SCHEMATIC LAYOUT

Richards Bay and Surrounding Towns Water Supply Schematic



APPENDIX B

GOVERNMENT GAZETTE NO. 38599: FINAL ALLOCATION SCHEDULE IN TERMS OF SECTION 47 OF THE NATIONAL WATER ACT FOR THE MHLATHUZE RUVER CATCHMENT

Government Gazette
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No. *Page No.* *Gazette No.*

GOVERNMENT NOTICE

Water Affairs, Department of

Government Notice

Government Notice

DEPARTMENT OF WATER AND SANITATION

No. 242 **25 March 2015**

NATIONAL WATER ACT, 1998

FINAL ALLOCATION SCHEDULE IN TERMS OF SECTION 47 OF THE NATIONAL WATER ACT, 1998 FOR THE MHLATHUZE RIVER CATCHMENT

I, Anil Bijman Singh, as the delegated authority in terms of section 63 of the National Water Act, 1998 (Act No. 36 of 1998), hereby state that in terms of section 47(1)*(a)*(i) and *(b)* of the said Act that the preliminary allocation schedule has become final for the Mhlathuze River Catchment.

The final allocation schedule can be accessed on the website www.dws.gov.za/WAR.

DEPUTY DIRECTOR GENERAL: REGULATION COMPLIANCE MONITORING

DATE: 15/3/2015

ANNEXURE

SUMMARY OF QUANTITY OF WATER ALLOCATED

Ecological Water Requirement (Reserve)	Position	Volume (million cubic metres per annum)
1	W12A Outlet	16.97
2	Downstream Goedertrouw Outlet of W12B	41.07
3	W12C Outlet	7.06
4	W12D downstream of Mhlathuze-Mfuli Confluence	32.61
5	W12D Outlet	31.81
6	W12E Outlet, not including Mhlathuzana river contribution	32.19
7	Upstream of Mhlathuze-Nsezi Confluence	37.19
8	W12G Outlet	3.40
9	W12H Outlet	10.22
10	Mhlathuze Mouth	10.85
11	W12J2 Mouth	0.76

A) Existing Licenses

Sector	Total Volume (million cubic metres per annum)
Industry	0.00
Irrigation	4.18
Mines	0.0
SFRA	420 (Hectares)
Storage	5.0
Urban	0.0

B) Volume of Water Set Aside

Category	Total Volume (million cubic metres per annum)	Percentage (Total WSA)
Future Allocation	6.2	58%
Government Departments	2.5	23%
Community Cooperatives	1.4	13%
Traditional Authorities	0.6	6%
TOTAL	**10.7**	**100%**

C) Summary of Total Volume of Water Allocated per Sector

Sector	Total Volume (million cubic metres per annum)
Industry	5.74
Commercial/ Domestic	0.18
Municipal	58.73
Mhlathuze water Board	94.48
Mines	14.02
Irrigation	124.41
SFRA (hectares)	55 971
Storage	7.93

NOTICE—CHANGE OF TELEPHONE NUMBERS: GOVERNMENT PRINTING WORKS

As the mandated government security printer, providing world class security products and services, Government Printing Works has adopted some of the highly innovative technologies to best serve its customers and stakeholders. In line with this task, Government Printing Works has implemented a new telephony system to ensure most effective communication and accessibility. As a result of this development, our telephone numbers will change with effect from 3 February 2014, starting with the Pretoria offices.

The new numbers are as follows:

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Please consult our website at for more contact details.

The numbers for our provincial offices in Polokwane, East London and Mmabatho will not change at this stage.

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APPENDIX C

DETAILED WATER REQUIREMENTS OF ALL USERS

Row ref	User	Details	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
2		Strategy (2015) Low							14.38	14.53	14.67	14.82	14.97	15.12	15.27	15.42	15.57	15.73	15.89	16.05	16.21	16.37	16.53	16.70	16.86	17.03	17.20	17.38	17.55	17.72	17.90	18.08	18.26	18.44	18.63	18.82	19.00	19.19	19.39	
3		Strategy (2015) Medium	10.77	10.33	7.47	10.46	12.53	14.24	14.52	14.82	15.11	15.41	15.72	16.04	16.36	16.68	17.02	17.36	17.71	18.06	18.42	18.79	19.17	19.55	19.94	20.34	20.74	21.16	21.58	22.01	22.46	22.90	23.36	23.83	24.31	24.79	25.29	25.79	26.31	
4	Richards Bay	Strategy (2015) High							14.67	15.11	15.56	16.03	16.51	17.00	17.51	18.04	18.58	19.14	19.71	20.30	20.91	21.54	22.19	22.85	23.54	24.24	24.97	25.72	26.49	27.29	28.10	28.95	29.82	30.71	31.63	32.58	33.56	34.56	35.60	
5a	Fig. 3.2	This Study High							15.27	16.31	13.11	11.95	17.12	17.54	17.97	18.43	18.90	19.37	19.83	20.30	20.82	21.34	21.87	22.39	22.91	23.48	24.06	24.64	25.21	25.79	26.44	27.10	27.75	28.41	29.06	29.80	30.55	31.29	32.03	32.78
5b		This Study Moderate											16.75	16.98	17.20	17.45	17.70	17.94	18.19	18.43	18.70	18.96	19.23	19.50	19.76	20.06	20.35	20.64	20.93	21.22	21.54	21.86	22.18	22.51	22.83	23.16	23.49	23.82	24.15	24.49
6		Allocation CoMLM								11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60
7		Allocation MW								6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57
8		Total Allocation								18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17	18.17
9		Strategy (2015) Low							7.87	7.95	8.03	8.11	8.19	8.27	8.35	8.44	8.52	8.61	8.69	8.78	8.87	8.95	9.04	9.13	9.23	9.32	9.41	9.51	9.60	9.70	9.79	9.89	9.99	10.09	10.19	10.29	10.40	10.50	10.60	
10		Strategy (2015) Medium	6.20	6.50	7.20	6.74	8.12	7.79	7.95	8.10	8.27	8.43	8.60	8.77	8.95	9.13	9.31	9.50	9.69	9.88	10.08	10.28	10.48	10.69	10.91	11.13	11.35	11.58	11.81	12.04	12.28	12.53	12.78	13.04	13.30	13.56	13.83	14.11	14.39	
11	Empangeni	Strategy (2015) High							8.02	8.26	8.51	8.77	9.03	9.30	9.58	9.87	10.16	10.47	10.78	11.11	11.44	11.78	12.14	12.50	12.88	13.26	13.66	14.07	14.49	14.93	15.37	15.84	16.31	16.80	17.30	17.82	18.36	18.91	19.48	
12a	Fig. 3.3	This Study High							8.03	8.04	7.12	6.52	8.55	8.82	9.08	9.38	9.68	9.98	10.27	10.57	10.92	11.26	11.60	11.95	12.29	12.67	13.05	13.43	13.81	14.19	14.62	15.06	15.49	15.93	16.36	16.88	17.41	17.93	18.45	18.97
12b		This Study Moderate											8.33	8.49	8.64	8.80	8.97	9.13	9.30	9.46	9.65	9.83	10.01	10.20	10.38	10.58	10.79	10.99	11.20	11.40	11.63	11.85	12.08	12.30	12.53	12.77	13.02	13.26	13.50	13.74
13		Allocation CoMLM								3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45
14		Allocation MW								5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91	5.91
15		Total Allocation								9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36	9.36
16		Strategy (2015) Low							11.27	11.38	11.50	11.61	11.73	11.85	11.97	12.08	12.21	12.33	12.45	12.58	12.70	12.83	12.96	13.09	13.22	13.35	13.48	13.62	13.75	13.89	14.03	14.17	14.31	14.46	14.60	14.75	14.89	15.04	15.19	
17		Strategy (2015) Medium	11.97	9.98	9.98	11.37	11.36	11.16	11.38	11.61	11.84	12.08	12.32	12.57	12.82	13.08	13.34	13.60	13.88	14.15	14.44	14.73	15.02	15.32	15.63	15.94	16.26	16.58	16.91	17.25	17.60	17.95	18.31	18.68	19.05	19.43	19.82	20.21	20.62	
18	Esikhaweni	Strategy (2015) High							11.49	11.84	12.19	12.56	12.94	13.33	13.73	14.14	14.56	15.00	15.45	15.91	16.39	16.88	17.39	17.91	18.45	19.00	19.57	20.16	20.76	21.38	22.03	22.69	23.37	24.07	24.79	25.53	26.30	27.09	27.90	
19a	Fig. 3.4	This Study High							10.43	10.43	10.43	9.92	10.86	11.08	11.31	11.55	11.79	12.03	12.27	12.51	12.78	13.04	13.31	13.58	13.84	14.13	14.42	14.71	15.00	15.29	15.60	15.92	16.24	16.55	16.87	17.23	17.58	17.94	18.29	18.65
19b		This Study Moderate											10.74	10.88	11.03	11.19	11.34	11.49	11.64	11.79	11.95	12.11	12.27	12.42	12.58	12.75	12.91	13.08	13.24	13.40	13.57	13.74	13.91	14.08	14.25	14.44	14.63	14.82	15.02	15.21
20		Allocation CoMLM								7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56	7.56
21		Allocation MW								4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93
22		Total Allocation								12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49	12.49
23		Strategy (2015) Low							2.57	2.59	2.62	2.64	2.67	2.70	2.72	2.75	2.78	2.81	2.83	2.86	2.89	2.92	2.95	2.98	3.01	3.04	3.07	3.10	3.13	3.16	3.19	3.23	3.26	3.29	3.32	3.36	3.39	3.42	3.46	
24		Strategy (2015) Medium	2.99	3.27	3.27	2.79	2.99	2.54	2.59	2.64	2.70	2.75	2.80	2.86	2.92	2.98	3.04	3.10	3.16	3.22	3.29	3.35	3.42	3.49	3.56	3.63	3.70	3.77	3.85	3.93	4.01	4.09	4.17	4.25	4.34	4.42	4.51	4.60	4.69	
25	Ngwelezane	Strategy (2015) High							2.62	2.69	2.78	2.86	2.94	3.03	3.12	3.22	3.31	3.41	3.52	3.62	3.73	3.84	3.96	4.08	4.20	4.32	4.45	4.59	4.73	4.87	5.01	5.16	5.32	5.48	5.64	5.81	5.99	6.17	6.35	
26a	Fig. 3.5	This Study High							2.40	2.35	1.86	1.69	2.47	2.54	2.61	2.67	2.74	2.81	2.88	2.95	3.03	3.10	3.18	3.25	3.32	3.41	3.49	3.57	3.65	3.74	3.83	3.92	4.01	4.10	4.18	4.29	4.40	4.51	4.61	4.72
26b		This Study Moderate											2.42	2.46	2.50	2.53	2.57	2.60	2.64	2.67	2.70	2.74	2.77	2.81	2.84	2.87	2.91	2.94	2.97	3.01	3.04	3.07	3.10	3.14	3.17	3.21	3.25	3.29	3.33	3.37
27		Allocation CoMLM								2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
28		Strategy (2015) Low							4.32	4.37	4.41	4.45	4.50	4.54	4.59	4.63	4.68	4.73	4.78	4.82	4.87	4.92	4.97	5.02	5.07	5.12	5.17	5.22	5.27	5.33	5.38	5.43	5.49	5.54	5.60	5.66	5.71	5.77	5.83	
29		Strategy (2015) Medium	4.10	3.88	3.88	4.13	4.29	4.28	4.37	4.45	4.54	4.63	4.73	4.82	4.92	5.01	5.11	5.22	5.32	5.43	5.54	5.65	5.76	5.88	5.99	6.11	6.24	6.36	6.49	6.62	6.75	6.88	7.02	7.16	7.31	7.45	7.60	7.75	7.91	
30	Nseleni	Strategy (2015) High							4.41	4.54	4.68	4.82	4.96	5.11	5.26	5.42	5.58	5.75	5.92	6.10	6.29	6.47	6.67	6.87	7.07	7.29	7.51	7.73	7.96	8.20	8.45	8.70	8.96	9.23	9.51	9.79	10.09	10.39	10.70	
31a	Fig. 3.6	This Study High							4.47	4.47	4.47	4.47	4.74	4.89	5.04	5.18	5.33	5.48	5.63	5.78	5.93	6.09	6.25	6.40	6.56	6.72	6.88	7.04	7.20	7.37	7.53	7.70	7.87	8.03	8.20	8.42	8.64	8.86	9.08	9.30
31b		This Study Moderate											4.63	4.70	4.78	4.85	4.92	5.00	5.07	5.14	5.21	5.28	5.36	5.43	5.50	5.57	5.64	5.71	5.78	5.85	5.92	5.99	6.05	6.12	6.19	6.28	6.36	6.45	6.54	6.62
32		Allocation CoMLM								5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
33																																								
34		Strategy (2015)	24.91	25.41	25.02	25.14	25.40	23.61	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
35	Mondi	This Study							24.57	21.54	19.72	18.02	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1
36	Fig. 4.1	Allocation MW (DWS info)								49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28	49.28
37		Allocation (MW info)								36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5	36.5
38		Strategy (2015)	9.64	9.20	9.91	9.33	6.56	7.09	7.09	9.54	9.54	12.41	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	12.77	
39	Foskor	This Study							7.98	5.80	5.94	6.00	7.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
40	Fig. 4.2	Allocation CoMLM								5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80
41		Allocation MW								4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47	4.47
42		Total Allocation								10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27	10.27
43	Hillside	Strategy (2015)	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	
44		This Study							0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
45		Strategy (2015)	0.52	0.52	0.52	0.52	0.52	0.52	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	
46	Bayside	This Study							0.52	0.07	0.07	0.07	0.11	0.16	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
47	Fig. 4.3	Allocation								0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
48	RBCT	Strategy (2015)	0.84	0.79	0.67	0.21	0.30	0.43	0.43	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	
49	Fig. 4.4	This Study							0.47	0.24	0.10	0.06	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
50		Strategy (2015)	1.01	0.91	0.91	0.71	0.96	0.71	0.86	0.86	0.86	0.86	0.86	0.86	0.86	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	
51	Tongaat	This Study							0.69	0.68	0.76	0.77	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
52	Fig. 4.5	Allocation								2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
53		Strategy (2015)	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	2.22	
54	Mpact	This Study							2.22	2.11	1.80	1.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
55	Fig. 4.6	Allocation								2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
56		Strategy (2015) Low							0.16	0.16	0.16	0.36	0.36	0.36	0.36	0.36	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	5.59	
57		Strategy (2015) Medium	0.00	0.00	0.00	0.00	0.00	0.00	0.74	1.05	1.38	2.37	2.86	3.35	3.85	4.35	13.72	14.39	15.06	15.74	16.42	17.11	17.80	18.50	19.21	19.92	27.48	28.31	29.14	29.98	30.82	31.67	32.52	33.38	34.24	35.11	35.97	36.85	37.73	
58	IDZ & further bulk	Strategy (2015) High							1.18	1.80	2.45	4.04	5.03	6.03	7.05	8.08	20.95	22.33	23.73	25.14	26.56	28.00	29.46	30.95	32.45	33.97	44.63	46.41	48.21	50.02	51.85	53.70	55.57	57.45	59.36	61.29	63.23	65.19	67.18	
59	Fig. 4.7	This Study							0.00	0.00	0.00	0.00	0.00	0.00	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57
60		Allocation								10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70	10.70
61		Strategy (2015)	21.30	27.07	25.75	25.10	16.27	15.34	20.00	20.00	20.00	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	31.68	
62	RBM	This Study							16.75	13.63	15.98	19.42	20	20	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
63	Fig. 4.8	Allocation								14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02	14.02
64		Allocation MW								14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78	14.78
65		Total Allocation								28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80	28.80
66		Strategy (2015)	10.62	6.73	4.60	5.82	5.01	5.30	3.08	3.84	13.03	13.03	13.03	13.03	13.03	15.81	15.81	15.81	15.81	15.81	15.81	15.81	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	17.76	
67	Tronox	This Study							5.59	2.19	3.66	2.68	5.80	8.92	17.83	17.83	17.83	17.83	17.83	17.83	17.83	17.83	17.83	17.83	17.83	17.83	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26	20.26
68	Fig. 4.9	Allocation MW								8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54	8.54
69																																								
70	Irrigation	Strategy (2015)	87.8	87.8	87.8	87.8	87.8	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	88.5	
71		This Study											114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114	114
72		Allocation								113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90	113.90
73																																								
74		Strategy (2015) Low							3.99	4.03	4.07	4.11	4.15	4.19	4.23	4.28	4.32	4.36	4.41	4.45	4.50	4.54	4.59	4.63	4.68	4.72	4.77	4.82	4.87	4.92	4.97	5.02	5.07	5.12	5.17	5.22	5.27	5.32	5.38	
75		Strategy (2015) Medium							4.07	4.19	4.32	4.45	4.58	4.72	4.86	5.00	5.15	5.31	5.47	5.63	5.80	5.97	6.15	6.34	6.53	6.72	6.93	7.13	7.35	7.57	7.80	8.03	8.27	8.52	8.77	9.04	9.31	9.59	9.88	
76		Strategy (2015) High							4.11	4.27	4.44	4.62	4.81	5.00	5.20	5.41	5.62	5.85	6.08	6.32	6.58	6.84	7.11	7.40	7.69	8.00	8.32	8.65	9.00	9.36	9.74	10.13	10.53	10.95	11.39	11.84	12.32	12.81	13.32	
77	Future accounted for	This Study							0.00	0.00	0.00	0.00	2.00	4.00	6.00	8.00	10.50	13.00	15.00	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84
78		Eskom																1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
79		Allocations from main resourse								17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84	17.84
80		Allocations from diffuse sources								19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41	19.41
81		Strategy (2015) Low							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
82	Mtubatuba / Mpukunyoni	Strategy (2015) Medium							0.00	0.00	0.00	0.00	2.50	2.58	2.70	2.84	2.98	3.13	3.29	3.45	3.62	3.80	3.99	4.19	4.40	4.62	4.86	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
83		Strategy (2015) High							0.00	0.00	0.00	0.00	7.50	7.73	8.11	8.52	8.94	9.39	9.86	10.35	10.87	11.41	11.98	12.58	13.21	13.87	14.57	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	
84		This Study							0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.05	5.38	5.71	6.04	6.37	6.70	7.03	7.36	7.69	8.02	8.35	8.68	9.01	9.34	9.67	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
	Fig 1.2 & 7.1	Total Strategy (2015) Low Scenario							192.63	196.40	206.04	221.24	222.06	222.52	222.99	227.04	230.47	230.95	231.43	231.92	232.69	233.19	235.64	236.15	236.66	237.18	239.99	240.52	241.06	241.60	242.15	242.70	243.26	243.82	244.39	244.97	245.55	246.13	246.73	
	formula row ref	=2+9+16+23+28+34+38+43+45+48+50+53+56+61+66+70+74+81																																						
	Fig 1.2 & 7.1	Total Strategy (2015) Medium Scenario							193.70	198.27	208.74	225.26	229.61	231.20	232.87	238.15	248.75	250.68	252.64	254.64	256.95	259.03	263.09	265.25	267.45	269.70	278.84	281.19	283.42	285.70	288.00	290.35	292.73	295.14	297.60	300.09	302.63	305.20	307.82	
	formula row ref	=3+10+17+24+29+34+38+43+45+48+50+53+57+61+66+70+75+82																																						
	Fig 1.2 & 7.1	Total Strategy (2015) High Scenario							194.57	199.91	211.21	228.83	239.22	242.03	245.07	251.77	266.80	270.42	274.13	277.94	282.11	286.12	292.18	296.42	300.78	305.25	318.97	323.62	327.93	332.33	336.84	341.45	346.16	350.98	355.92	360.96	366.13	371.41	376.82	
	formula row ref	=4+11+18+25+30+34+38+43+45+48+50+53+58+61+66+70+76+83																																						
	Fig 7.1	Total This Study High Projection											218.35	227.65	255.12	258.32	262.05	272.63	276.17	280.57	282.27	283.95	285.66	287.35	289.03	290.85	295.10	296.92	298.73	300.57	302.54	304.55	306.54	308.20	309.85	311.80	313.76	315.71	317.64	319.60
	formula row ref	=5a+12a+19a+26a+31a+35+39+44+46+49+51+54+59+62+67+71+77+78+84																																						
	Fig 7.1	Total This Study Moderate Projection											212.26	221.07	239.25	241.92	245.08	255.10	258.10	261.94	262.98	264.03	265.07	266.12	267.16	268.25	271.77	272.86	273.96	275.05	276.20	277.34	278.49	279.31	280.13	281.02	281.92	282.81	283.70	298.62
	formula row ref	=5b+12b+19b+26b+31b+35+39+44+46+49+51+54+59+62+67+71+77+78+84																																						
	Fig 7.1	Total Allocation								292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76	292.76
	formula row ref	=8+15+22+27+32+36+42+47+52+55+60+65+68+72+79																																						
	Table 2.1	Total Allocation MW								94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48	94.48
	formula row ref	=68+64+41+7+14+21+36																																						
	Sect: 2.2.1	Total CoMLM Allocation								36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22
	formula row ref	=6+13+20+27+32+40																																						

Note: Cells shaded in grey are observed values