For further information, please contact:

Planning Services
Engineering & Scientific Services Division
Umgeni Water

P.O.Box 9, Pietermaritzburg, 3200
KwaZulu-Natal, South Africa

Tel: 033 341-1522
Fax: 033 341-1218
Email: info@umgeni.co.za
Web: www.umgeni.co.za
UMGENI WATER

INFRASTRUCTURE MASTER PLAN 2012

2012/2013 - 2042/2043

MARCH 2012

Compiled by:

Alka Ramnath
Planner

Approved by:

Kevin Meier PrEng
Manager: Planning Services

Steve Gillham PrEng
General Manager: Engineering and Scientific Services
Preface

This Infrastructure Master Plan 2012 describes Umgeni Water’s infrastructure plans for the financial period 2012/2013 – 2042/2043. It is a comprehensive technical report that provides detailed information on the organisation’s current infrastructure and on its future infrastructure development plans. This report replaces the last comprehensive Infrastructure Master Plan that was compiled in 2011.

The report is divided into two volumes:

- **Volume I** describes the most recent changes and trends within the primary environmental dictates that influence Umgeni Water’s infrastructure development plans (Section 2). Section 3 provides a review of historic water sales against past projections, as well as Umgeni Water’s most recent water demand projections, compiled at the end of 2011. The current water resource situation, for both surface and groundwater, for the catchments that are important to Umgeni Water’s operational requirements, is described in Section 4. Climatic impacts on these water resources and the potential future impacts of climate change are presented. Future water resource development plans for these catchments, as well as alternatives to the traditional resources, are discussed. Linkages are made to the water supply infrastructure development plans that are discussed in Volume II.

- **Volume II** documents the current water supply infrastructure that Umgeni Water utilises for operational purposes and describes the most recent infrastructure plans that have been developed to address the future water supply requirements (Section 5). These plans are aligned to the latest water demand projections and proposed water resources infrastructure developments as presented in Volume I. Section 6 describes the waste water works currently operated by Umgeni Water, and Section 7 provides individual project sheets for those infrastructure projects discussed in Section 5. All references made throughout the entire Infrastructure Master Plan are listed at the end of each volume.

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

Cognisance is taken of the initiatives relating to water conservation and water demand management being undertaken by Umgeni Water and the various Water Services Authorities. However, these are not discussed in this Infrastructure Master Plan as they fall outside its primary focus, even though they are within the overall framework of Umgeni Water’s infrastructure planning process.

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

Preface ......................................................................................................................... i
Table of Contents ........................................................................................................... iii
List of Figures .................................................................................................................. v
List of Tables .................................................................................................................... ix
List of Acronyms ............................................................................................................. xi
List of Units ..................................................................................................................... xv
1 Introduction ................................................................................................................. 1
  1.1 Purpose ..................................................................................................................... 1
  1.2 Setting the Scene ..................................................................................................... 4
2 Situational Analysis ..................................................................................................... 6
  2.1 Existing Landscape ................................................................................................. 6
  2.2 Natural Environment ............................................................................................. 12
  2.3 Existing Development Status ................................................................................ 14
  2.4 Basic Needs ............................................................................................................ 22
  2.5 Development Plans ............................................................................................... 31
  2.6 Regional Water Planning Overview ...................................................................... 42
3 Demand Forecasts ..................................................................................................... 52
  3.1 Review of 2010/11 Sales ....................................................................................... 52
  3.2 2011 Short-Term Bulk Water Sales Forecasts ...................................................... 55
    3.2.1 eThekwini Municipality .................................................................................. 56
    3.2.2 The Msunduzi Municipality ............................................................................ 57
    3.2.3 Umgungundlovu District Municipality ........................................................ 59
    3.2.4 Ilembe District Municipality (including Sembcorp SizaWater) ...................... 61
    3.2.5 Ugu District Municipality ............................................................................. 63
    3.2.6 Sisonke District Municipality ....................................................................... 65
  3.3 Long-Term Forecast .............................................................................................. 65
4 Water Resources ......................................................................................................... 67
  4.1 Introduction ............................................................................................................ 67
  4.2 Climate ................................................................................................................... 69
  4.3 Climate Change ....................................................................................................... 75
  4.4 Water Resource Regions ....................................................................................... 82
4.4.1 Lower uThukela Region ........................................................................................................... 84
4.4.2 Mvoti Region ........................................................................................................................ 90
4.4.3 Mdloti Region ........................................................................................................................ 104
4.4.4 Mooi/Mgeni Region ............................................................................................................... 115
4.4.5 Mlazi/Lovu Region ............................................................................................................... 138
4.4.6 Mkomazi Region .................................................................................................................... 145
4.4.7 Middle South Coast Region .................................................................................................. 156
4.4.8 Mzimkhulu Region ............................................................................................................... 170
4.4.9 Mtamvuna Region ................................................................................................................ 179
4.5 Wastewater Reuse .................................................................................................................... 186
  4.5.1 Background and Existing Infrastructure ........................................................................... 186
  4.5.2 Proposed Options ................................................................................................................ 186
  4.5.3 Project Progress .................................................................................................................. 186
4.6 Seawater Desalination ............................................................................................................... 190
References ......................................................................................................................................... 192
Acknowledgements ......................................................................................................................... 197
List of Figures

Figure 1.1 Locality of Umgeni Water’s area of operation. ..............................................................1
Figure 1.2 Umgeni Water’s supply footprint ..............................................................................3
Figure 1.3 Changes in Umgeni Water’s infrastructure 2010/2011 – present ..................................5
Figure 2.1 Institutional boundaries. ..........................................................................................7
Figure 2.2 WSAs and their constituent local municipalities ........................................................8
Figure 2.3 Land cover (2008). ....................................................................................................9
Figure 2.4 Settlement footprints (2009). ..................................................................................10
Figure 2.5 Isoline map of population density (2009). ..............................................................11
Figure 2.6 Terrestrial Systematic Conservation Plan (2010). ......................................................13
Figure 2.7 Percentage contribution of municipal GVA to total KZN GVA (2009) .......................17
Figure 2.8 CoGTA’s A – C2 Categorisation .............................................................................18
Figure 2.9 Urban areas, rural areas and CoGTA’s A - C2 Categorisation .................................19
Figure 2.10 CoGTA’s spatial classification. .............................................................................20
Figure 2.11 DRDLR’s urban classification. ................................................................................21
Figure 2.12 KZN Flagship Programme (2010). .........................................................................23
Figure 2.13 Number of people per WSA (2004 – 2011). .........................................................24
Figure 2.14 Number of households per WSA (2004 – 2011).................................................25
Figure 2.15 Number of people with access to water below RDP levels per WSA (2004 – 2011) ....26
Figure 2.16 Water backlogs (2011). ........................................................................................27
Figure 2.17 Status of restitution claims (Oct 2010). .................................................................28
Figure 2.18 Types of redistribution projects (Oct 10). ..............................................................29
Figure 2.19 Existing and possible RDP water needs .................................................................30
Figure 2.20 Proposed development applications (2010). ..........................................................33
Figure 2.21 Composite map showing KZN PGDS Priority Intervention Areas
   (KZN Planning Commission 2011: 144) ................................................................................34
Figure 2.22 KZN PGDS Nodes in relation to the Level 1 and Level 2 Priority Areas
   (KZN Planning Commission 2011: 146) ................................................................................35
Figure 2.23 KZN Provincial Spatial Development Framework (KZN Planning Commission 2011:
   148) ........................................................................................................................................36
Figure 2.24 PSEDS ....................................................................................................................37
Figure 2.25 Alignment between the PSEDS & proposed developments ..................................38
Figure 2.26 Municipal SDFs ....................................................................................................39
List of Tables

Table 1.1 Recent additions to Umgeni Water Bulk Supply Infrastructure ........................................ 4
Table 2.1 Change in land cover (1994 – 2008) ................................................................................. 6
Table 2.2 CoGTA’s A – C2 categorisation and spatial classification system. ............................. 15
Table 2.3 Urban area classification (DRDLR 2009: 12)................................................................. 16
Table 4.1 Summary of available Global Circulation Models .......................................................... 78
Table 4.2 Distribution of surface water resources .......................................................................... 82
Table 4.3 Hydrological characteristics of the Lower uThukela Region (WR90).............................. 84
Table 4.4 Hydrological characteristics for the Mvoti region (WR90) .............................................. 93
Table 4.5 Existing Dams in the Mvoti Region .................................................................................. 98
Table 4.6 Yield information for the existing water resource abstractions in the Mvoti Region .... 98
Table 4.7 Proposed water resource infrastructure in the Mvoti Region ......................................... 101
Table 4.8 Hydrological characteristics of the Mdloti Region ......................................................... 104
Table 4.9 Characteristics of Hazelmere Dam ................................................................................. 111
Table 4.10 Existing Dams in the Mdloti Region ............................................................................. 111
Table 4.11 Yield Information for the existing water resource developments in the Mdloti Region ......................................................................................................................... 111
Table 4.12 Proposed water resource infrastructure for the Mdloti Region .................................. 113
Table 4.13 Hydrological characteristics of the Mgeni/Mooi Region (WR90). .............................. 117
Table 4.14 Summary of environmental (compensation) flow requirements ................................. 125
Table 4.15 Characteristics of Midmar Dam ..................................................................................... 126
Table 4.16 Characteristics of Albert Falls Dam .............................................................................. 127
Table 4.17 Characteristics of Nagle Dam ......................................................................................... 128
Table 4.18 Characteristics of Inanda Dam ....................................................................................... 129
Table 4.19 Characteristics of Mearns Weir .................................................................................... 130
Table 4.20 Characteristics of Henley Dam ....................................................................................... 131
Table 4.21 Existing Dams in the Mgeni/Mooi Region .................................................................... 132
Table 4.22 Yield Information for the existing and proposed water resource infrastructure in the Mgeni/Mooi Region ........................................................................................................ 133
Table 4.23 Hydrological characteristics of the Mlazi/Lovu Region (WR90). ............................... 138
Table 4.24 Characteristics of Nungwane Dam ............................................................................... 144
Table 4.25 Dams in the Mlazi/Lovu Region ................................................................................... 144
Table 4.26  Yield Information for the existing water resource developments in the Mlazi/Lovu Region. .................................................................144
Table 4.27  Hydrological characteristics of the Mkomazi Region (Umgeni Water 2002). ..........146
Table 4.28  Characteristics of Ixopo Dam.................................................................152
Table 4.29  Existing Dams in the Ixopo Region..........................................................152
Table 4.30  Proposed water resource infrastructure for the Mkomazi Region. .....................155
Table 4.31  Hydrological characteristics for the Middle South Coast Region (WR90). ............158
Table 4.32  Characteristics of Umzinto Dam..............................................................164
Table 4.33  Characteristics of E.J. Smith Dam. ............................................................165
Table 4.34  Dams in the Middle South Coast Region....................................................166
Table 4.35  Yield Information for the existing water resource infrastructure in the Middle South Coast Region.........................................................166
Table 4.36  Yield information for the proposed dams in the Middle South Coast Region..........170
Table 4.37  Hydrological characteristics of the Mzimkhulu Region (WR90).........................172
Table 4.38  Summary of the ecological status of the Mzimkhulu River and its tributaries........176
Table 4.39  Yield Information for the St Helen’s Rock Abstraction site. .............................177
Table 4.40  Hydrological characteristics of the Mtamvuna Region (WR90)........................182
Table 4.41  Yield Information for the proposed Ludeke Dam in the Mtamvuna Region........184
### List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADD</td>
<td>Annual Average Daily Demand</td>
</tr>
<tr>
<td>AC</td>
<td>Asbestos Cement</td>
</tr>
<tr>
<td>ADWF</td>
<td>Average Dry Weather Flow</td>
</tr>
<tr>
<td>AsgiSA</td>
<td>Accelerated and Shared Growth Initiative of South Africa</td>
</tr>
<tr>
<td>AVGF</td>
<td>Autonomous Valveless Gravity Filter</td>
</tr>
<tr>
<td>BID</td>
<td>Background Information Document</td>
</tr>
<tr>
<td>BPT</td>
<td>Break Pressure Tank</td>
</tr>
<tr>
<td>BWL</td>
<td>Bottom Water Level</td>
</tr>
<tr>
<td>BWSP</td>
<td>Bulk Water Services Provider</td>
</tr>
<tr>
<td>BWSS</td>
<td>Bulk Water Supply Scheme</td>
</tr>
<tr>
<td>CAPEX</td>
<td>Capital Expenditure</td>
</tr>
<tr>
<td>CMA</td>
<td>Catchment Management Agency</td>
</tr>
<tr>
<td>CoGTA</td>
<td>Department of Co-operative Governance and Traditional Affairs</td>
</tr>
<tr>
<td>CWSS</td>
<td>Community Water Supply and Sanitation project</td>
</tr>
<tr>
<td>DAEA</td>
<td>Department of Agriculture and Environmental Affairs</td>
</tr>
<tr>
<td>DEA</td>
<td>Department of Environmental Affairs</td>
</tr>
<tr>
<td>DFA</td>
<td>Development Facilitation Act (65 of 1995)</td>
</tr>
<tr>
<td>DM</td>
<td>District Municipality</td>
</tr>
<tr>
<td>DMA</td>
<td>District Management Area</td>
</tr>
<tr>
<td>DRDLR</td>
<td>Department of Rural Development and Land Reform</td>
</tr>
<tr>
<td>DWA</td>
<td>Department of Water Affairs</td>
</tr>
<tr>
<td>DWAF</td>
<td>Department of Water Affairs and Forestry</td>
</tr>
<tr>
<td>EFR</td>
<td>Estuarine Flow Requirements</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EKZN Wildlife</td>
<td>Ezemvelo KZN Wildlife</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>EWS</td>
<td>eThekwini Water Services</td>
</tr>
<tr>
<td>EXCO</td>
<td>Executive Committee</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>FC</td>
<td>Fibre Cement</td>
</tr>
<tr>
<td>FL</td>
<td>Floor level</td>
</tr>
<tr>
<td>FSL</td>
<td>Full Supply level</td>
</tr>
<tr>
<td>GCM</td>
<td>General Circulation Model</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GDPR</td>
<td>Gross Domestic Product of Region</td>
</tr>
<tr>
<td>GVA</td>
<td>Gross Value Added</td>
</tr>
<tr>
<td>HDI</td>
<td>Human Development Index</td>
</tr>
<tr>
<td>IDP</td>
<td>Integrated Development Plan</td>
</tr>
<tr>
<td>IFR</td>
<td>In-stream Flow Requirements</td>
</tr>
<tr>
<td>IMP</td>
<td>Infrastructure Master Plan</td>
</tr>
<tr>
<td>IRP</td>
<td>Integrated Resource Plan</td>
</tr>
<tr>
<td>ISP</td>
<td>Internal Strategic Perspective</td>
</tr>
<tr>
<td>IWRM</td>
<td>Integrated Water Resources Management</td>
</tr>
<tr>
<td>KZN</td>
<td>KwaZulu-Natal</td>
</tr>
<tr>
<td>LM</td>
<td>Local Municipality</td>
</tr>
<tr>
<td>LUMS</td>
<td>Land Use Management System</td>
</tr>
<tr>
<td>MA</td>
<td>Moving Average</td>
</tr>
<tr>
<td>MAP</td>
<td>Mean Annual Precipitation</td>
</tr>
<tr>
<td>MAR</td>
<td>Mean Annual Runoff</td>
</tr>
<tr>
<td>MBR</td>
<td>Membrane Bioreactor</td>
</tr>
<tr>
<td>MMTS</td>
<td>Mooi-Mgeni Transfer Scheme</td>
</tr>
<tr>
<td>MMTS-1</td>
<td>Mooi-Mgeni Transfer Scheme Phase 1</td>
</tr>
<tr>
<td>MMTS-2</td>
<td>Mooi-Mgeni Transfer Scheme Phase 2</td>
</tr>
<tr>
<td>mPVC</td>
<td>Modified Polyvinyl Chloride</td>
</tr>
<tr>
<td>MTEF</td>
<td>Medium-Term Expenditure Framework</td>
</tr>
<tr>
<td>MT SF</td>
<td>Medium-Term Strategic Framework</td>
</tr>
<tr>
<td>MWP</td>
<td>Mkomazi Water Project</td>
</tr>
<tr>
<td>MWP-1</td>
<td>Mkomazi Water Project Phase 1</td>
</tr>
<tr>
<td>NCP-1</td>
<td>North Coast Pipeline I</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>NCP-2</td>
<td>North Coast Pipeline II</td>
</tr>
<tr>
<td>NCSS</td>
<td>North Coast Supply System</td>
</tr>
<tr>
<td>NGS</td>
<td>Natal Group Sandstone</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>NSDP</td>
<td>National Spatial Development Perspective</td>
</tr>
<tr>
<td>NWSP</td>
<td>National Water Sector Plan</td>
</tr>
<tr>
<td>OPEX</td>
<td>Operating Expenditure</td>
</tr>
<tr>
<td>p.a.</td>
<td>Per annum</td>
</tr>
<tr>
<td>PEST</td>
<td>Political, Economical, Sociological and Technological</td>
</tr>
<tr>
<td>PGDS</td>
<td>Provincial Growth and Development Strategy</td>
</tr>
<tr>
<td>PPDC</td>
<td>Provincial Planning and Development Commission (KZN’s)</td>
</tr>
<tr>
<td>PSEDS</td>
<td>Provincial Spatial Economic Development Strategy</td>
</tr>
<tr>
<td>PWSP</td>
<td>Provincial Water Sector Plan</td>
</tr>
<tr>
<td>RCC</td>
<td>Roller Compacted Concrete</td>
</tr>
<tr>
<td>RDP</td>
<td>Reconstruction and Development Programme</td>
</tr>
<tr>
<td>RO</td>
<td>Reverse Osmosis</td>
</tr>
<tr>
<td>ROD</td>
<td>Record of Decision</td>
</tr>
<tr>
<td>RQO</td>
<td>Resource Quality Objective</td>
</tr>
<tr>
<td>SCA</td>
<td>South Coast Augmentation</td>
</tr>
<tr>
<td>SCP</td>
<td>South Coast Pipeline</td>
</tr>
<tr>
<td>SCP-1</td>
<td>South Coast Pipeline Phase 1</td>
</tr>
<tr>
<td>SCP-2a</td>
<td>South Coast Pipeline Phase 2a</td>
</tr>
<tr>
<td>SCP-2b</td>
<td>South Coast Pipeline Phase 2b</td>
</tr>
<tr>
<td>SDF</td>
<td>Spatial Development Framework</td>
</tr>
<tr>
<td>SHR</td>
<td>St Helen’s Rock (near Port Shepstone)</td>
</tr>
<tr>
<td>STEEPLE</td>
<td>Social/demographic, Technological, Economic, Environmental (Natural), Political, Legal and Ethical</td>
</tr>
<tr>
<td>SWRO</td>
<td>Seawater Reverse Osmosis</td>
</tr>
<tr>
<td>TBM</td>
<td>Tunnel Boring Machine</td>
</tr>
<tr>
<td>TLC</td>
<td>Transitional Local Council</td>
</tr>
</tbody>
</table>
TWL  Top Water Level
uPVC  Unplasticised Polyvinyl Chloride
UW  Umgeni Water
WA  Western Aqueduct
WBS  Work Breakdown Structure
WC  Water Conservation
WDM  Water Demand Management
WMA  Water Management Area
WRC  Water Research Commission
WSA  Water Services Authority
WSDP  Water Services Development Plan
WSNIS  Water Services National Information System
WSP  Water Services Provider
WTP  Water Treatment Plant
WWW  Wastewater Works

Spellings of toponyms have been obtained from the Department of Arts and Culture (DAC). DAC provides the official spelling of place names and the spellings, together with the relevant gazette numbers, can be accessed at http://www.dac.gov.za/doc/2012/APPROVED%20NAMES.XLSX2012.XLSX. Please note that for this report, the new spelling of the toponyms as approved in 2010 and 2011 have not been used to allow easy understanding as to which toponyms are referred to.
# List of Units

**Length/Distance:**

- **mm** millimetre
- **m** metre
- **km** kilometre

**Area:**

- **m²** square metres
- **ha** hectare
- **km²** square kilometres

**Level/Altitude:**

- **mASL** metres above sea-level

**Time:**

- **s** second
- **min** minute
- **hr** hour

**Volume:**

- **m³** cubic metres
- **ML** megalitre
- **million m³** million cubic metres
- **mcm** million cubic metres

**Water Use/Consumption/Treatment/Yield:**

- **l/c/day** litre per capita per day
- **kl/day** kilolitre per day
- **ML/day** megalitre per day
- **million m³/annum** million cubic metres per annum
- **kg/hr** kilograms per hour
<table>
<thead>
<tr>
<th>Flow velocity/speed:</th>
<th>m/s</th>
<th>metres per second</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>m³/s</td>
<td>cubic metres per second</td>
</tr>
<tr>
<td></td>
<td>l/hr</td>
<td>litres per hour</td>
</tr>
<tr>
<td></td>
<td>m³/hr</td>
<td>cubic metres per hour</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Purpose

“He who fails to plan, plans to fail”

Anonymous

Established in 1974, Umgeni Water has developed into the second largest water utility in South Africa, supplying over 412 million cubic metres of bulk potable water annually to six Water Services Authorities (WSAs), comprising one metropolitan municipality, four district municipalities, and one local municipality, within the province of KwaZulu-Natal (KZN). The locality of Umgeni Water’s area of operation, i.e. the area of these six WSAs, is shown in Figure 1.1. However, it is important to note that within this area Umgeni Water currently does not supply bulk water in the southern portion of Ugu District Municipality, nor in the portion of Ilembe District Municipality north of the uThukela River, and nor in the entire Sisonke District Municipality other than in the town of Ixopo.

![Figure 1.1 Locality of Umgeni Water’s area of operation.](image)

These municipalities collectively contribute approximately 75% of the province’s Gross Value Added (GVA). However, the highest poverty densities in KZN are also located in these areas. Hence, Umgeni
Water is faced with the dual challenge of ensuring that the province’s economic engine remains served with a reliable supply of potable water, whilst also ensuring that water is adequately provided for the eradication of water backlogs, the improvement of the level of water services, and the alleviation of poverty.

The WSAs are responsible for water service delivery to the people who reside within their respective areas of jurisdiction. The areas that receive reticulated water from the WSAs, who in turn receive bulk potable water from Umgeni Water, are shown in Figure 1.2. This collective reticulated area constitutes Umgeni Water ‘supply footprint’ and comprises of various levels of service based on a number of bulk supply schemes that are both interdependent and stand-alone.

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

For any organisation to effectively achieve its mission, it needs to have, amongst other things, a clearly defined plan of what is required in the future so that it can be addressed in the present. This Infrastructure Master Plan 2012 (IMP 2012) describes how Umgeni Water intends to address the future bulk water infrastructure requirements within its area of operation in order to meet the anticipated needs. It also indicates the proposed integration between these water supply infrastructure plans and the regional water resource plans being developed by the Department of Water Affairs (DWA).
This infrastructure master plan comprises the following sections:

- **Section 2** identifies the changes that have occurred in the external environment since the IMP 2011 that have had an impact on the provision of sustainable bulk potable water;
- **Section 3** presents a review of actual sales achieved in 2010/2011 against the IMP 2009 forecast, and provides revised short-term (3 year) and long-term (30 year) water demand projections;
- **Section 4** analyses the current water resource situation and identifies the new water resource infrastructure required to meet the projected water demands;
- **Section 5** identifies the water supply capacity constraints and the new infrastructure required to meet the projected water demands;
- **Section 6** describes and identifies the capacity constraints of the wastewater infrastructure; and
- **Section 7** provides individual project sheets for those infrastructure projects identified in Section 5.

### 1.2 Setting the Scene

The distribution of Umgeni Water’s infrastructure and the projects that have been commissioned since the publication of the IMP 2011 are shown in **Figure 1.3**. These changes are summarised in **Table 1.1**.

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>'57 Pipeline Augmentation</td>
<td>Certificate of completion issued in July 2011</td>
</tr>
<tr>
<td>Ndwedwe Reservoir 1 Upgrade</td>
<td>Commissioned in December 2011</td>
</tr>
<tr>
<td>Ndwedwe Reservoir 2 Upgrade</td>
<td>Commissioned in December 2011</td>
</tr>
<tr>
<td>Mhlabatshane Raw Water Pipeline (from dam to intermediate pump station)</td>
<td>Commission in August 2011</td>
</tr>
<tr>
<td>Bruyns Hill Reservoir Upgrade</td>
<td>Commissioned in December 2011</td>
</tr>
<tr>
<td>Umzinto Link (Ellingham to Umzinto WTP Emergency Water Supply)</td>
<td>Commissioned in March 2011</td>
</tr>
<tr>
<td>Middledrift/Madungela Abstraction (part of Ngcebo Bulk Water Supply Scheme)</td>
<td>Commissioned in December 2011</td>
</tr>
</tbody>
</table>
Figure 1.3 Changes in Umgeni Water’s infrastructure 2010/2011–present.
2 Situational Analysis

2.1 Existing Landscape

The “administrative landscape” (KZN Planning Commission 2011: 35) surrounding and within Umgeni Water’s area of operation is shown in Figure 2.1 and Figure 2.2.

The land cover distribution within Umgeni Water’s area of operation is shown in Figure 2.3. The increasing trend in the transformation of the natural environment, with urban areas increasing, is shown in Table 2.1.

Table 2.1 Change in land cover (1994 – 2008).

<table>
<thead>
<tr>
<th>Land Cover Category</th>
<th>1994 (%)</th>
<th>2000 (%)</th>
<th>2005 (%)</th>
<th>2008 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barren Lands</td>
<td>7.7</td>
<td>4.6</td>
<td>3.1</td>
<td>4.9</td>
</tr>
<tr>
<td>Cultivated Land</td>
<td>20.9</td>
<td>17.4</td>
<td>17.0</td>
<td>19.2</td>
</tr>
<tr>
<td>Forest Plantations</td>
<td>9.7</td>
<td>9.7</td>
<td>10.3</td>
<td>11.1</td>
</tr>
<tr>
<td>Forest and Woodland</td>
<td>1.3</td>
<td>1.9</td>
<td>4.1</td>
<td>13.6</td>
</tr>
<tr>
<td>Grassland</td>
<td>39.7</td>
<td>35.4</td>
<td>38.0</td>
<td>32.6</td>
</tr>
<tr>
<td>Mines and Quarries</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Thicket, Bushland, Scrub Forest and High Fynbos</td>
<td>16.5</td>
<td>25.8</td>
<td>17.3</td>
<td>6.8</td>
</tr>
<tr>
<td>Urban/Built-Up Land</td>
<td>3.4</td>
<td>3.7</td>
<td>8.9</td>
<td>10.1</td>
</tr>
<tr>
<td>Waterbodies</td>
<td>0.5</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Wetlands</td>
<td>0.2</td>
<td>0.8</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The settlement footprints, occurring within the “urban” land cover category as identified by the KZN Department of Rural Development and Land Reform (DRD LR), in relation to Umgeni Water’s infrastructure are illustrated in Figure 2.4 and the population density in Figure 2.5. The largest concentration of people is shown to be along the key routes of accessibility viz. the “T-junction” formed by the N3 and N2 highways. Figure 2.4 and Figure 2.5 also show that there is a concentration of people in the “shadow corridor” which runs parallel to the N2 highway. These concentrations of people show the areas in which there is a high potable water demand.
Figure 2.1 Institutional boundaries.

Legend
- UW Operated WTPs
- UW Operated Pipelines
- Rivers
- National Roads
- UW Operated Dams
- Water Management Areas (WMA)
- WSAs for whom UW is BWSP
  - Illenbe
  - eThekwini
  - Ugu
  - Sisonke
  - Umungundlovu
  - The Msunduzi

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale on A4 at 1:1,500,000

Indian Ocean
Figure 2.2  WSAs and their constituent local municipalities.

Legend
- National Roads
- Rivers
- UW Operated Dams
- WSAs for whom UW is BWSP
- eThekwini Municipality

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgungundlovu Water
Figure 2.5 Iso-line map of population density (2009).

Legend
- UW Operated WTPs
- UW Operated Pipelines
- National Roads
- Rivers
- UW Operated Dams
- WSAs for whom UW is BWSP

Population Density (No. of People/Km²)

- 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 50
- 51 - 75
- 76 - 100
- 101 - 150
- 151 - 200
- 201 - 15000

Source:
- DRDLR
- Department of Water Affairs
- KZN Department of Transport
- Municipal Demarcation Board
- Umgeni Water

Original Scale on A4 at 1:1 500 000

0 25 50 km

Indian Ocean

Durban

Pietermaritzburg

Mzimbulu

Mzimba

Mzimkhulu

Hibberdene

Scottburgh

Middendorp

Middelburg

New Hanover

Howick

Estcourt

Greytown

Maphumulo

Mandini

South Africa

Lesotho

Original Scale on A4 at 1:1 500 000
2.2 Natural Environment

The status of biodiversity is reflected by the Terrestrial Systematic Conservation Plan (TSCP) (Figure 2.6). The “transformation” as shown in the TSCP was obtained from the 2008 land cover and reflects those areas which have been completely transformed and all biodiversity value has been lost. These areas, shown in grey in Figure 2.6, correlate with the areas of human settlement shown in Figure 2.4 and Figure 2.5. However, a comparison of these maps also show that there are high numbers of people living in areas of high biodiversity value which results in a tension between the residential and conservation land uses. For these areas, guidance from the relevant planning authorities will need to be obtained as to the desired land use prior to the provision of bulk water supply. If the desired land use is conservation, stand-alone schemes (“off-grid”) may be the sustainable option for water provision.
2.3 Existing Development Status

The percentage contributions of municipal Gross Value Added (GVA) to the total KwaZulu-Natal GVA for 2009 is shown in Figure 2.7. This figure shows that the municipalities with the highest GVA are located along the N3-N2 T-junction. However, a comparison of Figure 2.7 with Figure 2.4 and Figure 2.5 shows that the concentration of people located in the “shadow corridor” running parallel to the N2 are living in municipalities that do not have high GVAs.

A comprehensive municipal categorisation was provided by the State of Local Government report (2009; IMP 2010) which provides the foundation for all planning work undertaken by government. The categorisation, which builds on the categorisation as defined in the Constitution (1996), “refers to the size of municipalities in terms of population, percentage of urban population and size of municipal budgets. These characteristics are relatively fixed over time and assist with understanding of municipal profiles” (CoGTA 2009b: 8). The categories are as follows:

- A – Metros. Large urban complexes with populations over 1 million and accounting for 56% of all municipal expenditure in the country.
- B1 – Local Municipalities with large budgets and containing secondary cities.
- B2 – Local Municipalities with a large town as a core.
- B3 – Local Municipalities with small towns, with relatively small population and significant proportion of urban population but with no large town as a core.
- B4 – Local Municipalities which are mainly rural with communal tenure and with, at most, one or two small towns in their area.
- C1 – District Municipalities which are not water service authorities.
- C2 – District Municipalities which are water service authorities.

(CoGTA 2009a: 9)

This categorisation as applied to Umgeni Water’s area is shown in Figure 2.8. Urban areas as identified by the DRDLR’s 2009 “Urban Edges” study (2009b) and rural settlements as identified by the DRDLR’s 2009 “Rural Settlements Update Project in KZN” study (2009a) (Figure 2.4) in relation to the CoGTA’s A – C2 categorisation are shown in Figure 2.9.
CoGTA (2009b: 76) has also developed a spatial classification system for local municipalities based on the indicators of functionality, socio-economic profile and backlog status. The four municipal classifications are:

- Class 1 – Most vulnerable.
- Class 2 – Second most vulnerable.
- Class 3 – Second highest performing.
- Class 4 – Highest performing.

(CoGTA 2009a: 76)

This classification is illustrated in Figure 2.10. Both classifications, as applicable to Umgeni Water’s area are summarised in Table 2.2.

<table>
<thead>
<tr>
<th>District Municipal ID</th>
<th>District Municipality</th>
<th>Local Municipal ID</th>
<th>Local Municipality</th>
<th>CoGTA A – C2 Categorisation</th>
<th>CoGTA Spatial Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETH</td>
<td>eThekwini</td>
<td>ETH</td>
<td>eThekwini</td>
<td>A</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>DC21</td>
<td>Ugu</td>
<td>KZN211</td>
<td>Vulamehlo</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC21</td>
<td>Ugu</td>
<td>KZN212</td>
<td>Umdoni</td>
<td>B2</td>
<td>Class 3: Second Highest Performing</td>
</tr>
<tr>
<td>DC21</td>
<td>Ugu</td>
<td>KZN213</td>
<td>Umzumbe</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC21</td>
<td>Ugu</td>
<td>KZN214</td>
<td>uMziwabantu</td>
<td>B3</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC21</td>
<td>Ugu</td>
<td>KZN215</td>
<td>Ezingoleni</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC21</td>
<td>Ugu</td>
<td>KZN216</td>
<td>Hibiscus Coast</td>
<td>B2</td>
<td>Class 3: Second Highest Performing</td>
</tr>
<tr>
<td>DC22</td>
<td>Umgungundlovu</td>
<td>KZN221</td>
<td>uMshwathi</td>
<td>B4</td>
<td>Class 2: Second Most Vulnerable</td>
</tr>
<tr>
<td>DC22</td>
<td>Umgungundlovu</td>
<td>KZN222</td>
<td>uMngweni</td>
<td>B2</td>
<td>Class 4: Highest Performing</td>
</tr>
<tr>
<td>DC22</td>
<td>Umgungundlovu</td>
<td>KZN223</td>
<td>Mpolana</td>
<td>B3</td>
<td>Class 3: Second Highest Performing</td>
</tr>
<tr>
<td>DC22</td>
<td>Umgungundlovu</td>
<td>KZN224</td>
<td>Impende</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC22</td>
<td>Umgungundlovu</td>
<td>KZN225</td>
<td>The Msunduzi</td>
<td>B1</td>
<td>Class 4: Highest Performing</td>
</tr>
<tr>
<td>DC22</td>
<td>Umgungundlovu</td>
<td>KZN226</td>
<td>Mkhambathini</td>
<td>B3</td>
<td>Class 2: Second Most Vulnerable</td>
</tr>
<tr>
<td>DC22</td>
<td>Umgungundlovu</td>
<td>KZN227</td>
<td>Richmond</td>
<td>B4</td>
<td>Class 2: Second Most Vulnerable</td>
</tr>
<tr>
<td>DC29</td>
<td>Ilembe</td>
<td>KZN291</td>
<td>Mandeni</td>
<td>B4</td>
<td>Class 2: Second Most Vulnerable</td>
</tr>
<tr>
<td>DC29</td>
<td>Ilembe</td>
<td>KZN292</td>
<td>KwaDukuza</td>
<td>B2</td>
<td>Class 4: Highest Performing</td>
</tr>
<tr>
<td>DC29</td>
<td>Ilembe</td>
<td>KZN293</td>
<td>Ndwedwe</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC29</td>
<td>Ilembe</td>
<td>KZN294</td>
<td>Maphumulo</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC43</td>
<td>Sisonke</td>
<td>KZN431</td>
<td>Ingwe</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
<tr>
<td>DC43</td>
<td>Sisonke</td>
<td>KZN432</td>
<td>KwaSani</td>
<td>B3</td>
<td>Class 2: Second Most Vulnerable</td>
</tr>
<tr>
<td>DC43</td>
<td>Sisonke</td>
<td>KZN433</td>
<td>Greater Kokstad</td>
<td>B2</td>
<td>Class 3: Second Highest Performing</td>
</tr>
<tr>
<td>DC43</td>
<td>Sisonke</td>
<td>KZN434</td>
<td>Ubuhlebeazi</td>
<td>B4</td>
<td>Class 2: Second Most Vulnerable</td>
</tr>
<tr>
<td>DC43</td>
<td>Sisonke</td>
<td>KZN435</td>
<td>Umzimkhulu</td>
<td>B4</td>
<td>Class 1: Most Vulnerable</td>
</tr>
</tbody>
</table>
It is shown in Figure 2.8, Figure 2.9 and Figure 2.10 that at present, Umgeni Water’s infrastructure is predominantly in those areas that are urban and which are “high-performing”.

The DRDLR’s Urban Edges study (2009) identified a classification for urban areas, which is shown in Table 2.3 and Figure 2.11. The study did not include eThekwini Municipality, as eThekwini is undertaking its own study. The lower-order urban centres should be monitored for growth into higher-order centres as the higher-order centres will have a higher consumption of potable water.

Table 2.3 Urban area classification (DRDLR 2009: 12).

<table>
<thead>
<tr>
<th>Code</th>
<th>Urban Continuum Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Dense rural settlement: rural hamlet</td>
</tr>
<tr>
<td>1</td>
<td>Rudimentary small town (formal and/or informal)</td>
</tr>
<tr>
<td>1a</td>
<td>Rudimentary service node</td>
</tr>
<tr>
<td>1b</td>
<td>Self-serving small centre focussed around industry/service</td>
</tr>
<tr>
<td>1c</td>
<td>Tourism centre</td>
</tr>
<tr>
<td>1d</td>
<td>Golfing estate</td>
</tr>
<tr>
<td>1e</td>
<td>Tourism resort</td>
</tr>
<tr>
<td>2</td>
<td>Low-order small towns</td>
</tr>
<tr>
<td>2a</td>
<td>Limited range of services and formal residential</td>
</tr>
<tr>
<td>2b</td>
<td>Dislocated dormitory suburb</td>
</tr>
<tr>
<td>3</td>
<td>Upper order small towns</td>
</tr>
<tr>
<td>3a</td>
<td>Wide range of services plus residential formal layout with services and industries</td>
</tr>
<tr>
<td>4</td>
<td>Centre with full range of services and formal housing</td>
</tr>
<tr>
<td>5</td>
<td>Emerging metros</td>
</tr>
<tr>
<td>6</td>
<td>Full metros</td>
</tr>
</tbody>
</table>
Figure 2.9 Urban areas, rural areas and CoGTA’s A - C2 Categorisation.
Figure 2.11 DRDLR's urban classification.

Legend

DRDLR Urban Classification
- Rudimentary Small Town
- Low-Order Small Towns
- Upper-Order Small Towns
- Centre with Full Range of Services
- Emerging Metros
- UW Operated WTPs
- UW Operated Pipelines
- National Roads
- Rivers
- UW Operated Dams
- WSAs for whom UW is BWSP

Source:

DRDLR
Department of Water Affairs
IDCM Department of Transport
Municipal Demarcation Board
Umdoni Water

Original Scale on A4 at 1:1 500 000
2.4 Basic Needs

The KZN Premier’s “Flagship Programme” (IMP 2011) identified the 57 most deprived wards (2006 ward boundaries) in KZN. Those wards occurring in Umgeni Water’s supply area are shown in Figure 2.12. The 2011 ward boundaries are delineated in brown. It is shown in Figure 2.12 that the 2006 wards used in the Flagship Programme and that are ranked as 20, 22, 23, 35, 36, 38, 48, 49 and 53 have had their boundaries amended for the 2011 local elections.

The total number of people, households and the number of people with access to water below RDP levels per WSA (2004 – 2010) as per the Water Services National Information System (WSNIS) are shown in Figure 2.13, Figure 2.14 and Figure 2.15, whilst the density of the backlogs is shown in Figure 2.16. A comparison of Figure 2.16 with Figure 2.12 shows that, as expected, there are water backlogs in those wards that are most deprived. However, Figure 2.16 also shows that there are significant backlog densities in the higher performing municipalities (compare with Figure 2.9 and Figure 2.10).

The status of the gazetted restitution claims are illustrated in Figure 2.17. It is shown in this figure that a number of claims have been settled in the Camperdown area and in the vicinity of the town of KwaDukuza. A number of settlement type redistribution projects are being undertaken in the KwaDukuza Town area (Figure 2.18) but there are also a number of settlement projects occurring in the north-eastern boundary of Mpofana Local Municipality. This figure shows that these two areas should be monitored in terms of increasing water consumption. The redistribution projects identify those areas where there may be future water demand in terms of basic needs.

Those areas requiring an assured supply of potable water in terms of basic needs (those areas below an RDP level of water supply) and the possible areas requiring a similar level of water service (the redistribution projects) are shown in Figure 2.19.
Number of People per WSA (2004 - 2011)

<table>
<thead>
<tr>
<th>Year</th>
<th>Umgungundlovu</th>
<th>The Msunduzi</th>
<th>Sisonke</th>
<th>Ugu</th>
<th>eThekweni</th>
<th>Ilembe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>395,013</td>
<td>585,024</td>
<td>472,620</td>
<td>744,832</td>
<td>3,269,896</td>
<td>592,883</td>
</tr>
<tr>
<td>2005</td>
<td>399,662</td>
<td>591,174</td>
<td>487,240</td>
<td>758,597</td>
<td>3,346,733</td>
<td>597,185</td>
</tr>
<tr>
<td>2006</td>
<td>402,226</td>
<td>595,214</td>
<td>492,084</td>
<td>764,328</td>
<td>3,375,631</td>
<td>602,205</td>
</tr>
<tr>
<td>2007</td>
<td>404,406</td>
<td>598,773</td>
<td>494,937</td>
<td>768,875</td>
<td>3,395,871</td>
<td>605,807</td>
</tr>
<tr>
<td>2008</td>
<td>407,012</td>
<td>603,278</td>
<td>498,465</td>
<td>774,625</td>
<td>3,421,552</td>
<td>610,362</td>
</tr>
<tr>
<td>2009</td>
<td>409,237</td>
<td>606,888</td>
<td>501,343</td>
<td>779,243</td>
<td>3,442,070</td>
<td>614,008</td>
</tr>
<tr>
<td>2010</td>
<td>385,769</td>
<td>618,027</td>
<td>469,931</td>
<td>735,583</td>
<td>3,509,256</td>
<td>580,001</td>
</tr>
<tr>
<td>2011</td>
<td>390,357</td>
<td>624,412</td>
<td>470,812</td>
<td>741,974</td>
<td>3,540,682</td>
<td>582,489</td>
</tr>
</tbody>
</table>

**Figure 2.13  Number of people per WSA (2004 – 2011).**
Figure 2.14  Number of households per WSA (2004 – 2011).
**Number of People with Access to Water Below RDP Levels per WSA (2004 - 2011)**

![Chart showing the number of people with access to water below RDP levels per WSA (2004 - 2011).](chart)

<table>
<thead>
<tr>
<th>Year</th>
<th>Umgungundlovu</th>
<th>The Msunduzi</th>
<th>Sisonke</th>
<th>Ugu</th>
<th>eThekwini</th>
<th>Ilembe</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>102,017</td>
<td>111,580</td>
<td>200,726</td>
<td>400,717</td>
<td>410,426</td>
<td>266,550</td>
</tr>
<tr>
<td>2005</td>
<td>87,569</td>
<td>112,686</td>
<td>174,260</td>
<td>364,971</td>
<td>360,642</td>
<td>228,524</td>
</tr>
<tr>
<td>2006</td>
<td>81,182</td>
<td>104,851</td>
<td>161,667</td>
<td>345,666</td>
<td>325,686</td>
<td>213,898</td>
</tr>
<tr>
<td>2007</td>
<td>71,088</td>
<td>92,485</td>
<td>148,226</td>
<td>313,205</td>
<td>272,218</td>
<td>189,969</td>
</tr>
<tr>
<td>2008</td>
<td>63,409</td>
<td>81,987</td>
<td>147,097</td>
<td>296,861</td>
<td>209,669</td>
<td>172,032</td>
</tr>
<tr>
<td>2009</td>
<td>53,412</td>
<td>70,275</td>
<td>137,056</td>
<td>267,024</td>
<td>157,044</td>
<td>149,840</td>
</tr>
<tr>
<td>2010</td>
<td>44,946</td>
<td>59,391</td>
<td>117,568</td>
<td>224,618</td>
<td>110,754</td>
<td>119,118</td>
</tr>
<tr>
<td>2011</td>
<td>42,335</td>
<td>54,881</td>
<td>110,654</td>
<td>212,344</td>
<td>90,872</td>
<td>109,320</td>
</tr>
</tbody>
</table>

**Figure 2.15** Number of people with access to water below RDP levels per WSA (2004 – 2011).
Figure 2.17 Status of restitution claims (Oct 2010).

Legend:
- UW Operated WTPs
- UW Operated Pipelines
- National Roads
- Rivers
- UW Operated Dams
- WSA for whom UW is BWSP
- Gazetted Restitution Claims (Oct 10)
- Settled
- Status Unknown
- Cadastral
- Ingoyama Land Trust

Source:
- DRELA Department of Water Affairs
- KZN Department of Transport
- Municipal Demarcation Board
- Surveyor-General
- Umgeni Water

Original Scale on A4 at 1:1,500,000
Figure 2.18 Types of redistribution projects (Oct 10).

Legend
Redistribution Projects (Oct 10)
- Other Types
- Settlement
- Food Safety Net & Settlement
- Food & Settlement
- Settlement, Crop & Grazing
- Settlement, Chicken, Stock Farming & Cr
- Settlement & Subsistence Farming
- UW Operated WTPs
- UW Operated Pipelines
- National Roads
- Rivers
- UW Operated Dams
- WSAs for whom UW is BWSP
- Cadastrals
- Ingoyama Land Trust

Source:
- DRA
  Department of Water Affairs
- KZN Department of Transport
- Municipal Demarcation Board
- Sunnymore General
- Umgeni Water

Original Scale on A4 at 1:1 500 000

0 25 50 km
2.5 Development Plans

Proposed developments from both the private and public sector (as received by KZN CoGTA) are shown in Figure 2.20. This figure shows that the proposed developments are predominantly located along the N3-N2 T-Junction with some congregation of proposed residential developments in the New Hanover (uMshwathi Local Municipality), Himeville (KwaSani Local Municipality), Kokstad (Greater Kokstad Local Municipality) and Harding (uMziwabantu Local Municipality) areas. Figure 2.20 shows possible new water demands from a market-driven perspective.

Areas of possible new water demands that have been formally planned are illustrated at the following levels of details via the:

- KZN Provincial Growth and Development Strategy (PGDS) 2011 and the KZN Spatial Development Framework (SDF) 2011 (KZN Planning Commission 2011) at a provincial level;
- KZN Provincial Spatial Economic Development Strategy (KZN PSEDS) also at the provincial level and this supports the KZN PGDS 2011.
- Respective municipal SDFs at the local level.

The KZN PGDS 2011 was adopted by the KZN Cabinet on 31 August 2011 and includes a draft 2030 vision for the province. The KZN Planning Commission (2011) explains as follows:

The PGDS is crucial to...
- Focus on a clear vision for the Province;
- Promote vertical, horizontal and spatial alignment;
- Mobilise all development partners to achieve predetermined development objectives and targets; and
- Build on the strengths and opportunities of the Province, while addressing weaknesses and threats.

The PGDS therefore has to...
- Set a long term (20 year +) vision and direction for development in the province;
- Serve as the overarching strategic framework for development in the Province applying the 80/20 principle (Not an inventory of all we do);
- Provide Spatial context and prioritisation (not just what, also where and when);
- Guide the activities & resource allocation of provincial government & other spheres of government, business sectors, organised labour & other role players from civil society that can contribute to development in the province;
- Establish clear institutional arrangement to secure buy-in and ownership, through a structured consultation process with all development partners;
- Set clear targets and indicators;
• Capitalise on the wealth of information available, and should focus new research only in areas where no credible information is available; and
• Has to be led by a strong centre & decisive leadership to ensure that the PGDS is afforded the status as the primary plan for the Province.

(KZN Planning Commission 2011 (b): 8 – 10)

The KZN Provincial SDF was developed using a “geospatial analysis platform” and a matrix scorecard (which provided a priority analysis towards interventions). Composite sectoral maps were produced from this analysis and a spatial intervention map resulted from the overlay analysis of the composite sectoral maps. The spatial intervention maps are shown in Figure 2.21 and Figure 2.22. The KZN Provincial SDF is shown in Figure 2.23. The WSAs for whom Umgeni Water is the bulk water supply provider are delineated in black on these figures.

The KZN PSEDS, developed in 2006, guided development in the province at a strategic level until the release of the KZN PGDS 2011. The KZN PSEDS informed the KZN PGDS 2011 and as it occurs at a more detailed level than the KZN PGDS, it will now be updated to be completely aligned with the KZN PGDS 2011. The nodes as identified in the KZN PGDS 2011 are the same as the nodes identified in the KZN PSEDS. Umgeni Water’s infrastructure in relation to the current version of the KZN PSEDS is shown in Figure 2.24.

Figure 2.25 shows that majority of proposed developments align with the proposed nodes as identified in the KZN PGDS 2011 and the KZN PSEDS. However, a comparison between Figure 2.20 and Figure 2.23 shows that there are conflicts in certain areas between the desired land use as identified in the KZN PGDS 2011 and the land use as proposed in the development applications.

Umgeni Water’s infrastructure in relation to the municipal SDFs is shown in Figure 2.26. A comparison of Figure 2.21, Figure 2.22, Figure 2.23, Figure 2.24 and Figure 2.26 shows that there is alignment between the nodes but that in certain areas, there are conflicts in the desired land uses. The KZN Planning Commission and KZN CoGTA are planning to address these conflicts in the 2012/2013 IDP cycle.

Figure 2.27 shows that there are proposed developments occurring outside the planned areas of settlement which results in sprawl and makes service provision expensive. The challenges of sprawl is further emphasised in Figure 2.28 with the distribution of RDP water needs in relation to the areas of planned development and those areas identified for development by market forces.
Figure 2.21 Composite map showing KZN PGDS Priority Intervention Areas (KZN Planning Commission 2011: 144).
Figure 2.22  KZN PGDS Nodes in relation to the Level 1 and Level 2 Priority Areas (KZN Planning Commission 2011: 146).
Figure 2.23  KZN Provincial Spatial Development Framework (KZN Planning Commission 2011: 148).
Figure 2.25 Alignment between the PSEDS & proposed developments.

Legend
- Proposed Developments (2010)
- UW Operated WTPs
- UW Operated Pipelines
- Rivers
- National Roads
- UW Operated Dams
- WSAs for whom UW is BWSP

Nodes
- 1
- 2
- 3
- 4

Activity Corridors
- Priority Primary Corridors
- Primary
- Priority Secondary Corridors
- Secondary
- Existing

Source:
- After Department of Cooperative Governance and Traditional Affairs
- Department of Water Affairs
- KZN Department of Transport
- Municipal Demarcation Board
- Umgeni Water

Original Scale on A4 at 1:1 500 000
0 25 50 km
Figure 2.27 Municipal SDFs and proposed developments.

Legend
- Proposed Developments (2010)

Nodes
- District Node
- Economic Opportunity Node
- Primary Node
- Secondary Node
- Tertiary Node
- UW Operated WTPs

Corridors
- Primary
- Secondary
- UW Operated Pipelines
- Rivers
- National Roads
- UW Operated Dams
- WSAs for whom UW is BWSP

Source:
After Department of Cooperative Governance and Traditional Affairs
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Un Morgan Warden

Original Scale on A4 at 1 : 1 500 000
0 25 50 km

Indian Ocean
2.6 Regional Water Planning Overview

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

With reference to Figure 2.22, the Provincial Growth and Development Strategy (PGDS) (KZN Provincial Planning Commission 2011) identifies eThekwini Municipality as a Primary Node within KZN, which is an urban centre with very high existing economic growth and with the potential for expansion and is of national and provincial economic importance. It is the only Primary Node in the province. Pietermaritzburg has been identified in the PGDS as a Secondary Node within KZN, which is an urban centre with good existing economic development and the potential for growth and services to the regional economy. It is one of four such nodes in the province. These two centres and the development corridor between them is the economic hub of the province (Figure 2.24).

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

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

This key KZN developmental region (T-shaped) defined by primary and secondary nodes and corridors falls largely within Umgeni Water’s area of operation. The primary, secondary and tertiary development nodes are indicated as circles in Figure 2.29 with the size proportional to its hierarchical level of importance. The KwaZulu-Natal Reconciliation Strategy Study that was completed by the Department of Water Affairs & Forestry (DWAF 2009) termed this region “the KwaZulu-Natal Coastal Metropolitan Area”.

In order to maintain its significance, and realise its future growth potential, this region needs to be supported by a sustainable long-term supply of water. The responsibility for the planning,
constructing and operating of the required water resource and water supply infrastructure rests with the Department of Water Affairs, Umgeni Water and the relevant Water Service Authorities. The roles and responsibilities of these institutions in this regard vary, with some overlap in certain instances.

![Map of water supply strategy](image)

**Figure 2.29 Current bulk water supply strategy.**

With reference to **Figure 2.29**, the major sources of water to supply the KwaZulu-Natal Coastal Metropolitan Area are as follows:

1. Water is abstracted from Nagle Dam on the Mgeni River to supply primarily the northern and central parts, and to a lesser extent the western part, of eThekwini Municipality. Raw water storage for this abstraction is provided at Albert Falls Dam, and can be supported by Midmar Dam situated upstream;

2. Water is abstracted from Inanda Dam on the Mgeni River to supply primarily the central and southern parts, and to a lesser extent the northern part, of eThekwini Municipality and the southern coastal strip as far south as Scottburgh within Ugu District Municipality. Raw water storage for this abstraction is provided at Inanda Dam, and can be supported by Albert Falls and Midmar dams upstream;
3. Water is abstracted from Midmar Dam on the Mgeni River to supply the Msunduzi Local Municipality (Pietermaritzburg), the western part of the eThekwini Municipality and the connecting corridor, which is within Umgungundlovu District Municipality;

4. Water is abstracted at the Mearns Weir on the Mooi River and transferred into Midmar Dam to support all abstractions from the Mgeni River. This water is transferred on an irregular basis whenever there is sufficient flow available in the Mooi River and when additional water is required in the Mgeni River; and

5. Water is abstracted from Hazelmere Dam on the Mdloti River to supply the northern part of eThekwini Municipality and the northern coastal strip of Ilembe District Municipality as far north as the town of KwaDukuza.

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

A holistic view of the projected water demands from the entire Mgeni system is shown in Figure 2.30 together with the existing yield (at a 99% level of assurance) available from the system. This yield includes the maximum additional support that it can obtain from the Mooi River. Since the demand exceeds the available yield, the system is currently in deficit with a worsening situation predicted into the future. This deficit means that water is being supplied at a lower level of assurance than is required and therefore the risk of a shortfall being experienced has increased. This risk increases as the size of the deficit increases.
Similarly, **Figure 2.31** illustrates a holistic view of the projected water demands from the entire Mdloti system together with the existing yield (at a 98% level of assurance) available from the system. For this system the deficit is currently anticipated in the near future.

The KwaZulu-Natal Reconciliation Strategy Study (DWAF 2009) concluded in 2009 that: “...the whole study area is running a risk of water shortages soon. This near crisis situation is masked by recent good rainfall which kept dams full. It is not possible to lower this risk with water resource development projects in the short term. As a result immediate water management measures as well as urgent resource extension investigations are required.”

---

**Figure 2.30** Mgeni System – Existing Water balance.
Figure 2.31 Mdloti System – Existing Water Balance.

Water Demand Management (WDM) initiatives are the quickest measure to implement and have the effect of lowering the demand curve and thereby either reducing the deficit or by delaying the need to implement other measures. However, the extent of the success to be achieved through the implementation of WDM initiatives is very difficult to predict accurately beforehand, and once achieved is difficult to maintain unless it is constantly monitored and managed. Nevertheless, the eThekwini Municipality has been implementing a wide range of WDM initiatives for a number of years now which have recently had a marked impact on the demand requirements from the Mgeni system. This is clearly evident in the current downturn in the demand curve in Figure 2.30. The other municipalities within the KwaZulu-Natal Coastal Metropolitan Area have also embarked on their own WDM initiatives in an attempt to slow growth in water demand and thereby reduce their risk of non-supply. Notwithstanding these initiatives, it is evident in both Figure 2.30 and Figure 2.31 that the long-term projection still anticipates a growth in water demand for the region where economic development and improved levels of water service will outweigh any savings achieved through the WDM initiatives. Hence, further water resource augmentation measures still need to be considered.

A significant infrastructure development project is currently underway which will create an important modification (refer to Figure 2.32) to the current bulk water supply strategy:
3a. eThekwini Municipality are in the process of constructing the Western Aqueduct, which will extend the existing pipeline system that runs from Midmar Dam to the western area of eThekwini such that it will also be able to supply parts of the central and northern areas of the municipality. The capacity of this conveyance system is also being increased to cater for additional volumes in the future;

With reference to Figure 2.32, the identified feasible surface water options available to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area are as follows:

6. Implementation of Phase 2 of the Mooi-Mgeni Transfer Scheme. This entails the construction of Spring Grove Dam on the Mooi River upstream of Mears Weir (Phase 2A) and the construction of a new raw water transfer pipeline from the dam to the Mgeni catchment (Phase 2B). This will enable a continuous transfer of water to be made throughout the year at an increase flow rate, and will thereby increase the yield (99% assurance) of the Mgeni system by an additional 164 Ml/day. The Mooi River is hereafter fully utilised and no additional water is available for transfer to the Mgeni catchment;

7. Transfer water from the adjacent Mkomazi River into the Mgeni catchment. An inter-basin transfer scheme, known as the Mkomazi Water Project, is current being investigated that entails the construction of two dams on the river, viz. Smithfield Dam (Phase 1) and Impendle Dam (Phase 2), a new Water Treatment Plant, and a conveyance system of a tunnel and pipelines. Potable water can then be added into the conveyance system (3a) from Midmar Dam that supplies the eThekwini area (western, central and northern). Supply would be primarily under gravity and pre-feasibility indications are that the yield (99% assurance) obtainable from Phase 1 is approximately 403 Ml/day;

5a. The embankment of Hazelmere Dam can be raised by 7m by the installation of radial gates. This will increase the yield (98% assurance) that can be supplied to the northern part of eThekwini Municipality and the northern coastal strip by an additional 25 Ml/day excluding Reserve requirements;

8. Water can be abstracted from the lower reaches of the uThukela River near Mandini to supply the north coast economic corridor, particularly the fast developing area to the south of the uThukela River. A maximum of 110 Ml/day is available for abstraction. This supply can be linked to the supply system from Hazelmere Dam on the Mdloti River to create an integrated system. It would alleviate the need for Hazelmere Dam to supply the distant demands and enable it to satisfy increasing local demands;
9. A dam can be developed on the Mvoti River to link into the supply system from Hazelmere Dam (and the uThukela River). Earlier studies indicated that a supply of approximately 127 Ml/day (98% assurance) could be available from this scheme;

10. Water can be abstracted from the lower reaches of the Mkomazi River and linked into the existing pipeline system to supply a large portion of the south coast economic corridor. Water could be supplied northwards to the southern area of eThekweni Municipality and southwards to the northern areas of Ugu Municipality. Reliance on the Mgeni system (2) to supply this area could then be removed. The south coast supply system could be extended to link into the supply from the Mzimkulu River to create an integrated system. Available yield from this option still needs to be determined.

![Map of Future Bulk Water Supply Strategy](image)

**Figure 2.32** Future bulk water supply strategy.

The identified *wastewater reuse* options (refer to **Figure 2.32**) available to augment the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area are as follows:

A. eThekwini Municipality have identified their Northern Wastewater Works (WWW) and KwaMashu WWW as potential sites for reclamation plants. These WWWs are both
situated within the northern part of the municipality, and their intention is to treat the
effluent back to potable standards on site and feed it directly into the local bulk supply
network. These reclamation plants are expected to jointly be able to augment the system by
about 110 ML/day; and

B. Treated effluent from the Darvill WWW in Pietermaritzburg can be reclaimed back
to potable water standards and fed into the bulk pipeline system (3a) that runs from Midmar
Dam through to the western and northern parts of eThekwini Municipality. The possibility of
direct treatment and supply, or abstraction from the Msunduzi River for treatment and
supply exist. This option has the potential to augment the supply to the western and
northern parts of eThekwini Municipality by an additional 65ML/day. However, the downside
of this option is that it decreases the available yield from Inanda Dam (2) by the
commensurate amount.

With reference to Figure 2.32, the identified seawater desalination options available to augment
the water resources to supply the KwaZulu-Natal Coastal Metropolitan Area are as follows:

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

D. A desalination plant in the vicinity of the Lovu River estuary to the south of the city
of Durban. Potable water can be fed into the local bulk supply network to augment the
southern part of eThekwini Municipality as well as into the bulk supply network running
southwards from Inanda Dam (2) into the Ugu District Municipality. It is estimated that the
maximum volume that these bulk networks can accommodate (based on pipeline capacities)
is in the order of 150 ML/day.

The time it takes to commission any of the options listed above becomes important if the existing
and looming supply deficits, as shown in Figure 2.30 and Figure 2.31, are to be able to adequately
addressed. Further to this, there is a spatial context to each option. The importance of developing
any specific option is also linked to its area of supply and the rate at which the water demands in
that specific area is predicted to increase.
Phase 2A of the Mooi-Mgeni Transfer Scheme is currently under construction and expected to be commissioned in 2013, while Phase 2B is expected to be completed a year later in 2014 (6). This will maximize the benefits obtained from the Mooi River to support the entire Mgeni system. As can be seen in Error! Reference source not found., the augmented total yield available at a 99% assurance level will only just match the demand (as projected) at the time of commissioning of Phase 2B of the scheme and will immediately revert back to a deficit position thereafter.

![Graph showing water demand projection](image)

**Figure 2.33 Mgeni System Water Balance with MMTS-2.**

Of all the remaining options for the Mgeni system, the Mkomazi Water Project (7) can provide the largest contribution and has the ability to meet the long-term requirements of the eThekwini region, particularly making use of the new Western Aqueduct infrastructure (3a) which is scheduled to be completed in 2014. This option would relieve the demands placed on other Mgeni abstraction points (1) (2) (4) (6) such that the entire Mgeni system needs would be met. However, the earliest date for the commissioning of Phase 1 of this project is estimated to be 2023, whilst a more realistic date is likely to be around 2030. With either of these dates a deficit still exists in the system that needs to be met by one or more of the other options.

The reuse (A) (B) and seawater desalination (C) (D) options, are relatively quick to implement and can be commissioned as early as 2016 if required and all legislative environment requirements can be met. None of these options are able to make as significant a contribution as the Mkomazi Water Project can, and other than the Darvill reuse option (B) they are all only capable of supplying the
coastal strip. Hence, whilst the Mkomaizi Water Project can possibly be delayed by implementation of one or more of these options, it will still ultimately be required.

Looking ahead, the choice of which option to implement, and by when, is going to have to be determined by both environmental (specifically public) acceptance and by economic benefit (taking into account capital and operational costs and service life). However, these may well be overridden by an urgency to augment the system by the quickest option possible if severe and prolonged drought conditions occur in the very near future.

For the North Coast, the raising of the embankment of Hazelmere Dam (5a) is expected to be completed by the end of 2013. DWA are currently undertaking the detailed design of this project. This is considered adequate to meet the short-term water resource requirements of the Mdloti System (DWA have agreed not to impose the Reserve requirements from the dam until such time as further water resources have been developed in the northern region to augment the system).

Umgeni Water is currently in the detailed design stage of the Lower Thukela Bulk Water Supply Scheme (8). The first phase of this project, which will augment the Mdloti system by 55 ML/day, is expected to be fully commissioned by the end of 2014. The commissioning of the other 55 ML/day that is available from this scheme can be achieved at relatively short notice thereafter, when required.

Thus, with the timely implementation of these two options plus the potential to further augment the Mdloti system from the northern seawater desalination plant (C), if it is constructed, the requirements of northern coastal region should be adequately addressed in the medium to long-term.

For the South Coast, the choice between implementing the Lower Mkomaizi Bulk Water Supply Scheme (10) and the Southern Seawater Desalination Plant (D) will depend largely on the time required to commissioning, environmental (specifically public) acceptance and the economic benefits (taking into account capital and operational costs and service life). At this stage insufficient detail is known on both of these options to be able to make this choice. Detailed feasibility investigations of both options are due to start in the near future. Implementation of the favoured option is likely to be required to commence immediately after the completion of the feasibility investigations.
3 Demand Forecasts

This section documents Umgeni Water's water demand forecast review that was completed in September 2011. The review process:

- Assessed and revised the short-term forecast for the financial year ending in June 2012 (2011/2012);
- Compiled short-term forecasts for the financial years ending in June 2013 (2012/2013), June 2014 (2013/2014) and June 2015 (2014/2015); and
- Extended these short-term forecasts to a long-term forecast (30-year forecast) to the end of June 2042 (2041/2042).

All data presented has been updated to include the October 2011 sales figures and all statistics and trends have been based on the moving annual average and year-on-year growth figures as determined at 31 October 2011.

3.1 Review of 2010/11 Sales

The initial forecasted water sales value for the financial year ending in June 2011 (2010/11), as determined in September 2009, was 1 193 ML/day. Sales volumes at the end of 2009/10 were marginally lower than what had been forecast and it was anticipated that the decreasing trend in water sales would intensify into the near future especially as a result of a significant anticipated reduction in non-revenue water in the eThekwini Municipality area. Hence the forecasted 2010/11 value was revised downward to 1 175 ML/day as part of the sales forecasting process that occurred in September 2010. Water sales started to noticeably decrease from July 2010 and continued with the same trend in subsequent months, such that the forecasted value was revised once again in March 2011 to 1 137 ML/day.

Total sales recorded for the 2010/11 financial year averaged 1 129 ML/day (412 200 ML), falling below the March 2011 revised value, and well below the September 2010 revised value. This reduced actual sales volume can primarily be attributed to 'better than initially expected’ results achieved by eThekwini Municipality with their various water demand management initiatives.
Total average water sales for the 2009/10 financial year was 1 167 Ml/day (425 848 Ml), and hence the 2010/11 sales are a 3.2% year-on-year decrease on the 2009/10 financial year. This can be compared to the 2.4% positive growth that was realized in the previous financial year.

After eight consecutive years of positive growth in Umgeni Water’s sales, the 2010/11 sales reflect a negative growth and a break in this trend. Since June 2002, when the annual sales amounted to 315 370 Ml, sales had increased by an average of 3.84% per annum up until June 2010. Annual sales over the past five years still reflect an average annual positive growth rate of 2.7% (down from 3.9% last year). Figure 3.1 shows the 12-month moving average of Umgeni Water’s total average daily water sales for the past 10 years.

Bulk water sales to eThekwini Municipality constituted by far the largest percentage (75.3%) of Umgeni Water’s total water sales for 2010/11. Their portion of the total sales has decreased from 77.1% in the previous year, due primarily to their lower water purchases that were facilitated by the successes achieved in their non-revenue water programme. The Msunduzi Municipality is Umgeni Water’s second largest customer, accounting for 15.1% of the organisation’s total sales. This is an increase of 1.4% on the previous year and is primarily due to the growth in water consumption experience by the municipality over the year. The remaining customers make up the balance of the sales. Figure 3.2 illustrates the average daily sales volume distribution per customer for the financial year 2010/11.
Figure 3.1  Umgeni Water Total Average Daily Sales.

Figure 3.2  Distribution of Sales Volumes for 2010/2011.
3.2 2011 Short-Term Bulk Water Sales Forecasts

The economy has shown slow growth following the recent economic slowdown and recession and has yet to recover fully, therefore economic growth (and its corresponding translation into growth in water demands) for the Umgeni Water area of supply is not expected to be significant over the next few years. eThekweni Municipality’s current water demand management (WDM) initiatives have also had a marked influence on Umgeni Water’s bulk water sales, and these initiatives are expected to influence future sales in the short-term.

In September 2010 the Umgeni Water short-term bulk water sales forecast for 2011/2012 was estimated to be 1 184 Ml/day and later revised to 1 146 Ml/day when it became evident that sales would fall well short of the projected value due to the unforeseen success being achieved by eThekweni Municipality’s WDM initiatives.

Whilst eThekweni Municipality do not expect to achieve the same level of success with their WDM initiatives during the next year or two, the retarded economic growth over this same period is expected to result in a negative overall growth for 2011/2012 and then turn into an improving situation in the following years as the economy recovers further. Hence, the Umgeni Water short-term bulk water sales forecast for 2011/2012 and 2012/2013 is estimated to be 1 127 Ml/day and 1 142 Ml/day respectively (Figure 3.3). This represents a 0.22% year-on-year decrease in growth from 2010/2011, which is an improvement on the previous year, and is again primarily determined by the forecast provided by eThekweni Municipality.
3.2.1 eThekwini Municipality

In the 2009/2010 financial year the year-on-year growth in sales to eThekwini Municipality increased by 1%.

In 2010, it was predicted that substantial growth would still occur in the northern eThekwini area with the proposed development of formal housing projects and the industrial development of the Dube Trade Port. eThekwini Municipality did, however, predict that their continuing water demand management initiatives would completely offset the expected growth in the northern areas. The impact of the water demand management initiatives, implemented over the last year, caused a greater than expected reduction in sales to eThekwini Municipality. This is shown in Figure 3.4, where the twelve-month moving average of sales decreased from 900 Ml/day in July 2010 to 860 Ml/day in June 2011 and further to 848 Ml/day in October 2011.

As at October 2011, the total sales to eThekwini were approximately 830 Ml/day. eThekwini Municipality do not believe that their water demand management initiatives will further reduce these sales and have predicted an increase in demand from 830 Ml/day to 839 Ml/day over
the 2011/2012 financial year and to 843 ML/day in 2012/2013. The historical sales and future
demand projection for eThekwini Municipality are presented in Figure 3.4.

eThekwini Municipality have predicted an increased demand from the Hazelmer WTP, due to
proposed development on the KwaZulu-Natal North Coast. If possible, this demand will be shifted to
the Durban Heights WTP. This load shift will occur via the eThekwini Northern Aqueduct and the
Hazelmer to Verulam Pipeline.

![Figure 3.4 eThekwini Municipality Total Volumes - Annual short-term forecast.](image)

### 3.2.2 The Msunduzi Municipality

The water sales to Msunduzi Municipality increased by 10% from 157.24 ML/day in the 2009/2010
financial year to 173.8 ML/day in 2010/2011. This significant increase can be attributed to the
following factors:

- Increase in meter readings at the Masons Industrial. This increase is as a result of “under
  readings” during much of the 2008/2009 financial year. The corrected readings has resulted in
  a stepped increase of approximately 5 ML/day;
- Double-digit percentage increase in demand in Sweetwaters and Vulindlela.
From discussions with The Msunduzi Municipality held on 29 July 2011, it was agreed that this extent of growth is not expected to be maintained over the short-term forecast period. The projected demands for 2011/2012 and 2012/2013 are expected to increase by 0.8% and 1.1% respectively. This equates to sales forecasts of 175.20 ML/day (63 948 ML/pa) and 177.14 ML/day (64 656 ML/pa) 2011/2012 and 2012/2013 respectively. The following significant factors influenced this short term forecast:

- Demand growth has been negligible since March 2011. This is evident in Figure 3.5 which indicated a flat 12 month moving average over this period.
- There are no significant developments (housing, commercial and industrial) that will result in a steeper increase.
- Msunduzi Municipality has embarked on an aggressive water demand strategy that will offset the natural growth that will take place in the region.

Msunduzi municipality have recently appointed a service provider to initiate a range of water demand management (WDM) initiatives throughout the entire municipal area. The initiatives include, *inter alia*, reducing operating pressures, replacing ageing pipelines and investigating and repairing leakages. Much of the reconnaissance work has been conducted and the service provider is now moving into the implementation phase. The programme anticipates making significant gains into reducing water losses in Msunduzi Municipality. This requires that these demand projections be reviewed at least every six months so that revisions can be made, based on the anticipated success of the WDM project.

The shopping centre in Edendale represents the major commercial development in Pietermaritzburg. It has been operational since the end of 2011. This development, however, will not contribute to a stepped increase in demand because it is not considered a high water consumption activity.

It is anticipated that WDM initiatives together with natural growth in demand will have the net effect of reducing demand growth to around 1% for the 2011/2012 financial year.

The projection for Msunduzi Municipality is reflected in the following graph:
3.2.3 Umgungundlovu District Municipality

The total sales to the Umgungundlovu District Municipality (UMDM) increased by 1% from 10 959 ML in the 2009/2010 financial year to 11 039 ML in 2010/11.

During the 2011/2012 financial year the following stepped increases are expected:

- 1.1 ML/day starting November 2011 - supply to Manyavu.
- 0.3 ML/day starting March 2012 – supply to Ogagwini and Umacalagwana in Greater Eston.

Apart from the stepped increase, a 1% growth rate is anticipated. The projected sales for 2011/2012 and 2012/2013 are expected to be 31.2 ML/day (11 382 ML/annum) and 32.2 ML/day (11 751 ML/annum) respectively.

The water demand in the uMshwati Local Municipality is constrained by the limited capacity of the existing Umgeni Water infrastructure to support further developments. The projection for
uMshwati Municipality, which is supplied from DV Harris WTP, has therefore been restricted to a 1% annual growth.

The major potential for increased water demand in uMngeni Local Municipality is in a low-cost housing development of 1500 units (Khayelisha) located next to Mpophomeni. Implementation of Phase 1, which will consist of 500 units, has begun. The impact of Phase 1 will only be realised in about 2 years. It has therefore not been factored into this demand forecast.

Umgungundlovu District Municipality have recently embarked on a water demand management (WDM) project. The project is in its conceptual stage with the appointed consultants currently busy with desktop work. WDM initiatives are not expected to influence projections for this municipality over this forecast horizon.

The projection for Umgungundlovu District Municipality is reflected in Figure 3.6.

![Figure 3.6](image_url)

**Figure 3.6** Umgungundlovu District Municipality Total Sales Volumes - Annual short-term forecast.
3.2.4 Ilembe District Municipality (including Sembcorp SizaWater)

Sales to Ilembe District Municipality can be described as follows:

- Sales to the Coastal Area of Ilembe through Sembcorp Siza Water.
- Sales to the Coastal Area of Ilembe through Ilembe District Municipality.
- Sales to Ilembe District Municipality through schemes owned by the municipality and managed by Umgeni Water.

Urban and peri-urban growth across Sembcorp Siza Water’s concession area has caused a corresponding increase in water demand with the growth for the 2010/2011 financial year being 10%. Sembcorp Siza Water expects that further developments in this area will increase the demand from 12.3 ML/day in 2010/2011 to 13.3 ML/day in 2011/2012 and 14.3 ML/day in 2012/2013. This prediction is not matched by the sales between June 2011 and October 2011 where the demand for water decreased to 10 ML/day, however, it is expected that demand will again increase during the summer season. The historical and future predicted increase in demand for Sembcorp Siza Water is presented in Figure 3.7.
Figure 3.7  Siza Water Total Sales Volumes - Annual short-term forecast.

The remaining water sales to Ilembe District Municipality for 2011/2012 include:

- approximately 9 Ml/day sales to the coastal areas from Umgeni Water’s Hazelmere WTP;
- 16 Ml/day sales to KwaDukuza (Stanger). Supply to the town of KwaDukuza includes 15 Ml/day from the Mvoti WTP and a further augmentation of 1 Ml/day from the Hazelmere System via an emergency pipeline from Honolulu Reservoir to the Mvoti Balancing Reservoirs; and
- 6 Ml/day sales to 36 inland rural schemes owned by Ilembe District Municipality and operated by Umgeni Water.

Ilembe District Municipality is implementing a number of water demand management (WDM) initiatives within the town of KwaDukuza (Stanger) and they estimate that savings from these initiatives will offset the growth in sales for the area. They therefore predict a zero percent growth rate in 2011/2012 (31 Ml/day) with an increase in demand of 1.5 Ml/day in 2012/2013. Historical and predicted future sales to Ilembe District Municipality are presented in Figure 3.8.
3.2.5 Ugu District Municipality

Total sales to the Ugu District Municipality increased by 0.7% from 7 871 Ml (21.56 Ml/day) in the 2009/2010 financial year to 7 923 Ml (21.71 Ml/day) in 2010/2011. The low increase, in comparison to the projection for this period, was primarily due to the water restrictions that were imposed as a result of the sharp drop in water levels of the Umzinto and E. J. Smith dams from May 2010 until October 2010. A number of infrastructure projects are being implemented by Umgeni Water in order to mitigate the future risk of non-supply.

Ugu District Municipality is currently constructing a pipeline from their Hazelwood Reservoir to the Greater Vulamehlo area to supply water from the Umzinto WTP supply system to this area resulting in an expected growth rate of 6.8%.
The expected growth in sales to the Ugu District Municipality (as confirmed by them) is estimated at 13.08% in the 2011/2012 financial year and 8.51% in 2012/2013. This equates to total sales for 2011/2012 and 2012/2013 of 8,959 Ml and 9,722 Ml respectively (Figure 3.9). Ugu District Municipality highlighted the growth potential of the Middle South Coast area if additional water becomes available and prompted the step increase towards April 2012 when Phase 2a of the South Coast Pipeline (SCP-2a) is commissioned.

This expected growth is a result of the Ugu District Municipality’s proposed initiatives towards the reduction of backlogs and the rapid growth in water sales in the inland rural areas of the municipality, specifically in the Greater Vulamehlo, Ifafa and Mathulini areas.

Ugu District Municipality has embarked on a number of water demand management (WDM) initiatives. However, these are mainly in the Lower South Coast region and not in the Umgeni Water area of supply and hence they do not expect to have an impact on the projected water demand growth rates.

![Graph showing water sales growth](image)

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

The Ixopo WTP supplies the Greater Ixopo area. Average daily sales from the WTP currently amount to approximately 2.5 Ml/day. There has been an inexplicable decreasing demand trend since December 2010. The projection for Sisonke District Municipality has been kept at a 0% growth using the 2.5 Ml/day base (Figure 3.10).

![Figure 3.10 Sisonke District Municipality Total Sales Volumes - Annual short-term forecast](image)

3.3 Long-Term Forecast

The 30-year long-term sales forecast for Umgeni Water’s supply area (Figure 3.11) has been based on the anticipated natural growth from the existing supply system, plus bulk sales from new supply infrastructure that would extend the area supplied. The base projection has been developed from the short-term forecasts described in Section 3.2 of this report and then extended at a compounded 1.5% per annum growth rate until 2040/2041. This growth rate has been agreed to by the major water users in the region and is considered acceptable for this long-term forecast as it closely
matches the forecast that was independently derived as part of the “Water Reconciliation Strategy Study for the KwaZulu-Natal Coastal Metropolitan Areas” recently completed by DWA, which used a population projection technique to estimate demand forecasts.

The drop in sales in the 2019/2020 and 2022/2023 financial years, as shown in Figure 3.11, is as a result of the anticipated commissioning by eThekwini Municipality of their Northern and KwaMashu wastewater re-use plants which are anticipated to produce 50 Ml/day and 60 Ml/day respectively. These plants intend to feed potable water directly into their bulk supply network, thereby reducing the requirement from Umgeni Water.

![Graph showing Umgeni Water Long-Term Bulk Water Sales Forecast](imageURL)

**Figure 3.11** Umgeni Water Long-Term Bulk Water Sales Forecast.
4 Water Resources

4.1 Introduction

In order for Umgeni Water to fulfil its function as a regional bulk water service provider, it requires a secure and sustainable supply of raw water. The reconciliation between water resource availability and water demands is therefore of primary importance to the organisation and forms an integral part of its infrastructure planning process. Understanding what water resources are available to the organisation both currently and in the future, and what impacts affect the level of assurance from these resources, is key to achieving the balance between supply and demand and in maintaining the assured level of supply required by the customers.

The natural climate is the principal determinant of surface water runoff and groundwater. This section describes the climate as experienced within Umgeni Water’s operational area, as well as the possible impacts of climate change on surface water runoff in the Mgeni System.

This section also describes the status quo of the water resources, both surface and groundwater, within Umgeni Water’s operational area, and mentions future development plans that are significant to the organisation. The water resources are grouped in logical regions as shown in Figure 4.1.

Finally, a progress note is provided on Umgeni Water’s investigation into the less conventional supply options of wastewater reclamation (re-use) and seawater desalination.
4.2 Climate

There are three distinct climatic zones within Umgeni Water’s operational area (Figure 4.2), namely:

- The Köppen classification Cwb which is the alpine-type climate found in and along the Drakensberg Mountains.
- The Köppen classification Cfb which is the more temperate summer rain climate of the Midlands region.
- The Köppen classification Cfa which is the subtropical perennial rainfall characterising the areas along the coast.

The mean annual precipitation (MAP) within the Umgeni Water operational area varies between 700 and 1000 mm (Figure 4.3) with most rains falling in summer (October to March), although there are occasional winter showers. The national average MAP is about 450 mm per year. The peak rainfall months are December to February in the inland areas and November to March along the coast.

The prevailing weather patterns are predominantly orographic, where warm moist air moves in over the continent from the Indian Ocean, rises up the escarpment, cools down and creates rainfall.

Rain shadows occur in the interior valley basins of the major rivers where the annual rainfall can drop to below 700 mm.

The spatial distribution of evaporation is shown in Figure 4.4. This distribution has a similar pattern to rainfall where a relative high humidity is experienced in summer. There is a daily mean peak in February, ranging from 68% in the inland areas to greater than 72% for the coast and a daily mean low in July, ranging from 60% in the inland areas to greater than 68% at the coast. Potential mean annual gross evaporation (as measured by ‘A’ pan) ranges from between 1 600 mm and 1 800 mm in the west to between 1 400 mm and 1 600 mm in the coastal areas (Figure 4.4).

Temperature distribution is shown in Figure 4.5. The mean annual temperature ranges between 12°C and 14°C in the west to between 20°C and 22°C at the coast. Maximum temperatures are experienced in the summer months of December to February and minimum temperatures in the winter months of June and July. Snowfalls on the Drakensberg Mountain between April and September have an influence on the climate. Frost occurs over the same period in the inland areas.
Figure 4.4  Mean annual evaporation (mm).

Legend
- Rivers
- National Roads
- UW Operated Dams
- WSAs for whom UW is BWSP

Mean Annual Evaporation (mm)
- High: 2000
- Low: 1000

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
SA Agrohydrology Atlas
Umgeni Water

Original Scale on A4 at 1:1 500 000

0 25 50 km
Figure 4.5  Mean annual temperature (°C).

Legend

- Rivers
- National Roads
- UW Operated Dams
- WSA As for whom UW is BWSP

Mean Annual Temperature (°C)

- High: 24
- Low: 8

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
SA Agrohydrology Atlas
Umgeni Water

Original Scale on A4 at 1:1,500,000

0 25 50 km
The average number of heavy frost days per annum range from 31 to 60 days for inland areas to nil for the eastern coastal area.

The mean annual runoff is illustrated in Figure 4.6.

4.3 Climate Change

Introduction

Clear evidence exists that the climate is changing globally and that this will have an amplified impact on water resources and therefore on water security and supply. In South Africa, the Department of Environment Affairs (DEA) is designated to lead the country’s climate change agenda, guided by their recently adopted Long Term Mitigation Strategy on Climate Change. Climate change features as one of several strategic national objectives in DEA’s Strategic Plan (2010/11 – 2012/13) namely, to respond and adapt to climate change impacts, which would otherwise threaten South Africa’s ability to realise the Millennium Development Goals. Furthermore, the Department of Science and Technology has identified Global Change as one of the five “Grand Challenges” to be addressed in the ten year plan for research focus in South Africa. Climate change is a component of Global Change, and water quality and quantity are key elements which will be addressed in this “Grand Challenge”, with one of the intended outcomes being to develop the skills base required to deal with the consequences of climate change.

It is thus imperative that water service providers consider the possible impacts in their water planning in order to sustain water supply at acceptable assurance levels. Umgeni Water is aware of this potential risk which has featured prominently in the organisations Strategies, Business Plans, Scorecards and Risk Frameworks since 2006. Whilst the significance of this risk is understood, Umgeni Water recognised as early as 2006, that not enough was known about the magnitude of the potential impacts, especially at the operating level of its key water resource, the Mgeni River. It was identified that an investigation was necessary in order to establish a better understanding of the potential impacts at this local scale such that appropriate adaptation controls could be developed and implemented if necessary to bring the residual risk to a level that the organisation was willing to accept. The Mgeni catchment was chosen for this assessment due to its importance in supplying one of South Africa’s most important economic hubs, viz. the Greater Durban-Pietermaritzburg area, at a high level of assurance. The catchment is therefore critical to the utility’s operations.
A Framework to Quantify the Impacts of Climate Change

Umgeni Water developed a framework (see Figure 4.7) to guide its efforts towards quantifying the possible impacts of a changing climate on its business. At the core of the framework is a hydrological model wherein rainfall and temperature are altered to represent possible scenarios of the impact of future climates on runoff in rivers. These runoff scenarios are then used in water allocation models that contain the physical constraints of a supply system (e.g. the dam and the future demand for water on the dam), using a risk based approach to determine the security of future water supplies. Runoff can also be used in hydraulic and open channel flow models to determine possible impacts on dam safety and flooding respectively. The results of these scientific assessments are included in various short and long term plans, including the Infrastructure Master Plan. The framework is generic in nature, and to date has been applied to the Umgeni catchment as a case study to improve the methodologies, but also since this is Umgeni Water’s most important and complex catchment. The ensuing sections expand on some of the key aspects of the framework, as pertaining to the Umgeni catchment.

Figure 4.7 Modelling framework to determine the impacts of a changing climate on water resources.
Hydrological Modelling

The daily ACRU agro-hydrological model (Schulze, 1995 and updates) from the University of KwaZulu-Natal (UKZN) and their quinery catchment based hydrological modelling has been used for this assessment of the Umgeni catchment (see Figure 4.8). The strengths of this model lie in its ability to model the actual physical processes that occur in the hydrological cycle, and although the model has initially been applied to climate change in this project, it will be invaluable for other applications. Consequently, considerable effort was expended in ensuring accurate input data describing rainfall patterns, land cover and its water use patterns, irrigation, reservoir abstractions, wetlands, soils, and evaporation which were configured as a base scenario in the hydrological model.

![Image](image.png)

**Figure 4.8** The Mgeni Catchment, KwaZulu-Natal.

Climate Modelling

The possible impact of increasing greenhouse gas emissions (see Figure 4.9) on global climates has been researched by scientists for some time. Four broad greenhouse gas emission scenarios have been developed by the Intergovernmental Panel on Climate Change and were published in their Special Report on Emissions Scenarios (IPCC, 2007). These emission scenarios have been incorporated into more than 20 Global Circulation Models (GCMs) that have been developed for the purpose of, inter alia, providing possible scenarios of global climate over the next 50 to 100 years.
Furthermore, these GCMs have been downcaled to local catchments using either dynamic or statistical techniques that incorporate local climates. Umgeni Water has through its partners including the school of Bioresources Engineering and Environmental Hydrology at the UKZN, the Climate Systems Analysis Group (CSAG) at the University of Cape Town (UCT), the Swedish Meteorological and Hydrological Institute in Sweden, and the Council for Scientific and Industrial Research (CSIR) obtained 35 runoff scenarios that incorporate different GCMs, downscaling techniques and emission scenarios (see Table 4.1).

![Figure 4.9 CO₂ emissions (left panel) and CO₂ concentrations (right panel).](image)

**Table 4.1 Summary of available Global Circulation Models.**

<table>
<thead>
<tr>
<th>Source</th>
<th># of Scenarios</th>
<th>Downscale method</th>
<th>GCMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSAG UCT (vers 1)</td>
<td>4</td>
<td>Statistical</td>
<td>CCC, CRM, ECH and IPS</td>
</tr>
<tr>
<td>SMHI</td>
<td>5</td>
<td>Dynamic</td>
<td>EC4_A2, EC4_A1B, CCSM3_A1B, CCSM3_B2</td>
</tr>
<tr>
<td>CSIR</td>
<td>6</td>
<td>Dynamic</td>
<td>CSIRO, GFDL20, GFDL21, MIROC, MPI, UKMO</td>
</tr>
<tr>
<td>CSAG UCT (vers 2)</td>
<td>20</td>
<td>Statistical</td>
<td>MR2, MR1, IP2, IP1, GI2, GI1, G22, G21, G12, G11, E22, E21, E12, E11, CS2, CS1, CN2, CN1, CC2, CC1</td>
</tr>
</tbody>
</table>

**A Changing Climate and Water Supply - Results**

To date, the potential impacts on hydrology of the Mgeni catchment and water security (yield) at the 4 main dams has been modeled using 9 GCMs (from CSAG UCT version 1 and SMHI). Unfortunately these results (typified in Figure 4.10, Figure 4.11, Figure 4.12 and Figure 4.13) are far from conclusive with for example the potential impact on water yield ranging between -15 and +40%, with the SMHI and UCT models seeming to be relatively dry and wet respectively. There are a
number of possible reasons for this including that the models have been downscaled using different
techniques by different institutions and that the UCT models are now dated, around 5 years.
Furthermore, there is no scientific (or any other) basis to support the credibility of any 1 model or
scenario over another. Put another way, any one of the 9 modelled has an equal possibility of
representing the climate of the future.

![Map](image1.png)

**Figure 4.10** Possible changes in runoff for a particularly wet GCM (GFDL).

![Map](image2.png)

**Figure 4.11** Possible changes in runoff for a particularly dry GCM (ECHAM5).
Figure 4.12 Possible average monthly runoff (as % of annual total).

Figure 4.13 Possible future water yields (as % of present).

Way Forward

The most up-to-date science has been used in this assessment. However, the discipline of performing impact studies, such as water resources, based on scenarios of future climates is relatively new. There are also numerous complexities that are associated with modelling the natural climate – water processes, resulting in increased uncertainty. The confidence levels in the results of such studies are therefore less than ideal. There are, however, several improvements that can be made to the modelling process. At the heart of these improvements is the inclusion of new scientific developments especially with regards to modelling of future climates such as new improved models and using bias correction techniques to ensure that predicted rainfall and potential evaporation are
more adequately represented. These improvements should greatly reduce uncertainty and enhance the credibility of the water planning process at Umgeni Water.

In this regard, a further 26 scenarios recently became available viz. from the CSIR and more recent GCMs from the UCT. These scenarios are to be analysed during the first quarter of 2012, using the same methodology as the first 9 scenarios. It is hoped that this further analysis will provide a convergence of results, at the very least agree on the direction of change. Failing this, at least the spread of results, which could be summarised using a probabilistic approach, should be more meaningful.

Regardless of the results, which are fundamentally based on uncertainty, it will be important for Umgeni Water to develop flexible adaptive strategies to cope with these potential impacts. It is undesirable for the utility to be faced with issues such as unachievable deadlines for water resource development, or loss of supply potential, hence the results from the process described above will be used to develop sustainable solutions. Water resource development plans, system operating rules and disaster risk management plans will contain the means of implementing these strategies.
4.4 Water Resource Regions

KwaZulu-Natal is relatively well endowed with surface water resources and represents the wettest part of an otherwise semi-arid country. Approximately 27% of South Africa’s natural Mean Annual Runoff (MAR) of 49 x 10⁶ m³/annum occurs within the province (NWRS, 2004). It is estimated that the surface runoff and groundwater resources occurring in the Mvoti to Mzimkulu Water Management Area (WMA) are 433 million m³ per annum and 6 million m³ per annum, respectively. This WMA together with the Mooi and the Lower Thukela catchments encompass, and impact upon, Umgeni Water’s operational area. These catchments have been grouped into logical regions (as shown in Figure 4.1 and Table 4.2) and are described further in this section. The quaternary catchments in these regions are shown in Figure 4.14.

Table 4.2  Distribution of surface water resources.

<table>
<thead>
<tr>
<th>Region</th>
<th>Quaternary Catchments</th>
<th>Major Rivers</th>
<th>Significant Dams</th>
<th>WSAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower uThukela</td>
<td>V40, V50</td>
<td>uThukela</td>
<td></td>
<td>Portion of Ilembe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Portion of Mzinyathi</td>
</tr>
<tr>
<td>Mvoti</td>
<td>U4</td>
<td>Mvoti</td>
<td></td>
<td>Portion of Ilembe</td>
</tr>
<tr>
<td></td>
<td>U5</td>
<td>Nonoti</td>
<td></td>
<td>Portion of Umgungundlovu</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lake Merthely Darnall Dam</td>
<td>Portion of Mzinyathi</td>
</tr>
<tr>
<td>Mdloti</td>
<td>U30A</td>
<td>Mhlali</td>
<td></td>
<td>Portion of eThekini</td>
</tr>
<tr>
<td></td>
<td>U30B</td>
<td>Tongati</td>
<td></td>
<td>Portion of Ilembe</td>
</tr>
<tr>
<td></td>
<td>U30C</td>
<td>Mdloti</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U30D</td>
<td></td>
<td>Hazelmere Dam Siphon Dam Dudley Pringle Dam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U30E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mgeni/Mooi</td>
<td>V20</td>
<td>Mooi</td>
<td>Craigieburn Dam Mearns Weir Midmar Dam Albert Falls Dam Nogle Dam Inanda Dam</td>
<td>Portion of Umgungundlovu</td>
</tr>
<tr>
<td></td>
<td>U20</td>
<td>Mgeni</td>
<td></td>
<td>Portion of eThekini</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Portion of Mzinyathi</td>
</tr>
<tr>
<td>Mlazi/Lovu</td>
<td>U60</td>
<td>Mlazi</td>
<td></td>
<td>Portion of Umgungundlovu</td>
</tr>
<tr>
<td></td>
<td>U70</td>
<td>Lovu</td>
<td></td>
<td>Portion of eThekini</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nungwane</td>
<td></td>
<td>Portion of Mzinyathi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mgababa</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nungwane Dam Mgababa Dam Bealulieu Dam Shongweni Dam</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mkomazi</td>
<td>U10</td>
<td>Mkomazi</td>
<td></td>
<td>Portion of Umgungundlovu</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Portion of Sisonke</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Portion of eThekini</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Portion of Ugu</td>
</tr>
<tr>
<td>Middle South Coast</td>
<td>U80</td>
<td>Mpambanyoni</td>
<td></td>
<td>Portion of Ugu</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mzimayi</td>
<td></td>
<td>Portion of Sisonke</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mzinto</td>
<td></td>
<td>Portion of eThekini</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fafa</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mtwalume</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mzumbe</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>E.J. Smith Dam Umnzinto Dam</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mzimkhulu</td>
<td>T50</td>
<td>Mzimkhulu</td>
<td></td>
<td>Portion of Sisonke</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Portion of Ugu</td>
</tr>
<tr>
<td>Mtamvuna</td>
<td>T40</td>
<td>Mtamvuna</td>
<td></td>
<td>Portion of Ugu</td>
</tr>
</tbody>
</table>

82
4.4.1 Lower uThukela Region

The Lower uThukela region (Figure 4.15) comprises the lower portion of the uThukela River, one the largest rivers within the country. The water resources of the uThukela River have been substantially allocated to users within the uThukela basin itself, to inter-basin transfers to the Vaal, and to the Mhlathuze catchment.

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

Surface Water

The hydrological characteristics for this region are summarised in Table 4.3.

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Annual Average</th>
<th>Natural Runoff (million m³/annum)</th>
<th>Natural Runoff (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower uThukela</td>
<td>uThukela River (lower portion)</td>
<td>4 183</td>
<td>1 340</td>
<td>848</td>
<td>434</td>
</tr>
</tbody>
</table>

Groundwater

The Lower uThukela region occurs in the KwaZulu-Natal Coastal Foreland Groundwater Region (Figure 4.16). This Groundwater Region is characterised by fractured aquifers which are formed by predominantly arenaceous rocks consisting of sandstone and diamicite that is Dwyka tillite.

Hydrogeological Units

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

Geohydrology

Eighty nine percent of all reported borehole yields are less than 3 l/s, confirming that overall the groundwater resources are moderately poor to marginal.
Figure 4.15  General layout of the uThukela Region.
Figure 4.17 Groundwater potential in the uThukela Region.

Legend
- **Rivers**
- **National Roads**
- **Water Resource Regions**
- Groundwater Potential (l/s)
  - Yield
    - >0 - 0.1 l/s
    - >0.1 - 0.5 l/s
    - >0.5 - 3 l/s
    - >3 l/s
- **WSAs for whom UW is BWSP**

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale at 1:400,000
**Groundwater Potential**

The development potential in the area (Figure 4.17) can be classified as moderate, where resources are, on average, suitable for development of small reticulation schemes for small villages, schools, clinics and hospitals. Recharge calculations indicate the potential groundwater resources are underutilised: less than 25% of potentially available groundwater is presently used.

**Water Quality**

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

**Reserve**

Water for the ecological Reserve is water that must remain in the river and may not be abstracted. This is expressed as an estimated reduction in available yield and shown as part of the resource.

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

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

**Water Balance/Availability**

This region appears to be in balance even after making an allowance for the Ecological Reserve. Umgeni Water applied for an abstraction licence of 40.2 million m$^3$/annum (110 Ml/day) from DWA during the financial year 2010/11. According to the uThukela Water Management Internal Strategic Perspectives (ISP) (DWA, 2004) it is estimated that there is about 45 million m$^3$/annum (120 Ml/day) which is not allocated. The main water abstractions in the Lower uThukela Area were identified as follows:

• Middeldrift abstractions consisting of the transfer scheme that takes water to the Mhlathuze River System, and the recently developed scheme supplying water to the Ngcebo communities (Figure 4.15 and Table 4.3) located south of the uThukela River.
• The abstraction situated upstream of Mandini supplying the Sundumbili WTP which serves Sundumbili and the surrounding areas.
• The abstraction supplying the uThukela paper mill of SAPPI, including the town of Mandini.
• Irrigation demands in the main river course situated in the Lower uThukela area.

**Existing Infrastructure and Yield**

Currently the Lower uThukela catchment is unregulated and does not have any significant water resource infrastructure on it. Major abstractions are all run-of-river as discussed in the preceding section.
Proposed Water Resource Infrastructure

Whilst the ultimate DWA strategy is to transfer uThukela River water northwards to meet the future demands of the Richards Bay area, this water is not required for that area in the near future. Hence, the uThukela River has been identified as a potential water resource to supply the North Coast area (i.e. south of the uThukela River) in the medium and possibly the long-term. A total amount of 40 million m³/annum (approximately 110 ML/day) is available in the Lower uThukela Region for abstraction for urban and domestic supply. The storage dams in the upper reaches of the uThukela catchment (including the planned Spring Grove Dam) will need to make releases in the winter months to ensure this quantity is always available.

Umgeni Water is currently concluding the design of the Lower Thukela Bulk Water Supply Scheme (this scheme is discussed in Section 4.4). The scheme will include an abstraction works situated on the uThukela River in the vicinity of Mandini (Figure 4.18), utilising a run-of-river abstraction mechanism. The works will initially abstract 20 million m³/annum (55 ML/day) and will be upgraded to 40 million m³/annum (110 ML/day) at a later stage when needed to meet growth requirements.

4.4.2 Mvoti Region

The Mvoti region comprises two tertiary catchments, viz. U40 (Mvoti River) and U50 (Nonoti River) (Figure 4.19).

Land cover consists primarily of communal land in the inland areas, commercial timber in the upper reaches of the Mvoti catchment and dryland and irrigated sugar cane along the coastal strip.

The urban and peri-urban areas of the town of KwaDukuza (previously known as Stanger), Greytown, Zinkwazi, Darnall and Groutville are located within this region. The town of KwaDukuza relies on run-of-river abstractions from the Mvoti River, supported by water transfers from the Mdloti catchment. Groutville also uses water transfers from the Mdloti catchment. Zinkwazi utilises local groundwater resources, while Greytown relies on Lake Merthley and groundwater. The Darnall Dam on the Nonoti River supports the town of Darnall.
Figure 4.18  Proposed water resource infrastructure in the Lower uThukela Region.

Legend
- Proposed Abstraction Points
- Existing Abstraction Points
- Rivers
- National Roads
- WSAs for whom UWIs BWSP

Elevation (m)
- High: 2000
- Low: 0

Source:
- Department of Water Affairs
- KZNR Department of Transport
- Municipal Demarcation Board
- Umgidi Water

Original Scale on A4 at 1:400 000
Figure 4.19  General layout of the Mvoti region.

Legend
- Rivers
- National Roads
- Water Resource Regions
- WSAs for whom UW is BWSP

Source:
Department of Water Affairs
Ezemvelo KZN Wildlife
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale at 1:600 000
0 10 20 km

Land Cover (2005)
- Bare rock
- Bare sand
- Annual commercial crops dryland
- Annual commercial crops irrigated
- Permanent orchards (banana, citrus) irrigated
- Sugarcane - commercial
- Sugarcane - emerging farmer
- Degraded bushland (all types)
- Degraded grassland
- Erosion
- Forest
- Plantation
- Plantation clearfelled
- Grassland
- Grassland / bush clumps mix
- Golf courses
- Smallholdings - grassland
- Mines and quarries
- Woodland
- Dense bush (70-100 cc)
- Bushland (<70cc)
- Old cultivated fields - bushland
- KZN main & district roads
- KZN national roads
- Rural dwellings
- Subsistence (rural)
- Urban
- Wetlands
- Dams
- Estuarine Water
- Natural Fresh Water
- Outside KZN
Surface Water

The hydrological characteristics of the catchments in the Mvoti region are shown in Table 4.4.

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaporation (mm)</td>
</tr>
<tr>
<td>Mvoti</td>
<td>Nonoti River (U50)</td>
<td>179</td>
<td>1 250</td>
</tr>
<tr>
<td>Mvoti</td>
<td>Mvoti River (U40)</td>
<td>3 035</td>
<td>1 223</td>
</tr>
</tbody>
</table>

Groundwater

The Mvoti region occurs in the KwaZulu-Natal Coastal Foreland Groundwater Region (Figure 4.16). This Groundwater Region is characterised by fractured aquifers which are formed by predominantly arenaceous rocks consisting of sandstone and diamictite that is Dwyka tillite.

Hydrogeological Units

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

Geohydrology

Natural groundwater discharge occurs in the form of springs, seeps and in isolated cases, uncapped artesian boreholes. The wetlands and dams in the headwaters of the Mvoti River are supported by perennial groundwater seeps associated with the dolerite sill intrusions in the mudstone/shale lithologies. Springs rising in the sandstone and granite/gneiss lithologies relate to structural features (faults and fracture zones, lineaments). An analysis of baseflow-derived stream runoff values per quaternary catchment suggests that groundwater recharge from rainfall varies in the range 3% to 7% of the mean annual precipitation.
Figure 4.20 Groundwater potential in the Mvoti Region.

Legend
- Rivers
- National Roads
- Water Resource Regions
- WSA for whom UW is BWSP

Groundwater Potential (l/s)
- Yield
  - >0 - 0.1 l/s
  - >0.1 - 0.5 l/s
  - >0.5 - 3 l/s
  - >3 l/s

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale at 1:600 000
0 10 20 km
**Groundwater Potential**

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

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

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

The groundwater potential is particularly high (greater than 3.0 l/s) in the upper catchment in the Natal Group sandstones in a band just south of the towns Greytown, Kranskop and Seven Oaks (Figure 4.20).

**Water Quality**

The Mvoti Water Treatment Plant (WTP) abstracts raw water from the Mvoti River for treatment and supply of potable water. Turbidity seems to have been a problem in this catchment during 2011 as there are a significant number of instances when the Resource Quality Objectives (RQO) have been exceeded (Figure 4.21). High turbidity values are contributed by the sand mining activities upstream of the plant.
Figure 4.21 Percentage compliance vs. non-compliance with the Resource Quality Objective for Mvoti.
Reserve

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

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

Water Balance/Availability

According to the Mvoti to Mzimkhulu ISP (DWA, 2004) the water balance of the Mvoti region is in deficit of 56 million m$^3$/annum. Umgeni Water applied for an abstraction licence of 6.57 million m$^3$/annum (18 ML/day) from the Mvoti River for the Mvoti WTP during the financial year 2010/11. Another abstraction licence application of 2.56 million m$^3$/annum (7 ML/day) was made for the proposed Imvutshane Dam in the Hlimbitwa catchment which is a tributary of the Mvoti River.

Existing Infrastructure and Yields

Surface Water

There are no major storage dams on the Mvoti or Nonoti rivers and consequently the available yield from this system is limited. Lake Merthley, situated in the upper reaches of the Mvoti catchment, and the Darnall Dam on the Nonoti River are the only dams of any significance in this region.

The Mvoti Region has a high MAR, however, the high sediment loads on the main rivers make the development of small dams on these rivers non-viable. Large storage dams or off-channel storage
dams are therefore required. **Table 4.5** shows a summary of existing water resource statistics.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Merthely</td>
<td>Heine</td>
<td>1.98</td>
<td>Domestic</td>
</tr>
<tr>
<td>Darnall Dam</td>
<td>Nonot</td>
<td>0.3</td>
<td>Domestic</td>
</tr>
</tbody>
</table>

**Table 4.6** Yield information for the existing water resource abstractions in the Mvoti Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/annum)</th>
<th>Stochastic Yield (million m³/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Historical</td>
<td>1:50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1:100</td>
</tr>
<tr>
<td>Mvoti Run-of-River at Mvoti WTP</td>
<td>Mvoti</td>
<td>0</td>
<td>Not Available</td>
<td>3.3 (9.0 Ml/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not Available</td>
</tr>
<tr>
<td>Lake Merthely</td>
<td>Heinespruit (tributary of the Mvoti)</td>
<td>1.98</td>
<td>0.74 (2.02 Ml/day)</td>
<td>0.95 (2.60 Ml/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.89 (2.44 Ml/day)</td>
</tr>
<tr>
<td>Darnall Dam</td>
<td>Nonot</td>
<td>0.3</td>
<td>Not Available</td>
<td>1.8 (4.9 Ml/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.1 (3.0 Ml/day)</td>
</tr>
</tbody>
</table>

**Groundwater**

Umgeni Water operates the Efaye groundwater scheme on behalf of the Umgungundlovu District Municipality. The Efaye community is situated just north of Mount Elias. The scheme is supplied by two production boreholes. The sustainable yield of the two production boreholes supplying the Efaye scheme is approximately 256 kl/day, although the demand is far greater and new groundwater resources to augment the scheme are required. Umgeni Water completed a groundwater resources investigation in 2010 that involved the drilling of 6 exploration boreholes. Pump testing (24 hrs) results indicate that four of the boreholes have a combined sustainable yield of 265 kl/day that can potentially be utilised to augment existing supplies. The other two boreholes were low yielding and therefore not pump tested. Preliminary infrastructure feasibility studies are currently being undertaken by Umgeni Water with a view to connecting up the new boreholes to the existing potable water distribution system.

The relevant WSA’s operate boreholes to augment traditional surface water supplies in Greytown and KwaDukuza. In Greytown, six boreholes pump into the town’s water supply distribution system. The sustainable yield of the wellfield is not known, but has previously been reported as being in the
order of 1.5 Ml/day (GCS 1993). Previous studies (Umgeni Water 1997) indicated that some of the boreholes were hydraulically linked. As the boreholes are using the same aquifer and no records of groundwater levels are being kept there is a possibility that the aquifer is being over-utilised. There are numerous rural stand-alone water supply schemes in the Mvoti catchment that currently rely on boreholes for their water supply.

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

The coastal village of Zinkwazi obtains all of its water resources from groundwater. Umgeni Water operates the groundwater scheme infrastructure on behalf of llembe District Municipality. The scheme currently has five operational production boreholes with a combined yield of approximately 1080 kl/day operating on a 24-hour pump cycle. Investigations undertaken in 2010 have shown that the current abstraction rate is unsustainable and the true yield of the borehole wellfield is closer to 250 kl/day. Urgent augmentation of the water supply system is thus required and plans are underway to augment the water supply using surface water from Darnall Dam. Water from Darnall Dam will be treated at the Darnall Mill Water Treatment Plant and supplied to an existing reticulation reservoir. A new pipeline is currently being constructed from this reservoir to Zinkwazi village.

**Operating Rules**

There is an existing link between Umgeni Water’s North Coast Supply System (NCSS) (Section 5.5), which obtains water from Hazelmere Dam on the Mdloti River (Section 4.4.3), to the supply system from the Mvoti River which abstracts water for the Mvoti WTP. Thus, when the Mvoti System is unable to fully meet the demands placed on it, water from Hazelmere Dam can be delivered via the NCSS to supplement the supply. This support is limited to the capacity of the linking pipeline, which is currently 2.5 Ml/day on average.
Proposed Water Resource Infrastructure

Major Surface Water Developments

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

Investigations of the various Mvoti River options, completed in the late 1990’s, concluded that the most favourable water resource development option is the proposed Isithundu Dam (Figure 4.22), situated on the Mvoti River immediately upstream of its confluence with the Hlimbitwa River. Water would be released from the dam back into the river for abstraction by downstream irrigators. The remaining released water would be diverted through an existing weir and tunnel at Mvoti View to supply raw water into a small balancing dam situated on a tributary of the Mvoti River. Water would then be pumped to the proposed Fawsley Park WTP to supply into the NCSS under gravity.

Subsequent changes to legislation saw the irrigators withdrawing from the proposed scheme due to the higher cost of raw water from the scheme becoming unaffordable for them. With the resultant shift to a single purpose scheme for domestic and industrial supply only, the criteria used to select the preferred option changed. This implies that the findings of the selection process will have to be reviewed in order to confirm the preferred development option. An alternate option of developing a dam lower on the Mvoti River at Welverdient (Figure 4.22) to supply directly to the proposed Fawsley Park WTP now also needs to be considered. A detailed investigation to determine the preferred option is to be undertaken by DWA.

A potential dam site in the upper reaches of the Mvoti River at Mvoti-Poort (Figure 4.22) in the vicinity of Greytown was identified during the initial investigations of supply options for the northern coastal regions. Whilst not deemed a suitable option to supply the town of KwaDukuza and surrounds, this site is considered favourable to be developed as a water resource that could support an Upper Mvoti regional bulk scheme to supply potable water to Greytown, Kranskop and surrounds on a sustainable basis in the long-term (Section 5.5). A detailed investigation of this site still needs to be undertaken by DWA.

In order to supply the communities in Maphumulo, Maqumbi and Ashville, a scheme is being developed that will obtain its raw water from the Imvutshane River, which is a tributary of the Hlimbitwa River (which in turn is a tributary of the Mvoti River). A dam site has been identified on
the Imvutshane River (Figure 4.22) which has the potential to support these communities with sufficient water in the medium to long-term. The dam can later be augmented from the Hlimbitwa River. The dam embankment is currently in the detailed design phase.

Similarly, to supply the Ozwatchini community a scheme has been investigated on the Sikoto River, which is a tributary of the Mvoti River. A dam site has been identified on the Sikoto River that has the potential to support this community in the medium to long-term. This scheme is an alternate short-term option to a supply from the Mgeni Sytem via an extension of the Wartburg Pipeline. The detailed feasibility of this scheme has recently been concluded.

Details of the proposed water resources infrastructure developments in the Mvoti Region are given in Table 4.7.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/annum)</th>
<th>Stochastic Yield (million m³/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mvoti-Poort Dam</td>
<td>Mvoti</td>
<td>80.1</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>isithundu Dam</td>
<td>Mvoti</td>
<td>51.3</td>
<td>45 (123 M³/day)</td>
<td>49.0 (134 M³/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>47.0 (129 M³/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45.1 (124 M³/day)</td>
</tr>
<tr>
<td>Raised isithundu Dam</td>
<td>Mvoti</td>
<td>102.0</td>
<td>57 (156 M³/day)</td>
<td>67.0 (184 M³/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>63.2 (173 M³/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>59.4 (163 M³/day)</td>
</tr>
<tr>
<td>Welverdient Dam</td>
<td>Mvoti</td>
<td>108.1</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imvutshane Dam</td>
<td>Imvutshane</td>
<td>3.2</td>
<td>Not Available</td>
<td>2.4 (6.5 M³/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not Available</td>
</tr>
<tr>
<td>Sikoto Dam</td>
<td>Sikoto</td>
<td>5.6</td>
<td>Not Available</td>
<td>2.3 (6.3 M³/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 4.22 Proposed water resource infrastructure in the Mvoti Region.
**Imvutshane Dam**

An investigation has been concluded into the feasibility of supplying Maphumulo, Maqumbi and Ashville from the Imvutshane River (Section 5.5), which is a tributary of the Hlimbitwa River, which in turn is a tributary of the Mvoti River. A dam site and abstraction point has been identified on the Imvutshane River approximately 10 km south of the town of Maphumulo and approximately 1 km upstream of the confluence of the Imvutshane and Hlimbitwa rivers.

At the proposed abstraction point, the run-of-river yield is approximately 1.5 million m³/annum (4 Ml/day) at a 98% level of assurance, and the proposed Imvutshane Dam situated at the same site on the river with augmentation from the Hlimbitwa River can yield 3.7 million m³/annum (10 Ml/day) at a 98% level of assurance. A water supply scheme is currently being constructed by Umgeni Water that will transfer raw water directly from the river to initially supply Maphumulo and surrounding areas. Thereafter the proposed Imvutshane Dam will be constructed on the river and the supply infrastructure will be extended to supply the areas of Maqumbi and Ashville.

**Sikoto Dam**

The Ozwatinini area has rural communities that are currently being supplied with water from a rudimentary water supply scheme fed from local boreholes that are insufficient and unsustainable. A dam site has been identified on the Sikoto River (Section 5.6), a tributary of the Mvoti River that can be developed as a sustainable raw water source to support a water supply scheme to the Ozwatinini area. A detailed feasibility study of the proposed Sikoto Dam and the water supply infrastructure has been completed by Umgeni Water. The proposed dam will have a yield of 2.3 million m³/annum (6.3 Ml/day) at a 98% level of assurance.

**Efaye Groundwater**

The additional groundwater resources (265 kl/day) secured in 2010 through the drilling of six boreholes have not been equipped with pumps or water distribution infrastructure and have been capped. A decision has now been made not to equip these boreholes, but to rather connect the scheme up to the planned extension to the Wartburg pipeline.
4.4.3 Mdloti Region

The Mdloti region is located in the U30 tertiary catchment and covers the Mdloti, Tongaat and Mhlali rivers (Figure 4.23). The main urban areas located in this region are Tongaat, Canelands, Verulam and Umhlanga.

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

The Mdloti region obtains its raw water primarily from Hazelmere Dam on the Mdloti River. Raw water is abstracted from the dam for treatment at Umgeni Water’s Hazelmere WTP and supply into the North Coast Supply System (NCSS) (Section 5.5). Raw water is also abstracted from the Mdloti River upstream of Hazelmere Dam to supply the Ogunjini WTP, which is currently operated by eThekwini Municipality (Section 5.4). eThekwini Municipality also operates the Tongaat WTP which receives raw water from the run-of-river abstraction from the Tongati River (Umgeni Water 2010: personal communication).

Surface Water

The hydrological characteristics for the Mdloti region catchments are shown in Table 4.8.

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Evaporation (mm)</td>
<td>Rainfall (mm)</td>
</tr>
<tr>
<td>Mdloti</td>
<td>Mhlali River (U30E)</td>
<td>290</td>
<td>1 252</td>
</tr>
<tr>
<td></td>
<td>Tongati River (U30C and U30D)</td>
<td>423</td>
<td>1 252</td>
</tr>
<tr>
<td></td>
<td>Mdloti River (U30A and U30B)</td>
<td>597</td>
<td>1 200</td>
</tr>
</tbody>
</table>
Groundwater

The Mdloti region occurs in the KwaZulu-Natal Coastal Foreland Groundwater Region (Figure 4.16). This Groundwater Region is characterised by fractured aquifers which are formed by predominantly arenaceous rocks consisting of sandstone and diamictite that is Dwyka tillite.

Hydrogeological Units

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

Geohydrology

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

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

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

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

An analysis of baseflow-derived stream run-off values per quaternary catchment suggests that groundwater recharge from rainfall varies in the range 3% to 7% of the mean annual precipitation.
Figure 4.24 Groundwater potential in the Mdloti Region.

Legend
- UW WTP
- UW Operated Dams
- National Roads
- Water Resource Regions
- WSA for whom UW is BWSP

Groundwater Potential (l/s)
- Yield
  - >0 - 0.1 l/s
  - >0.1 - 0.5 l/s
  - >0.5 - 3 l/s
  - >3 l/s

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale at 1:400,000
Groundwater Potential

The groundwater potential for this region is illustrated in Figure 4.24. The greatest widespread demand on the groundwater resources in this catchment is represented by its use as a source of potable water for communities in the rural areas and, to a lesser extent, households in the farming areas. Other demands of a more concentrated nature are represented by its use to supplement rainfall and traditional surface water supplies for irrigation.

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

Water Quality

The Hazelmere system seems to have a problem with suspended solids and this is due to the nature of the catchment which is overgrazed as a result of improper farming practices and therefore the soil is highly erodible. *E. coli* compliance against RQO limit in 2011 has increased compared to previous year (Figure 4.25).

Reserve

No comprehensive assessment of the ecological Reserve of the Mdloti River has been undertaken to date. In the 2003 feasibility study of the raising the full supply level of Hazelmere Dam, the Reserve was established at a desktop level of detail (DWA 2003). This study also determined that the 98% assured yield of Hazelmere Dam would reduce from an estimated 25.5 million m³/annum to 16.2 million m³/annum when the ecological Reserve is implemented. This reduction will have a dramatic impact on the useful life of the dam for supply purposes and make the proposed raising unviable from a potable water supply point of view. It has therefore been agreed by DWA to not implement the Reserve on the Mdloti River immediately, but rather to do it in a phased manner, once further water resources have been developed in the region. Future treated effluent discharges from the proposed Mdloti Wastewater Works (still to be developed by eThekwini Municipality) back into the Mdloti River will form part of the additional flow requirements needed for the Reserve.
Figure 4.25 Percentage compliance vs. non-compliance with the Resource Quality Objective for Hazelmere WTP.
No Reserve determinations have been conducted on the other rivers within this region. Detailed estuarine studies have been undertaken on the Mdloti and Tongati rivers (2008). The results of these studies will form part of the full Reserve studies once undertaken.

**Water Balance/Availability**

According to the Mvoti to Mzimkulu ISP (DWA 2004) the water balance of this region is in deficit by 8 million m³/annum. Umgeni Water maintained the water use registration with DWA of 16 million m³/annum (44 ML/day). The licence application of 33.5 million m³/annum (92ML/day) in anticipation of the proposed raising of Hazelmere Dam was submitted to DWA in 2010. The Ogunjini WTP has been taken over by eThekwinini Municipality and the registration for the Mdloti run-on-river abstractions transferred to them.

**Existing Infrastructure and Yields**

**Surface Water**

The significant dams in the catchment are Hazelmere Dam (Figure 4.26, Table 4.9) in quaternary catchment U30A and Dudley Pringle Dam and Siphon Dam in quaternary catchment U30D (Table 4.10). The yields for the water resource developments in the Mdloti Region are shown in Table 4.11.

![Hazelmere Dam](image)

**Figure 4.26** Hazelmere Dam.
### Table 4.9 Characteristics of Hazelmere Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area:</td>
<td>377 km²</td>
</tr>
<tr>
<td>Total Catchment Area:</td>
<td>377 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation:</td>
<td>967 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff:</td>
<td>70.7 million m³</td>
</tr>
<tr>
<td>Annual Evaporation:</td>
<td>1 200 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero:</td>
<td>61.0 mASL</td>
</tr>
<tr>
<td>Full Supply Level:</td>
<td>85.98 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity:</td>
<td>17.858 million m³</td>
</tr>
<tr>
<td>Dead Storage:</td>
<td>0.0 million m³</td>
</tr>
<tr>
<td>Total Capacity:</td>
<td>17.858 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level:</td>
<td>1.81 km²</td>
</tr>
<tr>
<td>Dam Type:</td>
<td>Concrete gravity wall with central spillway</td>
</tr>
<tr>
<td>Crest Length:</td>
<td>Spillway Section: 91 m</td>
</tr>
<tr>
<td>Type of Spillway:</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway:</td>
<td>950 m³/s</td>
</tr>
</tbody>
</table>

### Table 4.10 Existing Dams in the Mdloti Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazelmere Dam</td>
<td>Mdloti</td>
<td>17.9</td>
<td>Domestic/Irrigation</td>
</tr>
<tr>
<td>Siphon Dam</td>
<td>Tongati</td>
<td>0.4</td>
<td>Domestic</td>
</tr>
<tr>
<td>Dudley Pringle Dam</td>
<td>Wewe</td>
<td>2.3</td>
<td>Domestic</td>
</tr>
</tbody>
</table>

### Table 4.11 Yield Information for the existing water resource developments in the Mdloti Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/year)</th>
<th>Stochastic Yield (million m³/year)#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Historical</td>
<td>1:50</td>
</tr>
<tr>
<td>Hazelmere Dam</td>
<td>Mdloti</td>
<td>17.9</td>
<td>22 (60 Ml/day)</td>
<td>20.0 (54.8 Ml/day)</td>
</tr>
<tr>
<td>Siphon Dam</td>
<td>Tongati</td>
<td>0.4</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td>Dudley Pringle Dam</td>
<td>Wewe</td>
<td>2.3</td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

* Excluding Ecological Reserve
Groundwater

Umgeni Water manages, among others, two significant groundwater schemes in the Mdloti Catchment on behalf of the Ilembe District Municipality, namely Driefontein and Ntabaskop.

Driefontein production borehole has a sustainable yield of 180 kl/day and pumps to a distribution reservoir that feeds the Driefontein community. The borehole and reservoir are fitted with a remote water level monitoring system, which allows Umgeni Water to manage the scheme more effectively. The borehole is drilled into Natal Group Sandstone to a depth of 110 m and is cased to the bottom. The water strike occurs at 72 m in fractured sandstone. The borehole does not intersect any dolerite dykes or geological lineaments.

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

Operating Rules

The North Coast region from Phoenix/Verulam to KwaDukuza obtains its water primarily from Hazelmere Dam on the Mdloti River. The Phoenix area can be supplied from the Mdloti system (a maximum of 11 Ml/day) and less from the Mgeni System (Section 5.5). The supply source for this area is changed on occasion according to operational requirements.

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

The major portion of the KwaDukuza water demand is currently met from the Mvoti WTP. Raw water is supplied to the WTP via run-of-river abstraction from the Mvoti River. There is no storage on the Mvoti River and the yield from this system is therefore limited. Any shortfall in the Mvoti system is met from the Mdloti system via the NCSS (Section 5.5).

Proposed Water Resource Infrastructure

The raising of the Hazelmere Dam (Figure 4.27) wall by 7m is scheduled to commence in 2012. Radial gates will be installed into the existing spillway portals in the dam wall. The dam was designed to be
raised in this manner and was constructed accordingly. The detailed investigation of this option has been concluded and the environmental Record of Decision (RoD) to proceed with this project was issued by the Department of Environment Affairs (DEA) in November 2009. DWA is now in the process of implementing this project with the latest commissioning date set for the end of 2013. Even with the planned raising of the dam and the Hazelmere system’s interconnection with the Tongati and Mvoti systems, this resource will not be adequate to provide for the long-term requirements of the North Coast region. Augmentation of this system will be required. Options that have been investigated, or will be in the near future, include a scheme to abstract water from the uThukela River in the vicinity of Mandini (Section 5.5), a scheme to utilise water from the Mvoti River (Section 5.5), the reuse of treated effluent and seawater desalination. The uThukela River option is currently in the detailed design phase with construction expected to commence later in 2012.

Details of the proposed water resources infrastructure developments in the Mdloti Region are given in Table 4.12.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m$^3$)</th>
<th>Yield (million m$^3$ /year)</th>
<th>Stochastic Yield (million m$^3$ /year)#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Historical</td>
<td>1:50</td>
</tr>
<tr>
<td>Raised Hazelmere Dam</td>
<td>Mdloti</td>
<td>36.1</td>
<td>31.0 (84.9 Mi/day)</td>
<td>27.7</td>
</tr>
</tbody>
</table>

*aUW, 2011  
*bExcluding Ecological Reserve
4.4.4 Mooi/Mgeni Region

The Mgeni/Mooi region comprises of the two tertiary catchments of U20 (Mgeni River) and V20 (Mooi River) (Figure 4.28).

The major urban centres of Durban and Pietermaritzburg are situated within the Mgeni catchment. There are a number of other urban and peri-urban centres within this region including Mooi River, Rosetta, Nottingham Road, Howick, Wartburg, Cato Ridge, and the greater surrounds of both Durban and Pietermaritzburg. The urban centres from Howick towards the coast receive their water from the Mgeni system.

The water demands in the Mgeni catchment currently exceed the available yield. The risk of water restrictions within the next few years is unacceptably high as a result of the ever increasing demands in the Mgeni system. In the Mooi River catchment, the only domestic and industrial water demands are associated with the town of Mooi River and Rosetta village. Numerous groundwater schemes feed many of the rural and outlying peri-urban centres in the region.

The Mgeni River has been fully developed with the construction of four major dams, viz. Nagle (1950), Midmar (1965), Albert Falls (1976) and Inanda (1988). Both the Mooi and Mgeni catchments are no longer open to stream flow reduction activities such as afforestation, expansion of irrigated agriculture or the construction of storage dams, i.e. they are ‘closed’ catchments. The predominant land use in the Mooi catchment is commercial agriculture, and there is large-scale irrigation of pastures and summer cash crops, with an estimated water requirement of 49 million m³/annum (Thukela Water Management Area ISP 2004). The other large water use is transfers out to the Mgeni catchment.

In 1983, during a period of severe drought, the Mearns Emergency Transfer Scheme was constructed by DWA to enable water to be transferred from the Mooi River into the Mgeni catchment. The scheme consisted of a 3 m high weir and a pump station at Mearns on the Mooi River, a 13.3 km long, 1 400 mm diameter steel rising main to a break pressure tank situated at Nottingham Road and a 8.3 km long 900 mm diameter steel gravity main to an outfall structure on the Mpofana River. The emergency scheme was operated for a short period until the drought broke and was then mothballed until 1993 when Umgeni Water re-commissioned it for a short period again during a drought cycle.
In 2003, Phase 1 of the Mooi-Mgeni Transfer Scheme (MMTS-1) was commissioned, which ensured that a maximum flow of 3.2 m³/s could be transferred from the Mooi River into the Mgeni catchment on a more sustained basis than was possible before with the emergency scheme. Raw water is pumped from a larger Mears Weir on the Mooi River via the transfer pipeline to an outfall on the Mpofana River. From the Mpofana River the water flows into the Lions River and then into the Mgeni River upstream of Midmar Dam. Phase 2 of the Mooi-Mgeni Transfer Scheme (MMTS-2), which incorporates the construction of Spring Grove Dam on the Mooi River will ultimately enable water to be transferred on a continuous basis at a rate of 4.5 m³/s. Construction of Spring Grove Dam (Phase 2A) is currently underway, while the new transfer pipeline from the dam (Phase 2B) is still in the design phase.

**Surface Water**

The hydrological statistics of the catchments in the Mgeni/Mooi Region are summarised in Table 4.13.

**Table 4.13 Hydrological characteristics of the Mgeni/Mooi Region (WR90).**

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaporation (mm)</td>
</tr>
<tr>
<td>Mgeni/Mooi</td>
<td>Mooi River (V20)</td>
<td>2,868</td>
<td>1,342</td>
</tr>
<tr>
<td>Mgeni River (U20)</td>
<td></td>
<td>4,439</td>
<td>1,214</td>
</tr>
</tbody>
</table>

**Groundwater**

The Mgeni/Mooi Region occurs in the KwaZulu-Natal Coastal Foreland and Northwestern Middleveld Groundwater Regions (Figure 4.29). This Groundwater Region is characterised by intergranular and fracture rock aquifers with extremely low to medium development potential. The underlying geology is mostly arenaceous rocks of the Ecca Formation.

**Hydrogeological Units**

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

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

The mudstone/shale of the Ecca Group occurs almost entirely inland at the head of the Mgeni River and is the dominant lithology around Pietermaritzburg and Howick. Boreholes tapping these lithologies have median yields of 0.4 l/s.

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

The granite/gneisses of the Natal Metamorphic Province (NMP) flank the Mgeni River and are concentrated around Nagle and Inanda dams. This lithological unit supports a median yield of 0.18 l/s.

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

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


**Groundwater Potential**

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

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

A good to fair correlation exists between boreholes supporting yields in the moderate (greater than 0.5 l/s to less than 3.0 l/s) and high (greater than 3.0 l/s) classification ranges and structural features represented by faults and remotely sensed lineaments (Figure 4.29).

**Water Quality**

**Mgeni Catchment**

Poor sewage infrastructure in the Mphophomeni area resulted in incidences of nutrient levels higher than the RQO limit (Figure 4.30); this poses an eutrophication risk for the resource and potential treatment problems. This is further confirmed by the algal counts over the RQO limits. Turbidity increases are probably due rainfall related runoff and poor farming practices in the catchment area.

Previously the turbidities have been consistently above the RQO values in the Nagle system (however, during the last year there seems to have been a significant improvement which bodes well for the dam in terms of sedimentation). The nutrients are still problematic in this catchment although an increased compliance with respect to RQO values was observed in 2011 (Figure 4.31). These problems are probably caused by the improper management of farm effluent ponds upstream and poor farming practices in the catchment.
Figure 4.30 Percentage compliance vs. non-compliance with the Resource Quality Objective for Midmar WTP.
Figure 4.31 Percentage compliance vs. non-compliance with the Resource Quality Objective for the Nagle System.
Figure 4.32 Percentage compliance vs. non-compliance with the Resource Quality Objective for Inanda System.
The Inanda system has shown an excessive nutrient load thus resulting in significant algal blooms in the dam. The graphs for nitrate and SRP confirm that nutrients loads into the system have breached the RQO limits for most of the year thus creating the potential for raw quality problems (Figure 4.32). Turbidity breaches have also increased supporting the fact that the sand mining in the area is still a problem.

**Mooi System**

Water quality in the Mooi Catchment ranges from excellent to good. This is due to the low density farming practices in the catchment. Both the Mooi and the Little Mooi rivers flow into Mearns Weir, and through the seasonal variations within the catchment no significant issues have arisen.

**Groundwater**

The ambient water quality of groundwater in the Mgeni/Mooi Region is generally excellent based on observations that 83% of recorded field observations of electrical conductivity parameters do not exceed a value of 450 mg/l (70 mS/m). It appears that the least saline groundwater is associated with dolerite intrusions (median value of 11 mS/m) and the most saline with the tillite lithology (median value of 56 mS/m).

**Reserve**

The Ecological Reserve has not yet been determined for the Mgeni catchment. However, estimates of the Reserve indicate that the ecological Reserve will have a large impact on the availability of water in the catchment. Considering that the catchment is already stressed, the determination and implementation of the ecological Reserve will require careful consideration.

Estimates of environmental flow requirements represented as compensation flows released from the main dams in the Mgeni System are indicated in Table 4.14. As with the IFRs, the estuarine flow requirement (EFR) of the Mgeni River also has not been determined in a comprehensive manner, however, preliminary estimates have been simulated in the past.
Table 4.14  Summary of environmental (compensation) flow requirements.

<table>
<thead>
<tr>
<th>Description</th>
<th>Simulated Compensation Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(m³/s)</td>
</tr>
<tr>
<td>Midmar Compensation</td>
<td>0.900</td>
</tr>
<tr>
<td>Albert Falls Compensation</td>
<td>0.710</td>
</tr>
<tr>
<td>Inanda Compensation</td>
<td>1.500</td>
</tr>
<tr>
<td>Mgeni EFR</td>
<td>1.426</td>
</tr>
</tbody>
</table>

As part of the Water Reconciliation Project (DWA 2011), to assess the impacts of re-utilising treated waste water, the rapid reserve for the Mgeni River estuary was undertaken. The present ecological status of the estuary was found to be a Class E which indicates that it is highly degraded. The study shows that the estuary importance score is 82 which means that it is a highly important estuary. The study recommends that the ecological status of the Mgeni estuary should be improved to at least a category D.

A detailed assessment of the Ecological Reserve for the whole of the uThukela Water Management Area (WMA) was recently undertaken, which included the Mooi River catchment. This assessment indicated an over allocation of water, particularly on the Little Mooi River. In order to ensure that the correct Reserve flows are maintained in the Little Mooi River about a 50% curtailment of the existing registered irrigation and afforestation is required. Additionally all existing farm dams will be required to release their rightful share of the Reserve. Currently none of these dams are contributing to the Reserve. Hence a compulsory licensing process will need to be completed by DWA before the Reserve can be fully implemented in the Mooi catchment.

The necessary river outlets have been included into the design of Spring Grove Dam to ensure that it will be able to release the required volumes of water needed for the Reserve.

**Water Balance/Availability**

The water balance of this region has been in deficit for some time and currently this deficit is about 63 million m³/annum. During the financial year 2011/12, Umgeni Water reduced its water use registration with DWA from 401 to 397 million m³/annum (1088 Ml/day) for the entire Mgeni System. The licence application of 470 million m³/annum (1288 Ml/day) in anticipation of the proposed Spring Grove Dam was submitted to DWA in 2005.
Existing Infrastructure and Yields

There are four major dams on the Mgeni River, namely Midmar (Figure 4.33), Albert Falls (Figure 4.34), Nagle (Figure 4.35) and Inanda (Figure 4.36) dams. These dams are all used as part of the water supply system. The characteristics of these dams are summarised in Table 4.15, Table 4.16, Table 4.17 and Table 4.18. The characteristics of Mearns Weir (Figure 4.37) are summarised in Table 4.19. Henley Dam (Figure 4.38, Table 4.20), situated on the Msunduzi River, a tributary of the Mgeni River, is no longer used for water supply purposes. All significant dams within the Mgeni/Mooi Region are listed in Table 4.21.

<table>
<thead>
<tr>
<th>Table 4.15 Characteristics of Midmar Dam.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Catchment Details</strong></td>
</tr>
<tr>
<td>Incremental Catchment Area: 926 km²</td>
</tr>
<tr>
<td>Total Catchment Area: 926 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation: 1 011 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff: 209.4 million m³</td>
</tr>
<tr>
<td>Annual Evaporation: 1 300 mm</td>
</tr>
<tr>
<td><strong>Dam Characteristics</strong></td>
</tr>
<tr>
<td>Gauge Plate Zero: 1 021.7 mASL</td>
</tr>
<tr>
<td>Full Supply Level: 1 047.5 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity: 235.414 million m³</td>
</tr>
<tr>
<td>Dead Storage: 31.0 million m³</td>
</tr>
<tr>
<td>Total Capacity: 235.414 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level: 17.93 km²</td>
</tr>
<tr>
<td>Dam Type: Concrete gravity with earth embankments</td>
</tr>
<tr>
<td>Crest Length: Spillway Section: 139.6 m</td>
</tr>
<tr>
<td>Type of Spillway: Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway: 3 150 m³/s</td>
</tr>
</tbody>
</table>
**Table 4.16  Characteristics of Albert Falls Dam.**

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area</td>
<td>728 km²</td>
</tr>
<tr>
<td>Total Catchment Area</td>
<td>1 654 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation</td>
<td>1 005 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff</td>
<td>131.1 million m³</td>
</tr>
<tr>
<td>Annual Evaporation</td>
<td>1 200 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero</td>
<td>634.3 mASL</td>
</tr>
<tr>
<td>Full Supply Level</td>
<td>655.9 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity</td>
<td>289.133 million m³</td>
</tr>
<tr>
<td>Dead Storage</td>
<td>0.975 million m³</td>
</tr>
<tr>
<td>Total Capacity</td>
<td>290.108 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level</td>
<td>23.5 km²</td>
</tr>
<tr>
<td>Dam Type</td>
<td>Concrete with earth embankments</td>
</tr>
<tr>
<td>Crest Length</td>
<td>Spillway Section: 100 m</td>
</tr>
<tr>
<td>Type of Spillway</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway</td>
<td>3 330 m³/s</td>
</tr>
</tbody>
</table>
Table 4.17  Characteristics of Nagle Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area:</td>
<td>885 km²</td>
</tr>
<tr>
<td>Total Catchment Area:</td>
<td>2 539 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation:</td>
<td>940 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff:</td>
<td>139.7 million m³</td>
</tr>
<tr>
<td>Annual Evaporation:</td>
<td>1 200 mm</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero:</td>
<td>379.71 mASL</td>
</tr>
<tr>
<td>Full Supply Level:</td>
<td>403.81 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity:</td>
<td>23.237 million m³</td>
</tr>
<tr>
<td>Dead Storage:</td>
<td>1.366 million m³</td>
</tr>
<tr>
<td>Total Capacity:</td>
<td>24.6 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level:</td>
<td>1.56 km²</td>
</tr>
<tr>
<td>Dam Type:</td>
<td>Concrete gravity dam</td>
</tr>
<tr>
<td>Crest Length:</td>
<td>Spillway Section: 121 m</td>
</tr>
<tr>
<td>Type of Spillway:</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway:</td>
<td>900 m³/s</td>
</tr>
</tbody>
</table>
Table 4.18 Characteristics of Inanda Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area:</td>
<td>2 219 km²</td>
</tr>
<tr>
<td>Total Catchment Area:</td>
<td>4 082 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation:</td>
<td>870 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff:</td>
<td>60.1 million m³</td>
</tr>
<tr>
<td>Annual Evaporation:</td>
<td>1 200 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero:</td>
<td>115.8 mASL</td>
</tr>
<tr>
<td>Full Supply Level:</td>
<td>147.0 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity:</td>
<td>241.685 million m³</td>
</tr>
<tr>
<td>Dead Storage:</td>
<td>9.957 million m³</td>
</tr>
<tr>
<td>Total Capacity:</td>
<td>251.642 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level:</td>
<td>14.63 km²</td>
</tr>
<tr>
<td>Dam Type:</td>
<td>Concrete with earth embankments</td>
</tr>
<tr>
<td>Crest Length:</td>
<td>Spillway Section: 140 m</td>
</tr>
<tr>
<td>Type of Spillway:</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway:</td>
<td>4 000 m³/s</td>
</tr>
</tbody>
</table>
Figure 4.37  Mearns Weir.

Table 4.19  Characteristics of Mearns Weir.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental catchment area</td>
<td>242 km²</td>
</tr>
<tr>
<td>Total catchment area</td>
<td>887 km²</td>
</tr>
<tr>
<td>Mean annual precipitation</td>
<td>857 mm</td>
</tr>
<tr>
<td>Mean annual runoff</td>
<td>4.412 x 10⁶ m³</td>
</tr>
<tr>
<td>Annual evaporation</td>
<td>1350 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weir Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge plate zero</td>
<td>1375.11 m.s.l</td>
</tr>
<tr>
<td>Full supply level</td>
<td>1382 m.s.l</td>
</tr>
<tr>
<td>Net full supply capacity</td>
<td>5.116 x 10³ m³</td>
</tr>
<tr>
<td>Dead storage</td>
<td>0.0 x 10³ m³</td>
</tr>
<tr>
<td>Total capacity</td>
<td>5.116 x 10³ m³</td>
</tr>
<tr>
<td>Surface area of weir at full supply level</td>
<td>2.375 km²</td>
</tr>
<tr>
<td>Weir type</td>
<td>Concrete</td>
</tr>
<tr>
<td>Material content of a weir wall</td>
<td>Concrete</td>
</tr>
<tr>
<td>Crest length</td>
<td>N/A</td>
</tr>
<tr>
<td>Type of spillway</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of spillway</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Table 4.20  Characteristics of Henley Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area:</td>
<td>219 km²</td>
</tr>
<tr>
<td>Total Catchment Area:</td>
<td>219 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation:</td>
<td>940 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff:</td>
<td>42.1 million m³</td>
</tr>
<tr>
<td>Annual Evaporation:</td>
<td>1 200 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero:</td>
<td>900 mASL</td>
</tr>
<tr>
<td>Full Supply Level:</td>
<td>923.3 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity:</td>
<td>1.5 million m³</td>
</tr>
<tr>
<td>Dead Storage:</td>
<td>0.0 million m³</td>
</tr>
<tr>
<td>Total Capacity:</td>
<td>1.5 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level:</td>
<td>0.3 km²</td>
</tr>
<tr>
<td>Dam Type:</td>
<td>Concrete with earth embankment</td>
</tr>
<tr>
<td>Crest Length:</td>
<td>Spillway Section: N/A m</td>
</tr>
<tr>
<td>Type of Spillway:</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway:</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.21 Existing Dams in the Mgeni/Mooi Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m$^3$)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craigie Burn Dam</td>
<td>Mnyamvubu</td>
<td>23.5</td>
<td>Irrigation</td>
</tr>
<tr>
<td>Mears Weir</td>
<td>Mooi</td>
<td>5.1</td>
<td>Domestic</td>
</tr>
<tr>
<td>Midmar Dam</td>
<td>Mgeni</td>
<td>235.4</td>
<td>Domestic</td>
</tr>
<tr>
<td>Albert Falls Dam</td>
<td>Mgeni</td>
<td>289.1</td>
<td>Domestic</td>
</tr>
<tr>
<td>Nagle Dam</td>
<td>Mgeni</td>
<td>23.2</td>
<td>Domestic</td>
</tr>
<tr>
<td>Inanda Dam</td>
<td>Mgeni</td>
<td>241.7</td>
<td>Domestic</td>
</tr>
</tbody>
</table>

Raw water is supplied from Midmar Dam under gravity to DV Harris WTP, and under pumping (8 m lift) to Midmar WTP (Section 5.2). Water is released from Albert Falls Dam to Nagle Dam from where it is supplied under gravity to Durban Heights WTP (Section 5.2). Raw water is supplied from Inanda Dam under gravity to Wiggins WTP (Section 5.2). It is possible to pump water from Inanda Dam to Durban Heights WTP utilising two different pump sets, viz. the ‘Shaft’ pumps, comprising three pumps capable of delivering a maximum of 150 MI/day, and the ‘Inanda’ pumps, comprising three pumps capable of delivering a maximum of 150 MI/day. Thus, it is possible to pump a total of 300 MI/day from Inanda Dam to Durban Heights WTP.

In 2003, Phase 1 of the Mooi-Mgeni Transfer Scheme (MMTS-1) was commissioned. This phase consists of an 8 m high weir on the Mooi River at Mears (at the site of the original weir), an additional 1.6 m$^3$/s standby pump set in the existing pump station, and the raising of the Full Supply Level (FSL) of Midmar Dam by 3.5 m. This transfer scheme makes use of the original 21.6 km steel transfer pipeline installed in 1983. The pump station at Mears contains four low-lift pumps (one pump set being a standby) and three high-lift pumps (one pump set being a standby). Each high-lift pump is capable of delivering 1.6m$^3$/s, and the pumps can either be run separately or together, thereby delivering a maximum of 3.2 m$^3$/s. Raw water is pumped from the Mears Weir on the Mooi River via the transfer pipeline to an outfall on the Mpofana River. From the Mpofana River the water flows into the Lions River and into the Mgeni River upstream of Midmar Dam.

Other than the Mears Weir on the Mooi River, the only other major dam in the Mooi catchment is the Craigie Burn Dam on the Mnyamvubu River, which is a tributary of the Mooi River. This dam is owned and operated by DWA. It has a capacity of 23.5 million m$^3$ and mainly supplies water to approximately 2000 ha of predominantly citrus farming irrigation downstream of the dam and along
the Mooi River at Muden. There is an abundance of farm dams in the Mooi catchment, especially in the upper reaches.

The yield information of the existing water resources infrastructure was revised in 2006 based on the re-evaluation of the water requirements in the Mooi River catchment, and is presented in Table 4.22.

**Table 4.22 Yield Information for the existing and proposed water resource infrastructure in the Mgeni/Mooi Region.**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Position in system</th>
<th>Historic Firm Yield</th>
<th>Stochastic Yield (1 in 50 years risk of failure)</th>
<th>Stochastic Yield (1 in 100 years risk of failure)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>million m$^3$/annum</td>
<td>million m$^3$/annum</td>
<td>ML/day</td>
</tr>
<tr>
<td>System without MMTS (initial)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midmar Dam</td>
<td>60.8</td>
<td>78.0</td>
<td>213.7</td>
<td>66.3</td>
</tr>
<tr>
<td>Nagle Dam</td>
<td>166.9</td>
<td>210.0</td>
<td>575.3</td>
<td>189.5</td>
</tr>
<tr>
<td>Inanda Dam</td>
<td>269.5</td>
<td>309.8</td>
<td>848.8</td>
<td>279</td>
</tr>
<tr>
<td>MMTS-1 (Current)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midmar Dam</td>
<td>114.2</td>
<td>152.0</td>
<td>416.4</td>
<td>117.7</td>
</tr>
<tr>
<td>Nagle Dam</td>
<td>220.8</td>
<td>266.0</td>
<td>728.8</td>
<td>242.5</td>
</tr>
<tr>
<td>Inanda Dam</td>
<td>321</td>
<td>349.0</td>
<td>956.2</td>
<td>334</td>
</tr>
<tr>
<td>MMTS-2A (Proposed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midmar Dam</td>
<td>161.7</td>
<td>178.7</td>
<td>489.6</td>
<td>166.4</td>
</tr>
<tr>
<td>Nagle Dam</td>
<td>267.7</td>
<td>310</td>
<td>849.3</td>
<td>289.7</td>
</tr>
<tr>
<td>Inanda Dam</td>
<td>367.9</td>
<td>394.4</td>
<td>1080.6</td>
<td>380.8</td>
</tr>
<tr>
<td>MMTS-2B (Proposed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midmar Dam</td>
<td>177.3</td>
<td>192.0</td>
<td>526.0</td>
<td>173.8</td>
</tr>
<tr>
<td>Nagle Dam</td>
<td>283.5</td>
<td>329.0</td>
<td>901.4</td>
<td>302</td>
</tr>
<tr>
<td>Inanda Dam</td>
<td>384</td>
<td>408.0</td>
<td>1117.8</td>
<td>394</td>
</tr>
</tbody>
</table>

Note: Yields indicated above are obtained from DWAF Report No. P WMA 07/V20/00/1005, MMTS-2: Bridging Study No. 5: Stochastic Hydrology and Determination of Yield and Transfer Capacity of the Mooi-Mgeni Transfer Scheme (MMTS) and Operating Rules of the Mooi and Mgeni Systems with the MMTS in place, compiled for DWAF by WRP (Pty) Ltd. in 2005. The yields shown are those for all “e”-scenarios which provide the maximum yield values.

**MMTS-2A** = Spring Grove Dam supporting MMTS-1 via releases to Mearsn Weir.

**MMTS-2B** = Spring Grove Dam with new transfer directly from the dam with increased capacity.

Groundwater is utilised in the Mgeni catchment by private landowners mainly as the majority of towns are supplied by reticulated surface water. Groundwater is utilised to supplement irrigation and for stock watering. The exception is the Nottingham Road and Rosetta areas which are supplied by production boreholes. Very high yielding boreholes (140 kl/hr) have been drilled in the area. The contact zones between the Shales, Sandstone and the intrusive dolerite dykes are the water bearing
features in the areas. There are no faults or other structural features to target. In the Howick area groundwater is abstracted and bottled for commercial purposes. Although not accurately known it has been reported that the formal settlement of Mfolweni currently obtains their domestic water supply (in the order of 2000 kl/day) from boreholes.

**Operating Rules**

The Mgeni River system is relatively complex in terms of its operation. In addition to the four dams, the system is augmented by the Mooi River System by using the transfer scheme from the Mearns Weir on the Mooi River. There are four dams on the Mgeni River and water can be supplied to the demand centres from these dams via various routes, allowing for considerable flexibility in terms of the operation of the system (refer to description in the previous section and to the system schematic (Figure 4.39).

![Schematic of the Mgeni System](image)

**Figure 4.39  Schematic of the Mgeni System.**

The area of Phoenix to the north of Durban can be supplied from either the Mgeni System or from the Mdloti system (Section 5.2). The source of water to this area is currently determined through operational requirements and gets swapped over on occasion. There is also a linkage from the
Mgeni System through to the Upper and Middle South Coast Regions. Water from the Mgeni system is utilised to supplement the supply from the local sources to this area (Section 5.2).

Whenever possible the Mgeni System demands are supplied under gravity (i.e. not utilising the pumps at Mearns Weir and Inanda Dam). Due to the current stressed nature of the Mgeni system where demands far exceed the required assurance of supply from the system, a revised operating rule was developed in 2009 in order to maximise yield at all times, where cost becomes a secondary consideration. This revised operating rule targets the maximum utilisation of the resource, through pumping at any time of the year as long as there is excess water to pump and is defined as follows:

- Full pumping from the Mooi River until Inanda Dam reaches full supply capacity. This is both for the current system and when Spring Grove Dam and its conveyance are implemented. The water requirements in the Mooi System have to be satisfied first before any transfers to the Mgeni System can occur;
- If Nagle Dam is spilling the Inanda Dam pumps are not operational or are to be shut down;
- When Nagle or Albert Falls dam is not spilling, allow the maximum supply to come from Inanda Dam (through all the available pumps). All the Inanda Dam pumps including the Shaft pumps are operated to maximise the supply from Inanda Dam and prevent spills as far as possible; and
- Allow for possible down-time on all pumping routes in the system to account for scheduled maintenance and unplanned operational interruptions (e.g. as a result of power failures).

A hydrological analysis using the revised operating rule indicates a definite improvement in the overall water resource situation of the Mgeni System and hence a subsequent reduction in the risk of experiencing shortfalls.

**Proposed Water Resource Infrastructure**

Significant growth in water demand from the Mgeni system has occurred since the implementation of MMTS-1, such that the required level of assurance of supply is not being met. Therefore it is important that Phase 2 of the Mooi-Mgeni Transfer Scheme (Figure 4.40) is implemented, as it is the project closest to implementation and is the least expensive project per cubic metre of yield obtained. At the end of 2007 the Minister of Water and Environmental Affairs instructed the Trans-Calendon Transfer Association (TCTA) to implement this project as quickly as possible in order to augment the existing system and reduce the risk of possible future restrictions.
Two stages were defined in the feasibility study of MMTS-2. In the first stage only Spring Grove Dam (MMTS-2A) would be constructed. During this stage water will be released from Spring Grove Dam down the Mooi River into the impoundment of the Mearns Weir (MMTS-1) from where it will be abstracted and transferred, using the spare capacity of the existing transfer infrastructure, into the Mgeni River catchment to augment the supplies of Midmar Dam. MMTS-1 has spare pumping capacity because it utilises the river flow without any significant storage (the Mearns Weir has storage capacity for only one week of pumping), which means that whenever the river flow is less than the pumping capacity plus the compensation releases, which is most of the time, the pumping capacity is not fully utilised. The Mearns Weir is situated just downstream of the confluence of the Little Mooi and Mooi rivers.

For the second stage (MMTS-2B) a new pumping station would be constructed at Spring Grove Dam from where the bulk of the transfer from the Mooi to the Mgeni River would take place. The MMTS-2B would include the construction of a new transfer pipeline from Spring Grove Dam that would, apart from following an initial short route from the dam through an area of smallholdings to the existing transfer route, be following the same route as that of the existing Mearns pipeline, and running parallel to it within the existing servitude, to the discharge point in the Mpofana River. During this stage water from the Mooi River will be transferred from Spring Grove Dam via the MMTS-2B pipeline (and pumped against a much lower head than that from the Mearns Weir) while water from the Little Mooi River will be transferred from Mearns Weir utilising the existing MMTS-1 transfer pipeline.

Salient features of the proposed Spring Grove Dam, as determined during the detailed design phase of the dam are as follows:

- Full supply level: 1 433.50 mASL
- Minimum operating level: 1 408.00 mASL
- Gross storage volume: 139.5 million m$^3$
- Water surface area at FSL: 1 021.8 ha
Due to the currently extremely stressed state of the Mgeni system, it is necessary to proceed directly with the implementation of both phases (MMTS-2A and MMTS-2B) of the project simultaneously. Further analyses, indicate that not only should the full MMTS-2 be built as soon as possible, but that further augmentation of the system is also required. In this regard, options that are being considered, and still need to be investigated at detailed feasibility levels are the Mkomazi-Mgeni Transfer Scheme (known as the Mkomazi Water Project; Section 5.1), the reuse of treated effluent, and seawater desalination. Refer to Table 4.22 for yields of the proposed infrastructure.

The detail design of Spring Grove Dam has been completed, with construction of MMTS-2A currently underway, impoundment in September 2012 and water transfer in April 2013. The construction of MMTS-2B is expected to follow a year or two later.

4.4.5 Mlazi/Lovu Region

This region comprises of the two tertiary catchments U60 (Mlazi River) and U70 (Lovu River) (Figure 4.41).

The region is dominated by irrigation and afforestation, with irrigation being the main land use. The urban and peri-urban areas within this region are Richmond and Amanzimtoti which receive their water from boreholes and Beaulieu Dam, and Nungwane Dam, respectively. The Mgeni system also supports the coastal area.

Surface Water

The hydrological characteristics for this region are summarised in Table 4.23.

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaporation (mm)</td>
</tr>
<tr>
<td>Mlazi/Lovu</td>
<td>Mlazi River (U60)</td>
<td>1,439</td>
<td>1,200</td>
</tr>
<tr>
<td></td>
<td>Lovu River (U70)</td>
<td>944</td>
<td>1,200</td>
</tr>
</tbody>
</table>
Figure 4.41  General layout of the Mlazi/Lovu Region.

Legend
- Rivers
- UW Operated Dams
- National Roads
- Water Resource Regions
- WSAs for whom UW is BWSP

Source:
Department of Water Affairs
Ezemvelo KZN Wildlife
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale at 1:500,000
Groundwater
The Mlazi/Lovu Region occurs in the KwaZulu-Natal Coastal Foreland and Northwestern Middleveld Groundwater Regions (Figure 4.16). As such this Groundwater Region is characterised by and combination of intergranular and fractured arenaceous rocks.

Hydrogeological Units
The hydrogeologically relevant lithologies recognised in the Mlazi/Lovu Region comprise sandstone, tillite and granite/gneiss.

Geohydrology
The Natal Group Sandstone (NGS) is the most important water bearing lithology in the two catchments. Boreholes favourable located in the NGS provide good yields. Yields of 3l/s (greater than 10 000 l/hr) are not uncommon where large scale fracturing/faulting provide conduits for groundwater movement.

Groundwater Potential
Primary groundwater supplies using boreholes fitted with handpumps, windpumps or submersibles are obtainable in most of the lithological units. The exceptions are the Dwyka formation (tillites) or massive granites (southern portions of the Mlazi/Lovu Region). In these areas groundwater supply could be obtained within an adjacent fault valley where the potential for high yielding boreholes is much enhanced.

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

The highly fractured nature of the NGS in the Golokodo section of Umbumbulu and along linear fault features near Folweni are areas where high yielding boreholes are prevalent (Figure 4.42).

Water Quality
The problematic determinands in this catchment seem to have been *E. coli*, SRP and turbidity. However, the data for 2011 (Figure 4.43) show a drastic improvement in water quality.
Figure 4.42  Groundwater potential in the Mlazi/Lovu Region.

Legend
- UW Operated Dams
- Rivers
- Water Resource Regions
- WSAs for whom UW is BWSP

Groundwater Potential (l/s)

Yield
- >0 - 0.1 l/s
- >0.1 - 0.5 l/s
- >0.5 - 3 l/s
- >3 l/s

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale at 1:500 000
Figure 4.43 Percentage compliance vs. non-compliance with the Resource Quality Objective for Nungwane.
Reserve

No comprehensive assessment of the ecological Reserve of either the Mlazi or the Lovu rivers has been undertaken to date. The catchment has surplus water available, even taking the estimated ecological Reserve requirements into account. There is no urgency for the ecological Reserve determination and compulsory licensing processes in the catchment.

Water Balance/Availability

According to the Mvoti to Mzimkhulu ISP (DWA, 2004) the water balance of this region is in surplus by 1 million m$^3$/annum. Umgeni Water has maintained the water use registration of 9.67 million m$^3$/annum (26.5 ML/day) with DWA in the current 2011/12 financial year for the Nungwane Dam abstractions.

Existing Infrastructure and Yields

The significant dams in the region are Shongweni Dam on the Mlazi River (quaternary U60D), Nungwane Dam situated on the Nungwane River (quaternary U70D) which is a tributary of the Lovu River, Beaulieu Dam on the Lovu River (quaternary U70A), and Umgababa Dam situated on the Mgababa River within the U70 catchment (Figure 4.41).

The Nungwane Dam (Figure 4.44, Table 4.24) is owned and operated by Umgeni Water and supplies raw water to the Amanzimtoti WTP. Beaulieu Dam is an irrigation dam but is also used to supply water to the Richmond WTP. The Umgababa and Shongweni dams were initially used to supply water for mining and domestic purposes respectively, but are no longer used as such, and have become recreational facilities.

Figure 4.44  Nungwane Dam.
### Table 4.24 Characteristics of Nungwane Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area:</td>
<td>58 km²</td>
<td></td>
</tr>
<tr>
<td>Total Catchment Area:</td>
<td>58 km²</td>
<td></td>
</tr>
<tr>
<td>Mean Annual Precipitation:</td>
<td>938 mm</td>
<td></td>
</tr>
<tr>
<td>Mean Annual Runoff:</td>
<td>11.9 million m³</td>
<td></td>
</tr>
<tr>
<td>Annual Evaporation:</td>
<td>1 200 mm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero:</td>
<td>345.95 mASL</td>
<td></td>
</tr>
<tr>
<td>Full Supply Level:</td>
<td>362.7 mASL</td>
<td></td>
</tr>
<tr>
<td>Net Full Supply Capacity:</td>
<td>2.179 million m³</td>
<td></td>
</tr>
<tr>
<td>Dead Storage:</td>
<td>0.059 million m³</td>
<td></td>
</tr>
<tr>
<td>Total Capacity:</td>
<td>2.238 million m³</td>
<td></td>
</tr>
</tbody>
</table>

| Surface Area of Dam at Full Supply Level: | 0.29 km² |
| Dam Type: | Concrete with earth embankment |
| Crest Length: | Spillway Section: 76.2 m |
| Type of Spillway: | Uncontrolled |
| Capacity of Spillway: | 760 m³/s |

### Table 4.25 Dams in the Mlazi/Lovu Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nungwane Dam</td>
<td>Nungwane</td>
<td>2.40</td>
<td>Domestic</td>
</tr>
<tr>
<td>Umgababa Dam</td>
<td>Umgababa</td>
<td>1.28</td>
<td>Recreation</td>
</tr>
<tr>
<td>Beaulieu Dam</td>
<td>Lovu</td>
<td>2.40</td>
<td>Irrigation/Domestic</td>
</tr>
<tr>
<td>Shongweni Dam</td>
<td>Mlazi</td>
<td>4.50</td>
<td>Recreation</td>
</tr>
</tbody>
</table>

### Table 4.26 Yield Information for the existing water resource developments in the Mlazi/Lovu Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/year)</th>
<th>Stochastic Yield (million m³/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Historical 1:50 1:100</td>
<td></td>
</tr>
<tr>
<td>Nungwane Dam</td>
<td>Nungwane</td>
<td>2.24</td>
<td>2.2 (6.0 Ml/day)</td>
<td>3.3 (9.0 Ml/day)</td>
</tr>
</tbody>
</table>

Sustained irrigation utilising groundwater from production boreholes occur in the Umlaas, Eston and Richmond areas. As an example of the quantities of groundwater being extracted for irrigation
purposes, production boreholes discharging at between 5 to 20 l/s are currently being utilised in the vicinity of Richmond.

Richmond town also abstracts groundwater to augment its surface water supply from Beaulieu Dam. Six boreholes are utilised and have recorded pump tested yields of 470 kl/day in total. Previous studies (E.Martenelli & Associates 1999) have indicated that no groundwater management system is in place and that the boreholes are being over abstracted. The boreholes are manually operated and are often pumped for 24 hours continuously, allowing no time for recovery. As a result the aquifer is being mined, borehole yields will decline and the groundwater supply will ultimately fail.

Operating Rules

Raw water is supplied to the Amanzimtoti WTP from Nungwane Dam for treatment and distribution to the surrounding areas and to the upper and middle South Coast areas. This supply is limited and current demand exceeds the assured yield of the dam. It is therefore being augmented with potable water from the Mgeni System (Section 5.4) via the South Coast Augmentation Pipeline.

Proposed Water Resource Infrastructure

No significant water resource developments are planned for this region, primarily because the water resources available for use are limited. Sedimentation in these rivers is also a constraint to development.

4.4.6 Mkomazi Region

The Mkomazi River has its source at an elevation of approximately 3000 m above sea level in the Drakensberg Mountains. The region encompasses the entire U10 tertiary catchment (Figure 4.45). The river flows in a south-easterly direction and enters the Indian Ocean near the town of Umkomaas about 40 km south of Durban. Several large tributaries, including the Loteni, Nzinga, Mkomazane, Elands and Xobho rivers flow into the Mkomazi. The region includes the small towns of Bulwer, Impendle, Ixopo, Mkomazi, Craigieburn and Magabheni which have small water requirements. The main land use activities in the catchment are large industry (Sappi Saiccor) located at the mouth of the catchment, irrigation and afforestation.
Surface Water

The hydrological characteristics for this region are summarised in Table 4.27.

Table 4.27  Hydrological characteristics of the Mkomazi Region (Umgeni Water 2002).

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Incremental Area (km²)</th>
<th>Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaporation (mm)</td>
</tr>
<tr>
<td>Mkomazi</td>
<td>Impendle</td>
<td>1,422</td>
<td>1,200</td>
</tr>
<tr>
<td>Smithfield</td>
<td></td>
<td>632</td>
<td>1,200</td>
</tr>
<tr>
<td>Ngwadini</td>
<td></td>
<td>2,242</td>
<td>1,200</td>
</tr>
<tr>
<td>Mkomazi Estuary</td>
<td></td>
<td>91</td>
<td>1,200</td>
</tr>
<tr>
<td>Luhane</td>
<td></td>
<td>46.3</td>
<td>1361</td>
</tr>
</tbody>
</table>

* Present day MAR

Groundwater

The Mkomazi Region occurs in the KwaZulu-Natal Coastal Foreland and Northwestern Middleveld Groundwater Regions (Figure 4.16). As such this Groundwater Region is characterised by and combination of intergranular and fractured arenaceous rocks.
Figure 4.45 General layout of the Mkomazi Region.
Figure 4.46  Groundwater potential in the Mkomazi Region.
Hydrogeological Units

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

Geohydrology

The Dwyka Tillite formation has the smallest coverage in comparison to the other lithological units in the catchment. It occurs just south of Richmond where it lies exposed in the river banks of the Mkomazi. The Eccca Group is represented by the mudstones/shale of the Pietermaritzburg, Vryheid and Volksrust Formation. The foothills of the Drakensberg Mountains at the head of the Mkomazi River and the central areas of the catchment are dominated by these lithologies. These lithologies support marginal to poor borehole yields (0.1 – 0.5 l/s). However the presence of extensive intrusive dolerite in the form of sheets and dykes has greatly enhanced the potential of the mudstones to store and yield groundwater.

Groundwater Potential

Primary groundwater supplies using boreholes fitted with handpumps, wind pumps or submersibles are obtainable in most of the lithological units. The exceptions are the Dwyka formation (tillites) or massive granites. In these areas groundwater supply could be obtained within an adjacent fault valley where the potential for high yielding boreholes is much enhanced.

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

Boreholes favourably located in the Natal Group Sandstone (NGS) provide good yields (Figure 4.46). Yields of 3 l/s (greater than 10 000 l/hr) are not uncommon where large scale fracturing/faulting provide conduits for groundwater movement.

Boreholes located in metamorphic lithologies (gneisses) indicate yield characteristics in the range 0.1 to 0.5 l/s, with a median value of 0.3 l/s.
Water Quality

The Ixopo Dam inflow has shown increasing breaches of the RQO limit during the last year for turbidity. This is due to erosion in the catchment.

![Graph](image)

**Figure 4.47 Percentage compliance vs. non-compliance with the Resource Quality Objective for the Ixopo Dam.**

Reserve

No comprehensive assessment, using the accepted standardised methodology, has been undertaken of the Ecological Reserve of the Mkomazi River to date. A Reserve determination was undertaken in the late 1990’s as part of the pre-feasibility investigations into a transfer scheme from the Mkomazi to the Mgeni catchment. The comprehensive reserve determination has been scheduled for 2012 as part of the detailed investigation of the Mkomazi-Mgeni Transfer Scheme, and the study will be undertaken by DWA (Section 5.2).
The current Sappi Saiccor abstraction during low flows impacts on the water availability at the estuary of the Mkomazi River and will need to be addressed as part of the future implementation of the Reserve. The pending construction of the Ngwadini Dam by Sappi Saiccor has been proposed to mitigate this concern.

**Water Balance/Availability**

According to the Mvoti to Mzimkulu ISP (DWA, 2004) the water balance of this region is in deficit by 72million m$^3$/ annum. The major water users in the catchment are Sappi Saiccor with a daily demand of about 120 ML/day supplied from a run-of-river system, and widespread irrigation throughout the catchment. During the 2011/2012 financial year, Umgeni Water registered an amount of 0.84 million m$^3$/ annum (2.3 ML/day) with DWA for the Ixopo Dam abstraction.

**Existing Infrastructure and Yields**

Currently the region is unregulated and there is no major water resource infrastructure on the Mkomazi River or on any of its tributaries.

The Ixopo System lies within the Mkomazi catchment and is not connected to any of Umgeni Water’s regional bulk systems. The Ixopo system is situated at the town of Ixopo within the Sisonke District Municipality area. Umgeni Water owns and operates the bulk supply system comprising of water resource infrastructure, raw water pipelines, and the WTP. Potable water is sold at the WTP to the uBuhlebezwe Local Municipality who is responsible for reticulation within the town of Ixopo and the adjacent peri-urban areas (**Section 5.3**).

![Figure 4.48 Ixopo Dam.](image-url)
### Table 4.28 Characteristics of Ixopo Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area:</td>
<td>77.53 km²</td>
</tr>
<tr>
<td>Total Catchment Area:</td>
<td>77.53 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation:</td>
<td>793 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff:</td>
<td>6.95 million m³</td>
</tr>
<tr>
<td>Annual Evaporation:</td>
<td>1 200 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero:</td>
<td>935.8 mASL</td>
</tr>
<tr>
<td>Full Supply Level:</td>
<td>939.8 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity:</td>
<td>0.555 million m³</td>
</tr>
<tr>
<td>Dead Storage:</td>
<td>0.0 million m³</td>
</tr>
<tr>
<td>Total Capacity:</td>
<td>0.555 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level:</td>
<td>0.20 km²</td>
</tr>
<tr>
<td>Dam Type:</td>
<td>Earth embankment</td>
</tr>
<tr>
<td>Crest Length:</td>
<td>Spillway Section: Not Available</td>
</tr>
<tr>
<td>Type of Spillway:</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway:</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

### Table 4.29 Existing Dams in the Ixopo Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ixopo (Homefarm) Dam</td>
<td>Ixopo</td>
<td>0.55</td>
<td>Domestic</td>
</tr>
</tbody>
</table>

The water resources that support the Ixopo System comprise of the Ixopo Dam (Table 4.28 and Figure 4.48) and a production borehole. These two sources are used conjunctively supply the current Ixopo town demand of 2.5 Ml/day. The dam has a full supply capacity of 0.55 million m³ and a firm yield of 2.7 Ml/day. The production borehole is capable of a sustainable yield of about 400 kl/day using a pump cycle of 16 h/day at a rate of 25 kl/h.

**Operating Rules**

The two water resources at Ixopo are used in a conjunctive manner. During times when Ixopo Dam (surface water supply) is spilling the borehole abstraction rate is reduced. If there are operational problems at the WTP the borehole is often used to make up shortfalls during shutdowns or reduced production.
Ixopo Dam supplies its own demand without the support of the two upstream farm dams until the dam storage has dropped to 20%. The 20% storage of Ixopo Dam storage triggers the need for support from the farm dams simultaneously. These dams continue to support Ixopo Dam until they reach dead storage. Restrictions are imposed in the system when the farm dams have reached dead storage.

**Proposed Water Resource Infrastructure**

The current water resources of the Mgeni System are insufficient to meet the long-term water demands of its own system. Past investigations have indicated that, possibly, the most suitable long-term solution would be to develop a scheme that transfers raw water from the still undeveloped Mkomazi River to the Mgeni catchment. Water resources development options on the Mkomazi River (Figure 4.49) have already been investigated at a pre-feasibility level of detail with the view to augmenting the supply in the Mgeni catchment through an inter-basin transfer scheme. Various potential sites and transfer options were assessed in this investigation. The recommended scheme, known as the Mkomazi Water Project (MWP) comprised of two phases.

The first phase (MWP-1) would consist of a once-off constructed 58 m high (FSL to RBL) Smithfield Dam on the Mkomazi River near Richmond from where water would be pumped into a 33 km long free surface flow tunnel to deliver raw water to a new water treatment plant at Baynesfield in the Mlazi River catchment. Treatment water would be transferred to an appropriate delivery node within the Mgeni catchment.

The second phase (MWP-2) would comprise of the construction of a large dam at Impendle further upstream on the Mkomazi River. Once in place, water would be released from the Impendle Dam down the Mkomazi River for abstraction and transfer at Smithfield Dam. The Impendle Dam could be built either in two phases or as a once-off constructed scheme component. The MWP-2 would only be implemented at a future date when needed.
Figure 4.49 Proposed water resource infrastructure in the Mkomazi Region.
### Table 4.30  Proposed water resource infrastructure for the Mkomazi Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/year)</th>
<th>Stochastic Yield (million m³/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Historical</td>
<td>1:100</td>
</tr>
<tr>
<td>Smithfield Dam</td>
<td>Mkomazi</td>
<td>137</td>
<td>131</td>
<td>177</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(359 Mi/day)</td>
<td>(485 Mi/day)</td>
</tr>
<tr>
<td>Impendle Dam</td>
<td>Mkomazi</td>
<td>270</td>
<td>204</td>
<td>228</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(559 Mi/day)</td>
<td>(625 Mi/day)</td>
</tr>
<tr>
<td>Ngwadini Dam</td>
<td>Mkomazi (Off-channel)</td>
<td>10</td>
<td>Not Available</td>
<td>16.4*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(45 Mi/day)</td>
</tr>
<tr>
<td>Temple Dam</td>
<td>Mkomazi (Off-channel)</td>
<td>6.7</td>
<td>10.5</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(29 Mi/day)</td>
<td></td>
</tr>
<tr>
<td>Bulwer Dam</td>
<td>Luhane</td>
<td>9.8</td>
<td>Not Available</td>
<td>3.4*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(9.3 Mi/day)</td>
</tr>
</tbody>
</table>

* 98% assurance level

In the late 1990’s Umgeni Water, together with Sappi Saiccor, conducted an investigation into the water resource options in the lower reaches of the Mkomazi River in order to support growing water demands in the Upper and Middle South Coast regions, and to also to provide an assured supply of water to the mill. Two possible sites for off-channel storage were identified in the lower reaches of the Mkomazi River, namely the Ngwadini and Temple dams. The Ngwadini option was preferred due to the more positive social and bio-physical aspects of the development, and the larger storage volume. This water resource would support the proposed Hull Valley WTP to be situated close to the existing Craigieburn WTP to then feed into the South Coast Pipeline.

This project was not taken forward to implementation by Umgeni Water due to the predicted growth in demands not materialising as rapidly as was anticipated at the time, and lack of joint commitment from Sappi Saiccor. They had also decided not to pursue this option at that time due to financial/operational reasons. Subsequently, Sappi Saiccor has decided to continue with the construction of Ngwadini Dam, with revised calculations indicating that they require the entire storage available in the dam to meet their own requirements. To date, they have completed the detailed design and obtained the environmental RoD approval. Construction was scheduled to have commenced in 2009, but this has been delayed due to the recent downturn in the economy.

In order to develop a sustainable water resource to support the long-term supply of water to the upper and middle south coast regions it is now necessary to reassess the water availability in the lower reaches of the Mkomazi River, both with and without the proposed Mkomazi Water Project.
(Section 5.2) in place. This assessment will confirm whether storage is required in the lower reaches. If positive, then potential dam sites will need to be investigated.

**Greater Bulwer-Donnybrook Bulk Water Supply Scheme**

The Sisonke District Municipality identified the towns of Bulwer and Donnybrook as well as many communities in the corridor between the two towns as not having a reliable water source. Although there are small schemes in place in some areas these are either insufficient or problematic. A regional bulk water supply scheme was proposed as a sustainable long-term solution for this area. The Luhane River, a tributary of the Mkomazi River was identified as the potential water resource for this scheme, which could then be augmented from the Pholela River at a later stage if necessary. A detailed feasibility study for the proposed Bulwer Dam on the Luhane River has been completed. The detailed design for the dam is currently in progress by Sisonke District Municipality.

**Ixopo Groundwater**

The water demands of the Ixopo system have been increasing over the last few years (Section 5.3) and as a result further groundwater resources are being investigated to augment the existing supply. An existing borehole situated in the valley adjacent to Ixopo Wastewater Works was pump tested in the later part of 2010 and proved to have a sustainable yield of 350 kl/day. Infrastructure investigations are currently being undertaken in order to determine the feasibility and cost of utilising this borehole to augment the existing water supply.

### 4.4.7 Middle South Coast Region

The Middle South Coast region extends in a coastal strip from the Mkomazi River southwards to the Mtwalume River (Figure 4.50). The region includes the Mzinto, Mpambanyoni, Mzumbe and Mtwalume river catchments in the U80 tertiary catchment. Whilst the region contains a number of rivers with significant runoff, no major impoundments exist in the region. The Umzinto supply system, which receives its water from the Umzinto WTP, includes the areas of Freeland Park, Hazelwood, Kelso, Pennington, Umzinto and Park Rynie. The Mtwalume supply system receives water from the Mtwalume WTP and includes the areas of Elysium, Ifafa, Mtwalume and Sezela. Afforestation and irrigation are widespread in the region.
Surface Water

The statistics of mean annual runoff for the catchments within the Middle South Coast region are summarised in Table 4.31.

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Annual Average</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Evaporation (mm)</td>
<td>Rainfall (mm)</td>
<td>Natural Runoff (million m³/yr)</td>
</tr>
<tr>
<td>Middle South Coast</td>
<td>Mpambanyoni River (U80)</td>
<td>555</td>
<td>1,200</td>
<td>895</td>
<td>58.9</td>
</tr>
<tr>
<td></td>
<td>Mzimayi River (U80)</td>
<td>35</td>
<td>1,200</td>
<td>1,013</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>Umzinto River (U80)</td>
<td>146</td>
<td>1,200</td>
<td>1,013</td>
<td>33.9</td>
</tr>
<tr>
<td></td>
<td>Fafa River (U80)</td>
<td>261</td>
<td>1,200</td>
<td>939</td>
<td>34.8</td>
</tr>
<tr>
<td></td>
<td>Mtwalume River (U80)</td>
<td>552</td>
<td>1,200</td>
<td>887</td>
<td>53.4</td>
</tr>
<tr>
<td></td>
<td>Mzumbe River (U80)</td>
<td>641</td>
<td>1,200</td>
<td>882</td>
<td>55.1</td>
</tr>
</tbody>
</table>

Groundwater

The Middle South Coast Region occurs in the KwaZulu-Natal Coastal Foreland Groundwater Region (Figure 4.16). This Groundwater Region is characterised by fractured aquifers which are formed by predominantly arenaceous rocks consisting of sandstone and diamicite that is Dwyka tillite.

Hydrogeological Units

The hydrogeologically relevant lithologies recognised in the Middle South Coast comprise of sandstone, mudstone/ shale, tillite and granite/gneiss.
Geohydrology

On the South Coast the thickness of the Natal Group Sandstone (NGS) is irregular, decreasing northwards from a maximum in the Eastern Cape of about 500 m, to some 200 m in Oribi Gorge. North of the Mzimkhulu River it is overstepped by the Dwyka Formation. The Dwyka is the most extensive lithological unit in the region. It occurs in a belt from northeast of Ixopo southwards to Ezingolweni. The Shales of the Pietermaritzburg Formation outcrop chiefly in the uplands around Ixopo and extend southwards through Harding. They are extensively intruded by dolerite sills. The coastal regions especially prevalent in the Mtwalume catchment are the rocks of the Natal Metamorphic Province (NMP).

Groundwater Potential

Primary groundwater supplies using boreholes fitted with handpumps, wind pumps or submersibles are obtainable in most of the lithological units. The exceptions are the Dwyka formation (tillites) or massive granites. In these areas groundwater supply could be obtained within an adjacent fault valley where the potential for high yielding boreholes is much enhanced.

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

Boreholes favourable located in the Natal Group Sandstone (NGS) provide good yields. Yields of 3 l/s (greater than 10 000 l/hr) are not uncommon where large scale fracturing/faulting provide conduits for groundwater movement (Figure 4.51).

Boreholes located in metamorphic lithologies indicate yield characteristics in the range 0.1 to 0.5 l/s, with a median value of 0.3 l/sec.

Water Quality

The EJ Smith system is supplied by the EJ Smith Dam which is highly impacted by the town, farming and industrial activities upstream in the catchment. Due to interventions by the municipality the frequency of nutrient input into the river has decreased and this is reflected in Figure 4.52. However, there is still some nutrient input into the system from informal housing and sewer problems.
Figure 4.52 Percentage compliance vs. non-compliance with the Resource Quality Objective for the E.J. Smith – Umzinto System.
Figure 4.53 Percentage compliance vs. non-compliance with the Resource Quality Objective for the Mtwalume.
The Mtwalume WTP abstracts water from the Mtwalume River and since there is no impoundment of water point source and rainfall related pollution will have immediate effects on the raw water quality. The algal counts in 2010 have increased thus breaching the ROQ limit (Figure 4.53). Turbidity is also a problem and this is probably caused by sand mining along the banks of the river upstream of the treatment facility.

The ambient quality of groundwater in the Middle South Coast Region is generally very good with only 3% of the recorded electrical conductivity (EC) values exceeding a value of 450 mg/l (70 mS/m). Iron concentrations are generally higher than SANS 241 standards for drinking water, however, high iron concentrations are not detrimental to health but rather to taste.

**Reserve**

No comprehensive assessment of the Ecological Reserve of the Middle South Coast Region has been undertaken to date. Estimates of the Reserve indicate that the ecological Reserve will have a large impact on the availability of water in the catchment.

**Water Balance/Availability**

According to the Mvoti to Mzimkhulu ISP (DWA 2004) the water balance of this region appears is in deficit by 4million m$^3$/annum. The Mzinto System (Umzinto and E.J. Smith dams) is in deficit by 0.73 million m$^3$/annum in the current 2011/12 financial year. The urban requirements include those of the towns of Pennington, Hazelwood, Umzinto, Park Rynie, Mtwalume, Ifafa, Sezela, Elysium and Hibberdene. There is a small industrial requirement (1.2 million m$^3$/annum or 3.3 MI/day) relating to the Sezela Sugar Mill which abstracts water directly from a run-of-river structure on the Ifafa River. Umgeni Water maintained the water use registration of 4.4million m$^3$/annum (12MI/day) with DWA for the abstractions from both Mzinto and E.J. Smith dams in the 2011/12 financial year. The registered water use for the Mtwalume run-of-river abstraction is 3.1million m$^3$/annum (8.5 MI/day) in the 2010/11 financial year.

Some of the individual catchments (e.g., Mzinto and EJ Smith dams) are stressed and cannot meet the domestic and industrial requirements during the low flow periods. Part of the reason is the high summer season water demands due to the influx of holiday-makers to the area over this period.
Existing Infrastructure and Yields

The only significant existing infrastructure in the Middle South Coast Region is the existing impoundments of Umzinto Dam (Figure 4.54, Table 4.32) on the Mzinto River and the E.J. Smith Dam (Figure 4.55, Table 4.33) on the Mzimayi River.

Table 4.32  Characteristics of Umzinto Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area:</td>
<td>51.6 km²</td>
</tr>
<tr>
<td>Total Catchment Area:</td>
<td>51.6 km²</td>
</tr>
<tr>
<td>Mean Annual Precipitation:</td>
<td>985 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff:</td>
<td>6.91 million m³</td>
</tr>
<tr>
<td>Annual Evaporation:</td>
<td>1 200 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero:</td>
<td>125.3 mASL</td>
</tr>
<tr>
<td>Full Supply Level:</td>
<td>142 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity*:</td>
<td>0.42 million m³</td>
</tr>
<tr>
<td>Dead Storage:</td>
<td>0.0 million m³</td>
</tr>
<tr>
<td>Total Capacity*:</td>
<td>0.42 million m³</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level:</td>
<td>0.0734 km²</td>
</tr>
<tr>
<td>Dam Type:</td>
<td>Concrete</td>
</tr>
<tr>
<td>Material Content of a Dam Wall:</td>
<td>Concrete: 27 500 m³</td>
</tr>
<tr>
<td>Crest Length:</td>
<td>Spillway Section: 52 m</td>
</tr>
<tr>
<td>Type of Spillway:</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway:</td>
<td>730 m³/s</td>
</tr>
<tr>
<td>Future Capacity Once Dam Wall has been Raised:</td>
<td>N/A m³</td>
</tr>
</tbody>
</table>

* Silt Survey done in October 2010
Table 4.33  Characteristics of E.J. Smith Dam.

<table>
<thead>
<tr>
<th>Catchment Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Catchment Area</td>
<td>15.84 km$^2$</td>
</tr>
<tr>
<td>Total Catchment Area</td>
<td>15.84 km$^2$</td>
</tr>
<tr>
<td>Mean Annual Precipitation</td>
<td>1060 mm</td>
</tr>
<tr>
<td>Mean Annual Runoff</td>
<td>3.43 million m$^3$</td>
</tr>
<tr>
<td>Annual Evaporation</td>
<td>1 240 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dam Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauge Plate Zero</td>
<td>93.0 mASL</td>
</tr>
<tr>
<td>Full Supply Level</td>
<td>109.1 mASL</td>
</tr>
<tr>
<td>Net Full Supply Capacity*</td>
<td>0.89 million m$^3$</td>
</tr>
<tr>
<td>Dead Storage</td>
<td>0.0 million m$^3$</td>
</tr>
<tr>
<td>Total Capacity*</td>
<td>0.89 million m$^3$</td>
</tr>
<tr>
<td>Surface Area of Dam at Full Supply Level</td>
<td>0.1724 km$^2$</td>
</tr>
<tr>
<td>Dam Type</td>
<td>Concrete</td>
</tr>
<tr>
<td>Material Content of a Dam Wall</td>
<td>Concrete: 3 800 m$^3$</td>
</tr>
<tr>
<td>Crest Length</td>
<td>Spillway Section: 24.4 m</td>
</tr>
<tr>
<td>Type of Spillway</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>Capacity of Spillway</td>
<td>220 m$^3$/s</td>
</tr>
<tr>
<td>Future Capacity Once Dam Wall has been Raised</td>
<td>N/A m$^3$</td>
</tr>
</tbody>
</table>

*Silt Survey done in December 2010
Table 4.34  Dams in the Middle South Coast Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m²)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.J. Smith Dam</td>
<td>Mzimayi</td>
<td>0.89</td>
<td>Domestic</td>
</tr>
<tr>
<td>Umzinto Dam</td>
<td>Mzinto</td>
<td>0.42</td>
<td>Domestic</td>
</tr>
</tbody>
</table>

Table 4.35  Yield Information for the existing water resource infrastructure in the Middle South Coast Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/annum)</th>
<th>Stochastic Yield (million m³/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Historical</td>
<td>1:20</td>
</tr>
<tr>
<td>E.J. Smith Dam</td>
<td>Mzimayi</td>
<td>0.89</td>
<td>0.9 (2.5 Ml/day)</td>
<td>1.7 (4.7 Ml/day)</td>
</tr>
<tr>
<td>Umzinto Dam</td>
<td>Mzinto</td>
<td>0.42</td>
<td>1.6 (4.4 Ml/day)</td>
<td>3.2 (8.8 Ml/day)</td>
</tr>
<tr>
<td>Mtwalume (Run-off-River)</td>
<td>Mtwalume</td>
<td>-</td>
<td>1.7 (4.7 Ml/day)</td>
<td>1.2 (3.3 Ml/day)</td>
</tr>
</tbody>
</table>

Operating Rules

The operating rules for this region used to consider three water resource systems, viz. Mkomazi, Mzinto/Mzimayi and Mtwalume rivers as a single entity. After the commissioning of the South Coast Pipeline (SCP-1), the Craigieburn WTP, which received raw water from the Mkomazi River, was closed and the system from the WTP is now fed with potable water from the SCP-1 (Section 5.2). The transfer link from the WTP to the Umzinto area has not been used due to the growth of demands in the Craigieburn area. The transfer link from the Mtwalume River to the Umzinto area is in place but has not been used due to the growth of demands in the Mtwalume area.

A schematic of this system is shown in Figure 4.56.
Figure 4.56 Schematic of the Middle South Coast system.

The operating rule has changed over time due to the higher demands in the Middle South Coast area. It does not involve the Mtwalume and Mkomazi systems anymore which were used to support the Umzinto area. DWA has commissioned a study to develop operating rules for small to medium dams and the dams in this area are part of the study. The current operating rule is as follows:

- Use E.J. Smith Dam spills – lowest unit cost route of supply.
- Use Umzinto Dam or Esperanza Weir spills – second lowest cost supply route.
- Use more storage from Umzinto Dam than E.J. Smith Dam.
- The last source to be used is E.J. Smith Dam storage.

Towards the end of 2010 DWA undertook a study to develop water supply and drought operating rules for the Mzinto region. The final report is currently being concluded.

The recommended operating rule is to use water from the new extension of the South Coast pipeline as soon as the two dams (Umzinto and E.J. Smith) drop below full supply level. Further to this, storage in Umzinto Dam should be used before storage in E.J. Smith Dam.

The drought restriction rule was also developed based on the the reliability of supply criterion defined for urban requirements not to experience a failure (non-supply event) of more than once in fifty years. This drought restriction rule with allocation is based on monthly reservoir storage volumes for the Umzinto Supply System for every year from 2010 to 2012. Beyond 2012 other
additional interventions will be required to augment the supply to satisfy the growing requirement of the Umzinto Supply System.

Proposed Water Resource Infrastructure

Potential development options that have been identified in the Middle South Coast Region are:

- The abstraction efficiency at the existing Mtwalume Abstraction Works will need to be improved as a short-term solution. At the moment it can only pump water when water in the Mtwalume River exceeds an estimated flow rate of 0.2 m³/s;
- The abstraction efficiency at the existing Umzinto Abstraction Works at the Esperanza Weir could be improved as a short-term measure because it has been estimated that an average system loss of 20% occurs between the dam and the abstraction works;
- The Umzinto Dam has been designed to be raised. This could possibly provide a short-term local solution, if the increased yield is not adversely affected by siltation and upstream land use practices;
- Another medium to long-term solution is to link the lower Mzimkhulu water resource to the Middle South Coast system; and
- The long-term solution is to construct Phase 2 of the South Coast Bulk Pipeline (SCP-2) to extend the bulk water supply south from Park Rynie to Hibberdene (Section 5.4). Simultaneously, a regional abstraction and WTP facility will need to be constructed on the lower Mkomazi River (Section 5.4) to provide the necessary sustainable water resources. The SCP-2 would link into the Lower South Coast system being supplied from the Mzimkhulu River to provide flexibility.

Mhlabatshane Bulk Water Supply Scheme

The Mhlabatshane River BWS Scheme will supply water to the communities within the Umzumbe Municipality, and the Hibiscus Coast Municipality. The scheme includes the construction of a dam on the Mhlabatshane River (Figure 4.57), a tributary of the Umzumbe River to provide the necessary water resources, which will supply raw water to a new WTP in the area. It is estimated that the available water resources for the scheme is 2.4 million m³/annum after accounting for all stream flow reduction activities including the reserve (Stemele Bosch and Associates 2007).
Table 4.36  Yield information for the proposed dams in the Middle South Coast Region.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/year) Historical</th>
<th>Stochastic Yield (million m³/year) 1:100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raised Umzinto Dam</td>
<td>Mzinto</td>
<td>1.1</td>
<td>1.8 (4.9 Ml/day)</td>
<td>2.8 (7.7 Ml/day)</td>
</tr>
<tr>
<td>Mhabatshane Dam</td>
<td>Mhabatshane</td>
<td>2.5</td>
<td>Not Available</td>
<td>1.5 (4.1 Ml/day)</td>
</tr>
</tbody>
</table>

* 98% assurance level

4.4.8  Mzimkhulu Region

The Mzimkhulu Region comprises of the tertiary catchment of T50 (Mzimkhulu River; Figure 4.58). The main towns situated in the Mzimkhulu catchment (Figure 4.58) are Underberg, Himeville, Creighton, Harding and Port Shepstone which is situated in the Mtamvuna Area but is supplied by the Mzimkhulu River. The main land uses in the catchment are domestic rural use and afforestation and irrigation to a lesser extent.

A water resource feasibility study (DWA 2011) for the entire Mzimkhulu catchment is currently being finalised, and some of the results have been referenced in the sections below.

The Mzimkhulu River water demands are primarily from agriculture and afforestation; these are the largest water users in the system representing 31% and 41% of total water use respectively. The remaining demands are rural and urban demands (10%), dryland sugar cane and stock watering (3% and 1% respectively), and invasive alien vegetation (14%).

The Mzimkhulu River agricultural demand is primarily supplied through direct abstractions from rivers and streams, as well as from farm dams. The DWA, 2011 study modelled irrigation demands by using the WRSM2000 model which incorporates the Water Quality Model methodology with inputs of area, crop factors and crop types. The catchment irrigation supply is estimated to be 87 million m³/annum and stock water demands account for an additional 4 million m³/annum. Sugarcane is not irrigated in this catchment and is considered to be a dry land crop. Therefore it is modelled as a flow reducing activity in the WRSM2000 model and it accounts for 7 million m³/annum of the total catchment water demand.
Figure 4.58 General layout of the Mzimkhulu Region.

Legend
- Rivers
- National Roads
- Water Resource Regions
- WSA for whom UW is BWSP

Source:
Department of Water Affairs
Ezenvuto KZN Wildlife
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale on A4 at 1:900 000

Land Cover (2005)
- Bare rock
- Bare sand
- Annual commercial crops dryland
- Annual commercial crops irrigated
- Permanent orchards (banana, citrus) irrigated
- Bushland (< 700cc)
- Sugarcane - commercial
- Sugarcane - emerging farmer
- Degraded bushland (all types)
- Erosion
- Forest
- Plantation
- Plantation clearfelled
- Grassland
- Grassland / bush clumps mix
- Golf courses
- Smallholdings - grassland
- Mines and quarries
- Woodland
- Dense bush (70-190 cc)
- Bushland (700-900 cc)
- Old cultivated fields - bushland
- KZN main & district roads
- KZN national roads
- Rural dwellings
- Subsistence (rural)
- Urban
- Dams
- Estuarine Water
- Natural Fresh Water
- Outside KZN
Forest plantations are distributed throughout the Mzimkulu catchment but are concentrated in the Bisi, the Mzimkuluwana and the Middle Mzimkulu sub-catchments. Forestry is estimated to be the largest consumer of water in the Mzimkulu catchment and is estimated to use 113 million m³/annum.

The industrial and domestic water demands in the rural and urban areas are supplied from point source abstractions from the Mzimkulu River and its tributaries. Rural settlements are found throughout the catchment and obtain their water from diffuse sources, including groundwater. Rural water requirements are estimated to be in the order of 7 million m³/annum and urban water requirements within the catchment are estimated to be in the order of 4 million m³/annum. Port Shepstone’s demand, which is supplied from the catchment is estimated to be some 17 million m³/annum.

**Surface Water**

The hydrological characteristics for the Mzimkulu Region are shown in Table 4.37.

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Annual Average</th>
<th>Natural Runoff (million m³/annum)</th>
<th>Natural Runoff (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mzimkulu</td>
<td>Mzimkulu River (T50)</td>
<td>6 678</td>
<td>1 190</td>
<td>934</td>
<td>1 373.0</td>
</tr>
</tbody>
</table>

**Groundwater**

The Mzimkulu Region occurs in the KwaZulu-Natal Coastal Foreland and Transkeian Coastal Foreland and Middlelevd Groundwater Regions (Figure 4.16). As such this Groundwater Region is characterised by and combination of intergranular and fractured arenaceous rocks. The aquifer types occurring in this region are mapped as low to medium potential.

**Hydrogeological Units/Geohydrology**

The hydrogeologically relevant lithologies recognised in the Mzimkulu Region comprise of the siltstone/shale, feldspathic sandstones and tillites of the Karoo Supergroup; the micaceous sandstones of the Natal Group; and the granite/gneiss of the Natal Metamorphic Province (NMP).
These hydrogeological units are clearly defined within the Mzimkhulu River catchment and occur in
distinct bands or areas. The Natal group sandstones can be found in a relatively small area to the
south of the Mzimkhulu River in an area known as the Oribi Flats as well as around the town of
Paddock. Extending inland from the Oribi Flats the Mzimkhulu River is bounded on both sides by
extensive tillite deposits of the Dwyka Formation. The Dwyka Formation covers the Ntabankulu and
St Faiths area and extends southwards to Isingolweni. Further west all the way up to the
Mzimkulu River source at the foothills of the Drakensberg Mountains the hydrogeology is dominated
by the Karoo Supergroup. Here Shales are interspersed with igneous dolerite intrusions. The Shales
of the Pietermaritzburg Formation outcrop chiefly in the uplands around Ixopo and extend
southwards through Harding.

**Groundwater Potential**

Primary groundwater supplies using boreholes fitted with handpumps, wind pumps or submersibles
are obtainable in most of the lithological units. The exceptions are the Dwyka formation (tillites) or
massive granites. In these areas groundwater supply could be obtained within an adjacent fault
valley where the potential for high yielding boreholes is much enhanced.

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

Boreholes favourably located in the Natal Group Sandstone (NGS) provide good yields. Yields of 3l/s
(greater than 10 000 l/hr) are not uncommon where large scale fracturing/faulting provide conduits
for groundwater movement (Figure 4.59).

Boreholes located in metamorphic lithologies indicate yield characteristics in the range 0.1 to 0.5 l/s,
with a median value of 0.3 l/s.
Figure 4.59  Groundwater potential in the Mzimkhulu Region.
Water Quality

Borehole water quality data is very scarce, but from the information available the following general statements can be made:-

- All boreholes for which there are values fall within the SANS 241 maximum permissible limits for conductivity.
- Boreholes with elevated Iron (Fe) levels are not uncommon. Iron is a problem as it stains laundry but it is not a health risk.
- Some boreholes exceed Nitrate (NO₃) levels, but these are isolated.

Generally the borehole water quality is good.

Reserve

The Reserve estimates, based on desktop studies, indicate that the Ecological Reserve will have a large impact on the availability of water in the catchment. The implementation of the Reserve will result in shortfalls that will increase in magnitude and frequency occurring every second year on average. It has been recommended from previous studies that, in order to provide for the water requirements for all user sectors, including the Reserve, the construction of an off-channel storage dam in one of the tributaries to the Mzimkhulu River, should be considered.

During the DWA, 2011 study surveys were conducted at eight sites where intensive ecological data and information was collected to describe the present ecological state of the river and its major tributaries (Table 4.38).
Table 4.38 Summary of the ecological status of the Mzimkulu River and its tributaries.

<table>
<thead>
<tr>
<th>Quaternary catchment</th>
<th>River</th>
<th>Level</th>
<th>PES*</th>
<th>REC#</th>
</tr>
</thead>
<tbody>
<tr>
<td>T51C</td>
<td>Mzimkulu</td>
<td>Intermediate</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>T52A</td>
<td>Mzimkulu</td>
<td>Intermediate</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>T52D</td>
<td>Mzimkulu</td>
<td>Intermediate</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>T52M</td>
<td>Mzimkulu</td>
<td>Intermediate</td>
<td>A/B</td>
<td>A/B</td>
</tr>
<tr>
<td>T51E</td>
<td>Pholela</td>
<td>Rapid 3</td>
<td>B/C</td>
<td>B/C</td>
</tr>
<tr>
<td>T51F</td>
<td>Ngwangwane</td>
<td>Rapid 3</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>T52G</td>
<td>Bisi</td>
<td>Rapid 3</td>
<td>A/B</td>
<td>A/B</td>
</tr>
<tr>
<td>T52L</td>
<td>Mzimkulwane</td>
<td>Intermediate</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>

* Present Ecological State
# Recommended Ecological Class

The main river and its tributaries are primarily in a B ecological state or higher which suggests that the ecosystem is in a near natural or slightly transformed state. It is important to point out that the investigation was only undertaken on the main river and the some main tributaries and not on the smaller tributaries where local impacts may be concerning. The developments in the upper catchment and the degradation in parts of the catchment due to poor land use management practices have not had negative impacts on the river ecology.

The impacts of significant forest plantation increases can only be mitigated by the provision of storage, which would also improve the state of the river to meet the EWRs in the lower reaches of the catchment. This additional storage would also deliver surplus yield which could supply demands of the neighbouring catchments.

**Water Balance/Availability**

Umgeni Water has no abstractions from this region. According to the recent DWA study (DWA 2011) the deficit in the catchment can be mitigated by the construction of the dams on the Ngwangwane and Bisi rivers.

**Existing Infrastructure and Yields**

There are no storage impoundments on the Mzimkulu River. The northern part of the Lower South Coast Water Supply System (from Hibberdene to Ramsgate, including Port Shepstone) is presently supplied from a run-of-river abstraction from the Mzimkulu River. The water is abstracted at the St Helen’s Rock (SHR) abstraction works near Port Shepstone and is further
pumped to the Bhabhoyi WTP (owned and operated by Ugu Municipality). The current water requirements at Port Shepstone is 16.6 million m³/annum which are supplied from the Mzimkulu River abstraction works at St Helen’s Rock.

If the Ecological Reserve is not released, the available yield at the St Helen’s Rock abstraction works is estimated at 49 million m³/annum (Table 4.39). However, the construction of a weir across the Mzimkulu River at St. Helen’s Rock would be required in order to access the available river flows during low river flow conditions.

**Table 4.39 Yield Information for the St Helen’s Rock Abstraction site.**

<table>
<thead>
<tr>
<th>Site</th>
<th>River</th>
<th>Capacity (million m³)</th>
<th>Yield (million m³/year)</th>
<th>Stochastic Yield (million m³/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St Helen’s Rock</td>
<td>Mzimkulu</td>
<td>-</td>
<td>49</td>
<td>Not Available</td>
</tr>
</tbody>
</table>

### Proposed Water Resource Infrastructure

The abstraction works at St Helen’s Rock is currently being upgraded. The maximum possible abstraction rate will be 1.25 m³/s (39.4 million m³/annum) and it will have a capacity of 900 000 m³. The future design capacity of the Bhabhoyi water treatment works is 110 Ml/day (40 million m³/annum).

The lower Mzimkulu system requires additional augmentation in the medium to long-term. Possible off-channel storage dam sites have been identified upstream of the abstraction works. Four off-channel storage dam sites were evaluated by DWA at a reconnaissance level - two each on the Cwabeni and Gugamela rivers (tributaries of the Mzimkulu River). An assessment of the yield capabilities, environmental acceptability, engineering risk, and the project costs of the four remaining sites revealed that one of the sites on the Cwabeni River is the most feasible. DWA is currently finalising the detailed feasibility investigation of this dam site.
Figure 4.60 Proposed water resource infrastructure in the Mzimkhulu Region.
Linking of the Northern (Mzinto) and Southern (Mzimkhulu) potable water distribution systems was found to be feasible. It was recommended to commence with a phased construction programme that would utilise the available spare capacity in the Mzimkhulu system and will provide for future operational flexibility to distribute potable water northwards or southwards.

A potential dam site has been identified in the upper reaches of the Mzimkhulu River near Underberg (Figure 4.60). This dam could be utilised to provide a sustainable water resource for a regional bulk scheme to supply the urban and rural areas in a strip north of the main river between Underberg towards the coastal areas.

Two other dam sites have been identified on the Mzimkhulu River (UW 2006). These sites are located 3 km north of Umzimkhulu Town and the possible wall lengths are approximately 300 m and 30 m in height. The possible storage capacities of these two dams are 230 and 335 million m³, respectively. These dams may be suitable for inter-basin transfer scheme as the high yield is not required for the Umzimkhulu area.

4.4.9 Mtamvuna Region

The Mtamvuna Region comprises of the tertiary catchment of T40 (the Mtamvuna River and a few small coastal rivers to the north of it; Figure 4.61).

The main water requirements are domestic; both the urban and rural sectors. The urban requirements are from the coastal towns that includes Margate, Ramsgate and Port Edward. Port Shepstone is situated in this region but is supplied with water from the Mzimkhulu River (Section 4.4.8).

The Mtamvuna catchment consists mostly of communal land. There are also large areas of afforestation and dryland sugar cane in the catchment.
Figure 4.61  General layout of the Mtamvuna Region.
Figure 4.62  Groundwater potential in the Mtamvuna Region.

Legend
- Rivers
- National Roads

Groundwater Potential (l/s)
- >0 - 0.1 l/s
- >0.1 - 0.5 l/s
- >0.5 - 3 l/s
- >3 l/s

Water Resource Regions
- WSAs for whom UW is BWSP
- Outside KZN

Source:
Department of Water Affairs
KZN Department of Transport
Municipal Demarcation Board
Umgeni Water

Original Scale on A4 at 1 : 550 000
Surface Water

The hydrological characteristics for the Mtamvuna Region are shown in Table 4.40.

<table>
<thead>
<tr>
<th>Region</th>
<th>River (Catchment)</th>
<th>Area (km²)</th>
<th>Evaporation (mm)</th>
<th>Rainfall (mm)</th>
<th>Natural Runoff (million m³/annum)</th>
<th>Natural Runoff (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mtamvuna</td>
<td>Mtamvuna River (T40)</td>
<td>2 216</td>
<td>1 180</td>
<td>912</td>
<td>426.0</td>
<td>192</td>
</tr>
</tbody>
</table>

Groundwater

The Mtamvuna Region occurs in the KwaZulu-Natal Coastal Foreland and Transkeian Coastal Foreland and Middleveld Groundwater Regions (Figure 4.16). As such this Groundwater Region is characterised by a combination of intergranular and fractured arenaceous rocks. The aquifer types occurring in this region are mapped as low to medium potential.

Hydrogeological Units/Geohydrology

The hydrogeologically relevant lithologies recognised in the Mtamvuna Region comprise of the siltstone/shale, feldspathic sandstones and tillites of the Karoo Supergroup; the micaceous sandstones of the Natal Group; and the granite/gneiss of the Natal Metamorphic Province (NMP).

These hydrogeological units are clearly defined within the Mtamvuma River catchment and occur in distinct bands or areas in the Mzimkulu River catchment. The Natal group sandstones can be found in a narrow band extending inland from the coast at the mouth of the Mtamvuma River. Inland around the Izingolweni area on both sides of the river extensive tillite deposits of the Dwyka Formation occur. The headlands of the river around the town of Harding are predominated by shales that are interspersed with igneous dolerite intrusions.

Groundwater Potential

Primary groundwater supplies using boreholes fitted with handpumps, wind pumps or submersibles are obtainable in most of the lithological units. The exceptions are the Dwyka formation (tillites) or
massive granites. In these areas groundwater supply could be obtained within an adjacent fault valley where the potential for high yielding boreholes is much enhanced.

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

Boreholes favourable located in the Natal Group Sandstone (NGS) provide good yields. Yields of 3 l/s (greater than 10 000 l/hr) are not uncommon where large scale fracturing/faulting provide conduits for groundwater movement (Figure 4.62).

Boreholes located in metamorphic lithologies indicate yield characteristics in the range 0.1 to 0.5 l/s, with a median value of 0.3 l/sec.

**Water Quality**

Borehole water quality data is very scarce, but from the information available the following general statements can be made:-

- All boreholes, for which there are values, fall within the SANS 241 maximum permissible limits for conductivity.
- Boreholes with elevated Iron (Fe) levels are not uncommon. Iron is a problem as it stains laundry but it is not a health risk.
- Some boreholes exceed Nitrate (NO3) levels, but these are isolated.

Generally the borehole water quality is good.

**Reserve**

The catchment is in balance even after making an allowance for the ecological Reserve which means that it has surplus water.
Water Balance/Availability

Umgeni Water has no abstractions from this region. According to the Mvoti to Mzimkhulu ISP (DWA 2004) the water balance of this region appears to be in surplus by 5 million m³/annum.

Existing Infrastructure and Yields

There are no impoundments on the Mtamvuna River. The only significant abstraction that occurs is a run-of-river facility owned and operated by Ugu District Municipality to provide raw water to the Mtamvuna WTP, which supplies potable water to the south of Margate to Port Edward. The Mtamvuna abstraction works for the greater Port Edward to Margate area is located in the lower reaches of the Mtamvuna River.

Proposed Water Resource Infrastructure

There is currently no water resource development plan for the main river.

Greater Mbizana Regional Bulk Water Supply Scheme

A regional scheme is currently being implemented by Umgeni Water on behalf of Alfred Nzo District Municipality to supply a significant portion of the Mbizana Municipality (Eastern Cape) with a sustainable supply of bulk potable water for growth and development. The water resource for this scheme is a storage dam which is currently being constructed on the Ludeke River, a tributary of the Mtamvuna River and is due for completion in the first half of 2013.

<table>
<thead>
<tr>
<th>Impoundment</th>
<th>River</th>
<th>MAR</th>
<th>Capacity (million m³)</th>
<th>IFR Scenario</th>
<th>Yield (million m³/year)</th>
<th>Stochastic Yield (million m³/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Historical</td>
<td>1:50</td>
</tr>
<tr>
<td>Ludeke Dam</td>
<td>Ludeke</td>
<td>16.9</td>
<td>14.5</td>
<td>With IFR</td>
<td>4.6 (12.6 Ml/day)</td>
<td>4.9 (13.4 Ml/day)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Without IFR</td>
<td>7.5 (20.5 Ml/day)</td>
<td>8.5 (23.3 Ml/day)</td>
</tr>
</tbody>
</table>

Table 4.41 Yield Information for the proposed Ludeke Dam in the Mtamvuna Region.
Figure 4.63  The proposed Ludeke Dam.
4.5 Wastewater Reuse

4.5.1 Background and Existing Infrastructure

The reuse or reclamation of wastewater not only improves the sustainability of water resources, but is strategically important as it improves the security of supply through the diversification of water resources. Wastewater is available throughout the year and the supply is consistent.

Umgeni Water currently owns an 18% share in the Durban Wastewater Recycling (DWR) Plant. The DWR treats domestic sewage to near potable standards for industrial use. The plant has the capacity to treat approximately 40 MI/day of wastewater.

4.5.2 Proposed Options

Umgeni Water is currently investigating the option of treating domestic sewage from Darvill Wastewater Works (WWW) (Section 6.2) to potable standards. The proposal is to return the treated water back into the distribution system at Umlaas Road (Section 5.2). The water can then be used to augment the supply to the Western Aqueduct which will serve the high growth areas along the western corridor of the eThekwini Municipality (Section 5.2). The advantage of this of this is that water is made available higher up in the system and can therefore be supplied using gravity. The alternative is reliant on pumping from Durban Heights WTP to serve these demand centres (Section 5.2).

4.5.3 Project Progress

A number of studies have been undertaken as part investigations into wastewater reclamation at Darvill WWW. These include infrastructure and environmental pre-feasibility studies as well as treatment technology investigations.

The infrastructure study involves the evaluation of two methods of utilising Darvill wastewater to augment the potable supply. The first, a Direct Reuse option, is designed to treat the Darvill effluent at a proposed wastewater reclamation plant adjacent to the existing works. The second, an Indirect Reuse option, is designed to abstract the Darvill effluent from a location downstream of the WWW on the Msunduzi River. Both options require the water to be pumped to the Umlaas Road Node
(Section 5.2) for distribution. The Indirect Reuse (river abstraction) option will require treatment and therefore the WTP at the Umlaas Road Node will need to be re-commissioned for this purpose.

Due to the poor water quality of the Msunduzi River (Section 4.4.4) the WTP would have to be upgraded to cater for the inclusion of more advanced water treatment technology. Treatment technology studies are presently being undertaken which will provide design information for the WTP upgrade.

Storage reservoirs, distribution pipelines and the associated infrastructure to pump the treated water to Umlaas Road WTP are required for both alternatives and preliminary designs and pipeline routes have been completed.

Both the Direct and Indirect Reuse options will reduce the flow in the Msunduzi River by approximately 60 Ml/day which potentially may have an environmental impact on the river and its users. A specialist environmental study has recently been completed to assess the possible impacts of this reduction in flow on the river. The study revealed that reduction in flow would have no to limited impact on the ecology of the river, because the flow would be returning to its natural or “virgin” state. The river habitat and ecosystem would therefore adapt to what it was formally used to. The discharge from Darvill WWW is a return flow and therefore not part of the natural flow regime of the river. Social impacts where more difficult to quantify without the undertaking of a full Environmental Impact Assessment, but were also limited and could be mitigated against.

A vital component in the Direct Reuse option is the design of the advanced water treatment technology process train for the reclamation plant. The treating of wastewater for potable reuse requires that appropriate technologies are used to ensure the public’s safety at all times. This is achieved by designing treatment systems that ensure no harmful substances or viruses will pass through the system. The most effective way of doing this is to design “multiple treatment barriers”. International experience at NEWater in Singapore and at Goreangab in Windhoek makes use of this philosophy. These plants also undertook extensive treatment trials using pilot plants to obtain the best treatment train design.

Umgeni Water is following a similar strategy, and with the approval and sponsorship of the Water Research Commission (WRC), is undertaking a wastewater reclamation pilot plant investigation. The first stage in these investigations involves the installation of the Membrane Bioreactor (MBR) pilot
plants. The MBR’s will provide excellent pre-treatment for further advanced treatment technologies such as Reverse Osmosis and Ultra Violet Irradiation. Combinations of advanced treatment technologies will be tested to ascertain the most effective “multiple barrier” system (Figure 4.64). These tests will take place over the next two years and will culminate in a WRC report. The study will provide the recommended process train for design purposes. A preliminary design for the reclamation plant can then be undertaken and costed.

Coupled with the pilot plant investigations is a rigorous water quality monitoring programme. Of major concern when reclaiming wastewater to potable standards are the health and safety aspects, especially those relating to the presence of Contaminants of Emerging Concern (CEC) in the final water. CEC represent a range of contaminants that include pesticides, pharmaceuticals and personal care products. Much attention has been given to particular contaminants that fall under the banner of Endocrine Disrupting Chemicals (EDCs) such as Estrogen. Umgeni Water is sampling and analysing for Estrogen in the product water from the MBR’s and will be gradually increasing the sampling programme for other contaminants as the project progresses.
4.6 Seawater Desalination

Umgeni Water has recently completed a desalination pre-feasibility study. The objective of this study was to investigate the viability of constructing a large scale desalination plant in the eThekwini area as a possible alternative to the proposed Mkomazi Water Project (Sections 4.4.4 and 5.2). The ultimate capacity of the plant was set at 450 ML/day (164 million m$^3$/annum), making it potentially one of the largest SWRO to ever be built.

The study identified the northern end of the Durban Airport as the optimal site to construct a seawater reverse osmosis (SWRO) desalination plant. The cost of constructing and operating the plant was estimated as well as the possible environmental implications.

Few points exist within the water supply infrastructure of eThekwini Municipality that have the capacity to receive the water from a single point desalination plant producing 450 ML/day of potable water. Early investigations have also shown that due to the limited space for the pipeline installation, it is highly likely that a phased implementation of the pipelines will not be feasible because of these space constraints. At this point it is proposed that about 150 of the 450 ML/day would be injected into the Wiggins System (Section 5.2) at its WTP whilst the balance is injected into the Central Aqueducts.

An economic comparison, at a pre-feasibility level of detail, between this desalination plant and the alternative Mkomazi Water Project, indicated no discernable difference. It is therefore necessary to undertake more detailed investigations of both options so as to obtain a higher level of accuracy in their comparison.

In order to understand the required components to be focused on during the detailed investigation of the desalination option, a workshop was arranged with desalination experts from Australia. Lessons learnt from this workshop have assisted in planning the feasibility study for the desalination plant. In particular the recommendations regarding the proposed site and linkages to existing supply infrastructure will need to be reviewed.

A revised strategy has now been adopted. The detailed feasibility investigation is considering the option of a 150ML/day plant on both the North Coast and South Coast. The capacity of these plants is based on the capacity of existing and proposed bulk water supply infrastructure in these areas,
which will be utilised to convey the potable water from the desalination plants to the various distribution points. Datasets on the various criteria that affect the positioning of a desalination plant have been sourced and two potential sites have now been identified through a site selection study undertaken by Umgeni Water’s Planning Department (Umgeni Water 2011). These sites are located on either side (north and south) of the Mgeni Supply Area and would have the ability to sufficiently augment the Mgeni and Hazelmere Systems in the medium-term with supply to areas in eThekweni Municipality, Ugu District Municipality and Ilembe District Municipality.
References


Acknowledgements

Umgeni Water’s comprehensive 2011 Infrastructure Master Plan has been updated and improved to produce this 2012 version. The concerted effort of the Planning Services Department as a whole in producing this document is acknowledged and appreciated. Specific contributions by the various team members deserves acknowledgement: Alka Ramnath’s (Planner) contribution in managing the entire project process, writing Section 2 of this report, preparing a number of the maps and in compiling and editing the two volumes, was substantial. Without such valuable input the project would just never get completed. Kevin Meier, Mark Scott, and Gavin Subramanian (Planning Engineers) updated the various components relating to the water supply infrastructure plans and projects within the North, South and Central, and Inland regions respectively. Zanele Mbense (Technician) assisted them with updating water supply infrastructure maps. Sandile Sithole (Hydrologist), supported by Sakhile Hlalukane (Assistant Hydrologist), and Graham Metcalf (Geohydrologist) updated the various sections relating to the water resource regions in Volume I. Mark Summerton (Planning Analyst) revised the section on climate change. David Stephen (Planning Engineer) once again took on the onerous task of proofreading the report, and Thembi Sibiya (Administrator) kept the department functioning smoothly throughout the project.

The 2012 Infrastructure Master Plan was not completed by the abovementioned people without the valued assistance of numerous other staff members within Umgeni Water. Their contributions are gratefully acknowledged. Operations Division staff provided assistance in updating and confirming infrastructure information. A special word of thanks is extended to Gordon Borain (Manager-Production) for updating Section 6 on the Wastewater Works. The Water and Environment Department kindly provided updated information on water quality within the various water resource regions in Section 4, and Process Services supplied the process and treatment details for each of the water treatment plants in Section 5.

Special acknowledgement is given to Steve Gillham, under whose leadership Umgeni Water’s Infrastructure Master Plan has been annually updated and improved. His consistent attention to detail has contributed to the high standard of work produced. As Umgeni Water’s new General Manager: Engineering and Scientific Services, Steve’s role changes from being responsible for its production to that of its custodian.

Kevin Meier,
PLANNING SERVICES MANAGER