

## **5. WATER CONSERVATION / DEMAND MANAGEMENT**

Water conservation and demand management is related to the wise use of water, such that the inefficiencies within the bulk and reticulation system that result in water losses are minimised and controlled, and that the wastage of treated water either within the network or by the consumer is reduced. Through education and appropriate tariff structures the ZDM may reduce the water services demand and provide effective water conservation.

### **5.1 Water Resource Management Interventions**

The ZDM liaised closely with the DWA Water Resources Department in the province when the back-to-back, regional, water master planning exercise was done. Water resources that were known to be under stress were avoided and the more sustainable water resources were targeted for long-term future supply. Chapter 3 of this report provides an overview of which resources are under stress.

The ZDM participates in DWA and other initiatives aimed at protecting the water resources in the district, e.g. the Working for Water Programme and is also an active member of the various Catchment Management Agencies within which the water resources of the District are located as well as the various Water User Associations that have been established in the District.

The quantum of water available for use within the District is both stressed and finite such that the only way of ensuring an adequate and sustainable supply in the long terms is to manage wasteful practices. In this regard the ZDM has recognised the need and embarked on a plan of action to address non-revenue water (NRW).

This programme is intended to quantify the usage of water within the district by way of a water balance, compare this with the design norms and standards set by the ZDM and to identify specific interventions to manage the demand within acceptable limits and to reduce waterlosses.

The information gathered from the NRW programme will be incorporated into MANZI, be aligned with the ZDM WSP reporting system and used to develop a water balance for individual schemes and eventually a water balance for the entire District as required by the WSDP.

The NRW programme will assist in aligning O&M interventions where most needed and thereby improve the efficiency of scarce resources.

The following specific interventions will address water losses through:

- Pressure management;
- Leak repair programmes;
- Meter repair & replacement programmes;
- Internal plumbing leaks; and
- Consumer end-use demand management initiatives.

The NRW strategy that the ZDM has adopted may be summarised as follows:

### **NEED FOR AN NRW PROGRAMME**

The municipality has identified the need to embark on a Non Revenue Water (NRW) programme for the District not only to save water but also to benefit from the many added advantages that can be linked to such a programme such as:

- Reduced water consumption and water wastage;
- Improved quality of service provided with more consumers receiving water consistently (the need for example to close reservoirs at night will be substantially reduced or even completely eliminated);
- Improved coverage with billing and improved income stream for the municipality;
- Reduced costs to provide water services (less chemicals used, less maintenance required, etc);
- More efficient use of limited financial and human resources by focusing resources where most needed;
- Increased lifespan of infrastructure assets and postponing huge capital investments required to upgrade infrastructure in order to meet excessive growth in consumer consumption.

### **PRINCIPLES**

Before embarking on any new initiative it is best to first clarify the principles that must guide the programme and thereby set the framework within which to operate, as follows:

- The approach should be holistic and should deal with the complete solution from design issues, through to operational challenges and included metering and billing shortcomings. All role-players within the organisation must be brought on board and ownership of the programme established in-house.
- Remedial actions identified through the programme must involve the relevant staff of the municipality and thereby work towards permanent change for the long term. The programme should influence daily operations in such a manner that it becomes a “way of life” within the organisation and leads to ongoing sustainability.
- Remedial actions that are decided upon have to be reviewed or at least judged economically by comparing the investment required versus the anticipated “win” that will be achieved. The 80/20 principle should apply whereby the effort is firstly focused where the major challenges occur. Schemes need to be prioritised for intervention and one possible method could be to prioritise

schemes in terms of their estimated contribution to the total estimated NRW in the District (see Table 1 below).

- Pressure Management activities should aim at achieving static pressures in the reticulation networks of urban areas of between 2,5 – 6 bar and in rural areas of between 1- 6 bar. Proper network modelling should however dictate the final solution for each individual scheme.
- Measurement devices installed through this programme must be compatible with the telemetry and SCADA systems that will be installed by the ZDM through a parallel processes.
- All field information must be captured electronically on the existing central database called MANZI (Infrastructure Management System) and thereby linked to the GIS.
- The IWA method is recommended to be used to categorize water usage and to compile a water balance for each scheme, as shown in the figure below:

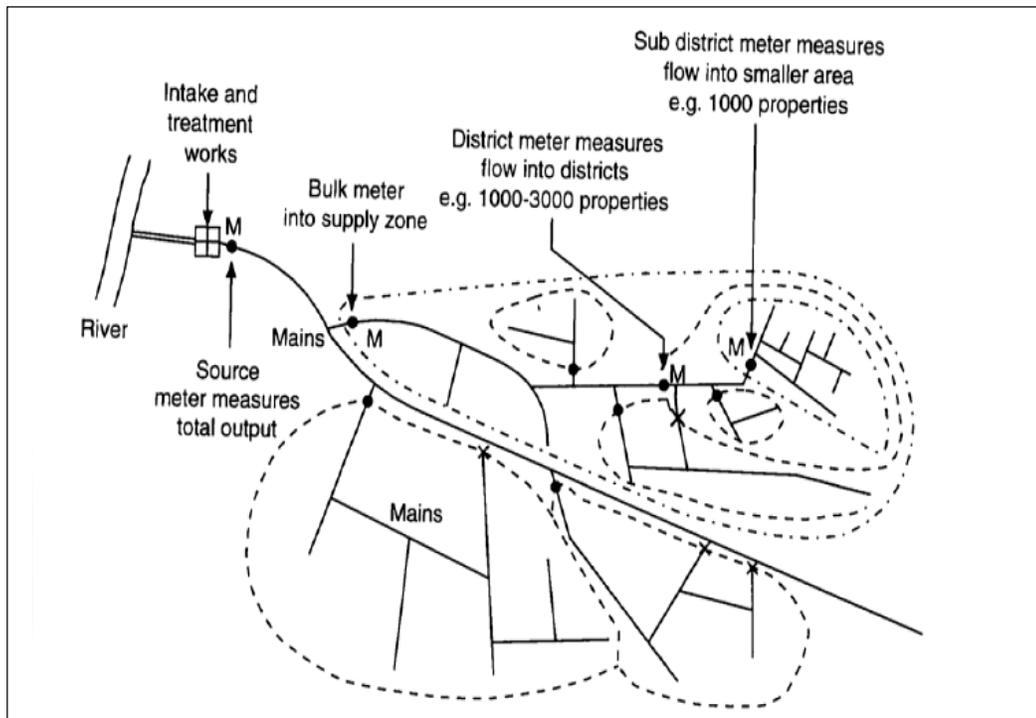
**Figure 4.1: IWA Method of categorizing water use**

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorized Consumption	
			Customer Meter Inaccuracies and Data Handling Errors	
		Real Losses	Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Storage Tanks	
			Leakage on Service Connections up to point of Customer Meter	

## METHODOLOGY

The methodology to be used with the implementation of the NRW programme is summarised below:

- Understanding the functioning of the scheme from source to end user with the scheme information available;
- Managing scheme operations to achieve as closely as possible a situation where all consumers can receive water all day round and reservoirs do not have to be closed down at night (this allows for more accurate measurement);
- Identify water demand zones for each scheme and metering and logging points (temporary and permanent) and initiate implementation of the measurement devices as well as measures required to make zones discreet (see illustration below).



- The accurate recording and regular review of flow profiles and water supply volumes into each discrete zone, i.e. the metering infrastructure and data logging systems, including the compilation of system water balances.
- The accurate recording and regular review of consumer demand and the sustained implementation of specific tasks (e.g. leak detection surveys, step testing, pressure management reviews, prompt burst repairs, etc.) and sustained overall maintenance of all system components.
- The roll out of a meter testing and meter replacement programme.
  - Consumer metering and billing
  - Identify unmetered consumers and systematically install meters at all consumer connections.
  - Accurate and consistent billing of consumers as per the tariff policy.
  - Deal with non-payment in accordance with the ZDM by-laws and debt collection policy.

## PRIORITY SCHEMES

It is difficult to determine accurately the extent of NRW in the district at this point in time and the pilot investigations that were discussed earlier indicated variances in NRW of between 41% and 68% between different schemes.

Table 4.1 (a) below lists the schemes in the district and the known System Input Volumes (SIV). Although the state of NRW in each individual scheme is unknown it could be safely assumed, based upon the previously mentioned pilot investigations, that at least a 40% NRW scenario prevails throughout. When 40% NRW is applied and the NRW contribution from each scheme is calculated as a percentage of the total NRW for the district, the schemes can be prioritised as indicated in Table 4.1 (a) overleaf.

**Table 4.1 (a): List of schemes with total monthly production and estimated UAW**

Plant Name	Production (Ml/month)	Estimated NRW	% of Total District NRW
Vryheid Klipfontein / Bloemveld	373.0	71%	20.1%
Coronation	39.1	47%	2.1%
Hlobane	12.2	59%	0.7%
Paulpietersburg – eDumbe	82.5	63%	4.5%
Louwsburg	12.3	11%	0.7%
Mpungamhlope	39.5	78%	2.1%
eMakhosini	8.5	43%	0.5%
Babanango	13.6	53%	0.7%
Mandlakazi	29.5	94%	1.6%
Enyokeni Royal Palace	0.9	65%	0.1%
Kombuzi	1.9	0%	0%
Nongoma	156.4	78%	8.4%
Ophuzane	13.1	57%	0.7%
Tholakela	8.5	38%	0.5%
Mangosuthu	32.3	10%	1.7%
eMondlo	39.0	12%	2.1%
Msibi	10.1	23%	0.5%
Nkonsentsha	1.2	50%	0.1%
Belgrade	23.8	67%	1.3%
Khiphunyawo	12.0	66%	0.6%
Khambi Village	8.6	80%	0.5%
Mountain View	2.5	98%	0.1%
Osingisingini	1.7	50%	0.1%
Ceza	3.4	50%	0.1%
Sidinsi	6.0	11%	0.3%
Ulundi – Nkonjeni	623.0	79%	33.6%
Pongola Town/ Simdlangentsha East	228.8	59%	12.4%
Spekboom	30.3	44%	1.6%
Khangela Royal Palace	0.3	29%	0.1%
Mvuzini	15.3	54%	0.8%
Nkonjeni Hospital	4.6	47%	0.2%
Itshelejuba Hospital	5.1	53%	0.3%
Thulasizwe Hospital	2.6	9%	0.1%
Masokaneni	0.0	0%	0.0%
Purim	10.4	22%	0.6%
	<b>1 852</b>	<b>43%</b>	<b>100%</b>

## 5.2 Status of the ZDM NRW programme

To date the ZDM has established a dedicated NRW team for North and South comprising the following:

### North

- DD WSP (North)

### South

- DD WSP (South)
- 1 x NRW technician
- 1 x Water inspector
- Reaction Team: 1 x plumber + 1 handyman + 1 labourer

The programme is focused on a number of key interventions as follows:

- Ensuring that adequate measures are implemented at a planning stage to facilitate the ongoing management of NRW including zone determination, meter sizing / specification and positioning etc;
- Compiling a comprehensive infrastructure database to facilitate NRW management;
- Datalogging of flow profiles;
- Meter zone identification;
- Pressure management;
- NRW management training;
- Installation of GSM dataloggers at key locations;
- Leak detection and repair – linked to customer service centre; and
- Establishment of a web based management system linked to Siza/Manzi.

The ZDM has also procured the services of a specialist NRW service provider to assist in capacitating the ZDM NRW team and to establish a NRW management system.

Progress to date may be summarised as follows:

### Nkonjeni RWSS/Ulundi

- Survey of metering and pressure control infrastructure;
- Logging water meters within rural and urban areas and identification of areas of high night flows;
- Identify metering zones/districts;
- Set up NRW management systems;
- Procure additional loggers;
- Implement NRW training; and
- Compile infrastructure records.

### **Frischgewaagd**

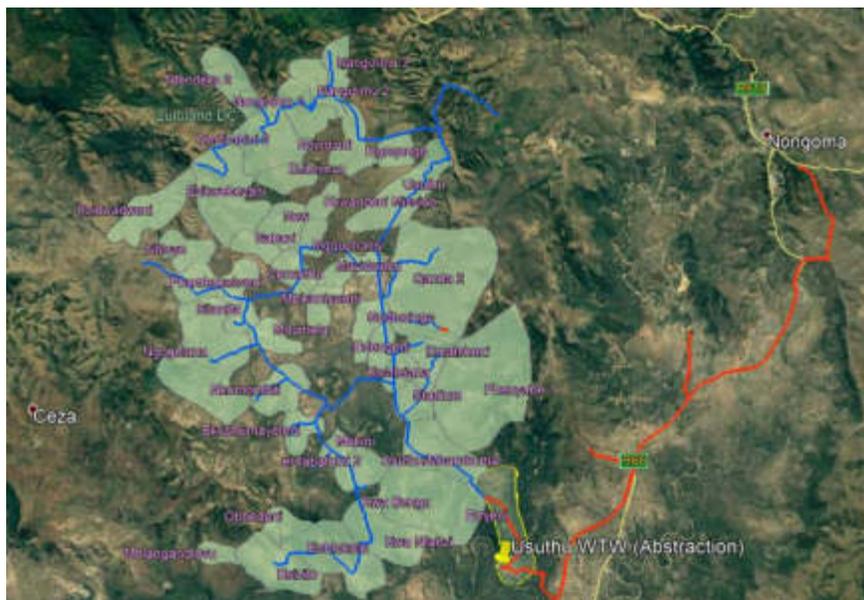
The networks at the township of Frischgewaagd were refurbished during 2007 to manage water losses, but no funding was available to install individual household connections. The township was divided into six supply zones and water is restricted per zone. This creates social problems as the usage per household cannot be controlled and if individuals waste water the entire zone is penalized. Water consumption per zone was measured during this period (2007/2008), just after the reticulation networks were refurbished. The initial daily consumption was between 650 and 750 kl/day for a period of 24 hours. Due to financial constraints at the time, it was decided to install **unmetered** yard connections at Frischgewaagd Township. Over time the home owners connected the new yard connection to their old internal plumbing systems without disconnecting their internal system from the old network, causing water losses.

During February 2012 loggers were re-installed and measurements taken. Early indications are that water is released to the township for 12 hours per day at a consumption of 780 kl/day (12 hours). This indicates that severe losses were present.

It is suggested that unmetered yard connections should be upgraded to metered yard connections to determine accurate water usage per reticulation zone. The home owners should be made aware of losses and loss management and should be restricted to free basic water, with an option to apply for a larger allocation of water (and be billed for it). Metered yard connections are being installed at Mangosuthu and were programmed to supply 200l/hh/day without any social issues.

### **USUTHU REGIONAL SCHEME WATERLOSS PROGRAMME**

From the knowledge and outcomes gained from the above pilot projects, ZDM has recently embarked on the first full-scale Waterloss Management Programme on the Usuthu Regional Water Supply Scheme.



The goals of this programme will be to:

1. Establish and maintain the integrity of water zones and districts for the entire water supply system.
2. Monitor the level of NRW continuously for each district and zone.
3. Reduce and maintain the level of NRW to acceptable standards and benchmarks using best management practices.
4. Implement a consumer meter management programme.
5. Implement a pressure management programme.
6. Implement a pipeline maintenance and replacement programme.
7. Implement efficient water effluent management systems.
8. Install meters to all existing consumer connections.

The programme is currently being implemented and the expected deliverables are as follows:

DELIVERABLE	CAPACITY BUILDING APPROACH
1. WLM Action Plan	The WLM Action Plan will contain activities that will be prioritised for a period of 5 years. ZDM staff can use the plan to budget and execute prioritised WLM projects systematically
2. Signed Funding Agreement	ZDM staff will be exposed to the extracting of data, analysing data and preparing a financial model and business plan to apply for funding. This can be used as template for additional funding applications.
3. 10% NRW reduction by 30 June 2020	ZDM staff will be closely involved with the implementation of the first WLM project so that a similar approach can be followed with subsequent projects.
4. Trained O&M teams with adequate budget, staff, resources and systems	The capacity building approach will be to achieve the objective of this phase namely to ensure that the staff in the department responsible for operations and maintenance of the water services system are adequately trained and the department has the required budget, staff, resources and systems in place in order to deliver an efficient service to the community.

The outcomes and lessons learnt from this programme will be used to lead the way in rolling out the ZDM Waterloss Management Programme to all the other regional water supply schemes.

### 5.3 Water Demand Management Interventions

ZDM is in the process of finalising a Water Demand Management Strategy (WDMS), in conjunction with the NRW programme.

Excessive water usage in many areas is putting the bulk infrastructure under immense pressure and upgrading will soon become necessary unless this can be postponed through effective demand management interventions.

The roll-out of new infrastructure to communities without services is of highest priority and leaves the ZDM with very little available capital for upgrading of existing services. Promoting more efficient usage of water can therefore have a significant impact in relieving this pressure with relatively low capital input.

The water demand strategy will focus on a number of ways to ensure the reduction of water demand by consumers, for example:

- **Influencing the behaviour of consumers**
  - School and public educational and awareness programmes aimed at promoting effective usage of water (brochures, advertising, newsletters, demonstrations, exhibits, informative billing, etc)
  - Water services tariff that promotes efficient water usage
  - Any other “win-win” initiatives that could influence consumers positively
  
- **Specific targeted projects like;**
  - Repair plumbing leaks inside properties
  - Installation of water flow control devices, etc.

ZDM by-laws have also been promulgated in 2008 and these assist the municipality to effectively regulate water usage in the district.

To date the WDMS has largely been driven at project level by the ISD service providers and at a political level by councillors. Part of the Usuthu Regional Scheme Waterloss Management Programme will be to lead the way in establishing effective water demand management.