

WATER DEMAND MANAGEMENT AND WATER CONSERVATION STRATEGY (WC/WDM) FOR MONTAGU, ROBERTSON, McGREGOR, ASHTON & BONNIEVALE IN LANGEBERG LOCAL MUNICIPALITY

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Prepared for:



Langeberg Municipality
Izak van der Westhuizen
Director Engineering Services

Robertson
52 Church Street
6705

Tel: (023) 614 8000
ivdwest@langeberg.gov.za

Prepared by :



WRP Engineers
Mr Niel Meyer

PO Box 1522
Brooklyn Square
Pretoria
0075

Tel: (012) 346 3496
nielm@wrp.co.za

EXECUTIVE SUMMARY

BACKGROUND and OBJECTIVES

The Langeberg Municipality appointed WorleyParsons with WRP Engineers and GLS Consulting to prepare a water demand management and water conservation strategy (WC/WDM) for the towns of Robertson, Montagu, Ashton, Bonnievale and McGregor.

The primary objectives of the study can be summarised as:

- Quantifying the existing water losses and determining if the water losses are excessive or not;
- Determining the main water loss contributors;
- Providing recommendations in the form of a strategy on the how the water losses can be reduced and how the efficient use of water can be improved.

CONCLUSIONS

- The water losses vary from town to town and can be basically be grouped as low losses in Robertson, medium in Montagu and McGregor and relatively high in Ashton and Bonnievale.
- The non-revenue water as a percentage of the system input volume varied from good in Robertson (15%) to fairly high in Bonnievale (37%). The NRW for all towns are however either in line or lower than the South African average of 35%.
- The Infrastructure Leakage Index (ILI) is a dimensionless indicator that is used to rate the physical leakage in a reticulation system. The ILI varied from low in Robertson (2.1) to relatively high in Bonnievale (7.1). The average ILI for 62 suppliers in South Africa was 7.6.
- The system input volume per capita varied from average in Robertson (215litre/capita/day) to high in Bonnievale (468litre/capita/day). If the water usage from top consumers are however excluded (Industrial, commercial and large public buildings using $\geq 20\text{kl/d}$) the input volume per capita is reduced to 167litre/capita/day in Robertson and 322litre/capita/day in Bonnievale.
- The system input volume per connection varied from 27l/connection/month in McGregor to 69kl/connection/month in Bonnievale
- Bulk metering is generally in good order and bulk meters are read monthly. Some additional bulk meters can be installed at reservoir outlets and zone inlets to assist with monitoring water demand and losses.
- The individual water reticulation systems have already been sectorised into water management zones. Zones have not yet been checked for discreteness.
- The scope for further pressure management was evaluated by GLS Consulting as part of this study. Seven possible areas were identified. Further analysis will however be required to determine the exact scope, potential cost and viability for pressure management implementation in each of the areas. If found to be feasible, pressure management should be implemented in selected areas in future.
- Consumer metering seems generally in good order, most properties are metered and readings are

obtained monthly. A few metering problems were however identified during a sample meter audit and it's recommended to undertake a full meter audit in all towns.

SUMMARY of WC/WDM STRATEGY

The water demand management strategy is summarised below. It should be noted that the costs quoted in this section are based on rough estimates for 2014 and excludes VAT.

Summary of Water Demand Management Strategy for Langeberg Local Municipality

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
1	Water Audit	Update water balance annually.	Water Balance can be undertaken by the Municipality.	1	None
2	Pressurised System	None	None	n/a	None
3 & 4	Consumer Metering	A complete meter audit should be undertaken in all towns. Subsequently all illegible/broken meters should be replaced. Any un-metered stand identified should be metered. All meter readings in the billing system should be updated. As part of the audit all meter boxes should also be cleaned.	Meter audit and cleaning of meter boxes at approximately 18 000 stands. (18 000 x R400 = R720 000). Budget to replace illegible/broken meters: To be determined after the meter audit.	1	Additional metered consumption if all meter boxes are cleaned, broken meters replaced and accurate readings obtained: 5% improvement in billed consumption: 280 000kl/a
5	Effective and Informative Billing System	- The Langeberg Municipality may consider to alert consumers of possible leaks on their properties. For instance if the consumption for a particular month is >20% than the average consumption of the previous months the consumer may be alerted of a possible leak on the property. - The Langeberg Municipality may also consider adding a graph of the previous 12 months' consumption and helpful hints on effective water usage on the monthly bills.	Cost to enhance the user friendliness of the municipal bill: Estimate R60 000	3	Difficult to estimate what the impact will be but in long term it will be to the benefit of the municipality and consumers.
6 & 7	Complaints System	The municipality should continually ensure that consumers are familiar with the telephone numbers to lodge complaints/ report leaks – this can be linked to awareness campaign on water conservation.	None	n/a	None
8	Asset Register	The total value of water infrastructure in the asset register is too low. The asset register should be checked to ensure that all network items are listed and that items are corrected priced.	Undertaken by Municipality or service provider that prepared the asset register	n/a	None
9	Asset Management: Capital Works	The Langeberg Municipality should continue to allocate budget for the upgrading/ replacement of water infrastructure in Langeberg – as they have done over the last number of years.	None	n/a	None

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
10	Asset Management: O&M	The O&M Budget allocated to repairs and maintenance should be increased to address amongst other tasks the following: Replacement of malfunctioning and old consumer meters, clearing of meter boxes, buying replacement mechanisms for bulk meters, speedy repair of leaks, leak detection in areas with higher than expected night flows.	To be determined by the municipality.	2	Difficult to estimate what the impact will be but in long term it will be to the benefit of the municipality.
11	Dedicated WC/WDM Support	For a start Langeberg Municipality should allocate at least 1 person to head WC/WDM. The number of people involved with WC/WDM can later be increased as and when required.	The municipality may be able to use one of their existing staff members. If a new person has to be appointed the municipality can determine the costs involved with such an appointment.	1	No direct saving – but seen as crucial for effective WC/WDM program.
12	Active Leakage Control	According to the municipality, and the based on observations by the project team there is currently minimal visible leakage on the water network. In the night flow analysis some zone were identified with higher than expected leakage. - Robertson Res 1 - Nkqubela Res - Bonnievalie New Reservoir East It was not possible to measure night flows in Zolani in Ashton - and it's possible that this area will also have excess night flow.	R200 000 to undertake leak detection/inspections in zones with high excess night flows. Budget to repair any leaks identified will be determined after the inspection. R100 000/year for annual visual leak inspections.	2	Estimate 1% of Input Volume = 80 000kl/a
13	Sectorising	The individual water reticulation systems have already been sectorised. Zones have not yet been checked for discreteness. During the logging exercise the following zone interconnections were discovered: - The outlet of Nkqubela Res in Robertson is connected to the outlet of the Nkqubela Pumpstation. - There seems to be link between the 1 outlet (currently closed) at the George Brink Res in Montagu and the Kanonkop Res Zone. - The zone boundary between George Brink Res zone and Kanonkop Res Zone is different to shown on drawings. - The night flow in Robertson Res 1 was very high while the night flow in Res 3 in Robertson was very low and the night flow for Res 2 could not be measured. It should be investigated if there are possible interconnections between these zones.	A budget should be allocated to investigate and resolve the zone interconnections listed and any other connections that the operational staff suspect. Difficult to price such investigations. Possible budget: R200 000.	3	No direct saving – but zone discreteness will assist the municipality to measure zonal usage and losses more accurately.
14	Bulk Metering	No additional meters required at this stage.	none	n/a	none

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
15	Zone Meter Management	- Install bulk meters at locations identified in this study. Montagu (x4), McGregor (X2), Ashton (x4), Bonnievale (x2), Robertson (x5). - Record bulk meter readings monthly for all bulk meters not only for meters at the treatment plants. - Keep stock of meter inserts at depot so that meters can be replaced as soon as the municipality becomes aware of a faulty meter.	Installation of complete new bulk meter with isolating valves and strainers, housed in a brick chamber. Assumed meter installation cost of R40 000. (R40 000 x 19 = R760 000) Replace/repair broken meters: R40 000 Minimum night flows should be measured and analysed annually. Permanent loggers can be considered at critical meters. Allow R200 000 for general logging/ logging equipment.	2	No direct saving – but accurate bulk metering and monitoring of night flows will assist the municipality to monitor usage and losses more accurately.
16	Pressure Management	The existing Robertson PRV should be serviced and set. This PRV is not currently working. The scope for further pressure management was evaluated by GLS Consulting as part of this study. Further analysis will however be required to determine the exact scope, potential cost and viability for pressure management implementation in each of the areas. A total of 7 possible areas were identified. If found to be feasible, pressure management should be implemented in selected areas.	Service and set PRV at Robertson: R6000 Budget for detailed analysis to determine exact scope for pressure management: R200 000 Budget to implement pressure management: To be determined as part of the detailed analysis.	2	Potential saving from implementing pressure management in 7 identified areas: 5% of input volume = 380 000kl/a
17	As-Build Drawings	No Tasks	None	n/a	None
18	Schematic layouts	Schematic layouts have been prepared for Langeberg Municipality (Annexure A).	None	n/a	None
19	Regulation of water fittings	The municipality should add a section on authorised fittings in the water bylaws. The use of authorised fittings should then be enforced.	Can be undertaken by municipality or by consultant updating the water by-laws.	3	Difficult to estimate what the impact will be but in long term it will be to the benefit of the municipality.
	By-laws	The municipality should update their water bylaws to address water conservation. These by-laws should then be enforced.	Can be undertaken by municipality or by consultant updating the water by-laws.	3	Difficult to estimate what the impact will be but is expected to make consumers more aware.

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
20	Tariffs	It is recommended that the municipality adopt a block tariff system. Such a rising block tariff can be phased in over a number of years. The actual charges per block should be determined in a separate study. Example: 0-6kl, 7to12kl, 13-18kl, 19-25kl, 25-30kl, 31-42kl, 43-72kl, 72+kl. The benefit of adding categories in the block tariff system is that the municipality will be able to generate additional income through consumers with excessive consumption but that consumers will also become more aware of managing and reducing their own water consumption.	The cost for a study to determine the best suited block tariff system for Langeberg: Estimate R80 000	1	Reduce Consumption 1% of potable Input Volume = 50 000kl/a
21	Technical Support to Consumers	Once a dedicated person has been allocated to WC/WDM it is recommended to engage with large customers and to identify areas where the municipality can provide assistance. Such support can include but not be limited to: checking that large consumers are correctly metered and billed, providing tips on water conservation and water conservation, informing consumers of any sudden change in consumption patterns, arranging for leakage inspections in public buildings.	None additional – pending on the appointment of a dedicated person for WC/WDM.	2	Difficult to estimate what the impact will be but is expected to make consumers more aware.
22	Removal of illegal connections	According to the Langeberg Municipality there are few un-metered or un-authorised connections that they are aware of.	None	n/a	None
23	Community Awareness on WDM	It is estimated that R60 000/ year should be allocated for water conservation awareness activities and material to be included with monthly water bills.	R60 000/yr	2	Minor direct impact on consumption but seen as crucial part of overall WC/WDM program.
24	Schools Education on WDM	Once a year a schools education programme on water conservation should be undertaken. The municipality should assist the school with the monitoring (water audit) of their water consumption.	R40 000/yr	2	Minor direct impact on consumption but seen as crucial part of overall WC/WDM program.
25	Retrofit internal plumbing leaks	An exercise could be initiated to check for visual leakage at public buildings and households using more than 60kl/month. Where possible the municipality can assist these properties to repair visual leaks and to inform the consumers to repair such leaks in future. Special focus on indigent consumers.	R100 000 for ongoing exercise to repair leakages at properties using in excess of 60kl/month. EPWP funding can possibly be used.	2	Estimate 0.4% of Input Volume in Bonnievale and Ashton = 30 000kl/a

TOTAL			Once of costs: R2.6 mil Annual Costs for ongoing tasks: R200 000/a		Improvement in billing: 280 000kl/a Water Savings: 490 000kl/a Reduction in Consumption: 50 000kl/a
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Priority: 1- high priority, 2 – medium priority, 3 – Lower priority

GLOSSARY OF TERMS

DWA	:	Department of Water Affairs
ILI	:	Infrastructure Leakage Index
IWA	:	International Water Association
kl	:	kiloliter = cubic meter = m^3 = 1000 litre
lpcpd	:	litre per capita per day
m	:	meter (10 meter water pressure = 1 bar)
m^3	:	cubic meter = kilolitre = kl
MNF	:	Minimum Night Flow
MI	:	Megalitre = 1000 kilolitre = 1000 m^3
PRV	:	Pressure Reducing Valve
NRW	:	Non-Revenue Water
SABS	:	South African Bureau of Standards
UAW	:	Un-accounted-for Water
WDM	:	Water Demand Management
WSDP	:	Water Services Development Plan
WRC	:	Water Research Commission of South Africa

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1 INTRODUCTION

1.1 PROJECT BACKGROUND AND OBJECTIVES

The Langeberg Municipality appointed WorleyParsons with WRP Engineers and GLS Consulting to prepare a water demand management and water conservation strategy (WC/WDM) for the towns of Robertson, Montagu, Ashton, Bonnievale and McGregor.

The primary objectives of the study can be summarised as:

- Quantifying the existing water losses and determining if the water losses are excessive or not;
- Determining the main water loss contributors;
- Providing recommendations in the form of a strategy on the how the water losses can be reduced and how the efficient use of water can be improved.

1.2 PROJECT AREA

Montagu, Robertson, McGregor, Ashton and Bonnievale are five towns in the Langeberg Municipality situated in the Western Cape Province (See **Figure 1** for locality map).

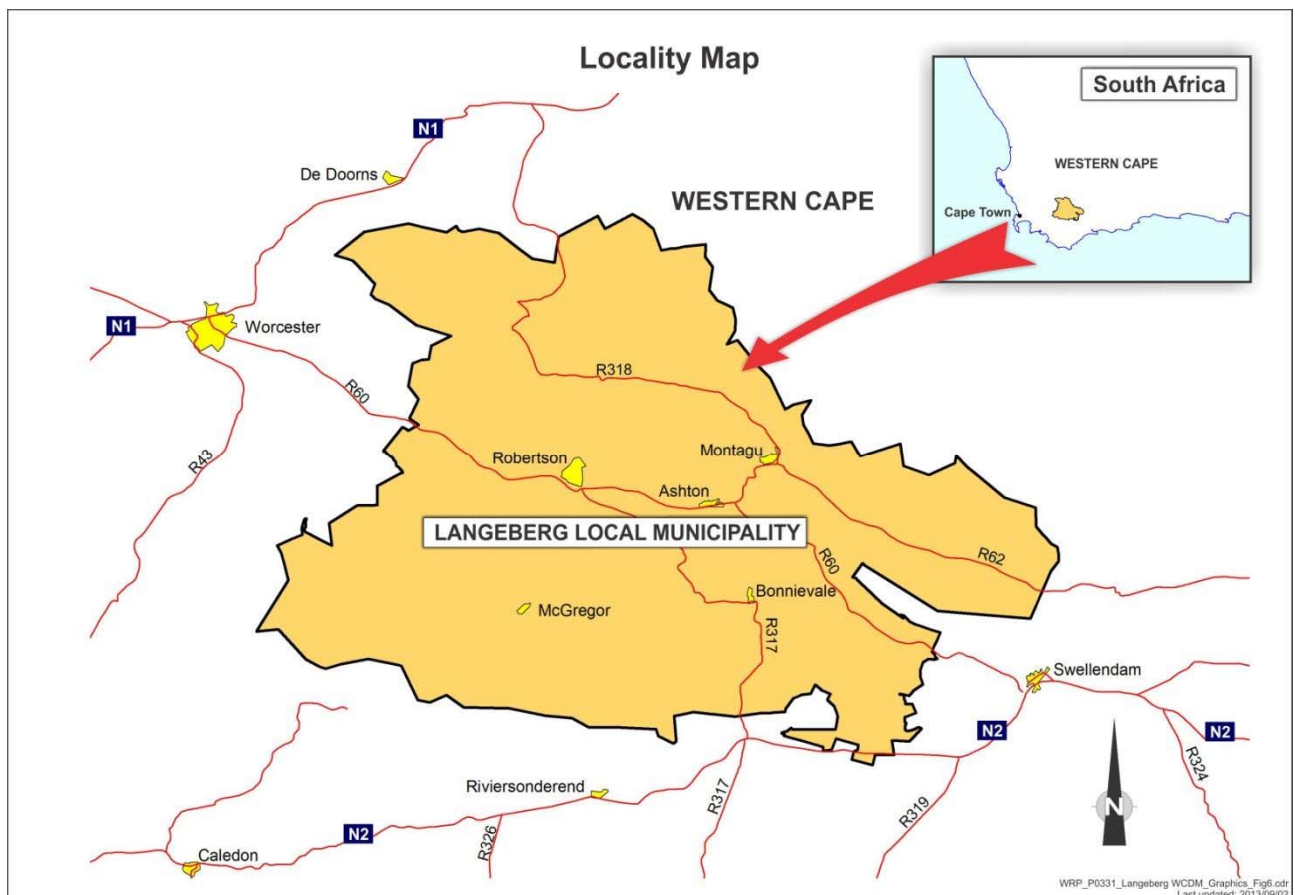


Figure 1: Locality Map.

1.3 TASK DESCRIPTIONS

The following tasks were undertaken as part of the study:

- Task 1: Data Collection and Desktop study
- Task 2: Field Investigations
- Task 3: Data Logging
- Task 4: Analysis of Data
- Task 5: Development of Water Demand Management and Water Conservation Strategy

Each task is discussed in the remainder of this report.

2 TASK 1: DATA COLLECTION AND DESKTOP STUDY

General information regarding the number households, population and length of mains for Montagu, Robertson, McGregor, Ashton and Bonnievale are summarised in **Table 1** and **Table 2**.

Table 1: General Information per Town (2013)

	Number of stands from GIS ^[1]	Length of Mains (km) ^[1]	Number of Households from Census 2011 ^[2]	Average Population Density ^[2]	Population, 2012 ^[2]
Ashton	2 962	61.5	3 357	4.5	13 592
Bonnievale	1 934	50.0	2 377	4.7	9 365
McGregor	815	13.2	654	3.8	3 219
Montagu	3 801	72.3	4 029	4.0	15 783
Robertson	6 169	92.6	7 525	4.5	28 407

Notes:

- 1- Obtained from GLS Consulting, Sep 2013. Only formal stands included.
- 2- Population and households obtained from WorleyParsons, based on Census 2011. Average population density calculated using population and number of stands.

Table 2: General Information per Zone (2013)

Zone	Average pressure from hydraulic model (m) ^[1]	Length of mains (km) ^[1]	Number of stands in GIS ^[1]	Approximate Population Density ^[2]	Estimate Population ^[2]
Ashton					
Cogmanskloof	58	21.1	970	4.0	3880
Conradiedorp	54	10.5	440	4.0	1760
Conradiedorp PRV	69	8.6	135	4.0	540
Zolani	59	18.1	1415	5.2	7412
Sub-total Ashton		58.3	2 960		13 592
Bonnievale					

New reservoir	64	22.9	1400	4.8	6776
Old reservoirs	65	27.0	535	4.8	2589
Sub-total Bonnievale		50.0	1935		9365
McGregor					
McGregor	36	13.2	815	4.0	3219
Sub-total McGregor		13.2	815		3219
Montagu					
Ashbury Lower	37	18.3	1570	4.3	6815
Ashbury Upper	14	0.2	0	4.3	0
Badshoogte	29	3.7	225	3.5	788
George Brink	37	19.2	625	3.5	2188
Kanonkop	47	7.2	480	4.3	2084
Kanonkop booster	84	2.1	260	4.3	1129
Qui Sana	24	0.3	1	2.5	3
South	58	9.5	320	4.3	1389
West	63	6.9	320	4.3	1389
Sub-total Montagu		67.4	3801		15783
Robertson					
Reservoir 1	58	44.8	2110	4.0	8440
Reservoir 1 PRV	58	1.5	450	4.0	1800
Reservoir 2	43	23.3	1790	4.5	8055
Reservoir 3	59	10.7	1110	4.5	4995
Reservoir 4	38	12.2	710	7.2	5117
Sub-total Robertson		92.6	6170		28407

Notes:

- 1- Obtained from GLS Consulting, Sep 2013. Minor differences in total properties and length of mains between Table 1 and 2 are due to some pipes and stands not being inside a specific zone.
- 2- Population density estimated per zone using the average density per town as a guideline, as shown in **Table 1**. Approximate population per zone calculated using number of stands per zone and approximate density.

Schematic layouts summarising each of the water supply systems are shown in **Annexure A**. Bulk Meter and PRV locations are also indicated on the schematics.

3 TASK 2: FIELD INVESTIGATIONS

Information presented in this section was obtained by the project team during field investigations undertaken in November 2013.

3.1.1 Visual Leakage

A few visual leaks were located - as summarised below in **Table 3**.

Table 3: Visual Leaks located by Project Team during logging exercise.



Ashton – Mains leak in unnamed street next to Ashton Police Station.



Ashton – Rooiwalde airvalve leaking, located near Rooiwalde bulk meter



Robertson - Nkqubela PS – Leak on control valve circuit



Montagu – Leak on airvalve located at Badshoogte PS, near Ashbury LL Reservoir



Montagu - Badshoogte Reservoir Outlet / Inlet leaking

3.1.2 Bulk Water Meters

As part of the field investigations all bulk meters were visited and assessed. Summary of bulk meters shown in **Table 4**.

Table 4: Summary of bulk water meters for Montagu, Robertson, McGregor, Ashton and Bonnievale

No	Location	Supply	Meter Exist?	Meter Working?	Meter Logged?
Montagu					
1	Inlet of Montagu Water Purification Works	Water Purification Works	Yes	Yes	No
2	Outlet of Water Purification Works	All of Montagu	Yes	Yes	No
3	Outlet of Water Purification Works	Montagu South PS	Yes	Yes	No
4	Outlet of Water Purification Works	George Brink PS	Yes	Yes	No
5	Outlet of Water Purification Works	Ashbury PS	Yes	Yes	No
6	Outlet of Montagu South (2.0MI) Reservoir	Montagu South Zone	Yes	Yes	Yes
7	Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	George Brink Zone, Kanonkop (0.2MI) Reservoir & Kanonkop Zone & Kanonkop Booster Zone	Yes	Yes	Yes
8	Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	Outlet currently isolated.	No	-	Ultrasonic Logging
9	Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	George Brink Zone, Montagu West (0.15MI) Reservoir & Montagu West Zone	Yes	Yes	Yes
10	Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	George Brink Zone, Kanonkop (0.2MI) Reservoir & Kanonkop Zone & Kanonkop Booster Zone	Yes	Yes	Yes
11	Montagu West PS	Montagu West Reservoir	Yes	Yes	Yes
12	Outlet of Montagu West (0.15MI) Reservoir	Montagu West Zone	No	-	-
13	George Brink PS	Kanonkop Reservoir	No	-	-
14	Outlet of Kanonkop (0.2MI) Reservoir	Kanonkop Booster Zone and Kanonkop Zone	No	-	
15	Outlet of Ashbury Upper (2MI) Reservoir	Ashbury Lower Reservoir	No	-	-
16	Outlet of Ashbury Lower (1.5MI) Reservoir	Ashbury Zone, Badshoogte (0.2MI) Reservoir, Badshoogte Zone, Qui Sana (0.5MI) Reservoir & Qui Sana Zone	No	-	Ultrasonic Flow Logging
17	Ashbury – Badshoogte PS	Badshoogte (0.2MI) Reservoir	Yes	Yes	Yes
18	Outlet of Badshoogte (0.2MI) Reservoir	Badshoogte Zone, Qui Sana (0.5MI) Reservoir & Qui Sana Zone	No	-	Ultrasonic Logging
Robertson					
19	Inlet of Robertson Water Purification Works from Hoopsriver	Water Purification Works	Yes	Yes	No
20	Inlet of Robertson Water Purification Works from Koos Kok	Water Purification Works	Yes	Yes	No
21	Inlet of Robertson Water Purification Works from Dassieshoek	Water Purification Works	Yes	Yes	No
22	Inlet of Robertson Water Purification Works	All Inlet to Water Purification Works	Yes	Yes	No

No	Location	Supply	Meter Exist?	Meter Working?	Meter Logged?
23	Outlet of Robertson (6.75MI) Reservoir 1 towards Reservoir 1 Zone	Robertson Reservoir 1 Zone, Reservoir 1 PRV Zone, Nkqubela Booster Zone, Nkqubela (0.7MI) Reservoir & Nkqubela Reservoir Zone	Yes	Yes	Yes
24	Outlet of Robertson (6.75MI) Reservoir 1 towards Reservoir 2	Robertson (2.25MI) Reservoir 2, Reservoir 2 Zone, Robertson (2.0MI) Reservoir 3, Reservoir 3 Zone	Yes	Yes	No
25	Nkqubela PS	Nkqubela (0.7MI) Reservoir & Booster Zone	No	-	-
26	Outlet of Nkqubela (0.7MI) Reservoir	Nkqubela Reservoir Zone	No	-	Ultrasonic Logging
27	Outlet of Reservoir 2 (2.25MI)	Reservoir 2 Zone, Robertson (2.0MI) Reservoir 3	No	-	-
28	Outlet of Robertson (2.0MI) Reservoir 3	Reservoir 3 Zone	No	-	Ultrasonic Logging
McGregor					
29	Inlet of McGregor Water Purification Works	Water Treatment Works	Yes	Yes	No
30	Outlet of Water Purification Works	All of McGregor	Yes	Yes	No
31	Outlet of McGregor Reservoir 2	McGregor Reservoir Zone	Yes	Yes	Yes
32	Outlet of McGregor (0.45MI) Reservoir 3	McGregor Reservoir Zone	No	-	Ultrasonic Logging
33	Outlet of McGregor (0.45MI) Reservoir 3	McGregor Booster Zone	No	-	-
Ashton					
34	Inlet of Ashton Water Purification Works	Water Treatment Works	Yes	Yes	No
35	Outlet of Water Purification Works towards Langeberg Factories	Langeberg Factories	Yes	Yes	No
36	Outlet of Water Purification Works towards Cogmanskloof Reservoir 1 & 2	All of Ashton	Yes	Yes	No
37	Outlet of Ashton Cogmanskloof (2.2MI) Reservoir 1	All of Ashton	Yes	No	Ultrasonic Logging
38	Outlet of Ashton Cogmanskloof (2.2MI) Reservoir 2	All of Ashton	No	-	Ultrasonic Flow Logging
39	Cogmanskloof PS	Ashton Conradiedorp (2.4MI) Reservoir	Yes	No	No
40	Outlet of Ashton Conradiedorp (2.4MI) Reservoir towards Conradiedorp PRV	Conradiedorp Zone, Conradie (Rooiwal) Zone, Conradiedorp PRV Zone & Zolani (2.1MI) Reservoir	No	No	No
41	Outlet of Ashton Conradiedorp (2.4MI) Reservoir towards Rooiwal	Conradiedorp (Rooiwal) Zone	Yes	No	No
42	Inlet of Conradiedorp PRV Zone	Conradiedorp PRV Zone, Zolani (2.1MI) Reservoir & Zolani Zone	No	-	Ultrasonic Logging
43	Zolani PS	Zolani (2.1MI) Reservoir & Zolani Zone	Yes	Yes	Yes

No	Location	Supply	Meter Exist?	Meter Working?	Meter Logged?
44	Outlet of Zolani (2.1Ml) Reservoir	Zolani Zone	No	-	-
Bonnievale					
45	Inlet of Bonnievale Water Purification Works	Water Treatment Works	No	-	-
46	Outlet of Water Purification Works	All of Bonnievale	Yes	Yes	No
47	Inlet of New Reservoir Zone East	New Reservoir Zone East	No	-	Ultrasonic Logging
48	Inlet of New Reservoir Zone West	New Reservoir Zone West	No	-	Ultrasonic Logging
49	Outlet of New Reservoir	New Reservoir Zone	No	-	-
50	Outlet of Old Large Reservoir (0.75Ml) and Old Small Reservoir (0.227Ml)	Old Reservoir Zone	No	-	-

3.1.3 Sample Consumer Meter Inspection

As part of the billing data assessment (undertaken by GLS Consulting, Sep 3013) some potential metering anomalies/problems were identified. During the field investigations a small sample of stands with potential metering anomalies were briefly inspected, as well as a sample of large consumer meters. In total 112 meter were checked. The results from these investigations are summarised in **Table 5**. Detailed information on the meter investigations are included in **Annexure F**.

Table 5: Summary of Sample Consumer Meter Inspection

	Ashton	Bonnievale	Montagu	McGregor	Robertson
Tot stands flagged with <0.1kl/d demand	513	82	176	32	222
Developed stands checked	10	4	7	6	8
Stands with no apparent meter problem - conventional meter	3	1	0	4	5
Pre-paid meter	2	0	0	0	0
Stands where meters were covered with soil	3	2	5	1	3
Stands where meters could not be located	2	1	2	1	0
ToT Stands flagged as no water meter	317	109	82	29	190
Stands Checked	8	5	9	7	9
Prepaid Meters	4	0	0	0	0

	Ashton	Bonnievale	Montagu	McGregor	Robertson
Vacant Stands	2	0	4	2	1
Stands with no apparent meter problem - conventional meter	1	2	4	5	5
Developed stands where no meter could be located	1	1	1	0	3
Stands where meters were covered with soil	0	1	0	0	0
Stands where meter should be replaced	0	1	0	0	0
Tot Large Water Users	8	5	10	6	20
Stands Checked	6	2	10	6	15
Stands with no apparent meter problem	2	2	5	1	12
No meters located or no access	3	0	3	3	1
Stands where meter should be replaced	1	0	2	2	2

Based on the outcome of the sample consumer meter inspection the following conclusions are drawn:

- Consumer metering seems generally in good order.
- A few meter problems / anomalies were picked up and a recommendation will be made to undertake a complete meter audit for all towns.
- Problems identified mainly comprised:
 - o Meter not located. This could be due to meters that don't exist or meters that are difficult to locate.
 - o Access to properties. Some properties were locked and access to the meters could not be obtained. It is possible that meter readers face the same problem and that actual readings at these properties are not regularly obtained (only estimates).
 - o Meter buried under soil. A few meters check were covered with varying thickness of soil which indicates that these meters were not read recently.
 - o Meter illegible. A small number of meters checked were illegible (algae or damaged meter register). It is not possible to obtain accurate readings at such a meter and these meters should be replaced.

4 TASK 3: LOGGING OF PRESSURES AND FLOWS

4.1 BACKGROUND TO LOGGING

One of the useful tools that can be used to gain information on the system operation is logging of pressures and flows in selected points throughout the network. A logger is an electronic device that can be programmed to record flow on a bulk meter or pressure on a fire hydrant or tap. (**Figure 2 and Figure 3**) The logger can be programmed to save the flow and pressure data for any required interval (i.e. every 1 sec, 1 min, 15 min etc.) Once the required logging period has ended the data on the logger can be downloaded onto a computer for viewing and analysis.

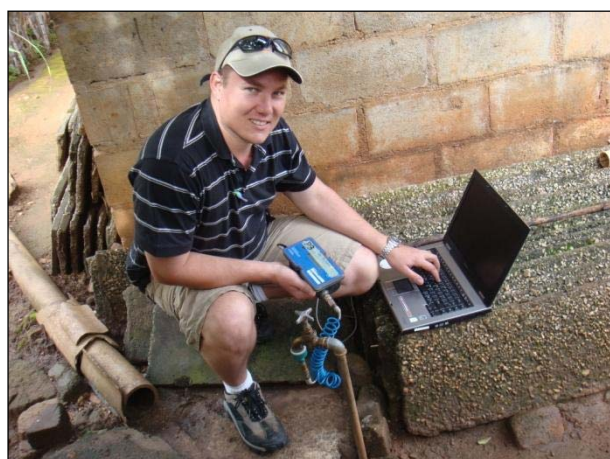


Figure 2: Example of pressure logging.



Figure 3: Example of flow logging.

4.2 RESULTS OF LOGGING EXERCISE

Flow and pressure logging was undertaken in November 2013. The flow logging results are summarised in **Table 6**. Flow logging included ultrasonic logging at 12 locations where bulk meters don't currently exist or where meters were not operational. Graphs are shown in **Annexure B**.

Table 6: Summary of flow logging results in Langeberg Municipality (Nov 2013).

Meters	Meter Size	Meter Make	Meter Model	Minimum Night Flow (m ³ /h)	Average Daily Flow (m ³ /h)	Maximum Flow (m ³ /h)
Montagu						
Outlet of Montagu South (2.0MI) Reservoir	200	Sensus	WPD	3.0	22.1	48.2
Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	150	Sensus	WPD	0.5	13.3	37.9
Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	No Meter	-	-	-	-5.0	-15.8
Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	100	Sensus	WPD	3.4	13.5	23.1
Outlet of George Brink 1 (1.5MI) & 2 (2.5MI) Reservoirs	150	Sensus	WPD	11.4	63.1	177.1

Combined NETT Outlet of George Brink 1 Reservoir	-	-	-	16.7	25.3	38.6
Combined Total Outlet of George Brink 1 Reservoir	-	-	-	16.7	90.1	234.9
Montagu West PS	50	Sensus	WPD	0	6.6	10.6
Outlet of Ashbury Lower (1.5MI) Reservoir	No Meter	-	-	17.8	61.8	138.4
NETT Outlet of Ashbury Lower (1.5MI) Reservoir to Ashbury Zone	No Meter	-	-	17.2	42.2	89.6
Ashbury – Badshoogte PS	150	Sensus	WPD	0	22.5	52.9
Outlet of Badshoogte (0.2MI) Reservoir	No Meter	-	-	6.7	12.4	36.0
Robertson						
Outlet of Robertson (6.75MI) Reservoir 1 towards Reservoir 1 Zone	?	Flowmetrix	SAFMAG	71.7	219.3	398.6
Outlet of Nkqubela (0.7MI) Reservoir	-	-	-	22.2	17.3	22.2
Outlet of Robertson (2.0MI) Reservoir 3	-	-	-	4.7	33.1	70.3
McGregor						
NETT Flow to McGregor Res Zone (Res 2 + Res 3 Outlet)	-	-	-	0	18.6	35.0
Ashton						
Outlet of Ashton Cogmanskloof (2.2MI) Reservoir 1 & 2	?	?	?	13.4	40.1	70.2
Inlet of Conradiedorp PRV Zone	-	-	-	11.5	43.0	126.0
Zolani PS	200?	Endress & Hauser	Promag 50	0	38.4	130.6
Bonnievale						
Inlet of New Reservoir Zone East	-	-	-	27.1	44.6	68.9
Inlet of New Reservoir Zone West	-	-	-	10.7	37.5	67.1
Total Flow to New Reservoir Zone	-	-	-	39.1	82.1	132.0

Based on the flow logging results the following conclusions are drawn:</

Table 7: Summary of pressure logging results (Nov 2013)

Logging Points	Approximate Elevation (m) *	Expected Maximum Pressure (m) #	Minimum Logged Pressure (m)	Average Logged Pressure (m)	Maximum Logged Pressure (m)
Montagu					
Montagu South Reservoir CP Pressure	256	37	35	45	50
Montagu West Reservoir CP Pressure	258	44	-	38 **	-
George Brink Reservoir CP Pressure	232	30	26	32	34
George Brink Reservoir AZP Pressure	238	24	26	30	32
Kanonkop Reservoir CP Pressure	262	32	-	32 **	-
Kanonkop Booster CP Pressure	292	??	-	11 **	-
Ashbury LL Reservoir CP Pressure	265	23	20	25	27
Ashbury LL Reservoir AZP Pressure	246	42	38	43	47
Badshoogte Reservoir CP Pressure	291	21	23	27	32
Robertson					
Reservoir 1 CP Pressure	199	16	22	39	48
Reservoir 1 AZP Pressure	188	27	38	54	62
Reservoir 1 PRV D/S Pressure	174	41	40	61	74
Reservoir 3 CP Pressure	262	35	32	39	40
Reservoir 3 AZP Pressure	251	46	20	50	54
Nkqubela Reservoir CP Pressure	223	5	-	5 **	-
McGregor					
Reservoir 2 & 3 CP Pressure	244	34	18	30	34
Reservoir 3 Booster CP Pressure	257	??	26	30	32
Ashton					
Cogmanskloof Reservoir CP Pressure	202	40	38	41	42
Cogmanskloof Reservoir AZP Pressure	187	55	52	57	60
Conradiedorp Reservoir CP Pressure	231	31 (Not incl booster)	30	37	48
Conradiedorp PRV D/S Pressure	2				

5 TASK 4: ANALYSIS

5.1.1 Billing Data Analysis (GLS Consulting)

GLS Consulting analysed the billing data obtained from the municipality and prepared a number of tables and maps. Some of the outputs from GLS are included in **Annexure D**.

Key outcomes from the GLS assessment includes:

- One of the large water users in the billing system is shown to be the Zolani Pump Station. The Langeberg Municipality should ensure that the pumpstation is removed from the billing data. For the calculations in this report the Zolani Pump Station Meter was not treated as a consumer meter.
- A meter at the Bonnievale water treatment work (for chorine application) is also listed as a top consumer using 42kl/d. This meter should also be removed from the billing system. For the calculations in this report the Bonnievale WTP chorine meter was not treated as a consumer meter.
- 1028 properties had recorded water use of less than 0.1kl/d.
- 727 developed stands could not be linked to a water meter. Some of these properties may have a pre-paid meters, some may not be metered and at others the meter location and details may have to be verified in a detailed meter audit.

5.2 WATER BALANCE

One of the most important steps in a WC/WDM assessment is to prepare a water balance of the water supplied versus the water consumed. In the past the general water balance approach by water suppliers involved taking the total water supplied into a system and subtracting the authorised use in order to establish the total losses which were usually termed to be the Unaccounted-for-Water (UAW / UFW). As can be seen in **Figure 4** the UAW is a collective term covering a multitude of different losses including both real losses and apparent losses (meter problems, billing errors etc.). The problem, however, with the UAW is that it can easily be manipulated if the water supplier assumes unrealistic high water usage for any un-metered consumption such as mains flushing and firefighting etc. This will then result in calculating an unrealistic low UAW. For this reason the International Water Association (IWA) has recommended that the UAW should rather be replaced with the term “Non-Revenue Water”. By definition the term “Non-Revenue Water” includes all water supplied for which the Municipality does not generate income.

Note:

In some low income areas in South Africa there are un-metered yard connections and community standpipes and often the consumers using these connections are not billed for water use. Generally, for this scenario, it will be assumed that the water use must be categorised as unbilled and un-metered. It should, however, be taken into account that these consumers are entitled to free basic water (6kl/household/month). It can be argued that the municipality can never reduce the free basic water to these consumers and, therefore, the free basic water component should actually not be categorised as non-revenue water.

In order to carry out a meaningful Water Balance for any water supply system, it is necessary to use standard terminology that has been approved and accepted internationally. In this regard, the terminology used is based on the International Water Association (IWA) guidelines which are accepted and used throughout the world. The basic layout of the standard water balance is shown in **Figure 4**. (Based on IWA Report 'Performance Indicators for Water Supply Systems', July 2000).

The water supplier should aim to complete Level A and Level C (see **Figure 4** for self-explanatory guidelines). Level B can be calculated from the values entered in Level C. Once every block in Level A to C is completed the Revenue Water and Non-Revenue Water can be calculated (Level D). Water Balance software packages are available to assist water suppliers with these calculations – this is discussed later on. One of the additional benefits of completing such an audit is that it forces the municipality to list all the components of water use and often problem issues are highlighted such as un-metered parks or illegal connections.

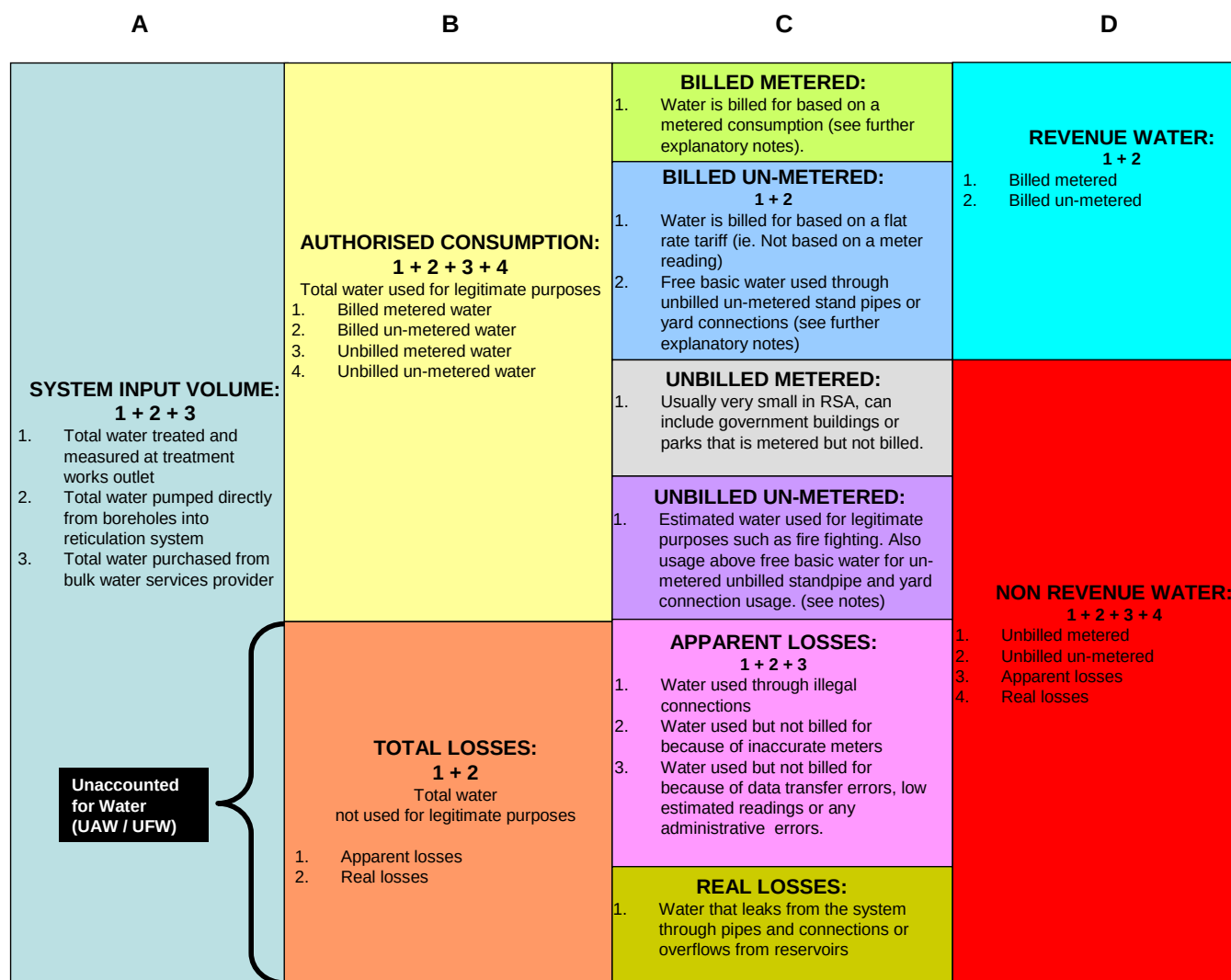


Figure 4: Standard IWA Water Balance (Adapted by WRP)

The water balance was completed for Langeberg using the information presented in this report. The results are summarised in **Table 8**.

Table 8: Summary of input parameters and water balance results

Description	Units	Ashton	Bonnievale	McGregor	Montagu	Robertson
Length of mains #	km	61.5	50	13.2	72.3	92.6
Formal Properties #	no.	2962	1934	815	3801	6169
Total connections #	no.	2962	1934	815	3801	6169
Density of service connections	conns/km	48	39	62	53	67
Average operating pressure #	m	59	65	36	46	52
% Time that the system is pressurised	%	100	100	100	100	100
Population served by the system ##	no.	13592	9365	3219	15783	28407
Total potable water system input volume ##	m ³ /yr	2 121 840	1 600 230	263 809	1 422 639	2 231 038
Metered Consumption #	m ³ /yr	1 433 061	1 015 255	200 993	1 136 983	1 896 690
Billed Un-metered (Informal Area)	m ³ /yr	0	0	0	0	0
Revenue Water	m ³ /yr	1 433 061	1 015 255	200 993	1 136 983	1 896 690
Un-billed Un-Metered **	m ³ /yr	0	20 166	0	0	20 075
Un-billed Metered	m ³ /yr	0	0	0	0	0
Total Water Consumption (Revenue Water + Un-billed un-metered)	m ³ /yr	1 433 061	1 035 421	200 993	1 136 983	1 916 765
Non-Revenue Water	m ³ /yr	688 779	584 975	62 816	285 656	334 348
Unit consumption (Using Input Volume)	l/capita/day	428	468	225	247	215
Unit consumption (Using Input Volume) - EXCLUDING TOP WATER USERS 20kl/d	l/capita/day	186	322	225	212	167
Unit consumption (Using Total Consumption)	l/capita/day	289	303	171	197	185
Avg System input volume per						

Table 9: Summarised explanation for using performance indicators (More detailed explanation provided in Annexure E)

Indicator	Guideline
Non –revenue Water as percentage of input volume	A good target percentage for Non-revenue Water is usually 20% or less. This is based on experience in other areas in SA and not on a report. In Annexure C it is shown that this PI should be used with caution – as percentage can sometimes be misleading.
Infrastructure Leakage Index (ILI)	In a study by the WRC (An assessment of Non-Revenue Water in South Africa) the average ILI for the 62 water suppliers in SA was 7.6 and an ILI value of 4 and lower was categorised as acceptable. This does not necessarily mean that if the ILI is lower than 4 that water demand management is not required. (The higher the ILI value the higher the leakage in an area)
System input volume per unit (connection) supplied	In the WRC report (An assessment of Non-Revenue Water in South Africa) this PI was calculated for 62 water suppliers in South Africa and the following two guidelines were stated as benchmarks: - 12 kilolitres per connection per month in low income areas where people are not paying for water – using system input volume. - 35 kilolitres per connection per month in medium to high income areas where people are paying for water – using system input volume.
Avg Billed consumption per connection supplied	The billed consumption per connection is simply the total billed consumption divided by the total number of connections.

The following conclusions are based on the interpretation of these indicators for Langeberg:

- The water losses vary from town to town and can be basically be grouped as low losses in Robertson, medium in Montagu and McGregor and relatively high in Ashton and Bonnievale.
- The non-revenue water as a percentage of the system input volume varied from good in Robertson (15%) to fairly high in Bonnievale (37%). The NRW for all towns are however either in line or lower than the South African average of 35%.
- The Infrastructure Leakage Index (ILI) is a dimensionless indicator that is used to rate the physical leakage in a reticulation system. The ILI varied from low in Robertson (2.1) to relatively high in Bonnievale (7.1). The average ILI for 62 suppliers in South Africa was 7.6.
- The system input volume per capita varied from average in Robertson (215litre/capita/day) to high in Bonnievale (468litre/capita/day). If the water usage from top consumers are however excluded (Industrial, commercial and large public buildings using $\geq 20\text{kl/d}$) the input volume per capita is reduced to 167litre/capita/day in Robertson and 322litre/capita/day in Bonnievale.
- The system input volume per connection varied from 27l/connection/month in McGregor to 69kl/connection/month in Bonnievale.

5.3 MINIMUM NIGHT FLOW ANALYSIS (MNF ANALYSIS)

The Minimum Night Flow (MNF) is the lowest flow entering a water supply area during a 24-hour period and usually occurs sometime between midnight and 04:00 when the consumption in the network is at its lowest (because most people are asleep then). Example of an MNF is shown in **Figure 5**.

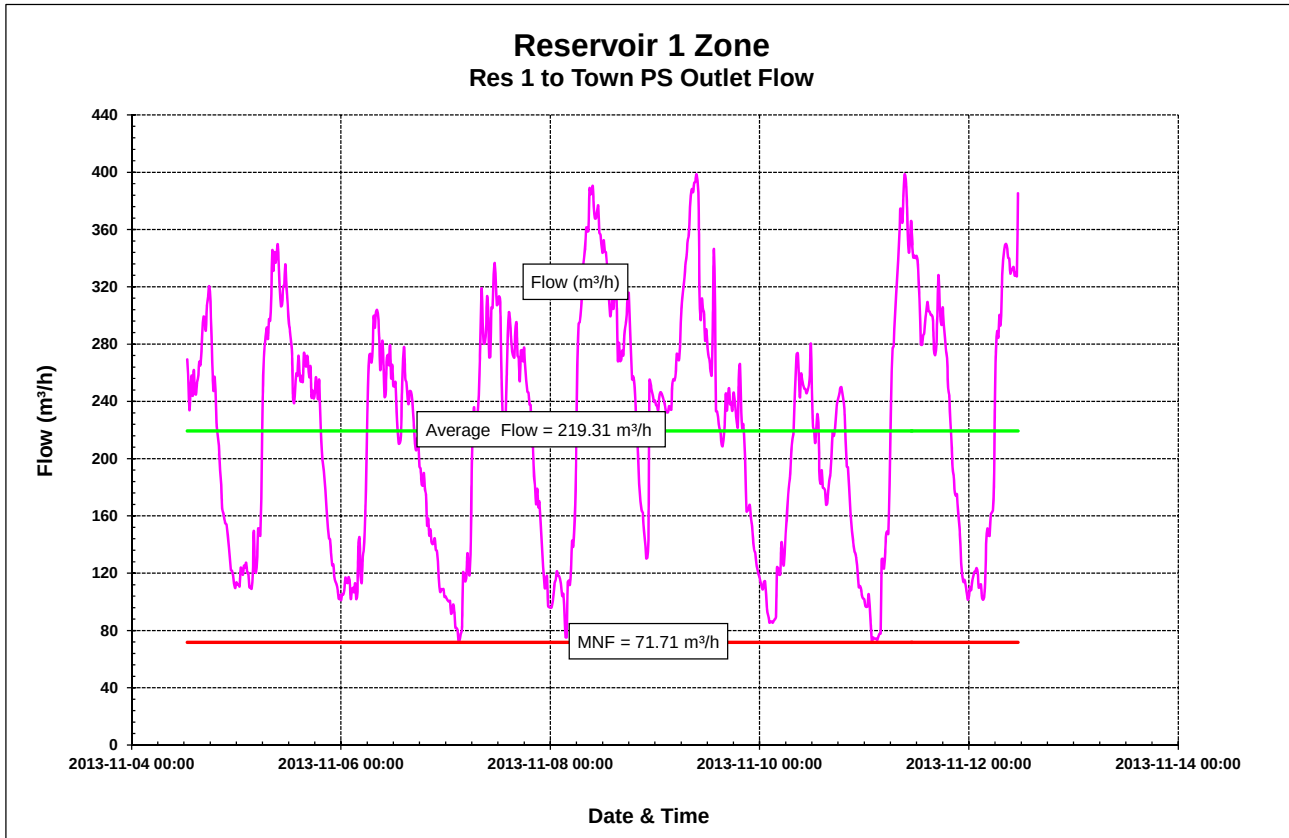


Figure 5: Minimum Night Flow (MNF) example from Langeberg

In this task the minimum night flows from Nov 2013 were analysed using the **SANFLOW** software. SANFLOW is a useful tool to determine the theoretical minimum night flow (MNF) for an area and to compare it to the actual measured MNF. The difference between the theoretical and actual MNF is called “Excess night flow” and gives a good estimate of the physical water leakage in an area. The higher the excess flow the higher the expected water leakage.

The results are based on the following assumptions, which are considered to be conservative:

- 10 litre toilet cisterns for all households with toilets (households with waterborne sewerage);
- Of households with waterborne sewerage, 6% population active during the hour of MNF;
- No industrial consumers that use water during hour of MNF.

The results from the night flow analyses is summarised in **Table 10**. Not all zones are listed below and only zones at which flow logging was possible are included.

Table 10: Results of Minimum Night Flow (MNF) Analyses

Zone Name	Length of mains (km)	Stands	Population	Average Night Zone Pressure (m)	Logged Minimum Night Flow (m³/h)	Estimate Backgr Losses (m³/h)	Estimate Normal Night Use (m³/h)	Expected Night Flow (m³/h)	Excess Night Flow (m³/h)
					(1)			(2)	(1)– (2)
Ashton									
Cogmanskloof	21.1	970	3880	60	13.4	6.2	2.3	8.5	4.9
Conradiedorp PRV	8.6	135	540	40	11.5	0.6	0.3	1.0	10.6
Bonnievale									
New Res West	13.7	840	4066	50	10.7	3.9	2.4	6.4	4.4
New Res East	9.2	560	2710	70	27.1	4.3	1.6	6.0	21.2
McGregor									
Reservoir Zone	10.5	652	2575	36	0	1.9	1.5	3.4	0.0
Montagu									
Montagu South	9.5	320	1389	60	3	2.2	0.8	3.0	0.0
George Brink	19.2	625	2188	36	16.7	4.3	1.3	5.6	11.1
Ashbury Lower	18.3	1570	6815	47	17.2	6.4	4.1	10.5	6.7
Badshoogte	3.7	225	788	35	6.7	0.6	0.5	1.1	5.6
Robertson									
Reservoir 1 incl PRV Zone	46.4	2560	10240	62	71.7	16.7	6.1	22.8	48.9
Reservoir 3	10.7	1110	4995	54	4.7	5.5	3.0	8.5	0.0
Reservoir 4	12.2	710	5117	30	22.2	1.6	3.1	4.6	17.6

The excess night flow varied from zero in some zones such as McGregor and Montagu South, medium in some zones such as George Brink in Montagu and Conradiedorp PRV in Ashton, and high for Robertson Res 1, Nkqubela Res in Robertson and Bonnievale New Res East.

For most of the zones analysed, except Res 1 and Nkqubela in Robertson the level of excess night flows ties in with the level of NRW for the town. For Res 1 and Nkqubela in Robertson the excess night flows are high even though the NRW for Robertson is the lowest of all towns in Langeberg. The reason for this anomaly is not known and further investigations will be required to verify the cause of the high night flows.

The MNF could not be measured in Zolani in Ashton. It's possible that the excess night flow in this zone will also be high.

5.4 PRESSURE MANAGEMENT POTENTIAL

The scope for further pressure management was evaluated by GLS Consulting (see **Table 11**). Further analysis will however be required to determine the exact scope, potential cost and viability for pressure management implementation in each of these areas.

Table 11: Zones with possible pressure management potential (GLS Consulting January 2014)

Zone	AADD (kl/d)	Average pressure (m)	Pressure management potential	Length of mains (km)	Number of stands in GIS	Pressure Management Possibility
Ashton						
Cogmanskloof	3 138	58	Yes	21.1	970	New PRV and medium upgrades to existing network required.
Conradiedorp	337	54	Yes	10.5	440	New PRV and medium upgrades to existing network required.
Zolani	857	59	Yes	18.1	1415	New PRV and medium upgrades to existing network required.
Bonnievale						
New reservoir	1 273	64	Yes	22.9	1400	Two potential new PRV zones. New PRV's and medium upgrades to existing network required.
Montagu						
South	405	58	Yes	9.5	320	New PRV and medium upgrades to existing network required.
Robertson						
Reservoir 1 PRV	51	58	Existing	1.5	450	Service and Commission Existing PRV
Reservoir 2	1 029	43	Yes	23.3	1790	New PRV and minimal upgrades to existing network required.
Reservoir 3	582	59	Yes	10.7	1110	New PRV and minimal upgrades to existing network required.

5.5 THEORETICAL MAXIMUM SCOPE FOR SAVINGS THROUGH WC/WDM

5.5.1 Calculation of Theoretical Maximum Scope for physical water savings through WC/WDM

The theoretical scope for water savings was roughly estimated using 2 different methods:

Method 1 – using unavoidable annual real loss (UARL):

- System input volume minus authorised consumption is equal to the total loss. The total loss consist of real loss and apparent loss. It was assumed that real loss vary between 70% and 80% of the total loss – as shown in **Table 8**.
- The unavoidable annual real loss (UARL) was calculated per town based on a theoretical formula developed through the burst and background leakage research. The UARL is seen as a theoretical minimum level of physical leakage in any reticulation system. $UARL (kl/day) = [(18litre \text{ per km pipe }) + (0.8litre \text{ per connection})] * pressure / 1000$. It was assumed that the real loss could possibly be reduced to a level double that of the calculated UARL. This meant that the theoretical water savings achievable = Real Loss – (2 x UARL).

Method 2 –using minimum night flows:

- In Robertson the NRW was low (15%), which meant based on method 1 (indicated above) very little savings would theoretically be possible. The night flows in Robertson were however high, which normally is an indication of high leakage levels. In method 2 it was proposed that the excess night flows could be halved. Night flow analysis results including excess night flows were shown in **Table 10**. In method 2 the theoretical water savings achievable was estimated as: Excess night flow /2.

Table 12: Theoretical scope for physical water savings

	Ashton	Bonnievale	McGregor	Montagu	Robertson
Method 1 Theoretical scope for water savings – using UARL x 2 (m ³ /year)	200 000	150 000	20 000	60 000	14 000
Method 2 Theoretical scope for water savings – using night flows /2 (m ³ /year)	56 000 based on night flows only recorded for 60% of town	90 000 based on night flows only recorded for 60% of town	0	85 000 based on night flows only recorded for 60% of town	200 000 based on night flows recorded for 80% of town
Combination of Method 1 and 2 Theoretical maximum scope for water savings (m ³ /year)	200 000	150 000	20 000	100 000	200 000

The figures shown in **Table 12** indicates the theoretical scope for physical water savings through WC/WDM. The actual savings achievable will depend on the effort, time and budget allocated to WC/WDM. The figures shown above can be deducted in annual increments (over a 5yr or 10yr period) from the future water supply projection volumes for each town to create a theoretical WC/WDM water demand scenario for each town.

5.5.2 Potential to reduce NRW through WC/WDM

The highest potential to reduce NRW is in Ashton and Bonnievale where the NRW was 32% and 37% respectively. The target should be to reduce the NRW in Ashton and Bonnievale to the same levels as the other three towns: McGregor(24%), Montagu(20%), Robertson(15%).

5.5.3 Potential to reduce per capita usage through WC/WDM

Per capita consumption in all towns are not excessive, especially if the water usage from top consumers are excluded (Industrial, commercial and large public buildings using >20kl/d). In this regard the potential to reduce per capita usage is seen as moderate.

The WC/WDM Strategy provided in the next section is aimed at assisting the municipality to reduce water losses and water demand.

6 TASK 5: WATER CONSERVATION AND WATER DEMAND MANAGEMENT STRATEGY

A basic scorecard (shown in **Table 13**) was used to assess the potential for WC/WDM efforts in Langeberg. The aim of the scorecard was to establish areas where the municipality has made good progress in relation to WC/WDM and where there is still room for improvement.

Table 13: Summary of WC/WDM Scorecard for Langeberg

Item No.	Description	Max Points	Score
1	Development of Standard Water Balance	4	3
2	Pressurised Supply to all consumers 100% of time	4	4
3	Consumer Metering System: Residential	4	3
4	Consumer Metering System: Commercial & Industrial	4	4
5	Effective Billing System including Informative Billing	4	2
6	Network Complaints System	4	4
7	Billing & Metering Complaints System	4	4
8	Asset Register for Water Reticulation System	4	3
9	Asset Management - Capital Works	4	4
10	Asset Management - Operations and Maintenance	4	2
11	Dedicated WDM Support	4	0
12	Active Leakage Control	4	2
13	Effective Sectorisation	4	3
14	Effective Bulk Meter Management	4	4
15	Effective Zone Meter Management	4	2
16	Pressure Management	4	1
17	As-Built Drawings of Bulk and Reticulation Infrastructure	4	4
18	Schematic Layout of Water Networks	4	4
19	Regulation of Water Fittings and By-Laws that relate to Water Conservation	4	2
20	Tariffs	4	2
21	Technical Support to Customers	4	1
22	Removal of un-authorized connections	4	3
23	Community Awareness and Education Programmes	4	1
24	Schools Awareness and Education Programmes	4	1
25	Retrofit Internal Plumbing in Public Buildings & Indigent Properties	4	1
Totals		100	64

It can be seen in **Table 13** that there are 25 questions each of which carries a maximum of 4 points providing a possible maximum score of 100. If the Municipality has the specific item completely under control, it receives the maximum points and if it is neglecting the item completely it receives no points. There are various levels between the maximum and minimum number of points assigned to the municipality for each item depending on the level of completeness or lack thereof. From **Table 13** it can be seen that the scorecard suggests a total score of **64 out of a possible 100** suggesting that the Langeberg Municipality have made some progress but that there is room for improvement in the implementation of WC/WDM. (A copy of the complete scorecard is shown in **Annexure C**). The water demand management / water conservation strategy is discussed in the remainder of this section.

6.1 ITEM 1: DEVELOPMENT OF A STANDARD WATER BALANCE (3 POINTS)

Introduction
The development of a standard water balance based on the International Water Association (IWA) methodology is considered as one of the most important actions that all water utilities must undertake in order to establish the levels of water loss and non-revenue water in their supply systems.
Situation in Langeberg
An updated water balance per town was prepared as part of this study. The Non-Revenue Water (NRW) for 2012/2013 varied between 15% and 37% for the individual towns. The ILI varied from 2 to 7. The results indicate that the leakage levels are fairly low in some towns but more significant in others.
Recommendations and Strategy
Recommendations are provided in this report on how NRW can be reduced.
Additional Funding and Budget Requirements
None. The Water Balance can be updated annually by the municipality.
Scorecard Results
3 out of 4 - Indicating that a water balance has been prepared and that the losses are low in some towns but more significant in others.

6.2 ITEM 2: PRESSURISED SYSTEM AT ALL TIMES (4 POINTS)

Introduction
All water utilities must aim to keep their reticulation systems pressurised 100% of the time as any level of intermittent supply can lead to serious health problems as well as causing damage to the reticulation system.
Situation in Langeberg
In Langeberg the water reticulation networks remains pressurised most of the time.
Recommendations and Strategy
None
Funding and Budget Requirements
None
Scorecard Results
4 out of 4 - Indicating that the system remains pressurised most of the time at a minimum pressure of at least 20m.

6.3 ITEM 3 AND 4: CONSUMER METERING (3 POINTS)

Introduction
All water utilities must aim to properly meter and bill all consumers. It is important that systems are in place to undertake monthly meter reading and billing with the necessary back-up customer complaint services.
Situation in Langeberg
Most connections are metered with very few un-metered connections. Meter readings are obtained on a monthly basis. Consumer meter ages vary from 10 to 30 years. Billing data can be extracted per town. Through the assessment of billing data undertaken by GLS Consulting a few metering anomalies were identified. These included: • 1028 properties had recorded water use of less than 0.1kl/d over the last year. • 727 developed stands could not be linked to a water meter. Some of these properties may have pre-paid meters, some may not be metered and at others the meter location and details may have to be verified.

- Stands for which consumption drastically increased or reduced over last 3 months were also identified.

A sample of meters were inspected as part of the field investigations. These investigations confirmed that metering is generally in good order but a few problems were identified which included: meters covered with soil, meters not located, no access to meter, meters illegible.

Recommendations and Strategy

A complete meter audit should be undertaken in all towns. All illegible/broken/old meters should be replaced. Any unmetered stand identified should be metered and meter readings in the billing system should be updated where required. As part of the audit all meter boxes should also be cleaned.

Funding and Budget Requirements

Meter audit and cleaning of meter boxes at approximately 18 000 stands. (18 000 x R400 = R720 000)

Budget to replace illegible/broken meters: To be determined after the meter audit.

Scorecard Results

3 out of 4 - Indicating that consumer metering is generally in good order. A few metering anomalies were identified and as a result a complete meter audit is recommended.

6.4 ITEM 5: EFFECTIVE AND INFORMATIVE BILLING SYSTEM (2 POINTS)

Introduction

An effective and informative billing system is used to help consumers understand how much water they are using and how their water bill is made up. It is usually very helpful in explaining how the block-tariffs are applied to each customer so that they can see exactly what they pay for water in each block. This in turn will encourage many customers to reduce their water use and in this regard, such informative billing becomes another WDM intervention.

Situation in Langeberg

The current bill is reasonably clear and easy to understand – see example below.

DATUM	VERW	BESONDERHEDE	BTW	BEDRAG
24/05/13	141029b	BALANS OORGEERING		432.42
09/06/13	202676	KWITTANSIE		-432.42
		WATER	30.01	244.42
	TAR:1001	8375 - 8328 = 47 Kl 25 DAYS (29/04/2013-24/05/2013)		
		BASIES: = 50.76		
		4.93 Kl @ 0.0000 = 0		
		42.07 Kl @ 3.8900 = 163.65		
09/06/13	1550	RIOOL	14.36	116.96
09/06/13	1600	VULLIS	10.88	88.64

Recommendations and Strategy

- The Langeberg Municipality may consider to alert consumers of possible leaks on their properties. For instance if the consumption for a particular month is >20% than the average consumption of the previous months the consumer may be alerted of a possible leak on the property.
- The Langeberg Municipality may also consider adding a graph of the previous 12 months' consumption and helpful hints on effective water usage on the monthly bills.
- The number to report leakages should also be visible on the account.

Funding and Budget Requirements

Cost to enhance the user friendliness of the municipal bill: Estimate R60 000

Scorecard Results

2 out of 4 - Indicating that there is scope to make the water bills more informative.

6.5 ITEM 6 AND 7: GENERAL COMPLAINTS SYSTEM (4 POINTS)

Introduction

Every municipality should have a complaints system where consumers can lodge technical or billing complaints and where water leaks can be reported. Residents should be encouraged to report any leaks they find. This is one of the

key elements of an efficient WC/WDM strategy since most leaks repaired in South Africa result from such Passive Leakage Control and not Active Leakage Control.
Situation in Langeberg General billing/technical complaints can be lodged telephonically at the municipality during all hours. According to the municipality most consumers are familiar with the phone numbers to report water problems.
Recommendations and Strategy The municipality should continually ensure that all consumers are familiar with the telephone numbers to lodge complaints and report leaks. One suggestion would be to include these numbers on the monthly water bill.
Additional Funding and Budget Requirements No additional budget requirement.
Scorecard Results 4 out of 4 - Indicating that general complaints can be lodged telephonically at the municipality and that most reported problems are apparently resolved within reasonable time.

6.6 ITEM 8: ASSET REGISTER FOR WATER INFRASTRUCTURE (3 POINTS)

Introduction It is essential for all water utilities to establish a proper asset register as a pre-requisite to some form of asset management programme. Unless a proper asset register has been developed, the water utility cannot allocate the appropriate maintenance budget to ensure that the water reticulation system is kept in good condition.
Situation in Langeberg An asset register is available for Langeberg Municipality. The total replacement value of the water infrastructure in the asset register is however too low. Condition assessment results are also included in the asset register. Asset condition varied from very good to poor for the various water infrastructure components (6% fair, 81% good or very good, 14% poor or very poor).
Recommendations and Strategy The water infrastructure in the asset register should be checked to ensure that all network items are listed and that items are corrected priced. The total replacement value in the asset register should be reviewed.
Additional Funding and Budget Requirements None.
Scorecard Results 3 out of 4 - Indicating that an Asset Register is in place and that conditional assessment has been undertaken. The total replacement value in the asset register should however be reviewed.

6.7 ITEM 9: ASSET MANAGEMENT – CAPITAL WORKS PROJECTS (4 POINTS)

Introduction Water utilities should allocate a budget of approximately 2% of the total asset value per annum to undertake replacement of existing infrastructure. The 2% is calculated based on an approximate design life of 50 years for the different infrastructure components. If components of the system has a design life of 100 years then at least 1% of the asset value should be spend annually on replacing those components of the system. It is important to differentiate between budget allocated to maintenance of the water infrastructure and budget for the replacement of the infrastructure.
Situation in Langeberg The following capital budgets were allocated to water infrastructure replacement/refurbishment over the last 3 years. 2010/11 – R11.9 mil

2011/12 – R3.5 mil

2011/13 – R8.5mil

The annual capital expenditure over the last 3 years on water infrastructure upgrades/replacement has been in the order of 2% of the replacement value.

Recommendations and Strategy

The Langeberg Municipality should continue to allocate budget for the upgrading/ replacement of water infrastructure in Langeberg.

Additional Funding and Budget Requirements

None additional. The Langeberg Municipality should continue to allocate budget for the upgrading/ replacement of water infrastructure in Langeberg.

Scorecard Results

4 out of 4 - Indicating that sufficient budget is allocated annually for the upgrading/replacement of water infrastructure.

6.8 ITEM 10: ASSET MANAGEMENT, OPERATIONS & MAINTENANCE (2 POINTS)

Introduction

Lack of maintenance of water infrastructure is one of the key problems facing most municipalities in South Africa. It is important for a water utility to differentiate between budget allocated to maintenance of the water infrastructure and budget for the replacement of infrastructure. In the case of operations and maintenance of the system, a budget of approximately 1% to 2% of the value of the system is typically required to ensure that the system remains in good condition.

(The 1%-2% guideline is based on discussions with technical staff from some municipalities and will obviously vary from area to area. Very few municipalities in South Africa spend enough on operations and maintenance and as a result, there is a serious backlog of maintenance developing in many areas - and the problem continues to grow with each year that insufficient maintenance budget is allocated to the water infrastructure.)

Situation in Langeberg Municipality

The O&M budget for water infrastructure for the last 3 years is summarised below. The O&M Budget allocated to repairs and maintenance could be higher if the extent of the water networks are taken into account.

Category	Actual 10/11	Actual 11/12	Actual 12/13
Salaries, Wages and Allowances	R 6 042 927	R 6 840 828	R 7 505 319
General Expenditure	R 13 660 241	R 16 674 849	R 16 430 471
Repairs and Maintenance	R 1 356 244	R 1 813 695	R 1 815 909
Capital Costs	R 880 257	R 642 715	R 587 181
Contribution to Capital Expenditure	R 14 557	R 17 562	R 29 024
Contribution to Funds	R 892 023	R 888 632	R 1 512 746
Bulk Purchases	R 2 232 890	R 2 759 252	R 3 000 805
TOTAL	R 25 079 139	R 29 637 534	R 30 881 455

Recommendations and Strategy

The O&M Budget allocated to repairs and maintenance seems a bit low and additional budget should be allocated to address amongst other tasks the following: Replacement of malfunctioning and old consumer meters, clearing of meter boxes, buying replacement mechanisms for bulk meters, speedy repair of leaks, leak detection in areas with higher than expected night flows etc.

Additional Funding and Budget Requirements

Additional budget should be allocated to the repairs and maintenance budget in Langeberg. The additional budget should be determined by the municipality.

Scorecard Results

2 out of 4 - Indicating that budget is allowed for O&M but that the allocation for repair and maintenance could be higher.

6.9 ITEM 11: DEDICATED WC/WDM SUPPORT (0 POINTS)**Introduction**

Municipalities should have a dedicated section that deals with water demand management (WDM and water conservation (WC) initiatives.

Situation in Langeberg

Langeberg Municipality does not currently have staff dedicated to WC/WDM.

Recommendations and Strategy

For a start Langeberg Municipality should allocate at least 1 person to head WC/WDM. The number of people involved with WC/WDM can later be increased as and when required.

Funding and Budget Requirements

The municipality may be able to use one of their existing staff members. If a new person has to be appointed the municipality can determine the costs involved with such an appointment.

Scorecard Results

0 out of 4 – Indicating that Langeberg Municipality does not currently have staff dedicated to WC/WDM.

6.10 ITEM 12: ACTIVE LEAKAGE CONTROL (2 POINTS)**Introduction**

Active Leakage Control involves sending teams out to search for unreported leaks as opposed to Passive Leakage Control which involves relying on residents to report leaks.

Situation in Langeberg

According to the municipality, and the based on observations by the project team there is currently minimal visible leakage on the water network. A few visual leaks were however identified as shown in Section 3.1.1.

In the night flow analysis some zone were identified with higher than expected leakage.

To date active leakage control has not been undertaken.

Recommendations and Strategy

Leak detection should be undertaken in the following zones where higher than expected night flows were measured:

1. Robertson Res 1
2. Nkqubela Res
3. Bonnievale New Reservoir East

It was not possible to measure night flows in Zolani in Ashton - and it's possible that this area will also have excess night flow.

Funding and Budget Requirements

R200 000 to undertake leak detection in zones with high excess night flows. In addition allocate approximately R100 000/year for general visual leak inspections.

Scorecard Results

2 out of 4 – To date active leakage control has not been undertaken. Physical leakage is however not high in most zones but there is scope for leak investigations in selected zones.

6.11 ITEM 13: SECTORISATION OF RETICULATION SYSTEM (3 POINTS)

Introduction

In order to manage a large water reticulation system it is necessary to split the system into smaller zones which can then be monitored individually in order to identify and localise key problem areas. This process is called Sectorisation and is one of the key elements of an effective WC/WDM programme. Zone meters are used to monitor the water supplied into the zones with particular emphasis on the recording of the Minimum Night Flows (MNF). From the analyses of the MNF it is possible to establish the level of leakage and/or wastage in each zone after which selective WDM interventions can be properly prioritised.

Situation in Langeberg

The individual water reticulation systems have already (to a large extent) been sectorised in reservoir supply zones. Zones have not yet been checked for discreteness. The inlets to some zones are metered but a number of zone inlets are not yet metered.

During the logging exercise the following zone interconnections were discovered:

- The outlet of Nkqubela Res in Robertson is connected to the outlet of the Nkqubela Pumpstation. If the pump is running there is reverse flow on the outlet of the reservoir.
- There is a link between the 1 outlet (currently closed) of the George Brink Res in Montagu and the Kanonkop Res Zone.
- The zone boundary between George Brink Res zone and Kanonkop Res Zone is different to shown on drawings. Further investigation will be required to determine the exact position of the new boundary.
- The night flow in Robertson Res 1 was very high while the night flow in Res 3 in Robertson was very low and the night flow for Res 2 could not be measured. It should be investigated if there are possible interconnections between these zones.

Recommendations and Strategy

- Some night flows were measured as part of this study. It is recommended to re-log the night flows every few years to evaluate if there has been an increase in leakage.

Funding and Budget Requirements

A budget should be allocated to investigate and resolve the zone interconnections listed above. Difficult to price such investigations. Possible budget: R200 000.

Scorecard Results

3 out of 4 – The individual water reticulation systems have already (to a large extent) been sectorised - but there is scope to confirm zone discreteness and to meter all zone inlet points.

6.12 ITEM 14: EFFICIENT BULK MANAGEMENT METERING SYSTEM (4 POINTS)

Introduction

Bulk meters are typically used to measure the water supplied from the source, at the inlet and outlet of purification works and on the inlet and outlet of storage reservoirs.

Situation in Langeberg

Water sources and treatment plants are metered and meter readings are recorded.

Recommendations and Strategy

None

Funding and Budget Requirements

None

Scorecard Results

4 out of 4 - Indicating that water sources and treatment plants are metered.

6.13 ITEM 15: EFFECTIVE ZONE METER MANAGEMENT AND ASSESSMENT OF NIGHT FLOWS (2 POINTS)

Introduction Bulk meters are typically used to measure the water supplied from the source, at the inlet and outlet of purification works and on the inlet and outlet of storage reservoirs.
Situation in Langeberg Some reservoir inlets and outlets are metered but many still require meters. The possible new meter positions are listed in Table 4 in the report. Where possible, minimum night flows were measured and analysed as part of this study.
Recommendations and Strategy - Install bulk meters at locations listed in Table 4 in the report. Montagu (x4), McGregor (X2), Ashton (x4), Bonnievale (x2), Robertson (x5). - Record bulk meter readings monthly for all bulk meters not only for meters at the treatment plants - Keep stock of meter inserts at depot so that meters can be replaced as soon as the municipality becomes aware of a faulty meter. - Once the bulk meters are installed the minimum night flows should be measured and analysed every 2 years.
Funding and Budget Requirements Installation of complete new bulk meters with isolating valves and strainers, housed in a brick chamber. Approximate complete meter installation cost: R40 000. (R40 000 x 19 = R760 000) Budget required to replace/repair broken meters: Approximately R40 000 Minimum night flows should be measured and analysed annually. Permanent loggers can be considered at critical meters. Allow R200 000 for general logging/ logging equipment.
Scorecard Results 1 out of 4 - Indicating that some reservoir inlets and outlets are metered but that a number of additional meters should be installed.

6.14 ITEM 16: PRESSURE MANAGEMENT (1 POINT)

Introduction Pressure management is one of the key WDM interventions that can be used to reduce leakage and extend the life of the reticulation system in areas which experience high leakage. The basic principle is that any reduction in pressure will result in a reduction of water leakage.
Situation in Langeberg A few pressure reducing valves are currently used. The PRV in Ashton is operational but the PRV in Robertson is not currently working. The scope for further pressure management was evaluated by GLS Consulting as part of the study. The zones listed in Table 11 were identified as areas with pressure management potential. Further analysis will however be required to determine the exact scope, potential cost and viability for pressure management implementation in each of the areas. A total of 7 possible areas were identified.
Recommendations and Strategy The Robertson PRV should be serviced and set. This PRV is not currently working. Further analysis will be required to determine the exact scope, potential cost and viability for pressure management implementation in each of the 7 potential areas. If found to be feasible pressure management should be implemented in selected areas.
Funding and Budget Requirements Budget to service and set the Robertson PRV: R6000 Budget for detailed analysis to determine exact scope for pressure management: R200 000

Budget to implement pressure management: To be determined as part of the detailed analysis.
Scorecard Results 1 out of 4 - Indicating that some PRVs already exist but that there is scope for further pressure management in high pressure areas.

6.15 ITEM 17: AS BUILT DRAWINGS OF WATER RETICULATION (4 POINTS)

Introduction Proper “as-built” drawings are essential to any water utility. In many parts of South Africa it is found that even if the municipality has drawings of the reticulation system the drawings do not always match the pipes as laid in the ground and this in turn can result in operational difficulties and water supply problems. It is therefore necessary for a water utility to have some form of system whereby the drawings can be updated to reflect the “as-built” conditions and that measures are taken to clarify the situation in areas where it is known that the available drawings may not be accurate.
Situation in Langeberg As-built drawings are available for all water reticulation systems in Langeberg. A few minor differences exist between the drawings and the actual systems.
Recommendations and Strategy Update as-built drawings on an ongoing basis
Funding and Budget Requirements None
Scorecard Results 4 out of 4 - Indicating that the Langeberg Municipality has as-built drawings for all water reticulation systems

6.16 ITEM 18: SCHEMATIC LAYOUT OF WATER INFRASTRUCTURE (4 POINTS)

Situation in Langeberg Schematic layouts have been prepared for Langeberg Municipality. Copies included in Annexure A.
Recommendations and Strategy None
Funding and Budget Requirements None
Scorecard Results 4 out of 4 – Indicating that Schematic layouts have been prepared for Langeberg Municipality.

6.17 ITEM 19: REGULATION AND BYLAWS (2 POINTS)

Introduction Water utilities should regulate the type of water fittings that may be installed in buildings and enforce the use of these fittings through by-laws. Water utilities should also have by-laws that relates to water conservation and effective water usage and enforce these by-laws when required.
Situation in Langeberg Langeberg Municipality does not currently regulate the type of water fittings that may be used on properties. Currently there is also not a section on authorised pipes and fittings in the water by-laws.

Example for Section in Bylaws on authorised pipes and water fittings (prepared by Aurecon):

Use of Pipes and Water Fittings to be Authorised

1. No person shall, without the prior written authority of the engineer, install or use a pipe or water fitting in a water installation within the municipality's area of jurisdiction unless it is included in the Schedule of Approved Pipes and Fittings as compiled by the municipality.
2. Application for the inclusion of a pipe or water fitting in the Schedule referred to in subsection (1) must be made on the form prescribed by the municipality.
3. A pipe or water fitting may be not be included in the Schedule referred to in subsection (1) unless it -
 - a. bears the standardisation mark of the South African Bureau of Standards in respect of the relevant SANS specification issued by the Bureau;
 - b. bears a certification mark issued by the SANS to certify that the pipe or water fitting complies with an SANS Mark specification or a provisional specification issued by the SANS, provided that no certification marks shall be issued for a period exceeding two years; or
 - c. is acceptable to the municipality.
4. The municipality may, in respect of any pipe or water fitting included in the Schedule, impose such additional conditions, as it may consider necessary in respect of the use or method of installation.
5. A pipe or water fitting shall be removed from the Schedule if it -
 - a. no longer complies with the criteria upon which its inclusion was based; or
 - b. is no longer suitable for the purpose for which its use was accepted.

Langeberg Municipality does not currently address water conservation in their water bylaws. Example shown below of sections that may be incorporated in water bylaws to address water conservation (prepared by Aurecon)

CHAPTER 4: CONDITIONS FOR WATER SUPPLY SERVICES:

Water Demand Management

1. In any water installation where the dynamic water pressure is more than 200 kPa at a shower control valve, and where the plumbing has been designed to balance the water pressures on the hot and cold water supplies to the shower control valve, a shower head with a maximum flow rate of greater than 10 litres per minute must not be installed.
2. The maximum flow rate from any tap installed on a wash hand basin must not exceed 6 litres per minute.

CHAPTER 5: CONDITIONS FOR SANITATION SERVICES:

Water Demand Management

1. Notwithstanding the provisions of sections 92 and 113, no flushing urinal that is not user-activated shall be installed or continue to operate in any water installation. All flushing urinals that are not user-activated installed prior to the commencement of these regulations must be converted to user-activated urinals within two years of the commencement of these by-laws.
2. No cistern, and related pan designed to operate with such cistern, shall be installed with a cistern capacity of greater than 9 litres and all cisterns not intended for public use shall be fitted with flushing devices allowing interruptible or multiple flushes, provided that such flushing device shall not be required in cisterns with a capacity of 4,5 litres or less.

CHAPTER 7: UNAUTHORISED WATER SERVICES:

Waste of Water

1. No customer shall permit -
 - a. the purposeless or wasteful discharge of water from terminal water fittings;
 - b. pipes or water fittings to leak;
 - c. the use of maladjusted or defective water fittings; or
 - d. an overflow of water to persist.
2. An owner shall repair or replace any part of his water and sanitation installation which is in such a state of disrepair that it is either causing or is likely to cause an occurrence listed in subsection (1).
3. If an owner fails to take measures as contemplated in subsection (2), the municipality shall, by written notice, require the owner to comply with the provisions of subsection (1).
4. The municipality may, by written notice, prohibit the use by a customer of any equipment in a water or sanitation installation if, in its opinion, its use of water is inefficient. Such equipment shall not be returned to use until its efficiency has been restored and a written application to do so has been approved by the municipality.

Recommendations and Strategy The municipality should add a section on authorised fittings to the water bylaws (example shown above). The use of authorised fittings should then be enforced. The municipality should update their water bylaws to address water conservation (example shown above). These by-laws should then be enforced.
Additional Funding and Budget Requirements Can be undertaken by municipality or by consultant who prepared the water by-laws.
Scorecard Results 2 out of 4 - Indicating that the municipality is not currently enforcing the use of approved pipes and fittings, and that water conservation is not currently addressed in the water bylaws.

6.18 ITEM 20: TARIFFS (2 POINTS)

Situation in Langeberg The tariff system currently used in Langeberg municipality is 6kl/month free basic water and R3.89/kl for all usage above 6kl. This type of billing structure does not encourage consumers to save water.
Recommendations and Strategy It is recommended that the municipality adopt a rising block tariff system. Such a rising block tariff can be phased in over a number of years. The actual charges per block should be determined in a separate study. Example: 0-6kl, 7to12kl, 13-18kl, 19-25kl, 25-30kl, 31-42kl, 43-72kl, 72+kl. The benefit of adding categories in the block tariff system is that the municipality will be able to generate additional income through consumers with excessive consumption but that consumers will also become more aware of managing and reducing their own water consumption.
Funding and Budget Requirements The cost for a separate study to determine the best suited block tariff system for Langeberg: Estimate R80 000
Scorecard Results 2 out of 4 - Indicating that a rising block tariff system should be phased in over the next few years.

6.19 ITEM 21: TECHNICAL SUPPORT TO CUSTOMERS (1 POINT)

Introduction Municipalities should be able to offer support to customers (especially large customers) on water demand management and water conservation.
Situation in Langeberg The Langeberg Municipality currently offers limited support on water demand management to large consumers.
Recommendations and Strategy Once a dedicated person has been allocated to WC/WDM it is recommended to engage with large customers and to identify areas where the municipality can provide assistance. Such support can include but not be limited to: checking that large consumers are correctly metered and billed, providing tips on water conservation and water conservation, informing consumers of any sudden change in consumption patterns, arranging for leakage inspections in public buildings.
Funding and Budget Requirements None additional – pending on the appointment of a dedicated person for WC/WDM.
Scorecard Results 1 out of 4 - Indicating that the municipality is not actively providing support to consumers on water demand management.

6.20 ITEM 22: REMOVAL OF UN-AUTHORISED CONNECTIONS (3 POINTS)

Introduction
Illegal or un-authorized water connections is a serious problem in South Africa and one with which very few municipalities can deal with effectively. Un-authorized connections directly impacts on the Non-Revenue Water and also can negatively impact on the operation of the system if too many illegal connections are made in one area.
Situation in Langeberg
According to the municipality there are very few known un-authorized connections. An estimated 5 such connections per year are located and legalised.
Recommendations and Strategy
The Langeberg Municipality should continue to remove un-authorized connections as and when they are detected.
Funding and Budget Requirements
None
Scorecard Results
3 out of 4 - Indicating that there are very few know un-authorized connections - but that the municipality is also not actively looking for un-authorized connections.

6.21 ITEM 23: COMMUNITY AWARENESS ON WDM (1 POINT)

Introduction
Community awareness programmes are required to ensure that any WDM interventions are clearly understood and supported by the community they are designed to serve. In many cases, WDM interventions that are technically sound and have been properly implemented fail due to the fact that they do not carry the support of the community. It is therefore essential that any water utility wishing to promote water use efficiency or any form of WC/WDM intervention has a proper community awareness programme in place to support any technical interventions.
Situation in Langeberg
The Langeberg Municipality currently does not have a community awareness programme in place relating to water conservation.
Recommendations and Strategy
The Langeberg Municipality can consider adding helpful hints on effective water usage on the monthly bills. Community awareness programmes should be initiated to inform consumers of the importance of water conservation/ water demand management.
Funding and Budget Requirements
It is estimated that R60 000/ year should be allocated for water conservation awareness activities, material to be included with monthly water bills and placing of notices in local newspaper.
Scorecard Results
1 out of 4 - Indicating that community awareness initiatives relating to water conservation has never been undertaken.

6.22 ITEM 24: SCHOOLS EDUCATION ON WDM (1 POINT)

Introduction
Schools are often key problem areas with regard to water wastage and often the situation within schools is so bad that they are not fit to house the scholars they teach. Education on the value of water and how to conserve water does not form part of any formal curriculum in schools and where such training is provided, it is normally through the local water service provider.
Situation in Langeberg

The Langeberg Municipality currently does not have a school education programme on water conservation.
Recommendations and Strategy At least once a year, a schools education programme on water conservation should be undertaken. The municipality should assist the school(s) with the monitoring (water audit) of their water consumption.
Funding and Budget Requirements It is estimated that an R40000/ year should be allocated for the establishment of a schools education programme in Langeberg. DWA will also be able to assist the municipality with pamphlets and posters on water WC/WDM.
Scorecard Results 1 out of 4 - Indicating that a schools awareness initiative relating to water conservation has never been undertaken.

6.23 ITEM 25: RETROFIT INTERNAL PLUMBING (1 POINT)

Introduction In the context of Water Demand Management, retrofitting refers to projects that focus on fixing internal leaks and fitting of water efficient devices (i.e. water savings toilets, taps etc.). In South Africa these types of projects have been mostly undertaken in the following buildings: 1. Houses of Indigent users with high internal plumbing leakage, where consumers don't always have the funds or knowledge to fix the leaks themselves or to purchase water efficient devices. 2. Public buildings with high internal plumbing leakage (i.e. schools, prisons, police stations, hospitals etc.) It is a common problem in South Africa that many public buildings have high internal plumbing leakage and that water inefficient devices are still being used in the ablution facilities. One of the key contributors to water wastage in public buildings is tip-tray urinals. These urinals flush continuously and can be retrofitted with a push button flush mechanisms, which will only flush when activated by a user.
Situation in Langeberg The municipality has not yet initiated a project to identify and repair plumbing leaks on properties.
Recommendations and Strategy An exercise could be initiated to check for visual leakage at public buildings and households using more than 60kl/month (with special attention to indigent households). Where possible the municipality can assist these properties to repair visual leaks and to inform the consumers to repair such leaks in future.
Funding and Budget Requirements R100 000 for ongoing exercise to repair leakages at properties using in excess of 60kl/month. EPWP funding can be requested in this regard.
Scorecard Results 1 out of 4 - Indicating that the municipality has not yet implemented a retrofitting project.

7 SUMMARY OF WC/ WDM STRATEGY

The water demand management strategy is summarised in **Table 14**. It should be noted that the costs quoted in this section are based on rough estimates for 2014 and excludes VAT.

Table 14: Summary of Water Demand Management Strategy for Langeberg

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
1	Water Audit	Update water balance annually.	Water Balance can be undertaken by the Municipality.	1	None
2	Pressurised System	None	None	n/a	None
3 & 4	Consumer Metering	A complete meter audit should be undertaken in all towns. Subsequently all illegible/broken meters should be replaced. Any un-metered stand identified should be metered. All meter readings in the billing system should be updated. As part of the audit all meter boxes should also be cleaned.	Meter audit and cleaning of meter boxes at approximately 18 000 stands. (18 000 x R400 = R720 000). Budget to replace illegible/broken meters: To be determined after the meter audit.	1	Additional metered consumption if all meter boxes are cleaned, broken meters replaced and accurate readings obtained: 5% improvement in billed consumption: 280 000kl/a
5	Effective and Informative Billing System	- The Langeberg Municipality may consider to alert consumers of possible leaks on their properties. For instance if the consumption for a particular month is >20% than the average consumption of the previous months the consumer may be alerted of a possible leak on the property. - The Langeberg Municipality may also consider adding a graph of the previous 12 months' consumption and helpful hints on effective water usage on the monthly bills.	Cost to enhance the user friendliness of the municipal bill: Estimate R60 000	3	Difficult to estimate what the impact will be but in long term it will be to the benefit of the municipality and consumers.
6 & 7	Complaints System	The municipality should continually ensure that consumers are familiar with the telephone numbers to lodge complaints/ report leaks – this can be linked to awareness campaign on water conservation.	None	n/a	None
8	Asset Register	The total value of water infrastructure in the asset register is too low. The asset register should be checked to ensure that all network items are listed and that items are corrected priced.	Undertaken by Municipality or service provider that prepared the asset register	n/a	None
9	Asset Management: Capital Works	The Langeberg Municipality should continue to allocate budget for the upgrading/ replacement of water infrastructure in Langeberg – as they have done over the last number of years.	None	n/a	None
10	Asset Management: O&M	The O&M Budget allocated to repairs and maintenance should be increased to address amongst other tasks the following: Replacement of malfunctioning and old consumer meters, clearing of meter boxes, buying replacement mechanisms for bulk meters, speedy repair of leaks, leak detection in areas with higher than expected night flows.	To be determined by the municipality.	2	Difficult to estimate what the impact will be but in long term it will be to the benefit of the municipality.

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
11	Dedicated WC/WDM Support	For a start Langeberg Municipality should allocate at least 1 person to head WC/WDM. The number of people involved with WC/WDM can later be increased as and when required.	The municipality may be able to use one of their existing staff members. If a new person has to be appointed the municipality can determine the costs involved with such an appointment.	1	No direct saving – but seen as crucial for effective WC/WDM program.
12	Active Leakage Control	According to the municipality, and the based on observations by the project team there is currently minimal visible leakage on the water network. In the night flow analysis some zone were identified with higher than expected leakage. - Robertson Res 1 - Nkqubela Res - Bonnievale New Reservoir East It was not possible to measure night flows in Zolani in Ashton - and it's possible that this area will also have excess night flow.	R200 000 to undertake leak detection/inspections in zones with high excess night flows. Budget to repair any leaks identified will be determined after the inspection. R100 000/year for annual visual leak inspections.	2	Estimate 1% of Input Volume = 80 000kl/a
13	Sectorising	The individual water reticulation systems have already been sectorised. Zones have not yet been checked for discreteness. During the logging exercise the following zone interconnections were discovered: - The outlet of Nkqubela Res in Robertson is connected to the outlet of the Nkqubela Pumpstation. - There seems to be link between the 1 outlet (currently closed) at the George Brink Res in Montagu and the Kanonkop Res Zone. - The zone boundary between George Brink Res zone and Kanonkop Res Zone is different to shown on drawings. - The night flow in Robertson Res 1 was very high while the night flow in Res 3 in Robertson was very low and the night flow for Res 2 could not be measured. It should be investigated if there are possible interconnections between these zones.	A budget should be allocated to investigate and resolve the zone interconnections listed and any other connections that the operational staff suspect. Difficult to price such investigations. Possible budget: R200 000.	3	No direct saving – but zone discreteness will assist the municipality to measure zonal usage and losses more accurately.
14	Bulk Metering	No additional meters required at this stage.	none	n/a	none

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
15	Zone Meter Management	- Install bulk meters at locations identified in this study. Montagu (x4), McGregor (X2), Ashton (x4), Bonnievale (x2), Robertson (x5). - Record bulk meter readings monthly for all bulk meters not only for meters at the treatment plants. - Keep stock of meter inserts at depot so that meters can be replaced as soon as the municipality becomes aware of a faulty meter.	Installation of complete new bulk meter with isolating valves and strainers, housed in a brick chamber. Assumed meter installation cost of R40 000. (R40 000 x 19 = R760 000) Replace/repair broken meters: R40 000 Minimum night flows should be measured and analysed annually. Permanent loggers can be considered at critical meters. Allow R200 000 for general logging/ logging equipment.	2	No direct saving – but accurate bulk metering and monitoring of night flows will assist the municipality to monitor usage and losses more accurately.
16	Pressure Management	The existing Robertson PRV should be serviced and set. This PRV is not currently working. The scope for further pressure management was evaluated by GLS Consulting as part of this study. Further analysis will however be required to determine the exact scope, potential cost and viability for pressure management implementation in each of the areas. A total of 7 possible areas were identified. If found to be feasible, pressure management should be implemented in selected areas.	Service and set PRV at Robertson: R6000 Budget for detailed analysis to determine exact scope for pressure management: R200 000 Budget to implement pressure management: To be determined as part of the detailed analysis.	2	Potential saving from implementing pressure management in 7 identified areas: 5% of input volume = 380 000kl/a
17	As-Build Drawings	No Tasks	None	n/a	None
18	Schematic layouts	Schematic layouts have been prepared for Langeberg Municipality (Annexure A).	None	n/a	None
19	Regulation of water fittings	The municipality should add a section on authorised fittings in the water bylaws. The use of authorised fittings should then be enforced.	Can be undertaken by municipality or by consultant updating the water by-laws.	3	Difficult to estimate what the impact will be but in long term it will be to the benefit of the municipality.
	By-laws	The municipality should update their water bylaws to address water conservation. These by-laws should then be enforced.	Can be undertaken by municipality or by consultant updating the water by-laws.	3	Difficult to estimate what the impact will be but is expected to make consumers more aware.

No	Item	Summary of Tasks	Estimated Costs (Rand)	Priority	Potential Water Saving or Reduction in Demand
20	Tariffs	It is recommended that the municipality adopt a block tariff system. Such a rising block tariff can be phased in over a number of years. The actual charges per block should be determined in a separate study. Example: 0-6kl, 7to12kl, 13-18kl, 19-25kl, 25-30kl, 31-42kl, 43-72kl, 72+kl. The benefit of adding categories in the block tariff system is that the municipality will be able to generate additional income through consumers with excessive consumption but that consumers will also become more aware of managing and reducing their own water consumption.	The cost for a study to determine the best suited block tariff system for Langeberg: Estimate R80 000	1	Reduce Consumption 1% of potable Input Volume = 50 000kl/a
21	Technical Support to Consumers	Once a dedicated person has been allocated to WC/WDM it is recommended to engage with large customers and to identify areas where the municipality can provide assistance. Such support can include but not be limited to: checking that large consumers are correctly metered and billed, providing tips on water conservation and water conservation, informing consumers of any sudden change in consumption patterns, arranging for leakage inspections in public buildings.	None additional – pending on the appointment of a dedicated person for WC/WDM.	2	Difficult to estimate what the impact will be but is expected to make consumers more aware.
22	Removal of illegal connections	According to the Langeberg Municipality there are few un-metered or un-authorised connections that they are aware of.	None	n/a	None
23	Community Awareness on WDM	It is estimated that R60 000/ year should be allocated for water conservation awareness activities and material to be included with monthly water bills.	R60 000/yr	2	Minor direct impact on consumption but seen as crucial part of overall WC/WDM program.
24	Schools Education on WDM	Once a year a schools education programme on water conservation should be undertaken. The municipality should assist the school with the monitoring (water audit) of their water consumption.	R40 000/yr	2	Minor direct impact on consumption but seen as crucial part of overall WC/WDM program.
25	Retrofit internal plumbing leaks	An exercise could be initiated to check for visual leakage at public buildings and households using more than 60kl/month. Where possible the municipality can assist these properties to repair visual leaks and to inform the consumers to repair such leaks in future. Special focus on indigent consumers.	R100 000 for ongoing exercise to repair leakages at properties using in excess of 60kl/month. EPWP funding can possibly be used.	2	Estimate 0.4% of Input Volume in Bonnievale and Ashton = 30 000kl/a

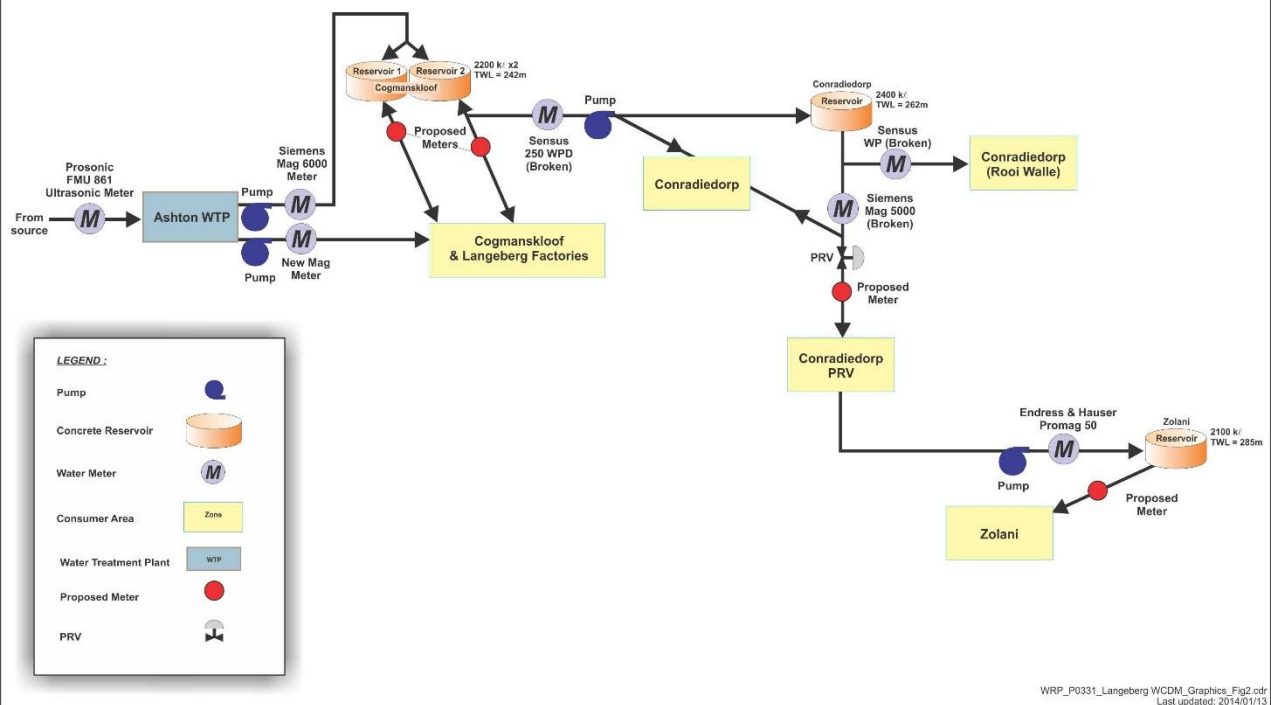
TOTAL			Once of costs: R2.6 mil Annual Costs for ongoing tasks: R200 000/a		Improvement in billing: 280 000kl/a Water Savings: 490 000kl/a Reduction in Consumption: 50 000kl/a
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Priority: 1- high priority, 2 – medium priority, 3 – Lower priority

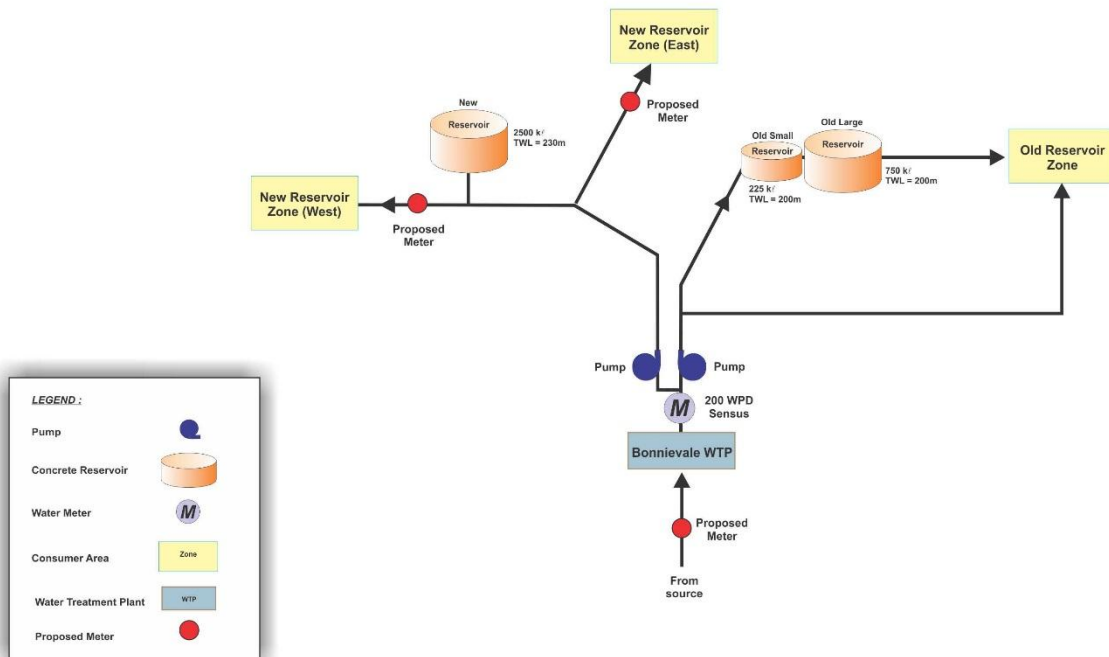
ANNEXURE A

SCHEMATIC LAYOUTS OF WATER SUPPLY NETWORKS

Ashton Schematic Layout

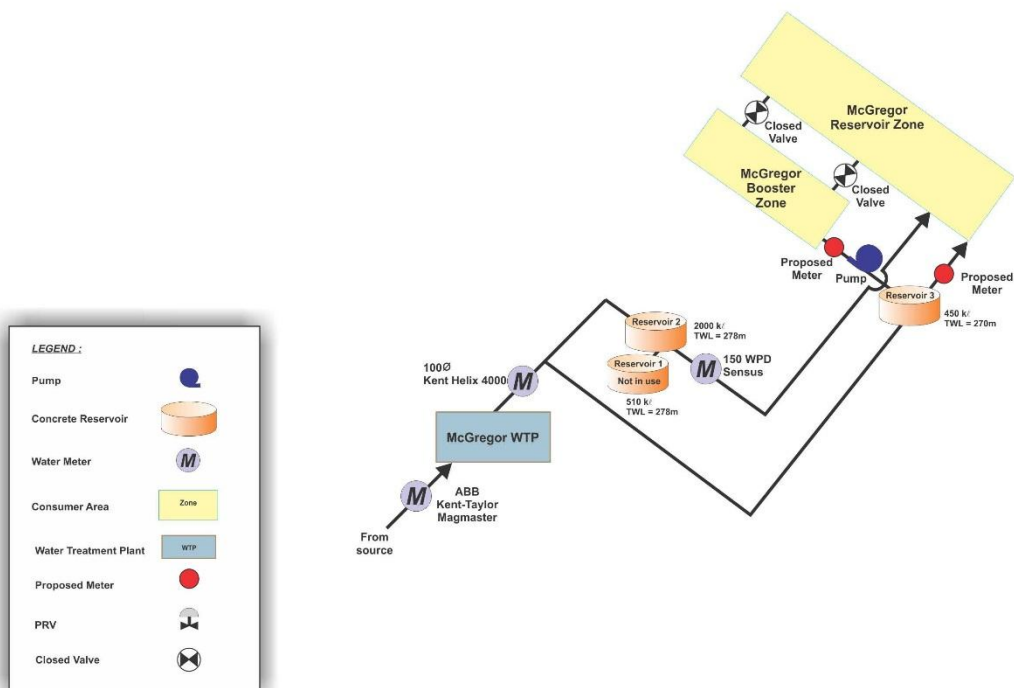


Bonnievale Schematic Layout



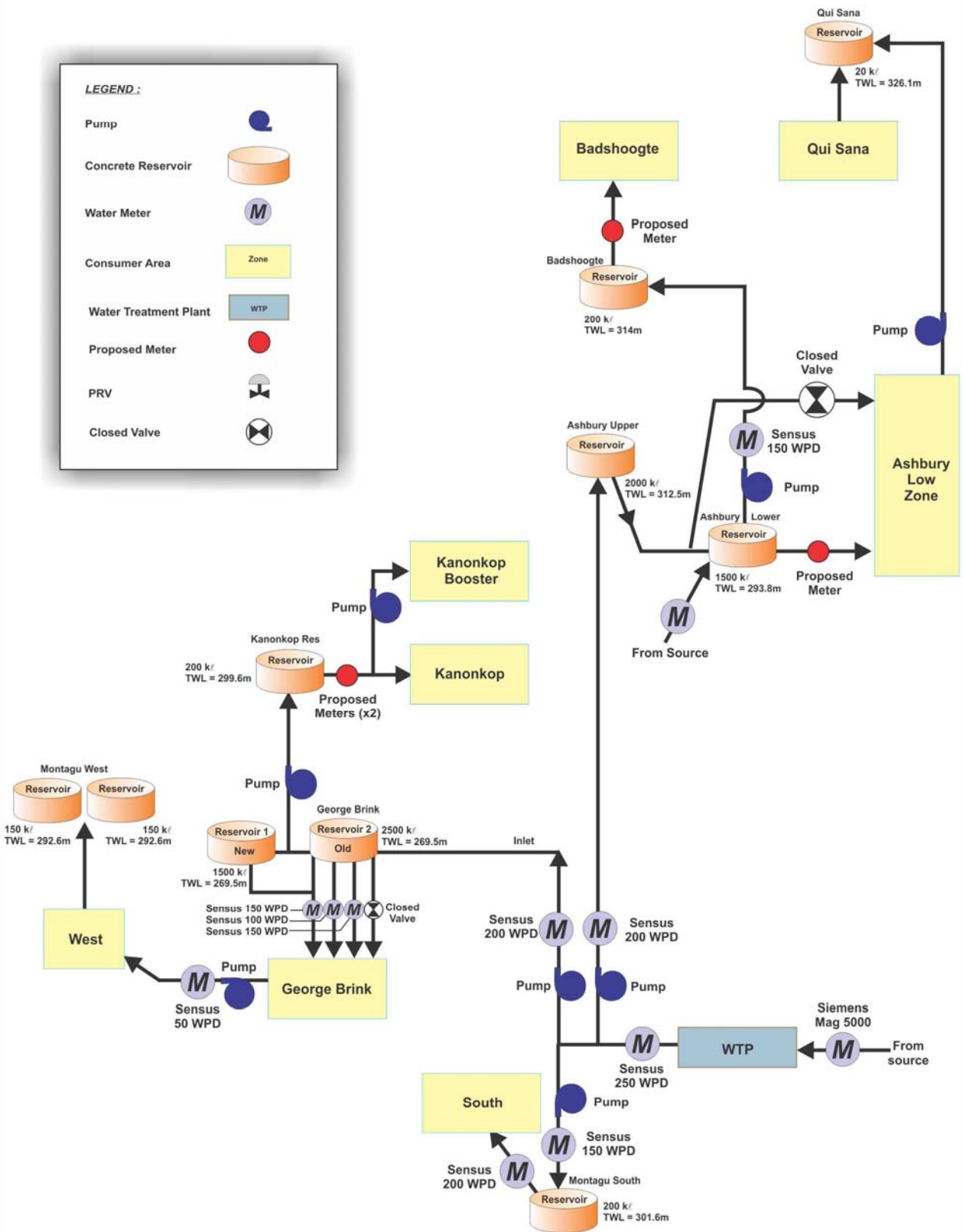
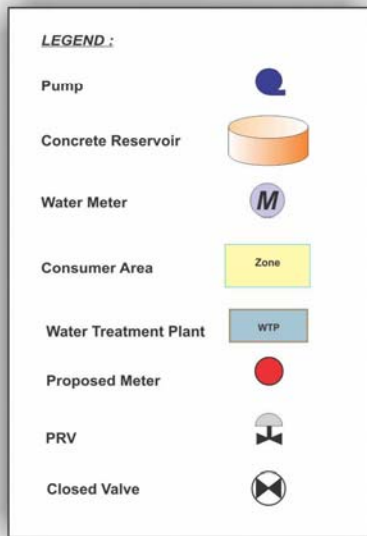
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Last updated: 2014/01/13

McGregor Schematic Layout



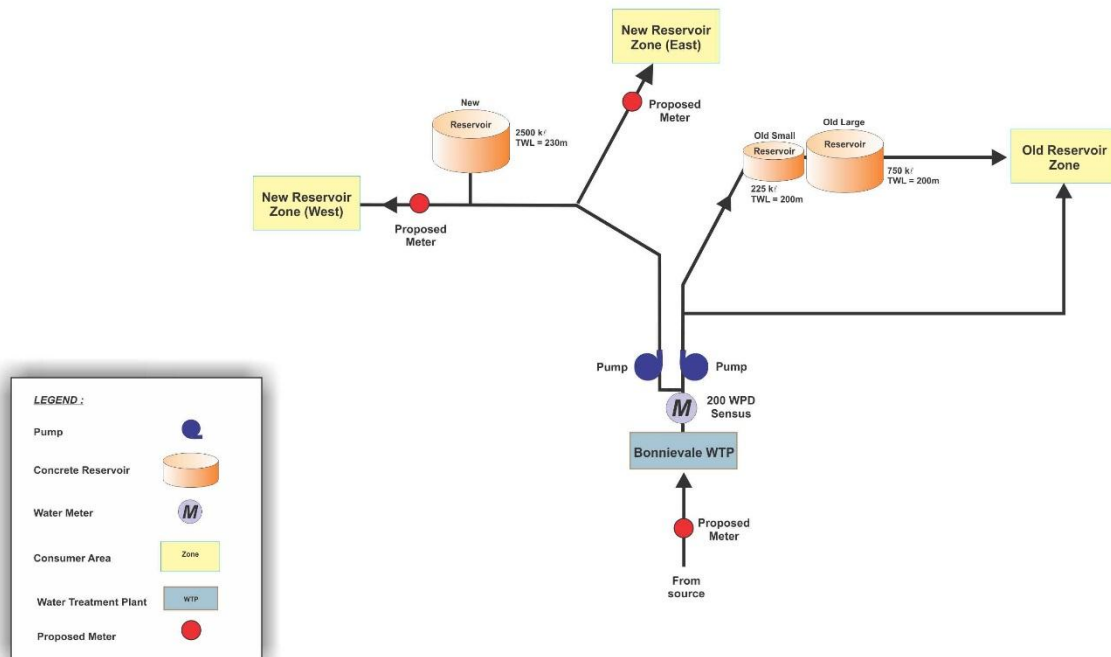
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Montagu Schematic Layout



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Last updated: 2014/01/14

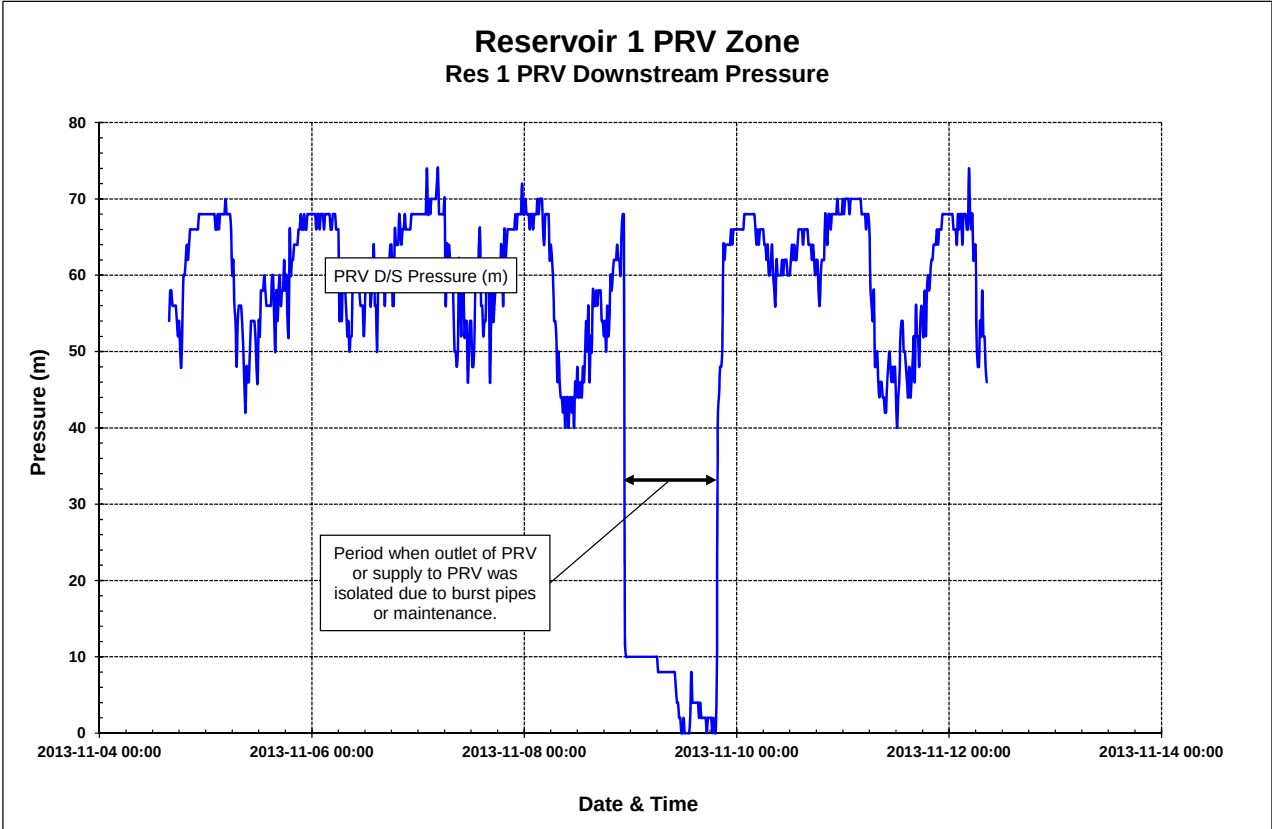
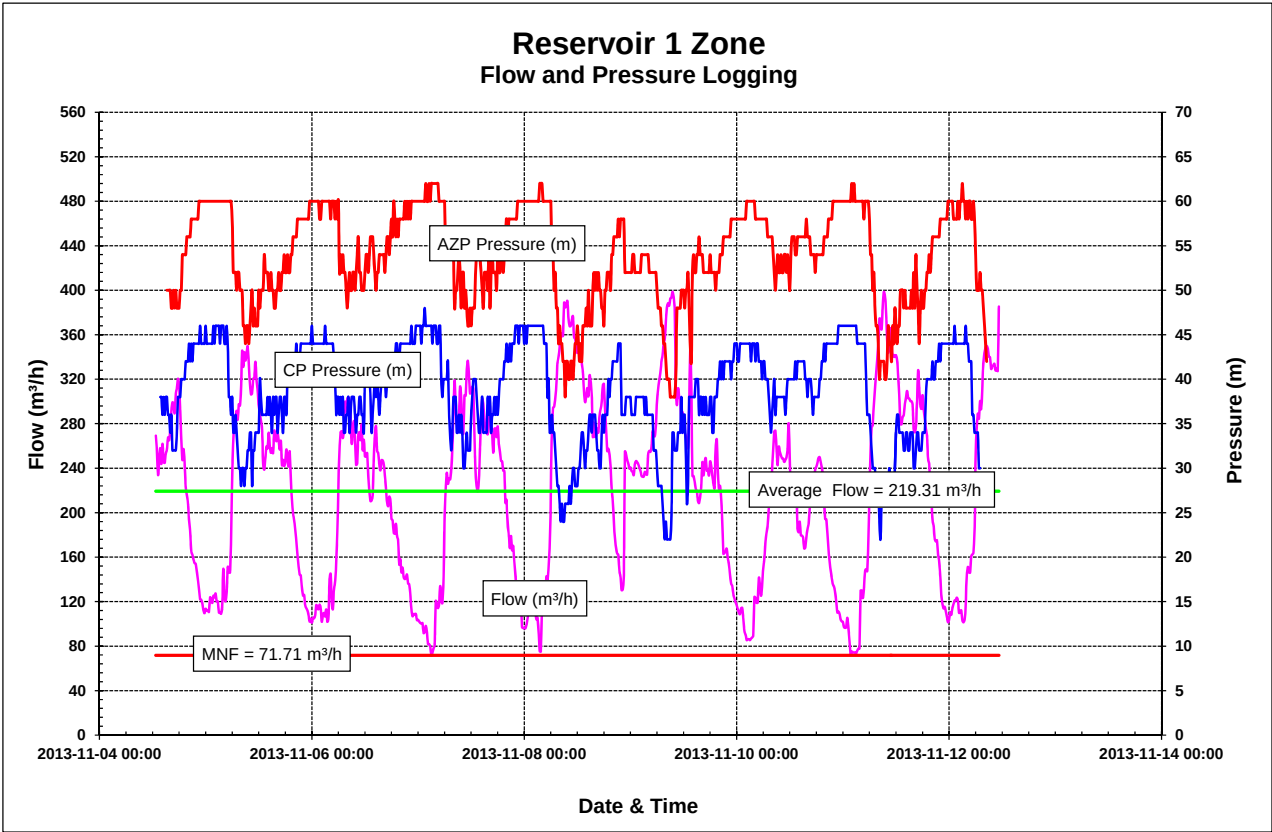
Bonnievale Schematic Layout

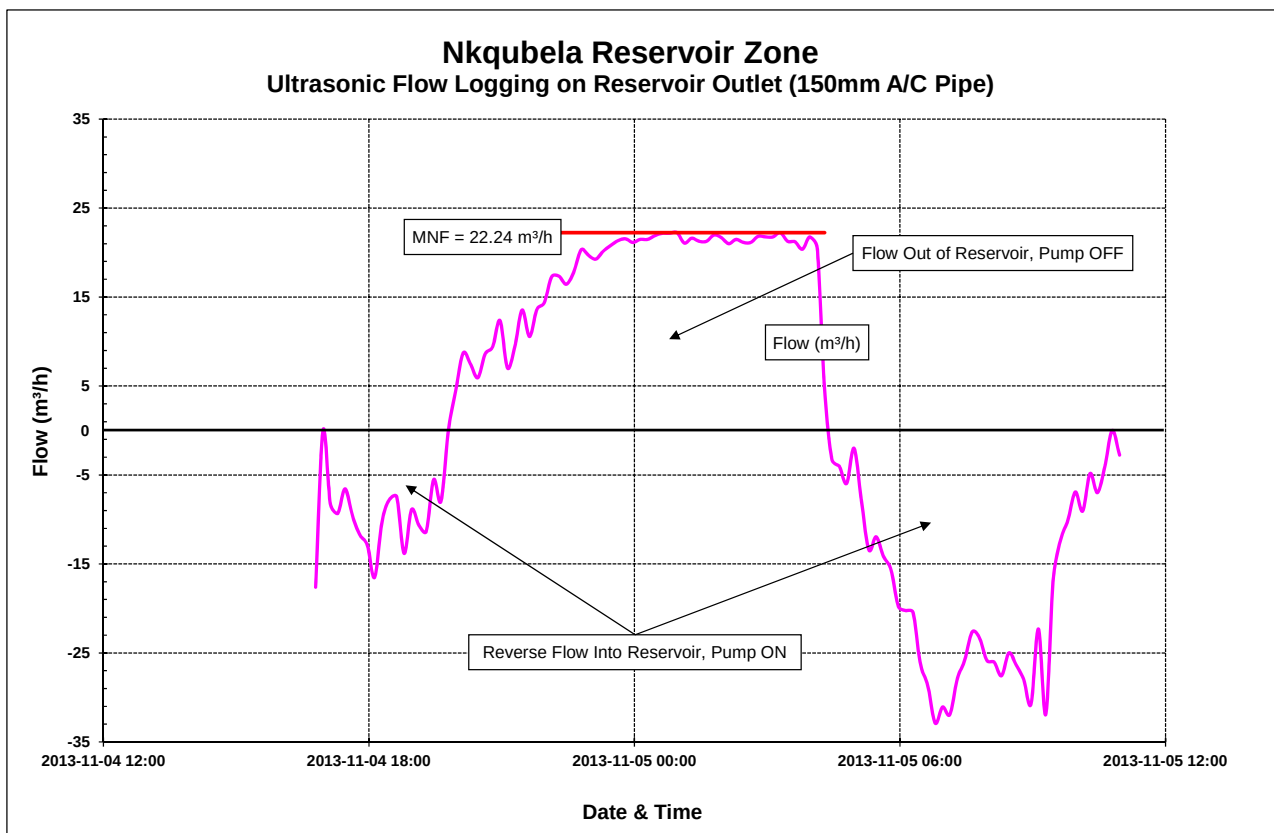
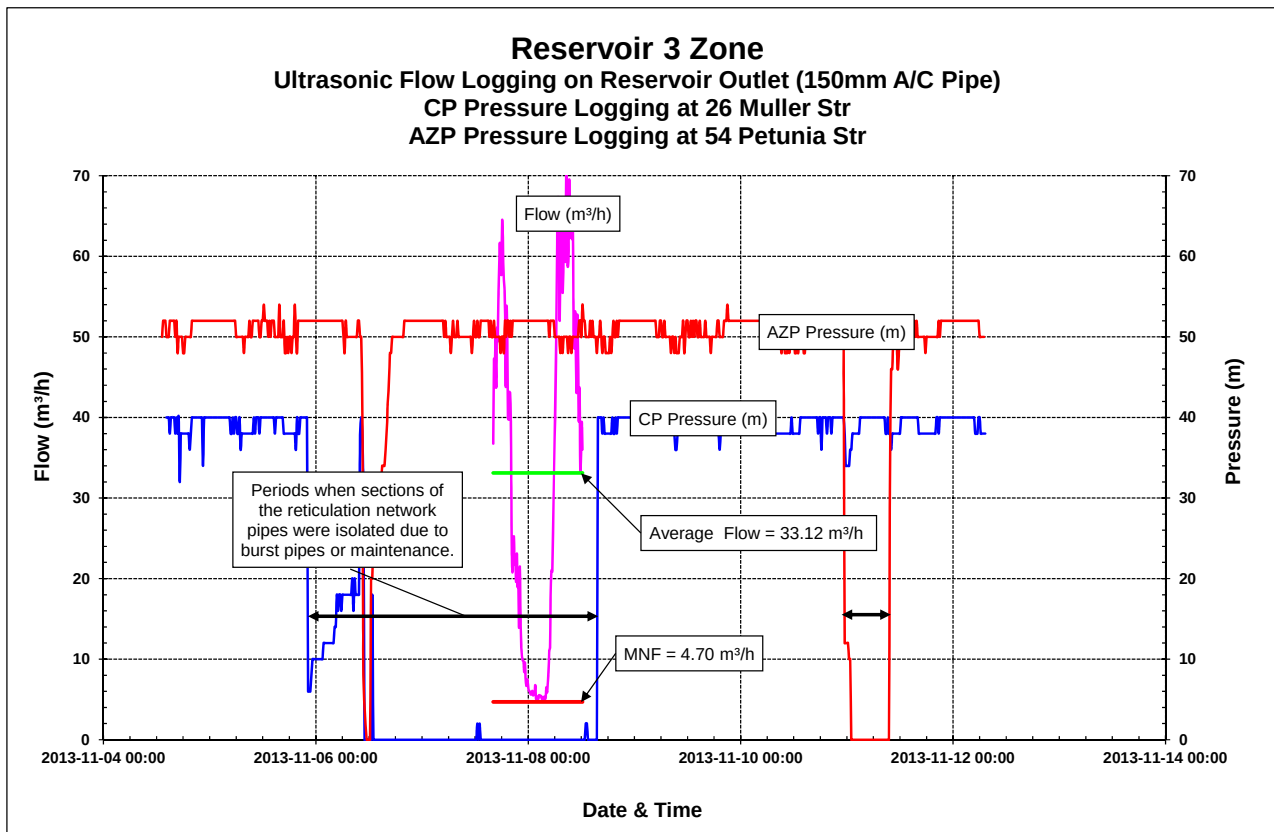


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Last updated: 2014/01/13

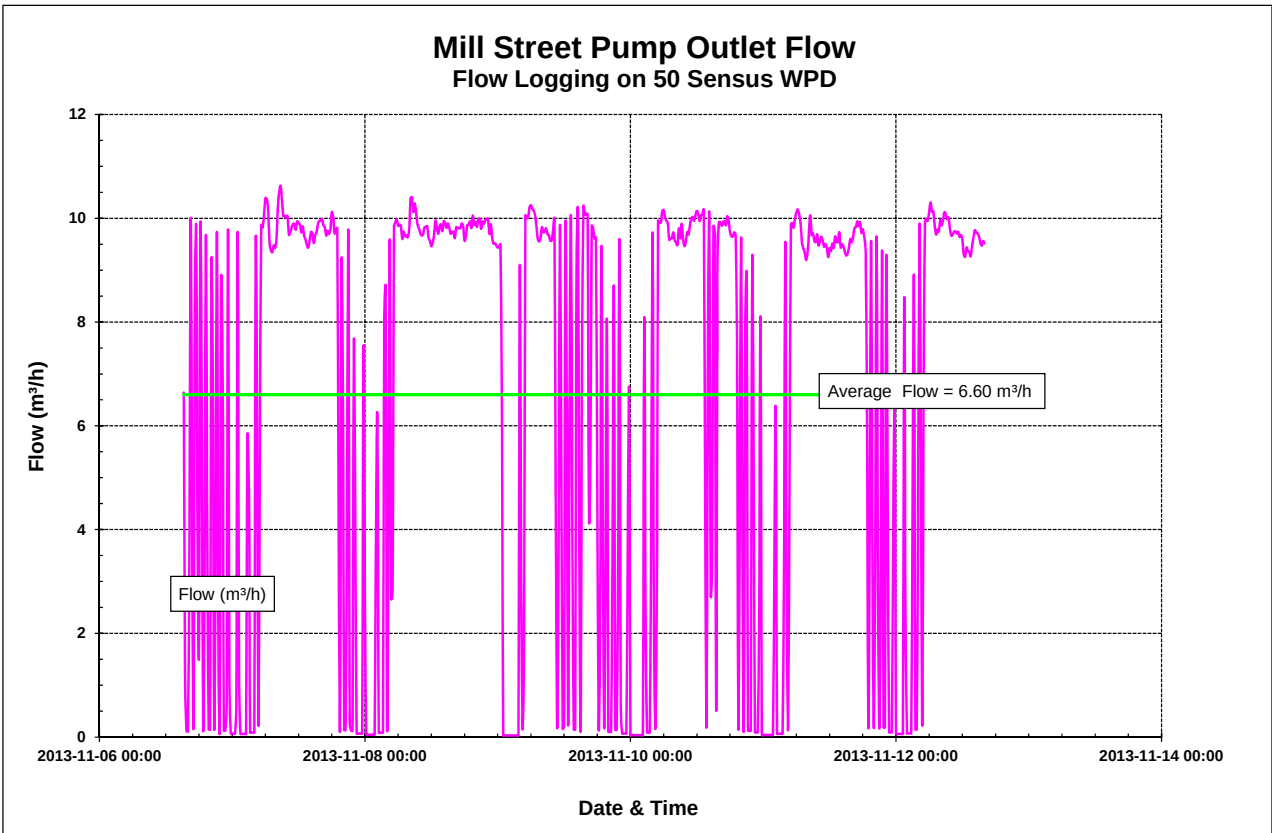
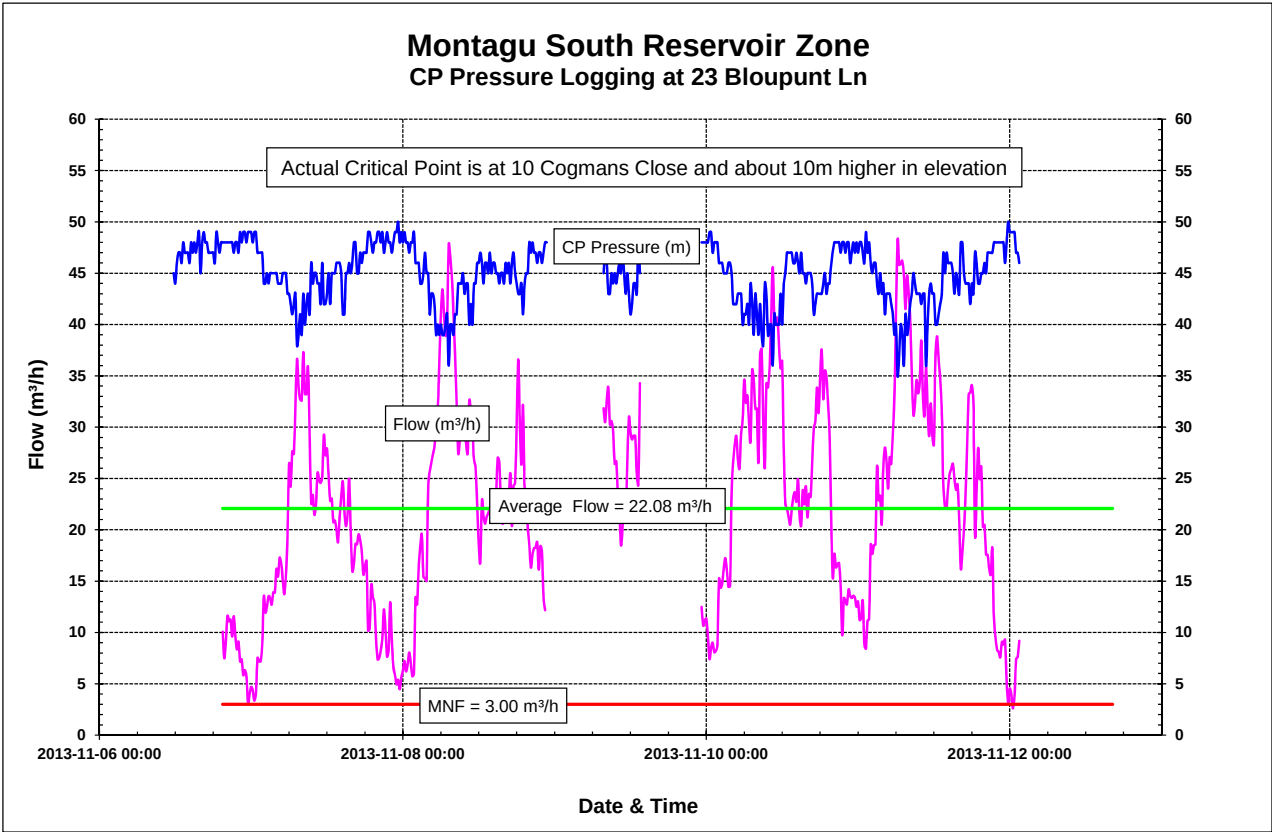
ANNEXURE B

**PRESSURE AND FLOW LOGGING RESULTS INCLUDING LOCALITY
MAPS SHOWING LOGGING POSITIONS**

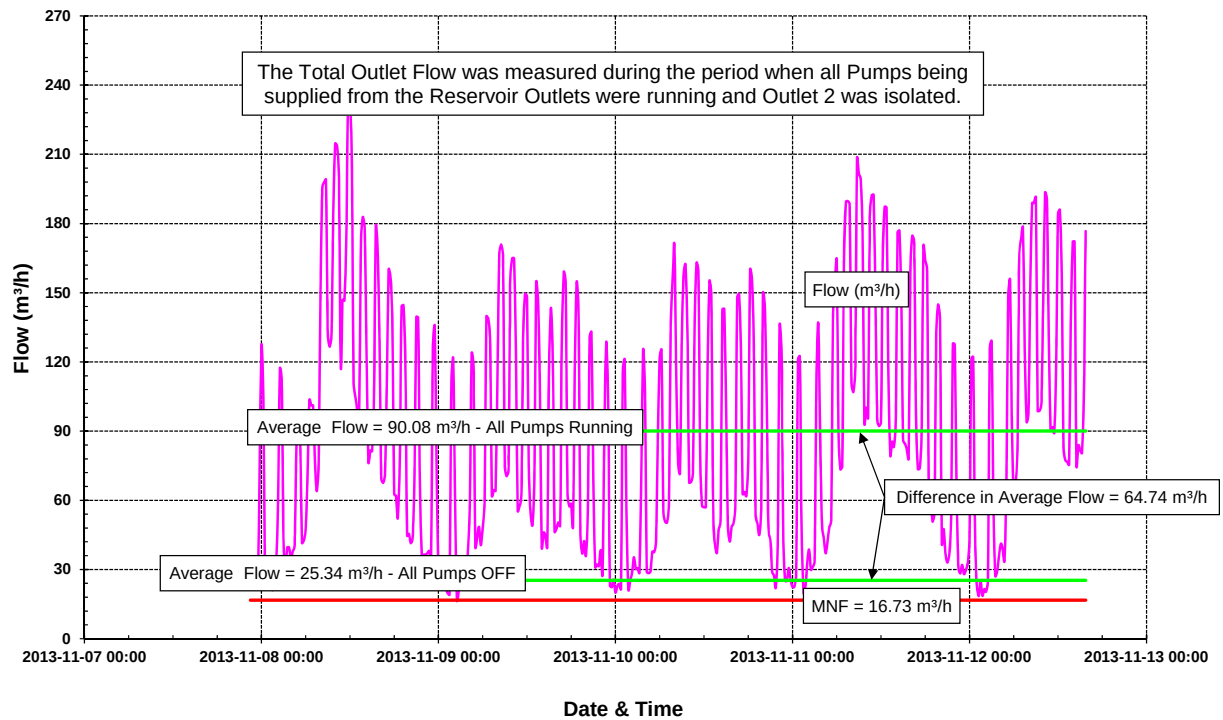




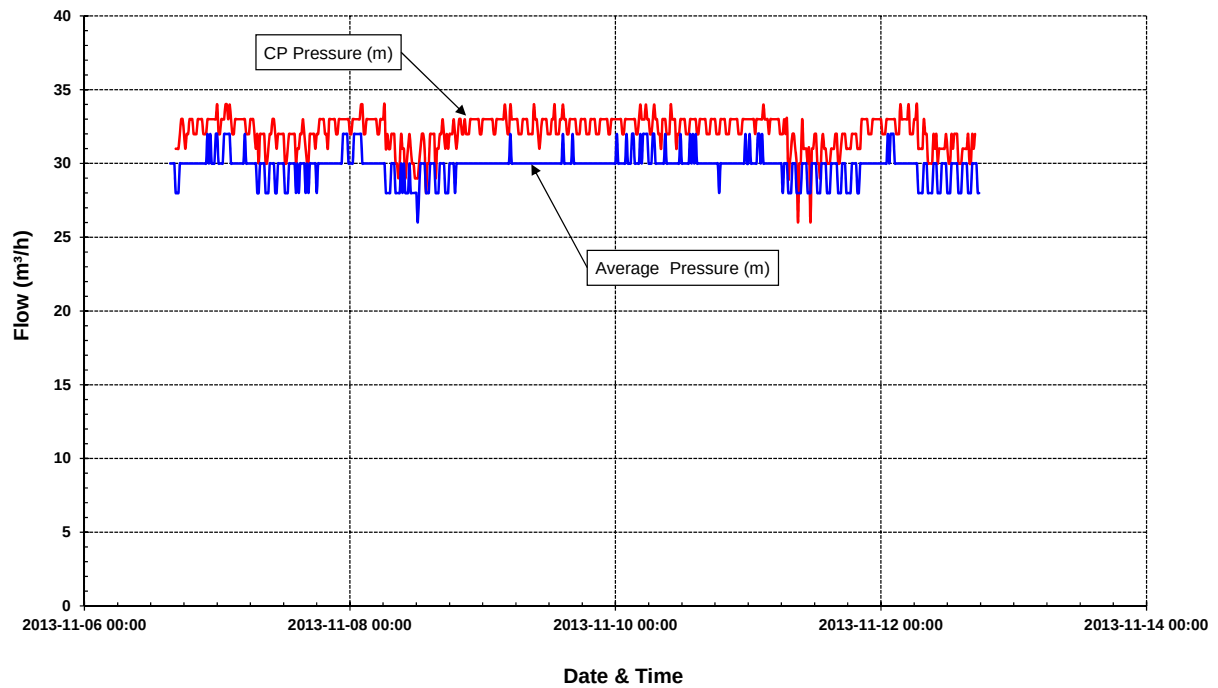
MONTAGU LOGGING RESULTS

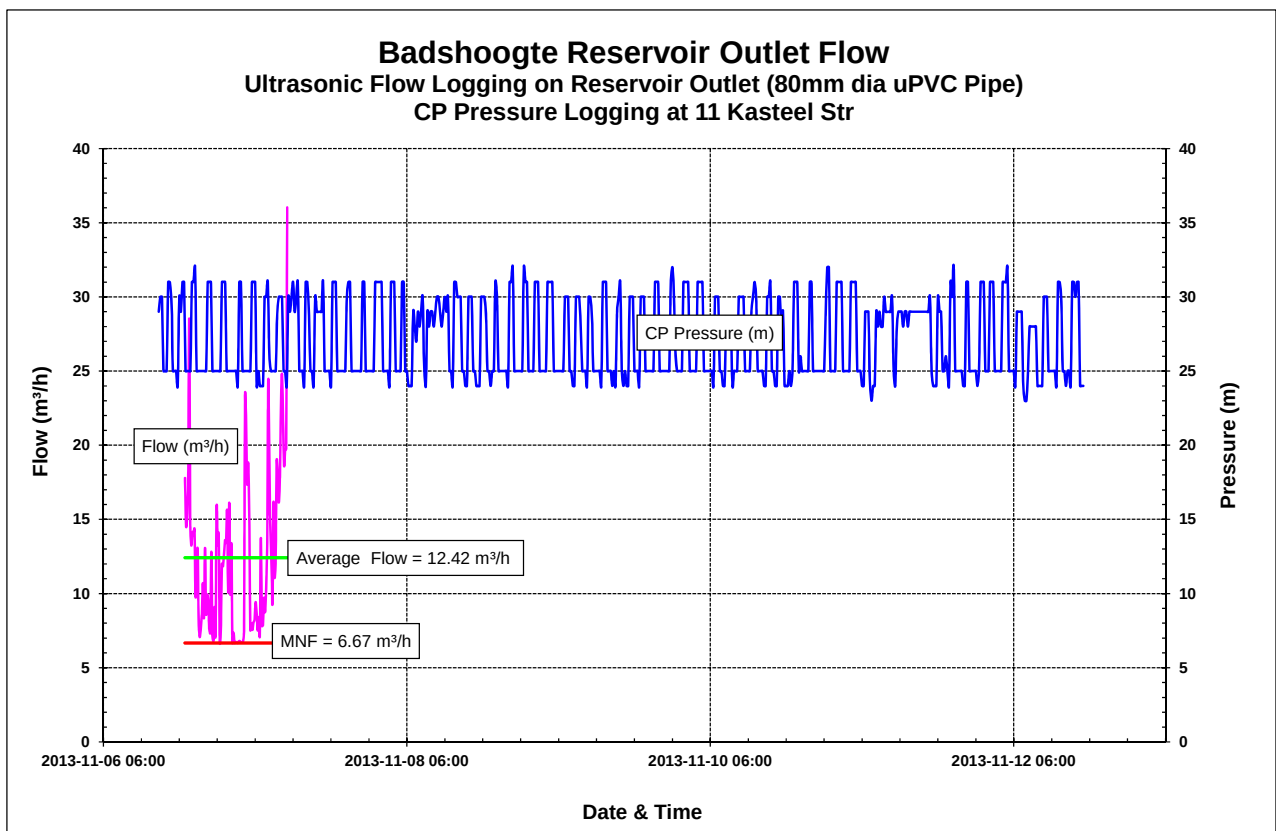
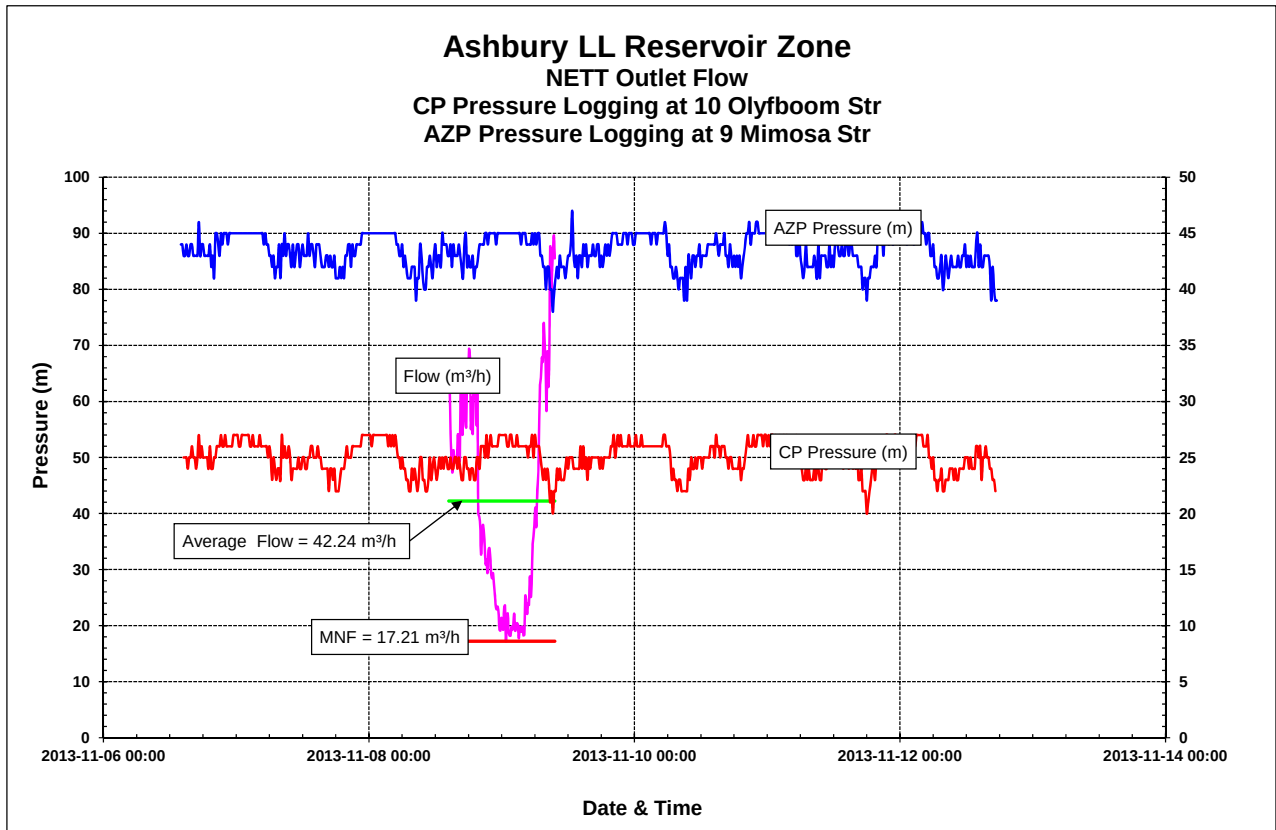


George Brink Reservoir Combined Total Outlet Flow Flow Logging on Reservoir Outlet Meters

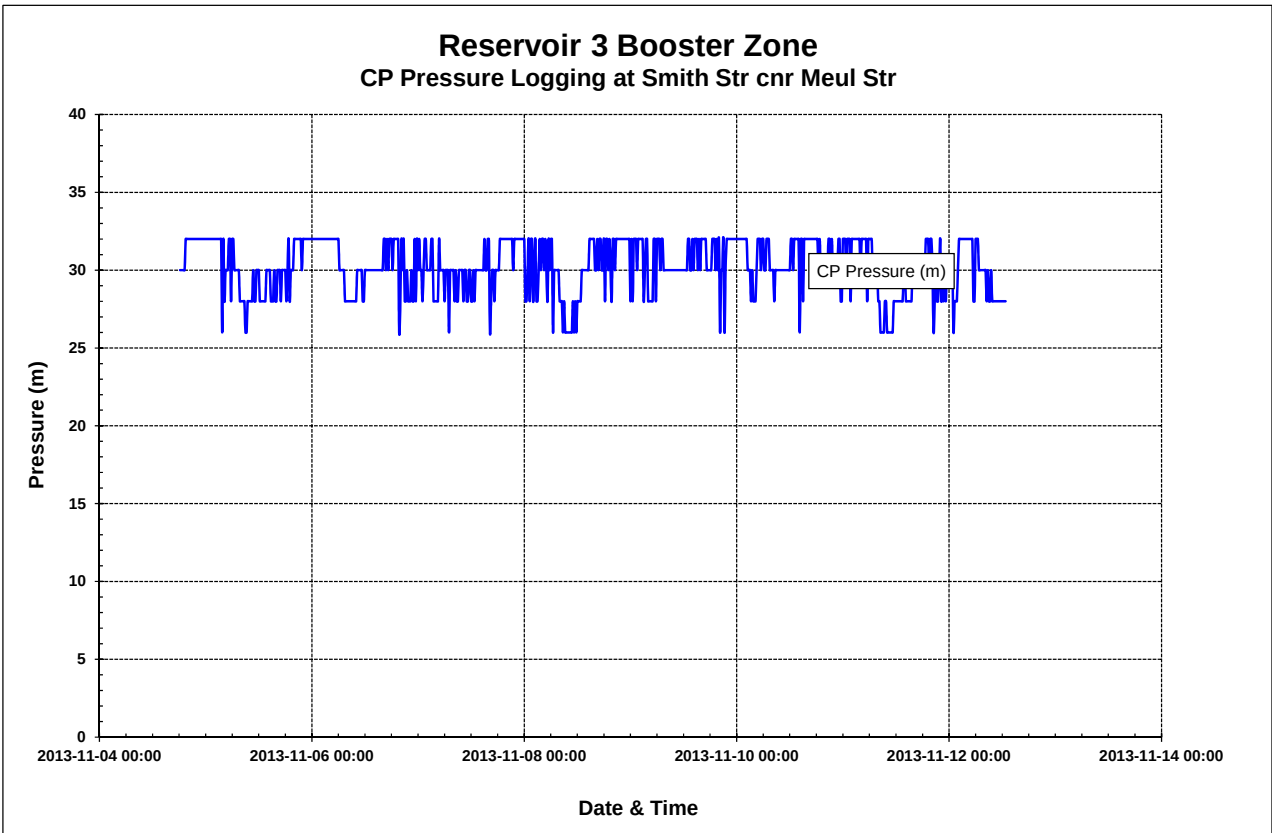
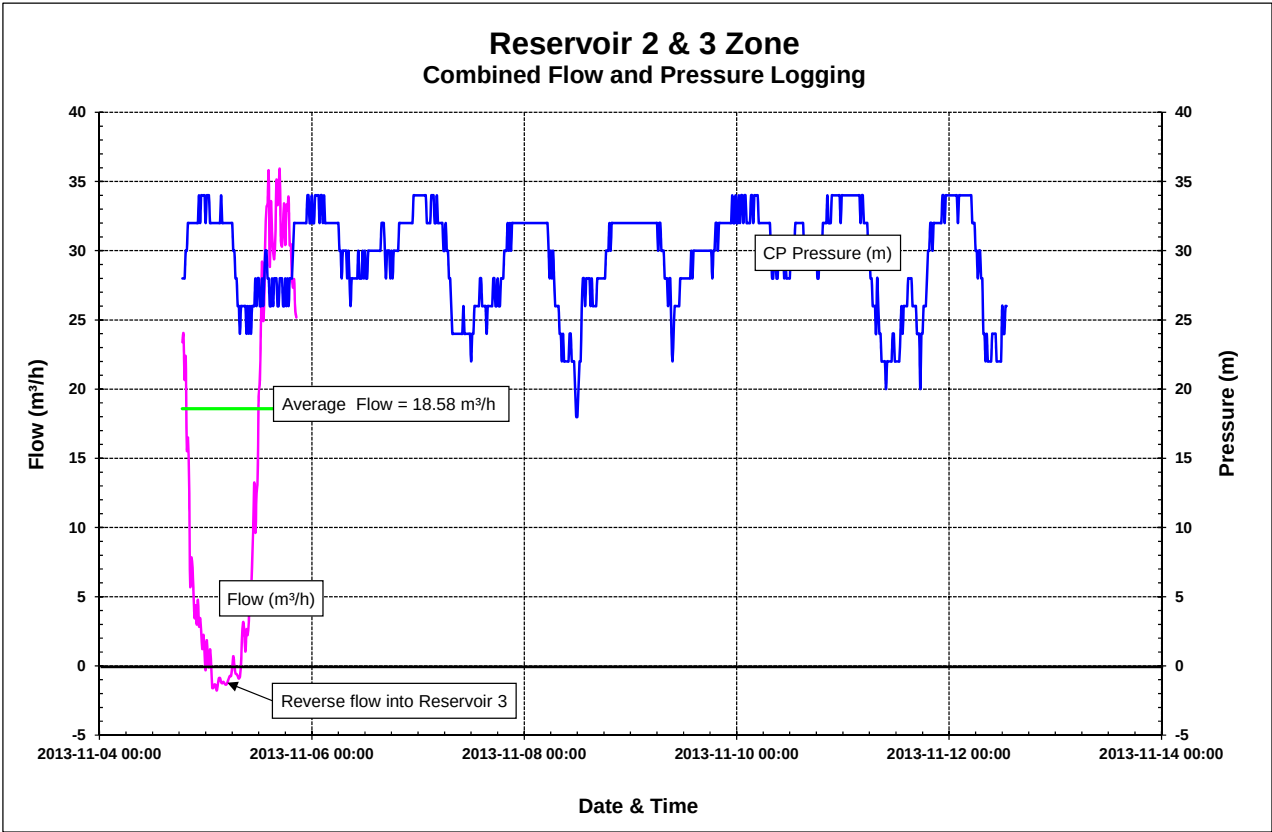


George Brink Reservoir Zone Pressures CP Pressure Logging at Sultana Cres AZP Pressure Logging at 6 Joubert Str

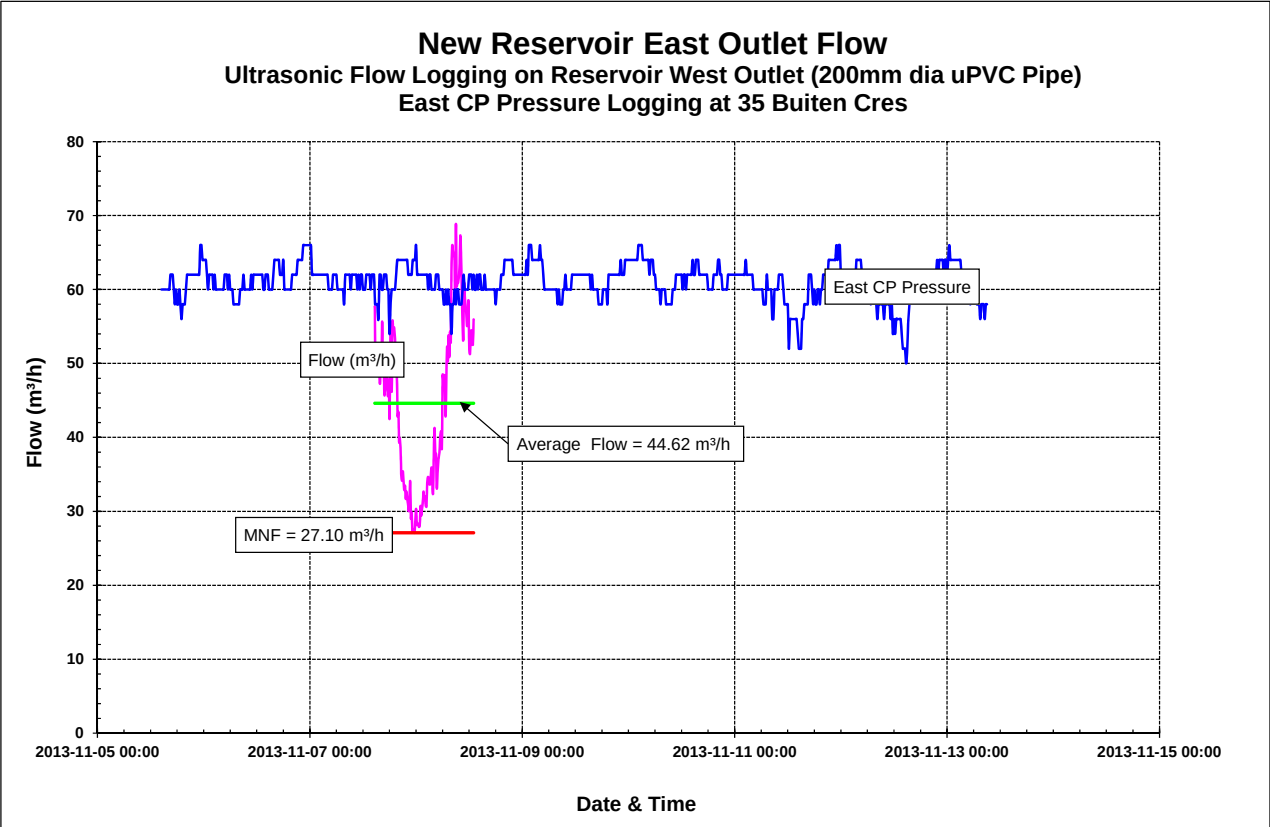
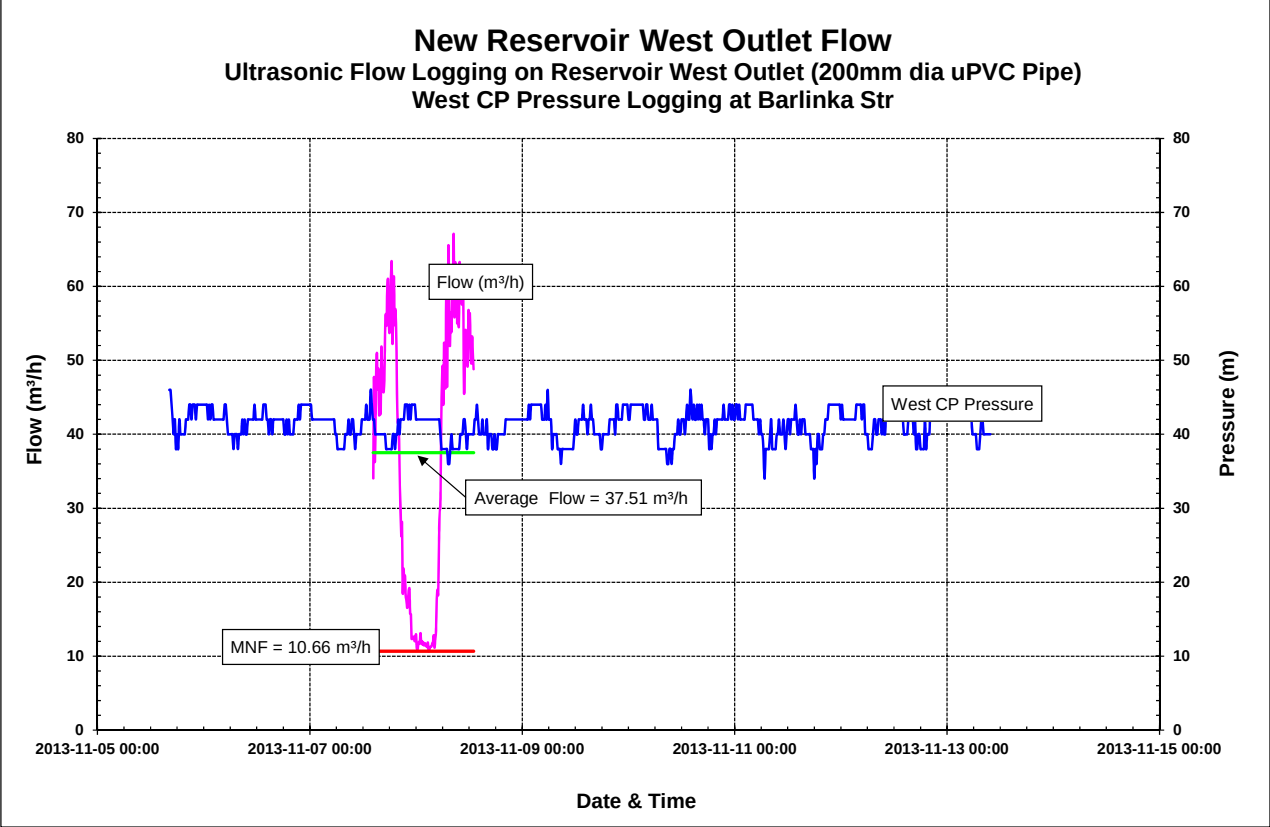




MCGREGOR LOGGING RESULTS



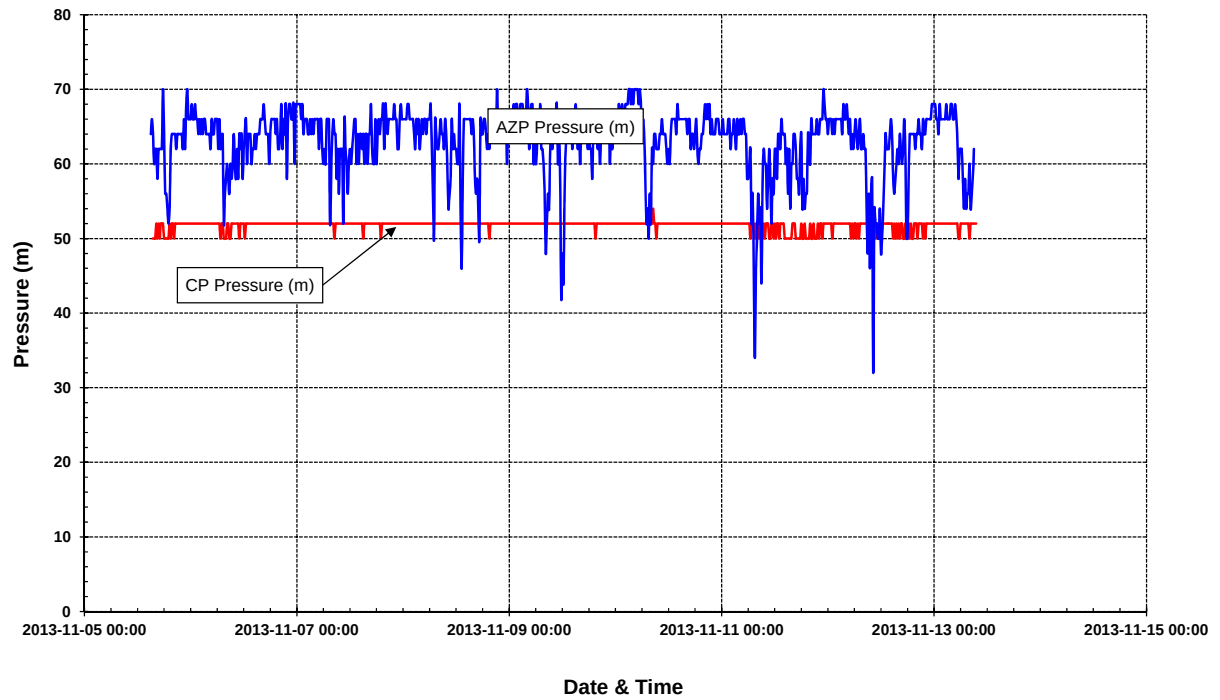
BONNIEVALE LOGGING RESULTS



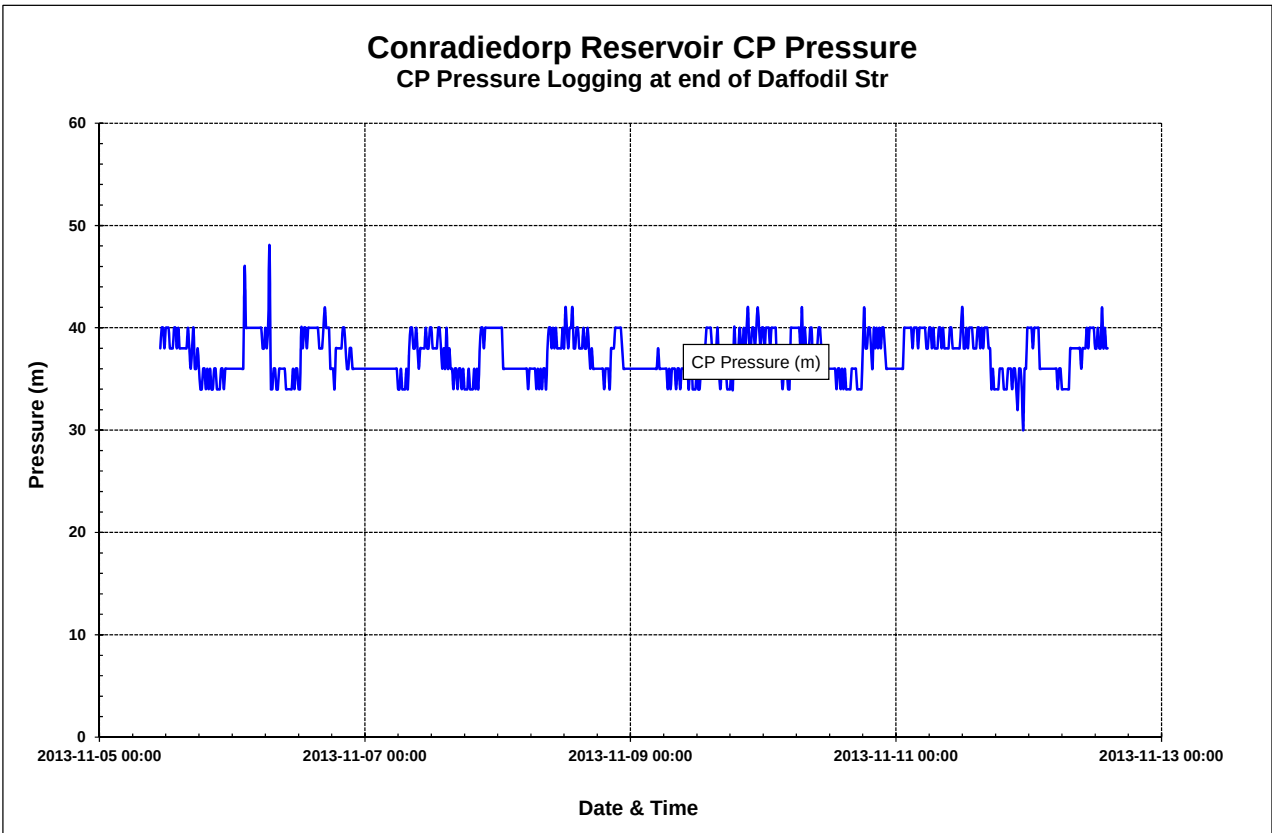
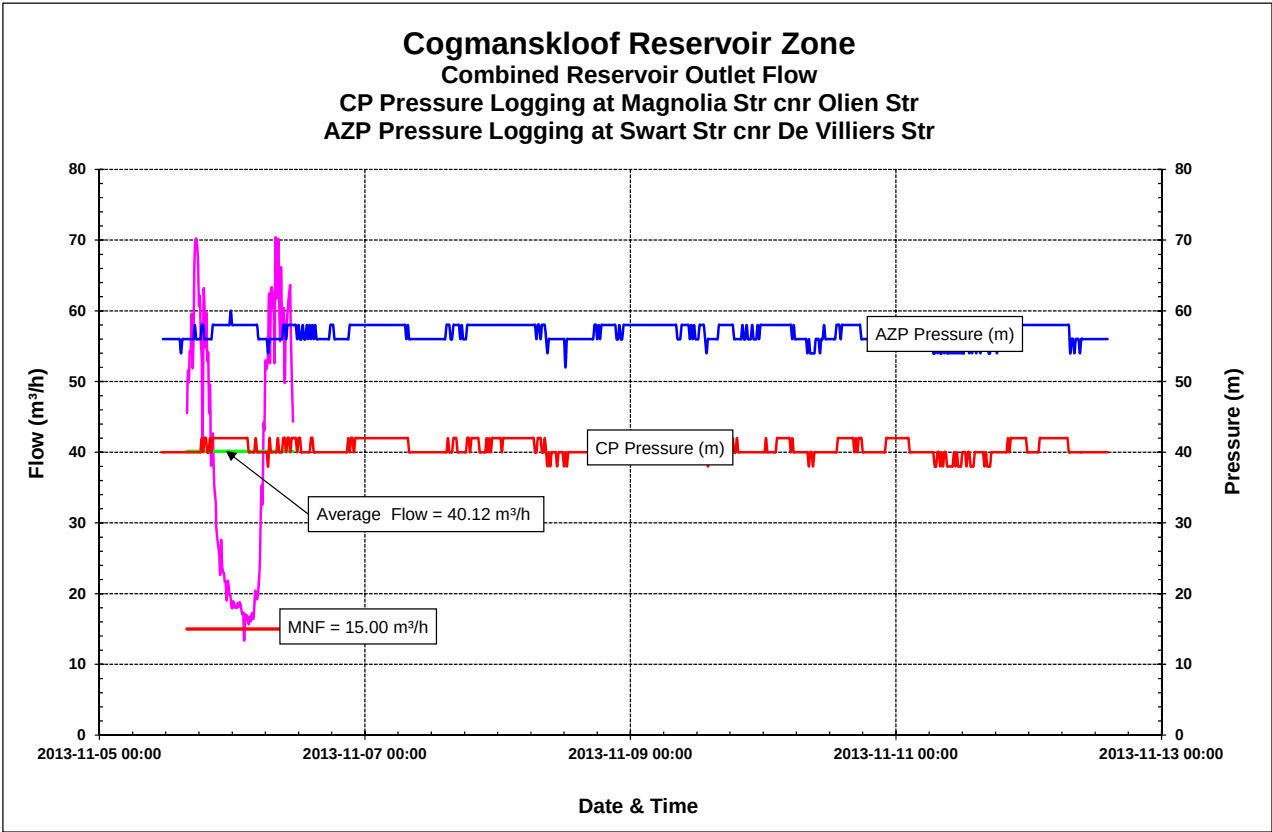
Old Reservoir CP & AZP Pressure

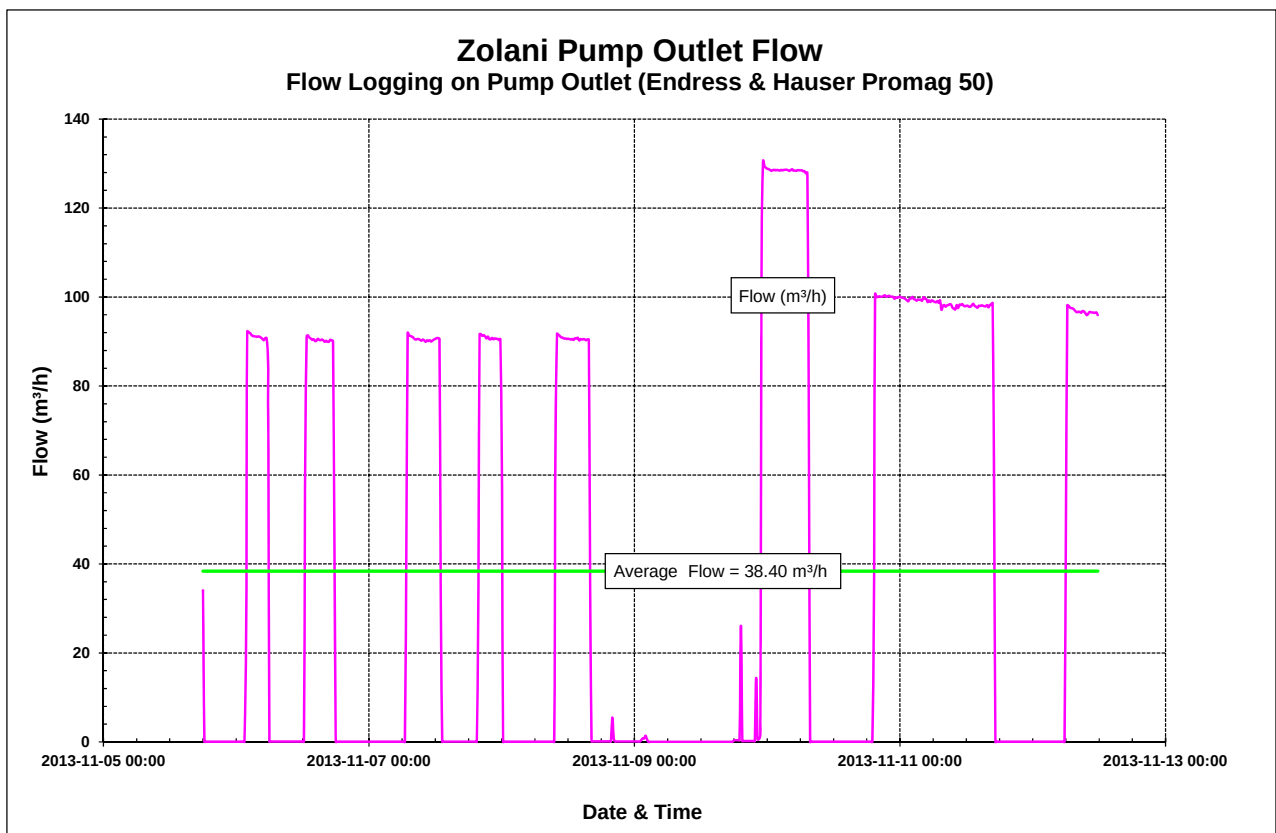
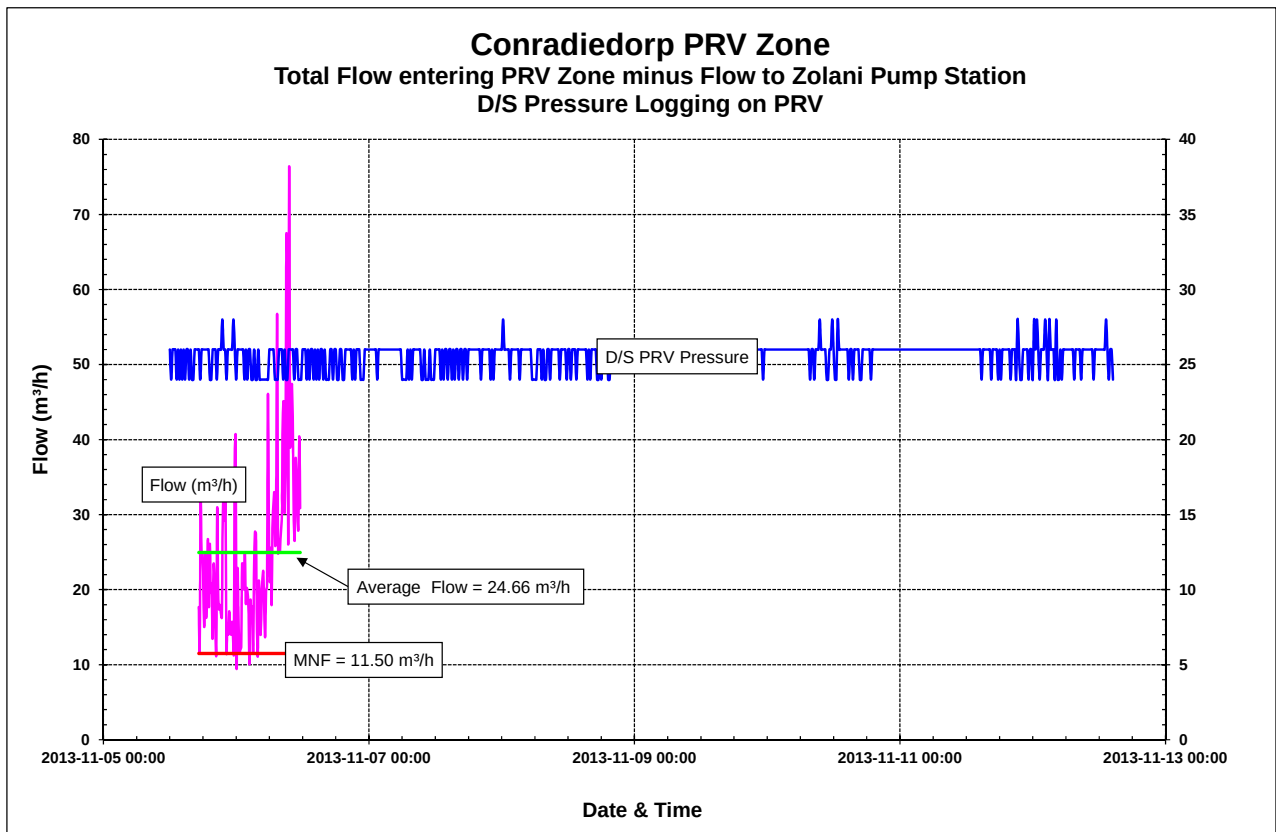
CP Pressure Logging at Hanepoot Ave

AZP Pressure Logging at Tuin Str



ASHTON LOGGING RESULTS





ANNEXURE C

WATER DEMAND MANAGEMENT AND WATER CONSERVATION

SCORECARD

1. Development of Standard Water Balance	WSA has developed reliable water balance and results indicate UAW/NRW at less than 20%
	WSA has developed reliable water balance and results indicate UAW/NRW at 20% to 40%
	WSA has developed reliable water balance and results indicate UAW/NRW at more than 40%
	WSA has no water balance. Is currently developing one
	WSA has no water balance
2. Pressurised Supply to all consumers 100% of time	WSA maintains a pressurised supply to all areas within the water distribution network all of the time at a minimum of 20m pressure
	WSA maintains a pressurised supply to all areas within the water distribution network however pressure drops below 10m in certain areas
	Small isolated sections of the network experience intermittent supply
	Many sections of the network experience intermittent supply
	The entire network experiences intermittent supply
3. Residential Metering System	More than 98% of all connections are metered and billed.
	75% to 98% of all connections are metered and billed
	50 - 75% of connections are metered and billed
	Less than 50% of connections are metered and billed
	No metering takes place
4. Non Residential Metering System (Commercial, Industrial and Institutional)	More than 98% of all non-residential connections, including fire supply connections, are metered and billed based on metered use
	75% to 98% of all non-residential connections, including fire supply connections, are metered and billed based on metered use
	50 - 75% of non-residential connections, including fire supply connections, are metered and billed based on metered
	Less than 50% of non-residential connections, including fire supply connections, are metered and billed based on metered use
	No non—residential metering takes place
5. Effective Billing System including Informative Billing	WSA produces informative billing to all customers based on meter readings
	WSA produces informative billing to most customers based on meter readings
	WSA produces informative billing to only some customers based on meter readings
	WSA has an uninformative billing system in place
	WSA has no billing
6. Network (Leakage) Complaints System	Efficient reporting system in place (90% of reported leaks are repaired within 24 hours)
	Efficient reporting system in place (90% of reported leaks are repaired within 48 hours)
	Leakage reporting system in place response times need to be improved
	Leakage reporting system in place but few if any field response teams to undertake repairs
	No leakage reporting system in place and no plans to create one
7. Billing and Metering Complaints System	Efficient reporting system for metering and billing problems in place (90% dealt with within 14 days)
	Efficient reporting system for metering and billing problems in place (90% dealt with within one month)
	Metering and billing problem reporting system in place response times need to be improved
	Metering and billing problem reporting system in place but very poor response time with many problems never resolved
	No Metering and billing problem reporting system in place
8. Asset Register for Water Reticulation System	WSA has a comprehensive and accurate asset register in place which is available digitally
	WSA has a partially completed accurate asset register in place
	WSA has a poor asset register in place
	SA is in the process of developing an asset register
	WSA has no asset register in place and no immediate intention of generating an asset register
9. Asset Management - Capital Works	2% or more of the value of the water network is invested annually into new capital works related to the existing
	1% - 2% of the value of the water network is invested annually into new capital works related to the existing infrastructure
	Less than 1% of the value of the water network is invested annually into new capital works related to the

	existing infrastructure
	No estimate of asset value of water supply system is available but WSA feels that sufficient budget is spent on new
	No estimate of asset value of water supply system is available and WSA feels that insufficient budget is spent on new Capital Works
10. Asset Management - Operations and Maintenance	2% or more of the value of the water network is invested annually into the maintenance of the existing infrastructure
	1% - 2% of the value of the water network is invested annually into the maintenance of the existing infrastructure
	Less than 1% of the value of the water network is invested annually into the maintenance of the existing infrastructure
	No estimate of asset value of water supply system is available but WSA feels that sufficient budget is spent on operations and maintenance
	No estimate of asset value of water supply system is available and WSA feels that insufficient budget is spent on operations and maintenance
11. Dedicated WDM support	Efficient WDM Section in place with sufficient resources
	WDM section in place requires some resources and capacity building
	WDM section in place. Major resources and capacity building required
	No WDM section currently in place, intention to create WDM section
	No WDM Section and no intention to create WDM section
12. Active Leakage Control	Active leakage detection and repair undertaken continuously with average sweep time of 12 months or less
	Active leakage detection and repair undertaken continuously with average sweep time of 48 months
	Active leakage detection and repair is undertaken on an add-hoc basis
	No active leakage detection is currently undertaken however the WSA intends to initiate such measures
	No active leakage detection is undertaken and the WSA has no intention to conduct such measures
13. Effective Sectorisation	Reticulation network has been sectorised and is checked regularly to maintain discrete zones
	Reticulation network has been sectorised but is not checked regularly to ensure discrete zones
	Only portions of the reticulation network have been sectorised
	Few if any zones have been created but plans are in place to sectorise the system
	No sectorisation has been undertaken and no plans are in place to implement such measures
14. Effective Bulk Meter Management	All bulk water sources to the WSA are metered by the WSA using some form of check metering (either permanent or temporary)
	All bulk water sources to the WSA are metered by the Bulk water supplier or by the WSA
	Few bulk meters are operational
	No Bulk metering in place, however, WSA has plans to install bulk meters
	No Bulk metering in place and no plans for such meters have been made
15. Effective Zone Meter Management and Assessment of Minimum Night Flows	All inlet points to discrete zones are metered and accurate with Minimum Night Flows logged and analysed on a regular basis
	All inlet points to discrete zones are metered and accurate but no Minimum Night Flow analyses are undertaken
	All inlet points to discrete zones are metered but many are broken or considered to be inaccurate
	Zone inputs are currently not metered although the WSA has planned to install meters on all zone inlets
	No accurate zone metering is in place and there are no plans to introduce such measures
16. Pressure Management and Maintenance of Pressure Reducing Valves	Reticulation is comprehensively sectorised into pressure zones which are all discrete. All PRV's are maintained under maintenance schedule
	Reticulation is comprehensively sectorised into pressure zones which are all discrete. PRV's are only maintained when problems become apparent.
	Reticulation is sectorised in pressure zones but the zones are not verified and little or no maintenance is undertaken on the PRVs
	WSA intends to introduce pressure zones and the use of PRVs to manage system pressures.
	No Discrete pressure zones and no PRV maintenance
17. As-Built Drawings of Bulk and Reticulation Infrastructure	Accurate as-built drawings for all reticulation are available digitally
	As-built drawings available digitally for the majority of the network and available in hardcopy for the remainder of the network
	A mixture of digital and hard copy as-built drawings available for the majority of the network but many problems are known to exist with the quality of the data.
	Only some hard copy as-built drawings are available for portions of the network
	No as-built drawings available

18. Schematic Layout of Water Infrastructure	An up-to date and detailed schematic of the whole bulk reticulation network is available showing all bulk mains, pumps, reservoirs, meters and control valves.
	A detailed schematic of the bulk reticulation network is available but is known to be outdated and/or inaccurate.
	Only a rough schematic of the bulk reticulation network is available which is known to be inaccurate and/or outdated
	No schematic of the bulk reticulation is available although the WSA is planning to develop such a schematic.
	No schematic of the bulk reticulation is available and the WSA has no plans to develop such a schematic.
19. Regulations and Bylaws	Regulations and Bylaws are in place which address WDM issues and some form of enforcement is undertaken
	Regulations and Bylaws are in place which address WDM issues but are not enforced
	Regulations and Bylaws are in place but do not address WDM issues
	There are no Bylaws in place but WSA is intending to introduce such measures
	There are no Bylaws in place and WSA has no plans to introduce them
20. Tariffs	WSA has rising block tariffs in place that encourage water use efficiency
	WSA has rising block tariffs in place but they do not encourage water use efficiency sufficiently
	WSA has single water tariff in place
	WSA has a declining block tariff in place
	WSA does not know what tariff structure is in place
21. Technical Support to Customers	The WSA actively engages with customers and offers technical support on WDM to both domestic as well as commercial/industrial customers
	The WSA offers technical support on WDM to large consumers on a pro-active basis
	The WSA only offers technical support on WDM on a reactive basis
	The WSA currently offers no technical support but plans to introduce a support mechanism
	The WSA has no plans to offer technical support on WDM measures to any customers
22. Removal of Unlawful Connections	The WSA actively monitors and removes all unlawful connections
	The WSA selectively monitors and removes unlawful connections
	The WSA monitors unlawful connections but has no policy for removal
	The WSA plans to introduce measures to tackle unlawful connections
	The WSA has no plans to deal with illegal connections
23. Community Awareness and Education Programmes	WSA is actively involved in conducting workshops on water conservation within the communities with a dedicated team
	WSA is involved in conducting workshops on water conservation within the communities however no dedicated team exists
	WSA has very little involvement with workshops on water conservation within the communities
	WSA currently does not conduct workshops on water conservation within the communities, however these interventions are proposed
	WSA currently does not conduct workshops on water conservation within the communities
24. Schools Awareness and Education Programmes	WSA is actively involved in conducting workshops on water conservation within the schools with a dedicated team
	WSA is involved in conducting workshops on water conservation within the schools however no dedicated team exists
	WSA has very little involvement with workshops on water conservation within the schools
	WSA currently does not conduct workshops on water conservation within the schools, however these interventions are proposed
	WSA currently does not conduct workshops on water conservation within the schools
25. Retrofitting	WSA has undertaken a detailed plumbing repair in public buildings and inside properties of indigent users.
	WSA has undertaken limited plumbing repair in public buildings and inside properties of indigent users.
	WSA has undertaken limited plumbing repair in public buildings but not inside properties of indigent users.
	WSA has not undertaken internal plumbing repair in public buildings or inside properties of indigent users.

ANNEXURE D

**Tables prepared by GLS Consulting based on billing data
assessment undertaken in September 2013**

Langeberg Municipality Water Demand Management (GLS Consulting, Sep 2013)

List of tables (GLS Consulting, Sep 2013):

Table 1	Langeberg Municipality NRW summary
Table 2	Langeberg Municipality Unavoidable annual real losses (UARL)
Table 3	Langeberg Municipality Infrastructure leakage index (ILI)
Table 4	Summary of Langeberg cadastral link with treasury data
Table 5	Summary of Langeberg treasury data link with GIS
Table 6	Large water users (> 20 kl/d)
Table 7	Summary of treasury data analysis - Water meter & AADD < 0.1 kl/d
Table 8	Summary of treasury data analysis - No water meter
Table 9	Summary of treasury data analysis - Meters to be verified

List of Appendixes (GLS Consulting, Sep 2013):

Appendix A1	Ashton water losses
Appendix A2	Bonnievale water losses
Appendix A3	McGregor water losses
Appendix A4	Montagu water losses
Appendix A5	Robertson water losses
Appendix B	Summary of treasury records without a GIS link (as per treasury data)
Appendix C	Summary of developed stands with a water meter, but water demand < 0,1 kl/d
Appendix D	Summary of developed stands without a water meter
Appendix E	List of stands where the water demands have reduced drastically in recent months
Appendix F	List of stands where the water demands have increased drastically in recent months
Appendix G	List of water meter readings to be verified

Table 1: Langeberg Municipality NRW summary (GLS Consulting, Sep 2013)

Langeberg Municipality Non-revenue water					
Area	Time period	Bulk Input (kl)	Sold (kl)	UAW (kl)	% UAW
Ashton	Jul '12 - Jun '13	2 121 840	1 433 061	688 779	32.5%
Bonnievale	Jul '12 - Jun '13	1 600 230	1 030 585	569 645	35.6%
McGregor	Jul '12 - Jun '13	263 809	200 993	62 816	23.8%
Montagu	Jul '12 - Jun '13	1 422 639	1 136 983	285 656	20.1%
Robertson	Jul '12 - Jun '13	2 231 038	1 896 690	334 348	15.0%
Langeberg Total		7 639 556	5 698 312	1 941 244	25.4%

Table 2: Langeberg Municipality Unavoidable annual real losses (UARL) (GLS Consulting, Sep 2013)

Langeberg Municipality Unavoidable annual real losses (UARL)					
Town	L_m (km)	N_c	L_p (km)	P (m)	UARL (kℓ/d)
Ashton	61.5	2 962	0	59	206
Bonnievale	50.0	1 934	0	65	158
McGregor	13.2	815	0	36	32
Montagu	72.3	3 801	0	46	200
Robertson	92.6	6 169	0	52	342
Langeberg Total					938

$$\text{UARL} = (18 \times L_m + 0,8 \times N_c + 25 \times L_p) \times P$$

L_m = mains length (km)

N_c = Number of service connections

L_p = 0 (service connection points located at the street property boundary)

P = average operating pressure (m head)

Table 4: Summary of Langeberg cadastral link with treasury data (GLS Consulting, Sep 2016)

Langeberg Cadastral GIS-link			
Town/area	Number of erven	Linked to treasury dataset	
		no.	%
Ashton	2 962	2 937	99%
Bonnievale	1 934	1 900	98%
McGregor	815	740	91%
Montagu	3 801	3 693	97%
Robertson	6 169	6 007	97%
Farms	2 471	2 277	92%
Langeberg Total	18 152	17 554	97%

Langeberg Treasury GIS-link				
Description		Municipal erven	Diverse & rural accounts	Total
GIS link:				
Number of records		23 487	2 995	26 482
Number of unlinked records ¹		5 072	2 399	7 471
Number of stands		22 910	2 913	25 823
Stands linked to GIS	no.	17 926	522	18 448
	%	78%	18%	71%
Meters:				
Number of meters		14 052	93	14 145
Meters linked to GIS	no.	12 062	4	12 066
	%	86%	4%	85%
Water demand:				
Water sold (kl/d)		15 051	503	15 554
AADD linked to GIS	kl/d	14 510	399	14 910
	%	96%	79%	96%

Notes:

¹ All records in the treasury system with no link to the GIS are shown in Appenix B

Ashton data				
Description		Municipal erven ²	Diverse & rural accounts	Total
GIS link:				
Number of records		3 976	269	4 245
Number of unlinked records ¹		842	240	1 082
Number of stands		3 954	267	4 221
Stands linked to GIS	no.	3 114	28	3 142
	%	79%	10%	74%
Meters:				
Number of meters		2 592	19	2 611
Meters linked to GIS	no.	2 474	1	2 475
	%	95%	5%	95%
Water demand:				
Water sold (kl/d)		3 779	18	3 797
AADD linked to GIS	kl/d	3 720	2	3 722
	%	98%	10%	98%

Bonnievale data				
Description		Municipal erven ³	Diverse & rural accounts	Total
GIS link:				
Number of records		2 443	577	3 020
Number of unlinked records ¹		587	314	901
Number of stands		2 309	530	2 839
Stands linked to GIS	no.	1 728	218	1 946
	%	75%	41%	69%
Meters:				
Number of meters		1 855	30	1 885
Meters linked to GIS	no.	1 368	1	1 369
	%	74%	3%	73%
Water demand:				
Water sold (kl/d)		2 662	167	2 829
AADD linked to GIS	kl/d	2 580	163	2 743
	%	97%	97%	97%

McGregor data				
Description		Municipal erven ⁴	Diverse & rural accounts	Total
GIS link:				
Number of records		983	0	983
Number of unlinked records ¹		174	0	174
Number of stands		961	0	961
Stands linked to GIS	no.	789	0	789
	%	82%	-	82%
Meters:				
Number of meters		616	0	616
Meters linked to GIS	no.	520	0	520
	%	84%	-	84%
Water demand:				
Water sold (kl/d)		498	0	498
AADD linked to GIS	kl/d	466	0	466
	%	94%	-	94%

Montagu data				
Description		Municipal erven ⁵	Diverse & rural accounts	Total
GIS link:				
Number of records		4 935	171	5 106
Number of unlinked records ¹		1 121	150	1 271
Number of stands		4 907	171	5 078
Stands linked to GIS	no.	3 791	21	3 812
	%	77%	12%	75%
Meters:				
Number of meters		3 258	2	3 260
Meters linked to GIS	no.	2 961	0	2 961
	%	91%	0%	91%
Water demand:				
Water sold (kl/d)		3 123	16	3 139
AADD linked to GIS	kl/d	3 038	9	3 047
	%	97%	54%	97%

Robertson data				
Description		Municipal erven ⁶	Diverse & rural accounts	Total
GIS link:				
Number of records		8 013	1 978	9 991
Number of unlinked records ¹		1 570	1 695	3 265
Number of stands		7 642	1 945	9 587
Stands linked to GIS	no.	6 145	255	6 400
	%	80%	13%	67%
Meters:				
Number of meters		5 656	42	5 698
Meters linked to GIS	no.	4 671	2	4 673
	%	83%	5%	82%
Water demand:				
Water sold (kl/d)		4 924	301	5 226
AADD linked to GIS	kl/d	4 644	226	4 870
	%	94%	75%	93%

Langeberg farms data				
Description		Farm portions ⁷	Diverse accounts	Total
GIS link:				
Number of records		3 137	0	3 137
Number of unlinked records ¹		778	0	778
Number of farms		3 137	0	3 137
Farms linked to GIS	no.	2 359	0	2 359
	%	75%	-	75%
Meters:				
Number of meters		75	0	75
Meters linked to GIS	no.	68	0	68
	%	91%	-	91%
Water demand:				
Water sold (kl/d)		65	0	65
AADD linked to GIS	kl/d	62	0	62
	%	95%	-	95%

Notes:

¹ All records in the treasury system with no link to the GIS are shown in Appenix B

² Erven in Conradiedorp, Cogmanskloof & Zolani suburbs

³ Erven in Bonnievale town, Town Central, Happy Valley & Mountainview suburbs

⁴ Erven in McGregor North & South suburbs

⁵ Erven in the Montagu Mid town, Montagu South & West, Badshoogte, Industrial area, Bergsig, Old town and Ashbury suburbs

⁶ Erven in the Nkqubela, Industrial area, Lane, Roodezand, old town, Extension 9, Mid town, Duimpiesdorp, Môreson, Sonskyn, Jubelsdorp, Burnhme, Appelkoosboord, Gevangenig, Extension 15, Panorama North & South, Dagbreek, Dorpsig, Droëheuwel and Silwerstrand suburbs

⁷ Farm portions within the Langeberg Municipal area

Table 6: Large water users (> 20 kl/d) (GLS Consulting, Sep 2013)

No.	Erf owner (as per treasury data)	Consumer	Address (as per treasury data)	Suburb (as per treasury data)	Account number	SG21 code (GIS code)	AADD * (kl/d)
1	LANGEBOEG & ASHTON FOODS PTY L	LANGEBOEG & ASHTON FOODS (PTY)	HOOFWEG	A - CONRADIEDORP	340011110012	C05000010000111100000	1 671
2	PARMALAT SA PTY LTD - FABRIEK	PARMALAT SA PTY LTD - FABRIEK	KAPTEINSDRIFT	B - RURAL	468801450051	Linked by hand	1 326
3	ASHTON MUNISIPALITEIT-POMP ZOL	ASHTON MUNISIPALITEIT-POMP ZOL	BOOSTERPOMP NA ZOLANI	A - DIVERSE	349900460064	Not linked	783
4	ASHTON CANNING CO (Fabriek)	LANGEBOEG & ASHTON FOODS (PTY)	HOOFWEG	A - CONRADIEDORP	340007710008	C05000010000077100000	191
5	MUNISIPALITEIT STRAATLIGTE	MUNISIPALITEIT KANTORE Dienste	HOOFWEG	A - CONRADIEDORP	340014790016	C05000010000147900000	169
6	J S B ASSETS C C	ASHTON EXTRACTS (PTY) LTD	HOOFWEG	A - CONRADIEDORP	340020230028	C05000010000202300000	151
7	ROBERTSON WINERY PTY LTD	ROBERTSON WINERY PTY LTD	VOORTREKKERSTRAAT 17	R - INDUSTRIAL	102076680018	Linked by hand	138
8	DEPT OPENB WERKE GRONDSAKE(FAX)	DEPT OPENBARE WERKE & GRONDSAK	DE JONGRYLAAN 2	R - TOWN NORTH	114013330007	C06500030000133300000	136
9	MUNISIPALITEIT SWEMBAD	SWEMBAD	DIRKIE UYSSTRAAT 6	R - LANE	103013280021	C06500030000132800000	126
10	ROBERTSON KO-OP WYNAKERY	ROBERTSON KOOP (5)	KONSTITUSIESTRAAT 3	R - INDUSTRIAL	102010600002	C06500030000106000000	120
11	DIE DIREKTEUR	DIE DIREKTEUR	N I W W PROEFPLAAS 0	R - RURAL	128046210024	Linked by hand	108
12	AVALON SPRINGS HOTEL	AVALON SPRINGS HOTEL	BADHOTEL	M - TOWN	574020930016	C05000020000209300000	92
13	GOVERNMENT OF THE WESTERN CAPE	ROBERTSON LAERSKOOL	DIRKIE UYSSTRAAT LAERSKOO 11	R - LANE	103010730067	C06500030000107300000	79
14	REBEN TRUST	ROBERTSON ABATTOIR BK	WOLHUTERSTRAAT 17	R - INDUSTRIAL	102058240008	C06500030000582400000	79
15	ROODEZANDT KO-OP WYNAKERY	ROODEZAND KO-OP	VOORTREKKERSTRAAT 10-18	R - INDUSTRIAL	102025970045	C06500030000259700000	75
16	PROVONCIAL GOVERNMENT W C	ASHTON SEKONDERE SKOOL	GLADIOLILAAN 18	A - COGMANSKLOOF	341010970082	C06500040000109700000	69
17	LANGEBOEG MUNISIPALITEIT	SPORTRAAD KING EDWARD	RUGBYVELD	M - TOWN	570005340203	C05000020000053400000	68
18	MUNISIPALITEIT ASHTON	ZOLANI BIBLIOTEEK	BUILDING LAAN	A - ZOLANI	343002820067	C05000030000028200000	64
19	COPPER MOON TRADING 25 PTY LTD	MONTAGU SPRINGS HOME OWNERS AS	PLETT SWEMBAD VILLA 92	M - TOWN	574028900029	C05000020000289000000	64
20	FREEWHEEL TRADE & INVEST 23 PT	FREEWHEEL TRADE & INVEST 23 PT	VOORTREKKERSTRAAT 17	R - INDUSTRIAL	102076670019	Linked by hand	59
21	UNIPACK FRUIT (PTY) LTD	UNIPACK FRUIT (PTY) LTD	HOOFWEG	A - COGMANSKLOOF	341013750052	C06500040000137500000	57
22	MOOIVALLEI SUIWEL PTY LTD	MOOIVALLEI SUIWEL PTY LTD	MEENT	B - TOWN	460026140043	C07300020000261400000	53
23	MUNISIPALITEIT MONTAGU	LANGEBOEG MUNISIPALITEIT		M - ASHBURY	583000010042	Linked by hand	47
24	SINODALE KOMMISSIE VIR DIENS	SINODALE KOMMISSIE VIR DIENS	VAN ZYLSTRAAT 2B	R - LANE	103011740014	C06500030000117400000	47
25	MUNISIPALITEIT - WATERWERKE	MUNISIPALITEIT - WATERWERKE	HOOGGELEGEN	B - TOWN	460008540037	C07300020000085400000	42
26	R F & K A WEILERS	R F & K A WEILERS	LANGSTRAAT 37	M - TOWN	570002400033	C05000020000024000000	41
27	BODY CORPORATE KINGNA VILLAS	BODY CORPORATE KINGNA VILLAS	AVALON PLACE	M - TOWN	570056200011	C05000020000562000000	40
28	PARMALAT SA (Pty) Ltd	PARMALAT SA (Pty) Ltd	KAPTEINSDRIFT	B - RURAL	468801390097	Linked by hand	40
29	BONNIEVALE WYNKELDER KOOP LTD	BONNIEVALE WYNKELDER KOOP LTD	KAPTEINSDRIFT	B - RURAL	468800200001	Linked by hand	36
30	MONTAGU KOOP WYNKELDER LTD	MONTAGU KOOP WYNKELDER LTD	CINSAUTSTRAAT (WYNKELDER) 1	M - TOWN	575009010044	C05000020000090100000	34
31	PROVINCIAL GOVERNMENT-W/CAPE	HOSPITAAL ROBERTSON (POMP)	VAN OUDTSHOORNSTRAAT 1	R - TOWN SOUTH	104022550018	C06500030000225500000	33
32	MUNISIPALITEIT BREERIVIER WYNL	MUNISIPALITEIT PARKE	DUM	R - INDUSTRIAL	102000020187	Linked by hand	32
33	ROBERTSON KOOP WYNAKERY LTD(1	ROBERTSON KOOP WYNAKERY LTD(1	KONSTITUSIESTRAAT MUUR 1	R - INDUSTRIAL	102010640076	C06500030000106400000	32
34	J D BURGER	J D BURGER		R - TOWN SOUTH	104043700002	C06500030000437000000	31
35	GOVERNMENT OF THE WESTERN CAPE	HOERSKOOL	DIRKIE UYSSTRAAT 7	R - LANE	103010710006	C06500030000107100000	30
36	ORIBEL PROP 12 PTY LTD	ORIBEL PROP 12 PTY LTD	PAUL KRUGERSTRAAT 1A	R - TOWN SOUTH	105043650084	C06500030000436500000	30
37	MONTAGU WINE & SPIRITS CO (PTY	MONTAGU WINE & SPIRITS CO (PTY	BADSTRAAT (SOETWYNBOERE) 98	M - TOWN	575037330005	C05000020000373300000	30
38	PROVINCIAL GOVERNMENT	ASHBURY PRIMER SKOOL	EIKELAAN ASHBURY PRIMER	M - ASHBURY	582014330027	C05000020000143300000	28
39	ROODEVILLAS HEV	ROODEVILLAS HEV	ROODEVILLAS WATER/HEKLIK	R - LANE	103069170017	Linked by hand	27
40	J F VAN ZYL JNR FAMILIETRUST	EXCULL	WOLHUTERSTRAAT 17	R - INDUSTRIAL	102026630078	C06500030000266300000	27
41	DIE HERBERG (ERF 2260)	DIE HERBERG (ERF 2260)	VAN ZYLSTRAAT HERBERG 2A	R - LANE	103022600005	C06500030000226000000	24
42	R/SON VRUGTEVERPAKKERS PTY LTD	R/SON VRUGTEVERPAKKERS PTY LTD	WOLHUTERSTRAAT VRUGTEVERP 21	R - INDUSTRIAL	102046430072	C06500030000464300000	22
43	C W R BENTLEY	D F & L BOWKER	KERKSTRAAT 14	M - TOWN	570002440157	C05000020000024400000	22
44	ELKANA BOERDERY TRUST	ELKANA BOERDERY TRUST	ELKANA	M - TOWN	574007250052	C05000020000072500000	22
45	HUIS UITVLUCHT	HUIS UITVLUCHT (W/STEL)	PIET RETIEFSTR.(HUIS UITV	M - TOWN	570017800012	C05000020000178000000	20
							5 630

Large users not linked to SG21 code (linked by hand)

Control meter (data not included in total)

* AADD excluding UAW

Table 7: Summary of treasury data analysis - Water meter & AADD < 0.1 kl/d (GLS Coi

Erven with a water meter, but water demand of Erf is less than 0,1 kl/d:	
Town/area	Number of erven
Ashton	513
Bonnievale	82
McGregor	32
Montagu	176
Robertson	222
Farms	3
Langeberg Total	1 028

Notes:

List of records are shown in Appenix C

Records in Ashton includes pre-paid meters (no spatial link for pre-paid meters)

Table 8: Summary of treasury data analysis - No water meter (GLS Consulting, Sep 2016)

Developed erven without a water meter	
Town/area	Number of erven
Ashton	317
Bonnievale	109
McGregor	29
Montagu	82
Robertson	190
Farms	0
Langeberg Total	727

Notes:

List of records are shown in Appenix D

Records in Ashton includes pre-paid meters (no spatial link for pre-paid meters)

Table 9: Summary of treasury data analysis - Meter readings to be verified (GLS Cons

Water meter readings to be verified	
Town/area	Number of meters
Ashton	0
Bonnievale	0
McGregor	0
Montagu	24
Robertson	0
Farms	0
Langeberg Total	24

Note:

List of water meters are shown in Appenix G

Appendix A1: Ashton water losses (GLS Consulting, Sep 2013)

Month	Year	Treated Water from WTW	Consumption [m³]				Monthly Losses		Pre-paid meters:				
			Metered (data from SWIFT)	Unmetered	Pre-paid meters	Total	[m³]	[%]	No of meters	Pre-paid (R)	Tariff		Consumption (m³)
												(0 - 6 kl)	
Jul'12	12/13	89 991	68 960	0	2 981	71 941	18 050	20.1%	254	7 402	free	R 5.08	2 981
Aug'12		82 326	60 272	0	3 156	63 428	18 898	23.0%	254	8 292	free	R 5.08	3 156
Sep'12		79 628	65 283	0	3 644	68 927	10 701	13.4%	254	10 771	free	R 5.08	3 644
Oct'12		69 678	65 768	0	3 395	69 163	515	0.7%	254	9 505	free	R 5.08	3 395
Nov'12		107 848	79 393	0	5 218	84 611	23 237	21.5%	254	18 763	free	R 5.08	5 218
Dec'12		265 173	150 437	0	6 537	156 974	108 199	40.8%	254	25 468	free	R 5.08	6 537
Jan'13		304 472	172 960	0	5 800	178 760	125 712	41.3%	254	21 721	free	R 5.08	5 800
Feb'13		348 514	203 449	0	5 094	208 543	139 971	40.2%	254	18 138	free	R 5.08	5 094
Mrt'13		270 205	181 920	0	5 450	187 370	82 835	30.7%	254	19 943	free	R 5.08	5 450
Apr'13		201 983	130 535	0	4 057	134 592	67 391	33.4%	254	12 867	free	R 5.08	4 057
May'13		196 108	112 822	0	3 846	116 668	79 440	40.5%	254	11 796	free	R 5.08	3 846
Jun'13		105 914	88 726	0	3 357	92 083	13 831	13.1%	254	9 312	free	R 5.08	3 357
Jul'12 to Jun'13 Total		2 121 840	1 380 525	0	52 536	1 433 061	688 779	32.5%					

Notes: 1. Number of pre-paid meters in system = 254 (to be verified)

Appendix A2: Bonnievale water losses (GLS Consulting, Sep 2013)

Month	Year	Treated Water from WTW	Consumption [m³]				Monthly Losses	
			Metered (data from SWIFT)	Unmetered	Pre-paid meters	Total	[m³]	[%]
Jul'12	12/13	107 230	64 912	0	0	64 912	42 318	39.5%
Aug'12		111 490	67 567	0	0	67 567	43 923	39.4%
Sep'12		121 260	76 096	0	0	76 096	45 164	37.2%
Oct'12		116 850	77 022	0	0	77 022	39 828	34.1%
Nov'12		143 500	81 114	0	0	81 114	62 386	43.5%
Dec'12		164 360	69 493	0	0	69 493	94 867	57.7%
Jan'13		177 220	135 578	0	0	135 578	41 642	23.5%
Feb'13		154 580	109 028	0	0	109 028	45 552	29.5%
Mrt'13		160 680	98 134	0	0	98 134	62 546	38.9%
Apr'13		121 990	90 515	0	0	90 515	31 475	25.8%
May'13		120 040	83 488	0	0	83 488	36 552	30.4%
Jun'13		101 030	77 638	0	0	77 638	23 392	23.2%
Jul'12 to Jun'13 Total		1 600 230	1 030 585	0	0	1 030 585	569 645	35.6%

Appendix A3: McGregor water losses (GLS Consulting, Sep 2013)

Month	Year	Treated Water from WTW	Consumption [m³]				Monthly Losses	
			Metered (data from SWIFT)	Unmetered	Pre-paid meters	Total	[m³]	[%]
Jul'12	12/13	8 545	10 621	0	0	10 621	-2 076	-24.3%
Aug'12		14 315	10 083	0	0	10 083	4 232	29.6%
Sep'12		15 025	13 649	0	0	13 649	1 376	9.2%
Oct'12		17 716	12 447	0	0	12 447	5 269	29.7%
Nov'12		26 216	19 347	0	0	19 347	6 869	26.2%
Dec'12		26 833	21 827	0	0	21 827	5 006	18.7%
Jan'13		34 368	24 352	0	0	24 352	10 016	29.1%
Feb'13		28 325	22 550	0	0	22 550	5 775	20.4%
Mrt'13		29 217	14 538	0	0	14 538	14 679	50.2%
Apr'13		22 486	24 533	0	0	24 533	-2 047	-9.1%
May'13		24 711	16 085	0	0	16 085	8 626	34.9%
Jun'13		16 052	10 961	0	0	10 961	5 091	31.7%
Jul'12 to Jun'13 Total		263 809	200 993	0	0	200 993	62 816	23.8%

Appendix A4: Montagu water losses (GLS Consulting, Sep 2013)

Month	Year	Total Treated Water Supply ¹	Consumption [m³]				Monthly Losses	
			Metered (data from SWIFT)	Unmetered	Pre-paid meters	Total	[m³]	[%]
Jul'12	12/13	67 145	84 816	0	0	84 816	-17 671	-26.3%
Aug'12		77 932	67 820	0	0	67 820	10 112	13.0%
Sep'12		102 218	71 311	0	0	71 311	30 907	30.2%
Oct'12		107 030	74 717	0	0	74 717	32 313	30.2%
Nov'12		140 371	111 044	0	0	111 044	29 327	20.9%
Dec'12		167 324	119 998	0	0	119 998	47 326	28.3%
Jan'13		170 357	127 395	0	0	127 395	42 962	25.2%
Feb'13		144 077	113 213	0	0	113 213	30 864	21.4%
Mrt'13		152 103	120 020	0	0	120 020	32 083	21.1%
Apr'13		118 542	100 571	0	0	100 571	17 971	15.2%
May'13		95 210	76 936	0	0	76 936	18 274	19.2%
Jun'13		80 330	69 142	0	0	69 142	11 188	13.9%
Jul'12 to Jun'13 Total		1 422 639	1 136 983	0	0	1 136 983	285 656	20.1%

Notes: 1. Include water from the Kruis supply

Appendix A5: Robertson water losses (GLS Consulting, Sep 2013)

Month	Year	Treated Water from WTW	Consumption [m³]				Monthly Losses	
			Metered (data from SWIFT)	Unmetered	Pre-paid meters	Total	[m³]	[%]
Jul'12	12/13	127 864	101 422	0	0	101 422	26 442	20.7%
Aug'12		133 620	107 806	0	0	107 806	25 814	19.3%
Sep'12		160 935	126 115	0	0	126 115	34 820	21.6%
Oct'12		162 239	128 199	0	0	128 199	34 040	21.0%
Nov'12		200 731	151 177	0	0	151 177	49 554	24.7%
Dec'12		229 329	227 395	0	0	227 395	1 934	0.8%
Jan'13		248 428	217 882	0	0	217 882	30 546	12.3%
Feb'13		226 901	202 465	0	0	202 465	24 436	10.8%
Mrt'13		242 825	195 491	0	0	195 491	47 334	19.5%
Apr'13		180 560	173 030	0	0	173 030	7 530	4.2%
May'13		170 107	140 339	0	0	140 339	29 768	17.5%
Jun'13		147 499	125 369	0	0	125 369	22 130	15.0%
Jul'12 to Jun'13 Total		2 231 038	1 896 690	0	0	1 896 690	334 348	15.0%

APPENDIX E

EXPLANATION OF WATER AUDIT PERFORMANCE INDICATORS

(Based on a WRC Report: An assessment of Non Revenue Water in South Africa)

Experience has shown that the use of only one performance indicator (PI) can sometimes be misleading and, therefore, it is recommended to use **two or three PI's**.

1. The non-revenue water can be expressed as a percentage of the system input volume.

A good target percentage for non revenue water is usually 20% or less. However, it should be noted that percentages can sometimes be misleading (if used in isolation) and therefore the IWA does not actually recommend the use of percentages to express non revenue water. To illustrate that percentages can sometimes be misleading the non revenue water in two imaginary towns are compared in **Table E1**.

Table E1: Example indicating why care should be taken when expressing NRW as %

Town	Service Level	Input Volume (kl/day) X	Actual Usage (kl/day) Y	Non Revenue (kl/day) Z = (X-Y)	Non revenue (%) (Z/X) X 100
A	Standpipes - low income	16250	6250	10 000	62 (suggest severe leakage)
B	House Connections - high income	47500	37500	10 000	21 (suggest moderate leakage)

Although the non revenue volume is exactly the same for Town A and Town B the percentage non revenue water varies significantly because the actual usage volume differs for the two towns. If percentages are used to express non revenue water it should ideally be used to compare the year on year situation at one town and not to compare the percentages between towns. It should also be used in conjunction with the other performance indicators – discussed below.

2. The real losses can be expressed in terms of the Infrastructure Leakage index (ILI)

The recommended IWA performance indicator for real losses is the infrastructure leakage index (ILI). The ILI is a dimensionless parameter and is calculated as follows:

$$ILI = \frac{\text{Current Annual Real Loss (CARL)}}{\text{Current Annual Real Loss (CARL)}}$$

Unavoidable Annual Real Loss (UARL)

The current annual real loss (CARL) was calculated in the water audit and represents the combination of all water that leaks from the system through pipes and connections and/or overflows from reservoirs. The unavoidable annual real loss (UARL) represents the theoretical lowest level of leakage that will always be present in a particular system. The UARL is calculated as follows:

$$\text{UARL (kl/day)} = \frac{[(18 \text{ litre/km of mains/day} \times \text{pressure}) + (0.8 \text{ litres/connection/day} \times \text{pressure})]}{1000}$$

The UARL formula is based on empirical data of a number of supply systems. If the real losses can be reduced to the same value as the unavoidable real losses then the ILI value will be 1. This means that theoretically the lowest ILI value is one and the higher the ILI value the higher the leakage.

In a WRC report (An assessment of Non Revenue Water in South Africa) the ILI values were calculated for 62 water suppliers in South Africa and the results for low income and medium to high income areas are shown respectively in **Figure E1** and **Figure E2**. In this study the average ILI for the 62 water suppliers was 7.6 and an ILI value of 4 and lower was categorised as acceptable. This does not necessarily mean that if the ILI is lower than 4 that water demand management is not required.

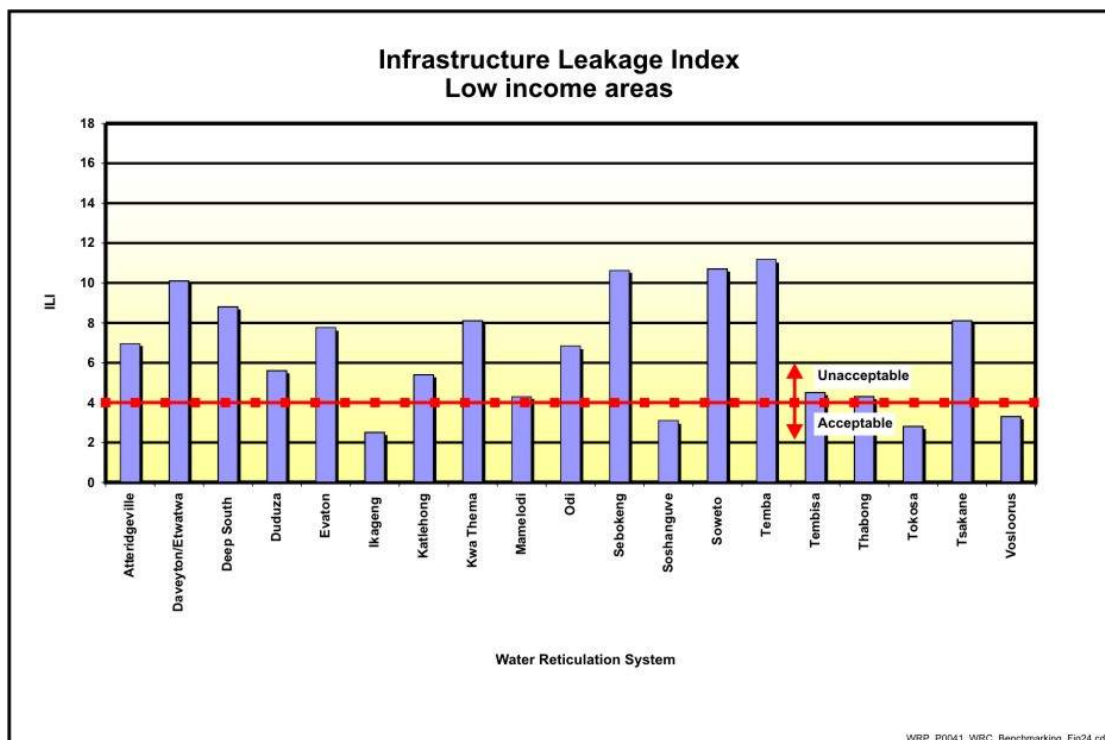


Figure E1: ILI for low income areas (WRC Report: An assessment of Non Revenue Water in SA)

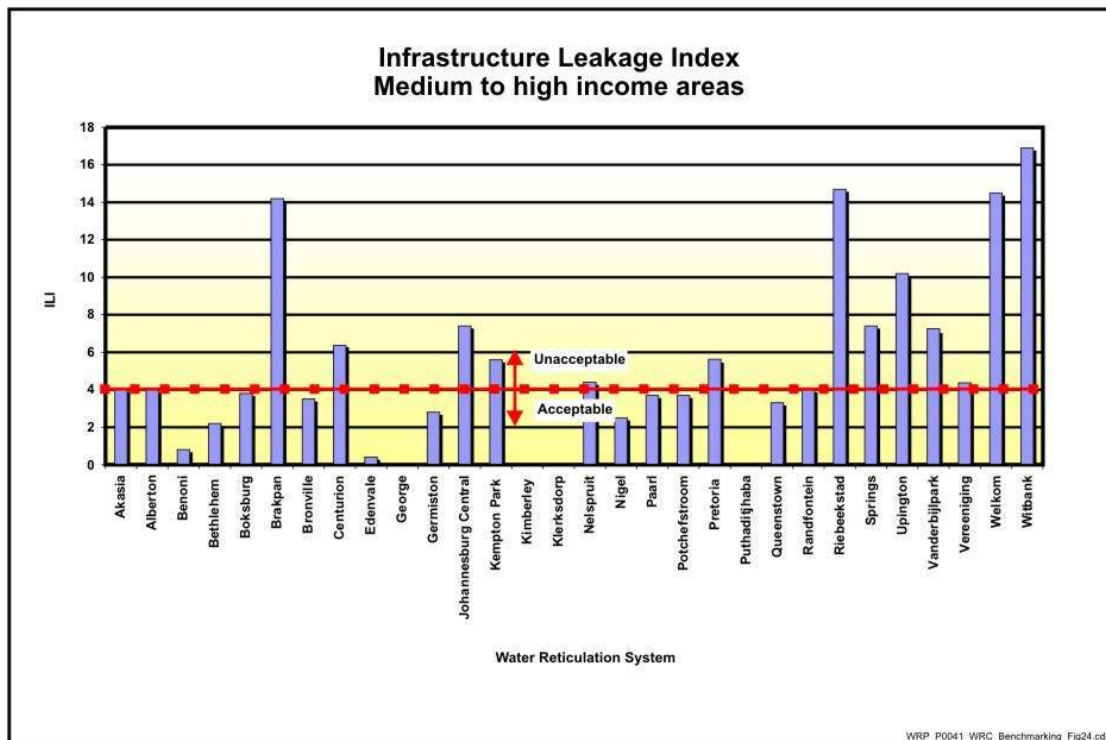


Figure E2: ILI for medium to high income areas (WRC Report: An assessment of Non Revenue Water in SA)

(Note: The ILI for Kimberley could not be calculated because the length of mains and the average operating pressure was not available during the writing of the WRC report.)

As an example the ILI for Uptington is calculated using the following data:

Length of water reticulation:	263km
Number of connections:	12555
Average system pressure:	30m
System input volume:	12.02 million kl/yr
Authorised consumption:	10.08 million kl/yr
Apparent Losses:	0.3 million kl/yr
Real Losses:	Input Volume – consumption – apparent loss. (12.02 – 10.08 - 0.3 = 1.64 mill kl/yr).

$$\begin{aligned}
 &1.64 \text{ million kl/yr} = 4493 \text{ kl/day} \\
 \text{ILI} &= \frac{4493 \text{ kl/day}}{[(18 \text{ litre} \times 263 \text{ km} \times 30 \text{ m pressure}) + (0.8 \text{ litre} \times 12555 \text{ connections} \times 30 \text{ m pressure})] \div 1000} \\
 &= \frac{4493 \text{ kl/day}}{443 \text{ kl/day}} \\
 \text{ILI} &= 10.1 \text{ (dimensionless parameter)}
 \end{aligned}$$

The calculated ILI for Uptington in the above example is 10.1 which is higher than the ILI of 4 that was

categorised as acceptable in the WRC report. This indicates that there is scope to reduce the water losses in Upington. Theoretically the real losses can be reduced to the UARL but this is not always practical and cost effective to achieve.

3. Bulk System input volume per connection supplied

Another indicator that can be used to assess the overall supply system (combination of losses and consumption) is to calculate the system input volume per connection supplied. In the WRC report (An assessment of Non Revenue Water in South Africa) this PI was calculated for 62 water suppliers in South Africa and the following two guidelines were stated as benchmarks:

- 12 kilolitres per connection per month in low income areas where people are not paying for water (see **Figure E3**)
- 35 kilolitres per connection per month in medium to high income areas where people are paying for water (see **Figure E4**)

If the calculated bulk system input volume per connection is higher than the benchmarks mentioned above it will highlight that there is a problem that should be further investigated – either high consumption or high losses. It should be understood that the 12 kl/connection/month and 35 kl/connection/month are calculated using the **system input volume** and will therefore include the actual usage plus losses in the system. For this reason the 12 kl/connection/month is much higher than the free basic water limit of 6kl/household/month.

It should be noted that the figures of 12 and 35 kilolitres per connection per month are approximate, and if the actual demands are found to be high, closer inspection of the situation is required. For example, an area containing many industrial connections is likely to have a higher volume per connection than a predominantly residential area.

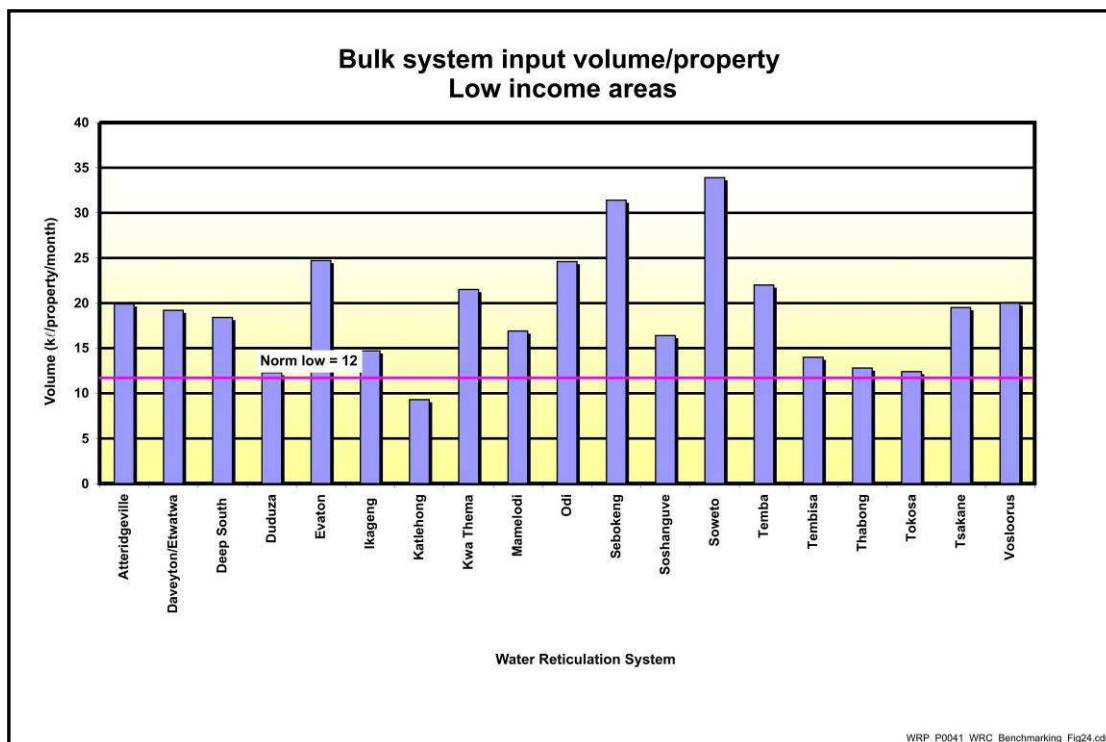


Figure E3: Bulk system input volume per property: low income areas (WRC Report: An assessment of Non Revenue Water in SA)

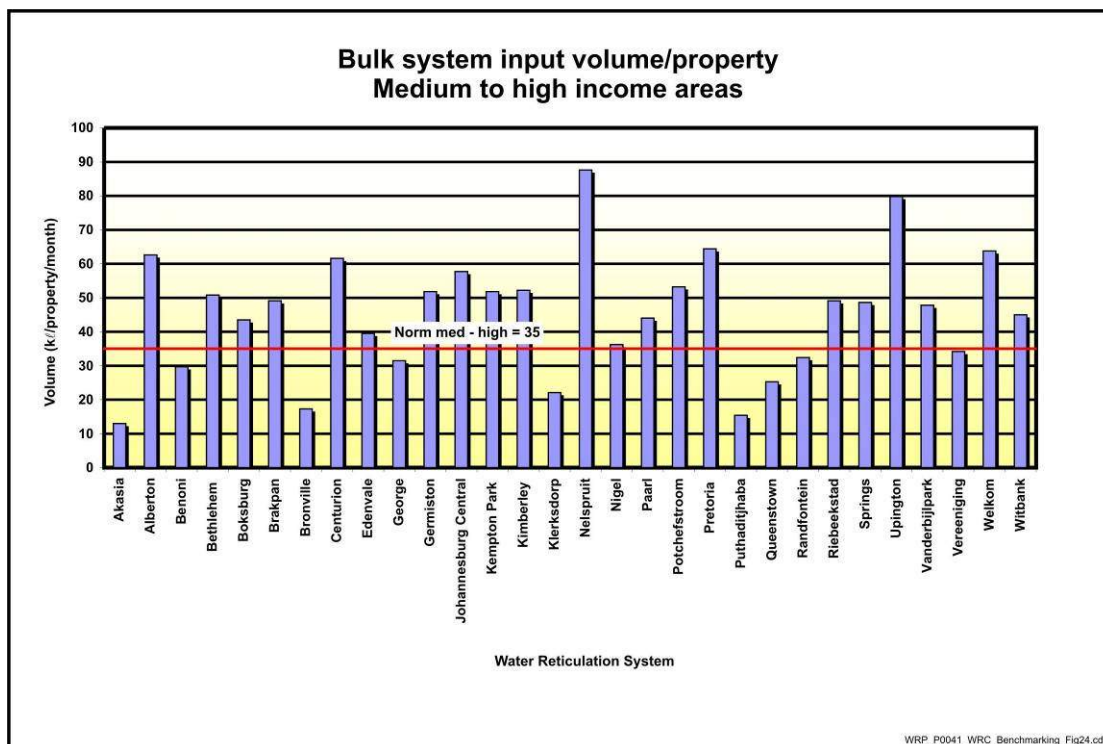


Figure E4: Bulk system input volume per property: medium to high income areas (WRC Report: An assessment of Non Revenue Water in SA)

ANNEXURE F

Results from sample Meter Investigation

Town	Meter Audit Reason	Inspection Date	Time	Ref Number	Suburb Name	Stand Number	Street Name	Street Number	Photo Number	Main Meter Serial Number	Main Meter Reading	Meter Position	Meter in Meter Box	Meter Covered with Soil	Meter Position Clearly Visible	Removed	Not Working	No Meter Located	Not Legible	Comments
Ashton	Erf without water meter	2013-11-07	15:10	1	Ashton	1830	Msizi Street		020-022	-	-	Inside / Below Ground	Yes	No	Yes	Yes				Occupied stand, access to property was obtained. No meter in meter box, only an isolating valve. Meter was removed and replaced with a piece of straight pipe.
Ashton	Erf without water meter	2013-11-07	15:48	6	Ashton	1510	Mafuya Street		033-034	-	-	Inside / Below Ground	Yes		No					Occupied stand, no access to property could be obtained. A meter box was seen inside stand.
Ashton	Erf without water meter	2013-11-07	16:01	8	Ashton	315	Notwalana Street		035	-	-							Yes		Vacant Stand, access to property was obtained. No meter could be located for this stand.
Ashton	Erf without water meter	2013-11-07	16:55	10	Ashton	120	Paul Kruger Street	40	041-042	-	2319	Inside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Prepaid water meter was clearly visible inside stand. Meter serial number was not written down.
Ashton	Erf without water meter	2013-11-07	17:15	12	Ashton	354	Hoog Street		044	-	-							Yes		Vacant Stand, access to property was obtained. No meter could be located for this stand.
Ashton	Erf without water meter	2013-11-07	17:20	13	Ashton	1299	Denne Street	1	045-046	-	31	Inside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Prepaid water meter was clearly visible inside stand. Meter serial number was not written down.
Ashton	Erf without water meter	2013-11-07	17:35	16	Ashton	1484	Ranonkel Street	18	053-054	MOK965	39	Inside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Prepaid water meter was clearly visible inside stand.
Ashton	Erf without water meter	2013-11-07	17:53	18	Ashton	1523	Narsing Street	5	056-057	MOL744	1158	Inside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Prepaid water meter was clearly visible inside stand.
Ashton	Erf without water meter	2013-11-07	18:45	19	Ashton	158	Stasie Street		073-075	C-FUC167	00122	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Ashton	Large water users	2013-11-07	18:15	1 LWU	Ashton	1111	Hoof Street		067-069	TXV 219	340920	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with no lid.
Ashton	Large water users	2013-11-07	17:40	16 LWU	Ashton	1097	Gladidli Street		55									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand.
Ashton	Large water users	2013-11-07	16:10	18 LWU	Ashton	282	Building Avenue		037									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand.
Ashton	Large water users	2013-11-07	18:12	4 LWU	Ashton	771	Hoof Street		061-066	PMI 120426810	430065	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Bulk meter, manufactured by Precision Meters, found. The meter was working but the accuracy of this meter is questionable. Meter in small chamber with no lid.
Ashton	Large water users	2013-11-07	18:29	5 LWU	Ashton	1479	Main Road		070-071 (261-264)	742829	12285	Inside / Below Ground	Yes	Yes	Yes					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean.
McGregor	Erf without water meter	2013-11-08	10:22	2	McGregor	1162	Plein Street		165-167									Yes		Vacant stand with only outbuilding, access to property was obtained. No meter could be located for this stand. No water pipes seen on building.
McGregor	Erf without water meter	2013-11-08	10:30	3	McGregor	398	Long Street	95	169-172	350282	5063	Inside / Above Ground	No	No	No					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter located near back of stand behind braai area, not easy to access.
McGregor	Erf without water meter	2013-11-08	10:59	9	McGregor	Portion of 44	Buitenkant Street	67	183-188	B-WTH671	2010	Inside / Below Ground	No	Yes	No					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter located inside property near fence.
McGregor	Erf without water meter	2013-11-08	11:01	10	McGregor	Portion of 44	Buitenkant Street	66	190-192	FRM0280	2	Inside / Above Ground	No	No	No					Vacant stand, access to property was obtained. No problem could be found with this meter. Meter supplies to standpipe only.
McGregor	Erf without water meter	2013-11-08	11:06	11	McGregor	Portion of 44	Buitenkant Street	65	193-203	C-UUE739	204	Inside / Below Ground	No	No	No					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter located under boundary wall. Small opening left open but difficult to see and read.
McGregor	Erf without water meter	2013-11-08	11:41	17	McGregor	183, 184 & 1163	Voortrekker Street	31	225-230									Yes		Occupied stands, access to property was obtained. No meters could be located for the stands. Three stands belong to the School, two unmetered connections was identified.
McGregor	Erf without water meter	2013-11-08	11:53	18	McGregor	149, 150 & 151	Voortrekker Street	35	231-234	350184	10625	Inside / Below Ground	No	No	Yes					Occupied stands, access to property was obtained. Three stands belong to the SAPD, only one meter was located inside property. No problem could be found with this meter.
Ashton	Large water users	2013-11-07	18:40	6 LWU	Ashton	1824	Main Road		072									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand.
Ashton	Water meter with zero demand	2013-11-07	15:16	2	Ashton	1831	Mantlana Street	15	023-024	-	-	Inside / Below Ground	Yes	Yes	No					Occupied stand, access to property was obtained. Leak found near meter, meter box is flooded. Meter is covered in mud, no meter details could be obtained. It was also found that the single meter supplies to two stands.
Ashton	Water meter with zero demand	2013-11-07	15:25	3	Ashton	1324	Wenzile Street		026-027	-	-	Inside / Below Ground	Yes	Yes	Yes					Occupied stand, access to property was obtained. Meter is buried inside meter box and evident that it had not lately been read. Meter was not excavated to obtain details.
Ashton	Water meter with zero demand	2013-11-07	15:30	4	Ashton	1322	Wenzile Street		028-031	B YL765	-	Inside / Below Ground	Yes	Yes	Yes		Yes			Occupied stand, access to property was obtained. Meter is buried inside meter box and evident that it had not lately been read. Meter was exposed to obtain details, but reading is not clearly visible. Meter is also not working.
Ashton	Water meter with zero demand	2013-11-07	15:42	5	Ashton	1508	Mafuya Street		032	-	-	Inside / Above Ground	Yes		Yes					Occupied stand, no access to property could be obtained. A meter box was seen inside stand.
Ashton	Water meter with zero demand	2013-11-07	16:00	7	Ashton	316	Notwalana Street		036									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Ashton	Water meter with zero demand	2013-11-07	16:45	9	Ashton	1990	Paul Kruger Street	38	038-040	UUE 307	248	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Meter was found isolated and consumer was not at home. No problem could be found with this meter.
Ashton	Water meter with zero demand	2013-11-07	17:10	11	Ashton	352	Hoog Street	16	043									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Ashton	Water meter with zero demand	2013-11-07	17:26	14	Ashton	1263	Denne Street	48	048-050	30007819	6	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Robertson	Erf without water meter	2013-11-12	07:10	2	Robertson	2486	Affodil Street	18	147-149	665481	13091	Inside / Above Ground	No	No	No					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter found inside stand behind the boundary wall.
Robertson	Erf without water meter	2013-11-12	07:35	4	Robertson	3553	Dagbreek Street	46	-									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand.
Robertson	Erf without water meter	2013-11-12	08:06	7	Robertson	2345	Tindalls Street	33	162									Yes		Vacant stand, access to property was obtained. No meter could be located for this stand.
Robertson	Erf without water meter	2013-11-12	08:00	8	Robertson	1154	Tindalls Street	10	158-161	819659	03123	Inside / Above Ground	No	No	No					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter found inside stand behind the boundary wall.
Robertson	Erf without water meter	2013-11-12	08:20	10	Robertson	391	Le Roux Street	53	166	-	-	Inside / Above Ground	No	No	No					Occupied stand with vacant building, no access to property could be obtained. The meter was seen inside stand in a flower bed.

Town	Meter Audit Reason	Inspection Date	Time	Ref Number	Suburb Name	Stand Number	Street Name	Street Number	Photo Number	Main Meter Serial Number	Main Meter Reading	Meter Position	Meter in Meter Box	Meter Covered with Soil	Meter Position Clearly Visible	Removed	Not Working	No Meter Located	Not Legible	Comments
Robertson	Erf without water meter	2013-11-12	08:35	12	Robertson	170	Van Reenen Street		171-172	8062841	13831	Outside / Below Ground	No	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter found outside stand next to the boundary wall.
Robertson	Erf without water meter	2013-11-12	08:45	14	Robertson	7878	Adderley Street		177-179	537845	05361	Inside / Above Ground	No	No	Yes					Occupied stand, no access to property could be obtained. No problem could be found with this meter. Meter found inside stand next to the boundary wall.
Robertson	Erf without water meter	2013-11-12	09:00	15	Robertson	254	Hani Street	14	180-183	C-LUD679	00369	Outside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter found outside stand in meter box.
Robertson	Erf without water meter	2013-11-12	09:12	18	Robertson	651	Luthuli Street		188									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Robertson	Erf without water meter	2013-11-12	09:20	19	Robertson	450	Nonyawaza Street	22	192									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Ashton	Water meter with zero demand	2013-11-07	17:33	15	Ashton	1372	Ranonkel Street	9	051-052	NKT794	774	Inside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Prepaid water meter was clearly visible inside stand.
Ashton	Water meter with zero demand	2013-11-07	17:47	17	Ashton	1516	Bluebells Street	1	058-060	NLG651	1270	Inside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Prepaid water meter was clearly visible inside stand.
Ashton	Water meter with zero demand	2013-11-07	18:52	20	Ashton	656	Stasie Street		076-081	OZN528	3408	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
Bonnievale	Erf without water meter	2013-11-08	09:15	1	Bonnievale	552	Ceder Lane		082-084	-	010315	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with no lid.
Bonnievale	Erf without water meter	2013-11-08	10:03	3	Bonnievale	664	Muller Street		090-094	-	0059515	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Meter is old and accuracy is questionable. Serial number not visible and reading is barely visible due to dial being hazed over. Meter in small chamber with lid.
Bonnievale	Erf without water meter	2013-11-08	11:10	5	Bonnievale	2571	Violotjie Street	26	109-111	B XRY676	2764	Outside / Below Ground	Yes	Yes	Yes					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean.
Bonnievale	Erf without water meter	2013-11-08	11:18	6	Bonnievale	1659	New Cross Street		112									Yes		Occupied stand with vacant building, access to property was obtained. No meter could be located for this stand.
Bonnievale	Erf without water meter	2013-11-08	11:30	8	Bonnievale	1354	Muskadel Street		116-119	C-ZSH 721	05978	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
Bonnievale	Large water users	2013-11-08	10:15	28 LWU	Bonnievale	60/174	Kaptein Drift Street		095-098	EZM432	037119	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
Bonnievale	Large water users	2013-11-08	10:30	22 LWU	Bonnievale	2614	Kerk Street		099-102	BZM675	029968	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with no lid.
Bonnievale	Large water users	2013-11-08	10:48	25 LWU	Bonnievale	854	Hooeglegan Street		103-105	-	500900	Inside / Above Ground	No	No	Yes					Occupied stand, access to property was obtained. The meter serial number is not visible. This meter is the outlet of the water treatment works.
Bonnievale	Water meter with zero demand	2013-11-08	09:50	2	Bonnievale	665	Muller Street		085-089	746341	9802	Inside / Below Ground	Yes	No	No					Occupied stand, access to property was obtained. Meter in small chamber with no lid. No problem could be found with this meter.
Bonnievale	Water meter with zero demand	2013-11-08	11:05	4	Bonnievale	2563	Violotjie Street	14	106-108	B XPA525	1119	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. No problem could be found with this meter.
Bonnievale	Water meter with zero demand	2013-11-08	11:22	7	Bonnievale	790	New Cross Street		113-115	66350	4630	Inside / Below Ground	Yes	Yes	No					Occupied stand, access to property was obtained. Meter in small chamber with no lid. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. No problem could be found with this meter.
Bonnievale	Water meter with zero demand	2013-11-08	11:35	9	Bonnievale	1361	Muskadel Street		120									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Montagu	Erf without water meter	2013-11-07	10:10	6	Montagu	4893	Bietou Street	1	949									Yes		Vacant stand with no buildings, access to property was obtained. No meter could be located for this stand.
Montagu	Erf without water meter	2013-11-07	10:40	8	Montagu	1461	Eike Street		955									Yes		Vacant stand with no buildings, access to property was obtained. No meter could be located for this stand.
Montagu	Erf without water meter	2013-11-07	11:11	11	Montagu	4055	Doringboom Street	22	966									Yes		Occupied stand with vacant building, access to property was obtained. No meter could be located for this stand.
Montagu	Erf without water meter	2013-11-07	12:05	14	Montagu	1146	Protea Street	28	973-975	B WT1493	1599	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Robertson	Large water users	2013-11-08	13:10	10 LWU	Robertson	1060	Konstitusie Street		138-139	82 003 717	2316	Outside / Above Ground	No	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter installed above ground with protective cover.
Robertson	Large water users	2013-11-08	12:42	13 LWU	Robertson	1073	Dirkie uys Street		126-129	2663	116371	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Accuracy of meter is questionable as meter is very old. Meter in small chamber with lid.
Robertson	Large water users	2013-11-12	09:35	14 LWU	Robertson	5824	Wolhuter Street		197-200	C-PUO601	13875	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter installed in a meter box.
Robertson	Large water users	2013-11-08	13:00	15 LWU	Robertson	2597	Voortrekker Street		135-137	EZM321	021813	Outside / Above Ground	No	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter installed above ground with no protective cover.
Robertson	Large water users	2013-11-12	10:35	24 LWU	Robertson	1174	Van Zyl Street		211-212	...ZN253	035656	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
Robertson	Large water users	2013-11-12	10:05	31 LWU	Robertson	2255	Van Oudtshoorn Street		206-210	-	001860	Inside / Below Ground	No	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Serial number is not visible. Meter installed below ground with no chamber.
Robertson	Large water users	2013-11-08	13:30	33 LWU	Robertson	1064	Konstitusie Street		144-145	95165485	-	Outside / Below Ground	Yes	No	No					Occupied stand, access to property was obtained. Meter reading is not visible, algae on dial. Meter in small chamber with lid.
Robertson	Large water users	2013-11-08	12:50	35 LWU	Robertson	1071	Dirkie uys Street		130-134	DZTS56	017191	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
Robertson	Large water users	2013-11-08	13:35	36 LWU	Robertson	4365	Paul Kruger Street		-									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand. Team was told meter is located in locked basement.
Robertson	Large water users	2013-11-12	09:45	40 LWU	Robertson	2633	Voit Street	2	204-205	CGXA135	06182	Inside / Above Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter installed above ground with no protective cover.
Robertson	Large water users	2013-11-12	10:48	41 LWU	Robertson	2260	Van Zyl Street		213-215	...839	-	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Meter serial number and reading is not visible. Meter in a small chamber with no lid.

Town	Meter Audit Reason	Inspection Date	Time	Ref Number	Suburb Name	Stand Number	Street Name	Street Number	Photo Number	Main Meter Serial Number	Main Meter Reading	Meter Position	Meter in Meter Box	Meter Covered with Soil	Meter Position Clearly Visible	Removed	Not Working	No Meter Located	Not Legible	Comments
Robertson	Large water users	2013-11-12	09:40	42 LWU	Robertson	4643	WoluterStreet		201-203	-	141274	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with concrete lid. Serial number could not be taken through opening in lid, but reading is visible.
Robertson	Large water users	2013-11-08	13:12	7 LWU	Robertson	4373	Voortrekker Street		140-143	D2R628	030833	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
Robertson	Large water users	2013-11-12	10:50	8 LWU	Robertson	1333	Van Oudtshoorn Street		215-219	314446	5792946	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Accuracy of meter is questionable as meter is very old. Meter in small chamber with lid.
Robertson	Large water users	2013-11-08	12:35	9 LWU	Robertson	Next to Stand 4484	Dirkie uys Street		121-125	EZS002	075532	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
McGregor	Water demand decreased drastically	2013-11-08	10:32	4	McGregor	18	Long Street	91	-									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand. Water pipes visible inside property.
McGregor	Water demand decreased drastically	2013-11-08	10:36	5	McGregor	1037	Long Street	98	-									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand. Water pipes visible inside property.
McGregor	Water demand decreased drastically	2013-11-08	10:46	6	McGregor	417	Darling Street	22	174-176			Inside / Above Ground	No	No	No					Occupied stand, no access to property could be obtained. Meter was seen inside a flower bed, not easy to find.
McGregor	Water demand decreased drastically	2013-11-08	11:10	12	McGregor	535	Hartzenberg Street	7	205-210	-	5755	Inside / Below Ground	Yes	Yes	No				Yes	Occupied stand, access to property was obtained. Meter located behind lapa in meter box and covered with soil. Reading not clearly visible, but could be taken. Serial number could not be taken.
McGregor	Water demand decreased drastically	2013-11-08	11:15	13	McGregor	546	Meyer Crescent	11	212-217	95254891	2798	Inside / Above Ground	No	No	Yes				Yes	Occupied stand, access to property was obtained. Meter reading not clearly visible.
McGregor	Water demand decreased drastically	2013-11-08	11:29	14	McGregor	697	Voortrekker Street	34	218											Occupied stand, no access to property could be obtained. No meter could be located for this stand. Building is currently not occupied.
Montagu	Erf without water meter	2013-11-07	12:28	15	Montagu	4338	Cabarnet Street		979-981	93322349	09502	Outside / Below Ground	Yes	No	Yes					Vacant stand with no buildings, access to property was obtained. No problem could be found with this meter and the meter was also turning at the time of the audit although it supplies a vacant stand.
Montagu	Erf without water meter	2013-11-07	12:35	16	Montagu	5329	Bad Street	102	982-984	B YWA455	26619	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with no lid.
Montagu	Erf without water meter	2013-11-07	13:44	19	Montagu	5198	Bad Street	27										Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Montagu	Erf without water meter	2013-11-07	14:25	21	Montagu	3858	Banie Street	6	015									Yes		Vacant stand with no buildings, access to property was obtained. No meter could be located for this stand.
Montagu	Erf without water meter	2013-11-07	14:40	24	Montagu	5172	Bree Street	9	018-019	-	2976	Inside / Below Ground	No	Yes	No					Occupied stand, access to property was obtained. No problem could be found with this meter. Stand being used for agriculture, no buildings on stand.
Montagu	Large water users	2013-11-07	10:45	38 LWU	Montagu	1433	Eike Street		956-959	TZR 158	051760	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with lid.
Montagu	Large water users	2013-11-07	11:45	12 LWU	Montagu	2093	Uitlug Street		968-971	FXR 579	040884	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter. Meter in small chamber with no lid.
Montagu	Large water users	2013-11-07	12:20	30 LWU	Montagu	901	Sultana Crescent		976-978	FZR 587	012930	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Meter did not turn during audit. Meter in small chamber with no lid.
Montagu	Large water users	2013-11-07	12:45	17 LWU	Montagu	534	Park Street		985-987	FZN 316	022571	Inside / Above Ground	No	No	Yes		Yes			Occupied stand, access to property was obtained. Meter is not working. Meter is not protected in small chamber.
Montagu	Large water users	2013-11-07	12:50	17 LWU	Montagu	534	Park Street		988-991	RZN 725	009484	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with the meter. Meter in small chamber with lid.
Montagu	Large water users	2013-11-07	13:04	37 LWU	Montagu	3733	Bath Street		992-994	OXN 192	055543	Inside / Below Ground	Yes	No	Yes			Yes		Occupied stand, access to property was obtained. Meter is not working. Meter in small chamber with lid.
Montagu	Large water users	2013-11-07	13:53	45 LWU	Montagu	1780	Bad Street		003-004	-	41796	Ground	No	No	Yes					visible. Meter is not protected in meter box.
Montagu	Large water users	2013-11-07	13:58	43 LWU	Montagu	244	Kerk Street	14	005									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand.
Montagu	Large water users	2013-11-07	14:08	26 LWU	Montagu	240	Lang Street	37	006									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Montagu	Large water users	2013-11-07	14:14	27 LWU	Montagu	5620	Mark Street		007									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand.
McGregor	Water meter with zero demand	2013-11-08	10:00	1	McGregor	100	Mill Street	67	153-157	570868	13816	Inside / Above Ground	No	No	No					Occupied stand, access to property was obtained. Algea on meter dial but reading is still visible.
McGregor	Water meter with zero demand	2013-11-08	10:03	1	McGregor	100	Mill Street	67	158-163	C-LUF010	3620	Inside / Above Ground	No	No	No					Occupied stand, access to property was obtained. No problem could be found with this meter.
McGregor	Water meter with zero demand	2013-11-08	10:54	7	McGregor	784	Bree Street	32	178-181	FRM0279	50	Inside / Above Ground	No	No	No					Occupied stand, access to property was obtained. No problem could be found with this meter.
McGregor	Water meter with zero demand	2013-11-08	10:56	8	McGregor	904	Buitenkant Street	69	-									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand. Water pipes visible inside property.
McGregor	Water meter with zero demand	2013-11-08	11:33	15	McGregor	1202	Office Street (Kantoor Street)	20	219-221	C-OSK790	3724	Outside / Below Ground	No	No	No					Occupied stand, access to property was obtained. No problem could be found with this meter. This meter was located next to another buried meter.
McGregor	Water meter with zero demand	2013-11-08	11:35	16	McGregor	211	Office Street (Kantoor Street)	20	222-224	91467765	-	Outside / Below Ground	No	Yes	No				Yes	Occupied stand, access to property was obtained. This meter was found buried. Reading is not visible.
Montagu	Water meter with zero demand	2013-11-07	09:47	1	Montagu	4839	Bietou Street	64	939-941	C MOE 988	0733	Outside / Below Ground	Yes	Yes	Yes					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. No problem could be found with this meter.
Montagu	Water meter with zero demand	2013-11-07	10:05	5	Montagu	4837	Bietou Street	60	945-947									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Montagu	Water meter with zero demand	2013-11-07	10:25	7	Montagu	4594	Ysterhout Street	10	950-954	C MKB 722	1449	Outside / Below Ground	Yes	Yes	No					Occupied stand, access to property was obtained. Meter is buried inside meter box, evident that meter had not lately been read. Meter reading was clearly visible after meter was excavated and dial was wiped clean. No problem could be found with this meter.
Montagu	Water meter with zero demand	2013-11-07	11:05	10	Montagu	4029	Hibiscus Street	18	963-965	B WTI693	0762	Inside / Below Ground	Yes	Yes	No					Occupied stand, access to property was obtained. Meter box located in flower bed and covered with soil and grass. Meter is also covered with grass and that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. No problem could be found with this meter.
Montagu	Water meter with zero demand	2013-11-07	11:30	12	Montagu	5039	Peperboom Street	35	967	C H	0470	Outside / Below Ground	Yes	Yes	No					Occupied stand, access to property was obtained. Meter is buried inside meter box, evident that meter had not lately been read. Meter reading was clearly visible after meter was excavated and dial was wiped clean. Meter serial number is not visible.
Montagu	Water meter with zero demand	2013-11-07	12:00	13	Montagu	1427	Protea Street	35	972									Yes		Vacant stand with no buildings, access to property was obtained. No meter could be located for this stand.

Town	Meter Audit Reason	Inspection Date	Time	Ref Number	Suburb Name	Stand Number	Street Name	Street Number	Photo Number	Main Meter Serial Number	Main Meter Reading	Meter Position	Meter in Meter Box	Meter Covered with Soil	Meter Position Clearly Visible	Removed	Not Working	No Meter Located	Not Legible	Comments
Montagu	Water meter with zero demand	2013-11-07	13:30	18	Montagu	1088	Bad Street		997-998									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand. There was also a leak on the property.
Montagu	Water meter with zero demand	2013-11-07	14:26	22	Montagu	3857	Banie Street	4	011-014	B WTX240	0694	Inside / Below Ground	Yes	Yes	No					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. No problem could be found with this meter.
Montagu	Water meter with zero demand	2013-11-07	14:35	23	Montagu	794	Bree Street	3	016-017			Inside / Below Ground	Yes		No					Occupied stand with vacant building, no access to property could be obtained. Meter box was visible behind fence in flower bed but meter details could not be obtained.
Robertson	Water meter with zero demand	2013-11-12	07:30	3	Robertson	3551	Dagbreek Street	42	150	-	-	Inside / Below Ground	Yes		Yes					Occupied stand, no access to property could be obtained. A meter box was seen inside stand.
Robertson	Water meter with zero demand	2013-11-12	07:40	5	Robertson	6105	Bloubos Street	21	152-154	C-PKI7780	0137	Inside / Below Ground	Yes	Yes	Yes					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. No problem could be found with this meter.
Robertson	Water meter with zero demand	2013-11-12	07:50	6	Robertson	6136	Bloubos Street	20	155-157	B ZMB135	0510	Inside / Below Ground	Yes	Yes	No					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. No problem could be found with this meter.
Robertson	Water meter with zero demand	2013-11-12	08:15	9	Robertson	417	Le Roux Street	56	163-165	593427	08882	Outside / Above Ground	No	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Robertson	Water meter with zero demand	2013-11-12	08:30	11	Robertson	236	Van Reenen Street		167-170	GZK128	00005	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Robertson	Water meter with zero demand	2013-11-12	08:40	13	Robertson	1692	Adderley Street	55	173-176	C-DUG695	00117	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Robertson	Water meter with zero demand	2013-11-12	09:05	16	Robertson	309	Hani Street		184-187	B XRZ670	0786	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Robertson	Water meter with zero demand	2013-11-12	09:15	17	Robertson	192	Luthuli Street		189-191	2368474	5771	Inside / Below Ground	Yes	Yes	Yes					Occupied stand, access to property was obtained. Meter is buried inside meter box, evident that meter had not lately been read. Meter reading was clearly visible after meter was excavated and dial was wiped clean. No problem could be found with this meter.
Robertson	Water meter with zero demand	2013-11-12	09:23	20	Robertson	455	Nonyawaza Street	32	193-196	C4-133011	653	Inside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. No problem could be found with this meter.
Montagu	Water meters to be verified	2013-11-07	09:55	2	Montagu	4840	Bietou Street	66	942									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Montagu	Water meters to be verified	2013-11-07	10:00	3	Montagu	4842	Bietou Street	70	943	-	-	Outside / Below Ground	Yes		No					Occupied stand, access to property was obtained. Buried meter box located in front of gate, evident that meter had not lately been read. Meter box was not excavated.
Montagu	Water meters to be verified	2013-11-07	10:02	4	Montagu	4845	Bietou Street	45	944									Yes		Occupied stand, access to property was obtained. No meter could be located for this stand.
Montagu	Water meters to be verified	2013-11-07	10:58	9	Montagu	4025	Hibiscus Street	6	960-962	B WT1687	2432	Inside / Below Ground	Yes	Yes	Yes					Occupied stand, access to property was obtained. Meter is buried inside meter box, evident that meter had not lately been read. Meter reading was clearly visible after meter was excavated and dial was wiped clean. Meter registering in m³.
Montagu	Water meters to be verified	2013-11-07	13:20	17	Montagu	356	Piet Retief Street	22	995-996									Yes		Occupied stand, no access to property could be obtained. No meter could be located for this stand.
Montagu	Water meters to be verified	2013-11-07	14:20	20	Montagu	2303	Banie Street	1	008-010	-	02221	Outside / Below Ground	Yes	No	Yes					Occupied stand, access to property was obtained. Meter dial covered with layer of soil, evident that meter had not lately been read. Meter reading was clearly visible after dial was wiped clean. Meter registering in m³.