2017

SMART WATER METERING & NON-REVENUE WATER

LAISON TECHNOLOGY

SMART METERING, SMART CHOICE

OPEN DAYS 2017
STC of African Water Association

Contents

Smart Metering Platforms

Prepaid Solution - STS (Standard Transfer Specification)

Targeted for Bills & Arrears Collection

Various STS Solutions

- Recharge By Customer Interface Unit(RF Wireless)
- Recharge by APP(Bluetooth)
- Recharge by IR Keypad(Infrared)

Meter Features

- **STS compliance.**
- **Variable Purchase Way optional (Vending Points, POS, SMS etc.)**
- **Integated with local Mobile Payment(Airetel, MTN, M-pesa)**
- **Anti-tamper & Event Record**
- **Monthly /Daily/ Hourly** Consumption Data Record
- **Step Tariff**

AMR Solution - Automated Meter Reading

Targeted for leakage & tamper detection

Fixed Network AMR

- Upload: GPRS
  Download: RF Wireless
- Daily Data Uploading
- Leakage & Bypassing Detect
- Remote Valve Control
- Long Distance comm.(2.5km+)

Walk-by/Drive-by AMR

- Walk-by APP with GIS
- Automated Data Collection
- Tamper & Alarm Upload
- No Household Visiting

Integration of Platforms

Water Meter Options

Volumetric Dry Type
Brass Body
R160

or

Multi-jet Liquid Sealed Type
Brass Body
R80/R100

or

Ultrasonic Flow Meter
Brass Body
R160/R200

or

Multi-jet Wet Type
Plastic Body
R80

Development in Water Metering

STS Prepaid Solution

RF Wireless STS

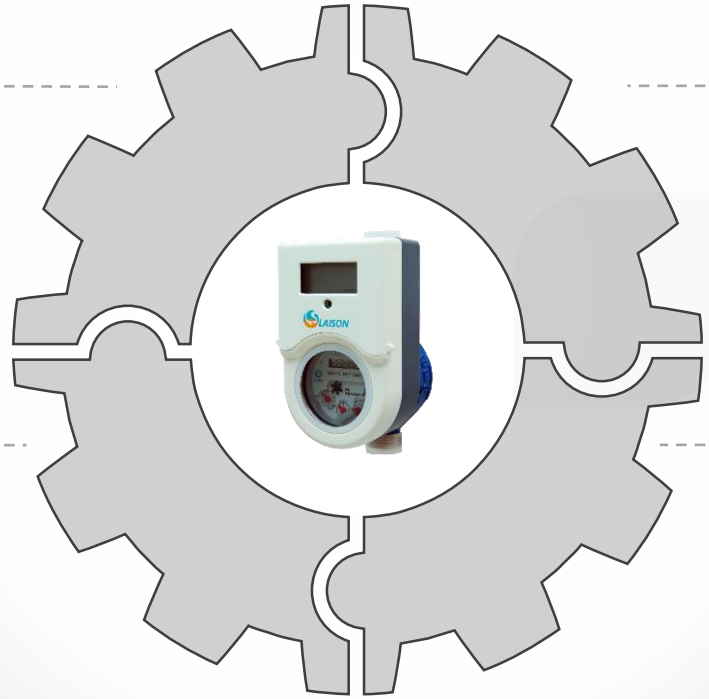
Blue-tooth STS

Infrared STS

Vending System

LAPIS STS Vending Software

LAPIS STS Vending APP



AMI Smart Solution

RF Wireless Smart Water Meter

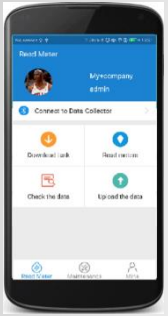
NB-Iot Smart Water Meter

Management System

LIMAS Management Software

LIMAS Management APP

Mobile APPs

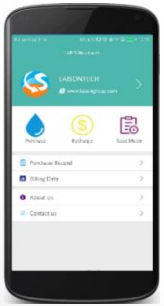


APP For Maintainer

Walk-by APP
Batch Meter Data Collection
No Household Visiting

APP For Vender

LAPIS Vending APP
Mobile Vending
Easy Operation
Account Monitor



APP For Customer

Blue-tooth APP
Consumption Query
Mobile Payment
Bluetooth Comm.

Complete Metering Solution

Meter Solutions

- Various STS Meter Solutions
- Covers different budget
- Afford different application requirement.

System Solution

Could be customized based on Utility’ s requirement(Step-tariff/additional fee/report etc)

Convenient Solution application

Based on Utility’ s concerns, provide the advanced APP solutions, solve the vending issue in remote area and easy management of Vendor.

CASE STUDIES

Case Study – STS Prepaid Solution

Blantyre Water Board (BWB) Malawi started a 5,000pcs STS Prepaid Water Meter & System Pilot Project in 2016

BWB will install 10000 STS Prepaid Water Meters in 2017

BWB plans to replace all post paid meters by STS prepaid meter

BWB STS Prepaid Meters is reserved for AMR functions

Case Study – AMR Solution

Pilot Site Description

- Limeira is a city located in Sao Paolo state about 115 kilometers from Sao Paolo city. It has a population of approximately 300,000 and the municipal area covers more than 500 km2.
- "Area 53" was selected as the pilot site as it comprised a well-defined DMA of one bulk meter and 290 residential and commercial water meters. An additional eight meters were connected to the AMR network outside of the Area 53 DMA.
- The pilot system was installed and commissioned on 8 March 2017

Bulk Meter

The Area 53 DMA has one bulk meter, located in an underground pit.

AMR Endpoint

Consumer Meters

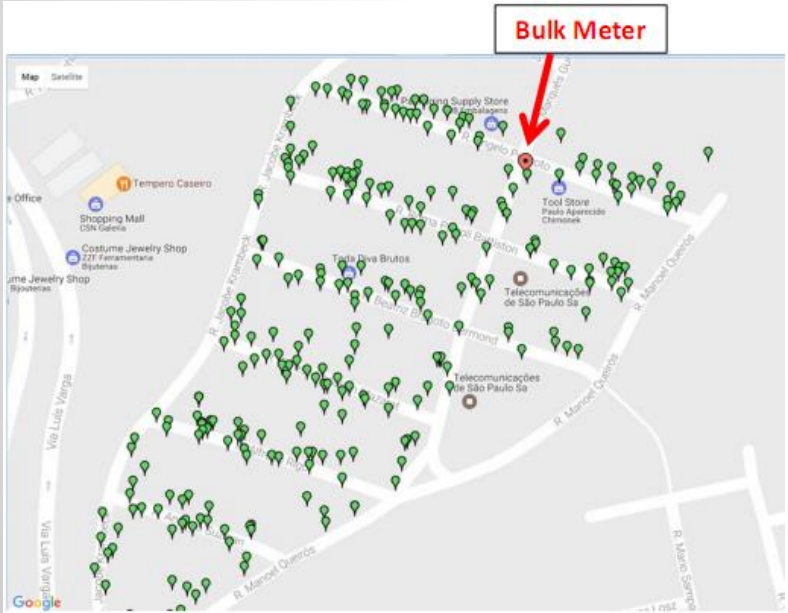
Typical installation in the outside wall of a residence or commercial establishment. The meter cabinet is covered by a plastic or metal cover.

AMR Endpoint

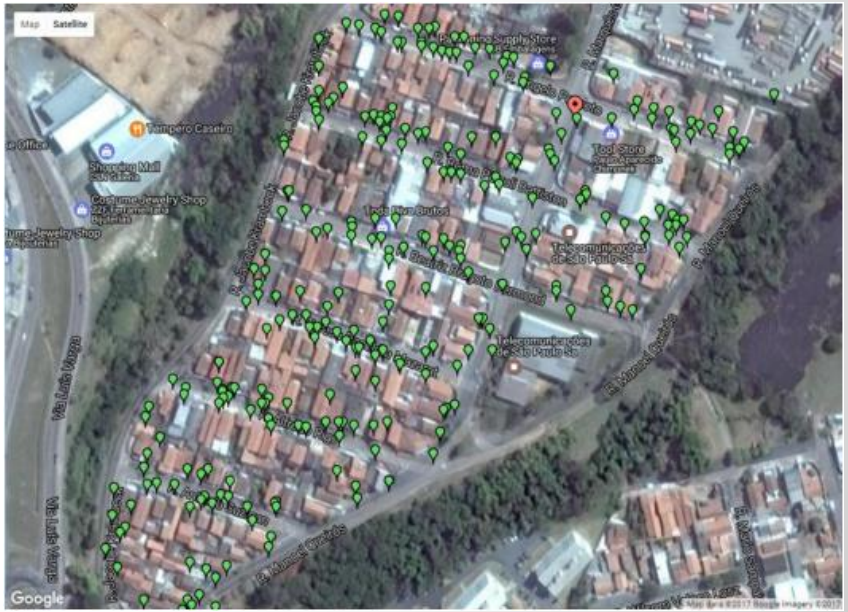
Area 53 District Metering Area

Shown on the map are the bulk meter and all of the consumer (residential and commercial) water meters in the DMA.

Area 53 District Metering Area:
The Area 53 DMA is shown below:



Below is a satellite view of the DMA:



Data Verification

With respect to the Non-Revenue Water ("NRW") analyses and the Night Flow analyses generated via the control center software, it was further verified that all data had been captured by the system. The screenshot below was taken from management software, showing the percent endpoint reception during the NRW and Night Flow analysis period.

Day	Date	Total Associated Endpoints	Total Active Endpoints	%Reception
Tue	16/05/2017	299	299	100
Wed	17/05/2017	299	299	100
Thu	18/05/2017	299	299	100
Fri	19/05/2017	299	299	100
Sat	20/05/2017	299	299	100
Sun	21/05/2017	299	299	100
Mon	22/05/2017	299	299	100
Tue	23/05/2017	299	299	100
Wed	24/05/2017	299	298	99.67
Thu	25/05/2017	299	298	99.67
Fri	26/05/2017	299	298	99.67
Sat	27/05/2017	299	298	99.67
Sun	28/05/2017	299	298	99.67
Mon	29/05/2017	299	298	99.67
Tue	30/05/2017	299	298	99.67

Non-Revenue Water Analysis

The utility was aware of the fact that Area 53 had significant non-revenue water, though they had previously not been able to accurately measure the percentage of non-revenue water.

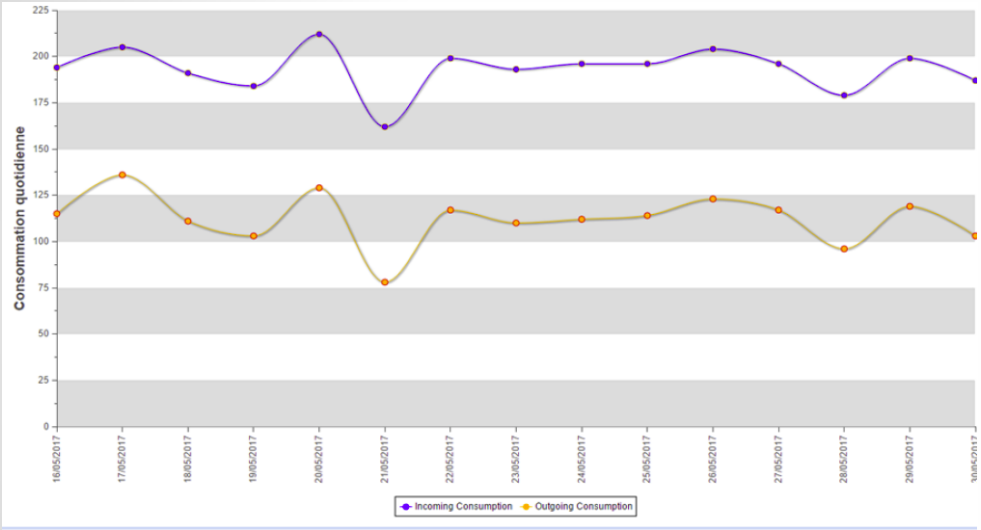
Below is a screenshot from the NRW Analysis for the period 16 May – 30 May 2017:

Group Name	Level	Total Incom... Meters	Total Outgo... Meters	Incoming Consumption	Consumption	Unaccounted Consumption	%Unacc... Consum...
DMA - 53 Area	DMA	1	290	2,897	1,685	1,212	41.83%

For this period, the consumption measured by the bulk meter was 2,897 m3, and the total consumption measured from all of the consumer meters was 1,685 m3. Thus, 1,212 m3 of water consumption was unaccounted, and total NRW was almost 42%.

Non-Revenue Water Analysis

The chart for the analysis period is shown below:



The top line in the chart is the consumption measured at the bulk meter, and lower line is the consumption measured at all of the consumer meters. These two lines basically have the exact same shape, which confirms that the majority of the NRW is due to system water loss (i.e. leaks in the pipes), and insignificantly from theft or fraud. This conclusion can be reached since the difference between the bulk meter consumption and the consumer meters total consumption remains constant. Thus, as opposed to what the leakage consultant concluded, it is clear that **there is significant system water leakage in Area 53.**

Non-Revenue Water Analysis

An additional analysis that was performed was to look at the total consumption during the period for each of the consumers in the DMA. In the NRW Analysis, the consumption readings can be displayed (and exported) as follows. This display is shown in AMR number sequence.

Ala...	Amr No.	Address	Total Consumpti...	Reading At Begin Period	Reading A End Period
	706-000001	Rua Thereza Rosolen Mazzarat 48	8.080	190.310	198.390
	706-000002	Rua Beatriz Bragotto Dermond 116	7.697	202.996	210.693
	706-000007	Rua Angelo Pessoto 240	3.061	107.080	110.141
	706-000008	Rua Angelo Pessoto 240	4.339	137.186	141.525
	706-000009	Rua Angelo Pessoto 245	14.311	473.515	487.826
	706-000010	Rua Angelo Pessoto 255	2.580	30.890	33.470
	706-000011	Rua Angelo Pessoto 273	3.190	95.460	98.650
	706-000012	Rua Angelo Pessoto 274	3.481	122.177	125.658
	706-000013	Rua Angelo Pessoto 200	4.030	105.550	109.580
	706-000014	Rua Angelo Pessoto 208	3.354	163.037	166.391
	706-000015	Rua Angelo Pessoto 15	1.116	100.499	101.615
	706-000016	Rua Manoel Queiroz 520	12.170	337.440	349.610
	706-000017	Rua Angelo Pessoto 225	3.340	90.050	93.390
	706-000018	Rua Angelo Pessoto 239	0.000	21.122	21.122

Non-Revenue Water Analysis

After sorting the consumer listing by total consumption from smallest to largest, the following was displayed:

Ala...	Amr No.	Address	Total Consumpti...	Reading At Begin Period	Reading End Peri
	706-000018	Rua Angelo Pessoto 239	0.000	21.122	21.122
	706-000052	Rua Angelo Pessoto 123	0.000	34.288	34.288
	706-000069	Rua Roma Pizzoli Battiston 157	0.000	1.891	1.891
	706-000075	Rua Beatriz Bragotto Dermond 60	0.000	31.559	31.559
	706-000077	Rua Guilherme Marconi 173	0.000	3.790	3.790
	706-000091	Rua Guilherme Marconi 61	0.000	0.176	0.176
	706-000099	Rua Beatriz Bragotto Dermond 66	0.000	441.943	441.943
	706-000188	Rua Antonio Suzzigan 26	0.000	234.892	234.892
	706-000232	Rua Beatriz Bragotto Dermond 119	0.000	20.650	20.650
	706-000237	Rua Beatriz Bragotto Dermond 165	0.000	1.380	1.380
	706-000282	Rua Angelo Pessoto 133	0.000	5.130	5.130
	706-000285	Rua Beatriz Bragotto Dermond 227	0.000	2.240	2.240
	706-000144	Rua Roma Pizzoli Battiston 45	0.002	37.828	37.830
	706-000072	Rua Beatriz Bragotto Dermond 106	0.005	45.192	45.197
	706-000057	Rua Guilherme Marconi 217	0.049	8.436	8.485

The display now shows 15 consumers (5% of the total) with zero or very minimal consumption during a two-week period. The utility must now send a technician into the field to inspect each of these connections and ensure that the consumer has not devised a “bypass” around the water meter or installed magnets to inhibit the meter’s ability to record consumption.

Night Flow Analysis

The AMR endpoints record and store the meter reading for every water meter at exactly midnight (00:00) and at 5:00 AM (05:00) – midnight reading and morning reading. The difference between these two readings is the Night Flow Consumption. This is an important analytical tool as most water distribution systems operate on a minimal basis during those hours, and it is easier to detect anomalies in the system through this analysis.

Amr No.	Name	Address	Account Secondary Id	Billing Number	Meter No.	Diameter Name	Last Reading	Midnight Reading	Morning Reading	Nightly consumption	Reading Date Time
706000006	ODB Macro Area...	Rua Guilherme ...	00002.0006	0	F13B000075	3/4"	45414.5	45216.450	45240.160	23.710	07/06/2017 05:59:59
706000158	PML Centro Com...	Rua Guilherme ...	00002.0158	0	101062155	3/4"	344.1	325.900	328.600	2.700	07/06/2017 05:59:59
706000102	CENTRO INTEGR...	Av. Arlinda Abre...	00002.0102	0	A13B266115	Unkown	5863.8	5855.757	5856.922	1.165	07/06/2017 05:59:59
706000160	PML - EMEIEF PR...	Rua Ademar Per...	00002.0160	0	B13S060588	Unkown	550.43	543.860	544.320	0.460	07/06/2017 05:59:59
706000003	ODB ETA casa b...	Rua Dr. Renato ...	00002.0003	0	101055068	3/4"	1169.2	1162.200	1162.600	0.400	07/06/2017 05:59:59
706000122	Antonio Suzziga...	Rua Antonio Suz...	00002.0122	0	A13B216655	3/4"	289.902	288.316	288.642	0.326	07/06/2017 05:59:59
706000161	PML - CRECHE J ...	Rua Antonio Mal...	00002.0161	0	B13S060608	Unkown	794.12	784.090	784.380	0.290	07/06/2017 05:59:59
706000121	PML CENTRO DA...	Av. Arlinda Abre...	00002.0121	0	101065230	3/4"	221.5	219.100	219.300	0.200	07/06/2017 05:59:59
706000005	ODB ETA CTO m...	Rua Dr. Renato ...	00002.0005	0	101062114	3/4"	326.4	324.500	324.700	0.200	07/06/2017 05:59:59
706000174	Antonio Suzziga...	Rua Antonio Suz...	00002.0174	0	A13B216395	Unkown	388.956	388.242	388.383	0.141	07/06/2017 05:59:59
706000111	Guilherme Marc...	Rua Guilherme ...	00002.0111	0	A13B216573	Unkown	314.352	313.761	313.886	0.125	07/06/2017 05:59:59
706000073	Beatriz Bragotto...	Rua Beatriz Brag...	00002.0073	0	A13B216364	3/4"	521.957	520.065	520.179	0.114	07/06/2017 05:59:59
706000129	Alfredo Rigo 74	Rua Alfredo Rig...	00002.0129	0	Y16S270512	3/4"	330.24	329.120	329.230	0.110	07/06/2017 05:59:59
706000172	Antonio Suzziga...	Rua Antonio Suz...	00002.0172	0	A13B216657	Unkown	65.374	64.870	64.974	0.104	07/06/2017 05:59:59
706000262	Antonio Suzziga...	Rua Antonio Suz...	00002.0262	0	Y16S270518	Unkown	206.23	205.880	205.960	0.080	07/06/2017 05:59:59
706000164	Thereza Rosolen...	Rua Thereza Ro...	00002.0164	0	A13B216576	Unkown	236.634	236.139	236.219	0.080	07/06/2017 05:59:59
706000183	Thereza Rosolen...	Rua Thereza Ro...	00002.0183	0	A13B216470	Unkown	399.998	399.073	399.150	0.077	07/06/2017 05:59:59
706000043	Angelo Pessoto ...	Rua Angelo Pess...	00002.0043	0	Y16S270430	3/4"	209.39	208.420	208.490	0.070	07/06/2017 05:59:59
706000155	Thereza Rosolen...	Rua Thereza Ro...	00002.0155	0	A13B216467	3/4"	125.839	125.510	125.574	0.064	07/06/2017 05:59:59
706000097	Alfredo Rigo 95	Rua Alfredo Rig...	00002.0097	0	A16B026058	Unkown	178.867	178.270	178.333	0.063	07/06/2017 05:59:59
706000031	Angelo Pessoto ...	Rua Angelo Pess...	00002.0031	0	A13B216425	3/4"	120.841	120.536	120.595	0.059	07/06/2017 05:59:59
706000151	Thereza Rosolen...	Rua Thereza Ro...	00002.0151	0	A13B216464	3/4"	115.608	115.350	115.407	0.057	07/06/2017 05:59:59
706000147	Beatriz Bragotto...	Rua Beatriz Brag...	00002.0147	0	A13B216331	3/4"	321.88	321.452	321.505	0.053	07/06/2017 05:59:59
706000177	Guilherme Marc...	Rua Guilherme ...	00002.0177	0	A13B216513	Unkown	37.714	37.503	37.556	0.053	07/06/2017 05:59:59
706000117	Alfredo Rigo 65	Rua Alfredo Rig...	00002.0117	0	A13B216659	3/4"	207.753	207.433	207.482	0.049	07/06/2017 05:59:59
706000088	Roma Pizzoli Ba...	Rua Roma Pizzo...	00002.0088	0	A13B216366	Unkown	490.473	489.787	489.834	0.047	07/06/2017 05:59:59
706000009	Angelo Pessoto ...	Rua Angelo Pess...	00002.0009	0	A13B216588	3/4"	495.276	494.468	494.515	0.047	07/06/2017 05:59:59
706000100	Manoel Queiroz ...	Rua Manoel Que...	00002.0100	0	A13B216357	Unkown	230.98	230.408	230.454	0.046	07/06/2017 05:59:59
706000290	Alfredo Rigo 125	Rua Alfredo Rig...	00002.0290	0	A14B023333	Unkown	43.908	43.668	43.711	0.043	07/06/2017 05:59:59
706000026	Angelo Pessoto ...	Rua Angelo Pess...	00002.0026	0	A13B216428	3/4"	283.851	283.143	283.186	0.043	07/06/2017 05:59:59

Night Flow Analysis

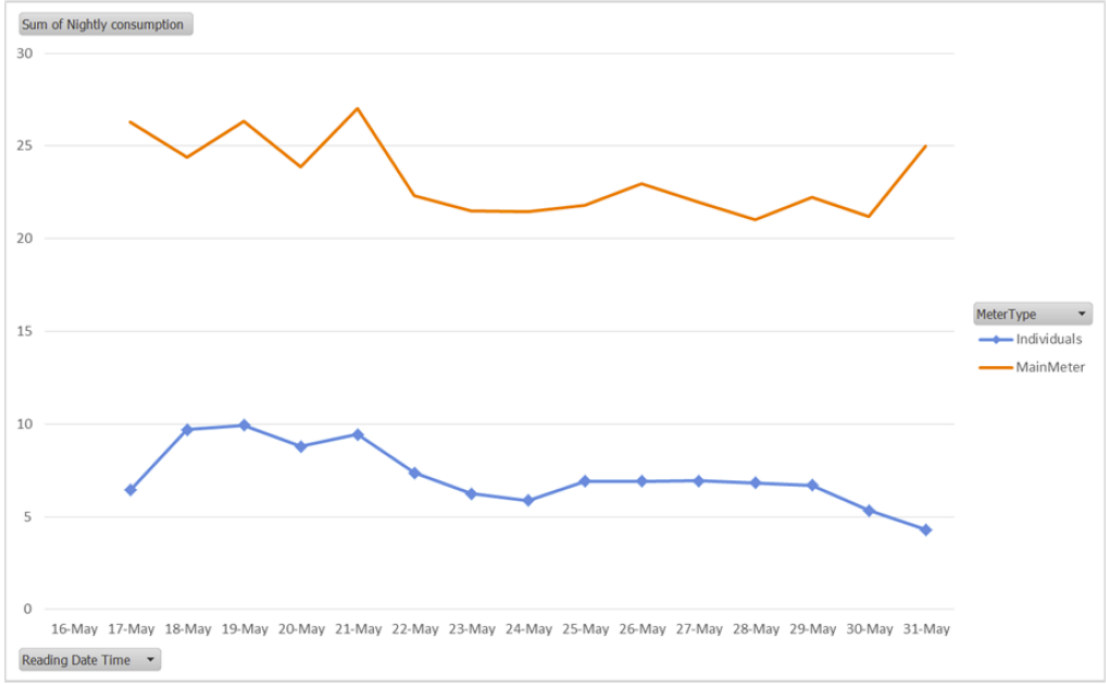
These Night Flow data points for the same analysis period (16 May – 30 May 2017) were exported from the management system and analyzed with Excel. The results were as follows:

Limeira Night Flow Analysis			
16 May to 30 May 2017			
	Total	Night Flow	Night Flow
AMR No.	Consumption	Consumption	Percentage
706000006	2,896.92	349.36	12.06%
Period NRW	41.83%	79.65%	
NF Calculated NRW		1,335.65	
Total Night Flow	1,685.13	71.10	4.22%

This analysis shows that of the total bulk meter consumption (2,897 m3), 12% or 349 m3 occurred during the night flow period. In comparison, only 4.2% (71 m3) of the consumer meter consumption occurred during the night flow period. These findings further confirm that there is significant water loss from the water distribution pipes.

Night Flow Analysis

The chart below shows the bulk meter Night Flow and the consumer meters Night Flow:



Quite significantly, these two Night Flow chart lines parallel each other (in a manner similar to the Total Consumption chart lines shown earlier in this document) – **until the last few days.**

Night Flow Analysis

This divergence of the chart lines led us to examine the consumer data more closely. The individual night flow totals over the analysis period (16 May – 30 May 2017) are listed, and sorted the total Night Flow consumption by consumer from largest to smallest:

Limeira Night Flow Analysis

16 May to 30 May 2017

AMR No.	Total Consumption	Night Flow Consumption	Night Flow Percentage
Total Night Flow	1,685.13	71.10	4.22%
706000063	49.10	12.27	24.99%
706000158	51.60	5.10	9.88%
706000122	25.12	4.70	18.71%
706000174	13.57	2.20	16.21%
706000172	8.99	1.97	21.91%

As can be seen, meter number 706000063 has a total Night Flow of 12.27 m3 over the fourteen day analysis period, or 0.77 m3 of Night Flow every night. This one meter represented more than 17% of the combined consumer meter Night Flow total.

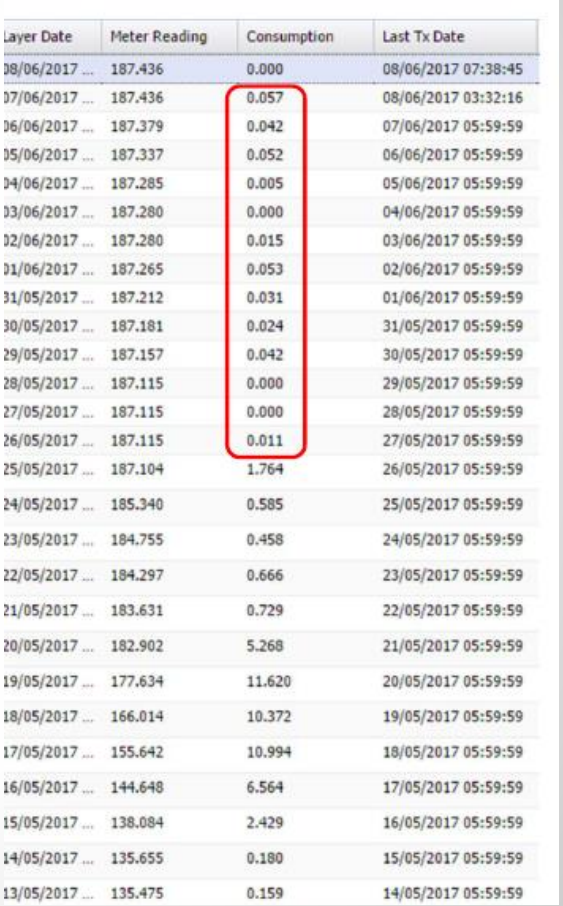
Night Flow Analysis

This finding led us to examine the daily consumption for this consumer and we discovered the following:

From 8 March until 25 May, (78 days) this consumer had an average daily consumption of 1.34 m3. From 26 May until 7 June (the highlighted area), the average daily consumption decreased to just 0.025 m3. Thus, the Night Flow has stopped completely, as has the total consumption. This change explains the divergence of the chart lines in the Night Flow analysis chart.

This is a commercial customer, so while it is possible that the consumer repaired a leak, it is unlikely that the consumption has decreased to almost zero.

The utility intends to send a technician to the consumer site to determine the cause of the sudden and significant decrease in consumption.



Layer Date	Meter Reading	Consumption	Last Tx Date
08/06/2017 ...	187.436	0.000	08/06/2017 07:38:45
07/06/2017 ...	187.436	0.057	08/06/2017 03:32:16
06/06/2017 ...	187.379	0.042	07/06/2017 05:59:59
05/06/2017 ...	187.337	0.052	06/06/2017 05:59:59
04/06/2017 ...	187.285	0.005	05/06/2017 05:59:59
03/06/2017 ...	187.280	0.000	04/06/2017 05:59:59
02/06/2017 ...	187.280	0.015	03/06/2017 05:59:59
01/06/2017 ...	187.265	0.053	02/06/2017 05:59:59
31/05/2017 ...	187.212	0.031	01/06/2017 05:59:59
30/05/2017 ...	187.181	0.024	31/05/2017 05:59:59
29/05/2017 ...	187.157	0.042	30/05/2017 05:59:59
28/05/2017 ...	187.115	0.000	29/05/2017 05:59:59
27/05/2017 ...	187.115	0.000	28/05/2017 05:59:59
26/05/2017 ...	187.115	0.011	27/05/2017 05:59:59
25/05/2017 ...	187.104	1.764	26/05/2017 05:59:59
24/05/2017 ...	185.340	0.585	25/05/2017 05:59:59
23/05/2017 ...	184.755	0.458	24/05/2017 05:59:59
22/05/2017 ...	184.297	0.666	23/05/2017 05:59:59
21/05/2017 ...	183.631	0.729	22/05/2017 05:59:59
20/05/2017 ...	182.902	5.268	21/05/2017 05:59:59
19/05/2017 ...	177.634	11.620	20/05/2017 05:59:59
18/05/2017 ...	166.014	10.372	19/05/2017 05:59:59
17/05/2017 ...	155.642	10.994	18/05/2017 05:59:59
16/05/2017 ...	144.648	6.564	17/05/2017 05:59:59
15/05/2017 ...	138.084	2.429	16/05/2017 05:59:59
14/05/2017 ...	135.655	0.180	15/05/2017 05:59:59
13/05/2017 ...	135.475	0.159	14/05/2017 05:59:59

Repair Work

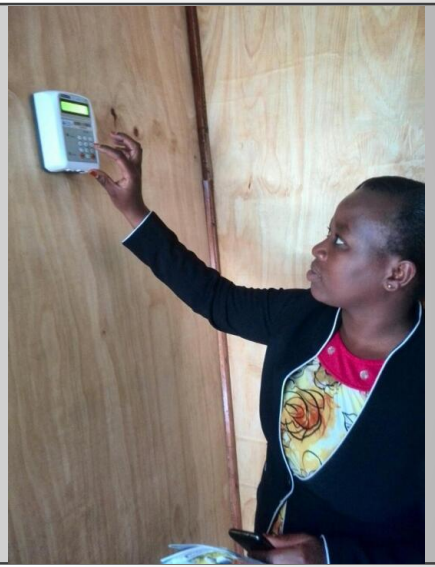
The repair work was completed on 27 June 2017. The NRW percentage prior to the repair averaged approximately 42%. For the past week following the repair, the average NRW is 12.63% -- an improvement of almost 30%.

Prior to the repair work, the average daily consumption at the Area 53 bulk meter was approximately 193 m3. Today the average daily consumption at this bulk meter is 120 m3 – a daily savings of 73 m3. On an annual basis, this translates into a savings of more than $25,000.

The daily NRW percentages appear in the screenshot below:

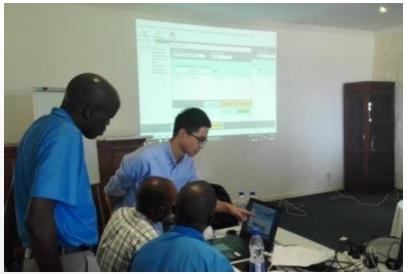
Sev...	From Date	Total Inco... Meters	Total Outg... Meters	Incoming Consumption	Consumption	Unaccounted Consumption	%Unac... Consu...
	28/06/2017	1	290	124	108	15	12.41%
	29/06/2017	1	290	126	111	14	11.5%
	30/06/2017	1	290	138	123	15	10.98%
	01/07/2017	1	290	126	110	16	12.6%
	02/07/2017	1	290	97	81	16	16.26%
	03/07/2017	1	290	118	103	15	12.39%
	04/07/2017	1	290	114	96	17	15.04%

Summary



Summary

- Technology (Smart Water Meter) is a Tool, not a Cure.
- Whether this tool is suitable for the corresponding problem
- A tool can not guarantee to fix a problem, it depends how this tool is used and many other factors.



Thank You!

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