A Solution Story

Validation of Water Authority Flow Meter Data

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The Situation

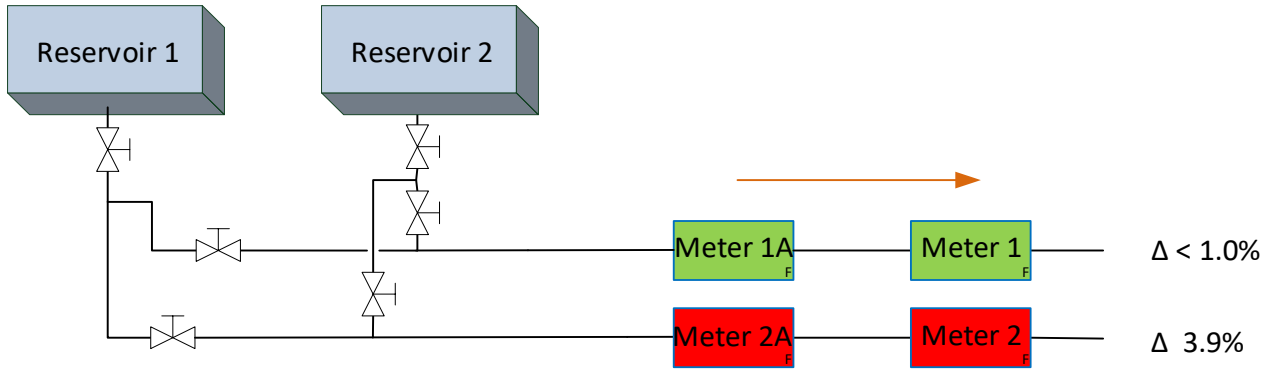
A water authority client suspected that one of their Electromagnetic billing meters was reading inconsistent with the rest of the measurements in the system.

Metsolv were approached to investigate and assess the accuracy of the existing flow metering equipment.

The Insight – Series Flow

Several series flow tests were conducted with the suspected Electromagnetic meter (Meter 2A) and an Ultrasonic flow meter (Meter 2) downstream.

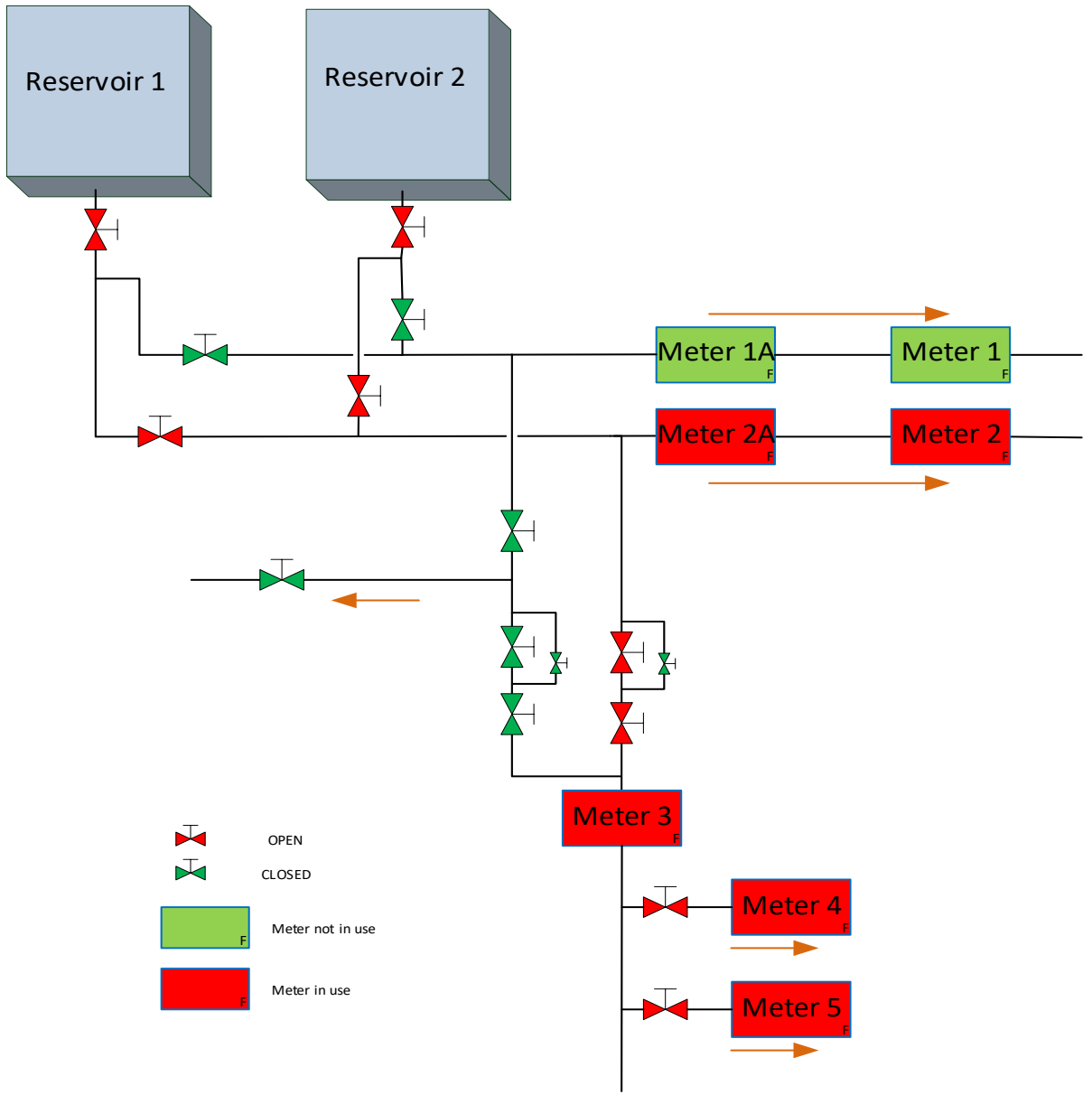
The results showed a discrepancy between the meters of 3.9%.



The Insight – Data Analysis

Metsolv carried out a Student's t-distribution analysis on the series flow data along with additional meters in the network.

A student's t-distribution determines whether two sets of data are consistent with each other (i.e. they came from the same population).



The Insight – Data Analysis Results

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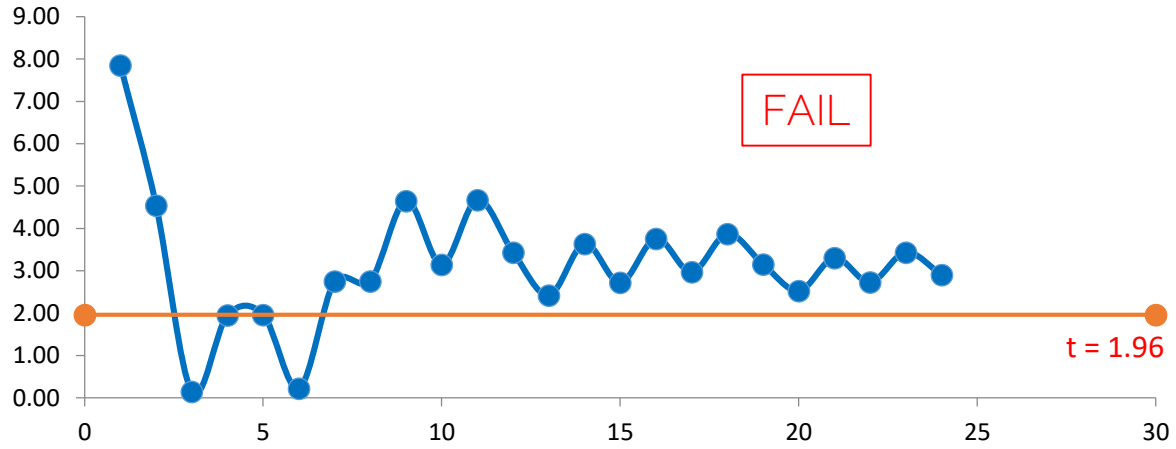
The Student's t-distribution result shows that Electromagnetic meter (Meter 2A) was reading inconsistent, indicating there was definitely an issue with Meter 2A.

	Meter 1A	Meter 2A	Meter 3	Meter 4	Meter 5
Meter 1A		2.902	0.767	0.399	0.018
Meter 2A	2.902		3.668	3.301	2.920
Meter 3	0.767	3.668		0.367	0.749
Meter 4	0.399	3.301	0.367		0.382
Meter 5	0.018	2.920	0.749	0.382	

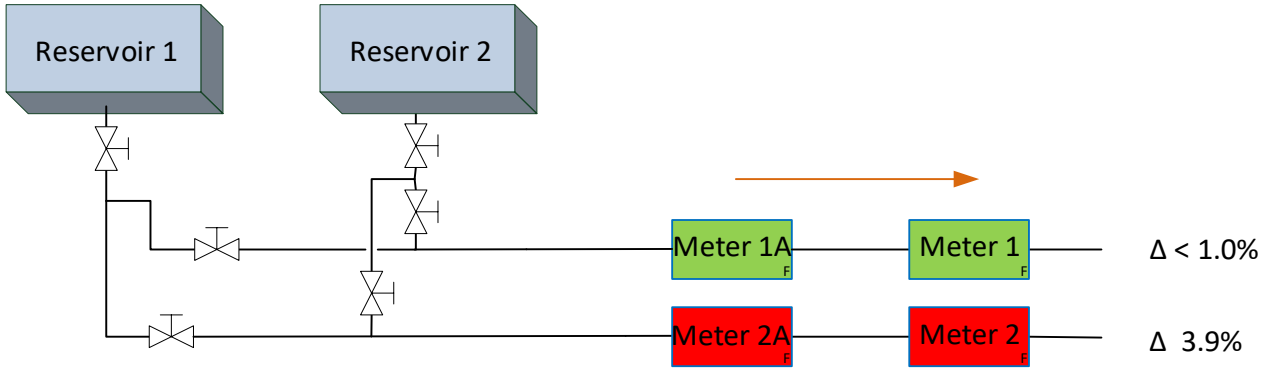


A t-statistic value of < 1.96 indicates the meter is consistent with the other meters in the system.

The Solution – Drop Test Uncertainty Analysis

The water authority conducted a water drop test against the suspected Electromagnetic meter (Meter 2A) and supply Reservoir.

Metsolv analysed the data and built an uncertainty calculation to determine the uncertainty on the Electromagnetic meter against the reservoir levels.

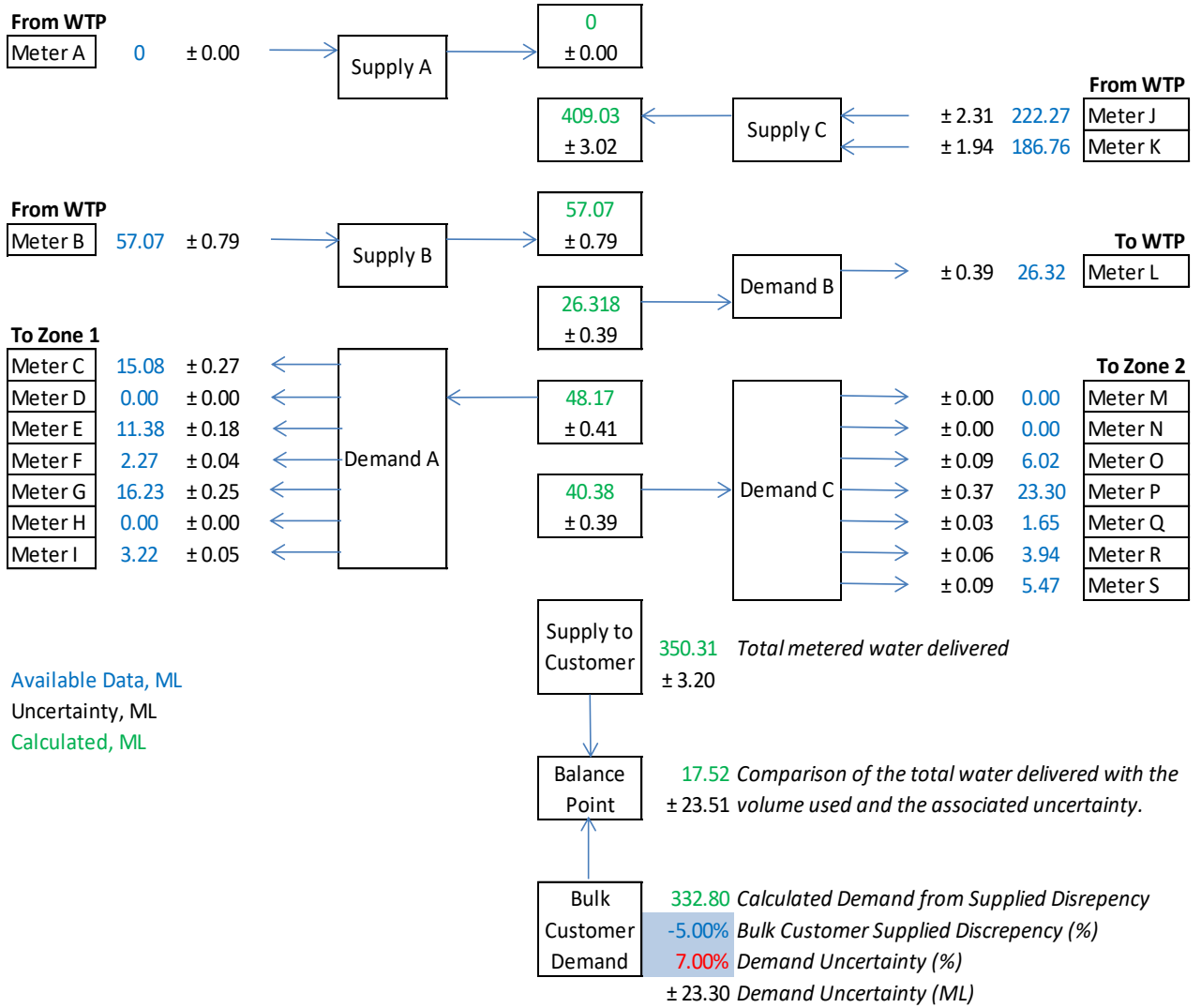


The overall test uncertainty of the observed volume was outside of acceptable tolerance limits.

The Solution – Network Uncertainty Analysis

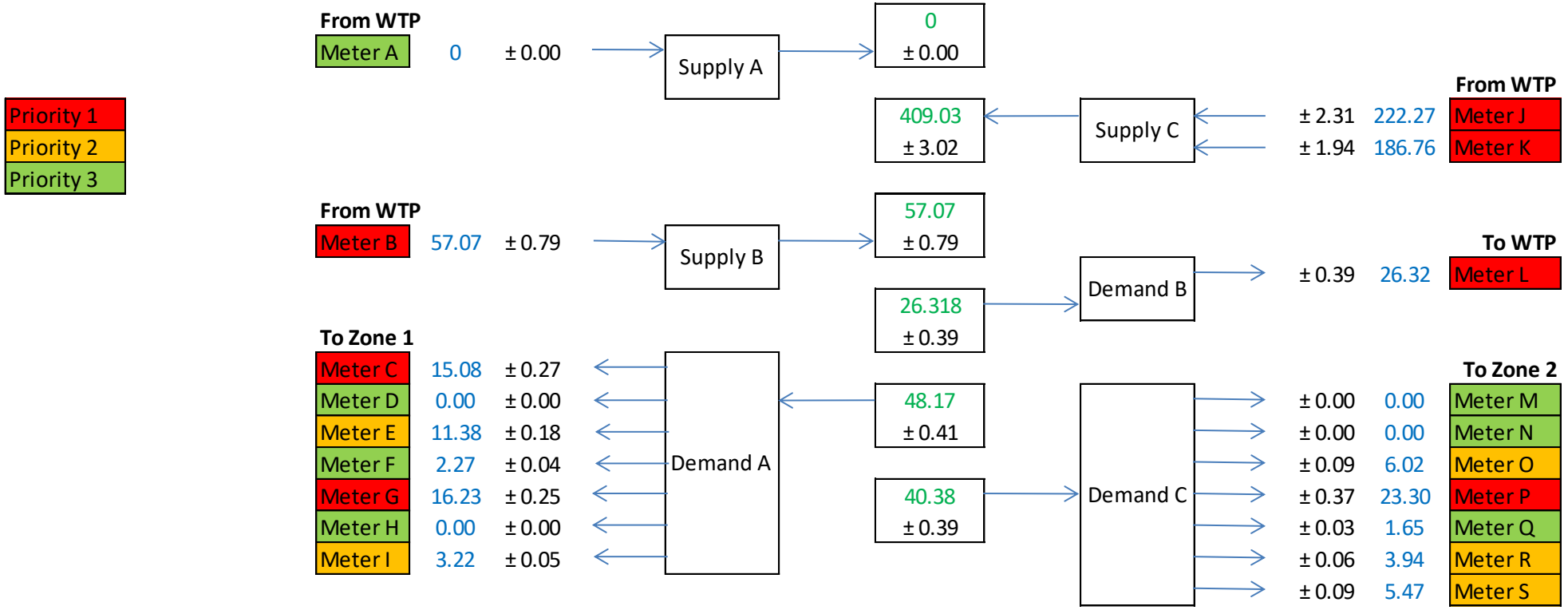
The search for inconsistent metering data was expanded to the entire supply zone.

Metsolv built uncertainty calculations for assets to determine areas and meters that required further investigation.



The Solution – Network Uncertainty Analysis

A rectification plan was created with priorities of which meters would be investigated and options for additional testing.



Uncertainty calculations help you to be smart about implementing engineering tasks on your assets and save money by tackling the most costly problems first.

The Solution – Drop Test Procedure

Metsolv wrote a new drop test procedure to aid the client in successfully completing an accurate drop test on their meters.

Metsolv provided further data analysis on the results to determine the overall uncertainty on the meter in question and the system as a whole.

The Solution – Drop Test Data Analysis

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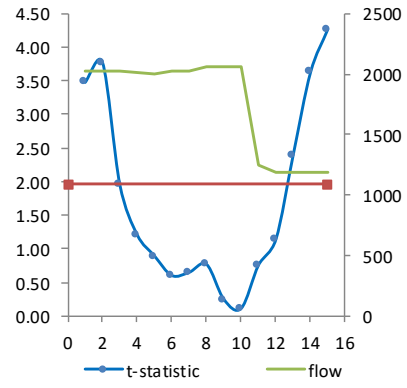
	Date/Time	Tx Flow Volume (ML)	L/s	SCADA Flow Volume (ML)
1	1:15:00 PM	21.9159	2031.8	4914.69
2	1:25:00 PM		2018.37	4915.9
3	1:35:00 PM		2025.82	4917.11
4	1:45:00 PM		2029.6	4918.32
5	1:55:00 PM		2014.59	4919.53
6	2:05:00 PM		2004.09	4920.74
7	2:15:00 PM		2023.26	4921.94
8	2:25:00 PM		2019.59	4923.15
9	2:35:00 PM		2058.17	4924.36
10	2:45:00 PM		2057.44	4925.57
11	2:55:00 PM		2058.9	4926.78
12	3:05:00 PM		1244.42	4927.79
13	3:15:00 PM		1188.27	4928.39
14	3:25:00 PM		1186.68	4929
15	3:35:00 PM		1188.27	4929.6
16	3:45:00 PM		1185.46	4930.2
	2:30:00			

Cell #1 Level (m)	Cell 1 Level (mAHD)	Cell 1 Cal. Level (mAHD)	Cell 1 Volume (m3)	Cell #2 Level (m)	Cell 2 Level (mAHD)	Cell 2 Calibrated Level (mAHD)	Cell 2 Volume (m3)
6.47	34.60	34.73	26723.41	6.44	34.58	34.71	26626.19
6.36	34.49	34.62	26105.549	6.34	34.48	34.61	26064.387
6.26	34.39	34.52	25546.325	6.23	34.37	34.50	25449.157
6.15	34.28	34.41	24933.925	6.12	34.26	34.39	24836.804
6.04	34.17	34.30	24324.371	6.01	34.15	34.28	24227.324
5.93	34.06	34.19	23717.678	5.9	34.04	34.17	23620.722
5.82	33.95	34.08	23113.841	5.79	33.93	34.06	23017
5.71	33.84	33.97	22512.85	5.68	33.82	33.95	22416.134
5.6	33.73	33.86	21914.733	5.57	33.71	33.84	21818.157
5.49	33.62	33.75	21319.465	5.45	33.59	33.72	21169.087
5.37	33.50	33.63	20673.245	5.34	33.48	33.61	20576.996
5.27	33.40	33.53	20137.195	5.24	33.38	33.51	20041.104
5.21	33.34	33.47	19816.684	5.18	33.32	33.45	19720.692
5.14	33.27	33.40	19443.853	5.11	33.25	33.38	19347.977
5.07	33.20	33.33	19072.179	5.04	33.18	33.31	18976.425
5.01	33.14	33.27	18754.521	4.97	33.11	33.24	18606.035

Student's t analysis determine if the individual flow rate measurements were consistent with the rest of the measurements in the system.

Calculation Settings

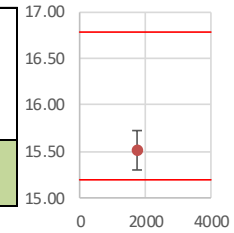
Confidence level	95%
Coverage factor	1.96
Uncertainty in meters (%)	1.38
Uncertainty in cells (%)	0.31



Point #	FIT Total (ML)	Cell Total (ML)	FIT Total (ML)	Cell Total (ML)	Cum. Diff. (%)	Adj FIT Std. Unc (ML)	Cell Std. Unc (ML)	t statistic
	15.510	15.989						
1	1.210	1.180	1.210	1.180	-2.57	0.0085	0.0019	3.47
2	1.210	1.174	2.420	2.354	-2.80	0.0171	0.0038	3.77
3	1.210	1.225	3.630	3.579	-1.43	0.0256	0.0057	1.95
4	1.210	1.219	4.840	4.798	-0.88	0.0341	0.0077	1.20
5	1.210	1.213	6.050	6.011	-0.65	0.0426	0.0096	0.89
6	1.200	1.208	7.250	7.219	-0.43	0.0511	0.0116	0.60
7	1.210	1.202	8.460	8.421	-0.47	0.0596	0.0135	0.64
8	1.210	1.196	9.670	9.617	-0.55	0.0682	0.0154	0.76
9	1.210	1.244	10.880	10.861	-0.17	0.0767	0.0174	0.24
10	1.210	1.238	12.090	12.099	0.08	0.0852	0.0194	0.11
11	1.010	1.072	13.100	13.171	0.54	0.0923	0.0211	0.75
12	0.600	0.641	13.700	13.812	0.81	0.0966	0.0221	1.13
13	0.610	0.746	14.310	14.558	1.70	0.1009	0.0233	2.39
14	0.600	0.743	14.910	15.301	2.56	0.1051	0.0245	3.62
15	0.600	0.688	15.510	15.989	3.00	0.1093	0.0256	4.27

The measurement uncertainty interval was constructed for each test and a statement of compliance created

	Date	25/09/09		Average Flow L/s	1771			
Time	Meter Total (Logica) (ML)	Cell 1 Cal. Level (mAHD)	Cell 1 Volume (ML)	Cell 2 Logica Level (mAHD)	Cell 2 Tank Volume (ML)	Cell 1 & Cell 2 Volume (ML)	Meter Volume (ML)	Error %
13:15:00	4,915	34.729	26.7	34.709	26.6	15.99	15.51	-3.00
15:45:00	4,930	33.269	18.8	33.239	18.6			
	15.51	1.460	7.97	1.470	8.02			



The Solution – Clamp on Ultrasonic Check Meter

With Metsolvs wide range of testing and verification equipment we were able to supply the use of a direct measuring device.

A clamp on ultrasonic meter was used to compare the volume flow between the meter under test and the reference meter (clamp on ultrasonic).

The Results

The previously described testing assisted the water authority in identifying meters which required investigation.

- Comparison Testing
- Drop Test Analysis
- Uncertainty Calculations
- Series Ultrasonic Check Meter

These processes provide confidence in the measurement quality.

Thank You

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