METER ERROR REPORT

FINAL

Reconcile?	Y
Safety Issue?	N
Thesis Report No.	

1. EXECUTIVE SUMMARY

SITE NAME	BACTON	
LDZ	EA	
START DATE (actual)	07/04/2014	
LAST GOOD DATE	07/04/2014	
END DATE	10/10/2014	
SIZE OF ERROR (No reconciliation required if under 0.1%)	59382 scm under read (5.74%)	
ESTIMATE – Y/N?	N	
ROOT CAUSE	Intermittent loss of turbine pulse signal	
ANALYSIS	In the attached spreadsheets	
METER TYPE	Turbine	
AUTHOR	Piers Eldridge	
CHECKED BY	Sarah Kimpton	
ACCEPTED BY UKD NETWORK	A Finch	
RECONCILIATION	Distribution	Transportation

2. BACKGROUND

Gas is supplied to part of the East Anglia Network at Bacton FWACV offtake. The site comprises one turbine meter system with a Danalyzer gas chromatograph for CV determination and PTZ correction.

On the 28th June 2014, the Measurement and Process Group of Network Integrity was contacted by the system operator to query a drop in flow over the evening peak at 18:00 and 19:00.

Upon investigation, it was established that the turbine pulse signals to the flow computer were being intermittently lost.

An initial attempt to correct the problem took place on 30th June 2014. This technician stated that he thought the fault was caused by a corroded meter body connection. This was cleaned up and the connection was reinstated. This was believed to have been successful and was verified by careful data study immediately after the event, however, a much later extended study of data suggested that occasional very short-duration pulse loss might once again be suspected.

The remaining fault was finally corrected on 10th October 2014.

3. ERROR QUANTIFICATION AND IMPACT

Historic RBD data from Bacton was used to calculate the flow rate during periods of the missing turbine pulse signal. Where the signal loss was less than one hour the flow rate was calculated by interpolation between the period of signal loss and signal return.

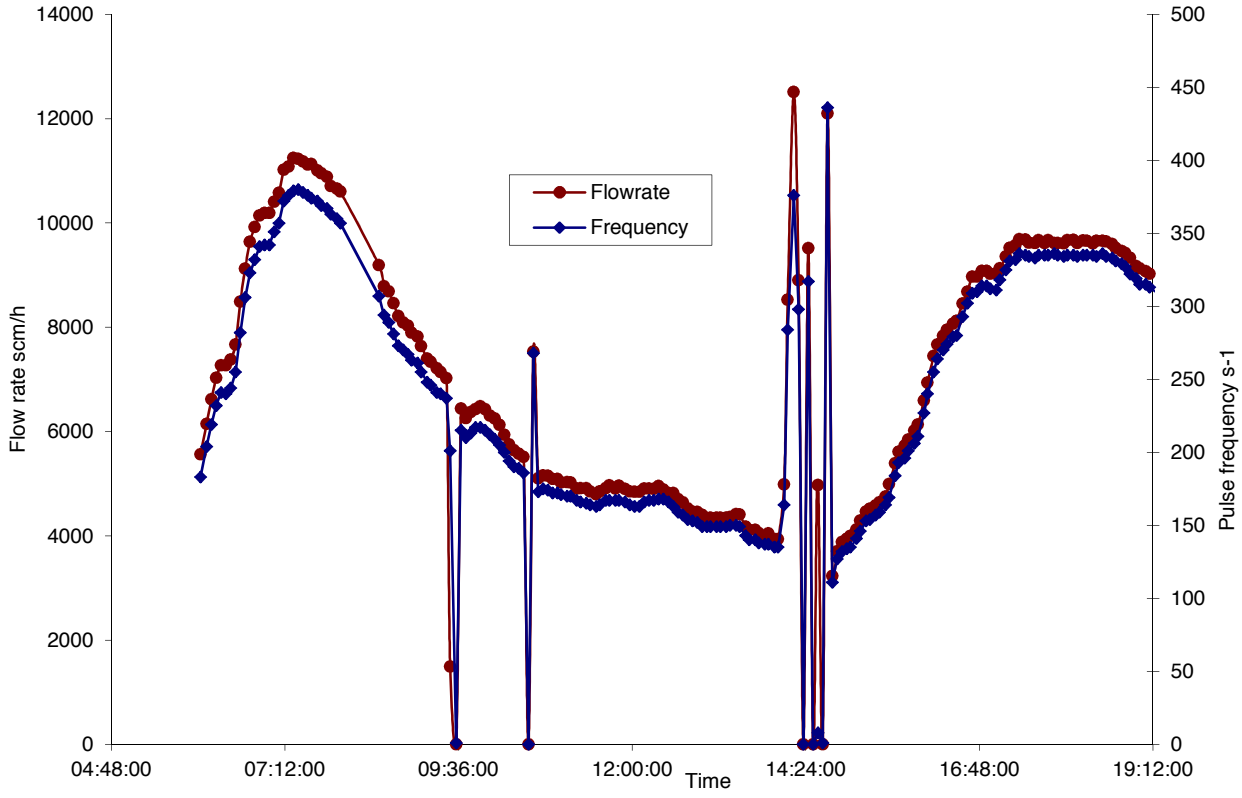

Figure 1 Example of the RbD data where the turbine signal was lost.

Where the period of signal loss was greater than an hour the missing data was calculated by profiling flow rates from the same weekday.

The difference between the flow rate before and after the loss of signal was calculated from corresponding days and times two weeks before and two weeks after the period of signal loss. This is described by equation 2

$$\overline{\mathbf{Q_{O,n}}} = \frac{\mathbf{Q_{W-2,n}+Q_{W-1,n}+Q_{W+1,n}+Q_{W+2,n}}}{\mathbf{4}} \qquad \textbf{Equation 1}$$

$$\Delta\mathbf{Q_{W,n}} = \mathbf{Q_{W,n}} - \overline{\mathbf{Q_{O,n}}} \qquad \textbf{Equation 2}$$

$Q_{W,n}$ is the flow rate at week W and n is the time

$\overline{Q_{O,n}}$ is the average flow rate at time n at W=-2,-1,1,2

The average $\Delta Q_{W,n}$ of about 20 minutes prior to and after the loss of signal was used to interpolate the $\Delta Q_{W,n}$ during the loss of signal. This interpolated $\Delta Q_{W,n}$ was applied to the average $\overline{\mathbf{Q_{O,n}}}$ described in equation 1.

Figure 2 shows a period of missing data on the 16th May 2014; this was calculated using corresponding data from 2nd, 9th 23rd, and 30th May 2014.

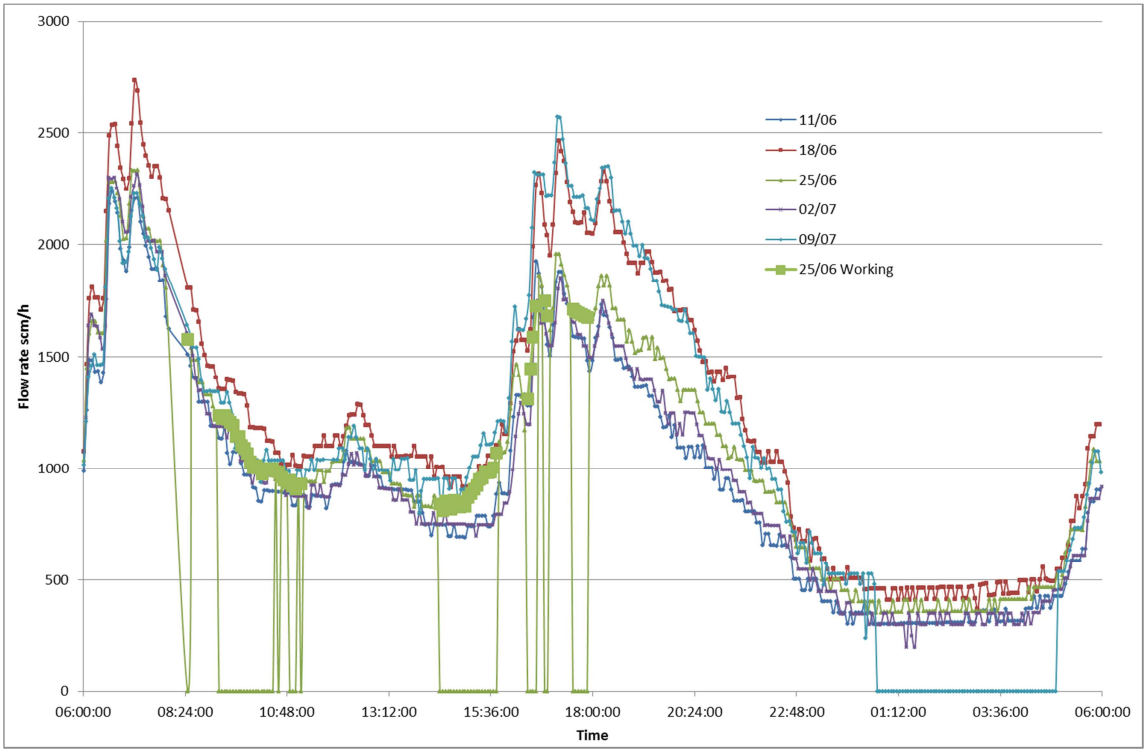

Figure 2 Example of the calculation of the missing flow data by profiling.

A spreadsheet detailing the calculations is available on request.

4. CAUSES

The metering signal loss was due to (a) tarnished connector pins and (b) a corroded cable at the connector to the meter.

5. RECOMMENDATIONS AND LEARNING

Independent verification of the integrity of the connector and its terminations post validation should be carried out.

The possibility of installing pulse fidelity checking should be investigated, as this may have been capable of raising a real time alarm which would have led to early detection and hence prompt correction. This might be especially useful as Bacton offtake does not have a second metered stream available.

REFERENCES

Bacton mer.xlsx
Bacton mer2.xlsx
Network Technician
T/PR/ME/2 parts 1 to 3
Measurement and Process Group of Network Integrity
HPMIS database

VERSION HISTORY

Version	*Changes*	*Author*	*Date*
Rev 0	*Original*	*Piers Eldridge*	*12/11/2014*
Rev 1	*Andy Finch's comments have been included*	*Piers Eldridge*	*17/11/2014*
Rev 1	*Andy Finch's comments have been included*	*Piers Eldridge*	*05/12/2014*

DISTRIBUTION

Asset Owner
Energy Performance
Measurement and Process Group
Asset Strategy
Measurement Assurance Group of NGGT
Joint Office of Gas Transporters

Appendix
Daily correction factors

Gas date	Measured volume Mscm	Correct volume scm	Error scm	Correction factor
07/04/2014	0.05723	57297.9	-67.9	1.0012
08/04/2014	0.07595	76241.4	-291.4	1.0038
09/04/2014	0.06152	61494.7	25.3	0.9996
16/05/2014	0.02934	30820.3	-1480.3	1.0505
09/06/2014	0.02087	21594.7	-724.7	1.0347
10/06/2014	0.02060	21517.0	-917.0	1.0445
22/06/2014	0.01268	22993.4	-10313.4	1.8134
23/06/2014	0.02112	21823.0	-703.0	1.0333
24/06/2014	0.02328	23461.6	-181.6	1.0078
25/06/2014	0.02094	24894.6	-3954.6	1.1889
26/06/2014	0.01923	25178.5	-5948.5	1.3093
27/06/2014	0.02515	27640.4	-2490.4	1.0990
28/06/2014	0.02403	28001.0	-3971.0	1.1653
29/06/2014	0.01756	29993.6	-12433.6	1.7081
30/06/2014	0.02641	25651.6	758.4	0.9713
07/07/2014	0.02248	23199.4	-719.4	1.0320
08/07/2014	0.02155	23102.0	-1552.0	1.0720
09/07/2014	0.02610	28078.1	-1978.1	1.0758
12/07/2014	0.02372	25384.9	-1664.9	1.0702
13/07/2014	0.02400	24151.3	-151.3	1.0063
14/07/2014	0.02150	22392.8	-892.8	1.0415
15/07/2014	0.02193	21973.9	-43.9	1.0020
16/07/2014	0.01959	20936.4	-1346.4	1.0687
20/07/2014	0.02002	20601.0	-581.0	1.0290
22/07/2014	0.02414	24134.4	5.6	0.9998
26/08/2014	0.02939	29400.5	-10.5	1.0004
13/09/2014	0.02452	24755.4	-235.4	1.0096
16/09/2014	0.02452	24578.3	-58.3	1.0024
25/09/2014	0.03304	35269.8	-2229.8	1.0675
26/09/2014	0.02702	27618.0	-598.0	1.0221
27/09/2014	0.02927	29281.1	-11.1	1.0004
28/09/2014	0.02604	26106.5	-66.5	1.0026
29/09/2014	0.02525	26761.3	-1511.3	1.0599
30/09/2014	0.02533	25550.7	-220.7	1.0087
01/10/2014	0.02368	25303.3	-1623.3	1.0685
02/10/2014	0.02536	26559.7	-1199.7	1.0473