Spike Validation Analysis

(AMR sites)

TWG - 12th Feb 2014

Background

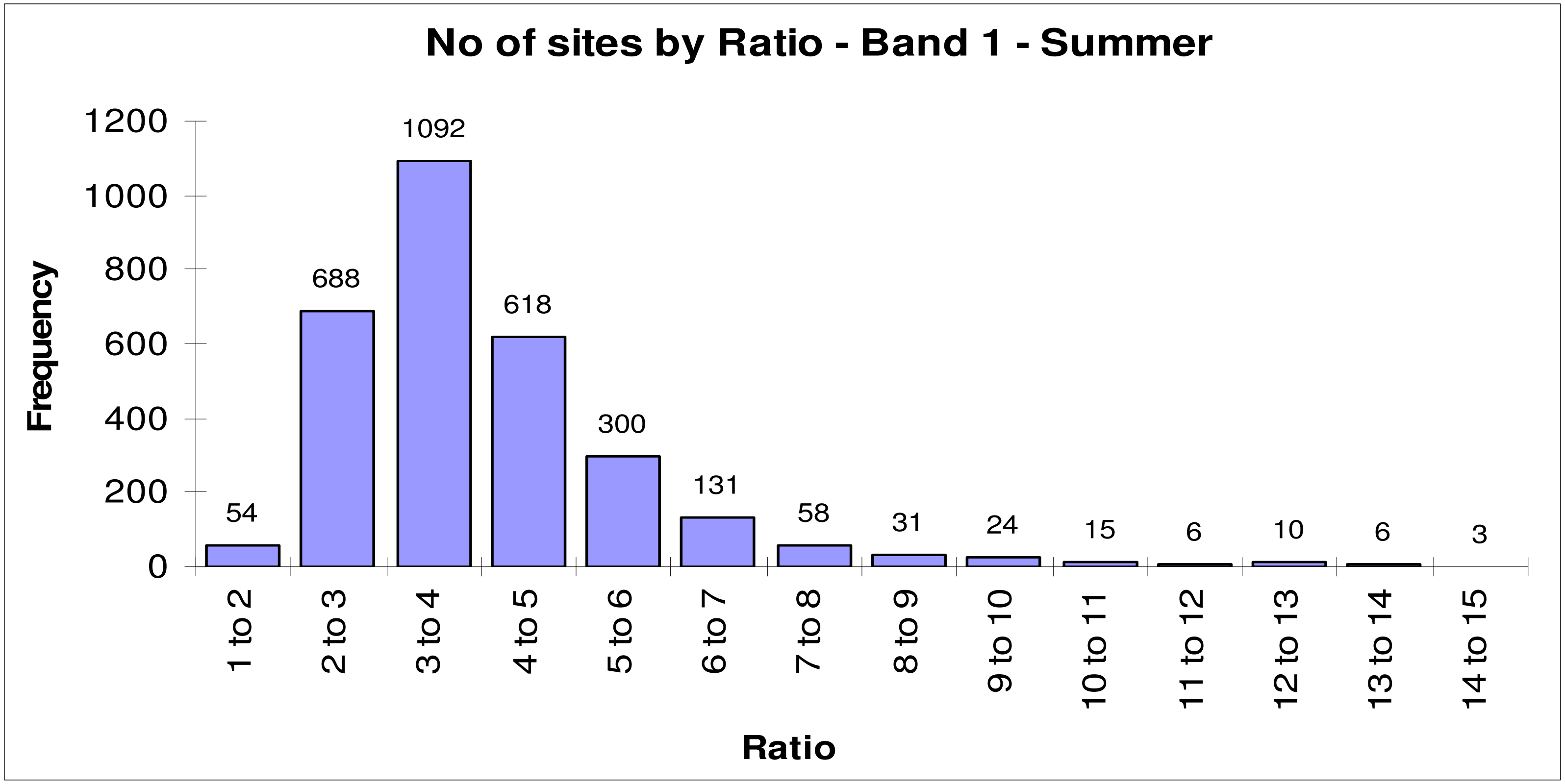
- The purpose of this analysis is to investigate the appropriateness of the current spike validation rules as there are concerns that there is an increased number of sites being rejected. There is also a concern that by removing these sites the algorithms might not respond adequately to the cold weather.
- The current validation rules for AMR spikes are as follows:
  - The ratio of the maximum consumption to the average consumption cannot exceed 8:1 during winter (01 Oct – 31 Mar)
  - The ratio of the maximum consumption to the average consumption cannot exceed 15:1 during summer (01 Apr – 30 Sep)

Data Used in Analysis

- The data analysed:
  - 01/04/2012 – 31/03/2013
  - Band 1 – domestic sites only (Mon – Thu excluding holidays)
    - 3036 sites passed validation
    - 23 sites failed summer spike validation
    - 23 sites failed winter spike validation

  - Band 2 – domestic and non domestic sites (Mon – Thu excluding holidays)
    - 767 sites passed validation
    - 6 sites failed summer spike validation

Frequency of ratio values – sites that passed validation



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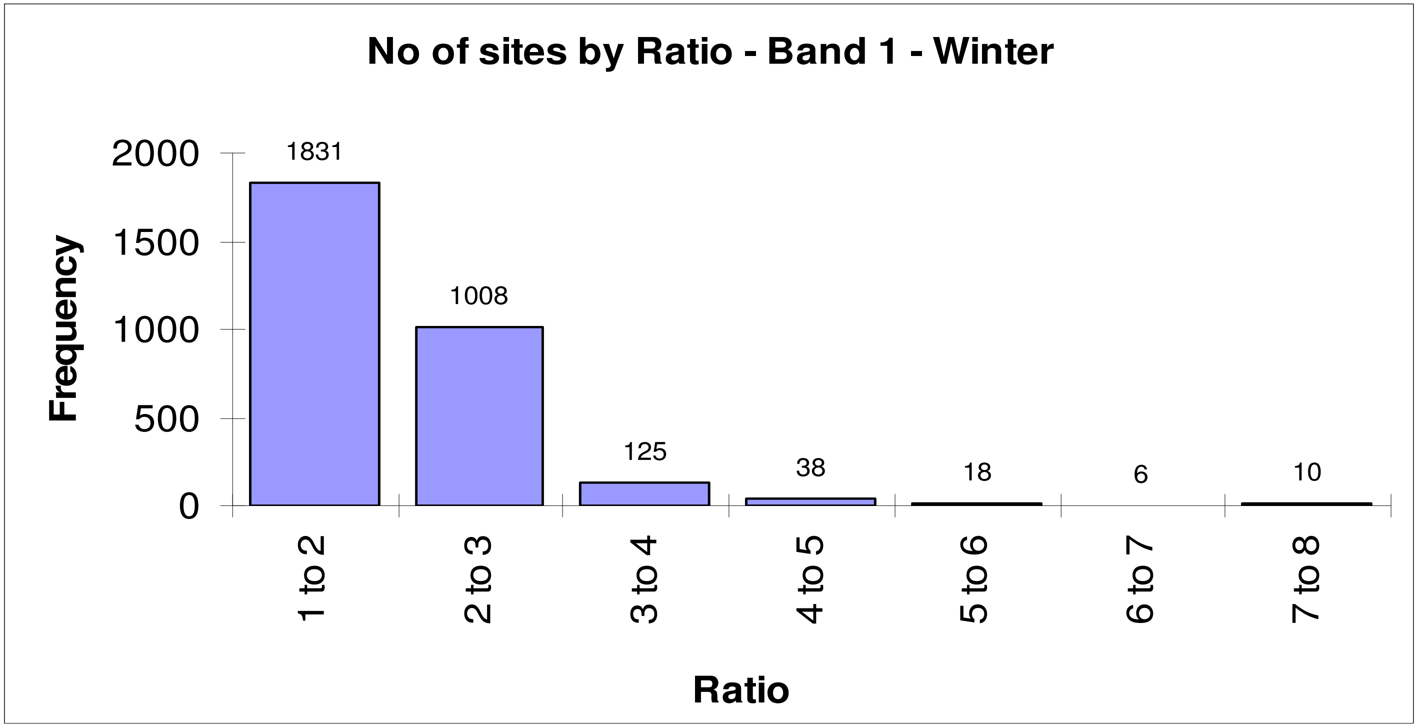
Frequency of ratio values – sites that passed validation



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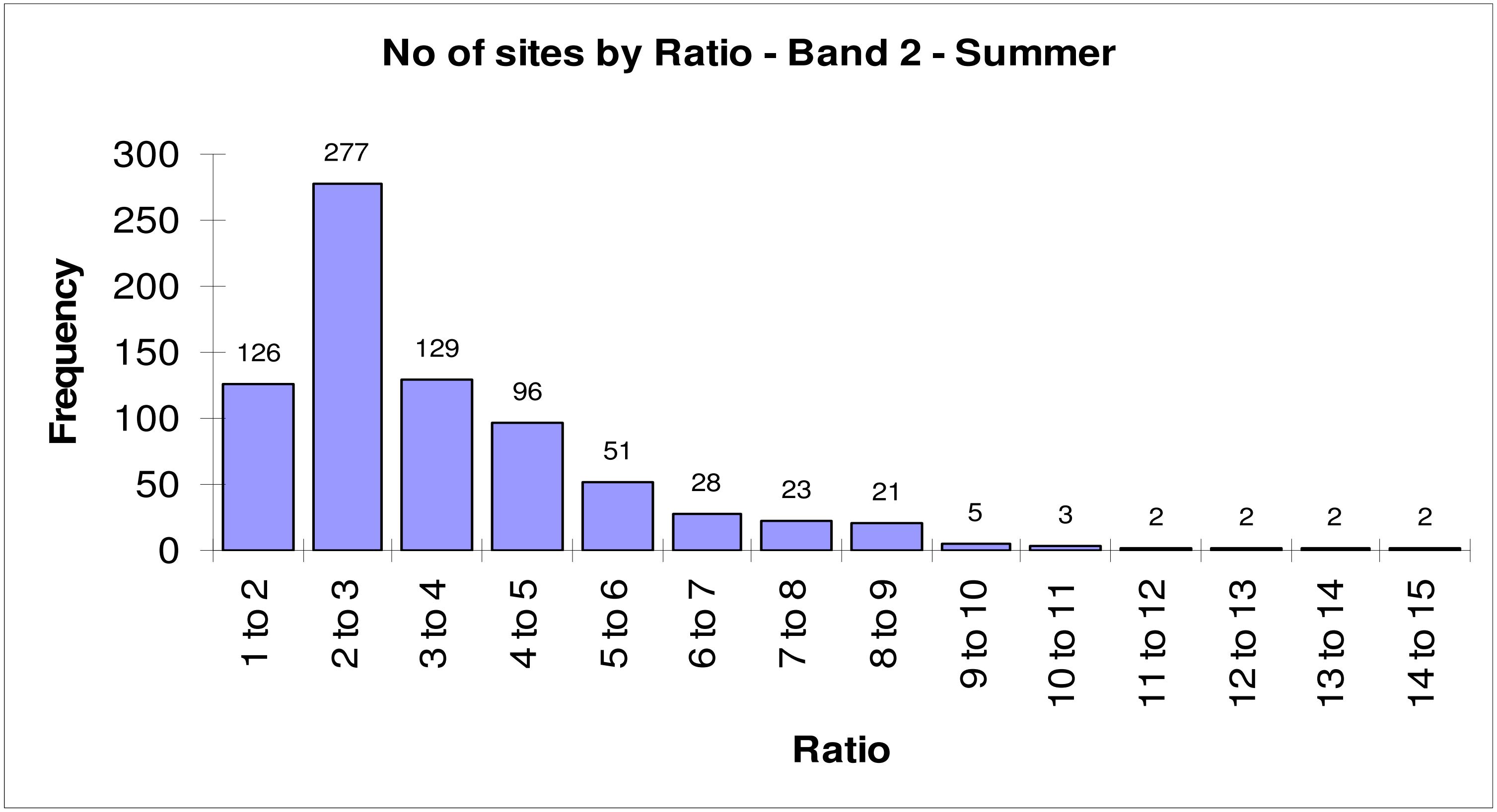

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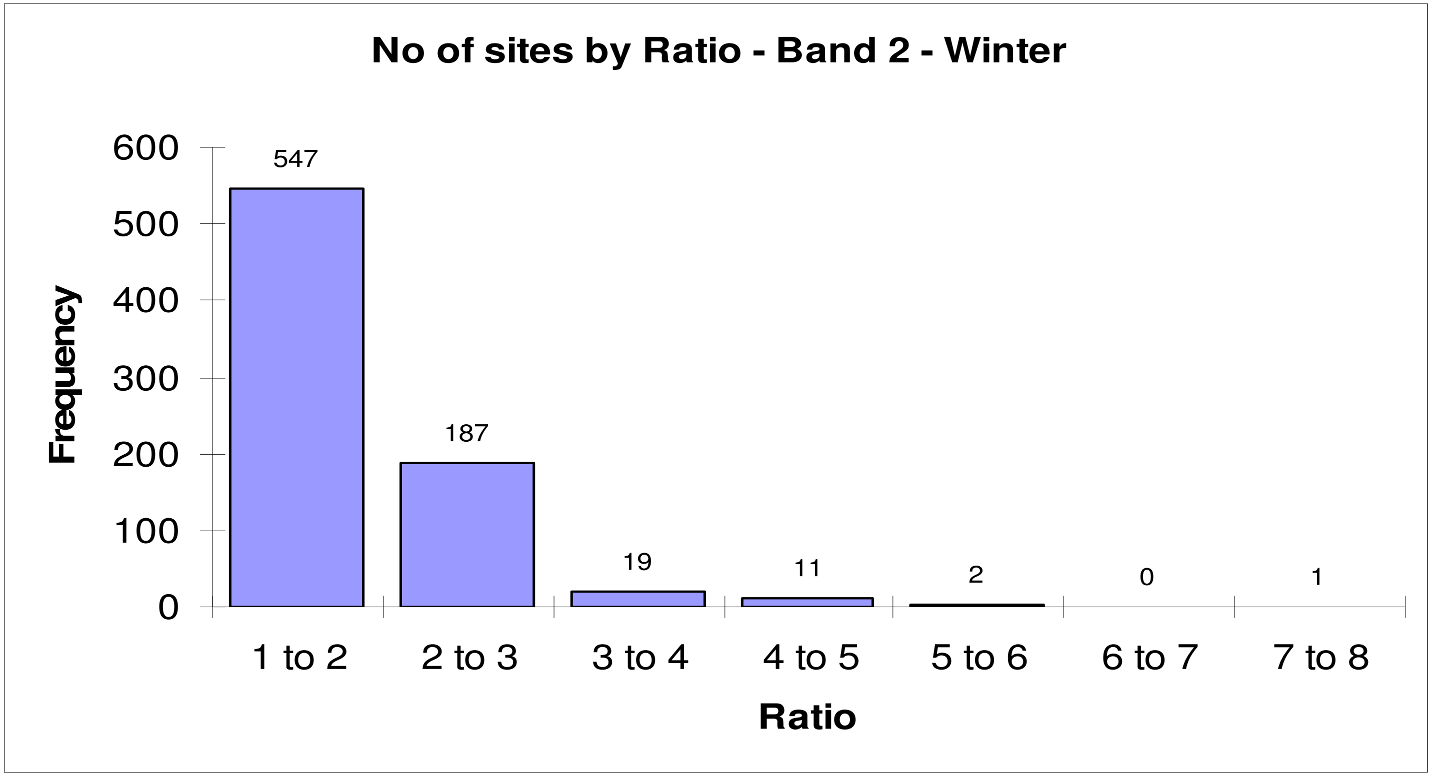
Frequency of ratio values – sites that passed validation



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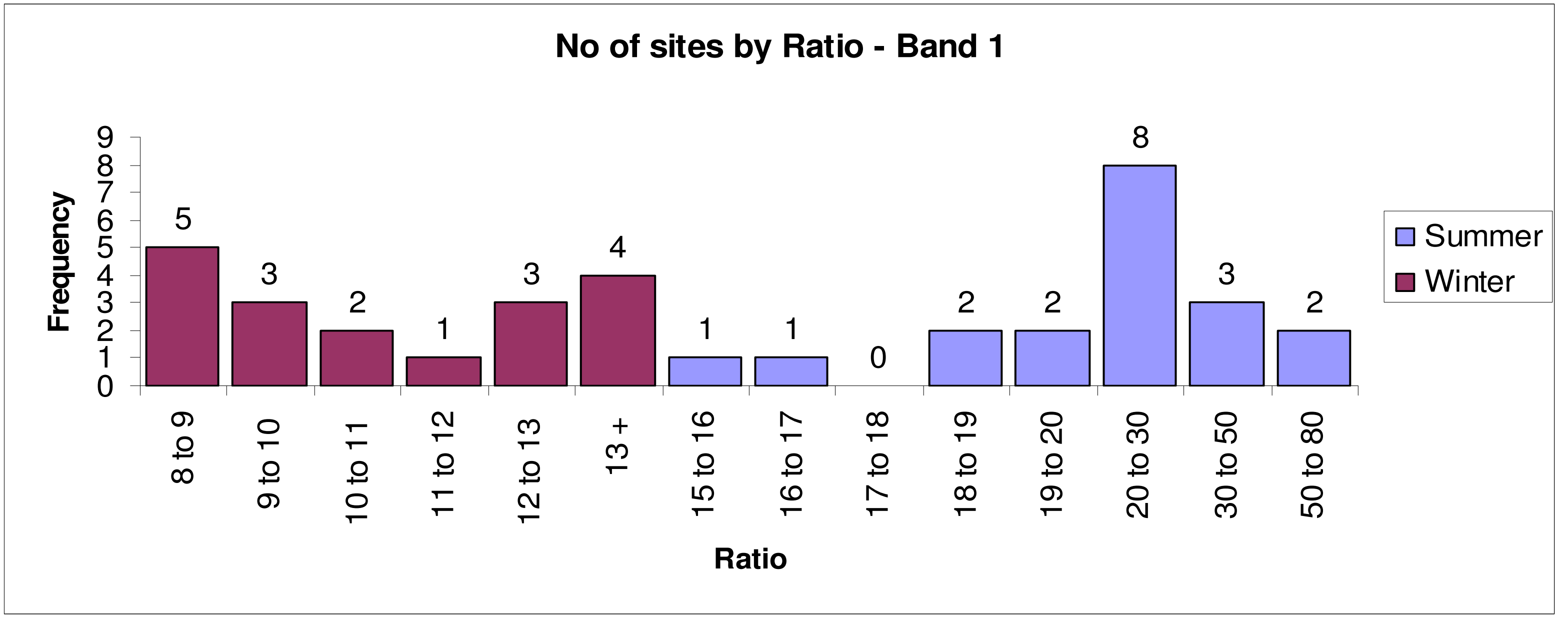
Frequency of ratio values – sites that failed validation



52 sites failed spike validation in 2012/13. Of those 52 sites:

46 were in Band 1 but only 37 could be used in modelling as 9 sites were non domestic.

6 sites were Band 2 (failed summer spike validation) with Ratios between 15 to 19.

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Analysis

- Firstly, regression models were run with the sites that passed validation for bands 1 and 2 to replicate the current modelling process results to use as a benchmark.

- The spike ratio was then increased by 1 at a time – first for the summer ratio (with the winter ratio remaining as the default 8:1). This was then repeated for the winter ratio (with the summer ratio remaining as the default 15:1).

- The ratios for summer and winter were then increased simultaneously.

Band 1 Results – comparison of R^2

LDZ	Summer Spike 15 Winter Spike 8	Summer Spike 16 Winter Spike 8	Summer Spike 17 Winter Spike 8	Summer Spike 18 Winter Spike 8
No. of sites	3036	3037	3038	3038
EA	0.9889	0.9889	0.9889	0.9889
EM	0.9887	0.9887	0.9887	0.9887
NE	0.9816	0.9816	0.9816	0.9816
NO	0.9803	0.9803	0.9803	0.9803
NT	0.9886	0.9886	0.9886	0.9886
NW	0.9872	0.9872	0.9872	0.9872
SC	0.9802	0.9802	0.9802	0.9802
SE	0.9893	0.9893	0.9893	0.9893
SO	0.9863	0.9863	0.9863	0.9863
SW	0.986	0.986	0.986	0.986
WM	0.9904	0.9904	0.9904	0.9904
WS	0.9759	0.9759	0.9759	0.9759

Band 1 results – comparison of R^2 cont…

LDZ	Summer Spike 15 Winter Spike 8	Summer Spike 15 Winter Spike 9	Summer Spike 15 Winter Spike 10	Summer Spike 15 Winter Spike 11
No. of sites	3036	3041	3044	3046
EA	0.9889	0.9889	0.9889	0.9889
EM	0.9887	0.9887	0.9887	0.9887
NE	0.9816	0.9816	0.9816	0.9816
NO	0.9803	0.9803	0.9803	0.9803
NT	0.9886	0.9884	0.9884	0.9884
NW	0.9872	0.9873	0.9873	0.9873
SC	0.9802	0.9802	0.9802	0.9802
SE	0.9893	0.9893	0.9893	0.9893
SO	0.9863	0.9863	0.9863	0.9863
SW	0.986	0.9858	0.9858	0.9858
WM	0.9904	0.9904	0.9904	0.9904
WS	0.9759	0.9759	0.9759	0.9759

Band 1 – comparison of R^2 results cont…

LDZ	Summer Spike 15 Winter Spike 8	Summer Spike 16 Winter Spike 9	Summer Spike 17 Winter Spike 10	Summer Spike 18 Winter Spike 11
No. of sites	3036	3042	3046	3048
EA	0.9889	0.9889	0.9889	0.9889
EM	0.9887	0.9887	0.9887	0.9887
NE	0.9816	0.9816	0.9816	0.9816
NO	0.9803	0.9803	0.9803	0.9803
NT	0.9886	0.9884	0.9884	0.9884
NW	0.9872	0.9873	0.9873	0.9873
SC	0.9802	0.9802	0.9802	0.9802
SE	0.9893	0.9893	0.9893	0.9893
SO	0.9863	0.9863	0.9863	0.9863
SW	0.986	0.9858	0.9858	0.9858
WM	0.9904	0.9904	0.9904	0.9904
WS	0.9759	0.9759	0.9759	0.9758

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Band 2 – comparison of R^2 results

- Band 2 analysis has only been carried out by adjusting the summer ratios as there are no sites that failed winter spike validation

LDZ	Summer Spike 15 Winter Spike 8	Summer Spike 16 Winter Spike 8	Summer Spike 17 Winter Spike 8	Summer Spike 18 Winter Spike 8
No. of sites	767	769	770	772
EA	0.9833	0.9833	0.9833	0.9833
EM	0.9821	0.9821	0.9821	0.9816
NE	0.9813	0.9813	0.9813	0.9813
NO	0.9793	0.9793	0.9793	0.9791
NT	0.9859	0.9859	0.9859	0.9859
WN/NW	0.9829	0.9829	0.9829	0.9829
SC	0.9842	0.9842	0.9842	0.9842
SE	0.9846	0.9847	0.9847	0.9847
SO	0.9874	0.9874	0.9874	0.9874
SW	0.9798	0.9798	0.9798	0.9798
WM	0.9866	0.9866	0.9866	0.9866
WN				
WS	0.9752	0.9754	0.9772	0.9772

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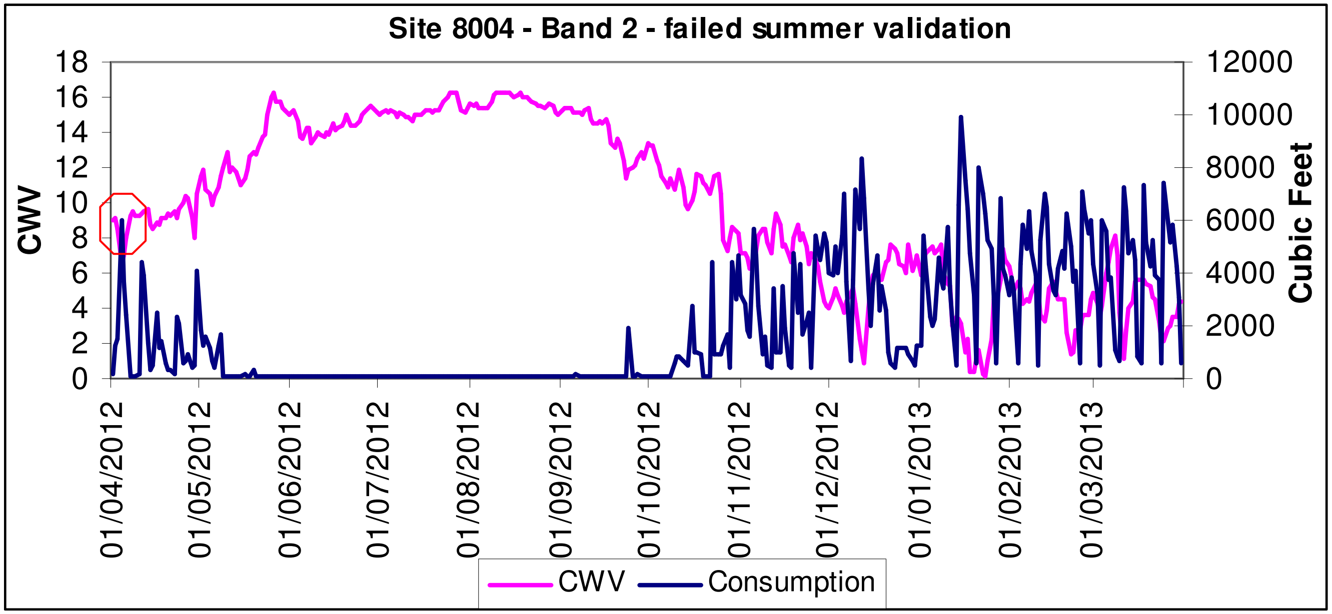
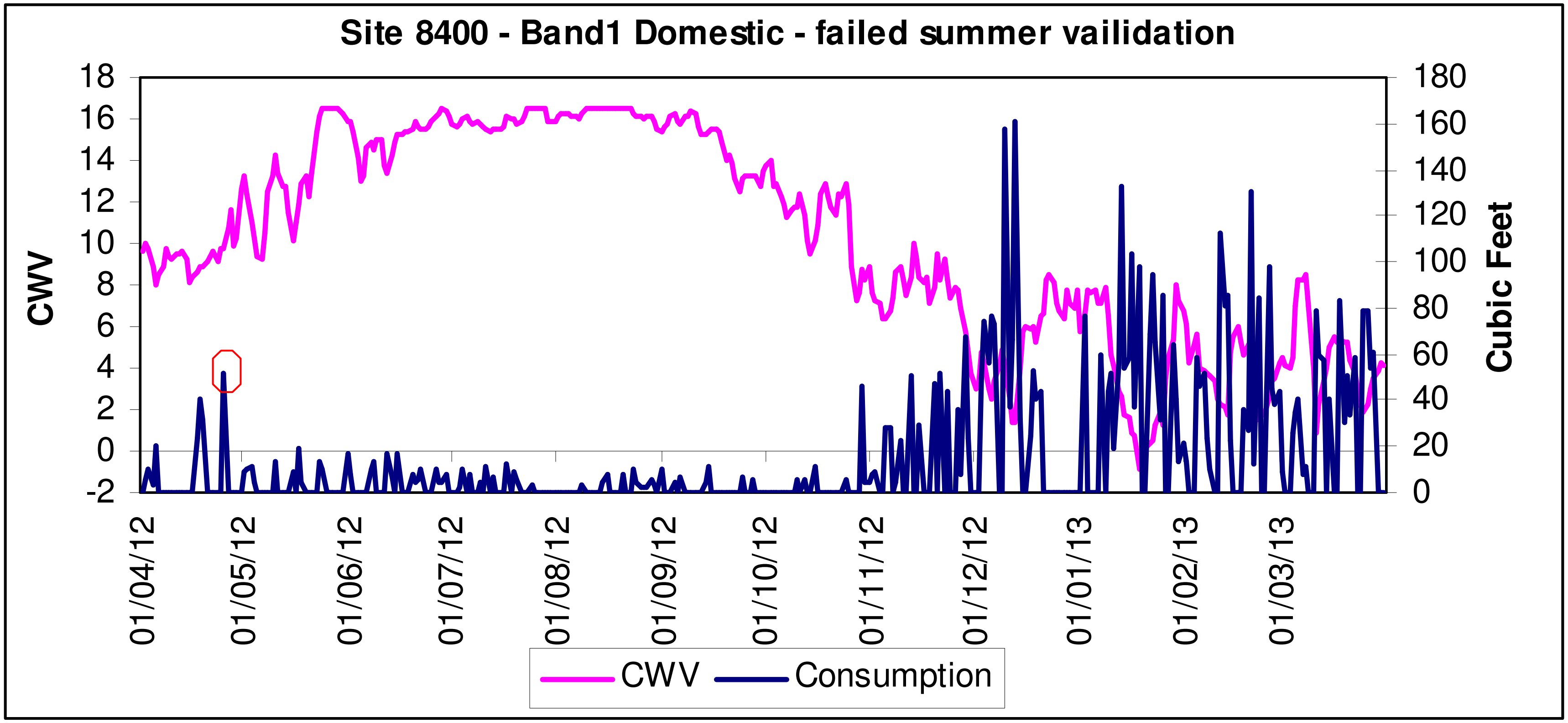
Analysis of those sites that failed validation

Further analysis was carried out on those sites that failed validation to assess if the spikes were genuine in relation to the weather or if they were actual errors. The following 2 graphs demonstrate what appears to be genuine spikes:



This site failed summer validation on Weds 04/04/2012. The CWV for the day was 6.45, the consumption was 5980 Cubic Feet.

Analysis of those sites that failed validation cont...



This site failed summer validation on Weds 25/04/2012. The CWV for the day was 9.71, the consumption was 52 Cubic Feet.

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Analysis of decreasing the spike ratio

- Regressions were re run by also decreasing the summer spike ratio to 14:1 and winter spike ratio to 7:1
  - By decreasing the summer spike ratio to 14 – we reduce the sample size by 3 sites in band 1 and 2 sites in Band 2. This made no difference to the overall results.
  - By decreasing the winter spike ratio to 7 – we reduce the sample size by 10 sites in Band 1 and 1 site in Band 2. Again, this had minimal impact on the results.

Further work

- Next steps:
  - It appears that of those sites that are failing validation and appear to be genuine consumption in relation to the weather – are in April which is when the summer period begins – but cold weather is still being experienced – hence genuine reactions to the cold weather are being picked up as spikes and dismissed from the modelling process.
    - Consider adjusting the summer period (May to Sep) rather than adjusting the spike ratio
  - Carry out the same analysis on data loggers and report results back to TWG (date to be confirmed)