GO SYSTEMS - ISA UV-VIS SPECTROMETER TRIAL RESULTS

Trial Performed on Behalf of a Local Council at the Inlet to a Municipal WWTP in Queensland, Australia

Royce RWT Water Technologies

Trial Scope and Aims

1) The Local Council identified a need to monitor Hydrogen Sulphide (HS^-) in relation to adverse impacts from corrosion and odour both at treatment plants and in the network.

2) Real time data relating to incoming loads to the plant, and toxicity events; are also required for monitoring and control of the treatment plant. These events can then be traced within the network for further action.

To achieve this the trial measured:

- COD
- BOD
- TSS
- Total Oil and Grease (TOG)
- Ammonia
- HS^-

Trial Scope and Aims

The Local Council identified UV-Vis measurement technology as a candidate technology that could provide cost effective real time multiparameter analysis of wastewater incoming to the Treatment Plant in a single instrument.

Locations for potential monitoring include:

- WWTP inlets
- Bioreactors
- Key pump stations
- The sewer network

Method

Royce Water provided a GO Systems ISA UV-Vis spectrometer for this trial which was installed in a bypass setup connected to one of three inlets to the plant.

Because the chemical matrix of the influent are typically different for each treatment plant; 25 reference samples must be taken and will be used to build the calibration used for future measurement. This was performed for inlet 1.

This calibration was then used to monitor inlet 2 to check the measurement confidence across multiple applications. The SQI feature was used to monitor the confidence of the calibration in the new inlet.

SITE SETUP

A simple temporary overflow measurement chamber was constructed

Notes

The sample line leading to the bypass setup regularly blocked causing periods of stagnation – these can be seen and are marked on the 3 week trends.

Leachate was spiked to the sensor to simulate an unknown toxic event – this can be seen in the 3 day trends for inlet 2

HS^-, TOG, & TSS use 3 different wavelengths within the spectrum (200-708nm) because no benefit was seen from using 4.

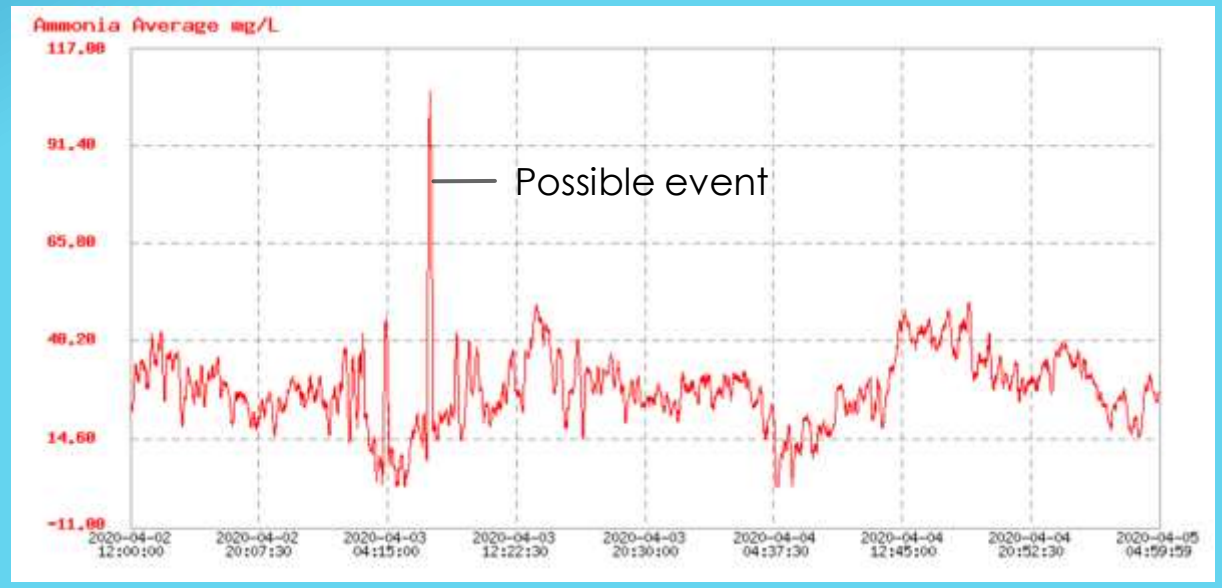
Results – Inlet 1

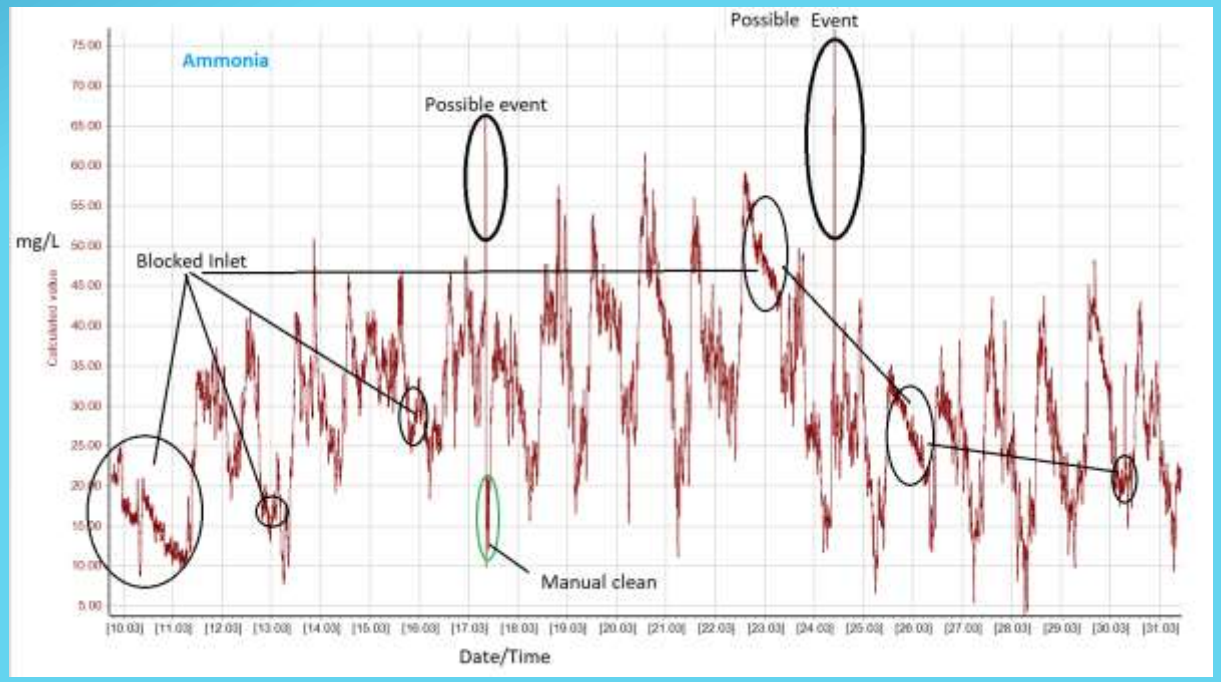
Ammonia

Measurement range: 7-63.2 mg/L
Accuracy: 7.5%
Correlation coefficient: 0.9429
Wavelengths (nm):

312	406
320	410

3 day trend -





- 3 week trend

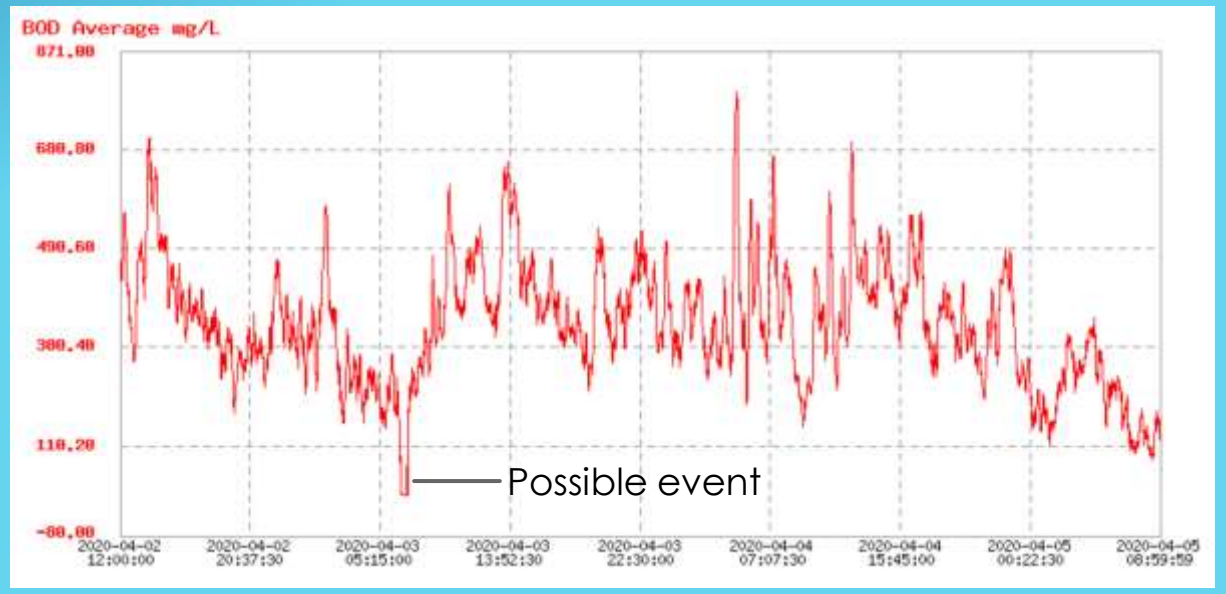
Results – Inlet 1

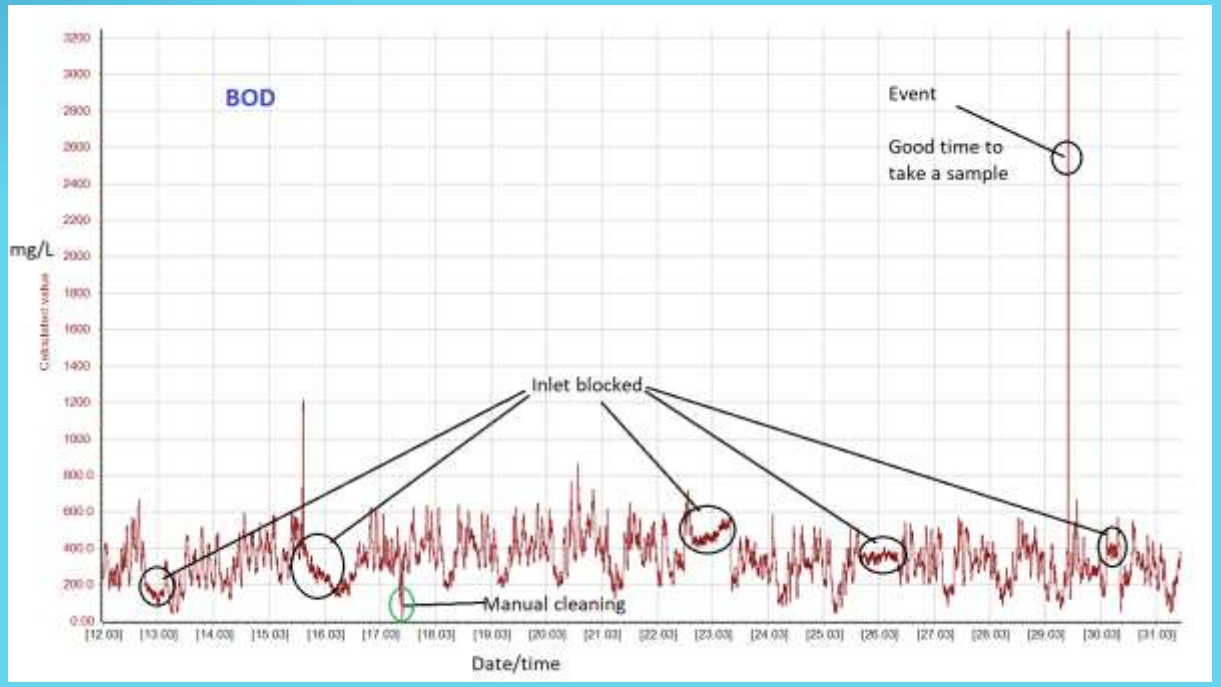
BOD

Measurement range: 80-700mg/L
Accuracy: 9.03%
Correlation coefficient: 0.9282
Wavelengths (nm):

288	610
290	614

3 day trend -





- 3 week trend

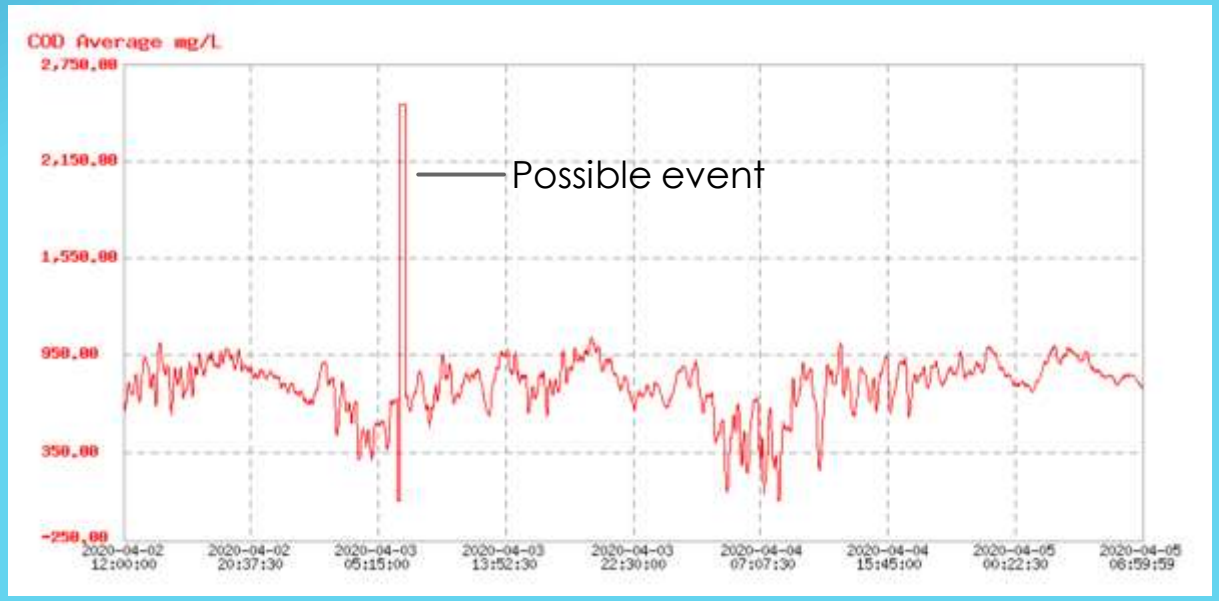
Results – Inlet 1

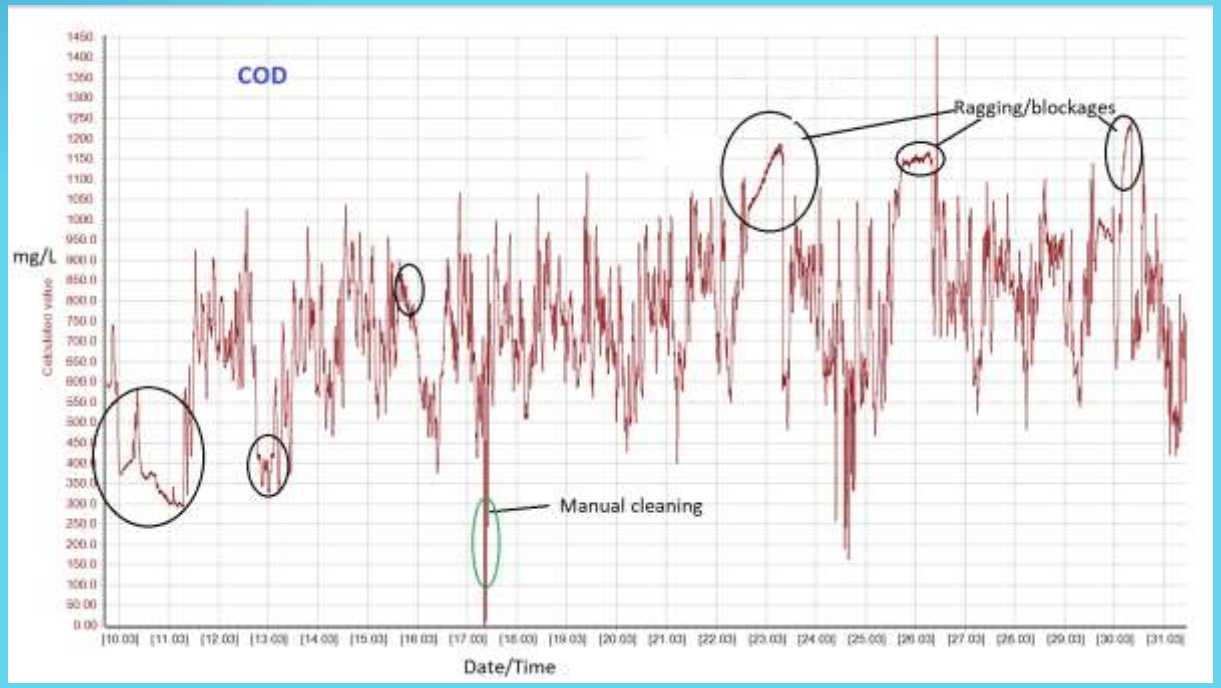
COD

Measurement range: 200-1210mg/L
Accuracy: 7.9%
Correlation coefficient: 0.8620
Wavelengths (nm):

234	292
244	512

3 day trend -





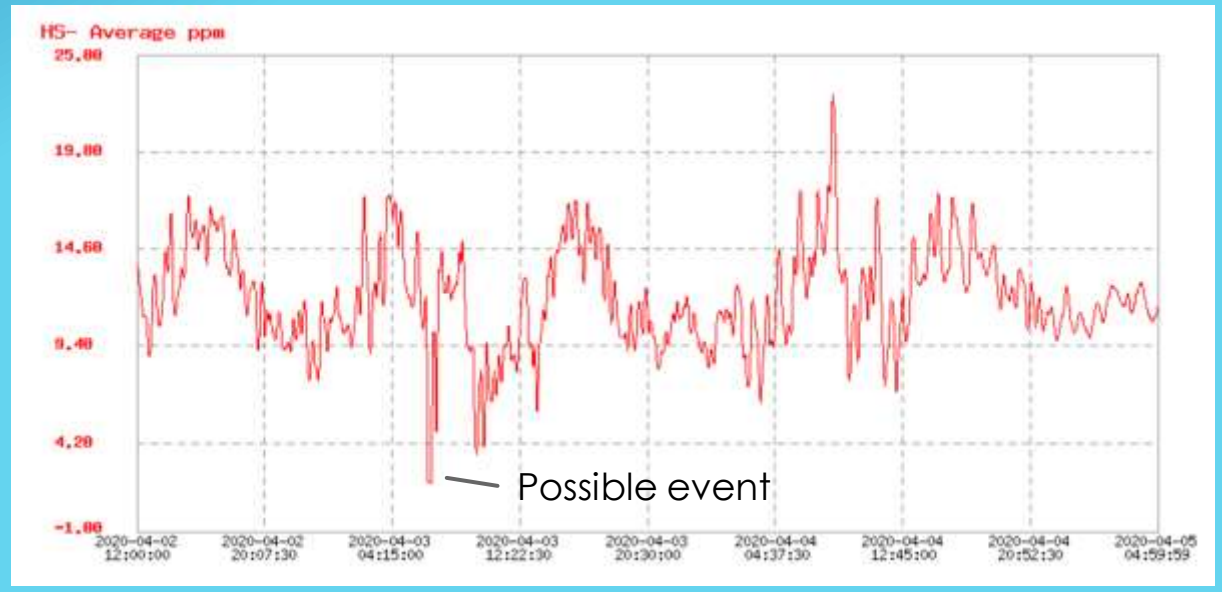
- 3 week trend

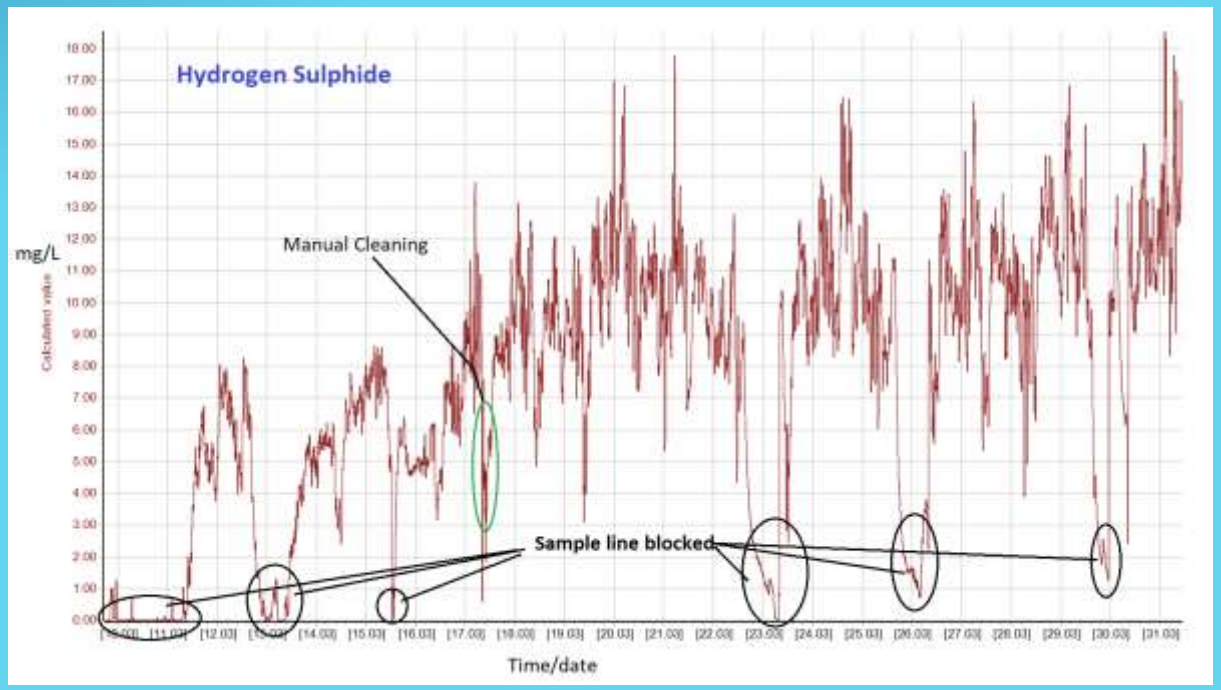
Results – Inlet 1

HS-

Measurement range: 0.7-15 mg/L
Accuracy: 10.86%
Correlation coefficient: 0.8884
Wavelengths (nm):
244 424
292

3 day trend -





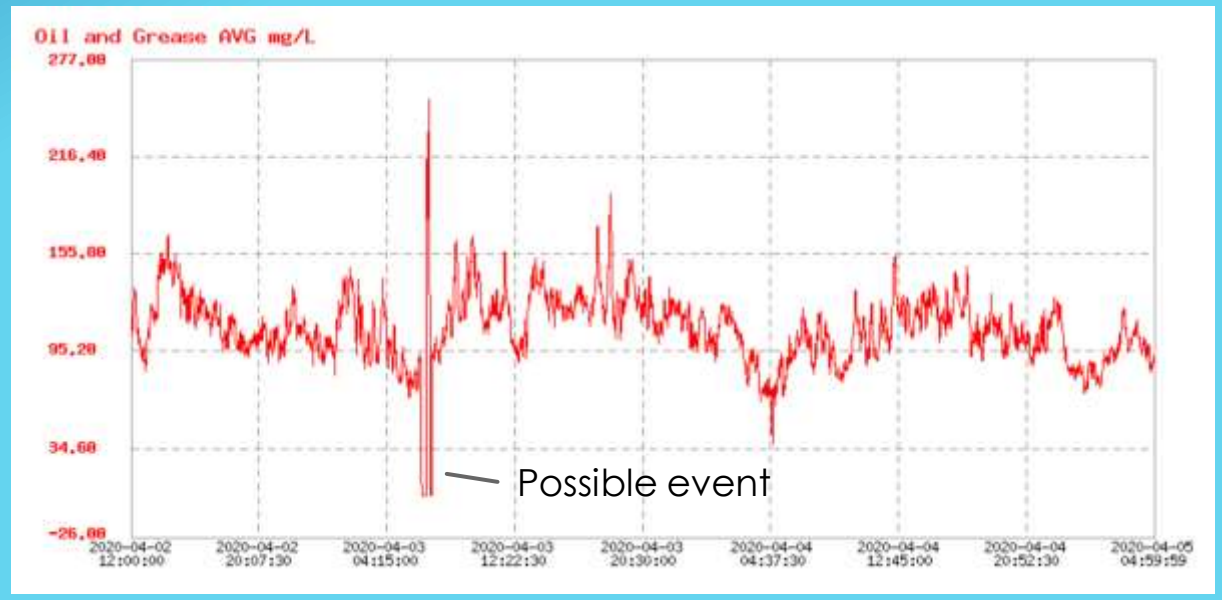
- 3 week trend

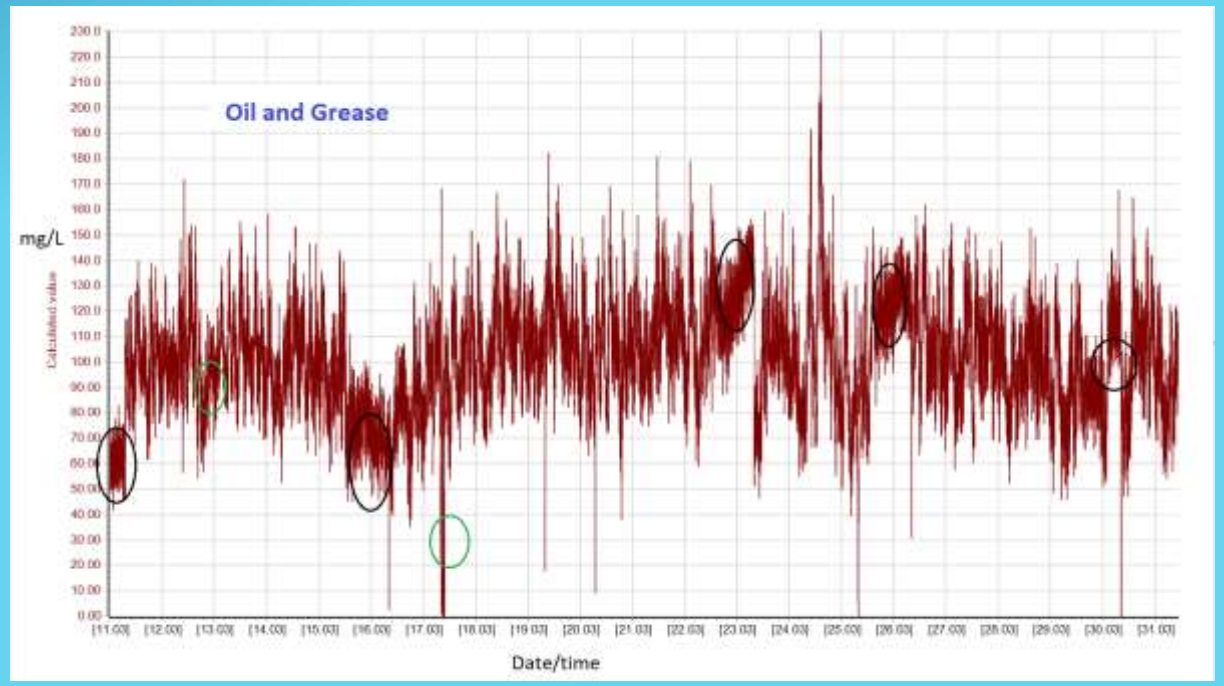
Results – Inlet 1

Oil and Grease

Measurement range: 10-220 mg/L
Accuracy: 12.1%
Correlation coefficient: 0.7827
Wavelengths (nm):
286 622
614

3 day trend -





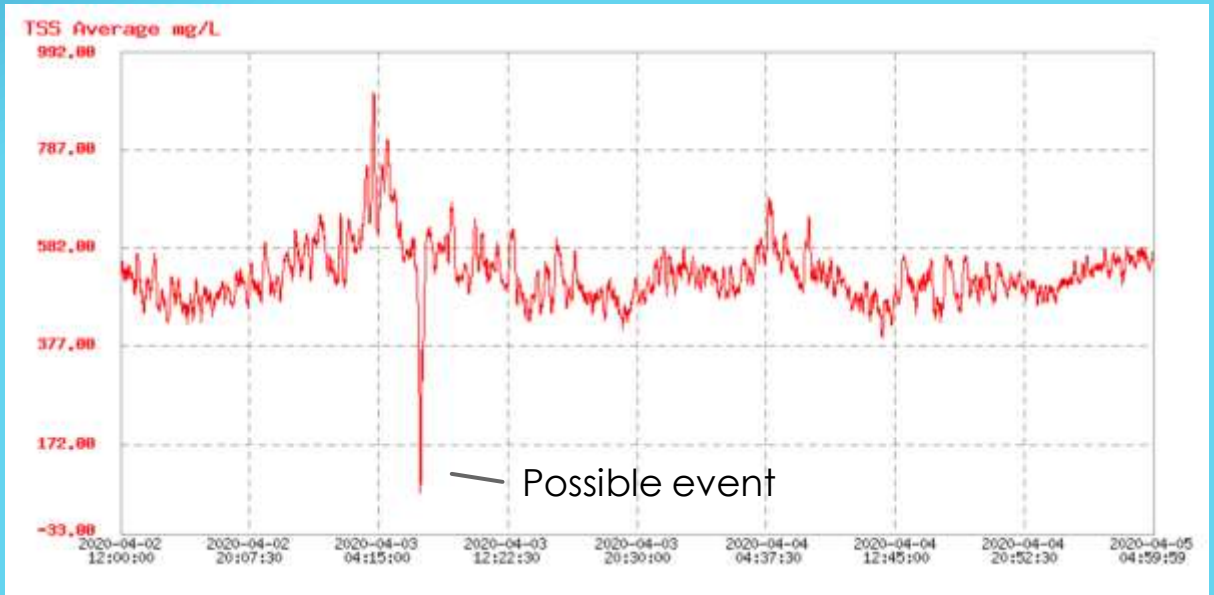
- 3 week trend

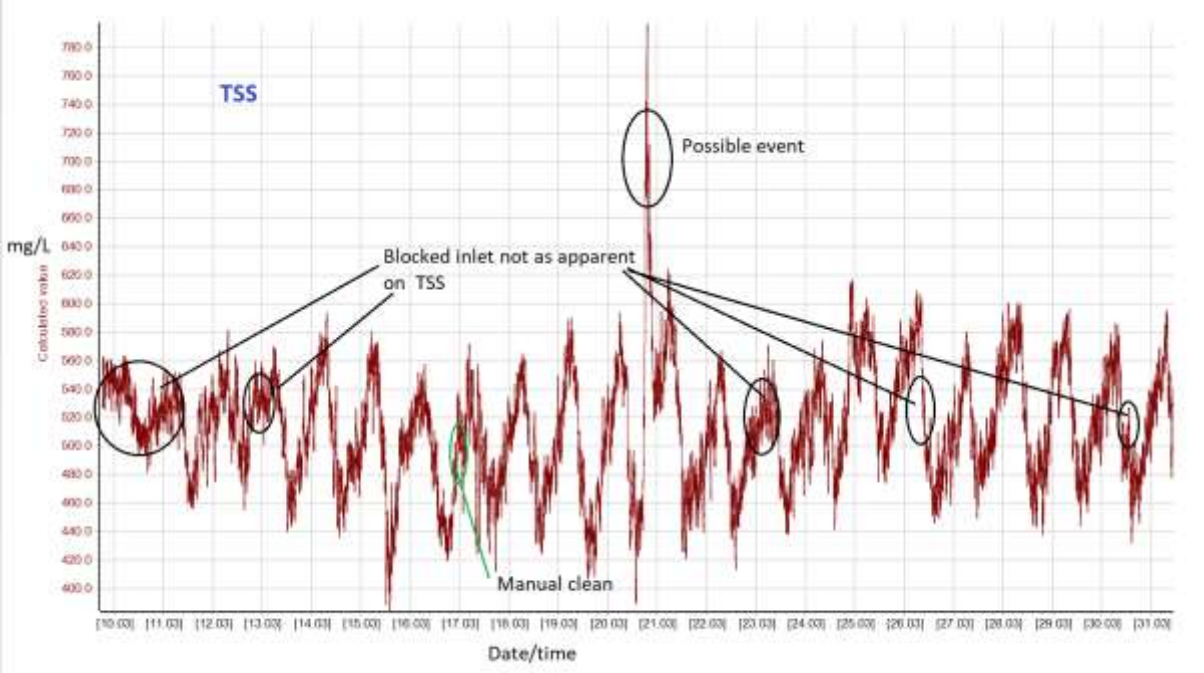
Results – Inlet 1

TSS

Measurement range: 140-480 mg/L
Accuracy: 10.36%
Correlation coefficient: 0.8371
Wavelengths (nm):
620 688
642

3 day trend -





- 3 week trend

Inlet 2 – The SQI

The SQI feature produces a value that monitors the statistical confidence that what the sensor is seeing actually matches the calibration being used. It can be seen as a green line in the lower graphs in the next slides.

This can be used to:

- Monitor the measurement confidence
- Monitor for changes in the water matrix over time
- Monitor for unusual and unknown events
- Distinguish between different processes

At a value of 0 we are at the 99.9% confidence level that the calibration fits the application. At an SQI value of 4 we are at a 90% confidence level – this 90% threshold is the red flat line.

When the green SQI line is below the threshold (flat red line) we can assume a confidence of 90% or greater and thus a suitable calibration.

(The SQI values for Inlet 1 are all above 90% in confidence)

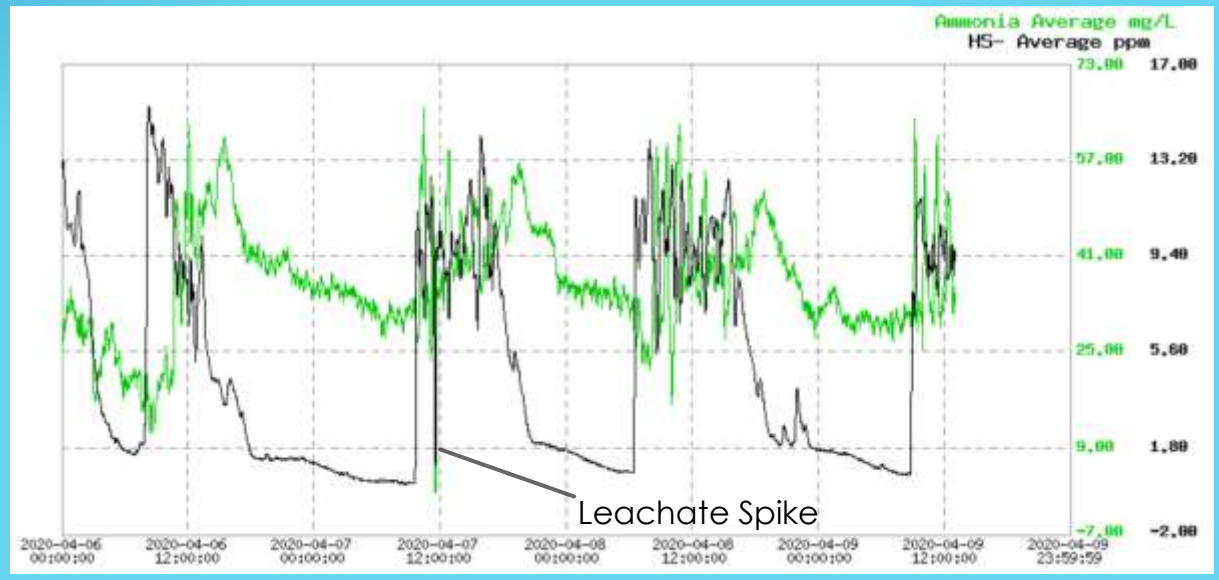
Results – Inlet 2

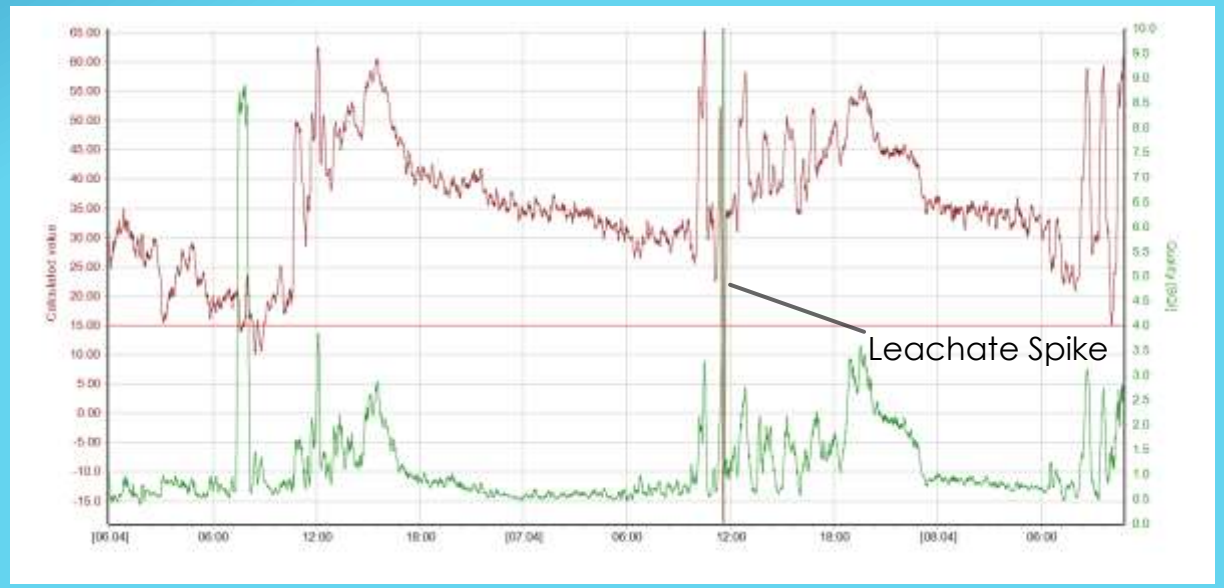
Ammonia & HS^-

The Ammonia calibration is over 90% confident consistently

The HS^- calibration also has high confidence in the new inlet.

3 day trend





Ammonia

HS^-

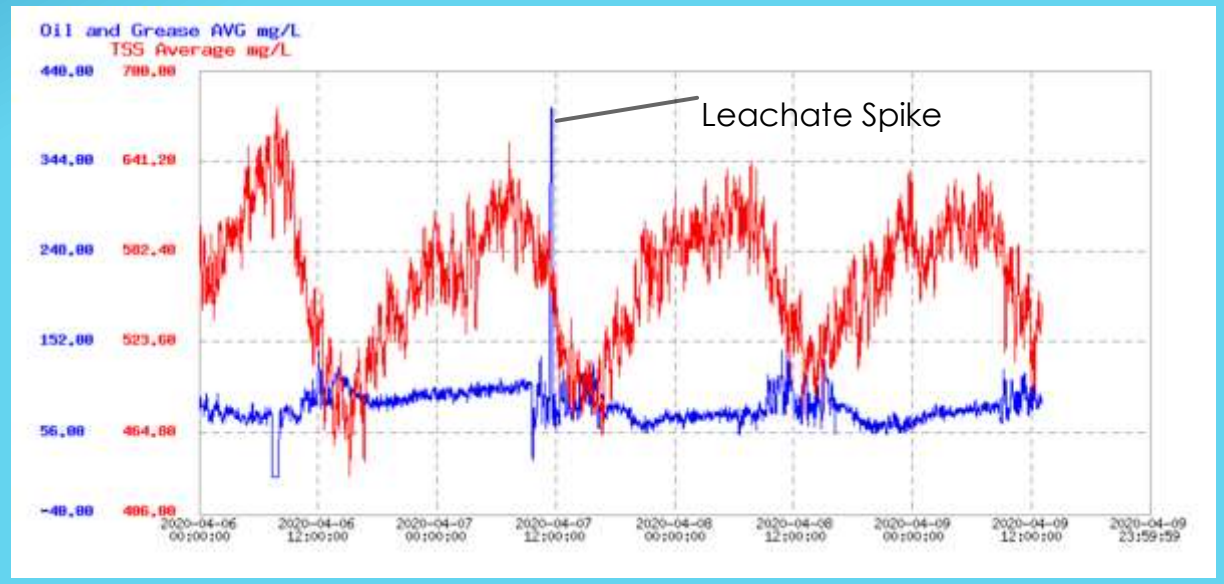
Results – Inlet 2

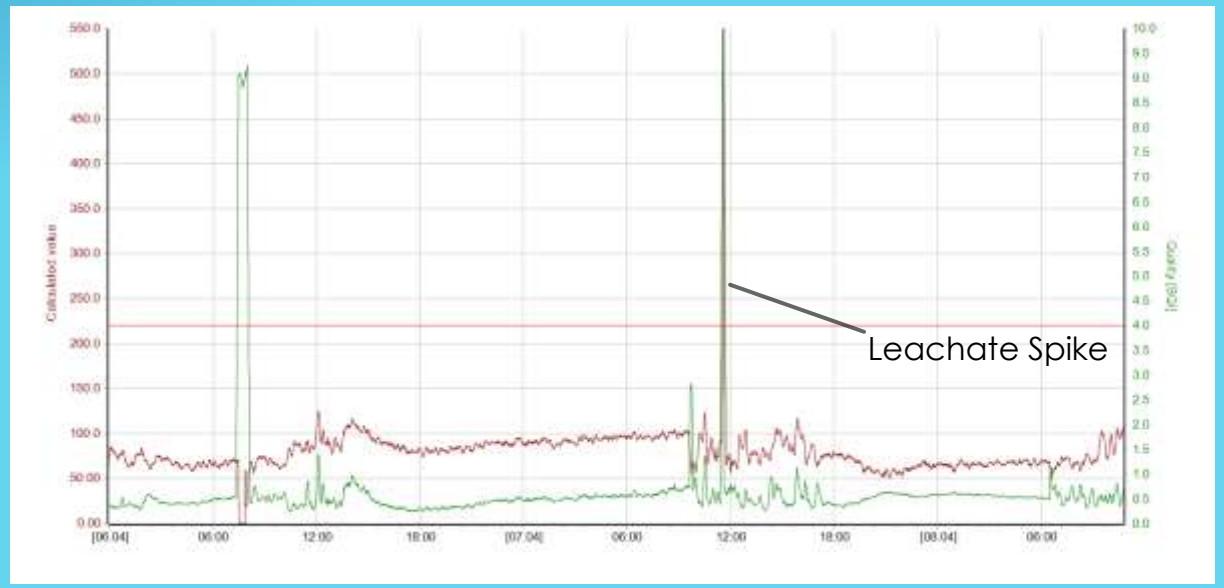
TOG & TSS

The TOG calibration has high confidence in the new inlet.

TSS confidence has dropped significantly in the new inlet. While the results may be correct still – new reference samples need to be added to the calibration.

3 day trend





Oil and Grease

TSS

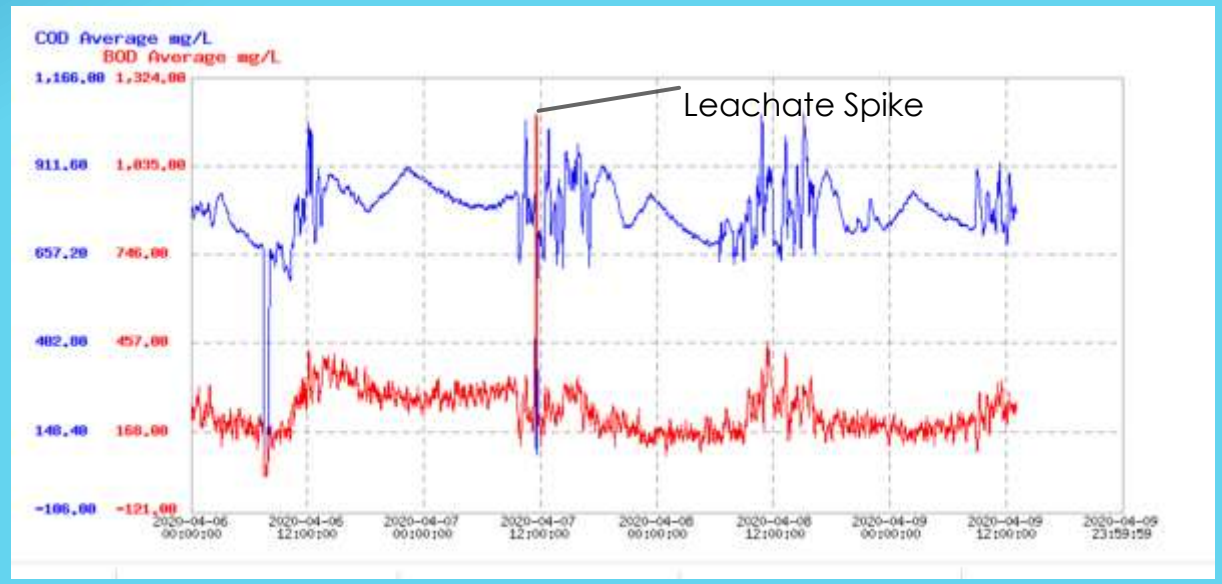
Results – Inlet 2

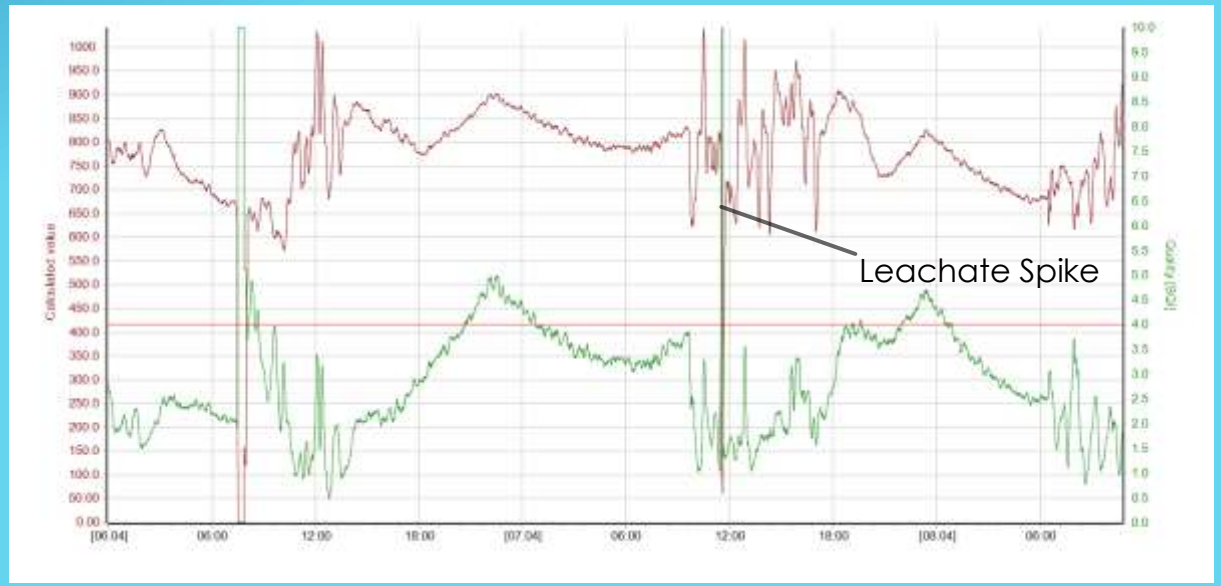
COD & BOD

The BOD calibration has high confidence in the 2nd inlet

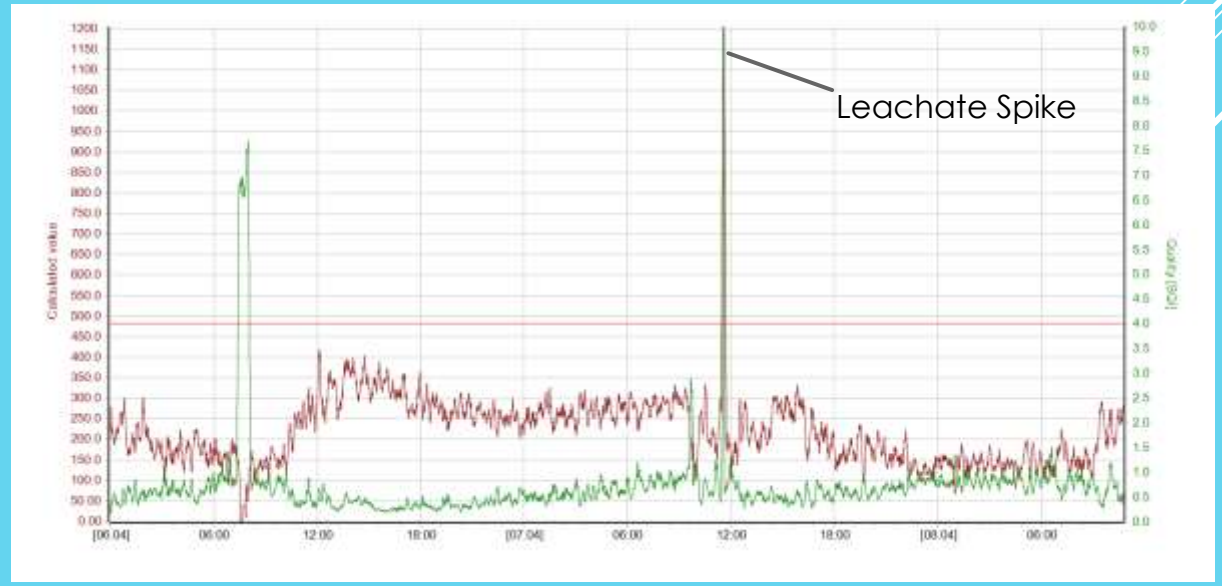
The COD calibration is better than 90% confident the majority of the time; however, it could use approximately 2-3 more samples in this new inlet.

3 day trend





COD



BOD

Trial conclusions

Trend and laboratory analysis indicate that the parameters included in this trial can be measured successfully and with high accuracy

This custom calibration can be used for investigations in the network with minimal adaptation. Similarly this calibration will need minimal adaptation for other treatment plants within the larger catchment.

Normal plant processes that cause periodic sample stagnation are visible in the data

Via the SQI - the calibration performed on inlet 1 was shown to also be appropriate for inlet 2 excepting TSS - this is likely due to a change in TSS particle sizing

The SQI correctly identified the leachate spike on all parameters except TSS.

For more information please email Contact@RoyceWater.com.au