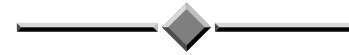


IMPROVED MAINTENANCE OF OUR RETICULATION SYSTEMS USING INNOVATION AND DATA



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ABSTRACT

Historically, Goulburn Valley Water (GV Water) has carried out maintenance of the water reticulation systems based on time, the availability of resources – operators and air scour unit; and/or the number of complaints received to improve water quality within the distribution network.

GV Water in partnership with Veolia Water commenced the first of three case studies using the Aquadiag service.

- Case Study 1 – Rushworth Township – Sediment Re-Suspension Index
- Case Study 2 – Shepparton to Tallygaroopna system – Free Chlorine
- Case Study 3 – Marysville comparing flushing, air scouring and ice pigging

These case studies have proven to be extremely successful and it is proposed to use the Aquadiag service system as a base for the mains cleaning in all 54 townships within GV Water.

1.0 INTRODUCTION

In August 2013, GV Water and Veolia Water held discussions about setting up a trial, using Veolia Water's new and innovative Aquadiag service. The discussions centred on using the service essentially for some analytical science to predict best timing methods to remove biofilm build up within the pipe network.

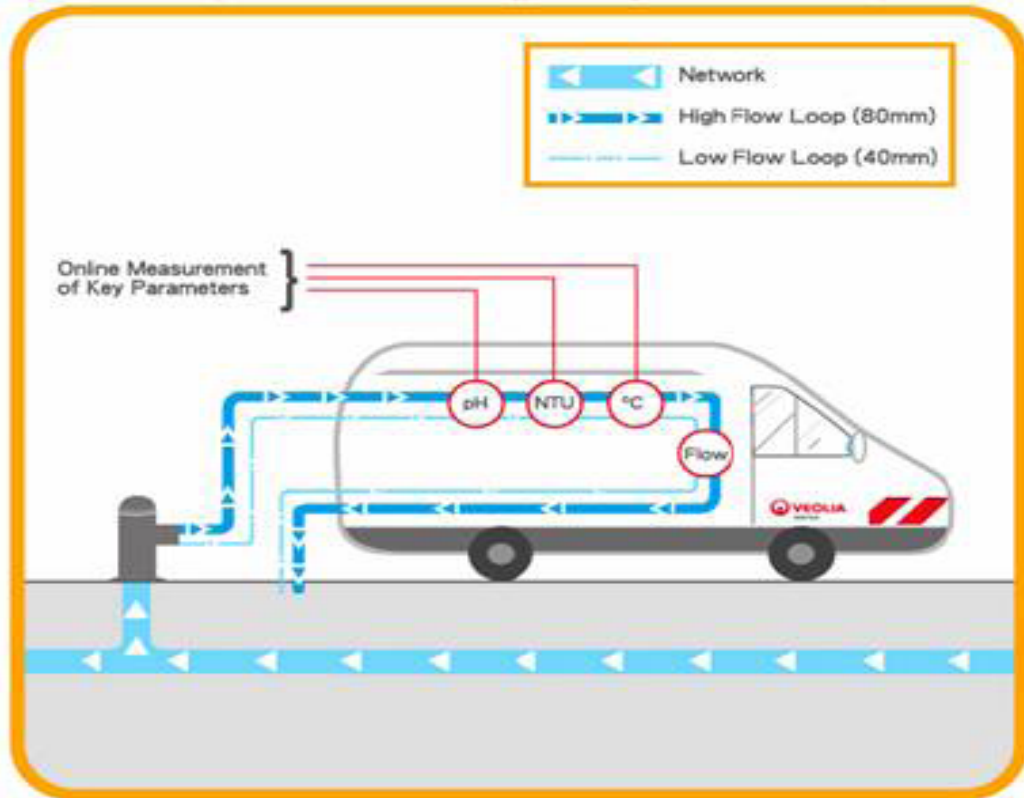
The Aquadiag is a unique service developed by Veolia Water that uses a mobile diagnosis vehicle which is fully equipped with state of the art laboratory and on line water quality monitoring and analytical equipment. A broad range of water quality data can quickly diagnose the networks conditions and provide you with an accurate snapshot of the health of the water distribution system.

The vehicle is fitted with on line water quality probes that measure continually and are linked to an on board SCADA logging system that automatically records the following parameters.

- Turbidity
- Total & free chlorine residuals
- Dissolved Oxygen
- pH
- Conductivity
- Temperature
- Flow
- Pressure

AQUADIAG:

Pipe water quality assessment technology with high and low flow loops



The van also carries an on board spectrophotometer along with reagents for batch testing other parameter such as iron, nitrite, nitrate and free ammonia.

The van is connected to the reticulation system on a fire plug via a hydrant and this can accommodate a wide range of flows.

The Aquadiag was used to assess the general water quality and potential for re-suspension of sediment. Sediment Re-suspension Index (SRI) is assessed by on line turbidity and the flow velocity in the mains is raised to 0.35 m/s (10 kL/hr for 100mm, 22.5 kL/hr for 150 mm) this simulates a peak demand. Note this is not suitable for >200mm as required flows cannot be achieved via fire plugs.

The data collected provides a base for that particular reticulation system which can determine if and when maintenance is required on the system.

2.0 DISCUSSION

In October 2013, GV Water in partnership with Veolia Water commenced the first of three case studies using the Aquadiag service.

Case Study 1 – Rushworth Township – Sediment Re-suspension Index

The Rushworth Township consists of approx. 622 properties serviced by 26kms of water mains and had not been air scoured or flushed for three years.

The aim of the case study was to determine the base line for the township, with the main focus on turbidity and chlorine residual results.

As part of establishing the baseline condition of the network in the township Veolia Water made the following recommendations.

- Carry out a mains cleaning program for the entire township.
- Reassessment of the sediment re-suspension potential using the Aquadiag after the mains cleaning to confirm the success of the mains cleaning.
- Establish an ongoing assessment of the reticulation system.

Following the air scouring the Aquadiag tests were repeated to determine the effectiveness of the air scouring program.

Figure 1 before shows the SRI (before air scouring) / SRI (after air scouring).

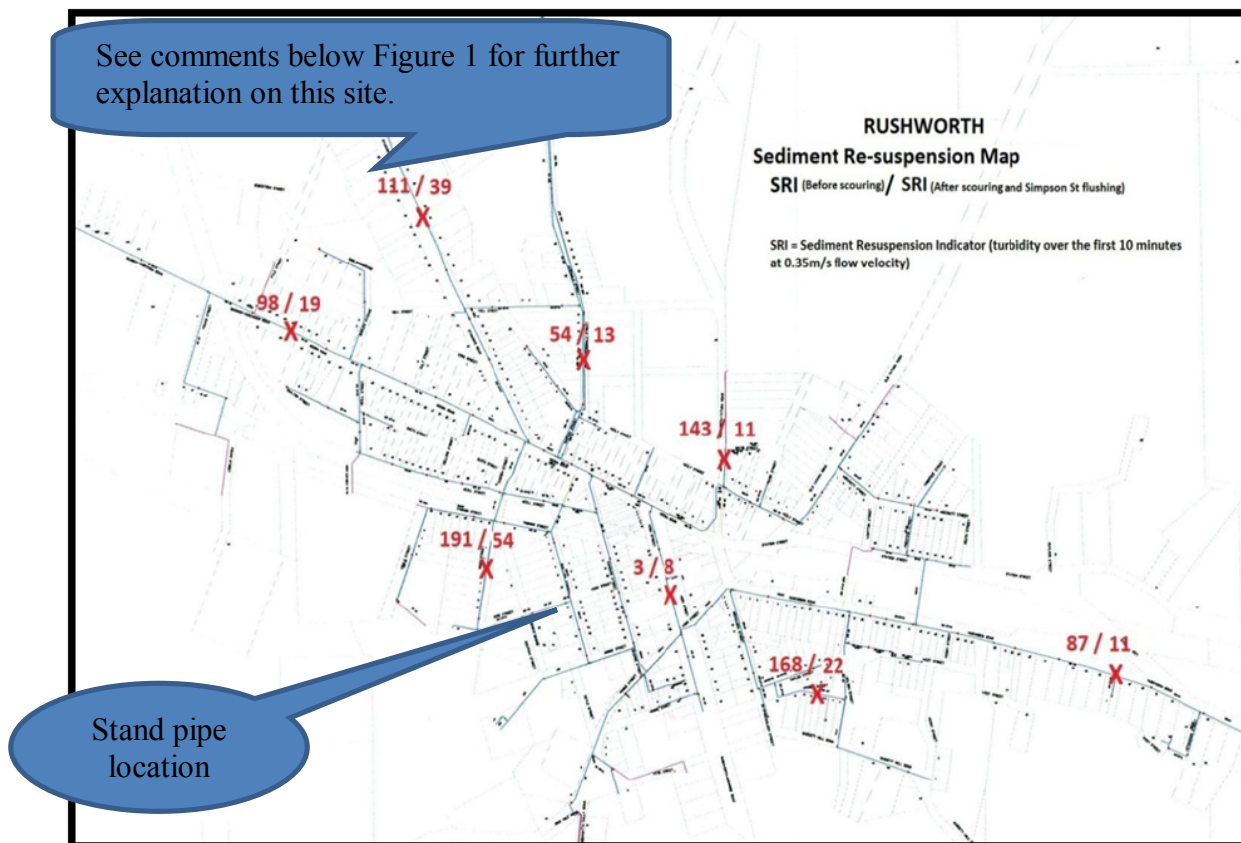


Figure 1: *SRI before & SRI after Air Scouring*

The site marked 111/39 is on the main 200 mm dia supply main to the township. The retesting showed there was no improvement at this site, an investigation was carried out and found that the operators didn't include this section on the air scouring program as planned due to the difficulty in shutting down the complete township. The supply line was flushed, and then retested with the results as shown. This enables the operators to better understand their systems and the importance of leaving out sections of the reticulation system.

The data has shown that the air scouring was very effective in cleaning the system, in one case from 191 NTU minutes before air scouring to 54 NTU minutes after air scouring.

There is an overhead stand pipe in the middle of the township which the local water carters use regularly; this had a starting point of 3 NTU minutes before cleaning and 8 NTU minutes after cleaning.

Case Study 2 – Shepparton to Tallygaroopna System – Free Chlorine

This involved a series of Aquadiag tests on approx. 12 km of 200 diameter water main supply to two small townships of Congupna and Tallygaroopna.

This supply main has fire plugs at the high points and scour valves at the low points, historically GV Water have not scoured or flushed this pipeline due to the issues involving dirty water and interrupting the flows into the two townships.

The aim was to determine the free chlorine within the reticulation system.

After establishing the baseline condition of the main supply pipeline the pipe was scoured then flushed and the Aquadiag tests were repeated.

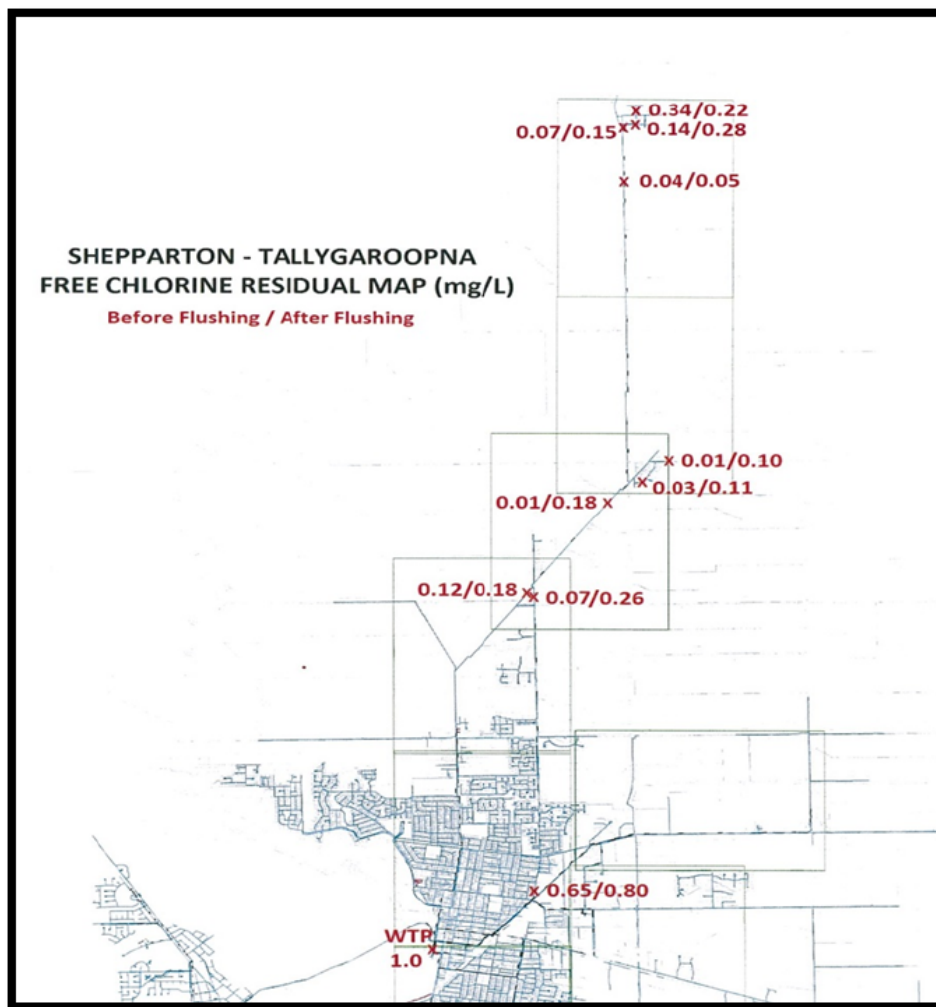


Figure 2: Shows Results of Free chlorine before & after flushing & scouring.

Figure 2 shows the results proving that scouring and flushing on this 200mm AC water main has increased the free chlorine residual in the system.

Another key finding was to put on hold a proposed chlorine booster station at Congupna and it will enabled GV Water to manage the system into the future based on data.

Frequent cleaning may enable a chlorine residual to be established without having to construct the chlorine booster pump station.

Case Study 3 – Marysville Comparing Flushing, Air Scouring And Ice Pigging

In May 2014, a study commenced in Marysville a small town of approx. 327 properties serviced by 24 km of water mains.

The main aim of this case study was to compare flushing, air scouring and ice pigging to see which is the most successful in removing *Plumatella* (tobacco weed) from the water source and to set a base line for the system using the Sediment Re-suspension Index.

Aquadiag tests were carried out to determine the base line parameters for the township.

The township was flushed, air scoured and ice pigging in sections as per the plan in figure 3 below. The Aquadiag service was repeated after cleaning and the results compared to determine the most effective method of mains cleaning.

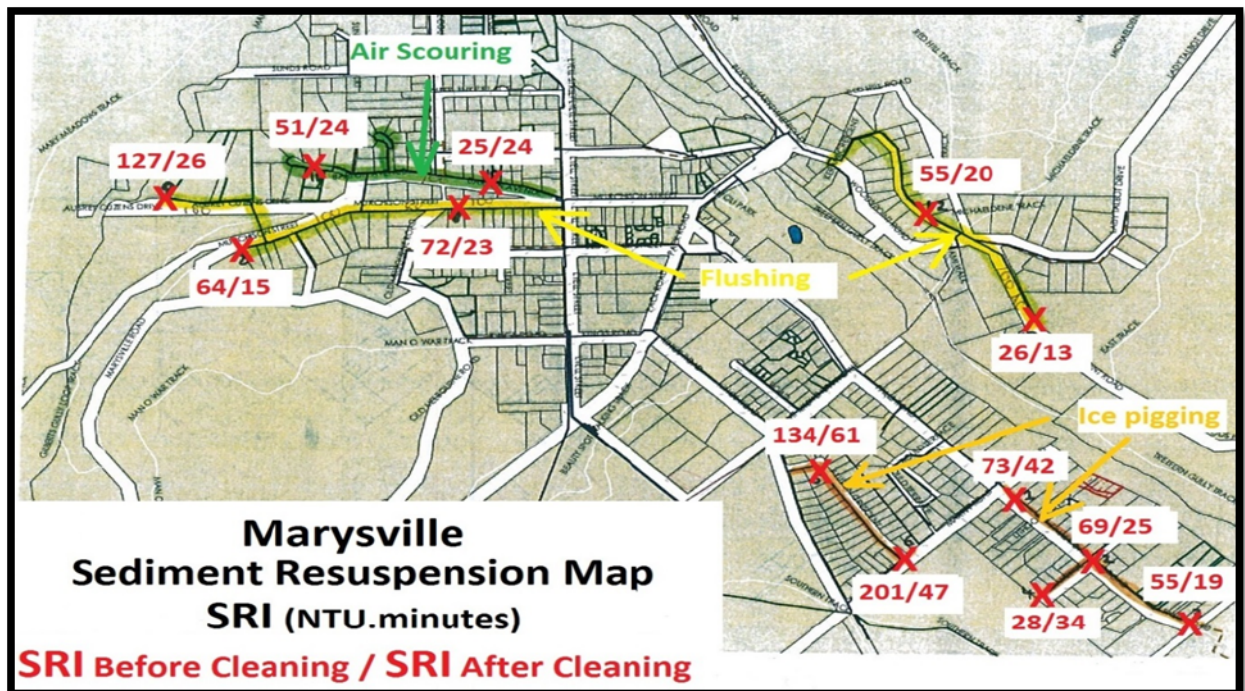


Figure 3: Shows SRI before cleaning & after cleaning

The key findings of this case study are listed below and in the table 1 below:

- There was significant sediment re-suspension risk throughout Marysville network before mains cleaning.
- Water quality improved considerably at all sites as fresh water was drawn to each sample during testing before and after mains cleaning. This indicates water quality and chlorine residual is deteriorating due to detention time rather than biofilm or sediment build-up in the mains.
- Flushing and ice pigging were effective at removing sediment from the mains.
- The air scouring results are considered inconclusive as the mains were relatively clean before the study and only 2 sample points were used in the study.
- Ice pigging was successful in removing *Plumatella*. There was no evidence of *Plumatella* being removed using flushing or air scouring as GV Water didn't take samples during this process. This is an area for improvement in the future.

Table 1: Shows the data using each cleaning system

	Sediment Re-suspension Indicator Average Reduction		Peak Turbidity Average Reduction	
	NTU. minutes	%	NTU	%
Ice Pigging	55.28	47%	16.02	53%
Flushing	50	68%	49.37	89%
Air Scouring*	14	30%	13.21	64%

* Air scouring results are from only 2 sites



Figure 4: Shows *Plumatella* in the ice pig

3.0 CONCLUSION

These case studies have proven to be extremely successful and it is proposed to use the Aquadiag service system as a base for the mains cleaning in all 54 townships within GV Water. The benefits of each case study have included but not limited to

1. Reducing the hazards and possible water quality issues thanks to a better understanding of the systems.
2. The overall cleaning campaign is now being tailor made based on this study to drastically lower the costs associated with mains cleaning.
3. The estimated saving can be up to \$2,500 per km of water main over a 10 year period of time.

4.0 ACKNOWLEDGEMENTS

GV Water would like to acknowledge the partnership we have had with Veolia Water in particular David Both for his knowledge and cooperation during these case studies and Brett Fisher for his field work.

The Central O&M and South East team needs to be acknowledged for their assistance and field work and thanks to GV Water senior management for their approval and trust to carry out the case studies.