

DEVELOPING A SYSTEM TO MONITOR AND CONTROL VARIATIONS IN PRESSURE AT VARIOUS POINTS IN THE WATER RETICULATION SYSTEM



Paper Presented by:

Steven Davey & David Cundell

Author:

Steven Davey, Automation Consultant,

Rad-tel Engineering



*7th Annual WIOA NSW Water Industry Operations Conference
and Exhibition
Exhibition Park in Canberra (EPIC),
9 to 11 April, 2013*

DEVELOPING A SYSTEM TO MONITOR AND CONTROL VARIATIONS IN PRESSURE AT VARIOUS POINTS IN THE WATER RETICULATION SYSTEM

Steven Davey, *Automation Consultant*, Rad-tel Engineering

ABSTRACT

This paper is designed to provide water supply operators with additional tools for monitoring and controlling water and ultimately providing consumers with adequate water pressure in all areas of a water reticulation system.

1.0 INTRODUCTION

We were asked to investigate a method to monitor pressure in various points within a council water reticulation network. The key questions were to:

- To investigate a solution where Council can confirm, that the water reticulation system has adequate water pressure throughout the entire system.
- To provide an ongoing database, for water operators and management alike, to glean maximum information for any particular system.
- To gather information, in near time, depending on the existing SCADA system.
- To investigate how accessing new data could provide a reduction in energy costs and thereby reduce Greenhouse emissions.

2.0 INVESTIGATION

Water enterprises regularly travel to various points throughout the reticulation system and test water pressure levels manually. Other information is also collected at times such as flow meter readings and often samples are collected for Residual Chlorine measurement. This is a time consuming process and it only provides a result of a snapshot in time.

The solution of adding an additional system that could provide more than a single snapshot in time would be more useful.

The outcome of investigations found that an integrated live monitoring system that could be integrated into the existing SCADA system is required. This would provide all the necessary data to conform to government water regulations. More importantly, it could provide reliable data that could be trended to extrapolate processes to ensure the water quality and water supply was meeting the end users requirements.

In this concept, imagine a series of sensor points at various branch points of the reticulation system that is able to supply a reading to the main SCADA every few minutes.

The problem that operators have is that the current RTU & Telemetry systems, based on 400 Mhz radios and other transmission mediums, could have additional RTU's & Radios installed, but the high cost of the standard products currently available, made this too cost prohibitive.

An alternative low cost option was investigated and determined feasible.

The main concepts were:

- Low cost of ownership equipment purchasing, power usage
- To be able to integrate to existing SCADA systems
- To give more regular updates of information / data
- To lower cost of operations of water system
- To have low maintenance costs
- Low visual impact on environment.

2.1 New technologies

New technologies are now available that can provide this monitoring in a much more effective and economic way than ever before.

The system proposed would use a pressure sensor and perhaps a flow meter that is attached to the water mains in various areas. The data accessed from these sensor points is transmitted to a nearby, existing RTU. The new data readings are integrated into the main SCADA system.

The pressure sensor produces 4-20 mA signal output. The output signal is then sent via a non-licensed, 900 MHz, Frequency Hopping, Spread Spectrum Radio transmitter, to a localised main RTU which maybe 2-3kms away. This is similar to a cell phone system where you only need to communicate to the nearest cell point, in this case the main RTU. It is this method that allows for super low power devices to operate.

Power consumption has been an issue for a remote site. Providing 240 Volt to a site is costly and in a number of situations is not a tenable situation. Likewise, solar solutions are open to theft & vandalism. The option of self-contained low powered devices was investigated.

The low power consumption combination sensor/radio communications devices have a simple, low cost battery incorporated within the IP Rated enclosure. Depending on it's configurable set up, it can process readings and transmit them with the battery lasting many years.

A series of these Pressure Transmission Units (PTU), are placed at various points in the reticulation system, especially in positions known to have pressure differential issues. Once the main problem areas are connected, it is altogether possible to include many of these transmitter devices into the network.

It's probably worth noting that these low power transmitter devices are ideally suited to other tasks such as monitoring at Sewage Pump Stations, water towers, dams etc. Actually it's very open to your imagination to see how this data is turning into a mesh of data encompassing Water & Sewerage information.

2.2 Environmental

All water enterprises must be prepared to keep costs down and be more "Green" in their management of systems but at the same time provide quality services. The electrical power used in water treatment and reticulation is a high cost to water enterprises.

Managing these pressures and flow points could provide a system with greater flexibility in

its management of the system.

At times of low consumption, pressure & flow equipment can be idled back or turned off. As demand increases, pressure is increased. Even unusual event like a Fire Brigade call out, could be assisted with higher pressures to their fire plug or hydrant.

Residual Chlorine readings and pipe sanitation maintenance can be assisted by the use of simple, low powered, no licensed, transportable equipment.

Imagine after gathering data for one year how useful the graphed data would be for planning.

2.3 Wireless

A free to use wireless radio channel system operates using the 900 MHz spread spectrum system. Other than the purchase and installation of the equipment, there are no radio authority costs (ACMA).

There are no concerns about security on the network since the spread spectrum network is very secure. Intentional or unintentional interference is negated by the Frequency hopping process, developed in WW2 to stop radio jamming. It should be noted that systems have setup tables that allow two identical systems to run side by side without interference or false data results.

Values from the sensor transmitter are sent to a receiver located at a strategic location, usually an RTU from the main SCADA network. This main RTU will forward the data directly to the existing SCADA system so that logging can be established and operators can review the information.

If pressure or flow falls outside predetermined set points, the system triggers alarms or even a booster pump or bore. Obviously, knowing water pressure had dropped rapidly could indicate a broken water main.

3.0 CONCLUSION

Low power transmitters are readily available and have been in use now for many years in application such as the petrochemical industries, methane gas fields and oil fields.

It's important to realise that while we present this as a concept, we know from past experience, that technically it will work and provide the data for further analysis. It's because these modules have been in use for quite some time in other industries, they have proven to be very cost effective for what they are able to provide.

The environmental impact is low. Once the main is exposed to install the pressure or flow meter, the assembly is housed within a Green, low profile electrical enclosure (similar to the electrical main covers used for underground Electrical Transmission terminations). Exciting times and change is coming.

4.0 ACKNOWLEDGEMENTS

Many thanks to our valued client base throughout Eastern Australia and in particular, Dirk Joel, Queanbeyan Council.

I would also acknowledge my colleague, David Cundell from Rad-tel Engineering.

The demonstration equipment for the WIOA presentation and guidance from Mr Graeme Lane, Lattitude Products.

Finally, and especially to the WIOA organisation, for their help and support of the water industry.

5.0 REFERENCES

<http://www.oleumtech.com>