

MANAGING CRITICAL ASSET CHANGES/OUTAGES THROUGH OPERATIONAL CHANGE CONTROL PLAN (OCCP) PROCESSES



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ABSTRACT

Yarra Valley Water's DN900 M340 Craigieburn Reservoir Outlet distribution main is one of the company's most critical water supply assets, forming the primary supply to the Hume Corridor and servicing parts of the northern suburbs of Melbourne. In excess of 10,000 customers would be directly impacted by any disruption to this main. This paper outlines the steps taken and the experience gained in executing a planned outage of this main.

Significant development along the Hume Corridor, and the construction of a new arterial road brought about the need to relocate a critical fitting, requiring the main to be shut down. This provided a fantastic development opportunity for an inexperienced operator.

This system has several, flexible modes of operation not previously used. Most significantly for this outage was the Craigieburn pump station reservoir by-pass mode, which provides the only alternate supply to this area, should the reservoir outlet main be unavailable. This operating mode is highly dependent on the reliability and redundancy of the distribution network, which forms the 'backbone' for the alternate operating mode.

This alternate operation required extensive field checking and trialling to ensure our customer service levels could be maintained during this extended period. Coordination of resources from Yarra Valley Water (YVW), Lend Lease (YVW's Maintenance Contractor) and sub-contractors was required during both the trial and actual shutdowns.

Following weeks of planning and trialling the shutdown went ahead in February 2012. Through the rigorous use of YVW's OCCP process, a shutdown with the potential to disrupt supply to thousands of customers was executed seamlessly, resulting in no customer complaints or system issues within the Hume Corridor.

1.0 INTRODUCTION

Situated in Melbourne's outer north, Craigieburn and its surrounding areas within Hume City Councils Aitken Ward, is one of Melbourne's fastest growing communities. According to Hume City Council forecasting data, residential development peaked in 2010 with close to 1000 new developments within Craigieburn, contributing to an overall figure of well over 10,000 total lots. On top of this, Hume expects Craigieburn's population to increase by 3.33% per annum until 2036. In the same period, Mickleham-Kalkallo, an area that includes the rapidly expanding Mt Ridley, is expected to increase by 13.56% per annum.

As a result of the forecast growth in the area, several major infrastructure projects are either imminent or underway. One of these projects is the Aitken Boulevard construction, which involves a new arterial road from Roxburgh Park to Mt Ridley, running through Craigieburn. Along its route, Aitken Boulevard will cross several Yarra Valley Water assets, including the DN900 M340 Craigieburn reservoir outlet main. While the crossing of the main itself was not an issue, the location of an existing air valve was, as it turned out to be within a future lane of the road.

Consequently, the M340 main needed to be shutdown to remove the air valve assembly and make the main 'good'. However, this particular section of the M340 had never been shut down, and the procedure relied on modes of operation that had never been utilised before. This paper will outline the steps taken to execute the shut-off, including the use of YVW's Operational Change Control Procedure (OCCP) process, and how it provided an excellent development opportunity for an inexperienced operator.

2.0 DISCUSSION

2.1 Craigieburn Water Superzone

Yarra Valley Water's (YVW) Craigieburn service reservoir (WRS062) has, historically, been supplied from Melbourne Water's (MW) Somerton reservoir via Craigieburn No. 1 pump station (WPS051), with the M340 - a common inlet/outlet main. The reservoir itself services approximately 10,000 customers directly, making the M340 main and WPS051 the most critical assets in YVW's system. Indirectly, the reservoir also supplies Mt Ridley, Beveridge and Wallan, via a series of pump stations and storage reservoirs. In 2010, YVW commissioned Yuroke pump station, which would draw water from MW's Yuroke reservoir and pump to Craigieburn. However, due to a hydraulic choke between MW's Greenvale pump station and Yuroke reservoir, the station was unable to be utilised until January 2012 after a new link main was built between Yuroke and Greenvale. Yuroke pump station then became the primary feed to Craigieburn reservoir, with WPS051 acting as a back-up to Yuroke. Thus, the M340 became a singular outlet main, rather than a common inlet/outlet main. A schematic of the Craigieburn to Wallan system is provided in Figure 2.

In the event of an outage of the M340, alternate supplies in place relied on the arrangement shown in Figure 1. To the north, supply relied on a DN300 main in Hanson Rd that looped around through Medway Rd and Cimberwood Dr to link into a DN300 in Craigieburn Rd West, which then linked with a DN300 in Bridgewater Rd, the main link road between Craigieburn and Roxburgh Park. To the south, a DN225 main that tees off of the DN450 WPS051 delivery main provides supply to the Roxburgh Park area and, after a journey through the reticulation area, links to a DN375 main that heads north and connects to the DN300 in Bridgewater Rd at a tee with the M340. However, to isolate the M340 requires isolating these off-takes, meaning that the DN375 heading south is reliant on the DN300 to the north and the DN225 to the south.

Prior to the shut down going ahead, a DN375 cross connection from the M340 was to be constructed, shown dashed in Figure 1. This was to combat the head losses that would be encountered in the existing alternate supply arrangements. This cross-connection was identified in the OCCP as a hold point prior to the shut down even beginning.

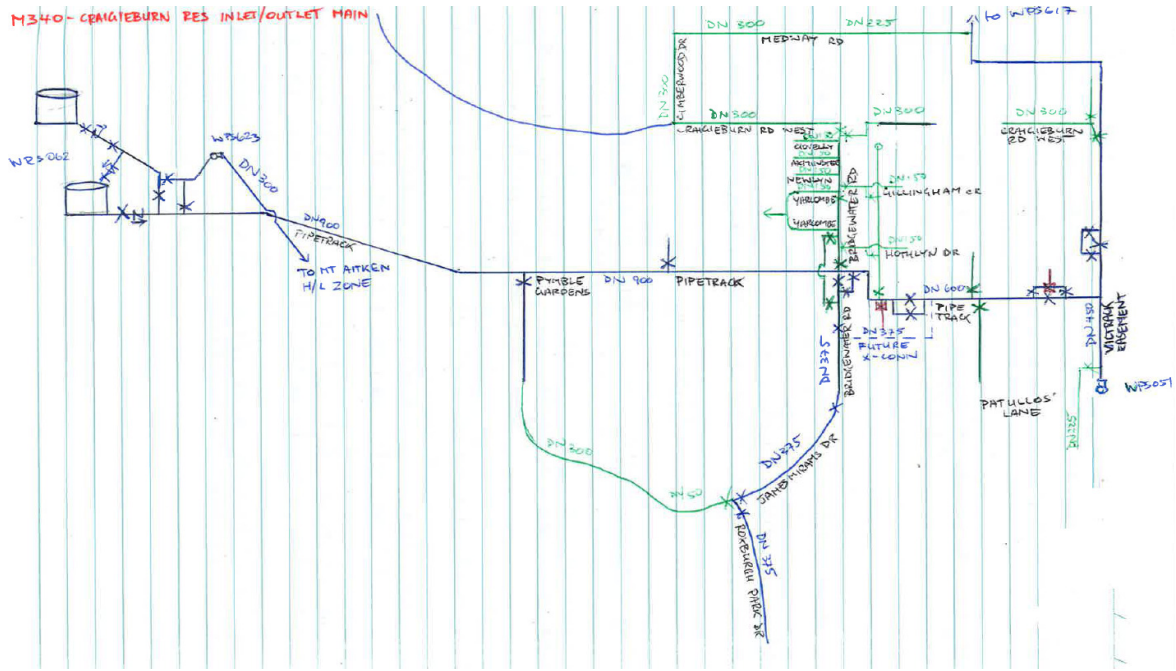


Figure 1: M340 and its alternative supplies through Craigieburn

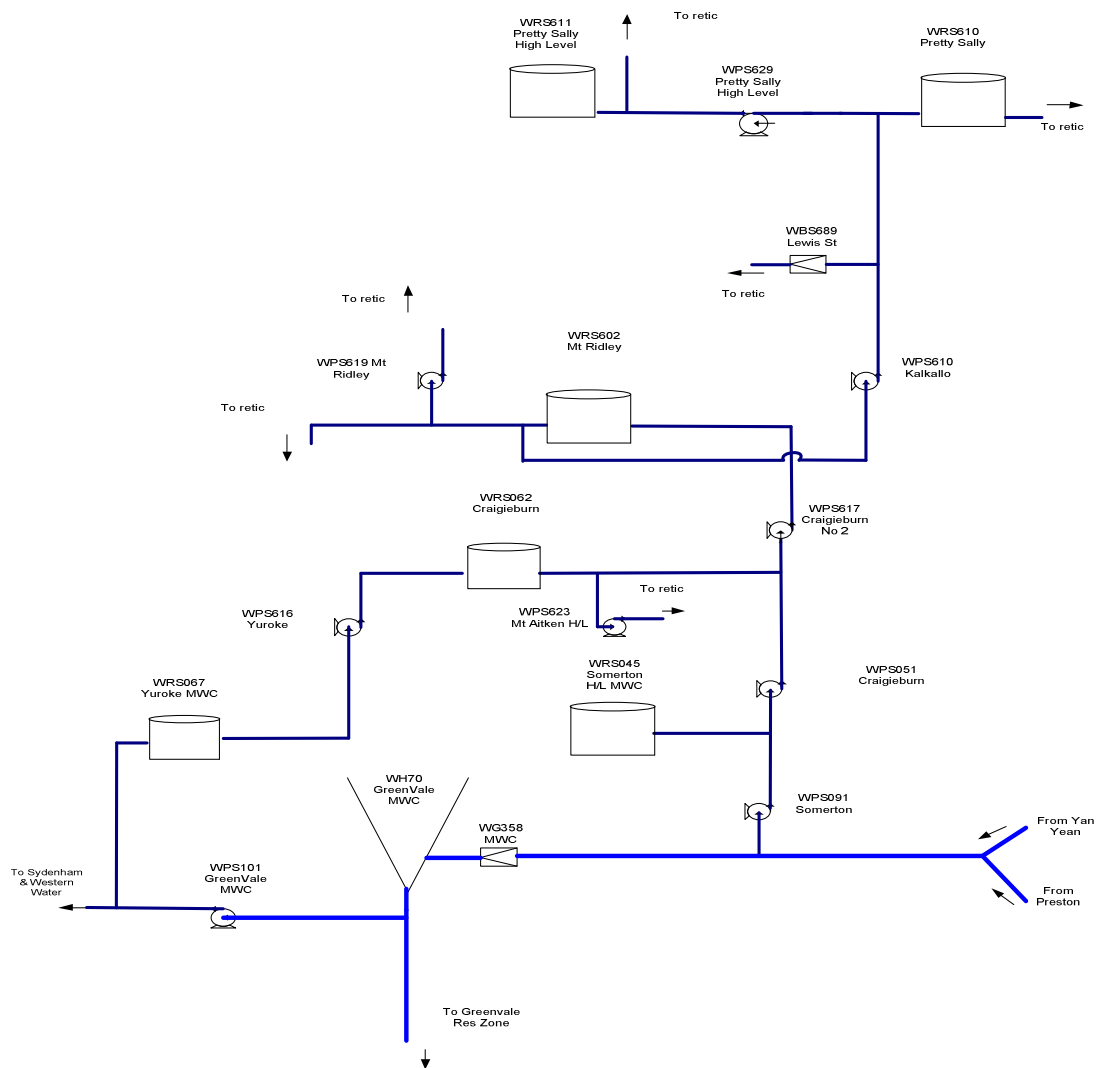


Figure 2: Craigieburn-Wallan system overview

2.2 Technician development

Despite the risks inherent in the shutdown, it was decided that there was a development opportunity for an inexperienced (or junior) operator. As such, the shutdown was assigned to one of the two operators who had been in Water Operations for less than one year. With the assistance of a senior operations technician, the junior operator was instructed to draft an OCCP (see below), organise the required resources and perform system checks. The assistance of the senior operator was limited to reviewing the OCCP and fielding questions from the operator, while the junior operator arranged everything associated with the shut down and took a supervisory role during the actual works. This had the benefits of familiarising the junior operator with an important area within YVW's business boundaries and exposing them to a large-scale, critical asset outage.

2.3 Operational Change Control Procedure (OCCP)

Operational Change Control Procedures, or OCCP's, are used for all YVW planned water asset outages of mains greater than 300mm in diameter, pressure reducing valve (PRV) stations, pump stations and service reservoirs/tanks. Utilised in conjunction with hydraulic isolation applications and permits, they provide Water Operations with greater control on the isolation of key assets. The OCCP outlines all the key information for shutting down an asset, including:

- Who will perform the shutdown
- Who is responsible for preparing/reviewing the procedure
- A summary of all hold points
- Expected impact (if any) of the shutdown on other key assets
- Alternative supplies, and their minimum required service levels
- Contingency actions in the event of failure
- A step-by-step shutdown process
- And, upon completion, a list of any issues that were encountered during the shutdown.

OCCP's are saved and, with each subsequent shutdown, updated to reflect operational changes in the system and the issues encountered previously.

The application to shut down the M340 main was made to Water Operations in December, 2011. The technician assigned to the shutdown immediately set about writing the OCCP. Due to the criticality of the main, as the sole outlet from Craigeburn reservoir, it was agreed with the applicant early on that until Water Ops was completely satisfied with the procedure, the shutdown would not go ahead.

A deficiency had previously been identified with the alternative supply to the distribution zone. The shutdown became conditional on this issue being rectified, which was captured as a hold point in the OCCP. As part of the system familiarisation, the responsible technician identified over 100 valves that made up the 'back-bone' of the alternate supply. Confirmation of the status of these valves was also identified as a hold point within the OCCP. The field investigations found that of the 104 valves, 18 were inoperable (either buried, missing or seized) and 9 divide valves were found shut.

A major component of the OCCP was the alternative supply provided by Craigeburn No.1 pump station.

YVW's Operations Reference Manual (ORM) for the station claimed that there was a reservoir by-pass mode programmed into the PLC, which would call the smaller, VSD pumps to run to maintain a set-point equivalent to the reservoirs TWL. However, a trial of this mode of operation found that the code simply called the pumps to run at their maximum speed, similar to a reservoir fill, which was inappropriate in the closed-head situation of the shutdown. In addition, while performing the trial, it was found that the delivery pressure instrumentation at the pump station was obstructed and providing incorrect data. Fortunately, the station has a pressure sustaining valve on a bypass, which has a pressure gauge tapped to the station's delivery main, providing operators with the relevant pressure information.

2.4 Asset Isolation

Before the live isolation could be performed, the OCCP was tested through a trial shutdown. This gives operators the chance to confirm that the procedure is correct and effective, and confirms the operability of valves in the shutdown, as well as presenting an opportunity to exercise the valves. When performing the trial shut down, it was found that several of the valves that had seen little-to-no use for quite a number of years were failing to seal. When two of the larger (i.e. greater than DN300) off-take valves were shut, a significant drop in pressure was noticed. This was caused by the new DN375 cross-connection, which had been constructed to allow these works to go ahead, had been left shut by the contractors who had built it. The trial shut down meant that the new cross connection was available for the shutdown proper, while all the valves had been exercised and sealed much better.

When performing the shutdown proper, two customer service officers (CSO's) from Yarra Valley Water's civil contractor Lend Lease were present, along with an electrical contractor and two civil sub-contractors, all under the supervision of a Yarra Valley Water operations technician were required to perform the shutdown. The civil sub-contractors were positioned on hydrants within the distribution zone with pressure gauges, with the task of monitoring the pressure as the valves were shut. The two CSO's were assigned to the physical shutting of the valves, while the electrician altered the settings on the VSD's for the pumps as required. The YVW operator supervised from the pump station through constant mobile phone contact with the others.

The shutdown commenced after 9:00am and the main was isolated by 10:30. Dewatering commenced shortly after. It was determined that the council drain that the scour was discharged to was obstructed, resulting in water flooding a portion of a major thoroughfare between Craigieburn and Roxburgh Park. After employees of the Hume City Council attended and notified their civil works department of the obstruction, signage was put in place to make motorists aware of the potential hazard.

At approximately 12:30pm, the main was sufficiently dewatered for the required welding to take place. By 1:00pm, the main was being recharged. At 4:30pm, after recharging the main and pushing the water that had been held in the main during the shutdown into tank 2 at the reservoir site, the off-takes were reopened. By 5:00pm, all the shut valves had been reopened and Craigieburn No. 1 pump station had been returned to normal operation and the job was complete. During the mains outage, there had been two calls of low pressure, which occurred during the recharge (the main had to be recharged from the nearby reticulation mains) that were caused by over-zealous contractors, and several calls were received regarding the water from the scour over the road, which was an unforeseeable consequence of inadequate maintenance on the behalf of another authority.

3.0 CONCLUSION

The isolation of the Craigieburn Reservoir outlet main began as a daunting, intimidating task for an operator with only one year in the position. However, with thorough planning and strict adherence to YVW's OCCP process, sufficient checks and balances were in place to ensure that the potentially disastrous consequences of system failures were avoided.

Despite the few calls that were received, the shutdown was executed with no serious interruption of supply to any customers. The OCCP process allowed YVW's operations team to fully document what was required and, in doing so, highlighted what needed to be confirmed prior to the shutdown taking place. The reservoir by-pass mode at the pump station and the extensive alternative supply checking were both highlighted as part of the process, and the by-pass mode was found to be inadequate, while the alternative supply would have most likely failed had the valves not been checked prior, due to the amount of valves that were found shut. Three months of planning and constant checking and re-checking of the procedure culminated in a well executed shut down, one the people of Craigieburn never knew had been performed.

4.0 ACKNOWLEDGEMENTS

Many thanks to all in Water Operations, but especially Domenic Ziino for knowing the answers before I asked the question, and Kristen Knight for being the calm, reassuring voice on the other end of the phone during the shutdown.