

# TOOWOOMBA WATER SUPPLY NETWORK WESTERN TRUNK MAIN REPAIRS AND CHALLENGES



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## ABSTRACT

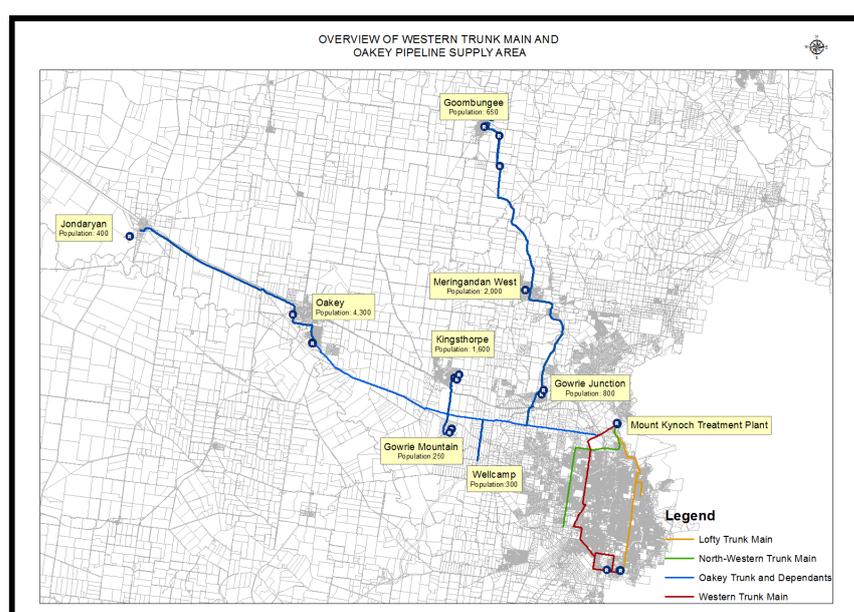
The Western Trunk Water Main (WTM) is one of the critical water mains in the Toowoomba Water Supply Network. The WTM delivers treated water from the Mount Kynoch Water Treatment Plant (KWTP) to the western part of Toowoomba City, to a number of outlying western townships and areas including the Brisbane West (Wellcamp) Airport via the Toowoomba - Oakey pipeline. The WTM operates at a high pressure (up to 2,000 kPa) and was originally designed to distribute water to the western suburbs of Toowoomba.

The WTM comprises mainly DN675 prestressed concrete, rubber ring jointed pipe. Constructed and commissioned during 1969, it has been in continuous service for over 45 years. Most sections of the WTM are located in easements within private properties, however some sections are located in road reserves. The WTM crosses Gowrie Creek via an underground, concrete encased pipeline crossing.

This paper discusses the challenges faced during the repairs of an isolation and scour valve combination at the Gowrie Creek crossing, and how TRC successfully managed to overcome those challenges, by incorporating stakeholder participation to plan and stage the project.

## 1.0 INTRODUCTION

Toowoomba Regional Council (TRC) owns and operates three dams namely Cooby, Perseverance and Cressbrook for Toowoomba's primary water supply. Raw water is delivered to the Mount Kynoch Water Treatment plant for treatment via raw trunk water mains. Treated water is distributed into network through a trunk water main network comprising the Western Trunk Main, North Western Trunk Main, Lofty Trunk Main and Harlaxton Trunk Main. In addition, to that TRC operates several basalt aquifer bores for water supply which directly feed chlorinated water into the reticulation system.



**Figure 1:** *Extent of Water Supply from the Western Trunk Main*

Western Trunk Water Main (WTM) is one of the critical water mains in the Toowoomba water supply network. The WTM delivers treated water from the Mount Kynoch Water Treatment Plant (KWTP) to the western part of Toowoomba City and to outlying western townships and areas including Oakey, Kingsthorpe, Gowrie Mountain, Gowrie Junction, Meringandan, Goombungee, Toowoomba Enterprise Hub – Charlton and the Brisbane West (Wellcamp) Airport via the Toowoomba - Oakey pipeline.

The WTM operates at a high pressure (up to 2,000 kPa) and was originally designed to distribute water to the western suburbs of Toowoomba. In 1998, the Toowoomba – Oakey pipeline was connected to the WTM to supply water to Oakey and western townships. Figure 1 provides the details.

## 2.0 DISCUSSION

### 2.1 The WTM - Its Criticality and Maintenance Issues

The WTM comprises mainly DN675 prestressed concrete, rubber ring jointed pipe. Constructed and commissioned during 1969, it has been in continuous service for over 45 years. The WTM crosses Gowrie Creek via an underground, concrete encased pipeline crossing.

In 1998, the DN375 Toowoomba - Oakey pipeline was constructed to supply water to Oakey and western townships from the WTM. Connection to the WTM was made using an existing DN150 valved offtake (to Hermitage Road). No additional isolation valves were installed in the WTM at that time.

During Toowoomba's January 2011 floods, TRC lost one of its major trunk water mains, the DN900 North Western Trunk Main (NWTM), at the Gowrie Creek pipe bridge crossing. Also the WTM Gowrie Creek underground crossing on the western bank was badly eroded leaving an exposed pipeline. Fortunately the WTM was still in operational condition. Repair works were carried out as high-priority emergency works as this was the only feeder line for western part of Toowoomba city and the western townships. Nevertheless, as the NWTM was out of operation, the risk to continuity of water supply was very high at that time for the western parts of the Toowoomba water supply network, as all water was supplied through the WTM.

When constructed, a combined isolation valve and scour valve in a valve chamber was installed on the western bank of at the Gowrie Creek for operational and maintenance purposes. As a result of Gowrie Creek bank erosion over the years, the valve chamber was in the flow path of the creek. This contributed to the erosion of the western bank during the 2011 floods. The isolation valve and the associated steel fittings were badly corroded and there were some leaks due to corrosion and pitting. Figure 2 illustrates the condition of isolation valve installation at Gowrie Creek.



**Figure 2:** Condition of the Gowrie Creek WTM Valve Chamber and Pipework

Whilst replacement of the installation was required, due to other operational and maintenance issues at that time, an emergency repair was completed by welding a piece of steel over the leak. These repair works were completed within two days, with a reliable water supply maintained from available reservoir storages. However, the risk of failure was very high as the isolation valve, pipes and fittings were in very poor operational condition.

## **2.2 Planning for repairs of Gowrie Creek Valve**

For the isolation of the WTM for repairs/replacement, preliminary investigations and planning were carried out in the following areas. Associated risk profiles are listed.

### Maintenance Plans:

As constructed details of the WTM and the physical location of the isolation valve were studied carefully to determine the time frame for repairs. As there was no isolation valves between the Gowrie Creek valve installation and the Toowoomba – Oakey pipeline offtake, it was impossible to isolate the WTM without impacting the Toowoomba – Oakey pipeline.

Further, due to the uncertainty of the condition of the pipe under the Gowrie Creek crossing, it was difficult to estimate the time frame for repair works. Special pipes and fittings need to be designed, ordered and fabricated to match the existing prestressed concrete pipes in the ground. Therefore, it was very important to investigate alternative water supply options during repairs.

### Stakeholder Engagement for Alternative Water Supply Options:

Water Infrastructure Services organised stakeholder consultation mainly to collate information of water supply demand and alternative supply options available for the areas serviced by the WTM. Water Operations (Northern team) actively participated in these regular weekly meetings.

A shared spreadsheet was developed where stakeholders had access and could include relevant information. Information included details of townships connected to the WTM, available alternative water supply options including reservoir capacities, major customers and water supply demand. After analysing the information it was identified the critical townships, water demands with and without the WTM, how long the reliable water supply could be maintained without supply from the Toowoomba - Oakey pipeline via the WTM.

Initial investigations revealed that without the Toowoomba - Oakey pipeline via the WTM that Oakey Township was the most critical township, with only a 2-3 day storage capacity. This prompted the working group to look for additional water supply options for each township and investigate alternative supply options.

### Environmental Issues:

Repair works being done almost within Gowrie Creek and the associated risk of higher creek flows following storms, was identified as a major risk.

### Decision Making:

Having all the collected information in hand, a meeting was organised with upper-level management to provide a briefing on the situation and to present all available alternative options.

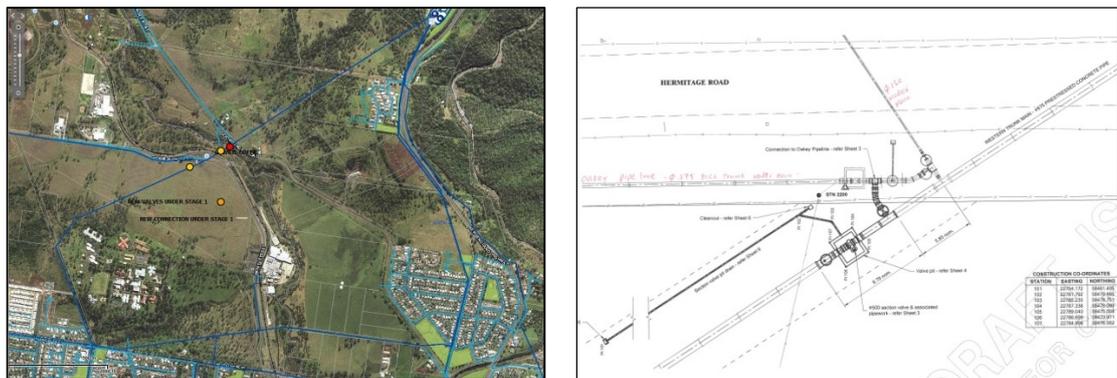
As a result a decision was taken to do the repairs in two stages as follows:

- Stage 1: Installation of two additional valves in WTM and a second feeder line to the Oakey Pipeline; and
- Stage 2: Gowrie Creek Repair Works.

### **Stage 1:**

Due to the strategic location of the Gowrie Creek isolation valve and the Toowoomba - Oakey pipeline offtake point, there was an opportunity to create an alternative water supply to the Toowoomba - Oakey pipeline by back feeding from the Toowoomba western water supply using the NWTM via the WTM. In doing so, a continuous water supply to western townships would be in place during isolation of the KWTP to Gowrie Creek section of the WTM. However, this required installation of two additional DN675 isolation valves in the WTM and DN450 pipework and an isolation valve for the second feeder line to the Toowoomba - Oakey pipeline (Refer Figure 3). The estimated cost was \$400,000 and the installation was estimated to be completed within 7 days.

It was necessary to investigate a temporary (7 day) alternative water supply option until the alternative permanent water supply connection was completed. To manage the 7 day period, two DN100 temporary supplies were planned from the reticulation system via a hydrant and DN100 reticulation connection, along with the available reservoir storages.



**Figure 3:** Stage 1 Works

### **Stage 2**

Due to many unknowns, the duration of Stage 2 works was difficult to estimate. An alternative water supply plan was to isolate the KWTP to Gowrie Creek section of the WTM using the newly installed valves under Stage 1, and to back feed the water supply using the installed DN450 connections. It was also necessary to organise an alternative water supply to Council's Wetalla Water Reclamation Facility, as the water service to the facility was in the section of the WTM to be isolated. The estimated cost of the Stage 2 project was \$190,000.

Further, for both options it was decided to do a water supply trial prior to isolating the water supply for repair works.

## **2.3 Execution of Works – Stage 1: Water Supply Trial, Issues and Construction**

Usual regular stakeholder meetings were organised and alternative options discussed prior to Stage 1 works commencing. Also management meetings were held to brief on the status of the works. TRC Customer Service Centre was notified about low pressures in the system. System pressure monitoring points were setup in strategic locations during the water supply trial as an early warning mechanism.

The water supply trial was organised on a specific date and time, with specific tasks assigned to operations and maintenance staff. Unfortunately, once the system was isolated for trial, there were customer complaints after 30-45 minutes. As a result, the water supply had to be restored and the trial was unsuccessful.

The reasons for the failure of the trial were investigated and identified that there were gaps in communication links as well as failure to perform some of the assigned tasks in time. More specific instructions were issued to operations and maintenance staff and a second successful trial was undertaken. The trial continued for 7 days to ensure all water supply requirements are adequate and reliable. Reservoir monitoring was also in place.

Once the water supply trial was completed successfully, construction was planned for completion within 7 days. A media release was organised advising of the works and possible low pressure supply in the system. Two work sites and construction teams were established, each with parallel tasks and activities. All trade personnel in different work groups (including carpenters and welders) were informed about the commencement dates and work commenced as planned. All construction works went as planned and there were no issues with the alternate temporary water supply. Water supply was restored as planned and Stage 1 works were commissioned successfully.

## 2.4 Execution of Works - Stage 2: Water Supply Trial, Issues and Construction

The only alternative water supply that was required for Stage 2 works was for the Toowoomba Water Reclamation Facility, as the Old Goombungee Road connection was in the isolated section just upstream of the Gowrie Creek crossing. However, this was managed by organising a pressure-reduced temporary supply line strung across Gowrie Creek to the Old Goombungee Road reticulation main.

Similar to Stage 1, but having more confidence in the system, a water supply trial was commenced with all set procedures in place. The newly installed connection back feeding from the Toowoomba network via the NWTM was planned. Unfortunately the trial had to be immediately abandoned as TRC received multiple customer complaints about poor or no water supply, mainly for Toowoomba western customers. As this was an alarming situation, immediate field investigations were commenced to find out the reasons for failures. These investigations revealed that there was a defective butterfly valve in closed position in the NWTM at Dwyer Street resulting in no flows through the NWTM. In addition, it was discovered that a critical Mount Kynoch reservoir isolation valve which connects to the NWTM was defective and need repair.

All efforts were made to replace these two valves in the NWTM. Draining of one of the Mount Kynoch reservoirs was required. Staff in Water and Waste Services Group worked as a team, which displayed a great team spirit. As a result, and within short period of time, both valves in operational condition and the NWTM were back in operation. This allowed the water supply trial for the Gowrie Creek valve repair works to progress successfully.



**Figure 4:** Construction Photos

The Gowrie Creek valve and pipework replacement works were completed with great success, with minimal wet weather delays.

### **3.0 CONCLUSION**

One of major challenges of the project was to maintain a reliable water supply to TRC customers, including major industries connected to the system. By detailed investigations and through stakeholder participation, it was possible to adopt best alternative water supply options throughout the project duration. TRC has achieved the best outcome as no customer complaints were received during the actual repair works. Further, the project has significantly improved the water supply network operational capability, with security of supply to the western townships.

Major lessons learnt through the successful completion of this project are the importance of stakeholder participation and communication throughout the project works – from planning through to construction and commissioning. This is considered to be the primary reason for the success of the project. Handling unexpected major events like the Dwyer Street valve and reservoir valve issues provide good lessons learnt.

Successful project completion was achieved by dedicated teams from different Council departments with the valuable support from management. The project provided an opportunity to recognise the strengths and weaknesses of staff. The team was recognised through the Water and Waste Services Group's annual Staff Recognition Awards.

### **4.0 ACKNOWLEDGEMENTS**

I take this opportunity to thank the Toowoomba Regional Council Water and Waste Services Group as a whole for their contribution towards this project. More specifically acknowledgement is given to General Manager, Mr Kevin Flanagan for his ongoing support throughout the project, Manager Water Project Services, Mr Greg Dinsey, Manager Water Infrastructure Services, Mr Phil McEwan and Manager Water Operations, Mr Alan Kleinschmidt for their valuable technical support, direction and advice to complete the works successfully. TRC Design Branch also performed admirably to complete design works on time.

The skills and dedication of the Trunk Main Foreman, Allan Gillam and the maintenance staff, and the assistance throughout the project of staff in Water Operations (Wayne Handford and staff), Water Infrastructure Services Active Asset team, Infrastructure Services Group, Construction and Maintenance personnel, and Trade Services personnel is recognised.

### **5.0 REFERENCES**

TRC GIS System

Western Trunk Main Pipeline Design and As-constructed Details

Pentair Pipes and Fittings Catalogue