BLACKWATER WATER IMPROVEMENT PROJECT

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ABSTRACT

The Central Queensland townships of Blackwater and Bluff, 200 kms west of Rockhampton, have experienced periodic poor water quality for a number of years, primarily due to high levels of manganese in the source water. This has progressively led to a loss of customer confidence, public health concerns and a disenchanted community stigmatised by what was believed to be a potentially unsafe water supply.

After a number of partially successful attempts to address these issues, The *Central Highlands Regional Council* sought independent expert advice and invested in much needed upgrades to the Blackwater WTP and the use of "ice pigging", to thoroughly clean the water reticulation mains of both townships.

A dedicated Project Manager and specialist Communications Manager were appointed to manage the water improvement project, and to re-engage the community and re-establish confidence in the improved water supply. This project was successfully implemented across 2015 and 2016, and demonstrates the vital role of dedicated project management, backed with sustained communications to rebuild community confidence.

1.0 INTRODUCTION

The townships of Blackwater and Bluff had been experiencing significant water quality issues for a number of years. Both towns are situated within the *Central Highlands Regional Council* area, with Blackwater located about 200 kms west of Rockhampton and 80 kms east of Emerald in Central Queensland, and Bluff located 20 kms east of Blackwater on the Capricorn Highway.

Blackwater is a mining town with a current population of 5,500 - 6,000, post mining boom. At its peak, Blackwater was thought to have a population in the order of 13,000 people. Bluff is a small railway based town with a stable population of about 380 people.

The water quality issues appeared a number of years ago as dirty, 'black', odorous water, attributed largely to organics and manganese which had accumulated in the source water and in raw water storage dams that feed the Blackwater water treatment system. Blackwater sources its water from Sunwater's Bedford Weir on the Mackenzie River, and is delivered through a 25 km long pipeline to Blackwater, through three turkeys nest dams.

The water quality problem steadily escalated into a community wide concern, despite Council's efforts to resolve the problems. This paper demonstrates the vital role consultation and communication with the community plays, coupled with a sound technical solution, in resolving a serious problem with something as important as a community's water supply.

2.0 BACKGROUND

Dissolved, organically bound manganese started to become a problem in the water supply a number of years ago, and proved very difficult to remove by conventional water treatment processes alone.

Residents increasingly complained of sporadic dirty or discoloured water and expressed their concerns about the 'health' of the water. Council 'mapped' the locations of the complaints and developed a more rigorous testing regime across the Blackwater and Bluff reticulation networks, but there was no readily evident patterns of occurrences that could identify sources of the problem – registered incidents appeared randomly without any apparent consistency or reason.

The key issues and concerns for residents were:

- discolouration of water / unpalatable tastes and odours / stained washing;
- uncertainty around the quality of the water and the short and long term health impacts of using and ingesting the water;
- perceived inability of Council to resolve the issues;
- the level of communication between Council and residents.

In February 2013, Council held a public meeting in Blackwater to advise residents what it would be doing to improve the water quality in Blackwater and Bluff. The key commitments made by Council included:

- contact Sunwater to investigate whether the extraction point at Bedford Weir could be raised to access better quality water in the water column (not proceeded with due to cost);
- changing the flow direction from the water reservoirs to town – to minimise retention times in the network (implemented successfully);
- trialling granulated activated carbon (GAC) on top of a sand filter bed to adsorb tastes and odours and improve filtration (trialled unsuccessfully – carbon was lost through the backwash process);
- removing and replacing aged sand media in the filters (implemented successfully);
- improved notifications to customers (implemented successfully);
- increased reticulation flushing program (*implemented with some success*).

In January 2014, Council engaged water engineering consultants City Water Technology (CWT) as technical experts to assist with addressing the ongoing water quality issues relating to manganese. CWT made several key recommendations, including:

- increased monitoring for various parameters to better define the problem;
- destratification of the raw water dam at the WTP to increase dissolved oxygen in the water;
- improved removal of manganese through additional pre-treatment oxidation and manganese oxide coated media;
- removal of tastes and odours and potential algal toxins through powdered activated carbon dosing into a contact tank.

Further public meetings were convened by Council, and these meetings became increasingly volatile as the community's frustration escalated. Council engaged a contractor to clean out the two 10ML Blackwater treated water reservoirs, and to air-scour a number of critical water mains within the Blackwater township. Unfortunately, these attempts had little effect on rectifying the problem.

3.0 MULTI-FACETED APPROACH

As a result of further investigations and advice from CWT, Council decided to adopt a multi-faceted approach to resolving the manganese problem.

It was thought that, as well as the treatment plant not being equipped to remove the excessive manganese from the raw water, the reticulation system was in such poor condition that regular sloughing of the biofilm was also a source of the dirty water. Hence, to properly eliminate the problem, rectification and upgrade work needed to be undertaken at the WTP and within the reticulation system.

Council also saw the need to restore the relationship with a very disenchanted community and decided to take a holistic and comprehensive approach to addressing the Blackwater water problems, which involved:

- upgrading the Blackwater Water Treatment Plant (BWTP);
- scouring both reticulation systems;
- cleaning the reservoirs, including the raw water storage;
- employing a dedicated project manager to ensure a full-time focus on completing the rectification works;
- employing a dedicated communications manager to focus on consulting and communicating with the community to restore confidence in the water supply and in Council.

Council also applied for, and was granted, $360,000 subsidy from the State Government for the upgrade works, under the *Royalties for Regions* subsidy scheme.

3.1 Blackwater Water Treatment Plant Upgrade

The Blackwater Water Treatment Plant (BWTP) was constructed in the 1970's as a conventional water treatment plant. It was upgraded in the 1980's to a capacity of 12 ML/day, but was not equipped with any pre-treatment facilities that would remove manganese. Bluff receives treated water from the BWTP through a 20 km long pipeline from Blackwater.

CWT was engaged by Council to prepare a concept design for upgrade works for the BWTP and tender documentation to advertise for a *Design & Construct* contractor to undertake the works. The upgrade works included:

- construction of a ~500 kL concrete dosing / contact tank
- refurbishment of the six (6) filters and under-drains, including filter media replacement
- new and upgraded chemical dosing systems & associated works, including potassium permanganate / powdered activated carbon / polyacrylamide / Allclear 325 / sodium hypochlorite pre-filtration dosing
- plant automation upgrade, including PLC / SCADA-based automation of clarifier, filter & backwash systems, online manganese measurement, upgrade of plant control air system
- valve and instrumentation upgrade

Tenders closed in February 2015 and Monadelphous was awarded the contract in April 2015. As was to be expected from an aged brown-field operating plant in need of an upgrade, progress was slow and many problems were encountered and rectified during the contract.

3.2 Ice Pigging of Reticulation System

After an unsuccessful air scouring of mains within the Blackwater reticulation, Council staff recommended 'ice pigging'.

The process involves the injection of a thick ice slurry (made from a brine solution) into an isolated section of a main through a hydrant, and uses the mains pressure to force the ice through the main, extracting the 'ice pig' and the scoured material from a hydrant at the other end of the main. The waste material and the 'ice pig' are collected in a tanker and discharged into drying beds at sewerage treatment plant. The potable water preceding the ice pig is de-chlorinated and discharged to stormwater drainage. The main is then flushed and returned to service.

Suez Environnement has the licence for the technology in Australia, and was awarded the Blackwater contract in early May 2015. The ice pigging took 30 days to complete, commencing in late May. There were initial concerns about the high ambient and ground temperatures experienced in Blackwater, but any misgivings proved unfounded.

Suez established an ice-making plant, contained in two sea containers, on-site at the WTP – their only real requirements were access to a standard hose connection for water and sufficient space for their semi-trailer to access the plant. The plant was capable of producing 10 t of brine slurry per day. Their ice pigging plant consists of a semi-trailer mounted ice delivery tank with slurry pumping equipment, and a utility with analysis equipment mounted on the tray.

The benefits of ice pigging over conventional pigging are:

- no chemicals other than salt;
- nothing to get 'stuck' in the main – if the main clogs, the 'pig' is allowed to melt;
- uses minimal water – only minor flushing required;
- generally domestic connections are not required to be isolated;
- very portable / mobile operation – the semi and utility can be parked in a suburban street with minimal traffic management controls required;
- relatively quick – mains are usually isolated for no more than two hours;
- no high pressures in pipeline.

From a selection of mains, regular jar samples are taken from the effluent discharging from the outlet hydrant, as the ice pig proceeds through the main. The effluent from the sample jars is filtered, dried and weighed to determine an estimate of the material removed from the main. From some mains, it was determined that as much as 67 kg/km of sediment / biofilm was removed from the main.

Some interesting statistics relating to the ice-pigging project are below:

No of completed operations	126
Length of main cleaned	73 kms
Average distance cleaned per operation	580 m
Water used	~2,710 Kl
Estimated water saved compared to swabbing	~6,250 Kl *
Average disruption time per operation	< 2 hrs

* Estimated by Suez Env

3.3 De-sludging of Raw Water Dam

In order to remove as much manganese-laden silt as possible from the bottom of the raw water lagoon, Council purchased a small floating dredge, appropriately called a *Sludge Rat*.

The *Sludge Rat* took up residency at the BWTP raw water lagoon for a period of 3-4 months, and steadily removed the manganese-laden sludge from the base of the storage, depositing it in a pre-constructed settling pond with an overflow to another storage. After testing to determine that the supernatant was free from manganese, it was pumped back to the raw water lagoon. The dried sludge was removed to landfill.

4.0 COMMUNITY CONSULTATION

The Blackwater and Bluff communities made it very clear to Council that they were very disenchanted by the lack of progress in resolving the unacceptable dirty water problem. A Reference Group of very vocal residents had been formed to represent the community, and a residents' Facebook page had been established, which was constantly uncomplimentary towards Council. This culminated in a very volatile public meeting of 65 residents in December 2014, where Council gave commitments to resolve the problems, and to communicate more openly and timely about what was to be done and how it was progressing. Council admitted that the situation was unacceptable and gave a commitment to finally resolve the issue.

The first stage of this commitment was the employment of a dedicated Project Manager and dedicated Communications Manager, whose roles were to expedite the project and develop communication strategies to re-engage the community. The following communication lines were established and commitments given by the project team, senior Council staff and Councillors:

- monthly public meetings were established (separate meetings were held in Blackwater and Bluff), and were attended by the project team, the Council's CEO, senior Council staff and Councillors; with detailed Minutes published;
- a project webpage was established, detailing all information about the project, including all water analysis results in their original format, and detailed public meeting Minutes;
- the Project Manager and Communications Manager committed to visit residents who wanted to discuss anything at all to do with the project, and take samples of dirty water for testing;
- an Issues Register was established and published, listing every issue raised by the general public in relation to the water problem – with a Council response, actions and status for each issue;
- regular media releases were prepared and published, and uploaded to the webpage, to keep the community informed;
- fact sheets were prepared and distributed (on occasion by letterbox drop) to inform the community about complex issues (such as elevated THMs), and also upcoming events, such as the ice-pigging;
- a liaison officer was engaged during the ice-pigging to ensure immediate responses to residents' concerns.

The success of the communication strategies was evident in the reduced attendances at public meetings as the project progressed.

December 2014	65 very annoyed residents
January 2015	45 annoyed residents
February	12 residents
March	5 residents
April	0 residents (2 turned up ½ hr late)
May	2 interested residents

and the fact that very few ongoing complaints were received about water quality. There were actually occasions when a former protagonist responded to a rare Facebook complaint, supporting Council and admonishing the complainant – such was the success of the communications exercise.

5.0 PUBLIC HEALTH ISSUES

Because of the prolonged duration of the discoloured water, the community became increasingly concerned about the potential effects that the dirty water would have on public health, especially families with babies and young children. Many families installed in-line filters in their internal plumbing, and it would seem that the majority of people in both townships stopped drinking the water – the sales of bottled water sky-rocketed for a prolonged period of time. There were also regular anecdotal reports from the community of increased cases of gastric and skin irritation problems, however no connection to the dirty water was found.

5.1 Extended Water Testing Regime

As a result, Council instigated a comprehensive and rigorous water testing regime in attempt to identify the source of the problem, and to provide some confidence to the community that the water was not a public health threat. Testing for manganese levels was conducted daily through the WTP, and this was done manually as there was very little automatic sampling and testing fitted to the plant. Testing for manganese was done daily at known 'hotspots' in the reticulation and rapid response flushing was done when elevated levels were detected. Standard water analysis sampling was done weekly and sent to *Queensland Health* laboratories for testing, as was full chemical and biological sampling on a monthly basis.

In an attempt to remove the excessive manganese levels prior to it entering the plant, chlorine was dosed into the untreated water as it entered the plant. While this was successful in removing manganese, it also raised Trihalomethane (THM) levels within both townships, and hence was discontinued thereafter. The chlorine dosing was re-introduced into the plant just prior to the filters with greater success.

5.2 Queensland Health Involvement

Council was regularly receiving advice from *Queensland Health* confirming the absence of any public health issues associated with the dirty water. Queensland Health staff were enormously helpful and supportive with developing an extended testing regime and ensuring that samples received high priority through their laboratories.

As a result of the community's disenchantment and distrust, a petition was signed by approximately 20 residents of Blackwater, petitioning Queensland Health's involvement in resolving ongoing perceived public health problems. This matter was dealt with most capably by the then recently appointed Regional Public Health Physician, who phoned each individual on the petition and spoke to them personally about their problems. The outcome was that there was little substance to the claims of significant public health issues.

6.0 CONCLUSION

The gauge of the success of this project is not only obvious in the quality of the water delivered since the WTP has been upgraded and the mains cleaned, but it is also apparent in the turn-around of the community's attitude, which was one of Council's main goals at the commencement of the project. It is also evident in the lessons learned by Council in being accountable to its community and delivering on its commitments. Council should also be acknowledged for its courage in employing an innovative new technology which has made a major contribution to the success of this project.

7.0 ACKNOWLEDGEMENTS

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