SURVIVING THE BREAKING OF THE DROUGHT

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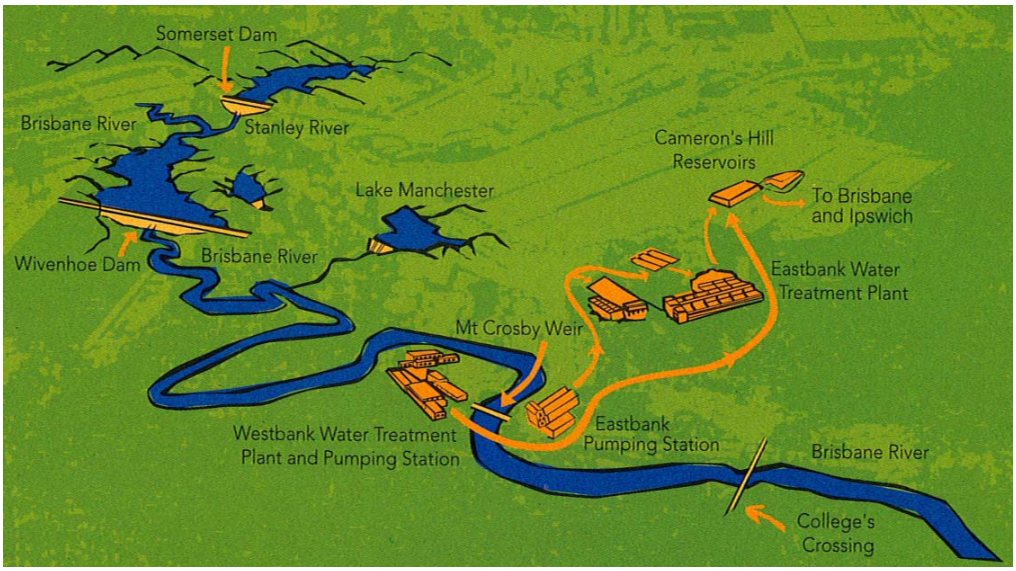
BACKGROUND

Mt Crosby Eastbank and Westbank Water Treatment Plants are conventional alum coagulation, sedimentation and rapid sand filtration plants with Westbank having an additional dissolved air flotation process. Eastbank has a maximum capacity of 700ML/day and Westbank has a maximum capacity of 250ML/day.

Both treatment plants source their water from the Brisbane River with Wivenhoe Dam being some 60 kilometres upstream of the treatment plant raw water intakes. Numerous creeks enter the Brisbane River between Wivenhoe Dam and Mt Crosby creating a variety of treatment challenges through changes in soluble manganese, taste, algae, turbidity, colour, alkalinity and conductivity.

During the drought from 2002 to 2007 the storage levels in the dams had reduced to <15%. On 19th November 2008, a rain depression dumped >200mm of rain over much of the mid-Brisbane River Catchment in approximately 4 hours, starting at 7:00pm. This rain event for Mt Crosby WTPs was the breaking of the drought and for the following 6 months, the start of the post-drought water treatment challenges.



1.0 INTRODUCTION

Mt Crosby Water Treatment Plants have experienced dirty (turbid) water events in the past but very rarely to the extreme levels experienced in November 2008 and never with such a rapid change in raw water conditions. There were very limited numbers of dirty water events during the drought so even the experienced staff were out of practice in handling such events and the new operators were inexperienced in such situations. The need for treatment of manganese had been infrequent and the elevated manganese events would come and go very quickly. Mt Crosby does not have facilities to treat manganese.

Elevated levels of taste and odour compounds had not been present in the past so again there were no treatment facilities at either plant to treat these compounds. Algal blooms in the Mt Crosby Weir pumping pool were rare and had never caused taste and odour complaints. Blue/Green algae has been present in the storages of Somerset and Wivenhoe Dams for many years but had not been seen in the river at Mt Crosby until December 2008 when Anabaena Circinalis was seen on the top side of the Mt Crosby Weir.

2.0 DISCUSSION

2.1 Dirty Water.

Mt Crosby Water Treatment Plants have had an operating integrated quality assurance system since the late 1990 which contains procedures and work instructions to cover many issues including 'Preparation for Dirty Water' and 'Dirty Water Treatment'. Unfortunately on 19th November 2008, the time between the rainfall and the dirty water arriving at the Mt Crosby Weir was very short (hours rather than the previous experience of days) which did not allow for the normal level of preparedness. Eastbank WTP had to be shutdown by 9am on the 20th due to dirty water in the Sedimentation basins. Westbank WTP was started while Eastbank was made ready to come back on-line. On 21st November 2008, the raw water turbidity reached 1540 NTU with 146 True Colour. The turbid water was treatable with high doses of liquid aluminium sulphate (alum) and sodium hydroxide (caustic soda). Both treatment plants were running at below normal flows to allow for optimal treatment results. The shortfall in production from Mt Crosby treatment plants was managed through operation of the South-East Queensland Water Grid by supplying the shortfall compared to consumer demand by increasing production from the north: North Pine WTP and south: Gold Coast Water Treatment Plants, largely Molendinar WTP.

One of the challenges during the worst of the event was the requirement for additional staff to operate under these demanding conditions. Normally, there are two shift Water Treatment Plant Operators working three shifts per day. Extra Operators were rostered on to help with the extra work load. Four of the six Relief Operators only had 2 to 3 months operating experience. The Relief Operators reduced the leg work required by the experienced Operators but were not capable of making decisions. Extra assistance came from technical support personnel who provided valuable assistance.

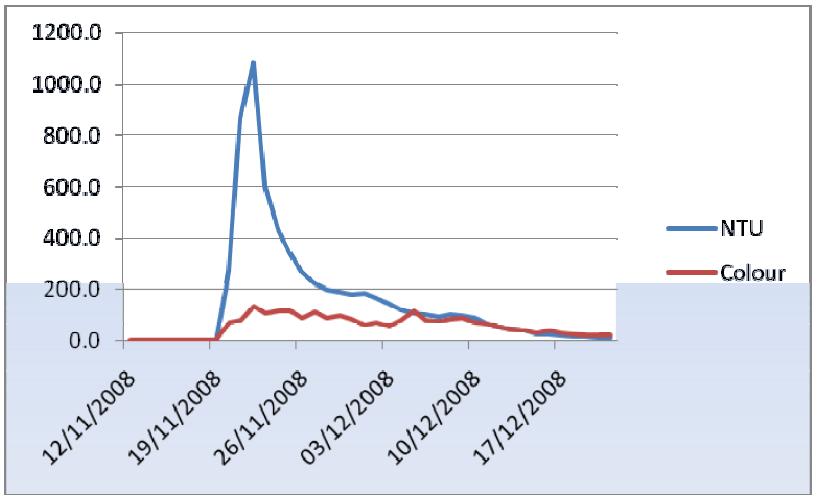


Figure 1: ***Brisbane River water quality***

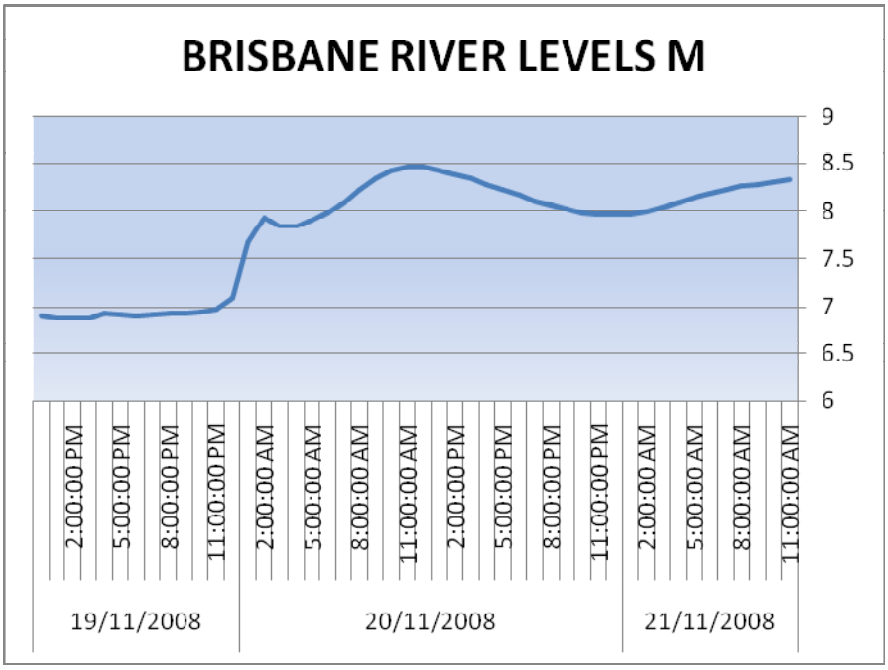


Figure 2: ***Brisbane River Manganese levels***

Along with the turbid water came elevated levels of soluble manganese. The target level of manganese is <0.02mg/L. To reduce the levels of manganese in the treated water, temporary dosing of potassium permanganate was set-up at the inlet to the sedimentation basins, at the outlet of the sedimentation basins and into the re-cycle water stream. Limited success was achieved because of low pH in the settled water. The most success was achieved with pH correction to ~7.5 with sodium hydroxide and oxidation with sodium hypochlorite. This was possible at the Westbank WTP after the necessary sodium hydroxide dose had reduced (for coagulation pH adjustment) to allow two dosing pumps to be used to dose sodium hydroxide into the settled water.

At Eastbank WTP, limited success was achieved by using the sodium hypochlorite with very limited pH correction because of the lack of dosing facility. Due to limitation of the temporary equipment, the sodium hypochlorite dosing was only possible on 6 of the 20 filters at Eastbank WTP so the flow through the now inert filters was biased to these 6 filters as much as possible to produce the best overall manganese result. Levels of the manganese in the raw water fluctuated up and down but peaked after the flow from Wivenhoe Dam was increased to flush the river of the elevated turbidity and colour. Permanent manganese treatment facilities for pre-filter sodium hypochlorite dosing and pre-filter sodium hydroxide dosing for both Eastbank and Westbank WTPs is planned to be installed and available before Christmas 2010. Post-coagulation potassium permanganate and sodium hydroxide dosing is also planned for the same time. This will provide manganese treatment for clean and dirty water conditions.

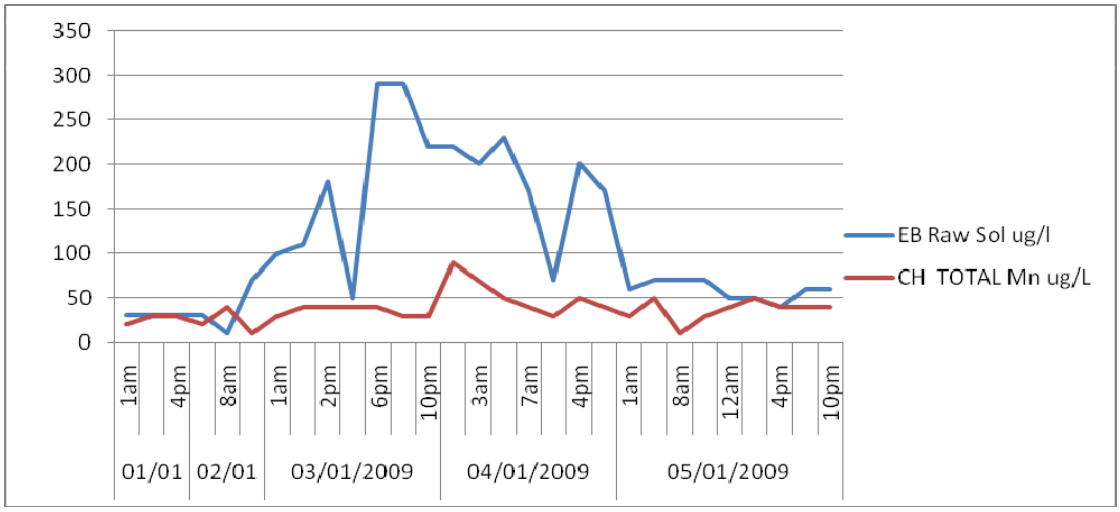


Figure 3: ***Eastbank Raw and Treated Water Manganese***

2.1 Taste and Odour

Since the start of the drought, there were a number of initiatives implemented to reduce the demand on the water stored in South-East Queensland Dams. A combination of public education and water restrictions drastically reduced the demand per capita of over 300L per day to 140L per day. This meant that the Mt Crosby Water Treatment Plants were not pumping more than 300 ML/day, on average, from the pumping pool above the Mt Crosby Weir. The pumping pool has a capacity of approximately 2000ML. On 23rd November 2008, the flow of water through the Southern Region Water Pipeline from the Gold Coast water supply system to Brisbane's water supply system just downstream of Mt Crosby WTPs commenced. The water draw from the Mt Crosby Weir reduced further.

Due to the issues with manganese during December, and to reduce customer complaints, the output from Mt Crosby WTPs was reduced further to a pumping rate of 225 ML/day for the period from 5th December 2008. The pumping pool at Mt Crosby was later found to have higher than normal nutrients from the recent floods and, with the hot weather an algal bloom and the formation of Geosmin (earthy taste) occurred. At Mt Crosby WTPs, a taste panel operates and they first detected traces of Geosmin above threshold on 24th December and samples were collected for testing. On 29th December an Incident Alert Notification was issued because the blue/green algae Anabaena Circinalis (6,500cells/ml) and Geosmin (48ng/L) were detected in the samples. (Mt Crosby does not have a process to treat taste compounds).

Flushing of the pumping pool was undertaken by increasing the release from Wivenhoe Dam but the hydraulic effect of an increased release takes several days to travel the 60 kilometres to the Mt Crosby Weir. By 4th January 2009, the Mt Crosby Weir was over-topping by 400 ML/day. By 8th January, the taste and odour from Geosmin had reduced to below taste threshold. As of 23rd January 2009, the taste and odour had cleared the distribution system.

2.2 Sludge Treatment

Mt Crosby Eastbank has three centrifuges that can process approximately 40 dry tonne of sludge per day but during a turbid water event the amount of sludge generated can be

many times the centrifuge capability.
Excess sludge is transferred to a storage facility one kilometre away. This facility has storage for 18ML of sludge. Since the sludge contained very high levels of manganese, it was not possible to re-process it at Eastbank WTP for de-watering while the treatment process was already being stretched to treat manganese in the raw water.

After further rain that created more excess sludge, the sludge storage capacity was reaching its limit. Once the sludge storage was exhausted, Eastbank WTP would have been forced to shutdown or at least reduce the treatment to match the settled sludge volume generated to the de-watering rate. Some excess sludge was transported to sludge drying lagoons at Westbank WTP and at 16ML of sludge stored, the manganese situation eased and the processing of the sludge re-commenced. While increasing the storage capacity for sludge is not an option, additional temporary and permanent dewatering capacity for contingency under similar conditions is being investigated.

3.0 CONCLUSION

Extensive planning and attention went into drought risk assessments and contingency planning for possible drought treatment issues previously not experienced. None of these eventuated, but once the drought broke normal conditions have yet to return. Indeed, both in breaking of the drought and post-drought conditions, many raw water quality conditions never before seen at Mt Crosby Water Treatment Plants have been experienced.

The Incident Management Team conducted a full investigation and identified 20 findings and made 18 improvement recommendations. A number of the recommendations have been adopted and several have been implemented to date with more to be installed before the end of this year.