WTP OPERATORS RESPONSE TO HIGH IRON LEVELS IN WASHWATER HANDLING SYSTEM

Paper Presented by:

Wes Trotter

Author:

Wesley Trotter, *Water Industry Operator,*

ACTEW Water

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

WTP OPERATORS RESPONSE TO HIGH IRON LEVELS IN WASHWATER HANDLING SYSTEM

Wesley Trotter, *Water Industry Operator*, ACTEW Water

ABSTRACT

The Mount Stromlo Water Treatment Plant (SWTP) abstracts water from Bendora Dam via gravity, Cotter Dam via Cotter Pump Station and the Murrumbidgee River via Murrumbidgee and Cotter Pump Stations. Since the 2003 bushfires the catchment has been very prone to erosion during wet weather events. The dirt and sediment washing into the dams are high in Iron and Manganese.

Dissolved Air Flotation and Filtration has been a very effective treatment process for the low quality raw water from the catchment during wet weather events. However the float from the filters and waste backwash water is a concentrated mix of turbidity, metals and anything else that has made its way from the catchment. This mix continues to the waste water handling system.

The SWTP Washwater Handling System comprises of two sludge thickeners and two dewatering centrifuges. The thickeners and centrifuges have proven to be very good places to concentrate Iron and Manganese. This paper discusses how the operators of SWTP coped with a wet weather event in early March 2012. This event caused massive turbidity, Manganese and Iron issues within the wash water handling system.

1.0 INTRODUCTION

The original Mount Stromlo Water Treatment Plant (SWTP) was commissioned in June 1967. It contained facilities for the chlorination, fluoridation and pH correction for all water drawn from the Cotter River catchment.

The 2003 bushfire damage to the Cotter River catchment meant that the existing water treatment plant was not adequate to treat the potentially turbid water drawn from the dams in the burnt-out catchment. A substantial upgrade of the water treatment plant was undertaken to ensure the quality of Canberra's drinking water was protected during the Cotter River catchment's lengthy recovery. The new, more sophisticated SWTP was commissioned in November 2004.

Many of the old SWTP components, such as the chlorination and fluoridation systems, were incorporated into the new water treatment plant.

SWTP provides for two methods of treatment:

- Direct Filtration: used when the raw water quality is good
- Dissolved Air Flotation and Filtration: used together when the raw water quality is relatively poor.

The availability of the two different treatment processes allows for more efficient water treatment. The plant is typically run in direct filtration mode, which is the more cost effective of the two processes. The dissolved air flotation system is used to ensure the quality of treated water continues to meet stringent drinking water quality criteria even when the raw water quality deteriorates.

Figure 1: ***Mount Stromlo Water Treatment Plant***

2.0 DISCUSSION

The SWTP is designed to treat 250 ML/day. The plant is manned 24 hours per day on a single operator 12 hour shift rotation. HACCP Certification for the water supply system was achieved in 2006.

Normally, water is sourced by gravity via pipeline from Bendora Dam, or pumped from Cotter Dam. Source water is generally good quality with low turbidity (1-2 NTU), low DOC (<2 mg/L) and colour (5-10 Pt Co), but low alkalinity (10-20 mg/L). Raw water temperatures vary seasonally from 7^{o}C to 25^{o}C.

The filtration plant consists of 10 multimedia filters with filter coal and sand filter media and garnet support media. Normal operation is direct filtration mode, however dissolved air flotation and filtration (DAF) is available.

Pre-treatment chemical dosing includes pre-lime for alkalinity, carbon dioxide for pH control, aluminium sulphate and poly-aluminium chloride for coagulation, and polymer as filter aid. Potassium permanganate can also be dosed for dissolved manganese removal. Post-treatment chemical dosing includes chlorine gas disinfection, fluoride dosing and post-lime for final pH control.

Wash water and sludge handling consists of a waste backwash water tank that is pumped to the sludge thickeners (flow paced at < 5% of plant flow). As the washwater enters the thickener it is dosed with LT27AG polymer typically at 0.35 mg\L for flocculation. The solids are settled in the thickener and then drawn off to a centrifuge feed tank to be centrifuged. Centrate from the centrifuges is returned to the waste backwash water tank to be processed again unless it they contains high levels of metal or turbidity. If the centrate is high in metals or turbidity it is directed out of the process to recovery tanks and then pumped to drying beds.

The supernatant from the thickener is returned to the head of the plant. The supernatant return turbidity target is < 10 NTU. If the supernatant is greater than this it is also diverted to the recovery tanks and then pumped to drying beds. Normally all waste backwash water is recycled and there is no discharge from site.

Figure 2: ***Sludge Thickener***

The source water to Stromlo WTP is generally low in turbidity and metals, but higher in organics. In March 2012, following major inflows into Bendora Dam, the raw water turbidity increased from 1 NTU to 50 NTU for a period of four weeks. The majority of the turbidity was due to high levels of total Iron and Manganese. These metals were easily removed prior to filtration through coagulation, flocculation and dissolved air flotation.

With the increased loading on the filters and the operation of the dissolved air flotation process came an increased loading on the wash water system. As there was increased backwashing and DAF floats the thickeners were working harder and harder. The thickeners started to carry over and supernatant turbidity rose to over 80 NTU. The carryover was effectively returning concentrated Iron and Manganese to the head of the plant, with risk of passing through the filters if it became soluble in the sludge handling processes.

The centrate and supernatant could not be diverted out of the process to the recovery tanks and drying beds as they were already running above the design capacities. With this high turbidity the sludge thickeners struggled to remove Iron and Manganese from the waste backwash water. The thickeners and centrifuges had proven to be very good places to concentrate Iron and Manganese. Manganese returning to the head of the plant in the supernatant was 0.181 mg\L total and 0.049 mg/L soluble. Iron returning to the head of the plant in the supernatant was 0.78 mg/L total.

2.1 Jar Testing

The WTP operators started completing numerous jar tests on the waste wash water in an effort to improve thickener supernatant quality using chemicals available on-site.

The chemicals used included LT27 Polymer, Aluminium Sulphate (Alum) and Poly-aluminium Chloride.

After numerous tests the operators decided on an Alum dose of 30 mg/L and Polymer dose of 0.40 mg/L. The Alum was working as a coagulant for the suspended metals which the polymer simply could not capture.

2.2 Chemical Dosing

The sludge thickeners are equipped with Polymer dosing so this was set at the appropriate rate. Alum was initially dosed in the washwater tank with mixed results. It appeared the flocs were forming in the wash water tank but were being "smashed" on the way to the thickener.

The operators then found a 20 L carboy, made a "calibrated hole" in the bottom of the carboy, and placed it above the inner mixing well on the thickener as a trial. The results were quite fast and supernatant turbidity dropped below 28 NTU. The operators filled the carboy every 2 hours (day and night) until a dosing skid could be put in place.

When the dosing skid arrived it was tapped into a carrier water supply and to the dosing point. The pump was run locally and adjusted according to ongoing jar tests. Supernatant turbidity was managed around 20 NTU until the raw water quality improved and operation returned to normal.

Figure 3: ***Alum dosing skid***

3.0 CONCLUSION

The operators of Stromlo Water Treatment Plant learned a lot from the very difficult circumstances they faced. Alum coagulation to the sludge thickeners was the key to managing high Iron levels that were concentrating in the waste wash water handling process following a wet weather event.

The Alum dosing skid is now a very important piece of equipment used at both Stromlo Water Treatment Plant and Googong Water Treatment Plant on a regular basis.

4.0 ACKNOWLEDGEMENTS

Thanks to the ACTEW Water Operators and Fitters for their hard work in difficult conditions. Thanks to Cameron Patrick for his guidance and expertise.

5.0 REFERENCES

ACTEW Water, Water and sewage systems. Mt Stromlo Water Treatment Plant
http://www.actew.com.au