

UNITYWATER INFLUENT QUARANTINE INNOVATION AT SEWAGE TREATMENT PLANT



Paper Presented by:

James Castle

Author:

James Castle, *Treatment Plants Operations Manager,*

Unitywater



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ABSTRACT

Unitywater's Burpengary East Sewage Treatment Plant, with a process capacity of 50,000 equivalent persons, services a relatively notorious industrial estate which demands a high level of monitoring and regulation by our Trade Waste Team. It was not completely out of the usual for the Burpengary East STP process to cop the occasional hit from substances in the influent that temporarily affected process performance. Effects would quickly be overcome and would not generally manifest into an environmental compliance issue.

In 2013 the plant received an influent trade waste shock which became apparent to operators when significant foaming, uncharacteristic of normal operations, was observed at the inlet works.

This paper presents an innovative solution that has been adopted at this site to reduce potential risk of process performance being adversely affected as a result of variability in influent quality.

1.0 INTRODUCTION

Within one hour of foam being observed during the 2013 event, a spike in bioreactor aeration demand resulted in all blowers being called to run at 100%. This lasted for a number of hours, then air demand began to trend down.

The team saw this as being a good indication that the process had been able to take the hit and cope with the shock. Thinking that the event had been successfully managed and the process would continue to return to normal operations, the site was left unattended at the close of business for the day as per standard arrangements.

During peak flow the following morning the operators became very concerned that there seemed to be an uncharacteristically low demand for air in the reactors and alerted the treatment plants management team. Furthermore, the final effluent quality was beginning to deteriorate.

To our dismay it became apparent that the spike in aeration demand that occurred on the previous day, followed by what appeared to be the process returning to normal operation, was in fact the first few hours of the process biomass being killed.

We lost 25 tonnes of active living biomass across the plant's three parallel bioreactors and there was nowhere to run, nowhere to hide. The entire biomass of the activated sludge STP process was effectively dead.

We ensured that we reported the incident to the environmental regulator (the Department of Environment and Heritage Protection (DEHP)) in accordance with our reporting obligations.



Figure 1: *Trade Waste Shock at Inlet Works – Burpengary East STP.*

At the peak of the incident we received significant interest internally within our organisation from (Board, CEO and Executives), the media (including interviews with locals at the nearby boat ramp and a TV news helicopter overhead) and ongoing concern from DEHP. The pressure being placed on our team was considerable and we needed to respond.

Operational actions taken in response to the incident ensured no ongoing adverse environmental impact. We were very fortunate to receive excellent support from DEHP at the time.

The trade waste shock that took out the process at the Burpengary East STP is considered to be a rare event within our industry. The cost of incident response was significant, in the order of hundreds of thousands of dollars. Reseeding the process and intensive laboratory testing including catchment, process and environmental monitoring were two key cost drivers.

No repeat events have occurred since the knock-out blow was delivered but we do not want to be put in the same situation again.

2.0 DISCUSSION

Unitywater chose to undertake a brownfield upgrade of the Burpengary East STP, which was originally commissioned in September 2011, to improve process capacity.

Operations staff were given the opportunity to have a very high level of input into process design. The input into the design of the upgraded STP process by operational staff ultimately provided the solution to our trade waste shock problem.

Operators lobbied the design team very hard to ensure that the design incorporated a raw sewage balance tank (RSBT), and it was also the largest capacity possible within budget constraints. After initial resistance, a four megalitre RSBT was approved.



Figure 2: *Four ML Raw Sewage Balance Tank (RSBT) – Burpengary East STP.*

The treatment plant Operator in Charge (OIC) was also adamant that flow from the RSBT to the bioreactors should be pumped. Given that the process consisted of three parallel bioreactors, (two “mirrored” and one double the capacity of the others) the OIC had little faith that the flow to each reactor could be controlled accurately using a conventional flow splitter. Previous experience (and untold levels of frustration by operators) supported this view. Pumped flow from the RSBT to the bioreactors would ensure that optimum flow control could be achieved to each of the three parallel reactors, ensuring that process performance could be tightly controlled. In another win for operations, the request was approved.



Figure 3: *Raw Sewage Balance Tank (RSBT) Pump Station in the foreground with Flow splitter in the background – Burpengary East STP.*

As operators we also wanted to ensure that maximum process flexibility was retained as part of the design. The thinking behind this was to ensure that process units could be easily bypassed/taken out of service for inspection, cleaning and maintenance. As a result of the above design concepts being accepted for inclusion into the final process design, an innovative influent quarantine opportunity became available. Necessity is the mother of invention!

The fact is that that water utilities cannot fully control the type of substances that are disposed of into the sewerage system 100% of the time. Unfortunately, a small percentage of the population either doesn't have any awareness of the potential environmental consequences that can occur as a result of an illegal discharge, or they don't care.

Taking this into consideration, we looked at options that might be available to us to deal with a trade waste shock under a worst case scenario, that is, it's just arrived at the front door of the treatment plant process.

2.1 Detection

As soon as a distinct change to raw influent quality is detected, (foaming, odour and or appearance), it's an indication that a toxic or inhibitory substance is potentially arriving on site at the head of the STP process and our first action is to immediately shut down the RSBT pumps. This ensures that any flow entering the plant is stored in the capacity available in the RSBT.

2.2 Isolation

Unitywater calculated the capacity of the trunk sewer between the industrial estate and the inlet works of the STP. After operators become aware of a potential problem with influent quality, one detention time of this sewerage rising main is allowed to elapse, with the volume being stored in the RSBT. The bioreactors do not receive any flow for this period.

After one detention time of the sewerage rising main has elapsed, operators open up a bypass valve that brings that original flow splitter flow path back into service and shut a valve that isolates flow from entering the RSBT. This effectively enables us to quarantine the suspect raw sewage.



Figure 4: *Raw Sewage Balance Tank (RSBT) Isolation Valves – Burpengary East.*

2.3 Response

Samples are immediately taken from the RSBT and sent away for a full suite of analysis to determine if the raw sewage quality is satisfactory for processing through the bioreactors. In the interim, the process is fed raw sewage via the original flow split pathway without flow balancing. The plant has been operated this way on a number of occasions and process performance is satisfactory although not as well controlled as when the RSBT is on line.

After results of analysis become available, Unitywater process engineers calculate a flow rate that the process is capable of treating and the contents of the RSBT are bled back into the bioreactors at this rate. When the RSBT is emptied, the process flow is put back to its business-as-usual configuration ready for us to be able to respond to the next influent quality concern.

2.4 Continuous Improvement

An increased level of automation is on our wish list. As a minimum we would like automatic actuators fitted to the 750mm diameter valves that are currently manually operated each time we bypass flow to the flow splitters which enable the RSBT to be isolated. We currently use a three man team to operate these valves as you tend to knock up pretty quickly when you're swinging off valves this size!

Foaming has been linked to each raw sewage quality concern that has occurred to date. The inlet channel level sensor upstream of the screens is triggered into a critical high alarm by the foam. Operators know to dial in and isolate the RSBT pumps under these circumstances until they've been able to report to site to further investigate the root cause. Once we have installed automatic actuators on the flow splitter and RSBT isolation valves, we'll have further automation opportunities by incorporating the use of sensors and modified programmable logic controller (PLC) code.

3.0 CONCLUSION

As a team we feel more empowered and ready to respond to any incidents that may occur in the future. As operators responsible for a treatment plant, you don't want to feel that there's nothing that can be done when faced with these circumstances.

The process improvement allows more effective management of potential environmental and financial impacts. The environmental regulator (DEHP) was very impressed that we were able to adopt this response protocol as part of our contingency plan for managing potential trade waste shock events. It's never a bad idea to have the regulator on your side!

Operators are encouraged to participate to the fullest extent possible in any activities that have the ability to affect operations. This is an example of how having a high level of Operator input into the planning and design of a process upgrade has paid off in more ways than one. The value that motivated operators can add to a water utility should never be underestimated.