IN THE DEEP END! BUSHFIRES, FLOODS, MUDSLIDES AND SWIMMING POOLS

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ABSTRACT

Licola is a small town in the high country of Gippsland. In 1969 the then derelict logging town was purchased by the Lions Club of Victoria, and restored to provide a high country experience for children of all backgrounds. In Summer 2006-07 the community was under siege by bushfires which passed right through the town, burning trees and bushes within meters of buildings and homes. The fires caused extensive damage to the towns water distribution system, melting pipes both above and below ground. While the dedicated team of Lions volunteers set about rebuilding the distribution system, another problem was brewing. Loss of ground cover and deposits of ash in the catchment area sent the historically pristine Macalister River to a dirty muddy creek, with worse still to come. The Lions Club approached Gippsland Water for assistance in treating the water to supply the camp and town. Chemical dosing options were assessed, and the town swimming pool was modified and utilised as an emergency clarifier, with some generous assistance from water industry suppliers the system was a success.

KEY WORDS

Dirty Water, Turbidity, Water Treatment, Bushfire, Mudslide.

1.0 INTRODUCTION

I was excited! After three years in business development and the commercial side of the water treatment industry, I was about to return to the front lines of water treatment. I had been watching the news and observing the bushfires which burnt so wildly over the Christmas – new year period, predicting the impact it would later have on water supplies. Having been heavily involved in post bushfire water treatment during time spent in North East Water, I was looking forward to the challenges that awaited me, when I returned to the battlefield that is potable water treatment.

On the 8th of January 2007, I started work as Water Treatment Technologist with Gippsland Water. Without having had a chance to settle in, on my second day of employment, Gippsland Water was approached by the Lions Club of Victoria for advice and assistance on treating dirty water from the Macalister River which had degraded significantly after the fires. Having the luxury of being new to Gippsland Water, I was not yet overloaded with other projects and was delegated the task of working out a suitable means of treating what was once pristine mountain water.

Water samples were delivered for testing, and a site visit was undertaken to assess options and available infrastructure, that could some how, be utilised as an emergency water treatment system. On arrival on site, the situation became clear. 280 Children staying in the village were allocated water for only 4 hours per day, such was the shortage of supply and the cost of trucking water to the remote town, no hot water was offered for bathing to further minimise use. Exhausted volunteers who had just fought off the fires, were now rebuilding the water distribution system, and awaiting a means of treatment.

After assessing what was available, the decision was made to utilise the town swimming pool as an emergency clarifier, and work began on determining appropriate chemicals for flocculation and designing dosing systems. Several water industry suppliers provided assistance and donated their time, equipment and chemicals to help the struggling charity, and the communities they serve. Within a week, a temporary system was installed to supplement supply while more work went into creating something of a slightly more permanent type of temporary system. By early February a workable solution was in place and the town had a secure supply of safe drinking water.

Since installation the system has successfully treated water of up to 2500ntu to well within WHO Guidelines for Drinking Water Quality. Twice the town has been flooded and buried by mud slides, which has impacted on supplies to other towns in Gippsland Waters area downstream on the Macalister River. The lessons learned helping the community of Licola, proved invaluable in helping Gippsland Water prepare their downstream water treatment plants for possible dirty water events after rain.

This report outlines in brief, the process of determining a suitable chemical dosing regime, and problems encountered in achieving a suitable water quality from the system.

2.0 DISCUSSION

2.1 Chemical Selection for Flocculation

Several samples were collected so that different turbidity raw water could be tested for flocculation and settling. To ensure simplicity of the process a 'single chemical' dosing option was preferred, since no trained water treatment personnel were available to operate the system. Several readily available chemicals were trialled including; Polymer 1190, Alum, PolyAluminiumChloride and Aquapac55.

Polymer 1190 was trialled and found to be unsuitable as a coagulant/flocculant reducing turbidity as seen in Figure 1, where optimal dose resulted in settled water turbidities of >150ntu.

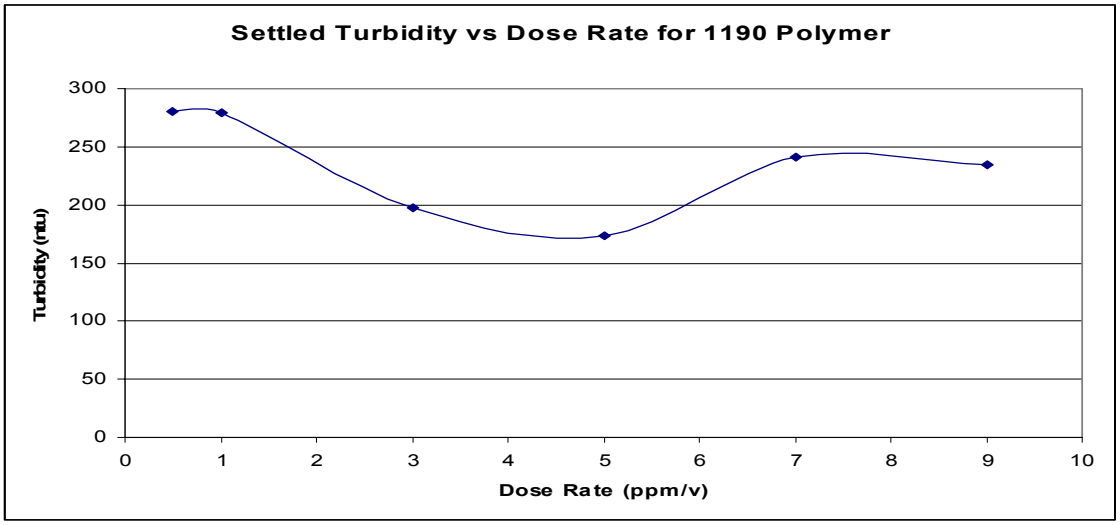

Figure 1: ***Jar Test Results for Polymer 1190.***

Alum was then dosed in conjunction with 1190 (at 5ppm which showed best results in

first trial) showing improved results as seen in Figure 2.
Settled turbidities were reduced to 50ntu. Although to improve performance pH correction was required, and was dis-regarded due to increasing complexity of the process. fairly narrow working range also makes this option less attractive.

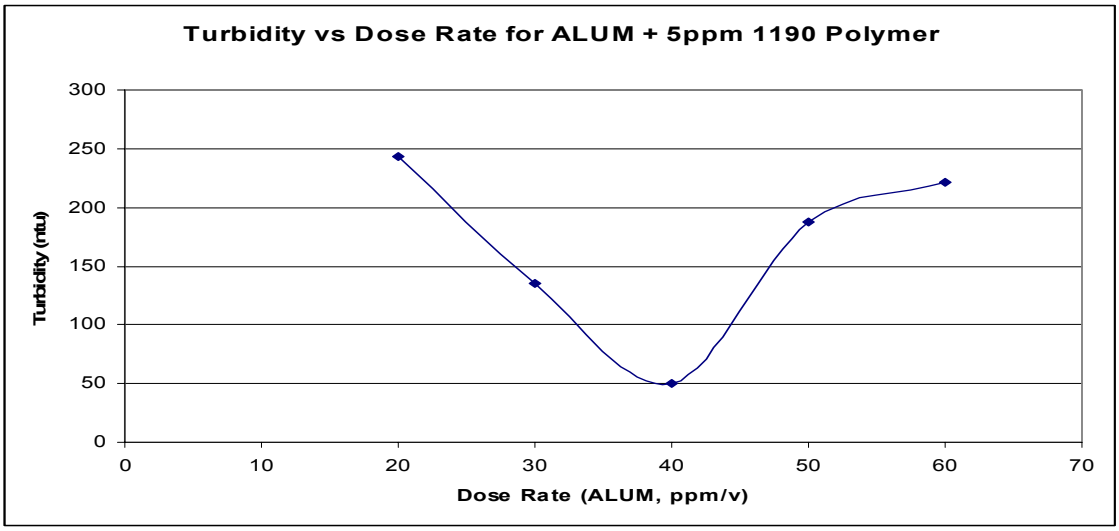

Figure 2: *Jar test results for Alum.*

Aquapac55 was tested showing much improved results. Figure 3 shows settled water turbidities of 17ntu at the optimal dose rates, which would be expected to improve in the actual application due to the extra settling time that will be available on site. 45 and 50ppm/v were the optimal dose rates.

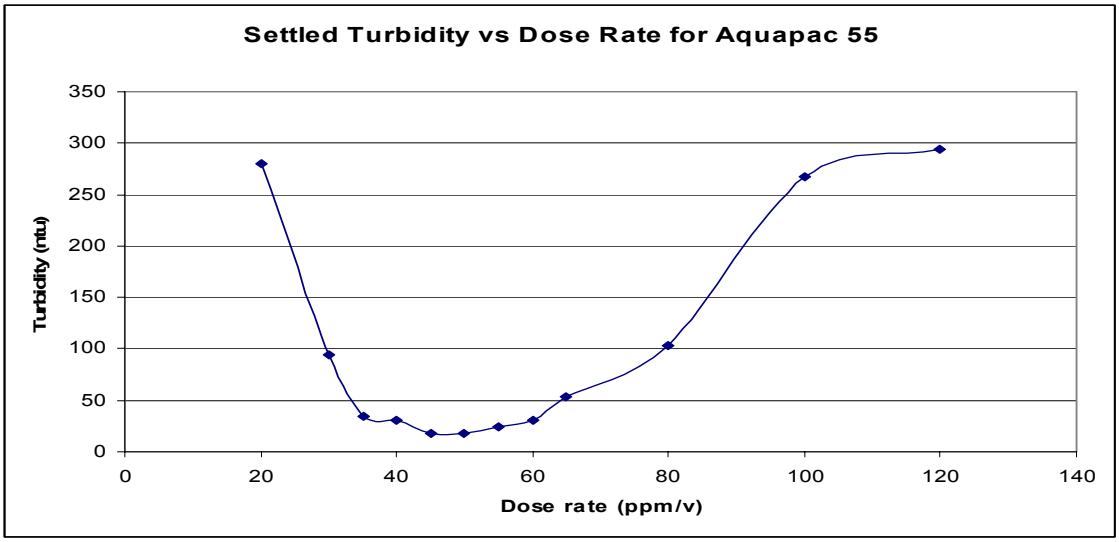

Figure 3: *Aquapac55 jar test Results*

The preferred Chemical for flocculation proved to be PAC10LB (10% PolyAluminiumChloride – Low Basisity) as shown in Figure 4. Results of jar tests using PAC10LB gave excellent results with a very broad working range which suits the application and experience of operators likely to manage the system once installed. Settled turbidites of less than 2ntu were achieved.

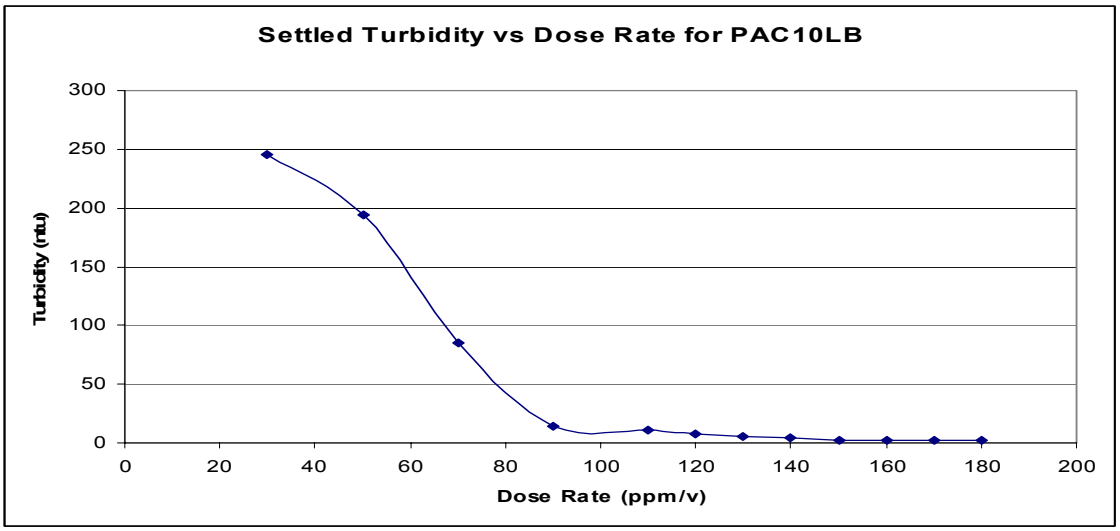

Figure 4: ***PAC10LB Jar test Results***

The ability of PAC10LB to floc over such a wide range of dose rates was seen as an ideal characteristic, to ensure successful operation of the system. All otyher chemicals not only produced higher settled water turbidities, but also had a narrower working range which increased the level of expertise and control operators would need to have to keep the system working, especially where raw water turbidities varied so widely in such short time frames.

Operational Issues – Problems Encountered in Commissioning and Running the System.
Based on results of jar testing the chemical selection was complete, now the system had to be set up. Based on the jar tests on PAC10LB a dosing pump was sized and scavenged from within Gippsland Waters spares. Chemicals were ordered in small 15L containers to remove the need to install chemical storages and bulk loading/unloading facilities. Since it is a small town with relatively low demand, one 15L container was calculated to last between 3 and 9 days depending on the raw water quality. A flow meter was ordered to determine flow rate for calculation of dose rates.

The concept for system was starting to take shape, and to minimise sludge migration through the pool three plastic baffles were installed to ensure the pool did not short circuit and as much sludge as possible was retained. Figures 5 & 6 show the temporary baffles being installed by Lions club volunteers and GW staff, and the Macallister River at 4000ntu.

Figure 5: ***Temporary baffles in the Licola swimming pool.***

Figure 6: ***Macallister River, 4000ntu.***

Chemical dosing systems were set up with rapid mixing provided by a half cocked valve and bends in the pipe work. When the plant was started slow mixing was insufficient to encourage good floc formation which reduced the process efficiency. It was decided to operate the pool as a "batch" system, which operated in only fill and drain phases. This enabled the pool more settling time to settle the fine floc. Generally the pool was filled during the afternoon, allowed to settle overnight, then pumped out in the morning.

After a week of successful operation the key concerns of staff were that sludge removal from the pool was very labour intensive. A "creepy crawly" pool vacuum was used to remove sludge periodically, however frequently got caught on the plastic baffles rendering it unsuitable for the job. Sludge had to be manually removed via the pool vacuum system. This took a volunteer up to eight hours depending on the raw water quality and how much sludge had been generated.

The second main issue, was an inability to maintain a disinfection residual, despite the treated water quality being below 1.5ntu, higher organic loads were consuming a 2mg/L free chlorine residual to nearly nothing in the space of two hours. After a few phone calls, the team at Powder Activated Carbon Technologies Pty Ltd, came to the party and donated free of charge to the Lions Club, 3 months supply of pre-wet powder activated carbon. All we needed to do was install a PAC batching/mixing tank and dosing system.

Aeramix were contacted for help with the PAC mixing system, and proved again that the water industry does have a heart, donating a mixer and a days labour to install and commission the PAC mixing and dosing system (Figure 9). In addition to this, we also needed to deal with the sludge migration problem! Aeramix donated more time to assist with construction of a more permanent solid baffle system as seen in Figure 7 and 8.

Figure 7: ***Licola swimming pool baffles.***

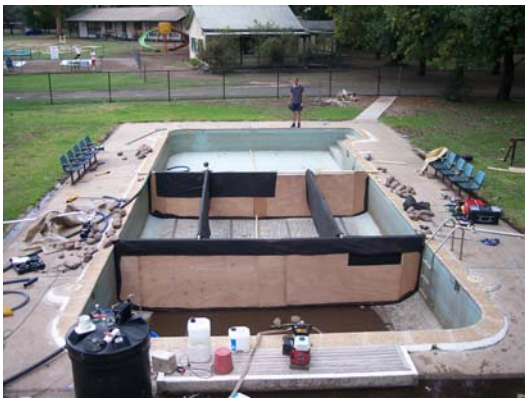

Figure 8: ***Licola swimming pool baffles.***

After installation of the PAC dosing system chlorine residuals increased and were maintained into the reticulation system at satisfactory levels. The solid baffles worked much better at keeping sludge from migrating throughout the pool reducing the amount of time and effort required to remove sludge significantly, as well as enabling the process to be run as a "flow through" rather than "batch" system.

Chemical mixing was improved by adding a 200L container to the flocculation zone into which the inflow entered. This was half filled with rocks to improve the rapid mix and spread or diffuse the flow to minimise short circuiting of the flocculation and settling zones and provide better slow mixing to aid floc formation at the inlet to the flocculation area.

Figure 9: ***PAC mixing system and Jerry Rigged rapid mixing and diffuser tank.***

3.0 CONCLUSION

The town of Licola has had a torrid year in 2007, surviving bushfire, re-establishing a water supply and distribution system, flooding and mudslides, and more recently, more sever flooding and destruction of the roads and bridge that permits access to the site by raging flood waters.

Beyond the temporary system put together by GW, Aeramix, Powder Activated Carbon Technologies and of course the Lions Club Volunteers, preliminary design and investigation into supply of a purpose built water treatment system was undertaken. The water industry showed great support for this project providing many discounts, and donations of equipment and time.

The Lions club submitted an application for funding to secure a safe water supply and were awarded $100,000.00, but to date little progress has been made. Of the allocation to Licola for a water supply, much of this is being spent on consultancy, into the viability of supplying a shallow bore, and after it all the DSE do not intend for the supply to be classified as potable, and it will not be plumbed into the towns reticulation. The Lions club, after all this, will most probably have to generate their own funding to install a treatment plant regardless.

The challenges presented by bushfire affected catchments for the potable water industry are wide and varied. This project shows that even under the worst of conditions, the bear essentials and basics of water treatment theory, if investigated properly and implemented with attention to detail to ensure the process chemistry confined to a less than ideal physical structure can and does work.

4.0 ACKNOWLEDGEMENTS

In completing this project the following organisations and individuals deserve great thanks for their assistance, with many more being worthy of note for their contribution to equipment for a permanent plant.

- Orica Chemicals Morwell - Scott Laidlaw – chemical supply and selection assistance.
- Powder Activated Carbon Technologies Pty Ltd. – Peta Thiel and Peter Cullum - Supply of 3 months PAC.
- Aeramix – Cole Harvey - Supply and installation of PAC mixing system, construction of baffles.
- Gippsland Water – supply of dosing pumps, tanks, process investigation and materials for baffle construction.