MITTAGONG REGIONAL SEWERAGE SCHEME UPGRADE AND COMMISSIONING

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ABSTRACT

In the year 2000 the upgrade of The Mittagong Regional Sewerage scheme took place under a design and consruct contract. This was a $40 million project which included the design, construction, commissioning and process proving of a new treatment plant at Braemar with a capacity of 14,000 EP. It also included the provision of sewer to the northern villages of the shire which entailed the laying of approximately 80 kilometres of pipeline including trunk mains, gravity mains and rising mains. A total of 15 new pump stations were constructed. The project also included the decommissioning and demolition of the existing trickling filter plant.

In conjunction with the project some upgrades of the existing reticulation systems and pump stations were carried out. Installations of PLC control and telemetry systems were provided to all pump stations and the plant.

1.0 INTRODUCTION

Wingecarribee Shire covers the area known as the Southern Highlands approximately 120km from Sydney on the way to Canberra. We have five sewerage plants located at Bundanoon, Berrima, Moss Vale, Bowral and Mittagong and seventy pump stations delivering sewage to these plants. A $16 million augmentation was recently undertaken on the Bowral scheme. The Bundanoon scheme will under go an augmentation at the cost of 12 million later this year and a new scheme in Robertson at the cost of $17.2 million will be carried out in the next three years. This paper concentrates on the Mittagong Regional Sewerage Scheme.

This was a project long overdue as pollution from aging septic systems in the northern villages and the inadequacies of the existing plant were having a negative effect on receiving waterways. Our Council is situated in the middle of the Sydney Catchment Area and we were under immense pressure from various regulatory authorities, such as the DEC, SCA and DEUS to upgrade our systems to ensure the protection of Sydney's water supply. All effluent from our treatment plants is discharged into rivers that directly and indirectly feed Warragamba Dam, so it is important that we have treatment plants capable of producing very high quality effluent consistently. It was also important that our new treatment plant and transportation systems were capable of handling wet weather flows, extended power outages and equipment breakdowns to minimize pollution incidents and ensure no reduction in effluent quality when these situations occurred. For this reason all new pump stations were supplied with 8 hours ADWF storage as well as dual control systems and dual electric power supplies. The treatment plant was supplied with dual power supplies, a wet weather storage pond and was hydraulically sized to treat flows that far exceeded its design capacity.

It was a requirement to discharge the treated effluent in the same location as the old plant, as this was the only waterway with the correct classification for effluent disposal available for our system, and to prevent any degradation of previously untouched river systems in the Wollondilly catchment. This involved the construction of a treated effluent transfer main to pump effluent 6.4km from the new treatment plant site to our old effluent outfall at Iron

Mines Creek. As this main passed through the Mittagong Golf Course Council had the option of reusing the treated effluent. We are currently reducing our effluent loadings by using approximately 20% of our effluent in plant operations and in an irrigation system at Highlands Golf Course at Mittagong.

Other challenges that Council faced with this project were the provision of training and up-skilling of our operators and service providers to enable a smooth transition from the old system to the new system. This was all part of the project and a huge effort was required to make this successful. Often the importance of this task is under-estimated.

After extensive consultation and investigations, we were provided with a reasonably well constructed plant and transportation system that consistently met our needs with planned options for future upgrades.

As with all large projects the commissioning of the new scheme provided the team with a number of hurdles. In the following discussion I would like to outline some of the problems encountered and the solutions we came up with as we progressed.

2.0 DISCUSSION

2.1 Odour Complaints From The Reticulation System

As with the commissioning of all sewerage systems until they get up to the design capacity odour complaints are not uncommon. We tried many different ways to address these issues with varying results. We lowered pump cut off levels and rebenched the bottom of some wet wells so they would be kept cleaner. We dosed chemical into some wet wells both manually and through permanent dosing systems and used odour caps on vent stacks. A very regular pump station cleaning routine was included in our maintenance schedule

Many complaints were received early in the morning from the rising main which was fed from the main pump station in Mittagong. This main went through the centre of an exclusive residential area so the Member of Parliament for our area was quickly involved. Insufficient flows in the early stages were identified as the main cause of the odour problems. The effluent main from the new plant passed close by this pump station so we thought if we could recirculate some of the effluent through that pump station as a short term solution it would solve our immediate problem. We made changes to the PLC program at the plant so the effluent pump station started at midnight and installed a pipe from the effluent main to the pump station recirculating about 10% of our effluent and making the pump station run more regularly in the early hours. This arrangement solved the problem until the pump station reached its design load.

2.2 Delivery System/ Inlet works

All sewage is delivered to the plant through the main pump station at 385Kl/hour for occasional three minute bursts. Sewage travelling at that rate has a detrimental effect on the process. It results in a drop in the efficiency of the rag removal systems and the operation of the anoxic zone. It provides the plant with spasmodic flows which make it harder to operate the plant and causes short circuiting. This means operators must be more vigilant with their monitoring and sampling. It affects plant stability. Short circuiting is a major problem in our plant considering that we have such a stringent licence. It is particularly bad in the cold Highlands Winters. Our operators are experienced in analysing when the plant is short circuiting and quite often ignore high ammonia results knowing they are not caused by the need for more air, but by short circuiting in peak flow periods. When these results occur they dilute in our catch pond and have minimal affect on our effluent. Not being aware of short circuiting leads to over aeration.

Council is currently investigating the installation of VSDS for the pumps at the main pump station, both to save power costs and to provide a more consistent, controlled delivery of sewage to the plant. Another option is to install a smaller pump for normal flows and only use the bigger pumps in periods of wet weather. Basically you are using the main pump station as a balance tank for the plant which would have a positive effect on the process and minimize short circuiting. To eliminate short circuiting altogether we have asked that automatic penstocks be installed into the inlet works at the divider boxes so as the IDALS can only be fed during aeration. This would eliminate short circuiting completely.
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2.3 Not That Lime System.

When the plant was first handed over to Council, it was expected that substantial biological **p** removal could be achieved at the plant. It was for this reason that a sophisticated lime plant had been constructed to allow for the chemical removal of **p** from the supernatant return of the drying beds and sludge lagoons. The designers expected with biological **p** removal that levels of **p** in the supernatant would have a detrimental effect on the process if delivered back to the head of the works untreated. This would have been the case if a good level of biological **p** removal was achieved.

Unfortunately the method of delivering the sewage to the plant is not conducive to standard treatment let alone biological **p** removal. There was no truly anaerobic zone or temperature control at the inlet works as needed. Apart from the limited seasonal success which we achieve at all our plants biological removal of **p** has essentially not been achieved.

After carrying out analysis on the supernatant we found that **p** levels were consistently low as the alum we were dosing kept it chemically bound. This left us with a complex **p** removal plant with limited use. It seemed senseless to be using power and having to maintain up to 15 machines just to add alkalinity to our IDALS. Not only this, but the very material you were trying to dose to the system would end up settling out in the clarifier and become just another sludge you would have to dry and dispose of. An excessive amount of lime was being used just to maintain alkalinity. The system became a constant burden with continual blockages and breakdowns and the use of it could not be justified.

At present Council operators are manually adding lime to the system. We are currently investigating the installation of a more simplified lime dosing system or a caustic dosing system. We are swinging towards lime as it is a safer chemical, just as effective and the cost savings over the plant lifetime will be significant. In relation to the lime dosing system the plant was very well constructed but not designed for purpose.

2.4 Nutrient Removal Issues

The problems already mention combined with the fact that we have a very stringent licence, made achieving licence limits consistently very difficult. The short circuiting problem even after allowing for operator awareness at times results in over aeration which results in a drop in alkalinity. We dose alum to ensure we meet our required **p** limits which once again compounds our alkalinity problems. Operators must have a proper understanding of chemical dosing in this situation. Alum dosing is exponential, meaning it takes significantly more alum to drop **p** from 0.4 to 0.2 than it does from 1 to 0.8mg/L. Also once alkalinity drops **PH** problems occur and the alum become less effective resulting in a rise in **p.** In this case an inexperienced operator will increase the alum dose and compound the problem. Quite often when there is a rise in **p** we have to add lime and decrease alum as the problem is due to low **PH,** not insufficient alum. At the plant we have a pre-dose and post-dose systems for alum. The post dosing seems to be relatively ineffective forcing us to reduce **p** level down as low as 0.3mg/L in our IDALS. I think the post-dose is ineffective due to **PH** problems and lack of mixing. This makes us dose more alum into the IDALS than we would like. Also because the biomass needs **p** to work we have to ensure we don't strip the **p** out totally.

Dosing alum also enhances settling which is normally helpful. Unfortunately when sludge starts to settle too quickly it affects denitrification which once again compounds alkalinity problems. This happens because a quick settling sludge is not in contact with the nitrates loaded effluent long enough to achieve denitrification. The alkalinity return which occurs during denitrification does not happen. This can led an operator to think he is over aerating when he actual may not be. The way we addressed this problem was to continue returning activated sludge to the anoxic zone well into the settling phase to create some mixing so the biomass has time to denitrify before settling. It is obvious you must find the appropriate balance and ensure sludge is properly settled before decanting. If you do not return activated sludge at your plant you could try flash mixing during the settlement period.

As you can see a lot of the above actions lead to a reduction in alkalinity and if operators make the wrong decisions, serious damage to a healthy biomass can occur. Remembering the fact that our plant has no proper method of adding alkalinity apart from manually dosing of lime you can imagine the problems we face. A proper chemical dosing system which could deliver alkalinity consistently during the aeration phase is what is required to achieve plant stability. The line is very thin and very close process monitoring is required to achieve good results. All our operators have had extra training in chemical dosing.

Table 1: ***EPA Concentration Limits***

Pollutant	**Units of Measure**	**50 percentile concentration limit**	**90 percentile concentration limit**	**100 percentile concentration limit**
Ammonia	mg/L	**1**	**2**	
Oil & Grease	mg/L	-	**10**	
pH	pH	-		**6.5-8.5**
Nitrogen (total)	mg/L	**7**	**10**	
Phosphorus (total)	mg/L	**0.2**	**0.3**	
Faecal Coliforms	mg/L		**200**	
Total suspended solids	mg/L	**10**	**15**	
Biochemical oxygen demand	mg/L	**7**	**10**	

2.5 Sumps In Tanks And Ponds.

One simple thing which seems to get overlooked in plant upgrades is the provision of sumps in tanks and ponds. We were supplied with a series of flat bottom tanks and ponds throughout the plant which eventually, either for cleaning or repair purposes will need to be emptied. Totally emptying a pond or tank becomes difficult when there is no sump. These include the anoxic zone tanks, average dry weather balance tank, catch pond and sludge lagoons.

At the commissioning stage of the plant we immediately saw the importance of a cleaning system for the catch pond. We knew we had no chance of meeting our licence unless this pond was kept clean. We insisted that a sump and pump including access walkways and associated pipe work to deliver sludge to the head of the plant be installed straight away. This included a lifting device for retrieving the pump for maintenance and repair. An extension of the effluent re-use system to enable us to hose the catch pond out was also necessary.

When we first started using the new cleaning system we would walk down the sides of the pond to gain access for hosing. As the pond was heavily sloped and rubber lined it was very slippery particularly when wet. On doing a risk assessment immediate rectification of this hazard was necessary. We investigated the use of different footwear, as well as the installation of a non-slip surface. We eventually concluded that a combination of both was needed. We painted the liner with a non-slip surface and included in our SWMS that reef walkers must be worn while doing the task. This method was successful until the non-slip surface started to lift. This again presented us with a dangerous situation. We investigated the availability of a more effective hose nozzle which enabled the hosing to be carried out from the top eliminating the need for entry. Hind-sight is a wonderful thing but this is still our work practice today. This task is carried out once a fortnight.

We also found that we needed to remove grit form the anoxic zones every two years. If that wasn’t done we would have continuous problems with the mixers in this area. Once again there are no sumps in these tanks. This causes us to have to hire super suckers and enter a confine space to carry out the task. If sumps were provided we would definitely be able to save the cost of hiring a super sucker and possibly even entry.

Only this year we installed a sump and pump into the average dry weather balance tank for cleaning purposes. This makes cleaning this area of the plant a lot easier. The sludge lagoons will be our next challenge. They are rubber lined lagoons which one day will require maintenance. It will be a problem to empty them out to carry out this maintenance as they don’t have sumps.

When you are operating plants to meet strict EPA licences that don’t have filters it is so important to keep all areas of the plant clean. We are slowly installing the sumps necessary to achieve this but it should be remembered it would have been so much easier and more cost effective to do this during construction.

3.0 CONCLUSION

During the commissioning stage many lessons were learnt which should be considered in future projects. Some of these include the importance of staff preparation in the transition period. If staff have been operating trickling filter plants and are now being asked to run the new plant they will need considerable training particularly in chemical dosing. Staff should be well trained in the operations of the new system so they can look forward to system commissioning rather than approaching it with fear and uncertainty which creates negativity at the beginning. They should be involved in the pre- commissioning testing to gain experience in operating the plant before sewerage is introduced. Experienced operators should have a chance to discuss design issues before construction starts and have input into areas of concern. They should be listened to.When a project includes both reticulation work and plant construction both sections should be preferably designed by the same company to ensure compatibility in design. This prevents the situation of having the intended design of the plant as biological **p** removal yet having the reticulation system deliver sewerage to the plant in a mode that makes this impossible. Plant short circuiting should be expected and rectified at the design stage. Asset managers should allocate sufficient funds during the first few years of operation to resolve issues which may have been overlooked.

Having said all that, after six years since commissioning, we now have a plant which treats all the effluent from Mittagong and the Northern Villages and consistently achieves licence conditions. We are very fortunate to have dedicated and experienced operators who often work beyond their required duties to ensure high standards are maintained at all times. We are also very fortunate to have engineers and managers who listen to and support the operators in seeking improvements and allocating funds for plant improvements in the capital works program. I would like to take this opportunity to congratulate everyone involved in the design, construction, commissioning and operation of the Mittagong Regional Sewerage Scheme. Incidentally, the Mittagong plant is nearing is design capacity and we are getting prepared for the next upgrade.

Irrespective of how good the design and construction was done, there will always be teething and on going problems when a new sewerage system is commissioned. It is imperative that involvement, understanding and good communication between the designers, contractors, project managers, Councils' operators, supervisors, engineers and managers is maintained through the design, commissioning and operations stages to address and solve problems.

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