TALBINGO WASTEWATER TREATMENT PLANT UPGRADE

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ABSTRACT

A three-stage Bardenpho wastewater treatment plant was built and constructed at the Talbingo township in the mid-1990s. Design of the plant allowed for low wastewater temperatures due to snow melt infiltration in spring, periodic low loading conditions and sensitive waters requirements for effluent quality. The community were also consulted on the plant design. The performance of the plant over the 14 years since commissioning has now been reviewed and, with the exception of effluent TP, has generally been good, although this has been assisted by the lower than anticipated flows and loads. This paper reviews operating experience of the plant and lessons learned.

KEY WORDS

Talbingo, Bardenpho, plant performance review, sensitive waters.

1.0 INTRODUCTION

In preparation for becoming corporatised, the Snowy Mountains Hydro-Electric Authority (SMHEA) handed over operation of services for the township of Talbingo to Tumut Shire Council in the 1990s. For their part, the Tumut Shire Council wanted to make sure the infrastructure they were accepting was satisfactory, including the wastewater treatment facilities.

The two Authorities decided to work together to ensure a satisfactory outcome for all concerned, beginning with engaging consultants to review the current state of the town's services.

That review identified, amongst other works, the need to replace the existing package plants, provided in the late 1960s. The existing three package plants were in poor condition, and the process stream was incapable of providing the nutrient reduction required for discharge into inland waterways.

2.0 DESIGN OF THE WASTEWATER TREATMENT PLANT

2.1 Site Issues

This project had several unique features, beginning with having to satisfy two clients – SMHEA and the Tumut Shire Council. Other issues considered included:

- the 400 – 500 m altitude and relative isolation;
- possibility of low wastewater temperatures, due partly to the climate and partly to the potential inflow of spring melt as a result of plumbing in the former construction camp being exposed (the camp had been demolished by a bulldozer, with no work to isolate pipes; this section of the sewerage system was able to be relatively easily isolated during construction);

- uncertainty as to whether the treatment plant operators would be based locally or in Tumut, 40km away;
- variations in population due to summer tourism, a significant reduction in town population every second weekend, when SMHEA employees had a Rostered Day Off, and potential for future growth of the town (adopted design loads are presented in Table 1);
- the restrictions on land availability due to proximity to Lake Jounama, and the need to cater for future growth of the town between surrounding hills and the Lake;
- effluent quality requirements were set by "Sensitive Waterways" requirements (refer to Table 2); and
- the local community were consulted on the design

Community consultation led to proposed maturation lagoons and wetlands being located around 450 m away from the main part of the plant, with a commitment to provide tree and shrub screening.

The adopted design flow was 500 kL/d, based on a design Equivalent Population of 1,200 (417 L/EP.d).

Table 1: ***EPA Licence Requirements***

Parameter	Standard	Required conformance
BOD_5	15 mg/L	90^{th} percentile
SS	20 mg/L	90^{th} percentile
Total Nitrogen	10 mg/L (summer)	90^{th} percentile
	15 mg/L (winter)	90^{th} percentile
Ammonia Nitrogen	5 mg/L (summer)	90^{th} percentile
	7 mg/L (winter)	90^{th} percentile
Total Phosphorus	0.5 mg/L	90^{th} percentile
Faecal coliforms	200 org./100mL	Maximum

2.2 Final Plant Design

The core of the plant constructed was a 3 stage Bardenpho process with design hydraulic retention times (HRTs) of 15hrs in both the nitrification basin and the denitrification basin, to cater for the potentially low wastewater temperatures. To cater for seasonal variation, the depth in the denitrification basin was adjustable from 2m to 3m, and either one or two clarifiers can be operated.

After the effluent discharge limit was amended, phosphorous reduction by chemical dosing with pressure filtration was adopted. Before then, P removal was by lime dosing and sedimentation, with pH adjustment through the subsequent lagoons.

After discussion with the EPA, disinfection was achieved through 2 No. maturation lagoons with a design retention time of 20 days, and a wetland with 3 day retention time. Insufficient area was available to provide maturation lagoons with a 30 day retention time.

The treatment process has a long sludge age (30 days or more), so waste activated sludge (WAS) was managed by being stored in a sludge lagoon.
Two sludge lagoons were provided to operate in parallel and thus enable batch filling and storage, followed by drying. One side of each lagoon was relatively flat, to allow machine

access for sludge removal. A schematic of the Talbingo wastewater treatment plant is provided in Figure 1.

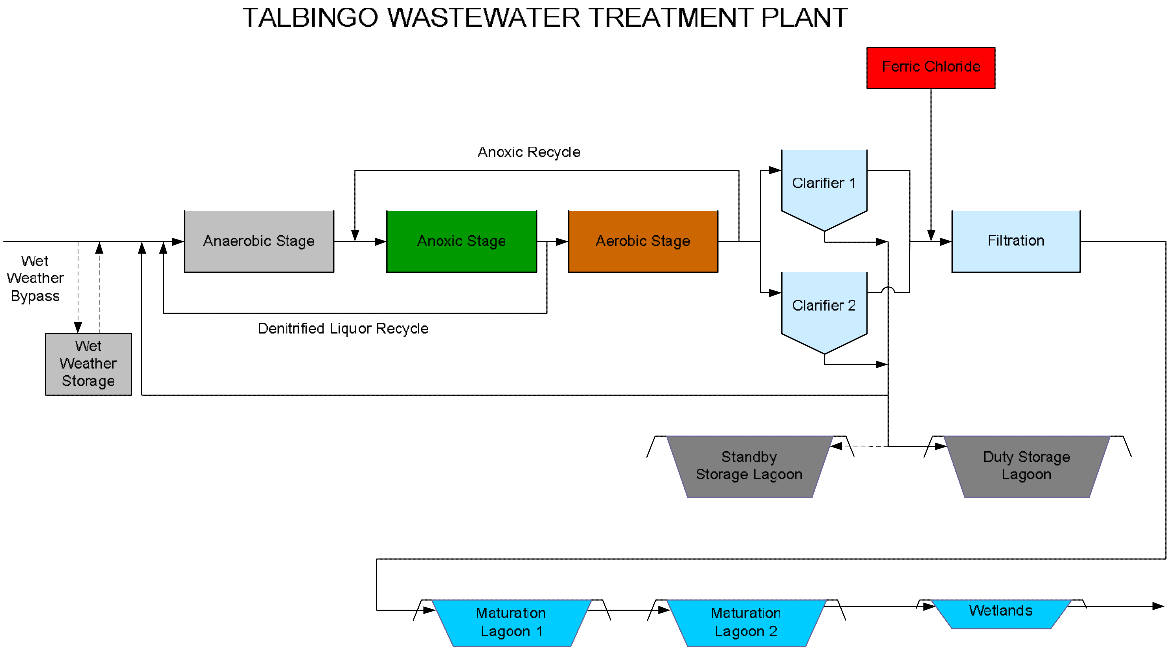


Figure 1: ***Talbingo WWTP***

3.0 REVIEW OF PERFORMANCE

3.1 Basis of Review

Arrangement to conduct a review started a few years after commissioning of the plant. The site was visited in 2007 for the purposes of taking comparison photos and holding discussions with the operators. Data was also reviewed from commissioning until Year 2010.

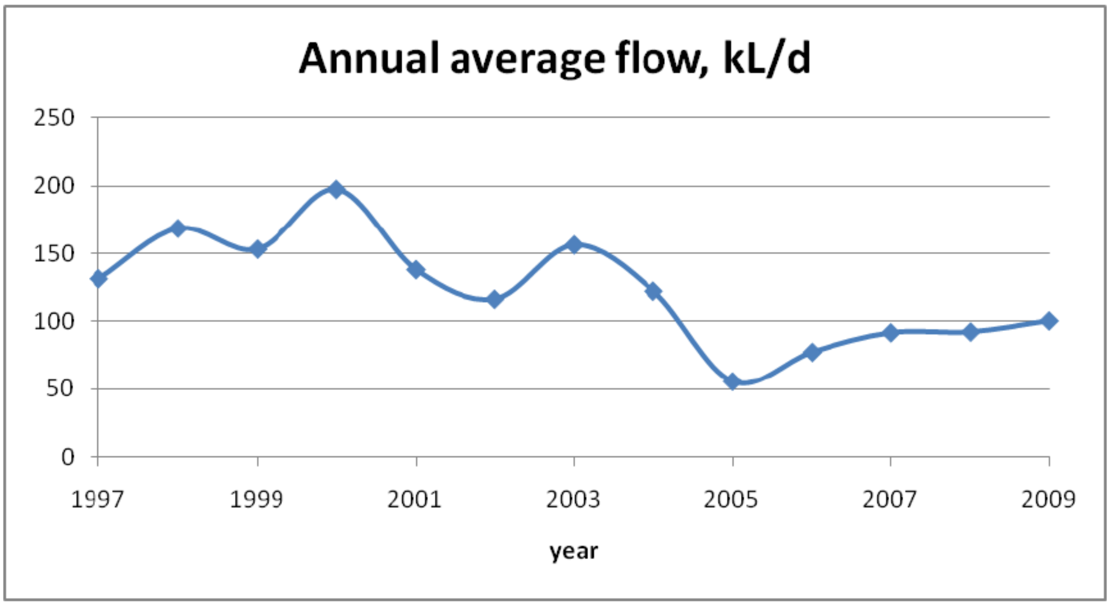
The comparison photos showed that the plant was in good condition after 14 years of operation.

3.2 Operating conditions

Before examining effluent quality over the entire 14 year period of the review, it is worth reviewing the operating conditions in comparison to the design assumptions.

The main change between actual and assumed operating conditions is lower than anticipated flows. This was due partly to the effects of water conservation measures adopted during the drought, but also due to remedial works to reduce infiltration, reduced Snowy Hydro workforce at Talbingo, and some growth not eventuating. Actual flows are shown in Figure 2.

Generally Tumut Shire Council has experienced a 30% reduction in flows across the Shire over the past five years.



<u>Figure 2:</u> ***Flows at Talbingo WWTP***

In response to these reduced flows:

- one sedimentation tank and one maturation lagoon were taken out of service, the latter to address algal and TDS issues;
- the denitrification basin depth did not need adjustment; and
- one sludge lagoon has not been used, and the other has not needed desludging.

3.3 Effluent quality over 14 years

Advice from Tumut Shire Council is that the plant has generally performed well with respect to effluent quality, with the exception of total phosphorous (TP).

Effluent suspended solids (SS) from the filter had a mean of 1.5 mg/L and a 90th percentile of 3.3 mg/L, which compared favourably with the Licence requirement of 20 mg/L, as a 90th percentile.

COD results, which were only available for January 1998, had a 90th percentile of 97 mg/L. It is not possible to definitively relate these to BOD_5, as no site-specific data on the ratios between the two parameters is available. However, based on the principal author's past experience at other plants, it is considered that effluent BOD_5 values would be below the required 90th percentile licence requirement of 15 mg/L.

It is also noted that the mean influent COD during this month is closer to typical full strength domestic wastewater, rather than the reduced strength adopted for design.

Ortho-P influent and effluent concentrations at the filter, and removals over the 14 years are summarised in Table 2. The site laboratory was not able to test for TP, and hence Ortho-P was adopted for monitoring performance at the site.

Table 2: *Ortho-P influent, effluent and removals*

Statistical quality	**Influent ortho-P** *mg/L*	**Nitrif. Basin ortho-P** *mg/L*	**Filter effluent ortho-P** *mg/L*	**Removal** *%*	**Comments**
Maximum	15.1	1.4	6.4	99.4	
90th percentile	**12.1**	**1.0**	**1.0**	**96.6**	**All values**
	9.6	0.8	1.1	96.2	*Winter*
	13.6	1.2	0.9	96.0	*Summer*
80th percentile	11.3	0.8	0.7	96.0	
Mean	**8.9**	**0.6**	**0.7**	**92.0**	**All values**
	7.0	*0.6*	*0.7*	*89.8*	*Winter*
	11.1	*0.8*	*0.8*	*92.6*	*Summer*
Median	9.1	0.6	0.5	93.8	
25th percentile	6.9	0.5	0.4	89.5	
Minimum	2.6	0.2	0.1	72.9	

With regard to nitrogen, the design intent for this plant is that:

- nitrate from the Denitrification Basin will be low, with some increase as flows pass through the nitrification basin;
- ammonia from the Nitrification Basin will be low;
- compliance would be achieved prior to the maturation lagoons-wetlands.

Data on nitrogen species through the plant is presented in Table 3.

Table 3: *Nitrogen species through the plant*

Statistical quality	**Denitrification basin effluent NO_3-N** *mg/L*	**Nitrification basin effluent NO_3-N** *mg/L*	**Nitrification basin effluent NH_3-N** *mg/L*	**Estimated Filter effluent Total Nitrogen** *mg/L*	**Filter Effluent NH_3-N** *mg/L*
Maximum	5.0	10.2	2.2	19.0	8.5
90th percentile	**3.1**	**6.6**	**0.5**	**8.4**	**0.9**
80th percentile	2.4	5.9	0.3	7.2	0.3
Mean	**1.8**	**5.0**	**0.3**	**6.3**	**0.5**
Median	1.6	5.1	0.2	6.0	0.1
Minimum	0.1	2.3	0.1	0.0	0.1

The plant has complied with the Licence requirements. After the lagoon and wetlands, recent data indicates the effluent TN is consistently < 5 mg/L.

3.4 Changes

The following changes have been made to the plant over 14 years of operation:

- ferric dosing at the inlet has been added; and
- additional mixing to the nitrification basin, by a floating surface aspirating aerator, has been provided to ensure MLSS flows to the clarifiers.

In addition, knowledge of provisions included for removal of the diffuser air aeration grids was lost over time. It would have been better had this been made more obvious – for instance, by extending the position poles for return of the diffuser grids above the TWL.

4.0 CONCLUSIONS

With the exception of effluent total phosphorous, the performance of the Talbingo WWTP since commissioning has generally been well proven over a fourteen year period. This has clearly generally been assisted by the lower than anticipated flows and loads to be treated. This indicates the plant has reserve capacity available for future growth.

A number of refinements were made in response to operational experience, including adoption of two-stage chemical dosing for phosphorous removal, with the initial dosing point being at the head of the plant.

No odour, noise or other community complaints have been reported to Tumut Shire Council, owner/operator of the facility.

5.0 ACKNOWLEDGEMENTS

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A copy of the full length paper (a 3Mb file with 56 pages including 43 figures and 15 Tables) is available by emailing the primary author at kayleen.white@smec.com