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AFM Case Study

AN "IN-HOUSE" SUCCESS AT ESKDALE

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ABSTRACT

In February 2009 the community-owned-and-operated water supply scheme in the small town of Eskdale in North East Victoria ran dry. A few weeks later it was announced that the scheme would cease operation within eight months after approximately 60 years of supplying the town. This led to North East Water increasing its involvement and subsequent Board endorsement of a business case to deliver a completely new drinking water supply scheme for the town, including a Water Treatment Plant (WTP).

North East Water (NEW) considered options for delivery of the WTP, knowing that both budget and time constraints limited typical project delivery paths such as Option Studies and Tender Processes, and therefore opted to back itself and utilise in-house expertise to deliver the project in the challenging timeframe.

This paper presents the key activities, challenges and innovations adopted by North East Water Operations staff to deliver a stunning little Plant at Eskdale.

KEY WORDS

DBO – Design, Build, Operate; NEW – North East Water; AFM – Activated Filter Media.

1.0 INTRODUCTION

Not all towns in the North East have complex drinking water supplies, with some relying on 'communal' type schemes that carry both quality (health) and continuity risks. Eskdale, a small township of approximately 90 residents in the Mitta Mitta Valley relied on such a scheme since the 1950's, where a timber mill established the supply. The majority of township residents received raw water from this infrastructure, which was pumped from the Little Snowy Creek, downstream of the non-sewered township. This was followed by distribution of untreated water to residents under gravity from an open tank through an aged, degraded pipe network. Despite the Mill closing down in 1975, the water distribution system remained the predominant source of water for the town under the management of the Eskdale Water Trust.

In February 2009, (although not the first time in 60 years), the creek ran dry, leaving the residents without water. Without obligation, NEW stepped in immediately and assisted via coordination of tankers of potable water to the town, and also recognised the need to take a lead role in the longer term solution. Late March 2009, North East Water facilitated a public meeting at Eskdale in partnership with the Council, Eskdale Water Trust and Mitta Valley Advancement Forum in which the Eskdale Water Trust manager to announce that the raw water supply would cease operation in November 2009 (due to legal and insurance issues) which would leave Eskdale residents without a reticulated water supply. That meeting was the catalyst which eventually resulted in the North East Water Board endorsing the business case for a proposed safe and reliable water supply scheme for Eskdale. At an estimated cost of \$1.1m to be shared between key stakeholders, the project included a river off-take pump station, new WTP and storage as well as an entirely new reticulation. NEW decided to back itself, to Design, Build and ultimately Operate the proposed WTP in-house.



2.0 DISCUSSION

2.1 The Reconnaissance

For NEW staff to begin the design and construction of a new WTP, it was critical to visit the township and 'eye-ball' options. Integration of the existing system was critical, as a transition phase was anticipated. Fortunately, the town is quite small, and gravity was to play a critical role in supply. The identification of the proposed site for the WTP was evident at that visit, which immediately triggered action to progress the various 'red-tape' requirements to acquire the land as well as building permits, approvals and an upgraded power supply.

With the location selected, and preferred treatment technology assumed, sizing and purchase of the river pumps to supply the plant occurred.

2.2 The Constraints

NEW set themselves a challenging task, not only was this the first North East Victorian town to receive an entirely new drinking water supply in three decades, but the project had to be delivered only six months after the endorsement of the business case. This allowed only a fraction of the timeframe normally allocated to projects of this nature, which limited typical project delivery paths such as Option Studies and Tender Processes, therefore necessitating the in-house approach. While this demonstrated NEW Management team had confidence in its staff to undertake such a project, it also highlighted that there would be resource consequences, and additional stressors on the day to day Operations activities.

The WTP budget allocation was approximately \$275k, which incorporated all WTP costs and associated contingencies, as well as a 100kl Clear Water Storage and excavation works.

One hurdle that was not anticipated, related to the lack of options for off-site discharges. As the township is not sewered, the various 'waste' streams such as treated backwash water and analyser supplies were to be managed within the site.

2.3 The Design (& Research)

Although NEW only had limited data on the Mitta Mitta raw water, some useful information was attained via an external 'data-warehouse'. The variation and upper concentrations in key parameters such as turbidity and colour presented the option of Direct Filtration as viable. North East Water operations staff had recent experience in fundamental plant design and construction, with the relocation of a packaged filtration plant to supply into the township of Bright (Scobie et al 2008).

Another key event which assisted with design and layout occurred via opportunistic coincidence. Key NEW operational and engineering staff arranged to visit Melbourne Water's Yarra Valley during March 2009 to assess options of relocating a series of direct filtration plants.



Although unable to achieve a timely outcome that would suit both parties, NEW staff gained valuable insight into design options and considerations for the Eskdale plant, particularly around plant layout and backwash management.

Town demand and therefore plant capacity were based on an “educated guess” due to limited available consumption data and the unknown variable in relation to potential change in customer behaviour. ie. From a flat annual payment of \$70.00/yr to a user pay system. It was decided that an educated 500kl/day plant would meet the present and future obligations of the community.

Coagulation-Flocculation was to be achieved with Aluminium Chlorohydrate (ACH) with provision of an Alkalinity source (NaOH) and Polymer dosing. Disinfection would be carried out using Sodium Hypochlorite.

Knowing that the Mitta Mitta River catchment has substantial agriculture, considerations on appropriate filter media materials were crucial. Add to this, the constraints involving backwash management, time and finance, the decision to use Activated Filter Media (AFM) was made. AFM is media designed as an option to replace sand where typically utilised. AFM has surface catalytic properties and a high negative zeta potential which compliments positively charged coagulants such Aluminium Chlorohydrate and Alum (Dryden 2009). Other benefits which assisted the decision to selection of AFM included the following claims:

- Cryptosporidium and Giardia control
- 30% improved solids removal compared with conventional media
- Reduce backwash water volume (30% reduction).
- Generate Life Cycle Cost saving and employ sustainable procurement
- Removal of iron and manganese (Dryden 2009)

Next, development of more detailed design which considered filter rates and sizes, dosing configurations, pump sizing, automation and control options and the online analytical monitoring instrumentation. The final design was carefully ‘sketched’, in general layout form, which became the key design map for the WTP. Unfortunately, the sketch was not adequate for the NEW Automation and Electrical group to develop the control logic, so with the assistance of a Graduate Engineer, a Process and Instrument Diagram (PID) was developed.

Finally, the backwash recovery process was designed with consideration of the nil discharge from site requirements. The design included a supernatant recovery system to include a Lamella Clarifier & control (ie. greater than 1 NTU backwash recovery shutdown) and Ultra Violet disinfection.

Further wastewater recovery initiatives were considered and designed into the project, for example the capturing the analyser water as well as a vegetation irrigation system housed within the WTP compound, providing an alternate reuse option.

2.4 The Build

Construction involved site preparation, shed fabrication (including office and lab testing area), installation of filtration components, as well as all other peripheral mechanical and electrical works. This involved the co-ordination of both external contractors and internal personnel. Remoteness of the site was a severe handicap, which often limited contractor assistance availability.





Figure 1: WTP filter cells with manifolds

The plant was immaculately finished in particular due to the Stainless Steel pipework and electrical workmanship. Overall the plant was designed and constructed with plenty of open space for operators to carry out routine work as well as maintenance. Figure 1 illustrates the finished filter cells.

The ability to utilise internal staff with "hands on" operational experience enabled layout and process alterations to be made during construction mode with minimum fuss which aided the project.

NEW's management system teams were continually invited and involved in the construction phase avoiding issues and complications at the end of the project because of their active involvement throughout.

The final cost of the WTP excluding the clear water storage was in the vicinity of \$180k plus \$75k for electrical and automation works.

2.5 Commissioning & Hand-over

The new drinking water supply for Eskdale was commissioned late November 2009. Less than ten days after the scheme was commissioned, new connection application forms were received by more than half the Eskdale residents.

A transition period followed, to fine tune and debug the processes, and conduct staff training. It was also critical to complete the less glamorous, yet critical activities such as Manuals, SOP's and Plant Log sheets. SDWA commitments were also undertaken including Risk Assessments, development of a Risk Management Plan, establishment of CCP's and critical limits, etc..... A precautionary Boil Water Notice was also implemented during this period, however after the first 3 weeks in operation, this was lifted due to 100% compliant results.



2.6 Operation

The treatment plant has maintained compliance in the 6 months of full operation, with excellent quality results. Average (NATA) results over the 6 months period are presented in Table 1.

Table 1: *DWQ results presented as averages for the period Jan- July 2010*

Parameter (unit)	Ex-WTP	Reticulation
Turbidity (NTU)	0.12	0.34
Aluminium (mg/l)	0.048	N/A
Free Cl ₂ (mg/l)	0.52 +/- 0.2	
THM's (ppb)	N/A	31
Iron (mg/l)	0.02	N/A
E Coli (orgs/100ml)	0	0
Coliforms (orgs/100ml)	0	0
HPC's	< 1	< 1

Typically the plant has been reliable, with minimal operator intervention. Average dose of 6 ppm of ACH has been required, and rarely changes. Dirty water events in the Mitta Mitta river are simply managed by switching off the plant and relying on supply of existing treated water.

The backwash management infrastructure is holding up well, with supernatant being returned as a shandy to the head of the plant throughout the winter months. To date (7 months operation), staff have not had to transfer a single load of sludge off site from the holding tank.

Since the introduction of the upgraded water supply, a customer survey has been conducted which generated an overall high (92%) level of satisfaction in relation to Drinking Water Quality key measures, being Taste, Smell and Clarity.

3.0 CONCLUSIONS

The Design, Build and Operation of the drinking water treatment plant for Eskdale was considered a significant achievement within NEW operations (& Electrical) departments. We do, however concede that such a project can 'stretch' both in-house ability and resources to achieve success, which highlights the need to carefully scope, resource and understand limitations before embarking on such an activity.

Ultimately, NEW staff delivered a stunning little water filtration plant which is functioning smoothly and delivering compliant drinking water to the small township of Eskdale.

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