

LIFTING THE LID ON FILTER COVERS



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ABSTRACT

Covering Water Treatment Plant (WTP) filters generally presents some challenges with solutions typically drawn towards do nothing, various fabric covers or a carport style hard roof. But what if these solutions are not fit for purpose? Goulburn Valley Water's (GVW) Pyalong WTP slow sand filters are GVW's only slow sand filter type and these have been experiencing some performance issues contributed by sunlight generated algae growth. A permanent ridged cover is the obvious solution, but how do you get in to inspect filter operation and maintain the filter media. A series of sliding covers turned out to be the preferred answer.

The four filter beds are each 2.5m wide by 10m long resulting in a roof area of 10m x 10m over the four filters. One single cover was not the answer, so the option was to look at a best fit for this site. This sounds like an easy task but in theory this is not without some technical challenges. These include the difficulty of getting quotations without technical drawings, material to be used and consideration to a number of what if's. A few conversations later and sketches transform from conventional shed arrangement fitted with rollers doors to roller doors mounted in a horizontal plane to the final version of a series of sliding panels on two levels engineered to allow staged access to the four filter beds.

Once fabricated the solution speaks for its self.

1.0 INTRODUCTION

This paper is focused on media filters. Over the last 5 years filter performance has become highly scrutinised with instrumentation being installed on the outlets of all filters to verify each filters performance. GVW has identified the turbidity level of the outlet of the filter as a critical control point. Filter inspection have become more formalised and operator training both on and off the job has occurred. Taking this forward there is now an emphasis on protecting filters from contamination that can cause the filter to degrade resulting in poor /less than optimum water quality.

GVW has 33 full WTP's. Of these, 22 have media filters for the filtration process. These are made up of DAFF, direct filtration and slow sand filtration.

The status of the current types of covers is all the DAFF filters are covered, which was part of the original construction of the plant. The types of covers vary in their design but can be grouped into a class called "shed type covers fitted". These structures are a necessary part as the integrity of the filter float would be compromised without them.

The remaining filters are part of Conventional, Direct Filtration plants or slow sand filtration plants. Four of the conventional plants are package conventional plants that have had sheds built over the whole plant. This was a viable option due to the small size and relative low cost at the time of construction.

DAFF	Slow Sand Filtration
Shed type cover fitted over filters Rushworth WTP Cobram WTP 2 Alexandra WTP Bonnie Doon WTP Kilmore WTP Tatura WTP Kyabram WTP	Sliding covers fitted over filters Pyalong WTP (New 2013)
Shed type cover fitted over whole plant Kyabram WTP Shepparton WTP 1	Conventional
Membrane Filtration	Pressure filters - covers not required Shepparton WTP 2 Nathalia WTP Numurkah WTP
Shed type cover fitted over whole plant Colbinabbin WTP Dookie WTP Girgarre WTP Katamatite WTP Katandra West WTP Stanhope WTP Upper Delatite WTP Nagambie WTP	Shed Type Cover fitted over filters Mansfield WTP (New 2012) Murchison WTP (New 2012) Yea WTP
	Shed Type Cover fitted over Whole Plant Tongala WTP Barmah WTP Picola WTP Longwood WTP
	No Covers Fitted Shepparton WTP 3 Shepparton WTP 4 Euroa WTP Seymour WTP
	Direct Filtration
	No Covers Fitted Cobram WTP 1 Broadford WTP

Figure 1: *Types of WTP's and Filter Cover Arrangements at GVW*



Murchison WTP



Pyalong WTP

Figure 2: *Examples of Algae growth found in Filters*

During GVW filter inspections and maintenance works over the last 5 years vegetation matter, algae, plastic media bags, plastic temporary signs, pipe and fittings thrown into a filter by vandals have been uncovered as various forms of contamination. These all contribute to degrading the operation of a filter in different ways.



Cobram WTP

Kilmore WTP

Mansfield WTP



Murchison WTP

Alexandra WTP

Pyalong WTP

Figure 3: *Photos of Traditional Style Covers over Filters at GVW Sites*



Pyalong WTP

Figure 4: *Example of non traditional Poly tarp Filter Cover*



Shepparton WTP Filter

Murchison WTP Filter

Figure 5: *Examples of Objects found in Filters*

2.0 DISCUSSION

Some progress has been made at Mansfield WTP, Murchison WTP and Pyalong WTP sites in the last couple of years to alleviate the contamination of the filter media. The detail of these in particular at Pyalong will be the focus of this paper.

2.1 Mansfield 2012

Low cost option cost \$7K the carport style cover (8m X 12m) installed over both the clarifier and filters this site suffered from twig, branches and leave ingress due to some nearby trees during strong wind. This material was migrating through the filter coal and binding in the media. The feedback from the site operator has been very positive with a noticeable reduction of ingress of vegetation as well as a reduction of algae growth of over 60%. Further works are planned at this site to cover some of the sides to further reduce the ingress and algae formation. One of the concerns from the operator was available natural light for the purpose of inspections and maintenance activities if the sides are enclosed. It is interesting to note that with plenty of roosting point for birds that there has been no activity seen in the 12 months the structure has been in place.

Operator will continue to monitor into the future.

2.2 Murchison 2012

Medium cost option (34K) \$8K for the filters cover, \$19K for the clarifier and \$7K to install connecting cat walk linking the filter and clarifier. It was necessary at this site to have covers installed over both the clarifier and filters as separate structures. This site suffered from twig, branches and leaf ingress due to some nearby trees on an ongoing basis. The site also had evidence of considerable amount of bird droppings present around the filters and clarifier. At the time the covers were installed the filters also underwent a rebuild with filter nozzles and filter media replaced. The deposit of vegetation within the filter was to such a state that backwashing was not able to remove the load.

Operator feedback on filter performance was that algae has been eliminated resulting in time savings and due to the structure being bird proof the loading from faecal matter had been eliminated.

2.3 Pyalong 2013

High cost \$ 74,000 this site had sliding covers installed made up of four doors (total cover 10m X 10m). This enables any 2 filters to be open at any time. As a slow sand filtration plant it has a larger labour component than a traditional filter, as typically on an annual basis the filters require scrapping as the media surface block. The Pyalong filters rely on a combination of the media sieving particulate from the water as well as there being biomass activity within the filter. The big issue for this site was algae. Over the past 15 years there have been various forms of temporary covers use over the filter, these have varied from 90% shade cloth or poly tarp type products. There has also been OH&S risks regarding installing and removing these.

Operator feedback at this time is not possible as the install is so new with works only being finished at this time.

2.4 What is the best cover for each application?

2.4a	What is the purpose of covering the filter? <ul style="list-style-type: none"> • Prevent the formation of algae. • Prevent vegetation/foreign matter from blowing into a filter. • Prevent access /vandalism? • Preventing disruption to the filter float (DAFF)
2.4b	What access is required and for what purpose and frequency?
2.4c	How is new media to be installed into the filters?
2.4d	Is there an ability to observe the filter operation?
2.4e	Is there any requirement for emergency retrieval of personal?
2.4f	Does entry or exit require consideration of working at heights?
2.4g	Guttering? Will the structure require guttering? If so how will it be cleaned? Is gutter guard an option?

Pyalong WTP Filter Cover

2.4a	Prevent the formation of algae
2.4b	Pyalong filters require access to scrape the top surface of sand on an annual basis. This requires 2 staff with the aid of a small size excavator to lift the removed sand out of the filter space. (This activity was previously performed via a bucket and rope) For this task to occur clear access is required or a special piece of equipment would be needed.
2.4c	Typically via 1000kg bulk bags with the aid of a crane.
2.4d	Natural light verse preferred A current issue with the temporary covers over the filters can be the inability or hindered ability to observe the operation of the filter (see Figure 4)
2.4e	GVW in the past has assumed that in an emergency ring 000 and the CFA would be able to get the person out. The new approach is to have the ability to remove personal from the work site to normal ground level whether that is from heights or depths as part of the rescue plan. A tripod can be set up between the filter entry platform and the sliding cover for the purpose of rescue of personal with a sliding cover.
2.4f	Filter height is about 1.8m from the top of filter to media
2.4g	No guttering required.

2.5 What to Build at Pyalong?

The design started out as a carport/enclosed shed sketch. The above questions were then asked with the result – This is not going to be fit for purpose. Some other options were then looked at including roller doors mounted in a horizontal plane to the final version of a series of sliding panels on two levels engineered to allow staged access to the four filter beds.

This option allowed for unimpeded access to the filter for an excavator to remove the sand out of the filter space while performing filter scrapes. Reinstalling/topping up media would remain a simple exercise. Access in and out needed to be addressed any way so there were no negative affect there either.

2.6 The Way Forward

We now know what we wanted the easy way would have been to run a design and construct contract but as we knew what we wanted and there being no process component we opted to go to some local fabricators. Both parties advised that they would need to engage an engineer to design the covers. GVW then elected to engage a engineering consultant on its own to enable input to the design. Deacon Engineering Shepparton easy engaged to turn our concept into shop drawing with a cost estimate for manufacture and installation of \$50,000. This would allow quotations for manufacture and installation to be arranged with relative ease.

After a couple of meetings to fine tune the design, a final design was complete with some important features.

- Each door had to be light enough to enable one operator to open and close.
- Natural light had to be reduced to about 95% (eliminate algae growth)
- Materials were required to offer good corrosion resistance increasing asset life.

Material used

- Doors - Aluminium angle construction
- Roof sheeting – Aluminium (Permalite light 0.7mm) Colour - Sahara
- Tracks and support posts - Hot dipped galvanised mild steel.

The benefits of the Pyalong sliding cover design over solid roof structures

- Ability to slide the cover away leaving unhindered access for machinery
- No need to remove the roof for media replacement.
- Able to view the whole filter in natural light.
- No lighting required.
- Easy and simple method of opening and closing.

3.0 CONCLUSION

A major part of this paper has looked at the process involved in the design of the correct filter cover. It must be noted that with conventional type plants the same process needs to be used on the clarifiers and connecting open troughs through to getting optimum algae removal as well as total reduction of ingress leaf litter.

It is essential to consider all the activities that occur within the filter cell now and in the future and how the cover will affect performing the activity. Consideration to ensure the cover to be built is fit for purpose and that this also includes the entry and exit to the space as well as emergency retrieval of personal. If these factors are covered the desired outcome of an operator friendly cover that is fit for pupose will be a deliverable outcome.

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