Filters for a Greenfield Site

AWI has made a very good living over the years replacing filter underdrain systems in existing filters. Despite the fact that AWI is known for retrofitting existing filters that had underdrain systems manufactured by others, don't overlook the capability AWI has to provide a unique and economical approach for greenfield site granular media filter designs or the addition of new filters to an existing treatment facility.

THE QUESTION

Constructing new filters represents an opportunity that is relatively rare these days – the designer gets to start with a clean sheet of paper. As a result, the question becomes, "What is the best available filter design for the client?" The answer to that question involves balancing a number of criteria:

- Filter equipment costs
- Facility construction costs
- Underdrain system reliability
- Underdrain system repairability
- Filter operating cost

In other venues we have talked about how AWI Underdrain Systems perform when it comes to reliability and repairability. The answer is that they are exceptional or AWI would not be able to offer its precedent setting 5 year comprehensive warranty. Similarly, AWI Underdrain Systems accomplish distribution of backwash water and air scour air to exacting standards well beyond industry norms so that filters are properly maintained and operating costs are minimized. That leaves the key issues related to cost.

THE ADVANTAGE

When constructing new filters, AWI has a unique advantage that minimizes overall project costs. Often, AWI Underdrain Systems are not the lowest cost if one takes a shortsighted view and looks only at the price paid for filter underdrain equipment. Fortunately, equipment cost is only a fraction of the total cost of a filter installation. The key cost advantage that AWI Phoenix™ Underdrain Systems possess is their ability to accommodate almost any filter geometry. When laying out a filter, the filter designer can seek out the optimal combination of reliability and

construction cost without concern for accommodating constraints imposed by the filter underdrain system.

Consider these points regarding filter layout with AWI Underdrain Systems:

- There is no need to excavate to an elevation well below the filter floor and pour concrete for a filter gullet to distribute backwash water – with or without a gullet beneath the filter floor, AWI Underdrain Systems can evenly distribute water and air for cleaning but eliminating a gullet beneath the filter floor is much less costly
- AWI Underdrain Systems impose few limits on filter dimensions – underdrain laterals can extend up to 60 feet from the point at which they are fed to their capped end and distribution of flow to individual laterals is tightly controlled without excessive headloss
- Air for air scouring can be fed to the underdrain laterals from above the laterals, below them, or from one end of the filter
- The strength of stainless steel AWI Underdrain Laterals means that no costly control provisions need to be made to modulate air flow to the filters for air scouring in order to prevent damage to the filter underdrain system – just open the air scour valve and get on with the backwash cycle without concern for the integrity of the AWI Underdrain System

In order to achieve the greatest possible economy, the designer must pay attention to items such as pipe sizes, pump sizes, blower sizes, and how much of the facility's capacity can be taken off line at one time for filter cleaning but with AWI the constraints imposed by the filter underdrain system are few.

THE ANSWER

You might ask yourself the question, "What is the most economical way to design a filter using an AWI Underdrain System?" The best answer to that question draws upon a very traditional filter layout called an "H" gullet design (we think the old timers got it right) and then takes advantage of the unique characteristics of AWI Underdrain Systems:

- Start with a very low profile underdrain – the AWI Phoenix Underdrain System – so that the desired filter media selection can be placed in the filters with the lowest possible filter wall height
- Build a central "H" gullet - backwash water for cleaning and air for air scouring can be fed through the bottom portion of the "H" and dirty backwash water can be drawn off from the filter troughs through the top portion of the "H"

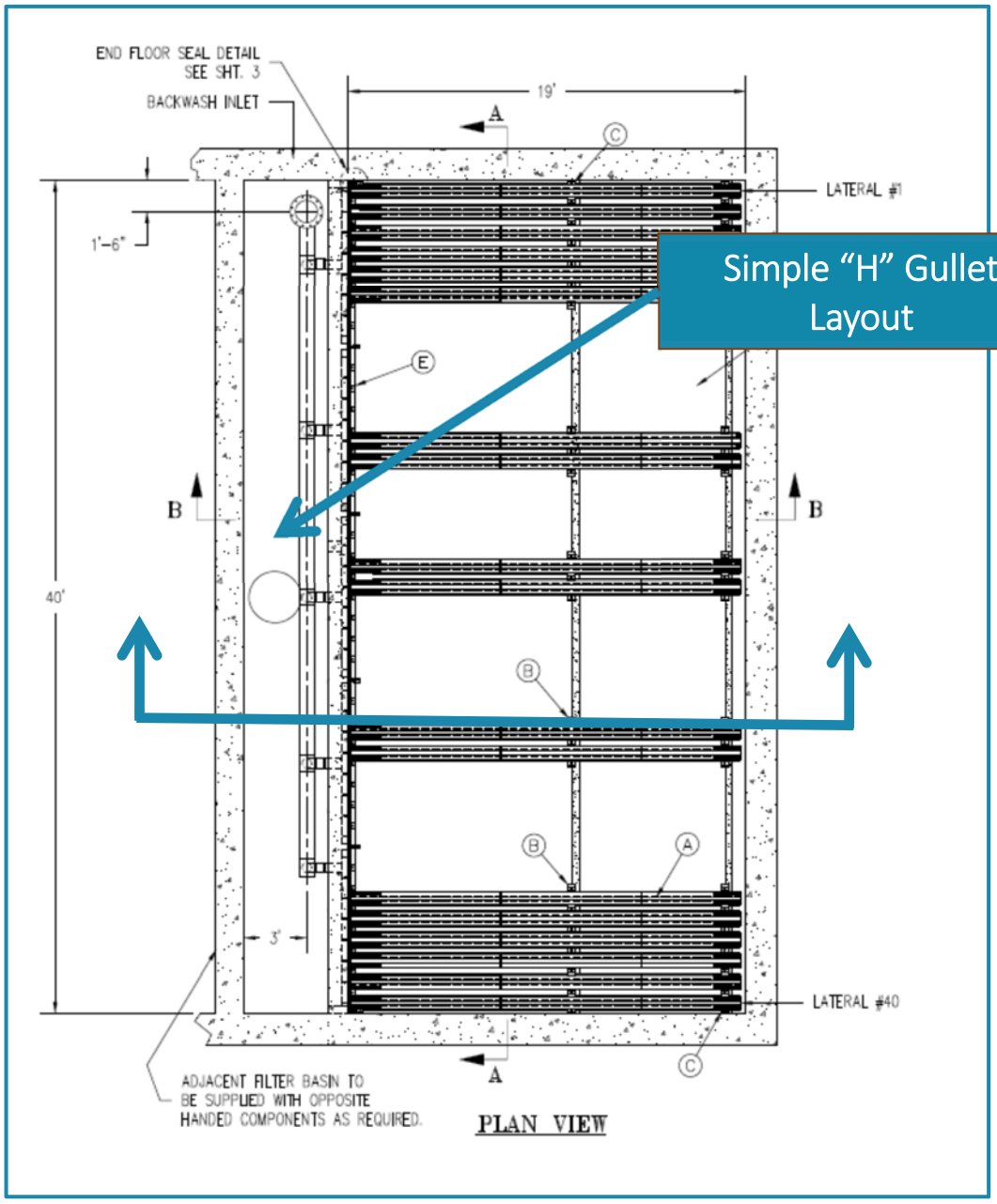


Figure 1 – Plan View of a Filter with an "H" Gullet Layout

- Filters can be aligned down one side of the "H" gullet or down both sides
- Make the filter width and length as close to equal as possible so the filter dimensions approximate a square – this minimizes the total lineal feet of wall resulting in less concrete to be poured
- Block out a slot at the bottom of each filter cell wall to connect from the bottom of the "H" gullet to the filter underdrain system and AWI will take it from there
- Installation of a feedplate over the slot at the bottom of one filter wall for each filter as shown in the following illustrations allows even distribution of both backwash water and air for air scouring

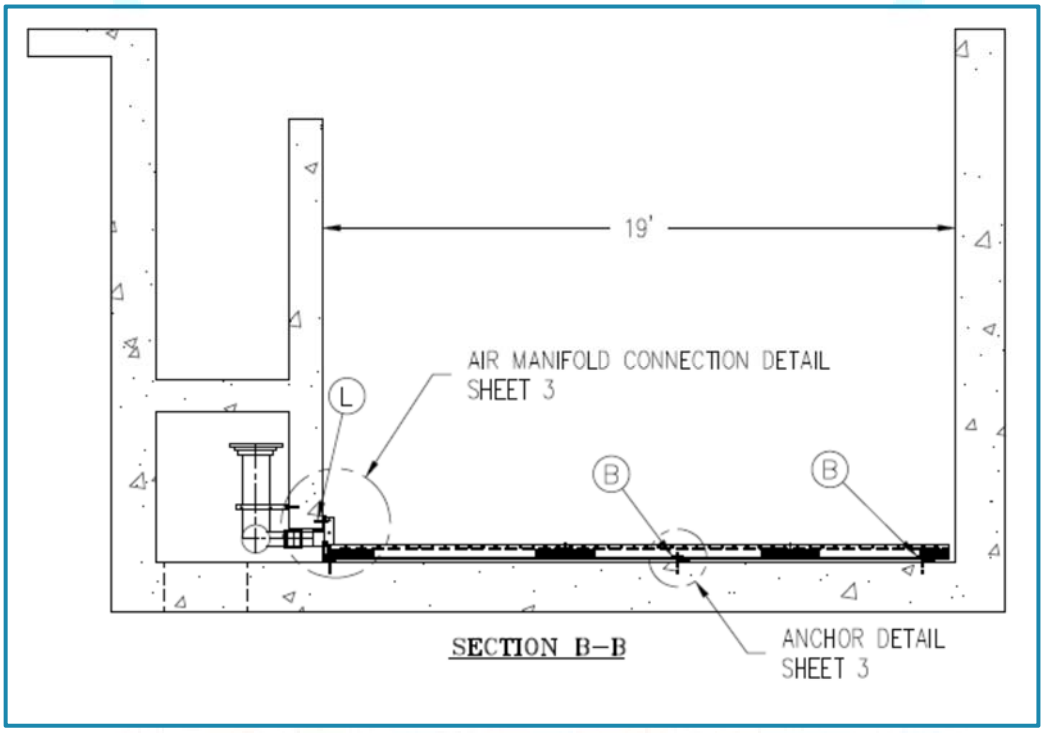
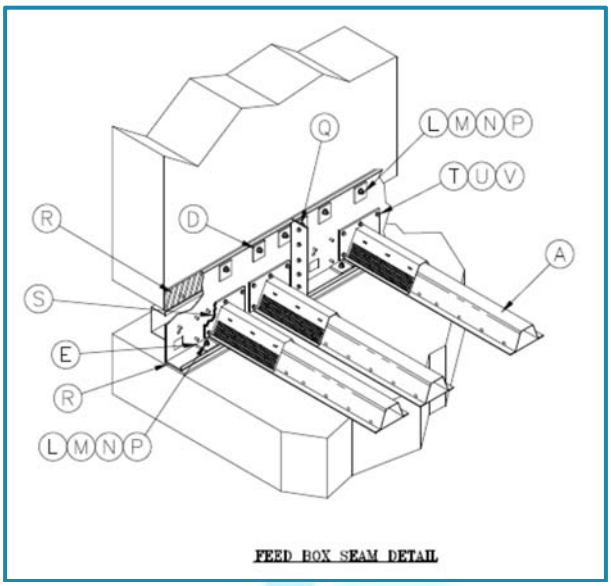
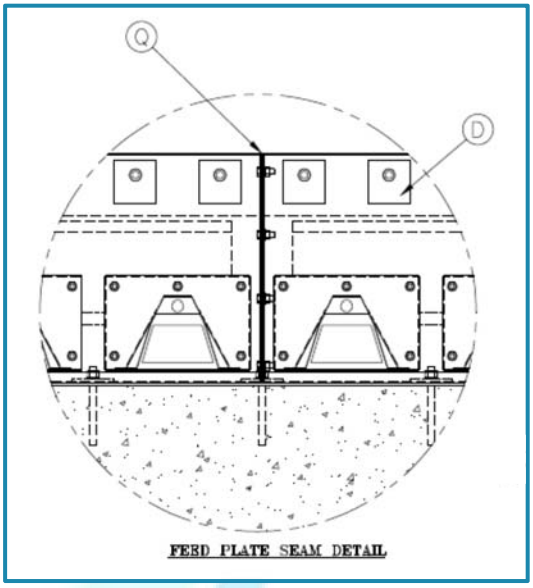


Figure 2 – Section of a Filter with an "H" Gullet





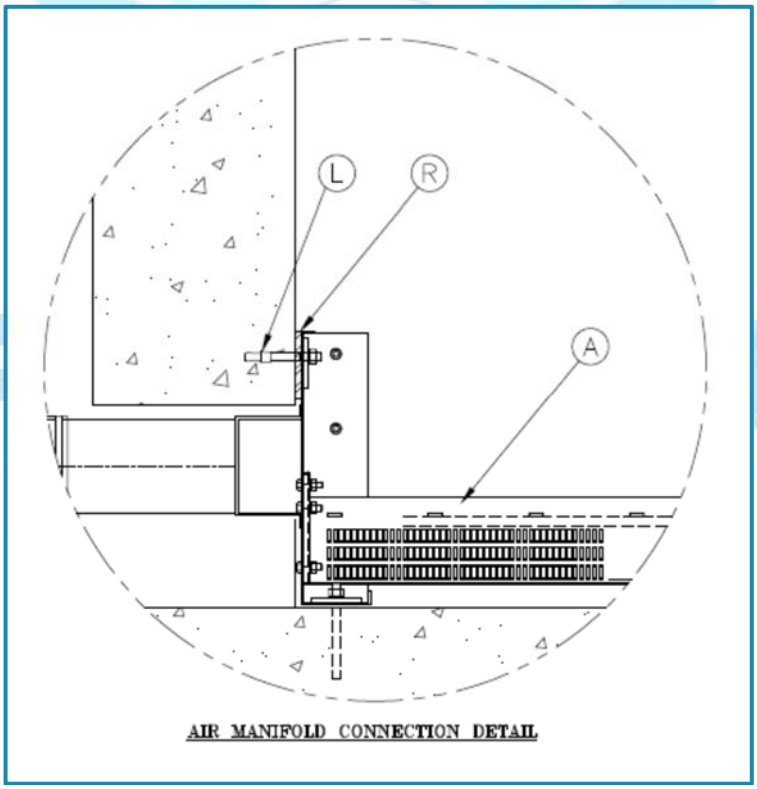


Figure 3 – Details from a Filter with an "H" Gullet

AWI....Leaders in Filter Optimization

MANAGING RISK

There is one more aspect to consider when designing a facility around AWI Underdrain Systems and that is the management of project risk. Risk management always has a value but that value can be difficult to quantify. Nonetheless, I think everyone can agree that less risk is better than more risk.

AWI Underdrain Systems improve a project's risk posture in three ways:

- Durability/Reliability – Filter underdrain system failures are far from rare. They are both costly and they tend to occur at the most inopportune times taking the affected filters off line for a substantial period of time. Try opening Google as a browser, search on the phrase "filter underdrain failure", and see what you get. You will see many modes of failure by many underdrain systems but you will not see a failure by an AWI Underdrain System.
- Repairability – AWI Underdrain Systems can be disassembled by unbolting and later reassembled at modest cost. This feature allows AWI to make repairs in the rare instance when they might be needed but, more importantly, AWI Underdrain Systems can be repaired when problems totally unrelated to the underdrain system arise. Problems that AWI has seen and helped customers to address without replacing underdrains include;
  - Having material that has accumulated in a clearwell backwashed into the underdrain system
  - Having construction debris backwashed into the underdrain system
  - Having paint peel from the inside of filter gullets
  - Experiencing an earthquake
  - Dropping a heavy object from a crane onto underdrain laterals
  - Having a filter sit empty so that accumulated dried growth sloughs from the walls of the backwash water supply circuit and is backwashed into the underdrain system
- Life Cycle – Thanks to the durability of its stainless steel design and construction, AWI Underdrain Systems that were installed 25 years ago still look like new. We conservatively estimate the design life of the underdrain system to be 40 years. In contrast, AWI has frequently replaced other types of filter underdrain systems that have been in service substantially less than their 20 year design life.
- Warranty – AWI has sufficient confidence in the durability, reliability, and repairability of its underdrain systems that we back AWI Underdrain Systems with a comprehensive 5 year warranty. In this case, the word "comprehensive" means that the warranty covers

not only the underdrain system as a product but also the costs associated with getting access to the underdrain laterals, making any needed repairs, and placing the affected filters back into service

We submit that there is very significant value associated with mitigating project risk to this extent.

CONCLUSION

By taking advantage of the flexibility that AWI Underdrain Systems provide, a designer can build a filter that will perform better – improved distribution of backwash water and air for air scouring – at a lower overall capital cost than can be achieved with designs based upon other types of filter underdrain systems. Key cost saving elements include:

- Lower filter walls
- Less total length of filter wall
- No additional excavation or concrete work for a gullet
- Simpler concrete form work
- Long service life
- Less project risk

AWI would welcome the opportunity to demonstrate the capabilities that we have discussed here.