Pennsylvania AWWA
American Water Works Association

The McCaysville Story: How to Rehabilitate a Filter in Seven Days

Prepared and Presented by Hollie Scott of AWI

Your Mission (should you decide to accept it) Is:

- Retrofit filter underdrains into two existing filters
- Gain head space in the filters for a more effective media selection
- Minimize the potential for filter underdrain failure
- Insure that the filter underdrain laterals can quickly be removed and reinstalled in case there are any hiccups (there were)
- Make provision for future use of air scour to improve filter performance
- Do

- **Do it all in seven days**

Reasons for Upgrading Filters

- Improve filter performance with a better media selection (greater media depth and an upgraded media selection)
  - Lower treated water turbidities
  - Reduced disinfection by-products precursors
  - Better control during adverse conditions (turbidity spikes, algal blooms, etc.)
- Improve backwash performance to maintain media performance long term
- Prevent media migration into the underdrain system
- Improved conservation of water through increased filter run times or achieving proper filter cleaning at lower overall backwash rates
- Eliminate the risk of failure at an inopportune time
- Improve the maintainability of the filters

The Background at McCaysville

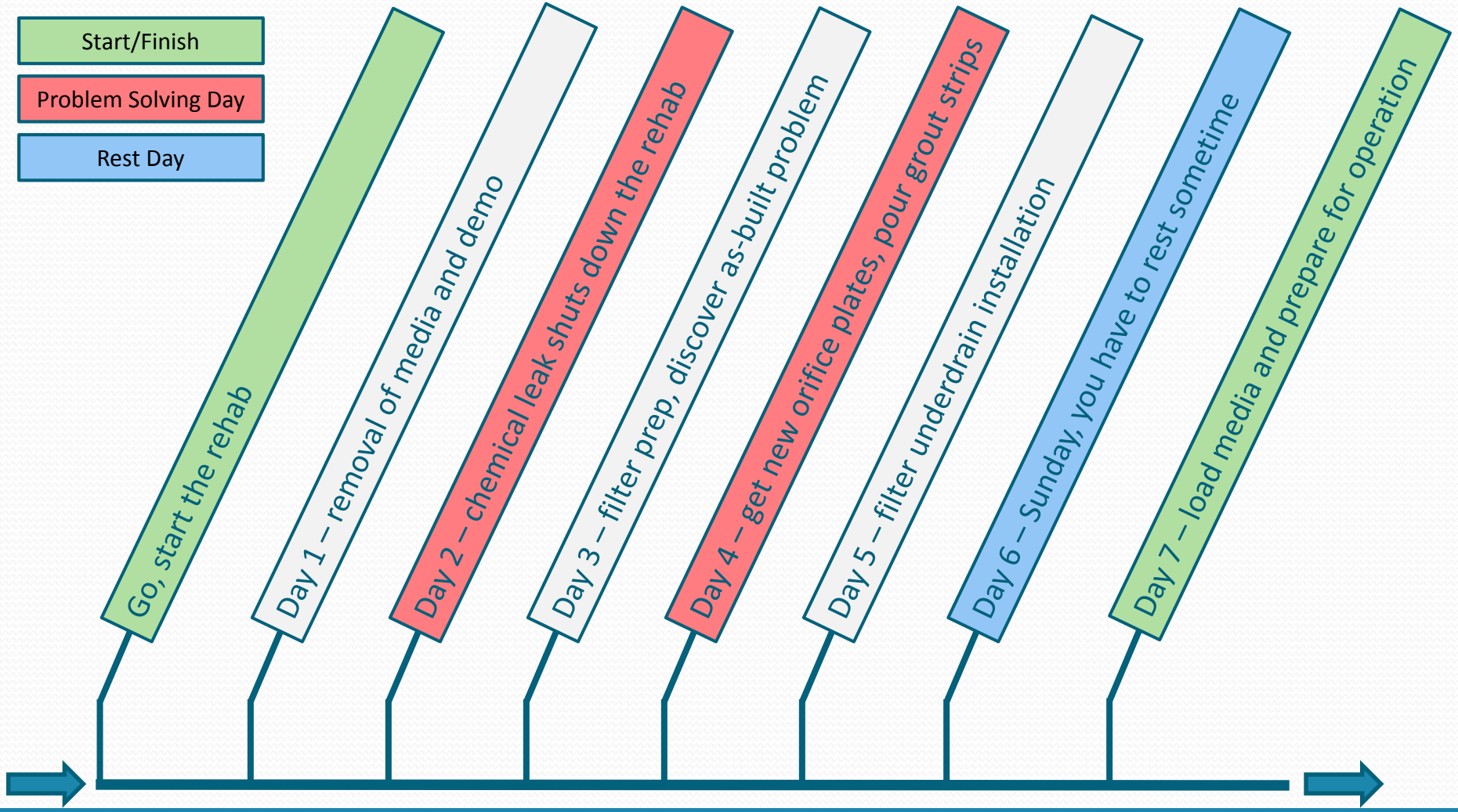
- The existing plant was built in 1981
- The peak capacity at McCaysville is 1 million gallons per day
- There are two (2) filters
- The filter dimensions are 12’ x 15’
- The deteriorated underdrains being replaced are clay tile blocks
- Stevenson & Palmer Engineers directed the upgrade
- Critical production needs dictated that each filter underdrain upgrade be accomplished within a very tight time window

- The job was to be completed in seven days which ultimately included only roughly three full work days

The Steps in Upgrading Filter Underdrains

- Remove the media from the filter
- Demolish the existing filter underdrains
- Clean and prepare the filter box
- Backwash to clean the piping and gullet
- Backwash again
- Pour grout strips around the gullet
- Install the filter underdrains
- Load new media
- Place the filter in operation

The McCaysville Timeline



Flush the Backwash Circuit Before Installation Begins

Then Flush It Again

- Here's why

- You would be amazed at what gets thrown into filters during construction
- The most common form of catastrophic failure in filters is backwashing material (to put it nicely) into the back side of the underdrains
  - Can happen with construction debris
  - Often happens when deteriorating grout allows media into the underdrain and clearwell

Start with a Clean Filter – Demolition Has Been Completed

Pour the Grout Leveling Strips

- Shoot the elevation of the existing floor to determine the height of the leveling strips
- Install forms to contain the grout and set the proper elevation
- Pour grout within the forms

THIS IS WHAT YOU GET

Every Once in a While Disaster Strikes

- Surprise, surprise – the as-built drawings didn't match reality
- The filter gullet dimensions were different than shown
- Why is this important?
  - The cross-sectional area of the gullet determines the velocity of flow in the gullet
  - If the velocity changes, the rate of flow into the filter laterals will change
  - Normally, this is accounted for by varying the size of the primary orifices that control flow to the laterals
  - If the cross-sectional area of the gullet changes then the rate of flow to the laterals will be different than the design for the filter
  - Result – uneven distribution of backwash flow, poor filter cleaning, and potentially short circuiting through the filter and/or mudballing
- What do we do now???

Fortunately, this Isn't Our First Rodeo – a Few Studs Can Come in Handy

- Gullet dimensions have been wrong before
- The primary orifice in each lateral where the lateral spans the gullet is made with studs to attach new orifice plates just in case

- The call went out for new orifice plates and they were resized immediately
- New orifice plates were manufactured that afternoon and airfreighted out for arrival in McCaysville the next morning
- New orifice plates were attached to the studs – the McCaysville filter rehab remained on schedule

LATERAL INSTALLATION

- Filter underdrain laterals were custom designed specifically for the McCaysville filters
- The primary orifices located on the under side of the laterals vary in size for each lateral down the length of the gullet - key for good distribution
- Because of the varying primary orifice sizes laterals have to be installed in numerical order starting with the #1 lateral at the backwash inlet

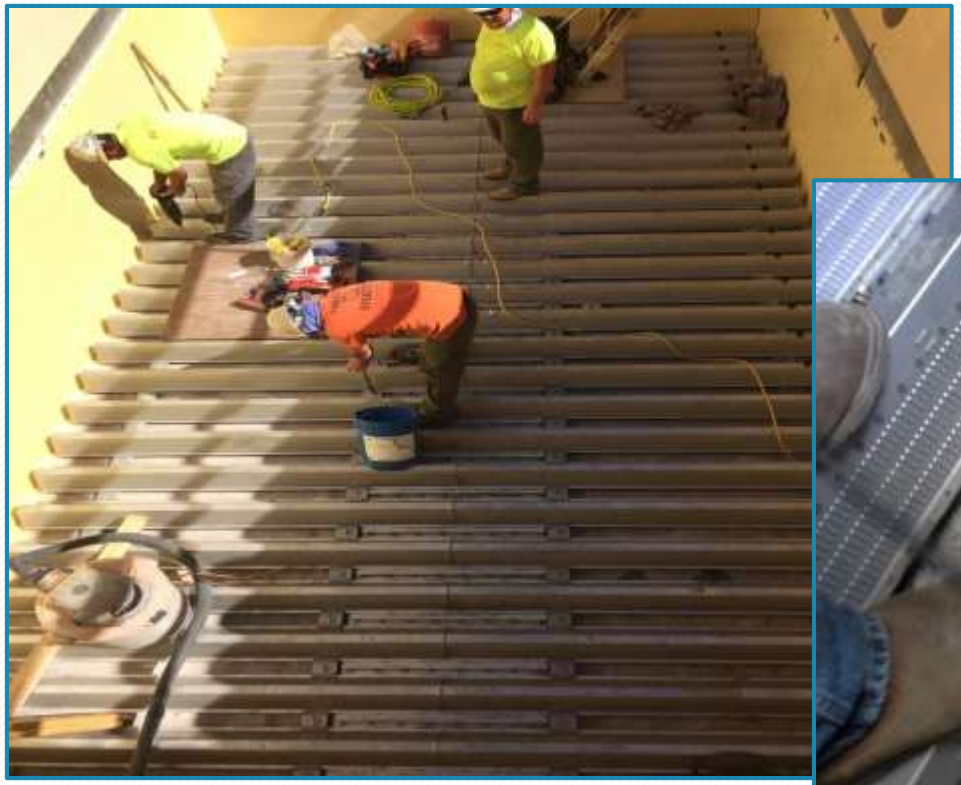
INSTALLING LATERAL #1

Remaining Laterals Except the Last One

- Laterals #2 through the next to last one are installed in order and bolted together at the seal plate connection flange
- Laterals are shimmed at the grout leveling strips

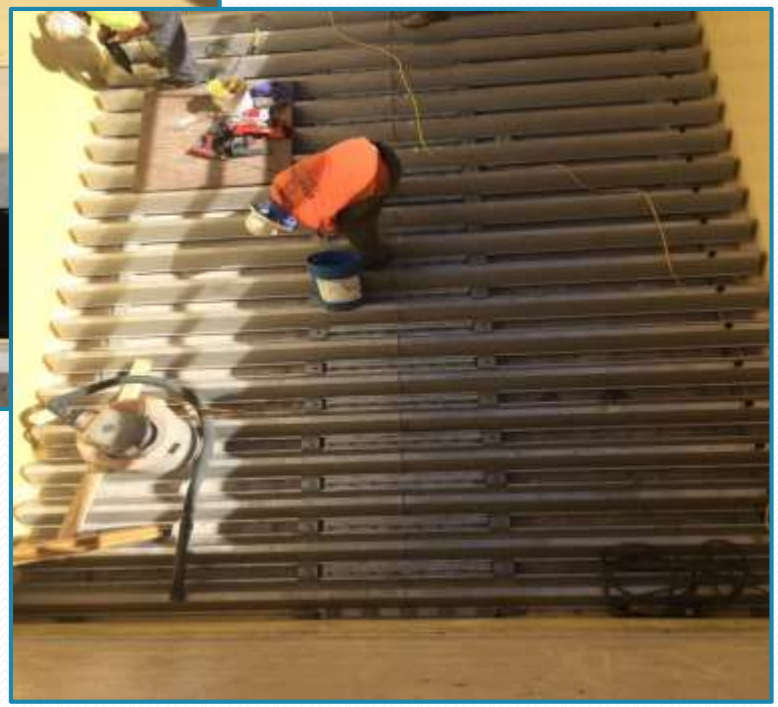
Last Lateral Installation

- In between each lateral adjacent to the grout seal strip anchors are installed to a minimum embed depth of 4½ inches



Anchors Installed

- The last lateral is installed using the previously poured 4 inch end plug opposite the backwash inlet



Here Is What McCaysville Looked Like

The McCaysville Gullet and Filter Underdrain Laterals

THAT'S HOW MCCAYSVI ABBED A FILTER IN S S

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Mission Accomplished!

Questions? Comments? What Do You Think?