Hysham Notes for 3/10/2023

Understand why the clear well effluent turbidity is not stabilizing.

- We felt good about our progress today and think we have found plausible root cause for the elevated turbidity at the distributions system point of entry. It appears that a relatively thick layer of material at the bottom of the clearwell is causing the turbidity. The material is a mix of small pebbles, small black particles, and a dark brown flock. The flock is very light, is easily stirred up, and settles slowly. It seems like this light flock might be agitated in the clearwell by the influent and pump starts causing the turbidity increase in the clearwell. Images of the material collected from the bottom of the clearwell are shown in Figure 1 and Figure 2.

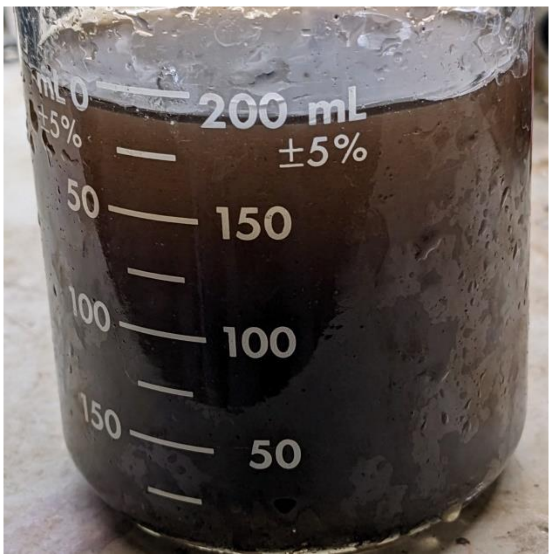

Figure 1 – Sample of material vacuumed off the bottom of the south clearwell.

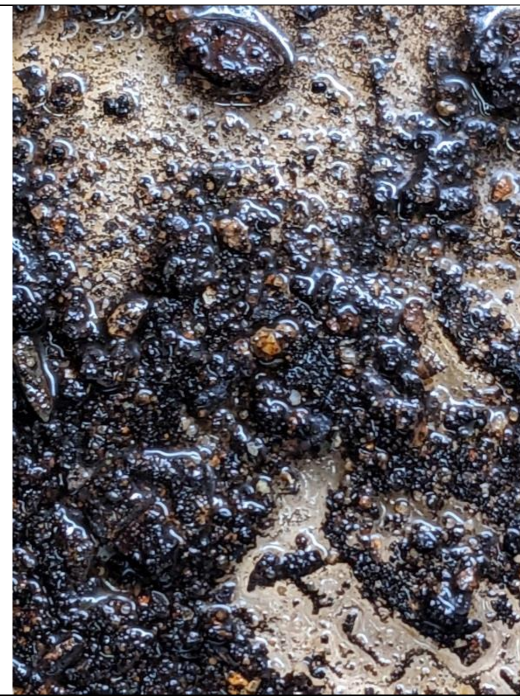

Figure 2 – Solids vacuumed off the bottom of the south clearwell after decanting fluid and lighter solids off. Material appears to be fine pebbles and dark particles.

- Material was vacuumed off the bottom of the clearwells using a homemade airlift pump shown in Figure 3. We pumped a mix of water and solids from the bottom of the clearwells into a clean bucket. We could feel the layer of material at the bottom of the clearwell and very approximately estimate thicknesses. The south clearwell had maybe ½” of material at the bottom that had accumulated since cleaning in 2022. The north clearwell had maybe 3” of material that had accumulated since the 2017 cleaning.
- The material at the bottom of the clearwell included pebbles, small black particulates, and a light flock. The pebbles are presumed to be from aging concrete in the clearwell. The black particulates and flock are presumably precipitated iron and manganese. We attempted to reduce the precipitates using citric acid as shown in Figure 4 with a generous amount of citric acid. The acid did remove some color from the solution and may indicate reducing the oxidation state of suspended manganese and driving in into solution where it is clear. It is also possible

that the acidity of the solution helped to digest suspended manganese into solution. We could try to duplicate the experiment with a less acid reducing agent like vitamin C. The flock is very light and takes a long time to settle.

Figure 3 – Homemade airlift pump used to vacuum material from the bottom of the clearwells.

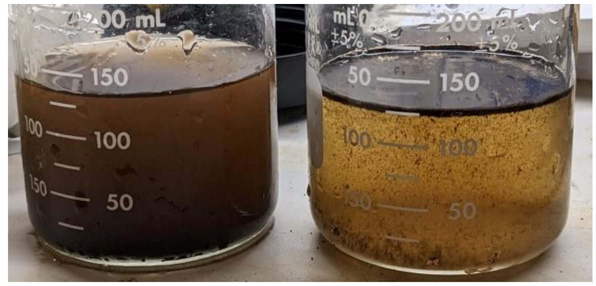

Figure 4 – Material from bottom of clearwell. The right sample has been reduced with a generous amount of citric acid which seemed to bring some of the material into solution consistent with the black material being oxidized manganese.

- We used a homemade tank sample thief shown in Figure 5 to collect clean water samples from different levels in the clearwell for turbidity testing. Result of the testing are documented in Figure 6 and showed a significant increase in turbidity as the filter effluent at 0.04-0.06 NTU entered the first clearwell and increased to 0.32-0.65 NTU. The turbidity further increased to 0.77-1.27 NTU in the second clearwell. Turbidity at the distribution system point of entry was 0.75-0.88 NTU measured by the analyzer and with a grab sample on the discharge of the high service pumps. This data seemed to support the theory that some of the turbidity observed at the distribution entry is being picked up in the clearwells.

Figure 5 – Homemade tank sample thief used to collect clean water samples from different levels in the clearwell for turbidity analysis.

Optimize filter / CAC unit backwash / rinse cycles

- Bill and Roy increased CAC rinse time from 800 to 1000 seconds
- Bill and Roy increased CAC air + water cycle from 160 to 320 seconds

Review proposed changes to the daily paperwork.

- We reviewed the new paperwork process that was discussed a few weeks ago. 14 copies for the daily forms were delivered in their own binders and we practiced filling them out today. Recording turbidity and chlorine every 15 minutes is an additional workload, but we like the process in Forsyth. It helps us identify operational changes quickly and the organized records are useful for troubleshooting.

- Roy is preparing a list of flush and backwash times for the past month that we can use to correlate with operating performance.

Spec Improved Permanganate Pump

- We re-installed the IWAKI 4.3 GPH diaphragm pump from Forsyth on the permanganate system to address the other pump seeming to wander from its setpoint. Getting the pump to prime / pump took a lot of troubleshooting and time. We never found a root cause for the problem, but it finally started pumping. The pump was set at 100% stroke length and 30% rate. Flow was 100 ml/min on the downgauge equating to about 1.25 ppm. The flow as 200 ml/min at the start of the day or 2.5 ppm. We decided to test the impact at lower rate for a few days because we have stopped seeing improvement.

The following items are still in progress:

- Spec Improved Permanganate Pump
- Prepare Diagram with parts list for chlorine system repairs.
- Troubleshoot inlet flow controller if plant is off
- CAC losing level
- Troubleshoot ALUM pump which is pumping about 25% of pump curve.

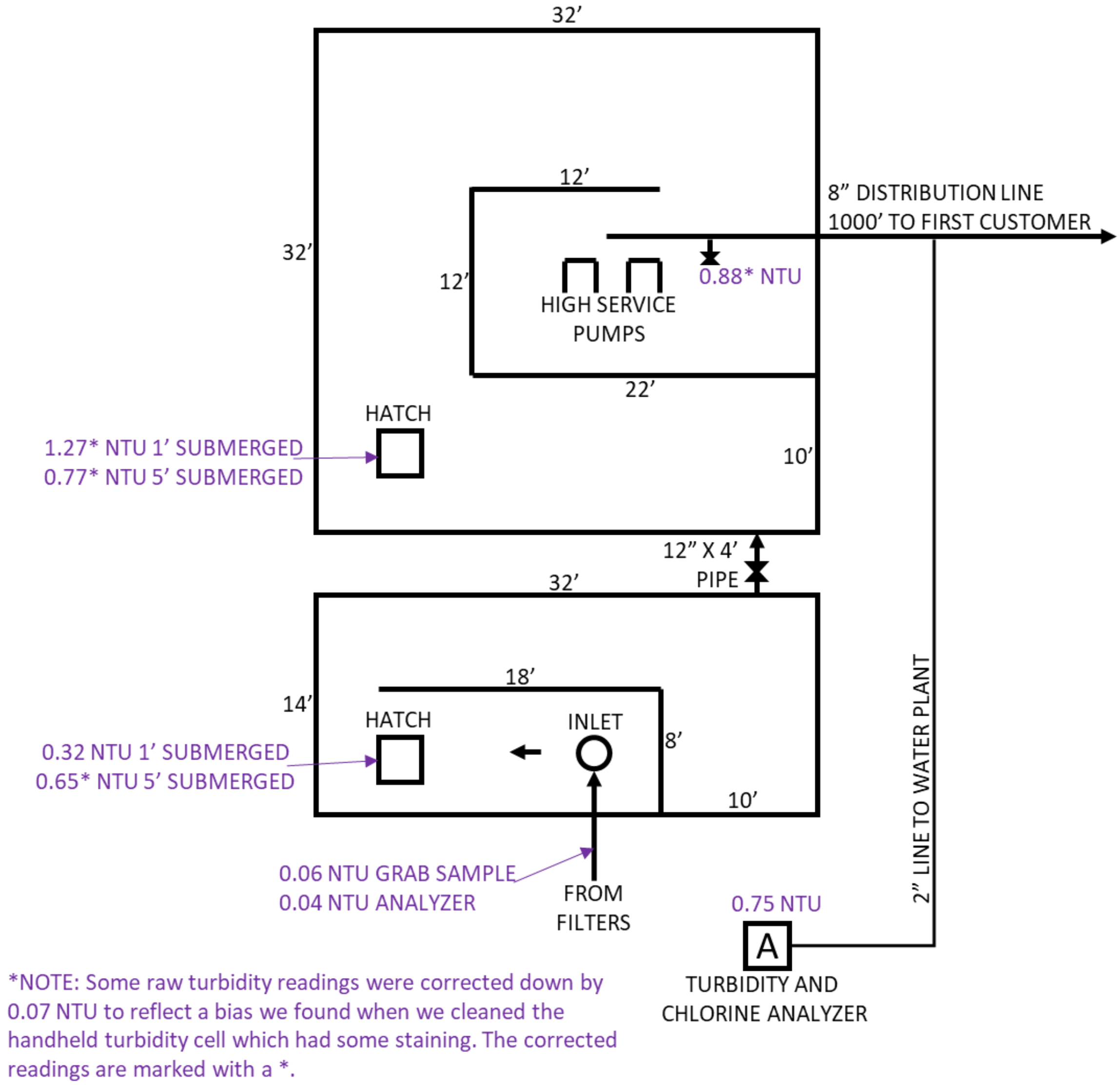

Figure 6 – Clearwell configuration showing turbidity sample results and a rapid increase in turbidity when the clean filtered water enters the clearwell.