Stacked Rapid Sand Filtration - Pilot Scale

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1. Develop new hydraulic conditions when using 5-gallon bucket instead of 6-qt.
   (a) New alum concentration needed, can be of a higher concentration than previous designs due to lower flow rate and larger container.
   (b) New clay stock concentrations for same reasons as alum concentration above. Need approximately 5-NTU influent.
2. Repair SRSF
   (a) Leaking points in push-to-connect/backwash connection pipe.
3. Ready SRSF for beginning of runs
   (a) Set the flow rate for 5.3 L/min, any larger and it is possible for media to escape during backwash.
   (b) Calibrate all sensors present to correctly monitor water height in filter and flow throughout.
   (c) Adjust the inlet and outlet boxes so head accumulated during experiments will not cause overflow.
4. Run continuous filtration, 48+ hrs.
   (a) Optimize the backwash duration to minimize water waste, which will determine the water efficiency of the SRSF. Currently it is 10-minutes in the field, are hoping to reduce this period of time down to 6-minutes.
   (b) Determine if there is an advantage in water savings to having particles removed by the floc/sed system even when the SRSF would meet the effluent turbidity requirements without floc/sed treatment.
   (c) Water efficiency (filtered water as a percentage of total water) associated with the backwash cycle.
      i. Minimize total time required for backwash and filter-to-waste cycle, which will improve overall efficiency of SRSF.

5. Measure flow distribution between layers.
    (a) Replace layer sensors that are damaged due to water leakage.
    (b) Measure change in flow distribution over course of filtration cycle.
        i. Change initial conditions to determine even and uneven flow.
6. Perfect hydraulic controls for cycling between filtration and backwash mode and transmit any new design criteria to the SRSF-design team.
7. Test a sand removal system that uses a horizontal pipe through the bottom of the filter and then a vertical section of pipe to elevate the sand discharge location.
    (a) Test this system for operation during filtration mode when the hydrostatic pressure at the bottom of the filter is highest.
    (b) If that doesn't work, then test it during backwash mode.
8. Test the stratification of sand after backwash for various sand uniformity coefficients.
    (a) Perhaps the sand can be completely mixed by providing a route for sand from the top of the fluidized bed to return to the bottom of the fluidized bed. A pipe with a slope would provide a means to return fine sand to the bottom of the filter.
9. Build and test a four-layer (30 cm per layer) SRSF and compare performance with the six-layer SRSF
    (a) Layers will have a larger flow distribution amoung them due to it being a deeper layer, which may possibly improve the performance of the system.
10. Based on observations at Tamara, devise improved methods to keep air out of the filter. Evaluate methods to remove air after the weir that divides flow into the filter boxes.