Sedimentation Tank Hydraulics: Detailed Task List Summer 2012

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1 Objective 1–June 19-30: Jet Reverser sizes and placement errors

- June 19-25: Determine a relationship between the diameter of the jet reverser and the upflow velocity at failure, average concentration of the floc blanket, average effluent turbidity, time for floc blanket formation. This will help us to show if larger diameter jets are viable in AguaClara plants.
  - Fabricate 0.5", 1", 1.5", and 2" radius jet reversers.
  - For each radius jet reverser:
    - Form a floc blanket and record the time to floc blanket formation.
    - Monitor the effluent turbidity and the average floc blanket density at the initial upflow velocity using data acquisition software.
    - Slowly turn down the flow rate and record the flow rate at floc blanket failure.
- Determine a relationship between the horizontal or vertical displacement of the jet from the center of the jet reverser and the upflow velocity at failure, average concentration of the floc blanket, average effluent turbidity, time for floc blanket formation. This will help us determine the sensitivity of the floc blanket to inexact jet placement during construction.
  - June 25-27: Test horizontal displacement of jet 0.5" and 1.5" from center of 2" radius jet reverser by June 27.
  - June 27-30: Test vertical displacement of jet 0.5" above and below lip of 2" radius jet reverser by June 30.
  - For each jet position:
    - Form a floc blanket and record the time to floc blanket formation.
    - Monitor the effluent turbidity and the average floc blanket density at the initial upflow velocity using data acquisition software.

* Slowly turn down the flow rate and record the flow rate at floc blanket failure.

2 Objective 2–June 31-July 11: Floc Blanket Stability

- Determine the lowest alum dose at which a floc blanket at a given influent turbidity can be maintained.
  - For influent turbidities of 50, 100, 500, and 1000 NTU form a floc blanket at an effective alum dose and step down the coagulant dose to a "failure level" at which will be the point at which no floc-water interface can be observed.
- Determine the lowest alum dose at which a floc blanket at a given influent turbidity can be formed.
  - Attempt to form a floc blanket at the previously determined alum dose at failure. If the floc blanket formation can not be achieved, increase the alum dose by 5 mg/L and attempt to form a floc blanket again. Repeat until floc blanket formation can be achieved.

3 Objective 3–July 12-Aug 4: Floc Hopper Geometry

- Review the previous mathematical model for the wasting rate of sludge from the hopper and explore improvements to the model.
  - The sludge wasting rate from the hopper given by the model depends on the influent turbidity and the concentration of sludge that is being wasted. Perform a literature review to find a relationship between the settling time of sludge and the concentration of sludge. This may help us to determine a wasting rate based on the residence time of sludge in the hopper.
  - Perform a total solids test on settled sludge to determine the density of sludge after it has been left to settle for 30 minutes, 1 hour, 5 hours, and 1 day.
  - Brainstorm experiments to test the validity of this model.
- Determine a relationship between the ratio of floc hopper plan-view area to floc blanket plan-view area and volumetric growth rate of sludge in the hopper at various influent turbidies. Vary the with of the hopper and measure the volumetric growth rate of sludge in the hopper for each influent turbidity.

  - Fabricate rectangular strips 2.5 cm wide which will be inserted into the hopper and will allow us to change the hopper width.
  - For each influent turbidity:
    * Form a floc blanket with a 2.5 cm floc hopper. Measure the height of sludge over time at regular intervals. We do not expect the relationship to be linear. Explore the possibility of measuring the concentration of sludge at the bottom of the hopper to see if this concentration agrees with the total solids test and the mathematical model.
    * While the floc blanket is still formed, increase the with of the hopper by 2.5 cm by removing a strip of PVC. Completely drain the sludge from the hopper and again begin measuring the growth height of sludge over time at regular intervals. Repeat for each floc hopper width.
    * For each experiment, fit the volumetric growth of sludge to a governing equation.

- For a given hopper size and influent turbidity, suggest a constant wasting rate equal the instantaneous volumetric growth rate of sludge that would maintain steady state for this system at a given sludge height.
- Explore the effects of an angle in the hopper to the volumetric growth rate of sludge in the hopper. 60 degrees, 45 degrees, 75 degrees