Sedimentation Tank Hydraulics: Detailed Task List

September 14, 2011

Week 1-3: Examining mechanisms for floc resuspension.

- We hypothesize that floc resuspension is related to the upward jet velocity and the hydrostatic pressure caused by the solids built up on the incline. If the hydrostatic pressure is greater than the dynamic pressure, the solids would fall into the trench and divert the path of the jet. This in turn would greatly reduce the amount of floc resuspension. In addition, there may be instability in jet position which can scour consolidated solids, ultimately worsening effluent performance.
- Experiments will be necessary to prove or disprove this hypothesis. We plan to:
  - Week 1: Inject red dye into the apparatus to observe fluid flow with and without flocs throughout the experiment. By taking photos of the apparatus at high frequencies (1 shot/0.1 s),_we can measure the jet velocity by taking distance between the dye markings and dividing by the time interval between shots.We can measure dynamic pressure by measuring jet width at point of contact with solids. Jet width will also determine jet velocity and the dynamic pressure of the jet at this point.
  - Week 2: Devise a method to measure the hydrostatic pressure on the incline by measuring the concentration and height of solids.
  - Week 3: Run experiments with lower jet velocities to observe failures. Determine a relationship between jet velocity and height of solids at failure.

Week 4-13: Further experimentation and floc weir design.

- We plan to:
  - Add plate settlers to the apparatus.
  - Set up an extra turbidimeter that will measure the effluent turbidity and determine floc blanket effectiveness.

- Determine the extent of the effects of further reducing the diameter of the semicicrcular trench on sludge accumulation, floc blanket formation, and floc blanket performance.
- Determine a final design for the floc weir and set up an experiment to test this design. We must take into consideration the height of the floc weir, rate of growth of the floc blanket, and the density of flocs in the built up in the hopper. We will calculate the rate of sludge removal from the hopper so that the mass flow rate into the tank equals the mass flow rate out of the tank, and the rate of removal from the hopper equals the rate that sludge of sludge build up in the hopper.
- Run performance studies and analyze various bottom geometries. We should look at mechanisms of floc resuspension associated with different geometries around the jet, and look at relationships between the bottom geometry and the dynamic pressure of the jet.
- Come up with a relationship governing the optimal trench diameter based on the inlet pipe diameter and inlet jet velocity.