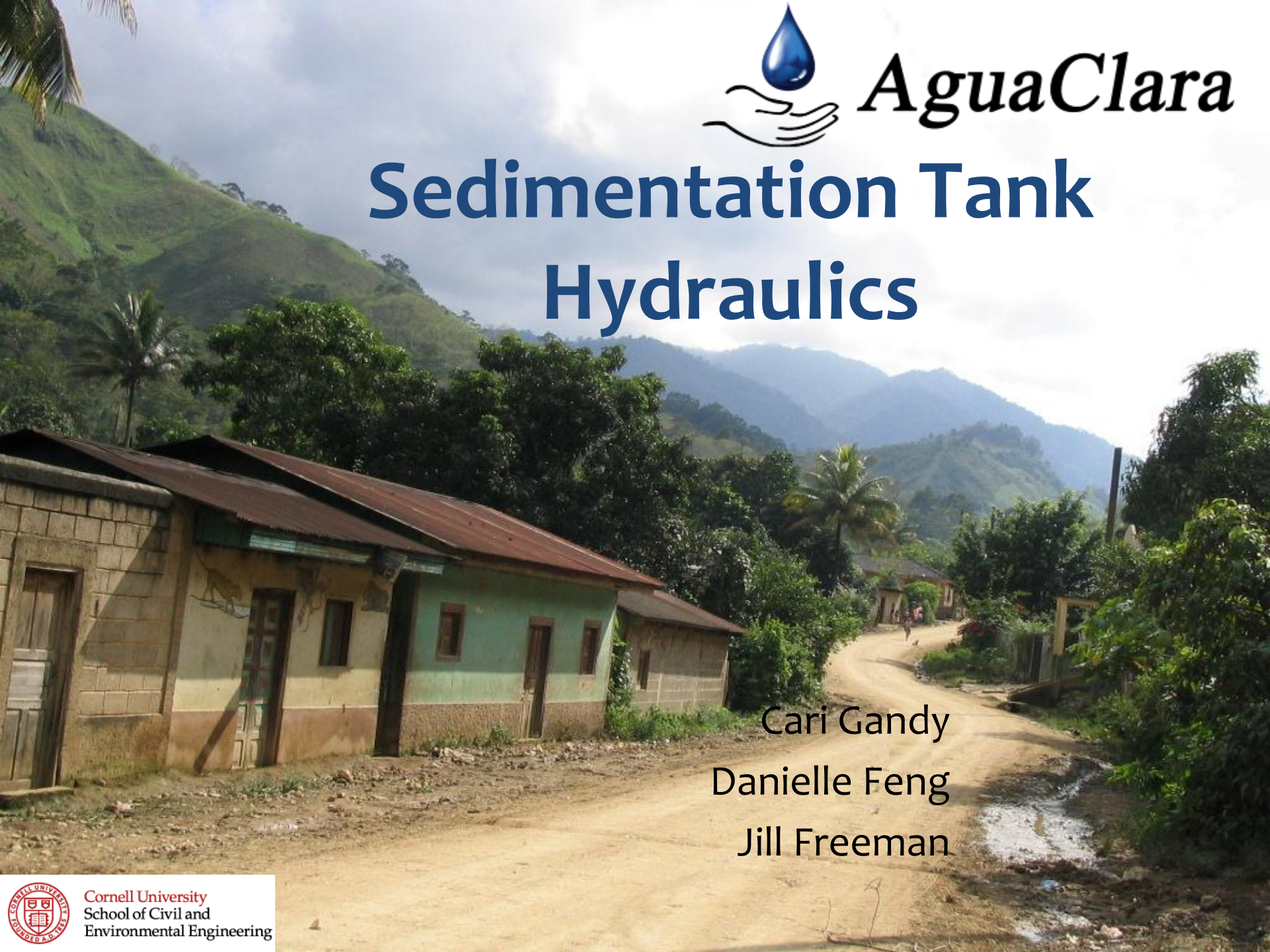

AguaClara

Sedimentation Tank Hydraulics

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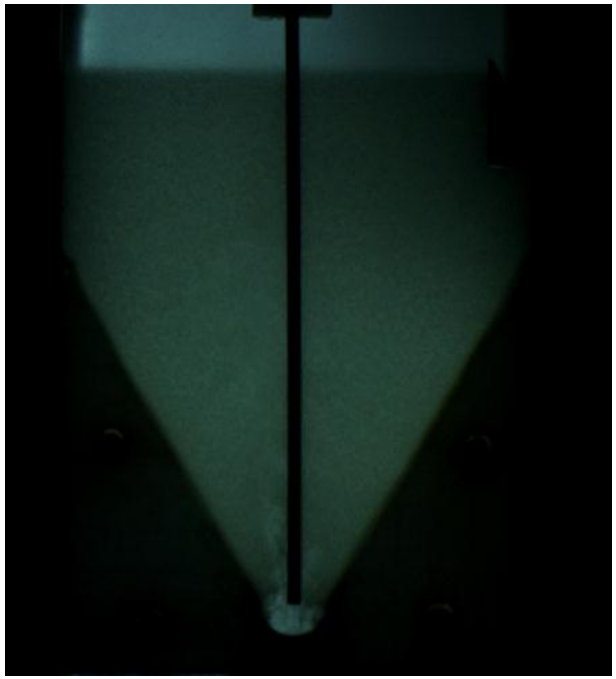
What is a Floc Blanket?

- A floc blanket is a dense, fluidized bed of particles.
- Occurs when flocs switch from a state of differential settling to hindered settling.

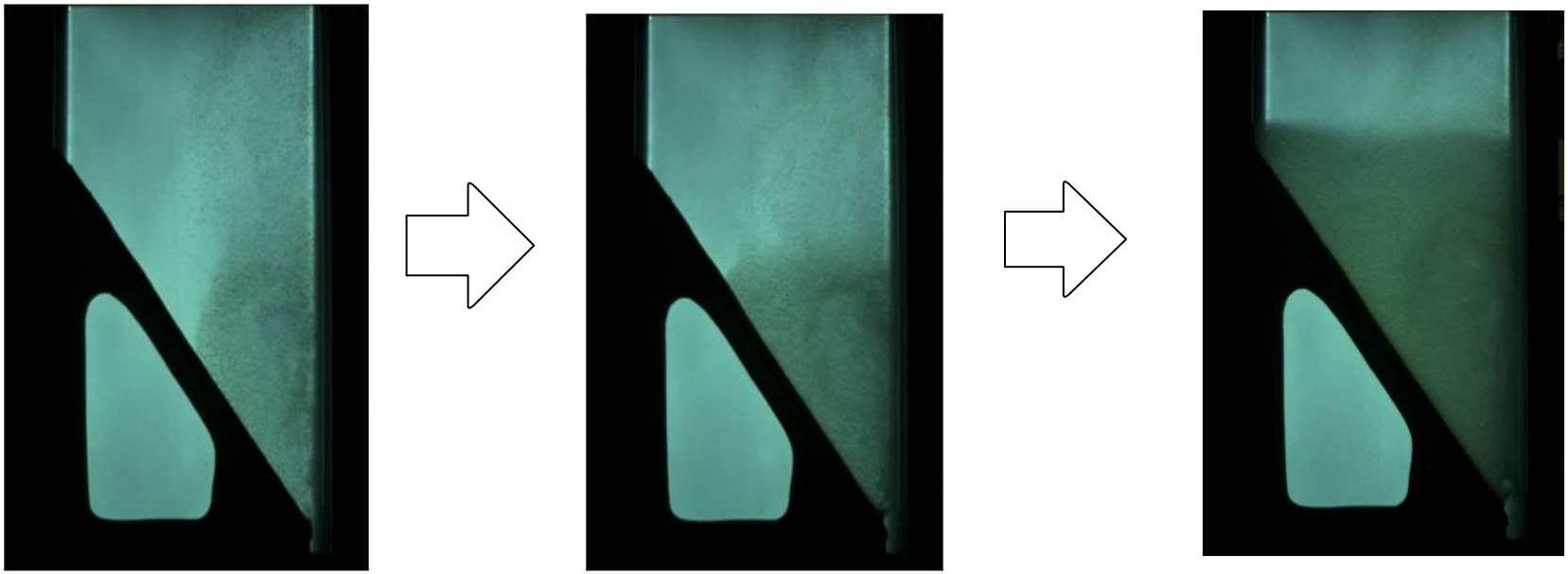


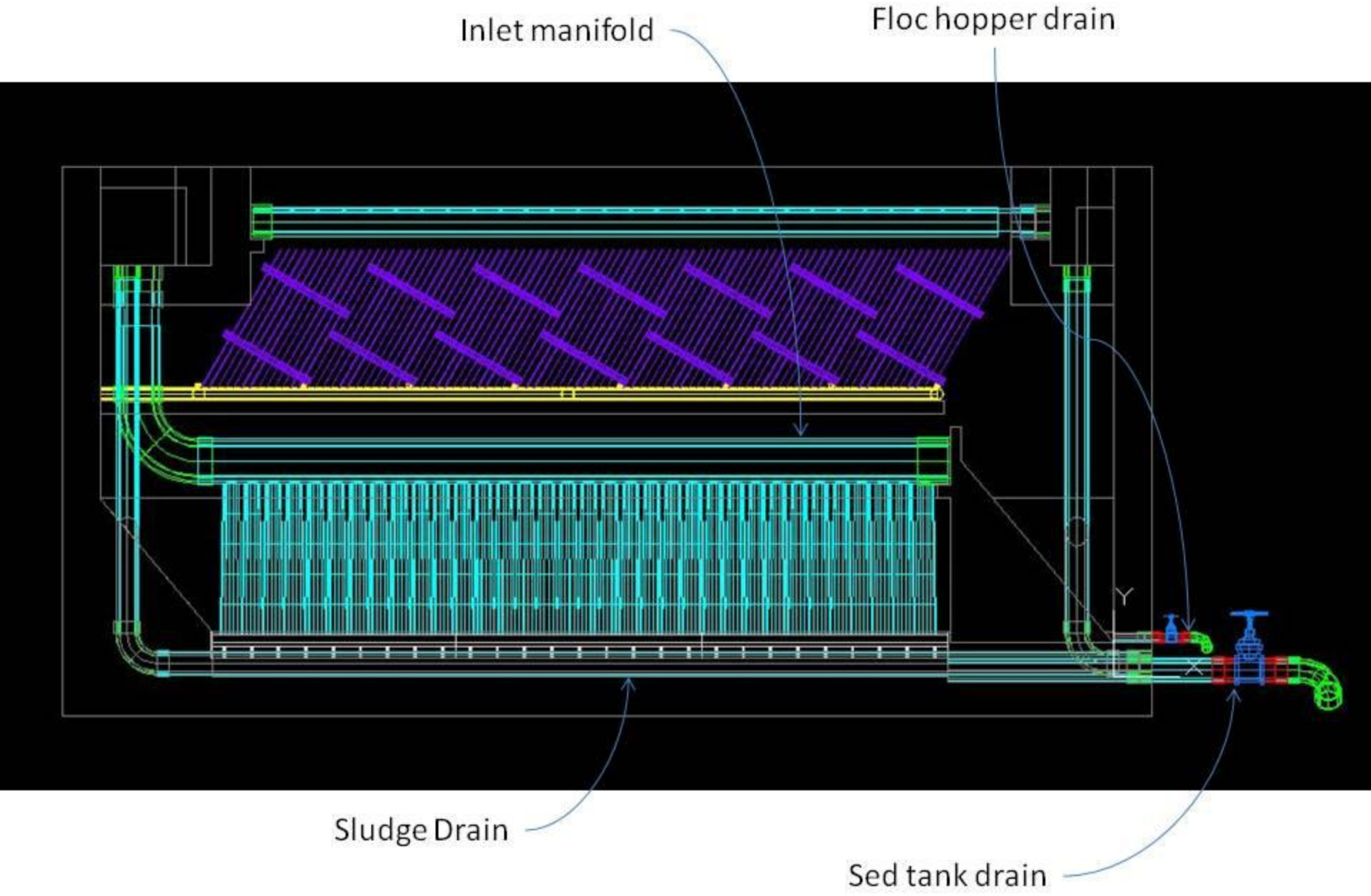
Benefits of a Floc Blanket:

- Reduces effluent turbidity by trapping small flocs.
- Reduces clean water wasting by less frequent draining of the sedimentation tank.

Conditions for Floc Blanket Formation

- Adequate floc re-suspension by inlet jet
- Inclines to direct settling flocs towards inlet jet

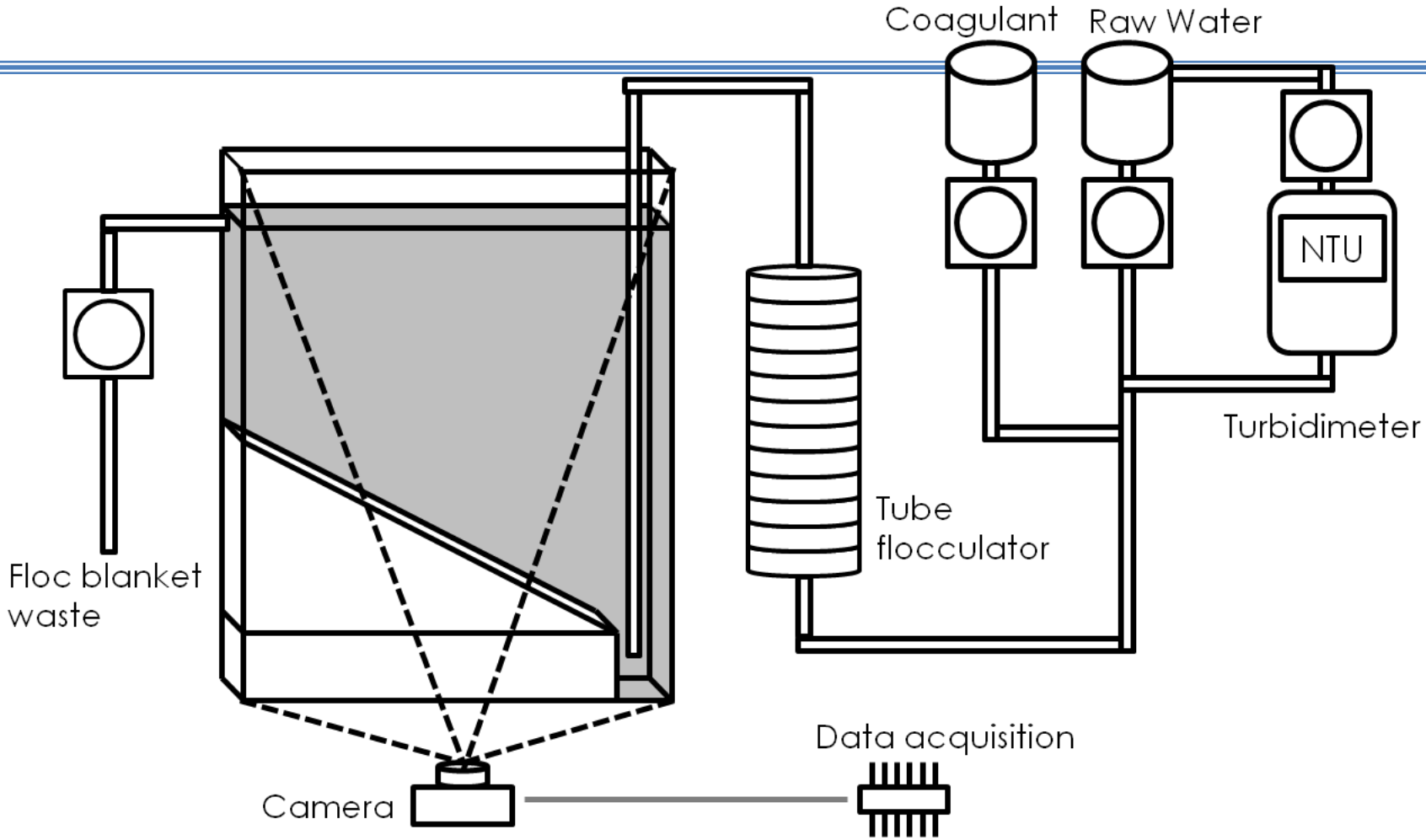



Inlet manifold
Floc hopper drain
Sludge Drain
Sed tank drain

Objectives

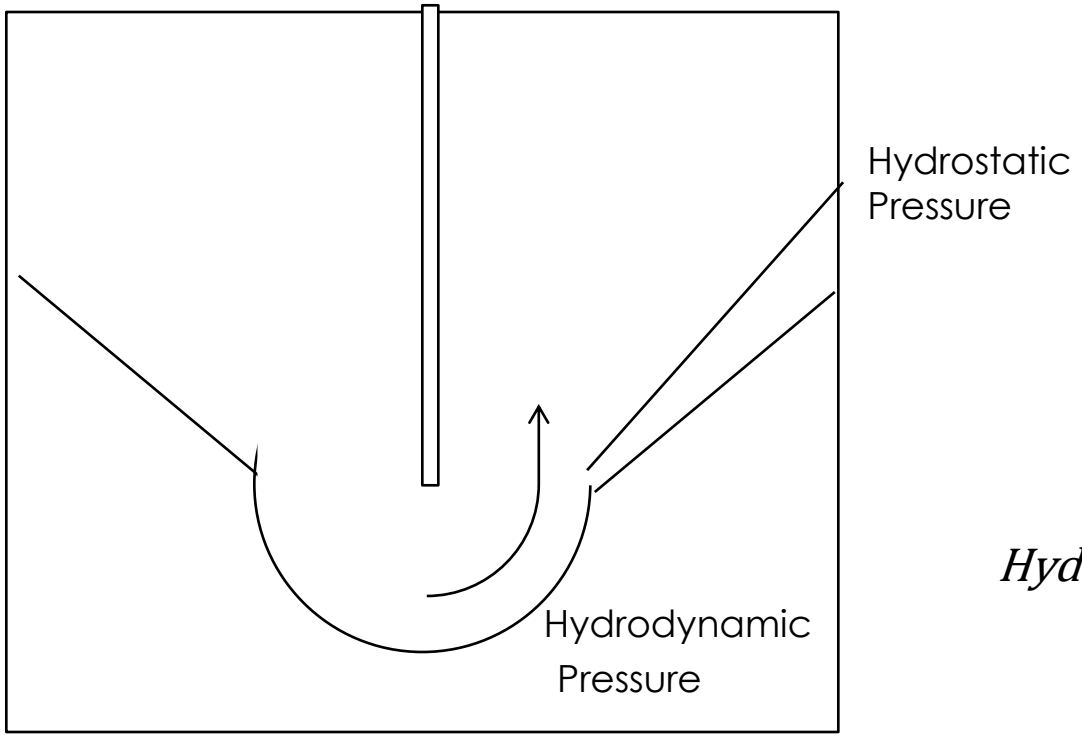
- Determine a relationship between jet reverser size and floc blanket stability.
- Determine the effects of jet placement on floc blanket stability.
- Determine the lowest alum dose at which a floc blanket at a given influent turbidity can be formed and maintained.
- Examine relavent floc hopper parameters, including ratio floc hopper plan-view area to floc blanket plan-view area, and floc hopper volume.

Methods: Our Experimental Setup



Experimental Setup

Hydrostatic vs. Hydrodynamic Pressure



Hydrodynamic Pressure:

$$P = \rho \int \frac{V^2}{R} dn$$

Jet Reverser Size

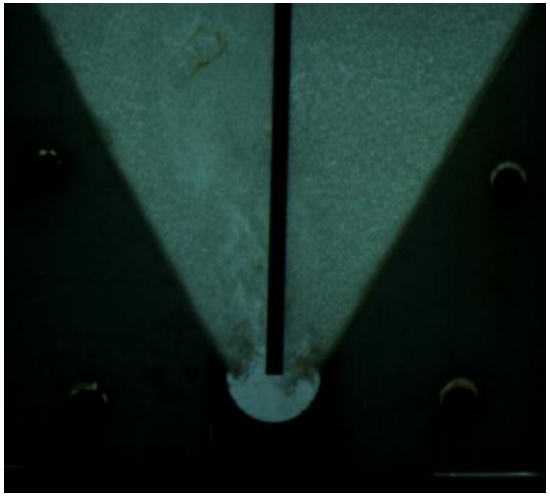
- Small jet reverser: Higher hydrodynamic pressure; better floc resuspension
- Large jet reverser: Easier to construct; requires less precise alignment of the jet

Jet Reverser Size

496 mL/min

1" Diameter

2" Diameter



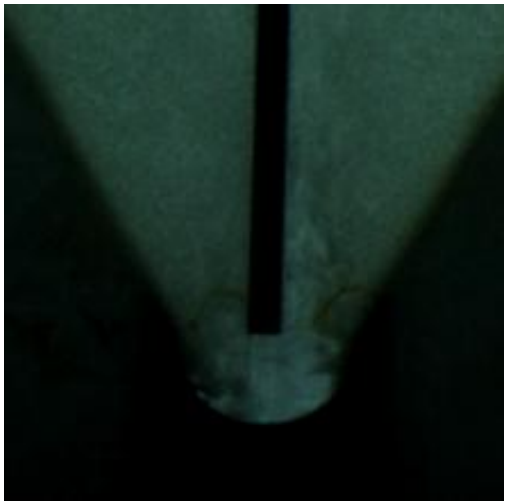
3" Diameter

Jet Reverser Size

376 mL/min

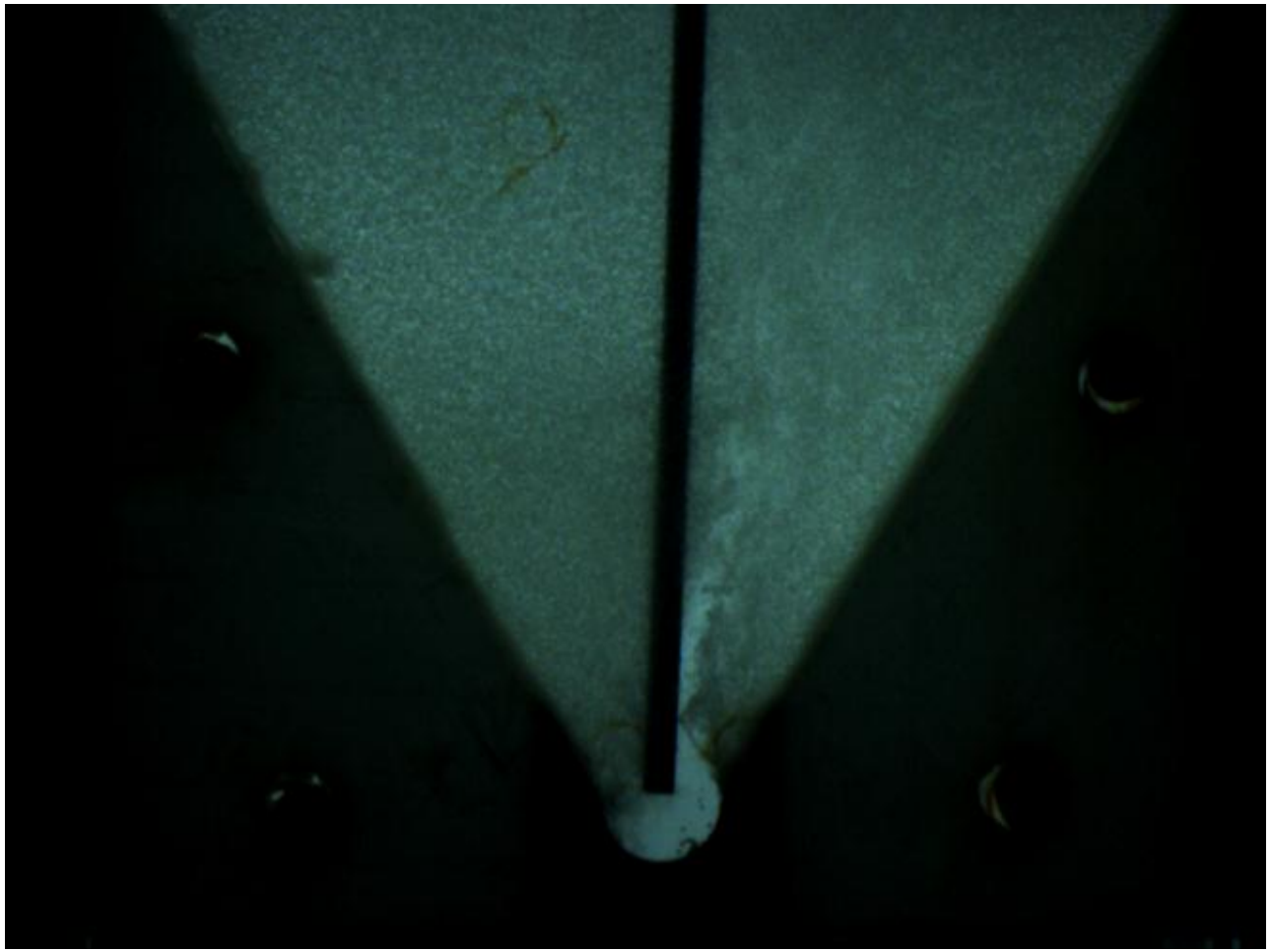
1" Diameter

2" Diameter

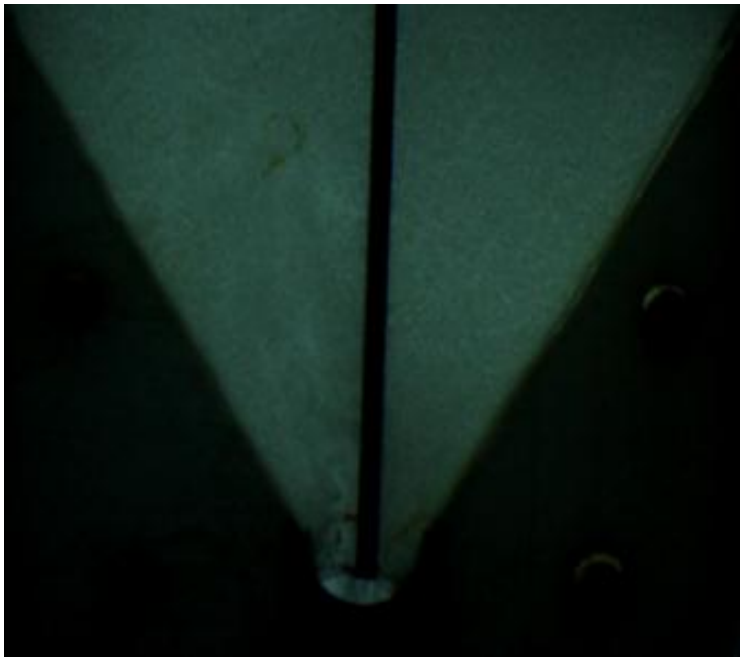


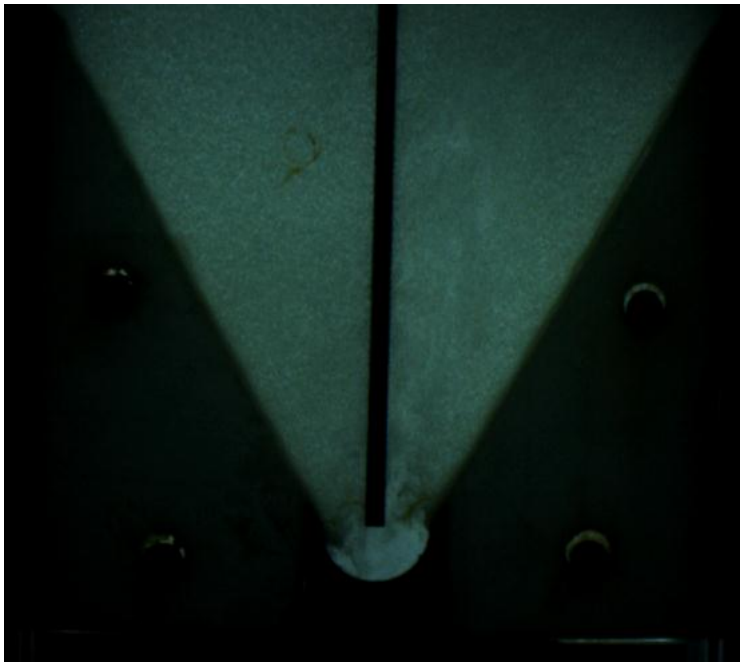
3" Diameter

Jet Reverser Size

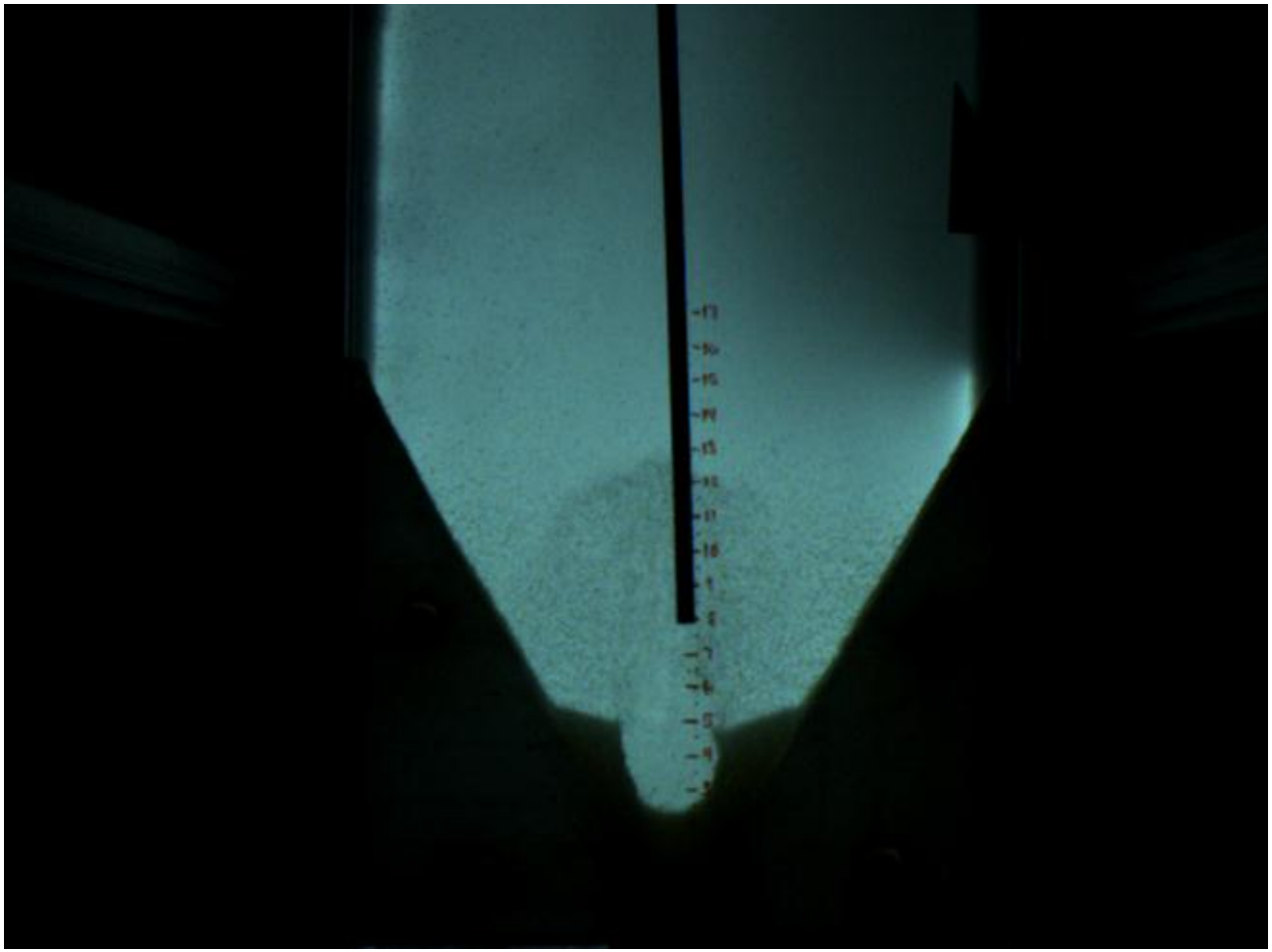


Downwards Jet Displacement





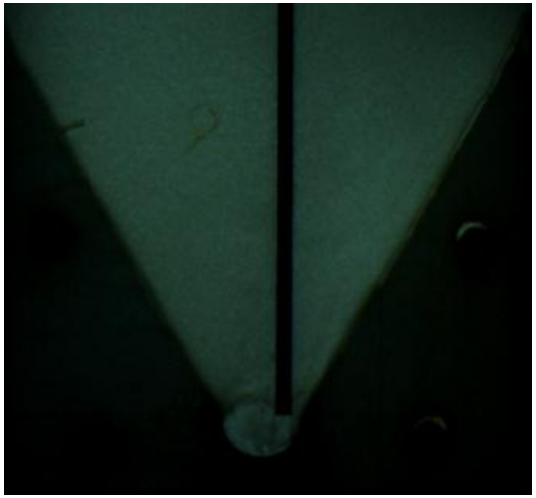
Upwards Jet Displacement



Upwards Jet Displacement

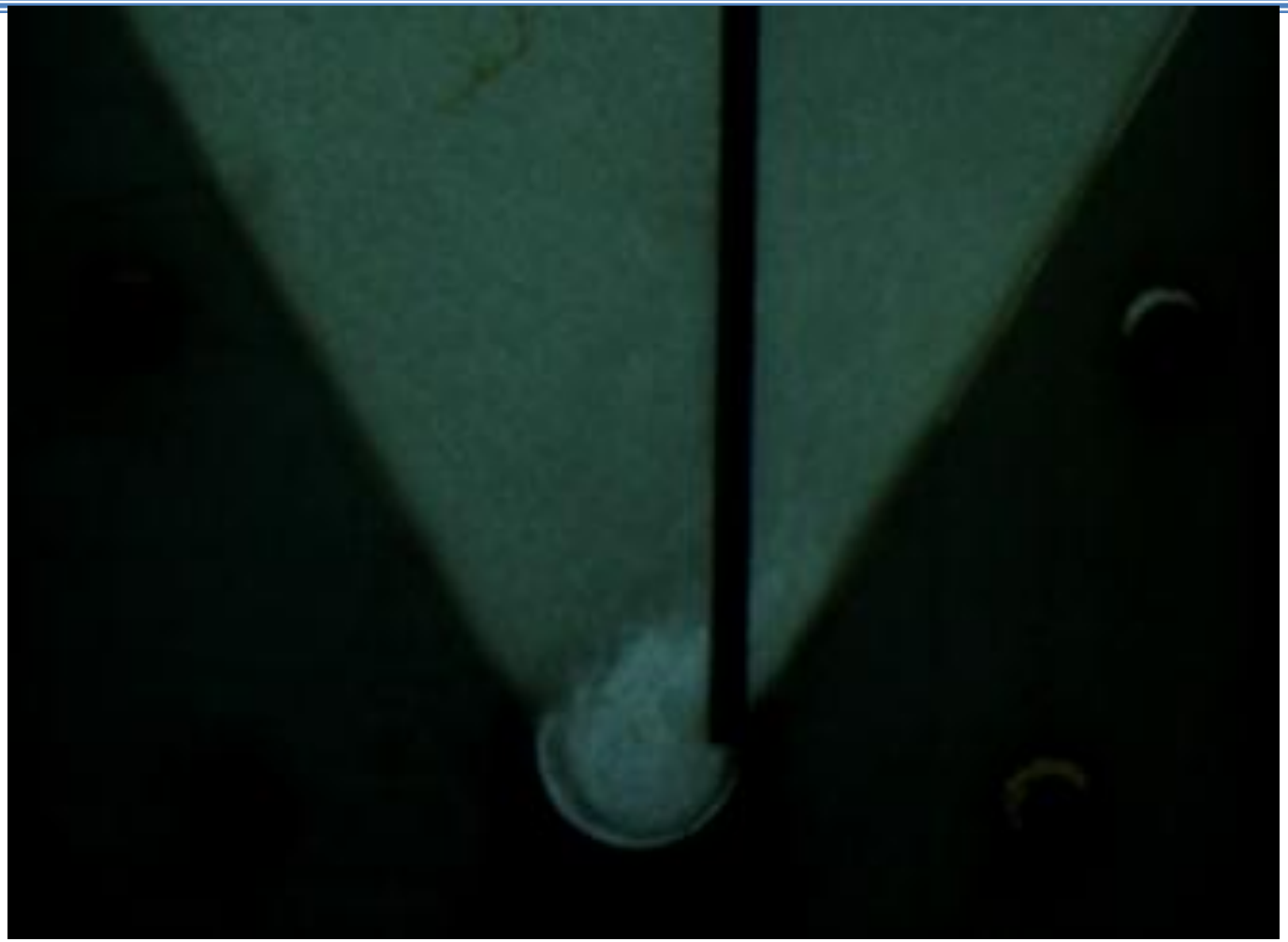
Horizontal Jet Displacement

- Jet takes a preferential flow path.
- Dead zone formed in right side of reverser.



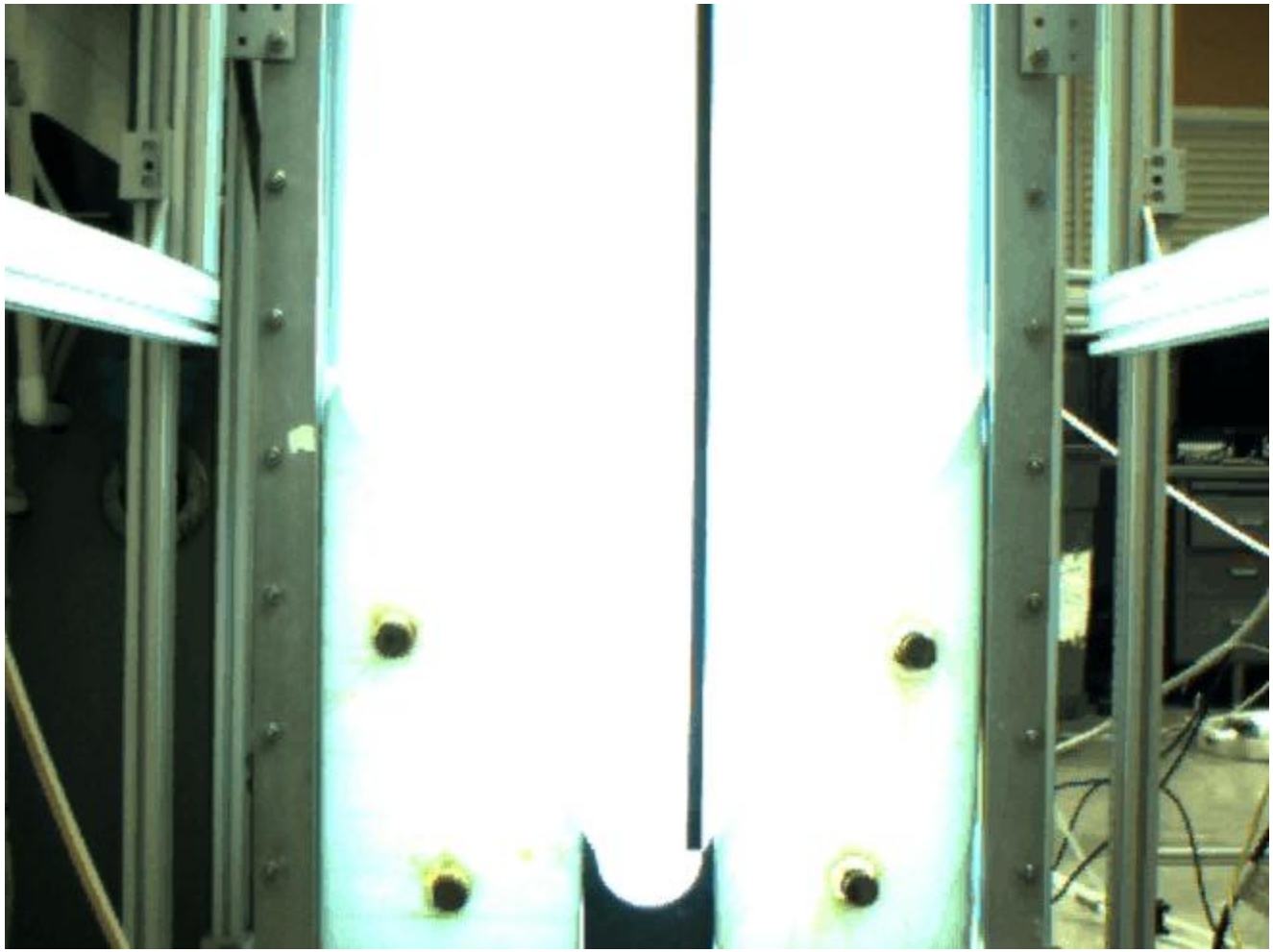
316 mL/min

Horizontal Jet Displacement



376 mL/min

Horizontal Jet Displacement

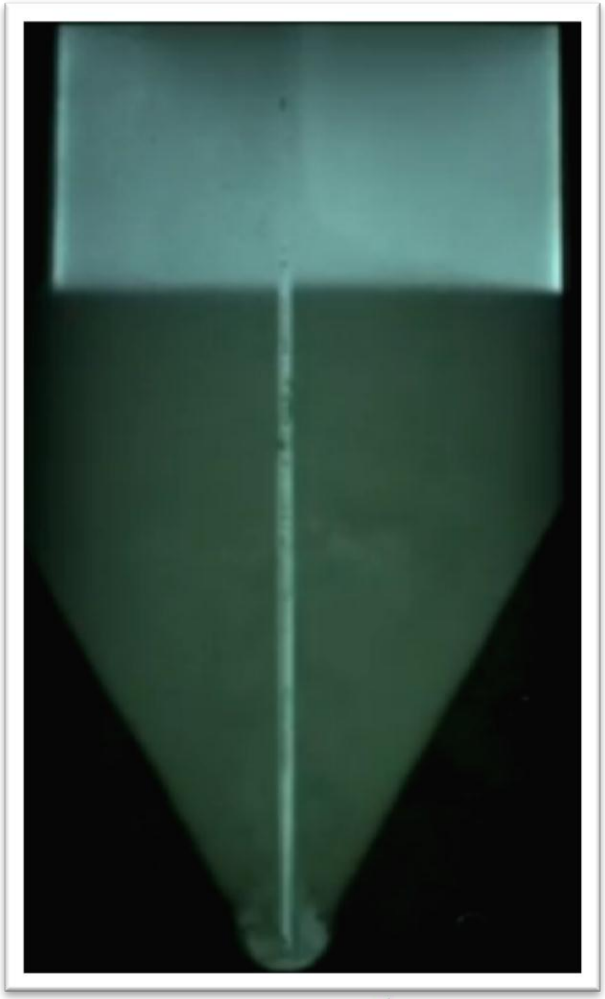


Asymmetric vs. Symmetric Jet Placement

Asymmetric	Symmetric
Will require more changes to design.	Splits jet reverser path
Sludge on one side is not directly resuspended.	More sensitive to slight jet displacement

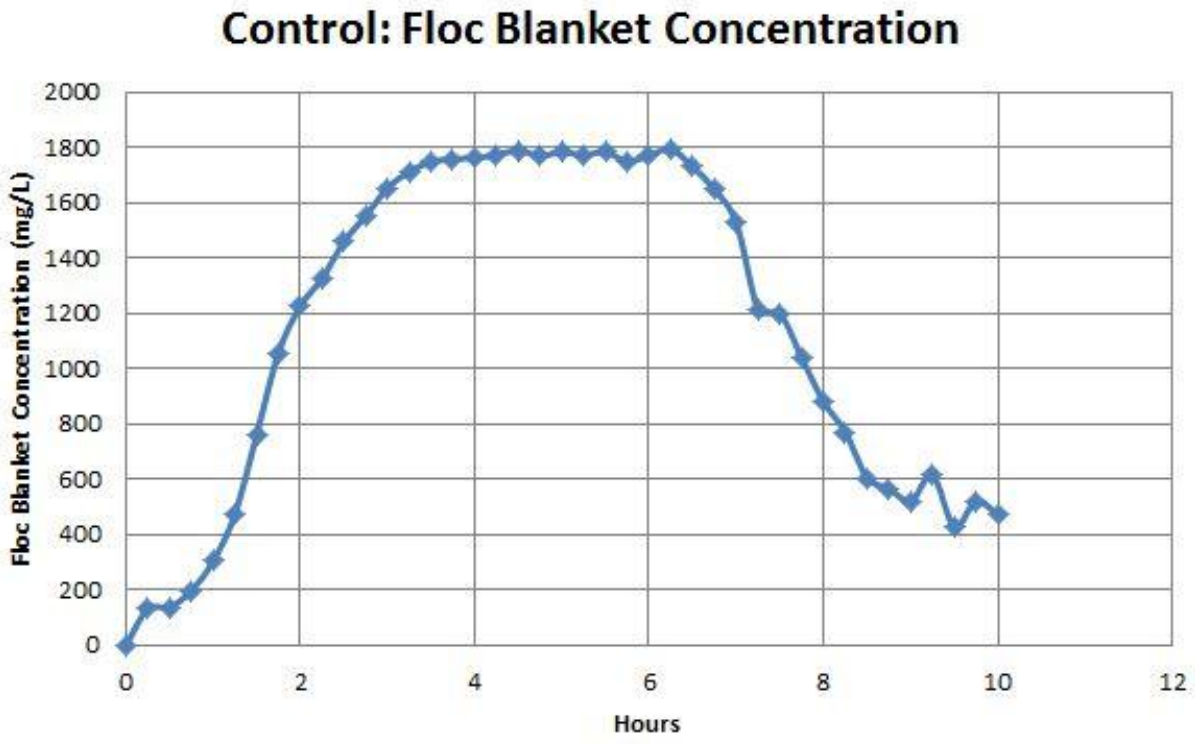
Floc Blanket Stability

- Determine the alum dose at which a previously formed floc blanket will fail.
- Determine the minimum alum dose at which a floc blanket can be formed.
- Find these values for 50, 100, and 200 NTU and determine if there is a general relationship between dosage and turbidity.

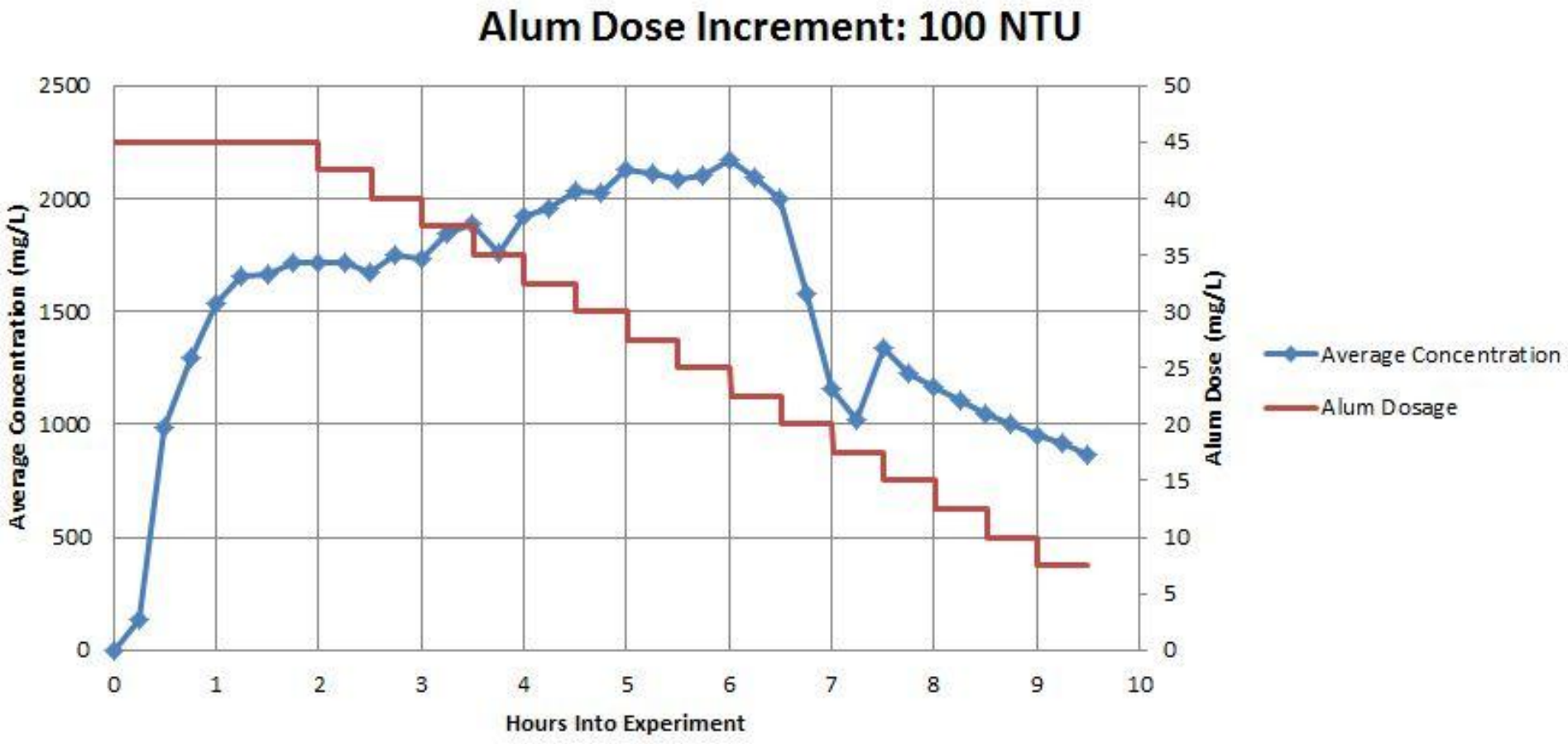


Concentration Analysis

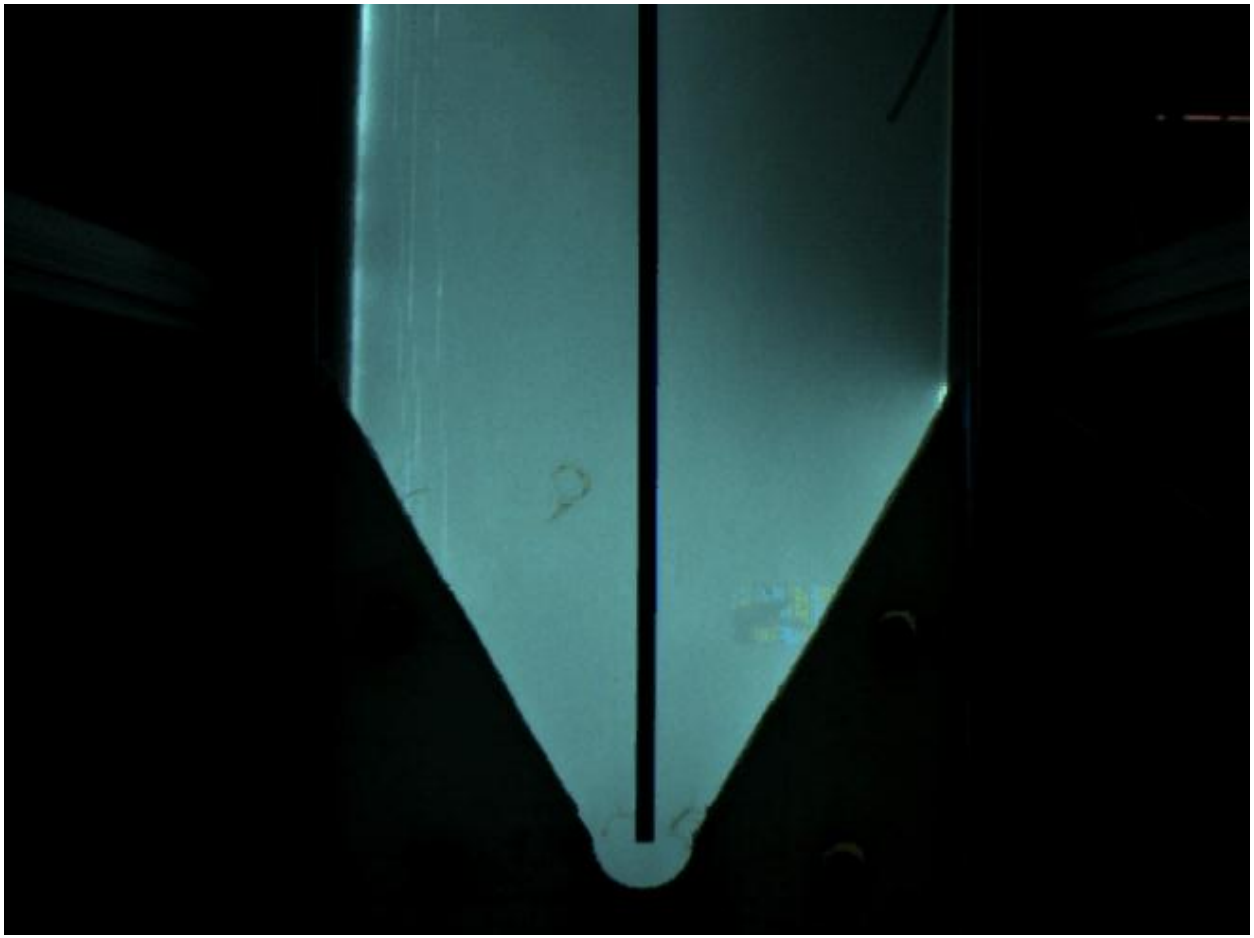
- Find relative concentration by comparing experimental images to one background image.



Turning Down the Dose

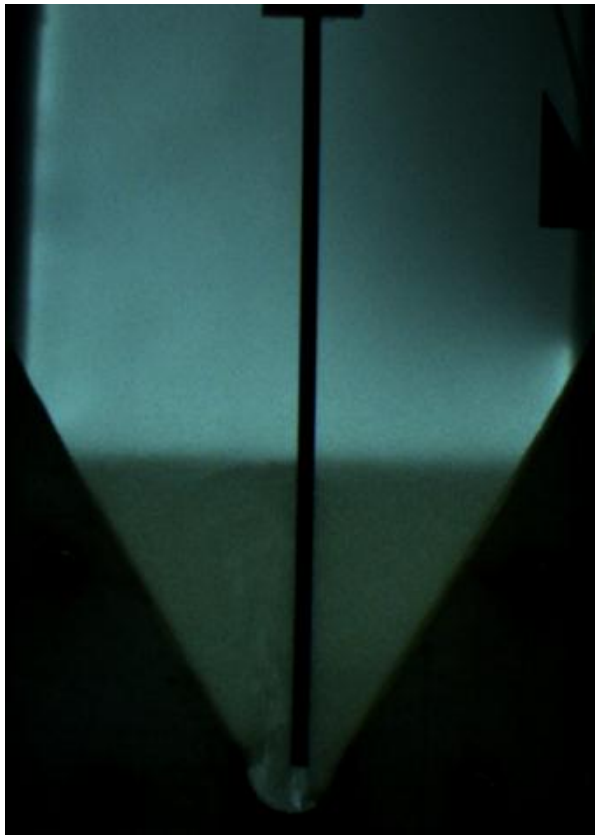


Alum Dose Increment: 100 NTU

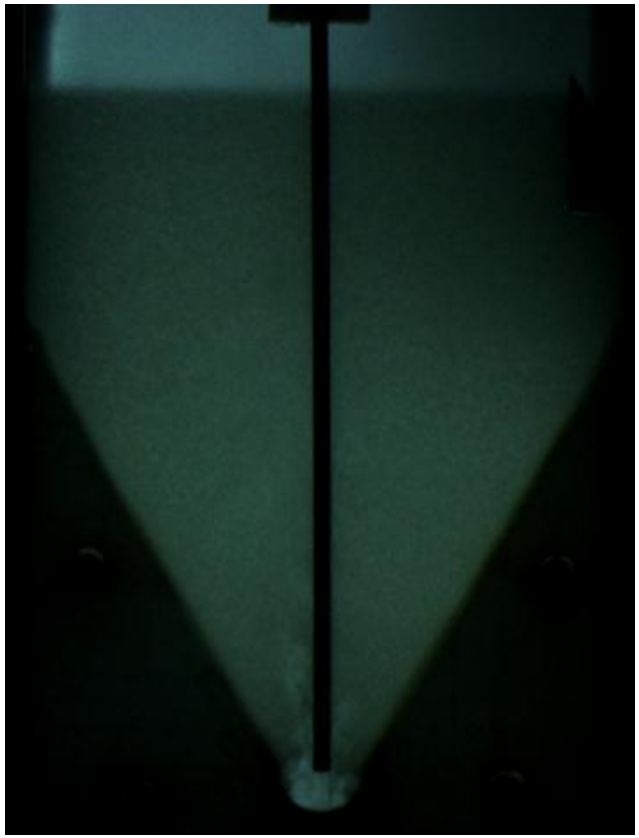


Optimal Dose for 100 NTU

25 mg/L Floc Blanket level



30 mg/L Floc Blanket level



Future Work

- Alum Dose for 50 and 200 NTU
- Symmetric vs. Asymmetric Jet Placement
- Explore jet angle and energy dissipation
- Floc Hopper Geometry and Wasting Rate