Solution Algorithm

Color Code:

Green: Horizontal and Vertical

Purple: Vertical

Blue: Horizontal

All annotations made in these colors were by Julie Pierce. Black comments on MathCAD files are from original files.

CFD Results and Functions

CFD1. Define array of ratio of baffle height to baffle spacing from experimental results

CFD2. Define array of the fraction of the maximum collision potential that could be achieved if the energy dissipation rate was uniformly distributed from experimental results

CFD3. Define array of collision potential from experimental results

CFD4. Define array of minor loss coefficients from experimental results

CFD5. Define array of maximum energy dissipation rate over average energy dissipation rate from experimental results

CFD6. Use linear interpolation of the experimental results to create functions

Choosing Between Horizontal and Vertical

HV1. Define generic variables so that both horizontal and vertical flocculators use the same variables and they are not as confusing.

HV2. Set the minimum T/S value as 3 for horizontal flocculator.

HV3. Set the minimum baffle spacing as 45 cm for a horizontal flocculator. This corresponds to a human width so that someone can walk through it if needed.

HV4. Determine the height of the water at the end of the flocculator (equal to the height of the water in the sed tank). This is equal to the minimum height of the tank. For now, set this value as P (the height of the water in the flocculator). Might need to check to see if the head loss of the water is actually negligible later.

HV5. Create an equation that calculates the minimum flow rate as a function of the energy dissipation and height of the water.

HV6. Create a variable that will be used to distinguish between horizontal and vertical when deciding which algorithm to use in future steps.

Flocculator Functions

FF1. Create a function that determines the number of spaces in a flocculator channel.

Make sure they create an odd number of baffles. Round to an odd number instead of flooring to get closer to the desired energy dissipation.

Create another function that determines the spacing between the baffles.

FF2. Calculate S

Create an iterative solution to solve for the space between the baffles since we don’t know H/S before calculating S

Since we know the H/S ratio (optimum is 3) (as opposed to the vertical flocculator where we don’t), create a function that directly solves for S.

FF3. Create a function for the collision potential

FF4. Create a function for the maximum energy dissipation rate.

FF5. Create an algorithm to find the target energy dissipation rate as a function of the collision potential.

FF6. Create an algorithm to find the number of spaces in each channel with the correct energy dissipation rate and cumulative collision potential.

Calculation of Flocculator Geometry

FGH1. Calculate S using the function created in FF2.

FGH2. Create a function that makes S the maximum of what was found in step 14 and 45 cm.

FGH3. Calculate J (width of channel) as the S found in FGH2 multiplied by Pi.TS=3.

FGH4. Calculate the number of spaces in each channel using the function created in FF1

FGH5. Determine the collision potential in each space.

FGH6. Divide the target overall collision potential by the collision potential in each space to find the total number of spaces. Round this value up.

FGH7. Divide the total number of spaces by the number of spaces per channel to get the number of floc channels. Round this value up.

FGH8. Create an array for the number of floc spaces in each channel. Subtract 1 from this array to get the number of baffles per channel. Sum all the baffles in all the channels to find the total number of baffles.

FGH9. Calculate the actual spacing in the channels and the actual J of the channels.

FGV1. Determine the maximum baffle spacing by using the minimum H/S ratio

FGV2. Determine the width of the floc channel as the maximum of the spacing found from step FF2 and the width of the floc channel as determined by a human being able to walk through it.

FGV3. Determine the minimum floc baffle spacing and the minimum and maximum number of floc spaces.

FGV4. Calculate the maximum energy dissipation rate given the range of possible baffle spacings and the total collision potential for a channel full of baffles of that spacing.

FGV5. Calculate the number of spaces in each channel, the number of channels, and the number of baffles in each channel.

FGV6. Calculate the actual baffle spacing

Assign Correct Values for Either Horizontal or Vertical

Assign Remaining Flocculator Geometry Values

FG1. Verify that the channels are the correct length.

FG2. Calculate the actual energy dissipation and collision potential in each channel.

FG3. Calculate the head loss per baffle in each channel, per each channel, and for the whole flocculator. Calculate the height of the floc tank.

Make sure the head loss is negligible enough for untapered flocculation? Algorithm or manual? NEED TO LOOK INTO

FG4. Calculate the total length of all the flocculator channels and the residence time in the flocculator.

FG5. Determine the height and width, and thus the area, of the ports that connect the floc channels.

For horizontal this is more of a channel than a port. Set the port width equal to a normal baffle spacing and set the height equal to the height of the floc tank.

Position calculations for each baffle

BP1. Calculate the **length of the baffles**. Subtract half of the freeboard height from the length of the top baffles to allow a place for water to go in the event of an overflow.

BP2. Create an array for the X (distance along flocculator) positions of the baffles.

BP3. Create an array for the Y positions of the baffles.

BP4. Create an array for the Z (height) positions of the baffles.

BP5. Create an array for the length of the baffles in each channel.