Flocculator Tank A

Basis for Design

Guiding Principles

- make sure G¿ is high enough for entire system (minimum of 20,000)
- make sure G is not so big it is going to break up flocs (flocs will be smallest in this tank though, and small flocs are harder to break)
- perhaps it would be best to use multiple baffle spacings
- The space above a down baffle should be 1.5b under a condition of no headloss
- The first baffle should be an underflow
- try to maintain a design that will allow 3 baffles to be cut from 1 12 ft sheet of polycarbonate

Constraints:

- width of tank (w): 98 cm
- flow rate (Q): 500 gpm
- K: 3
- Height at end of flocculator(h_0): 140 cm (this is a bit confusing because of the sloped floor. The height at the end of the tank is actually 155 cm, but at the beginning the tank is only 145 cm. I set the water height to be 140 cm at the end after headloss, this ensures that the water level at the beginning of the tank will be less than 145cm)
- Headroom (h_{room}): 5 cm
- Ratio between baffle spacing and the height of the horizontal channel (h_{ratio}): 1.5

Procedure:

NOTE all calculations are based on the MathCAD files attached

- I started by running some tests on the flocculator program used last semester to try to get an idea of what general range the baffle spacings should be in. I am trying to follow the guideline that G_{avg} should go from 75 s^-1 to 45 s^-1 to 15 s^-1. These guidelines were created for a flocculator with a depth of 3 m and a b of 45 cm, so L/b is approximately 7. Since our L/b ratio (1.4m/20cm) is also close to 7, this guideline is applicable. The G_{avg} values for tank A should be about 75 s^-1 .
- I then edited a program that we created in CEE 454 (fall '07) which allows the user to specify the baffle spacing. This program needed to be changed slightly to allow for multiple baffle spacings. This program outputs the ideal number of baffles, the G and G¿ values, the water height throughout the flocculator, a graph of G_{max} vs. G¿, and draws a picture of the flocculator.
- I edited Monroe's floc design program since the original program uses G¿ to determine the baffle spacing. Since the first part of the G vs G¿ curve is relatively flat so it might be more reasonable base the baffle spacing G.
- I calculated the total G¿ for all four tanks to make sure it is large enough
- I calculated the force on the first baffle due to the water coming out of the pipe. Its max value is 30 N, and this would only occur if all the water from the pipe directly hit the baffle, which is not the case. Based on this value, it was determined that a surge chamber is NOT necessary.
- The spacing above or below a baffle is supposed to be 1.5b. It is a little more complicated to maintain this distance since the slope is sloped. However, for ease of construction I still decided that it would be best to keep the length of the baffles uniform throughout this section. The spacing above and below with increase slightly through the tank, however the slope is fairly gradual so this increase should not pose a problem to the effectiveness of the flocculator.

MathCAD Files

Determines B: Flocculator Design
Allows user to specify B: Floc A Design v2

Design

Tank	Baffle spacing	No. of baffles	G_{max}	G_{avg}	G¿	baffle length
A	**17 cm**	**4**	**244.74 s^-1**	**83.52 s^-1**	**2647**	**114.5 cm**
A	**20 cm**	**5**	**176.8 s^-1**	**65.3 s^-1**	**3044**	**110 cm**
A	**22 cm**	**6**	**146.14 s^-1**	**56.55 s^-1**	**3479**	**107 cm**
A	**28 cm**	**5**	**90.2 s^-1**	**39.3 s^-1**	**2563**	**98 cm**
B	34 cm	1	61.18 s^-1	29.319 s^-1	465	
B	40 cm	11?	53.974 s^-1	26.675 s^-1	4950	
C	73.35 cm	1	13.855 s^-1	9.58 s^-1	319	
C	55.25 cm	3	26.72 s^-1	15.707 s^-1	1130	
C	58.4 cm	3	23.726 s^-1	14.363 s^-1	1096	
D	60 cm	1	20.953 s^-1	13.08 s^-1	354	

D	70 cm	5	16.139 s^-1	10.746 s^-1	1658
				sum:	23150

Drawing is attached.
Marcala Tank A Drawing

Comments on design

- Since I do not have all the elevation information for the Marcala plant, i was unable to calculate the minimum water level for the flocculators. The lower baffles need to be cut to such at length that even at low flow the water will be able to pass over them. This constraint should be verified on site.