Lafayette College

**Department of Civil and Environmental Engineering**

CE 425: Water Supply and Pollution Control Fall 2011

**Homework #12  
Due Date: Wednesday – 4/21/11**

1. A flocculation basin is to be design for a water coagulation plant, and the design flow for the basin is 13.0 MGD. The basin is to be a cross-flow horizontal shaft, paddle-wheel type with a mean velocity gradient of 26.7 sec-1 (at 50oF), a detention time of 45 minutes, and a GT value from 50,000 to 100,000. Tapered flocculation is to be provided, and three compartment of equal depth in series are to be used. The compartments are to be separated by slotted, redwood baffle fences, and the basin floor is level. The G values are to be 50, 20 and 10 sec-1. The flocculation basin it to have a width of 90ft-0in to adjoin the settling basin. The paddle wheels are to have blades with 6 in. width and length of 10 ft. The outside blades should clear the floor by 1.0 ft. and be 1.0 ft below the water surface. There are to be six blades per paddle wheel, and the blades should have a clear spacing of 12 in. Adjacent paddle wheels should have a clear spacing of 30 to 36 in. between blades. The wall clearance is 12 to 18 in. Determine:
   1. The basin dimensions if increments of 1 in are used.
   2. The paddle-wheel design.
   3. The power to be imparted to the water in each compartment and the total power required for the basin.
   4. The range in rotational speed for each compartment if 1:4 variable-speed drives are employed.
2. A batch settling test has been performed on an industrial wastewater having an initial suspended solids concentration of 597 mg/L to develop criteria for the design of a primary clarifier. The test column was 5in (125 mm) in diameter and 8 ft (2.44 m) high, and sampling ports were located 2, 4, 6, and 8 ft (0.61, 1.22, 1.83, and 2.44 m) from the water surface in the column. The suspended solids remaining after the various sampling times are given the following table. The wastewater flow is 2.5 MGD (9460 m3/d). Determine:
   1. The design overflow rate and detention time if 65% of the suspended solids are to be removed. Use scale up factors of 0.65 for the overflow rate and 1.75 for the detention time.
   2. The diameter is a circular clarifier is used.
   3. The design diameter of the clarifier is equipment is available in 5-ft increments of tank diameter.
   4. The depth of the tank.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Depth ft (m) | Time (minutes) | | | | |
| 10 | 20 | 30 | 45 | 60 |
| 2 (0.62) | 394 | 352 | 243 | 182 | 148 |
| 4 (1.22) | 460 | 406 | 337 | 295 | 216 |
| 6 (1.83) | 512 | 429 | 376 | 318 | 306 |
| 8 (2.44) | 1018 | 1142 | 1208 | 1315 | 1405 |