Minnesota Pollution Control Agency

Water Quality

Wastewater Technical Review and Guidance

SETTLING REVIEW CHECKLIST

Water/Wastewater/#5.73, May 2001

FACILITY NAME | DATE

CONSULTING ENGINEER | SITE INSPECTION (DATE & INSPECTOR)

PLANNING OR DESIGN PHASE

Average Wet Weather (Peak Month) Flow to Plant		**gal/day**
Recirculation Flow	+	**gal/day**
Total Average Flow (Peak Month)	=	**gal/day**
PHWW Flow (Peak Hourly)		**gal/day**
Pump Delivery Rate		**gal/day**
Organic Loading, CBOD5		**lbs/day**
(Including Recirc), TSS		**lbs/day**
Location (check one)		**Primary**
		Intermediate
		Final
Type (check one)		**Circular**
		Rectangular
Feed (check one)		**Center Feed**
Rim feed clarifiers should not be approved unless clearly demonstrated to achieve the desired results.		**Rim Feed**

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% Removal	_____	**%**
Effluent $CBOD^5$	_____	**lbs/day**
Effluent TSS	_____	**lbs/day**
Process Preceded by (specify process)	_____	
Process Followed by (specify process)	_____	

GENERAL

Flow Distribution *– Effective flow measurement devices and control appurtenances (i.e., valves, gates, splitter boxes, etc.) should be provided to permit proper proportion of flow and organic load to each unit. If main plant flow is metered, weirs for each unit would suffice to provide measurement. Where duplicate units are provided, a central collection and distribution point including proportional flow and organic load splitting shall be provided for the return sludge flows. There shall be flexibility within each unit operation to enable the wastewater flow to any unit out of service to be distributed to the remaining units in service. Two flow splitting devices that do not perform well are:*

- *Wedgewall-the entrance and exit characteristics do not provide adequate splitting of the hydraulic flow and organic load.*
- *Single weir wall when the entrance pipe velocity is not dissipated prior to entering the header box.*

Number of settling units provided (multiple units required if flow>0.1 MGD).	_____
Room provided for possible future units.	_____
Splitter boxes assure equal distribution.	_____
Valves or gates provided to isolate each unit.	_____
Flexibility to redistribute flow from any unit out of service to remaining units in service.	_____
If single unit: bypass structure shall be provided to remove unit from service.	_____
If multiple units: When one unit out, hydraulic capacity of remaining units sufficient to handle peak hourly flow. Multiple units shall be designed to provide bypass capabilities.	_____

Where sludge return utilized, central collection and distribution point including flow splitters provided. _____

DESIGN CONSIDERATIONS

Dimensions (Diameter or length and width) (ft) **ft** _____

For circular clarifiers the tank radius should preferably not exceed five times the sidewater depth. For rectangular clarifiers it is recommended that the maximum length should not exceed ten time the depth.

Surface area (ft^2)

a) Including inlet baffle **ft^2** _____

b) Downstream of inlet baffle (use this for activated sludge) **ft^2** _____

Sidewater Depth (ft) **ft** _____

Capacity (ft^3) **ft^3** _____

Primary settling tank sizing should reflect the degree of solids removal needed and the need to avoid septic conditions during low flow periods.

Detention Time (hrs)

a) At average wet weather flow **hr** _____

b) At peak hourly wet weather flow **hr** _____

Distance between inlet and outlet (10' minimum) **ft** _____

Surface settling rate (gpd/ft^2) (must be calculated downstream of inlet baffle for activated sludge).

a) At average wet weather flow **gpd/ft^2** _____

b) At peak hourly wet weather flow **gpd/ft^2** _____

Solids loading rate (lbs solids/day/ft^2) at peak rate for activated sludge process. **$lb/day/ft^2$** _____

Inlet structuredesigned to dissipate inlet velocity, distribute flow equally both horizontally and vertically, and prevent short circuiting. _____

Weirs-*The use of both stainless steel nuts and bolts for adjustable weirs is not advisable because once tightened down they are difficult to loosen again. When using fiberglass weirs, special provisions should be available to insure a good seal and that no leakage will occur.* _____

Adjustable overflow weirs provided. _____

Location of weirs.
When using multiple weir troughs, they should be located sufficiently far apart to avoid excessive upward velocity between the troughs. _____

For rectangular clarifiers, ratio of distance of weirs from end wall to total length (recommend 25 percent). _____

Weir overflow rate (gal/day/ft). If pumping to clarifier, use pump delivery rate.

_____ **gal/day/ft**

To calculate the lineal feet of weir length use the horizontal length at the overflow water level at the design average wet weather flows. This is especially critical when using the intermittent notch type weir.

Weir troughs prevent submergence at peak design hourly flow. _____

Weir trough velocity (>1 ft/second at ½ design average flow) _____ **ft/s**

Slope of top of submerged surfaces (minimum 1.4 vertical to 1 horizontal) _____

Slope of undersides of submerged surfaces (minimum 1:1) _____

Method of dewatering

The dewatering should not adversely effect the performance of the unit receiving the drainage. Drainage of a unit directly to the digester is not acceptable. The design engineer should evaluate local ground water conditions and determine if pressure relief valves or methods of tank buoyancy prevention are warranted. Each process compartment are warranted. Each process compartment shall be constructed with load bearing walls, piping, valves and other appurenances to allow bypassing and dewatering each process compartment individually. Sufficient tank bottom slope should be provided to assure complete drainage.

Freeboard provided.

Freeboard-*Walls of settling tanks shall extend at least 6 inches (15 cm) above the surrounding ground surface and shall provided not less than 12 inches (30 cm) freeboard. Additional freeboard and/or the use of wind screens is recommended for settling tanks subject to wind currents that would cause tank surface waves and inhabit effective scum removal, and to reduce the heat loss during cold periods.*

SLUDGE AND SCUM REMOVAL

Scum collection and removal facilities shall be provided

If scum discharged with sludge, are special provisions for disposal needed?

When Scum is discharged to the digester, increased Operation and Maintenance may be required to maintain complete mix of the digester. Locating scum baffles too close to the outlet weir may cause an orifice effect and should be avoided. Consideration should be given to using positive displacement pumps. Also, piping with a high "C" factor should be used to prevent grease accumulation.

Type of sludge withdrawal. Suction withdrawal required for activated sludge plants designed for nitrification.
Gravity removal of sludge within the settling tank has been shown to be inadequate, causing problems such as rising sludge, sludge clumps, etc. Capabilities must be provided to waste sludge directly to the primary clarifier in order to blend the secondary sludge with primary sludge before going to the digester. Blending the primary and secondary sludge in this manner can be an operational advantage. Air lift pumping not allowed for primary sludges.

Slope of sludge hopper side walls (minimum 1.7 vertical tol horizontal). _____

Dimensions of sludge hopper bottom (maximum dimension of two feet). _____

Diameter of sludge withdrawal line (minimum 6"). _____

Static head necessary to maintain 3 ft/sec. Velocity in withdrawal pipe minimum 30"). _____

Provisions for rodding or back flushing individual sludge removal pipe runs. _____

Method for viewing, sampling and controlling rate of sludge withdrawal. _____

When a site glass is used, access for cleaning and maintenance of the glass must be provided. It is recommended that return sludge piping be terminated above the aeration tank liquid level to allow for observation and sampling. Capabilities should be considered to return and waste sludge concurrently. Facilities should be considered to add chlorine to return sludge lines for control of sludge bulking. In addition, consideration should be made to measure sludge removal rates and provide for sampling.

Means of measuring sludge removal rate. _____

Type of sludge removal (air lift not allowed for primary sludges).

Covers provided when Clarifier influent temperature is at or near freezing or when clarifiers follow activated sludge system with 12 hours or more detention time. _____

SAFETY

Safety features provided including machinery covers, life lines, stairways, walkways, hand rails, and slip resistant surfaces. _____

Convenient and safe access to gear boxes, scum removal mechanism, baffles, weirs, inlet stilling baffle area, and effluent channels. _____
If sidewalls are extended more than three feet above the liquid level or four feet above the ground level, convenient walkways and/or steps must be provided to facilitate cleaning and maintenance.
Operator Protection-*Swing gates may want to be considered in lieu of chains for gates in high traffic areas. Swing gates shall not open into the tank. Any effluent pipe large enough to allow accidental entry by a person shall be covered with a grate having a minimum of six inch openings.*

The fixtures and controls hall be located so as to provide convenient and safe access for operation and maintenance. Adequate area lighting shall be provided. When clarifiers are covered, lighting inside the cover shall be provided. _____

If covers provided, they allow easy accessibility for inspection and maintenance. _____

SETTLING CRITERIA REFERENCES

1. “Water Supply and Pollution Control,” Third Edition John W. Clark, Warren Viessman, Jr., Mark J. Hammer.

2. “Wastewater Engineering: Treatment, Disposal, Reuse” Second Edition, Metcalf & Eddy, Inc.

3. “Field manual for Performance Evaluation and Troubleshooting at Municipal Wastewater Treatment Facilities” EPA-430/9-78-001.

4. “Inspections Guide for Evaluation of Municipal Wastewater Treatment Plants” Epa-430-9-79-010.

5. “Process Design Manual for suspended Solids Removal” EPA-625/1-75-003a.

6. “Operation of Wastewater Treatment Plants” Manual of Practices No. 11 WPCF.

7. “Wastewater Treatment Plant Design,” Manual of Practices No. 8 WPCF.

8. “Design Criteria for Mechanical, Electrical and Fluid System and Component Reliability” EPA-430-99-74-001.

9. “Recommended Standards for Wastewater Facilities”, Health Education Services, 1997.