



**Minnesota  
Pollution  
Control  
Agency**

# SETTLING REVIEW CHECKLIST

Water Quality

Water/Wastewater/#5.73, May 2001

Wastewater  
Technical  
Review and  
Guidance

_____	_____
FACILITY NAME	DATE
_____	_____
CONSULTING ENGINEER	SITE INSPECTION (DATE & INSPECTOR)
_____	_____
PLANNING OR DESIGN PHASE	

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

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<b>% Removal</b>	_____	<b>%</b>
<b>Effluent CBOD<sup>5</sup></b>	_____	<b>lbs/day</b>
<b>Effluent TSS</b>	_____	<b>lbs/day</b>
<b>Process Preceded by (specify process)</b>	_____	
<b>Process Followed by (specify process)</b>	_____	

**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.**

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

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**DESIGN CONSIDERATIONS**

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

**ft**

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*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<sup>2</sup>)**

**a) Including inlet baffle**

**ft<sup>2</sup>**

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**b) Downstream of inlet baffle (use this for activated sludge)**

**ft<sup>2</sup>**

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**Sidewater Depth (ft)**

**ft**

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**Capacity (ft<sup>3</sup>)**

**ft<sup>3</sup>**

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*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**

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

**hr**

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

**ft**

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

**a) At average wet weather flow**

**gpd/ft<sup>2</sup>**

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

**gpd/ft<sup>2</sup>**

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**Solids loading rate (lbs solids/day/ft<sup>2</sup>) at peak rate for activated sludge process.**

**lb/day/ft<sup>2</sup>**

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**Inlet structured designed to dissipate inlet velocity, distribute flow equally both horizontally and vertically, and prevent short circuiting.**

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*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.*

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**Adjustable overflow weirs provided.**

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

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

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

**gal/day/ft**

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*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.**

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

**ft/s**

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

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

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### **Method of dewatering**

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*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.**

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***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**

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

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*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 to horizontal).**

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

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

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

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

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

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*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.**

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

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**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.**

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**SAFETY**

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

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**Convenient and safe access to gear boxes, scum removal mechanism, baffles, weirs, inlet stilling baffle area, and effluent channels.**

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*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 shall 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.**

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

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## 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.