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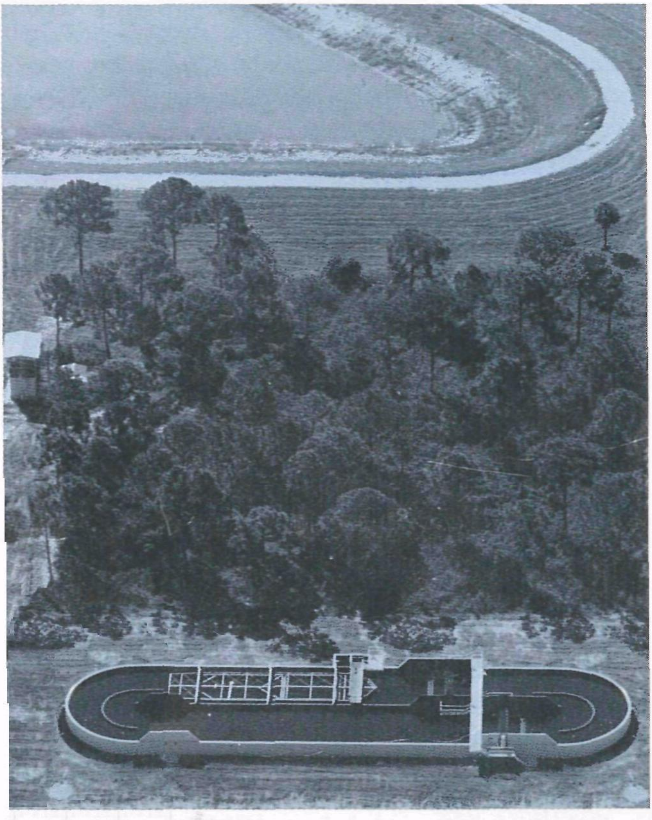
Intrachannel Clarification

An Update



Intrachannel Clarification - An Update

Introduction

Intrachannel clarifiers have now been funded almost seventy times through the construction grants program, and twelve of these systems were operational as of June 1986. The geographical distribution of these facilities is shown in Table 1. The operational experiences at these facilities have shown that while construction, O&M, and energy savings can be achieved using an intrachannel clarifier, problems may also be experienced especially if proper design criteria are not utilized. An evaluation of several of the operating systems was conducted in early 1986. The evaluation identified several advantages and common problems which are highlighted herein. Many of the systems were in start-up; thus, the problems reported may not be typical of the long-term performance of the systems.

The Process

The intrachannel clarifier originated as a modification of the oxidation ditch process in which aeration and clarification are conducted in the same basin. A subsequent modification by several manufacturers was to place the clarifier adjacent to the oxidation ditch using common wall construction. Due to the unique means of wastewater flow into and sludge return from these common wall clarifiers, these systems are also included in the assessment of intrachannel clarifiers.

The systems funded the most to date have been the United Industries BOAT CLARIFIERS™ and the Armco Environmental Enterprises-Burns and McDonnell Treatment System (BMTS™).

The BOAT CLARIFIER™ is constructed of stainless steel and requires little to no modification in design for installation into a conventional oxidation ditch. The clarifier is fabricated independent of the ditch structure and can be placed directly into the channel. Independent construction also allows for surface flow around the unit which eliminates the possibility of floating debris accumulating in the channel. The mixed liquor enters through the stern of the BOAT™ where quiescent conditions exist. As the wastewater flows toward the bow of the BOAT™ the solids settle and

EPA Region	State	Manufacturer 1	2	3	4	5	6	7	Total
II	New York		1			1	2		4
	New Jersey	1						1	2
III	Delaware		1						1
	Maryland	1							1
	Virginia	1	2						3
	West Virginia		3			1			4
IV	Alabama	1	6						7
	Florida	1	8						9
	Kentucky	4	1	2	1				8
	Mississippi		3						3
	South Carolina	1							1
	Tennessee	2							2
V	Illinois	2							2
	Minnesota	2							2
	Ohio	7							7
VI	Arkansas	1	2						3
	Louisiana		12						12
	Oklahoma	2	2						4
	Texas	2							2
VII	Iowa	2							2
	Kansas		2						2
	Missouri	5	2						7
VIII	South Dakota	2							2
IX	Arizona	1							1
X	Idaho		1						1
	Total	38	46	2	1	2	2	1	92

Manufacturer	Location	System
1 - Armco Environmental Enterprises	Kansas City, MO	BMTS™ (Burns & McDonnell Treatment System)
2 - United Industries	Baton Rouge, LA	BOAT CLARIFIER™
3 - EIMCO	Salt Lake City, UT	Carrousel Intraclarifier
4 - Lakeside Equipment Corp.	Bartlett, IL	Sidewall Separator
5 - Lightnin	Rochester, NY	Draft Tube Channel
6 - Innova-Tech	Valley Forge, PA	Pumpless Integral Clarifier
7 - Envirex	Waukesha, WI	Side-Channel Clarifier

Table 1. Location of Intrachannel Clarifier Systems in Design, Construction or Operation.

re-enter the ditch through sludge ports (Figure 1). The clarified effluent then flows over a weir in the bow and is removed from the ditch. Semi-concentrated solids are wasted from the stern of the BOAT™

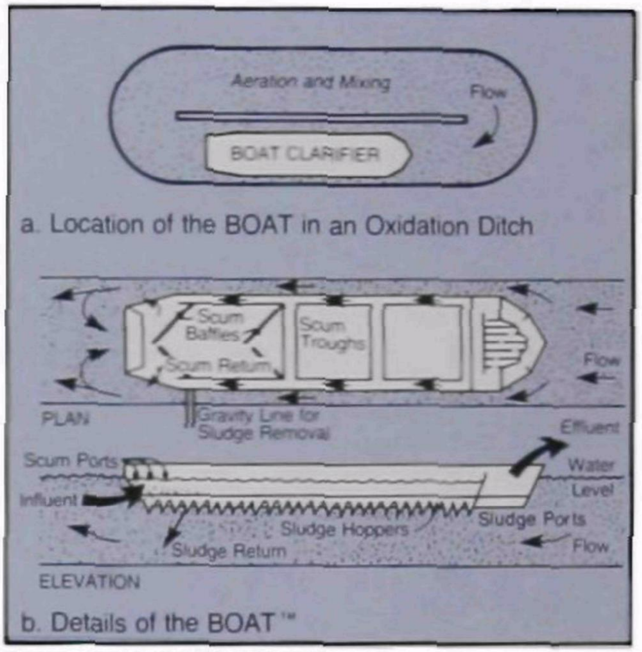


Figure 1. BOAT CLARIFIER™

In the BMTS™, the clarifier is constructed as part of the ditch (Figure 2). The mixed liquor enters the clarifier through baffles in the bottom of the clarifier. As the wastewater flows upward toward submerged orifice launderers, solids settle back down through the baffles and re-enter the ditch. Solids wasting is accomplished by wasting the mixed liquor from the ditch.

Advantages

The advantages of intrachannel clarifiers can include reduced construction and O&M costs and a reduction in land area requirements. Common wall construction reduces concrete requirements. Hydraulic head differences and gravity are used to force wastewater into the clarifier and return sludge back into the ditch. Pumping requirements are thereby reduced. Control over sludge return is eliminated, and sludge age is easily controlled by wasting mixed liquor from the ditch or from the intrachannel clarifier.

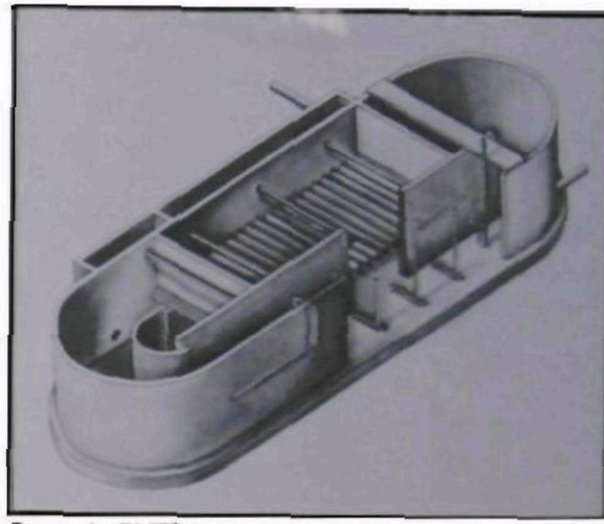


Figure 2. BMTS™ Intrachannel Clarifier

Start-up Operational Difficulties

As of March 1986, many of the systems listed in Table 1 had only recently begun operation. The operational problems reported may thus be more representative of start-up problems rather than long-term design deficiencies. At several systems, problems have been encountered with obtaining adequate flow velocity in the oxidation ditch. Proper operation of the clarifier is dependent upon adequate wastewater flow velocity around the ditch. Several facilities have reported that inadequate velocity has caused solids settling in the ditch, resulting in sludge bulking and excess scum accumulation. Changes in mixer design or mixing systems have since corrected velocity problems at some facilities.

Insufficient aeration has also occurred in several systems. In general, aeration systems which have performed well in conventional oxidation ditch systems provide adequate aeration in intrachannel clarifier systems.

Structural problems with submerged propeller mixers have also occurred. The original support masts were not strong enough to withstand the vibration of the mixer, and mast failure resulted. The use of stronger masts has corrected this problem.

Undersizing of the sludge handling facilities is the final common problem reported. Several systems are experiencing difficulty in wasting sufficient solids to keep the mixed liquor suspended solids (MLSS) concentration and the sludge age at desirable levels.

The design of the solids dewatering and removal facilities should take into account the consistency and settleability of the sludge associated with the specific intrachannel system being considered.

Design Keys

Based upon the operational problems discussed above, it is important to provide:

- Adequate mixing and aeration capacity
- Scum removal systems where flow barriers occur
- Adequate sludge handling capacity
- Adequate structural support for the mixing and aeration systems

In addition, one manufacturer recommends not using an intrachannel clarifier if the peak-to-average flow ratio exceeds 2.5. Finally before selecting or designing a system, it is recommended that operating systems be contacted.

Effluent Quality

When adequate flow velocity, aeration, and sludge handling facilities are available, secondary effluent quality is achieved. An effluent quality of 20 to 30 mg/L of BOD and TSS is reasonable to expect. Better effluent qualities have been attained at some systems; however, sufficient data are not available to determine if such treatment levels can be maintained continuously.

References

A brief review of the systems currently available is presented in the following references:

1. *Intrachannel Clarification - State of the Art*, by John Zirschky. Presented at the Field Evaluations of I/A Technologies, Technology Transfer Seminar Available from EPA-OMPC.

2. U.S.EPA. 1983. Intrachannel Clarification - A Project Assessment. DMPC-WH595; 401 M Street, SW; Washington, DC 20460. 2 page brochure.

3. Anon. 1986. Emerging Technologies with Roots in the Past. Water Engineering and Management. March, 1986. pp.28-31.

Mention of trade names or commercial products does not constitute endorsement

Prepared by Environmental Resources Management, Inc

For additional information on intrachannel clarifiers, the manufacturers listed in Table 1 or EPA regional offices, listed below, may be contacted.

EPA-OMPC(WH-595)
401 M Street, SW
Washington DC 20460
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John F Kennedy Federal Building
Boston, MA 02203

EPA Region 2
26 Federal Plaza
New York, NY 10278

EPA Region 3
841 Chestnut Street
Philadelphia PA 19107

EPA Region 4
345 Courtland Street, NE
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EPA Region 5
230 South Dearborn Street
Chicago, IL 60604

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26 West St Clair Street
Cincinnati, OH 45268
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Dallas TX 75270

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726 Minnesota Avenue
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999 18th Street
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