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MEMORANDUM
January 27, 1986

To: Darrel Anderson, Southwest Regional Office

From: Dale Clark

Subject: Tamoshan Wastewater Treatment Plant Limited Class II Inspection, June 17-18, 1985

ABSTRACT

On June 17 and 18, 1985, the Water Quality Investigations Section conducted a limited Class II inspection at the Tamoshan wastewater treatment plant (WTP). During the inspection, two fecal coliform samples exceeded the NPDES monthly average effluent permit limits. Dark, leathery foam was observed covering the secondary clarifier. Overall, the facility appeared to be doing well with respect to meeting National Pollutant Discharge Elimination System (NPDES) permit requirements.

INTRODUCTION

On June 17 and 18, 1985, a limited Class II inspection was carried out by the Washington State Department of Ecology (Ecology) at the Tamoshan WTP. The inspection was requested by the Ecology Southwest Regional Office (SWRO). The study objectives were to:

1. Provide a brief description of plant operation and flow scheme.

2. Provide information on plant loadings and treatment efficiency.

3. Compare Class II inspection data with the effluent limitations given in NPDES permit number WA-003729-0.

Limited Class II facility inspections are designed to meet the above-mentioned objectives and make general observations. In-depth plant design and process control are not a part of such investigations.

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In conjunction with the Class II inspection, a receiving water study was carried out by the Ecology Intensive Surveys Unit. The results of the intensive survey are documented in a separate report (Kendra and Determan, 1985).

The inspection was conducted by Dale Clark. The SWRO was represented by Darrel Anderson. Victor Berube (plant operator) was present during the second day of the inspection.

SETTING

The Tamoshan WTP is located on the Cooper Point Peninsula approximately 5 miles north of downtown Olympia, Washington, in Thurston County (Figure 1). Secondary treated effluent is discharged to Budd Inlet (Class A state water). The facility treats wastewater from the residential community of Tamoshan (population approximately 140 persons).

The WTP is a secondary treatment facility consisting of two aeration basins, a secondary clarifier, a chlorine contact chamber, and a final effluent sump chamber (Figure 2). Wastewater enters the system via a headworks which splits the waste stream between two aeration basins. The basins include a partially submerged bar screen at the head end. The basin provides secondary treatment using the extended aeration process (complete mix). Basin #1 is covered to prevent vandalism, while Basin #2 is not.

Mixed liquor flows from the basins to the secondary clarifier where sludge solids settle and is returned to the aeration basins or wasted by pumping directly to a tank truck, usually once per week. The clarifier is operating with a modified launder weir because of the inability to level the original weir. Clarified effluent flows into the chlorine contact basin for disinfection, then to the final effluent sump. Effluent is discharged (two pumps) to Budd Inlet through a 1,500-foot-long, six-inch line with diffuser at the end.

Because the facility does not have a flow meter, wastewater flows from the facility are estimated based on the number of sump pump cycles/day and sump volume. A small service building located over the chlorine contact basin houses the chlorine (hydrated calcium hypochlorite) storage tank, chlorine-feed regulator, sump pump cycle counter, and supplies. Another building houses air compressors (two) used to deliver air to the aeration basin diffusers, laboratory equipment, and supplies.

METHODS

Samples collected during the inspection are noted on Table 1. The sampling location for the 24-hour influent composite (just in front of the influent line "Y") and 24-hour effluent composite (from the effluent sump chamber) are shown on Figure 2. Manning automatic compositors were used to collect

200 mL sample aliquots every 30 minutes for both influent and effluent. Grab samples were also collected periodically at the same locations. In addition, grab samples were taken in the aeration basins and at the manhole located 50 feet downstream from the effluent sump chamber. The manhole location was used for collection of final chlorinated effluent for fecal coliform (FC) analysis. The WTP operator composited grab samples of equal volumes collected every two hours during the day: 0800 to 1600 on June 17 and 0800 to 1200 on June 18 for influent; 0900 to 1700 on June 17 and 0900 to 1300 on June 18 for effluent. Composite samples were split with the operator. FC grabs were simultaneously sampled by Ecology and the WTP; Ecology sampling included a replicate sample.

Physical dimensions and sludge depth were measured in the secondary clarifier, chlorine contact chamber, and effluent sump (wet well). Due to plant configuration and inaccessibility of locations adequate for flow measurement by available methods (Manning dipper or Marsh-McBirney flow meters), flow was estimated based on the effluent sump pump cycles/day and sump displacement.

RESULTS AND DISCUSSION

Table 2 presents the analytical results. Table 3 compares inspection data to NPDES permit limits. Most measurements were within the NPDES limits. The two fecal coliform samples analyzed at the Ecology Manchester laboratory exceeded the monthly and weekly NPDES permit limit average concentration. A third sample was analyzed at the LOTT treatment plant. This sample also exceeded the permit limit.

Table 4 compares plant capacity to Ecology design criteria (Ecology, 1980). All three operational units (aeration basins, secondary clarifier, and chlorine contact basin) appear to be underloaded. The aeration basins appeared to have the greatest estimated capacity and may be able to treat up to twice the present plant load.

The clarifier appeared to be operating well with the modified launder weir. If solids loss becomes a problem in the future, the flow pattern should be checked to ensure the modification continues to work. Sludge depth in the clarifier was seven feet (41 percent of total depth), which is considered too high. Also, excessive foam was observed in the clarifier (Figure 3). A possible cause is filamentous growth which often occurs when sludge is held too long. Sludge is now wasted once per week. It is recommended that the sludge-wasting rate be increased to reduce sludge age in the aeration basins. This also will reduce sludge depth in the clarifier.

Theoretically, detention time and chlorine residual in the chlorine contact basin were adequate, but FC counts were high, possibly a result of short-circuiting. The flow pattern should be checked, and baffling installed if required. The Daily Monitoring Reports (DMRs) suggest that high FC counts have been an on-going problem.

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During the inspection the operator indicated that installation of covers for aeration basin #2 was scheduled for the near future. This is a good idea since it will present vandalism.

Laboratory Review

The plant operator collects grab samples as required for NPDES permit requirements (pH, chlorine residual, fecal coliform). Laboratory reagents are stored in a high-temperature environment (compressor pump shed, Figure 2). They should be moved to a cooler storage area to decrease the potential for heat degradation. Four grab samples (equal volume every two hours) are composited over an 18-hour period for BOD_5 and suspended solids analysis per NPDES permit requirments. A sludge volume index (SVI) test is also run for process control. Lab analyses are contracted out to Thurston County Health Department (monthly FC test) and the LOTT STP (monthly BOD_5 and TSS tests).

Table 5 presents laboratory results for samples split with operator during the inspection. The agreement between the Ecology and Tamoshan results was generally close. The Tamoshan approach for collecting and analyzing samples appears reasonable.

CONCLUSIONS AND RECOMMENDATIONS

1. Both fecal coliform grab samples collected during the inspection exceeded the NPDES average permit limits and monthly average limits. Inspection of the chlorine contact chamber for short-circuiting is a likely starting point to try to solve problem. The other NPDES parameters fell within the permit limits.

2. Plant physical capacity appears to be more than adequate. The operator should investigate the possibility of using one aeration basin. This should reduce sludge age and could help resolve the foaming problem in the clarifier.

3. Although a problem was not noted during the inspection, the clarifier weir modification may be unfavorably influencing the flow pattern. The weir should be investigated if effluent solids loss becomes a problem in the future.

4. Composite sampling and contracted laboratory results were acceptable for plant monitoring. It is suggested that laboratory reagents used at the plant site be removed from the hot compresser building and stored in a cool, dark storage cabinet.

DC:cp

Attachments

LITERATURE CITED

Ecology, 1980. Criteria for Sewage Works Design. February 1980.

Kendra, W. and T.A. Determan, 1985. Effects of Three Small Treatment Plants on Budd Inlet Receiving Waters. Ecology memorandum of November 6, 1985, to Tom Eaton, Olympia, WA. 22 pp.

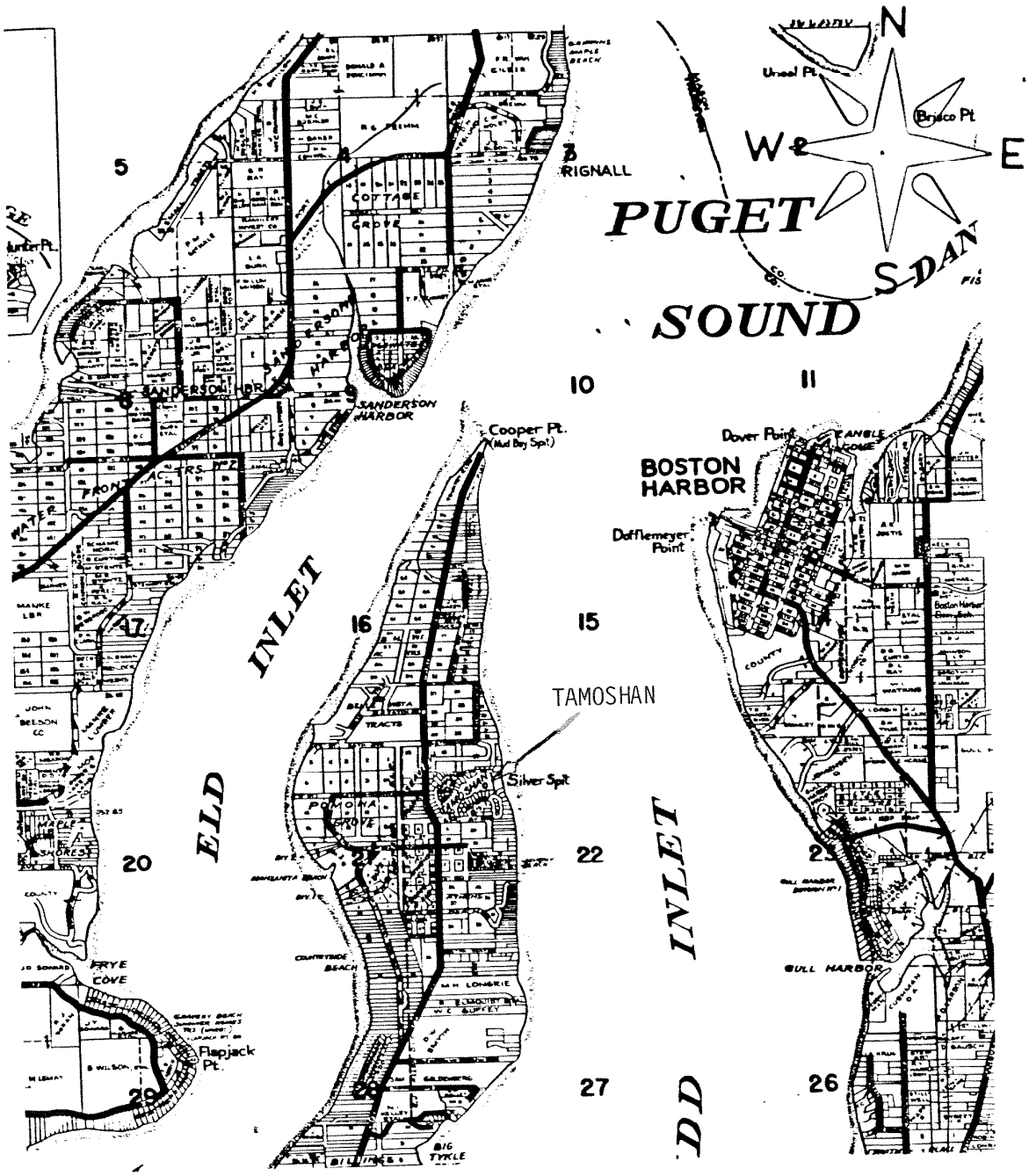

Figure 1. Location of the Tamoshan WTP on Cooper Point Peninsula, Class II Inspection, 1985.

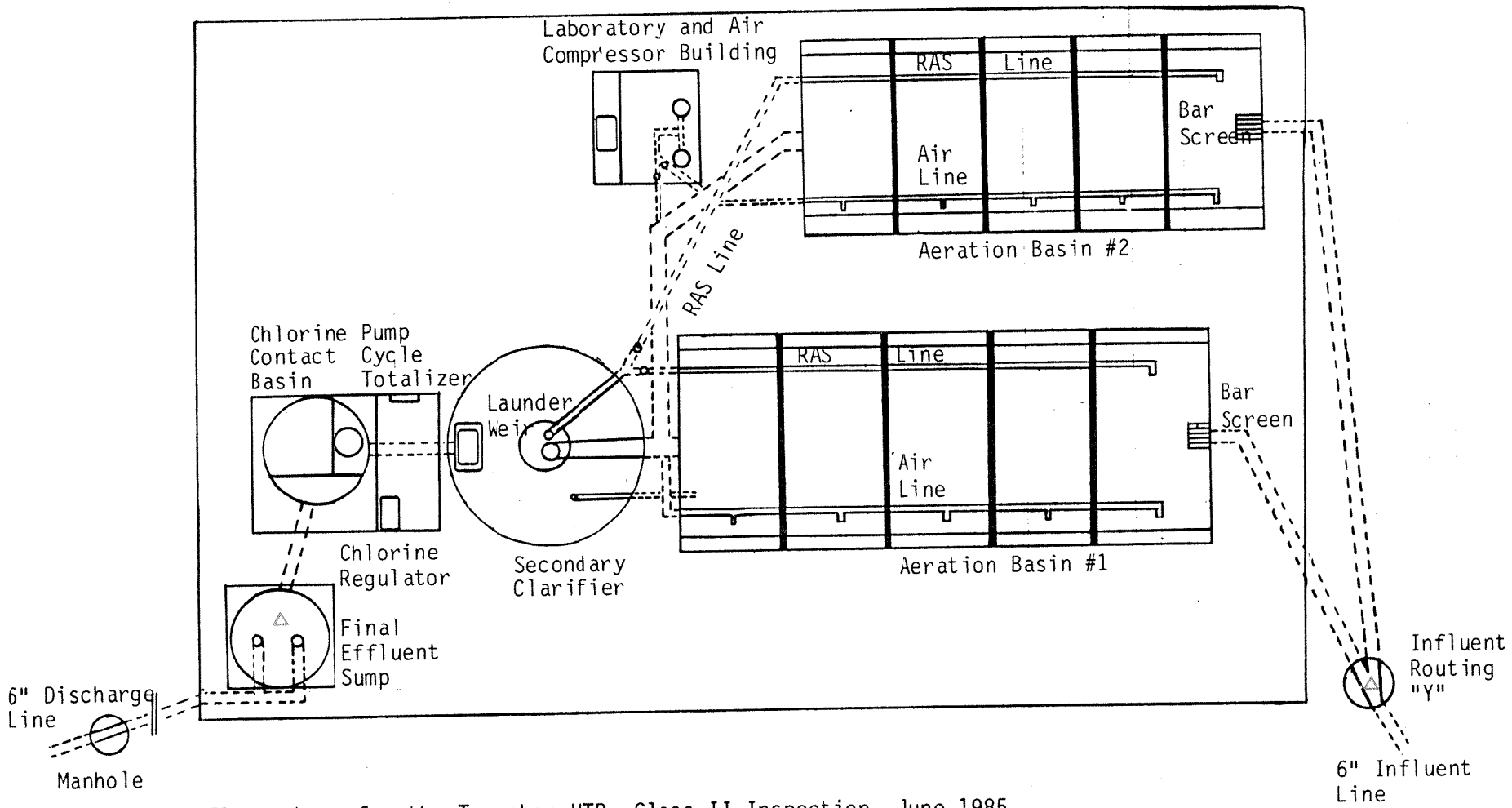

Figure 2. Flow scheme for the Tamoshan WTP, Class II Inspection, June 1985.

△ influent and effluent sampling locations

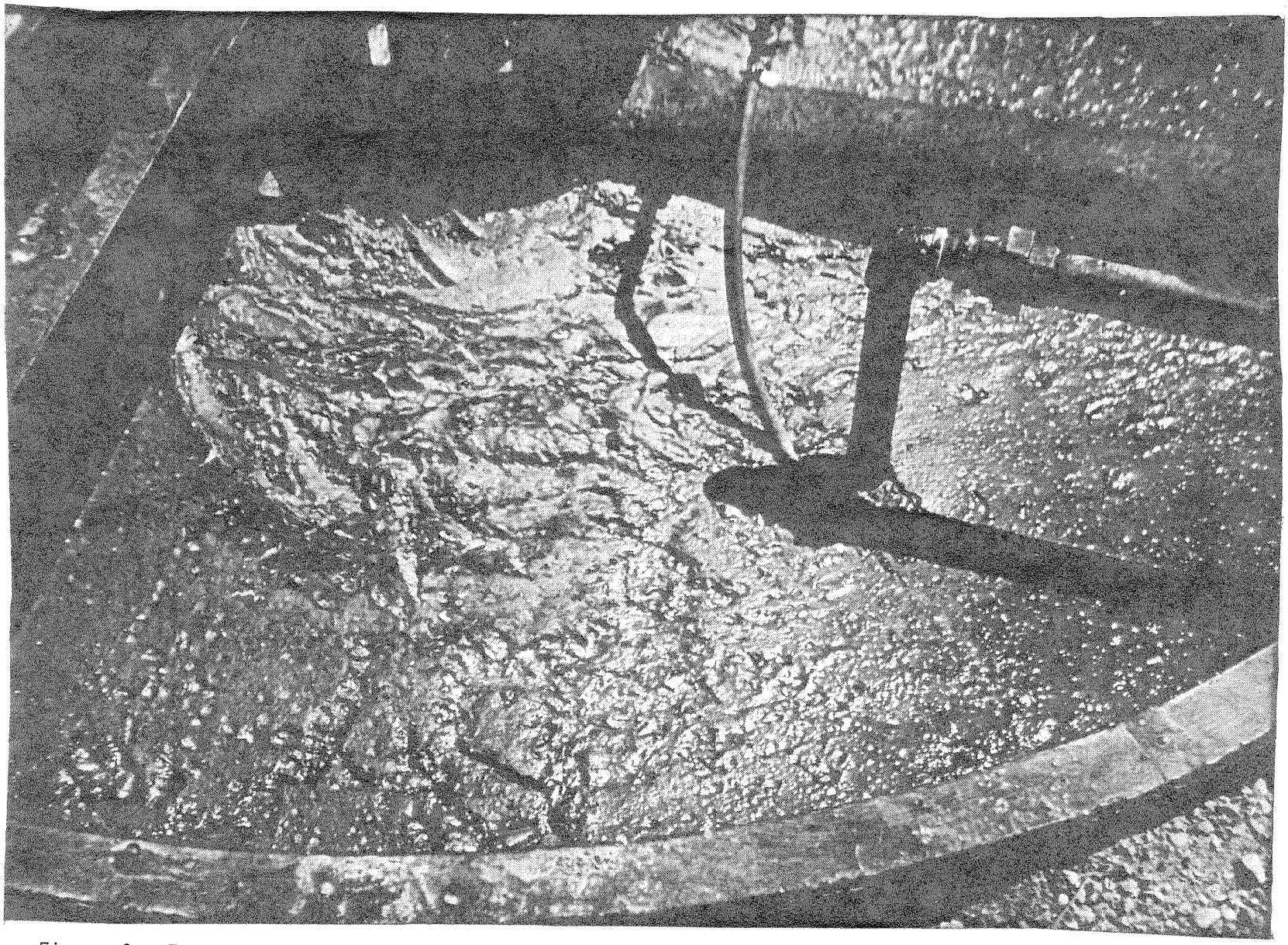

Figure 3. Tamoshan WTP secondary clarifier. Note dark, leathery foam on surface, indicative of old sludge.

Table 1. Sampling schedule for Class II facility inspection performed at Tamoshan wastewater treatment plant, June 17-18, 1985. All values in mg/L unless otherwise noted.

			Field Analyses						Laboratory Analyses												
	Date	Time	pH (S.U.)	Spec. Cond. (umhos/cm)	Temp (°C)	Dissolved Oxygen	Sludge Depth (ft)	Residual Chlorine	pH (S.U.)	Spec. Cond. (umhos/cm)	COD	BOD_5	Soluble BOD_5	Nutrients (5)	Solids (4)	MLSS	Turbidity (NTU)	Alkalinity	Oil & Grease	Fecal Coliform (#/100 mL)
Grab Samples																					
Influent	6/17	0825	X	X	X																
	6/17	0935	X	X	X																
	6/17	1010	X	X	X																
	6/17	1150	X	X	X																
	6/17	1515	X	X	X																
	6/18	1030	X	X	X																
	6/18	1215	X	X	X																
Aeration Basins	6/17	0945[1]				X	X														
	6/17	1525[1]				X															
	6/18	1400				X[3]	X[2]									X[3]					
Chlorine Contact Basin	6/18	1400					X														
Effluent Sump (wet well)	6/17	0835	X	X	X			X													
	6/17	0940	X	X	X	X		X													
	6/17	1015	X	X	X			X													
	6/17	1155	X	X	X	X		X													
	6/17	1505	X	X	X	X		X													
	6/18	1025	X	X	X	X		X													
	6/18	1230	X	X	X	X		X													
	6/18	1355	X	X	X	X	X	X													
Effluent (manhole)	6/18	1345																			X
Composite Samples																					
Influent*	6/17	1140																			
	6/18	1200	X	X	X				X	X	X	X	X	X	X		X	X	X		
Effluent*	6/17	1150																			
	6/18	1330	X	X	X				X	X	X	X	X	X	X		X	X	X		

[1]Sampled aeration basin #2 only.

[2]Sampled aeration basin #1 only.

[3]Sampled both aeration basins.

*24-hour time-paced composite. Approximately 200 mLs of sample were taken every 30 minutes during the compositing period.

Table 2. Grab and composite sample analytical results, Ecology Class II facility inspection performed at Tamoshan WTP, June, 1985. All values in mg/L unless otherwise noted.

			Field Analyses						Laboratory Analyses															
											Nutrients (5)					Solids (4)								
	Date	Time	pH (S.U.)	Spec. Cond. (umhos/cm)	Temp. (°C)	D.O.	Resid. Chl.	Sludge Depth (ft)	pH (S.U.)	Spec. Cond. (umhos/cm)	COD	BOD_5	NO_3-N	NO_2-N	NH_3-N	O-PO_4-P	T-PO_4-P	Total Solids	TNVS	TSS	TNVSS	MLSS	Turb. (NTU)	Alk. as $CaCO_3$	Resid. Oil & Grease	Fecal Coli. (col/100 mL)
Grab																										
Influent	6/17	0825	8.1	800	17.0																					
	6/17	0935	8.4	465	17.6																					
	6/17	1010	8.0	420	17.5																					
	6/17	1150	9.2	780	18.4																					
	6/17	1515	8.5	630	17.5																					
	6/18	1030	8.1	475	17.5																					
	6/18	1215	8.0	360	17.4																					
AB #1[1/]	6/18	1400				0.1		2.0														3200				
AB #2[1/]	6/17	0945				0.0		1.5																		
	6/17	1525				0.0																				
	6/18	1400				0.3																2300				
Clarifier	6/19							7.0																		
Chlorine Contact Basin	6/19							0.0																		
Effluent Sump (wet well)	6/17	0835	7.4	>1,000	17.5		1.0																			
	6/17	0940	7.4	>1,000	17.5	5.9	1.0																			
	6/17	1015	7.4	>1,000	17.5		1.3																			
	6/17	1155	7.6	>1,000	18.1	5.7	1.3																			
	6/17	1505	7.2	>1,000	18.4	5.2	2.5																			
	6/18	1025	7.4	>1,000	18.8	4.9	1.0																			
	6/18	1230	7.4	>1,000	19.0	5.0	2.0																			
	6/18	1355	7.7	>1,000	18.7	5.1	2.5																			
	6/19							0.0																		
Effluent Manhole	6/18	1335	7.4																							1500, 660, >2400[2/]
Composite																										
Influent	6/18	1200	8.3	>1,000	3.8				7.0	2670	380	150	0.23	0.03	11.0	6.4	12.5	1600	1300	290	170		140	260	<1	
Effluent	6/18	1330	7.7	>1,000	4.8				7.3	2720	100	<20	8.6	0.3	4.7	9.7	11.5	1600	1400	9	<1		7	140	<1	

[1/] AB = aeration basin; air diffusers were operating during D.O. sampling.

[2/] Fecal coliform grab sample analyzed by the Thurston County Health Department laboratory.

Table 3. Tamoshan WTP loadings and comparison with NPDES permit limits.

Sample Type	Inspection Measurements: Concentration	Flow (MGD)	lbs/day	NPDES Effluent Limitations: Monthly Average mg/L	Monthly Average lbs/day	Monthly Average col/100 mL	Weekly Average mg/L	Weekly Average lbs/day	Weekly Average col/100 mL
Influent BOD_5	150	0.014	17.5						
Effluent BOD_5	<20	0.014	<2.3	30	9		45	13	
Influent S.S.	290	0.014	33.9						
Effluent S.S.	9	0.014	1.1	30	9		45	13	
Effluent F.C.	/1600/ (col/100 mL)					200			100
	7660/ (col/100 mL)					200			100
Effluent pH (S.U.)	7.7			shall not be outside the range of 6.0 to 9.0					

/ / = Exceeds monthly and weekly average for NPDES permit effluent limitations.

Table 4. Comparison of inspection measurements to Ecology design criteria (1980) - Tamoshan, June 1985.

Influent	Flow (MGD)	BOD_5 mg/L	BOD_5 lbs/day	TSS mg/L	TSS lbs/day
Inspection Measurements	0.014	150	17.5	290	33.9

Aeration Basins (AB1 and AB2)

	Process Modification	Flow Regime	Mixed-Liquor Suspended Solids (mg/L)	Detention Time (hr)[1]	Aerator Loading (lb BOD/ 1000 ft^3 Tank Volume)	Tank Size Length (ft.)	Width (ft.)	Depth[2] (ft.)	Volume (gal.)
Inspection Measurements	extended aeration	complete mix	AB1 3,200	48	4.6[1]	22.6	9.3	9.0	14,100
			AB2 2,300	55	4.0[1]	25.0	10.2	8.5	16,200
				24[3]	9.25[3]	22.6[3]	9.3[3]	9.0[3]	14,100[3]
Ecology Criteria			2,000-6,000	10-24	10-25				

Secondary Clarifier

	Flow (MGD)	Surface Overflow Rate Average Flow (gpd/ft^2)	Surface Overflow Rate Peak Flow[5] (gpd/ft^2)	Solids Loading Rate[4] Average Flow (lbs/day/ft^2)	Solids Loading Rate[4] Peak Flow[5] (lbs/day/ft^2)	Tank Size Diameter (ft.)	Depth[2] (ft.)	Surface Area (ft^2)	Volume (gal.)
Inspection Measurements Physical dia. 10'	0.014	180	530	8	24	10	16.3	79	9,630
Ecology Criteria		200 - 400	800	25	40				

Chlorine Contact Chamber

	Flow (MGD)	Detention Time (minutes) Average Flow Minimum	Average Flow Maximum	Peak Flow[5]	Tank size Diameter (ft.)	Depth[2] (ft.)	Volume (gal.)
Inspection Measurements	0.014	200		67	6.0	9.25	1,960
Ecology Criteria		60	120	20			

[1] Based on 1/2 of total flow sent to each aeration basin.
[2] Depth of water measured during inspection.
[3] Assuming all flow sent to aeration basin #1.
[4] Based on mean MLSS of aeration basins #1 and #2. Assumes 100 percent sludge recycle.
[5] Based on a flow three times average flow.

Table 5. Laboratory comparison of split samples (Ecology and Treatment Plant) collected June 18, 1985, during the Tamoshan Class II inspection.

	Sampler	Laboratory	Time	BOD_5 (mg/L)	TSS (mg/L)	Fecal Coliform (col/100 mL)
Influent						
Composite	Ecology	Ecology	1200	150	290	
	Treatment Plant	Ecology	1200	170	88	
	Ecology	LOTT[1/]	1200	210	181	
	Treatment Plant	LOTT	1200	234	158	
Effluent						
Composite	Ecology	Ecology	1330	<20	9	
	Treatment Plant	Ecology	1330	20	14	
	Ecology	LOTT	1330	8.3	12	
	Treatment Plant	LOTT	1330	14.1	16	
Grab	Ecology-[2/]	Ecology	1355			1,500; 660
	Treatment Plant	TCHD[3/]	1355			>2,400

[1/]LOTT = Lacey, Olympia, Tumwater, and Thurston County WTP Laboratory.
[2/]Combined sampling by Ecology and treatment plant.
[3/]Thurston County Health Department Laboratory.