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Stanwood Class II Inspection - September 8-9, 1992

by
Marc Heffner

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Toxics, Compliance and Ground Water Investigations Section
Olympia, Washington 98504-7710

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ABSTRACT

A Class II Inspection was conducted at the Stanwood Wastewater Treatment Plant on September 8-9, 1992. Stanwood operates a lagoon-type secondary wastewater treatment system discharging to the Stillaguamish River. An algal bloom occurred in the lagoon during the inspection resulting in degraded effluent quality. Comparison of inspection data with NPDES permit limits found BOD_5, TSS, and fecal coliforms in excess of weekly and/or monthly permit limits. Few priority pollutant scan compounds were detected in the Stanwood influent, effluent, and sludge samples. Several of the bioassay organisms tested were sensitive to the Stanwood effluent. *Microcystis*, the organism comprising the algal bloom, may have contributed to the observed toxicity.

INTRODUCTION

A Class II Inspection was conducted at the Stanwood Wastewater Treatment Plant on September 8-9, 1992. Conducting the inspection were Guy Hoyle-Dodson and Marc Heffner of the Ecology Compliance Monitoring Unit. Stanwood was represented by John Magill and Kevin Hushagen.

Stanwood operates a secondary wastewater treatment system. The system consists of headworks, a stabilization pond (lagoon), and chlorination facilities (Figure 1). Wastewater discharge to the Stillaguamish River is regulated by NPDES Permit No. WA-002029-0. The permit expired on September 14, 1987, but is still in force pending a new permit.

The Class II Inspection was designed to serve as confirmation of the present plant operating status to aid in development of a revised permit. The inspection will also provide additional plant data to support a dilution study in the Stillaguamish River by the Ecology Watershed Assessment Section (Glenn, in preparation). Specific objectives were:

1. verify compliance with NPDES permit limits,

2. characterize wastewater toxicity with chemical scans and with bioassays,

3. assess plant operation and ability to treat wastewater flows, and

4. provide data to assist the Watershed Assessments Section dilution zone study.

SETTING

The Stanwood facility treats wastewater flows from Stanwood plus septage. Influent flow passes through the headworks consisting of a grit channel, bar screen, and Parshall flume (Figure 1). Septage also enters the system at the headworks. Wastewater is then routed to the 36-acre lagoon. Four small lagoons are also available, but were not being used. The four lagoons had been out of service for some time. The lagoon effluent is chlorinated and routed through a chlorine contact chamber. The chlorine contact chamber was unusual. It had numerous small compartments with gates in between allowing various routing and detention time options. At the time of the inspection, few of the gates worked and only one routing option was available. The treated wastewater then passed through an outlet gate and was discharged into the Stillaguamish River.

The lagoon system operates as a continuously discharging facility during the wet season and an intermittently discharging facility during the dry season. Hydraulics allow the plant to discharge only during low and moderately high tides. For roughly the first hour of a discharge cycle, flow consists of the water held in the chlorine contact basin since the last discharge cycle. The water had been previously chlorinated, but has no chlorine residual at the time of discharge.

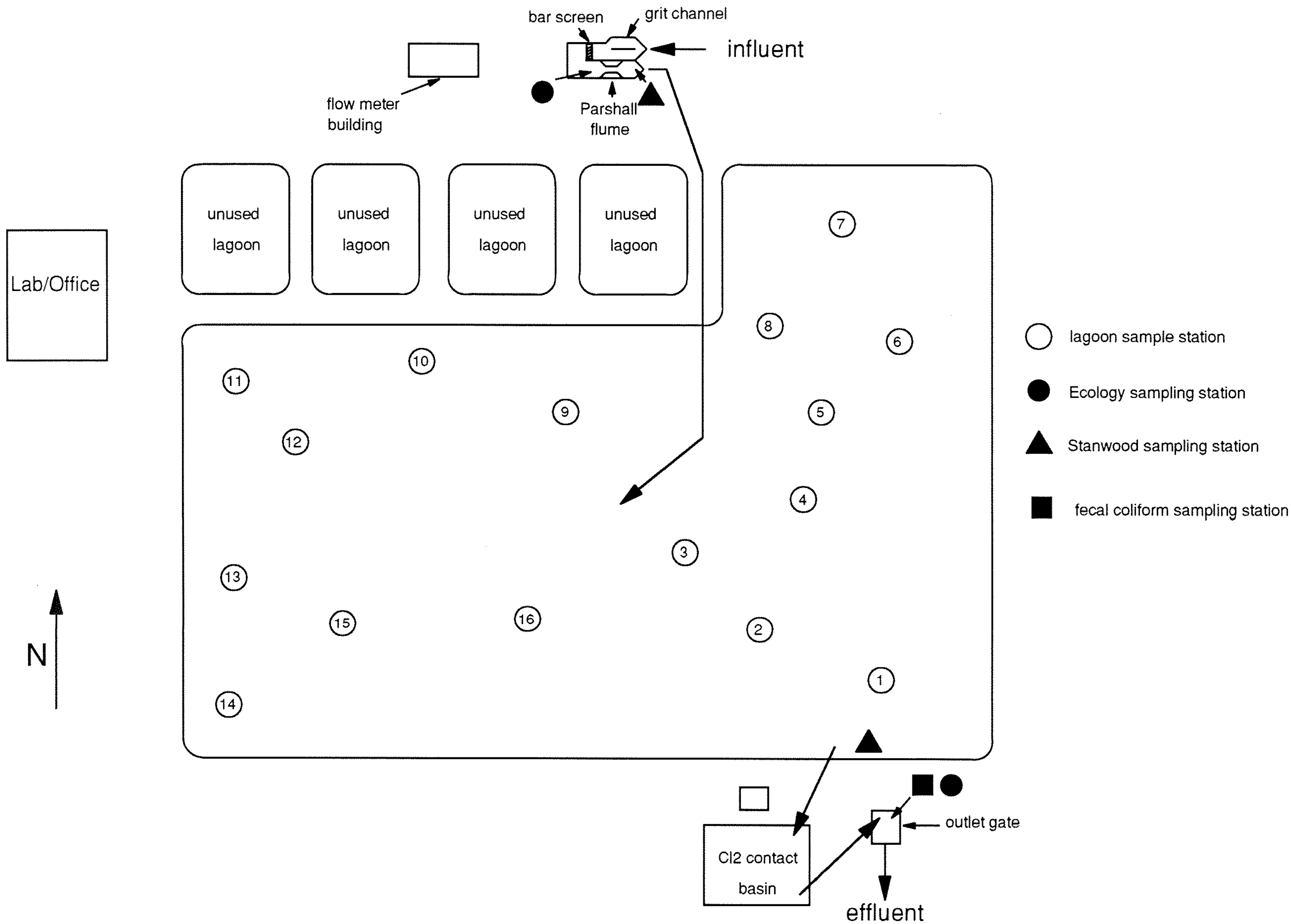

Figure 1 - Flow Scheme - Stanwood, September 1992.

Prior to the inspection, discharge had been minimal allowing the lagoon level to rise in preparation for the receiving water study by the Ecology Watershed Assessments Section (Glenn, in preparation). Discharge for all of August was for one hour while preliminary dye tests were conducted. September discharge prior to the Class II Inspection was approximately 0.5 MGD for 24 hours beginning on September 3 in coordination with the receiving water study. At the time of the Class II Inspection the lagoon was operating at a greater depth than normal. Discharge occurred between 0630-1530 as allowed by the tidal conditions. The day was sunny with the wind blowing from the northwest, across the lagoon toward the discharge area. The operator checked the effluent chlorine every two to four hours and adjusted as necessary.

After the receiving water study and Class II Inspection were completed, the lagoons were scheduled to be drawn down to allow repair of the chlorine contact chamber gate system.

PROCEDURES

Ecology collected grab and composite samples. Ecology collected influent and effluent composite samples at the plant. An Ecology Isco composite sampler was set up to collect equal volumes of influent sample every 30 minutes for 24 hours. An Ecology Isco composite sampler was set up to collect equal volumes of effluent sample every ten minutes for eight hours. The effluent sampler began sampling approximately one hour after discharge began. The time lag allowed the water held in the chlorine contact basin since the last discharge cycle to be discharged prior to composite sampling. Also, a grab-composite sample of effluent was collected for bioassay analysis. Sampling configurations and locations are summarized in Figure 1.

Samples collected from the lagoon were collected from a rowboat. Sludge depth and water depth measurements were made using a "Sludge Judge" core sampler. Sludge samples were collected using the "Sludge Judge" from three stations in the lagoon, composited, and sent for laboratory analysis.

Stanwood collected influent and effluent grab-composite samples. The samples include four grab samples taken at approximately two-hour intervals during the workday.

Ecology and Stanwood samples were split for analysis by both the Ecology and Stanwood labs. Samples collected, sampling times, and parameters analyzed are summarized in Appendix A.

Samples for Ecology analysis were placed on ice and delivered to the Ecology Manchester Laboratory. Ecology analytical procedures and the laboratories doing the analysis are summarized in Appendix B.

QUALITY ASSURANCE/QUALITY CONTROL

Sampling

Water sampling quality assurance/quality control (QA/QC) included pre-inspection cleaning of all sampling equipment, including the composite samplers, for priority pollutant sampling. QA/QC cleaning procedures are summarized in Appendix C.

Sediment sampling QA/QC included rinsing the "Sludge Judge" with lagoon water and sediment prior to collecting the sediment and pre-inspection cleaning for priority pollutant sampling of other equipment that would contact the samples (Appendix C).

Chain of custody was maintained on all samples.

General Chemistry Analysis

Holding times, procedural blanks, duplicate analysis results, spike recoveries, and laboratory control sample results met Ecology quality standards for most general chemistry parameters. Exceptions are marked with appropriate qualifiers in the data tables.

Priority Pollutant Organics Analysis

Volatile (VOA) scan holding times, method blanks, instrument calibration, and surrogate recoveries met Ecology standards for data use without further qualification with one exception. Methylene chloride was detected in the method blank for water samples, so methylene chloride data are appropriately qualified.

Base-neutral acid (BNA) data for sample 378091 are qualified because sample extraction was done after the holding time limit of seven days was exceeded. BNA analysis of the other samples met Ecology QA/QC requirements.

Pesticide/PCB data for sample 378082 were extracted after the holding time limit of seven days was exceeded. Matrix spike recoveries were poor and there was no reference peak in the standards used for quantitation to correlate the retention times of the analytes detected in the samples. All compounds quantified are qualified "NJ" - there is evidence the analyte is present; the associated numerical result is an estimate. Also, all non-detected analytes in sample 378091 are qualified "UJ" due to poor spike recoveries.

Priority Pollutant Metals Analysis

Holding times, instrument calibration, procedural blanks, and laboratory control sample data met Ecology standards. Spike recoveries were out of acceptance limits in water samples for thallium and silver; and in sediment samples for antimony, chromium, silver, thallium, selenium, and mercury. Corresponding data are qualified with an "N" qualifier (N = value not within control limits). Also, zinc data are qualified with an "E" qualifier, denoting possible interferences.

Bioassays

Control results, reference toxicant results, and test solution chemistry data (dissolved oxygen, pH, etc., as applicable) were acceptable with one exception. The dissolved oxygen concentration in the rainbow trout test fell to between 5.7 and 6.1 mg/L, slightly below the required minimum of 6.4 mg/L for the test conditions. The lab reported that "Although those levels of dissolved oxygen would not ordinarily be toxic to fish, it may add to the stress produced by the sample toxicity" (Stinson, 1992). An additional aliquot of sample was tested under continuous aeration to maintain the required dissolved oxygen concentration.

RESULTS AND DISCUSSION

Flow Measurement

Flows at the plant were measured by an influent flow meter in conjunction with a Parshall flume. The flume location was less than ideal - several feet upstream of the flume the channel made a 180 degree bend. A check of the flume found it to be slightly bowed - 12 inches at the top and 13 inches near the bottom at fluid level height during the inspection. Stanwood instantaneous flow meter measurements were 80 and 90% of Ecology instantaneous measurements of 0.352 MGD and 0.295 MGD for a 12-inch flume.

The effluent flow meter was not working during the inspection. A record of effluent flows for 1991 was provided, but the flows were only estimates rather than measured. The configuration of the outlet channels was not conducive to instantaneous flow measurements on a temporary basis. Because accurate effluent flow measurements could not be made, inspection effluent loads were estimated using the influent flow.

The facility needs accurate influent and effluent flow measurements. The influent flume/meter should be inspected and adjusted for accuracy and an accurate effluent flow meter should be installed and maintained.

General Chemistry Data

Considerable variability was noted between the grab and composite samples collected during the inspection (Table 1).

Ecology and Stanwood influent composite samples had higher TSS and TOC/COD concentrations than the Ecology grab samples. Both Ecology grab samples were collected during the day when no septage was being dumped. The Stanwood grab composite sample collected between 0800 and 1700 included septage in the last of four grabs. The impact of septage on the Ecology composite sample, which had the highest solids and BOD/TOC/COD

Table 1 – Ecology General Chemistry Results – Stanwood, 9/92.

Location:	Inf–1	Inf–2	Inf–E	Inf–S	Lag–1	Lag–2	Lag–3	Lag–4	Ef–3	Ef–1	Ef–2	Ef–GC	Ef–E	Ef–S	Sludge
Type:	grab	grab	E–comp	S–comp	grab	grab	grab	grab	grab	grab	grab	gr–comp	E–comp	S–comp	gr–comp
Date:	9/9	9/9	9/8–9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9
Time:	0820	1340	1500–1500	*	1205	1220	1235	1250	0725	0900	1430	**	0730–1530	*	***
Lab Log #:	378080	378081	378082	378083	378084	378085	378086	378087	378094	378088	378089	378090	378091	378092	378093
LABORATORY RESULTS															
Conductivity (umhos/cm)	871	777	932	939						1150	1120	1095	1150	1140	
Alkalinity (mg/L CaCO3)	310	241	293	338						216	216	216	217	219	
Hardness (mg/L CaCO3)	78.5	127	145	87.5						206	207	206	206	214	
TS (mg/L)			1420	1110									894	1390	
TNVS (mg/L)			501	584									583	577	
TSS (mg/L)	175	71	620	255	51J	20	11	43	85	44J	217	113	120	587	
TNVSS (mg/L)			200	85									30	80	
% Solids															17.6
% Volatile Solids															2.66
BOD5 (mg/L)			420	180									70	174	
Inhibited BOD (mg/L)													46	90	
Soluble BOD5 (mg/L)													28	>70	
COD (mg/L)	428	397	614	567					190	167	418		283	776	
TOC (water mg/L)	96.1	130	234	152	55.5	44.3	35.1	41.8	33.8	47.8	68.3		46.5	77.7	
TOC (soil/sed mg/L)															17600
NH3–N (mg/L)			19.9	26.8									5.33	4.69	
NO2+NO3–N (mg/L)			0.255	0.134									0.586	0.538	
Total–P (mg/L)			32.8	69.3									7.54	8.94	
Oil and Grease (mg/L)	26	27								<1	<1				
F–Coliform MF (#/100mL)									9700	120	6000				
FIELD OBSERVATIONS															
Temperature (C)	16.6	19.0							15.6	15.3	18.6				
Temp–cooled (C)			5.7	17.7									5.6	18.1	
pH	8.1	8.2	7.8	7.9					8.0	8.2	9.0		8.8	9.4	
Chlorine Residual (mg/L)															
Free									<0.1	0.1	<0.1				
Total									<0.1	0.6	<0.1				

Inf	Influent sample
Lag	Lagoon sample
Ef	Effluent sample
E–comp	Ecology composite sample
S–comp	Stanwood composite sample
gr–comp	grab composite sample
*	composite of 4 grab samples collected approximately every 2 hours starting at 0900
**	first half of sample collected with Ef–1, second half of sample collected with Ef–2
***	composite of grab samples from three locations in the lagoon
J	The analyte was positively identified. The associated numerical result is an estimate.

concentrations, is unknown. The Ecology sample suggests a much greater impact due to septage or stronger sewage coming in at night. The operator reported a total of 5 dumps - or 5000 gallons of septage were dumped during the two days of the inspection. He also reported that septage dumping in 1993 is roughly 25% of the 1992 rate.

The Ef-1 and Ef-2 effluent grab samples confirm the visual observations of effluent quality deteriorating during the day. The TSS concentration was five times greater and the COD concentration two and a half times greater in the afternoon sample than in the morning sample. An algal bloom occurred in the lagoon and intensified through the afternoon. The wind was blowing towards the outlet area of the lagoon, further complicating the problem. The portion of the Stanwood grab composite influenced by the bloom is likely much higher than the influence on the Ecology composite sample. A sample of the algae was identified as belonging to the genus *Microcystis* by Joe Joy, another member of the Ecology EILS staff (Joy, 1992).

Automatic composite samplers are suggested for Stanwood to collect more representative influent and effluent samples.

The Ef-3 effluent grab sample was collected to measure discharge quality at the start of the discharge cycle. Flow at the start of the cycle consists of the chlorine contact chamber contents held since the last discharge cycle. The Ef-3 sample had somewhat higher COD and TSS concentrations than the Ef-1 sample collected in the morning after fresh flow from the lagoon had passed through the contact chamber. The Ef-3 sample had no chlorine residual (<0.1 mg/L) and a high fecal coliform concentration (9700/100mL). Pumping the chlorine contact chamber contents back to the lagoon or rechlorinating the contents should be considered if inspection data are typical of the effluent held in the chlorine contact basin between discharge cycles.

Most other parameters were in expected ranges. One exception was the high influent total-P concentrations (32.8 mg/L Ecology sample; 69.3 mg/L Stanwood sample). The septage may have contributed to this, although somewhat higher NH_3-N concentrations would also be expected. Effluent NH_3-N, total inorganic nitrogen, and total-P concentrations were 12-25% of the influent concentrations.

NPDES Permit Comparison

Comparison of inspection data with NPDES permit limits shows several parameters exceeding weekly and/or monthly permit limits (Table 2). BOD_5 concentrations and loads exceeded monthly and weekly permit limits (note: effluent loads were calculated with the influent flow measurement). The TSS concentration exceeded monthly and weekly concentration limits in the Ecology sample and weekly and monthly concentration and load limits in the Stanwood sample. Two of the three fecal coliform samples collected exceed monthly and weekly permit limits.

Table 2 - Comparison of Ecology Results and NPDES Permit Limits - Stanwood, 9/92.

Parameter		NPDES Permit Capacity *+ Monthly Average	Inf-E	Inf-S	NPDES Permit Limits Monthly Average	NPDES Permit Limits Weekly Average	Ef-3	Ef-1	Ef-2	Ef-E	Ef-S
	Location:		Inf-E	Inf-S			Ef-3	Ef-1	Ef-2	Ef-E	Ef-S
	Type:		E-comp	S-comp			grab	grab	grab	E-comp	S-comp
	Date:		9/8-9	9/9			9/9	9/9	9/9	9/9	9/9
	Time:		1500-1500	*			0725	0900	1430	0730-1530	*
	Lab Log #:		378082	378083			378094	378088	378089	378091	378092
TSS	(mg/L)		620	255	75	110				120	587
	(lbs/D)	340	1500	617	312	460				290	1420
	% removal									81	-130
BOD5	(mg/L)		420	180	30	45				70	174
	(lbs/D)	800	1016	435	125	188				169	421
	% removal				85					83	3
F-Coliform	(#/100mL)				200	400	9700	120	6000		
pH					not outside 6.0 - 9.0		8.0	8.2	9.0		
Chlorine Residual	Total (mg/L)				***		<0.1	0.6	<0.1		
Flow	(MGD)	0.5		0.29						**	**

Inf Influent sample
Ef Effluent sample
E-comp Ecology composite sample
S-comp Stanwood composite sample
* composite of 4 grab samples collected approximately every 2 hours starting at 0900
** effluent loadings calculated with the influent flow rate
*** sufficient to attain fecal coliform limits, but excess avoided.
*+ design criteria included in the permit for prevention of facility overloading
[box] exceeds permit design capacity, or weekly average or monthly average limit

BOD_5 and TSS exceedences were likely due to the algal bloom. The Stanwood sample was collected directly from the lagoon prior to chlorination. The submerged outlet from the lagoon to the chlorine contact chamber may have resulted in lower algae concentrations in the effluent than in the lagoon. Effluent sample collection after chlorination is suggested to better represent the effluent.

The high fecal coliform concentrations are likely related to the high TSS concentrations. The operator had difficulty maintaining proper chlorine concentrations in the effluent. The operator checks the chlorine residual several times during the day and manually adjusts the chlorine residual. Fecal coliform samples were not routinely collected unless the chlorine residual was properly adjusted. Also, the entire contact chamber capacity could not be used because several gates used to route the water were stuck. Gate repairs were made last fall after the inspection. If appropriate chlorine residual concentrations cannot be maintained even after the chamber gates are improved, a flow proportional disinfection system should be installed. Also, fecal coliform samples should be collected with the chlorine residual sample, not after desirable chlorine residual results are attained.

Plant loading of TSS in both the Ecology and Stanwood samples and BOD_5 in the Ecology sample exceeded the plant design capacity included in the permit (Table 2). A plan and schedule to provide adequate capacity should be developed if the design capacity is regularly exceeded.

Lagoon Measurements

Water depth and sludge depth measurements taken from the lagoon showed minimal variation (Table 3). The lagoon was flooded by the Stillaguamish River in November 1990, so approximately two years of undisturbed deposition had occurred prior to the inspection. Water depths ranged from 4-5 feet and maximum sludge deposition was 9-12 inches.

Water samples for TOC and TSS analysis were collected at four stations as a gross indicator of short circuiting. The highest TOC and TSS concentrations were found in the sample collected in the discharge quadrant. Algal growth being blown into the discharge quadrant is the most likely explanation. The samples were collected as the algal bloom was beginning to thicken. The results cannot be used to make any conclusions about short circuiting.

Priority Pollutant Scan Results

Few priority pollutant scan compounds were detected in the Stanwood influent, effluent, and sludge samples (Table 4). A complete listing of target analytes, compounds detected, and detection limits is provided in Appendix D.

Four volatile organics were detected at estimated concentrations less than 5 ug/L in the influent. One of those compounds, 1,4-dichlorobenzene, was also detected in the sludge at a low concentration. Bis(2-ethylhexyl)phthalate, at 29 ug/L, was the only BNA compound

Table 3 - Water and Sludge Depth Measurements - Stanwood, September 1992.

Station No.	Water Depth (ft)	Sludge Depth (in)		TSS (mg/L)		TOC (mg/L)
1	4.0	9-12	*			
2	4.0	9-12	**	51	J	55.5
3	4.5	9-12				
4	4.0	3-6				
5	4.0	3-6				
6	5.0	9-12	*			
7	4.0	6-9				
8	4.5	6-9	**	20		44.3
9	4.0	3-6				
10	4.5	6-9				
11	4.0	3-6				
12	4.0	1-3	**	11		35.1
13	4.0	1-3				
14	4.5	9-12	*			
15	4.5	9-12	**	43		41.8
16	4.5	9-12				

* grab for the sludge composite sample collected at this station

** lagoon water sample collected at this station

J The analyte was positively identified. The associated numerical result is an estimate.

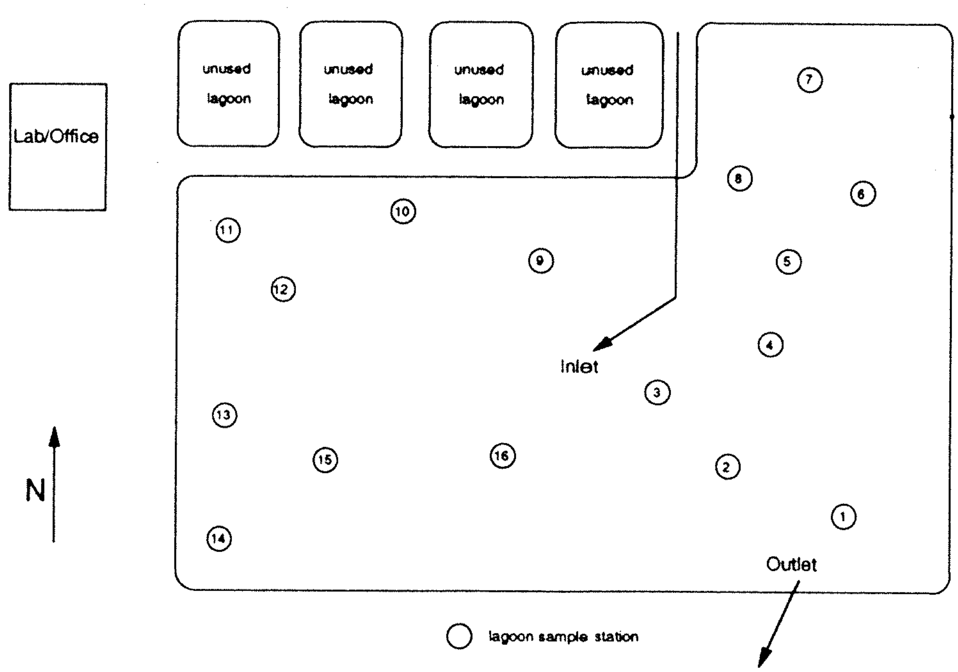

Table 4 - VOA, BNA, Pesticide/PCB and Metals Detected - Stanwood, September 1992.

							EPA Water Quality Criteria Summary (EPA, 1986)			
	Location:	Inf-1	Inf-2	Ef-1	Ef-2	Sludge				
	Type:	grab	grab	grab	grab	gr-comp				
	Date:	9/9	9/9	9/9	9/9	9/9	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
	Time:	0820	1340	0900	1430	***				
	Lab Log#:	378080	378081	378088	378089	378093				
(Group)[1]	VOA Compounds	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/Kg dry wt)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
a	Chloroform	2 J	4 J	5 U	5 U	28 U	28,900 *	1,240 *	12,000 *(a)	6,400 *(a)
c	1,1,1-Trichloroethane	5 U	2 J	5 U	5 U	28 U	18,000 *(c)		31,200 *	
	Toluene	4 J	3 J	5 U	5 U	28 U	17,500 *		6,300 *	5,000 *
h	1,4-Dichlorobenzene	1 J	2 J	5 U	5 U	11 J	1,120 *(h)	763 *(h)	1,970 *(h)	

	Location:	Inf-E	Ef-E	Sludge	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
	Type:	E-comp	E-comp	gr-comp				
	Date:	9/8-9	9/9	9/9				
	Time:	1500-1500	0730-1530	***				
	Lab Log#:	378082	378091	378093				
	BNA Compounds	(ug/L)	(ug/L)	(ug/Kg dry wt)				
i	Bis(2-Ethylhexyl)Phthalate	29	100 U	1310 J	940 *(i)	3 *(i)	2.944 *(i)	3.4 *(i)
	Pesticide/PCB Compounds							
	Aldrin	0.048 NJ	0.040 UJ	7.4 U	3.0		1.3	
r	Heptachlor Epoxide	0.084 NJ	0.83 UJ	159 U	0.52 (r)	0.0038 (r)	0.053 (r)	0.0036 (r)
q	beta-BHC	0.16 NJ	0.060 UJ	11 U	100 *(q)		0.34 *(q)	
u	4,4'-DDE	0.040 NJ	0.040 UJ	22 NJ	1,050 *	0.001 (u)	14 *	0.001 (u)
	Metals +*+			(mg/Kg dry wt)				
	Arsenic	20.2	7.0	9.92				
	Pentavalent				850 *	48 *	2,319 *	13 *
	Trivalent				360	190	69	36
	Cadmium	3.26	0.11 P	1.7 P	8.8 +	2.0 +	43	9.3
	Chromium	13 P	5.0 U	129 N				
	Hexavalent				16	11	1,100	50
	Trivalent				3,126 +	373 +	10,300 *	
	Copper	328	8.5 P	127	35 +	22 +	2.9	
	Lead	30.4	1.3 P	50 P	204 +	7.9 +	140	5.6
	Mercury	0.637 N	0.050 UN	1.09 N	2.4	0.012	2.1	0.025
	Nickel	17 P	10 U	109	2,603 +	289 +	75	8.3
	Selenium	6.3	4.4 P	0.83 N	260	35	410	54
	Silver	5.84 N	0.50 UN	4.0 PN	14.0 +	0.12	2.3	
	Zinc	1020 E	33 E	447	215 +	195 +	95	86

U The analyte was not detected at or above the reported result.
UJ The analyte was not detected at or above the reported estimated result.
J The analyte was positively identified. The associated numerical result is an estimate.
B Analyte was found in the analytical method blank, indicating the sample may have been contaminated.
P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
N The spike sample recovery is not within control limits.
E Reported result is an estimate because of the presence of interference.
UN The analyte was not detected at or above the reported result and spike sample recovery is not within control limits.
NJ There is evidence the analyte is present. The associated numerical result is an estimate.
PN The P and N qualifier explanations both apply.
+*+ Samples 378082 and 378091 - total recoverable metals except for Hg, which is total. Sample 378093 - total metals.
* Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.
** pH dependent criteria (7.8 pH used).
*** composite of grab samples from three locations in the lagoon
\+ Hardness dependent criteria (205 mg/L used).

1 group key - NOTE: in the criteria columns the (group) indicates the criteria is for the group of compounds
a Total Halomethanes
c Total Trichloroethanes
h Total Dichlorobenzenes
i Total Phthalate Esters
q Total BHCs
r Heptachlor
u DDT plus metabolites

detected in the influent sample. The same compound was the only BNA compound detected in the sludge sample (1310 ug/Kg dry wt - estimated).

VOA and BNA scan target compounds were not detected in the effluent. The effluent BNA scan detection limits were high, but the influent BNA detection limits were acceptable. The influent and sludge BNA results suggest few, if any, BNA compounds would have been detected in the effluent at the detection limits attained in the influent sample.

Several tentatively identified compounds (TICs) were detected by the scans (Appendix E). Three TICs were detected in the effluent BNA scan - the highest estimated concentration was 130 ug/L for the compound tentatively identified as cholesterol. TICs were not detected in the effluent VOA scans. TICs were detected in the influent at estimated concentrations up to 12000 ug/L (an "unknown fatty acid") and in the sludge at estimated concentrations up to 22160 ug/Kg - dry wt (an "unknown").

Few metals were detected in the effluent, and those detected were at concentrations less than EPA water quality criteria for freshwater (EPA, 1986). Influent copper and zinc concentrations were notably higher than effluent concentrations.

Sludge metals concentrations were less than the ceiling and pollutant concentrations for land application included in the EPA sewage sludge rules (Table 5 - EPA, 1993). A new Washington State Sludge Rule is being written which will likely include the concentrations found in the EPA rule (Dorsey, 1993). Sludge data should be compared with the new state rule after it is adopted.

Bioassays

Several of the bioassay organisms tested were sensitive to the Stanwood effluent (Table 6).

Ceriodaphnia dubia survival and reproduction showed no significant negative effects due to the effluent.

Fathead minnow survival was not affected, but growth was inhibited at 50% and 100% effluent concentrations. The NOEC (no observed effects concentration) for growth was 25% effluent.

The Microtox test was affected at high effluent concentrations. The EC_{50} (concentration at which there was a 50% effect) for microtox after a 15-minute exposure was 75.2% effluent.

All rainbow trout died within 48 hours in 100% effluent. Sample filtration through a 0.425 mm sieve was necessary to remove some of the algae, daphnids, and other organisms prior to the test. During the test the dissolved oxygen concentration dropped slightly below the required minimum test concentration. The concentration during the test would not

Table 5 – Sludge Metals/EPA Land Application Regulations Comparison
– Stanwood, September 1992.

	Location:	Sludge	Land Application Regulations (EPA, 1993)	
	Type:	gr–comp		
	Date:	9/9	Ceiling *	Pollutant **
	Time:	***	Concentrations	Concentrations
	Lab Log#:	378093		
Metals (total)		(mg/Kg dry wt)	(mg/Kg dry wt)	(mg/Kg dry wt)
Arsenic		9.92	75	41
Cadmium		1.7 P	85	39
Chromium		129 N	3000	1200
Copper		127	4300	1500
Lead		50 P	840	300
Mercury		1.09 N	57	17
Nickel		109	420	420
Selenium		0.83 N	100	36
Silver		4.0 PN		
Zinc		447	7500	2800

P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
N The spike sample recovery is not within control limits.
PN The P and N qualifier explanations both apply.
* sludge not suitable for land application if any ceiling concentration is exceeded
** sludge suitable for land application with minimal restrictions if no pollutant concentrations are exceeded
*** composite of grab samples from three locations in the lagoon

Table 6 - Effluent Bioassay Results - Stanwood, September 1992.

NOTE: all tests were run on the effluent (Ef-GC sample) - lab log # 378090

Ceriodaphnia dubia - 7 day survival and reproduction test
(Ceriodaphnia dubia)

Sample	# Tested	Day 7 Percent Survival	Day 7 Mean # Young per Original Female	Day 10 * Percent Survival	Day 10 * Mean # Young per Original Female
Control	10	90	7.4	70	21.4
6.25 % Effluent	10	60	19.0	60	46.6
12.5 % Effluent	10	100	14.2	80	48.6
25 % Effluent	10	100	18.5	90	46.6
50 % Effluent	10	90	21.7	60	57.7
100 % Effluent	10	90	18.8	90	43.4

Day 7 – Survival: NOEC = 100 % effluent; LC50 = >100 % effluent
Day 7 – Reproduction: NOEC = 100 % effluent
Day 10 – Survival: NOEC = 100 % effluent; LC50 = >100 % effluent
Day 10 – Reproduction: NOEC = 100 % effluent

* NOTE: test was extended to 10 days because of low reproduction in the control

Fathead Minnow - 7 day survival and growth test
(Pimephales promelas)

Sample	# Tested *	Percent Survival	Average Growth per Fish (mg)
Control	35	94	0.75
6.25 % Effluent	35	100	0.73
12.5 % Effluent	35	94	0.76
25 % Effluent	35	97	0.80
50 % Effluent	35	94	0.62
100 % Effluent	35	89	0.32

Survival: NOEC = >100 % effluent; LC50 = >100 % effluent
Growth: NOEC = 25 % effluent; LOEC = 50 % effluent

* five replicates of seven organisms

Table 6 - (cont'd) - Stanwood, September 1992.

Rainbow Trout - 96 hour survival test
(Oncorhynchus mykiss)

Sample*+	# Tested	Percent Survival
Control	30+	100
100% Effluent	30+	0 *
100% Effluent **	5	0 **

+ three replicates of ten organisms
* all organisms died within 48 hours of test initiation. DO concentrations ranged from 5.7 to 6.1 mg/L, slightly less than the 6.4 mg/L minimum. DO concentrations in the 5.7 to 6.1 mg/L range would not ordinarily be toxic to the fish (Stinson, 1992).
** retest done with continuous aeration. All organisms died within 48 hours.
*+ effluent sample filtered through a 0.425 mm sieve prior to analysis to remove algae, Daphnids, and other organisms.

Microtox

	EC50 (% effluent)
5 minutes	89.7
15 minutes	75.2

NOEC - no observable effects concentration
LOEC - lowest observable effects concentration
LC50 - lethal concentration for 50% of the organisms
EC50 - concentration at which there is a 50% effect

normally be toxic to trout (Stinson, 1992). A retest with the remaining sample subjected five fish to continuously aerated effluent. All retest organisms died within 48 hours.

The algae growing in the lagoon was identified as *Microcystis* (Joy, 1992). *Microcystis* can produce a potent liver toxin (Crayton, 1993). The toxin may have contributed to the toxicity noted.

Split Sample Comparison

Laboratory results for the split samples were similar in most cases (Table 7). Most BOD_5 and TSS results are similar suggesting appropriate analysis by both labs. The fecal coliform split results were also in the same range. The Stanwood chlorine residual result (0.2 mg/L) was slightly greater than the Ecology result (<0.1 mg/L). A recheck of chlorine residual measurements is suggested.

The Stanwood laboratory is not yet accredited. The lab should become accredited within the required time frame.

Respective Ecology and Stanwood influent and effluent composite samples did not compare closely. Differences were discussed in the general chemistry section of the report. Automatic influent and effluent composite samples are suggested.

CONCLUSIONS AND RECOMMENDATIONS

Flow Measurement

The influent Parshall flume was located several feet downstream of a 180-degree bend in the channel. The flume was found to be slightly bowed. Stanwood instantaneous flow meter measurements were 80 and 90% of Ecology instantaneous measurements.

The effluent flow meter was not working during the inspection. A record of effluent flows for 1991 was provided, but the flows were estimated rather than measured.

- The influent flume/meter should be inspected and adjusted for accuracy and an accurate effluent flow meter should be installed and maintained.

General Chemistry Data

Considerable variability was noted among the grab and composite samples collected during the inspection. An algal bloom occurred in the lagoon and, accompanied with the wind blowing towards the outlet area, degraded effluent quality.

Effluent flow at the start of each discharge cycle consists of the chlorine contact chamber contents held since the last discharge cycle.

Table 7 – Comparison of Ecology and Stanwood Laboratory Results – Stanwood, September 1992.

		Location:	Inf-E	Inf-S	Ef-2	Ef-E	Ef-S
		Type:	E-comp	S-comp	grab	E-comp	S-comp
		Date:	9/8-9	9/9	9/9	9/9	9/9
		Time:	1500-1500	*	1430	0730-1530	*
		Lab Log #:	378082	378083	378089	378091	378092
Parameter	Units	Laboratory					
TSS	(mg/L)	Ecology	620	255		120	587
		Stanwood	648	256		114	614
BOD5	(mg/L)	Ecology	420	180		70	174
		Stanwood	453	314		NA	169
F-Coliform	(#/100mL)	Ecology			6000		
		Stanwood			2700		
Chlorine Residual (Total)	(mg/L)	Ecology			<0.1		
		Stanwood			0.2		

Inf Influent sample
Ef Effluent sample
E-comp Ecology composite sample
S-comp Stanwood composite sample
* composite of 4 grab samples collected approximately every 2 hours starting at 0900
NA not analyzed

- Pumping the effluent held in the chlorine contact chamber between discharge cycles back to the lagoon or rechlorinating the contents should be considered.

NPDES Permit Comparison

Comparison of inspection data with NPDES permit limits found BOD_5, TSS, and fecal coliforms in excess of weekly and/or monthly permit limits. The exceedences were likely due to the algal bloom taking place. The Stanwood effluent sample was collected directly from the lagoon prior to chlorination, possibly including more algae in the sample than in the final effluent.

- Chlorinated effluent sample collection is recommended to better represent the effluent.

The operator had difficulty maintaining proper chlorine concentrations in the effluent. Fecal coliform samples were not routinely collected unless the chlorine residual was properly adjusted.

- If proper chlorine residual concentrations cannot be maintained, a flow proportional system should be installed.

- Fecal coliform samples should be collected with the chlorine residual sample, not after desirable chlorine residual results are attained.

TSS and BOD_5 plant loading exceeded the NPDES permit plant design capacity in some of the inspection samples.

- A plan and schedule to provide adequate capacity should be developed if the design capacity is regularly exceeded.

Lagoon Measurements

Water depths ranged from 4-5 feet and maximum sludge deposition was 9-12 inches.

Priority Pollutant Scan Results

Few priority pollutant scan compounds were detected in the Stanwood influent, effluent, and sludge samples.

VOA and BNA scan target compounds were not detected in the effluent. Few metals were detected in the effluent, and those detected were at concentrations less than EPA water quality criteria for freshwater (EPA, 1986).

Sludge metals concentrations were less than the ceiling and pollutant concentrations for land application (EPA, 1993).

Several tentatively identified compounds (TICs) were detected by the scans.

Bioassays

Several of the bioassay organisms tested were sensitive to the Stanwood effluent. *Ceriodaphnia dubia* survival and reproduction, and fathead minnow survival were not affected. Fathead minnow growth (NOEC 25% effluent), Microtox (EC_{50} 75.2% effluent), and rainbow trout (all died within 48 hours in 100% effluent) all displayed negative effects in the effluent.

The algae growing in the lagoon, *Microcystis*, may have contributed to the toxicity noted.

Split Sample Comparison

Laboratory results for the split samples were similar in most cases. Ecology and Stanwood influent and effluent composite samples did not compare closely.

- A recheck of chlorine residual measurements is recommended.
- Automatic samplers are recommended for influent and effluent composite sample collection.
- The Stanwood laboratory should become accredited within the required time frame.

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APPENDICES

Appendix A – Samples Collected and Parameters Analyzed – Stanwood, September 1992.

Parameter	Inf-1	Inf-2	Inf-E	Inf-S	Lag-1	Lag-2	Lag-3	Lag-4	Ef-3	Ef-1	Ef-2	Ef-GC	Ef-E	Ef-S	Sludge
Location:	Inf-1	Inf-2	Inf-E	Inf-S	Lag-1	Lag-2	Lag-3	Lag-4	Ef-3	Ef-1	Ef-2	Ef-GC	Ef-E	Ef-S	Sludge
Type:	grab	grab	E-comp	S-comp	grab	grab	grab	grab	grab	grab	grab	gr-comp	E-comp	S-comp	gr-comp
Date:	9/9	9/9	9/8-9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9	9/9
Time:	0820	1340	1500-1500	*	1205	1220	1235	1250	0725	0900	1430	**	0730-1530	*	***
Lab Log #:	378080	378081	378082	378083	378084	378085	378086	378087	378094	378088	378089	378090	378091	378092	378093
GENERAL CHEMISTRY															
Conductivity	E	E	E	E						E	E	E	E	E	
Alkalinity	E	E	E	E						E	E	E	E	E	
Hardness	E	E	E	E						E	E	E	E	E	
TS			E	E									E	E	
TNVS			E	E									E	E	
TSS	E	E	E S	E S	E	E	E	E	E	E	E	E	E S	E S	
TNVSS			E	E									E	E	
% Solids															E
% Volatile Solids															E
BOD5			E S	E S									E	E S	
Inhibited BOD5													E	E	
Soluble BOD5													E	E	
COD	E	E	E	E					E	E	E		E	E	
TOC (water)	E	E	E	E	E	E	E	E	E	E	E		E	E	
TOC (soil/sed)															E
NH3-N			E	E									E	E	
NO2+NO3-N			E	E									E	E	
Total-P			E	E									E	E	
Oil and Grease (water)	E	E								E	E				
F-Coliform MF									E	E	E S				
ORGANICS															
VOC (water)	E	E								E	E				
VOC (soil/sed)															E
BNAs (water)			E										E		
BNAs (soil/sed)															E
Pest/PCB (water)			E										E		
Pest/PCB (soil/sed)															E
METALS															
PP Metals (water: tot-rec)			E										E		
PP Metals (soil/sed: total)															E
BIOASSAYS															
Salmonid (acute 100%)												E			
Ceriodaphnia (chronic)												E			
Fathead Minnow (chronic)												E			
Microtox (solid acute)												E			
FIELD OBSERVATIONS															
Temperature	E	E							E	E	E				
Temp-cooled*+			E	E									E	E	
pH	E	E	E	E					E	E	E		E	E	
Chlorine Residual															
Free									E	E	E				
Total									E	E	E S				

E Ecology Laboratory Analysis
S Stanwood Laboratory Analysis
Inf Influent sample
Lag Lagoon sample
Ef Effluent sample
E-comp Ecology composite sample
S-comp Stanwood composite sample
gr-comp grab composite sample
* composite of 4 grab samples collected approximately every 2 hours starting at 0900
** first half of sample collected with Ef-1, second half of sample collected with Ef-2
*** composite of grab samples from three locations in the lagoon

Appendix B – Ecology Analytical Methods and Laboratories Performing the Analysis – Stanwood, September 1992.

Parameter	Method	Lab Used
Conductivity	EPA, Revised 1983: 120.1	Ecology
Alkalinity	EPA, Revised 1983: 310.1	Ecology
Hardness	EPA, Revised 1983: 130.2	Ecology
TS	EPA, Revised 1983: 160.3	Ecology
TNVS	EPA, Revised 1983: 160.4	Ecology
TSS	EPA, Revised 1983: 160.2	Ecology
TNVSS	EPA, Revised 1983: 160.4	Ecology
% Solids	EPA, Revised 1983: 160.3	Water Management Laboratories, Inc.
% Volatile Solids	EPA, Revised 1983: 160.4	Water Management Laboratories, Inc.
BOD5	EPA, Revised 1983: 405.1	Water Management Laboratories, Inc.
Inhibited BOD5	EPA, Revised 1983: 405.1	Water Management Laboratories, Inc.
Soluble BOD5	EPA, Revised 1983: 405.1	Water Management Laboratories, Inc.
COD	EPA, Revised 1983: 410.1	Water Management Laboratories, Inc.
TOC	EPA, Revised 1983: 415.1	Water Management Laboratories, Inc.
NH3-N	EPA, Revised 1983: 350.1	Ecology
NO2+NO3-N	EPA, Revised 1983: 353.2	Ecology
Total-P	EPA, Revised 1983: 365.3	Ecology
Oil and Grease (water)	EPA, Revised 1983: 413.1	Water Management Laboratories, Inc.
F-Coliform MF	APHA, 1989: 9222D	Ecology
VOC (water)	EPA, 1984: 624	Pacific Northwest Environmental Laboratory, Inc.
VOC (soil/sed)	EPA, 1986: 8240	Pacific Northwest Environmental Laboratory, Inc.
BNAs (water)	EPA, 1984: 625	Pacific Northwest Environmental Laboratory, Inc.
BNAs (soil/sed)	EPA, 1986: 8270	Pacific Northwest Environmental Laboratory, Inc.
Pest/PCB (water)	EPA, 1984: 608	Pacific Northwest Environmental Laboratory, Inc.
Pest/PCB (soil/sed)	EPA, 1986: 8080	Pacific Northwest Environmental Laboratory, Inc.
PP Metals	EPA, Revised 1983: 200	Ecology
Salmonid (acute 100%)	Ecology, 1981	Bio-Research Laboratories
Ceriodaphnia (chronic)	EPA, 1989	Ecology
Fathead Minnow (chronic)	EPA, 1989	Ecology
Microtox (solid acute)	Microbics, 1992	Ecology

METHOD BIBLIOGRAPHY

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Appendix C - Priority Pollutant Cleaning Procedures - Stanwood, September 1992.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO_3 solution
4. Rinse three (3) times with distilled/deionized water
5. Rinse with high purity methylene chloride
6. Rinse with high purity acetone
7. Allow to dry and seal with aluminum foil

Appendix D – VOA, BNA, Pesticide/PCB and Metals Scan Results – Stanwood, September 1992.

(Group)[1]		Location:	Inf-1		Inf-2		Ef-1		Ef-2		Sludge	
		Type:	grab		grab		grab		grab		gr-comp	
		Date:	9/9		9/9		9/9		9/9		9/9	
		Time:	0820		1340		0900		1430		***	
		Lab Log#:	378080		378081		378088		378089		378093	
	VOA Compounds		(ug/L)		(ug/L)		(ug/L)		(ug/L)		(ug/Kg dry wt)	
a	Chloromethane		10	U	10	U	10	U	10	U	57	U
a	Bromomethane		10	U	10	U	10	U	10	U	57	U
a	Methylene Chloride		5	U	5	U	5	U	5	U	28	U
a	Chloroform		2	J	4	J	5	U	5	U	28	U
a	Carbon Tetrachloride		5	U	5	U	5	U	5	U	28	U
a	Bromodichloromethane		5	U	5	U	5	U	5	U	28	U
a	Dibromochloromethane		5	U	5	U	5	U	5	U	28	U
a	Bromoform		5	U	5	U	5	U	5	U	28	U
	Chloroethane		10	U	10	U	10	U	10	U	57	U
	Vinyl Chloride		10	U	10	U	10	U	10	U	57	U
	1,1-Dichloroethane		5	U	5	U	5	U	5	U	28	U
	1,2-Dichloroethane		5	U	5	U	5	U	5	U	28	U
b	1,1-Dichloroethene		5	U	5	U	5	U	5	U	28	U
b	cis-1,2-Dichloroethene		5	U	5	U	5	U	5	U	28	U
b	trans-1,2-Dichloroethene		5	U	5	U	5	U	5	U	28	U
c	1,1,1-Trichloroethane		5	U	2	J	5	U	5	U	28	U
c	1,1,2-Trichloroethane		5	U	5	U	5	U	5	U	28	U
	Trichloroethene		5	U	5	U	5	U	5	U	28	U
f	1,1,2,2-Tetrachloroethane		5	U	5	U	5	U	5	U	28	U
	Tetrachloroethene		5	U	5	U	5	U	5	U	28	U
d	1,2-Dichloropropane		5	U	5	U	5	U	5	U	28	U
e	cis-1,3-Dichloropropene		5	U	5	U	5	U	5	U	28	U
e	trans-1,3-Dichloropropene		5	U	5	U	5	U	5	U	28	U
j	2-Chloroethylvinyl Ether		10	U	10	U	10	U	10	U	57	U
	Benzene		5	U	5	U	5	U	5	U	28	U
	Toluene		4	J	3	J	5	U	5	U	28	U
	Ethylbenzene		5	U	5	U	5	U	5	U	28	U
g	Chlorobenzene		5	U	5	U	5	U	5	U	28	U
h	1,2-Dichlorobenzene		5	U	5	U	5	U	5	U	28	U
h	1,3-Dichlorobenzene		5	U	5	U	5	U	5	U	28	U
h	1,4-Dichlorobenzene		1	J	2	J	5	U	5	U	11	J
	Acrolein		20	U	20	U	20	U	20	U	114	U
	Acrylonitrile		20	U	20	U	20	U	20	U	114	U

(Group)[1]		Location:	Inf-E		Ef-E		Sludge	
		Type:	E-comp		E-comp		gr-comp	
		Date:	9/8-9		9/9		9/9	
		Time:	1500-1500		0730-1530		***	
		Lab Log#:	378082		378091		378093	
	BNA Compounds		(ug/L)		(ug/L)		(ug/Kg dry wt)	
	Hexachloroethane		10	U	100	U	3750	U
	Hexachlorobutadiene		10	U	100	U	3750	U
	Hexachlorocyclopentadiene		10	U	100	U	3750	U
j	Bis(2-Chloroethyl)Ether		10	U	100	U	3750	U
j	Bis(2-Chloroisopropyl)Ether		10	U	100	U	3750	U
j	Bis(2-Chloroethoxy)Methane		10	U	100	U	3750	U
k	N-Nitroso-di-n-Propylamine		10	U	100	U	3750	U
k	N-Nitrosodimethylamine		10	U	100	U	3750	U
k	N-Nitrosodiphenylamine		10	U	100	U	3750	U
	Isophorone		10	U	100	U	3750	U
n	Naphthalene		10	U	100	U	3750	U
n	Acenaphthylene		10	U	100	U	3750	U
n	Acenaphthene		10	U	100	U	3750	U
n	Fluorene		10	U	100	U	3750	U
n	Phenanthrene		10	U	100	U	3750	U
n	Anthracene		10	U	100	U	3750	U
n	Fluoranthene		10	U	100	U	3750	U
n	Pyrene		10	U	100	U	3750	U
n	Benzo(a)Anthracene		10	U	100	U	3750	U
n	Chrysene		10	U	100	U	3750	U
n	Benzo(b)Fluoranthene		10	U	100	U	3750	U
n	Benzo(k)Fluoranthene		10	U	100	U	3750	U
n	Benzo(a)Pyrene		10	U	100	U	3750	U
n	Indeno(1,2,3-cd)Pyrene		10	U	100	U	3750	U
n	Dibenzo(a,h)Anthracene		10	U	100	U	3750	U
n	Benzo(g,h,i)Perylene		10	U	100	U	3750	U
h	1,2-Dichlorobenzene		10	U	100	U	3750	U
h	1,3-Dichlorobenzene		10	U	100	U	3750	U
h	1,4-Dichlorobenzene		10	U	100	U	3750	U
g	1,2,4-Trichlorobenzene		10	U	100	U	3750	U
g	Hexachlorobenzene		10	U	100	U	3750	U
m	2-Chloronaphthalene		10	U	100	U	3750	U

Appendix D (cont'd) – Stanwood, September 1992.

		Inf–E		Ef–E		Sludge	
	Location:	Inf–E		Ef–E		Sludge	
	Type:	E–comp		E–comp		gr–comp	
	Date:	9/8–9		9/9		9/9	
	Time:	1500–1500		0730–1530		***	
	Lab Log#:	378082		378091		378093	
	BNA Compounds	(ug/L)		(ug/L)		(ug/Kg dry wt)	
(Group)[1]							
i	Dimethyl Phthalate	10	U	100	U	3750	U
i	Diethyl Phthalate	10	U	100	U	3750	U
i	Di–n–Butyl Phthalate	10	U	100	U	3750	U
i	Butylbenzyl Phthalate	10	U	100	U	3750	U
i	Bis(2–Ethylhexyl)Phthalate	29		100	U	1310	J
i	Di–n–Octyl Phthalate	10	U	100	U	3750	U
	Nitrobenzene	10	U	100	U	3750	U
o	2,4–Dinitrotoluene	10	U	100	U	3750	U
o	2,6–Dinitrotoluene	10	U	100	U	3750	U
	Benzidine	100	U	1000	U	37500	U
	3,3'–Dichlorobenzidine	20	U	200	U	7390	U
	1,2–Diphenylhydrazine	10	U	100	U	3750	U
	Phenol	10	U	100	U	3750	U
	2,4–Dimethylphenol	10	U	100	U	3750	U
l	2–Nitrophenol	10	U	100	U	3750	U
l	4–Nitrophenol	50	U	500	U	18200	U
l	2,4–Dinitrophenol	50	U	500	U	18200	U
l	4,6–Dinitro–2–Methylphenol	50	U	500	U	18200	U
	2–Chlorophenol	10	U	100	U	3750	U
	2,4–Dichlorophenol	10	U	100	U	3750	U
	4–Chloro–3–Methylphenol	10	U	100	U	3750	U
	2,4,6–Trichlorophenol	10	U	100	U	3750	U
	Pentachlorophenol	50	U	500	U	18200	U
p	4–Chlorophenyl Phenylether	10	U	100	U	3750	U
p	4–Bromophenyl Phenylether	10	U	100	U	3750	U
	Pesticide/PCB Compounds						
(Group)[1]							
	Aldrin	0.048	NJ	0.040	UJ	7.4	U
	Dieldrin	0.040	U	0.020	UJ	3.9	U
v	Chlordane	0.28	U	0.14	UJ	27	U
s	Endosulfan I	0.28	U	0.14	UJ	27	U
s	Endosulfan II	0.28	U	0.14	UJ	7.4	U
s	Endosulfan Sulfate	1.32	U	0.66	UJ	125	U
t	Endrin	0.12	U	0.060	UJ	11	U
t	Endrin Aldehyde	0.46	U	0.23	UJ	44	U
r	Heptachlor	0.060	U	0.030	UJ	5.7	U
r	Heptachlor Epoxide	0.084	NJ	0.83	UJ	159	U
q	alpha–BHC	0.060	U	0.030	UJ	5.7	U
q	beta–BHC	0.16	NJ	0.060	UJ	11	U
q	delta–BHC	0.18	U	0.090	UJ	17	U
q	gamma–BHC (Lindane)	0.080	U	0.040	UJ	7.4	U
u	4,4'–DDT	0.24	U	0.12	UJ	23	U
u	4,4'–DDE	0.040	NJ	0.040	UJ	22	NJ
u	4,4'–DDD	0.22	U	0.11	UJ	21	U
	Toxaphene	4.8	U	2.4	UJ	455	U
	Methoxychlor	3.6	U	1.8	UJ	335	U
w	Aroclor–1016	1.3	U	0.65	UJ	125	U
w	Aroclor–1221	1.3	U	0.65	UJ	125	U
w	Aroclor–1232	1.3	U	0.65	UJ	125	U
w	Aroclor–1242	1.3	U	0.65	UJ	125	U
w	Aroclor–1248	1.3	U	0.65	UJ	125	U
w	Aroclor–1254	2.6	U	1.3	UJ	250	U
w	Aroclor–1260	2.6	U	1.3	UJ	250	U

Appendix D (cont'd) – Stanwood, September 1992.

	Location:	Inf–E		Ef–E		Sludge	
	Type:	E–comp		E–comp		gr–comp	
	Date:	9/8–9		9/9		9/9	
	Time:	1500–1500		0730–1530		***	
	Lab Log#:	378082		378091		378093	
Metals +*+	Hardness = 205	(ug/L)		(ug/L)		(mg/Kg dry wt)	
Antimony		30	U	30	U	15	UN
Arsenic		20.2		7.0		9.92	
Pentavalent							
Trivalent							
Beryllium		1.0	U	1.0	U	0.50	U
Cadmium		3.26		0.11	P	1.7	P
Chromium		13	P	5.0	U	129	N
Hexavalent							
Trivalent							
Copper		328		8.5	P	127	
Lead		30.4		1.3	P	50	P
Mercury		0.637	N	0.050	UN	1.09	N
Nickel		17	P	10	U	109	
Selenium		6.3		4.4	P	0.83	N
Silver		5.84	N	0.50	UN	4.0	PN
Thallium		2.5	UN	2.5	UN	0.25	UN
Zinc		1020	E	33	E	447	

1 NOTE: SOME INDIVIDUAL COMPOUND CRITERIA OR LOELS MAY NOT AGREE WITH GROUP CRITERIA OR LOELS. REFER TO APPROPRIATE EPA DOCUMENT ON AMBIENT WATER QUALITY CRITERIA FOR FULL DISCUSSION.
U The analyte was not detected at or above the reported result.
UJ The analyte was not detected at or above the reported estimated result.
J The analyte was positively identified. The associated numerical result is an estimate.
B Analyte was found in the analytical method blank, indicating the sample may have been contaminated.
P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
N The spike sample recovery is not within control limits.
E Reported result is an estimate because of the presence of interference.
UN The analyte was not detected at or above the reported result and spike sample recovery is not within control limits.
NJ There is evidence the analyte is present. The associated numerical result is an estimate.
PN The analyte was detected above the instrument detection limit but below the established minimum quantitation limit and the spike sample recovery is not within control limits.
+*+ Samples 378082 and 378091 – total recoverable metals except for Hg, which is total. Sample 378093 – total metals.
* Insufficient data to develop criteria. Value presented is the LOEL – Lowest Observed Effect Level.
** pH dependent criteria (7.8 pH used).
*** composite of grab samples from three locations in the lagoon
\+ Hardness dependent criteria (205 mg/L used).
a Total Halomethanes
b Total Dichloroethenes
c Total Trichloroethanes
d Total Dichloropropanes
e Total Dichloropropenes
f Total Tetrachloroethanes
g Total Chlorinated Benzenes (excluding Dichlorobenzenes)
h Total Dichlorobenzenes
i Total Phthalate Esters
j Total Chloroalkyl Ethers
k Total Nitrosamines
l Total Nitrophenols
m Total Chlorinated Naphthalenes
n Total Polynuclear Aromatic Hydrocarbons
o Total Dinitrotoluenes
p Total Haloethers
q Total BHCs
r Heptachlor
s Endosulfan
t Endrin
u DDT plus metabolites
v Total Chlordane
w Total Aroclors (PCBs)

Appendix E - VOA, BNA, and Pesticide/PCB Tentatively Identified Compounds (TICs) - Stanwood, September 1992.

TICs are noted on the attached lab data sheets. The EPA sample numbers on the data sheets correspond to the log lab numbers noted below.

Location:	Inf-2	Inf-E	Ef-E	Sludge
Type:	grab	E-comp	E-comp	gr-comp
Date:	9/9	9/8-9	9/9	9/9
Time:	1340	1500-1500	0730-1530	***
Lab Log#:	378081	378082	378091	378093

NJ There is evidence the analyte is present. The associated numerical result is an estimate.
*** composite of grab samples from three locations in the lagoon

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

378081

Lab Name: PNELI____________________ Contract: STANWOOD___

Lab Code: PNELI__ Case No.: 4346__ SAS No.: _______ SDG No.: 378080

Matrix: (soil/water) WATER_ Lab Sample ID: 4346-04______

Sample wt/vol: __5.0 (g/mL) ML__ Lab File ID: A1993______

Level: (low/med) LOW___ Date Received: 09/09/92

% Moisture: not dec. ____ Date Analyzed: 09/14/92

Column (pack/cap) CAP___ Dilution Factor: 1.0_____

Number TICs found: __7

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L_

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown alkane	12.45	7.0	JN NJ
2.	Unknown alkane	13.85	4.0	JN
3.	Unknown alkane	14.55	6.0	JN
4.	Unknown alkane	14.70	4.0	JN
5.	Unknown alkane	14.99	3.0	JN
6.	Unknown alkane	15.39	4.0	JN
7.	Unknown alkane	16.75	3.0	JN

001029

1E

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

378093

Lab Name: PNELI____________________ Contract: STANWOOD___

Lab Code: PNELI__ Case No.: 4346__ SAS No.: _______ SDG No.: 378080

Matrix: (soil/water) SOIL__ Lab Sample ID: 4346-07______

Sample wt/vol: __5.0 (g/mL) G___ Lab File ID: B8866______

Level: (low/med) LOW___ Date Received: 09/~~09~~ 10/92

% Moisture: not dec. ____ Date Analyzed: 09/14/92

Column (pack/cap) CAP___ Dilution Factor: 1.0_____

CONCENTRATION UNITS:

Number TICs found: _13 (ug/L or ug/Kg) UG/KG -dry wt

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown alkane	12.50	136	~~JN~~ NJ
2.	Unknown alkylcyclohexane	12.61	51	~~JN~~
3.	Unknown alkane	13.22	68	~~JN~~
4.	Unknown alkane	13.64	57	~~JN~~
5.	Unknown alkane	13.79	182	~~JN~~
6.	Unknown alkane	13.98	63	~~JN~~
7.	Unknown alkane	14.14	403	~~JN~~
8.	Unknown alkane	14.55	625	~~JN~~
9.	Unknown alkane	14.94	148	~~JN~~
10.	Unknown	15.21	63	~~JN~~
11.	Unknown alkane	15.80	119	~~JN~~
12.	Unknown alkane	16.49	57	~~JN~~
13.	Unknown alkane	16.65	273	~~JN~~

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

378082

Lab Name: PNELI___________________ Contract: STANWOOD___

Lab Code: PNELI__ Case No.: 4346__ SAS No.: _______ SDG No.: 378080

Matrix: (soil/water) WATER_ Lab Sample ID: 4346-01______

Sample wt/vol: 1000_ (g/mL) ML__ Lab File ID: C5372______

Level: (low/med) LOW___ Date Received: 09/~~09~~ 10/92 Sm

% Moisture: not dec. ____ dec. ____ Date Extracted: 09/15/92

Extraction: (SepF/Cont/Sonc) CONT Date Analyzed: 09/29/92

GPC Cleanup: (Y/N) N__ pH: __7.0 Dilution Factor: 1.0_____

Number TICs found: _21

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L_

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 107926	Butanoic acid	3.98	160	~~JN~~ NJT Sm
2.	Unknown fatty acid	17.37	130	~~JN~~
3.	Unknown fatty acid	20.37	940	~~JN~~
4.	Unknown fatty acid	21.60	300	~~JN~~
5.	Unknown fatty acid	23.57	12000	~~JN~~
6.	Unknown fatty acid	24.25	160	~~JN~~
7.	Unknown fatty acid	25.35	10000	~~JN~~
8.	Unknown	26.22	110	~~JN~~
9.	Unknown fatty acid	27.58	150	~~JN~~
10.	Unknown	31.44	98	~~JN~~
11.	Unknown	31.71	110	~~JN~~
12.	Unknown	31.98	460	~~JN~~
13.	Unknown	32.22	150	~~JN~~
14.	Unknown	32.98	180	~~JN~~
15.	Unknown alkane	34.26	90	~~JN~~
16. 80977	Cholestanol (VAN)	34.71	1000	~~JN~~
17. 57885	Cholesterol (SCI)	35.07	970	~~JN~~
18.	Unknown	35.94	140	~~JN~~
19.	Unknown	36.51	130	~~JN~~
20.	Unknown alkane	32.51	68	~~JN~~
21.	Unknown	33.73	88	~~JN~~

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

378091

Lab Name: PNELI____________________ Contract: STANWOOD___

Lab Code: PNELI__ Case No.: 4346__ SAS No.: _______ SDG No.: 378080

Matrix: (soil/water) WATER_ Lab Sample ID: 4346-02______

Sample wt/vol: 100__ (g/mL) ML__ Lab File ID: C5396______

Level: (low/med) LOW___ Date Received: 09/~~09~~ 10/92

% Moisture: not dec. ____ dec. ____ Date Extracted: 09/29/92

Extraction: (SepF/Cont/Sonc) CONT Date Analyzed: 10/02/92

GPC Cleanup: (Y/N) N__ pH: __7.0 Dilution Factor: 1.0_____

Number TICs found: __3

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L_

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	Unknown	20.88	70	J~~N~~ NJ
2.	Unknown	21.46	30	J~~N~~
3. 57885	Cholesterol	34.70	130	JN

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1F
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.: 378093

Lab Name: PNELI____________________ Contract: STANWOOD___

Lab Code: PNELI__ Case No.: 4346__ SAS No.: _______ SDG No.: 378080

Matrix: (soil/water) SOIL__ Lab Sample ID: 4346-07______

Sample wt/vol: _30.0 (g/mL) G___ Lab File ID: C5375______

Level: (low/med) LOW___ Date Received: 09/~~09~~ 10/92

% Moisture: not dec. ____ dec. ____ Date Extracted: 09/15/92

Extraction: (SepF/Cont/Sonc) CONT Date Analyzed: 09/29/92

GPC Cleanup: (Y/N) N__ pH: __7.0 Dilution Factor: 1.0_____

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG-dry wt

Number TICs found: _18

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 289167	1,2,4-Trithiolane	8.92	15909	~~JN~~ NJ
2.	Unknown substituted phenol	17.91	2670	~~JN~~
3.	Unknown substituted phenol	19.38	2670	~~JN~~
4.	Unknown substituted phenol	19.50	3409	~~JN~~
5.	Unknown	19.58	2670	~~JN~~
6.	Unknown substituted phenol	19.65	2273	~~JN~~
7.	Unknown	19.81	4943	~~JN~~
8.	Unknown substituted phenol	19.93	3409	~~JN~~
9.	Unknown substituted phenol	20.05	2670	~~JN~~
10.	Unknown alkane	28.69	2273	~~JN~~
11.	Unknown alcohol	30.63	3011	~~JN~~
12.	Unknown alkane	32.47	5682	~~JN~~
13.	Unknown	34.03	6250	~~JN~~
14.	Unknown alkane	34.19	4545	~~JN~~
15.	Unknown	34.71	11932	~~JN~~
16.	Unknown	34.91	12500	~~JN~~
17.	Unknown	35.35	5284	~~JN~~
18.	Unknown	35.88	22159	JN