EXHIBIT 4

VOL I

Exhibit 4

U.S. Army Center for Health Promotion and Preventive Medicine

USCHPPM

WASTEWATER TREATMENT PLANT
PERFORMANCE EVALUATION
SOLO POINT WASTEWATER TREATMENT PLANT
PROJECT NO. 32-EE-05Y1-07
FORT LEWIS, WASHINGTON
29 NOVEMBER-7 DECEMBER 2006

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CHPPM FORM 433-E (MCHB-CS-IPD), OCT 03

Readiness Thru Health

Exhibit 4

U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE

The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) lineage can be traced back over 50 years to the Army Industrial Hygiene Laboratory. That organization was established at the beginning of World War II and was under the direct jurisdiction of The Army Surgeon General. It was originally located at the Johns Hopkins School of Hygiene and Public Health, with a staff of three and an annual budget not to exceed $3000. Its mission was to conduct occupational health surveys of Army operated industrial plants, arsenals, and depots. These surveys were aimed at identifying and eliminating occupational health hazards within the Department of Defense's (DOD) industrial production base and proved to be beneficial to the Nation's war effort.

Until 1995, it was nationally and internationally known as the U.S. Army Environmental Hygiene Agency or AEHA. Its mission is expanding to support the worldwide preventive medicine programs of the Army, DOD and other Federal Agencies through consultations/ supportive services; investigations and training.

Today, AEHA is redesignated the U.S. Army Center for Health Promotion and Preventive Medicine. Its mission for the future is to provide worldwide technical support for implementing preventive medicine, public health and health promotion/wellness services into all aspects of America's Army and the Army Community anticipating and rapidly responding to operational needs and adaptable to a changing work environment.

The professional disciplines represented at the Center include chemists, physicists, engineers, physicians, optometrists, audiologists, nurses, industrial hygienists, toxicologists, entomologists, and many other as well as sub-specialties within these professions.

The organization's quest has always been one of excellence and continuous quality improvement; and today its vision, to be the nationally recognized Center for Health Promotion and Preventive Medicine, is clearer than ever. To achieve that end, it holds ever fast to its values which are steeped in its rich heritage:

- *Integrity is the foundation*
- *Excellence is the standard*
- *Customer satisfaction is the focus*
- *Its people are the most valued resource*
- *Continuous quality improvement is its pathway*

The organization, which stands on the threshold of even greater challenges and responsibilities, has General Officer leadership. As it moves into the next century, new programs are being added related to health promotion/wellness, soldier fitness and disease surveillance. As always, its mission focus is centered upon the Army Imperatives so that we are trained and ready to enhance the Army's readiness for war and operations other than war.

It is an organization fiercely proud of its history, yet equally excited about the future. It is destined to continue its development as a world-class organization with expanded services to the Army, DOD, other Federal Agencies, the Nation and the World Community.

DEPARTMENT OF THE ARMY
US ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
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EXECUTIVE SUMMARY
WASTEWATER TREATMENT PLANT PERFORMANCE EVALUATION
SOLO POINT WASTEWATER TREATMENT PLANT
PROJECT NO. 32-EE-05Y1-07
FORT LEWIS, WASHINGTON
29 NOVEMBER-7 DECEMBER 2006

1. PURPOSE. Evaluate the performance of the Solo Point wastewater treatment plant (WWTP) and verify compliance.

2. CONCLUSIONS

a. Data collected during the WWTP evaluation verified the following:

1) The WWTP effluent was in compliance with permit effluent limits.

2) The WWTP unit process removal efficiencies (for BOD and TSS) were within acceptable ranges.

b. Based on a review of WWTP records (2004 to 2006), the WWTP was operated in compliance with permit effluent limitations, with one exception, when treatment was inhibited by an unknown pollutant in May 2006. Treatment in one of the two trickling filters was upset and effluent pH levels were below the lower effluent limit for six days.

c. Several pollutants that are typically associated with "non-domestic discharges" were detected in WWTP samples. These included total petroleum hydrocarbons (TPH), and ten metals and eighteen organic compounds listed as toxic pollutants (per 40 CFR 122, Appendix D, Tables II and III).

1) TPH was detected in influent, effluent and sludge grab samples. The WWTP removed approximately 79 percent of influent TPH, some of which accumulated in the sludge with solids. The discharge permit requires TPH monitoring, but does not limit it. Available TPH data from Fort Lewis and this evaluation indicate that some components of influent TPH persist through the anaerobic digestion and composting processes. Biosolids management regulations (i.e., WAC 173-308) do not address TPH concentrations in biosolids.

2) Detected non-domestic pollutants will be identified as pretreatment pollutants of concern (POCs) and will be further evaluated as part of an initial pretreatment evaluation.

d. The Fort Lewis WWTP has the ability to produce biosolids that can meet the Class B biosolids criteria (i.e., pollutant ceiling concentrations and pathogen and vector attraction reduction), of WAC 173-308 (Biosolids Management).

e. A review of WWTP operating conditions and discussions with WWTP operators identified concerns related to treatment process equipment and operations. See the report conclusions for specifics.

f. The WWTP was staffed with only five operators and one lab technician, who covered day, night, and swing shifts for 24-hours per day, seven days per week. Operators were required to perform lab work in the absence of the lab technician and to work over-time to cover routine operations.

g. Per Washington Administrative Code (WAC) 173-230, the "operator in responsible charge" is defined as "the individual who is routinely on-site and in direct charge." A Class III WWTP requires a Group III (or higher) "operator in responsible charge" with at least a Group II "operator in charge of each shift." While the USEPA issued permit does not specify requirements for certification of operators, Army Regulation 420-49 (Facility Engineering Utility Services) states (in paragraph 2-4) that "utility plant operators…will meet applicable … State… certification requirements for the State in which they are located." The WWTP supervisor was not routinely on site and did not have a Group III license.

3. RECOMMENDATIONS.

a. Initiate a pretreatment program to: 1) verify the presence/absence of non-domestic pollutants identified in this evaluation, 2) identify pollutants of concern (POCs) and discharges that may interfere with the operation of a WWTP, pass through the WWTP, or interfere with sludge management (digestion, use, or disposal), 3) trace POCs (e.g., TPH, metals, toxic organic compounds) back to discharge source areas in the collection system and 4) provide a mechanism to enforce limits on dischargers of POCs.

b. Investigate alternative regulatory criteria (e.g., TPH soil remediation action levels) for reuse of TPH-containing biosolids and pursue regulatory approval for land application or properly dispose of biosolids.

c. Address treatment process equipment and operations concerns as outlined in the report conclusions.

d. Increase WWTP staff by one lab technician and at least one operator.

e. The operator in responsible charge should be routinely on site and have a Group III WWTP operator license.

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1. PURPOSE. Evaluate the performance of the Solo Point wastewater treatment plant (WWTP) and verify compliance.

2. AUTHORITY. Proposal, Fort Lewis Wastewater Management and Pretreatment Evaluation, accepted by Mr. Phillip Crawford, Fort Lewis Environmental Office, September 2006.

3. EVALUATION APPROACH.

a. Document the WWTP operating conditions.

b. Conduct a sampling-based performance evaluation to include the following:

1) Sample the WWTP influent and effluent and in/out of major unit processes for three consecutive 24-hour periods to determine pollutant removal efficiencies, and verify permit compliance.

2) Sample the supernatants from the sludge thickener, and primary and secondary anaerobic digesters to determine pollutant concentrations and mass loadings.

3) Sample digester and drying bed sludge to determine pollutant concentrations.

c. Evaluate existing WWTP data (from approximately January 2004 through September 2006) to summarize performance and compliance trends.

d. Provide recommendations for improved operation/treatment.

4. WWTP DESCRIPTION

a. The Fort Lewis WWTP operates under National Pollutant Discharge Elimination System (NPDES) Permit No. WA-002195-4 (effective 1 February 2004 through 1 February 2009) issued by Region 10 of the United States Environmental Protection Agency (USEPA 2004). The permit establishes numeric effluent limits and non-numeric compliance requirements and conditions. Monthly numeric effluent limits include 30 mg/L biochemical oxygen demand (BOD) and 30 mg/L total suspended solids (TSS).

b. Biosolids generated by the WWTP are regulated under a General Permit for Biosolids Management (No. BA-0021954) issued by the Washington Department of Ecology (WDOE 1998). The permit was administratively extended until issue of a new general biosolids permit (WDOE 2004).

c. The Solo Point WWTP, constructed in 1955 for primary treatment and upgraded to provide secondary treatment in 1974, provides preliminary, primary, and secondary treatment of both domestic and industrial wastewater. The WWTP was upgraded in 2005. Improvements included new preliminary treatment processes (fine screens and grit removal), sludge pumps, scum pumps, waste gas burner sytem, propane storage, digester gas system, and boilers. WWTP effluent is discharged to the Puget Sound via a 500-foot pipe (with diffusers) that is approximately 70 feet deep. The WWTP receives wastewater from Fort Lewis, McChord Air Force Base, Camp Murray and a Veterans Hospital. The WWTP has a design average flow of 7.0 million gallons per day (mgd). Per WWTP records, actual flow rates averaged 3.4 mgd (based on 2004 through 2006 data). Figure 1 provides a schematic of the WWTP.

5. OBSERVED WWTP OPERATING CONDITIONS

The following is a summary of unit processes and observed operating conditions.

a. Preliminary Treatment. The preliminary treatment processes were upgraded in 2005.

1) Two parallel, mechanically cleaned, bar screens removed larger materials from influent wastewater and automatically deposited them in a dumpster via screw augers and conveyor belts. One screen was in operation; the other served as a backup, but was not operational. The repair required a hoist to lift the screen out of position. The screen had been out of service for approximately two years.

2) Two parallel aerated grit chambers removed grit to a dumpster for removal as solid waste. One grit chamber was in operation; the other served as a backup, but was not in operation because the upstream screen was not operational. Aeration of the grit chamber is necessary to prevent settling of lighter solids. After screening and grit removal, influent wastewater mixed with return flows from the sludge thickener and secondary digester before flowing into the primary clarifiers.

b. Primary Clarification. Primary settling was achieved with up to four parallel, rectangular primary clarifiers. Three of the primary clarifiers were in use at the time of sampling; one was being renovated due to general deterioration and was out of service for five months, which included the wet season. The installation plans to renovate the other three as part of a $1.2 million upgrade project. Flow entered through two pipes. The east pipe fed one clarifier and the west pipe fed the other two clarifiers. The wastewater entering through the east pipe was darker, presumably because it received a higher concentration of digester supernatant, which is returned upstream of the primary clarifiers. Primary sludge was mechanically collected by scrapers and continuously pumped from a collection pit to the sludge thickener. One of the two primary

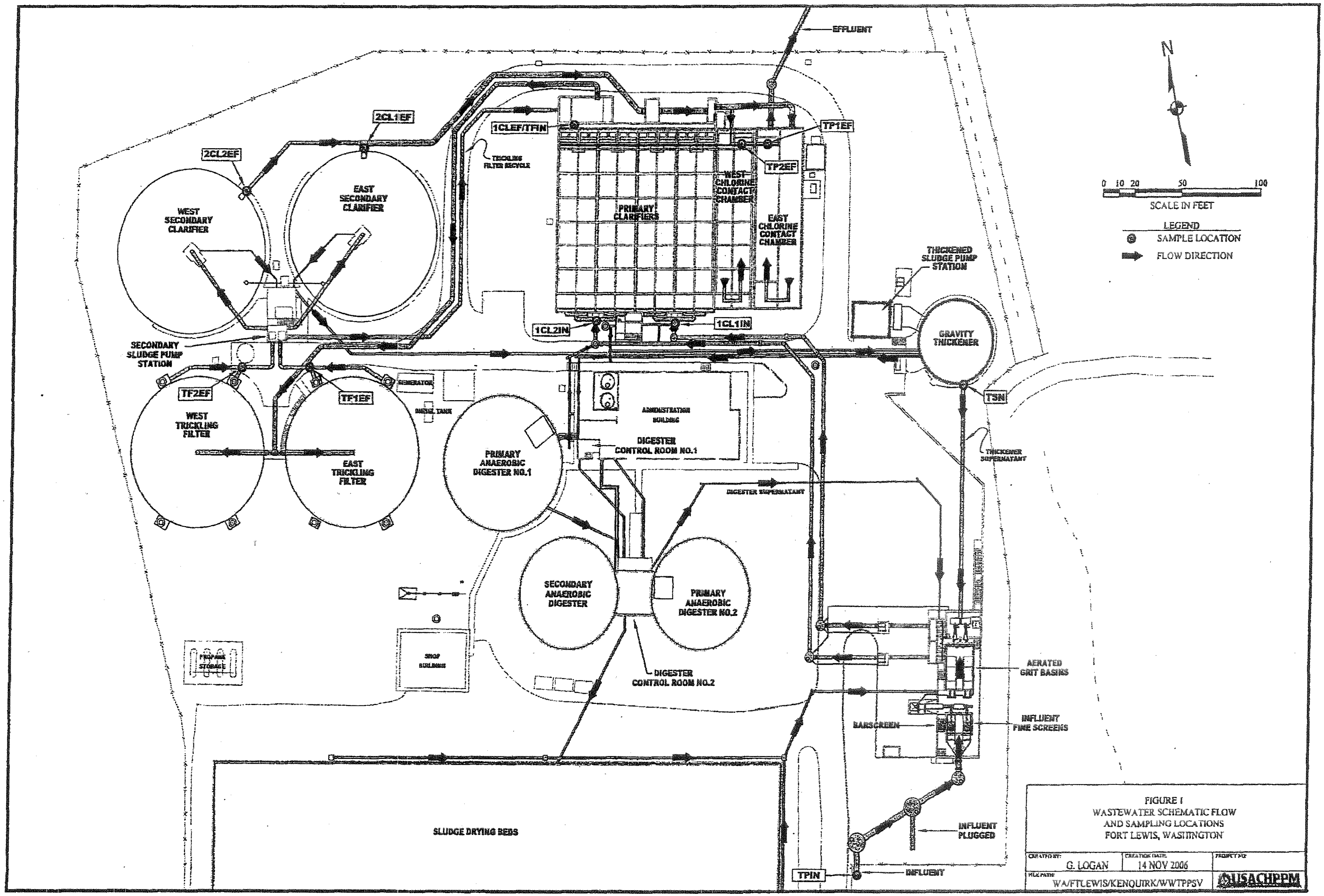

FIGURE 1
WASTEWATER SCHEMATIC FLOW
AND SAMPLING LOCATIONS
FORT LEWIS, WASHINGTON

CREATED BY:	CREATION DATE:	PROJECT NO:
G. LOGAN	14 NOV 2006	
FILE PATH: WA/FTLEWIS/KENQUIRK/WWTPPSV		USACHPPM

sludge pumps was not operational at the time of sampling, but was repaired shortly thereafter. The pumps were older (~1970s) constant speed pumps and lacked modern electronic controls. They were controlled by timers in the past to manage sludge pumping, but the timers are no longer operational.

c. Trickling Filters.

1) Secondary treatment was provided by two parallel, high rate rotary arm trickling filters. A portion of the trickling filter effluent was returned to a wet well at the end of the primary clarifiers where it mixed with primary clarifier effluent. Then one of three constant speed pumps returned the mixture to the influent of the trickling filters. The pumps were older (1970s) constant speed models and lacked modern electronic controls. Plant personnel estimated the pumping rate at approximately 7 mgd. No flow measurement was available on this pump or on the return line. A level sensor in the trickling filter feed wetwell controlled a throttling valve in the recirculation line to maintain a constant flow over the filters. Therefore, the recirculation ratio was increased as plant influent decreased and vice versa. The flow across the trickling filters remained constant, regardless of the influent flow rate. (Note: Variable speed pumps would allow treatment to be optimized with better control of trickling filter flow rates.) Prior to secondary clarification, a portion of the trickling filter effluent was pumped to the sludge thickener as "dilution water" to facilitate sludge settling.

2) Broken plastic trickling filter media was observed on the top of the filters.

d. Secondary Clarification. Secondary clarification was provided by two parallel, circular, center feed secondary clarifiers. Secondary sludge was pumped to the sludge thickener. The pumps were older (1970s) constant speed pumps and lacked modern electronic controls. Clarified effluent flowed to the chlorine contact chambers.

e. Disinfection.

1) Disinfection was performed in two parallel chlorine contact chambers (CCCs). An aqueous sodium hypochlorite solution was added to a mixing chamber at the head of the CCCs. An analyzer monitored the chlorine concentration in the mixing chamber. A software program (Wonderware™) was linked to the analyzer and sodium hypochlorite metering pumps. It automatically adjusted the pump feed rate to maintain a pre-set chlorine concentration in the mixing chamber. WWTP personnel indicated that they were planning to replace the chlorine feed metering pumps and chlorine probe analyzers because the technology has advanced and more reliable equipment (low vibration pumps and direct read analyzers) is available. Personnel also indicated that the existing chlorine feed system had not been calibrated within the last two years.

2) Sodium thiosulfate was used for dechlorination. It was added to the discharge from the CCCs to reduce the effluent total residual chlorine (TRC) concentration below 0.5 mg/L (permit limit). An analyzer monitored the chlorine concentration after sodium thiosulfate addition. A software program (Wonderware™) was linked to the analyzer and sodium

thiosulfate metering pumps. It automatically adjusted the feed rate to maintain compliance with the residual chlorine permit limit.

f. Grease Collection. Grease and scum skimmed from the clarifiers and CCCs were pumped to a rectangular grease vault. Once per week, the grease was pumped to a grease concentrator and then deposited in a dumpster. The grease was further dewatered in a dedicated drying bed before disposal as solid waste.

g. Sludge Management.

1) Sludge Thickener.

a) A circular (45-ft diameter) sludge thickener was used to increase the solids content of primary and secondary sludge before it was sent to the digesters. Dilution water from the trickling filter effluent was added to the thickener to maintain aerobic conditions.

b) Approximately 16,000 gpd of thickened sludge was pumped from the thickener to the primary digester. The thickener produced sludge with a total solids concentration of 3.1 percent with a total volatile solids component of 82 percent, based on 2006 WWTP data. Supernatant was returned to the primary clarifier influent.

2) Sludge Digesters.

a) Sludge was digested in a two-stage anaerobic process consisting of one or two mixed, heated primary digesters followed by one unheated secondary digester. Only one primary digester was in service at the time of sampling. The other digester was out of service for cleaning and maintenance. Approximately 16,000 gal/day of raw sludge was pumped to the 460,000 gallon primary digester. The primary digester provided approximately 29 days of residence time. In 2006, the primary digester was heated to a minimum temperature of 35 °C (95 °F). This combination of time and temperature meets the Class B biosolids pathogen reduction requirements of WAC 173-308-170, which requires values for the mean cell residence time and temperature to be between fifteen days at 35 to 55 °C and sixty days at 20 °C. When in service, the other primary digester (800,000 gallons) would provide 50 days of residence time. The secondary digester (460,000 gals) provided approximately 29 days of residence time. In 2006, the secondary digester temperature was a minimum of 29 °C. Supernatant from the secondary digester was returned by gravity to the head of the plant. The supernatant was very dark and thick with solids, which is typical when there is incomplete digestion in the primary digester. This generates gases in the secondary digester and causes floating solids and fine sized solids that have poor settling characteristics.

b) The digesters were heated with methane gas, a natural by-product of the digestion process. Excess methane gas was burned off in a flare. Propane was also available as a backup heat source.

c) Cracks and evidence of leaking gas (i.e., bubbles when wet) were observed in the cover/roof of primary digester No. 2. Leaking gas may contribute to air emissions, inefficient operation and unsafe working conditions.

3) Biosolids Drying Beds. A total of 24 biosolids drying beds were available. The beds had an asphalt base with no sand layer or underdrains; drying was by evaporation only, and resulted in inadequate drying during the wet season. Installation personnel indicated that valves feeding digester biosolids to drying beds were not water tight. When attempting to feed biosolids to one drying bed, biosolids leaked through valves to other beds. A roof was in place over the entire biosolids drying bed area to prevent precipitation from contacting the drying biosolids. A project was approved to replace the deteriorated roof covering. The WWTP treats and processes approximately 120 dry tons of biosolids annually (based on 2004 and 2005 data).

4) Biosolids Composting, Beneficial Reuse, and Disposal.

a) After drying, the biosolids were typically composted to Class A standards at Fort Lewis' Sequalitchew Creek Eco-Park and Earth Works or hauled off-site by a licensed biosolids handler to a permitted beneficial use facility (Fire Mountain Farms, Inc.). That facility applied the biosolids at two sites in Lewis County, WA (Burnt Ridge Ranch and Lincolm Creek Unit).

b) Recent concerns about the petroleum hydrocarbon content of the biosolids resulted in the temporary landfill disposal of biosolids. Composting of the biosolids in a covered and contained area (i.e., runoff from the area drains to the WWTP) would eliminate concerns about potential total petroleum hydrocarbon (TPH) runoff during composting.

c) The installation was planning to modify the on-site biosolids drying bed facility to incorporate improved biosolids dewatering (e.g., belt filter press, solid-bowl centrifuge) and on-site composting under the existing roof. Mechanical dewatering prior to composting could produce cake solids concentrations of 18 – 35 percent and reduce the requirements for supplemental bulking agents (e.g., wood chips) or amendments during composting. A filter press or centrifuge would require a small footprint and could readily reduce moisture content to desired levels for composting; however, these processes would require shelter and additional manpower to operate and maintain.

h. Flow Measurement and Automatic Sampling.

1) Effluent flow (which also approximates influent flow) was measured with ultrasonic sensors and flow meters at the effluent weirs of the chlorine contact chambers. The influent flow to the primary clarifiers was also measured with two in-line magnetic flow meters. The primary clarifier influent flow includes WWTP influent flow, sludge thickener supernatant, anaerobic digester supernatant, drying bed drainage, and storm water inflow from portions of the WWTP. WWTP personnel indicated that the magnetic flow meters had not been calibrated since they were installed in 2005. Flow rates were not recorded for primary sludge pumping, trickling filter influent, trickling filter recycle, secondary sludge pumping, thickener supernatant, and digester supernatant.

2) Automatic samplers were programmed to collect modified time composite samples, where samples were collected less frequently during typical low flow periods (e.g., at night). The NPDES permit requires samples to be representative of the "volume and nature" of the monitored discharge. Although a modified time composite may be representative of the volume during dry periods, it would not be representative during and after precipitation events when the sanitary sewer is subject to infiltration and inflow.

6. STAFFING EVALUATION.

a. At the time of the evaluation, five personnel operated the WWTP and another served primarily as a lab technician. One operator had recently retired and another was re-assigned to sewer maintenance. The low staffing levels required personnel to work significant overtime to cover routine operations. Operators were often required to perform lab tests in addition to their normal operator responsibilities. One additional operator and one additional lab technician would relieve the overtime burden on the existing staff. The WWTP supervisor did not serve as an "active operator," because he had other supervisory responsibilities.

b. Together, the five operators and lab technician possessed two Group II, three Group III, and one Group IV license. Per Washington Administrative Code (WAC) 173-230, the WWTP is a Class III plant (secondary treatment WWTP, with a design flow between 1 and 10 MGD, WAC 173-230). The code further states that the "operator in responsible charge" must be certified at a level that is equal to or greater than the level of the plant. The "operator in responsible charge" is defined as "the individual who is routinely on-site and in direct charge." A Class III WWTP requires a Group III (or higher) "operator in responsible charge," with at least a Group II "operator in charge of each shift." While the USEPA issued permit does not specify requirements for certification of operators, Army Regulation 420-49 (Facility Engineering Utility Services) states (in paragraph 2-4) that "utility plant operators…will meet applicable … State… certification requirements for the State in which they are located"; therefore, Fort Lewis should comply with the requirements of WAC 173-230.

7. PERFORMANCE EVALUATION

a. Sampling. During three 24-hour periods beginning at 0700 hours on 4 December 2006 and ending at 0700 hours on 7 December 2006, samples were collected from locations throughout the WWTP, as outlined in Table 1 and in accordance with procedures described in the WWTP Performance Evaluation Work Plan (USACHPPM 2006). The sample locations are shown on Figure 1.

b. Flow Measurements.

1) Flow rates corresponding to sampling locations were measured, if possible, or calculated/estimated based on available information. WWTP influent and effluent flow rates were measured with flow measuring devices as described in Table 1 and are summarized in Table 2. The average of these flow rates was 31% lower than Solo Point WWTP average effluent flow data for the same time period.

Table 1. Sample Summary

Sample Location	Sample ID	Sample Type	Sampling Frequency	Analytes	Comments
Wastewater Treatment Plant (WWTP) Influent	TPIN	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	Biochemical oxygen demand (BOD), TPH (diesel, lube oil, gasoline) (grab), Grease and Oil (grab), Ammonia Nitrogen, Nitrite/Nitrate-Nitrogen (NO_2/NO_3-N), Total Kjeldhal Nitrogen (TKN), Phosphate, Total Suspended Solids (TSS), Volatile Organic compounds (VOCs), Semi-Volatile Organics (SVOCs), Organochlorine Pesticides/PCBs, Organophosphorus Pesticides, Total Metals (Aluminum, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Zinc), Phenol	Flow composite samples were collected from a manhole with access to the WWTP influent pipeline. Flow was measured with an area/velocity probe and flow meter. This manhole was located outside of the WWTP fence line along Solo Point Road.
Primary Clarifier(s) Influent	1CLIN	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	BOD, TPH (diesel and lube oil) (grab), Grease and Oil (grab), Ammonia Nitrogen, NO_2/NO_3-N, TKN, Phosphate, TSS, Total Metals	Flow through two pipes was measured with two area/velocity probes and two flow meters. Flow composite samples were collected from the two influent channels and manually combined based on flow ratios.
Primary Clarifier(s) Effluent	1CLEF	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	Same as above.	Flow composite samples were collected from the channel that receives primary clarifier effluent from three operational clarifiers. The sampler was flow-paced via connection to a WWTP effluent flow meter.
Trickling Filter Influent	TFIN	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	Same as above.	The primary clarifier effluent was considered as the trickling filter influent. A portion of the trickling filter effluent is continuously returned (recycled) to the trickling filter; therefore, we neglected the recycle stream and evaluated the trickling filter(s) performance based on the difference in pollutant mass exiting the primary clarifiers and the mass entering the secondary clarifiers.
East Trickling Filter Effluent	TF1EF	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	Same as above.	Flow was assumed to be one-half of the primary clarifier influent/effluent flow. Flow composite samples were collected from an under-drain. The sampler was flow-paced via connection to a primary clarifier influent flow meter. Effluent samples from each trickling filter were collected to evaluate the performance of each filter, as one filter was recently "out of service" and restarted.
West Trickling Filter Effluent	TF2EF	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	Same as above.	Same as above.

Table 1. Sample Summary (continued)

Sample Location	Sample ID	Sample Type	Sampling Frequency	Analytes	Comments
Secondary Clarifier Influent/ Combined Trickling Filter Effluent	2CLIN	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	BOD, TPH (diesel and lube oil) (grab), Grease and Oil (grab), Ammonia Nitrogen, NO_2/NO_3-N, TKN, Phosphate, TSS, Total Metals	Flow composite samples were collected in the junction box that receives and mixes flow from the two trickling filters and feeds the two secondary clarifiers. Trickling filter recycle wastewater was also drawn from this junction box. The sampler was flow-paced via connection to one of the primary clarifier influent flow meters.
Secondary Clarifier Effluent	2CLEF	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	Same as above.	Flow composite samples [2CL1EF and 2CL2EF) were collected from each clarifier effluent drain. The samplers were flow-paced via connection to an effluent flow meter. Equal amounts of each sample were combined to form a composite sample.
Combined WWTP Effluent	TPEF	24-Hour Flow Composites and Grabs	Three consecutive 24-hour periods	BOD, TPH (diesel, lube oil, gasoline) (grab), Grease and Oil (grab), Ammonia Nitrogen, NO_2/NO_3-N, TKN, Phosphate, TSS, VOCs, SVOCs, Organochlorine Pesticides/PCBs, Organophosphorus Pesticides, Total Metals, hardness, Phenol (grab)	Samples were collected from the effluent end of each CCC. Flows were measured with the existing weirs and bubbler transducers and flow meters. The two effluent samples were manually combined based on flow ratios.
Sludge Thickener Supernatant	TSN	24-Hour Time Composites and Grabs	Three consecutive 24-hour periods	BOD, TPH (diesel and lube oil) (grab), Grease and Oil (grab), Ammonia Nitrogen, NO_2/NO_3-N, TKN, Phosphate, TSS, Total Metals	Samples were collected from the thickener effluent channel
Primary Digester Supernatant	1DSN	Grab	Once	BOD, TPH (diesel and lube oil) (grab), Grease and Oil, Ammonia Nitrogen, NO_2/NO_3-N, TKN, Phosphate, TSS, Total Metals	The sample was collected from the digester supernatant discharge (located on top of the digester)
Secondary Digester Supernatant	2DSN	Grab	Once	Same as above.	The sample was collected from the digester supernatant discharge (located on top of the digester)
Thickener Sludge	TSL	Wet Sludge Grab	Once	Total Solids (% of wet), Total Volatile Solids (% of dry), TPH (diesel and lube oil), Metals	The sample was collected from a sampling spigot in the thickener piping room.
Primary Digester Sludge	1DSL	Wet Sludge Grab	Once	Same as above.	The sample was collected from a sampling spigot in the digester piping room.
Secondary Digester Sludge	2DSL	Wet Sludge Grab	Once	Same as above.	The sample was collected from a sampling spigot in the digester piping room or from sludge being poured to a drying bed.
Drying Bed Sludge	DRYSL	Composite	Once	Same as above.	The sample was collected from the drying bed sludge in the north-east corner. WWTP personnel indicated the bed had been poured approximately 6 months prior.

2) The flow rates of individual "return flows" (e.g., primary clarifier sludge, secondary clarifier sludge and dilution water for the sludge thickener) were approximated by drawing down the level in the sludge thickener and filling it with a known volume during a known period of time. This procedure was performed using individual pumps and the combination of pumps operated during sampling. These approximate flow rates are presented in Table 3.

Table 2. Influent and Effluent Flow Rate Measurements

Date	Time	WWTP Influent*	WWTP Effluent*	Average of Influent/Effluent Flow Rates
		mgd	mgd	mgd
4 - 5 Dec 06	0700 - 0700	2.52	2.37	2.45
5 – 6 Dec 06	0700 - 0700	2.54	2.37	2.46
6 – 7 Dec 06	0700 - 0700	2.08	3.10	2.59
Average		2.38	2.61	2.50

* Field flow measurements generally have ±10% error. Temporary equipment problems resulted in segments of unusable data when flow measuring equipment was out of calibration. These segments were replaced with reliable data from another day with similar flow trends.

Table 3. Pump System Characteristics.

Pump	Measured pump flow rate when operated alone	Approximate flow rate during concurrent pumping*
Primary Clarifier Sludge Pump Aurora 663A SF, Size 4X4X9 Motor drive: 15 HP @ 1150 rpm Pump plate flow rating: 135 gpm @ 22 ft TDH	362 gpm	~293 gpm (0.422 mgd)
Secondary Sludge Pump: Weinman 4 inch Pump plate flow rating: 140 gpm @ 25 ft TDH	354 gpm	~287 gpm (0.413 mgd)
Dilution Pump: Weinman 4 inch 7.5 HP @ 1750 rpm Pump plate flow rating: 570 gpm @ 27 ft TDH	603 gpm	~488 gpm (0.703 mgd)
Total Measured Flow during concurrent pumping		~1068 gpm (~1.54 mgd)

* Pumps discharge to a common discharge pipe prior to thickener discharge; assumes a common proportional flow reduction for each pump.

3) Influent to the primary clarifiers enters through two 24-inch pipes. Flow rates were measured with flow measuring devices as described in Table 1. The flow rates are summarized in Table 4. It should be noted that the average of these flow rates was 18% higher than Solo Point WWTP average primary clarifier influent flow data for the same time period. An attempt to "balance" the field measured flows resulted in a discrepancy. The difference between influent/effluent average flow rates and primary clarifier influent flow rates should approximate the sum of the estimated flows from the pumps listed in Table 3. The data indicated an average discrepancy of 0.56 mgd. Factoring in a ±flow measurement error (i.e., 10% low on influent effluent flow and 10% high on primary clarifier influent) would reconcile the discrepancy. Rather than "alter" both sets of flow data, a decision was made to use the average of the influent and effluent flow rates as a basis for influent and effluent mass loading calculations, and to use

the approximate flow rates from Table 3 to calculate mass loadings through unit processes. A summary of inputs and outputs (including flow rates) to each unit process is provided in Table 5.

Table 4. Primary Clarifier Influent Flow Rate Measurements

Date	Time	Primary Clarifier Influent 1* (East)	Primary Clarifier Influent 2* (West)	Sum of Primary Clarifier Influent 1 and Influent 2 Flow Rates
		mgd	mgd	mgd
4 - 5 Dec 06	0700 - 0700	1.24	3.41	4.65
5 – 6 Dec 06	0700 - 0700	1.23	3.30	4.53
6 – 7 Dec 06	0700 - 0700	1.29	3.35	4.64
Average		1.25	3.35	4.60

*Field flow measurements generally have ±10% error.

Table 5. WWTP Unit Process Inputs and Outputs.

	Inputs	Unit Processes	Outputs
Wastewater Treatment	WWTP influent (~2.50 mgd) ▶ Sludge Thickener supernatant (~1.54 mgd) ▶ Secondary Anaerobic Digester supernatant (~0.016 mgd) ▶	Headworks/Preliminary Treatment (Screening and Grit Removal)	▶ Headworks effluent (~4.04 mgd) ▶ Screenings ▶ Grit
	Headworks effluent (~4.04 mgd) ▶	Primary Clarifiers	▶ Primary Clarifier effluent (~3.62 mgd) ▶ Primary Clarifier sludge (~0.42 mgd)
	Primary Clarifier effluent (~3.62 mgd) ▶ Partial Trickling Filter effluent recycle (volume varies) ▶ Multi-Media Filter backwash ▶	Trickling Filter	▶ Trickling Filter effluent (~3.62 mgd)
	Trickling Filter effluent minus dilution water (pumped continuously to sludge thickener at ~0.70 mgd) and partial Trickling Filter recycle flow (volume varies) = ~2.92 mgd ▶	Secondary Clarifiers	▶ Secondary Clarifier effluent (~2.50 mgd) ▶ Secondary Clarifier sludge (pumped to Sludge Thickener at ~0.42 mgd)
	Secondary Clarifier effluent (~2.50 mgd) ▶ Chlorine ▶ Dechlorinating Agent ▶	Chlorine Contact Chambers	▶ WWTP effluent (~2.50 mgd)
Sludge Management	Primary Clarifier sludge ▶ Secondary Clarifier sludge ▶ Dilution water (from Trickling Filter effluent at 0.70 mgd)) ▶	Sludge Thickener	▶ Thickened sludge (to anaerobic digesters at ~ 0.016 mgd) ▶ Sludge Thickener supernatant (to Headworks at ~1.54 mgd)
	Thickened sludge (~0.016 mgd) ▶	Anaerobic Digesters	▶ Supernatant (returned to Headworks at ~ 0.016 mgd) ▶ Digested sludge (to drying beds)

c. Wastewater Sampling Results.

1) A summary of detected parameters for each wastewater sample is provided in Appendix B, Table B-1. A summary of parameters detected in WWTP influent, primary clarifier influent (i.e., WWTP influent + recycle flows from WWTP processes), and effluent samples is provided in Table 6. Effluent concentrations were compared to applicable Washington marine surface water toxic substance criteria for the protection of aquatic life [WAC 173-201A, Table 240(3)] (see Appendic C). It should be noted that the Washington toxic substance criteria apply to the receiving water, not the WWTP discharge; however, the criteria were compared to effluent concentrations to screen for pollutants that have potential to impact receiving waters.

2) In addition to conventional wastewater pollutants (e.g., BOD_5, TSS, ammonia) influent and effluent samples were analyzed for toxic metals [from 40 CFR 122, Appendix D, Table III with Washington surface water criteria per WAC 173-201A, Table 240(3)], TPH, and toxic organic pollutants (VOCs, SVOCs, and pesticides/PCBs per 40 CFR 122, Appendix D, Table II) to provide data to support a planned pretreatment program. Additional pretreatment sampling will be conducted in May 2007 as part of an initial pretreatment evaluation and the detected toxic metals and organic compounds will undergo further analysis as pretreatment pollutants of concern.

a) TPH was detected in influent and effluent samples (see Table 6). Effluent grab sample TPH concentrations ranged from 2.3 to 10.9 mg/L. The discharge permit requires TPH monitoring, but does not include a concentration or mass limit. Washington does not have a surface water quality criteria for TPH.

b) Ten metals and eighteen organic compounds listed as toxic pollutants (per 40 CFR 122, Appendix D, Tables II and III) were detected in WWTP influent and/or primary clarifier influent samples. Five of the metals (arsenic, copper, lead, nickel, and zinc) were detected in WWTP effluent samples. Only copper was detected in effluent samples at concentrations that exceeded the Washington marine surface water toxic substance criteria for the protection of aquatic life. Four of the organic compounds [chloroform, bis (2-ethylhexyl) phthalate, naphthalene, and alpha chlordane] were detected in WWTP effluent samples at trace concentrations. Only alpha chlordane was detected (at estimated trace concentrations) in effluent samples above Washington marine surface water toxic substance criteria for the protection of aquatic life.

Table 6. Parameters Detected in WWTP Influent and/or Effluent Samples.

	Analyte	Date	Time	WWTP Influent	Primary Clarifier Influent[1]	WWTP Effluent	Comments
Conventional Pollutants	BOD (mg/L)	4-5 Dec 06	0700-0700	78	61	9.3	Effluent sample concentrations were below permit limit (30 mg/L). Day two and three data discarded due to lab QA/QC findings
	TSS (mg/L)	4-5 Dec 06	0700-0700	54	228	20	Effluent sample concentrations were below effluent limit (30 mg/L).
		5-6 Dec 06	0700-0700	98	220	24.7	
		6-7 Dec 06	0700-0700	204	178/220	26.4	
	Ammonia (mg/L)	4-5 Dec 06	0700-0700	24	21	3.5	No permit limit, but monitoring required. Effluent sample concs. above WA TSC: Acute = 0.233 mg/L, Chronic = 0.035 mg/L
		5-6 Dec 06	0700-0700	25	23	4.5	
		6-7 Dec 06	0700-0700	26	24/26	5.8	
	Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	ND (<0.050)	1.3	20	No permit limit, but monitoring required. No WA TSC.
		5-6 Dec 06	0700-0700	ND (<0.050)	3.5	21	
		6-7 Dec 06	0700-0700	ND (<0.050)	4/3.6	24	
	TKN (mg/L)	4-5 Dec 06	0700-0700	29	33	6.7	No permit limit, but monitoring required. No WA TSC.
		5-6 Dec 06	0700-0700	37	38	8.1	
		6-7 Dec 06	0700-0700	39	39/38	8.8	
	Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	3.61	6.17	3.72	No permit limit; monitoring not required. No WA TSC.
		5-6 Dec 06	0700-0700	4.2	6.25	4.34	
		6-7 Dec 06	0700-0700	4.8	6.25/6.3	4.54	
	Oil and Grease (mg/L)	4-Dec 06	grab	21	26	ND (<5.30)	No permit limit; monitoring not required. No WA TSC.
		5-Dec 06	grab	7.79	7.33	ND (<5.00)	
		6-Dec 06	grab	6.33	6.56	ND (<5.10)	
TPH	TPH-Diesel Range (mg/L)	4-Dec 06	grab	15	53	0.690J	No permit limit, but TPH monitoring required. No WA TSC.
		5-Dec 06	grab	12	14	0.830	
		6-Dec 06	grab	18	13	4	
	TPH-Heavy Range (mg/L)	4-Dec 06	grab	11	27J	1.6J	No permit limit, but TPH monitoring required. No WA TSC.
		5-Dec 06	grab	7.2J	11	1.6	
		6-Dec 06	grab	11J	13J	6.9	
	TPH-Gasoline (mg/L)	4-Dec 06	grab	0.280	NA	ND(<0.048)	No permit limit, but TPH monitoring required. No WA TSC.
		5-Dec 06	grab	0.140J	NA	ND(<0.048)	
		6-Dec 06	grab	0.150J	NA	ND(<0.048)	
Metals	Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.208	1.34	0.243	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	0.291	1.46	0.252	
		6-7 Dec 06	0700-0700	0.547	1.36	0.246	
	Arsenic (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.49	1.03	No permit limit. Detected below the WA TSC.
		5-6 Dec 06	0700-0700	1.15	1.74	1.17	
		6-7 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)	
	Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)	No permit limit. Detected below the WA TSC.
		5-6 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)	
		6-7 Dec 06	0700-0700	1.06	1.39	ND(<1.00)	
	Chromium (µg/L)	4-5 Dec 06	0700-0700	2.59	2.71	ND(<2.00)	No permit limit, but monitoring required. Detected below the WA TSC.
		5-6 Dec 06	0700-0700	ND(<2.00)	2.63	ND(<2.00)	
		6-7 Dec 06	0700-0700	2.38	2.82	ND(<2.00)	

330 mg/L
1.3 ug/l
u @ (0.057)
u (4.5)

1 Primary Clarifier Influent = WWTP Influent + WWTP recycle flows
J: estimated value ND: not detected WA TSC: Washington marine surface water toxic substance criteria for the protection of aquatic life.
Example: (<5.00) = the analyte was not detected above the 5.00 mg/L reporting limit

Table 6. Parameters Detected in WWTP Influent and/or Effluent Samples (continued).

	Analyte	Date	Time	WWTP Influent	Primary Clarifier Influent	WWTP Effluent	Comments	
Metals	Copper (µg/L)	4-5 Dec 06	0700-0700	45.8	100	32.7	No permit limit, but monitoring required. Detected in effluent samples above the WA TSC: Acute = 4.8 µg/L, Chronic = 3.1 µg/L	19.8 ug/l
		5-6 Dec 06	0700-0700	51.3	112	36.7		
		6-7 Dec 06	0700-0700	78.5	108	34.8		
	Lead (µg/L)	4-5 Dec 06	0700-0700	1.28	6.08	3.37	No permit limit, but monitoring required. Detected in influent/effluent samples below the WA TSC.	13 ug/l
		5-6 Dec 06	0700-0700	1.22	5.26	1.05		
		6-7 Dec 06	0700-0700	ND(<5.00)	6.67	ND(<5.00)		
	Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.200)	0.278	ND(<0.200)	No permit limit, but monitoring required. Not detected in effluent samples at the MRL (0.200 µg/L); MRL was below acute but above the chronic criteria. WA TSC: Acute = 4.8 µg/L, Chronic = 3.1 µg/L	0.1 ug/l
		5-6 Dec 06	0700-0700	ND(<0.200)	0.699	ND(<0.200)		
		6-7 Dec 06	0700-0700	0.297	0.527	ND(<0.200)		
	Molybdenum (µg/L)	4-5 Dec 06	0700-0700	12.4	11.7	5.67	No permit limit, but monitoring required. No WA TSC.	Not in Permit
		5-6 Dec 06	0700-0700	11.1	11.2	9.91		
		6-7 Dec 06	0700-0700	23.3	17.2	10.8		
	Nickel (µg/L)	4-5 Dec 06	0700-0700	11.2	4.49	2.45	No permit limit. Effluent sample concs. below WA TSC. monitoring required	u (43)
		5-6 Dec 06	0700-0700	6.93	3.79	2.64		
		6-7 Dec 06	0700-0700	6.56	3.71	ND(<2.00)		
	Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.15	ND(<1.00)	No permit limit, but monitoring required. All sample concs. below the WA TSC. Not detected in effluent samples.	0.55 ug/l
		5-6 Dec 06	0700-0700	ND(<1.00)	1.39	ND(<1.00)		
		6-7 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)		
	Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.26	ND(<1.00)	No permit limit. All sample concs. below the WA TSC.	6.3 ug/l
		5-6 Dec 06	0700-0700	ND(<1.00)	1.19	ND(<1.00)		
		6-7 Dec 06	0700-0700	ND(<1.00)	1.02	ND(<1.00)		
	Zinc (mg/L)	4-5 Dec 06	0700-0700	0.08	0.243	0.070	All sample concentrations were below the WA TSC.	33.3 ug/l
		5-6 Dec 06	0700-0700	0.095	0.237	0.079		
		6-7 Dec 06	0700-0700	0.135	0.222	0.112		
Volatile Organic Compounds	Chloroform (µg/L)	4-Dec	grab	ND	NA	ND	No permit limit. No WA TSC. J estimated	X
		5-Dec	grab	ND	NA	ND		
		6-Dec	grab	ND	NA	1J		
	1,4-dichlorobenzene (µg/L)	4-Dec	grab	2J	NA	ND	No permit limit. No WA TSC.	
		5-Dec	grab	3J	NA	ND		
		6-Dec	grab	2J	NA	ND		
	1,2-dichlorobenzene (µg/L)	4-Dec	grab	2J	NA	ND	No permit limit. No WA TSC.	
		5-Dec	grab	1J	NA	ND		
		6-Dec	grab	4J	NA	ND		
	Tetrachloroethene (µg/L)	4-Dec	grab	3J	NA	ND	No permit limit. No WA TSC.	
		5-Dec	grab	ND	NA	ND		
		6-Dec	grab	ND	NA	ND		
	Toluene (µg/L)	4-Dec	grab	2J	NA	ND	No permit limit. No WA TSC.	
		5-Dec	grab	2J	NA	ND		
		6-Dec	grab	3J	NA	ND		

NA: not analyzed MRL: method reporting limit

Table 6. Parameters Detected in WWTP Influent and/or Effluent Samples (continued).

	Analyte	Date	Time	WWTP Influent	Primary Clarifier Influent	WWTP Effluent	Comments
Semi-Volatile Organic Compounds	Phenol	4-5 Dec 06	0700-0700	6	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	24	NA	ND	
		6-7 Dec 06	0700-0700	11	NA	ND	
	Acenaphthene (µg/L)	4-5 Dec 06	0700-0700	0.5J	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	0.4J	NA	ND	
		6-7 Dec 06	0700-0700	ND	NA	ND	
	Diethylphthalate (µg/L)	4-5 Dec 06	0700-0700	4J	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	6	NA	ND	
		6-7 Dec 06	0700-0700	5	NA	ND	
	di-n-butylphthalate (µg/L)	4-5 Dec 06	0700-0700	2J	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	2J	NA	ND	
		6-7 Dec 06	0700-0700	1J	NA	ND	
	Fluorene (µg/L)	4-5 Dec 06	0700-0700	0.4J	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	0.6J	NA	ND	
		6-7 Dec 06	0700-0700	0.4J	NA	ND	
	Butylbenzylphthalate (µg/L)	4-5 Dec 06	0700-0700	4J	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	7	NA	ND	
		6-7 Dec 06	0700-0700	7	NA	ND	
	Bis(2-ethylhexyl)phthalate (µg/L)	4-5 Dec 06	0700-0700	10	NA	13	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	16	NA	7	
		6-7 Dec 06	0700-0700	16	NA	7	
	1,2-Dichlorobenzene (µg/L)	4-5 Dec 06	0700-0700	1J	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	1J	NA	ND	
		6-7 Dec 06	0700-0700	1J	NA	ND	
	1,4-Dichlorobenzene (µg/L)	4-5 Dec 06	0700-0700	1J	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	5J	NA	ND	
		6-7 Dec 06	0700-0700	5J	NA	ND	
	Napthalene (µg/L)	4-5 Dec 06	0700-0700	7	NA	0.2J	No permit limit. estimated No WA TSC.
		5-6 Dec 06	0700-0700	7	NA	ND	
		6-7 Dec 06	0700-0700	4J	NA	ND	
	Phenanthrene (µg/L)	4-5 Dec 06	0700-0700	ND	NA	ND	No permit limit. No WA TSC.
		5-6 Dec 06	0700-0700	1J	NA	ND	
		6-7 Dec 06	0700-0700	0.6J	NA	ND	
Pesticides	Alpha Chlordane (µg/L)	4-5 Dec 06	0700-0700	ND	NA	0.0079J	Effluent sample estimated concs. above acute/chronic WA TSC: Acute = 0.09 µ/L, Chronic = 0.004 µ/L
		5-6 Dec 06	0700-0700	ND	NA	0.0061J	
		6-7 Dec 06	0700-0700	0.0045J	NA	0.0059J	
	Heptachlor (µg/L)	4-5 Dec 06	0700-0700	0.094	NA	ND	Influent sample concs. only above WA TSC: Acute = 0.053 µ/L, Chronic = 0.0036 µ/L Not detected in effluent samples.
		5-6 Dec 06	0700-0700	0.52	NA	ND	
		6-7 Dec 06	0700-0700	0.51	NA	ND	
	o,p-DDD	4-5 Dec 06	0700-0700	ND	NA	ND	Influent sample estimated conc. above WA TSC: Acute = 0.13 µ/L, Chronic = 0.001 µ/L. Not detected in effluent samples.
		5-6 Dec 06	0700-0700	0.057J	NA	ND	
		6-7 Dec 06	0700-0700	ND	NA	ND	

3) Laboratory quality assurance and quality control reports indicate that problems were encountered when analyzing some BOD_5 samples. The analytical lab reported that the problems suggested a "toxic interference in the samples." Further review of the lab QA/QC led to the discarding of days 2 and 3 BOD5 data and two individual BOD results from day 1.

4) A review of the concentration data indicates that pollutant concentrations generally decreased across each major unit process (primary clarifiers, trickling filters and secondary clarifiers), as expected. However, the day 3 TSS result for secondary clarifier effluent was uncharacteristically high and not consistent with the concentration reduction trend exhibited by the remainder of the data. The result suggests that a significant increase in TSS concentration (70 mg/L to 128 mg/L) occurred through the secondary clarifier, which is highly unlikely, especially considering the WWTP effluent concentration was 26.4 mg/L. The 128 mg/L result was considered an outlier and was excluded from the unit process performance evaluation.

d. Field Measurement Parameters (Wastewater).

1) Specific Conductivity, pH, Dissolved Oxygen and Temperature. These parameters were measured continuously with calibrated field instruments at select locations throughout the WWTP. A summary of the data is presented in Appendix B, Table B-2.

2) Effluent chlorine residual was randomly checked on three occasions during the 3-day sampling event using a HACH™ chlorine test kit. A summary of the data is provided in Appendix B, Table B-3. It should be noted that readings were performed on samples collected prior to de-chlorination. WWTP data for the same period is included in Table B-3; concentrations ranged from 0.11 to 0.21 mg/L after dechlorination.

e. Sludge Sampling Results. A summary of detected parameters and their concentrations in sludge samples is provided in Appendix D, Table D-1, along with an evaluation of the sludge sample results and sludge management processes.

f. WWTP and Unit Process Pollutant Removal Efficiencies. Flow rates and pollutant concentrations were used to calculate pollutant mass loadings and removal efficiencies.

1) Average WWTP removal efficiencies are summarized in Table 7 for all detected pollutants. Organic compounds were detected only in trace concentrations and often reported as estimated values. WWTP influent and effluent flow rates, pollutant concentrations and mass loadings, and removal efficiencies are detailed for detected analytical parameters (if applicable) in Appendix E, Table E-1. Note that when the effluent metals concentrations were non-detect, the removal efficiency was conservatively calculated with ½ of the reporting limit.

2) Unit process removal efficiencies for non-metals are summarized in Table 8. Metals were mostly removed in the primary and secondary clarifiers with sludge; the primary clarifiers removed most of the mass (of metals). Metals removal rates for the primary and secondary clarifiers are summarized in Tables 9 and 10, respectively. Metals were concentrated in the sludge (see Appendix D, Table D-1). Unit process influent and effluent flow rates, pollutant

concentrations and mass loadings, and removal efficiencies are detailed for detected analytical parameters (if applicable) in Appendix E, Table E-2. A detailed summary of unit process removals, including lbs/day removed is included in Appendix E, Table E-3.

3) The average influent BOD concentration (78 mg/L) was indicative of a low strength domestic wastewater. Influent TSS concentrations (54 - 204 mg/L) were consistent with low to medium strength wastewater. On average, the primary clarifiers removed 39.9 percent of BOD and 67.5 percent of TSS. These values were in the range of typical primary clarifier removal rates of 25 to 45% for BOD and 50 to 80% for TSS (WPCF 1990). The trickling filters effectively removed BOD, with an efficiency of 63.4 percent, within the typical range of 60 to 90 % (Metcalf & Eddy 2003). Both trickling filters performed effectively. The secondary clarifiers removed 47.1 percent of BOD and 58.1 percent of TSS, resulting in a permit compliant effluent.

4) Influent total Kjeldahl nitrogen (TKN=organic nitrogen+ammonia+ammonium) concentrations (29 - 39 mg/L) and ammonia concentrations (24 – 26 mg/L) were consistent with a medium strength domestic wastewater. The WWTP effectively oxidized ammonia nitrogen to nitrite/nitrate as evidenced by similar mass increases and decreases in ammonia and nitrate/nitrite, respectively. On average, TKN was reduced by 77.5 percent. Significant nitrification occurred in the trickling filters, with a 71.5 percent reduction of ammonia nitrogen. This is an indication of an effective trickling filter, as significant nitrification occurs only after BOD concentration is appreciably reduced (i.e., to <30 mg/L) (Metcalf & Eddy 2003). Trickling filter effluent BOD concentrations ranged from 8.9 to 15 mg/L. Final effluent nitrate/nitrite concentrations ranged from 20 to 24 mg/L, most or all of which would be nitrate after chlorination. Final effluent ammonia concentrations ranged from 3.5 to 5.8 mg/L.

5) Influent phosphorus concentrations (3.6 - 4.8 mg/L) were consistent with typical low-strength domestic wastewater. Phosphorus persisted through the WWTP; however, the NPDES permit does not limit it.

6) Based on the averages of daily grab sample results, an estimated 314 lbs of diesel range TPH, 203 lbs of lube oil range TPH and 3.9 lbs of gasoline range TPH entered the WWTP each day. The lighter range TPH (gasoline and diesel) was more readily removed than the heavy range. An increase in TPH concentrations (based on grab samples) through the CCC was probably due to the floating scum layer at the end of the CCCs. Diesel range TPH effluent grab sample concentrations ranged from 0.83 to 4 mg/L. Heavy range TPH effluent concentrations ranged from 1.6 to 6.9 mg/L. The NPDES permit does not limit TPH, but requires no discharge of oily wastes which produce a sheen on the surface of the receiving water. No sheen was observed on the CCC effluent. The WWTP removed an estimated 79 percent of combined TPH.

Table 7. WWTP Average Removal Efficiencies.

	Analyte	Sample Dates	Sample Types	Average WWTP Removal Efficiency	Comments
Conventional Pollutants	BOD	4-5 Dec 06	24-hour composite	88.1	
	TSS	4-7 Dec 06	Three 24-hour composites	80.2	
	Ammonia	4-7 Dec 06	Three 24-hour composites	81.5	
	Nitrate/Nitrite	4-7 Dec 06	Three 24-hour composites	See comment	The mass of nitrate/nitrite increased from non-detect (~0 lbs/day) in the influent to 453 lbs/day in the effluent due to nitrification of ammonia to nitrate/nitrite.
	TKN	4-7 Dec 06	Three 24-hour composites	77.5	
	Total Phosphorus	4-7 Dec 06	Three 24-hour composites	0.2	
	Grease and Oil	4-7 Dec 06	Three grabs	See comment	Not detected in effluent at MRL (5.00 – 5.30 mg/L)
TPH	TPH-Diesel Range	4-7 Dec 06	Three grabs	87.5 [a b]	
	TPH-Heavy Range	4-7 Dec 06	Three grabs	64.8 [a b]	
	TPH-Gasoline	4-7 Dec 06	Three grabs	See comment	Not detected in effluent at MRL (48 µg/L) [b]
Metals	Aluminum	4-7 Dec 06	Three 24-hour composites	29.9	
	Arsenic	4-7 Dec 06	Three 24-hour composites	See comments	Detected in one of three influent samples at 1.15 µg/L. Detected in two of three effluent samples at 1.03 µg/L and 1.17 µg/L
	Cadmium	4-7 Dec 06	Three 24-hour composites	See comments	Detected in one of three influent samples at 1.06 µg/L. Not detected in effluent at MRL (1.0 – 2.0 µg/L)
	Chromium	4-7 Dec 06	Three 24-hour composites	See comments	Detected in two of three influent samples at 2.38 µg/L and 2.59 µg/L. Not detected in effluent at MRL (2.0 µg/L)
	Copper	4-7 Dec 06	Three 24-hour composites	41.0	
	Iron	4-7 Dec 06	Three 24-hour composites	37.9	
	Lead	4-7 Dec 06	Three 24-hour composites	See comments	Detected in two of three influent samples at 1.28 µg/L and 1.22 µg/L. Detected in two of three effluent samples at 3.37 ug/L and 1.05 ug/L. Not detected on third sampling day in influent or effluent samples.
	Mercury	4-7 Dec 06	Three 24-hour composites	See comments	Detected in one of three influent samples at 0.297 µg/L. Not detected in effluent at MRL (0.2 µg/L).
	Molybdenum	4-7 Dec 06	Three 24-hour composites	43.9	Not in Permit application but in DMR
	Nickel	4-7 Dec 06	Three 24-hour composites	75.5	
	Selenium	4-7 Dec 06	Three 24-hour composites	ND	Not detected in influent or effluent samples at MRL (1.0 – 2.0 µg/L)
	Silver	4-7 Dec 06	Three 24-hour composites	ND	Not detected in influent or effluent samples at MRL (1.0 µg/L)
	Zinc	4-7 Dec 06	Three 24-hour composites	15.8	

a: Removal efficiency is based on grab samples taken during snapshots in time. Actual concentrations may fluctuate with time.
b: Value is considered an estimate because it was calculated with grab sample results.
MRL: method reporting limit
ND: not detected

Table 7. WWTP Average Removal Efficiencies (continued)

	Analyte	Sample Dates	Sample Types	Average WWTP Removal Efficiency (%)	Comments
Volatile Organic Compounds	Chloroform	4-7 Dec 06	Three grabs	See comment	Not detected in influent samples. Detected in one effluent sample at estimated concentration of 1 µg/L. (Note: There are no Washington State marine surface water criteria for this pollutant)
	1,4-dichlorobenzene	4-7 Dec 06	Three grabs	See comment	Not detected in effluent samples.
	1,2-dichlorobenzene	4-7 Dec 06	Three grabs	See comment	Not detected in effluent samples.
	Tetrachloroethene	4-7 Dec 06	Three grabs	See comment	Not detected in effluent samples.
	Toluene	4-7 Dec 06	Three grabs	See comment	Not detected in effluent samples.
Semi-Volatile Organic Compounds	Phenol	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	Acenaphthene	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	Diethylphthalate	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	di-n-butylphthalate	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	Fluorene	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	Butylbenzylphthalate	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	Bis(2-ethylhexyl)phthalate	4-7 Dec 06	Three 24-hour composites	27.5	Note: There are no Washington State marine surface water criteria for this pollutant
	1,2-Dichlorobenzene	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	1,4-Dichlorobenzene	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	Napthalene	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	Phenanthrene	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
Pesticides	Alpha Chlordane	4-7 Dec 06	Three 24-hour composites	See comment	Detected in one of three influent samples at estimated concentration of 0.0045 µg/L. Detected in all three effluent samples at estimated concentrations of 0.0079, 0.0061, and 0.0059 µg/L. (Note: The Washington State marine surface water criteria for chlordane are: 1) acute criteria = 0.09 µg/L (instantaneous concentration not to be exceeded at any time), 2) chronic criteria = 0.004 µg/L (a 24-hr average not to be exceeded).
	Heptachlor	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.
	o,p-DDD	4-7 Dec 06	Three 24-hour composites	See comment	Not detected in effluent samples.

a: Removal efficiency is based on grab samples taken during snapshots in time. Actual concentrations may fluctuate with time.
b: Value is considered an estimate because it was calculated with grab sample results.
MRL: method reporting limit
ND: not detected

Table 8. WWTP Process Data – Removal Efficiencies.

Analyte	Date	Sample Types	Primary Clarifier Removal Efficiency (%)	Trickling Filter Removal Efficiency (%)	Secondary Clarifier Removal Efficiency (%)	Chlorine Contact Removal Efficiency (%)
BOD	4-6 Dec 06	24-hour composites	39.9	63.4	46.9 [a]	~0 [a]
TSS	4-7 Dec 06	24-hour composites	67.5	26.3	58.1 [b]	2.9 [b]
Ammonia	4-7 Dec 06	24-hour composites	18.2	71.5	30.5	4.3
Nitrate/Nitrite	4-7 Dec 06	24-hour composites	Increase [c]	Increase [c]	17.9	3.2
TKN	4-7 Dec 06	24-hour composites	27.5	65.3	34.6	-0.2
Total Phosphorus	4-7 Dec 06	24-hour composites	33.4	-2.6	23.2	1.2
Grease and Oil	4-7 Dec 06	Three grabs	71.1 [d, e]	51.9 [d, e]	ND [d]	ND [d]
TPH-Diesel Range	4-7 Dec 06	Three grabs	81.1 [d, e]	75.5 [d, e]	46.8 [d, e]	Increase [d, f]
TPH-Heavy Range	4-7 Dec 06	Three grabs	76.7 [d, e]	43.9 [d, e]	38.2 [d, e]	Increase [d, f]

a: Day 1 secondary clarifier effluent BOD result was discarded for laboratory QA/QC reasons. Removal efficiency across the secondary clarifier and CCC was calculated and all of the removal was presumed to occur in the secondary clarifier.
b: Removal efficiency was calculated with day 1 and day 2 TSS results.
c: Nitrate/nitrite concentration increases were indicative of nitrification of ammonia to nitrate/nitrite.
d: Removal efficiency is based on grab samples taken during snapshots in time. Actual concentrations may fluctuate with time.
e: Removal efficiency is considered an estimate because it was calculated with grab sample results.
f: TPH concentration increases through the WWTP/CCC were presumed to be attributed to the scum layer at the tail end of the CCCs. Diesel range TPH effluent concentrations ranged from 0.83 to 4 mg/L. Heavy range TPH effluent concentrations ranged from 1.6 to 6.9 mg/L.
ND: not detected

Table 9. WWTP Process Data – Primary Clarifier Metals Removal Efficiencies (3-Day Average) Data.

Analyte	Date	Primary Clarifier Removal Efficiency (%)	Comments
Aluminum	4-7 Dec 06	74.2	
Arsenic	4-7 Dec 06	36.0	Removal efficiency based on day one and two data. Not detected in influent or effluent on day three.
Cadmium	4-7 Dec 06	See comments	Detected in one of three clarifier influent samples at 1.39 µg/L. Not detected in clarifier effluent at MRL (1.0 - 2.0 µg/L).
Chromium	4-7 Dec 06	See comment	Not detected in clarifier effluent at MRL (2.0 µg/L).
Copper	4-7 Dec 06	56.1	
Iron	4-7 Dec 06	66.3	
Lead	4-7 Dec 06	73.0	Removal efficiency based on day one and two results. Not detected in clarifier effluent at MRL (5.0 µg/L) on day three.
Mercury	4-7 Dec 06	See comment	Not detected in clarifier effluent at MRL (0.2 µg/L).
Molybdenum	4-7 Dec 06	33.3	Not detected in clarifier effluent above MRL (5.0 µg/L) on day one; assume effluent concentration equals ½ MRL.
Nickel	4-7 Dec 06	45.0	
Selenium	4-7 Dec 06	See comment	Detected in two of three clarifier influent samples at 1.15 and 1.39 µg/L. Detected in one of three clarifier effluent samples at 1.04 µg/L.
Silver	4-7 Dec 06	See comment	Not detected in clarifier effluent at MRL (1.0 µg/L).
Zinc	4-7 Dec 06	60.0	

MRL: method reporting limit NA: not applicable ND: not detected

Table 10. WWTP Process Data – Secondary Clarifier Metals Removal Efficiencies (3-Day Average) Data.

Analyte	Date	Secondary Clarifier Removal Efficiency (%)	Comments
Aluminum	4-7 Dec 06	54.1	
Arsenic	4-7 Dec 06	25.1	Removal efficiency based on day one and two results. Not detected in clarifier effluent at MRL (2.0 µg/L) on day three.
Cadmium	4-7 Dec 06	ND	Not detected in clarifier influent or effluent at MRL (1.0 – 2.0 µ/L)
Chromium	4-7 Dec 06	ND	Not detected in clarifier influent or effluent at MRL (2.0 µ/L)
Copper	4-7 Dec 06	41.9	
Iron	4-7 Dec 06	48.4	
Lead	4-7 Dec 06	51.6	Removal efficiency based on day one and two results. Not detected in clarifier effluent at MRL (2.0 µg/L) on day three.
Mercury	4-7 Dec 06	ND	Not detected in clarifier influent or effluent at MRL (0.2 µ/L)
Molybdenum	4-7 Dec 06	31.2	
Nickel	4-7 Dec 06	49.6	Not detected in clarifier effluent above MRL (2.0 µg/L) on day one; assume effluent concentration equals ½ MRL.
Selenium	4-7 Dec 06	ND	Not detected in clarifier influent or effluent at MRL (1.0 – 2.0 µ/L)
Silver	4-7 Dec 06	ND	Not detected in clarifier influent or effluent at MRL (1.0 µ/L)
Zinc	4-7 Dec 06	39.9	

ND: not detected MRL: method reporting limit

8. PERMIT COMPLIANCE.

a. Effluent data verified compliance with permit limits. A summary of effluent limits and sampling results is provided in Table 11.

b. Based on a review of Monthly Facilities Engineering Operating Logs from 2004 to 2006; summarized in Appendix F, Tables F-1 through F-3, the WWTP was operated in compliance with permit effluent limitations, with one exception. In May 2006, treatment was inhibited by an unknown pollutant. Treatment in one of the two trickling filters was upset and effluent pH levels were below 6 for 6 days.

Table 11. NPDES Permit Effluent Limits and Evaluation Effluent Results.

Effluent Characteristic	Permit Effluent Limits				WWTP Evaluation Effluent Data
	Units of Measure	Average Monthly Discharge limit	Average Weekly Discharge Limit	Daily Maximum Discharge Limit	
BOD	mg/L	30	45	--	9.3 [a]
	lbs/day	1902	2852	--	190 [a]
TSS	mg/L	30	45	--	23.7 [b]
	lbs/day	1902	2852	--	495 [b]
Total Residual Chlorine	mg/L	--	--	0.5	0.11 – 0.21
pH	Between 6.0 and 8.5				6.94 – 7.08[c]

a: 6 Dec 2006 data b: Three-day average c: Three-day continuous monitoring

9. CONCLUSIONS

a. Data collected during the 3-day WWTP evaluation verified the following:

1) The WWTP effluent was in compliance with effluent limitations.

2) The WWTP unit process removal efficiencies (for BOD and TSS) were within acceptable ranges.

b. Based on a review of WWTP records (2004 to 2006), the WWTP was operated in compliance with permit effluent limitations, with one exception, when treatment was inhibited by an unknown pollutant in May 2006. One of the two trickling filters was upset, and effluent pH levels were below the lower effluent limit for six days.

c. In addition to conventional wastewater pollutants (e.g., BOD_5, TSS), WWTP influent and effluent samples were analyzed for numerous pollutants that are typically associated with "non-domestic discharges," including total petroleum hydrocarbons (TPH), metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs). Several "non-domestic pollutants" were detected in WWTP samples.

1) TPH was detected in influent, effluent and sludge grab samples. The WWTP removed approximately 79 percent of influent TPH, some of which accumulated in the sludge with solids. The TPH concentrations in the WWTP effluent grab samples ranged from 2.3 to 10.9 mg/L. The discharge permit requires TPH monitoring, but does not include a concentration or mass limit. Available TPH data from Fort Lewis and this evaluation indicate that some components of influent TPH persist through the anaerobic digestion and composting processes. Biosolids management regulations (i.e., WAC 173-308) do not address TPH concentrations in biosolids.

2) Ten metals and eighteen organic compounds listed as toxic pollutants (per 40 CFR 122, Appendix D, Tables II and III) were detected in WWTP influent and/or primary clarifier influent samples. Five of the metals (arsenic, copper, lead, nickel, and zinc) were detected in WWTP effluent samples. Only copper was detected in effluent samples at concentrations that exceeded the Washington marine surface water toxic substance criteria for the protection of aquatic life. Four of the organic compounds [chloroform, bis (2-ethylhexyl) phthalate, naphthalene, and alpha chlordane] were detected in WWTP effluent samples at trace concentrations. Only alpha chlordane was detected (at estimated trace concentrations) in effluent samples above Washington marine surface water toxic substance criteria for the protection of aquatic life. It should be noted that the Washington toxic substance criteria apply to the receiving water, not the WWTP discharge; however, the criteria was compared directly to effluent concentrations to screen for pollutants that have potential to impact receiving waters.

d. The Fort Lewis WWTP has the ability to produce biosolids that can meet the Class B biosolids criteria of WAC 173-308 (Biosolids Management). The combination of residence time (>15 days) and temperature (≥35 °C) in the primary digester meets the Class B biosolids pathogen reduction requirements of WAC 173-308-170. The vector attraction requirements may be met by incorporating the biosolids into the soil during land application or by one of the six methods described in WAC 173-308-180. Metals concentrations in digested sludge samples were below the ceiling concentration limits (of WAC 173-308-160) for biosolids applied to land.

e. A review of WWTP operating conditions and discussions with WWTP operators identified the following concerns.

- One of two influent fine screens was inoperable; a permanent hoist is needed to lift the unit for maintenance and repair.
- WWTP personnel indicated that several WWTP pumps were in need of maintenance, repair or replacement. These included several poor performing sludge transfer pumps. Most of the wastewater pumps were installed in the 1970s and lack variable speed operation and electronic controls that are necessary to optimize flow rates.
- Broken plastic trickling filter media was observed on the top of the filters.
- Cracks and evidence of leaking gas were observed in the cover/roof of primary digester No. 2.
- Redundant unit processes were out of service for extended periods of time (i.e., primary digester No. 1 since October 2006, one primary clarifier since November 2006, and one chlorine contact chamber during February and March 2007).
- Valves feeding digester sludge to drying beds are not water tight. When attempting to feed sludge to one drying bed, sludge leaks through valves to other beds.
- A safety stairway platform and safety railing is needed on the grease vault to facilitate safe access for maintenance.
- A catwalk is needed for safe sampling of digester sludge at the drying beds.
- The grease collection container has an open top.
- In-line magnetic flow meters had not been calibrated since they were installed in 2005.
- Automatic samplers were not flow paced.
- The chlorine feed system had not been calibrated for two years.
- The chlorine feed system required more modern feed pumps and chlorine sensors.
- Primary sludge pumping was not controlled based on sludge thickness (i.e., pumping was continuous and constant regardless of solids concentration). Pumping rates appeared to be excessive.
- Constant-speed pumps feed wastewater (including recycle flows) to the trickling filters. The pumping flow rate and recycle flow rate cannot be adjusted and monitored to optimize treatment.

f. The WWTP was staffed with only five operators and one lab technician, who covered day, night, and swing shifts for 24-hours per day, seven days per week. Operators were required to perform lab work in the absence of the lab technician and to work over-time to cover routine operations.

g. Per Washington Administrative Code (WAC) 173-230, the "operator in responsible charge" is defined as "the individual who is routinely on-site and in direct charge." A Class III

WWTP requires a Group III (or higher) "operator in responsible charge" with at least a Group II "operator in charge of each shift." While the USEPA issued permit does not specify requirements for certification of operators, Army Regulation 420-49 (Facility Engineering Utility Services) states (in paragraph 2-4) that "utility plant operators…will meet applicable … State… certification requirements for the State in which they are located." The WWTP supervisor was not routinely on site and did not have a Group III license.

10. RECOMMENDATIONS.

a. Initiate a pretreatment program to verify the presence/absence of non-domestic pollutants identified in this evaluation and identify pollutants of concern (POCs) and discharges that may interfere with the operation of a WWTP, pass through the WWTP, or interfere with sludge management (digestion, use, or disposal). A pretreatment program will serve to trace POCs (e.g., TPH, metals, toxic organic compounds) back to discharge source areas in the collection system and provide a mechanism to enforce limits on dischargers of POCs.

b. Investigate alternative regulatory criteria (e.g., TPH soil remediation action levels) for reuse of TPH-containing biosolids and pursue regulatory approval for land application or properly dispose of biosolids.

c. Ensure that primary digester temperatures are maintained at a minimum of 35°C.

d. Install a permanent hoist to lift the fine screens for maintenance and repair.

e. Repair or replace problematic pump components, as necessary. Prepare for the eventual replacement of primary/secondary sludge pumps and trickling filter feed pumps with variable speed, high efficiency pumps, with electronic controls.

f. Remove and replace broken trickling filter media; inspect underlying media and replace, as necessary.

g. Repair the cracks in the cover of primary digester No. 2.

h. Plan repairs of redundant major unit processes to minimize "out of service" time and, if possible, do not schedule maintenance and repairs of major wastewater treatment unit processes during the winter/wet season.

i. Repair or replace valves on digester sludge pipe to biosolids beds.

j. Install a stairway, platform and safety railing at the grease vault.

k. Install a catwalk for digester sludge sampling at the drying beds.

l. Provide a covered container for grease collection.

m. Calibrate flow meters and the chlorine feed system semi-annually.

n. Flow pace the influent sampler off of a new influent flume and flow meter and flow pace the primary clarifier effluent and WWTP effluent samplers off of an effluent flow meter.

o. Replace chlorine feed and sensor systems with new technology.

p. Control primary and secondary sludge pumping based on sludge thickness by adjusting pumping and/or collection schedules. At a minimum, minimize unnecessary pumping of "thin" sludge and dilution water.

q. Consider replacing trickling filter pumps with variable speed pumps and installing a flow measurement device on the trickling filter recycle line so that trickling filter treatment may be optimized.

r. Increase WWTP staff by one lab technician and at least one operator.

s. The operator in responsible charge should be routinely on site and have a Group III WWTP operator license.

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APPENDIX A

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APPENDIX B

WASTEWATER SAMPLING RESULTS

Table B-1. Detected Analytes and Concentrations in Wastewater.

Analyte	Date	Time	WWTP Influent	Primary Clarifier Influent	Primary Clarifier Effluent (Trickling Filter Influent)	Trickling Filter #1 Effluent	Trickling Filter #2 Effluent	Trickling Filter Combined Effluent/ Secondary Clarifier Influent	Secondary Clarifier Effluent/ Chlorine Contact Chamber Influent	WWTP Effluent	Sludge Thickener Supernatant (returned to Primary Clarifiers)	Primary Digester Supernatant (flows to Secondary Digester) (grab)	Secondary Digester Supernatant (flows to Primary Clarifiers) (grab)	Field Blank	Equipment Blank
BOD (mg/L)	4-5 Dec 06	0700-0700	78	61	41	14/7.4 J, D	8.9	15	3.8 J, D	9.3	34			1.1	
	5-6 Dec 06	0700-0700	340 J, D	50 J, D	82 D	24 D	15/29 J, D	22 J, D	29 J, D	26 J, D	46 J				6.4
	6-7 Dec 06	0700-0700	31 D	42/41 D	5.3 J, D	5.8J, D	28 D	34 J, D	38 J, D	27 J, D	33	720 J	680.0 J	2.7	
TSS (mg/L)	4-5 Dec 06	0700-0700	54	228	80	44/50	41.0	45	22	20	62.2			ND (<3.3)	
	5-6 Dec 06	0700-0700	98	220	79	45	50.0/52	49	24	24.7	100				ND (<3.3)
	6-7 Dec 06	0700-0700	204	178/220	68	34	48.0	70	128	26.4	95	19200	17900.0	ND (<3.3)	
Ammonia (mg/L)	4-5 Dec 06	0700-0700	24	21	19	3.4/3.6	4.0	4.1	3.4	3.5	9.4			0.1	
	5-6 Dec 06	0700-0700	25	23	19	5.3	6.7/6.6	6.3	4.8	4.5	12				ND (<0.050)
	6-7 Dec 06	0700-0700	26	24/26	24	6.5	7.1	7.4	6.2	5.8	13	630	690.0	ND (<0.050)	
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	ND (<0.050)	1.3	4	20/20	18	19	21	20	13			ND (<0.050)	
	5-6 Dec 06	0700-0700	ND (<0.050)	3.5	4.8	23	25/23	23	20	21	18				ND (<0.050)
	6-7 Dec 06	0700-0700	ND (<0.050)	4/3.6	4.1	26	25	28	26	24	18	0.091	0.1	ND (<0.050)	
TKN (mg/L)	4-5 Dec 06	0700-0700	29	33	27	8.6/7.9	8.7	8.9	5.8	6.7	16			0.2	
	5-6 Dec 06	0700-0700	37	38	30	9.5	11/12	11	8.3	8.1	20				0.18
	6-7 Dec 06	0700-0700	39	39/38	32	10	12	11	9.4	8.8	21	1300	1100.0	0.2	
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	3.61	6.17	4.3	4.27/4.35	4.28	4.35	3.73	3.72	4.68			ND (<0.0100)	
	5-6 Dec 06	0700-0700	4.2	6.25	4.9	4.85	4.98/4.87	4.93	4.46	4.34	6.11				ND (<0.0100)
	6-7 Dec 06	0700-0700	4.8	6.25/6.3	4.69	4.82	4.83	4.97	4.55	4.54	6.15	247	198.0	ND (<0.0100)	
Oil and Grease (mg/L)	4-Dec 06	grab	21	26	12	ND (<6.00)	ND (<6.00)	ND (<5.30)	ND (<5.50	ND (<5.30)	ND (<5.00)			ND (<6.00)	
	5-Dec 06	grab	7.79	7.33	10.6	ND (<5.00)	ND (<5.00)	ND (<5.00)	ND (<5.00)	ND (<5.00)	ND (<5.00)			ND (<5.20)	
	6-Dec 06	grab	6.33	6.56	ND (<5.00)	ND (<5.00)	ND (<5.00)	ND (<5.00)	ND (<5.70)	ND (<5.10)	ND (<5.00)	552	312.0	ND (<5.20)	
TPH-Diesel Range (mg/L)	4-Dec 06	grab	15	53	6.500	1.3	1.8	1.5	1.2	0.690J	7.4				
	5-Dec 06	grab	12	14	5.800	2	2.1	1.5	0.790	0.830	4.1				
	6-Dec 06	grab	18	13	4.500	1.1J	1.3	1.1J	0.560J	4	3	150J	ND(<80)		
TPH-Heavy Range (mg/L)	4-Dec 06	grab	11	27J	6.4J	1.9J	2.6J	2.2J	1.6	1.6J	7.3J				
	5-Dec 06	grab	7.2J	11	3.7J	2.5	2.8	2.3J	1.7J	1.6	3.3J				
	6-Dec 06	grab	11J	13J	3.2J	2.2J	2.4J	2.3J	1.6J	6.9	3.6J	570	380		
TPH-Gasoline (mg/L)	4-Dec 06	grab	0.280							ND(<0.048)					
	5-Dec 06	grab	0.140J							ND(<0.048)					
	6-Dec 06	grab	0.150J							ND(<0.048)					

J: estimated value ND: not detected D: data was discarded due to laboratory QA/QC findings Example: (<5.00) = the analyte was not detected above the 5.00 mg/L reporting limit

Table B-1. Detected Analytes and Concentrations (continued).

Analyte	Date	Time	WWTP Influent	Primary Clarifier Influent	Primary Clarifier Effluent (Trickling Filter Influent)	East Trickling Filter Effluent	West Trickling Filter Effluent	Trickling Filter Combined Effluent/ Secondary Clarifier Influent	Secondary Clarifier Effluent/ Chlorine Contact Chamber Influent	WWTP Effluent	Sludge Thickener Supernatant (returned to Primary Clarifiers)	Primary Digester Supernatant (flows to Secondary Digester) (grab)	Secondary Digester Supernatant (flows to Primary Clarifiers) (grab)	Field Blank	Equipment Blank
Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.208	1.34	0.47	0.436	0.422	0.482	0.27	0.243/0.227 [d]	0.532			ND (<0.200)	
	5-6 Dec 06	0700-0700	0.291	1.46	0.414	0.459	0.464	0.474	0.261	0.252	0.907				ND (<0.200)
	6-7 Dec 06	0700-0700	0.547	1.36	0.318	0.426	0.427	0.461	0.228	0.246	0.964	234	235	ND (<0.200)	
Arsenic (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.49	1.14	1.06	1.02	1.16	1.09	1.03ND(<1.0) [d]	1.09			ND (<1.00)	
	5-6 Dec 06	0700-0700	1.15	1.74	1.17	1.15	1.21	1.23	1	1.17	1.32				ND (<1.00)
	6-7 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND	ND	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND(<2.00)	101	94.4	ND (<2.00)	
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND	ND	ND(<2.00)	ND(<2.00)	ND(<2.00)/ ND(<2.00) [d]	ND(<2.00)			ND (<2.00)	
	5-6 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND	ND	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND(<2.00)				ND (<2.00)
	6-7 Dec 06	0700-0700	1.06	1.39	ND(<1.00)	ND	ND	ND(<1.00)	ND(<1.00)	ND(<1.00)	1.03	174	153	ND (<1.00)	
Calcium (mg/L)	4-5 Dec 06	0700-0700	16.9	20	17.3	17.6	17.4	17.9	17	16.6/16.2 [d]	18			ND (<0.100)	
	5-6 Dec 06	0700-0700	18.1	20.9	18.3	18.8	18.7	19	18	18.4	20.3				ND (<0.100)
	6-7 Dec 06	0700-0700	19.3	21.1	18.6	19.3	18.8	19.2	18.1	18.9	21.2	569	597	ND (<0.100)	
Chromium (µg/L)	4-5 Dec 06	0700-0700	2.59	2.71	ND(<2.00)	ND	ND	ND(<2.00)	ND(<2.00)	ND(<2.00)/ ND(<2.00) [d]	ND(<2.00)			ND (<2.00)	
	5-6 Dec 06	0700-0700	ND(<2.00)	2.63	ND(<2.00)	ND	ND	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND(<2.00)				ND (<2.00)
	6-7 Dec 06	0700-0700	2.38	2.82	ND(<2.00)	ND	ND	ND(<2.00)	ND(<2.00)	ND(<2.00)	2.05	471	375	ND (<2.00)	
Copper (µg/L)	4-5 Dec 06	0700-0700	45.8	100	48.7	45.9	44.7	49.8	35.7	32.7/33.7 [d]	48.8			ND (<1.00)	
	5-6 Dec 06	0700-0700	51.3	112	53	55.9	55.7	52.7	35.9	36.7	76.3				ND (<1.00)
	6-7 Dec 06	0700-0700	78.5	108	55.1	56.8	54.1	58.6	37.6	34.8	78.8	15300	12000	16.1	
Iron (mg/L)	4-5 Dec 06	0700-0700	0.362	1.04	0.471	0.437	0.445	0.512	0.333	0.269/0.178 [d]	0.488			ND (<0.0500)	
	5-6 Dec 06	0700-0700	0.337	1.11	0.42	0.465	0.463	0.459	0.279	0.258	0.718				ND (<0.0500)
	6-7 Dec 06	0700-0700	0.558	1.22	0.379	0.439	0.419	0.485	0.265	0.258	0.757	134	135	ND (<0.0500)	
Lead (µg/L)	4-5 Dec 06	0700-0700	1.28	6.08	1.84	1.67	2.04	1.67	1.14	3.37/1.03 [d]	1.91			ND (<1.00)	
	5-6 Dec 06	0700-0700	1.22	5.26	1.58	2.05	1.91	2.29	1.1	1.05	3.22				ND (<1.00)
	6-7 Dec 06	0700-0700	ND(<5.00)	6.67	ND(<5.00)	ND	ND	ND(<5.00)	ND(<5.00)	ND(<5.00)	ND(<5.00)	1170	1010	ND (<5.00)	
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.32	5.77	5.33	5.5	5.53	5.57	5.33	5.24/5.05 [d]	5.52			ND (<0.200)	
	5-6 Dec 06	0700-0700	5.63	5.9	5.54	5.67	5.67	5.74	5.49	5.64	5.91				ND (<0.200)
	6-7 Dec 06	0700-0700	5.74	5.93	5.66	5.79	5.6	5.75	5.47	5.66	6.06	70.6	71.9	ND (<0.200)	
Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.200)	0.278	ND(<0.200)	ND	ND	ND(<0.200)	ND(<0.200)	ND(<0.200)/ ND(<0.200) [d]	ND(<0.200)			ND (<0.200)	
	5-6 Dec 06	0700-0700	ND(<0.200)	0.699	ND(<0.200)	0.258	ND	ND(<0.200)	ND(<0.200)	ND(<0.200)	ND(<0.200)				ND (<0.200)
	6-7 Dec 06	0700-0700	0.297	0.527	ND(<0.200)	ND	ND	ND(<0.200)	ND(<0.200)	ND(<0.200)	ND(<0.200)	30.9	26.0	ND (<0.200)	
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	12.4	11.7	ND(<5.00)	8.59	9.45	9.61	6.28	5.67/ND(<5.00) [d]	8.03			ND (<5.00)	
	5-6 Dec 06	0700-0700	11.1	11.2	10.5	10.9	10.8	10.1	9.66	9.91	11.2				ND (<5.00)
	6-7 Dec 06	0700-0700	23.3	17.2	16.7	15.3	14.3	15.4	12.2	10.8	14.7	338	309.0	1.1	
Nickel (µg/L)	4-5 Dec 06	0700-0700	11.2	4.49	2.47	2.19	2.54	2.32	2.24	2.45/4.00 [d]	5.62			ND (<2.00)	
	5-6 Dec 06	0700-0700	6.93	3.79	2.41	2.56	3.18	3.87	ND(<2.00)	2.64	3.96				ND (<2.00)
	6-7 Dec 06	0700-0700	6.56	3.71	2.47	2.52	2.81	3.01	2.15	ND(<2.00)	3.45	349	283.0	ND (<2.00)	

J: estimated value ND: not detected d: dissolved metal concentration

Table B-1. Detected Analytes and Concentrations (continued).

Analyte	Date	Time	WWTP Influent	Primary Clarifier Influent	Primary Clarifier Effluent (Trickling Filter Influent)	East Trickling Filter Effluent	West Trickling Filter Effluent	Trickling Filter Combined Effluent/ Secondary Clarifier Influent	Secondary Clarifier Effluent/ Chlorine Contact Chamber Influent	WWTP Effluent	Sludge Thickener Supernatant (returned to Primary Clarifiers)	Primary Digester Supernatant (flows to Secondary Digester) (grab)	Secondary Digester Supernatant (flows to Primary Clarifiers) (grab)	Field Blank	Equipment Blank
Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.15	ND(<1.00)	ND	ND	ND(<1.00)	ND(<1.00)	ND(<1.00)/ ND(<1.00)^{d}	ND(<1.00)			ND (<1.00)	
	5-6 Dec 06	0700-0700	ND(<1.00)	1.39	1.04	ND	ND	ND(<1.00)	ND(<1.00)	ND(<1.00)	ND(<1.00)				ND (<1.00)
	6-7 Dec 06	0700-0700	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND	ND	ND(<2.00)	ND(<2.00)	ND(<2.00)	ND(<2.00)	102	98.3	ND (<2.00)	
Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.26	ND(<1.00)	ND	ND	ND(<1.00)	ND(<1.00)	ND(<1.00)/ ND(<1.00)^{d}	ND(<1.00)			ND (<1.00)	
	5-6 Dec 06	0700-0700	ND(<1.00)	1.19	ND(<1.00)	ND	ND	ND(<1.00)	ND(<1.00)	ND(<1.00)	ND(<1.00)				ND (<1.00)
	6-7 Dec 06	0700-0700	ND(<1.00)	1.02	ND(<1.00)	ND	ND	ND(<1.00)	ND(<1.00)	ND(<1.00)	ND(<1.00)	31.9	31.0	ND (<1.00)	
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.08	0.243	0.105	0.097	0.093	0.103	0.074	0.07/0.0740^{d}	0.112			ND (<0.0200)	
	5-6 Dec 06	0700-0700	0.095	0.237	0.121	0.109	0.109	0.114	0.076	0.079	0.169				ND(<0.0200)
	6-7 Dec 06	0700-0700	0.135	0.222	0.088	0.104	0.103	0.109	0.078	0.112	0.178	31.0	29.7	ND (<0.0200)	
VOCs (µg/L)															
Chloroform (µg/L)	4-Dec		ND							ND					
	5-Dec		ND							ND					
	6-Dec		ND							1J					
1,4-dichlorobenzene (µg/L)	4-Dec		2J							ND					
	5-Dec		3J							ND					
	6-Dec		2J							ND					
1,2-dichlorobenzene (µg/L)	4-Dec		2J							ND					
	5-Dec		1J							ND					
	6-Dec		4J							ND					
Tetrachloroethene (µg/L)	4-Dec		3J							ND					
	5-Dec		ND							ND					
	6-Dec		ND							ND					
Toluene (µg/L)	4-Dec		2J							ND					
	5-Dec		2J							ND					
	6-Dec		3J							ND					
SVOCs (µg/L)															
Phenol (µg/L)	4-5 Dec 06	0700-0700	6							ND				ND	
	5-6 Dec 06	0700-0700	24							ND					
	6-7 Dec 06	0700-0700	11							ND					
Acenaphthene (µg/L)	4-5 Dec 06	0700-0700	0.5J							ND				ND	
	5-6 Dec 06	0700-0700	0.4J							ND					
	6-7 Dec 06	0700-0700	ND							ND					
Diethylphthalate (µg/L)	4-5 Dec 06	0700-0700	4J							ND				ND	
	5-6 Dec 06	0700-0700	6							ND					
	6-7 Dec 06	0700-0700	5							ND					

J: estimated value ND: not detected d: dissolved metal concentration

Table B-1. Detected Analytes and Concentrations (continued).

Analyte	Date	Time	WWTP Influent	Primary Clarifier Effluent	Primary Clarifier Effluent (Trickling Filter Influent)	East Trickling Filter Effluent	West Trickling Filter Effluent	Trickling Filter Combined Effluent/ Secondary Clarifier Influent	Secondary Clarifier Effluent/ Chlorine Contact Chamber Influent	WWTP Effluent	Sludge Thickener Supernatant (returned to Primary Clarifiers)	Primary Digester Supernatant (flows to Secondary Digester) (grab)	Secondary Digester Supernatant (flows to Primary Clarifiers) (grab)	Field Blank	Equipment Blank
di-n-butylphthalate (ug/L)	4-5 Dec 06	0700-0700	2J							ND				ND	
	5-6 Dec 06	0700-0700	2J							ND					
	6-7 Dec 06	0700-0700	1J							ND					
Fluorene (ug/L)	4-5 Dec 06	0700-0700	0.4J							ND				ND	
	5-6 Dec 06	0700-0700	0.6J							ND					
	6-7 Dec 06	0700-0700	0.4J							ND					
Butylbenzylphthalate (ug/L)	4-5 Dec 06	0700-0700	4J							ND				ND	
	5-6 Dec 06	0700-0700	7							ND					
	6-7 Dec 06	0700-0700	7							ND					
Bis(2-ethylhexyl)phthalate (ug/L)	4-5 Dec 06	0700-0700	10							13				ND	
	5-6 Dec 06	0700-0700	16							7					
	6-7 Dec 06	0700-0700	16							7					
1,2-Dichlorobenzene (ug/L)	4-5 Dec 06	0700-0700	1J							ND				ND	
	5-6 Dec 06	0700-0700	1J							ND					
	6-7 Dec 06	0700-0700	1J							ND					
1,4-Dichlorobenzene (ug/L)	4-5 Dec 06	0700-0700	1J							ND				ND	
	5-6 Dec 06	0700-0700	5J							ND					
	6-7 Dec 06	0700-0700	5J							ND					
Napthalene (ug/L)	4-5 Dec 06	0700-0700	7							0.2J				ND	
	5-6 Dec 06	0700-0700	7							ND					
	6-7 Dec 06	0700-0700	4J							ND					
Phenanthrene (ug/L)	4-5 Dec 06	0700-0700	ND							ND				ND	
	5-6 Dec 06	0700-0700	1J							ND					
	6-7 Dec 06	0700-0700	0.6J							ND					
OC Pesticides/PCBs															
Alpha Chlordane (ug/L)	4-5 Dec 06	0700-0700	ND							0.0079J				ND	
	5-6 Dec 06	0700-0700	ND							0.0061J					
	6-7 Dec 06	0700-0700	0.0045J							0.0059J					
Heptachlor (ug/L)	4-5 Dec 06	0700-0700	0.094							ND				ND	
	5-6 Dec 06	0700-0700	0.52							ND					
	6-7 Dec 06	0700-0700	0.51							ND					
o,p-DDD (ug/L)	4-5 Dec 06	0700-0700	ND							ND				ND	
	5-6 Dec 06	0700-0700	0.057J							ND					
	6-7 Dec 06	0700-0700	ND							ND					
OP Pesticides (ug/L)	4-5 Dec 06	0700-0700	ND							ND				ND	
	5-6 Dec 06	0700-0700	ND							ND					
	6-7 Dec 06	0700-0700	ND							ND					

J: estimated value ND: not detected

Table B-2. Wastewater Quality Field Measurements.

Parameter	Date/ Time	WWTP Influent		Trickling Filter Influent / Primary Clarifier Effluent		Trickling Filter Effluent/ Secondary Clarifier Influent		WWTP Effluent	
		Readings	Comments	Readings	Comments	Readings	Comments	Readings	Comments
pH	4-5 Dec 06/ 0700-0700	Min.: 5.93 Max.: 6.80 Avg.: 6.49	Continuous readings	Min.: 6.88 Max.: 7.41 Avg.: 7.15	Continuous readings	7.46	Collected @ 0800 hrs	Min.: 6.99 Max.: 7.18 Avg.: 7.13	Continuous readings
	5-6 Dec 06/ 0700-0700	7.12	Collected @ 1630 hrs	Min.: 6.84 Max.: 7.31 Avg.: 7.03	Continuous readings	7.05	Collected @ 1630 hrs	Min.: 6.94 Max.: 7.11 Avg.: 7.02	Continuous readings
	6-7 Dec 06/ 0700-0700	Min.: 5.11 Max.: 7.53 Avg.: 6.05	Continuous readings	7.23	Collected @ 1000 hrs	6.75	Collected @ 1030 hrs	Min.: 6.95 Max.: 7.01 Avg.: 6.99	Continuous readings
Specific Conductivity (µS/cm)	4-5 Dec 06/ 0700-0700	Min.: 296 Max.: 594 Avg.: 441	Continuous readings	Min.: 314 Max.: 391 Avg.: 357	Continuous readings	335	Collected @ 0800 hrs	Min.: 361 Max.: 400 Avg.: 377	Continuous readings
	5-6 Dec 06/ 0700-0700	544	Collected @ 1630 hrs	Min.: 333 Max.: 424 Avg.: 375	Continuous readings	414	Collected @ 1630 hrs	Min.: 385 Max.: 431 Avg.: 413	Continuous readings
	6-7 Dec 06/ 0700-0700	Min.: 345 Max.: 1269 Avg.: 495	Continuous readings	466	Collected @ 1000 hrs	344	Collected @ 1030 hrs	Min.: 428 Max.: 432 Avg.: 431	Continuous readings
Dissolved Oxygen (%)	4-5 Dec 06/ 0700-0700	33.0	Collected @ 0730 hrs	Min.: 80.9 Max.: 97.7 Avg.: 84.4	Continuous readings	94	Collected @ 0800 hrs	Min.: 32.0 Max.: 43.9 Avg.: 38.4	Continuous readings
	5-6 Dec 06/ 0700-0700	10.2	Collected @ 1630 hrs	Min.: 70.7 Max.: 84.0 Avg.: 78.9	Continuous readings	90	Collected @ 1630 hrs	Min.: 31.4 Max.: 61.5 Avg.: 49.1	Continuous readings
	6-7 Dec 06/ 0700-0700	25.5	Collected @ 0800 hrs	31	Collected @ 1000 hrs	89	Collected @ 1030 hrs	Min.: 42.3 Max.: 47.2 Avg.: 46.1	Continuous readings
Temperature (°C)	4-5 Dec 06/ 0700-0700	Min.: 14.93 Max.: 16.29 Avg.:15.76	Continuous readings	Min.: 13.54 Max.: 14.66 Avg.: 14.39	Continuous readings	13.43	Collected @ 0800 hrs	Min.: 12.68 Max.: 13.70 Avg.: 13.34	Continuous readings
	5-6 Dec 06/ 0700-0700	15.88	Collected @ 1630 hrs	Min.: 14.00 Max.: 14.97 Avg.: 14.66	Continuous readings	14.91	Collected @ 1630 hrs	Min.: 13.61 Max.: 14.18 Avg.: 14.07	Continuous readings
	6-7 Dec 06/ 0700-0700	Min.: 14.75 Max.: 16.27 Avg.: 15.61	Continuous readings	14.90	Collected @ 1000 hrs	14.37	Collected @ 1030 hrs	Min.: 13.98 Max.: 14.34 Avg.: 14.02	Continuous readings

Table B-3. Chlorine Contact Chamber (CCC) Effluent Total Residual Chlorine Concentrations.

Date/ Time	Pre-Dechlorination CCC Effluent Total Residual Chlorine (TRC) Concentration* (mg/L)		WWTP Post-Dechlorination Effluent TRC Concentration (mg/L)
	East CCC Effluent	West CCC Effluent	
4 Dec 06	0.28	0.28	0.18
5 Dec 06	0.68	0.68	0.11
6 Dec 06	0.28	0.33	0.21

*Residual chlorine was mistakenly measured prior to dechlorination

APPENDIX C

WASHINGTON SURFACE WATER QUALITY TOXIC SUBSTANCE CRITERIA

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Water Quality Standards for Surface Waters of the State of Washington
Chapter 173-201A WAC

Amended November 20, 2006

Washington State Department of Ecology

November 2006
Publication Number 06-10-091

blooms, toxic phytoplankton, or excessive aquatic plants, are examples of various sources of impairment. The following are examples of quantitative measures that a study may describe: Total phosphorus, total nitrogen, chlorophyll-a, dissolved oxygen in the hypolimnion if thermally stratified, pH, hardness, or other measures of existing conditions and potential changes in any one of these parameters.

(b) Determine appropriate total phosphorus concentrations or other nutrient criteria to protect characteristic lake uses. If the existing total phosphorus concentration is protective of characteristic lake uses, then set criteria at existing total phosphorus concentration. If the existing total phosphorus concentration is not protective of the existing characteristic lake uses, then set criteria at a protective concentration. Proposals to adopt appropriate total phosphorus criteria to protect characteristic uses must be developed by considering technical information and stakeholder input as part of a public involvement process equivalent to the Administrative Procedure Act (chapter 34.05 RCW).

(c) Determine if the proposed total phosphorus criteria necessary to protect characteristic uses is achievable. If the recommended criterion is not achievable and if the characteristic use the criterion is intended to protect is not an existing use, then a higher criterion may be proposed in conformance with 40 CFR part 131.10.

(4) The department will consider proposed lake-specific nutrient criteria during any water quality standards rule making that follows development of a proposal. Adoption by rule formally establishes the criteria for that lake.

(5) Prioritization and investigation of lakes by the department will be initiated by listing problem lakes in a watershed needs assessment, and scheduled as part of the water quality program's watershed approach to pollution control. This prioritization will apply to lakes identified as warranting a criteria based on the results of a lake-specific study, to lakes warranting a lake-specific study for establishing criteria, and to lakes requiring restoration and pollution control measures due to exceedance of an established criterion.

The adoption of nutrient criteria are generally not intended to apply to lakes or ponds with a surface area smaller than five acres; or to ponds wholly contained on private property owned and surrounded by a single landowner; and nutrients do not drain or leach from these lakes or private ponds to the detriment of other property owners or other water bodies; and do not impact designated uses in the lake. However, if the landowner proposes criteria the department may consider adoption.

(6) The department may not need to set a lake-specific criteria or further investigate a lake if existing water quality conditions are naturally poorer (higher TP) than the action value and uses have not been lost or degraded, per WAC 173-201A-260(1).

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-230, filed 7/1/03, effective 8/1/03.]

173-201A-240
Toxic substances.

(1) Toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic

water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department.

(2) The department shall employ or require chemical testing, acute and chronic toxicity testing, and biological assessments, as appropriate, to evaluate compliance with subsection (1) of this section and to ensure that aquatic communities and the existing and characteristic beneficial uses of waters are being fully protected.

(3) The following criteria, found in Table 240(3), shall be applied to all surface waters of the state of Washington for the protection of aquatic life. The department may revise the following criteria on a statewide or water body-specific basis as needed to protect aquatic life occurring in waters of the state and to increase the technical accuracy of the criteria being applied. The department shall formally adopt any appropriate revised criteria as part of this chapter in accordance with the provisions established in chapter 34.05 RCW, the Administrative Procedure Act. The department shall ensure there are early opportunities for public review and comment on proposals to develop revised criteria. Values are μg/L for all substances except Ammonia and Chloride which are mg/L:

Table 240(3)
Toxics Substances Criteria

	Freshwater		Marine Water	
Substance	**Acute**	**Chronic**	**Acute**	**Chronic**
Aldrin/Dieldrin e	2.5a	0.0019b	0.71a	0.0019b
Ammonia (un-ionized NH3) hh	f,c	g,d	0.233h,c	0.035h,d
Arsenic dd	360.0c	190.0d	69.0c,ll	36.0d,cc,ll
Cadmium dd	i,c	j,d	42.0c	9.3d
Chlordane	2.4a	0.0043b	0.09a	0.004b
Chloride (Dissolved) k	860.0h,c	230.0h,d	-	-
Chlorine (Total Residual)	19.0c	11.0d	13.0c	7.5d
Chlorpyrifos	0.083c	0.041d	0.011c	0.0056d
Chromium (Hex) dd	15.0c,l,ll	10.0d,jj	1,100.0c,l,ll	50.0d,ll
Chromium (Tri) gg	m,c	n,d	-	-
Copper dd	o,c	p,d	4.8c,ll	3.1d,ll
Cyanide ee	22.0c	5.2d	1.0c,mm	d,mm
DDT (and metabolites)	1.1a	0.001b	0.13a	0.001b
Dieldrin/Aldrin e	2.5a	0.0019b	0.71a	0.0019b
Endosulfan	0.22a	0.056b	0.034a	0.0087b
Endrin	0.18a	0.0023b	0.037a	0.0023b
Heptachlor	0.52a	0.0038b	0.053a	0.0036b
Hexachlorocyclohexane (Lindane)	2.0a	0.08b	0.16a	-
Lead dd	q,c	r,d	210.0c,ll	8.1d,ll
Mercury s	2.1c,kk,dd	0.012d,ff	1.8c,ll,dd	0.025d,ff
Nickel dd	t,c	u,d	74.0c,ll	8.2d,ll
Parathion	0.065c	0.013d	-	-
Pentachlorophenol (PCP)	w,c	v,d	13.0c	7.9d
Polychlorinated Biphenyls (PCBs)	2.0b	0.014b	10.0b	0.030b
Selenium	20.0c,ff	5.0d,ff	290c,ll,dd	71.0d,x,ll,dd
Silver dd	y,a	-	1.9a,ll	-
Toxaphene	0.73c,z	0.0002d	0.21c,z	0.0002d
Zinc dd	aa,c	bb,d	90.0c,ll	81.0d,ll

Notes to Table 240(3):

a. An instantaneous concentration not to be exceeded at any time.

b. A 24-hour average not to be exceeded.

c. A 1-hour average concentration not to be exceeded more than once every three years on the average.

d. A 4-day average concentration not to be exceeded more than once every three years on the average.

e. Aldrin is metabolically converted to Dieldrin. Therefore, the sum of the Aldrin and Dieldrin concentrations are compared with the Dieldrin criteria.

f. Shall not exceed the numerical value <u>in total ammonia nitrogen (mg N/L)</u> given by:

For salmonids present:

$$\frac{0.275}{1 + 10^{7.204 - pH}} + \frac{39.0}{1 + 10^{pH - 7.204}}$$

For salmonids absent:

$$\frac{0.411}{1 + 10^{7.204 - pH}} + \frac{58.4}{1 + 10^{pH - 7.204}}$$

g. Shall not exceed the numerical concentration calculated as follows:

Unionized ammonia concentration for waters where salmonid habitat is an existing or designated use:

$$0.80 \div (FT)(FPH)(RATIO)$$

where:

RATIO = $13.5;\ 7.7 \le pH \le 9$

RATIO = $(20.25 \times 10^{(7.7-pH)}) \div (1\ 10^{(7.4-pH)});\ 6.5 \le pH \le 7.7$

FT = $1.4;\ 15 \le T \le 30$

FT = $10^{[0.03(20-T)]};\ 0 \le T \le 15$

FPH = $1;\ 8 \le pH \le 9$

FPH = $(1 + 10^{(7.4-pH)}) \div 1.25;\ 6.5 \le pH \le 8.0$

Total ammonia concentrations for waters where salmonid habitat is not an existing or designated use and other fish early life stages are absent:

$$\text{Chronic criterion} = \left(\frac{0.0557}{1 + 10^{7.688 - pH}} + \frac{2.487}{1 + 10^{pH - 7.688}} \right) (1.45 \times 10^{0.028(25-A)})$$

where: A = the greater of either T (temperature in degrees Celsius) or 7.

Applied as a thirty-day average concentration of total ammonia nitrogen (in mg N/L) not to be exceeded more than once every three years on average. The highest four-day average within the thirty-day period should not exceed 2.5 times the chronic criterion.

Total ammonia concentration for waters where salmonid habitat is not an existing or designated use and other fish early life stages are present:

$$\text{Chronic criterion} = \left(\frac{0.0557}{1 + 10^{7.688 - pH}} + \frac{2.487}{1 + 10^{pH - 7.688}} \right) \quad (B)$$

where: B = the lower of either 2.85, or $1.45 \times 10^{0.028 \times (25-T)}$
T = temperature in degrees Celsius.

Applied as a thirty-day average concentration of total ammonia nitrogen (in mg N/L) not to be exceeded more than once every three years on the average. The highest four-day average within the thirty-day period should not exceed 2.5 times the chronic criterion.

h. Measured in milligrams per liter rather than micrograms per liter.

i. ≤ (0.944)(e(1.128[ln(hardness)]-3.828)) at hardness =100. Conversion factor (CF) of 0.944 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.136672 - [(ln hardness)(0.041838)].

j. ≤ (0.909)(e(0.7852[ln(hardness)]-3.490)) at hardness =100. Conversions factor (CF) of 0.909 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.101672 - [(ln hardness)(0.041838)].

k. Criterion based on dissolved chloride in association with sodium. This criterion probably will not be adequately protective when the chloride is associated with potassium, calcium, or magnesium, rather than sodium.

l. Salinity dependent effects. At low salinity the 1-hour average may not be sufficiently protective.

m. $\leq (0.316)e^{(0.8190[\ln(\text{hardness})]\ 3.688)}$

n. $\leq (0.860)e^{(0.8190[\ln(\text{hardness})]\ 1.561)}$

o. $\leq (0.960)(e^{(0.9422[\ln(\text{hardness})] - 1.464)})$

p. $\leq (0.960)(e^{(0.8545[\ln(\text{hardness})] - 1.465)})$

q. $\leq (0.791)(e^{(1.273[\ln(\text{hardness})] - 1.460)})$ at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(ln hardness)(0.145712)].

r. $\leq (0.791)(e^{(1.273[\ln(\text{hardness})] - 4.705)})$ at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(ln hardness)(0.145712)].

s. If the four-day average chronic concentration is exceeded more than once in a three-year period, the edible portion of the consumed species should be analyzed. Said edible tissue concentrations shall not be allowed to exceed 1.0 mg/kg of methylmercury.

t. $\leq (0.998)(e^{(0.8460[\ln(\text{hardness})]\ 3.3612)})$

u. $\leq (0.997)(e^{(0.8460[\ln(\text{hardness})]\ 1.1645)})$

v.	$\leq e^{[1.005(pH) - 5.290]}$
w.	$\leq e^{[1.005(pH) - 4.830]}$
x.	The status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 ug/ l in salt water.
y.	$\leq (0.85)(e^{(1.72[\ln(hardness)] - 6.52)})$
z.	Channel Catfish may be more acutely sensitive.
aa.	$\leq (0.978)(e^{(0.8473[\ln(hardness)]\ 0.8604)})$
bb.	$\leq (0.986)(e^{(0.8473[\ln(hardness)]\ 0.7614)})$
cc.	Nonlethal effects (growth, C-14 uptake, and chlorophyll production) to diatoms (*Thalassiosira aestivalis* and *Skeletonema costatum*) which are common to Washington's waters have been noted at levels below the established criteria. The importance of these effects to the diatom populations and the aquatic system is sufficiently in question to persuade the state to adopt the USEPA National Criteria value (36 µg/L) as the state threshold criteria, however, wherever practical the ambient concentrations should not be allowed to exceed a chronic marine concentration of 21 µg/L.
dd.	These ambient criteria in the table are for the dissolved fraction. The cyanide criteria are based on the weak acid dissociable method. The metals criteria may not be used to calculate total recoverable effluent limits unless the seasonal partitioning of the dissolved to total metals in the ambient water are known. When this information is absent, these metals criteria shall be applied as total recoverable values, determined by back-calculation, using the conversion factors incorporated in the criterion equations. Metals criteria may be adjusted on a site-specific basis when data are made available to the department clearly demonstrating the effective use of the water effects ratio approach established by USEPA, as generally guided by the procedures in USEPA Water Quality Standards Handbook, December 1983, as supplemented or replaced by USEPA or ecology. Information which is used to develop effluent limits based on applying metals partitioning studies or the water effects ratio approach shall be identified in the permit fact sheet developed pursuant to WAC 173-220-060 or 173-226-110, as appropriate, and shall be made available for the public comment period required pursuant to WAC 173-220-050 or 173-226-130(3), as appropriate. Ecology has developed supplemental guidance for conducting water effect ratio studies.
ee.	The criteria for cyanide is based on the weak acid dissociable method in the 17th Ed. Standard Methods for the Examination of Water and Wastewater, 4500-CN I, and as revised (see footnote dd, above).
ff.	These criteria are based on the total-recoverable fraction of the metal.
gg.	Where methods to measure trivalent chromium are unavailable, these criteria are to be represented by total-recoverable chromium.
hh.	The listed fresh water criteria are based on unionized or total ammonia concentrations, while those for marine water are based on total ammonia concentrations. Tables for the conversion of total ammonia to un-ionized ammonia for freshwater can be found in the USEPA's Quality Criteria for Water, 1986. Criteria concentrations based on total ammonia for marine water can be found in USEPA Ambient Water Quality Criteria for Ammonia (Saltwater)-1989, EPA440/5-88-004, April 1989.

ii.	The conversion factor used to calculate the dissolved metal concentration was 0.982.
jj.	The conversion factor used to calculate the dissolved metal concentration was 0.962.
kk.	The conversion factor used to calculate the dissolved metal concentration was 0.85.
ll.	Marine conversion factors (CF) which were used for calculating dissolved metals concentrations are given below. Conversion factors are applicable to both acute and chronic criteria for all metals except mercury. The CF for mercury was applied to the acute criterion only and is not applicable to the chronic criterion. Conversion factors are already incorporated into the criteria in the table. Dissolved criterion = criterion x CF

Metal	CF
Arsenic	1.000
Cadmium	0.994
Chromium (VI)	0.993
Copper	0.83
Lead	0.951
Mercury	0.85
Nickel	0.990
Selenium	0.998
Silver	0.85
Zinc	0.946

mm.	The cyanide criteria are: 2.8µg/l chronic and 9.1µg/l acute and are applicable only to waters which are east of a line from Point Roberts to Lawrence Point, to Green Point to Deception Pass; and south from Deception Pass and of a line from Partridge Point to Point Wilson. The chronic criterion applicable to the remainder of the marine waters is l µg/L.

(4) USEPA Quality Criteria for Water, 1986, as revised, shall be used in the use and interpretation of the values listed in subsection (3) of this section.

(5) Concentrations of toxic, and other substances with toxic propensities not listed in subsection (3) of this section shall be determined in consideration of USEPA Quality Criteria for Water, 1986, and as revised, and other relevant information as appropriate. Human health-based water quality criteria used by the state are contained in 40 CFR 131.36 (known as the National Toxics Rule).

(6) Risk-based criteria for carcinogenic substances shall be selected such that the upper-bound excess cancer risk is less than or equal to one in one million.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), amended and recodified as § 173-201A-240, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97-23-064 (Order 94-19), § 173-201A-040, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-040, filed 11/25/92, effective 12/26/92.]

Notes:

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

173-201A-250
Radioactive substances.

(1) Deleterious concentrations of radioactive materials for all classes shall be as determined by the lowest practicable concentration attainable and in no case shall exceed:

(a) 1/12.5 of the values listed in WAC 246-221-290 (Column 2, Table II, effluent concentrations, rules and regulations for radiation protection); or

(b) USEPA Drinking Water Regulations for radionuclides, as published in the Federal Register of July 9, 1976, or subsequent revisions thereto.

(2) Nothing in this chapter shall be interpreted to be applicable to those aspects of governmental regulation of radioactive waters which have been preempted from state regulation by the Atomic Energy Act of 1954, as amended, as interpreted by the United States Supreme Court in the cases of *Northern States Power Co. v. Minnesota 405 U.S. 1035 (1972) and Train v. Colorado Public Interest Research Group, 426 U.S. 1 (1976).*

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), recodified as § 173-201A-250, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97-23-064 (Order 94-19), § 173-201A-050, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-050, filed 11/25/92, effective 12/26/92.]

173-201A-260
Natural conditions and other water quality criteria and applications.

(1) **Natural and irreversible human conditions.**

(a) It is recognized that portions of many water bodies cannot meet the assigned criteria due to the natural conditions of the water body. When a water body does not meet its assigned criteria due to natural climatic or landscape attributes, the natural conditions constitute the water quality criteria.

(b) When a water body does not meet its assigned criteria due to human structural changes that cannot be effectively remedied (as determined consistent with the federal regulations at 40 CFR 131.10), then alternative estimates of the attainable water quality conditions, plus any further allowances for human effects specified in this chapter for when natural conditions exceed the criteria, may be used to establish an alternative criteria for the water body (see WAC 173-201A-440).

(2) **Toxics and aesthetics criteria.** The following narrative criteria apply to all existing and designated uses for fresh and marine water:

(a) Toxic, radioactive, or deleterious material concentrations must be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health (see WAC 173-201A-240, toxic substances, and 173-201A-250, radioactive substances).

(b) Aesthetic values must not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste (see WAC 173-201A-230 for guidance on establishing lake nutrient standards to protect aesthetics).

(3) **Procedures for applying water quality criteria.** In applying the appropriate water quality criteria for a water, the department will use the following procedure:

(a) The department will establish water quality requirements for water bodies, in addition to those specifically listed in this chapter, on a case-specific basis where determined necessary to provide full support for designated and existing uses.

(b) Upstream actions must be conducted in manners that meet downstream water body criteria. Except where and to the extent described otherwise in this chapter, the criteria associated with the most upstream uses designated for a water body are to be applied to headwaters to protect nonfish aquatic species and the designated downstream uses.

(c) Where multiple criteria for the same water quality parameter are assigned to a water body to protect different uses, the most stringent criterion for each parameter is to be applied.

(d) At the boundary between water bodies protected for different uses, the more stringent criteria apply.

(e) In brackish waters of estuaries, where different criteria for the same use occurs for fresh and marine waters, the decision to use the fresh water or the marine water criteria must be selected and applied on the basis of vertically averaged daily maximum salinity, referred to below as "salinity."

(i) The fresh water criteria must be applied at any point where ninety-five percent of the salinity values are less than or equal to one part per thousand, except that the fresh water criteria for bacteria applies when the salinity is less than ten parts per thousand.

(ii) The marine water criteria must apply at all other locations where the salinity values are greater than one part per thousand, except that the marine criteria for bacteria applies when the salinity is ten parts per thousand or greater.

(f) Numeric criteria established in this chapter are not intended for application to human created waters managed primarily for the removal or containment of pollution. This special provision also includes private farm ponds created from upland sites that did not incorporate natural water bodies.

(i) Waters covered under this provision must be managed so that:

(A) They do not create unreasonable risks to human health or uses of the water.

(B) Discharges from these systems meet down gradient surface and ground water quality standards.

(ii) This provision does not apply to waterways designed and managed primarily to convey or transport water from one location to another, rather than to remove pollution en route.

(g) When applying the numeric criteria established in this chapter, the department will give consideration to the precision and accuracy of the sampling and analytical methods used, as well as the existing conditions at the time.

(h) The analytical testing methods for these numeric criteria must be in accordance with the "*Guidelines Establishing Test Procedures for the Analysis of Pollutants*" (*40 CFR Part 136*) or superseding methods published. The department may also approve other methods following consultation with adjacent states and with the approval of the USEPA.

(i) The primary means for protecting water quality in wetlands is through implementing the antidegradation procedures described in Part III of this chapter.

(i) In addition to designated uses, wetlands may have existing beneficial uses that are to be protected that include ground water exchange, shoreline stabilization, and storm water attenuation.

(ii) Water quality in wetlands is maintained and protected by maintaining the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses.

(iii) Wetlands must be delineated using the *Washington State Wetlands Identification and Delineation Manual*, in accordance with WAC 173-22-035.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-260, filed 7/1/03, effective 8/1/03.]

APPENDIX D

SLUDGE SAMPLING RESULTS AND EVALUATION

SLUDGE SAMPLING RESULTS AND EVALUATION
WWTP PERFORMANCE EVALUATION
29 NOVEMBER - 7 DECEMBER 2006
SOLO POINT WASTEWATER TREATMENT PLANT
FORT LEWIS, WASHINGTON

1. Sludge Data. A summary of detected parameters and their concentrations in sludge samples is provided in Table D-1.

a. Metals concentrations were consistent with concentrations detected in Solo Point biosolids samples analyzed by Anatek Labs, Inc. in July 2003, April 2005, and June 2005. Metals concentrations in digested sludge samples were below the ceiling concentration limits (of WAC 173-308-160) for biosolids applied to land.

b. TPH concentrations were consistent with concentrations detected in biosolids samples analyzed by Anatek Labs, Inc. in July, August and September 2006. TPH was detected in digested sludge samples at concentrations of 26,000 mg/kg (estimated) and 16,500 mg/kg of total solids. Lube oil range TPH was detected in samples collected by Fort Lewis from Fort Lewis composted biosolid piles on 31 July 2006 and analyzed by Anatek Labs, Inc.; concentrations ranged from 270 to 2390 mg/kg. The TPH data suggest that some heavier components of TPH persist through the anaerobic digestion and composting processes.

c. Total solids and total volatile solids concentrations in thickener sludge and secondary digester sludge were virtually the same as the averages calculated with 2006 Solo Point WWTP data (see Table F-4).

2. Evaluation of Sludge Thickness and Volatile Solids Reduction Data.

a. Approximately 16,000 gpd of thickened sludge was pumped from the thickener to the primary digester. The thickener produced sludge with a total solids concentration of ~3.2 percent with a total volatile solids component of 83 percent, based on 2006 WWTP data.

b. Typical unthickened and thickened primary sludges have solids concentrations of 2-6 percent and 5-10 percent, respectively. No data was available on the percent solids in the WWTP primary sludge (unthickened); however, it is evident from the low percent solids (3.2 percent) of the thickened primary sludge that unthickened primary sludge was "thin," probably about 1 percent or less. A thin sludge may needlessly overburden downstream sludge handling processes.

c. It should be noted that primary sludge, secondary sludge, and "dilution water" pumps were operated continuously and at constant rates, resulting in excessive flow (estimated at ~1.54 mgd) to the sludge thickener and excessive thickener supernatant return flow to the head of the WWTP. At the estimated flow rate of 1.54 mgd (see Table 3) the thickener has a surface overflow rate of 969 gal/ft^2-day, which exceeds the recommended maximum hydraulic overflow rate range (380 to 760 gal/ft^2-day) (Metcalf and Eddy 2003). This volume (~1.54 mgd) is returned to the primary clarifier influent as supernatant.

d. Sludge was digested in a two-stage anaerobic process consisting of up to two mixed, heated primary digesters followed by one unheated secondary digester. Only one primary digester was in service at the time of sampling. The other digester was out of service for cleaning and maintenance. Approximately 16,000 gal/day of raw sludge was pumped to the 460,000 gallon primary digester. The primary digester provided approximately 29 days of residence time. In 2006, the primary digester was heated to a minimum temperature of 35 °C (95 °F). When in service, the other primary digester (800,000 gallons) would provide 50 days of residence time. The secondary digester (460,000 gals) provided approximately 29 days of residence time. In 2006, the secondary digester temperature was a minimum of 29 °C. Supernatant (estimated at ~16,000 gal/day by WWTP personnel) from the secondary digester was returned by gravity to the primary clarifier influent. The digesters produced biosolids with a total solids concentration of 4.7 percent with a total volatile solids component of 67 percent, based on 2006 Solo Point WWTP data. On average, the Solo Point digesters reduced volatile solids by about 37 percent. Digesters are typically designed to reduce volatile solids by 38 - 50 percent.

e. The Fort Lewis WWTP has the ability to produce biosolids that can meet the Class B biosolids criteria of WAC 173-308. The combination of residence time and temperature (≥35 °C) in the primary digester meets the Class B biosolids pathogen reduction requirements of WAC 173-308-170, which requires values for the mean cell residence time and temperature to be between fifteen days at 35 to 55 °C and sixty days at 20 °C. The vector attraction requirements may be met by incorporating the biosolids into the soil during land application or by one of the six methods described in WAC 173-308-180.

f. Controlling sludge pumping based on primary and secondary clarifier sludge solids concentrations would result in lower hydraulic load on the thickener and primary clarifier (i.e., lower return volumes) and lower dilution water volumes. This would likely result in: improved primary clarifier performance, thicker primary sludge, lower sludge volumes sent to digesters, lower digester supernatant volumes, improved digester removal of volatile solids, increased gas production, decreased heating requirements, and higher quality biosolids drawn to drying beds. Sludge pumping control would require the intermittent pumping of sludge and may require intermittent operation of primary clarifier sludge collectors. The process goal would be to find a blanket or sludge hopper level that provides a thick sludge without overloading collectors or allowing decomposition of the settled sludge.

g. The quantity of sludge to be removed from the primary clarifier can be estimated with the influent and effluent total suspended solids (from Appendix D, Table D-2, page D-5), the percentage of dry solids in the primary sludge and the wastewater flow:

Dry solids removed (lbs) =

(influent-effluent TSS, mg/L)X(Wastewater flow, mgd)X(8.34 lb/gal)

= (6462 – 1827 mg/L) X ~3 mgd X 8.34 lbs/gal = 4635 lbs

Wet sludge removed, gal/day = [dry solids removed, lbs/day X (100/dry solids in sludge,%)]/8.34 lbs/gal

Assume dry solids in sludge = 1%

= [4635 lbs X 100/1]/8.34

= 55,576 gallons

The actual sludge pumping volume is estimated at ~420,000 gal/day.

Table D-1. Solo Point WWTP Sludge Data.

Analyte	Date	Sample Type	Thickener Sludge	Primary Digester Sludge	Secondary Digester Sludge	Sludge from Drying Bed
Total Solids (%)	6-Dec-06	grab	3.2	1.8	4.7	14.9
Total Volatile Solids (%)	6-Dec-06	grab	83	74	67	49
TPH						
TPH-Diesel Range (mg/kg-dry)	6-Dec-06	grab	9100.0	ND (<3300)	ND (<3200)	2500
TPH-Heavy Range (mg/kg-dry)	6-Dec-06	grab	9300J	22000J	26000J	14000
Metals (mg/kg-dry)						
Aluminum	6-Dec-06	grab	8000	7200.0	13000	15000
Arsenic	6-Dec-06	grab	3.6	ND (<3.7)	5.3	5.4
Cadmium	6-Dec-06	grab	4.7	4.8	6.9	6.8
Chromium	6-Dec-06	grab	27	26.0	34	37
Copper	6-Dec-06	grab	570	490.0	780	670
Iron	6-Dec-06	grab	7900	6900.0	11000	15000
Lead	6-Dec-06	grab	38	36.0	61	73
Mercury	6-Dec-06	grab	1.5	2.3	3.7	2.6
Molybdenum	6-Dec-06	grab	ND (<34)	ND (<47)	ND (<19)	14
Nickel	6-Dec-06	grab	12	11.0	21	24
Selenium	6-Dec-06	grab	8.1	<9.3	9	7.7
Silver	6-Dec-06	grab	14	14.0	11	8.4
Zinc	6-Dec-06	grab	1100.0	930.0	1500	1300

J: Estimated value ND: not detected

APPENDIX E
WWTP PROCESS DATA SUMMARY

Table E-1. WWTP Process Data – WWTP Removal Efficiencies.

Analyte	Date	Time	WWTP Influent (TPIN) Conc.	WWTP Influent (TPIN) Flow (mgd)	WWTP Influent (TPIN) Mass (lbs/day)	WWTP Effluent (TPEF) Conc.	WWTP Effluent (TPEF) Flow (mgd)	WWTP Effluent (TPEF) Mass (lbs/day)	WWTP Rem Effic. (%)	WWTP Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	FC	78	2.45	1593.77	9.3	2.45	190.03	88.1	1403.75
	5-6 Dec 06	FC	Data discarded due to unsatisfactory laboratory QA/QC findings							
	6-7 Dec 06	FC	Data discarded due to unsatisfactory laboratory QA/QC findings							
TSS (mg/L)	4-5 Dec 06	FC	54 b	2.45	1103.38	20	2.45	408.66	63.0	694.72
	5-6 Dec 06	FC	98 b	2.46	2010.61	24.7	2.46	506.76	74.8	1503.85
	6-7 Dec 06	FC	204	2.59	4406.52	26.4	2.59	570.26	87.1	3836.27
	Average			2.50	2506.84		2.50	495.22	80.2	2011.61
Ammonia (mg/L)	4-5 Dec 06	FC	24	2.45	490 39	3.5	2.45	71.52	85.4	418.88
	5-6 Dec 06	FC	25	2.46	512.91	4.5	2.46	92.32	82.0	420.59
	6-7 Dec 06	FC	26	2.59	561.62	5.8	2.59	125.28	77.7	436.33
	Average		25	2.50	521.64		2.50	96.37	81.5	425.26
Nitrate/Nitrite (mg/L)	4-5 Dec 06	FC	ND(<0.050)	2.45	0.51	20	2.45	408.66	-79900.0	-408.15
	5-6 Dec 06	FC	ND(<0.050)	2.46	0.51	21	2.46	430.84	-83900.0	-430.33
	6-7 Dec 06	FC	ND(<0.050)	2.59	0.54	24	2.59	518.41	-95900.0	-517.87
	Average		ND(<0.050)	2.50	0.52		2.50	452.64	-86737.3	-452.12
TKN (mg/L)	4-5 Dec 06	FC	29	2.45	592.56	6.7	2.45	136.90	76.9	455.66
	5-6 Dec 06	FC	37	2.46	759.11	8.1	2.46	166.18	78.1	592.92
	6-7 Dec 06	FC	39	2.59	842.42	8.8	2.59	190.09	77.4	652.34
	Average		35	2.50	731.36		2.50	164.39	77.5	566.97
Total Phosphorus (mg/L)	4-5 Dec 06	FC	3.61	2.45	73.76	3.72	2.45	76.01	-3.0	-2.25
	5-6 Dec 06	FC	4.2	2.46	86.17	4.34	2.46	89.04	-3.3	-2.87
	6-7 Dec 06	FC	4.8	2.59	103.68	4.54	2.59	98.07	5.4	5.62
	Average		4	2.50	87.87		2.50	87.71	0.2	0.17
Grease and Oil (mg/L)	4-5 Dec 06	grab	21	2.45	429.09	ND (<5.30)	2.45	54.15	87.4	374.95
	5-6 Dec 06	grab	7.79	2.46	159.82	ND(<5.00)	2.46	51.29	67.9	108.53
	6-7 Dec 06	grab	6.33	2.59	136.73	ND(<5.10)	2.59	55.08	59.7	81.65
	Average		12	2.50	241.88		2.50	53.51	77.9	188.38
TPH-Diesel Range (ppb)	4-Dec-06	grab	15000	2.45	306.50	690	2.45	14.10	95.4	292.40
	5-Dec-06	grab	12000	2.46	246.20	830	2.46	17.03	93.1	229.17
	6-Dec-06	grab	18000	2.59	388.81	4000	2.59	86.40	77.8	302.41
	Average		15000	2.50	313.83		2.50	39.18	87.5	274.66
TPH-Heavy Range (ppb)	4-Dec-06	grab	11000	2.45	224.76	1600	2.45	32.69	85.5	192.07
	5-Dec-06	grab	7200J	2.46	147.72	1600	2.46	32.83	77.8	114.89
	6-Dec-06	grab	11000J	2.59	237.61	6900	2.59	149.04	37.3	88.56
	Average		11000	2.50	203.36		2.50	71.52	64.8	131.84
TPH-Gasoline (ppb)	4-Dec-06	grab	280	2.45	5.72	ND(<48)	2.45	0.49	91.4	5.23
	5-Dec-06	grab	140	2.46	2.87	ND(<48)	2.46	0.49	82.9	2.38
	6-Dec-06	grab	150J	2.59	3.24	ND(<48)	2.59	0.52	84.0	2.72
	Average		210	2.50	3.94		2.50	0.50	87.3	3.44
Aluminum (mg/L)	4-5 Dec 06	FC	0.208	2.45	4.250	0.243	2.45	4.965	-16.8	-0.715
	5-6 Dec 06	FC	0.291	2.46	5.970	0.252	2.46	5.170	13.4	0.800
	6-7 Dec 06	FC	0.547	2.59	11.816	0.246	2.59	5.314	55.0	6.502
	Average		0	2.50	7.345		2.50	5.150	29.9	2.196
Arsenic (µg/L)	4-5 Dec 06	FC	ND(<1.00)	2.45	0.010	1.03	2.45	0.021	-106.0	-0.011
	5-6 Dec 06	FC	1.15	2.46	0.024	1.17	2.46	0.024	-1.7	0.000
	6-7 Dec 06	FC	ND(<2.00)	2.59	0.022	ND(<2.00)	2.59	0.022	0.0	0.000
	Average		1	2.50	0.018		2.50	0.022	-20.3	-0.004
Cadmium (µg/L)	4-5 Dec 06	FC	ND(<2.00)	2.45	0.020	ND(<2.00)	2.45	0.020	0.0	0.000
	5-6 Dec 06	FC	ND(<2.00)	2.46	0.021	ND(<2.00)	2.46	0.021	0.0	0.000
	6-7 Dec 06	FC	1.06	2.59	0.023	ND(<1.00)	2.59	0.011	52.8	0.012
	Average		1	2.50	0.021		2.50	0.017	18.9	0.004
Calcium (mg/L)	4-5 Dec 06	FC	16.9	2.45	345.318	16.6	2.45	339.188	1.8	6.130
	5-6 Dec 06	FC	18.1	2.46	371.347	18.4	2.46	377.502	-1.7	-6.155
	6-7 Dec 06	FC	19.3	2.59	416.892	18.9	2.59	408.251	2.1	8.640
	Average		18	2.50	377.852		2.50	374.980	0.8	2.872
Chromium (µg/L)	4-5 Dec 06	FC	2.59	2.45	0.053	ND(<2.00)	2.45	0.020	61.4	0.032
	5-6 Dec 06	FC	ND(<2.00)	2.46	0.021	ND(<2.00)	2.46	0.021	0.0	0.000
	6-7 Dec 06	FC	2.38	2.59	0.051	ND(<2.00)	2.59	0.022	58.0	0.030
	Average		2	2.50	0.042		2.50	0.021	49.9	0.021
Copper (µg/L)	4-5 Dec 06	FC	45.8	2.45	0.936	32.7	2.45	0.668	28.6	0.268
	5-6 Dec 06	FC	51.3	2.46	1.052	36.7	2.46	0.753	28.5	0.300
	6-7 Dec 06	FC	78.5	2.59	1.696	34.8	2.59	0.752	55.7	0.944
	Average		59	2.50	1.228		2.50	0.724	41.0	0.504
Iron (mg/L)	4-5 Dec 06	FC	0.362	2.45	7.397	0.269	2.45	5.496	25.7	1.900
	5-6 Dec 06	FC	0.337	2.46	6.914	0.258	2.46	5.293	23.4	1.621
	6-7 Dec 06	FC	0.558	2.59	12.053	0.258	2.59	5.573	53.8	6.480
	Average		0	2.50	8.788		2.50	5.454	37.9	3.334
Lead (µg/L)	4-5 Dec 06	FC	1.28	2.45	0.026	3.37	2.45	0.069	-163.3	-0.043
	5-6 Dec 06	FC	1.22	2.46	0.025	1.05	2.46	0.022	13.9	0.003
	6-7 Dec 06	FC	ND(<5.00)	2.59	0.054	ND(<5.00)	2.59	0.054	0.0	0.000
	Average		1	2.50	0.035		2.50	0.048	-37.3	-0.013
Magnesium (mg/L)	4-5 Dec 06	FC	5.32	2.45	108.704	5.24	2.45	107.069	1.5	1.635
	5-6 Dec 06	FC	5.63	2.46	115.507	5.64	2.46	115.712	-0.2	-0.205
	6-7 Dec 06	FC	5.74	2.59	123.987	5.66	2.59	122.259	1.4	1.728
	Average		6	2.50	116.066		2.50	115.014	0.9	1.053
Mercury (µg/L)	4-5 Dec 06	FC	ND(<0.200)	2.45	0.002	ND(<0.200)	2.45	0.002	0.0	0.000
	5-6 Dec 06	FC	ND(<0.200)	2.46	0.002	ND(<0.200)	2.46	0.002	0.0	0.000
	6-7 Dec 06	FC	0.297	2.59	0.006	ND(<0.200)	2.59	0.002	66.3	0.004
	Average		0	2.50	0.004		2.50	0.002	40.5	0.001
Molybdenum (µg/L)	4-5 Dec 06	FC	12.4	2.45	0.253	5.67	2.45	0.116	54.3	0.138
	5-6 Dec 06	FC	11.1	2.46	0.228	9.91	2.46	0.203	10.7	0.024
	6-7 Dec 06	FC	23.3	2.59	0.503	10.8	2.59	0.233	53.6	0.270
	Average		16	2.50	0.328		2.50	0.184	43.9	0.144
Nickel (µg/L)	4-5 Dec 06	FC	11.2	2.45	0.229	2.45	2.45	0.050	78.1	0.179
	5-6 Dec 06	FC	6.93	2.46	0.142	2.64	2.46	0.054	61.9	0.088
	6-7 Dec 06	FC	6.56	2.59	0.142	ND(<2.00)	2.59	0.022	84.8	0.120
	Average		8	2.50	0.171		2.50	0.042	75.5	0.129
Selenium (µg/L)	4-5 Dec 06	FC	ND(<1.00)	2.45	0.010	ND(<1.00)	2.45	0.010	0.0	0.000
	5-6 Dec 06	FC	ND(<1.00)	2.46	0.010	ND(<1.00)	2.46	0.010	0.0	0.000
	6-7 Dec 06	FC	ND(<2.00)	2.59	0.022	ND(<2.00)	2.59	0.022	0.0	0.000
	Average		ND	2.50	0.014		2.50	0.014	0.0	0.000
Silver (µg/L)	4-5 Dec 06	FC	ND(<1.00)	2.45	0.010	ND(<1.00)	2.45	0.010	0.0	0.000
	5-6 Dec 06	FC	ND(<1.00)	2.46	0.010	ND(<1.00)	2.46	0.010	0.0	0.000
	6-7 Dec 06	FC	ND(<1.00)	2.59	0.011	ND(<1.00)	2.59	0.011	0.0	0.000
	Average		ND	2.50	0.010		2.50	0.010	0.0	0.000
Zinc (mg/L)	4-5 Dec 06	FC	0.08	2.45	1.635	0.07	2.45	1.430	12.5	0.204
	5-6 Dec 06	FC	0.095	2.46	1.949	0.079	2.46	1.621	16.8	0.328
	6-7 Dec 06	FC	0.135	2.59	2.916	0.112	2.59	2.419	17.0	0.497
	Average		0	2.50	2.167		2.50	1.823	15.8	0.343

FC: 24-hour flow composite collected from approximately 0700 – 0700 hrs

a: Removal efficiency and mass removed calculated with ½ the method reporting limit for ND results.

b: A review of headworks TSS mass inputs and outputs (assuming 0% or more influent TSS removal in preliminary treatment) suggests that the first and second day WWTP influent sample results for TSS appear to be erroneously low. The analysis suggests that day 1 and 2 influent TSS concentrations should be ≥201 mg/L and ≥163 mg/L, respectively; thus the data suggests that day 3 data best represents the TSS removal efficiency (~87%) of the WWTP. Problems were noted during day 1 of sampling associated with rags clogging the sample intake strainer, which may have impacted WWTP influent sample quality. Therefore, the WWTP TSS removal efficiency will be reported as ≥ 80.2 percent.

Table E-1. WWTP Process Data – WWTP Removal Efficiencies (continued).

Analyte	Date	Time	WWTP Influent (TPIN) Conc.	WWTP Influent (TPIN) Flow (mgd)	WWTP Influent (TPIN) Mass (lbs/day)	WWTP Effluent (TPEF) Conc.	WWTP Effluent (TPEF) Flow (mgd)	WWTP Effluent (TPEF) Mass (lbs/day)	WWTP Rem Effic. (%)	WWTP Mass Removed (lbs/day)
VOCs										
Chloroform	4-Dec-06	grab	ND	2.45	0.000	ND	2.45	0.000	ND	NA
	5-Dec-06	grab	ND	2.46	0.000	ND	2.46	0.000	ND	NA
	6-Dec-06	grab	ND	2.59	0.000	1J	2.59	0.022	NA	NA
	Average								ND	NA
1,4-dichlorobenzene (µg/L)	4-Dec-06	grab	2J	2.45	0.041	ND	2.45	0.000	ND	NA
	5-Dec-06	grab	3J	2.46	0.062	ND	2.46	0.000	ND	NA
	6-Dec-06	grab	2J	2.59	0.043	ND	2.59	0.000	ND	NA
	Average								ND	NA
1,2-dichlorobenzene (µg/L)	4-Dec-06	grab	2J	2.45	0.041	ND	2.45	0.000	ND	NA
	5-Dec-06	grab	1J	2.46	0.021	ND	2.46	0.000	ND	NA
	6-Dec-06	grab	4J	2.59	0.086	ND	2.59	0.000	ND	NA
	Average								ND	NA
Tetrachloroethene (µg/L)	4-Dec-06	grab	3J	2.45	0.061	ND	2.45	0.000	ND	NA
	5-Dec-06	grab	ND	2.46	0.000	ND	2.46	0.000	ND	NA
	6-Dec-06	grab	ND	2.59	0.000	ND	2.59	0.000	ND	NA
	Average								ND	NA
Toluene (µg/L)	4-Dec-06	grab	2J	2.45	0.041	ND	2.45	0.000	ND	NA
	5-Dec-06	grab	2J	2.46	0.041	ND	2.46	0.000	ND	NA
	6-Dec-06	grab	3J	2.59	0.065	ND	2.59	0.000	ND	NA
	Average								ND	NA
SVOCs										
Phenol	4-5 Dec 06	0700-0700	6	2.45	0.123	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	24	2.46	0.492	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	11	2.59	0.238	ND	2.59	0.000	ND	NA
	Average								ND	NA
Acenaphthene	4-5 Dec 06	0700-0700	0.5J	2.45	0.010	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	0.4J	2.46	0.008	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	ND	2.59	0.000	ND	2.59	0.000	ND	NA
	Average								ND	NA
Diethylphthalate	4-5 Dec 06	0700-0700	4J	2.45	0.082	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	6	2.46	0.123	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	5	2.59	0.108	ND	2.59	0.000	ND	NA
	Average								ND	NA
di-n-butylphthalate	4-5 Dec 06	0700-0700	2J	2.45	0.041	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	2J	2.46	0.041	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	1J	2.59	0.022	ND	2.59	0.000	ND	NA
	Average								ND	NA
Fluorene	4-5 Dec 06	0700-0700	0.4J	2.45	0.008	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	0.6J	2.46	0.012	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	0.4J	2.59	0.009	ND	2.59	0.000	ND	NA
	Average								ND	NA
Butylbenzylphthalate	4-5 Dec 06	0700-0700	4J	2.45	0.082	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	7	2.46	0.144	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	7	2.59	0.151	ND	2.59	0.000	ND	NA
	Average								ND	NA
Bis(2-ethylhexyl)phthalate	4-5 Dec 06	0700-0700	10	2.45	0.204	13	2.45	0.266	-30.0	-0.061
	5-6 Dec 06	0700-0700	16	2.46	0.328	7	2.46	0.144	56.3	0.185
	6-7 Dec 06	0700-0700	16	2.59	0.346	7	2.59	0.151	56.3	0.194
	Average				0.293			0.187	36.2	0.106
1,2-Dichlorobenzene	4-5 Dec 06	0700-0700	1J	2.45	0.020	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	1J	2.46	0.021	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	1J	2.59	0.022	ND	2.59	0.000	ND	NA
	Average								ND	NA
1,4-Dichlorobenzene	4-5 Dec 06	0700-0700	1J	2.45	0.020	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	5J	2.46	0.103	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	5J	2.59	0.108	ND	2.59	0.000	ND	NA
	Average								ND	NA
Naphthalene	4-5 Dec 06	0700-0700	7	2.45	0.143	0.2J	2.45	0.004	97.1	0.139
	5-6 Dec 06	0700-0700	7	2.46	0.144	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	4J	2.59	0.086	ND	2.59	0.000	ND	NA
	Average								ND	NA
Phenanthrene	4-5 Dec 06	0700-0700	ND	2.45	0.000	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	1J	2.46	0.021	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	0.6J	2.59	0.013	ND	2.59	0.000	ND	NA
	Average								ND	NA
OC Pesticides/PCBs										
Alpha Chlordane (µg/L)	4-5 Dec 06	0700-0700	ND	2.45	0.000	0.0079J	2.45	0.000	NA	NA
	5-6 Dec 06	0700-0700	ND	2.46	0.000	0.0061J	2.46	0.000	NA	NA
	6-7 Dec 06	0700-0700	0.0045J	2.59	0.000	0.0059J	2.59	0.000	NA	NA
	Average								NA	NA
Heptachlor (µg/L)	4-5 Dec 06	0700-0700	0.094	2.45	0.002	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	0.52	2.46	0.011	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	0.51	2.59	0.011	ND	2.59	0.000	ND	NA
	Average								ND	NA
p,p-DDD (µg/L)	4-5 Dec 06	0700-0700	ND	2.45	0.000	ND	2.45	0.000	ND	NA
	5-6 Dec 06	0700-0700	0.057J	2.46	0.001	ND	2.46	0.000	ND	NA
	6-7 Dec 06	0700-0700	ND	2.59	0.000	ND	2.59	0.000	ND	NA
	Average								ND	NA

Table E-2. WWTP Unit Process Data.

Analyte	Date	Time	Sludge Thickener (TSN) Conc.	Sludge Thickener (TSN) Flow (mgd) (estimate)	Sludge Thickener (TSN) Mass (lbs/day)	Secondary Digester Supernate (2DSN) Conc. (7 Dec)	Secondary Digester Supernate (2DSN) Flow (mgd)	Secondary Digester Supernate (2DSN) Mass (lbs/day) Returned	WWTP/ Headworks Influent Mass (lbs/day)	Headworks Effluent to Prim. Clar. Mass (lbs/day)	Return Flows Added to Headworks Mass (lbs/day)	Influent + Return Flows Mass (lbs/day)	Removal Efficiency of Headworks %	Headworks Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	34	1.54	436.68	680.0	0.016	90.74	1593.77	2029.87	527.42			
	5-6 Dec 06	0700-0700	46	1.54	590.81	680.0	0.016	90.74			681.54			
	6-7 Dec 06	0700-0700	33	1.54	423.84	680.0	0.016	90.74			514.58			
	Average			1.54	483.78	680.0	0.016	90.74	1593.77	2029.87	574.51	2168.29	8.7	138.42
TSS (mg/L)	4-5 Dec 06	0700-0700	62.2	1.54	798.87	17900.0	0.016	2388.58	1103.38	7587.06	3187.45	4290.83	-298.7	-3296.23
	5-6 Dec 06	0700-0700	100	1.54	1284.36	17900.0	0.016	2388.58	2010.61	7339.20	3672.94	5683.54	-82.3	-1655.66
	6-7 Dec 06	0700-0700	95	1.54	1220.14	17900.0	0.016	2388.58	4406.52	6131.07	3608.72	8015.24	42.8	1884.17
	Average			1.54	1101.12	17900.0	0.016	2388.58	2506.84	7019.11	3489.70	5996.54	-40.8	-1022.57
Ammonia (mg/L)	4-5 Dec 06	0700-0700	9.4	1.54	120.73									
	5-6 Dec 06	0700-0700	12	1.54	154.12									
	6-7 Dec 06	0700-0700	13	1.54	166.97									
	Average			1.54	147.27	690.0	0.016	92.07	521.64	764.25	239.35	760.99	-0.6	-3.26
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	13	1.54	166.97									
	5-6 Dec 06	0700-0700	18	1.54	231.18									
	6-7 Dec 06	0700-0700	18	1.54	231.18									
	Average			1.54	209.78	0.1	0.016	0.01	0.52	99.27	209.79	210.31	21302.9	111.04
TKN (mg/L)	4-5 Dec 06	0700-0700	16	1.54	205.50									
	5-6 Dec 06	0700-0700	20	1.54	256.87									
	6-7 Dec 06	0700-0700	21	1.54	269.72									
	Average			1.54	244.03	1100.0	0.016	146.78	731.36	1236.38	390.81	1122.17	-15.6	-114.20
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	4.68	1.54	60.11									
	5-6 Dec 06	0700-0700	6.11	1.54	78.47									
	6-7 Dec 06	0700-0700	6.15	1.54	78.99									
	Average			1.54	72.52	198.0	0.016	26.42	87.87	209.70	98.94	186.82	-26.0	-22.88
Grease and Oil (mg/L)	4-5 Dec 06	grab	ND(<5.00)	1.54	32.11									
	5-6 Dec 06	grab	ND(<5.00)	1.54	32.11									
	6-7 Dec 06	grab	ND(<5.00)	1.54	32.11									
	Average			1.54	32.11	312.0	0.016	41.63	241.88	445.22	73.74	315.62	-53.6	-129.60
TPH-Diesel (ppb)	4-Dec-06	grab	7400	1.54	95.04									
	5-Dec-06	grab	4100	1.54	52.66									
	6-Dec-06	grab	3000	1.54	38.53									
	Average			1.54	62.08	ND(<80,000)	0.016	5.34	313.83	892.82	67.42	381.25	-163.0	-511.58
TPH-Heavy (ppb)	4-Dec-06	grab	7300J	1.54	93.76									
	5-Dec-06	grab	3300J	1.54	42.38									
	6-Dec-06	grab	3600J	1.54	46.24									
	Average			1.54	60.79	380000.0	0.016	50.71	203.36	571.07	111.50	314.86	-126.0	-256.20
Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.532	1.54	6.833									
	5-6 Dec 06	0700-0700	0.907	1.54	11.649									
	6-7 Dec 06	0700-0700	0.964	1.54	12.381									
	Average			1.54	10.288	235	0.016	31.358	7.345	46.713	41.646	48.99	31.0	2.278
Arsenic (µg/L)	4-5 Dec 06	0700-0700	1.09	1.54	0.014									
	5-6 Dec 06	0700-0700	1.32	1.54	0.017									
	6-7 Dec 06	0700-0700	ND(<2.00)	1.54	0.013									
	Average			1.54	0.015	94.4	0.016	0.013	0.018	0.047	0.027	0.05	-9.2	-0.002
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	1.54	0.013									
	5-6 Dec 06	0700-0700	ND(<2.00)	1.54	0.013									
	6-7 Dec 06	0700-0700	1.03	1.54	0.013									
	Average			1.54	0.013	153	0.016	0.020	0.021	0.038	0.033	0.05	77.5	0.016
Calcium (mg/L)	4-5 Dec 06	0700-0700	18	1.54	231.185									
	5-6 Dec 06	0700-0700	20.3	1.54	260.725									
	6-7 Dec 06	0700-0700	21.2	1.54	272.284									
	Average			1.54	254.731	597	0.016	79.664	377.852	696.510	334.395	712.25	4.2	15.738
Chromium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	1.54	0.013									
	5-6 Dec 06	0700-0700	ND(<2.00)	1.54	0.013									
	6-7 Dec 06	0700-0700	2.05	1.54	0.026									
	Average			1.54	0.017	375	0.016	0.050	0.042	0.092	0.067	0.11	41.6	0.017
Copper (µg/L)	4-5 Dec 06	0700-0700	48.8	1.54	0.627									
	5-6 Dec 06	0700-0700	76.3	1.54	0.980									
	6-7 Dec 06	0700-0700	78.8	1.54	1.012									
	Average			1.54	0.873	12000	0.016	1.601	1.228	3.595	2.474	3.70	8.8	0.108
Iron (mg/L)	4-5 Dec 06	0700-0700	0.488	1.54	6.268									
	5-6 Dec 06	0700-0700	0.718	1.54	9.222									
	6-7 Dec 06	0700-0700	0.757	1.54	9.723									
	Average			1.54	8.404	135	0.016	18.014	8.788	37.886	26.418	35.21	-30.5	-2.680
Lead (µg/L)	4-5 Dec 06	0700-0700	1.91	1.54	0.025									
	5-6 Dec 06	0700-0700	3.22	1.54	0.041									
	6-7 Dec 06	0700-0700	ND(<5.00)	1.54	0.032									
	Average			1.54	0.033	1010	0.016	0.135	0.035	0.203	0.167	0.20	0.0	0.000
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.52	1.54	70.897									
	5-6 Dec 06	0700-0700	5.91	1.54	75.906									
	6-7 Dec 06	0700-0700	6.06	1.54	77.832									
	Average			1.54	74.878	71.9	0.016	9.594	116.066	197.695	84.473	200.54	2.5	2.844
Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.20)	1.54	0.001									
	5-6 Dec 06	0700-0700	ND(<0.20)	1.54	0.001									
	6-7 Dec 06	0700-0700	ND(<0.20)	1.54	0.001									
	Average			1.54	0.001	26.0	0.016	0.003	0.004	0.017	0.005	0.01	-246.9	-0.009
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	8.03	1.54	0.103									
	5-6 Dec 06	0700-0700	11.2	1.54	0.144									
	6-7 Dec 06	0700-0700	14.7	1.54	0.189									
	Average			1.54	0.145	309.0	0.016	0.041	0.328	0.452	0.186	0.51	19.1	0.063
Nickel (µg/L)	4-5 Dec 06	0700-0700	5.62	1.54	0.072									
	5-6 Dec 06	0700-0700	3.96	1.54	0.051									
	6-7 Dec 06	0700-0700	3.45	1.54	0.044									
	Average			1.54	0.056	283.0	0.016	0.038	0.171	0.135	0.094	0.26	76.0	0.130
Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.54	0.006									
	5-6 Dec 06	0700-0700	ND(<1.00)	1.54	0.006									
	6-7 Dec 06	0700-0700	ND(<2.00)	1.54	0.013									
	Average			1.54	0.009	98.3	0.016	0.013	0.014	0.040	0.022	0.04	-28.4	-0.004
Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.54	0.006									
	5-6 Dec 06	0700-0700	ND(<1.00)	1.54	0.006									
	6-7 Dec 06	0700-0700	ND(<1.00)	1.54	0.006									
	Average			1.54	0.006	31.0	0.016	0.004	0.010	0.039	0.011	0.02	-172.1	-0.018
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.112	1.54	1.438									
	5-6 Dec 06	0700-0700	0.169	1.54	2.171									
	6-7 Dec 06	0700-0700	0.178	1.54	2.286									
	Average			1.54	1.965	29.7	0.016	3.963	2.167	7.880	5.928	8.09	9.9	0.215

Table E-2. WWTP Unit Process Data (continued).

Analyte	Date	Time	Primary Clarifier Influent (ICLIN) Conc. (ppm)	Primary Clarifier Influent (ICLIN) Flow (mgd)	Primary Clarifier Influent (ICLIN) Mass (lbs/day)	Primary Clarifier Effluent (ICLEF) Conc. (ppm)	Primary Clarifier Effluent (ICLEF) Flow (mgd)	Primary Clarifier Effluent (ICLEF) Mass (lbs/day)	Primary Clarifier Rem.Effic. (%)	Primary Clarifier Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	61	3.99	2029.87	41	3.57	1220.04	39.9	809.83
	5-6 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	6-7 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	Average									
TSS (mg/L)	4-5 Dec 06	0700-0700	228	3.99	7587.06	80	3.57	2380.57	68.6	5206.50
	5-6 Dec 06	0700-0700	220	4.00	7339.20	79	3.58	2357.40	67.9	4981.80
	6-7 Dec 06	0700-0700	178	4.13	6131.07	68	3.71	2102.88	65.7	4028.19
	Average			4.04	7019.11		3.62	2280.28	67.5	4738.83
Ammonia (mg/L)	4-5 Dec 06	0700-0700	21	3.99	698.81	19	3.57	565.39	19.1	133.42
	5-6 Dec 06	0700-0700	23	4.00	767.28	19	3.58	566.97	26.1	200.31
	6-7 Dec 06	0700-0700	24	4.13	826.66	24	3.71	742.19	10.2	84.47
	Average			4.04	764.25		3.62	624.85	18.2	139.40
Nitrate/Nitrite (mg/L)	4-5 Dec 06	[illegible]	1.3	3.99	43.26	4	3.57	119.03	-175.1	-75.77
	5-6 Dec 06	0700-0700	3.5	4.00	116.76	4.8	3.58	143.23	-22.7	-26.47
	6-7 Dec 06	0700-0700	4	4.13	137.78	4.1	3.71	126.79	8.0	10.99
	Average			4.04	99.27		3.62	129.68	-30.6	-30.42
TKN (mg/L)	4-5 Dec 06	[illegible]	33	3.99	1098.13	27	3.57	803.44	26.8	294.69
	5-6 Dec 06	0700-0700	38	4.00	1267.68	30	3.58	895.22	29.4	372.46
	6-7 Dec 06	0700-0700	39	4.13	1343.32	32	3.71	989.59	26.3	353.73
	Average			4.04	1236.38		3.62	896.08	27.5	340.29
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	6.17	3.99	205.32	4.3	3.57	127.96	37.7	77.36
	5-6 Dec 06	0700-0700	6.25	4.00	208.50	4.9	3.58	146.22	29.9	62.28
	6-7 Dec 06	0700-0700	6.25	4.13	215.28	4.69	3.71	145.04	32.6	70.24
	Average			4.04	209.70		3.62	139.74	33.4	69.96
Grease and Oil (mg/L)	4-5 Dec 06	grab	26	3.99	865.19	12	3.57	157.71	81.8	707.48
	5-6 Dec 06	grab	7.33	4.00	244.53	10.6	3.58	149.20	39.0	95.33
	6-7 Dec 06	grab	6.56	4.13	225.95	ND(<5.00)	3.71	78.86	65.1	147.10
	Average			4.04	445.22		3.62	128.59	71.1	316.63
TPH-Diesel Range (ppb)	4-Dec-06	grab	53000	3.99	1763.66	6500	3.57	193.42	89.0	1570.24
	5-Dec-06	grab	14000	4.00	467.04	5800	3.58	173.08	62.9	293.96
	6-Dec-06	grab	13000	4.13	447.77	4500	3.71	139.16	68.9	308.61
	Average			4.04	892.82		3.62	168.55	81.1	724.27
TPH-Heavy Range (ppb)	4-Dec-06	grab	27000J	3.99	898.47	6400J	3.57	190.45	78.8	708.02
	5-Dec-06	grab	11000	4.00	366.96	3700J	3.58	110.41	69.9	256.55
	6-Dec-06	grab	13000J	4.13	447.77	3200J	3.71	98.96	77.9	348.82
	Average			4.04	571.07		3.62	133.27	76.7	437.80
Aluminum (mg/L)	4-5 Dec 06	0700-0700	1.34	3.99	44.591	0.47	3.57	13.986	68.6	30.605
	5-6 Dec 06	0700-0700	1.46	4.00	48.706	0.414	3.58	12.354	74.6	36.352
	6-7 Dec 06	0700-0700	1.36	4.13	46.844	0.318	3.71	9.834	79.0	37.010
	Average			4.04	46.713		3.62	12.058	74.2	34.655
Arsenic (µg/L)	4-5 Dec 06	0700-0700	1.49	3.99	0.050	1.14	3.57	0.034	31.6	0.016
	5-6 Dec 06	0700-0700	1.74	4.00	0.058	1.17	3.58	0.035	39.9	0.023
	6-7 Dec 06	0700-0700	ND(<2.00)	4.13		ND(<2.00)	3.71			
	Average			4.04	0.054		3.62	0.034	36.0	0.019
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	3.99	0.033	ND(<2.00)	3.57	0.030	10.6	0.004
	5-6 Dec 06	0700-0700	ND(<2.00)	4.00	0.033	ND(<2.00)	3.58	0.030	10.6	0.004
	6-7 Dec 06	0700-0700	1.39	4.13	0.048	ND(<1.00)	3.71	0.015	67.7	0.032
	Average			4.04	0.038		3.62	0.025	34.5	0.013
Calcium (mg/L)	4-5 Dec 06	0700-0700	20	3.99	665.532	17.3	3.57	514.798	22.6	150.734
	5-6 Dec 06	0700-0700	20.9	4.00	697.224	18.3	3.58	546.082	21.7	151.142
	6-7 Dec 06	0700-0700	21.1	4.13	726.773	18.6	3.71	575.200	20.9	151.573
	Average			4.04	696.510		3.62	545.360	21.7	151.150
Chromium (µg/L)	4-5 Dec 06	0700-0700	2.71	3.99	0.090	ND(<2.00)	3.57	0.030	67.0	0.060
	5-6 Dec 06	0700-0700	2.63	4.00	0.088	ND(<2.00)	3.58	0.030	66.0	0.058
	6-7 Dec 06	0700-0700	2.82	4.13	0.097	ND(<2.00)	3.71	0.031	68.2	0.066
	Average			4.04	0.092		3.62	0.030	67.1	0.062
Copper (µg/L)	4-5 Dec 06	0700-0700	100	3.99	3.328	48.7	3.57	1.449	56.5	1.878
	5-6 Dec 06	0700-0700	112	4.00	3.736	53	3.58	1.582	57.7	2.155
	6-7 Dec 06	0700-0700	108	4.13	3.720	55.1	3.71	1.704	54.2	2.016
	Average			4.04	3.595		3.62	1.578	56.1	2.016
Iron (mg/L)	4-5 Dec 06	0700-0700	1.04	3.99	34.608	0.471	3.57	14.016	59.5	20.592
	5-6 Dec 06	0700-0700	1.11	4.00	37.030	0.42	3.58	12.533	66.2	24.497
	6-7 Dec 06	0700-0700	1.22	4.13	42.022	0.379	3.71	11.720	72.1	30.301
	Average			4.04	37.886		3.62	12.756	66.3	25.130
Lead (µg/L)	4-5 Dec 06	0700-0700	6.08	3.99	0.202	1.84	3.57	0.055	72.9	0.148
	5-6 Dec 06	0700-0700	5.26	4.00	0.175	1.58	3.58	0.047	73.1	0.128
	6-7 Dec 06	0700-0700	6.67	4.13		ND(<5.00)	3.71			
	Average			4.04	0.189		3.62	0.051	73.0	0.138
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.77	3.99	192.006	5.33	3.57	158.605	17.4	33.401
	5-6 Dec 06	0700-0700	5.9	4.00	196.824	5.54	3.58	165.316	16.0	31.508
	6-7 Dec 06	0700-0700	5.93	4.13	204.254	5.66	3.71	175.034	14.3	29.220
	Average			4.04	197.695		3.62	166.319	15.9	31.376
Mercury (µg/L)	4-5 Dec 06	0700-0700	0.278	3.99	0.009	ND(<0.200)	3.57	0.003	67.8	0.006
	5-6 Dec 06	0700-0700	0.699	4.00	0.023	ND(<0.200)	3.58	0.003	87.2	0.020
	6-7 Dec 06	0700-0700	0.527	4.13	0.018	ND(<0.200)	3.71	0.003	83.0	0.015
	Average			4.04	0.017		3.62	0.003	82.2	0.014
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	11.7	3.99	0.389	ND(<5.00)	3.57	0.074	80.9	0.315
	5-6 Dec 06	0700-0700	11.2	4.00	0.374	10.5	3.58	0.313	16.1	0.060
	6-7 Dec 06	0700-0700	17.2	4.13	0.592	16.7	3.71	0.516	12.8	0.076
	Average			4.04	[illegible]		[illegible]	[illegible]	33.3	0.150
Nickel (µg/L)	4-5 Dec 06	0700-0700	4.49	3.99	0.149	2.47	3.57	0.074	50.8	0.076
	5-6 Dec 06	0700-0700	3.79	4.00	0.126	2.41	3.58	0.072	43.1	0.055
	6-7 Dec 06	0700-0700	3.71	4.13	0.128	2.47	3.71	0.076	40.2	0.051
	Average			4.04	0.135		3.62	0.074	45.0	0.061
Selenium (µg/L)	4-5 Dec 06	0700-0700	1.15	3.99	0.038	ND(<1.00)	3.57	0.015	61.1	0.023
	5-6 Dec 06	0700-0700	1.39	4.00	0.046	1.04	3.58	0.031	33.1	0.015
	6-7 Dec 06	0700-0700	ND(<2.00)	4.13	0.034	ND(<2.00)	3.71	0.031	10.2	0.004
	Average			4.04	0.040		3.62	0.026	35.5	0.014
Silver (µg/L)	4-5 Dec 06	0700-0700	1.26	3.99	0.042	ND(<1.00)	3.57	0.015	64.5	0.027
	5-6 Dec 06	0700-0700	1.19	4.00	0.040	ND(<1.00)	3.58	0.015	62.4	0.025
	6-7 Dec 06	0700-0700	1.02	4.13	0.035	ND(<1.00)	3.71	0.015	56.0	0.020
	Average			4.04	0.039		3.62	0.015	61.2	0.024
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.243	3.99	8.086	0.105	3.57	3.124	61.4	4.962
	5-6 Dec 06	0700-0700	0.237	4.00	7.906	0.121	3.58	3.611	54.3	4.296
	6-7 Dec 06	0700-0700	0.222	4.13	7.647	0.088	3.71	2.721	64.4	4.925
	Average			4.04	7.880		3.62	3.152	60.0	4.728

Table E-2. WWTP Unit Process Data (continued).

Analyte	Date	Time	Trickling Filter Influent (TFIN) Conc.	Trickling Filter Influent (TFIN) Flow (mgd)	Trickling Filter Influent (TFIN) Mass (lbs/day)	Trickling Filter Effluent (TFEF) Conc.	Trickling Filter Effluent (TFEF) Flow (mgd)	Trickling Filter Effluent (TFEF) Mass (lbs/day)	Trickling Filter Rem.Effic. (%)	Trickling Filter Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	41	3.57	1220.04	15	3.57	446.36	63.4	773.69
	5-6 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	6-7 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	Average									
TSS (mg/L)	4-5 Dec 06	0700-0700	80	3.57	2380.57	45	3.57	1339.07	43.8	1041.50
	5-6 Dec 06	0700-0700	79	3.58	2357.40	49	3.58	1462.19	38.0	895.22
	6-7 Dec 06	0700-0700	68	3.71	2102.88	70	3.71	2164.73	-2.9	-61.85
	Average			3.62	2280.28		3.62	1655.33	26.3	624.96
Ammonia (mg/L)	4-5 Dec 06	0700-0700	19	3.57	565.39	4.1	3.57	122.00	78.4	443.38
	5-6 Dec 06	0700-0700	19	3.58	566.97	6.3	3.58	188.00	66.8	378.97
	6-7 Dec 06	0700-0700	24	3.71	742.19	7.4	3.71	228.84	69.2	513.35
	Average			3.62	624.85		3.62	179.61	71.5	445.24
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	4	3.57	119.03	19	3.57	565.39	-375.0	-446.36
	5-6 Dec 06	0700-0700	4.8	3.58	143.23	23	3.58	686.33	-379.2	-543.10
	6-7 Dec 06	0700-0700	4.1	3.71	126.79	28	3.71	865.89	-582.9	-739.10
	Average			3.62	129.68		3.62	705.87	-445.7	-576.19
TKN (mg/L)	4-5 Dec 06	0700-0700	27	3.57	803.44	8.9	3.57	264.84	67.0	538.60
	5-6 Dec 06	0700-0700	30	3.58	895.22	11	3.58	328.25	63.3	566.97
	6-7 Dec 06	0700-0700	32	3.71	989.59	11	3.71	340.17	65.6	649.42
	Average			3.62	896.08		3.62	311.09	65.3	585.00
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	4.3	3.57	127.96	4.35	3.57	129.44	-1.2	-1.49
	5-6 Dec 06	0700-0700	4.9	3.58	146.22	4.93	3.58	147.11	-0.6	-0.90
	6-7 Dec 06	0700-0700	4.69	3.71	145.04	4.97	3.71	153.70	-6.0	-8.66
	Average			3.62	139.74		3.62	143.42	-2.6	-3.68
Grease and Oil (mg/L)	4-5 Dec 06	grab	12	3.57	357.09	ND(<5.30)	3.57	74.39	79.2	282.69
	5-6 Dec 06	grab	10.6	3.58	316.31	ND(<5.00)	3.58	74.60	76.4	241.71
	6-7 Dec 06	grab	ND(<5.00)	3.71	77.31	ND(<5.00)	3.71	77.31	0.0	0.00
	Average			3.62	250.24		3.62	75.44	51.9	174.80
TPH-Diesel Range (ppb)	4-Dec-06	grab	6500	3.57	193.42	1500	3.57	44.64	76.9	148.79
	5-Dec-06	grab	5800	3.58	173.08	1500	3.58	44.76	74.1	128.31
	6-Dec-06	grab	4500	3.71	139.16	1100J	3.71	34.02	75.6	105.14
	Average			3.62	168.55		3.62	41.14	75.5	127.41
TPH-Heavy Range (ppb)	4-Dec-06	grab	6400J	3.57	190.45	2200J	3.57	65.47	65.6	124.98
	5-Dec-06	grab	3700J	3.58	110.41	2300J	3.58	68.63	37.8	41.78
	6-Dec-06	grab	3200J	3.71	98.96	2300J	3.71	71.13	28.1	27.83
	Average			3.62	133.27		3.62	68.41	43.9	64.86
Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.47	3.57	13.986	0.482	3.57	14.343	-2.6	-0.357
	5-6 Dec 06	0700-0700	0.414	3.58	12.354	0.474	3.58	14.144	-14.5	-1.790
	6-7 Dec 06	0700-0700	0.318	3.71	9.834	0.461	3.71	14.256	-45.0	-4.422
	Average			3.62	12.058		3.62	14.248	-20.7	-2.190
Arsenic (µg/L)	4-5 Dec 06	0700-0700	1.14	3.57	0.034	1.16	3.57	0.035	-1.8	-0.001
	5-6 Dec 06	0700-0700	1.17	3.58	0.035	1.23	3.58	0.037	-5.1	-0.002
	6-7 Dec 06	0700-0700	ND(<2.00)	3.71	0.031	ND(<2.00)	3.71	0.031	0.0	0.000
	Average			3.62	0.033		3.62	0.034	-2.3	-0.001
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	3.57	0.030	ND(<2.00)	3.57	0.030	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	3.58	0.030	ND(<2.00)	3.58	0.030	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	3.71	0.015	ND(<1.00)	3.71	0.015	0.0	0.000
	Average			3.62	0.025		3.62	0.025	0.0	0.000
Calcium (mg/L)	4-5 Dec 06	0700-0700	17.3	3.57	514.798	17.9	3.57	532.652	-3.5	-17.854
	5-6 Dec 06	0700-0700	18.3	3.58	546.082	19	3.58	566.970	-3.8	-20.888
	6-7 Dec 06	0700-0700	18.6	3.71	575.200	19.2	3.71	593.755	-3.2	-18.555
	Average			3.62	545.360		3.62	564.459	-3.5	-19.099
Chromium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	3.57	0.030	ND(<2.00)	3.57	0.030	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	3.58	0.030	ND(<2.00)	3.58	0.030	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<2.00)	3.71	0.031	ND(<2.00)	3.71	0.031	0.0	0.000
	Average			3.62	0.030		3.62	0.030	0.0	0.000
Copper (µg/L)	4-5 Dec 06	0700-0700	48.7	3.57	1.449	49.8	3.57	1.482	-2.3	-0.033
	5-6 Dec 06	0700-0700	53	3.58	1.582	52.7	3.58	1.573	0.6	0.009
	6-7 Dec 06	0700-0700	55.1	3.71	1.704	58.6	3.71	1.812	-6.4	-0.108
	Average			3.62	1.578		3.62	1.622	-2.7	-0.044
Iron (mg/L)	4-5 Dec 06	0700-0700	0.471	3.57	14.016	0.512	3.57	15.236	-8.7	-1.220
	5-6 Dec 06	0700-0700	0.42	3.58	12.533	0.459	3.58	13.697	-9.3	-1.164
	6-7 Dec 06	0700-0700	0.379	3.71	11.720	0.485	3.71	14.998	-28.0	-3.278
	Average			3.62	12.756		3.62	14.644	-15.3	-1.887
Lead (µg/L)	4-5 Dec 06	0700-0700	1.84	3.57	0.055	1.67	3.57	0.050	9.2	0.005
	5-6 Dec 06	0700-0700	1.58	3.58	0.047	2.29	3.58	0.068	-44.9	-0.021
	6-7 Dec 06	0700-0700	ND(<5.00)	3.71	0.077	ND(<5.00)	3.71	0.077	0.0	0.000
	Average			3.62	0.060		3.62	0.065	-11.9	-0.005
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.33	3.57	158.605	5.57	3.57	165.747	-4.5	-7.142
	5-6 Dec 06	0700-0700	5.54	3.58	165.316	5.74	3.58	171.285	-3.6	-5.968
	6-7 Dec 06	0700-0700	5.66	3.71	175.034	5.75	3.71	177.817	-1.6	-2.783
	Average			3.62	166.319		3.62	171.616	-3.2	-5.298
Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.200)	3.57	0.003	ND(<0.200)	3.57	0.003	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<0.200)	3.58	0.003	ND(<0.200)	3.58	0.003	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<0.200)	3.71	0.003	ND(<0.200)	3.71	0.003	0.0	0.000
	Average			3.62	0.003		3.62	0.003	0.0	0.000
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	ND(<5.00)	3.57	0.074	9.61	3.57	0.286	-284.4	-0.212
	5-6 Dec 06	0700-0700	10.5	3.58	0.313	10.1	3.58	0.301	3.8	0.012
	6-7 Dec 06	0700-0700	16.7	3.71	0.516	15.4	3.71	0.476	7.8	0.040
	Average			3.62	0.301		3.62	0.355	-90.9	-0.053
Nickel (µg/L)	4-5 Dec 06	0700-0700	2.47	3.57	0.074	2.32	3.57	0.069	6.1	0.004
	5-6 Dec 06	0700-0700	2.41	3.58	0.072	3.87	3.58	0.115	-60.6	-0.044
	6-7 Dec 06	0700-0700	2.47	3.71	0.076	3.01	3.71	0.093	-21.9	-0.017
	Average			3.62	0.074		3.62	0.093	-25.5	-0.019
Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	3.57	0.015	ND(<1.00)	3.57	0.015	0.0	0.000
	5-6 Dec 06	0700-0700	1.04	3.58	0.031	ND(<1.00)	3.58	0.015	51.9	0.016
	6-7 Dec 06	0700-0700	ND(<2.00)	3.71	0.031	ND(<2.00)	3.71	0.031	0.0	0.000
	Average			3.62	0.026		3.62	0.020	17.3	0.005
Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	3.57	0.015	ND(<1.00)	3.57	0.015	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<1.00)	3.58	0.015	ND(<1.00)	3.58	0.015	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	3.71	0.015	ND(<1.00)	3.71	0.015	0.0	0.000
	Average			3.62	0.015		3.62	0.015	0.0	0.000
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.105	3.57	3.124	0.103	3.57	3.065	1.9	0.060
	5-6 Dec 06	0700-0700	0.121	3.58	3.611	0.114	3.58	3.402	5.8	0.209
	6-7 Dec 06	0700-0700	0.088	3.71	2.721	0.109	3.71	3.371	-23.9	-0.649
	Average			3.62	3.152		3.62	3.279	-5.4	-0.127

Table E-2. WWTP Unit Process Data (continued).

Analyte	Date	Time	Trickling Filter Influent (TFIN) Conc.	Trickling Filter Influent (TFIN) Flow (mgd)	Trickling Filter Influent (TFIN) Mass (lbs/day)	East Trickling Filter Effluent (TFIEF) Conc.	East Trickling Filter Effluent (TFIEF) Flow (mgd)	East Trickling Filter Effluent (TFIEF) Mass (lbs/day)	East Trickling Filter Rem.Effic. (%)	East Trickling Filter Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	41	1.78	610.02	141	1.78	208.30	65.9	401.72
	5-6 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	6-7 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	Average									
TSS (mg/L)	4-5 Dec 06	0700-0700	80	1.78	1190.28	44	1.78	654.66	45.0	535.63
	5-6 Dec 06	0700-0700	79	1.79	1178.70	45	1.79	671.41	43.0	507.29
	6-7 Dec 06	0700-0700	68	1.85	1051.44	34	1.85	525.72	50.0	525.72
	Average			1.81	1140.14		1.81	617.26	45.9	522.88
Ammonia (mg/L)	4-5 Dec 06	0700-0700	19	1.78	282.69	3.4	1.78	50.59	82.1	232.11
	5-6 Dec 06	0700-0700	19	1.79	283.48	5.3	1.79	79.08	72.1	204.41
	6-7 Dec 06	0700-0700	24	1.85	371.10	6.5	1.85	100.51	72.9	270.59
	Average			1.81	312.42		1.81	76.72	75.4	235.70
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	4	1.78	59.51	20	1.78	297.57	-400.0	-238.06
	5-6 Dec 06	0700-0700	4.8	1.79	71.62	23	1.79	343.17	-379.2	-271.55
	6-7 Dec 06	0700-0700	4.1	1.85	63.40	26	1.85	402.02	-534.1	-338.63
	Average			1.81	64.84		1.81	347.59	-436.0	-282.74
TKN (mg/L)	4-5 Dec 06	0700-0700	27	1.78	401.72	8.6	1.78	127.96	68.1	273.77
	5-6 Dec 06	[illegible]	30	1.79	447.61	9.5	1.79	141.74	68.3	305.87
	6-7 Dec 06	0700-0700	32	1.85	494.80	10	1.85	154.62	68.8	340.17
	Average			1.81	448.04		1.81	141.44	68.4	306.60
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	4.3	1.78	63.98	4.27	1.78	63.53	0.7	0.45
	5-6 Dec 06	0700-0700	4.9	1.79	73.11	4.85	1.79	72.36	1.0	0.75
	6-7 Dec 06	0700-0700	4.69	1.85	72.52	4.82	1.85	74.53	-2.8	-2.01
	Average			1.81	69.87		1.81	70.14	-0.4	-0.27
Grease and Oil (mg/L)	4-5 Dec 06	grab	12	1.78	178.54	ND(<6.00)	1.78	44.64	75.0	133.91
	5-6 Dec 06	grab	10.6	1.79	158.15	ND(<5.00)	1.79	37.30	76.4	120.85
	6-7 Dec 06	grab	ND(<5.00)	1.85	38.66	ND(<5.00)	1.85	38.66	0.0	0.00
	Average			1.81	125.12		1.81	40.20	67.9	84.92
TPH-Diesel Range (ppb)	4-Dec-06	grab	6500	1.78	96.71	1300	1.78	19.34	80.0	77.37
	5-Dec-06	grab	5800	1.79	86.54	2000	1.79	29.84	65.5	56.70
	6-Dec-06	grab	4500	1.85	69.58	1100J	1.85	17.01	75.6	52.57
	Average			1.81	84.28		1.81	22.06	73.8	62.21
TPH-Heavy Range (ppb)	4-Dec-06	grab	6400J	1.78	95.22	1900J	1.78	28.27	70.3	66.95
	5-Dec-06	grab	3700J	1.79	55.20	2500	1.79	37.30	32.4	17.90
	6-Dec-06	grab	3200J	1.85	49.48	2200J	1.85	34.02	31.3	15.46
	Average			1.81	66.64		1.81	33.20	50.2	33.44
Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.47	1.78	6.993	0.436	1.78	6.487	7.2	0.506
	5-6 Dec 06	0700-0700	0.414	1.79	6.177	0.459	1.79	6.848	-10.9	-0.671
	6-7 Dec 06	0700-0700	0.318	1.85	4.917	0.426	1.85	6.587	-34.0	-1.670
	Average			1.81	6.029		1.81	6.641	-10.1	-0.612
Arsenic (µg/L)	4-5 Dec 06	0700-0700	1.14	1.78	0.017	1.06	1.78	0.016	7.0	0.001
	5-6 Dec 06	0700-0700	1.17	1.79	0.017	1.15	1.79	0.017	1.7	0.000
	6-7 Dec 06	0700-0700	ND(<2.00)	1.85	0.015	ND(<2.00)	1.85	0.015	0.0	0.000
	Average			1.81	0.017		1.81	0.016	3.0	0.000
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	1.78	0.015	ND(<2.00)	1.78	0.015	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	1.79	0.015	ND(<2.00)	1.79	0.015	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	1.85	0.008	ND(<1.00)	1.85	0.008	0.0	0.000
	Average			1.81	0.013		1.81	0.013	0.0	0.000
Calcium (mg/L)	4-5 Dec 06	0700-0700	17.3	1.78	257.399	17.6	1.78	261.863	-1.7	-4.464
	5-6 Dec 06	0700-0700	18.3	1.79	273.041	18.8	1.79	280.501	-2.7	-7.460
	6-7 Dec 06	0700-0700	18.6	1.85	287.600	19.3	1.85	298.424	-3.8	-10.824
	Average			1.81	272.680		1.81	280.262	-2.8	-7.582
Chromium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	1.78	0.015	ND(<2.00)	1.78	0.015	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	1.79	0.015	ND(<2.00)	1.79	0.015	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<2.00)	1.85	0.015	ND(<2.00)	1.85	0.015	0.0	0.000
	Average			1.81	0.015		1.81	0.015	0.0	0.000
Copper (µg/L)	4-5 Dec 06	0700-0700	48.7	1.78	0.725	45.9	1.78	0.683	5.7	0.042
	5-6 Dec 06	0700-0700	53	1.79	0.791	55.9	1.79	0.834	-5.5	-0.043
	6-7 Dec 06	0700-0700	55.1	1.85	0.852	56.8	1.85	0.878	-3.1	-0.026
	Average			1.81	0.789		1.81	0.798	-1.2	-0.009
Iron (mg/L)	4-5 Dec 06	0700-0700	0.471	1.78	7.008	0.437	1.78	6.502	7.2	0.506
	5-6 Dec 06	0700-0700	0.42	1.79	6.267	0.465	1.79	6.938	-10.7	-0.671
	6-7 Dec 06	0700-0700	0.379	1.85	5.860	0.439	1.85	6.788	-15.8	-0.928
	Average			1.81	6.378		1.81	6.743	-5.7	-0.364
Lead (µg/L)	4-5 Dec 06	0700-0700	1.84	1.78	0.027	1.67	1.78	0.025	9.2	0.003
	5-6 Dec 06	0700-0700	1.58	1.79	0.024	2.05	1.79	0.031	-29.7	-0.007
	6-7 Dec 06	0700-0700	ND(<5.00)	1.85	0.039	ND(<5.00)	1.85	0.039	0.0	0.000
	Average			1.81	0.030		1.81	0.031	-5.0	-0.001
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.33	1.78	79.303	5.5	1.78	81.832	-3.2	-2.529
	5-6 Dec 06	0700-0700	5.54	1.79	82.658	5.67	1.79	84.598	-2.3	-1.940
	6-7 Dec 06	0700-0700	5.66	1.85	87.517	5.79	1.85	89.527	-2.3	-2.010
	Average			1.81	83.159		1.81	85.319	-2.6	-2.160
Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.200)	1.78	0.001	ND(<0.200)	1.78	0.001	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<0.200)	1.79	0.001	0.258	1.79	0.001	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<0.200)	1.85	0.002	ND(<0.200)	1.85	0.002	0.0	0.000
	Average			1.81	0.002		1.81	0.002	0.0	0.000
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	ND(<5.00)	1.78	0.037	8.59	1.78	0.128	-243.6	-0.091
	5-6 Dec 06	0700-0700	10.5	1.79	0.157	10.9	1.79	0.163	-3.8	-0.006
	6-7 Dec 06	0700-0700	16.7	1.85	0.258	15.3	1.85	0.237	8.4	0.022
	Average			1.81	0.151		1.81	0.176	-16.6	-0.025
Nickel (µg/L)	4-5 Dec 06	0700-0700	2.47	1.78	0.037	2.19	1.78	0.033	11.3	0.004
	5-6 Dec 06	0700-0700	2.41	1.79	0.036	2.56	1.79	0.038	-6.2	-0.002
	6-7 Dec 06	0700-0700	2.47	1.85	0.038	2.52	1.85	0.039	-2.0	-0.001
	Average			1.81	0.037		1.81	0.037	1.0	0.000
Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.78	0.007	ND(<1.00)	1.78	0.007	0.0	0.000
	5-6 Dec 06	0700-0700	1.04	1.79	0.016	ND(<1.00)	1.79	0.007	51.9	0.008
	6-7 Dec 06	0700-0700	ND(<2.00)	1.85	0.015	ND(<2.00)	1.85	0.015	0.0	0.000
	Average			1.81	0.013		1.81	0.010	21.0	0.003
Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.78	0.007	ND(<1.00)	1.78	0.007	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<1.00)	1.79	0.007	ND(<1.00)	1.79	0.007	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	1.85	0.008	ND(<1.00)	1.85	0.008	0.0	0.000
	Average			1.81	0.008		1.81	0.008	0.0	0.000
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.105	1.78	1.562	0.097	1.78	1.443	7.6	0.119
	5-6 Dec 06	0700-0700	0.121	1.79	1.805	0.109	1.79	1.626	9.9	0.179
	6-7 Dec 06	0700-0700	0.088	1.85	1.361	0.104	1.85	1.608	-18.2	-0.247
	Average			1.81	1.576		1.81	1.559	1.1	0.017

Table E-2. WWTP Unit Process Data (continued).

Analyte	Date	Time	Trickling Filter Influent (TFIN) Conc.	Trickling Filter Influent (TFIN) Flow (mgd)	Trickling Filter Influent (TFIN) Mass (lbs/day)	West Trickling Filter Effluent (TF2EF) Conc.	West Trickling Filter (TF2EF) Flow (mgd)	West Trickling Filter (TF2EF) Mass (lbs/day)	West Trickling Filter Rem. Effic. (%)	West Trickling Filter Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	41	1.78	610.02	8.90	1.78	132.42	78.3	477.60
	5-6 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	6-7 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	Average									
TSS (mg/L)	4-5 Dec 06	0700-0700	80	1.78	1190.28	41.00	1.78	610.02	48.8	580.26
	5-6 Dec 06	0700-0700	79	1.79	1178.70	50.00	1.79	746.01	36.7	432.69
	6-7 Dec 06	0700-0700	68	1.85	1051.44	48.00	1.85	742.19	29.4	309.25
	Average			1.81	1140.14		1.81	699.41	38.7	440.73
Ammonia (mg/L)	4-5 Dec 06	0700-0700	19	1.78	282.69	4.00	1.78	59.51	78.9	223.18
	5-6 Dec 06	0700-0700	19	1.79	283.48	6.70	1.79	99.97	64.7	183.52
	6-7 Dec 06	0700-0700	24	1.85	371.10	7.10	1.85	109.78	70.4	261.31
	Average			1.81	312.42		1.81	89.75	71.3	222.67
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	4	1.78	59.51	18.00	1.78	267.81	-350.0	-208.30
	5-6 Dec 06	0700-0700	4.8	1.79	71.62	25.00	1.79	373.01	-420.8	-301.39
	6-7 Dec 06	0700-0700	4.1	1.85	63.40	25.00	1.85	386.56	-509.8	-323.16
	Average			1.81	64.84		1.81	342.46	-428.1	-277.62
TKN (mg/L)	4-5 Dec 06	0700-0700	27	1.78	401.72	8.70	1.78	129.44	67.8	272.28
	5-6 Dec 06	0700-0700	30	1.79	447.61	11.00	1.79	164.12	63.3	283.48
	6-7 Dec 06	0700-0700	32	1.85	494.80	12.00	1.85	185.55	62.5	309.25
	Average			1.81	448.04		1.81	159.70	64.4	288.34
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	4.3	1.78	63.98	4.28	1.78	63.68	0.5	0.30
	5-6 Dec 06	0700-0700	4.9	1.79	73.11	4.98	1.79	74.30	-1.6	-1.19
	6-7 Dec 06	0700-0700	4.69	1.85	72.52	4.83	1.85	74.68	-3.0	-2.16
	Average			1.81	69.87		1.81	70.89	-1.5	-1.02
Grease and Oil (mg/L)	4-5 Dec 06	grab	12	1.78	178.54	ND(<6.00)	1.78	44.64	75.0	133.91
	5-6 Dec 06	grab	10.6	1.79	158.15	ND(<5.00)	1.79	37.30	76.4	120.85
	6-7 Dec 06	grab	ND(<5.00)	1.85	38.66	ND(<5.00)	1.85	38.66	0.0	0.00
	Average			1.81	125.12		1.81	40.20	67.9	84.92
TPH-Diesel Range (ppb)	4-Dec-06	grab	6500	1.78	96.71	1800	1.78	26.78	72.3	69.93
	5-Dec-06	grab	5800	1.79	86.54	2100	1.79	31.33	63.8	55.20
	6-Dec-06	grab	4500	1.85	69.58	1300	1.85	20.10	71.1	49.48
	Average			1.81	84.28		1.81	26.07	69.1	58.20
TPH-Heavy Range (ppb)	4-Dec-06	grab	6400J	1.78	95.22	2600J	1.78	38.68	59.4	56.54
	5-Dec-06	grab	3700J	1.79	55.20	2800	1.79	41.78	24.3	13.43
	6-Dec-06	grab	3200J	1.85	49.48	2400J	1.85	37.11	25.0	12.37
	Average			1.81	66.64		1.81	39.19	41.2	27.45
Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.47	1.78	6.993	[illegible]	[illegible]	[illegible]	10.2	0.714
	5-6 Dec 06	0700-0700	0.414	1.79	6.177	0.464	1.79	6.923	-12.1	-0.746
	6-7 Dec 06	0700-0700	0.318	1.85	4.917	0.427	1.85	6.602	-34.3	-1.685
	Average			1.81	6.029		1.81	6.601	-9.5	-0.572
Arsenic (µg/L)	4-5 Dec 06	0700-0700	1.14	1.78	0.017	1.02	1.78	0.015	10.5	0.002
	5-6 Dec 06	0700-0700	1.17	1.79	0.017	1.21	1.79	0.018	-3.4	-0.001
	6-7 Dec 06	0700-0700	ND(<2.00)	1.85	0.015	ND(<2.00)	1.85	0.015	0.0	0.000
	Average			1.81	0.017		1.81	0.016	2.4	0.000
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	1.78	0.015	ND(<2.00)	1.78	0.015	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	1.79	0.015	ND(<2.00)	1.79	0.015	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	1.85	0.008	ND(<1.00)	1.85	0.008	0.0	0.000
	Average			1.81	0.013		1.81	0.013	0.0	0.000
Calcium (mg/L)	4-5 Dec 06	0700-0700	17.3	1.78	257.399	17.4	1.78	258.887	-0.6	-1.488
	5-6 Dec 06	0700-0700	18.3	1.79	273.041	18.7	1.79	279.009	-2.2	-5.968
	6-7 Dec 06	0700-0700	18.6	1.85	287.600	18.8	1.85	290.692	-1.1	-3.092
	Average			1.81	272.680		1.81	276.196	-1.3	-3.516
Chromium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	1.78	0.015	ND(<2.00)	1.78	0.015	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	1.79	0.015	ND(<2.00)	1.79	0.015	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<2.00)	1.85	0.015	ND(<2.00)	1.85	0.015	0.0	0.000
	Average			1.81	0.015		1.81	0.015	0.0	0.000
Copper (µg/L)	4-5 Dec 06	0700-0700	48.7	1.78	0.725	44.7	1.78	0.665	8.2	0.060
	5-6 Dec 06	0700-0700	53	1.79	0.791	55.7	1.79	0.831	-5.1	-0.040
	6-7 Dec 06	0700-0700	55.1	1.85	0.852	54.1	1.85	0.837	1.8	0.015
	Average			1.81	0.789		1.81	0.778	1.5	0.012
Iron (mg/L)	4-5 Dec 06	0700-0700	0.471	1.78	7.008	0.445	1.78	6.621	5.5	0.387
	5-6 Dec 06	0700-0700	0.42	1.79	6.267	0.463	1.79	6.908	-10.2	-0.642
	6-7 Dec 06	0700-0700	0.379	1.85	5.860	0.419	1.85	6.479	-10.6	-0.618
	Average			1.81	6.378		1.81	6.669	-4.6	-0.291
Lead (µg/L)	4-5 Dec 06	0700-0700	1.84	1.78	0.027	2.04	1.78	0.030	-10.9	-0.003
	5-6 Dec 06	0700-0700	1.58	1.79	0.024	1.91	1.79	0.028	-20.9	-0.005
	6-7 Dec 06	0700-0700	ND(<5.00)	1.85	0.039	ND(<5.00)	1.85	0.039	0.0	0.000
	Average			1.81	0.030		1.81	0.033	-8.8	-0.003
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.33	1.78	79.303	5.53	1.78	82.278	-3.8	-2.976
	5-6 Dec 06	0700-0700	5.54	1.79	82.658	5.67	1.79	84.598	-2.3	-1.940
	6-7 Dec 06	0700-0700	5.66	1.85	87.517	5.6	1.85	86.589	1.1	0.928
	Average			1.81	83.159		1.81	84.489	-1.6	-1.329
Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.200)	1.78	0.001	ND(<0.200)	1.78	0.001	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<0.200)	1.79	0.001	ND(<0.200)	1.79	0.001	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<0.200)	1.85	0.002	ND(<0.200)	1.85	0.002	0.0	0.000
	Average			1.81	0.002		1.81	0.002	0.0	0.000
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	ND(<5.00)	1.78	0.037	9.45	1.78	0.141	-278.0	-0.103
	5-6 Dec 06	0700-0700	10.5	1.79	0.157	10.8	1.79	0.161	-2.9	-0.004
	6-7 Dec 06	0700-0700	16.7	1.85	0.258	14.3	1.85	0.221	14.4	0.037
	Average			1.81	0.151		1.81	0.174	-15.7	-0.024
Nickel (µg/L)	4-5 Dec 06	0700-0700	2.47	1.78	0.037	2.54	1.78	0.038	-2.8	-0.001
	5-6 Dec 06	0700-0700	2.41	1.79	0.036	3.18	1.79	0.047	-32.0	-0.011
	6-7 Dec 06	0700-0700	2.47	1.85	0.038	2.81	1.85	0.043	-13.8	-0.005
	Average			1.81	0.037		1.81	0.043	-16.0	-0.006
Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.78	0.007	ND(<1.00)	1.78	0.007	0.0	0.000
	5-6 Dec 06	0700-0700	1.04	1.79	0.016	ND(<1.00)	1.79	0.007	51.9	0.008
	6-7 Dec 06	0700-0700	ND(<2.00)	1.85	0.015	ND(<2.00)	1.85	0.015	0.0	0.000
	Average			1.81	0.013		1.81	0.010	21.0	0.003
Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	1.78	0.007	ND(<1.00)	1.78	0.007	0.0	0.000
	5-6 Dec 06	0700-0700	ND(<1.00)	1.79	0.007	ND(<1.00)	1.79	0.007	0.0	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	1.85	0.008	ND(<1.00)	1.85	0.008	0.0	0.000
	Average			1.81	0.008		1.81	0.008	0.0	0.000
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.105	1.78	1.562	0.093	1.78	1.384	11.4	0.179
	5-6 Dec 06	0700-0700	0.121	1.79	1.805	0.109	1.79	1.626	9.9	0.179
	6-7 Dec 06	0700-0700	0.088	1.85	1.361	0.103	1.85	1.593	-17.0	-0.232
	Average			1.81	1.576		1.81	1.534	2.7	0.042

Table E-2. WWTP Unit Process Data (continued).

Analyte	Date	Time	Secondary Clarifier Influent (2CLIN) Conc.	Secondary Clarifier Influent (2CLIN) Flow (mgd)	Secondary Clarifier Influent (2CLIN) Mass (lbs/day)	Secondary Clarifier Effluent (2CLEF) Conc.	Secondary Clarifier Effluent (2CLEF) Flow (mgd)	Secondary Clarifier Effluent (2CLEF) Mass (lbs/day)	Secondary Clarifier Rem. Effic. (%)	Secondary Clarifier Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	15	2.87	358.41	9.3	2.45	190.18	46.9	168.23
	5-6 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	6-7 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	Average									
TSS (mg/L)	4-5 Dec 06	0700-0700	45	2.87	1075.23	22	2.45	449.89	58.2	625.34
	5-6 Dec 06	0700-0700	49	2.88	1174.90	24	2.46	492.79	58.1	682.10
	6-7 Dec 06	0700-0700	67.5% removal by combined secondary clarifier/CCC							
	Average			2.87	1125.07		2.46	471.34	58.1	653.72
Ammonia (mg/L)	4-5 Dec 06	0700-0700	4.1	2.87	97.97	3.4	2.45	69.53	29.0	28.44
	5-6 Dec 06	0700-0700	6.3	2.88	151.06	4.8	2.46	98.56	34.8	52.50
	6-7 Dec 06	0700-0700	7.4	3.01	185.46	6.2	2.59	134.03	27.7	51.43
	Average			2.92	144.83		2.50	100.70	30.5	44.12
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	19	2.87	453.99	21	2.45	429.44	5.4	24.54
	5-6 Dec 06	0700-0700	23	2.88	551.48	20	2.46	410.66	25.5	140.82
	6-7 Dec 06	0700-0700	28	3.01	701.73	26	2.59	562.05	19.9	139.68
	Average			2.92	569.07		2.50	467.38	17.9	101.68
TKN (mg/L)	4-5 Dec 06	0700-0700	8.9	2.87	212.66	5.8	2.45	118.61	44.2	94.05
	5-6 Dec 06	0700-0700	11	2.88	263.75	8.3	2.46	170.42	35.4	93.33
	6-7 Dec 06	0700-0700	11	3.01	275.68	9.4	2.59	203.30	26.3	72.48
	Average			2.92	250.70		2.50	164.08	34.6	86.62
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	4.35	2.87	103.94	N/A			26.6	27.66
	5-6 Dec 06	0700-0700	4.93	2.88	118.21	4.46	2.46	91.58	22.5	26.63
	6-7 Dec 06	0700-0700	4.97	3.01	124.56	4.55	2.59	98.36	21.0	26.20
	Average			2.92	115.57		2.50	88.74	23.2	26.83
Grease and Oil (mg/L)	4-5 Dec 06	grab	ND(<5.30)	2.87	63.32	ND(<5.50	2.45	56.24	11.2	7.08
	5-6 Dec 06	grab	ND(<5.00)	2.88	59.94	ND(<5.00)	2.46	51.33	14.4	8.61
	6-7 Dec 06	grab	ND(<5.00)	3.01	62.65	ND(<5.70)	2.59	61.61	1.7	1.05
	Average			2.92	61.97		2.50	56.39	9.0	5.58
TPH-Diesel Range (ppb)	4-Dec-06	grab	1500	2.87	35.84	1200	2.45	24.54	31.5	11.30
	5-Dec-06	grab	1500	2.88	35.97	790	2.46	16.22	54.9	19.75
	6-Dec-06	grab	1100J	3.01	27.57	560J	2.59	12.11	56.1	15.46
	Average			2.92	33.13		2.50	17.62	46.8	15.50
TPH-Heavy Range (ppb)	4-Dec-06	grab	2200J	2.87	52.57	1600	2.45	32.72	37.8	19.85
	5-Dec-06	grab	2300J	2.88	55.15	1700J	2.46	34.91	36.7	20.24
	6-Dec-06	grab	2300J	3.01	57.64	1600J	2.59	34.59	40.0	23.05
	Average			2.92	55.12		2.50	34.07	38.2	21.05
Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.482	2.87	11.517	0.27	2.45	5.521	52.1	5.996
	5-6 Dec 06	0700-0700	0.474	2.88	11.365	0.261	2.46	5.359	52.8	6.006
	6-7 Dec 06	0700-0700	0.461	3.01	11.553	0.228	2.59	4.929	57.3	6.625
	Average			2.92	11.479		2.50	5.270	54.1	6.209
Arsenic (µg/L)	4-5 Dec 06	0700-0700	1.16	2.87	0.028	1.09	2.45	0.022	19.6	0.005
	5-6 Dec 06	0700-0700	1.23	2.88	0.029	1	2.46	0.021	30.4	0.009
	6-7 Dec 06	0700-0700	ND(<2.00)	3.01		ND(<2.00)	2.59			
	Average			2.92	0.029		2.50	0.021	25.1	0.007
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	2.87	0.024	ND(<2.00)	2.45	0.020	14.4	0.003
	5-6 Dec 06	0700-0700	ND(<2.00)	2.88	0.024	ND(<2.00)	2.46	0.021	14.4	0.003
	6-7 Dec 06	0700-0700	ND(<1.00)	3.01	0.013	ND(<1.00)	2.59	0.011	13.7	0.002
	Average			2.92	0.020		2.50	0.017	14.3	0.003
Calcium (mg/L)	4-5 Dec 06	0700-0700	17.9	2.87	427.704	17	2.45	347.645	18.7	80.060
	5-6 Dec 06	0700-0700	19	2.88	455.573	18	2.46	369.595	18.9	85.977
	6-7 Dec 06	0700-0700	19.2	3.01	481.185	18.1	2.59	391.273	18.7	89.912
	Average			2.92	454.821		2.50	369.504	18.8	85.316
Chromium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	2.87	0.024	ND(<2.00)	2.45	0.020	14.4	0.003
	5-6 Dec 06	0700-0700	ND(<2.00)	2.88	0.024	ND(<2.00)	2.46	0.021	14.4	0.003
	6-7 Dec 06	0700-0700	ND(<2.00)	3.01	0.025	ND(<2.00)	2.59	0.022	13.7	0.003
	Average			2.92	0.024		2.50	0.021	14.2	0.003
Copper (µg/L)	4-5 Dec 06	0700-0700	49.8	2.87	1.190	35.7	2.45	0.730	38.6	0.460
	5-6 Dec 06	0700-0700	52.7	2.88	1.264	35.9	2.46	0.737	41.7	0.526
	6-7 Dec 06	0700-0700	58.6	3.01	1.469	37.6	2.59	0.813	44.7	0.656
	Average			2.92	1.307		2.50	0.760	41.9	0.547
Iron (mg/L)	4-5 Dec 06	0700-0700	0.512	2.87	12.234	0.333	2.45	6.810	44.3	5.424
	5-6 Dec 06	0700-0700	0.459	2.88	11.006	0.279	2.46	5.729	47.9	5.277
	6-7 Dec 06	0700-0700	0.485	3.01	12.155	0.265	2.59	5.729	52.9	6.426
	Average			2.92	11.798		2.50	6.089	48.4	5.709
Lead (µg/L)	4-5 Dec 06	0700-0700	1.67	2.87	0.040	1.14	2.45	0.023	41.6	0.017
	5-6 Dec 06	0700-0700	2.29	2.88	0.055	1.1	2.46	0.023	58.9	0.032
	6-7 Dec 06	0700-0700	ND(<5.00)	3.01		ND(<5.00)	2.59			
	Average			2.92	0.047		2.50	0.023	51.6	0.024
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.57	2.87	133.090	5.33	2.45	108.997	18.1	24.093
	5-6 Dec 06	0700-0700	5.74	2.88	137.631	5.49	2.46	112.727	18.1	24.904
	6-7 Dec 06	0700-0700	5.75	3.01	144.105	5.47	2.59	118.247	17.9	25.858
	Average			2.92	138.275		2.50	113.323	18.0	24.952
Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.200)	2.87	0.002	ND(<0.200)	2.45	0.002	14.4	0.000
	5-6 Dec 06	0700-0700	ND(<0.200)	2.88	0.002	ND(<0.200)	2.46	0.002	14.4	0.000
	6-7 Dec 06	0700-0700	ND(<0.200)	3.01	0.003	ND(<0.200)	2.59	0.002	13.7	0.000
	Average			2.92	0.002		2.50	0.002	14.2	0.000
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	N/A			6.28	2.45	0.128	44.1	0.101
	5-6 Dec 06	0700-0700	10.1	2.88	0.242	9.66	2.46	0.198	18.1	0.044
	6-7 Dec 06	0700-0700	15.4	3.01	0.386	12.2	2.59	0.264	31.7	0.122
	Average			2.92	0.286		2.50	0.197	31.2	0.089
Nickel (µg/L)	4-5 Dec 06	0700-0700	2.32	2.87	0.055	2.24	2.45	0.046	17.4	0.010
	5-6 Dec 06	0700-0700	3.87	2.88	0.093	ND(<2.00)	2.46	0.021	77.9	0.072
	6-7 Dec 06	0700-0700	3.01	3.01	0.075	2.15	2.59	0.046	38.4	0.029
	Average			2.92	0.075		2.50	0.038	49.6	0.037
Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	2.87	0.012	ND(<1.00)	2.45	0.010	14.4	0.002
	5-6 Dec 06	0700-0700	ND(<1.00)	2.88	0.012	ND(<1.00)	2.46	0.010	14.4	0.002
	6-7 Dec 06	0700-0700	ND(<2.00)	3.01	0.025	ND(<2.00)	2.59	0.022	13.7	0.003
	Average			2.92	0.016		2.50	0.014	14.1	0.002
Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	2.87	0.012	ND(<1.00)	2.45	0.010	14.4	0.002
	5-6 Dec 06	0700-0700	ND(<1.00)	2.88	0.012	ND(<1.00)	2.46	0.010	14.4	0.002
	6-7 Dec 06	0700-0700	ND(<1.00)	3.01	0.013	ND(<1.00)	2.59	0.011	13.7	0.002
	Average			2.92	0.012		2.50	0.010	14.2	0.002
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.103	2.87	2.461	0.074	2.45	1.513	38.5	0.948
	5-6 Dec 06	0700-0700	0.114	2.88	2.733	0.076	2.46	1.561	42.9	1.173
	6-7 Dec 06	0700-0700	0.109	3.01	2.732	0.078	2.59	1.686	38.3	1.046
	Average			2.92	2.642		2.50	1.587	39.9	1.055

* Secondary clarifier removal efficiency calculated with the WWTP effluent conc. on day 1 was ~46.9% mass removed 168.2 lbs/day; assume zero removal in CCC.

Table E-2. WWTP Unit Process Data (continued).

Analyte	Date	Time	Chlorine Contact Influent (CCCIN) Conc.	Chlorine Contact Influent (CCCIN) Flow (mgd)	Chlorine Contact Influent (CCCIN) Mass (lbs/day)	WWTP Effluent (TPEF) Conc.	WWTP Effluent (TPEF) Flow (mgd)	WWTP Effluent (TPEF) Mass (lbs/day)	Chlorine Contact (CCC) Rem.Effic. %	Chlorine Contact (CCC) Mass Removed (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	3.83	2.45	*	9.3	2.45	*	Assume 0*	Assume 0*
	5-6 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	6-7 Dec 06	0700-0700	Data discarded due to unsatisfactory laboratory QA/QC findings							
	Average									
TSS (mg/L)	4-5 Dec 06	0700-0700	22	2.45	449.89	20	2.45	408.66	9.2	41.23
	5-6 Dec 06	0700-0700	24	2.46	492.79	24.7	2.46	506.76	-2.8	-13.96
	6-7 Dec 06	0700-0700	67.5% removal by combined secondary clarifier/CCC							
	Average			2.46	471.34		2.46	457.71	2.9	13.64
Ammonia (mg/L)	4-5 Dec 06	0700-0700	3.4	2.45	69.53	3.5	2.45	71.52	-2.9	-1.99
	5-6 Dec 06	0700-0700	4.8	2.46	98.56	4.5	2.46	92.32	6.3	6.23
	6-7 Dec 06	0700-0700	6.2	2.59	134.03	5.8	2.59	125.28	6.5	8.74
	Average			2.50	100.70		2.50	96.37	4.3	4.33
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	21	2.45	429.44	20	2.45	408.66	4.8	20.78
	5-6 Dec 06	0700-0700	20	2.46	410.66	21	2.46	430.84	-4.9	-20.18
	6-7 Dec 06	0700-0700	26	2.59	562.05	24	2.59	518.41	7.8	43.63
	Average			2.50	467.38		2.50	452.64	3.2	14.75
TKN (mg/L)	4-5 Dec 06	0700-0700	5.8	2.45	118.61	6.7	2.45	136.90	-15.4	-18.29
	5-6 Dec 06	0700-0700	8.3	2.46	170.42	8.1	2.46	166.18	2.5	4.24
	6-7 Dec 06	0700-0700	9.4	2.59	203.20	8.8	2.59	190.09	6.5	13.12
	Average			2.50	164.08		2.50	164.39	-0.2	-0.31
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	3.73	2.45	76.28	3.72	2.45	76.01	0.3	0.27
	5-6 Dec 06	0700-0700	4.46	2.46	91.58	4.34	2.46	89.04	2.8	2.54
	6-7 Dec 06	0700-0700	4.55	2.59	98.36	4.54	2.59	98.07	0.3	0.29
	Average			2.50	88.74		2.50	87.71	1.2	1.03
Grease and Oil (mg/L)	4-5 Dec 06	grab	ND(<5.50	2.45	56.24	ND(<5.30)	2.45	54.15	3.7	2.09
	5-6 Dec 06	grab	ND(<5.00)	2.46	51.33	ND(<5.00)	2.46	51.29	0.1	0.04
	6-7 Dec 06	grab	ND(<5.70)	2.59	61.61	ND(<5.10)	2.59	55.08	10.6	6.53
	Average			2.50	56.39		2.50	53.51	5.1	2.89
TPH-Diesel Range (ppb)	4-Dec-06	grab	1200	2.45	24.54	690	2.45	14.10	42.5	10.44
	5-Dec-06	grab	790	2.46	16.22	830	2.46	17.03	-5.0	-0.81
	6-Dec-06	grab	560J	2.59	12.11	4000	2.59	86.40	-613.7	-74.30
	Average			2.50	17.62		2.50	39.18	-122.3	-21.55
TPH-Heavy Range (ppb)	4-Dec-06	grab	[illegible]			[illegible]			0.1	0.03
	5-Dec-06	grab	1700J	2.46	34.91	1600	2.46	32.83	6.0	2.08
	6-Dec-06	grab	1600J	2.59	34.59	6900	2.59	149.04	-330.9	-114.46
	Average			2.50	34.07		2.50	71.52	-109.9	-37.45
Aluminum (mg/L)	4-5 Dec 06	0700-0700	0.27	2.45	5.521	0.243	2.45	4.965	10.1	0.556
	5-6 Dec 06	0700-0700	0.261	2.46	5.359	0.252	2.46	5.170	3.5	0.189
	6-7 Dec 06	0700-0700	0.228	2.59	4.929	0.246	2.59	5.314	-7.8	-0.385
	Average			2.50	5.270		2.50	5.150	2.3	0.120
Arsenic (µg/L)	4-5 Dec 06	0700-0700	1.09	2.45	0.022	1.03	2.45	0.021	5.6	0.001
	5-6 Dec 06	0700-0700	1	2.46	0.021	1.17	2.46	0.024	-16.9	-0.003
	6-7 Dec 06	0700-0700	ND(<2.00)	2.59	0.022	ND(<2.00)	2.59	0.022	0.1	0.000
	Average			2.50	0.021		2.50	0.022	-3.4	-0.001
Cadmium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	2.45	0.020	ND(<2.00)	2.45	0.020	0.1	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	2.46	0.021	ND(<2.00)	2.46	0.021	0.1	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	2.59	0.011	ND(<1.00)	2.59	0.011	0.1	0.000
	Average			2.50	0.017		2.50	0.017	0.1	0.000
Calcium (mg/L)	4-5 Dec 06	0700-0700	17	2.45	347.645	16.6	2.45	339.188	2.4	8.457
	5-6 Dec 06	0700-0700	18	2.46	369.595	18.4	2.46	377.502	-2.1	-7.906
	6-7 Dec 06	0700-0700	18.1	2.59	391.273	18.9	2.59	408.251	-4.3	-16.979
	Average			2.50	369.504		2.50	374.980	-1.5	-5.476
Chromium (µg/L)	4-5 Dec 06	0700-0700	ND(<2.00)	2.45	0.020	ND(<2.00)	2.45	0.020	0.1	0.000
	5-6 Dec 06	0700-0700	ND(<2.00)	2.46	0.021	ND(<2.00)	2.46	0.021	0.1	0.000
	6-7 Dec 06	0700-0700	ND(<2.00)	2.59	0.022	ND(<2.00)	2.59	0.022	0.1	0.000
	Average			2.50	0.021		2.50	0.021	0.1	0.000
Copper (µg/L)	4-5 Dec 06	0700-0700	35.7	2.45	0.730	[illegible]			8.5	0.062
	5-6 Dec 06	0700-0700	35.9	2.46	0.737	36.7	2.46	0.753	-2.1	-0.016
	6-7 Dec 06	0700-0700	37.6	2.59	0.813	34.8	2.59	0.752	7.5	0.061
	Average			2.50	0.760		2.50	0.724	4.7	0.036
Iron (mg/L)	4-5 Dec 06	0700-0700	0.333	2.45	6.810	0.269	2.45	5.496	19.3	1.313
	5-6 Dec 06	0700-0700	0.279	2.46	5.729	0.258	2.46	5.293	7.6	0.435
	6-7 Dec 06	0700-0700	0.265	2.59	5.729	0.258	2.59	5.573	2.7	0.156
	Average			2.50	6.089		2.50	5.454	10.4	0.635
Lead (µg/L)	4-5 Dec 06	0700-0700	1.14	2.45	0.023	3.37	2.45	0.069	-195.4	-0.046
	5-6 Dec 06	0700-0700	1.1	2.46	0.023	1.05	2.46	0.022	4.6	0.001
	6-7 Dec 06	0700-0700	ND(<5.00)	2.59	0.054	ND(<5.00)	2.59	0.054	0.1	0.000
	Average			2.50	0.033		2.50	0.048	-44.5	-0.015
Magnesium (mg/L)	4-5 Dec 06	0700-0700	5.33	2.45	108.997	5.24	2.45	107.069	1.8	1.928
	5-6 Dec 06	0700-0700	5.49	2.46	112.727	5.64	2.46	115.712	-2.6	-2.986
	6-7 Dec 06	0700-0700	5.47	2.59	118.247	5.66	2.59	122.259	-3.4	-4.013
	Average			2.50	113.323		2.50	115.014	-1.5	-1.690
Mercury (µg/L)	4-5 Dec 06	0700-0700	ND(<0.200)	2.45	0.002	ND(<0.200)	2.45	0.002	0.1	0.000
	5-6 Dec 06	0700-0700	ND(<0.200)	2.46	0.002	ND(<0.200)	2.46	0.002	0.1	0.000
	6-7 Dec 06	0700-0700	ND(<0.200)	2.59	0.002	ND(<0.200)	2.59	0.002	0.1	0.000
	Average			2.50	0.002		2.50	0.002	0.1	0.000
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	6.28	2.45	0.128	5.67	2.45	0.116	9.8	0.013
	5-6 Dec 06	0700-0700	9.66	2.46	0.198	9.91	2.46	0.203	-2.5	-0.005
	6-7 Dec 06	0700-0700	12.2	2.59	0.264	10.8	2.59	0.233	11.5	0.030
	Average			2.50	0.197		2.50	0.184	6.4	0.013
Nickel (µg/L)	4-5 Dec 06	0700-0700	2.24	2.45	0.046	2.45	2.45	0.050	-9.3	-0.004
	5-6 Dec 06	0700-0700	ND(<2.00)	2.46	0.021	2.64	2.46	0.054	-163.8	-0.034
	6-7 Dec 06	0700-0700	2.15	2.59	0.046	ND(<2.00)	2.59	0.022	53.5	0.025
	Average			2.50	0.038		2.50	0.042	-11.5	-0.004
Selenium (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	2.45	0.010	ND(<1.00)	2.45	0.010	0.1	0.000
	5-6 Dec 06	0700-0700	ND(<1.00)	2.46	0.010	ND(<1.00)	2.46	0.010	0.1	0.000
	6-7 Dec 06	0700-0700	ND(<2.00)	2.59	0.022	ND(<2.00)	2.59	0.022	0.1	0.000
	Average			2.50	0.014		2.50	0.014	0.1	0.000
Silver (µg/L)	4-5 Dec 06	0700-0700	ND(<1.00)	2.45	0.010	ND(<1.00)	2.45	0.010	0.1	0.000
	5-6 Dec 06	0700-0700	ND(<1.00)	2.46	0.010	ND(<1.00)	2.46	0.010	0.1	0.000
	6-7 Dec 06	0700-0700	ND(<1.00)	2.59	0.011	ND(<1.00)	2.59	0.011	0.1	0.000
	Average			2.50	0.010		2.50	0.010	0.1	0.000
Zinc (mg/L)	4-5 Dec 06	0700-0700	0.074	2.45	1.513	0.07	2.45	1.430	5.5	0.083
	5-6 Dec 06	0700-0700	0.076	2.46	1.561	0.079	2.46	1.621	-3.9	-0.060
	6-7 Dec 06	0700-0700	0.078	2.59	1.686	0.112	2.59	2.419	-43.5	-0.733
	Average			2.50	1.587		2.50	1.823	-14.9	-0.237

* Secondary clarifier removal efficiency calculated with the WWTP effluent conc. (9.3 mg/L) on day 1 was ~46.9% mass removed 168.2 lbs/day; assume zero removal in CCC.

Table E-3. WWTP Unit Process Removal Efficiency Summary.

Analyte	Date	Time	Primary Clarifier Influent Mass	Primary Clarifier Removal Efficiency (%)	Primary Clarifier Mass Removed (lbs/day)	Trickling Filter Removal Efficiency (%)	Trickling Filter Mass Removed (lbs/day)	Secondary Clarifier Removal Efficiency (%)	Secondary Clarifier Mass Removed (lbs/day)	Chlorine Contact Removal Effic. (%)	Chlorine Contact CCC Mass Removed (lbs/day)	WWTP Effluent Mass (lbs/day)	Data Check (the below values in the left column should approximate those in the right column): Sum of Unit Process Mass Removed (lbs/day)	Data Check: Primary Clarifier Influent Mass Minus Effluent Mass (lbs/day)
BOD (mg/L)	4-5 Dec 06	0700-0700	2029.87	39.9	809.83	63.4	773.69	46.9	168.2	assume zero	assume zero	190.0	1751.7	1839.8
	5-6 Dec 06	0700-0700		Data discarded due to unsatisfactory laboratory QA/QC findings										
	6-7 Dec 06	0700-0700		Data discarded due to unsatisfactory laboratory QA/QC findings										
TSS (mg/L)	4-5 Dec 06	0700-0700	7587.06	68.6	5206.50	43.8	1041.50	58.2	625.34	9.2	41.23	408.66	6914.57	7178.40
	5-6 Dec 06	0700-0700	7339.20	67.9	4981.80	38.0	895.22	58.1	682.10	-2.8	-13.96	506.76	6545.16	6832.44
	6-7 Dec 06	0700-0700	6131.07	65.7	4028.19	-2.9	-61.85	67.5% removal by combined secondary clarifier/CCC				570.3	4969.0	5085.8
	Average		7019.11	67.5	4738.83	26.3	624.96	58.1	653.72	2.9	13.64	495.22	6031.14	6561.40
Ammonia (mg/L)	4-5 Dec 06	0700-0700	698.81	19.1	133.42	78.4	443.38	29.0	28.44	-2.9	-1.99	71.52	603.25	627.29
	5-6 Dec 06	0700-0700	767.28	26.1	200.31	66.8	378.97	34.8	52.50	6.3	6.23	92.32	638.02	674.96
	6-7 Dec 06	0700-0700	826.66	10.2	84.47	69.2	513.35	27.7	51.43	6.5	8.74	125.28	657.99	701.38
	Average		764.25	18.2	139.40	71.5	445.24	30.5	44.12	4.3	4.33	96.37	633.09	667.88
Nitrate/Nitrite (mg/L)	4-5 Dec 06	0700-0700	43.26	-175.1	-75.77	-375.0	-446.36	5.4	24.54	4.8	20.78	408.66	-476.80	-365.40
	5-6 Dec 06	0700-0700	116.76	-22.7	-26.47	-379.2	-543.10	25.5	140.82	-4.9	-20.18	430.84	-448.93	-314.08
	6-7 Dec 06	0700-0700	137.78	8.0	10.99	-582.9	-739.10	19.9	139.68	7.8	43.63	518.41	-544.80	-380.64
	Average		99.27	-30.6	-30.42	-445.7	-576.19	17.9	101.68	3.2	14.75	452.64	-490.18	-353.37
TKN (mg/L)	4-5 Dec 06	0700-0700	1098.13	26.8	294.69	67.0	538.60	44.2	94.05	-15.4	-18.29	136.90	909.05	961.23
	5-6 Dec 06	0700-0700	1267.68	29.4	372.46	63.3	566.97	35.4	93.33	2.5	4.24	166.18	1037.00	1101.50
	6-7 Dec 06	0700-0700	1343.32	26.3	353.73	65.6	649.42	26.3	72.48	6.5	13.12	190.09	1088.75	1153.24
	Average		1236.38	27.5	340.29	65.3	585.00	34.6	86.62	-0.2	-0.31	164.39	1011.60	1071.99
Total Phosphorus (mg/L)	4-5 Dec 06	0700-0700	205.32	37.7	77.36	-1.2	-1.49	26.6	27.66	0.3	0.27	76.01	103.80	129.31
	5-6 [illegible] 06	0700-0700	208.50	29.9	62.28	-0.6	-0.90	22.5	26.63	2.8	2.54	89.04	90.55	119.46
	6-7 Dec 06	0700-0700	215.28	32.6	70.24	-6.0	-8.66	21.0	26.20	0.3	0.29	98.07	88.07	117.21
	Average		209.70	33.4	69.96	-2.6	-3.68	23.2	26.83	1.2	1.03	87.71	94.14	121.99
Grease and Oil (mg/L)	4-5 Dec 06	grab	865.19	81.8	707.48	79.2	282.69	11.2	7.08	3.7	2.09	54.15	999.34	811.04
	5-6 Dec 06	grab	244.53	39.0	95.33	76.4	241.71	14.4	8.61	0.1	0.04	51.29	345.69	193.24
	6-7 Dec 06	grab	225.95	65.1	147.10	0.0	0.00	1.7	1.05	10.6	6.53	55.08	154.67	170.87
	Average		445.22	71.1	316.63	51.9	174.80	9.0	5.58	5.1	2.89	53.51	499.90	391.72
TPH-Diesel Range (ppb)	4-Dec-06	grab	1763.66	89.0	1570.24	76.9	148.79	31.5	11.30	42.5	10.44	14.10	1740.77	1749.56
	5-Dec-06	grab	467.04	62.9	293.96	74.1	128.31	54.9	19.75	-5.0	-0.81	17.03	441.22	450.01
	6-Dec-06	grab	447.77	68.9	308.61	75.6	105.14	56.1	15.46	-613.7	-74.30	86.40	354.92	361.37
	Average		892.82	81.1	724.27	75.5	127.41	46.8	15.50	-122.3	-21.55	39.18	845.64	853.65
TPH-Heavy Range (ppb)	4-Dec-06	grab	898.47	78.8	708.02	65.6	124.98	37.8	19.85	0.1	0.03	32.69	852.88	865.78
	5-Dec-06	grab	366.96	69.9	256.55	37.8	41.78	36.7	20.24	6.0	2.08	32.83	320.65	334.13
	6-Dec-06	grab	447.77	77.9	348.82	28.1	27.83	40.0	23.05	-330.9	-114.46	149.04	285.25	298.73
	Average		571.07	76.7	437.80	43.9	64.86	38.2	21.05	-109.9	-37.45	71.52	486.26	499.55
Aluminum (mg/L)	4-5 Dec 06	0700-0700	44.591	68.6	30.605	-2.6	-0.357	52.1	5.996	10.1	0.556	4.97	36.799	39.625
	5-6 Dec 06	0700-0700	48.706	74.6	36.352	-14.5	-1.790	52.8	6.006	3.5	0.189	5.17	40.756	43.535
	6-7 Dec 06	0700-0700	46.844	79.0	37.010	-45.0	-4.422	57.3	6.625	-7.8	-0.385	5.31	38.828	41.530
	Average		46.713	74.2	34.655	-20.7	-2.190	54.1	6.209	2.3	0.120	5.15	38.794	41.564
Arsenic (µg/L)	4-5 Dec 06	0700-0700	0.050	31.6	0.016	-1.8	-0.001	19.6	0.005	5.6	0.001	0.02	0.022	0.029
	5-6 Dec 06	0700-0700	0.058	39.9	0.023	-5.1	-0.002	30.4	0.009	-16.9	-0.003	0.02	0.027	0.034
	6-7 Dec 06	0700-0700	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.1	0.000	0.02	0.000	-0.022
	Average		0.054	36.0	0.019	-2.3	-0.001	25.1	0.007	-3.4	-0.001	0.02	0.025	0.032
Cadmium (µg/L)	4-5 Dec 06	0700-0700	0.033	10.6	0.004	0.0	0.000	14.4	0.003	0.1	0.000	0.02	0.007	0.013
	5-6 Dec 06	0700-0700	0.033	10.6	0.004	0.0	0.000	14.4	0.003	0.1	0.000	0.02	0.007	0.013
	6-7 Dec 06	0700-0700	0.048	67.7	0.032	0.0	0.000	13.7	0.002	0.1	0.000	0.01	0.034	0.037
	Average		0.038	34.5	0.013	0.0	0.000	14.3	0.003	0.1	0.000	0.02	0.016	0.021
Calcium (mg/L)	4-5 Dec 06	0700-0700	665.532	22.6	150.734	-3.5	-17.854	18.7	80.060	2.4	8.457	339.19	221.396	326.344
	5-6 Dec 06	0700-0700	697.224	21.7	151.142	-3.8	-20.888	18.9	85.977	-2.1	-7.906	377.50	208.325	319.722
	6-7 Dec 06	0700-0700	726.773	20.9	151.573	-3.2	-18.555	18.7	89.912	-4.3	-16.979	408.25	205.951	318.521
	Average		696.510	21.7	151.150	-3.5	-19.099	18.8	85.316	-1.5	-5.476	374.98	211.891	321.529
Chromium (µg/L)	4-5 Dec 06	0700-0700	0.090	67.0	0.060	0.0	0.000	14.4	0.003	0.1	0.000	0.02	0.064	0.070
	5-6 Dec 06	0700-0700	0.088	66.0	0.058	0.0	0.000	14.4	0.003	0.1	0.000	0.02	0.061	0.067
	6-7 Dec 06	0700-0700	0.097	68.2	0.066	0.0	0.000	13.7	0.003	0.1	0.000	0.02	0.070	0.076
	Average		0.092	67.1	0.062	0.0	0.000	14.2	0.003	0.1	0.000	0.02	0.065	0.071
Copper (µg/L)	4-5 Dec 06	0700-0700	3.328	56.5	1.878	-2.3	-0.033	38.6	0.460	8.5	0.062	0.67	2.368	2.660
	5-6 Dec 06	0700-0700	3.736	57.7	2.155	0.6	0.009	41.7	0.526	-2.1	-0.016	0.75	2.674	2.983
	6-7 Dec 06	0700-0700	3.720	54.2	2.016	-6.4	-0.108	44.7	0.656	7.5	0.061	0.75	2.625	2.968
	Average		3.595	56.1	2.016	-2.7	-0.044	41.9	0.547	4.7	0.036	0.72	2.556	2.870
Iron (mg/L)	4-5 Dec 06	0700-0700	34.608	59.5	20.592	-8.7	-1.220	44.3	5.424	19.3	1.313	5.50	26.109	29.111
	5-6 Dec 06	0700-0700	37.030	66.2	24.497	-9.3	-1.164	47.9	5.277	7.6	0.435	5.29	29.045	31.736
	6-7 Dec 06	0700-0700	42.022	72.1	30.301	-28.0	-3.278	52.9	6.426	2.7	0.156	5.57	33.605	36.449
	Average		37.886	66.3	25.130	-15.3	-1.887	48.4	5.709	10.4	0.635	5.45	29.587	32.432
Lead (µg/L)	4-5 Dec 06	0700-0700	0.202	72.9	0.148	9.2	0.005	41.6	0.017	-195.4	-0.046	0.07	0.124	0.133
	5-6 Dec 06	0700-0700	0.175	73.1	0.128	-44.9	-0.021	58.9	0.032	4.6	0.001	0.02	0.141	0.154
	6-7 Dec 06	0700-0700	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.1	0.000	0.05	0.000	-0.054
	Average		0.189	73.0	0.138	-11.9	-0.005	51.6	0.024	-44.5	-0.015	0.05	0.142	0.141
Magnesium (mg/L)	4-5 Dec 06	0700-0700	192.006	17.4	33.401	-4.5	-7.142	18.1	24.093	1.8	1.928	107.07	52.280	84.937
	5-6 Dec 06	0700-0700	196.824	16.0	31.508	-3.6	-5.968	18.1	24.904	-2.6	-2.986	115.71	47.458	81.112
	6-7 Dec 06	0700-0700	204.254	14.3	29.220	-1.6	-2.783	17.9	25.858	-3.4	-4.013	122.26	48.282	81.995
	Average		197.695	15.9	31.376	-3.2	-5.298	18.0	24.952	-1.5	-1.690	115.01	49.340	82.681
Mercury (µg/L)	4-5 Dec 06	0700-0700	0.009	67.8	0.006	0.0	0.000	14.4	0.000	0.1	0.000	0.0020	0.007	0.007
	5-6 Dec 06	0700-0700	0.023	87.2	0.020	0.0	0.000	14.4	0.000	0.1	0.000	0.0021	0.021	0.021
	6-7 Dec 06	0700-0700	0.018	83.0	0.015	0.0	0.000	13.7	0.000	0.1	0.000	0.0022	0.015	0.016
	Average		0.017	82.2	0.014	0.0	0.000	14.2	0.000	0.1	0.000	0.0021	0.014	0.015
Molybdenum (µg/L)	4-5 Dec 06	0700-0700	0.389	80.9	0.315	-284.4	-0.212	44.1	0.101	9.8	0.013	0.12	0.217	0.273
	5-6 Dec 06	0700-0700	0.374	16.1	0.060	3.8	0.012	18.1	0.044	-2.5	-0.005	0.20	0.111	0.170
	6-7 Dec 06	0700-0700	0.592	12.8	0.076	7.8	0.040	31.7	0.122	11.5	0.030	0.23	0.269	0.359
	Average		0.452	33.3	0.150	-90.9	-0.053	31.2	0.089	6.4	0.013	0.18	0.199	0.268
Nickel (µg/L)	4-5 Dec 06	0700-0700	0.149	50.8	0.0759	6.1	0.0045	17.4	0.0096	-9.3	-0.0043	0.05	0.086	0.099
	5-6 Dec 06	0700-0700	0.126	43.1	0.0545	-60.6	-0.0436	77.9	0.0723	-163.8	-0.0336	0.05	0.050	0.072
	6-7 Dec 06	0700-0700	0.128	40.2	0.0514	-21.9	-0.0167	38.4	0.0290	53.5	0.0249	0.02	0.089	0.106
	Average		0.135	45.0	0.0606	-25.5	-0.0186	49.6	0.0369	-11.5	-0.0043	0.04	0.075	0.093
Selenium (µg/L)	4-5 Dec 06	0700-0700	0.038	61.1	0.023	0.0	0.000	14.4	0.002	0.1	0.000	0.01	0.025	0.028
	5-6 Dec 06	0700-0700	0.046	33.1	0.015	51.9	0.016	14.4	0.002	0.1	0.000	0.01	0.033	0.036
	6-7 Dec 06	0700-0700	0.034	10.2	0.004	0.0	0.000	13.7	0.003	0.1	0.000	0.02	0.007	0.013
	Average		0.040	35.5	0.014	17.3	0.005	14.1	0.002	0.1	0.000	0.01	0.022	0.026
Silver (µg/L)	4-5 Dec 06	0700-0700	0.042	64.5	0.027	0.0	0.000	14.4	0.002	0.1	0.000	0.01	0.029	0.032
	5-6 Dec 06	0700-0700	0.040	62.4	0.025	0.0	0.000	14.4	0.002	0.1	0.000	0.01	0.027	0.029
	6-7 Dec 06	0700-0700	0.035	56.0	0.020	0.0	0.000	13.7	0.002	0.1	0.000	0.01	0.021	0.024
	Average		0.039	61.2	0.024	0.0	0.000	14.2	0.002	0.1	0.000	0.01	0.026	0.028
Zinc (mg/L)	4-5 Dec 06	0700-0700	8.086	61.4	4.962	1.9	0.060	38.5	0.948	5.5	0.083	1.43	6.052	6.656
	5-6 Dec 06	0700-0700	7.906	54.3	4.296	5.8	0.209	42.9	1.173	-3.9	-0.060	1.62	5.617	6.286
	6-7 Dec 06	0700-0700	7.647	64.4	4.925	-23.9	-0.649	38.3	1.046	-43.5	-0.733	2.42	4.588	5.227
	Average		7.880	60.0	4.728	-5.4	-0.127	39.9	1.055	-14.9	-0.237	1.82	5.419	6.056

* Secondary clarifier removal efficiency calculated with the WWTP effluent conc. (9.3 mg/L) on day 1 was ~42.7% mass removed 141.5 lbs/day; assume zero removal in CCC.

APPENDIX F

SOLO POINT WWTP DATA

Table F-1. 2004 Solo Point Data Summary.

2004		Flow (mgd)	Sludge Pumped (gal)	Influent BOD (mg/L)	BOD Primary Effluent (mg/L)	BOD Final Effluent (mg/L)	% Removal BOD	Influent TSS (mg/L)	Primary Effluent (mg/L)	Final Effluent (mg/L)	% Removal TSS	Fecal Coliform (col/100 ml)	Chlorine Residual	pH
Jan	Max.	4.6	33300	924	264	49	95	250	98	27	93	0.43		7.3
	Min.	2.49	3060	99	70	13	74	114	45	14	79	0.08		7.6
	Avg.	3.47	10277	223	130	25	89	185	66	20	89	0.21	<200	
Feb.	Max.	4.99	12870	203	126	20	92	381	81	30	96	0.39		6.9
	Min.	2.74	8010	78	48	12	74	95	33	9	76	0.03		6.6
	Avg.	3.86	10471	143	82	16	89	169	58	21	88	0.19	<200	
Mar	Max.	3.52	12150	223	107	24	94	218	83	27	97	0.23		7.2
	Min.	2.48	5130	69	30	8	83	117	32	5	84	0.05		6.4
	Avg.	3	8419	154	74	16	90	169	51	17	90	0.14	<200	
Apr	Max.	3.38	18000	291	165	29	94	360	93	27	95	0.41		7.4
	Min.	2.06	8010	102	41	14	83	38	22	10	74	0.07		5.3
	Avg.	2.91	11283	180	91	20	89	222	67	19	91	0.15	<200	
May	Max.	3.36	18000	330	195	24	95	446	149	31	96	0.4		6.9
	Min.	2.37	9000	120	72	11	86	105	40	14	80	0.04		6.1
	Avg.	2.84	11642	212	104	18	92	233	78	21	91	0.15	<200	
Jun	Max.	3.02	17100	375	150	24	95	450	200	31	96	0.23		7.0
	Min.	2.63	7200	126	66	12	86	154	40	17	84	0		6.3
	Avg.	2.84	12261	216	111	19	91	272	96	23	92	0.15	<200	
Jul	Max.	3.05	22500	477	141	29	96	816	101	29	98	0.23		6.9
	Min.	2.13	8100	124	78	9	85	203	40	11	86	0		6.5
	Avg.	2.82	14255	264	114	19	93	286	79	19	93	0.12	<200	
Aug	Max.	4	38700	300	126	23	96	381	94	26	96	0.26		7.1
	Min.	2.4	9000	102	48	8	86	187	15	11	86	0.03		6.6
	Avg.	2.96	17623	186	88	15	92	251	70	17	93	0.14	<200	
Sep	Max.	3.7	17100	285	114	31	95	366	76	22	98	0.39		7.2
	Min.	2.8	9000	93	53	8	0	157	34	8	86	0.1		6.8
	Avg.	3.21	12603	170	84	15	91	219	57	15	93	0.19	<200	
Oct	Max.	4	25200	320	129	30	97	330	135	16	97	0.41		7.2
	Min.	2.66	10800	99	71	10	75	102	43	7	85	0.1		6.7
	Avg.	3.12	13094	193	102	16	92	214	63	11	95	0.22	<200	
Nov	Max.	3.83	20700	288	141	25	97	319	86	25	95	0.3		6.9
	Min.	2.62	9000	54	42	7	84	166	48	12	88	0.07		6.5
	Avg.	3.14	11880	183	103	17	91	235	68	18	92	0.16	<200	
Dec	Max.	3.87	17100	309	159	33	94	348	91	30	96	0.27		7.0
	Min.	2.29	9000	45	54	9	56	168	40	13	87	0.07		6.5
	Avg.	3.07	11119	173	99	20	88	227	65	19	92	0.15	<200	
Average of Monthly Averages		3.10	11002	184	91	24	101	211	64	25	92	0.16		

Table F-2. 2005 Solo Point Data Summary.

2005		Flow (mgd)	Sludge Pumped (gal)	Influent BOD (mg/L)	BOD Primary Effluent (mg/L)	BOD Final Effluent (mg/L)	% Removal BOD	Influent TSS (mg/L)	Primary Effluent (mg/L)	Final Effluent (mg/L)	% Removal TSS	Fecal Coliform (col/100 ml)	Chlorine Residual	pH
Jan	Max.	4.29	18900	381	165	34	94	455	89	39	95		0.3	7.5
	Min.	2.52	8100	108	14	13	0	57	23	9	79		0.04	6.6
	Avg.	3.16	12861	188	109	23	88	216	63	20	91	<200	0.14	
Feb	Max.	3.86	18900	300	177	27	95	324	140	42	96		0.21	7.0
	Min.	2.46	9900	119	82	8	87	147	37	8	86		0.08	6.3
	Avg.	2.98	13243	203	126	16	92	244	74	19	92	<200	0.14	
Mar	Max.	4.09	20700	354	168	23	95	388	115	29	94		0.24	7.2
	Min.	2.48	12600	111	72	12	87	156	56	15	87		0	6.0
	Avg.	3.08	15823	197	117	16	92	243	79	21	91	<200	0.11	
Apr	Max.	4.78	30960	408	162	22	96	331	107	25	95		0.15	6.9
	Min.	2.28	11700	117	41	11	87	152	54	14	89		0.16	6.3
	Avg.	3.1	15402	209	113	16	92	237	78	19	92	<200	0.1	
May	Max.	3.87	24300	342	168	44	95	343	110	26	95		0.22	6.9
	Min.	2.25	16200	117	62	11	70	99	41	11	81		0.07	6.5
	Avg.	3.15	19074	174	101	18	90	220	79	19	91	<200	0.12	
Jun	Max.	3.58	27900	299	167	21	94	335	97	26	95		0.24	7.1
	Min.	1.64	16200	125	86	13	87	199	57	12	90		0.05	6.5
	Avg.	2.93	18780	200	116	18	91	254	73	17	93	<200	0.14	
Jul	Max.	3.54	31700	332	149	22	94	289	115	49	96		0.21	7.0
	Min.	1.73	12600	132	68	14	86	161	62	12	70		0.08	6.5
	Avg.	2.93	20825	185	115	18	90	231	81	18	92	<200	0.13	
Aug	Max.	3.7	29430	272	178	23	96	317	86	26	96		0.28	7.0
	Min.	2.16	17190	122	68	7	86	131	45	9	89		0.08	6.5
	Avg.	3.07	21137	179	105	15	92	240	68	13	95	<200	0.13	
Sep	Max.	3.9	24660	268	140	19	94	333	102	38	96		0.19	7.0
	Min.	1.93	11520	118	65	13	88	128	56	10	85		0.04	
	Avg.	3.07	20117	186	106	16	91	251	76	16	94	<200	0.1	6.5
Oct	Max.	4.23	24210	244	157	20	95	345	111	20	96		0.21	
	Min.	2.71	18000	140	70	12	88	187	52	12	91		0.04	7.0
	Avg.	3.34	20665	172	102	16	91	258	73	16	94	<200	0.1	6.4
Nov	Max.	4.41	29070	347	173	22	94	334	100	22	95		0.35	
	Min.	2.47	12600	123	0	14	87	165	53	14	90		0.05	6.9
	Avg.	3.44	21612	185	119	18	91	248	73	18	93	<200	0.13	6.3
Dec	Max.	4	27360	264	149	24	93	377	219	32	97		0.28	
	Min.	2.99	14130	84	56	10	84	144	57	8	85		0.01	6.8
	Avg.	3.48	19893	156	99	18	88	227	88	22	90	<200	0.12	6.0
Average of Monthly Averages		3.14	16578	180	104	24	105	224	71	25	92	<200	0.12	

Table F-3. 2006 Solo Point Data Summary.

2006		Flow (mgd)	Sludge Pumped (gal)	Influent BOD (mg/L)	BOD Primary Effluent (mg/L)	BOD Final Effluent (mg/L)	% Removal BOD	Influent TSS (mg/L)	Primary Effluent (mg/L)	Final Effluent (mg/L)	% Removal TSS	Fecal Coliform (col/100 ml)	Chlorine Residual	pH
Jan	Max	10.13	19080	199	124	27	92	368	101	26	96	0.34		7.1
	Min	3.48	14400	41	33	9	67	82	42	15	77	0.08		6.1
	Avg	6.84	17211	80	59	14	82	132	68	19	85	0.18	<200	
Feb	Max	11.67	19080	114	69	17	93	167	86	22	91	0.38		7.2
	Min	4.66	8370	31	25	4	58	62	30	6	76	0.2		6.5
	Avg	7.21	12064	67	45	10	85	107	54	15	86	0.29	<200	
Mar	Max	5.94	15390	204	136	33	91	230	92	23	92	0.36		6.9
	Min	3.28	9900	77	56	10	75	117	53	15	81	0.08		6.3
	Avg	4.62	12289	122	85	17	86	170	72	19	89	0.19	<200	
Apr	Max	4.09	61560	230	147	20	93	414	89	32	96	0.22		6.9
	Min	2.91	10800	57	4	4	84	134	52	17	84	0.04		5.9
	Avg	3.74	18981	140	86	15	89	202	75	22	89	0.1	<200	
May	Max	4.49	22320	280	147	22	94	351	108	28	96	0.17		6.4
	Min	2.59	9000	97	84	12	84	161	38	13	88	0.06		5.4
	Avg	3.43	15901	172	111	16	91	246	73	18	93	0.11	<200	
Jun	Max	4.06	27270	290	139	28	94	379	94	20	96	0.21		7.1
	Min	2.48	14400	62	68	16	68	131	35	12	89	0.02		6.6
	Avg	3.33	21160	171	99	20	88	244	68	16	93	0.13	<200	
Jul	Max	3.45	34020	338	221	30	95	302	168	24	97	0.31		7.3
	Min	2.55	13500	103	55	10	82	170	57	5	90	0.08		6.6
	Avg	3.03	19975	183	101	18	90	237	83	16	93	0.15	<200	
Aug	Max	3.08	23130	261	120	27	95	326	77	15	98	0.47		7.0
	Min	2.49	11160	109	51	7	85	184	33	7	93	0.08		6.3
	Avg	2.78	15137	164	81	14	91	250	61	10	96	0.19	<200	
Sep	Max	3.13	16740	247	98	20	94	287	197	15	98	0.21		7.1
	Min	2.4	11160	92	43	7	86	120	38	6	91	0.05		6.3
	Avg	2.75	13824	151	69	15	90	221	69	11	95	0.13	<200	
Oct	Max	3.3	15680	746	192	34	95	501	74	23	98	0.34		7.2
	Min	2.54	9270	118	54	9	80	127	35	7	89	0.09		6.4
	Avg	2.88	12267	185	87	19	90	224	58	13	94	0.19	<200	
Nov	Max	6.12	23200	330	193	40	95	474	122	25	96	0.8		7.2
	Min	1.81	10710	51	36	11	67	126	42	12	84	0.08		6.5
	Avg	3.96	18332	137	77	18	87	188	65	17	91	0.25	<200	
Dec	Max	7.27	16560	211	107	26	90	236	77	24	94	0.31		7.2
	Min	2.8	10530	47	28	12	68	49	16	9	74	0		6.7
	Avg	4.64	13819	110	56	17	85	148	49	17	89	0.18	<200	
Average of Monthly Averages		4.10	15913	140	80	16	88	197	66	16	91	0.17		

Table F-4. Solo Point WWTP Sludge Data (2006)

2006	Raw Sludge from Thickener		Secondary Digester Sludge to Drying Beds	
	%TS	%TVS	%TS	%TVS
Jan	3.81	84.40	none	none
	1.32	78.00		
	2.46	83.30		
	2.07	74.40		
Feb	1.92	84.40	5.18	68.06
	2.40	77.90		
	2.82	89.50		
	3.97	86.50		
Mar	4.32	87.00	4.49	67.62
	3.42	86.00		
	3.32	78.50		
	2.72	85.40		
	3.42	83.70		
Apr	3.85	87.60	4.84	67.47
	2.93	82.10		
	2.63	85.80		
	3.62	83.20		
May	2.90	84.40	none	none
	3.23	83.00		
	2.83	81.90		
	3.42	81.90		
	2.99	86.60		
Jun	3.47	76.10	4.93	66.88
	2.76	79.30		
	3.09	77.90		
	3.17	80.30		
Jul	3.09	78.80	5.03	67.1
	2.75	78.70		
	2.69	77.30		
Aug	2.96	79.60	4.87	68.29
	2.76	81.70		
	3.20	86.50		
	2.68	83.50		
Sep	2.42	82.50	4.43	65.87
	2.84	82.20		
	2.78	81.20		
	3.34	85.00		
Oct	2.67	81.60	4.68	68.29
	3.24	82.60		
	3.80	88.20		
	3.87	88.30		
Nov	3.86	83.90	4.33	66.58
	3.95	80.00		
	2.69	75.20		
	3.23	79.50		
Dec	3.37	82.30	4.42	67.23
	3.35	81.10		
	4.21	74.90		
	2.80	86.60		
	3.55	77.40		
Average	3.10	82.15	4.72	67.34

APPENDIX G

WWTP PHOTOS

Photo 1. 36-inch influent sewer line (view from manhole)

Photo 2. View of headworks (preliminary treatment including screening and grit removal)

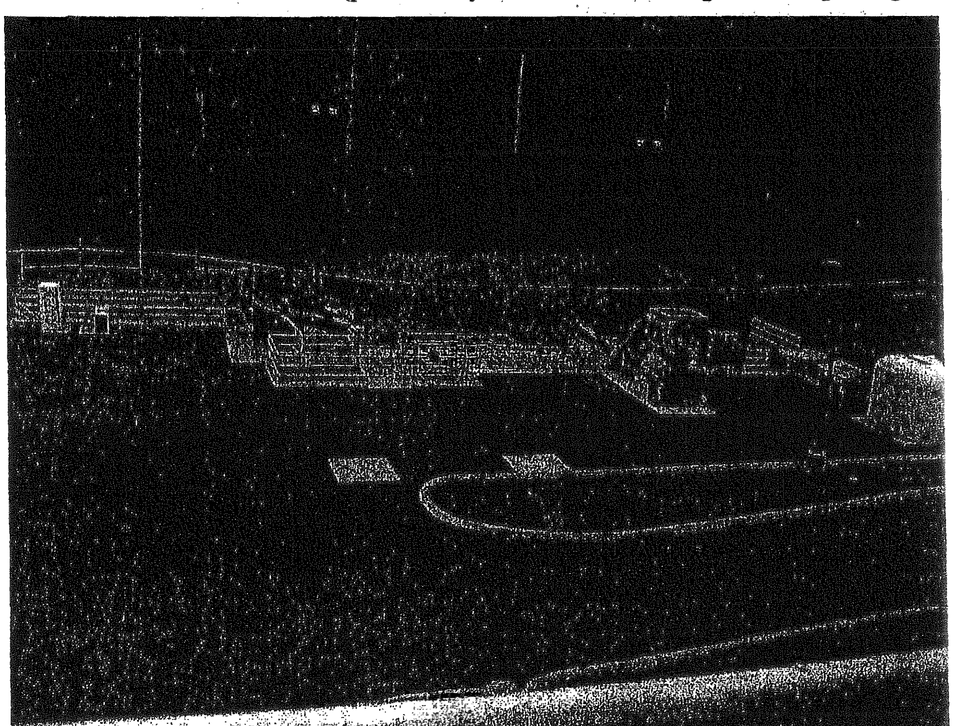


Photo 3. Influent sampler and split channel.

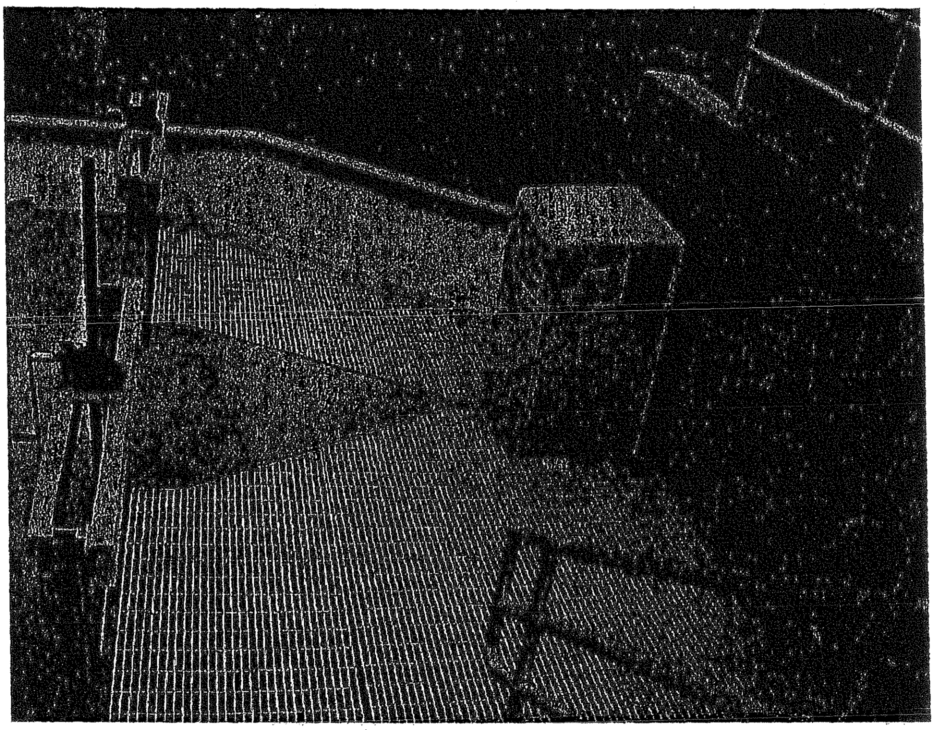


Photo 4. Parallel self-cleaning screens.

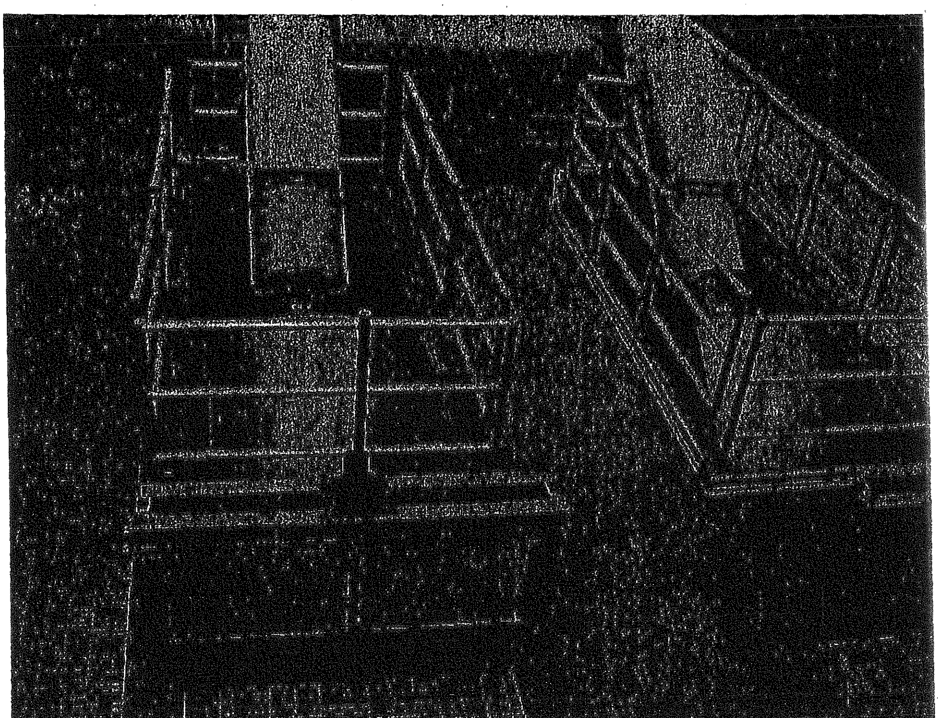


Photo 5. View of parallel influent screens, conveyor and dumpster.

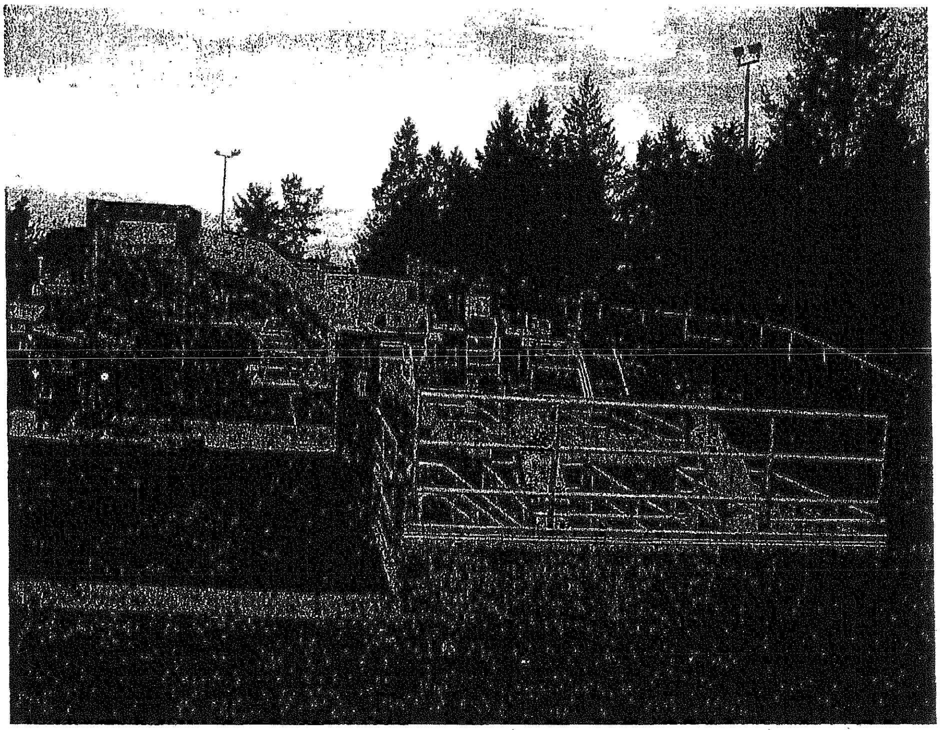


Photo 6. Close-up of screen

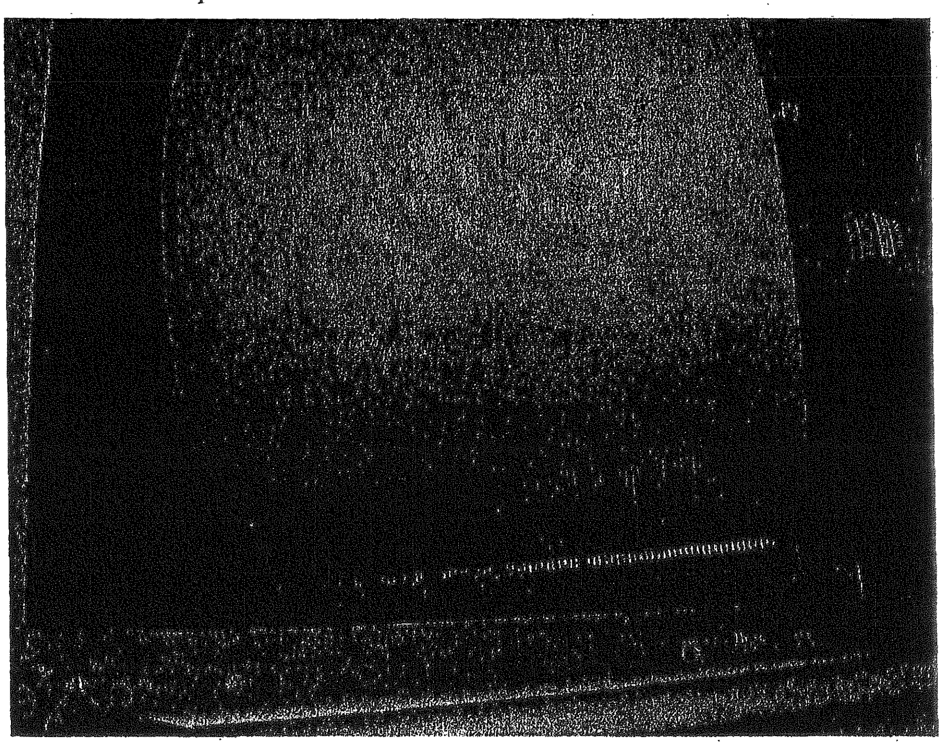


Photo 7. Conveyor belt for screenings.

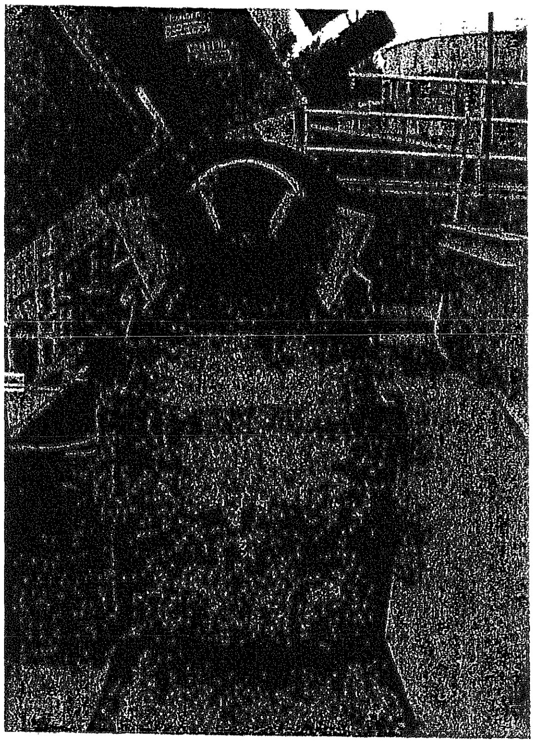


Photo 8. Empty grit chamber.

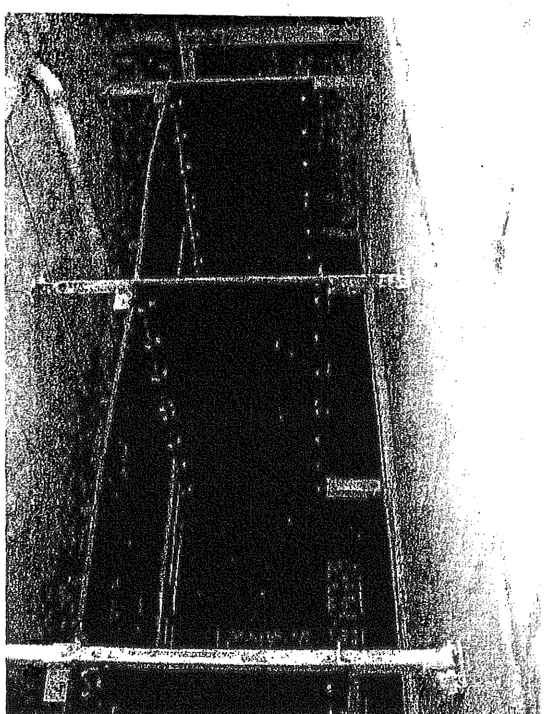


Photo 9. Empty grit chamber

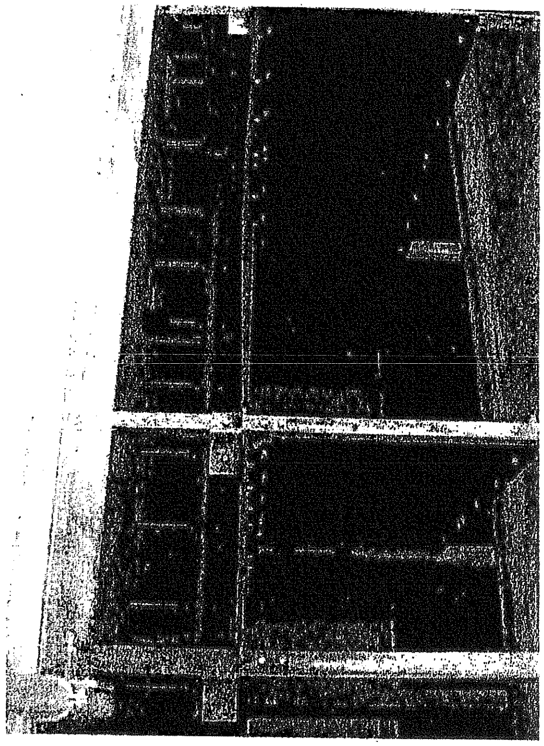


Photo 10. Empty grit chamber

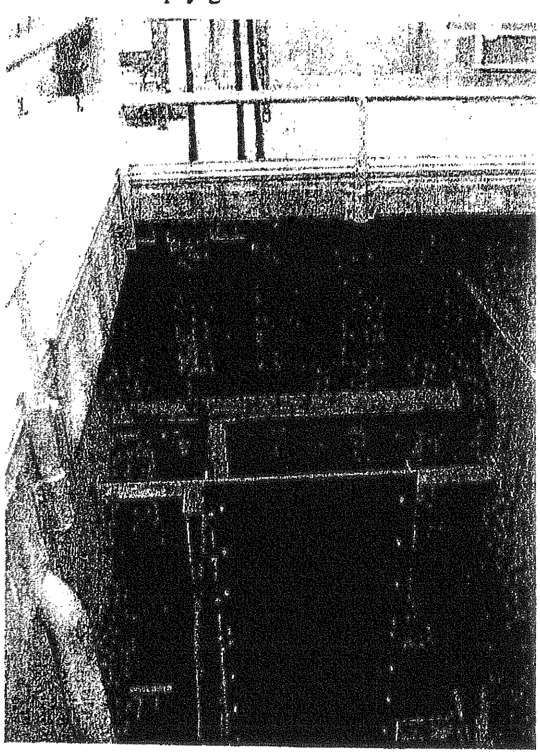


Photo 11. Sludge thickener supernatant return to primary clarifier influent.

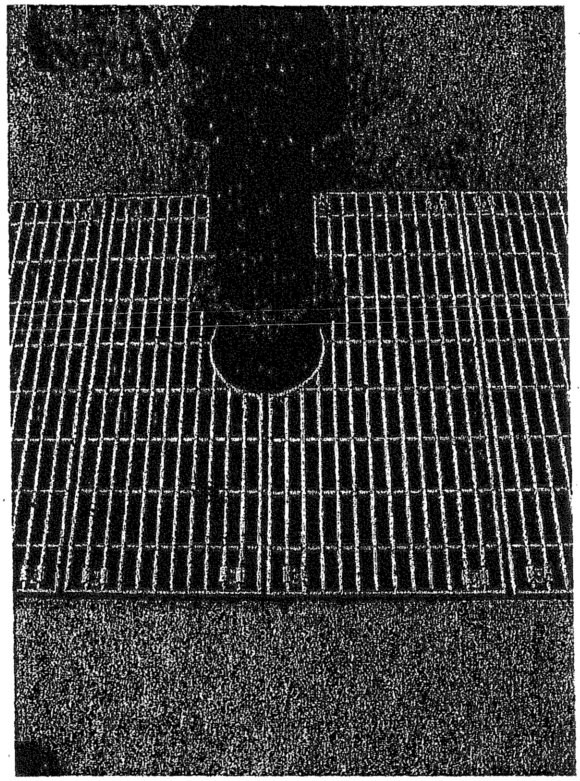


Photo 12. Empty primary clarifier.

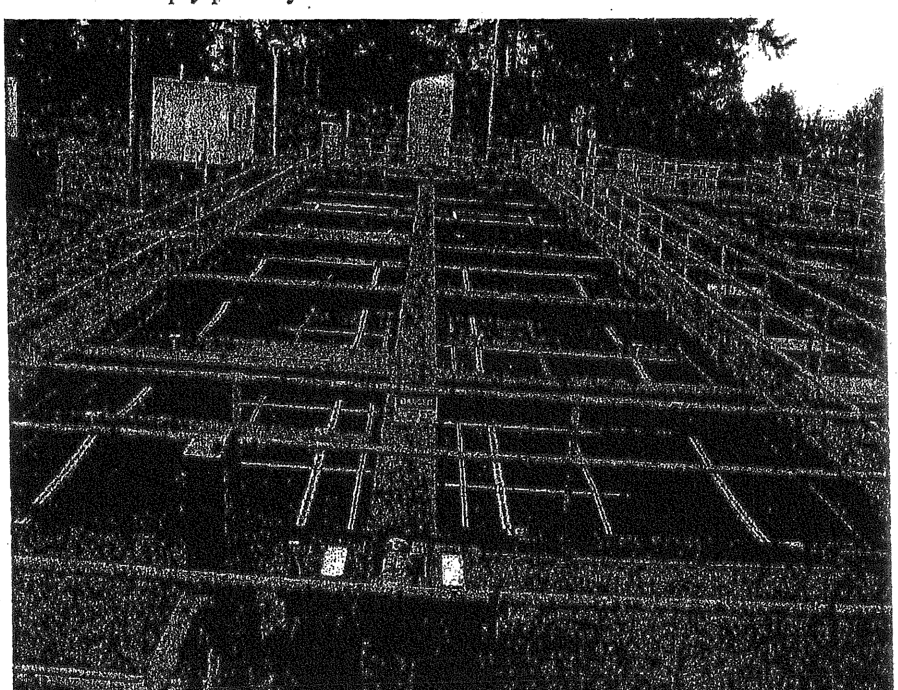


Photo 13. Empty primary clarifier.

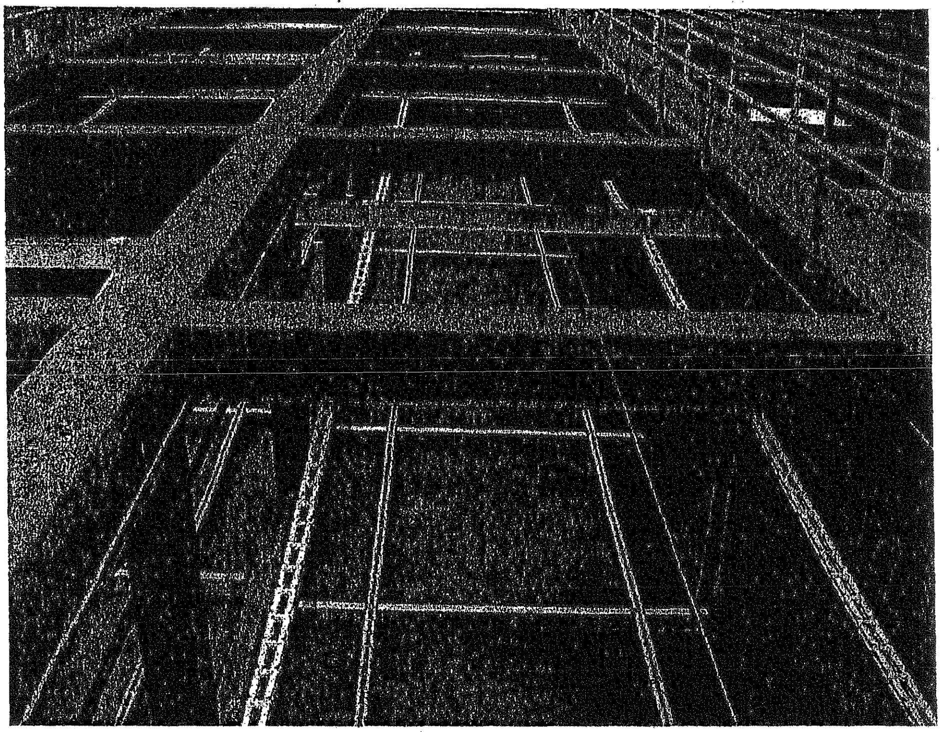


Photo 14. Empty primary clarifier effluent weir

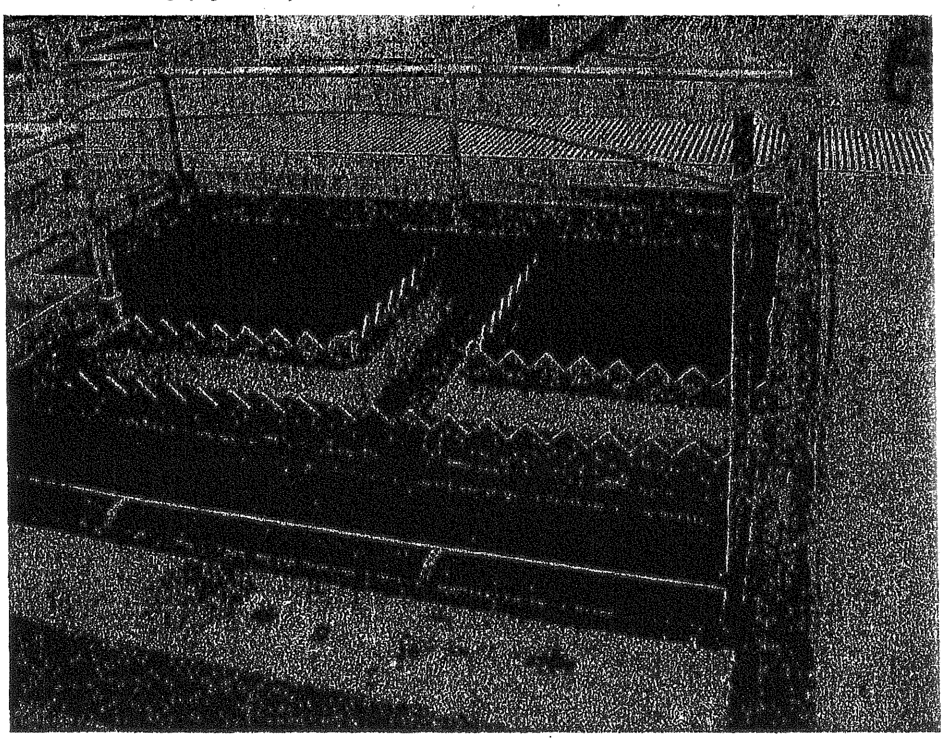


Photo 15. Primary clarifier effluent weir (note grease/oil scum)

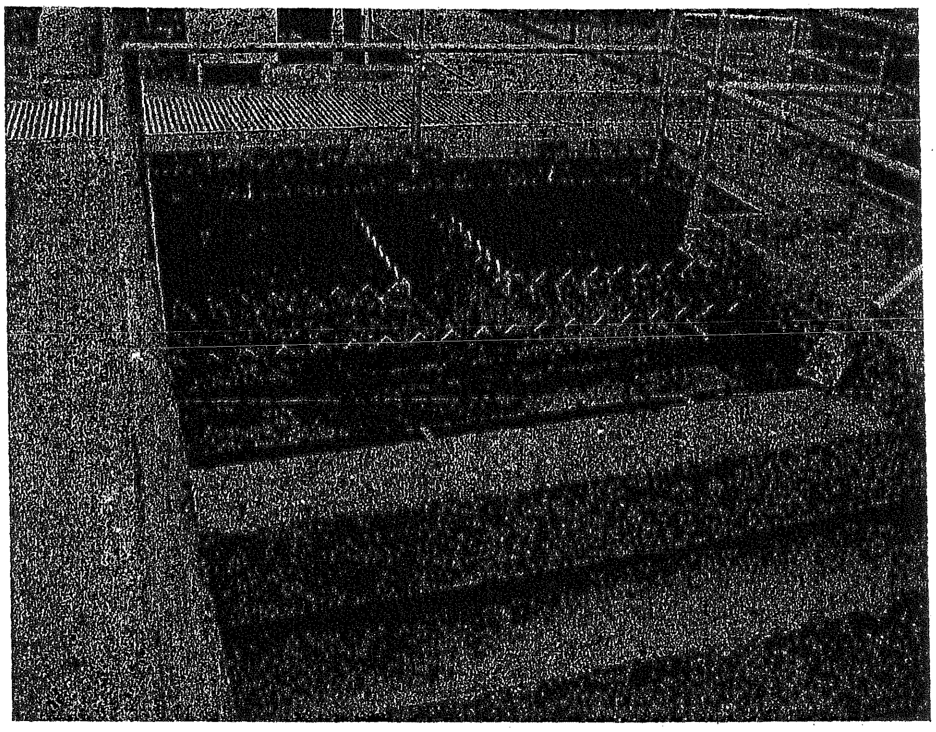


Photo 16. One (west) of two primary clarifier influent 24-inch pipes.

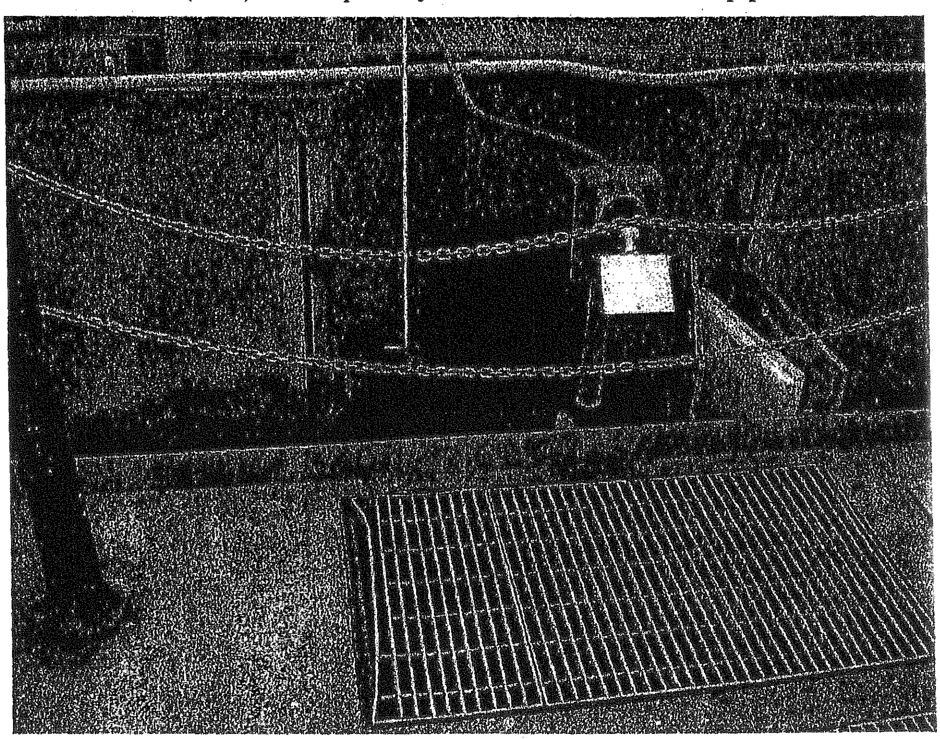


Photo 17. One (east) of two primary clarifier influent 24-inch pipes.

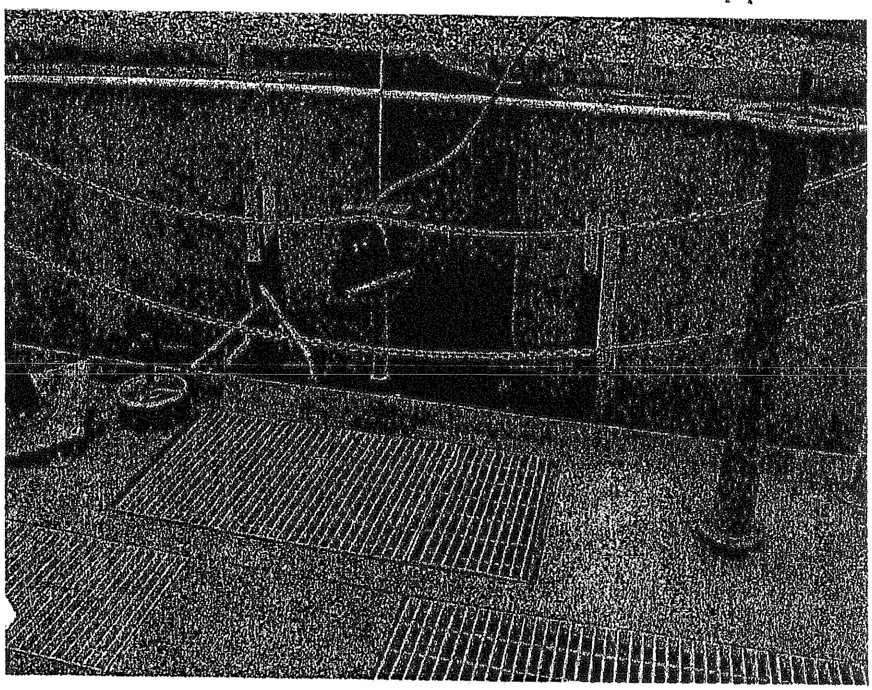


Photo 18. Channels that split flow to parallel primary clarifiers

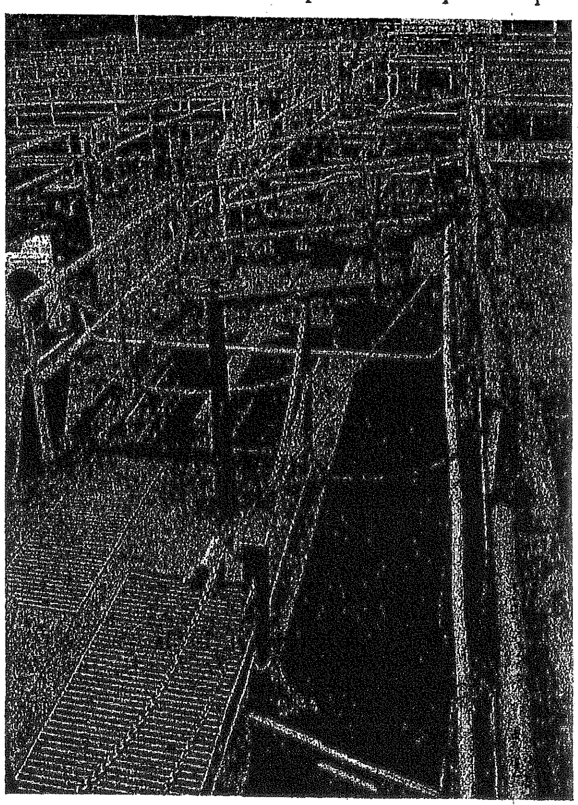


Photo 19. Primary clarifiers

Photo 20. Three pumps that feed primary clarifier effluent to trickling filters

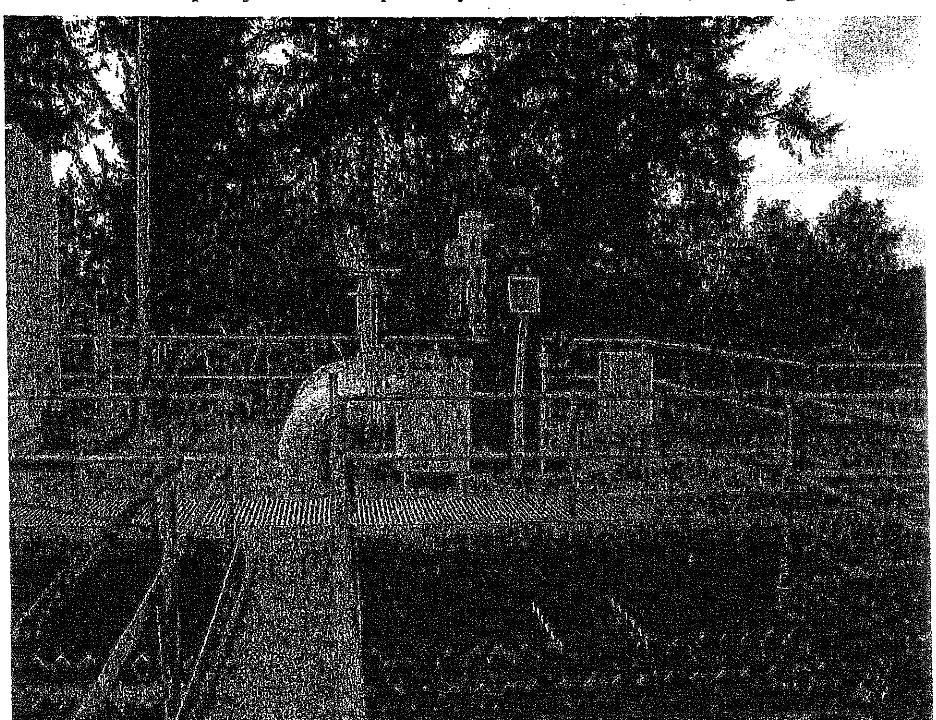


Photo 21. Primary sludge collection hopper

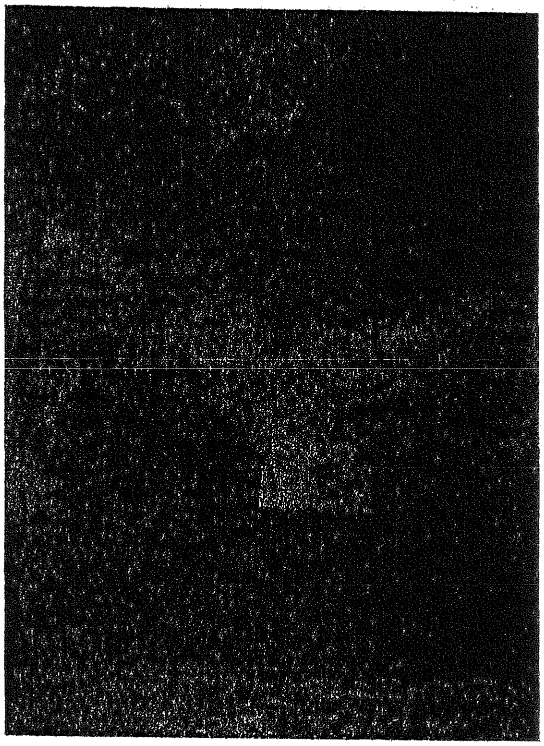


Photo 22. Scum on primary clarifiers

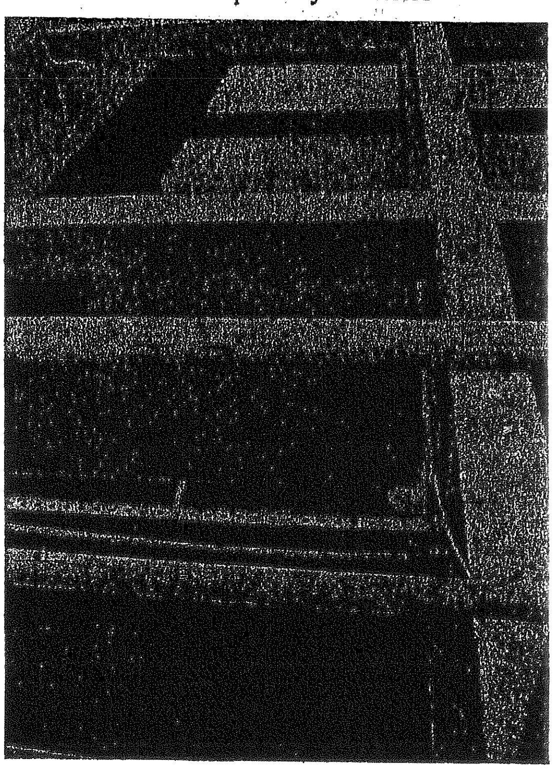


Photo 23. View of primary clarifiers and chlorine contact chambers

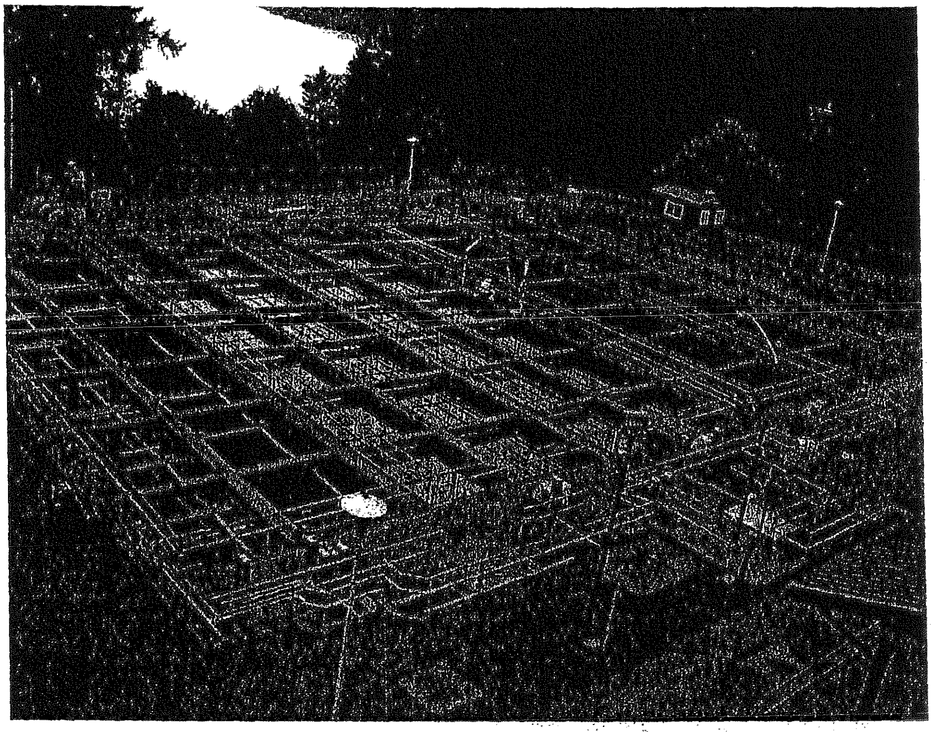


Photo 24. Three pumps that feed primary clarifier effluent to trickling filters

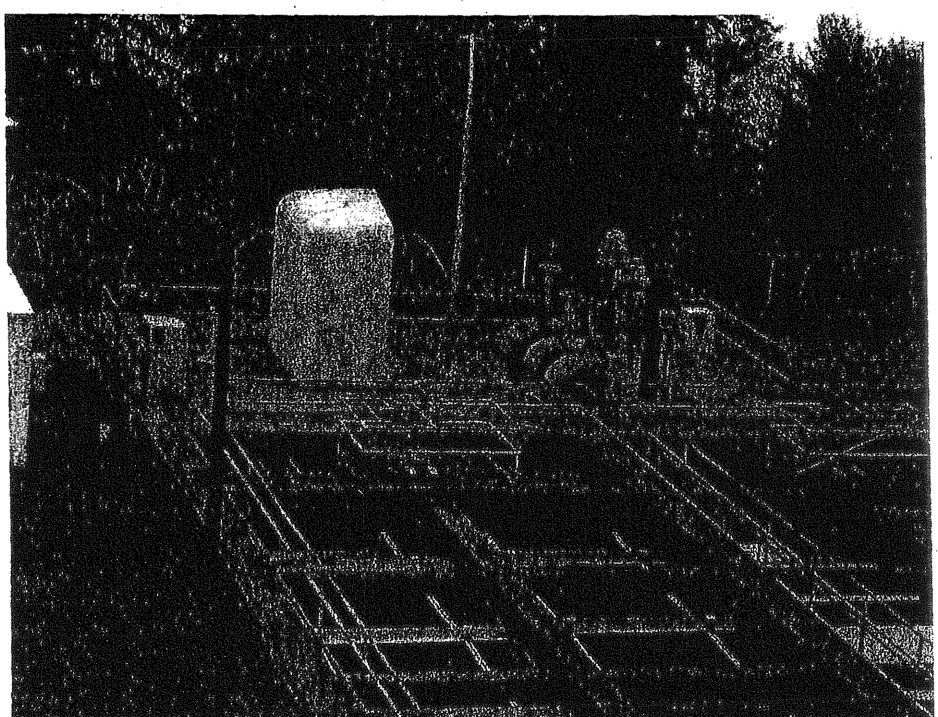


Photo 25. Parallel Trickling Filters

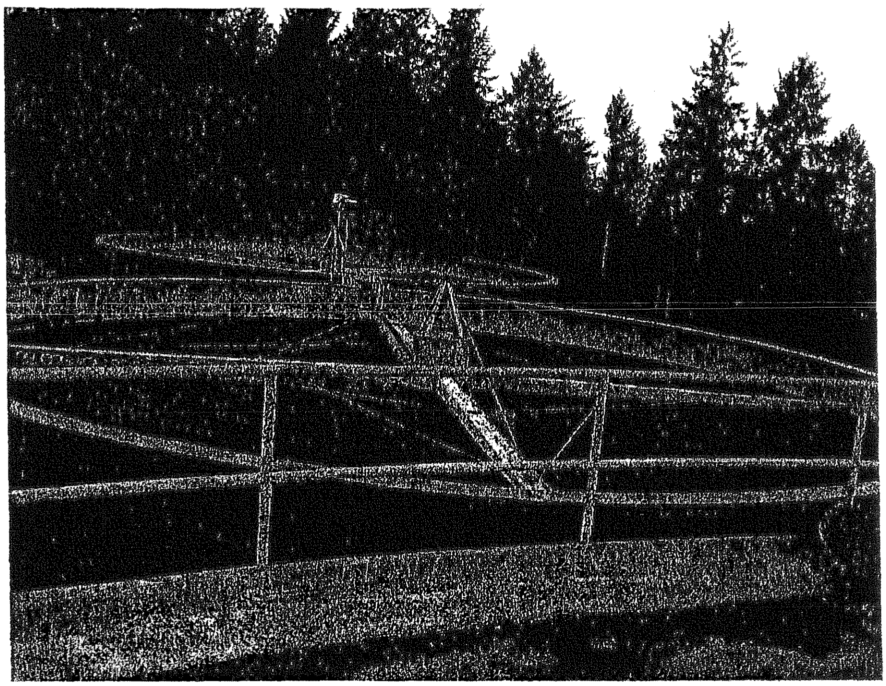


Photo 26. Top of west trickling filter

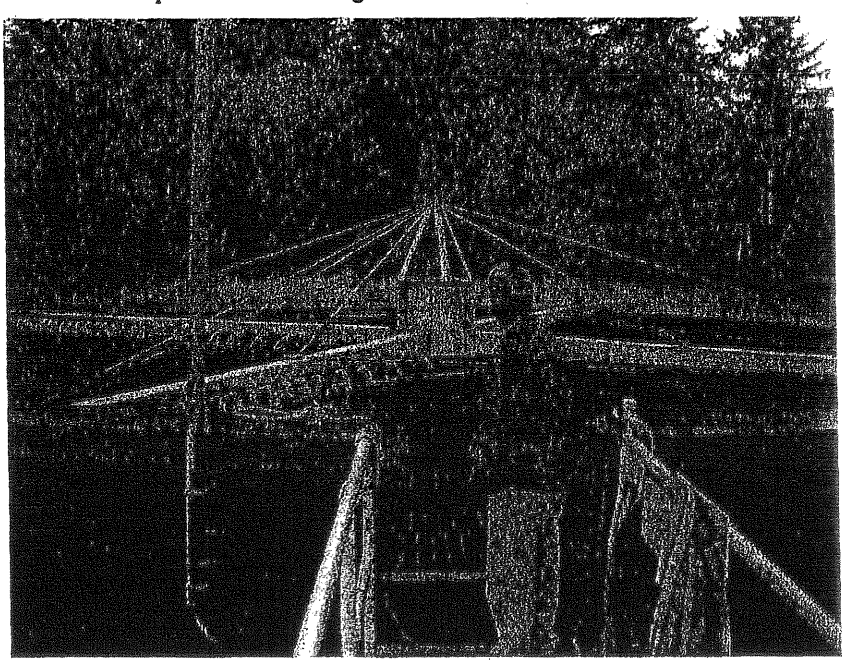


Photo 27. Top of east trickling filter

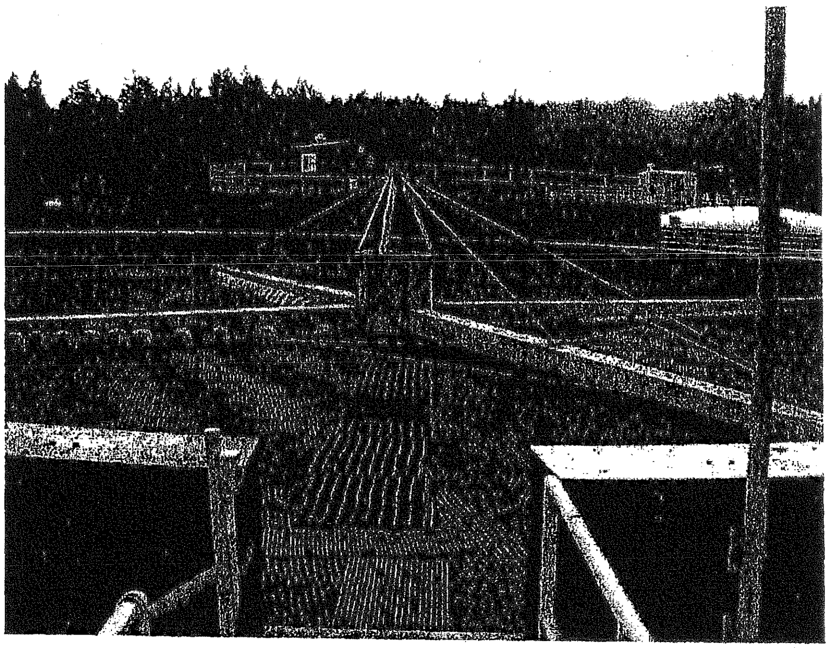


Photo 28. Trickling filter distribution arm and plastic media

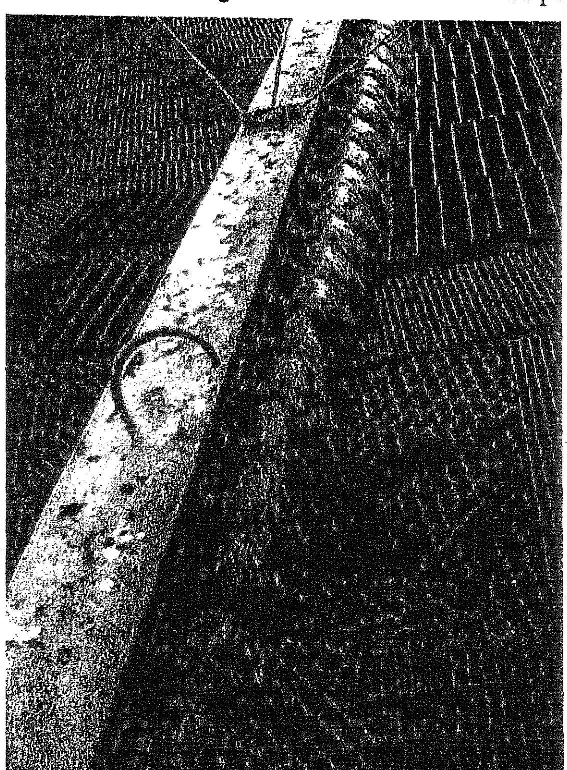


Photo 29. Splitter box that gravity feeds trickling filter effluent to secondary clarifiers

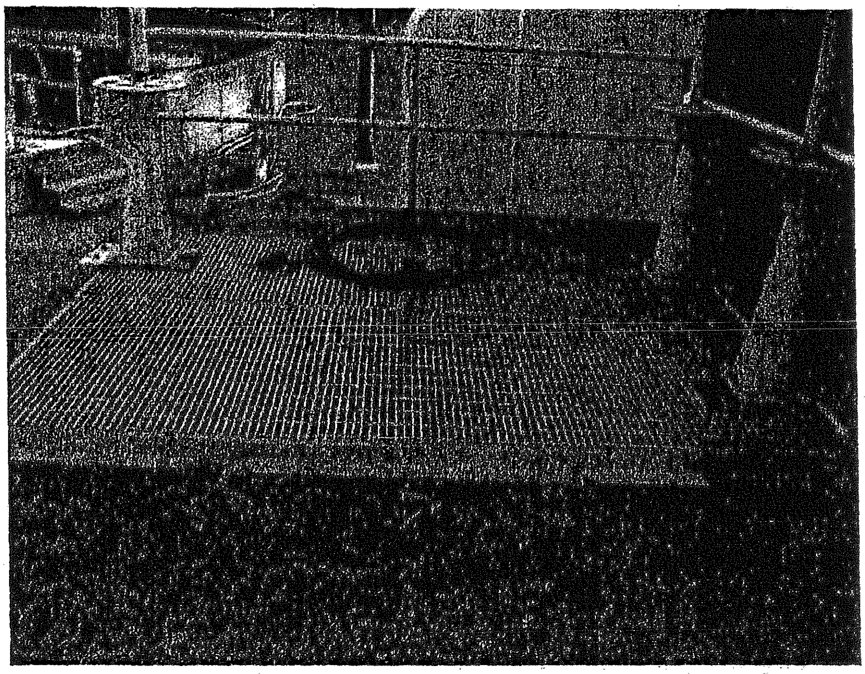


Photo 30. East secondary clarifier

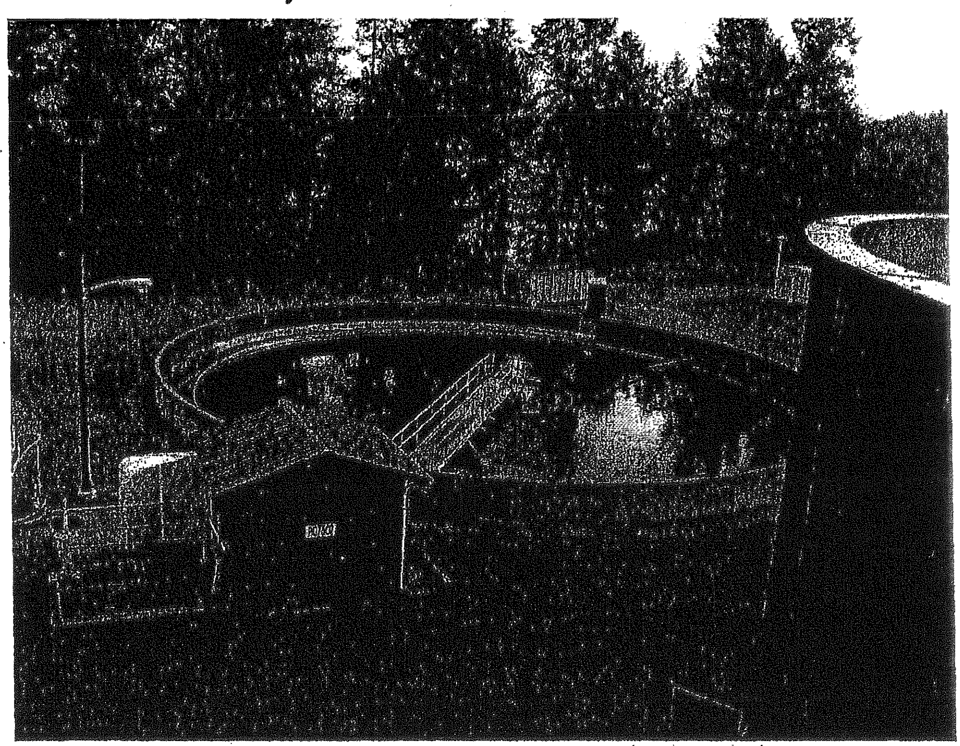


Photo 31. West secondary clarifier

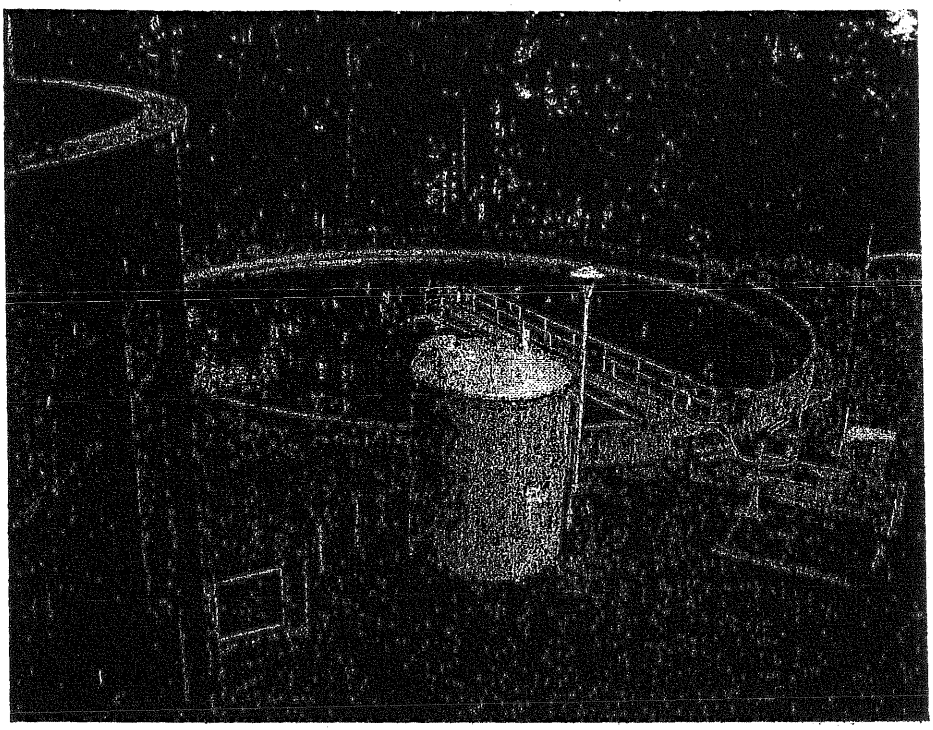


Photo 32. Secondary clarifier scraper arm

Photo 33. Secondary clarifier scum collector

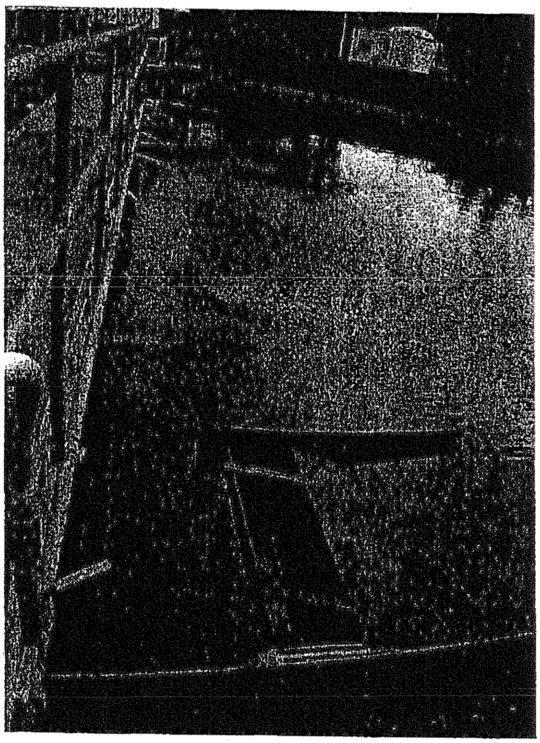


Photo 34. Secondary clarifier brushes on scraper arm

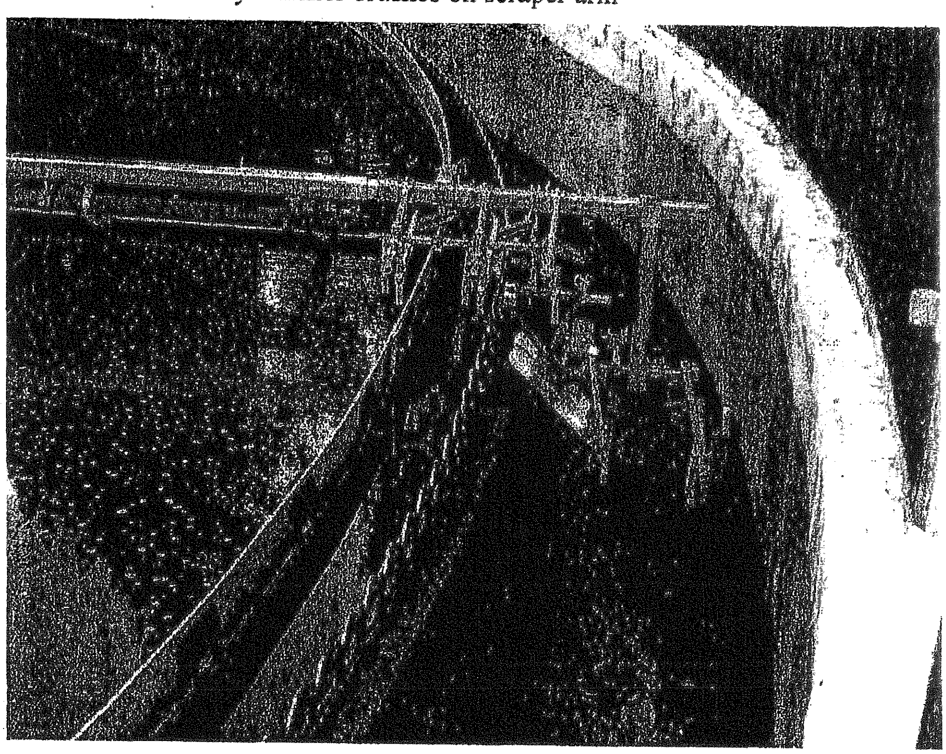


Photo 35. Empty east chlorine contact chamber

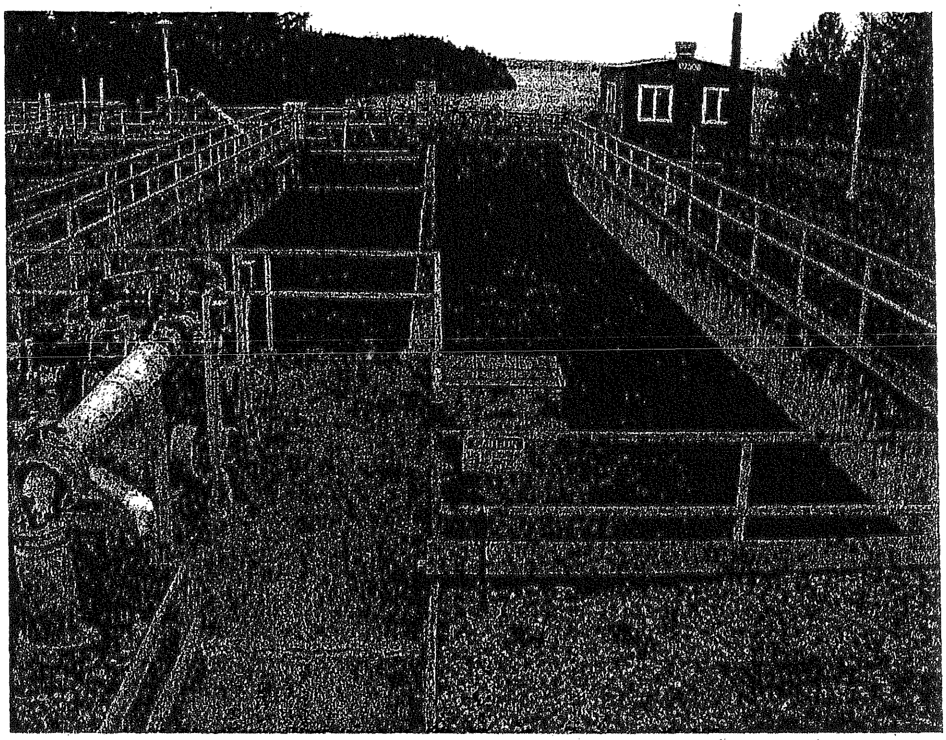


Photo 36. Empty chlorine contact chamber

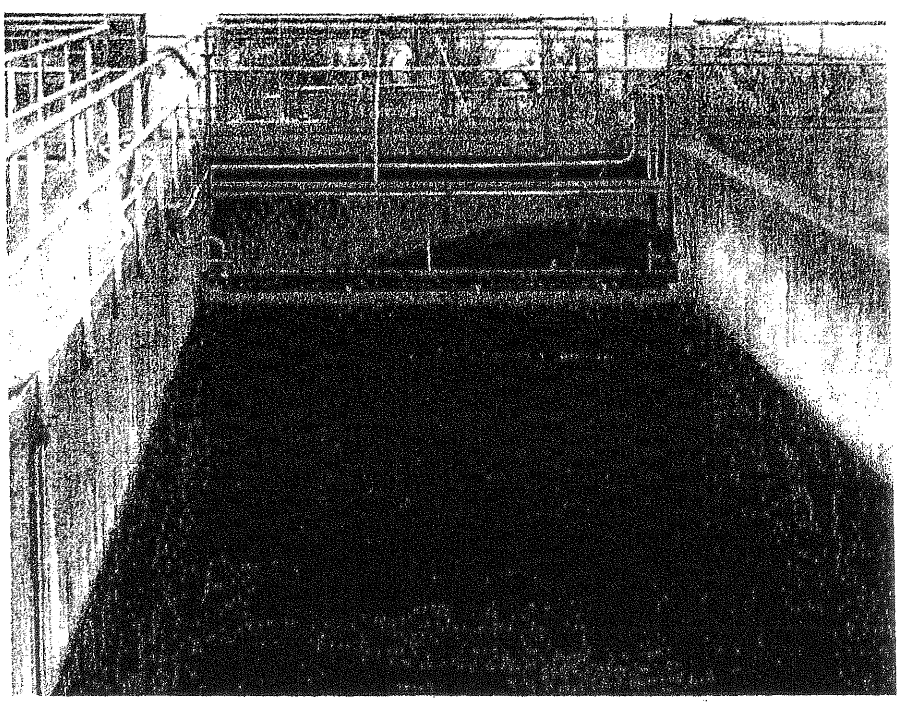


Photo 37. Chlorine contact chamber – effluent scum collection and weir

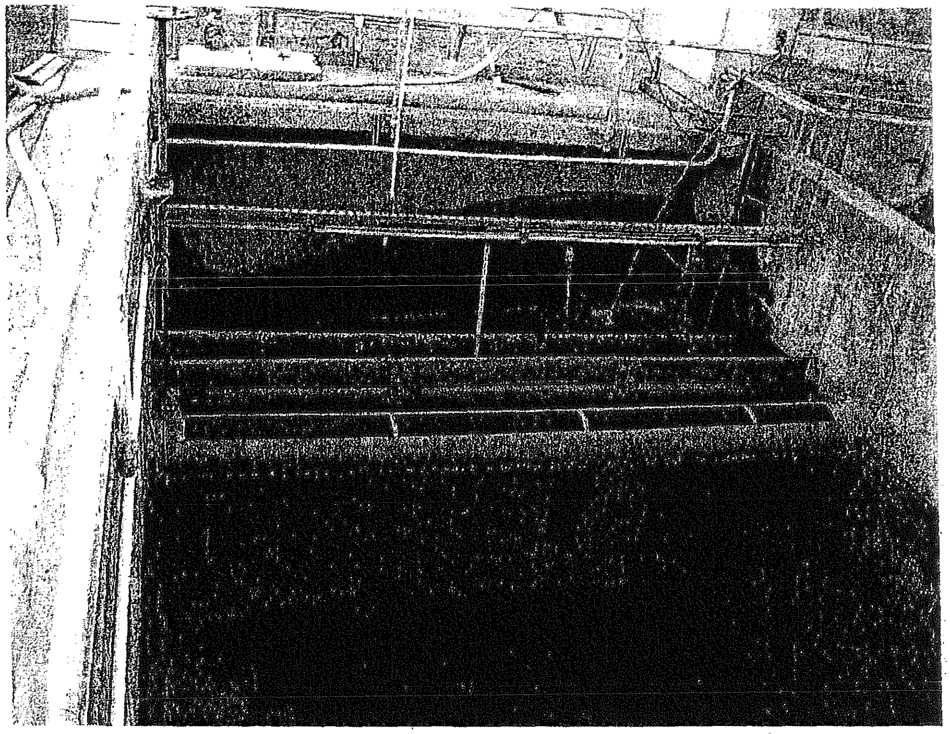


Photo 38. Chlorine contact chamber – close-up of scum collector and weir

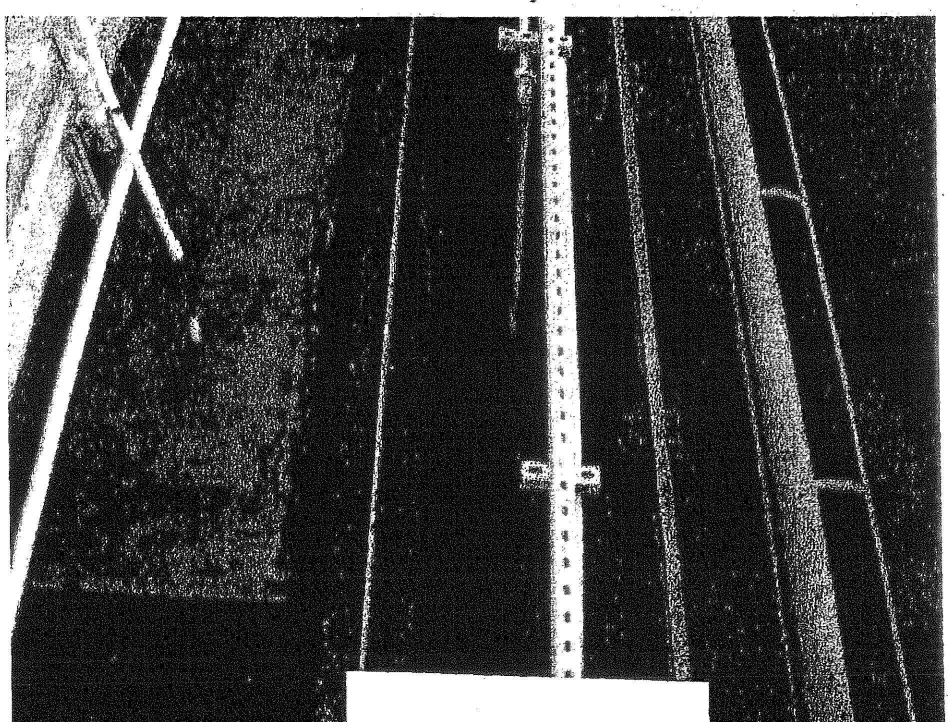


Photo 39. West chlorine contact chamber

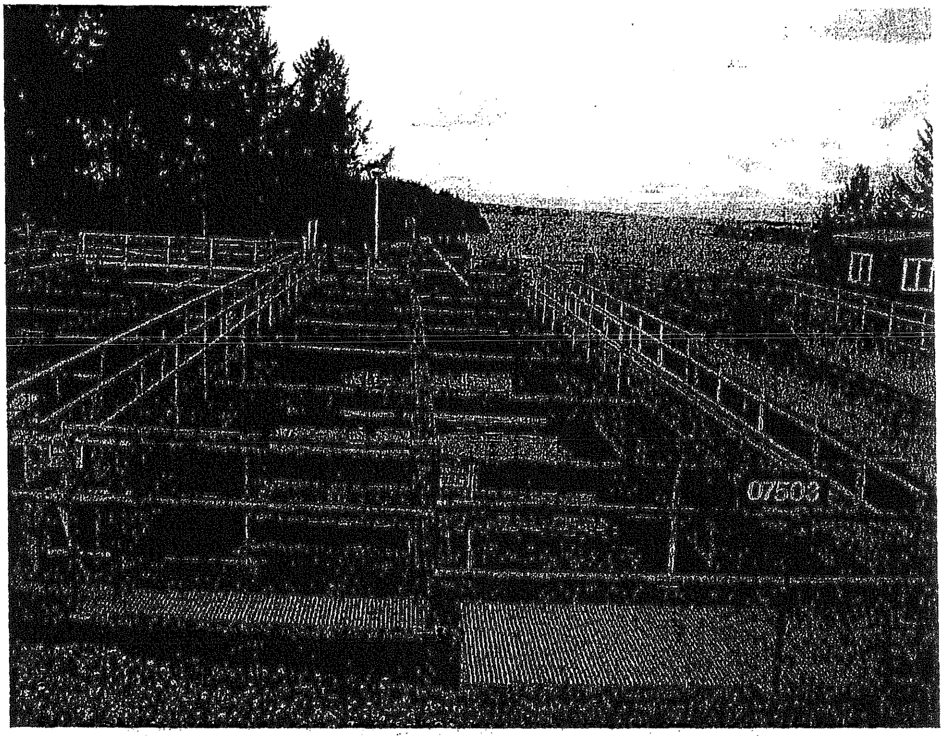


Photo 40. Chlorine contact chamber effluent weir and scum collector

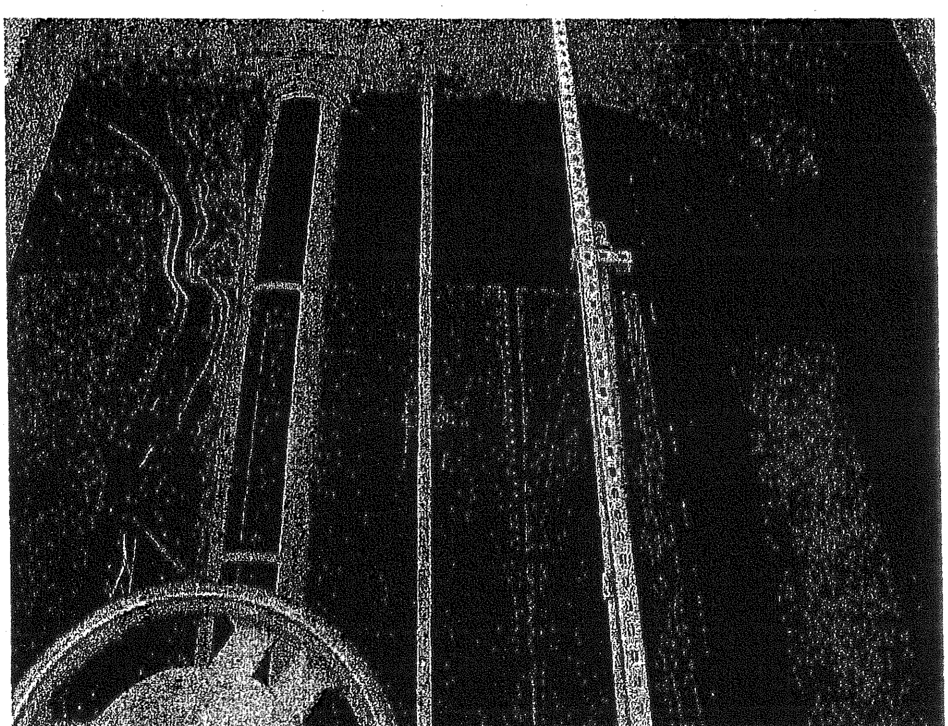


Photo 41. Chlorine contact chamber effluent weir

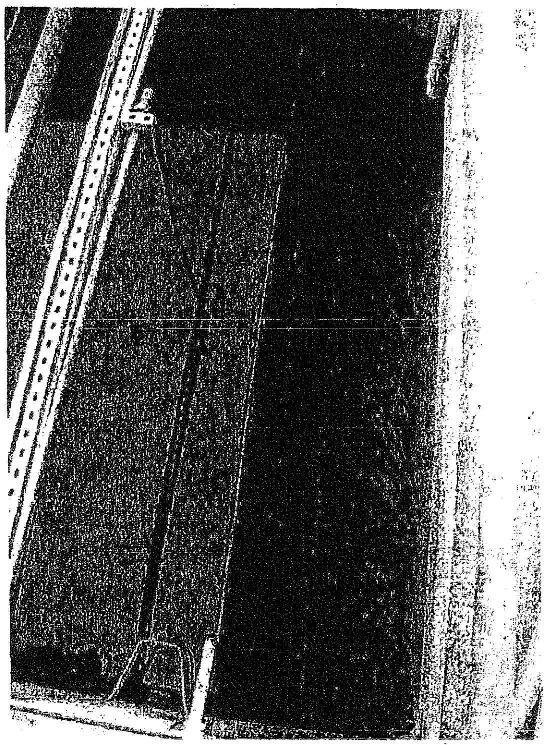


Photo 42. Sludge thickener and grease concentrator.

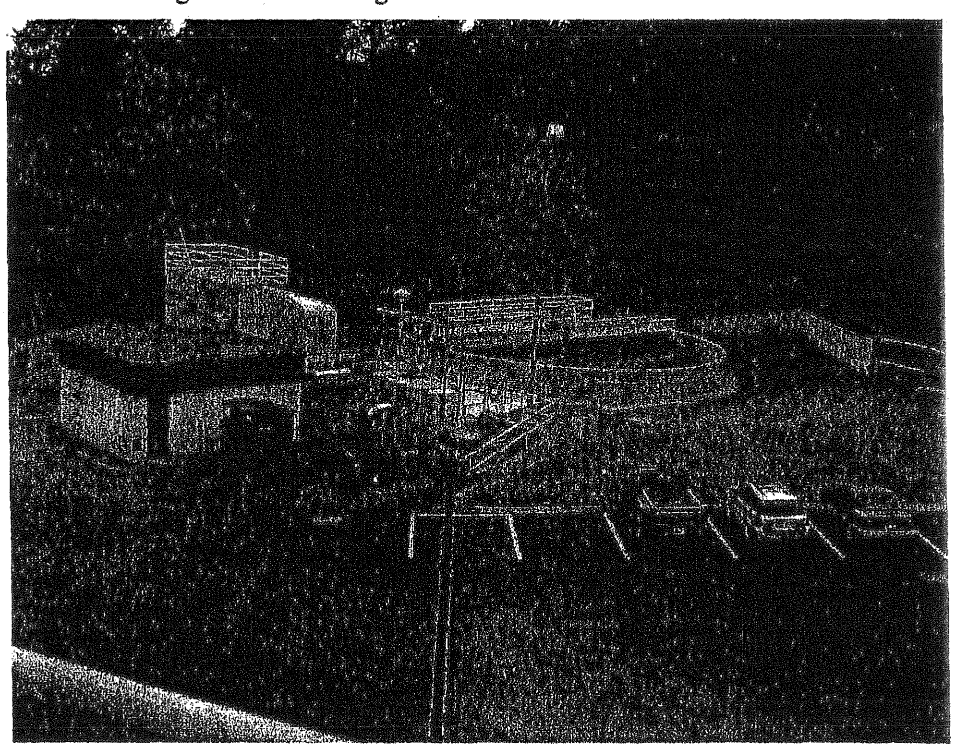


Photo 43. Sludge thickener

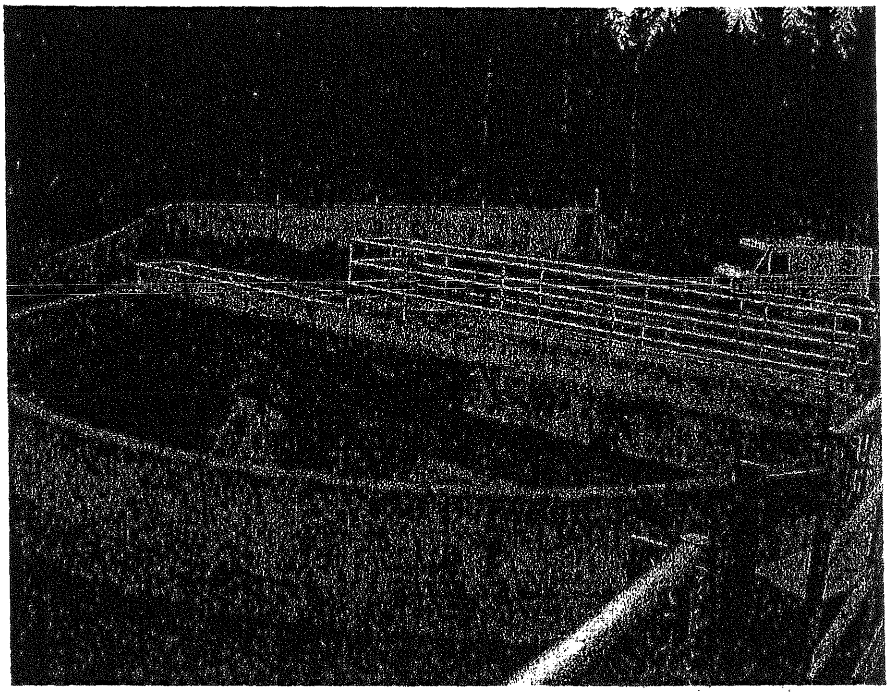


Photo 44. Two-stage anaerobic digestion tanks (two primary tanks – left and right, one secondary tank – center)

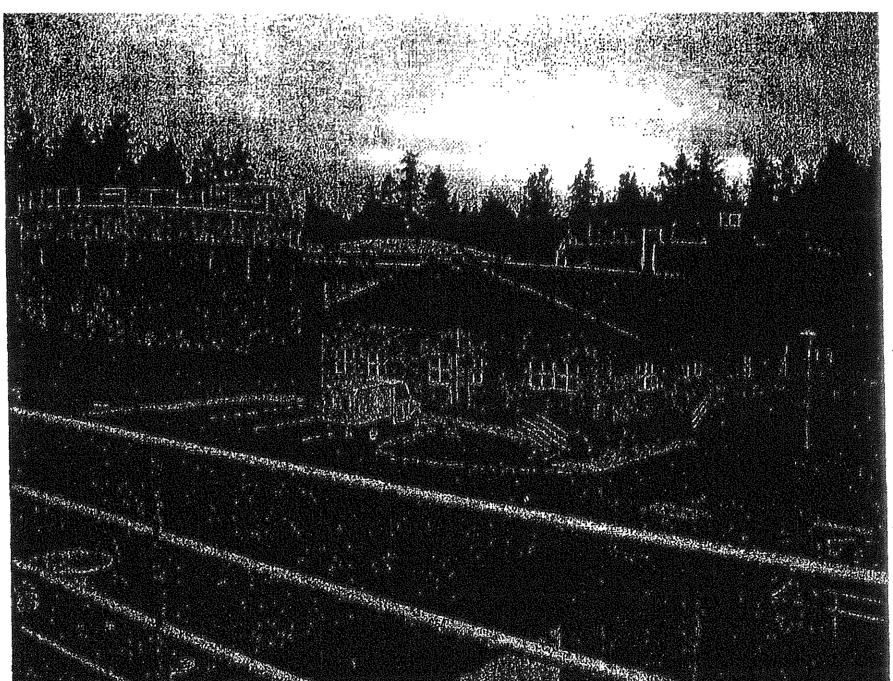


Photo 45. Anaerobic digesters

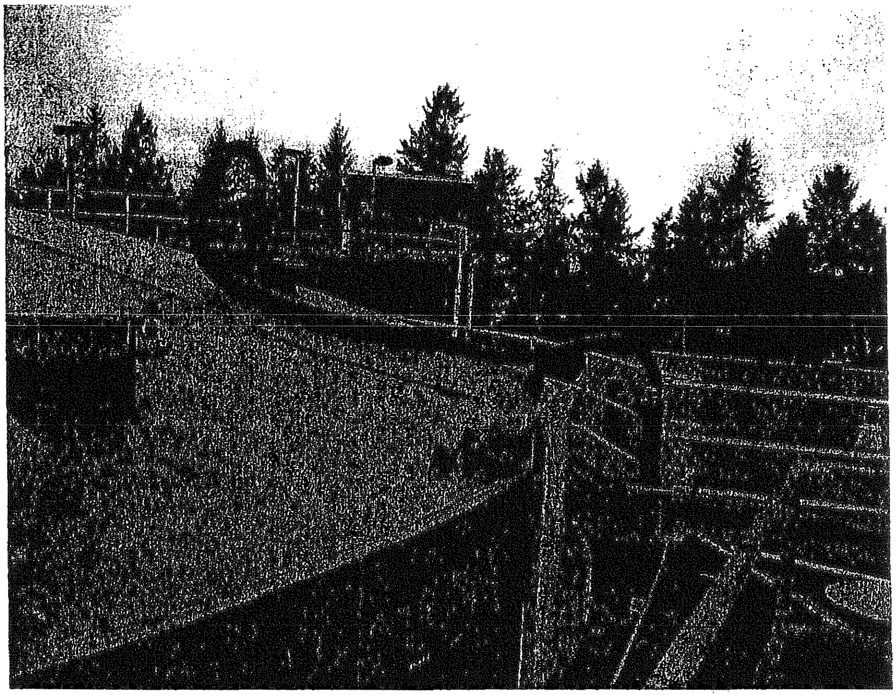


Photo 46. Tops of secondary (front) and primary (rear) digesters.

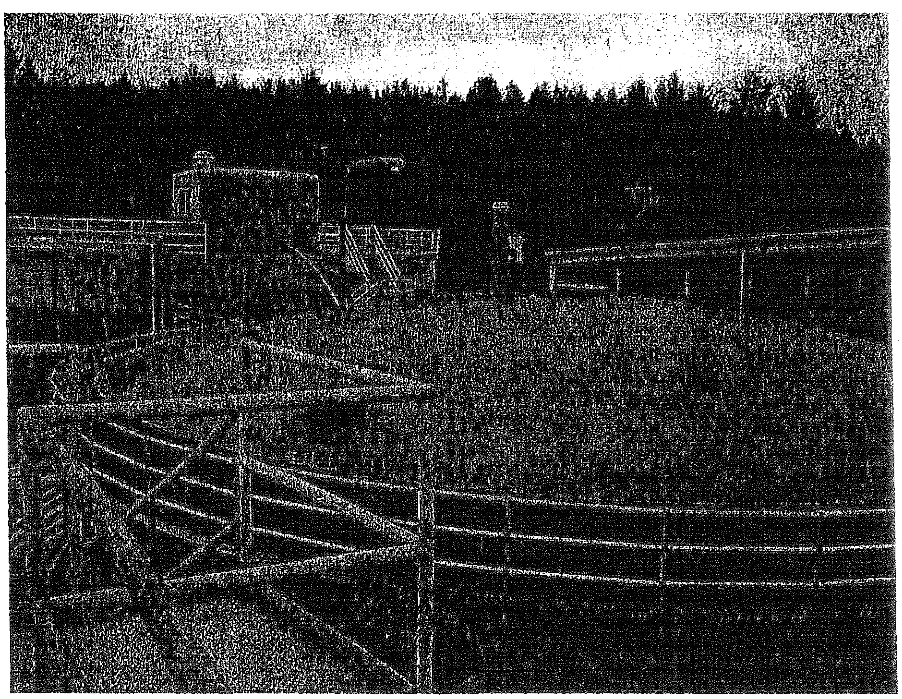


Photo 47. Digester supernatant

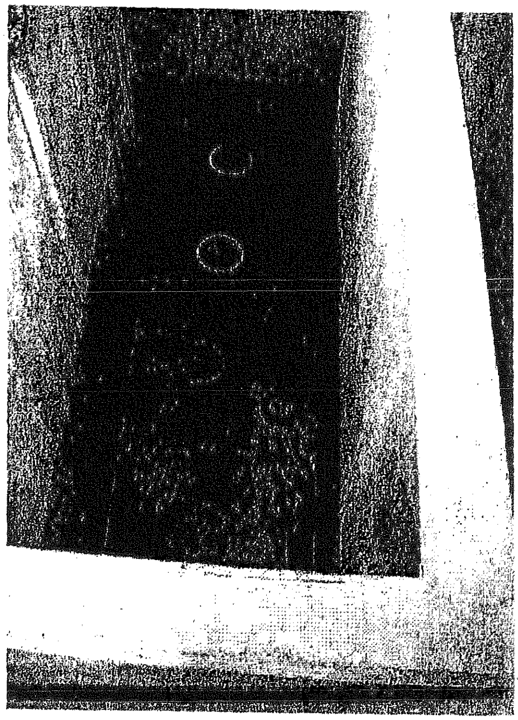


Photo 48. Digester supernatant

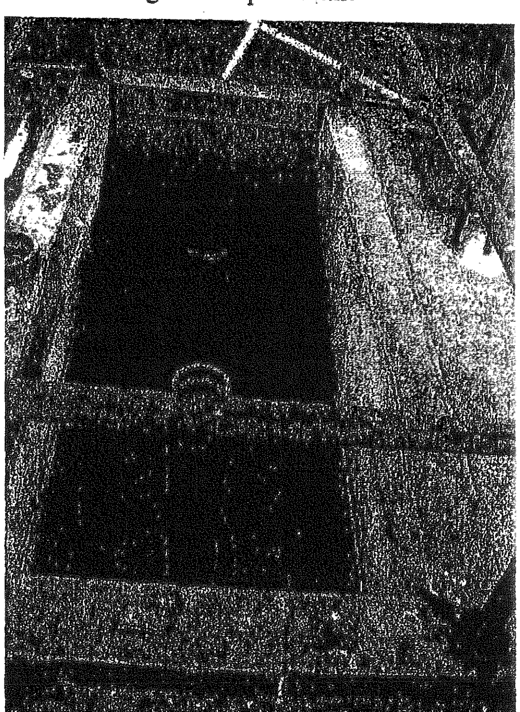


Photo 49. Secondary digester and sludge drying beds

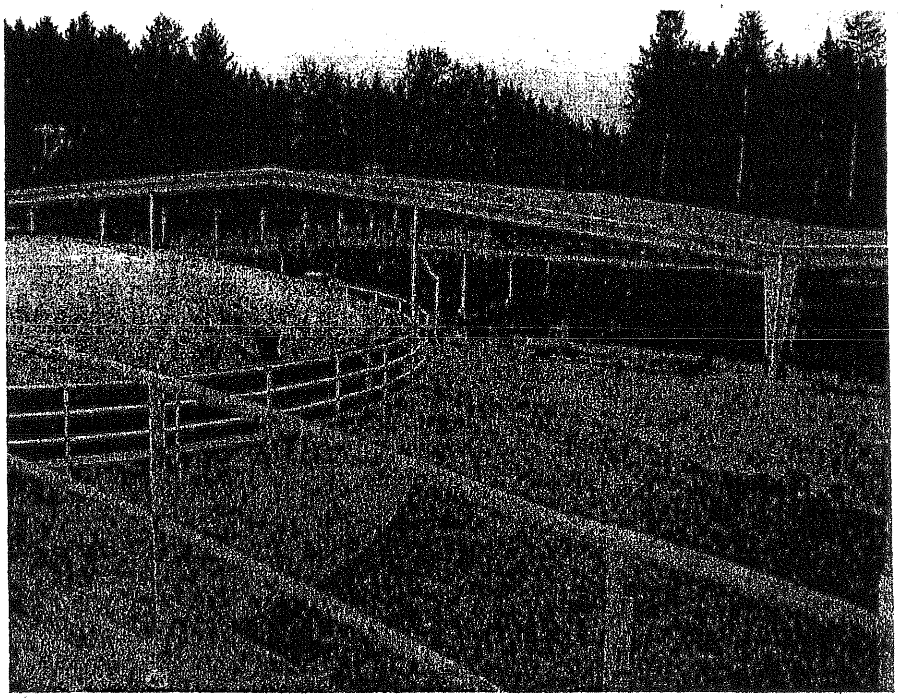


Photo 50. Excess gas flare and drying beds

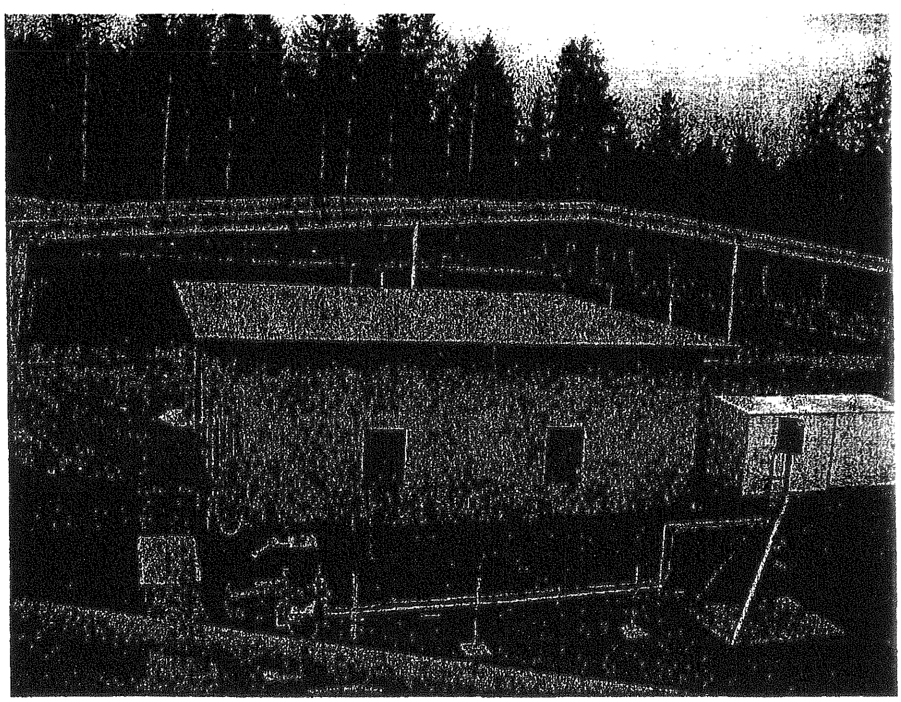
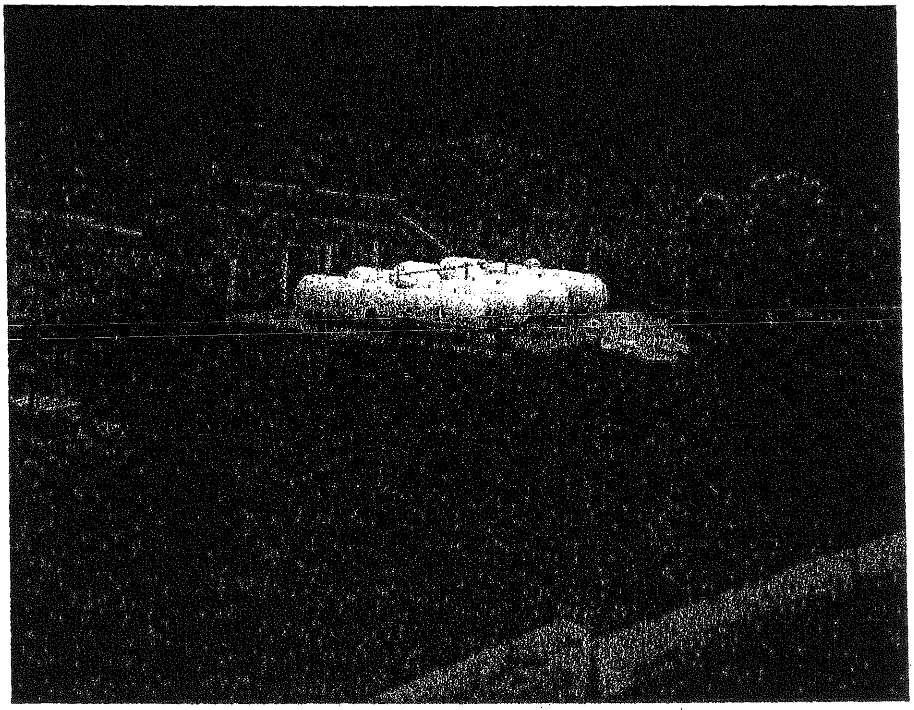


Photo 51. Propane back-up system for digesters/heat



APPENDIX H

SAMPLING-BASED
WWTP PERFORMANCE EVALUATION
ANALYTICAL REPORTS
(IN ELECTRONIC VERSION ONLY)