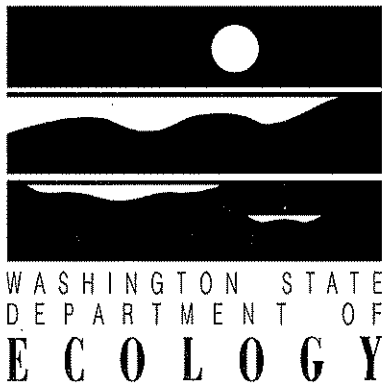

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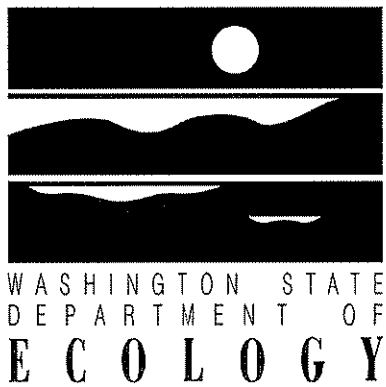

Clark County Salmon Creek Wastewater Treatment Plant Class II Inspection

by
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Olympia, Washington 98504-7710

May 1997

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Abstract

An announced Class II Inspection was conducted June 3-5, 1996 at the Clark County Salmon Creek Wastewater Treatment Plant (Salmon Creek) north of Vancouver, Washington. Influent characteristics were generally similar to other typical treatment plants. Good reductions in BOD_5, TOC, and TSS occurred across the Salmon Creek treatment plant. Ammonia nitrogen removal was less effective and its effluent concentration was relatively high. Verification of permitted dilution factors previously modeled for the outfall using UDKHDEN was not possible, and new estimates of dilution factors were derived using estuary regulatory boundaries and the 3PLUMES dilution zone model. The whole effluent ammonia nitrogen concentration was expected to be reduced to below water quality criteria using the new dilution factors derived for the three-riser diffuser configuration in place during the inspection. Dilution factors derived for the current five-riser diffuser configuration suggest that the maximum allowable chronic whole effluent ammonia nitrogen concentration would be exceeded by the effluent ammonia nitrogen results found during the inspection.

The 24-hour composite BOD_5 and TSS concentrations were well within the NPDES weekly and monthly permit limits. All other inspection results were also within applicable effluent limits and influent overloading limits. Detected whole effluent priority pollutant organics and metals concentrations were generally within water quality criteria, with the exception of gamma-BHC, copper, and lead which all exceeded the chronic criteria. Dilution at the edge of the chronic boundary is expected to reduce these concentrations to within the criteria. The Salmon Creek effluent chronic fathead minnow bioassay indicated toxicity at low concentrations, and a reasonable potential exists for chronic conditions in the receiving water. Additional bioassays are recommended. Effluent TSS and BOD_5 results were very similar for split sample results. Fecal coliform concentrations in Salmon Creek sludge exceeded the pathogen limits of Class A land application requirements, and it is recommended that these concentrations be reduced for this level of use. Organic and metal concentrations were well within both EPA land application concentration limits and state dangerous waste regulation designation criteria.

Summary

Flow Measurements

Daily 24-hour influent flows reported by Salmon Creek during the inspection were on the average 5.19 MGD. Effluent flow during the 24-hour composite was 4.07 MGD, with an 3.92 MGD average over two days. The inaccessibility of the effluent weirs precluded independent verification of effluent flow measurements. Verification of flows was attempted at the influent Parshall flume, but its walls were not fully vertical or parallel, and only an estimate of flume neck width could be determined. Also, debris in the surface level detection well adjacent to the flume likely affected the accuracy of the Salmon Creek ultrasonic meter, producing additional errors in their totalizer flow measurements. The calculated instantaneous influent flow, determined by Ecology from measurements in the flume, produced a relative percent difference of 22% from the instantaneous flow measured by Salmon Creek's meter.

Wastewater General Chemistry and Treatment Plant Design

Treatment Plant Influent

Influent concentrations of 5-day biochemical oxygen demand (BOD_5), total solids (TS), total non-volatile solids (TNVS), total suspended solids (TSS), total Kjeldahl nitrogen (TKN), and ammonia nitrogen (NH_3-N) were all slightly less than the typical medium concentration for untreated domestic wastewater. The average influent oil & grease concentration (O&G) was 50% less than the typical weak concentration. The total organic carbon (TOC) was less than the typical weak concentration, and the BOD_5/TOC ratio (2.78) was about two times greater than typical values. Since TOC is a measure of biologically inactive as well as active organic carbons, the ratio suggests a scarcity of compounds resistant to biological degradation in the influent. This would imply a smaller concentration of persistent organic compounds relative to typical treatment plant influents that could be passed to the effluent.

Treatment Plant Effluent

Ecology results showed a total BOD_5 reduction across the system for an approximate 92% removal efficiency. Total suspended solids (TSS) also decreased, with a removal efficiency of 93% across the system. Removal efficiency across the plant for TOC was 80%. Ammonia nitrogen was reduced 16%. Kjeldahl nitrogen and total phosphorous were reduced 39% and 78% respectively. The data suggest highly effective treatment of

TSS and BOD_5 and only moderately effective nitrification. Chlorine residual concentrations in all samples were less than detection limits.

Attempts to replicate a 1994 Ecology mixing zone study of Salmon Creek WWTP outfall performed using the UDKHDEN mixing zone model encountered problems. Due to drawbacks with the UDKHDEN model, dilution factors were estimated using 3PLUMES. Since the Columbia River is tidally influenced at the outfall estuary, regulatory boundaries were used. Incorporating ambient current velocities ranging from 0.0001 m/s to 10 m/s, critical ambient velocity acute and chronic dilution factors of 11.7 and 36.5 respectively were determined for a three-riser configuration. Subsequent to the Class II inspection two additional risers with similar nozzle configurations were installed at the outfall. The acute and chronic dilution factors for a five-riser configuration were estimated to be 11.7 and 18.5 for acute and chronic boundaries respectively.

A mass balance was calculated using dilution factors for the three-riser configuration, and it projects maximum end-of-pipe concentrations which would not produce violations of total ammonia criteria at either the acute or chronic dilution zone boundaries. The maximum allowable whole effluent ammonia nitrogen concentrations for this configuration were 34.6 mg/L and 19.0 mg/L for the acute and chronic criteria respectively, compared to the effluent ammonia nitrogen concentration of 16.5 mg/L. For the five-riser configuration the maximum allowable chronic whole effluent ammonia nitrogen concentration was determined to be lower (9.63), likely due to lower discharge velocity. Although this configuration was not present during the inspection, the inspection 24-hour ammonia nitrogen concentration would have exceeded the five-riser maximum allowable chronic whole effluent criteria by 71%.

NPDES Permit Comparisons

Ecology composite 24-hour effluent BOD_5 results were well below the permit monthly and weekly average limits. The percent reduction from the influent concentration was greater than the minimum reduction required by the permit. The Salmon Creek sample 24-hour effluent BOD_5 results and percent reduction were also within permit limits.

Ecology 24-hour composite effluent TSS results were under the monthly and weekly average permit limits. Percent reduction across the plant was greater than the permitted minimum monthly average reduction required by the permit. The Salmon Creek sample concentrations and loads gave similar results. Effluent fecal coliform results were well below permit limits, and all effluent pH results were within the stipulated range. The reported totalized average influent flow of 5.18 MGD was well below the NPDES permit design limit. Influent BOD_5 and TSS concentrations and load were well below permit overloading limits.

Detected Priority Pollutant Organics And Metals

VOA and BNA compounds detected in the treatment plant 24-hour composite effluent sample did not exceed either freshwater acute or chronic water quality criteria. One pesticide compound, gamma-BHC, exceeded the chronic water quality criteria, but would be reduced to below the criteria at the edge of the chronic dilution zone. Influent results at the highest concentrations included acetone and 3B-Coprostanol.

Copper exceeded the freshwater acute and chronic water quality criteria in the whole effluent. Lead exceeded the freshwater chronic water quality criterion in the whole effluent. Estimated dilution in the receiving water should reduce both effluent copper and lead concentrations to less than both the acute and chronic criteria.

Effluent Bioassays

Ecology bioassay results detected moderate acute effluent toxicity, but considerable chronic effluent toxicity. The *Daphnia magna* acute 48-hour survival test found survival was greater than 95% in 100% effluent, and produced a lowest-observable-effect-concentration (LOEC) greater than 100% and a no-observable-effect-concentration (NOEC) equal to 100%. The fathead minnow 96-hour survival test detected generally declining survival at higher concentrations, with 57.5% mortality at 100% effluent. The LC_{50} was estimated to be 97.4%. The LOEC and NOEC were 100% and 50% respectively. With an acute dilution factor of 11.7 at the edge of the acute boundary, the difference in response between the dilute effluent concentration and the control is not significant.

The fathead minnow (*Pimephales promelas*) chronic 7-day survival and growth test found generally declining survival and growth with increasing concentration. The survival analysis produced an LC_{50} of 65.2%, LOEC of 50%, and NOEC of 25%. The growth analysis produced an LOEC and an NOEC of less than 6.25%. The chronic test exceeds the Washington State Whole Effluent Toxicity Testing and Limits performance standard. A reasonable potential exists for chronic conditions in the receiving water, and the effluent should be further characterized to determine if a toxicity identification/reduction evaluation is required.

Sludge

General Chemistry

The sludge fecal coliform density of 540,000 colonies per 100 grams-wet wt. (MPN, most probable number - 246,000 #/g-dry wt.) exceeded the maximum limit for fecal coliform

density as required for Class A sewage sludge land application. It was within the Class B designation limit. The E. coli density was 350,000 colonies per 100 grams-wet wt. (MPN - 159,000 #/g -dry wt.).

Detected Priority Pollutants

Metals, VOA, and BNA compounds were detected in the composite sludge sample. One VOA, p-isopropyltoluene, as well as one BNA compound, 3B-coprostanol, were detected at appreciable concentrations. Silver, lead, and chromium were detected at moderate concentrations. Copper was detected at a somewhat higher concentration. The concentrations of priority pollutants in the sludge did not exceed either EPA standards for land application of sewage sludge or screening concentrations for the dangerous waste designation criteria.

Split Samples

Sample Comparisons

Ecology analysis of samples collected by Ecology and Salmon Creek produced very similar results for most parameters. Relative percent differences (RPD) between pairs of TSS, BOD_5, and pH samples were less than interlaboratory variation in analytic precision. The RPD between Ecology and Salmon Creek chlorine residual results averaged 83% , but this was for values near the detection levels of the instruments where considerable variability would be expected.

Laboratory Comparisons

Ecology and Salmon Creek laboratory results for influent samples collected by Salmon Creek were extremely close, with RPDs between samples of less than 8% for all parameters. This would suggest that the Salmon Creek laboratory performance was good.

Recommendations

Flow Measurements

- Salmon Creek should verify the accuracy of the influent flow measurement device and correct any structural or operational problems that may be causing errors in measurements.

General Chemistry and Plant Design

- Salmon Creek should conduct dilution zone modeling to establish representative acute and chronic dilution factors and verify the model's results with in-stream dye studies.

- Salmon Creek should investigate whether chronic ammonia nitrogen criteria are currently being exceeded.

Bioassay Results

- Salmon Creek should characterize effluent toxicity as outlined in WAC 173-205-050.

- Ammonia, lead, and copper concentrations in the whole effluent should be evaluated to determine if they are the source of the toxicity.

Introduction

A Class II Inspection was conducted at the Clark County Salmon Creek Wastewater Treatment Plant (WWTP) on June 3-5, 1996. Guy Hoyle-Dodson, environmental engineer (Toxics Investigations Section), and Dale Clark, environmental specialist (Ambient Monitoring Section), conducted the investigation. Chuck Meyer, permit manager (Ecology Southwest Regional Office), provided background information and assisted in planning the inspection. Gene Fix, Salmon Creek Wastewater Operations Manager, also provided information on facility operation and assistance on site.

The Salmon Creek WWTP contracts to provide treatment services to the Hazel Dell sewer district and to several smaller communities in Clark County, such as Battle Ground, Meadow Glade, and Hockinson (Figure 1). The plant provides secondary treatment for a population of over 36,200 people, which include residential, commercial and light industrial contributors. The largest industrial contributor is a milk bottling plant located in Battle Ground. An NPDES Permit (Permit No. WA-002363-9) was issued December 12, 1995 with an expiration date of January 12, 2001.

The Class II inspection was initiated by the Department of Ecology to evaluate permit compliance and to provide information about facility loading and performance. The inspection also focused on flow measurements, concentrations of priority pollutant organics and metals in effluent, bioassay toxicity, and sludge characterization. Specific objectives of the inspection included:

- Evaluate NPDES permit compliance by analysis of influent and effluent permit parameters to determine concentrations and loads and compare them to respective permit limits
- Evaluate wastewater toxicity by comparing priority pollutant organics and metals scan results to Washington State acute and chronic water quality criteria
- Evaluate wastewater toxicity with effluent bioassays
- Evaluate treatment plant performance
- Evaluate the WWTP self-monitoring program through sample splits and independent laboratory analysis
- Evaluate sludge toxicity by comparisons to federal and state land application and dangerous waste regulations
- Evaluate receiving water characteristics to ascertain its mediation effect on effluent toxicity

Setting

The Salmon Creek wastewater treatment facility is located on Salmon Creek, northwest of the city of Vancouver, in Clark County, Washington. The WWTP treatment system consists of a headworks, aeration basins, secondary clarifiers, chlorine contact chamber, anaerobic sludge digestion system, and a multiport discharge (Figure 2). The original facility was constructed in 1976 with a design capacity of 2 MGD, but over the years has gone through a number of upgrades which has increased capacity to 7.4 MGD. The original system used two aeration basins with a single secondary clarifier followed by chlorination. Sludge was aerobically digested. Dramatic increases in the service population required a substantial upgrade in 1991, which included improvements to the headworks, an expansion of the aeration system, the addition of an anaerobic sludge digestion system, and modifications to the aerobic digestion system. Subsequent population increases and projected demand initiated further upgrades in 1993 and 1994, with the installation of new aeration blowers, an influent pump station, modifications to the first pair of aeration basins to include an anaerobic selector, and the construction of baffles in the secondary clarifiers. The latest upgrade to the sludge digestion system includes a sludge press that was in the testing stage during the inspection.

The WWTP's headworks consists of a mechanical barscreen, manual barscreen, Parshall flume, and flowmeter, followed by an aeration basin splitter box. An ultrasonic flow measurement device is situated in a shallow wet well connected to the main influent channel just above the Parshall flume. Influent enters the headworks from a single line. All industrial contributors discharge directly to the plant's collection system.

Flow from the splitter box enters two aeration cells for initial treatment. The cells are connected in parallel and contain submerged baffles which act as anaerobic selectors. The selector cells are followed by two aeration basins connected in parallel and aerated by five bubble diffusers. Oxygenation is dissolved oxygen (DO) proportional, governed by a DO controller. Activated sludge from the two secondary clarifiers and the sludge holding tank is returned to the splitter box and added to the influent.

Flow from the aeration basins is directed to two large circular secondary clarifiers, also connected in parallel. Internal baffles have been added to the clarifiers to impede flow, improving sedimentation. Clarifier effluent flows to the chlorine contact chamber for disinfection. Chlorination is flow proportional. Dual magnetic flow meters record effluent flow over two weirs at the end of the chlorine contact chamber. Plant effluent is pumped through a buried pipe approximately 6200 ft to the Columbia River for discharge. During the inspection discharge was via a three-port (≅10-inch diameter) diffuser, 225 feet off shore and at a depth of approximately 17 feet. Subsequent to the inspection two additional ports had been installed.

The sludge digestion system consists of a sludge thickener, an anaerobic digestor, a sludge holding tank, and a sludge storage lagoon. The anaerobic digestor has a capacity of 380,000 gallons, but during the inspection sludge production at the facility exceeded this capacity. Excess untreated sludge was hauled to a sludge treatment facility in Newburg, Oregon. Treated sludge at the Salmon Creek facility was pumped to the storage lagoon, and then hauled by tanker truck to land application sites. During the inspection Salmon Creek was bringing on-line a sludge press, which would allow the facility to decommission the sludge storage lagoon. Polymer stabilized compressed sludge solids were also to be land applied.

Procedure

Ecology collected both grab and composite samples at the WWTP. Composite samples were collected June 4-5, 1996 from plant wastewater at two stations (Figure 2 & Appendix A): the influent at the headworks just upstream of the Parshall flume and the disinfected effluent just above the south weir at the end of the chlorine contact chamber. All strainers were submerged approximately 12 inches below the surface of the flow and positioned to prevent entrainment of sediments.

All composite samples were collected using Ecology ISCO composite samplers with equal volumes of the sample collected every 30 minutes over a 24-hour period. Due to rags plugging the influent strainer during the early morning of June 5, the final eight aliquots of the influent composite sample were not collected, reducing the final sample volume approximately 10% to 20%. The sample is believed to be representative of a 20-hour collection period, but likely missed a portion of the typical mid morning high flows and low concentrations. Because the compositor also missed a portion of the early morning low flows with typically high concentrations, it is not possible to conclude whether the sample under-represented full 24-hour concentrations. A single transfer blank was also collected on June 3 by running deionized (DI) water through the effluent compositor prior to sampling.

Grab samples targeting oil & grease, TSS, chlorine, and volatile organics were collected at influent and effluent composite stations, both in the morning and the afternoon of June 4. A three-part grab-composite for bioassays was collected on June 4-5 from the channel beyond the #2 (North) secondary clarifier perimeter weir just prior to the chlorine contact chamber. A morning and afternoon grab sample for fecal coliform was taken June 4 from the effluent sample location. The fecal coliform sample was pumped from the outfall pipe using a peristaltic pump provided by the Salmon Creek WWTP. The hose used with the pump was cleaned biweekly by flushing with chlorine, rinsing, and back-flushing with thiosulfate. The nozzle used to fill the fecal coliform bottles was cleaned with an alcohol wipe and rinsed prior to sampling. Digested sludge samples were collected from the spray discharge to the sludge holding tank on June 4.

Salmon Creek personnel collected a composite sample on June 4-5 just above the final effluent weir. The Salmon Creek sample location was similar to the location of Ecology's effluent composite sampler. Salmon Creek composite samples were split for analysis by both Ecology and Salmon Creek laboratories. Parameters analyzed, samples collected, and the sampling schedule appear in Appendix B.

Samples for Ecology analysis were put in appropriate containers and preserved as necessary. Samples were packed in ice for delivery to the Ecology Manchester Environmental Laboratory. Holding time restrictions were observed for all samples. Analytical procedures and laboratories performing the analyses are summarized in Appendix C. Sampling quality assurance included priority pollutant cleaning of sampling equipment (Appendix D).

Specific QA/QC Discussions

A transfer blank was submitted for metals analysis to establish baseline sampling conditions. Sampling quality assurance included ultra-cleaning (priority pollutant cleaning) of sampling equipment to remove trace priority pollutant contaminants. Sampling in the field followed all protocols for holding times, preservation, and chain-of-custody set forth in the Manchester Environmental Laboratory Lab Users Manual (Ecology, 1994).

Laboratory QA/QC, including holding times, matrix spike and duplicate spike sample analyses, surrogate recoveries, and precision data were, with a few exceptions, within appropriate ranges. Initial calibration verification standards and continuing calibration standards were within relevant USEPA (CLP) control limits. Procedural blanks were predominantly free from contamination. For bioassays the conduct of testing, responses to positive and negative controls, and water quality data are acceptable. Qualifiers are included in the data table where appropriate. The following are specific concerns:

General Chemistry

Relative percent difference (RPD) determined in the precision analysis of fecal coliform samples was not in the acceptable +/- 20% window. Reaction rates are controlled by several factors, including the kinetics of growing and decaying microorganisms, enzyme reactions, temperature, and organic catalysts. These reaction rate variables in biological analyses can produce high imprecision in duplicate samples.

Volatile and Semivolatile Organics

Low levels of certain target volatile and semi-volatile compounds were detected in laboratory blanks. The EPA five times rule was applied to all target compounds that were found in the blank. If the concentrations of the compounds in the samples were greater than or equal to five times the concentration of the compounds in the associated method blank, they are considered native to the sample. In the semi-volatile organic analysis two compounds, caffeine and 3B-coprostanol, exceeded the linear calibration range of the instrument. Both have been qualified with the "E" qualifier, indicating the presence of interference. The data are acceptable for use as qualified.

Metals

Spike recoveries for selenium in the water samples and selenium, arsenic, antimony, and silver in the sludge sample were outside CLP acceptance limits of +/- 25%. These parameter results have been qualified with a "J" qualifier as an estimate due to poor recovery. The relative percent difference (RPD) determined in the precision analysis of arsenic was high and has been qualified with a "J" qualifier to indicate that it is an estimate.

Results And Discussion

Flow Measurements

Salmon Creek determines plant effluent flows for NPDES permit reporting purposes by combining independent totalizer flow measurements at the two effluent weirs. Influent flows are also determined by totalizer flow measurements at the headworks Parshall flume. Daily 24-hour (0800-0800) combined totalized effluent flows reported by Salmon Creek were 3.76 MGD for June 3-4 and 4.07 MGD for June 4-5, with an average daily flow over the two-day period of 3.92 MGD. Influent flow volume for an approximate two-day period (June 3-5, 1235-1030: 45.9 hours) was 9.90 MGD, for an average flow of 5.18 MGD. The inaccessibility of the effluent weirs precluded independent verification of effluent flow measurements. Verification of flows was attempted at the influent Parshall flume.

It was noted during the inspection that the influent Parshall flume walls were not fully vertical or parallel, and only an estimate of flume neck width could be determined. This could have affected the accuracy of the Salmon Creek flow meter, as well as the Ecology verification measurement. Also, the accuracy of the Salmon Creek ultrasonic flow meter was likely impaired by floating debris in the surface level detection well, producing additional errors in their flow measurements. The instantaneous flow recorded from the Salmon Creek flow measurement device was 6.46 MGD. The Ecology calculated flow determined from measurements in the Parshall flume was 5.19 MGD, for a relative percent difference of 22%. Although both Ecology and Salmon Creek influent flows are likely inaccurate due to the problems noted above, it is possible that Salmon Creek is overestimating influent flow by a substantial margin. The Salmon Creek totalized effluent flow was 1.26 MGD less (24% less) than their totalized influent flow, but it is unlikely that such a large hydraulic loss could occur across the treatment plant. Salmon Creek should verify the accuracy of the influent flow measurement device and correct any structural or operational problems that may be causing errors in measurements.

General Chemistry Results And Treatment Plant Effectiveness

Treatment Plant Influent

Ecology general chemistry results are presented in Table 1. Influent concentrations of five-day biochemical oxygen demand (BOD_5 - 192 mg/L), total solids (TS - 494 mg/L), total non-volatile solids (TNVS - 251 mg/L), total suspended solids (TSS - 188 mg/L), total Kjeldahl nitrogen (TKN - 29.5), and ammonia nitrogen (NH_3-N - 19.6 mg/L) were all

approximately the same as the medium concentration for typical untreated domestic wastewater (Metcalf & Eddy, 1991). The average influent oil & grease concentration (O&G - 25 mg/L) was about 50% less than the typical weak concentration. The total organic carbon (TOC - 69 mg/L) was less than the typical weak concentration and the BOD_5/TOC ratio (2.78) was about two times greater than typical values (Metcalf & Eddy, 1991). Since TOC is a measure of biologically inactive as well as active organic carbons, the ratio suggests a scarcity of compounds resistant to biological degradation in the influent. This would imply a smaller concentration of persistent organic compounds relative to typical treatment plant influents which could be passed to the effluent.

Treatment Plant Effluent

Reductions across the entire system were calculated and the results presented in Table 2. Ecology results showed a total BOD_5 reduction across the system from 192 mg/L in the influent to 16 mg/L in the effluent for a 92% removal efficiency. Total suspended solids (TSS) decreased from 188 mg/L to 13 mg/L, with a removal efficiency of 93% across the system. Removal efficiency across the plant for TOC was 80%. Ammonia nitrogen was reduced from 19.6 to 16.4 for a reduction of 16%. Total Kjeldahl nitrogen and total phosphorous were reduced 39% and 78% respectively. Nitrate and nitrite nitrogen concentrations increased from 0.043 mg/L to 0.099 mg/L. Analysis of Salmon Creek samples displayed slightly greater reductions in TSS and total BOD_5, and similar reductions in TOC and ammonia nitrogen. The data suggest highly effective treatment of TSS and BOD_5 and only limited nitrification. Chlorine residual concentrations in all samples were less than detection limits.

Attempts to replicate an Ecology 1994 mixing zone study of Salmon Creek WWTP outfall (Ecology, 1995) performed using the UDKHDEN mixing zone model encountered several problems. The original analysis was premised on a freshwater river mixing zone boundary and produced mixing zone dilution factors of 39 and 86 for acute and chronic zones respectively. Since the Columbia River at the outfall flows in both directions due to tidal influences, the use of a river dilution zone boundary may not be appropriate (Glenn, 1997). Other problems resulted from the use of the UDKHDEN model. Of particular concern is the use of the model with an negative densimetric Froude number (negative plume buoyancy), as calculated using the 3PLUMES dilution zone model. The UDKHDEN model is unreliable at Froude numbers less than 2.5, and arbitrarily changes the sign for negative Froude numbers. It has been suggested that negative Froude numbers can be handled in UDKHDEN by inverting the axes and initial densities (Davis, 1997), but this was not done in the 1994 study. Also, the original analysis modeled the plume direction as 170° and 190° to the diffuser (80° & 100° counter clock-wise from the ambient current flow direction), but the reliability of the UDKHDEN model is limited at angles outside of 45° to 135° to the diffuser (Glenn, 1994). A final problem derives from the use of 10% and 90% ambient current velocities in the model. Since it is difficult to predict which velocity regime will produce the critical dilution factor, the conservative

procedure is to perform a sensitivity analysis over a wide range of current velocities to determine the critical dilution.

Due to the disadvantages of the UDKHDEN model, 3PLUMES was considered to be the preferred dilution zone model for analyzing this outfall. Estuary regulatory boundaries were set at 6.61 meters for the acute dilution and 66.1 meters for chronic dilution. The outfall was modeled with the assumption that the ambient current direction is oriented 90° to the diffuser. Also since the diffuser ports are three 5-inch by 5-inch square apertures located equally distant around the riser circumference (one in the direction of the ambient current), it was decided that this could best be modeled by a single port aperture of equal cross-sectional area. Based on a 3PLUMES model incorporating ambient current velocities ranging from 0.0001 m/s to 10 m/s and assuming each riser has a total port aperture equivalent to a cross-sectional diameter of 9.8 inches, chronic dilution factors were determined at critical ambient flows.

The factors determined by 3PLUMES for a three-riser configuration were estimated to be 11.7 and 36.5 for acute and chronic boundaries respectively. The former was based on a discharge of 7.4 MGD and ambient current velocity of 0.0001m/s, and the latter was based on a discharge of 6.2 MGD and ambient current velocity of 0.04 m/s Subsequent to the Class II inspection two additional risers with similar nozzle configurations were installed at the outfall (spacing between each riser was reduced to 10 feet). The dilution factors for a five-riser configuration were estimated to be 11.7 and 18.5 (ambient current velocity: 0.05 m/s) for acute and chronic boundaries respectively. Salmon Creek should conduct additional modeling in conjunction with in-stream dye studies to establish representative dilution factors at the edge of acute and chronic dilution zones.

A mass balance calculation incorporating Washington State Water Quality Standards mixing zone specifications was performed to project maximum end-of-pipe concentrations which would not produce violations of total ammonia criteria at the acute and chronic dilution zone boundaries (Ecology, 1994). The calculation uses an adjusted total ammonia nitrogen criteria, that is based upon the receiving water pH and temperature for samples collected during the Class II inspection (June 5, 1996). The receiving water ammonia concentration was also analyzed and found to be at or below the detection limit of 0.01 mg/L. The maximum allowable whole effluent ammonia nitrogen concentrations for the three-riser configuration were 34.6 mg/L and 19.0 mg/L for the acute and chronic criteria respectively. The effluent ammonia nitrogen concentration (16.4 mg/L) determined during the inspection was within the allowable acute and chronic concentrations. For the five-riser configuration the maximum allowable chronic whole effluent ammonia nitrogen concentration is lower (9.63), likely due to lower discharge velocity. Although this configuration was not present during the inspection, the inspection 24-hour ammonia nitrogen concentration would have exceeded the new maximum allowable chronic whole effluent criteria by 71%. An investigation should be conducted to determine whether ammonia nitrogen criteria are currently being exceeded under the current outfall configuration.

NPDES Permit Comparisons

Table 3 compares inspection results to NPDES permit limits. The Ecology composite 24-hour effluent BOD_5 concentration (16 mg/L) was well below the permit monthly average limit and the weekly average limit. The effluent 24-hour composite BOD_5 load (543 lb/day) was about 31% of the NPDES permit monthly average effluent load and about 20% of the weekly average load limit. The percent reduction from the influent concentration (93%) was greater than the minimum monthly average reduction (85%) required by the permit. The Salmon Creek sample 24-hour effluent BOD_5 results (11 mg/L and 373 lb/day) and percent reduction (95%) were also within permit limits.

The Ecology 24-hour composite effluent TSS concentration (13 mg/L) and load (441 lb/day) were within the monthly and weekly average permit limits. Percent reduction across the plant (95%) was greater than the 85% monthly average reduction required by the permit. The Salmon Creek sample concentrations and loads gave similar results. Effluent fecal coliform results (14 and 11 colonies/100ml) were well below permit limits, and all effluent pH results were within the stipulated range. The reported totalized average influent flow of 5.18 MGD was well below the NPDES permit design limit of 7.4 MGD. Influent BOD_5 and TSS concentrations and loads were well below permit overloading limits.

Detected Priority Pollutant Organics And Metals

Table 4 summarizes concentrations of organic and metal parameters detected with priority pollutant scans. Appendix E contains results of all targeted organic compounds and metals results. Tentatively identified compounds are presented in appendix F. A glossary is included in appendix G.

Three VOA compounds and twelve BNA compounds were detected in the 24-hour composite effluent sample. Results did not exceed either freshwater or marine acute and chronic water quality criteria. One Pesticide compound, gamma-BHC, was detected in the effluent at 0.082 µg/L. This exceeded the chronic water quality criteria of 0.8µg/L, but this concentration is expected to be reduced to below the criteria at the edge of the chronic dilution zone. Influent organic results at the highest concentrations included (1) the VOA, Acetone (199µg/L) and (2) the BNA, 3B-Coprostanol (210 µg/L).

Three priority pollutant metals were detected in the plant effluent. Copper (13 µg/L) exceeded the freshwater acute and chronic water quality criteria in the whole effluent (EPA, 1986). Lead (2.9 µg/L) exceeded the freshwater chronic water quality criterion in the whole effluent. Estimated dilution in the receiving water (acute - 11.7; and chronic - 36.5, three-risers, or 18.5, five-risers) will reduce inspection effluent copper and lead concentrations to less than both the acute and chronic criteria. Influent metal results at the

highest concentrations include chromium (0.39 µg/L), copper (61.9 µg/L), lead (2.5 µg/L), mercury (0.37µg/L), silver (1.9µg/L), and zinc (78µg/L) .

Effluent Bioassays

Ecology bioassay results detected moderate acute effluent toxicity, but considerable chronic effluent toxicity (Table 5). The *Daphnia magna* acute 48-hour survival test found survival was greater than 95% at all concentrations in the dilution series. Statistical analysis determined that the lowest-observable-effect-concentration (LOEC) was greater than 100%, and the no-observable-effect-concentration (NOEC) was equal to 100%. The fathead minnow 96-hour survival test detected generally declining survival at higher concentrations, with 57.5% mortality at 100% effluent. The LC_{50} (concentration with 50% mortality) was estimated to be 97.4%. The LOEC and NOEC were 100% and 50% respectively. With an acute dilution factor of 11.7 the acute critical effluent concentration is 8.55% which is less than the NOEC of 50%. This indicates that at the edge of the acute boundary there should be no significant difference in response between the dilute effluent concentration and the control.

The fathead minnow (*Pimephales promelas*) chronic 7-day survival and growth test found generally declining survival and growth with increasing concentration. The survival analysis produced an LC_{50} of 65.2%, LOEC of 50%, and NOEC of 25%. The growth analysis produced an LOEC and an NOEC of less than 6.25%. Since the NOEC is less than 6.25%, this represents a statistically significant difference in response at a concentration lower than the acute critical effluent concentration (an acute dilution factor of 11.7 produces a critical concentration at 8.55% of 100% effluent) The chronic test exceeds the performance standard cited in the Washington State Whole Effluent Toxicity Testing and Limits (WAC 173-205). Since a reasonable potential exists for chronic conditions in the receiving water, Salmon Creek should further characterize the effluent by toxicity testing as outlined in WAC 173-205-050.

The cause of toxicity in the effluent might be ammonia, lead, or copper concentrations, since all were found to exceed chronic water quality criteria in the whole effluent. The facility should evaluate whether these parameters are the source of the toxicity.

Sludge

General Chemistry

General chemistry sludge results are presented in Table 1. The sludge wet weight fecal coliform density is 540,000 colonies (MPN: most probable number) per 100 grams (246,000 #/gram - dry wt.). The dry weight result exceeds the maximum limit for fecal

coliform density of 1000 #/g dry wt. as required for Class A sewage sludge land application, but is within the Class B designation limit of 2,000,000 #/gram (EPA, 1993). The wet weight E. coli density is 350,000 colonies (MPN) per 100 grams (159,000 #/g - dry wt.). Salmon Creek should ensure that treated sludge destined for land application meets applicable pathogen density restrictions under 40 CFR 257.32.

Detected Priority Pollutants

Two VOA compounds and seven BNA compounds were detected in the composite sludge sample. One VOA, p-isopropyltoluene, was detected at 2130 µg/Kg-dry wt. One BNA compound, 3B-coprostanol, was detected at 35,600 µg/Kg-dry wt. Eleven metals were detected in the sludge. Copper, silver, lead, and chromium concentrations (694 mg/Kg-dry wt., 20.2 mg/Kg-dry wt., 29.3 mg/Kg-dry wt., and 32.4 mg/Kg-dry wt. respectively) were the most prominent. The concentrations of priority pollutants in the sludge did not exceed either EPA standards for land application of sewage sludge (EPA, 1993) or screening concentrations for the dangerous waste designation criteria (Table 6).

Split Samples

Sample Comparisons

Ecology analyses of samples collected by Ecology and Salmon Creek produced very similar results (Table 7). Relative percent differences (RPD) between pairs of TSS, BOD_5, and pH samples were less than variations in precision cited in the EPA comparison of interlaboratory analysis of selected parameters (EPA, 1983). The RPD between Ecology and Salmon Creek fecal coliform results averaged 19%. The RPD between Ecology and Salmon Creek chlorine residual results averaged 83% , but this was for values near the detect levels of the instruments where considerable variability would be expected.

Laboratory Comparisons

Only three parameters from one sample were available for laboratory comparisons, so conclusions have negligible statistical power. However, Ecology and Salmon Creek laboratory results for influent samples collected by Salmon Creek were extremely close, with RPDs between samples of 8% for TSS, 5% for pH, and identical results for BOD_5. This would suggest that the Salmon Creek laboratory performance was good.

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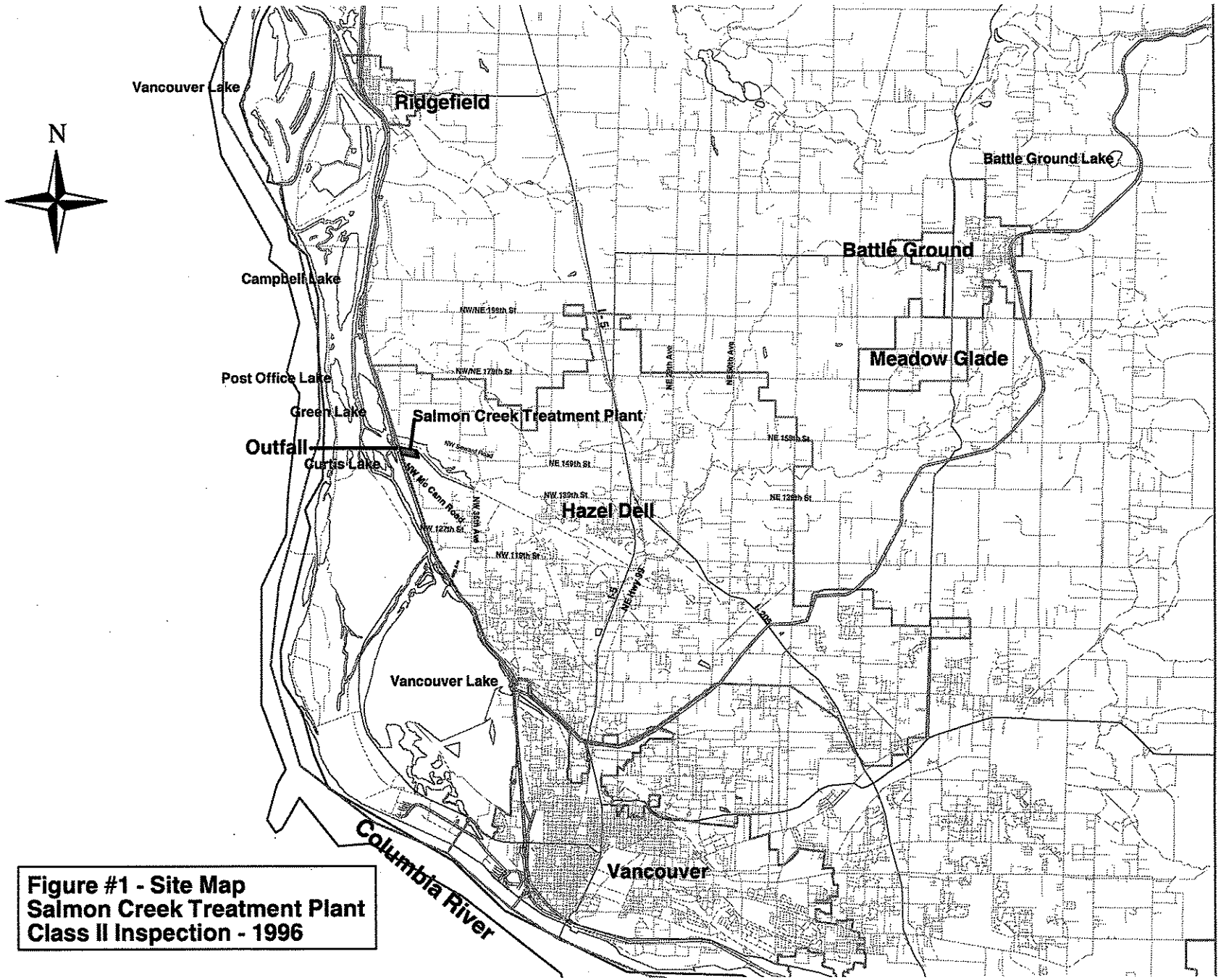
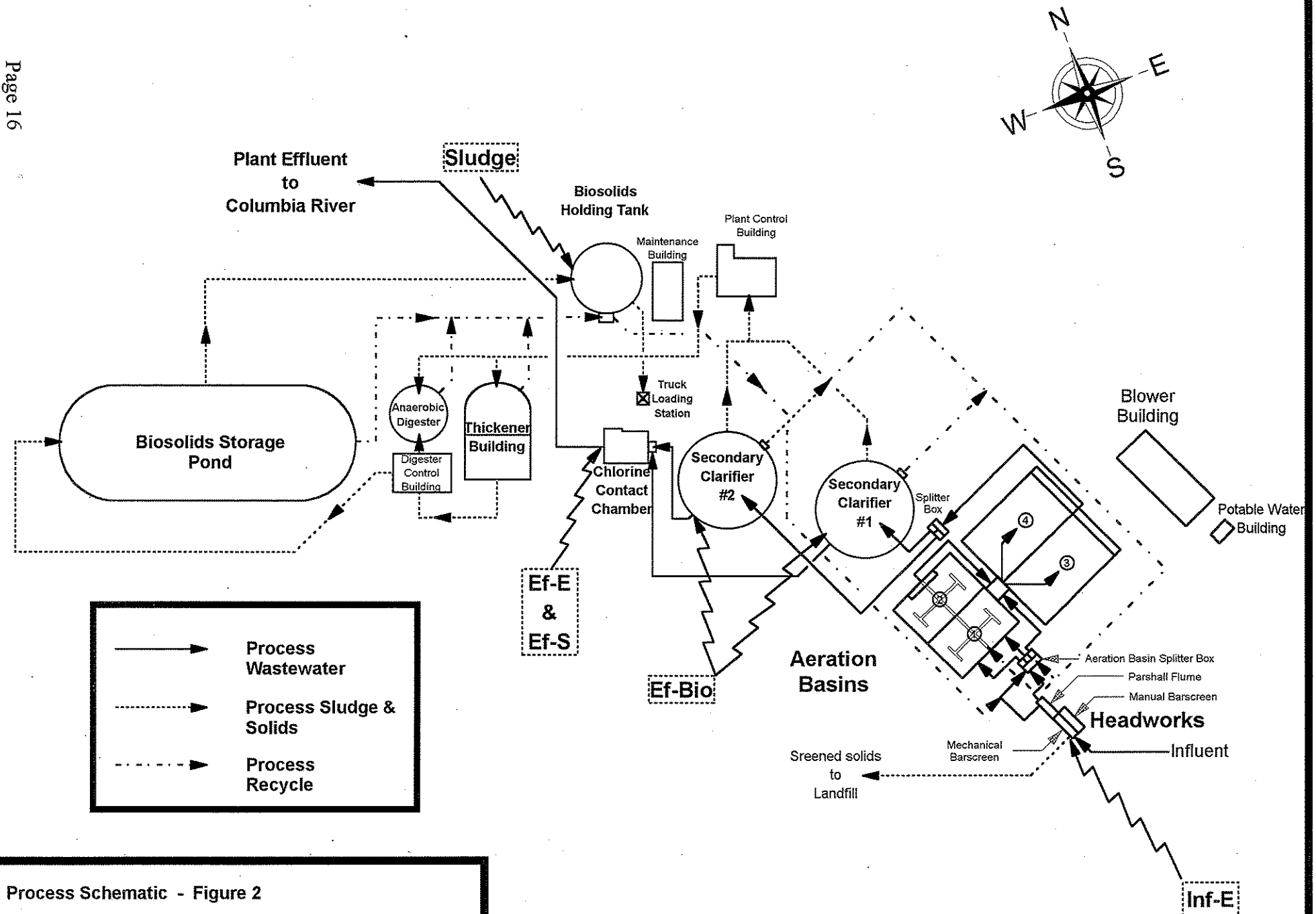


Figure #1 - Site Map
Salmon Creek Treatment Plant
Class II Inspection - 1996



Process Schematic - Figure 2
Salmon Creek Wastewater Treatment Plant
Class II Inspection, 1996

Table 1 - Ecology General Chemistry Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Ef-E-1	Ef-E-2	Ef-E	Ef-S
	Type:	grab	grab	comp	grab	grab	comp	comp
	Date:	06/04/96	06/04/96	06/4-5/96	06/04/96	06/04/96	06/4-5/96	06/4-5/96
	Time:	09:35	14:26	08:00-08:00	10:30	14:45	08:00-08:00	08:00-08:00
	Lab Log #:	238230	238231	238232	238233	238234	238235	238237
GENERAL CHEMISTRY								
Conductivity (umhos/cm)		593	536	551	517	520	527	527
Alkalinity (mg/L CaCO3)				211			196	197
Hardness (mg/L CaCO3)				95.6			87.5	87.8
SOLIDS								
TS (mg/L)				494			304	301
TNVS (mg/L)				251			221	223
TSS (mg/L)		163	161	188	13	12	13	12
TNVSS (mg/L)				28			3	3
% Solids								
% Volatile Solids								
OXYGEN DEMAND PARAMETER								
BOD5 (mg/L)				192			16	11
TOC (water (mg/L)				69			14	14
TOC (soil/sed (mg/L)								
NUTRIENTS								
Total Kjeldahl Nitrogen (TKN) (mg/L)				29.5			17.9	18.3
NH3-N (mg/L)				19.6			16.4	19.4
NO2+NO3-N (mg/L)				0.043			0.099	0.115
Total-P (mg/L)				6.37			1.43	1.3
MISCELLANEOUS								
Oil and Grease (mg/L)		24	26		2	3		
F-Coliform MF (#/100mL)								
Fecal Coliform MPN(sed - #/100g)								
E. Coli MPN(sed - #/100g)								
FIELD OBSERVATIONS								
Temperature (° C)		17.1	18.7		17	19.5		
Temp-cooled (° C)$^{-+}$				4.0			7.3	7.1
pH		7.04	7.34	6.73	6.93	7.31	7.29	7.68
Conductivity (umhos/cm)		663	550	587	536	541	558	561
Chlorine (Total - mg/L)		≤0.1	≤0.1		0.3	0.2	≤0.1	

Inf	Influent sample	-+	Refrigerated sample
Ef	Effluent sample	F	Fecal coliform sample
E	Ecology sample		
S	Salmon Creek sample		
grab	Grab sample		
comp	Composite sample		

Table 1 - Ecology General Chemistry Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Ef-E1-F	Ef-E2-F	Ef-Bio	Trnsf-Blk	Sludge	Columbia
	Type:	grab	grab	grab-comp	grab	grab	grab
	Date:	06/04/96	06/04/96	06/4-5/96	06/03/96	06/04/96	06/05/96
	Time:	11:25	16:55	12:10&09:15	12:45	15:30	1200
	Lab Log #:	238242	238241	238236	238238	238239	238240
GENERAL CHEMISTRY							
Conductivity (umhos/cm)				521			124
Alkalinity (mg/L CaCO3)							
Hardness (mg/L CaCO3)					0.2 U		53.3
SOLIDS							
TS (mg/L)							
TNVS (mg/L)							
TSS (mg/L)				14	1 U		16
TNVSS (mg/L)							
% Solids						2.2	
% Volatile Solids						1.4	
OXYGEN DEMAND PARAMETERS							
BOD5 (mg/L)							
TOC (water (mg/L)							
TOC (soil/sed (mg/L)						5700	
NUTRIENTS							
Total Kjeldahl Nitrogen (TKN) (mg/L)							
NH3-N (mg/L)							0.01 U
NO2+NO3-N (mg/L)							
Total-P (mg/L)							
MISCELLANEOUS							
Oil and Grease (mg/L)							
F-Coliform MF (#/100mL)		14	11				
Fecal Coliform MPN(sed - #/100g-wet wt.)						540000	
E. Coli MPN(sed - #/100g-wet wt.)						350000	
FIELD OBSERVATIONS							
Temperature (° C)		18.2	18.1				18.5
Temp-cooled (° C)-+				9.1			
pH		7.12	7.15	7.53			8.29
Conductivity (umhos/cm)		533	535	549			127
Chlorine (Total - mg/L)		≤0.1		≤0.1			

Ef	Effluent sample	Trnsf-Blk	Transfer blank sample
E	Ecology sample	Sludge	Sludge sample
S	Salmon Creek sample	Columbia	Columbia River receiving water sample
Bio	Bioassay sample	grab-comp	Grab composite sample
grab	Grab sample	U	The analyte was not detected at or above the reported result.
comp	Composite sample	-+	Refrigerated sample

Table 2 - Ecology General Chemistry Percent Reduction Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Inf-E	Ef-E	Ecology Percent Reduction In Total Load Across The Treatment Plant#	Ef-S	Salmon Creek Percent Reduction In Total Load Across The Treatment Plant#
	Type:	comp	comp		comp	
	Date:	06/4-5/96	06/4-5/96		06/4-5/96	
	Time:	08:00-08:00	08:00-08:00		08:00-08:00	
	Lab Log #:	238232	238235		238237	
GENERAL CHEMISTRY						
Conductivity (umhos/cm)		551	527	4%	527	4%
Alkalinity (mg/L CaCO3)		211	196	7%	197	7%
Hardness (mg/L CaCO3)		95.6	87.5	8%	87.8	8%
SOLIDS						
TS (mg/L)		494	304	38%	301	39%
TNVS (mg/L)		251	221	12%	223	11%
TSS (mg/L)		188	13	93%	12	94%
TNVSS (mg/L)		28	3	89%	3	89%
OXYGEN DEMAND PARAMETER						
BOD5 (mg/L)		192	16	92%	11	94%
TOC (water (mg/L)		69	14	80%	14	80%
NUTRIENTS						
Total Kjeldahl Nitrogen (TKN) (mg/L)		29.5	17.9	39%	18.3	38%
NH3-N (mg/L)		19.6	16.4	16%	19.4	1%
NO2+NO3-N (mg/L)		0.043	0.099	-130%	0.115	-167%
Total-P (mg/L)		6.37	1.43	78%	1.3	80%
FIELD OBSERVATIONS						
pH		6.73	7.29	72% *	7.68	89% *
Conductivity (umhos/cm)		587	558	5%	561	4%

Ef Effluent sample
E Ecology sample
S Salmon Creek sample
comp Composite sample

* Percent reduction in hydrogen ion concentration

\# Based on Ecology totalized effluent flows for June 4-5,1996.

Table 3 - NPDES Comparison Results - Salmon Creek Class II Inspection - June, 1996.

Parameter	NPDES Permit Effluent Limits			Inspection Results						
				Ecology Composites		Salmon Creek Composites	Ecology Grabs			
			Location:	Inf-E	Ef-E	Ef-S	Ef-E-1	Ef-E-2	Ef-E1-F	EF-E2-F
			Type:	comp	comp	comp	grab	grab	grab	grab
	Monthly Average	Weekly Average	Date:	06/4-5/96	06/4-5/96	06/4-5/96	06/04/96	06/04/96	06/04/96	06/04/96
			Time:	08:00-08:00	08:00-08:00	08:00-08:00	1200	1810	1100	1810
			Lab Log #:	238232	238235	238237	238233	238234	238242	238241
Effluent Biochemical Oxygen Demand (BOD_5)										
Concentration: (mg/L)	30	45			16	11				
Loading: (lbs/day)	1740	2610			543 *	373 *				
Percent Reduction	≥85% Monthly averages shall not exceed 30 mg/L or 15% of influent monthly average				93%	95%				
Effluent Total Suspended Solids (TSS)										
Concentration (mg/L)	30	45			13	12	13	12		
Loading: (lbs/day)	1740	2610			441 *	407 *				
Percent Reduction	≥85% Monthly averages shall not exceed 30 mg/L or 15% of influent monthly average				95%	95%				
Effluent Fecal Coliform										
Concentration (count/100 mL)	200	400							14	11
Effluent pH										
(S.U.)	6.0 < pH < 9.0				7.29	7.68	6.93	7.31	7.12	7.15
Influent Flow Overloading Limits										
(MGD)	7.4				5.18					
Influent BOD_5 Overloading Limits										
(mg/L)					192					
(lbs/day)	11600 (For Maximum Calendar Month)				8,295 **					
Influent TSS Overloading Limits										
(mg/L)					188					
(lbs/day)	11600 (For Maximum Calendar Month)				8,122 **					

E	Ecology 4-hour composite sample
S	Salmon Creek 24-hour composite sample
Inf	Influent sample
Ef	Effluent sample
comp	Composite sample
grab	Ecology grab sample.

Ef-E1-F	AM effluent fecal coliform sample
Ef-E2-F	PM effluent fecal coliform sample
*	Load calculated from daily effluent flow of 4.07 MGD recorded 6/4-5/96.
**	Load calculated from an average daily influent flow of 5.18 MGD recorded 6/3-5/96.

Table 4 - Ecology Detected Priority Pollutant Organics and Metals Results - Salmon Creek Class II, 1996

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Ef-E-1	Ef-E-2	Ef-E	Washington State Water Quality Criteria		Sludge
	Type:	grab	grab	comp	grab	grab	comp			grab
	Date:	06/04/96	06/04/96	06/4-5/96	06/04/96	06/04/96	06/4-5/96			06/04/96
	Time:	09:35	14:26	08:00-08:00	10:30	14:45	08:00-08:00	Acute	Chronic	15:30
	Lab Log #:	238230	238231	238232	238233	238234	238235			238239
VOA COMPOUNDS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.
Acetone		53 J	119 J							
Chloroform		0.7 J	1.9		0.86 J	0.6 J		28900 *	1240 *	
1,1,1-Trichloroethane		0.19 J	0.09 J					18000 *(c)		
Trichloroethene			3.2					45000 *	21900 *	
Tetrachloroethene		0.13 J	0.36 J					5280 *	840 *	
Toluene		0.81 J	0.98 J		0.25 J			17500 *		
1,2,4-Trimethylbenzene		0.09 J								
p-Isopropyltoluene			2.7							2130
1,4-Dichlorobenzene		0.81 J	0.92 J	0.59	0.54 J	0.5 J	0.27	1120 *(h)	763 *(h)	938 J
1,2-Dichlorobenzene		0.04 J		0.015 J				1120 *(h)	763 *(h)	

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Ef-E-1	Ef-E-2	Ef-E	Washington State Water Quality Criteria		Sludge
	Type:	grab	grab	comp	grab	grab	comp			grab
	Date:	06/04/96	06/04/96	06/4-5/96	06/04/96	06/04/96	06/4-5/96			06/04/96
	Time:	09:35	14:26	08:00-08:00	10:30	14:45	08:00-08:00	Acute	Chronic	15:30
	Lab Log #:	238230	238231	238232	238233	238234	238235			238239
BNA COMPOUNDS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.
Benzoic Acid				18			1.6 J			
Isophorone				0.54			0.062 J	117000 *		
Phenanthrene							0.009 J			
Pentachlorophenol							0.68 J	20 **	13 **	
2,4,6-Trichlorophenol							0.29 J		970 *	
2-Methylnaphthalene				0.094 J						
2-Methylphenol				0.16 J			0.028 J			
1,2-Dichlorobenzene		0.04 J		0.015 J				1120 *(h)	763 *(h)	
2,4,5-Trichlorophenol				0.23 J						
Benzyl Alcohol				6.4						
2,4-Dimethylphenol							0.094 J	2120 *		
4-Methylphenol				15			0.31			25
1,4-Dichlorobenzene		0.81 J	0.92 J	0.59	0.54 J	0.5 J	0.27	1120 *(h)	763 *(h)	938 J
4-Chloroaniline				1.7						27
Phenol				2.2				10200 *	2560 *	27
Di-n-Octyl Phthalate				0.86				940 *(i)	3 *(i)	46
2,4-Dichlorophenol							0.3	2020 *	365 *	
1-Methylnaphthalene				0.075 J						
3B-Coprostanol				210 E			6.1			35600 E
Caffeine				36 E						
Ethanol, 2-(2-Butoxyethoxy), Acetate				91 NJ			21 NJ			
Ethanol, 2-Butoxy-, Phosphate (3:1)							4.8 NJ			
Cholesterol										4080 NJ

Inf	Influent sample	Ef	Effluent sample	E	The reported result is an estimate because of the presence of interference.
E	Ecology sample	Sludge	Sludge sample	J	The analyte was positively identified. The associated numerical result is an estimate.
grab	Grab sample	h	Total Dichlorobenzenes	N	There is evidence that the analyte is present in this sample.
comp	Composite sample	i	Total Phthalate Esters	*	Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.

Table 4 - Ecology Detected Priority Pollutant Organics and Metals Results - Salmon Creek Class II, 1996

Parameter	Location:	Ef-E	Washington State Water Quality Criteria	
	Type:	comp		
	Date:	06/4-5/96		
	Time:	08:00-08:00	Acute	Chronic
	Lab Log #:	238235		
PESTICIDES/PCB COMPOUNDS		µg/L	µg/L	µg/L
gamma-BHC		0.082	2	0.08

Parameter	Location:	Inf-E	Ef-E	Trnsf-Blk	Washington State Water Quality Criteria		Sludge	Columbia
	Type:	comp	comp	grab			grab	grab
	Date:	06/4-5/96	06/4-5/96	06/03/96			06/04/96	06/05/96
	Time:	08:00-08:00	08:00-08:00	12:45	Acute	Chronic	15:30	1200
	Lab Log #:	238232	238235	238238			238239	238240
METAL COMPOUNDS		µg/L	µg/L	µg/L	µg/L	µg/L	mg/Kg-dry wt.	µg/L
Hardness =	53.3							
Arsenic							2.5 J	
Pentavalent					850 *	48.0 *		
Trivalent					360	190		
Beryllium					130 *	5.30 *	0.31	
Cadmium		0.39			1.67 +	0.60 +	2.5	
Chromium							32.4	
Hexavalent					16.0	11.0		
Trivalent					1037 +	124 +		
Copper		61.9	13		8.45 +	5.95 +	694	
Lead		2.5	2.9	1.9	25.2 +	0.98 +	29.3	1.1
Mercury (Total)		0.37			2.40	0.01	3.95	
Nickel					791 +	88.0 +	25.6	
Selenium					20	5	284	
Silver		1.9			0.73 +	0.12	20.2 J	
Zinc		78	21	4.5	61.2 +	55.4 +	789	5.9

Inf	Influent sample
E	Ecology sample
grab	Grab sample
comp	Composite sample
Columbia	Columbia River receiving water sample
Ef	Effluent sample
Sludge	Sludge sample

J	The analyte was positively identified. The associated numerical result is an estimate.
*	Insufficient data to develop criteria. Value presented is the LOEL - Lowest Observed Effect Level.
+	Hardness dependent criteria (53.3 mg/L - receiving water hardness used).

Table 5 - Effluent Bioassay Results - Salmon Creek Class II - June, 1996

NOTE: Composite sample taken from both secondary clarifier effluents, prior to chlorine contact chamber (Ef-Bio: Lab Log #238236)

Daphnia magna - 48-hour survival test

(Daphnia magna)

Sample	Number Tested *		Percent Survival
Control	20		100
6.25 % Effluent	20		95
12.5 % Effluent	20		95
25 % Effluent	20		100
50 % Effluent	20		95
100 % Effluent	20		100

Survival
LC50 Could not be calculated
LOEC > 100 % effluent
NOEC = 100 % effluent

* 4 replicates of 5 organisms

Fathead Minnow - 96-hour survival test

(Pimpephales promelas)

Sample	Number Tested *		Percent Survival
Control	40		92.5
6.25 % Effluent	40		90.0
12.5 % Effluent	40		87.5
25 % Effluent	40		85.0
50 % Effluent	40		82.5
100 % Effluent	40		42.5

Survival
LC50 = 97.4% effluent
LOEC = 100 % effluent
NOEC = 50 % effluent

* 4 replicates of 10 organisms

Fathead Minnow - 7 day survival and growth test

(Pimephales promelas)

Sample	Number Tested *		Percent Survival	Average Dry Weight per Fish (mg)
Control	40		92.5%	0.041
6.25 % Effluent	40		75.0%	0.118
12.5 % Effluent	40		65.0%	0.075
25 % Effluent	40		90.0%	0.093
50 % Effluent	40		60.0%	0.085
100 % Effluent	40		15.0%	0.066

Survival	Growth
LC50 = 65.2 % effluent	
LOEC = 50 % effluent	LOEC < 6.25 % effluent
NOEC = 25 % effluent	NOEC < 6.25 % effluent
IC_P = Not calculated	ICp = Not calculate

* four replicates of 10 organisms

NOEC	No observable effects concentration
LOEC	Lowest observable effects concentration
LC50	Lethal concentration for 50% of the organisms
IC_P	Inhibition Concentration 25/50% - the dilution concentration at which the exposed population showed a 25/50% growth inhibition

Table 6 - Sludge Result Comparisons to the EPA Land Application Concentration Criteria and to the Dangerous Waste Concentration Thresholds- Salmon Creek Class II - June, 1996

Parameter	Location: / Type: / Date: / Time: / Lab Log #:	Sludge grab 06/04/96 15:30 238239	Volumetric Concentration of Parameters@	EPA Standards for Land Application of Sewage Sludge		Dangerous Waste Regulations Designation Criteria	
				Ceiling Concentrations *	Pollutant Concentrations **	Toxicity Characteristics List +	Screening Concentrations# (20 Times)
Voa Compounds		µg/Kg-dry wt.	**mg/L**			(mg/L)	**(mg/L)**
1,4-Dichlorobenzene		938 J	**0.021**	N.A.	NA	7.5	**150**
Metals		(mg/Kg-dry wt.)	**(mg/L)**	(mg/Kg-dry wt.)	(mg/Kg-dry wt.)	(mg/L)	**(mg/L)**
Arsenic		2.5 J	**0.0554**	75	41	5.0	**100.0**
Cadmium		2.5	**0.055**	85	39	1.0	**20.0**
Chromium (Total)		32.4	**0.719**	3000	1200	5.0	**100.0**
Copper		694	**N.A.**	4300	1500		**N.A.**
Lead		29.3	**0.650**	840	300	5.0	**100.0**
Mercury (Total)		3.95	**0.088**	57	17	0.2	**4.0**
Nickel		25.6	**N.A.**	420	420		**N.A.**
Selenium		284	**6.301**	100	36	1.0	**20.0**
Silver		20.2 J	**0.448**	N.A.	N.A.	5.0	**100.0**
Zinc		789	**N.A.**	7500	2800		**N.A.**

* Ceiling concentration limit for bulk sewage sludge or for sewage sludge sold or given away in a bag or other container.

** Pollutant concentration limit of bulk sewage sludge if it is applied to agricultural land, forest land, a public contact site, or a reclaimation site.

\+ Maximum concentration of the contaminates for the leachate extract toxicity characteristic.

\# Screening concentration criteria of parameter which recommends that such wastes be designated by test methods set forth in WAC 173-303-110.

@ Wet weight concentration of parameter converted to volumetric concentration assuming a sludge specific gravity of 1.01.

Sludge Salmon Creek sludge sample

N.A. Not Applicable

Table 7 - Split Sample Result Comparison - Salmon Creek Class II - June, 1996

	Location:	Ef-E	Ef-S	Ef-E-1	Ef-E-2	Ef-E1-F	Ef-E2-F	Ef-S
	Type:	comp	comp	grab	grab	grab	grab	grab
	Date:	06/4-5/96	06/4-5/96	06/04/96	06/04/96	06/04/96	06/04/96	06/04/96
	Time:	08:00-08:0	08:00-08:0	10:30	14:45	11:25	16:55	
	Lab Log #:	238235	238237	238233	238234	238242	238241	
General Chemistry								
Parameter	**Laboratory**							
TSS	Ecology	13	12					
(mg/L)	Salmon Creek		13					
BOD5	Ecology	16	11					
(mg/L)	Salmon Creek		11					
pH	Ecology	7.29	7.68	6.93	7.31			
	Salmon Creek		7.33					
Fecal Coliform	Ecology					14.0	11.0	15.0
(#/100ml)	Salmon Creek							
Clorine Residual	Ecology			0.3	0.2			0.1
(mg/L)	Salmon Creek							

E	Ecology sample
S	Salmon Creek sample
F	Fecal coliform sample
grab	grab sample
comp	Composite sample
Ef	Effluent sample
Inf	Influent sample

Appendices

Appendix A - Sampling Stations Descriptions - Salmon Creek Class II - June, 1996

Inf-E-#	Ecology grab samples of Salmon Creek influent wastewater collected from the channel just above the influent Parshall flume. Collected 06/4/96 in both A.M. and P.M.
Inf-E	Ecology 24-hour composite sample of Salmon Creek influent wastewater collected from the channel just above the influent Parshall flume. Collected 06/4-5/96
Ef-E-#	Ecology grab samples of Salmon Creek effluent wastewater collected above the South weir at the end of the chlorine contact chamber, just prior to final discharge. Collected 06/4/96 in both A.M. and P.M.
Ef-E	Ecology 24-hour composite sample of Salmon Creek effluent wastewater collected above the South weir at the end of the chlorine contact chamber, just prior to final discharge. Collected 06/4-5/96.
Ef-S	Salmon Creek 24-hour composite samples of Salmon Creek effluent wastewater collected below the South weir at the end of the chlorine contact chamber, just prior to final discharge. Collected 06/4-5/96.
Ef-E#-F	Ecology fecal coliform grab samples of Salmon Creek effluent wastewater collected just prior to final discharge from the outfall pipe using a peristaltic pump provided by Salmon Creek. Collected 06/04/96 in both A.M. and P.M. Lat:45° 43.930 N; Long:122° 45.358 W.
Ef-Bio	Mixed three-part Ecology bioassay grab-composite sample of Salmon Creek unchlorinated effluent collected from both secondary clarifiers below each weir just prior to discharge to the chlorine contact chamber . One part collected on 0604/96 and two parts on 06/05/96.
Transblk	Ecology grab sample of effluent compositor distilled rinse. - Collected 06/03/96.
Sludge	Ecology grab-composite sample of Salmon Creek digested sludge collected from the discharge to the sludge holding tank. - Collected 06/04/96 in the P.M.
Columbia	Ecology grab sample of Salmon Creek receiving water (Columbia River) taken from the bank of the river at Lat:45° 43.330 N; Long:122° 45.478 W. Collected 06/05/96

Appendix B - Sampling Schedule - Salmon Creek Class II - June, 1996.

Parameter	Quantity	Location:	Inf-E-1	Inf-E-2	Inf-E	Ef-E-1	Ef-E-2	Ef-E	Ef-S
		Type:	grab	grab	comp	grab	grab	comp	comp
		Date:	06/04/96	06/04/96	06/4-5/96	06/04/96	06/04/96	06/4-5/96	06/4-5/96
		Time:	09:35	14:26	08:00-08:0	10:30	14:45	08:00-08:00	08:00-08:00
		Lab Log #:	238230	238231	238232	238233	238234	238235	238237
GENERAL CHEMISTRY									
Conductivity	9		E	E	E	E	E	E	E
Alkalinity	3				E			E	E
Hardness	5				E			E	E
SOLIDS									
TS	2				E			E	
TNVS	2				E			E	
TSS	9		E	E	E	E	E	E	ES
TNVSS	2				E			E	
% Solids	1								
% Volatile Solids	1								
OXYGEN DEMAND PARAMETERS									
BOD5	2				E			E	ES
TOC (water)	3				E			E	E
TOC (soil/sed)	1								
NUTRIENTS									
Total Kjeldahl Nitrogen (TKN)	3				E			E	E
NH3-N	4				E			E	E
NO2+NO3-N	3				E			E	E
Total-P	3				E			E	E
MISCELLANEOUS									
Oil and Grease (water)	4		E	E		E	E		
F-Coliform MF	4					E	E		S
F-Coliform (soil/sed)	1								
ORGANICS									
VOC (water)	4		E	E		E	E		
VOC (soil/sed) - Extensive TICs	1								
BNAs (water)	2				E			E	
BNAs (soil/sed) - Extensive TICs	1								
Pest/PCB (water) - Chlorinated	2				E			E	
Pest/PCB (soil/sed) - Chlorinated	1								
METALS									
PP Metals (water)	4				E			E	
PP Metals (soil/sed)	1								
BIOASSAYS									
Daphnia magna (acute)	1								
Fathead Minnow (acute)	1								
Fathead Minnow (chronic)	1								
FIELD OBSERVATIONS									
Temperature	7		E	E		E	E		
Temp-cooled	4				E			E	E
pH	10		E	E	E	E	E	E	ES
Conductivity	11		E	E	E	E	E	E	E
Chlorine	3					E	E		S
	116		**7**	**7**	**19**	**9**	**9**	**19**	**10**

Inf	Influent	E	Ecology Sample or Analysis
Ef	Effluent	S	Salmon Creek sample or Analysis
grab	grab sample		
comp	composite sanmple		

Appendix B - Sampling Schedule - Salmon Creek Class II - June, 1996.

Parameter II	Locatn:	Ef-E1-F	Ef-E2-F	Ef-Bio	Trnsf-Blk	Sludge	Columbia
	Type:	grab	grab	grab-comp	grab	grab	grab
	Date:	06/04/96	06/04/96	06/4-5/96	06/03/96	06/04/96	06/05/96
	Time:	11:25	16:55	12:10&09:	12:45	15:30	1200
	Lab Log #:	238242	238241	238236	238238	238239	238240
GENERAL CHEMISTRY							
Conductivity				E			E
Alkalinity							
Hardness					E		E
SOLIDS							
TS							
TNVS							
TSS				E	E		E
TNVSS							
% Solids						E	
% Volatile Solids						E	
OXYGEN DEMAND PARAMETERS							
BOD5							
TOC (water)							
TOC (soil/sed)						E	
NUTRIENTS							
Total Kjeldahl Nitrogen (TKN)							
NH3-N							E
NO2+NO3-N							
Total-P							
MISCELLANEOUS							
Oil and Grease (water)							
F-Coliform MF		E	E				
F-Coliform (soil/sed)						E	
ORGANICS							
VOC (water)							
VOC (soil/sed) - Extensive TICs						E	
BNAs (water)							
BNAs (soil/sed) - Extensive TICs						E	
Pest/PCB (water) - Chlorinated							
Pest/PCB (soil/sed) - Chlorinated						E	
METALS							
PP Metals (water)					E		E
PP Metals (soil/sed)						E	
BIOASSAYS							
Daphnia magna (acute)				E			
Fathead Minnow (acute)				E			
Fathead Minnow (chronic)				E			
FIELD OBSERVATIONS							
Temperature		E	E				E
Temp-cooled				E			
pH		E	E	E			E
Conductivity		E	E	E			E
Chlorine		E					
		5	**4**	**8**	**3**	**8**	**8**

Inf	Influent	E	Ecology Sample or Analysis	Trnsf-Blk	Transfer blank
Ef	Efluent	S	Salmon Creek sample or Analysis	Sludge	Sludge sample
grab	grab sample	F	Fecal coliform sample	Columbia	Columbia River sample
comp	composite sanmple	Bio	Bioassay sample		

Appendix C - Analytic Methods - Salmon Creek Class II - June, 1996

Parameter	Manchester Methods	APHA Methods	Lab Used
GENERAL CHEMISTRY			
Conductivity	EPA, Revised 1983: 120.1	APHA, 1992: 2510A.	Manchester lab
Alkalinity	EPA, Revised 1983: 310.1	APHA, 1992: 2320B.	Manchester lab
Hardness	EPA, Revised 1983: 130.2	APHA, 1992: 2340C.	Manchester lab
SOLIDS			
TS	EPA, Revised 1983: 160.3	APHA, 1992: 2540B.	Manchester lab
TNVS	EPA, Revised 1983: 160.3	APHA, 1992: 2540E.	Manchester lab
TSS	EPA, Revised 1983: 160.2	APHA, 1992: 2540D.	Manchester lab
TNVSS	EPA, Revised 1983: 160.2	APHA, 1992: 2540D&E.	Manchester lab
% Solids	APHA, 1992: 2540G.	APHA, 1992: 2540G.	Manchester lab
% Volatile Solids	EPA, Revised 1983: 160.4	APHA, 1992: 2540E.	Manchester lab
OXYGEN DEMAND PARAMETERS			
BOD5	EPA, Revised 1983: 405.1	APHA, 1992: 5210B.	Manchester lab
TOC (water)	EPA, Revised 1983: 415.1	APHA, 1992: 5310B.	Sound Analytical Services, Inc.
TOC (soil/sed)	EPA, Revised 1983: 415.1	APHA, 1992: 5310B.	
NUTRIENTS			
Total Kjeldahl Nitrogen (TKN)			Manchester lab
NH3-N	EPA, Revised 1983: 350.1	APHA, 1992: 4500-NH3D.	Manchester lab
NO2+NO3-N	EPA, Revised 1983: 353.2	APHA, 1992: 4500-NO3F.	Manchester lab
Total-P	EPA, Revised 1983: 365.3	APHA, 1992: 4500-PF.	Manchester lab
MISCELLANEOUS			
Oil and Grease (water)	EPA, Revised 1983: 413.1	APHA, 1992: 5520B.	Manchester lab
F-Coliform MF	APHA, 1992: 9222D.	APHA, 1992: 9221D.	Manchester lab
F-Coliform (soil/sed)	APHA, 1992: 9221A.	APHA, 1992: 9221A.	Manchester lab
ORGANICS			
VOC (water)	EPA, 1986: 8260	APHA, 1992: 6210D.	Manchester lab
VOC (soil/sed) - Extensive TICs	EPA, 1986: 8240	APHA, 1992: 6210B.	Manchester lab
BNAs (water)	EPA, 1986: 8270	APHA, 1992: 6410B.	Manchester lab
BNAs (soil/sed) - Extensive TICs	EPA, 1986: 8270	APHA, 1992: 6410B.	Manchester lab
Pest/PCB (water) - Chlorinated	EPA, 1986: 8080	APHA, 1992: 6630C.	Manchester lab
Pest/PCB (soil/sed) - Chlorinated	EPA, 1986: 8080	APHA, 1992: 6630C.	Manchester lab
METALS			
PP Metals (water)	EPA, Revised 1983: 200.299	APHA, 1992: 3000-3500*.	Manchester lab
PP Metals (soil/sed)	EPA, Revised 1983: 200-299	APHA, 1992: 3000-3500*.	Manchester lab
BIOASSAYS			
Daphnia magna (acute)	EPA 1985	APHA, 1989: 8711B&C.	Beak Consultants, Inc.
Fathead Minnow (acute)	EPA 1985	APHA, 1989: 8910B&C	Beak Consultants, Inc.
Fathead Minnow (chronic)	EPA 1989: 1000.0	APHA, 1989: 8910E&C	Beak Consultants, Inc.

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Appendix D - Quality Assurance/Quality Control - Salmon Creek Class II Inspection - June, 1996

Priority Pollutant Cleaning Procedures for Wastewater Collection Equipment.

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

Appendix E - Ecology Priority Pollutant Organics and Metals Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Inf-E-1	Inf-E-2	Ef-E-1	Ef-E-2	Sludge
	Type:	grab	grab	grab	grab	grab
	Date:	06/04/96	06/04/96	06/04/96	06/04/96	06/04/96
	Time:	09:35	14:26	10:30	14:45	15:30
	Lab Log #:	238230	238231	238233	238234	238239
VOA COMPOUNDS		µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.
Chloromethane		2 U	2 U	2 U	2 U	938 U
Dichlorodifluoromethane		1 UJ	1 UJ	1 UJ	1 UJ	938 U
Bromomethane		1 U	1 U	1 U	1 U	469 U
Vinyl Chloride		1 U	1 U	1 U	1 U	469 U
Chloroethane		1 U	1 U	1 U	1 U	469 U
Trichlorofluoromethane		1 U	1 U	1 U	1 U	938 U
Methylene Chloride		5 U	5 U	5 U	5 U	396 UJ
Acetone		53 J	119 J	4 UJ	4 UJ	14600 U
Carbon Disulfide		2 U	2 U	2 U	2 U	938 U
1,1-Dichloroethene		1 U	1 U	1 U	1 U	469 U
1,1-Dichloroethane		1 U	1 U	1 U	1 U	469 U
trans-1,2-Dichloroethene		1 U	1 U	1 U	1 U	469 U
cis-1,2-Dichloroethene		1 U	1 U	1 U	1 U	469 U
2,2-Dichloropropane		1 U	1 U	1 U	1 U	469 U
Bromochloromethane		1 U	1 U	1 U	1 U	469 U
Chloroform		0.7 J	1.9	0.86 J	0.6 J	469 U
1,2-Dichloroethane		1 U	1 U	1 U	1 U	469 U
1,1,1-Trichloroethane		0.19 J	0.091 J	1 U	1 U	469 U
Carbon Tetrachloride		1 U	1 U	1 U	1 U	469 U
1,1-Dichloropropene		1 U	1 U	1 U	1 U	469 U
Bromodichloromethane		1 U	1 U	1 U	1 U	469 U
1,2-Dichloropropane		1 U	1 U	1 U	1 U	469 U
Dibromomethane		1 U	1 U	1 U	1 U	469 U
trans-1,3-Dichloropropene		0.94 U	0.94 U	0.94 U	0.94 U	882 U
Trichloroethene		1 U	3.2	1 U	1 U	469 U
Dibromochloromethane		1 U	1 U	1 U	1 U	469 U
1,2-Dibromoethane (EDB)		1 U	1 U	1 U	1 U	469 U
1,1,2-Trichloroethane		1 U	1 U	1 U	1 U	469 U
1,3-Dichloropropane		1 U	1 U	1 U	1 U	469 U
Benzene		1 U	1 U	1 U	1 U	469 U
cis-1,3-Dichloropropene		1.1 U	1.1 U	1.1 U	1.1 U	497 U
Bromoform		1 U	1 U	1 U	1 U	938 U
2-Hexanone		10 UJ	10 UJ	10 UJ	10 UJ	1880 U
Tetrachloroethene		0.13 J	0.36 J	1 U	1 U	469 U
1,1,2,2-Tetrachloroethane		1 U	1 U	1 U	1 U	469 U
1,1,1,2-Tetrachloroethane		1 U	1 U	1 U	1 U	469 U
Toluene		0.81 J	0.98 J	0.25 J	1 U	469 U

Inf	Influent sample	Ef	Effluent sample	U	The analyte was not detected at or above the reported result.
E	Ecology sample	Sludge	Sludge sample	UJ	The analyte was not detected at or above the reported estimated result.
grab	Grab sample			J	The analyte was positively identified. The associated numerical result is an estimate.

Appendix E - Ecology Priority Pollutant Organics and Metals Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Ef-E-1	Ef-E-2	Ef-E	Sludge
	Type:	grab	grab	comp	grab	grab	comp	grab
	Date:	06/04/96	06/04/96	06/4-5/96	06/04/96	06/04/96	06/4-5/96	06/04/96
	Time:	09:35	14:26	08:00-08:00	10:30	14:45	08:00-08:00	15:30
	Lab Log #:	238230	238231	238232	238233	238234	238235	238239
VOA COMPOUNDS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.
Chlorobenzene		1 U	1 U		1 U	1 U		469 U
Ethylbenzene		1 U	1 U		1 U	1 U		469 U
Bromobenzene		1 U	1 U		1 U	1 U		938 U
1,2,3-Trichloropropane		1 UJ	1 UJ		1 UJ	1 UJ		938 U
2-Chlorotoluene		1 U	1 U		1 U	1 U		469 U
4-Chlorotoluene		1 U	1 U		1 U	1 U		938 U
1,2,4-Trimethylbenzene		0.092 J	1 U		1 U	1 U		469 U
tert-Butylbenzene		1 U	1 U		1 U	1 U		469 U
1,3,5-Trimethylbenzene		1 U	1 U		1 U	1 U		469 U
sec-Butylbenzene		1 U	1 U		1 U	1 U		469 U
p-Isopropyltoluene		1 U	2.7		1 U	1 U		2130
1,2,3-Trichlorobenzene		10 UJ	10 UJ		10 UJ	10 UJ		9380 U
1,4-Dichlorobenzene		0.81 J	0.92 J	0.59	0.54 J	0.5 J	0.27	938 J
1,2-Dichlorobenzene		0.044 J	1 U	0.015 J	1 U	1 U	0.18 U	469 U
1,2,4-Trichlorobenzene		10 U	10 U	0.14 U	10 U	10 U	0.18 U	9380 U
Naphthalene		5 U	5 U	0.14 U	5 U	5 U	0.18 U	9380 U
Hexachlorobutadiene		2 U	2 U	0.14 U	2 U	2 U	0.18 U	469 U
o-Xylene		1 U	1 U		1 U	1 U		469 U
1,3-Dichlorobenzene		1 U	1 U	0.14 U	1 U	1 U	0.18 U	938 U
1,1-Dichloropropanone		5 UJ	5 UJ		5 UJ	5 UJ		938 UJ
1-Chlorobutane		1 U	1 U		1 U	1 U		469 U
2-Methyoxy-2-Methylpropane		1 U	1 U		1 U	1 U		469 U
Acrylonitrile		10 UJ	10 UJ		10 UJ	10 UJ		2340 U
Allyl Chloride		1 U	1 U		1 U	1 U		469 U
Chloroacetonitrile		1 U	1 U		1 U	1 U		2340 U
Ethyl Ether		1 U	1 U		1 U	1 U		469 U
Ethylmethacrylate		1 U	1 U		1 U	1 U		469 U
Hexachloroethane		1 U	1 U	0.14 U	1 U	1 U	0.18 U	938 U
Methyacrilonitrile		10 U	10 U		10 U	10 U		938 U
Methyl acrylate		1 UJ	1 UJ		1 UJ	1 UJ		469 U
Methyl Methacrylate		1 U	1 U		1 U	1 U		2340 U
n-Butylbenzene		1 U	1 U		1 U	1 U		4690 UJ
n-Propylbenzene		1 U	1 U		1 U	1 U		469 U
Pentachloroethane		1 U	1 U		1 U	1 U		2340 U
Tetrahydrofuran		5 UJ	5 UJ		5 UJ	5 UJ		2340 U
Trans-1,4-Dichloro-2-butene		1 UJ	1 UJ		1 UJ	1 UJ		2340 UJ

Inf	Influent sample	Ef	Effluent sample	U	The analyte was not detected at or above the reported result.
E	Ecology sample	Sludge	Sludge sample	UJ	The analyte was not detected at or above the reported estimated result.
grab	Grab sample	comp	Composite sample	J	The analyte was positively identified. The associated numerical result is an estimate.

Appendix E - Ecology Priority Pollutant Organics and Metals Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Ef-E-1	Ef-E-2	Ef-E	Sludge
	Type:	grab	grab	comp	grab	grab	comp	grab
	Date:	06/04/96	06/04/96	06/4-5/96	06/04/96	06/04/96	06/4-5/96	06/04/96
	Time:	09:35	14:26	08:00-08:00	10:30	14:45	08:00-08:00	15:30
	Lab Log #:	238230	238231	238232	238233	238234	238235	238239
BNA COMPOUNDS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.
Benzo(a)Pyrene				0.14 U			0.18 U	23 U
2,4-Dinitrophenol				2.8 U			3.6 U	454 U
Dibenzo(a,h)Anthracene				0.14 U			0.18 U	23 U
Benzo(a)Anthracene				0.14 U			0.18 U	23 U
4-Chloro-3-Methylphenol				0.14 U			0.18 U	23 U
Aniline				0.14 U			0.18 U	23 U
Benzoic Acid				18			1.6 J	454 U
Hexachloroethane		1 U	1 U	0.14 U	1 U	1 U	0.18 U	938 U
Hexachlorocyclopentadiene				1.4 U			1.8 U	114 U
Isophorone				0.54			0.062 J	23 U
Acenaphthene				0.14 U			0.18 U	23 U
Phenanthrene				0.14 U			0.0091 J	23 U
N-Nitrosodiphenylamine				0.14 U			0.18 U	23 U
Fluorene				0.14 U			0.18 U	23 U
Carbazole				0.14 U			0.18 U	23 U
Hexachlorobutadiene		2 U	2 U	0.14 U	2 U	2 U	0.18 U	469 U
Pentachlorophenol				1.4 U			0.68 J	227 U
2,4,6-Trichlorophenol				0.28 U			0.29 J	23 U
2-Nitroaniline				0.14 U			0.18 U	114 U
2-Nitrophenol				0.28 U			0.36 U	114 U
Naphthalene		5 U	5 U	0.14 U	5 U	5 U	0.18 U	9380 U
2-Methylnaphthalene				0.094 J			0.18 U	23 U
2-Chloronaphthalene				0.14 U			0.18 U	23 U
3,3'-Dichlorobenzidine				0.14 U			0.18 U	23 U
Benzidine				0.28 U			0.36 U	227 U
2-Methylphenol				0.16 J			0.028 J	23 U
1,2-Dichlorobenzene		0.044 J	1 U	0.015 J	1 U	1 U	0.18 U	469 U
2,4,5-Trichlorophenol				0.23 J			0.89 U	114 U
Nitrobenzene				0.14 U			0.18 U	23 U
3-Nitroaniline				0.28 U			0.36 U	227 U
4-Nitroaniline				0.7 U			0.89 U	114 U
4-Nitrophenol				0.7 U			0.89 U	227 U
Benzyl Alcohol				6.4			0.36 U	45 U
2,4-Dimethylphenol				0.14 U			0.094 J	23 U
4-Methylphenol				15			0.31	25
1,4-Dichlorobenzene		0.81 J	0.92 J	0.59	0.54 J	0.5 J	0.27	938 J
4-Chloroaniline				1.7			0.18 U	27

Inf	Influent sample	Ef	Effluent sample	U	The analyte was not detected at or above the reported result.
E	Ecology sample	Sludge	Sludge sample	UJ	The analyte was not detected at or above the reported estimated result.
grab	Grab sample	comp	Composite sample	J	The analyte was positively identified. The associated numerical result is an estimate.

Appendix E - Ecology Priority Pollutant Organics and Metals Results - Salmon Creek Class II _ June, 1996

Parameter	Location:	Inf-E-1	Inf-E-2	Inf-E	Ef-E-1	Ef-E-2	Ef-E	Sludge
	Type:	grab	grab	comp	grab	grab	comp	grab
	Date:	06/04/96	06/04/96	06/4-5/96	06/04/96	06/04/96	06/4-5/96	06/04/96
	Time:	09:35	14:26	08:00-08:00	10:30	14:45	08:00-08:00	15:30
	Lab Log #:	238230	238231	238232	238233	238234	238235	238239
BNA COMPOUNDS		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/Kg-dry wt.
Phenol				2.2			0.18 U	27
Pyridine				0.7 U			0.89 U	114 U
Bis(2-Chloroethyl)Ether				0.14 U			0.18 U	23 U
Bis(2-Chloroethoxy)Methane				0.14 U			0.18 U	23 U
Di-n-Octyl Phthalate				0.86			0.18 U	46
Hexachlorobenzene				0.14 U			0.18 U	23 U
Anthracene				0.14 U			0.18 U	23 U
1,2,4-Trichlorobenzene		10 U	10 U	0.14 U	10 U	10 U	0.18 U	9380 U
2,4-Dichlorophenol				0.14 U			0.3	23 U
2,4-Dinitrotoluene				1.4 U			1.8 U	114 U
1,2-Diphenylhydrazine				0.14 U			0.18 U	23 U
Pyrene				0.14 U			0.18 U	23 UJ
Dibenzofuran				0.14 U			0.18 U	23 U
Indeno(1,2,3-cd)Pyrene				0.14 U			0.18 U	23 U
Benzo(b)Fluoranthene				0.14 U			0.18 U	23 U
Fluoranthene				0.14 U			0.18 UJ	23 UJ
Benzo(k)Fluoranthene				0.14 U			0.18 U	23 U
Acenaphthylene				0.14 U			0.18 U	23 U
Chrysene				0.14 U			0.18 U	23 U
4,6-Dinitro-2-Methylphenol				1.4 U			1.8 U	227 U
1,3-Dichlorobenzene		1 U	1 U	0.14 U	1 U	1 U	0.18 U	938 U
2,6-Dinitrotoluene				0.7 U			0.89 U	114 U
N-Nitroso-di-n-Propylamine				0.14 U			0.18 U	23 U
1-Methylnaphthalene				0.075 J			0.18 U	23 U
2-Chlorophenol				0.14 U			0.18 U	23 U
Bis(2-Chloroisopropyl)Ether				0.14 U			0.18 U	23 U
Retene				0.14 U			0.18 U	23 U
3B-Coprostanol				210 E			6.1	35600 E
Caffeine				36 E			0.18 U	23 U
N-Nitrosodimethylamine				0.7 U			0.89 U	454 U
Ethanol, 2-(2-Butoxyethoxy)-, Acetate				91 NJ			21 NJ	
Ethanol, 2-Butoxy-, Phosphate (3:1)							4.8 NJ	
Cholesterol								4080 NJ

Inf	Influent sample
E	Ecology sample
grab	Grab sample
comp	Composite sample
Ef	Effluent sample
Sludge	Sludge sample

E	The reported result is an estimate because of the presence of interference.
J	The analyte was positively identified. The associated numerical result is an estimate.
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.
N	There is evidence that the analyte is present in this sample.

Appendix E - Ecology Priority Pollutant Organics and Metals Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Inf-E	Ef-E	Sludge
	Type:	comp	comp	grab
	Date:	06/4-5/96	06/4-5/96	06/04/96
	Time:	08:00-08:00	08:00-08:00	15:30
	Lab Log #:	238232	238235	238239
PESTICIDES COMPOUNDS		µg/L	µg/L	µg/Kg-dry wt.
alpha-BHC		0.008 U	0.01 U	0.82 U
beta-BHC		0.008 U	0.01 U	0.82 U
delta-BHC		0.008 U	0.01 U	0.82 U
gamma-BHC (Lindane)		0.008 U	0.082	0.82 U
Aldrin		0.008 U	0.01 U	0.82 U
Heptachlor		0.008 U	0.01 U	0.82 U
Heptachlor Epoxide		0.008 U	0.01 U	0.82 U
Endosulfan I		0.008 U	0.01 U	0.82 U
Dieldrin		0.008 U	0.01 U	0.82 U
4,4'-DDE		0.008 U	0.01 U	0.82 U
Endrin		0.008 U	0.01 U	0.82 U
Endosulfan II		0.008 U	0.01 U	0.82 U
4,4'-DDD		0.008 U	0.01 U	0.82 U
Endosulfan Sulfate		0.008 U	0.01 U	0.82 U
4,4'-DDT		0.008 U	0.01 U	0.82 U
Methoxychlor		0.008 U	0.01 U	0.82 U
Endrin Ketone		0.008 U	0.01 U	0.82 U
Toxaphene		0.11 U	0.15 U	12.2 U
Endrin Aldehyde		0.008 U	0.01 U	0.82 U

E	Ecology sample	U	The analyte was not detected at or above the reported result.
comp	Composite sample	UJ	The analyte was not detected at or above the reported estimated result.
Ef	Effluent sample		
Sludge	Sludge sample		

Appendix E - Ecology Priority Pollutant Organics and Metals Results - Salmon Creek Class II - June, 1996

Parameter	Location:	Inf-E	Ef-E	Trnsf-Bl	Sludge	Columbia
	Type:	comp	comp	grab	grab	grab
	Date:	06/4-5/96	06/4-5/96	06/03/96	06/04/96	06/05/96
	Time:	08:00-08:00	08:00-08:	12:45	15:30	1200
	Lab Log #:	238232	238235	238238	238239	238240
METALS		µg/L	µg/L	µg/L	mg/Kg-dry wt.	µg/L
Antimony		40 U	40 U	40 U	4 UJ	40 U
Arsenic		1.5 U	1.5 U	1.5 U	2.5 J	1.5 U
Beryllium		1 U	1 U	1 U	0.31	1 U
Cadmium		0.39	0.1 U	0.1 U	2.5	0.1 U
Chromium		5 U	5 U	5 U	32.4	5 U
Copper		61.9	13	3 U	694	3 U
Lead		2.5	2.9	1.9	29.3	1.1
Mercury (Total)		0.37	0.05 U	0.05 U	3.95	0.05 U
Nickel		10 U	10 U	10 U	25.6	10 U
Selenium		1.5 UJ	1.5 UJ	1.5 UJ	284	1.5 UJ
Silver		1.9	0.5 U	0.5 U	20.2 J	0.5 U
Thallium		1.5 U	1.5 U	1.5 U	0.3 UJ	1.5 U
Zinc		78	21	4.5	789	5.9

Inf	Influent sample	J	The analyte was positively identified. The associated numerical result is an estimate.
E	Ecology sample	U	The analyte was not detected at or above the reported result.
grab	Grab sample	UJ	The analyte was not detected at or above the reported estimated result.
comp	Composite sample		
Ef	Effluent sample		
Sludge	Sludge sample		
Columbia	Columbia River receiving water sample		

Appendix F - Tentatively Identified Compounds - Salmon Creek Class II - June, 1996

Inf-E-1
grab
06/04/96
09:35
238230

Volatile Organic Analysis (VOA)

Parameter	Value/Qualifier/Units		
1. Methane, Thiobis	3.9	NJ	µg/L
2. Disulfide, Dimethyl	1.2	NJ	µg/L
3. Unknown 01	0.73	NJ	µg/L
4. D-Limonene	2.5	NJ	µg/L
5. Cineole (Van)	1.2	NJ	µg/L
6. Cyclohexene, 1-methyl-3-(1-methylethenyl	0.27	NJ	µg/L
7. Unknown 02	1.6	NJ	µg/L
8. Unknown 03	0.48	NJ	µg/L

Inf-E-2
grab
06/04/96
14:26
238231

Volatile Organic Analysis (VOA)

Parameter	Value/Qualifier/Units		
1. Methane, Thiobis	1.6	NJ	µg/L
2. Disulfide, Dimethyl	0.87	NJ	µg/L
3. Unknown 01	1.2	NJ	µg/L
4. 7-Oxabicyclo[2.2.1]Heptane, 1-Methyl-4-(1Methylethyl)	10	NJ	µg/L
5. Cineole (Van)	7.6	NJ	µg/L
6. Undecane	1.9	NJ	µg/L
7. Ocimene	7	NJ	µg/L
8. Unknown 02	2.1	NJ	µg/L
9. Unknown Hydrocarbon 01	0.99	NJ	µg/L
10. Bicyclo[2.2.1]Heptane-2-Ol, 1,3,3-Trimethyl	0.7	NJ	µg/L
11. Unknown Hydrocarbon 02	1.6	NJ	µg/L
12. Unknown 03	0.79	NJ	µg/L
13. Unknown Hydrocarbon 02	0.65	NJ	µg/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Salmon Creek Class II - June, 1996

Ef-E-1
grab
06/04/96
10:30
238233

Volatile Organic Analysis (VOA)

Parameter	Value/Qualifier/Units		
1. Unknown 01	0.5	NJ	µg/L
2. 4-Heptanol, 2,4-dimethyl	0.39	NJ	µg/L
3. Unknown 02	0.42	NJ	µg/L

Ef-E-2
grab
06/04/96
14:45
238234

Volatile Organic Analysis (VOA)

Parameter	Value/Qualifier/Units		
1. Unknown 01	0.51	NJ	µg/L
2. Unknown 02	0.29	NJ	µg/L
3. Unknown 02	1.2	NJ	µg/L
4. Unknown 04	0.26	NJ	µg/L

SLUDGE
grab
06/04/96
15:30
238239

Volatile Organic Analysis (VOA)

Parameter	Value/Qualifier/Units		
1. Unknown 01	202	NJ	µg/Kg dry wt.
2. Unknown Hydrocarbon 01	185	NJ	µg/Kg dry wt.
3. Cyclotetrasiloxane, Octamethyl-	641	NJ	µg/Kg dry wt.
4. Unknown Hydrocarbon 02	250	NJ	µg/Kg dry wt.
5. Unknown 02	158	NJ	µg/Kg dry wt.
5. Unknown 03	176	NJ	µg/Kg dry wt.

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Salmon Creek Class II - June, 1996

Inf-E
comp
06/4-5/96
0800-0800
238232

BNA/Pesticides

Parameter	Value	Qualifier	Units
1. Unknown Compound 16	12	NJ	µg/L
2. Ethanol, 2-Butoxy-	16	NJ	µg/L
3. Butanedioic Acid, Dimethyl Ester	22	NJ	µg/L
4. Butanedioic Acid, Methyl-, Dimethyl Ester	11	NJ	µg/L
5. Alpha-Terpeneol	18	NJ	µg/L
6. Unknown 01	6.2	NJ	µg/L
7. Ethanol, 2-(2-Butoxyethoxy)-, Acetate	91	NJ	µg/L
8. Decanoic Acid, Di	41	NJ	µg/L
9. Unknown 02	26	NJ	µg/L
10. Decanoic Acid, Tetra	38	NJ	µg/L
11. Unknown 15	34	NJ	µg/L
12. Unknown 03	38	NJ	µg/L
13. Hexadecanoic Acid	565	NJ	µg/L
14. Oleic Acid	348	NJ	µg/L
15. Octadecanoic Acid	146	NJ	µg/L
16. Unknown 04	56	NJ	µg/L
17. Unknown 05	18	NJ	µg/L
18. Unknown 06	17	NJ	µg/L
19. Unknown 07	11	NJ	µg/L
20. Unknown 08	14	NJ	µg/L
21. Unknown 09	56	NJ	µg/L
22. Unknown 10	16	NJ	µg/L
23. Unknown 11	18	NJ	µg/L
24. Unknown 12	58	NJ	µg/L
25. Unknown 13	14	NJ	µg/L
26. Unknown 14	25	NJ	µg/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix F (cont.) - Tentatively Identified Compounds - Salmon Creek Class II - June, 1996

Ef-E
comp
06/4-5/96
0800-0800
238235

BNA/Pesticides

Parameter	Value	Qualifier	Units
1. Unknown 08	1.7	NJ	µg/L
2. Unknown 10	2.9	NJ	µg/L
3. Unknown 01	2.9	NJ	µg/L
4. Ethanol, 2-(2-Butoxyethoxy)-	6.4	NJ	µg/L
5. Ethane, 1,1"-[Methylenebis(	3.1	NJ	µg/L
6. 2-Butanol, 3,3"-oxybis	1.7	NJ	µg/L
7. Ethanol, 2-(2-Butoxyethoxy)-, Acetate	21	NJ	µg/L
8. Unknown 02	2.7	NJ	µg/L
9. Unknown 03	7.9	NJ	µg/L
10. Unknown 04	4	NJ	µg/L
11. Unknown 05	4.2	NJ	µg/L
12. Unknown 06	4.8	NJ	µg/L
13. Unknown 07	3.8	NJ	µg/L
14. Unknown 09	2.7	NJ	µg/L
15. Unknown 11	2.9	NJ	µg/L
16. Unknown 12	1.9	NJ	µg/L
17. Unknown 13	2.3	NJ	µg/L
18. Ethanol, 2-Butoxy-, Phosphate (3:1)	4.8	NJ	µg/L
19. Unknown 14	2	NJ	µg/L
20. Unknown 15	4.6	NJ	µg/L

Sludge
grab-comp
06/04/96
15:30
238239

BNA/Pesticides

Parameter	Value	Qualifier	Units
1. Unknown 01	202	NJ	µg/L
2. Unknown Hydrocarbon 01	185	NJ	µg/L
3. Cyclotetrasiloxane, Octamethyl-	641	NJ	µg/L
4. Unknown Hydrocarbon 02	250	NJ	µg/L
5. Unknown 02	158	NJ	µg/L
6. Unknown 03	176	NJ	µg/L

NJ There is evidence that the analyte is present. The associated numerical result is an estimate.

Appendix G - GLOSSARY - Salmon Creek Class II Inspection - June, 1994

BOD_5	Five Day Biolchemical Oxygen Demand
$CaCO_3$	Calcium Carbonate
CLP	Contract Laboratory Program
EPA	Environmental Protection Agency
Kg	kilogram (1×10^3 grams)
L	Liter (1×10^3 milliliters)
lbs/day	Pounds per Day
m^3	Cubic meter (1×10^3 liters)
MF	Membrane Filter
mg	milligram (1×10^{-3} grams)
MGD	Million Gallons per Day
mL	Milliliter (1×10^{-3} liters)
MPN	Most Probable Number
NH_3	Ammonia
NPDES	National Pollutant Discharge Elimination System
PCB	Polychlorinated Biphenyls
pH	Negative Log_{10} of Hydrogen Ion Concentration
PO_4	Phosphate
PP	Priority Pollutant
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
TIC	Total Inorganic Carbon or Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TNVS	Total Non-Volatile Solids
TNVSS	Total Non-Volatile Suspended Solids
TOC	Total Organic Carbon
TP	Total Phosphorous
TS	Total Solids
TSS	Total Suspended Solids
TVS	Total Volatile Solids
µg	Microgram (1×10^{-6} grams)
µg/L	Micrograms per Liter
VOA	Volatile Organic Analysis
VSS	Volatile Suspended Solids
WWTP	Wastewater Treatment Plant