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MEMORANDUM
December 20, 1984

To: Harold Porath

From: Dale Clark DKC

Subject: Stevens Pass Class II Inspection

INTRODUCTION

On February 5-6, 1984, a Class II inspection and receiving water study was carried out by the Washington State Department of Ecology (WDOE) at the Stevens Pass Advanced Wastewater Treatment Plant (AWTP) and Nason Creek. The inspection and survey were requested by the WDOE Central Regional Office to:

1. Describe plant operation and wastewater routing.
2. Determine if the AWTP is complying with the effluent limitations designated in National Pollution Discharge Elimination System (NPDES) permit No. WA-002952-1.
3. Review laboratory results and analytical procedures.
4. Conduct a receiving water study on Nason Creek to determine the effects of the discharge on water quality.

Participants in the study included Marc Heffner and Dale Clark, WDOE Water Quality Investigations Section; and George Valentine, AWTP operator.

SETTING

The Stevens Pass AWTP is located two miles east of the summit just off U.S. Highway 2 (Figure 1). Advanced waste-treated effluent is discharged into Nason Creek which joins with Stevens Creek about 100 feet below the discharge. Numerous recreational chalets and the Stevens Pass ski resort are served by the treatment facility. The ski resort is the primary user of the treatment facility.

The Stevens Pass plant started operating on December 1, 1978. The plant's unit processes are described in Table 1. It was designed to serve an ultimate daytime recreational-use population of 15,000 at a design flow of 0.122 million gallons per day (MGD), with a design loading of 490 lbs/day of biochemical oxygen demand (BOD). A rough estimate of the population served by the AWTP was obtained by determining the number of ski lift tickets sold by the recreatinal ski area. This information is available through the ski area patrol office. During the Class II survey, the plant was serving a population of approximately 3,600. The peak population served for the 1983-84 season was approximately 8,000 (from January 14, 1984, ticket sales). It should be pointed out that the above population estimate and design flow are based on daytime use of recreational facilities. When considered as a facility serving full-time residents such as in a town or other community, the population served would be 2,450. This factor should be taken into account during future development of the area.

The flow scheme for the facility is diagrammed on Figure 2. Wastewater enters the headworks where it flows through a comminutor and bar screen unit. The influent then flows into an influent routing box for routing to four activated sludge basins. These basins can be used for a number of purposes. During the survey the basins were being used as follows: #1 basin, high-flow storage to provide flow equalization; #2 basin, extended aeration activated sludge; #3 basin, extended aeration activated sludge for nitrification; and #4 basin, aerobic digestion and sludge storage prior to final storage in sludge decant tank.

Wastewater is detained in activated sludge basin (#2) for approximately 1 1/2 days. This basin is maintained at a mixed liquor suspended solids (MLSS) concentration of 2,000 mg/L during the winter and 600 mg/L during the summer low-use period. Effluent from the #2 basin flows to the first of two center-feed, rim-discharge secondary clarifiers which serve as an intermediate clarifier for sludge settling and separation. Following clarification, the sludge is returned to basin #2 or wasted to the #4 basin as needed to maintain a balanced food-to-microorganism (f/m) ratio. Effluent from the intermediate clarifier is either returned to the influent routing box or sent to the #3 basin where nitrification takes place. Soda ash is added to the #3 basin to maintain alkalinity levels necessary for nitrification. During the inspection, soda ash was being added to the #2 basin because of low flows which had resulted in nitrification. Effluent originating from basin #3 flows into the second clarifier. Clarified effluent is then pumped to a filter storage tank, then on to a unit for filtering and floculation. To aid floculation, alum and a polyelectrolyte are added to the clarified effluent prior to filtration. Initial floc settling occurs in a horizontal tube settling unit followed by a mixed media filter (garnet sand and activated charcoal) which captures the remaining floc. The filter bed is cleaned by back-flushing which occurs when head pressure reaches a predetermined level. The backwash is then routed to a storage tank for decant. The backwash sludge and activated sludge from basin #4 are transferred to a final sludge storage tank for decanting. Following winter storage, the sludge is trucked to the ski slopes for land application during the summer.

The filtered effluent flows into a chlorine contact chamber for disinfection. Final effluent is discharge to Nason Creek via an outfall line approximately 240 feet long and 8 inches in diameter (Figures 1 and 2).

Plant flow has to be estimated by the operator due to a design deficiency within the automatic flow-measuring system. This system consists of a flow meter and Parshall flume which is biased when influent water backs up behind the comminutor and bar screen, in the influent routing box. As an alternative, plant flow is estimated from flow through the filtration unit. Flow is calculated using the total amount of time the filter pump operates during any 24-hour period. The running time (in minutes) is multiplied by the pumping rate at 60 gallons per minute (gpm), which represents the average flow value for the filter pump ball gauge. Ten percent of the total flow is subtracted to compensate for final effluent that is used in the plant as washdown water.

Influent flow fluctuates widely on a seasonal, weekly, and diel basis due to the use characteristics of the Stevens Pass ski area. Most of the loading to the plant occurs during the winter on weekends and daylight hours when facilities (i.e., public restrooms) associated with the recreational areas are used the most. During periods when recreational use is low, the flow to the plant is reduced substantially, particularly during the summer months (0.0123 MGD, July 1983 discharge monitoring report [DMR]). In the summer the plant is operated on a part-time basis, usually three to four days a week. On the other days, influent is stored in the #1 aeration basin. To check plant flow accuracy, the operator determines how much influent has been stored and calculates a daily flow assuming that flows remain relatively constant during the summer storage period. The flow estimate is then compared to the value obtained from the filter pump ball gauge.

SAMPLING DESIGN

Grab and composite samples were collected by WDOE and AWTP at the locations shown in Figure 2. The laboratory analyses are listed in Table 2. Composite samples were collected with a Manning automatic composite sampler (WDOE) and a Technical Systems, Inc. Sampler (AWTP).

The WDOE influent sample was composited over a 24-hour period on a flow-proportional basis using a Manning Dipper flowmeter. As during normal operations, the AWTP influent sample was hand-composited over an eight-hour period (0700 to 1500). AWTP samples were collected on a schedule that approximated diel flow by varying the sample volume and length of time between samples. The sampling strategy was based on observations that low flow characteristics at night resulted in non-representative composites when collected on a time basis over 24 hours by an automatic sampler. In addition, the influent sample line is prone to plugging, which also results in a biased sample.

The WDOE and AWTP effluent samples were composited on a time-proportional basis (250 mL/30 min.). Due to plant design, it was not possible for the effluent samples to be flow-composited. This was due to the lack of open channels or flow-measuring devices (flumes, weirs) located close to the sampling location.

Because of the various methods employed in collection of composites, the WDOE and AWTP samples are not always strictly comparable.

Immediately following compositing, samples were mixed and split for later analysis by the two laboratories (Table 3). Samples for AWTP analysis were refrigerated, and WDOE samples were iced and transported to the WDOE environmental laboratory in Tumwater, Washington. All WDOE analyses were performed using procedures in Standard Methods (15th edition).

RESULTS AND DISCUSSION

The results are presented in three parts: (1) Advanced Wastewater Treatment Plant; (2) Laboratory Review; and (3) Receiving Waters.

1. Advanced Wastewater Treatment Plant

Tables 4 and 5 summarize the results of the compositor and grab sampling data collected during the inspection. The following is a brief discussion of the results.

The BOD analysis indicates a substantial reduction during treatment, from 365 mg/L (WDOE composite, AWTP influent analysis) to 11 mg/L (WDOE composite, WDOE effluent analysis); a 97 percent decrease. AWTP laboratory results were used for the influent because the WDOE lab anticipated a weaker waste and used an inapropriate dilution range.

During the inspection, the effluent ammonia concentration was approximately twice that allowed by permit. Shock loading to the AWTP during the two-week period just prior to the inspection was the probable cause. During periods of low recreational user turnout, influent flow and strength drops dramatically. Low turnout can occur suddenly during periods of inclement weather (heavy rainfall, wind, etc.) that may last up to several weeks. Likewise, during periods of good weather, use can increase rapidly, resulting in high influent flow and concentration. Poor weather changed to good conditions just prior to the inspection. It has been found that rapid changes in influent flow strength can produce a marked change in the AWTP effluent nutrient load because the food supply (influent nutrients) is too great for the organisms to assimilate. The microorganisms in the aeration basins are initially "shocked," followed by an increase in effluent ammonia. Effluent ammonia increases yearly during the period following late December to early January, and steps are now taken to dampen this effect.

One corrective action taken at the AWTP is to feed the nitrobacteria population during periods of low nutrient loading. Ammonium chloride is added to the nitrification basin (Figure 2, basin #3). This practice maintains elevated levels of biological activity. The application takes place in mid-December prior to the expected shock loading. Another action is to gradually build up volume in the nitrifying basin over time. This is accomplished by using basins #1 and #2 to store wastewater and gradually increase flow to #3 basin (Figure 2).

The capacity for equalization also can be increased by using the storage basin located at the resort area. At present all equalization takes place at the plant, and the basin is not used.

Ammonium chloride procedures and other methods described above appear to be reasonable methods for minimizing the effects of shock loading to the plant.

Total suspended solids (TSS) were reduced by about 99 percent during treatment, as indicated by the WDOE composites.

Total chlorine residual (TCR) levels were lower than generally necessary for disinfection (0.1 mg/L). WDOE results indicate fecal coliform (FC) counts of 140 and 230 colonies/100 mL. It appears the chlorine dose could be increased to reduce FC counts to the level of the permit and still not exceed the NPDES residual chlorine daily maximum concentration of 0.5 mg/L. The NPDES permit limit for FC bacteria is 400 col/100 mL on a weekly basis and 200 col/100 mL monthly.

Wastewater turbidity was reduced by an average of 95 percent during treatment.

Mixed liquor pH and conductivity values as determined by analyzing the recycled influent including filter decant, sump, basin #1 return, and basin #4 supernatant were similar to values found in other parts of the AWTP process. The MLSS concentration (2200 mg/L) was within the WDOE criterion of 2000 to 5000 mg/L (WDOE Criteria for Sewage Works Design, 1978). The plant is functioning well, judging from the sampling data collected.

Table 6 lists the analytical results for those effluent parameters limited by NPDES permit. A summary of data collected by WDOE and AWTP as analyzed by the WDOE laboratory follows:

a. Total BOD (lbs/day) was generally within the daily limits. The WDOE composite sample exceeded the daily maximum allowable concentration by 1 mg/L. The lbs/day met the permit limit.

b. Carbonaceous BOD was well within the limit assuming a 10 mg/L limitation.

c. Suspended solids (SS) were within the daily maximum limits.

d. FC counts (colonies/100 mL) exceeded the limit of 50 colonies/100 mL (230 and 140).

e. Residual chlorine was below the daily maximum permitted (0.1 mg/L versus 0.5 mg/L).

f. pH values generally fell within the permitted range of 6.5 to 8.5 standard units (SU). One effluent sample displayed a pH value of 6.0, below the permitted range.

g. Ammonia at 6.4 to 6.8 mg/L exceeded the daily maximum permitted concentration (3 mg/L). The loading was within the permit limit of 2.5 lbs/day.

h. Dissolved oxygen (D.O.) (mg/L) violated the permit requirement of not less than saturation. AWTP results for February 4 through February 7 ranged from 91 to 96 percent of saturation (8.4 to 8.9 mg/L).

Overall, the plant effluent met the NPDES requirements. The exceedances cited are considered minor and not considered a problem for the receiving waters. The one noteworthy exception may be FC. A moderate increase in chlorine feed should resolve this problem.

2. Laboratory Review

The laboratory procedure review consisted of four main elements: (a) Sampling Protocol; (b) Split Samples; (c) BOD Procedures; and (d) TSS Procedures.

a. Sampling Protocol

As previously stated, AWTP influent samples are hand-composited due to operating problems associated with the comminutor and low flow during the night. Effluent samples are flow-composited via a feed line from the wet well. Influent composite grabs are collected on a schedule designed by the plant operator to reflect both the plant flow and time of day. Larger volumes are collected at shorter intervals during periods when higher influent flows are expected. Larger volumes are also collected for the first and last samplings to account for the time period when an operator is not available (late afternoon until early in the morning).

The laboratory results suggest that the hand-compositing method produces results comparable to those obtained by automatic sampling (Table 7). The effluent composites from both samplers also displayed very similar results. No changes in the existing sampling protocol are recommended.

b. Split Samples

The 24-hour composites were split with the AWTP in order to compare laboratory analytical results (Table 7).

WDOE and AWTP influent BOD results could not be compared, as the WDOE BOD data were reported as "greater than" values, while ATWP reported actual values.

The AWTP uses the inhibited biochemical oxygen demand (CBOD) test while the WDOE laboratory uses the total BOD (CBOD + NBOD) test. For this reason, the WDOE results (9 to 11 mg/L) were higher than the plant's (3 to 3.2 mg/L), and near the 10 mg/L permit limitation for this facility. The TBOD results probably would have been lower had the plant not been nitrifying at the time of the survey. Nitrification is considered beneficial because it reduces effluent toxicity and oxygen demand associated with ammonia.

The AWTP is required by permit to meet both total BOD and ammonia limitations. By doing this, WDOE is essentially requiring the plant to address NBOD twice. To alleviate this problem, it is recommended that the plant be allowed to continue using the CBOD test and the existing 10 mg/L limit be applied to this component.

Results from FC analyses indicate fair comparison between laboratories. Results reported for FC were 230 and 140 (WDOE) versus 117 (AWTP) colonies/100 mL. The AWTP uses membrane filters with a pore size of 0.7 micron, and WDOE uses 0.45 micron filters. The Environmental Protection Agency (EPA) Microbiological Manual (1978) and Standard Methods (15th edition, 1975) both recommend using 0.45 ± 0.02 micron filters for FC analysis. It is recommended that the AWTP use the smaller pore size.

Results of chlorine analysis for individual grabs suggest a good comparison of WDOE in-field versus AWTP laboratory analysis. WDOE uses a Lamotte DPD chlorine analyzing kit, and AWTP uses a Hach DPD kit.

c. BOD Procedures

The AWTP laboratory procedure is based on Standard Methods with modifications by the plant operator. Dilution water is prepared by adding four nutrient buffers (1 mg/L) to the reagent water approximately one week in advance of testing. The dilution water is maintained in darkness and stored in the AWTP incubator. The WDOE BOD procedure manual (1977) recommends adding nutrient buffers just prior to testing to reduce the possibility of biological growth in the dilution water. Therefore, it is recommended that this procedure be followed for future BOD analyses. Incubator temperature is checked by a mercury thermometer in a water bath. A log is not maintained. It is recommended that the temperature be checked on a regular schedule and adjusted as necessary to ensure a constant temperature of 20°C (± 1°C). Also, regularly collected incubation temperature data should be recorded in a log.

At present the BOD test is conducted weekly. Twenty-four-hour composites are held a maximum of two hours prior to testing. Effluent samples are dechlorinated using potassium iodide titrant to determine the amount of sodium thiosulfate needed. Following dechlorination, test samples are re-seeded using the influent supernatant. The seed material is added to the BOD bottle just prior to testing.

The five-day D.O. depletion for the blank is determined and normally falls within a range of 0.1 to 0.2 mg/L. The normal range of initial (zero-day) D.O. is between 7.0 and 8.0 mg/L. Initial D.O. concentrations should be near saturation which is 8.14 mg/L at 20°C and at 3,400 feet above sea level, the approximate elevation of the AWTP.

Sample pH is checked to ensure that it is in the range of 6.5 to 8.5 (SU). Sample pH is adjusted, if necessary, using sodium hydroxide or sulphuric acid. Sample determinations are accomplished using a Corning pH meter. The meter is calibrated on a weekly basis using buffers of pH 4 and pH 7. It is recommended that the meter be calibrated before each BOD test to ensure that the pH is within the specified range (Standard Methods, 15th Edition). It is further recommended that a pH 10 buffer be obtained and used to calibrate the meter whenever pHs above 7.0 are expected.

BOD D.O. analyses are determined using a YSI D.O. meter. The meter is air-calibrated and checked against D.O.s analyzed by the Winkler titration method. Calibration occurs every time the meter is used. Sodium thiosulfate is used as the titrant, and is standardized using a standard biniodate solution.

d. TSS Procedures

TSS is determined based on Standard Methods (15th Edition). The samples are filtered through Sands R & S #30 glass filters using a Gooch crucible. The filters are prewashed and dried for 20 minutes in an incinerator at 550°C. Following drying, the filters are cooled in a desiccator until needed. Following sample filtration, the filters and the crucible are dried for one hour and allowed to cool in a desiccator prior to weighing and reweighing. The filters are not redried prior to the reweighing procedure. It is recommended that the drying and cooling cycle be repeated prior to reweighing until a constant filter weight is obtained or until the weight loss is less than 0.5 mg.

3. Receiving Waters

On February 5, 1984, a study was carried out to determine waste discharge effects on Nason Creek. Stations were selected above (#1), 10 feet downstream (#2), and 300 feet downstream below the confluence with Nason Creek (#3) from the discharge (Figure 1). In addition, a station (#4) was located on Stevens Creek 20 feet above the confluence with Nason Creek, which is approximately 100 feet downstream from the discharge (Figure 1). Results from the receiving water study are found in Table 8.

Study results show that water quality was generally very good in the receiving water. Slight increases in conductivity, ammonia, total solids, and total suspended solids were observed. The only parameter that displayed a notable increase was nitrate which increased almost three-fold from less than 0.06 mg/L upstream at station #1 to 0.14 mg/L at station #3 at the lower limits of the dilution zone. Additional studies would have to be performed to determine if the effluent is promoting algal productivity in Nason or Stevens Creeks.

Due to conditions at the time of the survey, stream flow and dilution ratios could not be determined with accuracy. A stream flow estimate based on conservative parameters (conductivity, nitrate, and total nutrients) indicates that creek flow was somewhere in the range of 20 to 33 cubic feet per second (cfs) at station #3. Based on this range, the dilution ratio for receiving water to effluent was approximately 400-650:1, well above the 20:1 minimum dilution ratio criterion (WDOE Criteria for Sewage Works Design, 1978).

In order to evaluate whether the analytical results for nitrate concentrations were correct, a hypothetical nitrate concentration for station #3 was calculated using the following equation and data from Table 8.

$$C_b = \frac{(C_a \times Q_a) + (C_t \times Q_t)}{Q_a + Q_t}$$

where: C_b = Hypothetical average concentration of constituent (nitrate) in main stream below inflow (station #3)

C_a = Concentration of constituent (nitrate) in main stream above inflow

C_t = Concentration of constituent (nitrate)

Q_a = Flow of main stream (Nason Creek)

Q_t = Flow of waste stream (AWTP effluent)

Calculated results compared favorably with the analytical results (0.16 vs. 0.14).

A review of the previous year DMR data for Nason Creek supports the results of the receiving water study. Results indicate that very little impact is occurring to the stream as a result of the discharge. Ammonia concentrations indicate that a slight impact from nurients and ammonia may be occurring; however, as stated above, these are probably minimal at present loadings.

D.O. concentrations in the stream were above saturation at all stations. Oxygen concentrations in the effluent were below the daily discharge criterion requiring saturation; however, this did not appear to have any discernible impact on stream D.O. (Tables 6 and 8).

During the survey and from recent DMR data, it was observed that effluent D.O. does not meet the permit requirement of 100 percent saturation. During the survey, D.O. percent saturation ranged between 91 to 96 percent based on an elevation of 3,400 feet (Table 6). According to the operator, the 100 percent saturation is not ever achieved in the effluent. The receiving water study indicates that the less-than-saturation effluent D.O. is not a problem in Nason Creek during periods of above-average discharge. A re-evaluation of the permit requirements for this parameter may be appropriate.

Effluent ammonia discharge was exceeding the permitted concentration; however, the quantity discharged (lbs/day) was well within the daily limit. At the present loading levels this does not appear to be adversely affecting the receiving water (Table 8).

CONCLUSIONS AND RECOMMENDATIONS

The Stevens Pass advanced wastewater treatment plant appears to be well operated and maintained. Treatment of wastewater was such that receiving water quality did not appear to be impacted, with the exception of a possible increase in nitrate concentrations. In the future, monitoring of nitrate levels may become necessary as nitrate loading to the receiving water increases. A summary of other noteworthy findings and recommendations follows:

Memo to Harold Porath
Stevens Pass Class II Inspection
December 20, 1984

1. The ammonium chloride and other procedures used at the plant to minimize the impacts of shock loading which increases effluent ammonia are considered reasonable.

2. The dose rate for total residual chlorine should be increased to improve the bacterial kill.

3. The permit limitation for BOD should be based on the carbonaceous component (CBOD) using the existing 10 mg/L limitation.

4. 0.45 micron filter paper should be used for the fecal coliform test.

5. For the TSS test, the drying and cooling cycle should be repeated until a constant filter weight is obtained or the weight loss is less than 0.5 mg.

6. The percent D.O. saturation limitation should be re-evaluated since it may not be realistic.

7. BOD nutrient buffer should be added just prior to testing.

8. A BOD log should be maintained (incubator temperature, etc.).

9. The pH meter should be calibrated before each BOD test, and calibration using a pH 10 buffer implemented when pHs greater than 7.0 are expected.

10. For the most part the WDOE and AWTP laboratory results compared favorably.

DC:cp

Attachments

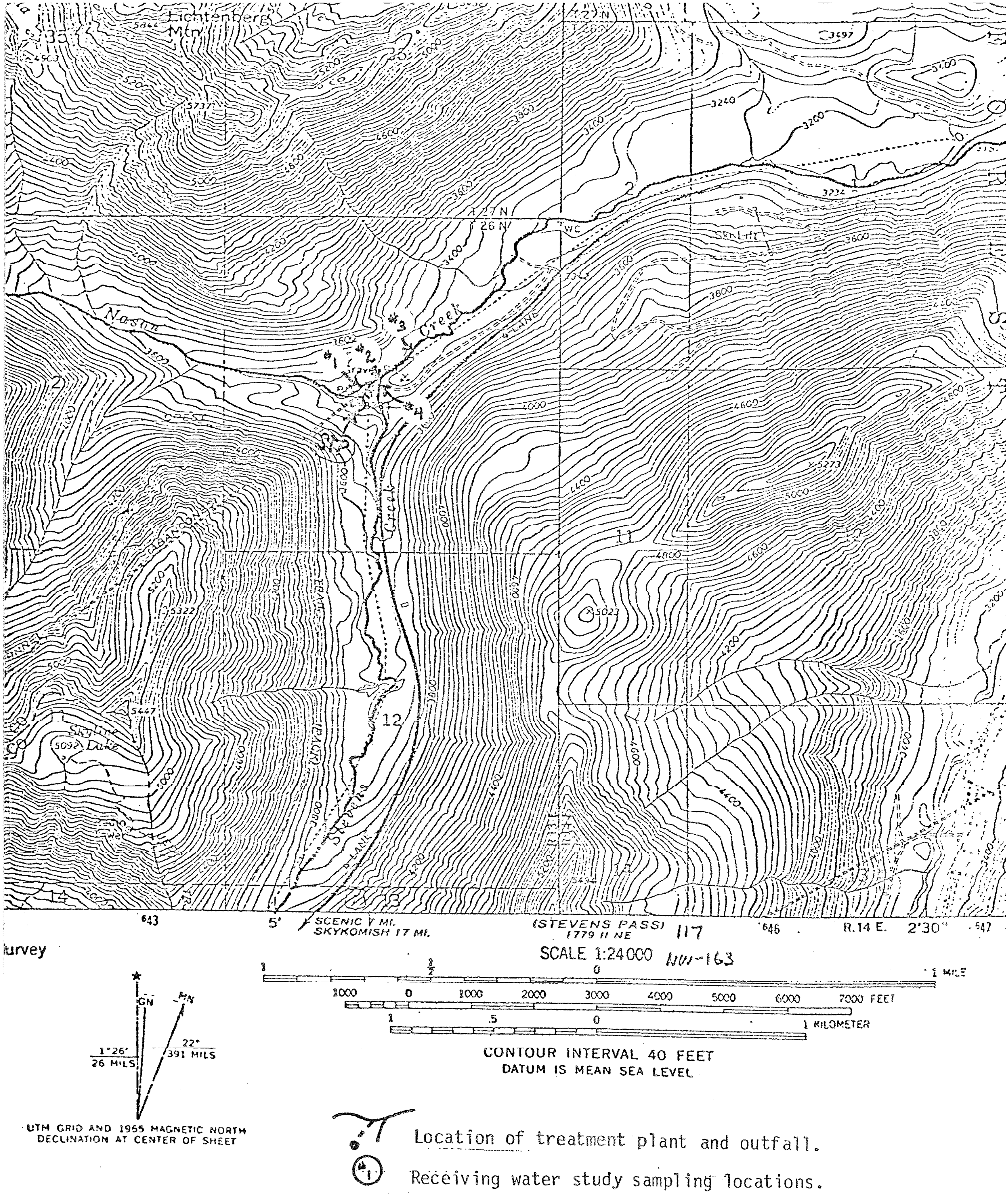

Figure 1. Map showing location of Stevens Pass wastewater treatment plant, Stevens Pass, Washington, February 1984.

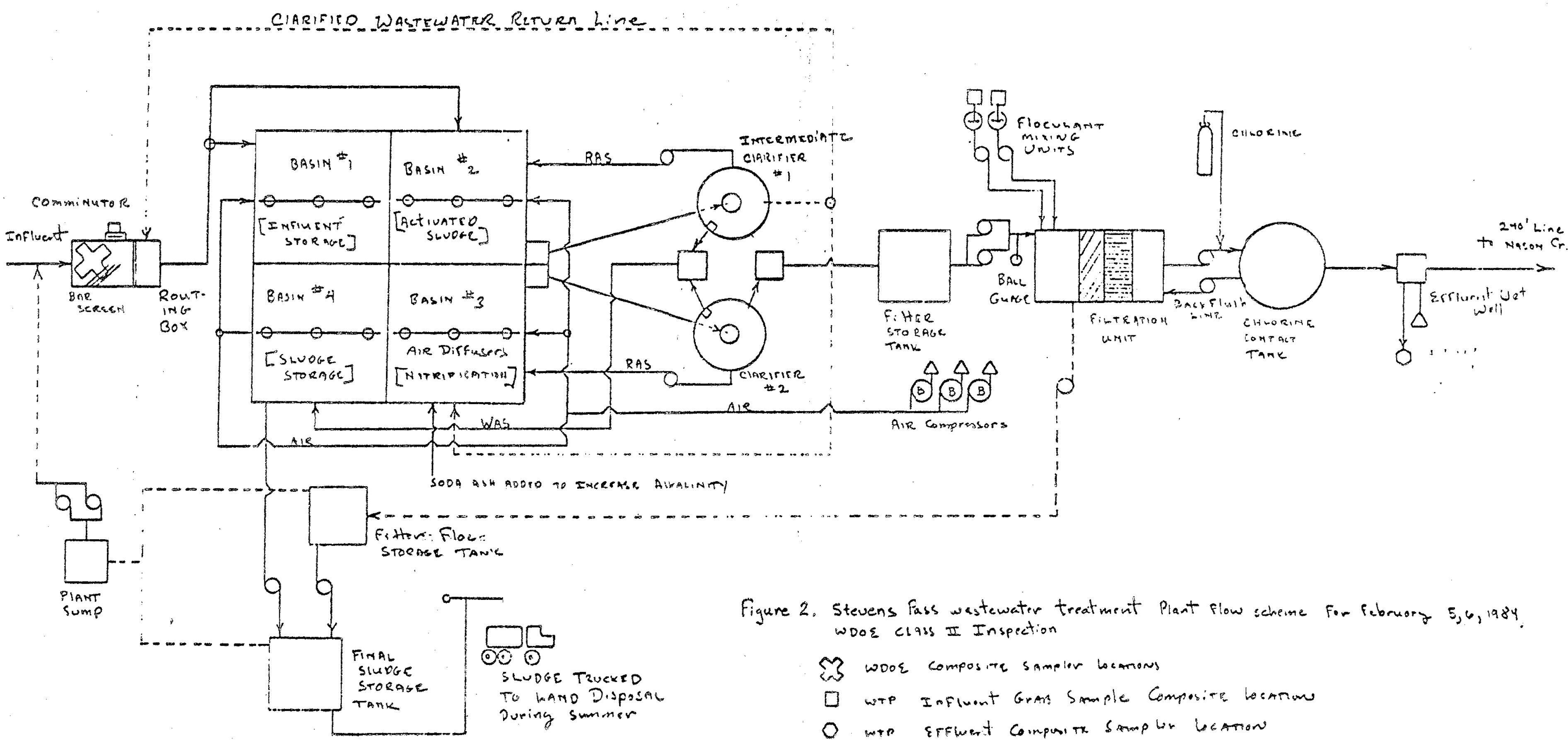

Figure 2. Stevens Pass wastewater treatment Plant flow scheme for February 5, 6, 1984, WDOE Class II Inspection

- ✕ WDOE composite sampler locations
- □ WTP Influent Grab Sample Composite location
- ○ WTP Effluent Composite Sampler location
- ---- In Plant Wastewater Routing

Table 1. Stevens Pass WTP operational units including capacity and description of each unit, February 1984.

Unit	Capacity	Description
Equalization Tanks	2 at 39,000 gal. ea.	Located at the ski resort site, the tanks can be used for storage of Stevens Pass ski area wastewater during high use periods. Presently not being used due to modified plant operation which allows for on-site storage of wastewater during peak and off-season intermittent plant operation.
Aeration Basins	4 at 47,300 gal. ea.	Two basins are used for storage. #1 for influent, and #4 for waste-activated sludge. Basin #2 is used as an activated sludge basin and #3 is used as second-stage activated sludge for nitrification. Multiple routing systems between the basins and other plant operational units can allow for numerous plant operating modes including complete mix; extended aeration; contact stabilization; plug flow with or without step-feed; dual sludge for nitrification and aerobic digestion.
Clarifiers	2 at 12-foot diameter, 7-foot side wall depth	Two center-feed rim discharge clarifiers each having a surface loading rate of 275 gal/ft^2/day and a solids loading rate of 9.2 lbs/day/ft^2. One unit is used for intermediate and one for final clarification of effluent.
Filter Unit	75,000 gpd	One physical-chemical filtration unit with tube settlers and mixed media (garnet sand, activated charcoal) for final effluent filtration prior to chlorination.
Chlorine Contact Tank	4,100 gallons	Chlorine disinfection with a 53-minute detention time at design flow (0.112 MGD).

Table 2. Sample times and locations for WDOE February 5-6, 1984 Stevens Pass Class II survey and Nason Creek receiving water study.

24-hour Composite Samples

Sample	Sampler	Installation Date (time in - time out)		Location
Influent	WDOE	2/5/84	0915 - 0915	Routing box upstream from comminutor
Recycle Influent[1]	WTP	2/5/84	1000 - 1000	Routing box recycle chamber
Chlorinated Effluent	WDOE	2/5/84	0925 - 0925	Effluent wet well
Chlorinated Effluent	WTP	2/5/84	0855 - 0900	Effluent wet well

Grab Samples

Sample	Collection Date (time)	Laboratory Analyses	Field Analyses
Influent	2/5/84 (0930)		pH, temperature, conductivity
	(1445)		pH, temperature, conductivity
	2/6/84 (0845)		pH, temperature, conductivity
Recycle Influent[1]	2/5/84 (0940)		pH, temperature, conductivity
	2/5/84 (1455)		pH, temperature, conductivity
Effluent	2/5/84 (0950)		pH, temperature, conductivity, total chlorine residual
	(1515)	Fecal coliform	pH, temperature, conductivity, total chlorine residual
	2/6/84 (0900)	Fecal coliform	pH, temperature, conductivity
Mixed Liquor	2/6/84 (0910)	Total solids, total suspended solids	
Sludge Storage	2/6/84 (0920)	Total solids, total suspended solids	

[1]Recycle water from sludge tank and filter mixed with influent in routing box

Table 2. - continued. Stations, sample time, locations, and analyses for the Stevens Pass WTP receiving water study, February 1984 (note: all grab samples are mg/L unless otherwise noted).

Station Number	Time	Description	Laboratory Analyses	Field Analyses
1	1400	Nason Creek 10 yards above discharge	pH (S.U.), turbidity (NTU), spec. cond. (umhos/cm), COD, nutrients (NO_3-N, NO_2-N, NH_3-N, O-PO_4-P, Total-P), solids (TS, TNVS, TSS, TNVSS), fecal coli. (col/100 mL)	pH, temperature, spec. cond., diss. oxygen
2	1345	Nason Creek 10 yards below discharge	pH (S.U.), turbidity (NTU), spec. cond. (umhos/cm), COD, nutrients (NO_3-N, NO_2-N, NH_3-N, O-PO_4-P, Total-P), solids (TS, TNVS, TSS, TNVSS), fecal coli. (col/100 mL)	pH, temperature, spec. cond., diss. oxygen
3	1235	Nason Creek 100 yards below discharge	pH (S.U.), turbidity (NTU), spec. cond. (umhos/cm), COD, nutrients (NO_3-N, NO_2-N, NH_3-N, O-PO_4-P, Total-P), solids (TS, TNVS, TSS, TNVSS), fecal coli. (col/100 mL)	pH, temperature, spec. cond., diss. oxygen
4	1315	Stevens Creek 10 yards above confluence	pH (S.U.), turbidity (NTU), spec. cond. (umhos/cm), COD, nutrients (NO_3-N, NO_2-N, NH_3-N, O-PO_4-P, Total-P), solids (TS, TNVS, TSS, TNVSS), fecal coli. (col/100 mL)	pH, temperature, spec. cond., diss. oxygen
Effluent	1500	Effluent wet well	Fecal coliform (col/100 mL)	pH, temperature, spec. cond.

Table 4. Summary of sampling data collected by compositor at Stevens Pass AWTP during February 6, 1984 (all concentrations in mg/L unless otherwise noted).

			Laboratory Analyses																Field Analyses				
Sample	Sampler	Laboratory	BOD_5	COD	TS	TNVS	TSS	TNVSS	pH (S.U.)	Spec. Cond. (umhos/cm)	Turb. (NTU)	NH_3-N	NO_2-N	NO_3-N	Dis. O-PO_4-P	Tot. PO_4-P	Alk. ($CaCO_3$)	Chloride	Date	Time	Temp. (°C)	pH (S.U.)	Spec. Cond. (umhos/cm)
Influent	WDOE	WDOE	>320	630	670	250	280	13	8.6	1090	110	65	<0.10	<0.10	8.9	12.0	320	78	2/6/84	0950	5.4	8.8	920
	WDOE	AWTP	365				296																
	AWTP	WDOE	>320	810	840	260	400	10	8.4	1071	110	53	<0.10	2.3	8.8	9.1	310	64					
	AWTP	AWTP	405				424																
Effluent	WDOE	WDOE	11	35	680	490	3	<1	7.2	1000	4	6.4	0.15	52	0.40	0.40	88	57	2/6/84	1000	4.8	7.2	>1000
	WDOE	AWTP	3				6.5				4	7.1											
Effluent	AWTP	WDOE	9	38	690	490	5	<1	7.1	981	7	6.8	0.10	52	0.50	0.55	94	60					
	AWTP	AWTP	3.2				5.5				7	7.4											
Mixed Liquor					2400		2200																
Sludge Storage					1100		660																

Table 5. Grab sample results - Stevens Pass AWTP, February 5 and 6, 1984.

			Field Analyses			WDOE Laboratory Analyses			
Sample	Date	Time	Temp. (°C)	Sp. Cond. (umhos/cm)	pH (S.U.)	Total Chlorine Residual (mg/L)	Fecal Coliform (col/100 mL)	Total Susp. Solids (mg/L)	Total Solids (mg/L)
Influent	2/5/84	0930	5.6	690	7.8				
	2/5/84	1445	6.9	820	8.2				
	2/6/84	0845	4.8	320	7.6				
Recycle Influent	2/5/84	0940	6.2	700	7.8				
	2/5/84	1455	6.3	800	8.1				
Effluent	2/5/84	0950	13.6	>1000	7.2	0.1			
	2/5/84	1515	13.3	>1000	6.0	0.1	140		
	2/6/84	0900	13.8	>1000	6.9	0.1	230		
Activated Sludge	2/6/84							2200	2400
Sludge Storage Basin	2/6/84							660	1100

Table 6. Comparison of Class II inspection data to NPDES permit limits - Stevens Pass AWTP, February 1984.

Parameter	WDOE Sample		AWTP Sample		NPDES Permit Limits	
	WDOE Analysis	AWTP Analysis	WDOE Analysis	AWTP Analysis	Daily Maximum Concentration (mg/L)	Daily Maximum Quantity (lbs/day)
BOD_5 (mg/L)	11	3	9	3	10 (mg/L)	
(lbs/day)	3	0.8	2.5	0.8		8.34
% Removal[1]	97	99	98	99		
TSS (mg/L)	3	6.5	5	5.5	10 (mg/L)	
(lbs/day)	0.8	1.8	1.4	1.5		8.34
% Removal	99	98	99	99		
F. Coli. (col/100 mL)	230,140			117	50/100 mL	
Chl. resid. (mg/L)	0.1			0.1	0.5 (mg/L)	
pH (S.U.)	7.2, 7.2, 7.2, 6.0, 6.9				$6.5 \leq pH \leq 8.5$ (S.U.)	
NH_3-N (mg/L)	6.4	7.1	6.8	7.4	3 (mg/L)	
(lbs/day)	1.8	2.0	1.9	2.0		2.5
% Removal[2]	90	89	87	86		
Diss. Oxygen (% Sat)				2/4 8.9[3] (96) 2/5 8.6 (92) 2/6 8.4 (90) 2/7 8.5 (91)	Not less than saturation.	
Flow (MGD)	0.033					

[1]Based on WTP analytical results for influent composite BOD_5.
[2]Based on WDOE analytical results for influent composite NH_3-N.
[3]From WTP D.O. analyses, February 4-7, 1984.

Table 7. Comparison of WDOE and Stevens Pass AWTP laboratory results - Stevens Pass AWTP, February 1984 (all mg/L unless otherwise noted).

Sample	Sampler	BOD_5		Total Susp. Solids		NH_3-N		Fecal Coliform (col/100 mL)		Turbidity (NTU)		TCR (mg/L)	
		WDOE Analysis	AWTP Analysis	WDOE Analysis	AWTP Analysis	WDOE Analysis	AWTP Analysis	WDOE Analysis	AWTP Analysis	WDOE Analysis	AWTP Analysis	WDOE Analysis	AWTP Analysis
Influent	WDOE	>320	365	280	296								
	AWTP	>320	405	400	424								
Effluent	WDOE	11	3	3	6.5	6.4	7.1			4	4		
	AWTP	9	3	5	5.5	6.8	7.4			7	7		
Effluent	Grab							230	117			0.1	0.1

Table 8. Receiving water study conventional parameter results, Nason Creek and Stevens Creek for February 5, 1984 (all mg/L unless otherwise noted).

								Nutrients					Solids					Field Analysis					
Station Number	Description	BOD_5	COD	pH (S.U.)	Spec. Cond. (umhos/cm)	Turbidity (NTU)	Chlorides	NH_3-N	NO_2-N	NO_3-N	Ortho-PO_4-P	Total-PO_4-P	TS	TNVS	TSS	TNVSS	Fecal Coliform (col/100 mL)	Time	Temp. (°C)	pH (S.U.)	Spec. Cond. (umhos/cm)	Diss. Oxygen	D.O. % Sat.[3]
#1	Nason Creek above dischg.		8	6.9	19	1	0.7	<0.01	<0.01	<0.06	<0.01	0.01	23	14	<1	<1	<1 <1	1400	1.6	6.8	18	12.7	102
Effluent[1]	Wet well	9	38	7.1	981	7	60	6.8	0.10	52	0.50	0.55	690	490	5	<1	140	0900				8.6	92
Effluent[2]	Wet well	11	35	7.2	1000	4	57	6.4	0.15	52	0.40	0.40	680	490	3	<1	230	1515	13.3	7.2	>1000		
#2	Nason Creek 10' below discharge		8	6.9	20	1	1.4	<0.01	0.01	0.1	<0.01	<0.01	21	<1	<1	<1	<1 <1	1345	1.6	6.8	21	13.1	105
#3	Nason Creek 100 yds blw discharge		4	6.9	22	1	0.7	0.02	<0.01	0.14	<0.01	<0.01	27	<1	3	<1	<1 <1	1235	1.3	6.8	24	13.1	105
#4	Stevens Creek 20' above confl. w/ Nason Creek		8	6.6	23	1	1.4	<0.01	<0.01	0.02	<0.01	<0.01	21	8	2	<1	<1 <1	1315	1.6	6.7	25	12.9	104

[1]Stevens Pass composite sample February 5-6, 1984.

[2]WDOE composite sample February 5-6, 1984. F.C. grab samples #1 Feb. 5 (1515); #2 Feb. 6 (0900).

[3]Based on an average elevation of 3400 feet above sea level.